Natural Resources Canada   Ressources naturelles Canada

GEOLOGICAL SURVEY OF CANADA
OPEN FILE 8595

One-dimensional Layered Earth Models of Canada for GIC Applications

Part 2. Detailed Description

L. Trichtchenko, P.A. Fernberg, and D.H. Boteler

2019

Canada

GEOLOGICAL SURVEY OF CANADA
OPEN FILE 8595

One-dimensional Layered Earth Models of Canada for GIC Applications

Part 2. Detailed Description

L. Trichtchenko[1], P.A. Fernberg[2], and D.H. Boteler[1]

[1]Geomagnetic Laboratory, 2617 Anderson Road, Ottawa, Ontario K1A 0Y3
[2]Peter Fernberg Technical Services

2019

Permanent link: https://doi.org/10.4095/314805

This publication is available for free download through GEOSCAN (https://geoscan.nrcan.gc.ca/).

Recommended citation
Trichtchenko, L., Fernberg, P.A., and Boteler, D.H., 2019. One-dimensional layered earth models of Canada for GIC Applications Part 2. Detailed Description; Geological Survey of Canada, Open File 8595, 586 p. https://doi.org/10.4095/314805

Publications in this series have not been edited; they are released as submitted by the author.

This report is Part 2 of two reports, presenting more detailed information for each province in addition to the more general information presented in the Trichtchenko, L., Fernberg, P.A., Boteler, D.H., 2019. One-dimensional Layered Earth Models of Canada for GIC Applications. Part 1. General Description; Geological Survey of Canada, Open File 8594, 66 pp. https://doi.org/10.4095/314804

For more information, please contact

Larisa Trichtchenko
Research Scientist
Geomagnetic Laboratory
2617 Anderson Road
Ottawa, ON
K1A 0E7

Tel: 613-837-9452
Email: larisa.trichtchenko@canada.ca

Table of Contents

This is a supplementary information on detailed descriptions of the layered earth resistivity models for each province of Canada, the general report is presented in OF 8594, https://doi.org/10.4095/314804

Summary

Evaluation of the impacts of space weather on ground infrastructure requires information on the size of geomagnetically induced (telluric) currents. For estimation of these currents in places where they are/were not recorded, numerical modelling needs to be employed. The most common approach in the modelling of geomagnetically induced currents is based on knowledge of the geoelectric field driving these currents. Because there are no continuous measurements of the geoelectric fields in many areas where the power networks are located, the common method is based on utilisation of the available geomagnetic observations recorded in the area together with the surface impedance of the Earth, derived from short-duration magnetotelluric surveys.

The compilation of two reports (main, Part 1, OF 8594 and supplementary, Part 2, OF 8595) presents one-dimensional Earth resistivity models and corresponding surface impedances for 10 Canadian provinces (located below 60 degrees in latitude), as derived from the available publications. The presented supplementary report provides a set of 10 Appendices with the detailed descriptions of the geological settings of each province, justification for choice of areas (zones) with one-dimensional models for each province and values of resistivities at different depths. The information has been originally prepared by Dr. P.A. Fernberg as multiple reports and then significantly edited for consistency and for omitted information by Dr. L. Trichtchenko.

The presented detailed descriptions with justification for values of the Earth resistivity models for each province, as well as the locations of the identified zones, together with the list of references of the sources of information are presented in the Appendices separately for each province for convenience of users. These detailed descriptions can serve for better justification of the chosen geoelectrical parameters and location of defined zones and give the opportunity to update the specific parameters when the new information becomes available.

General descriptions of layered Earths resistivity models for each province are presented in: Trichtchenko, L., Fernberg, P.A., Boteler, D.H., 2019. One-dimensional Layered Earth Models of Canada for GIC Applications. Part 1. General Description; Geological Survey of Canada, Open File 8594, 66 pp. https://doi.org/10.4095/314804.

Appendix 1

Detailed Description of the Earth Resistivity Models for Alberta

1. Geological Settings of the Alberta

The maps of geological Provinces of Canada (Figure 1) and the major rock types (Figure 2) demonstrate that all of Alberta is covered by sedimentary rock of the Western Canada Sedimentary Basin (WCSB), a component of the Interior Platform that covers much of the Canadian Prairies. Beneath the WCSB is a crystalline basement comprised mainly of granitic and gneissic rock, which has been subdivided into differing terranes on the basis of geophysical information (seismic, aeromagnetic, gravity, and in some areas magnetotelluric surveys) and drill core because bedrock exposure is limited. Ancient plate tectonics has resulted in the accretion and amalgamation of numerous, small, crustal fragments and magmatic arcs[1] of varying geological age, onto larger pre-existing Archean crust, forming the present-day mosaic of terranes. The terranes are distinguished by their particular aeromagnetic and gravity expression (orientation, pattern, magnitude).

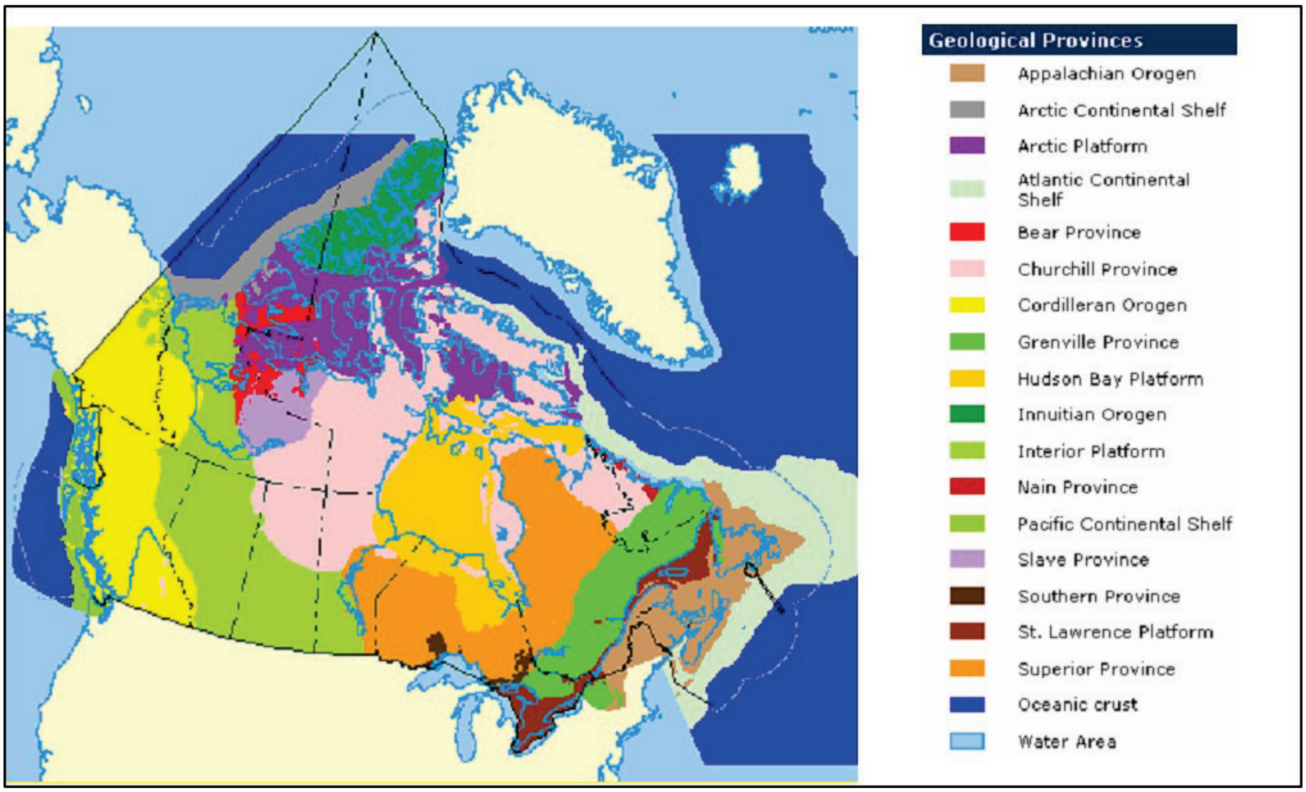


Figure 1. Geological Provinces of Canada, (NRCan 2012a)

[1] An arcuate range of volcanoes and intrusive bodies (plutons) parallel to a subduction zone, occurring on ocean or continental tectonic plates.

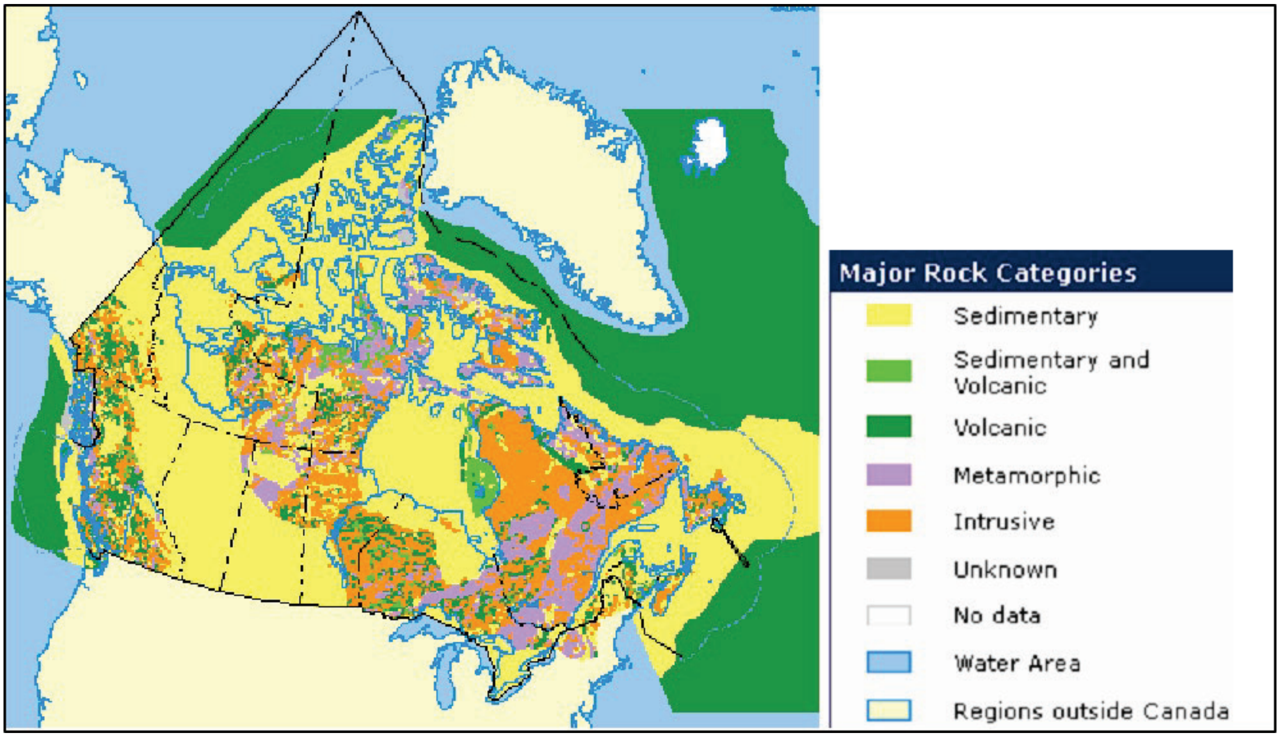


Figure 2. Major Rock Types in Canada, (NRCan 2012b)

The top layer (overburden) is mostly a glacial till blanket, with areas of glaciolacustrine deposits of clay and silt, and lesser amount of sand and gravel. Thickness of the overburden is highly variable, up to 300 m deep in some pre-glacial bedrock valleys, but generally > 50m thick north of Edmonton and < 30 m thick south of Edmonton.

Sedimentary strata of the WCSB of Paleozoic to Tertiary age has variable thicknesses, in general increases in thickness southwestward from < 200 m at the Alberta / Saskatchewan boundary to > 5500 m at the base of the foothills of the Cordillera mountain ranges where the sedimentary strata steepen considerably. Paleozoic strata, comprised mainly of carbonates, makes up 30 to 60 % of the basin. Mesozoic-Tertiary strata are predominately clastic sediments, and include the highly carbonaceous shale of the Mannville Group up to 700 m thick.

Buried beneath the WCSB is a collage of various crustal domains (e.g. Medicine Hat Block, Buffalo Head) of Archean (early Precambrian) and Proterozoic (late Precambrian) age, as well as major tectonic features (e.g. Kiskatinaw magnetic low, Vulcan Structure) identified by regional patterns in magnetic, gravity and EM differences (Figure 2). Descriptions of and crustal evolution of the Precambrian basement are provided in Villeneuve et al. (1993), Boerner et al. (2000), Clowes et al. (2002), Gorman et al. (2002), Hope and Eaton (2002), Lemieux et al. (2000), Ross (2002), and Pana (2003).

The geological Archean Provinces, Hearne Domain and Rae Domain underlie the southeastern part and northeastern parts of Alberta, respectively. Tectonic elements (Figure 3) within the Hearne Domain include the Medicine Hat and Loverna Blocks. Separating the two blocks is the Vulcan Structure (also known as the Vulcan Low), a 350-km long, more electrically resistive, prominent east-trending gravity and magnetic anomaly low, which possibly represents an ancient subduction zone (Nieuwenhuis, 2011).

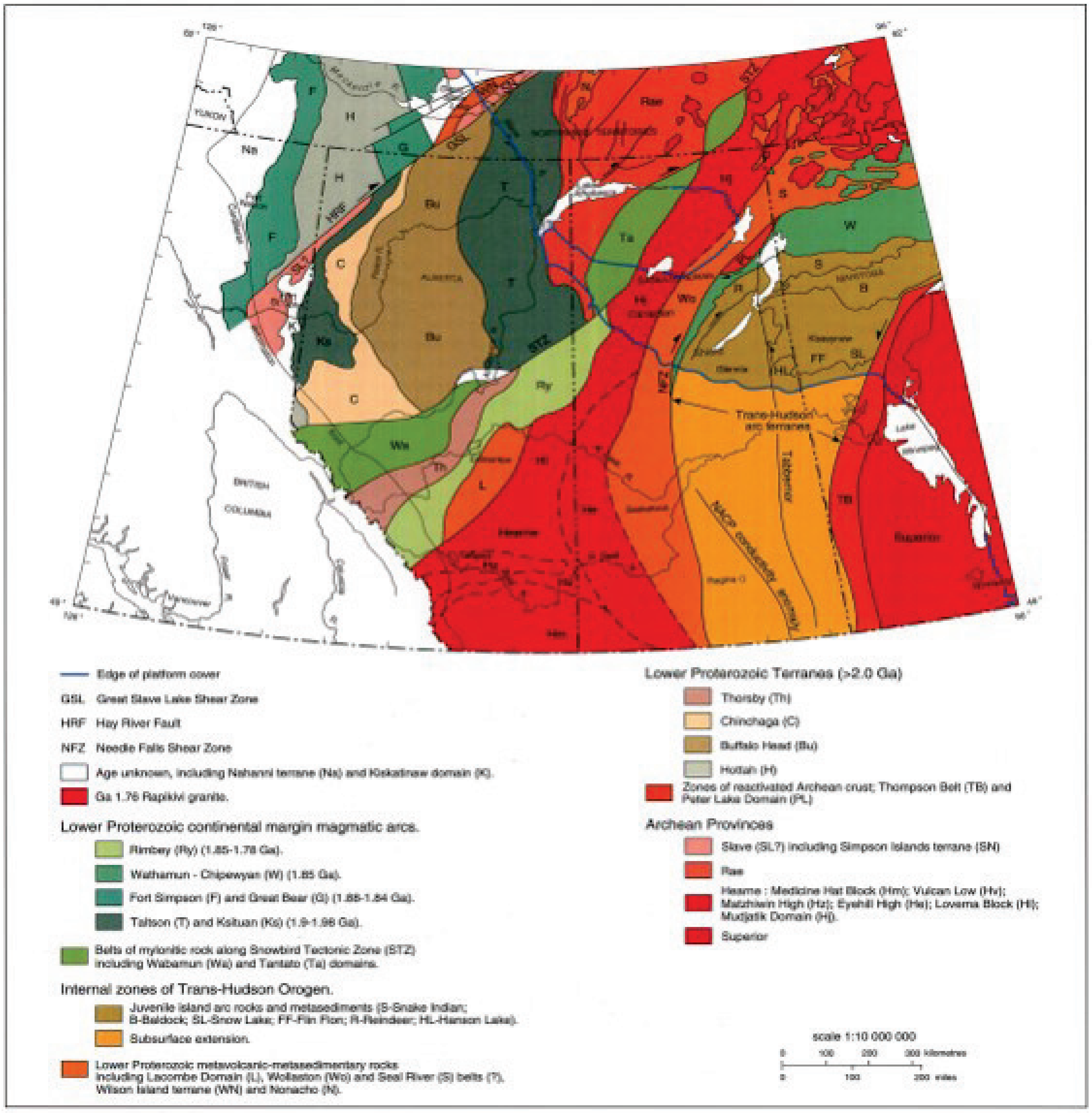


Figure 3. Tectonic domains underlying the Western Canada Sedimentary Basin. Trace of NACP conductivity anomaly, as shown, has been modified by subsequent research. Note blue line delineating eastern zero-edge of sedimentary cover rock. (Ross et al., 1994, their Fig. 4.1).

A number of domains, of younger Paleoproteozoic time, were accreted against the Hearne and Rae Domains and underlie the rest of Alberta (Figure 3). Subduction of small crustal components resulted in generation of magmatic belts (e.g. granites) that welded together the collage of crustal pieces.

Regional shear zones include the Snowbird Tectonic Zone (STZ) which separates the Hearne and Rae Domains (in Saskatchewan), would appear to continue into northern, and possibly southern Alberta. In northwestern Alberta, the Great Slave Lake Shear Zone (GSLsz) is a 25 km wide belt of mylonite, an intensely deformed rock, and electrically resistive.

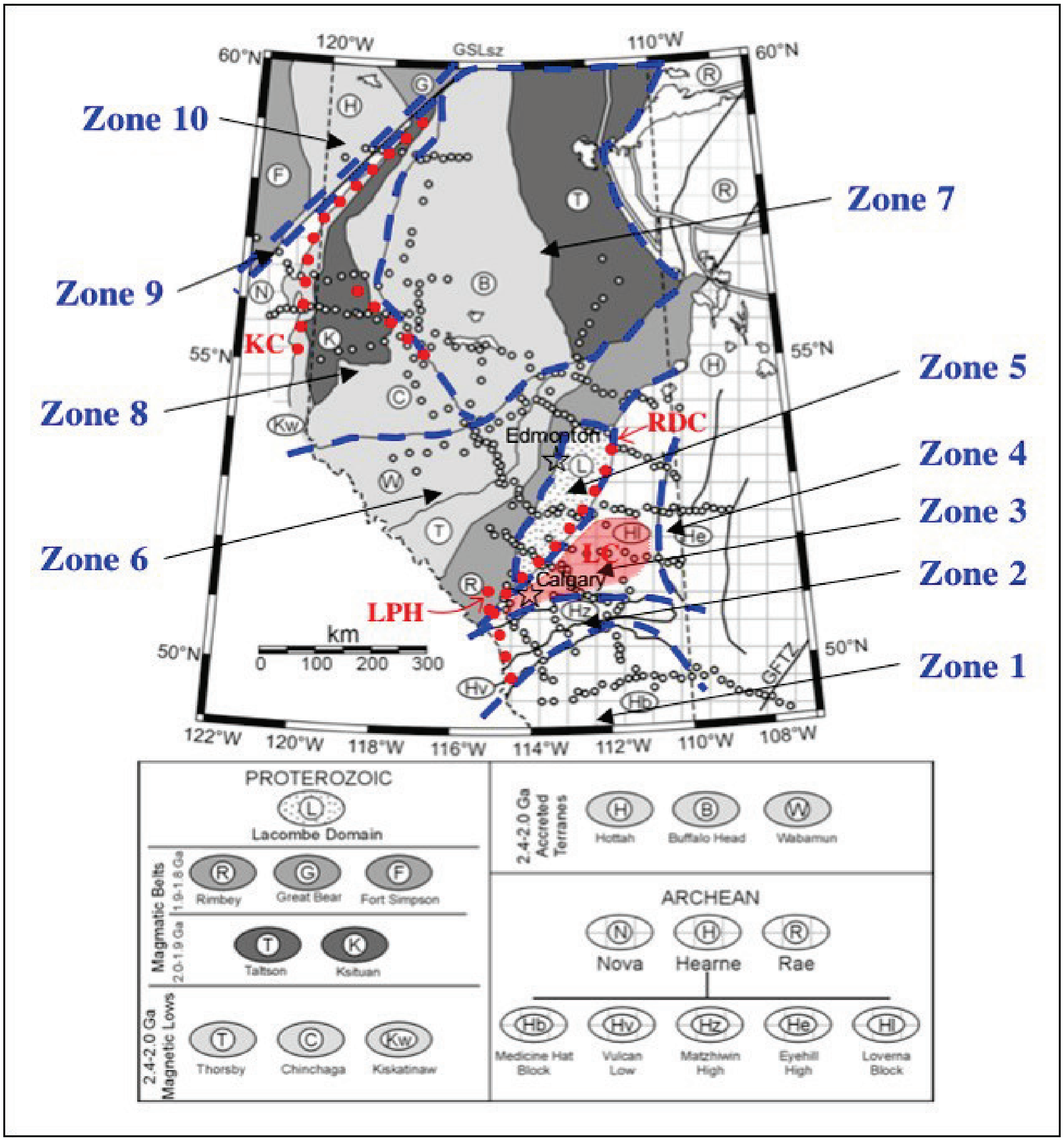


Figure 4. Coverage areas of ten proposed layered Earth models (separated by the blue dashed lines) with respect to the conductive anomalies and tectonic elements, of Precambrian age, underlying Alberta (modified from Boerner et al., 2000, their Fig. 2). Small circles represent locations of the 320 magnetotelluric stations of Alberta Basement Transect Experiment. Abbreviations: GFTZ, Great Falls tectonic zone; GLSsz, Great Slave Lake shear zone; LC, Loverna Conductor; KC, Kiskatinaw Conductor; LFH, Linear Foothills Anomaly; RDC, Red Deer Conductor, after (Nieuwenhuis, 2011; Turkoglu et al., 2009).

Regional shear zones include the Snowbird Tectonic Zone (STZ) which separates the Hearne and Rae Domains (in Saskatchewan), would appear to continue into northern, and possibly southern Alberta. In northwestern Alberta, the Great Slave Lake Shear Zone (GSLsz) is a 25 km wide belt of mylonite, an intensely deformed rock, and electrically resistive.

Conductive and Resistive Anomalies in Crust and Upper Mantle

From north to south the following conductive and resistive anomalies (Figure 4) have been identified (see cited references for details):

i) Loverna Conductor (LC) is a regional low resistivity feature in the upper mantle (~40-100 km) below the western part of the Loverna Block, exhibiting 3-30 ohm.m range, and broadly dipping southeasterly (Nieuwenhuis et al., 2014). The eastern portion of the Loverna Block is resistive, >3000 ohm.m, above 20 km depth. At shallower depths (17-37 km), the LC anomaly appears to merge partially with the RDC anomaly near the southwest boundary of the Lacombe Domain and Loverna Block, but to the northeast along the boundary the LC and RDC anomalies diverge. Graphite films and/or sulphides developed on mineral grains through introduction of carbon and/or metasomatic fluids, during subduction along the Vulcan structure, have been proposed as a cause of the high pervasive conductivity (Nieuwenhuis et al., 2014).

ii) Red Deer Conductor (RDC), a shallow linear conductor (3 - 30 ohm.m) within Precambrian basement rock just below the WCSB cover, possibly extending to a depth <10 km as imaged on MT profiles. The RDC follows the northeast trending boundary between the Proterozoic Lacombe Domain and the Archean Loverna Domain (Figure 4). It also coincides with a high magnetic anomaly (Boerner et al., 2000) called the Red Deer High, which suggests an association with banded iron formation as a possible cause of the high conductivity (Boerner et al, 2000).

iii) Linear Foothills Anomaly (LFH) is a north-south trending linear conductor (<10 ohm.m), imaged at 2 - 3 km depth, spatially associated with the thickening of the southwest margin of the WCSB (in the Rocky Mountain Foothills) against the more resistive (>1000 ohm.m) Cordillera fold and thrust belt to the west (Nieuwenhuis, 2011; Nieuwenhuis et al., 2014). Fracturing of the Precambrian basement caused by thrusting of the Cordillera terranes over the basement may have allowed migration of interconnecting saline fluids into surrounding rock which could lower the resistivity (Nieuwenhuis, 2011).

iv) Kiskatinaw conductor (KC), a southeast dipping conductor (~ 10 ohm.m) imaged between 20 and 50 km depth, which may represent a fossil subduction zone. Its conductivity is postulated to be due to graphic derived from subducted organic material (Turkoglu et al., 2007). The KC follows the trend of the Kiskatinaw magnetic low.

v) Upper mantle conductor (50-150 ohm.m) situated between the Ksituan and Chinchaga Domains at a depth of 50 – 100 km, striking northwest. Part of this conductor merges with the KC feature.

vi) Great Slave Lake shear zone is a near-vertical, crustal-scale, resistive anomaly (> 4000 ohm.m) bounded by more conductive crust on either side. This 25 km wide zone of mylonitic rock is coincident with a magnetic low. The high resistivity is interpreted to be due to the resistive nature of the granitic protolith of the mylonite (Wu et al., 2002).

Basement Subdivision / Tectonic Domains & Crustal Features Underlying Alberta

Descriptions were compiled from Pana (2003) and Villeneuve et al. (1993), as well as others cited below. Nomenclature used by researchers varies slightly (e.g. Taltston Arc, Taltson Domain), alternatives are listed below.

Medicine Hat Block

Medicine Hat Block is comprised of a northwest trending belt of Archean gneiss and plutonic rocks (quartz diorite, granodorite) (2.7-2.6 Ga) and an older diorite gneiss (3.3 Ga). It is geophysically expressed as a region of linear, parallel, northwest orientated low to moderate amplitude positive and negative aeromagnetic anomalies, as well as apparent in gravity data. In Alberta, the Vulcan Structure truncates the northern boundary of the Medicine Hat Block.

Vulcan Structure

Vulcan Structure is an arcuate northeast- to east-trending crustal feature, about 50 km wide, separating the MHB and LB domains, and interpreted as a Proterozoic (ca. 1.8 Ga) collision boundary (i.e. suture zone) (Eaton et al., 2000) along a northward dipping ancient subduction zone. It is geophysically expressed by anomalous aeromagnetic and gravity lows.

Loverna Block

Granite and granitic gneiss comprise the Loverna Block (Boerner et al., 2000), ranging in age from late Archean to Paleoproterozoic (1.8 Ga). This block is characterized by series of indistinct magnetic highs (Hope and Eaton, 2002) that coincide with biotite-magnetite granitic intrusions, but overall described as being geophysically indiscript. Underlying the Loverna Block, within the upper-mantle, is a major conductor known as the Loverna Conductor (LC).

Eyehill Domain / Eyehill High

Archean metaplutonic gneiss and some amphibolite gneiss comprise the Eyehill domain. Geophysically characterized by a curvilinear north-trending high aeromagnetic response and gravity high (Clowes et al., 2002). Eyehill Domain may represent an ancient fault zone into which upwelling mafic magma was emplaced in a near vertical, linear dike-like manner in the upper crust (Hope and Eaton, 2002).

Lacombe Domain

Proterozoic (<2.3 Ga) low-grade felsic metavolcanic and metasedimentary rocks comprise the northeast trending Lacombe Domain (Nieuwenhuis et al., 2014). The Red Deer High, a narrow (10-15 km) north-northeast trending positive aeromagnetic and electrically conductive anomaly forms the southeastern boundary of the Lacombe Domain. Spatially coincident with the Red Deer magnetic high is the Red Deer Conductor (RDC), both situated in the upper crust. The RDC is comprised of a set of discrete conductors dipping southeast (Nieuwenhuis et al., 2014) and interpreted to be iron formation deposits (Boerner et al, 2000).

Rimbey Domain / Rimbey High

Rimbey High is a belt of subparallel syenogranite to monzogranite plutonic rocks (1.85-1.79 Ga), mainly characterized by subcircular, moderately positive aeromagnetic anomalies with intervening negative regions. Rimbey High is interpreted as being a magmatic arc.

Thorsby Domain / Thorsby Low

Basement rocks within the Thorsby Low are plutonic (2.4-2.29 Ga). Thorsby Low is a narrow (~ 30 km) north-northeast trending curvilinear aeromagnetic and gravity low that merges with the Snowbird tectonic zone (STZ) to the northeast, and may delineate a crustal discontinuity (Boerner et al., 2000). The STZ may represent a Paleoproterozoic subduction zone (Ross et al., 2000, cited in Nieuwenhuis, 2011).

Wabamun Domain / Wabamun High

Wabamun High has a dominantly positive aeromagnetic and gravity signature, and is interpreted as a domain of mainly under-formed magmatic rocks (Boerner et al., 2000).

Taltson Domain / Taltson Arc

Talston Domain is a north-trending magmatic zone (1.99-1.90 Ga) – a belt of granitic to dioritic plutons – welding the Buffalo Head Domain to the Archean Rae geological Province. Basement consists of highly deformed biotite-hornblende gneiss and moderately deformed plutonic (e.g. syenogranite, monzogranite) rock. Geophysically, the Talston Domain is expressed as a "150-200 km wide, north-trending belt of strike-parallel, tightly corrugated, positive aeromagnetic anomalies that are contained within broader aeromagnetic lows" (Pana, 2003).

Buffalo Head Domain / Buffalo Head Terrane

Buffalo Head Domain is a magmatic belt (2.4-2.0 Ga). A wide variety of rock forms the basement, with felsic to intermediate metaplutonic (gabbro to leucogranite) rocks predominating, with minor felsic metavolcanic rock and high-grade gneiss. Geophysically, the Buffalo Head Domain is expressed as a "200-300 km wide, north-trending, elongate region of internally complex moderately positive aeromagnetic anomalies containing aeromagnetically negative septa (i.e. narrow lows) (Pana, 2003).

Geophysically, the Buffalo Head Domain is expressed as a 200-300 km wide, elongate region of internally complex, arcuate, "moderately positive aeromagnetic anomalies containing aeromagnetically negative septa" (i.e. narrow lows) (Pana, 2003).

Cinchaga Domain / Chinchaga Low

Comprised of metasedimentary and metaplutonic rock (porphyritic granite, monzonite gneiss, felsic gneiss) (2.17-2.08 Ga), the Cinchaga Domain is geophysically defined as a prominent, curvilinear, aeromagnetic low.

Ksituan Domain / Ksituan High

Ksituan Domain has been interpreted to be a magmatic arc (1.986-1.9 Ga) dominated by metaplutonic rocks (biotite-hornblende granite, granitic gneiss). Geophysically, the Ksituan High is a prominent, north-trending aeromagnetic high with variable width (130 km in south and 20 km in north).

Kiskatinaw Low

Comprised of granitic gneiss, the Kiskatinaw Low is a narrow aeromagnetic low that trends northerly and defines the boundary with the Nova domain.

Nova Domain

Mylonitic mafic gneiss (2.808 Ga) and meta-rhyolites or metasediment form the basement rock. Geophysically, the Nova Domain is expressed as a narrow region (10 km wide) of northeast-trending, positive aeromagnetic signature.

Great Bear Domain / Great Bear Arc

The Great Bear magmatic arc (1.885-1.840 Ga) is a 100 km wide area of volcanosedimentary sequences and plutonic rocks. The latter type of rock is granitic, ranging from unfoliated porphyritic synogranite to foliated mozogranite. The Great Bear Arc is thin (3-5 km) and lies unconformably on top of the Hottah Terrane, and has been interpreted to have resulted from the eastward subduction of oceanic lithosphere beneath the western margin of the Hottah Terrane. Geophysically, the Great Bear Arc is expressed as an aeromagnetically positive region.

Hottah Domain / Hottah Terrane

Hottah Terrane consists of magmatic arc and associated sedimentary rocks (paragneiss) (1.92-1.90 Ga) intruded by plutonic rock (biotite tonolite, granodiorite) (1.914-1.902 Ga). Its geophysical expression is as an aeromagnetically negative (low) region.

Fort Simpson Terrane / Fort Simpson High

Fort Simpson Terrane is a magmatic belt (1.845 Ga), geophysically expressed as a north-trending, strong, positive aeromagnetic anomaly.

Great Slave Lake Shear Zone

The GSLsz (1.9 Ga) is a crustal-scale transcurrent fault that accommodated up to 700 km of right-lateral displacement (Eaton et al., 2004). The shear zone is exposed as 25 km wide corridor of five belts of mylonitic rock. The geophysical aeromagnetic expression of the GSLsz is a northeast-trending corridor of striated positive and negative anomalies.

Snowbird Tectonic Zone

The 3000 km long STZ is traced from Hudson Bay, across exposed bedrock in northern Saskatchewan, forms the southern boundary of the Talston Domain in northern Alberta and continues into southern Alberta forming the southern boundary of the Thorsby Low, ending at the edge of the Cordillera deformation front. Consisting of Archean mylonitic rock, the STZ is geophysically expressed as a "composite belt of northeasterly-trending curvilinear aeromagnetic and gravity anomalies". The STZ has been interpreted as a shear zone in the exposed bedrock of the Precambrian Canadian Shield and the result of a converging plate boundary in southern Alberta beneath the WCSB (Ross et al., 1995; Ross, 2002; cited in Nieuwenhuis et al., 2014).

2. Zonal Earth resistivity models

The developed 1D models, as well as published sources of allocated values, are presented in Tables 1 to 10 summarize individual layer depths, thickness, and resistivity/conductivity for each 1D model.

Sources of Information

The dominant type of overburden and sedimentary rock were determined from generalized maps of Canadian surficial geology (Fulton, 1995) and descriptions from the 1994 *Geological Atlas of the Western Canada Sedimentary Basin*. Information about resistivity values for overburden specific to Alberta was found to be limited to recent airborne electromagnetic (EM) survey results (Slattery and Andriashek, 2012). The airborne EM results were assessed against resistivity values for similar overburden elsewhere in western Canada, and a resulting composite resistivity value was applied to overburden for Alberta. Resistivity for the WCSB was obtained from descriptions of past and recent MT transects.

Assembly of the resistivity values for crust and uppermost mantle relied on the results of two recent magnetotelluric (MT) surveys (Turkoglu et al., 2009; Nieuwenhuis et al., 2014) which also incorporated data from the Lithoprobe Alberta Basement Transect (ABT) undertaken in the mid-1990s (Boerner et al, 2000). A total of 320 MT soundings, as well as seismic recordings, were made during the ABT deployment. For southern Alberta (below 53 – 56 degrees north latitude), 2D and 3D resistivity models were prepared by Nieuwenhuis et al. (2014) using data from 67 MT soundings completed 2008-2010 and combined with data from some 300 MT stations previously collected during the ABT deployment. In northern Alberta (below 53 – 56 degrees), Turkoglu et al. (2009) completed 23 MT soundings during 2004-2006, combined it with data from some 80 ABT stations and prepared both 2D and 3D resistivity models.

Supplemental resistivity values for the central portion of Alberta, a gap between survey coverage by Nieuwenhuis et al, and Turkoglu et al., were obtained from Boerner et al. (2000). For the northern most part of Alberta, resistivity values for continuation of same terranes into Northwest Territories was obtained from Wu et al. (2002, 2005) who prepared 2D inversion models for the Lithoprobe SNORCLE transect Corridors 1 and 1a.

A two-step process was used to delineate areas (i.e. zones) occupied by the Earth models. First, continent-scale maps of lithospheric bulk-resistivity (at depths of 20, 40, 100 and 200 km), prepared by Jones et al. (2014, their figs. 8 and 11) were examined to identify gross differences that coincide with major tectonic domains (Figure 3) underlying Alberta.

Second, to construct the 1D model for tectonic domain(s) the resistivity values for crust and uppermost mantle were obtained from the results of two recent magnetotelluric (MT) surveys which also incorporated data from the Lithoprobe Alberta Basement Transect (ABT) undertaken in the mid-1990s (Figure 4). A total of 320 MT soundings, as well as seismic recordings, were made during the ABT deployment. In northern Alberta (north of 55 degrees north latitude) Turkoglu et al. (2009) completed 23 MT soundings during 2004-2006, combined it with data from some 80 ABT stations and prepared both 2D and 3D resistivity models. For southern Alberta, 2D and 3D resistivity models were prepared by Nieuwenhuis et al. (2014) and Nieuwenhuis (2011), using data from 67 MT soundings completed 2008-

2010 and combined with data from some 300 MT stations previously collected during the ABT deployment.

It is important to recognize that resistivity values assigned to the crust (Layers 3 to 5) could have been underestimated. Earlier MT interpretation by Boerner et al. (2000) and more recently in northern Alberta by Turkoglu et al. (2009) have on the MT inversion profiles a resistivity scale up to 1000 ohm.m. In contrast, newly done interpretation by Nieuwenhuis et al, (2014) has a resistivity scale up to 10,000 ohm.m but on the small-sized profiles the scale bar does not provide fine resolution between 1000 to 10,000 ohm.m.

General depths of the upper and middle crust were measured off the Lithoprobe's trans-Canada seismic transect for the Alberta section (Hammer et al., 2010). Within Alberta detailed depths to the crust / mantle boundary (Mohorovicic discontinuity) was obtained from an isopach map prepared by Bouzidi et al., (2002, Fig. 8). Additional seismic profiles, prepared by Clowes et al. (2002), Gorman et al. (2002), Hope and Eaton (2002), and Lemieux et al. (2002).

Depths and resistivity for the middle and lower divisions of the upper mantle, transition zones, and lower mantle – Layers 7 to 12 – between 100 and 1000 km were based on the North America regional conductivities determined by Kelbert et al. (2009).

Due to the presence of the Loverna Conductor, the uppermost mantle (~41~100 km) under the Archean crust (Loverna Block) in southern Alberta is substantially less resistive than the upper mantle immediately to the south (Medicine Hat Block) and to the north (Lacombe Domain, Rimbey Domain). In contrast, upper mantle resistivities below the Archean Rae/Hearne Domain in northern Manitoba and eastern Nunavut, and western Superior Province in Ontario have a range of 2500-8000 ohm.m.

Also, the presence of the Red Deer Conductor has reduced upper crust resistivity in the Lacombe Domain compared to adjacent terranes. As well, the Kiskatinaw Conductor has influenced, by lowering, crust and uppermost mantle resistivity.

3. References

Barker, A.A., Riddell, J.T.F., Slattery, S.R., Andriashek, L.D., Moktan, H., Wallace, S., Lyster, S., Jean, G., Huff, G.F., Stewart, S.A. and Lemay, T.G., 2011. "Edmonton–Calgary Corridor groundwater atlas," *Energy Resources Conservation Board*, ERCB/AGS Information Series 140, 90 p.
http://www.ags.gov.ab.ca/groundwater/ecc-atlas.html

Boerner, D.E., Kurtz, R.D., Craven, J.A., Ross, G.M. and Jones, F.W., 2000. "A synthesis of electromagnetic studies in the Lithoprobe Alberta Basement Transect: constraints on Paleoproterozoic indentation tectonics," *Canadian Journal of Earth Sciences*, v.37, 1509-1534
http://dx.doi.org/10.1139/E00-063

Bouzidi, Y., Schmitt, D.R., Burwash, R.A. and Kanasewich, E.R., 2002. "Depth migration of deep seismic reflection profiles: crustal thickness variations in Alberta," *Canadian Journal of Earth Sciences*, v.39, 331-350 http://dx.doi.org/10.1139/E01-080

Clowes, R.M., Burianyk, M.J.A, Gorman, A.R. and Ranasewich, E.R., 2002. "Crustal velocity structure from SAREX, the Southern Alberta Refraction Experiment," *Canadian Journal of Earth Sciences*, v.39, 351-373 http://dx.doi.org/10.1139/E01-070

Dobrin, M.H., and Savit, C.H., 1988. Introduction to geophysical prospecting, 4th ed; McGraw-Hill Company, New York, 867 p.

Eaton, D.W., Jones, A.G., and Ferguson, I.J., 2004. "Lithospheric anisotropy structure inferred from collocated teleseismic and magnetotelluric observations: Great Slave Lake shear zone, northern Canada," *Geophysical Research Letters*, v. 31, L19614, http://dx.doi.org/10.1029/2004GL020939

Eaton, D.W., Ross, G.M., Cook, F.A. and Van der Velden, A., 2000. "Seismic imaging of the upper mantle beneath the Rocky Mountain foreland, southwestern Alberta," *Canadian Journal of Earth Sciences*, v.37, 1493-1507 http://dx.doi.org/10.1139/E00-068

Fenton, M.M., Schreiner, B.T., Nielsen, E., and Pawlowicz, J.G., 1994. "Chapter 26 – Quaternary geology of the Western Plains," in *Geological Atlas of the Western Canada Sedimentary Basin*, G.D. Mossop and I. Shetsen (comp.), Canadian Society of Petroleum Geologists and Alberta Research Council, http://www.ags.gov.ab.ca/publications/wcsb_atlas/atlas.html

Ferguson, I. J., and Odwar, H.D., 1997. Review of conductivity soundings in Canada. Appendix 3, v.3; *in* Geomagnetically induced currents: Geomagnetic Hazard Assessment Phase II, Final Report, (contributing authors) D.H. Boteler, S. Boutilier, D. Swatek, Q. Bui-Van, R. Leonard, B. Hughes, L. Hajagos, I.J. Ferguson, and H.D. Odwar, Geological Survey of Canada and Canadian Electricity Association, 357 T 848A, p.A3-1-A3-121.

Fulton, R.J., 1995. "Surficial materials of Canada," *Geological Survey of Canada*, 'A" Series Map 1800A, 1 sheet, scale 1:5000000 http://dx.doi.org/10.4095/205040
Alternative on-line source: Atlas of Canada,
http://atlas.gc.ca/data/english/maps/geology/surficial_materials_map.pdf

Gorman, A.R., Clowes, R.M., Ellis, R.M., Henstock, T.J., Spence, G.D., Keller, R., Lebvander, A., Snelson, C.M., Burianyk, M.J.A., Kanasewich, E.R., Asudeh, I., Hajnal Z. and Miller, K.C., 2002. "Deep Probe: imaging the roots of western North America," *Canadian Journal of Earth Sciences*, v.39, 375-398 http://dx.doi.org/10.1139/E01-064

Gowan, E. J., Ferguson, I. J., Jones, A. G., and Craven, J. A., 2009. "Geoelectric structure of the Northeastern Williston basin and underlying Precambrian lithosphere," *Canadian Journal of Earth Science*, 46, no. 6, 46, 441-464. http://dx.doi.org/10.1139/E09-028.

Hammer, P.T.C., Clowes, R.M., Cook, F.A., Vasudevan, K. and van der Velden, A.J., 2011. "A lithospheric cross section of the North American continent," supplement to *GSA Today,* v.21, issue 6 ftp://rock.geosociety.org/pub/GSAToday/1106insert-hammer/G95A_Hammer_Insert_HighRes.pdf

Hope, J. and Eaton, D., 2002. "Crustal structure beneath the Western Canada Sedimentary Basin: constraints from gravity and magnetic modeling," *Canadian Journal of Earth Sciences*, v.39, 291-312 http://dx.doi.org/10.1139/E01-060

Jones, A.G., Ledo, J. Ferguson, I.J., Craven, J.A., Unsworth, M.J., Chouteau, M. and Spratt, J.E., 2014. " The electrical resistivity of Canada's lithosphere and correlation with other parameters: contributions from Lithoprobe and other programmes", *Canadian Journal of Earth Sciences*, v.51, 573-617 http://dx.doi.rog/10.1139/cjec-2013-0151

Jones, A.G., 1992. Electrical conductivity of the continental lower crust, in Chapter 3, Continental Lower Crust, Developments in Geotectonics 23, Elsevier, (ed.) D.M. fountain, R. Arculus, and R.W. Kay, p.81-143.

Kelbert, A., Schultz, A. and Egbert, G., 2009. "Global electromagnetic induction constraints on transition-zone water content variations," *Nature*, v.460, no.20, August 2009, 1003-1006. <http://dx.doi.org/10.1038/nature08257>

Lemieux, S., Ross, G.M. and Cook, F.A., 2000. "Crustal geometry and tectonic evolution of the Archean crystalline basement beneath the southern Alberta Plains, from new seismic reflection and potential-field studies," *Canadian Journal of Earth Sciences*, v.37, 1473-1491 http://dx.doi.org/10.1139/E00-URL

Mackay, D.K., 1979. Electrical resistivity measurements in frozen ground, Mackenzie Delta area, Northwest Territories, in Hydrology of Deltas, Proceeding of the Bucharest Symposium, Vol.2, p.363-375.

Mussett, A.E., and Khan, M.A., 2000. Looking into the Earth; An Introduction to Geological Geophysics, Cambridge Univ. Press, Cambridge, UK, 470 pp.

Nieuwenhuis, G., 2011. "Magnetotelluric Imaging of Precambrian Lithosphere Beneath Southern Alberta," Thesis, M.Sc in Geophysics, Department of Physics, Faculty of Graduate Studies and Research, *University of Alberta*, Edmonton, Alberta, 138p. www.ualberta.ca/~unsworth/theses/Nieuwenhuis-MSc-thesis-2011.pdf

Nieuwenhuis, G., Unsworth, M.J., Pana, D., Craven, J. and Bertrand, E., 2014. "Three-dimensional resistivity structure of Southern Alberta, Canada: implications for Precambrian tectonics," Geophysical Journal International Advanced Access published March 22, 2014, http://dx.doi.org/10.1093/gji/ggu068

NRcan, 2012a. "Geological Provinces Map," on-line Atlas of Canada, *Natural Resources of Canada* [retrieved December, 2012] http://atlas.nrcan.gc.ca/site/english/maps/environment/geology/geologicalprovinces

NRcan, 2012b. "Major Rock Categories Map," on-line Atlas of Canada, Natural Resources of Canada, [retrieved December, 2012] http://atlas.nrcan.gc.ca/site/english/maps/environment/geology/majorrockcategories

Oldenborger, G A; Pugin, A J -M; Hinton, M J; Pullen, S E; Russell, H A J; Sharpe, D R Geological Survey of Canada, Current Research (Online) no. 2010-11, 2010; 16 pages, doi:10.4095/286056

Pana, D.I., 2003. "Precambrian basement of the Western Canada Sedimentary Basin in northern Alberta", *Alberta Energy and Utilities Board*, EUB/AGS Earth Sciences Report 2002-02, 32p. www.ags.gov.ab.ca/publications/ESR/PDF/ESR_2002_02.PDF

Palacky, G.J., 1988. "Resistivity characteristics of geologic targets" in *Electromagnetic Methods in Applied Geophysics-Theory*, Vol.1, M.N. Nabighian (ed.); Society of Exploration Geophysicists, 53-130.

Palacky, G.J., 1992. Helicopter geophysical surveys at the Val Gagne test site, District of Cochrane, Ontario, *Geological Survey of Canada*, Open File Report 2503, 14 p. ftp://ftp2.cits.rncan.gc.ca/pub/geott/ess_pubs/133/133370/of_2503.pdf.

Parkhomenko, E. I. & Keller, G.V., 1967 Electrical Properties of Rocks*, translated from Russian and edited by George V. Keller* Plenum Press, New York.

Plover, P.W.J., 1996. Graphite and electrical conductivity in the lower continental crust: a review, Phy. Chem. Eunh, v.21, no.4, p.279-287.

Ross, G.M., Broome, J. and Miles, W., 1994. "Chapter 4 – Potential fields and basement structure - Western Canada Sedimentary Basin," in *Geological Atlas of the Western Canada Sedimentary Basin*, G.D. Mossop and I. Shetsen (comp.), Canadian Society of Petroleum Geologists and Alberta Research Council, <http://www.ags.gov.ab.ca/publications/wcsb_atlas/atlas.html>

Ross, G.M., 2002. "Evolution of Precambrian continental lithosphere in Western Canada: results from Lithoprobe studies in Alberta and beyond," *Canadian Journal of Earth Sciences*, v.39, 413-437 http://dx.doi.org/10.1139/E02-012

Sheriff, R.E., 2002. Encyclopedic dictionary of applied geophysics, 4th ed, Society of Exploration Geophysics, 429 pp.

Slattery, S.R. and Andriashek, L.D., 2012. "Overview of airborne-electromagnetic and –magnetic geophysical data collection and interpretation in the Edmonton–Calgary Corridor, Alberta," *Energy Resources Conservation Board*, ERCB/AGS Open File Report 2012-13, 218 p. <http://www.ags.gov.ab.ca/publications/abstracts/OFR_2012_13.html

Turkoglu, E., Unsworth, M.J. and Pana, D., 2007. "Deep electrical structure of Buffalo Head Hills, northern Alberta; implications for diamond exploration," *Alberta Energy and Utilities Board*, EUB/AGS Special Report 88, 34 p.
www.ags.gov.**ab**.ca/publications/SPE/PDF/SPE_088.pdf

Turkoglu, E., Unsworth, M. and Pana, D., 2009. "Deep electrical structure of northern Alberta (Canada): implications for diamond exploration," *Canadian Journal of Earth Sciences*, v.46, 139-154 http://dx.doi.org/10.1139/E09-009

Villeneuve, M.E., Ross, G.M., Theriault, R.J., Miles, W., Parrish, R.R., and Brome, J., 1993. "Tectonic subdivision and U-Pb geochronology of the crystalline basement of the Albert Basin, western Canada," *Geological Survey of Canada*, Bulletin 447, 86p. http://ftp2.cits.rncan.gc.ca/pub/geott/ess_pubs/77/77642/bu_447.pdf

Welford, J.K., Clowes, R.M., Ellis, R. M., Spence, G.D., Asudeh, I. and Zoltan, H., 2001. "Lithospheric structure across the craton–Cordilleran transition of northeastern British Columbia," *Canadian Journal of Earth Sciences*, v. 38, 1169-1189, DOI: 10.1139/cjes-38-9-1169

Wright, G.N., NcNechan, M.E. and Potter, D.E.G., 1994. "Chapter 3 – Structure and architecture of the Western Canada Sedimentary Basin," in *Geological Atlas of the Western Canada Sedimentary Basin*, G.D. Mossop and I. Shetsen (comp.), Canadian Society of Petroleum Geologists and Alberta Research Council, <http://www.ags.gov.ab.ca/publications/wcsb_atlas/atlas.html>

Wu, X., Ferguson, I.J., and Jones, A.G., 2002. "magnetotelluric response and geoelectric structure of the Great Slave lake shear zone," *Earth and Planetary Science Letters*, v.196, 35-50

Wu. X., Ferguson, I. J., and Jones, A.G., 2005. "Geoelectric structure of the Proterozoic Wopmay Orogen and adjacent terranes, Northwest Territories, Canada," *Canadian Journal of Earth Sciences*, v. 42, 955-981, http://dx.doi.org/10.1139/E05-042

Xiao, W. and Unsworth, M., 2006. "Structural imaging in the rocky Mountain Foothills (Alberta) using magnetotelluric exploration," *AAPG Bulletin*, v.90, no.3, March 2006, 321-333. DOI:10.1306/10150504140

Zelt, C.A., 1989. "Seismic structure of the crust and upper mantle in the Peace River Arch Region," Phd thesis, Department of Geophysics and Astronomy, *University of British Columbia*, 223 p.

Table 1
1D Earth Resistivity Model for Alberta Zone 1 (Medicine Hat Block)

Layer	Depth Confidence	Thickness	Resistivity (ohm-m) Confidence	Conductivity (S/m) Confidence	Comments
1. Overburden	0 – 75 m [1] [II]	75 m	30 [5, 3, 32, 6, 33] [III]	0.03333 [24]	Till is predominant, mostly as thicker blanket [4]. Large patchy areas of fine-grained (clay, silt) glaciolacustrine deposits and smaller areas with coarse-grained (silt, sand, gravel) glaciolacustrine deposits commonly along / nearby rivers [4]. Overburden typically <50m with areas 50-100 m thick, up to 150 m thick in Medicine Hat area [1]. Assigned midpoint thickness of 75 m. Airborne resistivity survey profiles over central Alberta indicate ~20 ohm.m, plan view maps show 10-20 ohm.m at 20m depth [5]. Borehole logs of Manitoba overburden show 40-50 ohm.m for till and 70-200 ohm.m for sand and gravel [3]. Resistivities for tills range 20-100 ohm.m [32]. MT survey in SE Manitoba indicates 5-30 ohm for mix of till, clay, silt and sand [6]. Glaciolacustrine clays average 30 ohm.m in northeastern Ontario [33] Assigned midpoint of resistivity range 10-50 ohm.m for tills.

Table 1 (continued)
1D Earth Resistivity Model for Alberta Zone 1 (Medicine Hat Block)

Layer	Depth Confidence	Thickness	Resistivity (ohm-m) Confidence	Conductivity (S/m) Confidence	Comments
2. Sedimentary Basin	< 3 km [7] [II]	2.2 km	30 [12b] [I]	0.03333 [24]	*WCSB*: Upper strata consist of Mesozoic sandstone, siltstone and shale. Lower strata consist of Paleozoic carbonate and subordinate shale [11] WCSB of Interior Platform mainly ranges 2000-2400m thick, increasing to 3000m at western end of MHB alongside the Rocky Mountain foothills, shallows to 2000 m at Cdn/USA border [7] Assign prevailing average thickness MT 3D inversion model indicates 5-10 ohm.m range over entire thickness of WCSB [12a] 0.6-0.8 km depth resistivity map [12b] shows range 3-25 ohm.m. Chose 15 ohm.m weighted average ((3 x 0.5)+(25 x 0.5)) 1.8-2.1 km depth resistivity map [12b] shows range 10-100 ohm.m. Selected approx. 40 ohm.m weighted average based on area occupied by dominant value ((10 x 0.20)+(50 x 0.80)) Assign 30 ohm.m, midpoint value of weighted averages (15, 40 ohm.m)
3. Upper Crust	2.2 - 15 km [14, 15] [I , II]	13 km	385 [12c, d] [I]	0.00259 [24]	*Medicine Hat Block*: plutonic (granitic) and gneissic rock [12h] Lower depth scaled from trans-continental seismic transect compilation (11-12 km) across southern Alberta [13] and seismic profiles; 20 km [15], 15 km [14] Assign averaged lower depth (11, 20, 15 km) MT 3D inversion profile slices show predominately 400 ohm.m [12c]; profile shows range 100-600 ohm.m, midpoint 350 ohm. [12d] Assign 385 ohm.m, average of values (400, 350 ohm.m). Limits 350, 400 ohm.m

Table 1 (continued)
1D Earth Resistivity Model for Alberta Zone 1 (Medicine Hat Block)

Layer	Depth / Confidence	Thickness	Resistivity (ohm-m) / Confidence	Conductivity (S/m) / Confidence	Comments
4. Middle Crust	15 – 27.5 km [16, 15, 14] / [I]	12.5 km	2500 [12b, d] / [I]	0.0004 [24]	Thickness scaled from seismic profiles across southern Alberta; 18 km [16], 12.8 km [15], 6.9 km [14] Assign 12.5 km, averaged thickness MT profiles show average of 2000 ohm becoming 3000 ohm.m approaching northern margin of MHB. [12d] 17-20 km depth resistivity map ranges 500-3000 ohm.m predominately at higher end of range [12b] Assigned 2500 ohm.m to reflect slightly more conductive nature than underlying layers [12b]. Limits 500, 3000 ohm.m
5. Lower Crust	27.5 – 45 km [18a] / [I]	17.5 km	2250 [12d] / [I]	0.00044 [24]	Lower depth, to Moho, averaged from seismic depth determinations and scaled off seismic profiles Moho depth contour map shows typical range 43-49, thickening westward to Cordillera mountains at BC/Alberta boundary, thins to 37 km beneath Medicine Hat city; Moho ranges 47-50 km on seismic profile [19c]; range 47-60 km, average 54 km, on seismic profile [15] Assign 45 km determined from seismic picks [18a] MT profiles show an upper range >3000 ohm.m [12c]; range 1000-4000 ohm.m, becoming more resistive approaching northern margin of MHB [12d] 20.6 km depth resistivity map shows dominantly >3000 ohm.m [12b] Assign 2500 ohm.m midpoint of range. Limits 1000, 4000 ohm.m

Table 1 (continued)

1D Earth Resistivity Model for Alberta Zone 1 (Medicine Hat Block)

Layer	Depth / Confidence	Thickness	Resistivity (ohm-m) / Confidence	Conductivity (S/m) / Confidence	Comments
6. Upper Mantle	45 - 100 km [23] [III]	55 km	2250 [12d] [I]	0.00044 [24]	Used generalized lower depth [23]. MT profiles show: * range 500 >3000 ohm.m with decreasing resistivity going SW direction [12d]. Chose >2000 to reflect more dominant higher resistivity * range 1000-4000, more resistive approaching northern margin of MHB [12d]. Chose average 2500 ohm.m 48-57 km depth resistivity map shows dominantly >3000 ohm.m [12b] 63-74 km depth resistivity map shows dominantly>3000 ohm.m [12b] Assign 2250 ohm.m average of above selected values (2000, 2500 ohm.m). Limits 500, 4000 ohm.m
7. Upper Mantle	100 - 250 km [23] [III]	150 km	100-130km 1550 [12c] [I] 130-250km 275 [12c] [I]	100-200km 0.00064 [24] 200-250km 0.00363 [24]	Used generalized lower depth [23]. MT profiles [12c] show distinct resistivity change at 130 km depth MT 3D [12c] profiles show: * 100-130 km depth, range 500-3000 ohm.m. Chose midpoint 1700 ohm.m * 130-250 km depth, range 200-400 ohm.m, dominantly 300 ohm.m * Select approx. 600 ohm.m weighted average ((1700 x 0.2)+(300 x 0.8)) based on percentage of depth occupied by dominant resistivity value

Table 1 (continued)
1D Earth Resistivity Model for Alberta Zone 1 (Medicine Hat Block)

Layer	Depth Confidence	Thickness	Resistivity (ohm-m) Confidence	Conductivity (S/m) Confidence	Comments
7. Upper Mantle - continued			100-250 km 550 [12c] [I]	100-250 km 0.00181 [24]	MT 2D profiles [12b] show: * 100-130 km depth, range 800-2000 ohm.m. Chose midpoint 1400 ohm.m * 130-250 km depth, range 80-400 ohm.m, dominantly 250 ohm.m * Select 475 ohm.m weighted average ((1400 x 0.2)+(250 x 0.8)) based on percentage of depth occupied by dominant resistivity value Assign: * 100-130 km depth, 1550 ohm.m, average of midpoints (1700, 1400 ohm.m) * 130-250 km depth, 275 ohm.m, average of values (300, 250 ohm.m) * 100-250 km depth, 550 ohm.m, average of weighted averages (600, 475 ohm.m). Limits 250, 1700 ohm.m
8. Upper Mantle	250–410 km [23] [III]	160 km	40 [35b, 12f] [I]	0.025 [24]	Used generalized lower depth [23]. MT 2Dprofiles show 10 ohm.m between 225-300 km depth [35b]; and an averaged resistivity of 75 ohm.m for southern Alberta [12f] Assign 40 ohm.m, average of values (10, 75 ohm.m). Limits 5, 75 ohm.m.
9. Transition Zone	410–520 km [23] [III]	110 km	8 [25]	0.1258 [23] [III]	Utilized Canada regional model [23], based on Ottawa magnetic observatory data, situated on Archean crust (early Precambrian time), for all depths and resistivities below 250 km For southern Alberta averaged resistivity 50 ohm.m over entire 3D model [12g] ranges 410-500 ohm.m. Hence, an alternative resistivity for layer 9 is 50 ohm.m

Table 1 (continued)
1D Earth Resistivity Model for Alberta Zone 1 (Medicine Hat Block)

Layer	Depth / Confidence	Thickness	Resistivity (ohm-m) / Confidence	Conductivity (S/m) / Confidence	Comments
10. Transition Zone	520–670 km [23]	150 km	2.4 [25]	0.4168 [23]	Assign Canada regional model
	[III]			[III]	
11. Lower Mantle	670–900 km [23]	230 km	0.89 [25]	1.1220 [23]	Assign Canada regional model. Upper limit 15 ohm.m 620-780 km depth resistivity map [12c] shows east half of MHB is 3 ohm.m and west half is 30 ohm.m Hence, alternative resistivity is 15 ohm.m, midpoint of range (3-30) ohm.m) for Layer 11. Upper limits 3 or 30 ohm.m
	[III]			[III]	
12. Lower Mantle	900–1000 km [23]	100 km	0.47 [25]	2.0892 [23]	Assign Canada regional model
	[III]			[III]	

See end of Table 10 for abbreviations and notes

Table 2
1D Earth Resistivity Model for Alberta Zone 2 (Vulcan Structure)

Layer	Depth Confidence	Thickness	Resistivity (ohm-m) Confidence	Conductivity (S/m) Confidence	Comments
1. Overburden	0 – 50 m [1] [II]	50 m	30 [5, 3, 32, 6, 33] [III]	0.03333 [24]	Till is predominant, mostly as thicker blanket [4]. Large patchy areas of fine-grained (clay, silt) glaciolacustrine deposits and smaller areas with coarse-grained (silt, sand, gravel) glaciolacustrine deposits commonly along / nearby rivers [4] Overburden typically <50m, minor areas 50-100 m, localized 100-150 m thick at west end of zone in vicinity of Ft. McLeod[1] Assigned midpoint thickness of 50 m Airborne resistivity survey profiles over central Alberta indicate ~20 ohm.m, plan view maps show 10-20 ohm.m at 20m depth [5]. Borehole logs of Manitoba overburden show 40-50 ohm.m for till and 70-200 ohm.m for sand and gravel [3]. Resistivities for tills range 20-100 ohm.m [32]. MT survey in SE Manitoba indicates 5-30 ohm for mix of till, clay, silt and sand [6]. Glaciolacustrine clays average 30 ohm.m in northeastern Ontario [33]. Assigned 30 ohm.m midpoint of resistivity range 10-50 ohm.m for tills

Table 2 (continued)
1D Earth Resistivity Model for Alberta Zone 2 (Vulcan Structure)

Layer	Depth Confidence	Thickness	Resistivity (ohm-m) Confidence	Conductivity (S/m) Confidence	Comments
2. Sedimentary Basin	0 – 2.4 km [7] [II]	2.4 km	20 [12b,c] [I]	0.05 [24]	*WCSB*: Upper strata consist of Mesozoic sandstone, siltstone and shale. Lower strata consist of Paleozoic carbonate and subordinate shale [11] WCSB of Interior Platform mainly ranges 2200-2400m thick, ranging 2400-4300 in foothills approaching the Cordillera deformation front [7] Assign average 2400m, covering majority of populated area MT 3D inversion model indicates 5-10 ohm.m range over entire thickness of WCSB [12a] 0.6-0.8 km depth resistivity map [12b] shows predominately 3 ohm.m with narrow band of increasing resistivity, from 30 to 3000 ohm.m, where foothills meet Cordillera 1.8-2.1 km depth resistivity map shows range 10-200 ohm.m, predominantly 50 ohm.m, with 10 ohm.m localized along west edge of VS where Cordillera mountains begin [12c] Assign 25 ohm.m, based on average of predominant values (3, 50 ohm.m). Limits 3, 200 ohm.m. Conceivably overall resistivity for entire thickness could be 7 ohm.m, on basis of 5-10 ohm.m range stated by [12a]
3. Upper Crust	2.4 - 24 km [16, 15, 14] [I]	21.6 km	3000 [12c, d] [I]	0.00033 [24]	Lower depth scaled from seismic profiles; maximum 26.5 km [16]; maximum 24 km [15]; 18-22 km [14] Assign 24 km, averaged lower depth maximums (26.5, 24, 22 km) MT 3D inversion profile slices show upper range possibly 3000 ohm.m [12c] MT profile shows range of 500-3000 ohm.m with resistivity increasing with depth [12d] 17-20 km depth resistivity map shows predominance of approx 3000 ohm.m [12b] Assign 3000 ohm.m. Lower limit 500 ohm.m

Table 2 (continued)
1D Earth Resistivity Model for Alberta Zone 2 (Vulcan Structure)

Layer	Depth / Confidence	Thickness	Resistivity (ohm-m) / Confidence	Conductivity (S/m) / Confidence	Comments
4. Middle Crust	24 – 37 km [15, 14] [I]	13 km	2000 [12c, d] [I]	0.0005 [24]	Thickness scaled from seismic profiles across southern Alberta; 14 km [15], 10.5 km [14], 13 km averaged 33-37 km depth resistivity map shows range 300-3000 ohm.m, with a 300-400 ohm.m band subparallel to northern margin and west flank of VS and 3000 ohm.m along central-south margin and east flank of VS [12c,d] Assigned 2000 ohm.m weighted average based on areal distribution of dominant resistivity value ((3000 x 0.6) + (300 x 0.4)). Limits 300, 3000 ohm.m
5. Lower Crust	37 – 45 km [18a] [I]	8 km	4000 [12b] [I]	0.00025 [24]	Moho depth contour map shows typical range 43-47, thickening westward to Cordillera mountains at BC/Alberta boundary, deepest NW of Medicine Hat city; average 44 km on seismic profile [19c]; 47 km on seismic profile [15] Assign 45 km, average determined from seismic picks [18a] MT profiles show an upper range >3000 ohm.m [12c]; range 3000-5000, more resistive approaching northern margin of MHB [12d] 33-37 km depth resistivity map shows range 300 to >3000 ohm.m. [12b], diminishing resistivity along northern boundary of VS Assign 40000 ohm.m, midpoint of range. Limits 3000, 5000 ohm.m

Table 2 (continued)
1D Earth Resistivity Model for Alberta Zone 2 (Vulcan Structure)

Layer	Depth Confidence	Thickness	Resistivity (ohm-m) Confidence	Conductivity (S/m) Confidence	Comments
6. Upper Mantle	45 - 100 km [23] [III]	55 km	2000 [12b, d] [I]	0.0005 [24]	Used generalized lower depth [23]. MT profiles show predominately 3000 ohm.m with northern margin having much lower resistivity of 300-400 ohm.m [12d]. Chose 2600 ohm.m weighted average based on areal distribution of dominant / midpoint resistivity values ((3000 x 0.85)+(350 x 0.15}) 48-57 km and 63-74 km depth resistivity maps shows show range 300-3000 ohm.m with low resistivity along north margin and west flank of VS and higher resistivity (3000 ohm,m) along part central-south margin and east flank [12b]. Overall lowering of resistivity. Chose approx. 1400 ohm.m weighted average based on areal distribution ((3000 x 0.40)+(300 x 0.60)) Assign 2000 ohm.m ohm.m, midpoint of weighted averages (2600, 1400 ohm.m). Limits 300, 3000 ohm.m
7. Upper Mantle	100 - 250 km [23] [III]	150 km	100-130km 700 [12c, d] [I] 130-250km 300 [12c, d] [I] 100-250 km 260 [12c, d] [I]	100-200km 0.00142 [24] 200-250km 0.00333 [24] 100-250 km 0.00384 [24]	Used generalized lower depth [23]. MT profiles [12d] show distinct resistivity change at 130 km depth MT 3D averaged profile [12g] shows 225 ohm.m average resistivity MT profiles [12c, d] show: * 100-130 km depth, averaging 700 ohm.m * 130-250 km depth, range 80-300 ohm.m, * chose 300 ohm.m weighted average ((700 x 0.2) + (200 x 0.8)) Assign approx. 260 ohm.m, average of resistivity values (225, 300 ohm.m). Limits 80, 700 ohm.m

Table 2 (continued)
1D Earth Resistivity Model for Alberta Zone 2 (Vulcan Structure)

Layer	Depth / Confidence	Thickness	Resistivity (ohm-m) / Confidence	Conductivity (S/m) / Confidence	Comments
8. Upper Mantle	250–410 km [23] [III]	160 km	70 [35b, 12g] [I]	0.01428 [24]	Used generalized lower depth [23]. MT profiles shows; range 50-80 ohm.m, chose midpoint 65 ohm.m, between 225-300 km depth [35b], and averaged resistivity of 75 ohm.m for southern Alberta [12g] Assign 70 ohm.m, average of values (65, 75 ohm.m). Limits 50, 80 ohm.m.
9. Transition Zone	410–520 km [23] [III]	110 km	8 [25]	0.1258 [23] [III]	Utilized Canada regional model [23], based on Ottawa magnetic observatory data, situated on Archean crust (early Precambrian time), for all depths and resistivities below 410 km For southern Alberta averaged resistivity 50 ohm.m over entire 3D model [12g] ranges 410-500 ohm.m. Hence, an alternative resistivity for layer 9 is 50 ohm.m
10. Transition Zone	520–670 km [23] [III]	150 km	2.4 [25]	0.4168 [23] [III]	Assign Canada regional model
11. Lower Mantle	670–900 km [23] [III]	230 km	0.89 [25]	1.1220 [23] [III]	Assign Canada regional model. Upper limit 3 ohm.m 620-780 km depth resistivity map [12c] shows dominantly 3 ohm.m except at western margin (near Cordillera) where resistivity increases to 20, 300 and 3000 ohm.m Hence, alternative resistivity approx 2 ohm.m, average of values (3, 0.89 ohm.m) for Layer 11
12. Lower Mantle	900–1000 km [23] [III]	100 km	0.47 [25]	2.0892 [23] [III]	Assign Canada regional model

See end of Table 10 for abbreviations and note

Table 3
1D Earth Resistivity Model for Alberta Zone 3 (Loverna Block)

Layer	Depth / Confidence	Thickness	Resistivity (ohm-m) / Confidence	Conductivity (S/m) / Confidence	Comments
1. Overburden	0 – 40 m [1] [II]	40 m	30 [5, 3, 32, 6, 33] [III]	0.03333 [24]	Till is predominant, mostly as thicker blanket [4]. Large patchy areas of fine-grained (clay, silt) glaciolacustrine deposits and smaller areas with coarse-grained (silt, sand, gravel) glaciolacustrine deposits commonly along / nearby rivers [4] Overburden typically <50m [1] overall, western half of zone typically < 35 m [2], <20m beneath Calgary, 50-100 m thick in the Brooks – Empress area[1] Assign midpoint depth of range 35-50m Airborne resistivity survey profiles over central Alberta indicate ~20 ohm.m, plan view maps show 10-20 ohm.m at 20m depth [5]. Borehole logs of Manitoba overburden show 40-50 ohm.m for till and 70-200 ohm.m for sand and gravel [3]. Resistivities for tills range 20-100 ohm.m [32]. MT survey in SE Manitoba indicates 5-30 ohm for mix of till, clay, silt and sand [6]. Glaciolacustrine clays average 30 ohm.m in northeastern Ontario [33] Assigned midpoint of resistivity range 10-50 ohm.m for tills. Limits 10, 100 ohm.m

Table 3 (continued)
1D Earth Resistivity Model for Alberta Zone 3 (Loverna Block)

Layer	Depth Confidence	Thickness	Resistivity (ohm-m) Confidence	Conductivity (S/m) Confidence	Comments
2. Sedimentary Basin	0 – 2.9 km [7] [II]	2.9 km	6 [12b] [I]	0.16666 [24]	*WCSB*: Upper strata consist of Mesozoic sandstone, siltstone and shale. Lower strata consist of Paleozoic carbonate and subordinate shale [11] WCSB of Interior Platform ranges 1800-4000 m thick, maximum in foothills, 3500 m at Calgary [7] Assign 2900m average thickness MT 3D inversion model indicates 5-10 ohm.m range over entire thickness of WCSB [12a] 0.6-0.8 km depth resistivity map [12b] shows predominately 3 ohm.m with narrow band of increasing resistivity, from 20 to 3000 ohm.m, where foothills meet Cordillera mountain range 1.8-2.1 km depth resistivity map [12b] shows range 3-100 ohm.m, predominantly 10 ohm.m Assign 6 ohm.m average of dominant values (3, 10 ohm.m). Limits 3, 100 ohm.m
3. Upper Crust	2.9 - 19 km [15, 14] [I]	16 km	2000 [12b] [I]	0.0005 [24]	*Loverna Block*: granite and granitic gneiss Lower depth scaled from seismic profiles across southern Alberta; 18 km [15], 20 km [14] Assign averaged lower depth MT profile shows range of 80-3000 ohm.m, predominantly 3000 ohm.m [12d] 17-20 km depth resistivity map [12b] shows predominance of approx. 3000 ohm.m, except narrow zone 3-300 ohm.m (midpoint 150 ohm.m) coincident with trend of RDC, core of conductive anomaly is 3 ohm.m Assigned approx. 2000 ohm.m, weighted average based on area occupied by dominant / midpoint values ((3000*0.66)+(150*0.34)). Limits 3, 3000 ohm.m

Table 3 (continued)
1D Earth Resistivity Model for Alberta Zone 3 (Loverna Block)

Layer	Depth Confidence	Thickness	Resistivity (ohm-m) Confidence	Conductivity (S/m) Confidence	Comments
4. Middle Crust	19 – 29 km [15, 14] [I]	10 km	3000 [12d] [I]	0.00033 [24]	Thickness scaled from seismic profiles across southern Alberta; 11.4 km [15], 8.6 km [14]. Lower depth scaled from seismic profile; 30 km [19a] Assign 10 km, averaged thickness MT profile shows predominantly 3000 ohm.m [12d], assigned. Limits 300, 3000 ohm.m
5. Lower Crust	29 – 41 km [18b] [I]	12 km	620 [12b] [I]	0.00161 [24]	Lower depth, to Moho, from seismic depth determinations [18a, b] and scaled off seismic profiles Moho depth contour map [18b] shows range 37-45, deepening westward to Cordillera mountains at BC/Alberta boundary. Seismic profiles show lower depth range 37-46 km, average 41 km [15]; average thickness 12.8 km [14] Assign 41 km, midpoint of range depicted on depth contour map MT profiles show predominant range 25-300 ohm.m, flanked by 3000 ohm.m [12d] 33-37 km depth resistivity map shows range of 3-3000 ohm.m, east and central areas occupied by LC anomaly 3-100 ohm.m (50 ohm.m midpoint), with 3 ohm.m core of LC occupying 40% of Loverna Block [12b] Assign 620 ohm.m, weighted average based on area occupied by dominant / midpoint values ((3000 x 0.2) + (50 x 0.4) + (3 x 0.4)). Limits 3, 3000 ohm.m.

Table 3 (continued)
1D Earth Resistivity Model for Alberta Zone 3 (Loverna Block)

Layer	Depth / Confidence	Thickness	Resistivity (ohm-m) / Confidence	Conductivity (S/m) / Confidence	Comments
6. Upper Mantle	41 - 100 km [23] / [III]	59 km	150 [12f] / [I]	0.00666 [24]	Used generalized lower depth [23]. MT profile shows predominant range of 25-125 ohm.m [12d] MT resistivity-depth curve [12f] shows range 35-260 ohm.m, averaging 150 ohm.m, between depth 40-100 km beneath LB 48-57 km and 63-74 km depth resistivity maps show range of 3-500 ohm.m overall (250 ohm.m midpoint), east and central areas occupied by LC anomaly 3-300 ohm.m, with 3 ohm.m core of LC occupying 30% of LB, and up to 30 ohm.m occupying 50% of LB [12b] Assign 150 ohm.m, based on average resistivity from resistivity depth curve. Limits 3, 500 ohm.m
7. Upper Mantle	100 - 250 km [23] / [III]	150 km	230 [12d, f] [I]	0.00434 [24]	Used generalized lower depth [23] MT profiles show range 80-400, dominantly 100 ohm.m [12d] MT resistivity-depth curve [12f] shows average 360 ohm.m, between 100-150 km depth beneath LB Assign 230 ohm.m midpoint of resistivity values (100, 360 ohm.m). Limits 100, 360 ohm.m
8. Upper Mantle	250–410 km [23] / [III]	160 km	90 [35b, 12g] / [I]	0.01111 [24]	Used generalized lower depth [23]. MT profile shows range 20-200 ohm.m (110 ohm.m midpoint) between 225-300 km depth [35b]; and an averaged resistivity of 75 ohm.m for southern Alberta [12g] Assign approx. 90 ohm.m, average of values (110, 75 ohm.m). Limits 20, 200 ohm.m.

Table 3 (continued)
1D Earth Resistivity Model for Alberta Zone 3 (Loverna Block)

Layer	Depth Confidence	Thickness	Resistivity (ohm-m) Confidence	Conductivity (S/m) Confidence	Comments
9. Transition Zone	410–520 km [23] [III]	110 km	8 [25]	0.1258 [23] [III]	Utilized Canada regional model [23], based on Ottawa magnetic observatory data, situated on Archean crust (early Precambrian time), for all depths and resistivities below 410 km For southern Alberta, between 410-500 km, averaged resistivity is 50 ohm.m over entire 3D model [12g]. Hence, an alternative resistivity for Layer 9 is 50 ohm.m
10. Transition Zone	520–670 km [23] [III]	150 km	2.4 [25]	0.4168 [23] [III]	Assign Canada regional model
11. Lower Mantle	670–900 km [23] [III]	L230 km	0.89 [25]	1.1220 [23] [III]	Assign Canada regional model. Upper limit 3 ohm.m 620-780 km depth resistivity map [12c] shows dominantly 3 ohm.m except at western margin (near Cordillera) where resistivity increases to 20, 300 and 3000 ohm.m Hence, alternative resistivity approx 2 ohm.m, average of values (3, 0.89 ohm.m) for Layer 11
12. Lower Mantle	900–1000 km [23] [III]	100 km	0.47 [25]	2.0892 [23] [III]	Assign Canada regional model

See end of Table 10 for abbreviations and notes

Table 4
1D Earth Resistivity Model for Alberta Zone 4 (Eyehill High)

Layer	Depth Confidence	Thickness	Resistivity (ohm-m) Confidence	Conductivity (S/m) Confidence	Comments
1. Overburden	0 – 50 m [1] [II]	50 m	50 [5, 3, 32, 6, 33] [III]	0.02 [24]	Till blanket and coarse-grained (silt, sand, gravel) glaciolacustrine deposits, approx. half of each type overburden [4]. Overburden typically <50m, 50-100m along major river valley [1] Assign maximum overall depth 50m Airborne resistivity survey profiles over central Alberta indicate ~20 ohm.m, plan view maps show 10-20 ohm.m at 20m depth [5]. Borehole logs of Manitoba overburden show 40-50 ohm.m for till and 70-200 ohm.m for sand and gravel [3]. Resistivities for tills range 20-100 ohm.m [32]. MT survey in SE Manitoba indicates 5-30 ohm for mix of till, clay, silt and sand [6]. Glaciolacustrine clays average 30 ohm.m in northeastern Ontario [33] Assigned midpoint of resistivity range (10-100 ohm.m) for combination of tills and sand/gravel. Limits 10, 100 ohm.m

Table 4 (continued)
1D Earth Resistivity Model for Alberta Zone 4 (Eyehill High)

Layer	Depth Confidence	Thickness	Resistivity (ohm-m) Confidence	Conductivity (S/m) Confidence	Comments
2. Sedimentary Basin	0 - 2 km [7] [II]	2 km	10 [12b] [I]	0.1 [24]	*WCSB*: Upper strata consist of Mesozoic sandstone, siltstone and shale. Lower strata consist of Paleozoic carbonate and subordinate shale [11] WCSB of Interior Platform mainly ranges 1700-2200m thick, thickening southwestward [7] Assign 2000m midpoint depth MT 3D inversion model indicates 5>10 ohm.m range over entire thickness of WCSB [12a] Limited number of MT sounding sites on resistivity maps, inversion model results potentially influenced by edge effect 0.6-0.8 km depth resistivity map [12b] shows range 3>30 ohm.m (15 ohm.m midpoint) 1.8-2.1 km depth resistivity map [12b] shows dominantly 3 ohm.m Assign approx. 10 ohm.m, average of dominant / midpoint values (15, 3 ohm.m). Limits 3, 30 ohm.m
3. Upper Crust	2 - 19 km [15, 14] [I]	17 km	1900 [12b] [I]	0.00052 [24]	*Eyehill High*: metaplutonic gneiss and amphibolite gneiss comprise the Eyehill domain [20]. Lower depth scaled from seismic profiles across southern Alberta; 18 km [15], 20 km [14] Assign averaged lower depth 17-20 km depth resistivity map [12b] shows range 300-3000 ohm.m Assign 1900 ohm.m weighted average based on areal extent of individual resistivity ranges ((300 x 0.4) + (3000 x 0.6)). Limits 300, 3000 ohm.m

Table 4 (continued)
1D Earth Resistivity Model for Alberta Zone 4 (Eyehill High)

Layer	Depth / Confidence	Thickness	Resistivity (ohm-m) / Confidence	Conductivity (S/m) / Confidence	Comments
4. Middle Crust	19 – 29 km [15, 14, 19a] / [I]	10 km	1700 [12c] / [I]	0.00058 [24]	Thickness scaled from seismic profiles across southern Alberta; 11.4 km [15], 8.6 km [14]. Lower depth scaled from seismic profile; 30 km [19a] Assign 10 km, averaged thickness MT profiles show a very approximate range 300-3000 ohm.m [12c]. Limited resolution of profile prevents finer selection of resistivity Assign 1700 ohm.m, midpoint of range. Limits 300, 3000 ohm.m
5. Lower Crust	29 – 43 km [18a] / [I]	14 km	850 [12b] / [I]	0.00117 [24]	Lower depth, to Moho, determined from seismic depth determinations [18a], showing range 39-46 km Assign 43 km, average of depth range 33-37 km depth resistivity map shows range of 100-3000 ohm.m, some influence from LC anomaly [12b] Assign 850 ohm.m weighted average based on areal extent of dominant resistivity ((150 x 0.75) + (3000 x 0.25)). Limits 100, 3000 ohm.m
6. Upper Mantle	43 - 100 km [23] / [III]	57 km	500 [12b] / [I]	0.002 [24]	Used generalized lower depth [23]. 48-57 km and 63-74 km depth resistivity maps [12b] show range of 30-3000 ohm.m Assign 500 ohm.m weighted average based on areal extent of dominant resistivity ((30 x 0.7)+(300 x 0.15) +(3000 x 0.15)). Limits 30, 3000 ohm.m
7. Upper Mantle	100 - 250 km [23] / [III]	150 km	530 [12c] / [I]	0.00188 [24]	Used generalized lower depth [23] MT profile shows range 100-1000, dominantly at lower end of range [12c] Assign 530 ohm.m weighted average based on areal extent of dominant resistivity ((300 x 0.63)+(1000 x 0.34)). Limits 100, 1000 ohm.m

Table 4 (continued)

1D Earth Resistivity Model for Alberta Zone 4 (Eyehill High)

Layer	Depth Confidence	Thickness	Resistivity (ohm-m) Confidence	Conductivity (S/m) Confidence	Comments
8. Upper Mantle	250–410 km [23] [III]	160 km	90 [35b, 12g] [I]	0.01111 [24]	Used generalized lower depth [23]. MT profile shows range 20-200 ohm.m (110 ohm.m midpoint) between 225-300 km depth [35b]; and an averaged resistivity of 75 ohm.m for southern Alberta [12g] Assign 90 ohm.m, average of resistivity value / midpoint value (110, 75 ohm.m). Limits 20, 200 ohm.m.
9. Transition Zone	410–520 km [23] [III]	110 km	8 [25]	0.1258 [23] [III]	Utilized Canada regional model [23], based on Ottawa magnetic observatory data, situated on Archean crust (early Precambrian time), for all depths and resistivities below 410 km
10. Transition Zone	520–670 km [23] [III]	150 km	2.4 [25]	0.4168 [23] [III]	Assign Canada regional model
11. Lower Mantle	670–900 km [23] [III]	230 km	0.89 [25]	1.1220 [23] [III]	Assign Canada regional model. Upper limit 3 ohm.m 620-780 km depth resistivity map [12c] shows range 3-30 ohm.m, half of area is 3 ohm.m, possible overestimate of higher end of range due edge effects of inversion process
12. Lower Mantle	900–1000 km [23] [III]	100 km	0.47 [25]	2.0892 [23] [III]	Assign Canada regional model

See end of Table 10 for abbreviations and notes

Table 5

1D Earth Resistivity Model for Alberta Zone 5 (Lacombe Domain)

Layer	Depth Confidence	Thickness	Resistivity (ohm-m) Confidence	Conductivity (S/m) Confidence	Comments
1. Overburden	0 – 35 m [1] [II]	35 m	30 [5, 3, 32, 6, 33] [III]	0.03333 [24]	Till is predominant, mostly as thicker blanket [4]. Large patchy areas of fine-grained (clay, silt) glaciolacustrine deposits and smaller areas with coarse-grained (silt, sand, gravel) glaciolacustrine deposits commonly along / nearby rivers [4]. Overburden typically <50m [1] overall, western half of zone typically < 20 m [2], 35-50m beneath Red Deer city and river [2]. Assign midpoint depth of range (20-50m) Airborne resistivity survey profiles over central Alberta indicate ~20 ohm.m, plan view maps show 10-20 ohm.m at 20m depth [5]. Borehole logs of Manitoba overburden show 40-50 ohm.m for till and 70-200 ohm.m for sand and gravel [3]. Resistivities for tills range 20-100 ohm.m [32]. MT survey in SE Manitoba indicates 5-30 ohm for mix of till, clay, silt and sand [6]. Glaciolacustrine clays average 30 ohm.m in northeastern Ontario [33] Assigned midpoint of resistivity range 10-50 ohm.m for tills. Limits 10, 100 ohm.m

Table 5 (continued)
1D Earth Resistivity Model for Alberta Zone 5 (Lacombe Domain)

Layer	Depth / Confidence	Thickness	Resistivity (ohm-m) / Confidence	Conductivity (S/m) / Confidence	Comments
2. Sedimentary Basin	0 - 3.1 km [7] / [II]	3.1 km	20 [12b] / [I]	0.05 [24]	*WCSB*: Upper strata consist of Mesozoic sandstone, siltstone and shale. Lower strata consist of Paleozoic carbonate and subordinate shale [11] WCSB of Interior Platform mainly ranges 1800-4500m, maximum at west margin adjacent to Cordillera deformation front, 2400-2800m south of Edmonton [7] Assign 3100m average thickness MT 3D inversion model [12b] indicates 5-10 ohm.m range over entire thickness of WCSB [12b] Average resistivity at Red Deer approx. 5 ohm.m [10] 0.6-0.8 km depth resistivity map [nie2014f9] shows dominantly 3 ohm.m 1.8-2.1 km depth resistivity map [12b] shows range 25-50 ohm.m (35 ohm.m midpoint) Assign 20 ohm.m, average of dominant / midpoint resistivity values (3, 35 ohm.m). Limits 3, 50 ohm.m
3. Upper Crust	3.1 - 19 km [15, 14] / [I]	16 km	440 [35a, 12b] / [I]	0.00227 [24]	*Lacombe Domain*: low-grade felsic metavolcanic and metasedimentary rocks Lower depth scaled from seismic profiles across southern Alberta; 18 km [15], 20 km [14] Assign averaged lower depth MT profiles show approx. 500 ohm.m [35a]; 3000 ohm.m [35b]. Limited resolution of profile prevents finer selection of resistivity. 17-20 km depth resistivity map [12b] shows range 3-3000 ohm.m, RDC anomaly is 3-30 ohm.m with core of 3 ohm.m. Chose 385 ohm.m weighted average based on areal extent of individual resistivity ranges ((15 x 0.75) + (1500 x 0.25)) Assign 440 ohm.m, average of dominant / midpoint values (385, 500 ohm.m). Limits 3, 3000

Table 5 (continued)
1D Earth Resistivity Model for Alberta Zone 5 (Lacombe Domain)

Layer	Depth / Confidence	Thickness	Resistivity (ohm-m) / Confidence	Conductivity (S/m) / Confidence	Comments
4. Middle Crust	19 – 29 km [15, 14, 19a] [I]	10 km	900 [35a, b] [I]	0.00101 [24]	Thickness scaled from seismic profiles across southern Alberta; 11.4 km [15], 8.6 km [14]. Lower depth scaled from seismic profile; 30 km [19a] Assign 10 km, averaged thickness MT profiles show range 500-3000 ohm.m [35a] or 10-1000 [35b]. Limited resolution of profile prevents finer selection of resistivity Assign approx. 900 ohm.m, average of midpoint values of ranges (1450, 500 ohm.m)
5. Lower Crust	29 – 39 km [18b] [I]	10 km	330 [35b, 12b] [I]	0.00303 [24]	Moho depth contour map [18b] shows range 37-42, deepening southwestward and southward, approx. 37 km beneath Red Deer city Assigned 39 km depth, midpoint of range MT profiles show approx. 3000 ohm.m [35a] or 10-1000 [35b]. Limited resolution of profile prevents finer selection of resistivity 33-37 km depth resistivity map [12b] shows range of 3-1000 ohm.m, RDC anomaly much diminished in size and exhibits 30-100 ohm.m. Chose 160 ohm.m midpoint value of range 30-300 which has largest areal extent. Assign 330 ohm.m average of midpoint values of ranges (500, 160 ohm.m). Limits 3, 1000 ohm.m
6. Upper Mantle	39 - 100 km [23] [III]	61 km	950 [35b, 12b] [I]	0.00105 [24]	Used generalized lower depth [23]. MT profile shows range 500-3000 ohm.m [35b] (midpoint 1700 ohm.m) 48-57 km and 63-74 km depth resistivity maps show range of 100-300 ohm.m [12b] (midpoint 200 ohm.m) Assign 950 ohm.m average of midpoint values of ranges (200, 1700 ohm.m). Limits 100, 3000 ohm.m

Table 5 (continued)
1D Earth Resistivity Model for Alberta Zone 5 (Lacombe Domain)

Layer	Depth / Confidence	Thickness	Resistivity (ohm-m) / Confidence	Conductivity (S/m) / Confidence	Comments
7. Upper Mantle	100 - 250 km [23] [III]	150 km	160 [35b, 12c] [I]	0.00625 [24]	Used generalized lower depth [23] MT profiles show shows range 25-300 ohm.m resistivity [35b,12c], (midpoint 160 ohm.m); Assign 160 ohm.m, midpoint of ranges
8. Upper Mantle	250–410 km [23] [III]	160 km	40 [35b, 12g] [I]	0.025 [24]	Used generalized lower depth [23]. MT profile shows 10 ohm.m between 225-300 km depth [35b]; and an averaged resistivity of 75 ohm.m for southern Alberta [12g] Assign 40 ohm.m, average of values (10, 75 ohm.m). Limits 10, 75 ohm.m
9. Transition Zone	410–520 km [23] [III]	110 km	20 [25]	0.050118 [23] [III]	Utilized North American regional model [23], based on Tucson magnetic observatory data, situated on Proterozoic crust (late Precambrian time) for all depths and resistivities below 410 km
10. Transition Zone	520–670 km [23] [III]	150 km	5.62 [25]	0.177827 [23] [III]	Assign North American regional model
11. Lower Mantle	670–900 km [23] [III]	230 km	1.58 [25]	0.630957 [23] [III]	Assign North American regional model. Upper limit 3 ohm.m 620-780 km depth resistivity map [12c] shows dominantly 3 ohm.m except at western margin (near Cordillera deformation front) where resistivity increases to 20, 300 and 3000 ohm.m
12. Lower Mantle	900–1000 km [23] [III]	100 km	0.89 [25]	1.122018 [23] [III]	Assign North American regional model

See end of Table 10 for abbreviations and notes

Table 6
1D Earth Resistivity Model for Alberta Zone 6 (Rimbey, Thorsby & Wabamun Domains)

Layer	Depth Confidence	Thickness	Resistivity (ohm-m) Confidence	Conductivity (S/m) Confidence	Comments
1. Overburden	0 – 65 m [1] [II]	65 m	50 [5, 3, 32, 6, 33] [III]	0.02 [24]	Till is predominant, mostly as thicker blanket [4]. Narrow areas of fine-grained (clay, silt) glaciolacustrine deposits and coarse-grained (silt, sand, gravel) glaciolacustrine deposits commonly major rivers, including beneath Edmonton [2] Overburden typically <50m thick for 2/3 of zone, eastern 1/3 of zone ranges 50-200m (average 125m) in Cold Lake – Lac La Biche area [1], usually <35m beneath Edmonton [2] Assign 65m, weighted average of areal coverage of dominant depth ((35 x 0.66) + (125 x 0.34)) Airborne resistivity survey profiles over central Alberta indicate ~20 ohm.m, plan view maps show 10-20 ohm.m at 20m depth [5]. Borehole logs of Manitoba overburden show 40-50 ohm.m for till and 70-200 ohm.m for sand and gravel [3]. Resistivities for tills range 20-100 ohm.m [32]. MT survey in SE Manitoba indicates 5-30 ohm for mix of till, clay, silt and sand [6]. Glaciolacustrine clays average 30 ohm.m in northeastern Ontario [33] Assign midpoint of resistivity range 10-100 ohm.m for combination of tills and sand/gravel.

Table 6 (continued)
1D Earth Resistivity Model for Alberta Zone 6 (Rimbey, Thorsby & Wabamun Domains)

Layer	Depth Confidence	Thickness	Resistivity (ohm-m) Confidence	Conductivity (S/m) Confidence	Comments
2. Sedimentary Basin	0 – 2.7 km [7] [II]	2.7 km	15 [11, 12b] [I]	0.06666 [24]	*WCSB*: Upper strata consist of Mesozoic sandstone, siltstone and shale. Lower strata consist of Paleozoic carbonate and subordinate shale [11] WCSB of Interior Platform (all 3 domains) ranges 900-4500 thick (midpoint 2700m) [7] *Rimbey Domain*: ranges 900-4500m (midpoint 2700m) *Thorsby Domain*: ranges 1700 ohm (midpoint 3100m) *Wabamun Domain*: ranges 2000-4500m (midpoint 3250m) Assign 2700m, midpoint of overall range MT survey [11] across Rocky Mountain foothills and adjacent WCSB determined an upper 20-50 ohm.m resistivity layer to depth of 2 km, and underlying 10 ohm.m layer at depth of 2-4 km, within zone 6 Limited number of MT sounding sites on resistivity maps, inversion model results potentially influenced by edge effect *Rimbey Domain* * 0.6-0.8 km depth resistivity map [12b] shows range 3-30 ohm.m (midpoint 15 ohm.m) * 1.8-2.1 km depth resistivity map shows predominantly 10 ohm.m * chose 10 ohm.m, approx. midpoint of range (15, 10 ohm.m) *Thorsby & Wabamun Domains* * Chose approx. 20 ohm.m, weighted average ((35 x 0.5) + (10 x 0.5)) based on MT survey [11] passing through Rocky Mountain House area Assign overall 15 ohm.m, average of midpoint / weighted average values (10, 20 ohm.m). Limits 3, 50 ohm.m

Table 6 (continued)
1D Earth Resistivity Model for Alberta Zone 6 (Rimbey, Thorsby & Wabamun Domains)

Layer	Depth Confidence	Thickness	Resistivity (ohm-m) Confidence	Conductivity (S/m) Confidence	Comments
3. Upper Crust	2.7 - 12 km [13] [II]	12 km	3000 [12e, 35a] [I]	0.00033 [24]	Rimbey, *Thorsby & Wabamun Domains*: plutonic (lecuogranite, quartz diorite, tonolite) rocks [20] Overall lower depth scaled from trans-continental seismic transect (11-12 km) across southern Alberta [13]. Same depth assigned to individual Rimbey, Thorsby and Wabamun Domains. Limited seismic profile information for better resolution. Noticeable resistivity change on 2D inversion profiles at 10-15 km depth [35]. *Rimbey Domain* * MT profiles show approx. range 1000-3000 ohm.m [12e], >3000 ohm.m [35a]. Limited resolution of resistivity differences on figures. *Thorsby & Wabamun Domains* * MT profile shows >3000 ohm.m [35a]. Limited resolution of resistivity differences on figure. Assign overall minimum 3000 ohm.m. Lower limit 1000 ohm.m
4. Middle Crust	12 – 29 km [19b] [I]	17 km	2300 [12b, 35a] [I]	0.00043 [24]	Depth to layer bottom scaled from seismic profile [19b] *Rimbey Domain*: 26 km to layer bottom *Thorsby Domain*: 31 km to layer bottom *Wabamun Domain*: 31 km to layer bottom Assign 29 km, average of depths from 3 domains *Rimbey Domain*: * 17-29 km depth resistivity map [12b] shows range of 300-3000 ohm.m due influence of RDC anomaly; 1000-3000 ohm.m occupies 75% of Zone 6, 300 ohm.m occupies 25 % of Zone 6 * chose 1575 ohm.m weighted average of midpoint / dominant value ((2000 x 0.75)+(300 x 0.25)) *Thorsby & Wabamun Domains* * 2D inversion profile depicts general > 3000 ohm.m [35a]; Limited resolution of profile prevents finer selection of resistivity Assign overall 2300 ohm.m. average of weighted average / dominant value (1575, 3000 ohm.m). Limits 300, 3000 ohm.m

Table 6 (continued)
1D Earth Resistivity Model Proximal for Alberta Zone 6 (Rimbey, Thorsby & Wabamun Domains)

Layer	Depth / Confidence	Thickness	Resistivity (ohm-m) / Confidence	Conductivity (S/m) / Confidence	Comments
5. Lower Crust	29 – 39 km [18a] [I]	10 km	2100 [12b, 35a] [I]	0.00047 [24]	Lower depth, to Moho, averaged from seismic depth determinations [18a] and scaled off seismic profiles
		Rimbey Domain * 26 km depth to top of layer, 36 km to bottom (Moho) [19b] * 37 km to Moho, midpoint 37 km [18b] * 36.5 km average of estimated depths to Moho from seismic picks [18c] * chose 37 km to bottom of layer *Thorsby Domain* * 31 km depth to top of layer, 42 km to bottom (Moho) [19b] * 35-43 km to Moho, midpoint 39 km [18b] * maximum 45 km estimated depth to Moho from seismic picks [18c] * chose 44 km estimated depth to Moho *Wabamun Domain* * 31 km depth to top of layer, 38 km to bottom (Moho) [19b] * 35-39 km to Moho, midpoint 37 km [18b] * 36 km average of estimated depths to Moho from seismic picks [18c] * chose 36 km to bottom of layer Assign overall depth averages, 29 km to top of layer, 39 km to bottom *Rimbey Domain* * 33-37 km depth resistivity map [12b] shows range of 3-1000 ohm.m due influence of RDC and LC anomalies; 1000-3000 ohm.m occupies 50% of RD, 3-300 ohm.m occupies 50 % of Rimbey Domain * chose 1150 ohm.m weighted average based on areal extent of midpoint resistivity value ((2000 x 0.5)+(150 x 0.5)) *Thorsby & Wabamun Domain* * MT profile depicts range 30 to > 3000 ohm.m [35a]; low range of resistivity due presence of conductive anomaly at 60-100 km depth, unknown if conductor is a processing artifact. Limited resolution of profile prevents finer selection of resistivity * chose 3000 ohm.m for Thorsby and Wabamun domains Assign overall 2100 ohm.m, average of resistivity values (1150, 3000 ohm.m). Limits 30, 3000 ohm.m			

Table 6 (continued)
1D Earth Resistivity Model for Alberta Zone 6 (Rimbey, Thorsby & Wabamun Domains)

Layer	Depth / Confidence	Thickness	Resistivity (ohm-m) / Confidence	Conductivity (S/m) / Confidence	Comments
6. Upper Mantle	39 - 100 km [23] / [III]	61 km	1400 [12b, 35a] / [I]	0.00071 [24]	Used generalized lower depth [23] *Rimbey Domain* * 48-57 km and 63-74 depth resistivity maps [12b] show range of 10-1000 ohm.m due influence of combining RDC and LC anomalies; 300-1000 ohm.m occupies 75% of RD, 3-300 ohm.m occupies 25 % of RD * chose 550 ohm.m weighted average ((650 x 0.75)+(150 x 0.25)) *Thorsby & Wabamun Domains* * MT profile depicts range 30 > 3000 ohm.m [35a]; low range of resistivity due presence of conductive anomaly at 60-100 km depth, unknown if conductor is a processing artifact * chose 3000 ohm.m for Thorsby and Wabamun domains. Limited resolution of profile prevents finer selection of resistivity * chose 2250 ohm.m weighted average ((30 x 0.25)+(3000 x 0.75)) Assign overall 1400 ohm.m, average of dominant / weighted average resistivity values (550, 2250 ohm.m). Limits 30, 3000 ohm.m
7. Upper Mantle	100 - 250 km [23] / [III]	150 km	160 [12e] / [I]	0.00625 [24]	Used generalized lower depth [23] MT profile shows overall range 30-300 ohm.m, dominantly 100 ohm.m [12e] Assign 160 ohm.m midpoint of range. Limits 30, 300 ohm.m
8. Upper Mantle	250–410 km [23] / [III]	160 km	50 [25] / [III]	0.019952 [23]	Utilized North American regional model [23], based on Tucson magnetic observatory data, situated on Proterozoic crust (late Precambrian time) for all depths and resistivities below 250 km.

Table 6 (continued)
1D Earth Resistivity Model for Alberta Zone 6 (Rimbey, Thorsby & Wabamun Domains)

Layer	Depth / Confidence	Thickness	Resistivity (ohm-m) / Confidence	Conductivity (S/m) / Confidence	Comments
9. Transition Zone	410–520 km [23] [III]	110 km	20 [25]	0.050118 [23] [III]	Assign North American regional model
10. Transition Zone	520–670 km [23] [III]	150 km	5.62 [25]	0.177827 [23] [III]	Assign North American regional model
11. Lower Mantle	670–900 km [23] [III]	230 km	1.58 [25]	0.630957 [23] [III]	Assign North American regional model. Upper limit 3 ohm.m 620-780 km depth resistivity map [12c] shows average 10 ohm; higher resistivity possible due limited data points Alternative resistivity is approx. 5 ohm.m, average of values (10, 1.58 ohm.m) for Layer 11. Upper limit 10 ohm.m
12. Lower Mantle	900–1000 km [23] [III]	100 km	0.89 [25]	1.122018 [23] [III]	Assign North American regional model

See end of Table 10 for abbreviations and notes

Table 7
1D Earth Resistivity Model Proximal for Alberta Zone 7 (Taltson Domain, Buffalo Head Domain)

Layer	Depth Confidence	Thickness	Resistivity (ohm-m) Confidence	Conductivity (S/m) Confidence	Comments
1. Overburden	0 – 50 m [1] [II]	50 m	30 [5, 3, 32, 6, 33] [III]	0.03333 [24]	Variety glacial deposits; till blanket being dominant, followed by fine-grained glaciolacustrine (clay, silt), localized organic and eolioan (windblown silt & sand) deposits [4] Depth ranges 0-200m, thicker in central portion where ranges 50-250m deep [1] Assign 50m thickness, weighted average based on areal extent of dominant thicknesses ((0.75 x 25m)+(0.25 x 125m)) Airborne resistivity survey profiles over central Alberta indicate ~20 ohm.m, plan view maps show 10-20 ohm.m at 20m depth [5]. Borehole logs of Manitoba overburden show 40-50 ohm.m for till and 70-200 ohm.m for sand and gravel [3]. Resistivities for tills range 20-100 ohm.m [32]. MT survey in SE Manitoba indicates 5-30 ohm for mix of till, clay, silt and sand [6]. Glaciolacustrine clays average 30 ohm.m in northeastern Ontario [33] Assigned midpoint of resistivity range 10-50 ohm.m for tills, the dominant overburden in Zones 7, 8 and 10. Lower and upper limits, 10 and 100 ohm.m respectively, applicable to glacial deposits ranging from till to glaciolacustrine
2. Sedimentary Basin	0 – 1.4 km [7] [II]	1.4 km	10 [9] [I]	0.1 [24]	WCSB of Interior Platform overlies area, deepening southwestward. Lower strata consist of Paleozoic carbonate, shale and evaporite. Upper strata consist of Mesozoic marine shales, and alternating sandstone and shales [8]
		Depth ranges 0-2800m, assign midpoint 1400m [7] 1.7 km depth resistivity map shows overall ~10 ohm.m with localized areas up to 30 ohm.m [9]. Low resistivity attributed to presence of pore fluids in sedimentary rock [8]. MT profile shows aprox. 8 ohm.m [10b] Profile shows range 50-200 ohm.m [34], midpoint 125 ohm.m, in nearby NWT Assign approx. 10 ohm.m, based on MT survey over northern Alberta [9]. Limits 3, 125 ohm.m			

Table 7 (continued)
1D Earth Resistivity Model Proximal for Alberta Zone 7 (Taltson Domain, Buffalo Head Domain)

Layer	Depth / Confidence	Thickness	Resistivity (ohm-m) / Confidence	Conductivity (S/m) / Confidence	Comments
3. Upper Crust	1.4 - 13 km [36] / [I]	11.6 km	3000 [9, 10b, 34] / [I, II]	0.00033 [24]	*Taltson Domain*: highly deformed gneiss and granitic rocks, and moderately deformed plutonic rocks [20]. *Buffalo Head Domain*: mainly metaplutonic rocks subordinate metavolcanic and high-grade gneissic rocks [39] Lower depth scaled off seismic profile [36] MT profiles show 500 >1000 ohm.m [9], dominantly 1000 ohm.m; >1000 ohm.m [10b], limited resolution; range 1000-5000 ohm.m [34], midpoint 3000 ohm.m, in nearby NWT Assign 3000 ohm.m midpoint based on range 1000-5000 ohm.m in adjacent NWT. Limits 500-5000 ohm.m
4. Middle Crust	13 - 29 km [36] / [I]	16 km	1750 [9, 10b, 34] / [I, II]	0.00057 [24]	Lower depth scaled off seismic profile [36] MT profiles show 400 >1000 ohm.m [9], dominantly 1000 ohm.m; >1000 ohm.m [10b], limited resolution; range 1000-2500 ohm.m [34], midpoint 1750 ohm.m, in nearby NWT Assign 1750 ohm.m midpoint based on range 1000-2500 ohm.m in adjacent NW. Limits 1000-2500 ohm.m
5. Lower Crust	29 – 38 km [18b, 36] / [I]	9 km	1200 [9, 10b, 34] / [I, II]	0.00083 [24]	Lower depth scaled of seismic profiles. Moho ranges 35-43 km deep, chose midpoint 39 km, deepest immediately north of Peace River 41-43 km & NW of Edmonton 41 km [18b]; depth 29-44 km, chose midpoint 37 km [36] Assign 38 km, average of midpoint depths MT profiles show 400 >1000 ohm.m [9], dominantly 1000 ohm.m; >1000 ohm.m [10b], limited resolution; range 800-2500 ohm.m [34], midpoint 1650 ohm.m, in nearby NWT 41 km depth resistivity map shows range 400 >1000 ohm. [9]. Select 700 ohm.m midpoint of range Assign approx. 1200 ohm.m, average of midpoints 700 and 1650 ohm.m. Limits 400, 2500 ohm.m

Table 7 (continued)

1D Earth Resistivity Model Proximal for Alberta Zone 7 (Taltson Domain, Buffalo Head Domain)

Layer	Depth Confidence	Thickness	Resistivity (ohm-m) Confidence	Conductivity (S/m) Confidence	Comments
6. Upper Mantle	38 - 100 km [23] [III]	62 km	1400 [9, 34] [I, II]	0.00071 [24]	Used generalized lower depth [23]. MT profiles show 300-800 ohm.m [9], chose 550 ohm.m midpoint; range 800-5000 ohm.m [34], midpoint 3000 ohm.m, in adjacent NWT 65 km depth resistivity map [9] shows range 500 >1000 ohm covering 90% of zone, and 100-300 ohm.m range covering 10% of zone along boundary with Zone 8, part of dipping KC anomaly. Chose 675 ohm.m weighted average ((midpoint 750 x 0.9)+(midpoint 200 x 0.1)) Assign 1400 ohm.m, average of midpoints 550, 675, 3000 ohm.m incorporating same terranes found in adjacent NWT. Limits 300, 5000 ohm.m
7. Upper Mantle	100 - 250 km [23] [III]	150 km	100-200km 950 [9] [I] 200-250km 20 [9] [I] 100-250 km 635 [9] [I]	100-200km 0.00105 [24] 200-250km 0.05 [24] 100-250 km 0.00157 [24]	Used generalized lower depth [23]. MT profiles [9] show distinct resistivity change at 200 km depth. MT profiles [9] show at: *100-200 km depth, range 800>1000 ohm.m. Chose 950 ohm.m weighted average ((1000 x 0.75)+(800 x 0.25)). * 200-250 km depth, range 10-30 ohm.m (midpoint 20 ohm.m) Assign 635 ohm.m weighted average ((midpoint 950 x 0.66)+(midpoint 20 x 0.34)) for entire layer. Limits 800, 1000 between 100-200 km and 10, 30 between 200-250 km
8. Upper Mantle	250–410 km [23] [III]	160 km	50 [25]	0.019952 [23] [III]	Utilized North American regional model [23], based on Tucson magnetic observatory data, situated on Proterozoic crust (late Precambrian time) for all depths and resistivities below 250 km

Table 7 (continued)
1D Earth Resistivity Model Proximal for Alberta Zone 7 (Taltson Domain, Buffalo Head Domain)

Layer	Depth / Confidence	Thickness	Resistivity (ohm-m) / Confidence	Conductivity (S/m) / Confidence	Comments
9. Transition Zone	410–520 km [23]	110 km	20 [25]	0.050118 [23]	---
	[III]			[III]	
10. Transition Zone	520–670 km [23]	150 km	5.62 [25]	0.177827 [23]	---
	[III]			[III]	
11. Lower Mantle	670–900 km [23]	230 km	1.58 [25]	0.630957 [23]	---
	[III]			[III]	
12. Lower Mantle	900–1000 km [23]	100 km	0.89 [25]	1.122018 [23]	---
	[III]			[III]	

See end of Table 10 for abbreviations and notes

Table 8
1D Earth Resistivity Model Proximal for Alberta Zone 8 (Chinachga, Ksituan, Kiskatinaw, Nova Domains)

Layer	Depth Confidence	Thickness	Resistivity (ohm-m) Confidence	Conductivity (S/m) Confidence	Comments
1. Overburden	0 – 25 m [1] [II]	25 m	30 [5, 3, 32, 6, 33] [III]	0.03333 [24]	Glacial deposits consisting of till blanket and fine-grained glaciolacustrine, with localized areas of coarse-grained (sand, gravel) glaciolacustrine deposits [4] Depth ranges 0-50m [1] Assign 25m, midpoint of range Airborne resistivity survey profiles over central Alberta indicate ~20 ohm.m, plan view maps show 10-20 ohm.m at 20m depth [5]. Borehole logs of Manitoba overburden show 40-50 ohm.m for till and 70-200 ohm.m for sand and gravel [3]. Resistivities for tills range 20-100 ohm.m [32]. MT survey in SE Manitoba indicates 5-30 ohm for mix of till, clay, silt and sand [6]. Glaciolacustrine clays average 30 ohm.m in northeastern Ontario [33] Assigned midpoint of resistivity range 10-50 ohm.m for tills, the dominant overburden in Zones 7, 8 and 10. Lower and upper limits, 10 and 100 ohm.m respectively, applicable to glacial deposits ranging from till to glaciolacustrine
2. Sedimentary Basin	0 – 3.3 km [7] [II]	3.3 km	10 [9] [I]	0.1 [24]	WCSB of Interior Platform overlies area, deepening southwestward. Lower strata consist of Paleozoic carbonate, shale and evaporite. Upper strata consist of Mesozoic marine shales, and alternating sandstone and shales [8] Depth ranges 1200-5500m, assign midpoint 3300m [7] 1.7 km depth resistivity map shows overall ~10 ohm.m with localized areas up to 30 ohm.m [9]. Low resistivity attributed to presence of pore fluids in sedimentary rock [8]. MT profiles show range aprox. 1-8 ohm.m [10b] Profile shows range 3-30 ohm.m [34], midpoint 15 ohm.m, in nearby NWT Assign approx. 10 ohm.m, based on MT survey over northern Alberta [9]. Limits 3, 30 ohm.m

Table 8 (continued)
1D Earth Resistivity Model Proximal for Alberta Zone 8 (Chinchaga, Ksituan, Kiskatinaw, Nova Domains)

Layer	Depth Confidence	Thickness	Resistivity (ohm-m) Confidence	Conductivity (S/m) Confidence	Comments
3. Upper Crust	3.3 – 15 km [36] [I]	11.7 km	900 [10b] [I]	0.00111 [24]	*Chinchaga Domain*: metasedimentary and metaplutonic rock [20]. *Ksituan Domain*: metaplutonic (granitic gneiss) [20, 39] *Kiskatinaw Low*: granitic gneiss [20] *Nova Domain*: mylonitic mafic gneiss [20] Lower depth from averaged values from regional seismic profile [36] MT profiles show >1000 ohm.m [9], limited resolution; >1000 ohm.m [10b], with two 5 ohm.m conductive anomalies Assign 900 ohm.m weighted average ((1000 x 0.9)+(5 x 0.1)) based on distribution of resistivity on profile by [10b]. Upper limit >1000 ohm.m
4. Middle Crust	15 – 30 km [36] [I]	15 km	275 [9] [I]	0.00363 [24]	Lower depth from averaged values from seismic profile [36] MT profiles show 100 >1000 ohm.m [9], limited resolution; >1000 ohm.m [10b], with two 40-60 conductive anomalies being continuation of same anomalies located in upper crust 20.6 km depth resistivity map [9] shows range 10-200 ohm.m (midpoint 100 ohm.m) covering 75% of, and 800 ohm.m covering 25% of Zone 8. Chose 275 ohm.m weighted average ((100*0.75) + (800*0.25)) Assign 275 ohm.m weighted average. Limits 10, 1000 ohm.m

Table 8 (continued)
1D Earth Resistivity Model Proximal for Alberta Zone 8 (Chinchaga, Ksituan, Kiskatinaw, Nova Domains)

Layer	Depth Confidence	Thickness	Resistivity (ohm-m) Confidence	Conductivity (S/m) Confidence	Comments
5. Lower Crust	30 – 39 km [18b, 36] [I]	9 km	360 [9, 10b] [I]	0.00277 [24]	Lower depth scaled off seismic profiles Moho ranges 37-49 km (midpoint 43 km), shallowest SW of Grande Prairie 37 km, depth increases rapidly southwestward in front of Cordillera 41-49 km [18b]; Moho is transitional between 35-42 km (midpoint 39 km) in Ft. Nelson BC area [37]; Moho averages 40 km, as scaled [36]; Moho depth ranges 30-40 km, thickness 10 km [36b] Assign 39 km, average of midpoint depths MT profiles shows range 40-200 ohm.m [9]; 100>1000 ohm.m [10b], dominantly > 1000 ohm.m, with large conductive 1-10 ohm.m anomaly underlying Chinchaga magnetic low; range 100>1000 ohm.m [10b]; chose 550 ohm.m weighted average ((100 x 0.5) + (1000 x 0.5)) 41 km depth resistivity map shows range 100-300 ohm.m [9], predominately 40-300 ohm.m. Chose 175 ohm.m midpoint of predominate range Assign approx. 360 ohm.m, average of midpoints 175 and 550 ohm.m. Limits 40, 1000 ohm.m
6. Upper Mantle	40 – 100 km [23] [III]	60 km	315 [9] [I]	0.00317 [24]	Used generalized lower depth [23] MT profiles show 300-400 ohm.m [9], chose 250 ohm.m midpoint 65 km depth resistivity map [9] shows range 100-300 ohm.m covering 80% of zone, and 400-800 ohm.m remaining 20%. Chose 380 ohm.m weighted average ((midpoint 200 x 0.8)+(midpoint 600 x 0.2)) Assign 315 ohm.m average of midpoint values 250, 380 ohm.m. Limits 100, 400 ohm.m

Table 8 (continued)
1D Earth Resistivity Model Proximal for Alberta Zone 8 (Chinchaga, Ksituan, Kiskatinaw, Nova Domains)

Layer	Depth / Confidence	Thickness	Resistivity (ohm-m) / Confidence	Conductivity (S/m) / Confidence	Comments
7. Upper Mantle	100 – 250 km [23]	150 km	100-200km 985 [9] [I]	100-200km 0.00101 [24]	Used generalized lower depth [23]. MT profiles [9] show distinct resistivity change at 200 km depth. MT profiles [9] show at: *100-200 km depth, range 300>1000 ohm.m, influence of KC anomaly (300-550 ohm.m) between 100-125 km depth, predominately >1000 ohm.m overall elsewhere. Choose 985 ohm.m weighted average ((1000 x 0.9)+(midpoint 425 x 0.20)) * 200-250 km depth, range 10-30 ohm.m (midpoint 20 ohm.m) Assign 660 ohm.m weighted average ((midpoint 985 x 0.66)+(midpoint 20 x 0.34)) based on areal coverage with respect to depth. Limits 200, 1000 between 100-200 km and 10, 30 between 200-250 km
	[III]		200-250km 20 [9] [I]	200-250km 0.05 [24]	
			100-250 km 660 [9] [I]	100-250 km 0.00151 [24]	
8. Upper Mantle	250 – 410 km [23]	160 km	50 [25]	0.019952 [23]	Utilized North American regional model [23], based on Tucson magnetic observatory data, situated on Proterozoic crust (late Precambrian time) for all depths and resistivities below 250 km
	[III]			[III]	
9. Transition Zone	410 – 520 km [23]	110 km	20 [25]	0.050118 [23]	---
	[III]			[III]	
10. Transition Zone	520 – 670 km [23]	150 km	5.62 [25]	0.177827 [23]	---
	[III]			[III]	

Table 8 (continued)
1D Earth Resistivity Model Proximal for Alberta Zone 8 (Chinchaga, Ksituan, Kiskatinaw, Nova Domains)

Layer	Depth Confidence	Thickness	Resistivity (ohm-m) Confidence	Conductivity (S/m) Confidence	Comments
11. Lower Mantle	670 – 900 km [23] [III]	230 km	1.58 [25]	0.630957 [23] [III]	---
12. Lower Mantle	900 – 1000 km [23] [III]	100 km	0.89 [25]	1.122018 [23] [III]	---

See end of Table 80 for abbreviations and notes

Table 9
1D Earth Resistivity Model Proximal for Alberta Zone 9 (Great Slave Lake Shear Zone)

Layer	Depth / Confidence	Thickness	Resistivity (ohm-m) / Confidence	Conductivity (S/m) / Confidence	Comments
1. Overburden	0 – 25 m [1] [II]	25 m	15 [5, 3, 32, 6, 33] [III]	0.06666 [24]	Glacial deposits, mostly fine-grained glaciolacustrine with lesser amount of till blanket [4] Depth ranges 0-50m [1] Assign 25m midpoint of range Airborne resistivity survey profiles over central Alberta indicate ~20 ohm.m, plan view maps show 10-20 ohm.m at 20m depth [5]. Borehole logs of Manitoba overburden show 40-50 ohm.m for till and 70-200 ohm.m for sand and gravel [3]. Resistivities for tills range 20-100 ohm.m [32]. MT survey in SE Manitoba indicates 5-30 ohm for mix of till, clay, silt and sand [6]. Glaciolacustrine clays average 30 ohm.m in northeastern Ontario [33] Assign 15 ohm.m midpoint of range 5-30 ohm.m for mix of till and glaciolacustrine deposits, reflects greater predominance of fine-grained glaciolacustrine deposits for Zone 9
2. Sedimentary Basin	0 – 1.9 km [7] [II]	1.9 km	10 [9] [I]	0.1 [24]	WCSB of Interior Platform overlies area, deepening southwestward Depth ranges 1000-2800m, assign midpoint 1900m [7] 1.7 km depth resistivity map shows overall ~10 ohm.m with localized areas up to 30 ohm.m [9]. Low resistivity attributed to presence of pore fluids in sedimentary rock [8] MT profiles show aprox. 5-8 ohm.m [10b]; range 3-30 ohm.m [35], midpoint 15 ohm.m, in nearby NWT Assign approx. 10 ohm.m, based on MT survey over northern Alberta [9]. Limits 3, 30 ohm.m

Table 9 (continued)
1D Earth Resistivity Model Proximal for Alberta Zone 9 (Great Slave Lake Shear Zone)

Layer	Depth Confidence	Thickness	Resistivity (ohm-m) Confidence	Conductivity (S/m) Confidence	Comments
3. Upper Crust	1.9 – 12 km [36] [I]	10.1 km	4200 [34] [II]	0.00023 [24]	*Great Slave Lake shear zone*: mylonitic rock (granitic protolith) [40] Lower depth scaled off seismic profile [36] Assigned 12 km bottom depth, average of Zones 8 and 10 MT profiles show 500 >1000 ohm.m [9], limited resolution; >1000 ohm.m [10b], limited resolution; range 1000-7500 ohm.m [34], midpoint 4200 ohm.m, in nearby NWT, top of resistive anomaly in upper crust Assign 4200 ohm.m midpoint based on range 1000-7500 ohm.m in adjacent NWT. Limits 1000, 7500 ohm.m
4. Middle Crust	12 - 24 km [36] [I]	12 km	4500 [9, 10b, 34] [I, II]	0.00022 [24]	Lower depth scaled of regional seismic profile [36] Assigned 24 km bottom depth, average of Zones 8 and 10 MT profiles show >1000 ohm.m [10b], limited resolution; range 7500-10000 ohm.m [34], midpoint 8800 ohm.m, in nearby NWT 20.6 km depth resistivity map shows dominantly 200 ohm.m [9], influence of western edge of KC conductive anomaly in lower crust Assign 4500 ohm.m, midpoint of range 200-8800 ohm.m, which accounts for presence of KC anomaly. Limits 1000, 2500 ohm.m
5. Lower Crust	24 – 40 km [18b] [I]	16 km	4500 [9, 34] [I, II]	0.00022 [24]	Moho ranges 39-40 km deep [18b] MT profiles show 40 >1000 ohm.m [9]; range 7500-10000 ohm.m [34], midpoint 8850 ohm.m, in adjacent NWT 41 km depth resistivity map shows range 10-200 (midpoint 100 ohm.m) ohm.m covering 90% of, and >1000 ohm.m covering 10% of Zone 9. Chose 200 ohm.m weighted average ((100*0.90) + (1000*0.10)) Assign 4500 ohm.m, average of midpoints 200 and 8800 ohm.m. Limits 100, 10000 ohm.m

Table 9 (continued)
1D Earth Resistivity Model Proximal for Alberta Zone 9 (Great Slave Lake Shear Zone)

Layer	Depth / Confidence	Thickness	Resistivity (ohm-m) / Confidence	Conductivity (S/m) / Confidence	Comments
6. Upper Mantle	40 - 100 km [23]	60 km	1600 [9, 34]	0.00062 [24]	Used generalized lower depth [23] MT profiles show 100-400 ohm.m [9], chose 250 ohm.m midpoint; range 800-5000 ohm.m [34] midpoint 3000 ohm.m, in adjacent NWT 65 km depth resistivity map [9] shows range 40-400 ohm. Chose 220 ohm.m midpoint of range Assign 1600 ohm.m average of midpoints 220, 3000 ohm.m incorporating continuation of GSLsz into adjacent NWT. Limits 40, 5000 ohm.m
	[III]		[I, II]		
7. Upper Mantle	100 - 250 km [23]	150 km	100-200km 1000 [9] [I]	100-200km 0.001 [24]	Used generalized lower depth [23]. MT profiles [9] show distinct resistivity change at 200 km depth MT profiles [9] show at: *100-200 km depth, >1000 ohm.m * 200-250 km depth, range 30-100 ohm.m (midpoint 60 ohm.m) Assign 680 ohm.m weighted average ((1000 x 0.66)+(midpoint 60 x 0.34)) based on areal coverage with respect to depth. Upper limit 1000 ohm.m between 100-200 km. Limits 30, 100 ohm.m between 200-250 km
	[III]		200-250km 60 [9] [I]	200-250km 0.01666 [24]	
			100-250 km 680 [9] [I]	100-250 km 0.00147 [24]	
8. Upper Mantle	250–410 km [23]	160 km	50 [25]	0.019952 [23]	Utilized North American regional model [23], based on Tucson magnetic observatory data, situated on Proterozoic crust (late Precambrian time) for all depths and resistivities below 250 km
	[III]			[III]	

Table 9 (continued)
1D Earth Resistivity Model Proximal for Alberta Zone 9 (Great Slave Lake Shear Zone)

Layer	Depth Confidence	Thickness	Resistivity (ohm-m) Confidence	Conductivity (S/m) Confidence	Comments
9. Transition Zone	410–520 km [23] [III]	110 km	20 [25]	0.050118 [23] [III]	---
10. Transition Zone	520–670 km [23] [III]	150 km	5.62 [25]	0.177827 [23] [III]	---
11. Lower Mantle	670–900 km [23] [III]	230 km	1.58 [25]	0.630957 [23] [III]	---
12. Lower Mantle	900–1000 km [23] [III]	100 km	0.89 [25]	1.122018 [23] [III]	---

See end of Table 90 for abbreviations and notes

Table 10
1D Earth Resistivity Model Proximal for Alberta Zone 10 (Great Bear, Hottah, Fort Simpson)

Layer	Depth Confidence	Thickness	Resistivity (ohm-m) Confidence	Conductivity (S/m) Confidence	Comments
1. Overburden	0 – 175 m [1] [II]	175 m	30 [5, 3, 32, 6, 33] [III]	0.03333 [24]	Variety glacial deposits; till blanket and fine-grained glaciolacustrine (clay, silt), localized organic deposits [4] Depth ranges 0-300m [1] Assign 175m midpoint depth of predominant range 50-300m Airborne resistivity survey profiles over central Alberta indicate ~20 ohm.m, plan view maps show 10-20 ohm.m at 20m depth [5]. Borehole logs of Manitoba overburden show 40-50 ohm.m for till and 70-200 ohm.m for sand and gravel [3]. Resistivities for tills range 20-100 ohm.m [32]. MT survey in SE Manitoba indicates 5-30 ohm for mix of till, clay, silt and sand [6]. Glaciolacustrine clays average 30 ohm.m in northeastern Ontario [33] Assigned midpoint of resistivity range 10-50 ohm.m for tills, the dominant overburden in Zones 7, 8 and 10. Lower and upper limits, 10 and 100 ohm.m respectively, applicable to glacial deposits ranging from till to glaciolacustrine.
2. Sedimentary Basin	0 – 1.9 km [7] [I]	1.9 km	10 [9] [I]	0.1 [24]	WCSB of Interior Platform overlies area, deepening southwestward. WCSB of Interior Platform overlies area, deepening southwestward. Lower strata consist of Paleozoic carbonate, Depth ranges 1000-2800m, assign midpoint 1900m [7] 1.7 km depth resistivity map shows overall ~10 ohm.m with localized areas up to 30 ohm.m [9]. Low resistivity attributed to presence of pore fluids in sedimentary rock [8] MT profiles show aprox. 5-8 ohm.m [10b]; range 3-30 ohm.m [34], midpoint 15 ohm.m, in nearby NWT Assign approx. 10 ohm.m, based on MT survey over northern Alberta [9]. Limits 3, 30 ohm.m

Table 10 (continued)
1D Earth Resistivity Model Proximal for Alberta Zone 10 (Great Bear, Hottah, Fort Simpson)

Layer	Depth / Confidence	Thickness	Resistivity (ohm-m) / Confidence	Conductivity (S/m) / Confidence	Comments
3. Upper Crust	1.9 - 8 km [37] [II]	6 km	1000 [9, 10b, 34] [I, II]	0.001 [24]	*Great Bear Domain*: plutonic (granitic) and volcano-sedimentary rock [34c]. *Hottah Domain*: plutonic and gneissic rock [20] *Fort Simpson Domain*: plutonic [20] and metasedimentary rock [34c]. Terrane lies immediately outside of west boundary of province. Lower depth scaled off regional seismic profile, for Ft. Nelson area in adjacent British Columbia [37] MT profiles show >1000 ohm.m [9], limited resolution; >1000 ohm.m [10b], with two 5 ohm.m conductive anomalies; in nearby NWT range 250-1000 ohm.m [34], dominantly 1000 ohm.m Assign 1000 ohm.m based on predominance. Limits 250, 1000 ohm.m
4. Middle Crust	8 - 18 km [37] [II]	10 km	1300 [9, 10b, 34] [I, II]	0.00076 [24]	Lower depth scaled off regional seismic profile, for Ft. Nelson area in adjacent British Columbia [37] MT profiles show 200 >1000 ohm.m [9], dominantly 1000 ohm.m, start of a lower crust conductor at bottom of layer 4; >1000 ohm.m [10b], with two 40-60 ohm.m conductive anomalies; range 100-2500 ohm.m [34], midpoint 1300 ohm.m, exclusive of conductive anomalies ranging 10-100 ohm.m, in nearby NWT. Conductor E is 10 ohm.m in middle crust, and its influence extends to 100 km depth where anomaly becomes 100 ohm.m, and occurs at boundary between Hottah and Great Bear terranes. 20.6 km depth resistivity map shows dominantly >1000 ohm. [9] Assign 1300 ohm.m midpoint of range 100-2500 based on nearby survey in NWT. Limits 100, 2500 ohm.m

Table 10 (continued)
1D Earth Resistivity Model Proximal for Alberta Zone 10 (Great Bear, Hottah, Fort Simpson)

Layer	Depth Confidence	Thickness	Resistivity (ohm-m) Confidence	Conductivity (S/m) Confidence	Comments
5. Lower Crust	18 – 40 km [34b, 37] [II]	22 km	800 [9, 10b, 34] [I, II]	0.00125 [24]	Lower depth scaled off seismic profiles. Moho possibly at 39 km [18b]; approx. 40 km depth beneath Hottah terrane and Great Bear magmatic arc [34]; at Ft. Nelson area (Ft. Simpson magmatic belt) Moho is transitional between 41-45 km [37]; in NWT adjacent northern Alberta ranges 37-40 km deepening eastward, midpoint 38.5 km [34b] Assign 40 km, average of midpoint depths MT profiles show 200 >1000 ohm.m [9], dominantly 1000 ohm.m; 100>1000 ohm.m [10b], lower resistivity due influence of upper crustal conductors. Chose 325 ohm.m weighted average ((100 x 0.75) + (1000 x 0.25)); range 100-2500 ohm.m [34], midpoint 1300 ohm.m, exclusive of conductive anomalies (C, D, E, F) ranging 10-100 ohm.m, in nearby NWT 41 km depth resistivity map shows 30-200 (midpoint 115 ohm.m) ohm.m covering 20% of, and >1000 ohm.m covering 80% of Zone. Chose 825 ohm.m weighted average ((115*0.20) + (1000*0.80)) Assign approx. 800 ohm.m, average of midpoints 825, 325 and 1300 ohm.m. Limits 30, 2500 ohm.m
6. Upper Mantle	40 - 100 km [23] [III]	60 km	500 [9, 34] [I, II]	0.002 [24]	Used generalized lower depth [23]. MT profiles show 250-800 ohm.m [9], dominantly 800 ohm.m; range 60-400 ohm.m [34] and includes conductive anomalies H and I at 80-100 km depth. Chose midpoint 230 ohm.m of range 65 km depth resistivity map [9] shows range 30-300 ohm.m (conductive anomaly) covering 25% of zone, and 400>1000 ohm.m remaining 75%. Chose approx. 800 ohm.m weighted average ((midpoint 160 ohm.m x 0.25) + (mainly 1000 x 0.75)) Assign approx. 500 ohm.m, average of midpoints 800, 230 ohm.m incorporating same terranes found in adjacent NWT. Limits 30, 1000 ohm.m

Table 10 (continued)
1D Earth Resistivity Model Proximal for Alberta Zone 10 (Great Bear, Hottah, Fort Simpson)

Layer	Depth / Confidence	Thickness	Resistivity (ohm-m) / Confidence	Conductivity (S/m) / Confidence	Comments
7. Upper Mantle	100 - 250 km [23]	150 km	100-200km 920 [9] [I]	100-200km 0.00108 [24]	Used generalized lower depth [23]. MT profiles [9] show distinct resistivity change at 200 km depth MT profiles [9] show at: *100-200 km depth, range 200>1000 ohm.m, influence of KC anomaly (200 ohm.m) between 100-125 km depth, predominately >1000 ohm.m overall elsewhere. Choose 920 ohm.m weighted average ((1000 x 0.9)+(200 x 0.10)) * 200-250 km depth, range 30-80 ohm.m (midpoint 50 ohm.m) Assign 625 ohm.m weighted average ((920 x 0.66)+(midpoint 50 x 0.34)) based on areal coverage with respect to depth. Limits 100, 1000 ohm.m between 100-200 km and 30, 80 ohm.m between 200-250 km
	[III]		200-250km 50 [9] [I]	200-250km 0.02 [24]	
			100-250 km 625 [9] [I]	100-250 km 0.0016 [24]	
8. Upper Mantle	250–410 km [23]	160 km	50 [25]	0.019952 [23]	Utilized North American regional model [23], based on Tucson magnetic observatory data, situated on Proterozoic crust (late Precambrian time) for all depths and resistivities below 250 km
	[III]			[III]	
9. Transition Zone	410–520 km [23]	110 km	20 [25]	0.050118 [23]	---
	[III]			[III]	
10. Transition Zone	520–670 km [23]	150 km	5.62 [25]	0.177827 [23]	---
	[III]			[III]	

Table 10 (continued)
1D Earth Resistivity Model Proximal for Alberta Zone 10 (Great Bear, Hottah, Fort Simpson)

Layer	Depth / Confidence	Thickness	Resistivity (ohm-m) / Confidence	Conductivity (S/m) / Confidence	Comments
11. Lower Mantle	670–900 km [23]	230 km	1.58 [25]	0.630957 [23]	---
	[III]			[III]	
12. Lower Mantle	900–1000 km [23]	100 km	0.89 [25]	1.122018 [23]	---
	[III]			[III]	

BC	British Columbia
GSLsz	Great Slave Lake shear zone
KC	Kiskatinaw Conductor
LC	Loverna Conductor
MHB	Medicine Hat Block
moho	Mohorovicic Discontinuity
MT	magnetotelluric
NE	northeast
NW	northwest
NWT	Northwest Territories
SE	southeast
SW	southwest
VS	Vulcan Structure
WCSB	Western Canada Sedimentary Basin
2D	two-dimensional
3D	three-dimensional

Table 10 (continued)
List of sources for 1D Earth Resistivity Model Proximal for Alberta

[1]	Fenton et al. (1994), Fig. 26.3-Surface to Bedrock Isopach drift thickness	[18a]	Bouzidi et al. (2002), Table 4
[2]	Barker et al (2011), p.27, Figs. 3.1, 3.2	[18b]	Bouzidi et al. (2002), Fig. 8
[3]	Oldenborger et al. (2010), p.3	[18c]	Bouzidi et al. (2002), Table 2
[4]	Fulton (1995), map, surficial materials	[19a]	Hope and Eaton (2002), Fig. 13
[5]	Slattery and Andriashek (2012), stratigraphic and resistivity cross-sections	[19b]	Hope and Eaton (2002), Fig. 7
[6]	Gowan et al. (2009), Figs. 7, 8	[19c]	Hope and Eaton (2002), Fig. 17
[7]	Wright et al. (1994), Fig. 3.2 isopach map	[20]	Villeneuve et al. (1993)
[8]	Turkoglu et al. (2007), Figs. 14 and 15	[23]	Kelbert et al. (2009), Figure 2, global and regional conductivity profile, Canada or North America regional conductivity chosen
[9]	Turkoglu et al. (2009), Figs. 7, 8.	[24]	Converted from resistivity obtained from listed reference source
[10a]	Boerner et al. (2000), Fig. 9	[25]	Converted from conductivity obtained from listed reference source
[11]	Xiao (2006), p.329	[32]	Palacky (1988)
[12a]	Nieuwenhuis (2014), p.851	[33]	Palacky (1992)
[12b]	Nieuwenhuis (2014), Fig. 9	[34]	Wu et al. (2005), Fig. 10
[12c]	Nieuwenhuis (2014), Fig. 10	[34b]	Wu et al. (2005), Fig. 13
[12d]	Nieuwenhuis (2014), Fig. 12	[34c]	Wu et al. (2005)
[12e]	Nieuwenhuis (2014), Fig. 7	[35a]	Nieuwenhuis (2011), Figs. 5.8
[12f]	Nieuwenhuis (2014), Fig. 14	[35b]	Nieuwenhuis (2011), Figs. 6.3
[12g]	Nieuwenhuis (2014), Fig. 13	[36]	Zelt (1989), Fig. 4.10
[12h]	Nieuwenhuis (2014), p. 4	[36b]	Zelt (1989), Fig. 4.34

Table 10 (continued)
1D Earth Resistivity Model Proximal for Alberta Zone 10 (Great Bear, Hottah, Fort Simpson)

[13] Hammer et al. (2011), lithospheric cross-section

[14] Lemieux et al. (2002) Fig. 13

[15] Gorman et al. (2002), Fig. 10

[16] Clowes et al., (2002), Fig. 8

[37] Welford et al (2001), Figs. 4, 11

[38] Eaton et al. (2000)

[39] Pana (2003)

[40] Wu et al. (2002)

NOTES:

Depth Confidence

I = best representation

* overburden: geological report/map coverage of local area.
* crust: seismic/gravity transects crossing local area, within 10 km.

II = likely representative

* overburden: geological report/map coverage of region
* crust/upper mantle: geological and/or seismic transect of a regional nature.

III = possibly representative (measurements from general compilations).

Resistivity/Conductivity Confidence

I = best representation (measurements from site or nearby).

* overburden: resistivity measurement by surface geophysical method and/or borehole in local area.
* crust: resistivity measurement from resistivity survey, MT survey and/or borehole in local area.

II = likely representative (resistivity values extrapolated from measurements taken at some distance from the site, typically greater than 100 km).

* overburden: resistivity value obtained by geophysical measurement, including borehole logs.
* sedimentary basin: value obtained by geophysical survey using variety of geophysical electromagnetic methods, including MT.
* crust: value obtained by regional MT survey.

III = possibly representative (measurements from general compilations).

Appendix 2

Detailed Description of the Earth Resistivity Models for British Columbia

1. Geological Settings of the British Columbia

From east to west, the five geomorphological belts are the Insular Belt, Coast Belt, Intermontane Belt and Foreland Belt. These subparallel belts trend in a north-northwest direction. Each belt has a distinctive combination of physiography, tectonic origin, geological age, lithology (rock type), degree of metamorphism[2], volcanism, plutonism and structural style (GSC, 2007e; Gabrielse and Yorath, 1991). Within each of the belts are a number of smaller terranes, also characterized by the distinctive features distinguishing the belts.

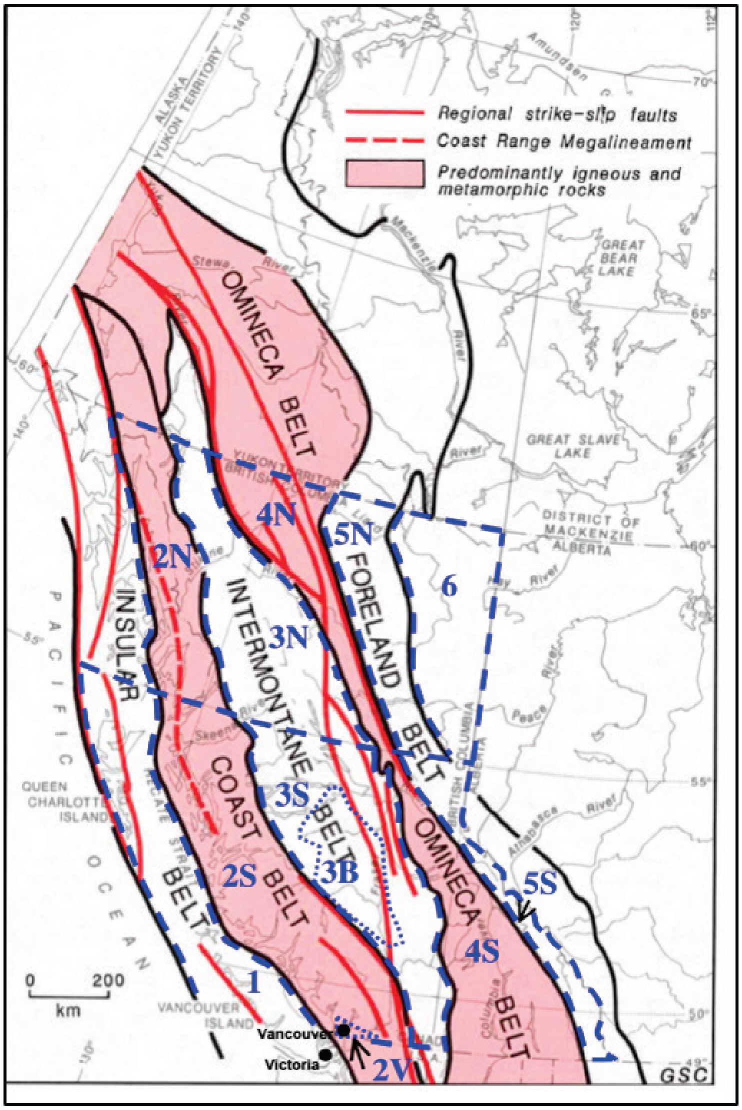


__Figure 1.__ Geomorphological belts of the Canadian Cordillera (after Gabrielse et al., 1991). Coverage area of 1D resistivity models labeled "1 to 6"

---

[2] Distinctive assemblage of minerals developed after original rock has been subjected to high pressure and heat condition

The northeast corner of BC is underlain by part of the vast Western Canadian Sedimentary Basin (WCSB), a wedge-like package of slightly dipping strata that extends beneath much of Alberta, southern Saskatchewan and southwestern Manitoba as well as the southwest corner of the Northwest Territories. The WCSB forms part of the Interior Platform geological Province that lies over crystalline basement rock of Precambrian age.

The Canadian Cordillera is interpreted to be a collage of oceanic and island-arc[3] fragments or terranes accreted to the ancestral North America during Mesozoic to Tertiary time (185 – 50 Ma[4]). The ancestral North American rocks are found mainly in the Foreland Belt (sedimentary rock that has been thrust-faulted and folded), and the Omineca Belt (metamorphosed sediments and plutonic[5] rock) (Struik and MacIntyre, 2001). Later collision against the North American continent by disparate crustal fragments, or terranes, some which originated at distant paleolatitudes, formed the Intermontane and Insular Belts (volcanic and sedimentary rock). The Coast Belt (mostly granitic and metamorphic rock) welds the Insular and Intermontane Belts (Gabrielse et al., 1991).

As presented in Figure 1, the 12 one-dimensional (1D) layered models are representing the vertical variance of electrical resistivity in the crust and mantle underlying British Columbia. Ten of the models provide coverage of the five geomorphological belts (i.e. linear geological Provinces) that define the Cordilleran Orogen[6] of Canada within in British Columbia. An additional two models are focused on the Vancouver metropolitan area on the BC mainland, and the Nechako Basin, which is a prospective host for petroleum hydrocarbon resources.

Because of the availability of two relatively recent magnetotelluric 2D inversion profiles (Jones et al, 2005; Rippe et al., 2013) traversing the north and south portions of British Columbia (BC), it was possible to supply Earth models for north and south halves of British Columbia for four of the geomorphological belts.

However, it is possible that models covering the northern half of BC for layers 3 to 7 (crust and uppermost mantle) depict an overestimation of the resistivity compared to southern BC. This is because the 2D inversion profile for northern BC (see Fig. 7 in Jones et al., 2005) has a resistivity-scale end-point (approx. 50000 ohm.m) that is one-magnitude larger than the profile for southern BC (see Fig. 11 in Rippe et al., 2013). Another ambiguity is the difference in the resistivity scales' colour codes between the inversion profiles for the depth 0-80 km (Fig. 7, Jones et al., 2005), and for a depth of 0-500 km (Fig 6, Jones et al., 2005), where the associated resistivity-scale has a lower end-point (approx. 10000 ohm.m) resulting in an overall reduction of depicted resistivity.

---

[3] An arcuate range of volcanoes and intrusive bodies (plutons) parallel to a subduction zone, occurring on ocean or continental tectonic plates.

[4] Million years

[5] Molten rock that has cooled beneath Earth's surface

[6] A regionally extensive belt of deformed rock (typically mountainous) resulting from collision of lithospheric plates and/or fragments. Gives rise to subduction and obduction zones and fold and thrust belts. An orogeny adds to expansion of a continent by accretion of terranes to pre-existing continent (Eyles and Miall, 2007, p. 487)

2. Zonal Earth resistivity models

Tables 1 to 12 summarize the sources for the chosen values of depth and resistivity values and justification for selection. Caution should be exercised when comparing resistivity values in northern BC versus southern BC for an individual zone, but comparisons between Zones inside either northern or southern BC would be valid since it is a relative comparison to Zones situated either north or south of latitude 55 degrees.

3. References

Andrews, G D M, and Russell, J K., 2008. "Cover Thickness across the Southern Interior Plateau, British Columbia (NTS 092O, P; 093A, B, C, F): Constraints from Water-Well Records," in Geoscience BC Summary of Activities 2007, *Geoscience BC*, Report 2008-1, 11–20.

Andrews, G D M, and Russell, J K., 2010. "Distribution and thickness of volcanic and glacial cover on the Interior Plateaus [Abstract]," in TGI-3 Workshop: Public geoscience in support of base metal exploration program and abstracts, *Geological Association of Canada*, Cordilleran Section, 45-48.

Andrews, G.D.M., Plouffe, A., Ferbey, T., Russell, J. K., Brown, S.R. and Anderson, R.G., 2011. "The thickness of Neogene and Quaternary cover across the central Interior Plateau, British Columbia: analysis of water-well drill records and implications for mineral exploration potential," *Canadian Journal of Earth Sciences*, v.48, 973-986, doi:10.1139/E10-080

Armstrong, J.E., 1990. "Vancouver Geology", edited by Charlie Roots and Chris Staargaard, *Geological Association of Canada – Cordilleran Section*, 128 p.

Best, M.E., Levson, V.M. and Diakow, L.J., 1997. "Electromagnetic mapping in drift covered regions of the Nechako Plateau, British Columbia," in Interior Plateau Geoscience Project" Summary of Geological, Geochemical and Geophysical Studies, (ed.) L.J. Diakow and J.M. Newell, *BC Geological Survey Branch*, Paper 1997-2, 159-172 (also available as Geological Survey of Canada Open File 3448).

Calvert, A.J. and Andrews, G.D.M., 2014. "New geoscientific constraints on the hydrocarbon potential of the nechako-Chilcotin plateau of central British Columbia," *Canadian Journal of Earth Sciences*, v.51, 5 p. doi:10.1139/cjes-2014-0054

Christiansen, E.A. and Schmid, B.J., 2014. "Glacial geology of southern Saskatchewan", 29 p. [available via web search using title; no URL provided]

Clague, J.J., 1984/ "Quaternary geology and geomorphology, Smithers-Terrace-Prince Rubert area, British Columbia," Memoir 413, *Geological Survey of Canada,* 71 p.

Clague, J.J. and Luternauer, J.L., 1983. "Field Trip 6, Late Quaternary geology of southwestern British Columbia," *Geological Association of Canada – Victoria Section*, 120 p.

Clowes, R.M., Zelt, C.A., Amor, J.R. and Ellis, R.M., 1995. "Lithospheric structure in the southern Canadian Cordillera from a network of seismic refraction lines," *Canadian Journal of Earth Sciences*. v.32, 1485-1513

Clowes, R.M., White, D.J. and Hajnal, Z., 2010. "Mantle heterogeneities and their significance: results from Lithoprobe seismic reflection and refraction – wide-angle reflection studies," *Canadian Journal of Earth Sciences*. v.47, 409-443, doi:10.1139/E10-009

Cook, F.A., Clowes, R.M., Snyder, D.B., van der Velden, A.J., Hall, K.W., Erdmer, P., and Evenchick, C.A., 2004. "Precambrian crust beneath the Mesozoic northern Canadian Cordillera discovered by Lithoprobe seismic reflection profiling," *Tectonics*, v.23, TC2010, 28 p., doi:10.1029/2002TC001412

Cook, F.A., White, D.J., Jones, A.G., Eaton, D.W.S., Hall, J. and Clowes, R. M., 2010. "How the crust meets the mantle: Lithoprobe perspectives on the Mohorovicic discontinuity and crust-mantle transition," *Canadian Journal of Earth Sciences*. v.47, 315-351, doi:10.1139/E09-076

Creaser, B. and Spence, G., 2005. "Crustal structure across the northern Cordillera, Yukon Territory, from seismic wide-angle studies: Omineca Belt to Intermontane Belt," *Canadian Journal of Earth Sciences*. v.42, 1187-1203, doi:10.1139/E04-093

Dixon-Warren, A., 1998. "Terrain mapping and drift prospecting in south central British Columbia," M.Sc. Thesis, *Simon Fraser University*, 205 p.

Dixon-Warren, A. and Hickin, A., 2000. "Surficial geology of the Swift River area, British Columbia, NTS 104N/9, 16 and 104 NW" *British Columbia Geological Survey Branch*, Open file 2000-5, scale 1:100,000

Enkin, R.J., 2014. "The rock physical property database of British Columbia, and the distinct petrophysical signature of the Chilcotin basalts," *Canadian Journal of Earth Sciences*, v.51, 327-338 doi:10.1139/cjes-2013-0159

Fenton, M.M., Schreiner, B.T., Nielsen, E., and Pawlowicz, J.G., 1994. "Chapter 26 – Quaternary geology of the Western Plains," in *Geological Atlas of the Western Canada Sedimentary Basin*, G.D. Mossop and I. Shetsen (comp.), Canadian Society of Petroleum Geologists and Alberta Research Council, http://www.ags.gov.ab.ca/publications/wcsb_atlas/atlas.html

Ferbey, T., 2014. "Surficial geology of the Colleymount map area (NTS 093L/01), British Columbia," *British Columbia Ministry of Energy and Mines*, British Columbia Geological Survey Geoscience Map 2014-02, Geoscience BC Map 2014-09-02, scale 1:50 000.

Ferri, F. and Riddell, J., 2006. "The Nechako basin project: new insights from the southern Nechako basin," *Summary of Activities 2006*, BC Ministry of Energy, Mines and Petroleum Resources, 89-124.

Gabrielse, H., 1962. "Geology, Kechika, British Columbia, Sheet 94L," *Geological Survey of Canada,* Preliminary Series Map 42-1962, scale 1:253,440.

Gabrielse, H., 1963. "Geology, Rabbit River, British Columbia, Sheet 94M," *Geological Survey of Canada,* Preliminary Series Map 42-1962, scale 1:253,440.

Gabrielse, H. and Yorath, C.J., 1991. "Intoduction, Chapter 1 - Geology of the Cordilleran Orogen in Canada," *Geological Survey of Canada*, Geology of Canada, no. 4, 3-11 (also Geological society of America, the Geology of North America, v. G-2)

Gabrielse, H., Monger, J.W.H., Wheeler, J.O., and Yorath, C.J., 1991. "Part A. Morphogeological belts, tectonic assemblages, and terranes," in Chapter 2 or Geology of the Cordilleran Orogen in Canada, *Geological Survey of Canada*, Geology of Canada, no. 4, 15-28 (also Geological society of America, the Geology of North America, v. G-2)

Gowan, E. J., Ferguson, I. J., Jones, A. G., and Craven, J. A., 2009. "Geoelectric structure of the Northeastern Williston basin and underlying Precambrian lithosphere," *Canadian Journal of Earth Science*, 46, no. 6, 46, 441-464. http://dx.doi.org/10.1139/E09-028

GSC, 2007a. "Island mountains and sea floor," Cordilleran Geoscience, *Geological Survey of Canada*, 2007-11-28, 1 p. http://gsc.nrcan.gc.ca/cordgeo/insular_e.php

GSC, 2007a. "The igneous sea-wall," Cordilleran Geoscience, *Geological Survey of Canada*, 2007-11-28, 1 p. http://gsc.nrcan.gc.ca/cordgeo/coast_e.php

GSC, 2007b. "Boundary of old and new continental crust," Cordilleran Geoscience, *Geological Survey of Canada*, 2007-11-28, 1 p. http://gsc.nrcan.gc.ca/cordgeo/omineca_e.php

GSC, 2007c. "Overlapping the old continental edge," Cordilleran Geoscience, *Geological Survey of Canada*, 2007-11-28, 1 p. http://gsc.nrcan.gc.ca/cordgeo/foreland_e.php

GSC, 2007d. "700 Ma. – Rifting and separation of a supercontinent," Cordilleran Geoscience, *Geological Survey of Canada*, 2007-11-28, 1 p. http://gsc.nrcan.gc.ca/cordgeo/700ma_e.php

GSC, 2007e. "Cordilleran geoscience," Cordilleran Geoscience, *Geological Survey of Canada*, 2007-11-28, 1 p. http://gsc.nrcan.gc.ca/cordgeo/index_e.php

Guthrie, R.H. and Penner, C.R., 2005. "Vancouver island surficial geology," *British Columbia Ministry of Environment*, scale 1:400000.

Hackbarth, D.D., 1978. "Hydrogeological map of the Grande Prairie area, Alberta, NTS 83M, "Map 125, *Alberta Geological Survey*, scale 1: 250,000.

Hamilton, T., 1990. “Georgia Basin: submarine and geophysics,” in Cordilleran Geology and Exploration Roundup, Programs and Abstracts, Vancouver, February 6-9, 1990, *Geological Survey of Canada*, Open File 2225, p.20

Hamilton. T.S. and Ricketts, B.D., 1994. “Contour map of the sub-Quaternary bedrock surface, Strait of Georgia and Fraser Lowland,” ,” in Geology and Geological Hazards of the Vancouver Region, southwestern British Columbia, (ed,) J.W.H. Monger, *Geological Survey of Canada*, Bulletin 481, 193-196.

Hammer P.T.C. and Clowes, R.M., 2004. “Accreted terrnes of northwestern British Columbi, Canada: lithospheric velocity structure and tectonics,” *Journal of Geophysical Research*, v.109, B06305, 19 p. doi:10.1029/2003JB002749

Hartman, G.M.D. and Clague, J.J., 2008. “Quaternary stratigraphy and glacial history of the Peace River valley, northeast British Columbia,” *Canadian Journal of Earth Sciences*, v.45, 549-564 doi:10.1139/E07-069

Hickin, A.S., Kerr, B., Turner, D.G. and Barchyn, T.E., 2008. “Mapping Quaternary paleovallys and drift thickness using petrophysical logs, northeast British Columbia, Fontas map sheet, NTS94I,” *Canadian Journal of Earth Sciences*, v.45, 577-591 doi:10.1139/E07-063

Holland, S.S., 1976. “Landforms of British Columbia: a physiographic outline,” Bulletin 48, *British Columbia Geological Survey*, 138 p.

Hoy, T., 1984. “Geology of the Cranbrook sheet and Sullivan Mine area,” (N.T.S. 82G/12, 82F/9), Preliminary Map No. 84, *Ministry of Energy, Mines and Petroleum Resources*, 1:50000.

Idowu, O.A., Frederiksen, A.W. and Cassidy, J.F., 2011. “Imaging the Nechako Basin, British Columbia, using ambient seismic noise,” *Canadian Journal of Earth Sciences*, v.48, 1038-1049 doi:10.1139/E11-007

Jones, A. G. and Gough, D.I., 1995. “Electromagnetic images of crustal structures in southern and central Canadian Cordillera,” *Canadian Journal of Earth Sciences*, v.32, 1541-1563

Jones, A.G., Ledo, J., Ferguson, I.J., Farquharson, C., Garcia, X., Grant, N., McNeice, G., Roberts, B., Spratt, J., Wennberg, G., Wolynec, L. and Wu Xianghong., 2005. “The electrical resistivity structure of Archean to Tertiary lithosphere along 3200 km of SNORCLE profiles, northwestern Canada,” *Canadian Journal of Earth Sciences*, v.42, 1257-1275 doi:10.1139/E05-080

Klassen, R.W., 1978. “Surficial geology, Blind Lake, Yukon Territory and British Columbia, NTS 105A-1,2, 104P-15, 16” *Geological Survey of Canada*, Open File 594, scale 1:100,000

Kelbert, A., Schultz, A., and Egbert, G., 2009. “Global electromagnetic induction constraints on transition-zone water content variations,” *Nature*, v. 460, no. 20, August 2009, 1003-1006. http://dx.doi.org/10.1038/nature08257.

Kenny, S., 2004. “Aquifers of the Capital Regional District, Appendix B: Hyrogeologic cross-sections” *British Columbia Ministry of Water, Land and Air Protection*, prepared for the Capital Regional District, Victoria, December 2004, 93 p. http://www.env.gov.bc.ca/wsd/plan_protect_sustain/groundwater/aquifers/aquifers_crd/aquif_crd.html

Kerr, D.E. and Levson, V.M., 1997. “Drift prospecting activities in British Columbia : an overview with emphasis on the Interior Plateau,” Paper 1997-2, *Ministry of Employment and Investment*, 14p.

Kim, H.S., Cassidy, J.F., Dosso, S.E. and Ka, H., 2014. “Mapping crustal structure of the Nechako–Chilcotin plateau using teleseismic receiver function analysis,” *Canadian Journal of Earth Sciences*, v.51, 407-417 dx.doi.org/10.1139/cjes-2013-0147

Ledo, J. and Jones, A.G., 2002. “Electromagnetic images of a strike-slip fault: the Tintina fault-Northern Canadian,” *Geophysical Research Letters*, v.29, no.8, 1225, doi:10.1029/2001GL013408

Levson, V.M. and Giles, T.R., 1997. “Quaternary geology and till geochemistry studies in the nechako and Fraser Plateaus, central British Columbia (NTS 93 C/1, 8, 9, 10; F/2, 3, 7; L/16; M/1),” in Interior Plateau Geoscience Project” Summary of Geological, Geochemical and Geophysical Studies, (ed.) L.J. Diakow and J.M. Newell, *BC Geological Survey Branch*, Paper 1997-2, 121-145 (also available as Geological Survey of Canada Open File 3448).

Levson, V.M., Mate, D.J., and Stuart, A.J., 1999. “Quaternary geology and drift prospecting studies in the north central Nechako Plateau (93F and K),” in Geological Fieldwork 1998, B.C. Ministry of Energy and Mines, Paper 1999-1, 5-24.

Levson, V.M., Kerr, D.E., Lowe, C. and Blyth, H., 2003. “Quaternary geology of the Atlin area, British Columbia,” *British Columbia Geological Survey Branch*, Geoscience Map 2003-1 and Geological Survey of Canada , Open File 1562, scale 1:50000

Levson, V. and Fournier, M., 2012. “Surficial geology, Fort Nelson (NTS 94-J/NE). British Columbia,” *Geological Survey of Canada*, Open File 7041; British Columbia Ministry of Energy and Mines, BCGS Geoscience Map 2011-06, scale 1:100,000 doi:10.4095/291399

Levson, V.M., 2001. “Quaternary geology of the Babine porphyry copper district: implications for geochemical exploration,” *Canadian Journal of Earth Sciences*, v.38, 733-749 doi:10.1139/cjes-38-4-733

Levson, V.M. (compiler), 2002. "Surficial geology compilation map of he Babine porphyry district, NTS 93L/9, 16; 93M/1, 2, 7, 8," *British Columbia Geological Survey Branch*, Geoscience Map 2002-2, scale 1:100,000

Luternauer, J.L., Barrie, J.V, Christian, H.A. et al., 1994. "Fraser River delta: geology, geohazards and human impact," in Geology and Geological Hazards of the Vancouver Region, southwestern British Columbia, (ed,) J.W.H. Monger, *Geological Survey of Canada*, Bulletin 481, 197-220.

Mayberry, J., 2000. "Groundwater resources near Vanderhoof, British Columbia," Current Research 2000, *Geological Survey of Canada*, 10 p.

Maynard, D.E., Ward, B.C., Geertsema, M., Roberts, N. and Sacco, D., 2010. "Relative drift thickness map, north-central BC, (93G, 93H/w, & 93J/s), *Geoscience BC*, map 2010-14-1, 1:250000

McCuaig, S., 2003. "Surficial geology, Kitsault Valley, Nass Valley, British Columbia," *Geological Survey of Canada*, Open file 3901, scale 1:100,000

Monger, J. and Price, R., 2002. "The Canadian Cordillera: geology and tectonic evolution," *CSEG Recorder*, February 2002, 17-36.

Mustard, P.S. and Rouse, G.E., 1994. " Stratigraphy and evolution of Tertiary Georgia Basin and subjacent Upper Cretaceous sedimentary rocks, southwestern British Columbia and northwestern Washington State," in Geology and Geological Hazards of the Vancouver Region, southwestern British Columbia, (ed,) J.W.H. Monger, *Geological Survey of Canada*, Bulletin 481, 97-169.

Mwenifumbo, C J., Bezys, R., Betcher, R., and Killeen, P G., 1995a. "Borehole geophysical logs, Manitoba (1992): contents include logs from Grand Rapids and Winnipeg," Geological Survey of Canada, Open File 2734, 22 p., doi:10.4095/203638.

Mwenifumbo, C J., Killeen, P G., Thorleifson, L H., 1995b. "Borehole geophysical logs, overburden holes, southeastern Manitoba," *Geological Survey of Canada*, Open File 2775, 1995, 15 p., doi:10.4095/203639.

Mwenifumbo, C.J. and Mwenifumbo, A.L., 2010. "Analysis of well logs from the Nechako Basin," *Geological Survey of Canada*, Open File 6542, 36 p.

Natural Resources Canada, 2009. "Surficial materials, 6th edition," The Atlas of Canada, Natural Resources Canada

Oldenborger, G A; Pugin, A J -M; Hinton, M J; Pullen, S E; Russell, H A J; Sharpe, D R., 2010. "Airborne time-domain electromagnetic data for mapping and characterization of the Spiritwood Valley aquifer, Manitoba, Canada," *Geological Survey of Canada*, Current Research (Online) no. 2010-11, 2010; 16 pages, doi:10.4095/286056

O'Leary, D.M., Clowes, R.M. and Ellis, R.M., 1993. "Crustal velocity structure in the southern Coast Belt, British Columbia," *Canadian Journal of Earth Sciences*, v.30, 2389-2403.

Palacky, G.J., 1988. "Resistivity characteristics of geologic targets" in *Electromagnetic Methods in Applied Geophysics-Theory*, Vol.1, M.N. Nabighian (ed.); Society of Exploration Geophysicists, 53-130.

Ricketts, B.D. and Liebscher, H., 1994. "The geological framework of groundwater in the Greater Vancouver area," in Geology and Geological Hazards of the Vancouver Region, southwestern British Columbia, (ed,) J.W.H. Monger, *Geological Survey of Canada*, Bulletin 481, 287-298.

Rippe, D., Unsworth, M.J. and Currie, C. A., 2013. "Magnetotelluric constraints on the fluid content in the upper mantle beneath the southern Canadian Cordillera: Implications for rheology," *Journal of Geophysical Research: Solid Earth*, v.118, 5601-5624 doi:10.1002/jgrb.50255

Roots, C., 1990. "Surficial and bedrock geology of the Fraser Lowland and Coast Mountains near Howe Sound (to accompany VANCOUVER GEOLOGY by J.E. Armstrong), map

Spratt, J. and Craven, J., 2008. "Initial results of a test survey in the Nechako Basin, B.C. designed to determine the usefulness of the magnetotelluric method in oil and gas exploration," *Back to Exploration – 2008 CSPG CWLS Convention*, 707-711.

Spratt, J. and Craven, J., 2010. "Magnetotelluric imaging of the Nechako Basin, British Columbia," *Geological Survey of Canada*, Current Research 2010-3, 9 p.

Spratt, J. and Craven, J., 2011. "Near-surface and crustal-scale images of the Nechako basin, British Columbia, Canada, from magnetotelluric investigations," *Canadian Journal of Earth Sciences*, v.48, 987-999, doi:10.1139/E10-098

Struik, L.C. and MacIntyre, D.G., 2001. "Introduction to the special issue of Canadian Journal of Earth Sciences: the nechako NATMAP project of the central Canadian Cordillera," *Canadian Journal of Earth Sciences*, v.38, 485-494, doi:10.1139/cjes-38-4-485

Trommelen, M. and Levson, V., 2008. "Quaternary stratigraphy o the Prophet River, northeastern British Columbia," *Canadian Journal of Earth Sciences*, v.45, 565-575, doi:10.1139/E07-072

Welford, J.K., Clowes, R.M., Ellis, R.M., Spence, G.D., Asudeh, I. And Hajnal, Z., 2001. "Lithospheric structure across the craton-Cordilleran transition of northeastern British Columbia," *Canadian Journal of Earth Sciences*, v.38, 1169-1189, doi:10.1139/cjes-38-9-1169

White, D. J. and Clowes. R. M., 1984. "Seismic investigation of the Coast Plutonic Complex - Insular Belt boundary beneath the Strait of Georgia," *Canadian Journal of Earth Sciences*, v.21, 1033-1049

Xiao, W. and Unsworth, M., 2006. "Structural imaging in the Rocky Mountain foothills (Alberta) using magnetotelluric exploration," *AAPG Bulletin*, v.90, no.3, March 2006, 321-333. doi:10.1306/10150504140

Zelt, B.C., Ellis, R. M. and Clowes, R.M., 1993. "Crustal velocity structure in the eastern Insular and southernmost Coast belts, Canadian Cordillera," *Canadian Journal of Earth Sciences*, v.30, 1014-1027.

Table 1
1D Earth Resistivity Model for British Columbia – Zone 1 (Insular Belt)

Layer	Depth Certainty	Thickness	Resistivity (ohm-m) Certainty	Conductivity (S/m) Certainty	Comments
	Insular Belt represents a set of exotic terranes that accreted onto North America [1]. The belt includes the mountain ranges of Vancouver Island, Queen Charlotte Islands and Alexander Archipelago in Alaska Panhandle, in addition to submerged regions of continental margin. Comprised of volcanic and sedimentary rock with intrusions of granitic rock. Most rocks within southern Insular Belt are of mid-Paleozoic and early Mesozoic time (350-180 Ma). Sandstones on east Vancouver Island and submerged around island are Late Cretaceous and Early Tertiary age (85-40 Ma). Present-day detrital sediments accumulating in Strait of Georgia and Fraser Delta in Vancouver region [2]. *Zone 1 includes a Layer 2, the Georgia Basin, situated between Vancouver Island and the BC mainland. Layer 2 appears as a distinct resistivity layer on MT inversion profile. For a layered Earth model of only Vancouver Island, then Layer 2 has to be excluded.* *Zone 1 is limited to extent of Insular Belt in Canada, mainly south of 55 degrees latitude.*				
1. Overburden	0 – 25 m [4] [I]	25 m	30 [s4, s5, s6, s36, s42] [III]	0.03333 [24]	Alpine Complexes (broken rock, colluvium, till pockets) predominant on higher ground. Patchy occurrences of a mix of till veneer / blanket, glaciofluvial (sands, gravels), glaciomarine to marine (clayey silt, sand and gravel) along coast of Vancouver Island [s40, 3]. In Greater Victoria area, typically clay overlies sand / gravel or till. Till has silty sand matrix. Surficial materials thickness varies from < 1 to > 1 m on Vancouver Island [3]. Variable thickness in Greater Victoria and Saanich Peninsula area, ranging approx. 2 m on steep slopes to 55 m in lowland areas, infrequently 100 m [4]. Assign 25 m thickness, midpoint of range determined for Greater Victoria and Saanich areas. Borehole logs of overburden in Saskatchewan, Manitoba and NE Ontario show: * till, 40-50 ohm.m, 20-100 ohm.m [s5, s6] * clayey and sandy till, 15-40 ohm.m range [s42] * clayey till, 25 ohm.m; silty till, 50 ohm.m; sandy till, 115 ohm.m [s36] * glaciolacustrine clay, 5-10 ohm.m, 30 ohm.m; silt, 10-20 ohm.m, 45 ohm.m; sand, 40-60 ohm.m, 80 ohm [s42, s36] * mix of till, clay, silt and sand, 5-30 ohm.m [s4] Assign 30 ohm.m overall, an average value on basis of glaciofluvial sands/silts and glaciomarine clays being predominant with possible range 5-60 ohm.m.

Table 1 (continued)
1D Earth Resistivity Model for British Columbia – Zone 1 (Insular Belt)

Layer	Depth Certainty	Thickness	Resistivity (ohm-m) Certainty	Conductivity (S/m) Certainty	Comments
2. Sedimentary Basin (offshore)	0 – 1 km [6] [I]	1 km	25 [8] [I]	0.04 [24]	Layer 2 applicable only to Georgia Strait, situated offshore between Vancouver Island and BC mainland. Layer 2 incorporates the Georgia Basin, a remnant forearc / strike-slip basin. It includes unconsolidated present-day detrital sediments (clay, silt, minor sand) accumulating in Strait of Georgia and Fraser Delta that overly Pleistocene glacial deposits (interlayers of till, sand, clay), all which rest on late Cretaceous – early Tertiary basin fill clastic sedimentary rock (sandstone, siltstone, mudstone, conglomerate [5, 2, 6]. Tertiary strata has gentle dips, overly the more deformed, faulted and folded, Cretaceous rock [7].
			Thickness approximately 2.5 km based on resistivity contrast on MT profile [8]. Seismic models [6] suggest maximum thickness 2 km (approx. 0.4 km unconsolidated sediments / glacial deposits; approx. 1.6 km clastic sedimentary rock). Depth to bedrock contour map illustrates maximum of 700 m unconsolidated sediments / glacial deposits [9]. Assign 1 km average thickness, midpoint of seismic determined depths. Depth 0 refers to sea-level. Well log in City of Richmond through Fraser Delta unconsolidated sediments reveal 90-100 ohm.m to 120 m depth [5]. MT profile Line ABC-N [8] across southern BC shows approximately 25 ohm.m overall crossing Strait of Georgia, and Line ABC-S shows approx. 25 ohm.m in area of Fraser Delta (continuation of Georgia Basin into Vancouver area Lower Mainland). Assign 25 ohm.m, on basis of MT profiles. Upper limit 100 ohm.m.		

Table 1 (continued)
1D Earth Resistivity Model for British Columbia – Zone 1 (Insular Belt)

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m) / Certainty	Comments
3. Upper Crust	1 – 9.5 km [10, 11, 12] / [I]	8.5 km	610 [8] / [I]	0.001639 [24]	Thick assemblage of middle Paleozoic to Jurassic volcanic, plutonic, and sedimentary rocks [6]. Depth scaled from regional seismic profile(s) across southern BC, approx. range 8-11.5 km [10, 11, 12]. Assign 9.5 km (below centre Vancouver Island), average of values.
			MT profiles [8] across southern BC show for: * Line ABC-N, dominantly 1030 ohm.m * Line ABC-S, weighted average approx. 195 ohm.m (see Note 1) * chose approx. 610 ohm.m, average of above lines 5-km depth resistivity map [13] shows overall 4250 ohm.m (see Note 2). 10-km depth resistivity map [13] shows overall 350 ohm.m. Assign 610 ohm.m, based on weighted averages of 2D inversion profiles. Limits 195, 1030 ohm.m.		
4. Middle Crust	9.5 – 20 km [11, 12] / [I]	10.5 km	310 [8] / [I]	0.003225 [24]	Depth scaled from regional seismic profile(s) across southern BC, approx. range 18.5-21.5 km [11, 12]. Assign 20 km (below centre Vancouver Island), average of values.
			MT profiles [8] across southern BC show for: * Line ABC-N, dominantly 560 ohm.m * Line ABC-S, weighted average approx. 50 ohm.m (see Note 1) * chose approx. 310 ohm.m, average of above lines 20-km depth resistivity map [13] shows overall 250 ohm.m (see Note 2). Assign 310 ohm.m, based on weighted averages of 2D inversion profiles. Limits 50, 560 ohm.m.		

Table 1 (continued)
1D Earth Resistivity Model for British Columbia – Zone 1 (Insular Belt)

Layer	Depth Certainty	Thickness	Resistivity (ohm-m) Certainty	Conductivity (S/m) Certainty	Comments
5. Lower Crust	20 – 30 km [11] [I]	10 km	90 [8] [I]	0.005714 [24]	Depth scaled from regional seismic profile across southern BC [11]. Assign 30 km (below centre Vancouver Island).
			MT profiles [8] across southern BC show for: * Line ABC-N, dominantly 115 ohm.m * Line ABC-S, weighted average approx. 60 ohm.m (see Note 1) * chose approx. 175 ohm.m, average of above lines 30-km depth resistivity map [13] shows overall 200 ohm.m (see Note 2). Assign approx. 90 ohm.m, based on weighted averages of 2D inversion profiles. Limits 60, 115 ohm.m.		
6. Upper Mantle	30 – 100 km [23] [III]	70 km	200 [8] [I]	0.005 [24]	Used generalized lower depth [23].
			MT profiles [8] across southern BC show for: * Line ABC-N, dominantly 270 ohm.m * Line ABC-S, weighted average approx. 130 ohm.m (see Note 1) Assign 200 ohm.m, based on weighted averages of 2D inversion profiles. Limits 130, 270 ohm.m		

Table 1 (continued)
1D Earth Resistivity Model for British Columbia – Zone 1 (Insular Belt)

Layer	Depth Certainty	Thickness	Resistivity (ohm-m) Certainty	Conductivity (S/m) Certainty	Comments
7. Upper Mantle	100 - 250 km [23] [III]	150 km	100-150km 230 [8] [I] 150-250km 200 [25] [III]	100-150km 0.004347 [24] 150-250km 0.005017 [23]	Layer 7 divisible into upper and lower segments. MT profiles [8] provide regional resistivity values between 100-150 km depth. Applied average of North American and Japan regional models for resistivity values between 150-250 km. 100-150 km depth: MT profiles [8] across coast Belt in southern BC show for: * Line ABC-N, weighted average 270 ohm.m [see Note 1] * Line ABC-S, weighted average 190 ohm.m * chose approx. 230 ohm.m, average of above lines Assign 230 ohm.m, based on weighted averages of 2D inversion profiles. Limits 190, 270 ohm.m. 150-250 km depth: Generalized depth [23] for base of lower segment. North American regional model [23], based on Tucson magnetic observatory data, situated on Proterozoic crust (late Precambrian time) indicates 210 ohm.m for 100-250 km. Japan regional model [23], situated on Phanerozoic subducting crust, indicates 190 ohm.m for 100-250 km. Assign approx. 200 ohm.m, average of North American and Japan models.

Table 1 (continued)
1D Earth Resistivity Model for British Columbia – Zone 1 (Insular Belt)

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m) / Certainty	Comments
8. Upper Mantle	250–410 km [23]	160 km	40 [25]	0.024732 [23]	Utilized average of North American regional model [23], based on Tucson magnetic observatory data, situated on Proterozoic crust (late Precambrian time) and Japan model situated on Phanerozoic subducting crust for all depths and resistivities below 250 km (see Note 3).
	[III]		[III]		
9. Transition Zone	410–520 km [23]	110 km	11 [25]	0.088005 [23]	Assign average of North American regional and Japan models.
	[III]			[III]	
10. Transition Zone	520–670 km [23]	150 km	2 [25]	0.486077 [23]	Assign average of North American regional and Japan models.
	[III]			[III]	
11. Lower Mantle	670–900 km [23]	230 km	1.22 [25]	0.815478 [23]	Assign average of North American regional and Japan models.
	[III]			[III]	
12. Lower Mantle	900–1000 km [23]	100 km	0.77 [25]	1.283728 [23]	Assign average of North American regional and Japan models.
	[III]			[III]	

See end of Table 12 for abbreviations and notes

Table 1 (continued)
1D Earth Resistivity Model for British Columbia – Zone 1 (Insular Belt)

NOTE 1: Calculation of Weighted Average for Layers 3 to 7, from 2D inversion profiles [8].

For each layer, percentage areal extent of dominant / midpoint resistivity value was determined by measurement (e.g. 25 % of layer is 150 ohm.m, thus 0.25 x 150). Resistivity estimated by visual comparison against provided resistivity scale.

Results below are rounded.

Layer 3, Upper Crust
Line ABC-N: ((0.35 x 150, midpoint of range 100-200) + (0.65 x 1500)) = approx. 1030 ohm.m
Line ABC-S: ((0.23 x 25, midpoint 10-40) + (0.71 x 140, midpoint 75-200) + (0.06 x 1500) = approx. 195 ohm.m

Layer 4, Middle Crust
Line ABC-N: ((0.18 x 45, midpoint of range 20-75) + (0.46 x 300, midpoint of range 100-500) + (0.28 x 1500)) = approx. 565 ohm.m
Line ABC-S: ((0.64 x 25, midpoint 10-40) + (0.36 x 90, midpoint 75-100))= approx. 50 ohm.m

Layer 5, Lower Crust
Line ABC-N: ((0.33 x 35 midpoint of range 30-40) + (0.08 x 75) + (0.44 x 100) + (0.15 x 350, midpoint of range 200-500)) = approx. 115 ohm.m
Line ABC-S: ((0.3 x 25, midpoint 10-40) + (0.14 x 35, midpoint 30-40) + (0.36 x 75) + (0.2 x 100) = approx. 60 ohm.m

Layer 6, Upper Mantle (Moho – 100 km)
Line ABC-N: ((0.04 x 35, midpoint of 30-40) + (0.06 x 75) + (0.04 x 100) + (0.08 x 150) + (0.44 x 200) + (0.24 x 400) + (0.1 x 650) = approx. 270 ohm.m
Line ABC-S: ((0.12 x 100) + (0.22 x 150) + (0.66 x 200)) = approx. 130 ohm.m

Layer 7, Upper Mantle (100- 150 km)
Line ABC-N: ((400 x 0.27) + (0.13 x 150) + (0.55 x 200) + ((0.05 x 650)) = approx. 270 ohm.m
Line ABC-S: ((0.06 x 150) + (0.94 x 200)) = approx. 190 ohm.m

NOTE 2: Determination of overall resistivity for specific depths, from depth resistivity maps [13], by (i) visual estimation of percentage areal extent of dominant / midpoint resistivity value (e.g. 50 % of area is 75 ohm.m, thus 0.5 x 75), and (ii) visual comparison against provided resistivity scale.

Results below are rounded to nearest 5 or 10.

5-km depth
((0.6 x 6500) + (0.4 x 875, midpoint of range 750-1000)) = approx. 4250 ohm.m

10-km depth
((0.2 x 6500) + (0.8 x 875, midpoint of range 750-1000)) = approx. 2000 ohm.m

20-km depth
((0.1 x 750) + (0.85 x 200) + (0.05 x 75)) = approx. 250 ohm.m

30-km depth
((0.1 x 750) + (0.9 x 140, midpoint of range 75-200)) = approx. 200 ohm.m

Table 1 (continued)
1D Earth Resistivity Model for British Columbia – Zone 1 (Insular Belt)

NOTE 3: Conductivity value obtained from measurement off Figure 2 in Kelbert et al. (2009). Resistivity listed below is the inverse of the conductivity value, and rounded where appropriate.

	North American Regional Model		Japan Model		Average	
Depth (km)	Conductivity (S/m)	Resistivity (ohm.m)	Conductivity (S/m)	Resistivity (ohm.m)	Conductivity (S/m)	Resistivity (ohm.m)
100 - 250	0.004786	210	0.005248	190	0.005017	200
250 - 410	0.019952	50	0.029512	34	0.024732	40
410 - 520	0.050118	20	0.125892	8	0.088005	11
520 - 670	0.177827	5.62	0.794328	1.26	0.486077	2
670 - 900	0.630957	1.58	1.0	1.0	0.815478	1.22
900 - 1000	1.122018	0.89	1.445439	0.69	1.283728	0.77

Table 2
1D Earth Resistivity Model for British Columbia – Zone 2S (Coast Belt)

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m) / Certainty	Comments
	Coast Belt includes Coast and Cascade mountains, plus the Fraser Lowland south and east of City of Vancouver. It is a long and narrow belt comprised mainly (80%) granitic rock, which intruded between Middle Jurassic and early Tertiary (170-45 Ma) time, and forms one of world's largest granitic masses known as the "Coast Plutonic Complex". Intervening between granitic intrusive bodies are "slivers" of metamorphosed, folded and faulted volcanic and sedimentary rock [14]. *Overall, for Zone 2N (Coast Belt) the Layer 2 – Sedimentary Basin – is considered absent. See Zone 2V (Vancouver and Lower Mainland) situated within Coast Belt but which includes the local Georgia Basin as Layer 2.*				
1. Overburden	0 – 2 m [s40] / [III]	2 m	115 [s36] / [III]	0.008695 [24]	Alpine complexes – a mix of colluvial material and till veneer / blanket, as patchy occurrences – are predominant on higher ground over much of Coast Belt interior. Patchy occurrences of colluvial blocks and rubble along west coast of belt, with addition of a patchy till veneer from Whistler to Vancouver. Patchy till veneer along east margin of Coast Belt [s40].
			Overburden thickness expected to be greatly variable, particularly in river valleys / fiords. Assign 2 m general thickness. Till source is plutonic rock forming the Coast Belt mountains, thereby a sandy till results. Assign 115 ohm.m, based on general resistivity value for sandy till in western Canada [s36]		
2. Sedimentary Basin	absent	---	---	---	---
3. Upper Crust	0 – 11 km [10] / [I]	11 km	820 [8] / [I]	0.001219 [24]	Complex mix of foliated plutonic rock, migmatite, gneisses, with minor zones of schists. Depth scaled from regional seismic profile(s) across southern BC, range 9.5-12 km [10]. Assign 11 km, average of values.
			MT profiles [8] across southern BC show for: * Line ABC-N, dominantly 1500 ohm.m * Line ABC-S, weighted average approx. 140 ohm.m (see Note 1) * chose approx. 820 ohm.m, average of above lines 5-km depth resistivity map shows overall 1660 ohm.m (see Note 2) [13]. 10-km depth resistivity map shows overall 1230 ohm.m [13]. Assign 820 ohm.m, based on weighted averages of 2D inversion profiles. Limits 140, 1660 ohm.m.		

Table 2 (continued)
1D Earth Resistivity Model for British Columbia – Zone 2S (Coast Belt)

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m) / Certainty	Comments
4. Middle Crust	11 – 23 km [10] / [I]	12 km	810 [8] / [I]	0.001234 [24]	Depth scaled from regional seismic profile(s) across southern BC, range approx. 20-24 km [10]. Assign 23 km, average of values.
			MT profiles [8] across southern BC show for: * Line ABC-N, weighted average approx. 1350 ohm.m (see Note 1). * Line ABC-S, weighted average aprrox. 265 ohm.m * chose approx. 810 ohm.m, average of above lines 20-km depth resistivity map [13] shows overall 175 ohm.m (see Note 2). Assign 810 ohm.m, based on weighted averages of 2D inversion profiles. Limits 180, 1350 ohm.m.		
5. Lower Crust	23 – 34.5 km [1010] / [I]	11.5 km	260 [8] / [I]	0.003846 [24]	Depth scaled from regional seismic profile(s) across southern BC, range approx. 32-35.5 km [10]. Assign 34.5 km, average of values.
			MT profiles [8] across southern BC show for: * Line ABC-N, range 30-800 ohm.m, midpoint 415 ohm.m * Line ABC-S, weighted average approx. 105 ohm.m (see Note 1) * chose approx. 260 ohm.m, average of above lines 30-km depth resistivity map [13] shows overall 180 ohm.m (see Note 2). Assign 260 ohm.m, based on weighted averages of 2D inversion profiles. Limits 30, 800 ohm.m.		
6. Upper Mantle	34.5 – 100 km [23] / [III]	65.5 km	120 [8] / [I]	0.008333 [24]	Used generalized lower depth [23].
			MT profiles [8] across southern BC show for: * Line ABC-N, weighted average 130 ohm.m (see Note 1) * Line ABC-S, weighted average 105 ohm.m * chose approx. 120 ohm.m, average of above lines Assign 120 ohm.m, based on weighted averages of 2D inversion profiles. Limits 75, 150 ohm.m (see Note 1).		

Table 2 (continued)
1D Earth Resistivity Model for British Columbia – Zone 2S (Coast Belt)

Layer	Depth Certainty	Thickness	Resistivity (ohm-m) Certainty	Conductivity (S/m) Certainty	Comments
7. Upper Mantle	100 - 250 km [23] [III]	150 km	100-150km 120 [8] [I] 150-250km 210 [25] [III]	100-150km 0.008333 [24] 150-250km 0.004786 [23]	Layer 7 divisible into upper and lower segments. MT profiles [8] provide regional resistivity values between 100-150 km depth. Applied North American regional model for resistivity values between 150-250 km. 100-150 km depth: MT profiles [8] across coast Belt in southern BC show for: * Line ABC-N, weighted average 120 ohm.m [see Note 1] * Line ABC-S, weighted average 115 ohm.m * chose approx. 120 ohm.m, average of above lines Assign 120 ohm.m, based on weighted averages of 2D inversion profiles. Limits 75, 100 ohm.m. 150-250 km depth: Generalized depth [23] for base of lower segment. North American regional model [23], based on Tucson magnetic observatory data, situated on Proterozoic crust (late Precambrian time) indicates 210 ohm.m for 100-250 km. Assign approx. 210 ohm.m, based on North American model.

Table 2 (continued)
1D Earth Resistivity Model for British Columbia – Zone 2S (Coast Belt)

Layer	Depth Certainty	Thickness	Resistivity (ohm-m) Certainty	Conductivity (S/m) Certainty	Comments
8. Upper Mantle	250–410 km [23] [III]	160 km	50 [25] [III]	0.019952 [23]	Utilized North American regional model [23], based on Tucson magnetic observatory data, situated on Proterozoic crust (late Precambrian time) for all depths and resistivities below 250 km.
9. Transition Zone	410–520 km [23] [III]	110 km	20 [25]	0.050118 [23] [III]	Assign North American regional model.
10. Transition Zone	520–670 km [23] [III]	150 km	5.62 [25]	0.177827 [23] [III]	Assign North American regional model.
11. Lower Mantle	670–900 km [23] [III]	230 km	1.58 [25]	0.630957 [23] [III]	Assign North American regional model.
12. Lower Mantle	900–1000 km [23] [III]	100 km	0.89 [25]	1.122018 [23] [III]	Assign North American regional model.

See end of Table 12 for abbreviations and notes

Table 2 (continued)
1D Earth Resistivity Model for British Columbia – Zone 2S (Coast Belt)

NOTE 1: Calculation of Weighted Average for Layers 3 to 7, from 2D inversion profiles [8].

For each layer, percentage areal extent of dominant / midpoint resistivity value was determined by measurement (e.g. 25 % of layer is 150 ohm.m, thus 0.25 x 150). Resistivity estimated by visual comparison against provided resistivity scale.

Results below are rounded.

Layer 3, Upper Crust
Line ABC-N: overall 1500 ohm.m
Line ABC-S: ((0.1 x 25) + (0.9 x 150)) = approx. 140 ohm.m

Layer 4, Middle Crust
Line ABC-N: ((0.1 x 200) + (0.9 x 1500)) = approx. 1350 ohm.m
Line ABC-S: ((0.1 x 10) + (0.25 x 150) + (0.65 x 360)) = approx. 265 ohm.m

Layer 5, Lower Crust
Line ABC-N: range 30-800 ohm.m, midpoint 415 ohm.m
Line ABC-S: ((0.15 x 10) + (0.1 x 75) + (0.05 x 200) + (0.7 x 125)) = approx. 105 ohm.m

Layer 6, Upper Mantle (Moho – 100 km)
Line ABC-N: ((0.25 x 200) + (0.25 x 150) + (0.25 x 100) + (0.25 x 75)) = approx. 130 ohm.m
Line ABC-S: ((0.1 x 25) + (0.25 x 75) + (0.25 x 100) + (0.4 x 150)) = approx. 105 ohm.m

Layer 7, Upper Mantle (100- 150 km)
Line ABC-N: ((0.4 x 150) + (0.5 x 100) + (0.1 x 75)) = approx. 120 ohm.m
Line ABC-S: ((0.4 x 150) + (0.3 x 100) + (0.25 x 75)) = approx. 115 ohm.m

NOTE 2: Determination of overall resistivity for specific depths, from depth resistivity maps [13], by (i) visual estimation of percentage areal extent of dominant / midpoint resistivity value (e.g. 50 % of area is 75 ohm.m, thus 0.5 x 75), and (ii) visual comparison against provided resistivity scale.

Results below are rounded to nearest 5 or 10.

5-km depth
((0.1 x 6500) + (0.9 x 1125, midpoint of range 750-1000)) = approx. 1660 ohm.m

10-km depth
((0.1 x 6500) + (0.75 x 750) + (0.1 x 140, midpoint of range 75-200) + (0.05 x 20)) = approx. 1230 ohm.m

20-km depth
((0.05 x 1500) + (0.3 x 200) + (0.5 x 75) + (0.15 x 20)) = approx. 175 ohm.m

30-km depth
((0.03 x 1500) + (0.15 x 200) + (0.75 x 75) + (0.07 x 20)) = approx. 180 ohm.m

Table 3
1D Earth Resistivity Model for British Columbia – Zone 2V (Vancouver & Lower Mainland)

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m) / Certainty	Comments
	Zone 2V - Vancouver and Lower Mainline - is situated within the Coastal Belt and is limited to area beneath City of Vancouver metropolitan area and extending south to the Canada-USA border. This 3000 km2 triangular-shaped zone is about 80 km at its widest and about 100 km long. Zone is bounded to the west by Strait of Georgia, to the north by the Coast Mountains and south and southeast by the Cascade Mountains [15]. *Zone 2V includes a Layer 2 that incorporates the sedimentary Georgia Basin.*				
1. Overburden	0 – 0.25 km [9] / [I]	0.25 km	100 [5] / [I]	0.01 [24]	Layer 1 incorporates the Fraser Lowland, which consists of gently rolling and flat-topped uplands (deposited earlier), separated by wide, flat-bottomed valleys (i.e. Fraser River delta) [16]. Uplands includes City of Vancouver proper, and North Vancouver; underlain by Pleistocene glacial deposits (till with stream gravel and sand interbeds, and glaciolacustrine silt/clay and marine shale). Lowlands occupied by Cities of Richmond, Ladner and Delta; underlain by thick deltaic sediments (sand, silt, clay, peat bogs) [16]. Cities of Surrey, Langley and Abbotsford underlain by glacial retreat and melt-out deposits (outwash gravel, sand, clay and lenses of till, silt, some marine shale), and in places overlain by deltaic sediments [16b].
		Up to 300 m unconsolidated to semi-consolidated sediments, including glacial and river – deltaic deposits [16]. Maximum thickness of 650 m at Point Roberts according to cross-section measurement [17]. Depth to bedrock contour map indicates overburden thickness of about 100-200 m beneath City of Vancouver, 300 m beneath City of Richmond, 500 m beneath City of Delta, and 100-200 m below cities of Surrey, Langley and Abbottsford [9]. Borehole in Ladner area indicates about 200 m Fraser River delta deposits on top of minimum 165 m of earlier glacial deposits; total 365 m of overburden [5]. Assign 250 m, midpoint of range 0-500 m. Well log in City of Richmond through Fraser delta unconsolidated sediments (sand, silt) reveal 90-100 ohm.m to 120 m depth [11]. Glacial tills in Canada exhibit variable resistivity depending on clast and matrix composition; in southeast Manitoba borehole logs show clayey till resistivity averages approx. 25 ohm.m, silty till 50 ohm.m, sandy till 115 ohm.m [s36]. Till in southwestern BC originates from plutonic rock, thereby a sandy till results. Assign 100 ohm.m, based on well log and general resistivity value for sandy till. Limits 25, 115 ohm.m.			

Table 3 (continued)
1D Earth Resistivity Model for British Columbia – Zone 2V (Vancouver & Lower Mainland)

Layer	Depth Certainty	Thickness	Resistivity (ohm-m) Certainty	Conductivity (S/m) Certainty	Comments
2. Sedimentary Basin	0.25 – 2.75 km [18] [I]	2.5 km	25 [8] [I]	0.04 [24]	Layer 2 incorporates the Georgia Basin (also referred to as Fraser Lowland Basin) comprised of clastic sedimentary rock, slightly dipping southward and thickening southward [16a]. Late Cretaceous sandstone conglomerate basal strata, overlain by Tertiary sandstone, siltstone, silty / sandy shale commonly interbedded. [16a,16b].
			Maximum thickness 4.4 km near Canada-USA border [16] Maximum thickness of 3.25 km at Point Roberts according to cross-section measurement [17]. Less than 500 m thick beneath Vancouver downtown to more than 2.5 km thick in Fraser Lowlands [18]. Assign 2.5 km thickness. MT profile Line ABC-S shows approx. 25 ohm.m in area of Fraser Delta [8] over a depth of 4 km. Assign 25 ohm.m, based on MT survey. Lower limit < 10 ohm.m.		

Table 3 (continued)
1D Earth Resistivity Model for British Columbia – Zone 2V (Vancouver & Lower Mainland)

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m) / Certainty	Comments
3. Upper Crust	2.75 – 11 km [11] / [I]	8.25 km	75 [8] / [I]	0.013333 [24]	Complex mix of foliated plutonic rock, migmatite, gneisses, with minor zones of schists. Depth scaled from regional seismic profile across southern BC, for area beneath Greater Vancouver region, range 9-13 km [11]. Assign 11 km, average of range.
			MT profile [8] across southern BC for area beneath Greater Vancouver region shows for: * Line ABC-S, ranges 50-100 ohm.m. Assign 75 ohm.m, midpoint of range of MT profile. Limits 50, 100 ohm.m.		
4. Middle Crust	11 – 20 km [11] / [I]	9 km	150 [8] / [I]	0.006666 [24]	Depth scaled from regional seismic profile across southern BC, for area beneath Greater Vancouver region, range 19-21.5 km [11]. Assign 20 km, average of range
			MT profile [8] across southern BC for area beneath Greater Vancouver region shows for: * Line ABC-S, dominantly 150 ohm.m. Assign 150 ohm.m. Limits 100, 200 ohm.m.		
5. Lower Crust	20 – 35 km [11] / [I]	15 km	110 [8] / [I]	0.009090 [24]	Depth scaled from regional seismic profile across southern BC, for area beneath Greater Vancouver region, range 34.5-36 km [11]. Assign 35 km, average of range
			MT profile [8] – Line ABC-S – across southern BC for area beneath Greater Vancouver region shows: * 150 ohm.m occupies 40% of layer * 100 ohm.m occupies 40% * 50 ohm.m occupies 20% Assign 110 ohm.m, based on weighted average of resistivity values ((150 x 0.4)+(100 x 0.4)+(50 x 0.2). Limits 50, 150 ohm.m.		

Table 3 (continued)
1D Earth Resistivity Model for British Columbia – Zone 2V (Vancouver & Lower Mainland)

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m) / Certainty	Comments
6. Upper Mantle	35 – 100 km [23] [III]	65 km	115 [8] [I]	0.008695 [24]	Used generalized lower depth [23].
			MT profile [8] – Line ABC-S – across southern BC for area beneath Greater Vancouver region shows: * 200 ohm.m occupies 6% of layer * 150 ohm.m occupies 63% of layer * 100 ohm.m occupies 20% * 50 ohm.m occupies 7% * 30 ohm.m occupies 4% Assign approx. 115 ohm.m, based on weighted average of resistivity values. Limits 30, 200 ohm.m.		
7. Upper Mantle	100 - 250 km [23] [III]	150 km	100-150km 150 [8] [I] 150-250km 210 [25] [III]	100-150km 0.006666 [24] 150-250km 0.004786 [23]	Layer 7 divisible into upper and lower segments. MT profiles [8] provide regional resistivity values between 100-150 km depth. Applied North American regional model for resistivity values between 150-250 km. 100-150 km depth: MT profile [8] across southern BC for area beneath Greater Vancouver region shows for: * Line ABC-S, dominantly 150 ohm.m. Assign 150 ohm.m. Upper limit 200 ohm.m. 150-250 km depth: Generalized depth [23] for base of lower segment. North American regional model [23], based on Tucson magnetic observatory data, situated on Proterozoic crust (late Precambrian time) indicates 210 ohm.m for 100-250 km. Assign approx. 210 ohm.m, based on North American model.

Table 3 (continued)
1D Earth Resistivity Model for British Columbia – Zone 2V (Vancouver & Lower Mainland)

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m) / Certainty	Comments
8. Upper Mantle	250–410 km [23]	160 km	50 [25]	0.019952 [23]	Utilized North American regional model [23], based on Tucson magnetic observatory data, situated on Proterozoic crust (late Precambrian time) for all depths and resistivities below 250 km.
	[III]		[III]		
9. Transition Zone	410–520 km [23]	110 km	20 [25]	0.050118 [23]	Assign North American regional model.
	[III]			[III]	
10. Transition Zone	520–670 km [23]	150 km	5.62 [25]	0.177827 [23]	Assign North American regional model.
	[III]			[III]	
11. Lower Mantle	670–900 km [23]	230 km	1.58 [25]	0.630957 [23]	Assign North American regional model.
	[III]			[III]	
12. Lower Mantle	900–1000 km [23]	100 km	0.89 [25]	1.122018 [23]	Assign North American regional model.
	[III]			[III]	

See end of Table 12 for abbreviations and notes

Table 4
1D Earth Resistivity Model for British Columbia – Zone 2N (Coast Belt, north part)

Layer	Depth Certainty	Thickness	Resistivity (ohm-m) Certainty	Conductivity (S/m) Certainty	Comments
1. Overburden	0 – 2 m [s40] [III]	2 m	115 [s36] [III]	0.008695 [24]	Alpine complexes – a mix of colluvial material and till veneer / blanket, are predominant [s40]
			Overburden thickness expected to be thin although thicker (several metres) on slope bottoms and valley bottoms. Assign 2 m general thickness. Till source is plutonic rock forming the Coast Belt mountains, thereby a sandy till results. Assign 115 ohm.m, based on general resistivity value for sandy till in western Canada [s36]		
2. Sedimentary Basin	absent	---	---	---	---
3. Upper Crust	0 – 12.5 km [50] [I]	12.5 km	43000 [42] [I]	0.0000232	Complex mix of foliated plutonic rock, migmatite, gneisses, with minor zones of schists. Depth scaled from regional seismic profile(s) across northern BC; 12.5 km thick [50]. *Note: crustal depth determinations rounded to nearest 0.5 km.*
			MT profile [42] of Corridor 3 across northwest margin of BC shows weighted average 43000 ohm.m (see Note 1). Assign weighted average of 2D inversion profile. Limits 5500, 55000 ohm.m. *Note*: for layers 3 to 7 in northern BC, assigned resistivity is possibly an overestimate (compared to southern BC) because of use of the resistivity-scale shown on the 2D inversion profile illustrated on Fig. 7 in reference 42, which has a higher end-value in contrast to lower end-values shown on 2D inversion of southern BC.		

Table 4 (continued)
1D Earth Resistivity Model for British Columbia – Zone 2N (Coast Belt, north part)

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m) / Certainty	Comments
4. Middle Crust	12.5 – 28 km [50] [I]	15.5 km	34800 [42] [I]	0.0000287 [42]	Depth scaled from regional seismic profile(s) across northern BC; 15.5 km thick [50]. MT profile [42] of Corridor 3 across northwest margin of BC shows weighted average 34800 ohm.m (see Note 1). Assign weighted average of 2D inversion profile. Limits 850, 55000 ohm.m.
5. Lower Crust	28 – 31.5 km [50] [I]	3.5 km	26000 [42] [I]	0.0000384 [24]	Depth scaled from regional seismic profile(s) across northern, 3.5 km thick [50]. MT profile [42] of Corridor 3 across northwest margin of BC shows weighted average 26000 ohm.m (see Note 1). Assign weighted average of 2D inversion profile. Limits 40, 55000 ohm.m.
6. Upper Mantle	31.5 – 100 km [23] [III]	68.5 km	25800 [42] [I]	0.0000387 [24]	Used generalized lower depth [23]. MT profile [42] shows for: * Corridor 3 across northwest margin of BC, weighted average 35250 ohm.m (see Note 1) to depth of 80 km * regional Corridor 2 crossing adjacent Intermontane Belt in northern BC, weighted average 2700 ohm.m for 80-100 km depth * choose approx. 25800 ohm.m, average of above corridors on premise that resistivity at 80-100 km is essentially same beneath both Coast and Intermontane Belts. Assign weighted average of 2D inversion profiles. Limits 850, 55000 ohm.m.

Table 4 (continued)
1D Earth Resistivity Model for British Columbia – Zone 2N (Coast Belt, north part)

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m) / Certainty	Comments
7. Upper Mantle	100 - 250 km [23] [III]	150 km	2300 [42] [II]	0.000434 [24]	Used generalized lower depth [23].
			Assign 2300 ohm.m (weighted average of 2D inversion profile) as determined for Intermontane Belt, on premise that resistivity for Layer 7 same across northern BC. Limits 175, 5500 ohm.m.		
8. Upper Mantle	250–410 km [23] [III]	160 km	100 [42] [II]	0.01 [24]	Generalized depth [23] for base of layer. North American regional model [23] depicts 50 ohm.m. Assign 95 ohm.m (weighted average of 2D inversion profile) as determined for Intermontane Belt, on premise that resistivity for Layer 7 same across northern BC. Limits 20, 175 ohm.m.
9. Transition Zone	410–520 km [23] [III]	110 km	20 [25] [II]	0.05 [23]	Generalized depth [23] for base of layer. North American regional model [23] depicts 20 ohm.m. Assign 20 ohm.m (weighted average of 2D inversion profile) as determined for Intermontane Belt, on premise that resistivity for Layer 8 same across northern BC.
10. Transition Zone	520–670 km [23] [III]	150 km	5.62 [25]	0.177827 [23] [III]	Utilized North American regional model [23], based on Tucson magnetic observatory data, situated on Proterozoic crust (late Precambrian time) for all depths and resistivities below 520 km.
11. Lower Mantle	670–900 km [23] [III]	230 km	1.58 [25]	0.630957 [23] [III]	Assign North American regional model.
12. Lower Mantle	900–1000 km [23] [III]	100 km	0.89 [25]	1.122018 [23] [III]	Assign North American regional model.

See end of Table 12 for abbreviations and notes

Table 4 (continued)
1D Earth Resistivity Model for British Columbia – Zone 2N (Coast Belt, north part)

NOTE 1: Calculation of Weighted Average for Layers 3 to 6, from 2D inversion profiles [42], specifically Corridor 3 and/or Corridor 2 (Jones et al. 2005, Fig.7)
Calculation of Weighted Average for Layers 7 to 9, from 2D inversion profile [42], specifically regional Corridor 2 (Jones et al. 2005, Fig.6)

For each layer, percentage areal extent of dominant / midpoint resistivity value was determined by measurement (e.g. 25 % of layer is 150 ohm.m, thus 0.25 x 150). Resistivity estimated by visual comparison against provided resistivity scale. Lower and upper limits (for a specific crustal / upper mantle layer) are chosen when the cumulative areas of resistivity exceed 5% of the total area.

Results below are rounded.

<u>Layer 3, Upper Crust</u>
Corridor 3: ((0.25 x 7000, midpoint of range 5500-8500) + (0.75 x 55000)) = 43000 ohm.m

<u>Layer 4, Middle Crust</u>
Corridor 3: ((0.4 x 4500, midpoint of range 850-8500) + (0.6 x 55000)) = 34800 ohm.m

<u>Layer 5, Lower Crust</u>
Corridor 3: ((0.25 x 40, midpoint of range 25-55) + (0.3 x 4000, midpoint of range 2500-5500) + (0.45 x 55000)) = 26000 ohm.m

<u>Layer 6, Upper Mantle (Moho – 100 km)</u>
Corridor 3: ((0.01 x 5) + (0.02 x 55) + (0.01 x 550) + (0.08 x 850) + (0.1 x 2500) + (0.12 x 5500) + (0.02 x 8500) + (0.62 x 55000)) = 35250 ohm.m to depth of 80 km

<u>Layer 7, Upper Mantle (100 - 250 km)</u>
Corridor 2: ((0.78 x 2500) + (0.22 x 5500)) = 3200 ohm.m

<u>Layer 8, Upper Mantle (250 - 410 km)</u>
Corridor 2: ((0.5 x 20) + (0.5 x 175)) = approx. 100 ohm.m

Table 5
1D Earth Resistivity Model for British Columbia – Zone 3S (Intermontane Belt)

Layer	Depth Certainty	Thickness	Resistivity (ohm-m) Certainty	Conductivity (S/m) Certainty	Comments
	Intermontane Belt, in southern BC, is topographically low in contrast to bounding Coast and Omineca Belts, and forms a collage of accreted allocthonous terranes [1]. The belt is comprised of marine volcanosedimentary sequences (upper Paleozoic to mid-Mesozoic age; < 370 to > 138 Ma) overlain by nonmarine sequences, with granitic intrusions (early Mesozoic to early Tertiary age; 210-50 Ma) [13, 2]. *Overall, for Zone 3S (Intermontane Belt) the Layer 2 – Sedimentary Basin – is considered absent. See Zone 3B situated within Intermontane Belt, which includes the local Nechako Basin as Layer 2.*				
1. Overburden	0 – 10 m [47] [II]	10 m	70 [s36] [III]	0.014285 [24]	Till blanket is predominant in plateau regions and valley bottoms and sides, with till veneer in areas of higher elevation. Fine-to coarse grained (silt, sand, gravel) glaciolacustrine deposits in major river valleys in the Fort St.James – Prince George – Quesnel and the Vernon – Kelowna – Penticton areas [s40]. Regionally, in south-central BC overburden comprised of glacial (till, silt, gravel) and non-glacial deposits (stratified gravelly sand, gravel, sand, silt and clay) and colluvium.
		Till thickness ranges < 2m to > 2m [46, 21]. Interior Plateau (includes Nechako, Fraser and Thompson plateaus; Quesnel, Shuswap and Okanagan highlands) may locally have till depths of 200m or more [47]. Valleys may have 10s to 100s m thickness of alluvial and glaciofluvial sediments [46, 48]. Majority of overburden typically < 10m thick [47]. Regionally, in south-central BC overburden rarely exceeds few 10s of metres; east of Kamloops, thickness typically < 10m [49]. Assign general overall depth of 10m. Glacial tills in Canada exhibit variable resistivity depending on clast and matrix composition; in southeast Manitoba borehole logs show clayey till resistivity averages approx. 25 ohm.m, silty till 50 ohm.m, sandy till 115 ohm.m [s36]. Till within Intermontane Belts originates from mix of sedimentary, volcanic, plutonic and metamorphic rock, thereby clayey / silty to sandy till sandy results. Assign 70 ohm.m, based on midpoint of resistivity range for tills. Limits 25, 115 ohm.m.			
2. Sedimentary Basin	absent	---	---	---	---

Table 5 (continued)
1D Earth Resistivity Model for British Columbia – Zone 3S (Intermontane Belt)

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m) / Certainty	Comments
3. Upper Crust	0 – 14 km [10] [I]	14 km	850 [8] [I]	0.001176 [24]	Volcanic, clastic sedimentary and granitic rocks [22].
			Depth scaled from regional seismic profile(s) across southern BC, range 12-15.5 km [10]. Assign 14 km, average of values. MT profiles [8] across southern BC show for: * Line ABC-N, weighted average approx. 850 ohm.m (see Note 1) * Line ABC-S, range 200-1500 ohm.m, midpoint 850 ohm.m * chose approx. 850 ohm.m, average of above lines 5-km depth resistivity map [13] shows overall 750 ohm.m (see Note 2). 10-km depth resistivity map [13] shows overall 570 ohm.m. Assign 850 ohm.m, based on weighted averages of 2D inversion profiles. Limits 200, 1500 ohm.m.		
4. Middle Crust	14 – 25 km [10] [I]	11 km	400 [8] [I]	0.0025 [24]	Depth scaled from regional seismic profile(s) across southern BC, range approx. 24.5-25.5 km [10]. Assign 25.5 km, average of values.
			MT profiles [8] across southern BC show for: * Line ABC-N, weighted average approx. 750 ohm.m (see Note 1) * Line ABC-S, weighted average approx. 60 ohm.m * chose approx. 400 ohm.m, average of above lines 20-km depth resistivity map [13] shows overall 470 ohm.m (see Note 2). Assign 400 ohm.m, based on weighted averages of 2D inversion profiles. Limits 60, 750 ohm.m.		

Table 5 (continued)
1D Earth Resistivity Model for British Columbia – Zone 3S (Intermontane Belt)

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m) / Certainty	Comments
5. Lower Crust	25 – 33 km [10] / [I]	8 km	300 [8] / [I]	0.003333 [24]	Depth scaled from regional seismic profile(s) across southern BC, range approx. 32-34.5 km [10]. Assign 33 km, average of values.
			MT profiles [8] across southern BC show for: * Line ABC-N, weighted average approx. 550 ohm.m (see Note 1) * Line ABC-S, weighted average approx. 50 ohm.m * chose approx. 300 ohm.m, average of above lines 30-km depth resistivity map [13] shows overall 320 ohm.m (see Note 2). Assign 300 ohm.m, based on weighted averages of 2D inversion profiles. Limits 50, 550 ohm.m.		
6. Upper Mantle	33 – 100 km [23] / [III]	67 km	140 [8] / [I]	0.007142 [24]	Used generalized lower depth [23].
			MT profiles [8] across southern BC show for: * Line ABC-N, weighted average 210 ohm.m (see Note 1) * Line ABC-S, weighted average 70 ohm.m * chose approx. 140 ohm.m, average of above lines Assign 140 ohm.m, based on weighted averages of 2D inversion profiles. Limits 70, 210 ohm.m.		

Table 5 (continued)
1D Earth Resistivity Model for British Columbia – Zone 3S (Intermontane Belt)

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m) / Certainty	Comments
7. Upper Mantle	100 - 250 km [23] [III]	150 km	100-150km 80 [8] [I] 150-250km 210 [25] [III]	100-150km 0.0125 [24] 150-250km 0.004786 [23]	Layer 7 divisible into upper and lower segments. MT profiles [8] provide regional resistivity values between 100-150 km depth. Applied North American regional model for resistivity values between 150-250 km. <u>100-150 km depth</u>: MT profiles [8] across southern BC show for: * Line ABC-N, weighted average 95 ohm.m [see Note 1] * Line ABC-S, weighted average 65 ohm.m * chose approx. 80 ohm.m, average of above lines Assign 80 ohm.m, based on weighted averages of 2D inversion profiles. Limits 65, 95 ohm.m. <u>150-250 km depth</u>: Generalized depth [23] for base of lower segment. North American regional model [23], based on Tucson magnetic observatory data, situated on Proterozoic crust (late Precambrian time) indicates 210 ohm.m for 100-250 km. Assign approx. 210 ohm.m, based on North American model.

Table 5 (continued)
1D Earth Resistivity Model for British Columbia – Zone 3S (Intermontane Belt)

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m) / Certainty	Comments
8. Upper Mantle	250–410 km [23]	160 km	50 [25]	0.019952 [23]	Utilized North American regional model [23], based on Tucson magnetic observatory data, situated on Proterozoic crust (late Precambrian time) for all depths and resistivities below 250 km.
	[III]		[III]		
9. Transition Zone	410–520 km [23]	110 km	20 [25]	0.050118 [23]	Assign North American regional model.
	[III]			[III]	
10. Transition Zone	520–670 km [23]	150 km	5.62 [25]	0.177827 [23]	Assign North American regional model.
	[III]			[III]	
11. Lower Mantle	670–900 km [23]	230 km	1.58 [25]	0.630957 [23]	Assign North American regional model.
	[III]			[III]	
12. Lower Mantle	900–1000 km [23]	100 km	0.89 [25]	1.122018 [23]	Assign North American regional model.
	[III]			[III]	

See end of Table 12 for abbreviations and notes

Table 5 (continued)
1D Earth Resistivity Model for British Columbia – Zone 3S (Intermontane Belt)

NOTE 1: Calculation of Weighted Average for Layers 3 to 7, from 2D inversion profiles [8].

For each layer, percentage areal extent of dominant / midpoint resistivity value was determined by measurement (e.g. 25 % of layer is 150 ohm.m, thus 0.25 x 150). Resistivity estimated by visual comparison against provided resistivity scale.

Results below are rounded.

<u>Layer 3, Upper Crust</u>
Line ABC-N: ((0.45 x 1500) + (0.12 x 30) + (0.43 X 400 , midpoint of range 200-600)) = approx. 850 ohm.m
Line ABC-S: range 200-1500 ohm.m, midpoint 850 ohm.m

<u>Layer 4, Middle Crust</u>
Line ABC-N: ((0.4 x 1500) + (0.25 x 30) + (0.15 x 650) + (0.2 x 250, midpoint of range 100-400)) = approx. 750 ohm.m
Line ABC-S: ((0.15 x 10) + (0.65 x 45, midpoint of range 15-75) + (0.2 x 150, midpoint of range 100-200)) = approx. 60 ohm.m

<u>Layer 5, Lower Crust</u>
Line ABC-N: ((0.15 x 40, midpoint of range 20-60) + (0.45 x 1050, midpoint of range 60-1500) + (0.45 x 150, midpoint 100-200)) = approx. 550 ohm.m
Line ABC-S: ((0.1 x 10) + (0.75 x 45, midpoint of range 15-75) + (0.15 x 100)) = approx. 50 ohm.m

<u>Layer 6, Upper Mantle (Moho – 100 km)</u>
Line ABC-N: ((0.06 x 30) + (0.04 x 30) + (0.15 x 75) + (0.22 x 75) + (0.07 x 1100) + (0.25 x 300) + (0.11 x 150) + (0.1 x 100) = approx. 210 ohm.m
Line ABC-S: ((0.14 x 100) + (0.08 x 40) + (0.03 x 20, midpoint of range 10-30) + (0.05 x 40) + (0.7 x 75)) = approx. 70 ohm.m

<u>Layer 7, Upper Mantle (100- 150 km)</u>
Line ABC-N: ((0.43 x 75) + (0.1 x 150) + (0.47 x 100)) = approx. 95 ohm.m
Line ABC-S: ((0.13 x 100) + (0.33 x 40) + (0.54 x 75)) = approx. 65 ohm.m

NOTE 2: Determination of overall resistivity for specific depths, from depth resistivity maps [13], by (i) visual estimation of percentage areal extent of dominant / midpoint resistivity value (e.g. 50 % of area is 75 ohm.m, thus 0.5 x 75), and (ii) visual comparison against provided resistivity scale.

Results below are rounded to nearest 5 or 10.

<u>5-km depth</u>
((0.05 x 6500) + (0.5 x 750) + (0.38 x 140, midpoint of range 75-200) + (0.07 x 20)) = approx. 750 ohm.m

<u>10-km depth</u>
((0.05 x 6500) + (0.2 x 750) + (0.65 x 140, midpoint of range 75-200) + (0.1 x 20)) = approx. 570 ohm.m

<u>20-km depth</u>
((0.02 x 6500) + (0.3 x 750) + (0.53 x 200) + (0.1 x 75) + (0.05 x 20)) = approx. 470 ohm.m

<u>30-km depth</u>
((0.3 x 750) + (0.4 x 200) + (0.25 x 75) + (0.05 x 20)) = approx. 320 ohm.m

Table 6
1D Earth Resistivity Model for British Columbia – Zone 3B (Nechako Basin)

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m) / Certainty	Comments
	Nechako Basin is situated within the Intermontane Belt of the Canadian Cordillera and is a potential host for petroleum hydrocarbon resources. Located in an area of low relief, the basin is made up of overlapping, folded, sedimentary sequences [26], covered in most part by extensive glacial overburden and extrusive volcanics, namely flood basalt. Movement during the Lower Jurassic to Oligocen (approx. 200 – 23 Ma) along strike-slip structures/faults created an extensional basin filled with more than 3 km of clastic sediments [27, 29].]. Later extrusion of basaltic lave in Eocene and Miocene tines formed a sheet varying from < 50 – 200 m in thickness, possibly up to 1 km in isolated places covering much of the basin [26]. The basin is crossed by numerous faults. *Glacial drift is extensive in the Nechako Plateau, drumlinoid ridges are dominant landform features. Other glacial features commonly present include large esker complexes, glaciofluvial deposits and meltwater channels that developed during deglaciation [30]. Clay-rich, interstadial lacustrine, and glaciolacustrine sediments are widespread in the Nechako Reservoir basin [30]. Widespread presence of basal till but debris flow deposits, glaciolacustrine sediments and glaciofluvial deposits overlie till in a number of areas [30].*				

Table 6 (continued)
1D Earth Resistivity Model for British Columbia – Zone 3B (Intermontane Belt-Nechako Basin)

Layer	Depth Certainty	Thickness	Resistivity (ohm-m) Certainty	Conductivity (S/m) Certainty	Comments
1. Overburden	0 – 50 m [37, 35] [I]	50 m	75 [33] [I]	0.013333 [24]	Recent alluvium, river gravel and colluvium overlies Pleistocene glacial deposits comprised of till and glaciofluvial (stratified outwash sands and gravels) and glaciolacustrine deposits (clay rich) [31, 30, 32]. Glaciofluvial gravelly outwash plains cover the valley bottoms [33].
	Till, glaciofluvial and glaciolacustrine deposits are of variable thickness, individually ranging from 1's to 10's m thick [34]. Overburden thicker in north than in south part of Nechako Basin [35]. In northwest and west-central part of basin (Vanderhoof area) till and clay/silt overburden ranges 10-150m [32]. On plateaus overburden is less or 10m and in valleys in excess of 200m [36]. Quaternary drift is typically <50 m thick across the basin surveyed; ranges 10-50m but >50m along Fraser River Valley between Quesnel and Williams [37]. [Stratigraphic sections show thicknesses 7 – approx 20m thick [34]. Geophysical EM ground surveys indicate overburden thicknesses of 10-130m [33]. Exploratory petroleum borehole revealed 250m of unconsolidated overburden [31]. Glacial deposits and alluvium can be as much as 300m in places [38]. Local overburden thickness as follows. * Vanderhoof area: dominated by Nechako River valley covered by mainly ≥ 50m glaciolacustrine sediments, till and alluvium on valley floor with till on valley margins [35] * Prince George area: 10-250m thick, thickest in Chilako and Fraser River valleys and buried paleochannels [35]; till on uplands typically < 3m to 10+ m thick [39] * Quesnel area: 10-150m thick, thickest (150m) in Fraser River Valley [35] * Williams Lake area: overburden thickness varies significantly, ≤ 5m in ravines and ≤ 100m over bedrock ridges; less 20m till blanket/veneer on southern Caribou and Bonaparte plateaus [35] * 100 Mile House area: ≤ 20m on plateau and ≤ 100m thick in paleovalleys [35] Assign overall 50m thickness. Ground EM geophysical survey shows resistivity ranges of 34-157 ohm.m (average 100 ohm.m), 30-98 ohm.m (average 63 ohm.m), and > 60 ohm. [33]. Assign 75 ohm.m (average of 100, 63, 60 ohm.m). Limits 35, 160 ohm.m.				

Table 6 (continued)
1D Earth Resistivity Model for British Columbia – Zone 3B (Nechako Basin)

Layer	Depth Certainty	Thickness	Resistivity (ohm-m) Certainty	Conductivity (S/m) Certainty	Comments
2. Sedimentary Basin	0 – 2.5 km [28b] [I]	2.5 km	50 [28a] [I]	0.02 [24]	Neogene Chilcotin flood-basalts and Eocene volcanoclastic rock (flows, tuff, breccia, minor sediments) overlie Early Cretaceous marine and fluvial sedimentary rock (interbedded chert, pebble conglomerate, sandstone, siltstone and shale) [28a]. Numerous faults, folding of sedimentary strata.
			Basin depth ranges 1000-4000m [28b]. Flood-basalts typically <50m thick, up to 200m thick, intermittent distribution. [Andrews2011] suggests flood-basalts typically up to 20m thick, and > 50m with paleovalleys. Volcanoclastic sequences up to 2000m thick, covers much of basin. Early Cretaceous sedimentary sequences range 1-4 km thick., not present throughout basin but localized in sub-basins. Assign 2.5 km, midpoint of thickness range. Resistivity, from MT survey [28a] * Neogene flood-basalts, > 500 ohm.m * Eocene vocanoclastic sequences, < 4 ohm.m * Early Cretaceous sedimentary rock, 10-100 ohm.m Resistivity, average from well logs [40] * Eocene volcanic flows, approx. 260 ohm.m * Eocene volcanoclastics, approx. 10 ohm.m * Early Cretaceous sedimentary (conglomeratic sandstone) rock with volcanoclastic interbeds, approx. 10-20 ohm.m; * Early Cretaceous sedimentary rock with volcanoclastic interbeds, typically < 50 ohm.m. Sedimentary rocks, individually: conglomerate/sandstone 13, 477 ohm.m; sandstone 350 ohm.m; shale 33-44 ohm.m. Volcanolastics (unspecified) 11 ohm.m; tuffs 35 ohm.m; ash 19 ohm.m. Interbedded sediments and volcanoclastics (tuff/sandstone/clay) 5, 296 ohm.m. Assign 50 ohm.m, midpoint of range < 4-100 ohm.m encompassing the Eocene volcanoclastics and Early Cretaceous interbedded sediments and volcanoclastics.		

Table 6 (continued)
1D Earth Resistivity Model for British Columbia – Zone 3B (Nechako Basin)

Layer	Depth Certainty	Thickness	Resistivity (ohm-m) Certainty	Conductivity (S/m) Certainty	Comments
3. Upper Crust	2.5 – 11 km [41] [I]	8.5 km	600 [28a] [I]	0.001666 [24]	Basement rock includes mix of volcanic rock (e.g. Cache Creek), sediments and granitoid intrusions. One, possibly two, mid-crustal conductors (< 4 ohm.m) beginning at depths 6-9 km, 5 km wide, interpreted as a rising magma pipe [28a].
			8.5 km average thickness, determined by seismic survey across Nechako Basin [41]. MT 2D profiles [28b] indicate typically 200-1000 ohm.m range (midpoint 600 ohm.m). Granitoid intrusions approx. 10000 ohm.m, occupies < 20% of area surveyed. Well log [40] indicates Chance Creek volcanic resistivity of approx. 650 ohm.m 5-km depth resistivity map [13] shows overall 470 ohm.m, specific to Nechako Basin (see Note 2). 10-km depth resistivity map [13] shows overall 215 ohm.m, specific to Nechako Basin. Assign 600 ohm.m, based on 2D inversion profiles. Limits 200, 1000 ohm.m.		

Table 6 (continued)
1D Earth Resistivity Model for British Columbia – Zone 3B (Nechako Basin)

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m) / Certainty	Comments
4. Middle Crust	11 – 23 km [41] / [I]	12 km	550 [8, 13] / [I]	0.001818 [24]	12 km average thickness, determined by seismic survey across Nechako Basin [41].
			MT 2D profiles by [28b] across Nechako Basin limited to depth of 10-15 km, therefore utilized resistivity values across southern BC determined by [8]. MT profiles [8] across southern BC show for: * Line ABC-N, weighted average approx. 750 ohm.m (see Note 1) 20-km depth resistivity map [13] shows overall 400 ohm.m, specific to Nechako Basin (see Note 2). Assign 550 ohm.m, average of resistivity values (750, 400). Limits 400, 750 ohm.m.		
5. Lower Crust	23 – 32 km [41] / [I]	9 km	415 [8, 13] / [I, II]	0.002409 [24]	8.4 km average thickness, determined by seismic survey across Nechako Basin [41]. Layer bottom (Moho) ranges 22-36 km, typically 30-34 km (midpoint 32 km) [41].
			MT 2D profiles by [28b] across Nechako Basin limited to depth of 10-15 km, therefore utilized resistivity values across southern BC determined by [8]. MT profiles [8] across southern BC show for: * Line ABC-N, weighted average approx. 550 ohm.m (see Note 1) 30-km depth resistivity map [13] shows overall 280 ohm.m, specific to Nechako Basin (see Note 2). Assign 415 ohm.m, average of resistivity values (550, 280). Limits 280, 550 ohm.m.		
6. Upper Mantle	32 – 100 km [23] / [III]	68 km	210 [8] / [II]	0.004761 [24]	Used generalized lower depth [23].
			MT profiles [8] for Intermontane Belt in southern BC show for: * Line ABC-N, weighted average 210 ohm.m (see Note 1) Assign 210 ohm.m.		

Table 6 (continued)
1D Earth Resistivity Model for British Columbia – Zone 3B (Nechako Basin)

Layer	Depth Certainty	Thickness	Resistivity (ohm-m) Certainty	Conductivity (S/m) Certainty	Comments
7. Upper Mantle	100 - 250 km [23] [III]	150 km	100-150km 95 [8] [II] 150-250km 380 [25, 42] [II, III]	100-150km 0.010526 [24] 150-250km 0.002631 [23]	Layer 7 divisible into upper and lower segments. MT profiles [8] provide regional resistivity values between 100-150 km depth. Applied average of northern BC regional MT profile and North American regional model for resistivity values between 150-250 km. 100-150 km depth: MT profiles [8] across southern BC show for: * Line ABC-N, weighted average 95 ohm.m [see Note 1] Assign 95 ohm.m, based on weighted averages of 2D inversion profiles. Limits 75, 150 ohm.m. 150-250 km depth: Generalized depth [23] for base of lower segment. Northern BC regional MT profile [42] shows 450-650 ohm.m (midpoint 550 ohm.m) at 150-250 km, for northern continuation of Intermontane Belt. North American regional model [23], based on Tucson magnetic observatory data, situated on Proterozoic crust (late Precambrian time) indicates 210 ohm.m for 100-250 km. Assign approx. 380 ohm.m, average of resistivity values (210, 550 ohm.m). Limits 210, 650 ohm.m. Note: possible over-estimate of resistivity for lower segment of Layer 7.

Table 6 (continued)

1D Earth Resistivity Model for British Columbia – Zone 3B (Nechako Basin)

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m) / Certainty	Comments
8. Upper Mantle	250–410 km [23] [III]	160 km	80 [23, 42] [II, III]	0.0125 [24]	Used generalized lower depth [23]
			Northern BC regional MT profile [42] shows 175-250 ohm.m (midpoint 110 ohm.m) at 250-410 km, for northern continuation of Intermontane Belt. North American regional model [23], based on Tucson magnetic observatory data, situated on Proterozoic crust (late Precambrian time) indicates 50 ohm.m for 250-410 km. Assign approx. 80 ohm.m, average of resistivity values (50, 110 ohm.m). Limits 40, 250 ohm.m		
9. Transition Zone	410–520 km [23] [III]	110 km	25 [23, 42] [II, III]	0.04 [24]	Used generalized lower depth [23]
			Northern BC regional MT profile [42] shows 15-40 ohm.m (midpoint 25 ohm.m) at 410-520 km, for northern continuation of Intermontane Belt. North American regional model [23], based on Tucson magnetic observatory data, situated on Proterozoic crust (late Precambrian time) indicates 20 ohm.m for 410-520 km. Assign approx. 25 ohm.m, based on MT profile. Limits 15, 40 ohm.m.		
10. Transition Zone	520–670 km [23] [III]	150 km	5.62 [25]	0.177827 [23] [III]	Utilized North American regional model [23], based on Tucson magnetic observatory data, situated on Proterozoic crust (late Precambrian time) for all depths and resistivities below 520 km
11. Lower Mantle	670–900 km [23] [III]	230 km	1.58 [25]	0.630957 [23] [III]	Assign North American regional model
12. Lower Mantle	900–1000 km [23] [III]	100 km	0.89 [25]	1.122018 [23] [III]	Assign North American regional model

See end of Table 12 for abbreviations and notes

Table 6 (continued)

1D Earth Resistivity Model for British Columbia – Zone 3B (Nechako Basin)

NOTE 1: Calculation of Weighted Average for Layers 3 to 7, from 2D inversion profiles [8].

For each layer, percentage areal extent of dominant / midpoint resistivity value was determined by measurement (e.g. 25 % of layer is 150 ohm.m, thus 0.25 x 150). Resistivity estimated by visual comparison against provided resistivity scale.

Results below are rounded.

<u>Layer 3, Upper Crust</u>
Line ABC-N: ((0.45 x 1500) + (0.12 x 30) + (0.43 X 400 , midpoint of range 200-600)) = approx. 850 ohm.m
Line ABC-S: range 200-1500 ohm.m, midpoint 850 ohm.m

<u>Layer 4, Middle Crust</u>
Line ABC-N: ((0.4 x 1500) + (0.25 x 30) + (0.15 x 650) + (0.2 x 250, midpoint of range 100-400)) = approx. 750 ohm.m
Line ABC-S: ((0.15 x 10) + (0.65 x 45, midpoint of range 15-75) + (0.2 x 150, midpoint of range 100-200)) = approx. 60 ohm.m

<u>Layer 5, Lower Crust</u>
Line ABC-N: ((0.15 x 40, midpoint of range 20-60) + (0.45 x 1050, midpoint of range 60-1500) + (0.45 x 150, midpoint 100-200)) = approx. 550 ohm.m
Line ABC-S: ((0.1 x 10) + (0.75 x 45, midpoint of range 15-75) + (0.15 x 100)) = approx. 50 ohm.m

<u>Layer 6, Upper Mantle (Moho – 100 km)</u>
Line ABC-N: ((0.06 x 30) + (0.04 x 30) + (0.15 x 75) + (0.22 x 75) + (0.07 x 1100) + (0.25 x 300) + (0.11 x 150) + (0.1 x 100) = approx. 210 ohm.m
Line ABC-S: ((0.14 x 100) + (0.08 x 40) + (0.03 x 20, midpoint of range 10-30) + (0.05 x 40) + (0.7 x 75)) = approx. 70 ohm.m

<u>Layer 7, Upper Mantle (100- 150 km)</u>
Line ABC-N: ((0.43 x 75) + (0.1 x 150) + (0.47 x 100)) = approx. 95 ohm.m
Line ABC-S: ((0.13 x 100) + (0.33 x 40) + (0.54 x 75)) = approx. 65 ohm.m

NOTE 2: Determination of overall resistivity for Nechako Basin at specific depths, from depth resistivity maps [13], by (i) visual estimation of percentage areal extent of dominant / midpoint resistivity value (e.g. 50 % of area is 75 ohm.m, thus 0.5 x 75), and (ii) visual comparison against provided resistivity scale.

Results below are rounded to nearest 5 or 10.

<u>5-km depth</u>
((0.75 x 575, midpoint of range 400-750, midpoint of range 575) + (0.15 x 200) + (0.1 x 75)) = approx. 470 ohm.m

<u>10-km depth</u>
((0.55 x 400) + (0.5 x 400) + (0.2 x 75) + (0.05 x 20))= approx. 215 ohm.m

<u>20-km depth</u>
((0.45 x 400) + (0.5 x 200) + (0.05 x 75)) = approx. 400 ohm.m

<u>30-km depth</u>
((0.5 x 400) + (0.35 x 200) + (0.15 x 75))= approx. 280 ohm.m

Table 7
1D Earth Resistivity Model for British Columbia – Zone 3N (Intermontane Belt, north part)

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m) / Certainty	Comments
1. Overburden	0 – 10 m [54, 56, 57] / [I]	10 m	70 [s36] / [III]	0.014285 [24]	Till blanket is predominant in plateau regions and valley sides, with till veneer in areas of higher elevation. Alpine complexes – a mix of colluvial material and till veneer / blanket, are predominant on steepest slopes. Glaciofluvial sands and gravels, glaciolacustrine clay and silt, and modern fluvial sand and gravel deposits are dominant in low-lying areas such as river and valley bottoms [54, 55]. Modern alluvial fans comprised of sands and gravels. Glaciolacustrine deposits are thin and discontinuous at north end of zone but more common in south end, and may overlie by tills [55]. Organic deposits of bog, marsh and peat in valley bottoms [55]. Overall, overburden can be complexly layered and distributed and thick in areas, in particular valley bottoms.
		Till and glaciofluvial thicknesses ranges from a veneer (1-2 m) to blanket (2-20 m) [56]. At south end of the north-half of Intermontane Belt in the Babine area, overburden reported to range 15-40 m thick [54, 57]. Assign general overall depth of 10m. Glacial tills in Canada exhibit variable resistivity depending on clast and matrix composition; in southeast Manitoba borehole logs show clayey till resistivity averages approx. 25 ohm.m, silty till 50 ohm.m, sandy till 115 ohm.m [s36]. Till within Intermontane Belts originates from mix of sedimentary, volcanic, plutonic and metamorphic rock, thereby resulting in a clayey / silty to sandy till. Assign 70 ohm.m, based on midpoint of resistivity range for tills. Limits 25, 115 ohm.m.			
2. Sedimentary Basin	absent	---	---	---	---

Table 7 (continued)
1D Earth Resistivity Model for British Columbia – Zone 3N (Intermontane Belt, north half)

Layer	Depth Certainty	Thickness	Resistivity (ohm-m) Certainty	Conductivity (S/m) Certainty	Comments
3. Upper Crust	0 – 13 km [50] [I]	13 km	27700 [42] [I]	0.00003610 [24]	Volcanic, clastic sedimentary and granitic rocks [22].
			Depth scaled from regional seismic profile(s) across northern BC; 13 km thick [50]. *Note: crustal depth determinations rounded to nearest 0.5 km.* MT 2D-profile [42] shows for: * Corridor 3 crossing SE Yukon, weighted average 34000 ohm.m (see Note 1) * regional Corridor 2 crossing northern BC, weighted average 21400 ohm.m (see Note 1) Assign 27700 ohm.m, based on midpoint of weighted averages (34000, 21400 ohm.m) of 2D inversion profiles. Limits 5, 55000 ohm.m. *Note*: for layers 3 to 7 in northern BC, assigned resistivity is possibly an overestimate (compared to southern BC) because of use of the resistivity-scale shown on the 2D inversion profile illustrated on Fig. 7 in reference 42, which has a higher end-value in contrast to lower end-values shown on 2D inversion of southern BC.		
4. Middle Crust	13 – 33 km [50] [I]	20 km	30900 [42] [I]	0.00003236 [24]	Depth scaled from regional seismic profile(s) across northwestern BC; 20 km thick [50]
			MT 2D-profile [42] shows for: * Corridor 3 crossing SE Yukon, weighted average 36800 ohm.m (see Note 1) * regional Corridor 2 crossing northern BC, weighted average 25000 ohm.m (see Note 1) * regional Corridor 2 a distinctive decrease of resistivity at middle and lower crustal depths Assign 30900 ohm.m, based on midpoint of weighted averages (36800, 25000 ohm.m) of 2D inversion profiles. Limits 5, 55000 ohm.m.		

Table 7 (continued)
1D Earth Resistivity Model for British Columbia – Zone 3N (Intermontane Belt, north half)

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m) / Certainty	Comments
5. Lower Crust	33 – 36.5 km [50] [I]	3.5 km	21000 [42] [I]	0.00004761 [24]	Depth scaled from regional seismic profile(s) across northwestern BC; 3.5 km thick [50]
			MT profile [42] show for: * Corridor 3 crossing SE Yukon, weighted average 34300 ohm.m (see Note 1) * regional Corridor 2 crossing northern BC, weighted average 7700 ohm.m (see Note 1) * regional Corridor 2 a distinctive decrease of resistivity at middle and lower crustal depths Assign 21000 ohm.m, based on midpoint of weighted averages (34300, 7700 ohm.m) of 2D inversion profiles. Limits 5, 55000 ohm.m.		
6. Upper Mantle	36.5 – 100 km [23] [III]	63.5 km	15600 [42] [I]	0.00006410 [24]	Used generalized lower depth [23].
			MT profile [42] show for: * Corridor 3 crossing SE Yukon, weighted average 28100 ohm.m (see Note 1) to depth of 80 km * regional Corridor 2 crossing northern BC, weighted average 3300 ohm.m to depth of 80 km, and 2700 ohm.m between 80-100 km (see Note 1); giving weighted average approx. 3100 ohm.m Assign 15650 ohm.m, based on midpoint of weighted averages (28100, 3100 ohm.m) of 2D inversion profiles. Limits 5, 55000 ohm.m.		

Table 7 (continued)
1D Earth Resistivity Model for British Columbia – Zone 3N (Intermontane Belt, north half)

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m) / Certainty	Comments
7. Upper Mantle	100 - 250 km [23] [III]	150 km	3200 [42] [I]	0.000312 [24]	Used generalized lower depth [23]. North American regional model [23] depicts 210 ohm.m. MT 2D-profile [42] of regional Corridor 2 across northern BC shows weighted average 3200 ohm.m (see Note 1). Assign 3200 ohm.m weighted average of 2D inversion profile. Limits 2500, 5500 ohm.m.
8. Upper Mantle	250–410 km [23] [III]	160 km	100 [42] [I]	0.01 [24]	Generalized depth [23] for base of layer. North American regional model [23] depicts 50 ohm.m. MT profile [42] of regional Corridor 2 across northern BC shows weighted average 95 ohm.m (see Note 1). Assign 100 ohm.m, weighted average of 2D inversion profile. Limits 20, 175 ohm.m. *Note:* for layers 8 and 9 assigned lower resistivity values as depicted on resistivity-scale shown on Fig. 6 in reference 42.

Table 7 (continued)
1D Earth Resistivity Model for British Columbia – Zone 3N (Intermontane Belt, north part)

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m) / Certainty	Comments
9. Transition Zone	410–520 km [23] [III]	110 km	20 [42] [I]	0.05 [24]	Generalized depth [23] for base of layer. North American regional model [23] depicts 20 ohm.m. MT profile [42] of regional Corridor 2 across northern BC shows < 20 ohm.m between 410-500 km depth. Assign 20 ohm.m, dominant resistivity on 2D inversion profile.
10. Transition Zone	520–670 km [23] [III]	150 km	5.62 [25]	0.177827 [23] [III]	Utilized North American regional model [23], based on Tucson magnetic observatory data, situated on Proterozoic crust (late Precambrian time) for all depths and resistivities below 520 km.
11. Lower Mantle	670–900 km [23] [III]	230 km	1.58 [25]	0.630957 [23] [III]	Assign North American regional model.
12. Lower Mantle	900–1000 km [23] [III]	100 km	0.89 [25]	1.122018 [23] [III]	Assign North American regional model.

See end of Table 12 for abbreviations and notes

Table 7 (continued)
1D Earth Resistivity Model for British Columbia – Zone 3N (Intermontane Belt, north half)

NOTE 1: Calculation of Weighted Average for Layers 3 to 6, from 2D inversion profiles [42], specifically Corridor 3 and/or Corridor 2 (Jones et al. 2005, Fig.7)
Calculation of Weighted Average for Layers 7 to 9, from 2D inversion profile [42], specifically regional Corridor 2 (Jones et al. 2005, Fig.6)

For each layer, percentage areal extent of dominant / midpoint resistivity value was determined by measurement (e.g. 25 % of layer is 150 ohm.m, thus 0.25 x 150). Resistivity estimated by visual comparison against provided resistivity scale. Lower and upper limits (for a specific crustal / upper mantle layer) are chosen when the cumulative areas of resistivity exceed 5% of the total area.

Results below are rounded.

<u>Layer 3, Upper Crust</u>
Corridor 3: ((0.15 x 1280, midpoint of range 55-250) + (0.125 x 1675, midpoint of 850-2500) + (0.05 x 7000, midpoint of range 5500-8500) + (0.125 x 25000) + (0.55 x 55000)) = 34000 ohm.m
Corridor 2: ((0.21 x 5) + (0.11 x 25) + (0.17 x 55) + (0.07 x 2500) + (0.06 x 5500) + (0.38 x 55000)) = approx. 21400 ohm.m

<u>Layer 4, Middle Crust</u>
Corridor 3: ((0.15 x 5500) + (0.2 x 8500) + (0.05 x 25000) + (0.6 x 55000)) = approx. 36800 ohm.m
Corridor 2: ((0.35 x 5) + (0.13 x 25) + (0.02 x 55) + (0.05 x 5500) + (0.45 x 55000)) = approx. 25000 ohm.m

<u>Layer 5, Lower Crust</u>
Corridor 3: ((0.2 x 5500) + (0.2 x 8500) + (0.05 x 25000) + (0.55 x 55000) = 34300 ohm.m
Corridor 2: ((0.53 x 5) + (0.1 x 25) + (0.13 x 55) + (0.02 x 2500) + (0.09 x 5500) + (0.13 x 55000))= approx. 7700 ohm.m

<u>Layer 6, Upper Mantle (Moho – 100 km)</u>
Corridor 3: ((0.07 x 2500) + (0.21 x 5500) + (0.23 x 8500) + (0.07 x 25000) + (0.42 x 55000)) = 28100 ohm.m to depth of 80 km
Corridor 2: ((0.48 x 5) + (0.08 x 25) + (0.07 x 55) + (0.23 x 2500) + (0.1 x 5500) + (0.04 x 5500)) = approx. 3300 ohm.m to depth of 80 km
Corridor 2: ((0.93 x 2500) + (0.07 x 5500)) = approx. 2700 ohm.m for depth 80 -100 km

<u>Layer 7, Upper Mantle (100 - 250 km)</u>
Corridor 2: ((0.78 x 2500) + (0.22 x 5500)) = 3200 ohm.m

<u>Layer 8, Upper Mantle (250 - 410 km)</u>
Corridor 2: ((0.5 x 20) + (0.5 x 175)) = approx. 100 ohm.m

Table 8
1D Earth Resistivity Model for British Columbia – Zone 4S (Omineca Belt)

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m) / Certainty	Comments
	The Omineca Belt In southern BC includes the Purcell, Selkirk, Columbia, Monashee and Caribou mountain ranges, and represents deeper extension of the adjacent Foreland Belt which is the deformed and shorten ancient sedimentary passive margin of ancestral North America [1]. The Omineca Belt is comprised of abundant metamorphic rock with lesser amounts of granitic rock. Metamorphic rock derived from sedimentary and, less commonly, volcanic and granitic rock, mainly Paleozoic (600-250 Ma) and early Mesozoic age (180 Ma). Granitic intrusions are Devonian (380 Ma) to Tertiary (50 Ma) age [19].				
1. Overburden	0 – 2 m [21] [II]	2 m	70 [s36] [III]	0.014285 [24]	Alpine Complexes (broken rock, colluvium, till pockets) predominant over most of Omineca Belt. Till veneer and some till blanket and alluvial (sand, gravel) deposits in the Cranbrook area and south to Canada/US border [s40, 20], as well as Grand Forks area.
			Thickness of Alpine Complexes unknown, expect thicker at bottom of valley slopes. Till veneer typically <2m. Overburden in Cranbrook area has maximum thickness ranging 100-300m [20]. Assign general overall depth of 2m, except for Cranbrook, Grand Forks to US border where overburden average estimated as 50m. Glacial tills in Canada exhibit variable resistivity depending on clast and matrix composition; in southeast Manitoba borehole logs show clayey till resistivity averages approx. 25 ohm.m, silty till 50 ohm.m, sandy till 115 ohm.m [s36]. Till within Omineca Belts originates from highly metamorphosed sedimentary rock and plutonic rock, thereby clayey / silty to sandy till sandy results. Assign 70 ohm.m, based on midpoint of resistivity range for tills. Limits 25, 115 ohm.m		
2. Sedimentary Basin	absent	---	---	---	---

Table 8 (continued)
1D Earth Resistivity Model for British Columbia – Zone 4S (Omineca Belt)

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m) / Certainty	Comments
3. Upper Crust	0 – 14.5 km [10] [I]	14.5 km	740 [8] [I]	0.001351 [24]	Sedimentary, volcanic and granitic rock, typically metamorphosed up to high grades [22]
			Depth scaled from regional seismic profile(s) across southern BC, range 13-15.5 km [10]. Assign 14.5 km, average of values. MT profiles [8] across southern BC show for: * Line ABC-N, weighted average approx. 450 ohm.m (see Note 1) * Line ABC-S, weighted average approx. 1025 ohm.m * chose approx. 740 ohm.m, average of above lines 5-km depth resistivity map [13] shows overall 600 ohm.m (see Note 2). 10-km depth resistivity map [13] shows overall 640 ohm.m. Assign 740 ohm.m, based on weighted averages of 2D inversion profiles. Limits 450, 1025 ohm.m.		
4. Middle Crust	14.5 – 24 km [10] [I]	9.5 km	300 [8] [I]	0.003333 [24]	Depth scaled from regional seismic profile(s) across southern BC, range approx. 21-25.5 km [10]. Assign 24 km, average of values.
			MT profiles [8] across southern BC show for: * Line ABC-N, weighted average approx. 350 ohm.m (see Note 1) * Line ABC-S, weighted average approx. 260 ohm.m * chose approx. 300 ohm.m, average of above lines 20-km depth resistivity map [13] shows overall 330 ohm.m (see Note 2). Assign 300 ohm.m, based on weighted averages of 2D inversion profiles. Limits 260, 350 ohm.m.		

Table 8 (continued)
1D Earth Resistivity Model for British Columbia – Zone 4S (Omineca Belt)

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m) / Certainty	Comments
5. Lower Crust	24 – 37 km [10] / [I]	13 km	65 [8] / [I]	0.015384 [24]	Depth scaled from regional seismic profile(s) across southern BC, range approx. 36-38.5 km [10]. Assign 37 km, average of values.
			MT profiles [8] across southern BC show for: * Line ABC-N, weighted average approx. 110 ohm.m (see Note 1) * Line ABC-S, weighted average approx. 20 ohm.m * chose approx. 65 ohm.m, average of above lines 30-km depth resistivity map [13] shows overall 620 ohm.m (see Note 2). Assign 65 ohm.m, based on weighted averages of 2D inversion profiles. Limits 20, 110 ohm.m.		
6. Upper Mantle	37 – 100 km [23] / [III]	63 km	130 [8] / [I]	0.007692 [24]	Used generalized lower depth [23].
			MT profiles [8] across southern BC show for: * Line ABC-N, weighted average approx. 150 ohm.m [see Note 1] * Line ABC-S, weighted average approx. 105 ohm.m * chose approx. 130 ohm.m, average of above lines Assign 130 ohm.m, based on weighted averages of 2D inversion profiles. Limits 100, 150 ohm.m.		

Table 8 (continued)
1D Earth Resistivity Model for British Columbia – Zone 4S (Omineca Belt)

Layer	Depth Certainty	Thickness	Resistivity (ohm-m) Certainty	Conductivity (S/m) Certainty	Comments
7. Upper Mantle	100 - 250 km [23] [III]	150 km	100-150km 265 [8] [I] 150-250km 210 [25] [III]	100-150km 0.003773 [24] 150-250km 0.004786 [23]	Layer 7 divisible into upper and lower segments. MT profiles [8] provide regional resistivity values between 100-150 km depth. North American regional model for resistivity values applied between 150-250 km. 100-150 km depth: MT profiles [rip13] across coast Belt in southern BC show for: * Line ABC-N, weighted average 115 ohm.m [see Note 1] * Line ABC-S, weighted average 315 ohm.m * chose approx. 265 ohm.m, average of above lines Assign 265 ohm.m, based on weighted averages of 2D inversion profiles. Limits 115, 315 ohm.m. 150-250 km depth: Generalized depth [23] for base of lower segment. North American regional model [23], based on Tucson magnetic observatory data, situated on Proterozoic crust (late Precambrian time) indicates 210 ohm.m for 100-250 km. Assign approx. 210 ohm.m, based on North American model.

Table 8 (continued)
1D Earth Resistivity Model for British Columbia – Zone 4S (Omineca Belt)

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m) / Certainty	Comments
8. Upper Mantle	250–410 km [23]	160 km	50 [25]	0.019952 [23]	Utilized North American regional model [23], based on Tucson magnetic observatory data, situated on Proterozoic crust (late Precambrian time) for all depths and resistivities below 250 km.
	[III]		[III]		
9. Transition Zone	410–520 km [23]	110 km	20 [25]	0.050118 [23]	Assign North American regional model.
	[III]			[III]	
10. Transition Zone	520–670 km [23]	150 km	5.62 [25]	0.177827 [23]	Assign North American regional model.
	[III]			[III]	
11. Lower Mantle	670–900 km [23]	230 km	1.58 [25]	0.630957 [23]	Assign North American regional model.
	[III]			[III]	
12. Lower Mantle	900–1000 km [23]	100 km	0.89 [25]	1.122018 [23]	Assign North American regional model.
	[III]			[III]	

See end of Table 12 for abbreviations and notes

Table 8 (continued)
1D Earth Resistivity Model for British Columbia – Zone 4S (Omineca Belt)

NOTE 1: Calculation of Weighted Average for Layers 3 to 7, from 2D inversion profiles [8].

For each layer, percentage areal extent of dominant / midpoint resistivity value was determined by measurement (e.g. 25 % of layer is 150 ohm.m, thus 0.25 x 150). Resistivity estimated by visual comparison against provided resistivity scale.

Results below are rounded.

Layer 3, Upper Crust
Line ABC-N: ((0.2 x 1500) + (0.15 x 550, midpoint of range 400-700) + (0.2 x 200) + (0.45 x 65, midpoint of range 30-100) = approx. 450 ohm.m
Line ABC-S: ((0.47 x 1500) + (0.3 x 950, midpoint of range 400-1500) + (0.23 x 150, midpoint of range 100-200)) = approx. 1025 ohm.m

Layer 4, Middle Crust
Line ABC-N: ((0.2 x 400) + (0.3 x 950, midpoint of range 400-1500) + (0.4 x 20, midpoint of range 10-30)) = approx. 350 ohm.m
Line ABC-S: ((0.18 x 10) + (0.18 x 50, midpoint of range 30-75) + (0.21 x 950, midpoint of range 400-1500) + (0.43 x 112, midpoint of range 75-150) = approx. 260 ohm.m

Layer 5, Lower Crust
Line ABC-N: ((0.15 x 150) + (0.3 x 200) + (0.15 x 90, midpoint of range 30-150) + (0.2 x 10) + (0.2 x 50, midpoint of range 30-75)) = approx. 110 ohm.m
Line ABC-S: ((0.45 x 10) + (0.55 x 25, midpoint of range 20-30)) = approx. 20 ohm.m

Layer 6, Upper Mantle (Moho – 100 km)
Line ABC-N: ((0.07 x 30) + (0.17 x 75) + (0.08 x 100) + (0.11 x 150) + (0.57 x 200)) = approx. 150 ohm.m
Line ABC-S: ((0.05 x 10) + (0.15 x 25, midpoint of range 20-30) + (0.35 x 75) + (0.2 x 100) + (0.1 x 150) + (0.1 x 200) + (0.05 x 400)) = approx. 105 ohm.m

Layer 7, Upper Mantle (100- 150 km)
Line ABC-N: ((0.15 x 75) + (0.48 x 100) + (0.3 x 150) + (0.07 x 200)) = approx. 115 ohm.m
Line ABC-S: ((0.1 x 75) + (0.2 x 100) + (0.15 x 150) + (0.15 x 200) + (0.2 x 400) + (0.15 x 700) + (0.05 x 1000)) = approx. 315 ohm.m

NOTE 2: Determination of overall resistivity for specific depths, from depth resistivity maps [13], by (i) visual estimation of percentage areal extent of dominant / midpoint resistivity value (e.g. 50 % of area is 75 ohm.m, thus 0.5 x 75), and (ii) visual comparison against provided resistivity scale.

Results below are rounded to nearest 5 or 10.

5-km depth
((0.05 x 6500) + (0.25 x 750) + (0.25 x 200) + (0.4 x 75) + 0.05 x 20))= approx. 600 ohm.m

10-km depth
((0.05 x 6500) + (0.25 x 750) + (0.6 x 200) + (0.1 x 75) + (0.05 x 20)) = approx. 640 ohm.m

20-km depth
((0.02 x 6500) + (0.15 x 750) + (0.3 x 200) + (0.3 x 75) + (0.05 x 20)) = approx. 330 ohm.m

30-km depth
((0.02 x 6500) + (0.4 x 750) + (0.4 x 200) + (0.15 x 75) + (0.02 x 20)) = approx. 620 ohm.m

Table 9
1D Earth Resistivity Model for British Columbia – Zone 4N (Omineca Belt, north part)

Layer	Depth Certainty	Thickness	Resistivity (ohm-m) Certainty	Conductivity (S/m) Certainty	Comments
1. Overburden	0 – 15 m [58, 59] [I]	15 m	70 [s36] [III]	0.014285 [24]	Mix of till veneer (<1 m thick) and till blanket (< 45 m) is predominant at northern most end of Omineca Belt, at lower elevations such as on gentle slopes and plateaus [s40, 58]. Alpine complexes – a mix of colluvial material and till veneer / blanket, on steepest slopes [s40]. Valley bottoms are a complex mix of modern alluvial plains, fans and terraces overlying a variety of glaciofluvial sand and gravel deposits and in places thick terraces of glaciolacustrine fine sand, silt and clay [58, 59]. Till veneer reported < 1 m thick [58] and ranging 0-5 m thick [59]. Till blanket reported < 45 m thick [58] and ranging 5-30 m thick [59]. Glaciofluvial outwash plans ranges 5-20 m thick, and glaciofluvial valley fills and blanket ranges 20-60m [59]. Glaciolacustrine / glaciofluvial terraces range 20-60m thick [59]. Alluvial plains (10-100), deltas (20-60 m), fans and terraces (5-20 m) exhibit variable thicknesses [59]. Alpine complexes likely < 5 m thick [59]. Thick (unspecified) overburden covering Laird Plain (part within Zone); mix of till, glaciofluvial outwash gravels and sands, and modern fluvial gravel, sand and silts [60, 61] Assign general overall depth of 15m, although local thickness in valleys and plateaus could be greater and on higher slopes likely to be < 5 m. Glacial tills in Canada exhibit variable resistivity depending on clast and matrix composition; in southeast Manitoba borehole logs show clayey till resistivity averages approx. 25 ohm.m, silty till 50 ohm.m, sandy till 115 ohm.m [s36]. Till within Omineca Belts originates from highly metamorphosed sedimentary rock and plutonic rock, thereby clayey / silty to sandy till sandy results. Assign 70 ohm.m, based on midpoint of resistivity range for tills. Limits 25, 115 ohm.m
2. Sedimentary Basin	absent	---	---	---	---

Table 9 (continued)
1D Earth Resistivity Model for British Columbia – Zone 4N (Omineca Belt, north part)

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m) / Certainty	Comments
3. Upper Crust	0 – 16.5 km [50, 52] [I]	16.5 km	27800 [42] [I]	0.00003597 [24]	Sedimentary, volcanic and granitic rock, typically metamorphosed up to high grades [22].
			Depth scaled from regional seismic profile(s) across: northern BC; 16 km thick [50], 17 km [52]; southeastern Yukon, 11.5 km thick [51]. Assign average from BC profiles, 16.5 km thick. *Note: crustal depth determinations rounded to nearest 0.5 km.* MT 2D-profile [42] shows for regional Corridor 2 crossing northern BC, weighted average 27800 ohm.m (see Note 1). Assign 27800 ohm.m, based on weighted average of 2D inversion profile. Limits 2500, 55000 ohm.m. *Note*: for layers 3 to 7 in northern BC, assigned resistivity is possibly an overestimate (compared to southern BC) because of use of the resistivity-scale shown on the 2D inversion profile illustrated on Fig. 7 in reference 42, which has a higher end-value in contrast to lower end-values shown on 2D inversion of southern BC.		
4. Middle Crust	16.5 – 28.5 km [50, 52] [I]	12 km	1400 [42] [I]	0.000714 [24]	Depth scaled from regional seismic profile(s) across: northern BC: 16-30 km (14 km thick) [50], 17-26.5 km (9.5 km thick) [52]; southeastern Yukon, 11.5-31 km (19.5 km thick) [51]. Assign average from BC profiles, approx. 12 km thick.
			MT 2D-profile [42] shows for regional Corridor 2 crossing northern BC, weighted average 1400 ohm.m (see Note 1). Assign 1400 ohm.m, based on weighted average of 2D inversion profile. Limits 5, 2500 ohm.m.		
5. Lower Crust	28.5 – 37.5 km [50, 52] [I]	9 km	20 [42] [I]	0.05 [24]	Depth scaled from regional seismic profile(s) across northern BC: 30-36 km (6 km thick) [50]; 26.5-39 km (12.5 km thick) [52]; southeastern Yukon, 31-36 km (5 km) [51]. Assign average from BC profiles, approx. 9 km thick.
			MT 2D-profile [42] shows for regional Corridor 2 crossing northern BC, weighted average 20 ohm.m (see Note 1). 20 ohm.m, based on weighted average of 2D inversion profile. Limits 5, 55 ohm.m.		

Table 9 (continued)
1D Earth Resistivity Model for British Columbia – Zone 4N (Omineca Belt)

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m) / Certainty	Comments
6. Upper Mantle	37.5 – 100 km [23] [III]	62.5 km	16350 [42] [I]	0.00006116 [24]	Used generalized lower depth [23].
			MT 2D-profile [42] shows for: * regional Corridor 2 crossing northern BC, weighted average approx. 23100 ohm.m to depth of 80 km, and 2050 ohm.m between 80-100 km (see Note 1). Assign approx. 16350 ohm.m, based on weighted averages of 2D inversion profile. Limits 55, 55000 ohm.m.		
7. Upper Mantle	100 - 250 km [23] [III]	150 km	1850 [42] [I]	0.000540 [24]	Used generalized lower depth [23].
			North American regional model [23] depicts 210 ohm.m. MT 2D-profile [42] of regional Corridor 2 across northern BC shows weighted average 1850 ohm.m (see Note 1). Assign approx. 1850 ohm.m, based on weighted average of 2D inversion profile. Limits 55, 2500 ohm.m.		

Table 9 (continued)
1D Earth Resistivity Model for British Columbia – Zone 4N (Omineca Belt, north half)

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m) / Certainty	Comments
8. Upper Mantle	250–410 km [23]	160 km	100 [42]	0.01 [24]	Generalized depth [23] for base of layer. North American regional model [23] depicts 50 ohm.m. MT profile [42] of regional Corridor 2 across northern BC shows weighted average 100 ohm.m (see Note 1). Assign 100 ohm.m, weighted average of 2D inversion profile. Limits 20, 175 ohm.m. *Note:* for layers 8 and 9 assigned lower resistivity values as depicted on resistivity-scale shown on Fig. 6 in reference 42.
	[III]		[I]		
9. Transition Zone	410–520 km [23]	110 km	20 [42]	0.05 [24]	Generalized depth [23] for base of layer. North American regional model [23] depicts 20 ohm.m. MT profile [42] of regional Corridor 2 across northern BC shows < 20 ohm.m between 410-500 km depth. Assign 20 ohm.m, dominant resistivity on 2D inversion profile.
	[III]		[I]		
10. Transition Zone	520–670 km [23]	150 km	5.62 [25]	0.177827 [23]	Utilized North American regional model [23], based on Tucson magnetic observatory data, situated on Proterozoic crust (late Precambrian time) for all depths and resistivities below 520 km.
	[III]			[III]	
11. Lower Mantle	670–900 km [23]	230 km	1.58 [25]	0.630957 [23]	Assign North American regional model.
	[III]			[III]	
12. Lower Mantle	900–1000 km [23]	100 km	0.89 [25]	1.122018 [23]	Assign North American regional model.
	[III]			[III]	

See end of Table 12 for abbreviations and notes

Table 9 (continued)
1D Earth Resistivity Model for British Columbia – Zone 4N (Omineca Belt, north half)

NOTE 1: Calculation of Weighted Average for Layers 3 to 6, from 2D inversion profiles [42], specifically Corridor 3 and/or Corridor 2 (Jones et al. 2005, Fig.7)
Calculation of Weighted Average for Layers 7 to 9, from 2D inversion profile [42], specifically regional Corridor 2 (Jones et al. 2005, Fig.6)

For each layer, percentage areal extent of dominant / midpoint resistivity value was determined by measurement (e.g. 25 % of layer is 150 ohm.m, thus 0.25 x 150). Resistivity estimated by visual comparison against provided resistivity scale. Lower and upper limits (for a specific crustal / upper mantle layer) are chosen when the cumulative areas of resistivity exceed 5% of the total area.

Results below are rounded.

Layer 3, Upper Crust
Corridor 2: ((0.02 x 5) + (0.26 x 2500) + (0.24 x 5500) + (0.47 x 55000)) = approx. 27800 ohm.m

Layer 4, Middle Crust
Corridor 2: ((0.28 x 5) + (0.15 x 25) + (0.57 x 2500)) = approx. 1400 ohm.m

Layer 5, Lower Crust
Corridor 2: ((0.5 x 5) + (0.34 x 25) + (0.16 x 55)) = approx. 20 ohm.m

Layer 6, Upper Mantle (Moho – 100 km)
Corridor 2: ((0.04 x 5) + (0.07 x 25) + (0.26 x 55) + (0.16 x 2500) + (0.02 x 5500) + (0.41 x 55000)) = approx. 23100 ohm.m to depth of 80 km (68% of layer)
Corridor 2: ((0.18 x 55) + (0.82 x 2500)) = approx. 2050 ohm.m for depth 80-100 km (32% of layer)
For entire thickness: ((0.68 x 23100) + (0.32 x 2050)) = approx. 16350 ohm.m

Layer 7, Upper Mantle (100-250 km)
Corridor 2: ((0.27 x 55) + (0.73 x 2500))= approx. 1850 ohm.m

Layer 8, Upper Mantle (250 - 410 km)
Corridor 2: ((0.5 x 20) + (0.5 x 175)) = approx. 100 ohm.m

Table 10
1D Earth Resistivity Model for British Columbia – Zone 5S (Foreland Belt)

<table>
<tr><th rowspan="2">Layer</th><th>Depth</th><th rowspan="2">Thickness</th><th>Resistivity (ohm-m)</th><th>Conductivity (S/m)</th><th rowspan="2">Comments</th></tr>
<tr><th>Certainty</th><th>Certainty</th><th>Certainty</th></tr>
<tr><td></td><td colspan="5">Foreland Belt is comprised of thrust-faulted and deformed continental margin rocks, mainly sediments deposited from Late Precambrian to early Tertiary time (700-50 Ma), and are represented by the Rocky Mountains. In southern BC (south of latitude 53.5 degrees), the Foreland Belt extends 50 to 100 km into Alberta where it includes the Rocky Mountain Foothills. Igneous rocks are rare [43].</td></tr>
<tr><td rowspan="3">1. Overburden</td><td>0 – 2 m
[s40]</td><td rowspan="3">2 m</td><td>70
[s36]</td><td rowspan="2">0.014285
[24]</td><td rowspan="2">Alpine Complexes (broken rock, colluvium, till pockets) predominant across Foreland Belt (south of 53 deg. N) [s40]. Patchy occurrences of till veneer and till blanket along flanks of mountain ranges [s40].</td></tr>
<tr><td rowspan="2">[III]</td><td>[III]</td></tr>
<tr><td colspan="3">Assign general overall depth of 2m, possibly thicker accumulations along valley bottoms and lower slopes.
Glacial tills in Canada exhibit variable resistivity depending on clast and matrix composition; in southeast Manitoba borehole logs show clayey till resistivity averages approx. 25 ohm.m, silty till 50 ohm.m, sandy till 115 ohm.m [s36]. Till within Foreland Belt originates from slightly metamorphosed sedimentary rock, thereby clayey / silty to sandy till sandy results.
Assign 70 ohm.m, based on midpoint of resistivity range for tills. Limits 25, 115 ohm.m.</td></tr>
<tr><td>2. Sedimentary Basin</td><td>absent</td><td>---</td><td>---</td><td>---</td><td>---</td></tr>
</table>

Table 10 (continued)
1D Earth Resistivity Model for British Columbia – Zone 5S (Foreland Belt)

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m) / Certainty	Comments
3. Upper Crust	0 – 13 km [10] / [I]	13 km	520 [8] / [I]	0.001923 [24]	Comprised of sedimentary rock, deposited from late Precambrian to early Tertiary time (700-50 Ma). Igneous rocks are rare. [43]. Includes Late Precambrian to Cambrian (700-540 Ma) clastic sediments (coarse sandstones, shales, slates) and minor volcanic rocks. Overlain by thick limestones, shale and lesser sandstone of Cambrian to Jurassic age (approx. 540 – 145 Ma), and Late Jurassic to Early Cenozoic (145-50 Ma) marine to non-marine clastic sediments [44, 22]. Deformed by thrust-faulted and folding.
			Depth scaled from regional seismic profile(s) across southern BC, [10], Assign 13 km. MT profiles [8] across southern BC show for: * Line ABC-N, weighted average approx. 580 ohm.m [see Note end of table] * Line ABC-S, weighted average approx. 460 ohm.m * chose approx. 520 ohm.m, average of above lines Petroleum well logs indicate 10-1000 ohm.m range (midpoint approx. 500 ohm.m) for upper 4 km of clastic and marine carbonate (e.g. limestone) sedimentary rock of Cambrian – Jurassic age [45]. MT 1D profiles of same well logs show approx. range of 20-200 ohm.m (midpoint approx. 100 ohm.m) [45]. Assign 520 ohm.m, average of Lines ABC. Limits 100, 1000 ohm.m.		
4. Middle Crust	13 – 20.5 km [10] / [I]	7.5 km	500 [8] / [I]	0.002 [24]	Depth scaled from regional seismic profile(s) across southern BC, [10], assign 20.5 km.
			MT profiles [8] across southern BC show for: * Line ABC-N, weighted average approx. 880 ohm.m [see Note end of table] * Line ABC-S, weighted average approx. 110 ohm.m. Assign approx. 500 ohm.m, average of Lines ABC. Limits 110, 880 ohm.m.		

Table 10 (continued)

1D Earth Resistivity Model for British Columbia – Zone 5S (Foreland Belt)

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m) / Certainty	Comments
5. Lower Crust	20.5 – 42 km [10] [I]	21.5 km	250 [8] [I]	0.004 [24]	Depth scaled from regional seismic profile(s) across southern BC, [10], assign 42 km. MT profiles [8] across southern BC show for: * Line ABC-N, weighted average approx. 400 ohm.m [see Note end of table] * Line ABC-S, weighted average approx. 90 ohm.m Assign approx. 250 ohm.m, average of Lines ABC. Limits 90, 400 ohm.m.
6. Upper Mantle	42 – 100 km [23] [III]	58 km	370 [8] [I]	0.002702 [24]	Used generalized lower depth [23]. MT profiles [8] across southern BC show for: * Line ABC-N, weighted average 215 ohm.m [see Note end of table] * Line ABC-S, weighted average 525 ohm.m Assign approx. 370 ohm.m, average of Lines ABC. Limits 215, 525 ohm.m.

Table 10 (continued)

1D Earth Resistivity Model for British Columbia – Zone 5S (Foreland Belt)

Layer	Depth Certainty	Thickness	Resistivity (ohm-m) Certainty	Conductivity (S/m) Certainty	Comments
7. Upper Mantle	100 - 250 km [23] [III]	150 km	100-150km 750 [8] [I] 150-250km 210 [25] [III]	100-150km 0.001333 [24] 150-250km 0.004786 [23]	Layer 7 divisible into upper and lower segments. MT profiles [8] provide regional resistivity values between 100-150 km depth. Applied North American regional model for resistivity values between 150-250 km. 100-150 km depth: MT profiles [8] across coast Belt in southern BC show for: * Line ABC-N, weighted average 150 ohm.m [see Note 1] * Line ABC-S, weighted average 1340 ohm.m * chose approx. 265 ohm.m, average of above lines Assign approx. 750 ohm.m, based on weighted averages of above 2D inversion profiles. Limits 150, 1340 ohm.m. 150-250 km depth: Generalized depth [23] for base of lower segment. North American regional model [23], based on Tucson magnetic observatory data, situated on Proterozoic crust (late Precambrian time) indicates 210 ohm.m for 100-250 km. Assign approx. 210 ohm.m, based on North American model.

Table 10 (continued)
1D Earth Resistivity Model for British Columbia – Zone 5S (Foreland Belt)

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m) / Certainty	Comments
8. Upper Mantle	250–410 km [23]	160 km	50 [25]	0.019952 [23]	Utilized North American regional model [23], based on Tucson magnetic observatory data, situated on Proterozoic crust (late Precambrian time) for all depths and resistivities below 250 km.
	[III]		[III]		
9. Transition Zone	410–520 km [23]	110 km	20 [25]	0.050118 [23]	Assign North American regional model.
	[III]			[III]	
10. Transition Zone	520–670 km [23]	150 km	5.62 [25]	0.177827 [23]	Assign North American regional model.
	[III]			[III]	
11. Lower Mantle	670–900 km [23]	230 km	1.58 [25]	0.630957 [23]	Assign North American regional model.
	[III]			[III]	
12. Lower Mantle	900–1000 km [23]	100 km	0.89 [25]	1.122018 [23]	Assign North American regional model.
	[III]			[III]	

See end of Table 12 for abbreviations and notes

Table 10 (continued)
1D Earth Resistivity Model for British Columbia – Zone 5S (Foreland Belt)

NOTE: Calculation of weighted average for Layers 3 to 7 of Foreland Belt, from visual estimation of 2D inversion profile [8]

For each layer, percentage areal extent of dominant / midpoint resistivity value was determined (e.g. 25 % of layer is 150 ohm.m, thus 0.25 x 150)

Results below are rounded.

Layer 3, Upper Crust
Line ABC-N: ((0.25 x 1500) + (.21 x 650, midpoint of range 300-1000) + (0.05 x 10) + (0.02 x 50, midpoint of range 30-75) + (0.47 x 150, midpoint of range 100-200)) = approx. 580 ohm.m
Line ABC-S: ((0.14 x 1500) + (0.33 x 500, midpoint of range 300-700) + (0.16 x 200) + (0.01 x 10) + (0.07 x 50, midpoint of range 30-75)) = approx. 460 ohm.m

Layer 4, Middle Crust
Line ABC-N: ((0.45 x 1500) + (0.21 x 650, midpoint of range 300-1000) + (0.34 x 200)) = approx. 880 ohm.m
Line ABC-S: ((0.15 x 15, midpoint of range 10-20) + (0.3 x 25, midpoint of range 20-30) + (0.05 x 85, midpoint of range 75-100) + (0.1 x 150) + (0.4 x 200)) = approx. 110 ohm.m

Layer 5, Lower Crust
Line ABC-N: ((0.06 x 1500) + (0.06 x 1000) + (0.14 x 700) + (0.1 x 300) + 0.1 x 150) + (0.54 x 200)) = approx. 400 ohm.m
Line ABC-S: ((0.07 x 15, midpoint of range 10-20) + (0.3 x 25, midpoint of range 75-100) + (0.23 x 85, midpoint of range 75-100) + (0.35 x 150) + (0.05 x 200)) = approx. 90 ohm.m

Layer 6, Upper Mantle (Moho – 100 km)
Line ABC-N: ((0.22 x 300) + (0.15 x 150) + (0.63 x 200)) = approx. 215 ohm.m
Line ABC-S: ((0.03 x 30) + (0.05 x 75) + (0.1 x 100) + (0.12 x 150) + (0.14 x 200) + (0.17 x 300) + (0.14 x 700) + (0.12 x 1000) + (0.13 x 1500)) = approx. 525 ohm.m

Layer 7, Upper Mantle (100- 150 km)
Line ABC-N: ((0.35 x 100) + (0.38 x 150) + (0.22 x 200) + (0.05 x 300)) = approx. 150 ohm.m
Line ABC-S: ((0.07 x 700) + (0.22 x 1000) + (0.71 x 1500)) = approx. 1340 ohm.m

Table 11
1D Earth Resistivity Model for British Columbia – Zone 5N (Foreland Belt, north half)

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m) / Certainty	Comments
1. Overburden	0 – 10 m [58, 59] [II]	10 m	70 [s36] [III]	0.014285 [24]	Mix of till veneer and till blanket is predominant at northern most end of Foreland Belt, at lower elevations such as on gentle slopes and plateaus [s40, 61]. Remainder of northern 1/2 of zone occupied by alpine complexes (broken rock, colluvium) at highest elevations, with colluvial blocks and rubble, with some patchy till veneer, flank the alpine complexes [s40].
			Overburden thickness not well determined. Till veneer likely < 1 m thick, with till blanket likely less than several 10's m thick. Alpine complexes likely < 2 m thick. Colluvial deposits likely highly variable, thickest at slope bottoms, possibly several 10's metres thick. Thick (unspecified) overburden in major valleys and covering Laird Plain (part within Zone); mix of till, glaciofluvial outwash gravels and sands, and modern fluvial gravel, sand and silts [60, 61]. Assign general overall depth of 10 m, possibly thicker accumulations along valley bottoms and lower slopes. Glacial tills in Canada exhibit variable resistivity depending on clast and matrix composition; in southeast Manitoba borehole logs show clayey till resistivity averages approx. 25 ohm.m, silty till 50 ohm.m, sandy till 115 ohm.m [s36]. Till within Foreland Belt originates from slightly metamorphosed sedimentary rock, thereby clayey / silty to sandy till sandy results. Assign 70 ohm.m, based on midpoint of resistivity range for tills. Limits 25, 115 ohm.m.		
2. Sedimentary Basin	absent	---	---	---	---

Table 11 (continued)
1D Earth Resistivity Model for British Columbia – Zone 5N (Foreland Belt, north half)

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m) / Certainty	Comments
3. Upper Crust	0 – 11.5 km [52] / [I]	11.5 km	43800 [42] / [I]	0.00002283 [24]	Comprised of sedimentary rock, deposited from late Precambrian to early Tertiary time (700-50 Ma). Igneous rocks are rare. [43]. Includes Late Precambrian to Cambrian (700-540 Ma) clastic sediments (coarse sandstones, shales, slates) and minor volcanic rocks. Overlain by thick limestones, shale and lesser sandstone of Cambrian to Jurassic age (approx. 540 – 145 Ma), and Late Jurassic to Early Cenozoic (145-50 Ma) marine to non-marine clastic sediments [44, 22]. Deformed by thrust-faulted and folding.
			Depth scaled from regional seismic interpretation-profile across north BC: thickness ranges 4-19 km [52]. Assign midpoint thickness of approx. 11.5 km. *Note: crustal depth determinations rounded to nearest 0.5 km.* MT 2D-profile [42] shows for regional Corridor 2 crossing northern BC, weighted average 43800 ohm.m (see Note 1) Assign 43800 ohm.m, based on weighted average of 2D inversion profile. Limits 5500, 55000 ohm.m. *Note*: for layers 3 to 7 in northern BC, assigned resistivity is possibly an overestimate (compared to southern BC) because of use of the resistivity-scale shown on the 2D inversion profile illustrated on Fig. 7 in reference 42, which has a higher end-value in contrast to lower end-values shown on 2D inversion of southern BC.		
4. Middle Crust	11.5 – 27.5 km [52] / [I]	16 km	24900 [42] / [I]	0.00004016 [24]	Depth scaled from regional seismic-interpretation profile across northwestern BC: average 27.5 km [52].
			MT profile [42] shows for regional Corridor 2 crossing northern BC, weighted average 24900 ohm.m (see Note 1). Assign 24900 ohm.m, based on weighted average of 2D inversion profile. Limits 25, 55000 ohm.m.		

Table 11 (continued)
1D Earth Resistivity Model for British Columbia – Zone 5N (Foreland Belt)

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m) / Certainty	Comments
5. Lower Crust	27.5 – 39 km [52, 53] [I]	11.5 km	46200 [42] [I]	0.00002164 [24]	Depth scaled from regional seismic interpretation-profile across north BC; ranges 38.5-43 km, average 41 km [52]. Moho depth reported approx. 38 km beneath Foreland Belt [53]. Assign midpoint depth, approx. 39.5 km.
			MT profile [42] shows for regional Corridor 2 crossing northern BC, weighted average 46200 ohm.m (see Note 1). Assign 46200 ohm.m, based on weighted average of 2D inversion profile. Limits 55, 55000 ohm.m		
6. Upper Mantle	39 – 100 km [23] [III]	61 km	1750 [42] [I]	0.000571 [24]	Used generalized lower depth [23].
			MT profile [42] shows for: * regional Corridor 2 crossing northern BC, weighted average 1500 ohm.m to depth of 80 km, and 2200 ohm.m between 80-100 km (see Note 1). Assign 1750 ohm.m, based on weighted average of 2D inversion profile. Limits 5, 2500 ohm.m		
7. Upper Mantle	100 - 250 km [23] [III]	150 km	1950 [42] [I]	0.000512 [24]	Used generalized lower depth [23].
			North American regional model [23] depicts 210 ohm.m. MT 2D-profile [42] of regional Corridor 2 across northern BC shows weighted average 1950 ohm.m (see Note 1). Assign 1950 ohm.m, based on weighted average of 2D inversion profile. Limits 55, 2500 ohm.m.		

Table 11 (continued)
1D Earth Resistivity Model for British Columbia – Zone 5N (Foreland Belt, north half)

Layer	Depth Certainty	Thickness	Resistivity (ohm-m) Certainty	Conductivity (S/m) Certainty	Comments
8. Upper Mantle	250–410 km [23] [III]	160 km	120 [42] [I]	0.000833 [24]	Generalized depth [23] for base of layer. North American regional model [23] depicts 50 ohm.m. MT profile [42] of regional Corridor 2 across northern BC shows weighted average 120 ohm.m (see Note 1). Assign 120 ohm.m, based on weighted average of 2D inversion profile. Limits 70, 175 ohm.m. *Note:* for layers 8 and 9 assigned lower resistivity values as depicted on resistivity-scale shown on Fig. 6 in reference 42.
9. Transition Zone	410–520 km [23] [III]	110 km	20 [42] [I]	0.5 [24]	Generalized depth [23] for base of layer. North American regional model [23] depicts 20 ohm.m. MT profile [42] of regional Corridor 2 across northern BC shows < 20 ohm.m between 410-500 km depth. Assign 20 ohm.m, based on 2D inversion profile.
10. Transition Zone	520–670 km [23] [III]	150 km	5.62 [25]	0.177827 [23] [III]	Utilized North American regional model [23], based on Tucson magnetic observatory data, situated on Proterozoic crust (late Precambrian time) for all depths and resistivities below 520 km.
11. Lower Mantle	670–900 km [23] [III]	230 km	1.58 [25]	0.630957 [23] [III]	Assign North American regional model.
12. Lower Mantle	900–1000 km [23] [III]	100 km	0.89 [25]	1.122018 [23] [III]	Assign North American regional model.

See end of Table 12 for abbreviations and notes

Table 11 (continued)
1D Earth Resistivity Model for British Columbia – Zone 5N (Foreland Belt, north half)

NOTE 1: Calculation of Weighted Average for Layers 3 to 6, from 2D inversion profiles [42], specifically Corridor 3 and/or Corridor 2 (Jones et al. 2005, Fig.7)
Calculation of Weighted Average for Layers 7 to 9, from 2D inversion profile [42], specifically regional Corridor 2 (Jones et al. 2005, Fig.6)

For each layer, percentage areal extent of dominant / midpoint resistivity value was determined by measurement (e.g. 25 % of layer is 150 ohm.m, thus 0.25 x 150). Resistivity estimated by visual comparison against provided resistivity scale. Lower and upper limits (for a specific crustal / upper mantle layer) are chosen when the cumulative areas of resistivity exceed 5% of the total area.

Results below are rounded.

<u>Layer 3, Upper Crust</u>
Corridor 2: ((0.03 x 5) + (0.03 x 25) + (0.16 x 5500) + (0.78 x 55000)) = approx. 43800 ohm.m

<u>Layer 4, Middle Crust</u>
Corridor 2: ((0.03 x 5) + (0.2 x 25) + (0.03 x 55) + (0.12 x 2500) + (0.16 x 5500) + (0.43 x 55000)) = approx. 24900 ohm.m

<u>Layer 5, Lower Crust</u>
Corridor 2: ((0.02 x 5) + (0.07 x 25) + (0.07 x 55) + (0.84 x 55000))= approx. 46200 ohm.m

<u>Layer 6, Upper Mantle (Moho – 100 km)</u>
Corridor 2: ((0.66 x 5) + (0.18 x 25) + (0.12 x 55) + (0.09 x 2500) + (0.03 x 5500) + (0.02 x 55000)) = approx. 1500 ohm.m to depth of 80 km (67% of layer)
Corridor 2: ((0.03 x 25) + (0.08 x 55) + (0.89 x 2500)) = approx. 2200 ohm.m for depth 80-100 km (33% of layer)
For entire thickness: ((0.67 x 1500) + (0.33 x 2200)) = approx. 1750 ohm.m

<u>Layer 7, Upper Mantle (100-250 km)</u>
Corridor 2: ((0.22 x 55) + (0.78 x 2500)) = approx. 1950 ohm.m

<u>Layer 8, Upper Mantle (250 - 410 km)</u>
Corridor 2: ((0.09 x 20) + (0.4 x 70) + (0.51 x 175)) = approx. 120 ohm.m

Table 12
1D Earth Resistivity Model for British Columbia - Zone 6 (Interior Platform)

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m) / Certainty	Comments
1. Overburden	0 – 50 m [s2] [II]	50 m	70 [s36] [III]	0.014285 [24]	Predominately a thick and continuous till blanket, with areas of till veneer. Fine-grained glaciolacustrine (clay, silt) in river valleys in Fort St. John area, also alluvial sediments (gravel, sand). Thick deposits in major river valleys, e.g. Peace River [62]. Extensive organic deposits (peat, mud) east and northeast of Fort Nelson, overly tills [40, 63].
			Overburden depth highly variable due presence of irregular bedrock topography and buried paleovalleys infilled with thick accumulations. Depth ranges typically 50-100m in adjacent Alberta and expected similar in BC [s2]. However, northwest corner of Alberta depth ranges 100-300 m, and expected similar in northeast corner of BC [s2]. Up to 180 m of overburden reported in Ft. St. John-Peace River valley [62]. In northeast BC in the Etsho Plateau to Nelson Lowland region, thick blanket of till covers glaciolacustrine deposits, ranging 25-125 m thick, averaging 75 m, and in paleovalleys could be as much as 300-350 m of overburden; overall overburden thickness averages 130 m thick [64]. 15-45 m thick in Alberta provincial boundary area [65]. Organic deposits less than few metres thick in Fort Nelson area [66]. Locally, along Prophet River valley, post-glacial gravels and silt layer (<3.5 m) are on top of a glacial till blanket (<5m) partially overlies glaciolacustrine (clay and silt) sediments, all overlying pre-glacial fluvial (sand/gravel) and lacustrine (silt, clay) deposits; overall thickness ranges 7-35 m, typically 20 m thick [67]. Along Peace River valley, overburden (post-glacial gravel and silt overlies till overlying glaciolacustrine clay/silt overlying pre-glacial fluvial gravel); overburden in valley some 60 m thick, and < 40 m at valley top [62]. Assign overall 50m thickness; likely considerable variation of overburden thickness within Zone. Glacial tills in Canada exhibit variable resistivity depending on clast and matrix composition; in southeast Manitoba borehole logs show clayey till resistivity averages approx. 25 ohm.m, silty till 50 ohm.m, sandy till 115 ohm.m [s36]. Borehole logs of Manitoba overburden show 40-50 ohm.m for till and 70-200 ohm.m for sand and gravel [a3]. MT survey in SE Manitoba indicates 5-30 ohm for mix of till, clay, silt and sand [a6]. Glaciolacustrine clays average 30 ohm.m in northeastern Ontario [a33]. Airborne resistivity survey profiles over central Alberta indicate ~20 ohm.m, plan view maps show 10-20 ohm.m at 20m depth [a5]. Assign 70 ohm.m, based on midpoint of resistivity range for tills. Limits 25, 115 ohm.m.		

Table 12 (continued)
1D Earth Resistivity Model for British Columbia - Zone 6 (Interior Platform)

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m) / Certainty	Comments
2. Sedimentary Basin	0 – 3.8 km [a7] / [I]	3.8 km	10 [a9] / [II]	0.1 [24]	WCSB of Interior Platform overlies area, gently deepening southwestward. Lower half of strata consist of Paleozoic carbonate (e.g. limestone) with shale. Upper half of strata consists of Mesozoic clastic sediments (shale, siltstone, sandstone, some limestone). Depth ranges 2100-5500m, assign midpoint 3800m [a7]. Beneath Fort Nelson, 2600m; Fort St. John, 4000m [a7]. In adjacent Alberta, 1.7 km depth resistivity map shows overall ~10 ohm.m with localized areas up to 30 ohm.m [a9]. Low resistivity attributed to presence of pore fluids in sedimentary rock [a8]. MT profiles show for: * Corridor 2 (across Zone), range 10-100 ohm.m (midpoint 50 ohm.m) [42] In adjacent Alberta: * MT profile shows approx. 5-8 ohm.m [a10b] * induction logs from petroleum wells, penetrating WCSB to Precambrian basement, show 5 ohm.m average resistivity [a10a]. In adjacent NWT: * SNORCLE Corridor 1 (200 km north of 60 deg.N) MT profile shows range 3-30 ohm.m (midpoint 15 ohm.m) [a34] * SNORCLE Corridor 3 (0-300 north of deg.N) MT profile shows range approx. 25-100 ohm.m (midpoint 60 ohm.m) [68]. Assign approx. 10 ohm.m, based on MT profile by [a9]. Limits 5, 100 ohm.m.

Table 12 (continued)
1D Earth Resistivity Model for British Columbia - Zone 6 (Interior Platform)

Layer	Depth Certainty	Thickness	Resistivity (ohm-m) Certainty	Conductivity (S/m) Certainty	Comments
3. Upper Crust	3.8 - 13 km [52] [I]	9.2 km	14000 [42] [I]	0.0000714 [24]	*Zone incorporates following terranes (westward from Alberta-BC provincial boundary):* * Hottah terrane - plutonic and gneissic rock [a20]. Its geophysical expression is as an aeromagnetically negative (low) region. * Fort Simpson terrane - plutonic [a20] and metasedimentary rock [a34c]. Geophysically expressed as a north- trending, strong, positive aeromagnetic anomaly [a39, a20]. * Nahanni terrane - defined by and characterized by variable, but mostly low-magnitude, magnetic anomalies; either thinned Fort Simpson crust or other differing rock type [42, 69] Depth scaled from regional seismic profile across northwestern BC: thickness ranges 8.5-17 km [52]. Assign midpoint thickness of approx. 13 km. *Note: crustal depth determinations rounded to nearest 0.5 km.* MT profile [42] of Corridor 2 across northeast BC shows weighted average 14000 ohm.m (see Note 1). Limits 5, 55000 ohm.m. *Note*: for layers 3 to 7 in northern BC, assigned resistivity is possibly an overestimate (compared to southern BC) because of use of the resistivity-scale shown on the 2D inversion profile illustrated on Fig. 7 in reference 42, which has a higher end-value in contrast to lower end-values shown on 2D inversion of southern BC.
4. Middle Crust	13 – 19 km [52] [I]	6 km	7700 [42] [I]	0.000129 [24]	Thickness scaled from regional seismic interpretation-profile across northwestern BC: average 6.5 km [52]. MT profile [42] of Corridor 2 across northeast BC shows weighted average 7700 ohm.m (see Note 1). Limits 5, 55000 ohm.m.
5. Lower Crust	19 – 39 km [52, 53] [I]	20 km	12000 [42] [I]	0.0000833 [24]	Lower depth scaled from regional seismic interpretation-profile across northwestern BC; average 42.5 km [52]. Moho depth reported approx. range 34-38 km beneath Interior platform in BC [53]. Depth to Moho contour map shows range 35-43 km (midpoint 39 km) [70]. Assign midpoint depth (36, 42.5 km), approx. 39 km. MT profile [42] of Corridor 2 across northeast BC shows weighted average 12000 ohm.m (see Note 1). Limits 55, 55000 ohm.m.

Table 12 (continued)
1D Earth Resistivity Model for British Columbia - Zone 6 (Interior Platform)

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m) / Certainty	Comments
6. Upper Mantle	39 - 100 km [23] [III]	61 km	3300 [42] [I]	0.000303 [24]	Used generalized lower depth [23]. MT profile [42] shows for: * regional Corridor 2 crossing northern BC, weighted average 4300 ohm.m to depth of 80 km, and 1180 between 80-100 km (see Note 1). Assign 3300 ohm.m, based on weighted average of 2D inversion profile. Limits 5, 55000 ohm.m.
7. Upper Mantle	100 - 250 km [23] [III]	150 km	700 [42] [I]	0.001428 [24]	MT 2D-profile [42] of regional Corridor 2 across northern BC shows weighted average 700 ohm.m (see Note 1). North American regional model [23] indicates 210 ohm.m for 100-250 km. Assign 700 ohm.m, based on weighted average of 2D inversion profile. Limits 55, 2500 ohm.m. *Note*: possible overestimate of resistivity, applied the higher resistivity values depicted on colour code shown on Fig. 7 in reference 42.
8. Upper Mantle	250–410 km [23] [III]	160 km	120 [42] [I]	0.008333 [24]	MT profile [42] of regional Corridor 2 across northern BC shows weighted average 120 ohm.m (see Note 1). North American regional model [23] depicts 50 ohm.m. Assign 120 ohm.m, based on weighted average of 2D inversion profile. Limits 55, 175 ohm.m. *Note:* for layers 8 and 9 assigned lower resistivity values as depicted on resistivity-scale shown on Fig. 6 in reference 42.

Table 12 (continued)
1D Earth Resistivity Model for British Columbia - Zone 6 (Interior Platform)

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m) / Certainty	Comments
9. Transition Zone	410–520 km [23]	110 km	20 [42]	0.05 [23]	MT profile [42] of regional Corridor 2 across northern BC shows < 20 ohm.m between 410-500 km depth. North American regional model [23] depicts 20 ohm.m. Assign 20 ohm.m, based on 2D inversion profile.
	[III]		[I]		
10. Transition Zone	520–670 km [23]	150 km	5.62 [25]	0.177827 [23]	Utilized North American regional model [23], based on Tucson magnetic observatory data, situated on Proterozoic crust (late Precambrian time) for all depths and resistivities below 520 km
	[III]			[III]	
11. Lower Mantle	670–900 km [23]	230 km	1.58 [25]	0.630957 [23]	Assign North American regional model.
	[III]			[III]	
12. Lower Mantle	900–1000 km [23]	100 km	0.89 [25]	1.122018 [23]	Assign North American regional model.
	[III]			[III]	

See end of Table 12 for abbreviations and notes

Table 12 (continued)
1D Earth Resistivity Model for British Columbia - Zone 6 (Interior Platform)

NOTE 1: Calculation of Weighted Average for Layers 3 to 6, from 2D inversion profiles [42], specifically Corridor 3 and/or Corridor 2 (Jones et al. 2005, Fig.7)
Calculation of Weighted Average for Layers 7 to 9, from 2D inversion profile [42], specifically regional Corridor 2 (Jones et al. 2005, Fig.6)

For each layer, percentage areal extent of dominant / midpoint resistivity value was determined by measurement (e.g. 25 % of layer is 150 ohm.m, thus 0.25 x 150). Resistivity estimated by visual comparison against provided resistivity scale. Lower and upper limits (for a specific crustal / upper mantle layer) are chosen when the cumulative areas of resistivity exceed 5% of the total area.

Results below are rounded.

<u>Layer 3, Upper Crust</u>
Corridor 2: ((0.33 x 5) + (0.09 x 25) + (0.0.03 x 55) + (0.12 x 2500) + (0.2 x 5500) + (0.23 x 55000)) = approx. 14000 ohm.m

<u>Layer 4, Middle Crust</u>
Corridor 2: ((0.46 x 5) + (0.05 x 25) + (0.2 x 55) + (0.2 x 5500) + (0.12 x 55000)) = approx. 7700 ohm.m

<u>Layer 5, Lower Crust</u>
Corridor 2: ((0.03 x 5) + (0.03 x 25) + (0.14 x 55) + (0.26 x 2500) + (0.37 x 5500) + (0.17 x 55000))= approx. 12000 ohm.m

<u>Layer 6, Upper Mantle (Moho – 100 km)</u>
Corridor 2: ((0.53 x 5) + (0.19 x 25) + (0.1 x 55) + (0.06 x 2500) + (0.05 x 5500) + (0.07 x 55000)) = approx. 4300 ohm.m to depth of 80 km (67% of layer)
Corridor 2: ((0.45 x 5) + (0.08 x 25) + (0.47 x 2500)) = 1180 ohm.m for depth 80-100 km (33% of layer)
For entire thickness: ((0.67 x 4300) + (0.33 x 1180)) = approx. 3300 ohm.m

<u>Layer 7, Upper Mantle (100-250 km)</u>
Corridor 2: ((0.01 x 5) + (0.03 x 25) + (0.7 x 55) + (0.78 x 2500)) = approx. 700 ohm.m

<u>Layer 8, Upper Mantle (250 - 410 km)</u>
Corridor 2: ((0.5 x 70) + (0.5 x 175)) = approx. 120 ohm.m

Table 12 (continued)
1D Earth Resistivity Model for British Columbia - Zone 6 (Interior Platform)

NOTES:
Depth Certainty
- I = best representation
  - * overburden: geological report/map coverage of local area.
  - * crust: seismic/gravity transects crossing local area
- II = likely representative
  - * overburden: geological report/map coverage of region
  - * crust/upper mantle: geological and/or seismic transect of a regional nature.
- III = possibly representative (measurements from general compilations).

Resistivity/Conductivity Certainty
- I = best representation (measurements from site or nearby).
  - * overburden: resistivity measurement by surface geophysical method and/or borehole in local area.
  - * crust: resistivity measurement from resistivity survey, MT survey and/or borehole in local area.
- II = likely representative (resistivity values extrapolated from measurements taken at some distance from the site, typically greater than 100 km).
  - * overburden: resistivity value obtained by geophysical measurement, including borehole logs.
  - * sedimentary basin: value obtained by geophysical survey using variety of geophysical electromagnetic methods, including MT.
  - * crust: value obtained by regional MT survey.
- III = possibly representative (measurements from general compilations).

Table 12 (continued)

1D Earth Resistivity Model for British Columbia - Zone 6 (Interior Platform)

CITED REFERENCES:

1 Enkin (2014), p.328

2 GSC (2007a), “Island mountains and sea floor”

3 Guthrie and Penner (2005), surficial geology map

4 Kenny (2004), hydrogeological cross-sections

5 Luternauer et al. (1994), Fig. 7 drill core lithology

6 White and Clowes (1984), Fig. 12

7 Hamilton (1990)

8 Rippe et al., (2013), Fig. 11

9 Hamilton and Ricketts (1994), Fig. 1 depth contour map

10 Clowes et al., (1995), Figs.7, 8 and 10

11 Zelt, Ellis and Clowes (1993), Fig. 7, 9

12 O’Leary et al. (1993), Fig. 7, 10

13 Jones and Gough, (1995), Fig. 4

14 GSC (2007b), “the igneous sea-wall”

15 Clague and Luternauer (1983)

16a Armstrong (1990)

16b Roots (1990), surficial and bedrock geology map

17 Ricketts and Liebscher (1994), Fig. 3

18 Mustard and Rouse (1994)

20 Hoy (1984)

21 Ferbey (2014), surficial geology map

22 Monger, J. and Price, R. (2002)

23 Kelbert et al. (2009), Figure 2, global and regional conductivity profile, Canada or North America regional conductivity chosen

36 Andrews and Russell (2010)

37 Andrews and Russell (2008)

38 Calvert and Andrews (2014)

39 Maynard et al., (2010)

40 Mwenifumbo and Mwenifumbo (2010), Table 1

41 Kim et al., (2014), Table 1

42 Jones et al. (2005), Figs. 4, 6, 7

43 GSC (2007c), “Overlapping the old continental edge”

44 GSC (2007d), “Rifting and separation of a super continent”

45 Xiao and Unsworth (2006)

46 Clague (1984)

47 Kerr and Levson (1997)

48 Holland (1976)

49 Dixon-Warren (1998)

50 Hammer and Clowes (2004), Figs. 5 and 9

51 Creaser and Spence (2005), Fig. 12

52 Welford et al., (2001), Fig. 12

53 Cook et al., (2004)

54 Levson (2001)

55 Levson et al. (2003), surficial geology map

56 McCuaig, (2003), surficial geology map

57 Levson (2002), surficial geology map

58 Dixon-Warren and Hickin (2000). surficial geology map

Table 12 (continued)
1D Earth Resistivity Model for British Columbia - Zone 6 (Interior Platform)

CITED REFERENCES: (continued)

24 Converted from resistivity obtained from listed reference source

25 Converted from conductivity obtained, from listed reference source

26 Spratt and Craven (2008)

27 Spratt and Craven (2010)

28a Spratt and Craven (2011)

28b Spratt and Craven (2011), Figs. 5 and 6

29 Idowu et al., (2014)

30 Levson et al., (1999)

31 Ferri and Riddell (2006), Table 1, p.90

32 Mayberry (2000)

33 Best et al. (1997)

34 Levson and Giles (1997)

35 Andrews et al. (2011), including cross-sections

59 Klassen (1978), surficial geology map

60 Gabrielse (1962), bedrock geology map

61 Gabrielse (1963), bedrock geology map

62 Hartman and Clague (2008)

64 Hickin et al. (2008), Fig. 8

65 Hackbarth (1978)

66 Levson et al. (2012), surficial geology map

67 Trommelen and Levson (2008), Fig. 3

68 Ledo and Jones (2002), Fig. 4

69 Clowes et al., (2010)

70 Cook et al., (2010), Fig. 2

Table 12 (continued)
1D Earth Resistivity Model for British Columbia - Zone 6 (Interior Platform))

CITED REFERENCES: (continued)

[a3]	Oldenborger et al. (2010), p.3
[a5]	Slattery and Andriashek (2012), stratigraphic and resistivity cross-sections
a6	Gowan et al. (2009), Figs. 7, 8
a7	Wright et al. (1994), Fig. 3.2 isopach map
a8	Turkoglu et al. (2007), Figs. 14 and 15
a9	Turkoglu et al. (2009), Figs. 7, 8.
[a20]	Villeneuve et al. (1993)
[a33]	Palacky (1992)
a34	Wu et al. (2005), Fig. 10
a34c	Wu et al. (2005)
a39	Pana (2003)
s2	Fenton et al. (1994), Fig. 26.3-Surface to Bedrock Isopach drift thickness
s4	Gowan et al. (2009), Figs. 7, 8
s5	Oldenborger et al. (2010), p.3
s6	Palacky (1988)
s36	Mwenifumbo et al. (1995a, b)
s40	Natural Resources Canada (2009), Surficial Materials map
s42	Christiansen and Schmid (2014)

Appendix 3

Detailed Description of the Earth Resistivity Models for Manitoba

1. Geological Settings of the Manitoba

Overall, four geological Provinces encompass Manitoba including the Hudson and Interior Platforms comprised of sedimentary rock, and the Superior Province and the Trans-Hudson Orogen[7] (THO) consisting of crystalline rock (Figure 1). A 50 km wide boundary zone occurs along the western and northern margin of the Superior Province.

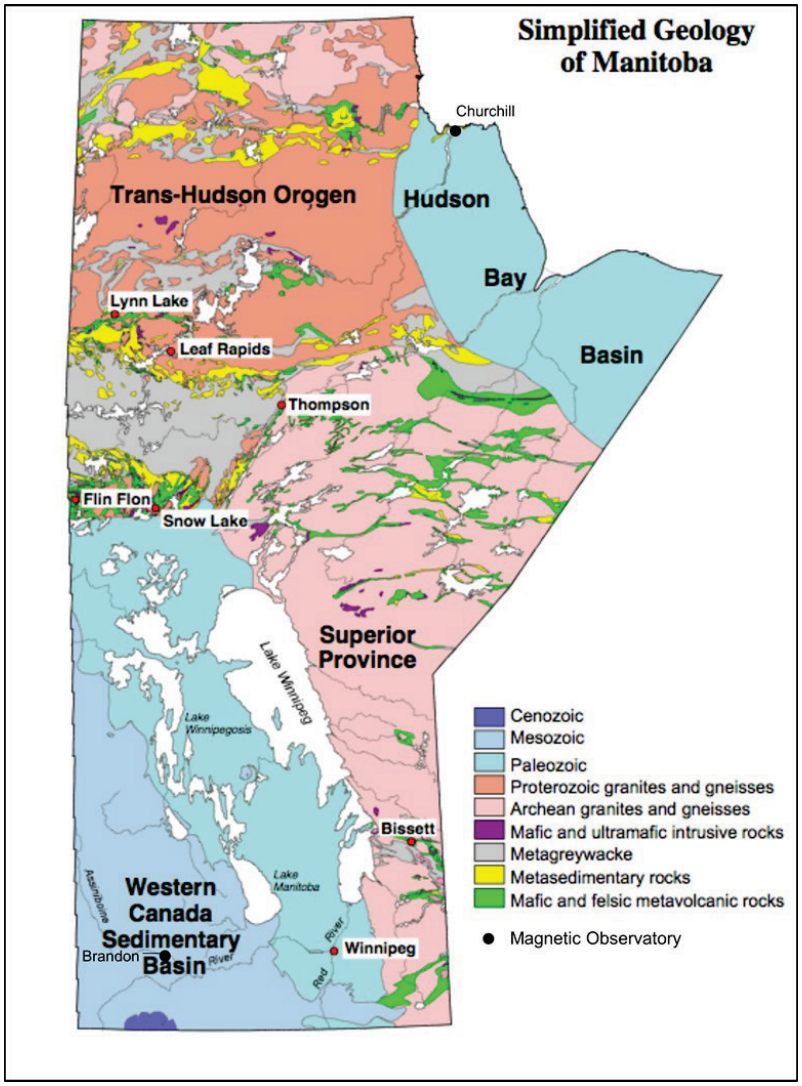


Figure 1. *Major rock types underlying Manitoba and the magnetic observatories at Brandon and Churchill (after MRD, 2012).*

[7] A regionally extensive belt of deformed rock (typically mountainous) resulting from collision of lithospheric plates. Gives rise to subduction and obduction zones and fold and thrust belts. An orogeny adds to expansion of a continent by accretion of terranes to pre-existing continent (Eyles and Miall, 2007, p. 487)

Overburden is variable. Glacial till is predominant west and south of Lake Winnipeg and in the northwest part of Manitoba, with areas of glaciolacustrine deposits of clay and silt, and lesser amount of sand and gravel. A vast area of northeast Manitoba is covered by glaciolacustrine deposits of clay and silt, and glaciomarine deposits of clay, silt, sand and gravel closer into Hudson Bay. Beneath the glaciolacustrine / glaciomarine deposits is till.

Northeastern and southwest-central Manitoba is underlain by gently dipping sedimentary strata (Figure 1). In the northeast is the Hudson Bay Basin (Platform) with a maximum onshore thickness of 884 m and possibly exceeding 1800 m in the basin centre (MRD, 2011). Paleozoic strata are comprised mostly of limestone, dolomitic limestone and dolostone, with argillite and sandstone beds in the upper parts of the succession. These rocks are partially correlative with rocks forming the sedimentary strata in southwestern Manitoba (Manitoba Geol. Survey, 2014).

In the southwest-central part of Manitoba is the edge of the much larger Interior Platform (also referred to as the Western Canada Sedimentary Basin (WCSB)). Strata consist of Paleozoic carbonates (dolostone, dolomitic limestone and limestone) and basal sandstone-shale, all overlain by Mesozoic shales. Thickness of the sedimentary basin increases southwestward from about 100m thick in the Winnipeg area to more than 2000 m at the Manitoba / Saskatchewan boundary.

Exposed and buried beneath the Hudson Bay Basin and WCSB is a collage of various crustal domains of Archean[8] (early Precambrian) and Proterozoic (late Precambrian) age (Figure 2). Much of central and eastern Manitoba is underlain by the Superior geological province, subdivided into 11 major east-west trending lithotectonic belts (also called domains, terranes, or subprovinces) 40-200 km wide. These domains are individually distinguished by a distinctive rock suite, structural configuration, and metamorphic[9] grade (Manitoba Geol. Survey, 2014). Granitic and gneissic rocks are predominate in the Superior with subordinate amount of metavolcanics ("greenstones") and metasediments. Domains are commonly separated by a fault or metamorphic boundary zone, and can be traced beneath the covering Interior Platform sedimentary rock by their geophysical signature and drill core samples.

The Paleoproterozoic[10] Trans-Hudson Orogen has been subdivided into 10 major lithostructural domains (Figure 2), each characterized by a distinctive association of supracrustral[11] and intrusive[12] igneous rocks, metamorphic grade and structural style (Manitoba Geol. Survey, 2014). The THO has been interpreted as a collisional orogenic belt which welded the Archean Superior (in Manitoba and western Ontario), Hearne-Rae (in Saskatchewan and Northwest Territories) and Wyoming (in the USA) geological Provinces. Prior to final collision with the Superior, the THO grew progressively outward by accretion and amalgamation of numerous,

[8] Division of geologic time, 4 – 2.5 billion years ago.
[9] Distinctive assemblage of minerals developed after original rock has been subjected to high pressure and heat condition.
[10] Division of geologic tine, whereby Proterozoic is 2.5 billion to 570 million years ago and the Paleoproterozoic is 2.5 – 1.6 billion years ago.
[11] Sedimentary and/or volcanic rocks deposited on pre-existing basement rock, may be subsequentilly metamorphosed.
[12] Molten rock that has cooled beneath Earth's surface.

small, crustal fragments and magmatic arcs[13]. Over 450 km wide, the THO extends from South Dakota, into Saskatchewan, through western and northwestern Manitoba, across Hudson Bay and into Northern Quebec, Labrador, Baffin Island and Greenland.

The Superior Boundary Zone, between the Superior Province and THO, is characterized by highly deformed gneisses, a gravity high, and a distinct aeromagnetic signature and trend (Manitoba Geol. Survey, 2014). This boundary zone can be traced beneath the overlying WCSB.

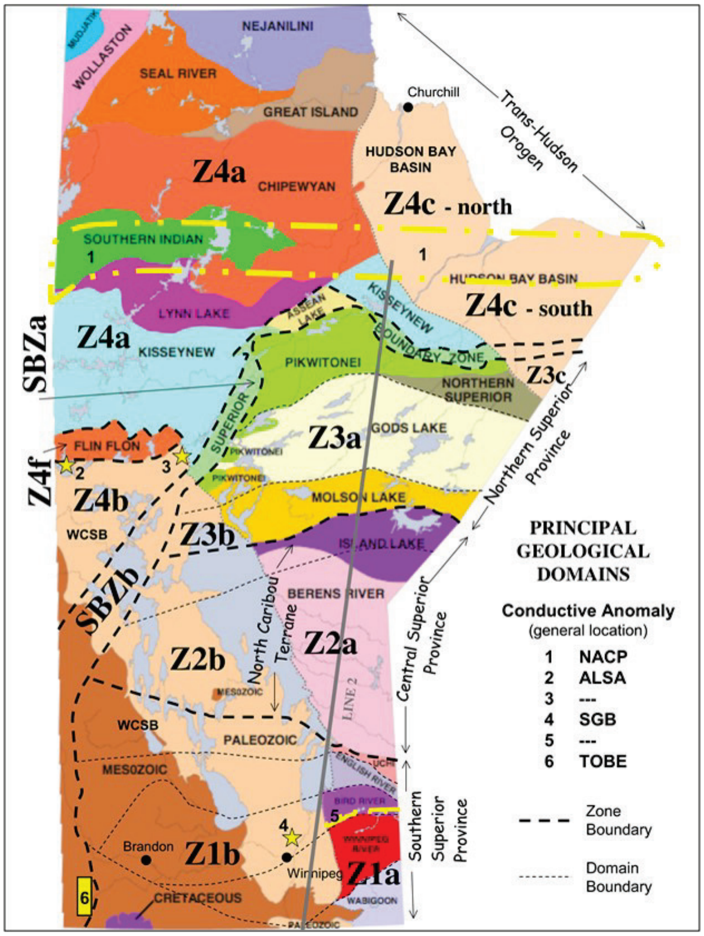


Figure 2. *Principal geological (tectonic) domains underlying Manitoba (modified from Manitoba Geol. Survey, 2014). Trace of interpreted domain boundaries beneath Hudson Bay Basin and Western Canada Sedimentary Basin (WCSB) from Ferguson et al. (2005b, Fig. 1). General location of conductive anomalies (NACP, North American Central Plains; TOBE, Thompson Belt; ALCA, Athapapuskow Lake; SGB, Selkirk Greenstone Belt) is shown. Grey line (labeled Line 2) represents trend of the stitched 1D profile prepared by Ferguson et al. (2005b).*

[13] An arcuate range of volcanoes and intrusive bodies (plutons) parallel to a subduction zone, occurring on ocean or continental tectonic plates.

Conductive Anomalies in Crust and Upper Mantle

From north to south the following conductive anomalies (Figure 2) have been identified (see cited references for details):

1) The continental long North American Central Plains (NACP) conductive anomaly (< 10 ohm.m), over 2500 km long, is situated in the THO (feature 1 on Figure 2). With respect to the Brandon and Fort Churchill magnetic observatories, the approximate trend of the NACP is roughly 275 km west and 100-200 km south, respectively.

   The NACP runs from South Dakota, through Saskatchewan, then swings eastward through northern Manitoba, beneath Hudson Bay and across Baffin Island. In mainland Canada, the NACP appears to consist of two conductive bodies (1-10 ohm.m) centred at 7 km and 15 km depth, possibly 10 km thick each, surrounded by a low resistivity halo (< 80 ohm) (Ferguson et al., 2005b). Garcia and Jones (2005) have remarked that the NACP in northern Saskatchewan is at a depth of 8 km, < 50 km wide and < 2 km thick. Sulphide mineralization that has migrated to fold hinges during compression of host rock is suggested to be the cause of the NACP anomaly. As a result the sulphides are interconnected along the length of the fold but disconnected perpendicular to the fold, causing a high degree of electrical anisotropy such that electrical current preferentially flows along the NACP than across it (Jones et al., 2005).

2) The much smaller Athapapuskow Lake Conductivity Anomaly (ALCA) (feature 2) is situated in the upper crust of the THO in the Flin Flon area, is at least 40 km long, extends 10 km down dip and is > 2 km thick (Ferguson et al., 1999). A possible cause of the anomaly suggested by Ferguson et al. (1999) is the occurrence of graphitic and sulphide mineral bearing bodies within a "layer" of metasediments contained in a large body of gneissic rock.

3) A small mid-crustal conductor (<60 ohm.m) (feature 3) occurs in the THO Kisseynew Domain gneiss belt near the boundary with the Superior province (Jones et al., 2005).

4) Enhanced conductivity (< 5 ohm.m) also occurs in the Selkirk Greenstone Belt (SGB) – within the Bird River Domain in the Superior geological province (feature 4), and partially due to presence of iron formations and sulphide mineralization (Gowan et al., 2009). The SGB conductor is located between Winnipeg and Selkirk (Fig. 2).

5) A regional deep-seated conductive (< 50 ohm.m) anomaly is associated with the southern margin of the Bird River-Separation Lake subprovince (in Manitoba), extending 600 km and ~100 km wide across the western Superior geological province from Winnipeg into Ontario. In Manitoba, this regional anomaly occurs at 60-100 km depth and in western Ontario 40-70 km deep (see Ferguson et al., 2005, Fig. 7). Accretion of micro-continents (subprovinces) in the formation of the larger Superior province may have subjected sediments, abundant in electrically conductive carbon and sulphides, to unique deformation and metamorphic conditions along the collision zone resulting in the regional anomaly.

6) The Thompson Belt (TOBE) anomaly (feature 6 on Figure 2) has been modeled as a relatively narrow (<20 km) conductor (1-5 ohm.m) extending vertically from top of the Precambrian basement to more than tens of kilometres deep, with a length of 50 km (Gowan et al., 2009). The TOBE conductor is located immediately southwest of Brandon.

2. Zonal Earth resistivity models

Presented 14 zones cover (each) one or more lithotectonic terranes previously identified to underlie Manitoba. Because the models are contiguous to each other, a general representation of lateral differences in crustal and mantle resistivity can be illustrated. Six of the models encompass the 60% of Manitoba where the Precambrian Shield crystalline bedrock is exposed at surface, and remaining eight models where the Precambrian is covered by sedimentary rock (i.e. Western Canada Sedimentary Basin, Hudson Bay Basin) deposited during Paleozoic, Mesozoic and Cenozoic eras.

The 1D models are presented in Tables 1 to 13, summarizing the sources for selection of depth and resistivity values and their justification.

<u>Sources of Information</u>

Depths for overburden were typically selected as half of the maximum thickness mentioned on surficial geology maps (Matile and Keller, 2007) prepared by the Manitoba Geological Survey. Thickness of the sedimentary strata was obtained from isopach maps found in *Geological Atlas of the Western Canada Sedimentary Basin* (Fenton et al., 1994) and in Johnson et al. (1992). Because of the wedge-like nature of the sedimentary basin thickening from its margin toward its centre, a midpoint value was assigned for basin thickness. Depths of the upper, middle and lower crust were measured off regional seismic profiles of transects across parts of Manitoba (Green et al., 1980; Hammer et al, 2010; Kanasewich et al., 1987; Nelson et al., 1993; White et al., 2005) and therefore are general values.

Information about resistivity values for overburden specific to Manitoba was found to be limited to relatively recent airborne electromagnetic (EM) survey results (Oldenborger, 2010). The airborne EM results were assessed against resistivity values for similar overburden elsewhere in western and central Canada, and a resulting composite resistivity value was applied to overburden for Manitoba. Resistivity for the WCSB was obtained from descriptions of MT transects.

Assembly of the resistivity values for crust and uppermost mantle relied on the results from magnetotelluric (MT) surveys undertaken as part of the Lithoprobe program in the 1990s and 2000, and a couple of more recent MT surveys. A mantle-scale transect (sounding to > 100 km depth) was done across the THO in part of western Manitoba and continuing into neighbouring north-central Saskatchewan, the results re-interpreted by Jones et al. (2005) provided resistivity values which were then extrapolated (for this report) to much of the THO underlying Manitoba. 2D inversion profiles presented by Ferguson et al. (2005b) and White et al. (2005) provided resistivity values to an approximate 60 km depth for the central part of the THO in Saskatchewan and western Manitoba. As well, interpretation of Lithoprobe data by Garcia and Jones (2005) of a north-south MT transect across the THO in Saskatchewan provided some collaborating resistivity values extrapolated to continuation of the THO into northern Manitoba.

Analysis of MT data by Ferguson et al. (2005a) from a 2000 Lithoprobe transect across the Superior geological province in western Ontario and eastern Manitoba provided a stitched 1D profile from which resistivity values to upper mantle depth were extracted for the 1D models presented in this report. Figure 2 shows the location and orientation of this profile. A MT transect across the southern margin of Manitoba undertaken by Gowan et al. (2009) revealed the 2D electrical structure to a depth of 60 km. Recently, Roberts and Craven (2012) completed an audio-MT (higher frequency) survey to investigate the shallow structure of the Hudson Bay Basin sedimentary strata and Precambrian basement to a depth of 7 km. Analysis of additional data in the Churchill area from the Roberts and Craven survey was undertaken by Bancroft et al. (2014), to evaluate potential petroleum source/ reservoir lithology in the Hudson Bay Platform sedimentary rock.

Resistivities were assigned to a particular layer in a Zone by visual examination of MT inversion profiles prepared by others, and selecting the average or the dominant resistivity depicted. In locations where a distinctive area of lower resistivity is present, a weighted average based on proportional representation was used, giving a "blended" resistivity value for the entire Zone's layer. For known electrically conductive anomalies (e.g. TOBE anomaly) in the crust that exerts a halo-like influence of lower resistivities, a representative value of crust resistivity was chosen away from the anomaly. The exception was for Zone 4c-south part where much lower crustal resistivity was measured in the THO, compared to higher resistivity elsewhere in the THO. The area of lower resistivity lies within the assumed approximate trend of the NACP anomaly.

Depths and resistivity for the middle and lower divisions of the upper mantle, transition zones, and lower mantle – Layers 7 to 12 – between 100 and 1000 km were based on the Canada regional conductivities determined by Kelbert et al. (2009).

3. References

Aiken, J.D., 1993. "Proterozoic sedimentary rocks," Subchapter 4A in Sedimentary Cover of the Craton in Canada, ed. Stott, D.F. and Aitken, J.D., *Geological Survey of Canada*, Geology of Canada, no.5, 81-95 (*Geological Society of America*, The Geology of North America, v.D-1)

Bancroft, B., Craven, J.A., Enkin, R.J., Nicolas, M.P.B., and Roberts, B., 2014. "Results from a Magnetotelluric and Rock Property Study near Churchill, Manitoba," *Geological Survey of Canada*, Open File 7549, 21 p. doi:10.4095/293454

Betcher, R., Grove, G. and Pupp, C., 1995. "Groundwater in Manitoba: hydrogeology, quality concerns, management," *Environment Canada*, National Hydrology Research Institute, NHRI contribution No. CS-9017, March 1995, 53 p

Bezys, R.K. and Conley, G.G., 1998. "The Precambrian in Manitoba," *Manitoba Energy and Mines*, Stratigraphic Map Series, OPC-1, 1:2000000.

Craven, J.A., Boerner, R.D., Skulski, D.E., Spratt, J., Ferguson, I. J., Wu, X., and Bailey, R.C., 2001. Conductivity of western Superior Province upper mantle in northwestern Ontario, *Geological Survey of Canada*, Current Research 2001-E6, 6p

Fenton, M.M., Schreiner, B.T., Nielsen, E., and Pawlowicz, J.G., 1994. "Chapter 26 – Quaternary geology of the Western Plains," in *Geological Atlas of the Western Canada Sedimentary Basin*, G.D. Mossop and I. Shetsen (comp.), Canadian Society of Petroleum Geologists and Alberta Research Council, http://www.ags.gov.ab.ca/publications/wcsb_atlas/atlas.html

Ferguson, I. J., Craven, J. A., Kurtz, R. D., Boerner, D. E., Baily, R. C., Wu, X., Orellana, M. R., Spratt, J., Wennberg, G., and Norton, M., 2005a. "Geoelectric response of Archean lithosphere in the Western Superior Province, Central Canada," *Physics of the Earth and Planetary Interiors*, v. 150, nos. 1-3, 123-143. < http://dx.doi.org/10.1016/j.pepi.2004.08.025>.

Ferguson, I. J., Stevens, K.M., and Jones, A.G., 2005b. "Electrical-resistivity imaging of the central Trans-Hudson orogen," *Canadian Journal of Earth Sciences*, v. 42, 495-515. <http://dx.doi.org/ 10.1139/E05-017>

Galley, A.G., Bailes, A.H., Syme, E.C., Bleekwe, W., Macek, J.J. and Gordin, T.M. 1991. "Geology and Mineral Deposits of the Flin Flon and Thompson Belts, Manitoba [Field Trip 10], Geological Survey of Canada, Open File 2165, 136 p. doi:10.4095/132363.

Garcia, X. and Jones, A.G., 2005. "Electrical-resistivity imaging of the central Trans-Hudson orogen," *Canadian Journal of Earth Sciences*, v. 42, 495-515.

Gowan, E. J., Ferguson, I. J., Jones, A. G., and Craven, J. A., 2009. "Geoelectric structure of the Northeastern Williston basin and underlying Precambrian lithosphere," *Canadian Journal of Earth Science*, 46, no. 6, 46, 441-464. <http://dx.doi.org/10.1139/E09-028>.

Green, A.G., Stephenson, O.G., Mann, G.D., Kanasewich, E.R., Cumming, G.L., Hajnal, Z., Mair, J.A., and West, G.F., 1980. "Cooperative seismic surveys across the Superior-Churchill boundary zone in southern Canada," *Canadian Journal of Earth Sciences*, 17, 617-632

Hammer, P.T.C., Clowes, R.M., Cook, F.A., van der Velden, A.J. and Vasudevan, K., 2010. "The Lithoprobe trans-continental lithospheric cross sections; imaging the internal structure of the North American continent," *Canadian Journal of Earth Sciences*, v.47, 821-857. <doi:10.1139/E10-036>

Johnson, M.D., Armstrong, D.K., Sanford, B.V., Telford, P.G. and Ritka, M.A., 1992. "Paleozoic and Mesozoic Geology of Ontario," *Ontario Geological Survey*, Special Volume 4, Part 2, 07-1010. http://www.geologyontario.mndmf.gov.on.ca/mndmfiles/pub/data/imaging/sv04-02/sv04-02.pdf

Jones, A.G., Ledo, J., Ferguson, I.J., Craven, J.A., Unsworth, M.J., Chouteau, M. and Spratt, J., 2014. “The electrical resistivity of Canada’s lithosphere and correlation with other parameters: contributions from Lithoprobe and other programmes,” *Canadian Journal of Earth Sciences*, v.51, 573-617, dx.doi.org/10.1139/cjes-2013-0151

Jones, A.G., Ledo, J. and Ferguson, I.J., 2005. “Electromagnetic images of the Trans-Hudson orogen: the North American Central Plains anomaly revealed,” *Canadian Journal of Earth Sciences*, v.42, 457-478. http://dx.doi.org/ 10.1139/E05-018

Kanasewich, E.R., Hajnal, Z., Green, A.G., Cumming, G.L., Mereu, R.F., Clowes, R.M., Morel-A-L’Huissier, P., Chiu, S., Macrides, C.G., Shahriar, M., and Congram, A.M., 1987. “Seismic studies of the crust under the Williston Basin,” *Canadian Journal of Earth Sciences*, 24, 2160-21, 71.

Manitoba Geological Survey, 2014. “Manitoba’ Mineral Resources, Manitoba Geology,” www.manitoba.ca/iem/mrd/geo/exp-sup/mbgeology.html

Manitoba Geological Survey, 2010. “Large Cross Section Map of Manitoba,” *Manitoba Innovation, Energy and Mines*, Mineral Resources Division, Geological Survey. <http://www.manitoba.ca/iem/mrd/geo/3dmodel/images/cross_section_large.gif>

Matile, G.L.D. and Keller, G.R., 2007. “Surficial geology of Manitoba,” *Manitoba Science, Technology, Energy and Mines*, Manitoba Geological Survey, Surficial Geology compilation Map Series, SG-MB, scale 1:1000000. <http://www.manitoba.ca/iem/mrd/geo/gis/sgcms/pdfs/sg-mb_front.zip>.

MRD, 2008. “Surficial geology map of Manitoba,” Manitoba Industry Trade and Mines, Mineral Resources Division, *Manitoba Geological Survey* <http://www.manitoba.ca/iem/mrd/geo/3dmodel/images/00-quaternary-large.gif>

Musacchio, G., White, D.J., Asudeh, I., and Thomson, C.J., 2004. Lithospheric structure and composition of the Archean western Superior Province from seismic refraction/wide angle reflection and gravity modeling, *Journal of Geophysical Research*, 109, B03304, 28 p. http://dx.doi.org/10.1029/2003JB002427

Nelson, K. D., Baird, D. J., Walters, J. J., Hauck, M., Brown, L. D., Oliver, J. E., Ahern, J. L., Hajnal, Z., Jones, A. G., and Sloss, L. L., 1993. “Trans-Hudson orogen and Williston basin in Montana and North Dakota: New COCORP deep-profiling results,” *Geology*, 21, no. 5, May 1993, 447-450. <http://dx.doi.org/10.1130/0091-7613(1993)021<0447:THOAWB>2.3.CO;2>.

Nicolas, M.P.B., Matile, G.L.D., Keller, G.R. and Bamburak, J.D., 2010. “Phanerozoic geology of southern Manitoba,” *Manitoba Innovation, Energy and Mines*, Manitoba Geological Survey, Stratigraphic Map SM2010-1, 2 sheets, scale 1:600000.

Oldenborger, G A; Pugin, A J -M; Hinton, M J; Pullen, S E; Russell, H A J; Sharpe, D R., 2010. “Airborne time-domain electromagnetic data for mapping and characterization of the Spiritwood Valley aquifer, Manitoba, Canada,” *Geological Survey of Canada*, Current Research (Online) no. 2010-11, 2010; 16 pages, doi:10.4095/286056

Palacky, G.J., 1988. “Resistivity characteristics of geologic targets” in *Electromagnetic Methods in Applied Geophysics-Theory*, Vol.1, M.N. Nabighian (ed.); Society of Exploration Geophysicists, 53-130.

Palacky, G.J., 1992. Helicopter geophysical surveys at the Val Gagne test site, District of Cochrane, Ontario, *Geological Survey of Canada*, Open File Report 2503, 14 p. <ftp://ftp2.cits.rncan.gc.ca/pub/geott/ess_pubs/133/133370/of_2503.pdf>.

Roberts, B. and Craven, J., 2012. Results of a Magnetotelluric Survey in Churchill, Manitoba: GEM Energy, Hudson Bay; *Geological Survey of Canada*, Open File 7151, 21 p. http://dx.doi.org/10.4095/291442

White, D.J., Thomas, M.D., Jones, A.G., Hope, J. Nemeth, B. and Hajnal, Z., 2005. Geophysical transect across a Paleoproterozoic continent-continent collision zoneL The Trans-Hudson Orogen, *Canadian Journal of Earth Sciences*, v. 42, 385-402. http://dx.doi.org/ 10.1139/E05-002

Wright, G.N., NcNechan, M.E. and Potter, D.E.G., 1994. “Chapter 3 – Structure and architecture of the Western Canada Sedimentary Basin,” in *Geological Atlas of the Western Canada Sedimentary Basin*, G.D. Mossop and I. Shetsen (comp.), Canadian Society of Petroleum Geologists and Alberta Research Council, http://www.ags.gov.ab.ca/publications/wcsb_atlas/atlas.html

Table 1
1D Earth Resistivity Model for Manitoba Zone 1a

Layer	Depth Confidence	Thickness	Resistivity (ohm-m) Confidence	Conductivity (S/m) Confidence	Comments
1. Overburden	0 – 50 m [1, 2] [I]	50 m	30 [4] [II]	0.03333 [24]	Variable depths, < 45m [1], thickest in Sandilands area, <100m at western margin of Zone. Assign 50m, midpoint of range. NE1/4 of Zone is exposed bedrock, patchy till veneer. Remaining western 3/4 of Zone underlain by sandy till, overlain in areas by glaciofluvial (sand, gravel) and glaciolacustrine (sand) deposits, central portion (overall 50% of Zone) covered by < 1-5m thick blanket of organic (peat, muck) deposits [3]. Sand plain at Sandilands. Borehole logs of Manitoba overburden show 40-50 ohm.m for till and 70-200 ohm.m for sand and gravel [5]. Resistivities for tills range 20-100 ohm.m [6]. MT survey in SE Manitoba indicates 5-30 ohm for mix of till, clay, silt and sand [4]. Glaciolacustrine clays average 30 ohm.m in NE Ontario [7]. Assign 30 ohm.m, high-end of range for mix of overburden deposits in SW Manitoba. Limits 5, 200 ohm.m.
2. Sedimentary Basin	absent	---	---	---	----
3. Upper Crust	0 - 12 km [8, 9]	12 km	5500 [4]	0.000181 [24]	*Zone includes Wabigoon, Winnipeg River, Bird River, English River and Uchi Domains, within the Superior geological*

	[II]		[I]		*province, Archean age.* Bedrock is predominately gneisses and granitoids, with lesser amount of metavolcanics and metagreywacke (metasediment). Depths scaled from regional seismic transects crossing SE Manitoba and northwestern Ontario; approx. average 12 km beneath Brandon [8], and 12 km at MB/ON boundary [9]. Assigned depths rounded to nearest whole number. Assigned 12 km averaged depth. Limited MT coverage for Layer 3. MT profile shows predominately 10000 ohm.m over granitoid WR Domain [4] that occupies 25% of Zone. Assign approx. 5500 ohm.m, midpoint value of range to account for other domains that likely exhibit lower resistivity. Limits 800, 10000 ohm.m.

Table 1 (continued)
1D Earth Resistivity Model for Manitoba Zone 1a

Layer	Depth Confidence	Thickness	Resistivity (ohm-m) Confidence	Conductivity (S/m) Confidence	Comments
4. Middle Crust	12 - 31 km [8, 9] [II]	19 km	350 [10, 4] [I]	0.0002857 [24]	Depths scaled from regional seismic transect; average 35.4 km beneath Brandon [8], and 31.4 km at Mb/ON boundary [9]. Assigned 31 km, averaged depth. MT profiles show: * 200-500 ohm.m range in MB, 100-200 ohm.m in NW Ontario [10] * predominantly >100 ohm.m in SE Manitoba [4]. Assign 350 ohm.m midpoint of range 200-500 ohm. Limits 100, 500 ohm.m.
5. Lower Crust	31 - 39 km [8, 9, 11] [I, II]	8 km	500 [10, 4] [I]	0.002 [24]	Depths scaled from regional seismic transect; average 44.2 km beneath Brandon [8], and 33.8 km at MB/ON boundary [9]. Overall 40 km, with 30 and 34 km east of Pine Lake / Lac du Bonnet and at part of MB/ON boundary [11]. Assigned 39 km averaged depth MT profiles show: * predominately 500 ohm.m in MB, 100-500 ohm.m in NW Ontario [10] * predominantly >100 ohm.m in SE Manitoba [4] Assign 500 ohm.m, reflecting predominance determined by [10]. Lower limit 100 ohm.m.
6. Upper Mantle	39 - 100 km [23] [III]	61 km	300 [10] [I]	0.003333 [24]	Used generalized lower depth [23]. MT profiles show: * range 50-1000 ohm.m, 50 ohm.m core at 60-100 km depth, surrounded by 100-500 ohm.m (midpoint 300 ohm.m) and 1000 ohm.m at edges of Zone [10] * >100 ohm.m overall at 39-60 km depth [4] Assign 300 ohm.m weighted average based on areal extent of dominant / midpoint resistivity values ((50 x 0.25)+(300 x 0.65)+(1000 x 0.10)). Limits 50, 500 ohm.m.

Table 1 (continued)
1D Earth Resistivity Model for Manitoba Zone 1a

Layer	Depth / Confidence	Thickness	Resistivity (ohm-m) / Confidence	Conductivity (S/m) / Confidence	Comments
7. Upper Mantle	100 - 250 km [23] [III]	150 km	158 [25]	0.006309 [23] [III]	Utilized Canada regional model [23], based on Ottawa magnetic observatory data for all depths and resistivities below 100 km
8. Upper Mantle	250–410 km [23] [III]	160 km	29 [25]	0.034673 [23] [III]	Assign Canada regional model
9. Transition Zone	410–520 km [23] [III]	110 km	8 [25]	0.125892 [23] [III]	Assign Canada regional model
10. Transition Zone	520–670 km [23] [III]	150 km	2.4 [25]	0.416869 [23] [III]	Assign Canada regional model
11. Lower Mantle	670–900 km [23] [III]	230 km	1.12 [25]	0.891250 [23] [III]	Assign Canada regional model
12. Lower Mantle	900–1000 km [23] [III]	100 km	0.48 [25]	2.089296 [23] [III]	Assign Canada regional model

See end of Table 13 for abbreviations and notes

Table 2

1D Earth Resistivity Model for Manitoba Zone 1b

Layer	Depth Confidence	Thickness	Resistivity (ohm-m) Confidence	Conductivity (S/m) Confidence	Comments
1. Overburden	0 – 70 m [1, 2] [I]	70 m	30 [4] [I]	0.03333 [24]	Variable depths, thickest between Portage and Brandon area of Assiniboine Delta [1]; overall < 50m; increasing to <100m in pre-glacial valleys and <150-220m around pre-glacial bedrock highs (e.g. Duck Mountain) [2]; 15-30m below Winnipeg [1]; 70-100m below Brandon [1]; MT survey indicates <100m [4]. Assigned 70m average based on [1]. Clay-rich till (10-110m) overlain by glaciolacustrine clay (10-60m) overlain by glaciofluvial sand (10-30m). Sand plain common east of Brandon and at Sandilands [12, 1]. Till is prevalent. Borehole logs of Manitoba overburden show 40-50 ohm.m for till and 70-200 ohm.m for sand and gravel [5]. Resistivities for tills range 20-100 ohm.m [6]. MT survey in SE Manitoba indicates 5-30 ohm for mix of till, clay, silt and sand [4]. Glaciolacustrine clays average 30 ohm.m in northeastern Ontario [7]. Assigned 30 ohm.m, high-end of range for mixed types of overburden. Limits 5, 200 ohm.m.
2. Sedimentary Basin	0 – 1.3 km [14, 1, 15]	1.3 km	25 [4]	0.04 [24]	Eastern side of Williston Basin (within the WCSB) underlies southwest Manitoba. Paleozoic carbonates (with minor

	[I]		[I]		interlayers of shale and evaporites) and a thin basal sandstone-shale; all overlain by Mesozoic shales Depth from stratigraphic sections. Southwestward increasing thickness; ~ 110m below Winnipeg, ~1105m at Brandon, ~2020m at Manitoba / Saskatchewan boundary. Regional Phanerozoic isopach maps show 2600 m thickness at SW corner of MB. Assigned 1.3 km, midpoint to maximum depth. Basin exhibits 3 resistivity ranges: 1-5 ohm.m Mesozoic and upper Paleozoic strata (shale dominant); 20-50 ohm.m lower Paleozoic carbonates; 2-3 ohm.m basal sandstone containing shale and saline porewater [4]. Assigned midpoint 25 ohm.m, prevalent on 2D resistivity profile by [4]. Limits 5, 100 ohm.m. Northern extent of WCSB – Paleozoic strata only – in adjacent SK exhibits 10-100 ohm.m range [16].

Table 2 (continued)
1D Earth Resistivity Model for Manitoba Zone 1b

Layer	Depth / Confidence	Thickness	Resistivity (ohm-m) / Confidence	Conductivity (S/m) / Confidence	Comments
3. Upper Crust	1.3 - 10 km [8, 17] / [I]	8.7 km	3000 [4] / [I]	0.000333 [24]	*Zone includes Wabigoon, Winnipeg River, Bird River, English River and Uchi Domains, within the Superior geological province, Archean age.* Bedrock is predominately gneisses and granitoids, with lesser amount of metavolcanics and metagreywacke (metasediment). Depths scaled from seismic transects crossing SW Manitoba; approx. average 10 km beneath Brandon [8, 17]. Assigned 10 km averaged depth MT profiles [4] show in a: * E-W direction, 100-10000 ohm.m range, with 5000-10000 ohm.m (7500 midpoint) occupying 50%, 800-5000 (2900 midpoint) ohm.m occupying 50%. Weighted average is 5200 ohm.m * N-S direction, 100-2500 ohm.m range, with 800-2500 ohm.m (1300 midpoint) occupying 40%, 100-800 (450 midpoint) ohm.m occupying 60%. Weighted average is approx. 800 ohm.m Assign approx. 3000 ohm.m, average of weighted values. Excludes influence of < 10 ohm.m TOBE anomaly. Limits 100, 10000 ohm.m.
4. Middle Crust	10 - 29 km [8, 17] / [I]	19 km	1450 [4] / [I]	0.000689 [24]	Depths scaled from seismic transects crossing Brandon and Dauphin [8, 17] Assigned 29 km averaged depth. MT profiles [4] show in a: * E-W direction, 100-2500 ohm.m range, with 800-2500 ohm.m (1650 midpoint) occupying 34%, 100-800 (450 midpoint) ohm.m occupying 66%. Weighted average is aprox. 860 ohm.m. * N-S direction, 100-6500 ohm.m range, with 800-6500 ohm.m (3650 midpoint) occupying 50%, 100-800 (450 midpoint) ohm.m occupying 50%. Weighted average is 2050 ohm.m. Assign approx. 1450 ohm.m, average of weighted values. Limits 100, 6500 ohm.m.

Table 2 (continued)
1D Earth Resistivity Model for Manitoba Zone 1b

Layer	Depth / Confidence	Thickness	Resistivity (ohm-m) / Confidence	Conductivity (S/m) / Confidence	Comments
5. Lower Crust	29 - 43 km [8, 17, 11] [I, II]	14 km	1500 [4] [I]	0.000666 [24]	Depths scaled from seismic transects crossing Brandon and Dauphin [8, 17] and Williston Basin [11]. Assign 43 km averaged depth. MT profiles [c] show in a: * E-W direction, 100-6500 ohm.m range, with 800-6500 ohm.m (3650 midpoint) occupying 16%, 100-800 (450 midpoint) ohm.m occupying 84%. Weighted average is aprox. 960 ohm.m * N-S direction, 100-6500 ohm.m range, with 800-6500 ohm.m (3650 midpoint) occupying 50%, 100-800 (450 midpoint) ohm.m occupying 50%. Weighted average is 1825 ohm.m * lower resistivity beneath Winnipeg, higher below Brandon Assign approx. 1500 ohm.m, average of weighted values. Limits 100, 6500 ohm.m.
6. Upper Mantle	43 - 100 km [23] [III]	57 km	2300 [4] [I]	0.000434 [24]	Used generalized lower depth [23]. Resistivity depicted on [4] extends only to depth of 60 km. Assume same resistivity for entire layer thickness. MT profiles [4] show in a: * E-W direction, 100-8000 ohm.m range, predominantly 8000 ohm.m occupying 34%, 100-800 (450 midpoint) ohm.m occupying 66%. Weighted average is 3000 ohm.m * N-S direction, 100-5000 ohm.m range, with 800-5000 ohm.m (2900 midpoint) occupying 50%, 100-800 (450 midpoint) ohm.m occupying 50%. Weighted average is 1675 ohm.m * lower resistivity beneath Winnipeg, higher below Brandon Assign approx. 2300 ohm.m, average of weighted values. Limits 100, 8000 ohm.m
7. Upper Mantle	100 - 250 km [23]	150 km	158 [25]	0.006309 [23]	Utilized Canada regional model [23], based on Ottawa magnetic observatory data for all depths and resistivities below 100 km

Table 2 (continued)
1D Earth Resistivity Model for Manitoba Zone 1b

Layer	Depth	Thickness	Resistivity (ohm-m)	Conductivity (S/m)	Comments
	Confidence		Confidence	Confidence	
8. Upper Mantle	250–410 km [23]	160 km	29 [25]	0.034673 [23]	Assign Canada regional model
	[III]			[III]	
9. Transition Zone	410–520 km [23]	110 km	8 [25]	0.125892 [23]	Assign Canada regional model
	[III]			[III]	
10. Transition Zone	520–670 km [23]	150 km	2.4 [25]	0.416869 [23]	Assign Canada regional model
	[III]			[III]	
11. Lower Mantle	670–900 km [23]	230 km	1.12 [25]	0.891250 [23]	Assign Canada regional model
	[III]			[III]	
12. Lower Mantle	900–1000 km [23]	100 km	0.48 [25]	2.089296 [23]	Assign Canada regional model
	[III]			[III]	

See end of Table 13 for abbreviations and notes

Table 3
1D Earth Resistivity Model for Manitoba Zone 2a

Layer	Depth / Confidence	Thickness	Resistivity (ohm-m) / Confidence	Conductivity (S/m) / Confidence	Comments
1. Overburden	0 – 10 m [12, 3] [II]	10 m	30 [4] [II]	0.033333 [24]	Eastern half of Zone has patchy sandy till veneer over Precambrian bedrock. Western half (east of Lake Winnipeg) has mix of organic (muck; <1-5 m) deposits and offshore glaciolacustrine (clay, silt, minor sand; 1-20 m) deposits [12, 3]. Assign 10 m, midpoint of range. Borehole logs of Manitoba overburden show 40-50 ohm.m for till [5]. Resistivities for tills range 20-100 ohm.m [6]. MT survey in SE Manitoba indicates 5-30 ohm for mix of till, clay, silt and sand [4]. Glaciolacustrine clays average 30 ohm.m in NE Ontario [7]. Assign 30 ohm.m, high-end of range for mixed deposits measured in SW Manitoba. Limits 5, 100 ohm.m.
2. Sedimentary Basin	absent	---	---	---	----
3. Upper Crust	0 - 13 km [9] [II]	13 km	13500 [10] [I }	0.000074 [24]	*Zone includes the Northern Caribou Superterrane, comprises the Berens River Domain and Island Lake Domain; within the Archean Superior geological province* Bedrock is predominately gneisses and granitoids, with minor metavolcanics. Depth scaled from regional seismic profile [9] located in NW Ontario, up to ~ 18km deep . [13] notes crust 13 km deep. Noticeable resistivity change at 13 km. Assign average depth. Partial MT coverage for Layer 3. MT profile [10] shows 5000-20000 ohm.m range. Assign 13500 ohm.m, midpoint value of range. Limits 5000, 20000 ohm.m. Note: At site red-200 in NW Ontario within NCS, resistivity change at approx. 14 km depth [10]. MT sounding at red-200 shows 100000 ohm.m midpoint value.

Table 3 (continued)
1D Earth Resistivity Model for Manitoba Zone 2a

Layer	Depth Confidence	Thickness	Resistivity (ohm-m) Confidence	Conductivity (S/m) Confidence	Comments
4. Middle Crust	13 - 30 km [9] [II]	13 km	35500 [10] [I]	0.0000281 [24]	Depth scaled from regional seismic profile [9] located in NW Ontario. Assign average depth. Partial MT coverage for Layer 4. MT profile [10] shows: * 50000 ohm.m core occupies 60% of layer * 5000-20000 ohm.m range occupies 40%. Assign approx. 35500 ohm.m weighted average based on areal extent of dominant / midpoint resistivity values ((50000 x 0.6)+(13500 x 0.4)). Limits 5000, 50000 ohm.m. Note: At site red-200 in NW Ontario within NCS, resistivity change at approx. 28 km depth [10]. MT sounding at red-200 shows 21000 ohm.m midpoint value.
5. Lower Crust	30 - 40 km [9, 11] [II]	10 km	28000 [10] [I]	0.0000357 [24]	Depth scaled from regional seismic profile [9], ranges 34-45 km. Overall 40 km maximum depth to Moho [11]. Assign 40 km average depth. 50000 resistive core tapers down into lower crust (and mantle), surrounded by halo of decreasing resistivity 20000 to 5000 ohm.m. MT profile [10] shows: * 50000 ohm.m core occupies 40% of layer * halo 5000-20000 ohm.m range occupies 60%. Assign 28000 ohm.m weighted average based on areal extent of dominant / midpoint resistivity values ((50000 x 0.4)+(13500 x 0.6)). Limits 5000, 50000 ohm.m. Note: At site red-200 in NW Ontario within NCS, resistivity change at approx. 45 km depth [10]. MT sounding at red-200 shows 10000 ohm.m midpoint value.

Table 3 (continued)
1D Earth Resistivity Model for Manitoba Zone 2a

Layer	Depth / Confidence	Thickness	Resistivity (ohm-m) / Confidence	Conductivity (S/m) / Confidence	Comments
6. Upper Mantle	40 - 100 km [23] / [III]	60 km	17000 [10] / [I]	0.0000588 [24]	Used generalized lower depth [23]. 50000 ohm.m resistive core continues to taper down in size, ending at approx. 80 km depth. in upper mantle, surrounded by 2000-20000 ohm.m. MT profile [10] shows: * 50000 ohm.m core occupies 15% of layer * range 2000-20000 ohm.m occupies remaining 85% Assign 17000 ohm.m weighted average based on areal extent of dominant / midpoint resistivity values ((50000 x 0.15)+(11000 x 0.85)). Limits 2000, 50000 ohm.m. Note: At site red-200 in NW Ontario within NCS, resistivity change at approx. 100 km depth [10]. MT sounding at red-200 shows 850 ohm.m midpoint value. 50000 ohm.m core terminates at bottom of lower crust.
7. Upper Mantle	100 - 250 km [23] / [III]	150 km	158 [25]	0.006309 [23] / [III]	Utilized Canada regional model [23], based on Ottawa magnetic observatory data for all depths and resistivities below 100 km. Note: MT sounding at red-200 [10] shows 200 ohm.m midpoint value. Upper limit 200 ohm.m.
8. Upper Mantle	250–410 km [23] / [III]	160 km	29 [25]	0.034673 [23] / [III]	Assign Canada regional model Note: MT sounding at centre of NCS in NW Ontario (site red-200) shows 55 ohm.m midpoint value for depth 250-1000km [10].
9. Transition Zone	410–520 km [23] / [III]	110 km	8 [25]	0.125892 [23] / [III]	Assign Canada regional model

Table 3 (continued)
1D Earth Resistivity Model for Manitoba Zone 2a

Layer	Depth / Confidence	Thickness	Resistivity (ohm-m) / Confidence	Conductivity (S/m) / Confidence	Comments
10. Transition Zone	520–670 km [23]	150 km	2.4 [25]	0.416869 [23]	Assign Canada regional model
	[III]			[III]	
11. Lower Mantle	670–900 km [23]	230 km	1.12 [25]	0.891250 [23]	Assign Canada regional model
	[III]			[III]	
12. Lower Mantle	900–1000 km [23]	100 km	0.48 [25]	2.089296 [23]	Assign Canada regional model
	[III]			[III]	

See end of Table 13 for abbreviations and notes

Table 4
1D Earth Resistivity Model for Manitoba Zone 2b

Layer	Depth Confidence	Thickness	Resistivity (ohm-m) Confidence	Conductivity (S/m) Confidence	Comments
1. Overburden	0 – 10 m [18] [II]	10 m	50 [5] [II]	0.02 [24] [m]	Mainly silty till overlain by lesser amount of glaciolacustrine deposits near west shoreline of Lake Winnipeg [12]. Overburden typically <10m in northern and western areas of Manitoba Lowland [18]. Regional overburden isopach map shows <50m thickness [2]. Assign 10 m on basis on typical thin overburden known to be present. Borehole logs of Manitoba overburden show 40-50 ohm.m for till and 70-200 ohm.m for sand and gravel [5]. Resistivities for tills range 20-100 ohm.m [6]. MT survey in SE Manitoba indicates 5-30 ohm for mix of till, clay, silt and sand [4]. Glaciolacustrine clays average 30 ohm.m in northeastern Ontario [7]. Assign 50 ohm.m, on basis of till being dominant. Limits 5, 100 ohm.m.
2. Sedimentary Basin	0 – 0.4 km [21] [II]	0.4 km	40 [4, 16] [II]	0.025 [24]	*WCSB*: Paleozoic carbonate (dolostone, dolomitic limestone, limestone), some shale beds, and a thin basal sandstone-shale [15, 18]. Limited exposure of Mesozoic strata (dominantly shales with lesser amounts of silt/sandstones, carbonates and evaporates) overlies Paleozoic in western margin of Zone 2b [15, 18]. Depth deepens southwesterly to 800m. Assign midpoint value. Northern extent of WCSB – Paleozoic strata only – in MB exhibits 10-100 ohm.m range (midpoint 50 ohm.m) [16]. Resistivity of lower Paleozoic carbonate strata in SW MB ranges 20-50 ohm.m (midpoint 35 ohm.m), with Mesozoic and upper strata exhibiting 1-5 ohm.m [4]. Assign approx. 40 ohm.m, average of midpoint values. Limits 10, 100 ohm.m.

3 to 12.	Lithotectonic terranes / domains exposed in Zone 2a continue into Zone 2b beneath the covering WCSB (Layer 2) Depth of Layer 3 is 0.4-13km, resistivity is same as in Zone 2a – refer to Table 3 Depths and resistivity values for Layers 4 to 12 are same as in Zone 2a – refer to Table 3

See end of Table 13 for abbreviations and notes

Table 5
1D Earth Resistivity Model for Manitoba Zone 3a

Layer	Depth Confidence	Thickness	Resistivity (ohm-m) Confidence	Conductivity (S/m) Confidence	Comments
1. Overburden	0 – 10 m [18] [II]	10 m	30 [7] [II]	0.033333 [24]	2/3 of Zone covered by glaciolacustrine (clay, silt, minor sand; 1-20 m) deposits overlying sandy till, 1/3 of Zone has large areas of exposed sandy till (e.g. Gods Lake), patchy areas of organic deposits (muck; <1-5m). Variable thickness [18]. Estimate <10m overburden. Borehole logs of Manitoba overburden show 40-50 ohm.m for till [5]. Resistivities for tills range 20-100 ohm.m [6]. MT survey in SE Manitoba indicates 5-30 ohm for mix of till, clay, silt and sand [4]. Glaciolacustrine clays average 30 ohm.m in northeastern Ontario [7]. Assign 30 ohm.m, to reflect dominance of glaciolacustrine clays and silt. Limits 5, 50 ohm.m.
2. Sedimentary Basin	absent	---	---	---	----
3. Upper Crust	0 - 13 km [10] [I]	13 km	10000 [10] [I]	0.0001 [24]	*Zone (also referred to Northern Superior Province for this report) includes the Munro Lake Terrane (Molson Domain), Oxford Lake-Stull Lake Terrane (Gods Lake Domain) and Northern Superior Superterrance (Northern Superior and part of Pikwitonei Domains); within the Archean Superior geological province.* Bedrock is predominately gneisses and granitoids, with metavolcanics (greenstone belts) and metasediments. Depths scaled from regional seismic profile across north-central Saskatchewan and Manitoba, 14 km [20], and in NW Ontario up to ~ 18km deep [9]. [r13] notes crust 13 km deep. Assign shallower depth based on noticeable resistivity change at 13 km [10]. MT profile [10] shows dominantly 10000 ohm. Limits 5000, 20000 ohm.m in adjacent NW Ontario.

Table 5 (continued)
1D Earth Resistivity Model for Manitoba Zone 3a

Layer	Depth / Confidence	Thickness	Resistivity (ohm-m) / Confidence	Conductivity (S/m) / Confidence	Comments
4. Middle Crust	13 - 28 km [9] [II]	15 km	15000 [10] [I]	0.0000666 [24]	Depths scaled from regional seismic profile across north-central Saskatchewan and Manitoba, 25 km [20], and up to 30 km [9] in NW Ontario. Assign average of values. MT profile [10] shows: * 10000-20000 ohm.m range Assign 15000 ohm.m, midpoint of range. Limits 10000, 20000 ohm.m.
5. Lower Crust	28 - 40 km [9, 11] [II]	12 km	9000 [10] [I]	0.000111 [24]	Depth scaled from regional seismic profile [9], ranges 34-45 km. Overall 40 km maximum depth to Moho [11]. Assign 40 km average depth. MT profile [10] shows: * 5000 ohm.m occupies 20% of layer * 10000 ohm.m occupies 80% Assign 9000 ohm.m, weighted average of dominant values ((5000 x .2)+(10000 x .8)). Limits 5000, 10000 ohm.m.
6. Upper Mantle	40 - 100 km [23] [III]	60 km	2200 [10] [I]	0.000454 [24]	Used generalized lower depth [23] MT profile [10] shows 1000-5000 ohm.m range with: * 5000 ohm.m occupying 20% of layer * range 1000 – 2000 ohm.m range occupies 80% Assign 2200 ohm.m weighted average based on areal extent of dominant / midpoint resistivity values ((5000 x 0.2)+(1500 x 0.8)). Limits 1000, 5000 ohm.m.
7. Upper Mantle	100 - 250 km [23] [III]	150 km	158 [25]	0.006309 [23] [III]	Utilized Canada regional model [23], based on Ottawa magnetic observatory data for all depths and resistivities below 100 km.

Table 5 (continued)
1D Earth Resistivity Model for Manitoba Zone 3a

Layer	Depth / Confidence	Thickness	Resistivity (ohm-m) / Confidence	Conductivity (S/m) / Confidence	Comments
8. Upper Mantle	250–410 km [23] [III]	160 km	29 [25]	0.034673 [23] [III]	Assign Canada regional model
9. Transition Zone	410–520 km [23] [III]	110 km	8 [25]	0.125892 [23] [III]	Assign Canada regional model
10. Transition Zone	520–670 km [23] [III]	150 km	2.4 [25]	0.416869 [23] [III]	Assign Canada regional model
11. Lower Mantle	670–900 km [23] [III]	230 km	1.12 [25]	0,891250 [23] [III]	Assign Canada regional model
12. Lower Mantle	900–1000 km [23] [III]	100 km	0.48 [25]	2.089296 [23] [III]	Assign Canada regional model

See end of Table 13 for abbreviations and notes

Table 6
1D Earth Resistivity Model for Manitoba Zone 3b

Layer	Depth Confidence	Thickness	Resistivity (ohm-m) Confidence	Conductivity (S/m) Confidence	Comments
1. Overburden	0 – 10 m [12, 15] [II]	10 m	5 [4, 7] [II]	0.02 [24]	*M*ainly organic (muck, peat; <1-5 m) deposits, some till and glaciolacustrine deposits [12]. Assign maximum thickness. MT survey in SE Manitoba indicates 5-30 ohm for mix of till, clay, silt and sand [4]. Glaciolacustrine clays average 30 ohm.m in northeastern Ontario [7]. Assign minimum resistivity on basis of conductive organic deposits being prevalent. Upper limit 30 ohm.m.
2. Sedimentary Basin	0 – 0.1 km [21] [II]	0.1 km	40 [4, 10] [II]	0.025 [24]	*WCSB*: Paleozoic carbonate (dolostone, dolomitic limestone, limestone), some shale beds, and a thin basal sandstone-shale [15, 18]. Depth deepens southwesterly to 200m [21]. Assign midpoint value. Northern extent of WCSB – Paleozoic strata only – in MB exhibits 10-100 ohm.m range [10]. Resistivity of lower Paleozoic carbonate strata in SW MB ranges 20-50 ohm.m (midpoint 35 ohm.m) [4]. Assign approx. 40 ohm.m, average of midpoint values. Limits 10, 100 ohm.m.
3 to 12.	Lithotectonic terranes / domains exposed in Zone 3a continue into Zone 3b beneath the covering WCSB (Layer 2) Depth of Layer 3 is 0.4-13km, resistivity is same as in Zone 3a – refer to Table 5 Depths and resistivity values for Layers 4 to 12 are same as in Zone 3a – refer to Table 5				

See end of Table 13 for abbreviations and notes

Table 7
1D Earth Resistivity Model for Manitoba Zone 3c

Layer	Depth Confidence	Thickness	Resistivity (ohm-m) Confidence	Conductivity (S/m) Confidence	Comments
1. Overburden	0 – 30 m [18] [II]	30 m	30 [4] [II]	0.03333 [24]	Variable materials and depth [12]. Majority of Zone covered by glaciomarine clay and silt, 1-20m thick, all overlying glaciolacustrine clay and silt, 1-20m thick, of former glacial Lake Agassiz. Silty and sandy tills underlie glaciolacustrine deposits. Organic deposits (peat, muck), 1-5m thick, on top of glacial material common in Hudson Bay Lowland. Up to 30 m thick cover of till and shallow marine and non-marine deposits [18]. Assign maximum thickness. Resistivity for tills range 20-100 ohm.m [6]. Glaciolacustrine clays average 30 ohm.m in northeastern Ontario [7]. MT survey in southeastern Manitoba across mixed glacial deposits indicates 5-30 ohm [4]. 1D inversion models for MT survey south of Churchill airport show average 100 ohm.m in upper 20m of overburden [22]. Assign 30 ohm.m to reflect dominance of lower resistivity glaciomarine and glaciolacustrine clays and silt covering sedimentary basin. Limits 20, 100 ohm.m.
2. Sedimentary Basin	0 – 0.25 km [27]	0.25 km	100 [22, 26]	0.01 [24]	*Hudson Bay Basin*: Lower Paleozoic strata, primarily carbonate (limestone +/- dolostone) [a]. Gently dipping northeast,

	[II]		[II]		undeformed. Overlies Precambrian basement (Superior province). Depth from stratigraphic contour map suggests approx. 250m [27]. Assigned midpoint thickness. MT profile [26] south of CNSC shows 20-100 ohm.m. Carbonate strata in WCSB in SE Manitoba ranges 20-50 ohm [4]. Rock samples of lower Paleozoic dolomitic mudstone, wackestone and dolomitic limestone show resistivity range 20-600 ohm.m, median 100 ohm.m [22]. Assign 100 ohm.m, on basis of measured rock resistivity and upper end resistivity as measured by MT. Limits 20, 600 ohm.m.

Table 7 (continued)
1D Earth Resistivity Model for Manitoba Zone 3c

Layer	Depth / Confidence	Thickness	Resistivity (ohm-m) / Confidence	Conductivity (S/m) / Confidence	Comments
3 to 12.	Lithotectonic terranes / domains exposed in Zone 3a continue into Zone 3c beneath the covering Hudson Bay Basin (Layer 2) Depth of Layer 3 is 0.125-13km, resistivity is same as in Zone 3a – refer to Table 5 Depths and resistivity values for Layers 4 to 12 are same as in Zone 3a – refer to Table 5				

See end of Table 13 for abbreviations and notes

Table 8
1D Earth Resistivity Model for Manitoba Zone 4a

Layer	Depth Confidence	Thickness	Resistivity (ohm-m) Confidence	Conductivity (S/m) Confidence	Comments
1. Overburden	0 – 10 m [18] [II]	10 m	40 [5, 4, 6] [II]	0.025 [24]	2/3 of Zone (north, west and southwest parts) covered by sand-rich till, and areas of glaciolacustrine and glaciolacustrine-beach (sand and gravel; 1-20 m deposits. 1/3 of Zone (east and southeast parts) covered by glaciolacustrine (clay, silt, minor sand; 1-20 m) deposits overlying silty and sand-rich till [3, 12]. Variable thickness [18]. Estimate <10 m. Borehole logs of Manitoba overburden show 40-50 ohm.m for till [5]. Resistivities for tills range 20-100 ohm.m [6]. MT survey in SE Manitoba indicates 5-30 ohm for mix of till, clay, silt and sand [4]. Glaciolacustrine clays average 30 ohm.m in northeastern Ontario [7]. Assign 40 ohm.m, to reflect predominance of both till and glaciolacustrine clay/silt sediments dominance. Limits 5, 100 ohm.m.
2. Sedimentary Basin	absent	---	---	---	---

Table 8 (continued)
1D Earth Resistivity Model for Manitoba Zone 4a

Layer	Depth Confidence	Thickness	Resistivity (ohm-m) Confidence	Conductivity (S/m) Confidence	Comments
3. Upper Crust	0 - 16 km [20] [II]	16 km	9200 [20, 16] [II]	0.000108 [24]	*Zone includes the Kisseynew Domain, Lynn Lake Belt, Southern Indian Domain, Chipewyan Domain / Batholith, Great Island Domain, Seal River Domain, Nejanlini Domain, Seal River Domain, Wollaston Domain and Mudadtik Domain; all within the Paleoproterozoic Trans-Hudson Orogen.* Predominately granitic and gneissic rock, metagreywacke (sedimentary), and lesser other metasedimentary and metavolcanic rock.
			Depths scaled from regional seismic profile across north-central SK and western MB, range 12.5-19.5 km, deeper crustal root at boundary between La Ronge Belt and Glennie domain in Saskatchewan [20]. Assign average of range. Depth minimum-resistivity maps (mainly covering THO in SK) show at: 5km, 400 ohm.m; 10 km, range 70-180 ohm.m (midpoint 125 ohm.m [28]. Excludes NACP and ALCA anomalies exhibiting 5 ohm.m. [29] remarks THO upper crust in north-central SK is highly resistive (>10000 ohm.m) with isolated near surficial conductive (1000 ohm.m, 200-400 ohm.m) anomalies (pyrite rich) and at shear zones between domains. Wathaman / Chipewyan batholith exhibits >10,000 ohm.m MT profile [16] shows range 800-10000 ohm.m (midpoint 5400 ohm.m), excluding conductive (<70 ohm.m) and highly resistive (>50000 ohm.m) anomalies MT profile [20] across north-central SK shows: * range 8000 >50000 ohm.m (midpoint 29000 ohm.m) occupying 40% of layer, mainly within Glennie Domain which overlies the Archean Sask Craton * 1000 ohm.m occupies 50% of layer * 500-8000 ohm.m (midpoint 4300 ohm.m) occupies 10% Chose 13000 ohm.m weighted average of dominant / midpoint values (29000 x 0.4)+(1000 x 0.5) + (4300 x 0.1)). Excluded NACP anomaly Assign 9200 ohm.m, average of midpoint and chosen weighted average values (5400, 13000 ohm.m). Limits 300, 50000 ohm.m. Note: Possible overestimate of assigned resisitivity due major influence of highly resistive Glennie Domain in north-central SK.		

Table 8 (continued)
1D Earth Resistivity Model for Manitoba Zone 4a

Layer	Depth Confidence	Thickness	Resistivity (ohm-m) Confidence	Conductivity (S/m) Confidence	Comments
4. Middle Crust	16 - 28 km [30] [II]	12 km	10400 [20, 16] [II]	0.000096 [24]	Depth scaled from regional seismic profile across north-central SK and western MB, average 27 km [30] and 29 km [20]. Assign average of values. 20 km depth minimum-resistivity map (mainly covering THO in SK) shows range 20-400 ohm.m, predominately 20 ohm.m, 400 ohm.m in area of Superior Province / THO boundary [28]. Excludes NACP 5 ohm.m anomaly. MT profile [16] across north-central SK shows: * range 800-8000 ohm.m (midpoint 4400 ohm.m) occupies 85% of layer * range 40000 >70000 ohm.m (midpoint 55000 ohm.m) occupies 15% of layer Chose approx. 12000 ohm.m weighted average of dominant / midpoint values ((4400 x 0.85)+(55000 x 0.15)). Excluded conductive (<70 ohm.m) anomaly. MT profile [20] across north-central SK shows same resistivity range and areal coverage as above in Layer 3. Chose 8700 ohm.m, average of midpoint and chosen weighted average values (4400, 13000 ohm.m). Assign approx. 10400 ohm.m, average of weighted averages (12000, 8700 ohm.m). Limits 500, 50000 ohm.m.

Table 8 (continued)
1D Earth Resistivity Model for Manitoba Zone 4a

Layer	Depth / Confidence	Thickness	Resistivity (ohm-m) / Confidence	Conductivity (S/m) / Confidence	Comments
5. Lower Crust	28 - 39 km [30] [II]	9 km	8400 [20, 16] [II]	0.0000119 [24]	Depth scaled from regional seismic profile across north-central SK and western MB, excluding 48-52 km deep root below Sask Craton situated in SK [30]. Assign average depth. 40 km depth minimum-resistivity maps (mainly covering THO in SK) shows range 5-70 ohm.m (midpoint approx. 40 ohm.m) [28]. 40 km maximum-resistivity map shows range 3100-10000 ohm.m [31]. MT profile [16] across north-central SK shows: * range 1000-8000 ohm.m (midpoint 4500 ohm.m) occupies 90% of layer * range 40000 >70000 ohm.m (midpoint 55000 ohm.m) Chose approx. 9500 ohm.m weighted average of dominant / midpoint values ((4500 x 0.9)+(55000 x 0.1)). Excluded conductive (<70 ohm.m) anomaly. MT profile [20] across north-central SK shows: * range 8000 >25000 ohm.m (midpoint 16500 ohm.m) occupying 40% of layer, mainly within Glennie Domain in SK * 1000 ohm.m occupies 60% of layer Chose 7200 ohm.m weighted average of dominant / midpoint values ((16500 x 0.4)+(1000 x 0.6)). Excluded influence of NACP anomaly. Assign approx. 8400 ohm.m, average of midpoint and chosen weighted average values (9500, 7200 ohm.m). Limits 1000, 50000 ohm.m.
6. Upper Mantle	39 - 100 km [23]	61 km	500 [28]	0.002 [24]	Used generalized lower depth [23] 100 km maximum-resistivity map shows range 700-1000

	[III]		[II]		ohm.m [31]. MT profile [28] of THO across north-central SK and west part of MB shows: * overall 500 ohm.m excluding conductive (<50 ohm.m) area below NACP anomaly in SK * conductive area top at 80-100 km depth, expands with depth, 10 ohm.m core at 200 km Assign 500 ohm.m. Upper limit 1000 ohm.m.

Table 8 (continued)
1D Earth Resistivity Model for Manitoba Zone 4a

Layer	Depth Confidence	Thickness	Resistivity (ohm-m) Confidence	Conductivity (S/m) Confidence	Comments
7. Upper Mantle	100 - 250 km [23] [III]	150 km	160 [28] [II]	0.00625 [23] [III]	Used generalized lower depth [23] 200 km maximum-resistivity map shows range 700-2000 ohm.m [31]. MT profile [28] of THO across north-central SK and west part of MB shows: * overall range 10-500 ohm.m * 500 ohm.m occupies 25% of layer * conductive area (10-100 ohm.m) occupies 75% of layer, top at 80-100 km, expands with depth, occurs beneath La Ronge Belt in SK which continues into MB as Lynn Lake Belt. . This conductive region situated below crustal NACP Assign 160 ohm.m, weighted average based on areal extent of dominant / midpoint resistivity values ()500 x 0.25)+(50 x 0.75)), on assumption that conductive area follows trace of NACP into MB. Limits 50, 500 ohm.m.
8. Upper Mantle	250–410 km [23] [III]	160 km	29 [25]	0.034673 [23] [III]	Utilized Canada regional model [23], based on Ottawa magnetic observatory data for all depths and resistivities below 250 km
9. Transition Zone	410–520 km [23] [III]	110 km	8 [25]	0.125892 [23] [III]	Assign Canada regional model

Table 8 (continued)
1D Earth Resistivity Model for Manitoba Zone 4a

Layer	Depth / Confidence	Thickness	Resistivity (ohm-m) / Confidence	Conductivity (S/m) / Confidence	Comments
10. Transition Zone	520–670 km [23]	150 km	2.4 [25]	0.416869 [23]	Assign Canada regional model
	[III]			[III]	
11. Lower Mantle	670–900 km [23]	230 km	1.12 [25]	0.891250 [23]	Assign Canada regional model
	[III]			[III]	
12. Lower Mantle	900–1000 km [23]	100 km	0.48 [25]	2.089296 [23]	Assign Canada regional model
	[III]			[III]	

See end of Table 13 for abbreviations and notes

Table 9
1D Earth Resistivity Model for Manitoba Zone 4b

Layer	Depth Confidence	Thickness	Resistivity (ohm-m) Confidence	Conductivity (S/m) Confidence	Comments
1. Overburden	0 – 10 m [18] [II]	10 m	30 [4] [II]	0.03333 [24]	Silty till (variable thicknesses) with lesser amount of overlying glaciolacustrine (clay, silt, minor sand; 1-20 m) deposits, organic deposits (peat, muck; <1-5 m), and alluvial deposits (sand and gravel, sand, silt; 1-15 m) [3, 12]. Overburden typically <10m in northern and western areas of Manitoba Lowland [18]. Regional overburden isopach map shows < 50m thickness [2]. Assign 10 m on basis on typical thin overburden known to be present. Borehole logs of Manitoba overburden show 40-50 ohm.m for till and 70-200 ohm.m for sand and gravel [5]. Resistivities for tills range 20-100 ohm.m [6]. MT survey in SE Manitoba indicates 5-30 ohm for mix of till, clay, silt and sand [4]. Glaciolacustrine clays average 30 ohm.m in northeastern Ontario [7]. Assign 30 ohm.m, because of mix of various overburden material. Limits 5, 100 ohm.m.
2. Sedimentary Basin	0 – 0.2 km [21] [II]	0.2 km	50 [16] [I]	0.02 [24]	*WCSB*: Mainly Paleozoic carbonate (dolomite, dolomitic limestone, limestone) with a thin basal sandstone-shale. Limited Mesozoic strata (shale and sand/siltstone) overlies Paleozoic along western margin of Zone 4b [15]. Depth deepens southwesterly to 400m [21] Assign midpoint value. MT profile across north-central SK and western MB shows 10-100 ohm.m range (midpoint 50 ohm.m) [16]. Assign 50 ohm.m, midpoint of range as measured by MT survey. Limits 10, 100 ohm.m.
3 to 12.	Lithotectonic terranes / domains exposed in Zone 4a continue into Zone 4b beneath the covering WCSB (Layer 2) Depths and resistivity values for Layers 3 to 12 are same as in Zone 4a – refer to Table 8				

See end of Table 13 for abbreviations and notes

Table 10
1D Earth Resistivity Model for Manitoba Zone 4c

Layer	Depth Confidence	Thickness	Resistivity (ohm-m) Confidence	Conductivity (S/m) Confidence	Comments
1. Overburden	0 – 40 m [12] [I]	40 m	30 [4, 6, 7] [II]	0.03333 [24]	Variable materials and depth [12]. Majority of Layer 1 covered by (i) glaciomarine clay and silt, 1-20m thick, with (ii) glaciomarine sands and gravel (beach ridges, spits), 1-10m thick, up to 20 km inshore of coastline; all overlying glaciolacustrine clay and silt, 1-20m thick, of former glacial Lake Agassiz. Silty and sandy tills underlie and protrude thorough glaciolacustrine and minor till deposits at western margin of Layer 1. Organic deposits (peat, muck), 1-5m thick, on top of glacial material common in Hudson Bay Lowland. Assigned estimated maximum thickness of 40m (20m glaciomarine clays and 20m glaciolacustrine clays). Resistivities for tills range 20-100 ohm.m [6]. Glaciolacustrine clays average 30 ohm.m in northeastern Ontario [7]. MT survey in southeastern Manitoba across mixed glacial deposits indicates 5-30 ohm [4]. 1D inversion models for MT survey south of Churchill airport show average 100 ohm.m in upper 20m of overburden [22] Assign 30 ohm.m to reflect dominance of glaciolacustrine clays and silt covering sedimentary basin. Limits 20, 100 ohm.m.

Table 10 (continued)
1D Earth Resistivity Model for Manitoba Zone 4c

Layer	Depth Confidence	Thickness	Resistivity (ohm-m) Confidence	Conductivity (S/m) Confidence	Comments
2. Sedimentary Basin	< ~900 m [1, 32, 27] [II]	550 m (midpoint)	100 [26, 22] [I]	0.01 [24]	*Hudson Bay Basin*: Paleozoic strata, primarily carbonate (limestone +/- dolostone) with upper succession of argillaceous and sandy beds [1]. Gently dipping northeast, undeformed. Overlies Precambrian basement (Superior province and Trans-Hudson orogen). Depth from stratigraphic contour map indicates 300-900m along Hudson Bay shoreline, and 300m below Churchill [27]. Petroleum well, 375 km southeast of Churchill, intersect Precambrian basement at ~ 900m [32] Maximum onshore thickness of 884 m noted by [1]. MT survey [26] near CNSC suggests varying depth to basement, revealed ~ 100m depth, increasing to 200m and then starting to taper out to edge of basin. MT survey [22] south of Churchill airport shows depth to basement ranges 200-500m. Assigned midpoint thickness, based on range 200-900m. MT profile [26] south of CNSC shows 20-100 ohm.m. Carbonate strata in WCSB in southeastern Manitoba ranges 20-50 ohm [4]. Rock samples of dolomitic mudstone, wackestone and dolomitic limestone show resistivity range 20-600 ohm.m, median 100 ohm.m [22]. Assigned 100 ohm.m, on basis of measured rock resistivity and upper end resistivity as measured by MT. Limits 20, 600 ohm.m.

Table 10 (continued)
1D Earth Resistivity Model for Manitoba Zone 4c

Layer	Depth Confidence	Thickness	Resistivity (ohm-m) Confidence	Conductivity (S/m) Confidence	Comments
3. Upper Crust	0.55 – 16 km [20] [II]	15.5 km	*north-part* 9300 [26] [I]	*north-part* 0.000107 [m]	Nelson River is boundary between north- and south-parts of Zone 4c. Depth for entire Layer 3 scaled from regional seismic profile [20] across north-central SK. Assign 16 km average value, range 13.5-20 km, deepest beneath La Ronge Belt / Glennie Domain boundary in SK *North-part*: likely underlain predominately by Chipewyan Domain (granitic batholith) exhibiting high resistivity, and a lesser extent of Great Island Domain. MT profile [29] shows range 3000-100000 ohm.m in equivalent domains in SK. MT profile [26] shows: * 0.1-0.4 km depth, range 230-3700 ohm.m, predominantly 920 ohm.m * 0.4-7 km depth, range approx. 300-15000, predominately 3700-15000 ohm.m (midpoint 9300 ohm.m) 1D resistivity profile shows maximum resistivity 100000 ohm.m at 2000 m depth. Rock samples of quartzite and a granite show average resistivity approx. 5800 ohm.m [22]. 1D inversion models show at 1000m depth, resistivity >100,000 ohm.m [22]. Assign 9300 ohm.m, midpoint of range from MT survey within Zone 4c-north, reflecting likely presence of granitic. Limits 3000, >50000 ohm.m.
			south-part 1000 [10]	*south-part* 0.001 [m]	*South-part*: likely partly underlain by Kisseynew Domain (mainly metagreywacke, a sedimentary rock) and east-trending segment of the SBZ. Low resistivity values (<20 ohm.m) could

			[I]		reflect presence of mid-crustal NACP anomaly postulated to transect across the Zone.. MT profile [10] across Hudson Bay Basin shows range 10-2000 ohm.m. Assign 1000 ohm.m midpoint value. Limits 10, 2000 ohm.m

Table 10 (continued)
1D Earth Resistivity Model for Manitoba Zone 4c

Layer	Depth / Confidence	Thickness	Resistivity (ohm-m) / Confidence	Conductivity (S/m) / Confidence	Comments
4. Middle Crust	16 – 29 km [30] [II]	13 km	*north-part* 14500 [29, 20] [II]	*north-part* 0.000068 [m]	Depth for entire Layer 4 scaled from regional seismic profile [30] across north-central SK. Assign 29 km average value, range 23.5-34 km. MT profiles show for equivalent domains in SK: * range 50->50000 ohm.m (midpoint 25000 ohm.m) [29] * range 800-10000 ohm.m (midpoint 5400 ohm.m), excluding conductive (<70 ohm.m) and highly resistive (>50000 ohm.m) anomalies [16] * range 8000 >50000 ohm.m (midpoint 29000 ohm.m) occupying 40% of layer; 1000 ohm.m occupies 50%; 500-8000 ohm.m (midpoint 4300 ohm.m) occupies 10% [20] Chose 13000 ohm.m weighted average of dominant / midpoint values (29000 x 0.4)+(1000 x 0.5) + (4300 x 0.1). Excluded NACP anomaly. Assign approx.14500 ohm.m, average of midpoint and chosen weighted average values (25000, 5400, 13000 ohm.m), on assumption same lithotectonic terrane continues into Zone 4c-north. Limits 300, 50000 ohm.m.
			south-part 325 [10] [I]	*south-part* 0.003076 [m]	MT profile [10] across Hudson Bay Basin shows: * range 10-2000 ohm.m * core 10-50 ohm.m (midpoint 30 ohm.m) occupies 70% of Layer 4 * 100-2000 ohm.m (midpoint 1000 ohm.m) occupies 30% Assign 325 ohm.m weighted average of dominant / midpoint values ((30 x 0.7)+(1000 x 0.3)). Limits 10, 2000 ohm.m

Table 10 (continued)
1D Earth Resistivity Model for Manitoba Zone 4c

Layer	Depth / Confidence	Thickness	Resistivity (ohm-m) / Confidence	Conductivity (S/m) / Confidence	Comments
5. Lower Crust	29 – 39 km [30] [II]	10 km	*north-part* 8400 [20, 16] [I]	*north-part* 0.000119 [m]	Depth for entire Layer 5 scaled from regional seismic profile across north-central SK and western MB, excluding 48-52 km deep root below Sask Craton situated in SK, deepest beneath La Ronge Belt / Glennie Domain boundary [30]. Assign average depth. 40 km depth minimum-resistivity maps (mainly covering THO in SK) shows range 5-70 ohm.m (midpoint approx. 40 ohm.m) [28]. MT profile [16] across north-central SK shows: * range 1000-8000 ohm.m (midpoint 4500 ohm.m) occupies 90% of layer * range 40000 >70000 ohm.m (midpoint 55000 ohm.m) Chose approx. 9500 ohm.m weighted average of dominant / midpoint values (4500 x 0.9)+(55000 x 0.1). Excluded conductive (<70 ohm.m) anomaly. MT profile [20] across north-central SK shows: * range 8000 >25000 ohm.m (midpoint 16500 ohm.m) occupying 40% of layer, mainly within Glennie Domain situated in SK * 1000 ohm.m occupies 60% of layer Chose 7200 ohm.m weighted average of dominant / midpoint values (16500 x 0.4)+(1000 x 0.6). Excluded influence of NACP anomaly. Assign approx. 8400 ohm.m, average of midpoint and chosen weighted average values (9500, 7200 ohm.m) on assumption same lithotectonic terrane continues into Zone 4c-north. Limits 1000, 50000 ohm.m.
			south-part 1000 [10] [I]	*south-part* 0.001 [m]	MT profile [10] shows same resistivity distribution as for Layer 4. Assign same resistivity 325 ohm.m value. Limits 10, 2000 ohm.m.

Table 10 (continued)
1D Earth Resistivity Model for Manitoba Zone 4c

Layer	Depth / Confidence	Thickness	Resistivity (ohm-m) / Confidence	Conductivity (S/m) / Confidence	Comments
6. Upper Mantle	39 - 100 km [23] [III]	61 km	*north-part* 500 [28] [II]	*north-part* 0.002 [m]	Used generalized lower depth [23] for entire Layer 6. MT profile [28] of THO across north-central SK shows: * overall 500 ohm.m excluding conductive (<50 ohm.m) area below NACP anomaly in SK Assign 500 ohm.m, on assumption same lithotectonic terrane underlying Zone 4a continues into Zone 4c-north.
			350 [10] [I]	*south-part* 0.002857 [m]	MT profile [10] across Hudson Bay Basin shows range 200-500 ohm.m, but limited coverage for depth interval. Assign 350 ohm.m midpoint value.
7. Upper Mantle	100 - 250 km [23] [III]	150 km	*north-part* 160 [28] [II]	*north-part* 0.00625 [m]	Used generalized lower depth [23] for entire Layer 7. Maximum-resistivity maps [31] show at: * 100 km depth, approx. 2500 ohm.m * 200 km depth, range 3100-10000 ohm.m. MT profile [28] of THO across north-central SK shows: * overall range 10-500 ohm.m * 500 ohm.m occupies 25% of layer * conductive area (10-100 ohm.m) occupies 75% of layer, top at 80-100 km, expands with depth, occurs beneath La Ronge Belt in SK which continues into MB as Lynn Lake Belt. This conductive region situated below crustal NACP. Assign 160 ohm.m, weighted average based on areal extent of dominant / midpoint resistivity values (500 x 0.25)+(50 x 0.75), on assumption that conductive area continues into Zone 4c-north. Limits 50, 500 ohm.m.
			south-part 158 [k] [III]	*south-part* 0.004761 [m]	Canada regional model [23] suggests 158 ohm.m. Maximum-resistivity maps [31] show at: * 100 km depth, range 1000-10000 ohm.m * 200 km depth, range 3100-10000 ohm.m. Assign regional model resistivity.

Table 10 (continued)
1D Earth Resistivity Model for Manitoba Zone 4c

Layer	Depth / Confidence	Thickness	Resistivity (ohm-m) / Confidence	Conductivity (S/m) / Confidence	Comments
8. Upper Mantle	250–410 km [23]	160 km	29 [25]	0.034673 [23]	Utilized Canada regional model [23], based on Ottawa magnetic observatory data for all depths and resistivities below 250 km.
	[III]			[III]	
9. Transition Zone	410–520 km [23]	110 km	8 [25]	0.125892 [23]	Assign Canada regional model
	[III]			[III]	
10. Transition Zone	520–670 km [23]	150 km	2.4 [25]	0.416869 [23]	Assign Canada regional model
	[III]			[III]	
11. Lower Mantle	670–900 km [23]	230 km	1.12 [25]	0.891250 [23]	Assign Canada regional model
	[III]			[III]	
12. Lower Mantle	900–1000 km [23]	100 km	0.48 [25]	2.089296 [23]	Assign Canada regional model
	[III]			[III]	

See end of Table 13 for abbreviations and notes

Table 11
1D Earth Resistivity Model for Manitoba Zone 4f

Layer	Depth Confidence	Thickness	Resistivity (ohm-m) Confidence	Conductivity (S/m) Confidence	Comments
1. Overburden	0 – 10 m [18] [II]	10 m	50 [5, 6] [II]	0.02 [24]	10% of Zone covered by patchy sand-rich till [3, 12]. Variable thickness [18]. Estimate <10 m. Borehole logs of Manitoba overburden show 40-50 ohm.m for till [5]. Resistivities for tills range 20-100 ohm.m [6]. Assign 50 ohm.m, to reflect predominance of till. Limits 20, 100 ohm.m.
2. Sedimentary Basin	absent	---	---	---	---
3. Upper Crust	0 – 14 km [20] [I]	14 km	8900 [20] [I]	0.000112 [24]	Flin Flon Belt consists of low-grade metavolcanic-plutonic (greenstone belt) rock and minor metasedimentary rock. Zone includes the Namew Gneiss Complex consisting of high-grade metamorphosed plutonic intrusive rock. Flin Flon Belt straddles SK – MB provincial boundary and continues south to southwesterly beneath WCSB.

			Depth scaled from regional seismic profile [20] across north-central SK and western MB. Assign average value. Depth minimum-resistivity maps [28] show at: 5km, 400 ohm.m; 10 km, range 180-400 ohm.m (midpoint 300 ohm.m). MT profile [16] shows range 10-10000 ohm.m for western half of Flin Flon Belt (in SK), and includes east-dipping conductive feature (10-400 ohm.m) surrounded by 700-10000 ohm.m. Choose approx. 1600 ohm.m, weighted average of midpoint values ((200 x 0.7)+(5000 x 0.3)) MT profile [20] across all of Flin Flon Belt shows: * >50000 ohm.m occupying 25% of layer, within Namew Gneiss Complex * range 8000-10000 ohm.m (midpoint 9000 ohm.m) occupies 40% * mainly 500 ohm.m occupies 35% * 10 ohm.m occupies 10% * ALSZ anomaly (divides west and east halves of Flin Flon Belt) occupies 10% of layer Make as separate note Choose approx. 16300 ohm.m, weighted average of dominant / midpoint values ((50000 x 0.25)+(9000 x 0.4)+(500 x 0.35)). Assign approx. 8900 ohm.m, average of weighted values (1600, 16300 ohm.m). Limits 300, 16300 ohm.m.

Table 11 (continued)
1D Earth Resistivity Model for Manitoba Zone 4f

Layer	Depth Confidence	Thickness	Resistivity (ohm-m) Confidence	Conductivity (S/m) Confidence	Comments
4. Middle Crust	14 - 23 km [30] [I]	9 km	1100 [20] [I]	0.000909 [24]	Depth scaled from regional seismic profile [30] across north-central SK and western MB, average 23 km. 20 km depth minimum-resistivity map [28] shows 400 ohm.m. MT profile [16] of west-half of Flin Flon Belt shows: * 100-700 ohm.m (midpoint 400 ohm.m) occupies 65% of layer * 1000-7000 ohm.m (midpoint 4000 ohm.m) occupies 35% Chose 1650 ohm.m, weighted average of midpoint values ((400 x 0.65)+(4000 x 0.35)). *Consider include west half info, thus reduce resistivity to overall 500 ohm* MT profile [20] shows overall 500 ohm.m, Limited resolution on profile. Assign approx. 1100 ohm.m, average of values (1650, 500 ohm.m). Limits 100, 7000 ohm.m.
5. Lower Crust	23 - 44 km [30] [I]	19 km	1300 [20] [I]	0.000769 [24]	Depth scaled from regional seismic profile [30] across north-central SK and western MB 40 km depth minimum-resistivity map [28] shows 70 ohm.m. MT profile [16] of west-half of Flin Flon Belt shows: * 10-70 ohm.m (midpoint 40 ohm.m) occupies 35% of layer * 100-700 ohm.m (midpoint 400 ohm.m) occupies 25% * 1000-10000 ohm.m (Midpoint 5000 ohm.m) occupies 40% Chose 2100 ohm.m, weighted average of midpoint values ((40 x 0.35)+(400 x 0.25)+(5000 x 0.4)). *Consider whethet include west half info, thus reduce resistivity to overall 500 ohm. Definitely remove [16]* MT profile [20] shows overall 500 ohm.m, excluding limited areal influence from western adjacent highly resistive (>50000 ohm.m) Hanson Lake Block; no significant change from above Layer 4. Limited resolution on profile. Assign approx. 1300 ohm.m, average of values (1650, 500 ohm.m). Limits 10, 10000 ohm.m.

Table 11 (continued)
1D Earth Resistivity Model for Manitoba Zone 4f

Layer	Depth	Thickness	Resistivity (ohm-m)	Conductivity (S/m)	Comments
	Confidence		Confidence	Confidence	
6. Upper Mantle	44 - 100 km [23]	56 km	500 [28]	0.002 [24]	Used generalized lower depth [23]. MT profile [28] of THO across west part of MB shows overall 500 ohm.m.
	[III]		[I]		
7. Upper Mantle	100 - 250 km [23]	150 km	500 [28]	0.002 [24]	Used generalized lower depth [23] MT profile [28] of THO across west part of MB shows overall 500 ohm.m; no change from Layer 6.
	[III]		[I]	[III]	
8. Upper Mantle	250–410 km [23]	160 km	29 [25]	0.034673 [23]	Utilized Canada regional model [23], based on Ottawa magnetic observatory data for all depths and resistivities below 250 km
	[III]			[III]	
9. Transition Zone	410–520 km [23]	110 km	8 [25]	0.125892 [23]	Assign Canada regional model
	[III]			[III]	
10. Transition Zone	520–670 km [23]	150 km	2.4 [25]	0.416869 [23]	Assign Canada regional model
	[III]			[III]	
11. Lower Mantle	670–900 km [23]	230 km	1.12 [25]	0.891250 [23]	Assign Canada regional model
	[III]			[III]	
12. Lower Mantle	900–1000 km [23]	100 km	0.48 [25]	2.089296 [23]	Assign Canada regional model

	[III]			[III]		

See end of Table 13 for abbreviations and note

Table 12
1D Earth Resistivity Model for Manitoba Zone SBZa

Layer	Depth / Confidence	Thickness	Resistivity (ohm-m) / Confidence	Conductivity (S/m) / Confidence	Comments
	Note: *Superior Boundary Zone (SBZ) is comprised of 3 segments: NNE trending Thompson Nickel Belt; Assean Lake Domain; E trending Fox River Belt. This table presents only the bedrock exposed Thompson Nickel Belt.*				
1. Overburden	0 – 10 m [18] [II]	10 m	30 [7] [II]	0.033333 [24]	Predominately covered by glaciolacustrine (clay, silt, minor sand; 1-20 m) deposits overlying silty and sand-rich till [3, 12]. Variable thickness [18]. Estimate <10 m. Glaciolacustrine clays average 30 ohm.m in northeastern Ontario [7]. Assign 30 ohm.m, to reflect predominance of glaciolacustrine clay/silt sediments. Lower limit 5 ohm.m.
2. Sedimentary Basin	absent	---	---	---	---
3. Upper Crust	0 - 15 km [10, 20] [II]	15 km	9600 [10, 20, 16] [II]	0.000104 [24]	Exposed bedrock consists of Archean gneisses of Superior geological province overlain by thin cover of Paleoproterozoic sedimentary (conglomerate, quartzite, greywacke, marble, graphitic sulphide iron formation, dolomite, pelitic schist) and mafic volcanic rock, intruded by ultramafic dykes and sills. Complex deformation [33]. Assign 15 km, average of depths chosen for adjacent Zones 3a (13 km) [10] and 4a (16 km) [20]. MT profile [20] across western MB and north-central SK shows range 4500-8500 ohm.m (midpoint 6500 ohm.m). Average of resistivities assigned for adjacent Zones 3a (10000 ohm.m) [10] and 4a (9200 ohm.m) [16, 20] is 9600 ohm.m. However, MT profile [21] shows dominantly 1000 ohm.m in Zone 4a adjacent to SBZ. Assign 9600 ohm.m, midpoint of adjacent Zone resistivities, on basis that SBZ is gradational between the two Zones.

Table 12 (continued)
1D Earth Resistivity Model for Manitoba Zone SBZa

Layer	Depth Confidence	Thickness	Resistivity (ohm-m) Confidence	Conductivity (S/m) Confidence	Comments
4. Middle Crust	15 - 28 km [9, 20, 30] [II]	13 km	12700 [10, 20, 16] [II]	0.0000787 [24]	Assign 28 km, average of depths chosen for adjacent Zones 3a (28 km) [9] and 4a (28 km) [20]. MT profile [20] across western MB and north-central SK shows range 4500-8500 ohm.m (midpoint 6500 ohm.m). Average of resistivities assigned for adjacent Zones 3a (15000 ohm.m) [10] and 4a (10400 ohm.m) [16, 20] is 12700 ohm.m. However, MT profile [21] shows dominantly 1000 ohm.m in Zone 4a adjacent to SBZ. Assign 12700 ohm.m, midpoint of adjacent Zone resistivities, on basis that SBZ is gradational between the two Zones.
5. Lower Crust	28 – 39.5 km [9, 11, 30] [II]	9.5 km	8700 [10, 20, 16] [II]	0.0000114 [24]	Assign 39.5 km, average of depths chosen for adjacent Zones 3a (40 km) [9, 11] and 4a (39 km) [30].MT profile [20] across western MB and north-central SK shows approx. 10000 ohm.m. Average of resistivities assigned for adjacent Zones 3a (9000 ohm.m) [10] and 4a (8400 ohm.m) [16, 20] is 8700 ohm.m. Assign 8700 ohm.m, midpoint of adjacent Zone resistivities, on basis that SBZ is gradational between the two Zones.
6. Upper Mantle	39.5 - 100 km [23] [III]	60.5 km	1350 [10, 28] [II]	0.000740 [24]	Used generalized lower depth [23] MT profiles across western MB and north-central SK show: * approx. 40000 ohm.m [20] between 40 – 60 km * average 5500 ohm.m [28] between 40 – 100 km Average of resistivities assigned for adjacent Zones 3a (2200 ohm.m) [10] and 4a (500 ohm.m) [28] is 1350 ohm.m. Assign 1350 ohm.m, midpoint of adjacent Zone resistivities, on basis that SBZ is gradational between the two Zones.

Table 12 (continued)
1D Earth Resistivity Model for Manitoba Zone SBZa

Layer	Depth / Confidence	Thickness	Resistivity (ohm-m) / Confidence	Conductivity (S/m) / Confidence	Comments
7. Upper Mantle	100 - 250 km [23] [III]	150 km	160 [28] [II]	0.00625 [23] [III]	Used generalized lower depth [23] MT profile across western MB and north-central SK shows approx. 5500 ohm.m [28]. Average of resistivities assigned for adjacent Zones 3a (158 ohm.m) [23] and 4a (160 ohm.m) [28] is 160 ohm.m. Assign 160 ohm.m, average of resistivities assigned for adjacent Zones 3a (158 ohm.m) [23] and 4a (160 ohm.m) [28].
8. Upper Mantle	250–410 km [23] [III]	160 km	29 [25]	0.034673 [23] [III]	Utilized Canada regional model [23], based on Ottawa magnetic observatory data for all depths and resistivities below 250 km
9. Transition Zone	410–520 km [23] [III]	110 km	8 [25]	0.125892 [23] [III]	Assign Canada regional model
10. Transition Zone	520–670 km [23] [III]	150 km	2.4 [25]	0.416869 [23] [III]	Assign Canada regional model
11. Lower Mantle	670–900 km [23] [III]	230 km	1.12 [25]	0.891250 [23] [III]	Assign Canada regional model
12. Lower Mantle	900–1000 km [23] [III]	100 km	0.48 [25]	2.089296 [23] [III]	Assign Canada regional model

See end of Table 13 for abbreviations and notes

Table 13

1D Earth Resistivity Model for Manitoba Zone SBZb

Layer	Depth / Confidence	Thickness	Resistivity (ohm-m) / Confidence	Conductivity (S/m) / Confidence	Comments
	Note: *Superior Boundary Zone (SBZ) is comprised of 3 segments: NNE trending Thompson Nickel Belt; Assean Lake Domain; E trending Fox River Belt. This table presents only the southwestern continuation of the Thompson Nickel Belt beneath the Western Canada Sedimentary Basin.*				
1. Overburden	0 – 50 m [18, 2, 4] [II]	50 m	50 [7] [II]	0.02 [24]	Predominately clay- and silt-rich till. Variable depth. Typically <10m in northern and western areas of Manitoba Lowland (i.e. Interlake region) [18]. Isolated pockets 100-200 m deep but 100 m deep in SE corner of MB [2]. MT survey [4] across SE corner of MB indicates <100m thickness. Regional overburden isopach map shows <50m thickness [2]. Assign 50 m average depth, based on range 10-100 m. Borehole logs of Manitoba overburden show 40-50 ohm.m for till and 70-200 ohm.m for sand and gravel [5]. Resistivities for tills range 20-100 ohm.m [6]. MT survey in SE Manitoba indicates 5-30 ohm for mix of till, clay, silt and sand [4]. Glaciolacustrine clays average 30 ohm.m in northeastern Ontario [7]. Assign 50 ohm.m, on basis of till being dominant. Limits 20, 100 ohm.m.
2. Sedimentary Basin	0 – 1.3 km [21] [II]	1.3 km	25 [4] [II]	0.04 [24]	*WCSB*: Northern half of Zone underlain by Paleozoic carbonate (dolostone, dolomitic limestone, limestone), some shale beds, and a thin basal sandstone-shale [15, 18]. Southern half of zone underlain by Mesozoic strata (dominantly shales with lesser amounts of silt/sandstones, carbonates and evaporates)

			which overly Paleozoic sedimentary rock [15, 18]. Depth deepens southwestly to 2600m, deepest at SW corner of MB. Northern half of zone underlain by Palezoic strata, depth ranges 0-800m. Southern half of Zone underlain by Mesozoic and Paleozoic strata ranges 800-2600 m. Assign 1.3 km, midpoint of maximum depth. Lower Paleozoic carbonates exhibit 20-50 ohm.m, and basal sandstone-shale with saline porewater exhibits 3 ohm.m [4]. Upper Paleozoic and Mesozoic strata (both shale dominant) exhibits 1-5 ohm.m [4]. Northern extent of WCSB – Paleozoic strata only – in MB exhibits 10-100 ohm.m range [16]. Assign Assigned midpoint 25 ohm.m, prevalent on 2D resistivity profile by [4] due presence of shale. Limits 5, 100 ohm.m.

Table 13 (continued)
1D Earth Resistivity Model for Manitoba Zone SBZb

Layer	Depth	Thickness	Resistivity (ohm-m)	Conductivity (S/m)	Comments
	Confidence		Confidence	Confidence	
3. Upper Crust	1.3 – 13.5 km [8, 9, 10, 17, 20] [II]	12.2 km	8900 [4,10, 16, 20] [II]	0.000112 [24]	Depth, 12.5 km, scaled from regional seismic profile [8] across SW corner of MB into SE corner of SK. Assign 13.5 km, averaged depth of Zone 1b, 2b, 3b and 4b adjacent to SBZb. Basement rock is predominately gneisses and granitoids, with lesser amount of metavolcanics and metagreywacke (metasediment) of the Superior geological province. Resistivity is variable along length of Zone SBZb, ranging 3000-13500 ohm.m; highest adjacent to Zone 2b. Assign 8900 ohm.m, averaged resistivities of Zone 1b, 2b, 3b and 4b adjacent to SBZb. Excludes influence of < 10 ohm.m TOBE anomaly. *Consider reducing the value to reflect that SBZ is more conductive at its southern end, note that Gowan shows 100 ~~500~~ ohm.m at station witin the SBZ at SW corner of MB*
4. Middle Crust	13.5 - 29 km [8, 9, 17, 30] [II]	15.5 km	15600 [4,10, 16, 20] [II]	0.0000641 [24]	Depth, 37 km, scaled from regional seismic profile [8] across SW corner of MB into SE corner of SK. Assign 29 km, average depth of Zone3s 1b, 2b, 3b and 4b adjacent to SBZb. Resistivity is variable along length of Zone SBZb, ranging 1450-35500 ohm.m;; highest adjacent to Zone 2b. Assign 15600 ohm.m, averaged resistivities of Zone 1b, 2b, 3b and 4b adjacent to SBZb. *Consider reducing the value to reflect that SBZ is more conductive at its southern end, for all layers 3, 4, 5, 6 – maybe make as SBZc i.e. new division*
5. Lower Crust	29 – 39.5 km [8, 9, 11, 17, 30]	10.5 km	12000 [4,10, 16, 20]	0.0000833 [24]	Depth, 47 km, scaled from regional seismic profile [8] across SW corner of MB into SE corner of SK.

	[II]		[II]		Assign 39.5 km, average depth of Zone3s 1b, 2b, 3b and 4b adjacent to SBZb. Resistivity is variable along length of Zone SBZb, ranging 1500-28000 ohm.m; highest adjacent to Zone 2b. Assign 12000 ohm.m, averaged resistivities of Zone 1b, 2b, 3b and 4b adjacent to SBZb

Table 13 (continued) 1D Earth Resistivity Model for Manitoba Zone SBZb

Layer	Depth Confidence	Thickness	Resistivity (ohm-m) Confidence	Conductivity (S/m) Confidence	Comments
6. Upper Mantle	39.5 - 100 km [23] [III]	60.5 km	5500 [10, 28] [II]	0.000181 [24]	Used generalized lower depth [23] Resistivity is variable along length of Zone SBZb, ranging 500-17000 ohm.m; highest adjacent to Zone 2b. Assign 5500 ohm.m, averaged resistivities of Zone 1b, 2b, 3b and 4b adjacent to SBZb
7. Upper Mantle	100 - 250 km [23]	150 km	158 [25]	0.006309 [23]	Utilized Canada regional model [23], based on Ottawa magnetic observatory data for all depths and resistivities below 100 km
8. Upper Mantle	250–410 km [23] [III]	160 km	29 [25]	0.034673 [23] [III]	Assign Canada regional model
9. Transition Zone	410–520 km [23] [III]	110 km	8 [25]	0.125892 [23] [III]	Assign Canada regional model
10. Transition Zone	520–670 km [23] [III]	150 km	2.4 [25]	0.416869 [23] [III]	Assign Canada regional model
11. Lower Mantle	670–900 km [23] [III]	230 km	1.12 [25]	0.891250 [23] [III]	Assign Canada regional model
12. Lower Mantle	900–1000 km [23] [III]	100 km	0.48 [25]	2.089296 [23] [III]	Assign Canada regional model

ABREVIATIONS:

MB	Manitoba
MT	magnetotelluric
NACP	North American Central Plains
NCS	North Caribou Superterrane
NE	northeast
ON	Ontario
SBZ	Superior Boundary Zone
SE	southeast
SGB	Selkirk Greenstone Belt
SW	southwest
TOBE	Thompson Belt
WCSB	Western Canada Sedimentary Basin
WR	Winnipeg River

NOTES:

Depth Confidence

I = best representation
- * overburden: geological report/map coverage of local area.
- * crust: seismic/gravity transects crossing local area, within 10 km.

II = likely representative
- * overburden: geological report/map coverage of region
- * crust/upper mantle: geological and/or seismic transect of a regional nature.

III = possibly representative (measurements from general compilations).

Resistivity/Conductivity Confidence

I = best representation (measurements from site or nearby).
- * overburden: resistivity measurement by surface geophysical method and/or borehole in local area.
- * crust: resistivity measurement from resistivity survey, MT survey and/or borehole in local area.

II = likely representative (resistivity values extrapolated from measurements taken at some distance from the site, typically greater than 100 km).
- * overburden: resistivity value obtained by geophysical measurement, including borehole logs.
- * sedimentary basin: value obtained by geophysical survey using variety of geophysical electromagnetic methods, including MT.
- * crust: value obtained by regional MT survey.

III = possibly representative (measurements from general compilations).

CITED REFERENCES:

1 Manitoba Geological Survey (2010), cross-section large.gif

2 Fenton et al. (1994), Fig. 26.3-Surface to Bedrock Isopach drift thickness

3 MRD (2008), generalized surficial geology

4 Gowan et al. (2009), Figs. 7, 8

5 Oldenborger et al. (2010), p.3

6 Palacky (1988)

7 Palacky (1992)

8 Green et al. (1980), Fig. 6, 7, Table 4

9 Musacchio et al. (2004), Fig. 5

10 Ferguson et al. (2005a), Figs. 7, 8

11 Kanasewich et al. (1987), Fig. 10

12 Matile and Keller (2007), surficial geology map

13 Craven et al. (2001)

14 Bezys and Conley (1998), insert: Depth to Precambrian Map

15 Nicolas et al. (2010), insert: Schematic cross-section profile by geological period

16 Ferguson et al. (2005b), Fig. 8

17 Nelson et al. (1993), Fig.2

18 Betcher et al. (1995)

19 This line blank

20 White et al. (2005), Figs. 7 and 8

21 Wright et al. (1994), Fig. 3.2 Phanerozoic thickness isopach map

22 Bancroft et al. (2014), Figs. 6, 7, 8

23 Kelbert et al. (2009), Figure 2, global and regional conductivity profile, Canada or North America regional conductivity chosen

24 Converted from resistivity obtained from listed reference source

25 Converted from conductivity obtained, from listed reference source

26 Roberts and Craven (2012), Fig. 5

27 Aiken (1993)

28 Jones et al. (2005), Figs. 5, 11

29 Garcia and Jones (2005), Fig. 7

30 Hammer et al. (2010), p. 832, Fig.2-Chart 1, Fig.7

31 Jones et al. (2014), Figs. 8, 11

32 Johnson et al. (1992), Figs. 20.2 and 20.20

33 Galley et al. (1991), p. 93-97

Appendix 4

Detailed Description of the Earth Resistivity Models for New Brunswick

1. Geological Settings of New Brunswick

Geologically, NB lies within northeastern part of the Appalachian Orogen[14] (Figure 1). The Appalachians evolved through the process of opening and closing of the Late Precambrian (Proterozoic) to Early Paleozoic Iapetus Ocean (pre-Atlantic Ocean), some 600-400 million years ago. Rifting of the proto-North American continent during the Late Precambrian formed the Iapetus Ocean. By the end of the Ordovician (435 ma) plate tectonic movement caused the Iapetus Ocean to be closed shut, and a continent-continent collision (involving proto-North America and Africa) during the Silurian (435-410 ma) and continued deformation into the Devonian (410-360 ma) occurred. Accompanying widespread magmatism gave rise to large intrusions of granitoid rock.

Figure 1. General distribution of the tectonic zones and terranes that comprise the Appalachian Mountains from Newfoundland to Alabama (Eyles and Miall, 2007, Fig. 6.4). Prince Edward Island lies mainly within the Avalon tectonic zone, except for the western edge of the island lying within the Gander Zone. Red dashed line – Logan's Line – is the northern limit of deformed rocks of the Appalachians.

[14] Orogen: a regionally extensive belt of strata that has undergone folding and deformation as a result of the collision of tectonic plates, creating a mountain range.

The resulting continental collisions formed a continuous mountain chain that extended from the southeastern and northeastern USA, through the Canadian Maritime provinces including New Brunswick, Novas Scotia, PEI and Newfoundland, into east Greenland, the Caledonian Mountains of Great Britain and Scandinavia, and the West African Mauritanides. (Petroleum Resources Branch, 1989, after Williams, 1986). Subsequent rifting, starting 200 my ago, formed the Atlantic Ocean and separated North America and Newfoundland from the Europe-Africa continent.

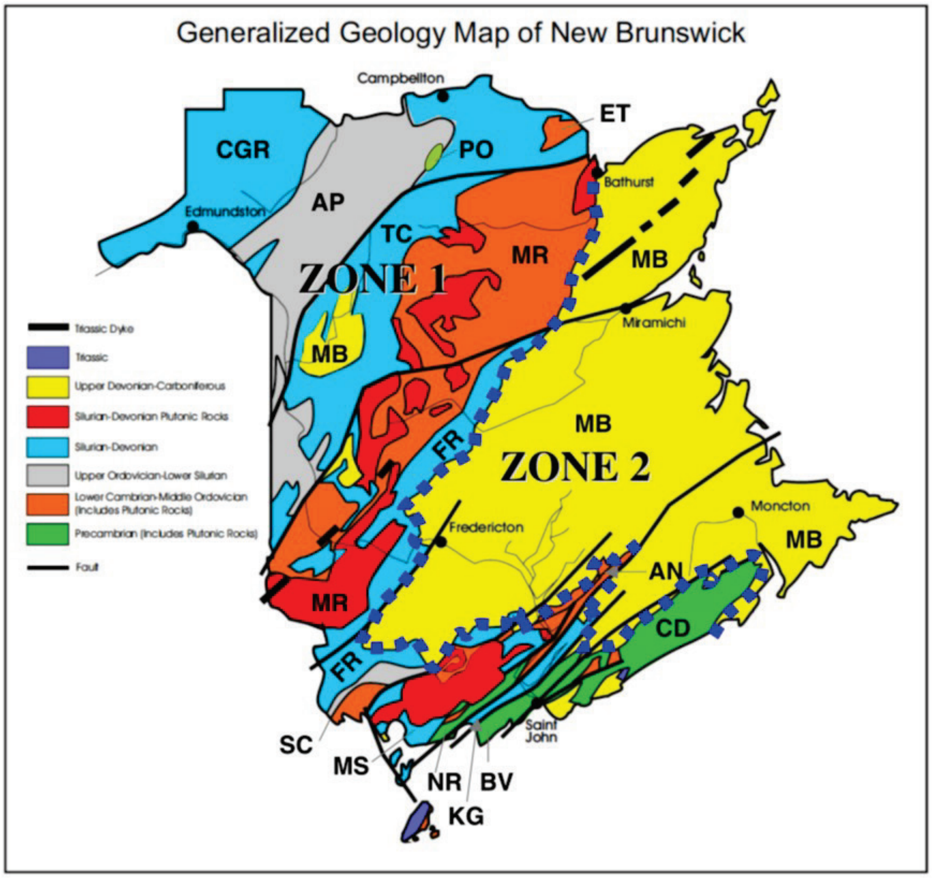
The Appalachian Orogen has been divided into a series of lithotectonic zones trending in a northeasterly direction, each representing a fragment of the Earth's crust brought together by plate-tectonic processes about 600-200 million years ago (Eyles and Miall, 2007).

Rocks of the Appalachian region in Atlantic Canada are divided into four temporal categories: Early Paleozoic and older; middle Paleozoic; late Paleozoic; and, Mesozoic (Williams, 1995). Each category is further divided on basis of lithology and geologic age and setting.

Early Paleozoic and older rocks forming the basement have been divided into five lithotectonic zones that reflect various paleogeographic settings marginal to, and within the early Paleozoic Iapetus Ocean (NB Dept. Natural Res., 2008) (see Figures 1 and 2):

- The Humber zone is underlain by sedimentary rocks deposited along the Laurentian[15] continental margin of ancient North America.
- The Dunnage Zone is made up of remnants of Iapetan island arcs and back-basins, comprised of a structurally complex mix of volcanic and clastic sedimentary rock, with thrust emplaced slices of oceanic crust/mantle rock. In NB, the Dunnage Zone has been subdivided into several subzones (also referred to as terranes) including the Elmtree and Popelogan
- The Gander and Meguma Zones are comprised of clastic sedimentary sequences deposited off the Gondwanan[16] continental margin. In New Brunswick the Gander Zone is about 200 km wide (Williams, 1995) but often intertwined with the Dunnage Zone. Also, in NB the Gander Zone has been divided into Miramichi and St. Croix subzones / terranes.
- The Avalon Zone consists of Precambrian sedimentary and volcanic rocks overlain by Cambrian clastic sediments (shales, sandstones) (NB Dept. Natural Res., 2008; Williams 1995). In New Brunswick and Nova Scotia are found the oldest rocks of the Avalon Zone, as marbles, quartzites and gneisses (Williams, 1995) that underlie the upper Precambrian sedimentary and volcanic rocks.

[15] Laurentia is the North American continent that broke away from the earlier Rodinia supercontinent after 750 Ma (Eyles and Miall, 2007).
[16] Gondwana is the southern part of supercontinent Pangea that was composed of present-day continents India, South America, Africa, Australia and Antarctica (Eyles and Miall, 2007).



AVALON LITHOTECTONIC ZONE			
CD	Caledonia Terrane		
DUNNAGE & HUMBER LITHOTECTONIC ZONE			
BV	Brookville Terrane	MR	Miramichi Terrane
NR	New River Terrane	ET	Elmtree Terrane
AN	Annidale Terrane	PO	Popelogan Terrane
SC	St. Croix Terrane		
SUCCESSOR BASINS (Early Paleozoic)			
FR	Fredericton Trough		
MS	Mascarene		
KG	Kingston		
	Metapedia Basin		
CGR	Connecticut Valley - Gaspe / Restigouche		
TC	Tobique - Chaleur		
AP	Aroostook - Perce		
SUCCESSOR BASINS (Late Paleozoic)			
MB	Maritimes Basin		

Figure 2. Lithotectonic zones, terranes and successor basins underlying New Brunswick (modified from Pronk and Allard, 2003. Coverage area of 1D-layered Earth model zones are also depicted.

As the Iapetus Ocean closed, rocks of the Dunnage, Gander and Avalon Zones were deformed and accreted to the Laurentian continental margin. As well, intrusive rocks (e.g. granites, gabbro) were emplaced into the Avalon, Dunnage and Gander Zones, which in places formed as large batholiths.

During the middle Paleozoic, to the northwest of the Avalon Zone, sedimentary and volcanic rocks were deposited in successor basins (also referred to as "belts") (Figure 2) that remained after destruction of much of the Iapetus Ocean. In central New Brunswick is the Fredericton Trough. In the northern-thirds of New Brunswick the Metapedia Basin covers the older Dunnage and Gander Zones. Within the Avalon Zone, middle Paleozoic basins (e.g. Mascarene Belt) infilled with mostly volcanic rock during accretion of the Meguma Zone to Laurentia (NB Dept. Natural Res., 2008).

The Maritimes Basin (Figures.2 and 3) itself is a composite successor basin, consisting of a series of sedimentary subbasins overlying the collage of earlier Paleozoic continental margin basins and Appalachian lithotectonic crustal zones of varying age and composition (Dietrich et al., 2011). The generally flat-lying clastic sedimentary strata of late Paleozoic time originated from detritus eroded from the uplifted Appalachian Orogen (NB Dept. Natural Res., 2008). About 75 % of the basin area is situated offshore (Hu and Dietrich, 2010). Offshore, up to 12 km of sandstone, conglomerate and shale, strata have accumulated in the Maritime Basin, with lesser amounts of limestone and evaporates (e.g. salt). In New Brunswick, the Maritimes Basin covers much of the eastern half of the province, increasing in depth towards the Atlantic Ocean.

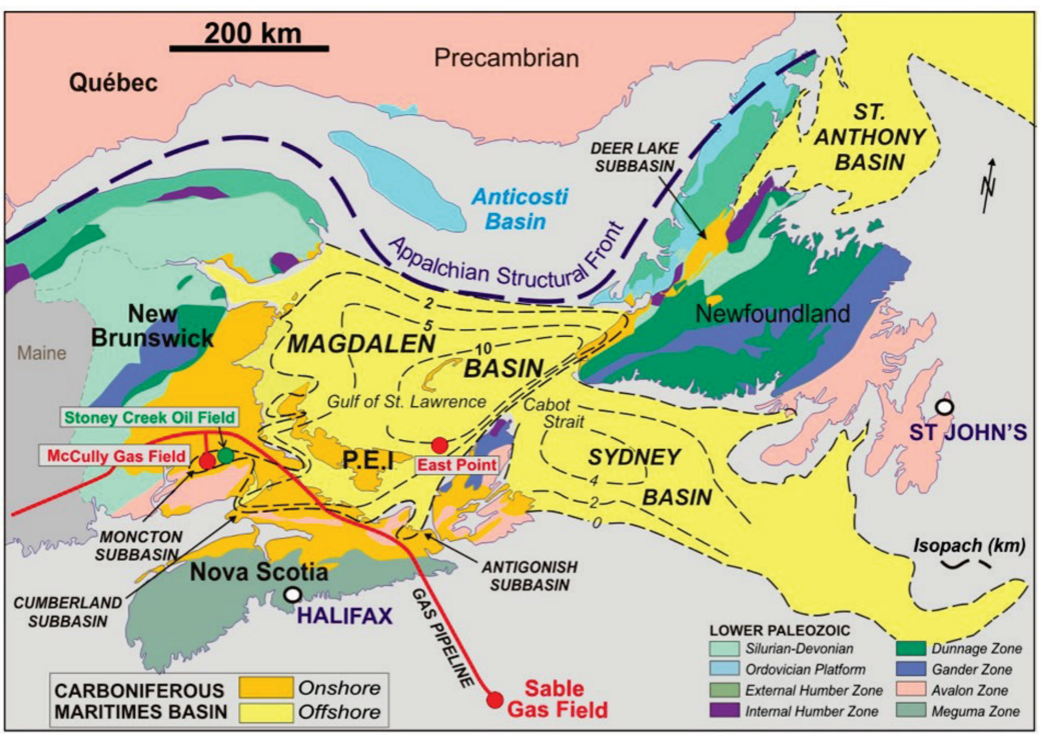


Figure 3. Simple distribution of the tectonic zones that comprise the Canadian portion of the Appalachian region, and coverage of the Maritimes Basin (Dietrich et al., 2009, Fig. 1). Isopach contour lines indicate depth to base of sedimentary basin.

Exposed along the northwest margin of mainland Nova Scotia is the Mesozoic Fundy Basin consisting of “redbed” sandstone and volcanic rocks deposited in a rift valley formed during opening of the modern Atlantic Ocean (NB Dept. Natural Res., 2008). The Fundy Basin lies outside of New Brunswick.
A thin cover of unconsolidated Quaternary glacial deposits, mostly till, overlies most of New Brunswick.

2. Zonal Earth resistivity models

Presented are two one-dimensional (1D) layered Earth models representing the vertical variance of electrical resistivity within the crust and mantle underlying the Province of New Brunswick (NB). One model encompasses that half of NB covered by essentially flat-lying sedimentary strata of the Maritime Basin, whereas the second model includes the remaining portion of the province outside off the covering basin. Beneath and exposed outside of the covering Maritime Basin is a mix of folded sedimentary rocks, volcanic rocks and in areas intrusive rocks, plus older gneissic rock, which has been subdivided into differing terranes (lithotectonic zones) on the basis of geological age and evolutionary history.

Previously, Ferguson and Odwar (1998) prepared a generalized 1D model (Appendix 1) covering all of Atlantic Canada generated from a compilation of crustal-scale conductivity surveys (MT and controlled-source EM) carried out from the late 1970s to mid-1990s.

Sources of Information

For consistency of application of resistivity values for each province, whenever possible local MT survey results were applied with preference to the most recent survey. MT surveys results from nearby provinces or the New England states were used to provide guidance on lower and upper limits to the estimated resistivity value. However, the same lithotectonic zone in different provinces may exhibit considerable higher/lower resistivity values compared to the same zone in New Brunswick. This difference could be due to geological differences and / or vintage of the MT survey. Early MT surveys, prior to 1990, tend to provide coarser resolution and shallower depth compared to recent MT surveys.

Assembly of the New Brunswick 1D models relied on an early regional MT survey (Kurtz and Garland, 1976) comprised of 20 recording sites covering Eastern Canada (including one at St. Antoine in New Brunswick) provided a coarse estimate of crustal resistivity to a depth of about 170 km.

Other MT surveys have been undertaken in New Brunswick. A limited regional MT survey (Srivastava and White, 1971) made soundings in 1966 at Fredericton, Halifax in Nova Scotia and Sable Island. An audio-magnetotelluric survey (Kurtz and Gupta, 1992) over a granitic intrusion in the Miramachi Terrane provided resistivity values to a depth of 32 km, but only over a local area. A detailed 3D model (Queralt et al., 2002) of the Bathurst No.12 base metal mine in New Brunswick was considered to be too limited to assist preparation of a province wide 1D Earth model. No published MT transects post-2000 were identified, however, Jones et al. (2014) prepared bulk-resistivity compilation maps for 20, 40, 100 and 200 km depths covering most of

Canada. Although for New Brunswick it appears that the depth-resistivity map used the same MT data collected in the 1970-1980s, as well as unpublished data for the Fredericton area.

Supplemental information about sub-surface resistivity for the Avalon, Dunnage & Gander Zones in Newfoundland was obtained from an MT transect across the Appalachian Orogen in Newfoundland, undertaken during 1989 and 1991 as part of the Lithoprobe East, part of a trans-Canada investigation of the crust and upper mantle (McNeice, 1998). Information regarding crustal resistivity values of the southern USA Appalachians was obtained from an MT transect prepared by Ogawa et al. (1996).

Depths for overburden – Layer 1 – was assigned by typically selecting half of the maximum general thickness mentioned on surficial geology maps. An estimated resistivity value, based on findings from overburden borehole logs (Crow et al., 2015) through glacially deposited sediments in Fredericton and nearby Cape Breton Island in Nova Scotia, was applied.

Thickness of the sedimentary basin strata – Layer 2 – was obtained from a regional isopach map (Stott and Aitken, 1993), and local stratigraphic cross-sections and petroleum well logs (Smith, 2010; Stewart, 2011) or other notations (Ewing et al, 1966; Srivastava and White, 1971).

Depths of the upper, middle and lower crust – Layers 3 to 5 – were measured off seismic profiles undertaken offshore of New Brunswick and Prince Edward Island (Ewing et al., 1966; Hughes and Hall, 1994; Jackson, 2002). However, because depths varied between different surveys an average was assigned.

Resistivities for the crust (Layers 3 to 5) were obtained from 1D and 2D models prepared by Kurtz and Garland (1976). For comparison purposes, resistivity values for the same crustal layers in Newfoundland (i.e. Avalon Zone) and its equivalent continuation into the southern Appalachians are also presented.

For the uppermost mantle (Layers 6 and 7), the generalized depths of 100 and 250 km was used and resistivity obtained from the coarse determination presented by Kurtz and Garland (1976) and depth-resistivity maps prepared by Jones et al. (2014).

Depths and resistivity for the middle and lower divisions of the upper mantle, transition zones, and lower mantle – Layers 8 to 12 – between 250 and 1000 km were based on the Canada regional conductivities determined by Kelbert et al. (2009).

Presentation of Findings

The 1D layered-Earth models are presented in Tables 1 and 2 summarize individual layer depths, thickness, and resistivity/conductivity for each 1D model, as well as sources of selected values.

Caution should be exercised when comparing resistivity values in New Brunswick versus other Atlantic Canada provinces, because resistivities were estimated from the results of local MT surveys whereby local geology may be considerably different.

3. References

Broster, B.E., Daigle, A.E. and Burtt, G.M., 2013. “Engineering properties of fine-grained estuarine sediments in the Saint John River Valley at Fredericton, New Brunswick, Canada,” *Atlantic Geology*, v. 49, 179-193 doi: 10.4138/atlgeol.2013.010

Crow, H.L, Good, R.L., Hunter, J.A., Burns, R.A., Reman, A., and Russell, H.A.J., 2015. “Borehole geophysical logs in unconsolidated sediments across Canada,” *Geological Survey of Canada*, Open File 7591, 1 .zip file. doi:10.4095/295753

Dietrich, J., Hannigan, P., Hu, K. and Gilles, P., 2009. “Petroleum resource potential of the Carboniferous Maritimes Basin, Eastern Canada,” AAPG Search and Discovery Article #90171, CSPG/CSEG/CWLS GeoConvention 2009, May 4-8, 2009, Calgary, Alberta, Canada, 3 p.

Dietrich, J., Lavoie, D., Hannigan, P. et al., 2011. “Geological setting and resource potential of conventional petroleum plays in Paleozoic basins in eastern Canada,” *Bulletin of Canadian Petroleum Geology*, v.59, no.1, 54-84.

Eyles, N. and Miall, A., 2007. “Canada Rocks” The Geologic Journey”, *Fitzhenry and Whiteside*, 1st Ed., 512 p.

Ewing, G.N., Dainty, A.M., Blanchard, J.E. and Keen, M.J., 1966. “Seismic studies of the eastern seaboard of Canada: the Appalachian system,” *Canadian Journal of Earth* Science, v. 3, 80-109

Ferguson, I. and Odwar, H., 1998. “Appendix 3: Review of conductivity soundings in Canada,” *Geomagnetically Induced Currents: Geomagnetic Hazard Assessment Phase II, Final Report*, Volume 3, (principal author) Boteler, D. H., Geological Survey of Canada and Canadian Electricity Association, 357 T 848A, 121 p.

Government of New Brunswick, 2015a. “Geology of sedimentary basins,” *Energy and Mines*, 2 p.

Government of New Brunswick, 2015c. “Carboniferous Maritime Basin,” *Energy and Mines*, 6 p.

Government of New Brunswick, 2015b. “Geological zonation,” *Energy and Mines*, 1 p.

Fyffe, L.R., Johnson, S.C. and van Staal, C.R., 2011. “A review of proterozoic to Early Paleozoic lithotectonic terranes in the northeastern Appalachiam orogen of New Brunswick, Canada, and their tectonic evolution during Penobscot, Taconic, Salinic, and Acadian rogensis,” *Atlantic Geology*, v. 47, 211-248 dx.doi.org/10.4138/atlgeol.2011.010

Hall, J., Marillier, F. and Dehler, S., 1998. “Geophysical studies of the structure of the Appalachian orogen in the Atlantic borderlands of Canada,” *Canadian Journal of Earth*

Science, v. 35, 1205-1221

Hu, K., Dietrich, J. ,2010. “Petroleum Reservoir Potential of Upper Paleozoic Sandstones in the Offshore Maritimes Basin, Eastern Canada,” *Geological Survey of Canada*, Open File 6679,

Hughes, S. and Hall, J., 1994. “The seismic velocity structure of the Newfoundland Appalachian orogen”, *Journal of Geophysical Research*, v. 99, no. B7, 13633-13653.

Jackson, H.R., Marillier, F. and Hall, J., 1998. “Seismic refraction data in the Gulf of Saint Lawrence: implications for the lower-crustal blocks,” *Canadian Journal of Earth Science*, v. 35, 1222-1237

Jackson, H.R., 2002 “Seismic refraction profiles in the Gulf of Saint Lawrence and implications for extent of continous Grenville lower crust,” *Canadian Journal of Earth Science*, v. 39, 1-17 doi:10.1139/E01-054

Jones, A.G. and Garland, G.D., 1986. “Preliminary interpretation of the upper crustal structure beneath Prince Edward Island”, *Annales Geophysicae*, 4, B, 2, 157-164.

Jones, A.G., Ledo, J., Ferguson, I.A., Craven, J.A., Unsworth, M.J., Chouteau, M. and Spratt, J.E., 2014. “The electrical resistivity of Canada’s lithosphere and correlation with other parameters: contributions from Lithoprobe and other programmes, *Canadian Journal of Earth Science*, v. 51, 573-617, doi:10.1139/cjes-2013-0154

Kelbert, A., Schultz, A., and Egbert, G., 2009. “Global electromagnetic induction constraints on transition-zone water content variations,” *Nature*, v. 460, no. 20, August 2009, 1003-1006. http://dx.doi.org/10.1038/nature08257

Kurtz, R.D, and Garland, G.D., 1976. “Magnetotelluric measurements in eastern Canada”, *Geophys. J. R. Soc*., v. 45, 321-347.

Kurtz, R.D. and Gupta, J.C., 1992. “Shallow and deep crustal conductivity studies in the Miramichi earthquake zone, New Brunswick,” *Canadian Journal of Earth Science*, v. 29, 1549-1564

Marillier, F. and Verhoef, J., 1989. “Crustal thickness under the Gulf of St. Lawrence, northern Appalachians, from gravity and deep seismic data,” *Canadian Journal of Earth Science*, v. 26, 1517-1532

McNeice, G.W., 1998. “Magnetotelluric investigation of the Appalachians, Newfoundland, Canada”, M.Sc thesis, *Memorial University of Newfoundland*, Dept. of Earth Sciences, St. John’s, 207 p. http://collections.mun.ca/PDFs/theses/GaryWayneMcNeice.pdf

New Brunswick Department of Natural Resources, 2008. “Bedrock geology of New Brunswick, *Minerals, Policy and Planning Division*, Map NR-1 (2008 Edition), 1:500000

Ogawa, Y., Jones, A.G., Unsworth, M.J., Booker, J.R., Xinyou, L., Craven, J., Roberts, B., Parmelee, J. and Farquharson, C., 1996. "Deep electrical conductivity structures of the Appalachian orogen in the southern U.S.", *Geophysical Research Letters*, v. 23, no. 13, 1597-1600.

Palacky, G.J., 1988. "Resistivity characteristics of geologic targets" in *Electromagnetic Methods in Applied Geophysics-Theory*, Vol.1, M.N. Nabighian (ed.); Society of Exploration Geophysicists, 53-130.

Petroleum Resources Branch, 1989. "Hydrocarbon potential of the western Newfoundland onshore area", *Department of Energy, Government of Newfoundland and Labrador*, Geofile Number: NFLD/1910, 11p.
http://www.nr.gov.nl.ca/mines&en/publications/onshore/hydrocarbon.pdf

Pronk, A.G. and Allard, S., 2003. "Landscape map of New Brunswick," *New Brunswick Department of Natural Resources and Energy*, Mineral, Policy and Planning division, Map NR-9, scale 1:770000

Queralt, P., Jones, A.G. and Ledo, J., 2002. "Deep electromagnetic imaging of the Bathurst No. 12 deposit, New Brunswick: three-dimensional forward modeling, two-dimensional inversion and sensitivity tests," *Geological Survey of Canada*, Current Research 2002-D8, 8p.

Rampton, V.N., 1984. "Generalized surficial geology map of New Brunswick," *Department of Natural Resources and Energy, Minerals*, Policy and Planning Division, NR-8, scale 1:500000

Shih, K.G., Kay, W., Woodside, J., Jackson, R., Adams, J., Drysdale, J., Bell, J.S. and Podrouzek, A.J. "Crustal thickness, seismicity and stress orientations of the continental margin of Eastern Canada," *Geological Survey of Canada*, map 1710A, scale 1:5000000

Smith, E.A., 2010. "Petroleum" *New Brunswick Department of Natural Resources*, Mineral, Policy and Planning Division, Mineral Commodity profile No. 5, 7p.

Srivastava, S.P. and White, A., 1971. "Inland, coastal, and offshore magnetotelluric measurements in Eastern Canada," *Canadian Journal of Earth Sciences*, v.8, 204-216

Stewart, H.J. 2011. "Petrographic, petrological, and seismic data from the western Sackville Subbasin of the Maritimes Basin, southeastern New Brunswick," *New Brunswick Department of Natural Resources*, Lands, Minerals and Petroleum Division, Open File 2011-2 (CD-ROM), 158 p.

Stott, D.F. and Aitken, J.D. 1993. "Introduction," Chapter 1 in Sedimentary Cover of the Craton in Canada, D.F. Stott and J.D. Aitken (ed.). *Geological Survey of Canada*, Geology of Canada, no.5, p.1-7 (also Geological society of America, The Geology of North America, v. D-1)

Williams, H., 1995. "Temporal and spatial divisions," Chapter 2 in Geology of the Appalachian-Caledonian Orogen in Canada and Greenland (ed.) H. Williams, *Geological Survey of Canada*, Geology of Canada, no.6, 21-44 (also *Geological Society of America*, the Geology of North America, V. F-1)

APPENDIX 1 – Previous 1D Earth Model, Atlantic Canada

From: Ferguson and Odwar (1998)

Geological Unit	Resistivity (Ω.m)		Comments
	Average	Range	
1. Overburden (0-25 m thick)	50	10-100	Conductance is typically 0.05-0.5 S.
2. Upper Crust (0-10 to 15 km)	2,000	500-100,000	Most conductive in sedimentary rocks
3. Middle Crust (15-25 km)	300	10-10,000	Average estimated from a limited number of MT survey results
4. Lower Crust (25-40 km)	300		
5. Mantle (40 km-100 km)	300	<20->300	
6. Mantle (100 km- 400 km)	100		
7. Mantle (400 m - 600 km)	10		

Table A3.5.1: 1D Resistivity Model for Atlantic Canada

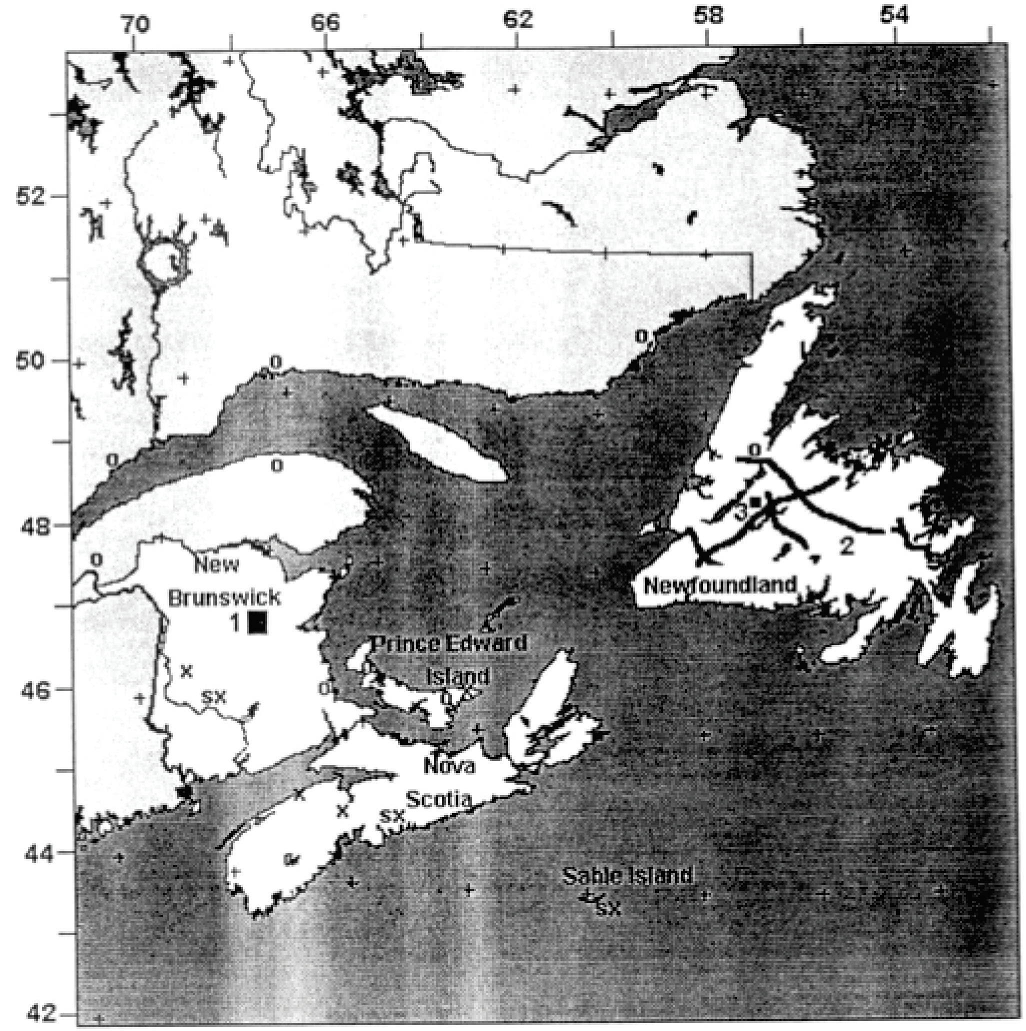


Fig. A3.5.2. Location of large-scale conductivity soundings in Atlantic Canada: New Brunswick, Nova Scotia, Prince Edward Island, and Newfoundland. The numbers and symbols denote the following surveys: **s**=MT site of Srivastava & White (1971); **x**=MT site of Cochrane & Hyndman (1974); **o**=MT site of Kurtz & Garland (1976); **1**=MT survey by Kurtz & Gupta (1992); **2**=MT surveys on LITHOPROBE East Transects (Clowes 1993); and **3**=CSAMT survey of Boerner *et al.* (1993).

Table 1
1D Earth Resistivity Models for New Brunswick – Zone 1

<table>
<tr><th rowspan="2">Layer</th><th>Depth</th><th rowspan="2">Thickness</th><th>Resistivity (ohm-m)</th><th>Conductivity (S/m)</th><th rowspan="2">Comments</th></tr>
<tr><th>Certainty</th><th>Certainty</th><th>Certainty</th></tr>
<tr><td></td><td colspan="5">20 % of Zone 1 (in southeast part of NB) underlain by lithotectonic Avalon Zone (referred to as Caledonia Zone in NB) comprised of Late Precambrian marbles, quartzites and gneisses, and a succession of volcanic and associated intrusive rocks. Overlying the Precambrian rocks are Early Paleozoic shales and sandstones [4, 5]

80 % of Zone 1 (in central NB) underlain by intertwined lithotectonic Dunnage and Gander Zones of Early Paleozoic time. In NB, this area referred to as Ganderia, made up of subzones Brookville, New River, Annidale, St. Croix, Miramichi, Elmtree and Popelogan [8]; comprised of a volcanic rocks mixed with clastic sediments (sandstone, shale, siltstone, some conglomerate), in areas limestone, with plutonic intrusions (especially Miramichi terrane) [8, 4]

Within Ganderia, several Middle Paleozoic successor basins were formed, overlying the Avalon, Dunnage and Gander lithothectonic zones. Strata within the basins is well folded, with some thrust faults and faults [5]. Kingston and Mascarene Basins were infilled with volcanic and interbedded clastic sedimentary rock (conglomerate, shale , sandstone) [8]. Fredericton Trough contains a thick succession of greywackes / turbidites [4, 5]. Northwestern NB underlain by the Restigouche and Tobique-Chaleur successor basins (together referred to as Metapedia Basin). Resitgouche is also a thick succession of clastic sediments with limestone [5] and , whereas Tobique-Chaleur contains volcanic rocks interbedded with clastic sedimentary rock as well as limestones [4, 5]. Metapedia Basin overlies about 35 % of NB.

Undeformed sedimentary basin – Layer 2 – is absent from Zone 1.</td></tr>
</table>

Table 1 (continued)
1D Earth Resistivity Models for New Brunswick - Zone 1

<table>
<tr><th rowspan="2">Layer</th><th>Depth</th><th rowspan="2">Thickness</th><th>Resistivity (ohm-m)</th><th rowspan="2">Conductivity (S/m)</th><th rowspan="2">Comments</th></tr>
<tr><th>Certainty</th><th>Certainty</th></tr>
<tr><td rowspan="2">1. Overburden</td><td>0.5 – 3 m
[1]</td><td rowspan="2">2 m</td><td>25
[2]</td><td>0.04
[24]</td><td>Till blanket (0.5-3 m thick) is predominant, mainly stoney [1]. Edmundston and St. John underlain mostly by till veneer with interspersed bedrock.
Glacial outwash deposits (sand, gravel; typically > 1.5 m thick), overlain by modern alluvial deposits (sand, gravel, some silt, minor clay; generally > 2 m thick) occur along river courses [1].
Assign average 2 m thickness on basis till is the dominant overburden.</td></tr>
<tr><td>[I]</td><td>[II]</td><td colspan="2">Resistivities for tills in Canada range 20-100 ohm.m [17]. Borehole logs reveal range 3-50 ohm.m for glacial overburden in parts of Nova Scotia (Cape Breton Island mostly) and Fredericton [2].
Borehole resistivity for glaciolacustrine and alluvial sediments beneath Fredericton, range about 30-125 ohm (midpoint 75 ohm.m) [2]
Assign midpoint 25 ohm.m, based on regional borehole data, on basis till is the dominant overburden; possibly higher due to more resistive stoney till being common in Zone 1. Limits 20, 100 ohm.m.</td></tr>
<tr><td>2. Sedimentary Basin</td><td>absent</td><td>---</td><td>---</td><td>---</td><td>---</td></tr>
</table>

Table 1 (continued)
1D Earth Resistivity Models for New Brunswick - Zone 1

Layer	Depth Certainty	Thickness	Resistivity (ohm-m) Certainty	Conductivity (S/m)	Comments
3. Upper Crust	0 – 9 km [13, 14, 15] [I, II]	9 km	550 [6] [II]	0.001818 [24]	Variety of rock types, including Late Precambrian marbles, quartzites, gneisses, Early Paleozoic succession of volcanics-interbedded clastic sediments, and clastic sediments, and Middle Paleozoic thick accumulations greywacke sedimentary rock. No onshore seismic transects across NB were identified. Scaled from regional seismic profiles situated offshore of NB: * Line 86/1 [14], bottom depth 10 km * Line 88/1 [14], bottom depth 6 km * Line 88-2 [15], bottom depth 9 km Site specific seismic sounding: * Tracadie on Line D [13], bottom depth 10 km Other depths: * Avalon zone on Newfoundland island [7], 12 km * New England (USA) Appalachians [16], 7 km Assign 9 km, average of above depths (10, 6, 9, 10 km)

Table 1 (continued)
1D Earth Resistivity Models for New Brunswick - Zone 1

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m)	Comments
3. Upper Crust (continued)			Resistivity - within New Brunswick: No post-2000s regional MT transects identified. * 1970s regional MT transect [6] indicates 2D resistivity 100 ohm.m at 0-6 km, and 200 ohm.m at 6-30 km depths in northwest NB, and 1000 ohm.m at 2-40 km depth in southeast NB. Choose 550 ohm.m, midpoint of range (100-1000 ohm.m) * 1983 AMT survey [12] in Miramichi area (over a granitic intrusion) delineated 10000 ohm.m to 2.4 km depth, and > 100000 ohm.m between 2.4-19 km depth Resistivity – other locations: * Lithoprobe MT transect [18] across Avalon Zone on island of Newfoundland shows range 400-5000 ohm.m (midpoint 2700 ohm.m), and across combined Dunnage-Gander Zone a resistivity of 27000 ohm.m, range 1000- >100000 ohm.m * Eastern Piedmont terrane (Avalon Zone equivalent) in southern Appalachians, weighted average 800 ohm.m, range 250-1000 ohm.m, at depth of 0~15 km [10] * Inner Piedmont & Blue Ridge terranes (western Dunnage equivalent) in southern Appalachians, weighted average 200 ohm.m, range 100-250 ohm.m for depth of 0~15 km [10] * Valley and Ridge terrane (possible equivalent rocks of Metapedia Basin) in southern Appalachians , weighted average 60 ohm.m, range 50-80 ohm.m [10] Assign 550 ohm.m, based on regional 2D model [6] across Atlantic Canada using limited number of MT survey stations. Limit 100, 10000 ohm.m		

Table 1 (continued)
1D Earth Resistivity Models for New Brunswick - Zone 1

Layer	Depth Certainty	Thickness	Resistivity (ohm-m) Certainty	Conductivity (S/m)	Comments
4. Middle Crust	9 – 30 km [13, 14, 15] [I, II]	21 km	2800 [6] [II]	0.000357 [24]	Scaled from regional seismic profiles situated offshore of NB: * Line 86/1 [14], bottom depth 31 km * Line 88/1 [14], bottom depth 27 km * Line 88-2 [15], bottom depth 17.5 km Site specific seismic sounding: * Tracadie on Line D [13], bottom depth 31.5 km Other depths: * Avalon zone on Newfoundland island [7], 23 km * New England (USA) Appalachians [16], 22 km Assign approx. 30 km, average of above depths (31, 27, 31.5 km)

		Resistivity - within New Brunswick: * 1966 MT survey 1D model for Fredericton suggests 1000 ohm.m between 5 - 100 km depth [19] * 1970s regional MT transect [6] indicates 2D resistivity 200 ohm.m at 6-30 km depth in northwest NB, and 1000 ohm.m at 2-40 km depth in southeast NB. * 1983 AMT survey [12] in Miramichi area delineated > 100000 ohm.m between 2.4-19 km depth, and 10000 ohm.m between 19-32 km * 20-km depth resistivity map shows predominantly 5500 ohm.m [20] Resistivity – other locations: * Lithoprobe MT transect [18] across Avalon Zone on island of Newfoundland shows range 400-5000 ohm.m (midpoint 2700 ohm.m), and across combined Dunnage-Gander Zone a resistivity of 27000 ohm.m, range 1000- >100000 ohm.m * Eastern Piedmont terrane (Avalon Zone equivalent) in southern Appalachians, weighted average approx. 1900 ohm.m, range 30-8000 ohm.m [10] * Inner Piedmont & Blue Ridge terranes (western Dunnage equivalent) in southern Appalachians, weighted average 100 ohm.m, range 30-250 ohm.m [10] * Valley and Ridge terrane (possible equivalent rocks of Metapedia Basin) in southern Applalachians , weighted average 50 ohm.m, range 5-30 ohm.m [10] Assign approx. 2800 ohm.m, midpoint of values (200 [6], 5500 [20] ohm.m). Limits 200, 5500 ohm.m

Table 1 (continued)
1D Earth Resistivity Models for New Brunswick - Zone 1

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m)	Comments
5. Lower Crust	30 – 39 km [14, 15] / [I, II]	9 km	2000 [6] / [II]	0.0005 [24]	Scaled from regional seismic profiles situated offshore of NB: * Line 86/1 [14], bottom depth 41 km * Line 88/1 [14], bottom depth ranges 37-43 km (midpoint 40 km) * Line 88-2 [15], bottom depth 35 km Site specific seismic sounding: * Tracadie on Line D [13], bottom depth 46 km Other depth determinations for NB: * average 42 km depth, calculated from gravity anomaly data [21] * 35 km [22] deep at southern margin of NB Assign approx. 39 km, average of above depths (41, 37, 43, 35 km) determined from more recent seismic surveys Other depths: * Newfoundland island - average of Dunnage and Gander zones [16], 36 km; Avalon zone, 34 km onshore [7] and 40 km offshore [16] * New England Appalachians [16], 35 km

Table 1 (continued)
1D Earth Resistivity Models for New Brunswick - Zone 1

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m)	Comments
5. Lower Crust (continued)					<u>Resistivity - within New Brunswick</u>: * 1966 MT survey 1D model for Fredericton suggests 1000 ohm.m between 5 - 100 km depth [19] * 1970s regional MT transect [6] indicates 2D resistivity 5000 ohm.m at 30-170 km depth in northwest NB, and 1000 ohm.m at 2-40 km depth in southeast NB. * 1983 AMT survey [12] in Miramichi area delineated 300 ohm.m below 32 km * 40-km depth resistivity map shows predominately 3100 ohm.m [20] <u>Resistivity – other locations</u>: * Lithoprobe MT transect [18] across Avalon Zone on island of Newfoundland shows 15 ohm.m and across combined Dunnage-Gander Zone a weighted average resistivity of 610 ohm.m and range 100-5000 ohm.m * Eastern Piedmont terrane (Avalon Zone equivalent) in southern Appalachians, weighted average approx. 275 ohm.m, range 30-1000 ohm.m [10] * Inner Piedmont & Blue Ridge terranes (western Dunnage equivalent) in southern Appalachians, weighted average 200 ohm.m, range 30-1000 ohm.m [10] * Valley and Ridge terrane (possible equivalent rocks of Metapedia Basin) in southern Applalachians , weighted average 825 ohm.m, range 80-1000 ohm.m [10] Assign approx. 2000 ohm.m, midpoint of values (1000 [6], 3100 ohm.m [20]). Limits 1000, 3100 ohm.m

Table 1 (continued)
1D Earth Resistivity Models for New Brunswick - Zone 1

Layer	Depth Certainty	Thickness	Resistivity (ohm-m) Certainty	Conductivity (S/m)	Comments
6. Upper Mantle	39 - 100 km [23] [III]	61 km	500 [6] [II]	0.002 [24]	Upper depth scaled from seismic transects [14, 15]. Used generalized lower depth of 100 km [23]. Resistivity - within New Brunswick: * 1966 MT survey 1D model for Fredericton suggests 1000 ohm.m between 5 - 100 km depth [19] * 1970s regional MT transect [6] indicates 2D resistivity 5000 ohm.m at 30-170 km depth in northwest NB, and 100 ohm.m at 40-95 km depth in southeast NB * 1983 AMT survey [12] in Miramichi area delineated 300 ohm.m below 32 km * 100-km depth resistivity map shows predominately > 3100 ohm.m, [20] Resistivity – other locations: * Lithoprobe MT transect [18] across Avalon Zone on island of Newfoundland shows continuation of 15 ohm.m to depth of 45 km, and 600 ohm.m across combined Dunnage-Gander Zones based on average of 11 1D models * Eastern Piedmont terrane (Avalon Zone equivalent) in southern Appalachians, weighted average approx. 1200 ohm.m, range 250-3000 ohm.m [10] * Inner Piedmont & Blue Ridge terranes (western Dunnage equivalent) in southern Appalachians, weighted average approx. 200 ohm.m, range 100-1000 ohm.m [10] * Valley and Ridge terrane (possible equivalent rocks of Metapedia Basin) in southern Applalachians , weighted average 180 ohm.m, range 10-1000 ohm.m [10] * Canada regional model indicates 244 ohm.m for depth 0-100 km Assign 500 ohm.m, midpoint of values (100, 1000 ohm.m) based on 1970s 2D regional profile [6]. Limits 10, 3100 ohm.m

Table 1 (continued)
1D Earth Resistivity Models for New Brunswick - Zone 1

Layer	Depth Certainty	Thickness	Resistivity (ohm-m) Certainty	Conductivity (S/m)	Comments
7. Upper Mantle	100 - 250 km [23] [III]	150 km	2800 [20] [II]	0.000357 [24]	Used generalized lower depth of 100 km [23] . Resistivity - within New Brunswick: 100-250 km * 1970s regional MT transect [6] indicates 2D resistivity 5000 ohm.m from 30-170 km depth in northwest NB, and 20 ohm.m below 95 km in southeast NB, calculated midpoint 2500 ohm.m * 200-km depth resistivity map shows predominately > 3100 ohm.m, [20] Resistivity – other locations: * Eastern Piedmont terrane (Avalon Zone equivalent) in southern Appalachians, weighted average approx. 1350 ohm.m, range 30-6000 ohm.m [10] * Inner Piedmont & Blue Ridge terranes (western Dunnage equivalent) in southern Appalachians, weighted average approx. 600 ohm.m, range 50-1000 ohm.m [10] * Valley and Ridge terrane (possible equivalent rocks of Metapedia Basin) in southern Applalachians, predominately 10 ohm.m [10] * Canada regional model indicates 158 ohm.m for depth 100-250 km Assign 2800 ohm.m, average of values (midpoint 2500, 3100 ohm.m), on basis of depth resistivity map and general agreement with 1970s transect, and southern Appalachian resistivity values. Limits 100, 5000 ohm.m

Table 1 (continued)
1D Earth Resistivity Models for New Brunswick - Zone 1

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m)	Conductivity (S/m) / Certainty	Comments
8. Upper Mantle	250–410 km [23] / [III]	160 km	29 [25]	0.0346 [23] / [III]	Assign Canada regional model [23] for all depths and resistivities below 250 km.
9. Transition Zone	410–520 km [23] / [III]	110 km	8 [25]	0.1258 [23] / [III]	Assign Canada regional model
10. Transition Zone	520–670 km [23] / [III]	150 km	2.4 [25]	0.4168 [23] / [III]	Assign Canada regional model
11. Lower Mantle	670–900 km [23] / [III]	230 km	1.12 [25]	0.89125 [23] / [III]	Assign Canada regional model
12. Lower Mantle	900–1000 km [23] / [III]	100 km	0.47 [25]	2.0892 [23] / [III]	Assign Canada regional model

See end of Table 2 for abbreviations and notes

Table 2
1D Earth Resistivity Models for New Brunswick – Zone 2

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m) / Certainty	Comments
	20 % of Zone 2 (in southeast part of NB) underlain by lithotectonic Avalon Zone (referred to as Caledonia Zone in NB) comprised of late Precambrian marbles, quartzites and gneisses, and a succession of volcanic and associated intrusive rocks. Overlying the Precambrian rocks are Lower Paleozoic shales and sandstones [4, 5] 80 % of Zone 2 (in central NB) underlain by intertwined lithotectonic Dunnage and Gander Zones. Exposed bedrock (outside of covering Maritime Basin) comprised of sequences of Lower Paleozoic mafic volcanic rocks and clastic sedimentary rock (shales, sandstones, greywackes, mélanges, turbidites) [5], as well as plutonic intrusive rock in areas. In Zone 2, the Late Devonian-Carboniferous *Maritimes Basin* (model Layer 2) the largest and deepest sedimentary basin in Atlantic Canada underlies east half of New Brunswick. As well, it covers north half of Nova Scotia and parts of western Newfoundland, as well as Gulf of St. Lawrence [3]. In NB are two, onshore, deep subbasins (Moncton, Sackville) [27]. Undeformed except along fault structures in southeastern NB [4], especially within Moncton Subbasin, where also strata more tilted. Sequences of conglomerate, sandstone and siltstone common (especially dominant in upper part of Maritime Basin), with some limestone, evaporates, oil shales and some volcanic rock [8]. Substantial thicknesses of evaporates (potash / halite salt) within Moncton Subbasin [29]. Landscape is low-lying and gently undulating.				

Table 2 (continued)
1D Earth Resistivity Models for New Brunswick - Zone 2

Layer	Depth Certainty	Thickness	Resistivity (ohm-m) Certainty	Conductivity (S/m)	Comments
1. Overburden	0.5 – 3 m [1]	2 m	25 [2]	0.04 [24]	Till blanket (0.5-3 m thick) is predominant, with sandy matrix [1]. Moncton underlain by till. Eastern coastline overlain marine sediments as blanket and plains, consisting of sand, silt, minor clay and gravel, with patchy veneer of organic sediment (overall 0.5-3m thick) [1]. Deposits extend 2 to 20 km inland from coast. Bathurst underlain by marine sediments. Glaciolacustrine (1-10 m thick) and modern alluvial (> 2 m) deposits along major river valleys, consisting of alternating sand, silt, clay and gravels. Fredericton is partially underlain by till, and within the floodplain portion are thick (<60 m) glaciolacustrine and alluvial deposits infilling deep bedrock valley [26]. Assign average 2 m thickness on basis till is the dominant overburden
	[I]		[II]	Resistivities for tills in Canada range 20-100 ohm.m [17]. Borehole logs reveal range 3-50 ohm.m for glacial overburden in parts of Nova Scotia (Cape Breton Island mostly) and Fredericton [2]. Borehole resistivity for glaciolacustrine and alluvial sediments beneath Fredericton, range about 30-125 ohm (midpoint 75 ohm.m) [2] Assign midpoint 25 ohm.m, based on regional borehole data, on basis tills is the dominant overburden; possibly higher due to more resistive sandy till occurring on NB. Limits 20, 100 ohm.m.	

Table 2 (continued)
1D Earth Resistivity Models for New Brunswick - Zone 2

Layer	Depth Certainty	Thickness	Resistivity (ohm-m) Certainty	Conductivity (S/m)	Comments
2. Sedimentary Basin	0 - 1 km [11] [I]	1 km	150 [9] [II]	0.00666 [24]	Sedimentary bedrock consists of red and grey sandstone, siltstone, shale and minor conglomerates; and red soils common throughout the area [28]. Regional basin thickness map shows < 1.5 km, up to < 3 km in extreme SE corner of NB [11], deepening to offshore. Locally up to 4 km [30] deep in McCully natural gas field (east of Sussex), within the Moncton Subbasin. Locally about 2.8 km deep [31] within Sackville Subbasin. About 760 m beneath Fredericton [19]. And 1.8 km deep at Tracadie on NB coastline [13]. Assign overall 1 km thickness on basis that basin wedges deeper to the east.

			<u>Resistivity - within New Brunswick</u>: * 1966 MT survey 1D model for Fredericton suggests 10 ohm.m to 5 km depth [19] * 1970s regional MT transect [6] indicates 2D resistivity 100 ohm.m at 0-6 km depth in northwest NB, and 9 ohm.m at < 2 km depth in southeast NB. Coastal MT site at St. Antoine (N of Moncton) reveals 1D resistivities of 15 and 1.4 ohm.m, at depth < 2 km [6] * 1983 AMT survey [12] in Miramichi area identified 200 ohm.m for nearby 1 km thick Maritime Basin * well log (through Sackville Subbasin) using 90-inch induction array shows range 40-300 ohm (midpoint 170 ohm.m) [31] <u>Resistivity – other locations</u>: * 1970s MT and magnetic variation surveys for a PEI location reveal 9 ohm.m to depth of 3 to 4 km [6, 19]. * 1986 MT survey [9] across PEI reveals 150 ohm.m for “redbed” sandstones and shales (upper Pictou Group) at 0-500 m depth; 10 ohm.m for sandstone-shale-coaly material (lower Pictou Group), between 500-1500 to 2700 m; and, 150 ohm.m for sandstone-shale-coaly material plus underlying sandstone-conglomerate strata, between 2700-4000 m. Assign 150 ohm.m based on more recent MT survey across PEI transecting Maritime / Magdalen Basin lithology which is similar beneath NB, and similar resistivity from well log. Limits 10, 300 ohm.m.

Table 2 (continued)
1D Earth Resistivity Models for New Brunswick - Zone 2

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m)	Comments
3. Upper Crust	1 – 9 km [13, 14, 15] [I, II]	8 km	1000 [6] [II]	0.001 [24]	Variety of rock types, including Late Precambrian marbles, quartzites, gneisses, Early Paleozoic succession of volcanics-interbedded clastic sediments, and clastic sediments. No onshore seismic transects across NB were identified. Scaled from regional seismic profiles situated offshore of NB: * Line 86/1 [14], bottom depth 10 km * Line 88/1 [14], bottom depth 6 km * Line 88-2 [15], bottom depth 9 km Site specific seismic sounding: * Tracadie on Line D [13], bottom depth 10 km Other depths: * Avalon zone on Newfoundland island [7], 12 km * New England (USA) Appalachians [16], 7 km Assign 9 km, average of above depths (10, 6, 9, 10 km)

Table 2 (continued)
1D Earth Resistivity Models for New Brunswick - Zone 2

Layer	Depth Certainty	Thickness	Resistivity (ohm-m) Certainty	Conductivity (S/m)	Comments
3. Upper Crust (continued)					Resistivity - within New Brunswick: No post-2000s regional MT transects identified. * 1966 MT survey 1D model for Fredericton suggests 1000 ohm.m between 5 - 100 km depth [19] * 1970s regional MT transect [6] indicates 2D resistivity 1000 ohm.m at 2-40 km depth in southeast NB. Coastal MT site at St. Antoine (N of Moncton) reveals 1D resistivities of 1000 ohm.m from 2 to 400 km, and 1000 ohm.m from 1 to 43 km depth [6] * 1983 AMT survey [12] in Miramichi area (over a granitic intrusion) delineated 10000 ohm.m to 2.4 km depth, and > 100000 ohm.m between 2.4-19 km depth Resistivity – other locations: * Lithoprobe MT transect [18] across Avalon Zone on island of Newfoundland shows range 400-5000 ohm.m (midpoint 2700 ohm.m), and across combined Dunnage-Gander Zone a resistivity of 27000 ohm.m, range 1000- >100000 ohm.m * Eastern Piedmont terrane (Avalon Zone equivalent) in southern Appalachians, weighted average 800 ohm.m, range 250-1000 ohm.m, at depth of 0~15 km [10] * Inner Piedmont & Blue Ridge terranes (western Dunnage equivalent) in southern Appalachians, weighted average 200 ohm.m, range 100-250 ohm.m for depth of 0~15 km [10] Assign 1000 ohm.m, based on regional 2D model [6] across Atlantic Canada using limited number of MT survey stations. Upper limit 10000 ohm.m

Table 2 (continued)
1D Earth Resistivity Models for New Brunswick - Zone 2

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m)	Comments
4. Middle Crust	9 – 30 km [13, 14, 15] [I, II]	21 km	2000 [6] [II]	0.0005 [24]	Scaled from regional seismic profiles situated offshore of NB: * Line 86/1 [14], bottom depth 31 km * Line 88/1 [14], bottom depth 27 km * Line 88-2 [15], bottom depth 17.5 km Site specific seismic sounding: * Tracadie on Line D [13], bottom depth 31.5 km Other depths: * Avalon zone on Newfoundland island [7], 23 km * New England (USA) Appalachians [16], 22 km Assign approx. 30 km, average of above depths (31, 27, 31.5 km) <u>Resistivity - within New Brunswick</u>: * 1966 MT survey 1D model for Fredericton suggests 1000 ohm.m between 5 - 100 km depth [19] * 1970s regional MT transect [6] indicates 2D resistivity 1000 ohm.m at 2-40 km depth in southeast NB. MT site at St. Antoine (N of Moncton) reveals 1D resistivities of 1000 ohm.m from 2 to 400 km, and 1000 ohm.m from 1 to 43 km depth [6] * 1983 AMT survey [12] in Miramichi area delineated > 100000 ohm.m between 2.4-19 km depth, and 10000 ohm.m between 19-32 km * 20-km depth resistivity map shows range 1000-3500 ohm.m,, predominantly 3000 ohm.m [20] <u>Resistivity – other locations</u>: * Lithoprobe MT transect [18] across Avalon Zone on island of Newfoundland shows resistivity range 7-65 ohm.m (25 ohm.m weighted average), and across combined Dunnage-Gander Zone a weighted average resistivity of 17000 ohm.m, range 1000 - > 100000 ohm.m * Eastern Piedmont terrane (Avalon Zone equivalent) in southern Appalachians, weighted average approx. 1900 ohm.m, range 30-8000 ohm.m [10] * Inner Piedmont & Blue Ridge terranes (western Dunnage equivalent) in southern Appalachians, weighted average 100 ohm.m, range 30-250 ohm.m [10] Assign approx. 2000 ohm.m, midpoint of values (1000, 3000 ohm.m). Limits 200, 3500 ohm.m

Table 2 (continued)
1D Earth Resistivity Models for New Brunswick - Zone 2

Layer	Depth Certainty	Thickness	Resistivity (ohm-m) Certainty	Conductivity (S/m)	Comments
5. Lower Crust	30 – 39 km [14, 15] [II]	9 km	1600 [6] [II]	0.000625 [24]	Scaled from regional seismic profiles situated offshore of NB: * Line 86/1 [14], bottom depth 41 km * Line 88/1 [14], bottom depth ranges 37-43 km (midpoint 40 km) * Line 88-2 [15], bottom depth 35 km Site specific seismic sounding: * Tracadie on Line D [13], bottom depth 46 km Other depth determinations for NB: * average 42 km depth, calculated from gravity anomaly data [21] * 35 km [22] deep at southern margin of NB Assign approx. 39 km, average of above depths (41, 37, 43, 35 km) determined from more recent seismic surveys Other depths: * Newfoundland island - average of Dunnage and Gander zones [16], 36 km; Avalon zone, 34 km onshore [7] and 40 km offshore [16] * New England Appalachians [16], 35 km

Table 2 (continued)
1D Earth Resistivity Models for New Brunswick - Zone 2

Layer	Depth Certainty	Thickness	Resistivity (ohm-m) Certainty	Conductivity (S/m)	Comments
5. Lower Crust (continued)				Resistivity - within New Brunswick: * 1966 MT survey 1D model for Fredericton suggests 1000 ohm.m between 5 - 100 km depth [19] * 1970s regional MT transect [6] indicates 2D 1000 ohm.m at 2-40 km depth in southeast NB. MT site at St. Antoine (N of Moncton) reveals 1D resistivities of 1000 ohm.m from 2 to 400 km, and 1000 ohm.m from 1 to 43 km depth [6] * 1983 AMT survey [12] in Miramichi area delineated 300 ohm.m below 32 km * 40-km depth resistivity map shows range 1000-3500 ohm.m, calculated midpoint 2250 ohm.m [20] Resistivity – other locations: * Lithoprobe MT transect [18] across Avalon Zone on island of Newfoundland shows 15 ohm.m and across combined Dunnage-Gander Zone a weighted average resistivity of 610 ohm.m and range 100-5000 ohm.m * Eastern Piedmont terrane (Avalon Zone equivalent) in southern Appalachians, weighted average approx. 275 ohm.m, range 30-1000 ohm.m [10] * Inner Piedmont & Blue Ridge terranes (western Dunnage equivalent) in southern Appalachians, weighted average 200 ohm.m, range 30-1000 ohm.m [10] Assign approx. 1600 ohm.m, the average of values (1000 [6], midpoint 2250 ohm.m [20]). Limits 1000, 3500 ohm.m	

Table 2 (continued)
1D Earth Resistivity Models for New Brunswick - Zone 2

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m)	Comments
6. Upper Mantle	39 - 100 km [23] [III]	61 km	500 [6] [II]	0.002 [24]	Upper depth scaled from seismic transects [14, 15]. Used generalized lower depth of 100 km [23] Resistivity - within New Brunswick: * 1966 MT survey 1D model for Fredericton suggests 1000 ohm.m between 5 - 100 km depth [19] * 1970s regional MT transect [6] indicates 2D resistivity 5000 ohm.m at 30-170 km depth in northwest NB, and 100 ohm.m at 40-95 km depth in southeast NB. MT site at St. Antoine (N of Moncton) reveals 1D resistivities of 1000 ohm.m from 2 to 400 km, and 50 ohm.m between 43 to 93 km depth [6]. Choose 500 ohm.m, midpoint of range 50-1000 ohm.m * 1983 AMT survey [12] in Miramichi area delineated 300 ohm.m below 32 km * 100-km depth resistivity map shows range 310-3100 ohm.m, midpoint 1700 ohm.m [20] Resistivity – other locations: * Lithoprobe MT transect [18] across Avalon Zone on island of Newfoundland shows continuation of 15 ohm.m to depth of 45 km, and 600 ohm.m across combined Dunnage-Gander Zones based on average of 11 1D models * Eastern Piedmont terrane (Avalon Zone equivalent) in southern Appalachians, weighted average approx. 1200 ohm.m, range 250-3000 ohm.m [10] * Inner Piedmont & Blue Ridge terranes (western Dunnage equivalent) in southern Appalachians, weighted average approx. 200 ohm.m, range 100-1000 ohm.m [10] * Canada regional model indicates 244 ohm.m for depth 0-100 km Assign 500 ohm.m, midpoint of values (50, 1000 ohm.m) based on 1D profile at St. Antoine. Limits 50, 3100 ohm.m

Table 2 (continued)
1D Earth Resistivity Models for New Brunswick - Zone 2

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m)	Comments
7. Upper Mantle	100 - 250 km [23]	150 km	1700 [8]	0.000588 [24]	Used generalized lower depth of 100 km [23]
	[III]		[II]	Resistivity - within New Brunswick: * 1970s regional MT transect [6] indicates 2D resistivity 5000 ohm.m from 30-170 km depth in northwest NB, and 20 ohm.m below 95 km in southeast NB, calculated midpoint 2500 ohm.m * 200-km depth resistivity map shows range 310-3100 ohm.m, midpoint 1700 ohm.m [20] Resistivity – other locations: * Eastern Piedmont terrane (Avalon Zone equivalent) in southern Appalachians, weighted average approx. 1350 ohm.m, range 30-6000 ohm.m [10] * Inner Piedmont & Blue Ridge terranes (western Dunnage equivalent) in southern Appalachians, weighted average approx. 600 ohm.m, range 50-1000 ohm.m [10] * Canada regional model indicates 158 ohm.m for depth 100-250 km Assign midpoint 1700 ohm.m, on basis of depth resistivity map and general agreement with 1970s transect, and southern Appalachian resistivity values. Limits 310, 3100 ohm.m	

Table 2 (continued)
1D Earth Resistivity Models for New Brunswick - Zone 2

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m)	Conductivity (S/m) / Certainty	Comments
8. Upper Mantle	250–410 km [23] / [III]	160 km	29 [25]	0.0346 [23] / [III]	Assign Canada regional model [23] for all depths and resistivities below 250 km.
9. Transition Zone	410–520 km [23] / [III]	110 km	8 [25]	0.1258 [23] / [III]	Assign Canada regional model
10. Transition Zone	520–670 km [23] / [III]	150 km	2.4 [25]	0.4168 [23] / [III]	Assign Canada regional model
11. Lower Mantle	670–900 km [23] / [III]	230 km	1.12 [25]	0.89125 [23] / [III]	Assign Canada regional model
12. Lower Mantle	900–1000 km [23] / [III]	100 km	0.47 [25]	2.0892 [23] / [III]	Assign Canada regional model

Table 2 (continued)
1D Earth Resistivity Models for New Brunswick - Zone 2

NOTES:
Depth Certainty
- I = best representation
  - * overburden: geological report/map coverage of local area.
  - * crust: seismic/gravity transects crossing local area
- II = likely representative
  - * crust/upper mantle: geological and/or seismic transect of a regional nature.
- III = possibly representative (measurements from general compilations).

Resistivity/Conductivity Certainty
- I = best representation (measurements from site or nearby).
  - * overburden: resistivity measurement by surface geophysical method and/or borehole in local area.
  - * crust: resistivity measurement from resistivity survey, MT survey and/or borehole in local area.
- II = likely representative (resistivity values extrapolated from measurements taken at some distance from the site, typically greater than 100 km).
  - * overburden: resistivity value obtained by geophysical measurement, including borehole logs.
  - * sedimentary basin: value obtained by geophysical survey using variety of geophysical electromagnetic methods, including MT.
  - * crust: value obtained by regional MT survey.
- III = possibly representative (measurements from general compilations

Table 2 (continued)
1D Earth Resistivity Models for New Brunswick - Zone 2

CITED REFERENCES

1 Rampton (1984), surficial geology map
2 Crow et al. (2015)
3 Eyles and Miall (2007)
4 Gov't of New Brunswick (2015b)
5 Williams (1995)
6 Kurtz and Garland (1976), Fig. 13, 22
7 Hughes et al. (1994), Fig. 15
8 Fyffe et al. (2011)
9 Jones and Garland (1986), Table 1, Fig. 9
10 Ogawa et al. (1996), Fig. 4
11 Stott and Aitken (1993), Fig. 1.1
12 Kurtz and Gupta (1992)
13 Ewing et al. (1966), Table III
14 Hall et al. (1998), Figs. 1, 2
15 Jackson (2002), Fig. 3
16 Jackson et al. (1998) Fig. 11
17 Palacky (1988)
18 McNeice (1998) including Figs. 5.3, 6.5, 6.11, 6.15, 6.17, 6.22 and 7.1
19 Srivastava and White (1971)
20 Jones et al. (2014), Figs. 9, 11
21 Marillier and Verhoef (1989), Fig. 7
22 Shih et al. (1988), crustal thickness map
23 Kelbert et al. (2009), Fig. 2, global and regional conductivity profile, Canada regional conductivity chosen
24 Converted from resistivity obtained from listed reference source
25 Converted from conductivity obtained from listed reference source
26 Broster, Daigle and Burtt (2013)
27 Gov't of New Brunswick (2015a)
28 Pronk and Allard (2003), landscape map
29 Gov't of New Brunswick (2015c)
30 Smith (2010)
31 Stewart (2011), table 2, drill logs

Appendix 5

Detailed Description of the Earth Resistivity Models for Newfoundland and Labrador

1. Geological Settings of the Newfoundland and Labrador (island only)

The tectonic zones areas making up the island of Newfoundland are presented in Figure 1 with the identification of the locations (zones) of the developed layered Earth models. For one of the tectonic zones, three separate variants are provided to accommodate notable lithological differences in the upper crust. A fourth model represents the entire island based on an averaging of the three individual zones.

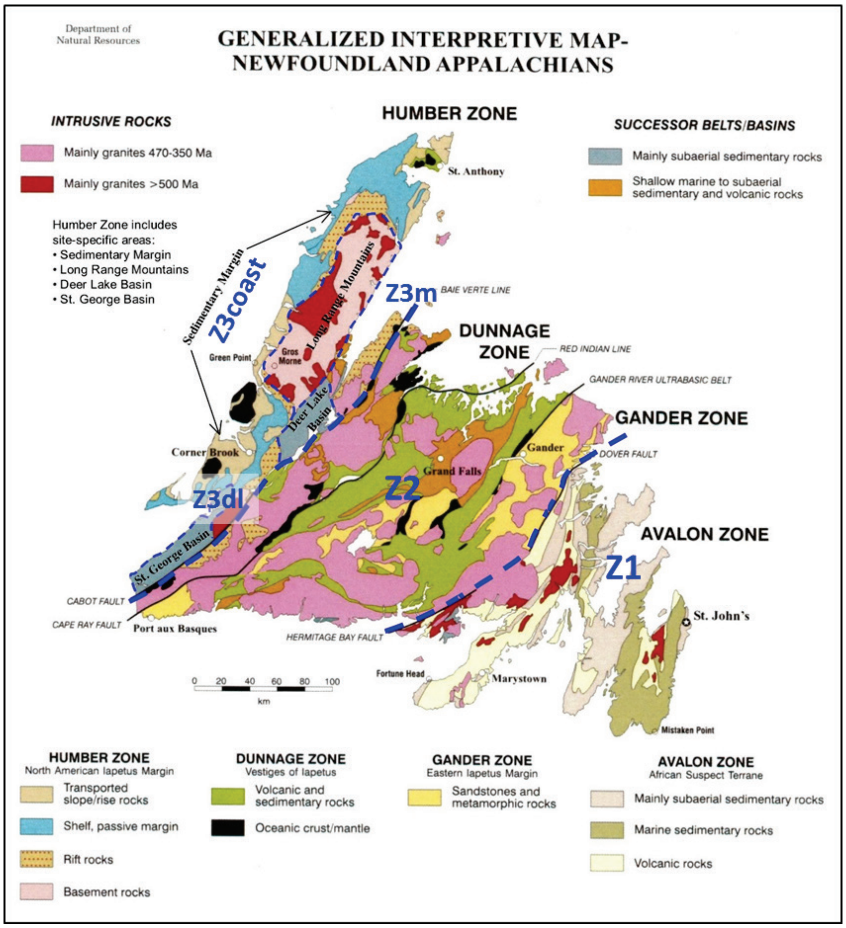


Figure 1. Major rock types and tectonic terranes (zones) underlying island of Newfoundland (Williams, 2004). Magnetic observatory located at St. John's. Areas of coverage for the three major 1D Earth models coincide with tectonic terranes, Avalon Zone, Dunnage-Gander Zone and Humber Zone.Zone 3 is sub-divided into 3 sub-Zones.

The island of Newfoundland has been divided into a series of zones trending in a northeasterly direction, each representing a fragment of the Earth's crust brought together by plate-tectonic processes about 600-200 million years ago (Eyles and Miall, 2007). Newfoundland's west coast was originally part of the ancient North American continent, the eastern part of the island was originally part of an ancient Africa-Europe continent, whereas central Newfoundland was ocean floor and volcanic islands that once lay between the continental margins. Thrust faults have placed some oceanic crustal and mantle rock over continental sedimentary strata. Rising magma during and after continental collision emplaced large granite bodies in central and western Newfoundland. The result is a complex geology.

The island encompasses the northeastern part of the Appalachian Orogen[17]. The Appalachians evolved through the process of opening and closing of the Late Precambrian (Proterozoic) to Early Paleozoic Iapetus Ocean (pre-Atlantic Ocean), some 600-400 million years ago. Rifting of the proto-North American continent during the Late Precambrian formed the Iapetus Ocean. By the end of the Ordovician (435 ma) plate tectonic movement caused the Iapetus Ocean to be closed shut, and a continent-continent collision (involving proto-North America and Africa) during the Silurian (435-410 ma) and continued deformation into the Devonian (410-360 ma) occurred. Accompanying widespread magmatism gave rise to large intrusions of granitoid rock, particularly in the central part of Newfoundland.

Figure 2. General distribution of the tectonic zones and terranes that comprise the Appalachian Mountains from Newfoundland to Alabama (Eyles and Miall, 2007, Fig. 6.4). Red dashed line – Logan's Line – is the northern limit of deformed rocks of the Appalachians.

---

[17] Orogen: a regionally extensive belt of strata that has undergone folding and deformation as a result of the collision of tectonic plates, creating a mountain range.

The resulting continental collisions formed a continuous mountain chain that extended from the southeastern and northeastern USA (Figure 2), through the Canadian Maritime provinces and Newfoundland, into east Greenland, the Caledonian Mountains of Great Britain and Scandinavia, and the West African Mauritanides. (Petroleum Resources Branch, 1989, after Williams, 1986). Subsequent rifting, starting 200 my ago, formed the Atlantic Ocean and separated North America and Newfoundland from the Europe-Africa continent.

Overburden enveloping the island of Newfoundland is mostly glacial drift, being a till. Depending on the source of information, a till veneer (< 2 m thick) covers the island, with a till blanket (>2 m) over the central core (Fulton, 1995). However, Grant (1989) shows a more extensive coverage of the till blanket. Underlying 85 % of the City of St. John's is a till veneer (King, 1990). Thicker and localized accumulations of Quaternary overburden consisting of glacial tills, usually overlain by glaciolacustrine, glaciofluvial and recent fluvial deposits occur in major river valleys, such as the Humber River basin northeast of Cornerbrook where thicknesses ranging 25-120 m occur (Batterson, 2003).

The western and southern coastline is predominantly bedrock, with limited overburden of marine lag sediment along part of the northwestern coast. As well, the Great Northern Highlands and Long Range Mountains of western Newfoundland usually lack overburden, but may have in areas a discontinuous till veneer. Wetland bogs and fens are common throughout Newfoundland, including the St. John's area, with depths usually < 2m but can reach 5-10m depths (Batterson, 2003; Grant, 1989; King, 1990).

The island of Newfoundland is underlain predominantly by rocks less than 1 billion years old, the result of the collision of two contrasting Late Proterozoic to Early Paelozoic continental blocks, preserved in western and eastern Newfoundland, and the resulting entrapment of ancient ocean crust and island arcs[18] (Mining Journal, 2009). Vestiges of the ancient Iapetus Ocean are found in the central part of the island. Collision resulted in wide-spread magmatism and placement of large bodies of granitoid intrusions, especially in the central part of the island.

The island of Newfoundland has been divided into four major zones based on lithologic characteristics and tectonic history (Williams, 1979). These are, from west to east (Petroleum Resources Branch, 1989; Mining Journal, 2009):

1. Humber Zone: represents the early continental shelf and rifted eastern margin of the ancient North American continent.

   Grenville-age crystalline basement rock (gneiss) are overlain by Cambrian-Ordovician carbonate (limestone, dolostone) and clastic sedimentary (shale, sandstone, conglomerate) rock. The sediments represent the western passive margin of the Iapetus Ocean, deposited on the continental shelf of ancient North America, and later deformed into a fold and thrust belt during development of the Appalachian Orogen. Also

[18] Island Arc: archipelago composed of an arc-shaped chain of volcanoes situated at boundary of two converging tectonic plates.

incorporated into the Humber zone are thrusted stacks of basal slices of "nearby continental margin rocks and ophiolites[19]" (McNeice, 1998).

2. Dunnage Zone: interpreted to represent remnants – island arc volcanics, sediments and oceanic crust – of the Iapetus Ocean which were accreted to the ancient North American continent. Flakes of oceanic crust (ophiolite sequence) were incorporated as a result of thrust faulting. In places, the Dunnage Zone overlies the Gander Zone.

   Dominantly mafic volcanics and associated marine clastic sediments (conglomerate, sandstone, siltstone) and melange (blocks of volcanic and sedimentary rocks) that records the development of Cambrian to mid-Ordovician crust of the ancient Iapetus Ocean. These rocks overlie an ophiolitic sequence

3. Gander Zone: represents a continental prism of sediment developed on the southeastern margin of the Iapetus Ocean.

   A thick sequence of mostly pre-Middle and Middle Ordovician poly-deformed, metamorphosed, quartz-rich clastic sedimentary (quartzite) that grade eastward into schists, gneiss and migmatitie. The Gander Zone also occurs as windows within the Dunnage Zone.

4. Avalon Zone: interpreted to be a fragment of pan-African terrane that formed the southeastern margin of the Iapetus Ocean. It was rifted away from Africa and into the Iapetus Ocean before being accreted onto eastern Canada (including Newfoundland) as the ocean closed and its crust subducted (Eyles and Miall, 2007).

   Late Precambrian volcanic (flows, ejecta) and clastic sedimentary rock (sandstone, siltstone, shale) is overlain by Cambrian and Ordovician fine-grained clastic sedimentary rock.

The closing of the Iapetus Ocean and resulting accretion of island arc terranes led to widespread magmatism and deformation throughout much of Newfoundland, including the intrusion of large bodies of granitoid bodies particularly in the Dunnage and Gander Zones. As a result of accretion, the crust in Newfoundland is an amalgam of differing origin.

Crustal scale cross-island faults form the boundaries between the tectonic zones, and some of the subzones within, as well as marking sharp lateral changes of crustal conductivity. These include the following:

- Long Range Fault / Cabot Fault and Baie Verte Line, separates the Humber and Dunnage zones, and marks a change from continental crust (Humber Zone) to crust of oceanic origin (Dunnage Zone). The result is a juxtaposition of Precambrian rock against younger Devonian age rock.
- Red Indian Line, boundary between the Notre Dame subzone and Exploits subzone of the Dunnage Zone, extending to approximately 6 km depth or greater (McNeice, 1998).

[19] Ophiolite: Blocks of oceanic crust (lava and sediments) and upper mantle that were sheared off and thrust inland (sometimes over younger rock), as a result of ocean closure between converging continents and/or island arcs.

- Noel Paul's Line, marks boundary between the Exploit and Meelpaeg subzones within the Dunnage Zone, and converges with the Red Indian Line.
- Dover Fault, a near-vertical boundary separating the Gander Zone from the Avalon Zone and extending to a mid-crustal depth of at least 20 km.
- The Heritage Bay fault is interpreted to be the southern extension of the Dover Fault, also separating the Gander and Avalon Zones.

Significant changes of electrical conductivity are reported to occur along strike of these faults (McNeice, 1998).

As a result of strike-slip and extension movement along the Cabot Fault, intermontane basins of Late Devonian to possibly Permian age, such as the Deer Lake and Bay St. George Basins, were formed (Wright et al., 1996). The basins were infilled mainly by detritus eroded off the surrounding mountains.

Conductive Anomalies in Crust

In the upper crust anomalous conductive areas, associated with conductive (usually shale) sediments, are found on the Avalon Peninsula, between the Red Indian Line ad Noel Paul's Line, the Deer Lake Basin (see Figure 3 for locations and resistivity value). On the Avalon, the upper crust consists of alternating resistive and conductive layers (McNeice, 1998). The upper 3 km of the Deer Lake Basin exhibits a resistivity of < 15 ohm.m, in which multiple black shale beds are found in the clastic sedimentary strata infilling the basin (Martin, 2001).

Large mid- to lower crustal anomalies (1-30 ohm.m) are evident within each of the three tectonic zones (Figure 3), but is most conductive for the Avalon Zone. McNeice (1998) remarked that cause of the conductors is unresolved but suggested strike-slip movement along the crustal-scale faults may have juxtaposed crust of contrasting electrical characteristics. Accretion of micro-continents during the formation of the Appalachians may have subjected sediments, abundant in electrically conductive carbon and sulphides, to unique deformation and metamorphic conditions along the collision zone resulting in these anomalies. For example, the North American Central Plains (NACP), in western Canada, found at mid-crustal depths is thought to be the result of sulphide mineralization that migrated to fold hinges during compression of host rock. In the case of the NACP, sulphides are interconnected along the length of the fold but disconnected perpendicular to the fold axis such that electrical current flows preferentially along the NACP than across it (Jones et al., 2005). Serpentinized basalts typical of oceanic crustal material have been known to exhibit high electrical conductivity (Cochran and Hyndman, 1974, citing Cox, 1971).

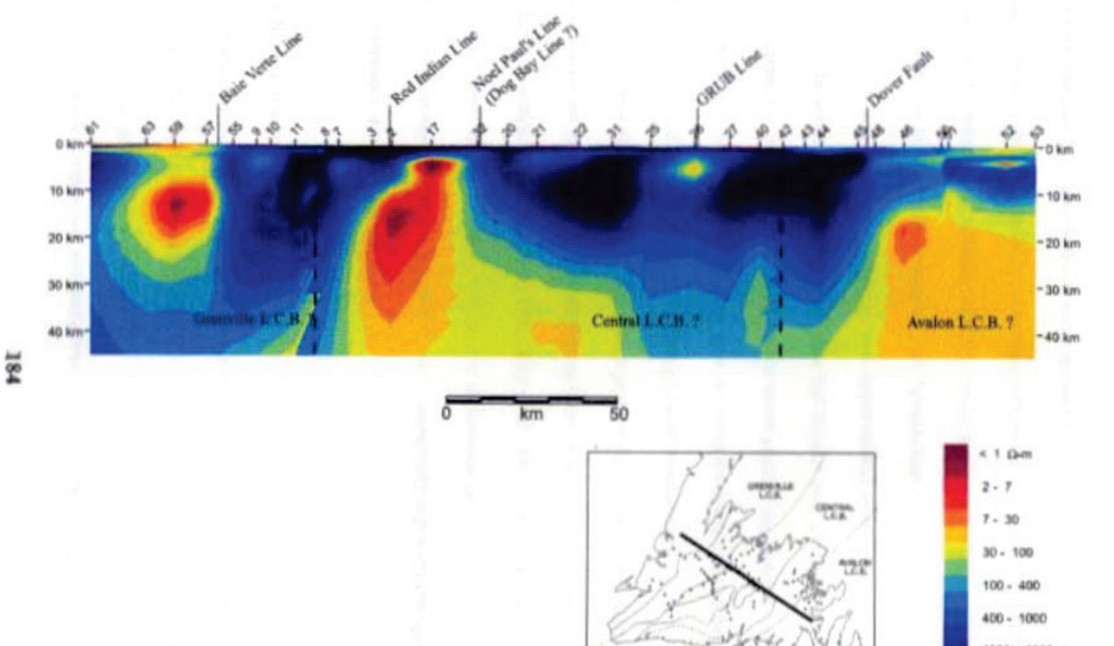


Figure 7.1 Electromagnetic model of the Newfoundland Appalachians, produced by stitching together three inverse models (dashed lines indicate model boundaries). Location of the profile is shown as a black line on the inset map of Newfoundland.

Figure 3. *The Lithoprobe composite 2D electrical resistivity profile across island of Newfoundland, constructed from three 2D inverse models stitched together, utilizing Lithoprobe MT transect data (McNeice, 1998, Fig 7.1). Dashed lines indicate model boundaries. Avalon Zone is right of station 42. Dunnage-Gander zone is between stations 11 to 42, and Humber Zone is left of station 11. Thick black line on insert map shows profile location.*

2. Zonal Earth resistivity models

Presented are three one-dimensional (1D) Earth models representing the vertical variance of electrical resistivity for selected tectonic zones areas making up the island of Newfoundland (Figure 1). For one of the tectonic zones, three separate variants are provided to accommodate notable lithological differences in the upper crust. A fourth model represents the entire island based on an averaging of the three individual zones.

Sources of Information

Assembly of the 1D models relied mainly on the results of a magnetotelluric (MT) transect across the Appalachian Orogen in Newfoundland, undertaken during 1989 and 1991 as part of the Lithoprobe East, part of a trans-Canada investigation of the crust and upper mantle. Data from 77 MT soundings was analyzed by McNeice (1998) to determine the conductivity structure of major tectonic boundaries of the orogen and the regional conductivity structure to a 50 km depth. Recently, Livada et al. (2013) completed a MT survey to investigate the Deer Lake / Howley Basin to a depth of 7 km, in support of petroleum hydrocarbon exploration. Resistivity values for Upper Paleozoic sediments deposited in this successor basin were obtained from this survey.

Supplemental information about sub-surface resistivity elsewhere in Atlantic Canada was obtained from the earlier geomagnetic and MT surveys carried out by Srivastava and White (1971), Hyndman and Cochrane (1971), Cochrane and Hyndman (1974), Bailey et al. (1974), Kurtz and Garland (1976), and Cochran and Wright, (1977). In particular, results from the simple three and four layer 1D inversion models for the Deer Lake (Newfoundland), Prince Edward Island and New Brunswick MT sounding sites were used to generate estimated ranges of resistivity values. A later MT transect (Jones and Garland, 1986) across Prince Edward Island provided more detail about sedimentary rock, to a depth of 4 km, its equivalent occurring on the western coast of Newfoundland. Information regarding crustal resistivity values of the southern USA Appalachians was obtained from an MT transect prepared by Ogawa et al. (1996).

Depths for overburden – Layer 1 – was assigned by typically selecting half of the maximum thickness mentioned on surficial geology maps. An estimated resistivity value, based on findings for glacially deposited sediments elsewhere in Canada (Palacky, 1988), was applied.
A sedimentary basin – Layer 2 – is considered absent in the presented 1D models. For model purposes, a sedimentary basin would comprise a province-wide or larger area of flat-lying to gently dipping strata. Although the sedimentary rock along the west coast of Newfoundland was laid down the same time as the essentially flay-lying St. Lawrence Platform covering parts of Ontario and Quebec, later folding and faulting as a result of the Appalachian Orogen has deformed the strata. Hence, sedimentary rock along Newfoundland's west coast has been included as a subdivision of the upper crust Layer 3.

Depths of the upper, middle and lower crust – Layers 3 to 6 – were measured off seismic profiles carried out across the island of Newfoundland, as part of the Lithoprobe East project (Hughes et al., 1994; Hammer et al., 2010; v.d. Velden et al., 2004). Stratigraphic cross-sections, produced from petroleum exploration activity, were used to determine upper crust depths along the west coast of Newfoundland, and the inshore successor basins (Cooper et al., 2001; Martin, 2001; Energy Branch, 2000).

For western Newfoundland, Layer 3 also includes the Deer Lake and the Bay St. George Basins as separate sub-layers because of their low resistivity characteristics and location along major electrical transmission powerlines.

Resistivities for the crust (Layers 3 to 5) were obtained by visual examination of the 2D inversion profiles produced by McNeice (1998). A mid-point value of the depicted resistivity was selected when there was a gradation and not much spatial variation. If there were areas of considerable differing resistivity then a weighted average was calculated and used as that particular layer's resistivity value. For comparison purposes, resistivity values for the southern Appalachians are also presented.

Depths and resistivity for the middle and lower divisions of the upper mantle, transition zones, and lower mantle – Layers 7 to 12 – between 100 and 1000 km were based on the Canada regional conductivities determined by Kelbert et al. (2009).

Presentation of Findings

The three 1D Earth models covering the island of Newfoundland are presented in Tables 1 to 3 provide individual layer depths, thickness, and resistivity/conductivity for each model, as well as sources and certainty of this data.

3. References

Associated Mining Consultants Ltd., 2004. "Report on the application of electrical and electromagnetic techniques in the design and construction of northern pipelines," *Geological Survey of Canada*, Open File Report (unpublished).

Bailey, R.C., Edwards, R.N., Garland, G.D, Kirtz, R. and Pitcher, D., 1974. "Electrical conductivity studies over a tectonically active area in Eastern Canada", *J. Geomag. Geoelectr*., vol. 26, 125-146.

Batterson, M.J., 2003. "Quaternary geography and sedimentology of the Humber River basin and adjacent areas", *Newfoundland Department of Mines and Energy, Geological Survey*, Report 03-02, 194 p.

Batterson, M.J. and Taylor, D.M., 2004. "Regional till geochemistry and surficial geology of the central Avalon and Bay de Verde peninsulas", Current Research (2004), *Newfoundland Department of Mines and Energy*, *Geological Survey*, Report 04-1, 93-106.

Brushett, D. 2011. "Till geochemistry of the Gander Lake and Gambo map areas (NTS 2D/16 and 2C/13)", Government *of Newfoundland and Labrador, Department of Natural Resources, Geological Survey*, Open File NFLD/3134, 104 pages.

Cochrane, N.A. and Hyndman, R.D., 1974. "Magnetotelluric and magnetovariational studies in Atlantic Canada", *Geophys. J. R. astr. Soc*., v. 39, 385-406.

Cochrane, N.A. and Wright, J.A., 1977. "Geomagnetic sounding near the northern termination of the Appalachian System", *Canadian Journal of Earth Sciences*, v. 14, 2858-2864.

Colman-Sadd, S.P., Hayes, J.P., and Knight, I., 2000. "Geology of the island of Newfoundland (digital version of Map 90-01 with minor revisions)", *Newfoundland Department of Mines and energy, Geological Survey*, Map 2000-30, scale 1:1,000,000.

Cooper, M., Weissenberger, J., Knight, I., Hostad, D., Gillespie, D., Williams, H., Burden, E., Porter-Chaudry, J., Rae, D. and Clark, E., 2001. "Basin evolution in western Newfoundland: new insights from hydrocarbon exploration", *AAPG Bulletin*, v. 85, no. 3, 393-418.

Energy Branch, 2000. "Sedimentary basins and hydrocarbon potential of Newfoundland and Labrador", *Government of Newfoundland and Labrador, Department of Mines and Energy, Energy Branch*, Report 2000-1, 71 p.

Evans, D.T.W. and Kean, B.F. 2002. "The Victoria Lake Supergroup, central Newfoundland - its definition, setting and volcanogenic massive sulphide mineralization", *Newfoundland Department of Mines and Energy, Geological Survey*, Open File NFLD/2790, 68 pages.

Ferguson, I. and Odwar, H., 1998. "Appendix 3: Review of conductivity soundings in Canada," Geomagnetically Induced Currents: Geomagnetic Hazard Assessment Phase II, Final Report, Volume 3, (principal author) Boteler, D. H., *Geological Survey of Canada and Canadian Electricity Association*, 357 T 848A, 121 p.

Fulton, R.J., 1995. "Surficial materials of Canada", *Geological survey of Canada*, Map 1880A, scale 1:5000000

Grant, D.R., 1986a. "Surficial geology, Port Saunders, Newfoundland", *Geological Survey of Canada*, Map 1622A, scale 1;250,000.

Grant, D.R., 1986b. "Surficial geology, St. Anthony – Blanc-Sabion, Newfoundland-Quebec", *Geological Survey of Canada*, Map 1610A, scale 1:125,000.

Grant, D.R. 1989a. Quaternary geology of the Atlantic Appalachian region of Canada. *in* Quaternary Geology of Canada and Greenland, edited by R.J. Fulton, *Geological Survey of Canada*, Geology of Canada, No. 1**,** Chapt. 5**,** pp. 393-440 (Also Geological Society of America, The Geology of North America, Vol. K-1

Grant, D. R., 1989b. "Surficial geology, Sandy Lake – Bay of Islands, Newfoundland", *Geological Survey of Canada*, Map 1664A, scale 1:250,000.

Grant, D.R., 1991. "Surficial geology, Stephenville-Port aux Basques, Newfoundland", *Geological Survey of Canada*, Map 1737A, scale 1:250,000.

Hammer, P.T.C., Clowes, R.M., Cook, F.A., Vasudevan, K. and van der Velden, A.J., 2011. "A lithospheric cross section of the North American continent," supplement to *GSA Today,* v. 21, issue 6, ftp://rock.geosociety.org/pub/GSAToday/1106insert-hammer/G95A_Hammer_Insert_HighRes.pdf

Henderson, E.P., 1974. "Surficial Geology, Avalon Peninsula, Newfoundland", *Geological Survey of Canada*, Map 1320A, scale 1:250000

Hughes, S. and Hall, J., 1994. "The seismic velocity structure of the Newfoundland Appalachian orogen", *Journal of Geophysical Research*, v. 99, no. B7, 13633-13653.

Jones, A.G. and Garland, G.D., 1985. "Preliminary interpretation of the upper crustal structure beneath Prince Edward Island", *Annales Geophysicae*, 4, B, 2, 157-164.

Jones, A. G., Ledo, J. and Ferguson, I. F., 2005. "Electromagnetic images of the Trans-Hudson orogen: the North American Central Plains anomaly revealed," *Canadian Journal of Earth Science*, v. 42, no. 4, 457-478. http://dx.doi.org/10.1139/e05-018

King, A.F., 1990. "Geology of the St. John's area", Report 90-2, *Geological Survey Branch, Dept. of Mines and Energy, Government of Newfoundland and Labrador,* 93 p.

Klassen, R.A. and Murton, J.B., 1996. Quaternary geology of the Buchans area, Newfoundland: implications for mineral exploration, *Canadian Journal of Earth Sciences*, v. 33, 363-377.

Kurtz, R.D, and Garland, G.D., 1976. "Magnetotelluric measurements in eastern Canada", *Geophys. J. R. Soc*., v. 45, 321-347.

Tijana Livada, Charles Hurich, Colin Farquharson, 2013. "Seismic and Magnetotelluric Fieldwork in the Howley Basin", *Memorial University of Newfoundland*, PowerPoint, 21 pages http://www.nr.gov.nl.ca/nr/energy/petroleum/onshore/PEEP/22_Presentation2013.pdf

Liverman, D. and Taylor, D., 1994. "Surficial geology of the St. John's (NTS 1N) and Trepassey (NTS 1K) map areas", *Government of Newfoundland and Labrador, Geological Survey*, Open File NFLD (2422), Map 94-230, scale 1:250,000

Mackay, D. K., 1970. "Electrical resistivity measurements in frozen ground, Mackenzie Delta area, Northwest Territories, in Hydrology of Deltas," *Proceeding of the Bucharest Symposium*, Vol. 2, p.363-375. http://iahs.info/redbooks/a090/iahs_091_0363.pdf.

Martin, C., 2001. "Canada's unexplored lands: Deer Lake basin case study", *Oil and Gas Journal*, v. 99, no. 52, http://www.ogj.com/articles/print/volume-99/issue-52/exploration-development/canadas-unexplored-lands-deer-lake-basin-case-study.html

McNeice, G.W., 1998. "Magnetotelluric investigation of the Appalachians, Newfoundland, Canada", M.Sc thesis, *Memorial University of Newfoundland*, Dept. of Earth Sciences, St. John's, 207 p. http://collections.mun.ca/PDFs/theses/GaryWayneMcNeice.pdf

Mining Journal, 2009. "Diverse geology and rich in minerals" in Newfoundland and Labrador, Canada, *Mining Journal Special Publication*, February 2009, 7-8p. http://www.mining-journal.com/supplements/newfoundland-and-labrador-supplement-0209/diverse-geology-and-rich-in-minerals

Ogawa, Y., Jones, A.G., Unsworth, M.J., Booker, J.R., Xinyou, L., Craven, J., Roberts, B., Parmelee, J. and Farquharson, C., 1996. "Deep electrical conductivity structures of the Appalachian orogen in the southern U.S.", *Geophysical Research Letters*, v. 23, no. 13, 1597-1600.

Palacky, G.J., 1988. "Resistivity characteristics of geologic targets" in *Electromagnetic Methods in Applied Geophysics-Theory*, Vol.1, M.N. Nabighian (ed.); Society of Exploration Geophysicists, 53-130.

Petroleum Resources Branch, 1989. "Hydrocarbon potential of the western Newfoundland onshore area", *Department of Energy, Government of Newfoundland and Labrador*, Geofile Number: NFLD/1910, 11p.
http://www.nr.gov.nl.ca/mines&en/publications/onshore/hydrocarbon.pdf

Scott, W. J., Sellmann, P. V., and Hunter, J. A. 1990. "Geophysics in the study of permafrost," in *Geotechnical and Environmental Geophysics, Vol. 1: Review and Tutorial*, (ed.) S. H. Ward, Society of Exploration Geophysicists, 355-384.

Smith, J.S., Batterson, M.J. and Taylor, D.M. 2009. "Till geochemistry of the south side of the Red Indian Lake basin (NTS map sheets 12A/6, 7, 9, 10, 11, 15 and 16)", *Government of Newfoundland and Labrador, Department of Natural Resources, Geological Survey*, Open File 12A/1449, 152 p.

Srnastava, S.P. and White, A., 1971. "Inland, coastal, and offshore magnetotelluric measurements in Eastern Canada", *Canadian Journal of Earth Sciences*, v. 8, 204-216.

van der Velden, Arie J., van Staal, Cees R. and Cook, F.A., 2004. "Crustal structure, fossil subduction, and the tectonic evolution of the Newfoundland Appalachians: evidence from a reprocessed seismic reflection survey", *GSA Bulletin*, v. 116, no. 11/12; 1485–1498, http://dx.doi.org/10.1130/B25518.1

Williams, H., 1979. "Appalachian orogen in Canada", *Canadian Journal of Earth Sciences*, v. 16, 792-806

Williams, H., 2004. "Generalized interpretive map – Newfoundland Appalachians", Geological Survey of Newfoundland and Labrador
http://www.nr.gov.nl.ca/mines&en/geosurvey/maps/nf.pdf

Wright, J.A., Hoffe, B.H., Langdon, G.S. and Quinlan, G.M., 1996. "The Deer Lake Basin, Newfoundland: structural constraints from new seismic data", *Bulletin of Canadian Petroleum Geology*, v. 44, no. 4, 674-682.
http://archives.datapages.com/data/cspg/data/044/044004/0674.htm

Table 1
1D Earth Resistivity Models for Island of Newfoundland – Avalon Zone

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m) / Certainty	Comments
1. Overburden (City of St. John's)	1 – 3 m [1]	2 m	100 [11]	0.01 [24]	Till veneer, ranges 1-3m thick. Thicker till plains infill topographic depressions, > 3m. Matrix of the till is usually silt dominant. Isolated pockets of organic and peaty soil, < 5m thick [1]. Assigned average 2m thickness.
	[I]		[III]	Resistivities for tills range 20-100 ohm.m [11]. Assigned high-end of range due tills tend to be more rock clast abundant with sandy – silty till matrix.	
1. Overburden (outside of city)	1.5 – 20 m [2]	8 m	100 [11] [III]	0.01 [24]	Till is stoney, extensive and continuous except in higher ground where becomes discontinuous, varying thickness, ranges 1.5-6m [3] usually < 1.5m thick in northern half of peninsula [4]. Central part of peninsula dominated by thicker till blanket > 2m [5], may also range 2-15m and up to 20m thick where occur as till ridges. Glaciofluvial gravel and sand in valleys and outwash plains, 2-80m thick.
	[I]		[III]	Assigned overall 8m average thickness based on 1.5-15m range for tills being dominant. Assigned high-end of resistivity range for tills and presence of higher resistivity glaciofluvial material.	
2. Sedimentary Basin	absent	---	---	---	---

Table 1 (continued)
1D Earth Resistivity Models for Island of Newfoundland – Avalon Zone

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m) / Certainty	Comments
3a. Upper Crust	*Upper Sublayer* 0 – 5 km [6, 36]	*Upper Sublayer* 3 km	*Upper Sublayer* 30 [36]	*Upper Sublayer* 0.03333 [24]	Late Precambrian igneous and sedimentary marine & subaerial clastic rocks overlain in places by Paleozoic shallow marine and terrestrial clastic sedimentary rocks with minor volcanic rock. Scattered, large, granitic intrusions, Late Precambrian-Cambrian and Devonian-Carboniferous age [8]. Upper crust divided into two sub-layers based on Lithoprobe transect MT profile [36]. A more conductive upper sublayer overlying a much resistive lower sublayer imaged in Bonavista peninsula area and which may extend eastward to St. John's area. Bottom depth of Layer 3 scaled from a NW-SE seismic transect. Thickness of uppermost sublayer interpreted from MT results. _Upper Sublayer_ Lithoprobe transect resistivity: Alternating, thin, more conductive (sediments) layers (5-50 ohm.m) at 0-2 km and 5 km depths in Bonavista peninsula area [36]. Other resistivity values: (i) on PEI within continuation of Avalon Zone, resistivity is 9 ohm.m to depth of 4 km, and in NB it's 15 ohm.m to depth of 2 km [6]; (ii) 9 ohm.m to 3 km depth [37] Assigned midpoint value for depth based on range 2-5 km. Assigned midpoint value for resistivity based on range 9-50 ohm.m.
	Lower Sublayer 3 - 12 km [7] [I]	*Lower Sublayer* 9 km	*Lower Sublayer* 2700 [36] [I]	*Lower Sublayer* 0.00037 [24]	

Table 1 (continued)

1D Earth Resistivity Models for Island of Newfoundland – Avalon Zone

Layer	Depth Certainty	Thickness	Resistivity (ohm-m) Certainty	Conductivity (S/m) Certainty	Comments
3b. Upper Crust	3 - 12 km [7] [I]	9 km	2700 [36] [I]	0.00037 [24]	*Lower Sublayer* Lithoprobe transect resistivity: dominantly ranges 400-5000 ohm.m [36]. Assigned midpoint value. Other resistivity values: Eastern Piedmont terrane (Avalon Zone equivalent) in southern Appalachians, 800 ohm.m for depth of 0~15 km [10].
4. Middle Crust	12 - 23 km [7] [I]	11 km	25 [36] [I]	0.04 [24]	Depth scaled from seismic transect. Lithoprobe transect resistivity: distinct low resistivity ranges 7-65 ohm.m [36]. Isolated 7 ohm.m body near west margin of zone, 15-23 km deep. Assigned weighted average value. Other resistivity values: (i) On PEI and NB within continuation of Avalon Zone, resistivity ranges 50-500 ohm at depth 4-44 km, and 1000 ohm at depth 1-44 km [6]; (ii) Eastern Piedmont terrane (Avalon Zone equivalent) in southern Appalachians, 1000-10000 ohm.m for depth of ~15-20 km [10].
5. Lower Crust	23 - 34 km [7] [I]	11 km	15 [36] [I]	0.066666 [24]	Depth scaled from a NW-SE seismic transect. Lithoprobe transect resistivity: dominantly 15 ohm.m [36]. Other resistivity values: (i) Eastern Piedmont terrane (Avalon Zone equivalent) in southern Appalachians, 45-450 ohm.m for depth of 20-45 km [o]; (ii) 1000 ohm.m for depth 3~35 km [37] Assigned upper end of range for Layer 4 is 450 ohm.m.

Table 1 (continued)
1D Earth Resistivity Models for Island of Newfoundland – Avalon Zone

Layer	Depth	Thickness	Resistivity (ohm-m)	Conductivity (S/m)	Comments
	Certainty		Certainty	Certainty	
6. Upper Mantle	34 - 100 km [7, 23]	66 km	200 [6]	0.005 [24]	Upper depth scaled from a NW-SE seismic transect. Crust-mantle boundary figure depicted general depth of 38 km beneath island, reported to range 35-40 km [9]. Used generalized lower depth of 100 km [23]. Lithoprobe transect resistivity: Depicted resistivity extends to depth of approx. 45 km., showing continuation of 15 ohm.m [36].
	[I, II]		[III]		Other resistivity values: (i) On PEI and NB within continuation of Avalon Zone, 50-500 ohm.m at 4-44km, 10-200 ohm.m at 44-94 km, 1000 ohm.m at 1-44 km, and 50 ohm.m at 44-94 km or 100 ohm.m for 30-95 km depth [6], for approx. average 200 ohm.m; (ii) 300 ohm.m. for Atlantic Canada [35], with range <20 to > 300 ohm.m; (iii) 244 ohm at depth of 0-100 ohm.m. for Canada regional model [23]; (iv) Eastern Piedmont terrane (Avalon Zone equivalent) in southern Appalachians, 1000-4000 ohm.m at 45-100 km [10]; (v) 100 ohm.m for depth ~35 –100 km depth for area beneath PEI [37] Assigned average of the midpoint s of the resistivity range values for PEI and NB. Assigned resitivity range for Layer 6 is 25-1000 ohm.m.

Table 1 (continued)
1D Earth Resistivity Models for Island of Newfoundland – Avalon Zone

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m) / Certainty	Comments
7. Upper Mantle	100 - 250 km [23]	150 km	158 [25]	0.0063 [23]	Applied Canada regional model [23] for all depths and resistivities below 100 km. North American craton extends beneath Newfoundland.
	[III]			[III]	Other resistivity values: Eastern Piedmont (Avalon zone equivalent) in southern Appalachians, 1000-7000 ohm.m for depth of 100-150 km, then 30-250 ohm.m for 150-200+ km [10].
8. Upper Mantle	250–410 km [23]	160 km	29 [25]	0.0346 [23]	---
	[III]			[III]	
9. Transition Zone	410–520 km [23]	110 km	8 [25]	0.1258 [23]	---
	[III]			[III]	
10. Transition Zone	520–670 km [23]	150 km	2.4 [25]	0.4168 [23]	---
	[III]			[III]	
11. Lower Mantle	670–900 km [23]	230 km	1.12 [25]	0.89125 [23]	---
	[III]			[III]	
12. Lower Mantle	900–1000 km [23]	100 km	0.47 [25]	2.0892 [23]	---
	[III]			[III]	

See end of Table 3 for abbreviations and notes.

Table 2
1D Earth Resistivity Model for Island of Newfoundland – Dunnage & Gander Zones

Layer	Depth Certainty	Thickness	Resistivity (ohm-m) Certainty	Conductivity (S/m) Certainty	Comments
1. Overburden	0 – 50+ m	5 m	100 [11]	0.01 [24]	Variable distribution and thickness and type. Comprised dominantly of till, lesser glaciofluvial sand and gravel in valleys, glaciolacustrine silt and clay, and organics [12]. Till blanket is predominant, extensive and thicker inland, discontinuous and veneer towards coast [14]. Till blanket > 2m overall [5], 5-10m [15] over much of central core of island, 2-10m in Red Indian Lake area [12]. Overburden 2-50m thick south of Springdale [15], thick accumulation in Buchans area, 8>50m [16]. Assigned midpoint of possibly common thickness range 2-10m.
	[I]		[III]		Resistivity ranges for surficial deposit are: tills 20-100 ohm.m [11]; mixed sand and gravel beach, 15-80 ohm.m [18]; sand, 80-150 ohm [19]; gravel 200-1000 ohm.m [11, 20]. Assigned high-end of resistivity range for tills, reflecting likely predominance of clasts derived from expansive granitic bedrock. Resistivity may be higher where thick glaciofluvial deposits occur.
2. Sedimentary Basin	absent	---	---	---	---

Table 2 (continued)
1D Earth Resistivity Models for Island of Newfoundland – Dunnage & Gander Zones

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m) / Certainty	Comments
3. Upper Crust - Basement	0 - 8 km [7]	8 km	27000 [36]	0.000037 [24]	Crustal depths scaled from a NW-SE seismic transect. Variable thickness, 12 km on east half, 3 km at west-central portion and 6.5 km at western margin. Assigned an overall weighted thickness value.
	[I]		[I]	Dunnage Zone is a structurally complex mix of volcanic flow, volcanoclastic and clastic sedimentary rock of early Ordovician age, with thrust emplaced slices of oceanic crust/mantle rock. Gander Zone consists of early Paleozoic clastic sedimentary rock (sandstones, siltstone) with metamorphosed equivalents. Both Dunnage and Gander Zones extensively (50%) intruded by mostly granitic rock of Ordovician to Carboniferous ages. Lithoprobe transect resistivity: Separate areas of very high resistivity (>100000 ohm.m) to very conductive (< 5 ohm.m) within surrounding 1000-5000 ohm.m [36]. Assigned weighted average value. Assigned resitivity range for Layer 3 is 1000-100,000 ohm.m Near surface conductor (< 5 ohm.m) between RIL and NPL expands with depth, coincides with graphitic / black shales of the Victoria Supergroup sediments [36, 21]. Highly resistive areas generally coincide with bodies of intrusive rock. Other resistivity values: (i) ranges 3100-11500 ohm.m at western margin of zone, at 1.5-7.5 km depth [22]; (ii) ranges 6000-9000 ohm.m, at depth 0-11 km in north-central Nfld [36]; (iii) Inner Piedmont & Blue Ridge terranes (western Dunnage equivalent) in southern Appalachians, 250-450 ohm.m for depth of 0~15 km [10]; (iv) 100 ohm.m to 6 km depth for area of NB to Gaspe-Quebec [37]	

Table 2 (continued)
1D Earth Resistivity Models for Island of Newfoundland – Dunnage & Gander Zones

Layer	Depth Certainty	Thickness	Resistivity (ohm-m) Certainty	Conductivity (S/m) Certainty	Comments
4. Middle Crust	8 - 22 km [7] [I]	14 km	17000 [36] [I]	0.0000588 [24]	Depth to layer bottom varies 21-23km. Variable thickness, 11 km on east half, increases to about 18 km in west-central portion, then diminish to 14.5 km at western margin. Assigned an overall weighted thickness value. Lithoprobe transect resistivity: Continuation of separate high resistivity (> 100,000 ohm.m) areas, but diminishes with depth. Conductor (2-30 ohm.m), between RIL and NPL, expanding with depth; origin of conductor unknown. Elsewhere resistivity ranges 1000-5000 ohm.m. Assigned weighted average value. Assigned resitivity range for Layer 4 is 1000-100,000 ohm.m Other resistivity values: (i) 600 ohm.m, at depth 11-20 km in north-central Nfld [36]; (ii) Inner Piedmont & Blue Ridge terranes (western Dunnage equivalent) in southern Appalachians, 10-300 ohm.m for depth of ~15-20 km [10].
5. Lower Crust	22 - 36 km [7] [I]	14 km	610 [36] [I]	0.000163 [24]	Depth to layer bottom varies 34-37 km. Assigned midpoint thickness value. Lithoprobe transect resistivity: Highly contrasting resistivity regions in lower crust. Conductive (2-100 ohm.m), between RIL and NPL, occupies 40% of D&G Zones. More resistive eastern portion of D&G Zones ranges 100-400 ohm.m, and western most portion with higher resistivity ranges 1000-5000 ohm.m. Assigned weighted average value. Range 100-5000 ohm.m Other resistivity values: (i) 100 ohm.m, at depth 20-50 km in north-central Nfld [36]; (ii) Inner Piedmont & Blue Ridge terranes (western Dunnage equivalent) in southern Appalachians, 30-450 ohm.m is dominant range for depth of 20-45 km [10]; (iii) 200 ohm.m for depth 6~35 km depth for area of NB to Gaspe-Quebec, continuation of Humber, Dunnage and Gander Zones [37]

Table 2 (continued)
1D Earth Resistivity Models for Island of Newfoundland – Dunnage & Gander Zones

Layer	Depth Certainty	Thickness	Resistivity (ohm-m) Certainty	Conductivity (S/m) Certainty	Comments
6. Upper Mantle	36 - 100 km [23] [III]	64 km	375 [36, 10] [I, II]	0.002666 [24]	Crust-mantle boundary depicted general depth of 38 km beneath island, reported to range 35-40km [9]. Used generalized lower depth [23]. Lithoprobe transect: 600 ohm.m, at depth 50-100 km in north-central Nfld, based on average of 11 1D models [36]. Other resistivity values: (i) 300 ohm.m. for Atlantic Canada [35], with range <20 to > 300 ohm.m., (ii) 244 ohm [25] at depth of 0-100 ohm.m. for Canada regional model [23]; (iii) Inner Piedmont & Blue Ridge terranes (western Dunnage equivalent) in southern Appalachians, 5-300 ohm.m (midpoint 150 ohm.m) for depth of 45-100 km [10]. Assigned midpoint resistivity value based on range of 150-600 ohm.m.

Table 2 (continued)
1D Earth Resistivity Models for Island of Newfoundland – Dunnage & Gander Zones

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m) / Certainty	Comments
7. Upper Mantle	100 - 250 km [23]	150 km	158 [25]	0.0063 [23]	Applied Canada regional model [23] for all depths and resistivities below 100 km. North American craton extends beneath Newfoundland.
	[III]			[III]	Other resistivity values: Inner Piedmont & Blue Ridge terranes (western Dunnage equivalent) in southern Appalachians, dominantly 300-1000 ohm.m for depth of 100-200+ km [10].
8. Upper Mantle	250–410 km [23]	160 km	29 [25]	0.0346 [23]	---
	[III]			[III]	
9. Transition Zone	410–520 km [23]	110 km	8 [25]	0.1258 [23]	---
	[III]			[III]	
10. Transition Zone	520–670 km [23]	150 km	2.4 [25]	0.4168 [23]	---
	[III]			[III]	
11. Lower Mantle	670–900 km [23]	230 km	1.12 [25]	0.89125 [23]	---
	[III]			[III]	
12. Lower Mantle	900–1000 km [23]	100 km	0.47 [25]	2.0892 [23]	---
	[III]			[III]	

See end of Table 3 for abbreviations and notes.

Table 3
1D Earth Resistivity Models for Island of Newfoundland – Humber Zone

Layer	Depth Certainty	Thickness	Resistivity (ohm-m) Certainty	Conductivity (S/m) Certainty	Comments
1. Overburden	0 – 30 m	15 m	100 [22, 11]	0.01 [m]	Variety of surficial deposits and thickness; till veneer is common, lesser till blankets, overlain by glaciofluvial (sand, gravel) and alluvial material in valleys and bay mouths, marine lag (sand, gravel, lesser silt) along parts of coastal shore. Discontinuous till veneer < 2m along spine of Long Range Mtns. Continuous till veneer 1-2m thick along mountain slopes and highlands [26]. Thicker tills in low coastal areas: St. Anthony, 2-25m [27]; Port-au-Basques to Stephenville, 2-30m [28]; Marine lag occurs as veneer, <1.5m thick, 100s m to < several km along shoreline.
	[II]		[II, III]	Cornerbrook area till typically 3 to > 5m [17]. Thick overburden (till, sand, silt, clay) at Deer Lake >60m, parts of Humber River basin 25-120m [17]. For Cornerbrook, estimate 15m average depth based on depth range 2-30 m. Resistivity ranges for surficial deposit are: tills 20-100 ohm.m [11]; mixed sand and gravel beach, 15-80 ohm.m [18]; sand, 80-150 ohm [19]; gravel 200-1000 ohm.m [11, 20]. AMT survey over Howley Sub-basin reveals approx. 120 ohm.m to approx. 12m depth [22]. Assigned higher resistivity value of tills based on AMT survey result. Resistivity may be higher where thicker glaciofluvial deposits occur.	
2. Sedimentary Basin	absent	---	---	---	---

Table 3 (continued)
1D Earth Resistivity Models for Island of Newfoundland – Humber Zone

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m) / Certainty	Comments
3a. Upper Crust (sedimentary margin)	*Overall* 0 – 7 or 12 km [29, 30]	4 km	250 [22]	0.004 [24]	Complex assemblage of marine deposited clastic (cgl, sst, sh) and carbonate (Ls, dol) sediments, some mafic volcanics, and melange deposited at eastern margin of ancient North American continent; overlying basement crystalline rock. Deposition occurred from late Proterozoic – middle Ordovician times. Folded and thrust-faulted. Incorporates thrust slices of ophiolites (oceanic crust and mantle rock). In places, overthrusting resulted in basement rock on top of younger sediments.
	[I]		[I]		Layer 3a includes Deer Lake and Bay St. George Basins which are separate, post-tectonic successor basins developed in strike-slip pull-apart basins during Late Devonian to Carbonaceous/Permian(?), along the Cabot Fault. Synformal shape to basins. Depths and resistivity shown separately. *Sedimentary Margin:* Variable thickness range, 1-7 km, depending on location along western Nfld coast [29] and 0-12 km inland [30]. Assigned midpoint value of range 1-7 km No known MT coverage along western coast across sedimentary margin. Lithoprobe transect ends prior to coast, however suggests 150 ohm.m at 0-2 km depth. Assigned midpoint resistivity based on range 150-360 ohm.m as measured for Deer Lake Basin [22]. Other resistivity values: (i) 9 ohm.m to 4 km depth on PEI [6]; (ii) 10 ohm.m for shales and 150 ohm.m for sandstones, to 4 km depth, for onshore Magdalen Basin sediments (Layer 3a equivalent rocks on PEI and NB) [33]; (iii) equivalent Paleozoic continental margin sediments of the Appalachian Plateau exhibits 65 ohm.m resistivity to ~ 5 km depth [10]; (iv) In Ontario, the undeformed Paleozoic St. Lawrence sedimentary basin (Ls, Dol, sst, sh) exhibits resistivity range 20–150 ohm·m (midpoint 80 ohm·m) to depth of 300 m; (v) 100 ohm.m to 6 km depth for area of NB to Gaspe-Quebec [37]

Table 3 (continued)
1D Earth Resistivity Models for Island of Newfoundland – Humber Zone

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m) / Certainty	Comments
CONTINUED 3a. Upper Crust (sedimentary margin)	*Deer Lake Basin* 0 - 5 km [31] [I]	2.5 km	10 [36, 22] [I]	0.1 [24]	Deer Lake Basin: depth from cross-section [31], ranges 1.5~5 km. Assigned midpoint value. Late Devonian-Permian clastic (sst, cgl, silt, sh) and underlying Cambrian-Ordovician carbonate (Ls) sediments. Black shale beds (15-75 m thick) common in clastic sequences. Lithoprobe transect: resistivity 15 ohm.m to depth of 3 km [36]. High conductivity areas < 1.5 km depth attributed due presence of organic black shales [36]. Other resistivity values: (i) 5 ohm.m to depth of 4 km [6], (ii) average 10 ohm .m to depth of 1.5 km [22] and range 150-360 ohm.m from 1.5 km–7 km. Also separated, 1-2 km wide, vertical conductive (2 ohm.m) zones generally aligned with faults, and a broader resistive (27000 ohm.m) zone below 4 km depth and possibly indicative of crystalline basement. Assigned midpoint resistivity value based on range 5-15 ohm.m [36, 22].
	St. George Basin 0-9 [32] [I]	4.5 km	180 [24] [II]	0.00555 [24]	St. George Basin: from generalized cross-section, 4-5 km; 5-6 km deep [32], reported 9 km deep [34]. Dominated by sst, with lesser amounts of cgl and sh, some Ls and evaporates. No known MT transect. Nearby Deer Lake Basin exhibits resistivity range 10-360 ohm.m [22]. On PEI, 10 ohm.m for shales and 150 ohm.m for sandstones, to 4 km depth, for equivalent onshore Magdalen Basin sediments [6]. Assigned midpoint resistivity value based on range 10-360 ohm.m; possibly more conductive due presence of shales.

Table 3 (continued)
1D Earth Resistivity Models for Island of Newfoundland – Humber Zone

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m) / Certainty	Comments
3b. Upper Crust (crystalline basement)	0 to - 7 km [7] [I]	3 km at margin 7 km for Long Range Mtns	16,000 [I]	0.0000625 [24]	Total crustal depth scaled from a NW-SE seismic transect [7]. Applied two thicknesses: 3 km for basement below Layer 3a folded and faulted sedimentary rocks comprising the ancient continental margin, and 7 km where basement rock outcrops as the Long Range Mtns, mostly in the northern half of the Humber Zone. Rocks of Long Range Mtn comprised of Grenvillian Paleo/Mesoproterozoic granitoid gneisses, intruded by large bodies of Neoproterozoic granitoids. Surrounded to N, W and S by Layer 3a rocks. Thrust faulted. Lithoprobe transect resistivity: (i) beneath Deer Lake Basin at 3-7 km, resistivity ranges 30-100 ohm.m [36], possibly influenced by overlying conductive sediments and midcrustal conductor in underlying Layer 4; (ii) beneath granitic Long Range Mtns – middle of Humber Zone – resistivity increases to >5000 ohm.m [36] westward of Deer Lake Basin. Other resistivity values: (i) localized 27,000 ohm.m resistive zone 4 km below Deer Lake Basin, depth corresponds to crystalline basement [22]; (ii) Valley and Ridge terrane (Humber Zone equivalent) in southern Appalachians, 80-100 ohm.m for depth of 0~15 km, then 8-10 ohm.m for depth of ~15-20 km [10]; (iii) 5000 ohm.m for depth 4-144 km, measured at Deer Lake [6] Assigned midpoint resistivity value based on range 5000-27000 ohm.m, applicable only to crystalline basement.

Table 3 (continued)
1D Earth Resistivity Models for Island of Newfoundland – Humber Zone

Layer	Depth Certainty	Thickness	Resistivity (ohm-m) Certainty	Conductivity (S/m) Certainty	Comments
4. Middle Crust	7 - 23 km [7] [I]	16 km	100 [36] [I]	0.01 [24]	Depth to layer bottom increases westward from14.5 – 17.5 km. Average depth chosen. Lithoprobe transect: conductive anomaly (<2 ohm.) 15 km below Deer Lake Basin [36], broad influence in diminishing resistivity of middle crust. Resistivity ranges 2-400 ohm.m [36], more resistive westward. Assigned weighted value. Other resistivity values: (i) Valley and Ridge terrane (Humber Zone equivalent) in southern Appalachians, 80-100 ohm.m for depth of 0~15 km, then 8-10 ohm.m for depth of ~15-20 km [10].
5. Lower Crust	23 - 37 km [7] [I]	14 km	150 [36] [I]	0.006666 [24]	Depth to layer bottom increases westward from 35.5 – 39 km. Average depth chosen. Humber Zone lower crust represents the North American craton [6]. Lithoprobe transect: resistivity ranges 60-250 ohm.m [36], influenced by mid-crustal conductor. Assigned midpoint value. Other resistivity values: (i) Valley and Ridge terrane (Humber Zone equivalent) in southern Appalachians, 100-650 ohm.m for depth of 20-45 km [10]; (ii) 200 ohm.m for depth 6~35 km depth for area of NB to Gaspe-Quebec, continuation of Humber, Dunnage and Gander Zones [37]

Table 3 (continued)
1D Earth Resistivity Models for Island of Newfoundland – Humber Zone

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m) / Certainty	Comments
6. Upper Mantle	37 - 100 km [23] / [I, III]	63 km	330 [10] / [III]	0.00303 [24]	Crust-mantle boundary depicted general depth of 38 km beneath island, reported to range 35-40 km [9]. Used generalized lower depth [23]. Other resistivity values: (i) 5000 ohm.m for depth of 8-140 km [6]; (ii) Valley and Ridge terrane (Humber Zone equivalent) in southern Appalachians, 80-650 ohm.m for depth of 45-70 km, then 10 ohm.m from 70-100 km [10] (iii) 100 ohm.m for depth ~35 –100 km depth for area of NB to Gaspe-Quebec [37] Assigned midpoint resistivity value based on range of 10-650 ohm.m.

Table 3 (continued)
1D Earth Resistivity Models for Island of Newfoundland – Humber Zone

Layer	Depth Certainty	Thickness	Resistivity (ohm-m) Certainty	Conductivity (S/m) Certainty	Comments
7. Upper Mantle	100 - 250 km [23] [III]	150 km	158 [25]	0.0063 [23] [III]	Applied Canada regional model [23] for all depths and resistivities below 100 km. North American craton extends beneath Newfoundland. Other resistivity values: Valley and Ridge terrane (Humber Zone equivalent) in southern Appalachians, 30 ohm.m for depth of 100-200+ km [10].
8. Upper Mantle	250–410 km [23] [III]	160 km	29 [25]	0.0346 [23] [III]	---
9. Transition Zone	410–520 km [23] [III]	110 km	8 [25]	0.1258 [23] [III]	---
10. Transition Zone	520–670 km [23] [III]	150 km	2.4 [25]	0.4168 [23] [III]	---
11. Lower Mantle	670–900 km [23] [III]	230 km	1.12 [25]	0.89125 [23] [III]	---
12. Lower Mantle	900–1000 km [23] [III]	100 km	0.47 [25]	2.0892 [23] [III]	---

Table 3 (continued)
1D Earth Resistivity Models for Island of Newfoundland – Humber Zone

approx	approximate	NB	New Brunswick province	RIL	Red Indian Line
cgl	conglomerate	Nfld	Newfoundland	SE	southeast
dol	dolomite/dolostone	NPL	Noel Paul's Line	sh	shale
D-G	Dunnage and Gander Zones	NW	northwest	sltst	siltstone
Ls	limestone	PEI	Prince Edward Island province	sst	sandstone
mtn	mountain(s)				

Table 3 (continued)
1D Earth Resistivity Models for Island of Newfoundland – Humber Zone

NOTES:
Depth Certainty
- I = best representation
  - * overburden: geological report/map coverage of local area.
  - * crust: seismic/gravity transects crossing local area
- II = likely representative
  - * crust/upper mantle: geological and/or seismic transect of a regional nature.
- III = possibly representative (measurements from general compilations).

Resistivity/Conductivity Certainty
- I = best representation (measurements from site or nearby).
  - * overburden: resistivity measurement by surface geophysical method and/or borehole in local area.
  - * crust: resistivity measurement from resistivity survey, MT survey and/or borehole in local area.
- II = likely representative (resistivity values extrapolated from measurements taken at some distance from the site, typically greater than 100 km).
  - * overburden: resistivity value obtained by geophysical measurement, including borehole logs.
  - * sedimentary basin: value obtained by geophysical survey using variety of geophysical electromagnetic methods, including MT.
  - * crust: value obtained by regional MT survey.
- III = possibly representative (measurements from general compilations

Table 3 (continued)
1D Earth Resistivity Models for Island of Newfoundland – Humber Zone

CITED REFERENCES

1	King (1990)	19	Scott et al. (1990)
2	Liverman and Taylor (1994), surficial geology map	20	Associated Mining Consultants (2004)
3	Henderson (1974), surficial geology map	21	Evans and Kean (2002)
4	Batterson and Taylor (2004)	22	Livada et al. (2013)
5	Grant (1989a), Fig. 5.7a	23	Kelbert et al. (2009), Fig. 2, global and regional conductivity profile, Canada regional conductivity chosen
6	Kurtz and Garland (1976)	24	Converted from resistivity obtained from listed reference source
7	Hughes et al. (1994), Fig. 15	25	Converted from conductivity obtained from listed reference source
8	Colman-Sadd et al. (2000), bedrock geology map	26	Grant (1986a), surficial geology map
9	Hammer et al. (2010), lithospheric cross-section	27	Grant (1986b), surficial geology map
10	Ogawa et al. (1996), Fig. 4	28	Grant (1991), surficial geology map
11	Palacky (1988)	29	Cooper et al (2001), stratigraphic cross-sections Fig. 15
12	Smith et al. (2009)	30	v.d.Velden et al. (2004), cross-section fig. 2
13	Brushett (2011)	31	Martin (2001)
14	Fulton (1995), Canada-wide surficial geology map	32	Energy Branch (2000), stratigraphic cross-sections
15	Grant (1991), surficial geology map	33	Jones and Garland (1985)
16	Klassen and Murton (1996)	34	Petroleum Resources Branch (1989)
17	Batterson (2003)	35	Ferguson and Odwar (1998), Atlantic model Fig. A.3.5.1
18	Mackay (1970)	36	McNeice (1998) including Figs. 5.3, 6.5, 6.11, 6.15, 6.17, 6.22 and 7.1
		37	Bailey et al. (1974), resistivity section Fig. 11

Appendix 6

Detailed Description of the Earth Resistivity Models for Nova Scotia

1. Geological Settings of Nova Scotia

Geologically, Nova Scotia (NS) lies within northeastern part of the Appalachian Orogen[20] (Figure 1). The Appalachians evolved through the process of opening and closing of the Late Precambrian (Proterozoic) to Early Paleozoic Iapetus Ocean (pre-Atlantic Ocean), some 600-400 million years ago. Rifting of the proto-North American continent during the Late Precambrian formed the Iapetus Ocean. By the end of the Ordovician (435 ma) plate tectonic movement caused the Iapetus Ocean to be closed shut, and a continent-continent collision (involving proto-North America and Africa) during the Silurian (435-410 ma) and continued deformation into the Devonian (410-360 ma) occurred. Accompanying widespread magmatism gave rise to large intrusions of granitoid rock.

Figure 1. General distribution of the tectonic terranes that comprise the Appalachian Mountains from Newfoundland to Alabama (Eyles and Miall, 2007, Fig. 6.4). Mainland Nova Scotia straddles the Avalon and Meguma tectonic zones. Figure does not show division of Cape Breton Island underlain by Avalon, Dunnage – Gander and portion of Humber Terranes. Red dashed line – Logan's Line – is the northern limit of deformed rocks of the Appalachians.

[20] Orogen: a regionally extensive belt of strata that has undergone folding and deformation as a result of the collision of tectonic plates, creating a mountain range.

The resulting continental collisions formed a continuous mountain chain that extended from the southeastern and northeastern USA, through the Canadian Maritime provinces including New Brunswick, Nova Scotia, PEI and Newfoundland, into east Greenland, the Caledonian Mountains of Great Britain and Scandinavia, and the West African Mauritanides. (Petroleum Resources Branch, 1989, after Williams, 1986). Subsequent rifting, starting 200 my ago, formed the Atlantic Ocean and separated North America and Newfoundland from the Europe-Africa continent.

The Appalachian Orogen has been divided into a series of lithotectonic zones (representing microcontinents) trending in a northeasterly direction, each a fragment of the Earth's crust that was amalgamated together by plate-tectonic processes about 600-200 million years ago (Eyles and Miall, 2007).

Rocks of the Appalachian region in Atlantic Canada are divided into four temporal categories: Early Paleozoic and older; middle Paleozoic; late Paleozoic; and, Mesozoic (Williams, 1995). Each category is further divided on basis of lithology and geologic age and setting.

Early Paleozoic and older rocks forming the basement have been divided into five lithotectonic zones (also referred to as terranes) that reflect various paleogeographic settings marginal to, and within the early Paleozoic Iapetus Ocean (NB Dept. Natural Res., 2008) (see Figures 1 and 2):

- The Humber zone is underlain by sedimentary rocks deposited along the Laurentian[21] continental margin of ancient North America.
- The Dunnage Zone is made up of remnants of Iapetan island arcs and back-basins, comprised of a structurally complex mix of volcanic and clastic sedimentary rock, with thrust emplaced slices of oceanic crust/mantle rock.
- The Gander and Meguma Zones are comprised of clastic sedimentary sequences deposited off the Gondwanan[22] continental margin. In Atlantic Canada and U.S Appalachians, the Meguma Terrane only occurs in Nova Scotia.
- The Avalon Zone consists of Precambrian sedimentary and volcanic rocks overlain by Cambrian clastic sediments (shales, sandstones) (NB Dept. Natural Res., 2008; Williams 1995). In New Brunswick and Nova Scotia are found the oldest rocks of the Avalon Zone, as marbles, quartzites and gneisses (Williams, 1995) that underlie upper Precambrian sedimentary and volcanic rocks.

As the Iapetus Ocean closed, rocks of the Avalon and other terranes were deformed and accreted to the Laurentian continental margin. As well, intrusive rocks (e.g. granites, gabbro) were emplaced into these terranes, which in places formed as large batholiths.

In Nova Scotia the province is divided geologically into three distinct portions. On the province's mainland the Avalon Terrane occupies the north part (geographically referred to as North Mainland) with the Meguma Terrane to the south (referred to as South Mainland). Cape Breton Island encompasses three lithotectonic terranes; Avalon on the eastern third of the island,

[21] Laurentia is the North American continent that broke away from the earlier Rodinia supercontinent after 750 Ma (Eyles and Miall, 2007).

[22] Gondwana is the southern part of supercontinent Pangea that was composed of present-day continents India, South America, Africa, Australia and Antarctica (Eyles and Miall, 2007).

the combined Dunnage-Gander Terranes includes much of the remaining two-thirds, with a small portion of the Humber Terrane at the northern tip of the island. Separating the Avalon and Meguma Terranes is the east-west-trending Minas Geofracture (also known as the Cobequid-Chedabucto Fault System) (Sangster and Smith, 2007). Partially overlying NS is the sedimentary Devonian-Carboniferous Maritimes Basin.

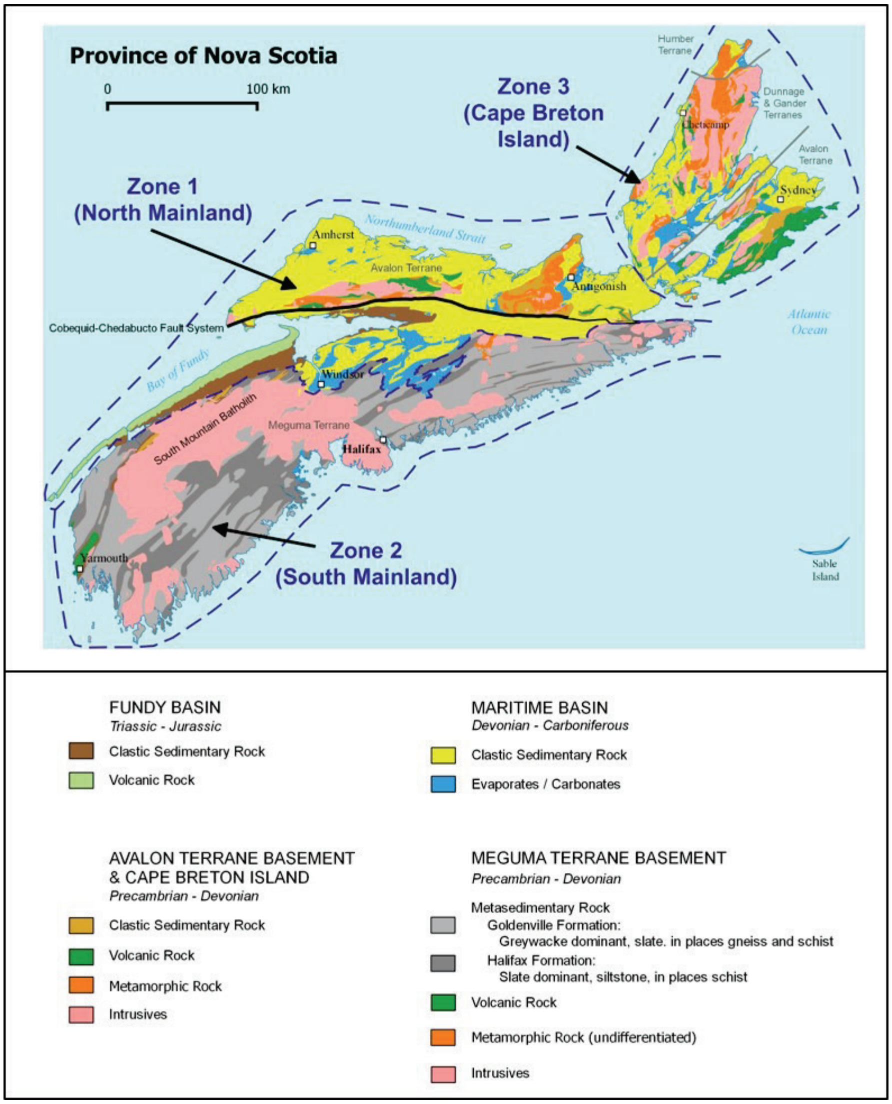


Figure 2. Bedrock geology and lithotectonic terranes and successor basins underlying Nova Scotia (modified from Kieppe, 2006). Coverage area of 1D-layered Earth model zones are also depicted.

The Avalon Terrane in mainland Nova Scotia is dominated by late Precambrian (ca. 620–605) arc-related volcanic–sedimentary successions (unmetamorphosed, thinly bedded sandstones, siltstone and shales) and cogenetic plutons (Webster et al., 1998, after Murphy et al. 1991; Pe-Piper et al. 1989). Strata have been deformed into regional NE-NNE trending folds.

The Meguma Terrane is consists of mainly Late Precambrian / Cambrian to Ordovician metasedimentary rocks that have been folded and regionally metamorphosed. Within the Meguma Terrane is the Meguma Supergroup, a thick (> 10 km) accumulation of the Goldenville

Formation metasandstone / metagreywacke[23] overlain by the Halifax Formation made up of about 75 % carbonaceous sulphidic slate and 25 % metasiltstone (Sangster and Smith, 2007; Waldron et al, 2009). Significant total field magnetic anomalies are reported to be associated with the Halifax Formation due to presence of pyrrhotite mineralization in thick slate units (Howells and Fox, 1998). Graphite also occurs in the Halifax formation slates. The metasediments were later intruded by voluminous Devonian granitoids. In particular is the South Mountain Batholith, which underlies much of Halifax city and is exposed over a considerable area in the west part of Nova Scotia's Meguma Terrane (see Figure 2).

The Maritimes Basin (Figure 3) itself is a composite successor basin, consisting of a series of sedimentary subbasins overlying the collage of earlier Paleozoic continental margin basins and Appalachian lithotectonic crustal zones of varying age and composition (Dietrich et al., 2011). The generally flat-lying clastic sedimentary strata of late Paleozoic time originated from detritus eroded from the uplifted Appalachian Orogen (NB Dept. Natural Res., 2008). About 75 % of the basin area is situated offshore (Hu and Dietrich, 2010). Offshore, up to 12 km of sandstone, conglomerate and shale, strata have accumulated in the Maritime Basin, with lesser amounts of limestone and salt. In NS the Maritimes Basin cover the northern portion of the province, and parts of Cape Breton Island. The basin increases in depth towards the Atlantic Ocean.

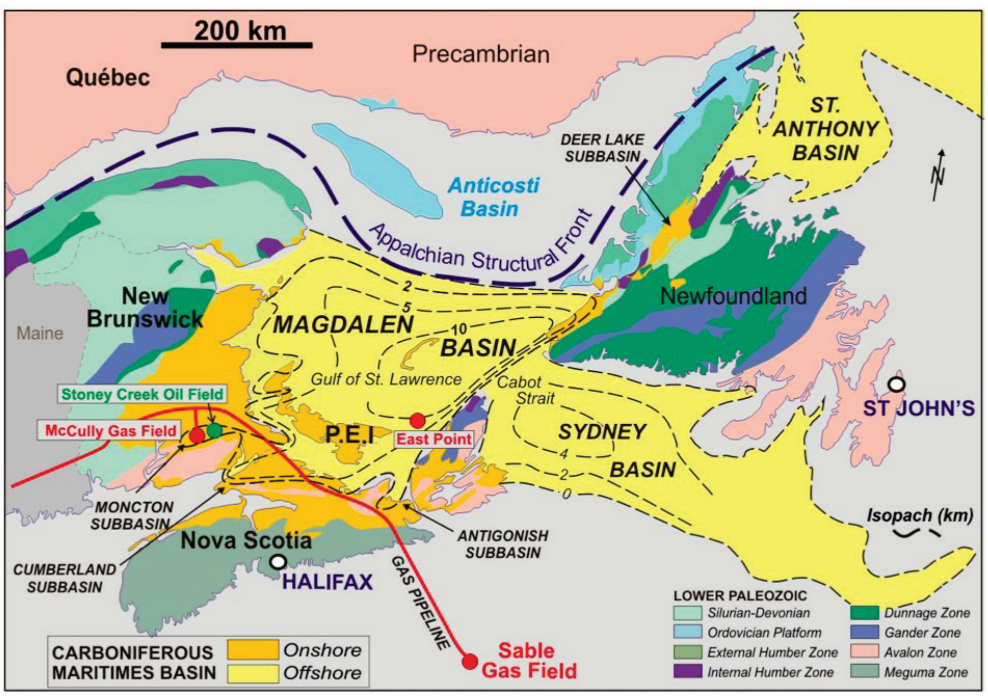


Figure 3. Simple distribution of the tectonic terranes that comprise the Canadian portion of the Appalachian region, and coverage of the Maritimes Basin (Dietrich et al., 2009, Fig. 1). Isopach contour lines indicate depth to base of sedimentary basin.

[23] Greywacke is an older term for poorly sorted sandstone deposited by turbidity currents; turbidite is the modern usage (Eyles and Miall, 2007).

Protruding through the Maritime Basin cover are "windows" of Avalon and Dunnage-Gander Terranes, which partially form the physiographic highlands and hills of Nova Scotia.

Exposed along the northwest margin of mainland Nova Scotia is the Mesozoic Fundy Basin consisting of "redbed" sandstone and volcanic rocks deposited in a rift valley formed during opening of the modern Atlantic Ocean (NB Dept. Natural Res., 2008). A 1D model was not developed for the present-day water-covered Fundy Basin separating New Brunswick and NS.
A cover of unconsolidated Quaternary glacial deposits of varying thickness, mostly till, overlies most of NS.

2. Zonal Earth resistivity models

Presented are three one-dimensional (1D) layered Earth models representing the vertical variance of electrical resistivity within the crust and mantle underlying the Province of Nova Scotia (NS). One model (Zone 1) encompasses the northern portion of NS – referred to as North Mainland – which is mostly covered by essentially flat-lying sedimentary strata of the Maritime Basin. The second model (Zone 2) includes the remaining portion of the province outside of the covering basin, an area referred to as South Mainland. The third model (Zone 3) only takes in Cape Breton Island also partially covered by Maritime Basin strata. Beneath and exposed outside of the covering Maritime Basin is a mix of folded sedimentary rocks, volcanic rocks and in areas intrusive rocks, plus older gneissic rock, which has been subdivided into differing terranes (lithotectonic zones) on the basis of geological age and evolutionary history.

Previously, Ferguson and Odwar (1998) prepared a generalized 1D model (summarised in Table A.3.5.1, and in Figure A3.5.2) covering all of Atlantic Canada generated from a compilation of crustal-scale conductivity surveys (MT and controlled-source EM) carried out from the late 1970s to mid-1990s.

<u>Sources of Information</u>

For consistency of application of resistivity values for each province, whenever possible local MT survey results were applied with preference to the most recent survey. MT surveys results from nearby provinces or the New England states were used to provide guidance on lower and upper limits to the estimated resistivity value. However, the same lithotectonic zone in different provinces may exhibit considerable higher/lower resistivity values compared to the same zone in Nova Scotia. This difference could be due to geological differences and / or vintage of the MT survey. Early MT surveys, prior to 1990, tend to provide coarser resolution and shallower depth compared to recent MT surveys.

Assembly of the 1D models for the mainland portion of Nova Scotia relied on an early regional MT survey (Kurtz and Garland, 1976) comprised of 20 recording sites covering Eastern Canada provided a coarse estimate of crustal resistivity to a depth of about 170 km. For the 1D model of Cape Breton Island (Nova Scotia), assembly relied more on data from a more recent MT transect across the island of Newfoundland because of presence of same geological terranes both on Cape Breton Island and Newfoundland.

Other MT surveys have been undertaken in Nova Scotia. A limited regional MT survey (Srivastava and White, 1971) made soundings in 1966 at Fredericton, Halifax in Nova Scotia and Sable Island. An audio-magnetotelluric survey (Kurtz and Gupta, 1992) over a granitic intrusion in the Miramachi Terrane provided resistivity values to a depth of 32 km, but only over a local area. No published MT transects post-2000 were identified, however, Jones et al. (2014) prepared bulk-resistivity compilation maps for 20, 40, 100 and 200 km depths covering most of Canada, including Atlantic provinces.

Supplemental information about sub-surface resistivity in Newfoundland was obtained from an MT transect across the Appalachian Orogen in Newfoundland, undertaken during 1989 and 1991 as part of the Lithoprobe East, part of a trans-Canada investigation of the crust and upper mantle (McNeice, 1998). Information regarding crustal resistivity values of the southern USA Appalachians was obtained from an MT transect prepared by Ogawa et al. (1996).

Depths for overburden – Layer 1 – was assigned by typically selecting half of the maximum general thickness mentioned on surficial geology maps. An estimated resistivity value, based on findings from overburden borehole logs (Crow et al., 2015) through glacially deposited sediments in Fredericton and nearby Cape Breton Island in Nova Scotia, was applied.

Thickness of the sedimentary basin strata – Layer 2 – was obtained from a regional isopach map (Stott and Aitken, 1993), and local stratigraphic cross-sections and petroleum well logs (Smith, 2010; Stewart, 2011) or other notations (Ewing et al, 1966; Srivastava and White, 1971).

Depths of the upper, middle and lower crust – Layers 3 to 5 – were measured off seismic profiles undertaken offshore of New Brunswick and Prince Edward Island (Ewing et al., 1966; Hughes and Hall, 1994; Jackson, 2002). However, because depths varied between different surveys an average was assigned.

Resistivities for the crust (Layers 3 to 5) were obtained from 1D and 2D models prepared by Kurtz and Garland (1976). For comparison purposes, resistivity values for the same crustal layers in Newfoundland (i.e. Avalon Terrane) and its equivalent continuation into the southern Appalachians are also presented.

For the uppermost mantle (Layers 6 and 7), the generalized depths of 100 and 250 km was used and resistivity obtained from the coarse determination presented by Kurtz and Garland (1976) and depth-resistivity maps prepared by Jones et al. (2014).

Depths and resistivity for the middle and lower divisions of the upper mantle, transition zones, and lower mantle – Layers 8 to 12 – between 250 and 1000 km were based on the Canada regional conductivities determined by Kelbert et al. (2009).

Presentation of Findings

The 1D layered-Earth models are presented in Tables 1 to 3, which summarize individual layer depths, thickness, and resistivity/conductivity for each 1D model, as well as sources of depth and resistivity values and justification for selection.

Caution should be exercised when comparing resistivity values in Nova Scotia versus other Atlantic Canada provinces, because resistivities were estimated from the results of local MT surveys whereby local geology may be considerably different within neighbouring provinces. Also, there are differences of resolution between surveys of different vintage likely due to instrument and data processing variation.

Furthermore, it is noted that on a local scale significant decreases of resistivity could occur where sulphide mineralization (> 10 %) and / or graphite is present, such as in the Halifax Formation slates within the South Mainland of NS. As well, presence of thick accumulations of evaporate (e.g. halite salt) within the Maritime Basin may depress the local near-surface resistivity.

3. References

Crow, H.L, Good, R.L., Hunter, J.A., Burns, R.A., Reman, A., and Russell, H.A.J., 2015. "Borehole geophysical logs in unconsolidated sediments across Canada," *Geological Survey of Canada*, Open File 7591, 1 .zip file. doi:10.4095/295753
Dietrich, J., Hannigan, P., Hu, K. and Gilles, P., 2009. "Petroleum resource potential of the Carboniferous Maritimes Basin, Eastern Canada," AAPG Search and Discovery Article #90171, CSPG/CSEG/CWLS GeoConvention 2009, May 4-8, 2009, Calgary, Alberta, Canada, 3 p.

Dietrich, J., Lavoie, D., Hannigan, P. et al., 2011. "Geological setting and resource potential of conventional petroleum plays in Paleozoic basins in eastern Canada," *Bulletin of Canadian Petroleum Geology*, v.59, no.1, 54-84.

Durling, P. and Marillier, F., 1996. "Stratigraphy and structural elements of the Cumberland Basin from seismic reflection data," *Geological Survey of Canada*, Open file 3310, 1 colour map sheet

Eyles, N. and Miall, A., 2007. "Canada Rocks" The Geologic Journey", *Fitzhenry and Whiteside*, 1st Ed., 512 p.

Ewing, G.N., Dainty, A.M., Blanchard, J.E. and Keen, M.J., 1966. "Seismic studies of the eastern seaboard of Canada: the Appalachian system," *Canadian Journal of Earth Science, v. 3, 80-109*

Ferguson, I. and Odwar, H., 1998. "Appendix 3: Review of conductivity soundings in Canada," *Geomagnetically Induced Currents: Geomagnetic Hazard Assessment Phase II, Final Report*, Volume 3, (principal author) Boteler, D. H., Geological Survey of Canada and Canadian Electricity Association, 357 T 848A, 121 p.

Fader, G.B.J. and Miller, R.O., 2008. "Surficial geology, Halifax Harbour, Nova Scotia," *Geological survey of Canada*, Bulletin 590, 163 p.

Grant, D.R., 1988. "Surficial geology, Cape Breton Island, Nova Scotia," *Geological Survey of Canada*, 2 sheets, scale 1:125000

Dept. of Energy and Mines, 1980. "Sheet 4, Pleistocene geology, central Nova Scotia," scale 1:100000

Dept. of Energy and Mines, 1980. "Sheet 7, Pleistocene geology, southwestern Nova Scotia," scale 1:100000

Hall, J., Marillier, F. and Dehler, S., 1998. "Geophysical studies of the structure of the Appalachian orogen in the Atlantic borderlands of Canada," *Canadian Journal of Earth Science, v. 35, 1205-1221*

Hibbard, J.P., van Staal, C.R., Rankin, D.W. and Williams, H., 2006. "Lithotectonic map of the Appalachian Orogen, Canada – United States of America," *Geological survey of Canada*, Map 2096A, scale 1:500000

Howells, K. and Fox, D., 1998. "Geophysical methods for detecting shallow sulphide mineralization in the Halifax Formation, Nova Scotia: a reconnaissance study," *Atlantic Geology*, v. 34, 211-227

Hu, K., Dietrich, J. ,2010. "Petroleum Reservoir Potential of Upper Paleozoic Sandstones in the Offshore Maritimes Basin, Eastern Canada," *Geological Survey of Canada*, Open File 6679,

Hughes, S. and Hall, J., 1994. "The seismic velocity structure of the Newfoundland Appalachian orogen", *Journal of Geophysical Research*, v. 99, no. B7, 13633-13653.

Jackson, H.R., Marillier, F. and Hall, J., 1998. "Seismic refraction data in the Gulf of Saint Lawrence: implications for the lower-crustal blocks," *Canadian Journal of Earth Science*, v. 35, 1222-1237

Jackson, H.R., 2002 "Seismic refraction profiles in the Gulf of Saint Lawrence and implications for extent of continous Grenville lower crust," *Canadian Journal of Earth Science*, v. 39, 1-17 doi:10.1139/E01-054

Jones, A.G. and Garland, G.D., 1986. "Preliminary interpretation of the upper crustal structure beneath Prince Edward Island", *Annales Geophysicae*, 4, B, 2, 157-164.

Jones, A.G., Ledo, J., Ferguson, I.A., Craven, J.A., Unsworth, M.J., Chouteau, M. and Spratt, J.E., 2014. "The electrical resistivity of Canada's lithosphere and correlation with other parameters: contributions from Lithoprobe and other programmes, *Canadian Journal of Earth Science*, v. 51, 573-617, doi:10.1139/cjes-2013-0154

Kelbert, A., Schultz, A., and Egbert, G., 2009. "Global electromagnetic induction constraints on transition-zone water content variations," *Nature*, v. 460, no. 20, August 2009, 1003-1006. http://dx.doi.org/10.1038/nature08257

Keppie, J.D. (compiler), 2000. "Geological map of the Province of Nova Scotia," *Nova Scotia Department of Natural Resources*, Minerals and Energy Branch, map ME 2000-1, scale 1:500000

Keppie, J.D. (compiler), 2006. "DP ME 43, Version 2, 2006, Digital version of Nova Scotia Department of Natural Resources Map ME 2000-1, Geological map of the Province of Nova Scotia, scale 1:500000," http://www.gov.ns.ca/natr/meb/download/dp043.htm

Kurtz, R.D, and Garland, G.D., 1976. "Magnetotelluric measurements in eastern Canada", *Geophys. J. R. Soc.*, v. 45, 321-347.

Kurtz, R.D. and Gupta, J.C., 1992. "Shallow and deep crustal conductivity studies in the Miramichi earthquake zone, New Brunswick," *Canadian Journal of Earth Science*, v. 29, 1549-1564

Lynch, G. and Deblonde, C., 1997. "Geological compilation, central Nova Scotia and Prnce Edward Island, Nova Scotia," *Geological Survey of Canada*, Open File 3484, scale 1:250000

Marillier, F. and Verhoef, J., 1989. "Crustal thickness under the Gulf of St. Lawrence, northern Appalachians, from gravity and deep seismic data," *Canadian Journal of Earth Science*, v. 26, 1517-1532

McNeice, G.W., 1998. “Magnetotelluric investigation of the Appalachians, Newfoundland, Canada”, M.Sc thesis, *Memorial University of Newfoundland*, Dept. of Earth Sciences, St. John’s, 207 p. http://collections.mun.ca/PDFs/theses/GaryWayneMcNeice.pdf

Natural Resources Canada, 2009. “Surficial Materials, Atlas of Canada 6th edition, (archival version)”, online ,<get url>

New Brunswick Department of Natural Resources, 2008. “Bedrock geology of New Brunswick, *Minerals, Policy and Planning Division*, Map NR-1 (2008 Edition), 1:500000

Dept. of Natural Resources, 2015. “Reading Room 5: List of Maps Outlining the Route, Elevation, Physiography, Bedrock, Glacial and Surficial Geology of Nova Scotia,” Nova Scotia, Department of Natural Resources, Geoscience and Mines Branch, on-line <get url>

Ogawa, Y., Jones, A.G., Unsworth, M.J., Booker, J.R., Xinyou, L., Craven, J., Roberts, B., Parmelee, J. and Farquharson, C., 1996. “Deep electrical conductivity structures of the Appalachian orogen in the southern U.S.”, *Geophysical Research Letters*, v. 23, no. 13, 1597-1600.

Palacky, G.J., 1988. “Resistivity characteristics of geologic targets” in *Electromagnetic Methods in Applied Geophysics-Theory*, Vol.1, M.N. Nabighian (ed.); Society of Exploration Geophysicists, 53-130.

Petroleum Resources Branch, 1989. “Hydrocarbon potential of the western Newfoundland onshore area”, *Department of Energy, Government of Newfoundland and Labrador*, Geofile Number: NFLD/1910, 11p.
http://www.nr.gov.nl.ca/mines&en/publications/onshore/hydrocarbon.pdf

Sangster, A.L., and Smith, P.K., 2007. “Metallogenic summary of the Meguma gold deposits, Nova Scotia, *in* Goodfellow, W.D., ed., Mineral Deposits of Canada: A Synthesis of Major Deposit-Types, District Metallogeny, the Evolution of Geological Provinces, and Exploration Methods: Geological Association of Canada, Mineral Deposits Division, Special Publication No. 5, p. 723-732.

Stea, R.R. and Fowler, J.H., 1979. “Pleistocene geology, eastern shore region, Nova Scotia,” *Nova Scotia Department of Mines*, 3 sheets, scale 1:100000 [to accompany Nova Scotia Dept. of Mines paper 79-4]

Stea, R.R. and Finck, P.W., 1988. “Surficial geology, Cumberland, Colchester and Hants counties (sheet 10),” *Nova Scotia Department of Mines and Energy*, Map 88-13, scale 1:100000

Shih, K.G., Kay, W., Woodside, J., Jackson, R., Adams, J., Drysdale, J., Bell, J.S. and Podrouzek, A.J. “Crustal thickness, seismicity and stress orientations of the continental margin of Eastern Canada,” *Geological Survey of Canada*, map 1710A, scale 1:5000000

Srivastava, S.P. and White, A., 1971. “Inland, coastal, and offshore magnetotelluric measurements in Eastern Canada,” *Canadian Journal of Earth Sciences*, v.8, 204-216

Stewart, H.J. 2011. “Petrographic, petrological, and seismic data from the western Sackville Subbasin of the Maritimes Basin, southeastern New Brunswick,” *New Brunswick Department of*

Natural Resources, Lands, Minerals and Petroleum Division, Open File 2011-2 (CD-ROM), 158 p.

Stott, D.F. and Aitken, J.D. 1993. "Introduction," Chapter 1 in Sedimentary Cover of the Craton in Canada, D.F. Stott and J.D. Aitken (ed.). *Geological Survey of Canada*, Geology of Canada, no.5, p.1-7 (also Geological Society of America, The Geology of North America, v. D-1)

Waldron, W.F., White, C.E., Barr, S.M, Simonetti, A. and Heaman, L.M., 2009. "Provenance of the Meguma terrane, Nova Scotia: rifted margin of early Paleozoic Gondwana," *Canadian Journal of Earth Sciences*, v.46, 1-8, doi:10.1139/E09-004

Webster, T.L., Murphy, J.B. and Barr, S.M., 1998. "Anatomy of a terrane boundary: an integrated structural, geographic information system, and remote sensing study of the late Paleozoic Avalon-Meguma terrane boundary, mainland Nova Scotia," *Canadian Journal of Earth Sciences*, v.35, 787-801

Williams, H., 1995. "Temporal and spatial divisions," Chapter 2 in Geology of the Appalachian-Caledonian Orogen in Canada and Greenland (ed.) H. Williams, *Geological Survey of Canada*, Geology of Canada, no.6, 21-44 (also *Geological Society of America*, the Geology of North America, V. F-1)

Utting, D. J. 2011. "Overview map showing locations of surficial geology maps of the Halifax metropolitan and surrounding areas, Halifax and Hants counties, Nova Scotia," *Nova Scotia Department of Natural Resources*, Open File Map ME 2011-001, scale 1:100 000.

APPENDIX 1 – Previous 1D Earth Model, Atlantic Canada

From: Ferguson and Odwar (1998)

Geological Unit	Resistivity (Ω.m) Average	Range	Comments
1. Overburden (0-25 m thick)	50	10-100	Conductance is typically 0.05-0.5 S.
2. Upper Crust (0-10 to 15 km)	2,000	500-100,000	Most conductive in sedimentary rocks
3. Middle Crust (15-25 km)	300	10-10,000	Average estimated from a limited number of MT survey results
4. Lower Crust (25-40 km)	300		
5. Mantle (40 km-100 km)	300	<20->300	
6. Mantle (100 km- 400 km)	100		
7. Mantle (400 m - 600 km)	10		

Table A3.5.1: 1D Resistivity Model for Atlantic Canada

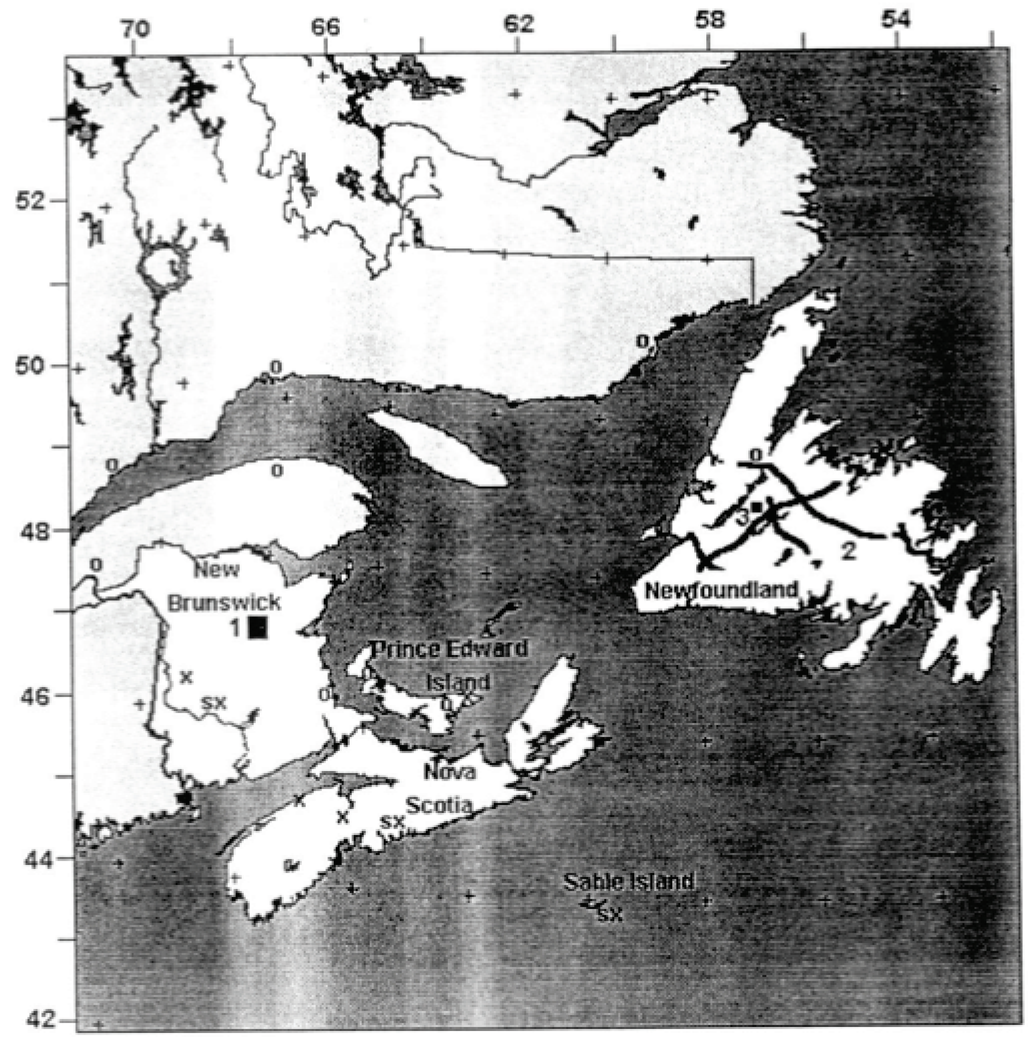


Fig. A3.5.2. Location of large-scale conductivity soundings in Atlantic Canada: New Brunswick, Nova Scotia, Prince Edward Island, and Newfoundland. The numbers and symbols denote the following surveys: **s**=MT site of Srivastava & White (1971); **x**=MT site of Cochrane & Hyndman (1974); **o**=MT site of Kurtz & Garland (1976); **1**=MT survey by Kurtz & Gupta (1992); **2**=MT surveys on LITHOPROBE East Transects (Clowes 1993); and **3**=CSAMT survey of Boerner *et al.* (1993).

Table 1
1D Earth Resistivity Models for Nova Scotia – Zone 1 (North Mainland)

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m) / Certainty	Comments
	Zone 1 incorporates the North Mainland portion of NS, all of Cape Breton Island, and about 10 % of the South Mainland portion. The lithotectonic *Avalon Terrane* underlies both the North Mainland and Cape Breton Island, whereas the Meguma Terrane underlies all of the South Mainland. Overlying the basement rocks of the Avalon and Meguma Terranes (model Layer 3) is the Late Devonian-Carboniferous *Maritimes Basin* (model Layer 2) the largest and deepest sedimentary basin in Atlantic Canada. It covers about 85 % on NS North Mainland and 10 % of South Mainland, as well as part of New Brunswick and PEI and western Newfoundland, in addition to the Gulf of St. Lawrence. Inliers of the older Avalon Terrane are exposed through the basin, forming highlands. Basin sedimentary rock is comprised of sequences of conglomerate, sandstone and siltstone (especially dominant in upper part of Maritime Basin), with some limestone and volcanic rock. There are also substantial thicknesses (overall 700-1500 m) of evaporates (anhydrite, halite (salt), gypsum) [34]. Coal measures are present in the upper part of the basin strata.				
1. Overburden	3 – 20 m [3, 4] [I]	10 m	25 [2] [II]	0.04 [24]	Till veneer and till blanket deposits are predominant [1]. Till characterized by reddish colour and silty clay matrix, covering lowland regions of NS [3]. Total till thickness ranges 3-23 m, average about 10 m [4] Assign average 10 m thickness overall
		Resistivities for tills in Canada range 20-100 ohm.m [17]. Borehole logs [2] reveal range 13-35 ohm.m for overburden in central NS (Musquodobit, Schubenacadie) and range 3-50 ohm.m in southern Cape Breton Island. Assign midpoint 25 ohm.m, based regional borehole data. Limits 20, 100 ohm.m			

Table 1 (continued)
1D Earth Resistivity Models for Nova Scotia - Zone 1 (North Mainland)

<table>
<tr><th rowspan="2">Layer</th><th>Depth</th><th rowspan="2">Thickness</th><th>Resistivity (ohm-m)</th><th rowspan="2">Conductivity (S/m)</th><th rowspan="2">Comments</th></tr>
<tr><th>Certainty</th><th>Certainty</th></tr>
<tr><td rowspan="3">2. Sedimentary Basin</td><td>0 – 2 km
[11]</td><td rowspan="2">2 m</td><td>150
[9, 31]</td><td rowspan="2">0.006666
[24]</td><td rowspan="2">Clastic sedimentary bedrock consists of early-to-late Carboniferous sandstone, siltstone, shale, conglomerate, and coal measures. In addition, carbonates (limestones) and evaporates (gypsum, anhydrite, halite) occur in Antigonish area and south of Turo [29]</td></tr>
<tr><td>[I]</td><td>[II]</td></tr>
<tr><td colspan="5">Regional basin thickness map shows < 1.5 km, up to < 3 km in Bay of Fundy [11], deepening to offshore. Northernmost part of mainland NS, basin reaches < 5 km [32]. Seismic sections indicate 3-6 km depth between Chinnecto Bay and Northumberland Strait [33].

Assign overall 2 km thickness on basis that basin wedges deeper to the northeast.

<u>Resistivity - within Nova Scotia</u>:
* No post-2000s regional MT transects identified
* 1966 MT survey 1D model for Halifax suggests 200 ohm.m to 5 km depth [19]
* 1970s regional MT transect [6] indicates 2D resistivity 9 ohm.m at 0-0.5 km depth, and 1000 ohm.m at 0.5-44 km depth within eastern half of NS [6]

<u>Resistivity – other locations</u>:
* 1970s MT and magnetic variation surveys for a PEI location reveal 9 ohm.m to depth of 3 to 4 km [6, 19]
* 1983 AMT survey [12] in Miramichi area of New Brunswick identified 200 ohm.m for nearby 1 km thick Maritime Basin
* 1986 MT survey [9] across PEI reveals 150 ohm.m for “redbed” sandstones and shales (upper Pictou Group) at 0-500 m depth; 10 ohm.m for sandstone-shale-coaly material (lower Pictou Group), between 500-1500 to 2700 m; and, 150 ohm.m for sandstone-shale-coaly material plus underlying sandstone-conglomerate strata, between 2700-4000 m
* 2001 well log (through nearby Sackville Subbasin in New Brunswick) using 90-inch induction array shows range 40-300 ohm (midpoint 170 ohm.m) [31]

Assign 150 ohm.m based on more recent MT survey [9] across PEI transecting Maritime / Magdalen Basin lithology which is similar beneath NS, and similar resistivity from well log [31]. Limits 10, 300 ohm.m.</td></tr>
</table>

Table 1 (continued)
1D Earth Resistivity Models for Nova Scotia - Zone 1 (North Mainland)

Layer	Depth Certainty	Thickness	Resistivity (ohm-m) Certainty	Conductivity (S/m)	Comments
3. Upper Crust	2 – 12 km [13, 14, 15] [I, II]	10 km	1000 [6] [II]	0.001 [24]	Variety of rock types, including Neoproterozoic (Late Precambrian) gneiss and schist (originally volcanic and sedimentary rock), and granitic intrusive rocks; Early Paleozoic succession of mixed clastic sedimentary (mudstone, siltstone, shale, sandstone, conglomerate) and volcanic rocks and granitoid intrusions [30, 34]. No onshore deep-seismic transects across NS were identified. Scaled from regional seismic profiles situated offshore of NB, PEI and Cape Breton Island: * Line 86/1 [14], bottom depth 10 km * Line 88/1 [14], bottom depth 6 km * Line 88-2 [15], bottom depth 9 km Site specific seismic sounding: * Line D [13], at Cheticamp on CBI, bottom depth 14.7 km Other depths to bottom of layer: * Avalon zone on Newfoundland island [7], 12 km * New England (USA) Appalachians [16], 7 km Assign 10 km thickness, average of above depths (10, 6, 9, 14.7 km)

Table 1 (continued)
1D Earth Resistivity Models for Nova Scotia - Zone 1 (North Mainland)

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m)	Comments
3. Upper Crust (continued)	Resistivity - within mainland Nova Scotia: No post-2000s regional MT transects across mainland NS identified * 1966 MT survey 1D model for Halifax suggests 1000 ohm.m between 5 - 100 km depth [19] * 1970s regional MT transect [6] indicates 2D resistivity 1000 ohm.m at 0.5-44 km depth within eastern half of NS [6] Resistivity – other locations: * 1970s regional MT transect [6] indicates 2D resistivity 1000 ohm.m at 2-40 km depth in southeast NB. Coastal MT site at St. Antoine (N of Moncton) reveals 1D resistivities of 1000 ohm.m from 2 to 400 km, and 1000 ohm.m from 1 to 43 km depth [6] * 1983 AMT survey [12] in Miramichi area (over a granitic intrusion) delineated 10000 ohm.m to 2.4 km depth, and > 100000 ohm.m between 2.4-19 km depth * Lithoprobe MT transect [18] across Avalon Zone on island of Newfoundland shows range 400-5000 ohm.m (midpoint 2700 ohm.m) * Eastern Piedmont terrane (Avalon Zone terrane) in southern Appalachians, weighted average 800 ohm.m, range 250-1000 ohm.m, at depth of 0~15 km [10] Assign 1000 ohm.m, based on regional 2D model [6] across Atlantic Canada using limited number of MT survey stations. Limits 250, 5000 ohm.m. Over large intrusive bodies much higher resistivity values, 10000 – 100000 ohm.m, may be present.				

Table 1 (continued)
1D Earth Resistivity Models for Nova Scotia - Zone 1 (North Mainland)

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m)	Comments
4. Middle Crust	12 – 26 km [13, 14, 15] / [I, II]	14 km	1000 [6, 19, 20] / [II]	0.001 [24]	Scaled from regional seismic profiles situated offshore of NB, PEI and Cape Breton Island: * Line 86/1 [14], bottom depth 29 km * Line 88/1 [14], bottom depth 25 km * Line 88-2 [15], bottom depth 17.5 km Site specific seismic sounding: * Line D [13], at Cheticamp on Cape Breton Island, bottom depth 25.3 km Other depths to bottom of layer: * Avalon zone on Newfoundland island [7], 23 km * New England (USA) Appalachians [16], 22 km Assign 26 km bottom depth, average of above depths (29, 25, 25,3 km)
	Resistivity - within mainland Nova Scotia: * 1966 MT survey 1D model for Halifax suggests 1000 ohm.m between 5 - 100 km depth [19] * 1970s regional MT transect [6] indicates 2D resistivity 1000 ohm.m at 0.5-44 km depth within eastern half of NS [6] * 20 km depth-resistivity map shows predominantly 1000 ohm.m [20] Resistivity – other locations: * 1970s regional MT transect [6] indicates 2D resistivity 1000 ohm.m at 2-40 km depth in southeast NB. * 1983 AMT survey [12] in Miramichi area delineated > 100000 ohm.m between 2.4-19 km depth, and 10000 ohm.m between 19-32 km * Lithoprobe MT transect [18] across Avalon Zone on island of Newfoundland shows distinct low resistivity, range 7-65 ohm.m (midpoint 35 ohm.m) * Eastern Piedmont terrane (Avalon Zone terrane) in southern Appalachians, weighted average approx. 1900 ohm.m, range 30-8000 ohm.m [10] Assign approx. 1000 ohm.m, based on regional 2D model [6, 19] and depth-resistivity map [20]. Limits 30, 8000 ohm.m				

Table 1 (continued)
1D Earth Resistivity Models for Nova Scotia - Zone 1 (North Mainland)

<table>
<tr><th rowspan="2">Layer</th><th>Depth</th><th rowspan="2">Thickness</th><th>Resistivity (ohm-m)</th><th rowspan="2">Conductivity (S/m)</th><th rowspan="2">Comments</th></tr>
<tr><th>Certainty</th><th>Certainty</th></tr>
<tr><td rowspan="3">5. Lower Crust</td><td>26 – 44 km
[13, 14, 15]</td><td rowspan="2">18 km</td><td>1000
[6, 19, 20]</td><td rowspan="2">0.0001
[24]</td><td rowspan="2">Scaled from regional seismic profiles situated offshore of NB, PEI and Cape Breton Island:
* Line 86/1 [14], bottom depth 47 km
* Line 88/1 [14], bottom depth 43 km
* Line 86/5 and 86/5A, bottom depth ranges 36-46 km (midpoint 41 km)
* Line 88-2 [15], bottom depth 35 km</td></tr>
<tr><td>[I, II]</td><td>[II]</td></tr>
<tr><td colspan="5">Site specific seismic sounding:
* Line D [13], at Cheticamp on Cape Breton Island, bottom depth 43.3 km

Other depth determinations for NB:
* range 40-46 km (midpoint 43 km), calculated from gravity anomaly data [21]
* approx. 37 km [22] deep, offshore at southern margin of NS

Other depths to bottom of layer:
* Newfoundland island - Avalon zone, 34 km onshore [7] and 40 km offshore [16]
* New England Appalachians [16], 35 km

Assign approx. 44 km bottom depth, average of above depths (47, 43, midpoint 41 km) determined from more recent seismic surveys

<u>Resistivity - within mainland Nova Scotia</u>:
* 1966 MT survey 1D model for Halifax suggests 1000 ohm.m between 5 - 100 km depth [19]
* 1970s regional MT transect [6] indicates 2D resistivity 1000 ohm.m at 0.5-44 km depth within eastern half of NS [6]
* 40 km depth-resistivity map shows predominantly 1000 ohm.m [20]

<u>Resistivity – other locations</u>:
* 1970s regional MT transect [6] indicates 2D resistivity 1000 ohm.m at 2-40 km depth in southeast NB
* 1983 AMT survey [12] in Miramichi area delineated 300 ohm.m below 32 km
* Lithoprobe MT transect [18] across Avalon Zone on island of Newfoundland shows 15 ohm.m, at depth 23-34 km
* Eastern Piedmont terrane (Avalon Zone terrane) in southern Appalachians, weighted average approx. 275 ohm.m, range 30-1000 ohm.m [10]

Assign approx. 1000 ohm.m, based on regional 2D model [6, 19] and depth-resistivity map [20]. Lower limit 30 ohm.m</td></tr>
</table>

Table 1 (continued)
1D Earth Resistivity Models for Nova Scotia - Zone 1 (North Mainland)

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m)	Comments
6. Upper Mantle	44 - 100 km [23] / [III]	56 km	325 [6, 20] / [II]	0.003076 [24]	Used generalized lower depth of 100 km [23].
	Resistivity – within mainland Nova Scotia: * 1966 MT survey 1D model for Halifax suggests 1000 ohm.m between 5 - 100 km depth [19] * 1970s regional MT transect [6] indicates 2D resistivity 100 ohm.m at 44-94 km depth within eastern half of NS [6] * 100 km depth-resistivity map shows predominantly 550 ohm.m [20] Resistivity – other locations: * 1970s regional MT transect [6] indicates 2D resistivity 100 ohm.m at 40-95 km depth in southeast NB * Eastern Piedmont terrane (Avalon Zone terrane) in southern Appalachians, weighted average approx. 1200 ohm.m, range 250-3000 ohm.m [10] * Canada regional model [23] indicates 244 ohm.m for depth 0-100 km Assign 325 ohm.m, midpoint of values (100, 550 ohm.m) based on 1970s 2D regional profile [6] and depth-resistivity map [20]. Limits 100, 3000 ohm.m				
7. Upper Mantle	100 - 250 km [23] / [III]	150 km	2000 [20] / [II]	0.0005 [24]	Used generalized lower depth of 250 km [23].

	<u>Resistivity - within mainland Nova Scotia</u>: * 1970s regional MT transect [6] indicates 2D resistivity 20 ohm.m below 94 km depth within eastern half of NS [6] * 200 km depth-resistivity map shows range 1000 to > 3100 ohm.m; higher resistivity in western half of NS [20] <u>Resistivity – other locations</u>: * 1970s regional MT transect [6] indicates 2D resistivity 20 ohm.m below 95 km in southeast NB * Eastern Piedmont terrane (Avalon Zone terrane) in southern Appalachians, weighted average approx. 1350 ohm.m, range 30-6000 ohm.m [10] * Canada regional model [23] indicates 158 ohm.m for depth 100-250 km Assign 2000 ohm.m, average of values (midpoint 1000, 3100 ohm.m), on basis of depth-resistivity map [20] and general agreement with southern Appalachian [10] resistivity values. Limits 20, 6000 ohm.m. Uncertain about validity of low resistivity indicated by 1970s survey when compared against more recent indications of [10] and [20]

Table 1 (continued)
1D Earth Resistivity Models for Nova Scotia - Zone 1 (North Mainland)

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m)	Conductivity (S/m) / Certainty	Comments
8. Upper Mantle	250–410 km [23] / [III]	160 km	29 [25]	0.0346 [23] / [III]	Assign Canada regional model [23] for all depths and resistivities below 250 km.
9. Transition Zone	410–520 km [23] / [III]	110 km	8 [25]	0.1258 [23] / [III]	Assign Canada regional model
10. Transition Zone	520–670 km [23] / [III]	150 km	2.4 [25]	0.4168 [23] / [III]	Assign Canada regional model
11. Lower Mantle	670–900 km [23] / [III]	230 km	1.12 [25]	0.89125 [23] / [III]	Assign Canada regional model
12. Lower Mantle	900–1000 km [23] / [III]	100 km	0.47 [25]	2.0892 [23] / [III]	Assign Canada regional model

See end of Table 3 for abbreviations and notes

Table 2
1D Earth Resistivity Models for Nova Scotia – Zone 2 (South Mainland)

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m) / Certainty	Comments
	Zone 2 incorporates the remaining 90 % of the South Mainland portion of NS not covered by sedimentary rock of the Maritimes basin. The lithotectonic *Meguma Terrane* underlies all of the South Mainland. It is comprised of Lower Proterozoic to Ordovician metasedimentary rock, later intruded by voluminous granitoids during Devonian times. Undeformed sedimentary basin – Layer 2 – is absent from Zone 2.				
1. Overburden	5 – 35 m [7, 8] [I]	20 m	25 [2] [II]	0.04 [24]	Till veneer and till blanket deposits are predominant [1]. Till veneer more common along east margin of NS. Till commonly stoney with sand matrix, underlain by hard Precambrian and Paleozoic rocks [3] in more southern part. Silty till common in lowland areas in northern part of Mainland-south [3]. Drumlin hills common, consisting of reddish silty till [3].
		Total till thickness (combination of individual till layers) ranges 5-35 m following Atlantic coast [7], 12-26 m along Yarmouth-Digby coast [8]. Individual till layers average 4 m, can reach up to 30 m thick [26] Halifax - Dartmouth: thin (< 4 m thick) discontinuous till over areas of bedrock dominated terrain [27]. Stoney till plain underlying Halifax and Dartmouth cities reaches 10-20 m thick and drumlins reach 30 m thick [27, 28]. Southeast of Dartmouth, combined tills and drumlins up to 40 m thick [27] Assign 20 m thickness, based on midpoint of range (5, 35 m) Resistivities for tills in Canada range 20-100 ohm.m [17]. Borehole logs [2] reveal range 13-35 ohm.m for overburden in central NS (Musquodobit, Schubenacadie) and range 3-50 ohm.m in southern Cape Breton Island. Assign midpoint 25 ohm.m, based regional borehole data. Limits 20, 100 ohm.m			
2. Sedimentary Basin	absent	---	---	---	---

Table 2 (continued)
1D Earth Resistivity Models for Nova Scotia – Zone 2 (South Mainland)

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m)	Comments
3. Upper Crust	2 – 12 km [13, 14, 15] [I, II]	10 km	1000 [6] [II]	0.001 [24]	Predominantly Meguma Terrane folded metasediments (metamorphosed greywacke, slate) of Neoproterozoic / Cambrian to Ordovician time. Extensively intruded by Devonian granitoids. Greywacke 6.7 km thick, overlying slate up to 11.7 km thick [30]. Along north shore parallel to Bay of Fundy, strip of Triassic-Jurassic bedrock comprised of “redbed” clastic sediments (siltstone, sandstone) and volcanic basalt [30, 34] No onshore deep-seismic transects across NS were identified. Scaled from regional seismic profiles situated offshore of NB, PEI and Cape Breton Island: * Line 86/1 [14], bottom depth 10 km * Line 88/1 [14], bottom depth 6 km * Line 88-2 [15], bottom depth 9 km Site specific seismic sounding: * Line D [13], at Cheticamp on Cape Breton Island, bottom depth 14.7 km Other depths to bottom of layer: * Avalon zone on Newfoundland island [7], 12 km * New England (USA) Appalachians [16], 7 km Assign 10 km thickness, average of above depths (10, 6, 9, 14.7 km).

Table 2 (continued)
1D Earth Resistivity Models for Nova Scotia – Zone 2 (South Mainland)

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m)	Comments
3. Upper Crust (continued)	Resistivity information limited for coverage of South Mainland, therefore applied values determined mainly for North Mainland for layers 3 to 7. Resistivity - within mainland Nova Scotia: No post-2000s regional MT transects across mainland NS identified. * 1966 MT survey 1D model for Halifax suggests 1000 ohm.m between 5 - 100 km depth [19] * 1970s regional MT transect [6] indicates 2D resistivity 1000 ohm.m at 0.5-44 km depth within eastern half of NS [6] * 1985 near-surface EM survey at Halifax airport indicates background resistivity about 200 ohm.m for Halifax Formation black slates, with localized low-resistivity (i.e. conductive) zones ranging 26-90 ohm.m due to pyyrrohite mineralization in shales [36] Resistivity – other locations: * 1970s regional MT transect [6] indicates 2D resistivity 1000 ohm.m at 2-40 km depth in southeast NB. Coastal MT site at St. Antoine (N of Moncton) reveals 1D resistivities of 1000 ohm.m from 2 to 400 km, and 1000 ohm.m from 1 to 43 km depth [6] * 1983 AMT survey [12] in Miramichi area (over a granitic intrusion) delineated 10000 ohm.m to 2.4 km depth, and > 100000 ohm.m between 2.4-19 km depth * Lithoprobe MT transect [18] across Avalon Zone on island of Newfoundland shows range 400-5000 ohm.m (midpoint 2700 ohm.m) * Eastern Piedmont terrane (Avalon Zone terrane) in southern Appalachians, weighted average 800 ohm.m, range 250-1000 ohm.m, at depth of 0~15 km [10] Assign 1000 ohm.m, based on regional 2D model [6] across Atlantic Canada using limited number of MT survey stations. Limits 200, 5000 ohm.m. Over large intrusive bodies much higher resistivity values, 10000 – 100000 ohm.m, may be present.				

Table 2 (continued)
1D Earth Resistivity Models for Nova Scotia – Zone 2 (South Mainland)

<table>
<tr><th rowspan="2">Layer</th><th>Depth</th><th rowspan="2">Thickness</th><th>Resistivity (ohm-m)</th><th rowspan="2">Conductivity (S/m)</th><th rowspan="2">Comments</th></tr>
<tr><th>Certainty</th><th>Certainty</th></tr>
<tr><td rowspan="3">4. Middle Crust</td><td>12 – 26 km
[13, 14, 15]</td><td rowspan="2">14 km</td><td>1000
[6, 19, 20]</td><td rowspan="2">0.001
[24]</td><td rowspan="2">Scaled from regional seismic profiles situated offshore of NB, PEI and Cape Breton Island:
* Line 86/1 [14], bottom depth 29 km
* Line 88/1 [14], bottom depth 25 km
* Line 88-2 [15], bottom depth 17.5 km
Site specific seismic sounding:
* Line D [13], at Cheticamp on Cape Breton Island, bottom depth 25.3 km
Other depths to bottom of layer:
* Avalon zone on Newfoundland island [7], 23 km
* New England (USA) Appalachians [16], 22 km
Assign 26 km bottom depth, average of above depths (29, 25, 25,3 km)</td></tr>
<tr><td>[I, II]</td><td>[II]</td></tr>
<tr><td colspan="5"><u>Resistivity - within mainland Nova Scotia</u>:
* 1966 MT survey 1D model for Halifax suggests 1000 ohm.m between 5 - 100 km depth [19]
* 1970s regional MT transect [6] indicates 2D resistivity 1000 ohm.m at 0.5-44 km depth within eastern half of NS [6]
* 20 km depth-resistivity map shows predominantly 1000 ohm.m [20]
<u>Resistivity – other locations</u>:
* 1970s regional MT transect [6] indicates 2D resistivity 1000 ohm.m at 2-40 km depth in southeast NB.
* 1983 AMT survey [12] in Miramichi area delineated > 100000 ohm.m between 2.4-19 km depth, and 10000 ohm.m between 19-32 km
* Lithoprobe MT transect [18] across Avalon Zone on island of Newfoundland shows distinct low resistivity, range 7-65 ohm.m (midpoint 35 ohm.m)
* Eastern Piedmont terrane (Avalon Zone terrane) in southern Appalachians, weighted average approx. 1900 ohm.m, range 30-8000 ohm.m [10]
Assign approx. 1000 ohm.m, based on regional 2D model [6, 19] and depth-resistivity map [20]. Limits 30, 8000 ohm.m</td></tr>
</table>

Table 2 (continued)
1D Earth Resistivity Models for Nova Scotia – Zone 2 (South Mainland)

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m)	Comments
5. Lower Crust	26 – 44 km [13, 14, 15] [I, II]	18 km	1000 [6, 19, 20] [II]	0.0001 [24]	Scaled from regional seismic profiles situated offshore of NB, PEI and Cape Breton Island: * Line 86/1 [14], bottom depth 47 km * Line 88/1 [14], bottom depth 43 km * Line 86/5 and 86/5A, bottom depth ranges 36-46 km (midpoint 41 km) * Line 88-2 [15], bottom depth 35 km Site specific seismic sounding: * Line D [13], at Cheticamp on Cape Breton Island, bottom depth 43.3 km Other depth determinations for NB: * range 40-46 km (midpoint 43 km), calculated from gravity anomaly data [21] * approx. 37 km [22] deep, offshore at southern margin of NS Other depths to bottom of layer: * Newfoundland island - Avalon zone, 34 km onshore [7] and 40 km offshore [16] * New England Appalachians [16], 35 km Assign approx. 44 km bottom depth, average of above depths (47, 43, midpoint 41 km) determined from more recent seismic surveys Resistivity - within mainland Nova Scotia: * 1966 MT survey 1D model for Halifax suggests 1000 ohm.m between 5 - 100 km depth [19] * 1970s regional MT transect [6] indicates 2D resistivity 1000 ohm.m at 0.5-44 km depth within eastern half of NS [6] * 40 km depth-resistivity map shows predominantly 1000 ohm.m [20] Resistivity – other locations: * 1970s regional MT transect [6] indicates 2D resistivity 1000 ohm.m at 2-40 km depth in southeast NB * 1983 AMT survey [12] in Miramichi area delineated 300 ohm.m below 32 km * Lithoprobe MT transect [18] across Avalon Zone on island of Newfoundland shows 15 ohm.m * Eastern Piedmont terrane (Avalon Zone terrane) in southern Appalachians, weighted average approx. 275 ohm.m, range 30-1000 ohm.m [10] Assign approx. 1000 ohm.m, based on regional 2D model [6, 19] and depth-resistivity map [20]. Lower limit 30 ohm.m

Table 2 (continued)
1D Earth Resistivity Models for Nova Scotia – Zone 2 (South Mainland)

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m)	Comments
6. Upper Mantle	44 - 100 km [23] / [III]	56 km	325 [6, 20] / [II]	0.003076 [24]	Used generalized lower depth of 100 km [23].
	Resistivity - within mainland Nova Scotia: * 1966 MT survey 1D model for Halifax suggests 1000 ohm.m between 5 - 100 km depth [19] * 1970s regional MT transect [6] indicates 2D resistivity 100 ohm.m at 44-94 km depth within eastern half of NS [6] * 100 km depth-resistivity map shows predominantly 550 ohm.m [20] Resistivity – other locations: * 1970s regional MT transect [6] indicates 2D resistivity 100 ohm.m at 40-95 km depth in southeast NB * Eastern Piedmont terrane (Avalon Zone terrane) in southern Appalachians, weighted average approx. 1200 ohm.m, range 250-3000 ohm.m [10] * Canada regional model [23] indicates 244 ohm.m for depth 0-100 km Assign 325 ohm.m, midpoint of values (100, 550 ohm.m) based on 1970s 2D regional profile [6] and depth-resistivity map [20]. Limits 100, 3000 ohm.m				
7. Upper Mantle	100 - 250 km [23] / [III]	150 km	2000 [20] / [II]	0.0005 [24]	Used generalized lower depth of 250 km [23].

	<u>Resistivity - within mainland Nova Scotia</u>: * 1970s regional MT transect [6] indicates 2D resistivity 20 ohm.m below 94 km depth within eastern half of NS [6] * 200 km depth-resistivity map shows range 1000 to > 3100 ohm.m; higher resistivity in western half of NS [20] <u>Resistivity – other locations</u>: * 1970s regional MT transect [6] indicates 2D resistivity 20 ohm.m below 95 km in southeast NB * Eastern Piedmont terrane (Avalon Zone terrane) in southern Appalachians, weighted average approx. 1350 ohm.m, range 30-6000 ohm.m [10] * Canada regional model [23] indicates 158 ohm.m for depth 100-250 km Assign 2000 ohm.m, average of values (midpoint 1000, 3100 ohm.m), on basis of depth-resistivity map [20] and general agreement with southern Appalachian [10] resistivity values. Limits 20, 6000 ohm.m. Uncertain about validity of low resistivity indicated by 1970s survey when compared against more recent indications [10, 20]

Table 2 (continued)
1D Earth Resistivity Models for Nova Scotia – Zone 2 (South Mainland)

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m)	Conductivity (S/m) / Certainty	Comments
8. Upper Mantle	250–410 km [23] / [III]	160 km	29 [25]	0.0346 [23] / [III]	Assign Canada regional model [23] for all depths and resistivities below 250 km.
9. Transition Zone	410–520 km [23] / [III]	110 km	8 [25]	0.1258 [23] / [III]	Assign Canada regional model
10. Transition Zone	520–670 km [23] / [III]	150 km	2.4 [25]	0.4168 [23] / [III]	Assign Canada regional model
11. Lower Mantle	670–900 km [23] / [III]	230 km	1.12 [25]	0.89125 [23] / [III]	Assign Canada regional model
12. Lower Mantle	900–1000 km [23] / [III]	100 km	0.47 [25]	2.0892 [23] / [III]	Assign Canada regional model

See end of Table 3 for abbreviations and notes

Table 3

1D Earth Resistivity Models for Nova Scotia – Zone 3 (Cape Breton Island)

Layer	Depth Certainty	Thickness	Resistivity (ohm-m) Certainty	Conductivity (S/m) Certainty	Comments
	Zone 3 is limited to Cape Breton Island. Three lithotectonic terrains (model Layer 3) same as on Newfoundland Island underlie CBI. The *Avalon Terrane* occupies the eastern 1/3 of CBI and is comprised of same basement rock as in Zone 1: Neoproterozoic mafic volcanic rocks and granitoid intrusives, with some associated clastic sedimentary rocks; and Upper Neoproterozoic to Cambrian clastic sedimentary rock; intruded in places by Middle Devonian to earliest Carboniferous plutonic rocks. The combined *Dunnage – Gander Terrane* underlies the much of the remaining 2/3 of CBI, and is comprised mainly of a mix of Neoproterozoic to Ordovician-Silurian metamorphic rocks with coeval and later intrusions of granitoid rock [35]. The *Humber Terrane* underlies the northern tip of CBI and is comprised of early Proterozoic (ca. 1 Ga) metamorphic rock (paragneiss, metavolcanics) [35] Overlying 70 % basement rocks of the three terranes is the Late Devonian-Carboniferous *Maritimes Basin* (model Layer 2). Windows of the older Avalon and Dunnage-Gander Terranes are exposed through the basin cover. Basin sedimentary rock is comprised of sequences of conglomerate, sandstone and siltstone (especially dominant in upper part of Maritime Basin), with some limestone and volcanic rock, and substantial thicknesses (100-700 m) of evaporates (anhydrite, halite (salt), gypsum) in lower part of basin [34]. Coal measures are present in the upper part of the basin strata.				
1. Overburden	4 – 10 m [1, 5] [I]	7 m	25 [2] [II]	0.04 [24]	Till blanket (average 10 m) is predominant on southern half of island, with till veneer (< 4 m) areas common in northern peninsula [1, 5]. Mix of stoney and silty till [3]. Drumlin hill cluster along east margin of island [3] Assign midpoint 7 m thickness over all the island
		Resistivities for tills in Canada range 20-100 ohm.m [17]. Borehole logs [2] reveal range 13-35 ohm.m for overburden in central NS (Musquodobit, Schubenacadie) and range 3-50 ohm.m in southern Cape Breton Island. Assign midpoint 25 ohm.m, based regional borehole data. Limits 20, 100 ohm.m			

Table 3 (continued)
1D Earth Resistivity Models for Nova Scotia - Zone 3 (Cape Breton Island)

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m)	Comments
2. Sedimentary Basin	0 – 1.5 km [11]	0.75 km	150 [9, 31]	0.006666 [24]	Clastic sedimentary bedrock consists of early-to-late Carboniferous sandstone, siltstone, shale, conglomerate, and coal measures. In addition, carbonates (limestones) and evaporates (gypsum, anhydrite, halite) are common surrounding Bras d'Or Lake [34].
	[I]		[II]		
	Regional basin thickness map shows basin < 1.5 km thick [32], deepening offshore Assign midpoint 0.75 km thickness overall <u>Resistivity - within mainland Nova Scotia</u>: * No post-2000s regional MT transects identified * 1966 MT survey 1D model for Halifax suggests 200 ohm.m to 5 km depth [19] * 1970s regional MT transect [6] indicates 2D resistivity 9 ohm.m at 0-0.5 km depth, and 1000 ohm.m at 0.5-44 km depth within eastern half of NS [6] <u>Resistivity – other locations</u>: * 1970s MT and magnetic variation surveys for a PEI location reveal 9 ohm.m to depth of 3 to 4 km [6, 19] * 1983 AMT survey [12] in Miramichi area of New Brunswick identified 200 ohm.m for nearby 1 km thick Maritime Basin * 1986 MT survey [9] across PEI reveals 150 ohm.m for "redbed" sandstones and shales (upper Pictou Group) at 0-500 m depth; 10 ohm.m for sandstone-shale-coaly material (lower Pictou Group), between 500-1500 to 2700 m; and, 150 ohm.m for sandstone-shale-coaly material plus underlying sandstone-conglomerate strata, between 2700-4000 m * 2001 well log (through nearby Sackville Subbasin in New Brunswick) using 90-inch induction array shows range 40-300 ohm (midpoint 170 ohm.m) [31] Assign 150 ohm.m based on more recent MT survey [9] across PEI transecting Maritime / Magdalen Basin lithology which is similar beneath NS, and similar resistivity from well log [31]. Limits 10, 300 ohm.m.				

Table 3 (continued)
1D Earth Resistivity Models for Nova Scotia - Zone 3 (Cape Breton Island)

Layer	Depth Certainty	Thickness	Resistivity (ohm-m) Certainty	Conductivity (S/m)	Comments
3. Upper Crust	0.75 – 12 km [13, 14, 15] [I, II]	11.25 km	8000 [6, 18] [II]	0.000125 [24]	Variety of rock types, including Neoproterozoic (Late Precambrian) gneiss and schist (originally volcanic and sedimentary rock), and granitic intrusive rocks; Early Paleozoic succession of mixed clastic sedimentary (mudstone, siltstone, shale, sandstone, conglomerate) and volcanic rocks and granitoid intrusions [30, 34]. No onshore deep-seismic transects across CBI were identified. Scaled from regional seismic profiles situated offshore of NB, PEI and Cape Breton Island: * Line 86/1 [14], bottom depth 10 km * Line 88/1 [14], bottom depth 6 km * Line 88-2 [15], bottom depth 9 km Site specific seismic sounding: * Line D [13], at Cheticamp on CBI, bottom depth 14.7 km Other depths to bottom of layer: * Avalon zone on Newfoundland island [7], 12 km * New England (USA) Appalachians [16], 7 km Assign 10 km thickness, average of above depths (10, 6, 9, 14.7 km)

Table 3 (continued)
1D Earth Resistivity Models for Nova Scotia - Zone 3 (Cape Breton Island)

Layer	Depth Certainty	Thickness	Resistivity (ohm-m) Certainty	Conductivity (S/m)	Comments
3. Upper Crust (continued)	Resistivity - within mainland Nova Scotia: No MT transects specific to CBI identified No post-2000s regional MT transects across mainland NS identified * 1966 MT survey 1D model for Halifax suggests 1000 ohm.m between 5 - 100 km depth [19] * 1970s regional MT transect [6] indicates 2D resistivity 1000 ohm.m at 0.5-44 km depth within eastern half of NS [6] Resistivity – other locations: * 1970s regional MT transect [6] indicates 2D resistivity 1000 ohm.m at 2-40 km depth in southeast NB. Coastal MT site at St. Antoine (N of Moncton) reveals 1D resistivities of 1000 ohm.m from 2 to 400 km, and 1000 ohm.m from 1 to 43 km depth [6] * 1983 AMT survey [12] in Miramichi area (over a granitic intrusion) delineated 10000 ohm.m to 2.4 km depth, and > 100000 ohm.m between 2.4-19 km depth * Lithoprobe MT transect [18] on island of Newfoundland across: Avalon Terrane shows range 400-5000 ohm.m (midpoint 2700 ohm.m); Dunnage-Gander Terrane shows range 1000-100000 (weighted average 27000 ohm.m); Humber Terrane shows range 5000-27000 (midpoint 16000 ohm.m). Overall average of combined midpoints and weighted resistivity value is approx. 15000 ohm.m * Eastern Piedmont terrane (Avalon Zone terrane) in southern Appalachians, weighted average approx. 800 ohm.m, range 250-1000 ohm.m, at depth of 0~15 km [10] * Inner Piedmont & Blue Ridge terranes (western Dunnage equivalent) in southern Appalachians, weighted average approx. 200 ohm.m, range 100-250 ohm.m for depth of 0~15 km [10] * Valley and Ridge terrane (Humber Zone terrane) in southern Appalachians, weighted average approx. 60 ohm.m, range 50-80 ohm.m for depth of 0~15 km [10] Assign 8000 ohm.m, midpoint between overall average for Newfoundland (15000 ohm.m) and mainland Nova Scotia (1000 ohm.m). Limits 250, 27000 ohm.m. Over large intrusive bodies much higher resistivity values, 10000 – 100000 ohm.m, may be present.				

Table 3 (continued)
1D Earth Resistivity Models for Nova Scotia - Zone 3 (Cape Breton Island)

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m)	Comments
4. Middle Crust	12 – 26 km [13, 14, 15] [I, II]	14 km	5000 [6, 18] [II]	0.0002 [24]	Scaled from regional seismic profiles situated offshore of NB, PEI and Cape Breton Island: * Line 86/1 [14], bottom depth 29 km * Line 88/1 [14], bottom depth 25 km * Line 88-2 [15], bottom depth 17.5 km Site specific seismic sounding: * Line D [13], at Cheticamp on Cape Breton Island, bottom depth 25.3 km Other depths to bottom of layer: * Avalon zone on Newfoundland island [7], 23 km * New England (USA) Appalachians [16], 22 km Assign 26 km bottom depth, average of above depths (29, 25, 25,3 km)

	Resistivity - within mainland Nova Scotia: * 1966 MT survey 1D model for Halifax suggests 1000 ohm.m between 5 - 100 km depth [19] * 1970s regional MT transect [6] indicates 2D resistivity 1000 ohm.m at 0.5-44 km depth within eastern half of NS [6] Resistivity – other locations: * 1970s regional MT transect [6] indicates 2D resistivity 1000 ohm.m at 2-40 km depth in southeast NB. * 1983 AMT survey [12] in Miramichi area delineated > 100000 ohm.m between 2.4-19 km depth, and 10000 ohm.m between 19-32 km * Lithoprobe MT transect [18] on island of Newfoundland across: Avalon Terrane shows shows distinct low resistivity, range 7-65 ohm.m (midpoint 35 ohm.m); Dunnage-Gander Terrane weighted average 17000 ohm.m; Humber Terrane shows range 2-400 ohm.m (weighted average 100 ohm.m). Overall average of combined midpoints and weighted resistivity value is approx. 8500 ohm.m * Eastern Piedmont terrane (Avalon Zone terrane) in southern Appalachians, weighted average approx. 1900 ohm.m, range 30-8000 ohm.m for depth of ~15-20 km [10] * Inner Piedmont & Blue Ridge terranes (western Dunnage equivalent) in southern Appalachians, weighted average approx. 100 ohm.m, range 30-250 ohm.m for depth of ~15-20 km [10] * Valley and Ridge terrane (Humber Zone terrane) in southern Appalachians, weighted average approx. 50 ohm.m, range 5-100 ohm.m for depth of ~15-20 km [10] Assign approx. 5000 ohm.m, midpoint between overall average for Newfoundland (8500 ohm.m) and mainland Nova Scotia (1000 ohm.m). Limits 10, 17000 ohm.m

Table 3 (continued)
1D Earth Resistivity Models for Nova Scotia - Zone 3 (Cape Breton Island)

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m)	Comments
5. Lower Crust	26 – 44 km [13, 14, 15] / [I, II]	18 km	625 [6, 18] / [II]	0.0016 [24]	Scaled from regional seismic profiles situated offshore of NB, PEI and Cape Breton Island: * Line 86/1 [14], bottom depth 47 km * Line 88/1 [14], bottom depth 43 km * Line 86/5 and 86/5A, bottom depth ranges 36-46 km (midpoint 41 km) * Line 88-2 [15], bottom depth 35 km
	Site specific seismic sounding: * Line D [13], at Cheticamp on Cape Breton Island, bottom depth 43.3 km Other depth determinations for NB: * range 40-46 km (midpoint 43 km), calculated from gravity anomaly data [21] * approx. 37 km [22] deep, offshore at southern margin of NS Other depths to bottom of layer: * Newfoundland island - Avalon zone, 34 km onshore [7] and 40 km offshore [16] * New England Appalachians [16], 35 km Assign approx. 44 km bottom depth, average of above depths (47, 43, midpoint 41 km) determined from more recent seismic surveys <u>Resistivity - within mainland Nova Scotia</u>: * 1966 MT survey 1D model for Halifax suggests 1000 ohm.m between 5 - 100 km depth [19] * 1970s regional MT transect [6] indicates 2D resistivity 1000 ohm.m at 0.5-44 km depth within eastern half of NS [6] <u>Resistivity – other locations</u>: * 1970s regional MT transect [6] indicates 2D resistivity 1000 ohm.m at 2-40 km depth in southeast NB * 1983 AMT survey [12] in Miramichi area delineated 300 ohm.m below 32 km * Lithoprobe MT transect [18] on island of Newfoundland across: Avalon Terrane shows 15 ohm.m, at depth 23-34 km; Dunnage-Gander Terrane shows 100-5000 ohm.m range (weighted average 610 ohm.m); Humber Terrane shows range 60-250 (midpoint 150 ohm.m). Overall average of combined midpoints and weighted resistivity value is approx. 250 ohm.m * Eastern Piedmont terrane (Avalon Zone terrane) in southern Appalachians, weighted average approx. 270 ohm.m, range 30-1000 ohm.m for depth of 20-40 km [10]				

Table 3 (continued)
1D Earth Resistivity Models for Nova Scotia - Zone 3 (Cape Breton Island)

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m)	Comments
5. Lower Crust (continued)	Resistivity – other locations: * Inner Piedmont & Blue Ridge terranes (western Dunnage equivalent) in southern Appalachians, weighted average approx. 200 ohm.m, range 30-1000 ohm.m for depth of 20-40 km [10] * Valley and Ridge terrane (Humber Zone terrane) in southern Appalachians, weighted average approx. 825 ohm.m, range 80-1000 ohm.m for depth of 20-40 km [10] Assign approx. 625 ohm.m, midpoint between overall average for Newfoundland (250 ohm.m) and NS North Mainland (1000 ohm.m). Limits 10, 5000 ohm.m				
6. Upper Mantle	44 - 100 km [23] [III]	56 km	450 [6, 18, 20] [II]	0.00222 [24]	Used generalized lower depth of 100 km [23]
	Resistivity - within mainland Nova Scotia: * 1966 MT survey 1D model for Halifax suggests 1000 ohm.m between 5 - 100 km depth [19] * 1970s regional MT transect [6] indicates 2D resistivity 100 ohm.m at 44-94 km depth within eastern half of NS [6] * 100 km depth-resistivity map depicting mainland NS shows predominantly 550 ohm.m [20] * Choose 325 ohm.m, midpoint of values (100, 550 ohm.m) based on 1970s 2D regional profile [6] and depth-resistivity map [20] Resistivity – other locations: * 1970s regional MT transect [6] indicates 2D resistivity 100 ohm.m at 40-95 km depth in southeast NB * Lithoprobe MT transect [18] on island of Newfoundland across Dunnage-Gander Terrane shows average 600 ohm.m * Eastern Piedmont terrane (Avalon Zone terrane) in southern Appalachians, weighted average approx. 1200 ohm.m, range 250-3000 ohm.m for depth 40-100 [10] * Inner Piedmont & Blue Ridge terranes (western Dunnage equivalent) in southern Appalachians, weighted average approx. 200 ohm.m, range 300-1000 ohm.m for depth of 40-100 km [10] * Valley and Ridge terrane (Humber Zone terrane) in southern Appalachians, weighted average approx. 180 ohm.m, range 10-1000 ohm.m for depth of 40-100 km [10] * Canada regional model [23] indicates 244 ohm.m for depth 0-100 km Assign approx. 450 ohm.m, midpoint between overall average for Newfoundland (600 ohm.m) and NS North Mainland (325 ohm.m). Limits 100, 1000 ohm.m				

Table 3 (continued)
1D Earth Resistivity Models for Nova Scotia - Zone 3 (Cape Breton Island)

Layer	Depth Certainty	Thickness	Resistivity (ohm-m) Certainty	Conductivity (S/m)	Comments
7. Upper Mantle	100 - 250 km [23] [III]	150 km	750 [10, 20] [II]	0.001333 [24]	Used generalized lower depth of 250 km [23]
	Resistivity - within mainland Nova Scotia: * 1970s regional MT transect [6] indicates 2D resistivity 20 ohm.m below 94 km depth within eastern half of NS [6] * 200 km depth-resistivity map shows range 1000 ohm.m [20] Resistivity – other locations: * 1970s regional MT transect [6] indicates 2D resistivity 20 ohm.m below 95 km in southeast NB * Eastern Piedmont terrane (Avalon Zone terrane) in southern Appalachians, weighted average approx. 1350 ohm.m, range 30-6000 ohm.m for depth of 100-225 km [10] * Inner Piedmont & Blue Ridge terranes (western Dunnage equivalent) in southern Appalachians, weighted average approx. 600 ohm.m, range 50-1000 ohm.m for depth of 100-225 km [10] * Valley and Ridge terrane (Humber Zone terrane) in southern Appalachians, dominantly 10 ohm.m for depth of 100-225 km [10] * Canada regional model [23] indicates 158 ohm.m for depth 100-250 km Assign approx. 750 ohm.m, average of values (1000, 1350, 650, 30 ohm.m), on basis of depth-resistivity map [20] and general agreement with southern Appalachian [10] resistivity values. Limits 20, 6000 ohm.m. Uncertain about validity of low resistivity indicated by 1970s survey when compared against more recent indications of [10] and [20]				

Table 3 (continued)
1D Earth Resistivity Models for Nova Scotia - Zone 3 (Cape Breton Island)

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m)	Conductivity (S/m) / Certainty	Comments
8. Upper Mantle	250–410 km [23] / [III]	160 km	29 [25]	0.0346 [23] / [III]	Assign Canada regional model [23] for all depths and resistivities below 250 km.
9. Transition Zone	410–520 km [23] / [III]	110 km	8 [25]	0.1258 [23] / [III]	Assign Canada regional model
10. Transition Zone	520–670 km [23] / [III]	150 km	2.4 [25]	0.4168 [23] / [III]	Assign Canada regional model
11. Lower Mantle	670–900 km [23] / [III]	230 km	1.12 [25]	0.89125 [23] / [III]	Assign Canada regional model
12. Lower Mantle	900–1000 km [23] / [III]	100 km	0.47 [25]	2.0892 [23] / [III]	Assign Canada regional model

Table 3 (continued)
1D Earth Resistivity Models for Nova Scotia - Zone 3 (Cape Breton Island)

NOTES:
Depth Certainty
- I = best representation
  - * overburden: geological report/map coverage of local area.
  - * crust: seismic/gravity transects crossing local area
- II = likely representative
  - * crust/upper mantle: geological and/or seismic transect of a regional nature.
- III = possibly representative (measurements from general compilations).

Resistivity/Conductivity Certainty
- I = best representation (measurements from site or nearby).
  - * overburden: resistivity measurement by surface geophysical method and/or borehole in local area.
  - * crust: resistivity measurement from resistivity survey, MT survey and/or borehole in local area.
- II = likely representative (resistivity values extrapolated from measurements taken at some distance from the site, typically greater than 100 km).
  - * overburden: resistivity value obtained by geophysical measurement, including borehole logs.
  - * sedimentary basin: value obtained by geophysical survey using variety of geophysical electromagnetic methods, including MT.
  - * crust: value obtained by regional MT survey.
- III = possibly representative (measurements from general compilations

Table 3 (continued)
1D Earth Resistivity Models for Nova Scotia - Zone 3

CITED REFERENCES

1 Natural Resources Canada (2009) Surficial Materials, Atlas of Canada

2 Crow et al. (2015)

3 Dept. of Natural Resources (2015)

4 Stea and Finck (1988), surficial geology map

5 Grant (1988), surficial geology map

6 Kurtz and Garland (1976), Fig. 21

7 Dept. Mines and Energy (1980), surficial geology map

8 Dept. Mines and Energy (1982), surficial geology map

9 Jones and Garland (1986), Table 1, Fig. 9

10 Ogawa et al. (1996), Fig. 4

11 Stott and Aitken (1993), Fig. 1.1

12 Kurtz and Gupta (1992)

13 Ewing et al. (1966), Table III

14 Hall et al. (1998), Figs. 1, 2

15 Jackson (2002), Fig. 3

16 Jackson et al. (1998) Fig. 11

17 Palacky (1988)

18 McNeice (1998) including Figs. 5.3, 6.5, 6.11, 6.15, 6.17, 6.22 and 7.1

19 Srivastava and White (1971), Fig. 6

20 Jones et al. (2014), Figs. 9, 11

21 Marillier and Verhoef (1989), Fig. 7

22 Shih et al. (1988), crustal thickness map

23 Kelbert et al. (2009), Fig. 2, global and regional conductivity profile, Canada regional conductivity chosen

24 Converted from resistivity obtained from listed reference source

25 Converted from conductivity obtained from listed reference source

26 Stea and Fowler (1979), surficial geology maps

27 Fader and Miller (2008) p.31, 34; Fig. 28

28 Utting (2011), surficial geology map

29 Lynch and Deblonde (1997), bedrock geology map

30 Sangster and Smith (2007), Fig. 1

31 Stewart (2011), table 2, drill logs

32 Dietrich et al (2009), Fig. 1

33 Durling and Marillier (1996)

34 Keppie (2000), bedrock geology map

35 Hibbard et al. (2006), lithotectonic map

36 Howells and Fox (1998)

Appendix 7

Detailed Description of the Earth Resistivity Models for Ontario

1. Geological provinces of Ontario

The subdivision of Ontario into zones with one-dimensional layered Earth structure has been made as presented in Figure 1. There are seven large one-dimensional (1D) Earth resistivity models for various zones of Ontario with additional two models representing the narrow zones with anomalous geological structures, such as Zone 3a, Grenville Front Tectonic Zone and Zone 4a, Kapuskasing Uplift.

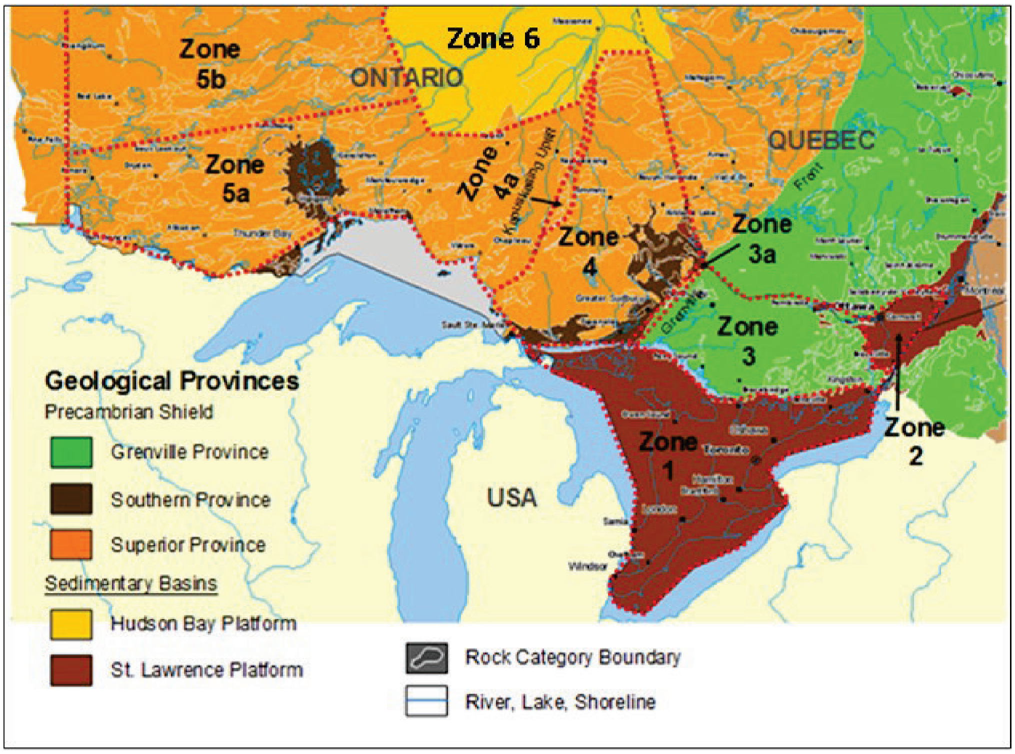


Figure 1*. The map of geological provinces of Ontario showing zones of each layered Earth model.*

The division into Zones was made on the basis of geological provinces, presented in Figure 2, and further subdivided into "sub-provinces", reflecting the dominant rock type, age of formation and tectonic evolution (Figure 3).

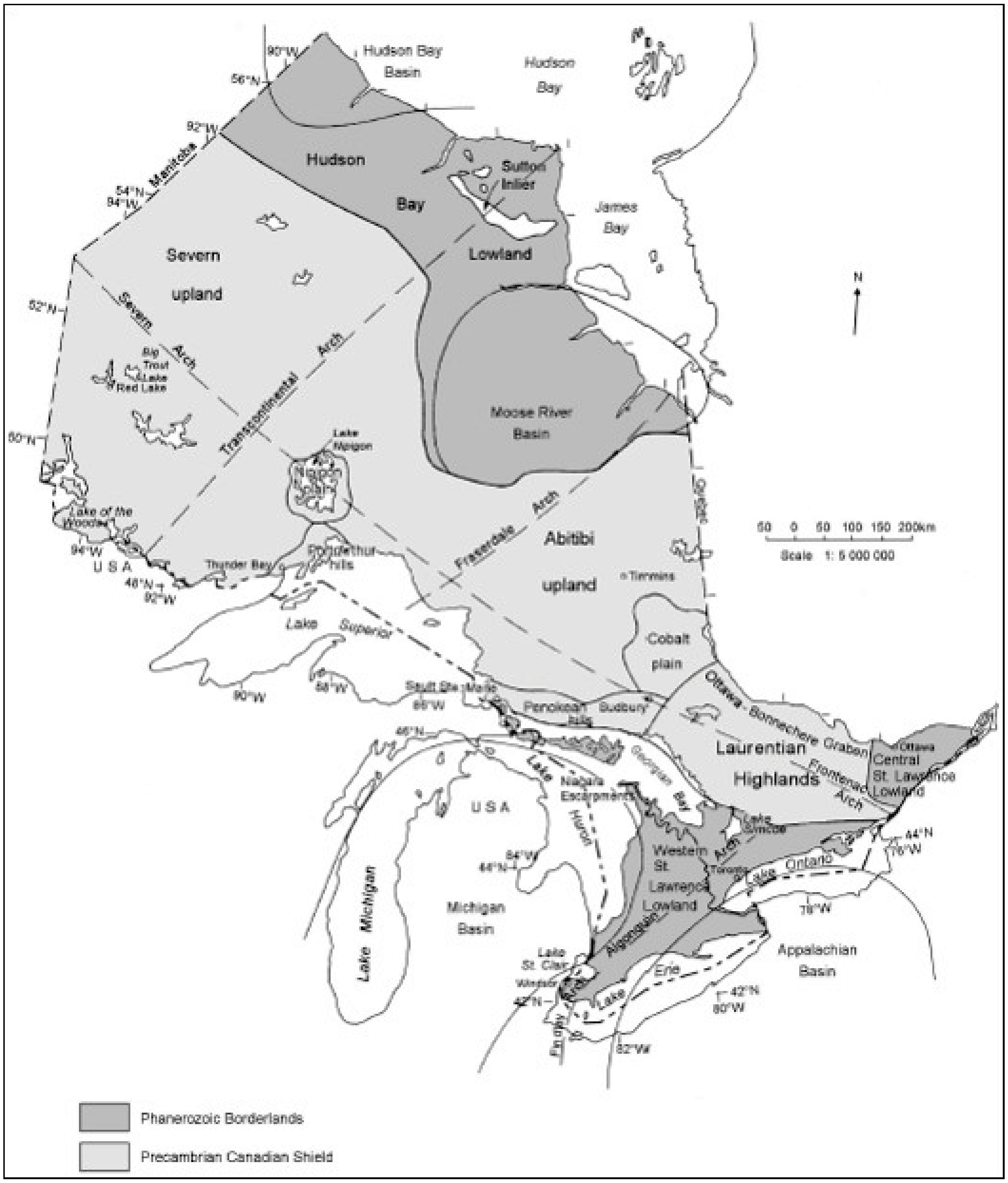


Figure 2. *Physiographic regions of Ontario and major tectonic features (Thurston, 1991 Fig. 1.2).*

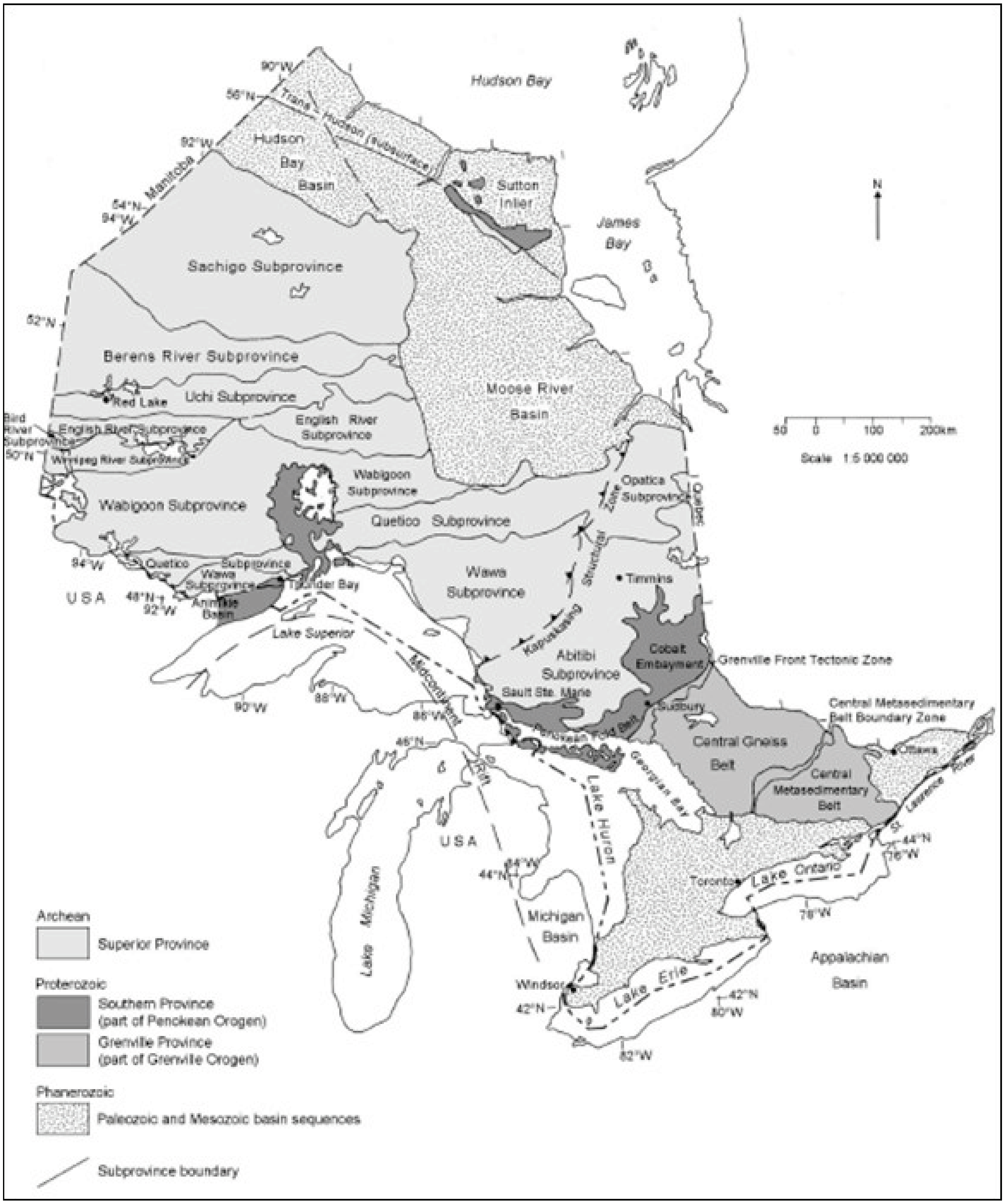


Figure 3. *Major subdivisions of the Superior and Grenville geological provinces (Thurston, 1991 Fig. 1.6). Note that the Berens River and Sachigo and other subprovinces have subsequently been further subdivided and some renamed as terranes and domains (see Figure 4).*

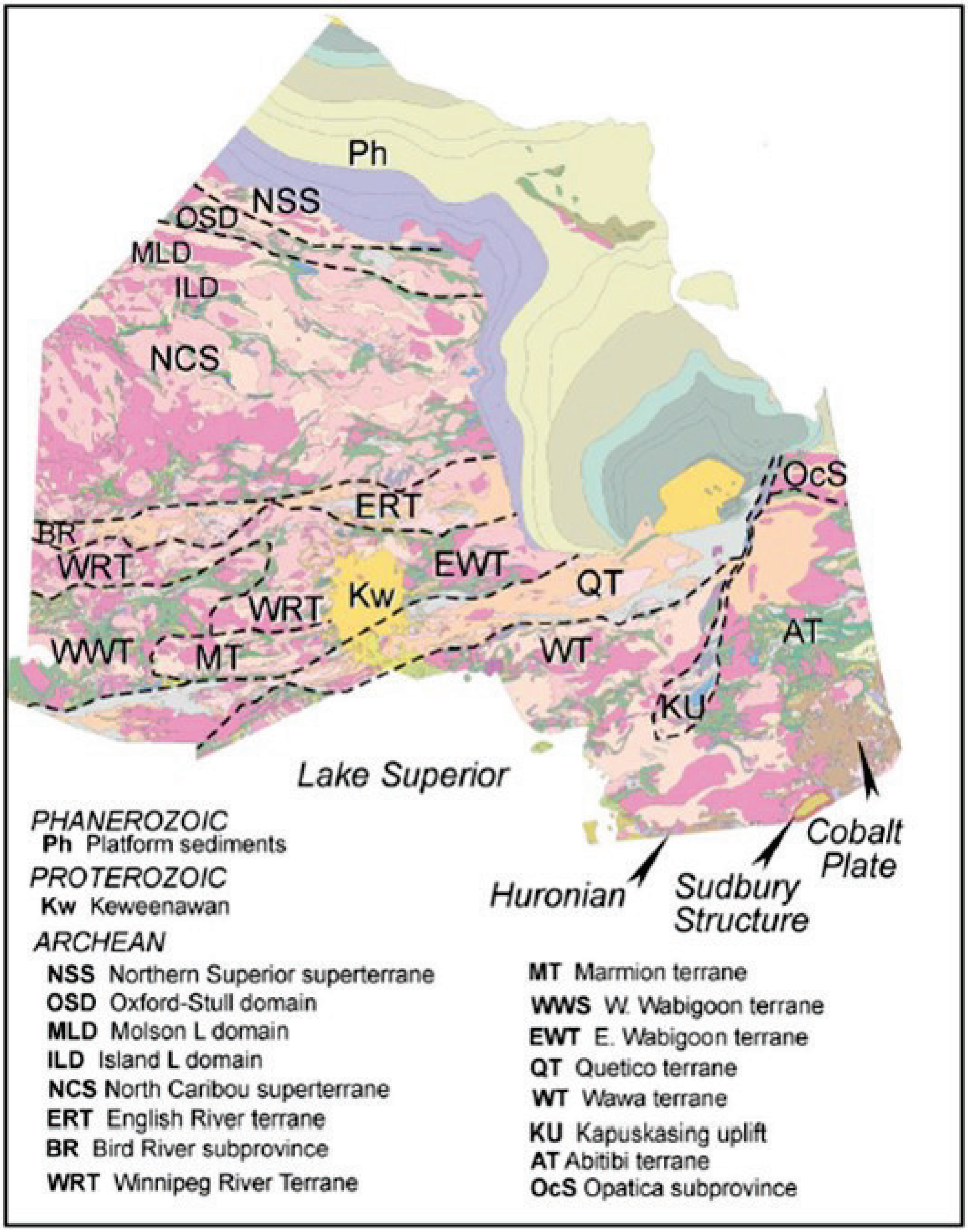


Figure 4. *Revised subdivisions of the Superior geological province which developed during the Archean (early Precambrian time) (Percival and Easton, 2007, Fig. 2). Cobalt Plate, Huronian and Kw (Nipigon Embayment) belong to the Southern geological province. Pink colours represent intrusive rock (granitoids, derived gneisses). Green represents metavolcanic rock. Blue represents metavolcanic and metasediments. Yellow Kw represents the late Precambrian intruded Nipigon diabase sills. Other yellow and brown colour represents sediments of the Southern province deposited onto the Superior during the Proterozoic (late Precambrian time).*

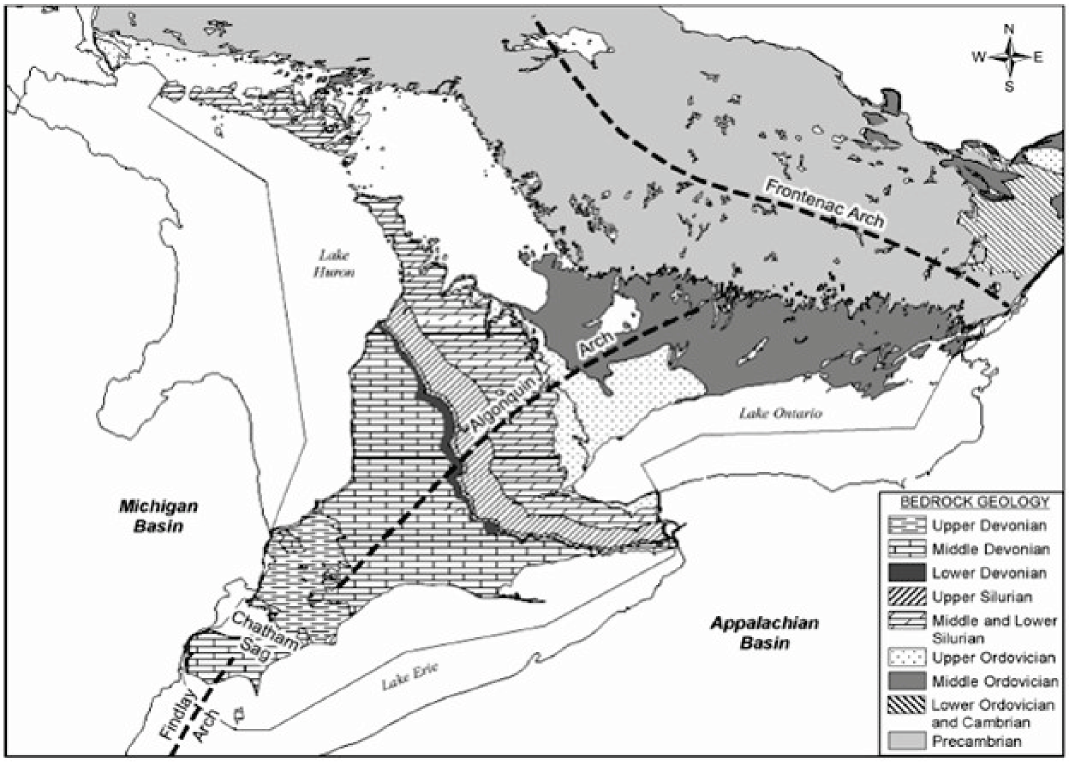


Figure 5. *Generalized geology map of Paleozoic sedimentary bedrock covering southern and eastern Ontario. Regional tectonic features also shown, e.g. arches, basins. Precambrian crystalline bedrock forming the Frontenac Arch (light gray shade) separates the Western St. Lawrence Lowland of southern Ontario from the Central St. Lawrence Lowland in eastern Ontario (Armstrong and Carter, 2006, Fig. 2).*

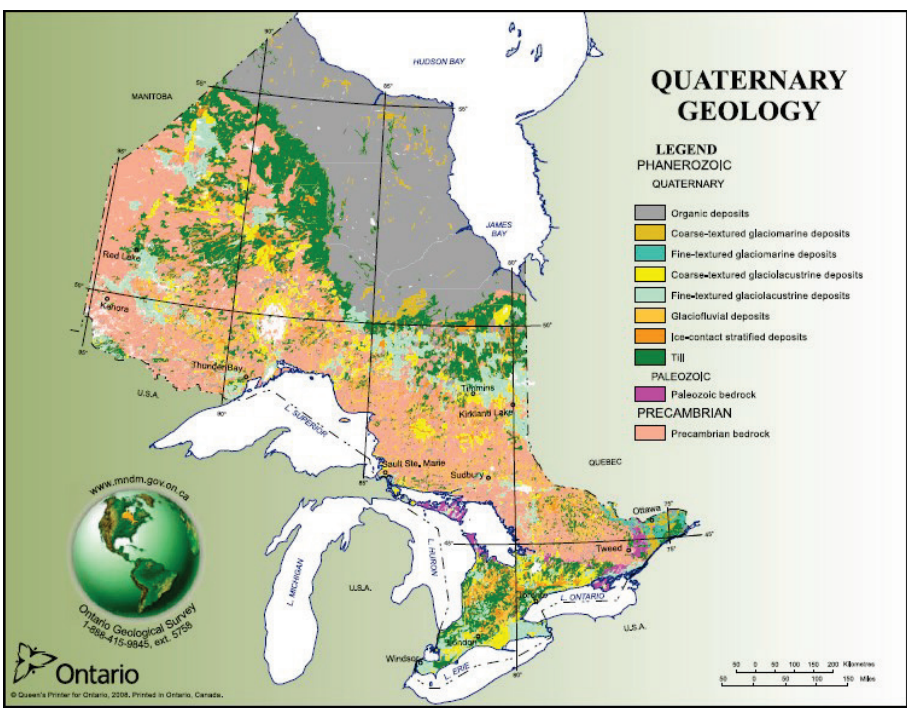


Figure 6. *Simplified surficial geology map of Ontario (MNDM, 2012).*

Zones 1 and 2 are situated in the St. Lawrence Lowlands physiographic region (Figure 4) in southern part of Ontario, covered by thick layers of relatively flat-lying sedimentary rock (Figure 5) and overburden (Figure 6). Geologically, the lowlands are also referred to as the St. Lawrence Sedimentary Platform, one of several basins formed at the edges of the Canadian Shield. Zones 3 to 5 occupy the Grenville and Superior geological provinces, with the Superior being divided into an eastern and western half, with each half regarded as a separate model. Furthermore, the western Superior province (Zone 5) was separated into a south (Zone 5a) and north (Zone 5b) region on basis of considerable resistivity differences. Two crustal-scale features, the Grenville Front Tectonic Zone (Zone 3b) and Kapuskasing Uplift (Zone 4b) warranted their own models due to presence of highly resistive upper crust compared to adjacent crust. Between the Grenville and Superior lies the smaller Southern geological province, which is considered as part of the Superior (Zones 4 and 5).

Methodology

Description and depth for overburden were obtained from surficial geology maps and reference publications. Resistivity values of the overburden were obtained through a compilation of results from near-surface geophysical surveys covering glaciated terrain in various parts of Canada (Table 1 below) usually completed for geotechnical engineering purposes.

Table 1 *Electrical Resistivity Values for Overburden*

Overburden Type	Resistivity (Ω.m)	Location	Reference
Sand, clean	100-200	landfill site	McNeil (1990, Fig. 26)
Sand	80-150	---	Scott et al (1990, Fig. 1)
Gravel	400-600	---	
Clay	10-45	Fort Simpson, NWT (unfrozen)	Associated Mining, (2004)
Silt	40-60	"	"
Clayey sand	40-100	"	"
Silty sand	300-1000	"	"
Gravel, well graded	500-1000	"	"
Gravel, clayey/silty	200-325	"	"
Gravel, poorly graded	1000-3000	"	"
Sand and gravel beach	15 - 80	Mackenzie Delta (thawed materials)	Mackay (1970)
Moist gravel	80 - 200	"	"
Fine lake bottom sediments	2 - 20	"	"
Peat saturated	4 - 10	"	"
Peat moist	800-1000	"	"
Champlain (marine)	1 - 4	Ottawa valley, Ontario	Palacky

clays			(1988, p.104)
Glaciolacustrine clay	27, 24.6-29.6	Timmins to Quebec provincial boundary	Palacky (1988, p.103)
Glacial clay	27-40	Val Gagne (Timmins), Ontario	"
Sand and soil	20-50	Alfred (Ottawa area)	Palacky (1988, p.104)
Glacial silt	13-20	---	Palacky (1988, Table 2)
Glacial tills	> 1000	Cigar Lake, Saskatchewan	Palacky (1988, Fig. 38)
Glacial till	20-100	Saskatchewan	Palacky (1988, p.101)
Overburden till	40	Saskatchewan	"
Till (buried)	80	Southern Ontario	Greenhouse & Karrow (1994)
Gravel	1000	Saskatchewan	Palacky (1988, p.101)
Basal silt	10	Saskatchewan	"

The sedimentary basin depth information was gathered from stratigraphic cross-sections (compiled from well logs) and general basin thickness maps (Figure 7). These cross-sections and maps provided the thicknesses of the sedimentary formations and depth to the crystalline basement rocks. Published crustal cross-sections, which are based on extensive seismic surveying and interpretation, were also used to determine the Moho (crust/mantle boundary) depth.

Overall thickness of the crust, as well as divisions between upper, middle and lower crust, were obtained from seismic transects undertaken as part of the Canada-wide Lithoprobe project (Figure 8). The 100, 400, and 600 km depths of each mantle division are the generally accepted depths in the geological literature.

Crustal-scale distribution of electrical resistivity was primarily obtained from Lithoprobe transects completed during the 1980s to 2000 (Figure 9). In particular, the resistivity profiles developed by Adetunji and Ferguson (2010) from their re-analysis of Lithoprobe MT data in combination with new data (2000-2006) from the southern Ontario Polaris array provided resistivity values for Zones 1 to 4.

Selection of a resistivity value for the upper crust layer can be problematic because overall resistivity is dependent on the most common rock types present, the degree of metamorphism and structural complexity, and the availability of interpreted MT data. Lower layers of an Earth resistivity model, comprising the mantle, tend to be more homogenous over a broader scale. The end result is greater non-uniformity of resistivity in the upper crust layer along the route. For divisions of the deeper Earth layers, the North American regional or Canada region conductivity profiles that Kelbert et al. (2009) compiled were used. The latter were derived from geomagnetic induction studies (Figure 10).

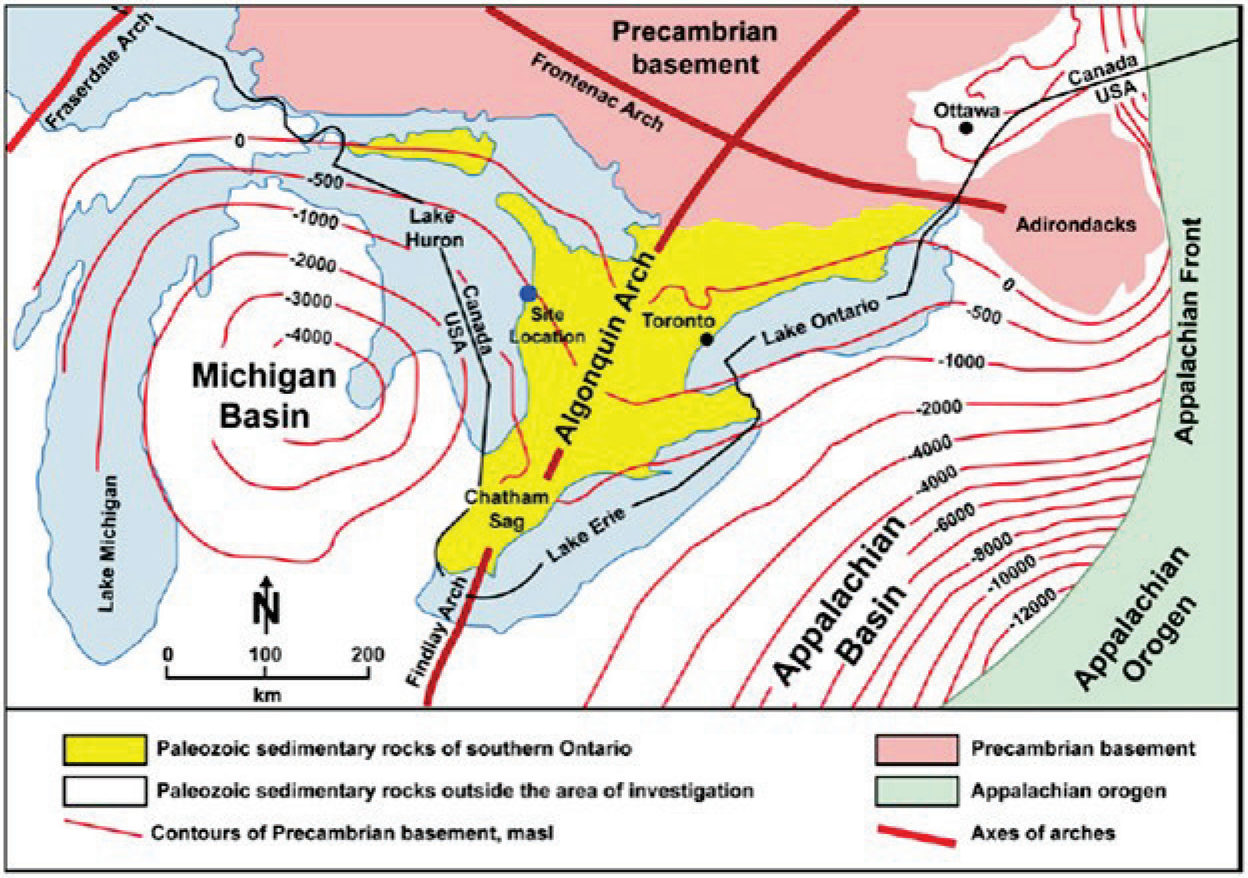


Figure 7. *Major tectonic elements in and surrounding southern Ontario and depth to Precambrian basement, i.e. approximately representative of thickness of Paleozoic sedimentary cover rocks.*

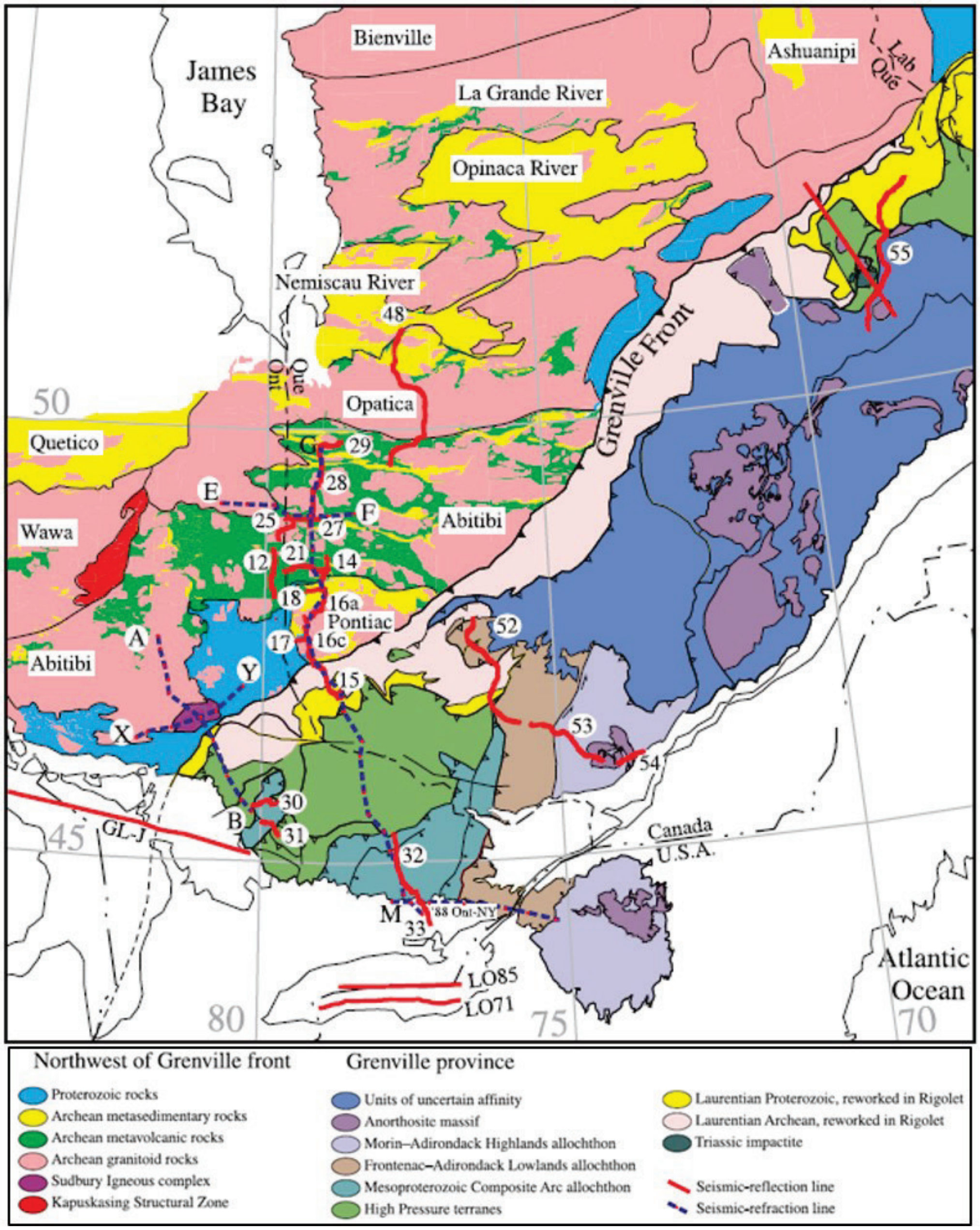


Figure 8. *General geology map of the eastern Superior and Grenville geological provinces, with locations of seismic surveys done for the Lithoprobe project covering part of Ontario and Quebec (Ludden and Hynes, 2000, Fig. 1). Suprovince names shown in white labels. Letters and numbers identify seismic profiles and survey lines, respectively. Seismic Line M to G (also referred to as Line MDG) is the Lithoprobe Abitibi-Grenville transect.*

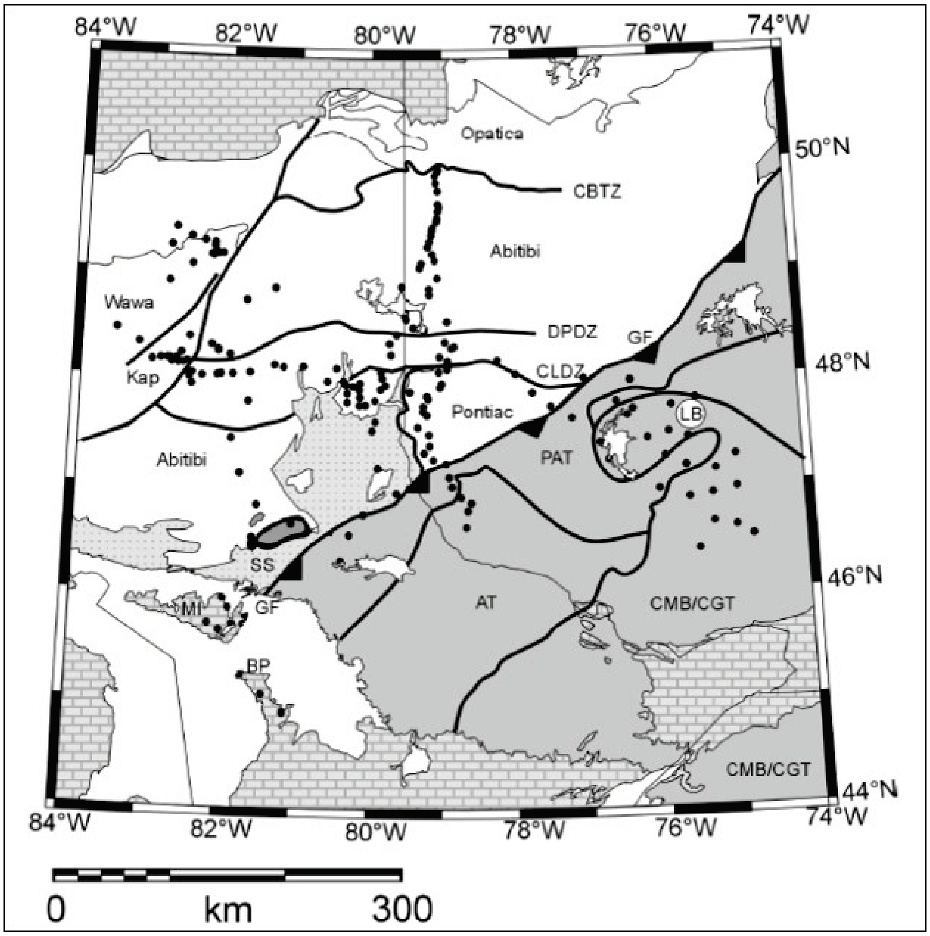


Figure 9. *Location of MT soundings (solid circles) in the eastern half of Ontario and western Quebec. Grenville province (grey shade). Southern province (stipple). Superior province (white). St. Lawrence Lowland (brick symbol). Abbreviations: AT, autochthonous terrane; BP, Bruce Peninsula;CBTZ, Casa Berardi tectoniczone; CLDZ, Cadillac-Larder deformation zone; CMB/CGT, Central Metasedimentary Belt – Central Granulite Terrane; DPDZ, Destor-Porcupine deformation zone; GF, Grenville Front; Kap, kapuskasing Structural Zone; SS, Sudbury structure (Boerner et al., 2000, Fig. 1)*

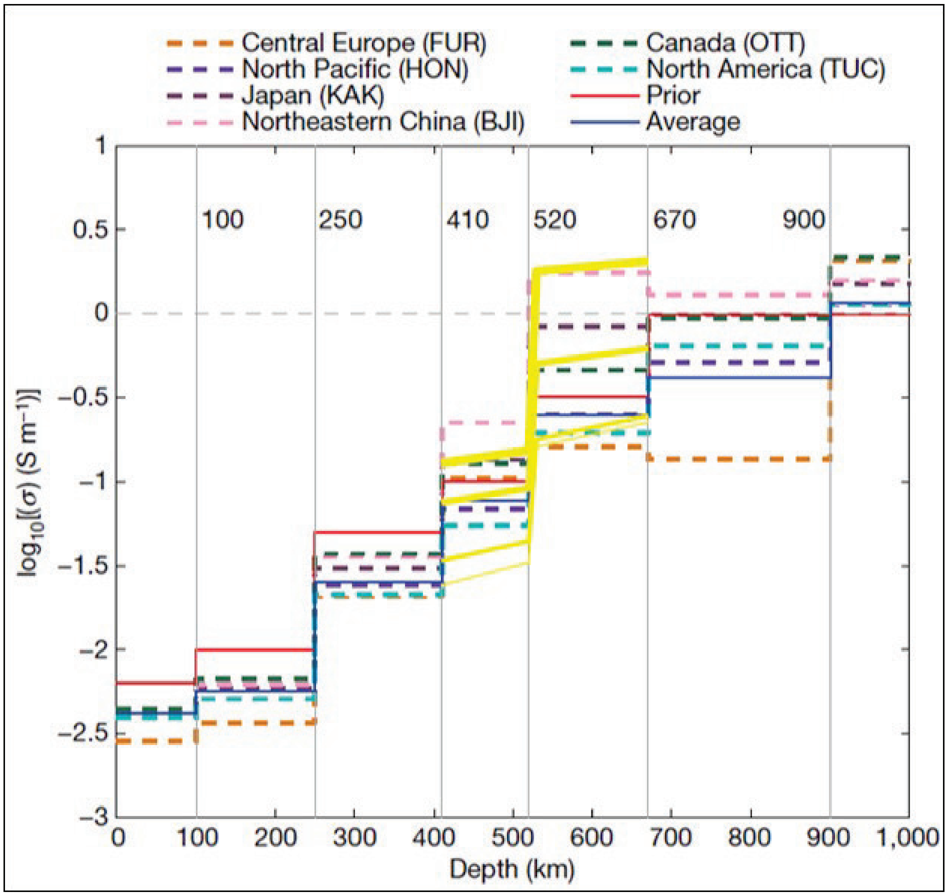


Figure 10. *Global and regional conductivity profiles from which resistivity (converted from conductivity depicted) value extracted for the Earth 1D models for layer depths between 100 and 1000 km (Kelbert et al., 2009, Fig. 2). The four yellow lines indicate how change in water content (from the bottom up, in wt%: 0; 0.1, 0.5, 1.0) within the mantle transition zone effects conductivity; data does not pertain to this report.*

2. Zonal Earth resistivity models

ZONE 1 - WESTERN ST. LAWRENCE PLATFORM / LOWLAND

The Western St. Lawrence Platform, a sedimentary basin, (Figure 2) covers the southwestern part of Ontario with gently-tilted sedimentary rocks of Paleozoic age forming the bedrock (Figure 5) when shallow inland seas covered much of eastern North America. Glacial-deposited overburden (Figure 11) is extensive across the lowland.Basement to the sedimentary cover is the Precambrian crystalline metamorphosed rock of the Grenville geological province (Figure 12).

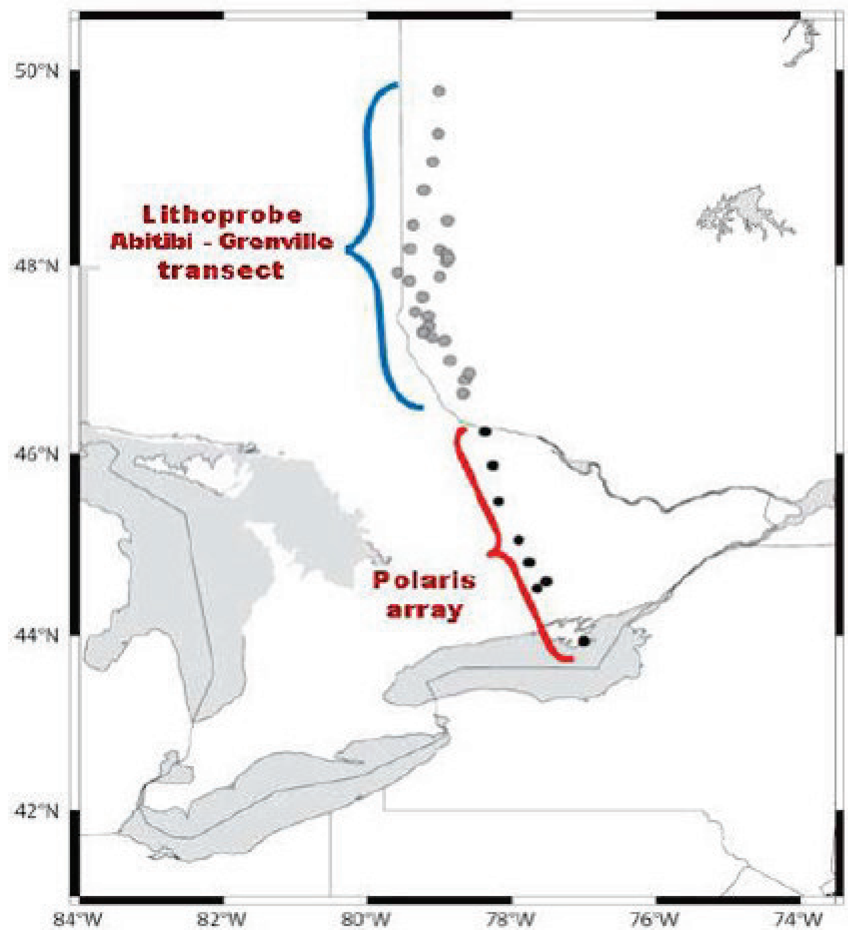


__Figure 11.__ MT sounding sites along the Lithoprobe Abitibi-Grenville transect and southern Ontario POLARIS array (Adetunji and Ferguson, 2010, Fig.4). Transect and array colocated with seismic Line MDG as shown in Figure 6. See Figures 20 and 25 for a 2D resistivity profile across the combined Lithoprobe Abitibi-Grenville transect and Polaris array.

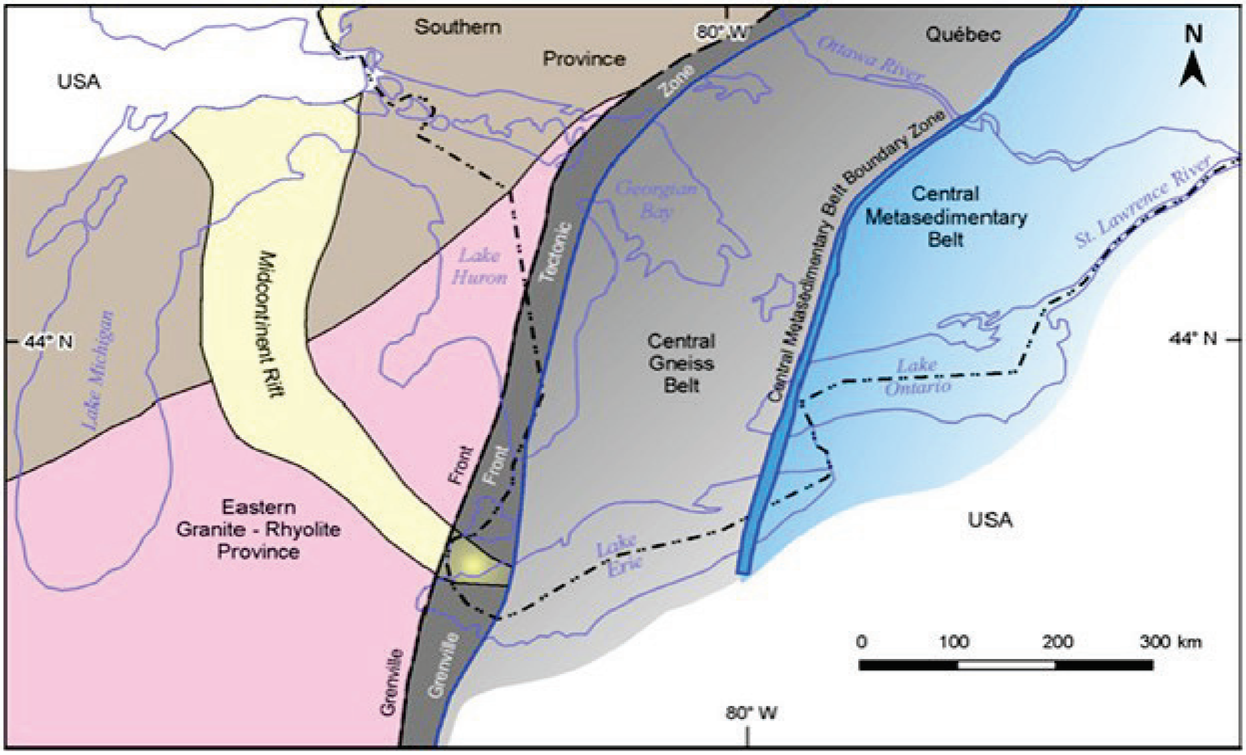


Figure 12. *Main geologic subdivisions of the Precambrian crystalline bedrock of southern and eastern Ontario and major tectonic features. Paleozoic sedimentary covers the Precambrian rock over southern and eastern Ontario except for a highland of exposed Precambrian separating the southern and eastern parts of Ontario. (Armstrong and Carter, 2010, Fig. 27).*

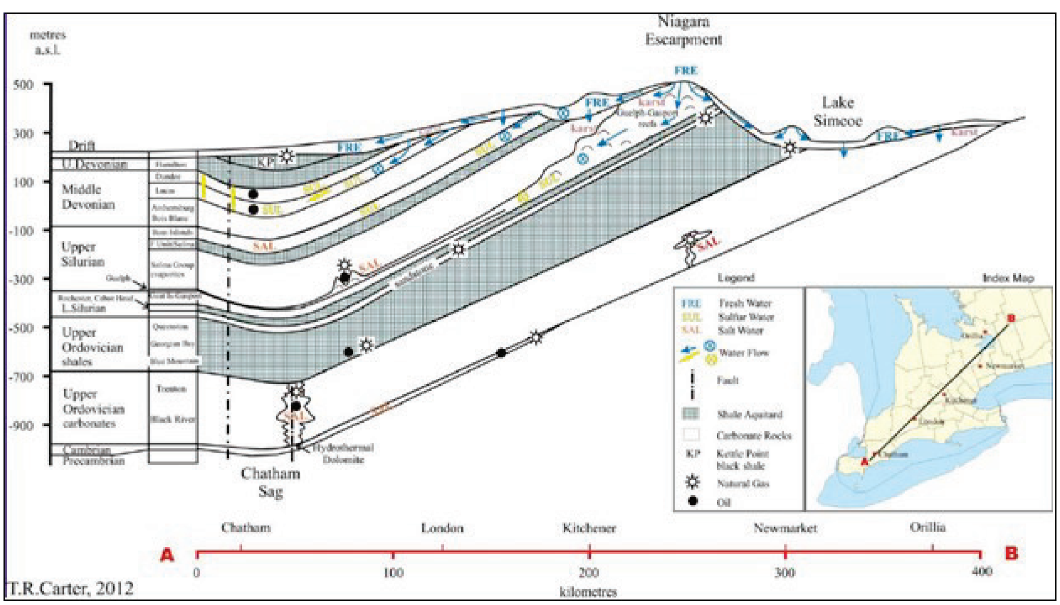


Figure 13. *Simplified stratigrphic cross-section across part of Western St. Lawrence Lowland (Carter, 2012).*

Sedimentary basins (Figure 7) to the northwest and southeast of southern Ontario and the upward arching of the Precambrian basement have influenced the type and thickness of deposited sedimentary rock. Sedimentary strata thicken (Figure 13) to the west and south toward the Michigan and Appalachian basins on either side of the Algonquin Arch, and thins over the Algonquin Arch (Figure 7). Maximum thickness is about 1400 m in at the western end of the lowland (Armstrong and Carter, 2010). At the east end, near Kingston, the Paleozoic stratum is 100 m thick (Armstrong and Carter, 2010). In the middle of the western St. Lawrence Lowland (cross-section G-G' on Figure 14) the strata is about 830 m over the Algonquin Arch and 1000 to nearly 1200 m flanking the arch to the north and south, respectively (Armstrong and Carter, 2010). Near Hamilton depth to Precambrian basement is about 700 m increasing to about 925 m near Adelaide (Sinha, 1990). Repetitive sequences of carbonates (limestone and dolostone) and shales account for the majority of sedimentary rock with much lesser amounts of sandstone and evaporites (i.e. salt beds).

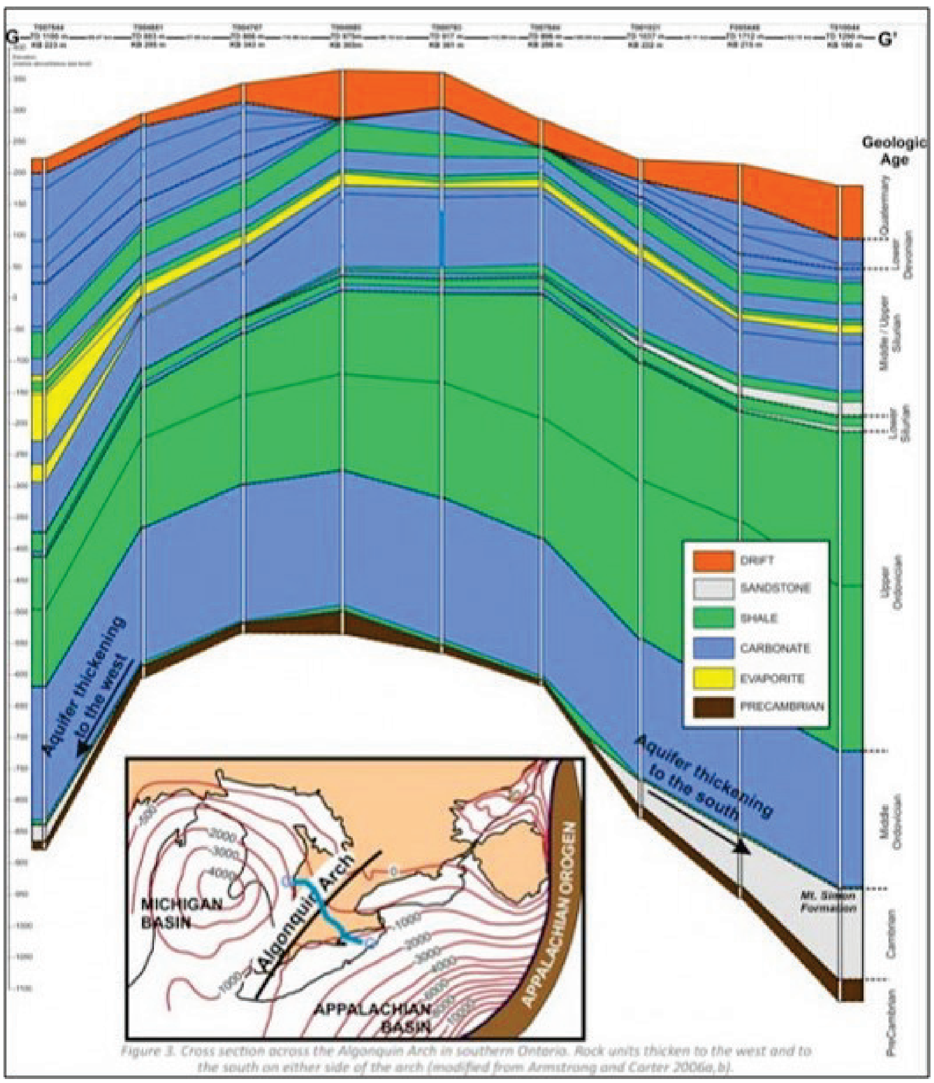


Figure 14. Stratigraphic cross-sections across the Algonquin Arch beneath the Western St. Lawrence Lowland (Carter et al. 2007, Fig. 9). [http://ccs101.ca/ccs_pro/opportunities_for_canada/ontario]

Crustal-scale seismic transects are, on land, limited to several short survey lines in the Niagara Peninsula, and along the Oak Ridge Moraine situated northeast of Toronto (Ouassaa et al., 2010). Marine seismic surveys have been carried out across Lakes Erie, Ontario and Superior. Using teleseismic data from the POLARIS broadband seismic network, Eaton et al, (2006) have mapped the crustal thickness of the Grenville province in eastern Ontario (Figure 15), including part of the eastern edge of the Western St. Lawrence Lowland.

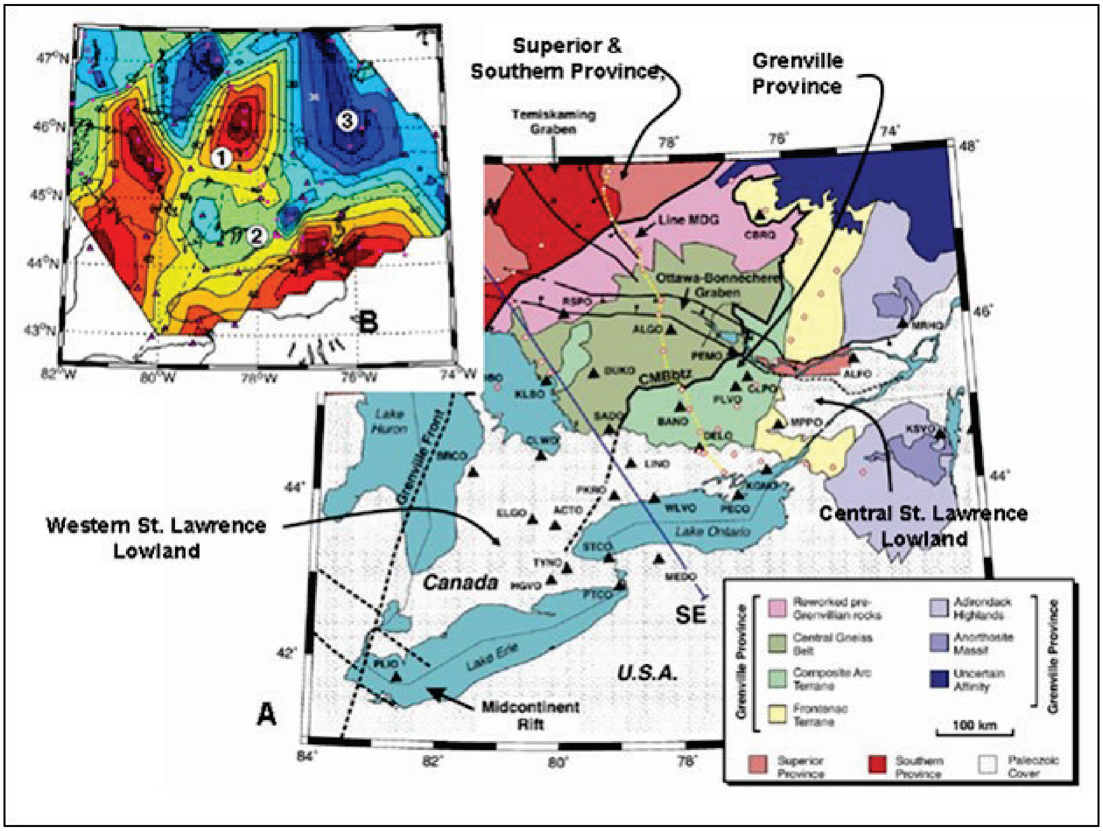


Figure 15 (A) Simplified geology map of south Ontario. Abbreviatins: CMBbtz, Central Metasedimentary belt boundary tectonic zone. (B) Crustal-thickness map. Dashed lines show geological boundaries. Area 1 indicates region of relatively thick crust. Area 2 is a region of intermediate-thickness crust within Composite Arc Terrane (part of Central Metasedimentary Belt). Area 3 is a region of thin crust east of Ottawa-Bonnechere Graben fault structure (Eaton et al., 2006, Figs. 1 and 12).

The only known regional crustal-scale magnetotelluric (MT) transect is the recent re-analysis by Adetunji and Ferguson (2010) of MT data collected from the Lithoprobe Abitibi-Grenville transects (early 1990s) and the Ontario Polaris array (2002-2006). Although the transect covers only the eastern margin of the western St. Lawrence Lowlands (Figure 11), it provided electrical resistivity values for that part of the Grenville province beneath the Paleozoic sedimentary cover rock.

Other measurements of electrical resistivity included several land-based electromagnetic (EM) surveys completed in southern Ontario during the 1980s and1990s, as summarized below.

Location	Reference	Method, Survey Length, Stations	Findings
Niagara Escarpment (50 km west of Toronto)	Duncan et al., 1980	CSEM	Resolution to ~500 m deep 3-layer model. Layer 1: 30m thick, 300 ohm.m. Layer 2 (shale): 500m thick, 20 ohm.m Layer 3 (limestone): 60 ohm.m.
Toronto-to-Sarnia	Gomez-Trevino and Edwards, 1983	CSEM, 200 km long, 6 stations	Alternating resistive & conductive strata in upper 0.8 – 1.2 km. Resistive strata (carbonate & evaportie rocks): ~ 1000 ohm.m. Conductive strata (shale): ~10 ohm.m
Hamilton, Guelph-Kitchener, Woodstock, Adelaide-Dublin	Sinha, 1990	Multi-frequency and Transient EM 6 profiles (3-65 km long)	Resistivities of sedimentary strata determined to 300m depth. Overburden: 75m, 100-200 ohm.m. Dolostone: 500-640, 900-1000 ohm.m. Dolostone ± mudstone: 100-160 ohm.m. Dolostone + shale: 9-30 ohm.m. Shale: 8-23 ohm.m
Bruce Peninsula and Manitoulin Island	Mareschal et al., 1991	MT, 100 km long, 11 stations	Shale: <8 to <15 ohm.m Shale and dolostone: 20 ohm.m Upper crust: 15000-50000 ohm.m Upper mantle to 200 km depth: 2000 ohm.m

Overburden – Layer 1 – covers nearly all of Western St. Lawrence Lowland of varying depth, up to 200 m thick in places. For the central part of the lowland, within the Oak Ridges Moraine and the area between Lake Simcoe and Georgian Bay, the overburden is more than 110m thick (Singer et al., 2003). Along the northern shore of Lake Erie overburden thickness ranges 30-90m

Specific overburden depths are 120 m below Toronto and shoreline of Lake Ontario, and up to 170 m in places on the Oak Ridges Moraine northeast of the city and more than 110 m within the Waterloo Moraine. However above the Niagara Escarpment the overburden can be less than 10m where bedrock comes close to ground surface.

Overburden predominantly consists of a variety of till sheets and moraines with inliers of glaciolacustrine derived deposits of sand and gravely. West of London and in the Niagara Peninsula, glaciolacustrine deposits of silt and clay are predominant with a much lesser amount of till. Bruce Peninsula and Manitoulin Island, in the northwest margin of the lowland, is covered by discontinuous, thin layer of unspecified unconsolidated sediment (Barnett et al., 1991c).

Electrical resistivity for Layer 1 would likely differ across the western St. Lawrence Lowland depending on the predominant kind of glacial deposit (Table 1). Resistivity of till is variable with a higher value in tills containing greater amounts of stone and sand. Palacky (1988) provides a 20 to 100 ohm-meter range for Saskatchewan tills and about 25 ohm-meter for glaciolacustrine clays. Tills in southern Ontario and bordering Lake Ontario range from 90 to 185 ohm-meter (Greenhouse and Karrow, 1994; Sharp et al., 2003, 2005a, 2005b). Resistivity of the glacial-derived overburden in Manitoba ranges from 5 to 30 ohm-meter, as measured by Gowan et al. (2009), and in southwestern Ontario it was measured to be 900-1000 ohm-meter (Sinha, 1990). Duncan et al. (1980), using a controlled source EM survey in Southern Ontario, determined a 30 m deep layer, possibly overburden, to have a resistivity of 300 ohm-meter. Resistivities of the uppermost layer across the Wisconsin Arch ranged from 75 to 200 ohm-meter as determined by Dowling (1970), the higher values possibly reflecting more widespread deposits of outwash sand and gravel. Gravel and sand-dominant deposits can show a wide range of resistivity depending on the percentage mix of the gravel and sand, for example, ranging from about 500 to 10,000 ohm-meter (Palacky, 1988), 10 to 800 ohm-meter (Scott et al., 1990), or 200 to 1000 ohm-meter (Assoc. Mining, 2004). In Michigan, glaciofluvial deposits form widespread surficial aquifers with a resistivity typically >100 ohm-meter (Westjohn and Weaver, 1998).

Based on the predominance of tills in southwestern Ontario, an overall resistivity of 100 ohm.m is assigned to Layer 1. Areas of sands and gravel deposits may have a resistivity up to 1000 ohm.m., whereas the clay rich glaciolacustrine deposits in the Niagara area and west of London are more likely to exhibit a much less resistive value, perhaps about 25 ohm.m.

The Paleozoic sedimentary rock – Layer 2 – consists of gently dipping carbonates and shale and lesser amount of sandstone and evaporites. Maximum and minimum depths are 1400 m and 100 m at the west and eastern margins of the Western St. Lawrence Lowland, respectively. Accordingly, a midpoint depth of 1000 m is assigned.

Electromagnetic surveying (see list above), including MT, has shown Layer 2 to exhibit alternating low and high resistivity values related to rock type. Conductive strata, such as shales, have resistivities values ranging 2-30 ohm.m. Resistive carbonate strata, such as limestone show a range of 20-150 ohm.m (increasing amount of shale interlayers suppresses the resistivity) and dolostone with a range of 150-750 and up to 1000 ohm.m for an average 500 ohm.m. Limestone (mixed with shale or siltstone) averaged 80 ohm-meter, and evaporates (mixed with shale or dolostone) averaged 130 ohm-meter.

In other places where Paleozoic sedimentary strata occur, such as in the Central St. Lawrence Lowland, an MT survey parallel to the Ottawa Valley (Fernberg, 2011) reveals a resistivity of < 150 ohm-m at depth < 1 km. The average resistivity of Paleozoic sedimentary rock (shale and carbonate dominant) in southeastern Manitoba/northeast corner of North Dakota is 20 ohm-meter (Gowan et al., 2009), up to a high of 50 ohm-meter.

To assign a representative resistivity of the Paleozoic strata, a weighted average was calculated on the basis of strata consisting of 32 % limestone with average resistivity of 80 ohm.m, 20 % dolostone at 500 ohm.m, and 48 % shale at 15 ohm.m, resulting in a ~ 130 ohm.m resistivity being assigned to Layer 2. However, the presence of deep saline aquifers within the Mt. Simon Formation sandstone, beneath the western margin of the St. Lawrence Lowland (Figure 16) could substantially reduce the overall resistivity of Layer 2 in the Windsor area. Gowan et al. (2009) observed that in Manitoba resistivity was 2 to 3 ohm-meter in an Ordovician sandstone and shale formation containing a saline aquifer.

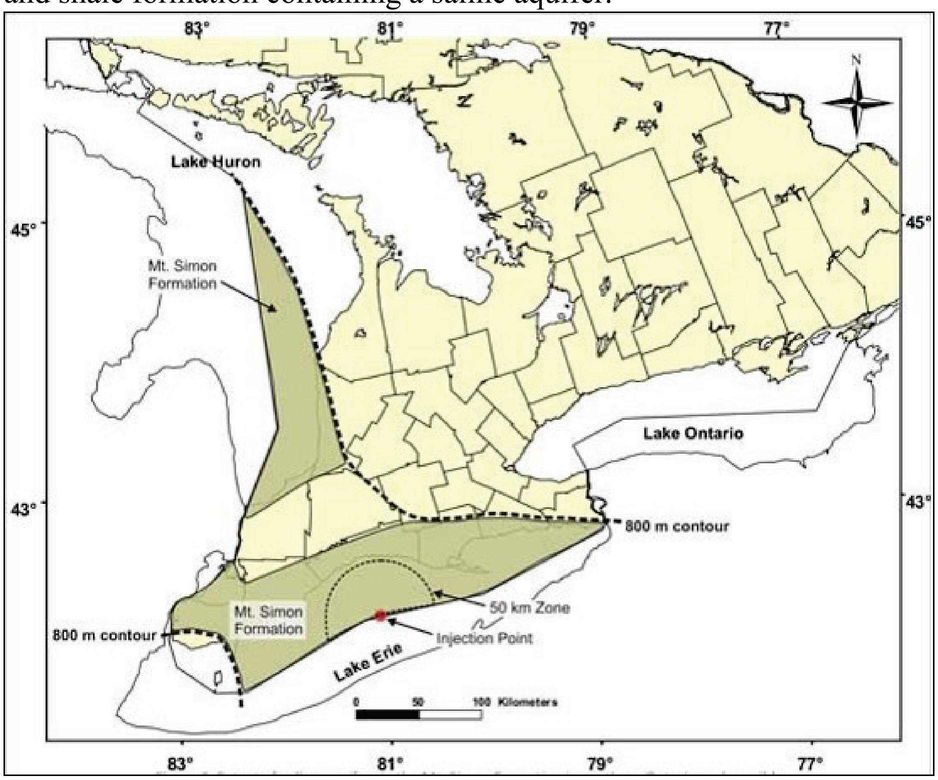


Figure 16. Extent of saline aquifer in the Mt.Simon Formation underlying southwestern Ontario, at 800 m depth (Carter et al., 2007, Fig. 12). [http://ccs101.ca/ccs_pro/opportunities_for_canada/ontario]

The crystalline rocks of the Grenville province – Layer 3 – are subdivided into two major divisions (Figure 12). Much of southwestern Ontario (i.e. Zone 1) is underlain by the Central Gneiss Belt (CGB), consisting of metasedimentary gneisses that have been intruded by granitoid plutons that were also subsequently deformed and metamorphosed into quartzofeldspathic gneisses (Armstrong and Carter, 2010). The Central Metasedimentary Belt (CMB) occupies the eastern end of the lowland, and consists of a variety of marbles and metamorphosed volcanic and clastic sedimentary rock intruded by a variety of metaplutonic rock. Dividing the two belts is the Central Metasedimentary Belt boundary thrust/tectonic zone (CMBbtz), a zone of intensely deformed rock several km wide. The Grenville Front Tectonic Zone (GFTZ) forms the northern margin of the Grenville province below the north edge of the Western St. Lawrence Lowland. Further details about the CGB, CMB, CMBbtz and GFTZ are provided in the description of the Zone 3 model.

Using the portion of the Polaris Array resistivity profile, prepared by Adetunji and Ferguson (2010) which extends across part of the eastern margin of the western St. Lawrence Lowland, depth and resistivity values were extracted for Layer 3. Resistivity at near-surface ranges 500-10000 ohm.m and then rapidly diminishes to 125 ohm.m at a depth of 8-15 km (Figure 17, TM mode). Accordingly, a midpoint thickness of 11 km and average resistivity of 5000 ohm.m is assigned to Layer 3. Beneath the CMBbtz there is an area of high resistivity (10000 ohm.m) extending to at least 15 km depth. Also, the GFTZ exhibits an exceptionally high resistivity (500000 ohm.m) area 10's km wide and partially down to 25 km depth.

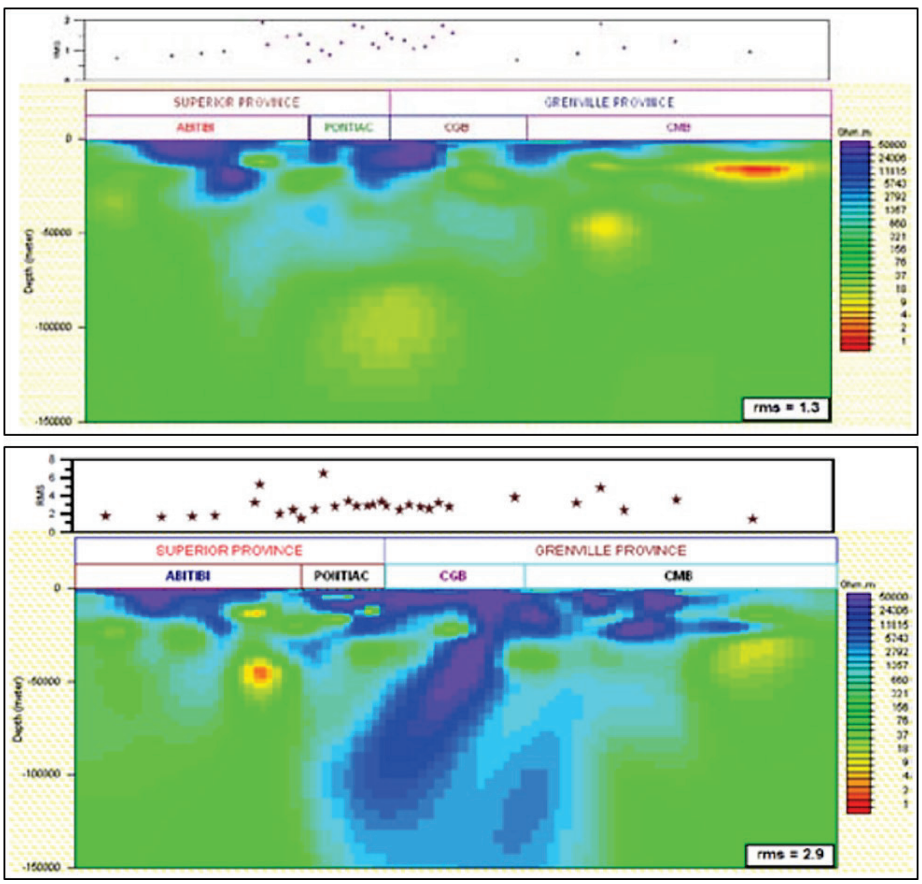


Figure 17. 2D electrical resistivity models across the combined Lithoprobe Abitibi-Grenville transect and southern Ontario POLARIS array. Top panel shows an inversion model using TM mode data only. Bottom panel shows a model using joint TE and TM modes. North on left side of panel, south on right side of panel (Adetunji and Ferguson, 2010, Figs. 5 and 6).

The middle crust – Layer 4 – thickness is based on the generalized depths suggested by Ferguson and Odwar since a lower depth resistivity change was not discernable on the Polaris Array and Ottawa Valley MT profiles (TM modes). Although, on the joint TM and TE mode (Figure 17) of the array profile there are noticeable large resistivity contrasts at 25 km depth. Resistivity range in the 11-25 km depth is <10-500 ohm.m on the Polaris Array (TM mode) with predominant resistivity of 125 ohm.m. The low resistivity of Layer 4 could be influenced by presence of a mid-crustal conductor underlying the shore of Lake Ontario, as in Figure 17.

The lower crust – Layer 5 – thickness was based on seismic analysis by Eaton et al. (2006) showing a crust – mantle boundary ranging from 38 – 43 km, thickening to the southeast and northwest (Figure 15). Overall thickness would appear to be 41 km.
In Ferguson and Odwar's (Ferguson et al, 1998) Ontario/Quebec model, the lower crust resistivity is 1000 ohm-meter, but because their model was based on data mostly from northern regions of the provinces, the suggested lower crust resistivity may be biased to the Superior geological province underlying northern Ontario and Quebec.

Depending on the mode, resistivity ranges 125-500 ohm.m on TM mode or averages 500 ohm.m on the joint TE and TM mode for the Polaris Array transect. Based only on the TM mode, a midpoint value of 300 ohm was assigned to Layer 5. Also depicted on the joint mode is the presence of a northerly dipping resistor, 10000-50000 ohm.m in the uppermost mantle which is thought to represent electrical anisotropy caused by preferred orientation of minerals as suggested by Adetunji and Ferguson (2010). Whether this resistive feature continues across all of southwestern Ontario is not known.

The upper mantle – Layer 6 – is imaged to have a resistivity of range of 10 – 225 ohm.m, predominately 125 ohm.m on the TM mode of the Polaris Array, and predominantly 500 ohm.m on the TM and joint TM and TE modes of the array. Small conductive areas (10 ohm.m) appear as either 30-40 or 40-50 km depth, depending on mode. Accordingly, this author assigned a resistivity value of 300 ohm-meter, the average of the entire range of the two mode's individual overall resistivities.

Depths and conductivities for the upper mantle, transition zones and lower mantle – layers 7 to 12 – to a final depth of 1000 km were based on the Canadian regional model (see Figure 10) prepared by Kelbert et al. (2009). The Canadian regional model was chosen since it was based on data from the relatively near Ottawa Magnetic Observatory located 150-700 km from east and west ends of the Western St. Lawrence Lowland.

The Zone 1 model is presented in Table 2 which summarizes individual layer depths, thickness, and resistivity/conductivity.

ZONE 2 - CENTRAL ST. LAWRENCE PLATFORM / LOWLAND

Within eastern Ontario and that part of upper New York State bordering the St. Lawrence River is the Central St. Lawrence Platform, a sedimentary basin, also referred to as the Ottawa Embayment (Figure 2). Physiographically, the area is the Central St. Lawrence Lowland. Precambrian rocks of the Grenville geological province bound the embayment to the north, west (the Frontenac Arch or Axis), and south (Adirondack Dome or "mountains" in upper New York). Eastward, the Ottawa Embayment becomes the Quebec Basin in southern Quebec. Gently-tilled sedimentary rocks of Paleozoic age form the bedrock.

Crustal-scale geophysical transects have been limited in the Central St. Lawrence Lowland. Local MT soundings were done by Telford et al. (1976) at a location 32 km west of Ottawa, north of the Ottawa River. The purpose was to measure the apparent resistivity contrast between the Grenville and Paleozoic rocks of the order of 1000 and 10 ohm.m, respectively.

During summer 2000, the GSC completed a 70 km long seismic reflection survey along the Upper Dwyer Hill Road, immediate west of Ottawa. Its purpose was to provide constraints on the crustal structure and the interaction of the Paleozoic sedimentary section with the underlying Precambrian Grenville basement rocks (Ouassaa et al., 2010). As part of a research project a 150 km long MT transect was completed in the Ottawa Valley, westward from Ottawa to Pembroke (Figures 18 and 19), covering the northwest part of the lowland.

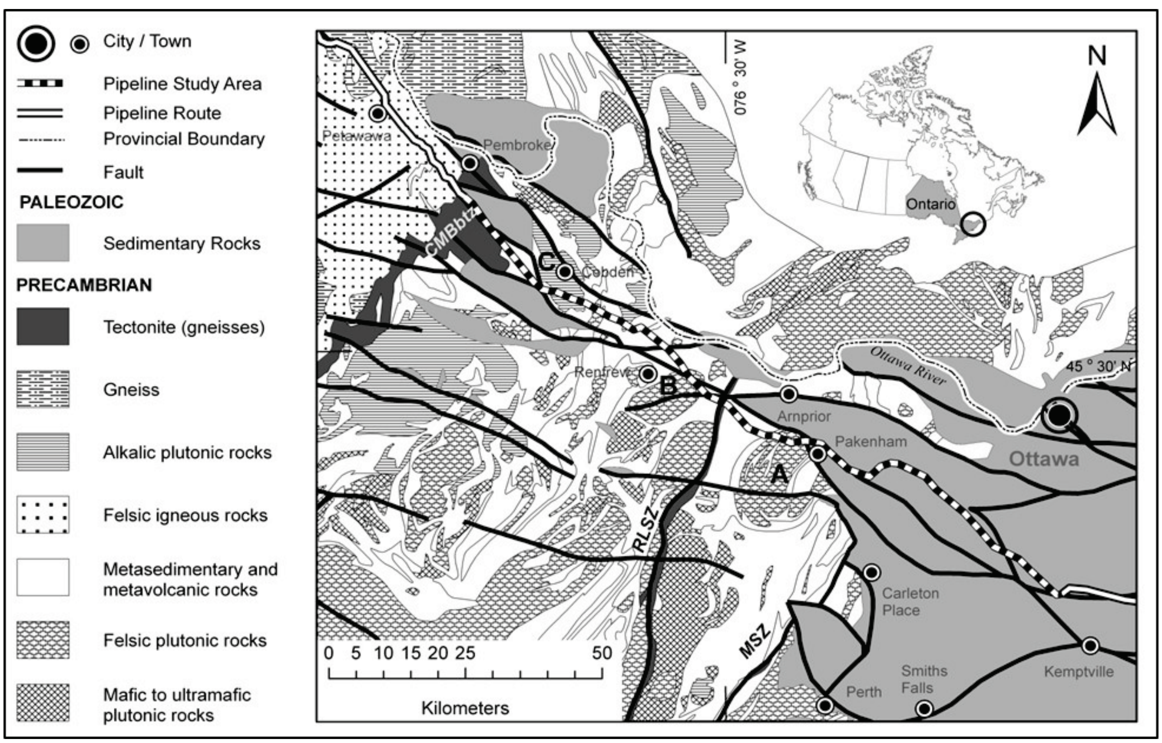


Figure 18. Bedrock geology map of the Ottawa Valley and extent (stripped line) of the Ottawa Valley MT transect completed by Fernberg (2011, Fig. 5.2).

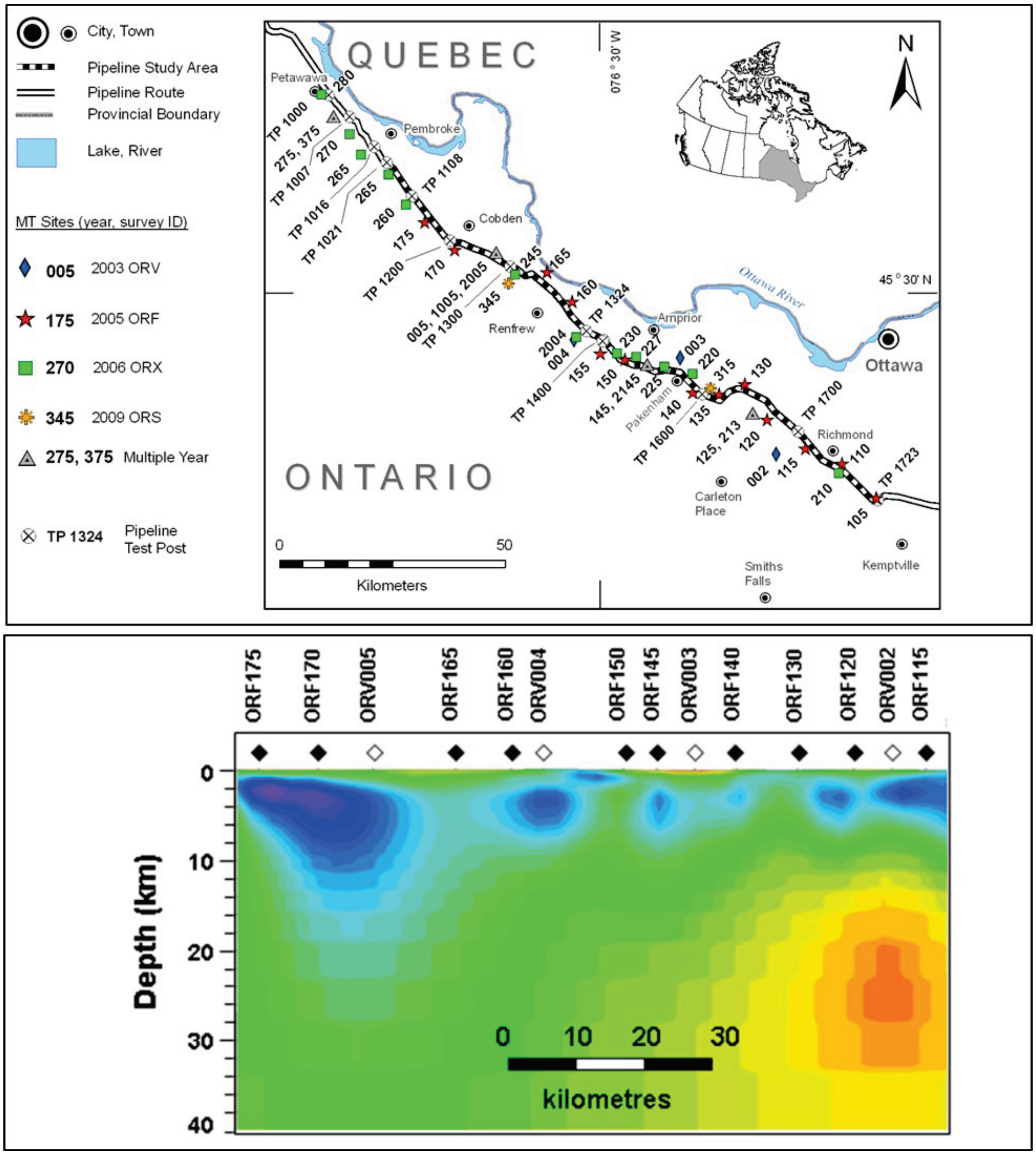


Figure 19. Top panel shows location of sounding sites for the Ottawa Valley MT transect. Bottom panel shows the 2D inversion model for the TM mode (Fernberg, 2011, Figs. 5.3 and 5.13)

Recently, analysis of MT data collected from the Lithoprobe Abitibi-Grenville transects (early 1990s) and the Ontario Polaris array (2002-2006) has been completed by Adetunji and Ferguson (2010). Although focused on the Grenville geological province, the southern end of the Polaris array provided electrical resistivity values for that part of the Grenville beneath the Paleozoic sedimentary cover rock of southern and eastern Ontario. The transect line was 150 km west of the Central St. Lawrence Lowland (Figure 11).

Other measurements of electrical resistivity have included a VLF-EM sounding (Telford et al., 1977) to test response of over a fault in the Paleozoic sedimentary rock in the Ottawa area. Borehole geophysical logs (Bernius, 1996) were completed by the Geological Survey of Canada

(GSC) on test holes through the Paleozoic sediments underlying Ottawa at the GSC Bells Corners test site

Overburden – Layer 1– in the Central St. Lawrence Lowland consists of Quaternary glacial tills, glaciofluvial deposited gravel and sand, commonly overlain by an expanse of paleo-Champlain Sea marine clays and silts locally known as Leda clay (Belanger, 2010). Leda Clay covers much of the northern and western two-thirds of Zone 2. Linear accumulations of sand and gravel (former nearshore and beaches deposits) lie on top of the clay. Glacial till is prevalent in the southeastern third of Zone 2. Overall the overburden thickness is variable, typically thin (< 4 m) with accumulations from 10 m up to 50 m deep in topographic depressions and river courses (Singer et al., 2003, Fig. 18). The Leda Clay itself can vary from < 2 m to 20 m thick, and can sometimes lie directly on the Paleozoic sedimentary bedrock (Schut and Wilson, 1987, Figs. 9-11). A midpoint thickness of 25 m was assigned.

Leda Clay has a very low resistivity varying, from 1 to 20 ohm-meter (J. Hunter, pers. comm.), due to presence of salty pore water as a result of its deposition in the former Champlain Sea marine environment. Palacky (1988) remarks that the clay has a resistivity range of 1 – 4 ohm.m. Where the clay is thin and the near surface of the clay is likely to have higher resistivity because fresh water precipitation is likely to have flushed out the salty pore water. The Ottawa Valley MT profile shows a resistivity of about 20 ohm-m where overburden (Highway 17 bridge over the Mississippi River) is known to be 46 m thick. Elsewhere, a resistivity of 80 – 125 ohm.m was measured in the near surface (Figure 19). Glacial deposited till and sand could be expected to be about 100 ohm.m based on typical resistivity measured elsewhere in eastern North America (see Table 1). Hence, overburden in Zone 2 could range from 1 – 100 ohm.m, a midpoint value of 50 ohm.m was adopted. However, in locations of known deep accumulation of Leda Clay, a resistivity of < 20 ohm.m could be considered.

The Paleozoic sedimentary rock – Layer 2 – consists of nearly flat-lying sandstone, dolostone, limestone and lesser shale. Extensive faulting has occurred, resulting up to 1000 m of vertical displacement. Faulting in combination with erosion has left a thickness variation of the sedimentary strata ranging from 20 m to 600 m thick beneath Ottawa. In places, almost 200 m of shale dominant lithology has been preserved within a fault block. The stratigraphic cross-sections by Sanford and Arnott (2010) show an average maximum depth of 875 m depth, shallowing between 50 to175 m deep at the west end of the Central St. Lawrence Lowland. At the GSC test site, a Paleozoic stratum is only 65 m thick.

Previous geophysical surveying reveals the resistivity of the Paleozoic sedimentary strata to be variable. Sinha (1990) determined that Paleozoic dolostone strata in southern Ontario have an average 525 ohm-meter resistivity. Anderson and Keller (1966) noted that in-situ borehole measurements of the Potsdam sandstones in upper New York State (equivalent to Nepean sandstone in Ottawa area) to have a 425 ohm-meter resistivity. Telford et al. (1977) report that a VLF-EM survey showed the Nepean Formation sandstone resistivity to range 1500- 3000 ohm.m, the Oxford Formation dolostone resistivity to be 5000 ohm.m, the Ottawa Formation limestone with shale-sandstone layers to range 2000-3000 ohm.m, and the Carlsbad Formation shale to have an 85 ohm.m resistivity. Borehole logs of the GSC geophysical test site in west Ottawa reveals resistivity of the sandstone and dolostone of the lower part of the Paleozoic sedimentary rock succession to range from about 250-400 ohm.m (Bernius, 1996, BH84-5). The Ottawa Valley MT (Fernberg, 2011) reveals a resistivity of < 150 ohm-m at shallow depth where occurs the Paleozoic sedimentary strata. Hence, a resistivity value of 250 ohm-m was assigned to Zone 2 to reflect the presence of the more abundant higher resistive sandstone and limestone / dolostone, but also account for occurrence of low resistive shales, and that MT reveals an overall lower resistivity value compared to borehole obtained values.

Crystalline rocks of the Precambrian Grenville geological province – Layer 3, upper crust – underlie the Paleozoic sedimentary rocks although some small exposures of crystalline rock protrude through the sedimentary cover. Test boreholes at the GSC test site in west Ottawa intersected gneissic dominant metamorphic rock intruded by a variety of igneous rocks (syenite, granite) over a depth of 235 m below the sedimentary strata (Bernius, 1996). Metamorphosed sediments (quartzite, marble) and mafic intrusives (gabbro) are also present beneath Ottawa (Belanger, 1998).

Examination of the Polaris Array resistivity profiles (Figure 17) shows distinct change from high to lower resistivity at a depth of 10 km. The Ottawa Valley MT (Figure 19) showed distinct resistivity change occurring at about 8 km deep. Accordingly a maximum depth of 10 km was assigned to Layer 3. The Polaris Array profile shows a resistivity range of about 125-10000 ohm.m, for an average of 5000 ohm.m. On the Ottawa Valley profile, resistivity ranges from about 1100-6000 ohm.m. Ferguson and Odwar's (1998) compilation shows a resistivity range of 3000 to 50,000, with an average 10,000 ohm-meter, for the upper crust. Compared to the upper crust of the Grenville province to the north in Zone 3, there is a distinctive lower resistivity for Layer 3 in Zone 2. On this basis of lower resistivities determined from the two MT surveys, a lower value of 5000 ohm.m was assigned to Layer 3 for Zone 2.

It is interesting to note that in the continuation of the Grenville province into the Adirondack Highlands of upper New York State, Anderson and Keller (1966) determined a resistivity of 3200 to 4200 ohm-meter for granites, 7500 ohm-meter for interlayered gneisses, and 9500 ohm-meter for marble in the Adirondack Highlands. Connerney et al. (1980) determined a resistivity of 10,000 ohm-meter for the Adirondack Highlands. Borehole logs from the GSC test site reveal a resistivity range of 5000 – 15000 ohm.m for the Precambrian metamorphic and intrusive rock of the Grenville province.

The middle crust – Layer 4 – thickness is based on the generalized depths suggested by Ferguson and Odwar, since a lower depth resistivity change was not discernable on the Polaris Array and Ottawa Valley MT profiles. Resistivity range in the 15-25 km depth is <10-125 ohm.m on the Polaris Array (TM mode) with a greater weighting toward the upper end for a visual average of 100 ohm. On the Ottawa Valley transect, resistivity ranges 150-400 ohm.m, averaging 300 ohm.m. Based on the TM mode of the Polaris Array, a visually averaged 100 ohm.m value was assigned to Layer 4.

The lower resistivity of Layer 4 could be influenced by presence of a mid-crustal conductor (<10 ohm.m) underlying the shore of Lake Ontario (Figure 17) where the St. Lawrence River widens into Lake Ontario. Interestingly, Fernberg (2011) also imaged a conductive (< 100 ohm.m) area at the south end of the Ottawa Valley MT profile. Connerney et al. (1980) showed a resistivity of 25 ohm-meter underlying the Adirondack Highlands. The cause of the imaged conductive area is not known whether it is actual or an artefact resulting from processing of MT data.

The lower crust – Layer 5 – thickness was based on a lower depth of about 40 km presented in a transect by Carr et al. (2001). Seismic analysis by Eaton et al. (2006) showed a crust – mantle boundary ranging from 38 – 42 km, thickening to the south, for an average of 40 km (Figure 15). Depending on the mode, resistivity is either about 125 ohm.m on TM mode or ranges from <10-500 ohm.m on the joint TE and TM mode for the Polaris Array transect. The low resistivity seen on the joint TE and TM mode is the influence from a mid-crustal conductor On the Ottawa Valley transect, dominant resistivity is 250 ohm.m due to influence of an apparent conductive zone at lower crust depth. Based on the TM mode only, a value of 125 ohm.m was assigned.

In Ferguson and Odwar's (1998) Ontario/Quebec model, the lower crust resistivity is 1000 ohm-meter, but because their model was based on data mostly from northern regions of the provinces, the suggested lower crust resistivity may be biased to the Superior geological province underlying northern Ontario and Quebec.

Compared to the continuation of the Grenville Province north into Zone 3, Adetunji and Ferguson have identified that there is a "conductive" lower crust and upper mantle region below the Central Metasedimentary Belt of the Grenville Province. Furthermore, they remark that Boerner et al (2000) suggested that present day pressure, temperature and fluid saturation of the lower crust could be responsible for lowering electrical resistivity.

The upper mantle – Layer 6 – is imaged to have a resistivity of range of 125 – 225 ohm.m and 10-500 ohm.m on the TM and joint TM and TE modes of the Polaris Array transect, respectively. A small conductive area (<10 ohm.m) appears at 40-50 km depth on the Polaris Array TM mode, but its influence appears minimal to the larger expanse of upper mantle. This author assigned a resistivity value of ~200 ohm-meter, the average of the entire range of the two modes.

Depths and conductivities for the upper mantle, transition zones and lower mantle – layers 7 to 12 – to a final depth of 1000 km were based on the Canadian regional model (see Figure 10) prepared by Kelbert et al. (2009). The Canadian regional model was chosen since it was based on data from the Ottawa Magnetic Observatory, located within Zone 2 – Central St. Lawrence Lowland.

The Zone 2 model is presented in Table 3 which summarizes individual layer depths, thickness, and resistivity/conductivity.

ZONE 3 – GRENVILLE GEOLOGICAL PROVINCE
The Grenville geological province comprises about 20 percent of the exposed Canadian Shield in Ontario, but is also present below the Paleozoic sedimentary cover rock of southwestern (Zone 1) and eastern Ontario (Zone 2). Between southwestern and eastern Ontario, a highland of Grenville bedrock known as the Frontenac Arch (or Axis) is exposed, lacking a cover of sedimentary strata (Figure 5).

From north to south, the Grenville province is subdivided into the Grenville Front Tectonic Zone, the Central Gneiss Belt (CGB), the Central Metasedimentary Belt Boundary Thrust Zone (CMBbtz), and the Central Metasedimentary Belt (CMB) (Figure 20). Part of the CMB is also referred to as the Composite Arc Terrane. The belts are further subdivided into terranes and domains (representing older micro-continents and intervening seas) that can be distinguished by differences of lithology, metamorphic grade, geologic history and geophysical signature (Easton, 1992). Typically, the terranes are separated by large fault / shear zones traceable for tens of kilometres, such as the Robertson Lake Shear Zone (Figure 18).

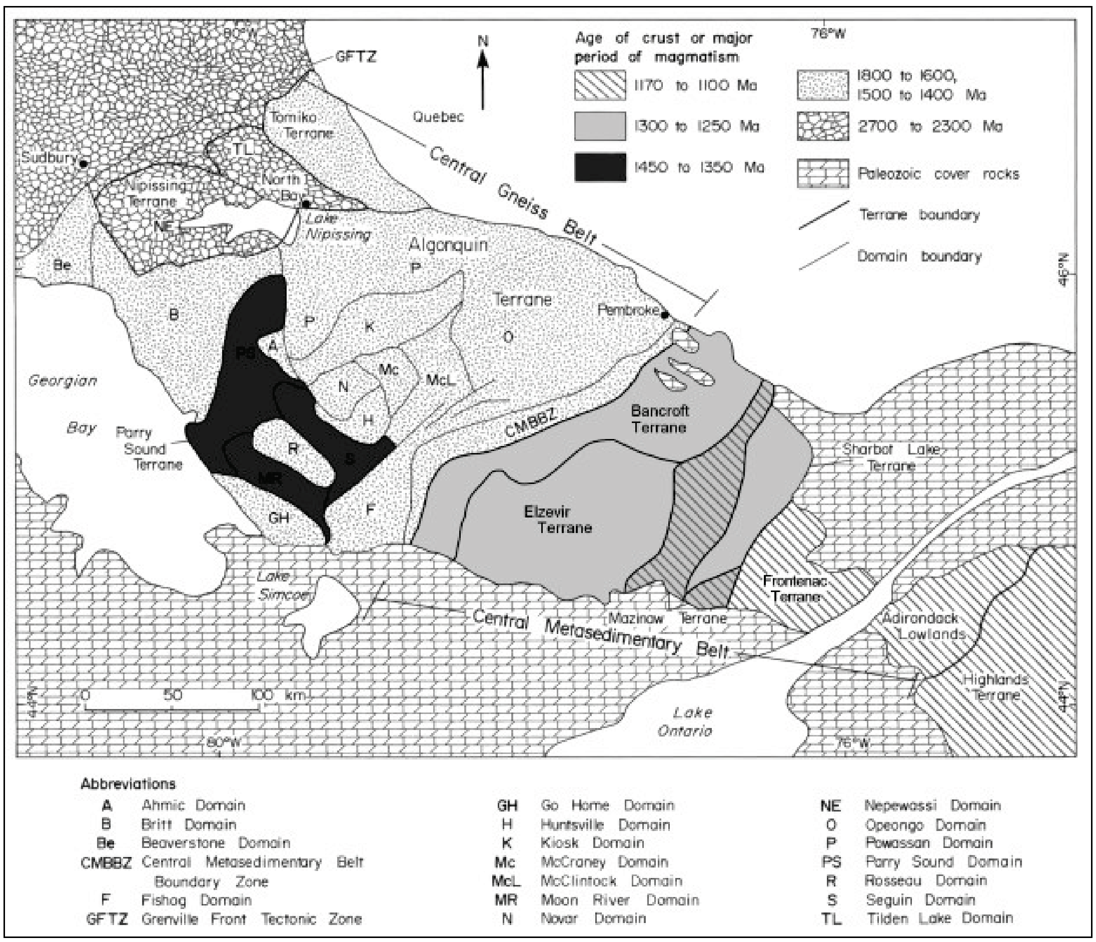


Figure 20. *Major divisions and structures of the exposed Grenville Geological Province in Ontario. Shown are lithotectonic terranes, domains and crustal ages. Note the covering Paleozoic sedimentary basin of the Western St. Lawrence Lowland and Central St. Lawrence Lowlands, west and east of Frontenac Terrane (Easton, 1992, Fig. 19.2*The Grenville province was formed by different pieces

of crust that collided to form an extensive mountain range long since eroded away. As a result of crustal collision, a variety of metamorphosed rocks ranging in age from 2.69 to 0.99 billion years old (Percival and Easton, 2007) make up the current Grenville. Evidence from the Lithoprobe transects suggests that the Grenville represents a northward thrusting of deep-level crustal rocks over the Superior and Southern provinces, with the Southern province possibly continuing some 200 km to the southeast as a southward-tapering wedge in the Grenville lower crust, ending approximately at the Central Metasedimentary Boundary Thrust Zone (Figure 21) (Percival and Easton, 2007).

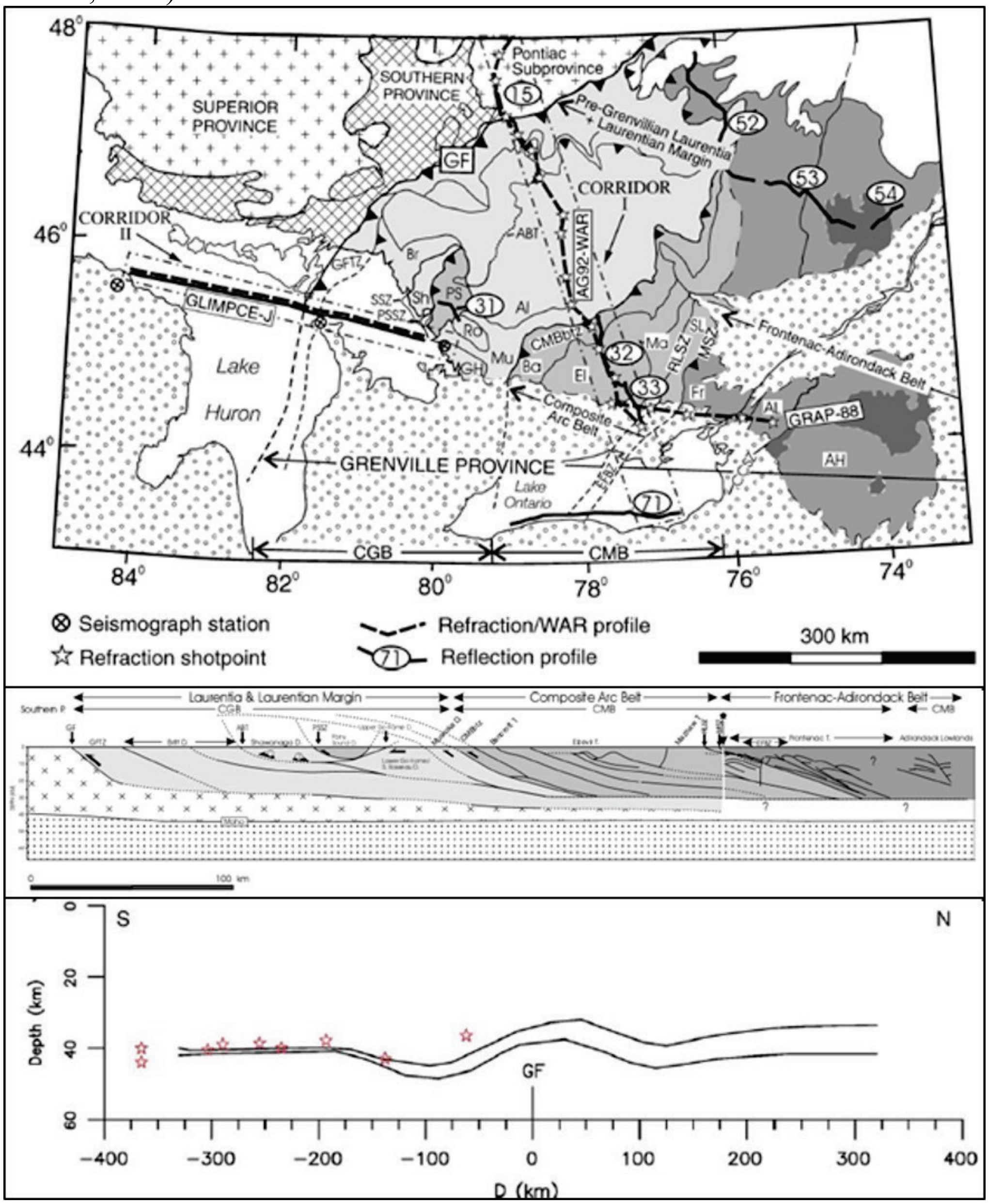


__Figure 21.__ Top panel: General geology map of the Grenville province and parts of the Superior and Southern provinces with seismic transects shown. Middle panel: Interpretational crustal-scale cross-section of Corridor I. Note stacking of belts and tapering wedge of Southern province beneath part of Grenville (White et al., 2000, Figs. 1 and 3). Bottom panel: Moho depth across Lithoprobe Line MDG (Eaton et al., 2006, Fig. 10). GF denotes Grenville Front.

Bounding the Grenville province to the west and north against the Superior and Southern geological provinces is the orogenic Grenville Front Tectonic Zone, a linear region that has been subject to deformation during an ancient mountain-building episode when the Grenville collided with a pre-existing continental landmass at about 1100 Ma. The front is postulated to be a major shear zone along which lower crustal rocks were transported to surface (Kellett et al 1994). In much of Ontario the GFTZ is a near-vertical fault that partly developed along rejuvenated older structures (Percival and Easton, 2007). Furthermore, the GFTZ marks the northwesterly limit of higher grade metamorphism and deformation in the Grenville against the less metamorphosed Southern province (Easton, 1992).

The Central Gneiss Belt consists mainly of highly metamorphosed gneissic rock which has been intruded by younger granitic plutons.

The Central Metasedimentary Belt is dominated by a variety of metasediments (originally limestone, conglomerate, sandstone, and siltstone) and plutonic rock (mainly granite, granodiorite, diorite, syenite, derived gneisses and lesser gabbro) with lesser amount of metavolcanics (originally flows, breccia). The metasediments (marble being common) and metavolcanics are often highly deformed. As a result of earlier micro-continent / island arc collision, the CMB was thrust up and over the deeper seated CGB and later intruded by a variety of plutonic rock (Eyles, 2002).

The Central Metasedimentary Belt Boundary Thrust Zone is a major feature, 2-15 km wide, separating the two major CGB and GMB belts, characterized by highly deformed sheets of gneissic rock steeply dipping to the east. Each sheet is a thrust fault formed when the CMB was pushed westward over the CGB. Exposed on surface for 200 km, from Minden northeastward to Pembroke, the CMBbtz continues southwestward beneath the Paleozoic sedimentary rocks of southern Ontario and into Pennsylvania where it is traceable as a strong magnetic lineation (Eyles, 2002).

Between the provinces of Ontario and Quebec, following the Ottawa River and obliquely crossing the Grenville, is the Ottawa-Bonnechere Graben (OBG) about 60 km wide and 700 km long (Eyles, 2002), whereby where blocks of crust have moved downward between faults to form a topographic low. The OGB is the result of failed rifting of supercontinent Rodinia 570 million years ago when the pre-Atlantic Iapetus Ocean was formed, and is related to the formation of the St. Lawrence rift system along which flows the present-day St. Lawrence River. Crustal scale geophysical investigations of the Grenville province in Ontario have mostly involved seismic surveys and re-analysis of the seismic data (White et al., 2000). A limited amount of MT transects have been completed across the Grenville within in Ontario, with most of the MT sites situated in the Quebec portion of the Grenville (Figure 9).

In 1982, the COCRUST experiment ran seismic refraction profiles across the Grenville in Ontario and Quebec, including the CMBBZ and OBG (Easton, 1992, *after* Mereu, 1986a, 1986b). Crust below the CMB was found to be thicker than in the CGB, possibility a result of thickening by thrusting along the CMBBZ and deforming the Moho. Also, the Moho along the OBG appears to exhibit a step-like 2 km upward deflection (Mereu et al., 1986), possibly due to intrusion of the upper mantle into the lower crust as consequence of the ancient rifting that formed the OBG.

A synthesis of seismic data (from surveys carried out in the 1980s to mid-1990s) by White et al. (2000) and resulted in a schematic crustal cross-section of the GFTZ and Grenville province in Ontario, from which crustal depths were obtained for construction of the Zone-3 model. The 2000 Southern Ontario Seismic Survey completed several profiles across exposed and buried Grenville terrane (Ouassaa et al., 2010).

Using teleseismic data from the POLARIS broadband seismic network, Eaton et al, (2006) have mapped the crustal thickness of the Grenville province in eastern Ontario (Figure 15). Crustal thickness variations were shown to have a strong correlation with surface geological belts and the GFTZ. These crustal thickness contour maps along with cross-sections in White et al., (2000) and Carr et al. (2000) provided excellent depth determination for the crust.

A synthesis of findings, as of 2000, from MT transects across the Superior and Grenville province was prepared by Boerner et al. (2000). Most of the MT sounding sites were situated in the Quebec portion of the Superior geological province. Nevertheless, relevant information about the GFTZ was relevant for construction of the Zone 3 and 3a models.
Since 2000, only two additional MT transects or data analysis is known. As part of a research project, a 150 km long MT transect was completed in the Ottawa Valley during 2003-2006, extending westward from Ottawa to Petawawa (Fernberg, 2011), covering the eastern margin of the Central Metasedimentary Belt and CMBbtz (Figure 18).

Analysis of MT data collected from the Lithoprobe Abitibi-Grenville transects (early 1990s) and the Ontario Polaris Array (2002-2006) has recently been completed by Adetunji and Ferguson (2010). The Polaris Array ran northwestward crossing the central parts of the CGB and CMB belts (Figures 11 and 17). The southern third of the Polaris Array crosses the Paleozoic sedimentary cover rock of southern Ontario, terminating at Lake Ontario. The electrical resistivity profiles of the Polaris Array were the primary source of resistivity values used to make the 1D model of Zones 3 and 3a.

Zone 3 – Model of Grenville Geological Province

Thick accumulations of overburden – Layer 1– are limited. Bedrock is either exposed at surface or covered by discontinuous, thin layer of unconsolidated sediment. Pockets of thicker deposits of overburden are limited to glaciofluvial outwash deposits of gravel and sand following river courses with occasional deposits of glaciolacustrine silt and clay. Patchy occurrences of till and moraine occur in the north central portion of Zone 3 between North Bay to Bancroft and bounded to the east by the Ottawa River (Barnett et al., 1991c). An average thickness of 3m was assigned to Layer 1, although it may be less over much of Zone 3.

Glacial deposits could be expected to range from 25-100 ohm.m (see Table 1 for compilation of resistivity values). Hence, an approximate midpoint value of 50 ohm.m was assigned to overburden in Zone 3.

A sedimentary basin – Layer 2 – is absent in Zone 3 and therefore not depicted in the 1D model.

Upper crust - Layer 3 - is the exposed bedrock of the Precambrian Grenville geological province. Gneisses and felsic plutonic rocks are dominant in the CGB that makes up the northern half of the exposed Grenville province in Ontario. Metavolcanic and metasedimentary rock and felsic plutonic rocks are the majority in the CMB of the southern half of the Grenville.

Overall thickness of the Grenville crust varies from 37 – 44 km (Eaton et al., 2006), thickening to the south (Figure 15). The CGB is an area of relatively thick crust, ranging 40-44 km, and the CMB has an intermediate thickness, ranging 37-39 km. Along the north edge of Lake Ontario, under the Frontenac Terrain, overall crustal thickness reaches 44 km. However, below the GFTZ overall crustal thickness varies from about 36 km in the northeast at the provincial boundary, thickening to about 44 km in the southwest at Lake Huron.

Results from the 2000 Southern Ontario Seismic Project (Ouassaa et al., 2010) revealed a 40 km overall crustal thickness for part of the CMB. The CMBbtz was imaged as a shallow east-dipping feature extending to a 24 km depth (Ouassaa et al, 2010).

On the interpreted seismic crustal cross-section prepared by White et al. (2000), an average depth for Layer 3 was 15 km. The Ottawa Valley MT profile (Figure 19) showed distinct resistivity change occurring at about 8 km deep. The Polaris Array resistivity profile (Figure 17) shows areas of high-resistive rock to a general depth of 15 km for portion of the Grenville not covered by Paleozoic sediments. Based on seismic data and the Polaris Array profile, a depth of 15 km was assigned to Layer 3.

The Polaris Array resistivity profile (TM mode) shows broad resistivity range of 125-50000 ohm, with the CGB upper crust being more resistive than the CMB upper crust. Excluding the 50000 ohm.m resistivity spatially associated with the GFTZ, the range becomes 125-10000 ohm.m, for an average of 5000 ohm.m. On the Ottawa Valley transect, a resistivity of 1100 ohm.m is associated with CMB upper crust rocks. Based on upper range values (1100-10000 ohm.m), a midpoint value of 6000 ohm.m was assigned to Layer 3.

The middle crust – Layer 4 – thickness is based on the average depth of 27 km shown on the seismic cross-section of White et al. In addition, areas of higher-resistive rock (10000-50000 ohm.m) extend to a 25 km depth on the Polaris Array joint TE and TM mode resistivity profiles (Figure 17). Based on the TM mode, resistivity range is 50-500 ohm.m, for an assigned midpoint resistivity of 275 ohm.m.

For the lower crust – Layer 5 – thickness was based on an average depth of 40 km to the lower crust / mantle boundary (Moho). However, seismic investigations have shown the Moho depth to vary beneath the Grenville province. Beneath the CGB the Moho ranges 40-44 km (Easton et al, 2006) Under the CMB, the Moho was found to be 37-39 km deep (Easton et al, 2006) or 40 km deep (Oussassa et al, 2000). Beneath the entire Ontario Grenville it was found to vary 41-42 km deep (White et al, 2000). On the Polaris Array transect, the overall resistivity trends towards 500 ohm.m (TM mode), and on the Ottawa Valley transect the overall resistivity is about 450 ohm. Due to near similar resistivities, a value of 500 ohm.m was assigned to Layer 5.

In Ferguson and Odwar's (1998) Ontario/Quebec model, the lower crust resistivity is 1000 ohm-meter, but because their model was based on data mostly from northern regions of the provinces, the suggested lower crust resistivity may be biased to the Superior geological province underlying northern Ontario and Quebec. Compared to the continuation of the Grenville province south into Zone 2 where it is buried under the Paleozoic sedimentary strata, for Zone 3 the upper crust is more resistive, with the middle and lower crust slightly more resistive.

Mantle anisotropy extends from the GFTZ into the CMB, according to analysis by Adetunji and Ferguson (2010). As well, zones of crustal anisotropy exist within the CMB. Electrical resistivity is greater in a southwest – northeast orientation.

The upper mantle – Layer 6 – is imaged to have a resistivity range of 125 – 500 ohm.m on the TM mode of the Polaris Array transect (Figure 17, upper panel). The midpoint value of ~300 ohm.m was assigned to Layer 6.

However, strong electrical anisotropy is present in the crust and upper mantle as indicated in the joint TE and TM modes of the Polaris Array. Figure 17 (bottom panel) shows background resistivity is 500 ohm.m with a large subvertical resistor of 25000 ohm.m as modelled by Adetunji and Ferguson (2010). Another a joint TE and TM mode interpretation of the Polaris Array by Adetunji et al. (2011) reveals similar background 300 ohm.m background with two dipping ~ 25000 ohm.m (Figure 22).

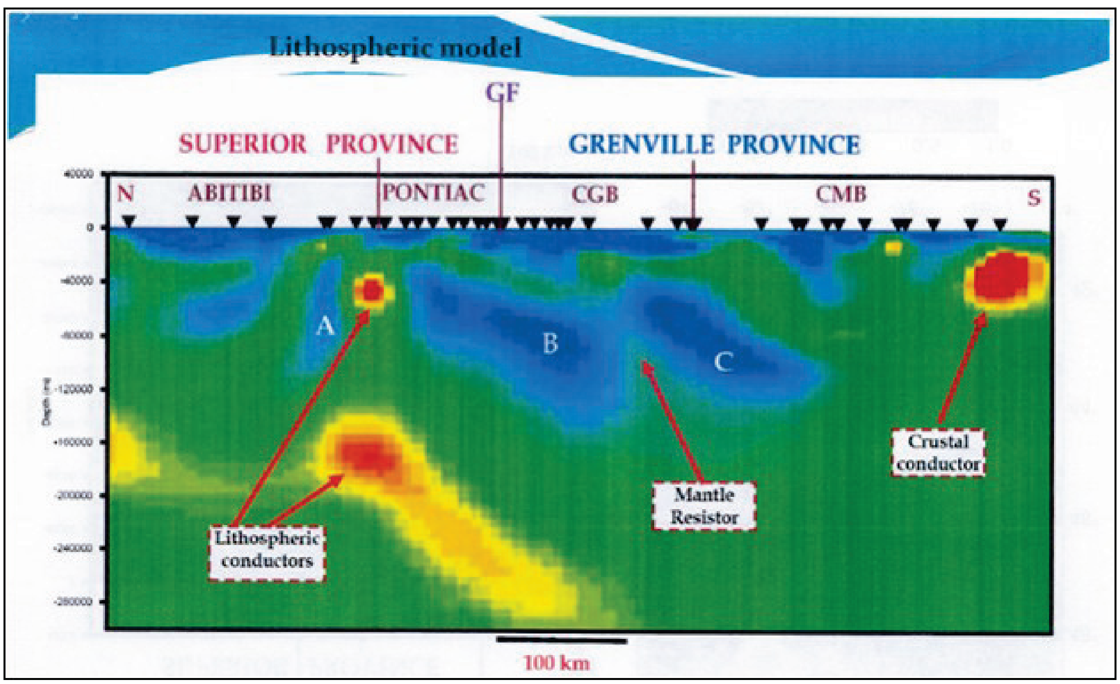


Figure 22. Interpretation of a joint TE and TM mode inversion model along the Lithoprobe Abitibi-Grenville transect and Polaris Array. Black triangles are locations of MT sounding sites. Mantle resistors labelled A, B and C. Note isolated southerly dipping lithospheric conductor at 100 – 280 km depth. Resistivity colour range: red to yellow, 1-10 ohm.m; greens, 50-500 ohm.m; blues, 1000 >25000 ohm.m. Abbreviations: CGB, Central Gneiss Belt; CMB, Central Metasedimentary Belt; GF, Grenville Front Tectonic Zone (Adetunji et al., 2011, Slide 14).

Depths and conductivities for the upper mantle, transition zones and lower mantle – layers 7 to 12 – to a final depth of 1000 km were based on the Canadian regional model (see Figure 10) prepared by Kelbert et al. (2009). The Canadian regional model was chosen since it was based on data from the Ottawa Magnetic Observatory which is underlain by the Grenville province.

Other Electrically Anomalous Geological Features

Two crustal-scale deformational boundaries in Zone 3 exhibit high electrical resistivity, and as such may create an electrical boundary condition. Resistivity at the CMBbtz is 10000 ohm.m to a depth of about 15 km, with a southerly dip revealed on the joint TE and TM modes Polaris Array profile (Figure 17). Interestingly, the Ottawa Valley transect showed a similar, high-resistive (3000-10000 ohm.m) southerly dipping feature in the vicinity south of the CMBbtz.
Due to the exceptionally high resistivity (50000 ohm.m) along the GFTZ, a subsidiary 1D model, Zone 3a, is also presented. The GFTZ is situated at the boundary between the Pontiac subprovince and the CGB. Geologically, the GFTZ ranges from several km to ten's of km wide (Davidson, 1995). Electrically, it appears to be about 30 km wide.

Zone 3a – Model of Grenville Front Tectonic Zone

For the Zone 3a model, Layers 1 and 7 to 12 are the same as for the Zone 3 model of the overall Grenville province. However, the resistivities depicted for Layers 3 and 4 are higher, and there are subtle differences for Layers 5 to 6.
For upper crust – Layer 3 – there is a distinctive high resistive (50000 ohm.m) zone along the GFTZ as apparent on the TM mode of the Polaris Array (Figure 17). Inspection of interpreted seismic cross-sections prepared by White et al. (2000) suggests a depth of 17 km.

In the lower crust – Layer 4 – the highly resistive zone diminishes to a halo of 500-10000 ohm.m, thus a mid-point value of 5000 ohm.m was assigned.

For the lower crust – Layer 5 – the depth was found to be variable along the length of the GTFZ in Ontario. In the northeast portion Eaton et al. (2006) showed depth to Moho (crust/mantle boundary) ranged 27-35 km and in the southwest portion of the GFTZ depth was 36-44 km. On the two seismic profiles prepared by White et al. (2000), depth in the northeast was 35 km and in the southwest 49 km. Because of this depth variation, both depths are shown in the Zone 3a model. Essentially the northeast part of the GFTZ is 37 km deep but thickening southwest to 42 km deep near Lake Huron. Resistivity ranges 125-500 ohm.m on the TM mode of the Polaris Array but visually appears to have an average 300 ohm.m which was assigned to Layer 4. On the joint TE and TM mode it is overall 125 ohm.m.

The uppermost mantle – Layer 6 – below the GFTZ becomes more conductive with depth as apparent on the TM mode of the Polaris Array profile (Figure 17). From an average 37 km depth to 80 km, there is a 200-500 ohm.m resistivity range with 500 ohm.m being the dominant overall resistivity which was allocated to the upper part of Layer 6. From 80-100 km depth, resistivity ranges 10-150 ohm.m; thus a midpoint value of 80 ohm.m was assigned to the lower part of Layer 6.

However, the joint TE and TM mode on the Polaris Array (Figure 17, bottom panel) reveals strong electrical anisotropy at uppermost mantle depths (37-100 km) below the GFTZ, being more conductive (10-500 ohm) parallel to GFTZ and more resistive (500-10000 ohm.m) when the orthogonal direction is included. A later interpretation by Adetunji et al., (2011) shows a conductive “slab-like” feature at mantle depth below the Superior province which terminates beneath the GTFZ (Figure 25).

The Zone 3 model is presented in Table 4, which summarizes individual layer depths, thickness, and resistivity/conductivity. Zone 3a shown in Table 5, is a model specific to the GFTZ, a major crustal-scale feature which exhibits greater upper crust resistivity.

ZONE 4 – SUPERIOR GEOLOGICAL PROVINCE-EASTERN REGION

Zone 4 encompasses the Abitibi subprovince of the Superior geological province (Figure 2). Dominated by belts of gneisses and granitoid intrusions, metavolcanic ("greenstones") rock and lesser amount of metasedimentary rock, it is of Precambrian age (2.75-2.67 Ga). Major east-west trending faults and shear zones separate the plutonic, metavolcanic and metasedimentary belts of rock (Senechal et al., 1996a).

Crustal-scale MT transects covering part of northeastern Ontario have been carried out as part of the Lithoprobe Abitibi-Grenville transects (Boerner et al, 2000) (Figure 9) undertaken in the late 1980s and early 1990s. The Abitibi portion (situated in the eastern region of the Superior geological province) was situated in western Quebec close to the Ontario provincial boundary. The Grenville portion was in Ontario. Another focus of these transects was across the Kapuskasing Uplift (or Structural Zone), a major crustal feature (see Figures 2, 3, 8 and 9 for location).

With respect to Zone 4, published results of the Abitibi-Grenville transects were focused on the Quebec part of the Abitibi subprovince, immediately east of the Ontario provincial boundary. Because of the proximity of the transect to Ontario, the published resistivity profiles are considered to be applicable to Zone 4 since the Abitibi subprovince underlies all of Zone 4.
The latest interpretations of the Abitibi-Grenville transect are by Adetunji and Ferguson (2010), Figure 17, and Adetunji et al. (2011), Figure 22. These profiles were the primary source for resistivity values for Layers 3 to 6. An earlier electrical profile of part of the same transect was completed by Kellett et al. (1994).

Because the Kapuskasing Uplift is a long and unique geological feature separating the western and eastern regions of the Superior Geological province, exhibits differing upper crust resistivity, and therefore represents an electrical boundary that may influence the magnitude of geomagnetically induced currents (GIC) of any crossing pipeline or transmission line, a separate 1D model was prepared. This particular model was based on MT surveys carried across the uplift region by Kurtz et al. (1998).

<u>Zone – 4, Superior Province eastern region</u>

Overburden – Layer 1 – in northeast Ontario is either a thin veneer discontinuously covering bedrock in the southern two-thirds of Zone 4, or thicker and extensive clay deposits accompanied by a till blanket in the upper third of Zone 4. Till (< 1m thick) and glaciofluvial deposits of sand and gravel along water courses occur in the south two-thirds. The flat-lying Abitibi Clay Belt, formed by deposition of lacustrine sediments of paleo-glacial lake Barrow-Ojibway covers Zone 4 from Cobalt to Kapuskasing (plus northwestward into Zone 5) and northward to the Hudson Lowlands, and also eastward into Quebec. The clay and silt can be up to 60 m thick lying on top of till 2-4m thick, and has a low electrical resistivity averaging 30 ohm.m (Palacky, 1992). In the Pontiac subprovince, overburden is < 50 m thick (Kellett et al., 1994). In the Kapuskasing area, electrically conductive 25 m thick accumulation of glacial till and clay was reported by Mareschal et al. (1994). Therefore, in Layer 1, overburden can be divided into two categories. The southern 2/3 of Zone 4 has overburden <1m deep with resistivity of glacial deposits (till, sand) ranging 20-100 ohm.m, for a midpoint assigned value of 60 ohm.m. The northern 1/3 of

Zone 4 is assigned a thickness of 50 m and resistivity of 30 ohm.m to represent the clay belt deposits and underlying till blanket.

A sedimentary basin – Layer 2 – is absent in Zone 4 and therefore not depicted in the 1D model. Upper crust - Layer 3 - is the exposed bedrock of the Precambrian Superior and Southern geological provinces. In the eastern region – Zone 4 – of the Superior province, plutonic rock (granites) is predominant with areas intermixed with lesser amounts of metavolcanics and metasediments. "Greenstones" of the Superior's Abitibi geological subprovince are comprised of metavolcanics, originally lava flows and pyroclastic, with intervening narrower belts of metasediments. The Abitibi extends eastward into Quebec. In contrast to adjacent Quebec, there exists the Southern Province situated between the Superior and Grenville (Figure 2). In Zone 4 the Southern province is made up of the Huronian Supergroup, comprised of flat-lying Precambrian metasediments.

Thickness and/or resistivity of Layer 3 presented by previous workers, includes the following below.

Source	Thickness (km)	Resistivity (ohm.m)	Comment
Kellett et al. (1992)	---	5000	* applies to Pontiac subprovince exposed in adjacent Quebec * in Ontario, Pontiac extends beneath Huronian Supergroup metasediments
Kurtz et al. (1993)	---	15000	* applies to Abitibi and Pontiac subprovinces
Kellett et al. (1994)	10-12	2500-25000 ± range predominately > 10000	* applies to Pontiac
White et al (2000)	15 ±	---	* applies to Pontiac
Adetunji and Ferguson (2010)	15 ±	1500-50000 range	* Noticeable resistivity change at 15 km depth.

Examination of the profile (Figure 17) by Adetunji and Ferguson (2010) suggests the highest resistivity (50000 ohm.m) associated with the core of the Abitibi where granitoid and gneissic rock predominates, and same with the Pontiac subprovince.

A 15 km depth was assigned to the upper crust – Layer 3– although it may be thin as 10 km. Based on a resistivity range of 5000-50000 ohm.m an approximate midpoint of 25,000 ohm.m was assigned, but it needs to be noted that half of the lateral extent of upper crust on Adetunji and Ferguson's (2010) profile has a resistivity of 50,000 ohm. It should also be noted that resistivity values were not found for the Proterozoic Huronian Supergroup of Southern Province in the southeast corner of Zone 4. Instead the resistivity for the Pontiac subprovince (in adjacent Quebec) was applied to Zone 4. The Pontiac subprovince is a block of Archean metasedimentary rock dominated by granitoid intrusives and gneisses (Kellett et al 1992 abs).
For the middle crust – Layer 4 – a general thickness of 27 km was obtained from the seismic cross-section of White et al. (2000) which only extends as far north as the Pontiac subprovince.

Kellett et al (1994) remark that the mid-crust is conductive (200 ohm.m interpreted from their Fig. 10) to a depth of 25 km or more. Interestingly, two resistive (10000-50000 ohm.m) keel-like structures to a depth of 25-30 km are shown on the electrical profile prepared by Adetunji and Ferguson (2010). Excluding the resistive keels and halo of diminishing resistivity, the common background resistivity is about 125 ohm.m. which was assigned to Layer 4.

For the lower crust – Layer 5 – thickness was based on an average depth of 37 km to the lower crust / mantle boundary (Moho). Overall thickness of the crust in Zone 4 tends to be less than 40 km. However, seismic investigations have shown the Moho depth to vary and to be transitional (Figure 21). A crustal cross-section by White et al. (2000) shows a 37 km depth under the Pontiac subprovince. Mereu (2000) suggests up to an 8 km thick Moho transition zone with upper part of the zone varying in depth 34-38 km crossing the Superior and Southern provinces. Ludden and Hynes (2000) indicate a Moho depth ranging 37-40 km below the Abitibi subprovince, with Winarhi and Mereu (1997) suggesting a Moho located 34-36 km below the Abitibi and Pontiac subprovinces. On the crustal thickness map prepared by Eaton et al (2006) the Moho depth is 37-39 km.

As with Layer 4, published resistivity values for lower crustal depths were limited. Kellett et al. (1994, Fig. 8b) shows a range of 500-2500 ohm.m, dominantly 1000 ohm.m, over a depth of 25-40 km below the Abitibi and Pontiac subprovinces in adjacent Quebec. Adetunji and Ferguson (2010), for the same area, show a range of 125-500 with higher end of resistivity range being dominant. Based on the more recent 2D profile by Adetunji and Ferguson, a resistivity of 500 ohm.m is applied to Layer 5.

The upper mantle – Layer 6 – on the profile (Figure 17) prepared by Adetunji and Ferguson (2010) is imaged to have a resistivity range of 125 – 500 ohm.m on the TM mode, tending more to the lower end of the resistivity range. Another interpretation of the same profile by Adetunji et al. (2011) reveals a background resistivity of about 300 ohm.m with several separated 3000 ohm.m resistive bodies (Figure 25). For Layer 6, based on a resistivity range of 125-500, a value of 250 ohm.m was assigned to reflect predominance of an overall lower resistivity.

Furthermore, as shown on Figure 22, a small conductive zone (< 10 ohm.m) at an upper mantle depth of 40-50 km occurs beneath the Abitibi subprovince. In the deeper mantle, 160-280 km, there is another and larger conductive zone (<10 ohm.m) dipping southward. The cause of these two mantle conductors is not presently known.

Depths and conductivities for the upper mantle, transition zones and lower mantle – layers 7 to 12 – to a final depth of 1000 km were based on the Canadian regional model (see Figure 10) prepared by Kelbert et al. (2009). The Canadian regional model was chosen since it was based on data from the Ottawa Magnetic Observatory which is underlain by the Grenville province. The observatory is located about 250 km from the centre of Zone 4.
It should also be noted that the lower crust and upper mantle underlying the eastern Superior province and the Grenville province exhibit pervasive electrical anisotropy to at least a depth of 70 - 100 km (Kurtz et al, 1993; Kellett et al, 1994) or even 400 km (Adetunji et al. 2011). The lower mantle is reported to be 30 times more conductive in an east-west direction compared to a

north-south direction (Boerner et al., 2000). It has also been shown that the crust has a different anisotropic direction from the mantle orientation of the anisotropy (Adetunji et al., 2011).

Zone – 4a, Kapuskasing Uplift

The Kapuskasing Uplift (KU) is a northeast-trending 500 km long region of high-grade metamorphic rock, fault-bounded, that divides the Superior geological province into eastern and western regions (Percival and Easton, 2007). It cuts across the east-west trending metasedimentary and metavolcanic subprovinces of the Superior province and is traceable by prominent positive gravity and magnetic anomalies. The KU exposes an oblique cross-section of up to 25 km of mid-to-lower crustal rock that was uplifted along a thrust fault (Kurtz et al, 1993). Seismic investigations (Percival and West, 1994) shows considerable variation of crustal thicknesses, with the Moho depth ranging 43 – 54 km with a 48 km average which is thicker than the 37 km determined for the eastern end of the Superior province. Inspection of seismic interpretations (see Percival and West, 1994, their Fig. 7) reveals the following averaged thickness for crustal layers: upper crust, 0-18 km; middle crust, 18-27 km; and, lower crust, 27-48 km.

Several EM investigations, including MT, have been undertaken to study the KU and which have been summarized by Mareschal et al. (1994). These investigations were done in the area between the small towns of Chapleau and Foleyet. Using the electrical resistivity values shown in the geoelectric model (see Figure 23) prepared by Kurtz et al. (1993) the Zone 4a 1D model was constructed. It should be noted that this model has different layer divisions compared to the Zone 4 model. Electrical anisotropy in the upper part of the mantle has also been recognized (Kurtz et al., 1993).

A narrow (~ 600 m) and shallow (< 1 km) electrically conductive zone (200-600 ohh.m) in the upper crust has been identified to be associated with the Ivanhoe Lake cataclastic zone (ILCZ) (Kurtz et al., 1993; Mareshal et al., 1994) which forms the eastern margin of the KU. Figure 24 5-2 provides a 2D model of the ILCZ conductive zone which may be a result of fluids infilling weather bedrock (Mareshal et al., 1994).

For the Zone 4a model, all the layer depths and resistivities were copied from the model developed by Kurtz et al. (1993). Note that for Layer 1, both overburden and fractured and weathered bedrock to a depth of 0.3 km are incorporated instead of the only metres thick Layer 1 overburden found in the Zone 4 model. Other major differences in the Zone 4a model is the merging of the lower crust and uppermost mantle into a single layer 215 km thick, and combining the lowermost upper mantle, transition zones and lower mantle into a single 750 km thick layer.

Other Electrically Anomalous Geological Features

Other geological features of interest in the Abitibi subprovince that could potentially act as significant electrical boundaries and influence the magnitude of GIC are two major shear zones; the Casi Berardi tectonic zone (CBTZ) and the Destor-Pocupine deformation zone (DPDZ). They are moderately electrically conductive (<1000 ohm.m) over a distance of 100 and 200 km, respectively, although to a relatively shallow depth of 10 km (Boerner et al, 2000). The CBTZ is made up of multiple subparallel 1 km wide conductive zones totaling several km wide. In the CBTZ the source of conductivity is due to presence of graphite, sulphide minerals and/or iron-carbonates which are observed at surface (Senechal et al, 1996a), with conductivity improving with depth by pressure or by presence of saline waters. Furthermore, the CBTZ may represent a crustal boundary (in Quebec) affecting upper and middle crust down to 20 km (Senechal et al., 1996a). The DPDZ is a discrete 3 km wide feature. Figure 9 shows the location of the two shear zones, with a simple 2D model of the zones and surrounding rock shown in Figure 25.

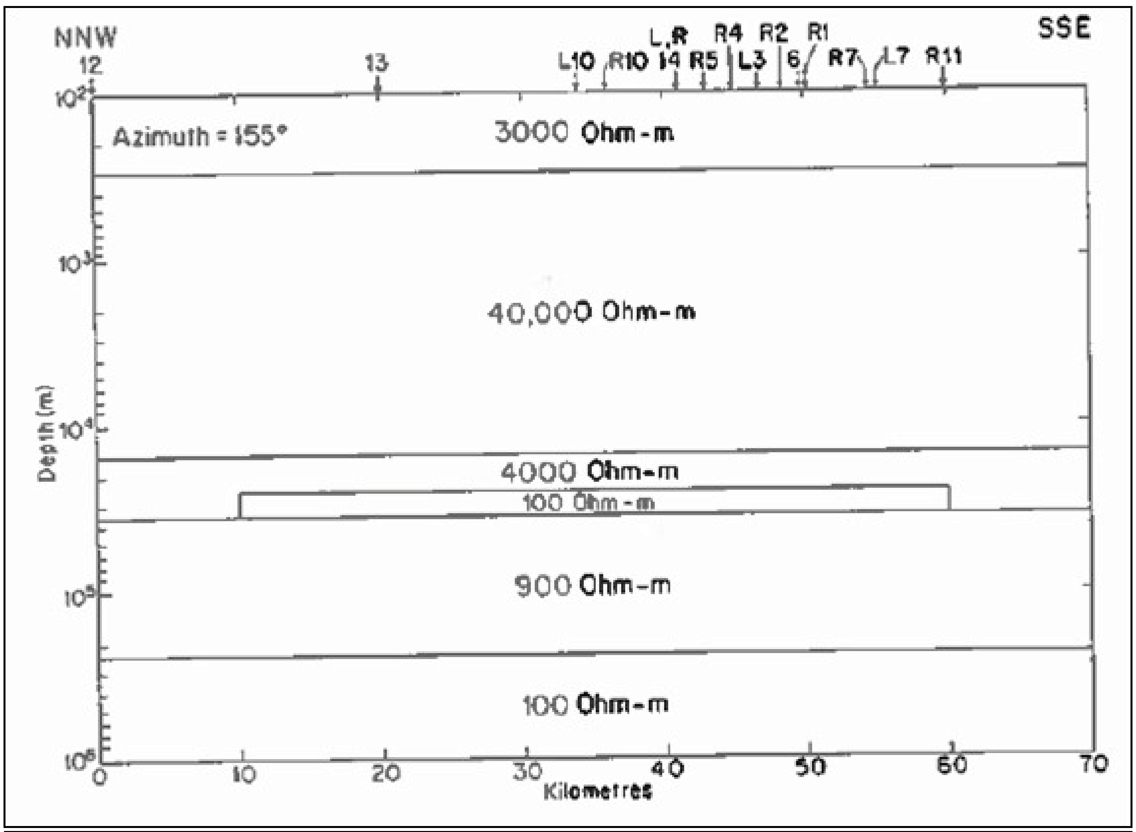


Figure 23. 2D model of the elecrtrical structure of the crust and upper mantle in the Kapuskasing uplift region (Kurtz et al., 1993, Fig. 13). 100 ohm.m conductive area at 15-25 km depth has been interpreted to be caused either by a lower crust conductive slab or electrical anisotropy in upper mantle;

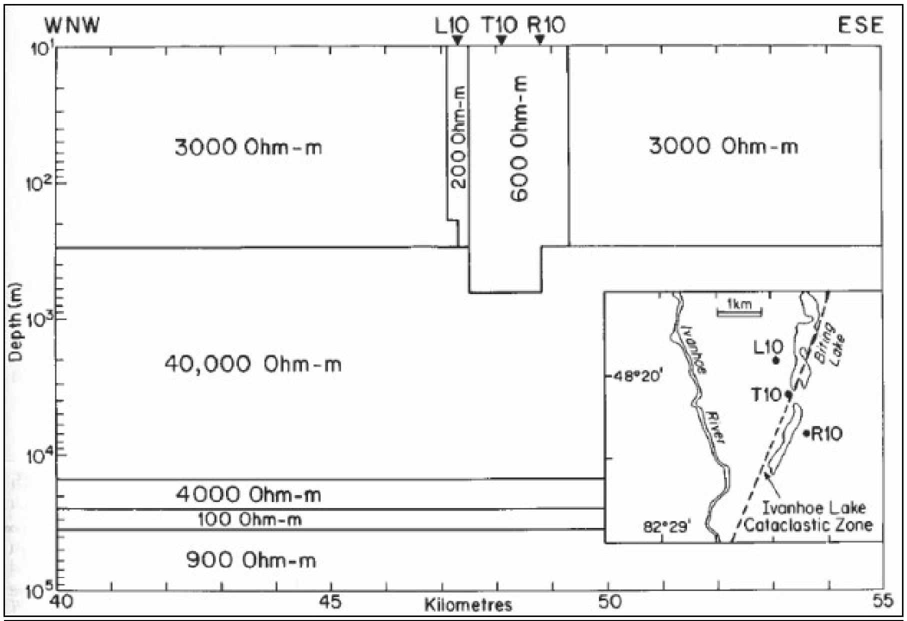


Figure 24. 2D model of the electrical structure across the Ivanhoe Lake cataclastic zone, part of the Kapuskasing Uplift (Kurtz et al., 1993, Fig. 16). Note 100 ohm.m zone remarks is Figure 23.

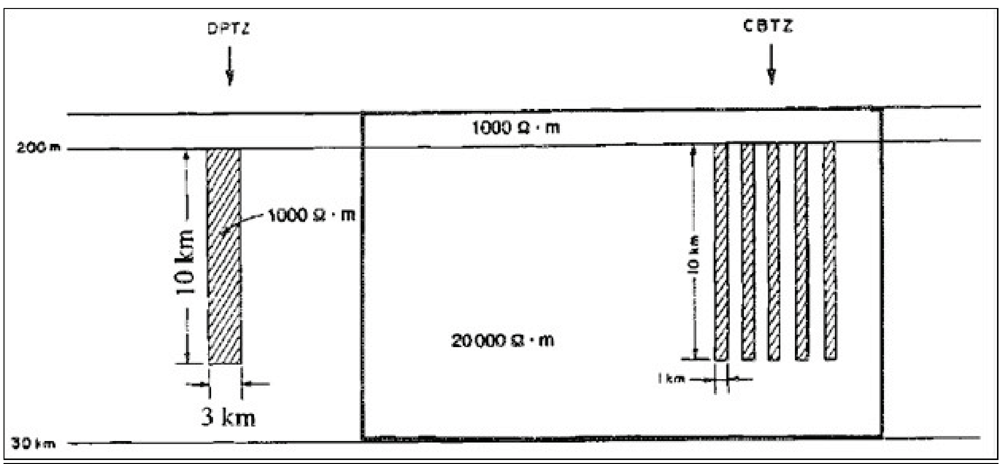


Figure 25. Geoelectric model (not to scale) for the electrically conductive shear zones in the Abitibi subprovince of the eastern region of the Superior geological province (Senechal et al, 1996a, Fig. 2). Resistivity below 30 km is 500 ohm.m (Boerner et al, 2000). Abbreviations: CBTZ, Casi Berardi tectonic zone; DPTZ, Destor-Porcupine deformation zone.

<u>Presentation of results:</u>

The Zone 4 model for the eastern Superior geological province is presented in Table 6, which summarizes individual layer depths, thickness, and resistivity/conductivity. Zone 4a is presented in Table 7, is a model specific to the Kapuskasing Uplift, a major crustal-scale feature which exhibits greater upper crust resistivity relative to surrounding crust.

ZONE 5 – SUPERIOR GEOLOGICAL PROVINCE-WESTERN REGION

The western half of the Superior geological province encompasses a number of repetitive east-west trending 100-200 km wide belts (referred to as subprovinces) of granite-volcanic and metasedimentary rock of early Precambrian age. A small portion of the late Precambrian Southern geological province extends into the western Superior province along the north shore of Lake Superior in the Thunder Bay area and encircling Lake Nipigon where it is known as either the Nipigon Embayment or Nipigon Plate. The Southern province portion was not specifically delineated as a separate model.

Crustal-scale MT transects of the western Superior geological province in northwestern Ontario were carried out under the Lithoprobe Western Superior Transect investigations during 1998-98 and 2000 (Figure 26). More than 230 MT soundings were completed (Ferguson et al., 2005). A few soundings were completed over the Hudson Lowlands in the most northern part of Ontario where a Paleozoic – Mesozoic sedimentary basin overlies Precambrian crystalline basement. Detailed AMT transects were completed in 2004 over the Nipigon Embayment, involving 837 sounding sites (Craven et al., 2006). Here, the purpose was to geophysically image the geological relationship between the mainly flat-lying Proterozoic Sibley Group sediments and intruding Nipigon Diabase sills of the Southern geological province which overly the earlier Precambrian crystalline basement.

The primary source for resistivity values for Layers 3 to 6 were obtained from Ferguson et al. (2005) who prepared two regional MT profiles, 400 km apart, 800-1000 km long, extending from the USA border to Hudson Bay. One profile (Line 1) transects the Superior province in northwest Ontario and the second profile (Line 2) crosses the eastern half of Manitoba (Figure 27). Resistivity values from Line 1 (Figure 28) were applied to the 1D models of the western Superior province.

Previous investigation (Craven et al., 2001; Ferguson et al., 2005) has identified exceptionally resistive crust in the northern half of northwestern Ontario, specifically associated with the North Caribou Superterrane (NCS) and continuing to a lesser degree northward. Crust south of the NCS is more conductive (i.e. less resistive) with resistivities similar to the eastern region of the Superior province (Ferguson et al., 2005). Therefore, two models, Zone 5a and 5b, were constructed to reflect the crustal resistivity differences.

A small portion of the late Precambrian Southern geological province extends into the western Superior province along the north shore of Lake Superior in the Thunder Bay area and encircling Lake Nipigon where it is known as either the Nipigon Embayment or Nipigon Plate. Models Zone -5a and 5b do not incorporate the Southern Province.

Crustal depths were obtained from a regional seismic transect prepared by Musacchio et al. (2004) approximately coincident with MT profile Line 1. Figure 29 presents an interpretative crustal cross-section of the Superior geological province in northwest Ontario, and illustrates how the current configuration of the Superior was the result of numerous accretions of micro-continental crust, island arcs, and oceanic crust and plateaus which are now the present-day subprovinces (Hammer et al., 2010).

Overall thickness for the western Superior province has a wide range (34-45 km) with an average of approximately 40-41 km (Musacchio et al., 2004), and slightly deepening to the east and south. For the crustal layers – 3 to 5 – the depths were measured and averaged from north-south orientated seismic profiles presented by Musacchio et al.,2004. Along seismic transect Line 1 (co-located with MT transect Line 2) the Moho ranges from 45 to 42 in a south to north direction.

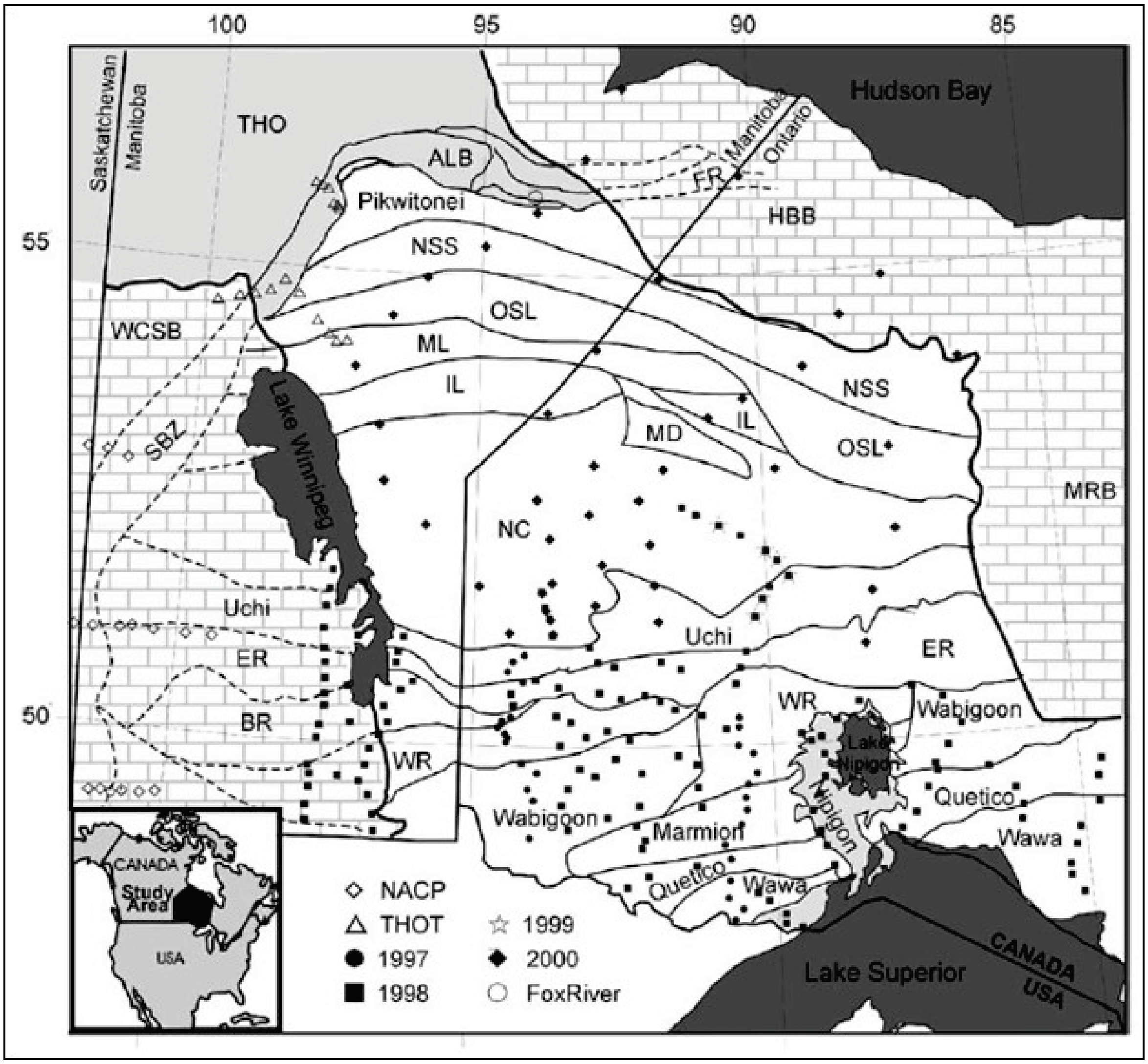


Figure 26. Location of MT sounding sites in the western Superior geological province completed as part of the Lithoprobe Western Superior Transect 1997-2000 (Ferguson et al., 2005, Fig. 1). Heavy black line is edge of sedimentary basins. Solid thin lines mark boundaries of geological subprovinces / terranes and dashed line is interpreted boundary beneath sedimentary basin cover. Abbreviations: THO, Trans-Hudson orogen; SBZ, Superior boundary zone; MRB, Moose River basin; FR, Fox River sill; ALB, Assean Lake block; NSS, northern Superior terrane; OSL, Oxford –Stull Lake terrane; ML, Zmunro Lake subprovince; IL, Island Lake subprovince; MD, Muskrat Dam subprovince; NC, North Caribou Superterrane; ER, English River subprovince; BR, Bird River-Separation Lake subprovince; WR, Winniper River subprovince; P, Pikwitonei; WBG, Wabigoon terrane; MM, Marmion domain; Q, Quetico terrane; WW, Wawa terrane.

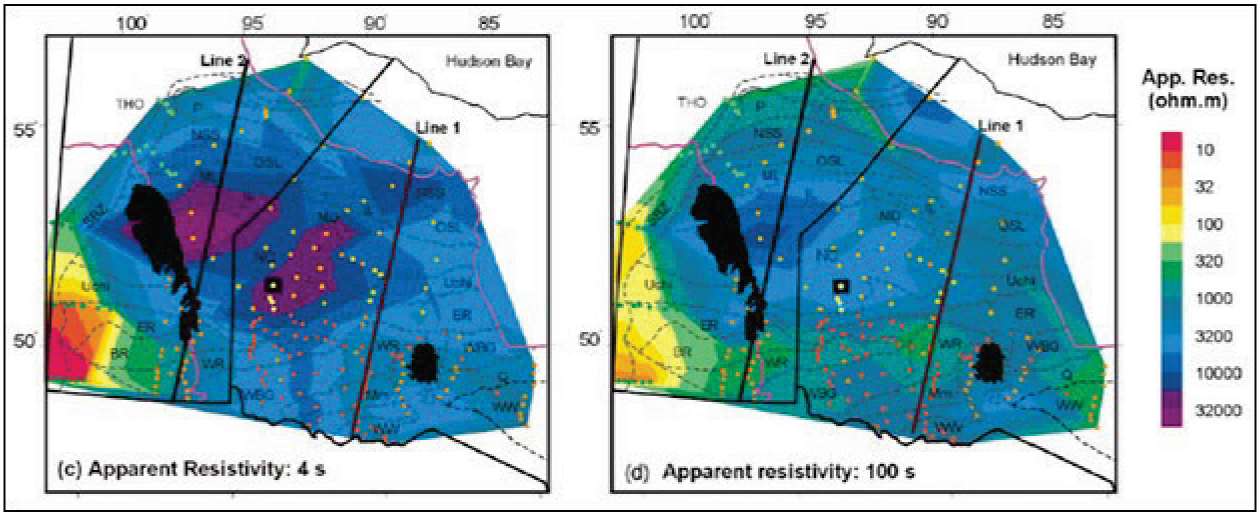


Figure 27. Location of MT profiles Line 1 and Line 2, and contour maps of apparent resistivity response at 4 seconds (crustal depth) and 100 seconds (upper mantle depth). MT sounding sites shown as yellow dots. Abbreviations listed in Fig. 5.1. (Ferguson et al., 2005, Fig. 5).

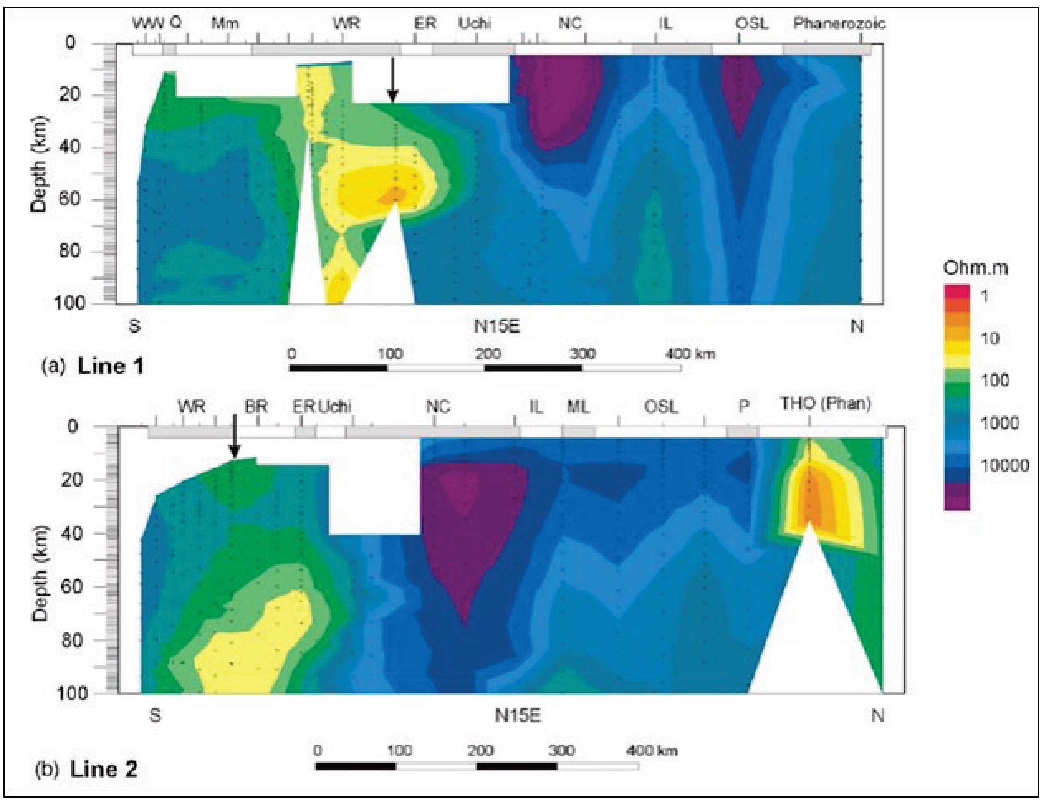


Figure 28. Electrical resistivity profiles for Lines 1 and 2 across (a) northwestern Ontario and (b) eastern Manitoba, constructed from stitched 1D MT soundings (Ferguson et al., 2005, Fig. 7). Bar at top of profiles shows surface geology, with abbreviations listed in Fig. 5.1.

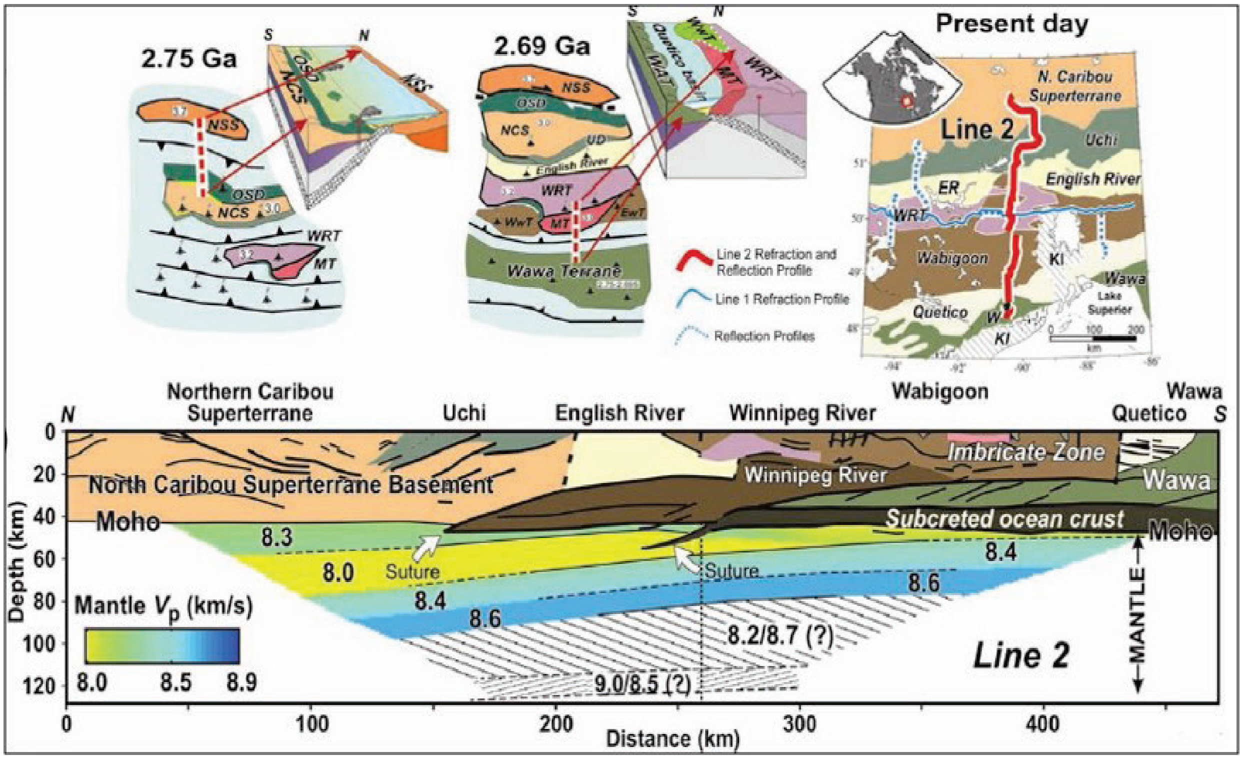
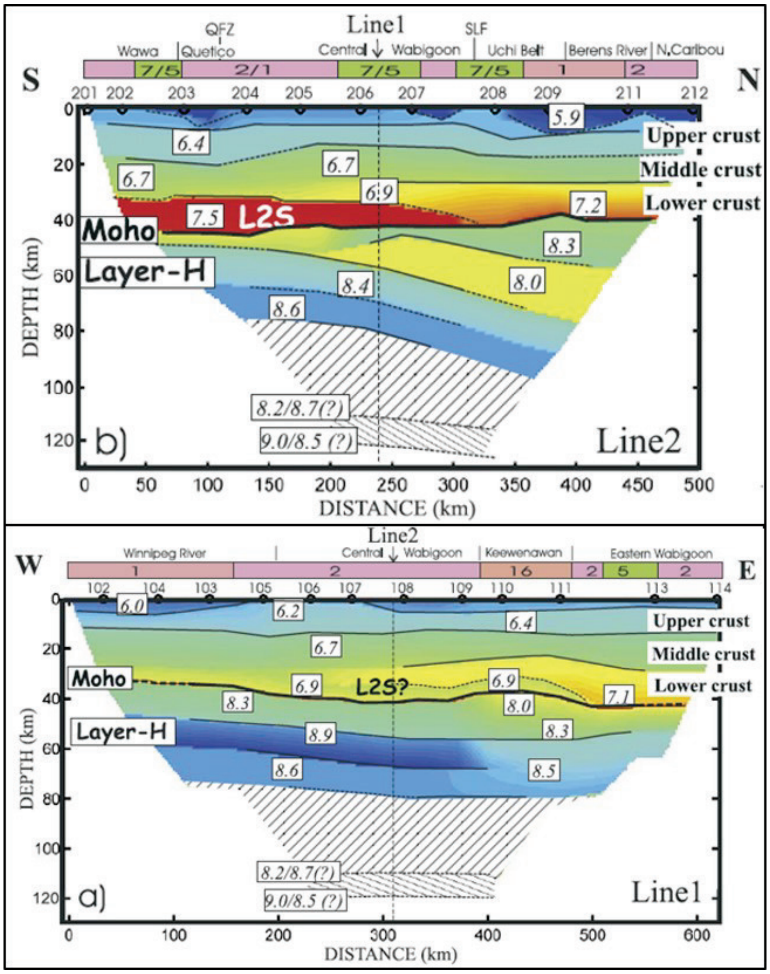


Figure 29. Top panel: A schematic illustration of 3 of 6 stages in the accretionary evolution of the western Superior geological province. Bottom panel: Simplified interpretation of a crustal-section along seismic Line 2 (Hammer et al., 2010, Fig. 4). Abbreviations: ER, English River terrane/subprovince; KI, Kewenawan intrusives; MT, Marmion terrane; NCS, Northern Cariboo Superterrane; OSD, Oxford Stull domain; UD, Uchi domain; WAT, Wawa-Abitii terrane; WRT, Winnipeg River terrane; WwT and EwT, western and eastern Wabagoon terranes.

Overall thickness for the western Superior province has a wide range (34-45 km) with an average of approximately 40-41 km (Musacchio et al., 2004), and slightly deepening to the east and south. For the crustal layers – 3 to 5 – the depths were measured and averaged from north-south orientated seismic profiles presented by Musacchio et al., such as the example shown in Figure 30. Along seismic transect Line 1 (co-located with MT transect Line 2) the Moho ranges from 45 to 42 in a south to north direction.



Map Unit	Generalized Lithology
Muscovite-bearing granitic rocks 13	felsic plutonic 1
Diorite-monzonite-granodiorite 14	felsic plutonic 1
Massive granodiorite to granite 15	felsic plutonic 1
Foliated tonalite suite 12	intermediate plutonic 2
Gneissic tonalite suite 11	intermediate plutonic 2
Felsic to intermediate metavolcanics 6	felsic-intermediate volcanic 4
Metasedimentary rocks 7	metasedimentary 7
Metasedimentary rocks and mafic/ultramafic metavolcanics 1	metasedimentary 7
Mafic to intermediate metavolcanics 5	intermediate-mafic volcanic 5
Mafic metavolcanics and metaseds 3	intermediate-mafic volcanic 5
Mafic and ultramafic rocks 10	mafic plutonic 3
Mafic intrusive rocks (Proterozoic) 31	mafic plutonic 16

Figure 30. Seismic velocity models for Line 1 and Line 2, showing depths of crustal layers (Musacchio et al., 2004, Fig. 5 and Table 3). Surface geology shown at top of each model with superposed numbers linking to table attached to this figure. Layers 2S and H interpreted to be relic oceanic crust and oceanic mantle, respectively, accreted to base of continental crust Abbreviations: SLF, St. Joseph Lake fault; QFZ, Quetico fault zone. Generalized lithology (Table) is to accompany the surface geology bar shown at top of Lines 1 and 2 seismic velocity models.

Models 5a and 5b

Overburden – Layer 1 – across the rocky Precambrian Shield in northwest Ontario (Zone 5) is typically a discontinuous veneer off till (<1 m) with thicker blanket of till north of 50 degree latitude (Fulton, 1995). This till is characterized by sand to silty sand matrix (Burnett et al., 1991a). Esker and moraine deposits also occur throughout Zone 5, as well as larger patchy deposits of glaciolacustrine deposits of sand, gravely sand and gravel (Barnett et al., 1991a; Puhl et al, 1991). Outwash and beach sand deposits are common around Lake Nipigon. Larger belt-like deposits of glaciolacustrine silt and clay occur to the west in the Dryden – Red Lake – Kenora area, and also in the upper half (north of 52 degree latitude) of the Superior.

Continuing northward from 50 degree latitude into the Hudson Bay Lowland, overburden becomes progressively thicker and continuous. In the lowlands, overburden can exceed 200 m, but commonly ranges 30-60 m (Barnet, 1992).

A general thickness for overburden, mostly till veneer, covering the southern half of the western Superior, is assumed to be 1 m. For the northern half, covering the North Caribou Superterrane up to the Hudson Bay Lowland, a general thickness of 15 m overburden is estimated on the basis that it is half of minimal average thickness in the lowlands.

Resistivity of Layer 1 can be expected to be variable, dominated by the type of glacially deposited material. Resistivity of the glacial derived overburden (lucustrine clays, lesser silt and sand) in southeast Manitoba ranges from 5 to 30 ohm-meter, as measured by Gowan et al. (2009). In Saskatchewan, a compilation by Palasky (1988) found glacial till resistivity to range from 20 to 100 ohm-meter and glaciolacustrine clay in Ontario to be about 25 ohm-meter. Resistivities of the uppermost layer across the Wisconsin Arch ranged from 75 to 200 ohm-meter as determined by Dowling (1970), the higher values possibly reflecting more widespread deposits of outwash sand and gravel. With a range of 30 ohm-meter (clays and silts) to about 100 ohm-m (tills), a midpoint resistivity value of 60 ohm-meter was assigned to Layer 1.

A sedimentary basin – Layer 2 – is absent in Zone 5 and therefore not depicted in the 1D model.

Resistivity values for the crustal layers – 3 to 5 – were obtained from the Line 2 MT profile by first determining the range for a particular layer and then selecting the approximate midpoint of the range. For the North Caribou Superterrane and area to the north, two highly resistive (50000 ohm.m) zones extend downward to the Moho boundary in a tapering manner. Thus for middle and lower crust, the assigned resistivity for these two layers was taken as the midpoint of resistivity range exclusive of the 50000 ohm.m core.

Depths and conductivities for the upper mantle, transition zones and lower mantle – layers 7 to 12 – to a final depth of 1000 km were based on the Canadian regional model (see Figure 10) prepared by Kelbert et al. (2009). Although the Canadian regional model is based on data from the Ottawa Magnetic Observatory distant to western Superior, its lower regional resistivity values (compared to the North American regional model) are closer to a conductive mantle that has been interpreted to occur beneath the North Caribou Superterrane. Enhanced conductivity (< 100 ohm.m at ~ 100 km) in the uppermost mantle beneath the North Caribou Superterrane could be due to introduction of carbon into mantle during ancient subduction events (Ferguson et al., 2005). For the Nipigon area, Craven et al (2001) identified a conductive (20 ohm.m) layer commencing at 100 km depth and suggested it may be Superior province wide. However, note that this observation is in direct contrast to Ferguson et al., (2005) who mention that mantle beneath the Nipigon Embayment is resistive.

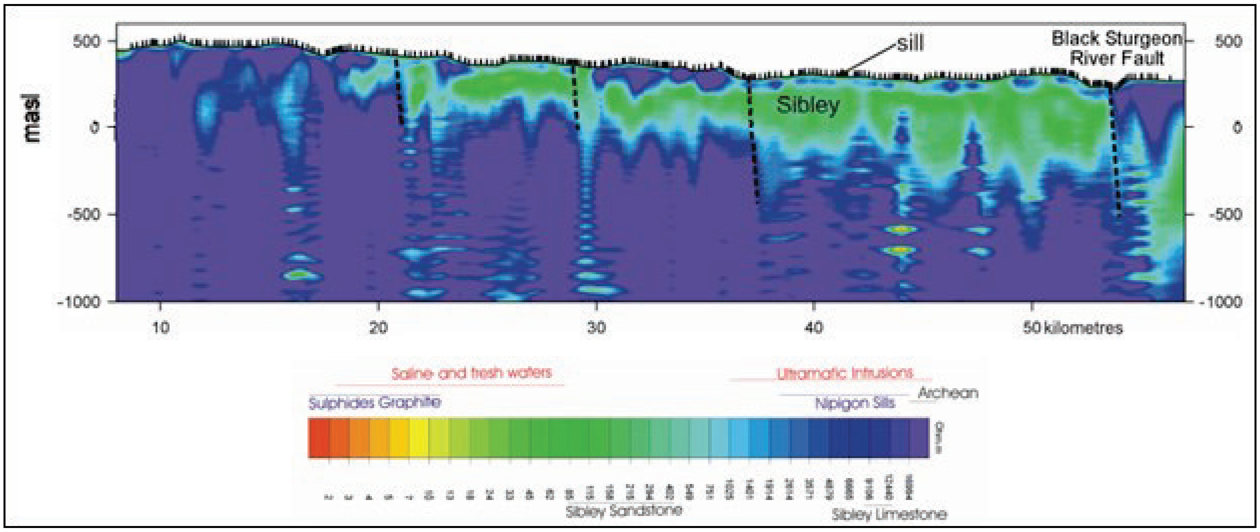


Figure 31. An east-west orientated electrical resistivity profile along Mawn Lake Road west of Lake Nipigon. Cross-section based on stitched and contoured 1D soundings from an audiomagnetotelluric survey. Sibley sandstone has a resistivity range of ~50-200 ohm.m, and Nipigon diabase sills have resistivities ~ 16000 ohm.m. Abbreviation: masl, metres above sea level. (Craven et al., 2006, Fig. 4).

Other Electrically Anomalous Geological Features

The Nipigon Embayment is an anomalous resistive area, 100 km wide, where the resistive nature penetrates into the upper mantle (Ferguson et al., 2005). The AMT survey across part of the Nipigon Embayment revealed the extensive Nipigon diabase sill to have a resistivity of ~ 16000 ohm.m to a minimum 1.5 km depth (Craven et al., 2006). Figure 31 provides an example of an AMT resistivity profile showing range and depths of sediments and diabase in the Nipigon area.

A regional-scale electrically anomalous feature, an east-west orientated 600 km long, crustal conductor (<10-50 ohm.m) has been identified along the southern boundary of the North Caribou Superterrane. It has been interpreted to be related of an ancient tectonic plate boundary possibly caused by a conductive component in the deformed metasedimentary rocks of the English River subprovince (Ferguson et al., 2005). The conductive component has been speculated to be due to graphite and/or sulphide minerals or iron formation. Another possibility for conductive, linear, anomalies observed at deep depths in the Superior province could be due to graphite in residue from partial melting that may have been deposited along weak fault zones (Craven et al., 2001).

MT profile Line 1 (Figure 28) shows a narrow conductor at mid-crust depth becoming wider at uppermost mantle depth. Model Zone-5a presents the crustal conductor in relation to the resistivity of the other layers.

Models for Zone 5a and 5b are presented in Table 8, which summarizes individual layer depths, thickness, and resistivity/conductivity. Zone 5a is specific to the western Superior province south of the North Caribou Superterrane; with Zone 5b encompass the area to the north including the North Caribou Superterrane.

ZONE 6 – NORTH-EASTERN ONTARIO

This conductivity model was originally developed for the Sannikiluaq Magnetic Observatory, which is located in the Hudson Bay Lowland region, thus the developed model is applicable for Zone 6 in north-east Ontario.

The area of coverage is a 500 km radius (Figure 32), encompassing the northern margin of Ontario and northeastern region of Quebec as well as the eastern half of saltwater Hudson Bay. Geologically, the coverage area straddles the Trans-Hudson Orogen (THO) and Superior geological province with part of the Hudson Platform exposed on top of the Superior.in northern Ontario.

Figure 32. *Map of the geological provinces underlying Nunavut, Ontario, Quebec and part of Manitoba. Shown in red are the various segments of the Circum-Superior Belt, formed along the margin of the Superior. Approximate limits of Trans-Hudson Orogen (long-dashed line) are shown. Rae and Hearne geological provinces are allocated the same shade of grey because these two provinces are often combined as the Churchill geological province. Shown in heavy dashed line is the area of coverage, 500 km radius, for the Sanikiluaq 1D model (modified from Minifie et al., 2010, Fig. 1).*

Because crustal resistivity differs significantly, with a highly resistive (< 50000 ohm.m) Superior province juxtaposed against a more conductive (<5000 ohm.m) THO crust, the approach was to present resistivity specific to the Superior province and THO and then assign a resistivity value midway between the two, resulting in a "blended" resistivity.

Sources of Information

The transects were completed in the late 1980s-early 1990s and early 2000s as part of the Lithoprobe program, with MT data undergoing re-analysis by Ferguson et al. (2005a, 2005b), Jones et al. (2005), and Adetunji and Ferguson (2010). Earlier synthesis of crustal structure and resistivity was done by White et al. (1999, 2005). Recently, Roberts and Craven (2012) completed an audio-MT (higher frequency) survey, at Churchill, Manitoba, to investigate the shallow structure of the Hudson Bay Basin sedimentary strata and Precambrian basement to a depth of 7 km.

Depths for overburden were selected as half of the maximum thickness mentioned on surficial geology maps. Thickness of the Hudson Platform sedimentary strata was obtained from an isopach maps prepared by Aitken (1993) and Johnston et al. (1992). A midpoint value for platform thickness was assigned because of the wedge-like nature of the sedimentary basin thickening from its margin towards the centre.

Seismic transects co-located with the MT transects, provided depths for the crustal layers. Depths of the upper, middle and lower crust were either measured off seismic profiles of north-central Manitoba and northern tip of Quebec (Hammer et al, 2010; Ludden and Hynes, 2000), or from point-specific teleseismic determinations by Thompson et al. (2010). Depths and resistivity for the middle and lower divisions of the upper mantle, transition zones, and lower mantle – Layers 7 to 12 – between 100 and 1000 km were based on the North America regional conductivities determined by Kelbert et al. (2009).

Geological Settings

Glaciomarine deposited clay, silt, sand and gravel occurs along the margins of Hudson Bay resting on glacial till sheets. Further inland, on the east side of Hudson Bay, into northern Quebec till becomes the predominant overburden material.

The northern margin of Ontario is underlain by gently dipping sedimentary strata of the Hudson Platform. Maximum onshore thickness is <500m and possibly exceeding either 1800m (MRD, 2011) or 2300m (Johnson et al., 1992) in the basin centre beneath the waters of Hudson Bay. Paleozoic strata are comprised mostly of limestone, dolomitic limestone and dolostone, with lesser amount of sandstone and shale and evaporites (Johnson et al., 1992).

Precambrian crystalline bedrock forms basement to the Hudson Platform sedimentary strata, and is surface exposed. The early Precambrian (Archean age) Superior geological province is predominately comprised of gneisses and granites with subordinate amount of metavolcanics ("greenstones") and metasediments typically emplaced as linear "belts". A number of major lithostructural belts (also referred to as subprovinces, terranes or domains) have been identified in the Superior province.

The later Precambrian (Proterozoic) Trans-Hudson Orogen (THO) is a global deformation zone marking ancient continental collision and accretion, similar to modern Himalayan Mountain range. The THO extends from South Dakota, through western and northern Manitoba (> 450 km wide), across Hudson Bay and into northern Quebec and Labrador, across Baffin Island and into Greenland (MRD, 2011). In Manitoba, 10 major lithostructural belts encompassing a collage of metamorphosed sediments and volcanics were welded by granitic intrusive rocks. As a result of juxtaposed terranes of varying rock type and degree of metamorphism, electrical resistivity of the upper crust varies accordingly on a scale of several 10's of km. Rocks of the THO are not surface exposed within the coverage area but are buried beneath the Hudson Platform.

The Circum-Superior Belt (CSB) consists of a number of exposed discontinuous segments of mafic-ultramafic volcanic rock along the western and northern margin of the Superior province (Ernst, 2004). The CSB continues into Manitoba where it has been referred to as the Superior Boundary Zone and hosts the nickel-producing mines in the Thompson area, and northwesterly into Quebec as the Cape Smith Belt hosting copper-nickel deposits. The bedrock consists of Early Proterozoic (1.8 billion year ago) volcanics, and continental and shallow-marine sedimentary rocks (Legault et al., 1994). Deformation during evolution of the THO has resulted in isoclinal folding of the rock giving the islands their characteristic topography,

Conductive Anomalies in Crust

The continental long North American Central Plains (NACP) conductive anomaly (< 10 ohm.m), over 2500 km long, likely extends across the area of coverage for the Zone 6 model but beneath the waters of Hudson Bay. It appears that the NACP continues northwestward across central Baffin Island (Evans et al., 2005).

Presentation of findings:

Models for Zone 6 are presented in Table 9 which summarizes individual layer depths, thickness, and resistivity/conductivity.

3. References

Associated Mining Consultants Ltd., 2004. Report on the application of electrical and electromagnetic techniques in the design and construction of northern pipelines, *Geological Survey of Canada,* Open File Report.

Adetunji, A. and Ferguson, I., 2010. Magnetotelluric investigation of Grenville province, Canada, IAGA WG 1.2 on Electromagnetic Induction in the Earth, 20th Workshop Abstract, Giza, Egypt, September 18-25, 2010, 4p.

Aiken, J.D., 1993. "Proterozoic sedimentary rocks," Subchapter 4A in Sedimentary Cover of the Craton in Canada, ed. Stott, D.F. and Aitken, J.D., *Geological Survey of Canada*, Geology of Canada, no.5, 81-95 (also *Geological Society of America*, The Geology of North America, v.D-1).

Armstrong, D.K. and Carter, T.R., 2006. An updated guide to the subsurface Paleozoic stratigraphy of southern Ontario, *Ontario Geological Survey*, Open File Report 6191, 214p.

Armstrong, D.K. and Carter, T.R., 2010. The subsurface Paleozoic stratigraphy of southern Ontario, *Ontario Geological Survey*, Special Volume 7, 301p.

Baragar, W.R.A., 2007. "Geology, Sleeper Islands, eastern Hudson Bay, Nunavut," Geological Survey of Canada, Map 2114A, scale 1:75000. <ftp://ftp2.cits.rncan.gc.ca/pub/geott/ess_pubs/224/224570/gscmap-a_2114_b_2007_mn01.pdf>

Barnett, P.J., Henry, A.P., and Babuin, D., 1991a. Quaternary geology of Ontario, west-central sheet, *Ontario Geological Survey*, map 2554, scale 1:1000000.

Barnett, P.J., Henry, A.P., and Babuin, D., 1991b. Quaternary geology of Ontario, east-central sheet, *Ontario Geological Survey*, map 2555, scale 1:1000000.

Barnett, P.J., Cowan, W.R., and Henry, A.P., 1991c. Quaternary geology of Ontario, southern sheet, *Ontario Geological Survey*, map 2556, scale 1:1000000.

Barnett, P.J., 1992. Quaternary geology of Ontario in Geology of Ontario, *Ontario Geological Survey*, Special Volume4, Part 2, p.1011-1088.

Becker, A., King, W F., Telford, W M., 1977. VLF mapping of geological structure, *Geological Survey of Canada*, Paper 76-25, 1977.

Bélanger, J.R., 1998, Urban Geology of Canada's National Capital Area, in *Urban Geology of Canadian Cities*, Karrow and White ed., GAC Special Paper 42, p. 365-384.

Bélanger, J. R., 2008. Urban geology of the National Capital area, *Geological Survey of Canada*, Open File 5311, doi:10.4095/226165 [on-line resource http://geogratis.cgdi.gc.ca/geogratis/en/collection/detail.do;jsessionid=4E983943E172991ADDEC84969A446728?id=377E8A66-E055-C223-7955-382A986E732A]

Bernius, G.R., 1996. Borehole geophysical logs from the GSC Borehole Geophysics Test Site at Bell's Corners, Nepean, Ontario, *Geological Survey of Canada*, Open File 3157, 1996, ; 38 pages, doi:10.4095/207617.

Boerner, D.E., Kurtz, R.D., and Craven, J.A., 2000. Asummary of electromagnetic studies on the Abitibi-Grenville transect, *Canadian Journal of Earth Science*, **37**, 427-437.

Carr, S.D., Easton, R.M., Jamieson, R.A., and Culshaw, N.G., 2000. Geologic transect across the Grenville Orogen of Ontario and New York. *Canadian Journal of Earth Sciences*, 37, 193-216.
Carter, T., Gunter, W., Lazorek, M., and Craig, R., 2007. Geological sequestration of carbon dioxide: a technology reviewand analysis ofopportunities in Ontario, Climate Change Research Report CCRR-07 [electronic resource], *Ontario Ministry of Natural Resources*, Applied Research and Development Branch, 24 p.
Colour version available at http://ccs101.ca/ccs_pro/opportunities_for_canada/ontario

Carter, T., 2012. Geology 101 for Geothermal Drilling in Ontario
On-line: ontariogeothermal.ca/sites/default/files/docs/OGA-Reg98-MNRCarter-Geology-for-Geothermal-Drilling.pdf

Craven, J.A., Boerner, R.D., Skulski, D.E., Spratt, J., Ferguson, I. J., Wu, X., and Bailey, R.C., 2001. Conductivity of western Superior Province upper mantle in northwestern Ontario, *Geological Survey of Canada*, Current Research 2001-E6, 6p.

Craven, J.A., Shareef, S., Hart, T.R., Marti, A., and Farquharson, C., 2006. Preliminary results of the audiomagnetotelluric study of the Nipigon Embayment: LakeNipigon Region Geoscience Initiative, *Ontario Geological Survey*, Miscellaneous Release – Data 192, 17 p.

Darbyshire, F.A., Eaton, D.W., Frederiksen, A.W. and Ertolahti, L., 2007. “New insights into the lithosphere beneath the Superior Province from Rayleigh wave dispersion and receiver function analysis,” *Geophysical Journal International*, v.169, no.3, 1043-1068. <http://dx.doi.org/10.1111/j.1365-246X.2006.03259.x>

Davidson, A., 1995. Tectonic history of the Grenville province, Ontario, Precambrian ’95 field Trio Guidebook A5, *Geological Survey of Canada*, Open File 3142, 157 p.

Dowling, F. L., 1970. “Magnetotelluric measurements across the Wisconsin Arch,” *Journal of Geophysical Research*, v. 75, no. 14, 2683-2698. http://dx.doi.org/10.1029/JB075i014p02683.

Duncan, P., Hwang, A., Edwards, R.N., Bailey, R.C., Garland, G.D., 1980. The development and applications of a wide band electroagnetic system using a pseudo-noise source, *Geophysics*, 45, 1276-1296.

Eaton, D.W., Dineva, S., and Mereu, R., 2006. Crustal thickness and Vp/Vs variations in the Grenville orogen (Ontario, Canada) from analysis of teleseismic receiver functions, *Tectonophysics* 420, 223–238

Easton, R.M. 1992. The Grenville Province and the Proterozoic history of central and southern Ontario in Geology of Ontario, *Ontario Geological Survey*, Special Volume 4, Part 2, 714-904.

Ernst, R.E., 2004. "Ca. 1880 Ma circum-Superior LIP," *Large Igneous Provinces Commission*, International Association of Volcanology and Chemistry of the Earth's Interior, electronic source <http://www.largeigneousprovinces.org/04may>

Evans, S., Jones, A.G., Spratt, J. and Katsube, J., 2005. "Central Baffin electromagnetic experiment (CBEX): mapping the North American Central Plains (NACP) conductivity anomaly in the Canadian arctic," *Physics of the Earth and Planetary Interiors*, v.150, 107–122. <http://dx.doi.org/10.1016/j.pepi.2004.08.032>

Eyles, N., 2002. Ontario Rocks: Three Billion Years of Environmental Change, Fitzhenry & Whiteside, 339 p.

Ferguson, I.J. and Odwar, H.D., 1998. Appendix 3: Review of conductivity soundings in Canada in Geomagnetically Induced Currents: Geomagnetic Hazard Assessment Phase II, Final Report, Vol. 3, *Geological Survey of Canada and Canadian Electricity Association*, 357 T 848A, p.A3-1-A3-121.

Ferguson, I. J., Craven, J. A., Kurtz, R. D., Boerner, D. E., Baily, R. C., Wu, X., Orellana, M. R., Spratt, J., Wennberg, G., and Norton, M., 2005. "Geoelectric response of Archean lithosphere in the Western Superior Province, Central Canada," *Physics of the Earth and Planetary Interiors*, 150, nos. 1-3, 123-143. http://dx.doi.org/10.1016/j.pepi.2004.08.025.

Fernberg, P.A., 2011. Earth Resistivity Structures and their Effects on Geomagnetic Induction in Pipelines, Ph.D thesis (unpublished), *Carleton University*, Dept. of Earth Sciences, 216 p.

Freeman, E.B., ed., 1979. Geological highway map, southern Ontario, *Ontario Geololgical Survey*, Map 2441.

Fulton, R.J., 1995. Surficial materials of Canada, *Geological Survey of Canada*, Map 1880A, scale 1:5000000.

Gomez-Trevino, E. and Edwards, R.N., 1983. Electromagnetic soundings in the sedimentary basins of southern Ontario – a case history, *Geophysics*, 48, 311-330.

Gowan, E. J., Ferguson, I. J., Jones, A. G., and Craven, J. A., 2009. "Geoelectric structure of the Northeastern Williston basin and underlying Precambrian lithosphere," *Canadian Journal of Earth Science*, 46, no. 6, 46, 441-464. http://dx.doi.org/10.1139/E09-028.

Greenhouse, J.P. and Karrow, P.F., 1994. Geological and geophysical studies of buried valleys and their fills near Elora and Rockwood, Ontario; *Canadian Journal of Earth Science*, 31, 1828-1848.

Hammer, P.T.C., Clowes, R.M., Cook, F.A., van der Velden, A.J., and Vasudevan K., 2010. The Lithoprobe trans-continental lithospheric cross sections: imaging the internal structure of the North American continent, *Canadian Journal of Earth Sciences*, 47, 821-857.
doi: 10.1139/E10-036.

Jackson, G. D., 1961. "Belcher Islands, District of Keewatin, Northwest Territories," *Geological Survey of Canada*, Preliminary Map 28-1960, 1961; 1 sheet, scale 1:125720.
ftp://ftp2.cits.rncan.gc.ca/pub/geott/ess_pubs/108/108721/gscprmap_28-1960_e_1961_mn01.pdf

Johnson, M.D., Armstrong, D.K., Sanford, B.V., Telford, P.G. and Ritka, M.A., 1992. "Paleozoic and Mesozoic Geology of Ontario," *Ontario Geological Survey*, Special Volume 4, Part 2, 07-1010.
http://www.geologyontario.mndmf.gov.on.ca/mndmfiles/pub/data/imaging/sv04-02/sv04-02.pdf

Jones, A.G., Ledo, J. and Ferguson, I.J., 2005. "Electromagnetic images of the Trans-Hudson orogen: the North American Central Plains anomaly revealed," *Canadian Journal of Earth Sciences*, v.42, 457-478. http://dx.doi.org/ 10.1139/E05-018

Legault, F., Francis, D., Hynes, A. and Budkewitsch, P., 1994. "Proterozoic continental volcanism in the Belcher Islands: implications for the evolution of the Circum Ungava Fold Belt," *Canadian Journal of Earth Sciences*, v.31, 1536-1549.
<http://dx.doi.org/ 10.1139/e94-136>

Kelbert, A., Schultz, A., and Egbert, G., 2009. "Global electromagnetic induction constraints on transition-zone water content variations," *Nature*, v. 460, no. 20, August 2009, 1003-1006. http://dx.doi.org/10.1038/nature08257.

Kellett, R.L., Mareschal, M., and Kurtz, R.D., 1992. A model of lower crustal electrical anisotropy for the Pontiac Subprovince of the Canadian Shield [abstract], *Geophysics Journal International*, 111, 141-150.

Kellett, R. L., Barnes, A.E., and Rive, M., 1994. The deep structure of the Grenville Front: a new prespective from western Quebec, *Canadian Journal of Earth Science*, 31, 282-292.

Kurtz, R.D., Craven, J.A., Niblett, E.R., and Stevens, R.A., 1993. The conductivity of the crust and mantle beneath the Kapuskasing Uplift: electrical anisotropy in the upper mantle, *Geophysics Journal International*, 113, 483-498.

Ludden, J. and Hynes, A., 2000. The Lithoprobe Abitibi-Grenville transect: tow billion years of crust formation and recycling in the Prcambrian Shield of Canada, *Canadian Journal of Earth Science*, 37, 459-476.

Mackay, D.K. 1970. Electrical resistivity measurements in frozen ground, Mackenzie Delta area, Northwest Territories, in Hydrology of Deltas, Proceeding of the Bucharest Symposium, Vol.2, 363-375.

Matile, G.L.D. and Keller, G.R., 2007. "Surficial geology of Manitoba," *Manitoba Science, Technology, Energy and Mines*, Manitoba Geological Survey, Surficial Geology compilation Map Series, SG-MB, scale 1:1000000.
<http://www.manitoba.ca/iem/mrd/geo/gis/sgcms/pdfs/sg-mb_front.zip>.
Mareschal, M., Kurtz, R.D., Choteau, M., and Chakridi, R., 1991. A magnetotelluric survey on Manitoulin Island and Bruce peninsula along GLIMPCE survey line J: black shales mask the Grenville Front, *Geophysics Journal International*,105, 173-183.

Mareschal, M., Kurtz, R.D., and Bailey, R.C., 1994. A review of electromagnetic investigations in the Kapuskasing uplift and surounding regions: electrical properties of key rocks, *Canadian Journal of Earth Science*, 31, 1042-1051.

McNeill, J.D. 1990. Use of electromagnetic methods for groundwater studies in Geotechnical and Environmental Geophysics, Vol. 1: Review and Tutorial, (ed.) S.H. Ward, Society of Exploration Geophysicists, 3191-218.

Minifie, M.J., Kerr, A.C., Ernst, R.E., Hastie, A.R., Ciborowski, T. Jake R., Desharnais, G. and Millar, I.L., 2010. "The northern and southern sections of the western ca. 1880 Ma Circum-Superior Large Igneous Province, North America: The Pickle Crow dyke connection?," *Lithos*, in press online March 2012 <http://dx.doi.org/10.1016/j.lithos.2012.03.017>

MNDM Ministry of Northern Development and Mines, 1994. ROCK ONtario, *Ontario Ministry of Northern Development and Mines*, ROCK ON Series 1, 89 p.

MNDM, 2012a. Bedrock topography and overburden thickess, southern Ontario, *Ontario Ministry of Northern Development and Mines*, Ontario, [electronic on-line resource http://www.mndm.gov.on.ca/en/mines-and-minerals/applications/ogsearth/bedrock-topography-and-overburden-thickness] [accessed 11 Dec 2012]

MNDM, 2012b. Quaternary Geology postcard, *Ontario Ministry of Northern Development and Mines*
http://www.mndm.gov.on.ca/sites/mndmweb/files/simplified_geology_and_selected_mineral_deposits.pdf [accessed 11 Dec 2012]

Musacchio, G., White, D.J., Asudeh, I., and Thomson, C.J., 2004. Lithospheric structure and composition of the Archean western Superior Province from seismic refraction/wide angle reflection and gravity modeling, *Journal of Geophysical Research*, 109, B03304, 28 p. http://dx.doi.org/10.1029/2003JB002427

NRcan, 2012a. "Geological Provinces Map," on-line Atlas of Canada, *Natural Resources of Canada* http://atlas.nrcan.gc.ca/site/english/maps/environment/geology/geologicalprovinces

NRcan, 2012b. “Major Rock Categories Map,” on-line Atlas of Canada, Natural Resources of Canada, http://atlas.nrcan.gc.ca/site/english/maps/environment/geology/majorrockcategories

OGS, 1991. “Bedrock geology of Ontario, northern sheet,” Ontario Geological Survey, Map 2541, scale 1:1000000.
<http://www.geologyontario.mndmf.gov.on.ca/mndmfiles/pub/data/imaging/M2541/M2541.pdf>

OGS, 2012. Bedrock Geology and Overburden Thickness Map, *Ontario Geological Survey* [electronic on-line resource http://www.mndm.gov.on.ca/en/mines-and-minerals/applications/ogsearth/bedrock-topography-and-overburden-thickness]

Ouassaa, K., Forsyth, D., and White, D., 2010. Data processing and preliminary interpretation of the 2000 Southern Ontario Seismic (SOS) project, Open File, *Geological Survey of Canada*, Open File 5056, 64 p.
http://dx.doi.org/10.4095/261744

Pala, S., Barnett, P.J., and Babuin, D., 1991. Quaternary geology of Ontario, west-central sheet, *Ontario Geological Survey*, map 2553, scale 1:1000000.

Palacky, G.J., 1988. Resistivity characteristics of geologic targets in *Electromagnetic Methods in Applied Geophysics-Theory*, Vol.1, M.N. Nabighian (ed.); Society of Exploration Geophysicists, 53-130.

Palacky, G.J., 1992. Helicopter geophysical surveys at the Val Gagne test site, District of Cochrane, Ontario, *Geological Survey of Canada*, Open File Report 2503, 14 p.

Percival, J.A., 2007. “Geology and metallogeny of the Superior Province,” in Goodfellow, W.D., *ed*., Mineral Deposits of Canada: A Synthesis of Major Deposit-Types, District Metallogeny, the Evolution of Geological Provinces, and Exploration Methods, *Geological Association of Canada*, Mineral Division, special Publications No. 5, 903-928.

Percival, J.A. and West, G.F., 1994. the Kapuskasing uplift: a geological and geophysical synthesis, *Canadian Journal of Earth Science*, 31, 1256-1286.

Percival, J.A. and Easton, R.M., 2007. Geology of the Canadian Shield in Ontario: An Update; *Geological Survey of Canada*, Open File 5511, *Ontario Geological Survey*, Open File Report 6196, Ontario Power Generation, Report 06819-REP-01200-10158-R00. 67 p.

Roberts, B. and Craven, J., 2012. Results of a Magnetotelluric Survey in Churchill, Manitoba: GEM Energy, Hudson Bay; *Geological Survey of Canada*, Open File 7151, 21 p.
<http://dx.doi.org/10.4095/291442>

Sanford, B. V. and Arnott, R. W. C., 2009. Stratigraphic and structural framework of the Potsdam Group in Eastern Ontario, Western Quebec, and Northern New York State, *Geological Survey of Canada*, Bulletin no. 597, 2009. http://dx.doi.org/10.4095/247669

Schutt, L.W. and Wilson, E.A., 1987. The soils of the Regional Municipality of Ottawa-Carleton (excluding the Ottawa urban fringe), Volume 1, *Report No.58 of theOntario Institute of Pedology*, 118 p.

Scott, W.J., Sellmann, P.V. and Hunter, J.A. 1990. Geophysics in the study of permafrost in Geotechnical and Environmental Geophysics, Vol. 1: Review and Tutorial, (ed.) S.H. Ward, Society of Exploration Geophysicists, 355-384.

Senechal, G., Mareschal, M., Hubert, C., Calvert, A.J., Grandjean, G., and Ludden, J., 1996a. Integrated geophysical interpretation of crustal structures in the northern Abitibi belt: constraits from seismic amplitude analysis, *Canadian Journal of Earth Science*, 33, 1343-1362.

Sharpe, D.R., Dyke, L.D., Good, R.L., Gorrell, G., Hinton, M.J., Hunter, J.A., and Russell, H.A.J., 2003. GSC high-quality borehole, "Golden Spike" data Oak Ridges Moraine, southern Ontario; *Geological Survey of Canada*, Open File Report 1670, 21p.

Sharpe, D.R., Russell, H.A.J., and Logan, C., 2005a. Structural model of the greater Toronto and Oak Ridges Moraine area, southern Ontario: Newmarket Till; *Geological Survey of Canada*, Open File 5066, scale 1:250,000.

Sharpe, D.R., Russell, H.A.J., and Logan, C., 2005b. Structural model of the greater Toronto and Oak Ridges Moraine area, southern Ontario: Lower Sediment; *Geological Survey of Canada*, Open File 5067, scale 1:250,000.

Sinha, A.J., 1990. Stratigraphic mapping of sedimentary formation in southern Ontario by ground electromagnetic methods, *Geophysics*, 55, 1148-1157.

Telmat, H., Mareschal, J-C., Gariepy, C., David, J. And Antonuk, C.N., 2000. "Crustal models of the eastern Superior Province, Quebec, derived from new gravity data," *Canadian Journal of Earth Sciences*, v.37, 385-397. <http://www.nrcresearchpress.com/doi/pdf/10.1139/e99-080>

Thompson, D.A., Bastow, I.D., Helffrich, G., Kendall, J-M., Wookey, J., Snyder, D.B. and Eaton, D.W., 2010. "Precambrian crustal evolution: seismic constraints from the Canadian Shield," *Earth and Planetary Science Letters*, v.297, no.3-4, 655-666, [abstract]. <http://dx.doi.org/10.1016/j.epsl.2010.07.021>

Thurston, P.C., 1991. Geology of Ontario: Introduction in Geology of Ontario, *Ontario Geological Survey*, Special Volume 4, Part 1, 3-26.

Westjohn, D. B. and Weaver, T. L., 1998. Hydrogeologic framework of the Michigan Basin regional aquifer system, *United States Geological Survey*, Professional Paper 1418, 45 p. http://pubs.er.usgs.gov/publication/pp1418.

White, D.J., Forsyth, D.A., Asudeh, I., Carr, S.D., Wu, H., Easton, R.M., and Mereu, R.F., 2000. A seismic-based cross-section of the Grenville Orogen in southern Ontario and western Quebec, *Canadian Journal of Earth Science*, 37, 183-192.

White, D.J., Jones, A.G., Lucas, S.B. and Hajnal, Z., 1999. "Tectonic evolution of the Superior Boundary Zone from coincident seismic reflection and magnetotelluric profiles," Tectonics, v. 18, no.3, 430-451. <http://onlinelibrary.wiley.com/doi/10.1029/1999TC900002/abstract>

White, D.J., Thomas, M.D., Jones, A.G., Hope, J. Nemeth, B. and Hajnal, Z., 2005. Geophysical transect across a Paleoproterozoic continent-continent collision zoneL The Trans-Hudson Orogen, *Canadian Journal of Earth Sciences*, v. 42, 385-402. < http://dx.doi.org/ 10.1139/E05-002>

Winardhi, S. and Mereu, R.F., 1997. Crustal velocity structure of the Superior and Grenville provinces of the southeastern Canadian Shield, *Canadian Journal of Earth Science*, 34, 1167-1184.

Zhang, P. and Choteau, M., 1992. "The use of magnetotellurics for mineral exploration: an experiment in the Chibougamau region of Quebec," *Canadian Journal of Earth Sciences*, v.29, 621-635. <http://dx.doi.org/ 10.1139/e92-054>

Table 2
1D Earth Resistivity Model (Zone 1) for Western St. Lawrence Platform / Lowland

Layer	Depth Confidence	Thickness	Resistivity (ohm·m) Confidence	Conductivity (S/m) Confidence	Comments
1. Overburden	100 m [aa] [II]	100 m	100 [bb, cc] [II]	0.01 [m]	Depth ranges 10-200m, midpoint depth assigned which is a typical thickness in many areas. Measured resistivity of till in southern Ontario ranges 90-185, 900-1000 ohm.m. Assigned midpoint of lower range. Sand/gravel deposits may be < 1000 ohm.m, and clay glaciolucustrine deposits ~ 25 ohm.m.
2. Sedimentary Basin	0 – 1 km [dd] [II]	1 km	130 [ee] [II]	0.0077 [m]	Basin thickens overall southwestward from 100 – 1400m [dd]. From well logs [dd]; 100m at Kingston, 150m Cannington, 420m Wiarton, 212 Pickering, 480m Toronto, 855 Woodstock, 1000m London, 1135 Chatham, ~885-1080m Windsor area (flexure due Findlay Arch). Below Niagara Escarpment ~990-1250m [ff]. Assigned common 1000m depth. Succession of Paleozoic limestone (32%), dolostone (20%), shale (48%) and lesser sandstone and evaporites. Resistivity ranges from [sinha1990]: dolostone, 150-750 ohm.m shale, 2-6 ohm.m shale and limestone, 11-23 ohm.m shale with limestone and dolomite, 30 ohm.m limestone with minor shale & silt, 20-150 ohm.m. Assigned a weighted average resistivity.

Table 2 (Continued)
1D Earth Resistivity Model (Zone 1) for Western St. Lawrence Platform / Lowland

Layer	Depth / Confidence	Thickness	Resistivity (ohm·m) / Confidence	Conductivity (S/m) / Confidence	Comments
3. Upper Crust	1 – 11 km [n] [II]	10 km	5000 [n] [II]	0.0002 [m]	Metamorphic rocks (gneisses, quartzite, marble) and intrusives (granite, syenite, gabbro) of the Grenville geological province. Depth based on visual change of resistivity on Polaris array transect [n] partially crossing east margin of Zone1. Resistivity ranges 125-10000 ohm.m. Midpoint value chosen.
4. Middle Crust	11 – 25 km [r] [III]	14 km	125 [n] [II]	0.008 [m]	Used generalized depth for middle crust [r]. Chose visually dominant resistivity on Polaris Array transect, TM mode. Ranges <10-500 ohm.m.
5. Lower Crust	25 – 41 km [q] [II]	16 km	300 [n] [II]	0.0033 [m]	Bottom depth varies 38-43 km [q], chose midpoint. Variable resistivity depending on mode, Polaris Array TM mode shows 125-500 ohm.m, joint TM and TE mode mainly 500 ohm.m. Assigned midpoint value of 300 ohm.m. Resistor 10000-50000 ohm.m, extends from lower to uppermost mantle Layer 6, likely due to effect of electrical anisotropy.
6. Upper Mantle	41–100 km [g] [III]	59 km	300 [n] [II]	0.0033 [m]	Used generalized bottom depth [[g]. Variable resistivity depending on mode. 10-225 ohm.m, overall 125 ohm.m for TM mode, 125-500 ohm.m and overall 500 ohm.m for joint TM and TE mode on Polaris Array transect. Assigned average of the two overall resistivity values.

Table 2 (Continued)
1D Earth Resistivity Model (Zone 1) for Western St. Lawrence Platform / Lowland

Layer	Depth / Confidence	Thickness	Resistivity (ohm·m) / Confidence	Conductivity (S/m) / Confidence	Comments
7. Upper Mantle	100–250 km [g]	100 km	158 [k]	0.0063 [g]	Utilize Canada regional model [g] for all depths and resistivites below 100 km.
	[III]			[III]	Canada model based on data from Ottawa Magnetic Observatory located in Zone 2. Grenville geological province underlies Zones 1 and 2.
8. Upper Mantle	250–410 km [g]	160 km	29 [k]	0.0346 [g]	---
	[III]			[III]	
9. Transition Zone	410–520 km g]	110 km	8 [k]	0.1258 [g]	---
	[III]			[III]	
10. Transition Zone	520–670 km [g]	150 km	2.4 [k]	0.4168 [g]	---
	[III]			[III]	
11. Lower Mantle	670–900 km [g]	230 km	0.89 [k]	1.1220 [g]	---
	[III]			[III]	
12. Lower Mantle	900–1000 km [g]	100 km	0.47 [k]	2.0892 [g]	---
	[III]			[III]	

Table 2 (Continued)
1D Earth Resistivity Model (Zone 1) for Western St. Lawrence Platform / Lowland

[aa] Singer et al. (2003)
[bb] Greenhouse and Karrow (1994)
[cc] Sharp et al. (2003, 2005a, 2005b)
[dd] Armstron and Carter (2010), various structural cross-sections
[ee] Sinha (1990), Figs. 6 – 10.
[ff] Ouassaa et al. (2010)
[k] Converted from conductivity obtained from listed reference source
[m] Converted from resistivity obtained from listed reference source
[n] Adetunji and Ferguson (2010), Figs. 5 and 6
[p] Palacky (1988)
[q] Eaton et al. (2006), Fig. 12
[r] Ferguson and Odwar (1998), Ontario and Quebec 1D model – Table A3.2.1

NOTES:
Depth Confidence
I = best representation
* overburden: geological report/map coverage of local area.
* crust: seismic/gravity transects crossing local area, within 10 km.

II = likely representative
* crust/upper mantle: geological and/or seismic transect of a regional nature.

III = possibly representative (measurements from general compilations).

Resistivity/Conductivity Confidence
I = best representation (measurements from site or nearby).
* overburden: resistivity measurement by surface geophysical method and/or borehole in local area.
* crust: resistivity measurement from resistivity survey, MT survey and/or borehole in local area.

II = likely representative (resistivity values extrapolated from measurements taken at some distance from the site, typically greater than 100 km).
* overburden: resistivity value obtained by geophysical measurement, including borehole logs.
* sedimentary basin: value obtained by geophysical survey using variety of geophysical electromagnetic methods, including MT.
* crust: value obtained by regional MT survey.

III = possibly representative (measurements from general compilations).

Table 3
1D Earth Resistivity Model (Zone 2) for Central St. Lawrence Platform / Lowland

Layer	Depth Confidence	Thickness	Resistivity (ohm·m) Confidence	Conductivity (S/m) Confidence	Comments
1. Overburden	< 50 m [a, b, c] [II]	25 m	50 [p, d, e] [II]	0.02 [m]	Glacial deposits (silt, sand, till), overlain by glaciomarine (Leda Clay) sediments mostly in northern and western 2/3 of platform. Variable depths, 2-50 m, typically <25 m, assigned midpoint depth. Leda Clay is conductive ranging 1-4 [p] or 1–20 ohm·m [d], 20-80 ohm.m [e]. Sand and till typically 100 ohm.m. Assigned midpoint value. Consider < 20 ohm.m where Leda Clay is extensive and thick.
2. Sedimentary Basin	< 65 – 875 m [a, f] [II]	0.9 km	250 [e, h, j] [II]	0.004 [m]	Maximum thickness ~ 0.9 km at basin centre Depth from stratigraphic cross-sections. Variable resistivity based on lithology. Ottawa area sandstone and dolo/limestone ranges 250-400 ohm.m [h] or 2000-5000 [j], Ottawa Valley MT profile indicates < 150 ohm.m [e]. Dominant lithology influences overall resistivity, 250 ohm.m chosen to reflect predominance of more resistive sandstone, dolostone / limestone.

Table 3 (continued)
1D Earth Resistivity Model (Zone 2) for Central St. Lawrence Platform / Lowland

Layer	Depth / Confidence	Thickness	Resistivity (ohm·m) / Confidence	Conductivity (S/m) / Confidence	Comments
3. Upper Crust	0 – 10 km [n] [II]	9.1 km	5000 [n] [II]	0.0002 [m]	Metamorphic rocks (gneisses, quartzite, marble) and intrusives (granite, syenite, gabbro) of the Grenville geological province Depth based on visual change of resistivity on Polaris Array transect [n] located 150 km west. Variable resistivity ranges determined by MT; 125-10000 [n], 1100-6000 ohm.m [e]. Assigned 5000 ohm.m to reflect a more conductive upper crust compared to more resistive Grenville province upper crust situated north of Zone 2.
4. Middle Crust	10 – 25 km [d] [III]	15 km	100 [e, n] [I, II]	0.01 [m]	No bottom depth distinction on [n]. Used generalized depth for middle crust [d]. Chose visually dominant resistivity on Polaris Array transect, TM mode. Ranges <10-125 on Polaris Array and 150-400 on Ottawa Valley MT transect.
5. Lower Crust	25 – 40 km [q] [I]	15 km	125 [n] [I, II]	0.005 [m]	Bottom depth varies 38-42 km [q], chose midpoint 40 km. Variable resistivity depending on transect and mode. Ottawa Valley TM mode has 250 ohm.m, Polaris array TM mode shows 125 ohm.m, and joint TE-TM mode range is <10-500 ohm.m. Assigned TM mode value of 125 ohm.m
6. Upper Mantle	40–100 km [r, g] [III]	60 km	200 [n] [II]	0.004 [m]	Used generalized bottom depth [r, g]. Variable resistivity depending on mode. 125-225 ohm.m for TM mode, 125-500 ohm.m for joint TM and TE mode on Polaris Array transect. Used midpoint of the two mode's range.

Table 3 (continued)
1D Earth Resistivity Model (Zone 2) for Central St. Lawrence Platform / Lowland

Layer	Depth Confidence	Thickness	Resistivity (ohm·m) Confidence	Conductivity (S/m) Confidence	Comments
7. Upper Mantle	100–250 km [g] [III]	100 km	158 [k]	0.0063 [g] [III]	Utilize Canada regional model [g] for all depths and resistivities below 100 km. Canada model based on data from Ottawa Magnetic Observatory located in Zone 2
8. Upper Mantle	250–410 km [g] [III]	160 km	29 [k]	0.0346 [g] [III]	---
9. Transition Zone	410–520 km g] [III]	110 km	8 [k]	0.1258 [g] [III]	---
10. Transition Zone	520–670 km [g] [III]	150 km	2.4 [k]	0.4168 [g] [III]	---
11. Lower Mantle	670–900 km [g] [III]	230 km	0.89 [k]	1.1220 [g] [III]	---
12. Lower Mantle	900–1000 km [g] [III]	100 km	0.47 [k]	2.0892 [g] [III]	---

Table 3 (continued)
1D Earth Resistivity Model (Zone 2) for Central St. Lawrence Platform / Lowland

[a] Belanger (2008), stratigraphic cross-sections AB, CD
[b] Schut and Wilson (1987), cross-sections Figs. 9-11
[c] MNDM (2012a)
[e] Fernberg (2011), Fig. 5.13
[f] Sandford and Arnott, 2010, Fig. 4
[g] Kelbert et al. (2009), Figure 2, global and regional conductivity profile, Canada regional conductivity chosen
[h] Bernius (1998)
[j] Telford (1978)
[k] Converted from conductivity obtained from listed reference source
[m] Converted from resistivity obtained from listed reference source
[n] Adetunji and Ferguson (2010), Figs. 5 and 6
[p] Palacky (1988)
[q] Eaton et al. (2006), Fig. 12
[r] Ferguson and Odwar (1998), Ontario and Quebec 1D model – Table A3.2.1

See Table 2 for confidence notes.

Table 4
1D Earth Resistivity Model (Zone 3) for Grenville Geological Province

Layer	Depth Confidence	Thickness	Resistivity (ohm·m) Confidence	Conductivity (S/m) Confidence	Comments
1. Overburden	< 3 m [a] [II]	3 m	100 [p] [II]	0.01 [m]	Thin, discontinuous unconsolidated overburden of glacial origin (till), thicker deposits of sand and gravel along rivers courses. Till and sand ranges 20-100+ ohm.m. Assigned high-end value
2. Sedimentary Basin	absent	---	---	---	---
3. Upper Crust	0 – 15 km [w] [II]	15 km	6000 [n] [II]	0.000166 [m]	Metamorphic rocks (gneisses, quartzite, marble) and intrusives (granite, syenite, gabbro) of the Grenville geological province Depth based on seismic crustal cross-section. Variable resistivity range determined by MT transect crossing through middle of Grenville province; 125-10000 [n] excluding higher resistive area below GFTZ; 1100-6000 ohm.m [e]. Assigned 6000 ohm.m based on midpoint between 1100-10000 ohm.m.
4. Middle Crust	15 – 27 km [w] [II]	17 km	275 [n] [II]	0.0036 [m]	Depth based on seismic crustal cross-section. Chose midpoint of 50-500 ohm.m range depicted on Polaris array transect TM mode.

Table 4 (continued)
1D Earth Resistivity Model (Zone 3) for Grenville Geological Province

Layer	Depth / Confidence	Thickness	Resistivity (ohm·m) / Confidence	Conductivity (S/m) / Confidence	Comments
5. Lower Crust	27 – 40 km [q] [II]	13 km	500 [n] [II]	0.002 [m]	Bottom depth varies 36-44 km, chose midpoint 40 km. Variable resistivity depending on transect and mode. Ottawa Valley MT shows 500 ohm.m, Polaris array TM mode shows 450 ohm.m. A resistive body 10000-50000 ohm.m extends from upper to lower crust.
6. Upper Mantle	40–100 km [r, g] [III]	60 km	300 [n, nn] [II]	0.0033 [m]	Used generalized bottom depth [r, g]. Variable resistivity depending on mode: 125-500 ohm.m for TM mode, 500 ohm.m for joint TE and TM mode on Polaris Array transect [n] with subvertical 25000 ohm.m resistor. Another interpretation [nn] of joint modes is 250>25000 ohm.m [nn]. Assigned midpoint value of the 125-500 ohm.m range depicted on TM mode.
7. Upper Mantle	100–250 km [g] [III]	100 km	158 [k]	0.0063 [g] [III]	Utilize Canada regional model [g] for all depths and resistivities below 100 km. Canada model based on data from Ottawa Magnetic Observatory located in Zone 2
8. Upper Mantle	250–410 km [g] [III]	160 km	29 [k]	0.0346 [g] [III]	---
9. Transition Zone	410–520 km [*] [III]	110 km	8 [k]	0.1258 [g] [III]	---

Table 4 (continued)
1D Earth Resistivity Model (Zone 3) for Grenville Geological Province

Layer	Depth / Confidence	Thickness	Resistivity (ohm·m) / Confidence	Conductivity (S/m) / Confidence	Comments
10. Transition Zone	520–670 km [g]	150 km	2.4 [k]	0.4168 [g]	---
	[III]			[III]	
11. Lower Mantle	670–900 km [g]	230 km	0.89 [k]	1.1220 [g]	---
	[III]			[III]	
12. Lower Mantle	900–1000 km [g]	100 km	0.47 [k]	2.0892 [g]	---
	[III]			[III]	

[a] Barnett et al. (1991c)
[e] Fernberg (2011), Fig. 5.13
[g] Kelbert et al. (2009), Figure 2, global and regional conductivity profile, Canada regional conductivity chosen
[k] Converted from conductivity obtained from listed reference source
[m] Converted from resistivity obtained from listed reference source
[n] Adetunji and Ferguson (2010), Figs. 5 and 6
[nn] Adetunji et al. (2011)
[p] Palacky (1988)
[q] Eaton et al. (2006), Fig. 12
[r] Ferguson and Odwar (1998), Ontario and Quebec 1D model – Table A3.2.1
[w] White et al. (2000), Figs. 2, 3 and 4

See Table 2 for confidence notes.

Table 5
1D Earth Resistivity Model (Zone 3a) for Grenville Front Tectonic Zone

Layer	Depth Confidence	Thickness	Resistivity (ohm·m) Confidence	Conductivity (S/m) Confidence	Comments
1. Overburden	< 3 m [a] [II]	3 m	100 [p] [II]	0.01 [m]	Thin, discontinuous unconsolidated overburden of glacial origin (till), thicker deposits of sand and gravel along rivers courses. Till and sand typically up to 100 ohm.m. Assigned midpoint value.
2. Sedimentary Basin	absent	---	---	---	---
3. Upper Crust	0 – 17 km [w] [II]	17 km	50000 [n] [I]	0.00002 [m]	Metamorphic rocks (gneisses, quartzite, marble) and intrusives (granite, syenite, gabbro) of the Grenville geological province GFTZ appears as highly resistive zone, extending southward from boundary with Superior / Southern province. Higher confidence assigned to resistivity because of linear nature of GFTZ.
4. Middle Crust	17 – 27 km [w] [II]	10 km	5000 [n] [I]	0.0002 [m]	Depth based on seismic crustal cross-section. Resistive keel-like feature extending into middle crust. Chose midpoint of 500-10000 ohm.m range depicted on Polaris array transect.
5. Lower Crust	27 – 36 km at NE end 27 - > 44 km at SW end [q] [II]	9 km at NE end 17 km at SW end	300 [n] [I]	0.0033 [m]	Variable depths of Moho, 35-36 at NE end, 44-49 at SW end. Chose depth ranges from [q] due its interpretation using latest teleseismic data. Both Moho depths shown on accompanying figure. Resistivity ranges 125-500 ohm.m on TM mode, but visually averages 300 ohm.m.

Table 5 (continued)
1D Earth Resistivity Model (Zone 3a) for Grenville Front Tectonic Zone

Layer	Depth Confidence	Thickness	Resistivity (ohm·m) Confidence	Conductivity (S/m) Confidence	Comments
6a. Upper Mantle	36 – 80 km at NE end 44 – 80 at SW end [q, n] [I]	44 km at NE end 36 km at SW end	500 [n] [I]	0.002 [m]	80 km lower depth subdivision based on noticeable resistivity difference below GFTZ, changing from an overall 500 ohm.m to 80 ohm.m below 80 km. Layer 6 divided into sub-layers 6a and 6b. Layer 6a, 37 km (average) – 80 km, 200-500 ohm.m range, assigned dominant 500 ohm.m.
6b. Upper Mantle	80 – 100 km at NE end 80 – 100 at SW end [w] [II, III]	20 km	80 [n] [I]	0.0125 [m]	80 km upper depth assigned as described above. 100 km lower depth global [g]. Layer 6b resistivity range 10-150 ohm.m, selected midpoint 80 ohm.m.
7. Upper Mantle	100–250 km [g] [III]	100 km	158 [k]	0.0063 [g] [III]	Utilize Canada regional model [g] for all depths and resistivities below 100 km. Canada model based on data from Ottawa Magnetic Observatory located in Zone 2
8. Upper Mantle	250–410 km [g] [III]	160 km	29 [k]	0.0346 [g] [III]	---
9. Transition Zone	410–520 km [*] [III]	110 km	8 [k]	0.1258 [g] [III]	---

Table 5 (continued)
1D Earth Resistivity Model (Zone 3a) for Grenville Front Tectonic Zone

Layer	Depth / Confidence	Thickness	Resistivity (ohm·m) / Confidence	Conductivity (S/m) / Confidence	Comments
10. Transition Zone	520–670 km [g]	150 km	2.4 [k]	0.4168 [g]	---
	[III]			[III]	
11. Lower Mantle	670–900 km [g]	230 km	0.89 [k]	1.1220 [g]	---
	[III]			[III]	
12. Lower Mantle	900–1000 km [g]	100 km	0.47 [k]	2.0892 [g]	---
	[III]			[III]	

[a] Barnett et al. (1991c)
[g] Kelbert et al. (2009), Figure 2, global and regional conductivity profile, Canada regional conductivity chosen
[k] Converted from conductivity obtained from listed reference source
[m] Converted from resistivity obtained from listed reference source
[n] Adetunji and Ferguson (2010), Figs. 5 and 6
[nn] Adetunji et al. (2011)
[p] Palacky (1988)
[q] Eaton et al. (2006), Fig. 12
[w] White et al. (2000), Figs. 2, 3 and 4

See Table 2 for confidence notes.

Table 6
1D Earth Resistivity Model (Zone 4) for Superior Geological Province – eastern region

Layer	Depth / Confidence	Thickness	Resistivity (ohm·m) / Confidence	Conductivity (S/m) / Confidence	Comments
1. Overburden	< 1 m southern 2/3 0-50 m northern 1/3 [a, pp] [II]	1 m southern 2/3 50 m northern 2/3	100 [p] 30 [pp] [II]	0.01 [m] 0.0333 [m]	Southern 2/3 of Zone 4: veneer of glacial till, thicker patchy deposits of sand and gravel outwash patches and eskers. Resistivity range 20-100 for tills, assigned high-end of range. Northern 1/3 of Zone 4: 50-60m thick clay on top 2-4 m till on eastern side of Zone 4, 25 m till and clay (?) on western side. Average resistivity 30 ohm.m determined by helicopter EM.
2. Sedimentary Basin	absent	---	---	---	---
3. Upper Crust	0 – 15 km [w, n] [II]	15 km	25000 [n] [II]	0.00094 [m]	Metamorphic rocks. Abitibi subprovince of the Superior geological province, half comprised of granitoids, rest mostly metavolcanics and lesser metasediments. Huronian Supergroup of the Southern province (in-between Superior and Grenville provinces) consists of clastic metasediments. Depth based on seismic crustal cross-section and noticeable resistivity change. Resistivity based on transect through Superior province rocks immediately adjacent in Quebec, ranging 5000-50000 ohm.m. Assigned midpoint 25000 ohm.m.

Table 6 (continued)
1D Earth Resistivity Model (Zone 4) for Superior Geological Province – eastern region

Layer	Depth / Confidence	Thickness	Resistivity (ohm·m) / Confidence	Conductivity (S/m) / Confidence	Comments
4. Middle Crust	15-27 [w] [II]	12 km	125 [n, t]] [II]	0.008 [m]	Depth based on seismic crustal cross-section. Possibly 25 km depth [t]. Resistivity range 125-250 ohm.m with 10000-50000 (30000 midpoint) ohm.m resistive keels to 25 km deep [n]. Averaged 200 ohm.m on [t]. Chose 125 ohm.m as overall background resistivity.
5. Lower Crust	27 – 37 km [w, u, v, x, q]] [II]	10 km	500 [n] [II]	0.002 [m]	Lower depth varies 34-40km from various sources, assigned average depth of 37 km. Resistivity ranges 125-500, dominant resistivity 500 ohm.m assigned.
6. Upper Mantle	40–100 km [r, g] [III]	60 km	250 [n] [II]	0.004 [m]	Used generalized lower depth [r, g]. Resistivity range 125-500 ohm.m on [n], selected 250 ohm.m indicative of tendency to lower end of resistivity range. Commonly 300 ohm.m with dipping 3000 ohm.m resistors on [nn].
7. Upper Mantle	100–250 km [g] [III]	100 km	158 [k]	0.0063 [g] [III]	Utilize Canada regional model [g] for all depths and resistivities below 100 km. Canada model based on data from Ottawa Magnetic Observatory located in Zone 2.
8. Upper Mantle	250–410 km [g] [III]	160 km	29 [k]	0.0346 [g] [III]	---

Table 6 (continued)
1D Earth Resistivity Model (Zone 4) for Superior Geological Province – eastern region

Layer	Depth Confidence	Thickness	Resistivity (ohm·m) Confidence	Conductivity (S/m) Confidence	Comments
9. Transition Zone	410–520 km [*] [III]	110 km	8 [k]	0.1258 [g] [III]	---
10. Transition Zone	520–670 km [g] [III]	150 km	2.4 [k]	0.4168 [g] [III]	---
11. Lower Mantle	670–900 km [g] [III]	230 km	0.89 [k]	1.1220 [g] [III]	---
12. Lower Mantle	900–1000 km [g] [III]	100 km	0.47 [k]	2.0892 [g] [III]	---

[a] Barnett et al. (1991b)
[g] Kelbert et al. (2009), Figure 2, global and regional conductivity profile, Canada regional conductivity chosen
[k] Converted from conductivity obtained from listed reference source
[m] Converted from resistivity obtained from listed reference source
[n] Adetunji and Ferguson (2010), Figs. 5 and 6
[nn] Adetunji et al. (2011)
[p] Palacky (1988)
[pp] Palacky (1992)
[q] Eaton et al. (2006), Fig. 12
[r] Ferguson and Odwar (1998), Ontario and Quebec 1D model – Table A3.2.1
[s] Mareschael et al. (1994)
[t] Kellett et al. (1994), Fig. 10
[u] Mereu (2000), Fig. 14
[v] Ludden and Hynes (2000), Fig. 4
[w] White et al. (2000), Figs. 2, 3 and 4
[x] Winardhi and Mereu (1997), Figs. 13, 14 and 15

See Table 2 for confidence notes.

Table 7
1D Earth Resistivity Model (Zone 4b) for Superior Geological Province – Kapuskasing Uplift

Layer	Depth Confidence	Thickness	Resistivity (ohm·m) Confidence	Conductivity (S/m) Confidence	Comments
1. Overburden & Upper Crust	0.3 km [z] [I]	0.3 km	3000 [z] [I]	0.000333 [m]	Includes near surface weathered and fractured bedrock into which groundwater accumulates, thereby reducing resistivity. Overburden itself reported < 25 m of conductive glacial till and clay [s]. Note: all layer depths and resistivities obtained from [z]. Higher confidence assigned to resistivity because of linear nature of Kapuskasing Uplift.
2. Sedimentary Basin	absent	---	---	---	---
3. Upper Crust	0 – 15 km [z] [I]	15 km	40000 [z] [I]	0.000025 [m]	High-grade metamorphic rock, including variety of gneisses, granulites, and intrusive rocks (granitoids, anorthosite) Depth based on resistivity change. Seismic profile[y] shows upper/middle crust boundary at range 12-25 km, average 18 km. Resistivity reported as 40000 +/- 10000 in Chapleau Block area of Kapuskasing Uplift, but 15000 ohm in Groundhog Block where metamorphic grade is lower.
4. Middle Crust	15 – 35 km [z] [I]	20 km	4000 [z] [I]	0.00025 [m]	Depth based on resistivity change. Seismic profile [y] shows lower/middle crust boundary at 18-33 km, average 27 km.

Table 7 (continued)
1D Earth Resistivity Model (Zone 4b) for Superior Geological Province – Kapuskasing Uplift

Layer	Depth Confidence	Thickness	Resistivity (ohm·m) Confidence	Conductivity (S/m) Confidence	Comments
5. Lower Crust & Upper Mantle	35 – 250 km [z] [I]	215 km	900 [z] [I]	0.00111 [m]	Depth based on resistivity change. Seismic profile [y] shows lower crust / mantle boundary at 43-54 km, average 48 km.
6. Upper Mantle, Transition Zones to Lower Mantle	250 – 1000 km [z] [I]	750 km	100 [z] [I]	0.01 [m]	Depth based on resistivity change.

[m] Converted from resistivity obtained from listed reference source
[y] Percival and West (1994), Fig. 7
[z] Kurtz et al. (1993), Fig. 13

See Table 2 for confidence notes.

Table 8
1D Earth Resistivity Model (Zones 5a and 5b) for Superior Geological Province-western region

Layer	Depth Confidence	Thickness	Resistivity (ohm·m) Confidence	Conductivity (S/m) Confidence	Comments
1. Overburden	*Zone 5a, South of NCS* < 1m [gg] *Zone 5b, NCS northward* 25 m [gg] [II]	*Zone 5a South of NCS* < 1m *Zone 5b NCS northward* 15 m	60 [hh, p, jj] [III]	0.0166 [m]	Variable glacially derived overburden, including tills, eskers, clay belts. Thicknesses estimated for NCS northward based on minimum 30 m in Hudson Bay Lowlands. *Zone 5a, South of NCS*: Till veneer prevails. Kenora-Red Lake-Dryden clay belt. *Zone 5b, NCS & northward*: Thicker till blanket and clay belts Resistivity 5-30 ohm.m for clay dominant deposits, 20-100 ohm.m for tills. Assigned 60 ohm.m as overall average.
2. Sedimentary Basin	absent	---	---	---	---

Table 8 (continued)
1D Earth Resistivity Model (Zones 5a and 5b) for Superior Geological Province-western region

Layer	Depth Confidence	Thickness	Resistivity (ohm·m) Confidence	Conductivity (S/m) Confidence	Comments
3. Upper Crust	0 – 13 km [mm] [II]	13 km	*South of NCS* 7500 [rr, hh] *NCS northward* 50000 [ss] [II]	0.000133 [m] 0.00002 [m]	Western Superior province south of the North Caribou Superterrane (includes English River Terrane and all other terranes and subprovinces to the south). Predominantly granitoids and gneisses interspersed with belts of metasedimentary and metavolcanic rock. *Zone 5a, South of NCS:* belts of metasedimentary, metavolcanic and metaplutonic rocks *Zone 5b, NCS & northward*: plutonic and minor volcanic belts.
			Depth scaled from seismic profiles, up to ~ 18km deep . Average depth shown. [rr] notes crust 13 km deep. *Zone 5a, South of NCS*: 5000 ohm.m [rr]. 10000 ohm.m [hh]. Applied mid point value. *Zone 5b, NCS & northward*: 50000 resistive cores surrounded by 5000-50000 ohm.m [ss]. Applied upper value of range.		
4. Middle Crust	13 – 30 km [mm] [II]	17 km	*South of NCS* 125 [rr, ss] *NCS northward* 10500 [ss] [II]	0.008 [m] 0.0000095 [m]	Depth scaled from seismic profiles. Average depth shown. *Zone 5a, South of NCS*: 50-200 ohm.m range [ss]. A 200 ohm.m middle & lower crust noted by [rr]. 100 ohm.m in adjacent Manitoba [hh]. Applied midpoint value.
			A 50 km wide 20-50 ohm.m conductive zone at centre of Winnipeg River subprovince extends into lower crust. 30 ohm.m average shown on figure. *Zone 5b, NCS & northward*: 50000 resistive cores taper down into middle crust, surrounded by 1000-20000 ohm.m [ss]. >5000 ohm.m for middle and lower crust noted by [rr]. Applied midpoint value.		

Table 8 (continued)
1D Earth Resistivity Model (Zones 5a and 5b) for Superior Geological Province-western region

Layer	Depth / Confidence	Thickness	Resistivity (ohm·m) / Confidence	Conductivity (S/m) / Confidence	Comments
5. Lower Crust	30 – 40 km [mm] [II]	10 km	*South of NCS* 275 [ss] *NCS northward* 6500 [ss] [II]	0.0036 [m] 0.000153 [m]	Depth scaled from seismic profiles, ranges 34-45 km. Average depth shown. *Zone 5a, South of NCS*: 50-500 ohm.m range [ss]. 200 ohm.m middle & lower crust noted by [rr]. 100 ohm.m in adjacent Manitoba [hh]. Applied midpoint value. *Zone 5b, NCS & northward*: 50000 resistive cores continue taper down into lower crust, surrounded by 100-20000 and 1000-5000 ohm.m [ss]. >5000 ohm.m for middle and lower crust noted by [rr]. > 5000 ohm.m for lower crust noted by [ss]. Applied average of midpoint values of ranges.
6. Upper Mantle	40–100 km [r, g] [III]	60 km	*South of NCS* 600 [ss] *NCS northward* 3000 [ss] [II]	0.00166 [m] 0.000333 [m]	Used generalized lower depth [d, g]. *Zone 5a, South of NCS*: 200-1000 ohm.m range, but 200-500 ohm.m from 80-100 km depth. 100-500 ohm.m range in adjacent Manitoba. A 100 km wide conductive zone 5-50 ohm.m at 40-70 km depth under Winnipeg River and English River subprovinces, then 10-500 ohm from 70-100 km. 30 ohm.m average shown on figure. Applied 600 ohm.m midpoint value exclusive of conductive zone. *Zone 5b, NCS & northward*: resistive taper-like zones in upper mantle, surrounded by 500-5000 ohm.m [ss]. >3000 ohm.m uppermost mantle noted by [ss]. Applied midpoint value.

Table 8 (continued)
1D Earth Resistivity Model (Zones 5a and 5b) for Superior Geological Province-western region

Layer	Depth Confidence	Thickness	Resistivity (ohm·m) Confidence	Conductivity (S/m) Confidence	Comments
7. Upper Mantle	100–250 km [g] [III]	100 km	158 [k]	0.0063 [g] [III]	Utilized Canada regional model [g] for all depths and resistivities below 100 km. Chose lower resistivities of Canada model because conductive upper mantle suggested from analysis by [rr] and [ss]. Conductive upper mantle >100 km, > 20 ohm.m with alternating 1000 ohm.m [rr]. <100 ohm.m at ~100 km [ss]. Profile by [ss] ends at 100 km depth.
8. Upper Mantle	250–410 km [g] [III]	160 km	29 [k]	0.0346 [g] [III]	---
9. Transition Zone	410–520 km [*] [III]	110 km	8 [k]	0.1258 [g] [III]	---
10. Transition Zone	520–670 km [g] [III]	150 km	2.4 [k]	0.4168 [g] [III]	---
11. Lower Mantle	670–900 km [g] [III]	230 km	0.89 [k]	1.1220 [g] [III]	---
12. Lower Mantle	900–1000 km [g] [III]	100 km	0.47 [k]	2.0892 [g] [III]	---

Table 8 (continued)
1D Earth Resistivity Model (Zones 5a and 5b) for Superior Geological Province-western region

NCS North Caribou Superterrane

[gg] Barnett et al. (1991a)
[hh] Gowan et al. (2009), Figs. 7 and 8 resistivity profiles
[jj] Dowling (1970), Fig. 6
[mm] Musacchio et al. (2004), Figs. 4, 5 & 14 seismic profiles and interpretation.
[rr] Craven et al. (2001)
[ss] Ferguson et al. (2005), Fig. 7 stitched 1D resistivity profile
[g] Kelbert et al. (2009), Figure 2, global and regional conductivity profile, Canada regional conductivity chosen
[k] Converted from conductivity obtained from listed reference source
[m] Converted from resistivity obtained from listed reference source
[p] Palacky (1988)
[r] Ferguson and Odwar (1998), Ontario and Quebec 1D model – Table A3.2.1

See Table 2 for confidence notes

Table 9
1D Earth Resistivity Model Proximal to the Zone 6 of Ontario

Layer	Depth Confidence	Thickness	Resistivity (ohm-m) Confidence	Conductivity (S/m) Confidence	Comments
1. Overburden	0 – 40 m [d] [II]	40 m	30 [c, p, pp] [II]	0.03333 [m]	*Sanikiluaq*: Estimate < 1m, discontinuous glaciomarine / marine clay and sand, some gravel, in bedrock depressions. Exposed bedrock > 75%. *Northeastern Superior Province (Nunavut)*: Glaciomarine deposits (gravel, sand, silt and clay; estimate < 20m total) along coastline up to 100 km inshore, then discontinuous till blanket (estimate < 3 m thick) or veneer (estimate < 1 m) [fn] *Hudson Platform (Ontario)*: Till overlain by glaciomarine / marine gravel and sand; all overlain by < 4m peat deposits [fn, pl], Assigned estimated maximum thickness of 40m (till estimated 20 m, with 20m glaciomarine clays or 20m glaciolacustrine clays), based on similar deposits along Hudson Platform in Manitoba [d]. Resistivity for tills range 20-100 ohm.m [p] Glaciolacustrine clays average 30 ohm.m in northeastern Ontario [pp]. MT survey in southeastern Manitoba across mixed glacial deposits indicates 5-30 ohm [c]. For Layer 1 overall, assigned 30 ohm.m to reflect dominance of glaciolacustrine clays and silt covering nearshore of Hudson Bay.

Table 9 (continued)
1D Earth Resistivity Model Zone 6 of Ontario

Layer	Depth Confidence	Thickness	Resistivity (ohm-m) Confidence	Conductivity (S/m) Confidence	Comments
2. Sedimentary Basin	*Hudson Platform* < ~500 m [s,aa] [II]	*Hudson Platform* 250 m (midpoint)	*Hudson Platform* 50 [ob,c, jj, jo] [II]	0.02 [m]	<u>Sanikiluaq</u>: Layer 2 absent. <u>Northeastern Superior Province (Nunavut)</u>: Layer 2 absent. <u>Hudson Platform (Ontario)</u>: <500m thick along shoreline, thinning inland; ~2300m thick at centre of Hudson Bay [s, aa]. Assigned midpoint thickness, 250m, within model coverage of nearshore area. Paleozoic strata, primarily carbonate (limestone +/- dolostone), lesser amount clastic sediments (sandstone, shale) and evaporites (gypsum, salt) with upper succession of argillaceous and sandy beds [s, os]. Gently dipping northeast, undeformed. In Ontario, overlies Precambrian basement (Superior province and Trans-Hudson orogen). Resistivity below Churchill Natural Science Centre varies 20-100 ohm.m [ob]. CNSC is 900 km northwest from model coverage area. Carbonate strata in WCSB in southeastern Manitoba ranges 20-50 ohm [c] and northwestern Manitoba ranges 10-100 [jj] or averages 30 ohm.m [jo] for a 200m thickness. Assigned approximate midpoint value, 50 ohm.m, of range of resistivity determined by [ob, jj] which is also high end for carbonates as determined by [c].

Table 9 (continued)
1D Earth Resistivity Model Zone 6 of Ontario

<table>
<tr><th rowspan="2">Layer</th><th>Depth</th><th rowspan="2">Thickness</th><th>Resistivity (ohm-m)</th><th>Conductivity (S/m)</th><th rowspan="2">Comments</th></tr>
<tr><th>Confidence</th><th>Confidence</th><th>Confidence</th></tr>
<tr><td rowspan="3">3. Upper Crust</td><td>0 – 13 km
[h, r]</td><td rowspan="2">13 km</td><td>16000
(midpoint)</td><td></td><td rowspan="2">Seismic transect , 500km northeast of Sanikiluaq, indicates average 10 km thickness in area south of Ungava Bay [h]. Assigned midpoint between 10 km and generalized depth of 15 km [r].
<u>Sanikiluaq</u>: Volcanic (basaltic massive and pillow flows, pyroclastics) and sedimentary rock (argillite, dolostone, limestone, quartzite, iron formation), intensely folded [ja, ba]. Volcanics form part of Circum-Superior Belt, inbetween Trans-Hudson Orogen and Superior Province, continuing into Manitoba as the Superior Boundary Zone where resistivity is ~3000-10000 ohm.m [ww].</td></tr>
<tr><td>[II, III]</td><td>[II]</td><td></td></tr>
<tr><td colspan="5"><u>Trans-Hudson Orogen</u>: In northeastern Manitoba, a tectonic collage of mainly granites and gneisses and metasediments, and lesser amount of metavolcanics. Minor exposed bedrock, mainly underlies Hudson Bay.
Assigned 3000 ohm.m to reflect lower resistivity associated with crust of younger Precambrian age (Proterozoic), generally in range of 1000-5000 ohm.m; some crustal blocks < 80 or 10000-50000 ohm.m [jj, w]. See Fort Churchill model for more detail.
<u>Northern Superior Province (Ontario):</u> Includes northern part of NCS, IL, OSL and NSS. Predominantly granitoids and gneisses interspersed with belts of metasedimentary and metavolcanic rock [pe].
NCS and OSL terranes have 50000 ohm.m resistive cores surrounded by 5000-20000 ohm.m [ss]. Assigned midpoint 25000 ohm.m resistivity.
<u>Northeastern Superior Province (Nunavut)</u>: Includes IN, TK, LM, G, LG and OPN domain/subprovinces. Predominantly granitoids and gneisses with belts of metasedimentary and metavolcanic rock [pc].
Resistivity ranges 25000-50000 ohm.m within northern AT underlain by plutonic rock, south of James Bay [af]. OPT, plutonic rock dominant, in Chibougamou area, has 10000 ohm.m resistivity [z]. Assigned midpoint 30000 ohm.m resistivity.
Layer 3 resistivity assigned midpoint value of range 3000-30000 ohm.m, encompassing both Trans-Hudson Orogen and northern and northwestern Superior province. NACP conductive anomaly, <10 ohm.m, possibly beneath Hudson Bay,</td></tr>
</table>

Table 9 (continued)
1D Earth Resistivity Model Zone 6 of Ontario

Layer	Depth / Confidence	Thickness	Resistivity (ohm-m) / Confidence	Conductivity (S/m) / Confidence	Comments
4. Middle Crust	13 – 26 km [h, lu, r] [II, III]	13 km	5500 (midpoint) [II]		Seismic transect , 500km northeast of Sanikiluaq, indicates Layer 4 is 10-18 km in area south of Ungava Bay [h]. Transect south of James Bay in OPT shows variable bottom depth of 27-35 km [lu]. Gravity survey shows 32 km depth [te]. Assigned a bottom depth midpoint between 18 km and 35 km
			Trans-Hudson Orogen: Resistivity range 10-50 ohm.m [j]; 1000-5000 [jj]; 500-1000 ohm.m [w], averaging 1000 ohm.m [ww]. Assigned low end value, 1000 ohm.m, of resistivity range 1000-5000. *Northern Superior Province (Ontario):* 50000 ohm.m resistive cores taper down into middle crust, surrounded by 500-20000 ohm.m [ss]. >5000 ohm.m for middle and lower crust noted by [rr]. Assigned midpoint 10500 ohm.m resistivity. *Northeastern Superior Province (Nunavut)*: Resistivity 200 ohm.m within northern AT [af] Layer 4 resistivity assigned midpoint value of range 1000-10500 ohm.m, encompassing both Trans-Hudson Orogen and northern Superior province. Possibility of conductive middle crust, ~ 200 ohm.m, in northeastern Superior (Nunavut).		
5. Lower Crust	26 – 39 km [th, h, lu] [I, II]	13 km	6000 (midpoint) [II]		Lower depth measured from teleseismic study, 44 km on west coast of Quebec opposite Sanikiluaq and 32-36 km at Cape Smith Belt, 750km north of Sanikiluaq [th], and 39 km near James Bay [Darbyshire et al.,2007]. Seismic transect, 500km northeast of Sanikiluaq, indicates average 36 km to crust/mantle boundary [h]. Transect south of James Bay in Opatica subprovince indicates 35-40 km bottom depth [lu]. Gravity survey shows 41 km depth [te]. Assigned 39 km average depth from above measurements.

Table 9 (continued)
1D Earth Resistivity Model Zone 6 of Ontario

Layer	Depth / Confidence	Thickness	Resistivity (ohm-m) / Confidence	Conductivity (S/m) / Confidence	Comments
5. Lower Crust (continued)					*Trans-Hudson Orogen*: Resistivity range 10-50 ohm.m [j], 1000-3000 [jj]; 500-1000 ohm.m [jo], averaging 1000 ohm.m [ww]. Assigned midpoint 1500 ohm.m based on range 500-3000 ohm.m *Northern Superior Province (Ontario):* Influence of resistive core extends to lower crust. Resistivity ranges 500-20000 ohm.m [ss]. >5000 ohm.m for middle and lower crust noted by [rr]. Assigned midpoint 10500 ohm.m resistivity. *Northeastern Superior Province (Nunavut)*: Resistivity 200 ohm.m within northern AT (little change of resistivity with depth on MT profile) [af] Layer 5 resistivity assigned midpoint value of range 1500-10500 ohm.m, encompassing both Trans-Hudson Orogen and northern Superior province. Possibility of conductive lower crust, ~ 200 ohm.m, in northeastern Superior (Nunavut).
6. Upper Mantle	38 – 100 km [g] [II, III]	62 km	2500 (midpoint) [II]		Used generalized lower depth [g]. *Trans-Hudson Orogen*: 500-1000 ohm.m [jj]; 500-1000 ohm.m [jo]; Assigned midpoint value, 750 ohm.m, of range. *Northern Superior Province (Ontario):* Influence of resistive core (20000 ohm.m) extends to upper mantle. Resistivity ranges 500-10000 ohm.m [ss], excluding core influence. Assigned midpoint 5000 ohm.m resistivity. *Northeastern Superior Province (Nunavut)*: Resistivity 200 ohm.m within northern AT (little change of resistivity with depth on MT profile) [af] Layer 6 resistivity assigned approximate midpoint value of range 750-5000 ohm.m, encompassing both Trans-Hudson Orogen and northern Superior province; possibly overestimated.

Table 9 (continued)

1D Earth Resistivity Model Zone 6 Ontario

Layer	Depth / Confidence	Thickness	Resistivity (ohm-m) / Confidence	Conductivity (S/m) / Confidence	Comments
7. Upper Mantle	100 - 250 km [g]	150 km	210 [k]	0.004786 [g]	Utilized Canada regional model [g] for all depths and resistivities below 100 km.
	[III]			[III]	
8. Upper Mantle	250–410 km [g]	160 km	50 [k]	0.019952 [g]	---
	[III]			[III]	
9. Transition Zone	410–520 km [g]	110 km	20 [k]	0.050118 [g]	---
	[III]			[III]	
10. Transition Zone	520–670 km [g]	150 km	5.6 [k]	0.177827 [g]	---
	[III]			[III]	
11. Lower Mantle	670–900 km [g]	230 km	1.58 [k]	0.630957 [g]	---
	[III]			[III]	
12. Lower Mantle	900–1000 km [g]	100 km	1.12 [k]	0.89125 [g]	---
	[III]			[III]	

Table 9 (continued)
1D Earth Resistivity Model Zone 6 Ontario Proximal to the Sanikiluaq (Nunavut) magnetic observatory

		Northern Superior		*Northeastern Superior*	
CNSC	Churchill Natural Studies Centre	IL	Island Lake Domain	AT	Abitibi Terrane
WCSB	Western Canada Sedimentary Basin	NCS	North Caribou Superterrane	BV	Bienville Subprovince
		NSS	Northern Superior Superterrane	G	Goudalie Domain
		OSL	Oxford-Stull Lake Domain	IN	Inukjuak Domain
				LG	La Grande Subprovince
				LM	Lake Minto Domain
				OPN	Opinaca Subprovince
				OPT	Opatica Subprovince

[aa] Aiken (1993)

[af] Adetunji and Ferguson (2010), Figs. 5 and 6

[ba] Baragar (2007), map, bedrock geology, Sleeper Islands

[c] Gowan et al. (2009), Figs. 7, 8

[d] Matile and Keller (2007), surficial geology map

[fn] Fulton (1995), map, surficial materials, Canada

[g] Kelbert et al. (2009), Figure 2, global and regional conductivity profile, Canada regional conductivity chosen

[h] Hammer et al. (2010), p. 832, Fig.2-Chart 1, Fig.8

[ja] Jackson (1961), map. bedrock geology, Belcher Islands

[jj] Ferguson et al. (2005b), p.504, Figs. 8, 9 and 10

[jo] Jones et al. (2005), p.464, Fig. 11

[k] Converted from conductivity obtained from listed reference source

[lu] Lunden and Hynes (2000), Fig. 4

[m] Converted from resistivity obtained from listed reference source

[ob] Roberts and Craven (2012), Fig. 5

[os] OGS (1991), map bedrock geology northern Ontario

[p] Palacky (1988)

[pc] Percival (2007)

[pe] Percival and Easton (2007)

[pl] Pala et al. (1991), map, quaternary geology, northern Ontario

[pp] Palacky (1992)

[r] Ferguson and Odwar (1998), Ontario and Quebec 1D model – Table A3.2.1

[rr] Craven et al. (2001)

[s] Johnson et al. (1992), Figs. 20.2, 20.30, 20.48

[ss[Ferguson et al. (2005a), Fig. 7 stitched 1D resistivity profile

[te] Telmat et al. (2000), Fig. 9

[th] Thompson et al. (2010), Fig. 5

[w] White et al. (2005), Figs. 7 and 8

[ww] White et al. (1999), Plates 1 and 2

[z] Zhang and Choteau (1992)

NOTES:
Depth Confidence
I = best representation
* overburden: geological report/map coverage of local area.
* crust: seismic/gravity transects crossing local area, within 10 km.
II = likely representative
* crust/upper mantle: geological and/or seismic transect of a regional nature.
III = possibly representative (measurements from general compilations).
Resistivity/Conductivity Confidence
I = best representation (measurements from site or nearby).
* overburden: resistivity measurement by surface geophysical method and/or borehole in local area.
* crust: resistivity measurement from resistivity survey, MT survey and/or borehole in local area.
II = likely representative (resistivity values extrapolated from measurements taken at some distance from the site, typically greater than 100 km).
* overburden: resistivity value obtained by geophysical measurement, including borehole logs.
* sedimentary basin: value obtained by geophysical survey using variety of geophysical electromagnetic methods, including MT.
* crust: value obtained by regional MT survey.
III = possibly representative (measurements from general compilations).

Appendix 8

Detailed Description of the Earth Resistivity Models for

Prince Edward Island

1. Geological Settings of province

Geologically, Prince Edward Island (PEI) lies within northeastern part of the Appalachian Orogen[24] (Figure 1). The Appalachians evolved through the process of opening and closing of the Late Precambrian (Proterozoic) to Early Paleozoic Iapetus Ocean (pre-Atlantic Ocean), some 600-400 million years ago. Rifting of the proto-North American continent during the Late Precambrian formed the Iapetus Ocean. By the end of the Ordovician (435 ma) plate tectonic movement caused the Iapetus Ocean to be closed shut, and a continent-continent collision (involving proto-North America and Africa) during the Silurian (435-410 ma) and continued deformation into the Devonian (410-360 ma) occurred. Accompanying widespread magmatism gave rise to large intrusions of granitoid rock.

Figure 1. General distribution of the tectonic zones and terranes that comprise the Appalachian Mountains from Newfoundland to Alabama (Eyles and Miall, 2007, Fig. 6.4). Prince Edward Island lies mainly within the Avalon tectonic zone, except for the western edge of the island lying within the Gander Zone. Red dashed line – Logan's Line – is the northern limit of deformed rocks of the Appalachians.

[24] Orogen: a regionally extensive belt of strata that has undergone folding and deformation as a result of the collision of tectonic plates, creating a mountain range.

The resulting continental collisions formed a continuous mountain chain that extended from the southeastern and northeastern USA, through the Canadian Maritime provinces including PEI and Newfoundland, into east Greenland, the Caledonian Mountains of Great Britain and Scandinavia, and the West African Mauritanides. (Petroleum Resources Branch, 1989, after Williams, 1986). Subsequent rifting, starting 200 my ago, formed the Atlantic Ocean and separated North America and Newfoundland from the Europe-Africa continent.

The Appalachian Orogen has been divided into a series of lithotectonic zones trending in a northeasterly direction, each representing a fragment of the Earth's crust brought together by plate-tectonic processes about 600-200 million years ago (Eyles and Miall, 2007). PEI lies mostly within the Avalon Zone, interpreted to be a fragment of pan-African continental terrane that formed the southeastern margin of the Iapetus Ocean, and was accreted onto eastern Canada as the ocean closed and its crust subducted (Eyles and Miall, 2007). The western margin of PEI is considered to be part of the Gander Zone, representing a continental prism of sediment developed on the southeastern margin of the Iapetus Ocean. In Newfoundland, the Gander Zone is a thick sequence of mostly pre-Middle and Middle Ordovician poly-deformed, metamorphosed, quartz-rich clastic sedimentary (quartzite) that grade eastward into schists, gneiss and migmatite (Petroleum Resources Branch, 1989; Mining Journal, 2009).

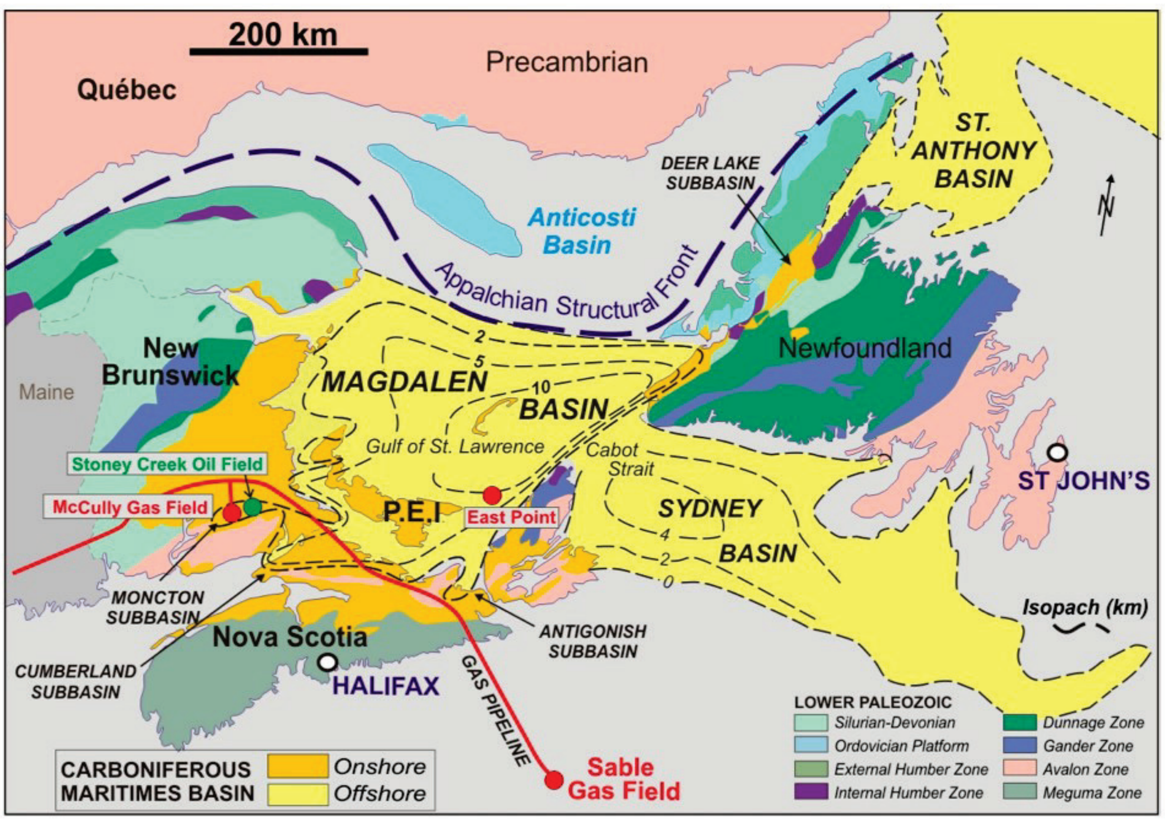


Figure 2. Simple distribution of the tectonic terranes that comprise the Canadian portion of the Appalachian region, and coverage of the Maritimes Basin (Dietrich et al., 2009, Fig. 1). Isopach contour lines indicate depth to base of sedimentary basin.

The Maritimes Basin (Figure 2), sedimentary strata of late Paleozoic time, overlies a collage of earlier Paleozoic continental margin basins and Appalachian lithotectonic crustal zones of varying age and composition (Dietrich et al., 2009, 2011).

The basin covers the southern half of the Gulf of St. Lawrence from eastern New Brunswick across Prince Edward Island to the southwestern tip of Newfoundland. About 75 % of the basin area is situated offshore (Hu and Dietrich, 2010). Up to 12 km of sandstone, conglomerate and shale, strata have accumulated in the Maritime Basin, lesser amounts of limestone and evaporates (e.g. salt).

The Maritime Basin itself is a composite basin that includes the Magdalen, Sydney, Deer Lake and St. Anthony basins and numerous local subbasins (Hu and Dietrich, 2010). PEI lies within the onshore part of the Magdalen Basin, the Magdalen being the largest and deepest sedimentary basin within the Atlantic margin of eastern Canada (Jones and Garland, 1986). The island is underlain entirely by rocks correlative with those of the Pictou Group of Nova Scotia and New Brunswick. On PEI, these deposits of sandstones, shales and conglomerates are informally termed the "Prince Edward Island Redbeds" (www.gov.pe.ca).

2. Earth resistivity model

Presented is a one-dimensional (1D) Earth model representing the vertical variance of electrical resistivity for PEI

<u>Sources of Information</u>

Assembly of the 1D model relied on two magnetotelluric (MT) transects. A reconnaissance MT survey across the island (Figure 3) involving 10 recording sites was done in 1983 to assist in the evaluation of the geothermal energy potential underlying PEI (Jones and Garland, 1986). This survey allowed for assignment of resistivity values to a depth of about 4 km. An earlier regional MT survey (Kurtz and Garland, 1976) comprised of 20 recording sites covering Eastern Canada, including two on PEI (Summerside and Morell) provided a coarse estimate of crustal resistivity to a depth of about 100 km.

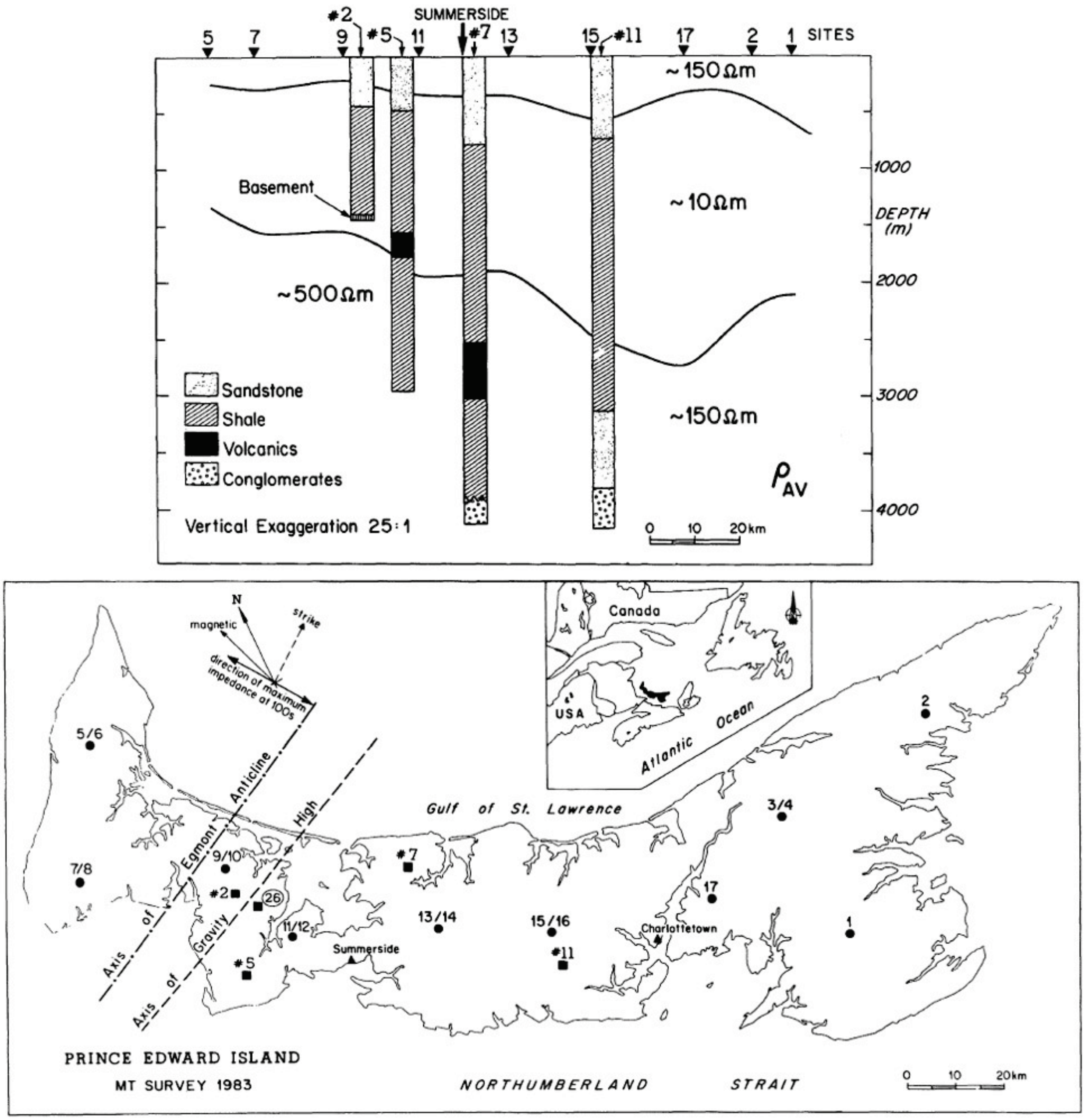


Figure 3. Top panel: 2D geoelectric model of the Earth structure beneath Prince Edward Island. Numbered triangles indicate a MT sounding site; locations shown below . Bottom panel: Location of MT sounding sites (circles) across PEI. Squares indicate location of boreholes (e.g. #11) (Jones and Garland, 1985, Figs. 1 and 9).

Supplemental information about sub-surface resistivity for the Avalon Zone in Newfoundland was obtained from an MT transect across the Appalachian Orogen in Newfoundland, undertaken during 1989 and 1991 as part of the Lithoprobe East, part of a trans-Canada investigation of the crust and upper mantle (McNeice, 1998). Information regarding crustal resistivity values of the southern USA Appalachians was obtained from an MT transect prepared by Ogawa et al. (1996).

Depths for overburden – Layer 1 – was assigned by typically selecting half of the maximum general thickness mentioned on surficial geology maps. An estimated resistivity value, based on findings from overburden borehole logs (Crow et al., 2015) through glacially deposited sediments in nearby New Brunswick and Nova Scotia, was applied.

Thickness of the sedimentary basin strata – Layer 2 – was obtained from a regional isopach map (Stott and Aitken, 1993), simplified regional stratigraphic cross-sections (Dietrich et al., 2009), and petroleum exploration well logs presented in Jones and Garland (1986). Although Jones and Garland (1986) present a three-layer resistivity structure (Figure 2) for Layer 2, a weighted average resistivity was calculated and applied.

Depths of the upper, middle and lower crust – Layers 3 to 5 – were measured off seismic profiles undertaken offshore of PEI (Ewing et al., 1966; Hughes and Hall, 1994; Jackson, 2002),

Resistivities for the crust (Layers 3 to 5) were obtained from 1D and 2D models prepared by Kurtz and Garland (1976), and the 2D generalized model (Figure 2) by Jones and Garland (1986). For comparison purposes, resistivity values for the same crustal layers in Newfoundland (i.e. Avalon Zone) and its equivalent Piedmont Terrane continuation into the southern Appalachians are also presented.

For the uppermost mantle (Layer 6), the generalized depth of 100 km was used and resistivity obtained from the coarse determination presented by Kurtz and Garland (1976).

Depths and resistivity for the middle and lower divisions of the upper mantle, transition zones, and lower mantle – Layers 7 to 12 – between 100 and 1000 km were based on the Canada regional conductivities determined by Kelbert et al. (2009).

<u>Conductive and Resistive Anomalies in Crust</u>

A highly conductive (10 ohm.m) layer underlies PEI and is associated with shale sequences and coaly material within the Pictou Group sedimentary strata (Jones and Garland, 1986). This conductive zone is at a depth of about 200 to 1300m on the west half of the island, and about 600 to 2700 m on the east half.

Beneath the 10 ohm.m conductive zone, there is a significant lateral difference of the electrical resistivity structure below the western and eastern parts of the island. The western half of the island exhibits a relatively high resistivity at shallow depth (between about 1400 to >2500 m), and is associated with a topographic basement high of granitic rock (Jones and Garland, 1986). 1D inversions reveal resistivities ranging from low 1000s to a high of 33000 ohm.m in the area of the basement high, whereas as resistivities of high 10s to less than 200 ohm.m occur in the lowermost sedimentary strata underlying the eastern half of the island. A generalized 2D model by Jones and Garland (1986) shows 500 ohm.m in the area of the basement high and 150 m in the eastern part of the island (Fig. 3).

Presentation of Findings

The 1D layered-Earth model for PEI is presented in Table 1, which provides individual layer depths, thickness, and resistivity/conductivity for the model, as well as sources and certainty of chosen values.

3. References

Bailey, R.C., Edwards, R.N., Garland, G.D, Kirtz, R. and Pitcher, D., 1974. "Electrical conductivity studies over a tectonically active area in Eastern Canada", *J. Geomag. Geoelectr*., vol. 26, 125-146.

Colman-Sadd, S.P., Hayes, J.P., and Knight, I., 2000. "Geology of the island of Newfoundland (digital version of Map 90-01 with minor revisions)", *Newfoundland Department of Mines and energy, Geological Survey*, Map 2000-30, scale 1:1,000,000.

Crow, H.L, Good, R.L., Hunter, J.A., Burns, R.A., Reman, A., and Russell, H.A.J., 2015. "Borehole geophysical logs in unconsolidated sediments across Canada," *Geological Survey of Canada*, Open File 7591, 1 .zip file. doi:10.4095/295753

Dietrich, J., Hannigan, P., Hu, K. and Gilles, P., 2009. "Petroleum resource potential of the Carboniferous Maritimes Basin, Eastern Canada," AAPG Search and Discovery Article #90171, CSPG/CSEG/CWLS GeoConvention 2009, May 4-8, 2009, Calgary, Alberta, Canada, 3 p.

Dietrich, J., Lavoie, D., Hannigan, P. et al., 2011. "Geological setting and resource potential of conventional petroleum plas in Paleozoic basins in eastern Canada," *Bulletin of Canadian Petroleum Geology*, v.59, no.1, 54-84.

Eyles, N. and Miall, A., 2007. "Canada Rocks" The Geologic Journey", *Fitzhenry and Whiteside*, 1st Ed., 512 p.

Ewing, G.N., Dainty, A.M., Blanchard, J.E. and Keen, M.J., 1966. "Seismic studies of the eastern seaboard of Canada: the Appalachian system," *Canadian Journal of Earth* Science, v. 3, 80-109

Hall, J., Marillier, F. and Dehler, S., 1998. "Geophysical studies of the structure of the Appalachian orogen in the Atlantic borderlands of Canada," *Canadian Journal of Earth* Science, v. 35, 1205-1221

Hu, K., Dietrich, J. ,2010. "Petroleum Reservoir Potential of Upper Paleozoic Sandstones in the Offshore Maritimes Basin, Eastern Canada," *Geological Survey of Canada*, Open File 6679,

Hughes, S. and Hall, J., 1994. "The seismic velocity structure of the Newfoundland Appalachian orogen", *Journal of Geophysical Research*, v. 99, no. B7, 13633-13653.

Jackson, H.R., Marillier, F. and Hall, J., 1998. “Seismic refraction data in the Gulf of Saint Lawrence: implications for the lower-crustal blocks,” *Canadian Journal of Earth Science*, v. 35, 1222-1237

Jackson, H.R., 2002 “Seismic refraction profiles in the Gulf of Saint Lawrence and implications for extent of continous Grenville lower crust,” *Canadian Journal of Earth Science, v. 39, 1-17* doi:10.1139/E01-054

Jones, A.G. and Garland, G.D., 1985. “Preliminary interpretation of the upper crustal structure beneath Prince Edward Island”, *Annales Geophysicae*, 4, B, 2, 157-164.

Kelbert, A., Schultz, A., and Egbert, G., 2009. “Global electromagnetic induction constraints on transition-zone water content variations,” *Nature*, v. 460, no. 20, August 2009, 1003-1006. http://dx.doi.org/10.1038/nature08257

Kurtz, R.D, and Garland, G.D., 1976. “Magnetotelluric measurements in eastern Canada”, *Geophys. J. R. Soc*., v. 45, 321-347.

McNeice, G.W., 1998. “Magnetotelluric investigation of the Appalachians, Newfoundland, Canada”, M.Sc thesis, *Memorial University of Newfoundland*, Dept. of Earth Sciences, St. John’s, 207 p. http://collections.mun.ca/PDFs/theses/GaryWayneMcNeice.pdf

Mining Journal, 2009. “Diverse geology and rich in minerals” in Newfoundland and Labrador, Canada, *Mining Journal Special Publication*, February 2009, 7-8p. http://www.mining-journal.com/supplements/newfoundland-and-labrador-supplement- 0209/diverse-geology-and-rich-in-minerals

Ogawa, Y., Jones, A.G., Unsworth, M.J., Booker, J.R., Xinyou, L., Craven, J., Roberts, B., Parmelee, J. and Farquharson, C., 1996. “Deep electrical conductivity structures of the Appalachian orogen in the southern U.S.”, *Geophysical Research Letters*, v. 23, no. 13, 1597-1600.

Palacky, G.J., 1988. “Resistivity characteristics of geologic targets” in *Electromagnetic Methods in Applied Geophysics-Theory*, Vol.1, M.N. Nabighian (ed.); Society of Exploration Geophysicists, 53-130.

Petroleum Resources Branch, 1989. “Hydrocarbon potential of the western Newfoundland onshore area”, *Department of Energy, Government of Newfoundland and Labrador*, Geofile Number: NFLD/1910, 11p. http://www.nr.gov.nl.ca/mines&en/publications/onshore/hydrocarbon.pdf

Pinet, N., Lavoie, D., and Dietrich, J., 2013. “Conventional Paleozoic petroleum systems of the Gulf of St. Lawrence and adjacent areas,” Geological Survey of Canada, Open File 7514, 1 poster, doi:10.4095/293150

Prest, V.K., 1973. “Surficial Deposits of Prince Edward Island,” *Geological Survey of Canada*, "A" Series Map 1366A, 1973, 1 sheet, doi:10.4095/108971.

Stott, D.F. and Aitken, J.D. 1993. "Introduction," Chapter 1 in Sedimentary Cover of the Craton in Canada, D.F. Stott and J.D. Aitken (ed.). *Geological Survey of Canada*, Geology of Canada, no.5, p.1-7 (also Geological society of America, The Geology of North America, v. D-1)

www.gov.pe.ca, 2015. "Oil and gas exploration," http://www.gov.pe.ca/energy/index.php3?number=1029909&lang=E

van de Poll, H.W., 1989. "Lithostratigraphy of the Prince Edward Island redbeds," *Atlantic Geology*, v. 23, 23-35

Table 1
1D Earth Resistivity Model for Prince Edward Island

Layer	Depth Certainty	Thickness	Resistivity (ohm-m) Certainty	Conductivity (S/m) Certainty	Comments
1. Overburden	1 – 3 m [1]	2 m	25 [2]	0.04 [24]	Till veneer (< 1 m thick) to blanket (< 3 m) is predominant over much of island, with a sand to clay-sandy matrix common [1]. Glaciofluvial deposits of kames, outwash plains, and small eskers comprised of poorly sorted sand-gravel and occasional boulders, occur on east half of island. Glaciomarine and postglacial marine deposits of sand and/or gravel common to west shoreline of island.
	[I]		[II]		Overburden has variable thickness < 1 m to < 3m, occasional deeper pockets of till and glaciofluvial deposits. Assign average 2 m thickness [1]. Resistivities for tills in Canada range 20-100 ohm.m [17]. Borehole logs reveal range 3-50 ohm.m for glacial overburden in parts of Nova Scotia (Cape Breton Island mostly) and Fredericton [2]. Assign midpoint 25 ohm.m, based on regional borehole data; possibly higher due to more resistive sandy till occurring on island. Limits 20, 100 ohm.m.

Table 1 (continued)
1D Earth Resistivity Model for Prince Edward Island

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m)	Comments
2. Sedimentary Basin	0 - 3 km [11]	3 km	140 [9]	0.007142 [24]	Magdalen Basin (part of Maritimes Basin / Maritime Rift), of Upper Paleozoic time, the largest and deepest sedimentary basin in Atlantic Canada, underlies PEI, east half of New Brunswick, north half of Nova Scotia, and parts of western Newfoundland, as well as Gulf of St. Lawrence [3].
	[I]		[II]		Near surface, nearly flat to shallow-dipping "redbed" clastic sedimentary strata (upper Paleozoic age) consisting sandstones, shales and conglomerates [4], with some coal beds. Minor limestone strata and evaporites (salt, anhydrite) in lower half of basin [5]. Greater degree of folded strata below approx. 2 km depth [5]. Limited exposure of bedrock on island [1]. On-shore exploration wells and MT survey indicate dominance of moderately electrically resistive sandstone and shale from surface to about 500 m depth, then highly conductive sandstone-shale with coaly material (with minor mafic volcanic rocks interlayers) is dominant to depth between 300-4000 m, with underlying moderately resistive sandstone to conglomerate strata. Granitic basement, highly resistive, encountered at 1400 m depth beneath west half of island [9]. Regional basin thickness map shows 1.5 km on western 1/3 of PEI and 3-4.5 km on eastern 2/3 [11]. Drury (1983) [ref. in [9]] suggests basin depth is 4 km on western part of PEI, increasing to 9 km beneath eastern portion. Offshore of PEI, generalized cross-section of Magdalen Basin shows 4 km thickness, but within a fault-bounded sub-basin depth increases to 7.3 km [12]. MT survey and on-shore exploration wells show basin is shallower beneath west half of island; with a granitic basement ridge about 1.4 km below west part of PEI [9]. Basement (Layer 3) not intersected at 4 km depth at east part of island [9]. Assign 3 km average thickness based on 1.4-4.5 km range.

Table 1 (continued)
1D Earth Resistivity Model for Prince Edward Island

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m)	Comments
2. Sedimentary Basin (continued)		Earlier (1970s) MT and magnetic variation surveys reveal: * 9 ohm.m to depth of 4 km [6] * 9 ohm.m to 3 km depth [19] 1986 MT survey [9] across PEI reveals: * 150 ohm.m for "redbed" sandstones and shales (upper Pictou Group), 0-500 m depth over entire island * <u>west half of island</u> - 10 ohm.m for sandstone-shale-coaly material (lower Pictou Group), between 500-1500 m - 500 ohm.m for sandstone-shale-coaly material plus underlying granitic basement ridge, between 1500-3000 m - area of granitic ridge, the 1D resistivity ranges 1600-33000 ohm.m across geoelectric strike, and 140-4300 ohm.m parallel to geoelectric strike * <u>east half of island</u> - 10 ohm.m for sandstone-shale-coaly material (lower Pictou Group), between 500-2700 m - 150 ohm.m for sandstone-shale-coaly material plus underlying sandstone-conglomerate strata, between 2700-4000 m Other resistivity values: * Assign 140 ohm.m weighted average (see Note1). based on most recent MT survey across PEI. Limits 10, 500 ohm.m.			

Table 1 (continued)
1D Earth Resistivity Model for Prince Edward Island

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m)	Comments
3. Upper Crust	3 – 8.8 km [13, 14, 15]	5.8 km	2700 [18]	0.000370 [24]	Encompasses the Avalon Zone, which on island of Newfoundland consists of late Precambrian igneous and sedimentary marine & subaerial clastic rocks overlain in places by Paleozoic shallow marine and terrestrial clastic sedimentary rocks with minor volcanic rock. Scattered, large, granitic intrusions, Late Precambrian-Cambrian and Devonian-Carboniferous age [8]. Potentially similar situation underlying PEI.
	[II]		[II]		Bottom depth scaled from regional seismic profiles situated offshore of PEI: * Line C [13] within 100 km of north shore of PEI, ranges 8.4-14.7 km, average 11.5 km * Line 88/1 [14] within 100 km of north shore of PEI, 6 km * Line 86-2 [15] is 40-100 km north of west end of PEI, 6 km Assign 8.8 km bottom depth, midpoint of range (6, 11.5 km) Other depths: * Avalon zone on Newfoundland island [7], 12 km * New England (USA) Appalachians [16], 7 km Lithoprobe MT transect [18] across Avalon Zone on island of Newfoundland shows resistivity range 400-5000 ohm.m. Other resistivity values: * Eastern Piedmont terrane (Avalon Zone equivalent) in southern Appalachians, 800 ohm.m for depth of 0~15 km [10]. Assign 2700 ohm.m, midpoint of range measured by Lithoprobe MT survey. Limits 400, 5000 ohm.m.

Table 1 (continued)
1D Earth Resistivity Model for Prince Edward Island

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m)	Comments
4. Middle Crust	8.8 – 23 km [13, 14, 15]	14.2 km	1000 [6]	0.001 [24]	Scaled from regional seismic profiles situated offshore of PEI: * Line C [13], thickness ranges 10.6-21.2 km, average thickness 15.9 km, bottom at 24.7 km * Line 88/1 [14], bottom depth 26 km * Line 86-2 [15], at 150 km north of PEI bottom depth 17.5 km Assign approx. 23 km, average of above depths. Other depths: * Avalon zone on Newfoundland island [7], 23 km * New England (USA) Appalachians [16], 22.2 km
	[II]		[I]		Regional MT transect [6] across Avalon Zone of PEI, indicates 2D resistivity 1000 ohm.m between 4-44 km depth. MT site at Morell (on east half PEI) reveals 1D resistivities of 50 and 500 ohm.m, at depth 4-44 km [6]. Other resistivity values: * Avalon zone on Newfoundland island ranges 7-65 ohm.m for depth 15-23 km [18] * Eastern Piedmont terrane (Avalon Zone equivalent) in southern Appalachians, 1000-10000 ohm.m for depth of ~15-20 km [10] Assign 1000 ohm.m, based on regional 2D model. Limit 50, 10000 ohm.m

Table 1 (continued)
1D Earth Resistivity Model for Prince Edward Island

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m)	Comments
5. Lower Crust	23 – 40.5 km [13, 14, 15]	17.5 km	1000 [6]	0.001 [24]	Scaled from regional seismic profiles situated offshore of PEI: * Line C [13], thickness ranges 14.9-18 km, average thickness 16.4 km, bottom at 41.1 km * Line 88/1 [14], bottom depth 43 km * Line 86-2 [15], at 150 km north of PEI bottom depth 37.5 km Assign approx. 40.5 km, average of above depths. Other depths: * Avalon zone on Newfoundland island [7], 34 km onshore [7], 40 km offshore [16] * New England (USA) Appalachians [16], 35.2 km
	[II]		[I]		Regional MT transect [6] across Avalon Zone of PEI, indicates 2D resistivity 1000 ohm.m between 4-44 km depth. MT site at Morell (on east half PEI) reveals 1D resistivities of 50 and 500 ohm.m, at depth 4-44 km [6]. Other resistivity values: * Avalon zone on Newfoundland island, 15 ohm.m for depth 23-34 km [18] * Eastern Piedmont terrane (Avalon Zone equivalent) in southern Appalachians, 45-450 ohm.m for depth of ~20-45 km [10] Assign 1000 ohm.m, based on regional 2D model. Limit 15, 10000 ohm.m. Possible overestimate of resistivity based on lower values detected on Newfoundland Avalon and Eastern Piedmont zones/terranes.

Table 1 (continued)
1D Earth Resistivity Model for Prince Edward Island

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m)	Comments
6. Upper Mantle	40.5 - 100 km [23]	59.5 km	100 [6]	0.01 [24]	Upper depth scaled from seismic transects [13, 14, 15]. Used generalized lower depth of 100 km [23].
	[III]		[I]		Regional MT transect [6] across Avalon Zone of PEI, indicates 2D resistivity 100 ohm.m between 44-95 km depth. MT site at Morell (on east half PEI) reveals 1D resistivities of 10 and 200 ohm.m, at depth 4-44 km [6]. Other resistivity values: * Eastern Piedmont terrane (Avalon Zone equivalent) in southern Appalachians, 1000-4000 ohm.m for depth of 45-100 km [10] * Canada regional model [23], 244 ohm.m for depth 0-100 km Assign 100 ohm.m, based on regional 2D model. Limits 10, 200 ohm.m.
7. Upper Mantle	100 - 250 km [23]	150 km	158 [25]	0.0063 [23]	Applied Canada regional model [23] for all depths and resistivities below 100 km. North American craton extends beneath Prince Edward Island. Canada regional model indicates 158 ohm.m for depth 100-250 km.
	[III]		[III]		Regional MT transect [6] across Avalon Zone of PEI, indicates 2D resistivity 20 ohm.m below 95 km depth. Other resistivity values: * Eastern Piedmont terrane (Avalon Zone equivalent) in southern Appalachians, 1000-7000 ohm.m for depth of 100-150 km, then 30-250 ohm.m for 150-200+ km [10]. Resistivity limits 20, 250 ohm.m.

Table 1 (continued)
1D Earth Resistivity Model for Prince Edward Island

Layer	Depth Certainty	Thickness	Resistivity (ohm-m)	Conductivity (S/m) Certainty	Comments
8. Upper Mantle	250–410 km [23] [III]	160 km	29 [25]	0.0346 [23] [III]	Assign Canada regional model
9. Transition Zone	410–520 km [23] [III]	110 km	8 [25]	0.1258 [23] [III]	Assign Canada regional model
10. Transition Zone	520–670 km [23] [III]	150 km	2.4 [25]	0.4168 [23] [III]	Assign Canada regional model
11. Lower Mantle	670–900 km [23] [III]	230 km	1.12 [25]	0.89125 [23] [III]	Assign Canada regional model
12. Lower Mantle	900–1000 km [23] [III]	100 km	0.47 [25]	2.0892 [23] [III]	Assign Canada regional model

Table 1 (continued)
1D Earth Resistivity Model for Prince Edward Island

NOTES:
Depth Certainty
- I = best representation
  - * overburden: geological report/map coverage of local area.
  - * crust: seismic/gravity transects crossing local area
- II = likely representative
  - * crust/upper mantle: geological and/or seismic transect of a regional nature.
- III = possibly representative (measurements from general compilations).

Resistivity/Conductivity Certainty
- I = best representation (measurements from site or nearby).
  - * overburden: resistivity measurement by surface geophysical method and/or borehole in local area.
  - * crust: resistivity measurement from resistivity survey, MT survey and/or borehole in local area.
- II = likely representative (resistivity values extrapolated from measurements taken at some distance from the site, typically greater than 100 km).
  - * overburden: resistivity value obtained by geophysical measurement, including borehole logs.
  - * sedimentary basin: value obtained by geophysical survey using variety of geophysical electromagnetic methods, including MT.
  - * crust: value obtained by regional MT survey.
- III = possibly representative (measurements from general compilations

NOTE 1: Calculation of Weighted Average for Layer 2, from 2D inversion profile [9].

Using Exploration Well #11 on Fig. 9 [9] to represent percentage extent of type of strata for (i) uppermost "redbed" sandstone and shale strata, (ii) sandstone-shale-coaly material strata, and (iii) lowermost sandstone and conglomerate strata, the areal extent of dominant / midpoint resistivity value was determined (e.g. uppermost strata accounts for 14 % of total rock types, and has an approximate resistivity of 150 ohm.m, thus 14 % x 150 ohm.m)

Well # 11: ((0.14 x 150) + (0.51 x 10) + (0.35 x 325, midpoint of range 150-500 ohm.m) = 140 ohm.m

Table 1 (continued)
1D Earth Resistivity Models for Prince Edward Island

CITED REFERENCES

1	Prest (1973) surficial geology map
2	Crow et al. (2015)
3	Eyles and Miall (2007)
4	van de Poll (1988)
5	Dietrich et al. (2009)
6	Kurtz and Garland (1976), Fig. 12, 21
7	Hughes et al. (1994), Fig. 15
8	Colman-Sadd et al. (2000), bedrock geology map
9	jones86] Jones and Garland (1986), Table 1, Fig. 9
10	Ogawa et al. (1996), Fig. 4
11	Stott and Aitken (1993), Fig. 1.1
12	Pinett et al. (2013)
13	Ewing et al. (1966), Table III
14	Hall et al. (1998), Fig. 2
15	Jackson (2002), Fig. 3
16	Jackson et al. (1998) Fig. 11
17	Palacky (1988)
18	McNeice (1998) including Figs. 5.3, 6.5, 6.11, 6.15, 6.17, 6.22 and 7.1
19	Bailey et al. (1974), resistivity section Fig. 11
23	Kelbert et al. (2009), Fig. 2, global and regional conductivity profile, Canada regional conductivity chosen
24	Converted from resistivity obtained from listed reference source
25	Converted from conductivity obtained from listed reference source

Appendix 9

Detailed Description of the Earth Resistivity Models for Quebec

1. Geological Settings of the Quebec

Major geological provinces underlying Quebec are presented in Figure 1, where the coverage area of 1Dlayered Earth model zones are also depicted.

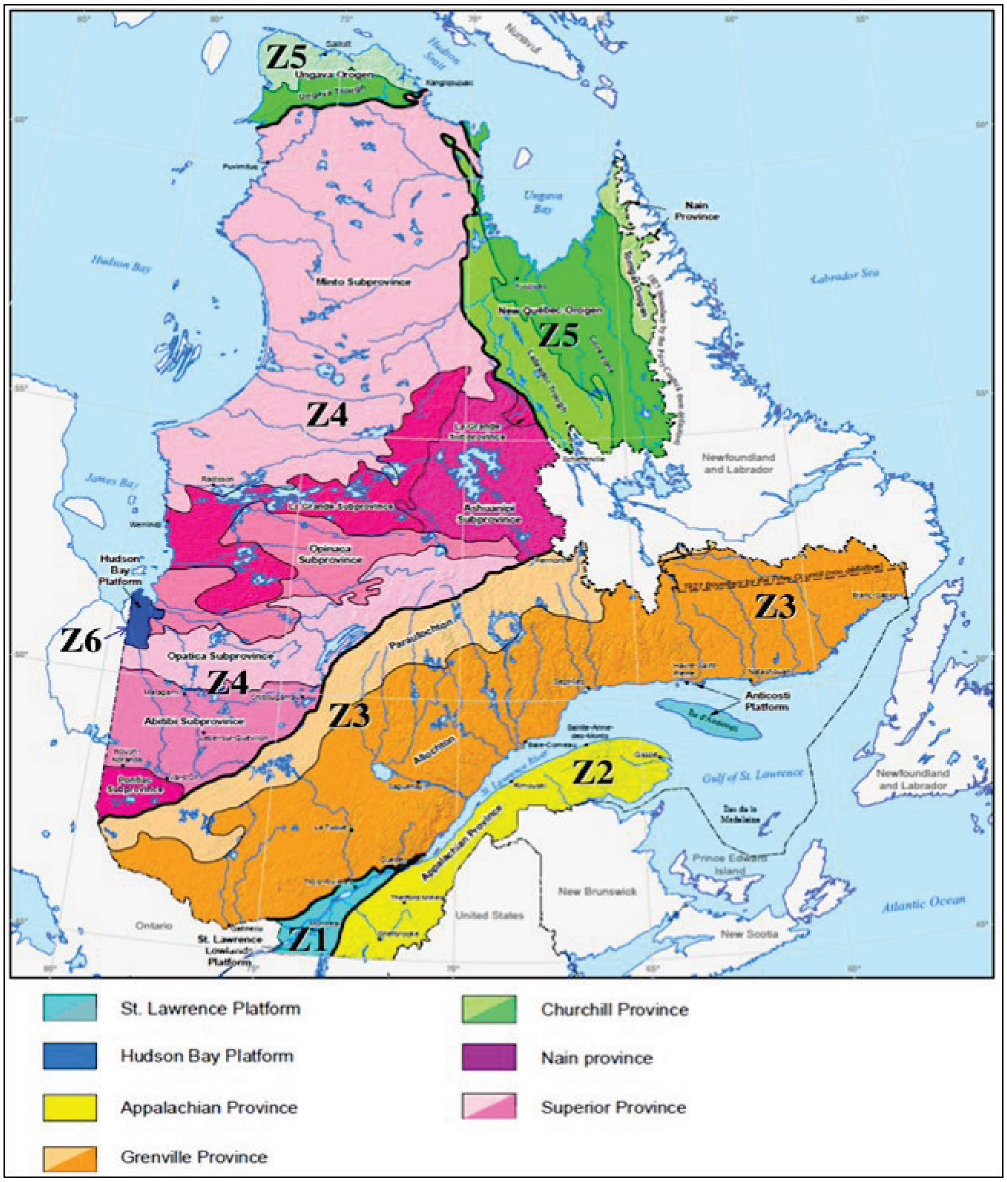


Figure 1. *Major geological provinces underlying Quebec (modified from MERN 2015). Coverage area of 1D-layered Earth model zones are also depicted.*

From MERN (2015), the geological setting of Quebec is described below:

- The **Superior Province** (4.3 to 2.5 billion years [Ga]) occupies a large part of the North American continent and also covers half of Québec, for a total surface area of 750,000 square km. The Superior Province is subdivided into a dozen subprovinces, half of them in Québec, with remainder in Ontario and Manitoba.

- The **Churchill Province** (2.9 to 1.1 Ga) covers an area of about 200,000 square km in the northern part of Québec, to the north and northeast of the Superior Province. It is characterized by four distinct geological zones: (i) the Ungava Orogen[25] (Ungava Trough), (ii) the New Québec Orogen (Labrador Trough), (iii) the Core Zone (formerly known as the Rae geological province), located between the Labrador Trough and the Torngat Orogen, is composed of Archean and Paleoproterozoic rocks (2.9 to 1.75 Ga) as well as Mesoproterozoic plutonic rocks (1.7 to 1.1 Ga), and (iv) the Torngat Orogen (2.1 to 1.75 Ga), located east of the Core Zone.

- The **Grenville Province** (2.7 Ga to 600 million years [Ma]) covers an area of 600,000 square km. It forms the southeast limit of the Superior Province and is divided into two parts: the parautochthonous and allochthonous belts
.
- The **Appalachian Province** (600 to 300 Ma) developed along the edge of the Canadian Shield during the Paleozoic, and covers an area of roughly 80,000 square km. It is divided into three distinct zones: 1) the Humber Zone, 2) the Dunnage Zone, and 3) the Gaspé Belt. It is bounded to the east by the Permo-carboniferous Magdalen Basin.

- The **St. Lawrence Platform** (570 to 430 Ma) developed at the end of the Proterozoic and during the Paleozoic, with the formation of the Saint Lawrence rift. It covers an area of more than 30,000 square km and overlies rocks of the Grenville Province.

- The **Hudson Bay Platform** (450 to 410 Ma) covers an area of roughly 5,500 square km in Québec just south of James Bay. It is composed of Paleozoic sedimentary rocks with a similar composition to those found in the St. Lawrence Platform

A thin cover of unconsolidated Quaternary glacial deposits, mostly till, overlies most of the Precambrian Shield, but up to 30m or more unconsolidated deposits – till, glaciomarine and glaciofluvial – overlie the St. Lawrence and Hudson Bay Platforms.

2. Zonal Earth resistivity models

Presented are 6 one-dimensional (1D) models representing the main geological provinces identified to underlie Quebec: Superior, Churchill, Grenville, Appalachian, St. Lawrence Platform and Hudson Bay Platform, as seen in Figure 1. Because the models are contiguous to each other, a general representation of lateral differences in crustal and mantle resistivity can be illustrated.

Three of the models (Superior, Churchill, Grenville geological provinces) encompass 93% of the province where the Precambrian Shield crystalline bedrock is exposed at surface. Two of the models (St. Lawrence Platform, Hudson Bay Platform) incorporate a sedimentary basin whereby the Precambrian is covered by sedimentary rock deposited during the Paleozoic era. The southern margin of Quebec is represented by the Appalachian province, a region of deformed sedimentary rock.

[25] Orogen: a regionally extensive belt of strata that has undergone folding and deformation as a result of the collision of tectonic plates, creating a mountain range.

Previously, Ferguson and Odwar (1998) prepared a generalized 1D model (Figure 2) covering all of Ontario and Quebec generated from a compilation of crustal-scale conductivity surveys (MT and controlled-source EM) carried out from the late 1970s to mid-1990s.

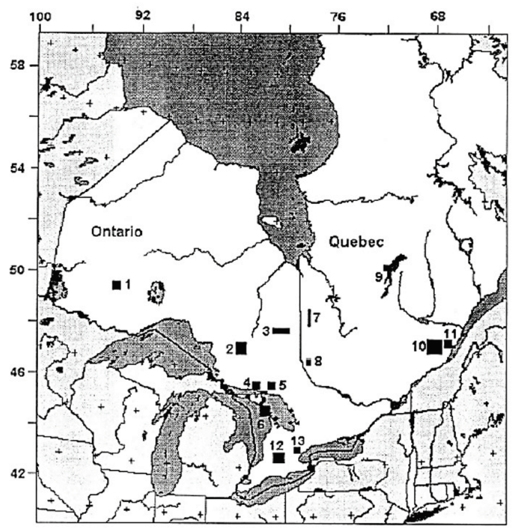


Fig. A3.2.3. Location of large-scale electrical conductivity soundings in Ontario and Québec. Numbers show the location of each study or group of studies: 1=AMT sounding by Koziar & Strangway (1978); 2= Kapuskasing Structural Zone, UTEM soundings by Kurtz et al. (1989), Bailey et al. (1989) and Jones et al. (1994), MT soundings by Kurtz et al. (1993), and long-period MT sounding by Schultz et al. (1993); 3=CSEM sounding by Duncan et al. (1980); 4=MT sounding by Kurtz et al. (1986*b*); 5=UTEM sounding by Boerner et al. (1994); 6=MT sounding by Mareschal et al. (1991); 7=MT sounding by Zhang & Chouteau (1992); 8=MT sounding by Kellett et al. (1992); 9=MT sounding by Zhang et al. (1995); 10=MT sounding by Kurtz (1982); 11=MT sounding by Mareschal & Cateland (1989); 12=CSEM sounding by Gómez-Trevino & Edwards (1983); 13=CSEM sounding by Duncan et al. (1980). GDS locations are not included in the figure.

Geological Unit	Resistivity (Ω.m) Average	Range	Comments
1. Overburden (0-25 m thick)	50	10-100	Conductance typically 0.05-0.5 S.
2. Sedimentary Basin (0-1 km)	100	10-1,000	Conductance typically 0-20 S.
3. Upper Crust (~0-15 km)	10,000	3,000-50,000	Locally more conducting in graphitic rocks, iron formations, and fractures.
4. Middle Crust (15-25 km)	300	100-10,000	Total mid and lower crustal conductance typically 20-40 S.
5. Lower Crust (25-40 km)	1000		
6. Mantle (40 km-100 km)	1000		
7. Mantle (100 km- 400 km)	100		
8. Mantle (400 m - 600 km)	10		

Table A3.2.1: 1D Resistivity Model for Ontario and Québec

Figure 2. *Quebec and Ontario layered Earth models (map with zone locations model and Table with model parameters) from Ferguson and Odwar, 1998.*

<u>Sources of Information</u>

Whenever possible regional MT survey results were applied with preference to the most recent survey. The most detailed MT-derived 2D profiles were produced by Adejunti et al. (2014, 2015) who re-processed MT data collected as part of the Lithoprobe program from the mid-1990s to 2000s which traversed across the Superior geological province of western Quebec and adjacent northeast and east Ontario. Where possible, localized audio-magnetotellutic survey (AMT) profiles were also used but these provide resistivity resolution to depths of only several km. MT surveys results from nearby New Brunswick and Nova Scotia provinces were used to provide guidance on lower and upper limits to the estimated resistivity value for the Appalachian geological province which continues into Quebec. However, the MT surveys preformed in New Brunswick and Nova Scotia were done prior to 1990 and tend to provide coarser resolution and shallower depth compared to recent MT surveys.

Depths for overburden – Layer 1 – was assigned by typically selecting half of the maximum general thickness mentioned on surficial geology maps. For models covering the Precambrian Shield north of the St. Lawrence River an estimated resistivity value, based on compilations prepared by others (e.g. Palacky, 1988) was applied. The same approach was applied to the overburden in the Hudson Bay

Platform. Resistivity of the overburden for the Appalachian model was based on values measured in down-hole resistivity surveys completed in adjacent New Brunswick and Nova Scotia. Numerous resistivity borehole logs have been completed in the St. Lawrence Platform within eastern Ontario with the average resistivity value applied to the Quebec part of the platform.

Thickness of the sedimentary basin strata – Layer 2 – for the St. Lawrence and Hudson Bay Platforms was obtained from regional isopach maps (Stott and Aitken, 1993; Sanford, 1993). Resistivity for the St. Lawrence Platform was chosen as the average midpoint for resistivities obtained from borehole logs of holes drilled into Paleozoic sedimentary rock in southwestern and eastern Ontario and Manitoba. For the Hudson Bay Platform, the applied resistivity for Layer 2 was obtained from a local magnetotelluric survey.

Depths of the upper, middle and lower crust – Layers 3 to 5 – were measured off a variety of seismic profiles undertaken mostly as part of the Lithoprobe program undertaken in the mid 1980s to 1990s. However, because depths varied between different surveys an average was assigned.

Depths, and in for some Zones the resistivity, for the middle and lower divisions of the upper mantle, transition zones, and lower mantle – Layers 8 to 12 – between 250 and 1000 km were based on the Canada regional conductivities determined by Kelbert et al. (2009).

For Zone 1 – St. Lawrence Platform – no regional or local MT transect was identified. However, resistivity for Layers 3 to 7 in Zone 1 were obtained by using results from the southernmost potion of 2D profiles prepared by Adejunti et el. (2014) and Fernberg (2011) crossing the same St. Lawrence Platform albeit in neighbouring eastern Ontario.

For Zone 2 – Appalachian Province – within Quebec no recent regional MT transect was identified. Instead, regional resistivity values for Layers 4 to 8 were estimated from earlier widely spaced resistivity measurements collected by Kurtz and Garland (1976), and resistivity values of upper Grenvillian crustal rocks obtained from 2D profiles covering eastern Ontario (Adejunti et al., 2014; Fernberg, 2011). For comparison purposes, resistivity values for the same crustal layers in Newfoundland (i.e. Humber Zone) and its equivalent continuation into the southern Appalachians (Ogawa et al., 1996) are also presented. A recent local AMT survey (J.A.G Mines, 2011) provided an estimate of resistivity for sedimentary rock comprising Layer 3 upper crust.

For Zone 3 – Grenville province – and Zone 4 – Superior province – the 2D profiles prepared by Adejunti et el. (2014, 2015) transecting northward following the Quebec-Ontario provincial boundary were the main source of resistivity values, which were applied to Layers 3 to 7 or 8 for the entire area of each respective Zone.

For Zone 5 – Churchill Province – no publicly available MT transects were found. Instead, a resistivity estimate for thee upper crust (Layer 3) was obtained by averaging resistivity values obtained from other MT transects across the Trans-Hudson Orogen in north-central Saskatchewan and western Manitoba, the western Churchill geological province of eastern NWT and Baffin Island. Because the Superior province is interpreted to underlie the Churchill province (i.e. Layer 3) (St. Onge et al., 2002; Bourlon et al. 2002), the resistivity values assigned for Layers 4 to 8 were obtained from the MT transect (Adejunti, 2014, 2015) across the northern part of the Superior Province.

For Zone 6 – Hudson Bay Platform - no publicly available MT transects particular to the Zone were found. Instead, resistivity values from the nearest MT transect (the profile following the Ontario-Quebec provincial boundary) were applied for Layers 3 to 8. Specifically, the resistivity values of the northern most end of this transect were used, obtained from examination of 2D profiles prepared by Adejunti et al. (2014, 2015).

The 1D layered-Earth models are presented in Tables 1 to 6 which summarize sources of depth and resistivity values and justification for their selection.

3. References

Adetunji, A., Ferguson, I.J. and Jones A.G., 2014. "Crustal and lithospheric scale structures of the Precambrian Superior-Grenville margin," *Tectonophysics*, vol.614, 146-169

Adetunji, A., Ferguson, I.J. and Jones A.G., 2015. "Imaging the mantle lithosphere of the Precambrian Grenville Province: large-scale electrical resistivity structures," *Geophysical Journal International*, v.201, no. 2, 1040-1061, 10.1093/gji/ggv060

Ayres, L.D., Lumbers, S.B., Milne, V.G. and Robeson, D.W., 1971. "Ontario geological map, northeast sheet," *Ontario Department of Mines and Northern Affairs*, Map 2200, scale 1:1013760

Bancroft, B., Craven, J.A., Enkin, R.J., Nicolas, M.P.B., and Roberts, B., 2014. "Results from a Magnetotelluric and Rock Property Study near Churchill, Manitoba," *Geological Survey of Canada*, Open File 7549, 21 p. doi:10.4095/293454

Becker, A., King, W F., Telford, W M., 1977. VLF mapping of geological structure, *Geological Survey of Canada*, Paper 76-25, 1977.

Bedard, P., 1993. "Postglacial and pre-last-glacial weathering of till on the high plateaus of central Gaspesie, Quebec, Canada," *Canadian Journal of Earth Sciences*, vol. 30. 1853-1860

Bernier, M.A., Elson, J.A. and Webber, J.A., 1987. "Overburden geochemistry and possible relations to gold-bearing alluvial deposits, southwest Gaspésie, Quebec,", *Geological Survey of Canada*, Open File 1586, 1987, ; 91 pages, doi:10.4095/130303

Bernius, G.R., 1996. Borehole geophysical logs from the GSC Borehole Geophysics Test Site at Bell's Corners, Nepean, Ontario, *Geological Survey of Canada*, Open File 3157, 1996, ; 38 pages, doi:10.4095/207617.

Blais, A. and Shilts, W.W., "Surficial geology of Saint-Joseph-de-Beauce map area, Chaudiere River valley, Quebec," <u>in</u> Current Research, Part B, Geological Survey of Canada, Paper 89-1B, 137-142

Boisvert, E. and Parent, M., 2008. "Carte isopaque des formations superficielles, secteur

Normetal/Lebel-sur-Quevillon, Abitibi, Quebec," *Commission geologique du Canada*, Dossier public 5830, echelle 1/250000

Bolduc, A.M., Paradis, S.J., Parent, M., Michaud, Y. et Cloutier, M., 2003. "Geologie des formation superficielles, Quebec, Quebec," *Commission geologique du Canada*, Dossier public 3835, echelle 1/50000 (version revisee)

Bourlon, E., Mareschal, J.C., Roest, W.R. and Telmat, H., 2002. "Geophysical correlation in the Ungava Bay area," *Canadian Journal of Earth Sciences*, vol. 39. 625-637 DOI: 10.1139/E01-098

Calvert, A.J. and Ludden, J.N., 1999. "Archean continental assembly in the southeastern Superior Province of Canada," *Tectonics*, vol.18, no.3, 412-429

Carr, S.D., Easton, R.M., Jamieson, R.A., and Culshaw, N.G., 2000. "Geologic transect across the Grenville Orogen of Ontario and New York," *Canadian Journal of Earth Sciences*, vol.37, 193-216

Clark, P.U., 1988. "Glacial geology of the Torngat mountains, "Labrador," *Canadian Journal of Earth Sciences*, v.25, 1184-1198

Comeau, F-A., Kirkwood, D., Malo, M., Asselin, E. and Bertrand, R. 2004. "Taconian mélanges in the parautochthonous zone of the Quebec Appalachians revisited: implications for foreland basin and thrust belt evolution," *Canadian Journal of Earth Sciences*, vol. 41, 1473-1490, doi: 10.1139/E04-083

Corrigan, D. and Tremblay, T., 2011. "Geology and metallogeny of Melville Peninsula: an update on recent activities of the GEM-Minerals Project," Geological Survey of Canada, 51 slides http://www.nunavutminingsymposium.ca/wp-content/uploads/2011/04/presentation-7-GEM-Multi-Metals-Project.pdf

Craven, J.A., Sanborn-Barrie, M., Roberts, B.J., Stefanescu, M. and Young, M., 2013. "Preliminary insights into the architecture of southern Cumberland Peninsula from magnetotelluric data," *Geological Survey of Canada*, Current Research 2013-3, 11 p. doi:10.4095/292117

Crow, H.L, Good, R.L., Hunter, J.A., Burns, R.A., Reman, A., and Russell, H.A.J., 2015. "Borehole geophysical logs in unconsolidated sediments across Canada," *Geological Survey of Canada*, Open File 7591, 1 .zip file. doi:10.4095/295753

Daigneault, R-A., 1996a. "Geologie des formations en surface, region du cap Wolstenhoime et de Kovik Bay, Quebec – Territoires du Nord-Quest," *Commission geologique du Canada*, Carte 1861A, echelle de 1/250000.

Daigneault, R-A., 1996b. "Geologie des formations en surface, region de Salluit et des las Nuvilik, Quebec – Territoires du Nord-Quest," *Commission geologique du Canada*, Carte 1862A, echelle de 1/250000.

Daigneault, R-A., 1997. "Geologie des formations en surface, region de Nouvelle-France, du Cratere du Nouveau-Quebec et Kangiqsujuaq, Quebec – Territoires du Nord-Quest," *Commission geologique du Canada*, Carte 1863A, echelle de 1/250000.

Daigneault, R-A., 2008. "Geologie du Quaternaire du nord de la peninsule d'Ungava, Quebec," *Commission geologique du Canada*, Bulletin 533, 115 p.

Dietrich, J., Lavoie, D., Hannigan, P. et al., 2011. "Geological setting and resource potential of conventional petroleum plays in Paleozoic basins in eastern Canada," *Bulletin of Canadian Petroleum Geology*, v.59, no.1, 54-84.

Eaton, D.W., Dineva, S., and Mereu, R., 2006. Crustal thickness and Vp/Vs variations in the Grenville orogen (Ontario, Canada) from analysis of teleseismic receiver functions, *Tectonophysics* 420, 223–238

Evans, S., Jones, A G., Spratt, J. and Katsube, J., 2003. "Central Baffin Electromagnetic Experiment (CBEX), Phase 2," Geological Survey of Canada, Current Research (Online) no. 2003-C24, 2003; 10 pages http://dx.doi.org/10.4095/214206

Evans, S., Jones, A.G., Spratt, J. and Katsube, J., 2005. "Central Baffin electromagnetic experiment (CBEX): Mapping the North American Central Plains (NACP) conductivity anomaly in the Canadian arctic," Physics of the Earth and Planetary Interiors, v.150, 107-122 <http://dx.doi.org/10.1016/j.pepi.2004.08.032>

Ferguson, I.J. and Odwar, H.D., 1998: "Appendix 4: Review of conductivity soundings in Canada," in Geomagnetically Induced Currents: Geomagnetic Hazard Assessment Phase II, Final Report, Volume 3; Geological Survey of Canada, Open File Report 3420, p. A3-1 -A3-121.

Fernberg, P.A., 2011. Earth Resistivity Structures and their Effects on Geomagnetic Induction in Pipelines, Ph.D thesis, *Carleton University*, Dept. of Earth Sciences, 216 p.

Gadd, N.R., 1971. "Pleistocene geology of the Central St. Lawrence Lowland," *Geological Survey of Canada*, Memoir 359

Geological Survey of Canada, 2014. "Surficial geology of Canada," Canadian Geoscience Map 195 (preliminary, Surficial Data Model v. 2.0 conversion of Map 1880A), scale 1:5000000 doi:10.4095/295462

Gowan, E. J., Ferguson, I. J., Jones, A. G., and Craven, J. A., 2009. "Geoelectric structure of the Northeastern Williston basin and underlying Precambrian lithosphere," *Canadian Journal of Earth Science*, 46, no. 6, 46, 441-464. <http://dx.doi.org/10.1139/E09-028>.

Hall, J., Louden, K.D., Funck, T. and Deemer, S., 2002. "Geophysical characteristics of the continental crust along the Lithoprobe Eastern Canadian shield Onshore-Offshore Transect (ESCOOT): a review," *Canadian Journal of Earth Science, v. 39, 569-587* doi:10.1139/E02-005

Haslam, C.R.S., 1971. "Magnetotellurics in the Eastern Townshops of Quebec," Ph.D thesis, Dept. of Mining and Metallurgical Engineering, *McGill University*, 239 p.

Hughes, S. and Hall, J., 1994. "The seismic velocity structure of the Newfoundland Appalachian orogen", *Journal of Geophysical Research*, v. 99, no. B7, 13633-13653.

Hunter, J.A., burns, R.A., Good, R.L., Aylsworth, J.M., Pullan, S.E., Perret, D. and Douma, M., 2007. "Borehole shear wave velocity measurements of Champlain Sea sediments in the Ottawa-Montreal region," *Geological Survey of Canada*, Open File 5345

Hynes, A., Indares, A., Rivers, T. and Gobeil, A., 2000. "Lithoprobe line 55: integration of out-of-plane seismic results with surface structure, metamorphism, and geochronology, and the tectonic evolution of the eastern Grenville Province," *Canadian Journal of Earth Science*, 37, 341-358.

J.A.G. Mines Ltd., 2011. "Forms 51-101 F1 and F2 statement of reserves data and other oil and gas information as at September 30th 2011," prepared by Paul Laroche, Report 5511, 74 p.

Jackson, H.R., Marillier, F. and Hall, J., 1998. "Seismic refraction data in the Gulf of Saint Lawrence: implications for the lower-crustal blocks," *Canadian Journal of Earth Science*, v. 35, 1222-1237

Johnson, M.D., Armstrong, D.K., Sanford, B.V., Telford, P.G. and Ritka, M.A., 1992. "Paleozoic and Mesozoic Geology of Ontario," *Ontario Geological Survey*, Special Volume 4, Part 2, 07-1010. http://www.geologyontario.mndmf.gov.on.ca/mndmfiles/pub/data/imaging/sv04-02/sv04-02.pdf

Jones, A.G., Snyder, D., Hanmar, S., Asudeh, I., White, D., Eaton, D. and Clarke, G., 2002. "Magnetotelluric and teleseismic study across the Snowbird Tectonic Zone, Canadian Shield: A Neoarchean mantle suture?," Geophysical Research Letters, v.29, no.17, 1829 <http://dx.doi.org/10.1029/2002GL015359>

Jones, A.G., Ledo, J., Ferguson, I.A., Craven, J.A., Unsworth, M.J., Chouteau, M. and Spratt, J.E., 2014. "The electrical resistivity of Canada's lithosphere and correlation with other parameters: contributions from Lithoprobe and other programs, *Canadian Journal of Earth Science*, v. 51, 573-617, doi:10.1139/cjes-2013-0154

Kelbert, A., Schultz, A., and Egbert, G., 2009. "Global electromagnetic induction constraints on transition-zone water content variations," *Nature*, v. 460, no. 20, August 2009, 1003-1006. http://dx.doi.org/10.1038/nature08257

Keyser, J.H. and Prest, V.K (compilers), 1975. "Drift-thickness contours, Montreal Island-Ile de Montreal," *Geological Survey of Canada*, Map 1427A, scale 1:50000 (to accompany Paper 75-27 by V.K Prest and J.Hode Keyser)

Kurtz, R.D, and Garland, G.D., 1976. "Magnetotelluric measurements in eastern Canada", *Geophys. J. R. Soc.*, v. 45, 321-347.

Lavoie, D., et al., D. Lavoie, C. Rivard, R. Lefebvre, S. Séjourné, R. Thériault, M.J. Duchesne, J.M.E.

Ahad, B.Wang, N. Benoit, and C. Lamontagne, 2013. "The Utica Shale and gas play in southern Quebec: Geological and hydrogeological syntheses and methodological approaches to groundwater risk evaluation." Int. J. Coal Geol. (2013), http://dx.doi.org/10.1016/j.coal.2013.10.011

Livada, T., Hurich, C. and Farquharson, C. 2013. "Seismic and Magnetotelluric Fieldwork in the Howley Basin", Memorial University of Newfoundland, PowerPoint, 21 pages http://www.nr.gov.nl.ca/nr/energy/petroleum/onshore/PEEP/22_Presentation2013.pdf

Ludden, J. and Hynes, A., 2000. The Lithoprobe Abitibi-Grenville transect: two billion years of crust formation and recycling in the Precambrian Shield of Canada, *Canadian Journal of Earth Science*, 37, 459-476.

Lyons, J.A., Forsyth, D.A. and Mair, J.A., 1980. "Crustal studies in the La Malbaie region, Quebec," *Canadian Journal of Earth Sciences*, vol. 17. 478-490

Martignole, J., Calvert, A.J., Friedman, R. and Reynolds, P., 2000. "Crustal evolution along a seismic section across the Grenville Province (western Quebec)," *Canadian Journal of Earth Sciences*, vol. 37. 291-306

Martignole, J. and Clavert, A.J., 1996. "Crustal-scale shortening and extension across the Grenville Province of western Québec, *Tectonics*, vol. 15, no. 2, abstract

McDonald, B.C. and Shilts, W.W., 1971. "Quaternary stratigraphy and events in southeastern Quebec," Geological Society of America Bulletin, vol. 82, 683-698
doi: 10.1130/0016-7606(1971)82[683:QSAEIS]2.0.CO;2

McNeice, G.W., 1998. "Magnetotelluric investigation of the Appalachians, Newfoundland, Canada", M.Sc thesis, *Memorial University of Newfoundland*, Dept. of Earth Sciences, St. John's, 207 p. http://collections.mun.ca/PDFs/theses/GaryWayneMcNeice.pdf

Mereu, R.F., 2000. "The complexity of the crust and Moho under the southeastern Superior and Grenville provinces of the Canadian Shield from seismic refraction – wide-angle reflection data," *Canadian Journal of Earth Science*, 37, 439-458.

MERN, 2015. "Geological Overview", Ministere des Energie et Ressources naturelles, 1 p. https://www.mern.gouv.qc.ca/english/mines/geology/geology-overview.jsp

Mwenifumbo, C J., Killeen, P G., Thorleifson, L H., 1995. "Borehole geophysical logs, overburden holes, southeastern Manitoba," *Geological Survey of Canada*, Open File 2775, 1995, 15 p., doi:10.4095/203639.

Norris, A.W., 1993. " Hudson Platform· Geology; Chapter 8 in Sedimentary Cover of the Craton in Canada, D.F. Stott and J.D. Aitken (ed.), *Geological Survey of Canada*, Geology of Canada, no. 5, p. 653-700 (also Geological Society of America, The Geology of North America, v. D-1).

Ogawa, Y., Jones, A.G., Unsworth, M.J., Booker, J.R., Xinyou, L., Craven, J., Roberts, B., Parmelee, J. and Farquharson, C., 1996. "Deep electrical conductivity structures of the Appalachian orogen in the southern U.S.", *Geophysical Research Letters*, v. 23, no. 13, 1597-1600.

Paradis, S.J., parent, M., Perret, D. and Begin, C., 2002. "Geologie des formations en surface, Bagotville, Quebec," *Commission geologique du Canada*, Carte 2015A, echelle 1:50000

Paradis, S.J., "Geologie des formations en surface et histoire glaciaire, Lac Blouin, Quebec," *Commission geologique du Canada*, Carte 2017A, echelle 1/100000

Parent, M., Rivard, C., Lefebvre, R., Carrier, M.-A., and S. Séjourné., 2014. "Hydrogeological systems of the Montérégie Est region, southern Quebec: Fieldtrip Guidebook," GeoMontréal 2013 Conference; *Geological Survey of Canada*, Open File 7605, 42 p. doi:10.4095/294604

Pinet, N., Lavoie, D., Keating, P. and Brouillette, P., 2008., "Gaspé belt subsurface geometry in the northern Québec Appalachians as revealed by an integrated geophysical and geological study: 1 — Potential field mapping," Tectonophysics, v. 460, no. 1-4, 34-54

Pinet, N., Lavoie, D., Keating, P. and Duchesne, M., 2013. "The St Lawrence Platform and Appalachian deformation front in the St Lawrence Estuary and adjacent areas (Quebec, Canada): structural complexity revealed by magnetic and seismic imaging," Geol. Mag., 17 p. doi:10.1017/S0016756813001015

Pinet, N., 2013. "Gaspé Belt subsurface geometry in the northern Québec Appalachians as revealed by an integrated geophysical and geological study: 2- Seismic interpretation and potential field modelling results," *Tectonophysics*, vol. 588, 100-117, doi:10.1016/j.tecto.2012.12.006

Palacky, G.J., 1988. "Resistivity characteristics of geologic targets" in *Electromagnetic Methods in Applied Geophysics-Theory*, Vol.1, M.N. Nabighian (ed.); Society of Exploration Geophysicists, 53-130.

Palacky, G.J., 1992. Helicopter geophysical surveys at the Val Gagne test site, District of Cochrane, Ontario, *Geological Survey of Canada*, Open File Report 2503, 14 p. <ftp://ftp2.cits.rncan.gc.ca/pub/geott/ess_pubs/133/133370/of_2503.pdf>.

Rampton, V.N., 1984. "Surficial geology, New Brunswick," *Geological Survey of Canada*, Map 1594A, scale 1:500000

Rappol, M., 1993. "Ice flow and glacial transport in lower St. Lawrence, Quebec," *Geological Survey of Canada*, Paper 90-19

Roberts, B. and Craven, J., 2012. Results of a Magnetotelluric Survey in Churchill, Manitoba: GEM Energy, Hudson Bay; *Geological Survey of Canada*, Open File 7151, 21 p. http://dx.doi.org/10.4095/291442

Rondenay, S., Bostock, M.G., Hearn, T.M., White, D.J., Wu, H., Senechal, G., Ji, S., and Mareschal, M., 2000. "Teleseismic studies of the lithosphere below the Abitibi-Grenville Lithoprobe transect," *Canadian Journal of Earth Science*, 37, 415-426.

Sanford, B.V. and Arnott, R.W.C., 2010. "Stratigraphic and structural framework of the Potsdam Group in eastern Ontario, western Quebec, and northern New York State," *Geological Survey of Canada*, Bulletin 597, 83 p.

Sanford, B.V., 1993. " St. Lawrence Platform - Geology; Chapter 11 in Sedimentary Cover of the Craton in Canada, D.F. Stott and J.D. Aitken (ed.), *Geological Survey of Canada*, Geology of Canada, no. 5, p. 723-786 (also Geological Society of America, The Geology of North America, v. D-1).

Shilts, W.W., 1981a. "Surfical geology of the Lac Megantic area, Quebec," *Geological Survey of Canada*, Memoir 397

Shilts, W.W., 1981b. "Surficial geology, Lac-Megantic, *Geological Survey of Canada*, Map 1494A, scale 1:100000

Shilts, W.W. and Smith, S.L., 1988. "Glacial geology and overburden frilling in prospecting for buried gold placer deposits, southeastern Quebec," in, Prospecting in areas of Glaciated Terrain, Macdonald, D R (ed.); Mills, K A (ed.)141-169

Sinha. A.K., 1980. "Overburden characteristics in the Alfred-Hawkesbury area, Ontario, obtained by d.c. electrical soundings," in Current Research, Part C, *Geological Survey of Canada* , Paper BO-1C. p.1-12

Sinha, A.J., 1990. Stratigraphic mapping of sedimentary formation in southern Ontario by ground electromagnetic methods, *Geophysics*, 55, 1148-1157.

Skinner, R.G., 1973. "Quaternary stratigraphy of the Moose River Basin, Ontario," *Geological Survey of Canada*, Bulletin 225, 77 p.

Spencer, C., Green, A., Morel-a-l'Huisser, P. and Milkereit, B., 1989. "The extension of Grenville basement beneath the northern Appalachians: results from the Quebec-Maine seismic reflection and refraction surveys," *Tectonics*, vol. 8, no. 4, 677-696

Spratt, J., Hogg, C., Jones, A.G. and Corrigan, D., 2010. "Preliminary images of the lithosphere beneath the Melville Peninsula, Nunavut using magnetotelluric methods," Canadian Society of Exploration Geophysicists, GeoCanada 2010 Conference Abstracts, 4p. <http://www.cseg.ca/conventions/abstracts/2010/2010abstracts/0692_GC2010_Preliminary_images_of_lithosphere_beneath_Melville_Peninsula.pdf>

Spratt, J., 2012c. "Diamonds III - MT acquisition and analysis report," Geological Survey of Canada, in-preparation, 31 p.

St. Onge, M.R., Scott, D.J. and Wodicka, N., 2002. "Review of crustal architecture and evolution in the Ungava Peninsula — Baffin Island area: connection to the Lithoprobe ECSOOT transect," *Canadian Journal of Earth Sciences*, vol. 39, 589-610, DOI: 10.1139/E02-022

Stott, D.F. and Aitken, J.D. 1993. "Introduction," Chapter 1 in Sedimentary Cover of the Craton in Canada, D.F. Stott and J.D. Aitken (ed.). *Geological Survey of Canada*, Geology of Canada, no.5, p.1-7 (also Geological society of America, The Geology of North America, v. D-1)

Theriault, R. and Laliberte, J-Y., 2009. "Current Exploration Activities and Hydrocarbon Plays in Québec, Presentation 13," in Hydrocarbon systems in the Paleozoic basins of eastern Canada – Presentations at the Calgary 2007 workshop (D. Lavoie et al), *Geological Survey of Canada*, Open File 5980, DVD, Slide 76

Theriault, R., 2012. "Geology of Quebec," *Ministere des Ressources naturelles, Direction de l'information geologique du Quebec*, , Map DV2012-7, scale 1:2000000

van Staal, C.R. and Barr, S.M., 2012. "Lithospheric architecture and tectonic evolution of the Canadian Appalachians and associated Atlantic margin", Chapter 2 *in* Tectonic Styles in Canada: the Lithoprobe perspective, *edited by* J.A. Percival, F.A. Cook, and R.M. Clowes, *Geological Association of Canada*, special Paper 49, 41-95.

Wardle, R.J., James, D.T., Scott, D.J. and Hall, J., 2002. "The southeastern Churchill Province: synthesis of a Paleoproterozoic transpressional orogen," *Canadian Journal of Earth Science*, v. 39, 639-663, doi: 10.1139/E02-004

White, D.J., Forsyth, D.A., Asudeh, I., Carr, S.D., Wu, H., Easton, R.M., and Mereu, R.F., 2000. A seismic-based cross-section of the Grenville Orogen in southern Ontario and western Quebec, *Canadian Journal of Earth Science*, 37, 183-192.

White, D.J., Thomas, M.D., Jones, A.G., Hope, J. Nemeth, B. and Hajnal, Z., 2005. "Geophysical transect across a Paleoproterozoic continent-continent collision zone, The Trans-Hudson Orogen," *Canadian Journal of Earth Sciences*, v. 42, 385-402. http://dx.doi.org/ 10.1139/E05-002

Williams, H., "Appalachian orogen in Canada," *Canadian Journal of Earth Science*, 16, 792-807.

Williams, H., 1995. "Temporal and spatial divisions," Chapter 2 in Geology of the Appalachian-Caledonian Orogen in Canada and Greenland (ed.) H. Williams, *Geological Survey of Canada*, Geology of Canada, no.6, 21-44 (also *Geological Society of America*, the Geology of North America, V. F-1)

Table 1
1D Earth Resistivity Models for Quebec – Zone 1 (St. Lawrence Platform)

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m) / Certainty	Comments
	Continuing from eastern Ontario to past Quebec City, Zone 1 incorporates the St. Lawrence Platform (also referred to as Central St. Lawrence Lowland), a sedimentary basin of moderately flat-lying sandstone, conglomerate, shale, dolostone and limestone. In turn, the sedimentary basin overlies crystalline rocks of the Precambrian Grenville geological province.				
1. Overburden	1.5 – 145 m [2, 3, 4, 5, 6]	30 m	20 [2]	0.05 [24]	Variety of overburden. Mainly glaciomarine / marine clay and silt (Leda Clay) with areas of sands / gravels overlying till blanket (till exposed as large patchy occurrences) [1]. Older and modern alluvial sediments (stratified silt, sand, clay and gravel) of early to present St. Lawrence River deposited on top of marine sediments, paralleling river. Organic peat bogs in some areas.
	[I]		[I]	Variable thickness. Casselman, Lefaivre and Lemieux (in Ontario) to Riguad, boreholes indicate 16-39m total thickness, locally thicker 63-145m near Lefaivre; 16-53m thick [2, 3]; Montreal Island, 1.5-15m, commonly 3-6m [4]. Boreholes show basal till typically < 2 m thick; remainder of overburden clay and silt, sometimes with interbeds of silt and sand 2-20m thick. Trois-Rivieres to Monteregain Hills region, overburden about 20-35m thick (continuous 5m till, continuous clay 20-30m thick), locally exceeds 80m [5, 6]. South of Monteregian Hills to Cdn-US border. Overburden <5-30m thick (continuous till 5-30m, discontinuous clay <6m thick) [6].	
	Leda Clay overburden is electrically conductive, ranging 1-4 [8], 1-20 [9], or 20-80 [10] ohm.m. Boreholes through Leda Clay dominant overburden in eastern Ontario show resistivity range about 3-40 ohm.m, average approx. 20 ohm.m [2]. Tills in Canada range 20-100 ohm.m [11]. Borehole logs reveal range 25-100 ohm.m, average 80 ohm.m, in tills within southern Ontario portion of St. Lawrence Lowlands [2]. Sand-dominant soil in eastern Ontario ranges 20-50 ohm.m [8]. Assign average 20 ohm.m, based on borehole data, on basis Leda Clay is dominant overburden. Limits 1, 40 ohm.m				

Table 1 (continued)
1D Earth Resistivity Models for Quebec – Zone 1 (St. Lawrence Platform)

<table>
<tr><th rowspan="2">Layer</th><th>Depth</th><th rowspan="2">Thickness</th><th>Resistivity (ohm-m)</th><th rowspan="2">Conductivity (S/m)</th><th rowspan="2">Comments</th></tr>
<tr><th>Certainty</th><th>Certainty</th></tr>
<tr><td rowspan="3">2. Sedimentary Basin</td><td>0 – 2 km
[12, 13, 14]</td><td rowspan="2">2 km</td><td>200
[16, 10, 2]</td><td rowspan="2">0.005
[24]</td><td rowspan="2">Bedrock comprised of Cambrian-Ordovician sequences of carbonates (dolostone, limestone) and clastics (conglomerate, sandstone, shale), moderately tilted , becoming more synclinal toward Quebec City. Western most part of Zone (w. of Montreal) underlain by clastic sedimentary rock with upper 1/3 of strata being dolostone & limestone . Middle (Trois-Rivieres) and eastern part of Zone underlain by clastic & carbonate sedimentary rock with upper 1/2 of strata being shales (including hydrocarbon-bearing Utica Group).</td></tr>
<tr><td>[I]</td><td>[I]</td></tr>
<tr><td colspan="5">Depth about 800 m in western part of Zone (Vaudreuil and Valleyfield areas), increasing southwestward to about 3500 m SE in the Eastern Townships towards the Quebec-Maine international border [12, 13]. Ste-Croix; about 800 m thick [14]. In Charlevoix area, about 1 km thick [15].

Assign approx. midpoint 2 km thickness. Shallower at west end of Zone, and along north shore of St. Lawrence River; deeper at SE margin of Zone. In Ottawa area Paleozoic sandstone and dolo/limestone ranges 250-400 ohm.m [16] in boreholes.

Borehole logs from southern and eastern Ontario show limestone ranges 55-200 ohm (average 105 ohm.m); dolostone 100-200 ohm.m; siltstone/mudstone 50-80 ohm.m; shale 20-60 ohm.m (average 40 ohm.m) [2].

MT profile in Ottawa valley indicates < 150 ohm.m [10].

MT transect across NE-SE Ontario indicates < 450 ohm.m [17].

In southwest Ontario, EM surveys indicate Paleozoic interbedded shale and limestone ranges, 11-23 ohm.m; limestone with minor shale & silt 20-150 ohm.m; dolostone 150-750 ohm.m [18].

Carbonate strata in WCSB in southeastern Manitoba ranges 20-50 ohm [19]. MT profile [20] south of Churchill Manitoba shows 20-100 ohm.m for Paleozoic bedrock (dolomitic mudstone, wackestone and dolomitic limestone [21].

Assign midpoint approx. 300 ohm.m for western part of Zone dominated by coarser clastic (pebble conglomerate, sandstone) and carbonate bedrock. Limits 150, 400 ohm.m.

Assign weighted average approx. 180 ohm.m for eastern part of Zone where half of strata is comprised of less resistive shales (see Note 1). Limits 20, 400 ohm.m

Assign overall weighted average approx. 200 ohm.m (see Note 2). Limits 20, 450 ohm.m</td></tr>
</table>

Table 1 (continued)
1D Earth Resistivity Models for Quebec – Zone 1 (St. Lawrence Platform)

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m)	Comments
3. Upper Crust	2 – 10 km [17, 26]	8 km	4300 [17,10]	0.000232 [24]	Metamorphic rocks (gneisses, quartzite, marble) and intrusives (granite, syentite, gabbro) of the Grenville geological province.
	[I, II]		[II]		Scaled from regional seismic profiles: * composite line 52-53-54 [22] NW of Montreal, possibly 15 km bottom depth * eastern Ontario-upper New York [26], 9-18 km (midpoint 13 km) Distinct visual change of resistivity on MT transect at 6 km depth [17] Assign 10 km, midpoint of above depths (6, 15 km)
	Resistivity – Zone 1 * no MT transect identified within the Zone Resistivity – other locations * MT transect [17] across NE and SE Ontario indicates approx. 2600 ohm.m to 6 km depth, within St. Lawrence valley * MT transect [10] in Ottawa Valley indicates range 1100 to predominately 6000 ohm.m to 6 km depth Assign 4300 ohm.m, (midpoint of 2600-6000 ohm.m). Limits 1100, 6000 ohm.m				
4. Middle Crust	10 – 30 km [22, 26]	20 km	300 [17]	0.003333 [24]	Scaled from regional seismic profiles: * composite line 52-53-54 [22] NW of Montreal, possibly 33 km bottom depth * eastern Ontario-upper New York [26], midpoint 13 – possible 28 km.
	[II]		[II]		Assign 30 km, midpoint of above depths (28, 33 km)
	Resistivity – Zone 1 * no MT transect identified within the Zone Resistivity – other locations * MT transect [17] across NE and SE Ontario indicates approx. 300 ohm.m, within St. Lawrence valley, excluding <10 ohm.m conductor at 24-40 km depth. * MT transect [10] in Ottawa Valley indicates < 500 ohm.m Assign 300 ohm.m. Upper limit 500 ohm.m				

Table 1 (continued)
1D Earth Resistivity Models for Quebec – Zone 1 (St. Lawrence Platform)

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m)	Comments
5. Lower Crust	30 – 45 km [27, 22]	15 km	300 [17]	0.003333 [24]	Scaled from regional seismic profiles: * average 36 km depth [27] in Vaudreuil area (depth diminishes from Ontario northeastward to Quebec) * composite line 52-53-54 [22] NW of Montreal, possibly average 45 km bottom depth * eastern Ontario-upper New York [26] average 45 km depth
	[I]		[II]		Assign 40 km, midpoint of above depths (36, 45 km)
	Resistivity – Zone 1 * no MT transect identified within the Zone Resistivity – other locations * MT transect [17] across NE and SE Ontario indicates approx. 300 ohm.m, within St. Lawrence valley, excluding <10 ohm.m conductor at 24-40 km depth Assign 300 ohm.m. Upper limit 500 ohm.m				
6. Upper Mantle	45 - 100 km [23]	55 km	700 [17]	0.001428 [24]	Used generalized lower depth of 100 km [23].
	[III]		[II]		Resistivity – Zone 1 * no MT transect identified within the Zone Resistivity – other locations * MT transect [17] across NE and SE Ontario indicates range 300-3000 ohm.m, within St. Lawrence valley Assign 700 ohm.m, weighted average (300 ohm.m x 85%, 3000 x 15%) Limit 300, 3000 ohm.m

Table 1 (continued)
1D Earth Resistivity Models for Quebec – Zone 1 (St. Lawrence Platform)

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m)	Comments
7. Upper Mantle	100 - 250 km [23]	150 km	300 [17]	0.003333 [24]	Used generalized lower depth of 250 km [23] .
	[III]		[II]	Resistivity – Zone 1 * no MT transect identified within the Zone Resistivity – other locations * MT transect [17] across NE and SE Ontario indicates 300 ohm.m, within St. Lawrence valley * Canada regional model [23] indicates 158 ohm.m for depth 100-250 km Assign 300 ohm.m. Lower limit 158 ohm.m	

Table 1 (continued)
1D Earth Resistivity Models for Quebec – Zone 1 (St. Lawrence Platform)

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m)	Conductivity (S/m) / Certainty	Comments
8. Upper Mantle	250–410 km [23] / [III]	160 km	29 [25]	0.0346 [23] / [III]	Assign Canada regional model [23] for all depths and resistivities below 250 km.
9. Transition Zone	410–520 km [23] / [III]	110 km	8 [25]	0.1258 [23] / [III]	Assign Canada regional model
10. Transition Zone	520–670 km [23] / [III]	150 km	2.4 [25]	0.4168 [23] / [III]	Assign Canada regional model
11. Lower Mantle	670–900 km [23] / [III]	230 km	1.12 [25]	0.89125 [23] / [III]	Assign Canada regional model
12. Lower Mantle	900–1000 km [23] / [III]	100 km	0.48 [25]	2.0892 [23] / [III]	Assign Canada regional model

See end of Table 6 for abbreviations and notes

Table 1
1D Earth Resistivity Models for Quebec – Zone 1 (St. Lawrence Platform)

NOTE 1: Calculation of Weighted Average for eastern part of Zone 1 for Layer 2, whereby 50 % of strata comprised of conglomerate / sandstone and limestone / dolostone, and 50 % of strata dominated by shale. Results below are rounded.

((0.5 x 325 ohm.m, midpoint of range 250-400 for strata consisting of sandstone and limestone / dolostone) + (0.5 x 40 ohm.m, average of range 20-60 for shale strata)) = approx. 180 ohm.m

NOTE 2: Calculation of Weighted Average for overall resistivity of Zone 1 for Layer 2, whereby western part comprises 20 % of the zone and has assigned resistivity of 300 ohm.m, and eastern part of the zone comprises 80 % of area and has assigned resistivity of 180 ohm.m.

(0.2 x 300 ohm.m) + (0.8 x 180 ohm.m) = approx. 200 ohm.m

Table 2
1D Earth Resistivity Models for Quebec – Zone 2 (Appalachian Geological Province)

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m) / Certainty	Comments
	The folded and thrust-faulted Appalachian geological province in Quebec is occupied by three lithotectonic zones, from northwest to southeast, the Humber Zone, the narrow and discontinuous Dunnage Zone and the Gaspe Belt [37]. At middle crustal depths, the Appalachian Geological Province rests on Precambrian metamorphosed crystalline rock of the Grenville Province. The Humber Zone represents the ancient continental margin of the North America. The western boundary of the Humber Zone is defined by the limit of Appalachian deformation (known as “Logan’s line”) with the eastern limit being the Baie Verte-Brompton Line, a complex steep dipping fault zone with numerous fragments of oceanic crust (ophiolites; forming asbestos deposits in Quebec’s Eastern Townships, and sedimentary melanges) [38, 39]. The Humber margin also extends further east at depth. Accretion during formation of the Appalachian Geological Province has resulted in deformation and thrusting of the Humber Zone over the St. Lawrence Platform. The Dunnage Zone represents remnants of various continental and oceanic arc terranes (prior accretion to the Humber Zone), and is dominated by ophiolites, mafic volcanic rocks, volcanoclastic rocks and associated clastic marine and carbonate sediment [37, 38, 39]. The Gaspé Belt is a successor basin that encompasses Upper Ordovician–Middle Devonian sedimentary strata (sandstone, mudrock/shale, conglomerate, slatey schist, limestone) and lesser amount of volcanic rock (basalt, rhyolite) [37, 40]. Folded and faulted strata in the Gaspé Belt unconformably overlie, or are in fault contact with older Paleozoic rocks of the Laurentian margin (Humber Zone) or accreted terranes of the Dunnage and Gander Zones [40]. Undeformed sedimentary basin – Layer 2 – is absent from Zone 2.				

Table 2 (continued)
1D Earth Resistivity Models for Quebec – Zone 2 (Appalachian Geological Province)

Layer	Depth	Thickness	Resistivity (ohm-m)	Conductivity (S/m)	Comments
	Certainty		Certainty		
1. Overburden	2 – 105 m [6, 41, 44, 47]	2 m (uplands) 10-105 m (valleys)	25 [2]	0.04 [24]	Eastern Townships area: Mainly veneer (< 2m thick) of till and littoral sands and gravels, often discontinuous at higher elevations. Champlain Sea clay limited to main valleys (e.g. Yamaska, Riviere Noire). At Riviere Noire 6m clay overlies 4m sand/gravel and 2m basal till. Glaciofluvial sand and gravel occur in valleys. Glaciolacustrine silt and sand (deposited in deltas and shorelines) common in main valleys (e.g. Upper Missisquoi, Sutton) [6].
	[I]		[I]		Lac Megantic area: thick accumulations of overburden (range 1-105m, average 41m [41] in major river valleys consisting of modern alluvium (sand, gravel), post-glacial sediments (sand, gravel; 2-4m thick) and patchy bog deposits (3-10 m thick) overlies glacial deposits of multiple till layers with interlayers of laminated silt and clay, which in turn rest on top of pre-glacial stratified sand and gravel [42]. Outside of valleys and slopes, overburden estimated < 5 m.
					SE Quebec (Sherbrooke-to-Thetford Mines): till interlayered with stratified silt and sand, and laminated silt and clay [43]. Patchy occurrences of Champlain Sea clay / silt following western boundary of Appalachian Geological Province.
					SE Quebec (Beauceville region): till veneer, thicker till (30-40m) with ice contact sand and gravel in river valleys (e.g. Chaudiere, Etchemin, Gilbert, Noire).
					Gaspe area: till veneer (< 2m) usually discontinuous, with occasional continuous till blanket overlies 1/3 of area, remainder bedrock covered by colluvium [1, 46]. Thicker overburden following northern coast [49] and valleys (e.g. 10m near St. Guy [47]. Till (stoney) thickness ranges 0.5-3m in adjacent New Brunswick [48].
					Assign average 2 m thickness on basis till is the dominant overburden. Overburden will be substantially thicker in river valleys.
					Resistivities for tills in Canada range 20-100 ohm.m [17]. Borehole logs reveal range 25-100 ohm.m, average 80 ohm.m, for glacial till in southern Ontario [2]
					Borehole logs reveal range 3-50 ohm.m (midpoint 25 ohm.m) for glacial overburden in parts of Nova Scotia (Cape Breton Island mostly) and Fredericton [2]
					Assign midpoint 25 ohm.m, based on regional borehole data, on basis overburden in Quebec derived from same Appalachian sedimentary bedrock as in Nova Scotia and New Brunswick. Limits 3, 50 ohm.m

Table 2 (continued)
1D Earth Resistivity Models for Quebec – Zone 2 (Appalachian Geological Province)

Layer	Depth	Thickness	Resistivity (ohm-m)	Conductivity (S/m)	Comments
	Certainty		Certainty		
2. Sedimentary Basin	absent	---	---	---	Small patches of Maritime Basin occur along southeast coast of the Gaspe, fronting Chaleur Bay between Pointe-Saint-Pierre and Miguasha. Too restricted in area to be considered for 1D model.

Table 2 (continued)
1D Earth Resistivity Models for Quebec – Zone 2 (Appalachian Geological Province)

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m)	Comments
3. Upper Crust	0 – 15 km [52, 53]	15 km	1500 [58]	0.000666 [24]	Appalachian Geological Province *Humber Zone*: Cambrian siliciclastic rock (e.g. sandstone, conglomerate, mudstone/siltstone) and Middle Ordovician mixed siliciclastic / carbonate strata with minor amount of mafic volcanic rock *Dunnage Zone*: Neoproterozoic to Ordovician mix of mafic volcanic rocks, phyllite schist, sandstone quartzite, dolostone, conglomerate, ultramafic to mafic intrusives, amphibolite, and blocks to silvers of sandstone, volcanic rock, granite and gabbro [37]. *Gaspe Belt*: Upper Ordovician to Middle Devonian succession of mainly siliciclastic strata with subordinate amounts of volcanic and carbonate (limestone) rocks [50]
	[I]		[I]	Scaled from cross-sections * Line M-2002 (onshore seismic profile southeastward from Trois-Rivieres) [5], depth to Grenvillian basement in Humber Zone > 7.5 km * Line M2001 (onshore seismic profile southeastward from Ste-Croix to Audet) [51], depth to basement across Humber Zone ranges 3.8 - >5.8 km * Line M2001 [52], shows 17 km maximum depth to basement across Appalachian sedimentary wedge * Gaspe Peninsula (north to south) [50], depth to basement across Humber Zone and Gaspe Belt ranges 13-18 km (midpoint 15 km) * Central Gaspe [53], maximum depth to basement ranges approx. 15-18 km * South shore of St. Lawrence River depth-velocity model [54] shows 7 km thickness for Humber Zone Other depths * Avalon zone on Newfoundland island [55], 12 km * New England (USA) Appalachians [56], 7 km Assign approx. 15 km, based on midpoint of profile across Gaspe Peninsula. Shallower depth (approx. 7 km) paralleling St. Lawrence River.	

Table 2 (continued)
1D Earth Resistivity Models for Quebec – Zone 2 (Appalachian Geological Province)

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m)	Comments
3. Upper Crust (continued)	Resistivity – within Zone 3 * 1970s regional MT interpretation [63] across Appalachians indicates 2D resistivity 100 ohm.m at 0-6 km depth, 200 ohm.m 6-30 km depth * 1971 regional MT transect between St. Edmond and Lennoxville [57] indicates 10-200 ohm.m (midpoint 100 ohm.m) range to 3 km depth * 2011 exploration-property AMT survey near Lake Temiscouata shows predominately overall 1500 ohm.m to 2.5 km depth [58]; upper 600 m varies 100-8000 ohm.m, with shales 100 ohm.m and sandstone 8000 ohm.m Resistivity – other locations: * MT and AMT survey across Newfoundland [59, 60] exhibits 150-360 ohm.m (midpoint 250 ohm.m) – excluding conductive shales– within a sedimentary successor basins and sedimentary margin situated within Humber Zone. * Lithoprobe MT transect [59] across combined Dunnage-Gander Zone in Newfoundland reveals separate areas of very high resistivity (>100000 ohm.m) to very conductive (< 5 ohm.m) within surrounding 1000-5000 ohm.m, giving weighted average 27000 ohm.m. Combined Dunnage-Gander Zone comprised of volcanoclastic and clastic sedimentary rock, with 50% of zone intruded by granitic rock. * Inner Piedmont & Blue Ridge terranes (western Dunnage equivalent) in southern Appalachians, weighted average 200 ohm.m, range 100-250 ohm.m for depth of 0~15 km [61]. * Valley and Ridge terrane (possible equivalent rocks of Gaspe Belt) in southern Appalachians , weighted average 60 ohm.m, range 50-80 ohm.m [61]. Assign 1500 ohm.m, based on recent AMT survey [58] (may be overestimate due limited MT coverage). Limits 100, 8000 ohm.m.				

Table 2 (continued)
1D Earth Resistivity Models for Quebec – Zone 2 (Appalachian Geological Province)

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m)	Comments
4. Middle Crust	15 – 22 km [54]	7 km	3900 [34, 10]	0.000256 [24]	Middle crust rocks in Zone 3 interpreted to be equivalent to upper crystalline crustal rocks (Grenville Province) within Zone 1
	[I]		[II]	Depth-velocity model [54] of south shore of St. Lawrence suggests 22 km depth. Generalized depth for middle crust is 25 km [62]	
	Resistivity – within Zone 3 * 1970s regional MT transect [63] across Quebec and New Brunswick Appalachians indicates 2D resistivity 200 ohm.m at 6-30 km depth * 20-km depth resistivity map (covering part of Appalachians in New Brunswick) shows predominantly 5500 ohm.m [34] Resistivity – other locations * MT transects across eastern Ontario's St. Lawrence valley [17] and Ottawa valley [10] of upper crustal Grenville province rocks exhibit 2600 and 1100-6000 ohm.m (midpoint 3500 ohm.m), respectively. Upper crustal Grenville rocks interpreted as being equivalent to middle crust in Zone 1. Same transects for middle crust (in eastern Ontario and Ottawa Valley) exhibit 300 and <500 ohm.m, respectively. * Lithoprobe MT survey across Newfoundland's [59] Humber Zone exhibits range 2-400 ohm.m, giving 100 ohm.m weighted average. Possible diminishment of resistivity by an overlying conductive sedimentary successor basin * Lithoprobe MT transect [59] across combined Dunnage-Gander Zone in Newfoundland exhibits variable resistivity ranging 1000-100000 ohm.m, giving 17000 ohm.m weighted average * Inner Piedmont & Blue Ridge terranes (western Dunnage equivalent) in southern Appalachians, weighted average 100 ohm.m, range 30-250 ohm.m [61] * Valley and Ridge terrane (possible equivalent rocks of Gaspe Belt) in southern Appalachians , weighted average 50 ohm.m, range 5-30 ohm.m [61] Assign approx. 3900 ohm.m, average of values (5500, 2600, 3500) on basis of more recent interpretation by [34] and upper crustal Grenvillian basement rock underlying St. Lawrence and Ottawa Valley continues beneath Appalachians. Limits 2600, 5500 ohm.m)				

Table 2 (continued)

1D Earth Resistivity Models for Quebec – Zone 2 (Appalachian Geological Province)

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m)	Comments
5. Lower Crust	22 – 39 km [27, 54]	17 km	2200 [63, 34, 59]	0.000454 [24]	Scaled from regional seismic / other profiles * average 36 km depth [27] in Vaudreuil area (depth diminishes from Ontario northeastward to Quebec) * Line M2001 [52], shows approx. 40 km depth to Moho * depth-velocity model [54] of south shore of St. Lawrence River shows 43 km depth to Moho * Line MDG [64] across NE – SE Ontario shows 40 km bottom depth * depth estimated at 30 km [63] based on resistivity difference
	[I]		[II]	Other depths * Newfoundland island - average of Dunnage and Gander zones [56], 36 km * New England Appalachians [56], 35 km Assign 39 km depth (midpoint of 36 and 43 km)	
	Resistivity - within Zone * 1970s regional MT transect [63] across Quebec and New Brunswick Appalachians indicates 2D resistivity 5000 ohm.m at 30-170 km depth * 40-km depth resistivity map (covering part of Appalachians in New Brunswick) shows predominately 3100 ohm.m [34] Resistivity – other locations * Lithoprobe MT survey across Newfoundland's [59] Humber Zone exhibits range 60-250 ohm.m, giving 150 ohm.m midpoint value. Lithoprobe MT transect [59] across combined Dunnage-Gander Zone in Newfoundland exhibits highly variable resistivity areas, ranging 100-5000 ohm.m, giving 610 ohm.m weighted average * Inner Piedmont & Blue Ridge terranes (western Dunnage equivalent) in southern Appalachians, weighted average 200 ohm.m, range 30-1000 ohm.m [61] * Valley and Ridge terrane (possible equivalent rocks of Gaspe Belt) in southern Appalachians , weighted average 825 ohm.m, range 80-1000 ohm.m [61] Assign 2200 ohm.m, average of values (5000, 3100, 150, 610 ohm.m). Limits 150, 5000 ohm.m				

Table 2 (continued)
1D Earth Resistivity Models for Quebec – Zone 2 (Appalachian Geological Province)

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m)	Comments
6. Upper Mantle	39 - 100 km [23]	61 km	3300 [63, 17, 34]	0.000303 [24]	Used generalized lower depth of 100 km [23]. .
	[III]		[II]		Resistivity – within Zone 2 * no MT transect identified
	Resistivity – other locations * 1970s regional MT transect [63] indicates 2D resistivity 5000 ohm.m at 30-170 km depth in northwest NB * MT transect [17] across NE and SE Ontario indicates range 300-3000 ohm.m within St. Lawrence valley, giving 700 ohm.m weighted average * 100-km depth resistivity map (covering part of Appalachians in New Brunswick) shows range 3100-5500 ohm.m (midpoint 4300 ohm.m) [34] * Canada regional model [23] indicates 244 ohm.m for depth 0-100 km Assign 3300 ohm.m, average of values (5000, 700, 4300 ohm.m). Limits 300, 5500 ohm.m				
7. Upper Mantle	100 - 250 km [23]	150 km	3600 [63, 17, 34]	0.000277 [24]	Used generalized lower depth of 250 km [23]
	[III]		[II]		Resistivity – within Zone 2 * no MT transect identified
	Resistivity – other locations * 1970s regional MT transect [63] indicates 2D resistivity 5000 ohm.m at 30-170 km depth in northwest NB * MT transect [17] across NE and SE Ontario indicates 300 ohm.m within St. Lawrence valley * 200-km depth resistivity map (covering part of Appalachians in New Brunswick) shows predominately 5500 ohm.m [34] * Canada regional model [23] indicates 158 ohm.m for depth 100-250 km Assign 3600 ohm.m, average of values (5000, 300, 5500). Limits 300, 5500 ohm.m				

Table 2 (continued)
1D Earth Resistivity Models for Quebec – Zone 2 (Appalachian Geological Province)

Layer	Depth Certainty	Thickness	Resistivity (ohm-m)	Conductivity (S/m) Certainty	Comments
8. Upper Mantle	250–410 km [23] [III]	160 km	150 [17, 23] [II, III]	0.00666 [24]	Used generalized lower depth of 250 km [23] Resistivity – within Zone 2 * no MT transect identified Resistivity – other locations * MT transect [17 across NE and SE Ontario indicates 300 ohm.m within St. Lawrence valley, to 360 km depth * Canada regional model [23] indicates 29 ohm.m for depth 100-250 km Assign approx. 150 ohm.m, average of values (300, 29). Limits 29, 300 ohm.m
9. Transition Zone	410–520 km [23] [III]	110 km	8 [25]	0.1258 [23] [III]	Assign Canada regional model [23] for all depths and resistivities below 410 km
10. Transition Zone	520–670 km [23] [III]	150 km	2.4 [25]	0.4168 [23] [III]	Assign Canada regional model
11. Lower Mantle	670–900 km [23] [III]	230 km	1.12 [25]	0.89125 [23] [III]	Assign Canada regional model
12. Lower Mantle	900–1000 km [23] [III]	100 km	0.47 [25]	2.0892 [23] [III]	Assign Canada regional model

See end of Table 6 for abbreviations and notes

Table 3
1D Earth Resistivity Models for Quebec – Zone 3 (Grenville Geological Province)

<table>
<tr><th rowspan="2">Layer</th><th>Depth</th><th rowspan="2">Thickness</th><th>Resistivity (ohm-m)</th><th>Conductivity (S/m)</th><th rowspan="2">Comments</th></tr>
<tr><th>Certainty</th><th>Certainty</th><th>Certainty</th></tr>
<tr><td></td><td colspan="5">Zone 3 is underlain by the Proterozoic Grenville Geological Province, and within Quebec it is divided into 3 main belts (Parautochthonous, Allochthonous Polycyclic, Allochthonous Monocyclic Belt) according to age of the rocks, their origin, and episodes of deformation [28]. Bounding the younger Grenville Province to the west and north against the older Archean Superior Geological Province is the Grenville Front Tectonic Zone, a crustal-scale linear feature that marks the exposed limit of penetrative Grenvillian deformation, metamorphism, and structural trends [29], the result of Grenville rocks being thrust over the margin of the Superior province. The Grenville Front is also well defined by its regional gravity and magnetic signature. Crust beneath the Front is also thicker.
Undeformed sedimentary basin – Layer 2 – is absent from Zone 4.</td></tr>
<tr><td rowspan="2">1. Overburden</td><td>0 – 2 m
[1]</td><td rowspan="2">1 m</td><td>80
[31]</td><td>0.0125
[24]</td><td>Mainly till veneer (typically < 1m thick) with areas of till blanket (typically > 2m thick), much less deposits of glaciofluvial plains (sand, gravel) and fine-grained glaciofluvial sediments (silt, clay) [1]. In Bagotville area, marine deposits (silt, clay) up to 60 m thick occur in the Saguenay River valley [30]</td></tr>
<tr><td>[III]</td><td>[III]</td><td colspan="2">Resistivities for tills range 20-100 ohm.m in Canada [31]. Assign overall 80 ohm.m, on basis silty-sandy till is dominant overburden.</td></tr>
<tr><td>2. Sedimentary Basin</td><td>absent</td><td>---</td><td>---</td><td>---</td><td>---</td></tr>
</table>

Table 3 (continued)
1D Earth Resistivity Models for Quebec – Zone 3 (Grenville Geological Province)

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m)	Comments
3. Upper Crust	0 – 13 km [22, 32, 33] / [I]	13 km	20200 [17] / [I]	0.0000495 [24]	Variety of metamorphic rock (gneisses, schist, marble, quartzite, migmatite) and extensive granitoid and mafic intrusives. Scaled depth from seismic regional transect running parallel to Ontario-Quebec provincial boundary [22] ranges 12-15 km, but not well-defined on north half of transect across Grenville Province. Scaling of Lithoprobe lines 52,53 & 54 (across central part of Grenville) indicates upper crust depth approx.13.5 km [32]. Scaling of Lithoprobe line 55 (Manicouagan area in west-central Quebec) indicates upper crust depth approx. 11 km [33]. Assign 13 km, midpoint of depth range (11-15 km)
		Limited regional MT transects across much of Grenville Province in Quebec. Used a MT transect running parallel to Ontario-Quebec provincial boundary [17] from which resistivity values were applied to entire Zone. Assign 20200 ohm.m, based on weighted averages of 2D inversion profile [17]. Limits 125, 50000 ohm.m. Highest resistivity 13600-50000 ohm.m occurs along northern half of Grenville Province, extending to 140 km depth.			
4. Middle Crust	13 – 32 km [22, 32] / [I]	19 km	12700 [17] / [I]	0.0000787 [24]	Scaled depth from seismic regional transect running parallel to Ontario-Quebec provincial boundary [22] ranges 28-34 km, midpoint 31 km. Scaling of Lithoprobe lines 52,53 & 54 (across central part of Grenville in western Quebec) indicates middle crust depth approx.32.5 km [32]. Assign approx. 32 km (average of 31 and 32.5 km)
		20-km depth resistivity map shows overall 10000 ohm.m [34] Assign 12700 ohm.m, based on weighted averages of 2D inversion profile [17]. Limits 125, 50000 ohm.m			

Table 3 (continued)
1D Earth Resistivity Models for Quebec – Zone 3 (Grenville Geological Province)

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m)	Comments
5. Lower Crust	32 – 43 km [22, 32, 33, 26] / [I]	11 km	8600 [17] / [I]	0.0001162 [24]	Scaled depth from seismic regional transect running parallel to Ontario-Quebec provincial boundary Moho (lower crust / mantle boundary) ranges 40-46 km, midpoint 43 km [22]. Scaling of Lithoprobe lines 52,53 & 54 (across central part of Grenville) indicates Moho depth ranges 39-48 km, midpoint approx. 43.5 km [32]. Scaling of Lithoprobe line 55 indicates lower crust depth range approx. 41-48 km, midpoint 44.5 km [33].
		Moho depth reported to range 40-45 [22] or 39-43 km [28] or 36-50 km [26] Beneath Grenville Front the Moho depth ranges 32-34 km [28] or 44 km [26]. Crust thins rapidly to 35 km south of GFTZ [35]. In Manicouagan area, Moho ranges 41-48 km (midpoint 44.5 km) to more than 51 km in areas, thickening towards the GFTZ [33]. Assign 43 km depth, average of midpoints (43, 43.5, 44.5, 42.5, 41, 43, 44.5) of ranges. 40-km depth resistivity map [34] shows 6800 ohm.m weighted average (see Note 1) Assign 8600 ohm.m, based on weighted averages of 2D inversion profile [17]. Limits 125, 13600 ohm.m			
6. Upper Mantle	43 - 100 km / [III]	57 km	2250 [17] / [I]	0.000444 [24]	Upper depth scaled from seismic transects [22, 32, 33, 26] Used generalized lower depth of 100 km [23].
				100-km depth resistivity map [34] shows 7700 ohm.m weighted average (see Note 1) Assign 2250 ohm.m midpoint resistivity, based on an averaged profile by [17-Fig.18] depicting a 1500-3000 ohm.m range. Limits 1500, 3000 ohm.m	

Table 3 (continued)
1D Earth Resistivity Models for Quebec – Zone 3 (Grenville Geological Province)

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m)	Comments
7. Upper Mantle	100 - 250 km [23]	150 km	280 [17]	0.003571 [24]	Used generalized lower depth of 250 km [23] .
	[III]		[I]	200-km depth resistivity map [34] shows 4000 ohm.m weighted average (see Note 1) Canada regional model [23] indicates 158 ohm.m for depth 100-250 km Assign 280 ohm.m based on weighted average determined from an averaged profile by [17-Fig.18] depicting: * 100-150 km, range 100-1300 ohm.m, midpoint 700 ohm.m * 150-250 km, range 40-100 ohm.m, midpoint 70 ohm.m Limits 40, 1300 ohm.m	

Table 3 (continued)
1D Earth Resistivity Models for Quebec – Zone 3 (Grenville Geological Province)

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m)	Conductivity (S/m) / Certainty	Comments
8. Upper Mantle	250–410 km [23] / [III]	160 km	50 [17, 36] / [I]	0.02 [24]	Used generalized lower depth of 410 km [23] Canada regional model [23] shows 29 ohm.m between 250-410 km Assign 50 ohm.m based on: * 250-300 km, range 40-55 ohm.m, midpoint 50 ohm.m, depicted on an average profile by [17-Fig.18] * 250-350 km, weighted average approx. 50 ohm.m, depicted on MT profile [36] Limits 10, 125 ohm.m Assign approx. 650 ohm.m midpoint resistivity, based on an averaged profile by [17-Fig. 18] depicting an approx. 40-1300 ohm.m range. Limits 40, 1300 ohm.m
9. Transition Zone	410–520 km [23] / [III]	110 km	8 [25]	0.1258 [23] / [III]	Assign Canada regional model [23] for all depths and resistivities below 250 km.
10. Transition Zone	520–670 km [23] / [III]	150 km	2.4 [25]	0.4168 [23] / [III]	Assign Canada regional model
11. Lower Mantle	670–900 km [23] / [III]	230 km	1.12 [25]	0.89125 [23] / [III]	Assign Canada regional model
12. Lower Mantle	900–1000 km [23] / [III]	100 km	0.47 [25]	2.0892 [23] / [III]	Assign Canada regional model

See end of Table 6 for abbreviations and notes

Table 3 (continued)
1D Earth Resistivity Models for Quebec - Zone 3 (Grenville Geological Province)

NOTE 1: Determination of overall resistivity for specific depths, from depth resistivity maps [34], by (i) visual estimation of percentage areal extent of dominant / midpoint resistivity value (e.g. 50 % of area is 1000 ohm.m, thus 0.5 x 1000), and (ii) visual comparison against provided resistivity scale.

Results below are rounded to nearest 100.

40-km depth
((0.35 x 1000) + (0.65 x 10000)) = approx. 6800 ohm.m

100-km depth
((0.25 x 800 ohm, midpoint of range 560-1000 ohm) + (0.75 x 10000)) = approx. 7700 ohm.m

200-km depth
((0.1 x 800 ohm, midpoint of range 560-1000 ohm) + (0.9 x 4400, midpoint of range 3160-5600 ohm)) = approx. 4000 ohm.m

Table 4
1D Earth Resistivity Models for Quebec – Zone 4 (Superior Geological Province)

<table>
<tr><th rowspan="2">Layer</th><th>Depth</th><th rowspan="2">Thickness</th><th>Resistivity (ohm-m)</th><th>Conductivity (S/m)</th><th rowspan="2">Comments</th></tr>
<tr><th>Certainty</th><th>Certainty</th><th>Certainty</th></tr>
<tr><td></td><td colspan="5">Zone 4 is underlain by the Archean Superior Geological Province, made up of 7 subprovinces (Abitibi, Ashuanipi, La Grande, Minto, Opinaca, Opatica, Pontiac) [37]. Granitoid gneisses and granitoid intrusive rock is predominant.

Northwestern Quebec, underlain by following subprovinces, from south to north. Pontiac subprovince is comprised of metasedimentary (gneiss, schist, iron formation, marble) rock and abundant granitoid intrusions (plutonic complexes). Abitibi subprovince is primarily comprised of series elongated belts of metavolcanic rock (“greenstones) and sedimentary rock separated by granitoid gneisses with lesser amount of granitoid intrusions. Opatica subprovince is predominantly granitoid (gneisses) rock [37].

Undeformed sedimentary basin – Layer 2 – is absent from Zone 4.</td></tr>
</table>

Table 4 (continued)
1D Earth Resistivity Models for Quebec – Zone 4 (Superior Geological Province)

Layer	Depth Certainty	Thickness	Resistivity (ohm-m) Certainty	Conductivity (S/m)	Comments
1. Overburden	*Overall* 0 – 5 m [65]	5 m	*Overall* 80 [31, 2, 70]	*Overall* 0.0125 [24]	Variable surficial material and depth. Majority of Zone covered either by till veneer (typically < 1 m thick, often discontinuous) or continuous till blanket, (commonly > 1 m, to maximum of 12 m) [1, 65, 66]. Extensive bedrock exposure (protruding through the tills) occurs in NW Quebec and Ungava peninsula. James Bay eastern shoreline, Hudson Bay and Ungava Bay shorelines are covered by a mix of glaciomarine and marine deposits consisting of: fine-grained silt and clay, coarse grained sand and gravel, and lag (sand and gravel resulting from winnowing of glacial deposits by waves); overlying the till blanket. These deposits can extend up to 50 km inshore from coast [1]. Thickness may range < 3 - < 10m [65]. Patchy organic deposits (< 0.5m thick) overly glaciomarine and marine deposits. Abitibi Clay Belt in central-NW Quebec, an extensive deposit of glaciofluvial clay and silt, covers the area encircled by Temiscaming, Matagami, Nemaska and Chibougamau. Average thickness is about 20 m, but can be greatly variable, up to > 40 m in areas [67, 68] or even 60 m [69]. The clay lies on top of till 2-4m thick [69]. Assign approx. midpoint 25 m thickness.
	[II]		[II, III]	*Abitibi Clay Belt* 0.04 [24]	
	Abitibi Clay Belt 0 – 20 m [67, 68]	20 m	*Abitibi Clay Belt* 25 [69, 2]		Assign overall 5 m thickness, on basis till veneer and blankets majority of Zone. For regionally extensive Abitibi Clay Belt, the average 20 m thickness is assigned.
	[I]		[II, III]		

Table 4 (continued)
1D Earth Resistivity Models for Quebec – Zone 4 (Superior Geological Province)

Layer	Depth Certainty	Thickness	Resistivity (ohm-m) Certainty	Conductivity (S/m)	Comments
1. Overburden (continued)	Resistivities for tills range 20-100 ohm.m in Canada [31]. Borehole logs reveal range 25-100 ohm.m, average 80 ohm.m, in tills within southern Ontario portion of St. Lawrence Lowlands [2]. Boreholes logs of SE Manitoba show resistivity for clayey till averages approx. 25 ohm.m, silty till 50 ohm.m, sandy till 115 ohm.m [70]. 1D inversion models for MT survey south of Churchill airport show average 100 ohm.m in upper 20m of overburden consisting of glaciomarine / marine deposits [21]. Glaciolacustrine clays average 30 ohm.m in northeastern Ontario [69].-Boreholes through glaciolacustrine Leda Clay overburden in eastern Ontario show resistivity range 3-40 ohm.m ohm.m, average approx. 20 ohm.m [2]. Assign overall 80 ohm.m to reflect dominance of silty-sandy glacial till overburden [65], derived from more resistive Precambrian metamorphic rock. Limits 20, 115 ohm.m. For area within Zone where Abitibi Clay Belt is situated, average 25 ohm.m is assigned.				
2. Sedimentary Basin	absent	---	---	---	---

Table 4 (continued)
1D Earth Resistivity Models for Quebec – Zone 4 (Superior Geological Province)

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m)	Comments
3. Upper Crust	0 – 11 km [22] [I]	11 km	13700 [17] [I]	0.0000729 [24]	In Quebec, seismic and MT transects limited to crossing the Pontiac and Abitibi subprovinces underlying northwestern Quebec. Variety of rock. Pontiac subprovince includes metasediments. Abitibi subprovince includes belts of mafic volcanic rock (basalt, andesite, volcanoclastics) with lesser belts of sedimentary rock (wacke, mudrock, conglomerate, iron formation, quartz arenite). Mix of granitoid intrusions comprises the remaining 70% of rock type within the two subprovinces. Scaled depth from seismic regional transect running parallel to Ontario-Quebec provincial boundary [22] crossing the Pontiac and Abitibi subprovinces. Assign 11 km, average of depth range
			Limited number of regional MT transects across northern Quebec. Used a MT transect running parallel to Ontario-Quebec provincial boundary [17] from which resistivity values were applied to entire Zone. Assign 13700 ohm.m, based on weighted averages of 2D inversion profile [17] (see Note 1). Limits 4400, 50000 ohm.m (based on predominant resistivity values)		

Table 4 (continued)

1D Earth Resistivity Models for Quebec – Zone 4 (Superior Geological Province)

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m)	Comments
4. Middle Crust	11 – 28 km [22] [I]	17 km	1000 [17] [I]	0.001 [24]	Scaled depth from seismic regional transect running parallel to Ontario-Quebec provincial boundary [22]. Assign 17 km, average of depth range.
		20-km depth resistivity map shows range 5600-10000 ohm.m [34]. Assign approx. 1000 ohm.m, based on weighted averages of 2D inversion profile [17] (see Note 1). Limits 125, 3000 ohm.m (based on predominant resistivity values)			
5. Lower Crust	28 – 40 km [22] [I]	12 km	640 [17] [I]	0.001562 [24]	Scaled depth from seismic regional transect running parallel to Ontario-Quebec provincial boundary [22], ranges 35-45 km. Assign average 40 km depth.
			40-km depth resistivity map shows 6800 ohm.m weighted average [34] (see Note 2) Assign 640 ohm.m, based on weighted averages of 2D inversion profile [17] (see Note 1). Limits 125, 2100 ohm.m		
6. Upper Mantle	40 - 100 km [22] [III]	60 km	125 [17] [I]	0.008 [24]	Upper depth scaled from seismic transects [22]. Used generalized lower depth of 100 km [23].
			100-km depth resistivity map shows 4500 ohm.m weighted average [34] (see Note 2) Assign 125 ohm.m, based on predominant resistivity value on MT profile [17] (see Note 1) Upper limit 2100 ohm.m. Isolated, narrow, 15 ohm.m conductor underlies southern part of Pontiac Subprovince between depth of 70-100 km.		

Table 4 (continued)
1D Earth Resistivity Models for Quebec – Zone 4 (Superior Geological Province)

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m)	Comments
7. Upper Mantle	100 - 250 km [23] / [III]	150 km	50 [17] / [I]	0.02 [24]	Used generalized lower depth of 250 km [23] .
			200-km depth resistivity map shows 2600 ohm.m weighted average [34] (see Note 2) MT profile [17] shows resistivity ranges are: * 100-140 km depth, dominantly 125 ohm.m * 140-220 km depth, weighted average 13 ohm.m Canada regional model [23] indicates 158 ohm.m for depth 100-250 km Assign approx. 50 ohm.m, weighted average based on area occupied by dominant or averaged resistivity (see Note 1), Limits approx. 5, 125 ohm.m		

Table 4 (continued)
1D Earth Resistivity Models for Quebec – Zone 4 (Superior Geological Province)

Layer	Depth Certainty	Thickness	Resistivity (ohm-m)	Conductivity (S/m) Certainty	Comments
8. Upper Mantle	250–410 km [23] [III]	160 km	7 [17, 36] [I]	0.1428 [24]	Used generalized lower depth of 410 km [23] MT profile [17, 36] shows resistivity ranges 5 – 9 ohm.m between 250 – 350 km Canada regional model [23] shows 29 ohm.m between 250-410 km Assign 7 ohm.m, midpoint of resistivity range. Limits approx. 5, 9 ohm.m
9. Transition Zone	410–520 km [23] [III]	110 km	8 [25]	0.1258 [23] [III]	Assign Canada regional model [23] for all depths and resistivities below 250 km.
10. Transition Zone	520–670 km [23] [III]	150 km	2.4 [25]	0.4168 [23] [III]	Assign Canada regional model
11. Lower Mantle	670–900 km [23] [III]	230 km	1.12 [25]	0.89125 [23] [III]	Assign Canada regional model
12. Lower Mantle	900–1000 km [23] [III]	100 km	0.47 [25]	2.0892 [23] [III]	Assign Canada regional model

See end of Table 6 for abbreviations and note

Table 4 (continued)
1D Earth Resistivity Models for Quebec - Zone 4 (Superior Geological Province)

NOTE 1: Calculation of Weighted Average for Layers 3 to 7, from 2D inversion profile [17].

For each layer, percentage areal extent of dominant / midpoint resistivity value was determined by measurement (e.g. 25 % of layer is 150 ohm.m, thus 0.25 x 150). Resistivity estimated by visual comparison against provided resistivity scale.

Results below are rounded.

<u>Layer 3, Upper Crust</u>
((0.09 x 740 ohm.m) + (0.26 x 4400) + (0.55 x 13600) + (0.10 x 50000)) = approx. 13,700 ohm.m

<u>Layer 4, Middle Crust</u>
((0.76 x 125 ohm.m) + (0.05 x 1160) + (0.08 x 2100) + (0.05 x 3000) + (0.03 x 5300) + (0.03 x 13600)) = 1038 ohm.m

<u>Layer 5, Lower Crust</u>
((0.55 x 125 ohm.m) + (0.29 x 800) + (0.16 x 2100) = 640 ohm.m

<u>Layer 6, Upper Mantle (Moho – 100 km)</u>
dominantly 125 ohm.m

<u>Layer 7, Upper Mantle (100 – 140 km, 34 %)</u>
dominantly 125 ohm.m

<u>Layer 7, Upper Mantle (140 – 220 km, 66%)</u>
((0.08 x 4 ohm.m) + (0.1 x 7) + (0.82 x 15)) = 13 ohm.m

Therefore overall weighed average is ((0.34 x 125 ohm) + (0.8 x 13)) = 52 ohm.m

NOTE 2: Determination of overall resistivity for specific depths, from depth resistivity maps [34], by (i) visual estimation of percentage areal extent of dominant / midpoint resistivity value (e.g. 50 % of area is 1000 ohm.m, thus 0.5 x 1000), and (ii) visual comparison against provided resistivity scale.

Results below are rounded to nearest 100.

<u>40-km depth</u>
((0.35 x 1000) + (0.65 x 10000)) = approx. 6800 ohm.m

<u>100-km depth</u>
((0.6 x 800 ohm, midpoint of range 560-1000 ohm) + (0.4 x 10000)) = approx. 4500 ohm.m

<u>200-km depth</u>
((0.5 x 800 ohm, midpoint of range 560-1000 ohm) + (0.5 x 4400, midpoint of range 3160-5600 ohm)) = approx. 2600 ohm.m

Table 1
1D Earth Resistivity Models for Quebec – Zone 5 (Churchill Geological Province)

<table>
<tr><th rowspan="2">Layer</th><th>Depth</th><th rowspan="2">Thickness</th><th>Resistivity
(ohm-m)</th><th>Conductivity
(S/m)</th><th rowspan="2">Comments</th></tr>
<tr><th>Certainty</th><th>Certainty</th><th>Certainty</th></tr>
<tr><td></td><td colspan="5">Zone underlain by Churchill Geological province, divided into two parts. [37]
Ungava Orogen occupies the northernmost tip of Quebec, and is divided into the Narsajuaq Arc and Ungava Trough (a.k.a. Cape Smith Belt). Narsajuaq Arc – including embedded portions of the Superior geological province -– comprised mainly of Archean granitoids (tonalite, quartz diorite, granodiorite, granite, porphyritic monzonite), and younger Paleoproterzoic gneissic granitoid rock (tonalite, quartz diorite, granodiorite) and felsic granitoids (granite, granodiorite, tonalite). Occurring as a central intrusive mass at contact between the two parts is Paleoproterozoic mafic (gabbro, diorite, anorthosite) and ultramafic (peridotite, pyroxonenite, dunite) rock.
Ungava Trough is mainly Paleoproterozoic volcanic rock (basalt, mafic volcanoclastics) containing narrow belts of sedimentary rock (arkose, quartz arenite, conglomerate, sandstone, dolostone) and ultramafic rock [37].
New Quebec Orogen is situated immediately south of Ungava Bay, and is divided into three parts, from west to east, the Labrador Trough, Core Zone and Torngat Orogen.
Labrador Trough consists of intensely deformed Paleoproterozoic metasedimentary (paragneiss, schist, quartzite, marble, calc-silicates), sedimentary (mudrock, wacke, dolostone, sandstone, siltstone, chert breccia), iron formation, felsic volcanic rock, and mafic intrusives (gabbro, diorite, anorthosite).
Core Zone is made up of Archean gneiss, granitoid gneiss and migmatite, with large intrusions of Paleoproterzoic granitoids (granite, granodiorite, monsonite, quartz monzonite, tonalite) and Mesoproterozoic granitoids.
Torngat orogen is comprised of mostly of Archean gneiss and granitoid gneiss, and Paleoproterozoic metasedimentary (paragneiss, schist, quartzite, marble, calc-silicates) rock with intrusions of Paleoproterozoic granitoids.
Undeformed sedimentary basin – Layer 2 – is absent from Zone 4.</td></tr>
<tr><td rowspan="2">1. Overburden</td><td>0 – 2 m
[1]</td><td rowspan="2">1 m</td><td>80
[31, 70]
[II]</td><td>0.0125
[24]</td><td>Till veneer (typically < 1m thick) and till blanket (typically > 2m thick) occurs in the Ungava Orogen at north tip of Quebec. Till blanket is dominant in the New Quebec Orogen, Core Zone and Torngat Orogen situated immediately south of Ungava Bay. Till 1 to< 13m thick in Torngat Mountains in northern Labrador [71]. Marine lag deposits (thin to discontinuous deposits of sand, gravel) occur along shoreline of Ungava Bay [1].</td></tr>
<tr><td>[II]</td><td>[II]</td><td colspan="2">Assign overall 80 ohm.m [31, 70] to reflect dominance of silty-sandy glacial till overburden [65, 71], derived from more resistive Precambrian metamorphic rock. Limits 20, 100 ohm.m.</td></tr>
</table>

Table 5 (continued)
1D Earth Resistivity Models for Quebec – Zone 5 (Churchill Geological Province)

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m)	Comments
2. Sedimentary Basin	Not present	---	---	---	---
3. Upper Crust	0 – 6 km [72]	6 km	10500 [73 - 79]	0.0000952 [24]	Variety of rock types; granitoids, gneissic granitoid rock, volcanic rock with narrow belts of sedimentary rock, lesser amount of mafic and ultramafic rock, large belt of metasedimentary rock occupying the Labrador Trough..
	[I]		[II - III]	Scaled depth from seismic transect across Core Zone of NQO ranges 5-9 km, average 6 km [72]. Across Torngat Orogen, upper crust depth is 5 km. Assign 6 km.	
	Due lack of MT transects across Zone 5, applied average of resistivity values obtained from MT regional transects across: * Trans-Hudson Orogen in north-central SK and western Manitoba, range 8000 to > 50000 ohm.m with a weighted average of 13000 ohm.m (excluding NACP crustal conductor) [73]. * Western Churchill Province-Rae Domain in eastern NWT extending from Baker Lake to Melville Peninsula, range 5000-50000 ohm.m (midpoint 27000 ohm.m) [74, 75, 76, 77]. * Western Churchill Province-Rae Domain (and continuation of Trans-Hudson Orogen) in central Baffin Island, > 10000 ohm.m in Rae Domain and 6000 ohm.m in upper 3 km of the metasediments within the THO (excluding possibly continuation of NACP crustal conductor) and >10000 ohm.m in the Cumberland Batholith [78]. Choose midpoint 8000 ohm.m (of 6000-10000 ohm.m range). * Trans-Hudson Orogen crossing Cumberland Peninsula on Baffin Island, ranges approx. 3000 ohm.m for Archean granitoids and < 50 ohm.m for metasediment, giving approx. weighted resistivity of 500 ohm.m [79]. Assign overall 10500 ohm.m (average of above weighted average and midpoint values). Limits 5000, > 50000 ohm.m				

Table 5 (continued)
1D Earth Resistivity Models for Quebec – Zone 5 (Churchill Geological Province)

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m)	Comments
4. Middle Crust	6 – 16 km [72] [I]	10 km	5000 [17] [II - III]	0.0002 [24]	Scaled depth from seismic transect across Core Zone of NQO ranges 13-18 km, average 16 km [72]. Across Torngat Orogen, middle crust depth is 15 km. Assign 16 km bottom depth Superior Province interpreted to extend wedge-like beneath the Ungava Orogen, the New Quebec Orogen, and possibly as far east beneath the Torngat Orogen [80, 81]. Assign approx. 5000 ohm.m, the average of Layers 3 (13700 ohm.m) and 4 (1000 ohm.m) in Zone 4, and Layers 4 (4900 ohm.m) and 5 (280 ohm.m) in Zone 6 estimated for Superior Province. Resistivity values were determined from the northernmost end of a MT transect [17] conducted across northeastern Ontario and northwestern Quebec. Limit 125, 19500 ohm.m
5. Lower Crust	16 – 38 km [72] [I]	22 km	1000 [17] [II – III]	0.0001 [24]	Scaled depth from seismic transect across Core Zone of NQO averages approx. 38 km [72]. Across Torngat Orogen, a 55 km deep root occurs in the lower crust. Interpretation by [82] indicates NQO and Core Zone bottom depth ranges 35-40 km and beneath Torngat Orogen it is 48 km thick with a relief of 12 km. Assign 38 km bottom depth, average of depth range Assign 1000 ohm.m, the average of Layers 4 (1000 ohm.m) and 5 (640 ohm.m) in Zone 4, and Layers 4 (280 ohm.m) and 5 (2100 ohm.m) in Zone 6 estimated for Superior Province. Resistivity values were determined from the northernmost end of a MT transect [17] [adejunti2014F10] conducted across northeastern Ontario and northwestern Quebec. Limits 125, 3000 ohm.m

Table 5 (continued)
1D Earth Resistivity Models for Quebec – Zone 5 (Churchill Geological Province)

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m)	Comments
6. Upper Mantle	38 - 100 km	62 km	330 [17]	0.003030 [24]	Used generalized lower depth of 100 km [23].
	[III]		[II – III]	Assign 330 ohm.m, the average of Layer 6 (125 ohm.m) in Zone 4, and Layer 6 (550 ohm.m) in Zone 6 estimated for Superior Province. Resistivity values were determined from the northernmost end of a MT transect [17] conducted across northeastern Ontario and northwestern Quebec. Limits 125, 2100 ohm.m	
7. Upper Mantle	100 - 250 km [23]	150 km	50 [17, 36]	0.02 [24]	Used generalized lower depth of 250 km [23]
	[III]		[II – III]	Assign 50 ohm.m, the weighted average in Zone 7 for Superior Province upper mantle as determined from the northernmost end of a MT transect [17, 36] conducted across northeastern Ontario and northwestern Quebec. Limits approx. 5, 125 ohm.m	

Table 5 (continued)
1D Earth Resistivity Models for Quebec – Zone 5 (Churchill Geological Province)

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m)	Conductivity (S/m) / Certainty	Comments
8. Upper Mantle	250–410 km [23] / [III]	160 km	10 [17] / [II – III]	0.1 [24]	Used generalized lower depth of 410 km [23] Canada regional model [23] shows 29 ohm.m between 250-410 km Assign 10 ohm.m, the average of Layer 8 (7 ohm.m) in Zone 4, and Layer 8 (15 ohm.m) in Zone 6 estimated for Superior Province. Resistivity values were determined from the northernmost end of a MT transect [17] conducted across northeastern Ontario and northwestern Quebec. Limits 5, 29 ohm.m
9. Transition Zone	410–520 km [23] / [III]	110 km	8 [25]	0.1258 [23] / [III]	Assign Canada regional model [23] for all depths and resistivities below 250 km.
10. Transition Zone	520–670 km [23] / [III]	150 km	2.4 [25]	0.4168 [23] / [III]	Assign Canada regional model
11. Lower Mantle	670–900 km [23] / [III]	230 km	1.12 [25]	0.89125 [23] / [III]	Assign Canada regional model
12. Lower Mantle	900–1000 km [23] / [III]	100 km	0.47 [25]	2.0892 [23] / [III]	Assign Canada regional model

See end of Table 6 for abbreviations and notes

Table 6
1D Earth Resistivity Models for Quebec – Zone 6 (Hudson Bay Platform)

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m) / Certainty	Comments
	Note. For Layers 1 and 2, description, thickness and resistivity were determined for Hudson Bay Platform (also known as HB Basin or HB Lowland) in adjacent Ontario and assigned to Quebec Zone 6. Hudson Bay Platform is comprised of two sedimentary basins, the Hudson Bay basin and the smaller Moose River basin, the latter which extends partially into Quebec and beneath James Bay [83]. Underlying the Hudson Bay Platform is the Archean Superior Geological Province, with northern 3/4 of Zone 6 within the Opinaca geological subprovince (of the Superior Province) which is comprised of metasedimentary rocks (gneiss, schist, iron formation, marble). Southern 1/4 of Zone 6 underlain by the medium- to high-grade metamorphosed Opatica subprovince (also referred to as Opatica Plutonic Belt) comprised of plutonic-gneissic rocks (tonolitic gneisses, granitoid intrusions) [22, 37, 84].				
1. Overburden	0 – 30 m [85]	25 m	30 [19, 31, 69]	0.03333 [24]	Multiple till sheets separated by nonglacial sediments (silt-clay rhythmites, sand, gravel) are overlain by post-glacial deposits (silt-clay rhythmites, sand, gravel, clay, silt), 1-8 m and likely thicker toward coast. Organic deposits (peat, muck and marl) cover 100% of land surface, < 4m thick [85]. Variable thickness of individual till and other sedimentary deposits, total thickness ranging 20-35m [85].
	[II]		[II, III]	Resistivities for tills range 20-100 ohm.m in Canada [31]. Glaciolacustrine clays average 30 ohm.m in northeastern Ontario [69] [M7]. MT survey in southeastern Manitoba across mixed glacial deposits indicates 5-30 ohm.m [19]. 1D inversion models for MT survey south of Churchill airport show average 100 ohm.m in upper 20m of overburden [21]. Assign 30 ohm.m to reflect dominance of glaciolacustrine clays and silt covering sedimentary basin. Limits 20, 100 ohm.m.	

Table 6 (continued)
1D Earth Resistivity Models for Quebec – Zone 6 (Hudson Bay Platform)

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m)	Comments
1. Overburden	0 – 30 m [85]	25 m	30 [19, 31, 69]	0.03333 [24]	Multiple till sheets separated by nonglacial sediments (silt-clay rhythmites, sand, gravel) are overlain by post-glacial deposits (silt-clay rhythmites, sand, gravel, clay, silt), 1-8 m and likely thicker toward coast. Organic deposits (peat, muck and marl) cover 100% of land surface, < 4m thick [85]. Variable thickness of individual till and other sedimentary deposits, total thickness ranging 20-35m [85].
	[II]		[II, III]		Resistivities for tills range 20-100 ohm.m in Canada [31]. Glaciolacustrine clays average 30 ohm.m in northeastern Ontario [69] [M7]. MT survey in southeastern Manitoba across mixed glacial deposits indicates 5-30 ohm.m [19]. 1D inversion models for MT survey south of Churchill airport show average 100 ohm.m in upper 20m of overburden [21]. Assign 30 ohm.m to reflect dominance of glaciolacustrine clays and silt covering sedimentary basin. Limits 20, 100 ohm.m.

Table 6 (continued)
1D Earth Resistivity Models for Quebec – Zone 6 (Hudson Bay Platform)

Layer	Depth Certainty	Thickness	Resistivity (ohm-m) Certainty	Conductivity (S/m)	Comments
2. Sedimentary Basin	0 – 0.25 km [13] [I]	0.125 km	100 [20, 21] [II]	0.01 [24]	Paleozoic (Silurian-Devonian) sedimentary strata consists primarily of carbonates (limestone, +/- dolostone), with lesser amount of clastic sediments (siltstone, shale, sandstone) forming the upper strata. Interlayers of evaporates (gypsum and salt) occur [86, 87]. Gently dipping, undeformed. Overlies Precambrian basement (Superior province and Trans- Hudson orogen). Regional basin thickness map shows approx. 250 m depth, thickening > 500 m offshore and northwest into Ontario [13]. Assign midpoint thickness of 125 m
	MT profile [20] south of Churchill Manitoba shows 20-100 ohm.m for Paleozoic bedrock. Rock samples of dolomitic mudstone, wackestone and dolomitic limestone in Churchill area (situated in Hudson Bay Platform) show resistivity range 20-600 ohm.m, median 100 ohm.m [21]. Carbonate strata in WCSB in southeastern Manitoba ranges 20-50 ohm [19]. In southwest Ontario, Paleozoic shale and limestone ranges, 11-23 ohm.m; limestone with minor shale & silt 20-150 ohm.m; dolostone 150-750 ohm.m [19]. In Ottawa area Paleozoic sandstone and dolo/limestone ranges 250-400 ohm.m [16] in boreholes or 2000-5000 [88], Ottawa Valley MT profile indicates < 150 ohm.m [10]. Assign 100 ohm.m, on basis of measured rock resistivity and upper end resistivity as measured by MT in Churchill. Limits 20, 600 ohm.m.				

Table 6 (continued)
1D Earth Resistivity Models for Quebec – Zone 6 (Hudson Bay Platform)

Layer	Depth Certainty	Thickness	Resistivity (ohm-m) Certainty	Conductivity (S/m)	Comments
3. Upper Crust	0.125 – 11 km [22] [II]	10.875 km	4900 [17] [II]	0.000204 [24]	3/4 comprised of metasedimentary rocks (gneiss, schist, iron formation, marble) and 1/4 being granitoid intrusive rock [37]. Depth scaled from seismic regional transect limited to Opatica Subprovince [22]. Plutonic rock ranges 5-18 km deep, 18 km at north margin of Opatica Subprovince Assign 11 km, midpoint of depth range
	No regional MT transect identified across Zone. Nearest transects cross Abitibi geological subprovince situated immediately south of Zone MT profile [17] crossing northern part of Abitibi Subprovince shows resistivity ranges at: * 0-3.5 km depth, ranging 7617-19515 ohm.m * 3.5-6 km depth, ranging 1160-2973 ohm.m * 6-11 km depth, ranging 125-1160 ohm.m Assign 4900 ohm.m, weighted average based on adjacent northern margin of Abitibi Subprovince. (see Note 1). Limits approx. 750, 19500 ohm.m				
4. Middle Crust	11 – 31 km [22] [II]	20 km	280 [17] [II]	0.003571 [24]	Scaled depth across Opatica Subprovince. Not well defined, appears to range 27-35 km [22]. Assign 31 km, midpoint of depth range MT profile [17] crossing northern part of Abitibi Subprovince shows resistivity ranges at: * 11-28 km depth, dominantly 125 ohm.m * 28-31 km depth, dominantly 1160 ohm.m Assign 440 ohm.m, weighted average based on adjacent northern margin of Abitibi Subprovince. (see Note 1). Limits approx. 125, 1160 ohm.m

Table 6 (continued)
1D Earth Resistivity Models for Quebec – Zone 6 (Hudson Bay Platform)

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m)	Comments
5. Lower Crust	31 – 38 km [22] [II]	7 km	2100 [17] [II]	0.0004 [24]	Assign 38 km, scaled depth at north margin of Opatica Subprovince. [22]. Assign approx. 2100 ohm.m, dominant resistivity on adjacent northern margin of Abitibi Subprovince. Lower limit 1160 ohm.m
6. Upper Mantle	38 - 100 km [23] [III]	62 km	550 [17] [II]	0.001818 [24]	Upper depth scaled from seismic transects [22]. Used generalized lower depth of 100 km [23]. MT profile [17] crossing northern part of Abitibi Subprovince shows resistivity ranges at: * 38-45 km depth, dominantly 2066 ohm.m * 45-72 km depth, dominantly 806 ohm.m * 72-100 km depth, dominantly 125 ohm.m Canada regional model [23] indicates 244 ohm.m for depth 0-100 km Assign 550 ohm.m, weighted average based on adjacent northern margin of Abitibi subprovince. (see Note 1). Limits approx. 125, 2100 ohm.m

Table 6 (continued)
1D Earth Resistivity Models for Quebec – Zone 6 (Hudson Bay Platform)

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m)	Comments
7. Upper Mantle	100 - 250 km [23] / [III]	150 km	50 [17, 36] / [II]	0.02 [24]	Used generalized lower depth of 100 km [23] .
	MT profile [17, 36] crossing northern part of Abitibi Subprovince shows resistivity ranges at: * 100-150 km depth, dominantly 125 ohm.m * 150-160 km depth, dominantly 27 ohm.m * 160-170 km depth, dominantly 19 ohm.m * 170-200 km depth, dominantly 8 ohm.m * 200-250 km depth, dominantly 5 ohm.m Canada regional model [23] indicates 158 ohm.m for depth 100-250 km Assign approx. 50 ohm.m, weighted average based on adjacent northern margin of Abitibi subprovince. (see Note 1). Limits approx. 5, 125 ohm.m				

Table 6 (continued)
1D Earth Resistivity Models for Quebec – Zone 6 (Hudson Bay Platform)

Layer	Depth / Certainty	Thickness	Resistivity (ohm-m) / Certainty	Conductivity (S/m) / Certainty	Comments
8. Upper Mantle	250 - 410 km [23] / [III]	160 km	15 [17] / [III]	0.066666 [24]	Used generalized lower depth of 410 km [23] .
	MT profile [17] crossing northern part of Abitibi province shows resistivity ranges at: * 250-320 km depth, dominantly 5 ohm.m * 320-350 km depth, dominantly 8 ohm.m Canada regional model [23] shows 29 ohm.m between 250-410 km Assign approx. 15 ohm.m, weighted average based on adjacent northern margin of Abitibi subprovince. and Canada regional model (see Note 1). Limits approx. 5, 29 ohm.m				
9. Transition Zone	410–520 km [23] / [III]	110 km	8 [25]	0.1258 [23] / [III]	Assign Canada regional model [23] for all depths and resistivities below 250 km.
10. Transition Zone	520–670 km [23] / [III]	150 km	2.4 [25]	0.4168 [23] / [III]	Assign Canada regional model
11. Lower Mantle	670–900 km [23] / [III]	230 km	1.12 [25]	0.89125 [23] / [III]	Assign Canada regional model
12. Lower Mantle	900–1000 km [23] / [III]	100 km	0.47 [25]	2.0892 [23] / [III]	Assign Canada regional model

Table 6 (continued)
1D Earth Resistivity Models for Quebec - Zone 6 (Hudson Bay Platform)

NOTE 1: Calculation of Weighted Average for Layers 3 to 6 from 2D inversion profile [17]
Calculation of Weighted Average for Layers 7 and 8, from 2D inversion profile [36], specifically regional Profile 1

For each layer, percentage areal extent of dominant / midpoint resistivity value was determined by measurement (e.g. 25 % of layer is 150 ohm.m, thus 0.25 x 150). Resistivity estimated by visual comparison against provided resistivity scale. Lower and upper limits (for a specific crustal / upper mantle layer) are chosen when the cumulative areas of resistivity exceed 5% of the total area.

Results below are rounded.

<u>Layer 3, Upper Crust</u>
((0.45 x 125) + (0.23 x 2066, midpoint of 1160-2973) + (0.32 x 13566, midpoint of range 7617-19515))= approx. 4900 ohm.m

<u>Layer 4, Middle Crust</u>
((0.15 x dominantly 1160) + (0.85 x dominantly 125)) = 280 ohm.m

<u>Layer 5, Lower Crust</u>
no weighted average assigned

<u>Layer 6, Upper Mantle (Moho – 100 km)</u>
((0.45 x dominantly 125) + (0.44 x dominantly 806) + (0.07 x dominantly 2066)) = approx. 550 ohm.m

<u>Layer 7, Upper Mantle (100 - 250 km)</u>
((0.45 x dominantly 5) + (0.2 x dominantly 8) + (0.07 x dominantly 19) + (0.07 x dominantly 27) + (0.33 x dominantly 125)) = approx. 50 ohm.m

<u>Layer 8, Upper Mantle (250 - 410 km)</u>
((0.44 x dominantly 5) + (0.19 x dominantly 8) + (0.37 x dominantly 29)) = approx. 15 ohm.m

Table 6 (continued)
1D Earth Resistivity Models for Quebec - Zone 6 (Hudson Bay Platform)

NOTES:
Depth Certainty
- I = best representation
  - * overburden: geological report/map coverage of local area.
  - * crust: seismic/gravity transects crossing local area
- II = likely representative
  - * crust/upper mantle: geological and/or seismic transect of a regional nature.
- III = possibly representative (measurements from general compilations).

Resistivity/Conductivity Certainty
- I = best representation (measurements from site or nearby).
  - * overburden: resistivity measurement by surface geophysical method and/or borehole in local area.
  - * crust: resistivity measurement from resistivity survey, MT survey and/or borehole in local area.
- II = likely representative (resistivity values extrapolated from measurements taken at some distance from the site, typically greater than 100 km).
  - * overburden: resistivity value obtained by geophysical measurement, including borehole logs.
  - * sedimentary basin: value obtained by geophysical survey using variety of geophysical electromagnetic methods, including MT.
  - * crust: value obtained by regional MT survey.
- III = possibly representative (measurements from general compilations

CITED REFERENCES

1 Geol. Surv. Cdn. (2014) surficial geology map

2 Crow et al. (2015) Appendix B

3 Hunter et al. (2007) Appendix A

4 Keyser and Prest (1975) drift-thickness map

5 Lavoie et al. (2013) p. 7 and 8

6 Parent et al. (2014) Figs. 5, 20

7 Gadd (1971), Fig. 13

8 Sinha (1980)

9 Hunter (pers. Comm.)

10 Fernberg (2011), include. Fig. 5.13

11 Palacky (1988)

12 Sanford and Arnott (2010) Fig. 4

13 Sanford (1993) Fig. 11.1, 11.3 cross sections

14 Theriault, and Laliberte (2009) cross-section on slide 76

15 Pinet et al (2013)

16 Bernius (1996)

17 Adetunji et al (2014) Figs. 10, 11, 18

18 Sinha (1990)

19 Gowan et al. (2009), Figs. 7, 8

20 Roberts and Craven (2012), Fig. 5

21 Bancroft et al. (2014), Figs. 6, 7, 8

22 Ludden and Hynes (2000) Fig. 4

23 Kelbert et al. (2009), Fig. 2, global and regional conductivity profile, Canada regional conductivity chosen

24 Converted from resistivity obtained from listed reference source

25 Converted from conductivity obtained from listed reference source

26 White et al (2000) Fig .2

27 Eaton et al (2006) Fig. 12

28 Rondenay et al. (2000)

29 Carr et al. (2000)

30 Paradis et al. (2002) surficial geology map

31 Palacky (1988)

32 Martignole et al. (2000)

33 Hynes et al (2000) p. 341, Fig. 9

34 Jones et al. (2014) Figs. 8, 11

35 Martignole and Calvert (1996)

36 Adetunji et al (2015) Fig. 9

37 Theriault (2012) bedrock geology map

38 Williams (1979)

39 van Staal and Barr (2012)

40 Dietrich et al (2011)

41 Shilts (1981a) Appendix 3-Table 6

42 Shilts (1981b) surficial geology map

43 McDonald and Shilts (1971)

44 Blais and Shilts (1989)

45 Shilts and Smith (1989)

46 Bedard (1993)

47 Rappol (1993) Fig. 6

48 Rampton (1984) surficial geology map

49 Bernier et al. (1987)

50 Pinet et al (2008) Fig 2C interpreted cross-section

51 Comeau et al (2004) Fig 2B

52 Spencer et al (1989) Fig. 11 interpretative cross-section

53 Pinet (2013) Figs. 3c, 16 interpretative cross-sections

54 Lyons et al (1980) Fig. 11

55 Hughes et al. (1994), Fig. 15

56 Jackson et al. (1998) Fig. 11

57 Haslam (1971) Fig. 5.14

58 J.A.G. Mines Ltd. (2011) Fig 5.21

59 McNeice (1998)

60 Livada et al. (2013)

61 Ogawa et al. (1996), Fig. 4

62 Ferguson and Odwar (1998) p. A3-11

63 Kurtz and Garland (1976), Fig. 13, 22

64 Mereu (2000), Fig. 14

65 Daigneault (2008) Table 4

66 Daigneault (1996a, 1996b, 1997) surficial geology maps

67 Boisvert and Parent (2008) surficial isopach map

68 Paradis (2007) surficial geology map

69 Palacky (1992)

70 Mwenifumbo et al. (1995)

71 Clark (1988)

72 Hall et al (2002) Fig. 5

73 White et al. (2005), Figs. 7 and 8

74 Spratt et al. (2010), Fig. 3

75 Spratt (2012c), Figs. 14, 16

76 Jones et al. (2002), Fig. 3

77 Corrigan and Tremblay (2011), Slides 15 and 16

78 Evans et al. (2003), Fig. 4 and Evans et al (2005), Fig. 5

79 Craven et al (2013)

80 St.Onge et al. (2002)

81 Bourlon et al. (2002)

82 Wardle et al (2002)

83 Stott and Aitken (1993), Fig. 1.1

84 Calvert and Ludden (1999)

85 Skinner (1989)

86 Ayers et al (1971) bedrock geology map

87 Norris (1993) Fig 8.8 stratigraphic column

88 Becker et al. (1977)

89 Johnson et al. (1993) Fig. 20.2

Appendix 10

Detailed Description of the Earth Resistivity Models for Saskatchewan

1. Geological Settings of the Saskatchewan

The geology of Saskatchewan is complex, with separate ancient Archean[26] continents and Proterozoic island arcs welded together and reworked during protracted Proterozoic orogenic events (Sask. Geol. Surv., 2003a), as shown in Figure 1. Parts of five geological provinces encompass Saskatchewan, and include the Rae Craton, Hearne Craton, and Trans-Hudson Orogen[27] (THO) consisting of crystalline rock (Figure 2), the Interior Platform comprised of sedimentary rock, and a 50 km wide boundary zone along the western and margin of the Superior Province.

Metamorphosed and deformed rocks of the Precambrian Shield form the basement upper crust that underlies the entire province. The Precambrian region has been divided into distinctive lithotectonic domains / terranes each characterized by a distinctive association of supracrustral[28] and intrusive[29] igneous rocks, metamorphic grade, structural style, geological age and tectonic origin. Younger, unmetamorphosed, sedimentary strata overlie the Precambrian basement in the central and southern part of the province.

Precambrian Shield. In the northwest, the Rae and Hearne Cratons / geological provinces (previously referred to as Rae and Hearne Domains of the Western Churchill geological province) comprise metamorphosed rocks of late Archean / Early Proterozoic age (2.7-2.2 Ga). Foliated to gneissic felsic granitoid is the dominant rock type, the remainder generally being metasedimentary rocks (extensive psammite to psammopelite), and lesser metavolcanics (mafic gneiss, amphibolite) and migmatites.

The Wollaston Domain, a complexly folded belt of metasedimentary rock (psammopelite, metampelite, arkose, quartzite, conglomerate, calc-silicates, some marble) overlies the margin of the Archean Hearne Craton granitoid basement.

The Athabasca Basin (1.75-1.7 Ga) consisting of unmetamorphosed sandstones and other sediments unconformably overlies much of the Rae and Hearne Cratons. Major uranium deposits are related to the weathered regolithic interface between the Athabasca Basin and the underlying basement.

On the northeast side of Saskatchewan is the 1.9-1.75 Ga Trans-Hudson Orogen (THO) made up of a collage of Proterozoic greenstone volcanics, greywacke (a clastic sedimentary rock) and granitic rock. The THO has been interpreted as a collisional orogenic belt which welded the Archean Superior (in Manitoba and western Ontario), Hearne-Rae (in Saskatchewan and Northwest Territories) and Wyoming (in the USA) Provinces. Prior to final collision with the Superior, the THO grew progressively outward by accretion and amalgamation of numerous,

---

[26] Division of geologic time, 4 to 2.5 billion (Ga) years ago

[27] A regionally extensive belt of deformed rock (typically mountainous) resulting from collision of lithospheric plates. Gives rise to subduction and obduction zones and fold and thrust belts. An orogeny adds to expansion of a continent by accretion of terranes to pre-existing continent (Eyles and Miall, 2007, p. 487).

[28] Sedimentary and/or volcanic rocks deposited on pre-existing basement rock, may be subsequently metamorphosed.

[29] Molten rock that has cooled beneath Earth's surface.

small, crustal fragments and magmatic arcs[30]. Over 450 km wide, the THO extends from South Dakota, into Saskatchewan, through western and northwestern Manitoba, across Hudson Bay and into Northern Quebec, Labrador, Baffin Island and Greenland. In northern Saskatchewan, the THO is also referred to as the 'Reindeer Zone'.

Buried within and beneath the THO upper crust is the Archean Sask Craton, interpreted to be a micro-continent entrapped during formation of the THO (Figure 3). The Sask Craton, exposed as tectonic windows in the THO, appears to underlie much of the THO / Reindeer Zone in northern Saskatchewan (Sask. Geol. Surv., 2003b) and pinch out with depth (Jones et al., 2005). Minimum-resistivity maps show the Sask Craton as a higher resistivity (>500 ohm.m) region extending as far south as central Saskatchewan at depths between 5-20 km, and shrinking to just beneath the northern Saskatchewan at the 40 km depth (Jones et al., 2005)..

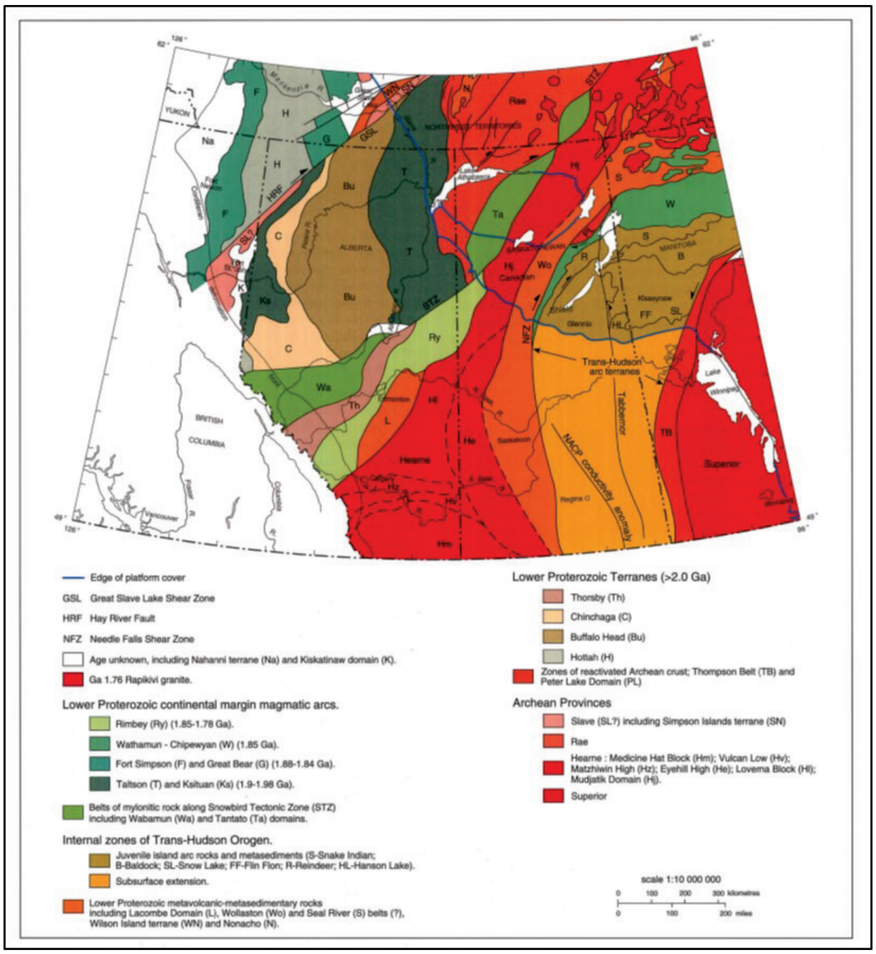


Figure 1*. Tectonic domains underlying the Western Canada Sedimentary Basin, based on interpretation of magnetic and gravity geophysical data, and dating of rock samples obtained from drill holes. Trace of NACP conductivity anomaly, as shown, has been modified by subsequent research. Note blue line delineating eastern zero-edge of sedimentary cover rock. (Ross et al., 1994, Fig. 4.1).*

[30] An arcuate range of volcanoes and intrusive bodies (plutons) parallel to a subduction zone, occurring on ocean or continental tectonic plates.

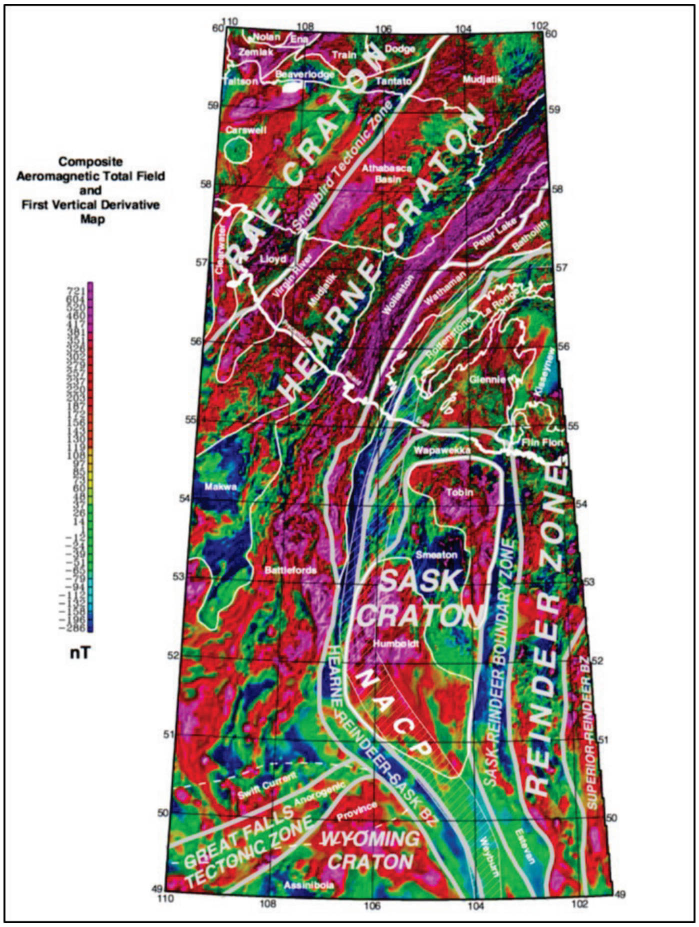


Figure 2. *Interpretive aeromagnetic geophysical map of Saskatchewan. (Sask. Geol. Surv., 2003b).*

Lithotectonic domains identified in the exposed Precambrian of northern Saskatchewan have been interpreted (using geophysical surveys and core samples from petroleum wells) to extend beneath the overlying Phanerozoic sedimentary rocks to the south. Figure 4 is showing the interpreted lithotectonic domains for the Precambrian basement of the Prairie provinces and individually for Saskatchewan, which were applied to the boundaries of each of the presented 1D models. The Superior Boundary Zone, between the Superior Province and THO, is characterized by highly deformed gneisses, a gravity high, and a distinct aeromagnetic signature and trend (Manitoba Geol. Survey, 2014).

Phanerozoic Sediments. Southern Saskatchewan is underlain by gently dipping sedimentary strata of the Interior Platform (Figure 1), also referred to as the Western Canada Sedimentary Basin (WCSB). Strata consist of Paleozoic carbonates (dolostone, dolomitic limestone and limestone) and basal sandstone-shale, all overlain by Mesozoic shales and lesser amount of sandstone and siltstone. Tertiary sands and gravels are exposed mainly in the US border region.
Thickness of the sedimentary basin increases southwestward to more than 2400 m at the Saskatchewan / Alberta boundary. Intercratonic downwarping has resulted in the Williston Basin (within the WCSB) along the Saskatchewan / North Dakota border where depth exceeds 3000 m and about 4900 m in northwestern North Dakota (Sask. Geol. Surv., 2013).

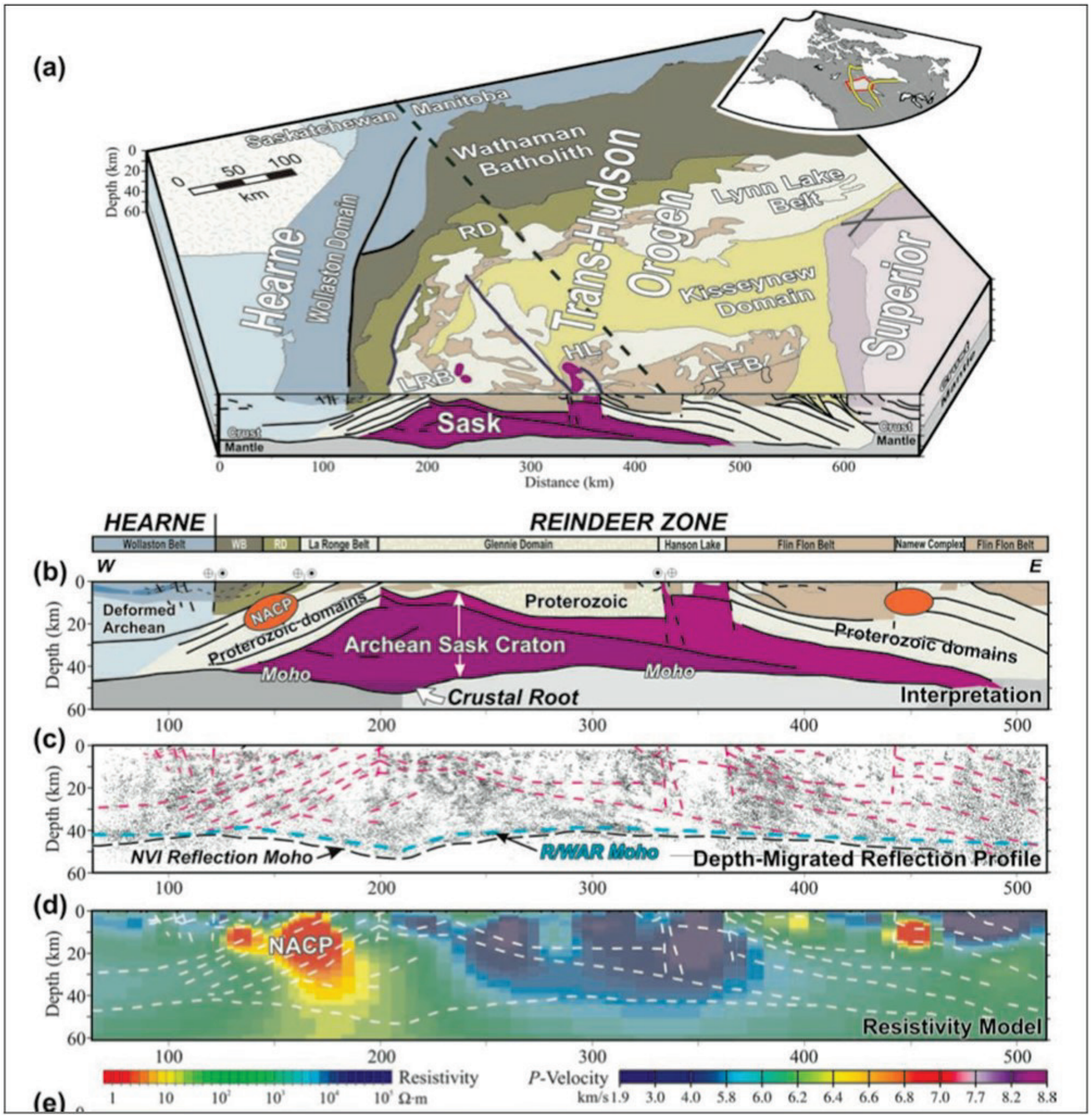


Figure 3. Results from the Trans-Hudson Orogen (THO) transect, Hammer et al. (2010, Fig. 7) (a) Simplified tectonic element map in a perspective with simplified interpretation across the orogen on the front face. FFB, – Flin Flon belt; HL,Hanson Lake block; LRB, La Ronge belt; RD, Rottenstone domain. Inset location map includes yellow lines that outline the bounds of the THO. (b) Simplified interpretation based on geological, near-vertical incidence reflection, refraction – wide-angle reflection, and magnetotelluric studies. The Archean Sask craton is a previously undiscovered microcontinent separate from either the Hearne to the west or the Superior to the east. Bar at top identifies the different domains crossed by the section. WB, Wathaman batholith. Orange ovals identify regions of high conductivity from interpretation of magnetotelluric (MT) results shown in (d). NACP, North American Central Plains conductivity anomaly. (c) Depth-migrated MCS seismic section. Pink dashed lines show interpreted crustal domain boundaries or prominent structures (adapted from White et al. 2005). (d) Resistivity model derived from MT surveys (adapted from Jones et al. 2005b). Very low resistivity at 250 km is the NACP. White dashed lines show interpretation from reflection data.

Overburden. Quaternary unconsolidated sediments (deposited by continental glaciers) are typically less than 20 m thick, and patchy in distribution, in northern Saskatchewan, a region of glacial erosion and scour (Sask. Geol. Surv., 2003b, Macdonald, 2014). The exception is over the Athabasca Basin where glacial erosion of the sandstone bedrock resulted in a more extensive and thicker drift cover up to 100 m thick in areas of the basin. Till is predominant and generally consists of a silty-sand matrix. Large patchy areas of glaciofluvial deposits (gravel, sand, silt) are common in the Athabasca Basin overlying the till. Large areas of glaciolacustrine deposits (clay and silt deposited by proglacial lakes) are common south of Reindeer Lake to Flin Flon. Organic deposits consisting of peat cover extensive areas in northern Saskatchewan (Simpson, 1997).

Southern Saskatchewan was an area of glacial deposition, resulting in an overburden thickness typically ranging 50 - 200 m, except for small areas of the Cypress Hills and Wood Mountain that stood above the ice sheets and therefore lack glacial deposits (Sask. Geol. Surv., 2003). Glacial stripping of soft Cretaceous shales resulted in multiple stacking of successive clay-rich till units. Overlying the till are glaciolacustrine deposits following major river valleys (South and North Saskatchewan Rivers, Battle River, Qu'Appelle River) and as remnants of proglacial lakes, such as the Regina clay belt. Overall, glaciolacustrine deposits mixed with minor glaciofluvial deposits are more common in the southern-third of Saskatchewan (Simpson, 1997).

Conductive Anomalies in Crust

The continental long North American Central Plains (NACP) conductive anomaly (< 10 ohm.m), over 2500 km long, is situated in the THO (red dotted feature on Figure 4). The NACP runs from South Dakota, through Saskatchewan and beneath the Williston Basin, then swings eastward through northern Manitoba, beneath Hudson Bay and across Baffin Island. The anomaly presented as a series of discontinuous conductive bodies at mid-crustal depths (Jones et al., 2005).

In the southern half of Saskatchewan, the NACP has both an upper crustal (centred at 13 km depth, about 3 km thick) part and a deeper crustal (25-35 km depth). Further north, along the south margin of the Precambrian Shield, the NACP again exhibits two conductive bodies (1-10 ohm.m) centred at 7 km and 15 km depth, possibly 10 km thick each, surrounded by a low resistivity halo (< 80 ohm) (Ferguson et al., 2005). Garcia and Jones (2005) have remarked that the NACP in northern Saskatchewan is at a depth of 8 km, < 50 km wide and < 2 km thick.

The upper crustal part of the NACP anomaly has been understand to be caused by sulphide mineralization that has migrated to fold hinges during compression of host rock caused by subduction and emplacement within the crust of the THO (Gowan al., 2009). As a result the sulphides are interconnected along the length of the fold but disconnected perpendicular to the fold, causing a high degree of electrical anisotropy such that electrical current preferentially flows along the NACP than across it (Jones et al., 2005). The lower crustal part of the NACP is interpreted to represent metasedimentary rocks deposited on the margin of the Sask Craton (Ferguson et al., 2005). Although the NACP has not been designated as a separate 1D model Zone, the depth and resistivity values of the anomaly are presented in two of the models of the area in which the NACP passes through.

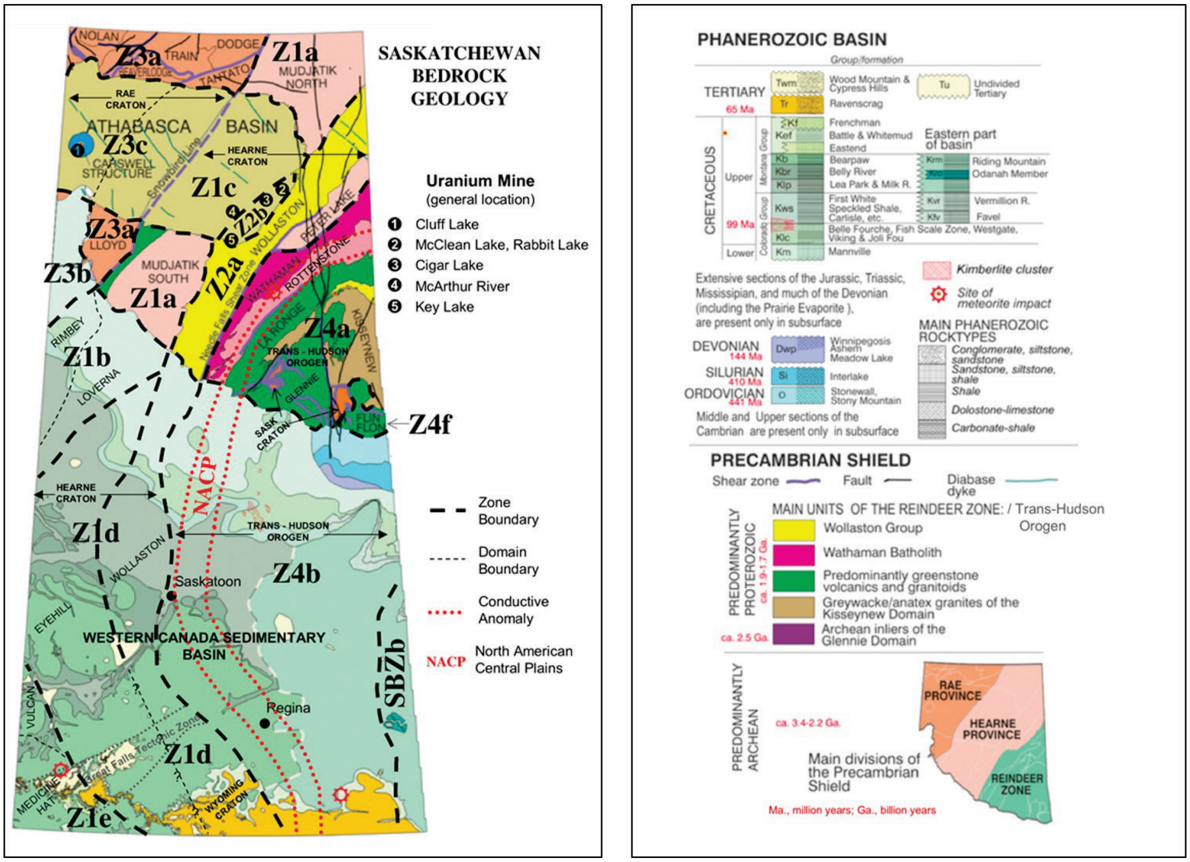


*Figure 4. Geological provinces, lithotectonic domains and major tectonic elements within Province of Saskatchewan (after McDonald, 2014). Trace of interpreted boundaries beneath Western Canada Sedimentary Basin and NACP conductive anomaly from Saskatchewan Geological survey. (2003b). Trace of interpreted boundaries for Rimbey and Loverna Domains, Vulcan Structure and Medicine Hat Block obtained from Ross et al. (1994, Fig. 4-1). Coverage area of the identified 1D resistivity models labeled "**Z##**" are presented as well.*

2. Zonal Earth resistivity models

Each of 14 identified Zones (Figure 4) covers one or more lithotectonic terranes previously identified to underlie Saskatchewan. Because the models are contiguous to each other, a general representation of lateral differences in crustal and mantle resistivity can be illustrated. Eight of the models encompass the 33% of the province where the Precambrian Shield crystalline bedrock (including the sedimentary Athabasca Basin) is exposed at surface. The remaining six models cover the southern two-thirds of the province that is overlain by unmetamorphosed younger sedimentary rocks (i.e. Western Canada Sedimentary Basin) deposited during Paleozoic, Mesozoic and Cenozoic eras. Glacial derived overburden covers almost the entire province, typically thin over the Precambrian shield and much thicker over the southern part of the province.

Sources of Information

Depths for overburden (Layer 1) were typically selected as half of the maximum thickness mentioned on surficial geology maps prepared by federal or provincial geological surveys, as well as a regional overburden thickness isopach map. Resistivity values for overburden were obtained from borehole logs for holes drilled in southern Saskatchewan and Manitoba, and provided enough detail for general resistivity values to be applied to specific types of overburden, such as sandy-till, clayey-till, glaciolacustrine slay/silt and glaciofluvial sand deposits. The applied resistivity was for the predominant type of overburden in a particular 1D model Zone, Where two types of overburden material (e.g. till and glaciofluvial sand) were present; a weighted resistivity average was applied.

Thickness of the Phanerozoic[31] sedimentary strata (Layer 2) was obtained from an isopach map found in *Geological Atlas of the Western Canada Sedimentary Basin* (Fenton et al., 1994). Because of the wedge-like nature of the sedimentary basin thickening from its margin toward its centre, a midpoint value was assigned for basin thickness. Resistivity for the WCSB was obtained from descriptions of MT transects, and inspection of 2D profiles of these transects.
The Proterozoic[32] Athabasca Basin in northwest Saskatchewan is considered as a Layer 2 sedimentary basin for modelling purposes because of its near-horizontal undeformed structure. Basin depth was obtained from stratigraphic sections (e.g. Rainbird et al., 2007). Resistivity information was obtained from borehole logs (Mwenifumbo et al., 2004, 2007) and limited MT / AMT surveys undertaken near uranium orebodies (Craven et al., 2007).

Depths of the upper, middle and lower crust (Layers 3, 4, 5) were measured off regional seismic profiles of transects across parts of Saskatchewan and adjacent Manitoba and Alberta, and therefore are general values. Assembly of the resistivity values for crust and uppermost mantle relied on the results from magnetotelluric (MT) surveys undertaken in the mid-1980s, the Lithoprobe program in the 1990s and 2000, and several more recent MT surveys undertaken in Alberta, Manitoba and Nunavut.

For central and southern Saskatchewan, resistivity values for crustal layers were obtained from relatively shallow MT transects (Lines S, M and N sounding to < 50 km depth) summarized in Jones et al. (2005). In the southeast corner of Saskatchewan, resistivity values for the Superior Boundary Zone (SBZ) were extrapolated from the MT survey undertaken by Gowan et al. (2009) across the southern margin of Manitoba. In contrast to overall resistivity determined for the SBZ in northern Manitoba, the resistivity for the SBZ in southeast Saskatchewan is lower and may be a reflection of the variability of resistivity along the SBZ as commented by Gowan et al. Along the western edge of Saskatchewan, resistivity values for lithotectonic domains (e.g. Rimbey, Loverna, Vulcan and Medicine Hat) continuing from Alberta were obtained from Nieuwenhius et al. (2014).

A mantle-scale transect (sounding to > 100 km depth) was done across the THO in part of western Manitoba and continuing into neighbouring north-central Saskatchewan, the results re-

---

[31] Division of geologic time, from 570 million years (ma) ago until the present, and includes the Paleozoic, Cenozoic and Mesozoic eras.
[32] Division of geologic time, 2.5 billion (Ga) to 570 million years ago

interpreted by Jones et al. (2005) provided resistivity values to the THO and Hearne Craton underlying northern Saskatchewan. 2D inversion profiles presented by Ferguson et al. (2005b) and White et al. (2005) provided resistivity values to an approximate 60 km depth for the central part of the THO, including the Flin Flon area in Saskatchewan and western Manitoba. Because no MT transects cross the Rae Craton in northwest Saskatchewan, resistivity values of the Rae Craton in Nunavut, 1400 km to the northeast, were applied. However, the very high resistivity of the Rae Craton, compared to adjacent Hearne Craton, may be an over estimation of actual resistivity for the Rae Craton.

Minimum-resistivity (Jones et al., 2005) and maximum-resistivity (Jones et al., 2014) depth maps provided general resistivity values when information from 2D inversion profiles lacked resolution.

Resistivities were assigned to a particular layer in a Zone by visual examination of MT inversion profiles prepared by others, and selecting the average or the dominant resistivity depicted. In locations where a distinctive area of lower / higher resistivity is present, a weighted average based on proportional representation was used, giving a "blended" resistivity value for the entire Zone's layer. For known electrically conductive anomalies (e.g. NACP anomaly) in the crust that exerts a halo-like influence of lower resistivities, a representative value of crust resistivity was chosen away from the anomaly.

Depths and resistivity for the middle and lower divisions of the upper mantle, transition zones, and lower mantle – Layers 7 to 12 – between 100 and 1000 km were based on the Canada regional conductivities determined by Kelbert et al. (2009).

The 1D models are presented in Tables 1 to 14 and summarize sources of values allocated for depth and resistivity values and justification for their selection.

3. References

Betcher, R., Grove, G. and Pupp, C., 1995. "Groundwater in Manitoba: hydrogeology, quality concerns, management," *Environment Canada*, National Hydrology Research Institute, NHRI contribution No. CS-93017, March 1995, 53 p

Boerner, D.E., Kurtz, R.D., Craven, J.A., Ross, G.M. and Jones, F.W., 2000. "A synthesis of electromagnetic studies in the Lithoprobe Alberta Basement Transect: constraints on Paleoproterozoic indentation tectonics," *Canadian Journal of Earth Sciences*, v.37, 1509-1534 http://dx.doi.org/10.1139/E00-063

Bouzidi, Y., Schmitt, D.R., Burwash, R.A. and Kanasewich, E.R., 2002. "Depth migration of deep seismic reflection profiles: crustal thickness variations in Alberta," *Canadian Journal of Earth Sciences*, v.39, 331-350 http://dx.doi.org/10.1139/E01-080

Card, C.D., Pana, D., Portella, P., Thomas, D.J., and Annesley, I.R., 2007a. "Basement rocks to the Athabasca Basin, Saskatchewan and Alberta," in EXTECH IV: Geology and Uranium

EXploration TECHnology of the Proterozoic Athabasca Basin, Saskatchewan and Alberta, (ed.) C.W. Jefferson and G. Delaney; *Geological Survey of Canada*, Bulletin 588, p. 69–87 (also Saskatchewan Geological Society, Special Publication 18; Geological Association of Canada, Mineral Deposits Division, Special Publication 4).

Card, C.D., Pana, D., Stern, R.A., and Rayner, N., 2007b. "New insights into the geological history of the basement rocks to the southwestern Athabasca Basin, Saskatchewan and Alberta," in EXTECH IV: Geology and Uranium EXploration TECHnology of the Proterozoic Athabasca Basin, Saskatchewan and Alberta, (ed.) C.W. Jefferson and G. Delaney; *Geological Survey of Canada*, Bulletin 588, p. 119–133 (also Saskatchewan Geological Society, Special Publication 18; Geological Association of Canada, Mineral Deposits Division, Special Publication 4).

Campbell, J.E., McMarlin, I. and Boucher, R., 1995. "Surficial geology, Cumberland Lake area, Saskatchewan, (NTS63L1,2, 7,8)," *Geological Survey of Canada*, Open file 3100, Scale 1:100 000

Campbell, J.E. and Henderson, P.J., 1997. "Surficial geology, Denare Beach-Schist Lake, Saskatchewan-Manitoba," *Geological Survey of Canada*, Map 1919A, Scale 1:50 000.

Campbell, J.E., McMarlin, I. and Millard, M., 1997. "Surficial geology, Sturgeon-Weir River area, Saskatchewan," *Geological Survey of Canada*, Open file 3485, Scale 1:100 000

Campbell, J.E., Millard, M. and McMarlin, I., 1998. "Surficial geology, Attitti Lake area, Saskatchewan (NTS 63 M/1 and M/2)," *Geological Survey of Canada*, Open file 3565, Scale 1:100 000

Campbell, J.E., 2007. "Quaternary geology of the eastern Athabasca Basin, Saskatchewan," in EXTECH IV: Geology and Uranium EXploration TECHnology of the Proterozoic Athabasca Basin, Saskatchewan and Alberta, (ed.) C.W. Jefferson and G. Delaney; *Geological Survey of Canada*, Bulletin 588, p. 211–228 (also Saskatchewan Geological Society, Special Publication 18; Geological Association of Canada, Mineral Deposits Division, Special Publication 4).

Christiansen, E.A. 1979. "Geology of the Regina-Moose Jaw Region 0016-003", Report prepared for Municipal Lands, Urban Division, Saskatchewan Municipal Affairs [available via web search using title; no URL provided]

Christiansen, E.A. 1979. "Geology of the Saskatoon Region 0016-002", need publisher Report prepared for Municipal Lands, Urban Division, Saskatchewan Municipal Affairs, 91 p. [available via web search using title; no URL provided]

Christiansen, E.A., 1992. "Pleistocene stratigraphy of the Saskatoon area, Saskatchewan, Canada: an update," *Canadian Journal of Earth Sciences*, v.29, 1767-1778

Christiansen, E.A. and Schmid, B.J., 2014. "Glacial geology of southern Saskatchewan", 29 p. [available via web search using title; no URL provided]

Clowes, R.M., Burianyk, M.J.A, Gorman, A.R. and Ranasewich, E.R., 2002. "Crustal velocity structure from SAREX, the Southern Alberta Refraction Experiment," *Canadian Journal of Earth Sciences*, v.39, 351-373 http://dx.doi.org/10.1139/E01-070

Collier, B., 2007. "Sequence stratigraphy in the western Athabasca Basin of Saskatchewan and Alberta," in EXTECH IV: Geology and Uranium EXploration TECHnology of the Proterozoic Athabasca Basin, Saskatchewan and Alberta, (ed.) C.W. Jefferson and G. Delaney; *Geological Survey of Canada*, Bulletin 588, p. 281–299 (also Saskatchewan Geological Society, Special Publication 18; Geological Association of Canada, Mineral Deposits Division, Special Publication 4).

Craig, B.G., 1959. "Surficial geology, Battleford, West of Third Meridian, Saskatchewan," *Geological Survey of Canada*, Map 15-1959, Sheet 73C (east half), scale 1:253440

Craven, J.A., Farquharson, C.G., Mackie, R.L., Siripunvaraporn, W., Tuncer, V. and Unsworth, M.J. "A comparison of the two- and three-dimensional modeling of audiomagnetotellurics data collected at the world's richest uranium mine, Saskatchewan, Canada," poster.

Craven, J.A., McNeice, G., Powell, B., Koch, R., Annesley, I.R., Wood, G., Mwenifumbo, C.J., Unsworth, M.J., and Xiao, W., 2007. "Audio-magnetotelluric studies at the McArthur River mining camp and Shea Creek area, northern Saskatchewan," in EXTECH IV: Geology and Uranium EXploration TECHnology of the Proterozoic Athabasca Basin, Saskatchewan and Alberta, (ed.) C.W. Jefferson and G. Delaney; *Geological Survey of Canada*, Bulletin 588, p. 413–424 (also Saskatchewan Geological Society, Special Publication 18; Geological Association of Canada, Mineral Deposits Division, Special Publication 4).

Fenton, M.M., Schreiner, B.T., Nielsen, E., and Pawlowicz, J.G., 1994. "Chapter 26 – Quaternary geology of the Western Plains," in *Geological Atlas of the Western Canada Sedimentary Basin*, G.D. Mossop and I. Shetsen (comp.), Canadian Society of Petroleum Geologists and Alberta Research Council, http://www.ags.gov.ab.ca/publications/wcsb_atlas/atlas.html

Ferguson, I. J., Stevens, K.M., and Jones, A.G., 2005b. "Electrical-resistivity imaging of the central Trans-Hudson orogen," *Canadian Journal of Earth Sciences*, v. 42, 495-515. http://dx.doi.org/ 10.1139/E05-017

Garcia, X. and Jones, A.G., 2005. "Electrical-resistivity imaging of the central Trans-Hudson orogen," *Canadian Journal of Earth Sciences*, v. 42, 495-515.

Gorman, A.R., Clowes, R.M., Ellis, R.M., Henstock, T.J., Spence, G.D., Keller, R., Lebvander, A., Snelson, C.M., Burianyk, M.J.A., Kanasewich, E.R., Asudeh, I., Hajnal Z. and Miller, K.C., 2002. "Deep Probe: imaging the roots of western North America," *Canadian Journal of Earth Sciences*, v.39, 375-398 http://dx.doi.org/10.1139/E01-064

Gowan, E. J., Ferguson, I. J., Jones, A. G., and Craven, J. A., 2009. "Geoelectric structure of the Northeastern Williston basin and underlying Precambrian lithosphere," *Canadian Journal of Earth Science*, 46, no. 6, 46, 441-464. http://dx.doi.org/10.1139/E09-028

Green, A.G., Stephenson, O.G., Mann, G.D., Kanasewich, E.R., Cumming, G.L., Hajnal, Z., Mair, J.A., and West, G.F., 1980. "Cooperative seismic surveys across the Superior-Churchill boundary zone in southern Canada," *Canadian Journal of Earth Sciences*, v.17, 617-632

Györfi, I., Hajnal, Z., White, D.J., Takács, E., Reilkoff, B., Annesley, I.R., Powell, B., and Koch, R., 2007. "High-resolution seismic survey from the McArthur River region: contributions to mapping of the complex P2 uranium ore zone, Athabasca Basin, Saskatchewan," in EXTECH IV: Geology and Uranium EXploration TECHnology of the Proterozoic Athabasca Basin, Saskatchewan and Alberta, (ed.) C.W. Jefferson and G. Delaney; *Geological Survey of Canada*, Bulletin 588, p. 397–412 (also Saskatchewan Geological Society, Special Publication 18; Geological Association of Canada, Mineral Deposits Division, Special Publication 4).

Hajnal, Z., Takács, E., White, D.J., Györfi, I., Powell, B., and Koch, R., 2007. "Regional seismic signature of the basement and crust beneath the McArthur River mine district, Athabasca Basin, Saskatchewan", in EXTECH IV: Geology and Uranium EXploration TECHnology of the Proterozoic Athabasca Basin, Saskatchewan and Alberta, (ed.) C.W. Jefferson and G. Delaney; Geological Survey of Canada, Bulletin 588, p. 389–396 (also Saskatchewan Geological Society, Special Publication 18; Geological Association of Canada, Mineral Deposits Division, Special Publication 4).

Hammer, P.T.C., Clowes, R.M., Cook, F.A., van der Velden, A.J. and Vasudevan, K., 2010. "The Lithoprobe trans-continental lithospheric cross sections; imaging the internal structure of the North American continent," *Canadian Journal of Earth Sciences*, v.47, 821-857. doi:10.1139/E10-036

Hammer, P.T.C., Clowes, R.M., Cook, F.A., Vasudevan, K. and van der Velden, A.J., 2011. "A lithospheric cross section of the North American continent," supplement to *GSA Today,* v.21, issue 6 ftp://rock.geosociety.org/pub/GSAToday/1106insert-hammer/G95A_Hammer_Insert_HighRes.pdf

Henderson, P.J., 2002. "Surficial geology, Annabel Lake-Flin Flon, Saskatchewan," *Geological Survey of Canada*, Map 2002A, Scale 1:50 000.

Hope, J. and Eaton, D., 2002. "Crustal structure beneath the Western Canada Sedimentary Basin: constraints from gravity and magnetic modeling," *Canadian Journal of Earth Sciences*, v.39, 291-312 http://dx.doi.org/10.1139/E01-060

Jones, A.G., 1988. "Static shift of magnetotelluric data and its removal in a sedimentary basin environment," *Geophysics*, v.53, no.7, 967-978

Jones, A.G. and Craven, J.A., 1990. "The North American Central Plains conductivity anomaly and its correlation with gravity, magnetic, seismic and heat flow data in Saskatchewan, Canada," *Physics of the Earth and Planetary Interiors*, v.60, 169-194.

Jones, A.G., Ledo, J. and Ferguson, I.J., 2005. “Electromagnetic images of the Trans-Hudson orogen: the North American Central Plains anomaly revealed,” *Canadian Journal of Earth Sciences*, v.42, 457-478. http://dx.doi.org/ 10.1139/E05-018

Jones, A.G., Ledo, J., Ferguson, I.J., Craven, J.A., Unsworth, M.J., Chouteau, M. and Spratt, J., 2014. “The electrical resistivity of Canada’s lithosphere and correlation with other parameters: contributions from Lithoprobe and other programmes,” *Canadian Journal of Earth Sciences*, v.51, 573-617, dx.doi.org/10.1139/cjes-2013-0151

Kanasewich, E.R., Hajnal, Z., Green, A.G., Cumming, G.L., Mereu, R.F., Clowes, R.M., Morel-A-L’Huissier, P., Chiu, S., Macrides, C.G., Shahriar, M., and Congram, A.M., 1987. “Seismic studies of the crust under the Williston Basin,” *Canadian Journal of Earth Sciences*, 24, 2160-2171.

Kelbert, A., Schultz, A., and Egbert, G., 2009. “Global electromagnetic induction constraints on transition-zone water content variations,” *Nature*, v. 460, no. 20, August 2009, 1003-1006. http://dx.doi.org/10.1038/nature08257.

Klassen, R.W., 1991. “Surficial geology and drift thickness, Cypress Lake, Saskatchewan,” *Geological Survey of Canada*, Map 1766A, scale 1:250000.

Lemieux, S., Ross, G.M. and Cook, F.A., 2000. “Crustal geometry and tectonic evolution of the Archean crystalline basement beneath the southern Alberta Plains, from new seismic reflection and potential-field studies,” *Canadian Journal of Earth Sciences*, v.37, 1473-1491 http://dx.doi.org/10.1139/E00-URL

MacDonald, R., 2014. “Geology – The Encyclopedia of Saskatchewan”, *University of Regina* esask.uregina.ca/entry/geology.html

MRD, 2008. “Surficial geology map of Manitoba,” Manitoba Industry Trade and Mines, Mineral Resources Division, *Manitoba Geological Survey* http://www.manitoba.ca/iem/mrd/geo/3dmodel/images/00-quaternary-large.gif

Mwenifumbo, C J., Bezys, R., Betcher, R., and Killeen, P G., 1995. “Borehole geophysical logs, Manitoba (1992): contents include logs from Grand Rapids and Winnipeg,” Geological Survey of Canada, Open File 2734, 22 p., doi:10.4095/203638.

Mwenifumbo, C J., Killeen, P G., Thorleifson, L H., 1995. “Borehole geophysical logs, overburden holes, southeastern Manitoba,” *Geological Survey of Canada*, Open File 2775, 1995, 15 p., doi:10.4095/203639.

Mwenifumbo, C.J., Elliott, B.E., Jefferson, C.W., Bernius, G.R. and Pflug, K.A., 2004. “Physical rock properties from the Athabasca Group: designing geophysical exploration models for unconformity uranium deposits,” *Journal of Applied Geophysics*, v.55, 117-135, doi:10.1016/j.jappgeo.2003.06.008

Mwenifumbo, C.J., Percival, J.B., Bernius, G.R., Elliott, B., Jefferson, C.W., Wasyliuk, K., and Drever, G., 2007. "Comparison of geophysical, mineralogical, and stratigraphic attributes in drillholes MAC-218 and RL-88, McArthur River uranium camp, Athabasca Basin, Saskatchewan," in EXTECH IV: Geology and Uranium EXploration TECHnology of the Proterozoic Athabasca Basin, Saskatchewan and Alberta, (ed.) C.W. Jefferson and G. Delaney; *Geological Survey of Canada*, Bulletin 588, p. 507–520 (also Saskatchewan Geological Society, Special Publication 18; Geological Association of Canada, Mineral Deposits Division, Special Publication 4).

Nelson, K. D., Baird, D. J., Walters, J. J., Hauck, M., Brown, L. D., Oliver, J. E., Ahern, J. L., Hajnal, Z., Jones, A. G., and Sloss, L. L., 1993. "Trans-Hudson orogen and Williston basin in Montana and North Dakota: New COCORP deep-profiling results," *Geology*, 21, no. 5, May 1993, 447-450. http://dx.doi.org/10.1130/0091-7613(1993)021<0447:THOAWB>2.3.CO;2

Natural Resources Canada, 2009. "Surficial materials, 6th edition," The Atlas of Canada, Natural Resources Canada

Nicolas, M.P.B., Matile, G.L.D., Keller, G.R. and Bamburak, J.D., 2010. "Phanerozoic geology of southern Manitoba," *Manitoba Innovation, Energy and Mines*, Manitoba Geological Survey, Stratigraphic Map SM2010-1, 2 sheets, scale 1:600000.

Nieuwenhuis, G., 2011. "Magnetotelluric Imaging of Precambrian Lithosphere Beneath Southern Alberta," Thesis, M.Sc in Geophysics, Department of Physics, Faculty of Graduate Studies and Research, *University of Alberta*, Edmonton, Alberta, 138p. www.ualberta.ca/~unsworth/theses/Nieuwenhuis-MSc-thesis-2011.pdf

Nieuwenhuis, G., Unsworth, M.J., Pana, D., Craven, J. and Bertrand, E., 2014. "Three-dimensional resistivity structure of Southern Alberta, Canada: implications for Precambrian tectonics," Geophysical Journal International Advanced Access published March 22, 2014, http://dx.doi.org/10.1093/gji/ggu068

Palacky, G.J., 1988. "Resistivity characteristics of geologic targets" in *Electromagnetic Methods in Applied Geophysics-Theory*, Vol.1, M.N. Nabighian (ed.); Society of Exploration Geophysicists, 53-130.

Palacky, G.J., 1992. Helicopter geophysical surveys at the Val Gagne test site, District of Cochrane, Ontario, *Geological Survey of Canada*, Open File Report 2503, 14 p. ftp://ftp2.cits.rncan.gc.ca/pub/geott/ess_pubs/133/133370/of_2503.pdf

Rainbird, R.H., Stern, R.A., Rayner, N., and Jefferson, C.W., 2007. "Age, provenance, and regional correlation of the Athabasca Group, Saskatchewan and Alberta, constrained by igneous and detrital zircon geochronology," in EXTECH IV: Geology and Uranium EXploration TECHnology of the Proterozoic Athabasca Basin, Saskatchewan and Alberta, (ed.) C.W. Jefferson and G. Delaney; Geological Survey of Canada, Bulletin 588, p. 193–209 (also Saskatchewan Geological Society, Special Publication 18; *Geological Association of Canada*, Mineral Deposits Division, Special Publication 4).

Ramaekers, P., Jefferson, C.W., Yeo, G.M., Collier, B., Long, D.G.F., Drever, G., McHardy, S., Jiricka, D., Cutts, C., Wheatley, K., Catuneanu, O., Bernier, S., Kupsch, B., and Post, R.T., 2007. "Revised geological map and stratigraphy of the Athabasca Group, Saskatchewan and Alberta," in EXTECH IV: Geology and Uranium EXploration TECHnology of the Proterozoic Athabasca Basin, Saskatchewan and Alberta, (ed.) C.W. Jefferson and G. Delaney; *Geological Survey of Canada*, Bulletin 588, p. 155–191 (also Saskatchewan Geological Society, Special Publication 18; Geological Association of Canada, Mineral Deposits Division, Special Publication 4).

Ross, G.M., Broome, J. and Miles, W., 1994. "Chapter 4 – Potential fields and basement structure - Western Canada Sedimentary Basin," in *Geological Atlas of the Western Canada Sedimentary Basin*, G.D. Mossop and I. Shetsen (comp.), Canadian Society of Petroleum Geologists and Alberta Research Council, http://www.ags.gov.ab.ca/publications/wcsb_atlas/atlas.html

Saskatchewan Geological Survey, (2003a). "Geology, and mineral and petroleum resources of Saskatchewan," *Saskatchewan Industry and Resources*, Miscellaneous Report 2003-7, 173p.

Saskatchewan Geological Survey, (2003b). "Interpretive geophysical maps of Saskatchewan," *Saskatchewan Industry and Resources*, Miscellaneous Report 2003-7, 173p. www.er.gov.sk.ca/InterpretiveGeophysicalMaps

Schreiner, B.T., 1984. "Quaternary geology of the Precambrian Shield, Saskatchewan," *Saskatchewan Energy and Mines*, Map 221A (to accompany Report 221), 1: 1000000.

Schreiner, B.T., 1984. "Quaternary geology of the Precambrian Shield, Saskatchewan," *Saskatchewan Energy and Mines*, Report 221, 106 p.

Spratt, J. E., Skulski, T., Craven, T.A., Jones, A.G., Snyder, D.B. and Kiyan, D., 2014. "Magnetotelluric investigations of the lithosphere beneath the central Rae craton, mainland Nunavut, Canada," *J. Geophys. Res. Solid Earth*, 119, 2415–2439, doi:10.1002/2013JB010221

Simpson, M.A. (compiler), 1997. "Surficial geology map of Saskatchewan," *Sask. Energy Mines / Sask. Research Council*, scale 1:1000000.

Thomas, M.D. and McHardy, S., 2007. "Magnetic insights into basement geology in the area of McArthur River uranium deposit, Athabasca Basin, Saskatchewan," in EXTECH IV: Geology and Uranium EXploration TECHnology of the Proterozoic Athabasca Basin, Saskatchewan and Alberta, (ed.) C.W. Jefferson and G. Delaney; Geological Survey of Canada, Bulletin 588, p. 425–440 (also Saskatchewan Geological Society, Special Publication 18; Geological Association of Canada, Mineral Deposits Division, Special Publication 4).

Thomas, M.D. and Wood, G., 2007. "Geological significance of gravity anomalies in the area of McArthur River uranium deposit, Athabasca Basin, Saskatchewan," in EXTECH IV: Geology and Uranium EXploration TECHnology of the Proterozoic Athabasca Basin, Saskatchewan and Alberta, (ed.) C.W. Jefferson and G. Delaney; Geological Survey of Canada, Bulletin 588, p.

441–464 (also Saskatchewan Geological Society, Special Publication 18; Geological Association of Canada, Mineral Deposits Division, Special Publication 4).

Turkoglu, E., Unsworth, M. and Pana, D., 2009. "Deep electrical structure of northern Alberta (Canada): implications for diamond exploration," *Canadian Journal of Earth Sciences*, v.46, 139-154 http://dx.doi.org/10.1139/E09-009

Villeneuve, M.E., Ross, G.M., Theriault, R.J., Miles, W., Parrish, R.R., and Brome, J., 1993. "Tectonic subdivision and U-Pb geochronology of the crystalline basement of the Albert Basin, western Canada," *Geological Survey of Canada*, Bulletin 447, 86p. http://ftp2.cits.rncan.gc.ca/pub/geott/ess_pubs/77/77642/bu_447.pdf

White, D.J., Thomas, M.D., Jones, A.G., Hope, J. Nemeth, B. and Hajnal, Z., 2005. Geophysical transect across a Paleoproterozoic continent-continent collision zone The Trans-Hudson Orogen, *Canadian Journal of Earth Sciences*, v. 42, 385-402. http://dx.doi.org/ 10.1139/E05-002

Wright, G.N., NcNechan, M.E. and Potter, D.E.G., 1994. "Chapter 3 – Structure and architecture of the Western Canada Sedimentary Basin," in *Geological Atlas of the Western Canada Sedimentary Basin*, G.D. Mossop and I. Shetsen (comp.), Canadian Society of Petroleum Geologists and Alberta Research Council, http://www.ags.gov.ab.ca/publications/wcsb_atlas/atlas.html

Table 1
1D Earth Resistivity Model for Saskatchewan Zone 1a

Layer	Depth Confidence	Thickness	Resistivity (ohm-m) Confidence	Conductivity (S/m) Confidence	Comments
1. Overburden	0 – 3 m [34] [II]	3 m	100 [36] [II]	0.01 [24]	80% of Zone covered by overburden; a sandy till veneer overlain (about 50% of overburden) by glaciofluvial outwash plain comprised of mainly sand, with minor glaciolacustrine clay-silt plain [34]. Some drumlins. Till veneer <3 m thick [34]. Glaciofluvial and glaciolacustrine deposit thickness estimated < 10 m. Assign overall 3 m thickness, based on presence of till veneer. Locally where mainly glaciofluvial and glaciolacustrine deposits occur, total thickness possibly up to 10 m. Borehole logs of Manitoba overburden show 40-50 ohm.m for till [5]. Boreholes logs of SE Manitoba average approx. 115 ohm.m for sandy till, 10 ohm.m for clay, 45 ohm.m for silt and 80 ohm.m for sand [36]. Resistivities for tills range 20-100 ohm.m [6]. MT survey in SE Manitoba indicates 5-30 ohm for mix of till, clay, silt and sand [4]. Glaciolacustrine clays average 30 ohm.m in NE Ontario [7]. Assign approx. 100 ohm.m weighted average based on areal coverage of overburden resistivity values ((sandy till 115 x 0.5)+(glaciofluvial sand 80 x 0.5)). Limits 80, 115 ohm.m
2. Sedimentary Basin	absent	---	---	---	---

Table 1 (continued)
1D Earth Resistivity Model for Saskatchewan Zone 1a

Layer	Depth / Confidence	Thickness	Resistivity (ohm-m) / Confidence	Conductivity (S/m) / Confidence	Comments
3. Upper Crust	0 – 13.5 km [20]	13.5 km	16900 [20]	0.0000591 [24]	*Zone includes the Mudjatik Domain (north and south parts) and the smaller Virgin River Domain (south of Athabasca Basin), all within the Hearne Craton / Hearne geological province of Archean time. Snowbird Tectonic Zone / Snowbird Line is division between the Archean Hearne and Rae Cratons / geological provinces.* Dominated by foliated to gneissic granitoid (synogranite, granodiorite protolith) rocks with minor infolded bands of metasedimentary (pelitic to psammopelitic gneiss) and metavolcanic rock. Metasedimentary rock (mainly psammopelite) occurs along western margin of Virgin River Domain [37, 38].
	[I]		[I]		
			Depth scaled from regional seismic profile across north-central SK and western MB [20]. Depth minimum-resistivity maps (mainly covering THO in SK) show at: 5km, 200-400 ohm.m (midpoint 300 ohm.m); 10 km, 180 ohm.m [28]. MT profile [20] across north-central SK shows: * >50000 ohm.m occupying 30% of layer; eastward dipping “slab”-like feature continues into lower crust (Layer 5) * range 7000-10000 ohm.m (midpoint 8500 ohm.m) occupies 20%, surrounds “slab” * 500 ohm.m occupies 30% * < 10 ohm.m conductive anomaly, near east margin of Zone, occupies 20% Assign approx. 16900 ohm.m, based on weighted average of dominant / midpoint values ((50000 x 0.3)+(8500 x 0.2)+(500 x 0.3)+(10 x 0.2)). Limits 500, 50000 ohm.m.		

Table 1 (continued)
1D Earth Resistivity Model for Saskatchewan Zone 1a

Layer	Depth / Confidence	Thickness	Resistivity (ohm-m) / Confidence	Conductivity (S/m) / Confidence	Comments
4. Middle Crust	13.5 – 27 km [30] [I]	13.5 km	4350 [20] [I]	0.000229 [24]	Depth scaled from regional seismic profile across north-central SK and western MB [30]. 20 km depth minimum-resistivity map shows range 20-40 ohm.m (midpoint 30 ohm.m) [28]. 20 km maximum-resistivity map shows predominately 2000 ohm.m [31]. MT profile [20] across north-central SK shows: * range 7000-10000 ohm.m (midpoint 8500 ohm.m) occupies 20% * 5500 ohm.m occupies 15% * 500 ohm.m occupies 25% * < 10 ohm.m conductive anomaly, near west margin of Zone, extends downward into Layer 4 and occupies 20% of Layer 3 Assign 4350 ohm.m, based on weighted average of dominant / midpoint values ((8500 x 0.2)+(5500 x 0.15)+(500 x 0.25)+(10 x 0.2)). Limits 500, 10000 ohm.m.

Table 1 (continued)
1D Earth Resistivity Model for Saskatchewan Zone 1a

Layer	Depth Confidence	Thickness	Resistivity (ohm-m) Confidence	Conductivity (S/m) Confidence	Comments
5. Lower Crust	27 – 38 km [20, 30, 39] [I]	11 km	4350 [20] [I]	0.000229 [24]	40 Moho depth scaled from regional seismic profile across north-central SK [20, 30]. 35 km Moho depth below Athabasca Basin [39]. 40-45 km depth beneath Archean cratons noted by [30]. Assign approx. 38 km depth (average of 35 and 40 km determinations). 40 km depth minimum-resistivity map shows range 20-70 ohm.m (midpoint 45 ohm.m) [28]. 40 km depth maximum-resistivity map shows predominantly 2000 ohm.m [31]. MT profile [20] across north-central SK shows: * range 5500-8500 ohm.m (midpoint 7000 ohm.m) occupies 60% of layer * 500 ohm.m occupies 30% * < 10 ohm.m conductive anomaly occupies 10% Assign 4350 ohm.m, based on weighted average of dominant / midpoint values ((7000 x 0.6)+(500 x 0.3)+(10 x 0.1)). Limits 10, 8500 ohm.m.
6. Upper Mantle	38 - 100 km [23] [III]	62 km	500 [28] [I]	0.002 [24]	Used generalized lower depth [23]. 100 km depth maximum-resistivity map shows 1000 ohm.m [31]. MT profile [28] of THO across north-central SK shows: * overall 500 ohm.m. Profile has poor resolution. Assign the overall 500 ohm.m. Upper limit 1000 ohm.m.

Table 1 (continued)
1D Earth Resistivity Model for Saskatchewan Zone 1a

Layer	Depth / Confidence	Thickness	Resistivity (ohm-m) / Confidence	Conductivity (S/m) / Confidence	Comments
7. Upper Mantle	100 - 250 km [23] [III]	150 km	200 [28] [I]	0.005 [24]	Used generalized lower depth [23]. 200 km depth maximum-resistivity map shows range 100-1000 ohm.m (midpoint 500 ohm.m) [31]. MT profile [28] of THO across north-central SK shows: * 500 ohm.m occupies 25% of layer * 150 ohm.m occupies 33% * midpoint 70 ohm.m occupies 42% Assign approx. 200 ohm.m weighted average of dominant / midpoint values ((500 x 0.25)+(150 x 0.33)+(70 x 0.42)). Limits 70, 500 ohm.m.
8. Upper Mantle	250–410 km [23] [III]	160 km	29 [25]	0.034673 [23] [III]	Utilized Canada regional model [23], based on Ottawa magnetic observatory data for all depths and resistivities below 250 km
9. Transition Zone	410–520 km [23] [III]	110 km	8 [25]	0.125892 [23] [III]	Assign Canada regional model
10. Transition Zone	520–670 km [23] [III]	150 km	2.4 [25]	0.416869 [23] [III]	Assign Canada regional model
11. Lower Mantle	670–900 km [23] [III]	230 km	1.12 [25]	0.891250 [23] [III]	Assign Canada regional model
12. Lower Mantle	900–1000 km [23] [III]	100 km	0.48 [25]	2.089296 [23] [III]	Assign Canada regional model

See end of Table 14 for abbreviations and notes

Table 2
1D Earth Resistivity Model for Saskatchewan Zone 1b

Layer	Depth Confidence	Thickness	Resistivity (ohm-m) Confidence	Conductivity (S/m) Confidence	Comments
1. Overburden	0 – 100 m [41] [II]	100 m	25 [36] [II]	0.04 [24]	Till blanket is predominant [40]. Glaciolacustrine deposits (10% overall of Zone) underlie Meadow Lake and to the northeast, and patchy organic deposits (15 % of Zone) north of Meadow Lake [40]. Regional overburden isopach map shows thickness range <50-200 m (midpoint 125 m), and <50 along northern margin of WCSB [2]. Stratigraphic cross-section shows average approx. 100 m thickness [41]. Assign 100 m general thickness. Borehole logs of southern Saskatchewan overburden show typical range 15-40 ohm.m (midpoint 25 ohm.m) for till (clayey and sandy); for glaciolacustrine/fluvial deposits, sand ranges 40-60 ohm, silt ranges 10-20 ohm and clay ranges 5-10 ohm.m [42]. In SE Manitoba, borehole logs show clayey till resistivity averages approx. 25 ohm.m, silty till 50 ohm.m, sandy till 115 ohm.m; and for glaciolacustrine deposits, sand 80 ohm.m, silt 45 ohm.m and clay 10 ohm.m [36]. MT survey in SE Manitoba indicates 5-30 ohm for mix of till, clay, silt and sand [4]. Glaciolacustrine clays average 30 ohm.m in NE Ontario [7]. Assign overall 25 ohm.m, on basis of clay-rich till being dominant. Limits (for till) 15, 40 ohm.m.

Table 2 (continued)
1D Earth Resistivity Model for Saskatchewan Zone 1b

Layer	Depth Confidence	Thickness	Resistivity (ohm-m) Confidence	Conductivity (S/m) Confidence	Comments
2. Sedimentary Basin	0.1 – 1.8 m [21] [II]	1.7 m	10 [A12a] [II]	0.01 [24]	Layer 2 is the WCSB, comprised of limited exposure of Tertiary clastic sedimentary rock (conglomerate, siltstone, sandstone) on top of Mesozoic strata (dominantly shales with lesser amounts of silt/sandstones, carbonates and evaporates), in turn overlying subsurface Paleozoic carbonate (dolostone, dolomitic limestone, limestone) [43]. Tertiary sediments limited to SK/USA border area. Depth deepens southeasterly. Combined Tertiary, Mesozoic and Paleozoic strata thickness ranges 600-3000 m [21]. Deepest 2600-3000 m within the Williston Basin, straddling the SK/USA border area. Assign 1.8 km, midpoint depth of range. In adjacent AB, Layer 2: * MT 3D inversion model indicates 5-10 ohm.m range over entire thickness of WCSB [A12a] * 0.6-0.8 km depth resistivity map [A12b] shows 3 ohm.m * 1.8-2.1 depth resistivity map [A12b] shows 3-10 ohm.m In southwestern MB, MT survey reveals Lower Paleozoic carbonates exhibit 20-50 ohm.m [4], upper Paleozoic and Mesozoic strata (both shale dominant) exhibits 1-5 ohm.m [4]; overall <5 ohm.m [4 p.451]. Along SK/USA border, MT survey reveals < 5 ohm.m resistivity (E-polarization direction) for WCSB to a 3 km depth [44]. Assign 10 ohm.m encompassing entire thickness of WCSB, based on resistivity in adjacent AB [A12a]. Lower limit 5 ohm.m

Table 2 (continued)
1D Earth Resistivity Model for Saskatchewan Zone 1b

Layer	Depth Confidence	Thickness	Resistivity (ohm-m) Confidence	Conductivity (S/m) Confidence	Comments
3. Upper Crust	1.8 – 16 km [20, A13-A15] [II]	14.2 km	2300 [A12e, 12d] [I]	0.000434 [24]	*Zone includes the south portion of the Mudjatik and Virgin Domains – within the Archean Hearne Craton / Hearne geological province – covered by the WCSB. Beneath the WCSB, Mudjatik divided into the Rimbey Domain and Loverna Block that extend from adjacent AB northeasterly into SK.* Syenogranite to monzogranite plutonic rocks in Rimbey Domain (Villeneuve et al. (1993). Granite and granitic gneiss in the Loverna Block (Boerner et al., 2000).
			depth *Note*: limited layer depth information, required importation of values depicted in Rimbey and Loverna Domains in adjacent AB supplemented by depth information from Mudjatik Domain in SK. *Rimbey*: 12 km lower depth scaled from trans-continental seismic transect (11-12 km) across southern Alberta [A13]. *Loverna*: Lower depth scaled from seismic profiles across southern Alberta; 18 km [A15], 20 km [A14]. *Mudjatik*: 13.5 km scaled from regional seismic profile across north-central SK and western MB [20]. Assign 16 km, average depth values (12, 18, 20, 13.5 km). resistivity *Note*: limited MT profiles for Zone in SK, required importation of resistivity values used for Zones in adjacent AB supplemented by resistivity maps covering part of SK. 5 km depth minimum-resistivity map shows 400 ohm.m [31]. 10 km depth minimum-resistivity map shows 180 ohm.m [31]. *Rimbey*: MT profiles show approx. range 1000-3000 ohm.m (midpoint 2000 ohm.m) [A12e], >3000 ohm.m [A35a]. Limited resolution of resistivity differences on figures. *Loverna*: MT profile shows range of 300-3000 ohm.m (midpoint 1650) [A12d]. Assign approx. 2300 ohm.m, average of dominant / midpoint resistivity values (3000, 1650 ohm.m) on MT profiles. Limits 400, 3000 ohm.m.		

Table 2 (continued)
1D Earth Resistivity Model for Saskatchewan Zone 1b

Layer	Depth / Confidence	Thickness	Resistivity (ohm-m) / Confidence	Conductivity (S/m) / Confidence	Comments
4. Middle Crust	16 – 28 km [A19b, A19a, 20] [II]	12 km	2500 [A12e, A12d] [II]	0.0004 [24]	<u>depth</u> *Rimbey*: 26 km lower depth scaled from trans-seismic profile [A19b]. *Loverna*: 10 km thickness scaled from seismic profiles across southern Alberta; 11.4 km [A15], 8.6 km [A14]. Lower depth scaled from seismic profile; 30 km [A19a] *Mudjatik*: 27 km scaled from regional seismic profile across north-central SK and western MB [20]. Assign 28 km, average depth values (26, 30, 27 km).
			<u>resistivity</u> 20 km depth minimum-resistivity map shows midpoint 45 ohm.m [28]. 20 km depth maximum-resistivity map shows at 1800 ohm.m *Rimbey*: MT profiles show approx. range 1000-3000 ohm.m (midpoint 2000 ohm.m) [A12e], >3000 ohm.m [A35a]. Limited resolution of resistivity differences on figures. 17-20 km depth resistivity map [A12b] shows predominant range of 1000-3000 ohm.m (midpoint 2000 ohm.m) excluding influence of RDC anomaly (300 ohm.m). *Loverna*: MT profile shows, predominantly 3000 ohm.m [A12d]. 17-20 km depth resistivity map [A12b] shows range of 1000-3000 ohm.m; excluded influence of RDC anomaly (3-300 ohm.m). Assign 2500 ohm.m, average of dominant / midpoint resistivity values (2000, 3000 ohm.m) on MT profiles. Limits 1000, 3000 ohm.m.		

Table 2 (continued)
1D Earth Resistivity Model for Saskatchewan Zone 1b

Layer	Depth Confidence	Thickness	Resistivity (ohm-m) Confidence	Conductivity (S/m) Confidence	Comments
5. Lower Crust	28 – 37 km [A18b, A15] [II]	9 km	2000 [A12b, A12d] [I]	0.0005 [24]	<u>depth</u> *Rimbey*: 35 km lower depth determined from Moho depth contour map [A18b]. *Loverna*: 37 km lower depth determined from Moho depth contour map [A18b]. Seismic profiles show lower depth range 37-46 km, average 41 km, in Alberta [A15]. *Mudjatik*: 40 km Moho depth scaled from regional seismic profile across north-central SK [20, 30]. Assign 37 km, average depth values (35, 37, 40 km). <u>resistivity</u> 40 km depth minimum-resistivity map [28] shows approx. 40 ohm.m. 40 km depth maximum-resistivity map [31] shows approx 2250 ohm.m *Rimbey*: 33-37 km depth resistivity map [A12b] shows range of 1000-3000 ohm.m (midpoint 2000 ohm.m), exclusive of influence of RDC anomaly (30-300 ohm.m). *Loverna*: 33-37 km depth resistivity map [A12b] and MT profile [A12d] show range of 1000-3000 ohm.m (midpoint 2000) closest to AB/SK boundary, exclusive of influence (i.e. low resistivity) of LC anomaly. Assign 2000 ohm.m, midpoint of resistivity range (1000-3000 ohm.m). Limits 1000, 3000 ohm.m.

Table 2 (continued)
1D Earth Resistivity Model for Saskatchewan Zone 1b

Layer	Depth / Confidence	Thickness	Resistivity (ohm-m) / Confidence	Conductivity (S/m) / Confidence	Comments
6. Upper Mantle	37 – 100 km [23] [III]	63 km	1600 [12b] [II]	0.000625 [24]	depth Used generalized lower depth [23]

resistivity

Minimum-resistivity depth map [28] shows at 40 km: approx. 40 ohm.m.

Maximum-resistivity depth maps [31] show at 40 km, approx 2250 ohm.m; and at 100 km, 1000 ohm.m.

Rimbey: 48-57 km and 63-74 depth resistivity maps [A12b] show range of 100-3000 ohm.m. 1000-3000 ohm.m (midpoint 2000 ohm.m) occupies 50% of domain, 100-300 ohm.m (midpoint 200 ohm.m) occupies 50% of domain; exclusive of influence of RDC and LC anomalies. Chose 1100 ohm.m, weighted average of midpoint values ((2000 x 0.50)+(200 x 0.50).

Loverna: MT resistivity-depth curve [12f] shows range 35-260 ohm.m, averaging 150 ohm.m, between depth 40-100 km, includes influence of LC anomaly.
MT profile [A12d] shows predominant range of 50-200 ohm.m (midpoint 125 ohm.m), exclusive of LC anomaly (<30 ohm.m).
48-57 km depth resistivity map [A12b] shows range of 1000-3000 ohm.m (midpoint 2000 ohm.m).
63-74 km depth resistivity map [A12b] shows 300 ohm.m occupies 50% of domain, 1000-3000 ohm.m occupies 50% of domain. Resistivity listed is exclusive of LC anomaly, and from part of domain closest to AB/SK boundary.

Assign approx. 1600 ohm.m, average of maximum-resistivity map values (2250, 1000 ohm.m). Limits 100, 3000 ohm.m.

Table 2 (continued)
1D Earth Resistivity Model for Saskatchewan Zone 1b

Layer	Depth / Confidence	Thickness	Resistivity (ohm-m) / Confidence	Conductivity (S/m) / Confidence	Comments
7. Upper Mantle	100 - 250 km [23] [III]	150 km	180 [31, A12e, A12d, A12f] [II]	0.005555 [24]	depth Used generalized lower depth [23] 200 km depth maximum-resistivity map shows about 250 ohm.m [31].
			resistivity 200 km depth maximum-resistivity map shows about 250 ohm.m [31]. *Rimbey*: MT profile shows overall range 30-300 ohm.m (midpoint 160 ohm.m), dominantly 100 ohm.m [12e] *Loverna*: MT profiles show range 80-400, dominantly 100 ohm.m [12d] MT resistivity-depth curve [12f] shows average 360 ohm.m, between 100-150 km depth beneath LB Choose 230 ohm.m midpoint of resistivity values (100, 360 ohm.m). Assign approx. 180 ohm.m, average of resistivity values (250, 160, 100, 230 ohm.m). Limits 30, 360 ohm.m.		
8. Upper Mantle	250–410 km [23] [III]	160 km	29 [25]	0.034673 [23] [III]	Utilized Canada regional model [23], based on Ottawa magnetic observatory data for all depths and resistivities below 250 km
9. Transition Zone	410–520 km [23] [III]	110 km	8 [25]	0.125892 [23] [III]	Assign Canada regional model

Table 2 (continued)
1D Earth Resistivity Model for Saskatchewan Zone 1b

Layer	Depth / Confidence	Thickness	Resistivity (ohm-m) / Confidence	Conductivity (S/m) / Confidence	Comments
10. Transition Zone	520–670 km [23]	150 km	2.4 [25]	0.416869 [23]	Assign Canada regional model
	[III]			[III]	
11. Lower Mantle	670–900 km [23]	230 km	1.12 [25]	0.891250 [23]	Assign Canada regional model
	[III]			[III]	
12. Lower Mantle	900–1000 km [23]	100 km	0.48 [25]	2.089296 [23]	Assign Canada regional model
	[III]			[III]	

See end of Table 14 for abbreviations and notes

Table 3
1D Earth Resistivity Model for Saskatchewan Zone 1c

Layer	Depth Confidence	Thickness	Resistivity (ohm-m) Confidence	Conductivity (S/m) Confidence	Comments
1. Overburden	0 – 15 m [39, 45, 46, 47, 48] [I]	15 m	100 [36] [II]	0.01 [24]	Sandy-till blanket, with drumlins (elongate hills comprised of till, > 25 m high) common. Till overlain in areas by glaciofluvial (sand and gravel) deposits associated with eskers and kames and outwash delta, with lesser amount of sandy glaciolacustrine deposits remnants of glacial lakes, and patchy organic deposits (<3 m thick) infilling depressions [45]. Varying thickness in eastern half of Athabasca Basin, ranging 0-100m, increases westward from eastern margin of basin. Bedrock topography controls thickness of overburden 90 m thick at Key Lake, >100 m at McArthur River, 77 m at Thorburn Lake, 35 m at Cigar Lake, and 15 m average at Rabbit Lake-McClean Lake which is situated at east margin of basin [, 46]. [45] also states, "In general, the glacial drift is thin, overlying bedrock highs (0 to 8 m) and thickest where drumlins are superimposed on bedrock topographic lows (greater than 40 m)". [46] remarks that in McArthur River area till depth averages 20 m but may be up to 100 m thick where drumlins occur. [39] notes that at McArthur River Mine, surficial deposits (till) range 0-30 m thick. Borehole logs indicate 10-20 m overburden [47, 48]. Assign 15 m general thickness, midpoint of typical range 10-20 m. Borehole logs of Manitoba overburden show 40-50 ohm.m for till [5]. Boreholes logs of SE Manitoba average approx. 115 ohm.m for sandy till, 10 ohm.m for clay, 45 ohm.m for silt and 80 ohm.m for sand [36]. Resistivities for tills range 20-100 ohm.m [6]. Assign approx. 100 ohm.m weighted average based on areal coverage of overburden resistivity values ((sandy till 115 x 0.5)+(glaciofluvial sand 80 x 0.5)). Limits 80, 115 ohm.m

Table 3 (continued)
1D Earth Resistivity Model for Saskatchewan Zone 1c

Layer	Depth / Confidence	Thickness	Resistivity (ohm-m) / Confidence	Conductivity (S/m) / Confidence	Comments
2. Sedimentary Basin	0 – 1.55 km [49, 50] [I]	1.55 km	2200 [51, 47, 52, 53] [I]	0.000454 [24]	*Athabasca Basin is comprised of unmetamorphosed, undeformed, near-horizontal, late Paleoproterozoic to Mesoproterozoic clastic sediments overlying the metamorphosed deformed basement rock of the Archean Rae and Hearne Cratons [49, 50]. The Snowbird Tectonic Zone / Snowbird Line divides the basin into a western and eastern portion.* Sedimentary rock is predominately quartz-rich sandstone, with subordinate conglomerate and siltstone. Basin has about 1500 m maximum thickness and near elliptical shape (400 x 250 km) [49]. Basin thickness at McArthur River (at eastern edge of Zone 1c) is 800 m, and 1500 m at Snowbird Line [50]. Assign 1150 m, midpoint basin depth between McArthur River and Snowbird Line. Borehole resistivity (away from uranium mineralized zones) has range approx. 440-3500 ohm.m, average 1470 ohm.m [51]. Large resistivity contrast between silicified (14000 ohm.m) and nonsilicified (2000 ohm.m) sandstone, whereby silicification is associated with uranium ore zones in eastern Athabasca Basin, according to borehole logs [47]. MT survey profile, in eastern Athabasca Basin, shows sandstone resistivity (away from uranium mineralized zone) to be approx. 3750 ohm.m [52]. DC resistivity survey, in western Athabasca Basin, shows regional sandstone resistivity to range 6000-9000 ohm.m (midpoint 7500 ohm.m [53]. AMT survey at same location suggests 1000-2000 ohm.m for sandstone [53]. Assign approx. 2200 ohm.m, average of resistivity values, unsilicified (1470, 2000, 3750, 1500 ohm.m). Limits 440, 3750 ohm.m.

Table 3 (continued)
1D Earth Resistivity Model for Saskatchewan Zone 1c

Layer	Depth / Confidence	Thickness	Resistivity (ohm-m) / Confidence	Conductivity (S/m) / Confidence	Comments
3. Upper Crust	1.55 – 13.5 km [20] [II]	12 km	12800 [20] [I]	0.0000781 [24]	*Zone includes the Mudjatik Domain (north and south parts) and the smaller Virgin River Domain (south of Athabasca Basin), all within the Hearne Craton / Hearne geological province of Archean time. Snowbird Tectonic Zone / Snowbird Line is division between the Archean Hearne and Rae Cratons / geological provinces.* Dominated by foliated to gneissic granitoid (synogranite, granodiorite protolith) rocks with minor infolded bands of metasedimentary (pelitic to psammopelitic gneiss) and metavolcanic rock. Metasedimentary rock (mainly psammopelite) occurs along western margin of Virgin River Domain [37, 38].
			Depth scaled from regional seismic profile across north-central SK and western MB [20]. Depth minimum-resistivity maps (mainly covering THO in SK) show at: 5km, 200-400 ohm.m (midpoint 300 ohm.m); 10 km, 180 ohm.m [28]. MT survey, in eastern Athabasca Basin, shows basement rock resistivity (away from uranium mineralized zone), between 0.5-2km depth, to be approx. 8750 ohm.m [52]. MT profile [20] across north-central SK shows: * >50000 ohm.m occupying 30% of layer; eastward dipping "slab"-like feature continues into lower crust (Layer 5) * range 7000-10000 ohm.m (midpoint 8500 ohm.m) occupies 20%, surrounds "slab" * 500 ohm.m occupies 30% * < 10 ohm.m conductive anomaly, near east margin of Zone, occupies 20% Choose 16850 ohm.m, based on weighted average of dominant / midpoint values ((50000 x 0.3)+(8500 x 0.2)+(500 x 0.3)+(10 x 0.2)). Assign 12800 ohm.m, average of dominant / weighted resistivity values (8750, 16850 ohm.m). Limits 500, >50000 ohm.m		

Table 3 (continued)
1D Earth Resistivity Model for Saskatchewan Zone 1c

Layer	Depth / Confidence	Thickness	Resistivity (ohm-m) / Confidence	Conductivity (S/m) / Confidence	Comments
4. Middle Crust	13.5 – 27 km [30] [I]	13.5 km	4350 [20] [I]	0.000229 [24]	Note: same depth and resistivity values as Zone 1a, Layer 4 Depth scaled from regional seismic profile across north-central SK and western MB [30]
			20 km depth minimum-resistivity map shows range 20-40 ohm.m (midpoint 30 ohm.m) [28]. 20 km maximum-resistivity map shows predominately 2000 ohm.m [31]. MT profile [20] across north-central SK shows: * range 7000-10000 ohm.m (midpoint 8500 ohm.m) occupies 20% * 5500 ohm.m occupies 15% * 500 ohm.m occupies 25% * < 10 ohm.m conductive anomaly, near west margin of Zone, extends downward into Layer 4, occupies 20% Assign 4350 ohm.m, based on weighted average of dominant / midpoint values ((8500 x 0.2)+(5500 x 0.15)+(500 x 0.25)+(10 x 0.2)). Limits 10, 10000 ohm.m.		

Table 3 (continued)
1D Earth Resistivity Model for Saskatchewan Zone 1c

Layer	Depth / Confidence	Thickness	Resistivity (ohm-m) / Confidence	Conductivity (S/m) / Confidence	Comments
5. Lower Crust	27 – 37.5 km [20, 30, 39] [II, I]	9.5 km	4350 [20] [I]	0.000229 [24]	Note: same resistivity value as Zone 1a, Layer 5 40 Moho depth scaled from regional seismic profile across north-central SK [20, 30]. 35 km Moho depth beneath Athabasca Basin at McArthur River determined by seismic survey [39]. Assign 37.5 m, average of Moho depths.
			40 km depth minimum-resistivity map shows range 20-70 ohm.m (midpoint 45 ohm.m) [28]. 40 km depth maximum-resistivity map shows predominantly 2000 ohm.m [31]. MT profile [20] across north-central SK shows: * range 5500-8500 ohm.m (midpoint 7000 ohm.m) occupies 60% of layer * 500 ohm.m occupies 30% * < 10 ohm.m conductive anomaly occupies 10% Assign 4350 ohm.m, based on weighted average of dominant / midpoint values ((7000 x 0.6)+(500 x 0.3)+(10 x 0.1)). Limits 10, 8500 ohm.m.		
6 to 12.	Depths and resistivity values for Layers 6 to 12 are same as in Zone 1b – refer to Table 2				

See end of Table 14 for abbreviations and notes

Table 4
1D Earth Resistivity Model for Saskatchewan Zone 1d

Layer	Depth Confidence	Thickness	Resistivity (ohm-m) Confidence	Conductivity (S/m) Confidence	Comments
1. Overburden	0 – 100 m [2] [II]	100 m	25 [42] [II]	0.04 [24]	Predominately clay-rich till blanket, with glaciolacustrine deposits (mostly fine-grained clay-silt, patches of coarser grained sand-gravel) along main river valleys (e.g. South Saskatchewan River, Battle River, Swift Current Creek) [40]. North Battleford, Kindersley and Assiniboia areas underlain by glaciolacustrine (clay-silt) plain (former glacial lake). Scattered small glaciofluvial deposits in southern SK. Eolian (sand) deposits occur as patches along South Saskatchewan River. Alluvial deposits along major river valleys. Overburden thickness dependent on bedrock topography and presence of buried pre-glacial valleys and glacial moraine landform. Overburden in southern SK commonly 100-200 m thick, but can range from 0 (e.g. Wood Mountain) to >300 m in Touchwood Hills [37], generally thicker in northern half of Zone 1d. Regional overburden isopach map [2] shows an overall typical thickness up to 100 m, with pockets ranging 100-250 m. Along SK/USA border area, <50 m thick [2]. NW-SE orientated stratigraphic cross-section across southern SK shows typical thickness ranges 20-40 m, in places < 120 m [41]. In North Battleford area thickness of till up to 10 m, in places overlain by < 2 m glaciolacustrine silt [54]. Assign overall 100 m depth, based on range 100-200 m. Borehole logs of southern Saskatchewan overburden show typical range 15-40 ohm.m (midpoint 25 ohm.m) for till (clayey and sandy); for glaciolacustrine/fluvial deposits, sand ranges 40-60 ohm, silt ranges 10-20 ohm and clay ranges 5-10 ohm.m [42]. In SE Manitoba, borehole logs show clayey till resistivity averages approx. 25 ohm.m, silty till 50 ohm.m, sandy till 115 ohm.m; and for glaciolacustrine deposits, sand 80 ohm.m, silt 45 ohm.m and clay 10 ohm.m [36]. MT survey in SE Manitoba indicates 5-30 ohm for mix of till, clay, silt and sand [4]. Glaciolacustrine clays average 30 ohm.m in NE Ontario [7]. Assign overall 25 ohm.m, midpoint of range for tills in southern SK. Limits (for till) 15, 40 ohm.m.

Table 4 (continued)
1D Earth Resistivity Model for Saskatchewan Zone 1d

Layer	Depth Confidence	Thickness	Resistivity (ohm-m) Confidence	Conductivity (S/m) Confidence	Comments
2. Sedimentary Basin	0.1 – 1.8 m [21] [II]	1.7 m	10 [A12a] [II]	0.01 [24]	Layer 2 is the WCSB, comprised of limited exposure of Tertiary clastic sedimentary rock (conglomerate, siltstone, sandstone) on top of Mesozoic strata (dominantly shales with lesser amounts of silt/sandstones, carbonates and evaporates), in turn overlying subsurface Paleozoic carbonate (dolostone, dolomitic limestone, limestone) [43]. Tertiary sediments limited to SK/USA border area. Depth deepens southwesterly (above 51 deg. N) and southeasterly (below 51 deg. N). Combined Tertiary, Mesozoic and Paleozoic strata thickness ranges 600-3000 m [21]. Deepest 2600-3000 m within the Williston Basin, straddling the SK/USA border area. Layer 2 is 1800 m thick at North Battleford and 2300 m at Swift Current. Assign 1.8 km, midpoint depth of range. In adjacent AB, Layer 2: * MT 3D inversion model indicates 5-10 ohm.m range over entire thickness of WCSB [A12a] * 0.6-0.8 km depth resistivity map [A12b] shows 3 ohm.m * 1.8-2.1 depth resistivity map [A12b] shows 3-10 ohm.m In southwestern MB, MT survey reveals Lower Paleozoic carbonates exhibit 20-50 ohm.m [4], upper Paleozoic and Mesozoic strata (both shale dominant) exhibits 1-5 ohm.m [4]; overall <5 ohm.m [4 p.451]. Along SK/USA border, MT survey reveals < 5 ohm.m resistivity (E-polarization direction) for WCSB to a 3 km depth [44]. Assign 10 ohm.m encompassing entire thickness of WCSB, based on resistivity in adjacent AB [A12a]. Limits 5, 20 ohm.m (midpoint of range 3-20 ohm.m).

Table 4 (continued)
1D Earth Resistivity Model for Saskatchewan Zone 1d

Layer	Depth Confidence	Thickness	Resistivity (ohm-m) Confidence	Conductivity (S/m) Confidence	Comments
3. Upper Crust	1.8 – 16 km [A15, A14, 20] [II]	14.2 km	2200 [A12b] [II]	0.000454 [24]	*Zone includes the Eyehill Domain that extends from adjacent Alberta northeasterly into SK, and the Wollaston Domain that extends from northern SK to the south. Not known if Wollaston extends entire length of province of SK. Eyehill and Wollaston Domains within the Archean Hearne Craton / Hearne geological province – covered by the WCSB.* *Eyehill*: Metaplutonic gneiss and amphibolite gneiss comprise the Eyehill domain [A20]. *Wollaston*: Predominately Paleoproterozoic metasedimentary rock (psammopelite, metampelite, arkose, quartzite, conglomerate, calc-silicates, some marble) underlain by Archean granitoids (granodiorite, monozogranite); complexly folded.
			depth *Note*: limited layer depth information, required importation of values depicted in Eyehill Domain in adjacent AB supplemented by depth information from Wollaston Domain in SK. *Eyehill*: 19 km lower depth scaled seismic profiles across southern Alberta; 18 km [A15], 20 km [A14] *Wollaston*: 13.5 km scaled from regional seismic profile across north-central SK and western MB [20]. Assign 16 km, average depth values (19, 13.5 km). resistivity *Note*: limited MT profiles for Zone in SK, required importation of resistivity values depicted in Eyehill Domain in adjacent AB supplemented by resistivity information from Wollaston domain in SK. 5 km depth minimum-resistivity map shows range 20-400 ohm.m (midpoint 210 ohm.m) [28]. 10 km depth minimum-resistivity map shows range 20-180 ohm.m (100 ohm.m) [28]. *Eyehill*: 17-20 km depth resistivity map [A12b] shows range 300-3000 ohm.m. Chose 1900 ohm.m weighted average based on areal extent of individual resistivity ranges ((300 x 0.4) + (3000 x 0.6)). *Wollaston*: 2500 ohm.m was assigned (see Table 2a for details) Assign approx. 2200 ohm.m, average of chosen resistivity values (1900, 2500 ohm.m). Limits 300, 3000 ohm.m.		

Table 4 (continued)
1D Earth Resistivity Model for Saskatchewan Zone 1d

Layer	Depth Confidence	Thickness	Resistivity (ohm-m) Confidence	Conductivity (S/m) Confidence	Comments
4. Middle Crust	16 – 29 km [A19a] [II]	13 km	1950 [A12c] [II]	0.000512 [24]	<u>depth</u> *Eyehill*: 30 km lower depth scaled from seismic profile [A19a]. *Wollaston*: 28 km scaled from regional seismic profile across north-central SK and western MB [30]. Assign 29 km, average depth values (30, 28 km). <u>resistivity</u> 20 km depth minimum-resistivity map shows range 20-40 ohm.m (midpoint 30 ohm.m) [28]. 20 km depth maximum-resistivity map shows dominantly 250 ohm.m, resistivity decreases southward [31]. *Eyehill*: MT profiles [A12c] show a very approximate range 300-3000 ohm.m (midpoint 1650 ohm.m). Limited resolution of profile prevents finer selection of resistivity. 17-20 km depth resistivity map [A12b] shows 300-3000 ohm.m (midpoint 1650 ohm.m). *Wollaston*: 2275 ohm.m was assigned (see Table 2a for details) Assign approx. 1950 ohm.m, average of dominant / midpoint resistivity values (1650, 2275 ohm.m) on MT profiles. Limits 300, 3000 ohm.m.
5. Lower Crust	29 – 42 km [A18, 20, 30] [II]	13 km	900 [A12b] [II]	0.001111 [24]	<u>depth</u> *Eyehill*: average 43 km lower depth determined from seismic depth determinations [A18a], showing range 39-46 km. *Wollaston*: 40 km Moho depth scaled from regional seismic profile across north-central SK [20, 30]. Assign approx. 42 km, average depth values (43, 40 km). <u>resistivity</u> 40 km depth minimum-resistivity map shows range 7-20 ohm.m (midpoint 15 ohm.m) [28]. 40 km depth maximum-resistivity map shows dominantly 250 ohm.m, resistivity decreases southward [31]. *Eyehill*: 33-37 km depth resistivity map shows range of 100-3000 ohm.m, some influence from LC anomaly [A12b]. Chose 850 ohm.m, weighted average based on areal extent of dominant/midpoint resistivity ((150 x 0.75) + (3000 x 0.25)). *Wollaston*: 900 ohm.m was assigned (see Table 2a for details) Assign 900 ohm.m. Limits 100, 3000 ohm.m.

Table 4 (continued)
1D Earth Resistivity Model for Saskatchewan Zone 1d

Layer	Depth / Confidence	Thickness	Resistivity (ohm-m) / Confidence	Conductivity (S/m) / Confidence	Comments
6. Upper Mantle	42 – 100 km [23] [III]	58 km	550 [A12b] [I]	0.001818 [24]	depth Used generalized lower depth [23] resistivity 100 km depth maximum-resistivity map shows dominantly 250 ohm.m, resistivity decreases southward [31]. *Eyehill*: 48-57 km and 63-74 km depth resistivity maps [A12b] show range of 30-3000 ohm.m. Low resistive body (on strike with LC anomaly) straddles the AB/SK boundary. Chose 500 ohm.m weighted average based on areal extent of dominant resistivity ((30 x 0.7)+(300 x 0.15) +(3000 x 0.15)). *Wollaston*: 600 ohm.m was assigned (see Table 2a for details) Assign 550 ohm.m, average of resistivity values (500, 600 ohm.m). Limits 30, 3000 ohm.m.
7. Upper Mantle	100 - 250 km [23] [III]	150 km	350 [A12c] [I]	0.002857 [24]	depth Used generalized lower depth [23] resistivity 200 km depth maximum-resistivity map shows dominantly 180 ohm.m, resistivity decreases southward [31]. *Eyehill*: MT profile [A12c] shows range 100-1000, dominantly at lower end of range. Chose 530 ohm.m weighted average based on areal extent of dominant resistivity ((300 x 0.63)+(1000 x 0.34)). *Wollaston*: 200 ohm.m was assigned (see Table 2a for details). Assign approx. 350 ohm.m, average of resistivity values (530, 200 ohm.m). Limits 200, 1000 ohm.m.

Table 4 (continued)
1D Earth Resistivity Model for Saskatchewan Zone 1d

Layer	Depth / Confidence	Thickness	Resistivity (ohm-m) / Confidence	Conductivity (S/m) / Confidence	Comments
8. Upper Mantle	250–410 km [23] [III]	160 km	90 [A35b, A12g] [II]	0.011111 [24]	depth Used generalized lower depth [23] resistivity *Eyehill*: MT profile [A35b] shows range 20-200 ohm.m (110 ohm.m midpoint) between 225-300 km depth, and an averaged resistivity of 75 ohm.m for southern Alberta [A12g]. *Wollaston*: Canada regional value of 29 ohm.m was assigned. Assign 90 ohm.m, average of resistivity value / midpoint value (110, 75 ohm.m) as determined for Eyehill Domain. Limits 20, 200 ohm.m.
9. Transition Zone	410–520 km [23] [III]	110 km	8 [25]	0.125892 [23] [III]	Utilized Canada regional model [23], based on Ottawa magnetic observatory data for all depths and resistivities below 410 km
10. Transition Zone	520–670 km [23] [III]	150 km	2.4 [25]	0.416869 [23] [III]	Assign Canada regional model
11. Lower Mantle	670–900 km [23] [III]	230 km	1.12 [25]	0.891250 [23] [III]	Assign Canada regional model
12. Lower Mantle	900–1000 km [23] [III]	100 km	0.48 [25]	2.089296 [23] [III]	Assign Canada regional model

See end of Table 14 for abbreviations and notes

Table 5
1D Earth Resistivity Model for Saskatchewan Zone 1e

Layer	Depth Confidence	Thickness	Resistivity (ohm-m) Confidence	Conductivity (S/m) Confidence	Comments
1. Overburden	0 – 50 m [2] [II]	50 m	25 [36] [II]	0.04 [24]	Till blanket is predominant [40], variable from clay to silt-rich [55]. Glaciofluvial and glaciolacustrine deposits along Swift Current Creek valley [40]. Regional overburden isopach map shows thickness range <50-150 m, <50 south of Swift Current Creek, 50-150 m north of river [2]. In Cyprus Hills and Shaunavon area overburden thickness is variable: tills 2-40 m, glaciofluvial 5-20 m, glaciolacustrine 5-50 m [55]. Assign 50 m general thickness. Borehole logs of southern Saskatchewan overburden show typical range 15-40 ohm.m (midpoint 25 ohm.m) for till (clayey and sandy); for glaciolacustrine / glacio/fluvial deposits, sand ranges 40-60 ohm, silt ranges 10-20 ohm and clay ranges 5-10 ohm.m [42]. In SE Manitoba, borehole logs show clayey till resistivity averages approx. 25 ohm.m, silty till 50 ohm.m, sandy till 115 ohm.m; and for glaciolacustrine deposits, sand 80 ohm.m, silt 45 ohm.m and clay 10 ohm.m [36]. MT survey in SE Manitoba indicates 5-30 ohm for mix of till, clay, silt and sand [4]. Glaciolacustrine clays average 30 ohm.m in NE Ontario [7]. Assign overall 25 ohm.m, midpoint of range for tills in southern SK. Limits (for till) 15, 40 ohm.m.

Table 5 (continued)
1D Earth Resistivity Model for Saskatchewan Zone 1e

Layer	Depth Confidence	Thickness	Resistivity (ohm-m) Confidence	Conductivity (S/m) Confidence	Comments
2. Sedimentary Basin	0 – 2.4 km [21] [II]	2.4 m	10 [A12a] [II]	0.01 [24]	Layer 2 is the WCSB, comprised of limited exposure of Tertiary clastic sedimentary rock (conglomerate, siltstone, sandstone) on top of Mesozoic strata (dominantly shales with lesser amounts of silt/sandstones, carbonates and evaporates), in turn overlying subsurface Paleozoic carbonate (dolostone, dolomitic limestone, limestone) [43]. Tertiary sediments limited to the Cyprus Hills. Depth deepens southeasterly. Combined Tertiary, Mesozoic and Paleozoic strata thickness ranges 2300-2500 m [21]. Assign 2.4 km, midpoint depth of range. In adjacent AB, Layer 2: * MT 3D inversion model indicates 5-10 ohm.m range over entire thickness of WCSB [A12a] * 0.6-0.8 km depth resistivity map [A12b] shows 3 ohm.m * 1.8-2.1 depth resistivity map [A12b] shows 40 ohm.m In southwestern MB, MT survey reveals Lower Paleozoic carbonates exhibit 20-50 ohm.m [4], upper Paleozoic and Mesozoic strata (both shale dominant) exhibits 1-5 ohm.m [4]; overall <5 ohm.m [4 p.451]. Along SK/USA border, MT survey reveals < 5 ohm.m resistivity (E-polarization direction) for WCSB to a 3 km depth [44]. Assign 10 ohm.m encompassing entire thickness of WCSB, based on resistivity in adjacent AB [A12a]. Limits 5, 20 ohm.m (midpoint of range 3-40 ohm.m).

Table 5 (continued)
1D Earth Resistivity Model for Saskatchewan Zone 1e

Layer	Depth Confidence	Thickness	Resistivity (ohm-m) Confidence	Conductivity (S/m) Confidence	Comments
3. Upper Crust	2.4 – 22 km [A13-A16] [II]	19.6 km	1700 [A12d, A12b] [II]	0.000588 [24]	*Zone includes the Medicine Hat Block and Vulcan Structure that extend from adjacent Alberta easterly into SK. Medicine Hat Block and Vulcan Structure occur within the Archean Hearne Craton / Hearne geological province – covered by the WCSB.* *Medicine Hat:* Gneiss and plutonic rocks (quartz diorite, granodorite *Vulcan:* A crustal collision zone, geophysically expressed by anomalous aeromagnetic and gravity lows.
			depth *Note*: limited layer depth information, required importation of depth assigned to Medicine Hat Block and Vulcan Structure underlying Alberta. *Medicine Hat:* 20 km average depth scaled from trans-continental seismic transect (11-12 km) [A13] and regional seismic profiles (20, 15 km) in Alberta [A15, A14] *Vulcan:* 24 km average depth scaled regional seismic profiles (26.5, 18-22, 24 km) in Alberta [A16, A15, A14]. Assign 22 km, average depth values (20, 24 km). resistivity *Note*: limited MT profiles for Zone in SK, required importation of resistivity values depicted for Medicine Hat Block and Vulcan Structure where close to the AB/SK provincial boundary. Excluded from resistivity determination the lower resistivity margin visible on depth-resistivity maps inferred to be a result of scarcity of data points in the modeling process. *Medicine Hat:* MT profile shows [A12d] predominately 400 ohm. 17-20 km depth resistivity map [A12b] shows range 800-3000 ohm.m (midpoint 1900 ohm.m), excluding lower resistivity margin due possibly modeling artifact. Chose 1150 ohm.m, average of values (400, 1900 ohm.m). *Vulcan:* MT profile shows [A12d] predominately 5000 ohm. 17-20 km depth resistivity map [A12b] shows predominately 4000 ohm.m. Chose 2150 ohm.m, average of values (4000, 300 ohm.m). Assign approx. 1700 ohm.m, average of chosen resistivity values (1150, 2150 ohm.m). Limits 400, 5000 ohm.m.		

Table 5 (continued)
1D Earth Resistivity Model for Saskatchewan Zone 1e

Layer	Depth / Confidence	Thickness	Resistivity (ohm-m) / Confidence	Conductivity (S/m) / Confidence	Comments
4. Middle Crust	22 – 35 km [A14-A16] [II]	13 km	3200 [A12d, A12b] [II]	0.000312 [24]	<u>depth</u> *Medicine Hat:* 12.5 km average thickness scaled from seismic profiles across southern Alberta; 18 km [A16], 12.8 km [A15], 6.9 km [A14]. *Vulcan:* 13 km average thickness scaled from seismic profiles across southern Alberta; 14 km [A15], 10.5 km [A14]. Assign 13 km thickness to Layer 4. <u>resistivity</u> 20 km depth maximum-resistivity map shows dominantly 180 ohm.m[31]. *Medicine Hat:* MT profile shows [A12d] predominately 1500 ohm. 33-37 km depth resistivity map [A12b] shows range 1500-3000 ohm.m (midpoint 2250 ohm.m). Chose approx. 1900 ohm.m, average of values (1500, 2250 ohm.m). *Vulcan: Vulcan:* MT profile shows [A12d] predominately 5000 ohm. 33-37 km depth resistivity map [A12b] shows predominately 4000 ohm.m. Chose 4500 ohm.m, average of values (5000, 4000 ohm.m). Assign approx. 3200 ohm.m, average of resistivity values (1900, 4500 ohm.m) on MT profiles. Limits 1500, 5000 ohm.m.
5. Lower Crust	35 – 46 km [A18a, A15] [II]	11 km	4000 [A12d] [II]	0.00025 [24]	<u>depth</u> *Medicine Hat:* 45 km from averaging of location-specific seismic depth determination [A18a]. *Vulcan:* 47 km on seismic profile [A15]. Assign 46 km, average of depth values (45, 47 km). <u>resistivity</u> 40 km depth maximum-resistivity map shows dominantly 180 ohm.m [31]. *Medicine Hat:* MT profile shows [A12d] range 1000-5000 ohm (midpoint 3000 ohm.m). *Vulcan:* MT profile shows [A12d] predominately 5000 ohm. Assign approx. 4000 ohm.m, average of resistivity values (3000, 5000 ohm.m) on MT profiles. Limits 1000, 5000 ohm.m.

Table 5 (continued)
1D Earth Resistivity Model for Saskatchewan Zone 1e

Layer	Depth / Confidence	Thickness	Resistivity (ohm-m) / Confidence	Conductivity (S/m) / Confidence	Comments
6. Upper Mantle	46 – 100 km [23] [III]	54 km	4000 [A12d, A12b] [II]	0.00025 [24]	<u>depth</u> Used generalized lower depth [23] <u>resistivity</u> 100 km depth maximum-resistivity map shows dominantly 125 ohm.m [31]. *Medicine Hat:* MT profile shows [A12d] range 800-5000 ohm (midpoint 2900 ohm.m). 48-57 and 63-74 km depth resistivity maps [A12b] show predominately 4000 ohm.m. Chose 3450 ohm.m, average of values (2900, 4000 ohm.m). *Vulcan:* MT profile shows [A12d] predominately 5000 ohm. 48-57 and 63-74 km depth resistivity maps [A12b] show predominately 4000 ohm.m. Chose 4500 ohm.m, average of values (5000, 4000 ohm.m). Assign approx. 4000 ohm.m, average of resistivity values (3450, 4500 ohm.m). Limits 800, 5000 ohm.m.
7. Upper Mantle	100 - 250 km [23] [III]	150 km	425 [A12d] [II]	0.002352 [24]	<u>depth</u> Used generalized lower depth [23] <u>resistivity</u> 200 km depth maximum-resistivity map shows dominantly 100 ohm.m [31]. *Medicine Hat:* MT profile [A12d] shows: * range 30-50 ohm.m (midpoint 40 ohm.m) occupies 19% of layer * range 100-250 ohm.m (midpoint 175 ohm.m) occupies 60% * range 300-2000 ohm.m (midpoint 1150 ohm.m) occupies 30% Choose approx. 450 ohm.m weighted average of midpoint values ((40 x 0.1)+(175 x 0.6) + (1150 x 0.3)). *Vulcan:* MT profile [A12d] shows: * range 100-250 ohm.m (midpoint 175 ohm.m) occupies 75% of layer * range 300-2000 ohm.m (midpoint 1150 ohm.m) occupies 25% Choose approx. 400 ohm.m weighted average of midpoint values ((175 x 0.75) + (1150 x 0.25)). Assign 425 ohm.m, average of resistivity values (450, 400 ohm.m). Limits 30, 2000 ohm.m.

Table 5 (continued)
1D Earth Resistivity Model for Saskatchewan Zone 1e

Layer	Depth Confidence	Thickness	Resistivity (ohm-m) Confidence	Conductivity (S/m) Confidence	Comments
8. Upper Mantle	250–410 km [23] [III]	160 km	70 [A12d] [II]	0.014285 [24]	<u>depth</u> Used generalized lower depth [23] <u>resistivity</u> *Medicine Hat and Vulcan:* MT profile shows [A12d] range 30-100 ohm.m (midpoint 65 ohm.m) between 250-300 km depth. Assign 70 ohm.m, midpoint of resistivity range (30, 110 ohm.m). Limits 30, 100 ohm.m.
9. Transition Zone	410–520 km [23] [III]	110 km	8 [25]	0.125892 [23] [III]	Utilized Canada regional model [23], based on Ottawa magnetic observatory data for all depths and resistivities below 410 km
10. Transition Zone	520–670 km [23] [III]	150 km	2.4 [25]	0.416869 [23] [III]	Assign Canada regional model
11. Lower Mantle	670–900 km [23] [III]	230 km	1.12 [25]	0.891250 [23] [III]	Assign Canada regional model
12. Lower Mantle	900–1000 km [23] [III]	100 km	0.48 [25]	2.089296 [23] [III]	Assign Canada regional model

See end of Table 14 for abbreviations and notes

Table 6
1D Earth Resistivity Model for Saskatchewan Zone 2a

Layer	Depth Confidence	Thickness	Resistivity (ohm-m) Confidence	Conductivity (S/m) Confidence	Comments
	Note: *Zone 2a continues into Province of Manitoba. Zone 2a excludes the overlapping portion of the sedimentary Athabasca Basin (i.e. Layer 2).*				
1. Overburden	0 – 3 m [34] [II]	3 m	115 [36] [II]	0.008695 [24]	Predominately sandy till veneer (< 3 m thick) with intervening strips of glaciofluvial plains (> 3 m thick, sandy outwash) and glaciofluvial veneer (< 3 m) [34]. Assign overall 3 m thickness, based on presence of till veneer. Borehole logs of Manitoba overburden show 40-50 ohm.m for till [5]. Boreholes logs of SE Manitoba average approx. 115 ohm.m for sandy till, 10 ohm.m for clay, 45 ohm.m for silt and 80 ohm.m for sand [36]. Resistivities for tills range 20-100 ohm.m [6]. MT survey in SE Manitoba indicates 5-30 ohm for mix of till, clay, silt and sand [4]. Assign approx. 115 ohm.m to reflect predominance of sandy till.
2. Sedimentary Basin	absent	---	---	---	---

Table 6 (continued)
1D Earth Resistivity Model for Saskatchewan Zone 2a

Layer	Depth Confidence	Thickness	Resistivity (ohm-m) Confidence	Conductivity (S/m) Confidence	Comments
3. Upper Crust	0 – 13.5 km [20] [I]	13.5 km	2500 [20, 16] [I]	0.0004 [24]	*Zone includes Wollaston Domain, the remnants of a rift–passive margin–foreland basin succession deposited along the eastern margin of the Hearne Craton, and the smaller Peter Lake Domain, which is part of the Hearne Craton. Deformation resulted in series of NE-trending linear rock units of diverse composition [38]* *Wollaston Domain*: Predominately Paleoproterozoic metasedimentary rock (psammopelite, metampelite, arkose, quartzite, conglomerate, calc-silicates, some marble) underlain by Archean granitoids (granodiorite, monozogranite); complexly folded. Occurrences of graphite and iron formation within metasediments. *Peter Lake Domain*: Mostly Paleoproterozoic granitoids (quartz monozogranite, monzogranite, granodiorite) that intruded into Archean gneisses, partially overlain by Wollaston Domain metasediments (quartzofeldspathic gneiss) [37, 38].
			Depth scaled from regional seismic profile across north-central SK and western MB [20]. Depth minimum-resistivity maps (mainly covering THO in SK) show at: 5km, 400 ohm.m; 10 km, 180 ohm.m [28]. MT profile [16] – limited coverage – across north-central SK shows: * 7000 ohm.m occupying 25% of layer * range 1000-4000 ohm.m (midpoint 2000 ohm.m) occupies 47% * 400 ohm.m occupies 28% Choose approx. 3000 ohm.m weighted average of dominant / midpoint values ((7000 x 0.25)+(2000 x 0.47) + (400 x 0.28)). MT profile [20] across north-central SK shows: * range 5500-8500 ohm.m (midpoint 7000 ohm.m) occupying 25% of layer * 500 ohm.m occupies 75% of layer Chose approx. 2100 ohm.m weighted average of dominant / midpoint values ((7000 x 0.25)+(500 x 0.75)). MT survey, in eastern Athabasca Basin at boundary between Mudjatik and Wollaston Domains (i.e. Zones Z1c and Z2b), shows basement rock resistivity (away from uranium mineralized zone), between 0.5-2km depth, to be approx. 8750 ohm.m [52]. Assign approx. 2500 ohm.m, average of chosen weighted average values (3000, 2100 ohm.m). Limits 400, 8500 ohm.m.		

Table 6 (continued)
1D Earth Resistivity Model for Saskatchewan Zone 2a

Layer	Depth / Confidence	Thickness	Resistivity (ohm-m) / Confidence	Conductivity (S/m) / Confidence	Comments
4. Middle Crust	13.5 – 28 km [30] [I]	14.5 km	2300 [20, 16] [I]	0.000434 [24]	Depth scaled from regional seismic profile across north-central SK and western MB [30]. 20 km depth minimum-resistivity map shows 180 ohm.m [28]. 20 km maximum-resistivity map shows predominately 1000 ohm.m [31]. MT profile [16] across north-central SK shows: * 7000 ohm.m occupying 36% of layer * range 1000-4000 ohm.m (midpoint 2000 ohm.m) occupies 64% Choose approx. 3800 ohm.m weighted average of dominant / midpoint values (7000 x 0.36)+(2000 x 0.64)). MT profile [20] across north-central SK shows: * 5500 ohm.m occupying 5% of layer * 500 ohm.m occupies 85% of layer Chose 750 ohm.m weighted average of dominant values (5500 x 0.05)+(500 x 0.85)). Assign approx. 2300 ohm.m, average of weighted averages (3800, 750 ohm.m). Limits 500, 7000 ohm.m.

Table 6 (continued)
1D Earth Resistivity Model for Saskatchewan Zone 2a

Layer	Depth / Confidence	Thickness	Resistivity (ohm-m) / Confidence	Conductivity (S/m) / Confidence	Comments
5. Lower Crust	28 – 38 km [20, 30, 39] [I]	10 km	900 [20, 16] [I]	0.001111 [24]	40 km Moho depth scaled from regional seismic profile across north-central SK [20, 30]. 35 km Moho depth beneath McArthur River from seismic survey [39]. Assign approx. 38 km, average of depth values (40, 35 km)
			40 km depth minimum-resistivity map shows 70 ohm.m [28]. 40 km depth maximum-resistivity map shows predominantly 1000 ohm.m [31]. MT profile [16] across north-central SK shows: * 1000 ohm.m occupies 28% of layer * 400 ohm.m occupies 72% Chose 570 ohm.m weighted average of dominant values ((1000 x 0.28)+(400 x 0.72)). Reduced resistivity due influence of conductive region beneath adjacent western-half of Zone 4a. MT profile [20] across north-central SK shows: * 5500 ohm.m occupying 15% of layer * 500 ohm.m occupies 85% of layer Chose 1250 ohm.m weighted average of dominant values ((5500 x 0.15)+(500 x 0.85)). Assign approx. 900 ohm.m, average of midpoint and chosen weighted average values (570, 1250 ohm.m). Limits 400, 5500 ohm.m		
6. Upper Mantle	38 - 100 km [23] [III]	62 km	600 [20,28] [I]	0.001666 [24]	Used generalized lower depth [23]. 100 km depth maximum-resistivity map shows 1000 ohm.m [31].
			MT profile [16] across north-central SK shows range 200-400 ohm.m (250 ohm.m midpoint). MT profile [20] across north-central SK shows: * 5500 ohm.m occupying 5% of layer * 500 ohm.m occupies 95% of layer Chose 750 ohm.m weighted average of dominant values (5500 x 0.05)+(500 x 0.95)). MT profile [28] of THO across north-central SK shows: * overall 500 ohm.m. Profile has poor resolution. Assign approx. 600 ohm.m, average of chosen weighted average values (750, 500 ohm.m). Limits 500, 5500 ohm.m.		

Table 6 (continued)
1D Earth Resistivity Model for Saskatchewan Zone 2a

Layer	Depth / Confidence	Thickness	Resistivity (ohm-m) / Confidence	Conductivity (S/m) / Confidence	Comments
7. Upper Mantle	100 - 250 km [23] [III]	150 km	200 [28] [I]	0.005 [24]	Used generalized lower depth [23]. 200 km depth maximum-resistivity map shows predominantly 1000 ohm.m [31]. MT profile [28] of THO across north-central SK shows: * 500 ohm.m occupies 23% of layer * 200 ohm.m occupies 19% * midpoint 70 ohm.m occupies 58% Assign approx. 200 ohm.m weighted average of dominant / midpoint values ((500 x 0.23)+(200 x 0.19)+(70 x 0.58)). Limits 70, 500 ohm.m.
8. Upper Mantle	250–410 km [23] [III]	160 km	29 [25]	0.034673 [23] [III]	Utilized Canada regional model [23], based on Ottawa magnetic observatory data for all depths and resistivities below 250 km
9. Transition Zone	410–520 km [23] [III]	110 km	8 [25]	0.125892 [23] [III]	Assign Canada regional model
10. Transition Zone	520–670 km [23] [III]	150 km	2.4 [25]	0.416869 [23] [III]	Assign Canada regional model
11. Lower Mantle	670–900 km [23] [III]	230 km	1.12 [25]	0.891250 [23] [III]	Assign Canada regional model
12. Lower Mantle	900–1000 km [23] [III]	100 km	0.48 [25]	2.089296 [23] [III]	Assign Canada regional model

See end of Table 14 for abbreviations and notes

Table 7
1D Earth Resistivity Model for Saskatchewan Zone 2b

Layer	Depth Confidence	Thickness	Resistivity (ohm-m) Confidence	Conductivity (S/m) Confidence	Comments
	Note: *Zone 2b continues into Province of Manitoba. Zone 2b includes the overlapping portion of the sedimentary Athabasca Basin (i.e. Layer 2).*				
1. Overburden	0 – 15 m [39, 45, 47] [I]	15 m	115 [36] [II]	0.008695 [24]	Varying thickness in eastern half of Athabasca Basin, ranging 0-100m, increases westward from eastern margin of basin. Bedrock topography controls thickness of overburden 90 m thick at Key Lake, >100 m at McArthur River, 77 m at Thorburn Lake, 35 m at Cigar Lake, and 15 m average at Rabbit Lake-McClean Lake which is situated at east margin of basin [45]. [45] states, "In general, the glacial drift is thin, overlying bedrock highs (0 to 8 m) and thickest where drumlins are superimposed on bedrock topographic lows (greater than 40 m)". [46] remarks that in McArthur River area till depth averages 20 m but may be up to 100 m thick where drumlins occur. [39] notes that at McArthur River Mine, surficial deposits (till) range 0-30 m thick. Borehole logs indicate 10-20 m overburden near eastern margin of basin [47]. Assign 15 m general thickness. Sandy-till blanket is predominant, with drumlin (elongate hills comprised of till, > 25 m high) landform common. Till overlain in areas by sand and gravel deposits associated with eskers and kames and outwash delta, with lesser amount of sandy glaciolacustrine deposits remnants of glacial lakes, and patchy organic deposits (<3 m thick) infilling depressions [45] Borehole logs of Manitoba overburden show 40-50 ohm.m for till [5]. Boreholes logs of SE Manitoba average approx. 115 ohm.m for sandy till, 10 ohm.m for clay, 45 ohm.m for silt and 80 ohm.m for sand [36]. Resistivities for tills range 20-100 ohm.m [6]. Assign approx. 115 ohm.m based on predominance of sandy-till within Athabasca Basin.

Table 7 (continued)
1D Earth Resistivity Model for Saskatchewan Zone 2b

Layer	Depth / Confidence	Thickness	Resistivity (ohm-m) / Confidence	Conductivity (S/m) / Confidence	Comments
2. Sedimentary Basin	0 – 0.4 km [49, 50] [I]	0.4 km	2200 [51, 47, 52, 38] [I]	0.000454 [24]	*Athabasca Basin is comprised of unmetamorphosed, undeformed, near-horizontal, late Paleoproterozoic to Mesoproterozoic clastic sediments overlying the metamorphosed deformed basement rock of the Archean Rae and Hearne Cratons [49, 50].* Sedimentary rock is predominately quartz-rich sandstone, with subordinate conglomerate and siltstone. Basin has about 1500 m maximum thickness and near elliptical shape (400 x 250 km) [49]. Basin thickness at McArthur River Mine is 800 m [50]. Assign 0.4 km, midpoint of basin between eastern margin and McArthur River. Borehole resistivity (away from uranium mineralized zones) has range approx. 440-3500 ohm.m, average 1470 ohm.m [51]. Large resistivity contrast between silicified (14000 ohm.m) and nonsilicified (2000 ohm.m) sandstone, whereby silicification is associated with uranium ore zones in eastern Athabasca Basin, according to borehole logs [47]. MT survey profile, in eastern Athabasca Basin, shows sandstone resistivity (away from uranium mineralized zone) to be approx. 3750 ohm.m [52]. DC resistivity survey, in western Athabasca Basin, shows regional sandstone resistivity to range 6000-9000 ohm.m (midpoint 7500 ohm.m [53]. AMT survey at same location suggests 1000-2000 ohm.m for sandstone [53]. Assign approx. 2200 ohm.m, average of resistivity values, unsilicified (1470, 2000, 3750, 1500 ohm.m). Limits 440, 3750 ohm.m.

Table 7 (continued)
1D Earth Resistivity Model for Saskatchewan Zone 2b

Layer	Depth / Confidence	Thickness	Resistivity (ohm-m) / Confidence	Conductivity (S/m) / Confidence	Comments
3. Upper Crust	0.4 – 13.5 km [20] [I]	13.1 km	4600 [20, 16, 52] [I]	0.000217 [24]	*Zone includes Wollaston Domain, the remnants of a rift–passive margin– foreland basin succession deposited along the eastern margin of the Hearne Craton. Deformation resulted in series of NE-trending linear rock units of diverse composition [38].* *Wollaston Domain*: Predominately Paleoproterozoic metasedimentary rock (psammopelite, metampelite, arkose, quartzite, conglomerate, calc-silicates, some marble) underlain by Archean granitoids (granodiorite, monozogranite); complexly folded. Occurrences of graphite and iron formation within metasediments. Narrow (1-20 m wide) and several km long graphitic conductors, 10-100 ohm.m (graphite-bearing metapelite) occur along some basement faults; commonly associated with economic uranium mineralization [52, 53]. Graphitic metapelite 100-500 ohm.m.
			Depth scaled from regional seismic profile across north-central SK and western MB [20]. Depth minimum-resistivity maps (mainly covering THO in SK) show at: 5km, 400 ohm.m; 10 km, 180 ohm.m [28]. MT profile [16] – limited coverage – across north-central SK shows: * 7000 ohm.m occupying 25% of layer * range 1000-4000 ohm.m (midpoint 2000 ohm.m) occupies 47% * 400 ohm.m occupies 28% Choose approx. 3000 ohm.m weighted average of dominant / midpoint values ((7000 x 0.25)+(2000 x 0.47) + (400 x 0.28)). MT profile [20] across north-central SK shows: * range 5500-8500 ohm.m (midpoint 7000 ohm.m) occupying 25% of layer * 500 ohm.m occupies 75% of layer Chose approx. 2100 ohm.m weighted average of dominant / midpoint values ((7000 x 0.25)+(500 x 0.75)). MT survey, in eastern Athabasca Basin, shows basement rock resistivity (away from uranium mineralized zone), between 0.5-2km depth, to be approx. 8750 ohm.m [52]. Assign approx. 4600 ohm.m, average of weighted / dominant resistivity values (3000, 2100, 8750 ohm.m). Limits 400, 8750 ohm.m		

Table 7 (continued)
1D Earth Resistivity Model for Saskatchewan Zone 2b

Layer	Depth	Thickness	Resistivity (ohm-m)	Conductivity (S/m)	Comments
	Confidence		Confidence	Confidence	
4 to 12.	Depths and resistivity values for Layers 4 to 12 are same as in Zone 2a – refer to Table 6				

See end of Table 14 for abbreviations and notes

Table 8
1D Earth Resistivity Model for Saskatchewan Zone 3a

Layer	Depth / Confidence	Thickness	Resistivity (ohm-m) / Confidence	Conductivity (S/m) / Confidence	Comments
	Note: *No available MT survey data covering Layers 3 to 7 for Zone 3a. Utilized MT measured resistivity values of central Rae Craton in mainland Nunavut, situated 1400 km northeast of Zone 3a.*				
1. Overburden	0 – 5 m [34] [I]	5 m	100 [36] [II]	0.01 [24]	North of Lake Athabasca, 50% of Precambrian Shield covered mainly by a sandy-till veneer and some sandy-till blanket. Remaining 50% exposed bedrock [40]. Estimate < 2m thickness on basis predominance till veneer. South of Athabasca Basin, predominately glaciofluvial plain / hummocky deposits (mainly sand), with isolated glaciolacustrine plain (clay-silt) and patchy till blanket [34, 40]. Estimate total thickness < 10 m. Assign 5 m thickness, based on predominance of glaciofluvial deposits. Borehole logs of Manitoba overburden show 40-50 ohm.m for till [5]. Boreholes logs of SE Manitoba average approx. 115 ohm.m for sandy till, 10 ohm.m for clay, 45 ohm.m for silt and 80 ohm.m for sand [36]. Resistivities for tills range 20-100 ohm.m [6]. MT survey in SE Manitoba indicates 5-30 ohm for mix of till, clay, silt and sand [4]. Glaciolacustrine clays average 30 ohm.m in NE Ontario [7]. Assign approx. 100 ohm.m, midpoint between sandy till and glaciofluvial resistivity values, on basis of their predominance in the Zone. Limits 80, 115 ohm.m
2. Sedimentary Basin	absent	---	---	---	---

Table 8 (continued)
1D Earth Resistivity Model for Saskatchewan Zone 3a

Layer	Depth / Confidence	Thickness	Resistivity (ohm-m) / Confidence	Conductivity (S/m) / Confidence	Comments
3 & 4. (combined) Upper-Middle Crust	0 – 18 km [58] [II]	18 km	37500 [58] [II]	0.0000266 [24]	*Zone includes the Nolan, Beaverlodge, Train, Dodge and Tantato domains, north of the Athabasca Basin, and Lloyd Domain south of the Athabasca Basin.* North of Athabasca Basin, 50% of domains are felsic granitoid rocks (gneisses), the remainder being metasedimentary rocks (extensive psammite to psammopelite, conglomerate, orthoquartzite, some iron formation), metavolcanic rocks (mafic gneiss, amphibolite), and migmatites [37]. South of the basin, the Lloyd Domain is predominately felsic granitoid rock (orthogneiss of granodioritic composition, rich in magnetite), which intruded into metasedimentary rock (psammite, psammopelite, impure quartzite, silicate-facies iron formation). A layered anorthosite intrusion occurs along east margin of Lloyd Domain [37, 56, 57]. Lloyd Domain may be continuation of Taltson Magmatic Arc into SK [57]. Central Rae Craton in Nunavut contains "Mesoarchean to Neoarchean, amphibolite to granulite grade metaplutonic gneisses and thin supracrustal {sedimentary and volcanic} belts deformed during the early Paleoproterozoic (2.5–2.3 Ga) Arrowsmith orogeny. These rocks are overlain by 2.19 to 1.75 Ga sedimentary and volcanic rocks, intruded by 1.83 and 1.78 Ga plutons, and were extensively reworked during early accretionary and later phases of the Trans- Hudson orogeny (1.9–1.8 Ga)" [58 p.2416].
			Note: insufficient seismic information to assign separate Layer 3 (upper crust) and Layer 4 (middle crust) thicknesses. 18 km average depth, based on noticeable resistivity difference on MT profiles [58]. 3 MT profiles [58] across Central Rae craton have following weighed averages based on percentage of areal distribution of dominant / midpoint resistivity values: * Profile 1-((>50000 ohm.m x 0.78)+(1000 x 0.22)) = 39220 ohm.m * Profile 2-((>50000 ohm.m x 0.90)+(500 x 0.10)) = 45050 ohm.m * Profile 3-((>50000 ohm.m x 0.46)+(25000 x 0.16)+(3025 x 0.38)) = 28150 ohm.m Assign approx. 37500 ohm.m, average of weighted resistivity values shown above. Limits 500, 50000 ohm.m.		

Table 8 (continued)
1D Earth Resistivity Model for Saskatchewan Zone 3a

Layer	Depth / Confidence	Thickness	Resistivity (ohm-m) / Confidence	Conductivity (S/m) / Confidence	Comments
5. Lower Crust	18 – 36 km [58] [II]	18 km	11500 [58] [II]	0.0000869 [24]	Moho estimated at 35-37 km, determined from seismic survey [58]. 40-45 km depth beneath Archean cratons noted by [30]. Assign 36 km, midpoint of depth range. 3 MT profiles [58] across Central Rae craton have following weighed averages based on percentage of areal distribution of dominant / midpoint resistivity values: * Profile 1-range 500-1000 ohm.m (midpoint 750 ohm.m) * Profile 2-((>50000 ohm.m x 0.28)+(23500 x 0.32)+(500 x 0.40)) = 21720 ohm.m * Profile 3-((>50000 ohm.m x 0.16)+(25000 x 0.07)+(3025 x 0.70)) = 12079 ohm.m Assign approx. 11500 ohm.m, average of weighted resistivity values shown above. Limits 500, 50000 ohm.m.
6. Upper Mantle	36 - 100 km [23] [III]	64 km	23600 [58] [II]	0.0000423 [24]	Used generalized lower depth [23]. 3 MT profiles [58] across Central Rae craton have following weighed averages based on percentage of areal distribution of dominant / midpoint resistivity values: * Profile 1-((>50000 ohm.m x 0.10)+(25000 x 0.55)+(7500 x 0.25)+(500 x 0.05)) = 20470 ohm.m * Profile 2-((>50000 ohm.m x 0.21)+(23500 x 0.43)+(500 x 0.36)) = 20780 ohm.m * Profile 3-((>50000 ohm.m x 0.10)+(32500 x 0.71)+(8500 x 0.19)) = 29690 ohm.m Assign approx. 23600 ohm.m, average of weighted resistivity. Limits 500, 50000 ohm.m.

Table 8 (continued)
1D Earth Resistivity Model for Saskatchewan Zone 3a

Layer	Depth / Confidence	Thickness	Resistivity (ohm-m) / Confidence	Conductivity (S/m) / Confidence	Comments
7. Upper Mantle	100 - 250 km [23] [III]	150 km	24800 [58] [II]	0.0000403 [24]	Used generalized lower depth [23]. 3 MT profiles [58] across Central Rae craton have following weighed averages based on percentage of areal distribution of dominant / midpoint resistivity values: * Profile 1-between 100-200 km, range 10000-50000 ohm.m (midpoint 30000 ohm,m), and between 200-250 km, mainly 500 ohm.m. Choose weighted average 19970 ohm.m ((30000 x 0.66)+(500 x 0.34)) * Profile 2-((>50000 ohm.m x 0.38)+(40000 x 0.46)+(5500 x 0.16)) = 38280 ohm.m. * Profile 3-((37500 ohm.m x 0.40)+(5500 x 0.15)+(500 x 0.45) = 16050 ohm.m. Assign approx. 24800 ohm.m, average of weighted resistivity values(19970, 38280, 16050 ohm.m). Limits 500, 50000 ohm.m.
8. Upper Mantle	250–410 km [23] [III]	160 km	500 [58] [II]	0.002 [24]	Used generalized lower depth [23]. 3 MT profiles [58] across Central Rae craton show predominately 500 ohm.m between 250-350 km (profile base 350 km), except for a 7800 ohm.m resistive keel (Profile 2 extending down from Layer 7. Assign 500 ohm.m, predominant resistivity value.
9. Transition Zone	410–520 km [23] [III]	110 km	8 [25]	0.125892 [23] [III]	Utilized Canada regional model [23], based on Ottawa magnetic observatory data for all depths and resistivities below 410 km

Table 8 (continued)
1D Earth Resistivity Model for Saskatchewan Zone 3a

Layer	Depth / Confidence	Thickness	Resistivity (ohm-m) / Confidence	Conductivity (S/m) / Confidence	Comments
10. Transition Zone	520–670 km [23]	150 km	2.4 [25]	0.416869 [23]	Assign Canada regional model
	[III]			[III]	
11. Lower Mantle	670–900 km [23]	230 km	1.12 [25]	0.891250 [23]	Assign Canada regional model
	[III]			[III]	
12. Lower Mantle	900–1000 km [23]	100 km	0.48 [25]	2.089296 [23]	Assign Canada regional model
	[III]			[III]	

See end of Table 14 for abbreviations and notes

Table 9
1D Earth Resistivity Model for Saskatchewan Zone 3b

Layer	Depth / Confidence	Thickness	Resistivity (ohm-m) / Confidence	Conductivity (S/m) / Confidence	Comments
	Note: *No available MT survey data covering Layers 3 to 7 for Zone 3b. For Layers 3 to 7, utilized MT measured resistivity values of central Rae Craton in mainland Nunavut, situated 1400 km northeast of Zone 3c.*				
1. Overburden	0 – 100 m [2] [I]	100 m	100 [36] [II]	0.01 [24]	Till blanket and glaciofluvial outwash plain deposits (sand) cover much of the Zone 3b [40]. Drumlin landforms are common. Regional overburden isopach map shows range 50-200 m (midpoint 125 m) thickness [2]. Stratigraphic cross-section shows average approx. 100 m thickness [41]. Assign 100 m general thickness. Borehole logs of Manitoba overburden show 40-50 ohm.m for till [5]. Boreholes logs of SE Manitoba average approx.: 115 ohm.m for sandy till, 50 ohm.m for silty till, 25 ohm.m for clay-rich till; and for glaciolacustrine deposits, 80 ohm.m for sand, 45 ohm.m for silt and 10 ohm.m for clay [36]. Resistivities for tills range 20-100 ohm.m [6]. MT survey in SE Manitoba indicates 5-30 ohm for mix of till, clay, silt and sand [4]. Glaciolacustrine clays average 30 ohm.m in NE Ontario [7]. Assume till is sandy (derived from up ice Athabasca Basin comprised of sandstone). Assign approx. 100 ohm.m weighted average based on areal coverage of overburden resistivity values ((sandy till 115 x 0.5)+(glaciofluvial sand 80 x 0.5)). Limits 80, 115 ohm.m

Table 9 (continued)
1D Earth Resistivity Model for Saskatchewan Zone 3b

Layer	Depth / Confidence	Thickness	Resistivity (ohm-m) / Confidence	Conductivity (S/m) / Confidence	Comments
2. Sedimentary Basin	0.1 – 0.3 km [21] / [II]	0.2 km	10 [59] / [II]	0.1 [24]	Layer 2 is the WCSB, comprised of Mesozoic strata (dominantly shales with lesser amounts of silt/sandstones, carbonates and evaporates) overlying Paleozoic carbonate (dolostone, dolomitic limestone, limestone) [43]. Depth deepens southwesterly. Combined Mesozoic and Paleozoic strata thickness ranges 0-600 m [21]. Assign 0.3 km, midpoint depth of range. In northwestern AB, MT survey shows at 1.7 km depth an overall approx. 10 ohm.m resistivity with localized areas up to 30 ohm.m [59]. In southwestern MB, MT survey reveals Lower Paleozoic carbonates exhibit 20-50 ohm.m [4], upper Paleozoic and Mesozoic strata (both shale dominant) exhibits 1-5 ohm.m [4]; overall <5 ohm.m [4 p.451]. Northeastern extent of WCSB – Paleozoic strata only – in SK exhibits 10-100 ohm.m range; strata < 200 m thick [16]. Along SK/USA border, MT survey reveals < 5 ohm.m resistivity (E-polarization direction) for WCSB to a 3 km depth [44]. Assign 10 ohm.m, based on resistivity in adjacent AB. Upper limit (overall) 30 ohm.m.
3 to 12.	Lithotectonic terranes / domains exposed in Zone 3a continue into Zone 3b beneath the covering WCSB (Layer 2) Depth of combined Layers 3 & 4 is 0.3-18 km (thickness 17.25 km), resistivity is same as in Zone 3a – refer to Table 8 Depths and resistivity values for Layers 5 to 12 are same as in Zone 3a – refer to Table 8				

See end of Table 14 for abbreviations and notes

Table 10
1D Earth Resistivity Model for Saskatchewan Zone 3c

Layer	Depth Confidence	Thickness	Resistivity (ohm-m) Confidence	Conductivity (S/m) Confidence	Comments
	Note: *Part of Athabasca Basin (Layer 2) extends into northeast corner of Province of Alberta. No available MT survey data covering Layers 3 to 7 for Zone 3c. For Layers 3 to 7, utilized MT measured resistivity values of central Rae Craton in mainland Nunavut, situated 1400 km northeast of Zone 3c.*				
1. Overburden	0 – 25 m [60, 57] [I]	25 m	100 [36] [II]	0.01 [24]	Blanket of sandy-till and glaciofluvial outwash plain deposits (sand) cover much of the Zone, with scattered organic deposits of peat/bog in the west / northwest part of the Athabasca Basin. Sand dunes common along south shore of Lake Athabasca [40, 45]. Eskers and drumlin landforms common in till overburden areas. Borehole logs and stratigraraphic cross-sections show typical thickness range 10-40 m, increasing along south and western rim of basin between 50-200m [60, 48]. Assign 25 m general thickness, based on midpoint of typical range Borehole logs of Manitoba overburden show 40-50 ohm.m for till [5]. Boreholes logs of SE Manitoba average approx. 115 ohm.m for sandy till, 10 ohm.m for clay, 45 ohm.m for silt and 80 ohm.m for sand [36]. Resistivities for tills range 20-100 ohm.m [6]. Assign approx. 100 ohm.m weighted average based on areal coverage of overburden resistivity values ((sandy till 115 x 0.5)+(glaciofluvial sand 80 x 0.5)). Limits 80, 115 ohm.m

Table 10 (continued)
1D Earth Resistivity Model for Saskatchewan Zone 3c

Layer	Depth Confidence	Thickness	Resistivity (ohm-m) Confidence	Conductivity (S/m) Confidence	Comments
2. Sedimentary Basin	0 – 0.75 km [49] [I]	0.75 km	2200 [51, 47, 52, 53] [I]	0.000454 [24]	*Athabasca Basin is comprised of unmetamorphosed, undeformed, near-horizontal, late Paleoproterozoic to Mesoproterozoic clastic sediments overlying the metamorphosed deformed basement rock of the Archean Rae and Hearne Cratons [49, 50].* Sedimentary rock is predominately quartz-rich sandstone, with subordinate conglomerate and siltstone. Graphitic-rich Archean metasedimentary gneiss forms conductor(s) in the basement rock (i.e. Layer 3) at base of the Athabasca Basin [53] Basin has about 1500 m maximum thickness and near elliptical shape (400 x 250 km) [49]. Assign 0.75 km, midpoint depth. Borehole resistivity (away from uranium mineralized zones) has range approx. 440-3500 ohm.m, average 1470 ohm.m [51]. Large resistivity contrast between silicified (14000 ohm.m) and nonsilicified (2000 ohm.m) sandstone, whereby silicification is associated with uranium ore zones in eastern Athabasca Basin, according to borehole logs [47]. MT survey profile, in eastern Athabasca Basin, shows sandstone resistivity (away from uranium mineralized zone) to be approx. 3750 ohm.m [52]. DC resistivity survey, in western Athabasca Basin, shows regional sandstone resistivity to range 6000-9000 ohm.m (midpoint 7500 ohm.m [53 p418]. AMT survey at same location suggests 1000-2000 ohm.m for sandstone [53, fig5]. Assign approx. 2200 ohm.m, average of resistivity values, unsilicified (1470, 2000, 3750, 1500 ohm.m). Limits 440, 3750 ohm.m.
3 to 12.	Lithotectonic terranes / domains exposed in Zone 3a continue into Zone 3c beneath the covering Athabasca Basin (Layer 2) Depth of combined Layers 3 & 4 is 0.75-18 km (thickness 17.25 km), resistivity is same as in Zone 3a – refer to Table 8 Depths and resistivity values for Layers 5 to 12 are same as in Zone 3a – refer to Table 8				

See end of Table 14 for abbreviations and notes

Table 11
1D Earth Resistivity Model for Saskatchewan Zone 4a

Layer	Depth Confidence	Thickness	Resistivity (ohm-m) Confidence	Conductivity (S/m) Confidence	Comments
	Note: *Zone 4a continues into Province of Manitoba.*				
1. Overburden	0 – 2 m [61, 62] [I, II]	2 m	100 [36] [II]	0.01 [24]	90% of Zone covered by overburden, interspersed with bedrock [61, 62]. Overburden generally <20 m thick in northern SK [37-p50]. Predominantly (80% coverage) sand-rich till veneer [40, 37-p50]. Glaciolacustrine deposits (20 % overburden) common between Creighton/Flin Flon and Reindeer Lake, and between La Ronge and Flin Flon [40]. Eskers common in till covered areas. Area specific maps [61, 62] indicate sand-rich till veneer 1-2 m thick, patchy sand-rich till blanket > 2 and locally 50 m thick; glaciolacustrine clay and silt deposits as veneer < 2 m thick or blanket <25 m thick, interspersed with organic deposits of peat bog, 1-5 m thick; some glaciofluvial outwash (fine sand) and stratified (sand and gravel) deposits, 3-25 m thick. Assign overall 2 m depth, based on prevalence of till veneer. Locally where mainly glaciolacustrine and glaciofluvial deposits occur, thickness possibly up to 25 m. Borehole logs of southern Saskatchewan overburden show typical range 15-40 ohm.m (midpoint 25 ohm.m) for till (clayey and sandy); for glaciolacustrine/fluvial deposits, sand ranges 40-60 ohm, silt ranges 10-20 ohm and clay ranges 5-10 ohm.m [42]. Borehole logs of Manitoba overburden show 40-50 ohm.m for till [5]. In SE Manitoba, borehole logs show clayey till resistivity averages approx. 25 ohm.m, silty till 50 ohm.m, sandy till 115 ohm.m; and for glaciolacustrine deposits, sand 80 ohm.m, silt 45 ohm.m and clay 10 ohm.m [36]. MT survey in SE Manitoba indicates 5-30 ohm for mix of till, clay, silt and sand [4]. Generally, resistivities for tills range 20-100 ohm.m [6]. Glaciolacustrine clays average 30 ohm.m in NE Ontario [7]. Assign approx. 100 ohm.m weighted average based on areal coverage of overburden resistivity values ((till 115 x 0.8)+(lacustrine 30 x 0.2)). Limits 30, 115 ohm.m.
2. Sedimentary Basin	absent	---	---	---	---

Table 11 (continued)
1D Earth Resistivity Model for Saskatchewan Zone 4a

Layer	Depth / Confidence	Thickness	Resistivity (ohm-m) / Confidence	Conductivity (S/m) / Confidence	Comments
3. Upper Crust	0 - 16 km [20] [I]	16 km	9200 [20, 16] [I]	0.000108 [24]	*Zone includes the Wathaman Domain / Batholith, Rottenstone Domain, La Ronge Domain, Glennie Domain and Kisseynew Domain, all within the Paleoproterozoic Trans-Hudson Orogen.* Predominately granitic and gneissic rock, metagreywacke (sedimentary), and lesser other metasedimentary and metavolcanic rock.
			Depth scaled from regional seismic profile across north-central SK and western MB, range approx 12.5-19.5 km, deeper crustal root at boundary between La Ronge Belt and Glennie domain in Saskatchewan [20]. Assign midpoint of range. Depth minimum-resistivity maps show at: 5km, range 200-400 ohm.m; 10 km, range 70-180 ohm.m (midpoint 125 ohm.m [28]. Excludes NACP and ALCA anomalies exhibiting 5 ohm.m. [29] remarks THO upper crust in north-central SK is highly resistive (>10000 ohm.m) with isolated near surficial conductive (1000 ohm.m, 200-400 ohm.m) anomalies (pyrite rich) and at shear zones between domains. Wathaman batholith exhibits >10,000 ohm.m. MT profile [16] shows range 800-10000 ohm.m (midpoint 5400 ohm.m), excluding conductive (<70 ohm.m) NACP anomaly. MT profile [20] across north-central SK shows: * range 8000 >50000 ohm.m (midpoint 29000 ohm.m) occupying 40% of layer, mainly within Glennie Domain (including Hanson Lake block) which overlies the Archean Sask Craton * 1000 ohm.m occupies 50% of layer * 500-8000 ohm.m (midpoint 4300 ohm.m) occupies 10% Chose 13000 ohm.m weighted average of dominant / midpoint values (29000 x 0.4)+(1000 x 0.5) + (4300 x 0.1)). Excluded NACP conductive anomaly, exhibiting 5 ohm.m, occupies approx. 15% of layer, situated beneath Rottenstone Domain and part of La Ronge Domain. Assign 9200 ohm.m, average of midpoint and chosen weighted average values (5400, 13000 ohm.m). Limits 300, 50000 ohm.m. Note: Possible overestimate of assigned resistivity due major influence of highly resistive Glennie Domain in north-central SK.		

Table 11 (continued)
1D Earth Resistivity Model for Saskatchewan Zone 4a

Layer	Depth Confidence	Thickness	Resistivity (ohm-m) Confidence	Conductivity (S/m) Confidence	Comments
4. Middle Crust	16 – 28 km [20, 30] [I]	12 km	12500 [20, 16] [I]	0.00008 [24]	Depth scaled from regional seismic profile across north-central SK and western MB, average 27 km [30] and 29 km [20]. Assign average of values. 20 km depth minimum-resistivity map shows range 20-180 ohm.m, predominately 30 ohm.m, 180 ohm.m in area of buried underlying Sask Craton [28]. Excludes NACP 5 ohm.m anomaly. 20 km depth maximum-resistivity map shows range 1000-10000 ohm.m [31]. MT profile [16] across north-central SK shows: * range 800-8000 ohm.m (midpoint 4400 ohm.m) occupies 85% of layer * range 40000 >70000 ohm.m (midpoint 55000 ohm.m) occupies 15% of layer Chose approx. 12000 ohm.m weighted average of dominant / midpoint values ((4400 x 0.85)+(55000 x 0.15)). Excluded conductive (<70 ohm.m) NACP anomaly. MT profile [20] across north-central SK shows same resistivity range and areal coverage as above in Layer 3, and therefore chose 13000 ohm.m weighted average. NACP conductive anomaly (see Layer 3) continues to base of Layer 4. Assign 12500 ohm.m, average of weighted averages (12000, 13000 ohm.m). Limits 800, 55000 ohm.m.

Table 11 (continued)
1D Earth Resistivity Model for Saskatchewan Zone 4a

Layer	Depth Confidence	Thickness	Resistivity (ohm-m) Confidence	Conductivity (S/m) Confidence	Comments
5. Lower Crust	28 – 40 km [20] [I]	12 km	5800 [20, 16] [I]	0.000172 [24]	Moho depth scaled from regional seismic profile across north-central SK ranges 36-47 km [20]. Assign average depth. Maximum 52 km depth beneath Sask Craton noted by [30]. 40 km depth minimum-resistivity maps (mainly covering THO in SK) shows range 5-40 ohm.m but 70-180 ohm.m in area of buried underlying Sask Craton [28]. 40 km depth maximum-resistivity map shows range 1000-10000 ohm.m [31]. MT profile [16] across north-central SK shows: * wide resistivity range, 10-70000 ohm.m; east-half of Zone (beneath Glennie and Kisseynew? Domains) resistive, west-half conductive (beneath La Ronge, Rottenstone and Wathaman domains) * East-half of Zone: chose 6275 ohm.m, based on weighted average of dominant resistivity values and areal coverage ((70000 ohm.m x 0.05)+(40000 x 0.05)+(7000 x 0.05)+(4000 x 0.05)+(1000 x 0.2)+(400 x 0.05)+(100 x 0.05)). * West-half of Zone: chose 65 ohm.m, based on weighted average of dominant resistivity values and areal coverage ((100 ohm.m x 0.05)+(70 x 0.75)+(40 x 0.15)+(190 x 0.05)) * approx. 3200 ohm.m overall average (6275, 65 ohm.m) MT profile [20] across north-central SK shows: * east-half of Zone (beneath Glennie and Kisseynew? Domains) resistive, west-half conductive (beneath La Ronge, Rottenstone and Wathaman domains) due influence of lower crust / uppermost mantle conductor * east-half of Zone: range 8000 >25000 ohm.m (midpoint 16500 ohm.m) occupying 50% of Zone * west-half of Zone: range 50-1000 ohm.m (midpoint 500 ohm.m) occupies 50% Chose 8500 ohm.m weighted average of dominant / midpoint values ((16500 x .5)+(500 x .5)). Assign approx. 5800 ohm.m, average of weighted averages (3200, 8500 ohm.m). Limits 1000, 25000 ohm.m, excluding conductive area.

Table 11 (continued)
1D Earth Resistivity Model for Saskatchewan Zone 4a

Layer	Depth / Confidence	Thickness	Resistivity (ohm-m) / Confidence	Conductivity (S/m) / Confidence	Comments
6. Upper Mantle	40 - 100 km [23] [III]	60 km	450 [28] [I]	0.002222 [24]	Used generalized lower depth [23]. 100 km depth maximum-resistivity map shows range 700-1000 ohm.m, majority 1000 ohm.m [31]. MT profile [28] of THO across north-central SK shows: * 500 ohm.m occupies 90% of Layer 6 * lower crust / uppermost mantle conductive anomaly, < 70 ohm.m, occupies 10%, expanding beyond 100 km depth Chose approx. 450 ohm.m weighted average of dominant / midpoint values ((500 x .9)+(70 x .1)). Assign 450 ohm.m. Limits 70, 500 ohm.m.
7. Upper Mantle	100 - 250 km [23] [III]	150 km	160 [28] [I]	0.00625 [23] [III]	Used generalized lower depth [23]. 200 km depth maximum-resistivity map shows predominantly 1000 ohm.m, localized up to 10000 ohm.m [31]. MT profile [28] of THO across north-central SK and west part of MB shows: * overall range 10-500 ohm.m * 500 ohm.m occupies 25% of layer * conductive area (10-100 ohm.m) occupies 75% of layer, top at 80-100 km, expands with depth, occurs beneath La Ronge Belt in SK which continues into MB as Lynn Lake Belt. This conductive region situated below crustal NACP. Anomaly core, 10 ohm.m, core between 175-250 km Assign 160 ohm.m, weighted average based on areal extent of dominant / midpoint resistivity values ((500 x 0.25)+(50 x 0.75)), on assumption that conductive area follows trace of NACP into MB. Limits 50, 500 ohm.m.
8. Upper Mantle	250–410 km [23] [III]	160 km	29 [25]	0.034673 [23] [III]	Utilized Canada regional model [23], based on Ottawa magnetic observatory data for all depths and resistivities below 250 km

Table 11 (continued)
1D Earth Resistivity Model for Saskatchewan Zone 4a

Layer	Depth / Confidence	Thickness	Resistivity (ohm-m) / Confidence	Conductivity (S/m) / Confidence	Comments
9. Transition Zone	410–520 km [23]	110 km	8 [25]	0.125892 [23]	Assign Canada regional model
	[III]			[III]	
10. Transition Zone	520–670 km [23]	150 km	2.4 [25]	0.416869 [23]	Assign Canada regional model
	[III]			[III]	
11. Lower Mantle	670–900 km [23]	230 km	1.12 [25]	0.891250 [23]	Assign Canada regional model
	[III]			[III]	
12. Lower Mantle	900–1000 km [23]	100 km	0.48 [25]	2.089296 [23]	Assign Canada regional model
	[III]			[III]	

See end of Table 14 for abbreviations and notes

Table 12
1D Earth Resistivity Model for Saskatchewan Zone 4b

Layer	Depth Confidence	Thickness	Resistivity (ohm-m) Confidence	Conductivity (S/m) Confidence	Comments
	Note: North Americal Central Plains (NACP) conductive anomaly trends follows the western margin of Zone 4b continuing into adjacent Zone 4a. NACP occurs at upper to mid-crustal depth and exhibits <10 ohm.m, but is not delinated as a separate layer in this model. However, NACP depth and resistivity shown on accompanying figure for 1D model of Zone 4b.				
1. Overburden	0 – 100 m [37] [I]	100 m	25 [42] [I]	0.04 [24]	Predominately clay-rich till blanket, with glaciolacustrine deposits (mostly fine-grained clay-silt, patches of coarser grained sand-gravel) along major river valleys (e.g. North Saskatchewan River) [40]. Regina-to-Weyburn area underlain by extensive glaciolacustrine (clay-silt) plain (former glacial lake). Saskatoon and Prince Albert underlain by glaciolacustrine silt and clay and deltatic sand and silt (former glacial lake) [65]. Sizeable organic deposits (< 5 m) in Cumberland House area [40, 63]. Scattered small glaciofluvial deposits in southern SK. Eolian (sand) deposits occur as patches along North Saskatchewan River. Alluvial deposits along major river valleys.
			Overburden thickness dependent on bedrock topography and presence of buried pre-glacial valleys and glacial moraine landform. Overburden in southern SK commonly 100-200 m thick, but can range from 0 (e.g. Wood Mountain) to >300 m in Touchwood Hills [37], generally thicker in northern half of Zone 4b. Regional overburden isopach map shows [2] shows an overall typical thickness up to 100 m, with pockets ranging 100-250 m. In Saskatoon area overburden thickness ranges 50-150m [2], generally 77 m (15 m of glaciolacustrine clay-silt overlying till) according to [65]; boreholes show 100 m inside city [42]. In Regina area total thickness about 20 m (8 m of clay overlying till) [64]. Assign overall 100 m depth, based on range 100-200 m. Borehole logs of southern Saskatchewan overburden show typical range 15-40 ohm.m (midpoint 25 ohm.m) for till (clayey and sandy); for glaciolacustrine/fluvial deposits, sand ranges 40-60 ohm, silt ranges 10-20 ohm and clay ranges 5-10 ohm.m [42]. At Saskatoon, tills range 25-50 ohm.m [65]. In SE Manitoba, borehole logs show clayey till resistivity averages approx. 25 ohm.m, silty till 50 ohm.m, sandy till 115 ohm.m; and for glaciolacustrine deposits, sand 80 ohm.m, silt 45 ohm.m and clay 10 ohm.m [36]. MT survey in SE Manitoba indicates 5-30 ohm for mix of till, clay, silt and sand [4]. Glaciolacustrine clays average 30 ohm.m in NE Ontario [7]. Assign overall 25 ohm.m, on basis of clay-rich till being dominant (continuation of same as in Manitoba [3]). Areas (e.g. Regina) underlain by glaciolacustrine deposits may have overall < 10 ohm.m. Limits (for till) 15, 40 ohm.m.		

Table 12 (continued)
1D Earth Resistivity Model for Saskatchewan Zone 4b

Layer	Depth / Confidence	Thickness	Resistivity (ohm-m) / Confidence	Conductivity (S/m) / Confidence	Comments
2. Sedimentary Basin	0.1 – 1.5 km [21] [II]	1.4 km	5 [4, 44] [I]	0.2 [24]	Layer 2 is the WCSB, comprised of Tertiary clastic sedimentary rock (conglomerate, siltstone, sandstone) on top of Mesozoic strata (dominantly shales with lesser amounts of silt/sandstones, carbonates and evaporates), in turn overlying Paleozoic carbonate (dolostone, dolomitic limestone, limestone), some shale beds, and a thin basal sandstone-shale [15, 18]. Mesozoic strata is predominant bedrock. Paleozoic carbonates occur as bedrock in the Cumberland House area, at north edge of Zone. Tertiary sediments exposed along SK/USA border area, at south margin of Zone.
			Depth deepens southwestly and southerly with greatest depth along SK/USA border where Williston Basin situated. Combined Tertiary, Mesozoic and Paleozoic strata thickness reaches 2400 m over most of Zone, and deepens from 2400-3000 m at Williston Basin. Layer 2 is 1700 m at Saskatoon, 2200 m at Regina and about 3000 m at Estevan. Assign 1.5 km, midpoint of maximum depth. In adjacent MB, MT survey reveals Lower Paleozoic carbonates exhibit 20-50 ohm.m, and basal sandstone-shale with saline porewater exhibits 3 ohm.m [4]. Upper Paleozoic and Mesozoic strata (both shale dominant) exhibits 1-5 ohm.m [4]; overall <5 ohm.m at MB/SK border [4 p.451]. Northern extent of WCSB – Paleozoic strata only – in MB exhibits 10-100 ohm.m range; strata < 200 m thick [16]. Borehole log at Winnipeg shows 120 ohm.m for limestone/dolostone to 100 m depth [67]. MT survey reveals < 5 ohm.m resistivity (E-polarization direction) for WCSB to a 3 km depth along SK/USA border [44]. 2D forward models show <3 ohm.m for transects across central and north portions of Zone 4b [28]. Borehole logs of southeastern SK show 1-10 ohm.m (midpoint 5 ohm.m) for 0-1250 m depth and 10-100 ohm.m (midpoint 55 ohm.m) for 1240-2000 m depth [68], giving a 25 ohm.m weighted average based on midpoint resistivity values. Assign 5 ohm.m, based on MT profiles [4, 44]. Upper limit (overall) 25 ohm.m.		

Table 12 (continued)
1D Earth Resistivity Model for Saskatchewan Zone 4b

Layer	Depth / Confidence	Thickness	Resistivity (ohm-m) / Confidence	Conductivity (S/m) / Confidence	Comments
3. Upper Crust	1.5 – 12.5 km [8, 17]	11 km	350 [4, 28, 44]	0.002857 [24]	Southern extension of the Trans-Hudson Orogen, buried beneath covering WCSB. Predominately granitic and gneissic rock, metagreywacke (sedimentary), and lesser other metasedimentary and metavolcanic rock. Depths: 14 km at Weyburn [8], 11 km scaled from regional seismic profile [17] parallel to SK/USA border. Assign 12.5 km bottom depth, midpoint of range 11-14 km.
	[I]		[I]		
			Minimum-resistivity depth maps show at 5 and 10 km, range 20-70 ohm.m [28]. MT 2D profile of Line S (TE mode, minimum resistivity) shows range 18-180 ohm.m, with weighted average of approx. 90 ohm.m [44]. MT 2D forward model - Line S (near SK/USA border) - reveals range 250-400 ohm.m (midpoint 325 ohm.m) [28]. MT 2D forward models of Line M (crossing part central SK) has range 150-725 ohm.m (midpoint 440 ohm.m), and Line N has range 20-2000 ohm.m with a weighted average of approx. 600 ohm.m [28]. Forward models have poor resolution for resistivity >2 ohm.m. Note: Low resistivity of NACP anomaly excluded from determination of resistivity on Lines S, M and N. Assign approx. 350 ohm.m, average of resisitivity values (90, 325, 440, 600 ohm.m). Limits 90, 600 ohm.m (based on midpoint resistivity values). Note: Possible underestimation of Layer 3 resistivity. In northern SK where WCSB absent, Layer 3 for Zone 4a is 9200 ohm.m and for Zone 4f it’s 1700 ohm.m.		

Table 12 (continued)
1D Earth Resistivity Model for Saskatchewan Zone 4b

Layer	Depth / Confidence	Thickness	Resistivity (ohm-m) / Confidence	Conductivity (S/m) / Confidence	Comments
4. Middle Crust	12.5 - 39 km [8, 17] [I]	26.5 km	375 [31] [I]	0.002666 [24]	Depths: 41 km at Weyburn [8], 37 km scaled from regional seismic profile [17] parallel to SK/USA border. Assign 39 km bottom depth, midpoint of range 37-41 km. 20 km depth minimum-resistivity depth map shows range 20-70 ohm.m (midpoint 45 ohm.m) [28]. 20 km depth maximum-resistivity depth map shows range 100-300 ohm.m (midpoint 200 ohm.m) [31]. Resistivity increases northward. MT 2D profile of Line S (TE mode, minimum resistivity) shows range 18-180 ohm.m (midpoint approx.120 ohm.m) between 12.5-30 km depth [44]. MT forward models of Lines S, M and N have same range and midpoint resistivity as determined for Layer 3 (see above) to depth approx. 50 km [28]. Assign approx. 375 ohm.m, average of resisitivity values (90, 325, 440, 600 ohm.m). Limits 120, 600 ohm.m (based on midpoint resistivity values). Note: Possible underestimation of Layer 4 resistivity. In northern SK where WCSB absent, Layer 4 for Zone 4a is 12500 ohm.m and for Zone 4f it's 1500 ohm.m.
5. Lower Crust	39 – 46 km [8, 17,11] [I]	7 km	300 [31] [I]	0.003333 [24]	Depths: 48 km at Weyburn [8], 48 km scaled from regional seismic profile [17] parallel to SK/USA border, averages 43 km in south-central SK [11]. Moho at approx 50 km beneath Williston Basin in North Dakota. Assign 46 km bottom depth, average of values (48, 48, 43 km). 40 km depth minimum-resistivity depth map shows range 20-70 ohm.m [28]. 40 km depth maximum-resistivity depth map shows range 100-500 ohm.m (midpoint 300 ohm.m) [31]. In adjacent MB, MT profile reveals predominately 100 ohm.m [4]; low value may be due influence of conductive TOBE anomaly underlying southwest MB. Assign 300 ohm.m, midpoint of maximum-resistivity depth map range. Limits 100, 500 ohm.m.

Table 12 (continued)
1D Earth Resistivity Model for Saskatchewan Zone 4b

Layer	Depth / Confidence	Thickness	Resistivity (ohm-m) / Confidence	Conductivity (S/m) / Confidence	Comments
6. Upper Mantle	46 - 100 km [23] [III]	54 km	500 [31] [I]	0.002 [24]	Used generalized lower depth [23] 100 km depth maximum-resistivity map shows range 100-1000 ohm.m (midpoint 550 ohm.m) [31]. Resistivity increases northward. Excluded influence of NACP conductive anomaly underlying SK/USA border. In adjacent MB, MT survey reveals – to 60 km depth – predominately 100 ohm.m [4]. Assign approx. 500 ohm.m, midpoint of maximum-resistivity depth map range. Limits 100, 1000 ohm.m.
7. Upper Mantle	100 - 250 km [23]	150 km	300 [31] [I]	0.003333 [24]	Utilized Canada regional model [23], based on Ottawa magnetic observatory data for bottom depth. 200 km depth maximum-resistivity map shows range 70-560 ohm.m (midpoint 315 ohm.m) [31]. Resistivity increases northward. Excluded influence of NACP conductive anomaly underlying SK/USA border. Assign approx. 300 ohm.m, midpoint of maximum-resistivity depth map range. Limits 70, 560 ohm.m.
8. Upper Mantle	250–410 km [23] [III]	160 km	29 [25]	0.034673 [23] [III]	Utilized Canada regional model [23], based on Ottawa magnetic observatory data for all depths and resistivities below 250 km
9. Transition Zone	410–520 km [23] [III]	110 km	8 [25]	0.125892 [23] [III]	Assign Canada regional model
10. Transition Zone	520–670 km [23] [III]	150 km	2.4 [25]	0.416869 [23] [III]	Assign Canada regional model

Table 12 (continued)
1D Earth Resistivity Model for Saskatchewan Zone 4b

Layer	Depth / Confidence	Thickness	Resistivity (ohm-m) / Confidence	Conductivity (S/m) / Confidence	Comments
11. Lower Mantle	670–900 km [23]	230 km	1.12 [25]	0.891250 [23]	Assign Canada regional model
	[III]			[III]	
12. Lower Mantle	900–1000 km [23]	100 km	0.48 [25]	2.089296 [23]	Assign Canada regional model
	[III]			[III]	

See end of Table 14 for abbreviations and notes

Table 13
1D Earth Resistivity Model for Saskatchewan Zone 4f

Layer	Depth / Confidence	Thickness	Resistivity (ohm-m) / Confidence	Conductivity (S/m) / Confidence	Comments
	Note: *West half of Zone 4f in Saskatchewan, and east half of Zone 4f continues into Manitoba*. Athapapuskow Lake Shear Zone and coincident ALCA anomaly divides Flin Flon Belt into west and east halves.				
1. Overburden	0 – 1 m [69, 70] [I]	1 m	70 [7, 36] [II]	0.014285 [24]	50% of Zone covered by overburden, commonly discontinuous, interspersed with bedrock [69, 70]. Sand-rich till veneer comprises about 20% overburden, generally <1 m thick. Glaciolacustrine deposits of clay and silt comprise about 25%, usually < 1 m thick, occasionally exceed 10 m in places. Patchy deposits of peat bog, 1-5 m thick, interspersed within glaciolacustrine deposits, Glaciofluvial outwash deposits of stratified sand and gravel occupy 5% of overburden, occur in valleys or as terraces or plains, > 20 m thick. Assign overall 1 m depth. Borehole logs of Manitoba overburden show 40-50 ohm.m for till [5]. In SE Manitoba, borehole logs show clayey till resistivity averages approx. 25 ohm.m, silty till 50 ohm.m, sandy till 115 ohm.m; and for glaciolacustrine deposits, sand 80 ohm.m, silt 45 ohm.m and clay 10 ohm.m [36]. Generally, resistivities for tills range 20-100 ohm.m [6]. MT survey in SE Manitoba indicates 5-30 ohm for mix of till, clay, silt and sand [4]. Glaciolacustrine clays average 30 ohm.m in NE Ontario [7]. Assign 70 ohm.m weighted average based on areal coverage of overburden resistivity values ((till 115 x 0.4)+(lacustrine 30 x 0.5)+(fluvial 80x0.1)). Limits 30, 115 ohm.m
2. Sedimentary Basin	absent	---	---	---	---

Table 13 (continued)
1D Earth Resistivity Model for Saskatchewan Zone 4f

Layer	Depth Confidence	Thickness	Resistivity (ohm-m) Confidence	Conductivity (S/m) Confidence	Comments
3. Upper Crust	0 – 14.5 km [20] [I]	14.5 km	1700 [16, 20] [I]	0.000588 [24]	Flin Flon Belt consists of low-grade metavolcanic-plutonic (greenstone belt) rock and minor metasedimentary rock. Zone includes the Namew Gneiss Complex consisting of high-grade metamorphosed plutonic intrusive rock. Flin Flon Belt straddles SK – MB provincial boundary and continues south to southwesterly beneath WCSB.
			Depth scaled from regional seismic profile [20] across north-central SK and western MB. Assign average value. Depth minimum-resistivity maps [28] show at: 5km, 200 ohm.m; 10 km, range 40-20 ohm.m (midpoint 135 ohm.m). Excludes influence on ALCA conductive anomaly. MT profile [16] shows range 10-10000 ohm.m for western half of Flin Flon Belt (in SK), and includes east-dipping conductive feature 10-400 ohm.m (midpoint 200 ohm.m) surrounded by 700-10000 ohm.m (midpoint 5000 ohm.m). Choose approx. 1600 ohm.m, weighted average of midpoint values ((200 x 0.7)+(5000 x 0.3)). MT profile [20] across west half of Flin Flon Belt shows: * 10 ohm.m occupies 10% of layer * 500 ohm.m occupies 70% * 7000 ohm.m occupies 20% Choose approx. 1750 ohm.m, weighted average of dominant values ((10 x 0.1)+(500 x 0.7)+(7000 x 0.2)). Assign approx. 1700 ohm.m, average of weighted values (1600, 1750 ohm.m). Limits 200, 7000 ohm.m.		

Table 13 (continued)
1D Earth Resistivity Model for Saskatchewan Zone 4f

Layer	Depth / Confidence	Thickness	Resistivity (ohm-m) / Confidence	Conductivity (S/m) / Confidence	Comments
4. Middle Crust	14.5-23.5 [30] / [I]	9 km	1500 [16, 20] / [I]	0.000666 [24]	Depth scaled from regional seismic profile [30] across north-central SK and western MB, ranges 20-27 km to bottom of layer, average 23.5 km. 20 km depth minimum-resistivity map [28] shows 20-40 ohm.m 20 km depth maximum-resistivity map [31] shows approx. 1400 ohm.m. MT profile [16] of west-half of Flin Flon Belt shows: * 100-700 ohm.m (midpoint 400 ohm.m) occupies 65% of layer * 1000-7000 ohm.m (midpoint 4000 ohm.m) occupies 35% Chose 1650 ohm.m, weighted average of midpoint values ((400 x 0.65)+(4000 x 0.35)). MT profile [20] shows: * 5500-7000 ohm.m (6250 ohm.m) occupies 15% of layer; influence of higher resistivity due Hanson Block * 500 ohm occupies 85% Chose 1350 ohm.m, weighted average of dominant/midpoint values ((46250 x 0.15)+(500 x 0.85)). Assign approx. 1500 ohm.m, average of values (1650, 1350 ohm.m). Limits 100, 7000 ohm.m.
5. Lower Crust	23.5 - 44 km [30] / [I]	20.5 km	1700 [20] / [I]	0.000588 [24]	Depth scaled from regional seismic profile [30] across north-central SK and western MB. 40 km depth minimum-resistivity map [28] shows 7 ohm.m 40 km depth Resistivity-resistivity map [31] shows approx. 1400 ohm.m. MT profile [16] of west-half of Flin Flon Belt shows: * 10-70 ohm.m (midpoint 40 ohm.m) occupies 35% of layer * 100-700 ohm.m (midpoint 400 ohm.m) occupies 25% * 1000-10000 ohm.m (midpoint 5000 ohm.m) occupies 40% Chose 2100 ohm.m, weighted average of midpoint values ((40 x 0.35)+(400 x 0.25)+(5000 x 0.4)). MT profile [20] shows: * 5500-7000 ohm.m (6250 ohm.m) occupies 15% of layer; influence of higher resistivity due Hanson Block * 500 ohm occupies 85% Chose 1350 ohm.m, weighted average of dominant/midpoint values ((46250 x 0.15)+(500 x 0.85)). Same value as for middle crust. Assign approx. 1700 ohm.m, average of values (2100, 1350 ohm.m). Limits 10, 7000 ohm.m.

Table 13 (continued)
1D Earth Resistivity Model for Saskatchewan Zone 4f

Layer	Depth / Confidence	Thickness	Resistivity (ohm-m) / Confidence	Conductivity (S/m) / Confidence	Comments
6. Upper Mantle	44 - 100 km [23]	56 km	500 [28]	0.002 [24]	Used generalized lower depth [23]. 100 km depth maximum-resistivity map [31] shows approx. 1400 ohm.m MT profile [28] of THO across east part of SK shows overall 500 ohm.m. Assign 500 ohm.m. Upper limit 1400 ohm.m.
	[III]		[I]		
7. Upper Mantle	100 - 250 km [23]	150 km	500 [28]	0.002 [24]	Used generalized lower depth [23] 200 km depth Resistivity-resistivity map [31] shows approx. 1400 ohm.m MT profile [28] of THO across east part of SK shows overall 500 ohm.m; no change from Layer 6. Assign 500 ohm.m. Upper limit 1400 ohm.m.
	[III]		[I]	[III]	
8. Upper Mantle	250–410 km [23]	160 km	29 [25]	0.034673 [23]	Utilized Canada regional model [23], based on Ottawa magnetic observatory data for all depths and resistivities below 250 km
	[III]			[III]	
9. Transition Zone	410–520 km [23]	110 km	8 [25]	0.125892 [23]	Assign Canada regional model
	[III]			[III]	
10. Transition Zone	520–670 km [23]	150 km	2.4 [25]	0.416869 [23]	Assign Canada regional model
	[III]			[III]	

Table 13 (continued)
1D Earth Resistivity Model for Saskatchewan Zone 4f

Layer	Depth Confidence	Thickness	Resistivity (ohm-m) Confidence	Conductivity (S/m) Confidence	Comments
11. Lower Mantle	670–900 km [23] [III]	230 km	1.12 [25]	0.891250 [23] [III]	Assign Canada regional model
12. Lower Mantle	900–1000 km [23] [III]	100 km	0.48 [25]	2.089296 [23] [III]	Assign Canada regional model

See end of Table 14 for abbreviations and note

Table 14
1D Earth Resistivity Model for Saskatchewan Zone SBZb

Layer	Depth / Confidence	Thickness	Resistivity (ohm-m) / Confidence	Conductivity (S/m) / Confidence	Comments
	Note: *Superior Boundary Zone (SBZ) is comprised of 3 segments: NNE trending Thompson Nickel Belt; Assean Lake Domain; and, east trending Fox River Belt. This table presents only the southwestern continuation of the Thompson Nickel Belt beneath the Western Canada Sedimentary Basin within Saskatchewan.*				
1. Overburden	0 – 75 m [1, 2, 4] / [II]	75 m	25 [36] / [II]	0.04 [24]	Predominately clay-rich till (assume continuation of same from Manitoba [3]). Approx. 100 m thick at SK/MB provincial boundary [1]. MT survey [4] across SE corner of MB indicates <100m thickness. Regional overburden isopach map shows 50-100 m thickness, with 150 m deep pocket [2]. Assign 75 m midpoint depth, based on range 50-100 m.
			Borehole logs of Manitoba overburden show 40-50 ohm.m for till [5]. Boreholes logs of SE Manitoba average approx. 25 ohm.m for clayey till [36]. Generally, resistivities for tills range 20-100 ohm.m [6]. MT survey in SE Manitoba indicates 5-30 ohm for mix of till, clay, silt and sand [4]. Assign 25 ohm.m, on basis of clay-rich till being dominant. Limits 20, 100 ohm.m.		
2. Sedimentary Basin	0 – 1.3 km [21] / [II]	1.3 km	5 [4, 44] / [II]	0.2 [24]	*WCSB*: Mesozoic strata (dominantly shales with lesser amounts of silt/sandstones, carbonates and evaporates) overlie Paleozoic carbonate (dolostone, dolomitic limestone, limestone), some shale beds, and a thin basal sandstone-shale [15, 18]. At southeast corner of SK, small exposure of Tertiary clastic sedimentary rock (conglomerate, siltstone, sandstone).
			Depth deepens southwestly with deepest at SE corner of SK. Combined Mesozoic and Paleozoic strata thickness ranges 800-2600 m. Assign 1.3 km, midpoint of maximum depth. MT survey reveals < 5 ohm.m resistivity (E-polarization direction) for WCSB to a 3 km depth along SK/USA border [44]. 2D forward models show <3 ohm.m for transects across central and north portions of Zone SBZb [28]. Borehole logs of southeastern SK show 1-10 ohm.m (midpoint 5 ohm.m) for 0-1000 m depth and 10-30 ohm.m (midpoint 20 ohm.m) for 1000-1500 m depth [68], giving a 25 ohm.m weighted average based on midpoint resistivity values. Assign 5 ohm.m, based on MT profiles [4, 44]. Upper limit (overall) 25 ohm.m.		

Table 14 (continued)
1D Earth Resistivity Model for Saskatchewan Zone SBZb

Layer	Depth / Confidence	Thickness	Resistivity (ohm-m) / Confidence	Conductivity (S/m) / Confidence	Comments
3. Upper Crust	1.3 – 12.5 km [8] [I]	11.2 km	500 [4] [I]	0.002 [24]	In adjacent MB, basement rock is predominately gneisses and granitoids, with lesser amount of metavolcanics and metagreywacke (metasediment) of the Superior geological province. Depth, 12.5 km, scaled from regional seismic profile [8] across SW corner of MB into SE corner of SK. Depth minimum-resistivity maps show at: 5km, approx. 20 ohm.m; 10 km, 40 ohm.m [28]. In adjacent MB, MT survey reveals predominately 500 ohm.m [4]. MT survey line 'S' reveals approx. 325 ohm.m overall, however, the 2D model resolution is poor [28]. Assign 500 ohm.m, as shown by [4] to reflect expected higher resistivity associated with the continuation of the SBZ into MB.
4. Middle Crust	12.5 - 35 km [8] [I]	22.5 km	100 [4, 31] [I]	0.01 [24]	Depth, 35 km, scaled from regional seismic profile [8] across SW corner of MB into SE corner of SK. Depth minimum-resistivity map shows at: 20 km, 40 ohm.m [28]. Depth maximum-resistivity map shows at 20 km, 100 ohm.m [31]. In adjacent MB, MT survey reveals predominately 100 ohm.m [4]; low value may be due influence of conductive TOBE anomaly underlying southwest MB. MT survey line 'S' reveals approx. 325 ohm.m overall, however, the 2D model resolution is poor [28]. Assign 100 ohm.m, as shown by [4] and [31].

Table 14 (continued)
1D Earth Resistivity Model for Saskatchewan Zone SBZb

Layer	Depth / Confidence	Thickness	Resistivity (ohm-m) / Confidence	Conductivity (S/m) / Confidence	Comments
5. Lower Crust	35 – 45 km [8] / [I]	10 km	100 [4, 31] / [I]	0.01 [24]	Depth, 45 km, scaled from regional seismic profile [8] across SW corner of MB into SE corner of SK. Depth minimum-resistivity map shows at: 40 km, range 20-40 ohm.m [28]. Depth maximum-resistivity map shows at 40 km, 100 ohm.m [31]. Note: no change from Layer 3 resistivity information. In adjacent MB, MT survey reveals predominately 100 ohm.m [4]; low value may be due influence of conductive TOBE anomaly underlying southwest MB. MT survey line 'S' reveals approx. 325 ohm.m overall, however, the 2D model resolution is poor [28]. Assign 100 ohm.m, as shown by [4] and [31].
6. Upper Mantle	45 - 100 km [23] / [III]	55 km	80 [10, 31] / [I]	0.0125 [24]	Used generalized lower depth [23] Depth maximum-resistivity map shows at 100 km, approx. range 30-100 ohm.m (midpoint 60 ohm.m) [31]. In adjacent MB, MT survey reveals – to 60 km depth – predominately 100 ohm.m [4]. Assign 80 ohm.m, based on average of values (60, 100 ohm.m). Limits 30, 100 ohm.m.
7. Upper Mantle	100 - 250 km [23] / [III]	150 km	55 [31] / [I]	0.018181 [24]	Utilized Canada regional model [23], based on Ottawa magnetic observatory data for bottom depth. Depth maximum-resistivity map shows at 200 km, approx. overall 55 ohm.m [31].
8. Upper Mantle	250–410 km [23] / [III]	160 km	29 [25]	0.034673 [23] / [III]	Utilized Canada regional model [23], based on Ottawa magnetic observatory data for all depths and resistivities below 250 km

Table 14 (continued)
1D Earth Resistivity Model for Saskatchewan Zone SBZb

Layer	Depth Confidence	Thickness	Resistivity (ohm-m) Confidence	Conductivity (S/m) Confidence	Comments
9. Transition Zone	410–520 km [23] [III]	110 km	8 [25]	0.125892 [23] [III]	Assign Canada regional model
10. Transition Zone	520–670 km [23] [III]	150 km	2.4 [25]	0.416869 [23] [III]	Assign Canada regional model
11. Lower Mantle	670–900 km [23] [III]	230 km	1.12 [25]	0.891250 [23] [III]	Assign Canada regional model
12. Lower Mantle	900–1000 km [23] [III]	100 km	0.48 [25]	2.089296 [23] [III]	Assign Canada regional model

Table 14 (continued)
1D Earth Resistivity Model for Saskatchewan Zone SBZb

ABREVIATIONS:

ALCA	Athapapuskow Lake Conductive Anomaly	SBZ	Superior Boundary Zone
ALSZ	Athapapuskow Lake Shear Zone	SE	southeast
MB	Manitoba	SK	Saskatchewan
MT	magnetotelluric	SW	southwest
NACP	North American Central Plains	TOBE	Thompson Belt
NE	northeast	WCSB	Western Canada Sedimentary Basin

NOTES:
Depth Confidence

I = best representation
* overburden: geological report/map coverage of local area.
* crust: seismic/gravity transects crossing local area

II = likely representative
* overburden: geological report/map coverage of region
* crust/upper mantle: geological and/or seismic transect of a regional nature.

III = possibly representative (measurements from general compilations).

Resistivity/Conductivity Confidence

I = best representation (measurements from site or nearby).
* overburden: resistivity measurement by surface geophysical method and/or borehole in local area.
* crust: resistivity measurement from resistivity survey, MT survey and/or borehole in local area.

II = likely representative (resistivity values extrapolated from measurements taken at some distance from the site, typically greater than 100 km).
* overburden: resistivity value obtained by geophysical measurement, including borehole logs.
* sedimentary basin: value obtained by geophysical survey using variety of geophysical electromagnetic methods, including MT.
* crust: value obtained by regional MT survey.

III = possibly representative (measurements from general compilations).

Table 14 (continued)
1D Earth Resistivity Model for Saskatchewan Zone SBZb

CITED REFERENCES:

2	Fenton et al. (1994), Fig. 26.3-Surface to Bedrock Isopach drift thickness
3	MRD (2008), generalized surficial geology
4	Gowan et al. (2009), Figs. 7, 8
5	Oldenborger et al. (2010), p.3
6	Palacky (1988)
7	Palacky (1992)
8	Green et al. (1980), Fig. 7
11	Kanasewich et al. (1987), Fig. 10
15	Nicolas et al. (2010), insert: Schematic cross-section profile by geological period
16	Ferguson et al. (2005b), plus Fig. 8
17	Nelson et al. (1993), Fig.2
18	Betcher et al. (1995)
20	White et al. (2005), Figs. 7 and 8
21	Wright et al. (1994), Fig. 3.2 Phanerozoic thickness isopach map
23	Kelbert et al. (2009), Figure 2, global and regional conductivity profile, Canada or North America regional conductivity chosen
24	Converted from resistivity obtained from listed reference source
25	Converted from conductivity obtained, from listed reference source
28	Jones et al. (2005), Figs. 5, 10, 11
29	Garcia and Jones (2005), Fig. 7
30	Hammer et al. (2010), p. 832, Fig.2-Chart 1, Fig.7
31	Jones et al. (2014), Figs. 8, 11
34	Schreiner (1984)
35	Schreiner (1984), p.16
36	Mwenifumbo et al. (1995)
37	Saskatchewan Geological Survey (2003), p. 50
38	Thomas and McHardy (2007), Fig. 2
39	Hajnal et al., (2007), various, p.385 (for Moho depth)
40	Natural Resources Canada (2009), Surficial Materials map
41	Wright et al. (1994), Fig. 3.4 cross-section
42	Christiansen and Schmid (2014)
43	Macdonald (2014), Fig. GEO-1 (bedrock geology map)
44	Jones and Craven (1990), Fig. 11
45	Campbell, J.E. (2007), Fig. 5
46	Thomas, M.D. and Wood, G. (2007), p.445

CITED REFERENCES (continued):

47 Mwenifumbo et al., (2007)
48 Ramaekers et al., (2007), Figs. 1-12
49 Rainbird et al., (2007)
50 Gyorfi et al., (2007), geological cross section Fig. 2
51 Mwenifumbo et al., (2004), Table 2
52 Craven et al., poster (utilize 2D inversion by Tuncer)
53 Craven et al., (2007), p.418, Fig. 5
54 Craig (1959)
55 Klassen (1991)
56 Card et al., (2007a)
57 Card et al., (2007b)
58 Spratt et al., (2014), Figs. 10-13
59 Turkoglu et al. (2009), Figs. 7, 8
60 Collier (2007), Fig. 5
61 Campbell et al. (1997), surficial geology map
62 Campbell et al. (1998), surficial geology map
63 McMarlin et al. (1995), surficial geology map
64 Christiansen (1979), Fig. 7 cross-section
65 Christiansen (1979), Dwg. 0016-002-15 cross-section
66 Christiansen (1992), Fig. 5 cross-section
67 Mwenifumbo et al. (1992)
68 Jones (1988), Fig. 12
69 Campbell and Henderson (1997), surficial geology map
70 Henderson (2002), surficial geology map

A12a Nieuwenhuis (2014), p.851
A12b Nieuwenhuis (2014), Fig. 9
A12c Nieuwenhuis (2014), Fig. 10
A12d Nieuwenhuis (2014), Fig. 12
A12e Nieuwenhuis (2014), Fig. 7
A12g Nieuwenhuis (2014), Fig. 13
A13 Hammer et al. (2011), lithospheric cross-section
A14 Lemieux et al. (2002) Fig. 13
A15 Gorman et al. (2002), Fig. 10
A16 Clowes et al., (2002), Fig. 8
A18a Bouzidi et al. (2002), Table 4
A18b Bouzidi et al. (2002), Fig. 8
A19a Hope and Eaton (2002), Fig. 13
A19b Hope and Eaton (2002), Fig. 7
A20 Villeneuve et al. (1993)
A35a Nieuwenhuis (2011), Figs. 5.8
A35b Nieuwenhuis (2011), Figs. 6.3