ISBN 0-7794-8703-6

Ontario

Ontario Geological Survey
Open File Report 6169

Two-Dimensional (2D) Reflection Seismic Surveying in the Timmins–Kirkland Lake Area, Northern Ontario; Acquisition, Processing, Interpretation: Discover Abitibi Initiative

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by

L.E. Reed, D.B. Snyder and M.H. Salisbury

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Reed, L.E., Snyder, D.B. and Salisbury, M.H. 2005. Two-dimensional (2D) reflection seismic surveying in the Timmins–Kirkland Lake area, Northern Ontario; acquisition, processing, interpretation: Discover Abitibi Initiative; Ontario Geological Survey, Open File Report 6169, 96p.

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A project of innovation, cooperation and revitalization
Découvrons l' Abitibi
Un projet d' innovation, de coopération et de renouvellement

Discover Abitibi Initiative
The Discover Abitibi Initiative is a regional, cluster economic development project based on geoscientific investigations of the western Abitibi greenstone belt. The initiative, centred on the Kirkland Lake and Timmins mining camps, will complete 19 projects developed and directed by the local stakeholders. FedNor, Northern Ontario Heritage Fund Corporation, municipalities and private sector investors have provided the funding for the initiative.

Initiative Découvrons l'Abitibi
L'initiative Découvrons l'Abitibi est un project de développment économique régional dans une grappe d'industries, projet fondé sur des études géoscientifiques de la ceinture de roches vertes de l'Abitibi occidental. Cette initiative, centrée sur les zones minières de Kirkland Lake et de Timmins, mènera à bien 19 projets élaborés et dirigés par des intervenants locaux. FedNor, la Société de gestion du Fonds du patrimoine du Nord de l'Ontario, municipalités et des investisseurs du secteur privé ont fourni les fonds de cette initiative.

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Reed, L.E., Snyder, D.B. and Salisbury, M.H. 2005. Two-dimensional (2D) reflection seismic surveying in the Timmins–Kirkland Lake area, Northern Ontario; acquisition, processing, interpretation: Discover Abitibi Initiative; Ontario Geological Survey, Open File Report 6169, 96p.

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Miscellaneous Release—Data 163

Images and Processed Data for Two-Dimensional (2D) Reflection Seismic Surveying in the Timmins–Kirkland Lake Area, Northern Ontario; Acquisition, Processing, Interpretation: Discover Abitibi Initiative

by L.E. Reed, D.B. Snyder and M.H. Salisbury

This digital release contains the processed data and products of the Timmins–Kirkland Lake 2D reflection seismic survey and is being released in conjunction with Open File Report 6169 and Geophysical Data Set 1054. Data in the form of xxx.sgy (the standard Society of Exploration Geophysicists SEGY format) are presented for final Migrated Dip Moveout (DMO) and Structure Stack, both filtered and unfiltered components; and Velocity Stack as Interval and RMS (root-mean-square) components. Receiver and source statics are presented. These provide UTM NAD 83, X and Y locations with elevations in metres, and the computed statics in milliseconds. TIFF images as delivered from the processing company come in two densities, 300 dots per inch (dpi) and 600 dpi. It has been observed that computer RAM may limit access to these files. A 2 gigabyte (GB) RAM computer had no problem with the 300 dpi TIFF images, but could not open the two largest 600 dpi files. A 512 K RAM computer had difficulty with the larger 300 dpi files.

The final Migrated DMO sections used the 300 dpi images but are presented as portable document format (PDF) and JPEG images. Geology and traverse locations (detailed and regional) are presented on these along with the seismic sections, processing sequence and additional processing informational surrounds.

There is a directory holding XYZ files locating the Common Depth Point (CDP) information in UTM NAD 83 and latitudes and longitudes. There is a separate directory holding the XYZ files for the surveyed shotpoints (UTM NAD 83 only). The image locations of these are also presented as Geosoft® xxx.plt files. There is an additional directory (survey) containing survey points that were not used (along much of Highway 655) or were shot, but are not receiver points. Some off-line shotpoints were necessitated by inaccessibility of the receiver stations to the vibrators.

There is a directory containing a Microsoft® Excel (*.xls*) file holding the rock properties study, and another containing an edited and reorganized version that is reproduced in the main report.

Viewing software will be required to view the *.sgy* files. Links are provided to various sources on the Web from which viewing software may be obtained. Acquisition and processing reports and a digital version of OFR 6169 are provided in portable document format (PDF). Available on 1 DVD.

Geophysical Data Set 1054

Primary Archive Acquisition Data for Two-Dimensional (2D) Reflection Seismic Surveying in the Timmins–Kirkland Lake Area, Northern Ontario: Discover Abitibi Initiative

by L.E. Reed and D.B. Snyder

This is a large digital database containing all the primary acquisition data from the acquisition company Kinetex Inc. The full volume is nearly 1.2 Terabytes (TB) (1200 GB) and is variously held on hard drives (Discover Abitibi and MNDM, Sudbury) and digital tape (DLTs at GSC seismic library, Ottawa).

Geophysical Data Set 1054 is held on four 300GB, Maxtor hard drives. These may be accessed by USB connectors and cables or by FireWire to Windows® 98, 2000 and XP computers. The primary archive data is presented as stacks in segments separately, of in-line, cross-line and vertical components of the data, recorded uncorrelated to 40 seconds. Correlated data for each of in-line, cross-line and vertical components is presented to 6 seconds for the high resolution data and to 12 seconds for the regional data. Gathers for each shot are presented in the correlated files.

All the primary and processed products are in xxx.sgy format. Viewing software will be required to view the *.sgy* files. Links are provided to various sources on the Web from which viewing software may be obtained. Note (advice from Kinetex Inc. the acquisition contractor) that a Network Shorting Plug may be required on some computers for correct installation of this software.

The primary product from the acquisition contractor (Kinetex Inc.) is on two hard drives. One of these, LaCie d2 EXTREME, 1000 GB (or 1 Terabyte, (1 TB)) drive, contains the Crawchest, Kettle Lakes, South Porcupine and Timmins regional lines. The other is a LaCie 200 GB drive which contains the Backroad, Shillington and Watabeg lines. (LaCie, 22985 NW Evergreen Parkway, Hillsborough. OR 97124 USA; LaCie, 17 rue Ampere, 91349 Massy Cedex FRANCE.) These reside with Discover Abitibi in Timmins. The 1 TB drive is accessed by Firewire connectors and cables while the 200 GB drive may be accessed by USB or Firewire connectors and cables to Windows® 98, 2000 and XP computers.

Copies of the field notes (scanned from paper originals) are part of this release.

Geophysical Data Set 1054 is not intended for the casual user, but for advanced users intending to develop additional information from the database, not acquired through the first-stage processing presented on MRD 163.

Abstract

Nine lines of two-dimensional (2D) reflection seismic surveying using Vibroseis vehicles as sources were acquired in the Timmins–Kirkland Lake area of Northern Ontario in mid 2004. Previous history of 2D seismic surveying in the area consisted of LITHOPROBE surveys in the Kapuskasing region to the northwest and in the eastern portions of the Abitibi, mostly in Québec in the mid to late 1980s. At that time, structures were mapped, including the Larder Lake–Cadillac and the Porcupine–Destor deformation zones north of Kirkland Lake. The present surveying is designed to expand the seismic testing westward to Timmins to develop seismic reflection images under the surveyed lines across major structures, stratigraphy and lithology of special interest to economic mineralization. Four lines, or parts of lines (total length 153 line kilometres), were surveyed in a regional mode with geophones spaced every 25 m and vibrate points every 50 m. Five lines (total length 51 km, one in combination with a regional line) were surveyed in a high-resolution mode with geophones spaced every 12.5 m and shooting every 25 m. North-south directed survey lines extended in parts from the north edge of the Abitibi greenstone belt, 82 km north of Timmins to Abitibi volcanics and granites 30 km south of Timmins, crossing many different lithologies and structures. Lines extended from Timmins to Shillington (48.5 km east of Timmins), crossing the Porcupine–Destor Fault at four locations. A single line 30 km west of Kirkland Lake crosses the Larder Lake–Cadillac structure where it is overlain by sediments of the younger Huronian embayment.

The vertical component data (Z, of X, Y and Z components collected) have been processed to reveal reflectors of varying character and depth on all lines. Reflection events are observed from near the surface in overburden, through a sharply defined bedrock surface in most places, thence deeper through various events in the sections. There is a preponderance of reflectance from as shallow as 0.5 s two-way time (TWT, about 1.5 km) to about 6 s TWT, or about 18 km. These may be related to surface lithologies in various ways, including developing implications about the dips and shapes of major structures in the area. A set of seismic reflection images is correlated with surface geology, drawn at the bedrock surface on each section. Direct imaging of the main breaks has not been achieved, as these are suggested to dip steeply (-70 degrees) to vertical at various locations. A number of features of stratigraphic significance have been imaged, including flat to gently dipping structures under the Shaw Dome area.

Detailed analysis of the currently processed data has not been done. Further interpretation should expand on the preliminary analysis accomplished here. Much of the data has not been processed (X and Y components, shear elements, data uncorrelated past the listen times of 6 (high resolution) and 12 (regional) seconds). These data hold considerable future promise for additional development of new information about the rocks underlying the area.

Two-Dimensional (2D) Reflection Seismic Surveying in the Timmins–Kirkland Lake Area, Northern Ontario; Acquisition, Processing, Interpretation: Discover Abitibi Initiative

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Ontario Geological Survey
Open File Report 6169
2005

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Introduction

A program of two-dimensional (2D) reflection seismic surveying was carried out in the Timmins–Kirkland Lake area as part of the Discover Abitibi Initiative (Figure 1 and Figure 3 on Chart A, back pocket). Lines surveyed were located west of Cochrane to west of Kirkland Lake. Previous surveying by LITHOPROBE in the Abitibi region (Calvert and Ludden 1999; Green et al. 1990) had shown that structures and stratigraphy could be mapped by this method. Previous work also showed that structures and stratigraphy at mine-deposit scale (Perron et al. 1997) and mine-environment scale (Calvert et al. 2003) could also be mapped with 2D seismic reflection surveying. A sound basis then existed to proceed with 2D seismic reflection surveying in the Timmins to Kirkland Lake corridor where little previous surveying of this kind had been carried out. One seismic line from the early LITHOPROBE era runs north, starting east of Kirkland Lake (Kapuskasing Line 12, *see* Figure 1). Interpretation of this line (Jackson et al. 1995) crossing the Larder Lake–Cadillac deformation zone (LLCDZ) and, to the north, the Porcupine–Destor deformation zone (PDDZ), suggested that these major breaks or their associated splay faults might be imaged by the seismic reflection work. This seismic program links well with a concurrent geological and geophysical program (summarized in Ayer et al. 2005b, OFR 6154) also done under the Discover Abitibi Initiative. OFR 6154 studies the greenstone architecture of this portion of the Abitibi Subprovince.

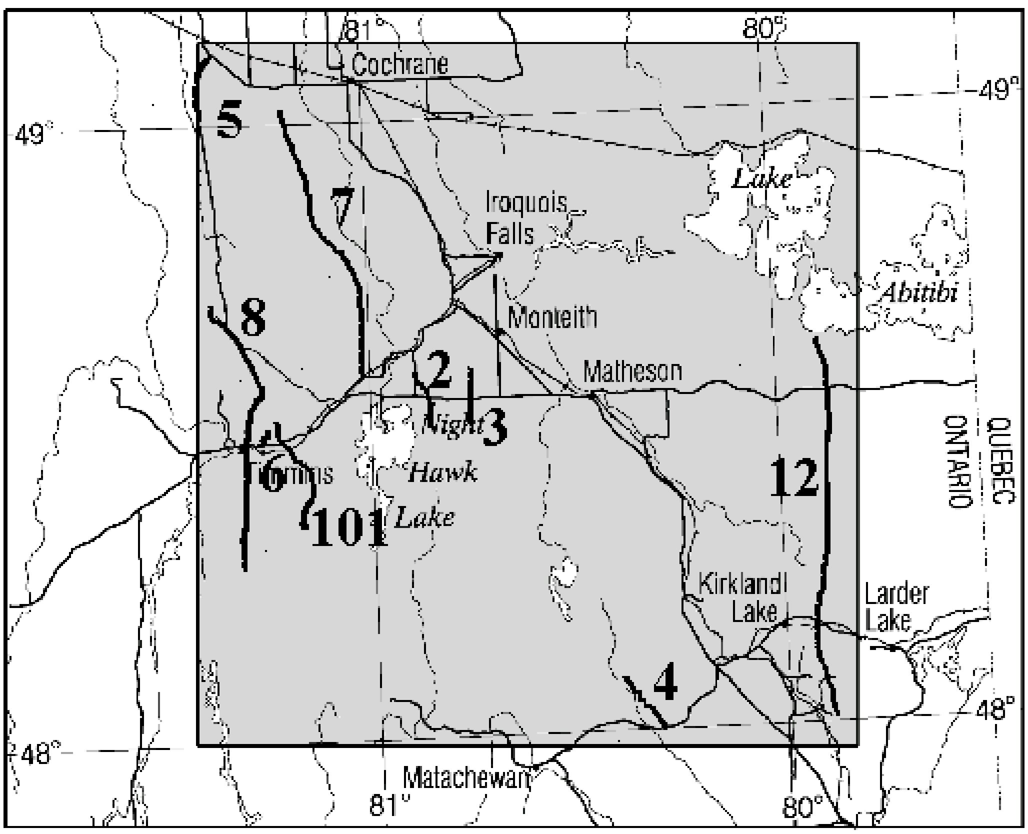

Figure 1. Location of 2D reflection seismic surveying. Line 101 (and 101A, north end), South Porcupine; Line 2, Kettle Lakes; Line 3, Shillington; Line 4, Watabeag; Line 5, Timmins North; Line 6, Back Road; Line 7, Crawchest; Line 8, Timmins South; and Line 12, LITHOPROBE Line 12.

The new seismic acquisition was accomplished through June and July 2004. The acquisition contractor for the surveying was Kinetex Inc. of Calgary (Appendix 2). The project was managed for Discover Abitibi by L.E. Reed Geophysical Consultant Inc. Four lines, or parts of lines (total length 153 line kilometres) were surveyed in a regional mode, that is with geophones spaced every 25 m and shooting (vibrate points) every 50 m. The frequency sweep for the regional data was from 10 to 84 Hz. Five lines (total length 51 km, one in combination with a regional line) were surveyed in a high-resolution mode, that is with geophones spaced every 12.5 m and shooting every 25 m (*see* Figure 3, back pocket; and page 42, Appendix 2; page 5, Appendix 3). The frequency sweep for the high-resolution data was 10 to 160 Hz. The purpose of this surveying was to develop seismic reflection images under the surveyed lines across major structures, stratigraphy and lithology of special interest to economic mineralization. North-south directed survey lines of varying lengths extend from the north edge of the Abitibi greenstone belt, 82 km north of Timmins (Line 5, Figure 1), to Abitibi volcanics and granites 30 km south of Timmins (Line 8, Figure 1), crossing many lithologies and structures. Lines extend from Timmins to Shillington (48.5 km east of Timmins; Line 3, Figure 1), crossing the Porcupine–Destor Fault at four locations. A single line 30 km west of Kirkland Lake (Line 4, Figure 1) crosses the Larder Lake–Cadillac structure where it is overlain by sediments of the younger Huronian embayment.

The specific selection of survey lines was dictated by available road systems where they covered desired geological targets. Roads were a necessity, as the seismic source vibrators were in trucks of 20 tonnes each (Appendix 2). These were variously employed as 1, 2 or 3 vibrators together depending on the setting and requirements of the survey. Single vibrators were used where there were concerns for surface damage such as parks, and the golf course in Timmins. Generally, the high-resolution lines employed 2 vibrators, while the regional lines used 3 vibrators. Single receiver geophones at each station were three-component vector sensors, receiving one vertical and two oriented horizontal components (Appendix 2). The present processing has used only the vertical (Z, or standard) component (Appendix 3). The new, and special X and Y components are being held in the data set for future processing.

Processing was carried out by Sensor Geophysical Ltd. of Calgary (Appendix 3). This was completed in March 2005. Final products include migrated DMO (Dip Moveout) stacks. Special care was employed to extract fine details from the section. It is apparent that more processing with different focus might extract other elements, such as steeper dip events, possibly from far source-local geophone selection; and smaller events through local focus or local source-receiver-frequency selection. Potentially, there is more information that can be extracted from these data.

The data were collected and correlated for 6 seconds on the high-resolution lines and 12 seconds on the regional lines. The sections are plotted using two-way times (TWT) corresponding to the two listen times. Assuming average rock velocities of 6000 m/s, the depths resolved on the sections are approximately 18 km and 36 km from surface to depth for the two survey styles (high-resolution and regional, respectively). Most overburden–bedrock interfaces are resolved on the sections; overburden thicknesses are in the database (Miscellaneous Release—Data 163 (MRD 163), available separately from this report). Dominant reflections are seen from 0.5 s (less than 1500 m) to as much as 7 s (about 21 km) depending on the location. Some sections show bedrock responses as shallow as 0.2 s (less than 600 m) or 0.3 s, although these shallower responses are weaker and will need further study to determine their validity.

Rock samples across the area were collected and measured for seismic properties (at the Dalhousie/GSC High Pressure Laboratory; Salisbury et al., 2003) as part of the Discover Abitibi seismic program (Figure 4, Chart A, back pocket). The results revealed significant variations in seismic impedance contrasts among rock types and foliations within rock types that were useful in the interpretation of the seismic sections.

The old LITHOPROBE, Kapuskasing Line 12 has been reprocessed as part of this program, but the final product was not available at the time of this report's publication.

Reports for the acquisition and processing of the data are found in Appendices 2 and 3, respectively, at the end of this report. The reports provide details of the survey and processing parameters.

The data have been presented in various forms and reside at various locations (Appendix 1). The processed data product has been issued as Miscellaneous Release—Data 163 (MRD 163). This data release forms an integral part of the present report and should be of assistance to those interpreting the seismic data. The full archive of raw, unprocessed data has been released as Geophysical Data Set 1054 (GDS 1054; available separately from this report).

Acknowledgements

The authors were significantly assisted by a number of individuals who directly contributed to the contents of this report.

David Secord and Rodney Couzens at Sensor Geophysical Ltd., Calgary, who, with the assistance of one of us (Snyder), recognized the special needs of this survey, stepped outside their normal petroleum seismic data processing environment and significantly enhanced the final product. They have, in addition, made an important recommendation for future work in this area (*see* Appendix 3, p.26).

Thanks to Erik Barr of the Porcupine Joint Venture in Timmins for rounding up and delivering the rock samples.

Tom Watkins, Publication Services, Ontario Ministry of Northern Development and Mines, made significant contributions to the appearance of the back pocket seismic sections, enhancing the geological relevance of the images.

An occasion arose during the course of the survey when it was necessary to traverse on private- and corporate-held surface rights. We wish to thank those who assisted us with access so that we could complete our survey. Our traverse through Kettle Lakes Provincial Park was graciously permitted by the park administrator, allowing us to remove a significant "dog leg" from our survey line.

Lines Surveyed

The survey lines were numbered in the field approximately in the order shot, although some inconsistency in the line numbering will be noted (*see* Figure 1, Figure 3 and location maps on seismic sections).

Line 5 (North Timmins Regional) is unusual as the survey on this line was terminated after a little more than a day of production because of damage to the highway. Half of the full spread extended beyond the shotpoint at that time. Six kilometres of the line recorded past the shotpoint were processed, so that the section for this line displays an image 12.1 km long, but with no definition at increasing depths past the final shot point.

The remainder of the lines were shot end to end.

The South Porcupine line, 30 km in length, was shot in part with high-resolution parameters (10 km at the north end). The southern 20 km was shot with regional parameters. The seismic sections for this line are presented in two ways. The high-resolution portion was processed by itself and is presented this way (Line 101A). The regional portion was merged with the high-resolution portion for processing with regional parameters. The processed section of the whole line is presented as one (Line 101). The shallower depth of the high-resolution section (6 s TWT) is evident on this section.

The name Crawchest for Line 7 derives from the names of the two roads used for this survey. The Ice Chest road lies to the south, while the Crawfish Lakes road extends to the north. A drag out, or bridge of geophones through the bush, joined the north and south parts of this survey line. Parts of this bridge were impassable for the Vibroseis vehicles.

Nine seismic sections are presented in the back pocket of this report:

Regional Lines

1) North Timmins, Line 5, shot 6.1 km, processed 12.1 km
2) South Timmins, Line 8, 65.8 km
3) South Porcupine (Shaw Dome section), Line 101, 20 km
4) Crawchest, Line 7, 56.5 km

High-Resolution Lines

5) Shillington, Line 3, 10.0 km
6) Kettle Lakes, Line 2, 15.0 km
7) South Porcupine, Line 101A, 10.0 km
8) Back Road, Line 6, 4.0 km
9) Watabeag, Line 4, 12.0 km

Seismic Sections

Products of the surveys are presented as 9 profiles, or sections (*see* back pocket). Each plot contains not only the migrated DMO stack, which contains the seismic reflection information, but a considerable amount of ancillary information important to understanding the contents of the image. The processor's sequence and actions are contained in the boxes to the bottom right. Reference should be made to the appendix of Appendix 3 (p.11), where the processor explains the processing sequence with examples from these data.

Product confidence can be assessed from the fold identifiers at the bottom and to the left of the seismic image. (Fold is the multiplicity of common mid-point data, that is the number of times a point on the section has been imaged in the overlapping acquisition and stacking process. Higher fold means more signal relative to noise.)

The shotpoints or station numbers are at the top of the section. At the bottom of the section is the CDP or Common Depth Point number (may be referred to as the Common Midpoint in other seismic work) developed in the processing and represents the number given to the point midway between the source and the receiver. Figure 2 illustrates the smoothing of the traverse line by the CDP on the South Porcupine regional and high-resolution line. The CDP line shows the sources of events in the seismic section to lie off the traverse line where the traverse line is crooked. XY data for both the shot (traverse) lines and the CDP lines are in the digital archive associated with this report (MRD 163 and GDS 1054). Similar off-line locations for CDP points occur for other crooked lines. For straight lines (e.g., Shillington), the shot lines and CDP lines lie over each other.

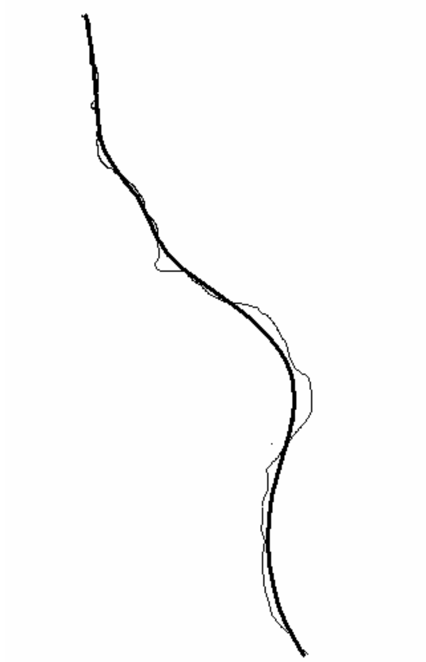

Figure 2. South Porcupine high-resolution and regional line (101A and 101, respectively). The fine line is the surface shotpoint line (i.e., the road traverse line). The heavy line is the Common Depth Point (CDP) line, which follows the mid point between the sources and the receivers. The CDP, developed in the processing, has the effect of smoothing out the sharp turns in the line, and more closely represents the locations of features in the seismic section.

Above the seismic section are two profiles. The upper one represents the surveyed ground surface elevation in metres above sea level. The lower one with the attached geology colour bar is the elevation in metres above sea level of the bedrock surface as identified by the processing of the seismic data.

Geology at the bedrock surface (*from* Ayer et al. 2005a) is identified by the colour bar attached to the bedrock surface line. The colour bar is derived from the detailed location map of the survey line immediately to the upper right of the survey profile. Centre right on the plot is the regional geology as assemblages (*after* Ayer et al. 2005a, Preliminary Map P.3565). The survey lines are plotted and numbered on this map, showing the overall regional setting of these lines. Line 12 is located on this map although the results of the final reprocessing were not available at the time of this publication.

At the top of each plot above the seismic section are sets of tables showing the velocities at TWT depth used in the processing of the data. These show that the velocities change with depth along the line as viewed through the processing. Note that the velocities increase from less than 6000 m/s near surface to as much as 7000 m/s at depth. Some sense of this appears in Figure 8 (Chart A, back pocket) where the velocities in the section are coloured and set in the reflection section.

INTERPRETATION

These interpretative comments are not intended to be comprehensive or exhaustive, rather to give some background on the purpose of each line, highlight a few prominent features on each section and briefly describe their possible significance. Some interpretation is drawn on the sections shown in Figures 5 to 8 (*see* Chart A, back pocket). The remainder of the comments are to be read in conjunction with the plotted sections (*see* back pocket).

Regional Lines

Regional profiles were designed to provide the relatively large-scale geologic framework of the Timmins mining camp and possibly to indicate crustal-scale pathways of mineralizing fluids as has been documented in Australia (Drummond et al. 1998). Seismic data were therefore recorded for a sufficient period of time to produce 12 s sections, equivalent to 35 to 40 km depth. From earlier LITHOPROBE surveys in the Abitibi greenstone belt, the Moho discontinuity, or the base of the crust, could be expected at 9 to 11 s two-way travel time (TWT) (e.g., Calvert and Ludden 1999).

The regional lines are identified in red on Figure 3 and on the location maps associated with the seismic sections (*see* back pocket).

NORTH TIMMINS, LINE 5 AND CRAWCHEST, LINE 7

Logistical considerations, primarily permission to work on provincial highways, which were changed during the course of the survey, required this profile to be collected in two segments (*see* Figure 1 and Figure 3, back pocket). The northern ends of both lines are near Cochrane. There is an offset to the east from the south end of Line 5 to the north end of Line 7 of about 18 km. The southern end of line 7 is northwest of Kettle Lakes Provincial Park. There is a further offset to the east to the north end of Line 2 of about 9 km (*see* Figure 1 and Figure 3, back pocket). The intent of surveying to the north was to learn the nature of the northern margin of the Abitibi greenstone belt at depth. Although the profile did not reach far enough north to achieve this goal fully, prominent reflections at 2.5 s (TWT), about 8 km depth, at the northern end of the Crawchest line and at 2.0 s on the North Timmins line are interpreted to possibly represent the base of the greenstone belt, the Deloro or Pacaud assemblage volcanic rocks (Ayer et al. 2002). Further south near vibrate point (VP) 1100, these reflections appear to splay above and below a wedge of less-reflective crust. This geometry suggests a thrust duplex structure typically associated with horizontal shortening or terrane accretion. Further south, at VPs 2150 to 2500, a prominent reflective band at 1 to 1.8 s defines an anticline–syncline fold pair. A similar pattern is observed 25 km to the west near the Kidd Creek mine (see below). Between the wedge and fold pair lies a section of weaker, uniformly north-dipping reflections beneath an area with Tisdale assemblage rocks mapped at the surface; this metasedimentary section could be as much as 8 to 10 km thick here.

At the northern end of the Crawchest line and on the North Timmins section, laterally continuous reflections occur down to 10.2 s TWT, but are very rare at greater depths. Further south the decrease in reflectivity with depth is much more gradual and no estimate of Moho depth possible. This pattern is similar to that observed on other Abitibi seismic reflection profiles and was previously related to a crustal underplate of relatively homogeneous mafic rocks (Calvert and Ludden 1999). It does appear that 12 s records were sufficient to image the entire crust of the Abitibi belt and that the Moho occurs at about 35 km depth, although clear confirmation of this will be needed through additional correlation and processing to greater two-way times, possibly 15 s TWT.

SOUTH TIMMINS, LINE 8

The north end of this regional line starts at the Kidd Creek base metal mine, passes through the Holliger and McIntyre gold mine sites (in part, the Timmins golf course) and ends 30 km south of Timmins on the Pine Street extension in volcanics south of the Adams pluton (*see* Figure 3 and seismic section plot, back pocket). The intent was to provide crustal-scale perspective on structures and potential fluid pathways related to some of the largest gold and copper-zinc-silver deposits in Canada. Other deposit types, such as copper-nickel, are found in this area as well.

Only very weak, north-dipping reflections appear in the uppermost 1 s or 3 km near the Kidd Creek mine site at VP 2010 (*see* seismic section and Figure 5, backpocket) although a strong reflection sequence occurs at 3.5 s TWT. To the south at VP 2440, two or three prominent reflective bands define an antiform structure at 1.2 to 2.0 s (3 to 6 km depths). This connects to the north to the reflector noted in the previous sentence, and to the south with a syncline/fold to form a pattern very similar to that observed on the Crawchest regional line (see above). Folded Tisdale and Porcupine assemblage volcanic rocks overlie this part of the section at the surface. Further south, only weak reflections occur beneath the former gold mines and the golf course (VPs 2900 to 3100, full section plot).

The Porcupine–Destor deformation zone crosses this profile at VP 3430. At 0.8 s a small, anticlinal reflector occurs beneath the fault, and a weak, semi-continuous, north-dipping reflector underlies this entire area (VPs 3380 to 3600) at 1.0 to 2.5 s. Further south between VPs 3744 and 4310 the profile traverses the Adam's pluton. This area is underlain by a prominent, broadly synformal reflection sequence at 1.0 to 2.0 s (3 to 6 km) and suggests that the pluton is a shallow, pancake-shaped body.

Within the mid-crustal part of this profile (3 to 7 s TWT) numerous reflections are observed in the north and the south, but generally less so in the centre of the section (VPs 2800 to 3600). This part of the section coincides with the crustal block immediately north of the Porcupine–Destor deformation zone and extensive gold mineralization near the surface.

SOUTH PORCUPINE, LINE 101

This regional line (as developed on the section that includes the high-resolution portion) starts just north of Highway 101, in the town of South Porcupine, passes the west end of Porcupine Lake and continues southward through Shaw Township, crosses the Redstone River, and ends southwest of Nighthawk Lake (Figure 6 and full section, back pocket). The purpose of the line was to image crustal structures near the Dome Mine and beneath the Deloro assemblage rocks within a regional geological structure that is called the "Shaw Dome". The northernmost 10 km of the line were collected with high-resolution parameters (e.g., only 6 s processed records) and will be discussed further below.

Nearly the entire line (VPs 500 to 1500) displays a prominent band of reflections at 0.4 to 1.5 s (1 to 5 km depth) that dip outward from an apex at about VP 1000 and thus largely correlate with the postulated Shaw Dome structure (*see* Figure 6, Deloro assemblage). This band of reflections is underlain (to 2.2 s) by a relatively reflectionless zone that may coincide with a homogeneous crust such as that typical of a granitic pluton. Between VP 1435 and 1560 the profile crosses the Shaw granodiorite; shallowly dipping reflections at 0.6 s suggest that this intrusive body is sill-like and less than 1.5 km thick. Several south-dipping reflections in the uppermost 1 s that cross other reflections may be due to a number of mafic Abitibi dykes that intersect the profile obliquely in this area. Most of the mid-crust imaged by this section is moderately reflective and the Moho is poorly defined.

High-Resolution Lines

High-resolution lines were designed to target specific structures that possibly control the pathways of mineralizing fluids or the eventual location of an ore body. In most cases, the target structure was a major fault zone, either the Porcupine–Destor deformation zone (PDDZ; *see* Lines 101A, 2 and 3 on Figure 3, Chart A, back pocket) or the Larder Lake–Cadillac deformation zone (LLCDZ) (Line 4 on Figure 3, back pocket). Acquisition parameters were guided by previous seismic surveys in Canada and Sweden (Milkereit et al. 1992; Spencer et al. 1993; Bergman et al. 2002) that targeted ore bodies or fault zones. The spacings of sources and receivers were halved from the regional lines to double spatial resolution. Recording time was reduced to produce 6 s sections. To further improve resolution, fewer vibrators were used to decrease the source size and put higher frequencies into the ground (to 160 Hz from 84 Hz).

The high-resolution lines and portions of lines are identified in blue on Figure 3 (Chart A) and on the seismic section location maps (back pocket).

SHILLINGTON, LINE 3

The Shillington line is the easternmost crossing of the PDDZ in this program, about 50 km east of Timmins and 80 km west of LITHOPROBE Line 12 (Figure 1; Figures 3 and 8 (Chart A), and seismic section, back pocket). Highway 101 intersects the profile at VP 642. The mapped trace of the PDDZ intersects the profile near VP 465 and separates Tisdale assemblage rocks to the south from Porcupine assemblage rocks to the north. The Tisdale assemblage rocks can be tied, through a thin layer of overburden, to southward-dipping reflections everywhere south of the PDDZ, and their northernmost extent may mark the southern margin of the PDDZ. At 0.75 s these reflections merge into a northward-dipping group of reflections (VPs 280 to 640, 0.8 to 1.7 s) to define a wedge-shaped structure. The most prominent feature occurs at VP 200 to 317, 0.5 to 0.7 s where an anticlinal fold structure appears to be offset from the northward-dipping reflections described above; this offset implies a steeply dipping reverse fault that projects to the surface near VP 380. This fault could also form part of the PDDZ.

KETTLE LAKES, LINE 2

The north-south Kettle Lakes line is also centered on the PDDZ and Highway 101 and passes through Kettle Lakes Provincial Park, about 30 km east of Timmins (Figure 1 and Figure 3 (Chart A), back pocket). Kettle lakes occur in glacial till deposits and this area is thought to have 100 to 200 m of glacial sand on top of the clay layers covering basement here and further to the east. Over 0.2 s of horizontal reflections at the top of the section mark this thicker layer of overburden. Sand is well known to attenuate seismic wave energy and this section looks like a much-subdued version of the Shillington seismic section. All the features described on the Shillington line also appear here. Reflections associated with Tisdale assemblage rocks dip southward from the surface trace of the PDDZ (VP 705 to VP 1150, 1 s). Northward-dipping reflections from 0.7 s at the southern edge of the section to VP 350, 1.9 s define a wedge geometry. A faint antiform geometry occurs at VP 280, 0.55 s (~1.5 km depth). This suggests strong along-strike continuity of structures along this segment of the PDDZ.

SOUTH PORCUPINE, LINE 101A

This profile forms part of the regional profile of the same name described above (South Porcupine Line 101, *see* Figure 1). The high-resolution segment was chosen to cross the Porcupine–Destor deformation zone (PDDZ) near the Dome gold mine in order to image structures that may have helped control the gold mineralization process and related fluid pathways (Figures 3 and 7, Chart A, back pocket). As noted above, on the western half of the high-resolution section (VPs >425), mafic volcanic rocks of the Deloro assemblage dip gently northward toward the PDDZ from the center of the Shaw dome structure down to 1.2 s TWT (~3 km depth). A number of parasitic anticlinal folds appear in the uppermost 0.3 s of this section (e.g., VP 560, 0.1 s). Between VPs 230 and 540 the generally weak, north-dipping reflections (*see* Figure 7, Chart A, back folder) are disrupted in several locations by nearly vertical zones that coincide with some faults mapped at the surface, including the PDDZ. These may represent subsidiary splays of the main fault that appears to dip very steeply (~70°) to the north below its surface location (nearly coincident with Highway 101). North of the PDDZ, shallowly dipping reflections in the uppermost 0.2 s suggest that the Timiskaming, Porcupine, Blake River (Krist Formation), and Tisdale assemblage rocks all dip gently southward into the PDDZ.

BACK ROAD, LINE 6

This 5 km profile (*see* Figure 1 and Figure 3 (Chart A), back pocket) was acquired near the entrance to Dome Mine in order to provide ties between reflections on the South Porcupine line and known structures and rock types that are based on information from the mine and from a Vertical Seismic Profile (VSP) that was planned near the centre of this profile (not carried out by the time this report was published). The survey route followed a new road built in places on thick fill composed of large boulder aggregate that may have attenuated the seismic waves. High levels of environmental noise from the nearby mine and processing plant further decreased signal-to-noise ratios. Nevertheless, some structures are seen. For example, a structural graben filled with Timiskaming assemblage sediments is defined by near-vertical contacts with the neighboring Porcupine assemblage rocks to the northeast and Tisdale assemblage rocks to the southwest, as indicated by breaks in reflections at VPs 170 and 215 in the uppermost 0.3 s.

WATABEAG, LINE 4

The Watabeag line was centered on the Larder Lake–Cadillac deformation zone (LLCDZ) and located about 50 km south of the Shillington line, and 30 km west of the LITHOPROBE Kapuskasing transect Line 12 (*see* Figure 1 and Figure 3 (Chart A), back pocket). It is the only new profile to cross this structure, but recent reprocessing of Line 12 provides additional information on the LLCDZ. Much of this line (VPs 500 to 870) is underlain by Proterozoic sediments of a Huronian inlier and can be easily located by the lack of strong reflections in the near surface. Beneath much of this inlier an antiformal structure can be seen at 0.4 0.8 s with its apex at VP 785. Prominent horizontal reflections at 2.5 and 5.3 s beneath this feature confirm that seismic energy penetrated well to these depths so that the general lack of reflections is due to nonreflective rocks in this part of the crust. The profile begins in the south in granitic rocks of the Round Lake batholith and ends to the north in a granodiorite, having traversed two alkali intrusives. The upper crust here may contain a large proportion of igneous rocks that are often found to be seismically “transparent”. The LLCDZ intersects the profile at VP 620 and no reflections that can be directly related to the fault zone are observed, only the lateral attenuation of some prominent reflections at VP 600, 2.5 s indicates a possible near-vertical attitude of the fault zone.

Physical Properties

Density and pressure wave (P wave) velocities were measured on samples at the Dalhousie/GSC High Pressure Laboratory in Dartmouth, N.S. Together these properties define seismic impedance. Seismic impedance contrasts between rock units, when sufficiently large, and when the units are sufficiently thick, will produce a reflection (Salisbury et al. 2003). The measurements on these rocks (Table 1 and Figure 9, Chart A, back pocket) show sufficient contrast for a variety of rock associations to produce reflectors. Notably, mafic volcanics (often Tisdale) show higher densities and velocities, and these generally have significant contrasts with sediments, intermediate volcanics and ultramafic volcanics.

Table 1. List of rock samples (rock type and assemblage association), UTM NAD 83 locations with measured density and oriented acoustic velocity (Vp; at 200 Mega-Pascals, MPa). Sample numbers with x, y and z identifiers indicate measurements along foliation (x and y) and across foliation (z). The locations for these samples are found on the line location maps on the seismic sections (back pocket), the sample location map (figure 4, Chart A, back pocket) and more particularly in the archive of these data (porcupine data & plot.xls) on the DVD (MRD 163).

Sample #	Rock type	Assemblage	UTM X	UTM Y	Density	Vp @ 200MPa
PJV-9xy	Komatiite	Tisdale	498955	5383735	2.9	6.29
PJV-9z	Komatiite	Tisdale	498955	5383735	2.87	5.88
PJV-16	Komatiite	Tisdale	486451	5370007	2.84	5.75
PJV-43x	Komatiite	Tisdale	475256	5372460	2.88	6.49
PJV-43y	Komatiite	Tisdale	475256	5372460	2.89	6.74
PJV-43z	Komatiite	Tisdale	475256	5372460	2.89	6.07
PJV-68xy	Komatiite	Tisdale	491350	5373615	2.68	6.24
PJV-15	Ultramafic	Tisdale	486260	5371078	2.86	5.82
PJV-20	Diabase	Metachewan	491750	5350011	3.01	6.68
PJV-56	Diabase	Matachewan	531405	5376174	3.04	6.82
PJV-55	Gabbro	Deloro	476316	5360400	2.97	6.89
PJV-45	Porphyry	Tisdale	476582	5368479	2.68	6.12
PJV-6xy	Metabasalt	Kidd-Munro	493390	5395885	2.84	6.79
PJV-6z	Metabasalt	Kidd-Munro	493390	5395885	2.85	6.72
PJV-10xy	Metabasalt	Tisdale	498955	5382895	2.95	6.89
PJV-10z	Metabasalt	Tisdale	498955	5382895	3.01	6.84
PJV-28	Metabasalt	Tisdale	512180	5373190	2.8	6.52
PJV-42x	Metabasalt	Tisdale	478380	5375675	2.76	6.76
PJV-42y	Metabasalt	Tisdale	478380	5375675	2.83	6.56
PJV-42z	Metabasalt	Tisdale	478380	5375675	2.84	6.56
PJV-44x	Metabasalt	Tisdale	476570	5368519	2.78	6.52
PJV-44y	Metabasalt	Tisdale	476570	5368519	2.74	6.13
PJV-44z	Metabasalt	Tisdale	476570	5368519	2.75	6.64
PJV-48	Metabasalt	Tisdale	478208	5366081	2.83	6.53
PJV-53	Metabasalt	Tisdale	475221	5359794	3.02	6.86
PJV-60xy	Metabasalt	Tisdale	517490	5377340	2.78	6.44
PJV-60z	Metabasalt	Tisdale	517490	5377340	2.78	5.77
PJV-62xy	Metabasalt	Tisdale	517495	5377310	2.74	6.4
PJV-62z	Metabasalt	Tisdale	517495	5377310	2.75	6.21
PJV-69xy	Metabasalt	Tisdale	491350	5373615	2.87	6.81
PJV-3	Andesite	Kidd-Munro	488295	5417685	2.72	6.13
PJV-17	Andesite	Deloro	485660	5368780	2.77	6.07
PJV-19	Andesite	Deloro	487159	5363792	2.86	6.46
PJV-40	Andesite	Kidd-Munro	479325	5379485	2.74	6.13
PJV-51	Andesite	Deloro	475899	5359830	2.72	6.11

Sample #	Rock type	Assemblage	UTM X	UTM Y	Density	Vp @ 200MPa
PJV-21	Granite	Shaw	491799	5350308	2.69	6.17
PJV-54	Granite	Adams	474635	5352135	2.67	6.58
PJV-37xy	Metarhyolite	Kidd-Munro	512180	5373190	2.81	6.67
PJV-37z	Metarhyolite	Kidd-Munro	512180	5373190	2.82	6.32
PJV-47	Metarhyolite	Porcupine	476594	5368303	2.71	6.7
PJV-66	Metarhyolite	Deloro	490649	5372648	2.64	6.07
PJV-59	Arkose	Timiskaming	507450	5376937	2.7	5.93
PJV-67	Sandstone	Timiskaming	491327	5373597	2.65	5.94
PJV-57	Conglomerate	Timiskaming	507451	5376934	2.84	5.96
PJV-58	Conglomerate	Timiskaming	507359	5376964	2.7	6.01
PJV-61xy	Metagreywacke	Timiskaming	517525	5377405	2.74	6.39
PJV-61z	Metagreywacke	Timiskaming	517525	5377405	2.73	5.68
PJV-63xy	Metagreywacke	Timiskaming	517475	5377365	2.7	6.13
PJV-63z	Metagreywacke	Timiskaming	517475	5377365	2.72	5.99
PJV-65xy	Metagreywacke	Porcupine	512612	5384410	2.73	6.39
PJV-65z	Metagreywacke	Porcupine	512612	5384410	2.73	5.82
PJV-64xy	Argillite	Porcupine	512620	5384405	2.77	6.59
PJV-64z	Argillite	Porcupine	512620	5384405	2.78	5.57
PJV-72xy	Argillite	Huronian	550505	5324314	2.78	6.00
PJV-72z	Argillite	Huronian	550505	5324314	2.87	5.65
PJV-5	Metasediment	Porcupine	495895	5399400	2.73	6.21
PJV-7xy	Metasediment	Porcupine	498115	5385755	2.77	6.43
PJV-7z	Metasediment	Porcupine	498115	5385755	2.76	5.86
PJV-8xy	Metasediment	Porcupine	498955	5383980	2.84	6.17
PJV-8z	Metasediment	Porcupine	498955	5383980	2.81	5.48
PJV-8Axy	Metasediment	Porcupine	498955	5383500	2.78	6.62
PJV-8Az	Metasediment	Porcupine	498955	5383500	2.75	5.99
PJV-36	Metasediment	Porcupine	512180	5373190	2.81	6.31
PJV-70xy	Metasediment	Timiskaming	493000	5374500	2.78	6.78
PJV-70z	Metasediment	Timiskaming	493000	5374500	2.78	5.49
PJV-71xy	Metasediment	Timiskaming	493000	5374500	2.78	6.82
PJV-71z	Metasediment	Timiskaming	493000	5374500	2.79	5.96
PJV-52xy	Iron Formation	Deloro	475930	5359835	2.94	5.78
PJV-52z	Iron Formation	Deloro	475930	5359835	2.98	5.55

It is observed on the plot of the velocities vs. density (the seismic impedance plot: Figure 9, Chart A, back pocket) that the impedances of some rock types cluster (e.g., mafic volcanics toward the top of the plot) while impedances of other rocks spread out (e.g., sediments). Closer inspection indicates that some of the reason for the spreading is found in differences in foliation (*see* Table 1) where velocities across foliation (z) are lower than velocities along foliation (x, y). While this effect is indicated in all the rocks where foliation was apparent and measured, it is most pronounced in the sediments. Almost all of the foliated rocks showed moderate to strong anisotropy, with Vp fast parallel to foliation. One reason for this is that micas, which cause the foliation, are much faster parallel to the sheet structure (~7.9 km/s) than they are normal to it (~4.5 km/s) (Shaocheng Ji et al. 2002). Structures inducing foliation might be expected to be better sources for reflectance signatures where traverse lines cross the foliation even without a change in rock type, but reflectance signatures will also be developed on contacts where rocks of significant impedance contrasts are juxtaposed. Sediments against basalts, especially where the sediments are sheared or foliated, and where units of contrasting impedance are sufficiently thick (Widess 1973), will be good sources for reflectance.

The pressure presented here (200Mpa) is equivalent to about 6 km depth in the earth. Practice Velocities are discussed and compared at 200 Mpa as a matter of practice, because this is the pressure at which the porosity in crystalline rocks tends to close and is therefore the lowest pressure for which the data are generally reproducible. The data are presented in the digital file (on MRD 163) as a table of velocities for a range of pressures. To compare reflection data with lab data, there is no need to adjust for pressure because reflectivity is defined as the difference, divided by the sum, of the impedances of two lithologies in contact (Sheriff 1991). The velocities and therefore the impedances all tend to rise together with increasing pressure, so the pressure effects cancel out. Since the reflection coefficients calculated using 600 Mpa data are about the same as those calculated from 200 Mpa data, the 200 Mpa data are used for most reflection applications and the higher pressure data are used to determine the intrinsic properties of crack-free rocks for quality control.

The file Porcupine data & plot.xls (MRD163) presents velocities from the pressure tank from 10 to 600 MPa. This covers the pressure conditions in the rocks at depth in the sections. Typically, measured velocities are higher under higher pressures (greater depth). The file displays seismic impedance plots of the data, providing the capability for further studies on these data. One of the impedance plots is reproduced with annotations as Figure 9 (Chart A) in the back pocket. Common rock types are highlighted on the plot of all samples to observe the spread of values, especially variations caused by sensing perpendicular and parallel to foliation.

The samples do not cover the whole range of rocks in the area, as soft, highly altered or foliated rocks could not be sampled as a solid piece. Some structures seen on surface are highly decayed. When recovered underground from drill holes these rocks fall apart as well, so that the needed 5 by 2 cm sample was not available. This resulted in an incomplete number sequence in the data presented in the table. It might be assumed that both densities and velocities in such rocks would be relatively low, and provide a significant seismic impedance contrast to more competent, confining rocks, but direct measurements, at least in this context, could not be made.

Opportunities for the Future for These Data

Much data have been collected that have not been processed. The images presented here, derived from the vertical P wave data, are the usual products developed in a seismic reflection survey. The horizontal X and Y components are new for this kind of survey, and hold promise for the development of information not previously seen. It was noted in the field that the cross-line gathers (from the Y component) show a lot of reflectance along with the normal components. It is possible that off-line information is contained in these data.

The shear data (S wave) in the vertical component, which arrives later than the P wave may contain useful information as well; this has not been interpreted. The X and Y components, suggested to be S-wave dominant, may complement the S wave elements in the vertical component.

The interpretation provided in this report (*see* Figures 5 to 8, Chart A, back pocket) is a small start on what may be achieved with a more extensive effort. These interpretations are not seen as definitive, but are presented as a guide for on-going interpretations.

The survey lines following the roads have developed a lot of data in crooked-line geometry. It may well be that processing focused on crooked-line segments will develop cross-line dips in structures and formational contacts.

The problem of imaging steeply dipping events may find resolution in processing focused on far offsets between shots and receiver points.

Some preliminary frequency-windowed processing, not delivered in final form (residing at the GSC in a preliminary form on one line from Sensor Geophysical Ltd., and not presented here), suggests that there is fine structure to be developed near surface, looking at the high end of the frequencies available. There is useful information in the high frequency band 110/130 to 140/160 Hz, from 0 to 1.6 s TWT, but the best high resolution is in the frequency band 100/120 to 130/150 Hz. This suggests that events as thin as 5 to 10 metres may be imaged by these higher frequencies. Widess (1973) suggests that seismic impedance contrast events may be observed to as small a thickness as 1/8 wavelength, but more reliably at 1/4 wavelength. At 6000 m/s and 140 Hz, the 1/8 wavelength thickness is 5.4 metres. Units with slower velocities would have correspondingly thinner reflectance source events. Currently the sections contain all the frequencies so that reflectance events in deeper portions of the sections may be imaged. It may be observed on the sections that the deeper portions contain only lower frequencies, while the upper portions contain higher frequencies, as well. This is a natural product of the earth filtering out higher frequencies with depth.

There resides in the uncorrelated raw data information from deeper portions of the earth not seen with the 12 second listen time/correlated data used to develop the sections presented here. The uncorrelated data could be correlated to develop deeper images fully and clearly to and below the crust (Moho) and into the mantle. This would develop very deep structure below the crust, although the implications for surface rocks is unclear.

Sensor, in their report (*see* "Possible Sweep Modification For Future Recording" in Appendix 3), suggest improvements to be made to future acquisition, and at the same time indicate some limitation of the present data at the higher end of the frequencies.

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Appendix 1

Data Disposition

DVD

A data DVD is being released separately from this report as Miscellaneous Release—Data 163 (MRD 163). This data release forms an integral part of the present report and should be of assistance to those interpreting the seismic data. It contains the final processed data and data images. The files are of several kinds. Standard xxx.sgy format files (or SEGY, Society of Exploration Geophysicists Y standard) for all lines come with several contents:

1) The final migration (DMO migrated stack)
2) Structure (an interim stack that may show useful information without migration)
3) Velocities (*see* Figure 8 (Chart A, back pocket) for a product example, where velocities vary throughout the final stack)

These files are in the identified directories. Migration and structure stacks are presented both as filtered and unfiltered xxx.sgy files. The velocity stacks are presented as interval and RMS (root-mean-square) xxx.sgy files. Viewing software will be required to view the *.sgy* files. Links are provided to various sources on the Web from which viewing software may be obtained.

Receiver and source statics are presented. These provide UTM NAD 83, X and Y locations with elevations in metres, and the computed statics in milliseconds (*see* Appendix 3, page 14-15).

TIFF images, as delivered from Sensor Geophysical Ltd., come in two densities, 300 dots per inch (dpi) and 600 dpi. The final presentation sections used the 300 dpi images. It has been observed that computer RAM may limit access to these files. A 2 gigabyte (GB) RAM computer had no problem with the 300 dpi TIFF images, but could not open the two largest 600 dpi files. A 512 K RAM computer had difficulty with the larger 300 dpi files.

The final Migrated DMO sections (9) with geology and traverse locations (also as paper, *see* back pocket) are presented as portable document format (PDF) and JPEG images.

There is a directory holding XYZ files locating the CDP information in UTM NAD 83 and latitudes and longitudes. There is a separate directory (finalines) holding the XYZ files for the surveyed shotpoints (UTM NAD 83 only). These are also presented as Geosoft® xxx.plt files. There is an additional directory (survey) containing survey points that were not used (along much of Highway 655) or were shot, not receiver points. Some off-line shotpoints were necessitated by inaccessibility of the receiver stations to the vibrators.

The acquisition and processing reports (Appendices 2 and 3) are presented as PDF files.

Hard Drives

This is a large digital database containing all the primary acquisition data from the acquisition company Kinetex Inc., and is being released separately from this report as Geophysical Data Set 1054 (GDS 1054).

The primary product from the acquisition contractor (Kinetex Inc.) is on two hard drives. One of these, is LaCie d2 EXTREME, 1000 GB (or 1 Terabyte (1 TB)) drive contains the Crawchest, Kettle Lakes, South Porcupine and Timmins Regional lines. The other is a LaCie 200 GB drive which contains the Back Road, Shillington and Watabeg lines. (LaCie, 22985 NW Evergreen Parkway, Hillsborough.

OR 97124 USA; LaCie, 17 rue Ampere, 91349 Massy Cedex FRANCE). These reside with Discover Abitibi in Timmins. The 1 TB drive is accessed by Firewire connectors and cables while the 200 GB drive is may be accessed by USB or Firewire connectors and cables to Windows 98, 2000 and XP computers.

Viewing software will be required to view the *.sgy* files. Links are provided to various sources on the Web from which viewing software may be obtained.

DLT

These are standard seismic product digital tapes which contain all the acquisition and processing products, and is equivalent to Geophysical Data Set 1054. These tapes reside in the GSC Seismic Archive Facility in Ottawa, Brian Roberts manager.

Paper Products

Preliminary paper products delivered from Sensor (Appendix 2) are held in part by L.E. Reed Geophysical Consultant Inc. and in part by the Geological Survey of Canada, Ottawa. Final paper products are in the back pocket of this report. There are 9 seismic sections and 1 chart (Chart A) containing 7 colour plots of figures.

SEISMIC SECTIONS

Regional

North Timmins, line 5, shot 6.1 km, processed 12.1 km
South Timmins, line 8, 65.8 km
South Porcupine (Shaw Dome section), line 101, 20 km
Crawchest, line 7, 56.5 km

High Resolution

Shillington, line 3, 10.0 km
Kettle Lakes, line 2, 15.0 km
South Porcupine, line 101A, 10.0 km
Back Road, line 6, 4.0 km
Watabeag, line 4, 12.0 km

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Appendix 2

Timmins Vibroseis 2D Multichannel Reflection, Final Report, Timmins, Ontario, Canada, 2004.

Kinetex Inc.

Dale Harrison – Party Manager
Darryl Armstrong – Sr. Observer
Jay Burchell – Surveyor

KINETEX INC.

Crew 101

TIMMINS VIBROSEIS 2D
MULTICHANNEL REFLECTION
FINAL REPORT

Timmins, Ontario
Canada 2004

TIMMINS ECONOMIC DEVELOPMENT COUNCIL

Prepared By:

Dale Harrison – Party Manager
Darryl Armstrong – Sr. Observer
Jay Burchnall – Sr. Surveyor

Distribution:

TEDC (2 copies)
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1) INTRODUCTION

Kinetex Inc. conducted a 2D Vibroseis multichannel seismic project for the Timmins Economic Development Council (TEDC) during the months of May, June, and July 2004. The seismic program consisted of 8 lines along existing highways, roads, and trails in and around the Timmins region in the province of Ontario.

The Timmins regional line was divided into a north and south line. The north regional line was 18.15 km. along Highway 655. The south regional line consisted of 65.8 km. starting south of Timmins on Naybob Road, which turns into Pine Street as it enters Timmins. Once entering Timmins, the line veered off of Pine Street onto a trail through undeveloped area up to the Timmins Golf and Country Club. At this point, the line carried on through the golf course down the west side of the 9th fairway. Once leaving the golf course the line went through a city park then crossed Algonquin Blvd. while continuing through Timmins. Once north of the city of Timmins, the line continued along a snowmobile and all-terrain vehicle trail until it reached Kidd Creek Mine property. At this point the line traveled along the side of the highway to the mine site. Carrying on through the mine site with the use of mine roads, the line finished just north of Kidd Creek Mine.

Shillington was a 10 km. line running north to south on Highway 577, with the hamlet of Shillington near the middle of the line. When the line came through Shillington and crossed Highway 101, it continued south on Currie road.

Kettle Lakes line was 15 km. long. The line was recorded from south to north starting on Gibson Lake Road. Once the line reached Highway 101, it traveled west on the north shoulder of Highway 101 for 1 km. before turning back north through Kettle Lakes Provincial Park. After following trails and paths through the park, the line moved north on the east shoulder of Highway 67.

The Back Road line was 4 km. long running northeast to southwest along the shoulder of Dome Gold Mine Road.

The South Porcupine/Shaw Dome line was 30 km. long. It started 25 km. south of the town of South Porcupine, on Langmuir Road. As the line came through the town streets it moved through a park then across Highway 101. The line proceeded through a residential area then ended 1.25 km. north of town.

Crawchest line was 58.2 km. long starting on Carrigan Road and heading north for 2.3 km., then running west on Frederickhouse Lake Road for 700 m. The line then headed north up Ice Chest Lake Road. In order to keep the northerly direction, the line moved onto a trail. At the end of this trail a narrow trail was widened to connect the line to Crawfish Lake Road where the line followed and ended 22.4 km. later.

The Watabeg line was 12 km. in length. The beginning was at the start of Watabeg Lake Road off of Highway 66.

Operations commenced on May 30th, 2004, with the arrival of the survey crew and vibrators. Once the survey crew arrived, they scouted potential RTK (real time kinetic) reference station locations, located Geodetic survey control monuments and then commenced chaining on the Shillington line. The layout of equipment and drilling holes to place sensors began on June 2nd. Parameter testing was completed on June 4th with production commencing on the 5th of June.

The program consisted of two and a half regional 2D lines of vibroseis data and four and half lines of high-resolution 2D vibroseis data. The entire program was completed on July 30th, 2004.

Data was collected using the I/O VectorSeis® System Four, and data was written to multiple external hard drives.

The energy source consisted of three Y-2400 vibrators (a breakdown in one of the vibrators required a change from the original plan to use 4 vibrators), providing a controlled frequency vibroseis source for the collection of reflection data.

Mechanical and technical problems were encountered with the vibrators and recording system. Questionable damage to a highway caused several program changes and an unexpected delay in the entire program.

2) OPERATIONS AND LOGISTICS

Operations for the project were based out of the Ramada Hotel in Timmins, the Thriftlodge in Cochrane, and finally at the Howard Johnson Motel in Kirkland Lake. Surveyors and recording crew were accommodated at the same facilities. Limited accommodations over the vast area of the project created delays due to lengthy travel times. All Kinetex personnel involved with the project attended a safety orientation prior to the initiation of operations, and tailgate meetings were conducted on a daily basis.

Telephone, fax machine, and internet hook ups were available at the Kinetex field office. A satellite phone was available at the recorder for emergency purposes or other necessary vital communication.

On July 1st, 2004, the initial recording crew arrived in Timmins, Ontario. The following day the crew began laying out equipment and drilling holes to place the sensors. On July 2nd and 3rd, the remaining Kinetex personnel arrived in Timmins. Parameter testing commenced and was completed on June 4th, and field parameters were chosen.

Pipeline locations were also marked using local services in order to avoid a ruptured line due to the force produced by the vibrators.

Data recording began on June 5th, and proceeded smoothly until June12th, when an engine on a vibrator cracked. The vibrator was taken to a heavy-duty diesel mechanic for inspection. The bad news was confirmed and the engine was irreparable. Being a very special engine, a significant amount of time was spent searching for a replacement with no success. The loss of the vibrator (to three available) meant that more time and vibrator effort would be spent on acquiring each record.

On July 15th, the Ministry of Transportation shut down recording operations due to questionable damage on Highway 655, just south of Highway 11. After a few days waiting on a decision from the ministry, Kinetex representatives decided to pick up the equipment from Highway 655, the north end of the Timmins regional line, and move to the south end of the South Porcupine/Shaw Dome line.

On the afternoon of June 19th, the crew commenced recording from south to north on the South Porcupine/Shaw Dome line.

During the early stages of data recording, a problem was encountered. The Recording Truck and the recording boxes deployed on line could not communicate due to radio interference caused by the hills, curves, and elevation changes along the seismic lines. The problem was resolved by setting up radio repeaters to communicate with the boxes and the Recording Truck.

On July 25th, recording was completed by day's end on the South Porcupine/Shaw Dome line. As there was still no approval for the north end of the Timmins regional line from the Ministry of Transportation, equipment was being deployed on the south end of the Timmins regional line working towards the north.

In daylight hours, recording equipment was stolen from the Timmins regional line, with more stolen during the evening. The Ontario Provincial Police were called and their officers were quickly assisted by a forensics team.

As recording moved closer to Timmins, there was no response from the Ministry of Transportation. Recording was halted at the end of June 30th. On July 1st a different location for the rest of the Timmins regional line was discussed and permission was obtained from property owners and rights of way holders in order for the line to continue north of Timmins. Highway 655 was the original route for the line north of Timmins, but with no approval from the Ministry of Transportation, trails and private property parallel to the highway was used.

Recording resumed on July 2nd, with a major setback occurring after the day's recording on July 3rd. The transcribing system used to process the data and write the recorded data to hard drives had an internal break down. A replacement transcribing system was sent from the manufacturer in Calgary to Timmins. Data recording could not continue until all data had been re-downloaded from the field boxes and processed.

Data recording resumed on July 6th. After consultation between engineers from Calgary and Houston, it was determined that the southernmost 11 km. on the regional line would have to be re-recorded.

As the recording proceeded north of Timmins, soft ground took its toll on line trucks and vibrators. In separate areas, a track hoe was needed to pull out a line truck and a Cat pulled 2 vibrators out of stuck positions. On July 9th, production had to be halted in order for Kinetex survey and recording crew members to attend an orientation meeting at Kidd Creek Mine.

Recording was completed on the Timmins regional line north of Kidd Creek Mine and the crew then moved back to the south end to re-record the 11 km. lost due to the transcriber break down.

Due to continued indecision by the Ministry of Transportation, it was decided that the kilometers that were lost in the gap created between the Kidd Creek Mine recording and the initial north end recording on Highway 655 would be made up on Ice Chest Lake Road and Crawfish Lake Road. In order to join the two roads together for the consistency of the data, a trail was widened to enable all terrain vehicles to haul equipment into waiting crew members. With the vibrators unable to move through the narrow 6.76 km. trail in the middle of the Crawchest line, the vibrators had to be trucked from the south side of the trail around to the north side. Once the vibrators were dropped off on the north side of the line, they had to be driven for the remaining 21.9 km. as the Crawfish Lake Road was too rough for the hauling trucks.

Recording was completed on the Crawchest line on the evening of July 27th.

With a shortage of trucks for hauling vibrators during the entire project, the vibrators did not arrive on the Watabeg line until late in the evening of July 28th. Recording began on the Watabeg line on July 29th, continued through the night, and was completed at 6:30 a.m. of July 30th. During the day of July 30th, all recording equipment was picked up and loaded for departure from the project.

3) SURVEY OPERATIONS

Introduction

Prior to the commencement of surveying activities, a search for potential survey control points was conducted via the internet on the Natural Resources Canada, Geodetic Survey Division website. The search for survey control monuments in the Timmins area indicated that very few points exist with precise data pertaining to both position and elevation. Fortunately, a Canadian Base Network (CBN) monument named Timmins was available for use as a reference station for survey control purposes. Given the proximity of this monument to all of the lines in the Timmins Prospect and since the CBN monuments have the most reliable and precise positions in Canada, it was determined that the Timmins monument would be the primary survey control reference point for all lines.

The seismic lines were surveyed using Real Time Kinematic (RTK) Differential GPS procedures with Leica GPS System 500 equipment (including two Leica SR530 GPS receivers with AT502 antennae). Prior to surveying, the geophone stations and vibrator points were chained and marked with pinflags.

Survey data was processed using the Leica Ski-Pro software for static differential GPS baseline computations and RTK DGPS position downloading. After ascii files containing positional information were exported, they were emailed to Jay Burchnall for conversion to grid coordinates and orthometric height calculations. The GSRUG program was used to convert geographic positions to grid coordinates, and the program used to apply the geoid separations to the ellipsoidal heights for obtaining orthometric heights is called GPS-H (version 2.1). These software packages (including the geoid model) were downloaded from the Geodetic Survey Division website.

Operational Summary

Survey control along Timmins 2D lines was established by conducting static differential sessions with GPS receivers. For a static session, one receiver was placed at the Timmins monument and another was placed at a strategic point along or near the seismic line. After the receivers were in place, data was collected simultaneously at each receiver. During the static sessions, at least three hours of simultaneous data was collected on both receivers.

The RTK surveys were conducted by placing one receiver at a base while roving with the other. The base receiver sends correction data to the rover via a radio link. Radio reception between the base and rover varied according to terrain and culture. In level terrain with significant forest canopy, radio reception was limited substantially. Where a base was located at a prominent elevation and the course of line was open terrain, radio reception extended as far as 12 km. from the base. The shortest radius of reception was less than 3 km.

Due to the fact that the seismic lines were located over an extensive area, a significant amount of time was required in order to establish several RTK base stations using static differential GPS surveying methods.

Ian Peace (surveyor for Kinetex) divided his time between conducting static session surveys, Real Time Kinetic (RTK) surveys of the lines, and when possible or necessary, assisting the Chaining crew.

By mid June the Shillington, Back Road and Kettle Lakes seismic lines were chained and surveyed. The original location of the Timmins regional line was almost entirely chained and the RTK traverse was complete from the north end to approximately 10 km. south of the city of Timmins.

After the completion of the original Timmins regional line, the chaining crew moved to the South Porcupine lines. Chaining began at the south end of the regional portion and proceeded north to the north end of the high-resolution course of the South Porcupine lines.

Some areas of the South Porcupine line, directly south of the main highway, traversed through a park. Some of these areas suffered some interference on pinflag locations and some re-survey work was done. Temporary marking paint was applied to the problem areas.

After finishing in South Porcupine the Chaining crew moved to the Kirkland Lake line (Watabeg Road) and finished chaining in two days.

At the end of June, work began on the Cochrane (Crawfish Lake) line and contingency work to move the Timmins regional line away from Ministry of Transportation Ontario (MTO) roadways was also well underway.

On July 5th, Ian Peace met with Don Ross and Findlay Stewart, MTO supervisors in Cochrane. At the meeting we learned MTO influence extends south of Highway 11 beyond roads owned by MTO. The outcome dictated that the roadway north of the landfill would not be a seismic line location. The senior MTO official commented that he did not believe our operation would damage the roadway in question. Since we had already chained the course of roadway north of the landfill, the pinflags were retrieved in a timely manner.

On July 6th, Ian Peace and other Kinetex representatives met with a group of geology department staff at the Kidd Creek Mine. At the end of the meeting we had an Agreement in Principle to conduct seismic operations on certain Kidd Creek properties. After the office session, Ian Peace was given a tour of the course to follow on the mine site.

On July 12th, the recording crew required the southernmost 17.6 km. of the Timmins regional line to be re-chained. The re-chaining was completed in one day.

Relocating the Timmins regional line parallel to the Kidd Creek Highway required a considerable number of offsets. Offsets were scouted, permission was sought, and the offset positions were located, chained and surveyed.

On July 13th, Ian Peace met with Laurie Reed (manager of seismic program for TEDC) and learned of his hope to shorten the gap between the Crawfish Lakes course of line and the Ice Chest Lakes course of line. Laurie preferred that, if possible, the two lines could join. Laurie spoke about his wish to cut re-growth along the side of a course of line near the south end of the Crawfish Lakes line. At that time, chaining on the north end of the Crawfish Lake line was complete and had started at the south end. This created a potential problem with numbering sequence and station interval associated with the connection of lines.

On July 15th, an ATV trail that connected the two lines was located and authorization on how to complete the line was sought. Chaining subsequently continued from the south end and followed the ATV trail.

A saw worker was hired to replace Ian Peace's sawing effort and a survey crew member was assigned the task of staying with and directing the contract saw worker. The saw work allowed for an extra 800 m of vibrator points.

Once chaining was complete, the last of the static sessions and RTK work was completed. In the energy gap area, survey conditions were not ideal but, with extra static sessions and a 7.5 m extendable, telescoping survey rod, the work was completed without excessive difficulty.

Control and Base Station Positions

Latitudes, longitudes, and ellipsoidal heights - NAD83CSRS datum, Geoid separation values (HT v.2.1), and Mean Sea Level elevations in CGVD28 datum.

Station Name	Latitude dd mm ss.sssss	Longitude dd mm ss.sssss	Ellipsoidal Height (m.)	Geoid Sep. (m.)	MSL Elev. (m.)
TIMMINS	48 31 22.69080	81 32 23.93360	288.221	-37.038	325.259
Driveway(300+11)	48 34 37.36461	80 40 51.28960	244.411	-37.178	281.589
Near Line	48 27 35.99684	81 15 20.73322	281.214	-37.204	318.418
Arquette Yard	48 32 39.71302	80 51 25.22102	257.319	-37.239	294.558
Quarry	49 01 37.47000	81 24 02.92503	230.724	-37.368	268.092
Park Office	48 34 20.07140	80 53 32.09655	257.722	-37.275	294.997
Tower	49 07 07.15389	81 23 04.00899	239.742	-37.423	277.165
Swimming Hole	48 46 33.04597	81 22 15.46363	263.944	-37.091	301.035
Ditch TA	48 42 12.60468	81 20 42.44762	253.823	-37.106	290.929
Truck Yard	48 30 34.12880	81 18 12.40918	286.817	-37.212	324.029
FMA	48 19 53.08289	81 19 46.64643	272.891	-37.112	310.003
Res Road	48 26 49.19332	81 11 03.82837	296.349	-37.228	333.577
Cut Block	48 21 47.80543	81 06 56.97726	261.293	-37.167	298.460
Log House	48 24 52.42602	81 08 58.73636	254.779	-37.214	291.993
Re Gen	48 13 14.73866	81 19 50.39646	330.321	-36.964	367.285
Lawn 261	48 29 24.32617	81 12 25.78142	257.788	-37.239	295.027
20 Year	48 04 38.37688	80 24 04.57097	297.653	-36.855	334.508

Universal Transverse Mercator (UTM) Zone 17 North grid coordinates in NAD83CSRS datum:

Station Name	Easting	Northing
TIMMINS	460128.660	5374569.556
Driveway(300+11)	523535.732	5380488.838
Near Line	481091.740	5367460.860
Arquette Yard	510554.021	5376816.853
Quarry	470699.488	5430542.967
Park Office	507948.445	5379911.337

Tower	471947.466	5440717.261
Swimming Hole	472745.369	5402604.505
Ditch TA	474607.257	5394553.738
Truck Yard	477588.002	5372973.813
FMA	475569.442	5353188.845
Res Road	486364.077	5366000.574
Cut Block	491420.660	5356684.972
Log House	488926.589	5362389.642
Re Gen	475439.260	5340890.188
Lawn 261	484693.618	5370794.815
20 Year	544595.717	5325068.220

4) RECORDING OPERATIONS

Introduction

The I/O System four is a Radio Telemetry System. The main operating system is called the V2. Through a CTR- Central Transceiver, the system operates in frequencies from 216 Megahertz to 220 Megahertz via which it communicates with VectorSeis® Remote Seismic Recorders (VRSR 2's). The VRSR2's are digital boxes which have 6 VectorSeis® sensors (SVSM's small VectorSeis® modules) connected to them – 3 on either side. Each sensor is essentially 3 sensors in one. Therefore the VRSR2's are handling 18 seismic channels each. The amount of data being recorded by each VRSR2 necessitates the use of 70 to 100 amp hour heavy duty Marine Batteries as power supplies.

The V2 is linked to a CTC (Central Transceiver Control) which is the communication and control path to the Source controller and the CTR. The CTR communicates to the VRSR2's that record data from the SVSM's. Since all communication is done through radio waves, the CTC is in charge of timing the accuracy between all components involved on data recording. The V2, communicating through the CTR to the VRSR2's, checks the deployment angle of each VectorSeis® sensor.

Using Stihl BT 120 auger drills with custom made drill bits and stems, a 1-7/8 inch diameter hole, 8 inches in depth was drilled for the coupling of all VectorSeis® sensors.

Once they were appropriately coupled in the hole, they were then aligned with a deployment tool. The deployment tool is an aluminum machined tool that fits on top of the modules. This tool has a compass unit in order for each sensor to be aligned at the same azimuth.

Through available testing capabilities in the V2, it is possible to determine how well the holes have been drilled. Occasionally the Driller needed to drill 20 holes in the gravel, in order to properly facilitate the correct coupling of the sensor.

The test provides one angle for each sensor, for a total of 3 in each module. Noise tests were also performed on the sensors. In previously used analog sensors (Geophones), the noise tests were performed in micro volts. The VectorSeis® modules noise tests from the X,Y,Z sensors are now measured utilizing micro gravity acceleration.

During deployment of equipment, a trouble shooter with an RDT (Remote Deployment Terminal) would connect this small computer to a VRSR2 to ensure that all SVSM's (modules) were operating and that there were no problems with the cable connecting the sensors back to the VRSR2.

Once checked, the Troubleshooter would contact the Observer in the Recording truck, and let him know that the VRSR2 (box) could be deployed. The radio communication deployment of the VRSR2 would take 45 seconds to establish and confirm deployment and run tests on the sensors for each VRSR2 controlling 6 sensors.

During data recording, there was a four second delay before every vibrator sweep. During this time, the V2 system communicating to the CTR would relay to VRSR2's informing which sensors were being recorded, and what type of stacking would be used at which sample rate, sweep length, and listened time.

Once all required daily testing of the sensors was completed, it was determined by the Observer that data recording could commence for the day. The data was recorded by the VRSR2's and stored on memory. Each record is given a UNIX time stamp. Once data recording was completed for a day, a crew member would take a DCU (Data Collector Unit) and plug into a VRSR2 and download any recorded data. The DCU is a water tight portable case with dual redundant hard disks. Once connected to a VRSR2, a screen on the DCU tells the data collector when it is downloading data and when it has completed the downloading of the specific box.

Once all VRSR2's were downloaded, the data collectors were taken to the recording truck and hooked up to another system called a Transcriber.

The Transcriber then downloaded all the data collected on the DCU. A file called an XTM file was transferred from the V2 operating system to the transcribing system. This XTM file contains all the UNIX time stamps for the recorded records. When data is read into the Transcriber from the DCU, it stores the data on RAID drives and produces archive files that can only be read by I/O transcribing systems. For Vibroseis systems, the data is stored in the VRSR2's in a stacked format. Once all the data is downloaded to the Transcriber, the stacked data is then correlated with the Auxiliary data and QC'ed according to additional data quality parameters. Once data has been collected for daily shot ranges, it is transferred to storage media.

Operations

Operations commenced on May 30th, 2004, with the arrival of the survey crew and vibrators. Surveyors commenced chaining on the Shillington line. On June 1st, 2nd, and

3rd, members of the recording crew arrived in Timmins. Equipment was deployed on the Shillington line with parameter testing completed on June 4th. Production recording began on the Shillington high-resolution line on June 5th and was completed with no delays on June 6th.

Even though the Kettle Lakes and South Porcupine/Shaw Dome line were closer to the Shillington line, the vibrators traveled along Highway 101 to the Back Road line. Permission to go through Kettle Lakes Provincial Park, and private land on the South Porcupine/Shaw Dome line had not been agreed to yet, so the Back Road line was the closest available line. Recording began and was completed on the Back Road high-resolution line on June 7th, with a minor stoppage in the afternoon for a rain shower and a mine blast at the Placer Dome Mine.

Production on the Kettle Lakes high-resolution line began on June 8th and was completed by midday on June 11th. Extremely high winds stopped recording for half a day and a servo valve had to be replaced on a vibrator during this period. Minor thefts occurred during one evening with batteries being stolen. Although recording was completed early on the 11th, trucks to haul the vibrators were not available until that evening.

The Timmins regional line began at midday on June 12th with four vibrators for the regional parameters. Problems arose quickly with one vibrator. Leaking antifreeze from the engine block created concern and the vibrator was pulled from production with a cracked engine block. To compensate for the loss of the fourth vibrator, vibrator effort was increased from 3 sweeps to 6 sweeps. During the next few days rain and high winds caused stoppages in recording.

On July 15th, recording was stopped by the Ministry of Transportation due to questionable damages to Highway 655.

After a few days of waiting for answers from the Ministry of Transportation, and no reply, equipment was picked up from the Timmins regional line after vibrating 6.15 km. and recording 18.15 km. on a line that was scheduled to be 110 km. Equipment was then deployed on the south end of the South Porcupine/Shaw Dome line with recording beginning on June 19th. The Shaw Dome portion of this line involved regional parameters for the southern most 20 km. At the northern portion for the additional 10 km of line, sensor spacing and vibrator specifications switched to high-resolution parameters. The last 10 km were considered the South Porcupine line. The extreme curves and hills on the South Porcupine/Shaw Dome line caused difficulties in communication between the recorder and VRSR2's and between the Recorder and repeaters. These problems along with unstable weather caused delays in data recording.

While recording was being completed on South Porcupine/Shaw Dome on June 25th, equipment was being deployed at the south end of the Timmins regional line where the beginning of costly thefts occurred. As production commenced on the Timmins regional line, working south to north because the road was gravel, locations were being scouted in order to shift the line off of Highway 655. With no positive response from the Ministry of Transportation on getting back onto Highway 655 north of Timmins, July 1st became a scouting and decision day with production halted. Private property, Hydro right of ways, all terrain vehicle trails and gravel pits became the only option in order to continue north of Timmins. The survey/chaining crew was brought back and shifted the line so it was off of the Ministry of Transportations right of way.

Production resumed on July 2nd and 3rd until the transcribing system broke down. Recording was stopped until the replacement Transcriber arrived in Timmins and data could be verified. Recording continued on July 6th, 7th, and 8th.

On July 9th, Kinetex personnel attended an orientation at the Kidd Creek Mine where the regional line would pass through and terminate. With unstable weather causing stoppages over the next few days, recording was completed on the north end of the regional line on July 14th.

With the initial Transcriber breaking down, it was determined that the southern most 11 km. of data on the regional line were lost. On July 15th, the vibrators were trucked from the Kidd Creek Mine back to the south end of the line to rerecord the lost data. By the late afternoon of July 17th, recording was completed on the Timmins regional line.

The vibrators were moved to the Crawchest regional line on July 18th, with the data recording starting in late evening at the south end. The Crawchest line was designed to make up for the loss of kilometers on the Timmins regional line that were supposed to have been on Highway 655. A narrow trail was discovered that connected Ice Chest Lake Road in the south to Crawfish Lake road in the north. This trail had to be widened to allow all terrain vehicles to move recording equipment in to a deployment crew. A slashing crew was brought in to widen the narrow trail that was 6.28 km. long. Minor slashing also had to be completed for 1 km. on the north and south sides of the ATV trail in order to get more coverage with the vibrators.

As the recording crew continued northward, the extent of the ATV area became a logistical problem that was solved by moving part of the recording crew to Cochrane while the rest stayed in Timmins. Weather came in gusts of wind and rain during the recording on this line, causing minor delays. Data recording was completed on the Crawchest regional line on July 27th.

Vibrators and equipment were moved from Crawchest line to the Watabeg line on July 28th. The Kinetex personnel moved from Timmins and Cochrane to Kirkland Lake. Recording began on July 29th and carried on through the night with the final record of the line and project being completed at 6:30 am on July 30th.

5) ACQUISITION PARAMETERS

Recording Instrument	I-O VectorSeis® System IV V-12 Thermal Plotter In-field Processing - Vista 4.0 NT Diversity Stack FFT correlation after diversity stack In-field Processing - Vista 4.0 NT
Source	3 –Vibrator (IVI Y2400 Buggy Mount)
Vibroseis **Control Electronics**	3 – Pelton Advance II Control Electronics Version 6
Peak Force (Pounds)	44,000 lbs. Per Unit @ 90% Force
No. of Channels	961
Fold	
Group Interval	25 m-regional, 12.5 m-high-resolution
V.P. Interval	50 m-regional, 25 m-high-resolution
No. of sweeps per V.P.	6-regional, 3-hi-resolution
Sweep Frequencies	10-84 Hertz Linear-regional 10-160 Hertz +3db Octave-high-resolution
Record Length	12 seconds-regional, 6 seconds high-resolution
Sweep length	28 seconds
Type	Linear-regional, +3db Octave-high-resolution
Low filter	Out
High filter	½ Nyquist Minimum
Notch filter	Out
Sample rate	2ms
Number per group	1 (3C Sensor Buried)
Sensor type	I/O VectorSeis® SVSM 3 Component Digital Sensor

6) HEALTH, SAFETY AND ENVIRONMENT

During start up operations, the majority of the company health, safety and environment policies were already in effect. An orientation was held to educate the employees on policies and procedures. Crew members were advised on the importance of reporting near-miss situations. These incidents were to be discussed in the daily tailgate meetings and recommendations were made to avoid the occurrence of similar situations. These tailgate meetings were also utilized to communicate other safety issues to the crew.

Due to the long drives to and from the field, safety was a major concern for the crew. Weekly safety meetings for the crew were conducted by the Party Manager and/or Senior Observer. All members of the crew had the opportunity to voice individual concerns and comments. Issues discussed included general safety concerns brought to attention through near miss-reports and observations, working procedures. Emergency Response Procedures (ERP), company policies and other issues were also discussed with the crew. Each individual was issued personal protective equipment (PPE). They were advised that PPE was to be worn at all times without exception. Further safety concerns raised by the crew were presented at daily tailgate meetings. Responsible and sensible solutions were subsequently implemented.

Traffic was the main point of concern due largely to the fact that the roads and highways were being utilized by a lot of gravel, logging, mining, and supply trucks. Regular everyday traffic, as well as other personnel working in the area added to high-traffic volumes on the seismic line locations. To protect the crew from the existing risks, the following precautions were taken: Road signs for the crews deploying/picking up equipment as well as surrounding the vibrators; flag personnel for the vibrators; speeds were kept to a minimum; radio communication was used to let other drivers know of on coming traffic; and mechanical checklists were completed to ensure the proper operation of the vehicles.

As with any project first aid and medical attention is always a primary concern. Medical supplies, including stretcher, splints, neck supports and back board, and basic first aid supplies, were on site at all times at the Kinetex Recorder. In addition, each vehicle was equipped with a first aid kit and fire extinguisher.

Due in large part to the conscientious attitude towards safety procedures, precautions, and seatbelt use by the crew and supervisors, medical and/or first aid treatment was never required.

Environmental concerns consisted of the following. Spills of any kind were to be addressed and resolved immediately. In order to execute the cleanup of any occurrences in a timely manner, the vibrators were equipped with absorbent pads. Daily clean up consisted of common sense procedures; all debris and garbage was disposed of in an environmentally acceptable manner. Any environment or safety hazards were relayed to the crew through the Observer.

APPENDIX A

PERSONNEL

Personnel

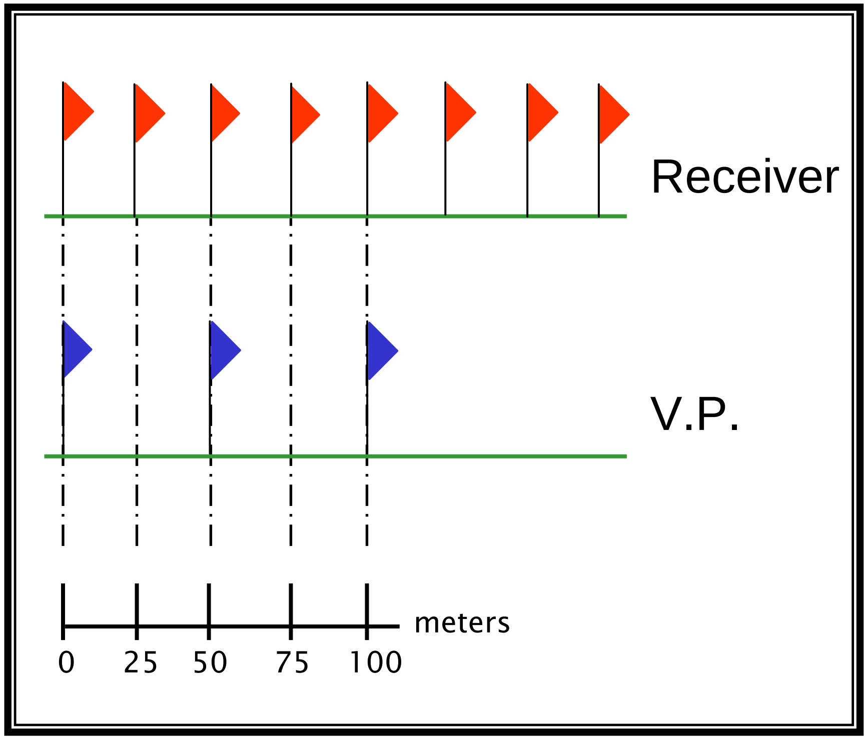
Qty.	Crew Management	Name	Duration on Site
1	Party Manager	Dale Harrison	05/24/04 to 07/30/04
1	Party Manager	Peter Blair	06/30/04 to 07/18/04
1	Sr. Observer	Darryl Armstrong	06/03/04 to 07/30/04
1	Jr. Observer	John White	06/01/04 to 07/30/04
1	Vibroseis Technician and Mechanic	Dave Miller	05/24/04 to 08/03/04
1	Surveyor	Ian Peace	05/31/04 to 07/26/04

APPENDIX B

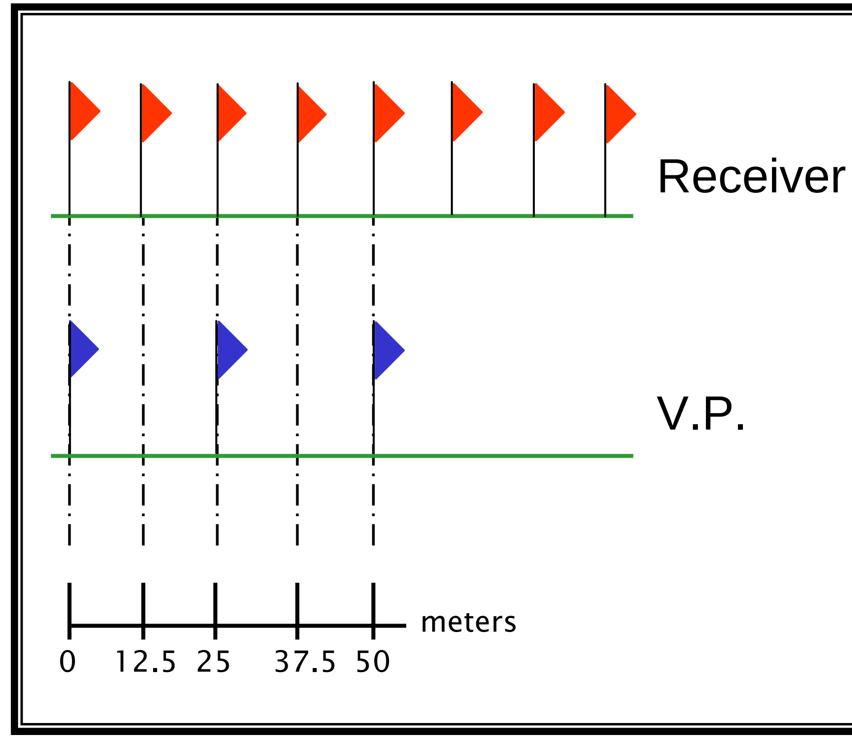
SOURCE AND RECEIVER ARRAYS

ACQUISITION PARAMETERS

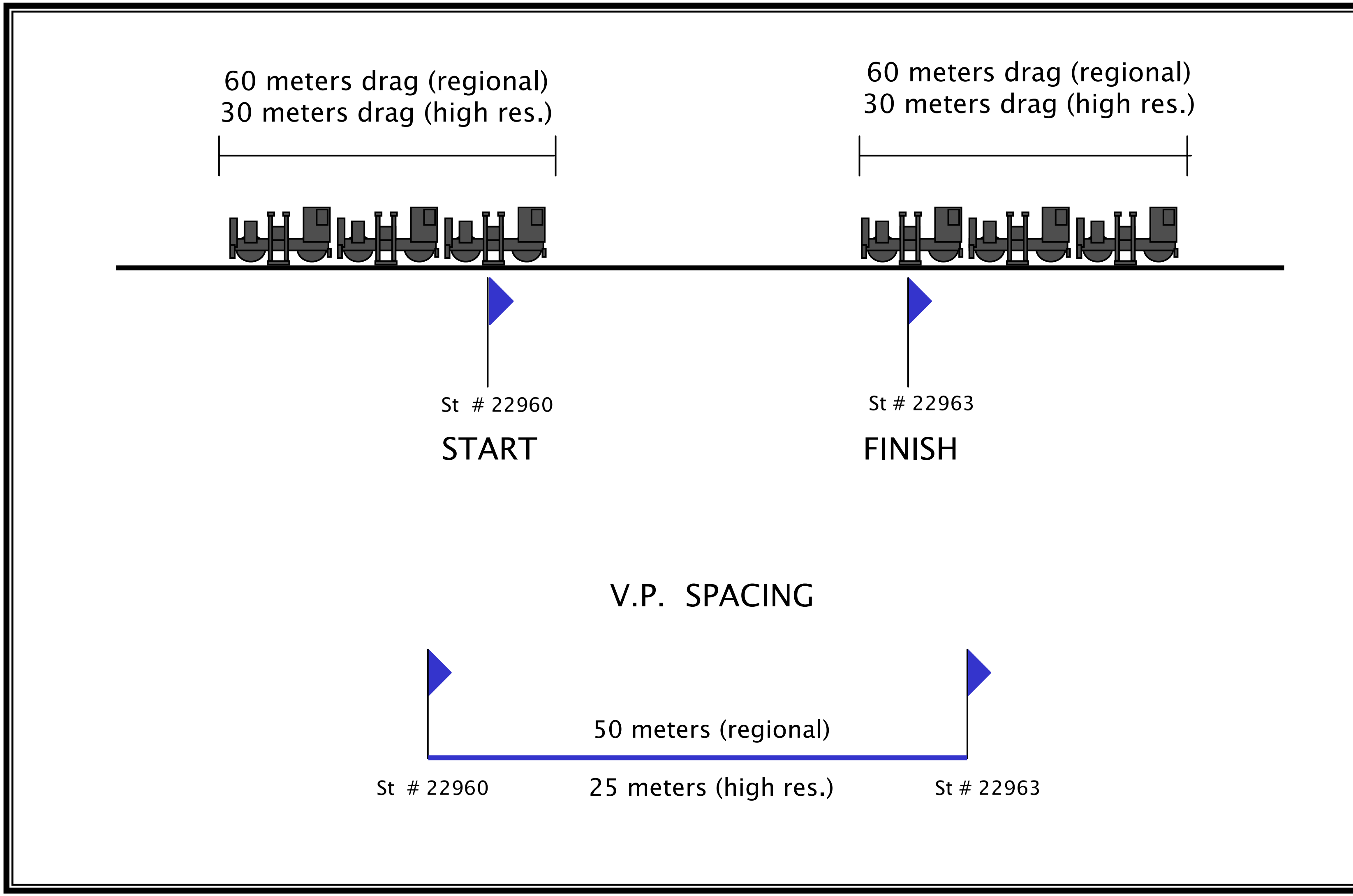
Regional



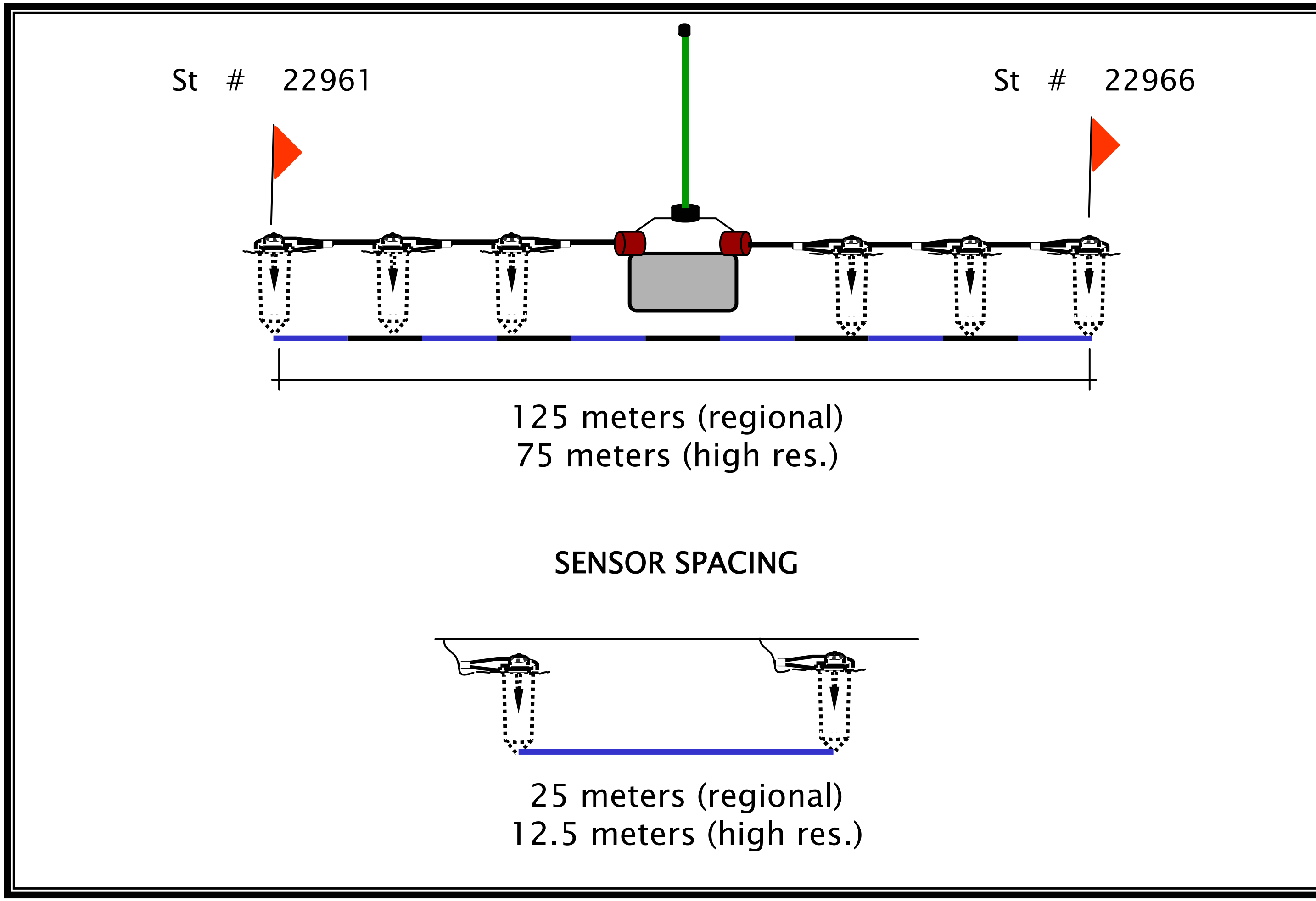
High resolution



SOURCE ARRAY



RECEIVER LAYOUT



APPENDIX C

RECORDING EQUIPMENT

System Four

System Four™, a new generation, field proven land seismic system, is purpose-built to improve operational efficiency and allow acquisition with either conventional geophones or digital VectorSeis sensors in any combination, even on the same survey. System Four is the seismic industry's premier, full-wave acquisition system. Geophysicists can now design seismic surveys with maximum flexibility, ensuring that field operations can be conducted at peak efficiency and that acquired seismic data delivers improved subsurface image quality.

From the simple user interface to the post acquisition SDP (seismic data processor), System Four has features required to record today's and tomorrow's survey designs. New generation ground electronics feature rapid cable fault identification, fast deployment and wakeup, automatic testing capability and redundant power and telemetry. Key System Four design features include:

- Scalable, hybrid sensor capability
  - Full vector wave-field recording with VectorSeis 3-C digital receiver modules
  - Conventional, single-component recording
    - Analog moving-coil geophones
    - Analog hydrophones
  - 30,000 channel (10,000 VectorSeis station) capability
- New SmartNet™ telemetry system (additional equipment may be required)
  - Quick location and replacement of cable breaks
  - Fast wakeup and spread configuration
  - Redundant network architecture
  - Buffered data transmission
- New SmartPower™ power delivery (additional equipment may be required)
  - Quick location and isolation of power faults
  - Power down the cable
  - Optional redundant power distribution architecture

System Four is designed around a unique central control system that simplifies operations, user training, field support and equipment pooling. I/O has tuned the central recording system design based on customer requests for efficient, high-capacity seismic acquisition and maximum system availability. Key features of the central recording system include:

- Intuitive user interface
  - Architecture based on Microsoft Windows®
  - Access to Microsoft productivity applications such as Word® and Excel®
  - Graphical acquisition flow builder and system configuration wizards
  - Source Aware™ quickly transmits and graphically displays QC information to the operator.

- Simultaneous acquisition and data handling
  - Acquisition operations decoupled from data handling tasks of plotting and taping
  - Data output to tape and/or disk volume (supports internal and external drives via Ethernet and USB 2.0)

System Four comes with a fully integrated package of cabling and ground electronics. Standard cable configuration supports operations in water depths up to 15 meters so you don't have to choose between dry-land-only or submersible configuration

Fourth-generation VectorSeis digital seismic receivers integrate with System Four. Digital full-wave VectorSeis sensors use silicon-based, micro-electro-mechanical systems (MEMS) based accelerometers to accurately record seismic energy. The three miniature accelerometers in the VectorSeis module are arranged in an orthogonal configuration and capture both p-wave and shear wave energy with the highest vector (X, Y and Z) fidelity. The accelerometers have been purpose-designed for seismic acquisition to provide high resolution subsurface images. Because VectorSeis is sensitive enough to measure gravity and uses gravity to measure module tilt, the module can be deployed at any angle to allow simplified, highly efficient field operations.

- Imaging qualities of the VectorSeis digital, full-wave sensor
  - Three accelerometers mounted orthogonally on a precision-machined aluminum cube for stability, industry-leading vector fidelity and delivery of crisp, high-resolution subsurface images
  - Full wave-field recording with VectorSeis modules
    - Vector filtering algorithms use the full wavefield to eliminate noise and improve the p-wave signal, while allowing seismic data processing to occur with enhanced p-wave data only (if desired).
    - 3-C data capture for comprehensive multicomponent processing for enhanced p-wave and shear wave data
- Flat frequency and phase response for high, broadband dynamic range
  - Accelerometers are mounted low in the sensor module for better ground coupling and less wind noise susceptibility.
  - Sensors are decoupled from line cables for isolation from cable-transmitted noise.

- Operational advantages of VectorSeis receiver deployment
  - Module measures and records apparent gravity for each sensor axis, making the receiver insensitive to deployment tilt.
  - Apparent gravity angles per component for every shot are recorded to tape header with component rotation to vertical orientation prior to tape output.
  - Sensors are decoupled from line cables for ease of sensor handling and repairs, separate from cable handling and repairs

Ground electronics for digital, full-wave VectorSeis recording

With the introduction of VectorSeis, a new generation of station based recording systems was required to fully capitalize on this revolutionary technology. The digital line unit (D-Unit) contains all the digital electronics to control, power and return data from three VectorSeis modules (nine channels), along with improved control algorithms to fully exercise the digital sensor. On-board buffers and packetized data telemetry architecture ensure that no data are lost in transmission back to the recording truck. Up to 10,000 three-channel VectorSeis stations can be operated from the System Four central control platform.

Ground electronics for geophone-based analog recording

For conventional analog geophone input to System Four, all ground electronics, central system components and software are the same, except for the D-unit. For conversion, four screws holding D-unit electronics modules to ground cables are removed and A-unit electronics modules easily replace the D-units. A -units and D-units are totally sealed with waterproof connectors so the conversion can be conducted in the field with unskilled labor, if required.

A-unit analog circuitry is a totally new design based on the latest 24 bit conversion technology. The design has a very high level of integration resulting in the highest level of unit reliability and outstanding analog performance, with little chance of variations with time from component changes. A-units have all the packetized data telemetry and power management capability of D-units. Analog power and test functions are left to user control, with system safeguards to best optimize the crew operational time.

Cross -line Unit (XLU), Battery Booster Unit (BBU) and Analog Unit (A-Unit)

Central System Components

CRS – Central Recording System +5°C to +40°C operating -40°C to + 75°C storage 120/240 Vac, 50/60 Hz, less than 700 W with standard equpment	**Human Computer Interface** Intel® Pentium® 4 CD-R/RW, optional DVD-R/RW Optional internal 8mm Exabyte® Mammoth tape drive 10/100 Base T Ethernet Ultra SCSI Raid disk array subsytem with minimum 180 Gbyte storage Dual DVI 4X AGP port (optionally up to 2 additional display ports) Ultra SCSI tape and plotter interface ports Microsoft® Windows® 2000 Professional or higher **FEI Field Electronics Interface / SDP Seismic Data Processor** PowerPC real-time host processor Array processor 1000 Base T Ethernet port Fiber channel port Dual port memory (sized depending on maximum stations / record length) 3,000 channel base capacity Upgradeable to 10,000 and 30,000 channel configurations with simple board additions **Truck Network Switch** Advanced network packet telemetry Interfaces central system components and truck input panel **Truck Input Panel** 4 each crossline ports Each port capable of 6000 channels @ 2ms data rate Multiple panels available **ACTI (auxiliary channel telemetry interface)** 6 analog auxiliary channels (24 bit)
Third Party Anciliary Equipment Environmental and power specifications per third party vendor datasheets	**Pelton Vib Pro™ Source Controller** Supports Vibroseis and dynamite (Shot Pro™) operations **Pelton Shot Pro II Source Controller** See Pelton datasheet **Tape Drives** Dual 3580 standard Other SCSI tape drives on special request, subject to availability **Monitors (3 standard, 4 optional)** Standard: 20” Flat Screen, 1600 x 1200 dpi Optional: 18” Flat Screen, 1600 x 1200 dpi **Printer** Standard: HP Inkjet series Optional: HP Laserjet series **Plotter** ISYS V12 with SCSI interface

 Revised 7/22/04

General System Specifications

Time Break Accuracy	+0, -8 µs
Time Standard	1 ppm
SPS Support	Spread, script and map generation SPS import SPS export

Special Source Operations	Integrated Pelton software resident on System Four
	Source driven acquisition
	Floating-point summing
	Noise edit with diversity or burst mode
	Vertical stack
	Diversity stack
	Correlate before or after stack (zero-phase FFT)
	Alternating fleets
	Enhanced sweep package
	    Interleaved fleets
	    Cascaded / Phase-rotated
	    Stored Pilot
	    Slip Sweep

Report Export Format	Microsoft Excel® (included)

Source Aware™ QC	Source point QC package
	    User set-points for allowable quality degradation of spread
	    Alerts operator of out of specification conditions 'before' the shot
	    Records actual quality data to shot report (sensor and source)
	    Quickly identifies available shot points based on current spread status

Data Monitoring	Screen and paper output displays
	    Phase and power spectrum
	    Time series trace displays
	        Digital AGC
	        True amplitude (defloat)
	        TAR (True Amplitude Recovery)
	Color-coded icons in schematic view represent source and receiver status
	    Box faults
	    Battery voltage
	    Instrument test results
	    Sensor test results

Ground System Components

A-unit
 	
Operating temperature -40C to +75C (Extended range available)
	Analog input line unit
	Supports up to 3 analog sensors
	Onboard processor for performing instrument and sensor tests in box
	SmartNet™ redundant buffered data telemetry (additional equipment may be required)
	    Supports non real- time data transmission for increased station capacity
	    Re-routing over redundant connections in case of cable failures
	SmartPower™ power handling system (additional equipment may be required)
	    Redundant power capability
	    Power switching for line power troubleshooting
	Integral twisted pair line cable with hermaphroditic Dynacon™ mid-span connectors
	    4.6 kg / station @ 55 m station spacing
	    Aramid core, gum filled for operation to 15 m water depth
	    Quick couple mid-span connector. Screw thread connector available on special request *
	Telemetry data rate @ 2ms real-time
	    319 stations @ 80 m or less station spacing, each side of XLU; 25.5 Km
	    477 stations @ 55 m or less station spacing, each side of XLU; 26.2 Km
	    623 stations @ 33 m or less station spacing, each side of XLU; 20.5 Km

D-unit
 	
Operating temperature -40C to +75C (Extended range available)
	Digital input line unit
	Supports up to 3 each VectorSeis SVSM sensors (3 components per SVSM)
	Onboard processor for evaluating D-unit and sensor tests
	SmartNet™ redundant buffered data telemetry (additional equipment may be required)
	    Supports non real-time data transmission for increased station capacity
	    Re-routing over redundant connections in case of cable failures
	SmartPower™ power handling system (additional equipment may be required)
	    Redundant power capability
	    Power switching for line power troubleshooting
	Integral twisted-pair line cable with hermaphroditic Dynacon mid-span connectors
	    4.6 kg / station @ 55 m station spacing
	    Aramid core, gum filled for operation to 15 m water depth
	    Quick-couple mid-span connector. Screw thread connector available on special request *
	Telemetry data rate @ 2ms real-time
	    213 stations @ 80 m or less station spacing, each side of XLU; 17.0 Km
	    318 stations @ 55 m or less station spacing, each side of XLU; 17.5 Km
	    415 stations @ 33 m or less station spacing, each side of XLU; 13.7 Km

XLU
 	
Operating temperature -40C to +75C (Extended range available)
	Digital crossline switch
	Advanced network packet telemetry
	Ports
	    3 each - crossline
	    2 each - D-unit or A-unit line
	Telemetry line capacity
	    Crossline 6000 channels @ 2ms real-time
	    Quick-couple mid-span connector. Screw thread connector available on special request *
	Fiber optic crossline cable up to 15 km

Ground System Components (contd.)

BBU Operating temperature -40C to +75C (Extended range available)	**Battery Booster Unit** 12 Volt nominal input +/- 24 Volt to earth nominal line output Powers 24 SVSMs at 55 m intervals, 18 SVSMs at 80 m intervals Powers 60 analog channels using A-Units at 55m intervals , 48 channels at 80 m intervals SmartPower™ redundancy and switching (additional equipment may be required) Dual hot swappable power inputs Quick-couple mid-span connector. Screw thread connector available on special request * Serial port for connecting HDU
Line Cable Operating temperature -40C to +75C (Extended range available)	**Line Cable** Same cable for A-Units and D-Uints Bi-directional power and telemetry Reversible installation, no required cable orientation Diameter OD 8.89 mm Pull Strength Short term (15 seconds) - 227 kg (500 pounds) Long term (24 hours) - 45 kg (100 pounds) Weight 8 kg per 100 m
Cross Line Cable Operating temperature -50C to +75C Storage temperature -60C to +75C	**Cross Line Cable** 9/125 micron ruggedized, military grade, harsh environment fiber optic cable Diameter 5.5 mm Pull strength 181 kg (400 pounds) Weight 2.8 kg per 100 m
HDU	**Hand held Deployment Unit** Performs full instrument tests for both A-Units and D-Units, tests of cable telemetry and power, and sensor tests via serial port on BBU Lightweight, 1 kg, including case and cable Splashproof case PocketPC based

* XLU, BBU, and A-Unit / D-Unit connectors must be the same option

VectorSeis SVSM Receiver Specifications

Digital Quantization	24-Bits (23 + Sign) LSB = 0.39 μm/s² or 40 ng*
Sample Rate	4 ms, 2 ms or 1 ms
Time Standard	Tied to System Four clock (s*ee System Four specification*)
Full Scale	+/- 3.3 m/s² or +/- 0.335 g peak, dynamic (*at all inclinations)*
Noise	0.44 μm/s² or 44.7 ng²/Hz (-147 dBg²/Hz) typical *(3Hz to 375Hz)*
Equivalent Input Noise (EIN)	4.18 μm/s² or 426 ng rms @ 4ms, 5.95 μm/s² or 607 ng rms @ 2ms, 8.46 μm/s² or 862 ng rms @ 1ms (*3 Hz to ¾ Nyquist)*
System Dynamic Range	118 dB @ 4ms, 115 dB @ 2ms, 112 dB @ 1ms, *3 Hz to ¾ Nyquist (at all inclinations)*
Frequency Response	1.450 Hz @ 4ms, 1.463 Hz @ 2ms or 1.470 Hz @ 1ms to ¾ Nyquist, +0/-3 dB typical (*See response curves*)
Filters	Digital Anti-Alias Filters: Linear or Minimum Phase Response 93.8 Hz @ 4ms 187.5 Hz @ 2ms 375 Hz @ 1ms Rejection above Nyquist Frequency –128 dB Pass-band Ripple +/-0.1 dB Digital Low-Cut Filter: Low-Cut A: Out or 1 of 32 Frequencies 3 to 90 Hz, 12 dB/octave Digital Offset Filter (*either*): Continuous Filter: 1.450 Hz @ 4ms or 1.463 Hz @ 2ms or 1.470 Hz @ 1ms, 6 dB/octave Fixed DC Offset Removal
Total Harmonic Distortion	Less than 0.002%** @ *12 Hz, 68.4 mg peak acceleration or 0.01778 m/s (0.7 in/s) p.p. velocity*
Sensor to Sensor Matching	+/-0.4% *at all inclinations*
Cross Axis Isolation	46 dB typical
Sensor Module Interface	Proprietary cable link Power provided by System Four
Deployment	Any orientation
Inclination Resolution	+/- 0.5° arc, *relative to vertical*
SVSM Test Capability	Embedded power-up self test: Sensor wake-up and self-configuration checks Control loop validation Sensor gravity measurement Power consumption True Digital™ system response verified by digital sensor loopback test Operator controlled System Four tests: Vertical Orientation *(evaluates each sensor axis gravity magnitude and vector sum of all 3 sensors)* Spread Noise Sensor Loopback *(verifies module telemetry and digital filter performance)* Telemetry Error Count

VectorSeis SVSM Receiver Specifications (contd.)

SVSM Test Capability (contd.)	End of record validation *(every record)*: Overscale status Vertical orientation Sensor offset Digital fault flags
Environmental:	Operating temperature: -40°C to +75°C Humidity Range: 0 to 100% Operating Altitude: -100 to +5500 m Depth Rating in Water: 15 m
Physical Specifications:	16.5 cm x 5 cm dia. (body), 6.9 cm dia. (top) (6.5" x 1.99" dia. (body), 2.48" dia. (top)) 0.625 kg (1.375 lb.) *including 1.3 m cable and connector*
Related Products	Alignment tool Extraction tool

* *Typical Specifications at 23°C*

** *Measurement limited by mechanical test apparatus*

A-Unit Analog Performance Specifications

A/D Converter	24-bit (23 + sign)
Data Channels Per A Unit	3
Preamplifier Fixed Gain Levels	G0, G2, G4, G6
Sample Interval	1 ms, 2 ms, or 4 ms
Dynamic Range Non-shorted input Instantaneous DR @ 2ms sampling	130 dB @ G0 129 dB @ G2 121 dB @ G4 110 dB @ G6
Total dynamic range @ 2ms sampling	146 dB
Equivalent Input Noise Terminated input @ 2ms sampling	0.76 μV *RMS* @ G0 0.23 μV *RMS* @ G2 0.14 μV *RMS* @ G4 0.13 μV *RMS* @ G6

Analog Performance Specifications (contd.)

Maximum Input Signal @ 2ms sampling	1768 mV *RMS* @ G0 442 mV *RMS* @ G2 110 mV *RMS* @ G4 27.6 mV *RMS* @ G6 2500 mV *Peak* @ G0 625 mV *Peak* @ G2 156 mV *Peak* @ G4 39.1 mV *Peak* @ G6
Distortion	0.0003% THD
Channel to Channel Matching	<0.1%
Common Mode Rejection	120 dB or greater
Crossfeed Isolation	120 dB or greater
Frequency Response	1.5 Hz – 750 Hz
Time Standard	1 ppm controlled by central clock
Input Impedance Differential mode Common mode	 22.1 kΩ in parallel with 0.049 μF 5.5 kΩ in parallel with 6.6nF
Powering Options	Power down the cable
Filters	All filters are resident and remotely-selectable including:
Digital anti-alias filters	Linear or minimum phase response 375 Hz @ 1 ms 187.5 Hz @ 2 ms 94 Hz @ 4 ms Rejection above Nyquist frequency = –130 dB Passband ripple = ±0.1 dB
Digital low-cut filters (ON or OFF, as desired)	32 frequencies (3 Hz – 90 Hz) Slope = 12 dB/octave
DC Removal	Dynamic (6dB/octave, corner @1.5 Hz.) Static (zero phase shift) Off
Operating Environment Temperature Humidity range Altitude	 –40°C to +75°C Extended range available 0% to 100% Up to 5,500 m *Analog specifications are typical values at room temperature*
A-unit, D-unit Dimensions Weight	 55mm X 90mm X 206mm 960 g

VectorSeis System Four™ VR

The I/O VectorSeis System Four VR is the first purpose built multi-component seismic acquisition system which incorporates I/O's unique TrueDigital™ MEMS accelerometer. This system offers optimized P-wave imaging, is operationally easier and more reliable, and has made full wave field acquisition affordable to acquire.

- Full wave-field recording
- Improved productivity
- Comprehensive remote testing capability
- TrueDigital sensor output
- Purpose built for multi-component acquisition
- Flexible layout geometry
- Virtually unlimited numer of stations
- Robust narrow-bandwidth radio
- Single or multiple RSR Repeater
- Extremely portable

System Components

VectorSeis TrueDigital Sensor (SVSM.)

I/O has a strong reputation for providing new technology in a cost-effective manner. Deploymentt of the industry leading VectorSeis sensor allows end-users access to unprecedented image quality and resolution by collecting not only seismic data but by also gaining lithology and rock property information through TrueDigital full wave-field seismic acquisition.

Some of the numerous features of the VectorSeis modules are:

- Full vector wave-field recording
- Ideal for P-wave or multi-component surveys
- Flat frequency and phase response throughout the seismic band
- Order of magnitude gain accuracy improvement over geophones
- Insensitive to deployment tilt – position in any orientation with no degradation in specifications
- Not sensitive to electrostatic or electromagnetic interference from sources such as power lines and buried cables
- Rugged – tested to the same demanding 'tumble barrel' standard as I/O's industry leading Sensor geophones

Central Electronics

The Central Electronics consists of the totally new I/O System Four™ Central Unit (V2), Central Transceiver Controller (CTC), a Central Transceiver (CTR) and an antenna for controlling the VRSR2 field electronics.

- ➢ Intuitive user interface based on Microsoft Windows 2000 platform
- ➢ Wizards to assist the operator
- ➢ Macro command capability to easily automate redundant tasks. Macros can be shared between systems. Great for automating both production and the running of periodic ground system tests

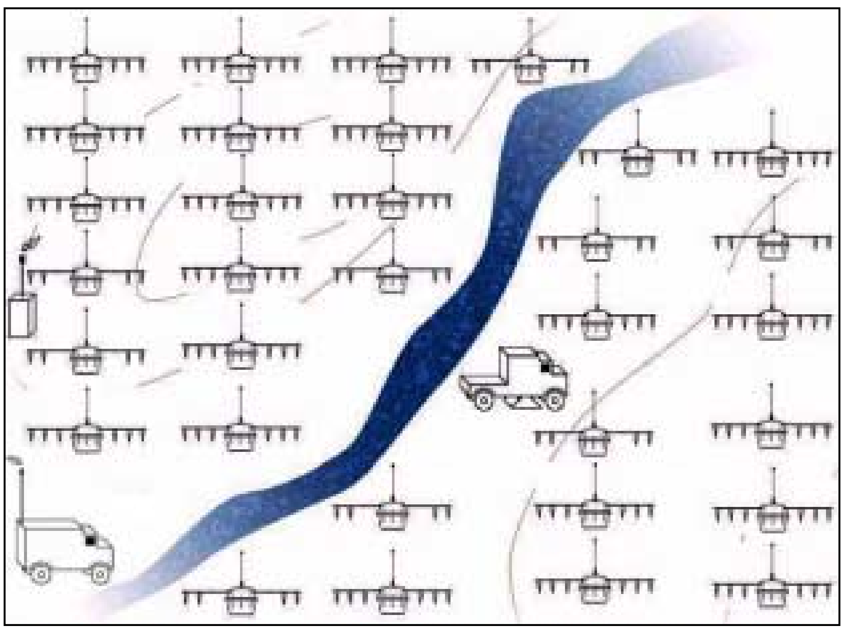
All Communication between the I/O System Four and the remote units is handled by radio telemetry using the CTR radio transceiver. The operating frequency can be selected from a large number of possible frequencies enabling effective operation in crowded RF environments

The V2 establishes radio contact with the remote units, allowing the operator to configure the recording parameters in the VRSR2s. A complete set of look-ahead tests may be initiated at selected VRSR2s. Results of these tests may be accessed by radio for evaluation, or kept in the VRSR2 memory.

A new recording cycle is started when a command is issued to the VRSR2s identifying the active recording spread. The VRSR2s evaluate the command and determine if they are required to record the event.

The spread status is displayed on top of a multi layered digital map, such as a TIFF or DXF file.

The attributes of each VRSR2 and its stations can be displayed using multiple colors to distinguish pass/fail criteria. Historical data is stored in a database for further analysis. Another important feature of the I/O System Four is that it will allow the user to "pull" select data from a VRSR2, allowing the operator to view trace data for quality control.



Remote Seismic Recorder (VRSR2)

The (VRSR2) is a radio-controlled seismic recorder capable of recording of up to six SVSM stations or 18 channels (X, Y, Z). During the recording sequence it gathers the TrueDigital™ seismic signals. It then stores the data along with shot identification and status information in non-volatile solid-state memory.

The VRSR2 has a programmable frequency-synthesized transceiver that is remotely controlled by the operator. It is designed to operate within a frequency range of 216 – 230 MHz

Remote Deployment Terminal (RDT)

The RDT may be used to assign a physical location to each VRSR2 unit at the time of deployment. The RDT provides field personnel the ability to configure, test and check status of the box and the VectorSeis units.

Data Collector Unit (DCU)

The process of data transfer from the VRSR2 to the Data Collector Unit (DCU) is automatic and does not interrupt the data recording process. Once the DCU is connected to the box, data is written to dual, redundant hard disk drives in the DCU.

The Data Collector Unit (DCU) is then used to transport the data to the Transcriber 2 (T2).

Transcriber 2™ (T2)

The T2 provides multiple high-speed data transfer ports for the data collection from the DCUs. Data from the collector units is transferred to an array of redundant disks in the T2. Transferred data is then verified to ensure complete data integrity. The data may be sorted and arranged in shot domain and receiver order, then written to tape in SEG-Y format. Data may be displayed on the monitor for QC purposes or sent to a plotting device. Optionally the data can be vertical rotated in the Transcriber to reduce processing time.

CRS – Central Recording System

+5°C to +40°C operating
-40°C to + 75°C storage
120/240 Vac, 50/60 Hz, less than 500 W with standard equipment

V2
- Intel® Pentium® 4
- CD-R/RW
- Optional internal 8mm Exabyte. Mammoth tape drive
- Optional internal Zip. drive
- 10/100 Base T Ethernet
- Dual DVI 4X AGP port (optionally up to 2 additional display ports)
- Microsoft® Windows® 2000 Professional

CTC Central Transmitter Controler
- RSR transmit control interface

CTR Transmitter/Receiver*
- 216.02 MHz to 219.98 MHz
- 216 MHz to 230 MHZ — available for sales outside of U.S.A. and Canada
- 25 W output power
- 20 kHz channel spacing
- Emissions Designator – 11K2F1D

* FCC or equivalent local license required

Pelton VibPro / ShotPro Source Controller
- Supports Vibroseis and Dynamite (ShotPro) operations
- See Pelton VibPro / ShotPro datasheet

Transcriber 2™ (T2)

See Data Sheet 121031

Disk Array	1000 st*, 6s, 4ms	1000 st*, 6s, 2ms	1000 st*, 6s, 1ms
200 Gbytes	6,660 shots	3,330 shots	1,660 shots
400 Gbytes	13,330 shots	6,660 shots	3,330 shots

Other Disk Array sizes are available on request

**1000 stations is equivalent to 3000 channels*

Ground Electronics

VRSR2 / SVSM (see VRSR2 - SVSM datasheet)
- Up to 6 TrueDigital stations per VRSR2
- Unlimitied VRSR2s

RSR (see RSR datasheet 121001D)
- Up to 6 analog channels per RSR
- Can be used for data and auxiliary channels
- Unlimited RSRs

Third Party Anciliary Equipment

Environmental and power specifications per third party vendor datasheets

Monitors (2 standard, up to 4 optional)
- Standard:
  - 20" Flat Screen
  - 1280 x 1024 dpi
- Optional:
  - 18" Flat Screen
  - 1280 x 1024 dpi

Printer
- Standard:
  - HP Laserjet series
- Optional:
  - HP Inkjet series

Repeater (Part number 1510010001) -55°C to +75°C operating -55°C to + 75°C storage 0 to 100% humidity -100m to 5500m operating altitude	216.02 MHz to 219.98 MHz 216 MHz to 230 MHZ — available for sales outside of U.S.A. and Canada 12 W output power 20 kHz channel spacing Emissions Designator – 11K2F1D Input Power 12 VDC Repeater module Dimensions 24.3 cm x 24.3 cm x 19 cm (9.6 in x 9.6 in x 7.5 in) Weight 5.9 kg (13 lb) Duplexex module Dimensions 38.8 cm x 58.4 cm x 63.6 cm (15.25 in x 23 in x 25 in) Weight 25.9 kg (57 lb)
Data Collector Unit (DCU) (Part Numer 1395000002) +5°C to +55°C operating -40°C to + 75°C storage 0 to 100% humidity -100m to 5500m operating altitude	Data Storage Capacity - Up to 18 Gbytes (94 full 192 Mb VRSR2 Units) Dimensions - 39.1 cm x 18.3 cm x 27.4 cm (15.4 in x 7.2 in x 10.8 in) Weight - 10 kg (22 lb) Input Power - 12 VDC
Remote Deployment Terminal -40°C to +55°C operating -40°C to + 75°C storage 0 to 100% humidity -100m to 5500m operating altitude	Hand-held unit, deploys and tests RSR, VRSR2 and SVSM

SURVEY PLANNING AND DESIGN

GMG MESA® Survey Design (optional)

Spread Definition

- Script Generation
  - Geometry
  - System Parameters
- Array Design
  - Receiver Array Design
- Geographic Modeling
  - Map Display
  - Imaging Tools
- Cultural Information
- Permitting Information
- Binning
  - Off-line Binning
  - Binning Statistics
  - Binning Analysis Tools
- Geologic Modeling
  - Ray Tracing
- Survey Economics

ACQUISITION

Central Electronics

- Control & Scheduling
  - SPS Input
  - Synchronous Cursor Views
    - Map View
      - Import
      - Receiver Schematic
      - Source Schematic
      - Source Aware.
    - Ordered Text View
- Vibroseis Processing
  - Correlation
  - Before or after Stack
- Special Vibroseis Methods
  - Alternating Fleets
  - Cascaded / Phase-rotated
    - Exxon Sweep®
  - Stored Pilot

Seismic Data QC

- Monitoring
  - Monitor and/or Hard Copy
  - Time Series Multiple Views
  - Line Energy Monitor
  - Trace Power Spectrum
- Reports
  - Crystal Reports. Engine
  - Export to Microsoft Office.

Ground Electronics

- Spread Management
- Spread Troubleshooting
- Quality Assurance
- LAT Processing & Display
  - Box/Sensor
  - Diversity and Vertical Stack

Sources

- Source Types
  - Impulsive
  - Vibroseis
- Impulse Control
  - *Pelton Shot Pro*
  - Generic Source Controller
- Vibrator Control
  - *Pelton Vib Pro*
- Quality Control
  - Vibrator QC
  - Source position

Seismic Channels	Virtually unlimited
Auxiliary Channels	Virtually unlimited
Sample Rates	1 ms , 2 ms , or 4 ms
Record Length	66 secs maximum @ 2ms
Multi-line Capabilities	1 line to 120 lines (software expandable) Station and shot roll capability Multiple-shotpoint roll configurations
Roll-along Capabilities	Automatic or manual roll 8-digit shotpoint numbering 8-digit station numbering
SPS Support	Spread, script, and map generation SPS import SPS export
Summing Operations	Floating-point summing Vertical stack Diversity stack
Correlation	Correlate after stack (*performed in T2. Transcriber post acquisition*) Technique: zero-phase FFT

Test capabilities	Automated daily, weekly, and monthly with embedded analysis
	Manual test operation
	Unit diagnostic test
	SVSM specific tests
	  Vertical Orientation (*evaluates gravity magnitude in each of 3 sensors and vector sum of all 3 sensors*)
	  Spread Noise
	  Sensor Loopback
	  Telemetry Error Count

Timing standard	2 ppm

Data Monitoring	Selected seismic and auxiliary traces returned over RF link for visual display
	  Phase and power spectrum
	  Digital AGC
	  True amplitude (defloat)
	  TAR (True Amplitude Recovery)
	Color-coded icons in map view represent source and receiver status
	  Box faults
	  Battery voltage
	  Instrument test results
	  Sensor test results

Specifications
IVI – Y 2400 Vibrator

Peak Force	47,700 lbs
Piston area	15.9 inches
Usable stroke	3.0 inches
Displacement limit	5-250 Hz
Reaction mass weight	5,830 lbs
Baseplate assembly weight	3,860 lbs
Weight on baseplate	48,026lbs
GVW	48,580 lbs
Front axle weight	23,200 lb
Rear axle weight	25,380 lb
Baseplate area	4,077 inches
Dimensions	
Wheelbase	167.8 inches
Overall length	317 inches
Overall width	98.5 inches
Overall height (over light beacon)	117 inches
Baseplate clearance	19 inches
Tires	620-75R-26, Good Year

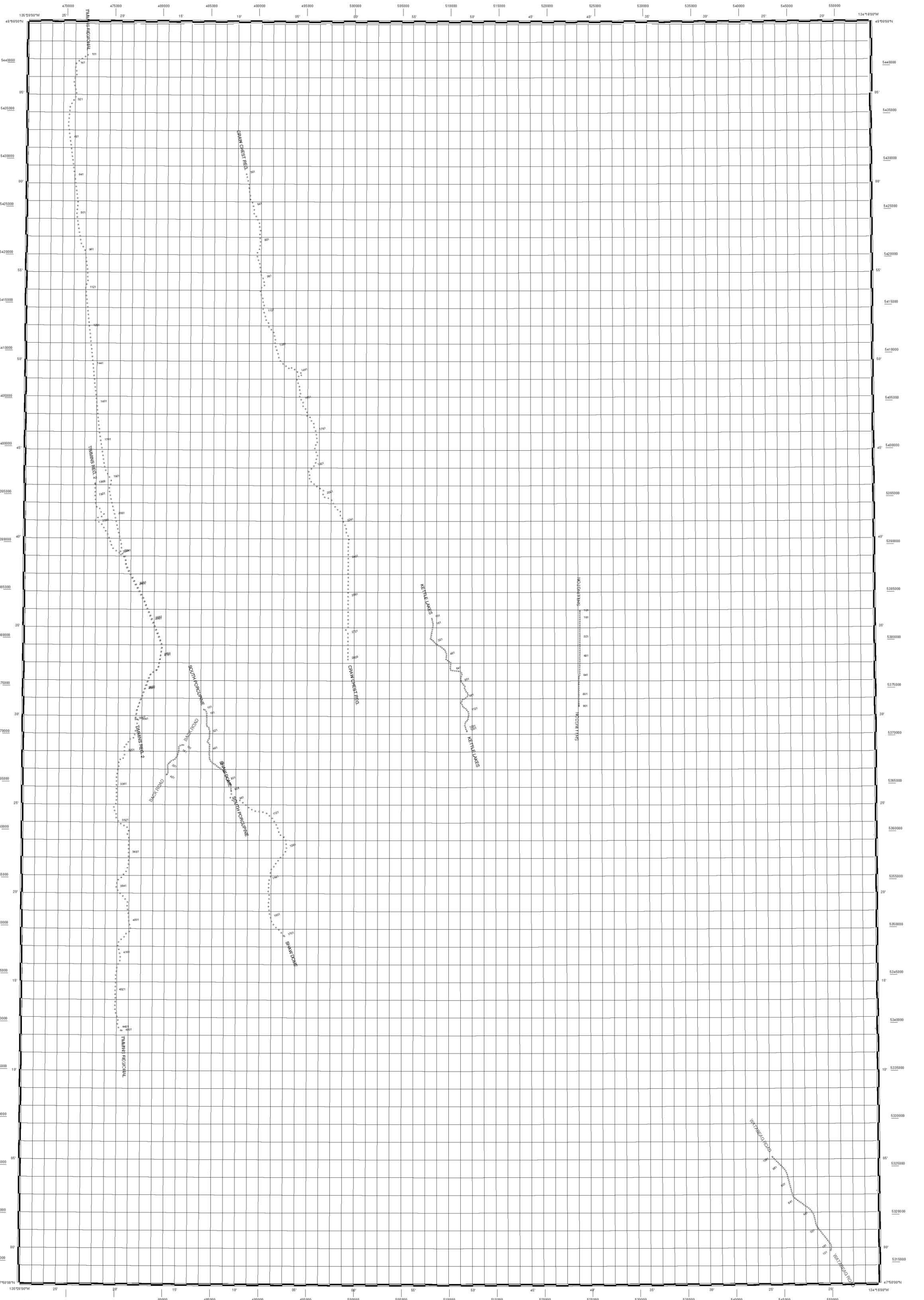
IVI Y-2400 VIBRATOR

The 'birdwagen' MARK IV off-road carrier with the Failing Y-2400 vibrator. This is an advanced seismic source production system designed for high quality and high production geophysical prospecting. The 48,000 pound output vibrator offers broad band output and a high signal to noise ratio for the deepest surveys.

The advanced features include high fidelity output, 4 speed transmissions, variable speed hydraulic motors, noise limiting systems, and ergonomic operator features. Wagon wheel articulated steering, which was first introduced to the geophysical industry by IVI in 1984, offers safe and reliable off road operation. The unique IVI traction system delivers the massive tractive effort, and the terrain following capability needed in rugged geophysical prospects.

APPENDIX D

SHOT POINT MAP 1:100 000



Universal Transverse Mercator
Zone : 8N, CM : 135 °W
NAD 1983 - Canada
Ellipsoid : GRS 1980

0 1 2 3 4
Kilometers
0 1 2 3
Statute Miles

Timmins Economic Development Corporation

Timmins 2D 2004

Reflection Seismic Survey
Kirkland Lake District of Northern Ontario
12.5m/25m and 25m/50m stn/src intervals

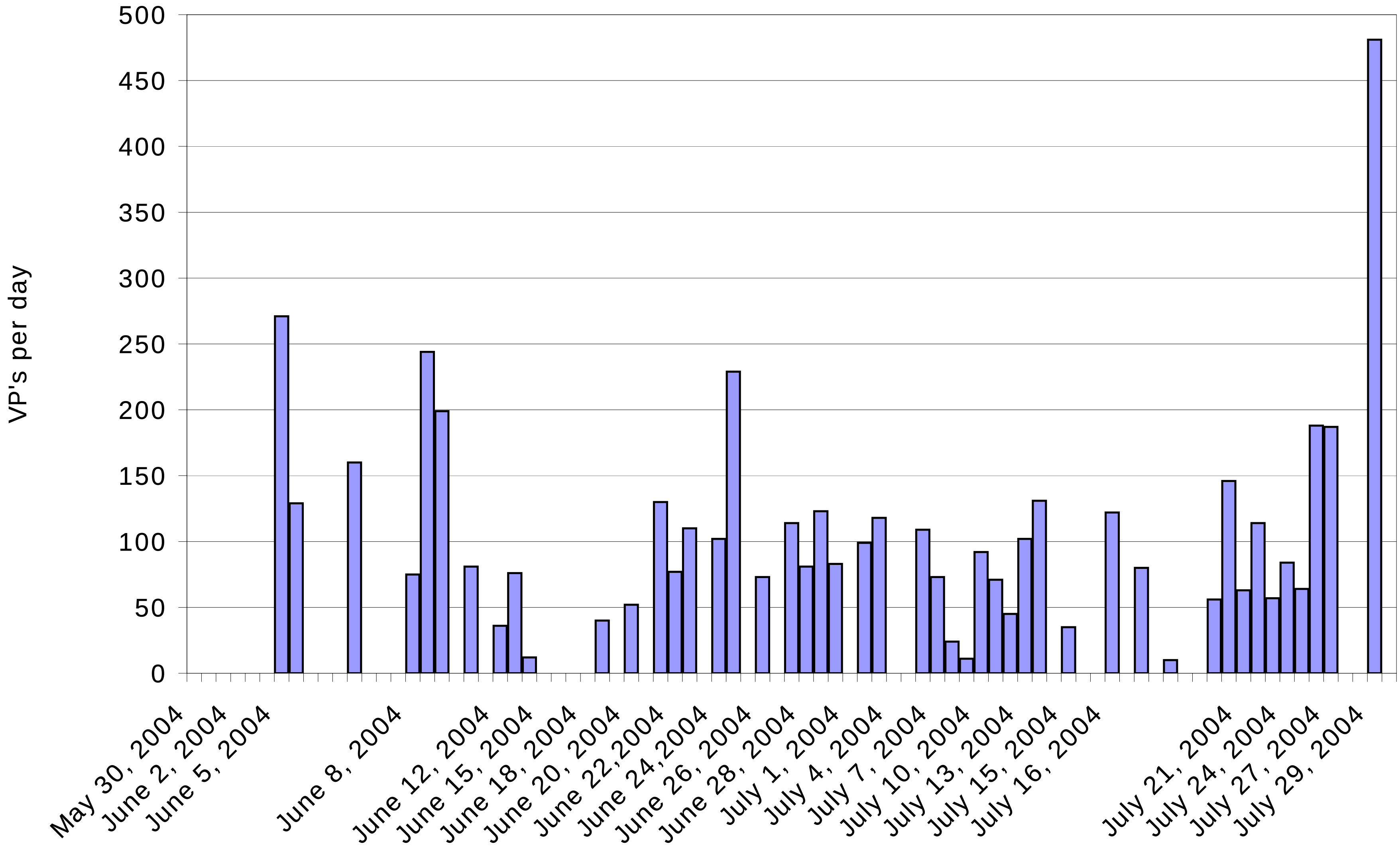
Date	Feb 9, 2005	Author	TJH
Scale	1 : 150000	DLS Vers.	

Geographic Wizard 2.00

APPENDIX E

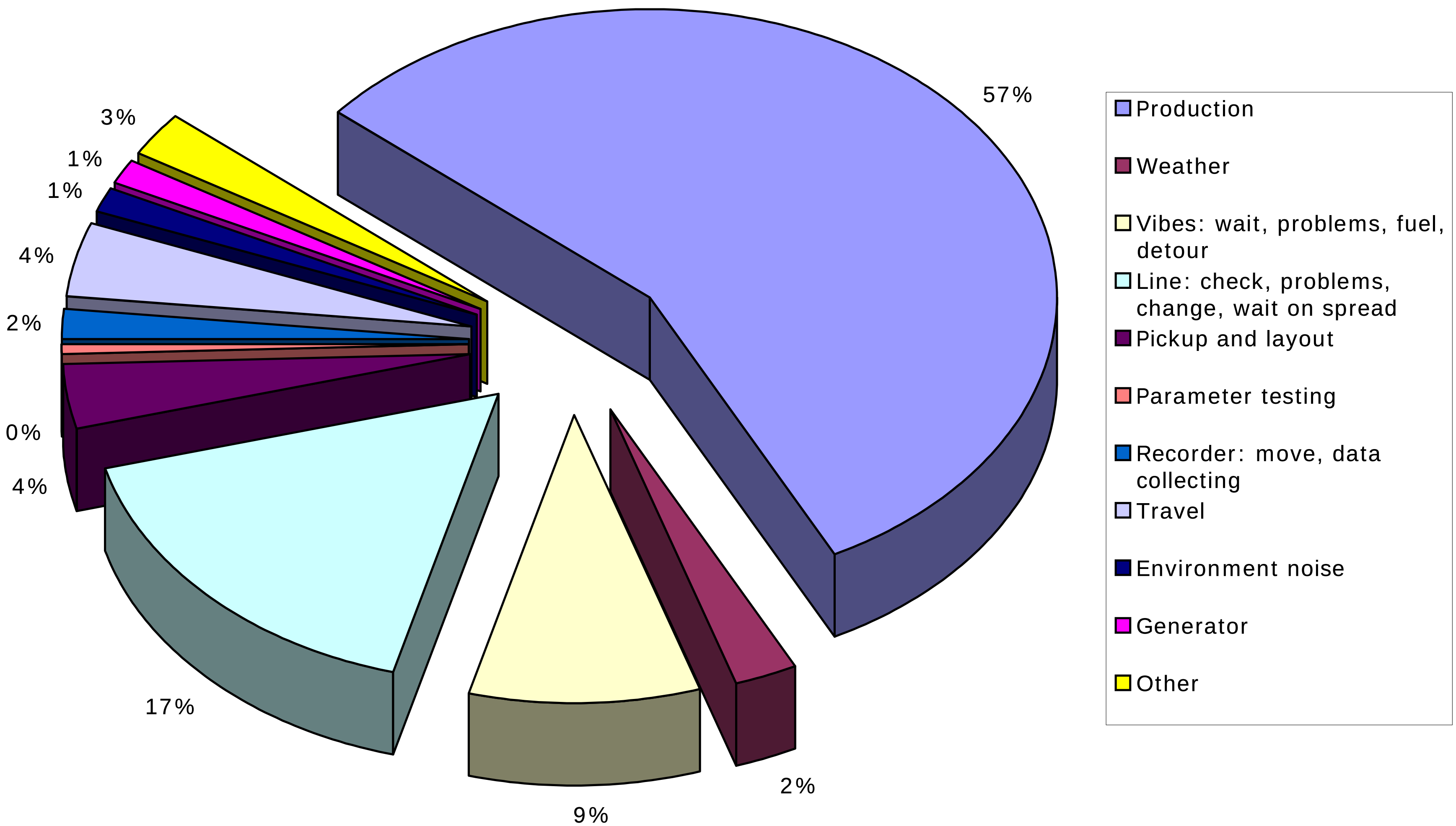
SURVEY STATISTICS

VP/day



VP's per day
500
450
400
350
300
250
200
150
100
50
0
May 30, 2004
June 2, 2004
June 5, 2004
June 8, 2004
June 12, 2004
June 15, 2004
June 18, 2004
June 20, 2004
June 22,2004
June 24,2004
June 26, 2004
June 28, 2004
July 1, 2004
July 4, 2004
July 7, 2004
July 10, 2004
July 13, 2004
July 15, 2004
July 16, 2004
July 21, 2004
July 24, 2004
July 27, 2004
July 29, 2004

Timmins Vibroseis 2D 2004
Downtime percentages



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Appendix 3

Processing of 2D Reflection Seismic Data, Timmins–Kirkland Lake Region of Northern Ontario

Sensor Geophysical Ltd.

Stephen Weber – Project Supervisor
Rodney Couzins – Technical advisor
David Secord – Lead Processor

TIMMINS-KIRKLAND LAKE REGION OF NORTHERN ONTARIO

Discover Abitibi Initiative

Discover Abitibi
A project of innovation, cooperation and revitalization

Découvrons l' Abitibi
Un projet d' innovation, de coopération et de renouvellement

Processing of 2D Reflection Seismic Data
for OFR 6169, MRD 163, Geophysical Data Set 1054

Steven Weber, Project Supervisor
Rodney Couzens, Technical Advisor
David Secord, Lead Processor
Sensor Geophysical Ltd.

Ontario
Northern Ontario Heritage Fund
Fonds du patrimoine du Nord de l'Ontario

FedNor
Canada

Timmins

TABLE OF CONTENTS

CREDITS

This survey is part of the Discover Abitibi Initiative, a regional cluster economic development project based on geoscientific investigations of the western Abitibi greenstone belt. FedNor, Northern Ontario Heritage Fund Corporation, municipalities and private sector investors have provided funding for the initiative. Project management was performed by the Timmins Economic Development Corporation.

List of accountabilities and responsibilities:

. Timmins Economic Development Corporation (TEDC) - overall project management
. Robert Calhoun, Project Manager, Discover Abitibi Initiative - contract management, project management
. Laurie Reed, L.E. Reed Geophysical Consultant Inc. - quality assurance and quality control
. David Snyder, Geological Survey of Canada – quality assurance and quality control
. Thomas Watkins, Ministry of Northern Development and Mines (MNDM) - preparation of base maps and map surrounds
. Kinetex Inc., Calgary, Alberta - data acquisition
. Sensor Geophysical Ltd., Calgary, Alberta - data processing

1. INTRODUCTION

Recognizing the value of geoscience data in reducing private sector exploration risk and increasing investment attraction, the Timmins Economic Development Corporation (TEDC), along with the FedNor, Northern Ontario Heritage fund and private sector investors funded the Timmins–Kirkland Lake Region of Northern Ontario Processing of 2D Reflection Seismic Data, consisting of :

. reflection seismic data acquisition
. reflection seismic data processing
. delivery of digital data products

The TEDC was charged with the responsibility to manage the project. The TEDC acted on the advice of Discover Abitibi Initiative subcommittees concerning the mineral industry needs and priorities. Various criteria were assessed, including:

. commodities and deposit types sought
. prospectivity of the geology
. state of the local mining industry and infrastructure
. existing, available data
. mineral property status.

In the summer of 2004, the TEDC managed a program of seismic data acquisition in the Timmins–Kirkland Lake region as part of the Discover Abitibi Initiative Program. The project involved one seismic data acquisition contractor and 204 line-km of data acquisition. The data acquisition contractor was Kinetex Inc. of Calgary, Alberta. The seismic data acquisition contract was awarded through a Request for Proposal and Contractor Selection process.

The project also involved one seismic data processing contractor, Sensor Geophysical Ltd. of Calgary, Alberta. The seismic data processing contract was awarded through a Request for Proposal and Contractor Selection process.

2. SURVEY LOCATION

Eight seismic lines were recorded (Figure 1). The map in Figure 1 was constructed from UTM-X and UTM-Y coordinates provided by TEDC. No latitude and longitude coordinates were provided.

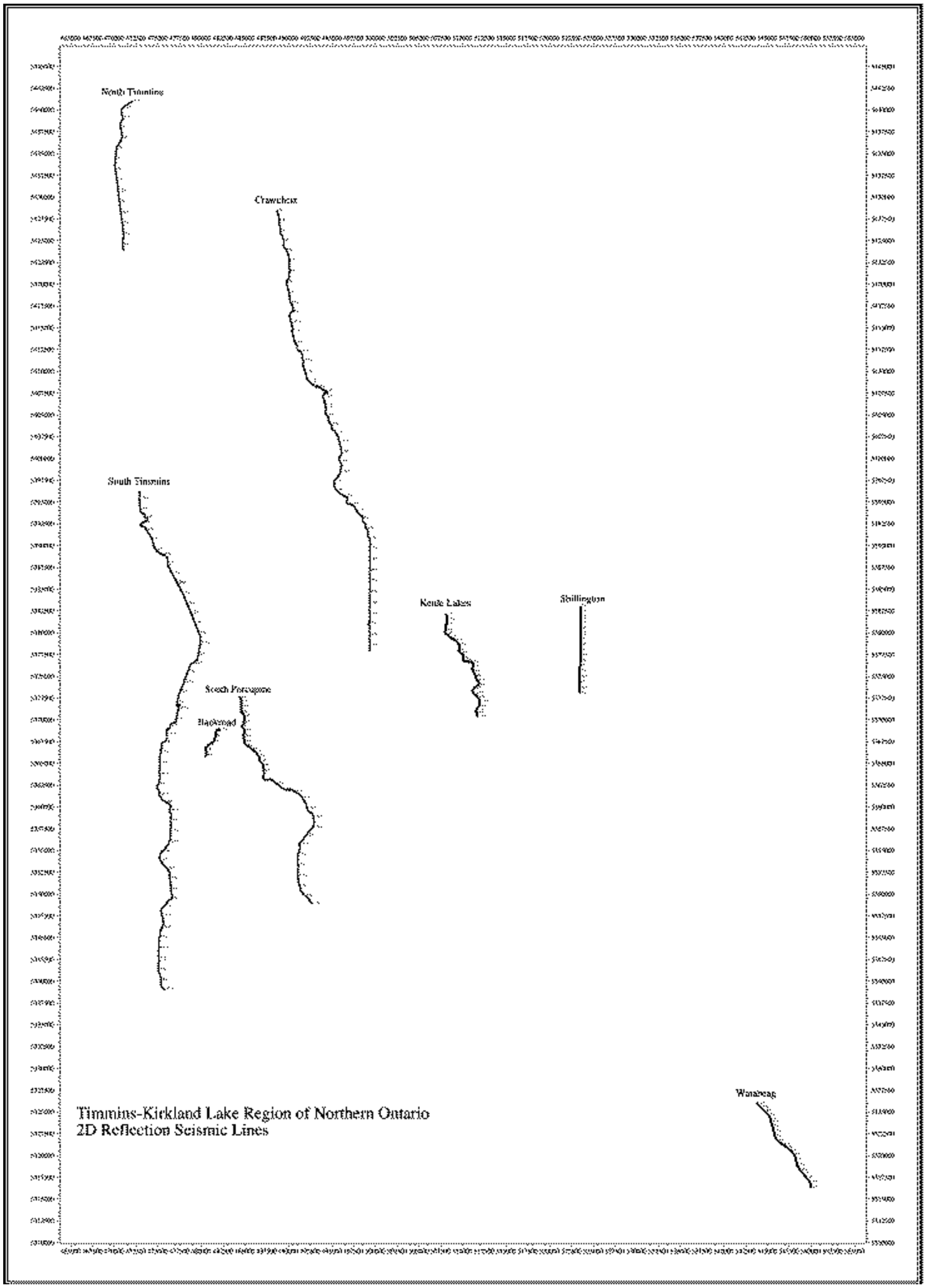

Figure 1. *Sketch map of seismic lines made from UTM coordinates*

3. PROCESSING EQUIPMENT AND PERSONNEL

Sensor Geophysical Ltd. Processing Equipment :

Processing was performed on SUN desktop computers and servers equipped with the Solaris operating system and Landmark Graphics Corporation ProMAX seismic processing software.

Sensor Geophysical Ltd. Processing Personnel :

Project Supervisor and Technical Representative	Steven Weber
Technical Advisor	Rodney Couzens
Lead Processor	David Secord
Processors	Glenn Ghaney
	Harvey Kwan
	Robert Pike

4. DATA ACQUISITION

Kinetex Inc. of Calgary, Alberta, acquired the seismic data. The seismic acquisition specifications are summarized in Table 1. Kinetex employed an I/O VectorSeis® system to record 3-component data. Kinetex correlated only the vertical component field records for processing.

Regional lines were recorded with 25 m receiver interval and 50 m shot interval using a vibroseis source array. The regional line sweep was 28 s long. The sweep was linear over the frequency band 10 to 96 Hz. The listen time was 40 s. The correlated record length was 12 s.

High resolution lines were recorded with 12.5 m receiver interval and 25 m shot interval using a vibroseis source array. The high-resolution line sweep was 28 s long. The sweep was nonlinear, +3 dB/Octave boost, over the frequency band 10-160 hertz. The listen time was 34 s. The correlated record length was 6 s.

Table 1. Acquisition Parameters – Regional Type

Instrumentation System:	I/O SYSTEM 4 VR
Number of Channels:	960 (or less, depending on length of line)
Sample Interval:	2 ms
High Cut Filter:	1/2 Nyquist Minimum Phase (~125 Hz)
Low Cut Filter:	Out
Tape Format:	SEG-Y IEEE
Receiver Station Interval:	25 m
Source Interval:	50 m
Source Type/Array:	Vibroseis/54 m drag
Number of Sweeps:	6
Sweep Spectrum:	10-96 Hz
Sweep Type:	Linear
Sweep Length:	28 s
Sweep Taper:	0.3 s
Listen Time:	12 s
Stack Type:	Diversity (Noise Edit)
Stack Trace Length:	40 s
Correlated Trace Length:	12 s
Receiver:	I/O SVSM 3-component accelerometer
Data Correlated:	Vertical Component
Data Storage:	MAXTOR USB External Hard Disks

Table 2. Acquisition Parameters - High-Resolution Type

Instrumentation System:	I/O SYSTEM 4 VR
Number of Channels:	960 (or less, depending on length of line)
Sample Interval:	2 ms
High Cut Filter:	1/2 Nyquist Minimum Phase (~125 Hz)
Low Cut Filter:	Out
Tape Format:	SEG-Y IEEE
Receiver Station Interval:	12.5 m
Source Interval:	25 m
Source Type/Array:	Vibroseis/18 m drag
Number of Sweeps:	3
Sweep Spectrum:	10-160 Hz
Sweep Type:	Non-Linear
Boost:	+3 dB/Octave
Sweep Length:	28 s
Sweep Taper:	0.3 s
Listen Time:	6 s
Stack Type:	Diversity (Noise Edit)
Stack Trace Length:	34 s
Correlated Trace Length:	6 s
Receiver:	I/O SVSM 3-component accelerometer
Data Correlated:	Vertical Component
Data Storage:	MAXTOR USB External Hard Disks

Tables 3 and 4 summarize some of the acquisition and subsequent processing parameters for the regional and high-resolution lines.

Table 3. Regional Line Parameters

Line	Receivers	Shotpoints	# Shots	#Channels	#CDPs	Km
Crawchest	501-2829	501-2705	968	961	1-4087	58.2
South Porcupine	101-1701	101-1701	741	960	1-2173	30
North Timmins	101-827	102-347	147	727	1-937	18.2
South Timmins	1869-4501	1869-4501	1295	960	1-4933	65.8

Table 4. High Resolution-Line Parameters

Line	Receivers	Shotpoints	# Shots	#Channels	#CDPs	Km
Back Road	101- 421	101- 421	171	321	1-594	4
Kettle Lakes	101-1300	101-1300	612	959	1-2063	15
Shillington	101-901	101-901	401	795	1-1596	10
South Porcupine[1]	101-1381	101-901	340	960	16-754	10
Watabeag	101-1061	101-1061	481	957	1-1869	12

5. DATA COMPILATION AND PROCESSING

The seismic data, digital observer reports, chaining notes and survey data were delivered to Sensor Geophysical Ltd. of Calgary, Alberta in July and August 2004. The seismic data and observer reports were delivered on USB hard drives. Chaining notes were delivered as paper photocopies. Survey data consisted of Microsoft® Excel files listing UTM-X coordinates, UTM-Y coordinates and elevations.

Processing began in July 2004 and was completed in March 2005. Only the vertical component seismic data were processed. The final processing flow is summarized in Table 5. Initial processing produced sections that were judged to be noisy. The processing flow was revised to that shown in the table and new sections were produced for all lines. The addition of shot and receiver f-k filtering and dip moveout correction (DMO) improved the sections. Also, velocities, statics and muting were revised.

[1]South Porcupine was laid out as a high-resolution line, 12.5 m group interval, from 101-901 and as a regional line, 25 m group interval, from 901-1701. Data recording was continuous.

Table 5. Vertical Component Processing Summary

. Assign geometry, i.e. verify source and receiver values in trace headers, attach UTM-X, UTM-Y, and elevation values, compute midpoints and define bin line to which midpoints are projected for 2D processing;
. Inspect records for exclusion of noisy traces;
. Automatic picking, review and adjustment of first break arrival times;
. Hampson-Russell GLI3D refraction statics calculation based on first break arrival times, datum 300 m, replacement velocity 6000 m/s, one layer model;
. Amplitude recovery, spherical divergence correction $1/tv^2$;
. Surface consistent deconvolution;
. Vibroseis deconvolution compensation;
. Application of refraction statics;
. Calculation and application of surface consistent residual statics;
. Trace muting (mild);
. Forward normal moveout correction, constant velocity 6500 m/s;
. f-k filtering common shot gathers;
. f-k filtering common receiver gathers;
. Inverse normal moveout correction, constant velocity 6500 m/s;
. Surface consistent deconvolution;
. Time-variant spectral whitening;
. Calculation and application of surface consistent residual statics;
. Normal moveout correction, based on constant velocity stack analysis;
. Common offset binning;
. Common midpoint stacking within common offset panels;
. f-x deconvolution of common offset panels;
. Common offset f-k dip moveout correction;
. Trace muting (final);
. Common depth point stacking;
. Trace equalization and/or time-variant scaling;
. Implicit finite difference time migration;
. Time-variant bandpass filtering;
. Trace equalization and/or time-variant scaling

6. FINAL PRODUCTS

. Final structure stacks and migrated structure stacks were written to DVD and DLT tape cartridge, in SEG-Y format;
. Raw seismic traces with geometry, crooked-line binning, trace edits, and first break arrival times in trace headers were written to DLT tape cartridges, in SEG-Y format;
. Shot and receiver refraction statics were exported to ascii files and written to compact disc (CD);
. Paper plots of the final migrated stacks were made at 1:50,000 for regional lines and 1:25,000 for high resolution lines;
. TIFF files for the migrated stack plots were written to CD;
. All original uncorrelated and correlated field files were bit-copied directly from USB hard drives to DLT cartridges for archival by the Geological Survey of Canada (GSC);
. All digital observer reports and associated documents were copied from the USB hard drives to CD for archival by the GSC;
. All paper chaining notes were organized and photocopied for archival by the GSC;
. All original survey data were copied to CD for archival by the GSC

7. QUALITY ASSURANCE AND QUALITY CONTROL

Quality assurance and quality control were undertaken by the processing contractor, Sensor Geophysical Ltd., by L.E. Reed, Geophysical Consultant Inc. and by D. Snyder, GSC. L.E. Reed and D. Snyder visited Sensor Geophysical Ltd. twice to review products while processing was underway.

Between office visits, paper and digital products were couriered and electronically transmitted to L.E. Reed and D. Snyder.

APPENDIX – PROCESSING EXAMPLES AND DISCUSSION

CROOKED-LINE BINNING

Initial processing of seismic data involves attaching source and receiver station numbers and X, Y, and Z coordinates to all traces so that source-receiver midpoints can be calculated. Conventional 2D seismic processing requires that traces be gathered into common midpoint bins for stacking. Stacking attenuates incoherent noise and enhances coherent signal. If a seismic line is crooked and the recording cable is long, the midpoints do not fall directly beneath the line but are scattered about the line. Typically, midpoints are assigned to bins that have width, in the line direction, of one half the receiver interval. In the offline direction, the bins must be high enough to capture the traces. Figure 2 illustrates the scatter of midpoints that occurs as a line goes around a bend. The bins are drawn in blue (light grey on monochrome printouts). In this case, because the line was recorded with 25 m receiver interval, the bin width is 12.5 m. The bin height is approximately 1000 m. Traces falling in a particular bin are projected to the centre of the bin, effectively smearing the subsurface image because of the offline sampling.

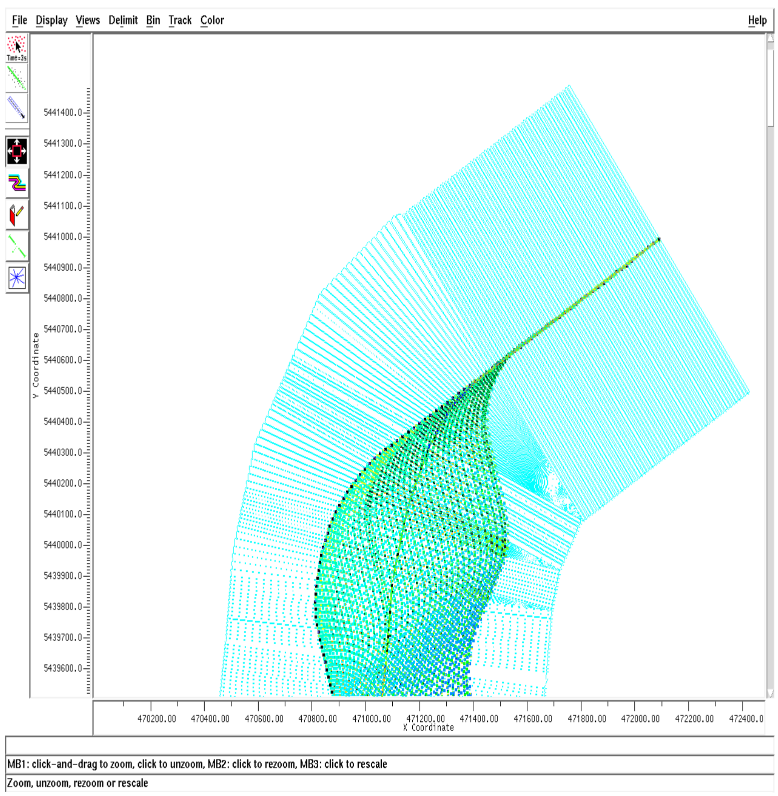

Figure 2*. Midpoint scatter and common midpoint bin configuration at the north end of the North Timmins regional line.*

PICKING VIBROSEIS FIRST BREAKS

Picking vibroseis first arrivals is often difficult because of correlation, and other, noise. Our approach with these data was to convert from zero phase to minimum phase, to apply minimum phase spiking deconvolution, using a 64 ms operator and 0.01 % white noise designed on a time window that encompassed the first arrivals, and to apply a Butterworth bandpass filter of 18(6)-90(48) Hz(dB/Octave). This method enhanced the first arrivals and made them easier to pick. Figure 3 illustrates the appearance of a few shots before and after the process.

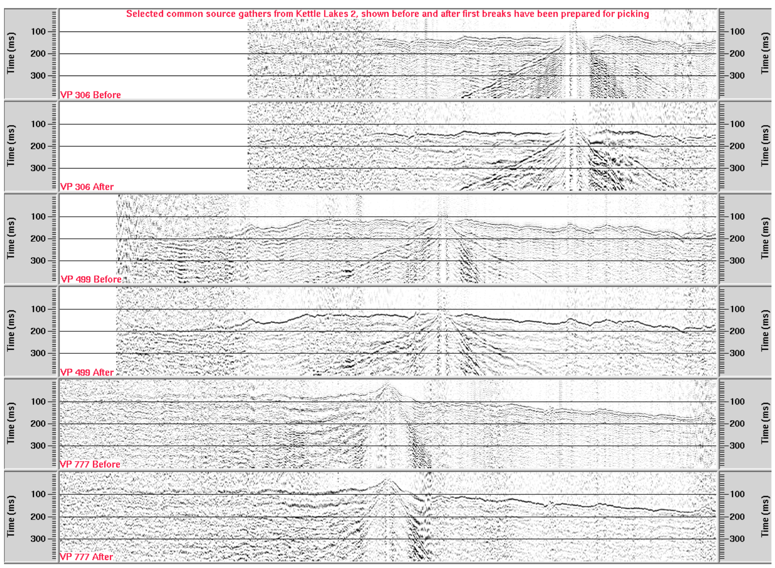

Figure 3*. A few shots from the Kettle Lakes high resolution line before and after converting from zero to minimum phase, deconvolving and bandpass filtering. The process enhances the first arrivals and makes them easier to pick.*

REFRACTION STATICS

Refraction statics were computed using the Hampson-Russell program, GLI3D. First arrival times were input to the program. The program was run interactively by the processor, who analyzed time-offset displays. The processor's analysis of the arrival times was input to the generalized linear inversion algorithm employed by GLI3D to compute a near-surface earth model and to compute statics, time shifts, that corrected for shallow lateral velocity variations and layer thickness variations. The effect of applying refraction statics to individual shots is illustrated in Figure 4. The shots in the display have been flattened, in time, by applying linear normal moveout. Before applying the refraction statics, the first arrival times are irregular. After applying the refraction statics, the first arrivals are better behaved.

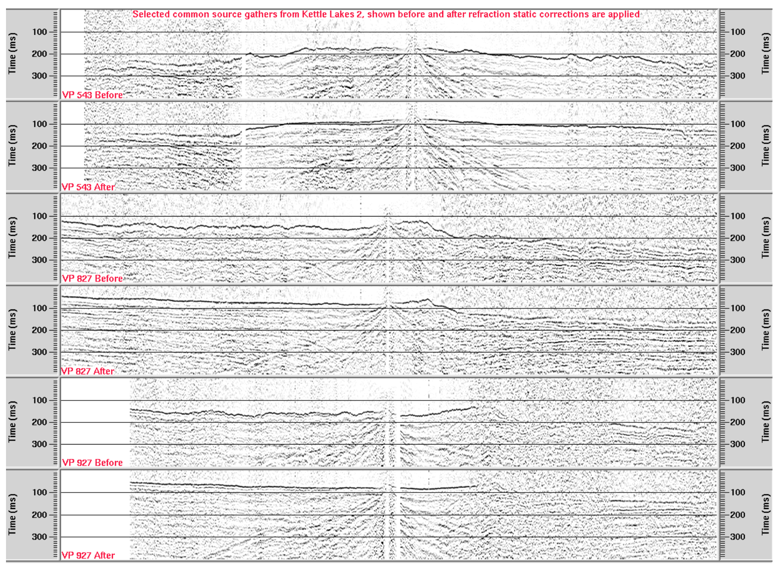

***Figure 4**. A few shots from the Kettle Lakes high resolution line before and after applying refraction statics.*

ELEVATION, REFRACTION, AND RESIDUAL STATICS

Figure 5 demonstrates the effects of applying elevation, refraction, and residual statics to the Crawchest regional line. In the figure, the first 400 milliseconds of 3 stacks are displayed. At the top of the figure is a profile that shows surface elevation and the base of the single layer modeled in GLI3D. In all 3 stacks, the zone from 2349 to 2016 is noisy. The noise could be related to the thickening of the shallow layer. In addition, note that elevation statics do a poor job of imaging the shallow seismic data. Refraction statics produce a more coherent section with better continuity. The residual statics, applied after refraction statics, change the appearance of the shallow features. Residual statics were computed based on time windows deeper in the seismic data.

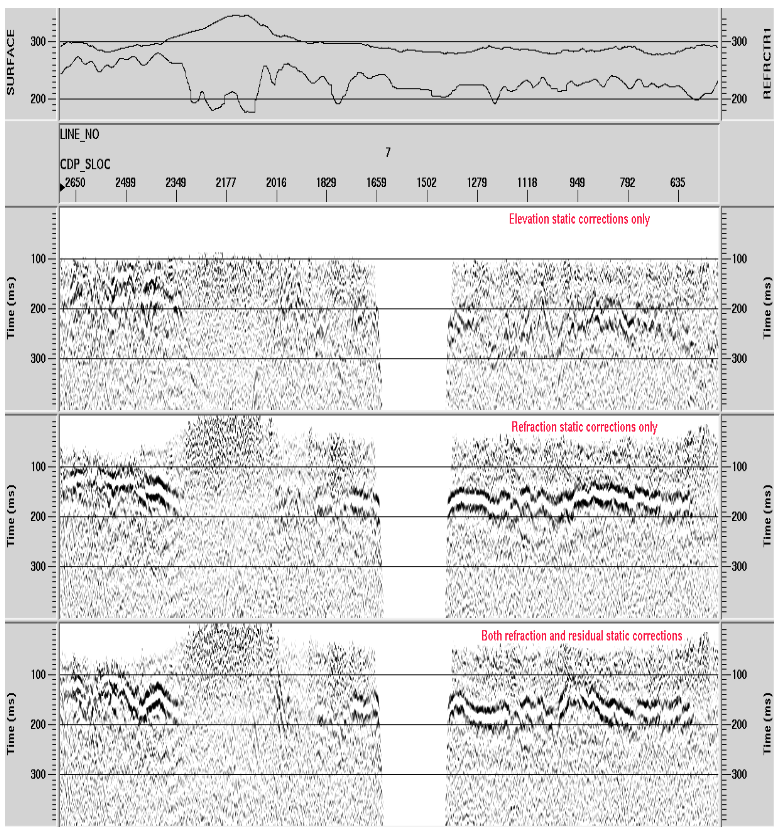

***Figure 5**. Elevation profile and 3 stacks for a portion of the Crawchest regional line. The profile shows surface elevation and the base of layer one output by GLI3D. The stacks have elevation, refraction, and residual statics applied.*

Figure 6 compares the magnitude of elevation, refraction, and residual statics for receivers contributing to the stacks shown in Figure 5. The receiver elevation statics are drawn in blue (upper, smooth line). The receiver refraction statics are drawn in red (bottom line). The receiver residual statics, computed after refraction statics were applied, are drawn in green (upper, variable line). The elevation statics are small compared to the refraction statics in the zone from 2349 to 2016. Elevation statics are incapable of modeling near-surface changes in layer thickness and velocity.

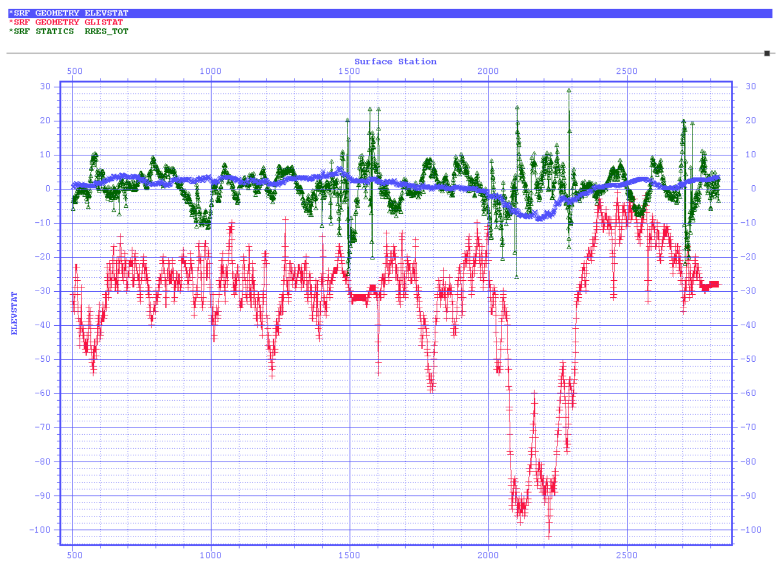

Figure 6*. ProMAX database display of receiver elevation, refraction, and residual statics for the portion of the Crawchest regional line shown in Figure 5. Elevation statics are drawn in blue (upper, smooth line). Refraction statics are drawn in red (bottom line). Residual statics, computed after refraction statics were applied, are drawn in green (upper, variable line).*

Figures 7a, 7b, 7c, 8a, 8b, and 8c continue the comparison of elevation and refraction and residual statics. Figures 7a and 8a show stacks of 2 different portions of the Crawchest regional line with elevation statics applied. Figures 7b and 8b show the same stacks with refraction statics applied. Refraction statics significantly improve continuity of events in the sections. Figures 7c and 8c show the same stacks with refraction and residual statics applied. Residual statics generate additional improvements in event continuity.

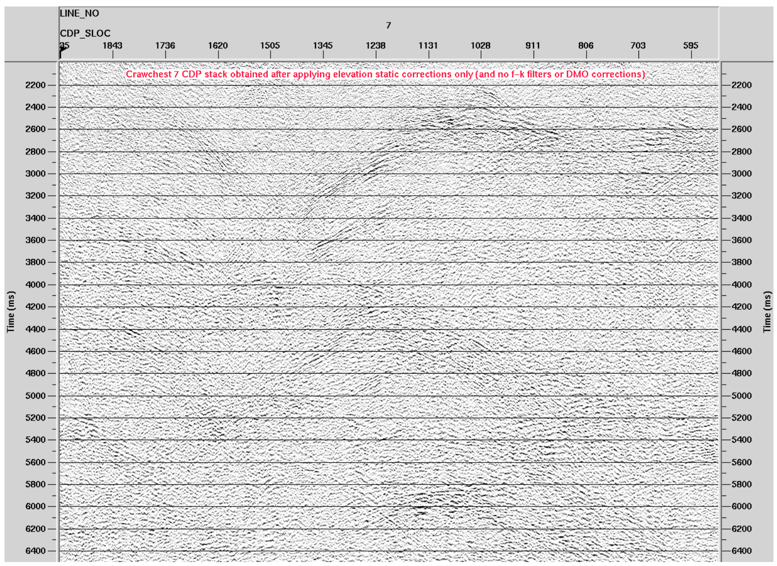

Figure 7a. *A portion of the Crawchest regional line stacked with elevation statics.*

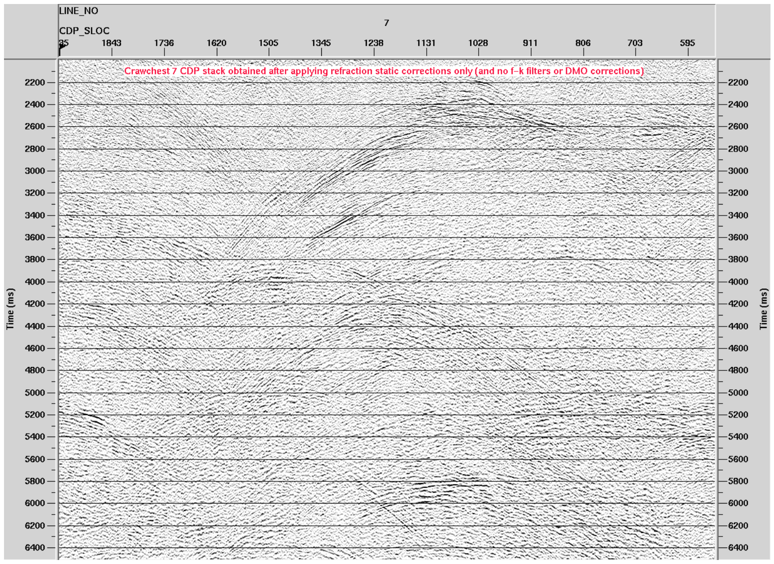

***Figure 7b**. A portion of the Crawchest regional line stacked with refraction statics.*

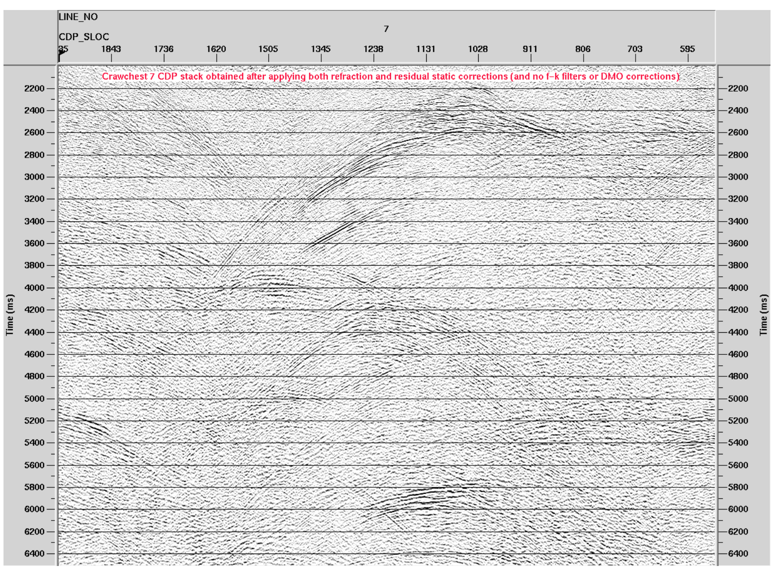

***Figure 7c**. A portion of the Crawchest regional line stacked with refraction and residual statics.*

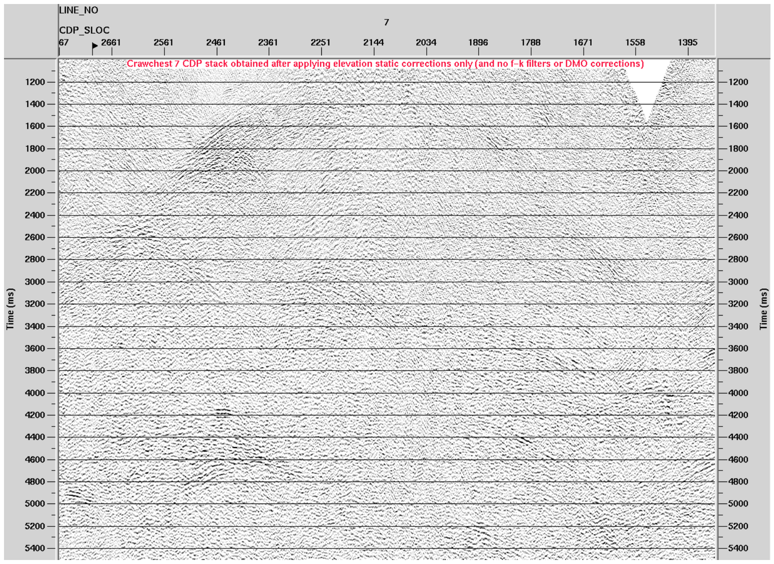

Figure 8a. *Another portion of the Crawchest regional line stacked with elevation statics.*

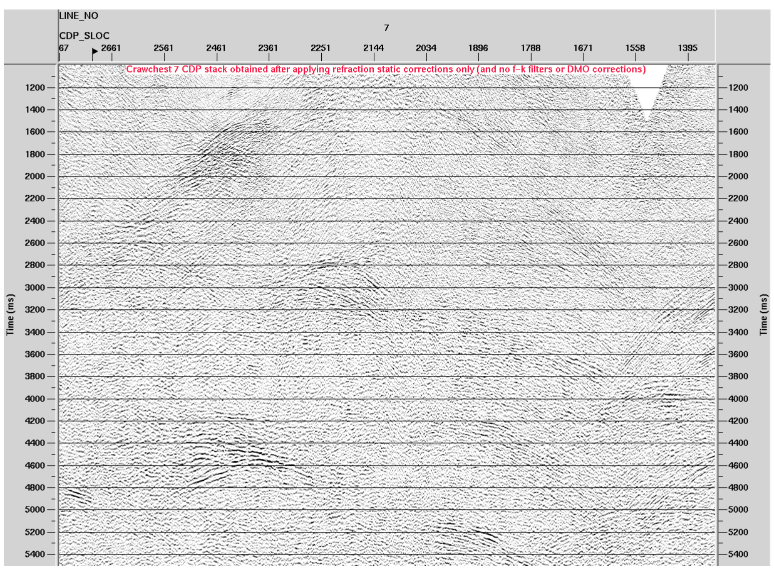

Figure 8b. *Another portion of the Crawchest regional line stacked with refraction statics.*

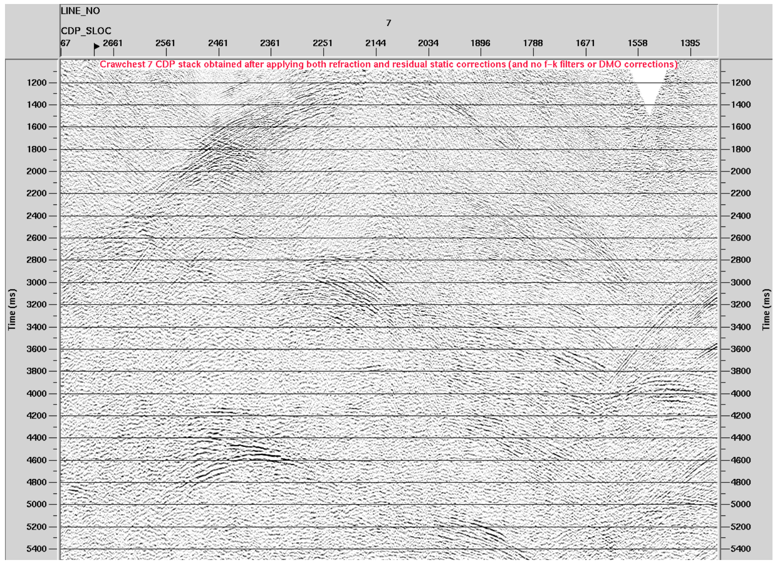

***Figure 8c**. Another portion of the Crawchest regional line stacked with refraction and residual statics.*

F-K FILTERING

Figures 9a – 9h support the discussion of f-k filtering source and receiver gathers to attenuate noise. Figure 9a shows one shot from the Shillington high-resolution line. The shot has only spherical divergence correction applied. The refracted arrivals on the shot appear to convert from compressional (P) to shear (S) and from S to P. Two f-k filters were designed to attenuate the shear refracted energy, including multiple refractions and side-scattered refractions evident in the data. Figure 9b is the same shot with gain, surface consistent deconvolution, refraction and residual statics and normal moveout, constant velocity 6500 m/s, applied. This shot was input to the f-k filter. Figure 9c is the f-k transform of the shot in Figure 9b. Only the shear refractions are attenuated. The areas within the polygons are zeroed. Attempting to remove the faster p refractions would make the filter too severe. Attempting to remove the slower groundroll would cause the subsequent time-variant spectral whitening to bring up too much low frequency compressional refracted energy, including multiple refractions and side-scatter. Figure 9d shows the shot after the f-k filter was applied. Figure 9e shows a receiver gather after the shot f-k filter was applied to the line. Figure 9f shows the receiver gather f-k filter design. Figure 9g shows the receiver gather after the source and receiver f-k filters were applied. Figure 9h shows the original source gather after both f-k filters were applied.

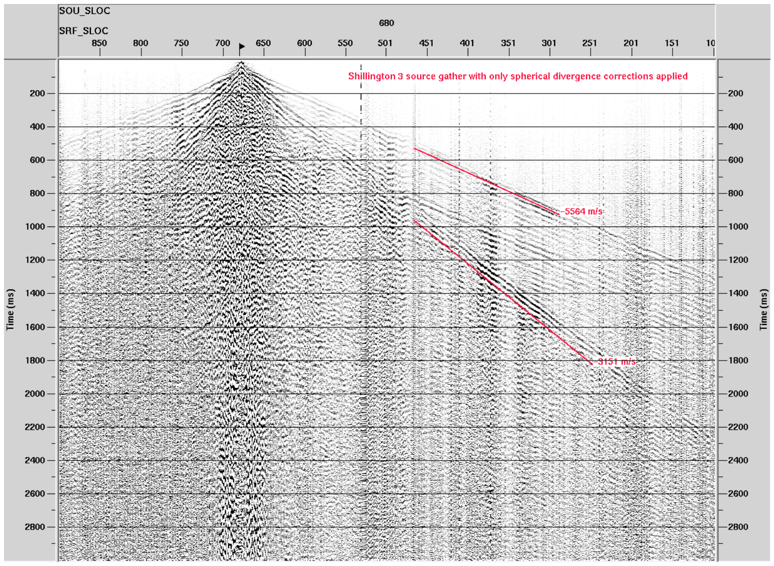

Figure 9a. *Raw shot from the Shillington high resolution line. Spherical divergence correction has been applied. SOU_SLOC is the source station number. SRF_SLOC is the receiver station number.*

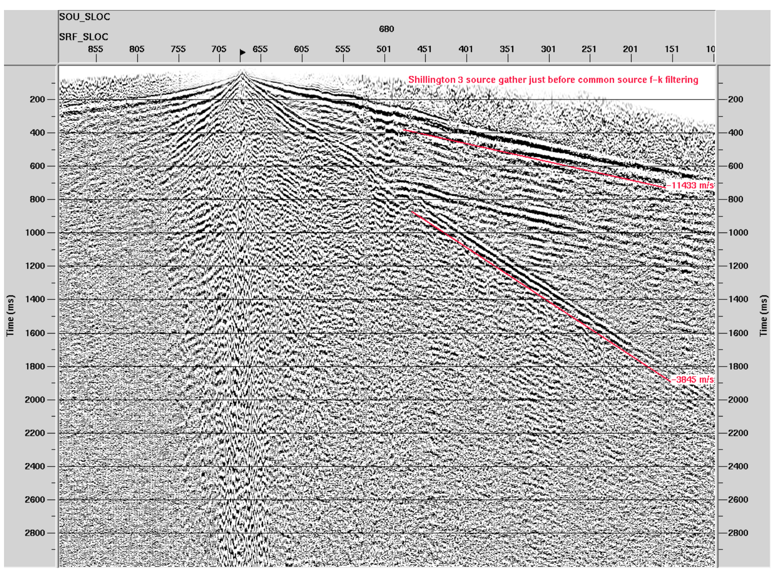

Figure 9b. *Input to common shot f-k filter. Gain, surface consistent deconvolution, refraction and residual statics, and normal moveout , constant velocity 6500 m/s, applied.*

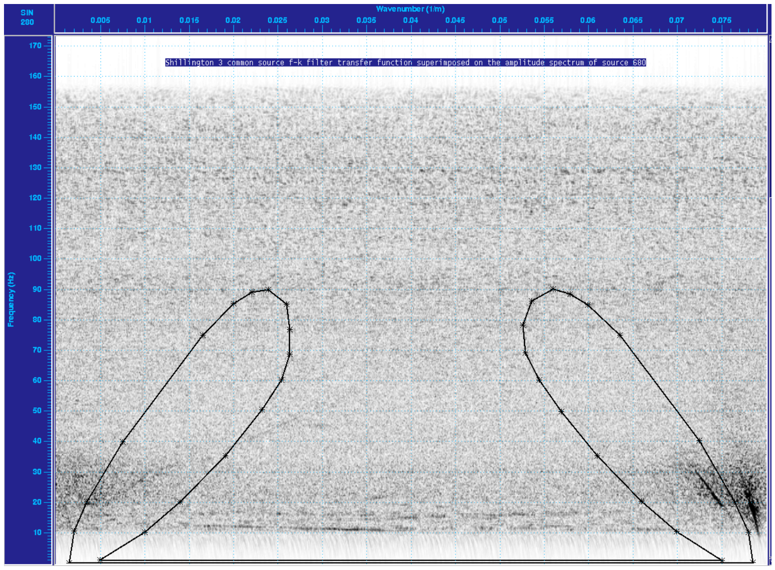

***Figure 9c**. f-k transform of the shot in Figure 9b. Areas within the polygons zeroed.*

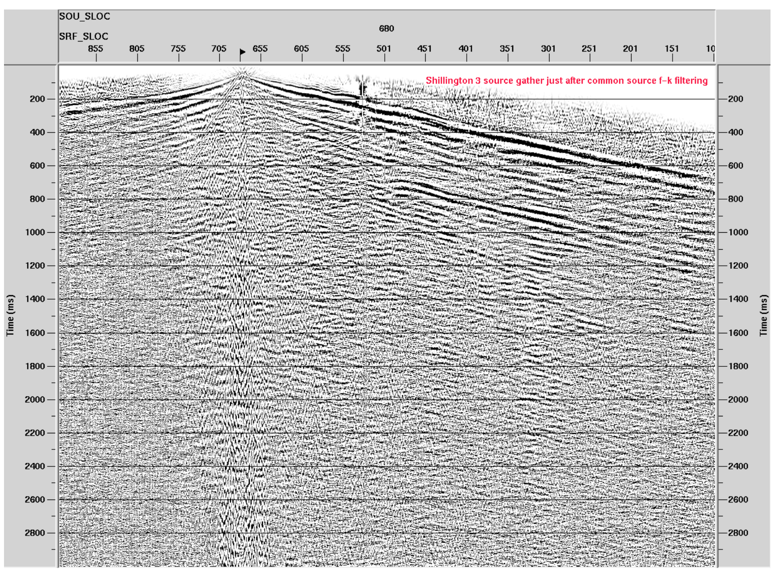

***Figure 9d**. Shot after f-k filter applied.*

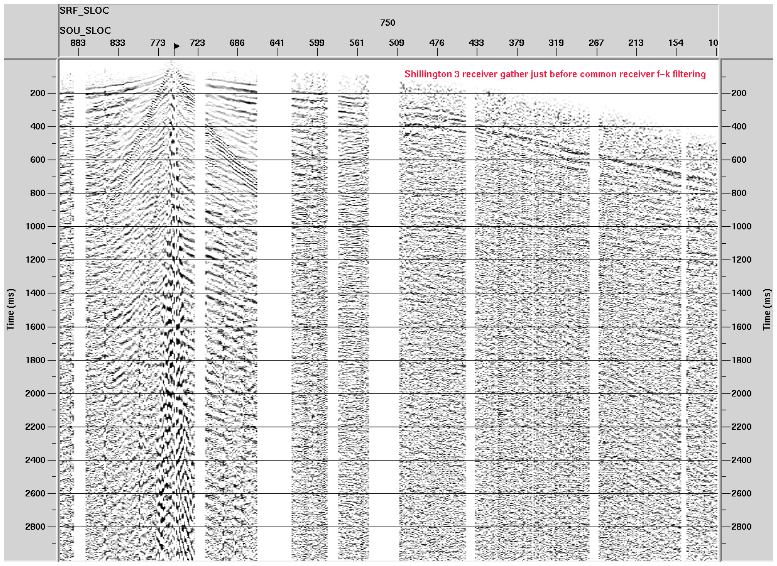

Figure 9e*. Receiver gather after shot f-k filter applied to the line. Input to receiver f-k filter.*

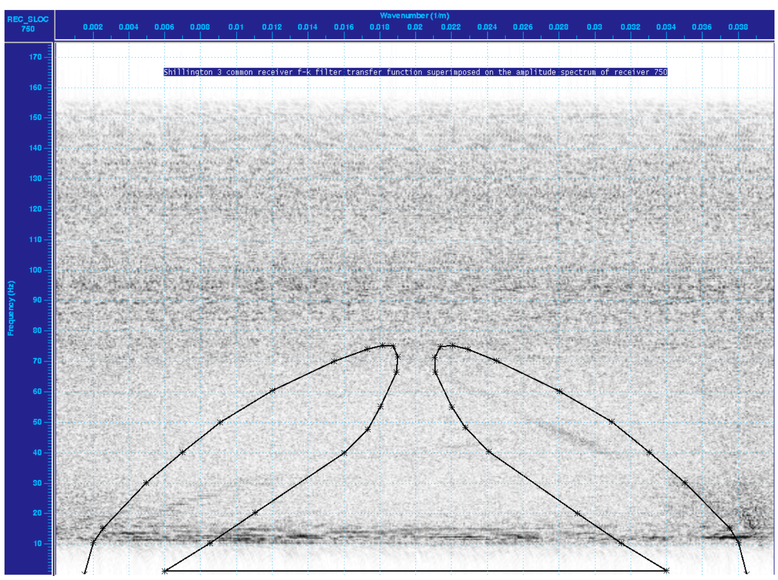

Figure 9f. *Receiver f-k filter design. Areas within the polygons zeroed.*

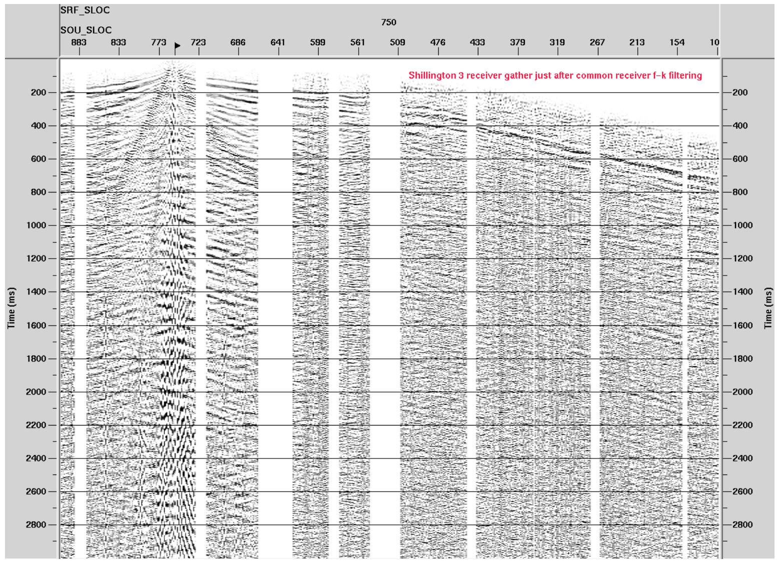

***Figure 9g**. Receiver gather after f-k filtering.*

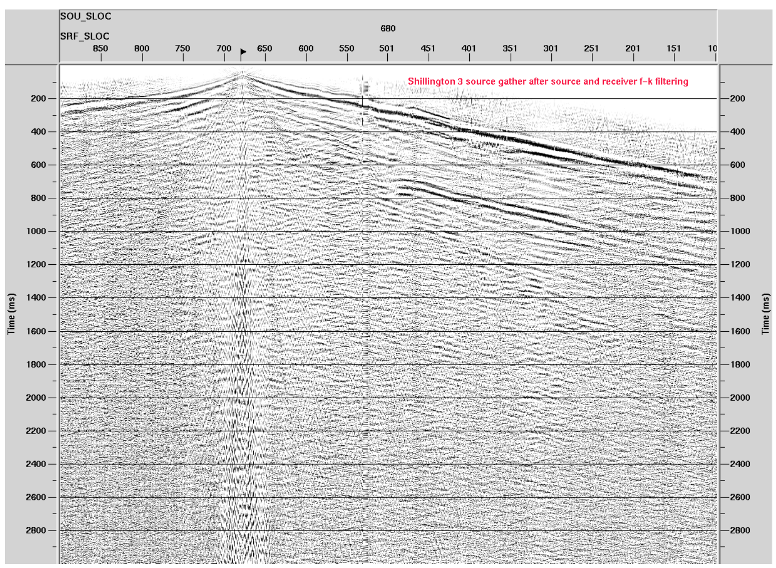

***Figure 9h.** Shot gather after shot and receiver f-k filtering applied. Compare this figure to Figure 9b.*

BENEFITS OF F-K FILTERING AND DIP MOVEOUT (DMO)

Figures 10a, 10b, 11a, and 11b illustrate the benefits of f-k filtering and dmo. Figure 10a shows 3 seconds of the Shillington high-resolution line without f-k filtering and without DMO. Figure 10b shows the same data after migration. Figure 11a shows the same line with f-k filtering and DMO before migration. The mute has been changed. Figure 11b shows the data in Figure 11a after migration. After f-k filtering and DMO, the section is less noisy and more coherent.

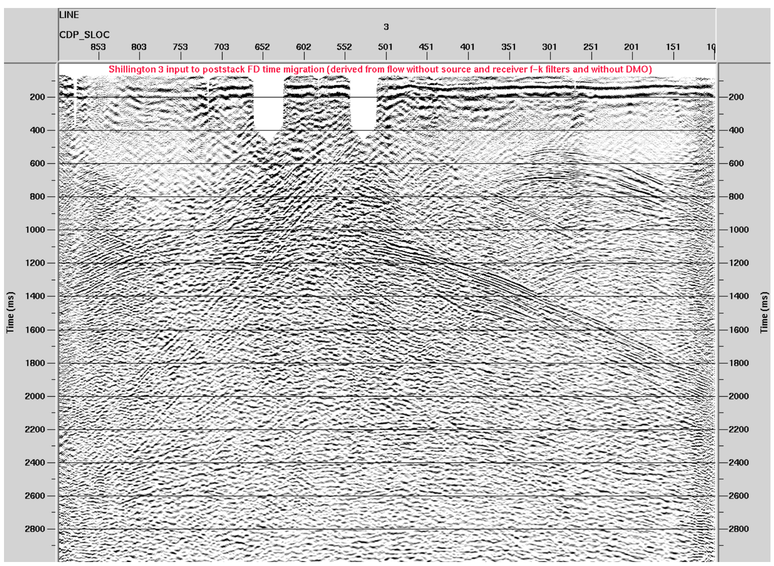

Figure 10a. *Shillington high-resolution line structure stack without f-k filtering and DMO. Input to migration.*

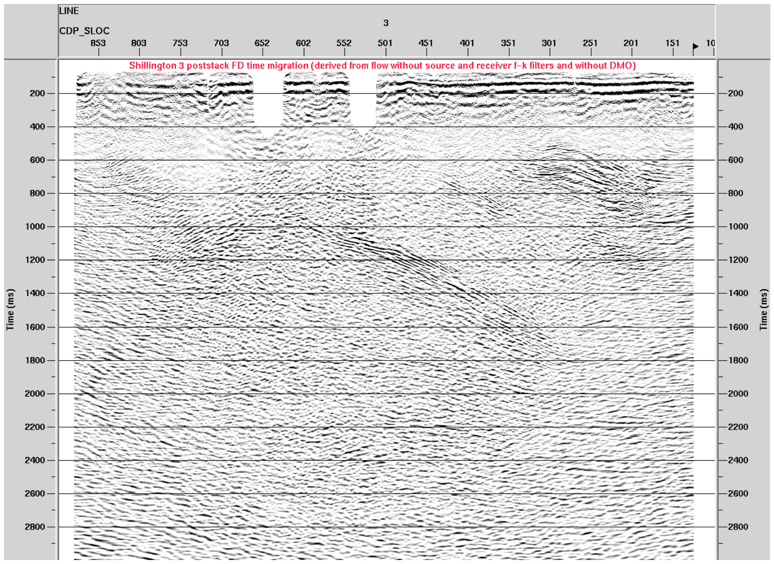

Figure 10b. *Shillington high-resolution line migrated stack without f-k filtering and DMO.*

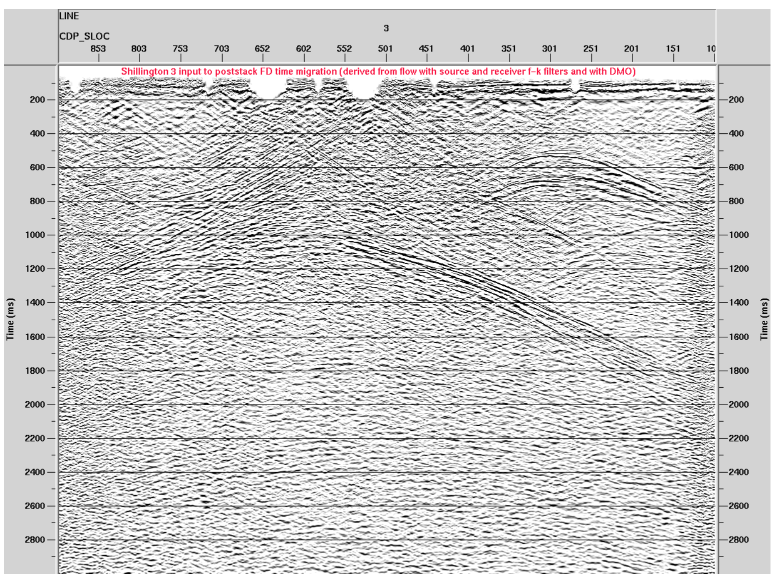

Figure 11a. *Shillington high-resolution line structure stack with f-k filtering and DMO. Input to migration.*

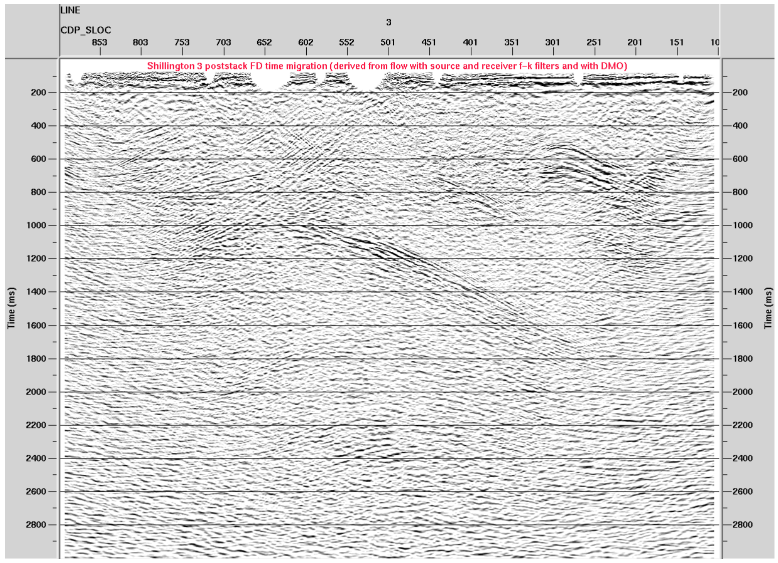

Figure 11b. *Shillington high-resolution line migrated stack with f-k filtering and DMO.*

POSSIBLE SWEEP MODIFICATION FOR FUTURE RECORDING

Figure 12 shows time envelopes of regional and high-resolution sweeps convolved with 0.5 Nyquist anti-alias filter and with 10/20 to 40/60 Hz Ormsby filter. The 10/20 to 40/60 Hz band is the limit of meaningful signal seen in deeper portions of the current lines. The regional sweep provides good signal duration, rolling off at 10 s. The high-resolution sweep provides limited signal duration, rolling off at 3 s. This may explain why the high-resolution lines had a lower signal to noise ratio at depth than did the regional lines.

Future vibroseis projects in this area might benefit from a 12 to 96 Hz non-linear, -3 dB/Octave de-emphasis sweep. In the 10/20 to 40/60 Hz band, this sweep starts to roll off at 13 s, providing better signal duration than both sweeps used for the current project, while still providing some high frequencies for the shallow section.

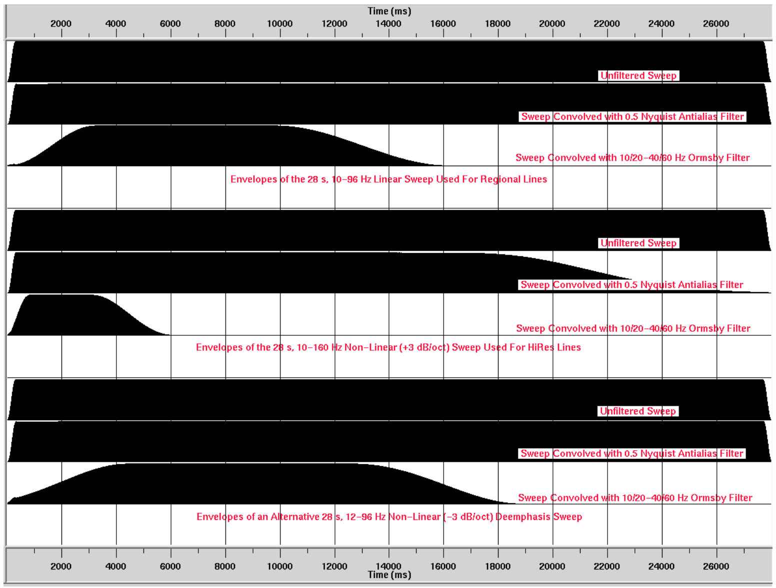

***Figure 12**. Comparison of regional and high-resolution sweeps and a possible alternative sweep. Time envelopes of sweeps are shown unfiltered, convolved with 0.5 Nyquist antialias filter, and convolved with 10/20 to 40/60 Hz Ormsby filter. The regional sweep has good signal duration, rolling of at 10 s. The high resolution sweep has limited signal duration, rolling off at 3 s. The alternative sweep has better signal duration, rolling off at 13 s.*

Metric Conversion Table

Conversion from SI to Imperial			Conversion from Imperial to SI		
SI Unit	*Multiplied by*	*Gives*	*Imperial Unit*	*Multiplied by*	*Gives*
			LENGTH		
1 mm	0.039 37	inches	1 inch	**25.4**	mm
1 cm	0.393 70	inches	1 inch	**2.54**	cm
1 m	3.280 84	feet	1 foot	**0.304 8**	m
1 m	0.049 709	chains	1 chain	20.116 8	m
1 km	0.621 371	miles (statute)	1 mile (statute)	**1.609 344**	km
			AREA		
1 cm^2	0.155 0	square inches	1 square inch	**6.451 6**	cm^2
1 m^2	10.763 9	square feet	1 square foot	**0.092 903 04**	m^2
1 km^2	0.386 10	square miles	1 square mile	2.589 988	km^2
1 ha	2.471 054	acres	1 acre	0.404 685 6	ha
			VOLUME		
1 cm^3	0.061 023	cubic inches	1 cubic inch	**16.387 064**	cm^3
1 m^3	35.314 7	cubic feet	1 cubic foot	0.028 316 85	m^3
1 m^3	1.307 951	cubic yards	1 cubic yard	0.764 554 86	m^3
			CAPACITY		
1 L	1.759 755	pints	1 pint	0.568 261	L
1 L	0.879 877	quarts	1 quart	1.136 522	L
1 L	0.219 969	gallons	1 gallon	**4.546 090**	L
			MASS		
1 g	0.035 273 962	ounces (avdp)	1 ounce (avdp)	28.349 523	g
1 g	0.032 150 747	ounces (troy)	1 ounce (troy)	**31.103 476 8**	g
1 kg	2.204 622 6	pounds (avdp)	1 pound (avdp)	**0.453 592 37**	kg
1 kg	0.001 102 3	tons (short)	1 ton (short)	**907.184 74**	kg
1 t	1.102 311 3	tons (short)	1 ton (short)	**0.907 184 74**	t
1 kg	0.000 984 21	tons (long)	1 ton (long)	**1016.046 908 8**	kg
1 t	0.984 206 5	tons (long)	1 ton (long)	**1.016 046 90**	t
			CONCENTRATION		
1 g/t	0.029 166 6	ounce (troy)/ ton (short)	1 ounce (troy)/ ton (short)	34.285 714 2	g/t
1 g/t	0.583 333 33	pennyweights/ ton (short)	1 pennyweight/ ton (short)	1.714 285 7	g/t

OTHER USEFUL CONVERSION FACTORS

	Multiplied by	
1 ounce (troy) per ton (short)	31.103 477	grams per ton (short)
1 gram per ton (short)	0.032 151	ounces (troy) per ton (short)
1 ounce (troy) per ton (short)	20.0	pennyweights per ton (short)
1 pennyweight per ton (short)	0.05	ounces (troy) per ton (short)

Note: Conversion factors which are in bold type are exact. The conversion factors have been taken from or have been derived from factors given in the Metric Practice Guide for the Canadian Mining and Metallurgical Industries, published by the Mining Association of Canada in co-operation with the Coal Association of Canada.

ISSN 0826-9580
ISBN 0-7794-8703-6

Chart A

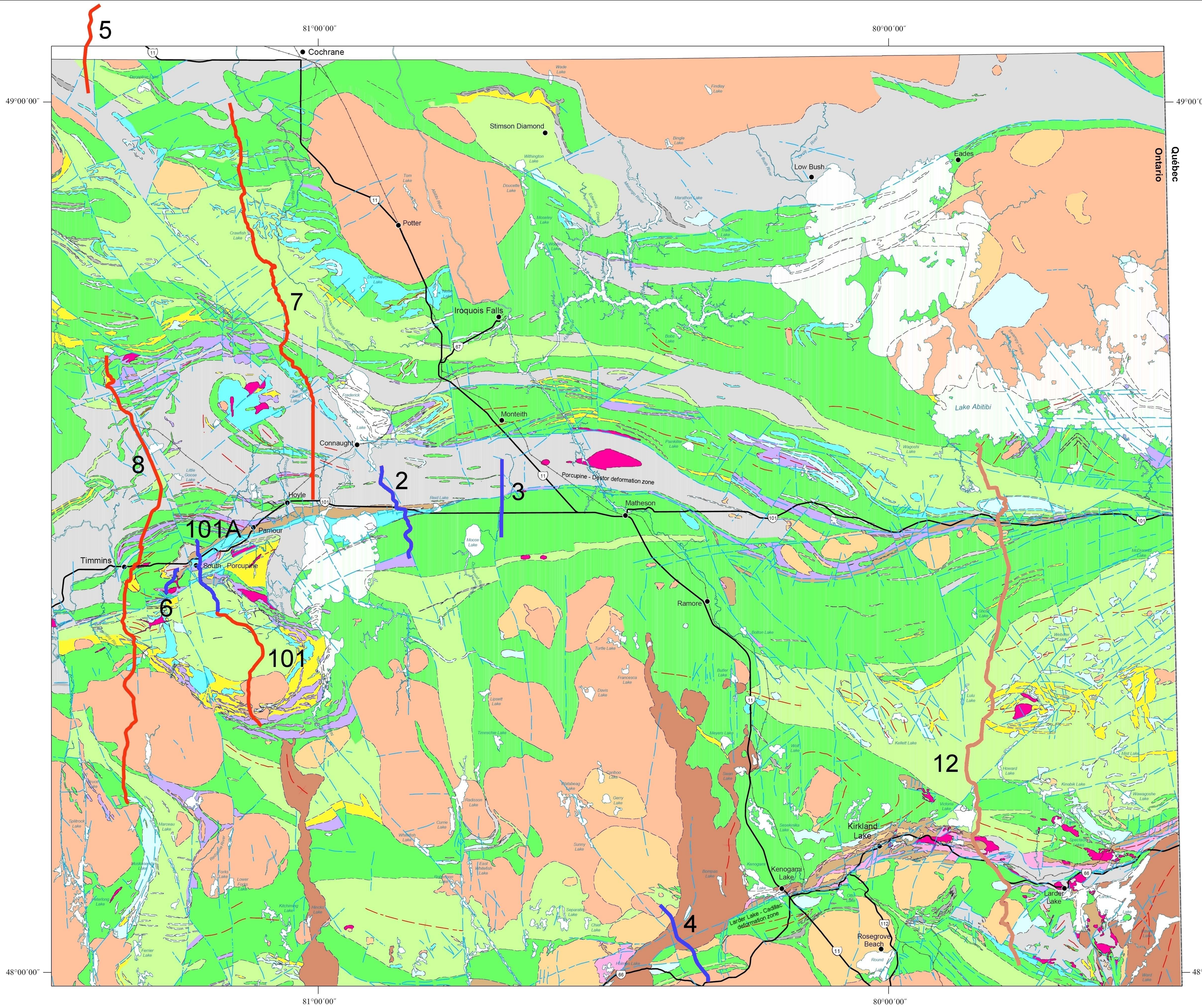

Figure 3. Reflection seismic survey lines on regional geology (*after* Ayer et al. 2005a). Lines identified in blue are the high resolution lines. Lines identified in red are the regional lines. 101 - South Porcupine/Shaw Dome, regional; 101A - South Porcupine, high resolution; 2 - Kettle Lakes, high resolution; 3 - Shillington, high resolution; 4 - Watabeag, high resolution; 5 - Timmins North, regional; 6 - Back Road, high resolution; 7 - Crawchest, regional; 8 - Timmins South, regional; and 12 - LITHOPROBE Kapuskasing Line 12, regional.

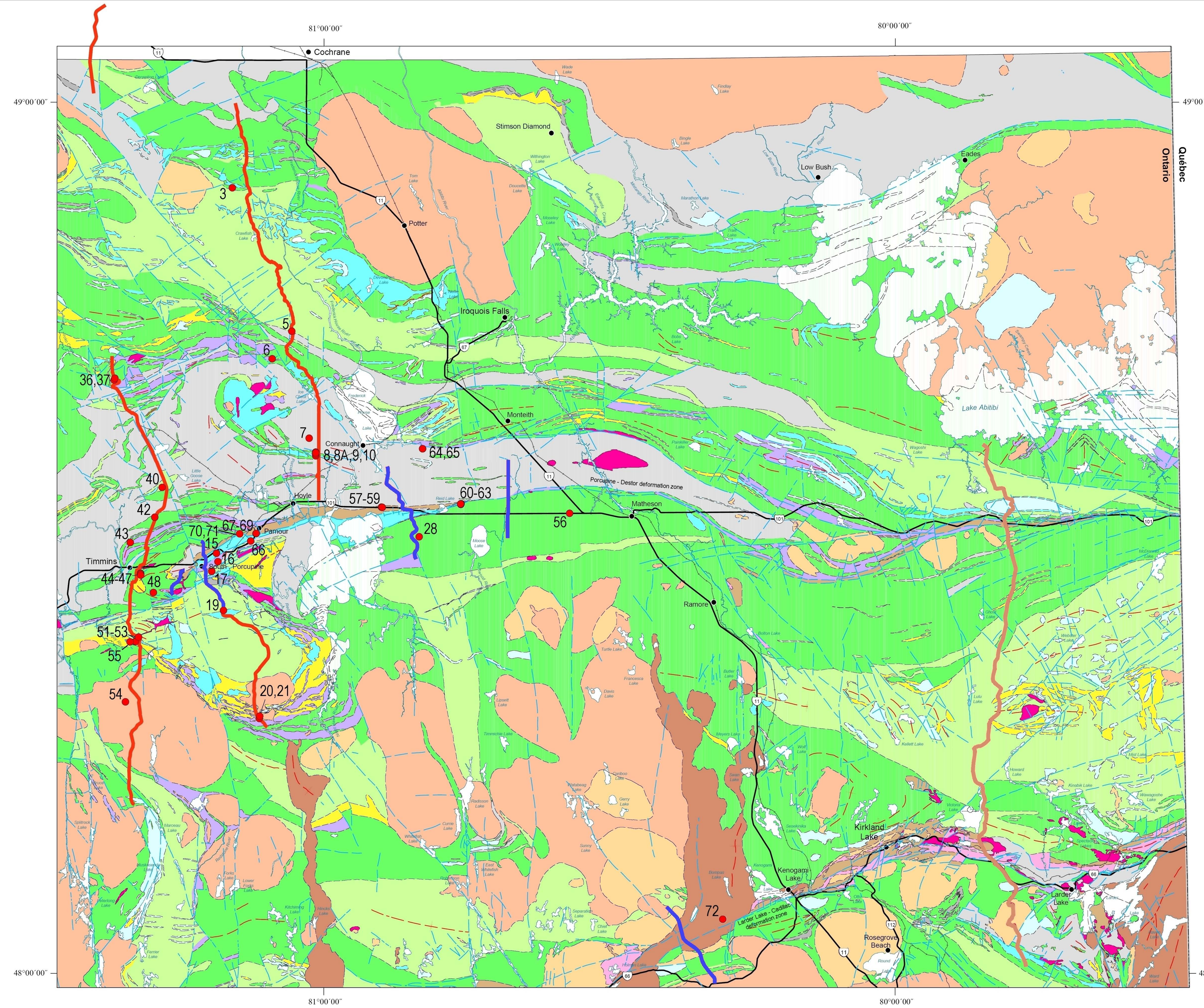

Figure 4. Rock sample locations for acoustic property (density and velocity) sampling (*see* Table 1), shown on regional geology (*after* Ayer et al. 2005a) with seismic survey lines.

Discover Abitibi
A project of innovation, cooperation and revitalization
Découvrons l' Abitibi
Un projet d' innovation, de coopération et de renouvellement

Discover Abitibi Initiative
The Discover Abitibi Initiative is a regional, cluster economic development project based on geoscientific investigations of the western Abitibi greenstone belt. The initiative, centred on the Kirkland Lake and Timmins mining camps, will complete 19 projects developed and directed by the local stakeholders. FedNor, Northern Ontario Heritage Fund Corporation, municipalities and private sector investors have provided the funding for the initiative.

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Timmins
KIRKLAND LAKE
THE RIGHT ENVIRONMENT

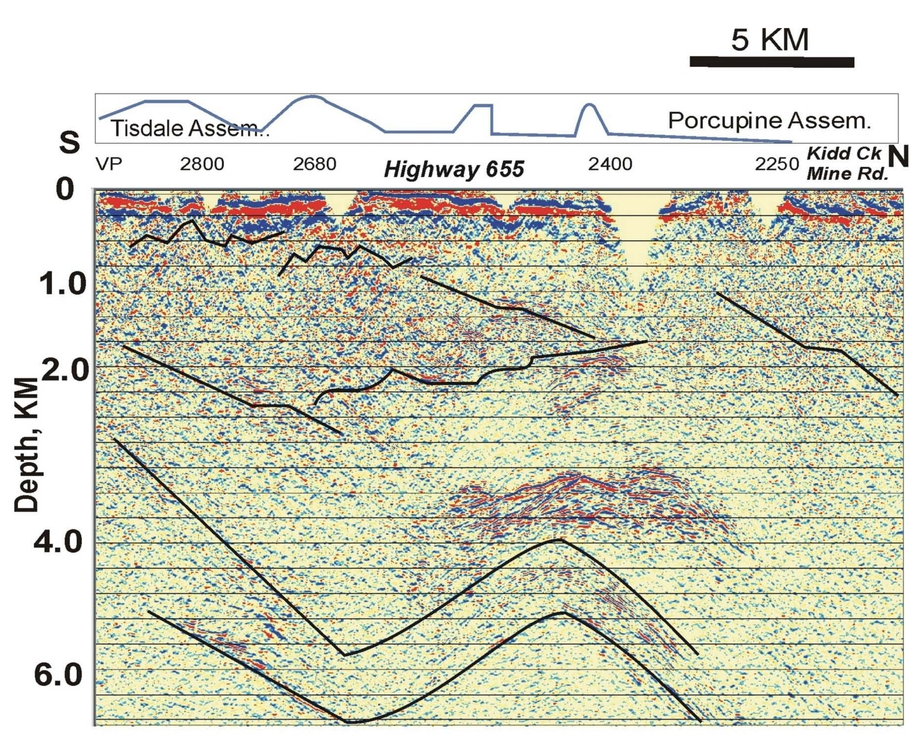


Figure 5. Kidd Creek section. VPs 2200-2900 of South Timmins Line 8; approximately top 6 km. Rocks hosting the Kidd Creek copper-zinc mine (current depth ~2.1 km) show generally little reflectivity; some reflectors dip northward at ~20°. South of the intersection of the mine access road and Highway 655, prominent reflectors define an anticline-syncline pair at 2-6 km depths. Shallower in the section, smaller-scale folds defined by reflections are consistent both as parasitic folds to the deeper, broader folds and with fold structures and the Tisdale assemblage and Porcupine assemblage contact mapped at the surface.

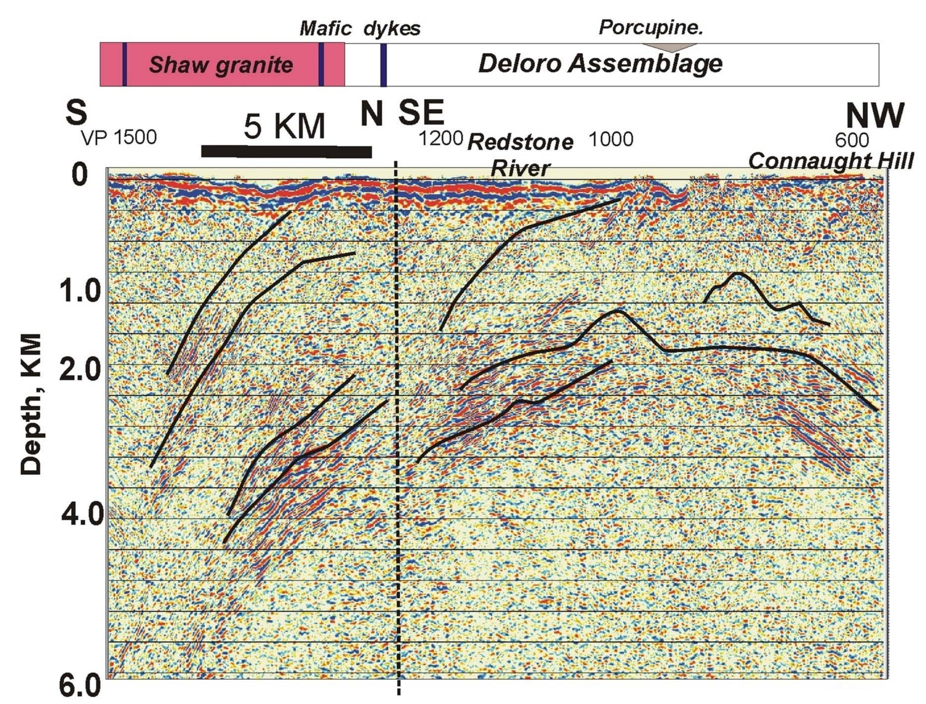


Figure 6. Shaw Dome section. VPs 580-1500 of South Porcupine regional Line 101; approximately top 6 km. Prominent reflectors across this entire section clearly define an anticline or dome structure in the upper 5 km of the crust. The relatively few reflections beneath this fold may suggest that a pluton cores the dome. The part of the section immediately below outcrops of the Shaw granite are also nonreflective down to projected Deloro assemblage rocks, but do indicate that the Shaw granite is a sill or "pancake" shaped.

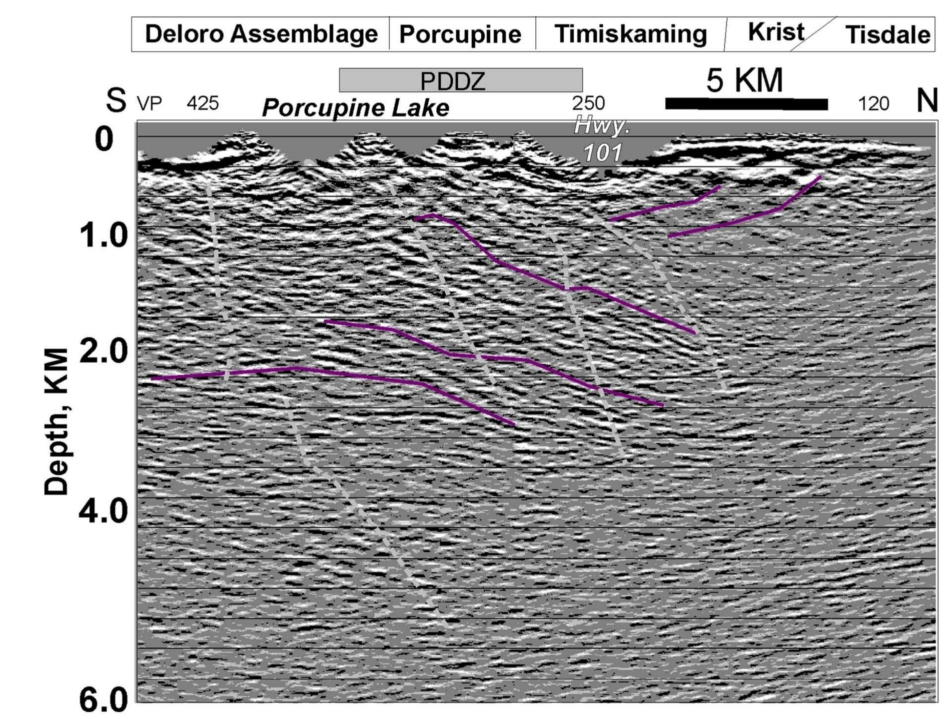


Figure 7. Porcupine-Destor deformation zone near South Porcupine (Line 101A). VPs 101-430 of South Porcupine high-resolution profile; approximately top 6 km. Continuous reflections (purple lines) dip gently northward beneath the entire Porcupine-Destor deformation zone (PDDZ) (faults shown as dashed grey lines) from outcrops of Deloro assemblage rocks and thus suggest that the fault zone must dip northward. Small offsets or truncations of some of these reflections may define a network of steeply north-dipping fractures over a zone 20 km wide that represents the fault zone here. Faint reflections dip southward from mapped contacts between the Tisdale assemblage, Krist Conglomerate and Timiskaming assemblage rocks that crop out north of the PDDZ.

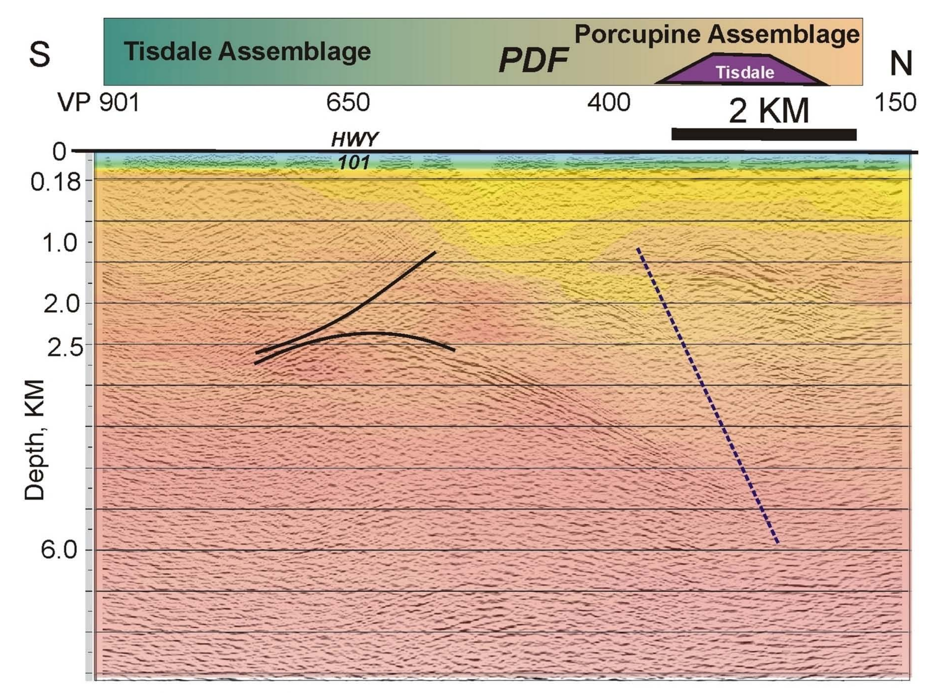


Figure 8. Shillington profile (Line 3). VPs 101-901; approximately top 7 km, with relative interval velocities as colour overlay. About 150 m of clay or till overburden is clearly defined by the low (green colors) interval velocities and closely spaced, near-horizontal reflectors across the entire top of the section. Prominent reflectors define anticlines at 1-3 km depths on both sides of the PDDZ. Reconstructing these prominent reflectors suggests that the PDDZ dips steeply northward from ~VP 410 and is a reverse fault. Listric, south-dipping reflections in the upper 2.5 km of the northern third of the section probably represent Tisdale assemblage rocks; the deepest of these reflections projects to the surface trace of the PDDZ and provides another possibility for its location at depth.

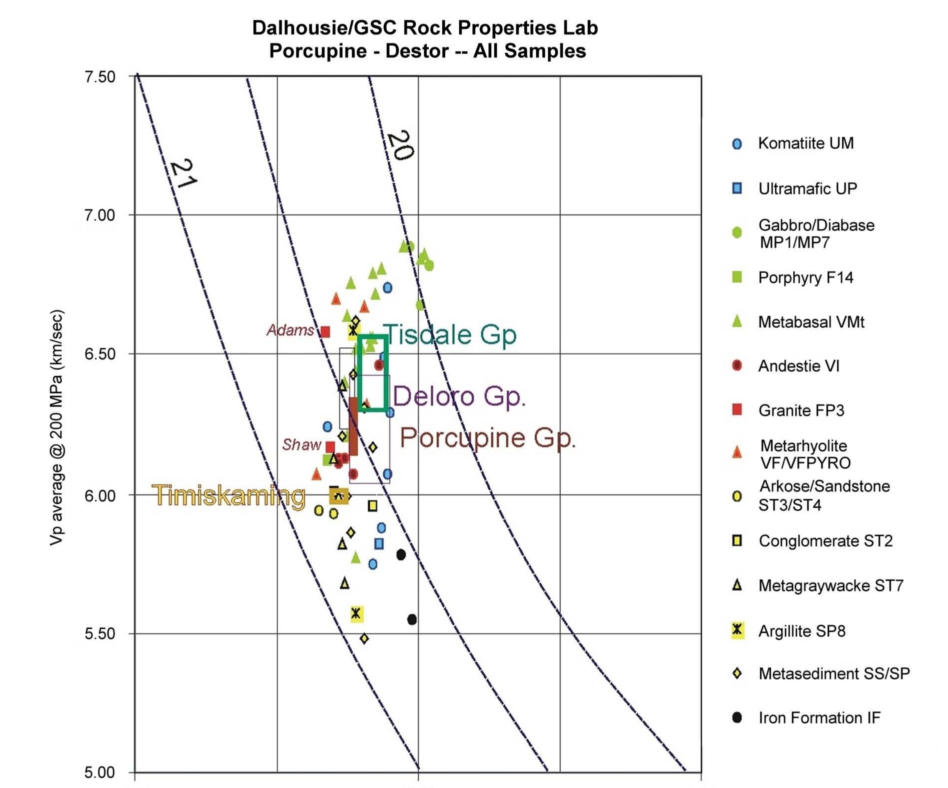


Figure 9. Physical Properties. Representative rock samples plotted as a function of their density and P-wave velocities as measured on core samples in a laboratory (*see* Table 1). Rectangles show average properties and suggest that the more mafic rocks of the Tisdale assemblage, juxtaposed against the other rocks measured, will have sufficient seismic impedance contrast (dashed lines, density vs velocity) and reflection coefficients (Sheriff 1991) to produce observable reflections.

Accompanies Open File Report 6169.

CDP 1700		
TIME	VEL	INTV
0	1500	
500	5593	5593
1000	5914	6217
1500	6135	6555
2000	6295	6752
2500	6374	6682
3000	6431	6707
3500	6467	6684
4000	6491	6655
4500	6511	6663
5000	6525	6652
5500	6547	6762
6000	6566	6775

CDP 1500		
TIME	VEL	INTV
0	1475	
500	5559	5559
1000	5927	6274
1500	6168	6625
2000	6350	6867
2500	6455	6859
3000	6519	6828
3500	6562	6817
4000	6592	6800
4500	6618	6821
5000	6639	6822
5500	6667	6946
6000	6693	6972

CDP 1300		
TIME	VEL	INTV
0	1451	
500	5525	5525
1000	5932	6313
1500	6188	6669
2000	6385	6942
2500	6520	7034
3000	6610	7044
3500	6674	7044
4000	6724	7069
4500	6770	7129
5000	6812	7171
5500	6861	7335
6000	6908	7402

CDP 1100		
TIME	VEL	INTV
0	1467	
500	5564	5564
1000	5969	6348
1500	6253	6786
2000	6480	7118
2500	6649	7286
3000	6748	7222
3500	6797	7088
4000	6833	7075
4500	6864	7104
5000	6889	7114
5500	6923	7250
6000	6954	7286

CDP 900		
TIME	VEL	INTV
0	1507	
500	5658	5658
1000	6020	6362
1500	6289	6794
2000	6532	7211
2500	6717	7410
3000	6838	7415
3500	6872	7070
4000	6881	6948
4500	6886	6921
5000	6885	6876
5500	6892	6961
6000	6896	6942

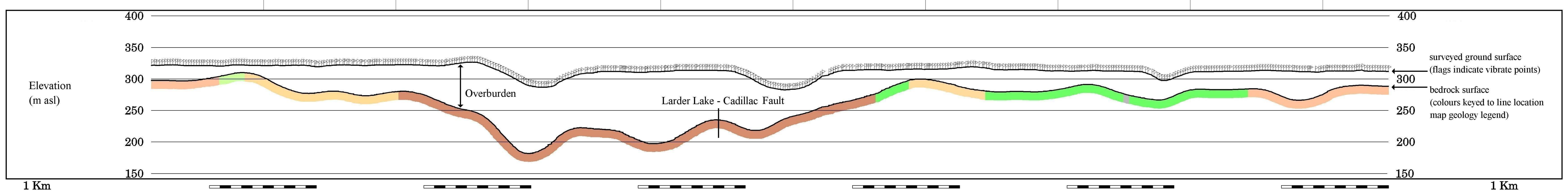
CDP 700		
TIME	VEL	INTV
0	1522	
500	5688	5688
1000	5991	6280
1500	6162	6490
2000	6410	7102
2500	6603	7323
3000	6772	7563
3500	6827	7146
4000	6849	7001
4500	6860	6948
5000	6866	6918
5500	6880	7016
6000	6891	7010

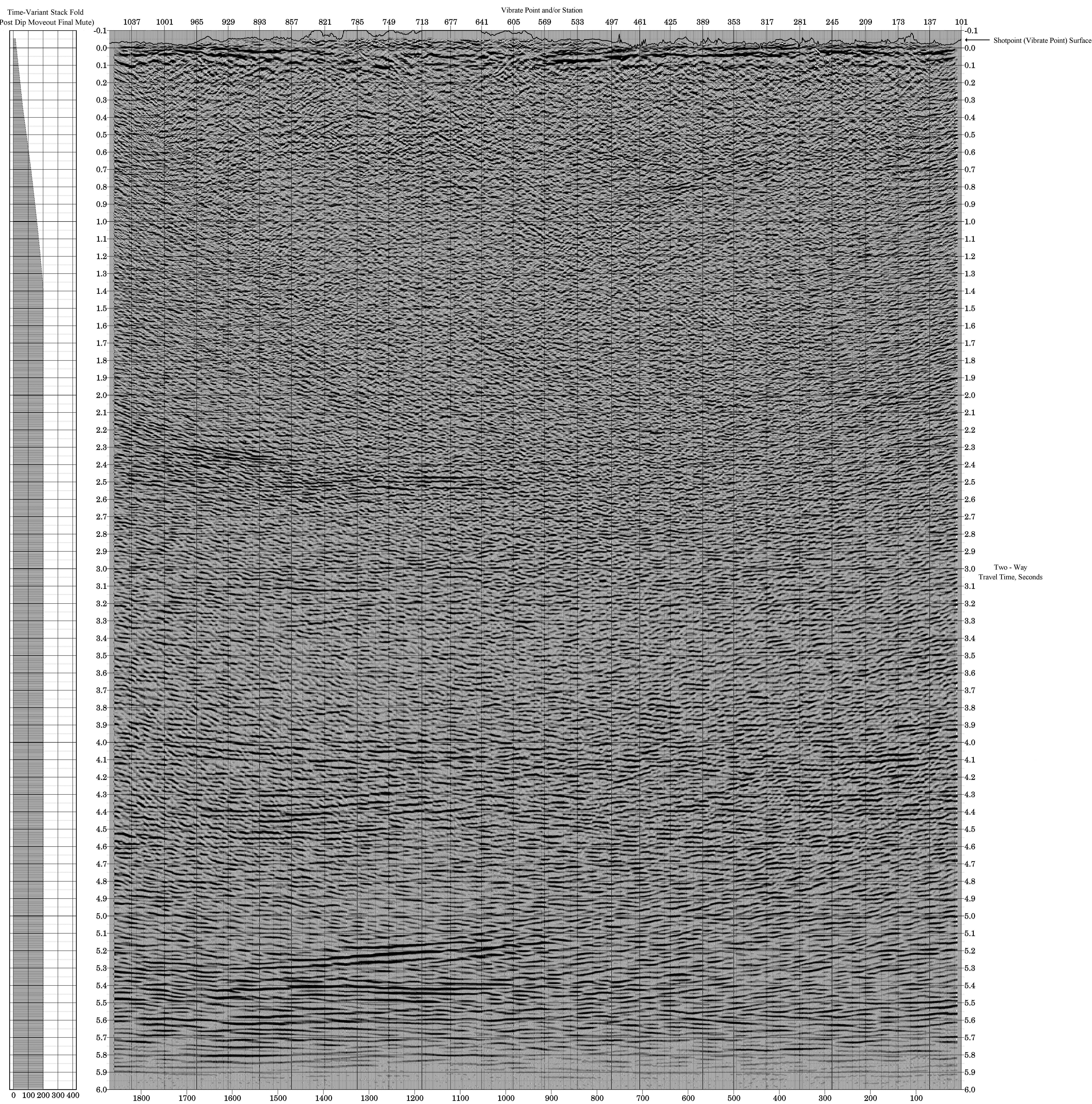
CDP 500		
TIME	VEL	INTV
0	1532	
500	5706	5706
1000	5991	6262
1500	6151	6460
2000	6353	6924
2500	6511	7108
3000	6655	7333
3500	6729	7159
4000	6777	7105
4500	6806	7032
5000	6830	7038
5500	6861	7170
6000	6890	7201

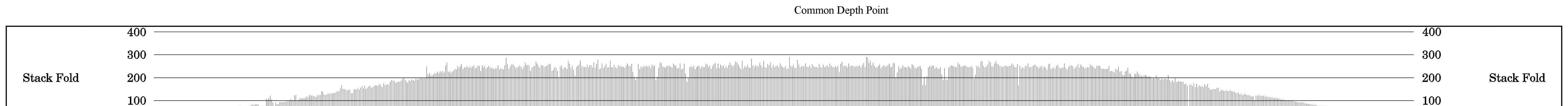
CDP 300		
TIME	VEL	INTV
0	1530	
500	5705	5705
1000	6014	6308
1500	6222	6617
2000	6383	6842
2500	6489	6897
3000	6580	7019
3500	6664	7149
4000	6724	7127
4500	6766	7092
5000	6803	7126
5500	6848	7282
6000	6890	7340

CDP 100		
TIME	VEL	INTV
0	1521	
500	5693	5693
1000	6023	6336
1500	6241	6656
2000	6398	6849
2500	6496	6871
3000	6579	6981
3500	6663	7145
4000	6719	7096
4500	6762	7099
5000	6800	7135
5500	6846	7294
6000	6890	7354

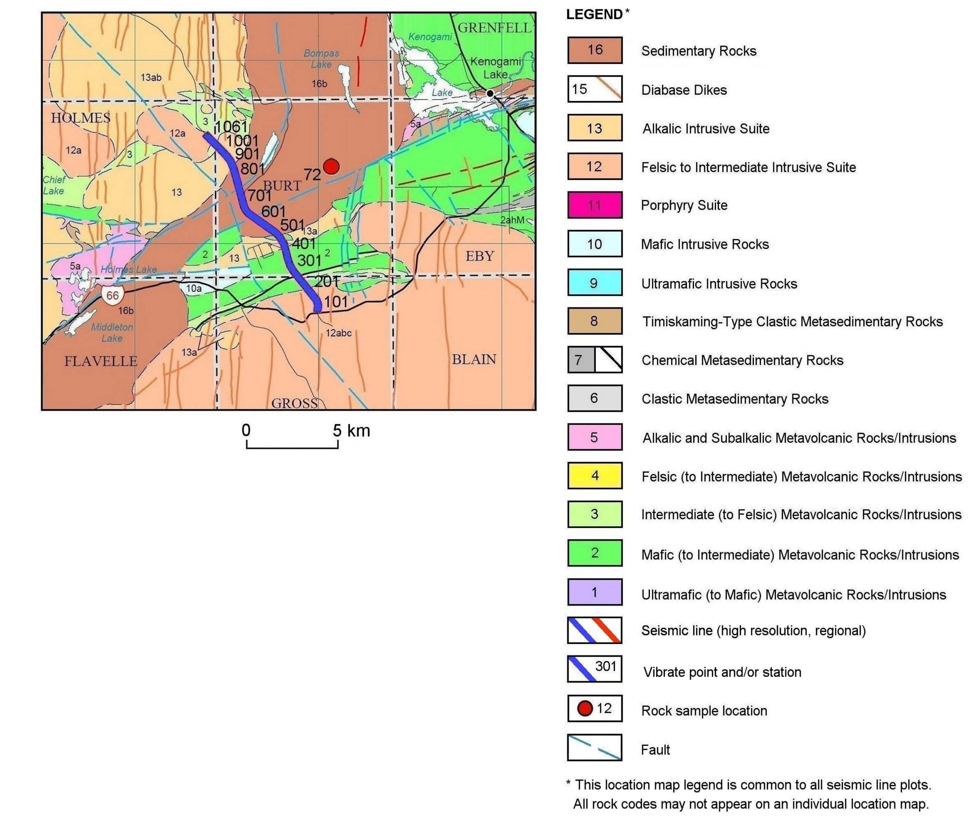
South East







Line 4 location map (geology *from* Ayer et al. (2005)).



WATABEAG HIGH-RESOLUTION REFLECTION SEISMIC LINE 4

Vibrate Points 1061 - 101
MIGRATED DMO STACK

Normal Polarity
Scale 1:25 000

Acquisition - Kinetex Inc.
Processing - Sensor Geophysical Ltd.

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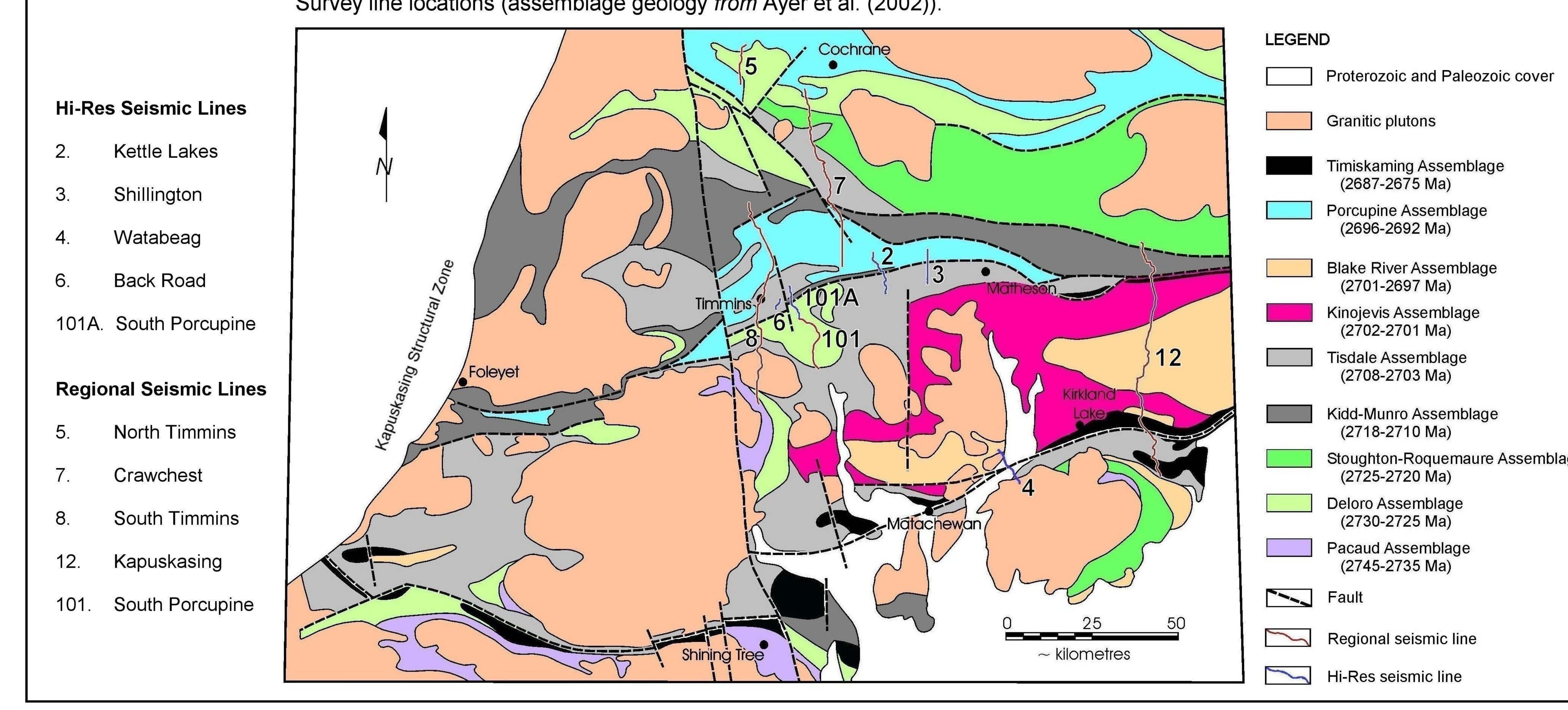
Survey line locations (assemblage geology *from* Ayer et al. (2002)).



FIELD PARAMETERS

Recorded by	Kinetex Inc., Party 101 June, 2004
Recorded for	Timmins Economic Development Corporation
Amplifier	I/O System Four, 957 channels maximum SEG-Y format, IEEE Floating Point 1/2 Nyquist Minimum Phase, Notch OUT
Record Length	6.0 seconds 2 ms sample interval
Source	Vibroseis, 2 Vibrators over 18 m 3 sweeps of 28 seconds, 10-160 Hz non-linear +3 dB/Oct boost
Geophones	I/O VectorSeis SVSM Single 3-component phone
Source Interval	25.0 meters
Group Interval	12.5 meters
Nominal Fold	24000%
Nominal Spread	6000 - 0 - VP - 0 - 6000 meters

PROCESSING SEQUENCE

Processed by	Sensor Geophysical Ltd. February, 2005
SEG-Y Reformat	
Record length	6.0 seconds
Sample interval	2 ms
Geometry Assignment	
Crooked Line Binning	
Common Depth Point (CDP) separation	6.25 m
Trace Kills	
Amplitude Recovery	
Method	Spherical divergence correction
1st Surface-Consistent Deconvolution	
Components	Resolved: Source, Receiver, Offset Applied: Source, Receiver
Type	Spiking
Operator length	100 ms
Prewhitening	0.1%
Design window	370-4500 ms at 25 m offset 2900-4700 ms at 8700 m offset
Offsets used in design	500-5000 m
1st Vibroseis Deconvolution Compensation	
Refraction Statics Correction	
Datum elevation	300 m
Replacement velocity	6000 m/s
Processing datum	Floating
Number of layers replaced	1
Velocity Analysis	
Surface-Consistent Statics	
Method	Stack power maximization
Maximum allowed shift	20 ms
Correlation window	Various
Normal Moveout Removal	
Automatic Gain Control (AGC)	
Application Mode	Apply and save
AGC operator length	500 ms
Analysis bandwidth	15/20-55/70 Hz
Shot-Mode f-k Filter	Polygon to attenuate shear refractions
Size of impulse response	250 ms by 1000 m
Automatic Gain Control	
Application Mode	Remove AGC
Automatic Gain Control	
Application Mode	Apply and save
AGC operator length	500 ms
Analysis bandwidth	15/20-55/70 Hz
Shot-Mode f-k Filter	Polygon to attenuate surface wave
Size of impulse response	400 ms by 625 m
Automatic Gain Control	
Application Mode	Remove AGC
Automatic Gain Control	
Application Mode	Apply and save
AGC operator length	500 ms
Analysis bandwidth	15/20-55/70 Hz
Receiver-Mode f-k Filter	Polygon to attenuate shear refractions
Size of impulse response	250 ms by 1000 m
Automatic Gain Control	
Application Mode	Remove AGC
Normal Moveout Restoration	
2nd Surface-Consistent Deconvolution	
Components	Resolved: Source, Receiver, Offset Applied: Source, Receiver
Type	Spiking
Operator length	100 ms
Prewhitening	0.1%
Design window	200-1750 ms at 0 m offset 300-2000 ms at 750 m offset 550-4500 ms at 1650 m offset 2500-4750 ms at 9000 m offset
Offsets used in design	37.5-6000 m
2nd Vibroseis Deconvolution Compensation	
Time-Variant Spectral Whitening	
Balancing window length	500 ms
Balancing bandwidth	4/10-148/170 Hz
Number of frequency panels	13
Velocity Analysis	
Surface-Consistent Statics	
Method	Stack power maximization
Maximum allowed shift	24 ms
Correlation window	400-5400 ms
Normal Moveout Correction	
Automatic Gain Control	
Application Mode	Apply
AGC operator length	1000 ms
Analysis bandwidth	15/20-55/70 Hz
Common Depth Point (CDP) Stack Within Common Offset Bins	
Method	Mean with linear fold interpolation
Offset bin centers	25 to 5775 m
Offset bin center increment	50.00 m
Offset bin width	62.50 m
CDP trace spacing	6.25 m
F-X Prediction Filtering	
Filter type	2-sided Wiener-Levinson
Number of slopes	8
Horizontal window length	40 traces
Time window length	100 ms
Time window overlap	50 ms
Automatic Gain Control	
Application Mode	Apply
AGC operator length	1000 ms
Analysis bandwidth	15/20-55/70 Hz
Dip Moveout (DMO) Correction	
Method	Common Offset F-K
Offset bin centers	25 to 5775 m
Offset bin center increment	50 m
DMO stretch factor	0.6
Perform dip filtering	Yes
Front-End Muting	
Offset	325 1525 7975 m
Mute time	0 400 2000 ms
Automatic Gain Control	
Application Mode	Apply
AGC operator length	1000 ms
Analysis bandwidth	15/20-55/70 Hz
CDP Stack	
Method	Simple mean
Bulk Shift	+100 ms
Anisotropic Diffusion Filter	
Design window size	40 traces x 80 ms
Number of diffusion steps	5
Diffusion rate	0.25
With edge preservation	Yes
Bandpass Filter	
Zero-phase Ormsby	5/10-100/120 Hz 0-2000 ms 5/10- 40/ 60 Hz 3500-6000 ms
Trace Equalization	
Mean window	500-5500 ms
Analysis bandwidth	10/20-40/60 Hz
Time Migration From Surface	
Method	Implicit finite difference
Dip aperture	0-65 degrees
Velocity function	100% of DMO stacking velocities
Bandpass Filter	
Zero-phase Ormsby	10/20 - 120/140 Hz
Time-Variant Scaling	
Method	Centre-to-centre
Mean windows	200-600, 500-2200, 2000-3200 and 3000-6000 ms
2:1 Trace Decimation	

DISPLAY PARAMETERS

Traces/Inch =	101.6	Display Gain =	0.8
Inches/Second =	3.75	Clip Limit =	6
NORMAL POLARITY		Tue Mar 8 17:36:02 2005	

SENSOR GEOPHYSICAL LTD.

REFERENCES

Ayer,J.A., Amelin,Y, Corfu,F., Kamo,S.L., Ketchum,J.W.F., Kwok,K. and Trowell,N. 2002. Evolution of the southern Abitibi greenstone belt based on U-Pb geochronology: autochthonous volcanic construction followed by plutonism, regional deformation and sedimentation; Precambrian Research, v.115, p.63-95.

Ayer,J.A., Berger,B.R., Hall,L.A.F., Houlé, M.G., Johns,G.W., Josey,S., Madon,Z., Rainsford,D., Trowell,N.F. and Vaillancourt,C. 2005. Geological compilation of the central Abitibi greenstone belt: Kapuskasing Structural Zone to the Québec border; Ontario Geological Survey, Preliminary Map P.3565, scale 1:250 000.

Accompanies Open File Report 6169.

CDP 4600		
TIME	VEL	INTV
[illegible]	[illegible]	[illegible]

CDP 4400		
TIME	VEL	INTV
0	1520	5697
500	5697	6330
1000	6022	6893
1500	6326	6797
2000	6447	6644
2500	6487	6626
3000	6510	6704
3500	6538	7053
4000	6605	7146
4500	6667	7222
5000	6725	7291
5500	6778	6907
6000	6789	6802
6500	6790	6681
7000	6782	6593
7500	6770	6566
8000	6757	6526
8500	6744	6845
9000	6749	6816
9500	6753	6823
10000	6756	6794
10500	6758	6797
11000	6760	6767
11500	6760	6767
12000	6761	

CDP 4200		
TIME	VEL	INTV
0	1520	5663
500	5663	6267
1000	5973	6819
1500	6268	6973
2000	6451	6818
2500	6526	6872
3000	6585	6851
3500	6624	6951
4000	6666	7011
4500	6705	7040
5000	6739	7155
5500	6778	6923
6000	6790	6852
6500	6795	6699
7000	6788	6612
7500	6776	6589
8000	6765	6541
8500	6752	6715
9000	6750	6815
9500	6753	6822
10000	6757	6792
10500	6758	6795
11000	6760	6765
11500	6760	6765
12000	6760	

CDP 4000		
TIME	VEL	INTV
0	1520	5609
500	5609	6118
1000	5869	6700
1500	6158	6900
2000	6352	6707
2500	6424	6759
3000	6481	6759
3500	6522	7065
4000	6592	7168
4500	6659	7251
5000	6720	7242
5500	6769	6832
6000	6774	6793
6500	6776	6621
7000	6765	6491
7500	6747	6628
8000	6740	6834
8500	6745	6847
9000	6751	6813
9500	6754	6819
10000	6757	6789
10500	6759	6792
11000	6760	6761
11500	6761	6761
12000	6761	

CDP 3800		
TIME	VEL	INTV
0	1530	5611
500	5611	6129
1000	5876	6485
1500	6086	6707
2000	6247	6800
2500	6361	6952
3000	6464	7026
3500	6547	7051
4000	6612	7135
4500	6672	7206
5000	6727	7190
5500	6771	6828
6000	6775	6787
6500	6776	6670
7000	6769	6507
7500	6752	6569
8000	6740	6835
8500	6746	6846
9000	6752	6811
9500	6755	6817
10000	6758	6787
10500	6759	6790
11000	6761	6759
11500	6761	6759
12000	6761	

CDP 3600		
TIME	VEL	INTV
0	1536	5637
500	5637	6170
1000	5909	6431
1500	6088	6708
2000	6249	6826
2500	6369	7020
3000	6482	7115
3500	6576	7067
4000	6639	7106
4500	6693	7162
5000	6741	7338
5500	6798	6803
6000	6798	6661
6500	6788	6626
7000	6776	6483
7500	6757	6498
8000	6741	6834
8500	6747	6845
9000	6752	6810
9500	6755	6816
10000	6758	6785
10500	6760	6788
11000	6761	6757
11500	6761	6756
12000	6760	

CDP 3400		
TIME	VEL	INTV
0	1536	5668
500	5668	6159
1000	5918	6448
1500	6100	6708
2000	6257	6745
2500	6358	6856
3000	6444	6893
3500	6510	6990
4000	6572	7164
4500	6640	7252
5000	6704	7451
5500	6775	6834
6000	6780	6791
6500	6781	6739
7000	6778	6506
7500	6760	6468
8000	6742	6825
8500	6747	6844
9000	6753	6809
9500	6756	6815
10000	6759	6784
10500	6760	6786
11000	6761	6755
11500	6761	6754
12000	6760	

CDP 3200		
TIME	VEL	INTV
0	1536	5698
500	5698	6267
1000	5989	6573
1500	6190	6727
2000	6328	6712
2500	6407	6776
3000	6470	6766
3500	6513	6766
4000	6545	7159
4500	6616	7272
5000	6685	7486
5500	6762	6983
6000	6780	6802
6500	6782	6765
7000	6781	6491
7500	6762	6450
8000	6743	6826
8500	6748	6843
9000	6753	6808
9500	6756	6814
10000	6759	6783
10500	6760	6785
11000	6761	6754
11500	6761	6753
12000	6760	

CDP 3000		
TIME	VEL	INTV
0	1536	5713
500	5713	6298
1000	6012	6572
1500	6205	6729
2000	6340	6709
2500	6415	6766
3000	6475	6748
3500	6515	6725
4000	6542	6937
4500	6587	7155
5000	6646	7350
5500	6713	7129
6000	6748	6603
6500	6737	6605
7000	6728	6489
7500	6712	6455
8000	6696	6874
8500	6707	6904
9000	6718	6881
9500	6727	6898
10000	6736	6880
10500	6742	6894
11000	6749	6875
11500	6755	6886
12000	6760	

CDP 2800		
TIME	VEL	INTV
0	1536	5671
500	5671	6163
1000	5922	6380
1500	6079	6563
2000	6203	6693
2500	6304	6805
3000	6390	6844
3500	6457	6878
4000	6511	6956
4500	6562	7086
5000	6616	7273
5500	6679	7365
6000	6739	6776
6500	6742	6503
7000	6725	6422
7500	6705	6379
8000	6685	6884
8500	6697	6918
9000	6710	6899
9500	6720	6919
10000	6730	6904
10500	6738	6920
11000	6747	6905
11500	6753	6918
12000	6760	

CDP 2600		
TIME	VEL	INTV
0	1536	5630
500	5630	6030
1000	5834	6260
1500	5979	6648
2000	6153	6736
2500	6274	6889
3000	6381	6877
3500	6454	6858
4000	6506	6922
4500	6554	6991
5000	6599	7151
5500	6651	7222
6000	6700	6607
6500	6693	6324
7000	6667	6450
7500	6653	6418
8000	6639	6935
8500	6656	6977
9000	6675	6970
9500	6691	7002
10000	6706	6998
10500	6721	7026
11000	6735	7023
11500	6748	7048
12000	6760	

CDP 2400		
TIME	VEL	INTV
0	1536	5662
500	5662	6133
1000	5902	6432
1500	6084	6737
2000	6253	6792
2500	6365	6925
3000	6462	6841
3500	6517	6716
4000	6542	6726
4500	6563	6817
5000	6589	6982
5500	6626	7023
6000	6660	6611
6500	6656	6455
7000	6642	6614
7500	6640	6608
8000	6638	6940
8500	6656	6978
9000	6674	6971
9500	6690	7002
10000	6706	6999
10500	6720	7027
11000	6735	7024
11500	6748	7049
12000	6760	

CDP 2200		
TIME	VEL	INTV
0	1536	5669
500	5669	6158
1000	5919	6426
1500	6093	6678
2000	6244	6774
2500	6354	6903
3000	6448	6900
3500	6515	6733
4000	6542	6726
4500	6563	6647
5000	6571	6657
5500	6579	6641
6000	6584	6605
6500	6586	6704
7000	6595	6912
7500	6616	6954
8000	6638	6942
8500	6656	6978
9000	6674	6971
9500	6690	7002
10000	6706	6999
10500	6720	7027
11000	6735	7024
11500	6748	7049
12000	6760	

CDP 2000		
TIME	VEL	INTV
0	1536	5696
500	5696	6245
1000	5977	6397
1500	6120	6570
2000	6236	6755
2500	6343	6879
3000	6435	6931
3500	6509	6743
4000	6538	6745
4500	6562	6658
5000	6571	6650
5500	6579	6632
6000	6583	6594
6500	6584	6747
7000	6596	6911
7500	6617	6954
8000	6639	6941
8500	6657	6977
9000	6675	6969
9500	6691	7001
10000	6707	6997
10500	6721	7025
11000	6735	7022
11500	6748	7047
12000	6760	

CDP 1800		
TIME	VEL	INTV
0	1530	5716
500	5716	6278
1000	6003	6337
1500	6116	6514
2000	6218	6710
2500	6320	6822
3000	6406	6812
3500	6466	6826
4000	6512	6878
4500	6553	6702
5000	6568	6618
5500	6573	6594
6000	6575	6588
6500	6576	6900
7000	6599	6910
7500	6621	6951
8000	6642	6938
8500	6659	6973
9000	6677	6965
9500	6693	6995
10000	6708	6991
10500	6722	7019
11000	6736	7014
11500	6748	7038
12000	6760	

CDP 1600		
TIME	VEL	INTV
0	1505	5635
500	5635	6267
1000	5959	6350
1500	6092	6357
2000	6159	6793
2500	6291	6969
3000	6409	6825
3500	6470	6818
4000	6515	6868
4500	6555	6777
5000	6577	6805
5500	6598	6816
6000	6617	6826
6500	6633	6912
7000	6653	6887
7500	6669	6918
8000	6685	6893
8500	6698	6918
9000	6710	6898
9500	6720	6918
10000	6730	6903
10500	6738	6919
11000	6747	6903
11500	6754	6917
12000	6760	

CDP 1400		
TIME	VEL	INTV
0	1505	5602
500	5602	6135
1000	5875	6375
1500	6046	6611
2000	6192	6786
2500	6315	6946
3000	6425	6859
3500	6489	6790
4000	6527	6827
4500	6561	6756
5000	6581	6829
5500	6604	6844
6000	6624	6839
6500	6641	6906
7000	6660	6880
7500	6675	6914
8000	6690	6888
8500	6702	6911
9000	6714	6890
9500	6723	6909
10000	6733	6892
10500	6740	6907
11000	6748	6890
11500	6754	6902
12000	6760	

CDP 1200		
TIME	VEL	INTV
0	1505	5712
500	5712	6256
1000	5990	6363
1500	6117	6863
2000	6312	6925
2500	6439	7052
3000	6545	7031
3500	6617	7073
4000	6676	7127
4500	6727	6635
5000	6718	6579
5500	6706	6639
6000	6700	6579
6500	6691	6594
7000	6684	6550
7500	6675	6913
8000	6690	6888
8500	6702	6911
9000	6714	6890
9500	6723	6909
10000	6733	6892
10500	6740	6907
11000	6748	6890
11500	6754	6902
12000	6760	

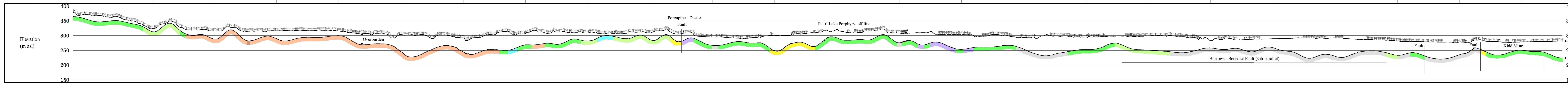
CDP 1000		
TIME	VEL	INTV
0	1505	5606
500	5606	6024
1000	5819	6247
1500	5965	7056
2000	6256	7451
2500	6512	7167
3000	6626	7153
3500	6704	7205
4000	6768	7217
4500	6820	6167
5000	6757	6361
5500	6722	6645
6000	6716	6583
6500	6706	6596
7000	6698	6509
7500	6685	6761
8000	6690	6888
8500	6702	6911
9000	6714	6890
9500	6723	6909
10000	6733	6892
10500	6740	6907
11000	6748	6890
11500	6754	6902
12000	6760	

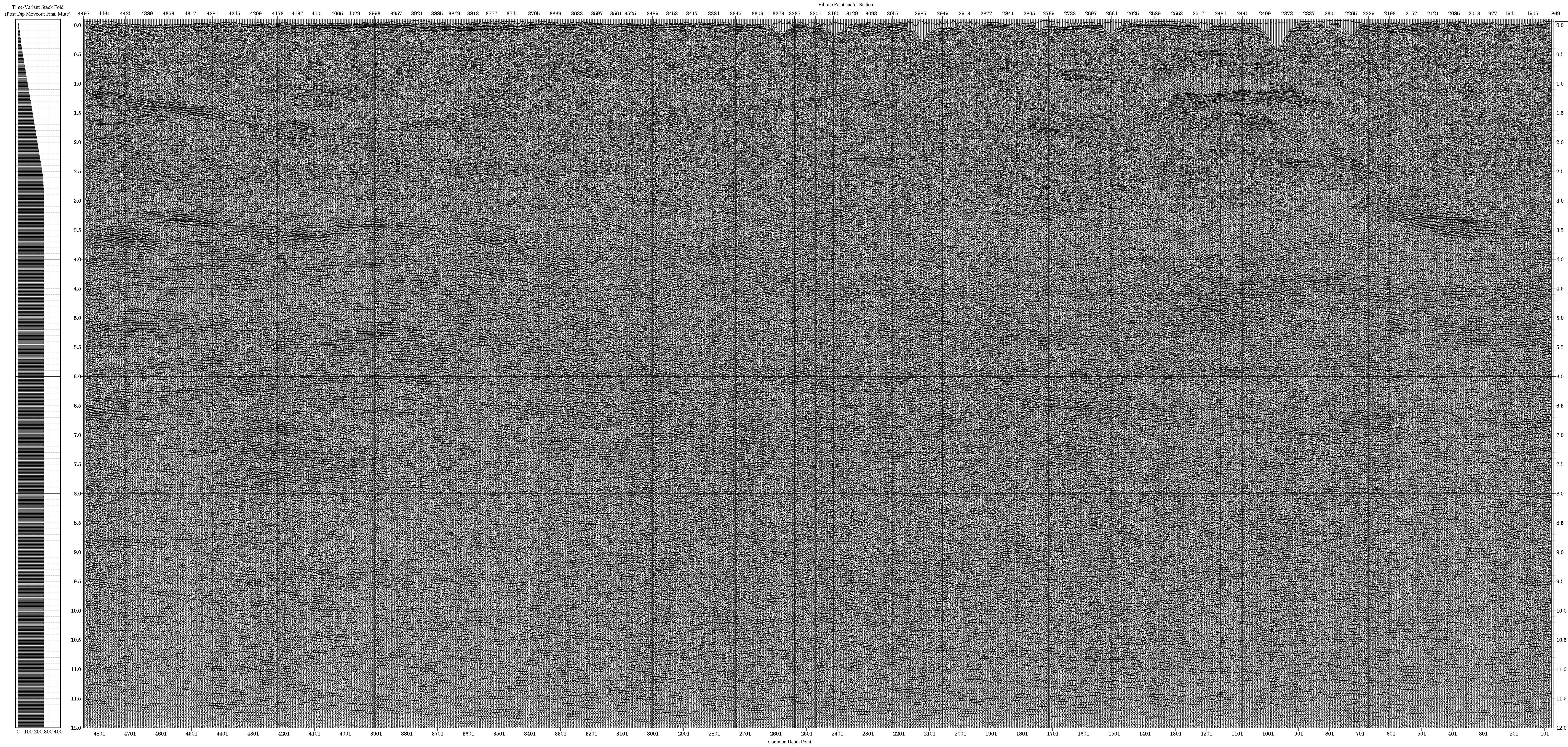
CDP 800		
TIME	VEL	INTV
0	1505	5581
500	5581	6071
1000	5831	6185
1500	5951	7006
2000	6232	7321
2500	6464	6890
3000	6537	6886
3500	6588	6885
4000	6626	6920
4500	6659	6432
5000	6637	6336
5500	6610	6836
6000	6629	6829
6500	6645	6893
7000	6663	6863
7500	6676	6894
8000	6690	6888
8500	6702	6911
9000	6714	6890
9500	6723	6909
10000	6733	6892
10500	6740	6907
11000	6748	6890
11500	6754	6902
12000	6760	

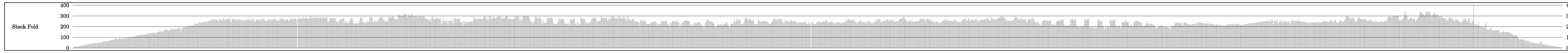
CDP 600		
TIME	VEL	INTV
0	1505	5649
500	5649	6311
1000	5989	6512
1500	6168	6651
2000	6293	6463
2500	6327	6946
3000	6434	7032
3500	6523	7111
4000	6600	7222
4500	6672	6865
5000	6691	6695
5500	6692	6662
6000	6689	6609
6500	6683	6630
7000	6679	6637
7500	6676	6894
8000	6690	6888
8500	6702	6911
9000	6714	6890
9500	6723	6909
10000	6733	6892
10500	6740	6907
11000	6748	6890
11500	6754	6902
12000	6760	

CDP 400		
TIME	VEL	INTV
0	1505	5613
500	5613	6192
1000	5910	6445
1500	6093	6720
2000	6256	6736
2500	6355	6891
3000	6447	7045
3500	6536	7261
4000	6631	7411
4500	6722	6783
5000	6728	6590
5500	6716	6529
6000	6700	6447
6500	6681	6441
7000	6664	6824
7500	6675	6914
8000	6690	6888
8500	6702	6911
9000	6714	6890
9500	6723	6909
10000	6733	6892
10500	6740	6907
11000	6748	6890
11500	6754	6902
12000	6760	

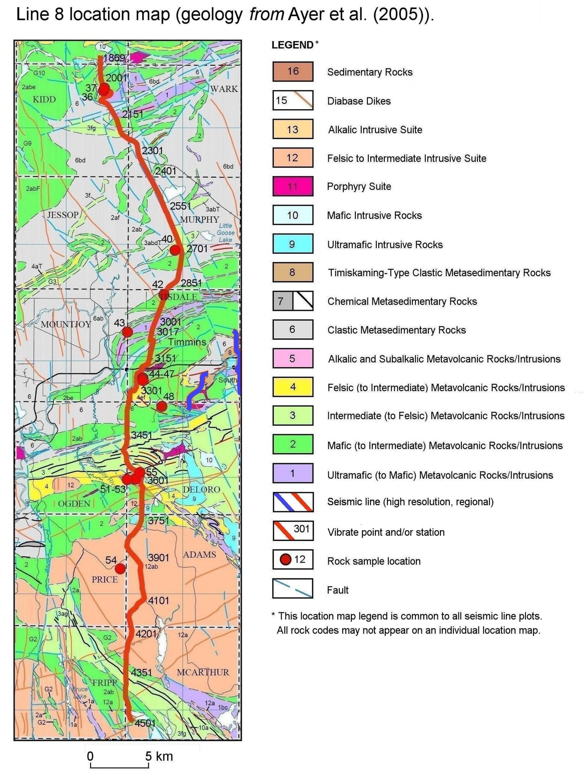
CDP 200		
TIME	VEL	INTV
0	1505	5598
500	5598	6182
1000	5897	6540
1500	6119	6741
2000	6280	6780
2500	6383	7005
3000	6491	7212
3500	6599	6985
4000	6648	7019
4500	6691	6743
5000	6696	6623
5500	6689	6575
6000	6680	6506
6500	6667	6573
7000	6660	6884
7500	6675	6914
8000	6690	6888
8500	6702	6911
9000	6714	6890
9500	6723	6909
10000	6733	6892
10500	6740	6907
11000	6748	6890
11500	6754	6902
12000	6760	







North



SOUTH TIMMINS REGIONAL REFLECTION SEISMIC LINE 8

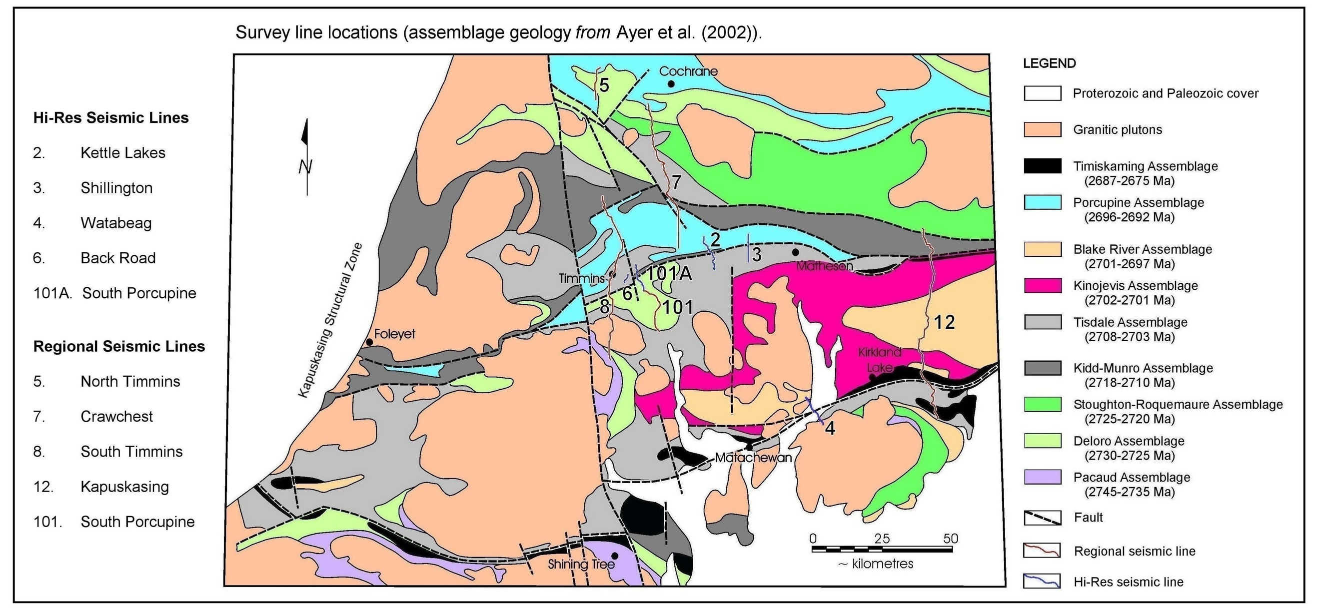
Vibrate Points 4501 - 1869
MIGRATED DMO STACK

Normal Polarity
Scale 1:50 000

Acquisition - Kinetex Inc.
Processing - Sensor Geophysical Ltd.

Discover Abitibi Initiative
Découvrons l'Abitibi

KIRKLAND LAKE



FIELD PARAMETERS

Recorded by	Kinetex Inc., Party 101 June, 2004
Recorded for	Timmins Economic Development Corporation
Amplifier	I/O System Four, 961 channels maximum SEG-Y format, IEEE Floating Point 1/2 Nyquist Minimum Phase, Notch OUT
Record Length	12.0 seconds 2 ms sample interval
Source	Vibroseis, 3 Vibrators over 27 m 6 sweeps of 28 seconds, 10-96 Hz Linear
Geophones	I/O Vectorseis SVSM Single 3-component phone
Source Interval	50 meters
Group Interval	25 meters
Nominal Fold	[illegible]
Nominal Spread	12000 - 0 - VP - 0 - 12000 meters

PROCESSING SEQUENCE

Processed by	Sensor Geophysical Ltd. February, 2005
SEG-Y Reformat	
Record length	12.0 seconds
Sample interval	2 ms
Geometry Assignment	
Crooked Line Binning	
Common Depth Point (CDP) separation	12.5 m
Trace Kills	
Amplitude Recovery	
Method	Spherical divergence correction
1st Surface-Consistent Deconvolution	
Components	Resolved: Source, Receiver, Offset Applied: Source, Receiver
Type	Spiking
Operator length	100 ms
Prewhitening	0.1%
Design window	370-4500 ms at 25 m offset 3500-4750 ms at 10750 m offset
Offsets used in design	500-5000 m
1st Vibroseis Deconvolution Compensation	
Refraction Statics Correction	
Datum elevation	300 m
Replacement velocity	6000 m/s
Processing datum	Floating
Number of layers replaced	1
Velocity Analysis	
Surface-Consistent Statics	
Method	Stack power maximization
Maximum allowed shift	20 ms
Correlation window	Various
Normal Moveout Removal	
Automatic Gain Control (AGC)	
Application Mode	Apply and save
AGC operator length	500 ms
Analysis bandwidth	15/20-55/70 Hz
Shot-Mode f-k Filter	Polygon to attenuate shear refractions
Size of impulse response	250 ms by 1000 m
Automatic Gain Control	
Application Mode	Remove AGC
Automatic Gain Control	
Application Mode	Apply and save
AGC operator length	500 ms
Analysis bandwidth	15/20-55/70 Hz
Receiver-Mode f-k Filter	Polygon to attenuate shear refractions
Size of impulse response	250 ms by 1000 m
Automatic Gain Control	
Application Mode	Remove AGC
Normal Moveout Restoration	
2nd Surface-Consistent Deconvolution	
Components	Resolved: Source, Receiver, Offset Applied: Source, Receiver
Type	Spiking
Operator length	100 ms
Prewhitening	0.1%
Design window	200-1750 ms at 0 m offset 300-2000 ms at 750 m offset 550-4500 ms at 1650 m offset 2500-4750 ms at 9000 m offset
Offsets used in design	37.5-6000 m
2nd Vibroseis Deconvolution Compensation	
Time-Variant Spectral Whitening	
Balancing window length	500 ms
Balancing bandwidth	4/10-96/120 Hz
Number of frequency panels	8
Velocity Analysis	
Surface-Consistent Statics	
Method	Stack power maximization
Maximum allowed shift	24 ms
Correlation window	400-5400 ms
Normal Moveout Correction	
Automatic Gain Control	
Application Mode	Apply
AGC operator length	1000 ms
Analysis bandwidth	15/20-55/70 Hz
Common Depth Point (CDP) Stack Within Common Offset Bins	
Method	Mean with linear fold interpolation
Offset bin centers	50 to 11550 m
Offset bin center increment	100.0 m
Offset bin width	125.0 m
CDP trace spacing	12.5 m
F-X Prediction Filtering	
Filter type	2-sided Wiener-Levinson
Number of slopes	8
Horizontal window length	40 traces
Time window length	100 ms
Time window overlap	50 ms
Automatic Gain Control	
Application Mode	Apply
AGC operator length	1000 ms
Analysis bandwidth	15/20-55/70 Hz
Dip Moveout (DMO) Correction	
Method	Common Offset F-K
Offset bin centers	50 to 11550 m
Offset bin center increment	100 m
DMO stretch factor	0.6
Perform dip filtering	Yes
Front-End Muting	
Offset	325 1525 7975 m
Mute time	0 400 2000 ms
Automatic Gain Control	
Application Mode	Apply
AGC operator length	1000 ms
Analysis bandwidth	15/20-55/70 Hz
CDP Stack	
Method	Simple mean
Bulk Shift	+100 ms
Anisotropic Diffusion Filter	
Design window size	40 traces x 80 ms
Number of diffusion steps	5
Diffusion rate	0.25
With edge preservation	Yes
Bandpass Filter	
Zero-phase Ormsby	5/10-100/120 Hz 0- 2000 ms 5/10- 40/ 60 Hz 3500-12000 ms
Trace Equalization	
Mean window	1000-5500 ms
Analysis bandwidth	10/20-40/60 Hz
Time Migration From Surface	
Method	Implicit finite difference
Dip aperture	0-65 degrees
Velocity function	100% of DMO stacking velocities
Bandpass Filter	
Zero-phase Ormsby	10/20 - 120/140 Hz
Time-Variant Scaling	
Method	Centre-to-centre
Mean windows	200-600, 500-2200, 2000-3200 and 3000-6000 ms
2:1 Trace Decimation	

DISPLAY PARAMETERS

Traces/Inch =	101.6	Display Gain =	0.8
Inches/Second =	1.875	Clip Limit =	6
NORMAL POLARITY		Tue Mar 8 19:53:05 2005	

SENSOR GEOPHYSICAL LTD.

REFERENCES

Ayer,J.A., Amelin,Y, Corfu,F., Kamo,S.L., Ketchum,J.W.F., Kwok,K. and Trowell,N. 2002. Evolution of the southern Abitibi greenstone belt based on U-Pb geochronology: autochthonous volcanic construction followed by plutonism, regional deformation and sedimentation; Precambrian Research, v.115, p.63-95.

Ayer,J.A., Berger,B.R., Hall,L.A.F., Houlé, M.G., Johns,G.W., Josey,S., Madon,Z., Rainsford,D., Trowell,N.F. and Vaillancourt,C. 2005. Geological compilation of the central Abitibi greenstone belt: Kapuskasing Structural Zone to the Québec border; Ontario Geological Survey, Preliminary Map P.3565, scale 1:250 000.

Accompanies Open File Report 6169.

NORTH TIMMINS
REGIONAL REFLECTION SEISMIC LINE 5

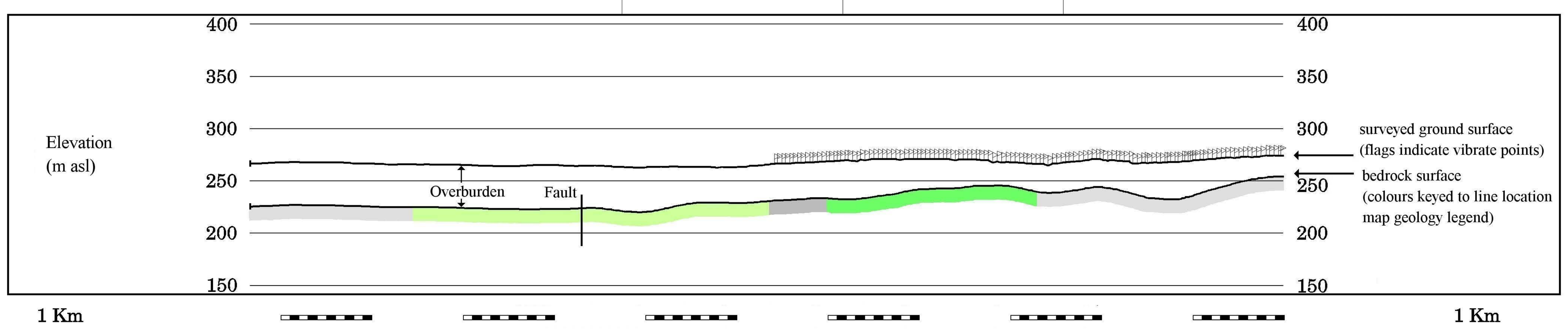
Vibrate Points 347 - 102
MIGRATED DMO STACK

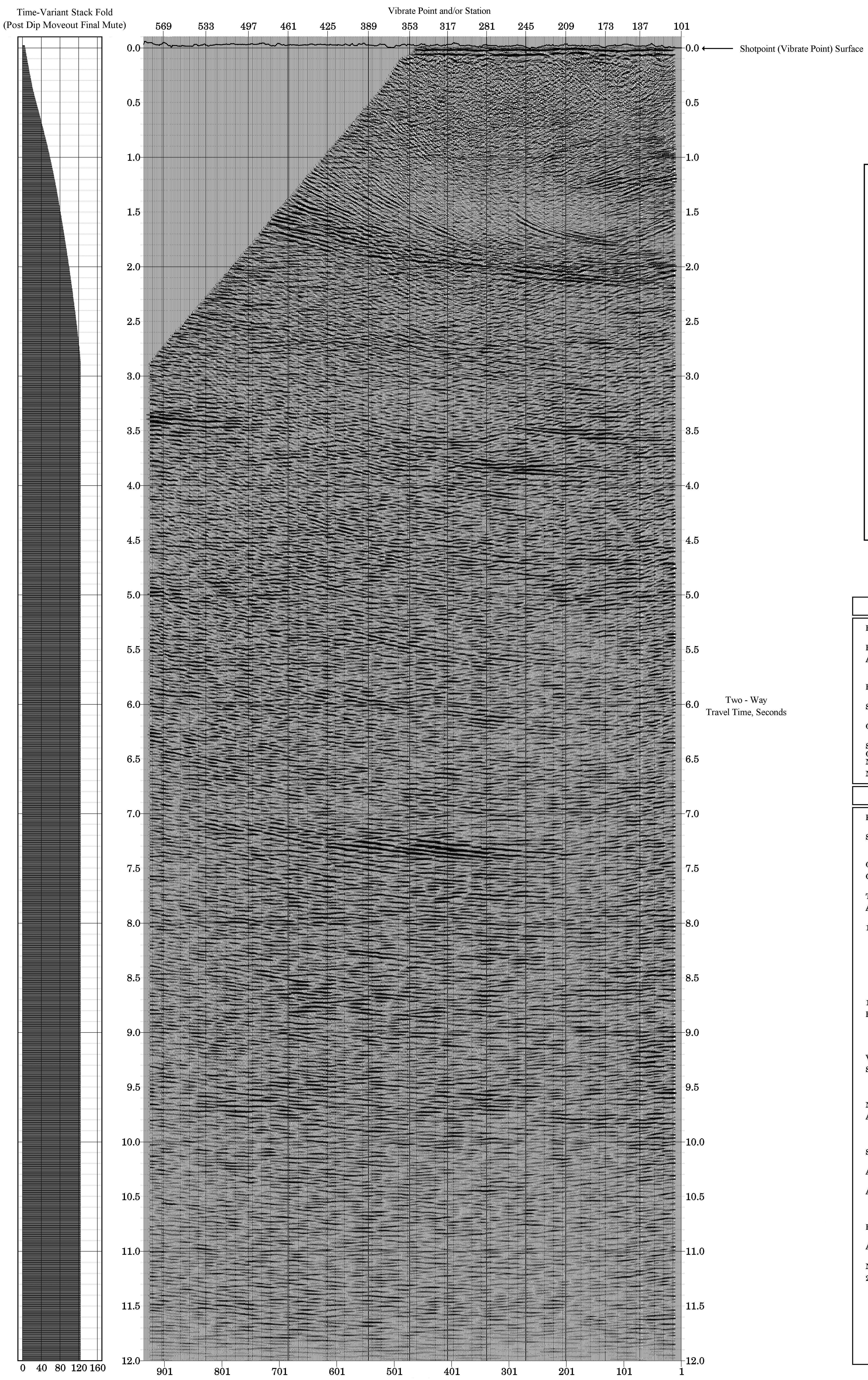
Normal Polarity
Scale 1:50 000

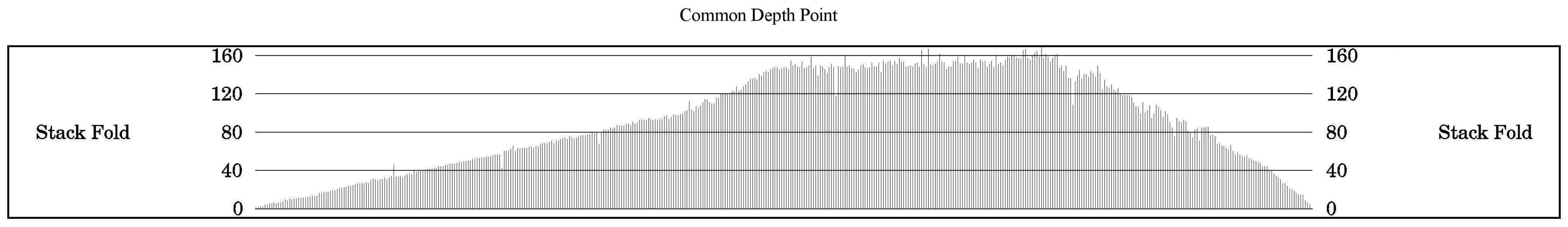
Acquisition - Kinetex Inc.
Processing - Sensor Geophysical Ltd.

CDP 600			CDP 400			CDP 200		
TIME	VEL	INTV	TIME	VEL	INTV	TIME	VEL	INTV
0	1523	5703	0	1480	5632	0	1505	5603
500	5703	6202	500	5632	6399	500	5603	6264
1000	5958	6378	1000	6028	6256	1000	5942	6638
1500	6101	6477	1500	6105	6309	1500	6183	6711
2000	6197	6405	2000	6156	6423	2000	6319	6452
2500	6239	6395	2500	6211	6442	2500	6346	6374
3000	6265	6310	3000	6250	6385	3000	6350	6240
3500	6272	6432	3500	6269	6408	3500	6335	6319
4000	6292	6668	4000	6287	6660	4000	6333	6632
4500	6335	6707	4500	6329	6697	4500	6367	6653
5000	6373	6860	5000	6367	6850	5000	6396	6789
5500	6419	6922	5500	6412	6911	5500	6433	6833
6000	6462	6965	6000	6455	6954	6000	6467	6858
6500	6502	6833	6500	6495	6923	6500	6498	6889
7000	6527	6747	7000	6527	6747	7000	6527	6747
7500	6542	6776	7500	6542	6776	7500	6542	6776
8000	6556	6750	8000	6556	6750	8000	6556	6750
8500	6568	6773	8500	6568	6773	8500	6568	6773
9000	6580	6752	9000	6580	6752	9000	6580	6752
9500	6589	6771	9500	6589	6771	9500	6589	6771
10000	6598	6754	10000	6598	6754	10000	6598	6754
10500	6605	6769	10500	6605	6769	10500	6605	6769
11000	6613	6752	11000	6613	6752	11000	6613	6752
11500	6619	6764	11500	6619	6764	11500	6619	6764
12000	6625		12000	6625		12000	6625	

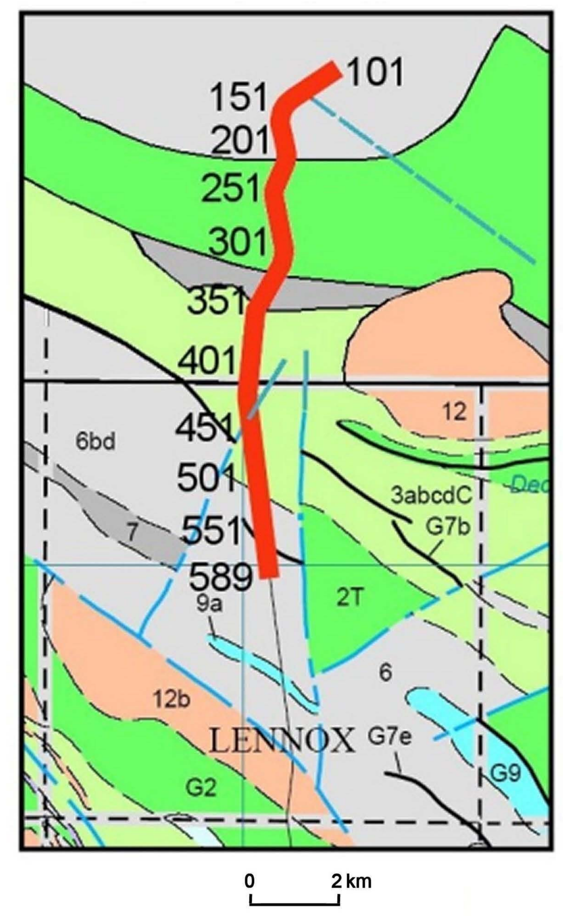
North







Line 5 location map (geology *from* Ayer et al. (2005)).



LEGEND*

16	Sedimentary Rocks
15	Diabase Dikes
13	Alkalic Intrusive Suite
12	Felsic to Intermediate Intrusive Suite
11	Porphyry Suite
10	Mafic Intrusive Rocks
9	Ultramafic Intrusive Rocks
8	Timiskaming-Type Clastic Metasedimentary Rocks
7	Chemical Metasedimentary Rocks
6	Clastic Metasedimentary Rocks
5	Alkalic and Subalkalic Metavolcanic Rocks/Intrusions
4	Felsic (to Intermediate) Metavolcanic Rocks/Intrusions
3	Intermediate (to Felsic) Metavolcanic Rocks/Intrusions
2	Mafic (to Intermediate) Metavolcanic Rocks/Intrusions
1	Ultramafic (to Mafic) Metavolcanic Rocks/Intrusions
	Seismic line (high resolution, regional)
301	Vibrate point and/or station
12	Rock sample location
	Fault

* This location map legend is common to all seismic line plots. All rock codes may not appear on an individual location map.

Discover Abitibi
A project of innovation, cooperation and revitalization
Découvrons l' Abitibi
Un projet d' innovation, de coopération et de renouvellement

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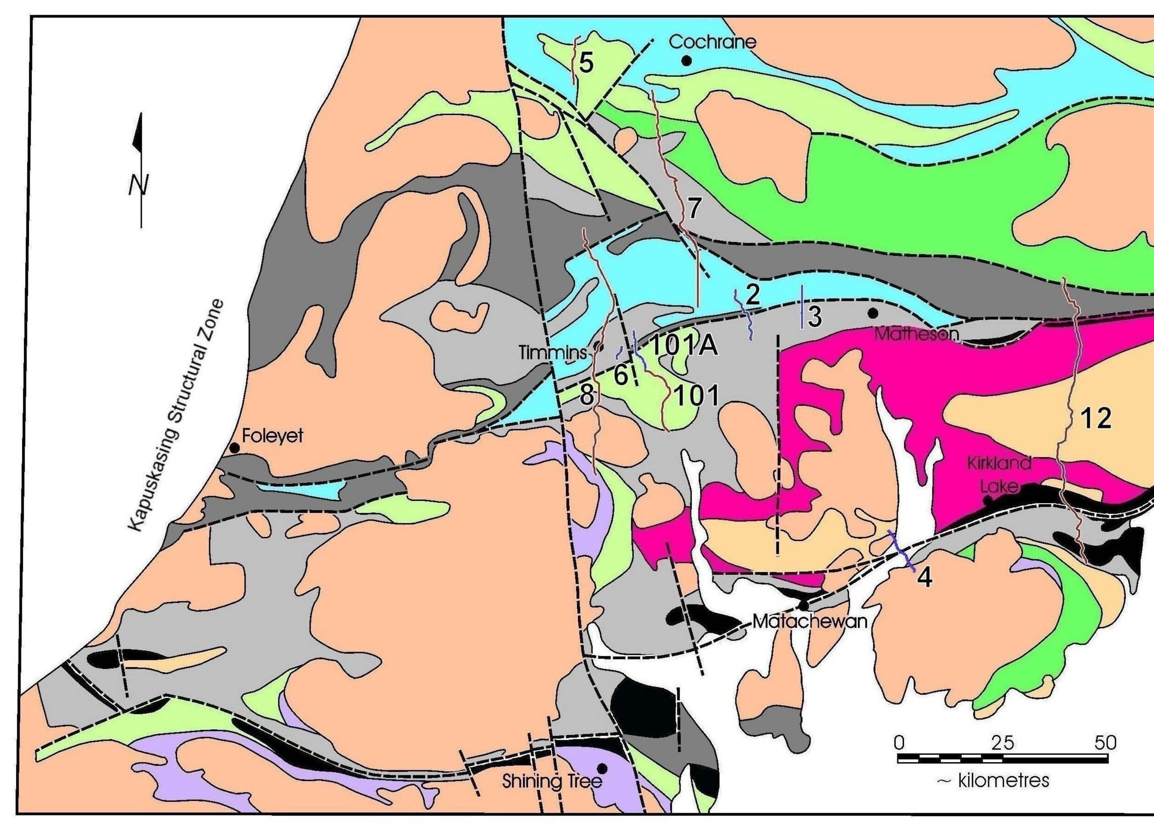
Survey line locations (assemblage geology *from* Ayer et al. (2002)).

Hi-Res Seismic Lines

2. Kettle Lakes
3. Shillington
4. Watabeag
6. Back Road
101A. South Porcupine

Regional Seismic Lines

5. North Timmins
7. Crawchest
8. South Timmins
12. Kapuskasing
101. South Porcupine



LEGEND

- Proterozoic and Paleozoic cover
- Granitic plutons
- Timiskaming Assemblage (2687-2675 Ma)
- Porcupine Assemblage (2696-2692 Ma)
- Blake River Assemblage (2701-2697 Ma)
- Kinojevis Assemblage (2702-2701 Ma)
- Tisdale Assemblage (2708-2703 Ma)
- Kidd-Munro Assemblage (2718-2710 Ma)
- Stoughton-Roquemaure Assemblage (2725-2720 Ma)
- Deloro Assemblage (2730-2725 Ma)
- Pacaud Assemblage (2745-2735 Ma)
- Fault
- Regional seismic line
- Hi-Res seismic line

FIELD PARAMETERS

Recorded by	Kinetex Inc., Party 101 June, 2004
Recorded for	Timmins Economic Development Corporation
Amplifier	I/O System Four, 727 channels maximum SEG-Y format, IEEE Floating Point 1/2 Nyquist Minimum Phase, Notch OUT
Record Length	12.0 seconds 2 ms sample interval
Source	Vibroseis, 3 Vibrators over 27 m 6 sweeps of 28 seconds, 10-96 Hz Linear
Geophones	I/O VectorSeis SVSM Single 3-component phone
Source Interval	50 meters
Group Interval	25 meters
Nominal Fold	24000%
Nominal Spread	12000 - 0 - VP - 0 - 12000 meters

PROCESSING SEQUENCE

Processed by	Sensor Geophysical Ltd. February, 2005
SEG-Y Reformat	
Record length	12.0 seconds
Sample interval	2 ms
Geometry Assignment	
Crooked Line Binning	
Common Depth Point (CDP) separation	12.5 m
Trace Kills	
Amplitude Recovery	
Method	Spherical divergence correction
1st Surface-Consistent Deconvolution	
Components	Resolved: Source, Receiver, Offset Applied: Source, Receiver
Type	Spiking
Operator length	100 ms
Prewhitening	0.1%
Design window	370-4500 ms at 25 m offset 2900-4700 ms at 8700 m offset
Offsets used in design	500-5000 m
1st Vibroseis Deconvolution Compensation	
Refraction Statics Correction	
Datum elevation	300 m
Replacement velocity	6000 m/s
Processing datum	Floating
Number of layers replaced	1
Velocity Analysis	
Surface-Consistent Statics	
Method	Stack power maximization
Maximum allowed shift	20 ms
Correlation window	Various
Normal Moveout Removal	
Automatic Gain Control (AGC)	
Application Mode	Apply and save
AGC operator length	500 ms
Analysis bandwidth	15/20-55/70 Hz
Shot-Mode f-k Filter	Polygon to attenuate shear refractions
Size of impulse response	250 ms by 1000 m
Automatic Gain Control	
Application Mode	Remove AGC
Automatic Gain Control	
Application Mode	Apply and save
AGC operator length	500 ms
Analysis bandwidth	15/20-55/70 Hz
Receiver-Mode f-k Filter	Polygon to attenuate shear refractions
Size of impulse response	250 ms by 1000 m
Automatic Gain Control	
Application Mode	Remove AGC
Normal Moveout Restoration	
2nd Surface-Consistent Deconvolution	
Components	Resolved: Source, Receiver, Offset Applied: Source, Receiver
Type	Spiking
Operator length	100 ms
Prewhitening	0.1%
Design window	200-1750 ms at 0 m offset 300-2000 ms at 750 m offset 550-4500 ms at 1650 m offset 2500-4750 ms at 9000 m offset
Offsets used in design	37.5-6000 m
2nd Vibroseis Deconvolution Compensation	
Time-Variant Spectral Whitening	
Balancing window length	500 ms
Balancing bandwidth	4/10-96/120 Hz
Number of frequency panels	8
Velocity Analysis	
Surface-Consistent Statics	
Method	Stack power maximization
Maximum allowed shift	24 ms
Correlation window	400-5400 ms
Normal Moveout Correction	
Automatic Gain Control	
Application Mode	Apply
AGC operator length	1000 ms
Analysis bandwidth	15/20-55/70 Hz
Common Depth Point (CDP) Stack Within Common Offset Bins	
Method	Mean with linear fold interpolation
Offset bin centers	50 to 11750 m
Offset bin center increment	100.0 m
Offset bin width	125.0 m
CDP trace spacing	12.5 m
F-X Prediction Filtering	
Filter type	2-sided Wiener-Levinson
Number of slopes	8
Horizontal window length	40 traces
Time window length	100 ms
Time window overlap	50 ms
Automatic Gain Control	
Application Mode	Apply
AGC operator length	1000 ms
Analysis bandwidth	15/20-55/70 Hz
Dip Moveout (DMO) Correction	
Method	Common Offset F-K
Offset bin centers	50 to 11750 m
Offset bin center increment	100 m
DMO stretch factor	0.6
Perform dip filtering	Yes
Front-End Muting	
Offset	325 1525 7975 m
Mute time	0 400 2000 ms
Automatic Gain Control	
Application Mode	Apply
AGC operator length	1000 ms
Analysis bandwidth	15/20-55/70 Hz
CDP Stack	
Method	Simple mean
Bulk Shift	+100 ms
Anisotropic Diffusion Filter	
Design window size	40 traces x 80 ms
Number of diffusion steps	5
Diffusion rate	0.25
With edge preservation	Yes
Bandpass Filter	
Zero-phase Ormsby	5/10-100/120 Hz 0- 2000 ms 5/10- 40/ 60 Hz 3500-12000 ms
Trace Equalization	
Mean window	1000-5500 ms
Analysis bandwidth	10/20-40/60 Hz
Time Migration From Surface	
Method	Implicit finite difference
Dip aperture	0-65 degrees
Velocity function	100% of DMO stacking velocities
Bandpass Filter	
Zero-phase Ormsby	10/20 - 120/140 Hz
Time-Variant Scaling	
Method	Centre-to-centre
Mean windows	200-600, 500-2200, 2000-3200 and 3000-6000 ms
2:1 Trace Decimation	

DISPLAY PARAMETERS

Traces/Inch =	101.6	Display Gain =	0.8
Inches/Second =	1.875	Clip Limit =	6
NORMAL POLARITY		Tue Mar 8 17:45:29 2005	

SENSOR GEOPHYSICAL LTD.

REFERENCES

Ayer,J.A., Amelin,Y, Corfu,F., Kamo,S.L., Ketchum,J.W.F., Kwok,K. and Trowell,N. 2002. Evolution of the southern Abitibi greenstone belt based on U-Pb geochronology: autochthonous volcanic construction followed by plutonism, regional deformation and sedimentation; Precambrian Research, v.115, p.63-95.

Ayer,J.A., Berger,B.R., Hall,L.A.F., Houlé, M.G., Johns,G.W., Josey,S., Madon,Z., Rainsford,D., Trowell,N.F. and Vaillancourt,C. 2005. Geological compilation of the central Abitibi greenstone belt: Kapuskasing Structural Zone to the Québec border; Ontario Geological Survey, Preliminary Map P.3565, scale 1:250 000.

Accompanies Open File Report 6169.

SHILLINGTON HIGH-RESOLUTION REFLECTION SEISMIC LINE 3

Vibrate Points 901 - 101
MIGRATED DMO STACK

Normal Polarity
Scale 1:25 000

Acquisition - Kinetex Inc.
Processing - Sensor Geophysical Ltd.

CDP 1400		
TIME	VEL	INTV
0	1545	5729
500	5729	6539
1000	6148	6826
1500	6385	6780
2000	6486	6609
2500	6511	6537
3000	6515	6542
3500	6519	6693
4000	6541	6781
4500	6568	6796
5000	6591	6811
5500	6612	6826
6000	6630	6826

CDP 1200		
TIME	VEL	INTV
0	1590	5882
500	5882	6428
1000	6161	6692
1500	6343	6750
2000	6447	6592
2500	6476	6535
3000	6486	6551
3500	6496	6750
4000	6528	6781
4500	6557	6796
5000	6581	6811
5500	6602	6826
6000	6621	6826

CDP 1000		
TIME	VEL	INTV
0	1544	5714
500	5714	6244
1000	5985	6528
1500	6171	6717
2000	6312	6648
2500	6381	6578
3000	6414	6601
3500	6441	6766
4000	6482	6781
4500	6516	6796
5000	6545	6811
5500	6569	6826
6000	6591	6826

CDP 800		
TIME	VEL	INTV
0	1500	5549
500	5549	6064
1000	5812	6443
1500	6030	6705
2000	6205	6721
2500	6312	6736
3000	6385	6751
3500	6438	6766
4000	6480	6781
4500	6514	6796
5000	6543	6811
5500	6568	6826
6000	6590	6826

CDP 600		
TIME	VEL	INTV
0	1499	5546
500	5546	6066
1000	5812	6443
1500	6030	6705
2000	6205	6721
2500	6312	6736
3000	6385	6751
3500	6438	6766
4000	6480	6781
4500	6514	6796
5000	6543	6811
5500	6568	6826
6000	6590	6826

CDP 400		
TIME	VEL	INTV
0	1455	5382
500	5382	5921
1000	5658	6475
1500	5943	6708
2000	6143	6781
2500	6276	6854
3000	6376	6799
3500	6438	6766
4000	6480	6781
4500	6514	6796
5000	6543	6811
5500	6568	6826
6000	6590	6826

CDP 200		
TIME	VEL	INTV
0	1455	5382
500	5382	5909
1000	5652	6373
1500	5902	6709
2000	6114	6810
2500	6259	6910
3000	6372	6819
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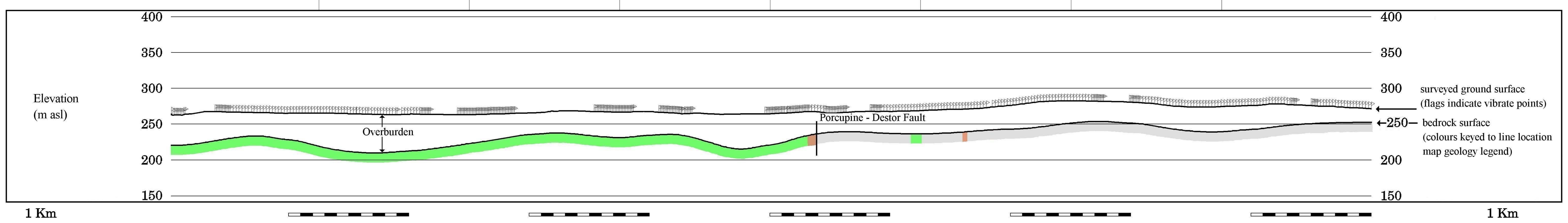
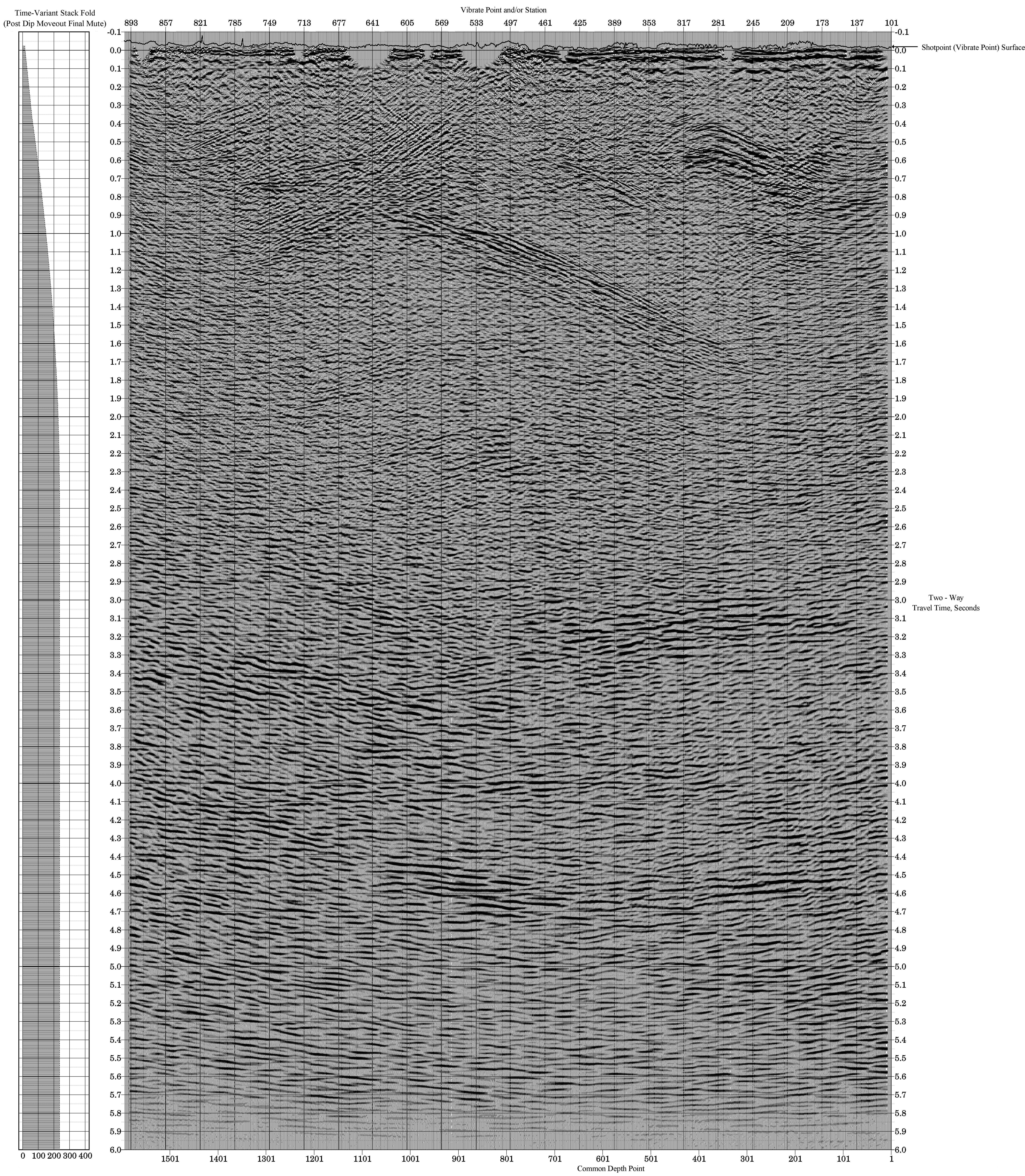
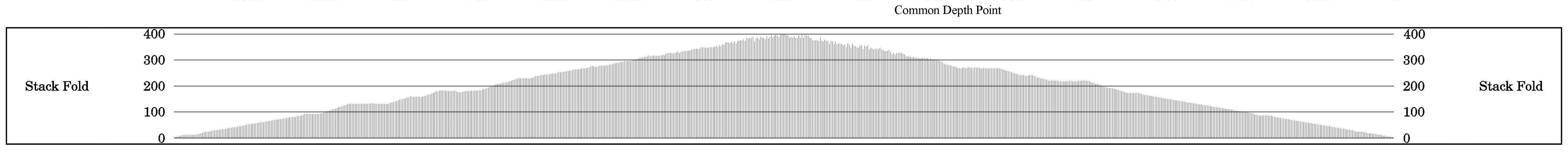
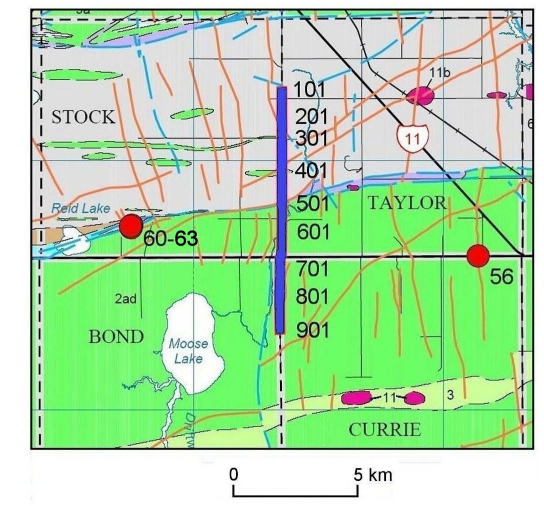
4000	6480	6781
4500	6514	6796
5000	6543	6811
5500	6568	6826
6000	6590	6826







Line 3 location map (geology *from* Ayer et al. (2005)).



LEGEND*

- 16 Sedimentary Rocks
- 15 Diabase Dikes
- 13 Alkalic Intrusive Suite
- 12 Felsic to Intermediate Intrusive Suite
- 11 Porphyry Suite
- 10 Mafic Intrusive Rocks
- 9 Ultramafic Intrusive Rocks
- 8 Timiskaming-Type Clastic Metasedimentary Rocks
- 7 Chemical Metasedimentary Rocks
- 6 Clastic Metasedimentary Rocks
- 5 Alkalic and Subalkalic Metavolcanic Rocks/Intrusions
- 4 Felsic (to Intermediate) Metavolcanic Rocks/Intrusions
- 3 Intermediate (to Felsic) Metavolcanic Rocks/Intrusions
- 2 Mafic (to Intermediate) Metavolcanic Rocks/Intrusions
- 1 Ultramafic (to Mafic) Metavolcanic Rocks/Intrusions
- Seismic line (high resolution, regional)
- 301 Vibrate point and/or station
- 12 Rock sample location
- Fault

* This location map legend is common to all seismic line plots. All rock codes may not appear on an individual location map.

FedNor Canada
Ontario Northern Ontario Heritage Fund / Fonds du patrimoine du Nord de l'Ontario
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Découvrons l'Abitibi - Un projet d'innovation, de coopération et de renouvellement

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Timmins
KIRKLAND LAKE

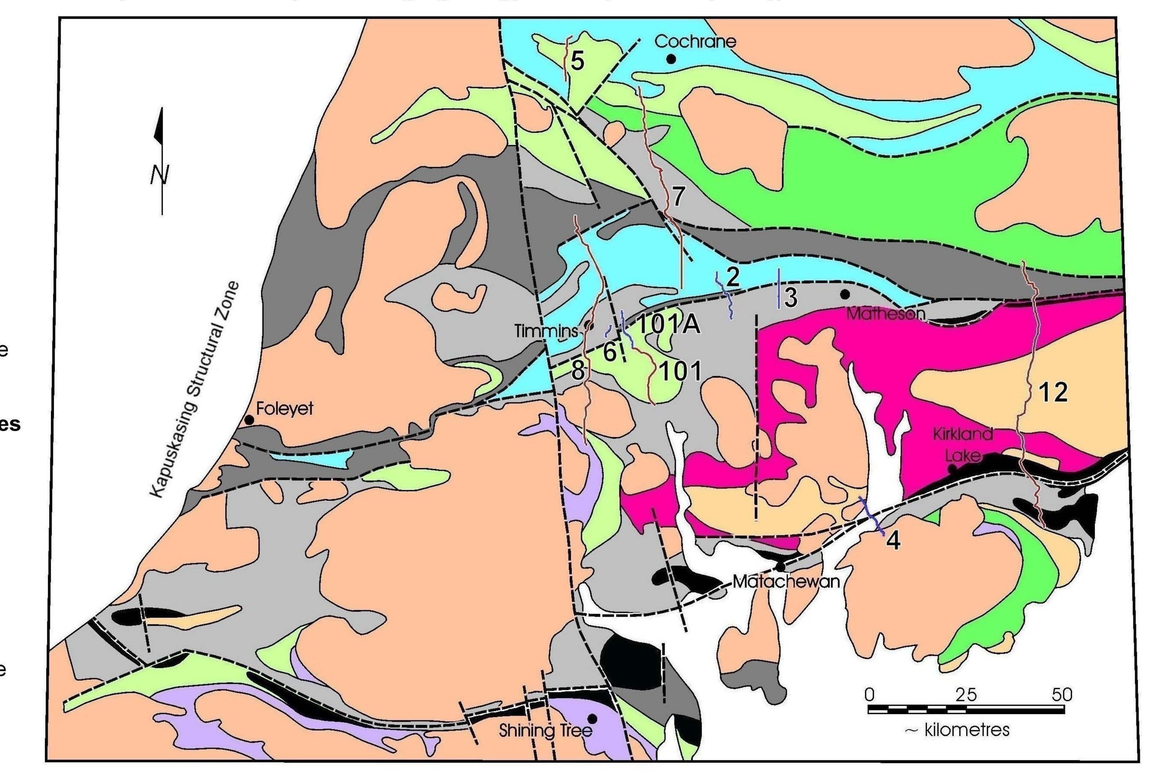
Survey line locations (assemblage geology *from* Ayer et al. (2002)).

Hi-Res Seismic Lines

2. Kettle Lakes
3. Shillington
4. Watabeag
6. Back Road
101A. South Porcupine

Regional Seismic Lines

5. North Timmins
7. Crawchest
8. South Timmins
12. Kapuskasing
101. South Porcupine



LEGEND

- Proterozoic and Paleozoic cover
- Granitic plutons
- Timiskaming Assemblage (2687-2675 Ma)
- Porcupine Assemblage (2696-2692 Ma)
- Blake River Assemblage (2701-2697 Ma)
- Kinojevis Assemblage (2702-2701 Ma)
- Tisdale Assemblage (2708-2703 Ma)
- Kidd-Munro Assemblage (2718-2710 Ma)
- Stoughton-Roquemaure Assemblage (2725-2720 Ma)
- Deloro Assemblage (2730-2725 Ma)
- Pacaud Assemblage (2745-2735 Ma)
- Fault
- Regional seismic line
- Hi-Res seismic line

FIELD PARAMETERS

Recorded by	Kinetex Inc., Party 101 June, 2004
Recorded for	Timmins Economic Development Corporation
Amplifier	I/O System Four, 795 channels maximum SEG-Y format, IEEE Floating Point 1/2 Nyquist Minimum Phase, Notch OUT
Record Length	6.0 seconds 2 ms sample interval
Source	Vibroseis, 2 Vibrators over 18 m 3 sweeps of 28 seconds, 10-160 Hz non-linear +3 dB/Oct boost
Geophones	I/O VectorSeis SVSM Single 3-component phone
Source Interval	25.0 meters
Group Interval	12.5 meters
Nominal Fold	24000%
Nominal Spread	6000 - 0 - VP - 0 - 6000 meters

PROCESSING SEQUENCE

Processed by	Sensor Geophysical Ltd. February, 2005
SEG-Y Reformat	
Record length	6.0 seconds
Sample interval	2 ms
Geometry Assignment	
Crooked Line Binning	
Common Depth Point (CDP) separation	6.25 m
Trace Kills	
Amplitude Recovery	
Method	Spherical divergence correction
1st Surface-Consistent Deconvolution	
Components	Resolved: Source, Receiver, Offset Applied: Source, Receiver
Type	Spiking
Operator length	100 ms
Prewhitening	0.1%
Design window	370-4500 ms at 25 m offset 3500-4750 ms at 10750 m offset
Offsets used in design	500-5000 m
1st Vibroseis Deconvolution Compensation	
Refraction Statics Correction	
Datum elevation	300 m
Replacement velocity	6000 m/s
Processing datum	Floating
Number of layers replaced	1
Velocity Analysis	
Surface-Consistent Statics	
Method	Stack power maximization
Maximum allowed shift	20 ms
Correlation window	Various
Normal Moveout Removal	
Automatic Gain Control (AGC)	
Application Mode	Apply and save
AGC operator length	500 ms
Analysis bandwidth	15/20-55/70 Hz
Shot-Mode f-k Filter	Polygon to attenuate shear refractions
Size of impulse response	250 ms by 1000 m
Automatic Gain Control	
Application Mode	Remove AGC
Automatic Gain Control	
Application Mode	Apply and save
AGC operator length	500 ms
Analysis bandwidth	15/20-55/70 Hz
Shot-Mode f-k Filter	Polygon to attenuate surface wave
Size of impulse response	400 ms by 625 m
Automatic Gain Control	
Application Mode	Remove AGC
Automatic Gain Control	
Application Mode	Apply and save
AGC operator length	500 ms
Analysis bandwidth	15/20-55/70 Hz
Receiver-Mode f-k Filter	Polygon to attenuate shear refractions
Size of impulse response	250 ms by 1000 m
Automatic Gain Control	
Application Mode	Remove AGC
Normal Moveout Restoration	
2nd Surface-Consistent Deconvolution	
Components	Resolved: Source, Receiver, Offset Applied: Source, Receiver
Type	Spiking
Operator length	100 ms
Prewhitening	0.1%
Design window	200-1750 ms at 0 m offset 300-2000 ms at 750 m offset 550-4500 ms at 1650 m offset 2500-4750 ms at 9000 m offset
Offsets used in design	37.5-6000 m
2nd Vibroseis Deconvolution Compensation	
Time-Variant Spectral Whitening	
Balancing window length	500 ms
Balancing bandwidth	4/10-148/170 Hz
Number of frequency panels	13
Velocity Analysis	
Surface-Consistent Statics	
Method	Stack power maximization
Maximum allowed shift	24 ms
Correlation window	400-5400 ms
Normal Moveout Correction	
Automatic Gain Control	
Application Mode	Apply
AGC operator length	1000 ms
Analysis bandwidth	15/20-55/70 Hz
Common Depth Point (CDP) Stack Within Common Offset Bins	
Method	Mean with linear fold interpolation
Offset bin centers	25 to 7975 m
Offset bin center increment	50.00 m
Offset bin width	62.50 m
CDP trace spacing	6.25 m
F-X Prediction Filtering	
Filter type	2-sided Wiener-Levinson
Number of slopes	8
Horizontal window length	40 traces
Time window length	100 ms
Time window overlap	50 ms
Automatic Gain Control	
Application Mode	Apply
AGC operator length	1000 ms
Analysis bandwidth	15/20-55/70 Hz
Dip Moveout (DMO) Correction	
Method	Common Offset F-K
Offset bin centers	25 to 7975 m
Offset bin center increment	50 m
DMO stretch factor	0.6
Perform dip filtering	Yes
Front-End Muting	
Offset	325 1525 7975 m
Mute time	0 400 2000 ms
Automatic Gain Control	
Application Mode	Apply
AGC operator length	1000 ms
Analysis bandwidth	15/20-55/70 Hz
CDP Stack	
Method	Simple mean
Bulk Shift	+100 ms
Anisotropic Diffusion Filter	
Design window size	40 traces x 80 ms
Number of diffusion steps	5
Diffusion rate	0.25
With edge preservation	Yes
Bandpass Filter	
Zero-phase Ormsby	5/10-100/120 Hz 0-2000 ms 5/10- 40/ 60 Hz 3500-6000 ms
Trace Equalization	
Mean window	2000-5500 ms
Analysis bandwidth	10/20-40/60 Hz
Time Migration From Surface	
Method	Implicit finite difference
Dip aperture	0-65 degrees
Velocity function	100% of DMO stacking velocities
Bandpass Filter	
Zero-phase Ormsby	10/20 - 120/140 Hz
Time-Variant Scaling	
Method	Centre-to-centre
Mean windows	200-600, 500-2200, 2000-3200 and 3000-6000 ms
2:1 Trace Decimation	

DISPLAY PARAMETERS

Traces/Inch =	101.6	Display Gain =	0.8
Inches/Second =	3.75	Clip Limit =	6
NORMAL POLARITY		Tue Mar 8 17:34:38 2005	

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REFERENCES

Ayer,J.A., Amelin,Y., Corfu,F., Kamo,S.L., Ketchum,J.W.F., Kwok,K. and Trowell,N. 2002. Evolution of the southern Abitibi greenstone belt based on U-Pb geochronology: autochthonous volcanic construction followed by plutonism, regional deformation and sedimentation; Precambrian Research, v.115, p. 63-95.

Ayer,J.A., Berger,B.R., Hall,L.A.F., Houlé, M.G., Johns,G.W., Josey,S., Madon,Z., Rainsford,D., Trowell,N.F. and Vaillancourt,C. 2005. Geological compilation of the central Abitibi greenstone belt: Kapuskasing Structural Zone to the Québec border; Ontario Geological Survey, Preliminary Map P.3565, scale 1:250 000.

Accompanies Open File Report 6169.

SOUTH PORCUPINE HIGH-RESOLUTION REFLECTION SEISMIC LINE 101A

Vibrate Points 901 - 101
MIGRATED DMO STACK

Normal Polarity
Scale 1:25 000

Acquisition - Kinetex Inc.
Processing - Sensor Geophysical Ltd.

CDP 2000		
TIME	VEL	INTV
0	1506	5594
500	5594	6198
1000	5904	6503
1500	6110	6673
2000	6255	6668
2500	6340	6710
3000	6403	6702
3500	6447	6685
4000	6477	6660
4500	6498	6682
5000	6515	6814
5500	6543	6839
6000	6568	

CDP 1800		
TIME	VEL	INTV
0	1458	5481
500	5481	6126
1000	5812	6438
1500	6028	6632
2000	6185	6663
2500	6283	6765
3000	6366	6798
3500	6429	6801
4000	6477	6677
4500	6500	6682
5000	6518	6814
5500	6546	6839
6000	6571	

CDP 1600		
TIME	VEL	INTV
0	1454	5496
500	5496	6156
1000	5835	6450
1500	6047	6634
2000	6199	6655
2500	6290	6752
3000	6372	6777
3500	6431	6790
4000	6477	6694
4500	6502	6695
5000	6521	6815
5500	6548	6839
6000	6573	

CDP 1400		
TIME	VEL	INTV
0	1464	5546
500	5546	6220
1000	5892	6487
1500	6097	6654
2000	6241	6654
2500	6326	6733
3000	6395	6738
3500	6445	6735
4000	6482	6694
4500	6506	6692
5000	6525	6816
5500	6552	6840
6000	6576	

CDP 1200		
TIME	VEL	INTV
0	1483	5594
500	5594	6265
1000	5939	6537
1500	6145	6704
2000	6289	6704
2500	6374	6782
3000	6444	6786
3500	6494	6778
4000	6530	6681
4500	6547	6665
5000	6559	6825
5500	6584	6845
6000	6606	

CDP 1000		
TIME	VEL	INTV
0	1501	5640
500	5640	6257
1000	5956	6560
1500	6164	6731
2000	6311	6734
2500	6398	6815
3000	6469	6821
3500	6520	6814
4000	6558	6672
4500	6571	6648
5000	6578	6830
5500	6602	6847
6000	6622	

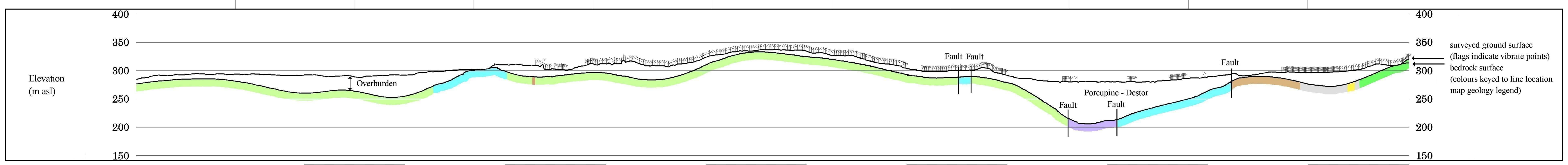
CDP 800		
TIME	VEL	INTV
0	1518	5653
500	5653	6241
1000	5954	6559
1500	6163	6732
2000	6310	6735
2500	6397	6818
3000	6469	6826
3500	6521	6818
4000	6559	6671
4500	6572	6645
5000	6579	6830
5500	6602	6847
6000	6623	

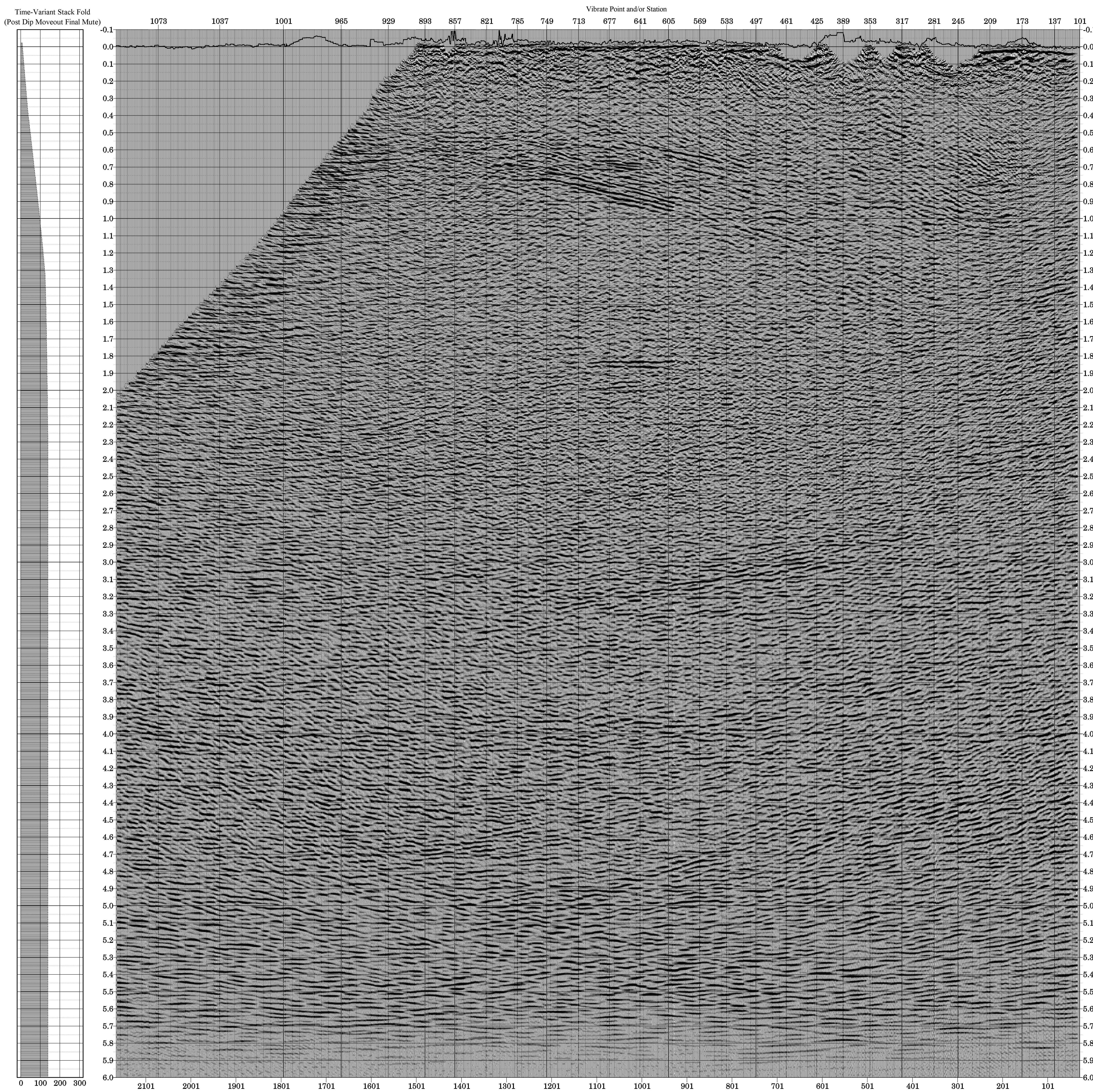
CDP 600		
TIME	VEL	INTV
0	1516	5642
500	5642	6225
1000	5940	6539
1500	6146	6724
2000	6296	6734
2500	6386	6821
3000	6460	6835
3500	6515	6831
4000	6556	6682
4500	6570	6660
5000	6579	6830
5500	6602	6847
6000	6623	

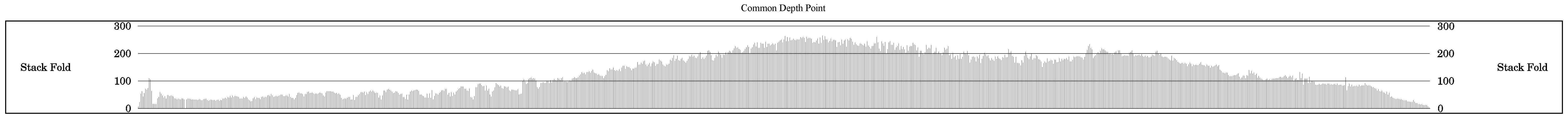
CDP 400		
TIME	VEL	INTV
0	1506	5605
500	5605	6184
1000	5901	6494
1500	6105	6695
2000	6258	6713
2500	6352	6810
3000	6430	6832
3500	6489	6836
4000	6534	6715
4500	6554	6706
5000	6569	6829
5500	6593	6846
6000	6615	

CDP 200		
TIME	VEL	INTV
0	1505	5598
500	5598	6177
1000	5895	6476
1500	6095	6651
2000	6239	6652
2500	6323	6730
3000	6393	6735
3500	6443	6728
4000	6479	6696
4500	6504	6696
5000	6523	6816
5500	6550	6840
6000	6575	

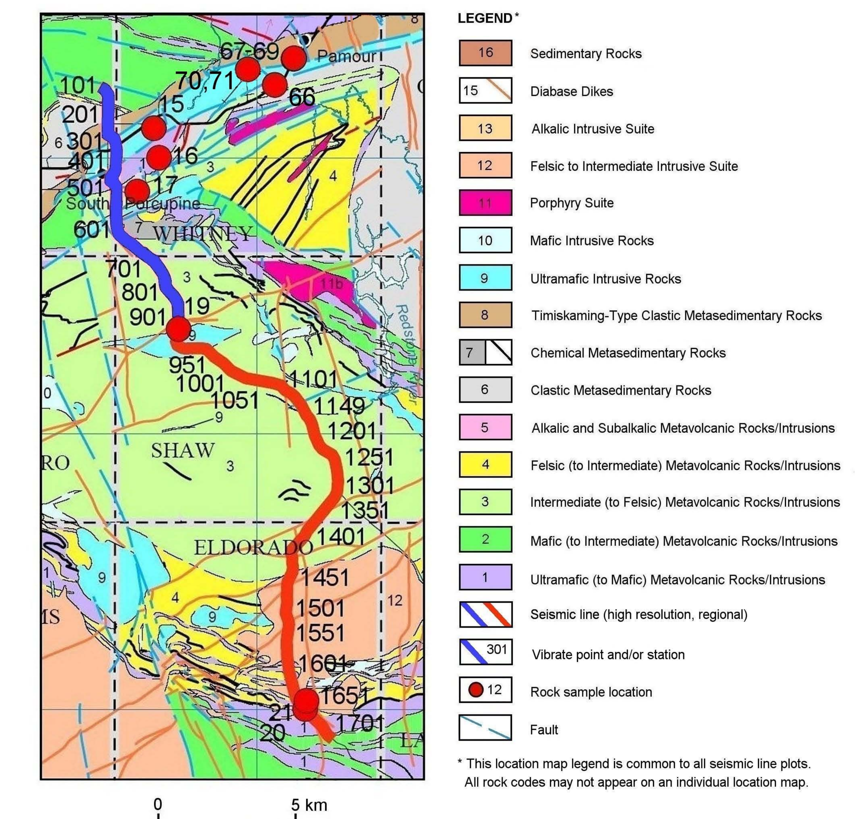
North West







Line 101A location map (geology *from* Ayer et al. (2005)).



Discover Abitibi Initiative
The Discover Abitibi Initiative is a regional, cluster economic development project focused on geoscientific investigations of the western Abitibi greenstone belt. The initiative, centred on the Kirkland Lake and Timmins mining camps, will complete 19 projects developed and directed by the local stakeholders. FedNor, Northern Ontario Heritage Fund Corporation, municipalities and private sector investors have provided the funding for the initiative.

Initiative Découvrons l'Abitibi
L'initiative *Découvrons l'Abitibi* est un projet de développement économique régional dans une grappe d'industries, projet fondé sur des études géoscientifiques de la ceinture de roches vertes de l'Abitibi occidental. Cette initiative, centrée sur les zones minières de Kirkland Lake et de Timmins, mènera à bien 19 projets élaborés et dirigés par des intervenants locaux. FedNor, la Société de gestion du Fonds du patrimoine du Nord de l'Ontario, municipalités et des investisseurs du secteur privé ont fourni les fonds de cette initiative.

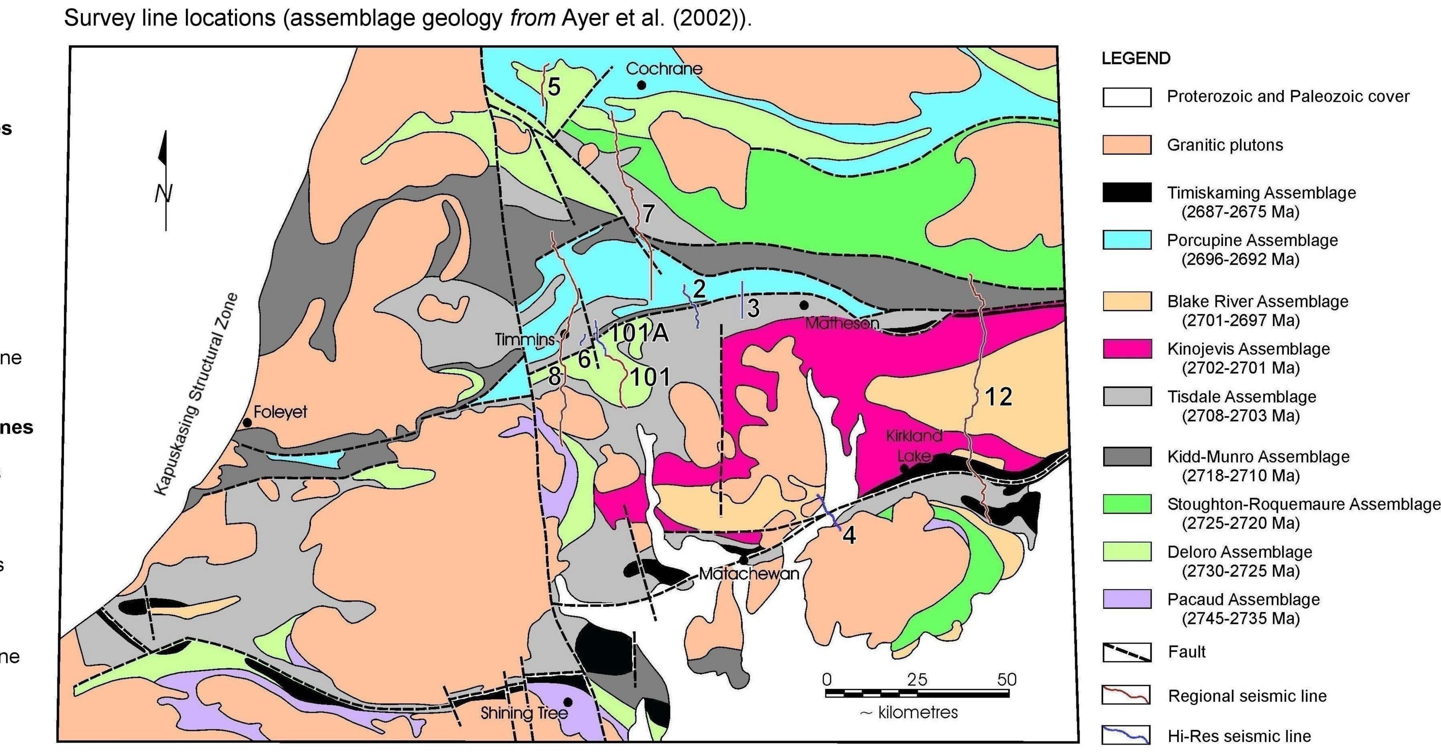
Survey line locations (assemblage geology *from* Ayer et al. (2002)).

Hi-Res Seismic Lines

2. Kettle Lakes
3. Shillington
4. Watabeag
6. Back Road
101A. South Porcupine

Regional Seismic Lines

5. North Timmins
7. Crawchest
8. South Timmins
12. Kapuskasing
101. South Porcupine



FIELD PARAMETERS

Recorded by	Kinetex Inc., Party 101 June, 2004
Recorded for	Timmins Economic Development Corporation
Amplifier	I/O System Four, 961 channels maximum SEG-Y format, IEEE Floating Point 1/2 Nyquist Minimum Phase, Notch OUT
Record Length	6.0 seconds 2 ms sample interval
Source	Vibroseis, 2 Vibrators over 18 m 3 sweeps of 28 seconds, 10-160 Hz non-linear +3 dB/Oct boost
Geophones	I/O VectorSeis SVSM Single 3-component phone
Source Interval	25.0 meters
Group Interval	12.5 meters for stations 101 - 901 25.0 meters for stations 902 - 1381
Nominal Fold	24000%
Nominal Spread	6000 - 0 - VP - 0 - 6000 meters

PROCESSING SEQUENCE

Processed by	Sensor Geophysical Ltd. February, 2005
SEG-Y Reformat	
Record length	6.0 seconds
Sample interval	2 ms
Geometry Assignment	
Crooked Line Binning	
Common Depth Point (CDP) separation	6.25 m
Trace Kills	
Amplitude Recovery	
Method	Spherical divergence correction
1st Surface-Consistent Deconvolution	
Components	Resolved: Source, Receiver, Offset Applied: Source, Receiver
Type	Spiking
Operator length	100 ms
Prewhitening	0.1%
Design window	370-4500 ms at 25 m offset 3500-4750 ms at 10750 m offset
Offsets used in design	500-5000 m
1st Vibroseis Deconvolution Compensation	
Refraction Statics Correction	
Datum elevation	300 m
Replacement velocity	6000 m/s
Processing datum	Floating
Number of layers replaced	1
Velocity Analysis	
Surface-Consistent Statics	
Method	Stack power maximization
Maximum allowed shift	20 ms
Correlation window	Various
Normal Moveout Removal	
Automatic Gain Control (AGC)	
Application Mode	Apply and save
AGC operator length	500 ms
Analysis bandwidth	15/20-55/70 Hz
Shot-Mode f-k Filter	Polygon to attenuate shear refractions
Size of impulse response	250 ms by 1000 m
Automatic Gain Control	
Application Mode	Remove AGC
Automatic Gain Control	
Application Mode	Apply and save
AGC operator length	500 ms
Analysis bandwidth	15/20-55/70 Hz
Shot-Mode f-k Filter	Polygon to attenuate surface wave
Size of impulse response	400 ms by 625 m
Automatic Gain Control	
Application Mode	Remove AGC
Automatic Gain Control	
Application Mode	Apply and save
AGC operator length	500 ms
Analysis bandwidth	15/20-55/70 Hz
Receiver-Mode f-k Filter	Polygon to attenuate shear refractions
Size of impulse response	250 ms by 1000 m
Automatic Gain Control	
Application Mode	Remove AGC
Normal Moveout Restoration	
2nd Surface-Consistent Deconvolution	
Components	Resolved: Source, Receiver, Offset Applied: Source, Receiver
Type	Spiking
Operator length	100 ms
Prewhitening	0.1%
Design window	200-1750 ms at 0 m offset 300-2000 ms at 750 m offset 550-4500 ms at 1650 m offset 2500-4750 ms at 9000 m offset
Offsets used in design	37.5-6000 m
2nd Vibroseis Deconvolution Compensation	
Time-Variant Spectral Whitening	
Balancing window length	500 ms
Balancing bandwidth	4/10-148/170 Hz
Number of frequency panels	13
Velocity Analysis	
Surface-Consistent Statics	
Method	Stack power maximization
Maximum allowed shift	24 ms
Correlation window	400-5400 ms
Normal Moveout Correction	
Automatic Gain Control	
Application Mode	Apply
AGC operator length	1000 ms
Analysis bandwidth	15/20-55/70 Hz
Common Depth Point (CDP) Stack Within Common Offset Bins	
Method	Mean with linear fold interpolation
Offset bin centers	50 to 9250 m
Offset bin center increment	100.00 m
Offset bin width	125.00 m
CDP trace spacing	6.25 m
F-X Prediction Filtering	
Filter type	2-sided Wiener-Levinson
Number of slopes	8
Horizontal window length	40 traces
Time window length	100 ms
Time window overlap	50 ms
Automatic Gain Control	
Application Mode	Apply
AGC operator length	1000 ms
Analysis bandwidth	15/20-55/70 Hz
Dip Moveout (DMO) Correction	
Method	Common Offset F-K
Offset bin centers	50 to 9250 m
Offset bin center increment	100 m
DMO stretch factor	0.6
Perform dip filtering	Yes
Front-End Muting	
Offset	325 1525 7975 m
Mute time	0 400 2000 ms
Automatic Gain Control	
Application Mode	Apply
AGC operator length	1000 ms
Analysis bandwidth	15/20-55/70 Hz
CDP Stack	
Method	Simple mean
Bulk Shift	+100 ms
Anisotropic Diffusion Filter	
Design window size	40 traces x 80 ms
Number of diffusion steps	5
Diffusion rate	0.25
With edge preservation	Yes
Bandpass Filter	
Zero-phase Ormsby	5/10-100/120 Hz 0-2000 ms 5/10- 40/ 60 Hz 3500-6000 ms
Trace Equalization	
Mean window	500-5500 ms
Analysis bandwidth	10/20-40/60 Hz
Time Migration From Surface	
Method	Implicit finite difference
Dip aperture	0-65 degrees
Velocity function	100% of DMO stacking velocities
Bandpass Filter	
Zero-phase Ormsby	10/20 - 120/140 Hz
Time-Variant Scaling	
Method	Centre-to-centre
Mean windows	200-600, 500-2200, 2000-3200 and 3000-6000 ms
2:1 Trace Decimation	

DISPLAY PARAMETERS

Traces/Inch =	101.6	Display Gain =	0.8
Inches/Second =	3.75	Clip Limit =	6
NORMAL POLARITY		Tue Mar 8 17:59:37 2005	

SENSOR GEOPHYSICAL LTD.

REFERENCES

Ayer,J.A., Amelin,Y, Corfu,F., Kamo,S.L., Ketchum,J.W.F., Kwok,K. and Trowell,N. 2002. Evolution of the southern Abitibi greenstone belt based on U-Pb geochronology: autochthonous volcanic construction followed by plutonism, regional deformation and sedimentation; Precambrian Research, v.115, p.63-95.

Ayer,J.A., Berger,B.R., Hall,L.A.F., Houlé, M.G., Johns,G.W., Josey,S., Madon,Z., Rainsford,D., Trowell,N.F. and Vaillancourt,C. 2005. Geological compilation of the central Abitibi greenstone belt: Kapuskasing Structural Zone to the Québec border; Ontario Geological Survey, Preliminary Map P.3565, scale 1:250 000.

Accompanies Open File Report 6169.

SOUTH PORCUPINE
REGIONAL REFLECTION SEISMIC LINE 101

Vibrate Points 1701 - 101
MIGRATED DMO STACK

Normal Polarity
Scale 1:50 000

Acquisition - Kinetex Inc.
Processing - Sensor Geophysical Ltd.

North West

CDP 2000 TIME	VEL	INTV
0	1536	5752
500	5752	6419
1000	6095	6201
1500	6130	6074
2000	6116	6630
2500	6222	6794
3000	6321	6813
3500	6394	6730
4000	6437	6777
4500	6476	6804
5000	6509	6812
5500	6537	6838
6000	6563	6845
6500	6585	6921
7000	6609	6905
7500	6630	6945
8000	6650	6929
8500	6667	6963
9000	6683	6952
9500	6698	6981
10000	6712	6975
10500	6725	7000
11000	6738	6993
11500	6749	7016
12000	6760	

CDP 1800 TIME	VEL	INTV
0	1536	5790
500	5790	6132
1000	5964	6175
1500	6035	6643
2000	6193	6690
2500	6295	6805
3000	6383	6846
3500	6451	6664
4000	6478	6653
4500	6498	6670
5000	6515	6814
5500	6543	6839
6000	6568	6845
6500	6590	6920
7000	6614	6904
7500	6634	6943
8000	6653	6926
8500	6670	6958
9000	6686	6947
9500	6700	6975
10000	6714	6968
10500	6726	6992
11000	6739	6984
11500	6749	7006
12000	6760	

CDP 1600 TIME	VEL	INTV
0	1536	5674
500	5674	6023
1000	5851	6463
1500	6062	6685
2000	6224	6723
2500	6327	6839
3000	6415	6799
3500	6471	6598
4000	6487	6594
4500	6499	6681
5000	6517	6814
5500	6545	6839
6000	6570	6845
6500	6592	6920
7000	6616	6903
7500	6635	6942
8000	6655	6925
8500	6671	6957
9000	6687	6945
9500	6701	6972
10000	6715	6965
10500	6727	6989
11000	6739	6981
11500	6750	7002
12000	6760	

CDP 1400 TIME	VEL	INTV
0	1551	5712
500	5712	6201
1000	5961	6529
1500	6156	6672
2000	6289	6647
2500	6362	6694
3000	6419	6660
3500	6454	6643
4000	6478	6658
4500	6498	6694
5000	6518	6814
5500	6545	6839
6000	6570	6845
6500	6592	6920
7000	6616	6903
7500	6635	6941
8000	6655	6924
8500	6671	6956
9000	6687	6945
9500	6701	6972
10000	6715	6964
10500	6727	6988
11000	6739	6980
11500	6750	7002
12000	6760	

CDP 1200 TIME	VEL	INTV
0	1563	5830
500	5830	6371
1000	6106	6592
1500	6273	6668
2000	6374	6578
2500	6415	6604
3000	6447	6527
3500	6459	6604
4000	6477	6659
4500	6497	6690
5000	6517	6814
5500	6545	6839
6000	6570	6845
6500	6591	6920
7000	6615	6903
7500	6635	6942
8000	6654	6925
8500	6671	6957
9000	6687	6946
9500	6701	6973
10000	6715	6966
10500	6727	6990
11000	6739	6982
11500	6750	7003
12000	6760	

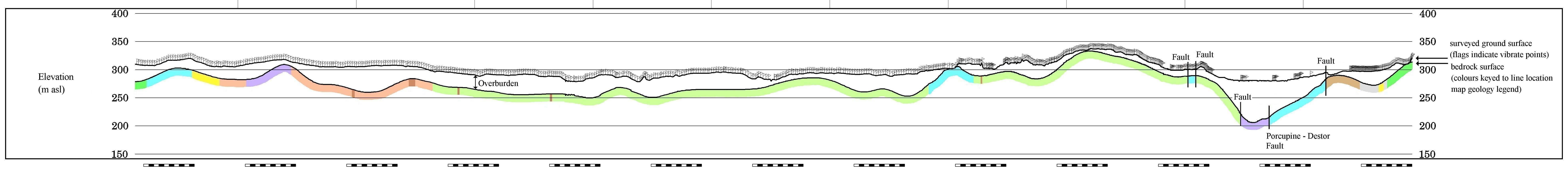
CDP 1000 TIME	VEL	INTV
0	1506	5594
500	5594	6198
1000	5904	6503
1500	6110	6673
2000	6255	6668
2500	6340	6710
3000	6403	6702
3500	6447	6685
4000	6477	6660
4500	6498	6672
5000	6515	6814
5500	6543	6839
6000	6568	6845
6500	6590	6920
7000	6614	6904
7500	6634	6943
8000	6653	6926
8500	6670	6958
9000	6686	6947
9500	6700	6975
10000	6714	6968
10500	6726	6992
11000	6739	6985
11500	6749	7006
12000	6760	

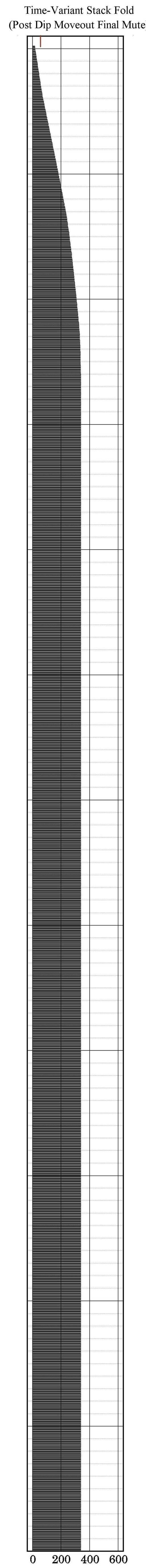
CDP 800 TIME	VEL	INTV
0	1454	5496
500	5496	6156
1000	5835	6450
1500	6047	6634
2000	6199	6655
2500	6293	6752
3000	6372	6777
3500	6431	6790
4000	6477	6694
4500	6502	6695
5000	6521	6815
5500	6548	6839
6000	6573	6844
6500	6594	6919
7000	6618	6902
7500	6637	6940
8000	6657	6922
8500	6673	6954
9000	6689	6942
9500	6702	6969
10000	6716	6961
10500	6728	6984
11000	6739	6976
11500	6750	6996
12000	6760	

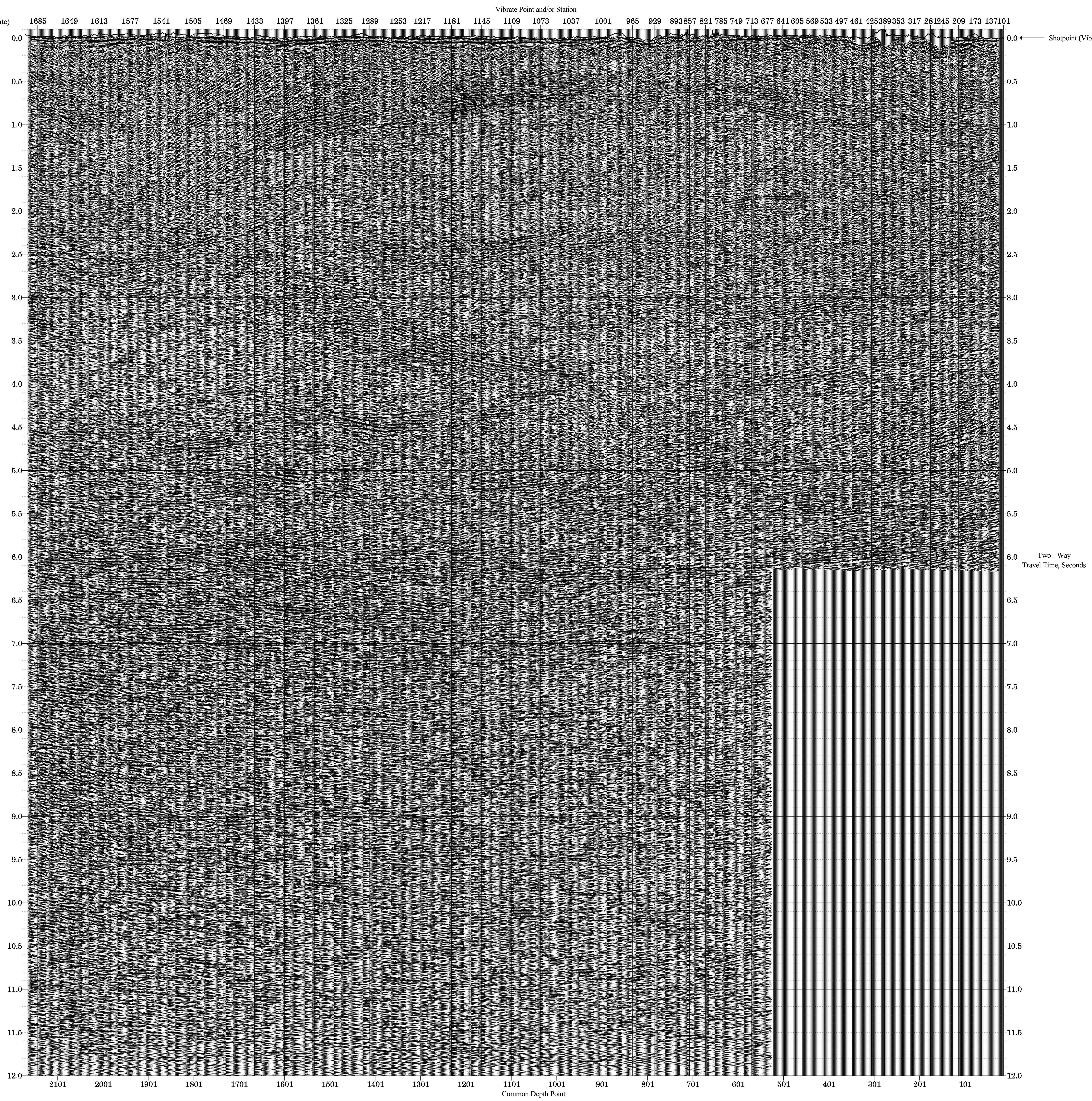
CDP 600 TIME	VEL	INTV
0	1483	5594
500	5594	6265
1000	5939	6537
1500	6145	6704
2000	6289	6704
2500	6374	6782
3000	6444	6786
3500	6494	6778
4000	6530	6681
4500	6547	6665
5000	6559	6825
5500	6584	6845
6000	6606	6844
6500	6624	6914
7000	6646	6891
7500	6662	6923
8000	6679	6900
8500	6692	6926
9000	6705	6908
9500	6716	6929
10000	6727	6916
10500	6736	6934
11000	6745	6919
11500	6753	6935
12000	6760	

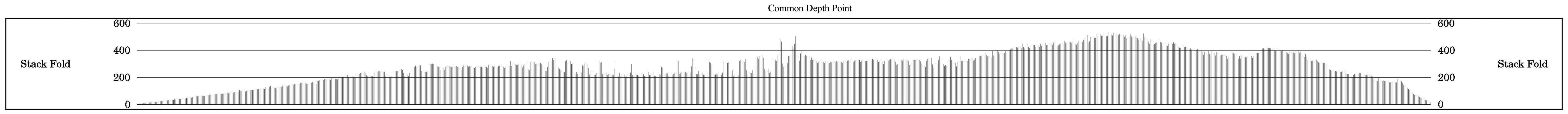
CDP 400 TIME	VEL	INTV
0	1518	5653
500	5653	6241
1000	5954	6559
1500	6163	6732
2000	6310	6735
2500	6397	6818
3000	6469	6826
3500	6521	6818
4000	6559	6671
4500	6572	6645
5000	6579	6830
5500	6602	6847
6000	6623	6844
6500	6640	6911
7000	6660	6885
7500	6675	6914
8000	6690	6888
8500	6702	6911
9000	6714	6890
9500	6723	6909
10000	6733	6892
10500	6740	6907
11000	6748	6890
11500	6754	6902
12000	6760	

CDP 200 TIME	VEL	INTV
0	1506	5605
500	5605	6184
1000	5901	6494
1500	6105	6695
2000	6258	6713
2500	6352	6810
3000	6430	6832
3500	6489	6836
4000	6534	6715
4500	6554	6706
5000	6569	6829
5500	6593	6846
6000	6615	6844
6500	6633	6913
7000	6653	6887
7500	6669	6919
8000	6685	6894
8500	6697	6918
9000	6710	6899
9500	6720	6919
10000	6730	6903
10500	6738	6920
11000	6747	6904
11500	6753	6918
12000	6760	

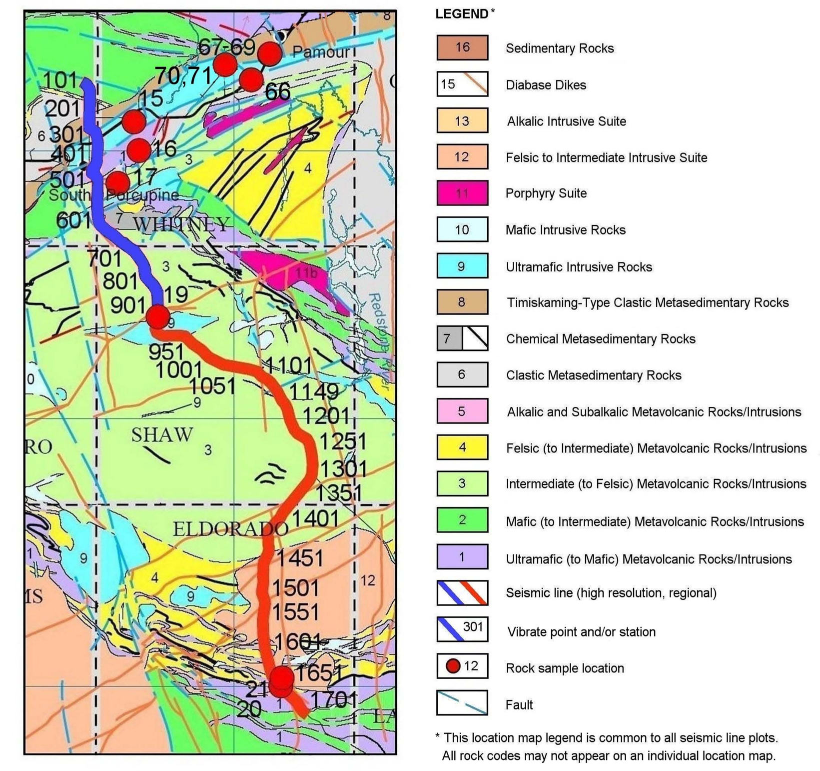








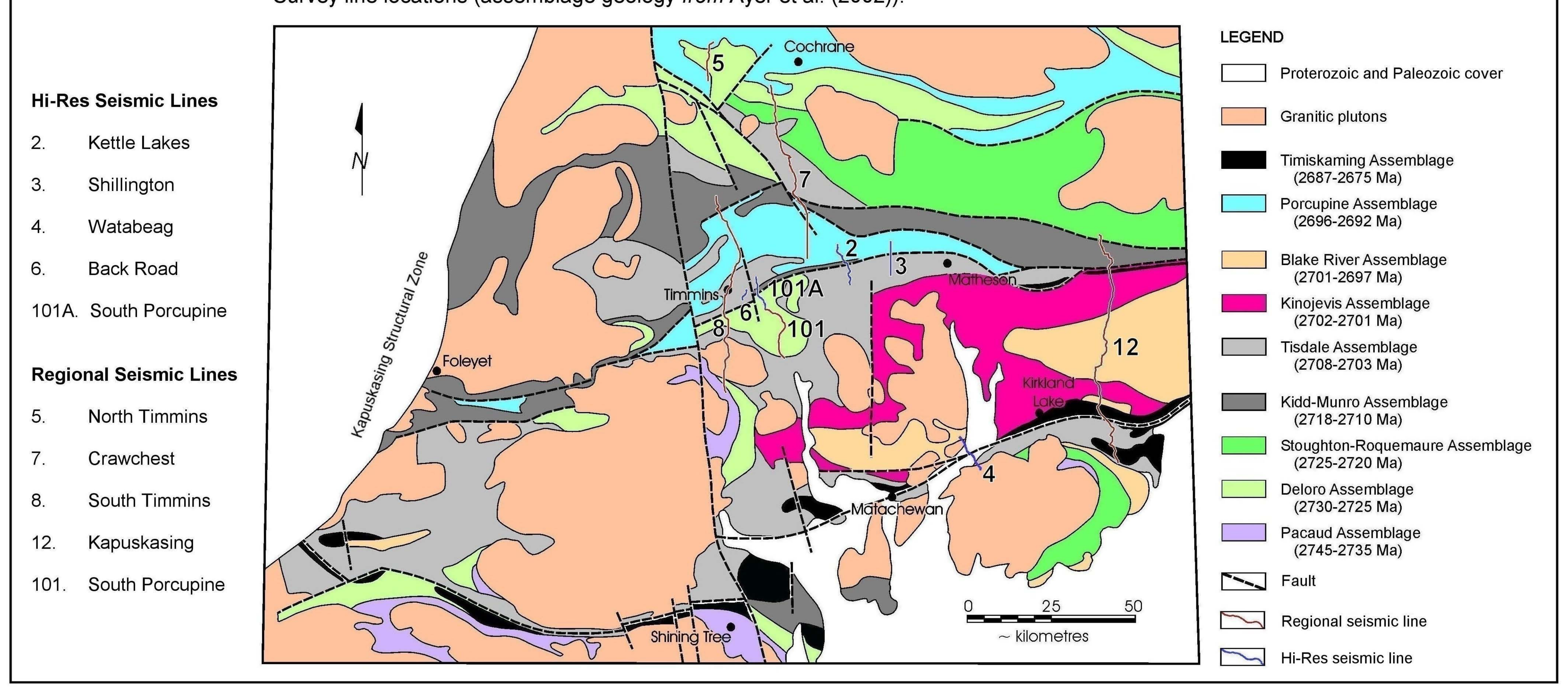
Line 101 location map (geology *from* Ayer et al. (2005)).



Discover Abitibi Initiative
The Discover Abitibi Initiative is a regional, cluster economic development project based on geoscientific investigations of the western Abitibi greenstone belt. The initiative, centred on the Kirkland Lake and Timmins mining camps, will complete 19 projects developed and directed by the local stakeholders. FedNor, Northern Ontario Heritage Fund Corporation, municipalities and private sector investors have provided the funding for the initiative.

Initiative Découvrons l'Abitibi
L'initiative *Découvrons l'Abitibi* est un projet de développement économique régional dans une grappe d'industries, projet fondé sur des études géoscientifiques de la ceinture de roches vertes de l'Abitibi occidental. Cette initiative, centrée sur les zones minières de Kirkland Lake et de Timmins, mènera à bien 19 projets élaborés et dirigés par des intervenants locaux. FedNor, la Société de gestion du Fonds du patrimoine du Nord de l'Ontario, les municipalités et des investisseurs du secteur privé ont fourni les fonds de cette initiative.

Survey line locations (assemblage geology *from* Ayer et al. (2002)).



FIELD PARAMETERS

Recorded by	Kinetex Inc., Party 101 June, 2004
Recorded for	Timmins Economic Development Corporation
Amplifier	I/O System Four, 961 channels maximum SEG-Y format, IEEE Floating Point 1/2 Nyquist Minimum Phase, Notch OUT
VPs 101 - 901	
Record Length	6.0 seconds 2 ms sample interval
Source	Vibroseis, 2 Vibrators over 18 m 3 sweeps of 28 seconds, 10-160 Hz non-linear +3 dB/Oct boost
Geophones	I/O VectorSeis SVSM Single 3-component phone
Source Interval	25.0 meters
Group Interval	12.5 meters
Nominal Fold	24000%
Nominal Spread	6000 - 0 - VP - 0 - 6000 meters
VPs 902 - 1701	
Record Length	12.0 seconds 2 ms sample interval
Source	Vibroseis, 3 Vibrators over 27 m 6 sweeps of 28 seconds, 10-96 Hz Linear
Geophones	I/O VectorSeis SVSM Single 3-component phone
Source Interval	50 meters
Group Interval	25 meters
Nominal Fold	24000%
Nominal Spread	12000 - 0 - VP - 0 - 12000 meters

PROCESSING SEQUENCE

Processed by	Sensor Geophysical Ltd. February, 2005
SEG-Y Reformat	
Record length	12.0 seconds
Sample interval	2 ms
Geometry Assignment	
Crooked Line Binning	
Common Depth Point (CDP) separation	12.5 m
Trace Kills	
Amplitude Recovery	
Method	Spherical divergence correction
1st Surface-Consistent Deconvolution	
Components	Resolved: Source, Receiver, Offset Applied: Source, Receiver
Type	Spiking
Operator length	100 ms
Prewhitening	0.1%
Design window	370-4500 ms at 25 m offset 3500-4750 ms at 10750 m offset
Offsets used in design	500-5000 m
1st Vibroseis Deconvolution Compensation	
Refraction Statics Correction	
Datum elevation	300 m
Replacement velocity	6000 m/s
Processing datum	Floating
Number of layers replaced	1
Velocity Analysis	
Surface-Consistent Statics	
Method	Stack power maximization
Maximum allowed shift	20 ms
Correlation window	Various
Normal Moveout Removal	
Automatic Gain Control	
Application Mode	Apply and save
AGC operator length	500 ms
Analysis bandwidth	15/20-55/70 Hz
Shot-Mode f-k Filter	Polygon to attenuate shear refractions
Size of impulse response	250 ms by 1000 m
Automatic Gain Control (AGC)	
Application Mode	Remove AGC
Automatic Gain Control	
Application Mode	Apply and save
AGC operator length	500 ms
Analysis bandwidth	15/20-55/70 Hz
Shot-Mode f-k Filter	Polygon to attenuate surface wave
Size of impulse response	400 ms by 625 m
Receivers filtered	101 - 901
Automatic Gain Control	
Application Mode	Remove AGC
Automatic Gain Control	
Application Mode	Apply and save
AGC operator length	500 ms
Analysis bandwidth	15/20-55/70 Hz
Receiver-Mode f-k Filter	Polygon to attenuate shear refractions
Size of impulse response	250 ms by 1000 m
Automatic Gain Control	
Application Mode	Remove AGC

Normal Moveout Restoration	
2nd Surface-Consistent Deconvolution	
Components	Resolved: Source, Receiver, Offset Applied: Source, Receiver
Type	Spiking
Operator length	100 ms
Prewhitening	0.1%
Design window	200-1750 ms at 0 m offset 300-2000 ms at 750 m offset 550-4500 ms at 1650 m offset 2500-4750 ms at 9000 m offset
Offsets used in design	37.5-6000 m
2nd Vibroseis Deconvolution Compensation	
Time-Variant Spectral Whitening	
Balancing window length	500 ms
VPs 101 - 901	
Balancing bandwidth	4/10-148/170 Hz
Number of frequency panels	13
VPs 902 - 1701	
Balancing bandwidth	4/10- 96/120 Hz
Number of frequency panels	8
Velocity Analysis	
Surface-Consistent Statics	
Method	Stack power maximization
Maximum allowed shift	24 ms
Correlation window	400-5400 ms
Normal Moveout Correction	
Automatic Gain Control	
Application Mode	Apply
AGC operator length	1000 ms
Analysis bandwidth	15/20-55/70 Hz
Common Depth Point (CDP) Stack Within Common Offset Bins	
Method	Mean with linear fold interpolation
Offset bin centers	50 to 10750 m
Offset bin center increment	100.0 m
Offset bin width	125.0 m
CDP trace spacing	12.5 m
F-X Prediction Filtering	
Filter type	2-sided Wiener-Levinson
Number of slopes	8
Horizontal window length	40 traces
Time window length	100 ms
Time window overlap	50 ms
Automatic Gain Control	
Application Mode	Apply
AGC operator length	1000 ms
Analysis bandwidth	15/20-55/70 Hz
Dip Moveout (DMO) Correction	
Method	Common Offset F-K
Offset bin centers	50 to 10750 m
Offset bin center increment	100 m
DMO stretch factor	0.6
Perform dip filtering	Yes
Front-End Muting	
Offset	325 1525 7975 m
Mute time	0 400 2000 ms
Automatic Gain Control	
Application Mode	Apply
AGC operator length	1000 ms
Analysis bandwidth	15/20-55/70 Hz
CDP Stack	
Method	Simple mean
Bulk Shift	+100 ms
Anisotropic Diffusion Filter	
Design window size	40 traces x 80 ms
Number of diffusion steps	5
Diffusion rate	0.25
With edge preservation	Yes
Bandpass Filter	
Zero-phase Ormsby	5/10-100/120 Hz 0-2000 ms 5/10- 40/ 60 Hz 3500-6000 ms
Time-Variant Scaling	
Method	Edge-to-edge
Mean windows	500-5000, 5500-6000, 6500-10000
Trace Equalization	
Mean window	500-5500 ms
Analysis bandwidth	10/20-40/60 Hz
Time Migration From Surface	
Method	Implicit finite difference
Dip aperture	0-65 degrees
Velocity function	100% of DMO stacking velocities
Bandpass Filter	
Zero-phase Ormsby	10/20 - 120/140 Hz
Time-Variant Scaling	
Method	Centre-to-centre
Mean windows	200-600, 500-2200, 2000-3200 and 3000-6000 ms
2:1 Trace Decimation	

DISPLAY PARAMETERS

Traces/Inch =	101.6	Display Gain =	0.8
Inches/Second =	1.875	Clip Limit =	6
NORMAL POLARITY		Tue Mar 8 17:55:25 2005	

SENSOR GEOPHYSICAL LTD.

REFERENCES

Ayer, J.A., Amelin, Y., Corfu, F., Kamo, S.L., Ketchum, J.W.F., Kwok, K. and Trowell, N. 2002. Evolution of the southern Abitibi greenstone belt based on U-Pb geochronology: autochthonous volcanic construction followed by plutonism, regional deformation and sedimentation; Precambrian Research, v.115, p.63-95.

Ayer, J.A., Berger, B.R., Hall, L.A.F., Houlé, M.G., Johns, G.W., Josey, S., Madon, Z., Rainsford, D., Trowell, N.F. and Vaillancourt, C. 2005. Geological compilation of the central Abitibi greenstone belt: Kapuskasing Structural Zone to the Quebec border; Ontario Geological Survey, Preliminary Map P.3565, scale 1:250 000.

Accompanies Open File Report 6169.

BACK ROAD HIGH-RESOLUTION REFLECTION SEISMIC LINE 6

Vibrate Points 421 - 101
MIGRATED DMO STACK

Normal Polarity
Scale 1:25 000

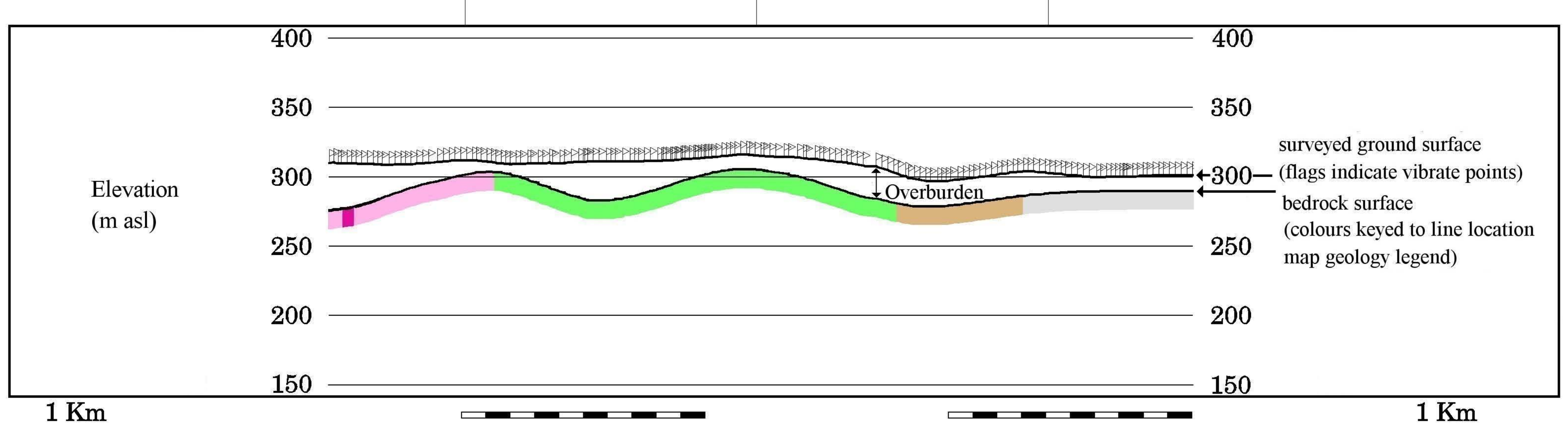
Acquisition - Kinetex Inc.
Processing - Sensor Geophysical Ltd.

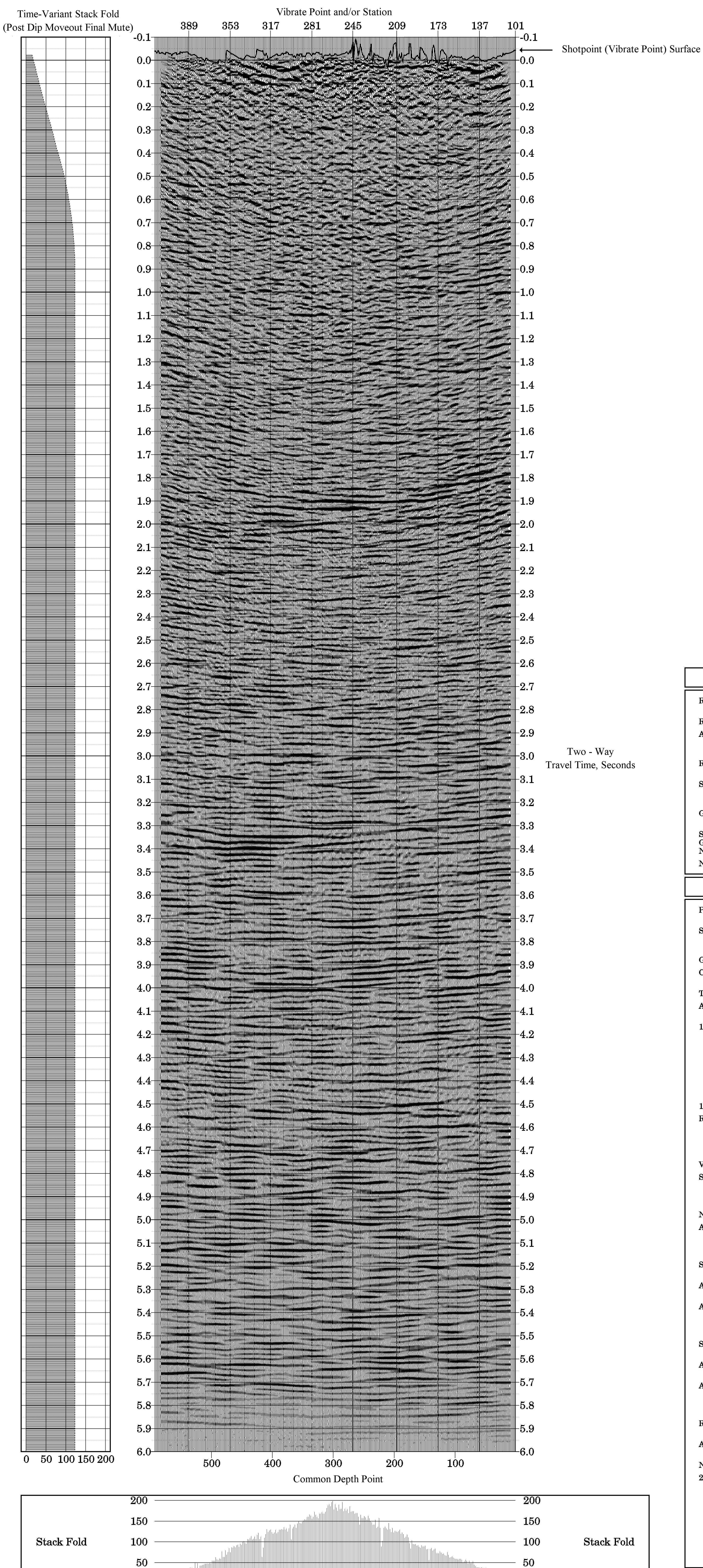
CDP 500		
TIME	VEL	INTV
0	1490	5583
500	5583	6307
1000	5956	6977
1500	6315	7379
2000	6597	6821
2500	6642	6811
3000	6671	6722
3500	6678	6626
4000	6672	6570
4500	6660	6493
5000	6644	6545
5500	6635	6492
6000	6623	

CDP 300		
TIME	VEL	INTV
0	1490	5577
500	5577	6319
1000	5959	6975
1500	6316	7376
2000	6597	6821
2500	6642	6811
3000	6671	6721
3500	6678	6626
4000	6672	6569
4500	6660	6492
5000	6644	6544
5500	6635	6493
6000	6623	

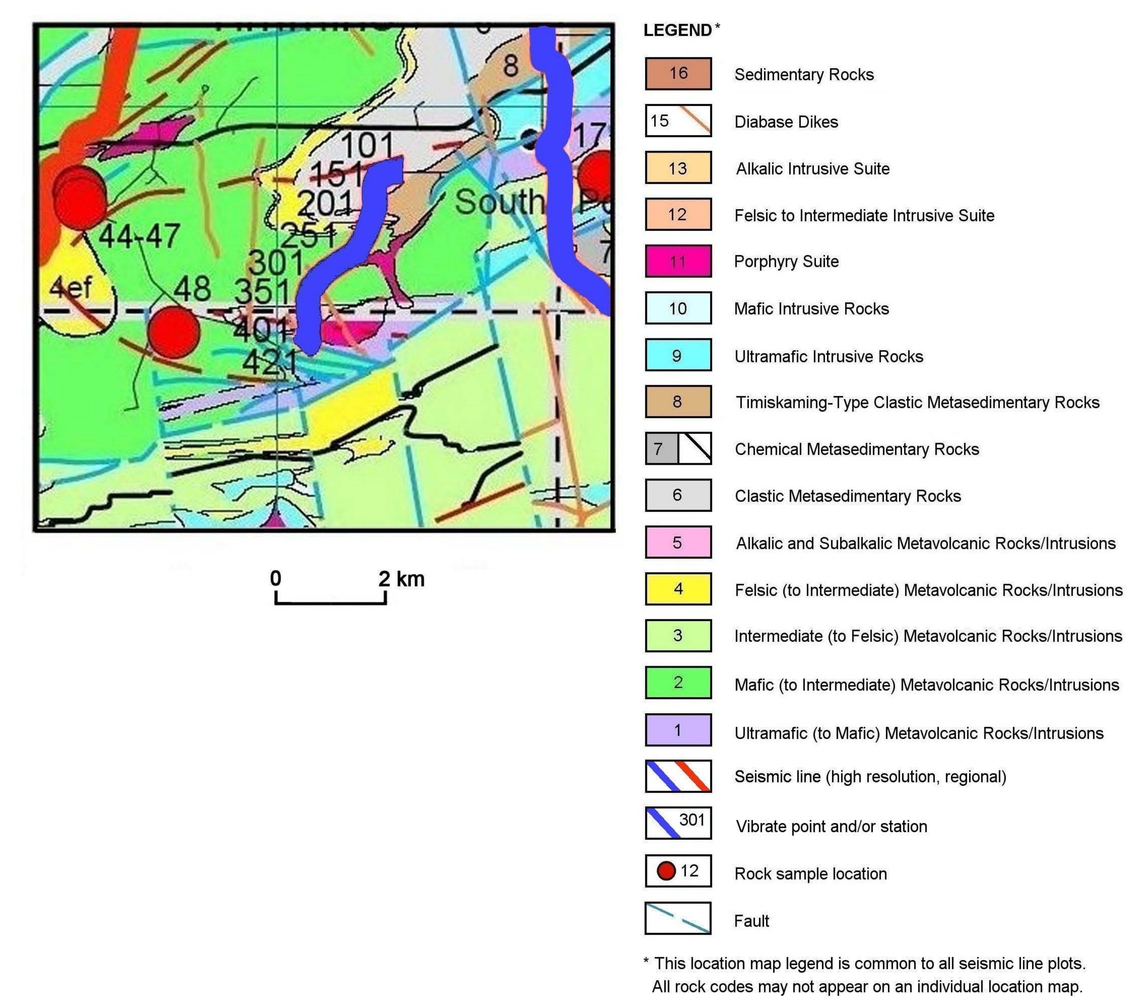
CDP 100		
TIME	VEL	INTV
0	1490	5576
500	5576	6367
1000	5984	7006
1500	6343	7287
2000	6592	6818
2500	6638	6810
3000	6667	6722
3500	6675	6628
4000	6669	6573
4500	6658	6498
5000	6642	6551
5500	6634	6500
6000	6623	

North East





Line 6 location map (geology *from* Ayer et al. (2005)).



FedNor Canada

Ontario
Northern Ontario Heritage Fund
Fonds du patrimoine du Nord de l'Ontario

Discover Abitibi
A project of innovation, cooperation and revitalization
Découvrons l' Abitibi
Un projet d' innovation, de coopération et de renouvellement

Discover Abitibi Initiative
The Discover Abitibi Initiative is a regional, cluster economic development project based on geoscientific investigations of the western Abitibi greenstone belt. The initiative, centred on the Kirkland Lake and Timmins mining camps, will complete 19 projects developed and directed by the local stakeholders. FedNor, Northern Ontario Heritage Fund Corporation, municipalities and private sector investors have provided the funding for the initiative.

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L'initiative *Découvrons l'Abitibi* est un project de développment économique régional dans une grappe d'industries, projet fondé sur des études géoscientifiques de la ceinture de roches vertes de l'Abitibi occidental. Cette initiative, centrée sur les zones minières de Kirkland Lake et de Timmins, mènera à bien 19 projets élaborés et dirigés par des intervenants locaux. FedNor, la Société de gestion du Fonds du patrimoine du Nord de l'Ontario, municipalités et des investisseurs du secteur privé ont fourni les fonds de cette initiative.

Timmins

KIRKLAND LAKE
THE RIGHT ENVIRONMENT

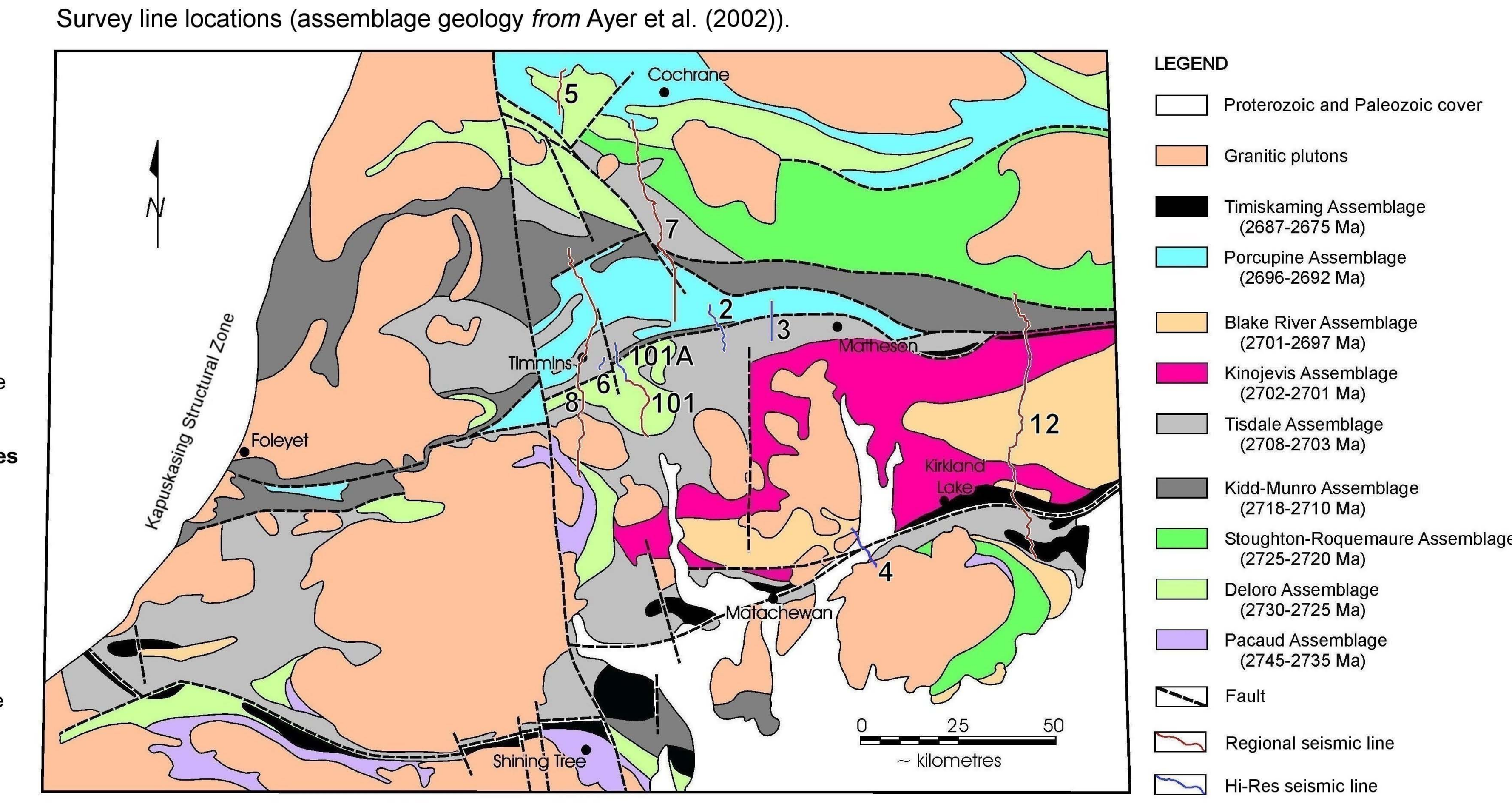
Survey line locations (assemblage geology *from* Ayer et al. (2002)).

Hi-Res Seismic Lines

2. Kettle Lakes
3. Shillington
4. Watabeag
6. Back Road
101A. South Porcupine

Regional Seismic Lines

5. North Timmins
7. Crawchest
8. South Timmins
12. Kapuskasing
101. South Porcupine



FIELD PARAMETERS

Recorded by	Kinetex Inc., Party 101 June, 2004
Recorded for	Timmins Economic Development Corporation
Amplifier	I/O System Four, 321 channels maximum SEG-Y format, IEEE Floating Point 1/2 Nyquist Minimum Phase, Notch OUT
Record Length	6.0 seconds 2 ms sample interval
Source	Vibroseis, 2 Vibrators over 18 m 3 sweeps of 28 seconds, 10-160 Hz non-linear +3 dB/Oct boost
Geophones	I/O VectorSeis SVSM Single 3-component phone
Source Interval	25.0 meters
Group Interval	12.5 meters
Nominal Fold	24000%
Nominal Spread	6000 - 0 - VP - 0 - 6000 meters

PROCESSING SEQUENCE

Processed by	Sensor Geophysical Ltd. February, 2005
SEG-Y Reformat	
Record length	6.0 seconds
Sample interval	2 ms
Geometry Assignment	
Crooked Line Binning	
Common Depth Point (CDP) separation	6.25 m
Trace Kills	
Amplitude Recovery	
Method	Spherical divergence correction
1st Surface-Consistent Deconvolution	
Components	Resolved: Source, Receiver, Offset Applied: Source, Receiver
Type	Spiking
Operator length	100 ms
Prewhitening	0.1%
Design window	370-4500 ms at 25 m offset 2900-4700 ms at 8700 m offset
Offsets used in design	500-5000 m
1st Vibroseis Deconvolution Compensation	
Refraction Statics Correction	
Datum elevation	300 m
Replacement velocity	6000 m/s
Processing datum	Floating
Number of layers replaced	1
Velocity Analysis	
Surface-Consistent Statics	
Method	Stack power maximization
Maximum allowed shift	20 ms
Correlation window	Various
Normal Moveout Removal	
Automatic Gain Control (AGC)	
Application Mode	Apply and save
AGC operator length	500 ms
Analysis bandwidth	15/20-55/70 Hz
Shot-Mode f-k Filter	Polygon to attenuate shear refractions
Size of impulse response	250 ms by 1000 m
Automatic Gain Control	
Application Mode	Remove AGC
Automatic Gain Control	
Application Mode	Apply and save
AGC operator length	500 ms
Analysis bandwidth	15/20-55/70 Hz
Shot-Mode f-k Filter	Polygon to attenuate surface wave
Size of impulse response	400 ms by 625 m
Automatic Gain Control	
Application Mode	Remove AGC
Automatic Gain Control	
Application Mode	Apply and save
AGC operator length	500 ms
Analysis bandwidth	15/20-55/70 Hz
Receiver-Mode f-k Filter	Polygon to attenuate shear refractions
Size of impulse response	250 ms by 1000 m
Automatic Gain Control	
Application Mode	Remove AGC
Normal Moveout Restoration	
2nd Surface-Consistent Deconvolution	
Components	Resolved: Source, Receiver, Offset Applied: Source, Receiver
Type	Spiking
Operator length	100 ms
Prewhitening	0.1%
Design window	200-1750 ms at 0 m offset 300-2000 ms at 750 m offset 550-4500 ms at 1650 m offset 2500-4750 ms at 9000 m offset
Offsets used in design	37.5-6000 m
2nd Vibroseis Deconvolution Compensation	
Time-Variant Spectral Whitening	
Balancing window length	500 ms
Balancing bandwidth	4/10-148/170 Hz
Number of frequency panels	13
Velocity Analysis	
Surface-Consistent Statics	
Method	Stack power maximization
Maximum allowed shift	24 ms
Correlation window	400-5400 ms
Normal Moveout Correction	
Automatic Gain Control	
Application Mode	Apply
AGC operator length	1000 ms
Analysis bandwidth	15/20-55/70 Hz
Common Depth Point (CDP) Stack Within Common Offset Bins	
Method	Mean with linear fold interpolation
Offset bin centers	25 to 3225 m
Offset bin center increment	50.00 m
Offset bin width	62.50 m
CDP trace spacing	6.25 m
F-X Prediction Filtering	
Filter type	2-sided Wiener-Levinson
Number of slopes	8
Horizontal window length	40 traces
Time window length	100 ms
Time window overlap	50 ms
Automatic Gain Control	
Application Mode	Apply
AGC operator length	1000 ms
Analysis bandwidth	15/20-55/70 Hz
Dip Moveout (DMO) Correction	
Method	Common Offset F-K
Offset bin centers	25 to 3225 m
Offset bin center increment	50 m
DMO stretch factor	0.6
Perform dip filtering	Yes
Front-End Muting	
Offset	325 1525 7975 m
Mute time	0 400 2000 ms
Automatic Gain Control	
Application Mode	Apply
AGC operator length	1000 ms
Analysis bandwidth	15/20-55/70 Hz
CDP Stack	
Method	Simple mean
Bulk Shift	+100 ms
Anisotropic Diffusion Filter	
Design window size	40 traces x 80 ms
Number of diffusion steps	5
Diffusion rate	0.25
With edge preservation	Yes
Bandpass Filter	
Zero-phase Ormsby	5/10-100/120 Hz 0-2000 ms 5/10- 40/ 60 Hz 3500-6000 ms
Trace Equalization	
Mean window	500-5500 ms
Analysis bandwidth	10/20-40/60 Hz
Time Migration From Surface	
Method	Implicit finite difference
Dip aperture	0-65 degrees
Velocity function	100% of DMO stacking velocities
Bandpass Filter	
Zero-phase Ormsby	10/20 - 120/140 Hz
Time-Variant Scaling	
Method	Centre-to-centre
Mean windows	200-600, 500-2200, 2000-3200 and 3000-6000 ms
2:1 Trace Decimation	

DISPLAY PARAMETERS

Traces/Inch =	101.6	Display Gain =	0.8
Inches/Second =	3.75	Clip Limit =	6
NORMAL POLARITY		Tue Mar 8 17:31:10 2005	

SENSOR GEOPHYSICAL LTD.

REFERENCES

Ayer,J.A., Amelin,Y, Corfu,F., Kamo,S.L., Ketchum,J.W.F., Kwok,K. and Trowell,N. 2002. Evolution of the southern Abitibi greenstone belt based on U-Pb geochronology: autochthonous volcanic construction followed by plutonism, regional deformation and sedimentation; Precambrian Research, v.115, p.63-95.

Ayer,J.A., Berger,B.R., Hall,L.A.F., Houlé, M.G., Johns,G.W., Josey,S., Madon,Z., Rainsford,D., Trowell,N.F. and Vaillancourt,C. 2005. Geological compilation of the central Abitibi greenstone belt: Kapuskasing Structural Zone to the Québec border; Ontario Geological Survey, Preliminary Map P.3565, scale 1:250 000.

Accompanies Open File Report 6169.

CRAWCHEST
REGIONAL REFLECTION SEISMIC LINE 7

Vibrate Points 2705 - 501
MIGRATED DMO STACK

Normal Polarity
Scale 1:50 000

Acquisition - Kinetex Inc.
Processing - Sensor Geophysical Ltd.

TIME	CDP 200 VEL	CDP 200 INTV	CDP 400 VEL	CDP 400 INTV	CDP 600 VEL	CDP 600 INTV	CDP 800 VEL	CDP 800 INTV	CDP 1000 VEL	CDP 1000 INTV
0	1536	5708	1528	5645	1468	5453	1399	5214	1371	5176
500	5708	6136	5645	6081	5453	6012	5214	5876	5176	6153
1000	5928	6329	5867	6163	5739	6112	5555	6615	5686	6720
1500	6080	6517	6036	6315	5866	6364	5929	6603	6050	6606
2000	6180	6640	6205	6704	6005	6765	6145	6646	6194	6609
2500	6244	6490	6200	6657	6156	6738	6261	6485	6279	6688
3000	6286	6536	6245	6504	6257	6490	6310	6401	6349	6503
3500	6310	6353	6316	6353	6291	6374	6315	6321	6371	6439
4000	6326	6320	6318	6322	6301	6356	6316	6604	6380	6416
4500	6326	6270	6316	6387	6307	6600	6345	6862	6384	6505
5000	6229	6908	6325	6686	6337	6860	6398	6953	6396	6795
5500	6377	7082	6376	6972	6387	6929	6444	7007	6433	6840
6000	6440	7162	6431	7033	6434	6981	6489	6994	6468	6867
6500	6499	6880	6476	7101	6477	7101	6527	6770	6500	6866
7000	6527	6747	6520	6785	6527	6790	6542	6776	6527	6747
7500	6542	6776	6542	6776	6542	6776	6556	6750	6542	6776
8000	6556	6750	6556	6750	6556	6750	6568	6773	6556	6750
8500	6568	6773	6568	6773	6568	6773	6580	6752	6568	6773
9000	6580	6752	6580	6752	6580	6752	6589	6771	6580	6752
9500	6589	6771	6589	6771	6589	6771	6598	6754	6589	6771
10000	6598	6754	6598	6754	6598	6754	6605	6769	6598	6754
10500	6605	6769	6605	6769	6605	6769	6613	6752	6605	6769
11000	6613	6752	6613	6752	6613	6752	6619	6764	6613	6752
11500	6619	6764	6619	6764	6619	6764	6625		6619	6764
12000	6625		6625		6625				6625	

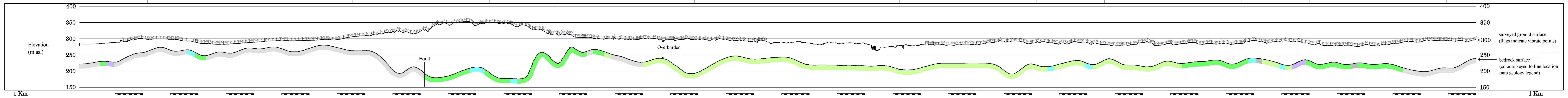
TIME	CDP 1200 VEL	CDP 1200 INTV	CDP 1400 VEL	CDP 1400 INTV	CDP 1600 VEL	CDP 1600 INTV	CDP 1800 VEL	CDP 1800 INTV	CDP 2000 VEL	CDP 2000 INTV
0	1371	5155	1388	5199	1466	5590	1474	5620	1474	5547
500	5155	6032	5199	5962	5590	6229	5620	6374	5547	6284
1000	5610	6527	5594	6467	5918	6614	6009	6589	5927	6618
1500	5932	6636	5899	6723	6159	6744	6208	6753	6166	6799
2000	6115	6729	6116	6886	6310	6747	6349	6801	6330	6835
2500	6243	6896	6277	7123	6400	6834	6442	6894	6434	6884
3000	6356	6765	6426	7010	6474	6815	6519	6912	6511	6865
3500	6416	6612	6512	6621	6524	6702	6577	6720	6563	6836
4000	6441	6622	6526	6607	6547	6706	6595	6620	6598	6671
4500	6462	6613	6535	6575	6564	6692	6598	6573	6606	6620
5000	6477	6673	6539	6639	6577	6807	6595	6675	6607	6707
5500	6495	6678	6548	6625	6598	6834	6602	6843	6617	6747
6000	6510	6664	6555	6591	6618	6829	6623	6844	6627	6747
6500	6522	6721	6557	6630	6635	6894	6640	6911	6637	6853
7000	6537	6684	6563	6573	6654	6866	6660	6885	6652	6879
7500	6547	6703	6563	6575	6668	6882	6675	6914	6668	6910
8000	6557	6749	6564	6755	6682	6849	6690	6888	6683	6884
8500	6568	6773	6575	6780	6692	6868	6702	6911	6695	6907
9000	6580	6752	6587	6760	6701	6844	6714	6890	6707	6887
9500	6589	6771	6596	6778	6709	6858	6723	6909	6717	6906
10000	6598	6754	6605	6762	6717	6838	6733	6892	6726	6889
10500	6605	6769	6613	6776	6722	6849	6740	6907	6734	6905
11000	6613	6752	6620	6760	6728	6828	6748	6890	6742	6868
11500	6619	6764	6627	6772	6733	6837	6754	6902	6747	6879
12000	6625		6633		6737		6760		6753	

TIME	CDP 2200 VEL	CDP 2200 INTV	CDP 2400 VEL	CDP 2400 INTV	CDP 2600 VEL	CDP 2600 INTV	CDP 2800 VEL	CDP 2800 INTV	CDP 3000 VEL	CDP 3000 INTV
0	1489	5573	1505	5634	1505	5682	1505	5677	1483	5584
500	5573	6232	5634	6308	5682	6497	5677	6490	5584	6336
1000	5912	6600	5981	6506	6103	6521	6097	6550	5972	6473
1500	6149	6642	6161	6410	6245	6304	6252	6344	6144	6535
2000	6276	6504	6224	6222	6260	6015	6275	6074	6244	6471
2500	6322	6513	6224	6121	6212	5910	6235	6454	6290	7000
3000	6354	6515	6207	6125	6163	6432	6272	6672	6414	7124
3500	6378	6483	6195	6283	6202	6437	6331	6691	6520	7239
4000	6391	6468	6206	6266	6232	6492	6377	6778	6614	7066
4500	6400	6397	6213	6204	6261	6560	6423	6666	6666	6007
5000	6399	6587	6212	6591	6292	6742	6447	6793	6603	5963
5500	6417	6591	6247	6632	6334	6787	6480	6789	6547	5993
6000	6431	6577	6280	6656	6373	6716	6506	6621	6503	6561
6500	6443	6820	6310	6822	6400	6781	6515	6771	6507	6773
7000	6470	6824	6348	6836	6428	6787	6534	6744	6527	6747
7500	6495	6872	6382	6903	6453	6836	6548	6772	6542	6776
8000	6519	6866	6416	6918	6477	6831	6562	6744	6556	6750
8500	6540	6907	6446	6979	6499	6873	6573	6766	6568	6773
9000	6561	6907	6477	6999	6520	6874	6584	6744	6580	6752
9500	6579	6944	6505	7056	6539	6912	6592	6761	6589	6771
10000	6598	6947	6534	7080	6558	6916	6601	6742	6598	6754
10500	6615	6981	6561	7133	6576	6950	6608	6756	6605	6769
11000	6632	6820	6588	7000	6593	6951	6614	6738	6613	6752
11500	6640	6835	6607	7036	6609	6983	6620	6748	6619	6764
12000	6649		6625		6625		6625		6625	

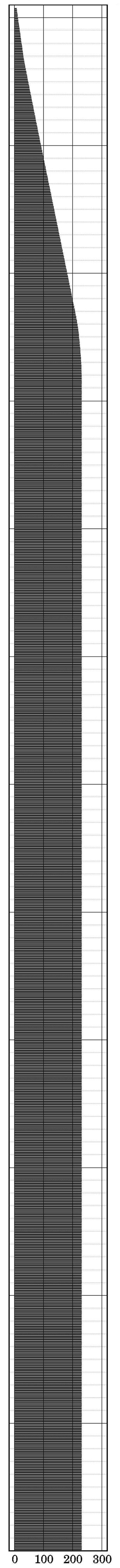
TIME	CDP 3200 VEL	CDP 3200 INTV	CDP 3400 VEL	CDP 3400 INTV	CDP 3600 VEL	CDP 3600 INTV	CDP 3800 VEL	CDP 3800 INTV	CDP 4000 VEL	CDP 4000 INTV
0	1447	5477	1504	5668	1528	5753	1476	5746	1474	5601
500	5477	6225	5668	6387	5753	6462	5746	6398	5601	6403
1000	5863	6455	6038	6696	6118	6672	6081	6603	6015	6588
1500	6067	6620	6265	6646	6308	6680	6260	6707	6212	6734
2000	6209	6632	6363	6536	6403	6565	6374	6637	6346	6709
2500	6296	7033	6398	6846	6436	6708	6428	6728	6421	6763
3000	6425	7160	6475	6942	6482	6778	6479	6742	6479	6742
3500	6535	7282	6543	6979	6525	6762	6517	6716	6517	6716
4000	6633	7435	6599	7050	6555	6782	6542	6726	6542	6726
4500	6727	6668	6651	7101	6581	6784	6563	6718	6563	6718
5000	6721	6173	6697	6861	6601	6739	6579	6731	6579	6732
5500	6673	6034	6712	6731	6614	6730	6593	6727	6593	6727
6000	6622	6411	6714	6692	6624	6703	6604	6704	6604	6704
6500	6606	6735	6712	6729	6630	6748	6612	6752	6612	6752
7000	6615	6708	6713	6663	6638	6698	6622	6705	6622	6705
7500	6622	6720	6710	6655	6642	6705	6627	6716	6627	6716
8000	6628	6674	6707	6587	6646	6654	6633	6669	6633	6669
8500	6630	6679	6700	6572	6647	6655	6635	6672	6635	6673
9000	6633	6640	6693	6510	6647	6610	6637	6631	6637	6631
9500	6634	6640	6683	6490	6645	6605	6637	6630	6637	6630
10000	6634	6604	6674	6433	6643	6565	6637	6593	6637	6593
10500	6632	6601	6662	6409	6639	6556	6634	6588	6635	6589
11000	6631	6565	6651	6350	6636	6515	6632	6551	6632	6551
11500	6628	6559	6638	6323	6631	6504	6629	6543	6629	6543
12000	6625		6625		6625		6625		6625	

North

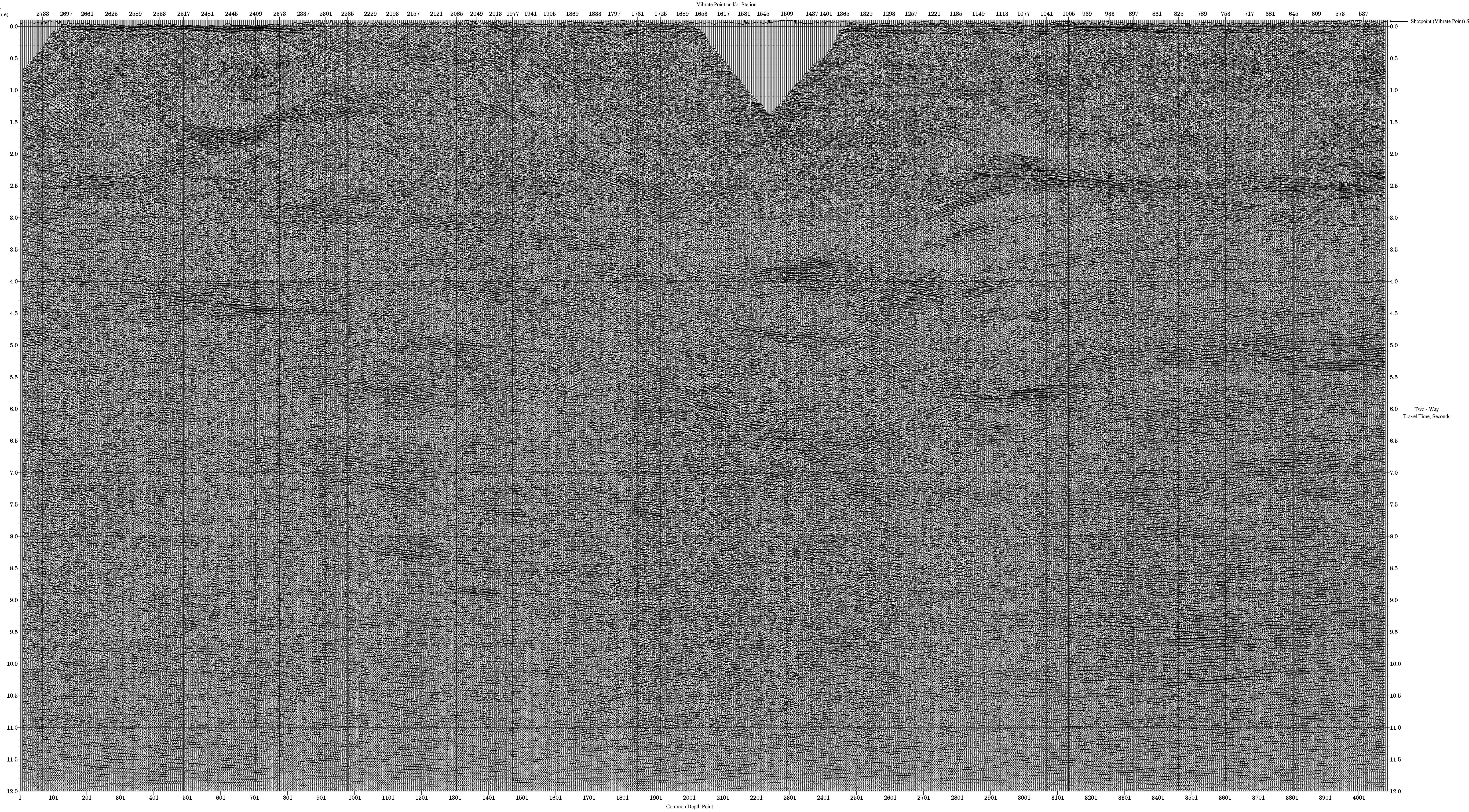
Elevation (m asl)

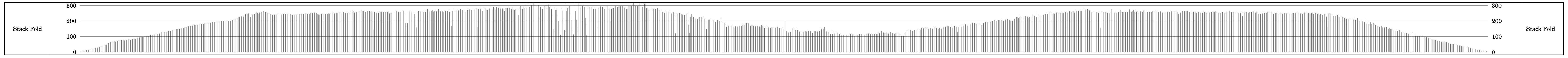


Time-Variant Stack Fold (Post Dip Moveout Final Mute)

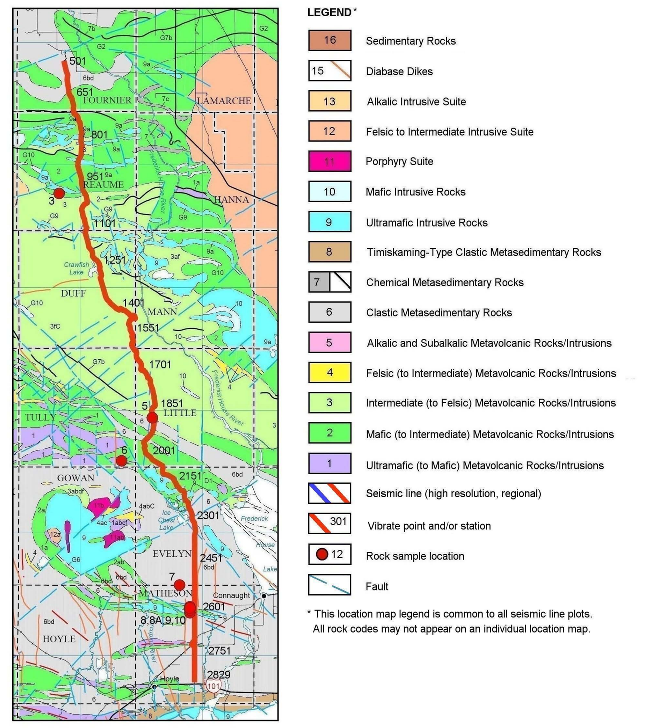


Vibrate Point and/or Station





Line 7 location map (geology *from* Ayer et al. (2005)).



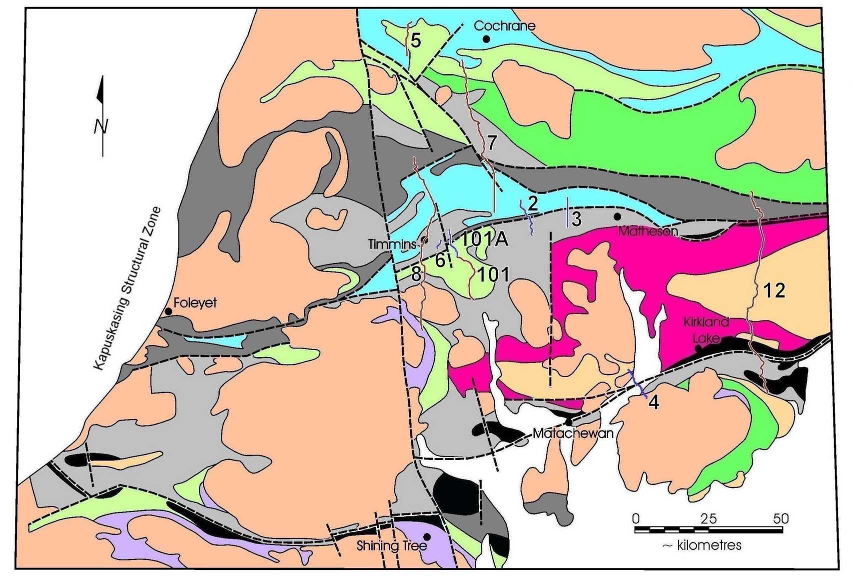
Discover Abitibi Initiative
The Discover Abitibi Initiative is a regional, cluster economic development project based on geoscientific investigations of the western Abitibi greenstone belt. The initiative, centred on the Kirkland Lake and Timmins mining camps, will complete 19 projects developed and directed by the local stakeholders. FedNor, Northern Ontario Heritage Fund Corporation, municipalities and private sector investors have provided the funding for the initiative.

Initiative Découvrons l'Abitibi
L'initiative Découvrons l'Abitibi est un projet de développement économique régional dans une grappe d'industries, projet fondé sur des études géoscientifiques de la ceinture de roches vertes de l'Abitibi occidental. Cette initiative, centrée sur les zones minières de Kirkland Lake et de Timmins, mènera à bien 19 projets élaborés et dirigés par des intervenants locaux. FedNor, la Société de gestion du Fonds du patrimoine du Nord de l'Ontario, des municipalités et des investisseurs du secteur privé ont fourni les fonds de cette initiative.

Survey line locations (assemblage geology *from* Ayer et al. (2002)).

Hi-Res Seismic Lines
2. Kettle Lakes
3. Shillington
4. Watabeag
6. Back Road
101A. South Porcupine

Regional Seismic Lines
5. North Timmins
7. Crawchest
8. South Timmins
12. Kapuskasing
101. South Porcupine



FIELD PARAMETERS

Recorded by	Kinetex Inc., Party 101 July, 2004
Recorded for	Timmins Economic Development Corporation
Amplifier	I/O System Four, 961 channels maximum SEG-Y format, IEEE Floating Point 1/2 Nyquist Minimum Phase, Notch OUT
Record Length	12.0 seconds 2 ms sample interval
Source	Vibroseis, 3 or 4 Vibrators over 27 m 6 sweeps of 28 seconds, 10-96 Hz Linear
Geophones	I/O VectorSeis SVSM Single 3-component phone
Source Interval	50 meters
Group Interval	25 meters
Nominal Fold	24000%
Nominal Spread	12000 - 0 - VP - 0 - 12000 meters

PROCESSING SEQUENCE

Processed by	Sensor Geophysical Ltd. February, 2005
SEG-Y Reformat	
Record length	12.0 seconds
Sample interval	2 ms
Geometry Assignment	
Crooked Line Binning	
Common Depth Point (CDP) separation	12.5 m
Trace Kills	
Amplitude Recovery	
Method	Spherical divergence correction
1st Surface-Consistent Deconvolution	
Components	Resolved: Source, Receiver, Offset Applied: Source, Receiver
Type	Spiking
Operator length	100 ms
Prewhitening	0.1%
Design window	370-4500 ms at 25 m offset 3500-4750 ms at 10750 m offset
Offsets used in design	500-5000 m
1st Vibroseis Deconvolution Compensation	
Refraction Statics Correction	
Datum elevation	300 m
Replacement velocity	6000 m/s
Processing datum	Floating
Number of layers replaced	1
Velocity Analysis	
Surface-Consistent Statics	
Method	Stack power maximization
Maximum allowed shift	20 ms
Correlation window	Various
Normal Moveout Removal	
Automatic Gain Control (AGC)	
Application Mode	Apply and save
AGC operator length	500 ms
Analysis bandwidth	15/20-55/70 Hz
Shot-Mode f-k Filter	Polygon to attenuate shear refractions
Size of impulse response	250 ms by 1000 m
Automatic Gain Control	
Application Mode	Remove AGC
Automatic Gain Control	
Application Mode	Apply and save
AGC operator length	500 ms
Analysis bandwidth	15/20-55/70 Hz
Receiver-Mode f-k Filter	Polygon to attenuate shear refractions
Size of impulse response	250 ms by 1000 m
Automatic Gain Control	
Application Mode	Remove AGC
Normal Moveout Restoration	
2nd Surface-Consistent Deconvolution	
Components	Resolved: Source, Receiver, Offset Applied: Source, Receiver
Type	Spiking
Operator length	100 ms
Prewhitening	0.1%
Design window	200-1750 ms at 0 m offset 300-2000 ms at 750 m offset 550-4500 ms at 1650 m offset 2500-4750 ms at 9000 m offset
Offsets used in design	37.5-6000 m
2nd Vibroseis Deconvolution Compensation	
Time-Variant Spectral Whitening	
Balancing window length	500 ms
Balancing bandwidth	4/10-96/120 Hz
Number of frequency panels	8
Velocity Analysis	
Surface-Consistent Statics	
Method	Stack power maximization
Maximum allowed shift	24 ms
Correlation window	400-5400 ms
Normal Moveout Correction	
Automatic Gain Control	
Application Mode	Apply
AGC operator length	1000 ms
Analysis bandwidth	15/20-55/70 Hz
Common Depth Point (CDP) Stack With Common Offset Bins	
Method	Mean with linear fold interpolation
Offset bin centers	50 to 11550 m
Offset bin center increment	100.0 m
Offset bin width	120.0 m
CDP trace spacing	12.5 m
F-X Prediction Filtering	
Filter type	2-sided Wiener-Levinson
Number of slopes	8
Horizontal window length	40 traces
Time window length	100 ms
Time window overlap	50 ms
Automatic Gain Control	
Application Mode	Apply
AGC operator length	1000 ms
Analysis bandwidth	15/20-55/70 Hz
Dip Moveout (DMO) Correction	
Method	Common Offset F-K
Offset bin centers	50 to 11550 m
Offset bin center increment	100 m
DMO stretch factor	0.6
Perform dip filtering	Yes
Front-End Muting	
Offset	325 1525 7975 m
Mute time	0 400 2000 ms
Automatic Gain Control	
Application Mode	Apply
AGC operator length	1000 ms
Analysis bandwidth	15/20-55/70 Hz
CDP Stack	
Method	Simple mean
Bulk Shift	+100 ms
Anisotropic Diffusion Filter	
Design window size	40 traces x 88 ms
Number of diffusion steps	5
Diffusion rate	0.25
With edge preservation	Yes
Bandpass Filter	
Zero-phase Ormsby	5/10-100/120 Hz 0-2000 ms 5/10- 40/ 60 Hz 3500-12000 ms
Trace Equalization	
Mean window	1000-5500 ms
Analysis bandwidth	10/20-40/60 Hz
Time Migration From Surface	
Method	Implicit finite difference
Dip aperture	0-65 degrees
Velocity function	100% of DMO stacking velocities
Bandpass Filter	
Zero-phase Ormsby	10/20 - 120/140 Hz
Time-Variant Scaling	
Method	Centre-to-centre
Mean windows	200-600, 500-2200, 2000-3200 and 3000-6000 ms
2:1 Trace Decimation	

DISPLAY PARAMETERS

Traces/Inch =	101.6	Display Gain =	0.8
Inches/Second =	1.875	Clip Limit =	6
NORMAL POLARITY		Tue Mar 8 20:02:06 2005	

SENSOR GEOPHYSICAL LTD.

REFERENCES

Ayer J.A., Amelin Y., Corfu F., Kamo S.L., Ketchum J.W.F., Kwok K. and Trowell N. 2002. Evolution of the southern Abitibi greenstone belt based on U-Pb geochronology: autochthonous volcanic construction followed by plutonism, regional deformation and sedimentation; Precambrian Research, v.115, p.63-95.

Ayer J.A., Berger B.R., Hall L.A.F., Houlé M.G., Johns G.W., Josey S., Madon Z., Rainsford D., Trowell N.F. and Vaillancourt C. 2005. Geological compilation of the central Abitibi greenstone belt: Kapuskasing Structural Zone to the Quebec border; Ontario Geological Survey, Preliminary Map P.3565, scale 1:250 000.

Accompanies Open File Report 6169.

KETTLE LAKES HIGH-RESOLUTION REFLECTION SEISMIC LINE 2

Vibrate Points 1300 - 101
MIGRATED DMO STACK

Normal Polarity
Scale 1:25 000

Acquisition - Kinetex Inc.
Processing - Sensor Geophysical Ltd.

CDP 1800		
TIME	VEL	INTV
0	1495	5659
500	5659	6504
1000	6096	6618
1500	6275	6722
2000	6389	6651
2500	6443	6661
3000	6479	6594
3500	6496	6522
4000	6499	6487
4500	6498	6433
5000	6491	6502
5500	6492	6472
6000	6491	

CDP 1600		
TIME	VEL	INTV
0	1479	5624
500	5624	6405
1000	6027	6563
1500	6211	6680
2000	6331	6625
2500	6391	6650
3000	6435	6599
3500	6459	6543
4000	6469	6523
4500	6475	6485
5000	6476	6569
5500	6485	6554
6000	6491	

CDP 1400		
TIME	VEL	INTV
0	1487	5652
500	5652	6329
1000	6000	6541
1500	6185	6663
2000	6308	6614
2500	6371	6645
3000	6417	6601
3500	6444	6551
4000	6457	6538
4500	6466	6506
5000	6470	6595
5500	6482	6587
6000	6490	

CDP 1200		
TIME	VEL	INTV
0	1464	5584
500	5584	6205
1000	5903	6476
1500	6100	6607
2000	6231	6579
2500	6302	6630
3000	6358	6607
3500	6394	6578
4000	6417	6585
4500	6436	6574
5000	6450	6683
5500	6471	6695
6000	6490	

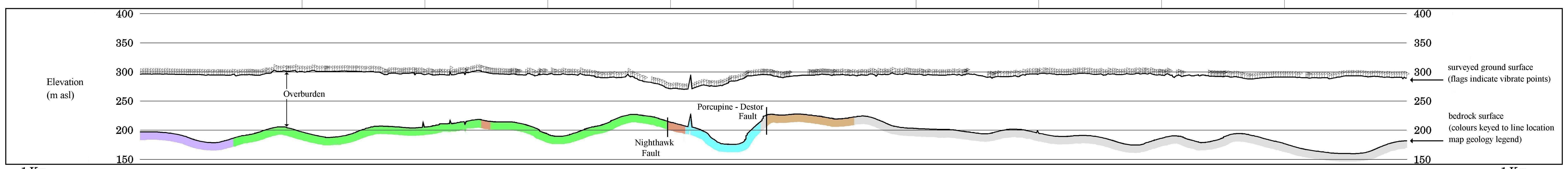
CDP 1000		
TIME	VEL	INTV
0	1423	5464
500	5464	6102
1000	5792	6405
1500	6003	6546
2000	6143	6543
2500	6225	6616
3000	6292	6612
3500	6339	6607
4000	6373	6636
4500	6403	6648
5000	6428	6777
5500	6460	6812
6000	6490	

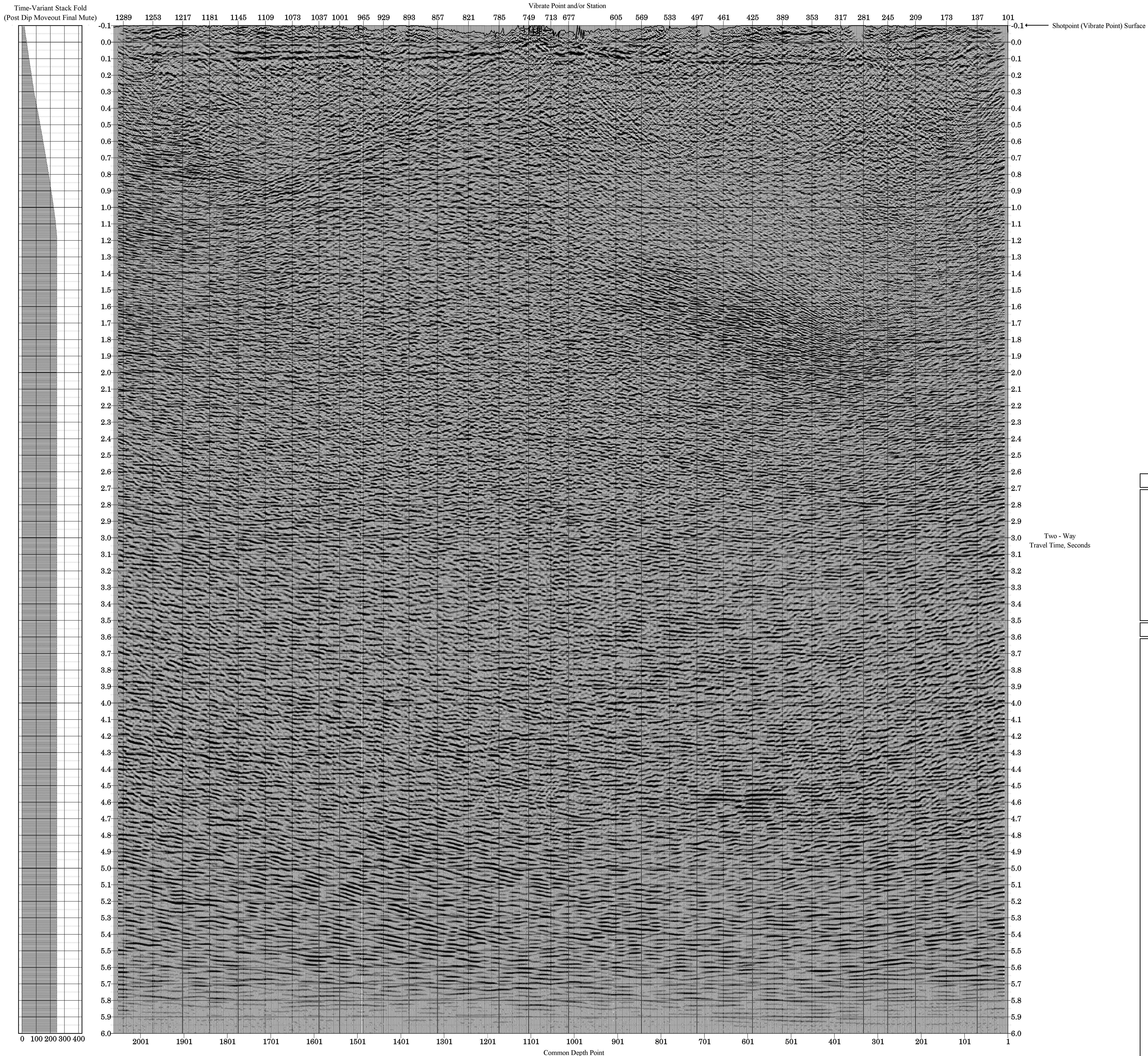
CDP 800		
TIME	VEL	INTV
0	1428	5466
500	5466	6149
1000	5817	6343
1500	5998	6556
2000	6142	6585
2500	6233	6668
3000	6308	6616
3500	6353	6600
4000	6384	6624
4500	6411	6629
5000	6433	6754
5500	6463	6783
6000	6490	

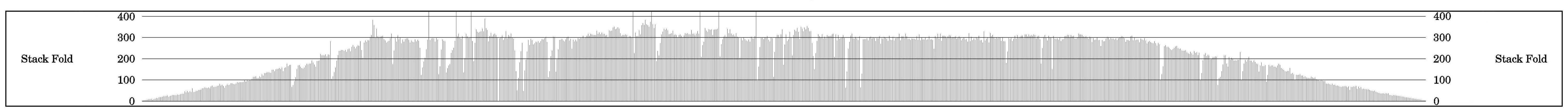
CDP 600		
TIME	VEL	INTV
0	1443	5485
500	5485	6242
1000	5875	6346
1500	6036	6534
2000	6165	6625
2500	6259	6722
3000	6339	6645
3500	6383	6584
4000	6409	6595
4500	6430	6588
5000	6446	6700
5500	6469	6717
6000	6490	

CDP 400		
TIME	VEL	INTV
0	1444	5496
500	5496	6242
1000	5880	6366
1500	6047	6492
2000	6161	6621
2500	6256	6721
3000	6336	6682
3500	6386	6582
4000	6411	6592
4500	6431	6584
5000	6447	6696
5500	6470	6711
6000	6490	

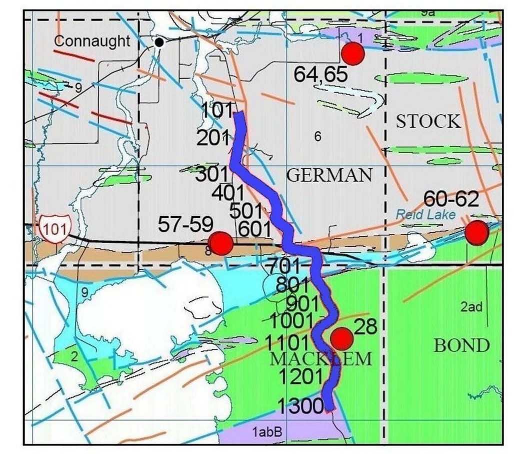
CDP 200		
TIME	VEL	INTV
0	1436	5467
500	5467	6210
1000	5850	6348
1500	6020	6455
2000	6132	6601
2500	6229	6709
3000	6311	6707
3500	6369	6591
4000	6397	6608
4500	6421	6607
5000	6440	6725
5500	6466	6748
6000	6490	







Line 2 location map (geology *from* Ayer et al. (2005)).



LEGEND*

- 16 Sedimentary Rocks
- 15 Diabase Dikes
- 13 Alkalic Intrusive Suite
- 12 Felsic to Intermediate Intrusive Suite
- Porphyry Suite
- 10 Mafic Intrusive Rocks
- 9 Ultramafic Intrusive Rocks
- 8 Timiskaming-Type Clastic Metasedimentary Rocks
- 7 Chemical Metasedimentary Rocks
- 6 Clastic Metasedimentary Rocks
- 5 Alkalic and Subalkalic Metavolcanic Rocks/Intrusions
- 4 Felsic (to Intermediate) Metavolcanic Rocks/Intrusions
- 3 Intermediate (to Felsic) Metavolcanic Rocks/Intrusions
- 2 Mafic (to Intermediate) Metavolcanic Rocks/Intrusions
- 1 Ultramafic (to Mafic) Metavolcanic Rocks/Intrusions
- Seismic line (high resolution, regional)
- 301 Vibrate point and/or station
- 12 Rock sample location
- Fault

* This location map legend is common to all seismic line plots. All rock codes may not appear on an individual location map.

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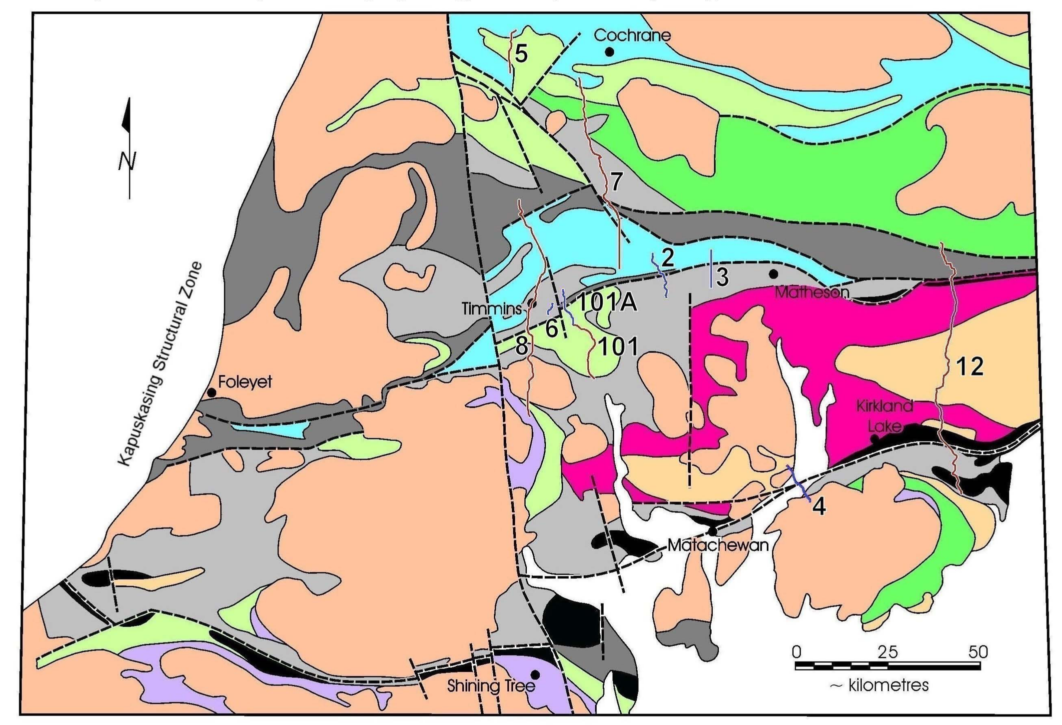
Survey line locations (assemblage geology *from* Ayer et al. (2002)).

Hi-Res Seismic Lines

2. Kettle Lakes
3. Shillington
4. Watabeag
6. Back Road
101A. South Porcupine

Regional Seismic Lines

5. North Timmins
7. Crawchest
8. South Timmins
12. Kapuskasing
101. South Porcupine



LEGEND

- Proterozoic and Paleozoic cover
- Granitic plutons
- Timiskaming Assemblage (2687-2675 Ma)
- Porcupine Assemblage (2696-2692 Ma)
- Blake River Assemblage (2701-2697 Ma)
- Kinojevis Assemblage (2702-2701 Ma)
- Tisdale Assemblage (2708-2703 Ma)
- Kidd-Munro Assemblage (2718-2710 Ma)
- Stoughton-Roquemaure Assemblage (2725-2720 Ma)
- Deloro Assemblage (2730-2725 Ma)
- Pacaud Assemblage (2745-2735 Ma)
- Fault
- Regional seismic line
- Hi-Res seismic line

FIELD PARAMETERS

Recorded by	Kinetex Inc., Party 101 June, 2004
Recorded for	Timmins Economic Development Corporation
Amplifier	I/O System Four, 959 channels maximum SEG-Y format, IEEE Floating Point 1/2 Nyquist Minimum Phase, Notch OUT
Record Length	6.0 seconds 2 ms sample interval
Source	Vibroseis, 2 Vibrators over 18 m 3 sweeps of 28 seconds, 10-160 Hz non-linear +3 dB/Oct boost
Geophones	I/O VectorSeis SVSM Single 3-component phone
Source Interval	25.0 meters
Group Interval	12.5 meters
Nominal Fold	24000%
Nominal Spread	6000 - 0 - VP - 0 - 6000 meters

PROCESSING SEQUENCE

Processed by	Sensor Geophysical Ltd. February, 2005
SEG-Y Reformat	
Record length	6.0 seconds
Sample interval	2 ms
Geometry Assignment	
Crooked Line Binning	
Common Depth Point (CDP) separation	6.25 m
Trace Kills	
Amplitude Recovery	
Method	Spherical divergence correction
1st Surface-Consistent Deconvolution	
Components	Resolved: Source, Receiver, Offset Applied: Source, Receiver
Type	Spiking
Operator length	100 ms
Prewhitening	0.1%
Design window	370-4500 ms at 25 m offset 2900-4700 ms at 8700 m offset
Offsets used in design	500-5000 m
1st Vibroseis Deconvolution Compensation	
Refraction Statics Correction	
Datum elevation	300 m
Replacement velocity	6000 m/s
Processing datum	Floating
Number of layers replaced	1
Velocity Analysis	
Surface-Consistent Statics	
Method	Stack power maximization
Maximum allowed shift	20 ms
Correlation window	Various
Normal Moveout Removal	
Automatic Gain Control (AGC)	
Application Mode	Apply and save
AGC operator length	500 ms
Analysis bandwidth	15/20-55/70 Hz
Shot-Mode f-k Filter	Polygon to attenuate shear refractions
Size of impulse response	250 ms by 1000 m
Automatic Gain Control	
Application Mode	Remove AGC
Automatic Gain Control	
Application Mode	Apply and save
AGC operator length	500 ms
Analysis bandwidth	15/20-55/70 Hz
Shot-Mode f-k Filter	Polygon to attenuate surface wave
Size of impulse response	400 ms by 625 m
Automatic Gain Control	
Application Mode	Remove AGC
Automatic Gain Control	
Application Mode	Apply and save
AGC operator length	500 ms
Analysis bandwidth	15/20-55/70 Hz
Receiver-Mode f-k Filter	Polygon to attenuate shear refractions
Size of impulse response	250 ms by 1000 m
Automatic Gain Control	
Application Mode	Remove AGC
Normal Moveout Restoration	
2nd Surface-Consistent Deconvolution	
Components	Resolved: Source, Receiver, Offset Applied: Source, Receiver
Type	Spiking
Operator length	100 ms
Prewhitening	0.1%
Design window	200-1750 ms at 0 m offset 300-2000 ms at 750 m offset 500-4500 ms at 1650 m offset 2500-4750 ms at 9000 m offset
Offsets used in design	37.5-6000 m
2nd Vibroseis Deconvolution Compensation	
Time-Variant Spectral Whitening	
Balancing window length	500 ms
Balancing bandwidth	4/10-148/170 Hz
Number of frequency panels	13
Velocity Analysis	
Surface-Consistent Statics	
Method	Stack power maximization
Maximum allowed shift	24 ms
Correlation window	400-5400 ms
Normal Moveout Correction	
Automatic Gain Control	
Application Mode	Apply
AGC operator length	1000 ms
Analysis bandwidth	15/20-55/70 Hz
Common Depth Point (CDP) Stack Within Common Offset Bins	
Method	Mean with linear fold interpolation
Offset bin centers	25 to 5025 m
Offset bin center increment	50.00 m
Offset bin width	62.50 m
CDP trace spacing	6.25 m
F-X Prediction Filtering	
Filter type	2-sided Wiener-Levinson
Number of slopes	8
Horizontal window length	40 traces
Time window length	100 ms
Time window overlap	50 ms
Automatic Gain Control	
Application Mode	Apply
AGC operator length	1000 ms
Analysis bandwidth	15/20-55/70 Hz
Dip Moveout (DMO) Correction	
Method	Common Offset F-K
Offset bin centers	25 to 5025 m
Offset bin center increment	50 m
DMO stretch factor	0.6
Perform dip filtering	Yes
Front-End Muting	
Offset	325 1525 7975 m
Mute time	0 400 2000 ms
Automatic Gain Control	
Application Mode	Apply
AGC operator length	1000 ms
Analysis bandwidth	15/20-55/70 Hz
CDP Stack	
Method	Simple mean
Bulk Shift	+100 ms
Anisotropic Diffusion Filter	
Design window size	40 traces x 80 ms
Number of diffusion steps	5
Diffusion rate	0.25
With edge preservation	Yes
Bandpass Filter	
Zero-phase Ormsby	5/10-100/120 Hz 0-2000 ms 5/10- 40/ 60 Hz 3500-6000 ms
Trace Equalization	
Mean window	500-5500 ms
Analysis bandwidth	10/20-40/60 Hz
Time Migration From Surface	
Method	Implicit finite difference
Dip aperture	0-65 degrees
Velocity function	100% of DMO stacking velocities
Bandpass Filter	
Zero-phase Ormsby	10/20 - 120/140 Hz
Time-Variant Scaling	
Method	Centre-to-centre
Mean windows	200-600, 500-2200, 2000-3200 and 3000-6000 ms
2:1 Trace Decimation	

DISPLAY PARAMETERS

Traces/Inch =	101.6	Display Gain =	0.8
Inches/Second =	3.75	Clip Limit =	6
NORMAL POLARITY		Tue Mar 8 19:33:40 2005	

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Accompanies Open File Report 6169.