

### STRATIFIED ROCKS

QUATERNAR	Y	
PLEISTOCENE AND RECENT		
Q	Glacial till, alluvium, colluvium; unit designators in parentheses are the inferred underlying early Tertiary sedimentary and volcanic bedrock.	

Glacial till, alluvium, colluvium; unit designators in parentheses are the inferred underlying bedrock units of Bowser and Sustut basins. Includes large areas covered by vegetation.

LOWER MIDDLE JURASSIC

BOWSER LAKE GROUP (mJBv, mJBs)

HAZELTON GROUP (JHu, JHsu)

(STIKINE TERRANE)

LOWER TO LOWER UPPER JURASSIC

LOWER AND LOWER MIDDLE JURASSIC

UPPER TRIASSIC TO LOWER JURASSIC

(STIKINE TERRANE)

TRIASSIC AND JURASSIC

TRIASSIC OR OLDER

DEVONION TO PERMIAN

TERTIARY

**CRETACEOUS** 

EARLY TERTIARY

monzodiorite.

LATE CRETACEOUS

EARLY CRETACEOUS

URASSIC OR CRETACEOUS

TRIASSIC TO TERTIARY

TRIASSIC OR JURASSIC

CARBONIFEROUS AND PERMIAN

LOWER CARBONIFEROUS AND OLDER?

DEVONIAN AND LOWER CARBONIFEROUS

conglomerate, siltstone, shale, and limestone.

intermediate granitoid rocks, and limestone.

STUHINI AND TAKLA GROUPS (Tsu, Tss, Tsv)

breccia, and minor volcanic rocks and limestone.

SITLIKA GROUP (CACHE CREEK TERRANE)

Undivided volcanic and clastic rocks.

Metapelite and metavolcanic rocks.

ASITKA GROUP (STIKINE TERRANE)

CARBONIFEROUS AND PERMIAN (may include UPPER TRIASSIC)

(STIKINE TERRANE)

Undivided Triassic and Jurassic volcanic and epiclastic rocks.

plagioclase porphyry flows, breccia and tuff.

Maroon plagioclase porphyry flows and breccia, green and grey-green aphyric and

Maroon sandstone and siltstone, chert pebble conglomerate, local grey and green

Undivided Bowser Lake Group and upper Hazelton Group clastic rocks.

Undivided clastic and related volcanic rocks of Spatsizi, Salmon River, Smithers, and

bedded tuffaceous(?) siltstone, tuff, limy siltstone, calcareous to siliceous organic

Undivided volcanic and intercalated clastic rock of the Hazelton Group; includes

Nilkitkwa formations; dominated by siltstone and shale, including siliceous well

shale, calcareous to siliceous siltstone, fine-grained sandstone; minor constituents

are mudstone, limestone, conglomerate, coarse grained arkose, basalt, and rhyolite.

subaerial and marine mafic volcanic rocks and epiclastic rocks; felsic volcanic rocks

include sills, dykes, welded and nonwelded ignimbrite, airfall tuff breccia; epiclastic

CARNIAN(?) AND NORIAN(?) TO HETTANGIAN AND/OR LOWER SINEMURIAN

Conglomerate, sandstone, shale, mafic to intermediate volcanic breccia, and

olistostrome; conglomerate clasts are mainly hornblende and plagioclase porphyry

Augite- and coarse bladed feldspar-phyric mafic lava flows, aphanitic basalt, breccia,

Mudstone, shale, sandstone, olistostrome, tuff, conglomerate, volcanic conglomerate,

pillow basalt, tuff; minor conglomerate, sandstone, mudstone, limestone and

Dark green, resistant and poorly stratified, crowded feldspar-phyric trachybasalt,

dark grey, laminated to thick-bedded silty mudstone, siltstone, fine- to

medium-grained and locally coarse-grained sandstone; massive tuffaceous

mudstone, and thick-bedded sedimentary breccia and conglomerate; minor

Argillite, chert, basalt, limestone, tuffaceous and argillaceous carbonate and

Phyllite, chert, marble, greenstone, and amphibolite; tectonically emplaced ultramafic

etavolcanic and metasedimentary rock: includes green chlorite phyllite, brown

Mafic to intermediate plagioclase-pyroxene phyric lapilli tuff, lapilli tuff-breccia, and

INTRUSIVE ROCKS

Undivided early Tertiary intrusive rocks; includes tonalite, granodiorite, granite,

quartz diorite, diorite, granite, tonalite, quartz monzodiorite.

gabbro), and dioritic to gabbroic rocks.

Cretaceous or Tertiary in Terrace map area.

Undivided Triassic and Jurassic intrusive rocks.

quartz diorite, and minor gabbro of uncertain age.

Highly strained and/or greenshchist facies rocks.

granodiorite, quartz diorite.

ultramafic intrusive rocks.

Geological contact (defined, approximate, assumed) .

Fault, sense of displacement unknown

(defined, approximate, assumed)

defined, approximate, assumed)

Fault, contractional (teeth on hanging wall;

defined, approximate, assumed) .

Fault, strike-slip dextral (defined)

Fault, assumed under Quaternary .

Fault, assumed under Quaternary .

Fault, normal (ornament on down thrown side;

Fault, reverse (defined, approximate, assumed)

Anticline (trace of axial surface: upright or inclined, assumed, overturned); arrow along line indicates direction of plunge

Syncline (trace of axial surface: upright or inclined, assumed,

Open, inclined anticline, trace of axial surface (defined);

long arrow points in direction of dip of axial surface

long arrow points in direction of dip of axial surface .

Railway, abandoned railway or railbed .

Provincial park or protected area

overturned); arrow along line indicates direction of plunge

Anticline or syncline, trace too short or too dense to show symbols

Open, inclined syncline, trace of axial surface (defined, assumed);

(between bedrock and surficial rock, inferred under Quaternary)

Geological contact

diorite, monzogranite, monzodiorite, quartz monzonite, quartz diorite, quartz

Undivided Late Cretaceous instusive rocks; includes granodiorite, quartz monzonite,

Undivided Early Cretaceous intrusive rocks; includes layered gabbro (Axelgold

Undivided Jurassic or Cretaceous intrusive rocks; includes quartz monzonite,

Undivided Jurassic intrusive rocks; includes granite, granodiorite, tonalite, diorite,

quartz diorite, monzonite, quartz monzonite, monzodiorite, gabbro, monzogranite,

Undivided Triassic to Tertiary intrusive rocks. Jurassic or Tertiary in SW Bowser Lake

and NW Nass River map areas; Triassic to Tertiary in Spatsizi River map area, and

Undivided Triassic intrusive rocks; includes metagranite, metadiorite, metagabbro,

granite, diorite and foliated granodiorite, quartz monzonite and monzodiorite; minor

Individed Paleozoic intrusive rocks; includes Carboniferous (ca. 342-353 Ma U-Pb)

complex (363±3 Ma U-Pb); and mylonitic to massive leucogranite, leucogranodiorite,

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granodiorite, quartz diorite, diorite, quartz monzonite and tonalite; mafic intrusive

flows; plagioclase-phyric amygdaloidal andesite(?) flows; rhyolite and rhyodacite

calcareous tuff, sericite and chlorite phyllite, amphibolite.

CACHE CREEK GROUP (CACHE CREEK TERRANE)

STIKINE ASSEMBLAGE (DMsv, Pvs, Pc) (STIKINE TERRANE)

rocks, includes serpentinite, serpentinized peridotite.

Marble, limestone, bioclastic limestone, micrite.

phyllitic argillite, grey-green to tan quartz-sericite schist.

commonly contains discontinuous, irregularly-oriented, crowded trachytic fabric outlined by tabular, fine- to medium-grained plagioclase feldspar phenocrysts. Also,

radiolarian chert and volcanic rocks, typically pyroxene- or pyroxene-feldspar-phyric

andesite, but include augite-phyric mafic lava and other volcanic rocks, felsic to

and bioclastic rocks, includes volcanic debris flow conglomerate, breccia,

Glacial till, alluvium, colluvium; unit designators in parentheses are the inferred underlying bedrock units of stratigraphic basement to Bowser and Sustut basins.

Glacial till, alluvium, colluvium; unit designators in parentheses are the inferred underlying bedrock units of intrusive rocks.

Aiyansh basalt flows and pyroclastic cones (ca. 220 years).

Basaltic (basanite) intrusion east of Spatsizi River, too small to show on map (1.3 Ma (K-Ar)); pillow basalt in upper Nass Valley; basalt or andesite flows and minor breccia in lower Nass Valley and east of Alice Arm (175,000 years); pillow lava and volcaniclastic rocks of the Bell-Irving volcanic district, east of upper Bell-Irving River

PLIOCENE Basalt and minor trachyte flows and related intrusions; columnar jointed, with rare pillows and breccia. MAITLAND VOLCANICS (5.2 to 4.6 Ma; K-Ar) in northwest Spatsizi River and northeast Telegraph Creek map area. The minor outcrops in

southeast McConnell Creek map area may include andesite. Basalt in Bulkley Valley; volcanic breccia, volcanic flows and volcanic conglomerate east of Portland Canal.

**EOCENE AND YOUNGER** Mount Edziza Volcanic Complex, undivided.

ENDAKO GROUP: amygdaloidal basalt flow rocks with intercalated volcaniclastic rocks. OOTSA LAKE GROUP: biotite +/- hornblende-phyric rhyolite to rhyodacite, with lesser feldspar-phyric basalt, andesite, and volcaniclastic rocks. NEWMAN FORMATION: hornblende-biotite-feldspar-phyric andesite to dacite flow rocks, breccia, and volcanic debris flow deposits.

Sandstone, conglomerate, siltstone, shale, and coal; subordinate epiclastic rocks; most clasts are andesitic and dacitic volcanic rocks similar to the Kasalka Group. Andesite flows and flow breccia; tuffaceous mudstone and siltstone at Driftwood

UPPER CRETACEOUS KASALKA GROUP

Hornblende-feldspar-porphyritic andesite-dacite flows, flow breccia, breccia: rhyolite to dacite flows and ash flow tuff, breccia; minor basalt and andesite feldspar porphyry; intercalated lacustrine, fluvial and tuffaceous sedimentary rocks, and volcanic debris flow conglomerate; includes sills, dykes, and intrusive domes. UPPER LOWER AND UPPER CRETACEOUS

SUSTUT GROUP (KTC, KBP) CAMPANIAN AND MAASTRICHTIAN BROTHERS PEAK FORMATION: sandstone, siltstone, conglomerate, and tuff; sandstone and siltstone are cream- and grey-weathering; tuff is cream-weathering; conglomerate in laterally continuous sheets is most common near base.

APTIAN OR ALBIAN TO CAMPANIAN TANGO CREEK FORMATION: micaceous sandstone, siltstone, mudstone, and minor quartz grit and pebble conglomerate; sandstone is grey- and green-weathering, occurring as laterally continuous sheets and as lenses; siltstone and mudstone are grey-, black-, and maroon-weathering. Includes layered and massive tuff and tuff breccia in northeast Hazelton map area.

LOWER AND UPPER CRETACEOUS SKEENA GROUP (ImKs, mKsR) BERRIASIAN TO CAMPANIAN Sandstone, siltstone, mudstone, tuff, coal, conglomerate, and volcaniclastic rocks; local detrital muscovite; sections commonly contain cycles fining upward from sandstone to siltstone and mudstone or coal.

ALBIAN TO CENOMANIAN ROCKY RIDGE FORMATION: unit mKSRv: porphyritic and amygdaloidal basalt flows and intercalated volcaniclastic sedimentary rocks; phenocrysts of pyroxene, plagioclase, and hornblende; includes breccia, lapilli tuff, and volcanic debris flow conglomerate; ca. 95 - 93 Ma ( <sup>™</sup>Ar/ <sup>™</sup>Ar); unit mKSnr: feldspar-phyric, flow-banded rhyolite to rhyodacite domes and interbedded dacitic volcanic rocks, includes lapilli tuff and flow breccia; 107.9 ± 0.2 Ma (U-Pb).

LOWER CRETACEOUS BOWSER LAKE GROUP (KBDC) DEVILS CLAW FORMATION: conglomerate, sandstone, and siltstone; high proportion of pebble conglomerate (30-80%) in laterally continuous, grey-weathering sheets with large-scale crossbedding; conglomerate forms bases of fining-upward cycles with medium-grained sandstone, fine-grained sandstone, carbonaceous siltstone, and minor coal; sandstone is dark green- and grey-weathering with planar-

and trough-crossbedding; fossil plants common; marine fossils absent.

JURASSIC AND CRETACEOUS Individed Bowser Lake and Skeena groups.

UPPER JURASSIC AND(?) LOWER CRETACEOUS BOWSER LAKE GROUP (JKBCR, JKBMC, JKBS, JKBGG, JKBJC, JKBU) Individed Bowser Lake Group.

JENKINS CREEK ASSEMBLAGE (nonmarine assemblage): mudstone, siltstone, fine-grained sandstone, medium-grained sandstone, and rare conglomerate and coal, commonly arranged in fining-upward cycles; sandstone is grey-, green-, and brown-weathering, and occurs as laterally continuous sheets, discontinuous sheets and lenses; lenses are planar- and trough-crossbedded; fossil plants abundant,

GROUNDHOG-GUNANOOT ASSEMBLAGE (deltaic assemblage): sandstone, siltstone, and carbonaceous and calcareous mudstone, with minor conglomerate and coal, locally arranged in fining-upward cycles; sandstone is fine- to medium-grained with planar bedding and tabular crossbedding; large proportion of sandstone is thinand thick-bedded, medium-grained, recessive drab green- or brown-weathering wacke; resistant and light grey-weathering arenite is less common and forms discontinuous sheets and lenses; finer-grained strata are thinly bedded and locally include densely packed plant fossils; conglomerate sheets and lenses, which

including in situ roots, and plants with delicate structure; marine fossils absent.

constitute 10% of the unit, are light grey-weathering, with large-scale crossbedding; plant fossils common and include in situ trees; marine fossils rare. SKELHORNE ASSEMBLAGE (deltaic assemblage): thinly intermixed and varicoloured siltstone, sandstone, and conglomerate (with or without coal), commonly arranged in coarsening- and thickening-upward cycles; common features of andstone are parallel bedding, crossbedding, ripples, burrows, bivalve coquina, and brown-, green-, and grey-weathered surfaces; conglomerate is rusty- and grey-weathering, but constitutes a lower proportion (15-30%) of the unit than in the aglenest assemblage; conglomerate units, up to 50 m thick, cap cycles up to 70 m thick, and tops locally have megaripples; plant and marine fossils are common, and trace fossils including Skolithus and Diplocraterion are present, as are tree fragments

MUSKABOO CREEK ASSEMBLAGE (shelf assemblage): sandstone, siltstone, and conglomerate; primary lithofacies is fine- to medium-grained sandstone, forming laterally continuous thin- to thick-bedded sheets; less common are siltstone interbedded with sandstone; rare lenses of conglomerate; sandstone is green-, brown-, and grey-weathering, thin- to thick-bedded, and locally arranged in coarsening-upward cycles; includes burrows, bivalve coquina, and other marine fossils, common ripple marks and crossbedding, and local hummocky

CRANBERRY RIVER ASSEMBLAGE (outer shelf/slope assemblage): sections observed or assumed to be at least tens to several hundred metres thick, consisting of >95% dark grey to black siltstone to silty mudstone and <5% very fine-grained andstone to coarse siltstone; siltstone to silty mudstone is generally massive, rarely faintly laminated, pyritic, or bioturbated; very fine-grained sandstone occurs as thick laminations or thin beds, commonly massive, rarely vaguely laminated or slightly normally graded, and locally rippled.

BOWSER LAKE GROUP (JBra, JBt, JBe, JBN) NETALZUL FORMATION: feldspar-hornblende-porphyritic andesite flows, breccia, and tuff; intercalated volcaniclastic sedimentary rocks, including volcanic debris flow

UPPER MIDDLE TO UPPER JURASSIC

EAGLENEST ASSEMBLAGE (deltaic assemblage): conglomerate, sandstone, siltstone, mudstone, and rare coal, arranged in coarsening, and fining-upward cycles of mudstone to pebble or cobble conglomerate; prominently rusty-weathering and 30 to 80% conglomerate; sheets of conglomerate, up to 50 m thick, include planar beds tabular crossbedding and trough crossbedding, with sets locally up to tens of metres thick; sandstone is green-, brown-, and grey-weathering, and has planar cross-bedding and local hummocky cross-stratification; sparse marine fossils, but abundant plant fossils, including silicified tree fragments.

ODAGIN ASSEMBLAGE (slope assemblage): siltstone, fine-grained sandstone, and onglomerate; mainly laminated siltstone and/or fine-grained sandstone, which are lark grey- to black-weathering and include thin, orange-weathering claystone beds, hert-pebble conglomerate occurs as lenses; includes syndepositional faults and folds; marine fossils. Locally contains sections characteristic of JBRA not separated at

RITCHIE-ALGER ASSEMBLAGE (submarine fan assemblage): sandstone, siltstone and rare conglomerate; approximately equal proportions of sheet-like intervals, up to 50 m thick, dominated either by siltstone, shale and very fine-grained sandstone, or by medium-grained sandstone; siltstone and/or fine-grained sandstone is dark grey and black-weathering, sandstone is medium- and light-grey-weathering; contains abundant turbidite features (e.g. Bouma cycles, flame structures, flute-and-groove casts); conglomerate includes debris flow deposits; marine fossils. Locally contains sections characteristic of JBT not separated at this scale of mapping.

This map is a compilation of the geology of Bowser and Sustut basins, British Columbia. It is a final product of th Integrated Petroleum Resource Potential and Geoscience Studies of the Bowser and Sustut Basins project, a collaborative project between the Geological Survey of Canada and the British Columbia Ministry of Energy, Mines and Petroleum Resources, with contributions from Simon Fraser University and the University of Alberta. The map show the current status of knowledge of the basins and immediately bounding areas. Consistent stratigraphic terminology used across the basins. Geology of underlying strata and intrusive rocks is generalized. For example, formations of intrusive rocks are grouped into general age units. Explanations of usage and revisions to stratigraphic terminology are given in the descriptive notes of each of the primary sources of information listed below.

Sustut Basin is late Early to latest Cretaceous age. Its two formations were deposited in nonmarine environments.

Primary sources of information for the compilation 1:125 000 scale maps of 94D, 94E, 93M, 103P, 104A, northern 93L and 103I (Evenchick et al. 2007f,h; 2008c,e,f,g). 1:250 000 compilations of 104H (Evenchick and Thorkelson, 2004); and eastern 104G (unpublished data).

These were compiled from additional data sources: 93L Richards and Tipper, 1976; MacIntyre, 2007 93M Richards, 1990; MacIntyre et al., 1997; MacIntyre, 2007.

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umbia Ministry of Energy, Mines and Petroleum Resources, Petroleum Geology Open File 2007-2, scale

ish Columbia Ministry of Energy, Mines and Petroleum Resources; Petroleum Geology Open File 2007-

Stratigraphic basement to the Bowser and Sustut basins is Triassic and Early to early Late Jurassic volcanic and clastic rocks of the Stuhini and Hazelton groups, respectively, and related intrusions. The Bowser Lake and Skeena groups of the Bowser Basin range from Middle Jurassic to mid-Cretaceous age. Bowser Lake Group has been divided int several lithofacies assemblages based on sedimentary character; the depositional environment of each assemblag has been interpreted based on these features (Evenchick and Thorkelson, 2005; see legend). Lithofacies assembla of the group comprise rocks deposited in marine and nonmarine environments. They interfinger laterally and vertically with the result that they contain components of neighbouring assemblages. Assumed contacts between lithofacies emblages locally cross structural trends at a high angle. In most of these cases the positions of the contacts ar poorly defined, and it is unclear whether they are lateral facies changes or faults. The contact between Bowser Lake Group and underlying Hazelton Group clastic rocks is gradational and regionally diachronous. The Skeena Group is a rgely nonmarine succession with intertongues of marginal marine strata. It has similar stratigraphic relationships lithology, and age to the marginal marine and nonmarine Groundhog-Gunanoot and Jenkins Creek assemblade respectively, of the Bowser Lake Group. Significant differences are that younger components of the Skeena Group ar similar in lithology and age to the Sustut Group, and it locally includes substantial volcanic flows. Sustut Group of t

Contractional structures of the Skeena Fold Belt are the dominant structures of all Cretaceous and older strata in th Bowser-Sustut region. In areas where the structural geometry is well displayed, axial surfaces of folds, thrust faults, an bedding traces outlining folds illustrate the structural geometry and large degree of horizontal shortening. These areas are representative of bounding areas where no structural details are shown. At this scale of compilation many folds appear as short features because they have short wavelengths and cannot be confidently extrapolated across valleys with no outcrop, although similar folds appear on neighbouring ridges. In most of the fold belt contractional structures trend northwest, but a wider variety of trends are present in the south and southwest, and domains in the southwest a dominated by northeast-trending structures. Previous compilations of the southeast part of the Bowser-Sustut regio display a rectilinear network of steep faults interpreted to be extensional faults (Richards, 1990; MacIntyre, 2007). New mapping demonstrates that many of these faults are not required by the distribution of map units (Evenchick et al 2008c), and that some are contractional faults. This compilation presents a more conservative approach in

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104G Souther, 1972; C.A. Evenchick, unpublished data.

# 104H Eisbacher, 1974; Read, 1984; Read and Psutka, 1990; Ash et al., 1997.

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Compilation by C.A. Evenchick (2008, 2009)

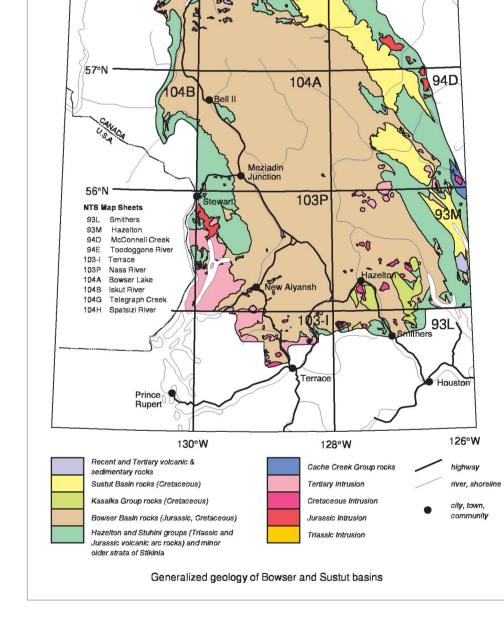
Geology by C.A. Evenchick (1985-2006); P.S. Mustard (1988,1992,1995,2003-2006); M.E. McMechan (2003-2006); C.J. Greig (1989-1993); F. Ferri (2002-2004); D.H. Ritcey (2004,2005); G.T. Smith (2003-2005); T. Hadlari (2003); J.W.F. Waldron (2004,2005).

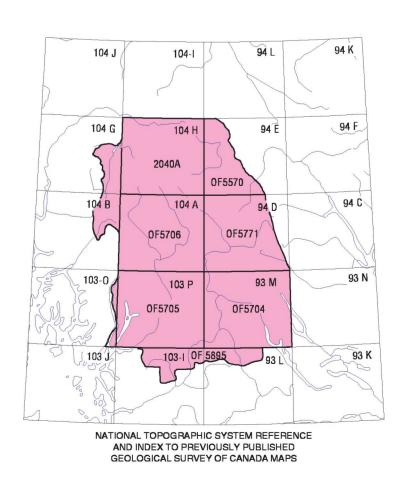
Digital cartography by C.L. Wagner, Data Dissemination Division (DDD) Digital base map from data compiled at 1:250 000 scale by Geomatics Canada, modified by DDD

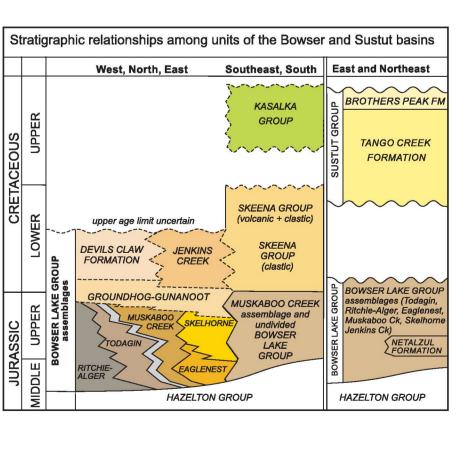
> Any revisions or additional geological information known to the user would be welcomed by the Geological Survey of Canada

Mean magnetic declination 2009, 20°58'E, decreasing 18.4' annually. Readings vary from 20°24'E in the southeast corner to 22°10'E in the northwest corner of the map

> Digital elevation model derived from BC TRIM data sets. Shaded relief image generated using an illumination source with a southeast azimuth and altitude 45° above the horizon







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