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GEOLOGICAL SURVEY OF CANADA | COMMISION GÉOLOGIQUE DU CANADA

NOTES

General physiography of the Fort Fraser map area.

The western portion of the Fort Fraser map area lies within the Nechako Plateau, a heavily glaciated region of subdued topography characterized by broad valleys between gentle, flat topped hills and low mountain ranges. It is flanked by the Skeena Mountains to the northwest, the Hazelton Mountains to the west and the Omineca Mountains to the north (Figure 1). The southern section of the Hogem Ranges, a subdivision of the Omineca Mountains, extend into the Fort Fraser map area. Surface elevations generally range from 1200 to 1500 m within the plateau and 1500 to 1900 m in the Hogem Ranges. The eastern portion of the map area is part of the Fraser Basin (Holland, 1976) and here topography is generally even more subdued with surface elevations typically less than 1000 m. Most of the rivers drain eastward into the Fraser River drainage, except Sutherland River which flows west into Babine Lake and the Skeena River drainage.

What does the map show?

The shaded-relief digital elevation model (DEM) shown on the right was compiled from a 25 m DEM grid supplied by Land Data BC. Details on the raw DEM data, and the gridding routine are given on the Land Data BC web site **(http://home.gdbc.gov.bc.ca/)**. In this image, the vertical scale has been exaggerated 2:1 to enhance small-scale features within the topographically subdued landscape. The data are displayed with an illumination from the north. As a consequence, west-trending topographic features are preferentially enhanced. The image shows clear evidence of past landslides, the impact of the last glaciation, structurally-controlled topography and anthropogenic activity. As such, it may be a useful tool for a variety of geoscience specialists. Explorationists using till geochemistry or other drift prospecting methodologies must consider regional and also local variations in the direction of ice-flow as well as differences in surficial materials. Several types of subglacial flow indicators can be readily distinguished in this shaded-relief image. In addition, the small scale of the image is useful as a reconnaissance aid in surficial geology studies. Large landforms and terrain patterns, not commonly imaged on more traditional aids such as aerial photographs, are readily identified in this image, albeit at lower resolution.

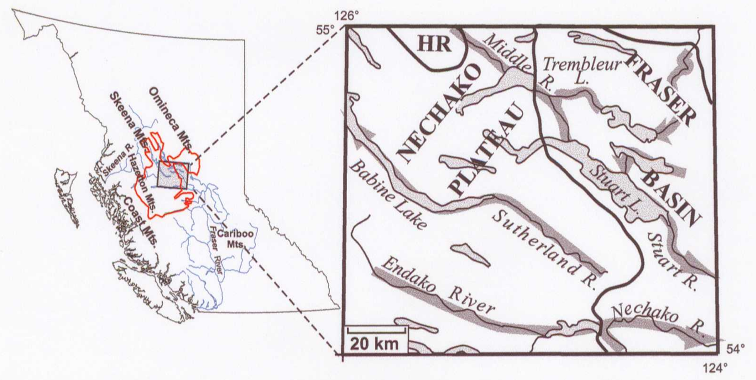


Figure 1. Extent of the physiographic subdivisions in map area from Plouffe (1997). The Nechako Plateau is outlined in red. Grey arrows indicate drainage direction, HR - Hogem Ranges.

Impact of the last glaciation

During the Late Wisconsinan Fraser Glaciation, ice covered all of central British Columbia. The first glaciers to form in the Fort Fraser map area were located in the cirques of the Hogen Ranges. Glaciers originating from the surrounding mountainous terrain (Coast, Hazelton and Skeena mountains) later reached the Fort Fraser map area and coalesced with local valley glaciers. Ice-flow throughout the map area was dominantly from west to east with some deflections around topographic highs (Figure 2). In the eastern map area, eastward flow was deflected to the northeast because of the influence of an ice lobe originating from the Cariboo Mountains (Armstrong and Tipper, 1948; Tipper, 1971; Plouffe, in press). Well developed flutings, drumlins and crag-and-tails ridges are dominant landform features throughout the Nechako Plateau and are a testament to the profound impact of glaciation on the topography of this region.

Flutings, also known as fluted moraines, are elongated, linear ridges aligned to the former direction of glacial flow. Drumlins are typically elliptical or tear-drop shaped hills consisting of unconsolidated materials. Their long-axes are parallel to the direction of ice movement and they taper or narrow in the down-ice direction. They are steepest and highest at the end that faced the advancing ice and slope more gently in the direction of movement. Crag-and-tail ridges usually consist of a knob (crag) of resistant bedrock with an elongate body (tail) of till or other sediment on the lee side. The crag forms in the up-ice direction and the tail in the down ice direction. Flutings, drumlins and crag-and-tail ridges all form at the base of active glaciers and generally are oriented parallel to the direction of ice flow. Although processes of formation can not be readily observed at the glacier base, many different processes of subglacial deformation, deposition and erosion, by both ice and water, have been proposed for their origin.

All of these streamlined landforms have been identified within the Fort Fraser map area (Plouffe, 2000; Figure 2) and many are delineated in this shaded-relief image. For example, well developed flutings and drumlins are visible in the area southwest of Stuart River, whereas crag-and-tail ridges dominate the more rocky terrain north and south of Cunningham Lake. However, as shaded-relief DEM data provide no information on composition, it is difficult in some areas to distinguish features such as drumlins from crag-and-tail ridges. Nonetheless, the strike of these features delineates the regional west-to-east ice-flow pattern throughout the map area, and variations in trend from one recognizable cluster to another provide an excellent record of local flow directions.

It is important to note that in many areas streamlined landforms are present and visible on airphotos but they are not easily discernable on the DEM at this scale. Also, ground investigations should be used in conjunction with remotely sensed data to reconstruct ice-flow histories as field data often provide more detailed and complete information. For example, in the low-lying region northeast of Babine Lake and west of Trembleur and Cunningham lakes, few drumlins or flutings are visible. However, Plouffe (2000) identified many flutings in this region on airphotos and Levson et al. (1999) found from field data that the ice-flow history of the area is more complex than the large scale landforms alone would suggest.

Well developed eskers are imaged along the southern shore of Burns Lake in the southwest part of the map area, east of Inzana Lake in the northeast map area, and southwest of Fort St James. In each case the eskers are approximately 7 to 10 km long, with a distinct, narrow (<500 m), sinuous ridge morphology. The former has an east-southeasterly strike, approximately parallel to the south shore of Burns Lake. The latter has a northwesterly strike. The esker to the west of Inzana Lake trends northeast. Northwest-trending eskers have been mapped at a number of localities in the Sutherland River valley (Plouffe, 2000) but are less distinct in this image, perhaps due to their shorter lengths and/or the steeper topography which characterizes this valley. Eskers are comprised of stratified glacial meltwater deposits and typically form beneath or within slow moving or stagnant ice. They are commonly oriented perpendicular to the ice-edge. The variations in trend of those in this map area preserves a record of local variations in subglacial water drainage directions.

Two large groups of kettled topography are imaged southwest of Fort St. James. The smaller of the two groups, encompassing an area approximately 2.5 km x 3 km, is located immediately west of the junction of Sowchea Creek and Stuart Lake. The second, larger group, encompassing an area approximately 4 km x 6 km, lies west of Pitka Creek. Both of these groups occur in glaciofluvial sediments. Another larger group of kettle holes occur southeast of Trembleur Lake. This group, which occurs in glaciolacustrine sediments, is not as well defined in this image. Kettle holes are basin- or bowl-shaped depressions in glacial drift and are produced by the melting of blocks of glacial ice that became buried, either wholly or partially, in the glacial drift. Individual kettles are typically 10-15 m deep and 30-150 m in diameter, and commonly contain a lake or swamp. They frequently occur in groups forming knob and kettle topography as exemplified by those imaged in the Fort Fraser area.

Glacial meltwater channels of varying dimensions, shapes, and trends are also common features in the Fort Fraser map area (Plouffe, 2000). Long, narrow and deeply incised channels, such as those mapped to the south and southwest of Taltapin Lake, northeast of Babine Lake and south of Stuart Lake are distinct in this shaded-relief DEM image. Others, with equal or even larger strike lengths, but which are broader and/or less deeply incised, are also well imaged, but their origin cannot be as reliably interpreted as the former from this type of data alone.

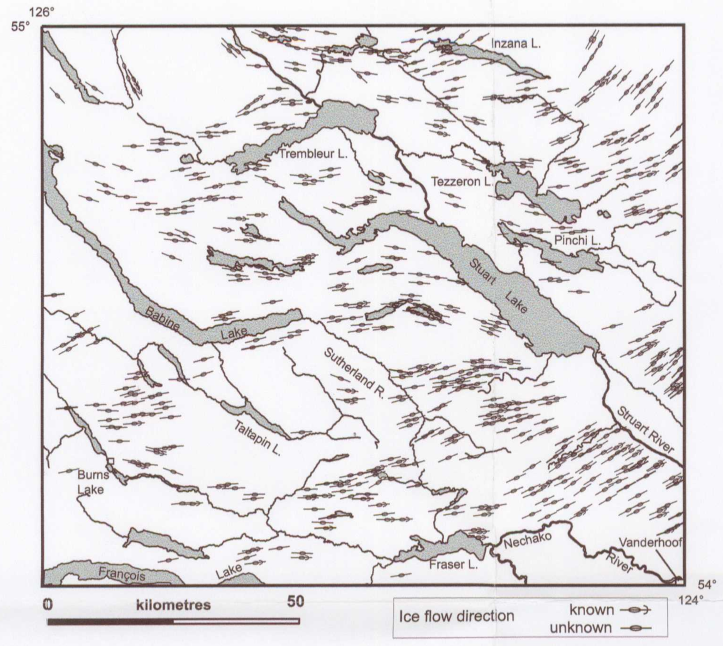


Figure 2. Ice flow direction indicators as mapped from macro-landforms (drumlins, crag-and- tail ridges and flutings) by Plouffe (1997).

Glaciolacustrine sediments are widespread in the map area, mainly in low-lying areas along modern lakes throughout the region. These sediments were deposited in glacial lakes during the final stages of deglaciation. Although present along many shorelines, glaciolacustrine sediments are most apparent on the DEM in regions where they occur as thick blankets (>10m), which mask the underlying topography. Particularly thick glacial lake sediments occur along the Stuart and Nechako rivers where they almost totally obscure the underlying topography. The lake sediments in the glaciolacustrine plain east of Fraser Lake are thinner and the underlying fluted topography is visible on the DEM, albeit subdued. The contrast between fluted topography and a glaciolacustrine plain is especially apparent southwest of the Stuart River where well developed, northeasterly trending flutings and drumlins are abruptly terminated by the lake sediment cover. The distribution of silt-rich lake sediments in the region is an important factor in landuse suitability due to its effect, for example, on soil erosion potential and agricultural capability.

Landslide scars

Most landslides within the Fort Fraser map area have resulted in the downslope transport of unconsolidated surfical materials only, bedrock failures being relatively rare. Plouffe (2000) and Levson et al. (1999) noted that large rotational landslides were most common, but not unique, in terrain underlain by older glaciolacustrine sediments. The failure scarps resulting from such landslides are often bare, or relatively bare, surfaces with a distinct concave morphology. Several rotational landslides with diameters greater than about 500 m are well-delineated in this image.

The eastern shore of Babine Lake, north of Pendleton Bay, has been particularly prone to failure as evidenced by the spectacular series of closely-spaced and overlapping landslide scars that extends for more than 10 km. Another impressive landslide scar is imaged on the eastern shore of Stuart Lake just south of the community of Pinchi. Equally large, but less spectacular, perhaps because of their orientation with respect to the illumination angle, are the landslide scars located: 1) in the Nechako River valley, east of Fraser Lake, 2) north of the junction of Trembleur Lake and Middle River in the northern map area.

Structurally-controlled topography

Although glacial deposits are extensive in the Fort Fraser map area and often as little as 5% of the bedrock is exposed, some indications of bedrock structure are apparent on the DEM. Much of the southern and western portions of the map sheet are underlain by horizontal to gently-dipping Tertiary lava flows and older granitic rocks of the Triassic to Early Cretaceous Endako batholith. Bedrock in the northern and eastern map area is dominated by Mesozoic clastic rocks and small ultramafic bodies. East of the Pinchi Fault (see Figure 3) these ultramafic bodies are more resistive than the clastic rocks they intrude and form distinct northwest-trending hills.

Structurally, the Nechako Plateau has been dissected by northwesterly, northeasterly, and easterly-trending fault systems (Struik and Wetherup, 1997). Most of the faults are poorly exposed and little is known of their geometry, timing and/or sense of motion. Examination of this shaded-relief DEM shows that several mapped faults, including the Pinchi, Prince George, Necoslie, Sutherland and Shovel faults correlate with clear topographic lineaments (compare with Figure 3). The nature of the lineament associated with these faults is variable. For instance, the surface trace of the Pinchi Fault correlates with a series of strong northwest-trending lineaments with a narrow ridge morphology. Subtle discontinuous lineaments correlate with portions of the Prince George and Necoslie Faults. In both cases, where lineaments exist, they have a gentle scarp morphology, separating more elevated topography east of the faults from lower ground to the west. East of Tochcha Lake, NNW-trending ridges correlate with the strike of lithologic units and a series sub-parallel NNW-trending faults. The user must, however, exercise caution when interpreting lineaments on this image, as several linear digitization and gridding artifacts are also evident.

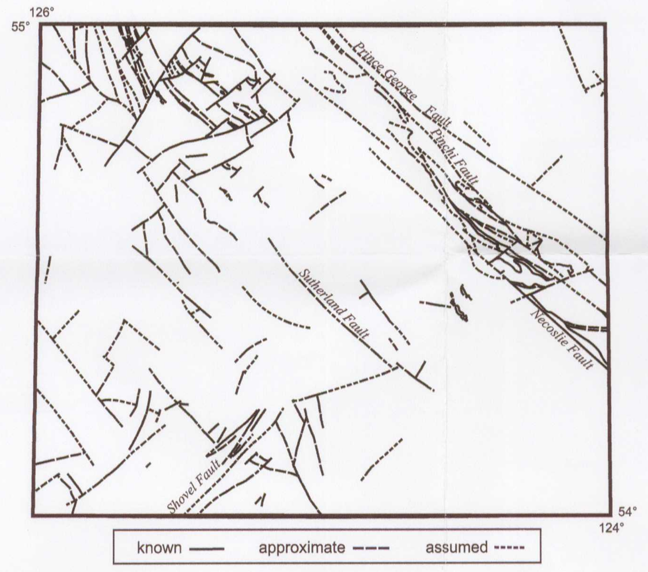
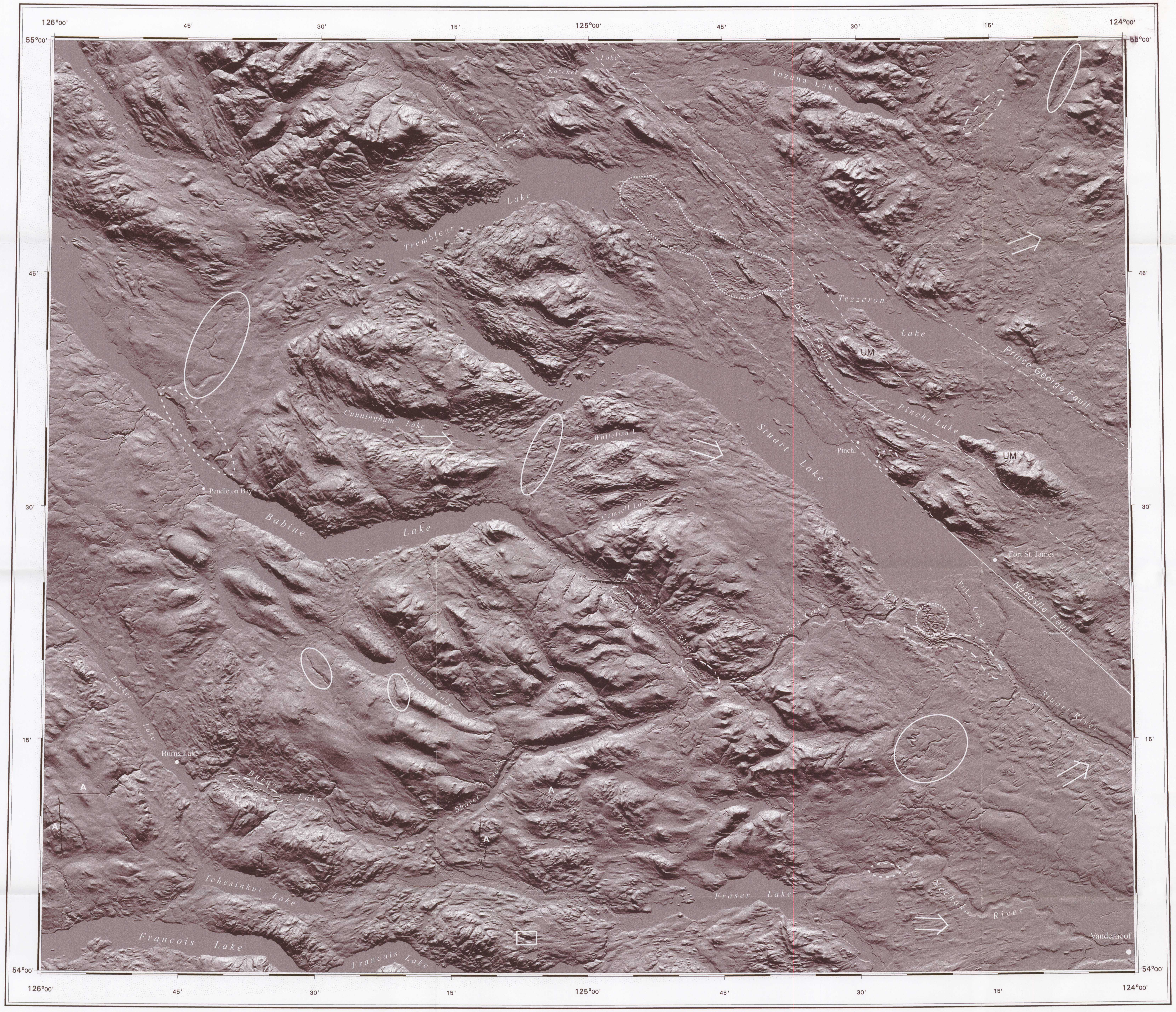


Figure 3. Mapped faults within the Fort Fraser Map area from Struik and Wetherup (1997).

Anthropogenic activity

Although anthropogenic activity has undoubtedly modified topography in the Fort Fraser map area, relatively little of man's impact on the landscape is visible at the scale and resolution of this shaded-relief image. Exceptions are the open-pits of Endako porphyry molybdenum mine which form a distinct northwest-trending topographic depression. The mine is located about 13 km west of Fraser Lake in the southern map area. The bottom of the largest pit, the Endako pit (Figure 4), lies approximately 240 m below the surrounding land level. The Denak East and Denak West pits are considerable shallower and smaller. The deposit was discovered in 1927, but was not opened as a mine until 1965. It has been in continuous operation as an open-pit mine since that time.



LEGEND

Landslide scar
Glacial meltwater channel/s
Kettled topography
Eskers
Ice flow direction
Endako Mine
Faults (known, approximate, assumed)
Ultramafic intrusion .... UM
Digitization and/or gridding artifact .... A

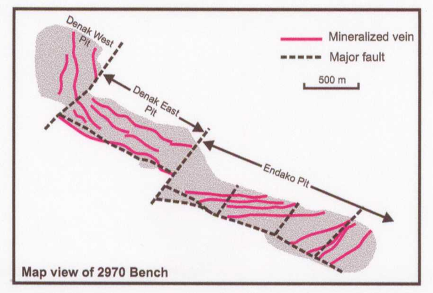


Figure 4. Morphology of the Endako Mine from Bysouth and Wong (1995).

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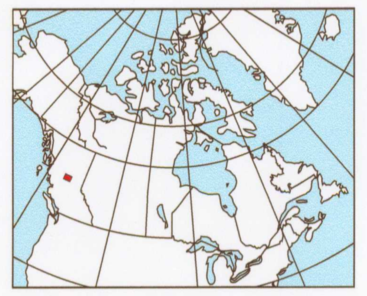

LOCATION MAP

Compilation by J.K. Porter, R. Kung and C. Lowe, 2000

Coordinated through the auspices of the Nechako NATMAP Project

Digital cartography by J.K. Porter, Geological Survey of Canada

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

OPEN FILE 3943

SHADED-RELIEF DIGITAL ELEVATION MODEL

FORT FRASER
BRITISH COLUMBIA

Scale 1:250 000/Échelle 1/250 000

kilometres 5 0 5 10 15 20 25 30 kilomètres

Universal tranverse Mercator Projection
North American Datum 1983

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Projection transverse universelle de Mercator
Système de référence géodésique nord-américain, 1983

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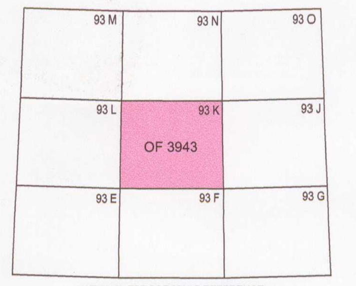

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