





Ministry of Energy and Mines  
Resource Development Division

Geological Survey Branch

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**SURFICIAL GEOLOGY OF THE HUCKLEBERRY MINE AREA**

NORTH-CENTRAL NTS 93E/11

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Cartography by T. Ferbey

SCALE 1:15 000

1,00001,0002,000

Metres

datum: NAD 83 projection: UTM Zone 9  
elevation in metres above mean sea level; contour interval 20 m  
Field survey carried out July to September, 2000

## GEOLOGY

### QUATERNARY SEDIMENTS

#### HOLOCENE

**Colluvial Deposits:** poorly sorted, angular gravels and sandy diamicts, found on moderate to steep slopes, associated with the down-slope transport and deposition (by gravity processes) of weathered bedrock and pre-existing Quaternary sediments.

**Colluvial Blanket:** colluvial deposit >1 m in thickness, generally conforming to underlying topography but masking small scale irregularities; found mainly on moderately steep (~15° to 20°), lower elevation slopes capping glacial units, locally forms talus deposits below steep slopes.

**Colluvial Veneer:** colluvial deposit 1 m or less in thickness, that conforms to minor surface irregularities of the underlying material; commonly found at higher elevations on steep to very steep slopes (~25° to 35°), where it is interpreted as being deposited with areas of bedrock or moraine deposits.

**Fluvial Deposits:** silt, sand, and gravel deposited by streams and creeks; usually stratified, and with the exception of alluvial fans, is moderately to well sorted.

**Fluvial Plain:** thick fluvial deposit (>1 m) found on gently sloping surfaces; includes overbank deposits, terraces, abandoned and active channels of Whiting and Rhine Creeks, and the Sweeney Lake outlet; locally includes small areas of organic deposits along Whiting Creek and includes a deltaic deposit located at the east end of Sweeney Lake.

**Alluvial Fan:** thick deposits (>1 m) found at the mouth of a gully or confined valley; these deposits are dominantly fluvial in origin but likely include debris flow sediments.

**Organic Deposits:** bog or swamp like, unfossilized, composed primarily of moss and organic soils, with a shallow water table found at or near the surface.

**Organic Blanket:** organic deposit >1 m in thickness, found in poorly drained areas that overlie thick moraine and fluvial deposits; typically fibric to mesic peats with identifiable organic material ranging in size from twigs and cones to tree limbs and stumps; can be capped by organic mounds or gyttja, small ponds are present with small, low discharge, streams running through or from them; these deposits occupy relatively large areas east of Sweeney Lake and on the Huckleberry Mine property between the Main and East Zone Pits.

**Organic Veneer:** organic deposit 1 m or less in thickness; commonly borders ponds, lakes, and streams, but is also associated with bog (i.e. Ob) margins; Ov is cross-hatched where other surficial units are also extensive.

### LATE PLEISTOCENE DEPOSITS

**Moraine Deposits:** typically massive, matrix-supported, sandy-silt, light brown to light grey, poorly sorted diamicts, originally deposited by or from glacial ice; these deposits are predominantly overconsolidated basal tills with vertical jointing and good sub-horizontal fissility; stratified clasts are common; locally these tills can have a more sand rich matrix and can contain discontinuous lenses, and in some cases interbeds, of poorly sorted gravely sands; at Huckleberry Mine, mineralized andesite and granodiorite clasts are common immediately adjacent to, and west of, the Main and East Zone pits; pyrite and chalcopyrite grains are also common here within the diamict matrix which is locally dark grey and clay-rich.

**Moraine Blanket:** moraine deposit >1 m in thickness, with a known maximum thickness of approximately 30 m in the vicinity of the Main and East Zone pits; generally conforms to underlying topography but masks small scale irregularities; these deposits form an extensive cover in valley bottoms and on the lower and mid-slopes of highland areas; gullied moraine deposits (Mb-V) have the same general characteristics but have been deeply incised by fluvial processes, and are typically found on the steeper flanks of Huckleberry Mountain and on the northern slopes of Tahtsa Reach.

**Moraine Veneer:** moraine deposit 1 m or less in thickness, that conforms to minor surface irregularities of the underlying material; typically a basal till that is found in higher relief areas (e.g. north shore of Tahtsa Reach and south of mine area) and higher elevations of Huckleberry Mountain; associated with bedrock outcrop, but can also contain small areas of colluvial and moraine blanket material; Mv is cross-hatched where other map units are also extensive.

### PRE-QUATERNARY BEDROCK

**Bedrock:** large areas of bedrock outcrop are limited to the higher elevations of Huckleberry Mountain; flooding of the Nechako Reservoir, and resulting wave-wash processes, have created discontinuous bedrock outcrop along the shores of Tahtsa Reach; small areas of bedrock outcrop are also found locally in steeper colluvialized areas above the north shore of Tahtsa Reach; bedrock of the Huckleberry Mine area is typically hornfelsed, fragmental, andesite of the Early Jurassic Telkwa Formation (MacIntyre, 1985); at Huckleberry Mine, mineralization occurs within a stockwork system of fractures and veinlets associated with two porphyritic hornblende-diorite-biotite granodiorite intrusions (Late Cretaceous Bulkley Intruded Euxine; these stocks are adjacent to or within the Main and East Zone pits; MacIntyre, 1985; Jackson and Illebrun, 1995); although there is copper and molybdenum mineralization within both stocks, nearly all ore mined is from the adjacent volcanic rocks (S. Blower, pers. comm., 2000).

NOTE: Composite delimiters on the map separate more extensive (single back-slash, /) and considerably more extensive (double back-slash, //) surficial units from less extensive units (e.g. Mv/R - Mv is considerably more extensive than R).

## SYMBOLS

surface till sample	•	roche moutonnée, crag and tal, flute (uni-directional)
sub-surface till sample (collected using Becker-hammer drill)	•	ridge, flute (bi-directional)
stratigraphic section site (section number)	1000-10	groove
mineral occurrence (MINFILE number)	93E/11	rat-tail
geologic contact (approximate)	—	strie (uni-directional)
active pit outline	—	strie (bi-directional)
active mine area	—	
road	—	

## GLACIAL FEATURES

**INTRODUCTION**  
During the 2000 field season, geochemical studies were conducted on the Huckleberry Mine area and interpretations of 1:15,000 scale aerial photographs. The terrain mapping conventions used here are based on those of Howse and Kenk (1997), and focus primarily on surficial materials and surface expression. A composite stratigraphic section (Figure 2), based on the detailed stratigraphic and sedimentologic studies conducted on the mine property, is included to assist in characterizing the Quaternary sediments of the Huckleberry Mine area.

This surficial geology map is a product of the 2000 field survey of the Huckleberry Mine area and interpretations of 1:15,000 scale aerial photographs. The terrain mapping conventions used here are based on those of Howse and Kenk (1997), and focus primarily on surficial materials and surface expression. A composite stratigraphic section (Figure 2), based on the detailed stratigraphic and sedimentologic studies conducted on the mine property, is included to assist in characterizing the Quaternary sediments of the Huckleberry Mine area.

### LOCATION AND PHYSICAL SETTING

The Huckleberry Mine area falls within the transition zone between

Figure 1 - NTS 93 E, Whitesail Lake, with study area location. At Huckleberry Mine, Quaternary sediments were studied in detail while surface and sub-surface basal till samples were collected for trace element geochemical analyses. A study of streamlined and erosional landforms and features extended into NTS 93E/10-11, 14-16, to help determine the Late Wisconsinan ice-flow history of the Huckleberry Mine area.

the Nechako Plateau to the east and the Coast Mountains to the west (Figure 1). This area, the Tahtsa Range, is a belt of mountains 16-24 km wide, oriented northwest-southeast, with peaks ranging from 2100 to 2400 m in elevation. The Tahtsa Ranges are divided roughly east-west by major valleys that are occupied by large lakes (e.g. Tahtsa, Trout, and Whitesail Lakes). These lakes are prominent features of the Tahtsa Ranges and occur at relatively high elevations (784 to 930 m) therefore reducing the overall relief of the area (Holland, 1976). Valley bottoms and mountain flanks are forested and have thick sequences of Quaternary sediments with little bedrock exposure. Upper slopes and peaks extend into sub-alpine and alpine environments.

Huckleberry Mine (MINFILE No. 093E/037) is located on the north side of Tahtsa Reach, approximately 120 km southwest of Houston, British Columbia, and is accessed via Forest Service and private mine roads (Figure 1). The mine site is located in a poorly drained, boggy, arcuate, U-shaped valley (averaging 1015 m elevation), adjacent to the southern flank of Huckleberry Mountain (1543 m). Huckleberry Mine is a porphyry copper-molybdenum open pit mine, with minor recoverable amounts of gold and silver, and has a production rate of 21,000 tonnes/day ore (Huckleberry, 2000). A more detailed discussion on local bedrock types and the style of mineralization can be found in the map unit descriptions. Other mineral occurrences

MINFILE NUMBER	NAME	STATUS	COMMODITY	DEPOSIT TYPE
093E/037	HUCKLEBERRY	Producer	Cu, Mo, Ag, Au	Porphyry Cu ± Mo ± Au
093E/038	LEN 45	Showing	Cu	Porphyry Cu ± Mo ± Au
093E/039	LEN 56	Showing	Cu, Zn	Polymetallic veins Ag-Pb-Zn-Au
093E/086	WEE	Showing	Cu, Mo	Porphyry Cu ± Mo ± Au
093E/113	WHITING CREEK (SWEENEY)	Showing	Cu, Mo	Porphyry Cu ± Mo ± Au

Table 1 - Mineral Occurrences located near Huckleberry Mine. Locations, with MINFILE number, are shown on the map with a star found near Huckleberry Mine are listed in Table 1, with locations shown on the map.

### PREVIOUS WORK

The surficial geology of the study area was first mapped by the British Columbia Ministry of Environment, Lands and Parks (1976) at a scale of 1:50,000, while a more detailed 1:10,000 scale map of the Huckleberry Mine property was produced by New Canim Resources (1993). In both cases, these maps are limited to the delineation and interpretation of surficial sediments only; identification and interpretation of ice flow indicators such as striae and streamlined landforms are not included.

Other Quaternary geological studies have been conducted in areas adjacent to the Whitesail Lake map area (NTS 93 E). Immediately north, Tipper (1994) and Levson *et al.* (1998) discuss the Quaternary geology and glacial and geomorphic features of NTS 93 L and M. Again to the north, a detailed report on the Quaternary geology and till geochemistry of the Babine Copper Belt (NTS 93 L, 9, 16, M, 1, 2, 7-8) is provided by Levson (2001) and Levson *et al.* (2002). Similar studies by Levson and Giles (1997), Levson *et al.* (1999), Plouffe and Levson (2001), Levson and Mate (2002), focus on areas bordering to the northeast, east, and southeast, within NTS 93 E, F, and G respectively. Stump *et al.* (2000) discuss the timing of the Fraser Glaciation in central British Columbia, and associated ice-flow events.

Quaternary geological studies within NTS 93 E have not yet revealed any Middle Wisconsinan (Olympia non-glacial) ages. However 100 km east of the Huckleberry Mine area, on Cheslatta Arm, organic rich sediments that underlie Late Wisconsinan (Fraser Glaciation) till have produced radiocarbon ages that range from approximately 27,000 to <45,000 years B.P. (Levson and Giles, 1997; Levson *et al.*, 1998). As well, nonglacial sediments under till that have yielded finite radiocarbon ages occur in a number of other localities further east in the Nechako Plateau (Plouffe and Jetté, 1997; Plouffe and Levson, 2001) and approximately 200 km north of the study area at the Bell Mine on Babine Lake (Harrington *et al.*, 1974; Levson, 2001). The Quaternary sediments of the Huckleberry Mine area are believed to be correlative with those found in areas adjacent to NTS 93 E which overlie the dated organic rich and lacustrine deposits and are therefore interpreted as being Late Wisconsinan (Fraser Glaciation) to Holocene in age.

### QUATERNARY GEOLOGY

Although the Quaternary landscapes depicted on this map is dominated by Late Wisconsinan moraine deposits, it has been modified significantly by post-glacial (or Holocene) fluvial and

Levson (2001).

### Advance Phase and Glacial Deposits

Advance phase sediments in the Huckleberry Mine area are only seen in vertical exposures and are composed primarily of clast supported, matrix filled, trough cross-bedded, large pebble to cobble gravels, bottom contacts are not exposed (e.g. Stratigraphic Section 2000-11). These deposits, interpreted as advance phase glaciofluvial sediments, are observed peripheral to, and slightly down-elevation from, the central part of the arcuate valley that hosts the Huckleberry Mine deposit. Up-section these deposits are interfused with matrix supported, massive to stratified, sandy-silt to silt-sand diamicts interpreted to be debris flow deposits.

In the vicinity of the Main Zone Pit and in the East Zone Pit area, seen in vertical exposures in the valley bottom (approximately 1040 m), are laminated silts and clays, pebbly muds, and massive fine sands. These fine sediments are locally deformed (e.g. millimetre scale shears, normal and thrust faults), and contain small to medium pebble-sized dropstones (Stratigraphic Section 2000-2). They infill a bedrock depression that opens to the east where a sediment dam may have prevented free drainage to the east. Similarly sediments are observed in gully exposures on the southern flank of Huckleberry Mountain (Stratigraphic Section 2000-3 and 4), at approximately 1120 m.

These fine grained sediments are interpreted as advance phase ice-marginal or sub-glacial glaciolacustrine sediments. At all exposures, these glaciolacustrine sediments are interbedded with the Holocene as indicated by wood fragments from a peat horizon overlying fan gravels that yielded a radiocarbon age of 7120 years B.P. (±60 years B.P.) (Beta 158482). Organic veneers (Ov), swampy like in character, commonly border bodies of standing water, bogs, and streams, while organic blankets (Ob), or bogs, are aerielly more extensive and substantially thicker, occupying large depressions in poorly drained areas. Other Holocene deposits in the area include fluvial fans (Ff) and fluvial plains (Fp), such as those deposited by Whiting Creek in the northeast corner of the map area and by Rhine Creek in the southwest. Both creeks drain areally extensive, high elevation areas to the north where glaciers continue to supply meltwater, helping account for these sizeable deposits.

Full glacial deposits are the dominant Quaternary deposit and form a ubiquitous cover in the Huckleberry Mine area. A product of comminution and reworking of bedrock and existing Quaternary deposits by glacial ice during the Fraser Glaciation, these deposits consist primarily of a massive and matrix supported, overconsolidated, sandy-silt diamict, that is typically fissile and well jointed. These deposits are interpreted as basal tills and form blankets typically overlie either bedrock (R) (e.g. Stratigraphic Sections 2000-1, 2000-3, and 2000-7) or glacio-fluvial sediments (e.g. Stratigraphic Section 2000-11). The exception to this would be east of the Main Zone Pit and in the East Zone Pit area, where in addition to overlying bedrock, basal tills are found overlying the previously described glaciolacustrine sediments (Stratigraphic Section 2000-2). At higher elevations, and on steeper slopes, till forms a thin veneer

(Mv) that mantles bedrock (R) or is found as a discontinuous cover in association with colluvial veneers (Cv).

At Stratigraphic Section 2000-1, multiple till units were identified. The units are distinguished primarily by differences in physical characteristics such as clast size, clast content, matrix texture and colour. The contacts between units are typically gradational over 20 to 30 cm. The presence of multiple till units (each 2 to 6 m in thickness) could be attributed to the complex ice-flow history of the area and changes in ice flow direction which resulted in a change in provenance for individual till units; a change in depositional facies (e.g. from basal lodgement to basal meltout), or a combination of both.

### Retreat Phase and Holocene Deposits

De-glacial phase deposits consist primarily of interbedded gravels and sands. Gravel beds are clast-supported and include both moderately to poorly sorted, matrix-filled, large pebble to cobble gravels and open work, small to medium pebble gravels. Sands are poorly sorted and mainly medium to coarse grained. These sands and gravels were observed on the Huckleberry Mine property in vertical exposures only (e.g. Stratigraphic Sections 2000-5 to 7, and 2000-10), directly over till. They are interpreted as glacio-fluvial sediments, deposited as ice retreated from the area.

Organic deposits are the dominant Holocene surficial material in the Huckleberry Mine area. They probably accumulated over much of the Holocene as indicated by wood fragments from a peat horizon overlying fan gravels that yielded a radiocarbon age of 7120 years B.P. (±60 years B.P.) (Beta 158482). Organic veneers (Ov), swampy like in character, commonly border bodies of standing water, bogs, and streams, while organic blankets (Ob), or bogs, are aerielly more extensive and substantially thicker, occupying large depressions in poorly drained areas. Other Holocene deposits in the area include fluvial fans (Ff) and fluvial plains (Fp), such as those deposited by Whiting Creek in the northeast corner of the map area and by Rhine Creek in the southwest. Both creeks drain areally extensive, high elevation areas to the north where glaciers continue to supply meltwater, helping account for these sizeable deposits.

Throughout the Holocene the main channel of Whiting Creek has moved laterally across the more open area at the mouth of the confined Whiting Creek valley. The decrease in stream competency as Whiting Creek exits the confined valley has resulted in sediment aggradation and formation of a large fluvial fan (Ff, northeast corner of the map area). At some point during early Holocene time, Whiting Creek flow shifted across this developing fluvial fan, and flowed southwest into Sweeney Lake. Deposition of the fluvial plain (Fp) on the east shore of Sweeney Lake may be the product of resultant increased lake levels which were likely maintained until a sediment dam at the west end of Sweeney Lake was topped and incised by the present day outlet. Seen in the field are poorly exposed, fine grained sediments, in the vicinity of the Mount Sweeney and Sweeney Lake Road intersection, these may be lacustrine sediments, perhaps also a product of increased lake level. The Whiting Creek main channel has since shifted back across the large fluvial fan towards the southeast and present empties into Tahtsa Reach.

Moraine deposits commonly occur at the surface but locally are covered by organic (Ob) or colluvial blankets (Cb). Moraine blankets typically overlie either bedrock (R) (e.g. Stratigraphic Sections 2000-1, 2000-3, and 2000-7) or glacio-fluvial sediments (e.g. Stratigraphic Section 2000-11). The exception to this would be east of the Main Zone Pit and in the East Zone Pit area, where in addition to overlying bedrock, basal tills are found overlying the previously described glaciolacustrine sediments (Stratigraphic Section 2000-2). At higher elevations, and on steeper slopes, till forms a thin veneer

Figure 2 - This composite stratigraphic section is composed of representative sedimentary units observed and described at 12 exposures at Huckleberry Mine. Individual units are drawn here in maximum true thickness.

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