Arctic Geophysics Inc.
Geophysical Surveys • Prospecting • Consulting

BC Geological Survey
Assessment Report
33342

Geophysical Survey with 2D Resistivity
Pine Creek, British Columbia

ON PLACER TENURES 611136, 619743 and 896529

ATLIN MINING DIVISON

MAPSHEET 104N.063

Latitude 59° 36' 30.0''N, Longitude 133° 29' 24.2''W

WORK PERFORMED ON MAY 25th – 26th 2012

OWNER: SCOTT, BRIAN WILLIAM 50% – Box 77 Tagish YT, Y0B 1T0
MARTINDALE, MARDELL 50% – Box 24 Tagish YT, Y0B 1T0

CONSULTANT: ARCTIC GEOPHYSICS INC. – BOX 747 DAWSON CITY YT, Y0B 1G0

AUTHOR: PHILIPP MOLL

DATE SUBMITTED: September 21st 2012

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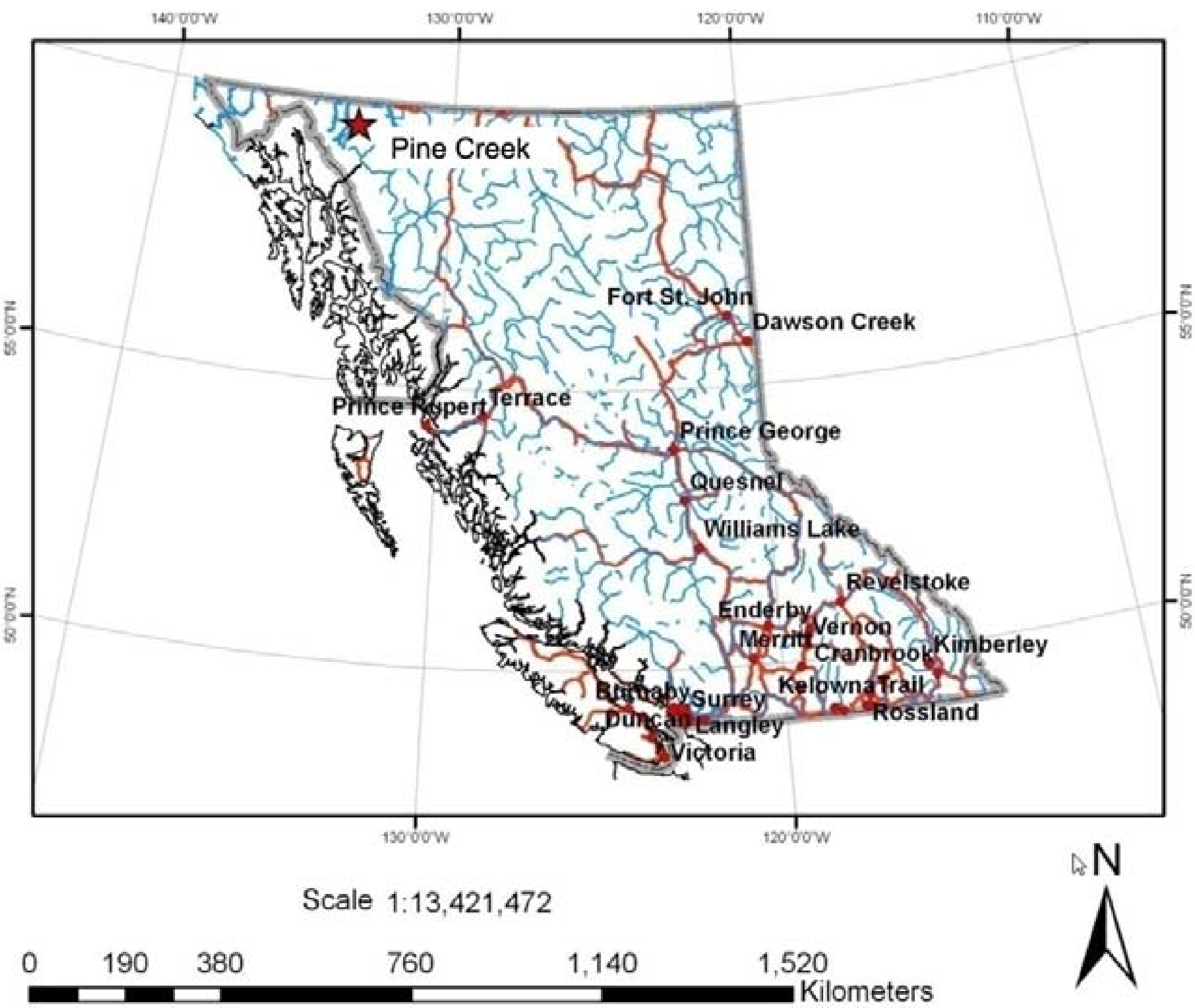
1. Introduction

The Atlin gold rush was an off shoot of the 1898 Klondike gold rush. Gold mining activities have continued in Atlin to the present day; and although some of the traditional creeks have been thoroughly mined out there are still potentially rich placer areas to be discovered.



The geology of the Atlin area shows extensive signs of glaciation. At Pine Creek (Atlin BC) commercial placer gold deposits are potentially sitting in glaciofluvial gravels, glaciolacustrine sediments, till on top of bedrock, and pre-glacial gravels which have been preserved.

This geophysical survey, using 2D Resistivity, was done on the placer tenures 611136, 619743 and 896529 at Pine Creek (Latitude 59° 36’ 30.0’’N, Longitude 133° 29’ 24.2) for Brian Scott and Martindale Mardell.

The claims are 15km east of Atlin and were accessed via the Surprise Lake Road and the Birch Creek road.

A total of 950m of measuring line was produced during the survey.

The survey was focussed on measuring and interpreting following **subsurface characteristics**:

1. Depth and topography of bedrock
   - Paleochannels
2. Sedimentary stratification
3. Groundwater table
4. Mining/prospecting history

This geophysical survey using Resistivity is delivering subsurface information as the foundation for a systematic advanced prospection with technological means such as trenching, drilling, or shafting.

2. Crew

Survey Leader:	Stefan Ostermaier
Assistance in the field:	Franz Piechotta
Support, Documentation:	Philipp Moll

3. Fieldwork - Schedule

Fieldwork: 25th May 2011 – 26th May 2012
Processing, Interpretation, First Documentation: 27th - 28t^{h} May 2012

4. Geophysical Method

Resistivity is not a time domain geophysical method such as Ground Penetrating Radar or Seismic. Resistivity measures a material property. In the Resistivity model the different underground zones are material-dependently differentiated according to their electrical conductivity. Thus, Resistivity promises good chances in respect of measuring the kind and character of the subsurface materials as well as the groundwater distribution, which would be of interest for placer mining. The equipment used (see below) allows for measuring of layer interfaces in depths from 0.5m to 100m by varying the electrode spacing. – Therefore, this prospecting concept is based on the use of 2D Resistivity.

Figure: 2D Resistivity measurement, Stefan Ostermaier, Arctic Geophysics Inc., Yukon 2009

5. Use of Geophysical Methods

5.1. Instrumentation

For this survey a lightweight, custom-built 2D RESISTIVITY and INDUCED POLARIZATION (IP) imaging system with rapid data acquisition was used. The system includes:

- "4 POINT LIGHT" EARTH RESISTIVITY METER[1]
- 96 ELECTRODE CONTROL MODULES[2]
- 96 STAINLESS STEEL ELECTRODES[3]
  480m MULTICORE CABLE: CONNECTOR SPACING: 5m[4]

[1] Constructed and produced by LGM (Germany)
[2] Ditto
[3] Constructed and produced by GEOANALYSIS.DE (Germany)
[4] Ditto

This system weighs approximately 120 kg which is about one third of regular standard equipment. It can be run with a 12V lead battery. The equipment facilitates high mobility and rapid data acquisition with a small crew.

5.2. Data Acquisition

Resistivity

The data acquisition is carried out by the automatic activation of 4-point-electrodes. Thus several thousand measurements are taken, one every 1-2 seconds. The AC transmitter current of 0.26 to 30 Hz is amplified by the electrode control modules, up to a maximum of 100mA and 400V peak to peak. The voltage measured at the receiver electrodes (M, N) is also amplified.
In this geoelectrical survey the **Schlumberger-array** were used. The Schlumberger array is appropriate to image horizontal layers as is needed for placer prospecting.

The 2D Resistivity imaging system, used for this survey, allows measurements with a depth of up to 90m. With a depth to bedrock of more than 6m, an electrode spacing of 5m can be used for placer surveys. This allows the measuring of large profile lengths in short time with a horizontal measuring resolution of 2.5m. This quantification has proven itself to be reliable in the determination of the bedrock topography and sedimentary arrangement for placer investigation at the most environmental conditions.

5.3. Processing

Resistivity

The measured Resistivity data were processed with the **RES2DINV** inversion program[5].

Schlumberger arrays, used in this geoelectrical survey, is appropriate to measure subsurface conditions predominantly showing a horizontal zoning of the ground materials.

5.4. Interpretation

In this survey the interpretation of the Resistivity models is high likely since the data quality is very high and the data structure of the models is most plausible!
The resistivity profile is the basic source for the interpretation of placer-related subsurface aspects of overburden and bedrock.

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[5] Produced by GEOTOMO SOFTWARE (Malaysia)

6. Mining History of Pine Creek[6]

The first discovery of gold in the camp was in surface gravel in Pine Creek in 1898 near what became the settlement of Discovery. By the next season 640 miners were working the surface gravels of the valley bottom and farther upstream at Gold Run were mining underground, and the total recorded production was 13,828 ounces which is more than was produced in any other season. Many of the miners left at the end of the 1899 season. Ditches to bring water for hydraulic mining were dug in 1900 and were put into use in 1902. A dredge was built at Gold Run in 1903 and was operated in 1904 and part of 1905, but could not successfully handle boulders encountered.

A dam was built at the mouth of Surprise Lake in 1905 to increase its storage capacity and provide more water for hydraulicking. A steam shovel was operated in 1906 and 1907 to handle gravel east of Discovery, and then in 1908 and major hydraulic operation was started. This continued until 1922, and at the end of that period the main pit had almost the extent it has now.

After suspension of the large scale hydraulic operation in most years only a few underground operations and some sniping was carried on and production generally was much less. A hydraulic operation at the southeast limit of the pit was successful in 1932-1935 and another along the southern limit was successful in 1938 and 1939. In 1940 a company was formed that used a dragline and bulldozers to move gravel along the northern part of the pit to a mobile washing plant. This operation was continued until 1942. Since then production has been low.

A company was formed in 1925 to hydraulic gravel west of the main hydraulic cut and presumed to be in an old channel of Pine Creek. The operation was continued until 1930 and in that period about two million yards of gravel was handled and a 1,500 foot length of bedrock was cleaned but no pay gravel was found.

The grade of bedrock in parts of the pit was too low for sluicing efficiently, and during operations it was necessary to cut ditches into bedrock and sluices were laid in these. Much of the bedrock is soft decomposed serpentinized rock and easily eroded. Intruding this are hard

[6] Black, J. M.: Report in the Atlin Placer Camp, 1953

dark green dykes and these project as ribs above the general rock surface. Preglacial gravel occurs or did occur in some areas, but much of it has been worked [...]. Yellow gravel is exposed in the banks of the pit and continues for an unknown distance north and south of the pit. Some of it has been drift-mined but the remaining gravel is not being worked. East and west of the main area except at Gold Run till rests on bedrock, some of which is glaciated and much of the remainder presumably is. Parts of Gold Run have been drift-mined but this section has not been hydraulicked and some sections presumably are of economic interest.

7. General Geology[7]

The survey area at Pine Creek is located in the Cache Creek Terrain west of Surprise Lake.

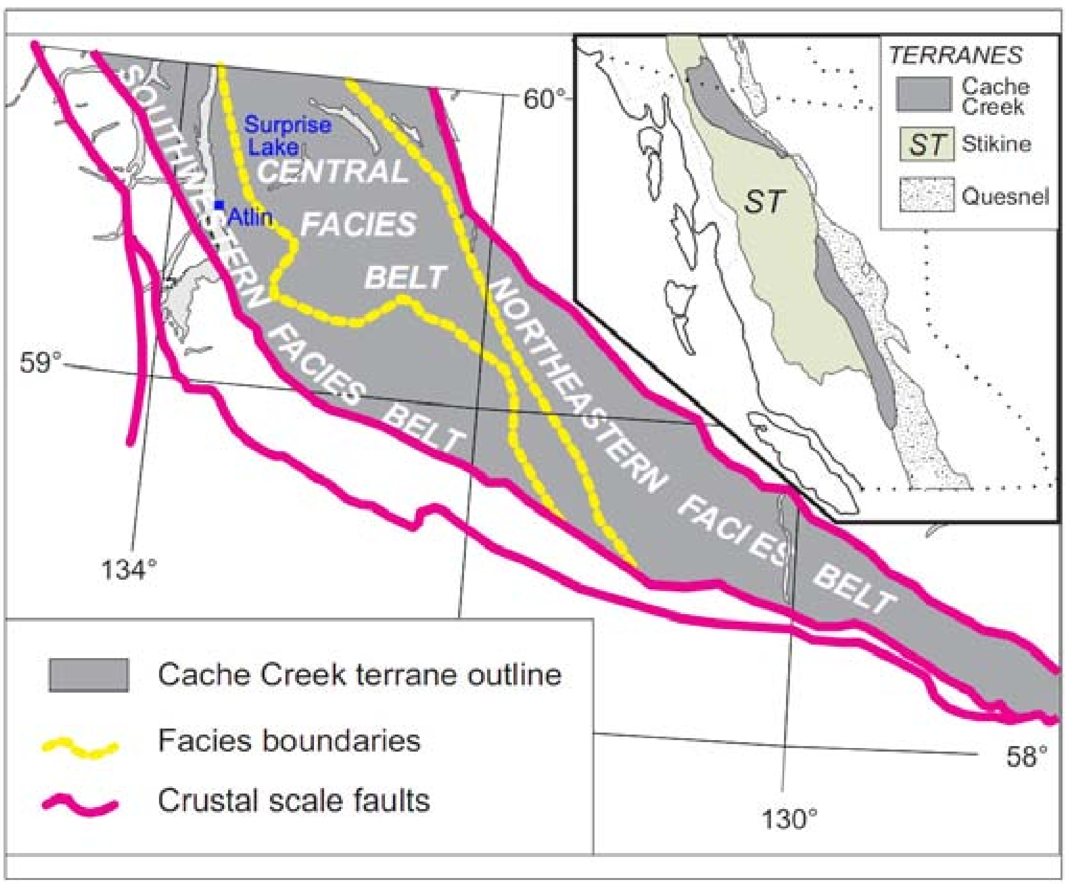


Figure: Cache Creek Terrain[8]

[7] W. Gruenwald, B. Sc.: Geological, Geochemical and Geophysical Report on the Eagle, Margarita and Butterfly Claims, Atlin Mining Division, BC, 1984
Black, J. M.: Report in the Atlin Placer Camp, 1953
Asg, C. H.: Origin and Tectonic Setting of Rocks in the Atlin Area, BC (NTS104N), Ophiolitic, Ultramafic and Related, Geological Survey Branch, Bulletin 94, 1994
[8] British Columbia Geological Survey Branch, Bulletin 105v25C05, Chapter 5

7.1. Bedrock

During the upper Paleozoic (Permo-carboniferous 360 - 250 million years ago) common components of the contemporary Cache Creek bedrock complex were created: Quarzite, argillite, greenstone[9], and marble.

In the Mesozoic (250 - 65 million years ago) numerous irregular bodies of ultrabasic rocks have intruded into host rock dominated by the above mentioned rock types (Atlin Intrusions). The majority of these bodies were altered to masses of quartz-carbonate with variable amounts of greenish nickel-chromium micas.

During the Jurassic period (200 - 145 million years ago) granitic intrusions occurred in the Cache Creek area: for example the granodiorite body at Mt. Carter north of Atlin, and the alaskite[10] quartz monzonite masses of the Surprise Lake Batholith east of Atlin.

The youngest rocks mapped in the Atlin area are the olivine basalt flows and scoria near the headwaters of Volcanic and Ruby Creeks.

Today the host rocks for the above mentioned intrusions are the sedimentary, metamorphic, and volcanic rocks of the Cache Creek Group seen in the Bedrock Geology Map below.

Lode gold occurrences, which are thought to be the source of the Atlin placer gold deposits, are found in quartz veins, veinlets and/or stockworks associated with structural features such as faults or shear zones within, along, or near intrusive bodies.

[9] Term for green schist including chlorite, actinolite, epidote
[10] American term for alcali feldspare granite

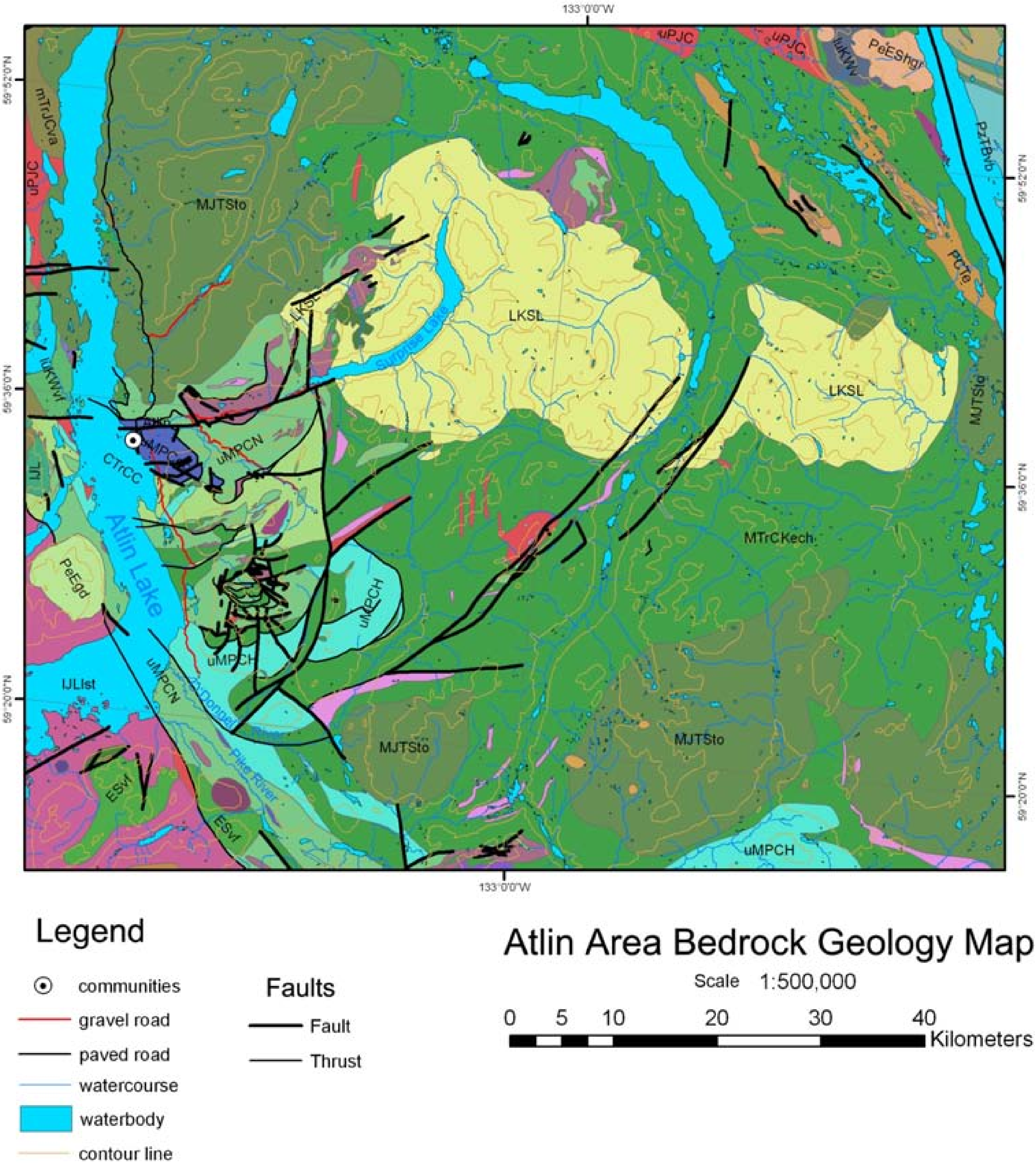


Figure: Bedrock Geology Map – Atlin Area[11]

[11] Massey, N.W.D., MacIntyre, D.G., Desjardins, P.J. and Cooney, R.T., 2005: Digital Geology Map of British Columbia: Tile NO8 Northwest B.C., B.C. Ministry of Energy and Mines, Geofile, 2005-8, scale 1:250,000

Bedrock Geology

STRAT_UNIT

- CTrCC - Paleozoic to Mesozoic - Cache Creek Complex undivided sedimentary rocks
- DCog - Paleozoic - Unnamed orthogneiss metamorphic rocks
- ESv - Cenozoic - Sloko Group undivided volcanic rocks
- ESvf - Cenozoic - Sloko Group rhyolite, felsic volcanic rocks
- ESvl - Cenozoic - Sloko Group coarse volcaniclastic and pyroclastic volcanic rocks
- LKSL - Mesozoic - Surprise Lake Plutonic Suite granite, alkali feldspar granite intrusive rocks
- LKWfp - Mesozoic - Windy Table Complex feldspar porphyritic intrusive rocks
- LMPCN - Paleozoic - Cache Creek Complex - Nakina Formation gabbroic to dioritic intrusive rocks
- MJTSdr - Mesozoic - Three Sisters Plutonic Suite dioritic intrusive rocks
- MJTSto - Mesozoic - Three Sisters Plutonic Suite tonalite intrusive rocks
- MTrCKech - Paleozoic to Mesozoic - Cache Creek Complex - Kedahda Formation chert, siliceous argillite, siliciclastic rocks
- MTrCKelm - Paleozoic to Mesozoic - Cache Creek Complex - Kedahda Formation limestone, marble, calcareous sedimentary rocks
- MiPiTvk - Cenozoic - Tuya Formation alkaline volcanic rocks
- PCFv - Paleozoic - Cache Creek Complex - French Range Formation undivided volcanic rocks
- PCTe - Paleozoic - Cache Creek Complex - Teslin Formation limestone, marble, calcareous sedimentary rocks
- PeEShgr - Cenozoic - Sloko-Hyder Plutonic Suite granite, alkali feldspar granite intrusive rocks
- PeEShqd - Cenozoic - Sloko-Hyder Plutonic Suite quartz dioritic intrusive rocks
- PeEgd - Cenozoic - Unnamed granodioritic intrusive rocks
- PzTBlm - Paleozoic - Big Salmon Complex limestone, marble, calcareous sedimentary rocks
- PzTBqz - Paleozoic - Big Salmon Complex quartzite, quartz arenite sedimentary rocks
- PzTBs - Paleozoic - Big Salmon Complex undivided sedimentary rocks
- PzTBvb - Paleozoic - Big Salmon Complex basaltic volcanic rocks
- PzTBvd - Paleozoic - Big Salmon Complex dacitic volcanic rocks
- QM - Cenozoic - Mount Edziza Complex alkaline volcanic rocks
- Qs - Cenozoic - Unnamed undivided sedimentary rocks
- Qvb - Cenozoic - Unnamed basaltic volcanic rocks
- lJL - Mesozoic - Laberge Group undivided sedimentary rocks
- lJLIst - Mesozoic - Laberge Group - Inklin Formation argillite, greywacke, wacke, conglomerate turbidites
- luKWcg - Mesozoic - Windy Table Complex conglomerate, coarse clastic sedimentary rocks
- luKWv - Mesozoic - Windy Table Complex undivided volcanic rocks
- luKWvf - Mesozoic - Windy Table Complex rhyolite, felsic volcanic rocks
- mTrJCcg - Mesozoic - Cache Creek Complex conglomerate, coarse clastic sedimentary rocks
- mTrJCst - Mesozoic - Cache Creek Complex argillite, greywacke, wacke, conglomerate turbidites
- mTrJCva - Mesozoic - Cache Creek Complex andesitic volcanic rocks
- uMPCH - Paleozoic - Cache Creek Complex - Horsefeed Formation limestone, marble, calcareous sedimentary rocks
- uMPCN - Paleozoic - Cache Creek Complex - Nakina Formation basaltic volcanic rocks
- uMPCec - Paleozoic - Cache Creek Complex eclogite/mantle tectonite
- uMPCum - Paleozoic - Cache Creek Complex ultramafic rocks
- uPJC - Paleozoic to Mesozoic - Cache Creek Complex mudstone/laminite fine clastic sedimentary rocks

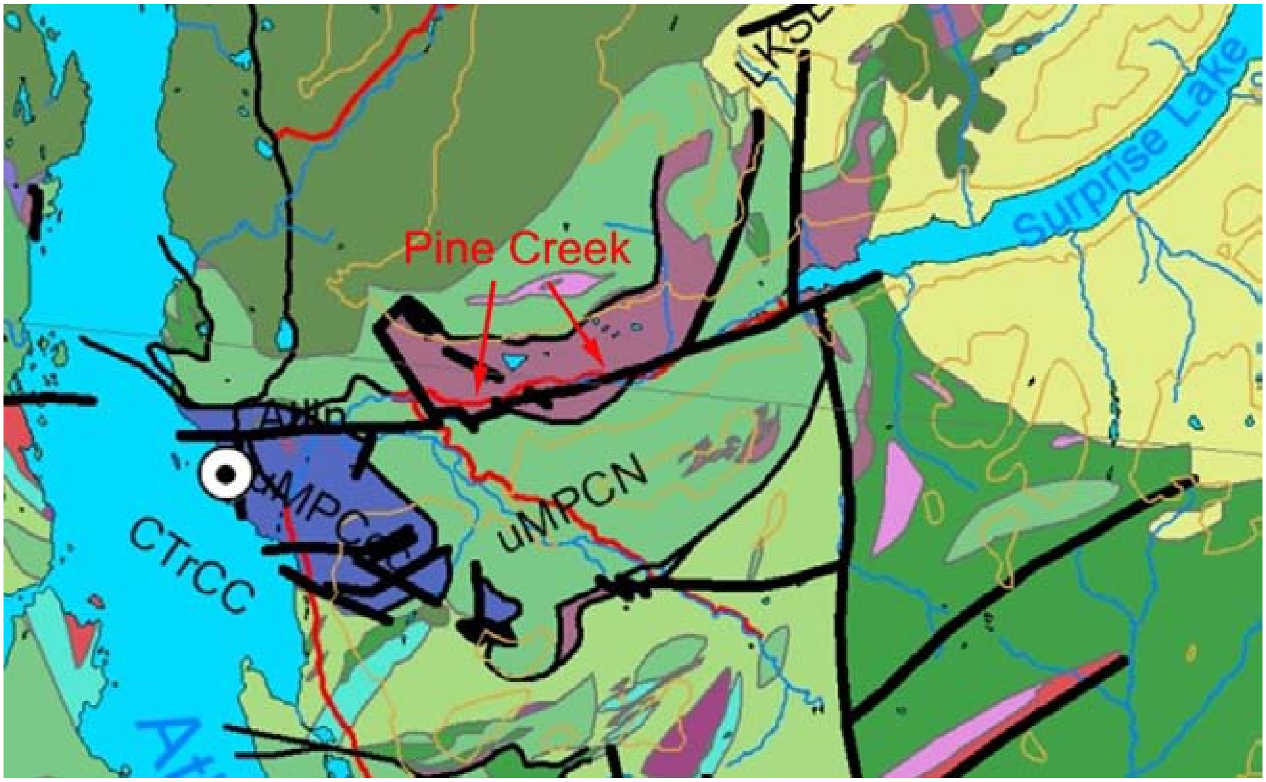


Figure: Bedrock Geology Map – Atlin Area – Pine Creek[12]

7.2. Physiography, Glaciation, Placer Deposits at Pine Creek[13]

As Atlin glacier thickened and advanced a lobe or tongue from it moved up Pine Valley, the lowest outlet to the east. In an ice marginal lake east of the advancing lobe detritus was deposited and then, as the lake advanced, was dispersed and the valley bottom was glaciated. Bedrock in a hydraulic cut south of Halfway is glaciated. The surface of the bedrock slopes indicating that possibly the old channel of Pine Creek at this point is south of the hydraulic cut.

Bedrock near the west limits of a large hydraulic cut on the central part of Pine Valley has also been glaciated. This suggests that most of the floor of the valley west of the cut is probably glaciated and

[12] Massey, N.W.D., MacIntyre, D.G., Desjardins, P.J. and Cooney, R.T., 2005: Digital Geology Map of British Columbia: Tile NO8 Northwest B.C., B.C. Ministry of Energy and Mines, Geofile, 2005-8, scale 1:250,000

[13] Black, J. M.: Report in the Atlin Placer Camp, 1953

Asg, C. H.: Origin and Tectonic Setting of Rocks in the Atlin Area, BC (NTS104N), Ophiolitic, Ultramafic and Related, Geological Survey Branch, Bulletin 94, 1994 that any placer deposits on it have been dispersed. However, the bedrock of the hydraulic cut has not been glaciated and the writer believes that because of the great load of detritus picked up to the west the erosive power of the lake was decreased and it did not erode to bedrock but moved over pre-glacial gravels. These gravels in the western part of the cut are only a few feet thick but towards the east become as much as 40 feet thick.

This difference in thickness indicates that the ice eroded less deeply as it moved eastward. Along this section of the valley the glacier straightened and smoothed the slope of Munroe Mountain. Probably it dammed Spruce Creek. The area in which there are undisturbed gravel deposits extends east of the hydraulic cut for an unknown but comparatively short distance and to the east bedrock is glaciated and till rests on it. The limit of unglaciated bedrock is not known. […] The reason that the glacier here eroded to bedrock east of Discovery is attributed to an influx of ice from Spruce Creek Valley, which could enter Pine Valley through a pass on the northwest slope of Spruce Mountain. Movement of ice on this slope apparently straightened and steepened the slope of Spruce Mountain.

One other section of Tertiary gravel deposits has been found in Pine Valley east of the main section. It is about at the point where a lobe of ice from Spruce Creek presumable flowed into the valley and occurs where a ridge of rock on the southern part of an old rim protected the channel from glaciation by a glacier moving northeastwards. This section, known as Gold Run, is covered with about 30 feet of gravel and till.

Pine glacier as it moved up the valley, straightened the walls and made the valley more nearly U-shaped. Probably a glacier flowed down Otter Creek valley to join it and thereby increased its effectiveness as an erosive agent and it eroded more deeply to form the basin occupied by Surprise Lake.

As the glacier moved through the part of Pine Valley now occupied by the lake, it probably glaciated the lower parts of the valleys of the tributary streams and dispersed gravel deposits and dammed the streams causing them to form ice marginal lakes. At the maximum extent of the ice, glaciers probably advanced down these tributary valleys and increased the erosive power of the main glacier. The valley towards the northeast is narrower , and here where the glacier was constricted the effects of glaciation are most marked.

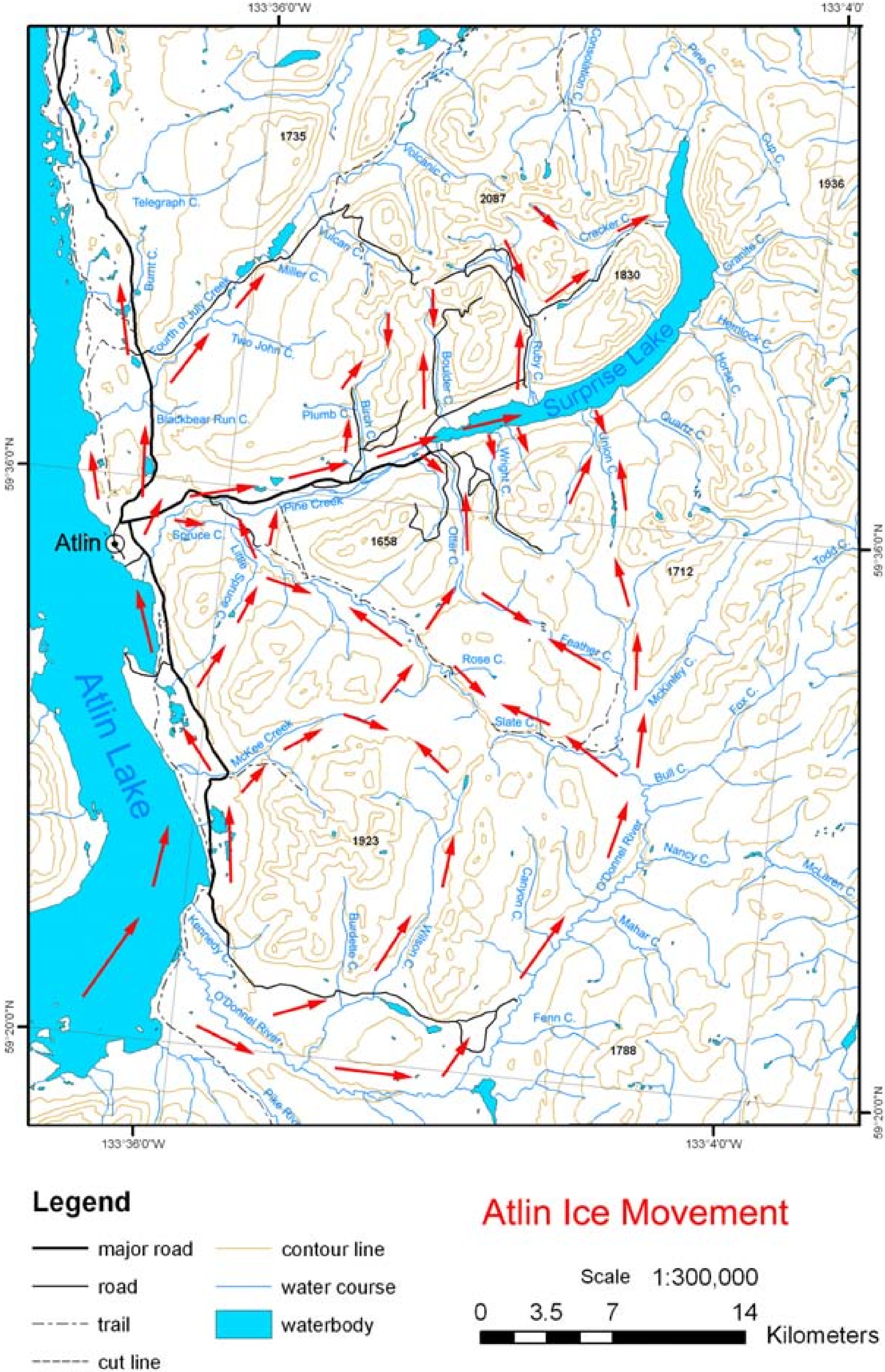
The valley occupied by a main tributary of Cracker Creek from the southwest is glaciated and U-shaped but it does not head in high ground where ice could have accumulated and therefore ice must have moved into it. From the configuration of the ground it appears probably that a lobe from Pine glacier moved up Ruby Valley and through the valley tributary to Cracker into Cracker Valley.
With continued expansion the glacier in Pine Valley thickened and glaciated the upper parts of the valley slopes and subsidiary lobes moved up the valleys of tributary streams. Lobes in the tributary streams also widened and the entire area may have been covered for a comparatively short time by ice.

When wastage of ice exceeded accumulation much till was deposited and then Pine Creek, swollen by meltwater, started to cut through the till and removed much of it from the valley. In some parts of the valley there is more than 70 feet of overburden, of which much is till but over considerable areas the depth of overburden is much less and in places bedrock is exposed. At Gold Run there is about 32 feet of overburden, of which eight feet is till; in the vicinity of the main hydraulic cut, till was largely removed and Tertiary gravels were exposed and some were removed. Some sections of the new course nearly coincided with the old, as at Discovery. Other sections of the new channel are incised in a rim of the old channel and have formed rock canyons. A narrow canyon west of Discovery and north of the present course, suggests that Pine Creek for a time was diverted through it and probably at that time flowed into Trend Gulch and, on into Fourth of July Creek.

A terrace of stratified sands and gravels more than 50 feet thick extends for about two miles across the valley, at an altitude of 2,500 feet. The upper beds dip gently downstream but the lower beds are covered with debris from above and their attitude is now known. The beds probably formed in a lake dammed behind ice that remained in the lower part of the valley at a late stage in the disappearance of the ice.
Several terraces lo-15 feet high which slope gently downstream north of Halfway, probably are remnants of flood plains left as the creek cut down to its present grade.

Figure below: Atlin Ice Movement[14]

[14] Black, J. M.: Report in the Atlin Placer Camp, 1953 and Ph. Moll, Arctic Geophysics Inc



Atlin Ice Movement
Legend
major road
road
trail
cut line
contour line
water course
waterbody
Scale 1:300,000
0 3.5 7 14 Kilometers
Atlin
Atlin Lake
Surprise Lake
Pine Creek
McKee Creek
O'Donnel River
Spruce C.
Little Spruce C.
Telegraph C.
Burnt C.
Fourth of July Creek
Miller C.
Two John C.
Blackbear Run C.
Plumb C.
Birch C.
Boulder C.
Ruby C.
Vulcan C.
Volcanic C.
Cracker C.
Granite C.
Hemlock C.
Horse C.
Quartz C.
Union C.
Wright C.
Otter C.
Feather C.
Rose C.
Slate C.
McKinley C.
Fox C.
Bull C.
Nancy C.
McLaren C.
Mahar C.
Fenn C.
Canyon C.
Wilson C.
Burdette C.
Kennedy C.
Pike River
Consolation C.
Pine C.
Gup C.
Todd C.
1735
2087
1936
1830
1658
1712
1923
1788
133°36'0"W
133°4'0"W
59°36'0"N
59°20'0"N

8. Profile image

In the **Resistivity profile** the interpreted layer interfaces are marked with a black line. The profiles show ground-layers approximately 15% thicker than they are in reality. The thickening of the model layers is caused by the inversion software. The **correction factor** of 0.85 for the determination of the true layer thickness has been established by the Arctic Geophysics Inc. team on the basis of numerous geoelectrical profiles verified by drilling, trenching, and mining done by our customers.[15]

The **graphical markings** showing the interpreted layer interfaces in the profiles (using a black line) are done according to the data structure in the profile itself. This means: the layers there will also show up approximately 15% thicker than they are expected in reality. At the measuring sticks in the profile image as well as in the interpretation text, the layer thicknesses and depths have been recalculated to the expected real values.

9. Line Arrangement

The **line locations** were discussed and decided upon by Stefan Ostermaier from Arctic Geophysics Inc. and Brian Scott. The goal of the survey was to establish the depth to bedrock and other mining relevant subsurface information, such as groundwater.

10. Geophysical Implications

The different components of the overburden (till, glaciofluvial/-lacustrine sediments, and non-glacial alluvium) can hardly be differentiated in the Resistivity profiles, because they show quite similar resistivity data and are sometimes too thin to be measured. The reason for the similar resistivity of the overburden materials is the relatively high amount of ground water in the sediments. The rock components of the gravels, clasts, or boulders show low resistivity itself and support the similarity of the resistivity.

However, interfaces between different overburden materials can sometimes be detected anyway. At data interfaces where high conducting overburden layers are sitting on top of low conducting overburden layers, a clay-rich layer could start downwards acting as a seal layer for groundwater.

The interface between overburden and bedrock was clearly measured and realistically interpreted in resistivity models.

[15] Program settings in RES2DINV for modifying the layer thickness do frequently not work well for our use and could falsify the profile. That's why this mode was not used.

11. Placer Targets in Profiles[16]

Seal-layers (consisting of clay) described in the “Geophysical Implications, could act as “false bedrock”: The upper part of the clay-layer itself and the material closely on top of it could contain concentrations of placer gold. The interpreted "false bedrock" layers in the profiles are not too likely - but the data structures in the resistivity models indicate its possible existence - so it seems to be reasonable to check the existence of the "false bedrock" since it would be a promising prospecting target for placer gold, laying shallower than bedrock sources.

Clay layers can also protect the deposits underneath from glacial erosion. So, the material below a clay-rich layer could have preserved older placers.

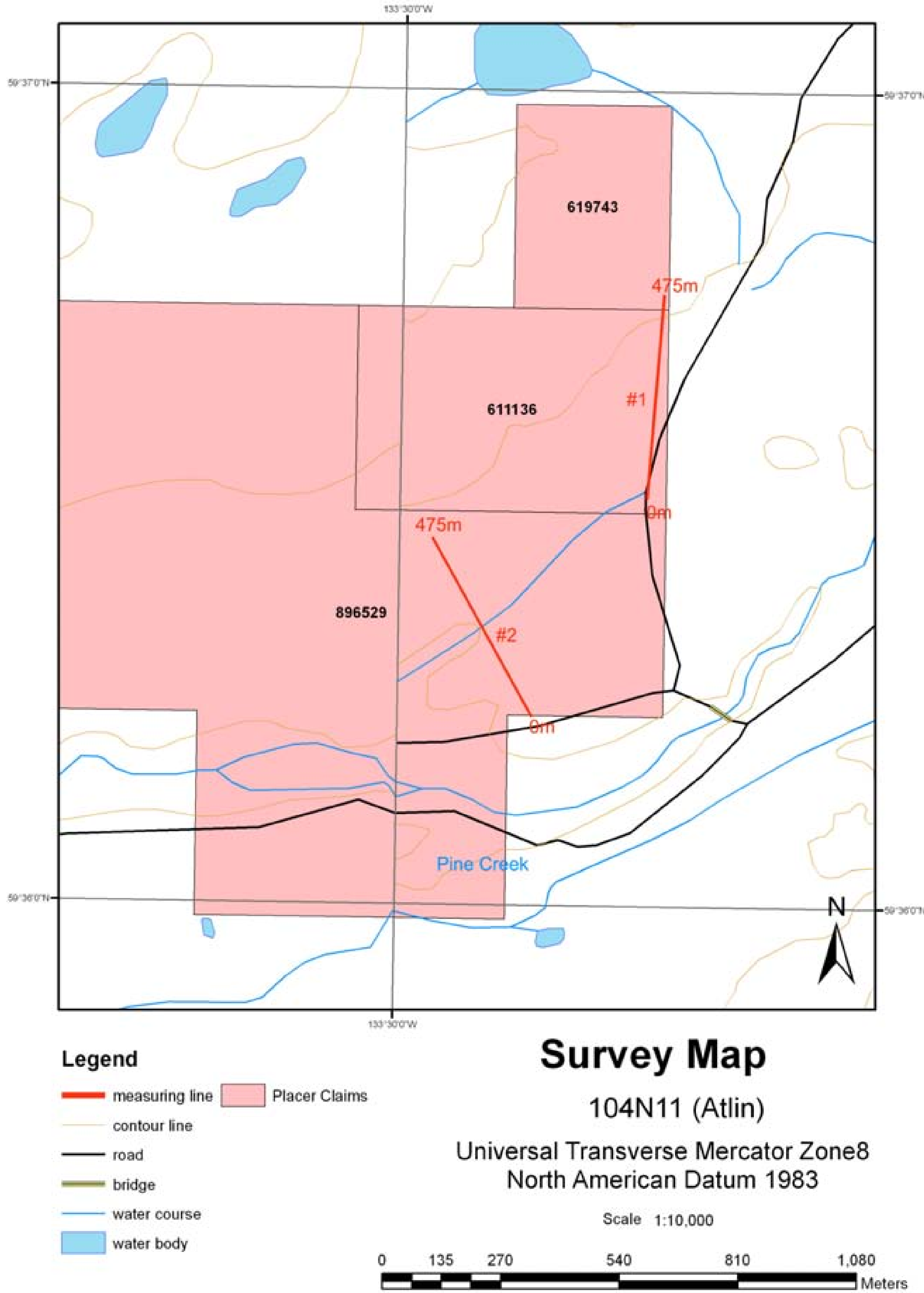
Normally, glaciofluvial gravels have much higher potential for placer gold deposits than till, especially if they reworked pre-existing placers or eroded and re-depositing gold-bearing bedrock.

The general case is that glacial till will incorporate placer gold into it and dilute rich paystreaks into a larger volume lower grade deposit which may be uneconomic. So placer gold in till is actually fairly rare in most settings, and usually only occurs when the glacial activity is right on top of a bedrock gold source. But this actually may be the case at Pine Creek .

All of the sandy, gravelly, silty, and clay-containing sediments at Pine valley can potentially contain placer gold. Each new sediment discovered when doing physical prospecting would be worth sampling.

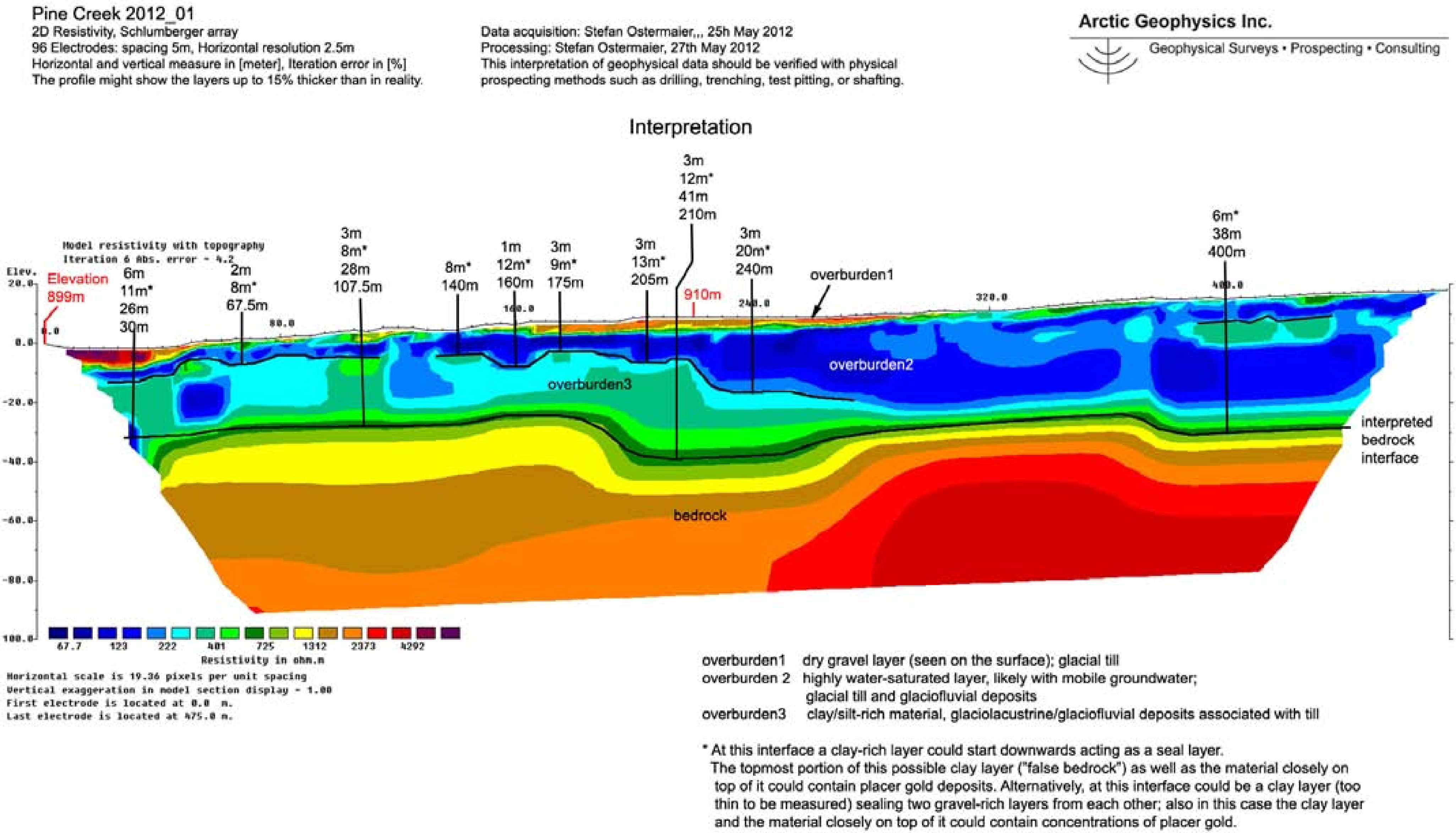
[16] Discussion between William LeBarge and Philipp Moll

12. Survey Map



13. Interpretation of Profiles

Pine Creek 01



Interpretation

Resistivity profile_01 (2012) might show 26-41m of overburden on top of bedrock.

Below the surface we see a low conducting layer (overburden1), 0.5-6m thick, most likely representing dry compacted gravel. This gravel seem to be modern stream gravel on top of glacial till and glaciofluvial deposits.[17]

The second layer (overburden2) is very well conducting as a result of high water-saturation of this gravel-dominated material.[18] This gravel deposit is most likely a mosaic of glacial till, glaciofluvial deposits, and possibly glaciolacustrine sediments. Because of the high water content these different materials cannot be differentiated in the resistivity model. Just at around 400m in the profile a glaciolacustrine inter-layer (turquoise), 6m deep, consisting of mainly clay ("false bedrock") could be located. However, more clay-rich layers, too thin to be measured, could sit in this gravel deposit acting as "false bedrock".

The third layer (overburden3) could be a sediment rich in fine materials such as silt and clay. So this layer could be a seal layer for groundwater acting as "false bedrock" again.

The likeliness of this scenario (a gravel deposit underlain by a clay-rich deposit) would be supported by the following aspect: The overburden is relatively thick at this profile location; here the glacial erosion must have been lower than at the valley floor a bit more southern.[19] The ice move seems to have left a large lateral moraine at the right limit of the valley (north) which was not too much eroded by the meltwater flow. This lateral moraine and the ice on top of it could have been a barrier for meltwater in the northern part of the valley. This way glaciolacustrine clay-/silt-rich sediments could have been deposited along this profile. - Alternatively, the relatively thick overburden in this profile could be dominated by just till and glaciofluvial deposits. Both theories sound realistic.

At 200-260m a 41m deep paleochannel in bedrock seems to be located. This deep channel could have been formed by the ice move in an earlier glacial cycle or by a powerful glaciofluvial stream running before the glaciolacustrine deposition has started. It is not unlikely that this channel is pre-glacial, filled with original river gravel on the bottom which has been preserved from the glacial erosion.[20]

Around 400m we see another bedrock depression, approx. 38m deep, which most likely does have a glacial origin, with mainly glaciofluvial influence.

The bedrock shows relatively homogeneous, high resistivity in the same range as at Resistivity profile_01 (2010). This bedrock seems to consist of Oceanic crustal ultramafic rocks: peridotite, dunite, pyroxenite, generally serpentized; locally includes pods of nephrite jade and small bodies of listwanite, rodingite and talc.[21]

[17] The existence of a dry compacted topmost gravel layer was verified in 2010 when running a resistivity profile nearby which was dug by Al Dendys up to a depth of about 3m.

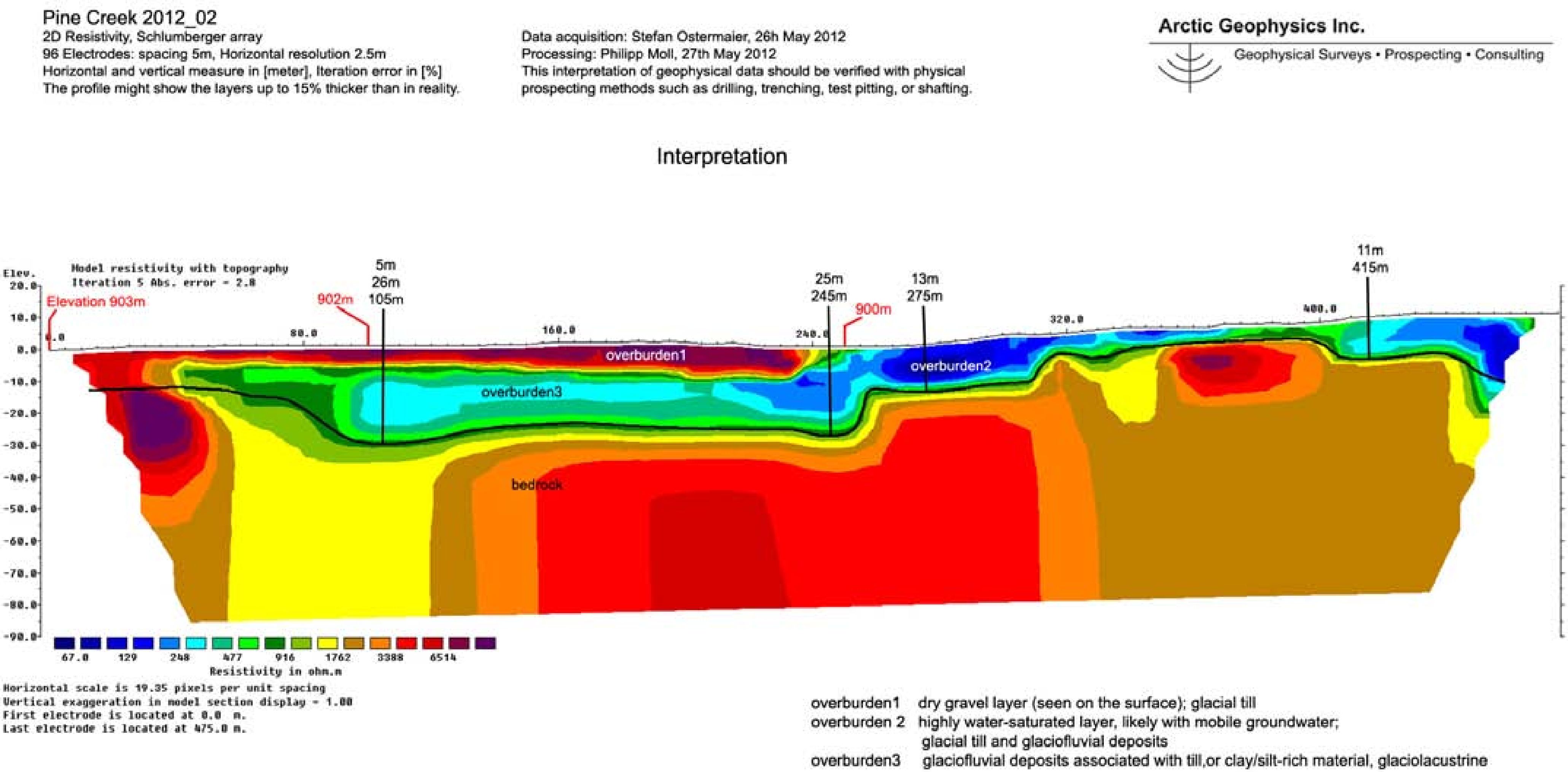
[18] The existence of a highly water-saturated gravel layer was verified in 2010 when running a resistivity profile nearby which was dug by Al Dendys up to a depth of about 3m. The groundwater was quite mobile and did drain quickly into the excavated hole.

[19] See Resistivity profile_02 (2012) and profile_01 (2010)

[20] Compare J.M. Black: 7.2. Physiography, Glaciation at Pine Creek

[21] Bedrock Geology Map

Pine Creek 02



Interpretation
Resistivity profile_02 (2012) might show 5-26m of overburden on top of bedrock.

At 0-240m we see again the low conducting material (overburden1), here 3-8m thick, on the surface: It should be again dry gravel consisting of modern stream gravel on top of glacial till and glaciofluvial deposits.

At 240-400m the topmost layer (overburden2), 5-13m thick, is very well conducting: This material is highly saturated with groundwater and should be also modern stream gravel on top of glacial till and glaciofluvial deposits. Alternatively, overburden2 could be a clay-/silt-rich glaciolacustrine deposit. At least in the middle of the profile, around 240m, there must be some clay to seal the groundwater at overburden2 against overburden1.

After 400m the overburden seems to become thicker. This accords with profile_01 showing a thickening of the overburden towards the northern side of the valley.

At 90-260m an U-shaped channel, around 25m deep, is sitting in the bedrock. This channel must have been produced by glacial erosion (ice move) since lot's of energy is needed to deform a hard bedrock type in such a distinctive way. This channel is located on the valley floor where the "large hydraulic cut on the central part of Pine Valley"[22] was formed. This channel must be filled with till and a larger amount of glaciofluvial gravel - possibly sitting above pre-glacial river gravel which has been preserved.[23] In case this channel is filled with 100% glacial deposits, a glaciofluvial stream likely has deepened this ice-formed channel at its left limit, at around 105m. Despite the large grade of erosion (by both ice move and meltwater flow) it is not impossible that glaciolacustrine clay/silt was deposited in this bedrock depression this would be possible when ice damming would have hindered the meltwater flow.

After 250m two bedrock benches, formed like stairs, 13 and 5m deep, are located. The surface of the bedrock is also leveled which is typical for glacial erosion by ice. A significant amount of glaciofluvial deposits sitting in these benches would be quite likely.

After 400m a bedrock bench, approx 11m deep, goes down. It might show the same overburden complex.

After 450m a next deeper bedrock bench seems to start.

The bedrock shows relatively homogeneous, high resistivity in the same range as at Resistivity profile_01 (2010). This bedrock seems to consist of Oceanic crustal ultramafic rocks: peridotite, dunite, pyroxenite, generally serpentized; locally includes pods of nephrite jade and small bodies of listwanite, rodingite and talc.[24]

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[22] Compare J.M. Black: 7.2. Physiography, Glaciation at Pine Creek
[23] Ditto

[24] Bedrock Geology Map

14. Qualifications

Philipp Moll
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Certificate of Qualifications

I, Philipp Moll, currently residing at “Am Holderstock 7, 77652 Offenburg, Germany, do hereby certify that:

1. I have studied Geology at the University of Freiburg, Germany.
2. I have visited of geophysical field courses at the University of Karlsruhe in Germany.
3. I have been working for Arctic Geophysics Inc. since June 2007 (foundation). For this company I have carried out geophysical field surveys using 2D Resistivity, Induced Polarization, and Magnetics: Data acquisition, processing, interpretation, documentation.
4. I have done geophysical surveying for mining exploration in the Yukon since 2005, and geological prospecting for precious metals and minerals in the Yukon, NWTs, and Alaska since 1989
5. I have written the following publications/reports:

    A) Numerous Assessment Reports about geophysical surveys done for Yukon mining companies, filed at Yukon Mining Recorder, Dawson City and Whitehorse, Yukon.

    B) Publication about a geophysical survey (45 field days) for the Yukon Government: Yukon Geological Survey:
    http://www.geology.gov.yk.ca/recent.html Open Files:
    Moll, P., & Ostermaier, S., 2010. 2D Resistivity/IP Data Release for Placer Mining and shallow Quartz Mining - Yukon 2010. Yukon Geological Survey Miscellaneous Report MR-4. PDF Report [10.3 MB] & Data Profiles, 45.4 MB]]

15. Confirmation

I have prepared this report entitled 2D Resistivity Survey on the Pine Creek Property for assessment credit, and reviewed the data contained in the report titled: “Geophysical Survey with 2D Resistivity Pine Creek, British Columbia”. The survey was carried out by Arctic Geophysics Inc.

Offenburg, Germany, 21st September 2012
“Signed and Sealed” Philipp Moll

Philipp Moll

Appendix

Literature

Location-specific

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Geophysical Data Table

Rock type	Resistivity range (Ωm)
Granite porphyry	4.5×10^3 (wet) – 1.3×10^6 (dry)
Feldspar porphyry	4×10^3 (wet)
Syenite	$10^2 - 10^6$
Diorite porphyry	1.9×10^3 (wet) – 2.8×10^4 (dry)
Porphyrite	$10 - 5 \times 10^4$ (wet) – 3.3×10^3 (dry)
Carbonatized porphyry	2.5×10^3 (wet) – 6×10^4 (dry)
Quartz diorite	$2 \times 10^4 - 2 \times 10^6$ (wet) –1.8×10^5 (dry)
Porphyry (various)	$60 - 10^4$
Dacite	2×10^4 (wet)
Andesite	4.5×10^4 (wet) – 1.7×10^2 (dry)
Diabase (various)	$20 - 5 \times 10^7$
Lavas	$10^2 - 5 \times 10^4$
Gabbro	$10^3 - 10^6$
Basalt	$10 - 1.3 \times 10^7$ (dry)
Olivine norite	$10^3 - 6 \times 10^4$ (wet)
Peridotite	3×10^3 (wet) – 6.5×10^3 (dry)
Hornfels	8×10^3 (wet) – 6×10^7 (dry)
Schists (calcareous and mica)	$20 - 10^4$
Tuffs	2×10^3 (wet) – 10^5 (dry)
Graphite schist	$10 - 10^2$
Slates (various)	$6 \times 10^2 - 4 \times 10^7$
Gneiss (various)	6.8×10^4 (wet) – 3×10^6 (dry)
Marble	$10^2 - 2.5 \times 10^8$ (dry)
Skarn	2.5×10^2 (wet) – 2.5×10^8 (dry)
Quartzites (various)	$10 - 2 \times 10^8$
Consolidated shales	$20 - 2 \times 10^3$
Argillites	$10 - 8 \times 10^2$
Conglomerates	$2 \times 10^3 - 10^4$
Sandstones	$1 - 6.4 \times 10^8$
Limestones	$50 - 10^7$
Dolomite	$3.5 \times 10^2 - 5 \times 10^3$
Unconsolidated wet clay	20
Marls	3 – 70
Clays	1 – 100
Oil sands	4 – 800

List of Costs

2012 Statement of Costs

Pine Creek Geophysical Program

Project Conducted from May 25th to May 26th 2012

Date	Item	Contractor	Description	Days	Km	Item Cost	Total
25-26.05.2012	Geophysical Lines	Arctic Geophysics Inc.	Field Crew (2 people)	2.0		$1 186.50	$2 373.00
	Transportation	Arctic Geophysics Inc.	Vehicle	2.25		$73.50	$165.38
			(2 people)	0.25		$472.48	$118.12
			Kilometres		200.00	$0.55 plus GST	$115.50
	Accommodation and meals						$490.00
Sub-Total							**$3.262.00**

Report			
Data	Arctic Geophysics Inc.	Data processing, interpretation	$367.50
Report	Arctic Geophysics Inc.	Report Preparation	$735.00
Sub-Total			**$1 102.50**

Total Value of Work	**$4 364.50**

Total Person Days = 4

GPS-Data

Pine Creek 01

Electrode No.	Location in Profile [m]	GPS-Coordinates UTM Zone 8 NAD 83	GPS-Accuracy [m]	Post [*]
1	0.0	585209, 6608762	3	*
2	5.0	585206, 6608768	3	
3	10.0	585205, 6608772	3	
4	15.0	585205, 6608772	3	
5	20.0	585206, 6608778	3	
6	25.0	585207, 6608785	3	
7	30.0	585207, 6608791	3	
8	35.0	585208, 6608796	3	
9	40.0	585209, 6608801	3	
10	45.0	585209, 6608805	3	
11	50.0	585208, 6608808	3	
12	55.0	585209, 6608813	3	
13	60.0	585209, 6608817	3	
14	65.0	585211, 6608824	3	
15	70.0	585210, 6608829	3	
16	75.0	585209, 6608836	3	
17	80.0	585210, 6608840	3	
18	85.0	585208, 6608842	3	
19	90.0	585209, 6608846	3	
20	95.0	585211, 6608852	3	
21	100.0	585211, 6608856	3	
22	105.0	585211, 6608861	3	
23	110.0	585215, 6608869	3	
24	115.0	585213, 6608873	3	
25	120.0	585213, 6608876	3	
26	125.0	585214, 6608881	3	
27	130.0	585213, 6608886	3	
28	135.0	585215, 6608891	3	
29	140.0	585215, 6608897	3	
30	145.0	585215, 6608904	3	
31	150.0	585216, 6608907	3	
32	155.0	585217, 6608910	3	
33	160.0	585217, 6608914	3	
34	165.0	585217, 6608920	3	
35	170.0	585218, 6608925	3	
36	175.0	585219, 6608931	3	
37	180.0	585220, 6608937	3	
38	185.0	585219, 6608942	3	
39	190.0	585220, 6608948	3	
40	195.0	585220, 6608954	3	
41	200.0	585222, 6608958	3	

Electrode No.	Location in Profile [m]	GPS-Coordinates UTM Zone 8 NAD 83	GPS-Accuracy [m]	Post [*]
42	205.0	585223, 6608963	3	
43	210.0	585223, 6608968	3	
44	215.0	585224, 6608972	3	
45	220.0	585224, 6608977	3	
46	225.0	585225, 6608982	3	
47	230.0	585226, 6608986	3	
48	235.0	585228, 6608991	3	
49	240.0	585228, 6608996	3	
50	245.0	585228, 6609001	3	
51	250.0	585227, 6609007	3	*
52	255.0	585227, 6609011	3	
53	260.0	585228, 6609017	3	
54	265.0	585228, 6609022	3	
55	270.0	585229, 6609026	3	
56	275.0	585229, 6609031	3	
57	280.0	585230, 6609037	3	
58	285.0	585230, 6609042	3	
59	290.0	585230, 6609047	3	
60	295.0	585231, 6609053	3	
61	300.0	585230, 6609057	3	
62	305.0	585230, 6609062	3	
63	310.0	585234, 6609065	3	
64	315.0	585232, 6609071	3	
65	320.0	585233, 6609077	3	
66	325.0	585232, 6609083	3	
67	330.0	585231, 6609088	3	
68	335.0	585232, 6609094	3	
69	340.0	585232, 6609097	3	
70	345.0	585233, 6609100	3	
71	350.0	585234, 6609105	3	
72	355.0	585234, 6609111	3	
73	360.0	585233, 6609118	3	
74	365.0	585234, 6609123	3	
75	370.0	585233, 6609126	3	
76	375.0	585233, 6609132	3	
77	380.0	585236, 6609134	3	
78	385.0	585236, 6609142	3	
79	390.0	585232, 6609146	3	
80	395.0	585232, 6609153	3	
81	400.0	585232, 6609155	3	
82	405.0	585233, 6609160	3	

Electrode No.	Location in Profile [m]	GPS-Coordinates UTM Zone 8 NAD 83	GPS-Accuracy [m]	Post [*]
83	410.0	585233, 6609164	3	
84	415.0	585231, 6609171	3	
85	420.0	585230, 6609175	3	
86	425.0	585233, 6609179	3	
87	430.0	585232, 6609182	3	
88	435.0	585232, 6609188	3	
89	440.0	585230, 6609195	3	
90	445.0	585230, 6609198	3	
91	450.0	585231, 6609203	3	
92	455.0	585232, 6609207	3	
93	460.0	585231, 6609214	3	
94	465.0	585230, 6609219	3	
95	470.0	585230, 6609224	3	
96	475.0	585231, 6609229	3	*

Pine Creek 02

Electrode No.	Location in Profile [m]	GPS-Coordinates UTM Zone 8 NAD 83	GPS-Accuracy [m]	Post [*]
1	0.0	584966, 6608257	3	*
2	5.0	584964, 6608262	3	
3	10.0	584961, 6608266	3	
4	15.0	584959, 6608271	3	
5	20.0	584957, 6608271	3	
6	25.0	584954, 6608275	3	
7	30.0	584952, 6608279	3	
8	35.0	584950, 6608283	3	
9	40.0	584947, 6608287	3	
10	45.0	584944, 6608291	3	
11	50.0	584942, 6608294	3	
12	55.0	584940, 6608298	3	
13	60.0	584938, 6608302	3	
14	65.0	584935, 6608307	3	
15	70.0	584932, 6608311	3	
16	75.0	584929, 6608316	3	
17	80.0	584927, 6608320	3	
18	85.0	584924, 6608325	3	
19	90.0	584921, 6608329	3	
20	95.0	584919, 6608332	3	
21	100.0	584918, 6608335	3	
22	105.0	584915, 6608340	3	
23	110.0	584912, 6608344	3	
24	115.0	584910, 6608349	3	
25	120.0	584908, 6608352	3	
26	125.0	584904, 6608362	3	
27	130.0	584903, 6608366	3	
28	135.0	584902, 6608369	3	
29	140.0	584900, 6608373	3	
30	145.0	584896, 6608377	3	
31	150.0	584893, 6608381	3	
32	155.0	584893, 6608386	3	
33	160.0	584890, 6608390	3	
34	165.0	584887, 6608395	3	
35	170.0	584885, 6608400	3	
36	175.0	584883, 6608405	3	
37	180.0	584881, 6608409	3	
38	185.0	584878, 6608416	3	
39	190.0	584876, 6608420	3	
40	195.0	584875, 6608425	3	
41	200.0	584872, 6608429	3	
42	205.0	584870, 6608432	3	
43	210.0	584868, 6608436	3	
44	215.0	584866, 6608443	3	
45	220.0	584864, 6608445	3	
46	225.0	584861, 6608450	3	
47	230.0	584857, 6608454	3	
48	235.0	584854, 6608457	3	
49	240.0	584852, 6608463	3	
50	245.0	584849, 6608467	3	
51	250.0	584846, 6608471	3	*
52	255.0	584844, 6608475	3	

Electrode No.	Location in Profile [m]	GPS-Coordinates UTM Zone 8 NAD 83	GPS-Accuracy [m]	Post [*]
53	260.0	584840, 6608479	3	
54	265.0	584838, 6608484	3	
55	270.0	584836, 6608490	3	
56	275.0	584833, 6608494	3	
57	280.0	584832, 6608497	3	
58	285.0	584829, 6608502	3	
59	290.0	584825, 6608507	3	
60	295.0	584822, 6608509	3	
61	300.0	584819, 6608514	3	
62	305.0	584816, 6608518	3	
63	310.0	584814, 6608522	3	
64	315.0	584812, 6608527	3	
65	320.0	584809, 6608532	3	
66	325.0	584805, 6608535	3	
67	330.0	584802, 6608538	3	
68	335.0	584799, 6608542	3	
69	340.0	584797, 6608546	3	
70	345.0	584794, 6608550	3	
71	350.0	584791, 6608555	3	
72	355.0	584789, 6608559	3	
73	360.0	584786, 6608563	3	
74	365.0	584783, 6608566	3	
75	370.0	584781, 6608571	3	
76	375.0	584779, 6608575	3	
77	380.0	584776, 6608579	3	
78	385.0	584773, 6608584	3	
79	390.0	584770, 6608589	3	
80	395.0	584766, 6608593	3	
81	400.0	584764, 6608596	3	
82	405.0	584762, 6608601	3	
83	410.0	584760, 6608605	3	
84	415.0	584758, 6608609	3	
85	420.0	584755, 6608614	3	
86	425.0	584752, 6608617	3	
87	430.0	584750, 6608621	3	
88	435.0	584747, 6608626	3	
89	440.0	584745, 6608630	3	
90	445.0	584742, 6608634	3	
91	450.0	584738, 6608638	3	
92	455.0	584735, 6608643	3	
93	460.0	584733, 6608646	3	
94	465.0	584731, 6608650	3	
95	470.0	584728, 6608654	3	
96	475.0	584725, 6608659	3	*