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McQUESTEN
MINERAL DEP...

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MINERALOGY
OF
SOME HEAVY SANDS
OF THE
McQUESTEN RIVER AREA
Y.T.

A.E. AHO

M I N E R A L O G Y

of

S O M E H E A V Y S A N D S

of the

M C Q U E S T E N R I V E R A R E A

Y. T.

A thesis submitted in partial fulfilment
of the requirements of the course of
Fourth Year Geological Engineering
at The University of British
Columbia

Aaro E. Aho
The University of British Columbia

April 15, 1949

Box 232,
Nanaimo, B.C.
April 15, 1949

The Department of Geology,
The University of British Columbia,
Vancouver, B.C.

Gentlemen:

I have the honour to submit herewith my thesis, Mineralogy of Some Heavy Sands of the McQuesten River Area, Y.T. The material presented herein was gathered by me during summer work with the Geological Survey of Canada in 1948. Most of the work was done in the geological laboratories of The University of British Columbia during the winter of 1948-49.

Sincerely yours,

Aaro E Aho

Aaro E. Aho.

ABSTRACT

This report deals with the mineralogy and origin of heavy sands from some of the creeks in the area of lower McQuesten River, Yukon. An attempt was made to ascribe some minerals to glacial origin, so that they may be used to delineate more closely the extent and directions of glaciation.

Placer deposits appear to have been formed from high and low temperature vein types associated with quartz porphyry and aplite[8] in the neighborhood of granitic stocks. Gold, tin and tungsten seem to be associated in most placer deposits. Joseite "A" was found in Highet and Clear Creeks, and monazite was found in Boulder and Clear Creek sands. Slight radioactivity was detected in heavy sands from Clear Creek dredge.

In general, the samples of glacial or partly glacial origin showed a greater diversity of mineral species and considerably more rounding of the particles than non-glacial sands. Hematite, which is probably sedimentary, and which showed pseudomorphs of jasper after pyrite, appears to be typically glacial.

C O N T E N T S

C O N T E N T S

P H O T O S

INTRODUCTION

The area investigated in this report lies between Stewart River and the Little South Fork of the Klondike, in the north half of the McQuesten River map area, Y.T. It is traversed south-westerly by McQuesten River.

The region is accessible from Whitehorse, Y.T. by several routes. During summer, river steamers run from Whitehorse down the Lewes and Yukon rivers to Stewart, then up the Stewart River to Mayo. Planes can land at Mayo, Clear Creek Airport, or an airstrip on Left Clear Creek. Motor roads extend from Mayo to Dublin Gulch or Minto Lake. Farther travel is best done by pack horse in summer, and dog team in winter. The trails marked on the map are usually quite good.

Gold was discovered in Stewart River in 1885, and in Haggart Creek ten years later[4]. Highet, Duncan and other nearby creeks were also staked in 1895; and many placer operations flourished in the years before World War I. Search for the source of the gold at this time led to intensive hardrock prospecting, but no profitable lode deposits were found. Many of the placers worked proved profitable, but most have since been depleted. At the present time only portions of Highet, Haggart, and Clear Creeks are profitable.

Investigations of the area were made by J. Keele, T. A. McLean, and D.D. Cairnes before and during World War I and after by C. H. Stockwell, H. S. Bostock, R. M. Thompson and others.

Fig. 1
Steamer Keno on Stewart River
enroute to Mayo

The reader should refer to the map inside the back cover.

ACKNOWLEDGEMENTS

The samples examined were panned and collected during the summer of 1948, while the author was an assistant on a Canadian Geological Survey party under the supervision of Dr. H. S. Bostock. Investigation of the heavy sands was suggested by Dr. Bostock because little previous work had been done on the problem.

Grateful acknowledgement is made to Dr. H. S. Bostock, who collected many samples; and to Dr. R. M. Thompson, who assisted in the laboratory work. Appreciation is also expressed for the use of equipment, and aid offered by the Mining and Geology departments of The University of B. C. and members of the survey party.

PHYSIOGRAPHY[14]

The Area lies within the Stewart Plateau[12], which is a maturely dissected upland. The valleys range from 1400 feet in elevation at Yukon River to about 2500 or 3000 feet in the creeks which end abruptly in gulches. These deep, Tertiary valleys are separated by zigzagging, smooth-topped ridges which show three erosion levels at approximately 4200, 5000, and 5800 ft. A few higher hills extend to elevations of 6000 ft. Positions of major valleys and ridges are closely connected with weak structural features such as anticlines, fault zones, or non-resistant strata.

GEOLOGY

The area is underlain by precambrian quartzose sediments composed of quartzite, quartz-mica schist, and minor limestone. The precambrian is overlain by continental and marine Paleozoic sediments in the northern part of the area. Both systems form broad, open, east-west folds with maximum dips of about 45°. The precambrian rocks are intruded by granitic stocks, plugs, and dikes of Mesozoic age. These intrusives seem to have been emplaced at shallow depths with little or no accompanying folding.

DEVELOPMENT OF PLACERS

During the early tertiary the area had become base-levelled and very deeply weathered. Later, Miocene uplift caused a rapid downcutting of the main streams, and concentration of the durable minerals to form the first pay streaks. Down-cutting continued to the end of Pliocene time when grade was reached and valleys were widened.

Slight subsidence caused aggrading, and valleys were filled with immense depths of white channel type gravels[1] consisting mainly of vein quartz, a few resistant like rocks, and some decomposed schist.

Local glaciation[12], probably of Wisconsin age, has removed the old deposits from some of the main valleys in the area, and has overridden or bypassed others. Ice moved westward along the McQuesten, Minto Lake, and Stewart River valleys, and probably extended to where Stewart River leaves Tintina Valley. Dublin Gulch was bypassed, Highet Creek was overridden, the McQuesten Valley creeks were choked with drift, and Clear Creek was untouched. Evidence of glaciation is absent in tributary valleys except for small cirques and occasional erratics in high hills as at the head of Clear Creek. Some evidence of a slightly more widespread earlier glaciation has been found at Dublin Gulch and several other localities in the Mayo[12] and Carmacks[13] map areas.

Post-glacial uplift and tilting has raised the older gravels and fluvio-glacial deposits to elevations of about 2500 or 3000 ft. Streams have cut through these gravels and left them as terraces. In most cases the streams have found their old channels; in other cases they have been superimposed over bedrock and have eroded canyons. The younger stream placers have been concentrated from these gravels.

INVESTIGATIONS

Methods of studying heavy sands, and minerals to look for, are outlined in several reports[15,16]. The method of study used here is as follows:

1. Tetrabromethane, specific gravity 2.98, was used to float off all light particles, which were then discarded.

2. Each sample was weighed approximately.

3. Large samples were screened, and the screened portions were weighed. All sizes are expressed in standard Tyler screen mesh.

4. Magnetic particles were removed by hand magnet.

5. Magnetic particles were weighed and studied under a binocular microscope to determine composition, grain size, degree of sizing and rounding, etc.

6. Non-magnetic particles were treated with hydrochloric acid on zinc to make cassiterite noticeable.

7. Each non-magnetic sample was tested with ultra-violet light and a geiger counter for fluorescence and radio-activity.

8. The non-magnetic sands were examined under binoculars. In coarse samples all recognizable species were separated, weighed, and studied individually. Composition, grain size, and degree of sizing and rounding of small particles were estimated.

9. Scheelite[17] was examined under ultra-violet light and non-fluorescent particles were removed. In this way barite was found in Clear Creek sands.

10. Specific gravity determinations, oil immersion tests for refractive indices, and chemical tests were used to check, identify, and determine unknown or doubtful minerals. Specific gravities of several garnets were determined with a view to determining the minerals by refractive indices. This problem was abandoned, but the specific gravities are still given.

11. Any extraordinary minerals were given to Dr. R. H. Thompson who, if unable to recognize them otherwise, determined them by their X-ray powder photographs.

12. Picked specimens of hematite, galena, cassiterite, ferberite, ilmenite, pyrite, arsenopyrite, stibnite, etc., were made into polished sections and studied microscopically.

13. A minus 100 mesh radioactive sample from Clear Creek was divided into several portions with a superpanner and an isodynamic separator, but time did not allow further investigation.

14. Specimens of gold were scraped clean and spectrographed, but time did not allow examination of the plates.

15. Photographs were taken to illustrate some important features.

Ordinary characteristics[21] by which minerals are recognized are considered superfluous here and only those features peculiar to the area are discussed. Estimated percentage compositions are very inaccurate, especially in the smaller percentages and small samples. Unless origin is quite apparent, theories of genesis of most minerals are left to more able investigators.

On the basis of drainage and glaciation, creeks from which samples were taken for study are grouped under Highet Creek, Dublin Gulch, McQuesten Valley, and Clear Creek areas. The creeks most easily accessible from Mayo are discussed first; and mineralogy is tabulated in descending order of abundance.

HIGHET CREEK AREA

HIGHET CREEK

Highet Creek[4] runs east of southeast for 8 miles in a narrow valley, and joins Minto Creek 2½ miles below

Minto Lake. During glaciation the valley was filled with boulder clay and, although much of this has been removed, the creek still flows on boulder clay twenty feet above its old channel.

Placer is found in the old channels, or where the creek has cut through old channel deposits and reconcentrated the minerals.

Fig. 2
Highet Creek, looking up at old dredge.

Several samples of heavy sand were taken from Highet Creek. The sample discussed below was taken from Highet Creek opposite Rudolph Gulch.

Mineralogy

Sizes and weights

+20 mesh 9.4 gm. -20 48 mesh 29.8 gm.	} Magnetic 2.2 gm.
-48 mesh 6.3 gm.	Magnetic 13.5 gm.

+20 mesh non-magnetic

1. Ilmenite: 50-60%. Flat angular black particles showing fine twinning lamellae, about half magnetic. Specific gravity of two selected specimens of weights 12.23, 23.4 mg., were 4.72, and 4.68, respectively. Error probably caused by impurity.

2. Hematite: 10%. Well-rounded pebbles up to one inch in diameter. A polished section shows contorted stringers and blebs of jasper, and limonitic pits probably caused by weathering out of pyrite.

3. Scheelite: 10%. Angular fragments.

4. Cassiterite: 10%. Angular fragments, massive and crystalline in small stout prisms, color greenish brown, translucent to black opaque. S.G. of 12.10 mg. and 24.62 mg. specimens, 7.03, 695 respectively.

5. Garnets: 2%. Colorless to brown, specific gravity of 6.4 mg. specimen, 4.2.

6. Arsenopyrite: Brown, oxide coated, vertically striated, tabular to prismatic crystals. S.G. of 10.85 mg. specimen, 5.43.

7. Native Bismuth: Rounded, yellow, oxide coated nuggets with characteristic pink tinge on a freshly broken surface.

8. Titanite: Wedge shaped, greasy to adamantine

lustred; translucent with parting or cleavage. S.G. of 1.3 mg. specimen, approx. 3.2.

9. Tourmaline or rutile: One small black, adamantine, strongly vertically striated prism.

10. Joseite "A": Flat, yellow, oxide coated, partly rounded, slightly flexible fragments with perfect basal cleavage. Associated with native bismuth.

11. Stibnite: Float collected by R. M. Thompson in 1943. Observation of a polished section showed pyrite, and arsenopyrite in isolated patches, probably older than stibnite.

12. Ferberite: In angular, black, prismatic to platey grains with two faces formed by cleavage or parting. A minor constituent.

13. Gold: Partly amalgamated with mercury but still in blebs and stringers in limonitic quartz.

Magnetic portions

Almost wholly magnetite in unsized or seriate angular fragments, and distorted and perfect octahedra; mainly -16 mesh. Some tramp iron.

A sample from the lowest of two old dredges 1½ miles up from the bend showed only the following differences from the above sample.

1. Gold: 5 - 10%. Rounded, flattened, deep yellow and orange flakes and nuggets. Fineness 835, 15% silver.

2. Pyrite: Very small amount, massive fragments.

3. Hematite: Of two pebbles sectioned and polished, one showed limonitic pits and the other showed pseudomorphs of jasper after pyrite. The latter pebble is divided by a straight, regular band of jasper, perhaps representing bedding. On one side of the jasper band the hematite contains regularly spaced round pseudomorphs of jasper, with very little jasper in the groundmass. Some hematite which forms blebs in the jasper is probably younger than the jasper. On the other side of the band are rounded, square, and six sided pseudomorphs of jasper, and some limonitic cavities which probably represent original pyrite. Another pebble showed well-shaped pseudomorphs at a jasper hematite boundary where a stringer of jasper enters the hematite. (See photo, fig. 4).

Two samples from Highet Creek just below the bend showed much greater quantities of magnetite, more mineral species, and greater grain rounding than either of the samples farther up the creek. Both of the localities below the bend are overlain by boulder clay up to 100 ft. thick.

Fig. 3
Highet Creek

Clockwise from bottom: Ilmenite, Cassiterite, Hematite, Pyrite, Joseite "A", Bismuth, Rutile, Arsenopyrite, Garnet. Middle: Gold, Scheelite.

Fig. 4
Highet Dredge

Jasper pseudomorphous after pyrite in hematite

Conclusions

The + 20 mesh portion of the Rudolph Gulch sands seems representative of this whole sample. According to H. S. Bostock[19] little or no tungsten is found above Rudolph Gulch. A sample collected further down Highet Creek by R. M. Thompson in 1943 is about half scheelite, indicating that the present sample represents only a partial intermingling of Rudolph Gulch minerals with those of Highet Creek.

Most of the heavy sand from Highet seems to be of local origin, and mineralogy suggests deposits similar to Dublin Gulch and Clear Creek. Native Bismuth, Stibnite, and Joseite "A", typical lower temperature minerals, occur with high temperature minerals such as cassiterite, and tungstates. This may indicate two periods of deposition, or deposits formed under shallow depth of cover. Source of the gold may be in arsenopyrite veins near the stock, since some of these carry gold[1]. At head of Scheelite Creek[20], near the granodiorite stock, much scheelite is found in skarn with pyrrhotite, epidote, and garnet. Gold can be panned from the skarn.

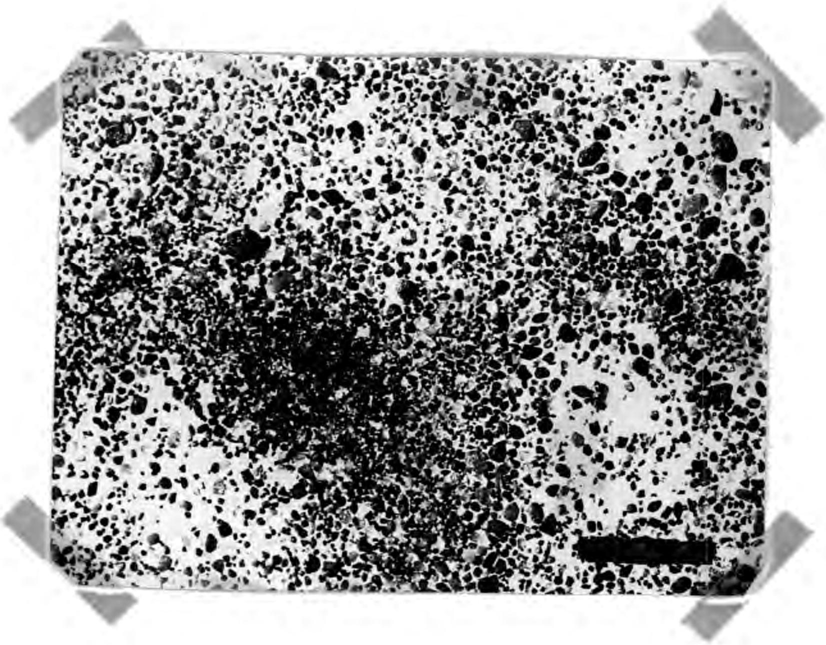
Johnson Creek, which heads with Highet Creek and flows into McQuesten River, was discovered in 1898. It has produced coarse massive gold with a fineness of 815, and silver content of 10%, from 20 ft. of illsorted glacial gravels.

No samples were taken from here but the similarity in fineness and silver content indicates the same origin for the gold as that of Highet Creek.

MINTO CREEK

Minto Creek flows southeast from Minto Lake over an old aggraded channel which is believed to be 300 ft. deep in places. The creek has cut through deposits of sand and gravel along bedrock terraces beside the old channel. Placer is found in this sand and gravel, but the deposits are overlain by boulder clay of variable thickness, so recovery is costly. A sample was taken from Gillespie's cut on the north side of the creek a half mile below Minto Lake.

The mineralogy of this sample was not exhaustively investigated, but extreme diversity of minerals, and rounding of many of the particles shows that this sand is mostly of glacial and partly of local origin.



Minto Creek Sands

Note variety and rounding of grains

Mineralogy

Size: 2 gm, about ½ magnetic, excluding large hematite pebbles which form 80% of sample.

1. Hematite: 80%. Large, well rounded, hard pebbles up to a half inch in diameter. In polished sections of five pebbles, two showed indistinct jasper pseudomorphs as at Highet Creek; one showed jasper seaming a recent fracture; and the others contained blebs and contorted stringers of jasper.

2. Garnets: 5%. Red, pink, and golden, some well rounded. S.G. of a deep reddish brown 3.90 gm fragment, 3.8.

3. Scheelite: 1%. Angular and rounded small, white fragments.

4. Ilmenite: 5%. Angular and rounded flat grains.

5. Schist and other vitreous: 5%.

6. Titanite: Greenish-brown, vitreous to adamant, wedge shaped plates.

7. Zircon: Small greenish to colorless, slightly rounded prisms.

8. Cassiterite: Small, massive, angular grains.

9. Gold: Clean, light yellow, well-rounded flakes.

10. Arsenopyrite: Black-coated metallic euhedra.

11. Tourmaline: Small, black fragment of a vertically striated prism.

12. Mercury-gold amalgam

Magnetic portion: Ilmenite 20%. Magnetite is rounded to subangular, unsized, mostly -28 mesh, 20% euhedral. One large pebble is partly hematite.

BENNET CREEK

Bennet Creek flows into Minto Creek 6 miles below Minto Lake. A small sample was taken in Minto valley so minerals will be mainly of drift origin. No gold or cassiterite were found. Much of this uninspiring sand appears to be local.

Mineralogy

1. Ilmenite: 60%.
2. Garnets: 10%. Brown to red, some well rounded.
3. Schist: Vitreous: 10%.
4. Pyrite: Cubes.
5. Zircon: Small transparent prisms.
6. Tourmaline: One small needle.
7. Scheelite: Trace.

Magnetic: Somewhat sized, angular, about half euhedral, mostly 48 mesh.

BEAR CREEK

The sample was taken from the first tributary on the north side of Bear Creek, about 6 miles above McQuesten River at Fortymile. The minerals are concentrated from drift, except for probably some garnets, ilmenite, and magnetite which could occur in nearby metamorphic rocks.

Mineralogy

Size: 0.1 gm, very little magnetic.

1. Garnets: 20%. Well-rounded, rose, red, brown, amber colored.

2. Ilmenite: 20%.

3. Zircon: Brownish green, rounded prisms.

4. Hematite: Small pebble, very poor to polish but appears to contain jasper.

5. Schist and vitreous: 50%.

6. Scheelite: Trace.

7. Gold: One small, well rounded, light yellow flake.

DUBLIN GULCH AREA

DUBLIN GULCH

Dublin Gulch is a fairly steep, westerly trending valley which drains into Haggart Creek 12 miles above McQuesten River. The Gulch contains earlier glacial deposits and about 60 to 20 feet of coarse gravel which carries gold up to $1.00 per yard or more.

A sample was taken from Taylor's cut a mile up Dublin Gulch. (See photo, fig. 6).

Mineralogy

Size: 24 gm, mostly + 20 mesh, about 0.5 gm. magnetic.

1. Scheelite[6]: 70%. Clean white, some euhedral. A polished section shows a few remnants of soft, white, vitreous calcite with scheelite veining and replacing it.

2. Ferberite: 5%. Soft, weathered, with limonite stain, limonitic streak, quartz gangue. Some eight-sided pyramids possibly pseudomorphous after scheelite. S. G. of a 12.28 mg octahedral form, 6.54. Polished sections of two specimens showed much alteration in an individual crystal and showed ferberite as a filling in a quartz breccia. S. G. of a 12.83 mg specimen, 6.62. Low because of alteration.

3. Ilmenite: 10%. Rounded to angular, flat grains showing good cleavage and sometimes twinning. Usually non-magnetic.

4. Gold: 5%. Rounded, flattened, but coarse, irregular, dark yellow nuggets associated with limonitic quartz. Fineness 895. Some electrum may be present in small amounts.

5. Arsenopyrite: Friable masses with quartz gangue. Polished sections of vein material from a vein in the bottom of Taylor's cut showed only quartz in very weathered arsenopyrite.

6. Limonite: Massive pebbles, sometimes with attached scheelite.

7. Pyrite: Massive, cubes, and pyritohedrons.

8. Hematite: Small pebbles. A polished section was made of a specimen collected by R. M. Thompson in 1943. It showed stringers and rounded blebs of jasper; and pseudomorphs of jasper after pyrite at the boundary between a mass of jasper and a mass of hematite. (See photo, fig. 8). The jasper contains ragged, unoriented particles of hematite and appears darker where it veins the hematite. These structures are identical to those found at Highet Creek.

9. Garnet: Reddish, transparent, colorless and brown euhedrons. S.G. of two brown, 5.59, and 7.10 mg fragments, 4.2. Some dark reddish fragments could be rutile.

10. Allanite: Small -14 + 20 mesh, dark brownish green, vitreous, 6 sided prisms. S.G. of a 2.56 mg specimen, approximately 3.3. Refractive indices by oil immersion are between 1.69 and 1.71. Some may be apatite.

11. Quartz, Diopside and Muscovite: A small pebble. Refractive indices of diopside by oil immersion are between 1.668 and 1.69.

12. Tourmaline: Finely fibrous, black, common in rounded pebbles with limonitic stain.

13. Mica Schist: Greenish.

14. Biotite: Small euhedral weathered books.

15. Hornblende: Black, columnar, brittle, white streak.

16. Cassiterite[10]: Black to greenish brown, adamant; small prisms and rough grains. S.G. of 27.25 mg and 5.53 mg specimens, 6.68 and 7.6 respectively.

17. Bismuth: Yellow, oxide-coated, pinkish-tinged metallic. Small rounded nuggets.

18. Monazite?: Small, rounded, honey colored, greasy lustered grains. Could be garnet.

19. Zircon: Very small, colorless, transparent prisms.

20. Galena: Collected by R. M. Thompson. Coated with anglesite, very weathered. A polished section etched with $FeCl_3$ failed to reveal other than the supergene

mineral anglesite, and probably limonite along the cleavage.

21. <u>Albite</u>: Finely striated, white translucent, with good cleavage. Refractive indices by oil immersion are above and below 1.534.

22. <u>Gold, Galenobismutite, and Quartz</u>: Specimen collected by R. M. Thompson.

23. <u>Tetradymite</u>: Also found by R. M. Thompson.

<u>Magnetic</u>

Half tramp iron. Magnetite mainly massive, angular, about 20% euhedral.

<u>HAGGART CREEK</u>

Haggart Creek[4] joins McQuesten River 13 miles above the North McQuesten. The creek flows in a somewhat restricted course over a pre-glacial channel about 100 feet below present creek level. Fluvioglacial deposits which once filled the valley have been largely removed. Gold was found in 1895 and the creek has been mined since then. Geologic history and general characteristics are similar to Duncan and Highet Creeks.

A sample was taken from Barker's workings on Haggart Creek (see photo, fig. 7) just below Dublin Gulch.

Minerals found: 30 gm.

Cassiterite: 20%. Some appears to have Colliform banding.

Scheelite 20%
Ferberite.
Ilmenite.
Monazite?
Allanite.
Hematite 10%
Schist.
Pyrite.
Arsenopyrite.
Bismuth.
Garnets.
Gold: 850 fine.

Magnetic portion:

Coarse, angular as at Dublin Gulch. Some pebbles partly hematite.

Conclusions:

The only distinct difference between the Barker sands and the Taylor sample is the great increase in amount of cassiterite below Dublin Gulch, and the introduction of more pebbles of hematite and rounded grains. The cassiterite occurs with tourmaline on the north side of Dublin Gulch[10], while the rounded grains and the hematite appear to be of glacial origin. Many gold-arsenopyrite veins[7] traverse the precambrian schists near the granodiorite, and gold can be panned from the weathered vein material.. Allanite, an accessory of the granodiorite, is produced by disintegration of the rock. Scheelite is found in skarn near the contacts.

Fig. 6.
Taylor's cut at Dublin Gulch

Note the coarse gravel on decomposed
bedrock on the left.

Fig. 7
Panning Barker's Ground

View toward Dublin Gulch.

Fig. 8
<u>Dublin Gulch</u>

Clockwise from bottom: Pyrite, cassiterite ferberite, scheelite arsenopyrite, garnet, allanite. Center: Gold.

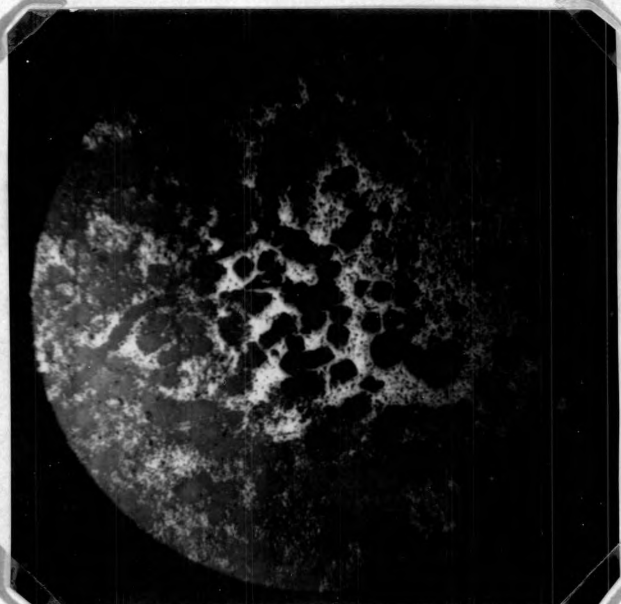


Fig. 9
<u>Dublin Gulch</u>

Pseudomorphs of jasper after pyrite in hematite.

McQUESTEN VALLEY AREA

HAGGART CREEK

This sample, which was taken a quarter mile up Haggart Creek, probably represents drift minerals with some addition from Haggart Creek area.

Mineralogy

Size: 0.5 gm, mostly -28 mesh, mostly well rounded, about 0.1 gm magnetic.

1. Schist, vitreous minerals, rocks: 60%.

2. Ilmenite, etc: 10%. May include some ferberite and other black rounded grains.

3. Garnet: Pink, red, brown, amber colored.

4. Scheelite: Less than 1%, -28 mesh, angular and rounded.

5. Cassiterite: A few subangular massive grains. Could be from Dublin Gulch area.

6. Hematite: Small pebbles.

7. Galena: Two + 20 mesh angular particles. Polished sections etched with $FeCl_3$ showed no other minerals. The galena could be from Dublin Gulch, Galena Hill, or elsewhere.

Magnetic portion

Rounded to subangular particles.

Fig. 10
McQuesten Valley at Sunchine Creek,

6 miles below North McQuesten River
View east.

GOODMAN CREEK

Goodman Creek flows into McQuesten River 12 miles above North McQuesten River. The sample, taken at elevation 2150 ft where the creek enters the main valley, is probably a concentrate from local minerals and drift which choked the creek during glaciation.

It is difficult to distinguish between foreign and local numerals since both the particle sizing and rounding is completely gradational.

Mineralogy

Size: 0.5 gm. 60% black, fairly well wounded to subangular, poorly sized, mainly 48 mesh, about one-tenth magnetic.

1. Schist and vitreous: 30%.

2. Ilmenite: 30%. Subangular to angular grains.

3. Garnet: 10%. Colorless to pink, brown, red, amber. Some well rounded. Monazite may be present.

4. Hematite: 2%. Small pebbles.

5. Scheelite: Less than 1%. Small angular particles.

6. Pyrite.

7. Zircon: Mainly greenish with black inclusions.

8. Gold: Small amount, fine flat flakes.

9. Cassiterite: Small amount, massive fragments.

10. Tourmaline?

Magnetic portion:

Mostly magnetite, 30% euhedra, mostly 48 mesh, not as well sized as at Rodin, mainly angular.

RODIN CREEK

Rodin Creek flows into McQuesten River 5 miles above North McQuesten River. The mouth of Rodin was choked with drift during glaciation and the sand sample seems to be a concentration of this drift and considerable local material. Two samples were taken; one where the creek enters the valley, the other slightly below. Both were very similar, so the former sample is here considered typical.

Much of the ilmenite, and some of the magnetite is local. Angular and euhedral, unsized, local grains contrast sharply with the well sized, rounded foreign ones. No cassiterite was identified, and scheelite content is very low. The gold is probably concentrated from drift. Where Rodin Creek enters McQuesten valley, some of the gravel has been worked and appears to have paid for a while, but depth of overburden is too great.

Mineralogy

Size: 3 gm, nearly all -48 + 65 mesh, except for large hematite pebbles. Well rounded to subangular, about 0.5 gm magnetic.

1. Ilmenite: 50%. Subangular to rounded.
2. Garnet: 30%. Mainly amber, also pink and red.
3. Hematite: 10%. Several large pebbles. Polished sections of two pebbles showed blebs and contorted stringers of jasper. No pseudomorphs were found, probably because pebbles with abundant jasper, which seem to carry the pseudomorphs, were lacking.
4. Schist and vitreous: 5%.
5. Zircon: 48 mesh greenish, quite abundant.
6. Scheelite: Small amount.
7. Arsenopyrite: Vertically striated prisms.
8. Gold: Fine to coarse, well rounded flakes.

No cassiterite.

Magnetic portion:

About 20% ilmenite. Magnetite well rounded and sized, -48 mesh. A few fresh angular pebbles and euhedra stand out in contrast.

Fig. 11
Rodin Creek

Note sized, rounded grains, large Hematite pebbles.

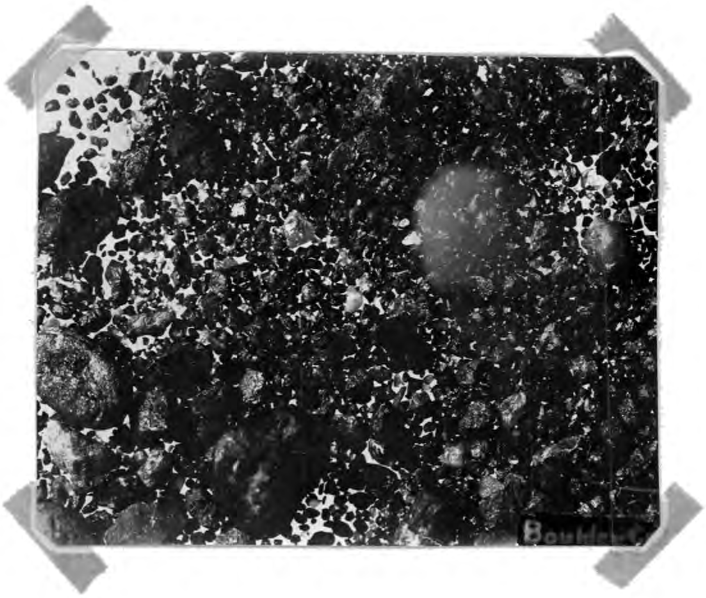


Fig. 12
Boulder Creek

Note poor sizing, angularity, Compare with Rodin Creek.

BOULDER CREEK

Boulder Creek flows southeast into McQuesten River about 12 miles below North McQuesten River. The creek is six miles long and drains an area of rugged hills, most of which is underlain by a stock of porphyritic granite (see map). The mouth of this creek was probably also choked by drift, ~~some~~ some minerals are glacial and others local in origin.

Mineralogy

Size: 5 gm, angular to subangular, poorly sized, about 0.5 gm. magnetic.

1. Ilmenite: 30%. Angular particles.
2. Cassiterite: 20%. Massive, some euhedral prisms.
3. Schist and vitreous: 20%.
4. Scheelite: 10%. Angular particles, some quite large.
5. Garnets: 20%. Red, pink, brown, amber. Some very well rounded. S.G. of 5.78 mg pink variety, 3.7.
6. Monazite: 5%. Golden, euhedral, tabular prisms. Determined by R. M. Thompson by an X-ray powder photograph.
7. Zircon: Brown and greenish.
8. Tourmaline: Small, black, vertically striated prism, may be rutile.
9. Gold: One small flake.

Magnetic portion:

10% ilmenite. Magnetite is unsized, angular, mostly -28 mesh, some with limonitic cavities.

Angularity of the particles; and the presence of cassiterite and angular scheelite and monazite suggest that most of the sand is local in origin.

FORTYMILE CREEK

Fortymile Creek drains a large area which extends into the hills at the head of Clear Creek. Much of the upper course of Fortymile may be a captured stream. The sample was taken where the creek joins the main valley, so it may contain small amounts of drift minerals.

The particles appear to be mainly local. Gold and scheelite could originate in the area at the head of Clear Creek. Some cassiterite is probably present although none was found.

Mineralogy

Size: 0.3 gm, about 0.1 gm. magnetic.

1. Ilmenite: 95%. Fairly angular.
2. Garnet: 2%. Red, brown, pink, amber.
3. Gold: Small amount of fine flakes.
4. Scheelite: Trace.
5. Hematite: Small amount.

Magnetic portion:

50% ilmenite; Magnetite is angular, well sorted, mainly 48 mesh, 20% euhedral.

VANCOUVER CREEK, MAIN FORK

Vancouver Creek comprises four forks which drain most of the area between Clear Creek and McQuesten River. The creek flows through gulches in drift at the main forks, and joins McQuesten River 20 miles above Stewart River. The sample was taken about a quarter mile above the west fork, opposite the small tributary which flows in from the south.

The overabundant ilmenite, and probably most of the other minerals are of local origin. Some of the rounded grains could be local but the presence of nearby drift, which has clogged the lower part of this valley, suggests that they are foreign. The gold, cassiterite and scheelite may be foreign, or they may originate from deposits connected with the nearby stock.

Mineralogy

Size: 0.2 gm, about one twentieth magnetic.

1. Ilmenite: 95%. Angular, fairly well sized.
2. Garnets: nearly 5%. Pink, amber colored.
3. Hematite: Limonitic.
4. Gold: A few small flakes.
5. Pyrite: Common.
6. Scheelite: Less than 1%.
7. Cassiterite.
8. Sphene: Brownish, greasy lustred wedge.

VANCOUVER CREEK, SOUTH FORK

A sample from the south fork was taken a quarter mile above the junction with the main fork. The constituents appear to be mainly, if not completely, local. There is no evidence that any glacial material was carried over the ridge separating this creek from McQuesten Valley.

Mineralogy

Size: 0.1 gm, mostly 28 mesh, angular, unsorted, trace of magnetite.

1. Ilmenite: 98%. Non-magnetic with whitish, calcareous coating.
2. Garnet: Golden, transparent.
3. Scheelite: Trace.
4. Tourmaline: One black trigonal prism.

McQUESTEN RIVER

This sample is representative of minerals in glacial drift, outwash, and river gravels. Well rounded grains, low tin and tungsten, abundant garnet and other vitreous minerals and rocks, and hematite seem to be characteristic.

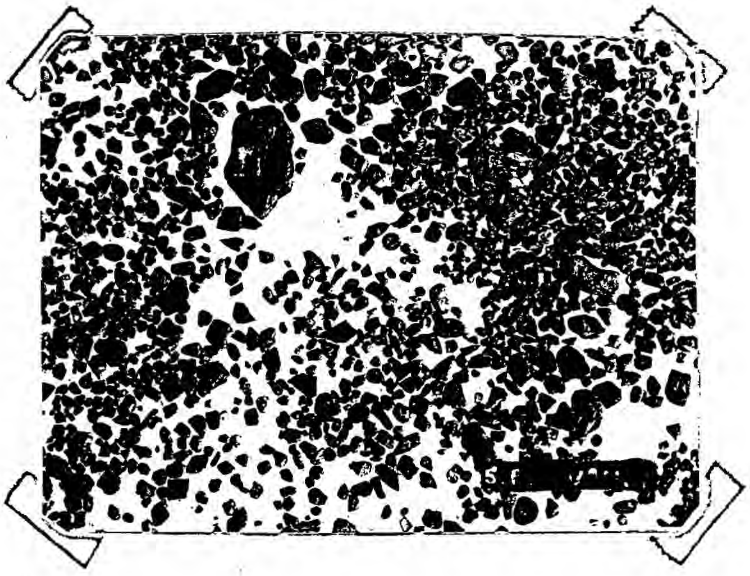


Fig. 13
South Fork of Vancouver Creek

An Ilmenite sand.

Mineralogy

Size: 0.3 gm, well rounded, mainly -35 mesh, 0.1 gm magnetic.

1. Ilmenite: 50%. Most of the black rounded grains are probably ilmenite.
2. Garnet: 20%. Red, brown, pink, amber colored. Many well rounded.
3. Rocks and vitreous: 20%
4. Zircon: Brownish-green and colorless 65 mesh prisms.
5. Scheelite: Less than 1%. Very fine particles.
6. Gold: A few fine flakes.
7. Hematite: Small pebbles.

Magnetic portion:

20% ilmenite. Magnetite is well rounded, -28 mesh, partly euhedral.

CLEAR CREEK AREA

CLEAR CREEK

Clear Creek drains a group of high ridges to the northwest of lower McQuesten Valley, and joins Stewart River in Tintina valley 8 miles below the mouth of McQuesten River.

The valley of lower Clear Creek is incised into bedrock in the floor of a narrow valley which was originally filled with gravels to an elevation of 3000 ft. Two distinct terraces are thus formed; one 500 ft above the creek at elevation 3000 ft, and the other 50 ft above the stream at the old valley floor.

LEFT CLEAR CREEK

The left fork occupies a valley which is, in places, up to a quarter mile wide. Here, too, the older gravels lie at elevations of 3000 ft or more, but deposits are not so extensive because the valley has steep walls. The stream has cut only moderately into bedrock in places. Most of the valley floor is covered with gravel up to 20 ft. deep.

Placer gold occurs extensively along the main valley, which is being dredged by Clear Creek Placers Co. Source of the gold seems to be in the gulch of the south tributary where a number of porphyritic granite plugs and numerous small acidic intrusives are found. Some dike rocks and vein quartz appear in the hills around the creek and in the bedrock dug up by the dredge.

Samples were taken from the dredge a half mile above the bend, and from an exposure of bedrock a quarter mile above the dredge.

Dredge Sample

The data below were used to plot the screen analysis (fig. 15). No conclusions were drawn from this chart.

Total weight 395 gm.

Size	Wt.	Wt.%	Wt.% Accummulative	Wt. Magnetic
+6 mesh	120 gm.	30.4	30.4	39 gm.
-6 +14	110 gm.	27.9	58.3	25 gm.
-14 +28	55.5 gm.	14.1	72.4	6.2 gm.
-28 +48	56.3 gm.	14.3	86.7	3.5 gm.
-48 +100	37.0 gm.	9.4	96.1	1.7 gm.
-100	15.4 gm.	3.9	100.0	trace
Total	394.2 gm.	100.0		

The -6 14 mesh portion was visually separated into its constituents after it was scoured clean in a 240 mesh carborundum-water mixture, and treated with hydrochloric acid and zinc.

Constituents:

	Wt.
Cassiterite	30 gm.
Scheelite	23.5

	Wt.
Hematite, Rocks	20
Pyrite	12.5
Ilmenite, Ferberite	7.5
Magnetite	1
Tramp metal	26
	110.5 gm.

This portion seems representative of the overall composition of the sample, except that more soft, brittle minerals like scheelite, and originally fine-grained particles would tend to be in the smaller sizes.

Mineralogy

1. **Cassiterite:** Mainly massive pebbles, some smaller euhedra. A polished section showed some quartz and limonite gangue. S. G. of 13.09 mg and 27.08 mg specimens, 6.89, 6.85 respectively.

2. **Scheelite:** White to brownish, limonitic. A polished section showed ferberite veining some at the scheelite. It also showed ferberite in a form which may be two monoclinic prisms simulating a bipyramid, or a pseudomorph after a scheelite bipyramid.

3. **Pyrite:** Coarse cubic crystals, fine replacements of schist, and encrustations showing comb structure (photo). Two polished sections showed deep weathering, but no other minerals.

4. Hematite: Well rounded pebbles. Several polished sections show that all contain stringers and prolific small blebs of jasper, but no pseudomorphs.

5. Ilmenite: Angular to subangular flat particles. Polished sections showed homogenous structure. S.G. of a 10.17 mg specimen, 4.62.

6. Ferberite: Deeply weathered with limonitic streak. A polished section shows extensive alteration.

7. Arsenopyrite: Friable masses, some fresh euhedra present in minor amount. S.G. of an 8.30 mg euhedron, 5.78. A polished section shows no other minerals.

8. Gold: Only as blebs and veinings in limonitic quartz from the dredge sample. From above the dredge in flattened massive, subangular, shotty particles, mostly 28 mesh. Little or no gangue.

9. Garnet: Colorless, red, brown, pink, some well rounded. S. G. of reddish brown, 6.91 mg specimen, 4.0.

10. Barite: White, vitreous, soft, two cleavages. Found in scheelite under ultra-violet lamp. S.G. of the 9.37 mg specimen, 4.57. Refractive index 1.638.

11. Tourmaline: One small, black, striated, trigonal prism.

12. Zircon: Colorless and greenish brown.

13. Monazite: Vitreous, orange-yellow, tabular prisms.

14. Joseite "A": Slightly flexible tabular particle with strong metallic lustre and good basal cleavage.

15. Galena: Two 20 mesh particles.

Magnetic portions

Generally two thirds tramp metal in the dredge sample. Angular, massive and euhedral magnetite, and little or no ilmenite. Some magnetite is found in hematite pebbles, probably sedimentary.

Radioactivity

The -100 mesh portion is definitely radioactive and coarser portions are less so. The radioactive mineral is probably a fine grained accessory of the granites, and may be radioactive zircon or monazite.

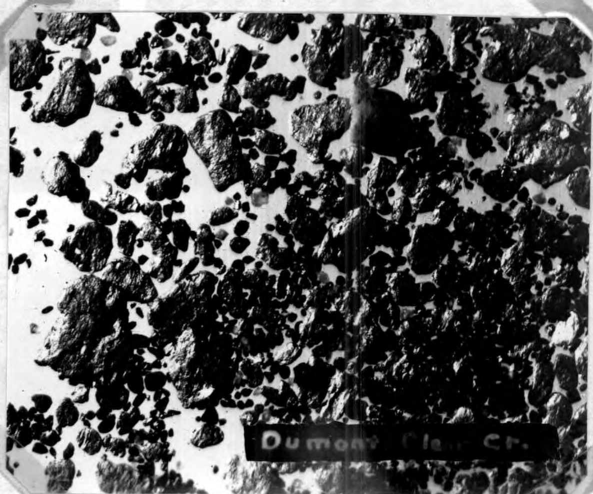


Fig. 14
Gold on left Clear Creek

Clear Creek Placers Limited continued operations with a diesel-driven dredge on Clear Creek where it holds 115 claims. During the winter of 1948-49 the valley bottom in the dredging area filled with ice and at the dredge itself reached a maximum thickness of almost twenty feet, completely covering the main deck and machinery. As a result much preparatory work had to be done before operations commenced on June 16th. A total of 239,400 cubic yards of material was dredged from which 3,301 fine ounces of gold and 812 ounces of silver were recovered.

About 25,000 cubic yards of material was stripped during the season but no mechanical thawing operations were carried on as gravel ahead of the dredge is allowed to thaw naturally.

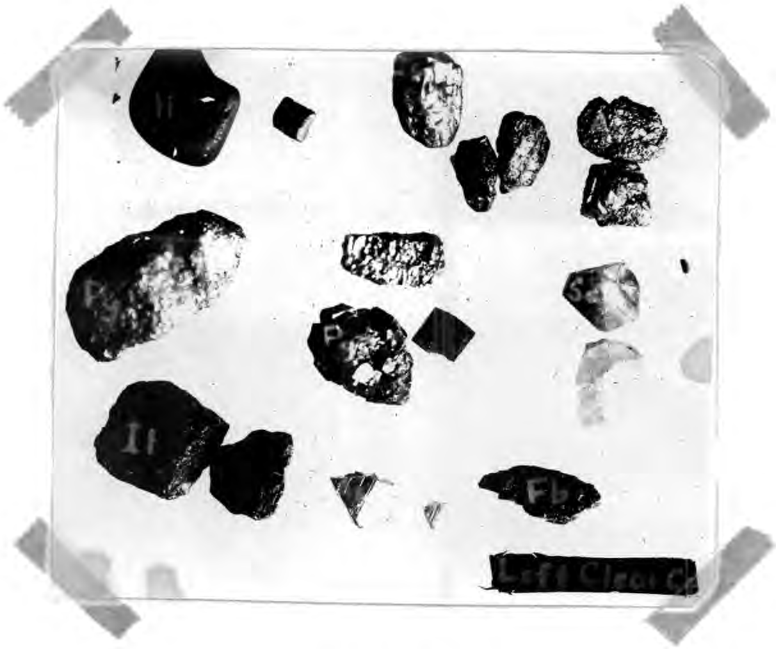


Fig. 16.
Left Clear Creek

Clockwise from bottom: Ferberite, arsenopyrite, ilmenite, massive pyrite, hematite, monazite, cassiterite arsenopyrite, scheelite.
Center: Pyrite. Note crustification in top specimen

Fig. 17
View west down Left Clear Creek

Note dredge tails and plateau surface.

Conclusions

All constituents of the sand are more or less typical associates of granitic intrusives. Gold, tin, and tungsten form the main placer minerals. Gold probably originates in quartz veins associated with aplite and quartz porphyry bodies[8] near the granitic intrusives at the head of the south tributary (see map).

Tourmaline and cassiterite indicate high temperature deposition, while joseite "A", and fine grained encrustations of pyrite may indicate lower temperature deposition in open fractures. These high and low temperature minerals may form part of a telescoped sequence of deposition from fluids originating in magmas at shallow depths. The porphyritic nature of the stocks indicates intrusion into regions of more rapid cooling than that in which the phenocrysts formed.

CLEAR CREEK, SOUTH FORK

The south fork occupies a more open valley than the left fork but characteristics are similar. The sample was panned two miles up from the fork, opposite the trail to Vancouver Creek.

Mineralogy

Size: 1 gm, -20 mesh, unsized, angular, about 0.2 gm. magnetic.

1. Ilmenite: 60%. Flat angular grains.
2. Pyrite: 10%. Massive and crystalline.
3. Garnet: 10%. Mainly amber-colored, some reddish pink, a few well rounded.

4. Schist and vitreous: 10%.

5. Cassiterite: 1%. Massive and crystalline.

6. Scheelite: 1%. Fine grains.

7. Zircon: Greenish brown and transparent.

8. Gold: A few small flakes.

Magnetic portion

40% ilmenite, 10% magnetite in massive octohedra, and cubes which are probably pseudomorphs after pyrite.

Conclusions

Cubic magnetite seems to be characteristic. If excess pyrite and ilmenite is discounted, the mineralogy appears very similar to that of the left fork. Tin, tungsten and gold probably originate in the same deposits as in the left fork. Probably much of the ilmenite comes from the area at the head of the west fork of Vancouver Creek, which appears to have captured the stream which flows into Clear Creek here.

Some small, well rounded grains occur but these are probably a chance result of greater abrasion, or they may be of pre-plateau age.

OTHER PLACER AREAS

Arizona Creek, at the northern border of the area, has characteristics very similar to the unglaciated placer creeks in the area. Gold, tin, and tungsten are closely associated with small granitic intrusives here. The placer is formed by reconcentration from an old channel.

McLagan Creek, above Minto Lake, carries placer which may be associated with the nearby stock.

Zinc Creek, a western tributary of Clear Creek, carries high gold values. This deposit may be related to the porphyritic granite stock on lower Clear Creek, although no other deposits in the vicinity are known.

CONCLUSIONS

Placer deposits in the McQuesten River area appear to have been formed either from telescoped (Xenothermal) vein types or, more probably, from two separate, high and lower temperature vein types. Quartz tourmaline, cassiterite, ferberite arsenopyrite, etc., could form relatively high temperature veins, perhaps earlier than lower temperature veins of gold, tellurides, bismuth, stibnite, etc. All mineral deposits seem closely associated with quartz porphyry and aplite[8] adjacent to small granitic stocks.

Gold, tin, and tungsten seem to be associated in most deposits. This area appears to be a northern extension of the meso-cordilleran tin[11] and tungsten[17] belts. The tin deposit at Dublin Gulch[10] differs from typical tin deposits[18] in the lack of topaz, fluorite, and feldspar. This may be true of other tin deposits here, too, since no greisen minerals were found. Much of the gold carries spectrographic amounts of tin[20] thus showing close association with tin deposits. It may be possible, however, that this is a result of replacement or precipitation of SnO_2 in the placer gold. Replacement of antlers by SnO_2 is known[18].

Hematite which shows pseudomorphs of jasper after pyrite was found in three sands from glaciated areas. Since a fairly complicated series of events leads to formation of the pseudomorphs, these occurrences could hardly be coincidental. The structures probably have a common origin.

Hematite which does not show pseudomorphs but which does contain veins and blebs of jasper is widely distributed. If an earlier glaciation distributed this hematite, it must have been quite extensive to include Clear Creek. Drainage systems existing before the Miocene uplift could have carried hematite from its source in the east[19] and distributed it over the country. Ice could transport the hematite further. Presence of pseudomorphs, then, would only indicate a common origin, not necessarily, but ~~often~~ probably mostly glacial.

Creek particles seem to be mostly angular, while those in main valleys tend to be well rounded. Assuming the same gradient, valley width, gravel type, and volume of stream, the overall degree of rounding would be proportional to stream length. In larger valleys particles would become more rounded and, since these valleys were glaciated, rounded grains would tend to be mainly glacial. If present in sufficient quantity, and supported by other criteria, well rounded grains with diverse mineralogy may be used as evidences of glaciation.

Some well rounded grains of resistant minerals such as garnet are found in all creeks. These were probably scattered over the old base-levelled surface by ancient streams, or they may have been rounded more by chance. Consequently, such grains should not be regarded as evidence of glaciation.

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20. Thompson, R. M. Personal communication.

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1949 Bachelor's thesis

1. tungsten - Li Kuo chin
Minerals assoc with W.
Cassit, wolf., scheelite
Qtz, Feld, Musc, Lepidolite Biot, tour. Fluorite topaz
Py, Aspy, cp, Bi, BiS_2 MoS_2 Stannite, Gn, Sp
Ilmenite Beryl corundum Apatite.
Decomp of wolfram, scheelite in Nature.
$WO_4^=$ leached out leaving Fe Mn Hydrates
H_2SO_4 from oxid. of Py may cause more rapid decomp.

2. Stevenson. J.S. W. deposits of B.C.
BCDM Bull. 10 1941

Scheel. 80.6% WO_3 Slocan, Quesnel, Hazelton areas mostly.
Ferb. 75.3 mostly pyrometasomatic
Wolf. " Little veins or magmatic segreg.
Gives Refs on tungsten.

3. Shannon, E.V. Black sands of Idaho
method:
1. Panning - used (tetrabromethane)
2. Magnetic separation
3. Binocular observation.
a. Determine X by symmetry → (Goniometer)
b. Au, Pt by HNO_3
c. "Non-magnetic" opaque Min
Chromite, Il, Limonite columbates etc.
by streak when crushed
d. U, thorium by photographic plate.
e. Slides & oils for non-opaques.

Flow sheet of Mineral Separations

conc^t
|
grade
|
Sepsperies

Electrostatic
Glass rod c̄ silk (+) — Seal wax / Ebony } catskin or flannel.

Isolate
{Ilmenite wolframite tantalite
Magnetite Columbite zircon, monazite Apatite
etc from cassit etc.

Hand Sorting cube stand

Magnetic

Dielectric

Vibration

Heavy liquid

X measurement — Mic. — Physical tests

Microchem — Chem

Microscopic

1. Low Power
   (a) Color transparency translucency opacity
   (b) X habit, shape
   (c) ℄ Fr parting
   (d) degree of abrasion — angular or rounded
2. Interm(ed) Power — as above
   (a) Inclusions, thickness — Refract index
3. Dark Background — lustre
4. Pleochroism — Interference Fig
   Isotropism — Dispersion
   Extinction
   Spectroscopic eyepiece

* on / Dmoc — Stage Micrometer — Coordinate to conc^t.

Michrochem P 288

Chemical Blowpipe Analysis etc. P 301

carat = 200 mg

Confirmatory tests

Spectroscopic
Radioactivity } Thompson
X ray

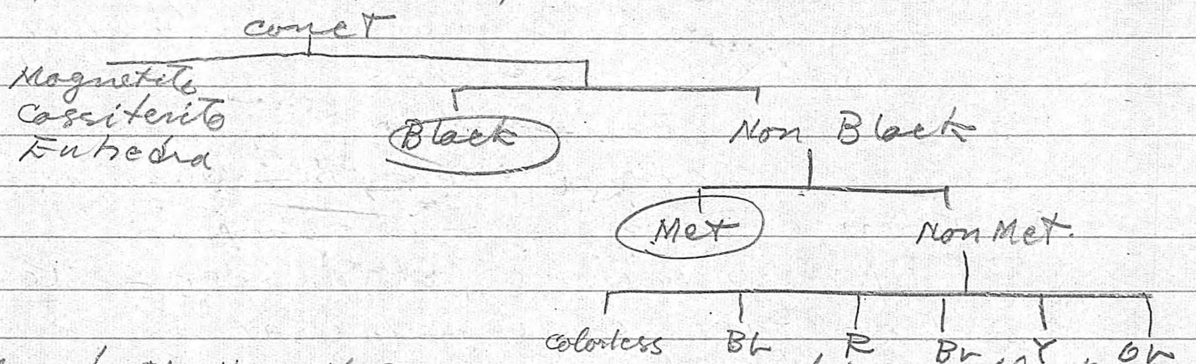
Physical tests

(a) Spec Grav. — color lustre streak
(b) Hardness — Fluorescence
(c) Cl, Fr, parting — Refract. index.
etc

Individual Min P 347
Bibliog good here too

Field Exam of Concentrates

Lustre, Color, Hardness, S.G.



Hot water & NaOH or H_2SO_4 removes coating off Gold
Remove Au, Diamonds
Remove Cassiterite (Zn, HCl reaction)
Remove all same species, Euhedra.
" Magnetite

Geologic Assoc, Age distance etc considered

S.G. of Cassit conc. Burette 30 cc H_2O add 126 gms conct
(table given)

Minerals in heavy sands

Black Minerals

	H.	S.G.	
tourmaline	7.5	3.1	— ~~vit~~ white streak
cassiterite	6.5	7	Zn HCl
Rutile	6.5	4.2	light Br str. Met lustre
tantalite	6.5	7.5	Met.
Columbite	6	5.6	"
Thorianite	6	9.5	" small rusty cubes.
Mag ← Chromite	6	4.3	Green beads or streak sub met.
Hematite	6	4.9	Red str Mag on Heating.
Wolfram	5.5	7.4	
Hubnerite		7.2	W, Mn reactions or streak
Ferberite			
Magnetite	5.5	5	magnetic
Ilmenite	5.5	4.7	magnetic
??Franklinite			

Met Min (Non Black)

Pyrite
(Pt)
Au
Electrum

Bi° — Fe Pb Sn rare

tramp metal

(Marcasite Pyrite Cp Brass Mica)

Colorless	Blue	Red	Brown	Yellow	Green
Corundum	Spinel	Garnets	Monazite	Beryl	Corundum
topaz	topaz	cassiterite	olivine	+	Beryl
Zircon	Kyanite	Rutile	+	feldspar	Zircon
Spodumene	Apatite	tourm.		olivine	tourmaline
Scheelite	tourmaline	Andalusite)			olivine
apatite	etc.	Staurolite			apatite
		Zircon			
		Spinel			
		topaz.			

Accessory Min of Granites

Magnetite *	Garnet	titanite
Ilmenite	Andalusite	Corundum
Hematite	topaz	Monazite.
Pyrite	tourmaline *	
Apatite +	Fluorite	
Zircon *	Cassiterite	

Met Rx accessories

tourmaline	Magnetite	Pyrite
Garnet	Rutile	corundum
cordierite	Sillimanite	
Monazite	Spinel	

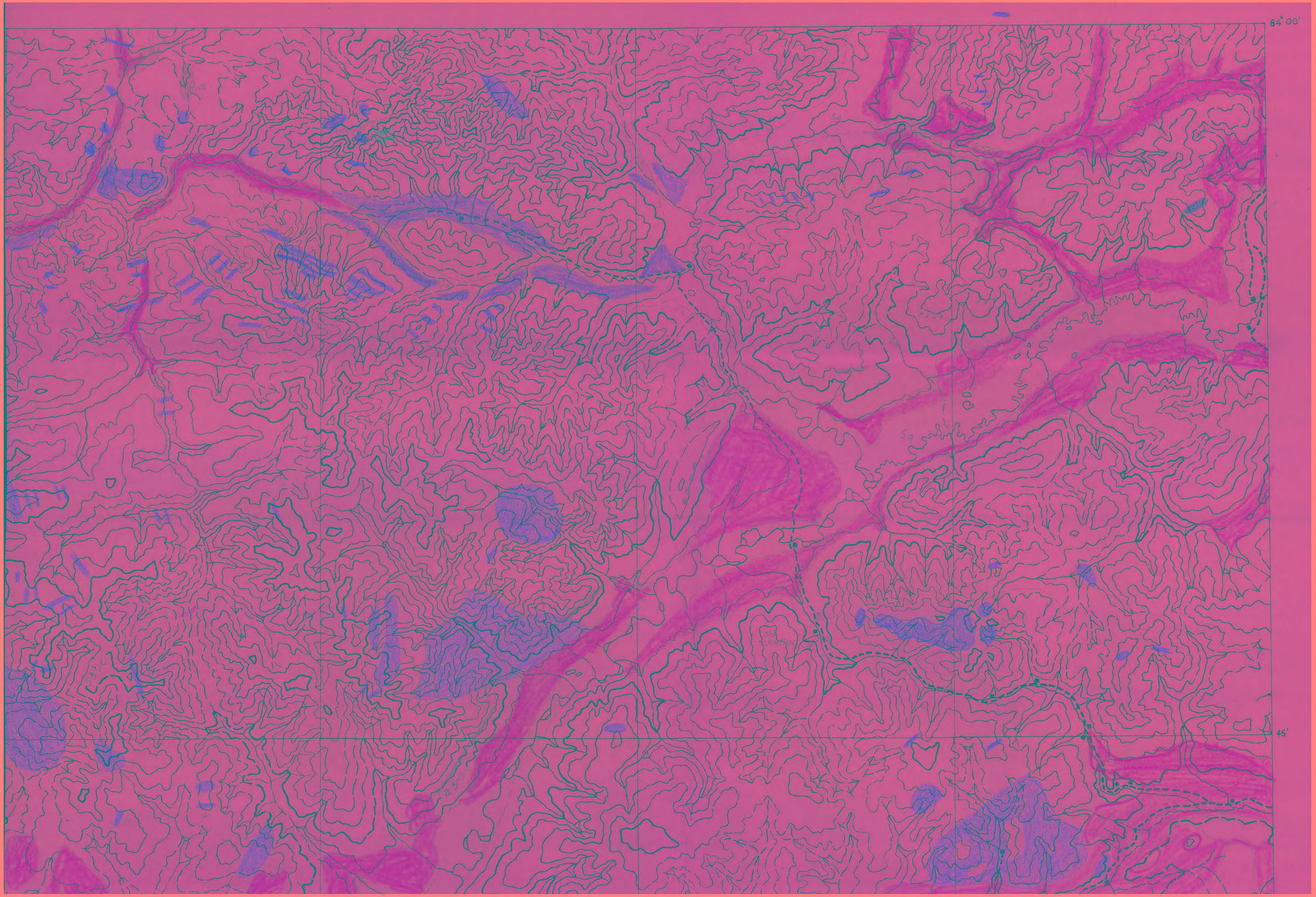
Sn Assoc in Granites

tourmaline	Limonite	Fluorite
topaz	Pyrite	Andalusite
apatite	Aspy *	
zircon	Native Bi	Garnet
titanite	Wolfram	
Magnetite Ilmenite	Siderite	
Hematite	Uranium	

Ferb-W — 7.-7.5 mm
Cassit — 6.8-7.1

Rutile — transmitted light
4.18-4.25
Molybdenite — ??
Fluorite 3.01-3.28
corundum 3.95-4.10
Hematite 4.9-5.3 } could be?
Ilmenite 4.5-5 }
Spinels — ?? 3.54 ← may be
Magnetite — 5.1-2
Franklinite -5-5.2
(Pyroxenes 3-3.5 } decomp
(amphiboles }
Garnet 3.1-4.3
(Idocrase (vesuv.) 3.35-3.4
Zircon 4.6-4.7
topaz 3.4-3.6
Allanite 3-4.2
tourmaline 3-3.2
-sphene (titanite) 3.4-3.56
columb, tan, Nb — 4-5
Monazite 4.9-5.3
Apatite 3.17-3.2


2500
30'
Emergency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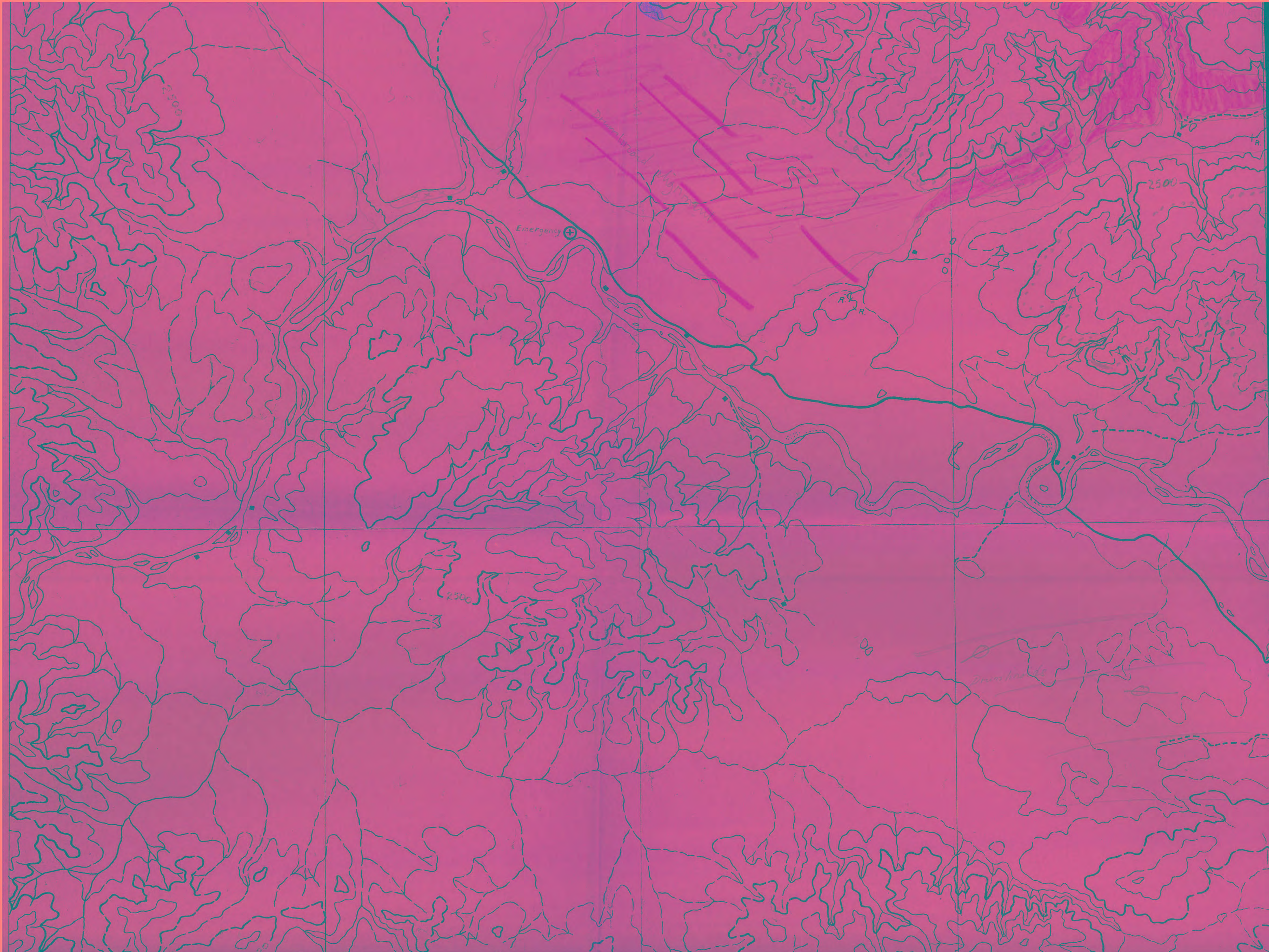
45'


2500
Emergency
2500
2500
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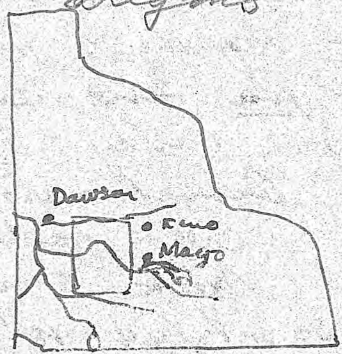
Speech given in Geol. Div. of Dawson Club
Seminar.

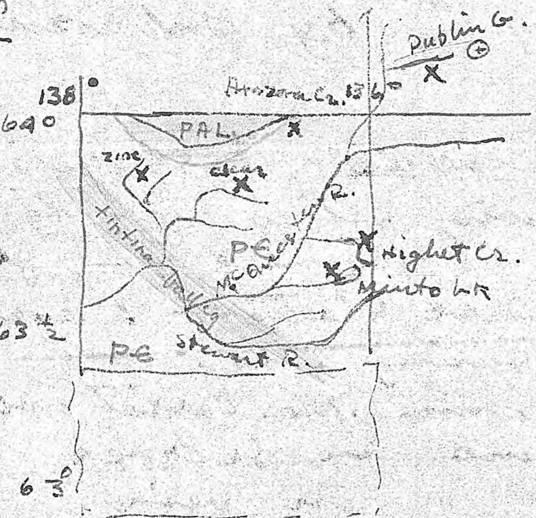
"Placers of McQuesten R. Area, Yukon.

Consider few of best, typical placers, try to link them, suggest origins

Location of Area:
Plane
Steamer



Area itself



~~Geol~~ Provinces
(a) S part. PE (b) Tintina Valley. (Rocky Mt)
(c) PE of N part. (d) Paleozoics.

Placer deposits in PE of N ½

Features in Common
All in PE here
All assoc. with small granite Bodies
All show higher previous base levels
of erosion by high level gravels
All preglacial tertiary in origin
~~Mineral associations somewhat similar~~

Individual Deposits in order of decreasing import.

(1) Clear Creek Au Dredging 25-30 ¢/yd 6-7 miles x ¼ mi
Cassit — Richest on left fork.
— Small porph gr bodies & series of Q porph dikes. — some in creek bed
— Reputed vein in bedrock
— Au fine to coarser toward head of
Unglaciated electrum valley Py Aspy cassit Hematite
Gravel terraces Elev 3000' 500' above creek valley. Au washed down into creek small bench placers.

25-30¢/yd 15' deep 6-7 mi x ¼ mi
Stripping by Bull dozers

(2) Dublin G
Au, Scheelite [Cassiterite] tetradymite
Gold (1) wiry yellow high Ag Assoc c̄ Aspy. veins — gd or Q Monz. body
(2) Dark shotty — ? leaching ?? Edwards scheelite during war.
High temp min, Mo. cassit wolf Ferb tourmaline
Aspy found in bedrock some veins
Sn vein
— High level gravels also
2 glaciations — old obscure.
— recent by passed.

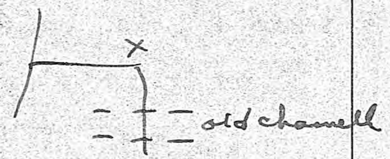
worked by 3 people $1.00/yd - steep, ¼ mi, 65' deep

(3) Wright Cr
— Coarse gold - some scheelite Hem. Sn Bi
— Assoc ? veins of Aspy & Q carrying some Au around gd body — Dr. Caulfield
— Old channel goes thru bend to Minto Lk 2-300' higher.
— Glaciation S of Minto Lk.
worked by one man

Nov 9/48 Placers AHO. A.E. Geol Eng.

(4) Arizona Crk.
- old gravels here also
- Assoc with small granitic bodies

Au Barite Sn



(5) other Creeks:
- some around Minto Lk. - partly old channel, part individual
- McQuesten R valley, Bear Cr etc. all show some Au in valley & small creeks - none commercial - By glacial propagation.
- Zinc Creek Richest for short time - ??

~~Localization~~

~~Distribution of source rocks~~
~~Stream action~~

Geologic Sequence of events leading to placer localization

(over)

Fineness of Gold ?

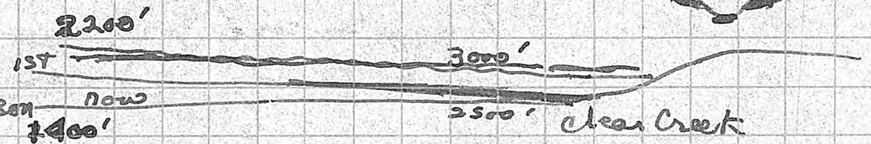
Sn Assoc ?

(g) Recent stream action — insig

(f) glaciation — advance from S & E in Yukon. From E. here.
Ice gradient by grooving etc about 1000'±/60 mi
Only in valleys Pelly Stewart McQuesten

See Bostock's Physiog.

By passed Dublin G., partly overrode (till)
over-rode Higlet Cr. (till on top of gravel)
to Elv 2500 – 3000'
Klondike unglac.
McQuesten partly — much gone.
Livingstone Cr all but ½ mi → Cassiar Bar
Wolf Ck ?? E of W.H.



Miocene (e) Uplift

(d) Subsidence — filled with gravels

Pay streak formed when valley 1st cut down

early tertiary (c) Uplift

(b) Uplift & erosion — subdued topog.

(a) Intrusions — Jurassic (Coast Range)
— Syenite 1st, rest in wave ... after.
— Mayo — Even g'd, then porph or
Dikes from gd to q. porph
(Au Assoc with dikes)
Porph — dike change in phys-chem cond. during
x → higher horizons. (shallow)

I Seds & Paleozoics → Jurr.

Conc by — Geologic origin → rocks.
— Stream action
— destroyed by glaciation