2773

GEOLOGICAL REPORT

GEO AND CHIEF PROPERTY

WALHACHIN AND BRASSIE CREEK AREA, 50° 45', 121°

KAMLOOPS MINING DIVISION

BRITISH COLUMBIA

SUPERTEST INVESTMENTS AND PETROLEUM LIMITED

CALGARY, ALBERTA
AUGUST 21, 1970

E. J. Wendeborn
E. J. WENDEBORN, B.Sc., P. Geol.

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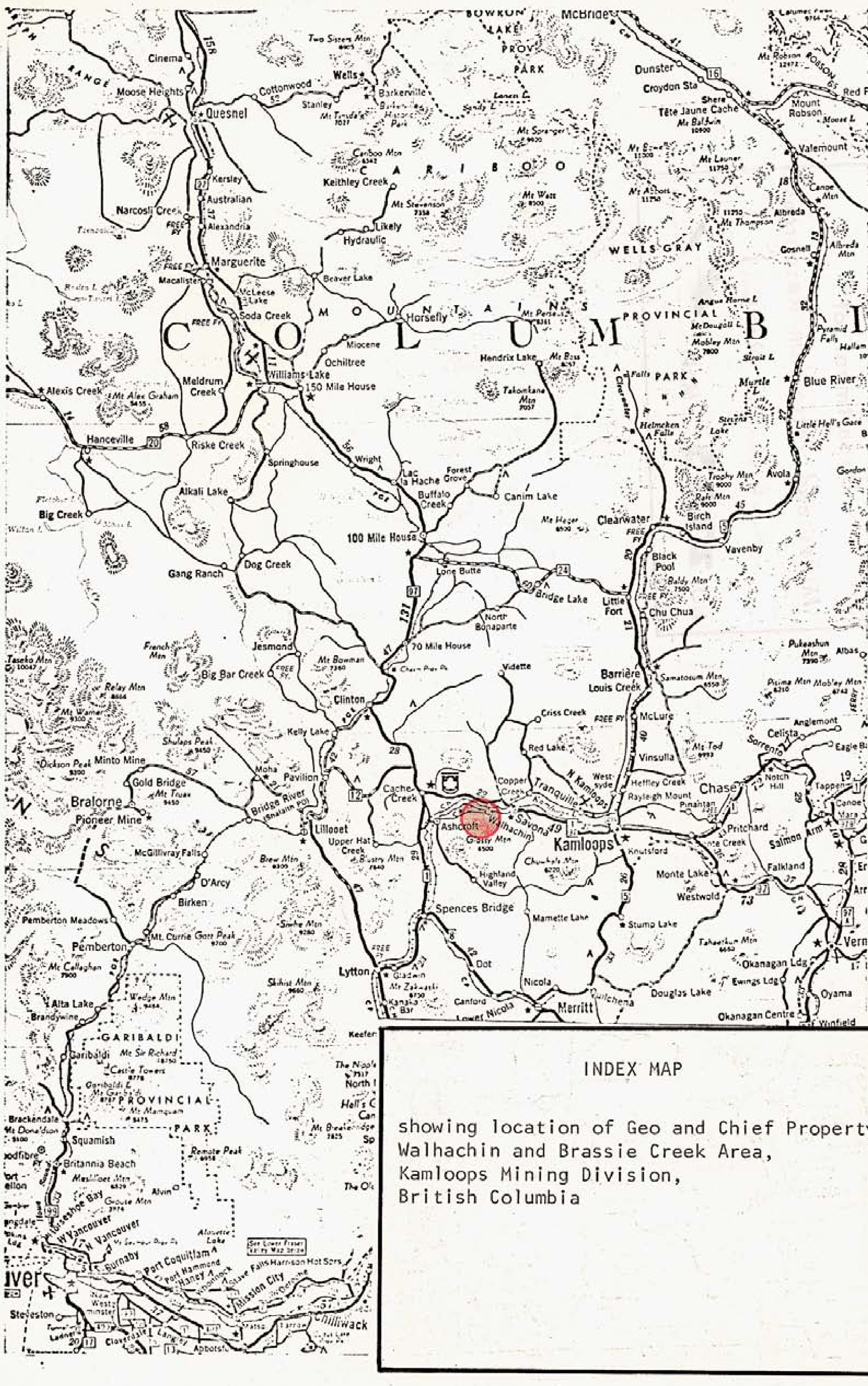


INDEX MAP

showing location of Geo and Chief Property,
Walhachin and Brassie Creek Area,
Kamloops Mining Division,
British Columbia

INTRODUCTION

LOCATION AND ACCESS

The map-area of the Geo and Chief Property in the Kamloops Mining Division lies approximately 48 road miles west of Kamloops, departing from the Trans-Canada Highway at the turn-off to Walhachin on the all-weather gravel municipal road. Prior to reaching Walhachin, there is an unmarked turn-off that crosses the Canadian Pacific Railway to the immediate south. This old wagon trail to Ashcroft crosses the property providing ready access to it by automobile. (See Index Map [front piece] and Property Map [Figure 1].

TOPOGRAPHY AND VEGETATION

The Geo and Chief Property lies on the rolling mountain slope above, and on the south side of the Thompson River valley. From an approximate elevation of 1200 feet above sea level in the valley flat, the old wagon trail access road climbs to some 1800 feet above sea level at its point of entry into the property. The mountain slope with its alternating gentle-dipping, grass and sage brush meadows and the steeper-dipping, rounded outcrop knolls, varies in elevation from approximately 1800 to 2800 feet above sea level.

Many shallow and short drainage draws join to form two main dendritic patterns that work down the mountain slope to the Thompson River. The local eastern network appears to accomodate the early spring run-off and dries up a short time after. The depths of the draws range from a foot to 10 feet where cutting through the drift and talus ridges, with narrow, 30-foot gullies where the young conglomerates have been incised down to the more resistant, older rocks below. The western drainage is through Brassie Creek which has its source at Pennie Lake. Although the creek has a year-round water flow, it can only be considered as a minor source of water supply. In the map-area the gully has an average width of 125 feet and depth of 50 feet. The V-shaped banks have considerable drift near the base with loose rubble and soil towards the top. Locally, outcrops appear as small scarps that may flatten and merge with the gently-dipping meadows or rise as larger cliffs of the more rugged mountainous slopes.

Timber supply is very sporadic with small stands of evergreens at the higher elevations ranging from new growth to more mature trees of 1 to 2 feet in diameter and heights of 50 to 70 feet. The drainage draws have some scattered shrub areas with the occasional Ponderosa Pine of up to two feet in diameter and 60 feet in height. New growth evergreens are randomly scattered on the steeper-dipping grassy slopes. A small amount of cattle grazing is carried out over portions of the property.

DESCRIPTION OF WORK DONE

The geological field mapping, on which this report is based, was carried out at short intervals during May, July and August, 1970. Location control was provided by the 400-foot grid lines previously established for a geophysical survey.

The mapping of the rock outcropping and other significant topographical features was accomplished by the writer, who is a professional geologist, and a junior assistant during 15 days of field work. Using the compass and pace method, rock exposures and the very lightly drift covered areas were studied throughout the grid area. The East-West lines were well marked with chained stations at 200-foot intervals. Good visibility in most directions from survey points allowed for rapid and fairly complete coverage.

During the survey a suite of rock specimens was collected for detailed microscopic examination to aid in determination of rock types and for the establishment of structural and age relationships and other interpretations. This was one of the main reasons for carrying out the survey in three stages thereby allowing for a certain amount of interim research and re-checking of the more difficult interpretational aspects. Air photos, published geological survey data and other available material was also used as an additional aid in interpretation.

The nature of outcrop material; strike and dips of bedding, fractures, shears and contact zones; mineral occurrences; and other geological data were recorded and plotted on the enclosed maps that portray the control location and data derived as well as the interpretation of the data.

GEOLOGY

GENERAL GEOLOGY OF THE AREA

The consolidated rock outcroppings and the light drift cover in their peripheral areas allowed fairly satisfactory study of the geological formations that range from Permian to Tertiary in age. They include both igneous and sedimentary rocks with the former apparently much more widespread, comprising both extrusive and intrusive types.

The Cache Creek Group, of later Paleozoic Permian age, outcrops in the north and northwestern parts of the map-area extending for some distance beyond the map boundaries. Rocks of this group comprise highly fractured, and somewhat altered, volcanics, mainly grey-green andesitic and dacitic lava flows, with intercalations of sedimentary, re-crystallized limestones. Rocks of this group constitute the oldest known in the map-area.

Widespread Triassic rocks of the Nicola Group outcrop in the more rugged, mountainous terrain to the west of Brassie Gulch. The few outcrops studied in the western portion of the map-area are of dark green, olivine basalt. These volcanic flows do not, however, exhibit the same degree of alteration as those of the older Cache Creek Group.

The Cache Creek and Nicola Groups have been intruded by the Jurassic and/or Lower Cretaceous age diorites, monzonites and granodiorites related to the Coast Intrusion. These plutonic rocks appear to form a large batholith occupying almost all of the south half and a considerable part of the northeast map-area. A large part of this batholith is unconformably covered by conglomerates 30 to 150 feet thick of young Tertiary age. The latter constitutes the youngest known rocks of the map-area.

TABLE OF FORMATIONS

Era	Period	Epoch	Formation	Lithology
Cenozoic	Quaternary	Pleistocene & Recent		stream alluvium, fluvial talus, glacial drift
	Unconformity			
	Tertiary	Miocene	Kamloops Group Coldwater Beds	conglomerate
Unconformity				
Mesozoic	Jurassic and/or later	Jurassic and/or L. Cretaceous	Coast Intrusions Brassie Creek Batholith	diorite, monzonite, and granodiorite
	Triassic	Upper Triassic	Nicola Group	basalt
Unconformity				
Paleozoic	Permian	Permian	Cache Creek Group	andesite, dacite and limestone

DESCRIPTION OF FORMATIONS

Cache Creek Group

The oldest rocks recognized in the map-area occupy an area along the north and west flank of the intruding batholith. Tongues of the latter cut the dacite, andesite and limestone of the Cache Creek Group, establishing the age relationship between the two groups. Much of the Cache Creek rocks consist of highly fractured and somewhat altered, resistant, volcanic flows that range from dark grey-green andesite, in part amygdaloidal, to lighter grey-green and greenish-red dacite. The many fractures are lined with considerable limonitic iron-oxide, with minor unaltered pyrite. The erosional debris in the area of the outcroppings consists of small blocky rubble with the light soil cover retaining the earthy yellow-brown limonite colour.

Limestone occurs with the volcanics and appears to be intercalated with the flows. In a few places the softer, metamorphosed limestone rocks appear to have been crushed against the more competent volcanic rocks, making it very difficult to establish the relationship. Outcrops that show the contact relationship are scarce, however, from the over-all mapping data it is suggested that the two units are contemporaneous. The limestone is generally light grey-buff and massive-like; locally indistinct and vague bedding is seen but more generally it is non-apparent. In places, in proximity to the batholith, the limestone has a very dioritic appearance. It exhibits a green colour with darker green amphibole shreds and flecking. Much of the matrix is so highly re-crystallized that the original character of the rock cannot be determined. Gradations from massive limestone to calcareous diorite can be found and although this may represent a normal encompassing of the limestone by the intrusive, it does not preclude the possibility that the limestone has an intrusive origin or includes intrusive members of contemporaneous or later age.

In the vicinity of Brassie Creek the limestone masses outcrop as low scarp hills, flattening rapidly towards the east with light to heavier drift covering where the limestone infringes on the knoll-like volcanic exposures.

Nicola Group

The rocks of the Nicola Group have a limited representation in the western part of the map-area although they have an apparent large areal extent westward of the map boundary. Examination of the few small outcrops and some of the larger exposures in the mountainous area, to the immediate west, shows the group to consist essentially of basaltic lava (greenstone) flows, ranging from comparatively unaltered, nearly aphanitic types to fine-grained rocks that show some alteration to epidote and chlorite. The minor, random fractures have epidote-chlorite-calcite infilling with very minor iron-oxide.

Coast Intrusions (Brassie Creek Batholith)

The large batholith of plutonic rocks appears to occupy a considerable portion of the map-area and extends for some distance beyond the map-area to the south. The extensive, overlying, younger Tertiary conglomerate cover masks the possible extent of the batholith to the east and southeast. This large intrusive body is being referred to by the writer as the Brassie Creek Batholith.

The rocks of the batholith are green to grey and pink, medium to coarse-grained, with plagioclase type feldspars and ferromagnesian minerals in varying composition from green gabbroic-diorite through grey diorite and grey-brown monzonite to pink granodiorite; they could encompass intrusive rocks of several different ages. The body has a massive and fairly homogeneous appearance in spite of the gradational and locally abrupt variations in composition. The rocks are seen to cut the various members of the Cache Creek Group but have not been observed in a similar relationship to the Nicola Group. The lithology, however, is very similar to the other major plutonic bodies beyond the map-area which have been reported to cut the rocks of the Nicola Group in many places.

Kamloops Group, Coldwater Beds

The formation consists essentially of conglomerate with some minor sandstone interbeds. The rock is brown and made up of vari-size roundstones from all of the underlying groups. Pebbles are slightly elongated and range from coarse sand to 10 inches or larger; cement is arenaceous to locally siliceous. Bedding planes are near-horizontal to gently-dipping and the contact with the underlying formations is clearly unconformable. No fossils were found to allow a precise age determination, but reports from earlier studies of the Ashcroft and Nicola map-areas have indicated a correlation with the Coldwater Beds.

Pleistocene and Recent Deposits

Boulder clay is the most prevalent of the unconsolidated deposits. It consists of grey to brown soil and encompasses a mixture of scattered talus and glacial debris. This drift cover is relatively thin in proximity to the knoll-like rock outcrops, increasing in depth as the hills flatten into the broad open upland meadows. These drift deposits also cover much of the sloping walls of the drainage draws but is continually being washed away in the lower stream bed leaving exposed the variety of boulder talus and the occasional bedrock.

The deposits of boulder clay, talus, glacial drift and stream alluvium are for the most part rather inconspicuously distributed throughout the area because of the many small rock exposures in the thinly drift-covered area. Small talus ridges formed locally, however, impart a gentle rolling character to some of the uplands.

STRUCTURAL GEOLOGY

No flow-top attitudes were apparent in the outcropping of the Cache Creek Group volcanics although amygdules locally indicated proximity to, or the presence of, flow top structures. The abundance of this relatively structureless volcanic rocks and the discontinuity of exposures through erosion effectively prevented any determination of structure, succession and thickness of the extrusive units within the group.

The heavy fracturing within the volcanics of the Cache Creek Group exhibited two persistant directions of approximately N50°E with steep northwesterly dips of 65° to near vertical, and N40°W with southwesterly dips of 70° to near vertical. Other, more random, fracture trends also have steep to near-vertical dips. The intercalated limestone rocks have considerably less fracturing, having tended to re-crystallize rather than fracture under the pressure of the intruding batholith. Some of the fracture trends are similar to those of the volcanics but important mineralized fracture zones within the limestones in proximity to volcanics have an apparent average trend of 45°E with a 75° northeasterly dip.

Vague remnant bedding within the limestone rocks show great variation in strike from N30°W to N70°E with accompanying gentle dips of 30° southwesterly to 35° northerly, indicating that the Cache Creek Group has been severely deformed. The lack of persistent and recognizable horizon markers has made it impossible to determine internal structures for interpretation of strata sequence and thickness.

No exposed contacts were noted between the Cache Creek and Nicola Groups in the map-area and their structural relationship could not be determined. The age relationship is therefore dependant upon the earlier studies encompassing the map-area. Only minor fracturing was noted in the basaltic flows of the Nicola Group.

The Brassie Creek Batholith has apparently intruded both Cache Creek and Nicola Group rocks. In the map-area considerable fracturing and hydrothermal alteration is apparent in members of the Cache Creek Group; the batholith itself appears massive, being relatively unsheared and without gneissic structures. Some fracturing or joint planes with trends averaging N50°W and dipping 70°NE, and N45°E and dipping approximately 75°SW were noted. At the batholith's north and northwestern flank area fracturing is somewhat more persistant along these indicated trends and dips.

MINERAL OCCURRENCES

Significant copper values, obtained from sediment samples of the streams draining through the map-area, and the occurrence of scattered malachite in the angular float and talus and bedrock along the eastern wall of Brassie Creek in the vicinity of the old adit resulted in the acquisition of the property. Preliminary examination and grab sampling established the existence of interesting copper and high silver values in fracture zones within the Cache Creek Group limestone masses, particularly in the areas of proximity to heavily fractured volcanic rocks of the same interpreted age. The old 75-foot adit of unknown age was driven along a 2 to 3-foot wide fracture-shear zone with strike of S45°E and dip of 70°NE. At the adit opening the zone shows considerable iron-oxide staining with scattered malachite and azurite. Grab sampling has indicated copper and silver values of current economic interest.

Detailed prospecting resulted in the discovery of a number of similar mineralized zones, however, in a few places signs of some previous work were noted. Disseminated to massive magnetite was also discovered, during the prospecting of the property, in the eastern wall slope of Brassie Creek, some 600 feet southeasterly of the adit opening. Evaluation is difficult because of the considerable float and rubble but it appears that the magnetite occurs within andesite that is in contact with limestone. Malachite has been noted in association with the magnetite and assays indicating up to 1% copper and zinc values have been obtained. The showing has been prospected along its southeasterly trend, away from the creek area, for a considerable distance but out-cropping is scarce and the contact zone is eventually masked by the conglomerate cover about 250 feet southeast of the last small outcrop showing magnetite mineralization. The deposit appears to be of the contact metamorphic type, with the foot-wall andesite containing the mineralization. The hanging-wall limestone varies from massive, unmineralized rock to locally fractured rock with traces of malachite. These fracture zones, however, are at an oblique angle to the trend of the contact area and consequently may not be related. Plutonic rocks of the Brassie Creek Batholith have not been observed in the immediate vicinity of the magnetite deposit but the edge of the batholith is mapped some 700 feet to the east. Although the deposit is apparently located within the volcanic rock at the contact with the limestone, it does not seem likely that the former is genetically associated with the emplacement but rather that the plutonic intrusion is responsible for originating the mineralizing solutions. The contact area, of course, would be structurally amenable for the locallizing of the mineralization and there is a strong possibility that a portion of the batholith, or a related tongue, underlies the deposit.

Extensive iron-oxide alteration, largely limonite that is clearly psuedomorphic-after-pyrite, is found in the considerable fractures common to the Cache Creek Group volcanics. The abundant, soft limonite has permitted the hard and normally weather-resistant rock to spall off considerable, small-size, angular rubble debris locally. In the areas where light drift overlies the volcanics, the rubble and limonitic soil provides a ready identification of the underlying material. It would seem that an appreciable amount of pyrite mineralization, possible up to 5% or more, occurs in the fractured volcanics below the depth of appreciable oxidization. Surface sampling of the iron-oxide stained fractures has not indicated the presence of any other minerals with the exception of very minor amounts of magnetite. Although the limonite and pyrite mineralization does not appear to encompass any zones of economic importance, it would appear to be of sufficient quantities locally to constitute geophysical anomalies of considerable size.

RECOMMENDATIONS

It is recommended that the known mineral occurrences be extended for evaluation through a program of stripping away of the shallow overburden and systematic rock trenching to provide for channel-type sampling control. This would also permit a better evaluation of the pattern of the mineralization and the environment.

Preliminary examination of the fracture zones in the limestone has indicated the mineralization to be largely malachite with traces of azurite, sphalerite and chalcopyrite. High silver values have been indicated by assaying. Owing to the fact that the mineralized zones, where exposed, are soft and crumbly due to weathering, the grab sampling may not be particularly representative of the mineral concentrations. Consequently, shallow diamond drilling, preferably under the systematically spaced trench control, would provide additional data and hopefully a more satisfactory economic evaluation.

The magnetite showing is considered to be an important one because of the copper and zinc mineral association, apart from the iron-ore potential of the magnetite itself. Preliminary stripping and trenching is recommended. Prior to any shallow drilling program, however, the extent of the deposit should be outlined by a local magnetometer survey. This could provide information as to the extent of the mineralization both to the northwest where overburden appears to be appreciably deeper, and to the southeast under the conglomerate cover.

Additional detailed prospecting aided by stripping and test pitting along the interpreted areas of limestone-volcanic contact is also recommended.

The property warrants a fairly extensive evaluation because of the indications of appreciable copper mineralization found in the stream sediment sampling, float and rubble debris, and known in situ showings; the favourable geological environment; the easy accessibility; and proximity to major railways, roads, water and power supply.

REFERENCES

I. Geological Survey of Canada: MEMOIR 262, Ashcroft Map-Area, British Columbia.

II. Geological Survey of Canada: MEMOIR 249, Geology and Mineral Deposits of Nicola Map-Area, British Columbia.

I. STATEMENT OF QUALIFICATIONS

I, Emil John Wendeborn, of the City of Calgary, in the Province of Alberta, do hereby declare that I graduated from the University of Manitoba in May, 1948 with a Bachelor of Science Degree; and further declare that I was accepted as a member of the Association of Professional Engineers of the Province of Manitoba on June 9th, 1950 and have held continuous membership in the Association, through transfer, with the provinces of Ontario, Quebec, Saskatchewan and Alberta, the latter since November 1, 1957.

I also declare that I have engaged in the practice of Geology since 1948 and am presently employed by Supertest Investments and Petroleum Limited, Calgary, Alberta, as a Special Projects Geologist and have been a resident of the Province of Alberta since May, 1955.

Emil John Wendeborn

EMIL JOHN WENDEBORN, B.Sc., P. Geol.

Declared before me this
6th day of November A.D. 1970
at Calgary, Alberta

[signature]

A Notary Public in and for the
Province of Alberta

II. STATEMENT OF COSTS

Field work fee 2-man party, dates May 16-24, July 15-17, August 14-16, 1970: 15 days at $125.00 per day	$1,875.00
Field work living expenses above dates: 15 days at $35.00 per day	525.00
Field work transportation above dates: Air fares $228.00; U-Drive $242.00	470.00
Air photos, mapping material	30.00
Research work including detailed sample examination and interpretation, dates May 26, July 20 and August 17, 1970: 3 days at $75.00 per day	225.00
Plotting of Map data, drafting, report	275.00
TOTAL	$3,400.00.

Declared before me this
6th day of November A.D. 1970
at Calgary, Alberta

A Notary Public in and for the
Province of Alberta

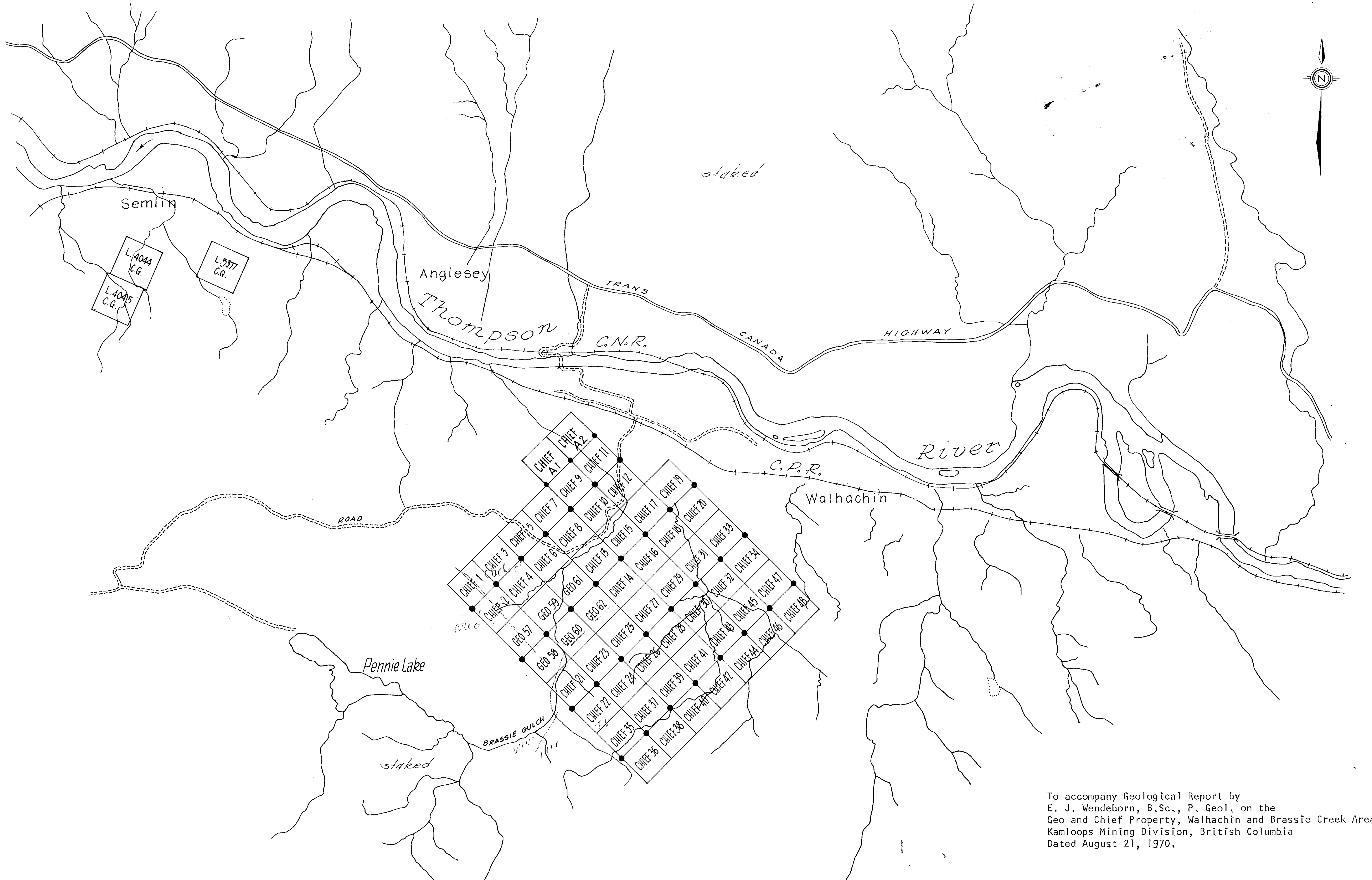
CERTIFIED CORRECT

EMIL JOHN WENDEBORN

APPENDIX

I. Statement of Qualifications.

II. Statement of Costs.



To accompany Geological Report by
E. J. Wendeborn, B.Sc., P. Geol. on the
Geo and Chief Property, Walhachin and Brassie Creek Area,
Kamloops Mining Division, British Columbia
Dated August 21, 1970.

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Figure I
PROPERTY MAP
showing
GEO and CHIEF CLAIMS
SCALE: 1/2 MI. TO 1 IN.

CLAIM REFERENCE MAPS 92I/10W; 11E; 14E & 15W.

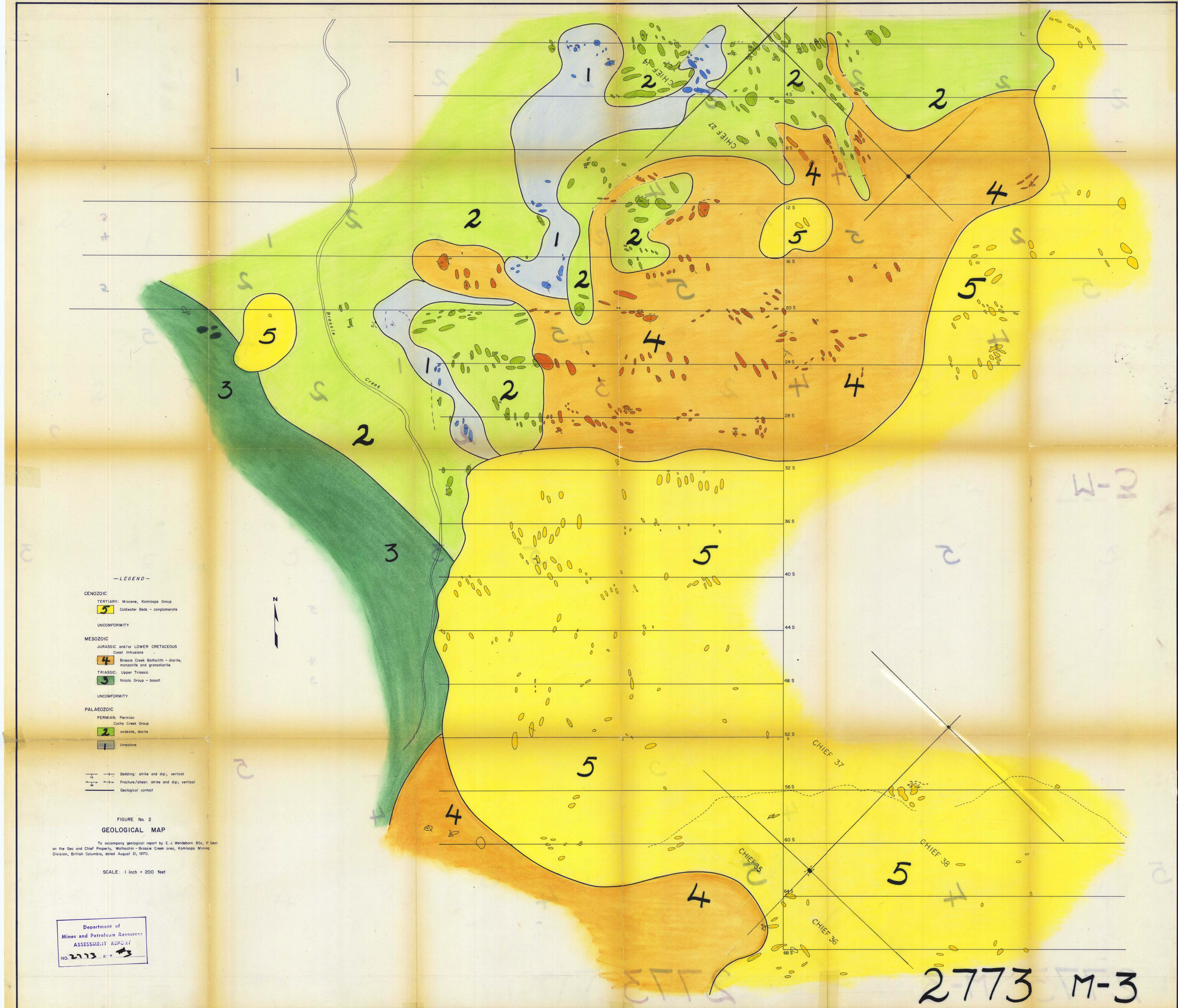

FIGURE No. 2

GEOLOGICAL MAP

To accompany geological report by E. J. Wendeborn BSc, P. Geol. on the Geo and Chief Property, Walhachin - Brassie Creek area, Kamloops Mining Division, British Columbia, dated August 21, 1970.

SCALE: 1 inch = 200 feet

SUPERTEST INVESTMENTS & PETROLEUM LTD.

CHIEF & GEO MINERAL CLAIMS

Scale: 4" = 1 MILE

Map showing results of sediment and hardrock sampling, geophysical survey grid

Figure III

MINERAL LOCATIONS

To accompany Geological Report by
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Geo and Chief Property, Walhachin and Brassie Creek Area,
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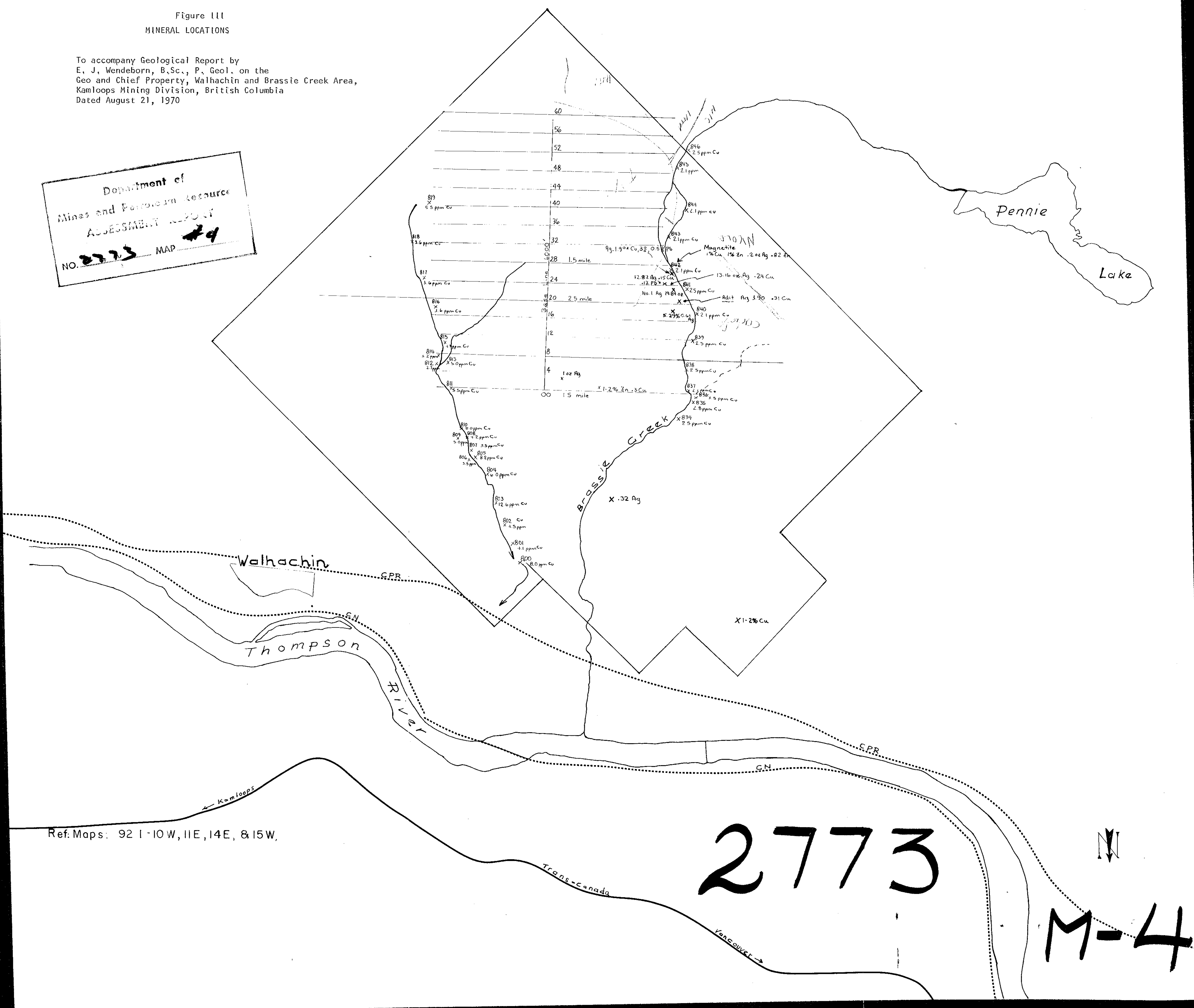

Ref. Maps: 92 I-10W, 11E, 14E, & 15W.

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