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# NORTHERN GOLD PROJECT

M504

# GEOLOGY AND GEOCHEMISTRY RESULTS
# FROM 1981 PROGRAM IN TULSEQUAH MAP AREA

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May 1982

TABLE OF CONTENTS

## I. ABSTRACT

A regional exploration programme for bulk tonnage gold was carried out in the Tulsequah (104-K) Map Area (Figure 1) during the period of May 25 to August 14, 1981. A total of 14 field personnel including one permanent Chevron employee operated from a centrally-located base field camp established at Trapper Lake.

Exploration criteria for bulk tonnage gold deposits was applied to four contrasting geologic environments within the map area. Anomalous geochemical values were obtained locally from rock, soil, and silt from each of the four environments and the more significant anomalies were protected by claims. To date over 700 units in 10 separate claim groups have been staked.

Geochemical data support initial exploration criteria and suggest the following controls on Au mineralization in the region.

1. major structures and their associated high-level hydrothermal alteration.
2. cross-structures which trend at a high angle off major structures.
3. high level intrusions, in part localized by major structures.
4. intense alteration of host rocks of which two types are significant:
   (1) quartz-carbonate alteration
   (2) silicification or "silica-soaking"

In 1982, geologic criteria developed during the present exploration should be applied in further regional exploration and detailed examination of claim groups should be carried out to bring at least some of the properties to the drilling stage.

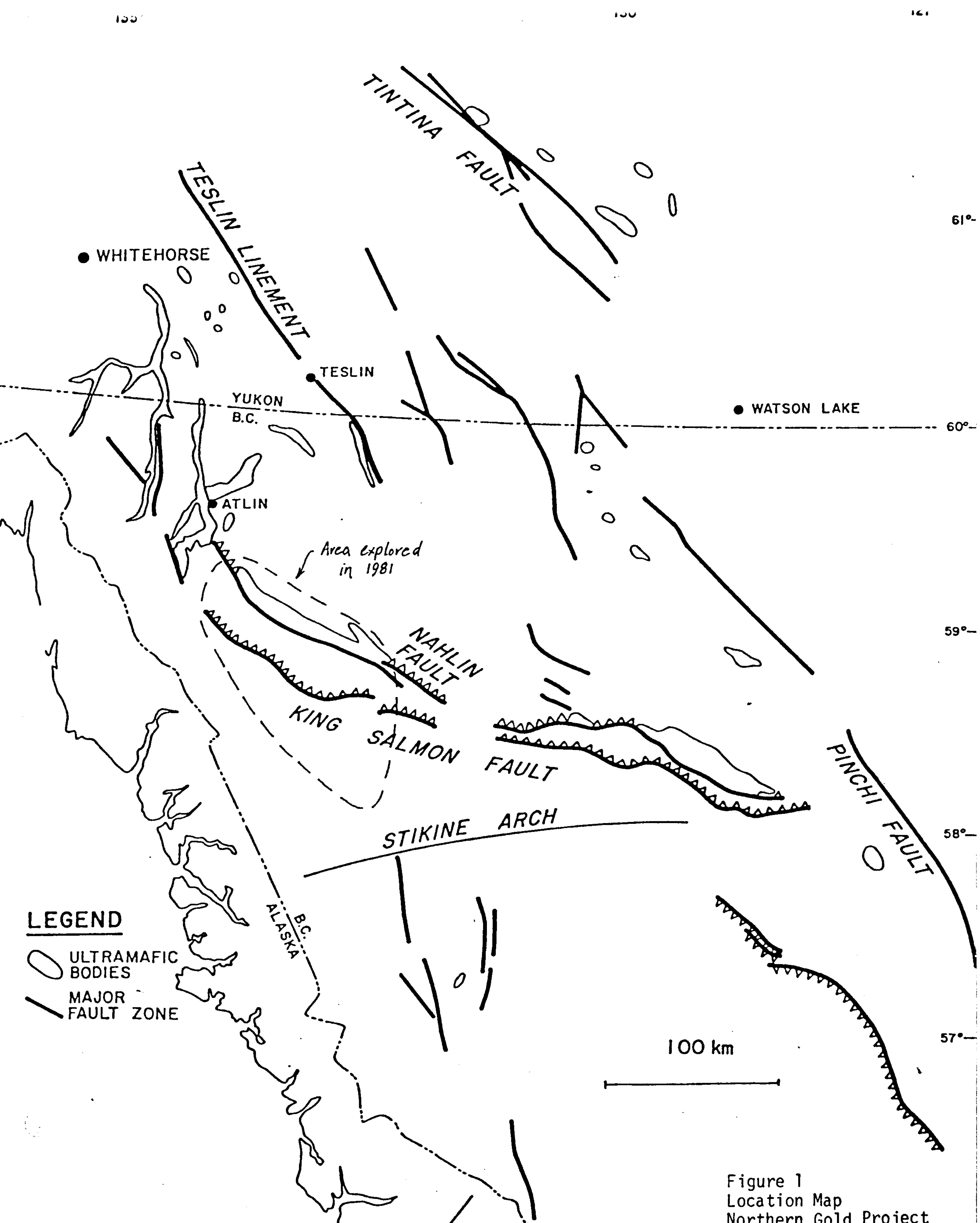


Figure 1
Location Map
Northern Gold Project
M504

## II. INTRODUCTION

### A. GENERAL PURPOSE AND AIM

The Tulsequah map sheet was initially selected by literature research for reconnaissance exploration for bulk-tonnage, low-grade gold deposits (C. Dyson, 1980, Dick, 1980) since a variety of known geological criteria for this ore-deposit type occur there. Some of the more important of these criteria, which could be abstracted from published data were:

1. large-scale structures, including thrust faults and steep-angle normal faults.
2. shallow-crystallizing felsic intrusions (post-structure)
3. extensive zones of silica-pyrite alteration
4. associated Sb, As, Ba minerals
5. known gold mineralization

All of these features were shown to occur over much of the map area.

Subsequently, in August, 1980 the region was visited for a one-week period. Results of this exploration (Dick, 1980) were promising and a regional programme was proposed. During February, 1981, two claim groups were staked as a result of the August, 1980 work in light of competition in the region (TUT and SAM claim groups). In late May, 1981 regional exploration, consisting of soil, stream, and rock-chip sampling, combined with geologic mapping was undertaken. The initial aim of the first phase of exploration in the region was to define which suites, or packages of lithologies and which structural elements in the region had the most potential for hosting disseminated gold, and to narrow down the large region by priority ranking target areas. Secondly, the target regions were to be sampled by standard geochemical methods and geologically mapped on a regional scale.

## B. EXPLORATION CRITERIA

### (a) General

Exploration criteria for low-grade, bulk-tonnage gold deposits are varied and confused, in large part due to the variety of geological environments within which this ore-deposit type can occur. There is no one single environment which can be categorized as hosting bulk-tonnage gold. As well, new discoveries are continually being made in which low-grade gold is being found in "new" environments. In this exploration, four distinct "types" of gold mineralization provided criteria:

1. "Carlin"-type, in which sub-microscopic gold is disseminated in a permeable, calcareous host.
2. "Vein-stockwork" type, wherein fine gold occupies networks of veins, fractures, or is disseminated in altered strata which overlie hypabyssal, silica-rich intrusions. Mineralization of this type (so-called "porphyry"-type) can also occur as a distal facies of mineralization surrounding copper porphyry occurrences or can occur within the intrusions, especially where the latter are syenitic in composition.
3. Vein-type mineralization where large, structurally-controlled quartz veins host gold mineralization.
4. Massive sulphide deposits.

(b) Structure

Gold deposits are related to large-scale structures, especially where the latter are cut by secondary structures. Deep seated structural features channel hydrothermal fluids to a near surface environment where boiling and resultant deposition of gold can occur. Secondly, major structures act as zones of weakness along which intrusive bodies and apophyses can intrude to a shallow level. The Tulsequah map area is transected by numerous major structural features.

(c) Alteration

Two main types of alteration are commonly associated with gold deposition: (a) carbonatization and; (b) silicification. Major structures in the Tulsequah map area are marked locally by both types of alteration, and significant alteration is generally confined to these structural zones.

(d) Mineralogy

Minerals which are often found associated with gold include quartz, ankerite, siderite, calcite, dolomite, chromian-mica, tourmaline, sheelite, pyrite, arsenopyrite and stibnite. These "tracer" minerals, with the exception of scheelite, are abundantly distributed in the Tulsequah map area.

## C. AREA EXPLORED IN 1981

Figure 2 (in pocket) shows the general area within which exploration was carried out in 1981. Approximately 3500 $km^2$ were covered.

## D. PHYSIOGRAPHY AND CLIMATE

Topography in the Tulsequah map area varies from extremely steep to moderately steep. Steep-walled gorges and valleys contain rapid flowing, poorly graded streams while major rivers occupy broad, glacial-scoured valleys. North of Tatsamenie Lake the valleys are heavily forested and contain an abundance of dense underbrush and devil's club, while to the south, more sparsely forested valleys are incised in vegetation-free plateaus. The southwestern half of Tulsequah map area is extensively ice-covered. Major ice-fields and glaciers persist above the 5000 foot contour but valley glaciers have receded substantially in recent years, exposing much previously covered bedrock.

Topography is more subdued but still steep and rugged in the more heavily forested northeast part of the map area. In this region glacial ice is absent and vegetation reflects a substantial decrease in annual rainfall amounts. Extensive burn areas in the vicinity of the Inklin River make traversing difficult.

Extreme care is required when traversing in all parts of Tulsequah map area due to the extremely rugged terrain, extensive areas of ice which must be crossed during traverse, unstable talus slopes, dense vegetation and rapid flowing drainages which are dangerous to cross.

Weather in the map area during 1981 field season was extremely variable and quick to change. While only one day was lost due to unflyable weather, long stretches of damp, cloudy weather and high winds occurred in June and early July. The remainder was a mixture of cloud and sun although winds were consistently strong and gusty at higher elevations. Snow flurries were common during June and early July, especially in the region south of Tatsamenie Lake. During winter, snow falls are heavy and south of Tatsamenie Lake, many areas were not workable until mid-July. In the northern half of the map area, however, snow falls are lighter and the region is workable in late May. In 1981, the ice left Trapper Lake on May 24, but this was reported to be a week earlier than usual. Freeze-up is approximately the first week in November.

## E. LOGISTICS

The exploration was conducted from a base camp at an excellent campsite where the east-flowing river draining Tunjony Lake enters Trapper Lake. This location is 85 air miles south from the town of Atlin. All supplies were mobilized by fixed-wing aircraft from Atlin which contains two grocery stores, three fixed-wing operators (Beaver and C-185), a gas station, hotel and the Mining Recorders office for the Atlin Mining district. Supplies, gear, samples, etc. are transported between Whitehorse and Atlin by Atlin Trucking & Cartage Ltd. which makes regular runs on Mondays, Wednesdays and Fridays. Expediting for the camp was done by Archer, Cathro & Associates in Whitehorse who communicated with the camp twice daily by VHF SBX-11 radio. This radio was found to be inadequate for placing radio telephone calls with Northwestel and it is recommended that in future, a more powerful system is employed. Groceries were flown to the camp from Atlin every week by Taku Air. Samples were back-hauled on grocery flights and trucked each Monday from Atlin to CP Air in Whitehorse.

Approximately two-thirds of the 150 barrels of fuel utilized during the project was mobilized to Trapper Lake and King Salmon Lake during the preceding winter to cut down on mobilization costs. Fuel was trucked from White Pass Petroleum in Whitehorse to Atlin, then mobilized by Otter to the sites. Drums were pulled off the ice by snowmobile. It is suggested that fuel be deposited in a similar manner prior to next season's field work since in addition to the cost benefit, the Otter aircraft is heavily booked during the normal spring mobilization period.

The helicopter employed during the project was a Hughes 500D with cargo pod provided by Viking Helicopters Ltd. of Prince George. This particular machine is the only practical helicopter to utilize in this region. Toe-in personnel drop-offs and pick-offs and pick-ups are the rule, landing spots difficult to find in many areas, and underbrush high making a short-blade, high skid machine necessary. With the cargo pod all gear and samples, etc., are stowed underneath the helicopter allowing an extra passenger inside. This allowed four passengers, or two crews to ride inside at once, increasing efficiency. In the field, crews carried walkie-talkie radios with which they could talk to each other and the helicopter. These radios paid for themselves in the first day of use in saving helicopter hours and are a necessary safety feature in this terrain.

No time was lost during the field work due to helicopter breakdowns or service problems. Pilot capability was of the highest caliber as was their attention to safety.

No serious injuries to field personnel occurred. The only accident which required outside medical attention was an arm burn to the cook which resulted from improper lighting procedure of the propane grill.

A total of 12 temporary field personnel were at one time or another involved in the project plus one permanently employed geologist. For the majority of the field season, three crews (6 persons) in addition to the project geologist carried out the bulk of the field work.

## F. FIELD METHODS

Control for geological mapping and geochemical reconnaissance traverses was provided by 1" = ½ mi. airphotos. Both Federal and Provincial photos were employed. These photos were obtained to cover the entire map-sheet. Property-scale geological maps were done on 1" = ¼ mi. air photo blow-ups made by McElhanney Engineering Ltd.

On traverse, data was entered on mylar overlays atop the photos. The data was re-drafted every evening by field personnel and field notes were removed from field books. The overlays and notes were stored in three-ring binders in the field office; this helps to reduce loss of notes while traversing. This method, taken from Archer, Cathro and Associates Ltd., also requires field personnel to summarize field data daily in a short paragraph.

On regional geochemical traverses, both soil and silt samples were collected. Soil samples were collected every 300 meters and stream silt samples wherever they could be obtained. On follow-up traverses of anomalies, soil samples were collected every 50 or 100 meters. In addition, rock-chip samples were routinely collected during geological mapping.

Soil and silt samples were analyzed by Chemex Labs Ltd. of North Vancouver for Au, As, Ag, and Sb. Rock samples were analyzed for Au, As and Ag. Geochemical method was by fire assay with an atomic absorption finish (FA + AA). On the TARDIS claims, 70 organic samples of the $A_0$ horizon were collected and analyzed for Au by neutron activation.

Soil and silt samples were collected in duplicate and dried in the base camp. One sample was sent to Chemex Labs Ltd. while the duplicate was held in camp for analysis for As by an Outokumpu X-MET portable XRF spectrometer being tested on this programme. These samples were screened in camp to -80 mesh size before analysis. In addition, a portable rock crusher and pulverizer were utilized to prepare rock specimens for analysis by the portable XRF. A discussion of these apparatus and the results of the analyses is given in a separate report by B. Dick.

Major drainages within the map area were "bulk sampled". By this method, 20 lb. samples of -20 mesh stream sediment were collected and sent for processing by C.P. Mineral Laboratories in Kelowna, B. C. Initially, the -200 mesh fraction will be analyzed by neutron activation for Au. Sample and analytical procedure is outlined in a Company report by G. Laforme (1980). Approximately 60 bulk samples were collected during the field work. Results are plotted on Fig. 3 (in pocket).

## III. GENERAL GEOLOGY OF THE TULSEQUAH MAP AREA

### A. INTRODUCTION

The Tulsequah map area (Fig. 4,) incorporates the eastern margin of the Coast Plutonic Complex and flanking, variably deformed and altered, volcanic and sedimentary strata. The strata range in age from Permian to Recent and comprise the western margin of the Intermontane Belt, a belt of eugeosynclinal arc-type sedimentary and volcanic rocks, which hosts most of the known lode and placer gold deposits in the Cordillera.

North of the Nahlin Fault the pre-Triassic basement rocks of the Intermontane Belt are referred to as the Cache Creek Group. Time equivalent rocks to the south of the Nahlin Fault have been differentiated on the basis of fusulinid faunas in limestone units. The pre-Triassic rocks south of the Nahlin Fault have been assigned the informal name, Stikine Assemblage. This usage will be adopted throughout this report.

Volcanic and sedimentary strata have been hydrothermally altered on a large scale as a result of the intrusion of a varied suite of plutonic rocks, which range in composition from granodiorite to quartz porphyry, and in age from Lower Triassic to Early Tertiary.

These intrusions range in size from large, composite batholiths of quartz diorite (Coast Range suite) to quartz-feldspar porphyry stocks. The latter are likely feeders to overlying Early Tertiary rhyolitcs, dacites, trachytic flows and pyroclastics (Sloko Group).

Volcanic and sedimentary rocks underlie approximately 65% of the map area. There are four main groups:

1. Pre-Triassic age oceanic suite of clastic sediments and intercalated mafic volcanic rocks, ribbon chert and limestone (includes Stikine Assemblage and Cache Creek Group).

2. Triassic-age Sinwa and Stuhini groups. The Stuhini group is comprised mainly of volcanic rocks, including andesite, basalt, tuffs and agglomerates. The Sinwa Formation is comprised dominantly of limestones, with minor sandstone and argillite.

3. Lower Jurassic-age Takwahoni and Inklin Formations. The former unit is comprised mainly of conglomerate and sandstone, while the latter is predominantly greywacke.

4. Late Cretaceous to Tertiary felsic volcanics and volcaniclastic rocks of the Sloko Group.

## Structure

Two major faults, of regional importance, cross the region from southeast to northwest and juxtapose strata of contrasting lithology and age. These are the Nahlin Fault and the King Salmon Fault.

1. The Nahlin fault was active in mid-Triassic to post-Jurassic time. The structure, which is delineated by a zone of ultramafic rocks, places Permian limestones against Jurassic Inklin Formation and has a vertical displacement of at least 20,000 feet.

2. The King Salmon thrust fault has a similar trend to the Nahlin Fault, and was active in Jurassic time. The base of the thrust conforms to the lower contact of the Sinwa Formation, juxtaposing it against the Takwahoni Formation. Where the Sinwa is absent this same structure places Stuhini group volcanics and limy sediments over Takwahoni conglomerates. During movement on the King Salmon Fault, large-scale, NW-SE trending anticlinoriums formed with Takwahoni and Stuhini groups. These same structures appear to be the locus of intrusive activity in the form of high level feeder dykes in Early Tertiary time.

Extensive block faulting accompanied deposition of Tertiary-age volcanic rocks and the widespread emplacement of shallow-crystallizing quartz-feldspar porphyry bodies occurred along these block faults.

## IV. GEOLOGY, GEOCHEMISTRY, AND CLAIMS WITHIN EXPLORATION TARGET AREAS

During the initial stages of exploration the region was narrowed down to specific regional exploration targets. Criteria for area selection were those outlined in the Introduction, combined with geological examination and initial geochemical results. These areas are shown on Figure 5 - 8. In the paragraphs that follow, general geology, geochemistry and claims within each of the areas are discussed separately.

## A. AREA I - NAHLIN REGION (Fig. 5)

### (i) General Geology

Area I encompasses the region along the Nahlin Fault including most of the Cache Creek Group (Units 1 to 4) and Inklin Formation (Unit 10). The Nahlin Fault is a deep crustal structure and has been active since mid-Triassic time. The fault is probably a major strike-slip fault (J. Monger, pers. comm., 1980) and is the locus of emplacement of many alpine ultramafic bodies collectively called the "Nahlin Ultramafic Body". Associated with the ultramafic rocks are minor amounts of gabbro and pyroxene diorite.

The main geological units in the Nahlin region are the Cache Creek Group (Units 3 & 4) which is predominantly limestone, ribbon chert, argillite and mafic volcanics; the Inklin Formation (Unit 10) comprised mainly of greywacke and siltstone; and minor amounts of Stuhini Group (Unit 7) which is mainly altered mafic volcanics, some Jurassic-Cretaceous hornblende diorite (Unit 12C), and Sloko Group (unit 14) felsic volcanic rocks and associated intrusives (Unit 15).

### (ii) Structure

Folds in Area I are dominated by NW-SE trending large scale folds in the Cache Creek Group. Large west-northwesterly folds with well developed north dipping axial plane cleavage are developed in the Inklin Formation south at the Nahlin Fault. In the vicinity of the Nahlin Fault itself intense shearing is common. Abundant slickensides are present in the serpentinites and usually indicate upward movement in the northeast side of the fault.

(iii) Claims

Hardluck (Fig. 5) - These claims were staked to cover a 1125 ppb Au anomaly in quartz-carbonate rocks along the Nahlin Fault south of Hardluck Peak. Geochemistry values and station locations are plotted on maps in Hardluck file in pocket. Most of the claims are underlain by unaltered serpentinite; small areas of bright orange weathering quartz-carbonate alteration were sampled for gold mineralization and one sample gave anomalous results, all other samples ran background for gold. Almost no follow-up work has been done on these claims other than the original reconnaissance traverse. Proposed work for 1982 includes detailed chip sampling in area of anomalous rock sample and follow-up sampling of quartz-carbonate rocks in the vicinity of the claims.

Goat, Goat 1, Goat 2, Goat 3 (Fig. 5) - These claims are located north of Yeth Creek on a creek which is named Nickel Creek because of the nickel showing indicated on the G.S.C. map (Souther, 1971) (Fig.4). Centered on the claims is a stock of quartz-feldspar porphyry of the Sloko Group which has intruded along the Nahlin Fault. The south side of the claims is predominantly siltstones and greywackes of the Inklin Formation while the north side is mainly serpentinite. The claims were discovered initially by follow-up of mineralized float in Nickel Creek. Prospecting outlined a pyritic quartz-feldspar porphyry and associated alteration in Inklin sediments. A high gold value of 4950 ppb in one float sample of pyritic Inklin sediments initiated the decision to stake the ground. Samples and sample locations are plotted on maps in the Goat file in pocket. Due to the extremely rugged nature of the Nickel Creek headwall, prospecting follow-up has been limited but some encouraging preliminary results are available.

Mineralization is related to the quartz-feldspar porphyry unit which intrudes the Inklin sediments. Diatreme rocks composed of angular blocks of Inklin siltstones and greywackes with a quartz-feldspar porphyry matrix are abundant on the claims. The amonnt of sedimentary blocks in the diatreme ranges from almost none to 90%. All phases of the diatreme are present, from the intrusive core to the almost completely sedimentary deposits peripheral to the vent. The Inklin sediments within and adjacent to the diatreme have been variably altered. The alteration is mainly quartz-carbonate and forms bright orange weathering outcrops. Within the altered zones are minor amoonts of pyrite, stibnite, arsenopyrite, galena-sphalerite veins and fine-grained tourmaline.

Based on the preliminary prospecting the geological setting of the Goat claims is as follows:

a) quartz-feldspar porphyry intrusive with kaolinite zones and diatreme breccias. Gold values in the porphyry are one to two orders of magnitude above background values (100 - 400 ppb Au).

b) host rock is fine-grained sediments including greywackes and siltstones of Jurassic age. The host rocks seem quite permeable as suggested by the large altered areas adjacent to the quartz-feldspar porphyry.

c) favourable mineralogy including stibnite, arsenopyrite and tourmaline is present.

This property is interesting and certainly deserves as much follow-up as we can obtain without undue risk to life and limb. Objectives for 1982 will include detailed sampling of altered rocks in the vicinity of the quartz feldspar porphyry and detailed geological mapping to cover the area of the claims.

Gringo (Fig. 5) - These claims are along the trace of the Nahlin Fault near the western headwaters of Teditua Creek. A reconnaissance soil sample which ran 330 ppb Au led to the decision to acquire the ground. Along the Nahlin Fault in the area of the claims-is a sliver of Triassic volcanics of the Stuhini group which is approximately 0.5 km x 3 km. To the south is Inklin Formation sediments and to the north is serpentinites outcropping along the Nahlin Fault. The discovery anomaly is located on the north edge of the block of Stuhini volcanics (see Gringo file in pocket). A brief examination of the Stuhini volcanics in the vicinity showed them to be highly fractured, weakly silicified, pyritic andesites.

Follow-up work for 1982 will include a soil grid in the area of the gold anomaly and detailed geological mapping to delineate contacts between units. Areas of high arsenic along the Nahlin Fault just to the east of the claims will also be followed-up with contour soil lines downhill from the fault.

B. AREA II - KING SALMON REGION (Fig. 6)

(i) General Geology

Area II is the region along and narrowly peripheral to the King Salmon Thrust Fault. This region is defined by the high values of arsenic and antimony which are common along the thrust fault. The main rock units are the Sinwa Formation which is an Upper Triassic bituminous limestone; the Inklin Formation of mainly greywacke and siltstones; and the Takwahoni Formation which is conglomerate and greywacke. A fault wedge of Triassic sediments and volcanics of the King Salmon Formation occurs to the north of King Salmon Lake. Along the fault are dykes of quartz-feldspar porphyry which are feeders to overlying felsic Sloko Group volcanics which have been mostly eroded away.

(ii) Structure

The dominant structure in this region is the west northwest striking King Salmon Thrust Fault of probable Late Jurassic age (Souther, 1971). This thrust fault has emplaced Inklin Formation and Sinwa Formation on top of Takwahoni Formation. The thrust is steeply dipping to the north in the western and central part of the map area and has been a focus for intrusion of quartz-feldspar porphyry dykes and associated intrusive breccias . The thrust fault is cut by northeast trending lineaments which may have an effect on localizing alteration along the thrust fault.

(iii) Claims

TARDIS, TARDIS 2, TARDIS 3, TARDIS 4, PETRO (Fig. 6) - These Claims were staked to cover a large zone of silicified Sinwa limestone along the thrust fault. Mineralization on the claims includes fine-grained arsenopyrite, stibnite, two generations of fluorite (purple and honey coloured) and probably cinnabar (source of Hg). The TARDIS geochem is plotted in the TARDIS file at the end of this report. Except for a few soil and silt anomalies in the 120 - 160 ppb Au range, there is no gold on the claims. There are two possible geological settings for the claims:

(a) this is a large hydrothermal system with As, Sb, Hg, F but no gold.

(b) this is a large hydrothermal system with As, Sb, Hg, F, however, the exposure on the TARDIS claims represents the very top of this system as indicated by the presence of large amounts of mobile Hg and F (Dick, 1980). Another indicator that this is the top of a hydrothermal system is the abundant vugs lined with fluorite and quartz crystals. Any gold in this system would be 200 - 500 m below the present surface.

Presently the latter possibility above is favoured. All the geological information on the TARDIS claims supports an epithermal hot springs type gold model. Faith in this model justifies a few short holes in the centre of the TARDIS system to check for gold mineralization. Proposed work for 1982 is to put in a grid in area of highest anomalies to accurately determine extent of the hydrothermal system. Detailed geological mapping will be done at the same time. To the ~~east~~ west of the claims on One-Way Creek a subvolcanic felsic breccia of the Sloko group intrudes Sinwa limestone and contains realgar and orpiment. The presence of the arsenic bearing minerals indicates that hydrothermal activity has occurred along the King Salmon Thrust in several localities and more detailed follow-up is planned for 1982.

BARB, BARB 3, BARB 4 (Fig. 6) - These claims are situated along the King Salmon Thrust Fault north of King Salmon Lake. An assessment report has been prepared under project M514 and is on file. Geological and geochemical information are contained in this report (Shannon, Thicke, 1982).

The most important observations are:

1. Anomalous Au (up to 700 ppb) occurs in magnetite-bearing altered limestones in the northeast part of the property.

2. The "breccia pipe" is a silica-rich zone adjacent to a Tertiary age dyke. The pipe is probably a large quartz vein with euhedral to subhedral coarse tetrahedrons of chalcopyrite and is of less exploration interest.

Proposed work for 1982 involves grid sampling along the King Salmon Fault to define source of scattered arsenic, antimony and gold anomalies.

## C. AREA III - TRAPPER LAKE REGION (Fig. 7)

### (i) General Geology

The regional geology in the Trapper Lake area is dominated by andesite flows, tuff and sediments of the Upper Triassic Stuhini Group and King Salmon Formation. Also common are quartz-feldspar porphyry dykes and associated felsic extrusive equivalents of the Sloko Group and conglomerates and sandstones of the Jurassic Takwahoni Formation. Minor amounts of Stikine Assemblage basement rocks and some intermediate intrusives of the Coast Plutonic Complex are also present.

Large rusty weathering quartz-carbonate altered zones occur northwest of the junction of Thorn Creek and Sutlahine River and along a northwest trending zone on the east side of Trapper Lake, These and other large gossans in the area are related to the intrusion of quartz-feldspar porphyry dykes of the Sloko Group along major northwest trending structures. Malachite coated fractures and quartz-calcite veins are common in these altered zones.

(ii) Structure

The structure is dominated by the northwest strike of the units. Parallel to this strike are numerous lineaments trending northwest which have controlled the emplacement of quartz-feldspar porphyry dykes. Trending at right angles to this is a second set of lineaments at a northeast bearing. Areas with many lineaments appear to have been the focus of more intense hydrothermal activity.

Large northwest to west trending open folds are common in the Triassic and Jurassic volcanic and sedimentary cover rocks. These folds exhibit no axial plane cleavage and are thought to have formed by compressional events in Upper Jurassic time.

(iii) Claims

EMU (Fig. 7) - The claims were staked to cover galena-bearing quartz veins within a Tertiary quartz-feldspar porphyry unit. Results from the initial reconnaissance soil traverses are plotted in the EMU file in the back pocket of this report. Anomalous amounts of arsenic and antimony are present on the claims. Subsequent staking by competitors has tied up ground on all but the north side of the claims. Proposed work for

1982 is to grid soil sample the claim block and do detailed mapping to check for further altered zones in the quartz-feldspar porphyry unit.

OUTLAW 1, OUTLAW 2, OUTLAW 3, OUTLAW 4 (Fig. 7) - The OUTLAW claims were staked on the basis of a large arsenic anomally which was delineated in the field by the Outokumpu X-Met X-ray fluorescence unit (B. Dick, 1981). Immediately to the north and west of the claims are two old porphyry Cu-Mo prospects called the Thorn and Kay groups. Associated with the porphyry deposits are northeast trending shear zones infilled with chalcedony and minor sulphides including pyrite, arsenopyrite and stibnite. Gold assays as high as 0.7 oz/T have been obtained in these chalcedony zones.

The geology on the claims is very complex with limestone and tuffs of the Stikine Assemblage forming the basement rocks. Also present are andesites of the Stuhini Group and argillites of the Takwahoni Formation. Intermediate Jurassic plutons and Tertiary quartz-feldspar porphyry dykes cross-cut the units. Sloko Group felsic volcanic rocks cap the entire assemblage.

Silicification and pyritization occurs along northeast trending lineaments mainly in the south part of the claims. A sample of silicified pyritic rhyolite runs 1400 ppb Au. The main target for work in 1982 is to delineate the large arsenic-gold anomaly which occurs on the claims (see OUTLAW file in pocket at back). A program of grid soil sampling and detailed geological mapping will be carried out to accomplish this objective.

On the north facing side of the property is a massive pyrrhotite unit (up to 2 m wide) with minor sphalerite and chalcopyrite. The host for this massive sulphide is a limestone sequence in the Stikine Assemblage. The mineralization appears conformable to bedding and is probably syngenetic massive sulphide mineralization. As the sulphides grade up to 2 oz/ton silver, some follow-up of this target will be carried out. This will be useful in documenting the nature of massive sulphide mineralization in the Stikine Assemblage rocks.

## D. AREA IV - TATSAMENIE LAKE REGION (Fig. 8)

### (i) General Geology

Geology in this region is dominated by pre-Triassic limestones, sediments and tuffs of the Stikine Assemblage and Mesozoic diorite to quartz monzonite intrusions of the Coast Plutonic Complex. Minor amounts of Takwahoni Formation, sediments and Stuhini Group volcanic rocks are found near Tatsamenie Lake. Numerous quartz-feldspar porphyry dykes are common throughout the region and locally the extrusive Sloko Group felsic volcanic and volcaniclastic rocks are still preserved.

### (ii) Structure

North and northwest trending lineaments are the most obvious structural features in this region. Rhyolite dyke swarms and serpentinite pods are associated with these north and northwest trending structures. Quartz-carbonate alteration is also common along these structures and is visible as extensive gossans with calcite, dolomite, siderite, ankerite and quartz predominating.

Large isoclinal north trending folds are common in the Stikine Assemblage limestones. The hinges of these folds are often highly fractured and form structurally favourable zones for localizing mineralization.

(iii) Claims

TUT 1, TUT 2, TUT 3, TUT 4, RAM (Fig. 8) - The TUT claims were staked in February, 1981 as a result of reconnaissance work in the summer of 1980 (Dick, 1980). Follow-up work in 1981 involved more sampling to locate source of Au anomalies and preliminary geological mapping (see TUT file in pocket in back). An assessment report on the TUT claims has been prepared and is in the M504 file (Shannon, 1981). The main units on the claims are pre-Triassic Stikine Assemblage limestones, argillites, tuffs and greenstones; a large sill of quartz-albite of unknown age; augite diorite of the Coast Plutonic Complex and minor quartz-potassium feldspar plagioclase dykes of Tertiary age. Extensive quartz - potassium feldspar and hematite veins along with quartz "sweats" are found in Stikine Assemblage rocks but these do not appear to be mineralized.

The geochemistry and geology on the claims is plotted in the TUT file. The TUT claims have been expanded to include the RAM claims on the north which were staked to cover the extension of anomalous soil and sill samples. Gold on the TUT claims appears associated with three types of mineralization:

a) the largest areas of gold anomalies are found with silicified limestones of the Stikine Assemblage. The limestones contain disseminated tetrahedrite which is often manifested as malachite and azurite staining on outcrops. Gold values of 100 - 500 ppb have been recorded in rock samples of this type of mineralization.

b) the highest gold anomalies (2200, 1800, 1400 ppb Au) are associated with quartz-potassium feldspar plagioclase dykes and associated quartz-pyrite-sphalerite-galena veins. The occurrences of this type discovered so far have been narrow, usually less than 0.5 m wide.

c) gold is also found in the several hundred ppb range in quartz-carbonate gossans which are mainly developed in Stikine Assemblage tuffs and fine grained sediments.

The presence of gold in a vicinity of environments over an extensive area indicates the possibility of a large hydrothermal system on the claims. On the RAM claim an outcrop with up to 30% arsenopyrite and stibnite in clay-altered felsic porphyry matrix looks exciting but does not carry any gold values. Follow-up work for 1982 is orientated towards locating drill targets on the claims by grid soil sampling, detailed geological mapping and trenching in areas of highest gold anomalies and stibnite-arsenopyrite mineralization.

<u>EWE</u> (Fig. 8) - These claims were staked to cover a 10000 ppb Au value in float and a 2500 ppb Au value in large talus boulders. The 10000 ppb Au is in a sample of quartz-galena-sphalerite vein material. The 2500 ppb Au occurs in a highly quartz-carbonate altered Stikine Assemblage breccia with a few percent finely disseminated pyrite. As this claim was staked at the end of the 1981 season no follow-up work has been done. Plans for 1982 include locating source of mineralized float and further prospecting of the claims.

felsic dykes and sills, abundant quartz veining, and extensive gossans. This region is a prime exploration target for 1982 follow-up.

## V. RECOMMENDATIONS FOR FUTURE WORK

With the exception of the BARB, TUT, and SAM claim groups, virtually no evaluation work has been done on any of the newly-acquired claims. To sample and map the claims staked during the 1981 program will require a major exploration program for 1982. An expenditure of $70,000. is required to meet assessment requirements on the approximately 700 units staked to date.

In 1982, it is proposed that M504 is continued as a major exploration program designed to: (a) assess the properties already staked; (b) carry on follow-up work on anomalies not yet covered with claims or otherwise evaluated; (c) continue field work on a regional scale using exploration criteria developed during the 1981 program. The aim of the property-evaluation part of the program should be to bring at least some of the properties to the drilling stage by the end of the season.

Property evaluation should consist of grid geochemistry (Au, As, Ag, Sb) with soil samples collected at 100 m intervals (maximum) initially. Follow-up of anomalous values should be done at 50 m intervals (maximum) to ensure delineation of low-dispersion targets. Rock chip geochemical sampling should be a major part of the program, as in the 1981 program routine rock sampling produced anomalies in lithologies which did not appear, from visual observation, to be mineralized. Detailed geological mapping, with concurrent rock geochemistry should be carried out on all properties. Specifically, geological mapping should include detailed accounts of the nature and mineralogy of alteration and all available structural data. Orthophoto maps should be prepared for the more promising properties to aid control. This is especially important in the Tulsequah Map Area where only a 1:250,000 topographic map (locally inaccurate) and 40 chain airphotos (many of poor quality) are available.

During the 1981 program, a hand specimen was collected and catalogued for every rock chip sample analyzed geochemically. A petrographic study of selected specimens should be carried out prior to property evaluation and further regional work to determine the mineralogy of specimens which contain anomalous gold to aid in future mapping and hand specimen analysis. In particular, it would be advantages to determine the mineralogical characteristics of quartz-carbonate altered rocks which contain anomalous Au relative to those which do not. Vast areas of Stikine Assemblage strata south of Tatsamenie Lake are altered to orange-weathering quartz-carbonate gossanous zones and such a study might provide exploration advantage.

In order to collect more representative rock chip samples next season, especially in assessing mineralized rocks such as those on the BEAR property, a portable rock crusher should be employed to pulverize and size-reduce bulk samples. In addition, a portable rock saw should be employed to slab rocks in the base camp for more thorough petrographic observations. This is critical since alteration petrology will prove an important component of geological mapping.

Prior to 1982, a study should be undertaken to determine the correlation between the pathfinder elements utilized in 1981 (i.e. As, Sb, Ag) and Au present in the rocks. As a generalization the correlation appears excellent in some environments and sporadic to non-existent in others. For example, on the TUT, SAM and BEAR properties, highly anomalous As and Sb occur in the immediate vicinity of Au and Ag anomalies while on the BANDIT claims, upon which highly anomalous Au occurs in soils over a wide area, As is notably low to absent. On the PETRO and TARDIS claims, and along the trace of the King Salmon Fault, As is extremely anomalous with As minerals present in intrusive dykes and altered carbonates, however Au is not present, except very locally, in anomalous concentrations. Thus, there appears, at first glance, to be a correlation between geological setting and the degree of correlation between pathfinder elements and Au.

In 1981, a portable XRF unit (see report by B. Dick, 1981) was used to analyze in the field for As. This instrument, although difficult to maintain in good operating condition in this first season of use, nonetheless, provided immediate results for As and was utilized in decision-making in staking and area-selection for follow-up work. Analyses obtained from this unit provided impetus for staking the OUTLAW claims, which were completed one day before a competitive company decided to stake the same ground.

Excellent turn-around time, reproductibility of results, and service was provided by Chemex Labs Ltd. and it is highly recommended that they be utilized for geochemical analyses in all future work on this program.

Regional exploration should be continued in 1982, preferably at a similar level to the 1981 program, to most effectively utilize exploration criteria compiled in the field this year. The regional exploration should focus on the Cache Creek group, both as more detailed coverage within the region explored in 1981 and its extension onto the Dease Lake Map Area. As well, all other areas of Cache Creek strata, where disected by structures and intrusions in the region, should be explored. A region between Tatsamenie Lake and Whiting Lake (Fig. 4) is a prime target area. A second broad region of interest is on the Bennett Map Area west and north of Atlin between the 60th parallel on the north and the Torres Channel arm of Atlin Lake on the south. The rocks within this region consist of Lower Jurassic Laberge Group clastic sediments and limestone, and Permian-age basic volcanics and limestones which are intruded by Jurassic granodiorite. Locally, rhyolitic rocks of the Sloko Group are present. This region (Fig. 9) hosts abundant minor occurrences of Au as well as Sb, which occur as vein-type occurrences, generally localized in northwest trending structures. An exploration approach similar to that applied in 1981 to this broad area is recommended as a future, grass-roots gold exploration program.

## VI. LOGISTICS FOR 1982 PROGRAM

The large number of properties and further regional work will require a major program in 1982. The geographical grouping of properties would permit two separate camps to be established: One to explore the properties and carry on regional work south of Tatsamenie Lake and one to explore properties and region in the northern part of the map area.

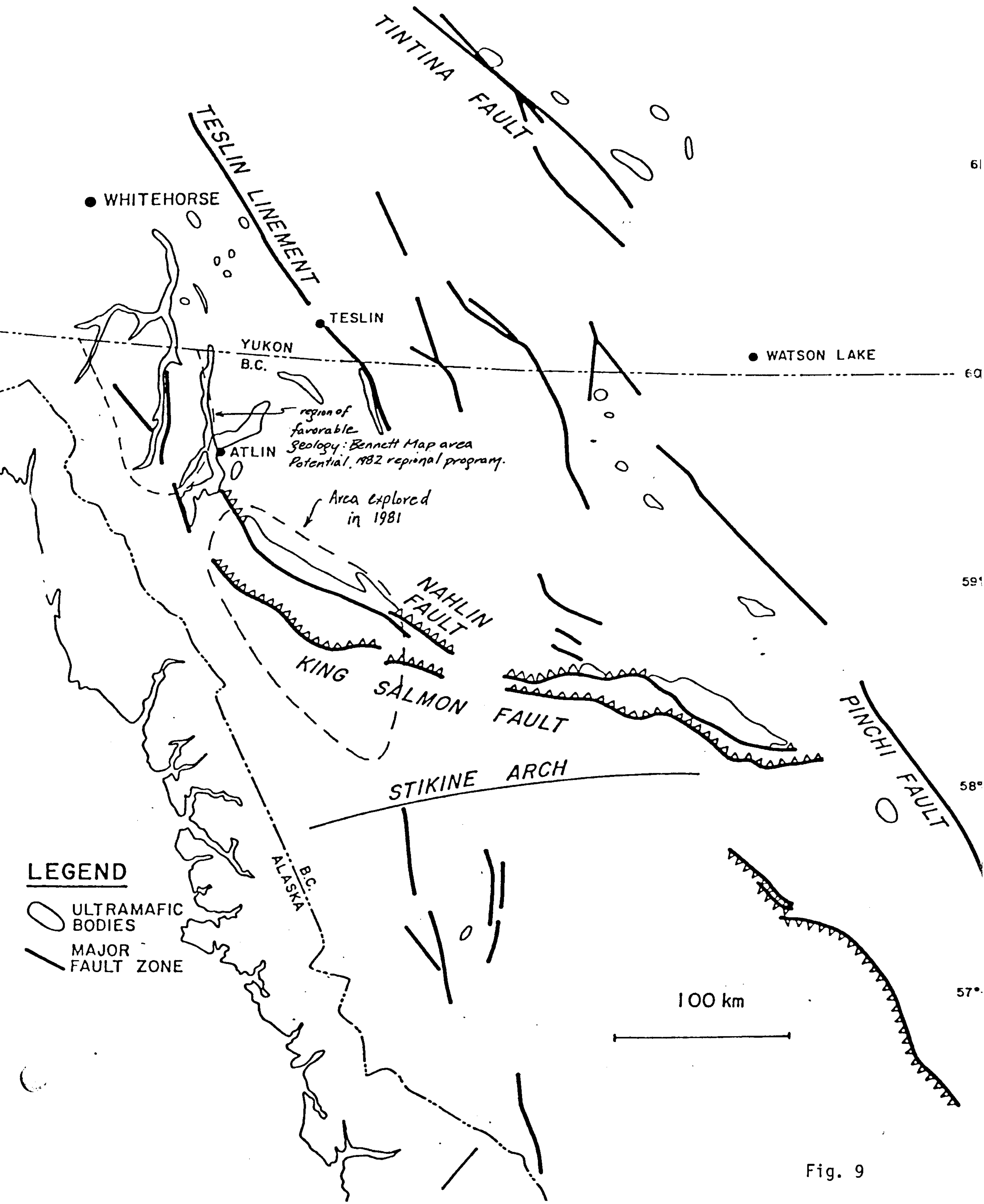
TINTINA FAULT
TESLIN LINEMENT
WHITEHORSE
TESLIN
YUKON
B.C.
WATSON LAKE
61
60
59
58°
57°
region of favorable geology: Bennett Map area
Potential, 1982 regional program.
ATLIN
Area explored in 1981
NAHLIN FAULT
KING SALMON FAULT
PINCHI FAULT
STIKINE ARCH
B.C.
ALASKA
LEGEND
ULTRAMAFIC BODIES
MAJOR FAULT ZONE
100 km

Fig. 9

An alternative is to re-establish a large base camp at Trapper Lake and operate fly camps on individual properties. This latter alternative is favoured for the following reasons:

(1) More efficient mob and de-mob of fuel and supplies;

(2) The lack of camp sites in the northern half of the map area. The flying time from Tatsamenie Lake to Trapper Lake is 15 minutes - not long enough to justify two complete camps. King Salmon Lake is unsuitable as a camp site;

(3) Heavy snow-fall and high altitude of properties south of Tatsamenie Lake preclude detailed exploration until July. However, properties along the Nahlin Fault zone and the King Salmon Fault receive less snow cover and are at a lower altitude. Therefore, it is proposed that these properties receive work early in the season, with crews moving south as the season progresses.

Fuel and lumber should be mobilized in winter with a Chevron employee present at Trapper Lake to supervise the mobilization.

## REFERENCES


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10. Souther, J.G., 1971: Geology and mineral deposit of Tulsequah map-area, British Columbia; Geological Survey of Canada, Memoir 362.

1981 PROGRAMME

NORTHERN GOLD - M504

FIELD PERSONNEL

| Personnel | Period | |
|---|---|---|
| L. Dick | Duration | Project geologist |
| K. Shannon | Duration | geologist |
| M. Thicke | Duration | geologist |
| T. Zanger | Duration | senior field assistant |
| P. Angley | Duration | field assistant |
| J. Hawthorne | Duration | field assistant |
| R. Lazenby | Duration | field assistant |
| D. Klassen | Duration | cook |
| G. Laforme | May 26 - June 5 | geologist |
| L. Rowan | May 26 - June 5 | field assistant |
| D. Madsen | May 26 - June 15 | field assistant |
| S. Goertz | May 26 - July 1 | field assistant |
| D. Abercrombie | May 26 - July 1 | field assistant |
| B. Dick | June 27 - August 1 | technician |
| D. Laamanen ]<br>P. Smith ] | | pilot/engineers |

CLAIM STATUS

NORTHERN GOLD - M504

| CLAIM (UNITS) | REGISTERED OWNER | DATE COMPLETED | DATE REGISTERED |
|---|---|---|---|
| TUT 1-4 (80) | Chevron Canada | Feb. 25, 1981 | March 5, 1981 |
| SAM 1-2 (25) | Chevron Canada | Feb. 24, 1981 | March 5, 1981 |
| TARDIS (20) | Chevron Canada | June 12, 1981 | July 2, 1981 |
| PETRO (6) | Chevron Canada | June 13, 1981 | July 2, 1981 |
| TARDIS 2 (2)<br>TARDIS 3 (4)<br>TARDIS 4 (10) | T.K. Zanger<br>for Chevron Canada | July 13, 1981<br>July 13, 1981<br>July 14, 1981 | July 20, 1981<br>July 20, 1981<br>July 20, 1981 |
| GOAT (20) | Chevron Canada | June 30, 1981 | July 20, 1981 |
| OUTLAW 1-4 (80) | T.K. Zanger<br>for Chevron Canada | July 8, 1981 | July 9, 1981 |
| EMU (20) | T.K. Zanger<br>for Chevron Canada | July 13, 1981 | July 20, 1981 |
| BARB (20) | R.E. Dale | June 28, 1979 | July 26, 1979 |
| Bear (20) | M. Thicke<br>for Chevron Canada | July 29, 1981 | August 21, 1981 |
| BANDIT 1-2 (40) | K. Shannon<br>for Chevron Canada | July 30, 1981 | " |
| RAM (20) | K. Shannon<br>for Chevron Canada | August 2, 1981 | " |
| GRINGO (20) | K. Shannon<br>for Chevron Canada | August 4, 1981 | " |
| TOTEM (20)<br>RON (1) | K. Shannon<br>for Chevron Canada | August 6, 1981 | " |
| GOAT 1, 2 (40) | M. Thicke<br>for Chevron Canada | August 8, 1981 | " |
| HARDLUCK (20)<br>GOAT 3 (10) | M. Thicke<br>for Chevron Canada | August 9, 1981 | " |
| MISTY 1, 2 (40)<br>POLE (20) | K. Shannon<br>for Chevron Canada | August 10, 1981 | " |
| BEAR 1, 2 (30) | M. Thicke<br>for Chevron Canada | August 27, 1981 | August 31, 1981 |
| EWE (20) | M. Thicke<br>for Chevron Canada | August 27, 1981 | August 31, 1981 |

| CLAIM (UNITS) | REGISTERED OWNER | DATE COMPLETED | DATE REGISTERED |
|---|---|---|---|
| NIE 1 (20) | T.K. Zanger for Chevron Canada | Sept. 7, 1981 | Sept. 18, 1981 |
| NIE 2 (20) | M. Phillips for Chevron Canada | Sept. 7, 1981 | " |
| NIE 3 (20) | M. Phillips for Chevron Canada | Sept. 9, 1981 | " |
| NIE 4 (20) | T.K. Zanger for Chevron Canada | Sept. 8, 1981 | " |
| NIE 5 (15) | T.K. Zanger for Chevron Canada | Sept. 11, 1981 | " |
| NIE 6 (20) | T.K. Zanger for Chevron Canada | Sept. 9, 1981 | " |
| NIE 7-8 (40) | M. Phillips for Chevron Canada | Sept. 11, 1981 | " |