

1993 - 94 UPDATE: INTERIOR PLATEAU PROGRAM

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(B.C. Ministry of Energy, Mines and Petroleum Resources Mineral Strategy - Targeted Geology Program
and Canada - British Columbia Mineral Development Agreement, 1991 - 1995)

KEYWORDS: Interior Plateau, regional geology, surficial geology, economic geology, lake sediment geochemistry, biogeochemistry, airborne geophysics, ground geophysics

INTRODUCTION

The Interior Plateau program is a major geoscience initiative that is funded federally under the guidelines of the Canada - British Columbia Mineral Development Agreement and provincially by the Ministry of Energy, Mines and Petroleum Resources as part of its 1993 Mineral Strategy.

Prospective geological environments favourable for economic mineral deposits exist in areas adjoining the Interior Plateau study area (e.g., porphyry deposits such as Endako and Gibraltar, the Equity Silver deposit and epithermal precious metal deposits such as Silver Queen and Blackdome). Extrapolation of structural trends, plutonic suites and stratigraphy suggests that there is potential for similar, undiscovered economic deposits in the region.

Mineral exploration and development in the region has been severely hampered by a number of factors which include: poor infrastructure, inaccessibility, dense vegetation, extensive and variably thick glacial drift, a blanket of Miocene and younger lava flows, an obsolete geological database and lack of modern geophysical and geochemical coverage. As a result most of this region of central British Columbia is under-explored and consequently poorly understood and undervalued.

Staff of the Geological Survey of Canada (GSC) and the British Columbia Geological Survey Branch (BCGS) have conducted a number of integrated multi-disciplinary projects throughout the Interior Plateau region (Figure 1). Two key objectives of this undertaking are to provide new data to upgrade the existing geological, geochemical and geophysical databases and the development of new exploration models and technologies. The integration of the new geoscientific information will aid mineral exploration and better support mineral potential assessment and informed resource management and land-use decisions in the region.

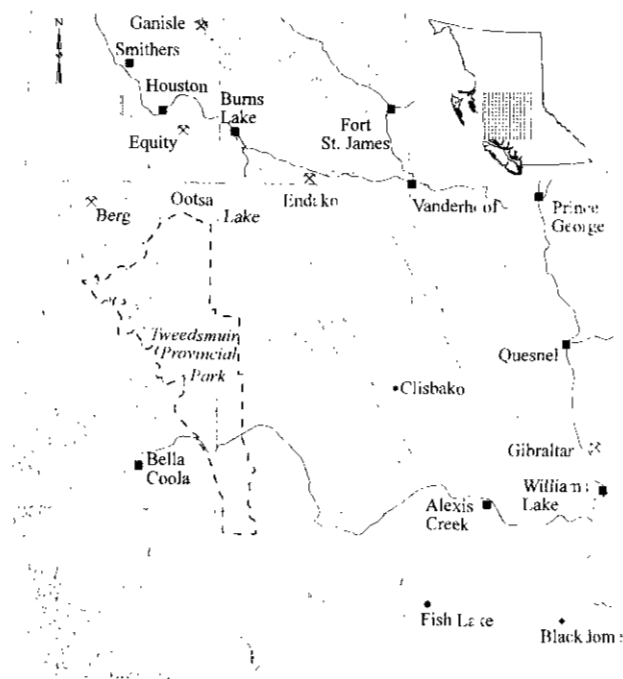


Figure 1. Producing mines (shown by diamonds) and other significant mineral deposits in the Interior Plateau region.

This report gives a brief overview and highlights of projects carried out by both the BCGS and GSC this past year. Annual reports and maps will be published for projects active during a given year. Geoscientists from both organizations meet semi-annually to review results and outline future and complimentary work. A final volume synthesizing the Interior Plateau program is planned for publication in 1995-96.

REGIONAL BEDROCK MAPPING

A number of bedrock mapping surveys were conducted last summer to develop a better understanding of the stratigraphy structure and the geological controls of mineral deposits in the Interior Plateau.

Continuing southward from last year's 1:50 000 mapping of NTS map-sheet 93F/6, (Diakow *et al.*, 1993; Green and Diakow, 1993), Larry Diakow and Ian Webster (BCGS) conducted 109 traverses over 800 square kilometres of NTS map-sheet 93F/3 (Fawnie Creek; Diakow and Webster, 1994, this volume). The area hosts a number of mineral occurrences which include the Wolf prospect, a low sulphidation, adularia-sericite epithermal gold-silver deposit, the Fawn showing, a precious metal bearing epithermal vein and the Paw showing, a porphyry copper molybdenum occurrence.

The following significant features were noted during the course of mapping:

- Bedrock exposures subcrop account for about 15% of the total area; the remainder is mantled by glacial overburden.
- The basement succession consists of silica bimodal volcanic rocks and intravolcanic marine sedimentary rocks. New fossil collections suggest that this mixed volcano-sedimentary succession may be entirely Middle Jurassic (Bajocian to Callovian) in age.
- Quartz monzonite of the Late Cretaceous Capoose batholith, mapped last season in the Nataalkuz Lake map area, extends southward into the Fawnie Creek map area. Porphyry copper, skarn and a new epithermal precious metal prospect are hosted by the altered country rocks near the pluton.
- The Fawnie Creek area is part of a roughly east-west trending zone of uplift encompassing the Fawnie and Nechako ranges. The uplift is delimited by several northeasterly trending structures. Uplift probably began as early as middle Cretaceous time and continued into the Late Cretaceous with the emplacement of the Capoose batholith.
- Two new epithermal precious metal prospects were discovered. The silicified rocks are Middle Jurassic in age. Occurrence 1 consists of pervasively silicified rocks exposed over an area 150 metres in diameter. Massive silica, with drusy lined cavities, is accompanied by sericite, barite and minor pyrite. It is exposed within a kilometre of the margin of the Capoose batholith. Occurrence 2 consists of isolated vein segments found in quartz-bearing rhyolite flows and minor ash-flow tuffs of probable Middle Jurassic age. The veins occur intermittently along a north-northeast trend. These showings are probably part of a zone of parallel veins that extends for a least 500 metres. The veins, up to 1.5 metres wide and 50 metres long, consist of massive and banded quartz, calcite and rare barite. Disseminated pyrite is the only sulphide observed. Geochemical results are pending.

In 1992, GSC geologists Peter van der Heyden and Arthur Calderwood commenced 1:50 000 mapping in the Charlotte Lake (93C/3) and Junker Lake (93C/4) map-sheets (van der Heyden *et al.*, 1993). In 1993 van der Heyden and Mustard completed 1:50 000 mapping of the Bussel Creek (92N/14 and Tatla Lake (92N/15) sheets.

The following notes summarize preliminary results of the 1993-94 field season (van der Heyden *et al.*, 1994):

- Auriferous arsenopyrite-quartz veins, hosted by small quartz diorite and felsite intrusions near Perkins Peak (Bussel Creek map area), occur in fault-bounded lenses below the base of a Late Cretaceous imbricate thrust zone. The quartz veins may be late-stage extension veins that formed perpendicular to thrust faults following compression. Other gold-bearing quartz veins in the study area also appear to be associated with thrust faults.
- Coast Belt plutons and metavolcanic rocks in the western part of the study area represent a Jura-Cretaceous magmatic arc which was situated outboard of the Tyaughton basin, and which was thrust over the basin in Late Cretaceous time along a major imbricate thrust zone. Preliminary geochronometry of a pluton from one of the higher thrust sheets, which was involved in the deformation, has yielded a 93 to 94 Ma crystallization age. A crosscutting apophysis of the large Klinaklini pluton yielded a preliminary 63 to 64 Ma emplacement age.
- Stikine Terrane, including the newly dated *ca.* 220 Ma Sapeye Creek pluton, may underlie the Tyaughton trough between the Yalakom and Tchaikazan faults.

Paul Metcalfe and Catherine Hickson (GSC) continued with their study of the stratigraphic succession and petrological relationships of the Early Tertiary felsic volcanic rocks which host epithermal mineralization discovered on the Baez and Clisbako claim groups near the headwaters of the Clisbako River. The study area comprises four 1:50 000 map sheets (93B/12, B/13, C/9 and /16). Metcalfe and Hickson (1994) determined that:

- Three volcanic assemblages are exposed in the Clisbako River area. The oldest undeformed units are felsic to intermediate volcanic flows and pyroclastic rocks, which host hydrothermal alteration and mineralization. These are overlain by an assemblage of intermediate to mafic lava flows.
- The area of outcrop of the felsic volcanic rocks and the overlying mafic assemblage is a circular highland area, approximately 40 kilometres in diameter. It is possible that this area is an eroded caldera, partially filled with younger basaltic lavas of the Chilcotin Group.

Catherine Hickson (GSC) completed the bulk of her mapping project in the Taseko Lakes map sheet (920) this summer. Her work concentrated on the stratigraphy of the Jackass Mountain Group in the Big Bar map area (920/1). Significant features from the mapping include:

- The Watson Bar thrust separates an upper plate of Jackass Mountain Group rocks from a lower plate of Jackass Mountain Group rocks and small Cretaceous (?) dioritic plutons. Plutons within the fault zone are strongly altered, including kaolinitic alteration of feldspars and oxidation of hornblende.

Further details can be obtained from Hickson *et al.*, 1994.

MINERAL DEPOSIT STUDIES

Tom Schroeter and Bob Lane (BCGS) concentrated on the evaluation, description and classification of a variety of deposit types, and their geological settings. This year's effort comprised literature research and brief site investigations of the Wolf precious metal deposit, the Fawn (Gran) epithermal and skarn occurrences, and the Blackwater-Davidson "transitional" precious and base metal deposit.

They report that, in the Fawnie Creek (93F/3) region:

- Mineralization and alteration is of two ages: approximately 48 Ma (Wolf) and approximately 64 to 68 Ma (Blackwater-Davidson and Capoose)
- Mineralization is predominantly structurally controlled.
- The Wolf prospect is a low sulphidation, adularia-sericite epithermal gold-silver deposit with potential for bonanza and bulk mineable economic mineralization.

Further details on the Wolf and other mineral showings are documented by Schroeter and Lane (1994, this volume). Additionally, as part of a larger project initiated in 1991 to develop a regional metallogenic synthesis of the Interior Plateau, landsat imagery and publicly available drill-hole data files of the Energy Division of the Ministry are being examined to determine their potential for outlining structures and stratigraphic contacts.

SURFICIAL GEOLOGY AND TILL GEOCHEMISTRY

Vic Levson and Tim Giles (BCGS) commenced a project in 1993 to map the surficial geology and complete a till geochemistry sampling program in the Fawnie Creek map area (93F/3; Giles and Levson, 1994, this volume). This project complements work done by Giles and Kerr (1993) and Proudfoot (1993) in the eastern portion of the Anahim Lake map area (93C/1, 8,

9, 16). Work included compiling a surficial geology map of the Fawnie Creek area, conducting stratigraphic and sedimentologic studies of the Quaternary deposits and defining the glacial history and ice-flow patterns. The till geochemistry portion of the program included collection of samples for a regional survey and development and refining of drift exploration methods by conducting detailed case studies around known mineral deposits.

Results to date indicate the following:

- Morainal sediments of the last glaciation are widespread and form a cover from a few to several metres thick in low-lying areas to less than 2 metres thick in upland regions.
- Glaciofluvial sediments are also common in the map area, occurring as eskers, kames, terraces, fans and outwash plains in valley bottoms and along valley flanks. They consist mainly of poorly to well-sorted, stratified, pebble and cobble gravels and sands in deposits up to 10 metres thick. Glaciolacustrine sediments are rare and occur on the east side of the Wolf property, in two valleys on the south side of Entiako Spur, and near Top Lake. There was one dominant ice-flow direction towards the east-northeast, modified by topographic control during both early and late stages of glaciation.
- Two hundred and ninety-nine samples were collected in 93F/3 at a density of 1 sample per 4 square kilometres. Samples were collected from the C mineral soil horizon, to reflect glacial dispersion processes. Approximately 100 pebbles were collected at till sample sites for lithologic analysis and provenance studies.
- Detailed case studies were completed at three mineral prospects: Wolf, Capoose and Blackwater-Davidson; two mineral showings: Fawn and Yellow Moose; and two newly discovered showings (Diakow and Webster, 1994, this volume). These studies were conducted to document mineral dispersion processes by glaciers and colluvial processes and to test methods of drift exploration. All till samples will be analysed by ICP-ES and INAA for more than 50 elements. Reports surficial geology, drift prospecting potential and till geochemistry maps are planned for publication in 1994.

Alaine Plouffe (GSC) is also engaged in a multi-year project that addresses regional surficial geochemistry and Pleistocene stratigraphy, ice-flow pattern indicators and till lithologies. The project area comprises the northwest quadrant of Taseko Lakes (920) and the northeast quadrant of Anahim Lake (93C). Reconnaissance sampling in the Taseko River valley, and a detailed survey in the Fish Lake area were completed in 1992 (van der Heyden *et al.*, 1993). In 1993, a total of 124 till and glaciofluvial sediment samples were collected and a number of ice-flow

indicators were measured. Most of the sampling was conducted along the major forestry roads on mapsheets 920/5 and 920/12. The silt plus clay size-fractions (<63 µm) of all samples collected in 1992 and 1993 will be analyzed by ICP-ES and by INAA. All project results including surficial geology and till geochemistry maps are planned for publication in 1994.

GEOCHEMISTRY SURVEYS AND STUDIES

REGIONAL GEOCHEMICAL LAKE-SEDIMENT SURVEYS

In preparation for planned regional geochemical surveys in the Interior Plateau, Steven Earle (1993) conducted a research study on the applicability of lake-sediment surveys for mineral exploration in the Nechako Plateau area and Steve Cook (1993) conducted a number of lake-sediment orientation surveys in the Vanderhoof-Houston region in 1992. Preliminary interpretation of the orientation data suggests:

- Lake sediments at Wolf Pond, Clisbako and Bentzi Lake clearly reflect the presence of nearby epithermal precious metal occurrences, containing maximum gold concentrations of 56 ppb, 16 ppb and 9 ppb, respectively. These concentrations are far in excess of the regional background of 1 ppb gold in lake sediments.
- More representative results will be obtained by the sampling of each lake and sub-basin during regional lake-sediment surveys.
- Sampling of near-shore organic sediments adjacent to drainage inflows is recommended in detailed/follow-up investigations.

An important outcome of these studies is the development of geochemical models for the transport and concentration of gold and other metals under a range of limnological conditions.

Incorporating recommendations from the orientation surveys Steve Cook and Wayne Jackaman (BCGS) conducted two regional lake-sediment and water geochemistry surveys this summer (Cook, 1994, this volume).

- The Fawnie survey covers map areas 93F/2 (Tsacha Lake) and 93F/3 (Fawnie Creek), where exploration has been centred on precious metal prospects such as the Wolf and Blackwater-Davidson occurrences.
- The Ootsa survey is centred on the Eocene volcanic basin south of Burns Lake and covers parts of map areas 93F/6 (Natalkuz Lake), 93F/11 (Cheslatta Lake), 93F/12 (Marilla), 93F/13 (Takysie Lake) and 93F/14 (Knapp Lake).

- A total of 460 sites were sampled over a combined area of approximately 3530 square kilometres at an average density of 1 site per 7.7 square kilometres.
- Sediment samples will be analysed for gold and 45 additional elements by a combination of atomic absorption spectroscopy and instrumental neutron activation analysis.
- Water samples will be analysed for uranium, fluoride, sulphate and pH.

Results, including data booklet, maps and floppy diskette, will be released in 1994. Follow-up of prospective anomalies as well as additional surveys of adjoining areas is planned for next year, with the eventual objective of completing Regional Geochemical Survey coverage of NTS map areas 93C (Anahim Lake), 93F (Nechako River) and 93K (Fort Fraser).

BIOGEOCHEMICAL SURVEYS

Following up encouraging results from 1992 orientation surveys in the Clisbako River and Fish Lake areas (van der Heyden *et al.*, 1993) Colin Dunn (GSC) directed an airborne reconnaissance and a detailed follow-up ground biogeochemical survey this summer. The program's focus is to evaluate the effectiveness of biogeochemistry as a prospecting tool in this type of terrain.

A regional tree-top (lodgepole pine) survey was undertaken by helicopter in the Fish Lake area in early May. A total of 276 samples were obtained from a 1625 square kilometre area at a grid spacing of 2.5 kilometres. Detailed sampling in August has provided further insight into the response of tree chemistry to a zone of gold enrichment in overburden and bedrock, and helps to quantify levels that may be of significance to mineral exploration. Samples were air dried, then needles were separated from stems and the stems were reduced to ash at 470°C. Ash samples were analysed by INAA and ICP-ES for determination of over 50 elements.

Results from the regional survey and detailed studies show:

- Low levels of metals in tree tissues, but subtle multi-element anomalies define broad geochemical trends
- Chromium is enriched along a zone 12 kilometres long centred on Fish Lake
- Several zones of coincident enrichment (*i.e.*, >90th percentile values) of gold, arsenic and antimony, with spatially related zones of cesium and chromium in the eastern half of the survey area; and copper and molybdenum in the western half.
- Biogeochemical sampling profiles, using the outer bark of lodgepole pine, show that background levels of gold in ash are less than

10 ppb, whereas over zones of gold enrichment concentrations are 30 to 50 ppb gold.

Data have yet to be fully evaluated, but results indicate that biogeochemical surveys in this part of the province are likely to yield only weak enrichments of metals. However, the absolute concentrations are of less importance than the patterns of metal distributions.

GEOPHYSICAL SURVEYS AND STUDIES

AIRBORNE AEROMAGNETIC SURVEYS

Dennis Teskey (GSC) co-ordinated a regional aeromagnetic survey over the Chilcotin-Nechako region (93B, C, F and G) this summer. Processing and interpretation of the digital data will be followed by a publication of high-resolution total field maps at 1:100 000 scale and specific maps at 1:50 000 scale, scheduled for release in 1994. It is anticipated that geologic structures underlying the thin but extensive Miocene and younger flood basalts will be identified.

AIRBORNE AND GROUND MULTIPARAMETER GEOPHYSICAL SURVEYS

Following up successful ground orientation surveys, Rob Shives, Bruce Ballantyne and Don Harris (van der Heyden *et al.*, 1993) conducted both a high-resolution airborne gamma ray spectrometry survey with accompanying total field magnetic and VLF-EM surveys as well as detailed ground follow-up investigations. The airborne survey consisted of two traverses 500 metres apart, over the Fish Lake and Clisbako River areas, using the GSC Skyvan fixed-wing aircraft. Ground follow-up consisted of gamma ray spectroscopy, rock and stream sediment and till sampling.

The following preliminary results have been noted:

- Strong potassium responses in at least two areas relate to unmapped felsic units within volcanics currently shown as Early to mid-Cretaceous and Miocene to Pleistocene olivine basalts (Hickson, 1993).
- Coincident magnetic and VLF anomalies define a north-trending linear which passes through the Fish Lake deposit and continues north along the west side of the Cone Hill intrusive complex.
- Tete Hill, a prominent circular topographic feature mapped as Cretaceous to Tertiary "Tete Hill granite (Riddell *et al.*, 1993) has strong circular magnetic and VLF responses. There is no airborne or ground spectrometric potassium anomaly associated with this feature. Field examination failed to find "granite" outcrops.

- Potassium concentrations in sulphide-bearing outcrops and intrusive phases are low and enrichment trends appear to be subtle.
- A small creek flowing into Fish Lake, yielding anomalous Regional Geochemical Survey gold concentrations (269 ppb gold, Jackaman *et al.*, 1992) was sampled by heavy mineral panning. Numerous fines (<100 µm) gold grains were recovered.

Results from these studies confirm that the airborne and ground geophysics techniques will directly aid bedrock and surficial mapping, geochemical interpretation and exploration.

COMMENTS

Other information including discussions, poster displays and Open File maps will be made available at the 1994 Cordilleran Roundup. Provincial surveys and studies will be continuing next summer beginning with a one-day field trip illustrating significant geological, geochemical and geophysical features.

ACKNOWLEDGMENTS

The authors would like to thank all project team members for their assistance. John Newell for a review of this paper and Wade Noble for formatting the manuscript.

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