NORTHWEST BRITISH COLUMBIA

MOUNT LEONARD BOSS – SURPRISE LAKE BATHOLITH
(104N)

By P. A. Christopher

Regional mapping of the Surprise Lake batholith was initiated during the 1979 field season. The Mount Leonard boss, the most westerly segment of the Surprise Lake batholith, was mapped during July and August. Continuation of mapping in the batholith is planned for 1980.

The map-area (Fig. 23), within the Atlin Horst tectonic subdivision, is situated east of Atlin Lake in northern British Columbia with the centre of the Surprise Lake batholith at latitude 59 degrees 42 minutes north and longitude 132 degrees 53 minutes west. The area is mountainous with peak elevations of 1 800 to 2 100 metres and the valley containing Surprise Lake at about 942 metres. Access is via the Alaska Highway and Highway 7 to Atlin. A good gravel road exists between Atlin and Surprise Lake and various mining roads provide access to most of the batholith situated northwest of Surprise Lake. Several mining companies actively explored the area around Ruby Mountain during 1979.

Prospecting and exploration efforts in the Surprise Lake batholith have located interesting molybdenum and/or tungsten properties including Adanac (molybdenum), Gladys Lake (molybdenum), Black Diamond (tungsten), and Weir Mountain (molybdenum, tungsten). Geochemical data obtained from stream silt and water samples collected during the Uranium Reconnaissance Program in 1977 demonstrate that the Surprise Lake batholith is anomalous in uranium, molybdenum, tin, tungsten, and fluorine.

GENERAL GEOLOGY

The Surprise Lake batholith intrudes Permo-Pennsylvanian Cache Creek metamorphic rocks and Atlin ultramafic rocks and Coast Intrusions which have been assigned a Jurassic age (Aitken, 1959). The lenticular batholith, comprising alaskite and quartz monzonite, is bisected by a band of older Cache Creek rocks in the Trout Lake graben. Biotite K/Ar ages of 75.4±5 Ma (N. C. Carter, unpublished data) from pegmatitic alaskite near Trout Lake and 62.0±2.2 Ma (Christopher, *et al.*, 1972) from coarse alaskite on the Adanac property suggest a composite batholith of Cretaceous and Early Tertiary age. In the Ruby Creek drainage, a Tertiary olivine basalt stratovolcano and Quaternary olivine basalt volcanic conelets and flows overlie auriferous gravels and granitic rocks of the batholith.

The presence of grey or smoky quartz is characteristic of both the Mount Leonard boss and the Surprise Lake batholith. The grey colouration of quartz is related to the generally high uranium background of the granitic bodies.

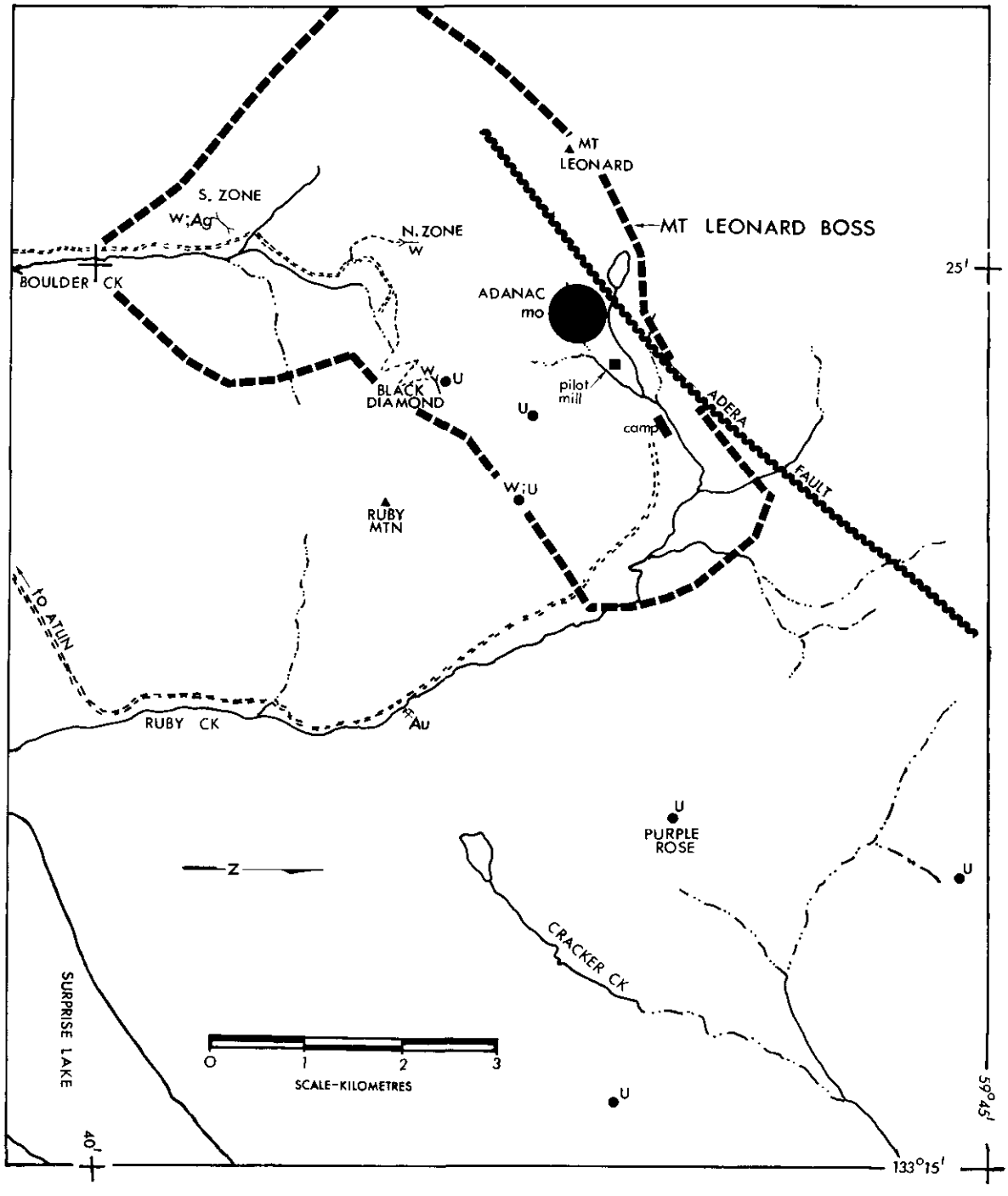

Figure 23. Mount Leonard boss – Surprise Lake batholith.

MINERAL DEPOSITS

ADANAC

The Adanac molybdenum property, owned by Adanac Mining and Exploration Ltd. and under option to Placer Development Limited, is situated at the headwaters of Ruby Creek (Fig. 23). In 1979, 39 NQ diamond-drill holes, totalling 5 351.7 metres, were drilled to further explore the deposit and concurrent environmental impact studies included testing of proposed tailings and plant site areas with eight NQ diamond-drill holes, totalling 457.2 metres, soil test pits and trenches, and geophysical surveys. Surprise Lake and Pine Creek were evaluated for hydroelectric potential.

PROPERTY GEOLOGY

The main mineral showings occur between 1 463 metres and 1 495 metres in the creek valley. Outcrops are generally limited to stream valleys, steeper slopes and ridges with diamond drilling relied upon for geological information. On gentle slopes felsenmeer mapping was attempted.

The Adanac deposit occurs in the northeasterly part of the multiphase Mount Leonard boss (Fig. 23). The geology of this area has been studied by Aitken (1959), Sutherland Brown (1970), Jones (1971), and White, *et al.* (1976). These authors generally agree on distribution of units but not on unit names. The writer and present operators have expanded on Sutherland Brown's nomenclature. The deposit geology is described in terms of six main units: quartz monzonite porphyry, coarse alaskite, crowded quartz-perthite-oligoclase porphyry, sparse quartz-perthite-oligoclase porphyry, fine-grained alaskite, and equigranular granite. The fine-grained alaskite is coincident with the higher grade molybdenite zone in the underground workings and the equigranular granite was encountered at a depth of 402 metres in drill hole 1W-1N. Quartz monzonite porphyry occurs in the eastern part of the property and the coarse alaskite is found in the southern and western areas. Sparse and crowded porphyries occur between the Adera fault and Coast Intrusions and Cache Creek rocks to the north, and at surface near the southeast boundary of the deposit (*see* Sutherland Brown, 1970, Fig. 4). Mafic varieties, textural gradations, aplitic dykes, basic dykes, and hybrid phases complicate the geologic picture but are not mappable units.

STRUCTURE

The Adera fault, which forms the northern boundary of the Adanac deposit, strikes north 65 degrees east and dips 80 degrees north between Molly Lake and Ruby Creek (White, *et al.*, 1976). Geophysical surveys (electromagnetic and magnetic) by Richard Cannon, diamond drilling for a proposed dam site and mapping indicate a strike of about north 45 degrees east for the easterly extension of the Adera fault. About 500 fracture measurements were used by White, *et al.* (1976) to define four principal trends: north 36 degrees east/82 degrees southeast, north 15 degrees to 30 degrees west/70 degrees to 80 degrees southwest, north 38 degrees east/77 degrees northwest, and nearly horizontal with molybdenum veins in the nearly horizontal and north 36 degrees east structures. They suggested that fracture density does not appear to increase in the area of the mineral deposit but that the higher grade zones result from an increase of intensity of mineralization in nearly horizontal veins.

MINERALIZATION

Molybdenum mineralization occurs in all phases of the Mount Leonard boss, with the exception of the post-mineral equigranular granite. The fine-grained alaskite, coarse alaskite, and sparse porphyry host the

higher grade mineralization on the Adanac property with molybdenite occurring mainly in quartz veins and as fracture coatings. The modes of occurrence of molybdenite are:

(1) rosettes in smoky quartz veins
(2) fine-grained fracture coatings with quartz envelopes
(3) quartz-pyrite-molybdenite veins with some carbonate
(4) molybdenite gouge on fault surfaces
(5) molybdenite-bearing quartz veins with potassium feldspar and/or biotite envelopes
(6) quartz-molybdenum-fluorite-potassium feldspar±biotite.

Barren veins include:

(1) quartz veins
(2) fracture coatings of pyrite with rare chalcopyrite and copper carbonates
(3) quartz and pyrite with rare chalcopyrite and copper carbonates
(4) quartz, calcite, and chalcopyrite
(5) potassium feldspar and/or biotite
(6) quartz, wolframite, arsenopyrite, scheelite, and fluorite
(7) carbonate.

Chalcopyrite is rare within the deposit and pyrite content of less than 1 per cent is restricted to veins and fractures. Examination of the adit area confirms the existence of pyrite in veins and fractures to the east of the deposit but pyrite appears to be more abundant within the molybdenum deposit. The density of fluorite-bearing veins appears to increase in the fine-grained core of the deposit. Only one quartz-wolframite vein was identified in core from the northern margin of the deposit but quartz, wolframite-arsenopyrite veins, and breccia zones are more common in peripheral areas.

Further evaluation of the 1979 drilling program will be required before the published tonnage and grade of 94 350 000 tonnes of 0.16 per cent molybdenite (established by Kerr Addison Mines Limited and reported in White, *et al.*, 1976) can be refined.

YKR

The YKR tungsten property is situated south and west of Adanac and covers parts of the southerly contact between the Mount Leonard boss and Cache Creek metasedimentary rocks (Fig. 23). The old Black Diamond, Tungsten, Silver Diamond, and Bub properties are included in the present holdings of Yukon Revenue Mines Limited.

Linecutting, soil sampling, bulldozer trenching, geophysical surveys, limited X-ray diamond drilling, and prospecting and mapping of the property were carried out in 1979. Coarse alaskite and porphyritic phases of the Mount Leonard boss intrude calcareous metasedimentary rocks of the Cache Creek Group. Vein, contact skarn, and porphyry potential of the property is presently being examined. Vein mineralization occurs mainly within the granitic rocks but has also been found at the alaskite-metasediment contact. The Black Diamond vein can be traced about 4 kilometres from near the Ruby Creek valley to Boulder Creek with the strike varying from about north 70 degrees east to about north 50 degrees east. A north 40 degrees to 45 degrees east striking quartz vein on the west side of Boulder Creek may be part of the vein system. Veins contain quartz, muscovite, arsenopyrite, wolframite, with minor chalcopyrite, scheelite, molybdenite, cassiterite, fluorite, and gold. Diopside-tremolite-garnet skarn occurs in pendants and contact altered Cache Creek rocks with pyrrhotite, pyrite, chalcopyrite, scheelite, wolframite, tetrahedrite, sphal-

erite, and fluorite. Bismuthinite ($PbBi_2S_4$) and possible tetradymite ($BiTe_2S$) have been reportec by Schroeter (1979).

URANIUM EXPLORATION

Uranium exploration in the Surprise Lake batholith was continued by Cominco Ltd., Wyoming Minerals, Mattagami Lake Mines Limited, St. Joseph exploration Limited, and E & B Explorations Ltd. The Mount Leonard boss was surveyed during mapping with a McPhar TVI and scintillometer and several anomalous areas were located on the ridge south of the Adanac property. Secondary uranium minerals, generally kasolite or zeunerite, occur in quartz veins or breccia zones with arsenopyrite, fluorite, tetrahedrite, chalcopyrite, and wolframite. Zeunerite has also been reported from the Black Diamond vein. The Purple Rose prospect (Fig. 23), a zeunerite-bearing quartz vein on the Pato claims, and the Cirque prospect, a quartz-fluorite stockwork or vein zone on the IRA claims (on Mount Edmund), are the best known and explored examples of structurally controlled uranium mineralization in the Surprise Lake batholith. The Cirque prospect was tested with limited diamond drilling by Wyoming Minerals.

Eight diamond-drill holes by Cominco Ltd. were used to test for secondary uranium mineralization in paleostream sediments capped by olivine basalt flows on the Vol, Per-Eye, and Dambouleo claim group between Boulder and Ruby Creeks.

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