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THE TOBY URANIUM PROJECT

The projected demand for uranium and the suddenly and rapidly increasing prices for this commodity has so stirred exploration activity that vast budgets are being allocated to the search for new deposits. Most of the money expended and most of the success has been for the conventional type of uranium deposit including those concentrated within relatively unconsolidated sandstone units (eg. the southwest states) and the deposits lying near the Athabasca Sandstone of northern Saskatchewan and Alberta. Search in British Columbia had a brief flurry almost ten years ago and was confined largely to searching for sandstone types in Cretaceous and Tertiary sedimentary basins.

The success in northern Saskatchewan has led to new theories concerning the concentration of the uranium deposits and many authorities now believe that the unconformity separating the shield areas from the Athabasca Sandstone was of prime importance in concentration of the uranium. This unconformity represented a lengthy period of weathering and erosion which <u>released the uranium from the rocks allowing it to eventually concentrate in structures under the</u> unconformity. The exact time and process of this concentration is still controversial. A similiar relationship to unconformities has also been noted for some of the uranium deposits in Australia.

regolith and/or structures

The widespread relationship of uranium deposits to unconformities has been carried to the Bancroft area by geologists such as Dr. Wynn-Edwards. These geologists point out that the pegmatitic deposits are all quite close to the trace of an overlying unconformity. They suggest that these pegmatitic deposits have a similiar genetic origin to those around the Athabasca Sandstone; but that the uranium concentrations have been metamorphosed and remobilized into pegmatitic structures.

It is becoming increasingly apparent that unconformities do have a major roll in controlling the concentration (by meteoric waters) of uranium. The fundamental source of uranium in most of these cases is the granitic areas of the Shield. These vast areas have considerably higher background uranium content than the normal for the crust of the earth. Also the granite is quite easily affected by chemical and mechanical weathering and erosion. Another extensive concentration of uranium includes shale formations. Vast quantities of uranium do end up in the ocean to eventually be concentrated in the shales. In some cases, black shales have sufficient uranium to be considered as a potential source for the metal. Thus one ponders whether an unconformity above an area containing shales and argillites might also be a suitable source for uranium to be concentrated in underlying structures.

With this in mind, I am sending you a geological map of the Lardeau area (East half). Note that the west half of the map sheet is included in the proposed search for base metal deposits (the Arrow project). There are a few comments that I would like to make regarding this map and some suggested exploration.

A major unconformity separates the Purcell Series from the overlying Toby conglomerate and Horsethief Creek Group. The upper part of the Proterozoic and the lower half of the Paleozoic do not appear to have major unconformities in British Columbia. The Purcell Series includes argillites, dolomites, and quartzites. The overlying Toby Formation is a conglomerate and the Horsethief Group is largely a thick group of clastic rocks with some argillite and limestone formations.

Intruding the series of Proterozoic rocks are some Cretaceous batholiths composed of quartz monzonite and granodiorite. These batholiths contain a number of uranium and columbian bearing minerals such as uraninite, pyrocholore-microlite, euxenite-polycrase. The northern two stocks, the Bugaboo at the head of Bugaboo Creek and the Horsethief at the head of Foster and Horsethief Creeks yield the heavy minerals for the unusual uranium-columbian "Bugaboo Placers".

These intrusives are of Cretaceous age and so one can not suggest that erosion of them could provide uranium for concentration in the rocks underlying the unconformity. Also one might point out that many of the stocks, and especially stocks of this nature, have a deep-seated origin from the crust or the mantle and so could not have gathered their anomalous metals from the intruded Purcell Groups. However isotopic studies done in the southwest states have indicated that flow of fluids at the margins of the eroded porphyry stocks was inward. This has led to the suggestion that much of the water flowed inward at the sides of the stocks and concentrated near the apices and that some of the metals were brought into the stock with this water. This may help to explain the observed fact that, although all the stockwork molybdenite deposits of British Columbia occur in the Intermontane Eugeosynclinal Belt which contains large amounts of andesitic volcanics, none of these deposits occurs in these volcanics. They all occur within country rocks of intermediate composition such as siltstone - graywacke sedimentary sequences or granodorite batholiths.

These few comments on the nature of porphyry type deposits are meant to suggest that the origin of the uranium minerals within the stocks on the Lardeau sheet could conceivably be the argillaceous horizons.

The search for uranium has become so important that consideration should be given to ideas that diverge a certain amount from the conventional. In this specific area, an unconformity overlain by conglomerates and clastic sequences is present. However, the underlying terrain is not granitic Shields, but does include abundant black argillite.

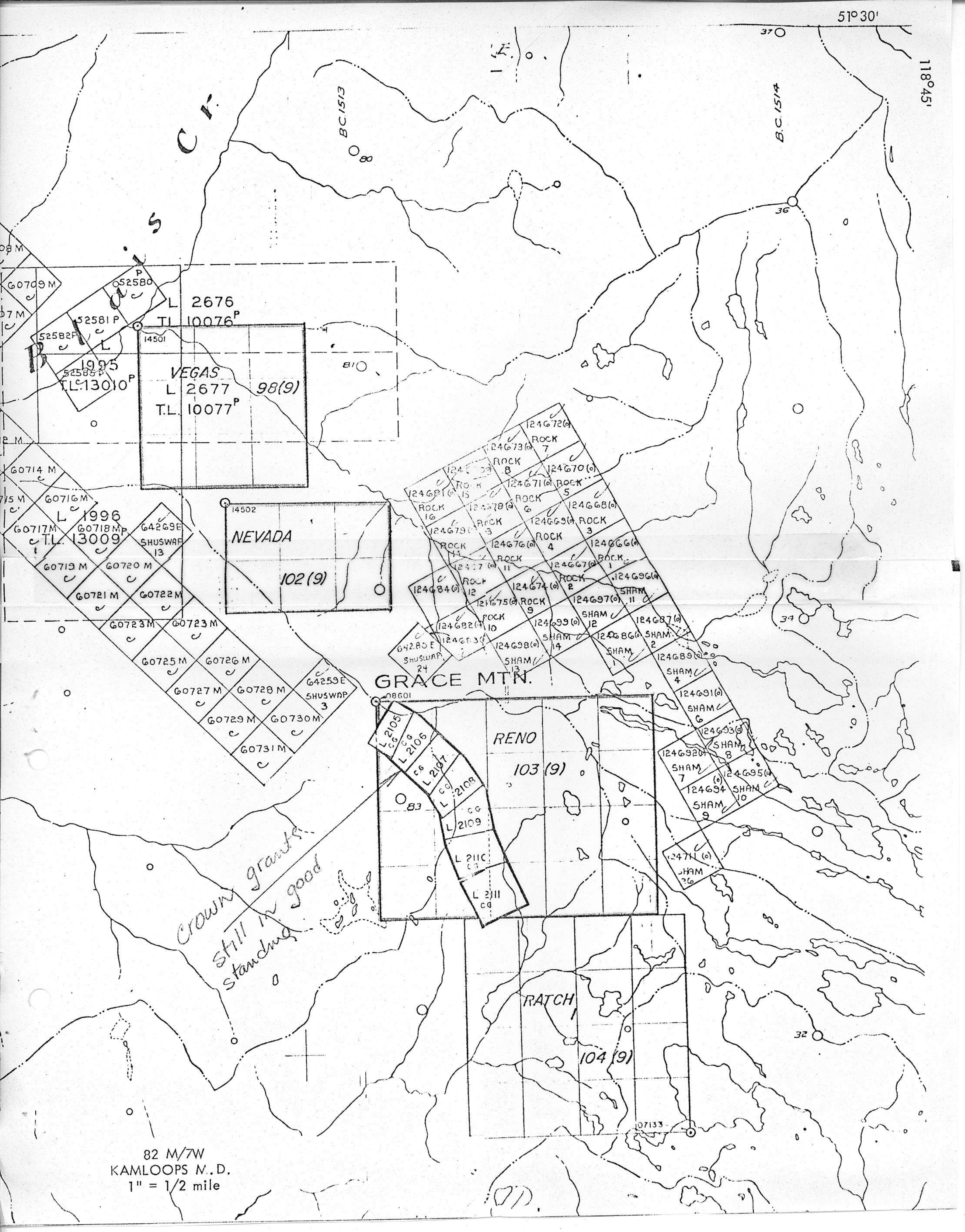
I suggest that some of this region underlying the Toby Conglomerate be investigated for uranium. This could be done by silt sampling. Orientation studies on the use of silt geochemistry to detect uranium mineralization have been successful in British Columbia. One would need to study the maps to select places where the Purcell strata in the higher parts of the mountains are stratigraphically close to the overlying unconformity. If deposits are related to the unconformity, then the main valleys which have been deepened by a glacier erosion might not be the most favourable places.

Many old lead-zinc prospects occur within the area. Roads to these prospects give access to parts of the more potential area. Thus some of the silt sampling could be done by using roads with a limited crew. However, helicopter support for part of the work is desirable.

The size of the program would depend on the size of the budget available. However, a minimum budget of $30,000 is necessary and a maximum budget of $50,000 is prudent. A budget of $40,000 would be suitable. The work would be done in August as this would be the most favourable time for getting silt sample results and it would be the time best suited to fit in with the program being conducted for base metals immediately to the west and northwest.

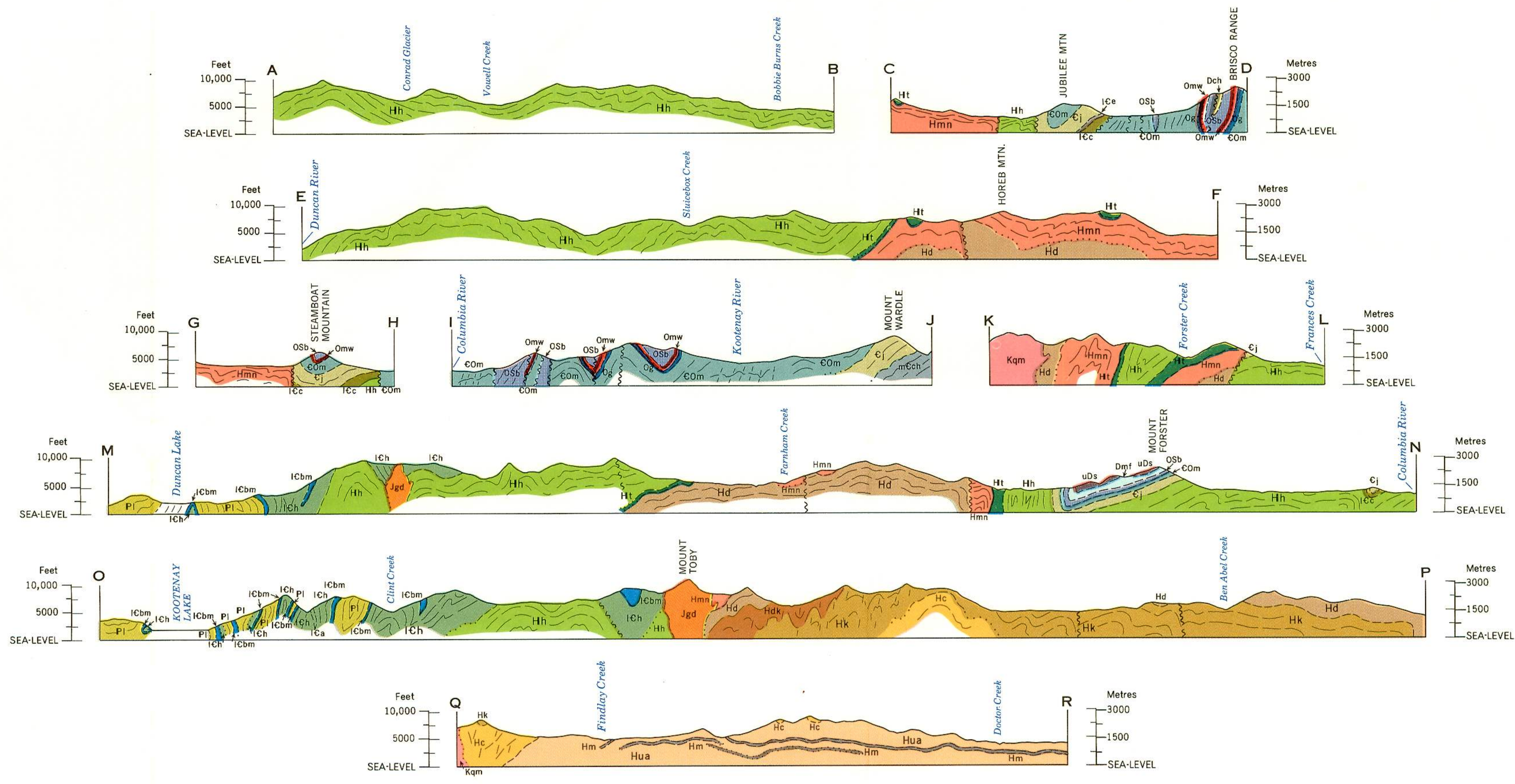
J R Woodcock
J. R. Woodcock

April 12, 1976
Date



82 M/7W
KAMLOOPS M.D.
1" = 1/2 mile

GEOLOGICAL SURVEY OF CANADA
DEPARTMENT OF ENERGY, MINES AND RESOURCES



Diagrammatic cross-sections along A-B, C-D, E-F, G-H, I-J, K-L, M-N, O-P, Q-R

LEGEND

CENOZOIC

QUATERNARY

- **Q** — *UNCONSOLIDATED SEDIMENTS: silt, sand, gravel*

MESOZOIC

CRETACEOUS

- **Kqm / Kgd** — *Quartz monzonite; Granodiorite*

JURASSIC

- **Jgd** — *Granodiorite*

WESTERN PURCELL AND SELKIRK MOUNTAINS

TRIASSIC

KASLO GROUP

- **Ŧk** — *Volcanic rocks*

CARBONIFEROUS AND PERMIAN

MILFORD GROUP

- **uPm** — *Slate and silty slate; limestone and chert*

PRE-MISSISSIPPIAN

LARDEAU GROUP

- **Pl** — *Chlorite-muscovite-quartz schist, biotite-muscovite schist, micaceous quartzite, and tremolite marble; chlorite-feldspar green schists; much garnet, staurolite and rare kyanite in some pelitic schists*

LOWER CAMBRIAN

- **l€bm** — *BADSHOT-MOHICAN FORMATION: marble, phyllite, muscovite-quartz schist*

HAMILL GROUP

- **l€h / l€ha** — *White, pure green, and grey quartzite and micaceous quartzite; dark slate, phyllite, and mica schist; some pebbly and feldspathic quartzite; l€ha, amphibolite*

PALEOZOIC

BRISCO RANGE

DEVONIAN

MIDDLE DEVONIAN

- **mDh** — *HARROGATE FORMATION: nodular grey limestone and grey calcareous shale*

DEVONIAN

- **Dc** — *CEDARED FORMATION: red quartz sandstone, quartz-bearing limestone; dolomite and quartzite*
- **Dch** — *CEDARED and HARROGATE FORMATIONS: undivided*

MT. FORSTER

DEVONIAN

UPPER DEVONIAN

- **uDs** — *STARBIRD FORMATION: grey limestone and gritty limestone*

DEVONIAN

- **Dmf** — *MOUNT FORSTER FORMATION: bright red and green argillite: brown weathering limestone*

EASTERN PURCELL, BRISCO, AND VERMILION RANGES

ORDOVICIAN AND SILURIAN

- **OSb** — *BEAVERFOOT FORMATION: massive, light grey weathering dolomite and dolomitic limestone*

ORDOVICIAN

- **Omw** — *MOUNT WILSON (WONAH) QUARTZITE: white orthoquartzite; brown weathering, crumbly quartz sandstone*
- **Og** — *GLENOGLE SHALES: black, fissile shale; brown argillaceous sandstone*

CAMBRIAN AND ORDOVICIAN

McKAY GROUP

- **€Om** — *Blue-grey limestone, argillaceous limestone, dark shale; intra-formational limestone conglomerate*

CAMBRIAN

UPPER CAMBRIAN

- **u€o** — *'OLENUS' STRATA: blue-grey limestone and grey shale*

MIDDLE AND/OR UPPER CAMBRIAN

- **€j** — *JUBILEE (OTTERTAIL) FORMATION: thinly laminated and massive dolomite; in Vermilion Range massive limestone and dolomitic limestone*

MIDDLE CAMBRIAN

CHANCELLOR GROUP

- **m€ch** — *Reddish brown and grey shale, grey limestone*

LOWER CAMBRIAN

- **l€e** — *EAGER (DONALD) FORMATION: buff weathering, gritty limestone, purple and green argillite; minor black limestone*
- **l€c** — *CRANBROOK (GOG) FORMATION: crossbedded white and purple quartzite and grit; minor pebbly quartzite, arenaceous purple shale*

PROTEROZOIC

PURCELL MOUNTAINS

WINDERMERE (HADRYNIAN)

HORSETHIEF CREEK GROUP

- **Hh** — *Grey, black, and green slate and argillite, quartz pebble conglomerate, quartzite, feldspathic quartzite and grit; red slate and arenaceous slate; minor blue-grey and black limestone; equivalent mica schist, schistose quartzite and grit, as well as marble in the more metamorphosed zones in the southwest part of the map-area; Hh1, slates dominant; Hh2, pebble conglomerate, grit, and quartzite are dominant; Hh3, limestone and slate*
- **Ht** — *TOBY FORMATION: pebble, cobble, and boulder polymictic conglomerate and breccia (matrix variously of quartzite, argillite, and limestone)*

PURCELL (HELIKIAN)

- **Hm** — *MOYIE INTRUSIONS: meta-quartz diorite and diorite*
- **Hmn** — *MOUNT NELSON FORMATION: buff weathering grey, cream and purple dolomite and dolomitic limestone, purple, grey and black argillite and slate; white quartzite*
- **Hd** — *DUTCH CREEK FORMATION: grey, green and black argillite and slate, buff dolomitic slate; thin-bedded, buff weathering dolomite, green, argillaceous quartzite*
- **Hk** — *KITCHENER-SIYEH FORMATION: laminated, buff weathering, dolomitic and calcareous argillite and quartzite, green and black argillite; grey and pink quartzite; minor purple argillite*
- **Hdk** — *DUTCH CREEK and KITCHENER-SIYEH FORMATIONS: undivided*
- **Hc** — *CRESTON FORMATION: massive and laminated, green and grey weathering, green and grey argillaceous quartzite and quartzite, green argillite*

ALDRIDGE FORMATION

- **Hua** — *Upper Division: grey quartzite with partings of black argillite; thin-bedded, argillaceous quartzite and argillite*
- **Hla** — *Lower Division: thin-bedded, rusty weathering, light grey quartzite and argillaceous quartzite*

Geological boundary (defined, approximate, assumed)
Bedding, tops known (horizontal, inclined, vertical, overturned)
Bedding, tops unknown (inclined)
Igneous primary foliation (inclined, vertical)
Cleavage (inclined, vertical)
Schistosity (inclined, vertical)
Lineation (horizontal, inclined)
Fault (defined, approximate, assumed)
Anticline (defined, approximate)
Syncline (defined, approximate)
Anticline and syncline (overturned)
Anticline or syncline (arrow indicates plunge)
Anticline and syncline (general trend)

Geology by J.E. Reesor 1953-1956 and part of 1957
(part of Windermere from published report of J.F. Walker, 1926;
part of southwest corner of map-area from published report of J.T. Fyles, 1964)

To accompany Memoir 369 by J.E. Reesor

Geological cartography by the Geological Survey of Canada

Any revisions or additional geological information known to the user would be welcomed by the Geological Survey of Canada

Base-map at the same scale published by the Surveys and Mapping Branch in 1959

Copies of the topographical edition of this map may be obtained from the Map Distribution Office, Department of Energy, Mines and Resources, Ottawa

Magnetic declination 1971 varies from 22°07′ easterly at centre of west edge to 21°50′ easterly at centre of east edge. Mean annual change - 2.6′

Elevations in feet above mean sea-level

inches 0 1 2
centimetres 0 1 2 3 4 5

BRITISH COLUMBIA GEOLOGICAL SURVEY

This reference scale bar has been added to the original image. It will scale at the same rate as the image, therefore it can be used as a reference for the original size.

LOCATION OF MINERAL PROPERTIES

× (Symbol indicates accurate location; number only, approximate location)

NORTHEASTERN ZONE (east of Purcell divide)

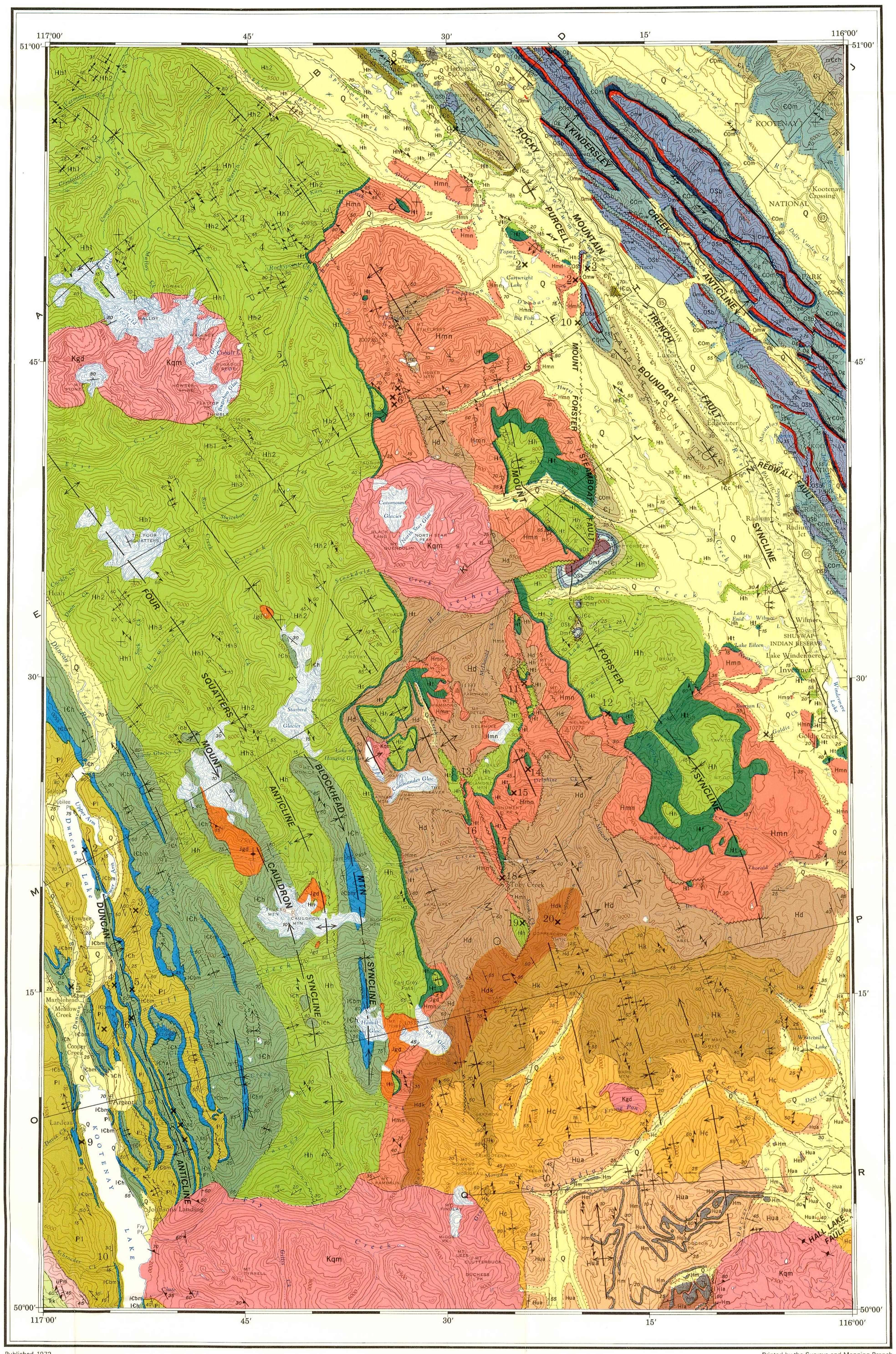
1. Ruth Vermont (Ag, Pb, Zn)
2. Atlas (Ag, Pb, Zn)
3. FE, HIL, etc. (Au, Ag, Pb, Zn)
4. Rocky Point-Warren Creeks (Cu)
5. Bugaboo Placer (uranium, columbium)
6. Lead Queen (Ag, Pb)
7. Steele Group (Ag, Pb)
8. Lead Mountain (Pb, Zn)
9. Silver Giant (Pb, Zn)
10. Jersey (Cu)
11. Ptarmigan (Ag)
12. Paradise (Ag, Pb, Zn)
13. Tatler, Great Northern, Copper King (Au, Ag, Pb, Zn, Cu)
14. Delphine (Ag, Pb)
15. Hot Punch (Ag, Pb, Zn)
16. Lisa A
17. Jumbo
18. Mineral King (Ag, Pb, Zn, Cu, Cd, barite)
19. Red Ledge (Ag, Pb, Zn)
20. Melody (Silver spray) (Ag, Pb, Zn)

SOUTHWESTERN ZONE (west of Purcell divide)

1. Omo (Pb, Zn)
2. Duncan (Pb, Zn)
3. Surprise (Ag, Cu)
4. Mag (Pb, Zn)
5. Lavina (Ag, Pb)
6. Argenta (Ag, Pb, Cu)
7. St. Patrick (Ag, Pb, Zn)
8. Sal (Pb, Zn)
9. Moonshine (Ag, Pb, Zn)
10. Hi-Lo (Ag, Pb, Zn)

NON-METALS

1. Baroid of Canada (barite)
2. A.P. Green Fire Brick Co., Ltd. (magnesite)
3. Mountain Minerals, Ltd. (barite)
4. Larrabee (barite)
5. Kootenay Marble Quarry (marble)



Published, 1972
Copies of this map maybe obtained from the Geological Survey of Canada, Ottawa

Printed by the Surveys and Mapping Branch

MAP 1326A

GEOLOGY

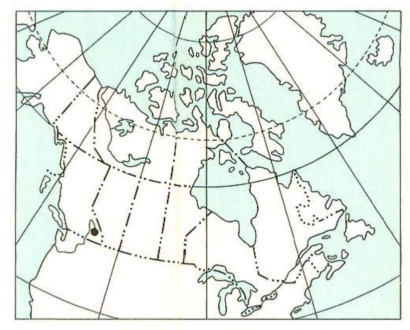
LARDEAU

(East Half)

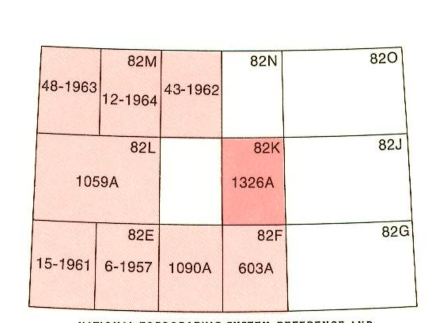
BRITISH COLUMBIA

Scale 1:250,000

Miles 4 0 4 8 12 Miles
Kilometres 6 0 6 12 18 Kilometres



INDEX MAP



NATIONAL TOPOGRAPHIC SYSTEM REFERENCE AND INDEX TO GEOLOGICAL SURVEY OF CANADA MAPS

MAP 1326A

LARDEAU

BRITISH COLUMBIA