

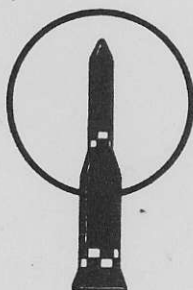
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JUNE 27, 1966

**MOLYBDENUM PROSPECTS**  
OF  
**APOLLO MINERALS LTD.**  
AT  
**ALICE ARM, B.C.**

BY  
**HAROLD A. QUINN**  
B.Sc., M.Sc., Ph.D., P.Eng.  
Consulting Geologist and Mining Engineer

# ENGINEERING REPORTS



**APOLLO MINERALS LTD. (N.P.L.)**

MOLYBDENUM PROSPECTS  
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HAROLD A. QUINN  
B.Sc. M.Sc. Ph.D.P. Eng.

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82 Mayfair Tower  
845 Hornby Street  
Vancouver 1, B.C.  
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27 June, 1966

HAROLD A. QUINN  
B.Sc. Ph.D., P.Eng.

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82 Mayfair Tower  
845 Hornby Street  
Vancouver 1, Canada.

27 June, 1966

Mr. N.E. Jenkinson,  
President,  
Apollo Minerals Ltd.,  
Suite 31, 845 Hornby St.,  
Vancouver 1, B.C.

Dear Sir,

As requested by you, I have prepared a report on the molybdenum properties of your Company at Alice Arm, province of British Columbia.

The report is based partly on a recent 8-day trip which I made to Alice Arm for your firm and during which I visited your Gus and Mac groups of mineral claims there. It is also based partly on study of the many items listed in its bibliography, and on discussions with numerous geologists, mining engineers, prospectors and others, both in Alice Arm and in Vancouver.

The report, including my recommendations, is submitted herewith.

Yours respectfully,

"H.A. Quinn"  
Harold A. Quinn

HAQ:iec

Encl.

## SUMMARY

Apollo Minerals Ltd., holds an option to purchase a 1/2 interest in two groups of strategically located mineral claims at Alice Arm, B.C. One of these, the Mac group of 35 claims, adjoins and lies between the properties of British Columbia Molybdenum Ltd., and Mastodon-Highland Bell Mines Ltd. The other, the Gus group of 20 claims, adjoins and lies between the properties of British Columbia Molybdenum Ltd., and Sileurian Chieftain Mining Co. Ltd.

An aeromagnetic anomaly reported over a prominent area of secondary biotite (alteration) on the Gus group indicates the probable occurrence beneath it of a stock of granite rocks. As this stock lies directly between the molybdenum-bearing stocks of B.C. Molybdenum and Sileurian Chieftain, it too, probably contains substantial amounts of molybdenum.

Aerial and ground work by some of the major mining exploration companies has established a north-trending belt of molybdenum-bearing granitic stocks. These stocks are found at intervals in the belt for 100 miles or more. It seems probable that this Alice Arm Molybdenum Belt will become, eventually, one of the world's largest sources of molybdenum

One of the stocks is now being brought into production by B.C. Molybdenum Ltd., a subsidiary of Kennecott Copper Corporation, at cost of \$23,000,000. The molybdenum content of another stock is currently being determined by four new diamond drills for a subsidiary of Newmont Mining Corporation. Exploration in 1965 by a subsidiary of Highland-Bell Ltd., discovered three or more new molybdenum-bearing granitic stocks.

In the light of all of the above circumstances, detailed and complete exploration of the Gus and Mac groups of claims must be carried out. It is recommended that \$60,310 be spent on preliminary exploration and survey of these properties in 1966.

## INTRODUCTION

I flew to Alice Arm from Vancouver for Apollo Minerals Ltd., on May 27 and returned to the city by air on June 3, 1966. During my six-day stay at Alice Arm I inspected the Company's Gus and Mac groups of mineral claims and visited the camps and mining properties of British Columbia Molybdenum Ltd., Newmont Mining Corporation of Canada Ltd., Sileurian Chieftain Mining Co. Ltd., and Dolly Varden Mines Ltd. Two visits were also made to the exploration tent camp of Amax Exploration Inc., on west bank of Kitsault River about three miles north of Alice Arm settlement. Mr. John N. Schindler, chief of the Amax exploration party, kindly took me by helicopter for an aerial reconnaissance of the Gus and Mac groups of Apollo Minerals Ltd., and for a visit to the camp and diamond drill of Sileurian Chieftain Mining Co. Ltd., on Roundy Creek.

Much useful, accurate and up to date information about the Alice Arm area and its molybdenum deposits was obtained during my trip. Additional information has been obtained in Vancouver during discussions with several geologists and mining engineers of the larger mining and exploration companies.

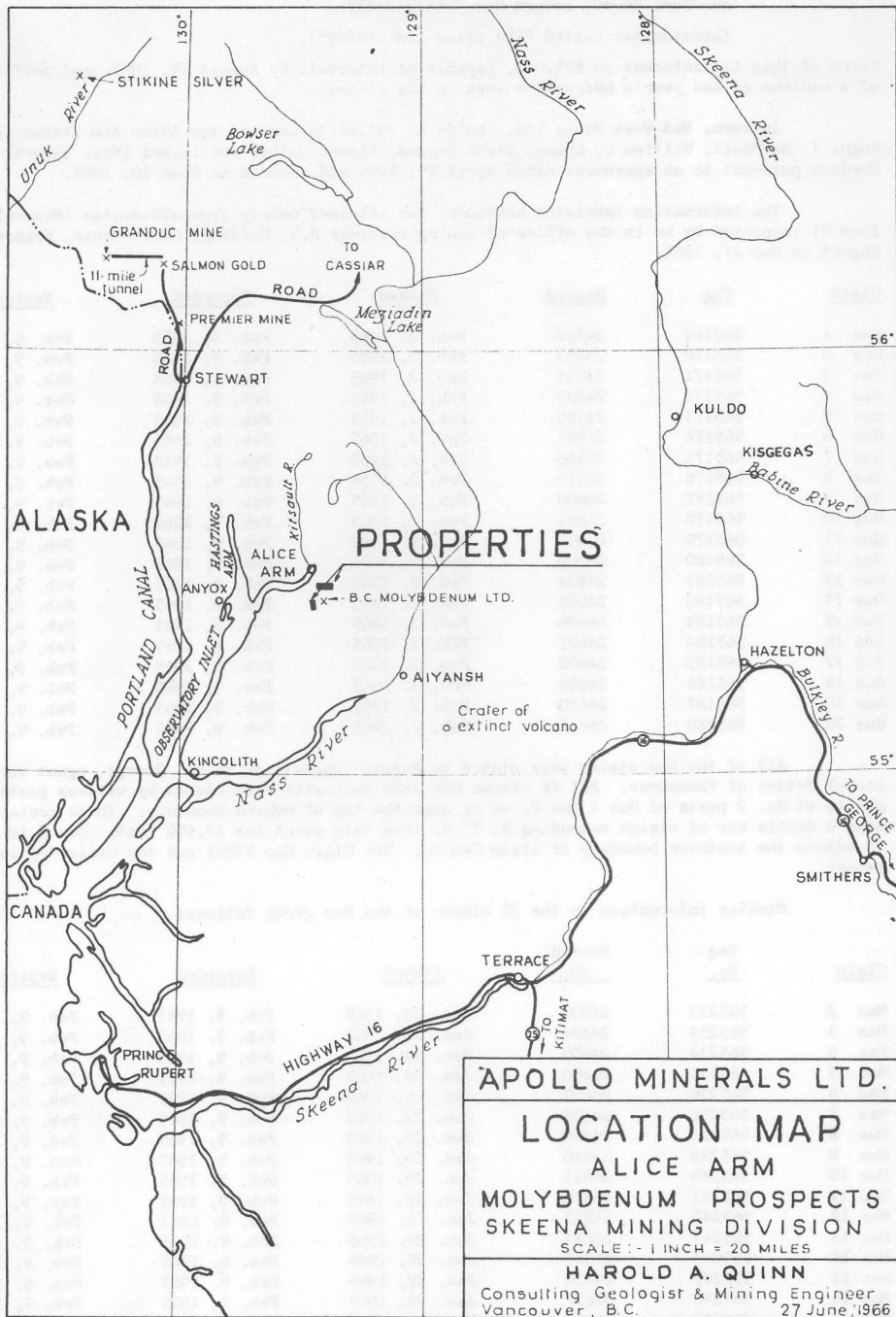
At Alice Arm, where there are no lodging and meals available for the general public, I was fortunate to be able to stay at the Dolly Varden guest house, by courtesy of Mr. T. E. Swanson, consulting mining engineer of Vancouver. The house is presently rented to Horie and Tynan Construction Ltd., which is extending the Government wharf. Some transportation of uncertain reliability was provided by ancient Jeep of Mr. Eric F. Lee, local agent for Imperial Oil Ltd., and Alice Arm Holdings Ltd. Additional transportation was provided by transfer service of Mr. Pete Neilsen. Mrs. Neilsen is local agent for Pacific Western Airlines Ltd., and looks after the radiotelephones of both this firm and of the Government (or B.C. Tel.?).

## THE PROPERTIES

According to its latest prospectus (39),\* Apollo Minerals Ltd., holds an option to purchase an undivided 1/2 interest from Mid-West Mines Ltd., in the following mineral claims in the Skeena Mining Division:

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\* Numbers in parentheses refer to Bibliography at end of this report.



Gus Nos. 1-20, record Nos. 24592-24611  
 Mac Nos. 2-31, record Nos. 24803-24832  
 Mac Nos. 36-40, record Nos. 24833-24837

(hereinafter called "The Alice Arm claims").

Price of this 1/2 interest is \$35,000, payable at intervals by August 15, 1967, and performance of a minimum of one year's assessment work on the claims.

In turn, Mid-West Mines Ltd., holds an option to acquire the Alice Arm claims from Angus I. MacPhail, William C. Lyons, Garth Braund, Lionel Setter and Isobel (Mrs. Robert) Goodson pursuant to an agreement dated April 29, 1965 and amended on June 10, 1965.

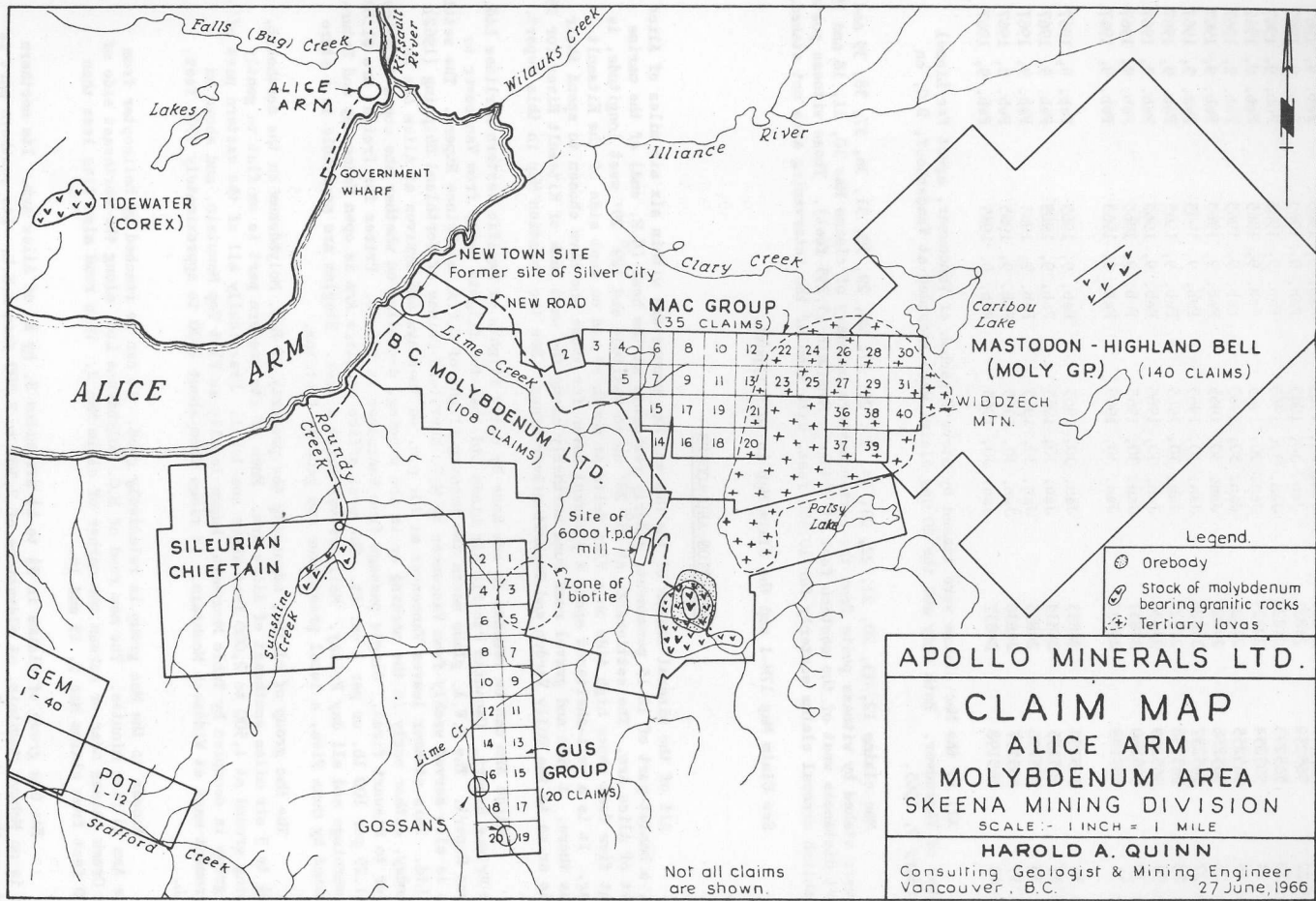
The information tabulated hereunder was obtained mainly from affidavits (Mineral Act, form G) inspected by me in the office of mining recorder H.W. Harding, Court House, Prince Rupert on May 27, 1966:

<u>Claim</u>	<u>Tag</u>	<u>Record</u>	<u>Staked</u>	<u>Recorded</u>	<u>Expires</u>
Gus 1	565169	24592	Feb. 2, 1965	Feb. 9, 1965	Feb. 9, 1967
Gus 2	565170	24593	Feb. 2, 1965	Feb. 9, 1965	Feb. 9, 1967
Gus 3	565171	24594	Feb. 2, 1965	Feb. 9, 1965	Feb. 9, 1967
Gus 4	565172	24595	Feb. 2, 1965	Feb. 9, 1965	Feb. 9, 1967
Gus 5	565173	24596	Feb. 2, 1965	Feb. 9, 1965	Feb. 9, 1967
Gus 6	565174	24597	Feb. 2, 1965	Feb. 9, 1965	Feb. 9, 1967
Gus 7	565175	24598	Feb. 2, 1965	Feb. 9, 1965	Feb. 9, 1967
Gus 8	565176	24599	Feb. 2, 1965	Feb. 9, 1965	Feb. 9, 1967
Gus 9	565177	24600	Feb. 2, 1965	Feb. 9, 1965	Feb. 9, 1967
Gus 10	565178	24601	Feb. 2, 1965	Feb. 9, 1965	Feb. 9, 1967
Gus 11	565179	26402	Feb. 2, 1965	Feb. 9, 1965	Feb. 9, 1967
Gus 12	565180	24603	Feb. 2, 1965	Feb. 9, 1965	Feb. 9, 1967
Gus 13	565181	24604	Feb. 2, 1965	Feb. 9, 1965	Feb. 9, 1967
Gus 14	565182	24605	Feb. 2, 1965	Feb. 9, 1965	Feb. 9, 1967
Gus 15	565183	24606	Feb. 2, 1965	Feb. 9, 1965	Feb. 9, 1967
Gus 16	565184	24607	Feb. 2, 1965	Feb. 9, 1965	Feb. 9, 1967
Gus 17	565185	24608	Feb. 2, 1965	Feb. 9, 1965	Feb. 9, 1967
Gus 18	565186	24609	Feb. 2, 1965	Feb. 9, 1965	Feb. 9, 1967
Gus 19	565187	24610	Feb. 2, 1965	Feb. 9, 1965	Feb. 9, 1967
Gus 20	565188	24611	Feb. 2, 1965	Feb. 9, 1965	Feb. 9, 1967

All of the Gus claims were staked by Murray Campbell of Prince George, agent for Lionel Setter of Vancouver. All of claims Gus 3-20 inclusive were staked by witness posts placed at No. 2 posts of Gus 1 and 2, on or near the top of Mohawk Mountain. These posts witness a double row of claims extending S. 5° E. from this point for 13,500 feet. Gus 2 is said to adjoin the southern boundary of claim Cam 20. See Claim Map 17M-1 and the Claim Map in this report.

Similar information on the 35 claims of the Mac group follows:

<u>Claim</u>	<u>Tag No.</u>	<u>Record No.</u>	<u>Staked</u>	<u>Recorded</u>	<u>Expires</u>
Mac 2	565232	24803	Jan. 28, 1965	Feb. 9, 1965	Feb. 9, 1967
Mac 3	565233	24804	Jan. 28, 1965	Feb. 9, 1965	Feb. 9, 1967
Mac 4	565234	24805	Jan. 28, 1965	Feb. 9, 1965	Feb. 9, 1967
Mac 5	565235	24806	Jan. 28, 1965	Feb. 9, 1965	Feb. 9, 1967
Mac 6	565236	24807	Jan. 29, 1965	Feb. 9, 1965	Feb. 9, 1967
Mac 7	565237	24808	Jan. 29, 1965	Feb. 9, 1965	Feb. 9, 1967
Mac 8	565238	24809	Jan. 29, 1965	Feb. 9, 1965	Feb. 9, 1967
Mac 9	565239	24810	Jan. 29, 1965	Feb. 9, 1965	Feb. 9, 1967
Mac 10	565240	24811	Jan. 29, 1965	Feb. 9, 1965	Feb. 9, 1967
Mac 11	565241	24812	Jan. 29, 1965	Feb. 9, 1965	Feb. 9, 1967
Mac 12	565242	24813	Jan. 29, 1965	Feb. 9, 1965	Feb. 9, 1967
Mac 13	565243	24814	Jan. 29, 1965	Feb. 9, 1965	Feb. 9, 1967
Mac 14	565244	24815	Jan. 29, 1965	Feb. 9, 1965	Feb. 9, 1967
Mac 15	565245	24816	Jan. 29, 1965	Feb. 9, 1965	Feb. 9, 1967
Mac 16	565246	24817	Jan. 29, 1965	Feb. 9, 1965	Feb. 9, 1967
Mac 17	565247	24818	Jan. 29, 1965	Feb. 9, 1965	Feb. 9, 1967
Mac 18	565248	24819	Jan. 29, 1965	Feb. 9, 1965	Feb. 9, 1967



APOLLO MINERALS LTD.

**CLAIM MAP**  
**ALICE ARM**  
**MOLYBDENUM AREA**  
**SKEENA MINING DIVISION**

SCALE - 1 INCH = 1 MILE

**HAROLD A. QUINN**  
 Consulting Geologist & Mining Engineer  
 Vancouver, B.C. 27 June, 1966

Not all claims  
 are shown.

Mac 19	565249	24820	Jan. 29, 1965	Feb. 9, 1965	Feb. 9, 1967
Mac 20	565250	24821	Jan. 29, 1965	Feb. 9, 1965	Feb. 9, 1967
Mac 21	565251	24822	Jan. 29, 1965	Feb. 9, 1965	Feb. 9, 1967
Mac 22	565252	24823	Jan. 30, 1965	Feb. 9, 1965	Feb. 9, 1967
Mac 23	565253	24824	Jan. 30, 1965	Feb. 9, 1965	Feb. 9, 1967
Mac 24	565254	24825	Jan. 30, 1965	Feb. 9, 1965	Feb. 9, 1967
Mac 25	565255	24826	Jan. 30, 1965	Feb. 9, 1965	Feb. 9, 1967
Mac 26	565256	24827	Jan. 30, 1965	Feb. 9, 1965	Feb. 9, 1967
Mac 27	565257	24828	Jan. 30, 1965	Feb. 9, 1965	Feb. 9, 1967
Mac 28	565258	24829	Jan. 30, 1965	Feb. 9, 1965	Feb. 9, 1967
Mac 29	565259	24830	Jan. 30, 1965	Feb. 9, 1965	Feb. 9, 1967
Mac 30	565260	24831	Jan. 30, 1965	Feb. 9, 1965	Feb. 9, 1967
Mac 31	565189	24832	Jan. 30, 1965	Feb. 9, 1965	Feb. 9, 1967
Mac 36	565194	24833	Jan. 30, 1965	Feb. 9, 1965	Feb. 9, 1967
Mac 37	565195	24834	Jan. 30, 1965	Feb. 9, 1965	Feb. 9, 1967
Mac 38	565196	24835	Jan. 30, 1965	Feb. 9, 1965	Feb. 9, 1967
Mac 39	565197	24836	Jan. 30, 1965	Feb. 9, 1965	Feb. 9, 1967
Mac 40	565198	24837	Jan. 30, 1965	Feb. 9, 1965	Feb. 9, 1967

All of the Mac claims were staked by Steve Ewaschuk of Vancouver, agent for Lionel Setter of Vancouver. Both they and the 20 Gus claims were recorded at Vanderhoof, B.C. on February 9, 1965.

Mac claims 12, 13, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 36, 37, 38, 39 and 40 were staked by witness posts from the common eastern boundary of claims Mac 10, 11, 18 and 19 short distances west of the western foot of Widdzech Mountain (3,295 feet). These witness posts establish mineral claims easterly for 10,500 feet, with some of the intervening area not staked.

See Claim Map 17M-1 and the Claim Map in this report.

#### LOCATION AND ACCESS

All of the mineral claims of the Gus and Mac groups are within six air miles of Alice Arm, a hamlet-port of 12-15 permanent, elderly residents at the head (N.E. end) of the marine inlet of Alice Arm. The settlement, at 55° 28' north latitude and 129° 29' west longitude, is about five feet above high tide on a flat delta at mouth of and on west side of the Kitsault River. It is a well-sheltered spot, a pleasant haven for those who have chosen to spend their lives there. A dirt and gravel road runs northerly along the west bank of Kitsault River for 16 miles or so to the Dolly Varden and Torbrit silver mines. See the Location Map in this report.

Alice Arm can be reached in one hour by daily flights of Pacific Western Airlines Ltd. from Prince Rupert. Canadian Pacific Air Lines Ltd. has two flights daily from Vancouver to Prince Rupert. The P.W.A. plane meets the morning flight of C.P.A. at Prince Rupert. The settlement is also served weekly from Vancouver by M.V. Northland Prince of Northland Shipping (1962) Co. Ltd. This steamer leaves Vancouver at 10: p.m. on Tuesdays and arrives at Alice Arm on Saturday, either early in the morning or in the evening, depending on whether she comes to Alice Arm or to Stewart first. Single passage from Vancouver is \$65.50. Prices for freight are \$1.08 to \$1.25 per 100 lb. or per 2 cu. ft. The post office at Alice Arm is open Wednesday and Saturday mornings and all day Friday. Mail arrives twice a week. Staples are available in a store operated by Gunn Fiva, a local prospector and general factotum.

The Mac group of claims, adjoining the property of B.C. Molybdenum on the northeast, is 2½ to 5 air miles southeast of Alice Arm. Much of its western part is on flat to gently sloping ground at 1,500 to 2,000 feet above sea-level. Practically all of the eastern part of the group is occupied by Table Mountain, known locally as Flat Top Mountain, and shown on Government maps at Widdzech Mountain. It rises from about 2500 to approximately 3500 feet A.S.L.

Access to the Mac group is relatively good. It can be reached by helicopter from Alice Arm in five minutes. The new road of B.C. Molybdenum Ltd. along the northeast side of Lime Creek passes near or across the corner of claim Mac 2. This road also lies less than 1,000 feet from claims Mac 5, 15 and 16.

The Gus group of claims is 3½ to 6½ air miles S. by E. of Alice Arm. Its northern part is on Mohawk Mountain, at elevations of 2,500 to 3,500 feet A.S.L. Its southern part is on the northern slopes of an unnamed, snow-capped mountain which rises to 5,000 feet A.S.L.

Except by helicopter, access to the Gus group is difficult. Perhaps the easiest route is up the valley of Lime Creek from site of the new mill of B.C. Molybdenum, a distance of 1 to 1½ miles. It is possible that an old trail exists here.

All bearings and directions given in this report are astronomic. The present magnetic declination at Alice Arm is about 28° E.

### HISTORY

The history of mining in the Alice Arm area is both old and new. General, intermittent prospecting of the area on a small scale probably began about 1898. Discovery of the Dolly Varden silver mine 16 miles north of Alice Arm in 1907 led to more intensive and widespread prospecting. A railroad was built to the mine in 1919 and 1,300,000 ounces of silver were produced during the next two years. In 1914 the Hidden Creek mine of Granby Consolidated Mining, Smelting & Power Co. began production at Anyox, 14 miles southwest of Alice Arm. This mine and the adjacent Bonanza mine of Granby Consolidated produced hundreds of millions of pounds of copper, many million ounces of silver and some hundreds of thousands ounces of gold. This substantial production led to more widespread prospecting of the Alice Arm area.

In 1947 Torbrit Silver Mines Ltd. acquired ground just across and on the eastern side of the Kitsault River from Dolly Varden. A 2,000 H.P. hydro-electric plant and a 400 t.p.d. mill were constructed. Some 19,000,000 ounces of silver were produced before the mine was closed in 1958.

Prospector William Maclean of Alice Arm discovered the molybdenite on Lime Creek in 1911. He staked the Canadian Girl mineral claim there, built a cabin on it and began driving an adit into the north wall of the canyon of Lime Creek. In 1916 he restaked the ground as the Caribou claim. In 1921 he staked the Lynx claim and drove his adit deeper. He tried in vain to interest Climax Molybdenum Ltd. of Colorado in the property.

During World War I a mill was built on a higher grade, but smaller, deposit of molybdenite at Alice Arm. Production was small, however, and interest in the molybdenite of the area waned, except briefly from 1929 to 1932. Interest was revived in 1956 and led to partial exploration of a deposit on Roundy Creek, four miles south of Alice Arm by Southwest Potash Corporation, exploration arm of American Metal Climax (Amamax) (24). This ground is now being explored further by Sileurian Chieftain Mining Co. Ltd.

About 1963 or earlier Patricia Barber of Alice Arm staked seven mineral claims on the Lime Creek molybdenite found in 1911 by Wm. Maclean. At some later date Gunn Fiva and Oscar Flint staked more claims over and/or around those of Patricia Barber. Their claims were purchased outright by Kennco Explorations (Western) Ltd. for \$37,000, of which Fiva received \$22,200. (60%) and Flint \$14,800. (40%). Kennco is reported to have paid about \$3,500. to Patricia Barber for her claims.

Early in 1965 or late in 1964 Kennco announced that its diamond drill programme of 44,648 feet in 66 holes had indicated the presence of 40,000,000 tons of ore with average grade of 0.23% Mo S<sub>2</sub> in an orebody of annular shape above the 1,600 foot elevation in and near a small stock of granodiorite-quartz diorite on Lime Creek (17). Kennco announced further that the orebody would be mined and milled by a new company, B.C. Molybdenum Ltd., at rate of 6,000 t.p.d. Estimated cost to production was about \$20,000,000. This figure has recently been increased to about \$23,000,000. Gunn Fiva advises that the tonnage given above includes 15,000,000 tons grading 0.36% Mo S<sub>2</sub>.

The above announcement led to the staking of a few hundred claims around the Kennco and Sileurian properties in January and February, 1965 by Lionel R. Setter and associates of Vancouver.

About April, 1965 prospector Stewart Barkley of Nelson, B.C. staked the Ajax group of claims on Mt. McGuire, eight miles N.N.E. of Alice Arm, for Newmont Mining Corporation of Canada Ltd. According to prospector Morris Petersen of Alice Arm, the molybdenite here was discovered in 1915 by Charles Gordon, policeman at Alice Arm. It was reported in 1927 by Howard T. James (2). Newmont now has four new diamond drills at work on the eastern slope of Mt. McGuire under supervision of Henry Brehaut. By the end of 1966 the company should know if an orebody exists there. In 1965 it made both high-level and low-level aeromagnetic surveys of most of the Alice Arm molybdenum belt. These surveys indicated several more stocks of granitic rocks, most of which have not yet been prospected for molybdenite.



During the summer of 1965, Mastodon-Highland Bell Mines Ltd. prospected quite a large area east and southeast of Alice Arm both by helicopter and by ground parties. Three or more Mo-bearing plugs, stocks or sills of granitic rocks were found and three groups of claims were staked. The largest of these groups, the Moly group of 128 claims, adjoins the Mac group of Apollo Minerals Ltd. on the northeast. M-Highland Bell is now exploring this group further. Some 30 miles of picket lines have been cut and complete soil sampling is in progress.

According to the residents of Alice Arm, no useful work has been done on the Gus and Mac groups to date. In the latter part of 1965 Merle Cloutier came to Alice Arm to examine the claims for Apollo Minerals Ltd. He stayed in the settlement for two or three days, and returned thence to the city. In the first half of February, 1966 Art Rivers and Fred Mack of Vancouver visited the Gus and Mac groups and did, or declared that they did, 450 cu. yd. of trenching on the Gus group and 780 cu. yd. of trenching on the Mac group — at total cost of \$5,535. for the two groups.

#### GEOLOGY

The geology of most of the Alice Arm area is not accurately known. Map 307A, Portland Canal Area, of the Geological Survey of Canada at scale of four miles to one inch was published in 1935, but it is based on reconnaissance field mapping done by various men between 1919 and 1932, without base maps of modern accuracy (1).

In 1964, N.C. Carter of the B.C. Department of Mines & Petroleum Resources, mapped the geology of 15 square miles of country extending south from Alice Arm for six miles. This mapping was done at scale of 1,000 feet to one inch and published at scale of 4,000 feet to one inch (2). It covers the Tidewater, Roundy Creek and Lime Creek (Alice) Molybdenum deposits.

On a regional scale Alice Arm is in the eastern part of the Coast Range Mountains. These mountains consist of rocks of Mesozoic age. Most of these rocks belong to the Hazelton group of sedimentary and igneous (mainly volcanic) rocks of Jurassic age. This group is intruded by batholithic and smaller bodies of Coast Intrusions, principally granite and related plutonic igneous rocks of acidic to intermediate types, all of them being of Jurassic or Cretaceous age.

The settlement of Alice Arm is underlain by sedimentary rocks of the Hazelton group. It is near the southern end of a northerly striking anticline some 18 miles wide. This big fold plunges gently to the south at its southern end and gently northward at its northern end. It includes both sedimentary and igneous rocks of the Hazelton group. The sediments consist mainly of argillite and greywacke, but they also include some quartzite and minor amounts of limestone and tuff. The igneous rocks of the group include both extrusive and intrusive rocks, the latter being of volcanic type. In the Alice Arm area they consist mainly of feldspar porphyry (felsite) and augite porphyrite, and fragmental rocks of similar compositions.

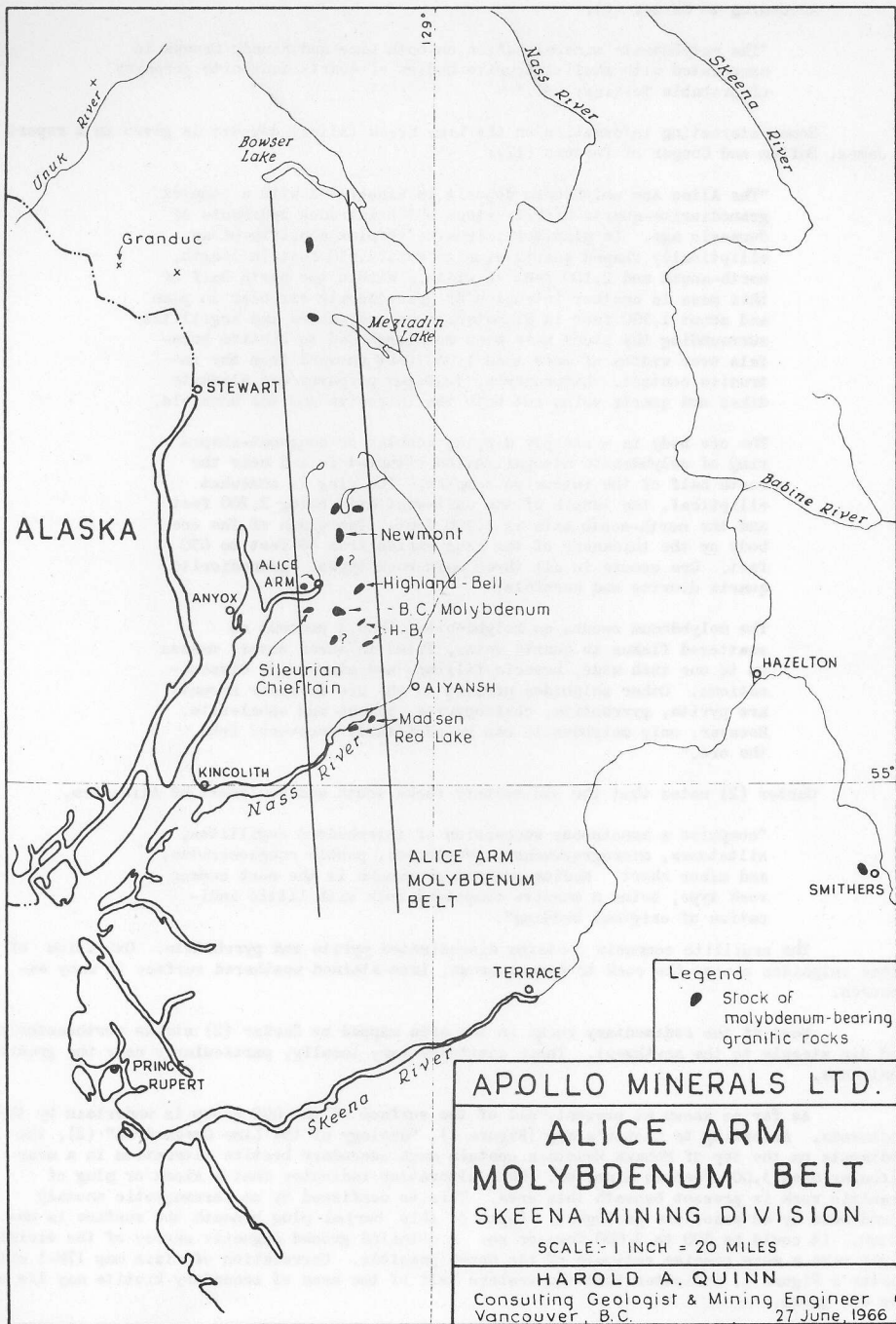
Many thousand dykes intrude both the Hazelton group rocks and the Coast-Intrusions. The dykes range from Jurassic to Tertiary in age and from gabbro to quartz porphyry in composition. They are from one inch to 100 yards or more wide. Dykes of diorite are found in the sediments on the shores of Alice Arm. A dyke of basalt or fine-grained gabbro is reported to cross the Illiance River north of Table Mountain.

Tertiary lavas of basaltic and phonolitic composition cap a few mountains between the Illiance and Nass rivers. One of these is Table (Widdzech) Mountain, four miles southeast of Alice Arm. In this mountain the horizontal lava flows are 10 to 50 feet thick and have a total thickness of 400 feet or more. They lie unconformably on the sediments of the Hazelton group.

Pleistocene and recent unconsolidated deposits include boulder clay, stratified blue clays, varved clays, gravel, sand and silt. The flat on which the settlement of Alice Arm stands consists of silt deposited there from the Kitsault, Dak and Illiance rivers. Gravel terraces are reported in the valley of Lime Creek at elevations of about 275,300, and 450 feet above sea-level.

#### ROCK TYPES AND MINERALIZATION

Most of the molybdenum found in the area to date is in and associated with small to medium sized plugs, stocks (and sills?) of granitic composition intruding interbedded argillite, greywacke and tuffaceous volcanics of the Hazelton group. As far as I know, no appreciable amounts of molybdenum have been found in stocks intruding only volcanic rocks.



According to Carter (2),

"The molybdenite mineralization on both Lime and Roundy Creeks is associated with small intrusive bodies of quartz monzonite porphyry of probable Tertiary age."

Some interesting information on the Lime Creek (Alice) deposit is given in a report by James, Buffam and Cooper of Toronto (17):

"The Alice Arm molybdenum deposit is associated with a complex granodiorite-quartz diorite stock which intrudes sediments of Jurassic age. In plan the intrusive complex consists of an elliptically shaped quartz diorite mass 2,650 feet in length, north-south and 2,100 feet in width. Within the north half of this mass is another intrusion of granodiorite circular in plan and about 1,500 feet in diameter. The greywackes and argillites surrounding the stock have been metamorphosed to biotite hornfels over widths of more than 1,000 feet outward from the intrusive contact. Lamprophyre, feldspar porphyry and alaskite dikes and quartz veins cut both the intrusive and the hornfels.

The ore body is a steeply dipping annular or doughnut-shaped ring of molybdenite mineralization situated in and near the north half of the intrusive complex. The ring is somewhat elliptical, the length of the east-west axis being 2,200 feet and the north-south axis is 1,500 feet. The width of the ore body or the thickness of the ring varies from 80 feet to 650 feet. Ore occurs in all three main rock types: granodiorite, quartz diorite and hornfels.

The molybdenum occurs as molybdenite, ( $\text{MoS}_2$ ) present as scattered flakes in quartz veins, films in shear zones, masses up to one inch wide, breccia filling, and minor fine disseminations. Other sulphides present in the ore in minor amounts are pyrite, pyrrhotite, chalcopyrite, galena and sphalerite. However, only molybdenite can be profitably recovered from the ore."

Carter (2) notes that the sedimentary rocks south and southeast of Alice Arm,

"comprise a monotonous succession of interbedded argillites, siltstones, microgreywackes, greywackes, pebble conglomerates, and minor chert. Medium-grained greywacke is the most common rock type, being a massive competent rock with little indication of original bedding".

The argillite commonly contains disseminated pyrite and pyrrhotite. Oxidation of these sulphides causes the rock to have a brown, iron-stained weathered surface in many exposures.

Most of the sedimentary rocks in the area mapped by Carter (2) strike northeasterly and dip steeply to the northwest. Their attitudes vary locally, particularly near the granitic contacts.

As far as known at present, all of the surface of the GUS group is underlain by the sediments. According to Carter's map (Figure 1), "Geology of the Lime Creek Area" (2), the sediments on the top of Mohawk Mountain contain much secondary biotite alteration in a near-circular area 3,000 feet in diameter. This alteration indicates that a stock or plug of granitic rock is present beneath this area. This is confirmed by an aeromagnetic anomaly found here by an associate geologist. Depth of this buried plug beneath the surface is unknown. It could be 500 to 2,000 feet or so. A detailed ground magnetic survey of the vicinity might make a more precise estimate of its depth possible. Correlation of claim map 17M-1 with Carter's Figure 1, indicates that the western half of the area of secondary biotite may lie on the Gus group.

During a helicopter recce of June 1 I noticed two prominent oxidized areas (gossans) in the southern part of the Gus group. These were seen in the canyon of a creek on the southwestern headwaters of Lime Creek. See the Claim Map in this report. The creek runs N.N.W.,

about parallel to Roundy Creek. These gossans are probably less than 1/2 mile east of the main contact of the granite of the Coast Range batholith. They may represent only rusty-weathering argillite or possibly an oxidized mineralized zone of economic importance.

Practically all of the eastern 1/2 of the MAC group is occupied by Widdzech Mountain, composed of sub-horizontal flows and beds of Tertiary volcanics. These volcanics consist of basalt, phonolite and trachyte. The chances of their containing any economic mineral deposits are slight.

The western 1/2 of the Mac group appears to be underlain by Hazelton sediments. An outcrop of these rocks on the shore of a tiny lake which I visited on June 1, 1966 consists of beds of greywacke striking N. 46° E. and dipping 70° S.E.

#### PRODUCTION AND ORE RESERVES

As the mineral claims of the Gus and Mac groups were staked on the snow because of their proximity to the important molybdenum orebody of B.C. Molybdenum Ltd. and as they have not been explored for minerals, no reserves of ore have been found on them and no ore has been produced from them.

#### CONCLUSIONS

1. Apollo Minerals Ltd. holds an option to purchase a 1/2 interest in two groups of strategically located mineral claims at Alice Arm, B.C.
2. The Mac group of 35 claims adjoins and lies between the molybdenum properties of British Columbia Molybdenum Ltd. and Mastodon-Highland Bell Mines Ltd.
3. The Gus group of 20 claims adjoins and lies between the molybdenum properties of British Columbia Molybdenum Ltd. and Sileurian Chieftain Mining Co. Ltd.
4. The Gus group contains part of a buried stock of granite which probably contains substantial amounts of molybdenum.
5. Both groups of claims lie within the major, north-trending Alice Arm Molybdenum Belt which has a length of at least 100 miles. More than ten molybdenum - bearing granitic stocks have been discovered in the Belt to date.
6. One of these stocks, known as Lime Creek or Alice, is being brought into production by B.C. Molybdenum Ltd., a subsidiary of the Kennecott Copper Corporation, at cost of \$23,000,000.
7. Another stock, on Mt. McGuire, is currently being tested for its molybdenum content with four new diamond drills by a subsidiary of Newmont Mining Corporation.
8. Two other stocks, on the Nass River, some 25 miles S.S.E. of Alice Arm, are being explored for molybdenum by Madsen Red Lake Gold Mines Ltd. and several associated larger mining companies.
9. Both the Gus and Mac groups of claims are underlain by sediments, in which all of the molybdenum-bearing granitic plugs have been found to date.
10. Two gossans in the southern part of the Gus group may indicate the presence of important mineralized zones there.
11. Careful and complete exploration of the Gus and Mac groups of mineral claims is warranted, both by their geological environment and by the mining developments on adjoining and adjacent properties.

RECOMMENDATIONS

1. Establish chained base lines on both the Gus and Mac groups of claims, parallel to the longest direction of each group.
2. Cut and chain picket lines across these two baselines at 400-foot intervals.
3. Take soil samples along these picket lines at 200-foot intervals.
4. Find all claim posts, and record their locations by coordinates of the grid of picket lines.
5. Stake all fractions open within each group, and all ground open for staking between the groups and the property of B.C. Molybdenum Ltd. (Claims COR 1 and 2 are reported to be open )
6. Have all of the 1,370 soil samples analyzed for molybdenum and copper, and plot the results on two maps based on the grids of picket lines.
7. Prospect both groups of claims carefully and completely. As the Gus group is still mostly covered by snow, the Mac group should be prospected first.
8. Consider the advisability of dropping all claims of the Mac group which are covered by the Tertiary volcanic rocks of Widdzech Mountain. Preliminary, and perhaps inexact, information indicates that these claims are Mac 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 36, 37, 38, 39 and 40.
9. Make a magnetometer survey of both groups of claims. For the Gus group, this survey should include an area up to 2,000 feet east of the northern 8 claims of the group.
10. Use the magnetic data to estimate the depth of the buried granite plug in the northern part of the Gus group.
11. Investigate and sample the two gossans on the southwestern headwaters of Lime Creek.
12. Survey the location lines of all claims of the Gus group, and of all claims of the Mac group lying west of Widdzech Mountain. A reliable firm of experienced land surveyors should be retained for this work.
13. Map the geology of both groups at scale of 400 feet to 1 inch.
14. If the depth of the buried granite plug estimated under item (10) above is less than say 700 feet, but down 1 diamond drill hole to 1,000 feet depth as a preliminary test of the plug for molybdenum.

ESTIMATE OF COST

(1)	Line Cutting:		
	(a) Mac group		
	Base Line . . . . .		2-3/4 miles
	Picket lines, 1 mile long at intervals of 400 ft		35 miles
	(b) Gus group		
	Base line . . . . .		2-1/2 miles
	Picket lines, 1/2 mile long x 400' apart		<u>16-1/2 miles</u>
	<b>TOTAL</b>		<u><u>57 Miles</u></u>

	Therefore, say 55 miles @ \$110/mile . . . . .	\$ 6,050.
(2)	Soil sampling - 52 line miles @ \$30/mile . . . . .	1,560.
(3)	Analyses of 1,370 soil samples for Mo & Cu @ \$2.00 . . . . .	2,740.
(4)	Staking of fractions and finding posts - say - . . . . .	1,000.
(5)	Prospecting - 2 men for 70 days @ \$30/day/man . . . . .	4,200.
(6)	Magnetometer survey - 57 line miles @ \$50 . . . . .	2,850.
(7)	Assaying of samples collected by prospectors . . . . .	500.
(8)	Geological mapping . . . . .	3,000.
(9)	Survey of location lines of 40 claims @ \$325. . . . .	13,000.
(10)	Diamond drilling - 1,000 ft. AXT core @ \$12. . . . .	12,000.
(11)	Engineering and supervision . . . . .	3,000.
(12)	Transport of men to and from Alice Arm by air @ \$130. return from Vancouver. Say 10 men . . . . .	1,300.
(13)	Helicopter transport at Alice Arm; say 3 trips of one hour each/wk. for 10 weeks. Therefore 30 hours @ \$120/hr. . . . .	3,600.
(14)	Expediter at Alice Arm, part time - 3 months @ \$100. . . . .	300.
(15)	Contingency . . . . .	5,210.
	TOTAL ESTIMATED COST . . . . .	<u>\$60,310.</u>

BIBLIOGRAPHY

(Alice Arm Area, B.C. and Molybdenum)

- (1) Hanson, George (1935) - Portland Canal Area, British Columbia; G.S.C., mem.175, pp. 179, plus 2 maps in pocket:  
OTTAWA.  
307A - Portland Canal Area (Geology), 1" = 4 miles.  
315A - Mining Properties in the Portland Canal Area,  
Cassiar District, B.C. 1" = 4 miles.
- (2) Minister of Mines and Petroleum Resources, Victoria, B.C.:  
Annual Reports for the years:  
1964 - N.C. Carter, pp. 24-25.  
1963 - H. Bapty, pp. 12-13.  
1961 - W.C. Robinson, p. 10.  
1960 - W.C. Robinson, pp. 8-10.  
1959 - W.C. Robinson, pp. 8-10.  
1927 - H.T. James, p. C74 (Le Roy property, ground now  
held by Newmont Mining Corp. of Canada Ltd.)  
1916 - J.M. Turnbull, pp. K53-84 (Caribou group, p. K66,  
ground now held by B.C. Molybdenum Ltd.).
- (3) Schneider, V.B. (1965) - Molybdenum 1964; Mineral Resources Div.,  
Dept. Mines & Tech. Surveys, prelim. mineral review No. 38,  
pp. 11, Ottawa, May, 1965.
- (4) Fawley, Allan P. (1965) - The Gus and Mac Groups of Mineral Claims,  
Alice Arm, B.C. of Mid-West Mines Ltd.; private report for  
Mid-West Mines Ltd., Vancouver, 7 pages, plus 1 or 2 maps,  
June 2, 1965.
- (5) Royal Securities Corp. Ltd. (1966) - The Outlook for the Canadian  
Molybdenum Industry; pamph. re. sale debentures of B.C.  
Molybdenum Ltd., 8 pages, Vancouver, March 18, 1966.
- (6) George Cross News Letter, Vancouver:  
No. 62 (1965) - March 30 - p.2  
No. 76 (1965) - April 21 - p.4  
No. 99 (1965) - May 25 - p.3  
No.100 (1965) - May 26 - p.4  
No.104 (1965) - June 1 - p.3  
No.105 (1965)  
No.111 (1965) - June 10 - Map  
No.137 (1965) - July 19 - p.2  
No. 92 (1966) - May 12 - p.3 Plus many others.

- (7) Dept. Mines & Tech. Surveys (1960) - Nass River, Cassiar District, B.C.: topo. map 103P, edition 2, produced by the Army Survey Establishment, scale 1:250,000 (1" = 4 miles, approx.), Ottawa.
- (8) Dept. Lands, Forests & Water Resources (1963) - Nass River, B.C., Cassiar Land District, Sheet 103P and part of 1030, 2nd status edn.; Geographic Division, Surveys & Mapping Branch, scale 1:250,000 (1" = 4 miles, approx.), Victoria.
- (9) Dept. Mines & Petroleum Resources (1966) - Mineral Claims Map 17M - 1; scale 1" = 1/2 mile, Victoria. (Parts of claim maps 17, 17B, 50 and 126 may be relevant also.)
- (10) Stevenson, John S. (1940) - Molybdenum Deposits of British Columbia; Dept. of Mines, Bulletin No. 9, pp. 96, Victoria.
- (11) Vokes, F.M. (1963) - Molybdenum Deposits of Canada; Geol. Surv. of Canada, Ec. Geol. Rept. No. 20, pp. 332, Ottawa.
- (12) (Author?) (1925) - Molybdenum: Metallurgy and Uses and the Occurrence Mining and Concentration of its Ores; Canada Dept. Mines, Mines Branch, Pub.592, pp., Ottawa.
- (13) (Author?) (1920) - Molybdenite in Canada; Munitions Res. Comm., Canada, pp., Ottawa.
- (14) U.S. Bureau of Mines: Molybdenum Monthly; (Pittsburgh?).
- (15) (Author?) (1915) - A List of Canadian Mineral Occurrences; Geol. Surv., Canada, Mem. 74, pp., Ottawa.
- (16) (Author?) (1911) - Report on the Molybdenum Ores of Canada; Dept. Mines, Mines Br., Canada, pp., Ottawa.
- (17) British Columbia Molybdenum Ltd. (1966) - Prospectus offering for sale \$17,000,000 of the company's 5 $\frac{1}{2}$ % debentures, series A - to raise most of the \$20,000,000 required to bring its Alice Arm molybdenum property into production at rate of 6,000 tons per day. Underwritten by Royal Securities Corp. Ltd., Vancouver, March 23, 1966.
- (18) B.C. Hydro & Power Authority (1966) - The Mining Industry of British Columbia and the Yukon; Industrial Development Dept., Industry Summary, 2nd edition, 45 pages, Vancouver, January, 1966.
- (19) Anonymous (1966) - Big Boom in British Columbia; World Mining, International Edition, vol. 19, No. 4, April., pp. 44-46, San Francisco and Brussels.
- (20) Climax Molybdenum Co. ( ) - What is Molybdenum; brochure, — pages, New York, (1966?).
- (21) Price, Franklin, L.C. (1965) - Private report on COR 1 - 24 mineral claims near Alice Arm, B.C. for Kidd Mining Co. Ltd., Toronto; 14 pages, plus 2 maps, Vancouver, June 14, 1965.
- (22) Price, F.L.C. (1965) - Private report on FYA 21-30 mineral claims near Alice Arm, Skeena Mining Division, B.C. for Marpat Mines Ltd., Toronto; 15 pages plus 2 maps, Vancouver, June 18, 1965.
- (23) Price, F.L.C. (1965) - Private report on mineral claims FYA 11 - 20 and 31 - 40 near Alice Arm, Skeena Mining Div., B.C. for Janlee Exploration Ltd., Toronto; 13 pages plus 2 maps, Vancouver, June 18, 1965.
- (24) Hodder, R.W. (1960) - Final Report, Roundy Creek Molybdenum Prospects, B.C., 103 N.E. - Prince Rupert District; private report for Southwest Potash Corp. (Amax), 20 pages plus 7 maps, Vancouver,

October 19, 1960. (One of the maps is "Geology of the Roundy Creek Molybdenite Prospect" by R.W. Hodder, 1 in. = 50 feet, October, 1960.)

- (25) The Vancouver Board of Trade (1965) - Report on Northern British Columbia Resource Development - 1965; prepared by Primary Resources Committee, 109 pages plus several maps, 1164 Melville St., Vancouver, December 1965 (\$5.00).
- (26) C.I.M. (1966) - Tectonic History and Mineral Deposits of the Cordillera in British Columbia and adjoining parts of the United States and Alaska; Can. Inst. Min. & Met., Special Volume No. 8, 343 pages (8½ x 11) plus 10 folding maps, 25 papers, 110 pages of diagrams and maps, Montreal, 1966. (Includes a paper on property of B.C. Molybdenum Ltd. by J. Richard Woodcock, Ben A. Bradshaw and Charles S. Ney, titled "Molybdenum Deposits at Alice Arm, British Columbia".
- (27) Fawley, A.P. (1965) - The Roundy Creek Property, Alice Arm, B.C.; private report for Sileurian Chieftain Mining Co. Ltd., 10 pages, Vancouver, June 4, 1965.
- (28) Sileurian Chieftain Mining Co. Ltd. (1965) - Annual Report; 10 pages, Vancouver, October 31, 1965. (Includes a 2-page report by Walter Eilers, president.)
- (29) Cannon, D.M. (1965) - Ajax Group, Skeena Mining Division, B.C.; private report for Newmont Mining Corporation of Canada Ltd., 10 pages, Vancouver, December, 1965.
- (30) Lowdon, J. Russell (1960) - Reconnaissance of Alice Arm District; private report for Southwest Potash Corp. (Amax), - pages, Vancouver.
- (31) Kitsault River Mining & Development Co. Ltd. (1925) - Prospectus; 9 pages, Vancouver, January 8, 1925.
- (32) Schindler, John N. (1965) - Reconnaissance of Terrace District, B.C.; private report for Southwest Potash Corp. or Amax Exploration Inc., - pages, Vancouver.
- (33) Schindler, John N. (1966) - Reconnaissance of Alice Arm Area, B.C.; private report for Amax Exploration Inc., - pages, Vancouver, autumn 1966.
- (34) Hawkes, H.E. (1957) - Principles of Geochemical Prospecting; U S G S, Bulletin 1000 - F, - pages, Washington, D.C.
- (35) Hawkes, H.E. and Webb, J.S. (1962) - Geochemistry in Mineral Exploration; 415 pages, Harper & Row, New York.
- (36) Warren, Harry Verney (1961) - Aqua Regia Extractable Lead & Molybdenum in Eruptive Rocks; Roy. Soc. Canada, Trans., 3rd series, vol. LV, p. 67-73, Ottawa, 1961.
- (37) Warren, H.V. (1965) - Further Studies of Biogeochemistry of Molybdenum; Western Miner, vol. 38, No. 10, p. 64-72, Vancouver, Oct., 1965.
- (38) Stephens, Fred H. (1965) - Endako Mines; Western Miner, Endako Number, vol. 38, No. 5, p. 38-60, Vancouver, May, 1965.
- (39) Apollo Minerals Ltd. (1966) - Prospectus, offering 200,000 of the Company's shares for sale at 45¢ each; 4 pages, plus exhibits A and B, Vancouver, May 4, 1966.



Little, Heward W. (1962) - Geological Map of British Columbia; Geol. Survey Canada, Map 932A (2nd edn.), scale 1" = 20 miles, Ottawa.

Respectfully submitted,

"Harold A. Quinn"  
Harold A. Quinn  
B. Sc. M.Sc. Ph.D. P. Eng.

Vancouver, B.C.  
June 27, 1966.

CERTIFICATE

I, Harold Arthur Quinn, do hereby certify that:

- (1) I am a practising Consulting Geologist and Mining Engineer with offices and residence at 82 Mayfair Tower, 845 Hornby Street, Vancouver, Province of British Columbia, Canada.
- (2) I have received the following University degrees:
  - (a) B.Sc. (hons.) in Mining Engineering from Queen's University, Kingston, Ontario, 1941.
  - (b) M. Sc. in Geology from Queen's University, 1942.
  - (c) Ph.D. in Geology from Cornell University, Ithaca, New York, U.S.A., 1950.
- (3) I have practised my profession for more than 25 years.
- (4) I am a member, in good standing, of the Associations of Professional Engineers of the Province of Ontario and Yukon Territory.
- (5) I am a fellow of the Geological Society of America and of the Geological Association of Canada, and a member of the Canadian Institute of Mining and Metallurgy.
- (6) I am the author of 20 published reports, articles, papers and maps on mining and geological matters in Canada and various other countries.
- (7) This certificate is part of the attached report on "Molybdenum Prospects of Apollo Minerals Ltd. at Alice Arm, B.C.", dated June 27, 1966.
- (8) This report is based on my examinations of the Gus and Mac groups of mineral claims at Alice Arm, B.C. on June 1, 1966, on study of the items listed in its Bibliography, and on discussions with several geologists, mining engineers, prospectors and others.
- (9) I have no direct, indirect or expected interest in the properties or securities of Apollo Minerals Ltd.

"H. A. Quinn"  
Harold A. Quinn  
B.Sc. Ph.D. P.Eng. (Ont. & Yukon)

Vancouver, B.C.  
27 June, 1966.