THE MAC PORPHYRY MOLYBDENITE PROPERTY, CENTRAL BRITISH COLUMBIA (93K/13E)

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INTRODUCTION

The Mac porphyry molybdenum property in the Intermontane Belt, 100 kilometres east of Smithers and 47 kilometres north-northwest of the south tip of Babine Lake, was discovered in 1982 by follow-up prospecting based on lake-sediment geochemical anomalies. There is about 2 per cent outcrop in the heavily timbered and covered area of the showings.

GEOLOGY

Regionally the Mac deposit is within a north-northwest-trending belt of Carboniferous or Permian greenstone, argillite, and chert (Armstrong, 1949). Near the property, these rocks are intruded by elongate, narrow bodies of peridotite and gabbro that are assigned to the Mesozoic Trembleur intrusions, and by granitic bodies assigned to the Upper Jurassic or Lower Cretaceous Omineca intrusions. These intrusions, dated as Lower Cretaceous (Table 1), are similar to the Topley intrusions (White, *et al.*, 1970) in age, molybdenum association, and initial strontium isotope ratios (Table 2).

Major units near the Mac property are shown on Figure 144. Schistose, actinolitic, chloritic basic metavolcanic rocks (Fig. 144, unit 1), and metaserpentinite bodies (unit 2) have been intruded by Lower Cretaceous (Table 1) granitic stocks consisting of medium-grained, biotite granodiorite (unit 3), and medium-grained, leucocratic quartz monzonite (unit 4). The granodiorite apparently generated a hornfelsic aureole up to 1 000 metres wide in the intruded units (Fig. 144). The hornfels is characterized by lack of schistosity, 2 per cent disseminated pyrite with lesser pyrrhotite, and local, weak biotitization. Quartz monzonite apparently intrudes the hornfels; therefore the quartz monzonite is at least somewhat younger than the granodiorite.

MINERALIZATION

Most of the molybdenite occurs in microveins and in quartz veins. These form stockwork and sheeted zones in the medium-grained leucocratic quartz monzonite host rock (Fig. 144). Only traces of molybdenite are found in

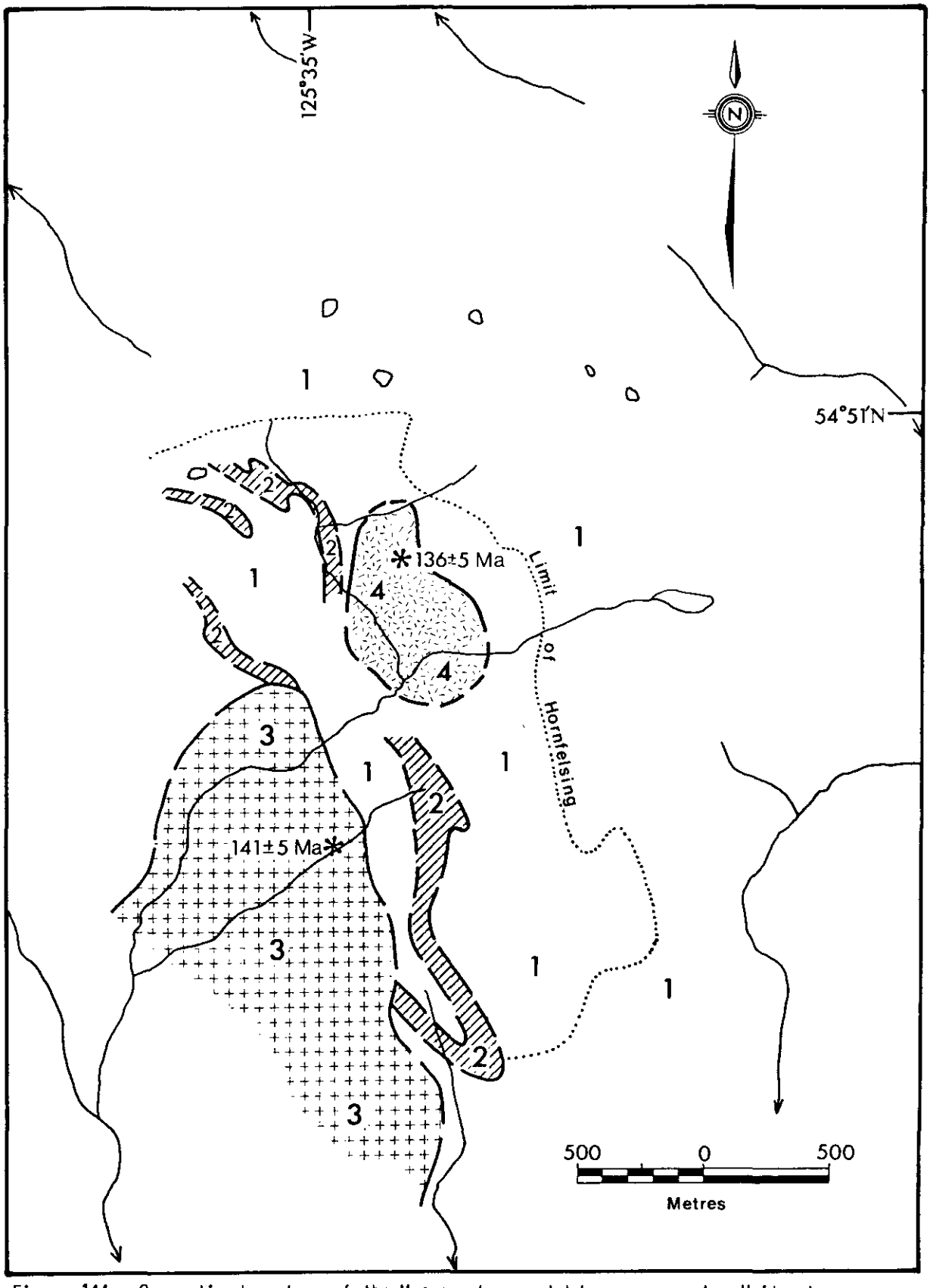

Figure 144. Generalized geology of the Mac porphyry molybdenum prospect. Units shown are: 1 — schistose, basic metavolcanic rocks; 2 -- metaserpentinite; 3 — biotite hornblende granodiorite; 4 -- leucocratic quartz monzonite. K/Ar date of 141±5 Ma is from sample G84MAC1 (Tables 1 and 2); date of 136±5 Ma is from G84MAC4 (Table 1).

microveins and quartz veins in the hornfels near the contact with the stock. Surface outcrops of the quartz monzonite commonly show no molybdenite and only traces of ferrimolybdite, but about 20 trenches and pits reveal molybdenite in freshly broken rock that is more than 1 centimetre in depth. Grades obtained in many of the areas sampled are between 0.018 and 0.166 per cent molybdenum. Limits of the mineralization have not been defined, however, trenching and pitting have exposed mineralization over a rectangular area which is about 500 metres long (northwest-southeast) and 200 metres wide.

Quartz-molybdenite veins contain less than 1 per cent pyrite and minor amounts of chalcopyrite. Alteration, which is generally weak, is most intense within a few centimetres of the veins. Envelopes of sericitic alteration are characteristic, but rare envelopes contain secondary biotite.

K-AR AND RB-SR ISOTOPE DATA

Potassium-argon dates on biotite from a regionally extensive granodiorite, and from altered leucocratic quartz monzonite associated with molybdenite mineralization, yielded Lower Cretaceous ages of 141±5 and 136±5 Ma respectively (Table 1). These dates are close to the Jurassic-Cretaceous boundary at 143 Ma (Armstrong, 1978) or 144 Ma (Harland, *et al.*, 1982). These ages are indistinguishable from those from the Topley intrusions (White, *et al.*, 1968; White, *et al.*, 1970) which contain the major Endako molybdenite porphyry mine, 95 kilometres south-southeast of the Mac property.

The initial ^{87}Sr to ^{86}Sr ratio of 0.7035 for the granodiorite (Table 2) is typical for most of plutonic rocks in this part of the Intermontane Belt of the Canadian Cordillera (R. L. Armstrong, personal communication, 1984). This ratio is slightly lower than those for the Topley intrusions in the Endako area, which are 0.7040 (R. L. Armstrong, unpublished data), for values from the Intermontane Belt near Whitehorse, Yukon Territory, which are 0.704 to 0.705 (Morrison, *et al.*, 1979), and for intrusions at Quartz Hill, Alaska, which are 0.705 (Karimpour and Bowes, 1983). Initial ratios from intrusives associated with molybdenum, tungsten, and tin deposits, which are emplaced in thick sequences of crustal rocks, tend to be markedly higher. Examples of this include 0.706 to 0.713 for the 'eastern suite' described in the northern and eastern part of the Canadian Cordillera (Sinclair, in press), and 0.706 to 0.710 for the Henderson type of molybdenum deposit in Colorado (Karimpour and Bowes, 1983).

CONCLUSIONS

The Mac property represents a new, significant molybdenum porphyry prospect. The geological setting, age, and initial strontium isotope ratios are very similar to those of the Topley intrusions, which host the

TABLE 1. Potasium-argon data from biotite for granitic rocks near the Mac property, central British Columbia.

Sample number	Location lat(°N)	Location long(°W)	Rock unit and rock name	%K (±)	$^{40}Ar^{*\prime}$ / $^{40}Ar_{total}$ [2]	$^{40}Ar^{*}$ / 10^{-5} cm^3 STP/g [2]	Apparent age (Ma)[3]	Time[4]
G84MAC1BI	54.85	125.58	Medium grained biotite granodiorite	6.34 0.03	0.970	3.6220	141 ± 5	Lower Cretaceous
G84MAC4BI	54.86	125.58	Medium grained leucocratic quartz monzonite	6.82 0.13	0.961	3.7439	136 ± 5	Lower Cretaceous

1. Argon analyses are by J. Harakal and potassium analyses are by K. Scott; all analyses were done at the Geochronology Laboratory, The University of British Columbia
2. Ar^{*} indicates radiogenic argon
3. Constants used are from Steiger and Jager (1977): $\lambda_e = 0.581 \times 10^{-10}\ yr^{-1}$; $\lambda_\beta = 4.962 \times 10^{-10}\ yr^{-1}$; $^{40}K/K = 1.167 \times 10^{-4}$
4. Time designation is from Armstrong (1978) and Harland *et al.* (1982).

TABLE 2. Rb-Sr analyses of granitic rock from near the Mac property, central British Columbia.

Number[1]	Sample description[1]	Latitude degrees N	Longitude degrees W	Sr ppm	Rb ppm	Rb/Sr	$^{87}Rb/^{86}Sr$	$^{87}Sr/^{86}Sr$	Initial ratio[3]
G84MAC1WR	Medium grained biotite granodiorite	54.85	125.58	334.8	72.96	0.218	0.6306	0.7047 ± 2	0.7035

1. Sample location is plotted on Figure 1. Analysis was on a whole rock sample.
2. Analyses were done in the Geochronology Laboratory by K. Scott under the direction of R.L. Armstrong at The University of British Coulumbia.
3. K-Ar date (141 Ma) for biotite from the same sample was used in the calculation of the initial ratio.

Endako molybdenum porphyry deposits. The lower initial strontium ratio from a pluton related to the Mac deposit, compared to those plutons associated with the 'eastern suite' of Sinclair (in press), implies that the former had an ultimate source that involved a lesser volume of old, sialic crustal rock (*see* Godwin, *et al.*, 1980).

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REFERENCES

Armstrong, J. E. (1949): Fort St. James Map Area, Cassiar and Coast Districts, British Columbia, *Geol. Surv., Canada,* Mem. 252, 120 pp.

Armstrong, R. L. (1978): Pre-Cenozoic Phanerozoic Time Scale - Computer File of Critical Dates and Consequences of New and In-progress Decay-constant Revisions, *in* Contributions to the Geologic Time Scale, G. V. Cohee, M. F. Glaessner, and H. D. Hedberg, editors, *Am. Assoc. Petrol. Geol.*, Studies in Geology No. 6, 388 pp.

Godwin, C. I., Armstrong, R. L., and Thompson, K. M. (1980): K-Ar and Rb-Sr Dating and the Genesis of Tungsten at the Clea Tungsten Property, Selwyn Mountains, Yukon Territory, *C.I.M.*, Bull., Vol. 73, No. 821, pp. 90-93.

Harland, W. B., Cox, A. V., Llewellyn, P. G., Pickton, C.A.G., Smith, A. G., and Walters, R. (1982): A Geologic Time Scale, *Cambridge Univ. Press,* 131 pp.

Karimpour, M. H. and Bowes, W. A. (1983): Application of Trace Elements and Isotopes for Discriminating between Porphyry Molybdenum, Copper and Tin Systems and the Implications for Predicting the Grade, *Global Tect. Metal.*, Vol. 2, pp. 145-150.

Morrison, G. W., Godwin, C. I., and Armstrong, R. L. (1979): Interpretation of Isotopic Ages and Sr/ Sr Initial Ratios for Plutonic Rock in the Whitehorse Map Area, Yukon, *Cdn. Jour. Earth Sci.*, Vol. 16, No. 10, pp. 1988-1997.

Sinclair, W. D. (in press): Molybdenum, Tungsten and Tin Deposits and Associated Granitoid Intrusions in the Northern Canadian Cordillera and Adjacent Parts of Alaska, *in* Northern Canadian Cordillera, *C.I.M.*, Special Vol.

Steiger, R. H. and Jager, E. (1977): Subcommission on Geochronology: Convention on the Use of Decay Constants in Geo- and Cosmochronology, *Earth Planet. Sci. Lett.*, Vol. 36, pp. 359-362.

White, W. H., Harakal, J. E., and Carter, N. C. (1968): Potassium Argon Ages of Some Ore Deposits in British Columbia, *C.I.M.*, Bull., Vol. 61, pp. 1326-1334.

White, W. H., Sinclair, A. J., Harakal, J. E., and Dawson, K. M. (1970): Potassium Argon Ages of Topley Intrusions near Endako, British Columbia, *Cdn. Jour. Earth Sci.*, Vol. 7, No. 4, pp. 1172-1178.