

Billings Glacier Molybdenum-Copper Occurrence, Whittier, Alaska

by:

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***** Open File Report 141-81

UNITED STATES DEPARTMENT OF THE INTERIOR

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BILLINGS GLACIER MOLYBDENUM-COPPER OCCURRENCE, WHITTIER, ALASKA

by

Robert B. Hoekzema¹, Gary E. Sherman²

ABSTRACT

A previously unreported occurrence of molybdenum and copper mineralization in a small granitic stock exposed at the toe of Billings Glacier, located 5.5 miles northeast of Whittier, Alaska, was discovered and examined briefly by personnel from the U.S. Bureau of Mines (BOM) in July and August, 1981. Molybdenite occurs as disseminated grains and crystalline clusters, up to 1 1/2 inches across, apparently associated with hydrothermally altered portions and also along fractures in the granitic pluton. Molybdenite also occurs as disseminated grains in spheroidally weathering granitic xenoliths found in the pluton near its eastern contact. Minor pyrite and very minor amounts of chalcopyrite are disseminated throughout marginal portions of the pluton. A high grade sample of the mineralized granite contained 2,000 ppm Mo but other samples did not exceed 30 ppm. Copper did not exceed 90 ppm and generally was less than 50 ppm in samples of the stock analyzed to date.

Altered and coarsely mineralized portions of the stock are lighter in color due to increased quartz content, sericitization of K-feldspar, and lack of biotite.

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Pegmatitic phases have been identified which crosscut the granite near its contacts. One pegmatite was found to contain a large clay filled pocket containing euhedral doubly terminated quartz crystals up to 1 1/2 feet long.

INTRODUCTION

The Bureau of Mines (BOM) and U.S. Geological Survey (USGS) are involved in a four year (1979-1982) multi-disciplinary appraisal of most of the Chugach National Forest, Alaska, in conjunction with the RARE II program (P. L. 94-588). During the 1981 field season a Bureau of Mines crew located a previously unreported molybdenum occurrence near Whittier, Alaska and spent 3 days sampling and evaluating the occurrence. This is a progress report to inform the mining public of the occurrence and provide the analytical data and geologic information presently available. The authors would like to acknowledge the help received from the USGS Elmendorf Analytical Laboratory which provided most of the chemical data in this report.

Location

The Billings Glacier molybdenum-copper prospect is located near the terminus of Billings Glacier about 1 1/2 miles north of Passage Canal, 5 1/2 miles NE of Whittier, Alaska and 45 miles ESE of Anchorage, Alaska (Figure 1). Mineralization has been identified between elevations of 400' and 1,150' along the eastern side of Billings Glacier and between 600' and 750' along the west side of the glacier (Figure 2). Due to the steep terrain and wasting glacial ice, much of the area of mineralization is relatively inaccessible for sampling.

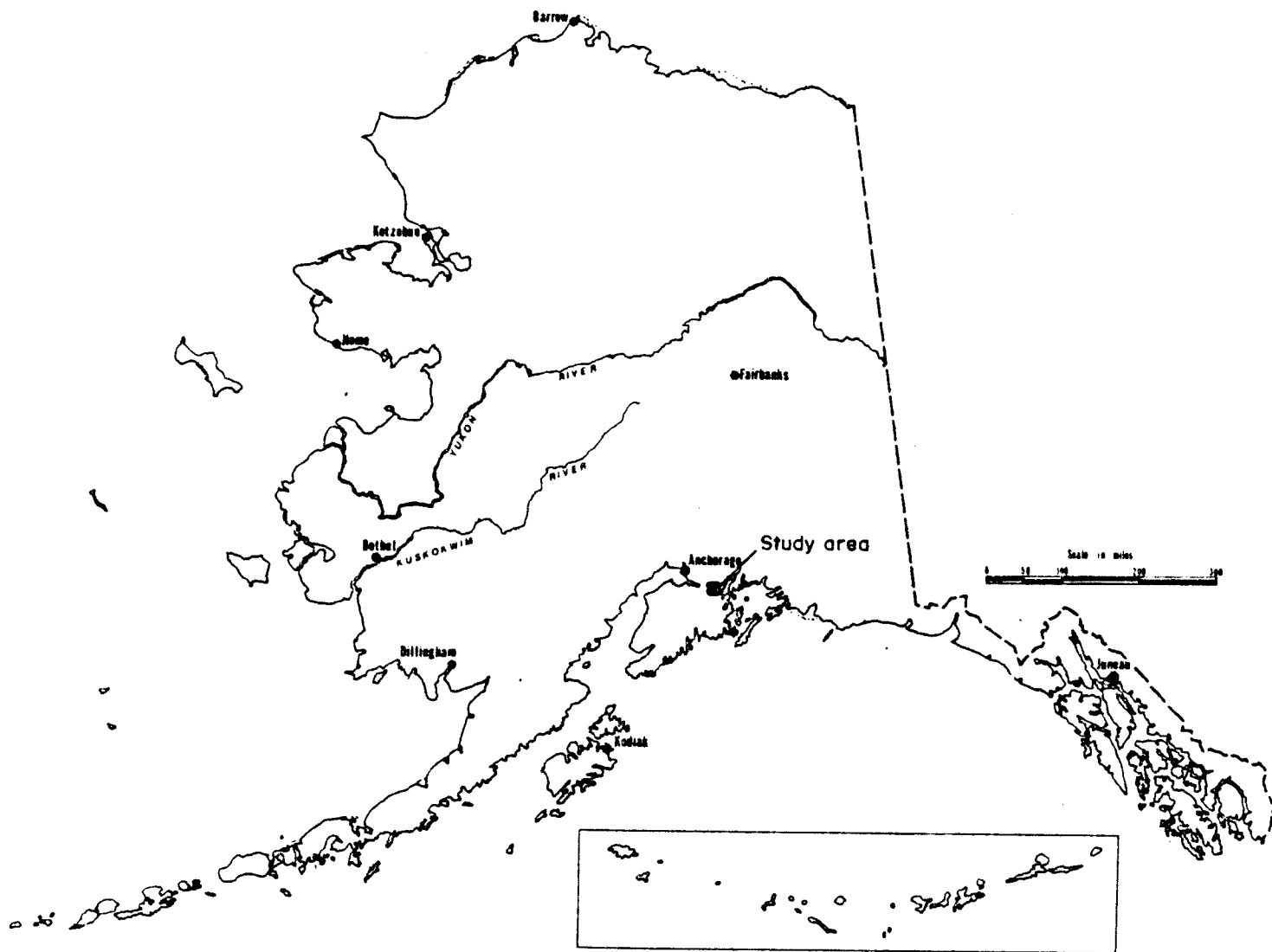


Figure 1. Location Map: Billings Glacier Molybdenum Prospect

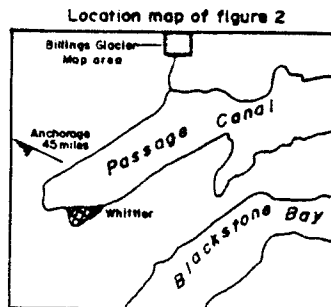
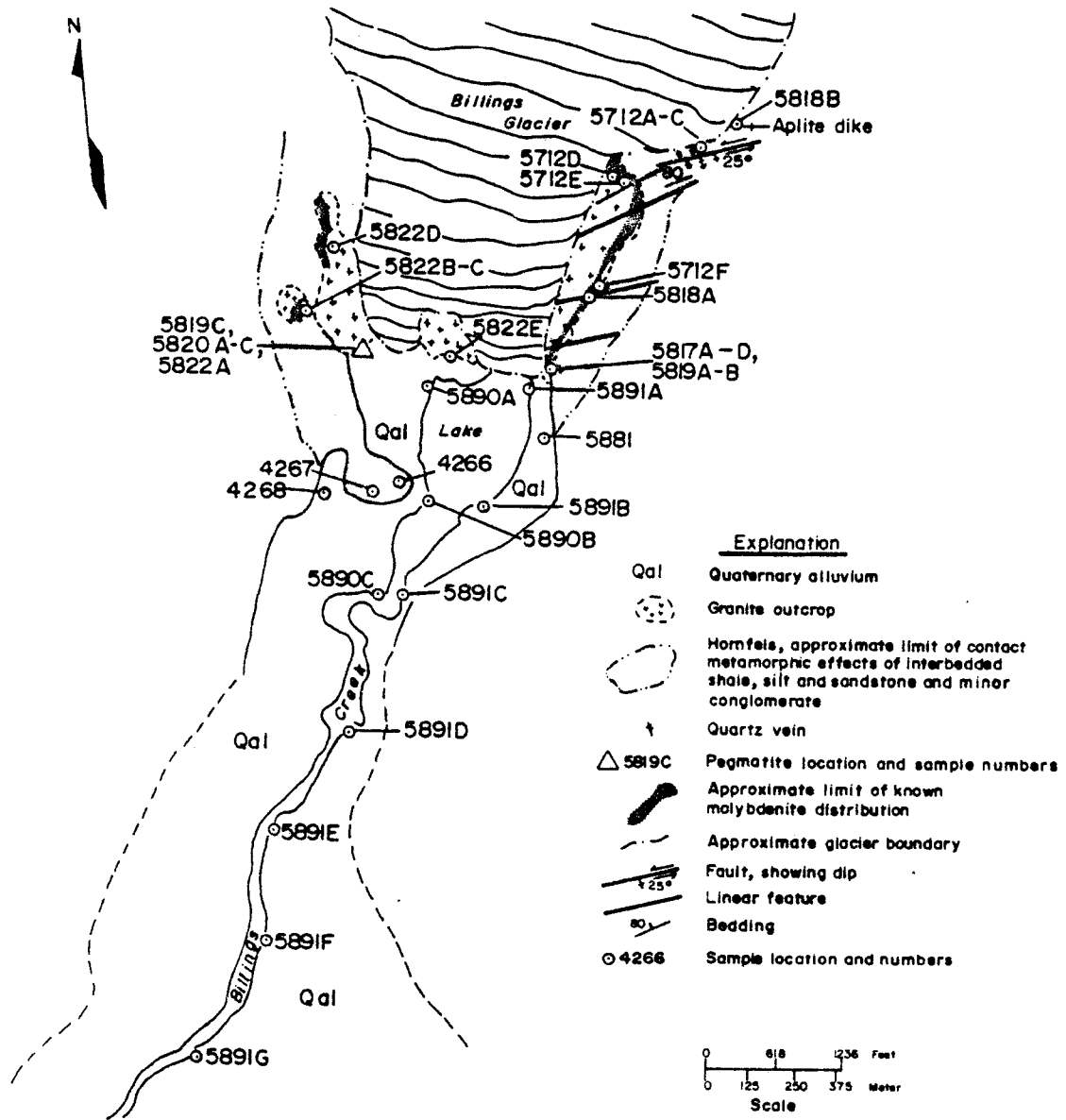


Figure 2. Sample Location and Geologic Map: Billings Glacier Molybdenum Prospect Seward (D-5), AK. Based upon U.S.D.A. aerial photo No. 1974-81

Previous Work

Early prospectors, primarily searching for gold, likely investigated the Billings Glacier area. However, there is no knowledge of a systematic evaluation of the mineral potential of the granitic rocks in this area. The 1951 USGS topographic map and 1974 U.S. Forest Service aerial photos indicate that the glacier has retreated rapidly since 1950 and suggest that the mineralized sections of the granite were not exposed until recently.

Only reconnaissance level geologic mapping at a 1:250,000 scale has been completed for the study area [6]³. Tysdal [5] reported the existence of two mineral occurrences (one gold, lead, zinc and one for gold) near the terminus of Billings Glacier but neither was reported to contain molybdenite. These reported occurrences are summarized in Appendix 2.

Analytical results of samples collected by the BOM during the 1979 season as part of the RARE II project were made public in 1981 [2]. Pertinent analytical data are included in Appendix 1.

Land Status

The mineralization occurs on lands which were reopened to mineral entry in December 1980 with the signing into law of the Alaska National Interest Lands Conservation Act (ANILCA) (P. L. 96-487). The majority of the Chugach National Forest had previously been withdrawn from mineral entry on December 5, 1978 by the Secretary of the Interior at the request of the Secretary of Agriculture, but was open to staking before that time.

3. Underlined numbers in brackets refer to items in the references listed at the end of this report.

Geologic Setting

The Billings Glacier molybdenum prospect occurs in a Tertiary granitic stock intruded into the Cretaceous Chugach Terrane which consists predominantly of a north to northeasterly striking, steeply dipping marine metaclastic sequence (Valdez Group slates and graywackes) (Figure 3). The Chugach Terrane accreted to the southern Alaska mainland during latest Cretaceous and early Tertiary time [6]. It is part of a large regional subduction complex which extends northeast from Kodiak Island through the study area and continues east across the Canadian border.

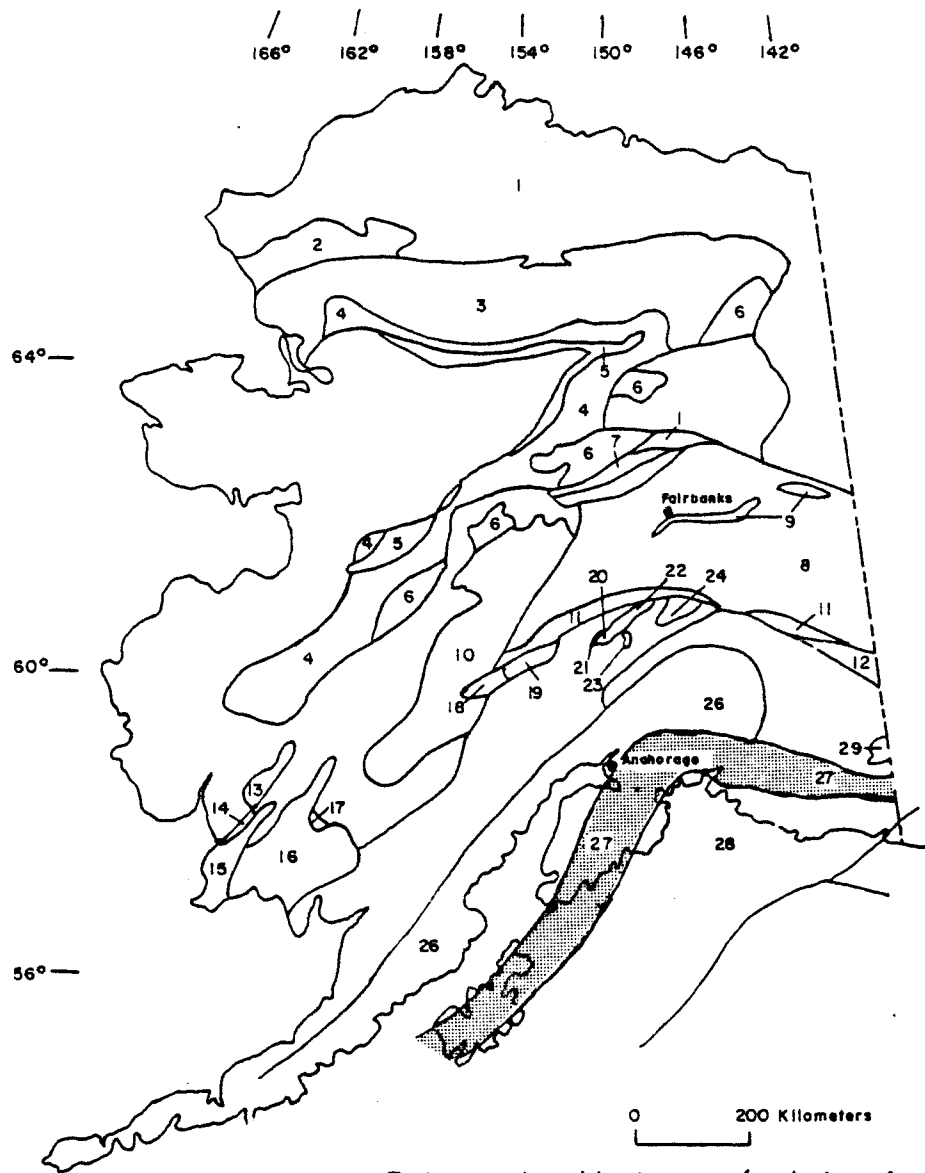
Small high-grade gold-bearing quartz veins and gold-bearing placer deposits, presumably derived from the veins as a result of glacial erosion and fluvial processes, are the major locatable mineral deposits in the region surrounding the Billings Glacier pluton.

PRESENT INVESTIGATIONS

This investigation of the Billings Glacier molybdenum-copper occurrence is part of a RARE II mineral evaluation of the Chugach National Forest begun in 1979 which has included library research and related studies, a field program, an evaluation of the geologic controls and environments of the deposits, and the identification of zones having potential for mineral occurrences.

Literature Research

A literature search and compilation of bibliographies has been made using the following sources: USGS (including a review of historical files in Menlo Park), BOM (including MAS files), U.S.D.A. Forest Service, State of Alaska, and mining companies active in the study area. Claim



Tectonostratigraphic terranes (exclusive of the Seward Peninsula and S.E. Alaska)

- | | | |
|-----------------|---------------------------------|-------------------|
| 1 North America | 11 Pingston-McKinley, undivided | 21 West fork |
| 2 Kagvik | 12 Mentasia | 22 Broad Pass |
| 3 Endicott | 13 Nyack | 23 Susitna |
| 4 Ruby | 14 Kilbuck | 24 McLaren |
| 5 Angayucham | 15 Goodnews | 25 Wangellia |
| 6 Innoka | 16 Togiak | 26 Peninsular |
| 7 Livengood | 17 Tikchik | 27 Chugach |
| 8 Yukon-Tanana | 18 Dillingar | 28 Prince William |
| 9 70-mile | 19 Mystic | 29 Alexander |
| 10 Nixon fork | 20 Chulitna | |

FIGURE 3. Tectonostratigraphic Terranes of Alaska, Exclusive of the Seward Peninsula and S. E. Alaska, from Jones and Silberling (1979)

records have been obtained and updated using the Bureau of Land Management and State of Alaska Kardex recording systems. Additional information has been obtained from interviews with and correspondence received from several miners and other individuals knowledgeable about the geology, mining history and mineral development of the area. Much of the above information, together with new data obtained by BOM and USGS, has been placed in files which have been established for all known mines, claims, and prospects in the study area. Existing claims and mineral occurrences have been plotted on both 1:250,000 and 1:63,360 scale topographic maps.

Field Programs

Field investigations of the area, which commenced in 1979 and continued during the 1980 and 1981 field seasons, have included obtaining stream sediment, placer, rock, and mineral samples; mapping and sampling of underground and surface mine workings; and prospecting potentially mineralized terrains in search of previously unreported deposits.

The BOM first examined the Billings Glacier area in 1979 at which time stream sediment and rock samples (2346-2347, 4266-4268, see Appendix 1) were collected while searching for the two reported prospects described in Appendix 2. Pan concentrate sample 4910 (Appendix 1) was collected near the site of stream sediment samples 2346 and 2347, one mile from the mouth of Billings Creek, to follow up on the gold anomaly indicated by results from the 1979 samples. None of the BOM samples contained molybdenum in sufficient quantity to be detected by emission spectrographic analysis (detection limit 2 ppm), however, a quartz vein (4767) sampled 1,000 feet south of the granitic stock was found to contain 700 ppm tungsten suggesting, in retrospect, the possibility of a tungsten halo around the Billings Glacier pluton.

Molybdenite was first identified in the Billings Glacier stock along its eastern contact in late July, 1981. Only three days were spent examining, collecting samples, and mapping portions of the pluton (See Figure 2).

The description of the Billings Glacier molybdenum occurrence which follows is preliminary and based solely on field work completed to date. A companion report will be published after all data are available and further laboratory research has been completed.

Description of Deposit

The Billings Glacier occurrence is a molybdenum and copper bearing biotite quartz monzonite stock of probable mid-Tertiary age with characteristics which appear to be similar to the Alice, British Columbia deposit (Appendix 3).

Host Intrusive

The Billings Glacier pluton has been tentatively identified megascopically as a biotite quartz monzonite though hand specimens range from quartz diorite to granite in composition. The stock is locally exposed over an area measuring roughly 2,000 x 2,500 feet though much of it remains ice covered. The age of this pluton has not yet been determined but is likely similar to that of the Passage Canal pluton located 3 miles east of Billings Glacier which has been dated at 36.6 ± 1.0 m.y. [4].

Stockwork veining is recognized by its lighter color due to the increased quartz content, sericitization of K-spar, destruction of biotite, and its coarser texture. Surface exposures of molybdenite occur between 400 and 1,150 feet of elevation, through a width of 300 feet and can be

traced along both contacts for a combined strike length of 2,000 feet. Also near the contacts, spheroidally weathering xenoliths occur which upon inspection are found to consist of plagioclase and quartz with minor disseminated grains of pyrite and molybdenite. The rapid weathering of the xenoliths, which produces bowl shaped depressions in the granite, may be due to their increased plagioclase content. Pegmatitic veins, including one exposed at the base of a granite cliff along the western side of the pluton which measures up to 12 feet wide and contains euhedral, doubly terminated quartz crystals up to 18 inches long, have been identified near the margins of the Billings Glacier stock. The dominant feldspar in the large pegmatite is cleavelandite (Na rich plagioclase). The quartz crystals occur in a clay filled pocket and are coated with muscovite crystals. The clay has not yet been analyzed.

Country Rock

The country rock to the intrusive consists of thermally metamorphosed and silicified (hornfels) interbedded sands and silts with occasional lenses of conglomerate and calcareous siltstones or marls. The bedding, which generally parallels foliation, is locally well developed and strikes northeast with steep dips to the northwest. Many of the sandier interbeds have been stretched and boudined and some are highly brecciated.

A well developed set of parallel north 65-80° east striking low angle (to 25°) southeast dipping, left lateral faults occurs along the eastern contact between the pluton and adjacent hornfels. Apparent left lateral offsets of hydrothermal veins of up to five feet have been measured along one of these faults. Some of them have well developed shear zones up to 18 inches thick.

Hydrothermal Veins

Numerous hydrothermal veins composed mostly of quartz with minor calcite and feldspar occur in the hornfels. Veins sampled up to 1,000 feet from the contact were found to contain minor amounts of pyrite, pyrrhotite, and chalcopyrite, tetrahedrite(?), galena, and specular hematite and assayed up to 3 ppm silver, 700 ppm tungsten (sample 5712B), and trace amounts of gold (Appendix 1). These veins probably post-date the intrusion as indicated by their offset by the contact faults and are likely associated with the hypogene alteration of the granite.

Sulfide Mineralogy

Molybdenite appears to be the major sulfide mineral occurring in the pluton which might be of economic importance with copper providing additional values. The molybdenite is generally restricted to a 200-300 foot wide zone of the granite that is parallel to the contact. The molybdenite occurs as (1) disseminated masses up to 1 1/2 inches across in the stockwork veins, (2) as small disseminated grains in the spheroidally weathering portions of the granite, and as (3) fracture fillings where they are best developed usually within 50 feet of the contact. Reddish-brown weathering pyrite is a common accessory mineral especially near the margins of the pluton. Minor quantities of disseminated chalcopyrite have been identified throughout the stock.

Analytical Results

Rock and stream sediment samples have been collected for chemical analyses. Each Bureau of Mines rock sample of the stock generally consisted of about 10-12 pounds of walnut-sized chips collected from an area

of about 200-300 square feet. These larger samples have not yet been analyzed, however, duplicate grab samples consisting of 1-2 pounds of chips taken from approximately the same sample locations, were analyzed at the USGS's Elmendorf laboratory. Atomic absorption and emission spectrographic results received to date for these samples and results of previously collected Bureau of Mines rock and stream sediment samples from the area are compiled as Appendix 1. All sampling sites, with the exception of 2346, 2347, and 4910 collected in 1979 and 1980 about 1 mile north of the mouth of Billings Glacier, are located on Figure 2.

Data received to date indicate that the grade of the Billings Glacier molybdenum prospect is low, but selected rock sample (5712F) contained 2,000 ppm Mo. Other granitic samples contained 30 ppm molybdenum or less. Copper values of up to 90 ppm (5712D) were obtained from samples of the pluton, however, most values were generally less than 50 ppm. Higher copper values, up to 150 ppm (5712B), were found in samples of the hydrothermal veins. These data are preliminary and are not believed to be representative due to the small sample size and the tendency to refrain from collecting samples in areas where visible molybdenite was common in order to prevent over optimistic evaluation.

Summary

Preliminary evaluation based upon limited field work and the presently available chemical data indicates that the Billings Glacier molybdenum-copper prospect is low in grade but has potential for moderate tonnages. This occurrence is the first significant mineralization found in association with Tertiary plutons of the Prince William Sound Region, Alaska. Additional field and analytical studies of these plutons now appears to be warranted.

Recommendations

Based upon available results and the limited visual evaluation which has been made of the Billings Glacier molybdenum occurrence, the following recommendations can be made:

1. The molybdenite mineralization is exposed over a large enough area to indicate that the prospect warrants detailed examination. Drilling will be required to properly evaluate grade and tonnage.
2. Neighboring plutons such as the Passage Canal body should be investigated in greater detail in light of potential molybdenum mineralization. A small molybdenite bearing pegmatitic vein was indentified and sampled in August of 1981. The vein is exposed in the Passage Canal pluton at high tide level on the north side of Passage Canal one mile west of the head of Logging Camp Bay.
3. The hydrothermal veins associated with the Billings Glacier pluton should be more extensively sampled. Free gold is present in Billings Creek and silver is present in quartz samples already collected. The veins could contain commercially valuable concentrations of precious metals.

REFERENCES

1. Clark, K. F. Stockwork Molybdenum Deposits in the Western Cordillera of North America. *Econ. Geol.*, v. 67, 1972, pp. 731-758.
2. Jansons, U. 1979 Bureau of Mines Sampling Sites and Analytical Results for Samples Collected in the Chugach National Forest, Alaska. Bureau of Mines Open File Report 83-81, 1981.
3. Jones, D. L., and N. S. Silberling. Mesozoic Stratigraphy, The Key to Tectonic Analysis of Southern and Central Alaska. U.S. Geological Survey Open File Report 79-1200, 1979, 41 p.
4. Lanphere, M. A. Potassium-argon Ages of Tertiary Plutons in Prince William Sound Region, Alaska, in Geological Survey Research 1966. U. S. Geological Survey Professional Paper 550-D, 1966, pp. D195-198.
5. Tysdal, R. G. Mines, Prospects, and Occurrences, Seward and Blying Sound Quadrangles, Alaska. U.S. Geological Survey Map MF 880A, 1978.
6. Tysdal, R. G., and J. E. Case. Geologic Map of the Seward and Blying Sound Quadrangles, Alaska. U.S. Geological Survey Miscellaneous Investigations Series Map I-1150, 1979.

APPENDIX 1

ANALYTICAL RESULTS OF BILLINGS GLACIER AREA SAMPLES.
VALUES ARE IN PARTS PER MILLION UNLESS OTHERWISE NOTED.
ANALYSES PROVIDED BY USGS.

APPENDIX 1

Sample Number/Year	: 2346/79	: 2347/79	:
Material Type	: STR SED	: STR SED	:
Rock Type	: MET SED	: MET SED	:
Rock Age	* CRET	* CRET	*
Quad 4 mile/1 mile	* Seward D5	* Seward D5	*
Sec/T/R/Mer	* 5/8N/5E/Seward	* 5/8N/5E/Seward	*
Location/Property	: Billings Creek	: Billings Creek	:
KX/MAS/MILS/File	: File 127, 128, 268	: File 127, 128, 268	:
Proj. no./Sub.	: 1219 Peninsula	: 1219 Peninsula	:
Reports	* OFR 83-81	* OFR 83-81	*

Element	E. Sp	AA/Wet	Assay	E. Sp	AA/Wet	Assay	E. Sp	AA/Wet	Assay
: Aluminum	:		:			:			
: Antimony	: <100		:	<100		:			
: Arsenic	: <500		:	<500		:			
* Barium	* 1,000		*	700		*			*
* Beryllium	* <2		*	<2		*			*
* Bismuth	* <10		*	<10		*			*
: Boron	: 30		:	30		:			
: Calcium	: 10,000		:	10,000		:			
: Cadmium	: <50		:	<50		:			
* Chromium	* 100		*	200		*			*
* Cobalt	* 10		*	15		*			*
* Columbium	*		*			*			*
: Copper	: 70 30		:	70 30		:			
: Fluorine	:		:			:			
: Gallium	: 15		:	20		:			
* Germanium	* <20		*	<20		*			*
* Gold	*	0.07	*	.06		*			*
* Hafnium	*		*			*			*
: Indium	:		:			:			
: Iron	: 30,000		:	30,000		:			
: Lanthanum	: 20		:	20		:			
* Lead	* 10 15		*	15 15		*			*
* Lithium	*		*			*			*
* Manganese	* 1,500		*	1,500		*			*
: Magnesium	: 20,000		:	20,000		:			
: Molybdenum	: <2		:	<2		:			
: Niobium	: 20		:	20		:			
* Nickel	* 50		*	50		*			*
* Phosphorous	*		*			*			*
* Platinum	*		*			*			*
: Rhenium	:		:			:			
: Scandium	: 20		:	20		:			
: Silver	: <1		:	<1		:			
* Silicon	*		*			*			*
* Sodium	*		*			*			*
* Strontium	* 200		*	200		*			*
: Tantalum	:		:			:			
: Tellurium	:		:			:			
: Thallium	:		:			:			
* Tin	* <10		*	<10		*			*
* Titanium	* 5,000		*	5,000		*			*
* Tungsten	* <50		*	<50		*			*
: Vanadium	: 150		:	100		:			
: Yttrium	: 10		:	10		:			
: Zinc	: <200 75		:	<200 75		:			
* Zirconium	* 50		*	100		*			*

APPENDIX 1 - Continued

Sample Number/Year	: 4266/79	: 4267/79	: 4268/79
Material Type	: FEL PLUT	: QUARTZ	: STR SED
Rock Type	: FEL INT	: MET SED	: MET SED
Rock Age	* TERT	* CRET	* CRET
Quad 4 mile/1 mile	* Seward D5	* Seward D5	* Seward D5
Sec/T/R/Mer	* 29/9N/5E/Seward	* 29/9N/5E/Seward	* 29/9N/5E/Seward
Location/Property	: Billings Glacier	: Billings Glacier	: Billings Glacier
KX/MAS/MILS/File	: File 127, 128, 268	: File 127, 128, 268	: File 127, 128, 268
Proj. no./Sub.	: 1219 Peninsula	: 1219 Peninsula	: 1219 Peninsula
Reports	* OFR 83-81	* OFR 83-81	* OFR 83-81

Element	E. Sp	AA/Wet	Assay	E. Sp	AA/Wet	Assay	E. Sp	AA/Wet	Assay
: Aluminum	:			:			:		
: Antimony	: <100			: <100			: <100		
: Arsenic	: <500	30		: <500	200		: <500	10	
* Barium	* 20			* 500			* 1,000		
* Beryllium	* 2			* 3			* <2		
* Bismuth	* <10			* <10			* <10		
: Boron	: 10			: 20			: 50		
: Calcium	: 1,500			: 100,000			: 7,000		
: Cadmium	: <50			: <50			: <50		
* Chromium	* 10			* 200			* 70		
* Cobalt	* <5			* 30			* 5		
* Columbium	*			*			*		
: Copper	: 50	30		: 200			: 50	25	
: Fluorine	:			:			:		
: Gallium	: 20			: 15			: 15		
* Germanium	* <20			* 20			* <20		
* Gold	*	<0.02		* 0.09			* <.02		
* Hafnium	*			*			*		
: Indium	:			:			:		
: Iron	: 7,000			: 30,000			: 30,000		
: Lanthanum	: <20			: <20			: 20		
* Lead	* 50	35		* 15			* 10	15	
* Lithium	*			*			*		
* Manganese	* 300			* 7,000			* 1,500		
: Magnesium	: 2,000			: 20,000			: 15,000		
: Molybdenum	: <2			: <2			: <2		
: Niobium	: 20			: 20			: <20		
* Nickel	* 5			* 70			* 100		
* Phosphorous	*			*			*		
* Platinum	*			*			*		
: Rhenium	:			:			:		
: Scandium	: 10			: 20			: 15		
: Silver	: <1	.200		: <1	.2		: <1		
* Silicon	*			*			*		
* Sodium	*			*			*		
* Strontium	* <100			* 500			* 100		
: Tantalum	:			:			:		
: Tellurium	:			:			:		
: Thallium	:			:			:		
* Tin	* 30			* 50			* <10		
* Titanium	* 300			* 5,000			* 5,000		
* Tungsten	* <50			* 700			* <50		
: Vanadium	: 10			: 100			: 100		
: Yttrium	: 20			: 20			: 10		
: Zinc	: <200	30		: <200			: <200	80	
* Zirconium	* 20			* 70			* 100		

APPENDIX 1 - Continued

Sample Number/Year	: 4910/80	: 5712A/81 304A	: 5712B/81 304B
Material Type	: PAN CONC	: QUARTZ	: QUARTZ
Rock Type	: MET SED	: MET SED	: MET SED
Rock Age	* CRET	* CRET	* CRET
Quad 4 mile/1 mile	* Seward D5	* Seward D5	* Seward D5
Sec/T/R/Mer	* 5/8N/5E/Seward	* 21/9N/5E/Seward	* 21/9N/5E/Seward
Location/Property	: Billings Creek	: Billings Glacier	: Billings Glacier
KX/MAS/MILS/File	: File 127, 128, 268	: File 127, 128, 268	: File 127, 128, 268
Proj. no./Sub.	: 1219 Peninsula	: 1219 Peninsula	: 1219 Peninsula
Reports	*	*	*

Element		E. Sp	AA/Wet	Assay	E. Sp	AA/Wet	Assay	E. Sp	AA/Wet	Assay
: Aluminum	:									
: Antimony	:				<100			<100		
: Arsenic	:				<200			<200		
* Barium	*				200			200		
* Beryllium	*				<1			3		
* Bismuth	*				<10			10		
: Boron	:				50			50		
: Calcium	:				3,000			3,000		
: Cadmium	:				<20			<20		
* Chromium	*				<10			<10		
* Cobalt	*				<5			<5		
* Columbium	*									
: Copper	:	20			<5	10		100	150	
: Fluorine	:									
: Gallium	:									
* Germanium	*									
* Gold	*	0.79			<10	<.05		<10	<.05	
* Hafnium	*									
: Indium	:									
: Iron	:				1,000			7,000		
: Lanthanum	:				<20			<20		
* Lead	*	26			<10	5		<10	5	
* Lithium	*									
* Manganese	*				200			500		
: Magnesium	:				500			700		
: Molybdenum	:				<5			<5		
: Niobium	:				<20			<20		
* Nickel	*				<5			<5		
* Phosphorous	*									
* Platinum	*									
: Rhenium	:									
: Scandium	:				<5			<5		
: Silver	:	2.7			<.5			3		
* Silicon	*									
* Sodium	*									
* Strontium	*				<100			<100		
: Tantalum	:									
: Tellurium	:									
: Thallium	:									
* Tin	*				<10			10		
* Titanium	*				200			200		
* Tungsten	*				<50			700		
: Vanadium	:				15			30		
: Yttrium	:				<10			<10		
: Zinc	:				<200	10		<200	10	
* Zirconium	*				<10			10		

APPENDIX 1 - Continued

Sample Number/Year	: 5712C/81 304C	: 5712D/81 304E	: 5712D/81 304EE
Material Type	: QUARTZ	: GRANITE	: GRANITE
Rock Type	: MET SED	: FEL PLUT	: FEL PLUT
Rock Age	* CRET	* TERT	* TERT
Quad 4 mile/1 mile	* Seward D5	* Seward D5	* Seward D5
Sec/T/R/Mer	* 21/9N/5E/Seward	* 21/9N/5E/Seward	* 21/9N/5E/Seward
Location/Property	: Billings Glacier	: Billings Glacier	: Billings Glacier
KX/MAS/MILS/File	: File 127, 128, 268	: File 127, 128, 268	: File 127, 128, 268
Proj. no./Sub.	: 1219 Peninsula	: 1219 Peninsula	: 1219 Peninsula
Reports	*	*	*

Element	E. Sp	AA/Wet	Assay	E. Sp	AA/Wet	Assay	E. Sp	AA/Wet	Assay
: Aluminum	:	:	:	:	:	:	:	:	:
: Antimony	: <100	:	:	: <100	:	:	: <100	:	:
: Arsenic	: <200	:	:	: <200	:	:	: <200	:	:
* Barium	* 200	*	*	* 500	*	*	* 300	*	*
* Beryllium	* 2	*	*	* 3	*	*	* 2	*	*
* Bismuth	* <10	*	*	* 10	*	*	* 20	*	*
: Boron	: 70	:	:	: 15	:	:	: 20	:	:
: Calcium	: 30,000	:	:	: 2,000	:	:	: 1,000	:	:
: Cadmium	: <20	:	:	: <20	:	:	: <20	:	:
* Chromium	* 20	*	*	* 10	*	*	* <10	*	*
* Cobalt	* <5	*	*	* <5	*	*	* <5	*	*
* Columbium	*	*	*	*	*	*	*	*	*
: Copper	: 20 20	:	:	: 20 35	:	:	: 70 90	:	:
: Fluorine	:	:	:	:	:	:	:	:	:
: Gallium	:	:	:	:	:	:	:	:	:
* Germanium	*	*	*	*	*	*	*	*	*
* Gold	* <10 <.05	*	*	* <10 .05	*	*	* <10 .05	*	*
* Hafnium	*	*	*	*	*	*	*	*	*
: Indium	:	:	:	:	:	:	:	:	:
: Iron	: 10,000	:	:	: 7,000	:	:	: 7,000	:	:
: Lanthanum	: <20	:	:	: <20	:	:	: <20	:	:
* Lead	* <10 15	*	*	* 30 15	*	*	* 20 10	*	*
* Lithium	*	*	*	*	*	*	*	*	*
* Manganese	* 1,000	*	*	* 200	*	*	* 200	*	*
: Magnesium	: 3,000	:	:	: 2,000	:	:	: 1,500	:	:
: Molybdenum	: <5	:	:	: <5	:	:	: <5	:	:
: Niobium	: <20	:	:	: <20	:	:	: <20	:	:
* Nickel	* 5	*	*	* <5	*	*	* <5	*	*
* Phosphorous	*	*	*	*	*	*	*	*	*
* Platinum	*	*	*	*	*	*	*	*	*
: Rhenium	:	:	:	:	:	:	:	:	:
: Scandium	: 5	:	:	: 5	:	:	: 7	:	:
: Silver	: <.5	:	:	: <.5	:	:	: .5	:	:
* Silicon	*	*	*	*	*	*	*	*	*
* Sodium	*	*	*	*	*	*	*	*	*
* Strontium	* 300	*	*	* <100	*	*	* <100	*	*
: Tantalum	:	:	:	:	:	:	:	:	:
: Tellurium	:	:	:	:	:	:	:	:	:
: Thallium	:	:	:	:	:	:	:	:	:
* Tin	* 10	*	*	* 10	*	*	* <10	*	*
* Titanium	* 700	*	*	* 700	*	*	* 1,000	*	*
* Tungsten	* <50	*	*	* <50	*	*	* <50	*	*
: Vanadium	: 50	:	:	: 10	:	:	: 10	:	:
: Yttrium	: 10	:	:	: 20	:	:	: 30	:	:
: Zinc	: <200 20	:	:	: <200 30	:	:	: <200 30	:	:
* Zirconium	* 20	*	*	* 100	*	*	* 50	*	*

APPENDIX 1 - Continued

Sample Number/Year	: 5712E/81 304F	: 5712E/81 304FF	: 5712F/81 304G
Material Type	: GRANITE	: GRANITE	: GRANITE
Rock Type	: FEL PLUT	: FEL PLUT	: FEL PLUT
Rock Age	* TERT	* TERT	* TERT
Quad 4 mile/1 mile	* Seward D5	* Seward D5	* Seward D5
Sec/T/R/Mer	* 21/9N/5E/Seward	* 21/9N/5E/Seward	* 21/9N/5E/Seward
Location/Property	: Billings Glacier	: Billings Glacier	: Billings Glacier
KX/MAS/MILS/File	: File 127, 128, 268	: File 127, 128, 268	: File 127, 128, 268
Proj. no./Sub.	: 1219 Peninsula	: 1219 Peninsula	: 1219 Peninsula
Reports	*	*	*

Element	E. Sp	AA/Wet	Assay	E. Sp	AA/Wet	Assay	E. Sp	AA/Wet	Assay
: Aluminum	:		:			:			
: Antimony	: <100		:	<100		:	<100		
: Arsenic	: <200		:	<200		:	<200		
* Barium	* 200		*	200		*	700		
* Beryllium	* 2		*	2		*	1.5		
* Bismuth	* 50		*	15		*	<10		
: Boron	: 30		:	30		:	50		
: Calcium	: 1,000		:	1,000		:	2,000		
: Cadmium	: <20		:	<20		:	<20		
* Chromium	* <10		*	<10		*	10		
* Cobalt	* <5		*	<5		*	<5		
* Columbium	*		*			*			
: Copper	: 5 15		:	100 45		:	20 40		
: Fluorine	:		:			:			
: Gallium	:		:			:			
* Germanium	*		*			*			
* Gold	* <10 <.05		*	<10 <.05		*	<10 <.05		
* Hafnium	*		*			*			
: Indium	:		:			:			
: Iron	: 3,000		:	5,000		:	10,000		
: Lanthanum	: <20		:	<20		:	<20		
* Lead	* 30 20		*	30 15		*	20 20		
* Lithium	*		*			*			
* Manganese	* 100		*	200		*	200		
: Magnesium	: 500		:	1,000		:	1,000		
: Molybdenum	: <5		:	7		:	2,000		
: Niobium	: <20		:	<20		:	<20		
* Nickel	* <5		*	<5		*	<5		
* Phosphorous	*		*			*			
* Platinum	*		*			*			
: Rhenium	:		:			:			
: Scandium	: <5		:	5		:	7		
: Silver	: 5		:	.7		:	1.5		
* Silicon	*		*			*			
* Sodium	*		*			*			
* Strontium	* <100		*	<100		*	<100		
: Tantalum	:		:			:			
: Tellurium	:		:			:			
: Thallium	:		:			:			
* Tin	* <10		*	10		*	20		
* Titanium	* 300		*	500		*	700		
* Tungsten	* <50		*	<50		*	<50		
: Vanadium	: <10		:	<10		:	15		
: Yttrium	: 20		:	20		:	20		
: Zinc	: <200 15		:	<200 25		:	<200 25		
* Zirconium	* 50		*	70		*	100		

Sample Number/Year	: 5712F/81	304GG	:	:
Material Type	: GRANITE		:	:
Rock Type	: FEL PLUT		:	:
Rock Age	* TERT		*	*
Quad 4 mile/1 mile	* Seward D5		*	*
Sec/T/R/Mer	* 21/9N/5E/Seward		*	*
Location/Property	: Billings Glacier		:	:
KX/MAS/MILS/File	: File 127, 128, 268		:	:
Proj. no./Sub.	:		:	:
Reports	*		*	*

Element	E. Sp	AA/Wet	Assay	E. Sp	AA/Wet	Assay	E. Sp	AA/Wet	Assay
: Aluminum	:		:	:		:	:		:
: Antimony	: <100		:	:		:	:		:
: Arsenic	: <200		:	:		:	:		:
* Barium	* 700		*	*		*	*		*
* Beryllium	* 3		*	*		*	*		*
* Bismuth	* <10		*	*		*	*		*
: Boron	: 50		:	:		:	:		:
: Calcium	: 2,000		:	:		:	:		:
: Cadmium	: <20		:	:		:	:		:
* Chromium	* <10		*	*		*	*		*
* Cobalt	* <5		*	*		*	*		*
* Columbium	*		*	*		*	*		*
: Copper	: 7	20	:	:		:	:		:
: Fluorine	:		:	:		:	:		:
: Gallium	:		:	:		:	:		:
* Germanium	*		*	*		*	*		*
* Gold	* <10	<.05	*	*		*	*		*
* Hafnium	*		*	*		*	*		*
: Indium	:		:	:		:	:		:
: Iron	: 7,000		:	:		:	:		:
: Lanthanum	: 100		:	:		:	:		:
* Lead	* 20	20	*	*		*	*		*
* Lithium	*		*	*		*	*		*
* Manganese	* 200		*	*		*	*		*
: Magnesium	: 1,000		:	:		:	:		:
: Molybdenum	: 30		:	:		:	:		:
: Niobium	: <20		:	:		:	:		:
* Nickel	* 5		*	*		*	*		*
* Phosphorous	*		*	*		*	*		*
* Platinum	*		*	*		*	*		*
: Rhenium	:		:	:		:	:		:
: Scandium	: 5		:	:		:	:		:
: Silver	: .7		:	:		:	:		:
* Silicon	*		*	*		*	*		*
* Sodium	*		*	*		*	*		*
* Strontium	* <100		*	*		*	*		*
: Tantalum	:		:	:		:	:		:
: Tellurium	:		:	:		:	:		:
: Thallium	:		:	:		:	:		:
* Tin	* 10		*	*		*	*		*
* Titanium	* 700		*	*		*	*		*
* Tungsten	* <50		*	*		*	*		*
: Vanadium	: 10		:	:		:	:		:
: Yttrium	: 30		:	:		:	:		:
: Zinc	: <200	25	:	:		:	:		:
* Zirconium	* 70		*	*		*	*		*

Sample Number/Year	: 5822A/81 310C	: 5822B/81 311A	: 5822C/81 311B
Material Type	: GRANITE	: GRANITE	: GRANITE
Rock Type	: FEL PLUT	: FEL PLUT	: FEL PLUT
Rock Age	* TERT	* TERT	* TERT
Quad 4 mile/1 mile	* Seward D5	* Seward D5	* Seward D5
Sec/T/R/Mer	* 29/9N/5E/Seward	* 29/9N/5E/Seward	* 29/9N/5E/Seward
Location/Property	: Billings Glacier	: Billings Glacier	: Billings Glacier
KX/MAS/MILS/File	: File 127, 128, 268	: File 127, 128, 268	: File 127, 128, 268
Proj. no./Sub.	: 1219 Peninsula	: 1219 Peninsula	: 1219 Peninsula
Reports	*	*	*

Element	E. Sp	AA/Wet	Assay	E. Sp	AA/Wet	Assay	E. Sp	AA/Wet	Assay
: Aluminum	:	:	:	:	:	:	:	:	:
: Antimony	: <100	:	:	: <100	:	:	: <100	:	:
: Arsenic	: <200	:	:	: <200	:	:	: <200	:	:
* Barium	* 700	:	:	* 700	:	:	* 700	:	:
* Beryllium	* 2	:	:	* 3	:	:	* 2	:	:
* Bismuth	* <10	:	:	* <10	:	:	* 10	:	:
: Boron	: 20	:	:	: 30	:	:	: 20	:	:
: Calcium	: 3,000	:	:	: 2,000	:	:	: 3,000	:	:
: Cadmium	: <20	:	:	: <20	:	:	: <20	:	:
* Chromium	* 15	:	:	* 15	:	:	* 10	:	:
* Cobalt	* <5	:	:	* <5	:	:	* <5	:	:
* Columbium	*	:	:	*	:	:	*	:	:
: Copper	: 15 20	:	:	: 10 25	:	:	: 10 35	:	:
: Fluorine	:	:	:	:	:	:	:	:	:
: Gallium	:	:	:	:	:	:	:	:	:
* Germanium	*	:	:	*	:	:	*	:	:
* Gold	* <10 <.05	:	:	* <10 <.05	:	:	* <10 <.05	:	:
* Hafnium	*	:	:	*	:	:	*	:	:
: Indium	:	:	:	:	:	:	:	:	:
: Iron	: 10,000	:	:	: 10,000	:	:	: 10,000	:	:
: Lanthanum	: <20	:	:	: 30	:	:	: 30	:	:
* Lead	* 20 10	:	:	* 20 10	:	:	* 20 10	:	:
* Lithium	*	:	:	*	:	:	*	:	:
* Manganese	* 200	:	:	* 200	:	:	* 300	:	:
: Magnesium	: 2,000	:	:	: 2,000	:	:	: 2,000	:	:
: Molybdenum	: <5	:	:	: <5	:	:	: <5	:	:
: Niobium	: <20	:	:	: <20	:	:	: <20	:	:
* Nickel	* 5	:	:	* 5	:	:	* 5	:	:
* Phosphorous	*	:	:	*	:	:	*	:	:
* Platinum	*	:	:	*	:	:	*	:	:
: Rhenium	:	:	:	:	:	:	:	:	:
: Scandium	: 7	:	:	: 7	:	:	: 7	:	:
: Silver	: <.5	:	:	: <.5	:	:	: <.5	:	:
* Silicon	*	:	:	*	:	:	*	:	:
* Sodium	*	:	:	*	:	:	*	:	:
* Strontium	* <100	:	:	* <100	:	:	* <100	:	:
: Tantalum	:	:	:	:	:	:	:	:	:
: Tellurium	:	:	:	:	:	:	:	:	:
: Thallium	:	:	:	:	:	:	:	:	:
* Tin	* 10	:	:	* 10	:	:	* 10	:	:
* Titanium	* 1,000	:	:	* 1,000	:	:	* 1,000	:	:
* Tungsten	* <50	:	:	* <50	:	:	* <50	:	:
: Vanadium	: 20	:	:	: 20	:	:	: 20	:	:
: Yttrium	: 20	:	:	: 50	:	:	: 20	:	:
: Zinc	: <200 35	:	:	: <200 35	:	:	: <200 35	:	:
* Zirconium	* 70	:	:	* 100	:	:	* 100	:	:

APPENDIX 1 - Continued

Sample Number/Year	: 5822D/81 312B	: 5822E/81 313A	:
Material Type	: GRANITE	: GRANITE	:
Rock Type	: FEL PLUT	: FEL PLUT	:
Rock Age	* TERT	* TERT	*
Quad 4 mile/1 mile	* Seward D5	* Seward D5	*
Sec/T/R/Mer	* 29/9N/5E/Seward	* 29/9N/5E/Seward	*
Location/Property	: Billings Glacier	: Billings Glacier	:
KX/MAS/MILS/File	: File 127, 128, 268	: File 127, 128, 268	:
Proj. no./Sub.	: 1219 Peninsula	: 1219 Peninsula	:
Reports	*	*	*

Element	E. Sp	AA/Wet	Assay	E. Sp	AA/Wet	Assay	E. Sp	AA/Wet	Assay
: Aluminum	:			:			:		
: Antimony	:	<100		:	<100		:		
: Arsenic	:	<200		:	<200		:		
* Barium	*	700		*	700		*		*
* Beryllium	*	3		*	3		*		*
* Bismuth	*	10		*	<10		*		*
: Boron	:	30		:	15		:		
: Calcium	:	3,000		:	5,000		:		
: Cadmium	:	<20		:	<20		:		
* Chromium	*	<10		*	10		*		*
* Cobalt	*	<5		*	<5		*		*
* Columbium	*			*			*		*
: Copper	:	10	35	:	10	35	:		
: Fluorine	:			:			:		
: Gallium	:			:			:		
* Germanium	*			*			*		*
* Gold	*	<10	<.05	*	<10	<.05	*		*
* Hafnium	*			*			*		*
: Indium	:			:			:		
: Iron	:	10,000		:	10,000		:		
: Lanthanum	:	50		:	50		:		
* Lead	*	20	10	*	20	10	*		*
* Lithium	*			*			*		*
* Manganese	*	200		*	300		*		*
: Magnesium	:	1,500		:	2,000		:		
: Molybdenum	:	<5		:	<5		:		
: Niobium	:	<20		:	<20		:		
* Nickel	*	5		*	5		*		*
* Phosphorous	*			*			*		*
* Platinum	*			*			*		*
: Rhenium	:			:			:		
: Scandium	:	5		:	10		:		
: Silver	:	<.5		:	<.5		:		
* Silicon	*			*			*		*
* Sodium	*			*			*		*
* Strontium	*	<100		*	<100		*		*
: Tantalum	:			:			:		
: Tellurium	:			:			:		
: Thallium	:			:			:		
* Tin	*	<10		*	10		*		*
* Titanium	*	1,000		*	1,500		*		*
* Tungsten	*	<50		*	<50		*		*
: Vanadium	:	15		:	20		:		
: Yttrium	:	20		:	50		:		
: Zinc	:	<200	40	:	<200	40	:		
* Zirconium	*	100		*	150		*		*

Sample Number/Year	: 5890A/81	: 5890B/81	: 5890C/81
Material Type	: STREAM SED	: STREAM SED	: STREAM SED
Rock Type	: MET SED, FEL PLUT	: MET SED, FEL PLUT	: MET SED, FEL PLUT
Rock Age	* CRET, TERT	* CRET, TERT	* CRET, TERT
Quad 4 mile/1 mile	* Seward D5	* Seward D5	* Seward D5
Sec/T/R/Mer	* 29/9N/5E/Seward	* 29/9N/5E/Seward	* 29/9N/5E/Seward
Location/Property	: Billings Creek	: Billings Creek	: Billings Creek
KX/MAS/MILS/File	: File 127, 128, 268	: File 127, 128, 268	: File 127, 128, 268
Proj. no./Sub.	: 1219 Peninsula	: 1219 Peninsula	: 1219 Peninsula
Reports	*	*	*

Element	E. Sp	AA/Wet	Assay	E. Sp	AA/Wet	Assay	E. Sp	AA/Wet	Assay
: Aluminum	:	:	:	:	:	:	:	:	:
: Antimony	:	:	:	:	:	:	:	:	:
: Arsenic	:	:	:	:	:	:	:	:	:
* Barium	*	:	*	:	:	*	:	:	*
* Beryllium	*	:	*	:	:	*	:	:	*
* Bismuth	*	:	*	:	:	*	:	:	*
: Boron	:	:	:	:	:	:	:	:	:
: Calcium	:	:	:	:	:	:	:	:	:
: Cadmium	:	:	:	:	:	:	:	:	:
* Chromium	*	:	*	:	:	*	:	:	*
* Cobalt	*	:	*	:	:	*	:	:	*
* Columbium	*	:	*	:	:	*	:	:	*
: Copper	:	Ins	:	30	:	:	Ins	:	:
: Fluorine	:	:	:	:	:	:	:	:	:
: Gallium	:	:	:	:	:	:	:	:	:
* Germanium	*	:	*	:	:	*	:	:	*
* Gold	*	<.5	*	<.05	*	<.1	:	:	:
* Hafnium	*	:	*	:	:	*	:	:	*
: Indium	:	:	:	:	:	:	:	:	:
: Iron	:	:	:	:	:	:	:	:	:
: Lanthanum	:	:	:	:	:	:	:	:	:
* Lead	*	Ins	*	20	*	Ins	:	:	:
* Lithium	*	:	*	:	:	*	:	:	*
* Manganese	*	:	*	:	:	*	:	:	*
: Magnesium	:	:	:	:	:	:	:	:	:
: Molybdenum	:	:	:	:	:	:	:	:	:
: Niobium	:	:	:	:	:	:	:	:	:
* Nickel	*	:	*	:	:	*	:	:	*
* Phosphorous	*	:	*	:	:	*	:	:	*
* Platinum	*	:	*	:	:	*	:	:	*
: Rhenium	:	:	:	:	:	:	:	:	:
: Scandium	:	:	:	:	:	:	:	:	:
: Silver	:	:	:	:	:	:	:	:	:
* Silicon	*	:	*	:	:	*	:	:	*
* Sodium	*	:	*	:	:	*	:	:	*
* Strontium	*	:	*	:	:	*	:	:	*
: Tantalum	:	:	:	:	:	:	:	:	:
: Tellurium	:	:	:	:	:	:	:	:	:
: Thallium	:	:	:	:	:	:	:	:	:
* Tin	*	:	*	:	:	*	:	:	*
* Titanium	*	:	*	:	:	*	:	:	*
* Tungsten	*	:	*	:	:	*	:	:	*
: Vanadium	:	:	:	:	:	:	:	:	:
: Yttrium	:	:	:	:	:	:	:	:	:
: Zinc	:	Ins	:	70	:	Ins	:	:	:
* Zirconium	*	:	*	:	:	*	:	:	*

APPENDIX 1 - Continued

Sample Number/Year	: 5891A/81	: 5891B/81	: 5891C/81
Material Type	: STREAM SED	: STREAM SED	: STREAM SED
Rock Type	: MET SED, FEL PLUT	: MET SED, FEL PLUT	: MET SED, FEL PLUT
Rock Age	* CRET, TERT	* CRET, TERT	* CRET, TERT
Quad 4 mile/1 mile	* Seward D5	* Seward D5	* Seward D5
Sec/T/R/Mer	* 29/9N/5E/Seward	* 29/9N/5E/Seward	* 29/9N/5E/Seward
Location/Property	: Billings Creek	: Billings Creek	: Billings Creek
KX/MAS/MILS/File	: File 127, 128, 268	: File 127, 128, 268	: File 127, 128, 268
Proj. no./Sub.	: 1219 Peninsula	: 1219 Peninsula	: 1219 Peninsula
Reports	*	*	*

Element	E. Sp	AA/Wet	Assay	E. Sp	AA/Wet	Assay	E. Sp	AA/Wet	Assay
: Aluminum	:	:	:	:	:	:	:	:	:
: Antimony	:	:	:	:	:	:	:	:	:
: Arsenic	:	:	:	:	:	:	:	:	:
* Barium	*	:	*	:	:	*	:	:	*
* Beryllium	*	:	*	:	:	*	:	:	*
* Bismuth	*	:	*	:	:	*	:	:	*
: Boron	:	:	:	:	:	:	:	:	:
: Calcium	:	:	:	:	:	:	:	:	:
: Cadmium	:	:	:	:	:	:	:	:	:
* Chromium	*	:	*	:	:	*	:	:	*
* Cobalt	*	:	*	:	:	*	:	:	*
* Columbium	*	:	*	:	:	*	:	:	*
: Copper	:	30	:	25	:	:	30	:	:
: Fluorine	:	:	:	:	:	:	:	:	:
: Gallium	:	:	:	:	:	:	:	:	:
* Germanium	*	:	*	:	:	*	:	:	*
* Gold	*	.1	*	2.5	*	:	<.05	:	:
* Hafnium	*	:	*	:	:	*	:	:	*
: Indium	:	:	:	:	:	:	:	:	:
: Iron	:	:	:	:	:	:	:	:	:
: Lanthanum	:	:	:	:	:	:	:	:	:
* Lead	*	20	*	15	*	:	20	:	:
* Lithium	*	:	*	:	:	*	:	:	*
* Manganese	*	:	*	:	:	*	:	:	*
: Magnesium	:	:	:	:	:	:	:	:	:
: Molybdenum	:	:	:	:	:	:	:	:	:
: Niobium	:	:	:	:	:	:	:	:	:
* Nickel	*	:	*	:	:	*	:	:	*
* Phosphorous	*	:	*	:	:	*	:	:	*
* Platinum	*	:	*	:	:	*	:	:	*
: Rhenium	:	:	:	:	:	:	:	:	:
: Scandium	:	:	:	:	:	:	:	:	:
: Silver	:	:	:	:	:	:	:	:	:
* Silicon	*	:	*	:	:	*	:	:	*
* Sodium	*	:	*	:	:	*	:	:	*
* Strontium	*	:	*	:	:	*	:	:	*
: Tantalum	:	:	:	:	:	:	:	:	:
: Tellurium	:	:	:	:	:	:	:	:	:
: Thallium	:	:	:	:	:	:	:	:	:
* Tin	*	:	*	:	:	*	:	:	*
* Titanium	*	:	*	:	:	*	:	:	*
* Tungsten	*	:	*	:	:	*	:	:	*
: Vanadium	:	:	:	:	:	:	:	:	:
: Yttrium	:	:	:	:	:	:	:	:	:
: Zinc	:	70	:	65	:	:	65	:	:
* Zirconium	*	:	*	:	:	*	:	:	*

APPENDIX 1 - Continued

Sample Number/Year	: 5891D/81	: 5891E/81	: 5891F/81
Material Type	: STREAM SED	: STREAM SED	: STREAM SED
Rock Type	: MET SED, FEL PLUT	: MET SED, FEL PLUT	: MET SED, FEL PLUT
Rock Age	* CRET, TERT	* CRET, TERT	* CRET, TERT
Quad 4 mile/1 mile	* Seward D5	* Seward D5	* Seward D5
Sec/T/R/Mer	* 29/9N/5E/Seward	* 29/9N/5E/Seward	* 32/9N/5E/Seward
Location/Property	: Billings Creek	: Billings Creek	: Billings Creek
KX/MAS/MILS/File	: File 127, 128, 268	: File 127, 128, 268	: File 127, 128, 268
Proj. no./Sub.	: 1219 Peninsula	: 1219 Peninsula	: 1219 Peninsula
Reports	*	*	*

Element	E. Sp	AA/Wet	Assay	E. Sp	AA/Wet	Assay	E. Sp	AA/Wet	Assay
: Aluminum	:	:	:	:	:	:	:	:	:
: Antimony	:	:	:	:	:	:	:	:	:
: Arsenic	:	:	:	:	:	:	:	:	:
* Barium	*	:	*	:	:	*	:	:	*
* Beryllium	*	:	*	:	:	*	:	:	*
* Bismuth	*	:	*	:	:	*	:	:	*
: Boron	:	:	:	:	:	:	:	:	:
: Calcium	:	:	:	:	:	:	:	:	:
: Cadmium	:	:	:	:	:	:	:	:	:
* Chromium	*	:	*	:	:	*	:	:	*
* Cobalt	*	:	*	:	:	*	:	:	*
* Columbium	*	:	*	:	:	*	:	:	*
: Copper	:	35	:	:	30	:	:	30	:
: Fluorine	:	:	:	:	:	:	:	:	:
: Gallium	:	:	:	:	:	:	:	:	:
* Germanium	*	:	*	:	:	*	:	:	*
* Gold	*	.1	*	:	1.5	*	:	<.05	*
* Hafnium	*	:	*	:	:	*	:	:	*
: Indium	:	:	:	:	:	:	:	:	:
: Iron	:	:	:	:	:	:	:	:	:
: Lanthanum	:	:	:	:	:	:	:	:	:
* Lead	*	15	*	:	15	*	:	15	*
* Lithium	*	:	*	:	:	*	:	:	*
* Manganese	*	:	*	:	:	*	:	:	*
: Magnesium	:	:	:	:	:	:	:	:	:
: Molybdenum	:	:	:	:	:	:	:	:	:
: Niobium	:	:	:	:	:	:	:	:	:
* Nickel	*	:	*	:	:	*	:	:	*
* Phosphorous	*	:	*	:	:	*	:	:	*
* Platinum	*	:	*	:	:	*	:	:	*
: Rhenium	:	:	:	:	:	:	:	:	:
: Scandium	:	:	:	:	:	:	:	:	:
: Silver	:	:	:	:	:	:	:	:	:
* Silicon	*	:	*	:	:	*	:	:	*
* Sodium	*	:	*	:	:	*	:	:	*
* Strontium	*	:	*	:	:	*	:	:	*
: Tantalum	:	:	:	:	:	:	:	:	:
: Tellurium	:	:	:	:	:	:	:	:	:
: Thallium	:	:	:	:	:	:	:	:	:
* Tin	*	:	*	:	:	*	:	:	*
* Titanium	*	:	*	:	:	*	:	:	*
* Tungsten	*	:	*	:	:	*	:	:	*
: Vanadium	:	:	:	:	:	:	:	:	:
: Yttrium	:	:	:	:	:	:	:	:	:
: Zinc	:	65	:	:	65	:	:	65	:
* Zirconium	*	:	*	:	:	*	:	:	*

Sample Number/Year	: 5891G/81	:	:
Material Type	: STREAM SED	:	:
Rock Type	: MET SED, FEL PLUT	:	:
Rock Age	* CRET, TERT	*	*
Quad 4 mile/1 mile	* Seward D5	*	*
Sec/T/R/Mer	* 32/9N/5E/Seward	*	*
Location/Property	: Billings Creek	:	:
KX/MAS/MILS/File	: File 127, 128, 268	:	:
Proj. no./Sub.	: 1219 Peninsula	:	:
Reports	*	*	*

Element	E. Sp	AA/Wet	Assay	E. Sp	AA/Wet	Assay	E. Sp	AA/Wet	Assay
: Aluminum	:	:	:	:	:	:	:	:	:
: Antimony	:	:	:	:	:	:	:	:	:
: Arsenic	:	:	:	:	:	:	:	:	:
* Barium	*	:	*	:	:	*	:	:	*
* Beryllium	*	:	*	:	:	*	:	:	*
* Bismuth	*	:	*	:	:	*	:	:	*
: Boron	:	:	:	:	:	:	:	:	:
: Calcium	:	:	:	:	:	:	:	:	:
: Cadmium	:	:	:	:	:	:	:	:	:
* Chromium	*	:	*	:	:	*	:	:	*
* Cobalt	*	:	*	:	:	*	:	:	*
* Columbium	*	:	*	:	:	*	:	:	*
: Copper	:	20	:	:	:	:	:	:	:
: Fluorine	:	:	:	:	:	:	:	:	:
: Gallium	:	:	:	:	:	:	:	:	:
* Germanium	*	:	*	:	:	*	:	:	*
* Gold	*	<.05	*	:	:	*	:	:	*
* Hafnium	*	:	*	:	:	*	:	:	*
: Indium	:	:	:	:	:	:	:	:	:
: Iron	:	:	:	:	:	:	:	:	:
: Lanthanum	:	:	:	:	:	:	:	:	:
* Lead	*	15	*	:	:	*	:	:	*
* Lithium	*	:	*	:	:	*	:	:	*
* Manganese	*	:	*	:	:	*	:	:	*
: Magnesium	:	:	:	:	:	:	:	:	:
: Molybdenum	:	:	:	:	:	:	:	:	:
: Niobium	:	:	:	:	:	:	:	:	:
* Nickel	*	:	*	:	:	*	:	:	*
* Phosphorous	*	:	*	:	:	*	:	:	*
* Platinum	*	:	*	:	:	*	:	:	*
: Rhenium	:	:	:	:	:	:	:	:	:
: Scandium	:	:	:	:	:	:	:	:	:
: Silver	:	:	:	:	:	:	:	:	:
* Silicon	*	:	*	:	:	*	:	:	*
* Sodium	*	:	*	:	:	*	:	:	*
* Strontium	*	:	*	:	:	*	:	:	*
: Tantalum	:	:	:	:	:	:	:	:	:
: Tellurium	:	:	:	:	:	:	:	:	:
: Thallium	:	:	:	:	:	:	:	:	:
* Tin	*	:	*	:	:	*	:	:	*
* Titanium	*	:	*	:	:	*	:	:	*
* Tungsten	*	:	*	:	:	*	:	:	*
: Vanadium	:	:	:	:	:	:	:	:	:
: Yttrium	:	:	:	:	:	:	:	:	:
: Zinc	:	60	:	:	:	:	:	:	:
* Zirconium	*	:	*	:	:	*	:	:	*

APPENDIX 2

PROPERTY SUMMARY

File No.: 127 (similar to 128) KX No. : 187
MAS No. : 243 BLM No.:

Deposit Type: Mineralized quartz cementing fractures in altered felsic dike cutting slate; dike is 1 1/2-5' wide and several hundred meters long, contains apy, gal, spal

Name of Claim(s): Golden Giant Group, Collins Fish & Barry Prospect

Owner(s):

Location: Billings Glacier, east side near the foot

Township: 9N Range: 5E Section: 28

Quad(1:250,000): Seward Quad(1:63,360): D5
Latitude : Longitude :

Commodities: Au, Pb, Zn

Production: Years:

Reserves: Demonstrated: Inferred:

Remarks: Last reported activity 1974
 1979 BuMines Assays - trace Au, Ag

Major Reference(s):
 U.S.G.S. Bulletin 592G, p. 234, pl IX, #45
 MF 880A, #139, 1978

APPENDIX 2 - Continued

PROPERTY SUMMARY

File No.: 128 (similar to 127) KX No. : 186
MAS No. : 242 BLM No.:

Deposit Type: Quartz stringers in a belt of slate 3,000' long by 1,100' wide,
stringers 1"-18" wide and 1-3' apart, low grade

Name of Claim(s): Bullion Ledge

Owner(s):

Location: Billings Glacier, east side near toe of glacier

Township: 9N Range: 5E Section: 29

Quad(1:250,000): Seward Quad(1:63,360): D5
Latitude : Longitude :

Commodities: Au

Production: Years:

Reserves: Demonstrated: Inferred:

Remarks: Last reported activity 1975, no underground workings
1979 BuMines Assays found trace Ag, Au.

Major Reference(s):
U.S.G.S. Bulletin 592, p. 233, pl IX, #46

APPENDIX 3

Comparison of Alice Molybdenum Deposit, British Columbia, with the Billings Glacier Molybdenum Occurrence.
(From Clark [1])

Deposit	Alteration Mineral Assemblage	Shape	Size	Associated Minerals Ore, Gangue, Secondary	Tenor % MoS ₂	Distribution
Alice	1. Quartz-K-feldspar-biotite	Circular Cylindrical	1,600 x 2,200 x 700+	Pyrite Chalcopyrite Scheelite Tetrahedrite Pyrrhotite Galena Sphalerite Quartz Fluorite	0.21 av 0.16 co	Stockwork veins, Quartz veinlets
	2. Quartz-sericite-kaolinite	Shell				Fractures Disseminated
Billings Glacier	Tentative	Circular	Tentative 300 x2,000+	Identified to date Pyrite	Unknown	Stockwork veins
	1. Quartz-K-feldspar-biotite	Possibly cylindrical	x 750	Chalcopyrite Possible Quartz Tetra- Pyrrhotite hedrite W Mineral Galena		Fractures Disseminated
	2. Na plagioclase					