FIELD REPORT ON THE RESULTS OF MANGANESE MINERAL EXPLORATION IN THE MCHUGH COMPLEX, KENAI PENINSULA, ALASKA

by Roger E. Burleigh and Kerry G. Lear

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DEPARTMENT OF THE INTERIOR
Manuel Lujan, Jr., Secretary

U.S. BUREAU OF MINES
T S Ary, Director

INTRODUCTION

The U.S. Bureau of Mines selected the McHugh Complex geologic terrane as a site of grassroots manganese mineral exploration based upon high manganese anomalies produced as a result of the National Uranium Resource Program reconnaissance surveys. Significant anomalies were only found in the Bradley Lake drainage basin. Discussions with Dwight Bradley, a USGS geologist, led to the transfer to the Bureau of a suspected manganese-enriched sample collected during a USGS AMRAP project. A manganese assay of the sample showed approximately 18% Mn. The sample was collected from a bed or vein hosted by bedded chert within the McHugh Complex.

The McHugh Complex is composed of cherty argillite, bedded chert, black shale and siltstone, and lesser mafic volcanic rocks deformed in a melange tectonic framework. The prospect of tracing manganiferous strata within the melange was expected to be difficult. However, it was hoped that a manganiferous unit could serve as a marker horizon to aid in unraveling the structure of the complex.

A helicopter supported, seven day, reconnaissance exploration project was conducted in August of 1992 by Kerry Lear (AFOC-Fairbanks), Russ Hicks (AFOC-Anchorage), Bill O'Conner (ALRC-Albany) and Roger Burleigh (AFOC-Fairbanks). The project was based out of Homer, Alaska. While adding to the knowledge of the manganese resource base of Alaska the project also delivered approximately 45 kg of manganese mineralized rock for mineral beneficiation studies to be conducted by Bill O'Conner (U.S. Bureau of Mines Albany Research Center).

RESULTS

Manganese mineralization was discovered during a USGS AMRAP survey of the Seldovia quadrangle. The location of the discovery outcrop is in section 36 of T. 6 S., R. 11 W. USGS topographic maps (1979 versions of the 1:63,360 scale map) show the lower half of section 36 to be covered by glacial ice. However, The Grewingk glacier has receded considerably to the extent that only the lower fifth of section 36 is now ice covered (plate 1). A black shiny manganese oxide stain is now exposed with a NE strike on glacial rubble-strewn bedrock in the west-central part of section 36. Considerable iron oxide staining also marks the location of the manganiferous bed. Exploration proceeded with detail mapping of the discovery outcrop and regional examination of bedrock along the general strike of the McHugh Complex.

Detail mapping of the discovery outcrop showed that a massive 0.3 m-thick manganese carbonate/silicate bed is intercalated within a thick sequence of bedded black and olive drab chert (fig. 1, table 1). A representative grade for the manganese mineralized bed at the discovery is between 25.71 to 32.19% Mn (table 1, fig. 1). The bed could be traced for 117 meters along strike. The dark-colored chert is spatially associated with massive cherty argillite and mafic volcanic rocks that locally contain irregular masses of red ferruginous chert. This assemblage of rock units was mapped by the USGS to roughly trend NE, parallel to the structural fabric of the McHugh Complex. Continuity of specific rock types along the trend is destroyed within the melange.

Regional exploration was focussed upon the extensions of belt of bedded chert, cherty argillite and mafic volcanic rocks to the northeast and southwest of the discovery outcrop. Significant indications of similar manganese mineralization was found at the toe of the receding Dixon Glacier 11-13 km north of the discovery outcrop. A 70 m by 70 m area of manganese oxide-stained chert boulders was discovered within the thin cover of glacial debris at the toe of the Dixon Glacier (sample MN28689, plate 1, table 1). Although none of the boulders were mineralized, the conspicuous accumulation of stained boulders is similar to that found at the manganese discovery 12 km to the southwest. A manganese mineralized glacial boulder was subsequently discovered at sample location MN28690 (plate 1, tables 1 and 2). Sample MN 28690 is a 15 cm-wide boulder of massive pink manganese carbonate/silicate with trace chalcopyrite that contains 489 ppm Co, 569 ppm Ga and assayed 29.01% Mn. The high gallium value is interesting but at the same time suspicious. Traverses along both limits of Dixon Glacier failed to turn up any other signs of manganese mineralization.

An large area of iron staining is visible on the northeast side of the toe of Dixon Glacier (plate 1). The Bureau found extensive siliceous alteration, bleaching, and pyrrhotitization of cherty argillite rocks. Minor quartz-sulfide veining is found within the altered rocks. Select samples of sulfide-bearing samples contained as much as 1.45% Cu, 20.7 ppm Ag, 351 ppm Bi, 1,292 ppm W, and >2,000 ppm As (Samples MN28336 and

MN28684, table 2, plate 1). The sulfide minerals are dominantly arsenopyrite with lesser chalcopyrite. Additional sample locations are found on figure 2.

RECOMMENDATIONS

Because of the severe deformation within the McHugh Complex melange the prospect of finding a continuous bed of manganese mineralization is remote. It is recommended that no further exploration for manganese be made within the area examined on the Kenai Peninsula.

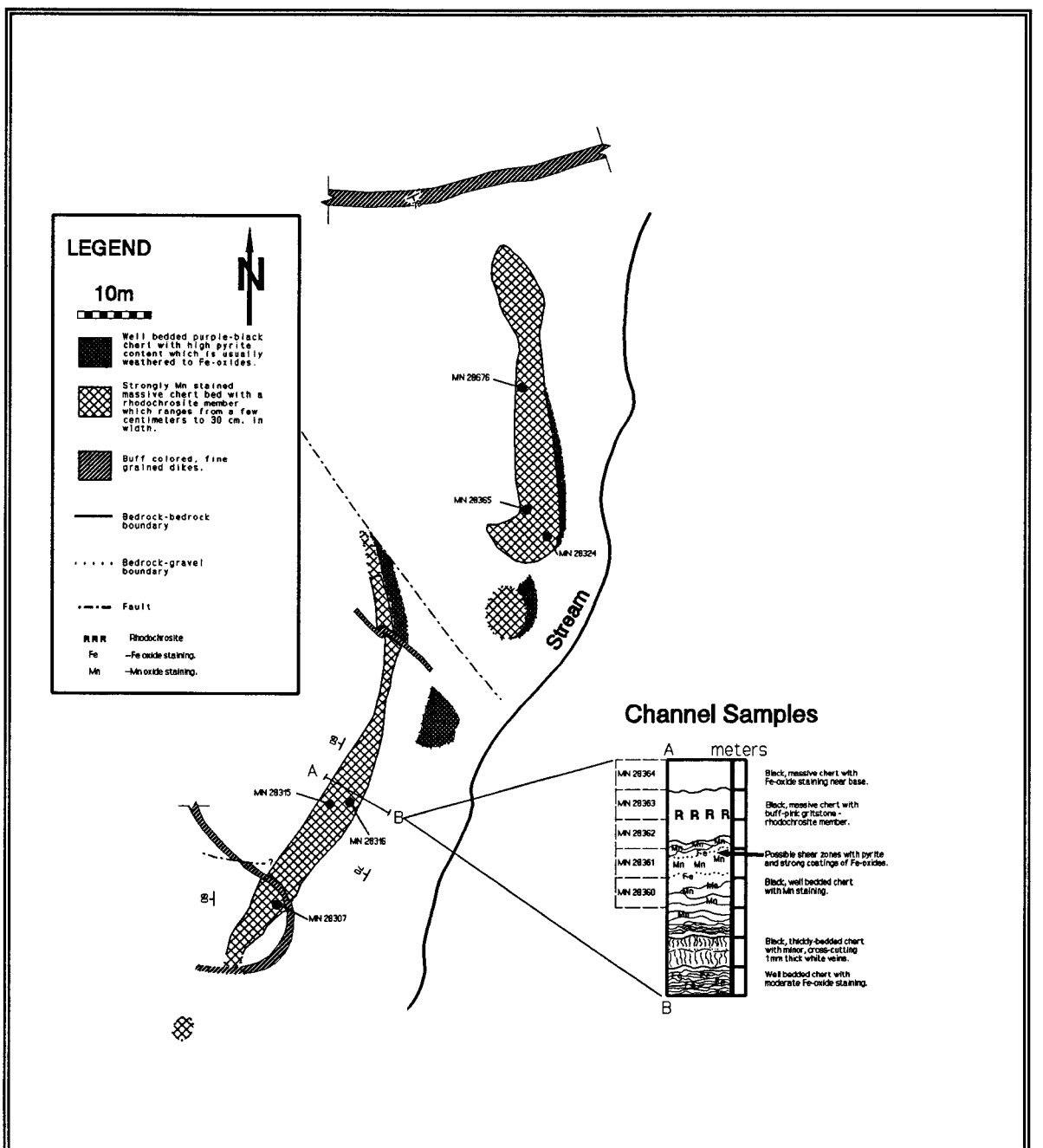

Figure 1. -- Detail map of the Grewingk Glacier manganese deposit

SELDOVIA


30'
151°
Ptarmigan Head
Caribou Creek
Caribou Hills
Clam
Deep
South Fork
Creek
Beeo Creek
Cytex Creek
Boxcar Hills
Caribou Lake
Ninilchik Dome
Clearwater
Eagle Lake
Emergency Landing Strip
River
Fox
Sheep
North Fork
Nikolaevsk
Eagle Lake
Kachemak Silo
(Village)
Landing Strip
Swift
Kachemak Bay
KENAI
Epperson Knob
Bald Mountain
Sheep
MN28318
MN28319
MN28317
Bradley Lake
Battle
Chugachik Island
MN28320
Beaver
Fritz Creek
WINTER TRAIL
EAST ROAD
Landing Strip
Bear Island
Anchor
Ohlson Mtn
Radio Tower
Lookout Mountain
Twitter Creek
Crossman Ridge
Aurora Spit
Aurora Lagoon
Cabin
Martin River
MN28678
MN28677
Diamond Ridge
Diamond Cr
Kachemak City
Mallard Bay
Dixon Glacier
Homer
Quarry
Millers Landing
Well
Seaplane Base
Light
Coal Bay
Glacier Spit
Cabins
Humpy
Portlock Glacier
Nuka Glacier
Grewingk Cr
Homer Spit
Iceworm Peak
Archimandritof Shoals
Coal Point
Light
Peterson
Ismailof Island
Halibut Cove
Grewingk Glacier
Gull Island
Peterson Bay
Halibut Cove Lagoon
Halibut
KACHEMAK
China Poot Bay
Neptune Bay
Yalik Glacier
McKeon Flats
Anisom Point
China Poot Lake
Yukon Island
Hesketh Island
Sadie Cove
Wosnesenski Glacier
Glacier
STATE
Nubble Point
Herring Is
Kasitsna Bay
Little Tutka Bay
Tutka Bay
Doroshin Glacier
Glacier
Glacier

Table 1. -- Inductively coupled plasma multi-element analyses of rock samples.

Sample Number	Ag ppm	Cu ppm	Pb ppm	Zn ppm	Mo ppm	Ni ppm	Co ppm	Cd ppm	Bi ppm	As ppm	Sb ppm	Fe ppm	Mn ppm	Te ppm	Ba ppm	Cr ppm	V ppm
MN28317	1.6	59	33	223	16	56	20	3.6	48	61	72	3.84	2461	35	722	53	130
MN28320	1.1	46	31	96	11	46	24	<2	55	72	27	3.66	4435	33	545	35	97
MN28323	2.0	46	31	61	10	44	20	<2	53	80	50	4.07	895	43	361	34	155
MN28330	2.3	75	37	98	15	65	28	<2	75	83	71	6.56	1411	54	494	75	258
MN28677	1.1	59	16	75	7	63	14	<2	41	60	35	3.28	637	35	462	71	130
MN28678	<0.5	51	14	86	9	63	16	<2	25	70	29	4.1	698	<25	637	78	147
MN28679	1.7	46	30	79	9	58	16	<2	49	103	39	3.83	837	36	566	64	130
MN28681	<0.5	70	9	66	16	75	17	<2	12	34	13	3.34	818	<25	1015	101	128

	Sn ppm	W ppm	Li ppm	Ga ppm	La ppm	Ta ppm	Ti pct	Al pct	Mg pct	Ca pct	Na pct	K pct	Nb ppm	Sr ppm	Y ppm	Zr ppm	
MN28317	44	<20	29	34	8	18	0.34	1.52	0.79	1.2	1.63	0.87	12	133	<5	31	
MN28320	36	<20	25	35	6	<5	0.28	1.64	0.56	1.22	1.33	0.67	11	113	<5	34	
MN28323	49	<20	22	35	<5	<5	0.39	1.99	0.62	2.7	2.10	0.80	13	136	<5	42	
MN28330	55	<20	25	45	5	<5	0.58	2.51	1.18	2.31	1.60	0.92	15	110	6	51	
MN28677	32	<20	33	29	<5	<5	0.34	1.47	0.50	0.62	1.51	1.07	11	75	<5	38	
MN28678	28	<20	42	24	9	<5	0.40	4.23	0.92	0.40	1.56	1.25	11	102	9	80	
MN28679	39	<20	39	33	9	8	0.35	3.79	0.92	0.61	1.63	1.03	12	119	8	63	
MN28681	20	<20	26	15	9	<5	0.34	1.91	0.92	1.53	1.42	0.80	7	138	<5	31	

	Sample Description
MN28317	Stream sediment sample; Possible influence from nearby road fill
MN28320	Stream sediment sample; Small creek crossing Bradley Lake haul road
MN28323	Stream sediment sample; Small stream
MN28330	Stream sediment sample
MN28677	Stream sediment sample; Draining Nuka Glacier and Valdez Group rocks
MN28678	Stream Sediment sample; From high energy gulch stream
MN28679	Stream sediment sample; sand and clay material
MN28681	Stream sediment sample

Table 1. -- Continued

Sample Number	Ag ppm	Cu ppm	Pb ppm	Zn ppm	Mo ppm	Ni ppm	Co ppm	Cd ppm	Bi ppm	As ppm	Sb ppm	Fe ppm	Mn ppm	Te ppm	Ba ppm	Cr ppm	V ppm
MN28318	1.6	41	24	48	10	45	17	2.2	55	86	74	3.76	1291	43	522	74	127
MN28319	2.4	113	48	469	14	80	24	9.4	52	>2000	130	10	5931	55	518	145	73
MN28336	9.9	14473	<2	765	3	40	13	<2	210	>2000	<5	10	512	<25	96	89	9
MN28684	20.7	14519	32	169	11	40	147	17.2	351	>2000	59	5.14	363	70	172	191	51
MN28685	3.0	114	32	59	10	74	34	<2	67	146	61	5.78	1240	41	374	210	267
MN28686	3.3	250	71	140	6	35	11	<2	36	56	61	3.89	2967	25	156	207	37
MN28690	12.5	809	87	39	19	204	489	4.7	246	165	122	1.56	>20000	125	839	39	174

	Sn ppm	W ppm	Li ppm	Ga ppm	La ppm	Ta ppm	Ti pct	Al pct	Mg pct	Ca pct	Na pct	K pct	Nb ppm	Sr ppm	Y ppm	Zr ppm	
MN28318	43	<20	27	35	<5	<5	0.36	2.20	0.85	1.92	1.96	0.92	11	94	<5	32	
MN28319	58	<20	38	41	7	<5	0.23	2.88	0.29	0.84	0.15	0.66	11	127	26	29	
MN28336	45	1292	7	<10	<5	<5	0.05	0.97	0.13	0.26	0.54	0.27	21	54	<5	20	
MN28684	58	<20	10	26	<5	<5	0.16	1.14	0.52	0.47	0.56	0.61	18	86	<5	15	
MN28685	71	<20	30	46	<5	<5	0.70	2.43	0.65	3.36	2.15	0.74	12	258	5	23	
MN28686	26	<20	23	20	<5	<5	0.10	0.55	0.37	0.20	0.25	0.56	5	17	<5	15	
MN28690	46	43	9	569	9	44	0.02	0.67	1.41	4.46	0.24	0.16	11	542	<5	19	

	Sample Description
MN28318	Grab bedrock; Blue-green coating on black graywacke of McHugh Complex
MN28319	Grab rubble; Deeply weathered rock-soil with orange-red-black oxide coatings
MN28336	Grab float; Quartz vein with 10% combined chalcopyrite, arsenopyrite in purple-brown altered graywacke; surrounding outcrops are gossany
MN28684	Grab bedrock; Vuggy quartz vein with 10% combined chalcopyrite, arsenopyrite in purple-brown altered graywacke; surrounding outcrops are gossany
MN28685	Grab float; cobble of altered melange; 3-5% disseminated pyrrhotite, trace chalcopyrite
MN28686	Grab float; 1 m-wide boulder of greenish tan altered and bleached dike rock with trace pyrrhotite
MN28690	Grab float; Pink to tan, massive rhodonite or rhodocrosite; 1% disseminated cpy

Table 2. -- Manganese assay results for rock samples.

Sample Number	Mn pct	Sample Description
MN28305	0.10	Rubble grab; Black cherty argillite with weak Mn-stain; heavy
MN28306	0.11	Bedrock grab; Black Mn-stained bedded chert
MN28307	30.29	Random chip; White to pink rhodonite or rhodocrosite; disseminated chalcopyrite and pyrite
MN28315		Select bulk sample; 0.3 m-wide bed of rhodonite or rhodocrosite in black chert
MN28316		Select bulk sample; Olive drab to black Mn-coated bedded chert
MN28321	0.06	Rubble grab; Mn-stained black chert
MN28322	0.33	Rubble grab; Mn-stained black chert
MN28324	25.71	Bedrock select; Tan to pink rhodonite-chert stone; 0.3 m-wide bed
MN28325	0.40	Bedrock grab; Mn-stained black chert
MN28327	2.48	Grab; Bedded chert with 0.5 cm-thick glassy fissile layer; Mn-stained
MN28328	0.17	Select stream cobble; Mn-stained, heavy, meso-scale melange
MN28334	0.22	Float; Mn-stained rock
MN28335	0.33	Rubble grab; Mn-stained greenstone
MN28359	0.73	Random chip; Mn-stained bedded chert; minor Fe-staining
MN28360	0.98	Continuous chip; 1.0 m segment of Mn-stained black chert with some Fe-staining
MN28361	1.21	Continuous chip; 1.0 m segment of Mn-stained black bedded chert
MN28362	4.34	Continuous chip; 1.0 m segment of Mn-stained chert with minor rhodonite beds
MN28363	32.19	Continuous chip; 1.0 m segment of massive rhodonite with lesser bedded chert
MN28364	0.70	Continuous chip; 1.0 m segment of Mn-stained bedded chert
MN28365	0.75	Random chip; Mn-stained bedded chert
MN28672	0.13	Grab; Cherty, argillaceous rock; greenstone components (?)
MN28673	0.22	Grab; Fine-grained cherty grey-black argillite
MN28674	0.12	Grab; Mafic volcanic
MN28675	0.12	Grab; Olive drab cherty argillite
MN28676		Bedrock bulk sample; Hematitic chert bands interbedded with manganese carbonates or manganese silicates; 9-11 kg sample
MN28687	2.69	Grab bedrock; 0.6 m diameter, Mn-stained black chert knot in mafic volcanic rock
MN28688	1.68	Grab bedrock; Olive drab chert adjacent to mafic volcanic; Mn-stained and 5% pyrite; 17 m-long outcrop
MN28689	0.52	Grab float; Black cherty argillite boulders with Mn-staining; 70 by 70 m area
MN28690	29.01	Grab float; Pink to tan, massive rhodonite or rhodocrosite; 1% disseminated cpy
MN28691	0.11	Grab float; Cobbles of weakly Mn-stained black chert and cherty argillite