UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

GEOCHEMICAL DATA FROM THE NABESNA A-4 QUADRANGLE, ALASKA

By

D. H. Richter and N. A. Matson, Jr.

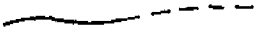
Open-file report

1970

This report is preliminary and has not been edited or reviewed for conformity with Geological Survey standards or nomenclature.

MAP EXPLANATION

Nabesna A-4 quadrangle,
Alaska



Approximate contact of Nabesna batholith; dashed where covered.

Stream sediment sample
and number
Solid circle indicates presence of anomalous elements. Anomalous elements and their concentration (in ppm) shown. See Table 1 for additional analytical data.

Rock sample and number
See Table 2 for sample description and analytical data.

Altered areas
Conspicuous limonite-staining due principally to weathering of disseminated sulfides in bedrock. May also include areas of hydrothermal alteration.

Localities described in "Economic geology notes" section in this report.

TABLE 1

Analyses of stream sediments
Nabesna (A-4) quadrangle, Alaska

L, detected but below limit of determination. N, not detected.
Limit of determination shown in parentheses under element.

Sample No.	Concentration (ppm)										
	Au (0.02)	Ag (0.5)	B (10)	Cr (5)	Cu (2)	Mo (2)	Ni (2)	Pb (10)	Sc (5)	V (5)	Zn (200)
ACK 100	L	N	L	150	50	L	70	N	20	150	N
ACK 101	L	N	L	200	70	L	100	N	30	200	N
ACK 102	L	N	L	150	150	N	70	N	20	150	N
ACK 103	L	N	N	50	5	N	30	L	10	150	N
ACK 106	L	N	L	150	15	L	50	L	30	200	N
ACK 107	L	N	20	200	70	L	100	N	30	300	N
ACK 119	L	1.5	30	70	1500	200	30	30	20	200	500
ACK 120	.06	N	15	300	70	L	150	L	30	200	L
ACK 121	L	L	20	70	100	L	30	70	30	200	500
ACK 122	L	L	20	150	100	L	70	70	30	200	1000
ACK 123	L	L	15	150	100	L	150	30	30	200	L
ACK 124	.04	.7	15	150	300	50	50	70	30	200	L
ACK 125	L	N	15	200	70	L	100	10	30	200	L
ACK 126	L	N	15	300	150	L	150	N	30	300	L
ACK 127	L	N	20	300	100	L	150	10	50	300	L
ACK 128	L	N	20	200	30	L	100	L	30	200	L
ACK 129	L	N	15	200	30	L	100	N	30	200	L
ACK 130	L	N	15	200	30	L	100	L	30	200	L
ACK 131	L	N	15	300	150	L	150	N	30	300	L
ACK 132	L	N	15	70	20	N	30	L	15	150	L
ACK 133	L	N	15	300	150	L	150	N	30	500	L
ACK 134	L	N	20	300	150	L	150	N	50	300	L
ACK 135	L	N	15	700	200	L	150	L	70	700	300
ACK 136	L	N	10	300	150	L	150	L	30	700	200
ACK 137	L	N	15	300	150	L	150	L	50	300	L
ACK 138	L	N	15	300	100	N	150	L	30	300	L
ACK 139	L	L	15	150	100	15	150	L	30	300	L
ACK 140	L	1	15	300	300	15	150	20	30	300	L
ACK 141	L	N	15	300	150	L	150	L	30	300	L
ACK 142	L	N	15	300	150	L	150	L	30	300	L

TABLE 1, cont.

Sample No.	Concentration (ppm)										
	Au (0.02)	Ag (0.5)	B (10)	Cr (5)	Cu (2)	Mo (2)	Ni (2)	Pb (10)	Sc (5)	V (5)	Zn (200)
ACK 143	L	.7	15	150	100	L	50	70	20	200	300
ACK 144	.1	.7	15	20	70	L	15	100	7	70	300
ACK 145	L	L	20	70	100	L	30	15	20	150	L
ACK 146	L	L	15	150	70	L	70	300	20	200	200
ACK 147	L	L	20	50	150	L	30	100	20	150	700
ACK 148	L	L	20	70	150	L	50	50	30	300	700
ACK 149	L	L	20	50	100	L	30	500	20	200	300
ACK 150	L	L	15	300	100	L	150	L	30	300	L
ACK 151	L	N	10	300	100	L	150	N	20	300	L
ACK 152	L	L	20	15	100	L	20	50	15	150	300
ACK 153	L	N	15	70	50	L	50	L	15	150	L
ACK 154	L	N	10	300	70	L	150	N	30	300	L
ACK 155	L	N	15	300	70	L	150	N	30	300	L
ACK 156	L	L	15	50	70	L	30	70	20	300	700
ACK 157	L	N	20	20	70	L	20	10	30	300	L
ACK 180	L	1.5	15	70	200	L	30	150	10	150	300
ACK 181	L	L	20	70	200	L	30	50	15	150	300
ACK 182	L	L	15	70	150	L	50	70	20	300	L
ACK 183	L	L	20	70	100	5	50	30	30	300	700
ACK 184	L	L	15	70	70	5	30	30	20	200	200
ACK 185	L	.7	20	30	500	5	30	70	15	150	1500
ACK 186	.04	.7	15	30	300	7	30	30	15	200	500
ACK 187	L	1.5	15	70	700	L	50	300	30	300	2000
ACK 188	L	3	20	150	1000	50	100	200	30	300	700
ACK 189	L	L	15	150	300	L	70	70	30	300	500
ACK 190	L	L	30	50	70	L	30	20	20	200	L
ACK 191	.04	L	20	150	70	5	100	20	30	500	200
ACK 192	L	L	15	70	50	L	50	30	15	200	L
ACK 193	L	N	30	70	150	L	50	30	30	300	L
ACK 194	L	N	20	20	70	5	20	L	20	300	N
ACK 195	.1	2	15	20	700	10	15	150	15	150	700
ACK 196	L	L	15	70	70	L	50	20	20	200	L
ACK 197	.06	1.5	15	20	300	5	20	15	15	200	300
ACK 198	L	.5	15	20	300	70	20	10	20	200	N
ACK 199	L	L	L	15	500	70	20	10	15	150	N
ACK 200	L	L	10	30	300	70	20	L	20	200	N
ACK 201	L	N	30	150	70	L	70	15	30	300	L
ACK 202	L	L	20	150	150	L	150	20	30	300	L
ACK 203	L	N	15	15	200	L	20	10	10	100	N
ACK 204	.04	L	15	15	70	L	15	20	15	200	L

TABLE 1, cont.

Sample No.	Concentration (ppm) Au (0.02)	Ag (0.5)	B (10)	Cr (5)	Cu (2)	Mo (2)	Ni (2)	Pb (10)	Sc (5)	V (5)	Zn (200)
ACK 205	L	L	15	15	70	L	20	L	7	150	L
ACK 206	L	L	15	10	70	L	20	L	5	70	N
ACK 207	.06	L	15	20	150	15	30	L	5	70	N
ACK 208	L	N	15	15	30	L	15	L	5	150	L
ACK 209	L	L	15	20	70	7	30	10	7	150	N
ACK 210	.04	1.5	15	30	500	50	20	20	20	200	L
ACK 211	L	.7	15	50	100	L	30	20	20	200	L
ACK 212	.02	L	15	20	150	7	20	L	15	150	N
ACK 213	L	L	15	100	100	L	5	10	30	200	L
ACK 214	.08	.7	15	20	300	30	30	30	20	200	300
ACK 215	L	L	L	10	300	L	15	N	7	50	N
ACK 216	L	.5	10	30	300	15	20	10	15	150	L
ACK 217	L	L	10	30	50	L	30	L	15	150	N
ACK 218	.2	1.5	15	30	2000	70	30	70	20	150	300
ACK 219	.3	1.5	15	70	3000	500	50	70	30	200	200
ACK 220	L	N	L	20	30	L	30	10	15	150	L
ACK 221	L	N	15	70	70	N	30	15	20	150	L
ACK 222	L	N	L	150	20	L	100	N	20	150	L
ACK 223	L	L	10	150	50	L	150	N	30	200	L
ACK 224	L	L	30	30	70	L	30	L	20	200	L
ACK 225	L	.7	20	30	70	L	30	30	20	200	L
ACK 240	.1	L	20	30	70	5	30	20	15	150	L
ACK 241	.06	2	20	150	300	15	100	300	30	200	3000
572	L	N	10	200	100	N	50	15	50	700	N
574	L	N	20	300	70	7	150	L	70	500	N
576	L	N	N	300	100	N	150	L	70	500	N
578	L	N	10	500	150	N	150	N	50	500	L
584	L	N	30	150	70	N	30	50	50	500	200
590	L	N	N	500	100	N	150	20	70	500	N
591	L	N	N	300	100	N	100	20	50	500	N
592	.1	N	20	150	70	N	50	20	50	200	L
603	L	N	10	300	70	N	200	N	70	700	N
640	L	N	20	500	70	N	100	30	50	300	N
641	L	N	20	50	50	N	50	30	20	150	L
644	L	L	50	20	200	L	30	150	20	200	1500
647	L	L	10	20	700	7	7	L	30	300	N
661	L	N	200	150	70	N	30	30	50	700	N
757	L	N	6	30	15	N	15	L	7	150	N
758	L	N	15	30	30	N	7	L	7	200	N
759	L	N	20	30	100	L	15	10	10	150	N

TABLE 1, cont.

Sample No.	Concentration (ppm) Au (0.02)	Ag (0.5)	B (10)	Cr (5)	Cu (2)	Mo (2)	Ni (2)	Pb (10)	Sc (5)	V (5)	Zn (200)
760	L	N	15	70	150	N	30	L	15	300	N
789	.04	N	10	30	100	L	70	L	30	150	L
791	L	N	15	30	5	L	200	N	30	150	L
792	L	N	10	200	100	L	150	L	50	150	L
793	L	N	L	100	50	L	150	10	30	200	L
794	L	N	30	30	70	L	70	L	30	150	L
795	L	N	L	200	50	L	50	15	20	150	L
796	L	N	20	150	20	5	70	10	30	100	L
797	L	N	15	150	50	N	150	10	30	150	L
799	L	N	N	700	150	N	100	L	30	200	L
804	L	N	30	30	150	N	100	L	50	500	L

Gold by atomic absorption. Analysts; King, H.D.; Miller, R.L.; Tripp, R.B.

Other elements by semi-quantitative spectrographic. Analysts: Curry, K.J.; Martinez, L.

TABLE 2

Analyses of rocks, veins, alteration zones and soils
Nabesna (A-4) quadrangle, Alaska

L, detected, but below limit of determination. N, not detected. G, greater than value shown. Limit of determination shown in parentheses under element.

Sample No.	Concentration (ppm)										
	Au (0.02)	Ag (0.5)	B (10)	Cr (5)	Cu (2)	Mo (2)	Ni (2)	Pb (10)	Sc (5)	V (5)	Zn (200)
ACK 226	.06	15	L	10	G(20000)	15	10	700	10	50	G(10000)
ACK 227	L	2	10	10	300	N	10	70	10	50	L
ACK 228	.02	50	15	10	G(20000)	200	10	1500	5	30	G(10000)
ACK 229	1.0	30	15	10	15000	L	10	15000	10	150	G(10000)
ACK 230	L	1	L	10	500	10	20	70	15	200	300
ACK 231	L	1.5	20	150	G(20000)	L	100	15	30	300	L
ACK 232	L	L	20	L	1500	L	15	15	30	150	L
ACK 233	L	N	L	10	300	N	30	15	7	70	N
ACK 234	.04	1.5	15	30	500	15	30	15	30	200	300
ACK 235	.04	1.5	15	20	1500	300	30	15	30	200	300
ACK 236	L	L	15	10	50	70	15	15	N	30	L
ACK 237	L	N	20	10	15	N	10	10	20	150	N
ACK 238	L	L	30	10	70	L	10	20	20	150	N
ACK 239	L	N	15	10	100	L	15	30	30	200	L
ACK 242	.1	N	L	10	15	15	L	L	L	20	L
ACK 243	.04	.7	15	70	700	7	100	L	20	150	L
573	L	N	20	30	70	N	10	L	70	500	N
575	L	N	50	70	100	5	20	15	100	500	N
577	L	N	N	10	30	N	15	L	10	100	N
579	L	.7	10	L	1500	N	N	15	10	100	L
580	L	.5	10	50	20	L	20	50	10	200	700
581	L	N	50	150	100	N	50	30	70	500	N
582	L	N	15	700	300	N	150	50	50	700	2000
583	L	.7	10	15	50	N	7	L	15	150	N
585	L	N	10	50	100	N	7	L	50	300	N
586	L	N	15	50	100	N	10	L	30	500	L
587	2.4	200	20	N	G(20000)	L	L	G(20000)	N	30	G(10000)
588	.2	150	N	10	5000	300	L	5000	N	20	7000
589	.04	50	50	50	5000	N	30	7000	15	200	7000
602	L	N	10	300	500	N	200	N	G(100)	700	N
604	.2	1.5	50	50	100	N	30	200	30	500	300
605	.9	30	70	70	70	50	30	1000	50	500	N
606	.02	N	50	N	50	N	L	700	10	100	N
607	.02	N	30	N	70	N	L	700	7	50	200
608	L	N	30	N	50	N	L	700	10	70	N

TABLE 2, cont.

Sample No.	Au (0.02)	Ag (0.5)	B (10)	Cr (5)	Cu (2)	Mo (2)	Ni (2)	Pb (10)	Sc (5)	V (5)	Zn (200)
612	L	N	100	7	70	N	L	N	7	70	N
613	L	N	100	L	70	N	L	15	15	100	N
614	.04	7	30	L	200	N	L	500	20	300	N
638	.1	L	20	15	300	7	7	10	20	100	N
639	L	N	30	30	30	N	70	15	15	150	N
642	.02	.7	30	10	3000	N	5	20	30	150	200
643	L	.5	30	7	70	5	5	20	50	70	L
645	.02	3	20	30	700	N	30	30	50	300	200
646	.04	L	10	150	2000	10	70	L	50	300	L
648	.02	3	30	30	70	N	50	N	15	150	N
649	L	N	30	150	150	5	70	50	30	200	300
650	L	L	30	30	500	N	L	5000	50	300	1500
651	L	L	N	300	70	L	100	15	50	500	N
652	L	1.5	30	30	150	L	20	15	30	300	300
827	L	N	30	30	15	N	20	10	15	100	N
828	L	.7	15	30	300	L	20	L	20	150	N
831	.04	L	L	7	(500)	70	7	N	15	100	L
832	4.0	2	L	5	150	20	7	300	7	70	700
833	.8	5	N	L	100	5	5	150	L	30	500
834	.9	N	L	N	300	5	5	3000	N	50	G(10000)
835	L	L	N	N	10	7	L	100	7	15	L
836	L	N	30	300	15	N	70	10	15	150	N
841	L	1.5	L	L	300	N	7	1500	N	10	300
844	L	N	N	20	15	5	50	15	15	200	N
845	L	N	10	7	7	N	15	N	15	100	N
848	.06	50	10	5	100	15	7	G(10000)	N	70	G(10000)
849	.06	.5	30	30	500	100	50	150	15	150	L
850	L	N	L	N	300	N	L	20	7	30	200
851	L	N	L	50	200	70	7	15	15	150	N
886	10	10	15	5	1000	70	5	10000	5	20	N
887	.06	L	10	5	200	5	7	100	5	50	N
907	L	N	L	50	10	N	50	10	10	100	N
908	L	.7	50	10	20	N	L	L	L	15	N
909	L	N	10	15	30	N	20	15	30	300	N
910	L	N	15	50	L	N	50	10	10	100	N
911	L	1	L	10	150	10	N	30	L	50	N
912	L	2	L	10	700	5	L	10	5	70	N
913	.02	N	L	50	L	L	30	L	5	100	N
914	L	N	L	20	L	N	15	L	5	70	N
915	L	N	10	50	L	N	30	L	10	100	N

TABLE 2, cont.

Sample No.	Concentration (ppm)										
	Au (0.02)	Ag (0.5)	B (10)	Cr (5)	Cu (2)	Mo (2)	Ni (2)	Pb (10)	Sc (5)	V (5)	Zn (200)
920	L	N	10	L	L	L	5	10	10	150	L
921	L	N	10	30	15	L	20	10	30	200	L
922	L	N	L	L	L	L	L	L	10	100	L

Gold by atomic absorption. Analysts: Friskin, J.G.; King, H.D.; Miller, R.L.; Tripp, R.B.; Wells, A.W.

Other elements by semi-quantitative spectrographic. Analysts: Cooley, E.F.; Curry, K.J.; Martinez, L.; Siems, D.; Watts, K.C.

TABLE 2, cont.

Description of Samples

Sample No.	Description
ACK 226	Channel sample across 1-foot quartz vein with pyrite, chalcopyrite, sphalerite.
ACK 227	Random chip sample across 300 feet of copper-stained silicified diorite.
ACK 228	Channel sample across 2-foot quartz-pyrite vein.
ACK 229	Grab sample of sulfide-bearing massive quartz vein float.
ACK 230	Chip sample across 1000 feet of pyrite-bearing diorite.
ACK 231	Chip sample across 50 feet of copper-stained amygdaloidal basalt.
ACK 232	Grab sample of altered greenstone.
ACK 233	Grab sample of pyrite-bearing leucodiorite.
ACK 234	Random grab sample across 500 feet of limonite-stained pyrite-bearing granodiorite.
ACK 236	Random grab sample of 1 inch pyrite-bearing quartz vein.
ACK 237	Chip sample across 2-foot pyrite-bearing porphyry.
ACK 238	Chip sample across 300 feet of altered felsic rocks.
ACK 239	Grab sample of pyrite-bearing greenstone.
ACK 242	Grab sample of 1 inch magnetite-pyrite vein in recrystallized limestone.
ACK 243	Grab sample of pyritized and epidotized amydgaloidal basalt.
573	Grab sample from 2 to 5 inch gougy shear zone in pyrite-bearing diorite.
575	Chip sample across 200 feet of hydrothermally altered zone on diorite contact.
577	Grab sample of pyrite-bearing diorite at diorite-porphyry contact.
579	Chip sample across 200 feet of altered sulfide-bearing quartz porphyry.
580	Grab sample of conglomerate with sulfide clasts.
581	Grab sample of pyrite-bearing greenstone.

TABLE 2, cont.

Sample No.	Description
582	Grab sample of sulfide-bearing porphyry dike.
583	Grab sample of volcanic breccia.
585	Chip sample across 100 feet of limonite-stained diorite.
586	Chip sample of limonite-stained diorite.
587	Chip sample across 6 inch sphalerite-chalcopyrite-galena vein in recrystallized limestone.
588	Chip sample across 1 foot quartz-pyrite-chalcopyrite vein in recrystallized limestone.
589	Chip sample across 20 feet of limonite-stained porphyry dike.
602	Chip sample of pyrite-bearing greenstone.
604	Chip sample of quartz-carbonate-pyrite vein.
605	Composite grab sample of red soil.
606	Chip sample across 60 feet of limonite-stained porphyry.
607	Chip sample of limonite-stained porphyry.
608	Chip sample of limonite-stained porphyry.
612	Channel sample across 1 foot of unaltered quartz porphyry.
613	Composite grab sample of limonite-stained quartz porphyry.
614	Grab sample of pyrite-rich quartz porphyry.
638	Grab sample of pyrite-bearing hornfelsed volcanics.
639	Grab sample of 12-foot limonite-stained hornblende-plagioclase porphyry dike.
642	Grab sample of sericitized quartz diorite.
643	Chip sample across 60 feet of propylitized and limonite-stained quartz diorite.
645	Grab sample of pyrite-bearing hornfelsed black argillite.
646	Chip sample across 200 feet of pyrite-bearing sericitized porphyry.
648	Grab sample of pyrite-bearing sericitized porphyry.
649	Grab sample of pyrite-bearing carbonate-altered hornblende plagioclase porphyry.

TABLE 2, cont.

Sample No.	Description
650	Grab sample of limonite-jarosite soil.
651	Grab sample of carbonate vein.
652	Grab sample of pyrite-bearing vein in silicified greenstone.
827	Grab sample of altered hornblende-plagioclase porphyry dike.
828	Random chip sample of pyrite-bearing mafic diorite.
831	Grab sample of chalcopyrite-molybdenite-bearing hornblende granodiorite float.
832	Grab sample of granodiorite float with pyrite-bearing quartz veins.
833	Grab sample of 20 foot quartz-pyrite vein.
834	Grab sample of volcanic hornfels float with disseminated galena and sphalerite.
835	Grab sample of silicified and limonite-stained hornfels float.
836	Grab sample of greenstone with pyrite veinlets at old prospect.
841	Random chip sample of recrystallized thick-bedded limestone.
844	Chip sample across 8 feet of limonite-stained shear zone in volcanic flows.
845	Random chip sample of limonite-stained brecciated flows in shear zone.
848	Grab sample of galena-and sphalerite-bearing quartz vein float from strong limonite-stained area.
849	Grab sample of pyrite-bearing altered feldspar porphyry float.
850	Grab sample of pyrite-bearing hornfelsed volcanic float.
851	Grab sample of chalcopyrite-bearing hornblende diorite.
886	Grab sample of small sulfide-bearing quartz hematite vein.
887	Random chip sample of metasomatized diorite.
907	Grab sample of 10-foot hornblende plagioclase porphyry dike.
908	Grab sample of small aplitic dike.
909	Grab sample of 5-foot hornblende plagioclase porphyry dike.

TABLE 2, cont.

Sample No.	Description
910	Grab sample of gray porphyry dike.
911	Grab sample of small sulfide-bearing quartz hematite vein at contact with diorite.
912	Grab sample of metasomatized diorite at contact with quartz hematite vein.
913	Grab sample of green hornblende diorite.
914	Grab sample of hornblende K-spar porphyry.
915	Grab sample of hornblende K-spar porphyry.
920	Grab sample of gray hornblende diorite.
921	Grab sample of gray hornblende diorite.
922	Grab sample of foliated hornblende quartz diorite.

Analytical notes:

1. All stream sediment analyses performed on -80 mesh fraction.

2. In all analyses, with the exception of gold, the results are reported to the nearest number in the series 1, 0.7, 0.5, 0.3, 0.2, 0.15, 0.1 etc.

3. Elements are considered anomalous if they are present in concentrations greater than 3 times mean background. With the exception of amygdaloidal basalt terrane, mean background in the quadrangle closely approximates average crustal abundance, i.e., copper,55 ppm; lead, 12.5 ppm; zinc, 70 ppm; molybdenum,1.5 ppm. Background concentrations for copper and certain other elements in amygdaloidal basalt terrane are considerably higher than crustal average, hence samples 126, 131, 133-137, 139-142 and 299 from streams draining amygdaloidal basalt and with copper contents of 150-200 ppm probably should not be considered anomalous.

Economic Geology Notes

Nabesna A-4 quadrangle,
Alaska

(numbers refer to localities shown on accompanying map)

1. Large area of hydrothermally altered volcanic rocks exposed in canyon on Monte Cristo creek. Original volcanic flows (?) have been intensely altered to a mixture of clay, silica, iron oxides and sulfates containing abundant veinlets of pyrite and veins and masses of gypsum as much as 6 inches thick.

2. Orange Hill porphyry copper-molybdenum deposit. Mineral occurrences at Orange Hill have been known since at least 1902 and are covered by 18 patented mining claims in private ownership (U.S.Geol.Survey Bull.933-B). The deposit consists of disseminated chalcopyrite, pyrite and molybdenite in a fractured and locally silicified quartz diorite-granodiorite.

3. Bond Creek porphyry copper-molybdenum deposit. Large mineralized area along margin of Nabesna batholith discovered in early 1960's and now held by a number of unpatented mining claims. Deposit consists of disseminated iron and copper sulfides with minor molybdenite in granodiorite and includes some contact sulfide deposits.

4. Boulders of granodiorite with fracture coatings of chalcopyrite and molybdenite fairly abundant in glacial moraine.

5. Small exposure of recrystallized limestone at contact with granodiorite contains abundant veins and irregular pods of quartz and massive sphalerite and galena as much as 1-foot wide. Small prospect pits have been dug on some of the mineralized veins.

6. A number of hydrothermally altered porphyry dikes and small masses of quartz diorite with disseminated chalcopyrite and pyrite occur in this area.

7. Hydrothermally altered quartz porphyry and diorite with abundant quartz-pyrite veins and veinlets. Zone 300 feet long by 100 feet wide is strongly limonite-stained and locally copper-stained.

8. Float of limonite-stained vein quartz with sphalerite and galena is abundant along base of large intensely altered zone in Permian volcanic rocks on upper Cross Creek. Deposit is apparently one referred to by Moffit (U.S.Geol.Survey Bull.989-D).

9. Zone of copper-bearing Triassic amygdaloidal basalt 200 feet long by 30 feet thick. No sulfides observed in surface exposure but rocks contain relatively abundant malachite.