Lithology and Chemical Analyses of Core and Cuttings from USGS Drill Hole near Gold Acres, Lander County, Nevada

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Abstract

In 1968 the USGS drilled a 1,916-foot-deep (584.0 m) hole 1.3 miles (2.1 km) west of the abandoned town of Gold Acres in the Shoshone Range of north-central Nevada. The hole was drilled mainly to determine the depth to the Roberts Mountains thrust, a prominent structural feature that influenced the localization of gold ore at the nearby Gold Acres open-pit mine. The thrust is interpreted as occurring at a depth of 890 feet (271.3 m) in the hole. This report presents the lithology of the core and cuttings obtained during the drilling and chemical analyses of 31 elements determined from samples of these materials.

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Introduction

As part of a study of the geology and geochemistry of gold deposits near the east edge of the Shoshone Range in north-central Nevada, the Geological Survey in 1968 drilled a 1,916 foot-deep (584.0 m) hole 1.3 miles (2.1 km) west of the abandoned town of Gold Acres (fig. 1). The hole was drilled to obtain information on the structure, stratigraphy, and geochemistry of the section penetrated, and especially to determine the depth to the Roberts Mountains thrust, the dominant structural feature in the area. This report presents a lithologic log of the rocks drilled and analytical data on the concentration of 31 elements in the core and cuttings recovered during drilling of the hole, which is interpreted as cutting the thrust at a depth of 890 feet (271.3 m).

Information on the depth to the thrust is useful in mineral exploration in the Gold Acres area because the largest gold deposit that has been mined in the northern Shoshone Range occurs in upper plate rocks close to the sole of the thrust. However, the position of the thrust at depth cannot easily be determined from the surface geology except close to the exposed trace. The hole discussed here was drilled 1.1 miles (1.8 km) from the nearest exposure of the thrust and in an area where the depth to the thrust was unknown.

The most detailed discussion of the general geology of the northern Shoshone Range, including the Gold Acres area, is by Gilluly and Gates (1965). However, Wrucke (1975) gives a more recent interpretation of the geology of the Gold Acres area and shows the drill

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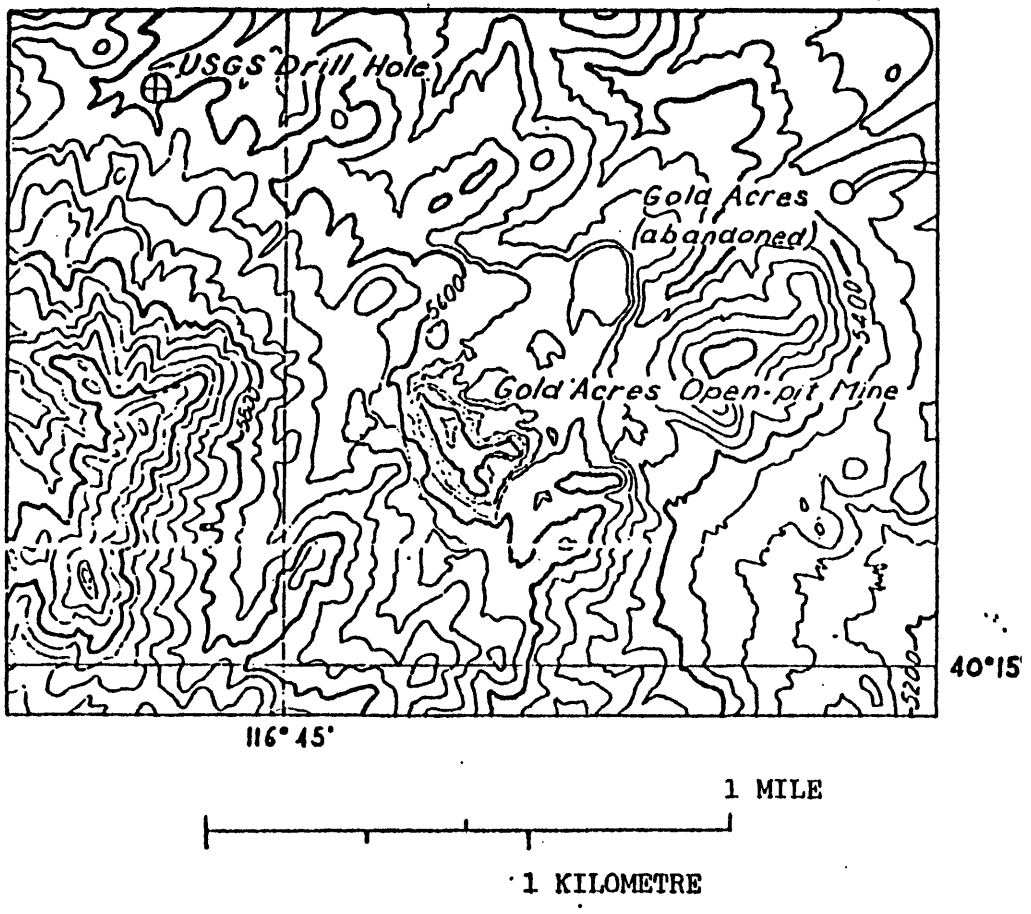

Figure 1.--Map showing the location of Gold Acres and USGS drill hole.

site. Other reports on this part of the range include a brief summary of the distribution of gold, silver, and other elements (Wrucke and others, 1968), and analytical data on 31 chemical elements in 1,520 samples collected during a geochemical reconnaissance (Wrucke and Armbrustmacher, 1973). A detailed account of the geology and geochemistry of the Gold Acres open-pit mine, 0.8 miles southeast of the drill hole, has been prepared for publication by the U. S. Geological Survey (Wrucke and Armbrustmacher, 1975).

Geologic setting

Rocks exposed in the vicinity of the drill hole are part of the western or siliceous assemblage of strata in the upper plate of the Roberts Mountains thrust, a structural feature of regional extent that formed in Mississippian time. The most abundant upper plate rocks within a mile of the hole belong to the Valmy Formation of Ordovician age and consist of chert, argillite, and minor greenstone. Siltstone, chert, and argillite of the Elder Sandstone of Silurian age form small exposures near the hole. The Slaven Chert of Devonian age, previously thought to be widespread in this part of the Shoshone Range (Gilluly and Gates, 1965) is now interpreted as occurring no closer than 1.3 miles (2.1 km) of the hole (Wrucke, 1975).

Rocks in the eastern or carbonate assemblage in the lower plate of the Roberts Mountains thrust crop out in the Gold Acres window centered about 1.5 miles (2.4 km) southeast of the drill hole. They consist mainly of limestone and silty limestone of the Wenban

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Formation of Devonian age but also include small amounts of fissile calcareous siltstone of the Pilot Shale of Devonian and Mississippian age. The Roberts Mountains Formation of Devonian and Silurian age, common in exposures of lower plate rocks in north-central Nevada, occurs in the Gold Acres area only at the Gold Acres open-pit mine, where it forms thrust slices interleaved with siliceous rocks low in the upper plate of the thrust (Wrucke and Armbrustmacher, 1975).

The northern edge of a north-northwest-trending zone of hydrothermally altered and weakly metamorphosed rocks about a mile wide and two miles long begins 1,000 feet (305 m) south of the drill hole. A granitic pluton of Cretaceous age, nowhere exposed but penetrated by drill holes in and near the Gold Acres open-pit mine, is interpreted to be buried beneath much of this altered area (Wrucke, 1975; Wrucke and Armbrustmacher, 1975). The drill hole was positioned as close as possible to this zone of mineralized and metamorphosed rock to provide the best chance of drilling through the Roberts Mountains thrust without entering the pluton.

The Roberts Mountains thrust occurs along the west side of the Gold Acres window. It traces a sinuous path from the Gold Acres open-pit mine south to the mountain front and passes beneath gravel of the adjacent valley. Elsewhere around the Gold Acres window the thrust has been dropped down along steep faults. As shown on a cross section by Wrucke (1975), the thrust rises only gradually eastward from the 890 foot (271.3 m) depth at the drill hole, but a short

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distance from the Gold Acres open-pit mine the thrust rises more steeply toward a nearly vertical fault that bounds the northwest side of the window.

Lithologic log

A detailed lithologic log of the rocks drilled at the hole is given in table 1. The log was made from cuttings recovered during drilling from the surface to a depth of 1,200 feet (366 m) and from core obtained from 1,200 feet (366 m) to the bottom of the hole at 1,916 feet (584.0 m). The logging was done by C. T. Wrucke and T. J. Armbrustmacher.

Rocks below the Roberts Mountains thrust have not been classified as to formation. The limestone resembles the Roberts Mountains Formation of Devonian and Silurian age in being laminated, carbonaceous, and fine grained, and the calc-silicate hornfels interlayered with the limestone originally must have been silty dolomite, a common rock in that formation. However, the suggestion that the limestone and hornfels might belong to the Roberts Mountains Formation is difficult to verify, as no complete well exposed section of the formation for comparison with the core is known in the Shoshone Range, and no fossils have been found in rocks drilled at the hole.

Evidence of deformation in the rocks drilled is limited to small folds in the uppermost section of limestone cored below the Roberts Mountains thrust. Unfortunately, the rocks most likely to be intensely deformed are in the upper plate of the thrust from which almost no core was recovered.

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Table 1.--Lithologic log of the drill samples

Location: NE¼ SW¼ sec. 25 (unsurveyed), T. 28 N., R. 46 E., 1.2 mi (1.9 km) west of Gold Acres (see fig. 1). Altitude of collar approx. 5,580 ft.

	Depth interval Feet (meters in parenthesis)	
	0 - 28 (0 - 8.5)	Alluvial sand and gravel
Valmy Formation (ORDOVICIAN)	28 - 55 (8.5 - 16.8)	Chert and argillite in about equal amounts, medium gray. Argillite silty in part. Fractures coated with yellow and brown iron oxides
	55 - 75 (16.8-22.9)	Siltstone, pale brown to pale brownish gray, but calcareous, laminated
	75 - 255 (22.9-77.7)	Argillite and minor chert, mostly medium gray but varies from light to dark gray. Argillite is soft and silty. Unit contains minor disseminated pyrite, trace of sphalerite
Elder Sandstone (SILURIAN)	255 - 380 (77.7-115.8)	Siltstone with subordinate argillite and chert, all light gray. Siltstone is calcareous, forms 80 percent of unit. Minor disseminated pyrite; trace of sphalerite
Valmy Fm. (ORD)	380 - 890 (115.8-271.3)	Chert and subordinate argillite, light to medium gray. Unit is 90 percent chert; contains minor disseminated pyrite
	890 (271.3)	Roberts Mountains thrust

Table 1.—Lithologic log of the drill samples (cont'd.)

890 - 1,300 (271.3-396.2)	Limestone, medium gray to very dark gray, laminated to very thin bedded, carbonaceous, fine clastic; contains minor tremolite, abundant pyrite. Folds a few feet (about 0.5 m) across common 1,295-1,298 (394.7-395.6): Light gray bleached limestone 1,298-1,300 (395.6-396.2): Many calcite veins
1,300-1,401 (396.2-427.0)	Calc-silicate hornfels, very light gray, pale greenish gray and pale brownish gray, faintly laminated, calcareous. Contains abundant diopside, minor tremolite, plagioclase, and adularia, and sparse disseminated pyrite
1,401-1,435 (427.0-437.4)	Limestone, dark bluish gray, laminated to thin bedded, carbonaceous, fine clastic. Contains minor tremolite, abundant calcite veins, moderately abundant disseminated pyrite
1,435-1,713 (437.4-522.1)	Calc-silicate hornfels, very light gray to pale greenish gray, faintly laminated, very fine grained. Contains abundant diopside, minor calcite, adularia, muscovite, biotite, and chlorite 1,671-1,675 (509.3-510.5): Limestone, black, laminated in part, carbonaceous, fine grained. Contains abundant pyrite and numerous calcite veins

Table 1.—Lithologic log of the drill samples (cont'd)

	1,706-1,713 (520.0-522.1): Tremolite-diopside hornfels, medium gray, rich in calcite
1,713-1,833 (522.1-558.7)	Limestone, dark bluish gray, laminated to thick bedded, carbonaceous, tremolite-bearing, fine grained. Abundant fine-grained disseminated pyrite. Contains bleached zones as much as 1 ft (30 cm) thick. Abundant calcite veins
	1,762 (537.1): Breccia zone rich in carbonaceous material
	1,806-1,809 (550.5-551.4): Tactite
	1,824-1,833 (556.0-558.7): Argillized limestone
1,833-1,916 (588.7-584.0)	Calc-silicate hornfels, pale green to pale greenish gray, massive, calcareous
	1,849 (563.6): Two-inch (5 cm) zone containing galena
	1,856 (565.8): Three-inch (8 cm) zone containing galena
	1,874 (571.2): Brecciated zone 6 inches (15 cm) thick
1,916 (584.0)	Bottom of hole, reached July 13, 1968

Chemical analyses

Chemical analyses of cuttings and core from the drill hole are given in table 2. Composite chip samples submitted for chemical analyses were made of cuttings from each 10-foot interval drilled and from each ten feet of lithologically uniform core. Where sections of core of similar lithology were shorter than 10 feet (3 m), or only a little longer, the sample interval was adjusted accordingly. No samples were collected from the upper 480 feet (146 m) and the bottom 8 feet (2.4m), as the recovery was poor.

Analytical determinations for 29 elements were made by a semiquantitative spectrographic method (Ward and others, 1963; Grimes and Marranzino, 1968). Gold was determined by a wet chemical method using atomic absorption spectrophotometry (Thompson and others, 1968). Mercury was analyzed instrumentally by an atomic absorption technique outlined by Vaughn and McCarthy (1964).

Spectrographic analyses were made by E. L. Mosier and J. M. Motooka; gold analyses by R. W. Leinz, M. S. Rickard, T. M. Stein, Z. C. Stephenson, and J. G. Viets; and mercury analyses by W. H. Ficklin, R. Vaughn, and J. G. Viets.

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SEMIQUANTITATIVE SPECTROGRAPHIC ANALYSES

Depth Interval (feet)	Fe%	Mg%	Ca%	Ti%	Mn	Ag	As	Au [1]	B	Ba	Be	Bi	Cd	Co	Cr	Cu
0-480	No data															
480-90	.7	.2	.5	.07	100	L	N	N	10	300	L	N	N	L	10	30
490-500	.7	.3	1	.05	300	L	N		L	200		L		L	5	30
500-10	.7	.2	.5	.07	150	N	N		L	200		N		L	7	30
510-20	.7	.3	.2	.1	100	N	N		10	200		N		5	10	30
520-30	1	.7	1	.07	500	N	N		10	300		N		5	15	50
530-40	1.5	.7	.7	.1	300	L	N		10	200		N		7	15	70
540-50	1	.5	.7	.1	200	N	L		10	200		L		7	15	50
550-60	1	.7	.7	.15	200	L	200		15	300		10		7	20	70
560-70	1	.7	.7	.15	200	L	L		10	300		10		7	30	70
570-80	.7	.5	.3	.1	150	N	N		L	300		N		5	20	30
580-90	1	.7	.2	.15	150	N	N		10	300		N		5	30	100
590-600	1	.5	.3	.15	150	N	N		L	300		L		5	20	70
600-10	.7	.5	.3	.07	100	N	N		L	300		L		5	15	30
610-20	.7	.5	.3	.07	100	N	N		L	300		N		5	20	30
620-30	1	.7	.5	.1	100	N	N		L	300		N		5	30	70
630-40	.7	.7	.7	.15	150	N	N		L	300		N		5	20	30
640-50	1	.7	.7	.15	100	N	N		L	300		N		7	30	100
650-60	2	1.5	.7	.2	200	N	N		10	500		N		10	30	70
670-80	1.5	.7	.7	.1	150	N	N		10	300		N		5	20	30
680-90	1.5	.7	.3	.1	150	N	N		10	300		N		5	20	30
690-700	2	.7	.5	.15	150	N	N		10	300		L		7	20	30
700-10	1	.3	.7	.07	150	.5	N		L	150		L		5	10	50

REMARKS: Fe, Mg, Ca, and Ti reported in %, all other elements reported in ppm. Results are reported in the series 1, 0.7, 0.5, 0.3, 0.2, 0.15, 0.1, etc.

1. For analyses of gold, see page 25.

Table 2.--Chemical analyses of drill samples (cont'd.)

Depth Interval (feet)	La	Mo	Nb	Ni	Pb	Pd	Pt	Sb	Sc	Sn	Sr	Te	U	V	W	Y	Zn	Zr
0-480	No data																	
480-90	N	N	N	20	10	-	-	N	L	N	N	-	-	50	N	L	200	30
490-500	N	N	N	10	15	-	-		L			-	-	30		L	200	20
500-10	N	N	N	10	L	-	-		L			-	-	20		L	N	50
510-20	N	N	N	20	L	-	-		5			-	-	30		L	N	70
520-30	N	N	L	50	10	-	-		5			-	-	30		10	N	70
530-40	N	N	L	100	15	-	-		7			-	-	30		15	L	70
540-50	N	N	L	70	L	-	-		7			-	-	30		10	200	70
550-600	N	N	L	70	15	-	-		7			-	-	50		15	200	100
600-70	20	N	N	100	15	-	-		7			-	-	70		15	L	100
570-80	N	N	N	50	N	-	-		5			-	-	70		10	L	70
580-90	20	N	L	50	L	-	-		7			-	-	70		15	L	70
590-600	20	N	L	30	L	-	-		5			-	-	70		10	L	70
600-10	20	N	N	20	L	-	-		5			-	-	50		10	L	70
610-20	L	N	N	15	L	-	-		L			-	-	70		10	N	70
620-30	L	L	N	50	L	-	-		5			-	-	70		15	N	70
630-40	20	N	N	20	L	-	-		5			-	-	70		15	N	150
640-50	20	L	L	50	L	-	-		7			-	-	100		15	N	100
650-60	L	N	L	50	L	-	-		7			-	-	100		15	N	150
670-80	L	L	L	30	10	-	-		5			-	-	70		15	200	70
680-90	L	N	N	30	L	-	-		7			-	-	70		15	L	70
690-700	L	5	L	50	L	-	-		7			-	-	70		15	L	70
700-10	N	10	N	50	15	-	-		L			-	-	100		10	500	20

G = Greater than 10%, or greater than value shown. N=Not detected at limit of detection, or at value shown.
H = Interference.
- = Not looked for.
L=Detected, but below limit of determination, or below value shown.
*=Usual limits of determinations do not apply due to use of dilution technique.

Table 2.--Chemical analyses of drill samples (cont'd.)

Depth Interval (feet)	Fe%	Mg%	Ca%	Ti%	Mn	Ag	As	Au[1]	B	Ba	Be	Bi	Cd	Co	Cr	Cu
710-20	.5	.2	.7	.07	100	L	N	N	10	150	L	N	N	5	10	30
720-30	1.	.3	1	.07	200	.7	200		10	150		L		5	20	50
730-40	.7	.3	.7	.07	100	L	N		10	200		L		5	20	50
740-50	.7	.3	.7	.07	150	L	N		10	200		N		5	30	30
750-60	.7	.3	1	.07	100	L	N		L	150		N		5	30	30
760-70	.7	.3	1	.07	150	L	L		10	200		L		5	30	50
770-80	.7	.3	.7	.07	150	L	L		L	100		10		L	30	30
780-90	.3	.1	.3	.03	100	N	N		L	70		N		N	5	20
790-800	.2	.1	.2	.03	70	N	N		L	100		L		L	L	20
800-10	.3	.5	.7	.05	300	L	L		L	150		N		L	5	20
810-20	1	.5	.7	.07	300	N	N		L	150		N		5	20	30
820-30	1	1	1	.1	300	L	N		10	300		10		7	30	50
830-40	.7	.7	.7	.07	300	.5	N		L	200		10		7	30	30
840-50	1	1.5	.7	.15	300	L	N		10	300		15		7	30	30
850-60	1	.7	.7	.15	150	L	L		15	300		15		7	30	20
860-70	1	1	1.5	.1	500	N	N		15	200		N		5	30	20
870-80	.7	.7	1.5	.07	500	L	200		15	150		L		5	30	20
880-90	1.5	1.5	1.5	.2	700	.7	N		15	200		L		7	30	30
890-900	1.5	2	3	.15	700	1	N		20	150		L		7	30	30
900-10	1	1.5	5	.1	300	.5	N		10	150		L		5	30	30
910-20	.7	3	7	.07	200	L	N		L	100		L		L	15	15
920-30	.7	5	7	.07	150	L	N	N	L	70	N	N	N	7	30	30

Fe, Mg, Ca, and Ti reported in %, all other elements reported in ppm. Results are reported in the series 1, 0.7, 0.5, 0.3, 0.2, 0.15, 0.1, etc.

1. For analyses of gold, see pages 23-24.

Depth Interval (feet)	La	Mo	Nb	Ni	Pb	Pd	Pt	Sb	Sc	Sn	Sr	Te	U	V	W	Y	Zn	Zr
710-20	N	20	N	50	10	-	-	N	5	N	N	-	-	200	N	15	L	50
720-30	N	15	N	70	10	-	-		5		N	-	-	200		15	1000	50
730-40	N	50	N	70	10	-	-		5		N	-	-	300		15	700	50
740-50	N	60	N	70	15	-	-		5		N	-	-	200		15	500	70
750-60	N	15	N	70	10	-	-		6		100	-	-	200		15	300	70
760-70	N	15	N	70	10	-	-		5		N	-	-	300		15	500	70
770-80	N	15	N	70	L	-	-		6		N	-	-	300		15	700	50
780-90	N	5	N	20	N	-	-		L		N	-	-	70		L	200	30
790-800	N	L	N	15	N	-	-		L		N	-	-	30		L	200	30
800-10	N	N	N	15	L	-	-		6		N	-	-	30		L	200	30
810-20	N	15	L	150	L	-	-		5		N	-	-	30		10	200	70
820-30	N	15	N	50	15	-	-		7		N	-	-	150		15	L	100
830-40	N	10	N	50	10	-	-		7		N	-	-	150		15	L	100
840-50	20	N	L	30	15	-	-		7		N	-	-	100		20	L	100
850-60	20	N	L	50	15	-	-		7		N	-	-	70		15	L	100
860-70	L	N	N	20	10	-	-		5		N	-	-	70		15	L	100
870-80	L	7	N	30	10	-	-		5		N	-	-	200		15	300	100
880-90	L	7	N	50	20	-	-		7		N	-	-	200		15	L	100
890-900	N	10	N	30	30	-	-		7		200	-	-	100		15	300	70
900-10	N	7	N	30	30	-	-		5		300	-	-	70		15	200	50
910-20	N	30	N	30	15	-	-		5		300	-	-	150		15	L	50
920-30	L	50	N	70	10	-	-	✓	5	✓	300	-	-	300	✓	20	L	30
						-	-					-	-					

G = Greater than 10%, or greater than value shown.
I = Interference.
- = Not looked for.

N=Not detected at limit of detection, or at value shown.
L=Detected, but below limit of determination, or below value shown.
*=Usual limits of determinations do not apply due to use of dilution technique.

Depth Interval (feet)	Fe%	Mg%	Ca%	Ti%	Mn	Ag	As	Au[1]	B	Ba	Be	Bi	Cd	Co	Cr	Cu
930-40	.7	2	7	.07	300	L	N	N	10	150	L	N	N	5	20	15
940-50	.5	2	7	.07	150	L	N		L	200				L	20	15
950-60	.3	2	7	.07	150	L	N		10	150				L	30	10
960-70	.3	3	5	.07	200	L	N		L	150				L	30	7
970-80	.3	2	5	.07	150	L	N		L	70				L	20	7
980-90	.2	2	5	.07	100	N	N		10	100				L	20	7
990-1000	.3	3	5	.07	100	N	N		10	150				L	30	5
1000-10	.2	2	5	.05	100	N	N		L	150				L	15	7
1010-20	.3	2	5	.07	100	N	N		10	150				L	20	7
1020-30	.3	2	5	.07	150	N	N		10	150				L	30	20
1030-40	.3	1.5	5	.07	150	N	N		10	150				L	30	10
1040-50	.3	1.5	5	.07	300	L	300		L	70				L	30	5
1050-60	.2	1.5	5	.05	200	N	L		L	50		↓		N	20	L
1060-70	.2	1.5	5	.05	100	0	N		L	70		L		N	30	5
1070-80	.3	1.5	5	.07	150	.5	N		10	150		N		N	50	15
1080-90	.2	1.5	5	.05	100	N	N		L	150		N		N	30	7
1090-1100	.3	2	5	.07	150	L	N		10	150		N		N	30	5
1100-10	.3	1.5	5	.05	100	L	N		L	150		L		N	30	7
1110-20	.3	1.5	5	.07	150	L	N		L	200		L		L	20	7
1120-30	.3	1.5	5	.07	150	L	N		L	150	↓	L		L	20	7
1130-40	.2	1	7	.05	150	N	N		L	70	N	N		N	10	5
1140-50	.15	1.5	7	.05	70	N	N	↓	10	70	N	N	↓	N	10	L

Fe, Mg, Ca, and Ti reported in %, all other elements reported in ppm. Results are reported in the series 1, 0.7, 0.5, 0.3, 0.2, 0.15, 0.1, etc.

1 For analyses of gold, see page 24.

Depth Interval (feet)	La	Mo	Nb	Ni	Pb	Pd	Pt	Sb	Sc	Sn	Sr	Te	U	V	W	Y	Zn	Zr
930-40	N	20	N	70	15	-	-	N	5	N	300	-	-	200	N	20	L	70
940-50	20	N		20	10	-	-		5			-	-	100		15	200	70
950-60	20	L		30	15	-	-		5			-	-	50		15	L	70
960-70	20	N		30	L	-	-		5			-	-	30		15	N	70
970-80	20	N		10	10	-	-		5			-	-	30		20	N	70
980-90	L	N		15	10	-	-		5			-	-	30		15	N	50
990-1000	L	N		20	15	-	-		5			-	-	30		15	N	50
1000-10	L	N		10	L	-	-		5			-	-	20		15	N	50
1010-20	20	N		15	L	-	-		5			-	-	20		15	N	70
1020-30	20	N		15	10	-	-		5			-	-	30		15	L	70
1030-40	20	N		15	10	-	-		5			-	-	30		15	L	70
1040-50	L	N		15	15	-	-		5			-	-	100		15	N	70
1050-60	L	N		7	L	-	-		5			-	-	70		10	N	20
1060-70	N	N		15	20	-	-		5			-	-	150		15	N	50
1070-80	20	N		20	30	-	-		7			-	-	150		20	L	50
1080-90	N	N		10	L	-	-		5			-	-	150		15	N	30
1090-1100	N	N		10	L	-	-		5			-	-	150		15	N	70
1100-10	N	N		7	L	-	-		5			-	-	70		15	N	50
1110-20	L	N		10	15	-	-		5			-	-	70		15	200	50
1120-30	L	N		10	20	-	-		5			-	-	70		15	L	30
1130-40	N	N		5	10	-	-		5			-	-	30		10	N	15
1140-50	N	N		5	L	-	-		L			-	-	30		10	N	15
						-	-					-	-					

G = Greater than 10%, or greater than value shown. N=Not detected at limit of detection, or at value shown.
I = Interference.
- = Not looked for.
L=Detected, but below limit of determination, or below value shown.
*=Usual limits of determinations do not apply due to use of dilution technique.

Depth Interval (feet)	Fe%	Mg%	Ca%	Ti%	Mn	Ag	As	Au[1]	B	Ba	Be	Bi	Cd	Co	Cr	Cu
1150-60	.2	2	7	.05	100	N	N	N	15	100	L	N	N		20	5
1160-70	.3	2	7	.07	150	L			L	150					30	10
1170-80	.3	3	5	.07	150	L			15	150					20	7
1180-90	.3	2	5	.07	150	N			L	150					30	7
1190-1200	.3	2	5	.07	100	N	↓	↓	L	150	↓	↓	↓	↓	30	7
1200-09	.7	5	20	.1	100	N			10	200	L	N		L	70	10
1209-20	.7	3	20	.15	150	N			20	200	L	N		L	100	7
1220-31	1	5	20	.15	300	N			30	300	L	N		5	150	15
1231-42	1	3	20	.2	300	L			50	300	L	N		5	100	30
1242-53	1	5	20	.2	300	N			15	300	L	N		5	150	15
1253-62	1	5	15	.15	300	N			15	500	L	N		5	150	15
1262-75	.7	5	15	.15	200	1.5			20	200	L	30		5	150	10
1275-87	.7	3	15	.15	500	N			15	200	L	N		5	100	10
1287-1300	.7	3	20	.1	700	N			10	150	L	N		5	70	10
1300-09	1.5	7	15	.2	1500	N			L	300	N	N		7	70	10
1309-21	1.5	5	15	.15	1500	N			L	300	L	10		7	70	50
1321-32	1.5	5	15	.15	1500	N			L	300	L	N		10	70	20
1332-42	1.5	5	10	.2	1500	N			L	1000	L	N		7	70	20
1342-52	1	7	15	.3	1500	N			L	1500	L	N		5	100	10
1352-64	.7	5	15	.3	1500	N			L	1000	L	N		5	70	10
1364-75	1.5	7	15	.2	1500	N			L	150	L	N		10	100	30
1375-85	1	5	15	.3	1500	N			L	200	L	N		7	70	15
1385-96	1	5	15	.15	1500	1			L	100	L	L		5	70	7

Fe, Mg, Ca, and Ti reported in %, all other elements reported in ppm. Results are reported in the series 1, 0.7, 0.5, 0.3, 0.2, 0.15, 0.1, etc.

1 For analyses of gold, see pages 24-25.

Table 2.—Chemical analyses of drill samples (cont'd.)

Depth Interval (feet)	La	Mo	Nb	Ni	Pb	Pd	Pt	Sb	Sc	Sn	Sr	Te	U	V	W	Y	Zn	Zr
1150-60	N	N	N	10	L	-	-	N	L	N	300	-	-	100	N	15	N	50
1160-70	N			10	10	-	-		5			-	-	50		15	200	55
1170-80	N			15	L	-	-		5			-	-	50		20	N	70
1180-90	L			10	L	-	-		5			-	-	50		15	L	70
1190-1200	20	↓	↓	15	L	-	-	↓	5	↓	↓	-	-	30	↓	15	N	50
1200-09	20	N	L	5	10	-	-		L		700	-	-	50		20	N	50
1209-20	L	N	N	10	10	-	-		L		700	-	-	70		20	N	100
1220-31	30	L	N	20	15	-	-		7		700	-	-	70		30	N	100
1231-42	30	L	L	30	15	-	-		7		500	-	-	100		30	700	150
1242-53	30	L	L	20	15	-	-		7		500	-	-	100		30	N	150
1253-62	30	N	N	20	20	-	-		7		700	-	-	70		30	N	100
1262-75	30	N	N	20	50	-	-		7		500	-	-	70		20	500	100
1275-87	70	N	N	20	10	-	-		7		300	-	-	70		30	N	100
1287-1300	20	5	N	15	L	-	-		5		500	-	-	70		20	N	70
1300-09	30	30	L	50	L	-	-		7		300	-	-	200		30	200	300
1309-21	20	15	L	30	L	-	-		7		300	-	-	150		30	700	200
1321-32	50	20	L	50	L	-	-		10		300	-	-	200		30	500	300
1332-42	50	20	L	50	L	-	-		7		300	-	-	150		30	500	300
1342-52	20	15	L	50	L	-	-		7		500	-	-	500		30	500	300
1352-64	20	10	L	50	L	-	-		7		500	-	-	300		30	200	300
1364-75	20	30	L	70	L	-	-		7		300	-	-	500		30	200	200
1375-85	20	10	L	30	L	-	-		7		200	-	-	200		30	200	300
1385-96	30	5	L	30	30	-	-		7		300	-	-	700		30	200	200

G = Greater than 10%, or greater than value shown.
H = Interference.
- = Not looked for.

N=Not detected at limit of detection, or at value shown.
L=Detected, but below limit of determination, or below value shown.
*=Usual limits of determinations do not apply due to use of dilution technique.

Depth Interval (feet)	Fe%	Mg%	Ca%	Ti%	Mn	Ag	As	Au[1]	B	Ba	Be	Bi	Cd	Co	Cr	Cu
1396-1401	1.5	5	15	.2	1500	N	N	N	L	100	L	N	N	7	150	20
1401-07	1	7	15	.15	300	N			L	150	L	N		5	100	30
1407-19	.5	3	15	.07	200	N	V	V	N	100	N	N	Y	L	30	10
1419-30	.5	5	20	.1	200	N			N	100	L	N		L	50	5
1430-43	1	7	30	.15	1500	N			L	500		N		5	70	20
1443-54	1	5	10	.15	1000	N				200		N		5	100	7
1454-66	1	5	15	.15	1000	L				1500		N		5	70	10
1466-78	1	5	15	.15	1000	L				1500		L		7	100	20
1478-89	.7	5	15	.15	1000	N				200		L		5	30	00
1489-99	.7	5	15	.15	1000	N				500		N		5	50	L
1499-1510	.7	5	15	.15	1000	N				1500		N		5	70	L
1511-21	1	5	15	.15	1000	N				500		N		5	70	L
1521-31	.7	5	15	.07	300	N				200		N		5	50	L
1531-43	1	5	15	.15	1500	N				300		N		5	50	7
1543-52	1	5	15	.15	1500	N				150		N		5	30	5
1552-63	.7	3	15	.10	1500	N				70		N		5	70	L
1563-74	.7	5	15	.15	1000	N				70		N		5	70	L
1574-84	1	5	15	.15	700	N				200		N		5	70	5
1584-94	1	5	15	.1	700	N				300		N		5	70	10
1594-1604	1	5	15	.1	1000	N				500		N		5	70	7
1604-15	1	5	15	.1	700	N				100		N		5	70	30
1615-26	1	7	15	.15	500	N				200	V	N		5	70	5
1626-38	1	5	15	.10	1500	N				200	5	N		5	70	5

Fe, Mg, Ca, and Ti reported in %, all other elements reported in ppm. Results are reported in the series 1, 0.7, 0.5, 0.3, 0.2, 0.15, 0.1, etc.

1. For analyses of gold, see pages 25-26.

dilution technique

Depth Interval (feet)	La	Mo	Nb	Ni	Pb	Pd	Pt	Sb	Sc	Sn	Sr	Te	U	V	W	Y	Zn	Zr
1376-1401	50	20	L	70	L	-	-	N	10	N	500	-	-	700	N	50	200	300
1401-07	50	L	N	70	L	-	-	↓	7	↓	300	-	-	150	↓	30	N	100
1407-19	50	N	N	10	L	-	-	↓	5	↓	300	-	-	70	↓	20	N	70
1419-30	20	N	N	10	70	-	-	↓	5	↓	700	-	-	70	N	20	N	50
1435-43	20	15	L	70	150	-	-	↓	7	↓	300	-	-	200	N	20	L	150
1443-54	30	15	L	70	70	-	-	↓	7	↓	200	-	-	200	L	30	700	300
1454-66	50	5	L	30	70	-	-	↓	7	↓	500	-	-	300	N	30	700	200
1466-78	30	15	L	50	70	-	-	↓	7	↓	500	-	-	300	N	30	700	200
1478-89	70	N	L	30	50	-	-	↓	7	↓	300	-	-	200	N	20	700	100
1489-99	30	L	L	20	30	-	-	↓	7	↓	500	-	-	150	N	20	500	200
1499-1510	30	10	10	30	30	-	-	↓	7	↓	500	-	-	100	N	20	500	200
1510-21	30	N	L	20	30	-	-	↓	7	↓	500	-	-	150	N	15	700	150
1521-31	20	5	L	20	30	-	-	↓	5	↓	500	-	-	200	N	15	N	70
1531-43	30	15	L	30	20	-	-	↓	7	↓	500	-	-	150	L	20	200	200
1543-52	30	20	L	20	20	-	-	↓	7	↓	500	-	-	100	N	20	500	200
1552-63	30	30	L	30	10	-	-	↓	7	↓	300	-	-	200	N	20	L	150
1563-74	30	20	L	30	10	-	-	↓	7	↓	300	-	-	200	L	30	200	150
1574-84	30	15	L	50	10	-	-	↓	7	↓	300	-	-	200	N	30	L	150
1584-94	30	7	L	30	10	-	-	↓	7	↓	300	-	-	200	N	20	500	100
1594-1604	30	5	L	20	10	-	-	↓	7	↓	300	-	-	200	N	20	500	150
1604-15	30	7	L	30	15	-	-	↓	7	↓	300	-	-	200	N	20	L	150
1615-26	50	L	L	50	15	-	-	↓	7	↓	300	-	-	150	N	30	L	200
1626-38	50	N	L	30	15	-	-	↓	7	↓	300	-	-	150	N	20	500	150

G = Greater than 10%, or greater than value shown. N=Not detected at limit of detection, or at value shown.
I = Interference. L=Detected, but below limit of determination, or below value shown.
- = Not looked for. *=Usual limits of determinations do not apply due to use of dilution technique.

Depth Interval (feet)	Fe%	Mg%	Ca%	Ti%	Mn	Ag	As	Au [1]	B	Ba	Be	Bi	Cd	Co	Cr	Cu
1638-49	1	5	15	.15	700	N	N	N	L	200	L	11	N	5	70	15
1649-60	1	7	15	.15	700	〃	〃	〃	〃	200	L	〃	〃	5	70	20
1660-71	.7	5	15	.1	1000					70	L			L	50	7
1671-75	.7	5	15	.1	300					70				5	30	20
1675-82	1	7	15	.15	500					150				7	70	15
1682-92	1.5	7	15	.15	500					150				10	70	30
1692-1703	1.5	7	15	.15	700					200				10	70	20
1703-13	.7	3	15	.1	500					70				5	50	10
1713-24	.7	5	15	.07	150					200				L	50	15
1724-34	.7	5	15	.07	100	〃	〃	〃	〃	200	〃	〃	〃	L	70	15
1734-48	2	7	15	.15	150	N	N	N	10	500	L	10	N	5	150	20
1748-63	1.5	7	20	.15	150	N	N	N	1000	200	L	L	N	5	70	20
1763-75	1.5	5	20	.15	200	N	N	N	20	200	L	L	N	L	70	15
1775-89	1.5	3	20	.1	150	N	N	N	20	200	L	L	N	N	50	7
1789-1801	1.5	5	20	.1	200	L	N	N	20	200	L	L	N	L	70	15
1801-15	3	7	20	.1	200	N	N	N	N	150	L	L	N	15	70	15
1815-29	3	7	20	.15	300	N	N	N	L	200	L	L	N	10	100	30
1829-44	2	5	20	.15	2000	1	N	N	10	100	1	L	N	5	100	20
1844-56	2	5	20	.2	1500	N	200	N	15	200	1	10	N	7	150	15
1856-69	2	7	20	.15	1500	N	N	N	10	100	L	L	N	5	150	7
1869-84	2	7	20	.2	700	N	N	N	10	700	L	L	N	7	100	20
1884-96	2	5	20	.2	1500	1	N	N	10	500	L	15	N	5	70	7
1896-1908	1.5	5	20	.15	1000	N	N	N	10	300	L	L	N	5	50	10
1908-16 No data																

Fe, Mg, Ca, and Ti reported in %, all other elements reported in ppm. Results are reported in the series 1, 0.7, 0.5, 0.3, 0.2, 0.15, 0.1, etc.

1. For analyses of gold, see page 26.

Depth Interval (feet)	La	Mo	Nb	Ni	Pb	Pd	Pt	Sb	Sc	Sn	Sr	Te	U	V	W	Y	Zn	Zr
1639-49	30	5	L	30	15	-	-	N	7	N	500	-	-	150	L	30	L	150
1649-60	30	N	L	30	10	-	-	"	7	"	500	-	-	150	N	30	200	100
1660-71	20	5	N	20	10	-	-		5		300	-	-	200		20	200	100
1671-75	20	30	N	70	10	-	-		5		500	-	-	300		30	N	70
1675-82	20	15	N	30	L	-	-		7		300	-	-	300		20	300	150
1682-92	50	L	L	30	10	-	-		7		500	-	-	150		30	500	200
1692-1703	50	15	L	50	10	-	-		7		300	-	-	200		30	700	200
1703-13	20	15	L	30	L	-	-		5		300	-	-	200		20	1000	100
1713-24	50	N	N	20	15	-	-		5		500	-	-	70		30	N	70
1724-34	50	N	N	20	10	-	-	"	5	"	700	-	-	70	"	20	N	70
1734-48	30	N	10	100	200	-	-	N	7		500	-	-	200	N	50	N	100
1748-63	200	N	10	70	50	-	-	N	5		700	-	-	100	N	30	300	100
1763-75	20	N	10	50	300	-	-	N	5		700	-	-	100	N	30	N	70
1775-89	20	N	L	20	10	-	-	N	L		1000	-	-	70	L	30	N	70
1789-1801	20	20	L	70	20	-	-	N	5		500	-	-	300	N	30	200	70
1801-15	30	70	L	100	10	-	-	N	5		500	-	-	300	N	20	200	70
1815-29	20	00	10	100	15	-	-	N	7		300	-	-	500	N	30	300	100
1829-44	30	200	10	50	50	-	-	N	7		200	-	-	500	50	50	500	100
1844-56	50	300	10	70	L	-	-	N	7		200	-	-	700	70	50	500	200
1856-69	30	70	10	50	N	-	-	N	7		300	-	-	300	N	30	500	150
1869-84	30	30	10	50	15	-	-	N	7		500	-	-	500	N	30	500	200
1884-96	30	50	10	20	20	-	-	N	5		300	-	-	200	N	10	700	200
1896-1908	20	5	L	15	10	-	-	N	5		500	-	-	150	N	20	300	200
1908-16	No data.																	

G = Greater than 10%, or greater than value shown.
H = Interference.
- = Not looked for.

N=Not detected at limit of detection, or at value shown.
L=Detected, but below limit of determination, or below value shown.
*=Usual limits of determinations do not apply due to use of dilution technique.

Table 2.—Chemical analyses of drill samples (cont'd.)

ATOMIC ABSORBTION ANALYSES

Depth Interval (feet)	Au(ppm)	Hg(ppm)	Depth Interval (feet)	Au(ppm)	Hg(ppm)
480-90	L(.02)	.24	690-700	.02	.30
490-500	.02	.22	700-10	L(.02)	.30
500-10	L(.02)	.30	710-20	L(.02)	.18
510-20	N(.02)	.70	720-30	.04	.55
520-30	.05	.50	730-40	.02	.26
530-40	N(.02)	2.20	740-50	.02	.24
540-50	N(.02)	1.80	750-60	.02	.13
550-60	.05	1.50	760-70	.03	.20
560-70	L(.02)	.60	770-80	.04	.45
570-80	.02	.14	780-90	.04	.22
580-90	.02	.12	790-800	.08	.12
590-600	.02	.16	800-10	.07	.16
600-10	L(.02)	.26	810-20	L(.02)	.40
610-20	.02	.90	820-30	.02	.16
620-30	L(.02)	.13	830-40	L(.02)	.18
630-40	.02	.10	840-50	L(.02)	1.00
640-50	.02	.14	850-60	.02	.50
650-60	.02	.07	860-70	L(.02)	.45
670-80	.02	.10	870-80	.04	.90
680-90	L(.02)	.10	880-90	L(.02)	.60

*Greater than value shown; I=Interference; --=Not looked for; N()=Not detected at limit of detection, or at value shown; L()=Detected, but below limit of determination, or below value shown; **=Usual limits of determinations do not apply due to use of dilution technique."

Table 2.—Chemical analyses of drill samples (cont'd.)

Depth Interval (feet)	Au (ppm)	Hg (ppm)	Depth Interval (feet)	Au (ppm)	Hg (ppm)
890-900	.02	1.80	1090-1100	.03	.04
900-10	L(.02)	.75	1100-10	.04	.11
910-20	N(.02)	.30	1110-20	.02	.14
920-30	N(.02)	.18	1120-30	.02	.12
930-40	L(.02)	.16	1130-40	L(.02)	.07
940-50	N(.02)	.20	1140-50	.02	.08
950-60	N(.02)	.09	1150-60	L(.02)	.06
960-70	N(.02)	.08	1160-70	.02	.07
970-80	L(.02)	.09	1170-80	L(.02)	.06
980-90	N(.02)	.10	1180-90	N(.02)	.08
990-1000	L(.02)	.06	1190-1200	L(.02)	.05
1000-10	L(.02)	.04			
1010-20	L(.02)	.06			
1020-30	.07	.12			
1030-40	.02	.15			
1040-50	.12	.11			
1050-60	.05	.07			
1060-70	.03	.11			
1070-80	.03	.09			
1080-90	.02	.05			

Greater than value shown; I=Interference; -=Not looked for; N()=Not detected at limit of detection, or at value shown; L()=Detected, but below limit of determination, below value shown; *=Usual limits of determinations do not apply due to use of dilution technique."

Table 2.—Chemical analyses of drill samples (cont'd.)

Depth Interval (feet)	ppm As	ppm Hg
1200-09	n(.02)	0.18
1209-20		0.16
1220-31		0.18
1231-42		0.30
1242-53		0.35
1253-62		0.14
1262-75		0.22
1275-87		0.18
1287-1300		0.08
1300-09		0.10
1310-21		0.12
1321-32		0.13
1332-42		0.15
1342-52		0.18
1352-64		0.12
1364-75		0.15
1375-85		0.13
1385-96		0.08
1396-1401	V	0.20

Depth Interval (feet)	ppm Cu	ppm Hg
1401-07	n(.2)	0.13
1407-19		0.13
1419-30		0.11
1430-43		0.10
1443-54		0.11
1454-66		0.15
1466-78		0.13
1478-89		0.14
1489-99		0.10
1499-1510		0.08
1510-21		0.12
1521-31		0.08
1531-43		0.10
1543-52		0.12
1552-63		0.07
1563-74		0.11
1574-84		0.10
1584-94		0.15
1594-1604		0.12
1604-15	V	0.15

G=Greater than value shown; I=Interference; -=Not looked for; N()=Not detected at limit of detection, or at value shown; L()=Detected, but below limit of determination, or below value shown; *=Usual limits of determinations do not apply due to use of dilution technique.*

Table 2.--Chemical analyses of drill samples (cont'd.)

Depth Interval (feet)	ppm Au	ppm Hg
1615-26	N(02)	0.10
1626-38		0.10
1638-49		0.09
1649-60		0.08
1660-71		0.13
1671-75		0.15
1675-82		0.11
1682-92		0.18
1692-1703		0.15
1703-13		0.15
1713-24		0.14
1724-34		0.30

Depth Interval (feet)	ppm Au	ppm Hg
1734-48	N	0.24
1748-63	N	.01
1763-75	N	.01
1775-89	N	L(.01)
1789-1801	N	.18
1801-15	N	.01
18-1529	N	L(.01)
1829-44	N	.01
1849-56	.12	L(.01)
1856-69	.02	L(.01)
1869-84	N	L(.01)
1884-96	N	.01
1896-1913	NJ	L(.01)
1908-16	No data	

G=Greater than value shown; I=Interference; --=Not looked for; N()=Not detected at limit of detection, or at value shown; L()=Detected, but below limit of determination, or below value shown; *=Usual limits of determinations do not apply due to use of dilution technique."

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