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THE YAKA TA KHOM ZINC-LEAD DEPOSITS, DAHLA DISTRICT, KANDAHAR PROVINCE, AFGHANISTAN

Prepared for

THE GOVERNMENT OF AFGHANISTAN

By

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Figure 1. - Old camel pack route in the vicinity of the Yaka Ta Khom mineral deposits.

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1/ Mining engineer, Bureau of Mines.

SUMMARY

The Yaka Ta Khom deposits are in southern Afghanistan 88.5 kilometers (55 miles) due north of Kandahar. The locality can be reached from Kandahar by traveling 57.8 kilometers (35.9 miles) northward on the new Kajkai road and the remaining distance on a rough automobile trail following an old camel route over Kaighatu Pass.

The deposits were investigated by drilling with the purpose of verifying the continuity of mineralization in depth rather than delineating the replacement deposits in detail. Twelve holes with an aggregate length of 459.03 meters (1,506.0 feet) were drilled at 6 surface sites by Morrison-Knudsen Afghanistan, Inc., and 26 core and 6 sludge samples were collected. In addition, 120 chip samples were cut from mineralized outcrops and from exposures in old surface workings and in solution cavities. Finally, 14 specimens, representative of the minerals and associated rocks, were selected for petrographic identification.

The deposits are in sharply sculptured, singularly barren limestone mountains forming the divide between the Arghandab and Helmand drainages and lie just inside the latter's watershed. In the vicinity of the deposits the Cretaceous (?) limestones comprise a light gray or bleached crystalline member overlain by a massive, thick-bedded, dark-gray member with about 13 meters (43 feet) of interbedded thin limestones and shales between the two. The known deposits are confined to the lower crystalline member, which is crenulated locally but generally strikes northwest and dips flatly to the northeast. The limestones are cut by narrow but persistent andesite dikes following at least three approximately parallel fissure zones, nearly vertical and north to northeast in direction. The more fractured limestone walls at the ends of the dikes and at bends are favored places for contact metamorphic mineralization, evidenced by dodecahedral garnet, tremolite-actinolite, epidote, and minor amounts of other silicates. The mineralization spreads for short distances from the contacts into certain more easily replaced limestone layers. Masses of coarsely crystalline, nearly clear calcite, and small amounts of quartz also occur along the contacts. The mineralization, particularly the calcite, is not confined entirely to the contacts but is also found in persistent veins near and parallel to the dikes. Minor easterly faults dipping moderately to the north displace the major fractures and are mineralized to a smaller degree.

The mineralization includes sparsely distributed sulfides, comprising galena, sphalerite, chalcopyrite, specularite, and pyrite. These metallic minerals are so highly oxidized at the surface to cerussite, smithsonite, calamine, malachite, limonite, and magnetite that cores of the primary minerals are seldom seen. Minor amounts of silver and traces of gold occur with the other metallic minerals.

The drill holes were directed to cut the more highly replaced limestone layers at their contacts with the dikes as projected from the surface. The first 10 were drilled only to shallow depths not exceeding 38 meters (125 feet), but

the last 2 were drilled down the limestone layers to intersect several fissures at depths as great as 90 meters (274 feet) below the surface. Oxidation was still in evidence at such depths, but in less degree. The only notable metal content found in any drill hole sample was 15.2 percent zinc in a core repre- 1.1 meters (3.6 feet) of hole. The surface samples, however, were somewhat higher grade than the drill samples. Some of these, selected from wall remnants in the underhand stopes and from sorted broken pieces on the dumps, represent the tenor of the zinc in the ores mined and sorted for their lead content. The mineralized bodies at the north end of the area are somewhat more numerous and higher grade than those elsewhere. There is evidence of minor leaching, but not enough to indicate important enrichment at depth. In general, there is no indication that any significant change in the grade or size of the mineralized bodies can be expected at depth.

The Afghans have mined the mineralized outcrops and followed the solution cavities underground to surprising depths to strip the leached minerals from the walls. The ores so mined were carefully sorted and smelted in crude hearths to recover the lead for bullets and other uses.

The mineralization in the area investigated is characterized by irregular, small replacement bodies and veins associated with andesite dikes. Metallization is weak and spotty, and the ore minerals are highly oxidized to depths exceeding 90 meters (274 feet). The investigation did not reveal continuous mineralized bodies of a grade high enough to constitute significant ore reserves, and there is no indication that the size or grade of the mineralized bodies will change in depth. Other areas to the southwest, nearer the sources of igneous rock, may prove more fruitful for prospecting.

INTRODUCTION

Zinc-lead occurrences about 88.5 kilometers (55 miles) north of the city of Kandahar in southern Afghanistan were explored with diamond drills during the period from October 12 to November 26, 1949. This report describes the deposits, gives an account of the work performed, and tabulates the resulting information. It also contains conclusions regarding the potentialities of this resource.

The deposits were designated for investigation by M. A. Walsh, American mining consultant to the Afghanistan Ministry of Mines. D. M. Lemmon and E. E. Garrett, geologists of the United States Geological Survey, mapped the geology and topography of the area in August 1949. A program of diamond drilling planned by Walsh and Lemmon on the basis of this work was carried out essentially as recommended.

The investigations were for the benefit of the Government of Afghanistan and were paid for almost entirely in dollar funds deposited with the United States Department of State. A portion of the cost of sample analysis, which exceeded the estimates submitted, and expenses of preparation and printing of this report were paid for by the Bureau of Mines. The work was directed by the author, a mining engineer, and George H. Todd, sampling and drilling foreman, personnel of the United States Bureau of Mines temporarily attached to the United States Department of State. They had arrived in Afghanistan on May 29.

For reasons of health Mr. Todd left on November 14; Volin left December 4 when the investigations were completed. The diamond drilling was done under contract by Morrison-Knudsen Afghanistan, Inc., a firm engaged in construction of public works in the country at that time. Two drills were operated by trained Afghan crews supervised by Walter Flannelly. In addition to diamond drilling, the investigations included sampling of the outcrops. This was done by Afghan laborers hired locally. The diamond-drill and surface samples were pulped in a small plant set up at Kandahar. The sample pulps were sent by United States Embassy pouch to the Bureau of Mines Intermountain Experiment Station, Salt Lake City, Utah, for analysis. Duplicate samples were delivered to the Ministry of Mines.

Acknowledgment is made to Dr. Abdullah, Deputy Minister of Mines, and his staff for their keen interest in the investigations and attitude of cooperation. The work was expedited by the friendly interest of Louis B. Dreyfuss, Jr., United States Ambassador at Kabul, and his staff. Morrison-Knudsen Afghanistan, Inc., radio communication facilities to Kabul were made available by the courtesy of L. H. Lynch, superintendent of construction for the company. Plane table mapping equipment also was made available. Samples sent to the United States were received in Washington, D. C., by R. S. Leach, Office of South Asian Affairs, United States Department of State, and forwarded to Salt Lake City for analysis. Progress reports were transmitted to Elmer W. Pehrson, Acting Regional Director, Foreign Minerals Region IX, and this report was prepared under his supervision. Samples were analyzed and petrographic studies made at the Intermountain Experiment Station under the supervision of S. R. Zimmerley, chief metallurgical engineer, Region IV. Geologic maps of the deposits were furnished by Lemmon, of the United States Geological Survey, and, with minor modifications, are reproduced in this report. Four of the photographic illustrations were furnished by Dean F. Frasche, who visited the area while the investigations were in progress.

Numerical data in this report are recorded in the metric system followed by the English equivalent in parentheses to the same degree of accuracy.

LOCALITY AND ITS FEATURES

The zinc-lead deposits are situated in limestone mountains forming the divide between the Helmand and Arghandab watersheds and lie in the extreme upper reaches of the Darra-i-Sarao River, a tributary of the Helmand. The limestone mountains are sharply sculptured and singularly barren both of soil and vegetation. The terrain is rugged and many of the slopes precipitous. The whole area is isolated and does not have any important villages.

The deposits are reached from Kandahar by traveling 57.8 kilometers (35.9 miles) north on the new Kajkai road, then crossing the Mukur Desert and following an old camel pack route that crosses the divide at Kaighatu Pass, a total distance of 88.35 kilometers (54.9 miles). The camel route connects Kandahar with main caravan routes farther north (fig. 1). The Kajkai road (fig. 2) is graveled and drained, but the rest of the route is a rough bulldozer trail that can be traveled only by jeep or similar vehicle in dry season. In the last 16 kilometers (10 miles), where the route is in the mountains, some of the grades are as steep as 24 percent for short distances.

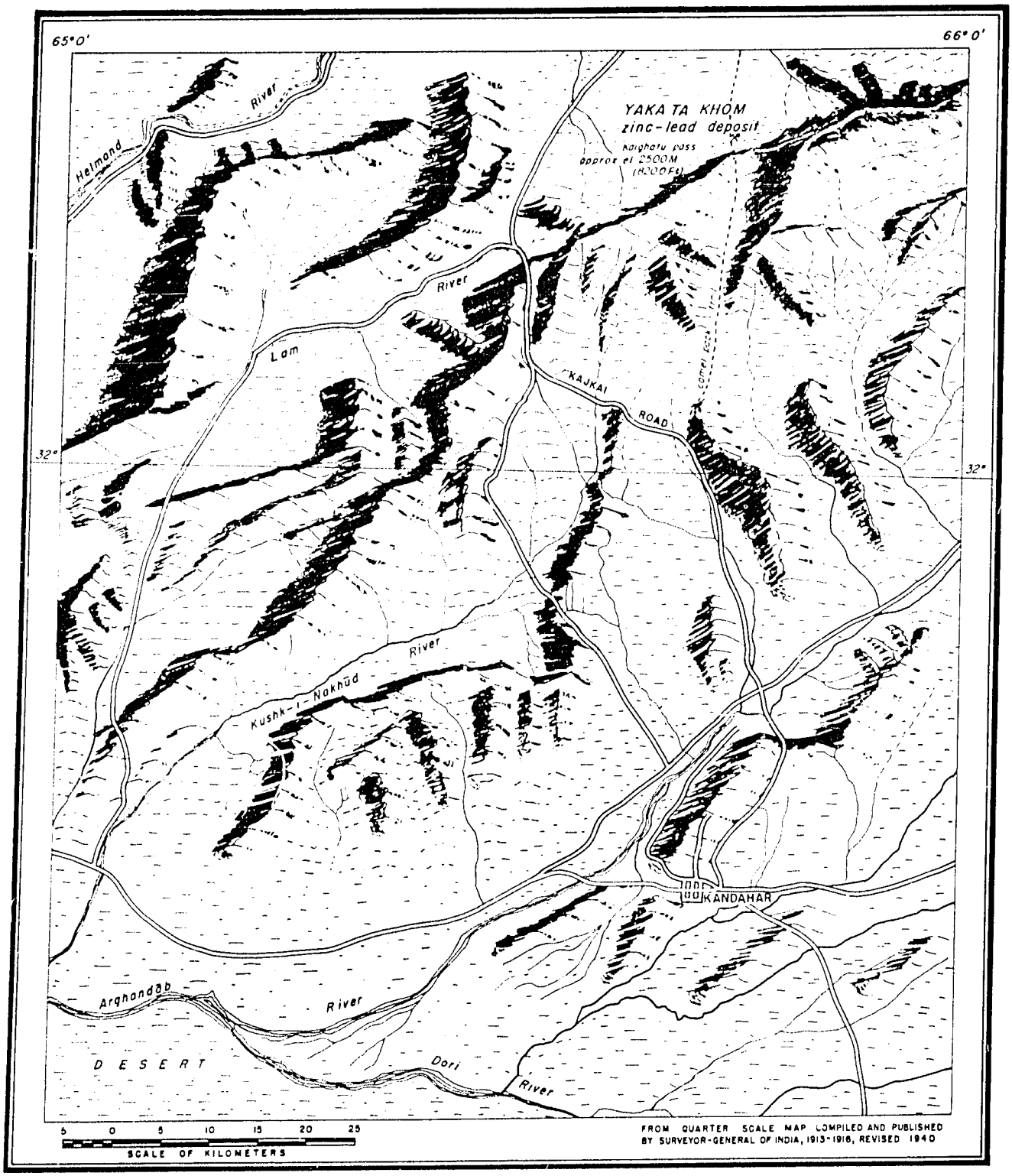

Figure 2.– Location map of Yaka Ta Khom zinc-lead deposits,
DAHLA DISTRICT, KANDAHAR PROVINCE, AFGHANISTAN.

The climate is arid, and water is found only in a few places; it was hauled 8 kilometers (5 miles) to supply the drills. There was no precipitation in the area while the investigations were in progress. The days generally were warm, but at this altitude of 2,330 meters (7,644 feet), the nights were cold, with freezing temperatures prevailing in November. A small annual precipitation in the form of snowfall is claimed for the months from December to March. The summers are described as hot, and it is said that the sun shines nearly every day during the year. The fine, parched soil is unstable, and dust storms are frequent. Unimproved roads deteriorate quickly because the soil soon breaks down into an impalpable powder.

Families and small groups of people dispersed throughout the area manage to subsist by cultivating tiny terraced fields where water is available. The supply of labor is limited, and an industry requiring many workers would have to bring them from distant villages or even from Kandahar, a city estimated to have about 30,000 inhabitants. By environment the people are farmers; but the operations of Morrison-Knudsen Afghanistan, Inc., have developed some semi-skilled workers. Also there are a few skilled foreigners in this section of the country. The Afghan diamond drillers employed for the investigations were paid 450 to 550 rupees ($26.74 to $32.74) a month and laborers 10 rupees ($0.60) a day of 10 hours.

The known mineral deposits mapped by Lemmon and Garrett, geologists of the United States Geological Survey, are in an area 600 meters (1,968 feet) north and south by 300 meters (984 feet) east and west. These have been mined intermittently by the Afghans, as evidenced by old pits, shallow underground workings, and small piles of rejects from cobbing operations. Without explosives, the miners could excavate only the soft, altered, and brecciated rocks. Also the many solution cavities in the limestones have been followed surprising distances in search of minerals that could be stripped from the walls. Some of the workings and cavities now are filled with mud and debris, while a few are caved. Several trenches and other excavations in the area were made by German technicians who investigated the deposits before World War II.

The Afghan miners were most interested in the galena, at least since firearms came into use, and smelted the mineral to recover the lead for bullets. The ores were carefully cobbed at the mines and carried in skin bags to nearby crude smelters. One such smelter was found at a small village about 3 kilometers (1.9 miles) south of the deposits. It was not in operation at the time but had been in recent use. The crude furnace, standing about 1.6 meters (5 feet) high was built of stones cemented with mud. A larger stone at the base with a vertical hole served as a flue, and a saucerlike basin beneath formed the hearth. Skin bellows behind the furnace were operated by hand to supply a draft on the hearth. The charge apparently was prepared by mixing finely broken ore with charcoal and was smelted on the hearth to clinkers containing globules of lead. The clinkers, when cool, were pounded, and the lead was separated by picking out the globules and panning the fines in hand-carved wooden bowls. The smelting operation may have been followed by a refining or resmelting cycle.

The exploitation of minerals in this area, as well as elsewhere in Afghanistan, is severely handicapped by lack of roads, transportation facilities, and communications. Mining supplies and manufactured goods are not

available in the country and must be imported at high cost. Local industries that would furnish markets for mineral raw materials are absent. Under these conditions only ores of premium grades that will bring the highest prices can be produced.

Afghanistan's supply and marketing position with respect to water-borne imports and exports is adversely affected because the country has no seaport and must depend on Karachi, at the south end of Pakistan, for this facility. This economic bottleneck through which most of the goods must be funneled results in slow delivery and high handling charges. Figure 3 shows the route and distances involved in shipping from Kandahar to Karachi. A newly constructed speed highway, with concrete bridges and culverts designed for heavy loads, connects Kandahar with the town of Chaman, just over the border inside Pakistan, a distance of 103 kilometers (64 miles). Goods are carried to and from Chaman on motor lorries operated by the shirkat (transportation and motor parts company sponsored by the Government). From Chaman to Karachi, a distance of 916 kilometers (569 miles),1/ goods are hauled on the Pakistan Railway. In the experience of Morrison-Knudsen Afghanistan, Inc., incoming shipments from the east coast of the United States take 8 to 10 weeks to reach Kandahar, and the delivered cost is 40 to 50 percent higher because of transportation and handling. Extra-heavy crating moreover, is, necessary to withstand the multiple handling.

Offsetting to some degree the high cost of transportation and imported goods is the low cost of labor, although wages have increased more than 100 percent in the past 3 years that construction operations by Morrison-Knudsen Afghanistan, Inc., have been going on in the country.

INVESTIGATIONS

The field work principally involved diamond drilling and outcrop sampling. Accessory work included access-road construction, installation of camp facilities, reduction of samples to pulp form, and collection of specimens for petrographic studies.

Twelve holes with a total length of 459.03 meters (1,506.0 feet) were diamond-drilled at 6 different surface sites, and 26 core samples and 6 sludge samples were recovered. The last and deepest hole, 6B, was drilled 85.34 meters (280.0 feet) in an attempt to reach unoxidized minerals. The amounts of drilling performed in the various sizes are listed as follows:

Size of bore	Bore diameter (inches)	Core diameter (inches)	Total meters drilled
NX plug.....			13.11 (43.0)
NX core.....	3	2 1/8	30.78 (101.0)
BX core.....	2 3/8	1 5/8	192.97 (633.1)
AX core.....	1 7/8	1 3/16	168.83 (533.9)
EX core.....	1 1/2	7/8	53.34 (175.0)

1/ Scaled from map.

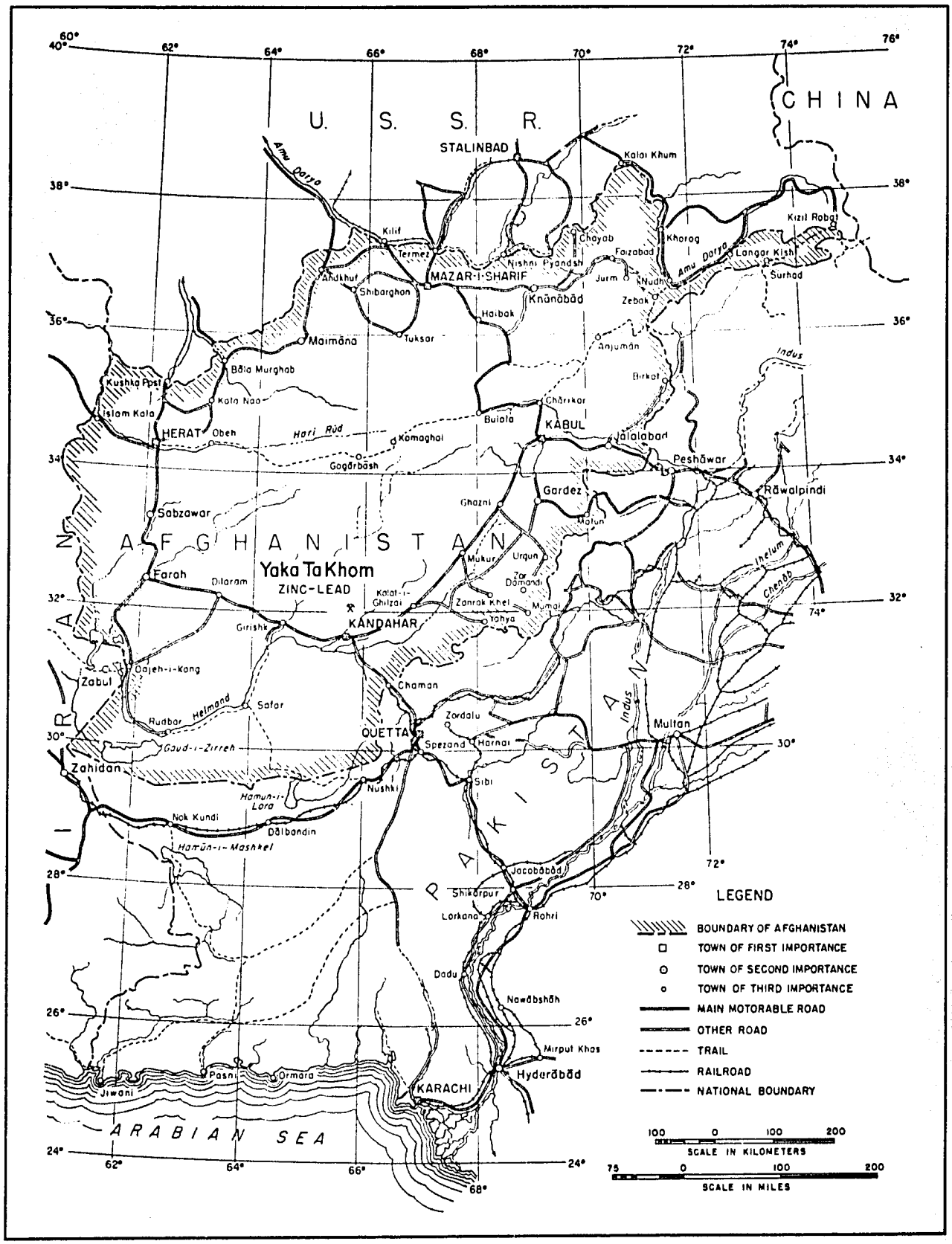

Figure 3. — Map of Afghanistan and part of Pakistan, showing transportation routes.

The project was activated when the author arrived at Kandahar on October 12. Inspections preliminary to starting the drilling were made on October 14, 15, and 16, and two drills were put into operation on October 17. Water was hauled by truck from a small farm storage pond on the road about 8 kilometers (5 miles) south of the deposits. Five of the sites were accessible to the water truck, but the last one (holes 6A and 6B) was on a steep slope where the water had to be pumped up from below. Both drills were in operation every day except during moves. Ten-hour shifts were worked. A crew of four Afghans operated each drill under close supervision, and accessory personnel included a truck driver, a helper for the driver, a pumpman, and three common laborers. Figure 4 shows one of the Afghan crews (one man not in picture) pulling rods at hole 1B.

A standard drilling procedure was developed and followed. All the holes were collared in solid rock and drilled 3 to 4 meters (10 to 13 feet) with NX plug or core bit through the more weathered surface rock. Then the holes were cased and drilled BX as far as possible until the water was lost. Some cementing was done to restore circulation; but it was not found effective where large fractures and cavities were cut, and under such conditions casing had to be installed. An effort was made to complete the holes in AX size, because EX core recovery was not very good, but three of the holes had to be completed in the latter size. The limit of drilling in the AX and larger sizes without a more effective cementing procedure was about 55 meters (180 feet).

The limestone and andesite both cored well where not extensively fractured; but, as was expected, core recovery was unreliable in the mineralized zones. For this reason the sampling procedure was to save all the sludge from each run in these zones, as nearly as they could be predicted. If core recovery for such runs was found to be 75 percent or better, the sludges then were dumped. With lower recovery, the sludges were collected and dried for analysis. This ideal procedure was not always realized because of frequent loss of water. The cores, as recovered, were placed in temporary receptacles, later washed and logged in detail, and then stored in sequence in properly labeled boxes. The cores from the last seven holes were dumped because of lack of suitable storage boxes.

The general drilling pattern was to fan two or three holes in a vertical plane to probe for extension in depth of the more replaceable limestone layers as indicated by mineralized outcrops. With the exception of 6A and 6B, the holes were directed to cut these layers at shallow depths of about 20 meters (66 feet). Holes 1A and 1B were drilled from two sites to cut extensions of a prominent outcrop located at the extreme southern end of the mineralized zone. Drilling operations at hole 1B are illustrated in figures 5 and 6. Holes 2A, 2B, and 2C were drilled from one site to investigate nearby occurrences. Figure 7 shows drilling in progress at hole 2C. Holes 4A, 4B, and 4C and holes 5A and 5B were drilled from two adjacent sites to cut deposits outcropping near the center of the zone. Holes 6A and 6B were drilled from one site to investigate several deposits grouped near the north end of the zone. Hole 6A was drilled down one of the limestone beds to cut three potential ore zones, while 6B was drilled to try to reach these zones at depths where oxidization had been less active.

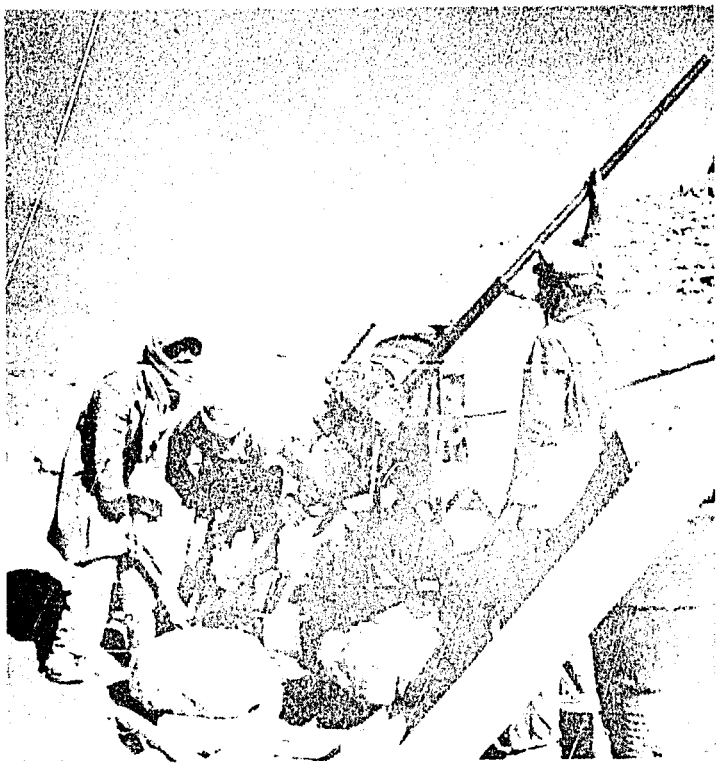

Figure 4. - Afghan drill crew pulling rods at hole 1B.
(Courtesy of Dean Frasche.)

Figure 5. - Diamond drill in operation on hole 1B.
(Courtesy of Dean Frasche.)

Figure 6. - Pulling rods at hole 1B. (Courtesy of Dean Frasche.)

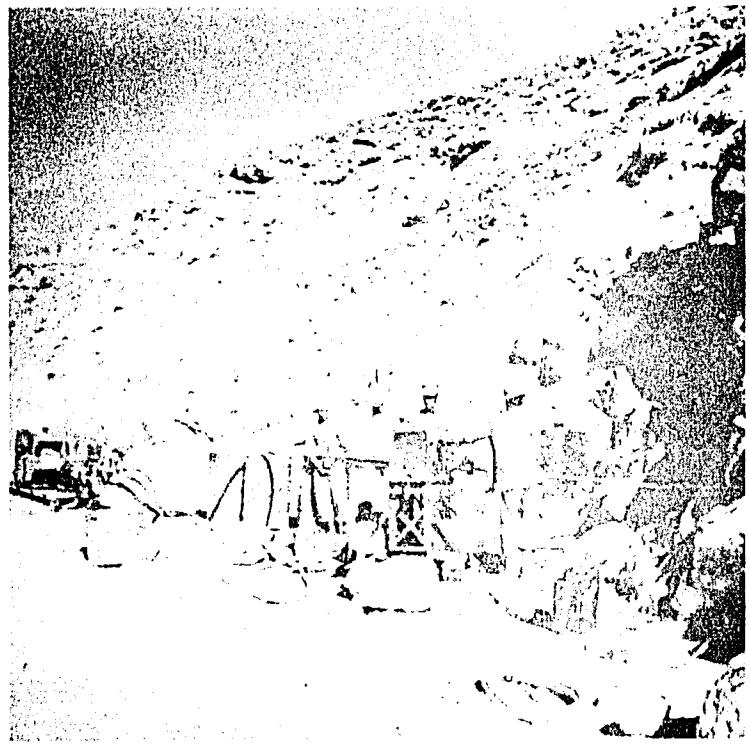

Figure 7. - Diamond drill in operation on hole 2C. (Courtesy of Dean Frasche.)

The records listing drilling data for all holes and analyses of the samples are given in appendix A. The logs of the holes are given in appendix B. The locations of the holes are shown on figures 8, 9, and 10. Vertical sections of the holes are shown on figure 11.

The mineralized outcrops were sampled by cutting rows of chips across their exposed widths at intervals of 3 meters (9.8 feet). Mineralized remnants in the surface workings also were sampled where accessible. The solution cavities were not sampled, but grab samples were taken from the piles of cobbing re rejects to give indications of the grade of ore mined. Local laborers were employed to do this work. Altogether, 120 surface samples were cut or collected. Appendix C lists the samples and their analyses. Their locations are shown in figures 8, 9, and 10.

The crushing-pulverizing equipment was set up at Manzel Bagh, where electric power was available at the Morrison-Knudsen Afghanistan, Inc., shops and offices. All of the drill and surface samples were hauled to this plant and pulped. The procedure was to break the pieces by hand to 2-1/2 centimeter (1-inch) size, crush each sample to 4-mesh, then put it through the pulverizer twice. The oversize on a 35-mesh screen was worked down by hand muller. The 35-mesh pulp was split in a Jones sampler to give duplicate samples of about 150 grams each, which were placed in labeled, heavy paper envelopes. One duplicate was sent for analysis to the Bureau of Mines Intermountain Experiment Station at Salt Lake City, Utah, U. S. The other was delivered to the Afghanistan Ministry of Mines as a reference sample. The plant was operated by three Afghans working under close supervision.

Fourteen specimens representative of the minerals and associated rocks were collected and sent to the Intermountain Experiment Station for microscopic identification.

Before the drilling equipment could be moved to the deposits, it was necessary to construct an access road about 30.5 kilometers (19 miles) long from a junction with the Kajkai road. A rough bulldozer trail was built on contract by Morrison-Knudsen Afghanistan, Inc., the last 14.5 kilometers (9 miles) generally following the old camel pack trail. Additional hand work was required in some places to make the road readily passable, and a crew of Afghan laborers was kept busy on this work most of October. A trailer camp was brought to a point about 9.7 kilometers (6 miles) from the deposits.

The field work was concluded November 25 upon Walsh's[2/] decision to terminate drilling operations.

An important factor in the accomplishment of investigations was the cooperation of the Afghan workmen, as well as their interest in learning how to operate and maintain the diamond drills and other equipment. Their acquired skills can be employed to advantage in other exploratory work needed for the development of mineral resources in Afghanistan.

2/ American mining consultant to the Afghanistan Ministry of Mines.

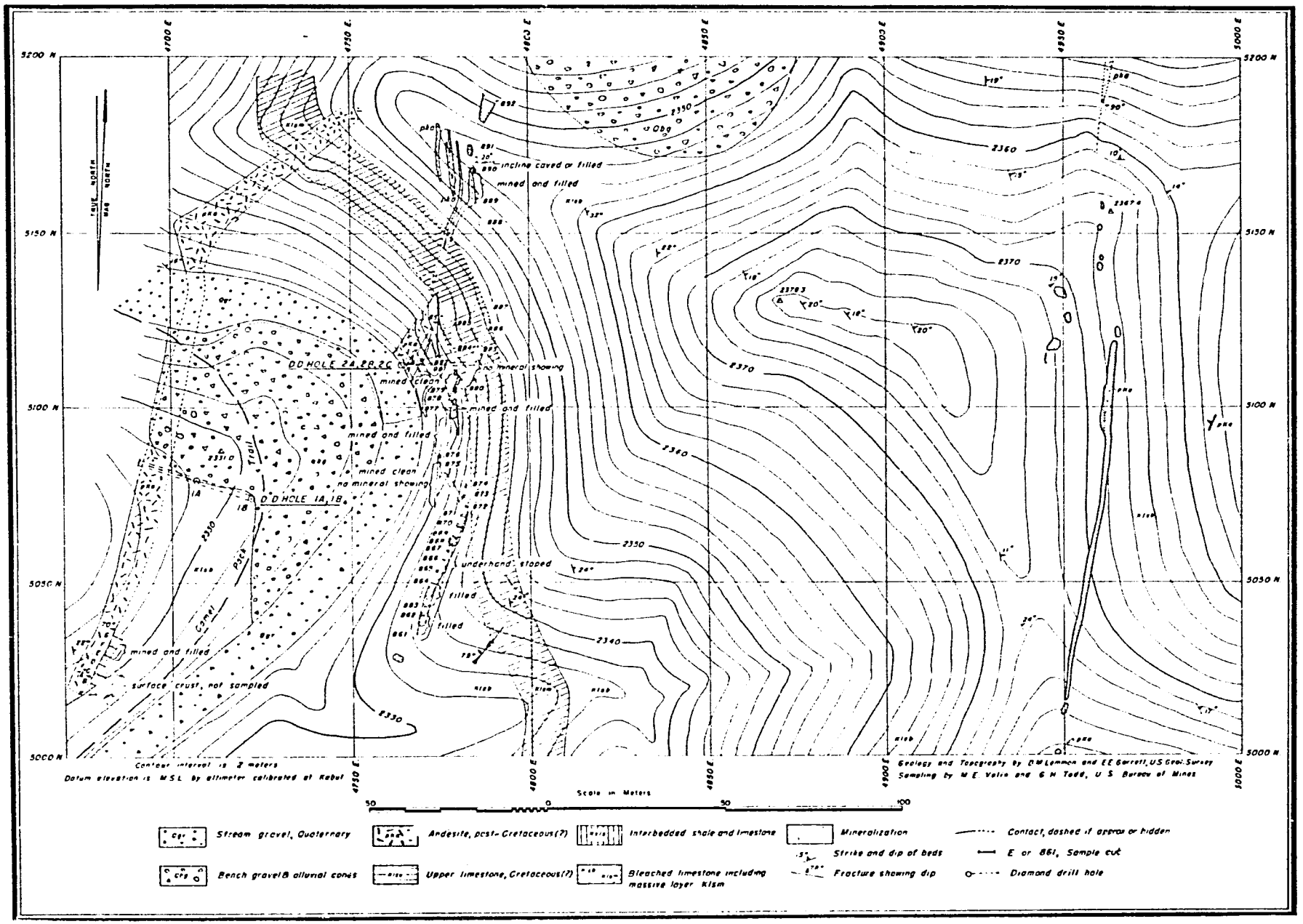

Figure 8. – Map of Yaka Ta Khom zinc-lead deposits, showing topography, geology, and samples, Dahla district, Kandahar Province, Afghanistan.

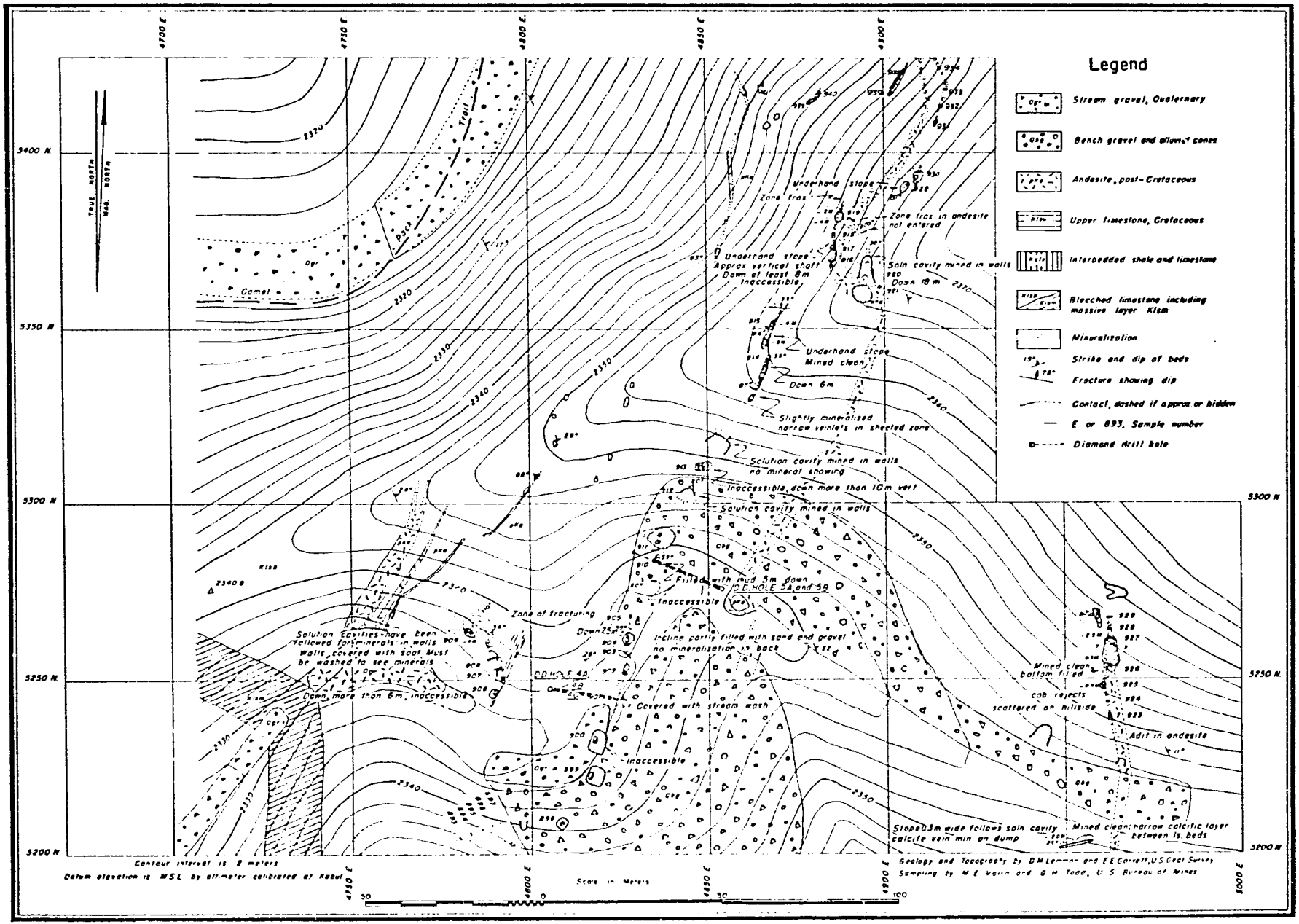

Figure 9. — Map of Yaka Ta Khom zinc-lead deposits, showing topography, geology, and samples, Dahla district, Kandahar Province, Afghanistan.

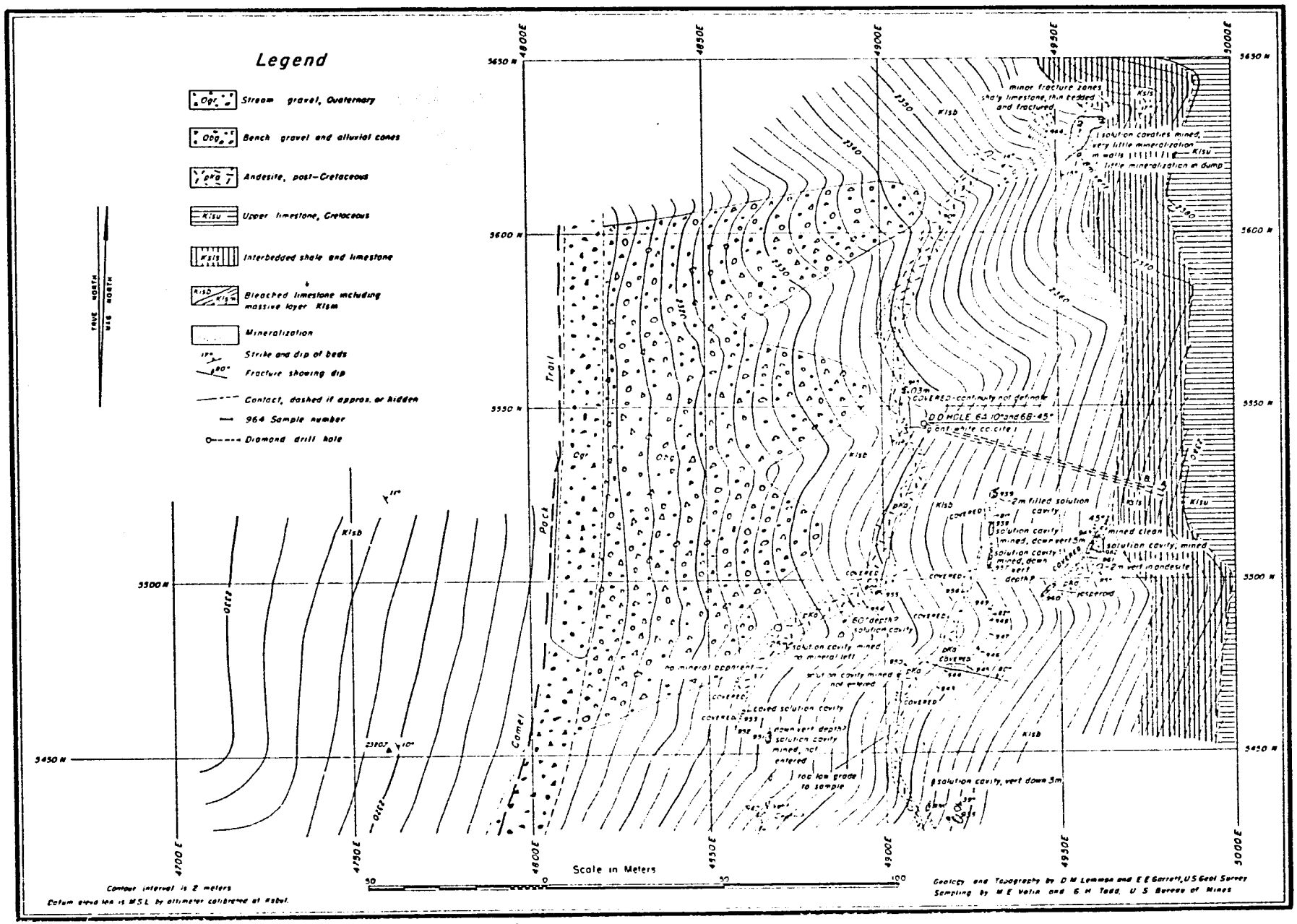

Figure 10.— Map of Yako Ta Khom zinc-lead deposits, showing topography, geology, and samples, Dahla district, Kandahar Province, Afghanistan.

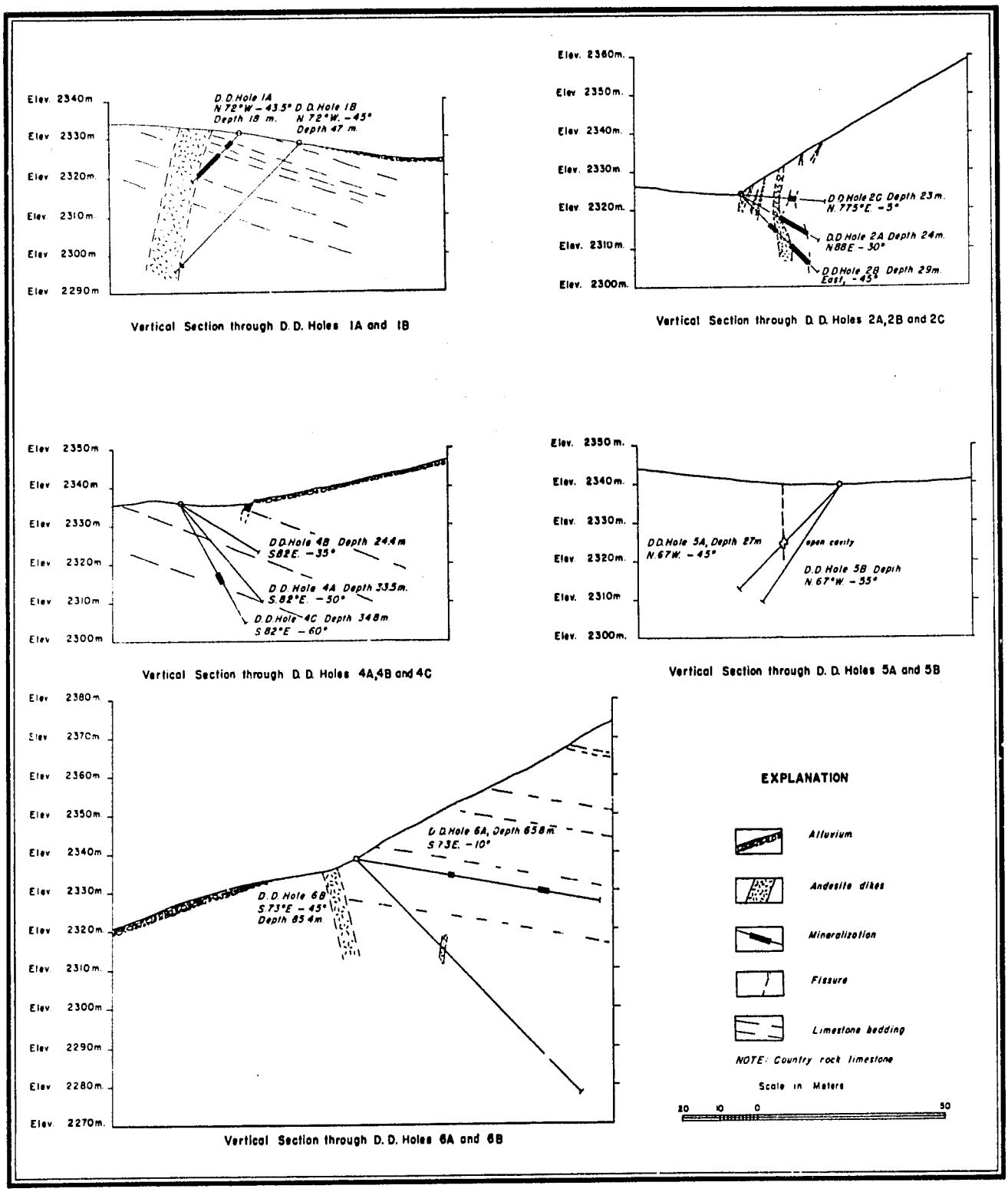

Figure 11.-Vertical sections through diamond-drill holes, Yaka Ta Khom zinc-lead deposits, Dahla district, Kandahar Province, Afghanistan.

ORE DEPOSITS

The deposits occur in limestone rocks and are found in association with andesite dikes and calcite veins. The limits of the limestone formations and types of bordering rocks were not determined; however, the access road crosses granite from the edge of the desert to approximately the crest of Kaighatu Pass, and this rock is inferred to be in contact with limestone on the southeast. In the vicinity of the deposits Lemmon and Garrett mapped three distinct members tentatively thought to be Cretaceous in age. The earliest exposed member is a crystalline bleached limestone, including a layer about 10 meters (32.8 feet) thick of massive blue-gray limestone. This bleached member is overlain by thin, interbedded shales and argillaceous limestones about 13 meters (43 feet) thick. The shale-limestone member is overlain by massive and thick-bedded, dark-gray, cliff-forming limestones. The thickness of this latter member was not measured, but apparently it is on the order of several hundred meters. Quarternary bench gravels and alluvial cones overlie the other formations and are dissected by the existing drainage.

The limestones generally strike northwest, but there are local crenulations. Dips range 10° to 32° to the northeast. The crystalline limestone is gray, soft, and made up almost wholly of translucent fine- to coarse-grained calcite, 0.3- to 1-millimeter sizes predominating. It weathers to light-gray and nearly white surfaces and is easily scraped with a knife to give a fine, white powder. Sugary textures result from leaching, and in general the limestone is porous and contains many solution cavities. Many of the fissures and cavities cut by the drill holes were "mudded." Elongate quartzite inclusions as wide as 0.6 meter (2 feet) and up to 3.3 meters (10 feet) in length were found in widely scattered places. Also the limestone contains occasional layers of coarse rhombohedral calcite up to 2.5 centimeters (1 inch) wide, as well as layers of soft, megascopically noncrystalline calcite in colors ranging from pink to tan and light green. The limestone is cut by many fractures, some showing leaching and limonitic mud filling, other larger ones filled with nearly clear, coarse rhombohedral calcite or colored, soft, megascopically noncrystalline calcite. Black manganese oxide dendrites are common along the fracture planes.

Andesite dikes and irregular small masses follow two roughly parallel fissure zones, 30 to 100 meters (98 to 328 feet) apart, striking N. 25° E., and a third zone over 100 meters (328 feet) to the east, striking nearly due north. These dikes and bodies are steep to vertical. Some are quite regular and continuous, while others are most irregular, reticulate, and without continuity. They roughly follow the crenulations of the limestone formation, indicating that folding occurred after the fissuring and perhaps even the intrusion of magma. Brecciation was not found along the walls, but many tongues branch off at slight angles. Apparently the magma filled existing systems of fissures, with absorption of some of the wall rocks but without the usual intrusive disturbances. Layering at some places indicates reopening and filling at more than one stage. Some dikes stand in prominent outcrops, while others weather faster than the limestone, breaking down into angular pieces along columnar jointing. Figure 12 is a photographic view of dikes exposed at the site of drill holes 2A, 2B, and 2C.

The andesite has a fine ground mass carrying feldspar phenocrysts 1 to 2 millimeters in size, scattered black hornblende laths 1 to 5 millimeters long,

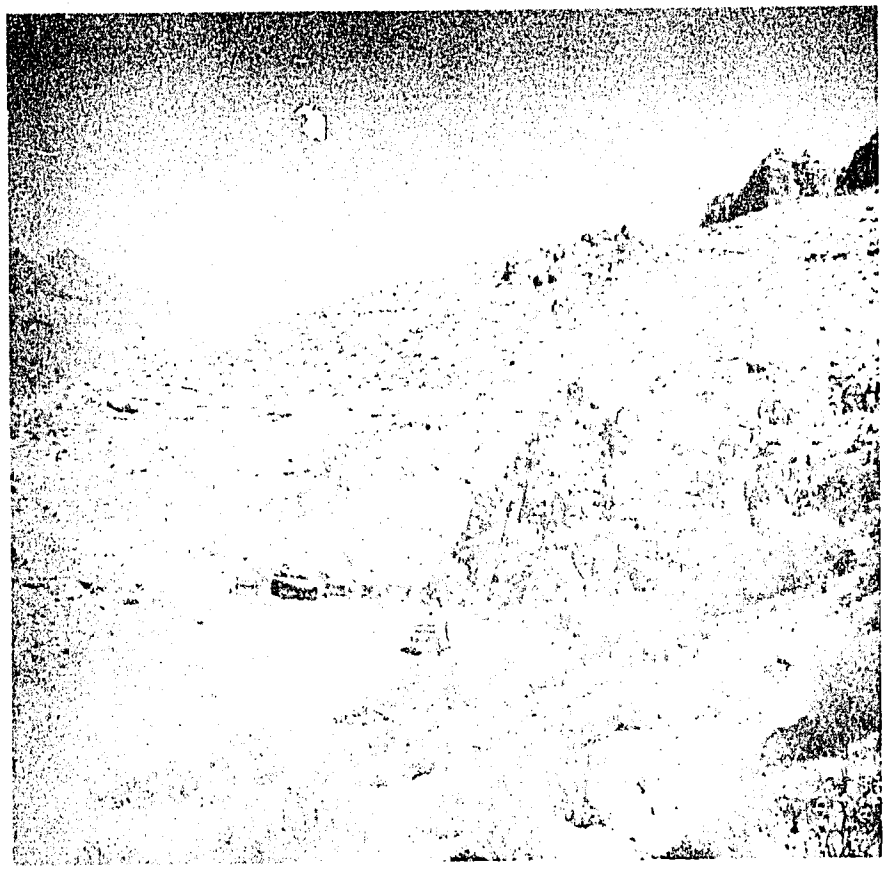

Figure 12. - Andesite dikes in bleached limestone formation. (Courtesy of Dean Frasche.)

and sporadic fine pyrite cubes. The fresh rock is dark green and almost glassy; it is hard and has a subconchoidal fracture. Weathered surfaces develop brown limonitic rims changing to red black as they progress inward, the surface then bleaching to gray or blue gray. The feldspars start altering to clay first, leaving the hornblende in relief. The many fractures in the andesite contain manganese oxide dendrites and coatings of finely crystalline green epidote.

The limestones in contact with the dikes have been replaced in varying amounts by silicate minerals or have been recrystallized to coarse calcite. Replacement has not been extensive, nor has it spread far into the walls, but it has been selective along certain limestone layers that are not apparent as separate strata. The more fractured walls at the ends of the dikes and at bends are the more favored places for mineralization along these layers. The predominant silicate is brown dodecahedral garnet, with small amounts of augite and radiating fribrous tremolite-actinolite, and some epidote, quartz, serpentine, and chlorite.

North to northeast fissures along the zones controlling the dikes are filled with coarse rhombohedral calcite, light gray to brown in color and translucent to nearly clear. These veins may branch from the dikes, parallel them, or be less intimately associated with them. The immediate limestone walls may be replaced by the coarse calcite.

Accompanying the sil ·tes and calcite are sparsely distributed metallic minerals including hematite, pyrite, sphalerite, galena, and chalcopyrite, along with minor amounts of silver minerals and traces of gold. The ore minerals are highly oxidized at and near the surface to limonite, smithsonite, calamine, cerrusite, malachite, and other less apparent alteration derivatives. In the field observations few residual sulfides were found in the mineralized outcrops. Oxidation in lesser degree was found 90 meters (274 feet) below the surface in the deepest diamond-drill hole (6B). Eleven surface samples taken by Lemmon and Garrett were analyzed at the Intermountain Experiment Station, Bureau of Mines, for oxides of zinc and lead, as well as total zinc and lead. The oxide zinc averaged 91 percent of the total, while oxide minerals accounted for 76 percent of the total lead content. A small cadmium content found with the zinc is lower than the average for American ores.

Leaching is evident in the more calcitic veins and bodies, but only the calcite seems to have been extensively removed.

There is little evidence of faulting. One of the veins in the northern part of the area is displaced 7 meters (23 feet) horizontally by a steep easterly fault.

Although all of the drill-hole samples contained small amounts of zinc, lead, copper, silver, and sporadic contents of gold up to 0.04 ounce per ton, a review of the analyzes shows that none of the samples contained significant amounts of lead, copper, silver, or gold, and only two samples from hole 4C contained interesting amounts of zinc. The analyses of these samples, one of core and the other of sludge, along with the core sample accompanying the sludge follow.

Analyses of selected samples from diamond-drill hole 4C

Hole No.	Meters		Oz./ton		Percent		
	From	To	Gold	Silver	Zinc	Lead	Copper
4C.....	20.57(67.5)	22.56(74.0)C	<0.005	0.1	15.2	1.2	0.06
	22.56(74.0)	23.67(77.5)C	< .005	<.1	.7	.35	.09
	22.56(74.0)	25.61(84.0)S	< .005	<.1	5.4	1.5	.20

C - Core sample; S - Sludge sample.

As a basis for evaluating the samples, a detailed log of the core and description of drilling operations for this immediate interval of hole 4C is given below.

Detailed log of portion of diamond-drill hole 4C

Hole 4C		Description
19.51(64.0)	20.27(66.5)	No water return; core recovery, 100 percent. Limestone, bleached, fine-grained, veined with fine networks of dark-gray to red calcite and a few mud seams.
20.27(66.5)	20.57(67.5)	No water return; core recovery, 100 percent. Limestone, bleached and fine-grained, light-tan color, with calcite veinlets and dark-gray inclusions of replacement calcite; some veins limonitic, some white with darkened walls; at 20.51(67.3) prominent light-gray calcite vein 1 centimeter (0.4 inch) wide with dark-gray rims and coarse, light-gray rhombohedral calcite in the walls.
20.57(67.5)	22.56(74.0)	No water return; core recovery, 20 percent. Limestone, broken and altered, soft, leached and vuggy, brown to black with limonite and manganese oxide; partly replaced with coarse, gray, nearly clear calcite. Irregular inclusions of red to black hematite up to 5 millimeters (0.2 inch).
22.56(74.0)	23.67(77.5)	No water return; core recovery, 54 percent. Limestone, broken, altered, discolored, and slightly mineralized. Hematite inclusions at wall.
23.67(77.5)	24.08(79.0)	No water return; core recovery, 94 percent. Calcite, coarse, gray, translucent rhombs.
24.08(79.0)	25.30(83.0)	No water return; core recovery, 93 percent. Limestone, light-tan coloration, veined with light-brown calcite and cut by fine, dark-brown stringers.
25.30(83.0)	25.61(84.0)	No water return; core recovery, 94 percent. Limestone, bleached, coarsely crystalline. Hole cased at 25.61(84.0). Caved about 3 meters (10 feet) at bottom. Caught sludge sample when washing down casing.

It is evident that the sludge sample cannot be given much weight. Inasmuch as the core recovery in the interval 20.57(67.5) to 22.56(74.0) was low and there was no sludge, the core sample from this interval has only indicatory value.

The surface samples vary greatly in grade and must be considered in relation to the places from which they were collected. Those from the cobbing piles can be expected to be comparatively high in all the metals except lead and are indicative only as to the contents of the other metals in the ores that have been selectively mined. The samples from ore remnants in the surface workings also may be expected to be comparatively high-grade; although they are somewhat indicative of the ores sought, they are representative only of the small tonnages removed. The other high-grade samples show an erratic, spotty distribution of the ore minerals.

Certain generalizations are apparent. Disregarding the samples that are unusually high-grade, the average tenor of the surface samples is above that of the drill-hole samples. This indicates surface enrichment, possibly from leaching of the calcite gangue. The calcite veins not in contact with the andesite generally carry higher concentrations of the ore minerals, but more erratically distributed. The silicate contact bodies generally are larger, with more uniform distribution of the ore minerals, but they are very low grade. Two replacement spreads, one an extension at the end of a dike and the other disposed along the contact with andesite, yielded higher than average samples.

Certain generalizations also are apparent with respect to the metal contents. Zinc predominates; and samples high in zinc are likely to be high in the other metals except gold, which seems to have no relationship to any other metal. The silver generally is associated with the lead, a common association in complex ores everywhere.

The investigations established continuity in depth for only one mineralized body, a silicate contact type at the extreme southern end of the mapped area. Between the outcrop and the intersection in drill hole 1A, this body contains roughly 3,500 metric tons (3,858 net tons), but the metal contents are so low that it cannot be considered a mineral resource. As elsewhere, the outcrop samples from this body were higher grade than the drill-hole samples, indicating enrichment by surficial leaching of gangue minerals. It is worth noting that one surface sample (No. 804) contained 0.15 ounce of gold to the ton.

It is evident that production from the location has been very small, although the ores selectively mined have been high-grade. The mineralized outcrops are well picked over, and the limit of selective surface mining is in sight.

CONCLUSIONS

The Yaka Ta Khom zinc-lead deposits occur in a crystalline limestone member and are more or less in association with andesite dikes. They consist of garnetite and other silicate contact bodies and also calcite veins occupying fissures related to the dikes.

Mineralization is not widespread. The replacement bodies are characteristically small and irregular, while the veins are narrow. Metallization, consisting of erratically distributed iron, zinc, lead, copper, and silver minerals, with traces of gold, can be described as weak. Zinc is the predominant metal. The minerals, particularly those of zinc, are highly oxidized to depths exceeding 90 meters (274 feet). Oxidized zinc minerals are not amenable to economic methods of concentration.

Evidences of leaching are largely the result of removal of calcite. This, along with the fact that the ore minerals are so thinly scattered, precludes hope of enrichment at depth. On the other hand, leaching probably has enriched the outcrops and oxidized zone.

The investigations did not reveal continuous mineralized bodies with high enough metal content to constitute significant ore reserves. There is no indication that the size or grade of the mineralized bodies will increase or materially change at depths beyond the limits investigated. This location holds little promise of becoming an important mineral resource and at this stage in the development of Afghanistan may be described as an interesting mineral curiosity.

The deposits have yielded a small production of high-grade ores by selective mining. With explosives, the local Afghan miners might continue to extract inconsequential amounts of such ores, but the outcrops have been so thoroughly picked over that the limit of such selective surface mining is in sight.

Areas nearer the intrusive sources to the southwest may be found to have more of the requisite conditions for ore occurrences and prove more fruitful for prospecting.

It is worth noting that the crystalline limestone member has the porosity characteristics of "a good oil formation."

APPENDIX A — DIAMOND-DRILL-HOLE RECORDS

Note: All linear measurements are in meters, with feet in parentheses.

Hole 1A

Coordinates: N5079;-E4707

Bearing: N72W

Inclination: -43½°

Elevation of collar: 2331.9 (7,650.5)

Drilled: NX - 3.05 (10.0)
BX - 3.14 (10.3)
AX - 11.67 (38.3)

Total length: 17.86 (58.6)

Date started: October 17, 1949

Date completed: October 21, 1949

Explanation: C - Core
S - Sludge

Drilled			Recovered		Size	Samples		Oz/Ton		Percent		
From -	To -	Meters	Meters	Pct.	hole	From -	To -	Au	Ag	Zn	Pb	Cu
0.0 (0.0)	3.05(10.0)	3.05(10.0)	0.0 (0.0)	0.0	NX plug							
3.05(10.0)	5.03(16.5)	1.98(6.5)	1.46(4.8)	73.8	BX	3.84(12.6)	5.03(16.0C)	<.005	0.5	1.45	0.8	0.04
5.03(16.5)	6.19(20.3)	1.16(3.8)	.34(1.1)	29.0	BX							
6.19(20.3)	7.62(25.0)	1.43(4.7)	.30(1.0)	21.3	AX	6.19(20.3)	7.62(25.0C)	.015	<.1	.5	.5	.09
7.62(25.0)	8.38(27.5)	.76(2.5)	.73(2.4)	96.0	AX	7.62(25.0)	8.38(27.5C)	<.005	<.1	.65	.15	.06
8.38(27.5)	9.75(32.0)	1.37(4.5)	.67(2.2)	48.8	AX	8.38(27.5)	9.75(32.0C)	.005	.3	.3	.85	.05
9.75(32.0)	10.45(34.3)	.70(2.3)	.64(2.1)	91.3	AX	9.75(32.0)	10.45(34.3C)	.01	.1	.2	.25	.07
10.45(34.3)	10.85(35.6)	.40(1.3)	.40(1.3)	100.0	AX	10.45(34.3)	10.85(35.6C)	.04	.1	.2	.1	.07
10.85(35.6)	11.09(36.4)	.24(.8)	.18(0.6)	75.0	AX	10.85(35.6)	11.09(36.4C)	<.005	.1	.25	.15	.05
11.09(36.4)	12.13(39.8)	1.04(3.4)	.98(3.2)	94.0	AX	11.09(36.4)	12.13(39.8C)	<.005	.4	.8	.5	.17
12.13(39.8)	13.62(44.7)	1.49(4.9)	1.40(4.6)	94.0	AX	12.13(39.8)	13.62(44.7C)	<.005	<.1	.2	<.1	.12
13.62(44.7)	13.90(45.6)	.28(.9)	.28(0.9)	100.0	AX	13.62(44.7)	13.90(45.6C)	<.005	.1	.25	<.1	.12
13.90(45.6)	14.02(46.0)	.12(.4)	.12(0.4)	100.0	AX)	13.90(45.6)	14.17(46.5C)	.01	.2	.5	<.1	.17
14.02(46.0)	14.17(46.5)	.15(.5)	.12(0.4)	80.0	AX)							
14.17(46.5)	15.73(51.6)	1.56(5.1)	1.13(3.7)	73.0	AX	14.17(46.5)	15.73(51.6C)	.01	.2	.25	.1	.34
15.73(51.6)	17.25(56.6)	1.52(5.0)	.67(2.2)	44.0	AX							
17.25(56.6)	17.59(57.7)	.34(1.1)	.18(0.6)	54.5	AX							
17.59(57.7)	17.86(58.6)	.27(.9)	.18(0.6)	66.7	AX							
Bottom hole 1A												

APPENDIX A — DIAMOND-DRILL-HOLE RECORDS

Note: All linear measurements are in meters, with feet in parentheses.

Hole 1B

Coordinates: N5074; E4722

Bearing: N72W

Inclination: -45°

Elevation of collar: 2329.0 (7641.0)

Drilled: NX - 4.57 (15.0)
BX - 17.07 (56.0)
AX - 25.30 (83.0)

Total length: 46.94 (154.0)

Date started: October 22, 1949

Date completed: October 29, 1949

Explanation: C - Core
S - Sludge

Drilled			Recovered		Size	Samples		Oz/ton		Percent		
From -	To -	Meters	Meters	Pct.	hole	From -	To -	Au	Ag	Zn	Pb	Cu
0.0 (0.0)	4.57(15.0)	4.57(15.0)	0.0 (0.0)	0.0	NX plug							
4.57(15.0)	6.10(20.0)	1.53(5.0)	1.25(4.1)	82.0	BX							
6.10(20.0)	7.89(25.9)	1.79(5.9)	1.55(5.1)	86.0	BX							
7.89(25.9)	9.42(30.9)	1.53(5.0)	1.49(4.9)	98.0	BX							
9.42(30.9)	10.67(35.0)	1.25(4.1)	1.25(4.1)	100.0	BX							
10.67(35.0)	11.89(39.0)	1.22(4.0)	1.16(3.8)	95.0	BX							
11.89(39.0)	14.75(48.4)	2.86(9.4)	1.16(3.8)	40.0	BX							
14.75(48.4)	15.54(51.0)	.79(2.6)	.49(1.6)	62.0	BX							
15.54(51.0)	17.07(56.0)	1.53(5.0)	.43(1.4)	28.0	BX							
17.07(56.0)	20.30(66.6)	3.23(10.6)	1.16(3.8)	36.0	BX							
20.30(66.6)	21.64(71.0)	1.34(4.4)	.55(1.8)	41.0	BX							
21.64(71.0)	23.47(77.0)	1.83(6.0)	.97(3.2)	53.0	AX							
23.47(77.0)	25.30(83.0)	1.83(6.0)	.97(3.2)	53.0	AX							
25.30(83.0)	27.43(90.0)	2.13(7.0)	.61(2.0)	29.0	AX							
27.43(90.0)	28.35(93.0)	.92(3.0)	.92(3.0)	100.0	AX							
28.35(93.0)	31.67(103.9)	3.32(10.9)	1.98(6.5)	60.0	AX							
31.67(103.9)	33.22(109.0)	1.55(6.1)	1.52(5.0)	82.0	AX							
33.22(109.0)	33.53(110.0)	.31(1.0)	.24(0.8)	80.0	AX							
33.53(110.0)	36.58(120.0)	3.05(10.0)	2.44(8.0)	80.0	AX							
36.58(120.0)	38.07(124.9)	1.49(4.9)	.91(3.0)	61.0	AX							
38.07(124.9)	39.01(128.0)	.94(3.1)	.43(1.4)	45.0	AX							
39.01(128.0)	42.37(139.0)	3.36(11.0)	2.50(8.2)	75.0	AX							
42.37(139.0)	42.98(141.0)	.61(2.0)	.58(1.9)	95.0	AX							
42.98(141.0)	43.74(143.5)	.76(2.5)	.64(2.1)	84.0	AX							
43.74(143.5)	46.02(151.0)	2.28(7.5)	1.52(5.0)	67.0	AX	44.50(146.0)	45.11(148.0C)	<.005	0.2	0.05	<0.1	0.05
46.02(151.0)	46.94(154.0)	.92(3.0)	.82(2.7)	90.0	AX							
Bottom hole 1B												

APPENDIX A — DIAMOND-DRILL-HOLE RECORDS

Note: All linear measurements are in meters, with feet in parentheses.

Hole 2A

Coordinates: N5112; E4764

Bearing: N88E

Inclination: -30°

Elevation of collar: 2323.9 (7624.3)

Drilled: NX - 3.05 (10.0)
BX - 9.21 (30.2)
AX - 11.86 (38.9)

Total length: 24.12 (79.1)

Date started: October 17, 1949

Date completed: October 19, 1949

Explanation: C - Core
S - Sludge

Drilled			Recovered		Size	Samples		Oz/ton		Percent		
From -	To -	Meters	Meters	Pct.	hole	From -	To -	Au	Ag	Zn	Pb	Cu
0.0 (0.0)	3.05(10.0)	3.05(10.0)	0.0 (0.0)	0.0	NX plug							
3.05(10.0)	5.43(17.8)	2.38(7.8)	2.13(7.0)	89.0	BX							
5.43(17.8)	6.40(21.0)	.97(3.2)	.76(2.5)	78.0	BX							
6.40(21.0)	8.17(26.8)	1.77(5.8)	1.58(5.2)	90.0	BX							
8.17(26.8)	8.54(28.0)	.37(1.2)	.30(1.0)	83.0	BX							
8.54(28.0)	10.28(33.7)	1.74(5.7)	1.43(4.7)	82.0	BX							
10.28(33.7)	11.22(36.8)	.94(3.1)	.70(2.3)	74.0	BX							
11.22(36.8)	11.59(38.0)	.37(1.2)	.15(.5)	42.0	BX							
11.59(38.0)	12.26(40.2)	.67(2.2)	.67(2.2)	100.0	BX							
12.26(40.2)	15.31(50.2)	3.05(10.0)	.73(2.4)	24.0	AX	12.26(40.2)	15.31(50.2C)	<.005	<0.1	0.1	0.1	0.01
15.31(50.2)	18.30(60.0)	2.99(9.8)	.76(2.5)	26.0	AX	15.31(50.2)	18.30(60.0C)	<.005	< .1	.05	.1	.01
18.30(60.0)	21.35(70.0)	3.05(10.0)	.85(2.8)	28.0	AX	18.75(61.5)	20.43(67.0C)	<.005	< .1	.15	.15	.02
21.35(70.0)	24.12(79.1)	2.77(9.1)	.58(1.9)	21.0	AX							

Bottom hole 2A

APPENDIX A — DIAMOND-DRILL-HOLE RECORDS

Note: All linear measurements are in meters, with feet in parentheses.

Hole 2B

Coordinates: N5112; E4764

Bearing: East

Inclination: -45°

Elevation of collar: 2323.9 (7624.3)

Drilled: NX - 4.57 (15.0)
BX - 12.01 (39.4)
AX - 12.38 (40.6)

Total length: 28.96 (95.0)

Date started: October 20, 1949

Date completed: October 25, 1949

Explanation: C - Core
S - Sludge

Drilled			Recovered			Samples		Oz/ton		Percent		
From -	To -	Meters	Meters	Pct.	Hole	From -	To -	Au	Ag	Zn	Pb	Cu
0.0 (0.0)	0.30(1.0)	0.30(1.0)	0.30(1.0)	100.0	NX Core.							
.30(1.0)	1.83(6.0)	1.53(5.0)	1.16(3.8)	76.0	NX							
1.83(6.0)	3.35(11.0)	1.52(5.0)	1.16(3.8)	76.0	NX							
3.35(11.0)	4.57(15.0)	1.22(4.0)	.91(3.0)	75.0	NX							
4.57(15.0)	5.03(16.5)	.46(1.5)	.30(1.0)	67.0	BX							
5.03(16.5)	5.73(18.8)	.70(2.3)	.55(1.8)	78.0	BX							
5.73(18.8)	7.16(23.5)	1.43(4.7)	.61(2.0)	43.0	BX							
7.16(23.5)	7.71(25.3)	.55(1.8)	.37(1.2)	67.0	BX							
7.71(25.3)	9.02(29.6)	1.31(4.3)	.55(1.8)	42.0	BX							
9.02(29.6)	9.27(30.4)	.25(0.8)	.25(0.8)	100.0	BX							
9.27(30.4)	11.34(37.2)	2.07(6.8)	1.43(4.7)	69.0	BX							
11.34(37.2)	14.11(46.3)	2.77(9.1)	1.04(3.4)	37.0	BX	11.59(38.0)	13.72(45.0C)	<.005	<0.1	0.25	0.2	0.02
14.11(46.3)	16.09(52.8)	1.98(6.5)	.30(1.0)	15.0	BX							
16.09(52.8)	16.58(54.4)	.49(1.6)	.12(0.4)	25.0	BX							
16.58(54.4)	19.54(64.1)	2.96(9.7)	.61(2.0)	21.0	AX							
19.54(64.1)	21.18(69.5)	1.64(5.4)	.52(1.7)	31.0	AX	19.54(64.1)	21.18(69.5C)	.02	< .1	.2	.2	.02
						19.54(64.1)	21.18(69.5S)	.01	< .1	.25	.35	.04
21.18(69.5)	22.40(73.5)	1.22(4.0)	.15(.5)	12.5	AX	21.18(69.5)	22.40(73.5C)	<.005	.3	.4	.55	.07
						21.18(69.5)	22.40(73.5S)	<.005	.1	.25	.25	.04
22.40(73.5)	24.23(79.5)	1.83(6.0)	0.0 (.0)	0.0	AX	22.40(73.5)	24.23(79.5C)	<.005	< .1	.45	.45	.05
						22.40(73.5)	24.23(79.5S)	<.005	.1	.35	.3	.04
24.24(79.5)	25.91(85.0)	1.67(5.5)	.49(1.6)	29.0	AX	24.24(79.5)	25.91(85.0C)	<.005	.1	.15	.1	.03
						24.24(79.5)	25.91(85.0S)	<.005	.1	.25	.2	.02
25.91(85.0)	28.59(93.8)	2.68(8.8)	1.71(5.6)	64.0	AX							
28.59(93.8)	28.96(95.0)	.37(1.2)	.30(1.0)	83.0	AX							

Bottom hole 2B

APPENDIX A — DIAMOND-DRILL-HOLE RECORDS

Note: All linear measurements are in meters, with feet in parentheses.

Hole 2C

Coordinates: N5112; E4764

Bearing: N77-1/2E

Inclination: -5°

Elevation of collar: 2323.9 (7624.3)

Drilled: NX - 4.88 (16.0)
BX - 10.36 (34.0)
AX - 7.31 (24.0)

Total length: 22.55 (74.0)

Date started: October 25, 1949

Date completed: October 27, 1949

Explanation: C - Core
S - Sludge

Drilled			Recovered		Size	Samples		Oz/ton		Percent		
From -	To -	Meters	Meters	Pct.	hole	From -	To -	Au	Ag	Zn	Pb	Cu
0.0 (0.0)	0.76(2.5)	0.76(2.5)	0.73(2.4)	96.0	NX core							
.76(2.5)	2.59(8.5)	1.83(6.0)	1.07(3.5)	58.0	NX							
2.59(8.5)	4.88(16.0)	2.29(7.5)	2.23(7.3)	97.0	NX							
4.88(16.0)	6.13(20.1)	1.25(4.1)	1.16(3.8)	93.0	BX							
6.13(20.1)	6.46(21.2)	.33(1.1)	.18(.6)	55.0	BX							
6.46(21.2)	8.02(26.3)	1.56(5.1)	1.55(5.1)	100.0	BX							
8.02(26.3)	9.54(31.3)	1.52(5.0)	1.40(4.6)	92.0	BX							
9.54(31.3)	11.03(36.2)	1.49(4.9)	1.46(4.8)	98.0	BX							
11.03(36.2)	12.19(40.0)	1.16(3.8)	1.07(3.5)	92.0	BX							
12.19(40.0)	15.24(50.0)	3.05(10.0)	1.71(5.6)	56.0	BX	13.05(42.8)	14.63(48.0C)	<.005	0.1	0.2	<.1	0.05
15.24(50.0)	18.29(60.0)	3.05(10.0)	1.07(3.5)	35.0	AX							
18.29(60.0)	21.03(69.0)	2.74(9.0)	.21(.7)	8.0	AX							
21.03(69.0)	22.55(74.0)	1.52(5.0)	1.13(3.7)	74.0	AX							

Bottom hole 2C

APPENDIX A — DIAMOND-DRILL-HOLE RECORDS

Note: All linear measurements are in meters, with feet in parentheses.

Hole 4A

Coordinates: N5247.5; E4805.5

Bearing: S82E

Inclination: -50°

Elevation of collar: 2336.0 (7663.9)

Drilled: NX - 4.57(15.0)
BX - 16.91(55.5)
AX - 12.05(39.5)

Total length: 33.53(110.0)

Date started: October 29, 1949

Date completed: November 2, 1949

Explanation: C - Core
S - Sludge

Drilled			Recovered		Size	Samples		Oz/ton		Percent		
From -	To -	Meters	Meters	Pct.	hole	From -	To -	Au	Ag	Zn	Pb	Cu
0.0 (0.0)	2.13(7.0)	2.13(7.0)	0.0 (0.0)	0.0	NX plug							
2.13(7.0)	4.57(15.0)	2.44(8.0)	1.28(4.2)	52.5	NX							
4.57(15.0)	7.62(25.0)	3.05(10.0)	2.29(7.5)	75.0	BX							
7.62(25.0)	8.26(27.1)	.64(2.1)	.61(2.0)	95.0	BX							
8.26(27.1)	10.82(35.5)	2.56(8.4)	2.35(7.7)	92.0	BX							
10.82(35.5)	11.12(36.5)	.30(1.0)	.21(.7)	70.0	BX							
11.12(36.5)	13.04(42.8)	1.92(6.3)	1.92(6.3)	100.0	BX							
13.04(42.8)	15.91(52.2)	2.87(9.4)	2.87(9.4)	100.0	BX							
15.91(52.2)	17.07(56.0)	1.16(3.8)	1.16(3.8)	100.0	BX							
17.07(56.0)	19.08(62.6)	2.01(6.6)	1.71(5.6)	85.0	BX							
19.08(62.6)	19.35(63.5)	.27(.9)	.18(.6)	67.0	BX							
19.35(63.5)	21.48(70.5)	2.13(7.0)	1.25(4.1)	59.0	BX							
21.48(70.5)	23.92(78.5)	2.44(8.0)	2.29(7.5)	94.0	AX							
23.92(78.5)	26.18(85.9)	2.26(7.4)	2.26(7.4)	100.0	AX							
26.18(85.9)	28.50(93.5)	2.32(7.6)	2.32(7.6)	100.0	AX							
28.50(93.5)	28.96(95.0)	.46(1.5)	.30(1.0)	67.0	AX							
28.96(95.0)	30.51(100.1)	1.55(5.1)	.64(2.1)	41.0	AX							
30.51(100.1)	33.53(110.0)	3.02(9.9)	2.38(7.8)	80.0	AX							

Bottom hole 4A

APPENDIX A — DIAMOND-DRILL-HOLE RECORDS

Note: All linear measurements are in meters, with feet in parentheses.

Hole 4B

Coordinates: N5247.5; E4805.5

Bearing: S82E

Inclination: -35°

Elevation of collar: 2336.0 (7663.9)

Drilled: NX - 3.05 (10.0)
BX - 14.84 (48.7)
AX - 6.50 (21.3)

Total length: 24.39 (80.0)

Date started: November 3, 1949

Date completed: November 7, 1949

Explanation: C - Core
S - Sludge

Drilled			Recovered		Size	Samples		Oz/ton		Percent		
From -	To -	Meters	Meters	Pct.	hole	From -	To -	Au	Ag	Zn	Pb	Cu
0.0 (0.0)	3.05(10.0)	3.05(10.0)	0.0 (0.0)	0.0	NX plug							
3.05(10.0)	5.79(19.0)	2.74(9.0)	2.59(8.5)	94.0	BX							
5.79(19.0)	8.84(29.0)	3.05(10.0)	2.56(8.4)	84.0	BX							
8.84(29.0)	11.89(39.0)	3.05(10.0)	2.99(9.8)	98.0	BX							
11.89(39.0)	13.72(45.0)	1.83(6.0)	1.83(6.0)	100.0	BX							
13.72(45.0)	15.24(50.0)	1.52(5.0)	1.52(5.0)	100.0	BX							
15.24(50.0)	16.76(55.0)	1.52(5.0)	1.52(5.0)	100.0	BX							
16.76(55.0)	17.16(56.3)	.40(1.3)	.34(1.1)	85.0	BX							
17.16(56.3)	17.89(58.7)	.73(2.4)	.46(1.5)	63.0	BX							
17.89(58.7)	20.88(68.5)	2.99(9.8)	.76(2.5)	26.0	AX	17.89(58.7)	19.51(64.05)	<.005	0.1	0.35	0.1	0.03
20.88(68.5)	22.65(74.3)	1.77(5.8)	1.40(4.6)	79.0	AX							
22.65(74.3)	24.39(80.0)	1.74(5.7)	1.65(5.4)	95.0	AX							

Bottom hole 4B

APPENDIX A — DIAMOND-DRILL-HOLE RECORDS

Note: All linear measurements are in meters, with feet in parentheses.

Hole 4C

Coordinates: N5247.5; E4805.5

Bearing: S82E

Inclination: -60°

Elevation of collar: 2336.0 (7663.9)

Drilled: NX - 3.05 (10.0)
BX - 22.56 (74.0)
AX - 9.23 (30.3)

Total length: 34.84 (114.3)

Date started: November 7, 1949

Date completed: November 9, 1949

Explanation: C - Core
S - Sludge

Drilled			Recovered		Size	Samples		Oz/ton		Percent		
From -	To -	Meters	Meters	Pct.	hole	From -	To -	Au	Ag	Zn	Pb	Cu
0.0 (0.0)	3.05(10.0)	3.05(10.0)	0.0 (0.0)	0.0	NX plug							
3.05(10.0)	3.99(13.1)	.94(3.1)	.61(2.0)	65.0	BX							
3.99(13.1)	7.01(23.0)	3.02(9.9)	2.83(9.3)	94.0	BX							
7.01(23.0)	10.06(33.0)	3.05(10.0)	2.44(8.0)	80.0	BX							
10.06(33.0)	13.29(43.6)	3.23(10.6)	3.02(9.9)	93.0	BX							
13.29(43.6)	16.46(54.0)	3.17(10.4)	3.11(10.2)	98.0	BX							
16.46(54.0)	19.51(64.0)	3.05(10.0)	3.05(10.0)	100.0	BX							
19.51(64.0)	22.56(74.0)	3.05(10.0)	1.52(5.0)	50.0	BX	20.57(67.5)	22.56(74.0C)	<.005	1.0	15.2	1.2	0.06
22.56(74.0)	25.61(84.0)	3.05(10.0)	2.44(8.0)	80.0	BX	22.56(74.0)	23.62(77.5C)	<.005	< .1	.7	.35	.09
						22.56(74.0)	25.61(84.0S)	<.005	< .1	5.4	1.5	.20
25.61(84.0)	28.87(94.7)	3.26(10.7)	3.02(9.9)	93.0	AX							
28.87(94.7)	30.39(99.7)	1.52(5.0)	0.88(2.9)	58.0	AX							
30.39(99.7)	32.46(106.5)	2.07(6.8)	1.07(3.5)	51.0	AX							
32.46(106.5)	34.84(114.3)	2.38(7.8)	2.19(7.2)	92.0	AX							

Bottom hole 4C

ADDENDIX A — DIAMOND-DRILL-HOLE RECORDS

Note: All linear measurements are in meters, with feet in parentheses.

Hole 5A

Coordinates: N5276; E4853.5

Bearing: N67W

Inclination: -45°

Elevation of collar: 2338.4 (7671.8)

Drilled: NX - 3.96 (13.0)
BX - 11.58 (38.0)
AX - 11.89 (39.0)
EX - 10.67 (35.0)

Total length: 38.10 (125.0)

Date started: November 1, 1949

Date completed: November 5, 1949

Explanation: C - Core
S - Sludge

Drilled			Recovered		Size	Samples		Oz/ton		Percent		
From -	To -	Meters	Meters	Pct.	hole	From -	To -	Au	Ag	Zn	Pb	Cu
0.0 (0.0)	3.96(13.0)	3.96(13.0)	0.0 (0.0)	0.0	NX plug							
3.96(13.0)	4.87(16.0)	.91(3.0)	.82(2.7)	90.0	BX							
4.87(16.0)	6.09(20.0)	1.22(4.0)	.88(2.9)	73.0	BX							
6.09(20.0)	7.46(24.5)	1.37(4.5)	1.13(3.7)	82.0	BX							
7.46(24.5)	7.80(25.6)	.34(1.1)	.21(.7)	64.0	BX							
7.80(25.6)	9.75(32.0)	1.95(6.4)	1.95(6.4)	100.0	BX							
9.75(32.0)	10.66(35.0)	.91(3.0)	.79(2.6)	87.0	BX							
10.66(35.0)	13.71(45.0)	3.05(10.0)	2.90(9.5)	95.0	BX							
13.71(45.0)	14.32(47.0)	.61(2.0)	.55(1.8)	90.0	BX							
14.32(47.0)	15.54(51.0)	1.22(4.0)	1.13(3.7)	93.0	BX							
15.54(51.0)	17.37(57.0)	1.83(6.0)	1.65(5.4)	90.0	AX							
17.37(57.0)	18.28(60.0)	.91(3.0)	.49(1.6)	53.0	AX							
18.28(60.0)	20.72(68.0)	2.44(8.0)	2.38(7.8)	97.0	AX							
20.72(68.0)	21.63(71.0)	.91(3.0)	0.0 (0.0)	0.0	AX							
21.63(71.0)	24.38(80.0)	2.75(9.0)	2.13(7.0)	78.0	AX							
24.38(80.0)	27.43(90.0)	3.05(10.0)	2.29(7.5)	75.0	AX							
27.43(90.0)	30.17(99.0)	2.74(9.0)	1.52(5.0)	56.0	EX							
30.17(99.0)	33.65(110.4)	3.48(11.4)	1.98(6.5)	57.0	EX							
33.65(110.4)	36.67(120.3)	3.02(9.9)	1.98(6.5)	66.0	EX							
36.67(120.3)	38.10(125.0)	1.43(4.7)	.91(3.0)	64.0	EX							

Bottom hole 5A

APPENDIX A — DIAMOND-DRILL-HOLE RECORDS

Note: All linear measurements are in meters, with feet in parentheses.

Hole 5B

Coordinates: N5276; E4853.5

Bearing: N67W

Inclination: -55°

Elevation of collar: 2338.4 (7671.8)

Drilled: NX - 3.05 (10.0)
BX - 22.25 (73.0)
AX - 11.28 (37.0)

Total length: 36.58 (120.0)

Date started: November 9, 1949

Date completed: November 15, 1949

Explanation: C - Core
S - Sludge

Drilled			Recovered		Size	Samples		Oz/ton		Percent		
From -	To -	Meters	Meters	Pct.	hole	From -	To -	Au	Ag	Zn	Pb	Cu
0.0 (0.0)	3.05(10.0)	3.05(10.0)	0.0 (0.0)	0.0	NX plug							
3.05(10.0)	4.88(16.0)	1.83(6.0)	1.77(5.8)	97.0	BX							
4.88(16.0)	5.67(18.6)	.79(2.6)	.61(2.0)	77.0	BX							
5.67(18.6)	6.68(21.9)	1.01(3.3)	.64(2.1)	64.0	BX							
6.68(21.9)	9.76(32.0)	3.08(10.1)	3.08(10.1)	100.0	BX							
9.76(32.0)	10.79(35.4)	1.03(3.4)	1.03(3.4)	100.0	BX							
10.79(35.4)	13.72(45.0)	2.93(9.6)	2.93(9.6)	100.0	BX							
13.72(45.0)	16.70(54.8)	2.98(9.8)	2.68(8.8)	90.0	BX							
16.70(54.8)	17.07(56.0)	.37(1.2)	.37(1.2)	100.0	BX							
17.07(56.0)	18.47(60.6)	1.40(4.6)	1.40(4.6)	100.0	BX							
18.47(60.6)	19.69(64.6)	1.22(4.0)	1.22(4.0)	100.0	BX							
19.69(64.6)	22.13(72.6)	2.44(8.0)	1.77(5.8)	73.0	BX							
22.13(72.6)	23.16(76.0)	1.03(3.4)	1.03(3.4)	100.0	BX							
23.16(76.0)	24.38(80.0)	1.22(4.0)	1.22(4.0)	100.0	BX							
24.38(80.0)	25.30(83.0)	.92(3.0)	.92(3.0)	100.0	BX							
25.30(83.0)	25.91(85.0)	.61(2.0)	.61(2.0)	100.0	AX							
25.91(85.0)	28.65(94.0)	2.74(9.0)	2.38(7.8)	87.0	AX							
28.65(94.0)	31.70(104.0)	3.05(10.0)	2.65(8.7)	87.0	AX							
31.70(104.0)	34.75(114.0)	3.05(10.0)	2.44(8.0)	80.0	AX							
34.75(114.0)	36.58(120.0)	1.83(6.0)	1.83(6.0)	100.0	AX							

Bottom hole 5B

APPENDIX A — DIAMOND-DRILL-HOLE RECORDS

Note: All linear measurements are in meters, with feet in parentheses.

Hole 6A

Coordinates: N5545; E4912

Bearing: S73E

Inclination: -10°

Elevation of collar: 2,338.0 (7,126.2)

Drilled: NX - 3.05 (10.0)
BX - 24.69 (81.0)
AX - 24.38 (80.0)
EX - 13.72 (29.0)

Total length: 65.84 (216.0)

Date started: November 14, 1949

Date completed: November 18, 1949

Explanation: C - Core
S - Sludge

Drilled			Recovered		Size	Samples		Oz/ton		Percent		
From -	To -	Meters	Meters	Pct.	hole	From -	To -	Au	Ag	Zn	Pb	Cu
0.0 (0.0)	3.05(10.0)	3.05(10.0)	0.0 (0.0)	0.0	NX plug							
3.05(10.0)	4.24(13.9)	1.19(3.9)	.88(2.9)	74.0	BX							
4.24(13.9)	7.29(23.9)	3.05(10.0)	2.96(9.7)	97.0	BX							
7.29(23.9)	9.88(32.4)	2.59(8.5)	2.59(8.5)	100.0	BX							
9.88(32.4)	12.81(42.0)	2.93(9.6)	2.93(9.6)	100.0	BX							
12.81(42.0)	13.30(43.6)	.49(1.6)	.40(1.3)	81.0	BX							
13.30(43.6)	16.04(52.6)	2.74(9.0)	2.74(9.0)	100.0	BX							
16.04(52.6)	19.21(63.0)	3.17(10.4)	3.17(10.4)	100.0	BX							
19.21(63.0)	22.26(73.0)	3.05(10.0)	3.05(10.0)	100.0	BX							
22.26(73.0)	23.78(78.0)	1.52(5.0)	1.37(4.5)	90.0	BX							
23.78(78.0)	25.61(84.0)	1.83(6.0)	.91(3.0)	50.0	BX							
25.61(84.0)	27.74(91.0)	2.13(7.0)	1.10(3.6)	51.0	BX							
27.74(91.0)	30.79(101.0)	3.05(10.0)	1.52(5.0)	50.0	AX							
30.79(101.0)	34.05(111.7)	3.26(10.7)	3.20(10.5)	98.0	AX							
34.05(111.7)	36.88(121.0)	2.83(9.3)	2.83(9.3)	100.0	AX							
36.88(121.0)	38.41(126.0)	1.53(5.0)	1.40(4.6)	92.0	AX							
38.41(126.0)	39.93(131.0)	1.52(5.0)	1.37(4.5)	90.0	AX							
39.93(131.0)	42.98(141.0)	3.05(10.0)	2.74(9.0)	90.0	AX							
42.98(141.0)	45.72(150.0)	2.74(9.0)	1.98(6.5)	72.0	AX							
45.72(150.0)	48.77(160.0)	3.05(10.0)	2.68(8.8)	88.0	AX							

APPENDIX A — DIAMOND-DRILL-HOLE RECORDS

Note: All linear measurements are in meters, with feet in parentheses.

Hole 6A (cont)

Drilled			Recovered		Size	Samples		Oz/ton		Percent		
From -	To -	Meters	Meters	Pct.	hole	From -	To -	Au	Ag	Zn	Pb	Cu
48.77(160.0)	51.21(168.0)	2.44(8.0)	1.98(6.5)	82.0	AX	48.77(160.0)	51.21(168.0C)	<.005	<0.1	0.1	<.1	0.02
51.21(168.0)	52.12(171.0)	.91(3.0)	.67(2.2)	74.0	AX	21.21(168.0)	52.12(171.0C)	<.005	< .1	.2	<.1	.02
52.12(171.0)	55.17(181.0)	3.05(10.0)	1.68(5.5)	55.0	EX							
55.17(181.0)	58.22(191.0)	3.05(10.0)	2.29(7.5)	75.0	EX							
58.22(191.0)	61.27(201.0)	3.05(10.0)	2.59(8.5)	85.0	EX							
61.27(201.0)	64.01(210.0)	2.74(9.0)	1.98(6.5)	72.0	EX							
64.01(210.0)	65.84(216.0)	1.83(6.0)	1.52(5.0)	83.0	EX							

Bottom hole 6A

APPENDIX A — DIAMOND-DRILL-HOLE RECORDS

Note: All linear measurements are in meters, with feet in parentheses.

Hole 6B

Coordinates: N5545; E4912

Bearing: S73E

Inclination: -45°

Elevation of collar: 2,338.0 (7,126.2)

Drilled: NX - 3.05 (10.0)
BX - 28.34 (93.0)
AX - 25.00 (85.4)
EX - 28.96 (91.6)

Total length: 85.35 (280.0)

Date started: November 19, 1949

Date completed: November 24, 1949

Explanation: C - Core
S - Sludge

Drilled			Recovered		Size	Samples		Oz/ton		Percent		
From -	To -	Meters	Meters	Pct.	hole	From -	To -	Au	Ag	Zn	Pb	Cu
0.0 (0.0)	3.05(10.0)	3.05(10.0)	0.0 (0.0)	0.0	NX plug							
3.05(10.0)	6.10(20.0)	3.05(10.0)	2.74(9.0)	90.0	BX							
6.10(20.0)	7.32(24.0)	1.22(4.0)	1.22(4.0)	100.0	BX							
7.32(24.0)	10.37(34.0)	3.05(10.0)	2.90(9.5)	95.0	BX							
10.37(34.0)	13.72(45.0)	3.35(11.0)	2.90(9.5)	86.0	BX							
13.72(45.0)	16.77(55.0)	3.05(10.0)	3.05(10.0)	100.0	BX							
16.77(55.0)	19.82(65.0)	3.05(10.0)	3.05(10.0)	100.0	BX							
19.82(65.0)	22.87(75.0)	3.05(10.0)	3.05(10.0)	100.0	BX							
22.87(75.0)	26.00(85.3)	3.13(10.3)	3.13(10.3)	100.0	BX							
26.00(85.3)	27.52(90.3)	1.52(5.0)	1.52(5.0)	100.0	BX							
27.52(90.3)	29.11(95.5)	1.59(5.2)	1.58(5.2)	100.0	BX							
29.11(95.5)	31.39(103.0)	2.28(7.5)	2.28(7.5)	100.0	BX							
31.39(103.0)	33.83(111.0)	2.44(8.0)	1.49(4.9)	61.0	AX							
33.83(111.0)	36.88(121.0)	3.05(10.0)	2.13(7.0)	70.0	AX							
36.88(121.0)	39.93(131.0)	3.05(10.0)	2.44(8.0)	80.0	AX							
39.93(131.0)	42.98(141.0)	3.05(10.0)	2.99(9.8)	98.0	AX							
42.98(141.0)	44.63(146.4)	1.65(5.4)	1.46(4.8)	89.0	AX							
44.63(146.4)	46.12(151.3)	1.49(4.9)	1.43(4.7)	96.0	AX							
46.12(151.3)	49.14(161.2)	3.02(9.9)	2.68(8.8)	89.0	AX							
49.14(161.2)	51.82(170.0)	2.68(8.8)	2.19(7.2)	82.0	AX							

APPENDIX A — DIAMOND-DRILL-HOLE RECORDS

Note: All linear measurements are in meters, with feet in parentheses.

Hole 6B (Cont)

Drilled			Recovered		Size	Samples		Oz/ton		Percent		
From -	To -	Meters	Meters	Pct.	hole	From -	To -	Au	Ag	Zn	Pb	Cu
51.82(170.0)	53.34(175.0)	1.52(5.0)	1.22(4.0)	80.0	AX							
53.34(175.0)	56.39(185.0)	3.05(10.0)	2.44(8.0)	80.0	AX							
56.39(185.0)	57.43(188.4)	1.04(3.4)	.91(3.0)	88.0	EX							
57.43(188.4)	59.44(195.0)	2.01(6.6)	1.43(4.7)	71.0	EX							
59.44(195.0)	63.09(207.0)	3.65(12.0)	2.83(9.3)	78.0	EX							
63.09(207.0)	66.29(217.5)	3.20(10.5)	2.65(8.7)	83.0	EX							
66.29(217.5)	69.19(227.0)	2.90(9.5)	2.29(7.5)	68.0	EX							
69.19(227.0)	72.24(237.0)	3.05(10.0)	2.47(8.1)	81.0	EX							
72.24(237.0)	75.29(247.0)	3.05(10.0)	2.29(7.5)	75.0	EX							
75.29(247.0)	76.93(252.4)	1.64(5.4)	0.0 (0.0)	0.0	EX							
76.93(252.4)	79.25(260.0)	2.32(7.6)	1.34(4.4)	58.0	EX							
79.25(260.0)	82.30(270.0)	3.05(10.0)	2.26(7.4)	74.0	EX							
82.30(270.0)	85.35(280.0)	3.05(10.0)	3.05(10.0)	100.0	EX							
Bottom hole 6B												

APPENDIX B—DIAMOND-DRILL-HOLE LOGS

Note: All measurements are in meters, with feet in parentheses.

Hole 1A

Distance From -	Distance To -	Description
0.0 (0.0)	3.05(10.0)	Limestone, weathered.
3.05(10.0)	5.03(16.5)	Limestone, silicified; slight ore mineralization.
5.03(16.5)	6.19(20.3)	Limestone; surface mud in cavity.
6.19(20.3)	7.62(25.0)	Limestone and garnetite; minor limonite; slight ore mineralization.
7.62(25.0)	8.38(27.5)	Limestone and garnetite; slight ore mineralization.
8.38(27.5)	10.85(35.6)	Limestone, garnetite, and coarse calcite; minor limonite and slight ore mineralization.
10.85(35.6)	14.02(46.0)	Limestone, garnetite, epidote, and coarse calcite; minor limonite and hematite; slight ore mineralization.
14.02(46.0)	15.73(51.6)	Limestone, brecciated and "mudded"; garnetite, epidote, and coarse calcite; minor hematite and manganese oxides; slight ore mineralization.
15.73(51.6)	17.59(57.7)	Andesite, altered.
17.59(57.7)	17.86(58.6)	Andesite.
Bottom hole 1A		

Hole 1B

0.0 (0.0)	44.50(146.0)	Limestone.
44.50(146.0)	45.11(148.0)	Limestone and garnetite; slight ore mineralization.
45.11(148.0)	46.94(154.0)	Andesite.
Bottom hole 1B		

Hole 2A

0.0 (0.0)	5.43(17.8)	Interlayered andesite and altered limestone.
5.43(17.8)	8.17(26.8)	Limestone.
8.17(26.8)	8.54(28.0)	Andesite.
8.54(28.0)	10.28(33.7)	Limestone.
10.28(33.7)	11.59(38.0)	Andesite.
11.59(38.0)	12.26(40.2)	Limestone breccia, leached and mudded.
12.26(40.2)	21.35(70.0)	Limestone, altered, leached; limonite stain.
21.35(70.0)	24.12(79.0)	Limestone, light gray crystalline.
Bottom hole 2A		

APPENDIX B — DIAMOND-DRILL-HOLE LOGS

Note: All measurements are in meters, with feet in parentheses.

Hole 2B

Distance From -	Distance To -	Description
0.0 (0.0)	0.52(1.7)	Andesite.
.52(1.7)	.85(2.8)	Limestone.
.85(2.8)	1.83(6.0)	Andesite.
1.83(6.0)	2.62(8.6)	Limestone.
2.62(8.6)	3.35(11.0)	Andesite.
3.35(11.0)	4.57(15.0)	Limestone.
4.57(15.0)	4.88(16.0)	Andesite.
4.88(16.0)	5.03(16.5)	Limestone.
5.03(16.5)	5.18(17.0)	Andesite.
5.18(17.0)	7.16(23.5)	Limestone.
7.16(23.5)	8.84(29.0)	Andesite.
8.84(29.0)	10.97(36.0)	Limestone.
10.97(36.0)	11.58(38.0)	Andesite.
11.58(38.0)	13.72(45.0)	Limestone, silicified and mineralized.
13.72(45.0)	16.58(54.4)	Limestone, brecciated and mudded; altered.
16.58(54.4)	17.68(58.0)	Andesite.
17.68(58.0)	19.54(64.1)	Limestone, slightly mineralized.
19.54(64.1)	19.81(65.0)	Andesite.
19.81(65.0)	21.18(69.5)	Limestone, silicified and mineralized.
21.18(69.5)	22.40(73.5)	Limestone, brecciated and mudded; slightly mineralized.
22.40(73.5)	24.23(79.5)	Limestone, leached and mudded; slightly mineralized.
24.23(79.5)	25.91(85.0)	Limestone, altered and mineralized.
25.91(85.0)	28.96(95.0)	Limestone, coarsely crystalline.
Bottom hole 2B		

Hole 2C

0.0 (0.0)	0.27(0.9)	Andesite.
.27(.9)	1.46(4.8)	Limestone.
1.46(4.8)	2.59(8.5)	Andesite.
2.59(8.5)	4.88(16.0)	Limestone cut by many thin tongues of Andesite.
4.88(16.0)	6.46(21.2)	Andesite.
6.46(21.2)	11.73(38.5)	Limestone.
11.73(38.5)	13.05(42.8)	Andesite.
13.05(42.8)	14.63(48.0)	Limestone, slightly mineralized.
14.63(48.0)	22.34(73.3)	Andesite.
22.34(73.3)	22.55(74.0)	Limestone.
Bottom hole 2C		

APPENDIX B — DIAMOND-DRILL-HOLE LOGS

Note: All measurements are in meters, with feet in parentheses.

Hole 4A

Distance From -	To -	Description
0.0 (0.0)	19.51(64.0)	Limestone, crystalline and bleached.
19.51(64.0)	19.66(64.5)	Limestone, silicified and discolored with limonite; coarse calcite; slight ore mineralization.
19.66(64.5)	33.53(110.0)	Limestone, crystalline and bleached.
Bottom hole 4A		

Hole 4B

0.0 (0.0)	17.89(58.7)	Limestone, crystalline and bleached.
17.89(58.7)	19.51(64.0)	Limestone, silicified and discolored.
19.51(64.0)	24.39(80.0)	Limestone, crystalline and bleached.
Bottom hole 4B		

Hole 4C

0.0 (0.0)	20.57(67.5)	Limestone, crystalline and bleached.
20.57(67.5)	23.62(77.5)	Limestone, silicified and discolored; slight ore mineralization.
23.62(77.5)	34.84(114.3)	Limestone, crystalline and bleached.
Bottom hole 4C		

Hole 5A

0.0 (0.0)	38.10(125.0)	Limestone, crystalline and bleached.
Bottom hole 5A		

Hole 5B

0.0 (0.0)	36.58(120.0)	Limestone, crystalline and bleached.
Bottom hole 5B		

APPENDIX B—DIAMOND-DRILL-HOLE LOGS

Note: All measurements are in meters, with feet in parentheses.

Hole 6A

Distance From -	Distance To -	Description
0.0 (0.0)	22.26(73.0)	Limestone, crystalline and bleached.
22.26(73.0)	23.78(78.0)	Limestone, silicified; slight ore mineralization.
23.78(78.0)	25.61(84.0)	Andesite.
25.61(84.0)	26.52(87.0)	Limestone, altered; slight ore mineralization.
26.52(87.0)	29.26(96.0)	Andesite.
29.26(96.0)	48.77(160.0)	Limestone, crystalline and bleached.
48.77(160.0)	52.12(171.0)	Limestone, silicified and altered; slight ore mineralization.
52.12(171.0)	53.64(176.0)	Limestone, altered, with tongues of andesite.
53.64(176.0)	65.84(216.0)	Limestone, crystalline and bleached.
Bottom hole 6A		

Hole 6B

0.0 (0.0)	6.10(20.0)	Limestone, crystalline and bleached.
6.10(20.0)	7.32(24.0)	Limestone, cut by tongues of andesite.
7.32(24.0)	32.61(107.0)	Limestone, crystalline and bleached.
32.61(107.0)	33.83(111.0)	Andesite.
33.83(111.0)	39.93(131.0)	Limestone, crystalline and bleached.
39.93(131.0)	42.98(141.0)	Limestone, with narrow bands of garnet.
42.98(141.0)	75.29(247.0)	Limestone, predominantly coarse crystalline; bleached, but veined and tinted in places.
75.29(247.0)	76.93(252.4)	Cavity.
76.93(252.4)	85.35(280.0)	Limestone, crystalline; bleached but tinted in places.
Bottom hole 6B		

APPENDIX C - SURFACE SAMPLES

Note: All linear measurements are in meters, with feet in parentheses.

Period sampled: October 30-November 2, 1949

Sample No.	Footage From -	Footage To -	Sample length	Position in excavation	Oz/ton Au	Oz/ton Ag	Percent Zn	Percent Pb	Percent Cu
800	0.0(0.0)	1.0(3.3)	1.0(3.3)	A	<0.005	2.2	1.8	0.35	0.10
801	0.0(0.0)	.8(2.6)	.8(2.6)	B	< .005	1.4	1.5	.15	.39
802	0.0(0.0)	1.0(3.3)	1.0(3.3)	C	< .005	2.0	1.3	.25	.16
803	1.0(3.3)	2.0(6.6)	1.0(3.3)	C	< .005	2.2	.5	.25	.16
804	2.0(6.6)	3.0(9.9)	1.0(3.3)	C	.15	1.7	1.25	.2	.11
805	3.0(9.9)	3.7(12.2)	.7(2.3)	C	< .005	.7	.3	< .1	.11
806	0.0(0.0)	1.0(3.3)	1.0(3.3)	D	.04	1.8	1.3	.25	.09
807	1.0(3.3)	1.9(6.2)	.9(2.9)	D	< .005	1.5	2.75	.6	.16
808	0.0(0.0)	1.0(3.3)	1.0(3.3)	E	< .005	.6	3.4	.35	.11
809	1.0(3.3)	1.7(5.6)	.7(2.3)	E	< .005	.3	2.3	.7	.06
810	0.0(0.0)	1.0(3.3)	1.0(3.3)	F	.01	.7	.3	< .1	.34
811	1.0(3.3)	2.5(8.2)	1.5(4.9)	F	< .005	.4	2.05	1.1	.36
812	0.0(0.0)	1.0(3.3)	1.0(3.3)	G	.005	.5	.25	< .1	.26
813	1.0(3.3)	2.0(6.6)	1.0(3.3)	G	.015	.4	.6	.35	.11
814	2.0(6.6)	2.8(9.2)	.8(2.6)	G	.005	.4	1.15	.75	.17
861			.4(1.3)	Horizontal across vein	< .005	.2	.3	.4	.04
862			1.4(4.6)	do	< .005	.3	.4	.2	.04
863			.9(2.9)	do	< .005	.5	6.75	1.4	.06
864			1.8(5.9)	2 meters below surface, horizontal across vein	< .005	.1	1.1	.6	.08
865			.5(1.6)	Horizontal across vein	< .005	.3	1.4	.85	.10
866			.5(1.6)	do	< .005	.2	4.1	.8	.23
867			1.0(3.3)	do	< .005	1.3	13.1	1.2	.42
868			1.0(3.3)	do	.01	.8	34.8	1.65	.58
869			1.6(5.2)	2 meters down stope, horizontal across vein	< .005	1.2	36.8	2.95	.69
870			2.0(6.6)	3.5 meters down stope, horizontal across vein	< .005	.3	2.2	.55	.10
871			1.5(4.9)	Horizontal across vein	.005	< .1	1.7	.2	.03
872			1.0(3.3)	do	.03	.8	30.6	1.25	.61
873			.3(1.0)	do	.005	5.4	1.8	3.5	.20
874			.4(1.3)	do	.008	.4	2.7	1.0	.09
875			.2(.7)	do	< .005	.2	.3	1.1	.09
876			.3(1.0)	do	< .005	.7	.2	1.45	.05
877			1.2(4.0)	FW side, horizontal across vein	< .005	2.4	.2	1.25	.06

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APPENDIX C - SURFACE SAMPLES

Note: All linear measurements are in meters, with feet in parentheses.

(Cont) Period sampled: October 30-November 2, 1949

Sample No.	Footage From - To -	Sample length	Position in excavation	Oz/ton Au	Oz/ton Ag	Percent Zn	Percent Pb	Percent Cu
878		1.0(3.3)	FW side, horizontal across remnant	<0.005	0.6	0.15	0.2	0.02
879		1.0(3.3)	FW side, horizontal across remnant	.01	5.2	.85	3.95	.10
880		.3(1.0)	Horizontal across vein	< .005	.3	.2	< .1	.02
881		.4(1.3)	do	< .005	.3	.1	< .1	.10
882		.7(2.3)	do	< .005	.1	.1	< .1	.01
883		.5(1.6)	do	< .005	< .1	.25	.35	.03
884		.5(1.6)	do	< .005	.1	.1	< .1	.03
885		.2(.7)	do	< .005	.2	.2	.1	.04
886		.3(1.0)	do	< .005	.2	.1	.1	.05
887		.2(.7)	do	< .005	.1	.15	< .1	.01
888		.5(1.6)	do	< .005	.1	.5	1.85	.10
889		.3(1.0)	do	< .005	.3	.2	.3	.24
890		.3(1.0)	do	< .005	< .1	.5	.35	.03
891		1.2(3.9)	do	< .005	< .1	.55	.5	.06
892		4.0(13.1)	do	< .005	.5	2.05	.85	.10
	(Sample 892 is composite of minerals from several veins 0.05 to 0.1 meter wide, 0.2 to 0.3 meter apart, in sheared zone 4.0 meters wide.)							
893		.6(2.0)	Horizontal across vein	< .005	.2	8.45	.4	.20
894		1.2(3.9)	do	.02	.3	.9	1.45	.14
895		.5(1.6)	do	< .005	< .1	.8	.4	.03
896		.3(1.0)	do	< .005	.2	2.65	2.45	.18
897		.3(1.0)	do	< .005	.1	.2	.6	.03
898			Selected pieces from dump	< .005	2.1	34.4	4.25	.71
899			do	< .005	.4	24.7	2.7	.26
900			do	< .005	1.0	22.3	1.6	.14
901		1.3(4.3)	Horizontal across vein	< .005	< .1	1.15	.2	.05
902		1.6(5.2)	do	< .005	.1	.25	< .1	.04
903		1.0(3.3)	Remnant on HW of vein	< .005	.7	1.1	1.25	.07
904			Selected pieces from dump	< .005	.5	12.9	1.35	.29
905		.75(2.5)	Horizontal across face	< .005	.1	2.95	.7	.18
906		.7(2.3)	Horizontal across remnant	< .005	.2	.4	.5	.03
907		1.5(4.9)	do	.005	.2	1.0	1.1	.05

APPENDIX C - SURFACE SAMPLES

Note: All linear measurements are in meters, with feet in parentheses.

(Cont) Period sampled: October 30-November 2, 1949

Sample No.	Footage From -	Footage To -	Sample length	Position in excavation	Oz/ton Au	Oz/ton Ag	Percent Zn	Percent Pb	Percent Cu
908			2.5(8.2)	Horizontal across remnant	<0.005	0.2	7.9	1.2	0.06
909			.7(2.3)	do	< .005	.1	4.05	2.95	.56
910			.6(2.0)	Horizontal across vein above portal	.005	< .1	32.6	.85	.26
911				Selected pieces from dump	.005	.5	27.5	2.0	.23
912				do	.005	< .1	14.0	.8	.13
913			2.0(6.6)	Horizontal across replacement mass	.01	.1	.8	.45	.03
914			.5(1.6)	Horizontal across face	< .005	< .1	1.6	1.15	.12
915			1.5(4.9)	Horizontal across face 2 meters down	.01	1.8	29.4	2.65	1.16
916			.6(2.0)	Horizontal across vein	< .005	< .1	.5	.25	.06
917			1.0(3.3)	Horizontal across vein, collar shaft	< .005	.5	9.6	2.25	1.44
918			.7(2.3)	Horizontal across vein	< .005	.9	31.2	1.9	1.47
919			.5(1.6)	do	< .005	.8	22.1	2.15	1.24
920			2.0(6.6)	-60° across vein in wall	.01	.4	29.1	2.3	.95
921			.7(2.3)	do	< .005	.1	2.45	3.45	.54
922			1.1(3.6)	Horizontal across vein in N. endstope	< .005	.2	2.3	.6	1.89
923			1.0(3.3)	Horizontal across remnants	< .005	.3	1.15	1.0	.18
924			.7(2.3)	Horizontal across vein	.01	< .1	.75	.45	.22
925			.7(2.3)	Horizontal across vein remnant	.005	.3	7.85	1.2	.18
926			1.4(4.6)	Horizontal across vein remnant S. end stope	.005	1.0	10.7	.75	.12
927			1.7(5.6)	Horizontal across vein N. end stope	.005	.5	21.0	.7	.15
928			.7(2.3)	Horizontal across vein	.005	.7	20.8	1.0	.27
929			1.5(4.9)	do	< .005	.1	14.6	.45	.10
930			1.4(4.6)	Horizontal across vein N. end pit	< .005	< .1	2.45	1.35	.48
931			.4(1.3)	Horizontal across vein S. end pit	.005	2.3	15.2	9.95	4.99
932			2.0(6.6)	-37° W. across vein	.005	1.1	7.55	1.4	1.62
933			1.1(3.6)	-45° W. across vein	< .005	.3	15.0	.9	1.00
934			.9(3.0)	Horizontal across vein	< .005	.6	3.6	.3	1.15
935			.7(2.3)	do	< .005	.1	41.35	1.3	.92
936			.5(1.6)	Horizontal across vein N. end pit	< .005	< .1	17.55	.85	.35
937			1.2(3.9)	Horizontal across vein remnant in S. end stope	< .005	.2	3.45	4.15	.80

APPENDIX C - SURFACE SAMPLES

Note: All linear measurements are in meters, with feet in parentheses.

(Cont) Period sampled: October 30-November 2, 1949

Sample No.	Footage From -	Footage To -	Sample length	Position in excavation	Oz/ton Au	Oz/ton Ag	Percent Zn	Percent Pb	Percent Cu
938			0.5(1.6)	Horizontal across vein in N. end stope	0.005	0.9	27.95	4.15	1.07
939			.9(3.0)	Horizontal across vein in S. end stope	< .005	.2	4.15	.9	.47
940			.6(2.0)	Horizontal across vein in N. end stope	< .005	.5	1.65	.9	1.24
941			1.3(4.3)	Horizontal across vein	.01	.3	9.85	1.5	1.97
942				Selected pieces from dump	.005	1.8	37.6	2.15	4.60
943			.5(1.6)	Horizontal across vein	< .005	1.4	3.35	2.6	.78
944			.8(2.6)	do	< .005	.2	4.3	.95	.17
945			2.0(6.6)	do	< .005	.2	2.8	.7	.06
946			1.7(5.6)	Horizontal across vein, 1.0 meter East Wall 0.7 meter waste, 0.7 meter West Wall	< .005	1.3	4.6	1.8	.13
947			.9(3.0)	Horizontal across vein	< .005	.3	6.6	.8	.26
948			.5(1.6)	do	< .005	1.1	8.85	5.05	.21
949			.7(2.3)	do	< .005	.4	13.5	3.35	.14
950			.4(1.3)	do	< .005	.1	2.1	.3	.20
951			.6(2.0)	do	< .005	.5	6.45	.85	.35
952			.6(2.0)	do	.015	.1	3.15	.15	.13
953			.8(2.6)	do	< .005	.3	5.6	1.0	.19
954			2.4(7.9)	do	< .005	.2	.35	< .1	.10
955			1.1(3.6)	do	< .005	.1	4.35	.15	.20
956			.9(3.0)	do	< .005	1.1	10.4	3.05	.43
957			1.0(3.3)	do	< .005	1.4	4.8	13.55	.12
958			1.6(5.2)	do	< .005	.4	8.2	1.6	.24
959			1.1(3.6)	Horizontal across vein remnant East Wall	< .005	.5	14.9	1.5	.64
960			1.0(3.3)	Horizontal across vein	< .005	< .1	.3	< .1	.03
961			2.0(6.6)	do	.005	.1	.25	< .1	.08
962			3.2(10.5)	do	< .005	.2	2.75	.5	.25
963			1.0(3.3)	do	< .005	.3	7.95	1.1	1.08
964				Selected pieces from dump	.005	4.1	18.5	10.0	3.40
965			.5(1.6)	Horizontal across vein	.005	.2	9.9	.35	.36

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