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SAUDI ARABIAN PROJECT REPORT 235

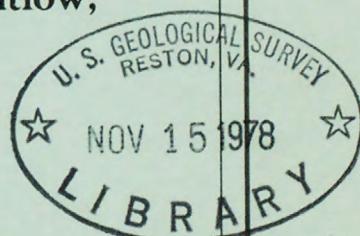


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PLACER GOLD DEPOSITS IN
THE MAHD ADH DHAHAB DISTRICT
KINGDOM OF SAUDI ARABIA

By

Abdulaziz Y. Bagdady, Jesse W. Whitlow,
and Ralph J. Roberts



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

PREPARED FOR
DIRECTORATE GENERAL OF MINERAL RESOURCES
MINISTRY OF PETROLEUM AND MINERAL RESOURCES

JIDDAH, SAUDI ARABIA U. S. Geological Survey

1978

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U.S. Geological Survey
Jiddah, Saudi Arabia

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ABSTRACT

Placer gold deposits in the Mahd adh Dhahab district were productive during ancient times, possibly during two periods, about 950 B.C. and 750-1258 A.D. These deposits were mapped and systematically sampled in 1973 to determine their future potential. The sampling program was facilitated by use of a backhoe which dug 1284 m of trenches and 17 pits. Five hundred and eight samples of surficial material were collected from the trenches and pits, and 78 samples were taken from bedrock exposed in the trenches.

Panning tests indicate that 710,910 m³ of gold-bearing material containing an average of 0.102 g/m³ gold are available; the total gold content is 72,268 g. Of this volume higher grade zones containing 263,455 m³ of auriferous detritus are available; this material averages 0.262 g/m³ gold and contains about 69,000 g gold. This gold could be recovered with simple washing and concentrating equipment.

In addition, a substantial amount of lower grade material which might be workable during times of higher gold prices is available in the district. It is concluded that the placer resources in the Mahd adh Dhahab district could form the basis for a small-scale local industry if the gold price is high.

INTRODUCTION

Jabal Mahd adh Dhahab is located at lat 23°29'19.3"N. and long 40°51'38.2"E. Ancient gold workings are scattered throughout the jabal but the principal workings are in the northeastern part where northwest-, northeast-, and north-striking vein systems were extensively stoped in ancient times. The Mahd adh Dhahab gold-silver mine was the most productive mine in Saudi Arabia. It was worked extensively during two periods in ancient times (950 B.C., and 750-1258 A.D.) and in modern times from 1939 to 1954 by the Saudi Arabian Mining Syndicate (SAMS) (Twitchell, 1958a, b; Goldsmith, 1971).

The early-day production of eluvial and placer gold from Mahd adh Dhahab is not known, but could have been significant. The Saudi Arabian Mining Syndicate reportedly mined 293,848 tons of old tailings and dumps. Though most of this probably came from mineralized rock mined from the northeastern flank of the jabal, it no doubt also included eluvial material eroded from the jabal.

This report describes the gold placer deposits and summarizes the results of a sampling program carried on in the Mahd adh Dhahab area during the spring of 1973. As part of the program of evaluating the ore deposits in the district, six trenches and 17 pits were dug in potential placer ground. The trenches were from less than 1 m to more than 5 m deep. The pits ranged from 2 to 4 m long and from 2 to 4 m deep. Five hundred and eight samples were collected from the trenches and 78 samples were collected from saprolite or bedrock in the lower parts of the trenches.

The writers wish to thank H. E. Dr. Fadil Kabbani, former Deputy Minister for Mineral Resources, for wholehearted cooperation in discussions relating to his earlier experiences at Mahd adh Dhahab. Al Amir Abdul Rahman Ben Abdul Rahman Assudeiri also helped by making available all facilities at Mahd adh Dhahab. Thor H. Kiilsgaard, former Project Chief, U.S. Geological Survey Mission, gave helpful advice in planning exploratory work. R.W. Luce, R.G. Worl, and W.P. Puffett were of great assistance in both field and office work. The writers also wish to acknowledge the able assistance of Ali Qarni, Ibrahim Eneze, and Hamad Almutteiri, panners; Ali Baraka Al Harbi, who helped with the drawing of trench profiles; and Ziyad Al Koulak, who assisted in the calculation of results.

This investigation is one of a series of studies by the U.S. Geological Survey made in accordance with a work agreement with the Ministry of Petroleum and Mineral Resources, Kingdom of Saudi Arabia.

GENERAL GEOLOGY

The geology, structure, and mineral deposits of Mahd adh Dhahab have been discussed in separate papers by Luce and others (1976) and by Worl (1978), and only a short summation is given here. The surficial rocks that contain the placer deposits are described in detail here.

Stratigraphy

The sequence of Precambrian rocks in Jabal Mahd adh Dhahab area, from oldest to youngest, is andesite, lower agglomerate, lower tuff, upper agglomerate, and upper tuff. MacLean (1961) first named these rocks the Mahd adh Dhahab series. Brown and others (1963) mapped them as Halaban Andesite and Fatima Formation; Aguttes and Duhamel (1971) assigned the entire sequence to the Halaban Group. Goldsmith and Kouther (1971) correlated the sequence with the Murdama and Fatima Formations; we concur in this correlation.

The stratigraphic section at Mahd adh Dhahab is summarized in table 1. The table includes thickness, lithology and stratigraphic relations, and favorability for metallization.

Plutonic rocks

The sequence of pyroclastic and clastic rocks of Mahd adh Dhahab area was intruded by plutonic rocks during two different periods. The first intrusive episode was the emplacement of a plug or dome and sills and dikes of rhyolite porphyry and the second was the emplacement of mafic dikes.

Quartz veins—the source of gold

Most of the placer gold at Mahd adh Dhahab was derived from the erosion of quartz veins that cut the lower and upper agglomerate, lower tuff, and rhyolite porphyry. The veins are especially abundant in the northeast part of the jabal. Gold in the veins occurs with sulfides, mainly pyrite, sphalerite, chalcopyrite, and galena, but is especially abundant in the selvages of the veins (Goldsmith, 1971). Weathering freed the gold from the veins and salvage zones and it first became part of the surficial cover; ultimately the gold was transported down to the pediments and fans that flank the range.

Surficial deposits

Surficial deposits in the Mahd adh Dhahab district are of three general types: talus and eluvial deposits, older alluvium, and younger alluvium. Talus and eluvial deposits mantle slopes below jabal outcrops; fan and stream deposits, locally as much as 5 m thick, flank the jabal. The fan and stream deposits have been divided into two units, older alluvium and younger alluvium. The principal placer deposits are in the older alluvium.

Talus and eluvial deposits

Talus and eluvial deposits at Jabal Mahd adh Dhahab are mostly coarse materials that accumulated on slopes below outcrops, but some ancient dumps are locally included in this unit as well. The material ranges in size from fine detritus a few millimeters in diameter to rock fragments 5 m across; the predominant size range is 10 to 50 cm. Part of the talus is probably correlative with the older alluvium, but most of it is considered to be correlative with the younger alluvium.

During the early-stage gold mining operations, the talus and eluvial material below vein outcrops on Mine Hill must have been very rich. No trace of the workings related to these operations can now be found, but remnants of ancient placer pits and drift operations are abundant in the older alluvium.

Table 1.- Stratigraphic section at Mahd adh Dhahab

Lithologic unit	Thickness (meters)	Lithology and stratigraphic relations	Favorability for mineralization
Surficial deposits	0-10	Talus, coarse debris on slopes and fans; includes dumps in mined areas. Younger alluvium, coarse, unsorted silt to gravel-size debris. Older alluvium, in part well washed material of sand to gravel size	Contains placer deposits, especially in older alluvium
Upper tuff	200	Tuff, thin-bedded, fissile, white to cream ashfall; weathers light brown to purplish red. Locally contains lapilli tuff layers.	Unfavorable: forms impermeable capping on ore deposits in upper agglomerate
Upper agglomerate	± 140	Agglomerate, crystal lapilli tuff with subangular rhyolite, andesite, and jasper fragments. Light olive gray where fresh; weathers reddish brown	Favorable: well mineralized
Lower tuff	207 { 80 72 55}	Upper part, mostly alternating tuff and sandstone; local lapilli tuff and shaly layers. Middle part, sandstone, gray to green; subgraywacke; and lapilli tuff layers. Lower part, siliceous ashfall tuff, cliff-forming, fine-grained, laminated; some sandy units; local lapilli tuff layers.	Unfavorable: contains weakly mineralized quartz veins
Lower agglomerate	± 120	Agglomerate, dark greenish-gray, weathers tan to reddish gray. Lithic fragments mostly andesite in lower part, rhyolite and jasper in upper part. Mostly poorly bedded; some tuff interbeds	Favorable: well mineralized along quartz veins and faults
UNCONFORMITY			
Andesite	300	Andesite, mostly dense to fine-grained; some crystalline units may be dioritic sills; few intercalated pyroclastic layers. Generally propylitically altered; in fault contact with lower agglomerate	Unfavorable: poorly mineralized

Older alluvium

The older alluvium lies on the lower slopes of the jabal below the talus and eluvial material, and is exposed on the fans, pediments, and terraces. It is commonly less than 5 m thick and is composed of a variety of materials ranging from clean, washed gravels to a mixture of angular rock fragments in a clayey matrix. At its base, the older alluvium generally grades into weathered bedrock or saprolite.

The older alluvium is mostly composed of fragments of andesite, tuff, agglomerate, and rhyolite; locally quartz vein fragments make up a significant part of the unit. The fragments range from a few millimeters to 30 cm or more in diameter. In places where the alluvium has been extensively reworked by streams on terraces and on pediments, the material may be rounded gravel in a sand matrix, but more commonly the fragments are angular to subangular and the matrix is clay to sandy clay. In many places the surface on older alluvium is covered with a lag pavement of desert-varnished cobbles and pebbles. The desert varnish colors light as well as dark rocks with a dark brown patina. The gold in the older alluvium is concentrated in lenses of gravel. The gold-bearing gravel lenses are distributed randomly through the unit with slight tendency of richer lenses in the lower part of the unit.

Younger alluvium

The younger alluvium is in the present stream channels. Because it is composed of detritus that has been recently transported, it is commonly light-colored in sharp contrast to the older alluvium which at the surface is covered by a lag pavement of desert-varnished cobbles and pebbles. The younger alluvium is composed of poorly-sorted detritus, mostly boulder- to pebble-sized in a matrix of sand- to clay-sized material.

Little gold was found in samples of the younger alluvium; it appears that the rapid erosion during the present cycle did not result in accumulation of significant amounts of placer gold.

SAMPLING PROGRAM

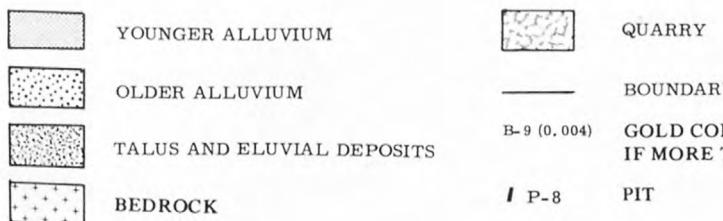
The sampling program at Mahd adh Dhahab was carried out in trenches and pits dug by a Poilain GY-120 backhoe loaned by Bureau de Recherches Géologiques et Minières. The methods of sampling, processing of samples, precision and accuracy of analyses, and calculations procedure of results are discussed in this section.

Method of sampling

Six trenches totalling 1,284 m in length and 17 pits were sampled. The trenches are designated 1, 2, 3, 4, 5, and 6; the pits are in the southeastern and northwestern areas (fig. 1).



Figure 1.- Sketch map of the northeast flank of Jabal Mahd adh Dhahab showing placer trenches and pits and the boundaries of placer blocks.



B-9 (0.004) **GOLD CONTENT IN g/m^3 . UNDERLINED IF MORE THAN 0.060.**

PIT

The gravel section was sampled at locations 5 or 10 m apart along the trench depending on the apparent abundance of gold in the trench. The vertical interval of sampling ranged from 0.25 m to more than 1 m, and shorter intervals were taken near the bedrock contact. Each sample was 0.01 m³ and was a composite collected randomly over the entire vertical interval and over a 2 or 4 horizontal sample interval, depending on the spacing between the sampling locations. If the detritus was distinctly layered, the layers were sampled separately. A maximum of four stratified samples were collected at each location in trenches 1 and 2, three in trenches 3, 4, and 5, and two in trench 6.

In general, greater care was taken in sampling in the lower part of the trench, especially the part in which gravel lies directly above the bedrock or the saprolite. However, in many places along the trenches the position of the bedrock-detritus contact was not clear. This uncertainty is due mainly to the caliche which in many places forms a dense layer in the lower part of the gravel section at the weathered bedrock contact.

At each sampling location the first sample was generally collected from the saprolite-gravel contact, if it was exposed; if not, it was taken from the bottom of the trench, up the bank to a height of 0.25 to 0.40 m. The second sample was collected from the top of the first sample to a height of 0.75 to 1.25 m, above the saprolite or above the bottom of the trench. The third was collected from the height of 0.75 to 1.25 m up to the top of the bank or up to approximately half the remaining thickness of the section if a fourth sample was to be taken. Where only two samples were to be collected from the gravel section, the first sample was collected as described above and the second sample was collected from the remaining thickness of the section. Where the gravel section was 0.5 m thick or less, only one sample was collected. An exception for the preceding general plan of sampling was made in the northwestern 95 m of trench 3 because that part did not reach bedrock. Here the thickness of the gravel section at each locality was divided into two equal parts and one sample was collected from each part.

The location and thickness of each sample interval, the thickness of the gravel section, and total depth are given in tables 3 through 10 and figures 2 through 7.

Processing of samples

Each sample consisted of 0.01m³ of unconsolidated material seived through a **screen** of 1.25 cm mesh. The oversize material, after being washed, was discarded. Material less than 1.25 cm in diameter was concentrated by panning. The concentrates were analyzed for gold by atomic absorption in the laboratory of the Directorate General of Mineral Resources (DGMR) in Jiddah.

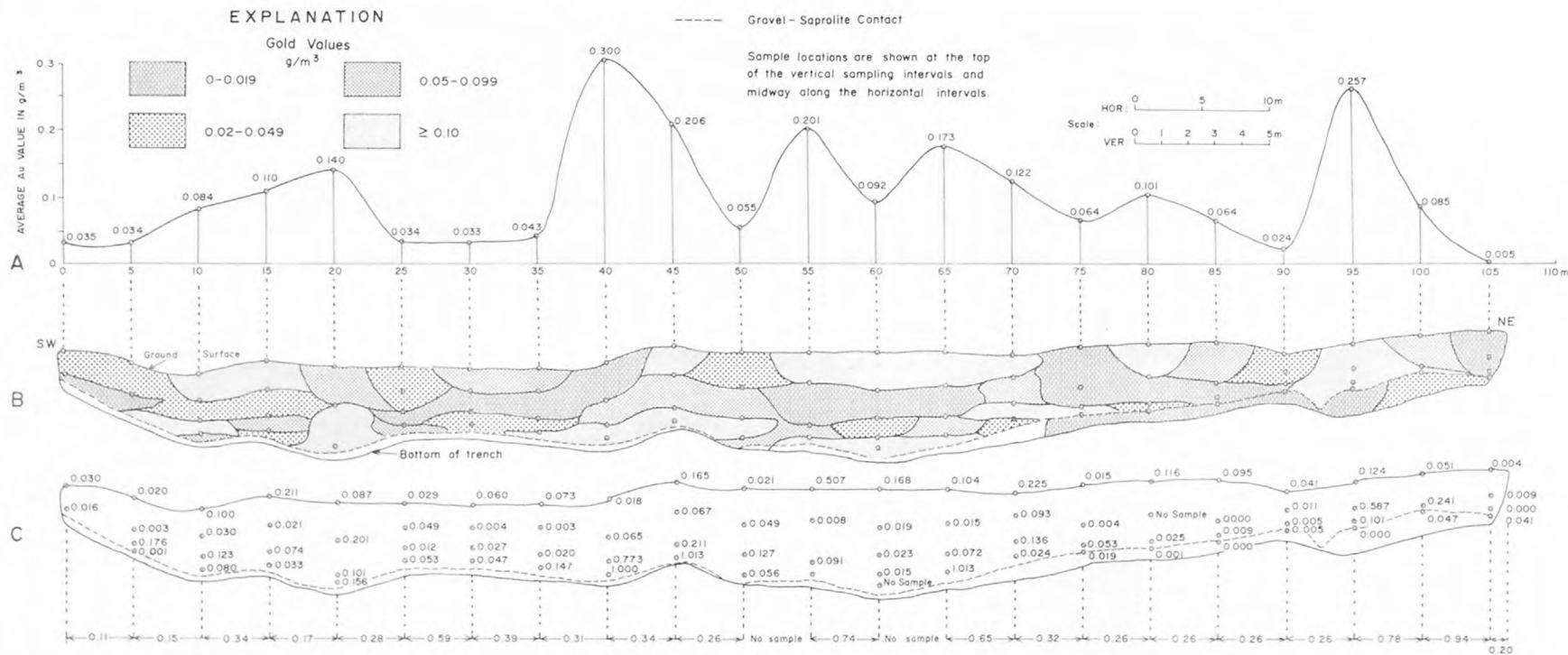


Figure 2. Section through trench 1. A, graph showing weighted average of gold content along trench wall; B, section showing distribution of gold values, and C, section showing gold content of each gravel sample in grams per cubic meter. The gold content of saprolitic bedrock is shown in parts per million below the section.

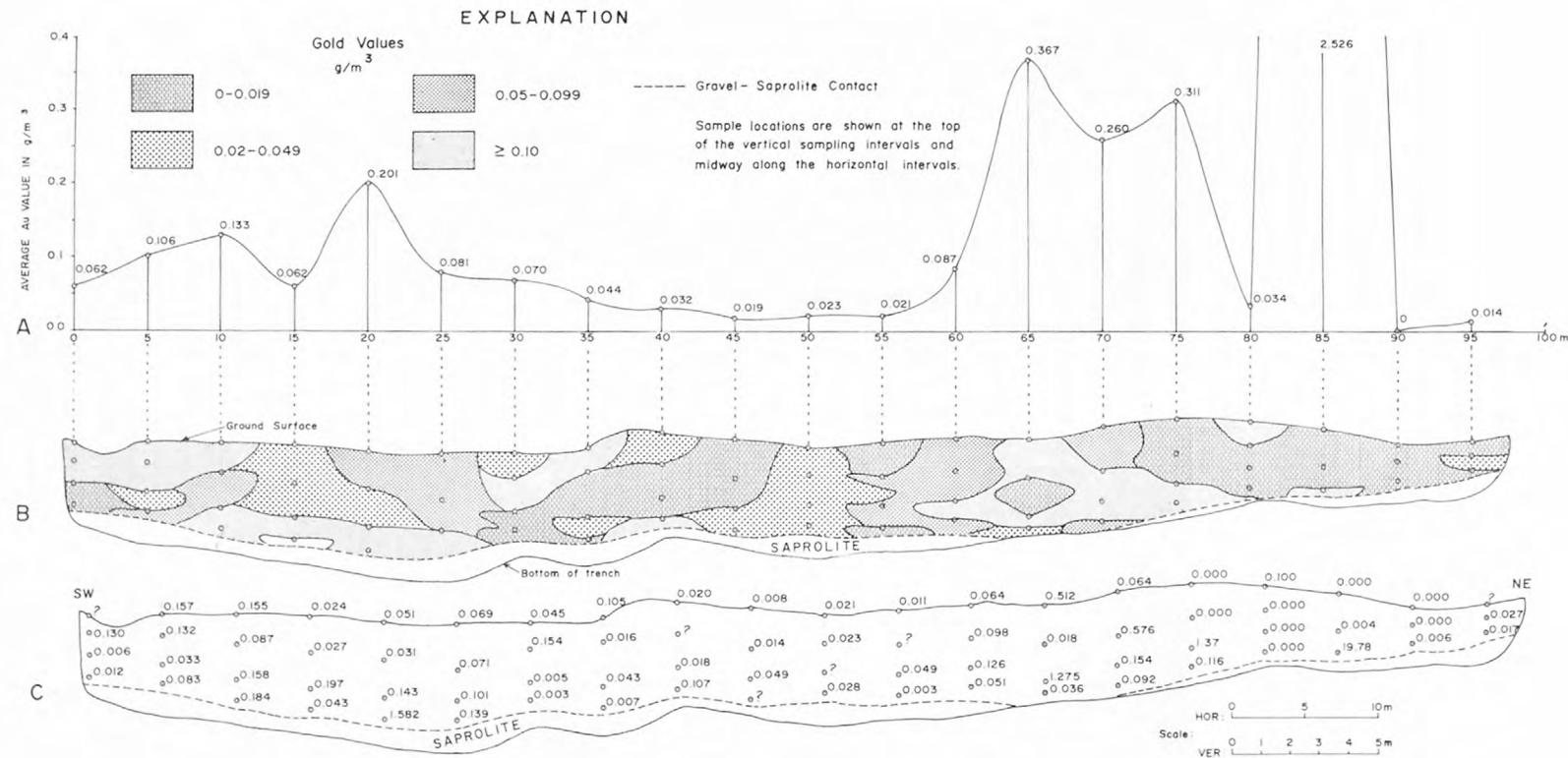


Figure 3. Section through trench 2. A, graph showing weighted average of gold content along trench wall; B, section showing distribution of gold values; and C, section showing gold content of each gravel sample in grams per cubic meter.

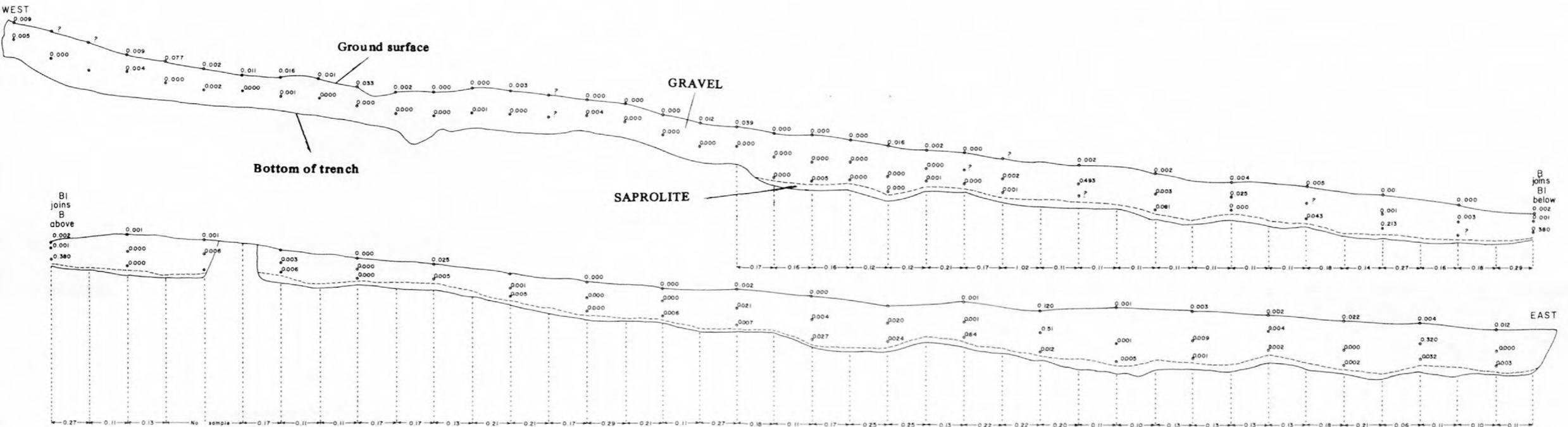


Figure 4. Section through trench 3 showing gold content of each gravel sample in grams per cubic meter. The gold content of the saprolitic bedrock is shown in parts per million below the section.

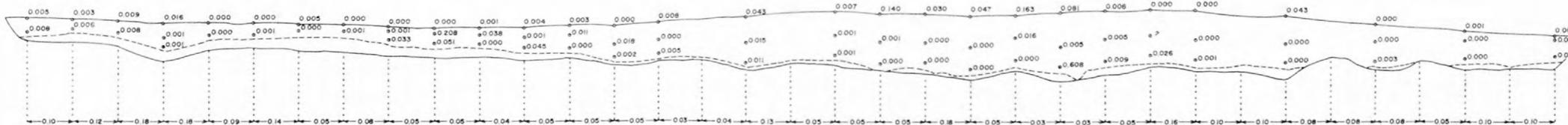


Figure 5. Section through trench 4 showing gold content of each gravel sample in grams per cubic meter. The gold content of the saprolitic bedrock is shown in parts per million below the section.

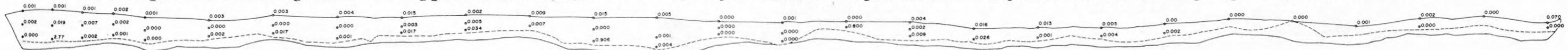


Figure 6. Section through trench 5 showing gold content of each gravel sample in grams per cubic meter.

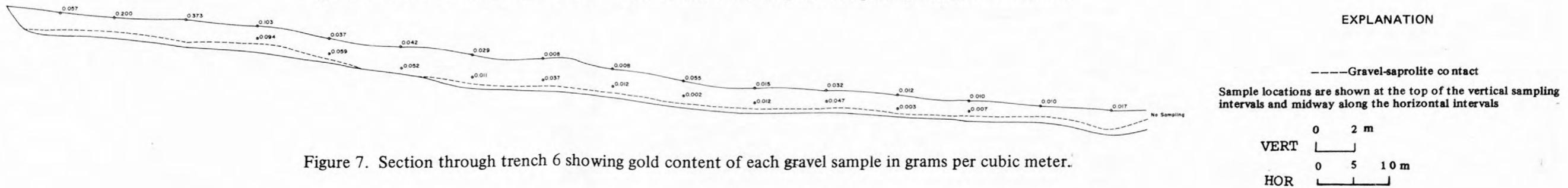


Figure 7. Section through trench 6 showing gold content of each gravel sample in grams per cubic meter.

Precision and accuracy of study methods

Some gold was lost in the panning process, as one might expect. This loss was confirmed by analysis of five samples taken at different times from the sand and silt tailings left in the panning tub. The five samples showed as much as 6 ppm of gold left in the sand and silt (table 2).

Table 2. – Analysis of panning tailings, Mahd adh Dhahab district

Sample number	Au (in ppm)	Ag (in ppm)
92005	0.06	1.1
92006	0.04	0.2
92007	0.10	1.0
92008	6.00	2.6
92009	0.26	1.3

In addition to the loss of gold in the panning process, Mr. Wesley Campbell, the technical advisor of the DGMR laboratory, indicated that the reported results may vary as much as 20 percent from the **actual** contained amounts. This variation is due largely to the particulate nature of the gold; mostly the variations are on the negative side. This was confirmed by submitting five gravel samples containing known amounts of particulate gold to the laboratory for analysis. The amounts of gold reported in the analyses were from 2 to 24 percent less than the amounts known to be present.

In calculating the amount of gold in grams per cubic meter, the swell factor of the volume of gravel is assumed to be 33.33 percent (Peele, 1947); that is, each sample that is $0.75 \times 10^{-2} \times 10^{-2} \text{ m}^3$ in place is actually $1.0 \times 10^{-2} \text{ m}^3$ after excavation. Any variance in this assumed swell factor will affect the calculated volume of gravel.

Procedure of calculations

To calculate the volume of in-situ gravel at each sample site, the assumption is made that the swell factor of the volume of gravel is 33.33 percent; that is, $V_e = V_o + 33.33 \text{ percent } V_o$, where V_e is the volume of gravel after excavation and V_o is the volume of gravel originally in place (Peele, 1947). To provide for the swell factor and the conversion factor from microgram to gram of 10^{-6} , the gold value in micrograms of each sample is multiplied by $133,33 \times 10^{-6}$ to give the gold value in grams per cubic meter.

To obtain the average gold value of a pit, a sampled interval, a part of trench, a trench, or a line of pits, the following procedure was used. First the weighted results were obtained by multiplying the gold value in grams per cubic meter of each sample by the thickness it represents, then weighted results were added together and divided by the total thickness which the samples represent to give the weighted average.

In estimating the volume and grade of the placer, the area was divided into twelve blocks (fig. 1) according to the gold distribution in the area and according to the location of the gold source area and the direction of streams. The average volume and grade of each block were obtained by averaging the values obtained from the trenches or pits which are inside the block or which form its boundary. The average for the whole area was obtained by taking a weighted average for each block.

DESCRIPTION AND RESULTS

Trench 1

Trench 1 is in the upper part of the wadi southeast of Mine Hill (fig. 1). The upper reaches of the wadi cover the highly mineralized area of Jabal Mahd adh Dhahab which contains many ancient and recent mine workings. Trench 1 is 106 m long and trends N.39°E. The average thickness of the gravel section along the trench is 2.56 m.

Eighty-four samples were collected from the gravel section along trench 1. The calculated weighted average gold value for the trench is 0.109 g/m³ of gravel (table 3).

Seventy-seven of the eighty-four samples from the trench showed gold values less than 0.25 g/ m³ of gravel. Only five samples had gold values higher than 0.25 g/m³. The highest gold value, .013 g/m³ of gravel, was obtained from two samples (nos. 86045 and 86061), collected at distances of 45 and 65 m from the southwest end of the trench, respectively (fig. 2C).

Figure 2B is a section along trench 1 that illustrates the distribution of gold in the trench wall. The section indicates that the gold is concentrated in randomly distributed lenses throughout the gravel section although several richer lenses directly overlie the bedrock, especially where channels were cut into the bedrock. The characteristics of the lenses suggest an origin by cut and fill of stream channels along the main wadi course.

Figure 2A illustrates the variation of the average gold value in grams per cubic meter of gravel along the trench.

Figure 2C is a section along trench 1 showing the location of each sample, and its gold content. The sample analyses and the thickness of the gravel section are recorded in table 3.

Table 3. - Table showing thickness and metal content of samples from trench 1

Distance from SW end (m)	Total depth (m)	Thickness of gravel section	Thickness and location of sampling intervals. 0 = bottom		Sample numbers	Gravel section		Bedrock									
			From	To		Au g/m ³ Each sample	Au g/m ³ average	Au ppm	Ag ppm	Cu ppm	Pb ppm	An ppm					
0	1.50	1.40	0	0.10	86800			0.11	0.6	2125	40	1400					
			0.10	0.35	86810	0.016	0.035										
			0.35	1.50	86011	0.039											
5	2.20	2.00	0	0.20	86801			0.15	0.6	3025	28	970					
			0.20	0.45	86014	0.178	0.034										
			0.45	0.95	86015	0.003											
			0.95	2.20	86016	0.020											
10	2.65	2.45	0	0.20	86802			0.34	0.6	1075	66	1100					
			0.20	0.45	86017	0.080	0.084										
			0.45	0.95	96018	0.124											
			0.95	1.70	86019	0.039											
			1.70	2.65	86020	0.100											
15	3.00	3.00	Trench's bottom		86803			0.17	0.6	1225	56	1140					
			0	0.25	86021	0.033	0.110										
			0.25	0.75	86022	0.074											
			0.75	1.75	86023	0.021											
			1.75	3.00	86024	0.211											
20	3.40	3.10	0	0.30	86804			0.28	0.6	1850	40	1140					
			0.30	0.55	86025	0.157	0.140										
			0.55	0.80	86026	0.101											
			0.80	2.05	86027	0.201											
			2.05	3.40	86028	0.087											
25	2.70	2.40	0	0.30	86805			0.59	0.9	8750	76	880					
			0.30	0.55	86029	0.053	0.034										
			0.55	1.05	86030	0.012											
			1.05	1.80	86031	0.049											
			1.80	1.70	86032	0.029											
30	2.60	2.30	0	0.30	86806			0.39	0.6	1850	45	1220					
			0.30	0.55	86033	0.047	0.033										
			0.55	1.05	86034	0.027											
			1.05	1.80	86035	0.004											
			1.80	2.60	86036	0.060											
35	2.80	2.60	0	0.20	86807			0.31	0.6	4675	312	3800					
			0.20	0.45	86037	0.147	0.043										
			0.45	0.95	86038	0.020											
			0.95	1.95	86039	0.003											
			1.95	2.80	86040	0.073											
40	2.60	2.35	0	0.25	86808			0.34	0.6	925	92	1400					
			0.25	0.50	86041	1.000	0.300										
			0.50	1.00	86042	0.773											
			1.00	1.85	86043	0.065											
			1.85	2.60	86044	0.018											

Table 3. - Table showing thickness and metal content of samples from trench 1 (cont'd.).

Distance from SW end (m)	Total depth (m)	Thickness of gravel section	Thickness and location of sampling intervals. 0 = bottom From To	Sample numbers	Gravel section		Bedrock				
					Au g/m ³ Each sample	Au g/m ³ Section average	Au ppm	Ag ppm	Cu ppm	Pb ppm	An ppm
45	3.00	3.00	Trench's bottom 0 0.25 0.25 0.75 0.75 1.90 1.90 3.00	86809			0.26	1.2	1075	135	1270
				86045	1.013	0.206					
				86046	0.211						
				86047	0.067						
50	3.50	3.50	0 0.40 0.40 1.10 1.10 2.25 2.25 3.50	86049	0.056	0.055					
				86050	0.127						
				86051	0.049						
				86052	0.021						
55	3.60	3.30	0 0.30 0.30 0.55 0.55 1.05 1.05 2.50 2.50 3.60	86810			0.74	0.9	1125	34	1380
				86053	0.192	0.201					
				86054	0.091						
				86055	0.008						
				86056	0.507						
60	4.00	3.60	0.40 0.80 0.80 1.50 1.50 2.50 2.50 4.00	86057	0.115	0.092					
				86058	0.023						
				86059	0.019						
				86060	0.168						
65	3.70	3.40	0 0.25 0.25 0.65 0.65 1.35 1.35 2.50 2.50 3.70	86811			0.65	0.8	1125	92	2040
				86061	1.013	0.173					
				86062	0.027						
				86063	0.016						
				86064	0.104						
70	3.20	2.60	0 0.60 0.60 0.90 0.90 1.50 1.50 2.40 2.40 3.20	86812			0.32	0.8	925	98	2110
				86065	0.024						
				86066	0.136						
				86067	0.053						
				86068	0.225						
75	3.00	2.50	0 0.50 0.50 0.75 0.75 1.50 1.50 3.00	86813			0.26	0.8	875	50	3100
				86073	0.019	0.064					
				86074	0.533						
				86075	0.004						
				86076	0.015						
80	2.90	2.45	0 0.45 0.45 0.70 0.70 1.70 1.70 2.90	86814			0.26	0.8	875	75	2430
				86077	0.001	0.010					
				86078	0.025						
				86079	missing						
				86080							
85	2.65	2.25	0 0.40 0.40 0.40 0.40 0.40 0.40 0.40	86815			0.261	0.9	525	70	2430
				86081	0.000	0.064					
				86082	0.009						
				86083	0.000						
				86084	0.095						

Table 3. - Table showing thickness and metal content of samples from trench 1. (cont'd.)

Distance from SW end (m)	Total depth (m)	Thickness of gravel section	Thickness and location of sampling intervals, 0 = bottom		Sample numbers	Gravel section		Bedrock				
			From	To		Au g/m ³ Each sample	Au g/m ³ Section average	Au ppm	Ag ppm	Cu ppm	Pb ppm	An ppm
90	1.90	1.40	0	0.50	86816	0.005 0.005 0.011 0.041	0.024	0.26	0.8	775	60	4950
			0	0.50	86085							
			0.50	0.75	86086							
			0.75	1.25	86087							
			1.25	1.90	86088							
95	2.70	1.70	0	1.00	86817	0.000 0.101 0.587 0.124	0.257	0.78	0.8	525	40	2260
			0	1.00	86089							
			1.00	1.25	86090							
			1.25	1.75	86091							
			1.75	2.70	86092							
100	2.30	1.40	0	0.90	86818	0.047 0.241 0.051	0.085	0.94	0.6	825	75	1880
			0	0.90	86093							
			0.90	1.15	86094							
			1.15	2.30	86095							
105	2.00	1.70	0	0.30	86819	0.041 0.000 0.009 0.004	0.041	0.20	1.1	925	200	1560
			0	0.30	86096							
			0.30	0.55	86097							
			0.55	1.05	86098							
			1.05	2.00	86099							

Twenty channel samples of saprolitic bedrock were collected on a 5-m interval in trench 1 (table 3 and figure 2C) and analyzed by atomic absorption methods for Au, Ag, Cu, Pb, and Zn. None of the samples show high gold values, the highest being 0.94 ppm. The average values for Au, Ag, Cu, Pb, and Zn are 0.39, 0.761, 1754, 83, and 1928 respectively.

Trench 2

Trench 2 is parallel to trench 1 and 48 m downslope. The length of the trench is 97 m and the average thickness of gravel section along it is 2.99 m.

Seventy-two samples were collected from gravel along trench 2. Only six samples had gold values higher than 0.25 g/m^3 of gravel. The highest gold value, 19.78 g/m^3 , was from sample 86186 collected from a 0.3 m interval directly above bedrock and 85 m from the southwest end of the trench. The second highest gold value of 1.37 g/m^3 was from sample 86179 collected from an interval 0.7 m thick, 0.3 m above bedrock and 75 m from the southwest end. The calculated average gold content of all gravel samples taken from trench 2 is 0.218 g/m^3 of gravel. If sample 86186 is omitted from the calculations, the remaining samples average 0.111 gram gold per cubic meter of gravel.

Figure 3B is a section along trench 2 illustrating the distribution of gold in the gravel section, and figure 2A is a graph showing the variation of the average gold content, in grams per cubic meter, of the gravel section along the trench. Figure 3B indicates that the gold is concentrated in lenses as in trench 1. The richest lenses are found between 60 and 90 m from the southwest end of the trench and in the first 25 m from the southwest end of the trench. Figure 3C is a section along trench 2 showing the location of each sample, and its gold content. Details of the analyses and the thickness of the gravel section are given in table 4.

As no significant mineralization was noted in the bedrock along trench 1, bedrock samples from trench 2 were not analyzed.

Trench 3

Trench 3 is 180 m south of trench 2, and extends from the wadi westward across a pediment cut in the lower tuff. Trench 3 is 398 m long and trends N.87°W, and its average depth is 2.51 m.

One hundred and thirty-five samples were collected from trench 3; of these only five had gold contents higher than 0.25 g/m^3 of gravel. The highest gold content was 64.27 g/m^3 in sample 86309 collected from a 0.3 m interval above the bedrock, 320 m from the northwest end of the trench. This sample had the highest gold content of all the samples collected in the area because it contained a piece of gold weighing 0.482 g. The second highest gold value is 0.493 g/m^3 of gravel in sample 86257 collected from an interval 0.9 m thick beginning at a point 0.3 m above bedrock, and 140 m from northwest end of the trench. The average gold value calculated from all samples from trench 3 is 0.165 g/m^3 of gravel. If the sample with the highest gold value is omitted from the calculation, the average gold value is reduced to 0.015 g/m^3 .

Table 4. - Table showing thickness and gold content of samples from trench 2

Distance from SW end (m)	Total depth (m)	Thickness of gravel section	Thickness and location of sampling intervals. 0 = bottom		Sample numbers	Gravel section	
			From	To		Au g/m ³ Each sample	Au g/m ³ Section average
0	2.75	2.35	0.40	0.70	86118	0.012	0.062
			0.70	1.40	86119	0.006	
			1.40	2.20	86120	0.130	
			2.20	top	86121	lost	
5	3.50	2.65	0.85	1.15	86122	0.083	0.106
			1.15	1.85	86123	0.033	
			1.85	2.85	86124	0.132	
			2.85	top	86125	0.157	
10	3.75	3.25	0.50	0.80	86126	0.184	0.133
			0.80	1.50	86127	0.158	
			1.50	2.70	86128	0.087	
			2.70	top	86129	0.155	
15	4.00	3.43	0.57	0.87	86130	0.043	0.062
			0.87	1.57	86131	0.197	
			1.57	2.77	86132	0.027	
			2.77	top	86133	0.024	
20	4.25	3.55	0.70	1.00	86134	1.582	0.201
			1.00	1.70	86135	0.143	
			1.70	3.00	86136	0.031	
			3.00	top	86137	0.051	
25	4.50	3.75	0.75	1.05	86138	0.139	0.081
			1.05	1.75	86139	0.101	
			1.75	2.75	86140	0.071	
			2.75	top	86141	0.069	
30	3.70	3.15	0.55	0.85	86142	0.003	0.070
			0.85	1.55	86143	0.005	
			1.55	2.65	86144	0.154	
			2.65	top	86145	0.045	
35	4.00	3.40	0.60	0.90	86146	0.007	0.044
			0.90	1.60	86147	0.043	
			1.60	3.10	86148	0.016	
			3.10	top	86149	0.105	
40	3.60	3.10	0.50	0.80	86150	0.107	0.032
			0.80	1.50	86151	0.018	
			1.50	2.60	86152	lost	
			2.60	top	86153	0.020	
45	3.60	3.30	0.30	0.60	86154	lost	0.019
			0.60	1.30	86155	0.049	
			1.30	2.30	86156	0.014	
			2.30	top	86157	0.008	

Table 4. - Table showing thickness and gold content of samples from trench 2 (cont'd.)

Distance from SW end (m)	Total depth (m)	Thickness of gravel section	Thickness and location of sampling intervals. 0 = bottom		Sample numbers	Gravel section	
			From	To		Au g/m ³ Each sample	Au g/m ³ Section average
50	3.75	2.95	0.80	1.10	86158	0.028	0.023
			1.10	1.80	86159	lost	
			1.80	2.80	86160	0.023	
			2.80	top	86161	0.021	
55	3.70	3.30	0.40	0.70	86162	0.003	0.021
			0.70	1.40	86163	0.049	
			1.40	2.40	86164	lost	
			2.40	top	86165	0.011	
60	3.75	3.20	0.55	0.85	86166	0.051	0.087
			0.85	1.55	86167	0.126	
			1.55	2.55	86168	0.098	
			2.55	top	86169	0.064	
65	3.30	3.30	0	0.30	86170	0.038	0.367
			0.30	0.70	86171	1.275	
			0.70	2.00	86172	0.018	
			2.00	top	86173	0.512	
70	3.50	3.50	0	0.30	86174	0.092	0.260
			0.30	1.00	86175	0.154	
			1.00	2.20	86176	0.576	
			2.20	top	86177	0.064	
75	3.40	3.20	0.20	0.50	86178	0.116	0.311
			0.50	1.20	86179	1.371	
			1.20	2.20	86180	0	
			2.20	top	86181	0	
80	2.80	2.63	0.17	0.47	86182	0	0.034
			0.47	1.17	86183	0	
			1.17	1.92	86184	0	
			1.92	top	86185	0.100	
85	2.70	2.35	0.35	0.65	86186	19.78	2.526
			0.65	1.35	86187	0.004	
			1.35	top	86188	0	
90	2.00	1.60	0.40	0.70	86189	0	0
			0.70	1.30	86190	0	
			1.30	top	86191	0	
95	2.00	1.25	0.75	1.00	86192	0.017	0.014
			1.00	1.50	86193	0.027	
			1.50	top	86194	0	

Figure 4 is a section along trench 3 showing the location of the samples and the gold content of each sample. The sample analyses are tabulated in table 5.

Trench 3 cuts a large area containing various concentrations of gold. To simplify the calculations, the trench is divided into 6 parts according to the gold concentration along it. Measuring from the northwest end of the trench, the respective intervals are 0-97.5, 97.5-135, 135-205, 205-285, 285-335, and 335-398 m.

The northwest part of trench 3 (0-97.5 m) was not deep enough to reach bedrock. Therefore it is uncertain whether there is a gold concentration in the lower part. The average depth of this part of the trench is 2.46 m. Forty samples were collected at 5-m intervals, from this part of the trench. The average gold content is 0.007 g/m³ of gravel.

The average thickness of the gravel section along the second part (97.5-135 m) is 2.65 m. Twenty-one samples were collected at 5-m intervals. The average gold content is 0.002 g/m³ of gravel.

In the 135-205 m interval the average thickness of the gravel is 2.32 m. Twenty-one samples were collected at 10-m intervals. They gave an average gold content of 0.044 g/m³.

In the segment 205-285 m twenty-three samples were collected at 10-m intervals. The average thickness of the gravel section is 1.87 and the average gold content is 0.003 g/m³.

In part 285-335 m, fifteen samples were collected at 10-m intervals. The average gold content is 1.495 g/m³. This is the highest average of all the trenches in the area. The average thickness of the gravel is 2.86 m. This part of the trench apparently intersected an old channel of the same wadi in which trenches 1 and 2 are located.

In the segment 335-398 m, eighteen samples were collected at 10-m intervals. The average thickness of the gravel is 3.10 m and the average gold content is 0.023 g/m³.

Trench 4

Trench 4 is located in pediment at the foot of a partially mineralized ridge of lower agglomerate. The trend of the trench is E-W, about parallel to trench 3. The total length of the trench is 170 m. The average thickness of the gravel section along the trench is 2.49 m. Except for a small stream channel, no major wadi was intersected by trench 4.

Seventy-nine samples were collected from the trench. Most of them had very low gold content, the highest and the second highest gold values being 0.608 and 0.208 g/m³, respectively. The average gold content along the trench is 0.023 g/m³ of gravel.

Table 5. - Table showing thickness and metal content of samples from trench 3

Distance from NW end (m)	Total depth (m)	Thickness of gravel section	Thickness and location of sampling intervals. 0 = bottom		Sample numbers	Gravel section		Bedrock			
			From	To		Au g/m ³ Each sample	Au g/m ³ Section average	Au ppm	Ag ppm	Cu ppm	Pb ppm
0	2.30	2.30	0 1.20	1.20 2.30	86195 86196	0.005 0.009	0.007	No bedrock exposed in the bottom of the trench to a distance of 95 m			
5	3.29	3.29	0 1.40	1.40 2.29	86221 86222	0.000 missing	0				
10	3.08	3.08	0 1.30	1.30 3.08	86197 86198	0.017 0.014	0.012				
15	2.74	2.74	0 1.20	1.20 2.74	86199 86200	0.004 0.009	0.007				
20	2.53	2.53	0 1.15	1.15 2.53	86201 86202	0.000 0.077	0.42				
25	2.41	2.41	0 1.10	1.10 2.41	86203 86204	0.002 0.002	0.002				
30	2.10	2.10	0 1.10	1.10 2.10	86204 86205	0.000 0.011	0.005				
35	2.23	2.23	0 1.00	1.00 2.23	86207 86208	0.001 0.016	0.010				
40	2.47	2.47	0 1.20	1.20 2.47	86209 86210	0.000 0.007	0.004				
45	2.38	2.38	0 1.10	1.10 2.38	86211 86212	0.000 0.033	0.018				
50	2.53	2.53	0 1.10	1.10 2.53	86213 86214	0.000 0.003	0.002				
55	3.05	3.05	0 1.50	1.50 3.05	86215 86216	0.000 0.001	0.001				
60	2.71	2.71	0 1.10	1.10 2.71	86217 86218	0.001 0.000	0.000				
65	2.81	2.81	0 1.20	1.20 2.81	86219 86220	0.000 0.003	0.002				
70	2.56	2.56	0 1.10	1.10 2.56	86223 86224	0.000 0.000	0.000				
75	2.19	2.19	0 1.10	1.10 2.19	86225 86225	0.004 0.000	0.002				
80	2.26	2.26	0 1.00	1.00 2.26	86227 86228	0.000 0.000	0.000				

Table 5. - Table showing thickness and metal content of samples from trench 3 (cont'd.)

Distance from NW end (m)	Total depth (m)	Thickness of gravel section	Thickness and location of sampling intervals. 0 = bottom		Sample numbers	Gravel section			Bedrock			
			From	To		Au g/m ³ Each sample	Au g/m ³ Section average	Au ppm	Ag ppm	Cu ppm	Pb ppm	Zn ppm
85	2.35	2.35	0	1.00	86229	0.000	0.000					
			1.00	2.35	86230	0.000						
90	2.56	2.56	0	1.00	86231	0.000	0.008					
			1.00	2.56	86232	0.012						
95	2.41	2.41	Trench's bottom		86839			0.17	0.6	390	40	1180
			0	1.10	86233	0.000	0.022					
			1.10	2.41	86234	0.040						
100	3.44	3.24	0	0.20	86840			0.16	0.6	825	65	1200
			0.20	0.55	86235	0.000	0.000					
			0.55	1.85	86236	0.000						
			1.85	3.44	86237	0.000						
105	3.69	3.24	0	0.40	86841			0.16	0.6	1125	30	970
			0.40	0.70	86238	0.005	0.001					
			0.70	1.90	86239	0.000						
			1.90	3.69	86240	0.000						
110	3.20	2.80	0	0.40	86842	0.120		0.12	1.0	1385	45	1000
			0.40	0.70	86241	0.000	0.000					
			0.70	1.80	86242	0.000						
			1.80	3.20	86243	0.000						
115	3.59	3.29	0	0.30	86843			0.12	0.76	1325	50	1000
			0.30	0.60	86244	0.000	0.011					
			0.60	1.50	86245	0.000						
			1.50	3.59	86246	0.017						
120	2.65	2.40	0	0.25	86844			0.21	0.70	1125	50	1070
			0.25	0.65	86247	0.001	0.001					
			0.65	1.55	86248	0.000						
			1.55	2.65	86249	0.002						
125	2.59	2.44	0	0.15	86845			0.17	0.64	575	60	1140
			0.15	0.45	86250	0.000	0.000					
			0.45	1.45	86251	0.000						
			1.45	2.59	86252	0.000						
130	2.77	2.50	0	0.27	86846			1.02	0.84	1535	40	4400
			0.27	0.57	86253	0.001	0.002					
			0.57	1.57	86254	0.002						
			1.57	2.77	86255	missing						
135	2.96	2.46	0	0.50	86847			0.11	0.80	725	160	3450
140	2.71	2.31	0	0.40	86848			0.11	0.70	685	60	4300
			0.40	0.70	86256	missing	0.222					
			0.70	1.60	86257	0.493						
			1.60	2.71	86258	0.002						

Table 5. - Table showing thickness and metal content of samples from trench 3 (cont'd.)

Distance from NW end (m)	Total depth (m)	Thickness of gravel section	Thickness and location of sampling intervals. 0 = bottom		Sample numbers	Gravel section				Bedrock		
			From	To		Au g/m ³ Each sample	Au g/m ³ Section average	Au ppm	Ag ppm	Cu ppm	Pb ppm	Zn ppm
145	2.68	2.48	0	0.20	86849			0.11	0.80	530	80	4220
150	2.90	2.55	0	0.35	86850			0.11	0.80	410	40	6800
			0.35	0.65	86259	0.081	0.012					
			0.65	1.65	86260	0.003						
			1.65	2.90	86261	0.002						
155	2.80	2.55	0	0.25	86851			0.11	0.80	80	45	4000
160	2.47	2.07	0	0.40	86852			0.11	0.80	85	45	2260
			0.40	0.70	86262	0.001	0.011					
			0.70	1.50	86263	0.025						
			1.50	2.47	86264	0.004						
165	2.47	2.17	0	0.30	86853			0.11	0.84	90	70	1560
170	2.59	2.39	0	0.20	86854			0.18	0.88	210	80	2400
			0.20	0.50	86265	0.043	0.008					
			0.50	1.50	86266	0.000						
			1.50	2.59	86267	0.005						
175	2.77	2.68	0	0.10	86855			0.14	0.80	250	80	3300
180	2.86	2.66	0	0.20	86856			0.27	0.80	165	70	2130
			0.20	0.50	86268	0.213	0.024					
			0.50	1.40	86269	0.001						
			1.40	2.86	86270	0.000						
185	2.71	2.51	0	0.20	86857			0.16	0.80	160	155	1560
190	2.44	2.24	0	0.20	86858			0.18	0.88	105	70	1820
			0.20	0.50	86271	0.000	0.001					
			0.50	1.40	86272	0.004						
			1.40	2.44	86273	0.000						
195	2.16	2.01	0	0.15	86859			0.29	0.88	105	80	1840
200	2.16	2.01	0	0.15	86860			0.27	0.88	110	100	1820
			0.15	0.45	86274	0.380	0.058					
			0.45	1.25	86275	0.001						
			1.25	2.16	86276	0.002						
205	2.50	2.40	0	0.10	86861			0.11	0.76	75	80	2460
210	2.84	2.49	0	0.35	86862			0.13	0.76	80	45	2430
			0.35	0.75	86277	0.000	0.005					
			0.75	1.65	86278	0.001						
			1.65	2.84	86279	0.010						
215	--- road ---							---- no sample ----				

Table 5. - Table showing thickness and metal content of samples from trench 3 (cont'd.).

Distance from NW end (m)	Total depth (m)	Thickness of gravel section	Thickness and location of sampling intervals. 0 = bottom		Sample numbers	Gravel section		Bedrock				
			From	To		Au g/m ³ Each sample	Au g/m ³ Section average	Au ppm	Ag ppm	Cu ppm	Pb ppm	Zn ppm
220	2.50	2.25	0	0.25								--- no sample ---
			0.25	0.55	86280	0.000	0.003					
			0.55	1.55	86281	0.006						
			1.55	2.50	86282	0.001						
225	2.50	2.25	0	0.25	86863			0.17	0.88	60	60	380
230	2.02	1.52	0	0.50	86864			0.11	0.88	80	50	360
			0.50	0.80	86283	0.006	0.002					
			0.80	1.40	86284	0.003						
			1.40	2.02	86285	0.000						
235	2.29	1.99	0	0.30	86865			0.11	1.00	90	80	400
240	1.80	1.50	0	0.30	86866			0.17	1.00	50	65	360
			0.30	0.55	86286	0.000	0.000					
			0.55	1.15	86287	0.000						
			1.15	1.80	86288							
245	1.74	1.29	0	0.45	86867			0.17	1.08	70	70	440
250	1.68	1.23	0	0.45	86868			0.13	0.64	55	60	420
			0.45	0.80	86289	0.005	0.020					
			0.80	1.68	86290	0.025						
255	1.90	1.45	0	0.45	86869			0.21	0.80	85	50	400
260	2.01	1.65	0	0.37	86870			0.21	0.80	40	40	380
			0.37	0.67	86291	0.009	0.002					
			0.67	1.27	86292	0.001						
			1.27	2.01	86293	0.000						
265	2.32	1.90	0	0.42	86871			0.17	0.80	60	40	350
270	2.57	2.22	0	0.35	86872			0.29	0.64	70	35	260
			0.35	0.65	86294	0.000	0.000					
			0.65	1.55	86295	0.000						
			1.55	2.57	86296	0.000						
275	2.38	2.23	0	0.15	86873			0.21	0.70	70	35	250
280	2.38	2.11	0	0.27	86874			0.11	0.76	55	35	250
			0.27	0.57	86297	0.005	0.001					
			0.57	1.57	86298	0.000						
			1.57	2.38	86299	0.000						
285	283	2.61	0	0.22	86875			0.27	0.88	55	50	280

Table 5. - Table showing thickness and metal content of samples from trench 3 (cont'd.)

Distance from NW end (m)	Total depth (m)	Thickness of gravel section	Thickness and location of sampling intervals. 0 = bottom			Sample numbers	Gravel section		Bedrock				
			From	To			Au g/m ³ Each sample	Au g/m ³ Section average	Au ppm	Ag ppm	Cu ppm	Pb ppm	Zn ppm
290	2.86	2.61	0	0.25	86876				0.18	0.76	70	50	350
			0.25	0.55	86300		0.007	0.014					
			0.55	1.65	86301		0.030						
			1.65	2.86	86302		0.002						
295	2.62	2.50	0	0.12	86877				0.11	0.64	70	40	200
300	3.38	3.31	0	0.07	86878				0.17	0.76	75	35	260
			0.07	0.47	86303		0.027	0.005					
			0.47	1.77	86304		0.004						
			1.77	3.38	86305		0.000						
305	3.38	3.08	0	0.30	86879				0.25	0.56	140	30	500
310	3.08	2.76	0	0.32	86880				0.25	0.60	60	25	350
			0.32	0.72	86306		0.024	0.021					
			0.72	1.92	86307		0.020						
			1.92	3.08	86308		missing						
315	2.56	2.21	0	0.35	86881				0.13	0.64	70	25	340
320	3.05	2.65	0	0.40	86882				0.22	0.70	55	45	240
			0.40	0.70	86309		64.271	7.277					
			0.70	1.70	86310		0.001						
			1.70	3.05	86311		0.001						
325	3.09	2.79	0	0.30	86883				0.22	0.64	70	50	140
330	3.27	2.95	0	0.32	86884				0.20	0.64	55	30	200
			0.32	0.62	86312		0.012	0.081					
			0.62	1.82	86313		0.051						
			1.82	3.27	86314		0.121						
335	3.96	3.26	0	0.70	86885				0.11	0.64	30	25	160
340	4.33	3.81	0	0.52	86886				0.10	0.64	30	30	140
			0.52	0.87	86315		0.005	0.001					
			0.87	2.02	86316		0.001						
			2.02	4.33	86317		0.001						
345	3.99	3.32	0	0.67	86887				0.13	0.60	30	30	170
350	3.82	3.42	0	0.40	86888				0.13	0.60	30	30	180
			0.40	0.75	86318		0.001	0.005					
			0.75	1.90	86319		0.009						
			1.90	3.82	86320		0.003						
355	3.93	3.43	0	0.50	86889				0.13	0.60	50	25	200
360	3.20	2.60	0	0.60	86890				0.13	0.60	70	25	160
			0.60	0.90	86321		0.002	0.003					
			0.90	2.10	86322		0.004						
			2.10	3.20	86323		0.002						

Table 5. - Table showing thickness and metal content of samples from trench 3 (cont'd.).

Distance from NW end (m)	Total depth (m)	Thickness of gravel section	Thickness and location of sampling intervals. 0 = bottom		Sample numbers	Gravel section		Bedrock				
			From	To		Au g/m ³ Each sample	Au g/m ³ Section average	Au ppm	Ag ppm	Cu ppm	Pb ppm	Zn ppm
365	3.35	2.80	0	0.55	86891			0.18	0.76	40	25	160
370	3.57	3.22	0	0.35	86892			0.21	0.76	60	20	160
			0.35	0.65	86324	0.002	0.014					
			0.65	1.65	86325	0.001						
			1.65	3.57	86326	0.022						
375	3.72	3.35	0	0.37	86893			0.06	0.76	50	20	140
380	3.23	2.76	0	0.47	86894			0.11	0.76	50	20	140
			0.47	0.87	86327	0.032	0.122					
			0.87	1.87	86328	0.320						
			1.87	3.23	86329	0.004						
385 3 26	3.26	2.51	0	0.65	86895			0.10	0.60	50	14	140
390	3.05	2.80	0	0.25	86896			0.11	0.60	60	14	100
			0.25	0.65	86330	0.003	0.006					
			0.65	1.65	86331	0.000						
			1.65	3.05	86332	0.012						
398								End of the Trench				

Though the gold content along the trench generally is very low, two segments have relatively higher gold content. The segments are between 37.5 and 57.5 m and between 97.5 and 117.5 m, measured from the west end of the trench; their average gold content is 0.033 and 0.064 g/m³ respectively. The average gold content for the rest of the trench exclusive of the rich zones is 0.008 g/m³.

Figure 5 is a section through trench 4 showing the location of the samples, and the gold content of each sample. The sample numbers and the sample analyses are tabulated in table 6.

Trench 5

Trench 5 is in the same wadi as trenches 1 and 2 and is parallel to them but 310 m downslope and southeast of trench 2. Trench 5 trends N.35°E. and is 240 m long. The average thickness of the gravel section along the trench is 1.26 m.

Sixty-five samples were collected from the trench. Sample 86416 had the highest gold content, 1.77 g/m³. This sample was collected from an interval 0.25 m thick, immediately above the bedrock, and 5 m from the southwest end of the trench. Sample 86477 contained the second highest gold content, 0.073 g/m³. The average gold content for the whole trench is 0.023 g/m³.

The average gold content of the first 7.5 m from the southwest end of the trench is 0.151 g/m³. The rest of the trench has an average gold concentration of 0.005 g/m³.

Figure 6 is a section along trench 5 showing the location of each sample and its gold content. Table 7 contains analyses of samples from trench 5.

Trench 5 is located in a recent channel of the wadi. In the past the wadi followed a channel to the southwest of its present course. This shift of the wadi course is suggested by the following:

1. The gravel section is thicker at the southwest end of trench 5 and at the southeast end of trench 3;
2. The gold concentration is relatively higher at the southwest end of the trench 5 and at the southeast end of trench 3;
3. There is an ancient water tunnel at the southwest end of trench 5.

If future exploration of the gravel is carried on, the old wadi course should be investigated rather than the present channel.

Trench 6

Trench 6 is northwest of the main open pit of the Mahd adh Dhahab mine and is at the foot of a partially mineralized agglomeratic ridge. The trench trends

Table 6. - Table showing thickness and metal content of samples from trench 4

Distance from W end (m)	Total depth (m)	Thickness of gravel section	Thickness and location of sampling intervals. 0 = bottom		Sample numbers	Gravel section						
			From	To		Au g/m ³ Each sample	Au g/m ³ Section average	Au ppm	Ag ppm	Cu ppm	Pb ppm	Zn ppm
0	1.52	1.22	0	0.30	86897	0.008	0.006	0.10	0.64	290	25	1625
			0.30	0.55	86333							
			0.55	1.52	86334							
5	1.52	0.92	0	0.60	86898	0.006	0.004	0.12	0.10	510	51	870
			0.60	0.85	86335							
			0.85	1.52	86336							
10	1.74	1.14	0	0.60	86899	0.008	0.009	0.18	0.10	325	35	660
			0.60	0.90	86337							
			0.90	1.74	86338							
15	2.16	1.46	0	0.70	86900	0.001	0.008	0.18	0.10	130	30	720
			0.70	1.00	86339							
			1.00	1.50	86340							
			1.50	2.16	86341							
20	1.83	1.18	0	0.65	86901	0.000	0.000	0.09	0.52	55	15	1020
			0.65	0.95	86342							
			0.95	1.83	86343							
25	1.60	1.08	0	0.52	86902	0.001	0.000	0.14	0.84	65	15	1880
			0.52	0.77	86344							
			0.77	1.60	86345							
30	1.77	0.85	0	0.92	76903	0.001	0.003	0.05	0.04	60	15	610
			0.92	1.22	86346							
			1.22	1.77	86347							
35	1.80	0.85	0	0.95	86904	0.001	0.000	0.08	0.20	300	20	1200
			0.95	1.25	86348							
			1.25	1.80	86349							
40	1.89	1.24	0	0.65	86905	0.033	0.009	0.05	0.40	490	30	1110
			0.65	0.95	86350							
			0.95	1.45	86351							
			1.45	1.89	86352							
45	1.92	1.37	0	0.55	86906	0.051	0.097	0.05	0.20	230	20	510
			0.55	0.85	86353							
			0.85	1.40	86354							
			1.40	1.92	86355							
50	1.92	1.43	0	0.52	86907	0.000	0.018	0.04	0.40	385	30	1020
			0.52	0.82	86356							
			0.82	1.32	86357							
			1.32	1.95	86358							
55	2.02	1.55	0	0.47	86908	0.045	0.011	0.05	0.64	1600	51	1040
			0.47	0.77	86359							
			0.77	1.37	86360							
			1.37	2.02	86361							

Table 6. - Table showing thickness and metal content of samples from trench 4. (cont'd.)

Distance from W end (m)	Total depth (m)	Thickness of gravel section	Thickness and location of sampling intervals. 0 = bottom		Sample numbers	Gravel section		Bedrock				
			From	To		Au g/m ³ Each sample	Au g/m ³ Section average	Au ppm	Ag ppm	Cu ppm	Pb ppm	Zn ppm
60	2.21	1.89	0	0.32	86909							
			0.32	0.62	86362	0.000	0.005	0.05	0.64	840	117	1100
			0.62	1.32	86363	0.011						
			1.32	2.21	86364	0.003						
65	2.17	2.00	0	0.17	86910							
			0.17	0.47	86365	0.002	0.007	0.05	3.30	1150	338	2080
			0.47	1.17	86366	0.018						
			1.17	2.17	86367	0.000						
70	2.56	2.44	0	0.12	86911							
			0.12	0.42	86368	0.005	0.005	0.03	3.00	965	175	2450
			0.42	1.22	86369	0.001						
			1.22	2.56	86370	0.008						
75	2.78	2.63	0	0.15	86912							
80	3.54	3.42	0	0.12	86913							
			0.12	0.42	86371	0.001	0.031	0.13	0.52	825	68	1180
			0.42	1.52	86372	0.016						
			1.52	3.54	86373	0.043						
85	3.35	3.08	0	0.27	86914							
90	3.36	3.04	0	0.32	86915							
			0.32	0.62	86374	0.001	0.005	0.05	0.52	405	51	820
			0.62	1.72	86375	0.001						
			1.72	3.36	86376	0.008						
95	3.73	3.73	Trench's bottom		86916							
			0	0.40	86377	0.000	0.008	0.05	0.52	1225	84	1500
			0.40	1.60	86378	0.001						
			1.60	3.73	86379	0.014						
100	3.96	3.81	0	0.15	86917							
			0.15	0.55	86380	0.000	0.018	0.18	0.52	1350	79	2080
			0.55	1.65	86381	0.000						
			1.65	3.96	86382	0.030						
105	4.20	3.98	0	0.22	86918							
			0.22	0.62	86383	0.000	0.028	0.05	0.52	980	68	820
			0.62	1.82	86384	0.000						
			1.82	4.20	86385	0.047						
110	3.81	3.59	0	0.22	86919							
			0.22	0.62	86386	0.000	0.095	0.03	10.00	700	35	1230
			0.62	1.82	86387	0.016						
			1.82	3.81	86388	0.163						
115	4.60	4.05	0	0.55	86920							
			0.55	0.95	86389	0.608	0.113	0.03	0.74	285	30	1915
			0.95	2.05	86390	0.005						
			2.05	4.60	86391	0.081						

Table 6. - Table showing thickness and metal content of samples from trench 4. (cont'd.)

Distance from W end (m)	Total depth (m)	Thickness of gravel section	Thickness and location of sampling intervals. 0 = bottom		Sample numbers	Gravel section		Bedrock				
			From	To		Au g/m ³ Each sample	Au g/m ³ Section average	Au ppm	Ag ppm	Cu ppm	Pb ppm	Zn ppm
120	4.23	3.68	0	0.55	86921			0.05	0.74	220	41	1500
			0.55	0.85	86392	0.008	0.007					
			0.85	2.05	86393	0.005						
			2.05	4.23	86394	0.008						
125	3.90	3.55	0	0.35	86922			0.16	0.74	700	41	5800
			0.35	0.75	86395	0.026	0.004					
			0.75	1.85	86396	missing						
			1.85	3.90	86397	0.000						
130	4.08	3.78	0	0.30	86923			0.10	2.64	370	63	1080
			0.30	0.70	86398	0.002	0.000					
			0.70	1.80	86399	0.000						
			1.80	4.08	86400	0.000						
135	3.78	3.28	0	0.50	86924			0.10	0.64	740	46	4500
140	4.30	3.65	0	0.65	86925			0.08	0.64	915	41	4200
			0.65	1.05	86401	0.000	0.030					
			1.05	2.05	86402	0.000						
			2.05	4.30	86403	0.049						
145			Trench's bottom		86926			0.08	1.08	875	84	4700
150	2.99	2.89	0	0.10	86927			0.08	0.74	445	46	1915
			0.10	0.50	86404	0.003						
			0.50	1.60	86405	0.000						
			1.60	2.99	86406	0.000						
155	2.39	2.39	Trench's bottom		86928			0.05	10.00	750	56	2340
160	2.54	2.22	0	0.32	86929			0.10	1.24	740	51	3950
			0.32	0.62	86407	0.000	0.000					
			0.62	1.62	86408	0.000						
			1.62	2.54	86409	0.001						
165	2.41	2.26	0	0.15	86930			0.10	1.00	245	51	2800
170	2.26	2.11	0	0.15	no sample			0.002				
			0.15	0.45	86410	0.000						
			0.45	1.35	86411	0.000						
			1.35	2.26	86412	0.003						

Table 7. - Table showing thickness and gold content of samples from trench 5.

Distance from SW end (m)	Total depth (m)	Thickness of gravel section	Thickness and location of sampling intervals. 0 = bottom		Sample numbers	Gravel section	
			From	To		Au g/m ³ Each sample	Au g/m ³ Section average
0	3.02	2.42	0.60	0.90	86413	0.001	0.001
			0.90	1.90	86414	0.002	
			1.90	3.02	86415	0.001	
5	3.08	2.58	0.50	0.75	86416	2.773	0.277
			0.75	1.80	86417	0.020	
			1.80	3.08	86418	0.001	
10	2.68	2.23	0.45	0.75	86419	0.002	0.004
			0.75	1.65	86420	0.008	
			1.65	2.68	86421	0.001	
15	2.36	1.91	0.45	0.70	86422	0.001	0.002
			0.70	1.55	86423	0.002	
			1.55	2.36	86424	0.002	
20	2.60	2.10	0.50	0.75	86425	0.000	0.000
			0.75	1.50	86426	0.000	
			1.50	2.60	86427	0.001	
25	2.19	1.64					
30	2.16	1.51	0.65	0.92	86428	0.002	0.002
			0.92	1.55	86429	0.001	
			1.55	2.16	86430	0.003	
40	1.89	1.74	0.15	0.45	86431	0.017	0.006
			0.45	1.05	86432	0.005	
			1.05	1.89	86433	0.003	
50	2.29	1.92	0.37	0.67	86434	0.001	0.005
			0.67	1.47	86435	0.008	
			1.47	2.29	86436	0.005	
60	1.92	1.45	0.47	0.72	86437	0.017	0.011
					86438	0.003	
					86439	0.015	
70	1.92	1.42	0.50	0.75	86440	0.034	0.009
			0.75	1.25	86441	0.005	
			1.25	1.92	86442	0.002	
80	1.65	1.63	0.62	0.92	86443	0.007	0.008
			0.92	1.65	86444	0.009	
90	2.50	2.08	0.42	0.67	86445	0.006	0.007
			0.67	1.62	86446	0.000	
			1.62	2.50	86447	0.015	
100	2.32	2.05	0.27	0.52	86448	0.004	0.004
			0.52	1.27	86449	0.001	
			1.27	2.32	86450	0.005	

Table 7. - Table showing thickness and gold content of samples from trench 5. (cont'd.)

Distance from SW end (m)	Total depth (m)	Thickness of gravel section	Thickness and location of sampling intervals. 0 = bottom		Sample numbers	Gravel section	
			From	To		Au g/m ³ Each sample	Au g/m ³ Section average
110	1.86	1.26	0.60	0.85	86451	0.000	0.000
			0.85	1.35	86452	0.000	0.000
			1.35	1.86	86453	0.001	0.000
120	1.77	1.77	0	0.30	86454	0.001	0.001
			0.30	0.90	86455	0.000	0.000
			0.90	1.70	86456	0.001	0.001
130	1.52	0.77	0.75	1.00	86457	0.001	0.003
			1.00	1.52	86458	0.005	0.003
140	1.80	1.40	0.40	0.70	86459	0.009	0.003
			0.70	1.25	86460	0.002	0.003
			1.25	1.80	86461	0.004	0.003
150	1.63	1.16	0.47	0.77	86462	0.026	0.018
			0.77	1.63	86463	0.015	0.018
160	1.52	1.07	0.45	0.75	86464	0.001	0.009
			0.75	1.52	86465	0.013	0.009
170	1.46	0.96	0.50	0.75	86466	0.004	0.005
			0.75	1.46	86467	0.005	0.005
180	1.52	0.90	0.62	0.87	86468	0.002	0.002
			0.87	1.52	86469	0.001	0.002
190	1.24	0.64	0.60	1.24	86470	0.000	0.000
200	1.58	0.00	0	1.58	86471	0.000	0.000
210	1.40	0.60	0.80	1.40	86472	0.001	0.001
220	1.24	0.89	0.35	0.65	86473	0.001	0.001
			0.65	1.24	86474	0.002	0.001
230	1.31	0.61	0.70	1.31	86475	0.000	0.000
240	1.30	0.68	0.62	1.02	86476	0.000	0.000
			1.02	1.30	86477	0.073	0.000

N.70°E. and is 273 m long. Because the Saudi Arabian Mining Syndicate had mined most of the gravel north of the floor of the open pit, only the western 150 m of the trench penetrates gravel thick enough to be sampled. The average thickness of the gravel section in this part of the trench is 1.4 m.

At 5-m intervals, 27 samples were collected from the western 150 m of the trench. The average gold concentration is 0.064 g/m³.

Figure 7 is a section along trench 6 showing the location of each sample and its gold content. Details on sample analyses and locations appear in table 8.

Pits in the southeastern area

Line I

Four pits (P-1 to P-4) were dug along line I which is parallel to trench 5 and 250 m downslope from it (fig. 1). The spacing between the pits is 50 m, and the average depth of the pits is 1.94 m. Fourteen samples of gravel were collected from these pits. The average gold content is 0.004 g/m³.

Line II

Six pits (P-5 to P-10) were excavated along a line II, which is parallel to line I but 278 m downslope from it (fig. 1). The average depth of the six pits is 1.57 m. Eleven samples of gravel were collected from the six pits, and their average gold content is 0.002 g/m³ (table 9).

Saprolite samples were collected from five of the pits. Each sample contained 0.08 ppm of gold.

The saprolite-gravel contact at the pits in the southeastern area is completely obscured by caliche. Thus, many of the samples considered to be of gravel could instead be of weathered bedrock in place. As is indicated in the discussion of trench 5, the main wadi course of the past was to the southwest of the present course. This may be the reason for low gold content and thinner gravel section in pits in the southeastern area.

Pits in the northwestern area

Seven pits (P-1 to P-7) were dug northwest of the main open pit, near trench 6 (fig. 1). Pit number one is about 75 m from trench 6 and is 2.30 m deep. Gold content of gravel from the pit averages 0.067 g/m³ which was approximately the same as the average along trench 6. Therefore, for the estimation of the placer in the area, the average of pit 1 is combined with the average of trench 6 and not with the other six pits in the area. The average gold content of pit number one plus trench 6 is 0.066 g/m³.

Table 8. - Table showing thickness and gold content of samples from trench 6.

Distance from SW end (m)	Total depth (m)	Thickness of gravel section	Thickness and location of sampling intervals. 0 = bottom		Sample numbers	Gravel section	
			From	To		Au g/m ³ Each sample	Au g/m ³ Section average
0	1.52						
5	1.65	1.23	0.42	1.65	86479	0.057	0.057
10	1.43	0.98	0.45	1.43	86480	0.200	0.200
20	1.89	1.49	0.40	1.89	86481	0.373	0.373
30	1.89	1.19	0.70	1.00	86482	0.094	0.101
			1.00	1.89	86483	0.103	
40	1.74	1.44	0.30	0.65	86484	0.059	0.043
			0.65	1.74	86485	0.037	
50	1.95	1.95	0	0.40	86486	0.052	0.044
			0.40	1.95	86487	0.042	
60	2.36	2.01	0.35	0.80	86488	0.011	0.025
			0.80	2.36	86489	0.029	
70	2.32	1.90	0.42	0.82	86490	0.037	0.021
			0.82	2.32	86491	0.008	
80	2.01	1.59	0.42	0.82	86492	0.012	0.009
			0.82	2.01	86493	0.008	
90	1.89	1.54	0.35	0.75	86494	0.002	0.041
			0.75	1.89	86495	0.055	
100	1.74	1.44	0.30	0.70	86496	0.012	0.014
			0.70	1.74	86497	0.015	
110	1.52	1.22	0.30	0.70	86498	0.047	0.037
			0.70	1.52	86499	0.032	
120	1.49	1.27	0.22	0.57	86500	0.003	0.009
			0.57	1.49	86501	0.012	
130	1.40	1.05	0.35	0.65	86502	0.007	0.009
			0.65	1.40	86503	0.010	
140	1.15	0.63	0.52	1.15	86504	0.010	0.005
150	1.62	1.27	0.35	1.62	86505	0.017	0.017

Table 9. - Table showing thickness and gold content of samples from pits in the southeastern area.

Pit number	Total depth (m)	Thickness and location of sampling intervals. 0 = bottom		Sample numbers	Gravel section	
		From	To		Au g/m ³ Each sample	Au g/m ³ Section average
<u>Line I</u>						
1	2.55	0	0.25	86631	0.000	0.001
		0.25	0.75	86632	0.001	
		0.75	1.65	86633	0.000	
		1.65	2.55	86634	0.003	
2	2.70	0	0.25	86635	0.000	0.001
		0.25	0.75	86636	0.000	
		0.75	1.70	86637	0.004	
		1.70	2.70	86638	0.000	
3	1.40	0	0.25	86639	0.001	0.001
		0.25	0.75	86640	0.000	
		0.75	1.40	86641	0.001	
4	1.10	0	0.25	86642	0.029	0.018
		0.25	0.75	86643	0.017	
		0.75	1.10	86644	0.010	
<u>Line II</u>						
5	1.60	0	0.80	86645	0.000	0.001
		0.80	1.60	86646	0.002	
6	0.95	0	0.45	86648	0.000	0.000
		0.45	0.95	86649	0.000	
7	1.80	0	0.90	86651	0.001	0.002
		0.90	1.80	86652	0.003	
8	1.70	0	0.60	86654	0.000	0.001
		0.60	1.70	86655	0.002	
9	1.30	0	0.65	86657	0.008	0.004
		0.65	1.30	86658	0.001	
10	2.10	0	1.00	86659	0.001	0.001
		1.00	2.10	86660	missing	

Pits 2 to 7 have an average depth of 2.25 m and an average gold content of 0.013 g/m³. Sample analyses of pits 1 to 7 and thicknesses are given in table 10.

ESTIMATE OF PLACER RESOURCES

For purposes of calculation of resources, the gold-bearing placer area at the northeastern flank of Jabal Mahd adh Dhahab is divided into twelve blocks, B-1 to B-12. In table 11 the size of the blocks, the average thickness of the detritus, the volume of gravel, and the average gold concentration of each block are shown. Trenches, pits and boundaries of the placer blocks are shown in figure 1. Placer blocks that contain more than 0.06 g/m³ (B-1, B-2, B-7, B-8, and B-11) are differentiated by cross-hatched pattern in figure 1. These five blocks contain 263,455 m³ of gravel that average 0.262 gram gold per m³.

Gravel in the rest of the placer blocks, B-3, B-4, B-5, B-6, B-9, B-10, and B-12, contains less than 0.06 gram of gold per m³. These seven blocks contain 477,455 m³ of gravel averaging 0.007 g/m³ of gold.

The twelve placer blocks have a total surface area of 329,422 m², a total gravel volume 710,910 m³, an average gold content of 0.102 g/m³, and a total gold content of 72,268 g.

SUMMARY AND CONCLUSIONS

The placer deposits explored at Mahd adh Dhahab are mostly in the lower part of the older alluvium unit of Quaternary age. The gold-bearing detritus has a total volume of 710,910 m³, an average gold content of 0.102 g/m³, and a total gold content of 72,268 g. The richest part of the detritus about 263,455 m³, averages 0.262 gm³ of gold, and contains about 69,000 g of gold.

The richest part of the detritus may be workable if the gold price is high. A small plant capable of treating about 200 m³ daily could treat this amount of detritus in about 6 years.

In addition, other areas around Jabal Mahd adh Dhahab may contain workable deposits of placer gold. Likely areas for future prospecting, should such be warranted, are on the west, north, and northeast sides of the jabal.

Table 10. - Table showing thickness and gold content of samples from pits in the northwestern area

Pit number	Total depth (m)	Thickness and location of sampling intervals. 0 = bottom		Sample numbers	Gravel section	
		From	To		Au g/m ³ Each sample	Au g/m ³ Section average
1	2.30	0	0.25	86601	0.015	0.067
		0.25	0.75	86602	0.020	
		0.75	1.50	86603	0.155	
		1.50	2.30	86604	0.029	
2	3.20	0	0.25	86605	0.042	0.019
		0.25	0.75	86606	0.028	
		0.75	1.95	86607	0.021	
		1.95	3.20	86608	0.010	
3	2.85	0	0.25	86609	0.018	0.016
		0.25	0.75	86610	0.030	
		0.75	1.80	86611	0.003	
		1.80	2.85	86612	0.023	
4	5.00	All from the pit's dump		86613	0.023	0.017
				86614	0.015	
				86615	0.013	
5	0.60	0	0.60	86616	0.007	0.007
6	2.20	0	0.25	86617	0.005	0.005
		0.25	0.75	86618	0.004	
		0.75	2.20	86619	0.005	
7	2.00	0	0.25	86620	0.008	0.011
		0.25	0.75	86621	0.018	
		0.75	2.00	86622	0.008	

TABLE 11. - Table showing thickness, volume, and gold content of blocks in the Mahd adh Dhahab area

Block No.	Area (m ²)	Average thickness (m)	Volume (m ³)	Average Au g/m ³	Au g each block	Average Au content and average block thickness obtained from averages of:
B-1	8,606	2.77	23,839	0.163	3,886	Trenches 1 and 2
B-2	39,960	2.90	119,480	0.393	46,956	Trench 2 + the SE 113 m of Trench 3 + the SW 7.5 m of Trench 5
B-3	8,668	2.32	20,110	0.044	885	Trench 3, 135 to 205 m from NW end
B-4	64,730	2.50	161,824	0.006	971	Trench 3, 0 to 135 and 205 to 285 m from the NW end + the portion of trench 4, 117.5 to 170 m from the W end
B-5	2,865	2.49	7,134	0.033	235	Trench 4, 37.5 to 57.5 m from the W end
B-6	5,652	2.49	14,073	0.011	155	Trench 4, 57.5 to 97.5 m from the W end
B-7	2,865	2.49	7,134	0.064	456	Trench 4, 97.5 to 117.5 m from the end
B-8	35,835	2.13	76,155	0.199	15,155	Block B-2 + Trench 5 minus the SW 7.5 m
B-9	56,851	1.60	90,962	0.004	364	Trench 5, minus the SW 7.5 m + line I
B-10	69,601	1.76	122,150	0.003	366	Lines I and II
B-11	19,918	1.85	36,847	0.066	2,432	The SW 150 m of Trench 6 + pit P-1
B-12	13,868	2.25	31,202	0.013	406	The six pits within the block; P-2 to P-7
TOTAL	329,422	—	710,910	0.102	72,268	

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