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ASARCO

cerk Gold Placers

Southwestern Exploration Division

WLK

November 21, 1986

FILE MEMO

Gold Placers - Imperial Co., CA

Selected Areas of Possible Lode Potential

According to "Geology and Mineral Resources of Imperial County (California Division of Mines and Geology, County Report 7, 1977)" the principal gold placers and lode occurrences form a SE trending belt in and near the Chocolate Mountains in the SE portion of the County. Recent discoveries of large, low grade gold deposits, particularly the Mesquite, have focused attention on this belt and very little open ground remains. However, exploration has not as yet reached the saturation stage, although remaining possibilities are mostly in areas of post-mineral cover.

The placer deposits very near what is now the Mesquite open pit mine are semi-residual (report of 3-20-47), the gold having been in part derived from bedrock in the immediate vicinity. "The deposition of iron and gold-bearing rock material (the pay streak) was no doubt accomplished by the flash floods characteristic of desert regions. Subsequently, rather well-washed gravel derived from more distant sources was deposited on, and to some extent mingled with, the earlier residual deposits." Distinguishing between residual (eluvial) and alluvial placer gold is of obvious importance in the search for lode deposits.

Potholes Placer

Located just west of the Colorado river (map Att. A&B), the deposit is described (County Report 7) as being in Quaternary gravels with Tertiary (?) sedimentary breccias on the west and pre-Tertiary granite on the east, across a north-trending fault. "The source of the gold may have been the Three C's (Duncan) deposit one mile to the north, but no direct drainage to the Pot Holes now exists." According to Watson (Report 5-27-68), the Three

C's is on a narrow quartz vein with no apparent potential ---- hardly the source of one to two million dollars as placer (20$ gold).

The Potholes gold should be examined and if it shows evidence of being transported only a short distance (hackly-surfaced particles), the source may be under the adjacent sedimentary breccia.

Indian Pass Placer

Located on the Chocolate Mountains pediment 7 or 8 miles WNW of the Picacho mine (map, Att. A), this placer occurs in a Pliocene fanglomerate (County Report 7) with rock fragments suggesting derivation from the Cargo Muchacho Mountains 6 to 10 miles south (down drainage), rather than from the Chocolate Mountains adjacent on the north (up drainage). The former source appears the least probable. Assuming the Indian Pass placer gold is eluvial, it would have been derived locally ---- from bedrock under the Pliocene fanglomerate. One mile to the north, cover terminates at outcrops of Chuckwalla gneiss.
According to a map accompanying Mr. Kreis' report on the Copperhead Claims, the area of interest is within a plus 100 sq. mile block labelled "Predominantly Gold Fields." A property investigation should be made to determine if the Indian Pass area is perchance held by others who might be willing to deal and permit an examination of the ground and the nature of the placer gold.

Hyduke Claims

This placer property consisting of about 4000 acres (including 75 lode claims) located 6 or 7 miles E. of the Mesquite Mine (map, Att.A) was examined by Mark Miller (Report 5-3-85). Under Conclusion and Recommendations he notes "... the coarse and irregular nature of the gold suggests a local source. The placers may be indicative of a disseminated gold deposit beneath the gravels ..." To this I would agree and recommend an aggressive attempt to deal with the owners, excluding, if necessary, the placer deposits, as

they should be of not interest to the Company.

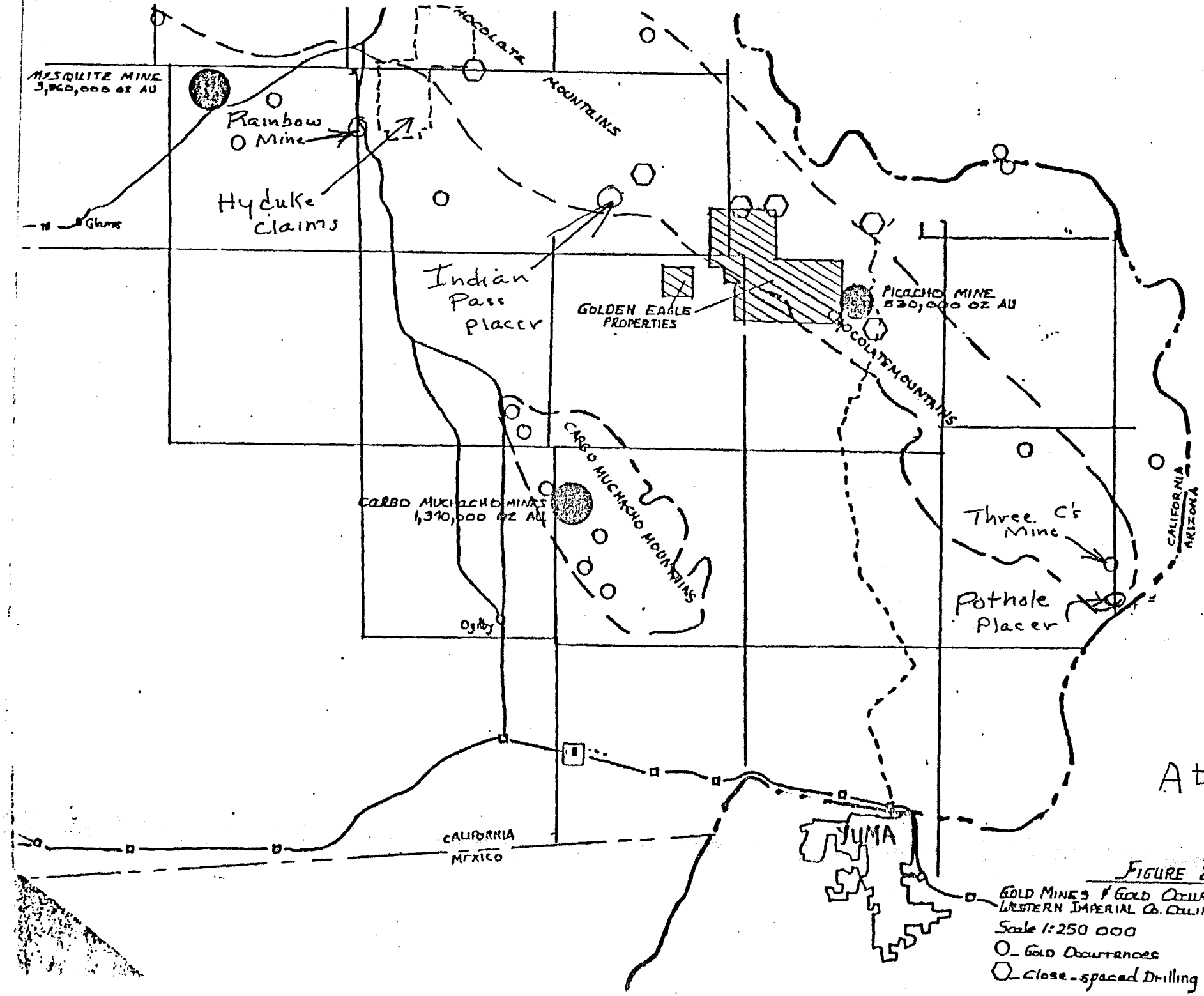
The southern part of the property may hold the best potential. Just outside the W boundary, near the S end (Att. A), the Rainbow mine (County Report 7) contains "narrow, discontinuous gold bearing stringers which appear to be part of a larger mineralized zone."

J. H. Courtright

J. H. Courtright

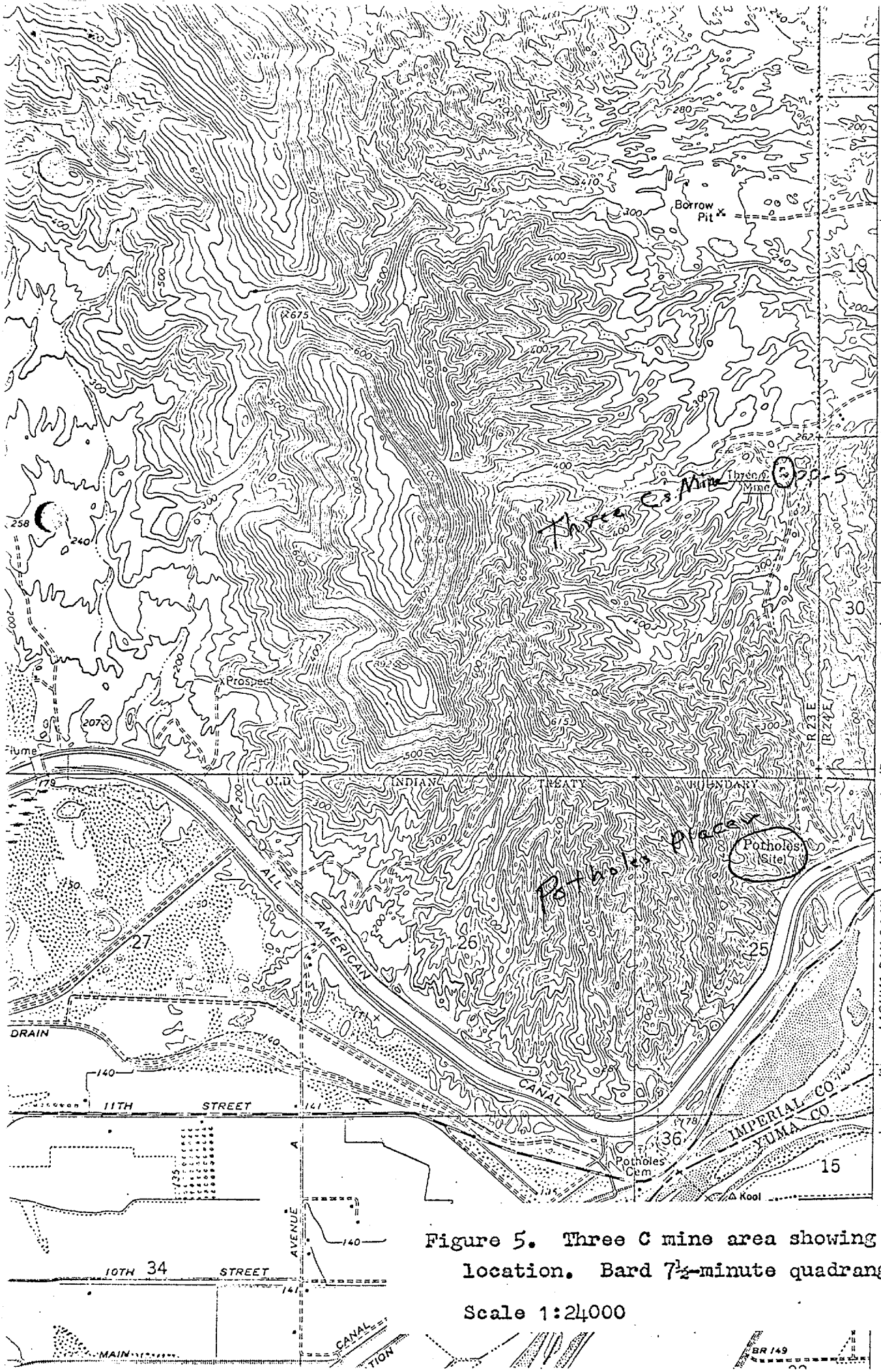
JHC:mek

cc: R.L. Brown
W.L. Kurtz
J.D. Sell



Att. A

FIGURE 2
GOLD MINES & GOLD OCCURRENCES
WESTERN IMPERIAL CO. CALIFORNIA
Scale 1:250 000
O_ GOLD OCCURRENCES
O_ Close-spaced Drilling



Att B

Figure 5. Three C mine area showing sample location. Bard 7½-minute quadrangle map.

Scale 1:24000

ASARCO

Southwestern Exploration Division

Extra copy Gold Placers

December 13, 1984

File Memorandum

Supergene Gold--A Possible Exploration Lead

A presentation entitled "Metallogeny and Tectonic Evolution of the Precambrian of Brazil" was given by Nigel Grant, Billiton Exploration, at a recent AGS meeting in Tucson.

The talk included a brief description of (1) the fabulous Carajas iron occurrence containing 18 billion tons of 66% Fe, located 550 km SSW of Belem at the mouth of the Amazon, (2) the nearby Salabro copper deposit with 1.1 billion tons of .85% Cu (in metasediments enclosed in gneiss), and (3) the Serra Pelada gold mine, an occurrence of supergene gold as nuggets in a 100m thick zone of saprolitic weathering. The deposit, located 50 km E of Carajás, was worked for many years as a placer by thousands of individual small claim miners. The grade is, of course, unknown; however, "waste" dumps of some 7 million tons average around 7 gms per ton. The deposit is underlain by a quartz vein stockwork containing relatively fine gold ranging from 1 to 2 gms per ton.

According to Grant, the nuggets (ranging up to several kilos in weight) were formed in the zone of weathering by the "nucleation" process ----progressive accumulation on particles of iron oxide, the gold having been originally dissolved from the "protore" by cyanide released from decaying vegetation. (Free cyanide is unlikely in tropical weathering according to Giesecke. More probably the gold was dissolved by organic or other acids such as nitrohydrochloric.)

This "growing of nuggets" has been reported elsewhere, such as at Stirrup Lake, B.C.,* where placers contain gold crystal growths believed to have formed from solution and redeposition of micron gold in bedrock;

*Supergene gold crystals at Stirrup Lake, B.C., Western Miner, June 1979. (From George Stathis file.)

and, at the Osceola placers, Nevada,** where the source of plus one ounce nuggets has not been identified, suggesting they may have "grown" from small particles of gold found in bedrock. The old timers mined placer gold at Carlin, but failed to recognize the values in bedrock simply because they were too fine to be visible in the pan (intercepts up to 5.0 oz/ton were cut in the diamond drilling). Since no bedrock source for the placers at Carlin has (according to my information) been identified, it is possible, if not probable that it (the coarse gold) was formed by supergene gold bearing solutions derived from the micron gold in bedrock.

It is concluded that some placer occurrences (excluding, say, river gravels with very large drainage basins) may offer clues to "no-see-um" gold deposits in bedrock----either exposed or concealed by post-mineral cover. Accordingly an aggressive search should be undertaken, which would logically start on file and literature reviews with the objective of first selecting those placers located in areas where the occurrence of disseminated gold, particularly micron gold deposits, is geologically permissible.

Most of the known placer areas have already been tested to some extent for lode gold deposits; however, there are no doubt many relatively small, non-economic placers which are not mentioned in the literature. A search for these should definitely be a part of the program.

**J.D. Sell file memo, 10/5/84.

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July 19, 1985 See Gold Placers

Mr. R. L. Brown
New York Office

New Mexico Gold Placers --
Selected Areas of
Possible Lode Potential

The 33 New Mexico placers described in Geological Survey Bulletin 1348 have been reviewed, using available geologic maps and literature. The 5 occurrences selected as deserving examination in the field are listed below. These probably should be rated as 2nd priority, as this state has only one known commercial deposit of disseminated gold ---- the breccia pipe hosted Ortiz mine.

Colfax Co.

3. Cimmaronito Dist. - Placer gold in Urraca Cr. and tributaries. Source: unknown. Possible source: Knp (shales with thin limey and sandy beds), or Tki. (Prelim. geologic map of NE NM, 1962, Bockman & Dane).

Sandoval Co.

16. Placitas - Tejon Region. - Placers around town of Placitas and in Tejon Grant. Gold occurs in cemented gravels. Source: unknown. Possible source in Mesozoic and/or Paleozoic sediments.

San Miguel Co.

19. Willow Cr. Dist. - "Willow Cr. frequently listed as a placer locality, but no description of deposits found in literature." Source: unknown. Possible source of gold in head waters of Willow Cr. in Penn. rocks (undifferentiated), or in Precambrian schists, congl. and granite exposed in Willow Cr. over a distance of 3 miles easterly from Pecos mine on the Pecos river (geologic map, Miller, John P., et al, Geology of part of south Sangre de Cristo Mts., NMBM & Mineral Resources, 1963, Memoir 11).

20. Villanueva Area - Fossil placer in Permian sandstone. Assays from adit driven in 1940 range from tr. to $22.00 per ton (±$200.00 at present gold price). Sandstone, may have economic gold potential. Source: unknown. Not of concern, as gold may have been derived from anywhere to the NW in the Pecos river drainage.

Taos Co.

32. Picuris District - Placers along Rio Grande river near Pilar. Source unknown, but not of concern. However, lode (?) gold which occurs in quartzites at Glenwoody (exposed in Rio Grande Cliff) may have potential. Mining of this large, low grade deposit was attempted in 1902. Mill returns were reportedly around 40¢ per ton (at $20.00 gold). I, 0202

JHC:mek
Att.: Map accompanying Bull. 1348
Excerpts from Bull. 1348

J. H. Courtright

J. H. Courtright

cc: W. L. Kurtz
J. D. Sell
D. M. Smith

——— 1966b: Mining history.
Raymond, 1870: Details of placer claims in Willow Creek.
——— 1872: Production information for Willow Creek placers for 1870.
Robinson, Wanek, Hays, and McCallum, 1964: Brief description of Ute Creek placers.

3. CIMARRONCITO DISTRICT

Location: South flank of Black Mountain in the Cimarron Range, south of the Cimarron River, T. 26 N., R. 18 E. (projected; on Maxwell Land Grant).

Topographic map: Tooth of Time 15-minute quadrangle.

Geologic maps:

Bachman and Dane, 1962, Preliminary geologic map of the northeastern part of New Mexico, scale 1:380,160.

Wanek, Read, Robinson, Hays, and McCallum, 1964, Geologic map of the Philmont Ranch region, New Mexico, scale 1:48,000.

Access: From Taos, 57 miles northeast on U.S. Highway 64 to Cimarron and junction with State Highway 21; from there, 3 miles south to Philmont Scout Ranch Headquarters. Dirt roads lead to vicinity of Black Mountain and Urraca Creek.

Extent: Placers were reported on Urraca Creek and tributaries.

Production history: Placers were apparently worked in 1898, but no production was recorded.

Source: Unknown.

Literature:

Anderson, 1957: Lists Cimarroncito as placer district.
Jones, 1904: Locates gold-bearing creeks.
Mining Reporter, 1898a: Placer mining in 1898.

GRANT COUNTY

4. WHITE SIGNAL DISTRICT

[White Signal district here includes placer deposits of districts previously named Malone (Gillerman, 1964; Anderson, 1957; Jones, 1904) or southwestern and central Big Burro Mountains (Gillerman, 1964); the deposits are included in the White Signal district by Howard (1967)]

Location: South flank of the Big Burro Mountains, T. 20 S., Rs. 14–16 W.

Topographic maps: Burro Peak and White Signal 7½-minute quadrangles; Redrock 15-minute quadrangle.

Geologic maps:

Ballman, 1960, Geology of the Knight Peak area, scale 1:63,360.

Dane and Bachman, 1961, Preliminary geologic map of the southwestern part of New Mexico, scale 1:380,160.

Geologic map: Bingler, 1968a, Geologic map of Rio Arriba County, east half (pl. 1b), scale approximately ½ in.=1 mile.

Access: The Rio Chama is accessible by dirt roads leading west from Abiquiu.

Extent: Gold reportedly occurs in the river sands and gravels along the Rio Chama a few miles above Abiquiu, but the exact location and extent of these deposits is unknown.

Production history: Placers have been worked along the Rio Chama near Abiquiu, possibly before 1848 and during the 1880's to 1900's. These deposits received some attention from mining companies before 1900, and some large-scale operations were attempted. News reports indicate that the placers were productive, although no production records are known. The district has apparently remained unworked throughout most of this century.

Source: Unknown, but thought to be derived from low-grade gold deposits in Precambrian rocks exposed along the deep canyon of the Rio Chama.

Literature:

Anderson, 1957: Location.

Bancroft, 1889: Reports knowledge of gold before 1848 near Abiquiu.

Burchard, 1885: Placer-mining activity.

Graton, 1910c: Reports placer occurrence; origin.

Howard, 1967: Reports placer occurrence.

Jones, 1904: Extent; placer-mining operations; thickness of gravels; gold values in bench gravels and river gravel.

Mining Reporter, 1898a: Placer-mining operations.

Prince, 1883: Reports placers known in 1844.

SANDOVAL, BERNALILLO, AND VALENCIA COUNTIES

[Small placer deposits occur in three widely separated localities on the flanks of the Sandia Mountains, which trend north-south through Sandoval, Bernalillo, and Valencia Counties. The presence of placers has been known for probably two centuries; many legends state that Spaniards engaged in mining in the area and probably prospected for placer gold. Despite the long history of the area, little is known of the exact location, extent, or worth of these placer deposits]

16. PLACITAS—TEJON REGION

Location: North end of the Sandia Mountains, T. 13 N., R. 5 E. (on the San Antonio de las Huertas Grant and the town of Tejon Grant).

Topographic map: San Felipe Pueblo 15-minute quadrangle.

Geologic map: Dane and Bachman, 1957, Preliminary geologic map of the northwestern part of New Mexico, scale 1:380,160.

Access: From Albuquerque, 17 miles north on U.S. Interstate 25 to State Highway 44; from there, about 7 miles east to Placitas (Sandoval County).

Extent: Placers are found in the area around the towns of Placitas and Tejon, at the north end of the Sandia Mountains in the vicinity of Las

Huertas Creek and Tejon Canyon (center sections of T. 13 N., R. 5 E.).

Production history: Gold reportedly occurs in beds of cemented gravels in this region; individuals using drywashing machines reportedly recovered gold worth $3 per day per man during the first decade of this century.

Source: Unknown.

Literature:

Anderson, 1957: Mentions presence of placers.

Elston, 1967: Describes vein mineralization; no placer information.

Heikes and York, 1913: Placer-mining operations; production; type of gravels.

Jones, 1904: Reports occurrence of auriferous cemented gravels.

Wells and Wooton, 1932: Production information for 1904.

17. TIJERAS CANYON REGION

Location: Central part of the Sandia Mountains, T. 10 N., Rs. 4–6 E.

Topographic maps: Albuquerque 15-minute quadrangle; Tijeras 7½-minute quadrangle.

Geologic map: Dane and Bachman, 1957, Preliminary geologic map of the northwestern part of New Mexico, scale 1:380,160.

Access: From Albuquerque, about 18 miles east on U.S. Highway 66 to Tijeras Canyon (Bernalillo County).

Extent: The dry streams around Tijeras Canyon and the alluvial flats between the Sandia Mountains and Albuquerque on the west have been drywashed intermittently.

Production history: No production has been recorded from this area. The area is now included in the Sandia Military base and is not accessible to prospectors.

Source: The gold was probably derived from small quartz lenses in Tijeras Canyon formed during the Precambrian mineralization which contain native gold in the oxidized parts of the veins.

Literature:

Anderson, 1957: Lists as placer district; no description.

Burchard, 1882: Reports placer excitement in Tijeras Canyon area in 1881.

——— 1884: Reports placer excitement in the Rio Grande north of Albuquerque in 1883; size of gold nuggets found.

Elston, 1967: Describes bedrock mineralization; no placer descriptions.

Howard, 1967: Placer prospecting history.

18. HELL CANYON REGION

Location: Southern part of the Sandia Mountains, T. 8 N., Rs. 3–5 E. (on the Isleta Pueblo Grant).

Topographic map: Mount Washington 7½-minute quadrangle.

Geologic maps:

Dane and Bachman, 1957, Preliminary geologic map of the northwestern part of New Mexico, scale 1:380,160.

Reiche, 1949, Geologic map of the Manzanita and North Manzano Mountains (pl. 5), scale approximately 1 in. = 1 mile.

Access: From Albuquerque about 13 miles south on U.S. Interstate 25 to Isleta; from there dirt roads lead east along Hell Canyon (Valencia County).

Extent: Placers are found in the gravels in Hell Canyon and other drywashes in that vicinity. A narrow strip of placer ground is located at the west end of the Milagras group of patented claims (sec. 29, T. 8 N., R. 5 E.).

Production history: No recorded placer production.

Source: The gold was probably derived from the gold sulfide ores mined at the Milagras group of lode claims.

Literature:

Jones, 1904: Reports placer occurrence; placer-mining development.

Reiche, 1949: Locates placer claim in Hell Canyon; describes lodes.

SAN MIGUEL COUNTY

19. WILLOW CREEK DISTRICT

Location: East side of the Pecos River in the Sangre de Cristo Range, T. 18 N., Rs. 12 and 13 E.

Topographic map: Cowles 7½-minute quadrangle.

Geologic maps:

Bachman and Dane, 1962, Preliminary geologic map of the northeastern part of New Mexico, scale 1:380,160.

Miller, Montgomery, and Sutherland, 1963, Geology of part of the southern Sangre de Cristo Mountains, New Mexico (pl. 1), scale 1:63,360.

Access: From Pecos about 12 miles north to junction of Willow Creek and the Pecos River.

Extent: Willow Creek is frequently listed as a placer locality, but no description of the deposits has been found in the literature. The Pecos Copper mine is located at the junction of Willow Creek and the Pecos River; the ores contain a complex mixture of sulfides, gold, and silver. It is possible that some placer gold was recovered from debris eroded from this lode.

Production history: The presence of placer gold in this area has been known for many years, but there is no reported placer production.

Source: Unknown.

Literature:

Anderson, 1957: Lists as placer district; no description.

Geologic maps:

Bachman and Dane, 1962, Preliminary geologic map of the northeastern part of New Mexico, scale 1:380,160.

Schilling, 1960, Geology, mines and prospects of the Rio Hondo mining district (pl. 2), scale 1⅛ in.=1 mile.

Access: From Taos, light-duty roads lead north about 8 miles to Arroyo Seco (town), between Rio Lucero and Rio Hondo. Dirt roads lead up these rivers.

Extent: Little is known about the exact occurrence and extent of these placers; apparently they were small and low grade. The placer area was in shallow surface gravels of small debris fans between Lucero Creek and Arroyo Hondo.

Production history: No recorded production.

Source: Unknown; see Red River district

Literature:

File and Northrup, 1966: States that placer gold was found in 1826.

Graton and Lindgren, 1910: Notes placer occurrence.

Howard, 1967: History.

Schilling, 1960: Gold values per cubic yard.

32. PICURIS DISTRICT

Location: Southeast side of the Rio Grande, west of the Picuris Mountains.

Topographic map: Carson 7½-minute quadrangle.

Geologic map: Montgomery, 1953, Geologic map of the Picuris Range (pl. 1.), scale 1:48,000.

Access: Placers are probably located in the vicinity of Pilar at the junction of State Highway 96 and U.S. Highway 64, 16 miles south of Taos.

Extent: Unkown. Placer gold recovered by the La Grande Gold Mining Co. was credited to the Picuris district; the probable location of the placer is along the Rio Grande in the vicinity of Pilar (sec. 32, T. 24 N., R. 11 E.), northwest of the Picuris Mountains.

Production History: The La Grande Gold Mining Co, produced gold from stream gravels worked by sluicing in 1908. The same company apparently installed a dredge to work gravels in the same area, or at Tres Piedras—26 miles northwest in the Tusas Mountains—in 1907. (Early mining records are frequently imprecise about locations.) Three miles southwest of Pilar, at a locality called Glenwoody, the "Oro Grande" of Pennsylvania (this company and the "La Grande" Co. are almost certainly the same) had made plans in 1902 to construct a dredge to work the river gravels above Glenwoody.

Source: Unknown. Small scattered quartz veins containing gold occur in the Precambrian rocks of the Picuris Mountains and could have supplied the gold recovered from the placers. At Glenwoody, gold reportedly occurs in a quartzite exposed in the Rio Grande cliff, and the Glen-Woody

Mining and Milling Co. was formed in 1902 to mine this supposedly large low-grade deposit. Estimates of gold values as high as $1.40 to $3 per ton were made, but mill returns apparently amounted to only 40¢ per ton and lower.

Literature:

Graton and Lindgren, 1910: Mining history at Glenwoody camp; gold values in quartzite.

Howard, 1967: History of placer mining at Glenwoody (under Rio Grande Placer Region).

Schilling, 1960: History of placer mining at Glenwoody.

U.S. Geological Survey, 1907, 1908: Placer-mining activity; operations of La Grande Gold Mining Co.

UNION COUNTY

33. FOLSOM AREA

Location: Cimarron River Valley, northeast of Folsom, T. 31 N., R. 31 E.

Topographic map: Dalhart 2-degree sheet, Army Map Service.

Geologic map: Bachman and Dane, 1962, Preliminary geologic map of the northeastern part of New Mexico, scale 1:380,160.

Access: State Highway 325 leads 20 miles northeast from Folsom to the Cimarron River Valley and placer area.

Extent: Gravels derived from erosion of basalt lava in the Cimarron River Valley contain small amounts of placer gold. The basalt is about 20 miles northeast of Folsom and flowed within the river valley for several miles. The exact location of the gold veinlets and placers near the flow is not known.

Production history: Apparently, some gold was recovered from the gravels as it is described as small flattened grains, but no production has been recorded from the area. The placer is not commercial.

Source: Small gold veinlets in basalt.

Literature:

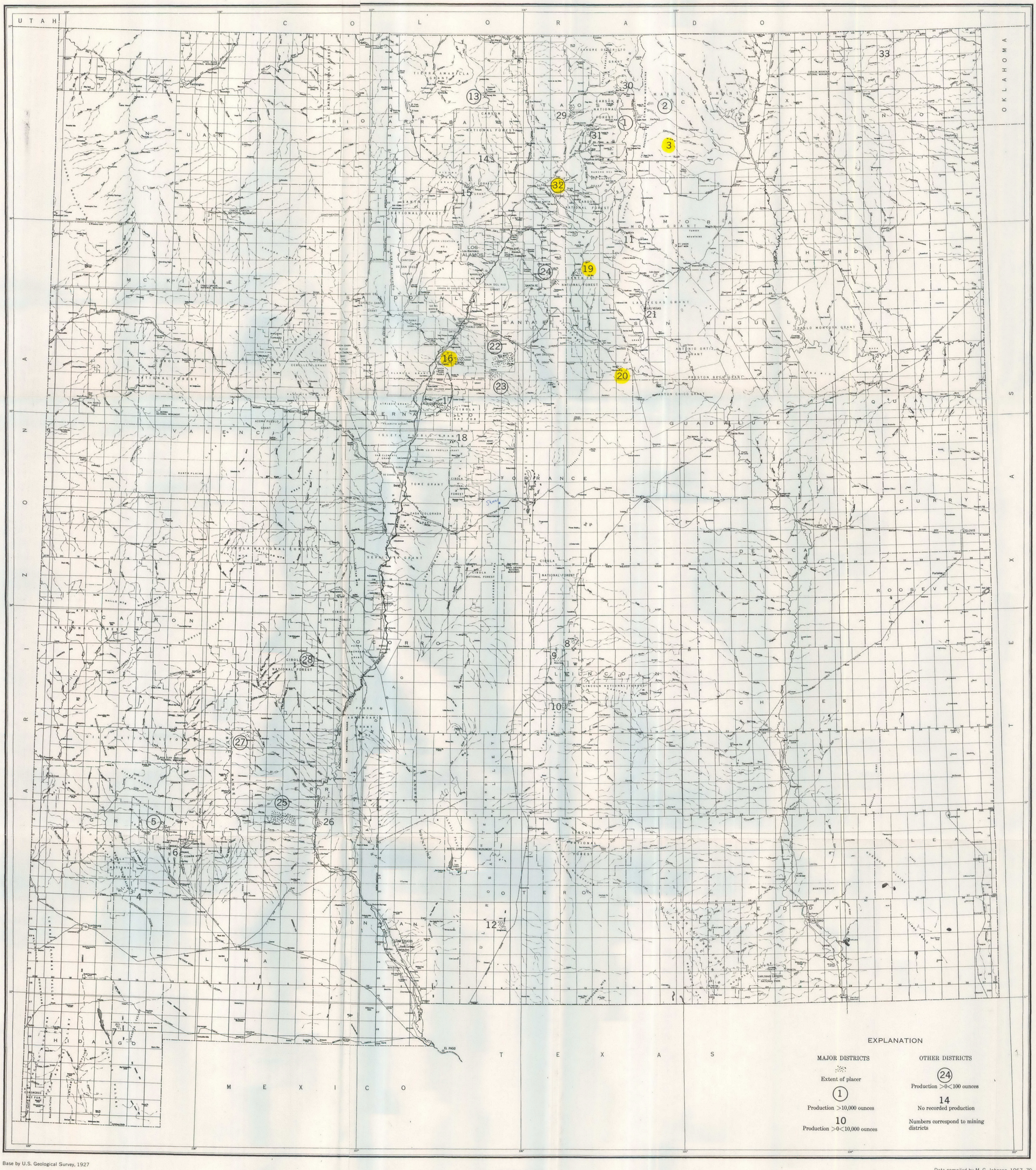
Anderson, 1957: Notes reports of placer gold.

Harley, 1940: Describes placer occurrences.

OTHER PLACER DEPOSITS

Various surveys of New Mexico mineral resources mention the occurrence of placers in many districts or areas not described in the present report, and frequently these citations are repeated in later publications. I have consulted the literature describing those areas where placers have been reported, but have found no description of any placers. There may be small concentrations of gold in gravel deposits near many lode mines which were worked by miners for a short time, but these occurrences probably were so minor that they received only passing attention.

Chaves County.—Schrader, Stone, and Sanford (1916, p. 214), report



Base by U.S. Geological Survey, 1927

SCALE 1:1 000 000

25 0 25 50 MILES

25 0 25 50 KILOMETERS

Data compiled by M. G. Johnson, 1967–70

MAP SHOWING LOCATION OF PLACER GOLD DEPOSITS IN NEW MEXICO

KEY TO PLACER DEPOSITS

Locality No.	District	Total estimate gold productio in ounces
1,2	Elizabethtown and Mount Baldy	250,000
3	Cimarroncito	unknown
4	White Signal	<1,000
5	Pinos Altos	50,000
6	Bayard area	<1,000
7	Sylvanite	<200
8	Jicarilla	8,000
9	White Oaks	1,000
10	Nogal	200
11	Mora River placers	0
12	Orogrande	>2,000
13	Hopewell	~16,000
14	El Rito region	0
15	Rio Chama	<100
16	Placitas-Tejon	>50
17	Tijeras Canyon	>50
18	Hell Canyon	>50
19	Willow Creek	100
20	Villanueva area	0
21	Las Vegas	0
22	Old Placers	>100,000
23	New Placers	>100,000
24	Santa Fe	0
25	Hillsboro	120,000
26	Pittsburg	8,000
27	Chloride	2
28	Rosedale	15
29	Rio Grande area	<1,000
30	Red River	<500
31	Rio Hondo	<500
32	Picuris	65
33	Folsom	0

468-955 O - 72 (In pocket)

ASARCO

Southwestern Exploration Division

WLK

Case file Gold Placer

August 7, 1985

R. L. Brown
New York Office

Fossil Placer Gold
Wyoming-Utah-Arizona

In summary, limited sampling has indicated the existence of low grade but very large gold deposits in Permian-Jurassic-Triassic sediments of Southern Utah (and Norther Arizona) and in late Cretacious to Mid-Tertiary sediments of NW Wyoming. Average values range from $.80-$1.60 per ton ($320 gold) in a part of the Shinarump near Paria, Utah to $2.00 per ton in a part of the Wind River Fm., Wyoming. In both regions, the samples represent only an almost infinitesimal portion of the total probable extent of these fossil placer gold-bearing rocks. Considering this, and the range of values, particularly in the Wind River (up to $18.00/s.t.) and Pinyon (up to $54.00/s.t.), it is a reasonable possibility that some horizons, or portions, contain sufficient gold to be worked profitably on a large scale by heap leaching.

At this stage of the game, it is hardly conceivable that some other mining companies have not already carried out investigations of these fossil placers; however, this should not be a deterrent to our moving in aggressively now. In view of the short Wyoming summer, the Wind River sample locality, 10 to 20 miles west of Dubois, should be tackled first. Most of this area appears open to prospecting on the Federal Land Status map.

.....

A review of Placer Gold Deposits of Utah (USGS Bull. 1357) turned up only one lead of interest ---- the San Juan River Placers, a possible source of which was stated by Gregory (USGS p.p. 188, 1938) to be Triassic and Jurassic rocks reportedly averaging 8.5¢ per yard. References listed

included B.S. Butler (1920) and A.C. Lawson (1913). The most recent paper, in E&MJ, May 1985 (unearthed by F. Koutz) titled "Inter-mountain Gold Anomaly..." by C.H. Phillips, (Att. A) reviews published data on bed rock occurrences (fossil placers) in Utah and Wyoming, as well as that on river placers.

Butler (Att. B) includes Lawson's description of sampling the Shinarump at Paria, near the confluence of the Colorado and San Juan rivers. The samples, mainly clay, weighed 25 to 30 lbs. and averaged 5¢ per ton ($20.67 gold) for the first group, 4¢ for the second and 2¢ for the third. A sample from a 15 ft. bed of sandstone ran 10¢ per ton. 14 Samples from the underlying Permian ran from trace to 10¢ and averaged 4¢.

Butler mentions 20¢-40¢ per ton reported in the sandstones of the San Juan River region and values over $1.00 in sandstone in the vicinity of the Henry Mts. ---- with some skepticism.

The 1967 publication, "Gold-bearing Sedimentary Rocks in Northwest Wyoming" (excerpt, Att. C) lists sample results and describes sampling procedure. The highest average gold content (222 ppb per cubic yd.) was found in the ss-qtzite-cg of the Wind River Fm. The highest individual sample (6,000 ppb) came from the Pinyon conglomerate; the next highest (2,000 ppb), from the Wind River. At $320 gold these amounts equate to $54.00 and $18.00 per ton, respectively (see note below Table 1). The authors conclude: "...variations in the amounts of gold from place to place are not necessarily random <u>but may be clues to large tonnage deposits of possible economic significance</u>."

The location of highest values (sample localities 40, 41, 42) is indicated on Figure 1 (Att. C). 40 Is in a "Public oil shale withdrawal" (Att. D), but 41 and 42 are in National Forest Lands. Investigation of

this and other fossil placer gold occurrences should include: (1) sampling, (2) land status, and (3) attempts to secure oil-gas well cores or cuttings for analysis.

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USGS P.P. 111, 1920 Att. B

GOLD DEPOSITS.

DISSEMINATED DEPOSITS IN CONSOLIDATED SEDIMENTARY ROCKS.

CHARACTER OF THE SEDIMENTS.

Finely distributed gold is reported to occur in the sedimentary rocks over wide areas in the Plateau region in formations ranging from Permian to Jurassic and possibly in still younger rocks. Considerable money and time have been expended on this class of deposits, but there had been no known production. Nevertheless the occurrence is of much geologic interest.

The gold occurs in sediments ranging from moderately coarse sandstone to extremely fine clay. It is all very finely divided and, it is said, can not be collected by panning, a fire or amalgamation assay being necessary to determine the tenor of the rock.

An attempt to extract the gold on an industrial scale has been made at Paria, on Paria River, in Kane County, about 15 miles north of the Utah-Arizona boundary, and at Spencer Camp, on lower San Juan River.[1]

PARIA AREA.

At Paria the gold is contained in part in an extremely fine clay of rather unusual character, which it was once thought might be treated by hydraulic methods. In the fall of 1911 considerable machinery for this purpose was freighted to the camp from Marysvale. So far, however, no method of profitable treatment has been devised.

Lawson[2] discusses the gold deposits of the clay as follows:

> The purpose of my examination of the sections at Paria was in part to determine the quantity of gold present. * * * The nearly horizontal attitude of the beds made it possible to sample the clays by vertical cuts on the face of the bare hill slopes. The cuts were made deep enough to get beneath the veneer of slacked pulp which covers the unweathered clay. A sample from of 25 to 30 pounds was taken every 10 feet measured vertically by leveling. The sampling was done on the assumption that whatever gold the clay might contain was all very fine, and practically uniformly disseminated in any given stratum. The lower part only of the formation was sampled, comprising from one-half to two-thirds its entire thickness. The samples, after careful crushing and quartering, were submitted to Mr. E. H. Simonds, of San Francisco, for assay. This he did with the utmost care, in quadruplicate for each sample.
>
> The first series of 18 samples was taken from a trench 174 feet high on the southwest side of the Paria River. Of these one was found to contain 10 cents per ton, nine 5 cents per ton, two 2½ cents per ton, four contained a trace, and one contained none. These results were checked by taking an aggregate made up of equal weights of every one of the 18 samples. The assay of this aggregate sample was 5 cents per ton. It is worth noting that the sample which yielded 10 cents per ton was taken from the 15-foot bed of sandstone described as occurring in this section.
>
> The second series of 22 samples was taken from a trench 210 feet high on the northeast side of Paria. Of these, one yielded 12½ cents per ton, two 7½ cents, eight 5 cents, five 2½ cents, five a trace, and one none. The average of the entire cut is about 4 cents per ton.
>
> The third series of samples was taken from a trench 240 feet high, beginning at the top of the Shinarump sandstone on the southwest margin of the formation. Of these one yielded 7½ cents per ton, five yielded 5 cents, one 2½ cents, sixteen a trace, and one none. Confirming these results, an aggregate of equal amounts of 13 samples from the first series of 18 yielded to assay by Mr. W. S. Morley 4 cents in gold per ton. A similar aggregate of 16 samples from the second series yielded Mr. Morley 2 cents per ton, and an aggregate of 20 samples from the third series yielded also 2 cents per ton. Comparable results are obtained by amalgamation assays on large samples, using chemically pure mercury.
>
> To those unfamiliar with the hydraulic method of mining, the gold content of the Shinarump clays may appear to be so small as to be insignificant and unworthy of attention from a practical point of view. But under the most favorable conditions gravel containing 5 cents per yard, or 2½ cents per ton, may be worked at a profit. The peculiar way in which the Shinarump clay slacks and runs with water suggests that it may be no less susceptible of hydraulicking than banks of gravel. This suggestion, coupled with an exaggerated notion of the amount of gold contained in the clays, has led to various attempts to exploit them for gold. The ground has been staked out in hundreds of placer claims and these have been offered for sale at large figures. The value of the ground is, however, very problematical. If a method of successful hydraulicking and recovery of the gold be developed, it will only be after a long period of experimentation, at large expense, at a few favored localities where a vast yardage of the clays is free from overburden and where abundant water may be had cheaply. No large expenditure for the acquisition of territory would be justified until the method of winning the gold has been demonstrated.
>
> At present, the occurrence is interesting from a geological rather than a practical point of view. We may safely assume, on the basis of the sampling at Paria, that the Shinarump clay there contains on the average 5 cents per cubic yard. The same formation appears to be similarly auriferous at Lees Ferry and at San Juan, and it is probable from the extreme uniformity in the physical characteristics of the formation wherever it has been observed, that it is similarly auriferous throughout its extent. * * *
>
> The gold is not confined to the Shinarump clays in the Plateau province. A cut 140 feet high was made in the underlying Permian shales and 14 samples secured for

[1] Gregory, H. E., Geology of the Navajo country: U. S. Geol. Survey Prof. Paper 93, p. 40, 1917.

[2] Lawson, A. C., op. cit.

USGS PP 111 Att. B

assay. Of these, two yielded 10 cents in gold to the ton, five yielded 5 cents, six a trace, and one none. An aggregate of equal parts of these 14 samples yielded to an amalgamation assay 4 cents per ton. This result is probably representative of the gold content of the entire thickness of the Permian, since the conditions of sedimentation appear to have been very uniform throughout. The Permian beds do not, however, slack in water, and there is no prospect of their being susceptible of hydraulic mining. They are, however, quite as interesting as the Shinarump as an instance of the occurrence of gold in fine-grained sedimentary rocks.

SAN JUAN RIVER REGION.

Gold was first reported from San Juan River by an Indian trader named Williams in the fall of 1892. Tales of fabulously rich deposits, both in river placers and in sandstones adjacent to the river, spread through the West, and several hundred men "stampeded" to the region in midwinter (1892–93) and suffered great hardships. The river and its tributaries were staked for many miles. After fighting and bloodshed it was found that the gold was too fine to be worked on a small scale, and in a few months the region was practically abandoned.

The possibility of working the sandstone deposits has been investigated several times since. As late as 1910 machinery was taken into the region to crush and treat the rock but was never operated. The sandstone is said to contain 20 to 40 cents, or even more, per ton, in gold. The writer has not visited the district and has no reliable data pertaining to the gold content of the sandstones. It may be recalled, however, that apparently reliable reports stated that the deposits at Paria contained from 30 to 65 cents per yard in gold, and considerable money was spent on this assumption, whereas Lawson found that the average for those deposits is about 5 to 10 cents per cubic yard. It is possible that a more careful sampling will show a much lower content for the sandstones of San Juan River region than is commonly reported.

OTHER DEPOSITS.

The Triassic sandstones in the vicinity of the Henry Mountains are said to carry gold, assay values exceeding $1 per ton being reported. However, anyone considering working these sandstones should remember the Paria experience, and make careful investigation before attempting to treat them. Assays of sandstone from the La Sal Mountain region show gold and silver present. Ash from the Pleasant Valley coal is said to have yielded 60 to 80 cents per ton in gold.[1]

It is evident, as pointed out by Lawson, that the gold is widely distributed, but thus far it has not been found possible to extract it profitably. The widespread occurrence of the gold is of interest, however, as indicating that the sediments were derived from a rather highly mineralized area, and further, as furnishing a possible source for the placer gold of Colorado, San Juan, Green, and Grand rivers.

PLACER DEPOSITS.

GENERAL FEATURES.

Placer gold has been known for a number of years in the rivers of eastern Utah, including the Colorado and its main tributaries, Grand, Green, and San Juan rivers. The deposits have been worked sporadically and numerous devices have been tried for saving the very fine gold.

The richer gravels have been worked in a small way, some probably at a profit, but attempts to operate on a large scale have not met with success. The total production has been only a few thousand dollars, of which Colorado and Green River deposits have furnished the greater part.

The gold-bearing gravels are found at intervals from Wyoming to Arizona. They are most extensive, however, on Colorado River, between the mouth of Fremont (Dirty Devil) River and the southern boundary of the State, on Green River, above the mouth of the Duchesne, and on San Juan River near Bluff. Few of the river placers were visited by the writer, and little concerning them is to be found in the literature.

COLORADO RIVER.

DEVELOPMENT.

The most active operations on Colorado River have been carried on from about the mouth of Crescent Creek southward to a few miles below the mouth of San Juan River. Attempts at dredging and other placer operations were carried on farther south. The region has little rainfall and the tributary

[1] Jeaney, W. P., The chemistry of ore deposits: Am. Inst. Min. Eng. Trans., vol. 33, p. 461, 1902.

Att. C

1967 - USGS Circ. 541

Gold-bearing Sedimentary Rocks in Northwest Wyoming—A Preliminary Report[1]

By J. C. Antweiler and J. D. Love

ABSTRACT

Thick sequences of gold-bearing quartzite conglomerate occur in latest Cretaceous and Tertiary formations and in Quaternary gravels derived from them in northwest Wyoming. Analyses of about 1,200 samples (by a new cyanide-atomic absorption method) and 750 panned concentrates representing 53 localities show the following averages in parts per billion and cents per cubic yard: Harebell Formation (latest Cretaceous), 65 (11 cents); Pinyon Conglomerate (Paleocene), 86 (14 cents); Fort Union Formation (Paleocene), 35 (6 cents); conglomerate of earliest(?) Eocene age, 94 (14 cents); Wind River Formation (early Eocene), 222 (35 cents); Pass Peak Formation of Eardley and others (middle(?) Eocene), 47 (8 cents); Miocene(?) conglomerate, 65 (11 cents); Quaternary deposits, 103 (16 cents). These values are for the bulk rock although the gold is largely confined to sandstone layers and the sandy matrix of the conglomerates, which contain various proportions of pebbles and cobbles. The conglomerates were derived chiefly from Precambrian and possibly Paleozoic quartzite in a now-buried uplift northwest of the Teton Range. Although the grade is low, the volume, 50 cubic miles or more, is so large as to constitute a resource of enormous proportions. The presence of above-average grades in some localities suggests that local concentrations may exist and makes the conglomerates and their derivatives attractive for additional prospecting.

RESULTS

This report presents a summary of analyses (tables 1 to 9) of the first 1,200 of 6,000 samples collected from a sequence of gold-bearing sedimentary rocks in northwest Wyoming and adjacent areas. The following conclusions and procedures, potentially useful to modern prospectors, are based on a preliminary study of the field and laboratory data related to these samples: (1) Gold occurs in all areas of Cretaceous and Tertiary quartzite-bearing conglomerate that have been sampled in northwest Wyoming, (2) the volume of low grade gold-bearing strata is so vast (50 cu mi or more) that development of new mining and recovery methods designed for low-cost handling of huge quantities of relatively poorly consolidated material may eventually be justified, (3) most of the gold was not derived from adjacent mountains but came from Precambrian and possibly Paleozoic quartzite in a now-buried uplift northwest of the Teton Range, (4) to analyze for gold in such low concentrations, a method combining cyanide extraction and atomic absorption was found most reliable, and (5) analyses of 754 panned concentrates demonstrate some of the problems of recovering gold by mechanical and chemical methods and of evaluating various types of analytical data.

We believe that there are genuine, even though small, variations in amounts of gold from one place to another and that these are not necessarily random but may be clues to the locations of large-tonnage deposits of possible economic significance. Because of the current interest in gold, evidence supporting our conclusions is given in this preliminary report in advance of completion of the final study. Sampling has not yet been done in sufficient detail to locate any areas of relatively high gold content, but we feel that the data shown in table 1 indicate the desirability of further intensive prospecting.

The results reported herein are based mainly on determinations of the gold content of small samples. A joint investigation with the U.S. Bureau of Mines is planned to develop methods for measuring the gold content of much larger samples and for technological appraisal of the deposits.

GEOLOGIC DISTRIBUTION OF GOLD

Placer gold has been known in northwest Wyoming for more than 100 years, but it is in such small flakes (max diam about 0.3 mm, and thickness less than 0.01 mm) that conventional recovery methods have not been commercially successful.

Table 1 summarizes data on the Cretaceous and younger sequences sampled for this study and shows their average gold content. More detailed descriptions of these gold-bearing strata—Harebell Formation and Pinyon Conglomerate (Love, 1956; 1956a), Fort Union Formation (Pierce, 1966; Hewett, 1914; 1926), Wind River Formation (Rohrer, 1967), Pass Peak Formation of Eardley and others (Eardley and others, 1944; Dorr, 1956), and Quaternary deposits (Maguire, 1899; Love, 1956a; Love and Taylor, 1961) —are found in the literature cited. The Miocene(?) conglomerates have not been described in publication

[1]Prepared with the cooperation of the Geological Survey of Wyoming and the Department of Geology, University of Wyoming.

Table 1.—Gold content of Cretaceous and Tertiary rocks and Quaternary deposits

Age	Formation	Lithology	No. of samples	No. of localities	Au content in ppb; dollars per cubic yard[1] in parentheses: Average of all samples	Maximum in single sample
Quaternary-------	----------	Gravel, sand, silt, and clay--	178	14	103 ($0.16)	2,000 ($3.20)
Miocene(?)-------	----------	Quartzite conglomerate and sandstone with tuff matrix.	21	1	65 (.11)	290 (.46)
Middle(?) Eocene-	Pass Peak Formation of Eardley and others (1944).	Quartzite conglomerate, sandstone, and siltstone.	25	1	47 (.08)	250 (.40)
Early Eocene-----	Wind River Formation--	Sandstone and quartzite conglomerate.	40	3	222 (.35)	2,000 (3.20)
Earliest(?) Eocene	----------	----do----------	26	1	94 (.14)	400 (.64)
Paleocene--------	Pinyon Conglomerate----	Quartzite conglomerate, sandstone, coal, and shale.	152	16	6 (.14)	6,000 (9.60)
Paleocene--------	Fort Union Formation--	Quartzite conglomerate, and sandstone.	14	1	35 (.06)	300 (.48)
Late Cretaceous--	Harebell Formation----	Quartzite conglomerate, sandstone, and siltstone.	145	5	65 (.11)	1,000 (1.60)

[1] The value of placer deposits is commonly expressed in dollars per cubic yard. To convert to dollars per ton, divide dollars by 1.6. 1 cu yd equals 1.6 tons; 10 ppb equals 1 cent per ton; 1 cent per ton equals 1.6 cents per cu yd.

but are similar to those in the Colter Formation (Love, 1956), 20 miles to the southeast.

Sample localities are shown on figure 1, and many are shown also on figure 2, a generalized geologic map (Love, 1956) that shows distribution of the Harebell Formation and Pinyon Conglomerate, the thickest and most widespread gold-bearing conglomeratic sequences in northwest Wyoming.

HAREBELL FORMATION

The Harebell Formation was deposited during latest Cretaceous time by a river system that flowed southeastward across Jackson Hole and brought quartzite debris from a now-buried source uplift northwest of the Teton Range. The trough line of maximum conglomerate deposition was near localities 10, 11, and 12, along the present course of the Buffalo Fork River. Conglomerates decrease in thickness and abundance to the north and south of that area.

The distribution of gold in various rock types in the Harebell Formation is summarized in table 2. Gold is more abundant in sandstone than in conglomerate. Among conglomerates, gold is most abundant in ferruginous varieties having some round stones larger than 3 inches and in conglomerate having a soft matrix. Ferruginous rocks containing organic debris appear to be particularly favorable hosts for gold. Table 3 gives the maximum, minimum, and average gold content at each of five sample localities, and table 1 shows a combined average. Regional distribution of gold elsewhere in the areas of outcrop (fig. 2) is being investigated.

PINYON CONGLOMERATE

The Pinyon Conglomerate was deposited by rivers that flowed from the quartzite source area eastward and southeastward across Jackson Hole although in courses different from those of the rivers that deposited the Harebell Formation. One river turned northeast and went past the present location of the town of Cody (fig. 1) in the Bighorn Basin. The area of maximum conglomerate deposition was in the vicinity of locality 5 and Gravel Mountain (fig. 2), where more than 5,000 feet of strata, largely conglomerate, was deposited. Farther east and southeast, the conglomerates thin and intertongue with sandstone.

Table 2 shows that the pattern of gold distribution in the Pinyon Conglomerate is similar to that in the Harebell Formation. In both formations gold is most abundant in sandstone. In the Pinyon, however, gold is appreciably more abundant than in the Harebell. Carbonaceous sandstone in the Pinyon has the highest average gold content of any samples.

Table 4 shows that both average and maximum gold content vary considerably from one locality to another. A cluster of localities (32, 33, 34, 36) in the southeast part of Jackson Hole displays moderately high values. Whether these richer localities are parts of linear trends of gold concentration has not yet been determined, for analytical data from the large areas of Pinyon Conglomerate farther north are presently incomplete.

FORT UNION FORMATION

The Fort Union Formation in the Bighorn Basin is an approximate eastern equivalent of the Pinyon Conglomerate plus the overlying sandstone, siltstone, and claystone of Paleocene age. Quartzite conglomerates were sampled in many places and parts of the section but, as yet, analyses are available for only one locality (52, fig. 1; table 5) in the lower 200 feet of a 5,000-foot succession. Table 1 shows that the gold content at this locality is much less than in the Pinyon Conglomerate. Analyses of conglomerates from other areas, however, may alter this preliminary

Table 2.—Data on samples from Harebell Formation and Pinyon Conglomerate

Material	No. of samples analyzed		No. with Au content 100 ppb or greater		Avg Au content in ppb; cents per cu yd in parentheses	
	Harebell	Pinyon	Harebell	Pinyon	Harebell	Pinyon
Roundstones (most are quartzite, but some are schist, granite, etc.)	11	112	0	4	19(3)	26(4)
Conglomerate, some roundstones larger than 3 in	37	175	6	35	52(8)	77(12)
Ferruginous conglomerate, some roundstones larger than 3 in	12	31	4	6	73(12)	60(10)
Conglomerate, roundstones smaller than 3 in	5	16	1	5	45(7)	143(23)
Ferruginous conglomerate, roundstones smaller than 3 in	2	3	0	2	30(5)	103(16)
Conglomerate with tough matrix	23	77	3	12	48(8)	52(8)
Conglomerate with soft matrix	24	127	7	30	70(11)	88(14)
Conglomerate overlying sandstone	5	6	0	1	40(6)	103(16)
Ferruginous conglomerate overlying sandstone	1	0	0	0	30(5)	0 --
Conglomerate under sandstone	4	8	0	4	23(4)	153(24)
Ferruginous conglomerate under sandstone	0	2	0	0	-- --	40(6)
Sandstone overlying conglomerate	10	30	3	9	120(19)	106(17)
Ferruginous sandstone overlying conglomerate	1	2	0	1	60(10)	348(56)
Pebbly sandstone lens	2	4	0	2	40(6)	94(14)
Sandstone lens	12	50	2	11	123(20)	118(19)
Ferruginous sandstone lens	9	22	2	4	45(7)	74(12)
Sandstone lens under conglomerate	5	18	1	5	98(16)	61(10)
Ferruginous sandstone lens under conglomerate	5	--	2	--	114(18)	-- --
Massive sandstone	6	14	1	3	47(8)	55(9)
Sandstone-shale	2	3	1	1	80(13)	100(16)
Ferruginous sandstone-shale	3	2	0	0	57(9)	50(8)
Sandstone with organic content or plant fossils	2	12	0	4	35(6)	430(69)
Ferruginous sandstone with organic content or plant fossils	3	--	3	--	127(20)	-- --
Shale	1	13	1	2	100(16)	42(7)
Limestone	2	11	0	1	20(3)	41(7)
Coal	0	9	0	0	-- --	27(4)
Soil on, or derived from, conglomerate	15	49	1	6	48(8)	36(6)
Stream sediment in area of conglomerate	--	75	--	18	-- --	192(31)
Conglomerate with clayey matrix	--	7	--	3	-- --	344(55)
Silicified wood	--	4	--	0	-- --	19(3)
Summary[1]						
Nonferruginous samples	84	346	16	78	72(12)	104(17)
Ferruginous samples	35	60	11	13	72(12)	77(12)
Conglomerate	56	225	11	48	55(9)	80(13)
Sandstone	55	152	14	39	81(13)	122(20)
Shale	6	18	2	3	72(12)	52(8)
Material containing carbonaceous debris	5	12	3	4	90(14)	430(69)
Limestone	2	11	0	1	20(3)	41(7)
Soil	15	49	1	6	48(8)	36(6)
Roundstones	11	112	0	4	19(3)	26(4)

[1] Some samples are included in more than one category in the preceding detailed list.

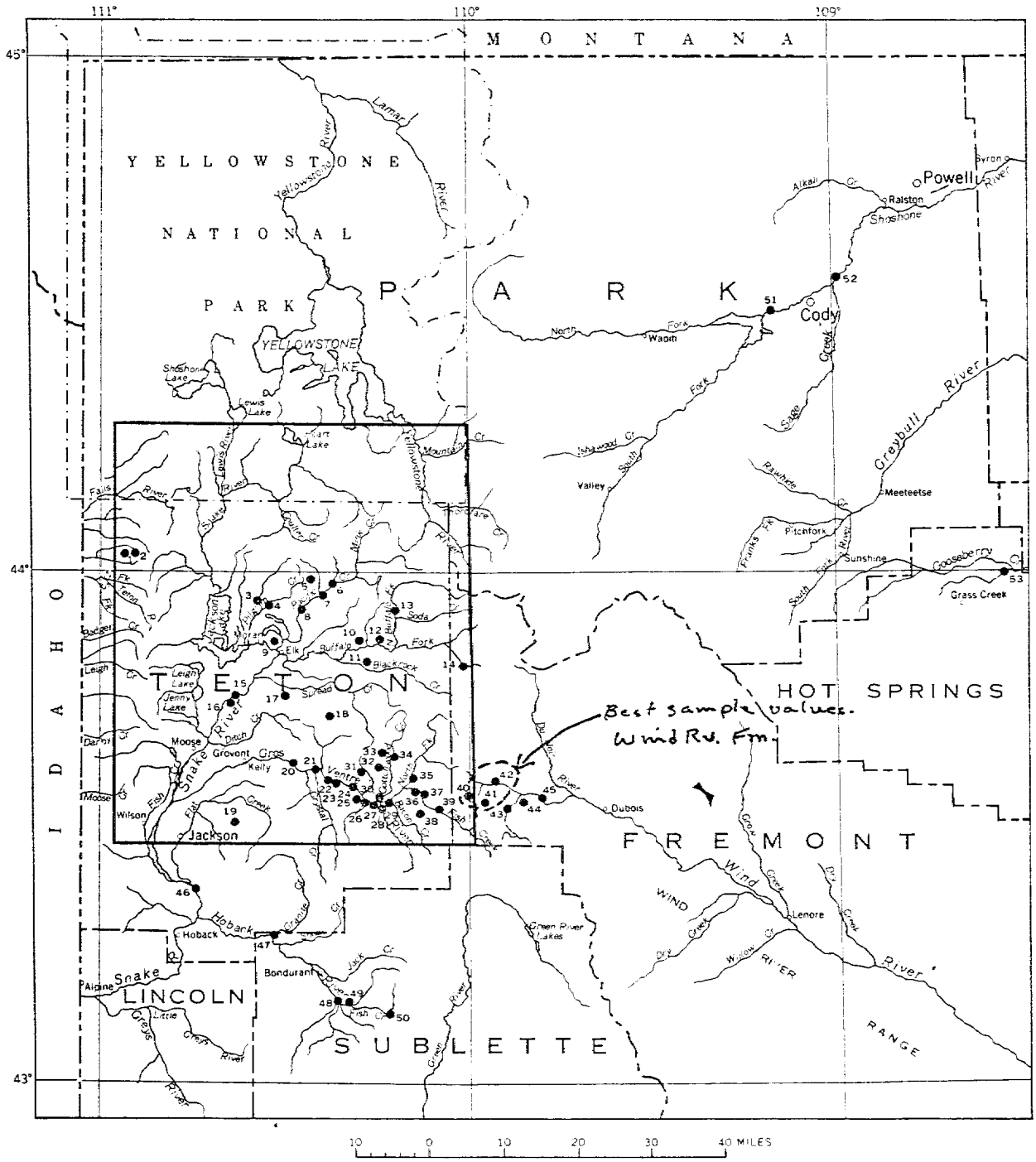


Figure 1.—Northwest Wyoming, showing numbered localities sampled for gold. Heavy line marks boundaries of area included in figure 2.

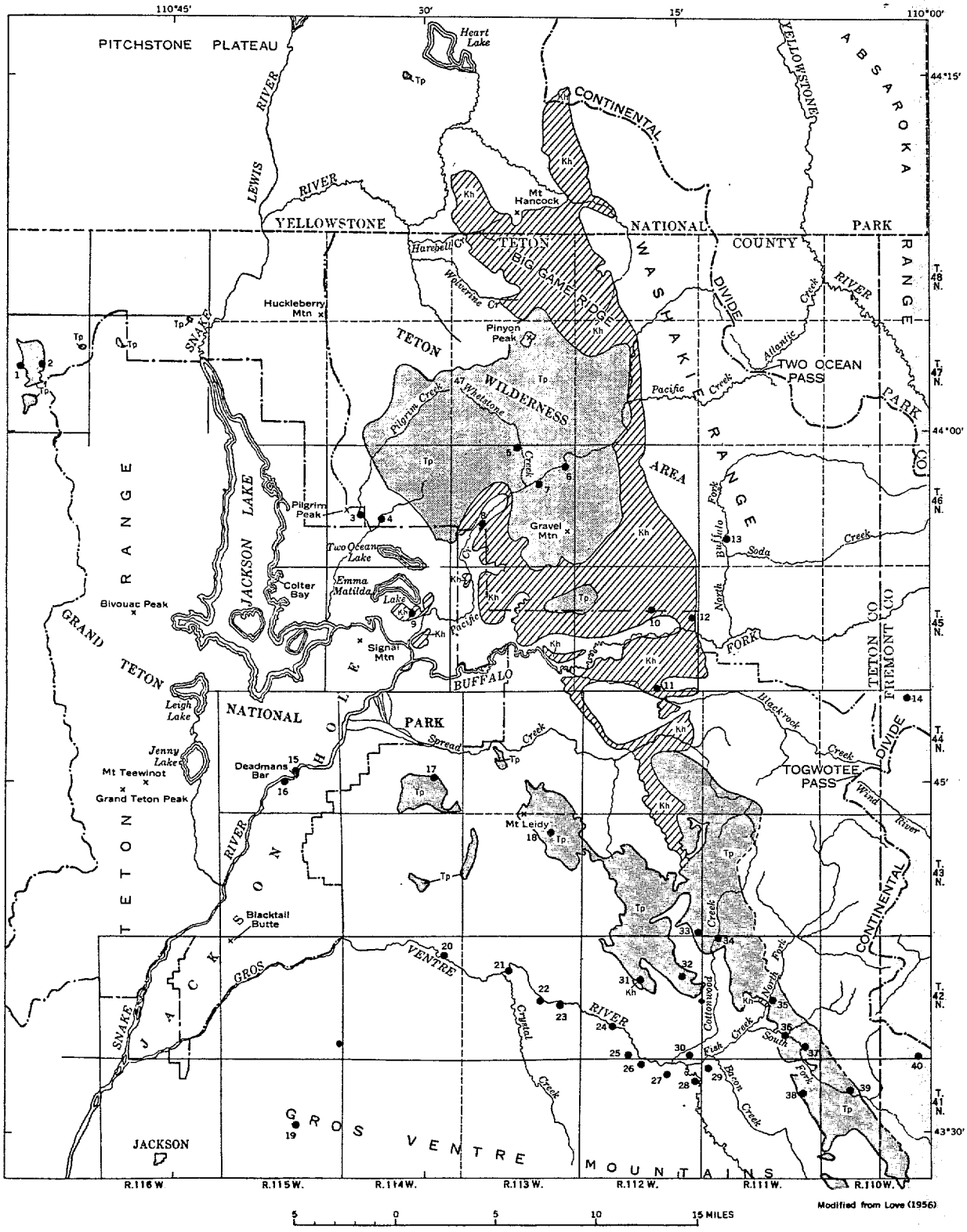


Figure 2.—Part of Jackson Hole area, showing numbered localities sampled for gold and major outcrop areas of Harebell Formation (Kh) and Pinyon Conglomerate (Tp). Boundaries of Grand Teton National Park and Teton Wilderness Area are approximately located. Geology adapted from Love (1956).

observation. The gold almost certainly came from the same source area as that in the Pinyon.

Table 3.—Gold content of sampled localities in Harebell Formation

Locality	No. of samples	Au content (ppb) Range	Average
9	23	<10- 200	31.3
10	39	<10- 200	43.3
11	59	<10-1,000	99.7
12	10	15- 250	70.0
31	14	15- 400	65.2

Table 4.—Gold content of sampled localities in Pinyon Conglomerate

Locality	No. of samples	Au content (ppb) Range	Average
2	13	40- 700	145.4
5	74	<10-2,000	75.4
6	37	<10-6,000	203.0
7	31	<10- 250	52.9
17	33	<10- 80	33.7
18	84	<10- 340	50.4
31	31	<10- 500	73.2
32	103	<10-4,350	112.7
33	26	<10-1,000	116.3
34	39	<10-3,250	151.0
35	45	<10- 200	30.2
1/35S	30	<20- 660	85.0
36	20	35- 500	138.0
37	24	<10- 280	50.8
38	31	<10- 200	27.6
39	31	<10- 450	87.1

1/ Scarp.

CONGLOMERATE OF EARLIEST(?) EOCENE AGE

Several hundred feet of quartzite conglomerate similar to that in the Pinyon and Fort Union but overlying the Fort Union in the Bighorn Basin has been considered to be part of the Willwood Formation of early Eocene age (Hewett, 1926, called it Wasatch but the name was later changed). Recent work by the writers suggests that the Willwood may unconformably overlap this conglomerate, so the conglomerate is herein called earliest(?) Eocene and tentatively set apart from both the Willwood and Fort Union Formations. The quartzite debris may have been derived from the Harebell, Pinyon, and Fort Union Formations, or it might have come directly from the same source area as the older conglomerates. Tables 1 and 5 show that the gold content of samples from one locality (53, fig. 1) is higher than the average for any of the older formations in either the Bighorn Basin or Jackson Hole.

WIND RIVER FORMATION

The Wind River Formation of early Eocene age is present along the Continental Divide (fig. 2) between the Wind River Basin and Jackson Hole and includes several quartzite conglomerates and brown sandstones similar to those in the Pinyon Conglomerate. The Wind River is between 500 and 1,000 feet thick and is especially interesting because the average gold content of samples analyzed to date is more than twice that of any other formation (tables 1 and 5). These rocks lap southward onto the Flathead Sandstone (Cambrian) and the Precambrian crystalline core of the Wind River Range. Analyses of four samples of Flathead Sandstone at two localities (44 and 45, fig. 1; table 6) show 100 to 150 parts per billion (ppb), or 16 to 24 cents per cubic yard, gold. Elsewhere (locs. 14 and 19), the Flathead has only 15 to 25 ppb, or 2½ to 4 cents per cubic yard, gold. These

Table 5.—Gold content of sampled localities of quartzite conglomerate in formations other than Harebell and Pinyon, northwestern Wyoming

Locality	Rock	No. of samples	Au content (ppb) Range	Average
52	Fort Union Formation----------	14	<10- 300	35.4
53	Lowest(?) Eocene conglomerate Bighorn Basin----------	26	15- 400	94.4
40	Wind River Formation----------	23	<10-2,000	220.0
41	----do----------	3	70- 500	227.0
42	----do----------	14	10-1,250	223.2
	Summary (40, 41, 42)-------	40	<10-2,000	221.8
50	Pass Peak Formation of Eardley and others (1944)----------	25	<10- 250	46.6
1	Quartzite boulder conglomerate in Miocene(?) pyroclastic sequence----------	21	<10- 290	64.8

Table 6.—Gold content of miscellaneous igneous and sedimentary rocks in northwestern Wyoming

Locality	Rock	No. of samples	Au content (ppb) Range	Average
19	Flathead Sandstone----------	4	20-25	22.5
44, 45	----------do----------	4	100-150	132.5
51	----------do----------	3	15-70	38.3
14	Flathead Sandstone and volcanic conglomerate of Oligocene Wiggins Formation----------	2	<100	<100
13	Precambrian gneiss and schist; Cambrian Flathead Sandstone; and sediment in streams draining Tertiary volcanic rocks----------	22	<10-100	25.0
19	Precambrian granite----------	2	15	15.0
51	----------do----------	1	50	--

preliminary data suggest that the Flathead may locally contain significant amounts of gold, probably derived from the Precambrian crystalline rocks of the Wind River Range. Some of this gold may have been reworked into the Wind River Formation. The Flathead Sandstone and adjacent beds of the Wind River Formation on both flanks of this part of the Wind River Range warrant further investigation.

PASS PEAK FORMATION OF EARDLEY AND OTHERS

The Pass Peak Formation of Eardley and others (1944) contains more than 2,000 feet of quartzite conglomerate along the south margin of the Gros Ventre Mountains; the conglomerate facies thins abruptly southward into sandstone. The age is uncertain but is probably middle Eocene. This conglomerate was almost certainly reworked from conglomerates in the Pinyon and Harebell Formations of Jackson Hole before the Gros Ventre Mountains rose to their present height (Dorr, 1956; Love; 1956b, 1960, p. 208-209). About 1,000 feet of section was sampled (loc. 50, fig. 1); the gold content averages somewhat less than that of all the older formations except the Fort Union (tables 1 and 5).

MIOCENE(?) CONGLOMERATE

A greenish-brown very coarse boulder conglomerate about 100 feet thick is in a sequence of pyroclastic rocks that directly overlies the Pinyon Conglomerate on the northwest side of the Teton Range at locality 1 (fig. 2). Many of the boulders are of quartzite, highly rounded, 2 to 3 feet in diameter, and are identical in size, appearance, and composition to those in the Pinyon. The matrix of the younger conglomerate is andesite crystal tuff, and the petrography, nature of matrix igneous material, and general appearance are much like those of the Colter Formation of Miocene age in Jackson Hole 20 miles to the southeast (Love, 1956). The gold content is slightly less than that in the Pinyon Conglomerate (tables 1 and 5).

QUATERNARY DEPOSITS

Maguire (1899) estimated that alluvial gravel along the Snake River downstream from the town of Jackson (fig. 1) contains at least $2 billion worth of gold (at $20.00 per oz). Table 7 presents the gold content of similar Quaternary deposits farther upstream that were derived chiefly from quartzite conglomerate in the Harebell, Pinyon, Pass Peak, and Wind River Formations. Table 1 shows that the average gold content in 178 alluvial samples is higher than that of any parent formation except the Wind River. All types of alluvial debris, ranging from coarse boulder deposits to very fine grained clay, were sampled. The greatest gold concentration is in gravel and coarse sand, but some high values have been found in finer grained sand

Table 7.—Gold content of sampled localities in Quaternary deposits derived chiefly from the Harebell Formation, Pinyon Conglomerate, Wind River Formation, and Pass Peak Formation of Eardley and others (1944)

Locality	No. of samples	Au content (ppb) Range	Average
3	5	<10-1,000	228.0
4	5	<20-2,000	739.0
8	20	<10- 300	66.0
15	14	<10- 300	104.6
16	16	<10- 250	65.0
20	49	<10- 600	44.0
1/20	20	<10-1,200	107.0
21	4	<10-2,000	579.0
23	9	<10- 30	3.3
24	12	<10- 600	88.8
30	8	<10- 40	21.2
45	8	<10- 500	188.7
46	7	25- 100	57.1
49	1	25	25

1/ River bottom.

and silt trapped in sod and at the roots of willow bushes along stream margins.

Alluvial deposits derived largely or entirely from pre-Harebell rocks were sampled in order to determine whether any significant amount of gold came from sources other than conglomerate. Results are given in tables 8 and 9. These data indicate that the Harebell and younger conglomeratic strata are the chief sources of gold in Quaternary deposits.

GEOCHEMICAL PROBLEMS AND PROCEDURES

In order to evaluate the significance of variations in distribution of gold in deposits such as those in northwest Wyoming, an adequate analytical method is necessary for determining chemically the amount of gold, and a satisfactory procedure must be devised to produce mechanical concentrates containing the maximum amount of gold; concentrates are useful not only to cross check analyses of unconcentrated samples but also to provide data on distribution and recovery of very small gold particles.

Related problems are: (1) the large volume of material (50 cu mi or more) to be sampled, (2) terrane so rough that it cannot quickly be explored, and (3) serious sampling difficulties because of the erratic distribution of discrete particles of gold, which is so malleable that it does not break up easily in grinding.

ANALYTICAL METHOD

The analytical method described here was developed as a part of this study in order to secure reliable data in the part-per-billion range on the gold content of the material that is actually analyzed. Details of the procedure and equipment needed are included here because they may be of value to others engaged in similar work. Most of the unconcentrated samples were analyzed by W. L. Campbell and Elizabeth Martinez, using this new method. In Addition, all were analyzed by other, less sensitive methods. The values reported in the tables are based on averages of at least two determinations for almost all samples; some samples were analyzed as many as five times. The other methods used and the analysts (names in parentheses) are: sodium bromate-hydrobromic acid-colorimetric method of Lakin and Nakagawa (1965), using 1- and 5-gram samples (J. C. Antweiler); sodium bromate-hydrobromic acid-atomic absorption procedure, using 2-g samples (Walter Ficklin and Sharon Noble); cyanide-atomic absorption procedure, using 15-g samples (Walter Ficklin, Sharon Noble, Luther Dickson, and J. C. Antweiler); cyanide-colorimetric procedure, using 15-g samples (J. C. Antweiler); and fire assay-atomic absorption procedures, using approximately 15-g (half assay ton) samples (O. L. Parker, C. H. Huffman, Jr., and John Mensik). J. C. Antweiler assumes the responsibility for the values reported.

The new method gave the best results. Recovery of gold was tested by analyzing samples to which a known amount of radioactive Au^{198} had been added and then measuring the radioactivity of the recovered gold; recovery averaged 90 percent. Accuracy was constantly checked by preparing procedural blanks and standards on material similar to that being analyzed and by referring each sample to these blanks and standards for comparison. The true mean at the 90-percent confidence limit for a 20 ppb standard is between 22 and 17 ppb (F. S. Fisher, written commun.). Values at 10 ppb are almost as good, and those at 100 ppb are considerably better.

Table 8.—Gold content of alluvium derived largely or entirely from pre-Harebell rocks

Locality	Material	No. of samples	Au content (ppb) Range	Au content (ppb) Average
22, 25 26, 27, 28, 29.	Stream sediments, landslide and glacial debris from Paleozoic and Mesozoic rocks in Gros Ventre Mountains	24	<10-50	11.3
43	Stream sediment. Drainage from Precambrian granite of Wind River Mountains and in part from Wind River Formation	2	<10-70	35
47	Glacial debris left by glacier that flowed southward from Gros Ventre Mountains along valley of Granite Creek	2	20-80	50.0
48	River gravel in Hoback River at U.S. 189 southeast of Bondurant	2	<10	<10

Apparatus and reagents

Atomic absorption spectrophotometer. The instrument used in this work was a Perkin-Elmer 303.

Shaker capable of handling 25- by 200-mm screwcap test tubes.

25- by 200-mm screwcap test tubes.

Water bath.

Centrifuge.

Sodium peroxide.

0.25-percent sodium cyanide solution: Dissolve 2.5 g sodium cyanide in 1 liter of water.

1:1 HBr solution containing free Br_2: Add 1 liter of hydrobromic acid and 10 g sodium bromate to 1 liter of water.

Methyl isobutyl ketone (MIBK).

Procedure

1. Roast 15 g of sample 1 hr at 600°C. When cool, add 0.1 g Na_2O_2.
2. Add 30 ml 0.25-percent NaCN solution to 25- by 200-mm screwcap test tube. Heat tube and contents to 85° in a water bath.
3. When the sodium cyanide solution is hot, add the roasted samples containing sodium peroxide. Allow to digest a few minutes in the water bath.
4. Cap the tube and shake for 15 minutes. After shaking, allow the sediment to settle, and siphon or decant the solution into another 25- by 200-mm screwcap test tube.
5. Add 10 ml 1:1 HBr solution containing free bromine to sediment remaining in first test tube. Heat tube and contents to 85° on water bath. Cap and shake 5 minutes. Allow sediment to settle after shaking, and siphon or decant HBr into the same test tube containing the cyanide extract. (CAUTION: Use a hood. Hydrogen cyanide is liberated.)
6. Digest the combined cyanide and bromide solutions on the water bath at 85° for ½ hr. Allow the tube to cool to room temperature.
7. Add 10 ml MIBK and shake for 2 minutes. Centrifuge if necessary to get a sediment-free layer of MIBK. Determine gold content in the MIBK layer by atomizing MIBK in the atomic absorption spectrophotometer, referring to the blanks and standards as described below.

Preparation of blanks and standards

Standard gold cyanide solution: Prepare a stock solution containing 1 mg of gold per ml by dissolving 100 mg of gold with aqua regia and diluting to 100 ml. Prepare a stock cyanide solution containing 100 micrograms of gold per ml by neutralizing 10 ml of the aqua regia solution with sodium hydroxide and diluting to 100 ml with 0.25-percent sodium cyanide solution. Dilute the stock cyanide solution with appropriate volumes of 0.25-percent sodium cyanide solution to obtain daily working solutions containing 1 and 10 micrograms gold per ml.

Barren sample material: Roast 1 hr at 600°C several hundred grams of material known to contain less than a measureable amount of gold but similar in general composition to the samples to be tested.

Procedural blanks and standards: Add 15 g of barren sample material and 0.1 g Na_2O_2 to a series of screwcap test tubes. Prepare a series of blanks and standards containing 0, 10, 20, 50, 100, 500, and 1,000 ppb gold by pipetting 0, 0.1, 0.2, 0.5, and 1.0 ml of the standard containing 1 microgram gold per ml, and 0.5 and 1.0 ml of the standard containing 10 micrograms of gold per ml into the tubes (all the gold added is recovered in 10 ml MIBK; therefore each ml MIBK contains 1/10 of the gold added). Run these blanks and standards through procedure steps 2 to 7 exactly like samples, setting the atomic absorption instrument to obtain a reliable curve that spans the range of gold content of the samples to be analyzed. Determination of gold for each sample by atomic absorption should be preceded and followed by readings of the blank in order to verify instrumental stability. Refer to the standard curve after each 10th sample, and make instrumental adjustments if necessary.

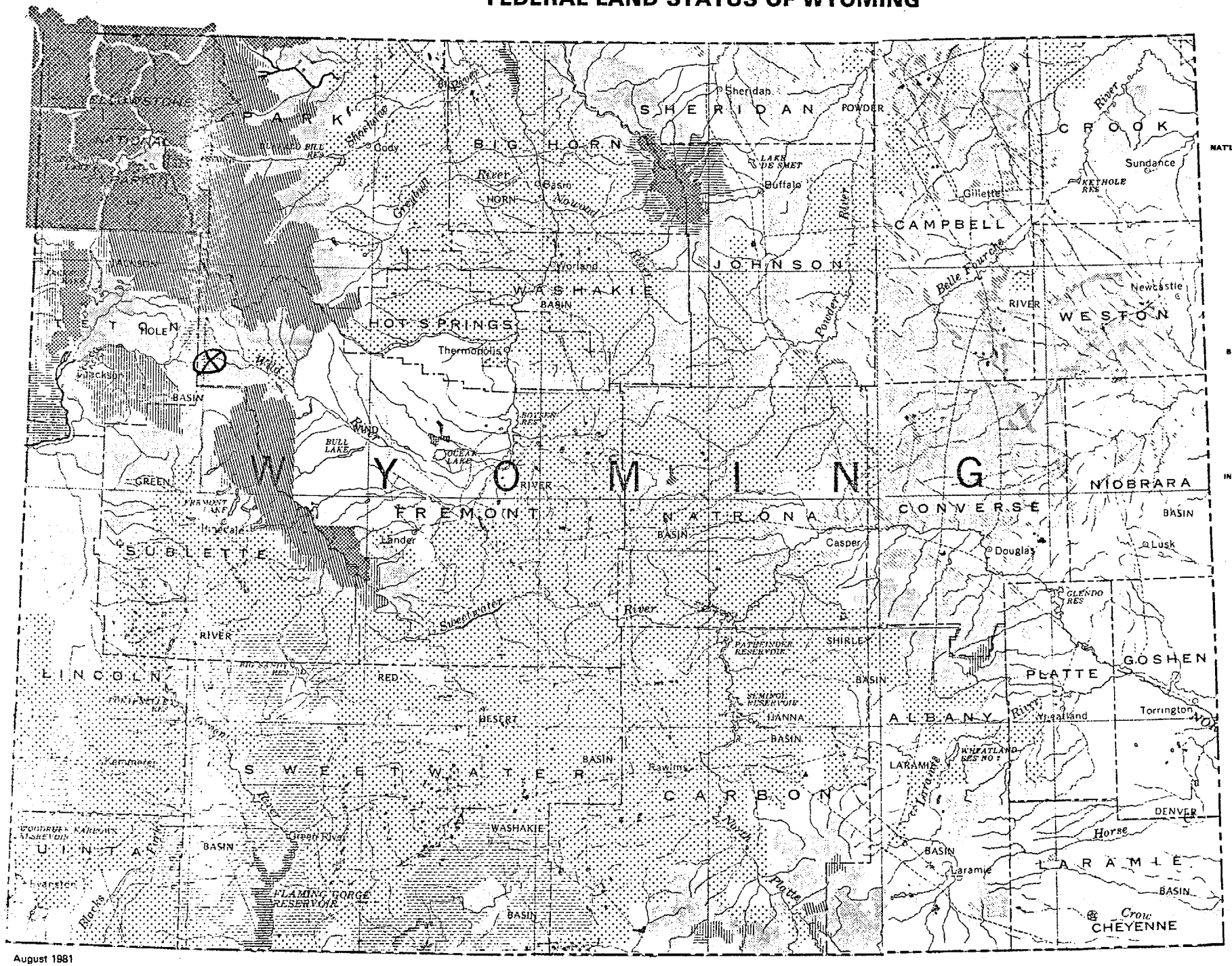
SAMPLING

We wish to emphasize that this report is not intended to present a resource appraisal but rather the preliminary results of geological and geochemical exploration. The objectives are to establish guides to prospecting, to locate areas that may warrant more detailed studies, and to obtain information on the source, areal distribution, and stratigraphic extent of gold. Consequently, the samples collected were small (1 to 2 lb), and preference was commonly given to sampling conglomerate matrix and sandstone lenses because previous analytical work showed that such samples are more likely to have concentrations of gold than are round stones. Round stones were included in samples of conglomerate but commonly were not in proportion to their abundance because of their size and the limitations on the weight of sample that could be collected. It is readily apparent that removal of pebbles and larger round stones from conglomerates will increase the gold content of the matrix material significantly.

A statistical analysis by A. T. Miesch (written commun., 1966) of grade and particle size shows that even with a definite sampling pattern, sampling problems are certain to occur. Experimental data obtained in the present study confirm the statistics and show that the

FEDERAL LAND STATUS OF WYOMING

Att D.



⊗ Location of best sample values in Wind River Fm

August 1981

ASARCO

Southwestern Exploration Division

File Gold Placers

WLK

May 22, 1985

Mr. R. L. Brown
New York Office

Nevada Gold Placers -
Selected Areas of Possible
Lode Potential

In my memo of 12-13-84 (Supergene Gold - a possible exploration lead), attention was called to certain placer deposits wherein the coarse gold had been derived from relatively fine, or micron gold occurrences in bedrock. It was proposed that placers within limited drainage areas ---- where the source was unknown, or not positively identified ---- could provide a means of tracking down hitherto undetected micron lode gold deposits.

All Nevada placers described in Geological Survey Bulletin 1356 (115 occurrences) have been checked out on available county geologic maps and in the literature which accompanied them. Those considered worthy of field investigation (17 areas) are listed below. Locations are shown on the map attached. As noted in the above-mentioned memo, there are undoubtedly many small uneconomic placers which are not listed in the literature. A search for these should definitely be included in all field investigations.

Incidentally, Bulletin 1356 reports small gold placers in the Fairfield District, Nye County ---- where the recently discovered Paradise Peak deposit is located. Hosted by rhyolitic flows and tuffs, the ore body reportedly contains 12 mil. tons of ±.10 oz. Au, 2 oz. Ag plus minor Hg.

Churchill County

1. Holy Cross - Location of placers not specified. Two samples of altered Tuff (bleached and silicified) from prospect in canyon south of Camp Terril ran 8.1 and 1.79 ppm Au with 100 ppm Ag (NBMG Bulletin 83, 1974). Extent of bleached silic. zones in tuff not stated.

2. Jessup - Small placer deposit on low hill near Valley King lode claims. 11 Samples from dump of lode prospect (bleached, silicified rhy.), located in NW part Sec. 20, T24N, R28E, averaged 3.19 ppm Au and 39 Ag. Areal extent of alteration in volcanics not stated (NBMG Bulletin 83).

Humboldt County

34. Sawtooth - 1½ miles WSW Antelope RR siding (map NBM Bulletin 59). Source: "unknown." Possible source in JTru (phyllites, slates, qtzite).

35. Dutch Flat - Placer also contains cinnabar and sheelite. Source: "gold from qtz veins in small grd stock." Possibly also derived from other sources in €h (Harmony fm.).

36. Gold Run - In Gold Run cr. Source: "veins, ls repl. deposits." Possible other sources: €p (preble fm), Osr (chert, argillite) and Ov (Valmy fm). Hot springs 3 miles south of placer.

37. Rebel Cr. & National - In (from S to N) Rebel, Willow, Pole and Canyon Crs. Source: "minor gold-silver-copper lead deposits of Laramide age, or gold-silver deposits - late Tert." The only mines and prospects listed (NBM Bulletin 59) are 1 to 5 miles north of Canyon Cr. drainage ---- in Tba (basalts, andesite). Unknown gold lodes may exist in the Willow and Rebel Cr. drainages to the south, in JTru (phyllite, qtzite), Trw (sh, ls, ss) and Trs (slate, phyllite, ls, cg).

38. Varyville - In NW fork of Leanord Cr, 3 miles north of Leanord Cr. Ranch. Source: "unknown." Possible sources in JTru (phyllites, slates, qtzite) and/or TKg.

Lander County

47. Bullion - In Mud Springs Gulch - in Ds (chert and siltstone) and Ov (Valmy fm).
Source: Reportedly derived from veins in Tg (2 miles west), but no mines or prospects shown on map (NBMG Bulletin 88) in that area; thus the source could be in the Devonian and/or Ordovician sediments.

48. Hilltop - In Crum Canyon.
Source: "Probably from veins in chert and qtzite in Valmy fm." Should be field checked in view of its proximity to Bullion placer.

Lyon County

57. Buckskin - Placers E & NE of Buckskin mine.
Source: "Gold may have been derived from (deposits in) Hartford Hill tuff (to the west) rather than from deposits in Jurassic sediments intruded by Cret. gr. (or the Buckskin copper-gold mine in andesite)." Only one lode prospect in rhyolite shown on map (NBMG Bull. 75) 2 m. N of Buckskin Mine.

Pershing County

88. Antelope - 3 Placers, about 1 mile apart, located SE of Majube Hill in the E edge of JTra (slate, phyllite, hnfls & qtzite) outcrop, (NBMG Bulletin 89).
Source: "unknown." Probable source to west, but no gold prospects indicated on map.

89. Placeritas - In Qts (older gravels).
Source: "unknown." Possible source: in Ts (sediments) to west, or JTra to E. Nearby source indicated by coarse nature of placer gold.

90. Rosebud and Rabbit Hole - On NE and WSW slopes of Rosebud Peak, Coarse Gold Canyon, Red Gulch, Long Gulch (tributaries of Rosebud Canyon) and Rabbit Hole Creek.

Source: "Probably derived from veins in northern Kamma Mts. (in rhyolite)." However, source is essentially unknown.

97. Sierra - In Rockhill Canyon which drains area of Mi (ss, cg, qtzite, slate, ls), Ov and Jgd. Source not identified.

98. Willow Cr. - Gold placers in Spaulding Canyon, 5 miles SE of Willow Cr. placers (Bulletin 89). Not mentioned in Bulletin 1356. Spaulding Canyon drains area of Ov (Valmy fw) and Trm (metasediments, including marble and slate). No lode prospects shown on map (Bulletin 89) in Spaulding Canyon drainage.

102. Star - In Star Cr. in Trpml (sh, slate, ls, ss) and Trl (greenstone). Silver prospects upstream, but no gold lodes identified.

White Pine County

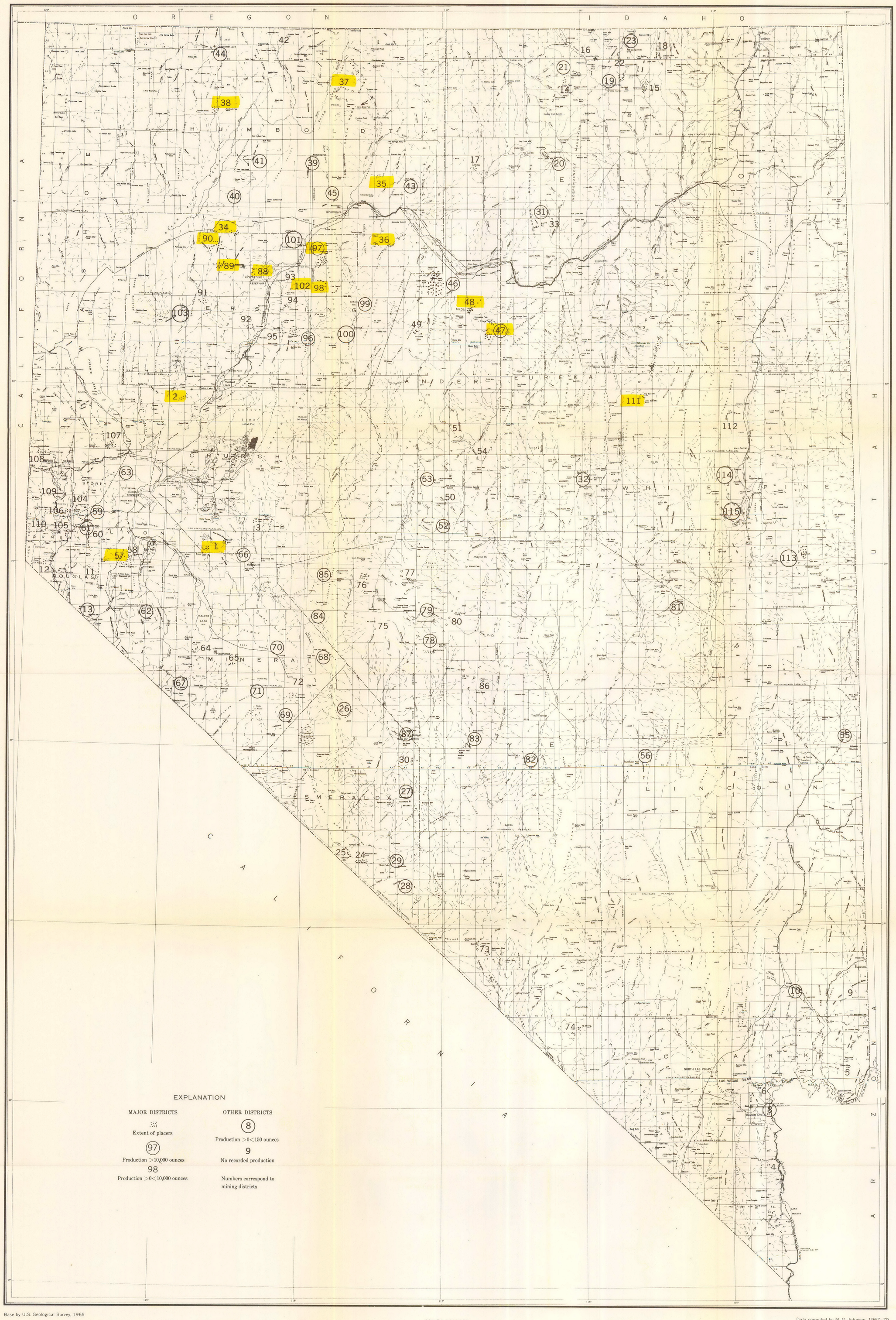
111. Bald Mt. - In Water Canyon.
Source: "Probable source from veins in Tert. qm, yet the placer gold is said to be coarser than the gold from these veins." Possible source in €m and €u (ls, sh).

J. H. Courtright
J. H. Courtright

JHC:mek

Att. Map accompanying
Bulletin 1356

cc: W.L. Kurtz
J.D. Sell
P.G. Vikre (2) (Plus one copy of Bulletin 1356)



Base by U.S. Geological Survey, 1965

SCALE 1:1 000 000

25 0 25 50 MILES

25 0 25 50 KILOMETERS

Data compiled by M. G. Johnson, 1967–70

MAP SHOWING REPORTED LOCATION OF PLACER GOLD DEPOSITS IN NEVADA

KEY TO PLACER DEPOSITS

Locality No.	District	Total estimated gold production, in ounces
1	Holy Cross	100
2	Jessup	5
3	Sand Springs	10
4	Eldorado Canyon	470
5	Gold Butte	10
6	Las Vegas	43
7	Searchlight	50
8	Boulder Dam	1
9	Bunkerville	0
10	Muddy River	6
11	Mount Siegel	6,000
12	Genoa	100
13	Mountain House (Pine Nut)	4
14	Centennial	30
15	Charleston	500
16	Cope (Mountain City)	<250
17	Gold Circle (Midas)	58
18	Jarbidge	10
19	Island Mountain	41,000
20	Tuscarora	36,000
21	Van Duzer	10,000
22	Alder	Unknown
23	Gold Basin	Unknown
24	Lida (Tule Canyon)	3,000–5,000
25	Sylvania	500
26	Desert	29
27	Goldfield	123
28	Gold Mountain (Tokop)	2
29	Hornsilver	16
30	Klondyke	Unknown
31	Lynn	10,000
32	Eureka	2
33	Maggie Creek	Unknown
34	Sawtooth	1,000
35	Dutch Flat	4,500
36	Gold Run	2,000
37	Rebel Creek and National	Unknown
38	Varyville (Leonard Creek)	200
39	Awakening	25
40	Dunnashee	10
41	Jackson Creek	4
42	Kings River (Disaster)	5
43	Potosi	28
44	Warm Springs	25
45	Winnemucca	130
46	Battle Mountain	156,000
47	Bullion	11,000
48	Hilltop	231
49	McCoy	41
50	Birch Creek	0
51	Iowa Canyon	0
52	Kingston	3
53	Reese River	3
54	Steiner Canyon	0
55	Eagle Valley	2
56	Freiburg	13
57	Buckskin	100
58	Yerington	250
59	Silver City	90,000–100,000
60	Como	Unknown
61	Eldorado Canyon	3
62	Pine Grove	3
63	Talapoosa	4
64	East Walker	235
65	Hawthorne	204
66	Rawhide	10,000
67	Aurora	4
68	Bell	2
69	Candelaria	46
70	Santa Fe	12
71	Silver Star	21
72	Telephone Canyon	5
73	Bullfrog	45
74	Johnnie	500
75	Cloverdale	100
76	Ione (Union)	100
77	Millett	23
78	Manhattan	210,000
79	Round Mountain	232,000
80	Belmont	0
81	Currant	1
82	Eden Creek	7
83	Ellendale	2
84	Fairplay	~10
85	Lodi (Mammoth)	33
86	Longstreet	5
87	Tonopah	2
88	Antelope	700
89	Placerites	2,500
90	Rosebud and Rabbithole	8,000
91	Seven Troughs	250
92	Trinity	100
93	Imlay (Humboldt)	1,000
94	Unionville	200
95–96	Rochester and Spring Valley	511,000
97	Sierra	200,500
98	Willow Creek	4,000
99	Goldbanks	5
100	Kennedy	34
101	Mill City	124
102	Star	50
103	Staggs	7
104	Comstock	1,000
105	Carson River	<100
106	Jumbo	50
107	Olinghouse	~2,000
108	Peavine	~200
109	Galena	<25
110	Little Valley	5,000
111	Bald Mountain	<10
112	Cherry Creek	<10
113	Osceola	95,000
114	Granite	27
115	Robinson (Ely)	9

✓ Copy for P&Y ob sent 6/7 mk
file mk Gold Placers

ASARCO

Exploration Department
R. L. Brown
Vice President

June 5, 1985

Mr. J. H. Courtright
Southwestern Exploration
Division
Tucson, Arizona

Nevada Gold Placers

Dear Harold:

I have your May 22nd note and the attached map, whereon you have plotted the location of gold placers in Nevada. You are suggesting that these placers might lead to as yet undiscovered sources of gold in bedrock and that logic seems undisputeable to me.

Graybeal tells me that he had been planning to do that job and that Vikre also had been planning to do it, so that this contribution seems especially appropriate and is certainly very much welcomed by them.

As it happens, we plan to have Fletcher, Gale, Olson, and Lancaster, working in Nevada on a part-time basis this summer. They will probably spend time following up the leads you have developed in your memo, which I hereby heartily thank you for.

Yours very truly,

Dick

R. L. Brown

cc: W. L. Kurtz

RECEIVED
JUN 7 1985
EXPLORATION DEPARTMENT

ASARCO

Kern Co Gold Placers

Southwestern Exploration Division

November 7, 1985

R. L. Brown
New York Office

Kern Co., Gold Placers----
Selected Areas of Possible Lode Potential

All placers listed in California Division of Mines and Geology, County Report 1, have been reviewed and 15 occurrences selected as being worthy of field examination. No Carlin type deposits are apparently known in the county; however, the vein stockwork deposits of the Rand District are of substantial size.

The map attached shows all lode gold deposits as open circles and all placer (and copper) deposits as solid black dots. The 8 placers with numbers referred to in the following are fringed in red. The other placers (A, B, C, etc.) are not shown on the map, but their approximate locations are provided, as well as large scale topo maps to aid in the field investigations. It should be emphasized that the prime objective in the field is not the evaluation of the placer potential, but identification of the bedrock gold source----which might be an undiscovered lode deposit, large or small.

124. Big Four Claims. In terrace gravels. Probable source: auriferous sedimentary rocks of the Paleocene Goler and Pliocene Ricardo Fm. which underlie the placer gravels on this property. Located N of El Paso Mts. within a group of several placers worked by dry washing in the 1890's.

134. Boulder Claim. At base of Quaternary gravels, located in area of No. 124. Bedrock is Goler Fm. and Mesozoic qtz monz.

146. Chamberlain Grp. Gold at base of Quaternary gravels in Goler Gulch, Eastern El Paso Mts. Several placers in this area. Source of gold may be Goler Fm. which is the bedrock in the upper half of the drainage (Geol. Map, Trona Sheet). An alternative source is gold veins in metavolcanics, located in center of Section 2.

173. Fredle Claim. Gold at base of Quat. gravels. Bedrock is Goler Fm. Located in area of 124.

180. Gladys Prospect. At base of alluvium. Located along east edge of small, shallow valley. Developed by adit driven on bedrock. Presence of gold not confirmed.

204. Greenhorn Caves. Gold bearing quartz gravel in open crevice channel along fault zone which strikes across Fremont Cr. 1 Mile N of Kern Rv., about 2 miles W of Hot Springs. Source unknown. No lode deposits reported on Fremont Cr., or elsewhere in vicinity. Cretaceous granitic bedrock.

245. Klondike Group. In stream gravels and fanglomerates. Near gold bearing NW shear zones which may be source of placer. Check shear zones for possible lode potential. Also, other possible sources for placer should be investigated. Located about 1 mile ENE of Redrock.

Precise locations were not given for the following placers which are described as "gold in alluvium." Some of these may be "eluvial" placers wherein the gold is relatively close to the bedrock source.

A. Black & Sullivan Mine. Gold in alluvium. Worked as dry placer in 1890's. Reported to be in Redrock District, in Redrock canyon.

B. Bonanza. Gold in alluvium (Pleistocene gravels) dry placer. Idle since 1939. Reported to be in El Paso Gulch, 2 miles E of Redrock

C. Last Chance. Gold in alluvium. Reported to be in Sec. 4 and 5, T29S, R38E, not confirmed. May be in vicinity of where Last Chance Canyon bends from W to S.

D. New York. Gold in alluvium, dry placer. Reported in Redrock District may be near no. 326, the Ricardo placer where the gold was presumably derived from conglomerates of the Ricardo and Goler Fms.

E. Rattler. Gold in alluvium. Reported to be Sec. 11, T29S, R39E, Goler District.

F. Sand Turtle. Gold in alluvium. Reported to be in same section as Rattler. Dry placer.

G. Side Hill Wedge. Gold in alluvium. Reported to be in Sec. 12, T29S, R39E, Goler District.

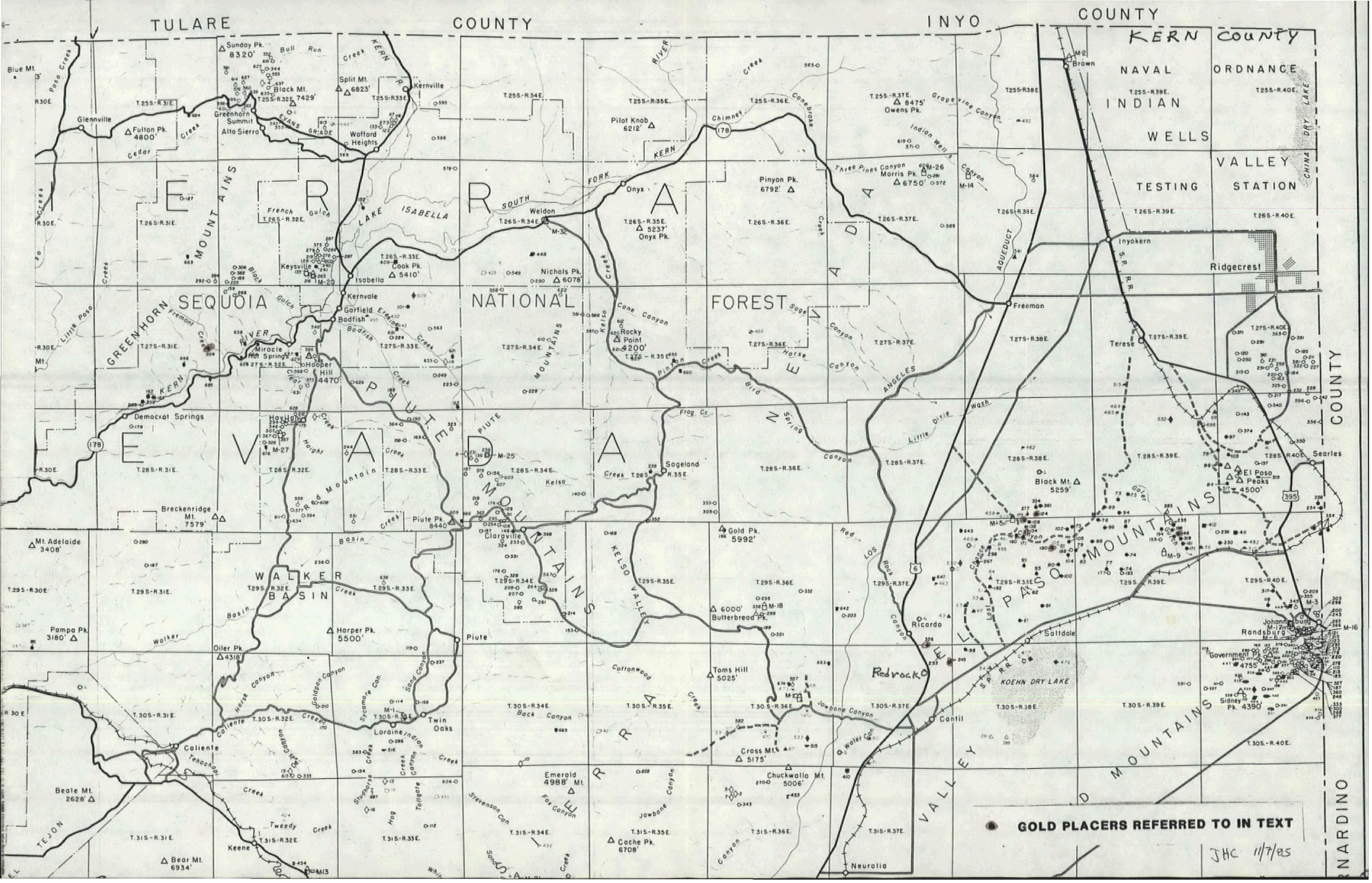
H. Sidewinder. Gold in alluvium. Reported to be in Sec. 2, T29S, R39E.

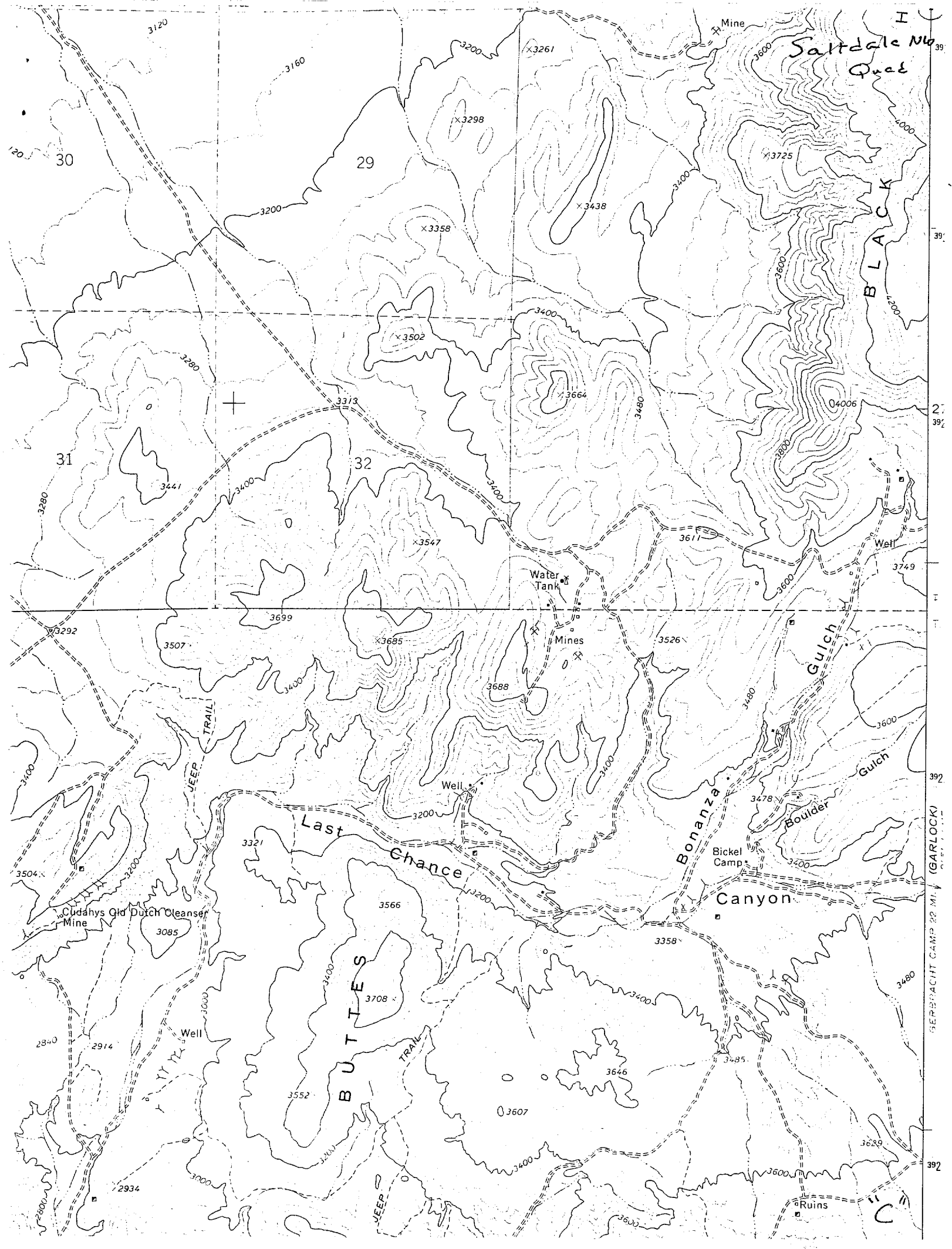
J. H. Courtright

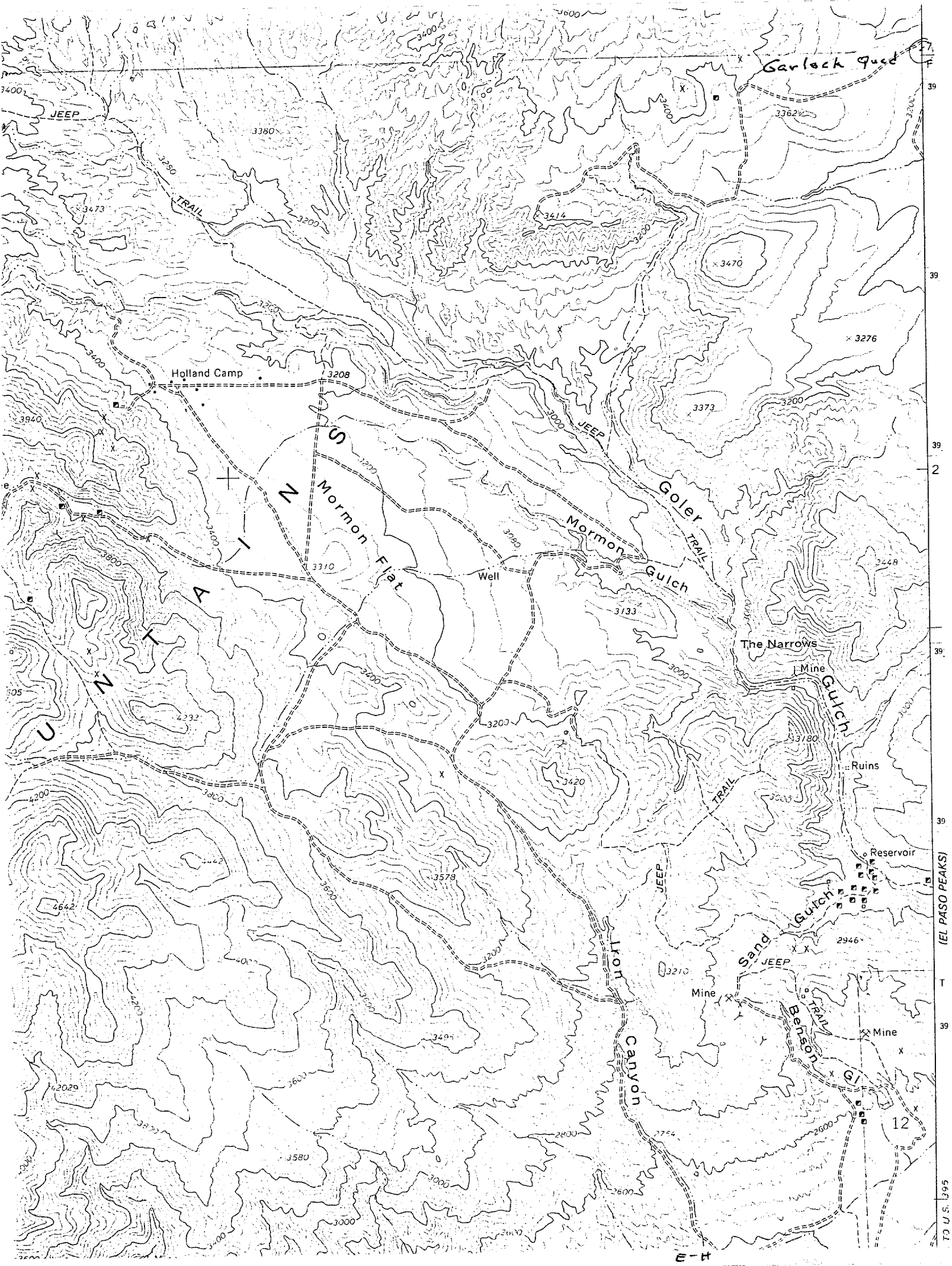
J. H. Courtright

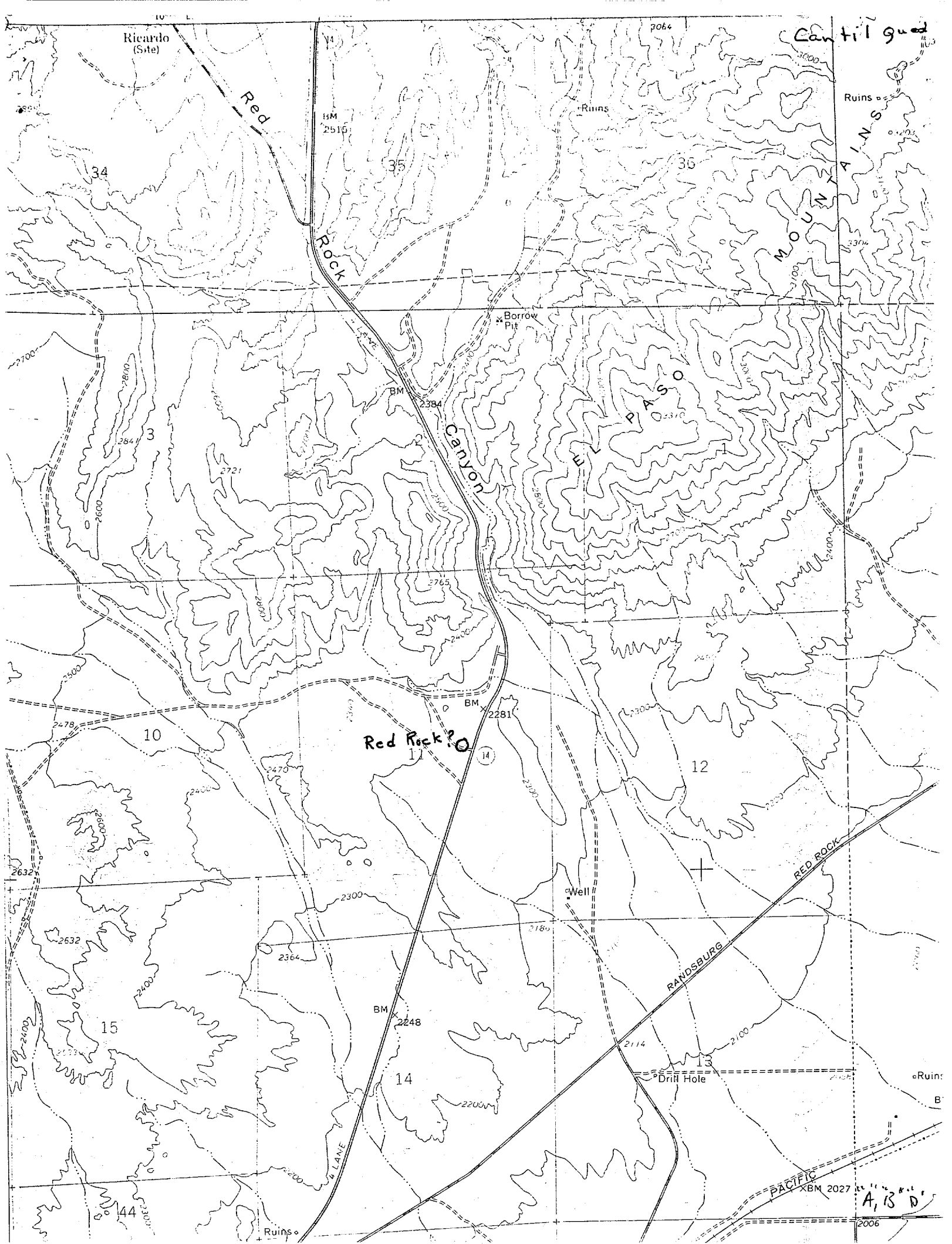
JHC:mek
Att.

cc: W.L.Kurtz
J.D.Sell (1 extra)
P.G.Vikre


TULARE COUNTY
INYO COUNTY
KERN COUNTY
SAN BERNARDINO COUNTY
SIERRA NEVADA
SEQUOIA NATIONAL FOREST
GREENHORN MOUNTAINS
SOUTH FORK KERN RIVER
LAKE ISABELLA
PIUTE MOUNTAINS
WALKER BASIN
KELSO VALLEY
TEJON
LOS ANGELES
AQUEDUCT
S.P. R.R.
NAVAL ORDNANCE INDIAN WELLS VALLEY TESTING STATION
CHINA DRY LAKE
KOEHN DRY LAKE
Redrock
Sunday Pk. 8320'
Bull Run
Black Mt. 7429'
Split Mt. 6823'
Kernville
Glennville
Fulton Pk. 4800'
Greenhorn Summit
Alto Sierra
Wofford Heights
Pilot Knob 6212'
Chimney
Cane Brake
Owens Pk. 8475'
Grapevine Canyon
Indian Wells
Three Pines Canyon
Morris Pk. 6750'
Pinyon Pk. 6792'
Onyx
Onyx Pk. 5237'
Weldon
Keysville
Cook Pk. 5410'
Isabella
Nichols Pk. 6078'
Kernvale
Garfield
Bodfish
Rocky Point 4200'
Miracle Hot Springs
Hooper Hill 4470'
Democrat Springs
Havilah
Sageland
Piute Pk. 8440'
Claraville
Gold Pk. 5992'
Butterbread Pk. 6000'
Toms Hill 5025'
Cross Mt. 5175'
Chuckwalla Mt. 5006'
Emerald Mt. 4988'
Cache Pk. 6708'
Ricardo
Saltdale
Cantil
Neuralia
Brown
Inyokern
Ridgecrest
Freemon
Terese
Black Mt. 5259'
El Poso Peaks 4500'
Searles
Randsburg
Johannesburg
Government Pk. 4755'
Sidney Pk. 4390'
Breckenridge Mt. 7579'
Mt. Adelaide 3408'
Pampa Pk. 3180'
Oiler Pk. 4318'
Harper Pk. 5500'
Twin Oaks
Loraine
Caliente
Beale Mt. 2628'
Bear Mt. 6934'
Keene
Tweedy
Piute
GOLD PLACERS REFERRED TO IN TEXT
JHC 11/7/85


Saltdale NW Quad
Mine
BLACK
Water Tank
Mines
Well
Gulch
Bonanza
Boulder
Gulch
Bickel Camp
Canyon
Last Chance
JEEP TRAIL
Cudahys Old Dutch Cleanser Mine
BUTTES
JEEP TRAIL
Ruins
(GARLOCK)

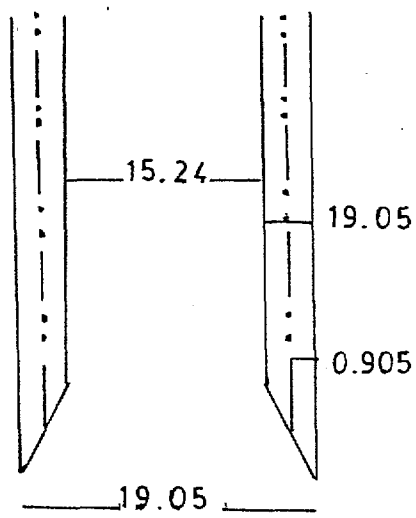

Garlock Quad
JEEP
TRAIL
Holland Camp
Mormon Flat
Well
Mormon Gulch
Goler
The Narrows
Mine
Gulch
Ruins
Reservoir
Sand Gulch
Iron Canyon
Benson Gl
(EL PASO PEAKS)
TO U.S. 395


Ricardo
(Site)
Red
Rock
Canyon
EL PASO
MOUNTAINS
Ruins
Borrow
Pit
BM
2515
BM
2384
BM
2281
BM
2248
Red Rock?
Well
Drill Hole
RED ROCK
RANDSBURG
PACIFIC
4 LANE
34
35
36
3
1
10
11
12
13
14
15
44
2721
2765
2478
2632
2364
2114
2180
2006
A, B, D

link copy

Socio Amplucos
Merida de Dios

FACTOR DE ZAPATA



ZAPATA NUEVA

$$\text{CORE FACTOR} = \frac{19{\cdot}05^2}{15{\cdot}24} = \frac{362{\cdot}925}{232{\cdot}2576} = 1{\cdot}5625$$

$$\text{ZAPATA} = \frac{\pi(\cdot 19{\cdot}05)^2}{4}\ h = 1\,\text{Mt}^3\ \ h = 35{\cdot}08$$

ZAPATA MITAD DE USO

$$\begin{array}{r} 19{\cdot}05 \\ -\ 15{\cdot}24 \\ \hline 3{\cdot}81 \end{array}$$

$$\text{CORE FACTOR} = \frac{17{\cdot}24^2}{15{\cdot}24^2} = \frac{297{\cdot}2176}{232{\cdot}2576} = 1{\cdot}279$$

$$\text{ZAPATA} = \frac{\pi(\cdot 17{\cdot}24^2)}{4}\ h = 1\ \text{Mt}^3\ \ h = 42{\cdot}84$$

PROMEDIOS

$$\text{CORE FACTOR} = \frac{1{\cdot}5625 + 1{\cdot}279}{2} = \underline{\underline{1{\cdot}420}}$$

$$\text{ZAPATA (Depth)}\ \frac{35{\cdot}08 + 42{\cdot}84}{2} = \underline{\underline{38{\cdot}96}}$$

CALCULO DEL BOLETIN DE SONDAJE

Una vez calculado el factor de zapata (sf) 39, el calculo del volúmen central (F) 1.4 procedemos a llenar el boletín de sondajes donde podremos obcervar las diferentes correcáiones y cálculo

1.- Se inicia la perforación introduciendo el primer tramo a una profundidad de 1.0 m de avance y se ha obtenido una subida de 82cm la medida obtenida del cilindro ha sido de 112 cm. Se han contado 15 chispas de oro en la batea cuyo valor estimado es de 1.5 mgr.En éste caso no existe corrección

Pump Time	Depth Drilled		Core				Colors				Cilindro Vol. cm.	Corrections Mgs.	Est. Wt. Mgs.	Formation
Hr. Min.	Mt.	cm.	Avance	Before Pumping cm.	After Pumping		1	2	3	4				
09.05	1	00	1 00	82						15	112	/	1.5	Grava fina arena gruesa

2.- En éste caso los avances han sido de 25 cm. Se ha obtenido una subida de 14 cm. se han contado 5 chispas, la medida del cilindro ha sido de 26 cm., el peso estimado es de 0.5 mgrs. Se ha calculado una corrección positiva, la subida teórica es de 35.

$$\frac{\text{Peso estimado X subida teórica}}{\text{Subida}}$$

$$\frac{\text{Peso estimado X subida teórica}}{\text{Medida del cilindro}}$$

$$\frac{0.5 \times 35}{14} = 1.25$$

$$\frac{0.5 \times 35}{26} = 0.67$$

$$0.67 - 0.5 = 0.17 \ (+ 0.2)$$

09.21	1	25		25		14						5	26	+0.2	0.5	Grava gruesa arena media
09.36	1	50		25		18						15	28	+0.4	1.5	" " " "

3· - El tercer caso que nos ocupa se ha tenido un avance de 25 cm· y una subida de 18 cm·, se han contado 10 chispas cuyo peso estimado es de 1·0 milígramo, la medida del cilindro ha sido de 40 cm·, se ha calculado una corrección negativa·

$$\frac{1{\cdot}0 \times 35}{18} = 1{\cdot}9$$

$$\frac{1{\cdot}0 \times 35}{40} = 0{\cdot}87$$

$$0{\cdot}87 - 1{\cdot}0 = -0{\cdot}12 \ (-0{\cdot}1)$$

09.52	2	00		25		19					5	24	+0.2	0.5	Grava Gruesa, Arena Fina
10.21	2	25		25		18					10	40	-0.1	1.0	Grava Gruesa, Arena Fina

4· - En este caso se ha tenido un avance de 25 cm·, una subida de 22 cm·, se han contado 25 chispas (colores del Nro· 4) cuyo peso estimado es de 2·5 mgrs·, la medida del cilindro ha sido de 35 cm· en este caso no existe corrección debido a que la muestra recuperada equivale a 100%·

$$\frac{2{\cdot}5 \times 35}{22} = 3{\cdot}98$$

$$\frac{2{\cdot}5 \times 35}{35} = 2{\cdot}5$$

$$2{\cdot}5 - 2{\cdot}5 = 0 \ (\text{corrección cero})$$

09.45	1	75		25		22					25	35	-	2.5	Grava Gruesa, Arena Medio

Correcciones negativas y positivas dependiendo del caso hasta llegar a una profundidad de 3·5 metros donde los valores desaparecen se calculan de la manera antes indicada·

De los 3·5 metros hasta finalizar la perforación se obtubieron valores; a partir de la profundidad de 4·75 mts· se perforó en bed - rock o peña de base, el pozo se termino a 5·25 mts, empleandose 3 horas de perforación·

10·40	2	50		25	22						2	20	+0.1	0.2	Grava gruesa Trit. arena Fina
10.45	2	75		25	14						3	21	+02	0.3	Grava gruesa, arena media
10.50	3	00		25	15						5	15	+0.5	0.5	Grava gruesa, arena media
10.55	3	25		25	24						5	47	-0.1	0.5	Grava gruesa, arena media
11.00	3	50		25	25						7	26	+0.2	0.7	Grava gruesa Trit. arena Fina
11.05	3	75		25	22						-	20	-	-	Grava gruesa Trit. arena Fina
11.25	4	00		25	22						-	07	-	-	Grava gruesa Trit. arena Fina
11.31	4	25		25	19						-	25	-	-	Grava gruesa Trit. arena Fina
11.39	4	50		25	47	15					2	30	-	0.2	Rest. grava gruesa, arena Fina
11.45	4	75		25	25						-	20	-	-	Arcilla Roja (Bed - Rock).
11.50	5	00		25	27						-	68	-	-	Arcilla Roja (Bed - Rock).
11.56	5	25		25	30						-	51	-	-	Arcilla Roja (Bed - Rock).

Una véz finalizada la perforación se procedio a la limpieza del barril para recuperar el oro que se hubiese perdido del cilindro de muestra, la muestra recuperada es nuevamente medida en el cilindro de muestra, en el caso que nos ocupa la medida fué de 32 cm· y se recuperaron 2 colores cuyo peso estimado fué de 0·2 mgrs·

La sumatoria de corrección nos dió + 1·6 y la sumatoria de pesos estimados 9·9

	Limpieza del barril:										2	32	-	0.2	
													+1.6	9.9	

Se calcularon los tenores para una profundidad de 3·5 mts·

Para conocer el tenor de este sondaje antes de analizar la muestra en el laboratorio se procede de la siguiente manera practica:

$$\frac{\text{Peso estimado del Oro x factor}}{\text{Profundidad·}}$$

$$\frac{9{\cdot}9\ (\text{mgrs·})\ \text{x}\ 39\ (\text{factor})}{3{\cdot}5\ (\text{mts·})} = 110\ \text{mgrs/m}^3$$

DRILL •

Type & No. B. E - 22 W (1)
Size Drive pipe 5 3/4" (2)
Dia. Drive Shoe 7 1/2" (3)

TIME LOG. •

Moving 1.25 hrs (4)
Drilling 3.00 " (5)
Pulling 1.30 " (6)
Delays 0.30 " (7)
Total 5.85 " (8)

DEPTH, ETC. •

Water Level Playa (9)
Overburden — (10)
Gravel 4.75 (11)
To Bedrock 4.75 (12)
Penetrated Bedrock 0.50 (13)
Total Drilled 5.25 (14)
Type Bedrock Arcilla (15)

CALCULATIONS

Calc. Vol. 4.90 (16)
Meas. Vol. 4.20 (17)
Core Vol. 2.73 (18)
Drive Shoe Factor 39 (19)
Core Factor 1.4 (20)
Vol. Factor 0.0182 (21)
Est. Wt. Mgs. • 9.9 (22)
Wt. Gold Mgs. 15 (Peso real) (23)
+ 1.6 x 15 / 9.9
Correction × = + 2.4 (24)
Corrected Gold, Mgs. 17.4 (25)
Est. Fineness 730 (26)
U. S. $ per Fine Oz.
Wt. Black Sand Oz Minimo (27)
Bedrock elev. 4.75 (28)
Normal W. L.

PERSONNEL

Driller • Perforista (29)
Foreman •
Calc. by Calculado
Checked by Chequeado
Engineer in Charge Ingeniero

(= 194 mgs. per cu yd).
HOLE

1• - Tipo de perforadora

2• - Diámetro interior

3• - Diámetro exterior de la zapata

4• - Control

A• - De

8• - Tiempos

9• - Observaciones en el terreno

A• - medidas de profundidades y

15 - tipo de material del bedrock

16 - Profundidad x factor = 3•5 x 1•4 = 4•90

17 - E cilindro + barril

18 - E subidas a la profundidad de 3•5

19 - Factor de zapata 39•

20 - Factor F 1•4

21 - Factor vol• 0•0182

22 - Peso estimado del oro•

23 - Peso real•

24 - Corrección $\frac{\text{Peso real}}{\text{f}}$ + 2•4

25 - Peso real corregido (peso real + corrección) 15 mgrs + 2•4 mgr=17•4

26 - Fineza

27 - Peso de arenas negras•

28 - Elevación del bedrock•

29 - Personal•

$$\text{Ley o tenor} = \frac{17{\cdot}4 \times 39}{3{\cdot}50} = 194 \text{ mgrs/m}^3$$

$$\text{Ley o tenor} = \frac{\text{Peso real corregido x factor de zapata}}{\text{Profundidad}}$$

Tenor y mímero de sondaje

DATOS GENERALES DE ENCABEZAMIENTO

ENG. FORM

SOUTH AMERICAN PLACERS INC.

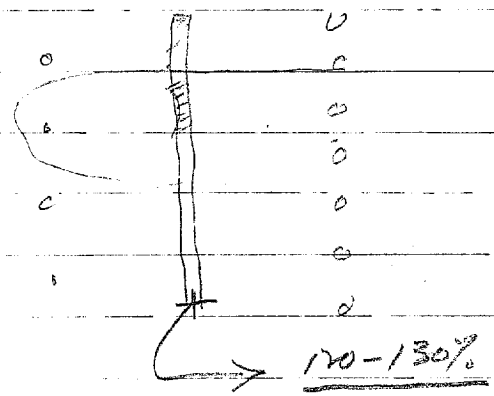
FIELD LO

Examination _____ Line _____ Hole _____ Sheet ____ of ____ Shee
Elevation Collar _____ Co-ord. N. _____, E _____ Date Started _____ 19__
Offset from Stake, Bear _____ ft. hor., ____ ft. vert. Date Compl. _____ 19__

7½"

6" → 5.731"

Radford — 100' (7½") — 1 cu. yd.



→ 5-7% +6

30% + 3/8"

70% − 3/8"

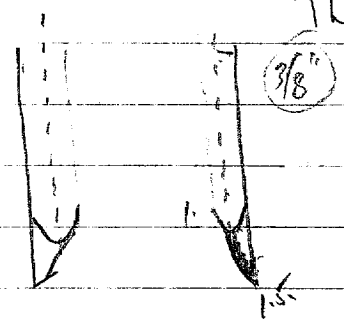
120-130%

23%

① Core Factor

Then: $\frac{7.5''}{6''} = 1.\frac{25}{36} = 1.5625$ ✓

1.4 +



3/8"

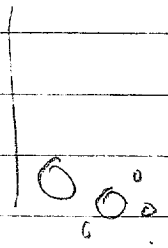
1.5

1.2 + ✓

② Shoe Factor (Depth)

1 cu yd. = 7.5" → 88 feet

100 feet



$\underline{25\,cm} \times 1.4 = \underline{35\,cm}$

$\underline{30\,cm}$

(A) Core

$\frac{1.9\,mgs}{30\,cm} \approx \frac{X}{35}$ $X = 2.2 - 1.9$

$= 0.3$

Mid Vol

(B) $\frac{1.9\,mgs}{23\,cm} \approx \frac{X}{35}$ $\cancel{X = 2.8}$

CONCLUSIONS ON THE PERCENT POSITIVE CORRECTIONS

A complete compilation of all the data with respect to drilling for gold dredging, we have for example, the time interval for each advance, the sample core, colors of gold, estimated weight and description of the material. In this case, I opted to make a summary of the positive corrections/and negative corrections of all the logs in the Huaypetue, Pukive, Caichive and the creeks and terraces.

Taking only the positive corrections, I took the respective percentages of each hole and of every line, seeing that the positive corrections were normal for the different rivers prospected.

Through a graph "Percentaje de Corrección Positiva, Versus Líneas (of the different rivers), and getting the average correction for each line and each river the data is as follows:

For Huaypetue River, average of	+ 22.0%
Pukive River, average of	+ 11.8%
Caichive River, average of	+ 10.2%
For the creeks:	
Qda. Aguajal, average of	- 0.08%
Qda. Sol de Oro, average of	+ 8.45%
Qda. Seca, average of	+ 6.0%
Qda. 4 Amigos, average of	+ 25.5%
Qda. Nueva, average of	+ 25.8%
Terrace I, average of	+ 7.4%

Note: The average percentage for all the creeks is 13.16%.

It is evident the good recovery of the samples from Huaypetue, Pukive, Caichive, Terrace I; with the Creeks it occurs that each line had a few holes, 2-3 holes, which indicate a maximum positive correction.

From: R. L. Brown

To: Bill Kurtz - Tucson

Background reading for Madre de Dios.

RLB

8/30/84

RECEIVED

SEP 4 1984

EXPLORATION DEPARTMENT

III THE PROJECT

3.1 Objective

The objective of this project is the exploitation of gold - bearing alluvial gravels in mining concessions owned by Cia. Aurífera Rio Inambari S.A. and Aurífera Pukibe S.A. on which - SAPI owns 84% of the shares - has outlined through a detailed drilling program initiated in February 1983, the existence of eighty million of cubic meters of alluvial gravels with an average tenor (grade) of 200 milligrams per cubic meter.

The placer mining concessions are located in the Province of Manú, Madre de Dios Department. Phisiographically the area is located on the lowest foothills of the eastern Cordillera de los Andes. The nearest city is Puerto Maldonado, the Capital town of Madre de Dios is located on the Amazonic Lowlands (300 A.S.L.) and constitute the principal river port along the Madre de Dios River (See location map).

The project considers the extraction and treatment of the gold-bearing gravels of the rivers Pukive, Huaypetue and Caichive as well as the terraces and neighboring creeks located inside the concessions. For this purpose bucket line dredges will be used. They will move * 57.0 million cubic meters with an average tenor (grade) of 225 milligrams during the first ten years of the project. In the future years, aditional reserves with a lower grade could be dredged if the market conditions and taxation are favorable.

3.2 The Concessions

The concessions covers an area of 31,790 hectares and were granted by the Peruvian Government in 1978 and 1979 to Aurife-

---

* as of July 16, 1984

ra Sur Oriente S.A. (AUSORSA) and Aurífera Claudia S.A. (CLAUDIA). Both companies are controlled by Messrs. David Ballón Vera and Hernando de Soto Polar, these were transferred to Cía. Aurífera Río Inambari S.A. and Aurífera Pukibe S.A. by mutual agreement, between South American Placers Inc. (SAPI) and AUSORSA-CLAUDIA celebrated on January 27, of 1983 (Annex A 2). This agreement establish a participation of 16% in the profits of the new companies for the AUSORSA-CLAUDIA grove. This participation was scheduled on this way due to taxation regime. This schedule represents the intention of paying a "Royalty" referred to the net earnings of the Company.

3.3 Geology

The gold-bearing gravels are secondary in origin. They originated as result of the rapid erosion of gold-bearing quartz veins hosted in schists, arquillites, quartzites and granites of paleozoic age, all these rocks making up the core and flanks of the eastern cordillera. Upstream of the project area there exist evidence of small mining (vein-type) since the incaic times. The erosional process of these veins (some of them eroded to its roots and no longer visible) as well the mechanical concentration has been a continued process since the middle tertiary when the eastern andean cordillera started to uplift. The concentration has been a repeated process since then, giving place first to coarse conglomerates on the vicinity of the areas being eroded and finer gravels and sand bars further away as erosion an time progressed in time. Several of the rivers and creeks having its headwaters or crassing the Ipururo group of late tertiary age show gold-bearing gravels. The perched gravels and conglomerates seen high up on the andes as well as the ipururo group fepresent the most clear examples of this process.

The Caichive and Huaypetue rivers seems to be result of a syn cline structure formed during the epeirogenic Quechua period. Their axis runs approximately parallel to the Ipururo group. This structure could represent in some way the structure of the basement. Several creeks of the region show the similar N 60º W strike.

The alluvial gravels seing evaluated by SAPI represents at least two cycles of erosion : (1) The gravels of the rivers and creeks are result of the erosion of Ipururo group and (2) the gravels seen on the terraces adjacent to the rivers and creeks. The gravels of the Tenaces are formed by an upper layer (horizont) white dull under which a reddish stained gravel bed is seen. The difference in color between these two horizonts could be result of a "Leaching process". These does not exist evidence that have occurred two different periods of deposition.

3.4 Reserves

The reserves determined up to date are sumarized on the following table :

ECONOMIC

MINING RESERVE SUMMARY - JULY 1984

Type	Vol.m3 (000)	Tenor mg/m3.	Recovered Troy O Z.	Product Value (000)	OPERATING Cost (000)	OPERATING Profit (000)	Total Exp. (000)	Gross Profit	Net Profit	Cap. Cost.
				3 DREDGE PLAN						
	43,340	231	266,334	83,429	36,132	47,297	29,919	17,378	15,753	17,819
				4 DREDGE PLAN						
	57,040	228	346,680	108,597	46,146	62,451	35,027	27,424	25,013	21,554

The ore reserves blocked out up to date is result of a very detailed work of drilling and projecting. This started on February 1983, is still in progress and consist of drilling churn holes along lives spaced 500 meters with 50 meters of distance between each hole. This pattern has been made alongthe axis of each river (Pukive, Caichive and Huaypetue). A similar pattern of drilling was used to evaluate the terraces and neighboring creeks.

The equipment used was churn drills Bucyrus Erie 20 W-22W. Its characteristics are :

- Maximum drilling depth : 100 meters.
- Drill vertical holes; not inclined;
- Skid mounted; in truck or steel derrick 12 mts. high; telescope Fype for lowering or pulling out the drill rods, the chisel and the pumping device. The churn drilling. The samble is result of the chisel and the casing shoe action.

The sampled gravel obtained is later checked through a selective treatment in a pilot plant. This is a small scale operation that duplicates the equipment of classification and gravimetric concentration of a dredge operation. The comparison between the tenors obtained by drilling and those with the pilot plant establish the grade of recovery (%) that will be applicable to the stage of exploitation. The chart # 7 is a summary of the results obtained by the pilot plant. This indicates the average gold recovery has been consistently above : 95%. For purposes of calculating the interval rate of return of the project a more conservative factor of 90% has been used. (Annex A4).

"Poor" hand samples; taken by driving a six inch pipe

RECUPERACIONES PLANTA PILOTO

Ubicación	Tenor Recuperado	Muestreado	Recuperación %
Río Caichive	250	209	119.6
Río Caichive	64	62	103.2
Río Caichive	122	121	100.8
Quebrada Seca	250	156	160.2
Quebrada Seca	357	239	149.0
Quebrada Seca	232	87	266.6
Quebrada Seca	373	225	165.7
Quebrada Seca	139	140	99.2
Terraza I	129	110	117.0
Terraza I	165	230	71.7
Huaypetue	395	201	196.0
Huaypetue	211	88	239.0
Huaypetue	150	109	137.0
Huaypetue	83	161	57.5
Huaypetue	131	327	40.3
Promedio General			127.5

3.5 Production Plan

Based on the drilling done and the evaluation of the river courses and creeks to be excavated, a production plan for the three dredges (see plans of Annex B 2) and an estimated production of the fourth. Tabulatio Nº 8 shows the volume of gold bearing gravels to be dredged till 1995;

CUADRO N° 8

EXTRACCION DE GRAVAS AURIFERAS

(m3 000)

Year Año	Dredge #1 Draga # 1	Dredge #2 Draga # 2	Dredge #3 Draga # 3	Dredge #4 Draga # 4	Total TOTAL
1985	–	–	–	–	–
1986	1,180	705	–	–	1,885
1987	1,380	1,485	1,220	590	4,675
1988	1,380	1,560	1,440	1,280	5,660
1989	1,380	1,560	1,440	1,380	5,760
1990	1,380	1,560	1,440	1,380	5,760
1991	1,380	1,560	1,440	1,380	5,760
1992	1,380	1,560	1,440	1,380	5,760
1993	1,380	1,465	1,440	1,380	5,665
1994	1,380	1,465	1,440	1,380	5,665
1995	1,380	1,560	1,440	1,380	5,760
	13,600	14,480	12,740	11,530	52,350

On the basis of the grades calculated from drilling done, the volume of material to be dredged till 1995 shows an estimated production of 12.1 M grams, before applying factors for recovery and fineness, production which is detailed by dredge and by year in Tab. # 9.

CUADRO N° 9

PRODUCCION DE ORO EN BRUTO

(Gramos)

Año	Draga # 1	Draga # 2	Draga # 3	Draga # 4	TOTAL
1985	–	–	–	–	–
1986	341,020	176,250	–	–	517,270
1987	540,960	374,962	311,100	129,800	1,356,822
1988	538,200	370,500	348,480	281,600	1,538,780
1989	405,720	368,940	331,200	303,600	1,409,460
1990	375,420	375,960	313,920	303,600	1,368,900
1991	317,400	342,420	290,880	303,600	1,254,300
1992	345,000	343,980	275,040	303,600	1,267,620
1993	264,960	279,082	381,600	303,600	1,229,242
1994	245,640	215,355	367,200	303,600	1,131,795
1995	173,880	232,440	272,160	303,600	982,080
	3,548,200	3,079,889	2,891,580	2,536,600	12,056,269

The production in crude grams which is adjusted for factor of recovery - in this case, the aplication of a conservative 90% inspite of proving a higher percent of rècovery - The fineness of gold - 0.92 - in order to determine the production of the fine gold is shown in Tab. Nº 10.

3.6 Recovery and Treatment

3.6.1 Recovery

Material sizing studies and gold sizing which resulted from the pilot plant (Annex A 4), as well as the character and depth of the deposit to be dredged indicated by prospecting, indicates the feasibility of bucketline dredges of 8 cu. ft. capacity equipped with jigs for gold recovery. The dredge design will be done by Alluvial Dredges Limited of Paisley, Scotland, a world rekown dredge designing company of which Comsur's operating dredge in Ocuri, Bolivia was designed.

The basic characteristics of the dredges are; (Annex B 2)

- Capacity	:	130,000 cubic meters per month (550 hours/month)
- Bucketline velocity	:	28 Buckets per minute
- Max Digging Depth	:	8 meters below waterline
- Hull dimensions	:	32.5 meters of length; 16.0 meters of width; 2.4 meters of depth.
- Displacement	:	700 tons
- Draft	:	0.55 meters
- Revolving screen	:	2 meters diameter
- Distribution	:	2 tanks 6 outlets for each.
- Roughers jigs	:	16 units 44 x 44 type Yuba
- Cleaner jigs	:	
- Amalgam plates	:	
- Scarcager jigs	:	

Dredging of the gravels is done by a chain of buckets activated by electric motors coupled to gear reducers. The movements of the dredge is done by a system of steel cables anchored on

and attached to winches abond the dredge. The winches are also powered by electric motors.

3.6.2 Treatment

The gravimetric treatment of approx. 29% of the total volumen of material dredged which pass through the 3/8" Ø perforations of the revolving screen; the rest of the material (+ 3/8" Ø), is stracked by a *conveyor* belt back to the river bed at the stern of the dredge.

The treatment of the - 3/8" Ø materials is as follows :

- The material is passed on to a sump. The overflow of the sump returns to the pond by channels running to the stern of teh dredge. The underflow or solids in the sump is pumped up to 2 (two) distributors which fed the material by gravity to 16 rougher jigs. The jig overflow is channelled through sluices on both sides of the dredge of the stern.
- The product of the rougher jig cells is then feed gravimetric to concentrate tanks on each side of the dredge.
- The concentrates of each tank are pumped to the cleaner jigs. Each pump feeds into a dewatering cyclone and each cyclone feeds a cleaner jig of 2 cells. The jig overflow from the cleaner jigs on passed on to sluices on each side of the dredge back to the pond.
- The cleaner jig conc. is then again fed by gravity into concentrate tanks. The cleaner jig conc. are fed by a hydraulic elevator to a dewater cone. From the dewatering cone, the concentrates are transferred by gravity to 2 (two) jackpots (mercury cones), installed at the end of each amalgamating table where the material gold is mixed with mercury and

amalgam is formed. The overflow of the jackpots by means of a number of ut-tubes flows at the head of the two amalgamating plates.

- The amalgaman plate overflow is the passed on by gravity to the scavenger jig. The conc. from the first cell of the scavenger passes to a concentrate barrel. The product of the second cell is recircuited to the cleaner jigs.
- The jackpot and amalgamating table overflows are circuited back to the scavenger jigs.
- The amalgam product is retorned. The sporge gold is then smelted to gold bars. No refining is done.

It should be noted that gold recovery from gravels on the dredges is by means of classification and gravimetric concentration of the material without any chemical reagents. Wigh respect to amalgamation all precautions will be taken to avoid losses of mercury in the jackpots and amalgamating tables. Also it should be noted that the separation of gold and mercury in the retort is a rapid process by water cooling, which in no way causes any enviromental polllution.

3.7 Infrastructure

The access from the pacific coast till the concessions is by the road Cuzco-Puerto Maldonado, one of its branches reaching Puerto Mazuco. This village is located on the right back of Rio Inambari and is connected with the road of the project through a ferry boat system. The fluvial access from Brazil is through Bolivia following the upper course of Rio Madre de Dios till Puerto Maldonado., to increase the accessibility to the project's area a 1000 meter long air ship has been built and one airplane Aero Commander has been purchased. This system will provide a fast access from Puerto Maldonado which have a daily commercial aero service from Lima and Cuzco.

Up to date, the personnel in charge of the exploration is living in a small campsite equiped with an electric power plant and a radio station. Clearing up the site where the new campsite will be located is in progress.

The infraestructure and the facilities the project will have considers the extension of the present airstrip, the construction of a new one on the vicinity of the base camp for the operation of the first dredge, the improvement and construction of new roads, the construction of workshops, warehouses, generating plant (diesel) and the installation of an hydroelectric power plant. (Annex A 5).

The social infraestructure considers the building of houses and offices for the manager, staff personnel, hospital and sport faiclities.

IV MARKET AND COMMERCIALIZATION

4.1 Market

The world gold production estimated for 1983 of 1,400 metric tons (TM) was monthly covered (approximately 80%) by South Africa and the Soviet Union, the remaining percentage was covered by other countries such as Australia, Domicican Republic, United States, Brazil, Colombia and others.

The gold market reacts basically to two fundamental mechanicsims :

(1) The physical gold and (2) gold futures. The physical gold is marketted by producers, jewelry fabricators, and traders of gold ingots. This market could be suseptible of variations in the world stock of physical gold (60,000 TM) as one minimal amount of this gold traded could mean substantial increments in the de-

mand that could not be easily covered because the demand of fabricators and industry absorbs approximately 1,100 Tons of the 1,400 tons. produced every year. The transactions in the stock market for the gold futures are made principally in London, Singapur, Now York and Sidney. These exceed in value that equivalent to 3,000 TM per year and this indicates that their influence in the market of the physical gold is significative.

4.2 Gold Production of the project

The gold output of the Madre de Dios project establish, for a project life of ten years a total amount of ten metric tons of gold. The yearly average will be less than 0.1% of the world production, therefor its influence in the world market will be us significative.

If the Peruvian production are kept in the levels of 1983 (5.1 metric tons) the incidence of the project will be approximately 20% of the yearly production.

4.3 Prices

Trying to establish a system for projecting the gold prices is rather than impossible because the world market is dominated by speculators and trades of future stocks which interests play an important role in trading. Another factor of importance in this market is the demand of most of the countries to keep it net reserves as solid gold at its central Banks, whreas the offer of the gold producers, its costs and other factors have no major incidence in the price. Therefore, the historic trend of the last years are not trustable to establish the future prices of gold.

In consequence, it is believed that the factibility of the project must be analyzed in reference to the prices used for the projections, having in mind that in spite of the differences in-

troduced in the sensitivity analysis, the project can accomplish with the debt service.

4.4 Marketing

Accoding to the article # 34 of the general law of mining (Legislative Decree # 109) the marketing of the solid gold or semi-finished correspond to the Banco Minero del Perú. Presently this commercialization is made by the Bank who pays to the gold producers in Peruvian soles. However, the article # 24 of the law of auriferous promotion (Decree -Law # 22178) gives rights to the Dirección General de Minería to authorize, previous accomplishment of some conditions, to the title holders of mining activities to sell in the international market (overseas) part of its gold production (Annex A 6).

Legal steps to get this Decree Law (22178) valid for the project are in progress on this way the Banco Minero del Perú will not market the gold output once contract authorizing the direct sale to overseas traders of the whole production required to pay the foreign debt plus a reasonable percentage of the gold produced.

On this way the project will able to :

- To celebrate contracts for selling gold on long term periods to banks and companies dedicated to the marketing of gold overseas; and
- To estblish fiduciary mechanisms with a bank of financial entity in foreign countries that would be responsible of the periodic payments to the institutions involved in the foreign credits.

PILOT PLANT - SAMPLING WITH CAISSONS

In order to determine expected recoveries of values with respect to values indicated by drilling caisson and pilot plant washing was done.

The caissons are circular gemgents of 3/16" Ø with diameters of 47 to 40 inches. Each section has 4 feet long. The caissons placed on the ground begining with the largest diameter and finishing with the smallest diameter, similar to a telescope; the difference between caissons to the next are 2" in the diameter. All the material inside the chissons on extracted manually and the water pumped out permitting a man to work in the bottom of the

For every 25 cm. advance a sample cut of 6" Ø similar to the drill pipe. The material from the 6" Ø was washed and concentrated separately from the material that came from the caisson.

The material obtained from caissons was treated in the pilot plant after determine the volume of the sample.

The pilot plant has a capacity of treating 5 cm.,met. por hora and duplicates in a scale the treatment plant which will be installed aboard the dreadge and constitutes basically of;

- Hopper
- Revolving screen with 3/8" Ø perforations
- Sump tank and sluice for the 3/8" material
- Rougher jig (24 x 24)
- Clearer jig

The conc. obtained from the clearer jig are sent to the lab. for amalgamation and final recovery of gold.

The gold recovered is weighed in a balance and this weight amd calculated will respect to the volume and compared to that obtained by the 6". The relationship between these two results, determine the percent of recovery of the plant with relationship to the drilling results of each point.

Besides these results, the treatment of the wash plant, material sizing of the material in the ground after classification and volume measurements after the revolving secreen.

The work of the pilot plant permitted us to recognize the diff. percentages of the different sized gravels as well as the gold grain granulometri.

Tabulation A shows the percent granulometric of the gravels.

Tabulation B shows the grunulometry of the gold grains. The gold fineness was determined by 2 different labs. and both samples were composite of samples from the rivers and terrazes Tab. C - D.

Sample Recovery

Some important points in drilling alluvials are :

1. Use short drivers
2. Do not drill below the shoe
3. Measure the core before pumping and measure the recovered core of each advance.
4. Try to obtain a normal vise in the pipe.
5. Keep a log (drill log)

The conservative procedure was to correct negatively for overcoming, but to correct positively 100 feet of advance (factor) was used get a one yard sample which corresponds to a core wise of 1.41' per foot of drive. When no positive corrections are use it is common that the pilot plant recovers values much higher their indicated by drilling. (Tab. E).

Schaland

we ✓ updated DREDGE COURSE (with Claims) 1/5000

✓ PLANO CATASTRAL CLAIM (not complete) 1/200,000

✓ PLANO GEOLOGIC WITH CLAIMS, DREDGE COURSE, DRILL LINES 1/57,700

✓ Terraza I - Terraza II 1/5000 4
1/5000 lt also profiles

✓ TERRAZA I - Rio Chaychuis 1/5000 t
1/5000 lt also profiles.

✓ Rio Caychuis Drill Line and wgln 1/10,000

Camp Layout 1/1000

Geology Regional 1/250,000

✓ mineralized areas 1/40,000

Dredge Plan 230 ltr 1:75

~~Airport 170 Ltr dredge 1:100~~

Calc. Structural Revisions May 1994

Quebrada Seca Lines calculations.

Review of Blocks (OSCAR)

Plant Bulk design

✓ Jaws Scubowski Reserve

✓ Example Preliminary Calculations

✓ Review Blocks Reserve' OSCAR July 30 August

✓ Review reserves
Comparision CAISSON August

Pilot Plant Caissons

✓ Preliminary Calculations Example

SA Mace Preliminary Calculations July 04

✓ Financial

✓ Shoe Tester

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MEMORANDUM

TO : W. H. Breeding

FROM : James Semborski

SUBJECT : Production Estimates/Dredge Courses

DATE : July 16, 1984

Per your June 21, 1984 Memo I have prepared production estimates for the three principle areas, Quebrada Seca, Rio Caychive and Rios Pukive and Huaypetue. The production estimate for the fourth area, Terrazas, was made from existing data, a summary of these estimates is attached.

The dredge courses were designed for a ten year mine life, with the first operation positioned to mine the highest grade area fist, the Quebrada Seca, with the second dredge in the Pukive/Huaypetue area and the third in the Rio Caychive. The fourth area, Lja Terrazas, lacked adaquate topographic control to justify detailed mine plans therefore, the production estimate was made from reserve estimates prepared by Oscar Kempff.

The general parameters used in the dredge course design are; minimum dredging depth three meters, a minimum tenor for the first five years of 200 mg/m3 and 120 mg/m3 thereafter. When a drill hole had to be recalculated to three meters, a zero valve was used for the underlying bedrock. The reserves were calculated by the use of weighted polygons or the mean area method of calculating reserves, high tenors were limited to one standard deviation, which was calculated separately for each area. Both the Quebrada Seca and Rio Caychive areas include estimated reserves as well as measured reserves. Estimated reserves include the upper Quebrada Seca, above line seven, and the lateral extensions of the existing exploration data and a downstream extension of the Rio Caychive to the Inambari.

The Pukive/Huaypetue area will be recalculated per our conversation on the subject. I will try to fit this in my schedule during early August.

STANDARD DEVIATION RESULTS

TENOR(Mg/M3)	RIO CAYCHIVE	QUEBRADA SECA	RIOS PUKIVE Y HUYAPETUE
Number of drill holes	84	126	199
Mean	247	285	253
Std. Dev.	111	214	98
One Std. Dev.	136-358	71-499	155-351
High value	629	1737	560
Low value	68	82	70
Ave. Depth (m)	4.02	4.68	3.68

VOLUME (CUBIC METERS)

YEAR	1	2	3	4	5	6	7	8	9	10	TOTAL
QUEBRADA SECA	1,180,000	1,380,000	1,380,000	1,380,000	1,380,000	1,380,000	1,380,000	1,380,000	1,380,000	1,380,000	13,600,000
PUKIVE-HUAYPETUE	1,410,000	1,560,000	1,560,000	1,560,000	1,560,000	1,560,000	1,560,000	1,370,000	1,560,000	1,560,000	15,260,000
CAYCHIVE	1,220,000	1,440,000	1,440,000	1,440,000	1,440,000	1,440,000	1,440,000	1,440,000	1,440,000	1,440,000	14,180,000
* TERRACE Nº 1	1,180,000	1,380,000	1,380,000	1,380,000	1,380,000	1,380,000	1,380,000	1,380,000	1,380,000	1,380,000	13,600,000

43.0 d

TENOR (MILLIGRAMS/CUBIC METER)

QUEBRADA SECA	289	392	390	294	259	230	250	192	178	126	260
PUKIVE-HUAYPETUE	250	255	220	253	229	210	231	150	144	154	207
CAYCHIVE	255	242	230	218	202	191	265	255	189	120	216
*TERRACE Nº 1	220	220	220	220	220	220	220	220	220	220	220

* ESTIMATED

QUEBRADA SECA AREA PRODUCTION ESTIMATE

YEAR	VOLUME (M3)	TENOR(MG/M3)
1	1,180,000	289
2	1,380,000	382
3	"	390
4	"	294
5	"	259
6	"	230
7	"	250
8	"	192
9	"	178
10	690,000 G. 126	
	690,000 G. 126 (Est.)	
	1,380,000	126

CAYCHIVE AREA PRODUCTION ESTIMATE

YEAR	VOLUME (M3)	TENOR(MG/M3)
1	1,220,000	225
2	1,440,000	242
3	"	230
4	"	218
5	"	202
6	"	191
7	"	265
8	1,080,000 @ 273	
	360,000 @ 200 (EST)	
	1,440,000	255
9	1,240,000 @ 200 (EST)	
	200,000 @ 120 (EST)	
	1,440,000	189
10	1,440,000	120 (EST)

PUKIVE - HUAYPETUE AREA PRODUCTION ESTIMATE

YEAR	VOLUME (M3)	TENOR (MG/M3)
1	1,410,000	250
2	1,560,000	255
3	"	220
4	"	253
5	"	229
6	"	210
7	"	231
8	1,370,000*	150
9	1,560,000	144
10	1,560,000	154

* INCLUDES 10 1/2 MONTHS PRODUCTION, 1 1/2 FLOTATION WITH NO PRODUCTION.

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PERU PROJECT INCOME STATEMENT - 3 DREDGES

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	TOTAL
Ounces		13,230	33,035	33,728	28,377	28,750	26,327	27,339	28,537	20,817	17,942	8,252	266,334
Gross at $350		4,630	11,562	11,805	9,932	10,063	9,214	9,569	9,988	7,286	6,280	2,888	93,217
Real'n 10.5%		486	1,214	1,240	1,043	1,057	967	1,005	1,049	765	659	303	9,788
Net Sales		4,144	10,348	10,565	8,889	9,006	8,247	8,564	8,939	6,521	5,621	2,585	83,429
Costs													
Direct		1,389	2,778	2,778	2,778	2,778	2,778	2,778	2,778	2,778	2,778	1,389	27,780
Indirect		622	773	773	773	773	773	773	773	773	773	773	8,352
		2,011	3,551	3,551	3,551	3,551	3,551	3,551	3,551	3,551	3,551	2,162	36,132
Operating Contb'n		2,133	6,797	7,014	5,338	5,455	4,696	5,013	5,388	2,970	2,070	423	47,297
G & A		150	150	150	150	150	150	150	150	150	150	150	1,650
D & D	59	920	1,628	1,679	1,692	1,726	1,725	1,785	1,774	1,807	1,841	1,183	17,819
Financial	509	1,272	1,525	1,525	1,474	1,296	1,016	710	406	152	25	-	9,910
Exploration		60	60	60	60	60	60	60	60	60	-	-	540
Total Expenses	568	2,402	3,363	3,414	3,376	3,232	2,951	2,705	2,390	2,169	2,016	1,333	29,919
Gross Profit (Loss)	(568)	(269)	3,434	3,600	1,962	2,223	1,745	2,308	2,998	801	54	(910)	17,378
Labor Ingemet 8.5%			-	292	306	167	189	148	196	255	68	4	1,625
Net Profit (Loss)	(568)	(269)	3,434	3,308	1,656	2,056	1,556	2,160	2,802	546	(14)	(914)	15,753

PERU PROJECT - CASH FLOW - 3 DREDGES

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	TOTAL
Source														
Net Income (Loss)		(568)	(269)	3,434	3,308	1,656	2,056	1,556	2,160	2,802	546	(14)	(914)	15,753
Dep'n Amort'n		59	920	1,628	1,679	1,692	1,726	1,725	1,785	1,774	1,807	1,841	1,183	17,819
Loans		6,790	3,380											10,170
		6,281	4,031	5,062	4,987	3,348	3,782	3,281	3,945	4,576	2,353	1,827	269	43,742
Application														
Working Capital		675	400	250	250									1,575
Property, Plant	1,449	7,961	5,887	300	100	100	100	190	610	300	100			17,097
Preoperating	722													722
Debt Repayment						679	1,696	2,034	2,034	2,034	1,355	338		10,170
	2,171	8,636	6,287	550	350	779	1,796	2,224	2,644	2,334	1,455	338		29,564
Cash (Required) Excess	(2,171)	(2,355)	(2,256)	4,512	4,637	2,569	1,986	1,057	1,301	2,242	898	1,489	269	14,178
Accum.		(4,526)	(6,782)	(2,270)	2,367	4,936	6,922	7,979	9,280	11,522	12,420	13,909	14,178	
IRR %														31.08
84% Basis				3,790	3,895	2,158	1,668	888	1,093	1,883	754	1,251	226	17,606
IRR %														25.05

Pear Project - Cash Flow - 3 Dredges

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	Total
Source														
Net Income (Loss)		(568)	(269)	3434	3308	1656	2056	1556	2160	2802	546	(14)	(914)	15753
Dep'n Amort'n		59	920	1628	1679	1692	1726	1725	1785	1774	1807	1841	1183	17819
Loans		6790	3380											10170
		6281	4031	5062	4987	3348	3782	3281	3945	4576	2353	1827	269	43742
Application														
Working Capital		675	400	250	250									1575
Property, Plant	1449	7961	5887	300	100	100	100	190	610	300	100			17097
Preoperating	722													722
Debt Repayment						679	1696	2034	2034	2034	1355	338		10170
	2171	8636	6287	550	350	779	1796	2224	2644	2334	1455	338		29564
Cash (Required) Excess	(2171)	(2355)	(2256)	4512	4637	2569	1986	1057	1301	2242	898	1489	269	14178
Accum		(4526)	(6782)	(2270)	2367	4936	6922	7979	9280	11,522	12,420	13,909	14178	
IRR %														31.08 0.19
84% Basis				3790	3895	2158	1668	886	1093	1863	754	1251	226	17.606
IRR %														25.05 0.11

Kay Project Income Statement - 3 Dredges

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	Total
Ounces		13230	33035	33728	28377	28750	26327	27339	28537	20817	17947	8252	246334
Gross at $350		4630	11562	11805	9932	10063	9214	9569	9988	7286	6280	2888	93217
Royal'l 10.5%		486	1214	1240	1043	1057	967	1005	1049	765	659	303	9788
Net Sales		4144	10348	10565	8889	9006	8247	8564	8939	6521	5621	2585	83429
Costs													
Direct		1389	2778	2778	2778	2778	2778	2778	2778	2778	2778	1389	27780
Indirect		622	773	773	773	773	773	773	773	773	773	773	8352
		2011	3551	3551	3551	3551	3551	3551	3551	3551	3551	2162	36132
Operating Cont'b'n		2133	6797	7014	5338	5455	4696	5013	5388	2970	2070	423	47297
G+A		150	150	150	150	150	150	150	150	150	150	150	1650
R+D	59	920	1628	1679	1692	1726	1725	1785	1774	1807	1841	1183	17819
Financial	509	1272	1525	1525	1474	1296	1016	710	406	152	25		9910
Exploration		60	60	60	60	60	60	60	60	60	-	-	540
Total Expenses	568	2402	3363	3414	3376	3232	2951	2705	2390	2169	2016	1333	29919
Gross Profit (Loss)	(568)	(269)	3434	3600	1962	2223	1745	2308	2998	801	54	(910)	17378
Labor Ingenuity 8.5%			-	292	306	167	189	148	196	255	68	4	1625
Net Profit (Loss)	(568)	(269)	3434	3308	1656	2056	1556	2160	2802	546	(14)	(914)	15753

Dredge #4 - Capital Expenditures

	1986	1987	Total
Dredge	1717	1717	3434
Lump	197	–	197
Equipment (last)	104	–	104
	2018	1717	3735

Capital Expenditures

4 Dredges and Dredging		21,554
Less Dredge 3 above		3735
3 Dredge Operation		
Preoperating	722	
Fixed Assets/Plant	17097	17819

Loan 1.5x equity

Peru Project - Loans + Interests - 3 Dredges

	Loans			Interest		
	#1	#2	Total	#1	#2	Total
1985	6790		6790	509		509
6	–	3380	3380	1018	254	1272
7	–	–	–	1018	507	1525
8	–	–	–	1018	507	1525
9	(679)	–	(679)	967	507	1474
1990	(1358)	(338)	(1696)	814	482	1296
1	(1358)	(676)	(2034)	610	406	1016
2	(1358)	(676)	(2034)	406	304	710
3	(1358)	(676)	(2034)	203	203	406
4	(679)	(676)	(1355)	51	101	152
5		(338)	(338)		25	25
				6614	3296	9910

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PERU PROJECT

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V REALIZATION COSTS - 10.5%.

PERU PROJECT - FIXED ASSETS EXPENDITURES

(US$ 000)

		List	105%	To Date Spent	1984	1985	1986	1987	1988/94	TOTAL
A	Dredge # 1									
	ADL Quote + 10%	2,585								
	Engineering	300								
	Freight and Erection	800								
		3,685	3,869			3,869				3,869
B	Dredge # 2/4									
	ADL Quote + 10%	2,420								
	Engineering	250								
	Freight and Erection	600								
		3,270	3,434			1,717	6,868	1,717		10,302
C	Camp # 1	2,055	2,158		375	1,205	578			2,158
	# 2	264	277			128	149			277
	Furniture	150	157			157				157
	Airplane and infrastructure	150	157		157					157
	Fuel tanks	95	100		100					100
	Shop Equipment & tools	155	163			163				163
	Lab. Equipment	27	28			28				28
	Dredge Tools	36	38			38				38
	Roads and Landing field	115	121			121				121
		3,047	3,199							3,199
	Heavy Equipment & vehicles	800	840		95	535	210			840
		3,847	4,039		727	2,375	937			4,039
	TOTAL A + 3 B + C	17,342	18,210							18,210
D	Spent to Date			722						722
E	Preoperating			722						722
F	Replacements						100	300	1,500	1,900
	T O T A L			1,444	727	7,961	7,905	2,017	1,500	21,554

```
*****************************************
**                                     **
**      MATERIAL COST ESTIMATE         **
**                                     **
**   PERU 230LTR DREDGE  6M D.D.       **
**                                     **
**        27TH OCTOBER 1983            **
**                                     **
*****************************************
```

CLIENT WILLIAM H. BREEDING & ASSOCIATES.INC

FIRST COUNTRY SOURCE OF SUPPLY	PERU/BRAZIL
SECOND COUNTRY SOURCE OF SUPPLY	U.K./U.S.A.
BUCKET SIZE	230 LITRES
MONTHLY THROUGHPUT(600HRS)	150000 CU.METRES
NUMBER OF BUCKETS	60
NUMBER OF LADDER ROLLERS	11
DIGGING DEPTH	6 METRES

CATERPILLAR FITTED NO IDLER FITTED NO

FEED SYSTEM PUMP STRIPPING FACILITY NO

HULL DIMENSIONS LENGTH 32.5 M BEAM 16 M DEPTH 2.4 M

SCREEN NO. OFF ONE DIA. 2 M PERF. LENGTH 8.4 M O/A LENGTH 12

JIGS	PRIMARY	SECONDARY	TERTIARY	CLEAN-UP
NUMBER OFF	16/2CELL	2/2CELL		1/2CELL

HULL DIMENSIONS LENGTH 32.5 M BEAM 16 M DEPTH 2.4 M

PUMP DUTY	NO. OFF	SUCTION DIA.	DISCHARGE DIA.
JIG	2	250	250
SPARGE	1	250	250
SLUICE	0	0	0
C.S.	1	150	125
PRIMARY CONC.	2	200	150
SECONDARY CONC.	2	50	38
TERTIARY CONC.	0	0	0
TAILINGS	0	0	0

PERU 230LTR DREDGE 8M D.D.

SUMMARY TABLE

TION	ESTIMATED WEIGHT	RATE/TONNE	COST
00	168.12	1354	227645
300	132.02	1461	192840
300	21.72	1650	35838
	103.34	4436	458448
400	121.96	2218	270543
	16.99	3277	55684
500	65.92	2961	195176
	.15	52000	7800
600	28.21	4080	115110
	41.00	5349	219309
700	39.15	5386	210849
	3.53	32253	113854
800	.38	4429	1683
	.75	10800	8100
900	0.00		
	SUMMARY TOTAL		
	587.48	2155	1266184
	165.76	5207	863195
	753.24 Tonnes	US$	2.129379

#1

2.129
221 Design
2350
235 10%
2585

#2/4

2129
71 Design
2200
220 10%
2420

PRESUPUESTO CAMPAMENTOS (4 DRAGAS)

	SUPERFICIE M2.	US$/M2.	PRECIO UNIDAD	NUMERO UNIDADES	TOTAL CAICHIVE	HUAYPETUE PUKIVE		GRAN TOTAL US$(000)
Gerente	265	140	37.1	1	37.1		-	37.1
Staff	200	140	28.0	5	140.0		-	140.0
Solteros Staff (4 hombres/unid.)	170	140	23.8	4	95.2	2.5	59.5	154.7
Empleados	100	120	12.0	24	288.0		-	288.0
Obreros Casados	93	105	9.8	56	548.8	4	39.2	588.0
Obreros Solteros (8 hombres/Unid.)	175	105	18.4	12	220.8	4	73.6	294.4
Casino Staff	235	140	32.9	1	32.9		-	32.9
Casino Emp./Obreros	450	130	58.5	1	58.5		19.5	78.0
Clínica	272	140	38.1	1	38.1		8.4	46.5
Oficina	360	140	50.4	1	50.4		8.4	58.8
Pulpería	180	100	18.0	1	18.0		6.0	24.0
Escuela	305	100	30.5	1	30.5		-	30.5
Laboratorio	162	140	22.7	1	22.7		-	22.7
Taller Mecánico	360	100	36.0	1	36.0		-	36.0
Almacén	360	100	36.0	1	36.0		-	36.0
Taller Eléctrico	168	100	16.8	1	16.8		-	16.8
Taller vehículos	240	100	24.0	1	24.0		-	24.0
Guardia	60	90	5.4	1	5.4		-	5.4
Planta Generadora	150	90	13.5	1	13.5		5.4	18.9
					1,712.7		220.0	1,932.7
Ingeniería Sanitaria, Eléctrica y habilitación de vías 20 Kms.					342.5		44.0	386.5
T O T A L					2,055.2		264.0	2,319.2

CAPITAL COST ESTIMATE

US$ (000)

A. Dredges			
# 1	3,685		
# 2	3,270		
# 3	3,270		
# 4	3,270		13,495
B. Camps			
# 1	2,055		
# 2	264		
Furnishings	150		2,469
C. Heavy Equipment and Vehicles			
4 ea CAT D-60 (99.0 x 4)		396.0	
1 ea Front End Loader		80.0	
1 ea Crane (used) 25 Ton		61.0	
1 ea Farming Tractor		24.0	
1 Dump Truck		36.0	
2 ea Pick Up		40.0	
1 ea Generator CAT 3306		26.0	
1 ea Generator CAT 3304		20.0	
1 ea Air Boat		16.0	
1 ea Tank Truck		36.0	
1 ea Craned (used) 35 Ton		65.0	800
D. Air Plane			
Airplane and spares		68.0	
Hangar		15.0	
Homing Beacon		10.0	
Duties		41.4	
Training and Ferrying		13.0	
License		2.6	150
E. Fuel Storage			
Diesel Tanks (4 x 20,000 gals)		66.4	
Gasoline Tanks		10.0	
Pumps		6.0	
Accesories		12.6	95.
F. Repair Shops			
Lathe (3 mts. x 35")		20.0	
Lathe (2.20 x 20")		15.0	
Shaper (42 cms)		3.0	
Mechanical Saw (4" ϕ)		2.0	
Drill Press (1 1|2")		7.6	
Hidraulic Press (200 ton)		8.3	
Air Compressor		6.0	
Overhead Crane & Structure (5 ton)		20.0	
Steam Cleaner		1.9	
Rotary Welders DC/AC 400 SAE (4 ea)		9.6	
Other Tools		10.0	
Electric Shop Tools		8.0	
Dredge Inretion Tools		43.6	155

G.	Laboratory		27
H.	Dredge Tools		
	Rotary DC Welders	14.4	
	Hand Hoists	5.8	
	Portable Drills w/. Magnetic Base	3.8	
	Acetylene Generators	1.6	
	Portable Disc Grinders	2.4	
	Pedestal Grinders	2.6	
	Other Tools	5.4	36
I.	Roads		
	(20 kms. x 5,750)		115
			US$ 17,342

PERU PROJECT - FIXED ASSETS, DEPRECIATION AND AMORTIZATION

	1984	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Fixed Assets															
Dredge 1			3,869												
2			1,717	1,717											
3				3,434											
4				1,717	1,717										
			5,586	6,868	1,717										
Camp & Equip.	722	727	2,285	427											
Replacements				100	100	100	100	100	100	100	100	100			
Vehic. & Equip.			90	510	200										
Replacements								90	510	200					
Preoperating	722														
	1,444	727	7,961	7,905	2,017	100	100	190	610	300	100	100			
Deprec. & Amort. Total															
Dredge 1	3,869			386	387	387	387	387	387	387	387	387	387		
2	3,434			172	343	343	343	343	343	344	344	344	344	171	
3	3,434				343	343	343	343	343	343	344	344	344	344	
4	3,434				172	343	343	343	343	343	344	344	344	344	171
Camp & Eq.	722		57	57	57	57	57	58	58	58	58	58	58	59	30
Camp & Eq.	3,012			137	274	274	274	274	274	274	274	274	273	273	137
Camp & Eq.	427			18	39	39	39	39	39	39	39	39	39	39	19
Replacements	100				9	10	9	10	9	10	9	10	9	10	5
	100					10	11	10	11	10	11	10	11	10	6
	100						12	12	12	12	12	12	12	11	5
	100							14	14	14	13	13	13	13	6
	100								15	16	15	16	15	15	8
	100									19	18	18	18	18	9
	100										22	23	22	22	11
	100											28	29	29	14
	100												40	40	20
Vehicles	1600			120	120	160	160	178	160	200	160	160	142	40	
Preoperating	722			33	65	65	65	66	66	66	66	66	66	66	32
	21,554		57	923	1,809	2,031	2,043	2,077	2,074	2,135	2,116	2,146	2,166	1,504	473

PERU PROJECT - OPERATING COSTS

	COST CATEGORY		
	Direct	Indirect	Total
Dredge	69.760		69.760
Camp		28,776	28,776
Shops	7,407	8,233	15,640
Airplane		5,800	5,800
	77,167	42,809	119,976
x 12	926,004	513,708	1'439,712
Use	926,000	519,000	1'445,000

	COST SUMMARY US$ 000		
	Direct	Indirect	Total
Dredge # 1	926	519	1,445
# 2	926	207	1,133
# 3	926	47	973
# 4	926	52	978

COST DETAILS

Dredge	IFC Ref.		
30 Men $ 9,600 x 1.60	94	15,360	
.20/m3 x 120.000	94	24,000	
Power		25,400	
Insurance, clearing, etc		5,000	69,760
Camp # 1			
33 Men & 11,860 x 1.60	95	18,976	
Material		6,000	
Power		1,800	
Insurance, etc.		2,000	28,776
Shops			
13 Men $ 3,650 x 1.60	96	5,840	
Material		6,000	
Power		1,800	
Insurance, etc.		2,000	15,640
Airplane	97		5,800
			119,976

	IFC Ref.		
28 Men $ 6,960 x 1.60	96	11,136	
Material		5,000	
Power		900	17,036
x 12			204,432
Use			207,000
General & Administrative			
Lima	96		12,500
x 12			150,000

ANEXO N° A7

COSTOS Y GASTOS

Los costos relativos al personal requerido por draga y campamentos necesariamente deben ser incrementados como efecto de los beneficios sociales que genera. Esta modificación sigue el siguiente esquema :

Sobretiempos y pagos extras por trabajo nocturno		22.5%
Aguinaldos		2%
Seguro Social	5% Max.	$ 540
Caja de Pensiones	5% Max.	$ 540
Impuesto a las Remuneraciones	2.5% x 30,760	
FONAVI	4% Max.	$ 360
Seguro de Accidentes	3.6% x 20,360	
Reserva por Indemnización	1 salario/año Max.	$ 729

1. Personal por draga (Costo Directo)

		US$/mes
1	Capitán de Draga	1,500
4	Wincheros (4 x 800)	3,200
1	Electricista	500
2	Soldadores (2 x 200)	400
15	Operadores (15 x 150)	2,250
2	Operadores de Equipo Pesado (2 x 300)	600
1	Ayudante	100
1	Jefe de planta diesel	600
3	Operadores de planta diesel	450
30	TOTAL MENSUAL	9,600

Costos de Materiales para Dragas. (Costo Directo)

2. El costo de material, de acuerdo a cifras reales en dragas similares se ha estimado en 0.25% $/m3 de material extraído.

0.25 US$/m3 x 120,000 m3/mes = 30,000 US$/mes

3. Personal del Campamento N° 1 (Costo Directo)

		US$/mes
1	Superintendente General	3,000
1	Secretaria - radio operadora	200
1	Contador General	1,000
1	Asistente de Contador	250
1	Cajero	250
1	Ingeniero	800
1	Topógrafo	300
1	Médico	800
1	Enfermera	300
1	Auxiliar Limpieza Hospital	120
1	Profesor Principal	250
1	Profesor	200
1	Carpintero	200
1	Gasfitero	150
2	Limpieza Campamento	200
1	Supervisor de Seguridad	300
3	Vigilantes (3 x 100)	300
1	Jefe de Laboratorio	800
1	Asistente de Laboratorio	200
2	Choferes (2 x 120)	240
1	Encargado de Almacén	600
1	Kardista	250
2	Despachadores	300
1	Encargado de Tienda	300
1	Cocinero	150
1	Asistente de Cocina	100
2	Operadores (planta diesel) (2 x 150)	300
33	TOTAL MENSUAL	11,860

4. Personal del Campamento Nº 2 (Costo Indirecto)

		US$/mes
1	Superintendente	1,500
1	Secretaria - radio operador	200
1	Contador Junior	250
1	Cajero	250
1	Sanitario	300
1	Ayudante Sanitario	120
1	Profesor principal	250
1	Profesor	200
1	Carpintero	200
1	Gasfitero	150
2	Limpieza Campamento	200
1	Supervisor de Seguridad	300
3	Vigilantes	300
1	Jefe de Laboratorio	800
1	Asistente de Laboratorio	200
2	Choferes	240
1	Encargado de Almacén	400
1	Despachador	150
1	Encargado tienda	250
1	Despachador	150
1	Cocinero	150
1	Asistente de Cocina	100
2	Operadores de planta diesel	300
	TOTAL MENSUAL	6,960

5. Personal de Taller (Costo Directo)

		US$/mes
1	Jefe de Taller	800
2	Torneros (300 + 200)	500
2	Soldadores (2 x 200)	400
2	Mecánicos (2 x 300)	600
2	Ayudantes de Mecánico (2 x 150)	300
1	Encargado de Herramientas	150
1	Jefe de Electricistas	500
2	Electricistas (250 + 150)	400
13	TOTAL MENSUAL	3,650

6. Costo estimado de operación del avión (Costo Indirecto)

Costos variables: (US$/hora)

Gasolina	112.00	
Aceite	1.07	
Mantenimiento	48.32	
Otros	34.74	
TOTAL	196.13 x 20 horas =	3,900 US$/mes

Costos fijos:

Salario piloto	1,000	
Seguro	900	
	1,900	1,900 US$/mes
	TOTAL	5,800 US$/mes

7. Gastos Generales
Oficina Lima

	US$ 000/mes
Sueldos	4,850
Beneficios Sociales	1,530
	6,380
Asesores/Directores	2,200
Overhead Oficina	3,290
TOTAL	12,500

P O W E R

DREDGES :

FUEL :

$\frac{254,000 \text{ KWH/Month}}{11 \text{ KWH per Galon}}$ = 23,091 gals/month x US$ 1.00 gal.= US$ 23,091 month

Spares & Lubricants :
254,000 KWH/Month x $ 0.0086 = $ 2,184 month

FUEL	US$	23,091
SPARES & LUB.		2,184
TOTAL	US$	25,275 month
		======

Figure used 25,400

CAMP # 1 : (Camp # 2 1/2 of Camp # 1)

FUEL :

$\frac{18,000 \text{ KWH/Month}}{11 \text{ KWH per gal.}}$ = US$ 1,636

Spares & Lub. :
18,000 x $ 0.086 = 155

TOTAL	US$	1,791
Figure used		1,800
Shop		1,800

CUADRO No. 15

CRONOGRAMA DE COSTOS OPERATIVOS

(US$ 000)

	1986	1987	1988 (1)	1989	1990	1991	1992	1993	1994	1995	1996	1997
COSTOS DIRECTOS												
Draga # 1	926	926	926	926	926	926	926	926	926	926	-	-
Draga # 2	463	926	926	926	926	926	926	926	926	926	463	-
Draga # 3	-	926	926	926	926	926	926	926	926	926	926	-
Draga # 4	-	463	926	926	926	926	926	926	926	926	926	463
TOTAL	1,389	3,241	3,704	3,704	3,704	3,704	3,704	3,704	3,704	3,704	2,315	463
COSTOS INDIRECTOS												
Draga # 1	519	519	519	519	519	519	519	519	519	519	519	208
Draga # 2	103	207	207	207	207	207	207	207	207	207	207	-
Draga # 3	-	47	47	47	47	47	47	47	47	47	47	-
Draga # 4	-	26	52	52	52	52	52	52	52	52	52	52
TOTAL	622	799	825	825	825	825	825	825	825	825	825	260

(1) Reducción por menor costo de energía a la implementación de planta hidroeléctrica (Anexo A5)

PERU PROJECT UNIT OPERATING COSTS

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	TOTAL
Dredge # 1													
m3 000	1,180	1,380	1,380	1,380	1,380	1,380	1,380	1,380	1,380	1,380			13,600
Costs $ 000	1,445	1,445	1,445	1,445	1,445	1,445	1,445	1,445	1,445	1,445			14,450
$/m3	1.22	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05			1.06
Dredge # 2													
m3 000	610	1,440	1,440	1,440	1,440	1,440	1,440	1,440	1,440	1,440	720		14,290
Costs $ 000	566	1,133	1,133	1,133	1,133	1,133	1,133	1,133	1,133	1,133	1,189		11,952
$/m3	.93	.79	.79	.79	.79	.79	.79	.79	.79	.79	1.65		.84
Dredge # 3													
m3 000		1,410	1,560	1,560	1,560	1,560	1,560	1,560	1,560	1,560	1,560		15,450
Costs $ 000		973	973	973	973	973	973	973	973	973	973		9,730
$/m3		.69	.62	.62	.62	.62	.62	.62	.62	.62	.62		.63
Dredge # 4													
m3 000		590	1,380	1,380	1,380	1,380	1,380	1,380	1,380	1,380	1,380	690	13,700
Costs $ 000		489	978	978	978	978	978	978	978	978	978	723	10,014
$/m3		.83	.71	.71	.71	.71	.71	.71	.71	.71	.71	1.05	.73
TOTAL													
m3 000	1,790	4,820	5,760	5,760	5,760	5,760	5,760	5,760	5,760	5,760	3,660	690	57,040
Costs $ 000	2,011	4,040	4,529	4,529	4,529	4,529	4,529	4,529	4,529	4,529	3,140	723	46,146
$/m3	1.12	.84	.79	.79	.79	.79	.79	.79	.79	.79	.86	1.05	.81

DIRECT COSTS

DREDGE No.	1	2	3	4
Salarios	115,000	115,000	115,000	115,000
Beneficios 60%	69,000	69,000	69,000	69,000
Materiales Dredge	288,000	288,000	288,000	288,000
Equipo, Vehículos & Shops	50,000	50,000	50,000	50,000
Energía	305,000	305,000	305,000	305,000
Camps. Energ.	22,000	22,000	22,000	22,000
Otros	77,000	77,000	77,000	77,000
TOTAL	926,000	926,000	926,000	926,000

INDIRECT COSTS

Salarios Taller	44,000	–	–	–
Beneficios	26,000	–	–	–
Salarios - Camp 1	142,000	–	–	–
Beneficios	85,000	–	–	–
Camp Salarios 2	–	83,000	–	–
Beneficios	–	50,000	–	–
Materiales, Eq. & Vehic.	22,000	–	–	–
Camp # 1	72,000	–	–	–
Camp # 2	–	60,000	–	–
Energía Camp 1	28,000	–	–	–
Energía Camp 2	–	14,000	–	–
Avión	70,000	–	–	–
Otros	30,000	–	–	–
TOTAL	519,000	207	47	52

DREDGE OPERATIONS SUMMARY

Labor	184,000 US$/year
Materials	336,000 US$/year
Energy	329,000 US$/year
Misc.	77,000 US$/year
TOTAL	926,000 US$/year per dredge

FIELD OPERATIONS SUMMARY FOR DREDGE N° 1 ONLY

Labor	297,000 US$/year
Materials	94,000 US$/year
Energy	28,000 US$/year
Plane	70,000 US$/year
Misc.	30,000 US$/year
TOTAL	519,000 US$/year

FIELD OPERATIONS SUMMARY FOR DREDGE N° 2 ONLY

Labor	133,000 US$/year
Materials	60,000 US$/year
Energy	14,000 US$/year
TOTAL	207,000 US$/year

SUMMARY PER YEAR PER DREDGE

Dredge N°	1	2	3	4
Dredge Operation	926,000	926,000	926,000	926,000
Field Operation	519,000	207,000	47,000	52,000
TOTAL	1'445,000	1'133,000	973,000	978,000

DREDGE OPERATIONS (DREDGE # 1 THRU DEDGE 4)

1) Personnel (p. 94)

9,600 US$/mo x 12 mo = 115,000 US$/year

plus social benefits 60% = 69,000 US$/year

TOTAL LABOR = 184,000 US$/year

2) Materials (p. 94)

a) It has been estimated that cost of materials for similar dredge operations ranges from 0.20 US$ to 0.25 US$ per cubic meter moved. The average volume to be moved will approximately be 120,000 cubic meters per month.

b) The cost of materials (spares, lubricants, etc. etc.) of support heavy equipment & vehicles for each dredge is estimated at 4,000 US$/mo.

a) 120,000 m^3/mo x 0.20 US$/$m^3$ = 24,000 US$/mo

24,000 US$/mo x 12 = 288,000 US$/year

b) 4,000 US$/mo x 12 = 48,000 US$

TOTAL MATERIALS = 336,000 US$/year

3) Energey.- New annex for Energy.

25,400 US$/mo x 12 = 305,000 US$/year

The cost of energy of the camps, destined to support the dredge operations (shops, lathes, lubricants, etc.) is estimated in 2,000 US$/mo. for each dredge.

2,000 US$/mo x 12 = 24,000 US$/year.

TOTAL ENERGY = 329,000 US$/year

4) Miscellaneous.- It is estimated thru experience that insurance, medicines, food, supplies, etc. run to approx. 9% of direct operating costs of each dredge.

TOTAL MISCELLANEOUS = 77,000 US$/year approx.

FIELD OPERATIONS FOR DREDGE N° 1

1) Personnel camp # 1 (p. 95) and shop (p. 96) go into operation with Dredge N° 1

(11,860 US$/mo + 3,650 US$/mo) x 12 = 186,000 US$/year

plus social benefits 60% = 111,000 US$/year approx.

TOTAL LABOR = 297,000 US$/year

2) Materials

a) Back up materials for camp N° 1 due to dredge N° 1 operation is estimated at 6,000 US$ per month.

6,000 US$/mo x 12 = 72,000 US$/year.

b) Spares, lubricants, fuel, etc. required for heavy equipment & vehicles destined to service the camp are estimated at 1,800 US$/mo.

1,800 US$/mo x 12 = 21,600 US$/year = 22,000 US$/year.

TOTAL MATERIALS = 94,000 US$/year.

3) Energy: (New annex for Energy)

The energy needed for operation of the camp itself is estimated at 2,300 US$/mo.

2,300 US$/mo. x 12 = 28,000 US$/year approx.

4) Plane: (p. 97)

5,800 US$/mo x 12 = 70,000 US$/year approx.

5) Miscellaneous: It is estimated that miscellaneous for field operations for the camps, the plane that cover supplies, food, medicines, insurance, etc. run to approx. 6%.

TOTAL MISC = 30,000 US$/year approx.

FIELD OPERATIONS FOR DREDGE N° 2

With dredge N° 2 going into operation, camp N° 2 must also operate and its cost is attributable to dredge N° 2.

Labor (p. 96)

6,960 US$/mo x 12 = 83,000 US$/year approx

plus social benefits 60% = 50,000 US$/year approx.

TOTAL LABOR = 133,000 US$/year approx.

Materials.- For operation of camp N° 2, supplies, lubricants, spares, food, medicines, etc. will run to 5,000 US$/mo

5,000 US$/mo x 12 = 60,000 US$/year

TOTAL MATERIALS = 60,000 US$/year.

Energy.- New annex for Energy.

To run camp N° 2, the cost is 1,200 US$/mo

1,200 US$/mo x 12 = 14,000 US$/year.

FIELD OPERATIONS FOR DREDGES 3 & 4

Field operations will increase due to dredges 3 & 4 in 47,000 US$/year with dredge N° 3 and in 52,000 US$/year with dredge N° 4. The difference between the two is due to need of extra water pumping for dredge N° 4.

PERU PROJECT - PRODUCTION SCHEDULE

	86	87	88	89	90	91	92	93	94	95	96	97
First Dredge (000 m3)	1,180	1,380	1,380	1,380	1,380	1,380	1,380	1,380	1,380	1,380		
(mgm/m3)	289	392	390	294	286	259	230	250	200	200		
kg.	341	540	538	406	394	357	317	345	276	276		
Second Dredge (000)	610	1,440	1,440								720	
(mgm/m3)	255	242	230	218	202	191	265	255	189	120	120	
kg.	156	348	331	314	291	275	382	367	272	173	86	
Third Dredge (000 m3)		1,410	1,560	1,560	1,560	1,560	1,560	1,560	1,560	1,560	1,560	
(mgm/m3)		250	255	222	254	229	210	231	150	144	144	
kg.		353	398	346	395	357	328	360	234	225	224	
Sub-Totals kg. to 1, 2, 3 (kg)	497	1,241	1,267	1,066	1,080	989	1,027	1,072	782	674	310	
Fourth Dredge	-	590	1,380	1,380	1,380	1,380	1,380	1,380	1,380	1,380	1,380	690
mgm	-	220										
kg.	-	130	304	304	304	304	304	304	304	304	304	152
Total - 4 dredges (kg)	497	1,371	1,571	1,370	1,384	1,293	1,331	1,376	1,086	978	614	152
Fine oz recover 92% x 90%	13,230	36,497	41,821	36,470	36,843	34,421	35,432	36,630	28,910	26,035	16,345	4,046

31,1035

Enclosure D-1

Dredge No 1 - Q. Seca

Year	Volume (cu meters) (1)	Tenor (gm/c.m)	Value of Production (2)	Op Costs (3)	Field Profit (4)
1	1,180,000*	.289*	$3,069,180*	$1,380,000	$1,689,180*
2	1,380,000	.392*	4,868,640*	1,248,000	3,620,640*
3	1,380,000	.390*	4,843,800*	1,176,000	3,667,800*
4	1,380,000	.294*	3,651,480*	1,176,000	2,475,480*
5	1,380,000	.286 ~~.259~~	3,216,780	1,176,000	2,040,780
6	1,380,000	.230*	2,856,600*	1,176,000	1,680,600*
7	1,380,000	.250	3,105,000	1,176,000	1,929,000
8	1,380,000	.200 ~~.192~~	2,384,640	1,176,000	1,208,640
9	1,380,000	.200 ~~.178~~	2,210,760	1,176,000	1,034,760
10 (6 mo)	690,000	~~.126~~	782,460	588,000	194,460

(1) Year 1 - 1st month 50%, 2nd month 60%, 3rd month 70%, 4th month 80%, 5th month 90%, 6th month 90%, 7th month 100% of normal production.

(2) $9/gram = estimated gold from prospecting ($375/oz ÷ 31.105gr/oz) X 0.92 (920 fine) X 0.90(recovery) X (1.000 - 0.098 production taxes)

(3) WHB estimate of op costs: one dredge $115,000/mo, two dredges $100,000/mo each, three dredges $92,000 each.

SJL estimate of op costs: one dredge $115,000/mo, two dredges $104,000/mo each, three dredges $98,000/mo each.

SJL estimate used as more conservative, but $115,800/mo changed to $115,000 in view of yardage reduction.

(4) Before head office and finance charges, worker and minority participation in profits, and any remittance taxes incurred. No Peruvian income tax is currently payable, and efforts are in progress to maintain that benefit, and limit production taxes.

* Changed from earlier estimate.

Enclosure 1-[illegible]

Dredge No. 2 - Conchita [illegible] Reserve

Year	Volume (Cubic Meters)	Tenor (Grams/cm)	Value of Production (US$)	Op. Costs (See note)	Fixed Costs (See note)
1	1,220,000	0.255	2,799,900.	1,248,000	1,551,90
2	1,440,000	0.242	3,136,320.	1,176,000	1,[illegible]
3	1,440,000	0.230	2,980,800.	1,176,000	1,804,50
4	1,440,000	0.218	2,825,280.	1,176,000	1,649,2
5	1,440,000	0.202	2,617,920	1,176,000.	1,441,9
6	1,440,000	0.191	2,475,360.	1,176,000.	1,299,3
7	1,440,000	0.265	3,434,400.	1,176,000.	2,258,4
8	1,440,000	0.255	3,304,800.	1,176,000.	[illegible]
9	1,440,000	0.189	2,449,440.	1,176,000	1,273,4
10	1,440,000	0.120	1,555,200.	1,176,000.	379,2

Notes (1), (2), (3) & (4) Same as for Enclosure D-1

Information received by telephone 7/18/84

Enclosure D-3

Dredge No. 3 - Hwy 66 Tree - Pikin Reserve

Year	Volume (Cu. meters)	Tenor (Grams/c.m)	Value of Production (US $)	Op Costs (See notes)	Free to Pilot (See notes)
1	1,410,000	0.250	$3,172,500.	$1,176,000	1,996,500
2	1,560,000	0.255	3,580,200.	1,176,000	2,404,200
3	1,560,000	0.222 .220	3,088,800.	1,176,000	1,912,800
4	1,560,000	0.253	3,552,120.	1,176,000	2,376,120
5	1,560,000.	0.229	3,215,160	1,176,000	2,039,160.
6	1,560,000	0.210	2,948,400.	1,176,000	1,772,400
7	1,560,000	0.231	3,243,240	1,176,000	2,067,240.
8	1,370,000	0.150	1,849,500.	1,176,000.	673,500
9	1,560,000	0.144	2,021,760.	1,176,000.	845,760
10	1,560,000	0.154	2,162,160.	1,176,000	986,160

Notes (1), (2), (3) & (9) Same as for Enclosure D-1

Information received by telephone 7/16/90

Enclosure D 4

Dredge No. 4 - Terrace Reserves

Year	Volume (Cu. meters)	Tenor Grms/cu m	Value of Production (US $)	Op Costs (See note)	Fixed Costs (See notes)
1	1,180,000	0.220	$2,336,400	$1,176,000	$1,160,400
2	1,350,000	0.220	2,732,400	1,176,000	1,556,400
3	↓	↓	↓	↓	↓
4	↓	↓	↓	↓	↓
5	↓	↓	↓	↓	↓
6	↓	↓	↓	↓	↓
7	↓	↓	↓	↓	↓
8	↓	↓	↓	↓	↓
9	↓	↓	↓	↓	↓
10	↓	↓	↓	↓	↓

Notes (1), (2), (3) & (4) Same as for Enclosure D-1

Studies of these reserves, and a mining plan for them are incomplete.

Information received by telephone 7/25/49

PERU PROJECT - INCOME STATEMENT

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	TOTAL
Ounces		13,230	36,497	41,821	36,470	36,843	34,421	35,432	36,630	28,910	26,035	16,345	4,046	346,680
Gross at $ 350		4,630	12,774	14,637	12,965	12,895	12,047	12,401	12,820	10,119	9,112	5,721	1,416	121,337
Real'n 10.5% -		486	1,341	1,537	1,340	1,354	1,265	1,302	1,346	1,062	957	601	149	12,740
Net Sales		4,144	11,433	13,100	11,425	11,541	10,782	11,099	11,474	9,057	8,155	5,120	1,267	108,597
Costs														
Direct		1,389	3,241	3,704	3,704	3,704	3,704	3,704	3,704	3,704	3,704	2,315	463	37,040
Indirect		622	799	825	825	825	825	825	825	825	825	825	260	9,106
		2,011	4,040	4,529	4,529	4,529	4,529	4,529	4,529	4,529	4,529	3,140	723	46,146
Operating Contribution		2,133	7,393	8,571	6,896	7,012	6,253	6,570	6,945	4,528	3,626	1,980	544	62,451
G y A		150	150	150	150	150	150	150	150	150	150	150	75	1,725
D y D	57	923	1,809	2,031	2,043	2,077	2,074	2,135	2,116	2,166	2,166	1,504	473	21,554
Finances	509	1,368	1,716	1,716	1,665	1,477	1,168	824	481	189	35			11,148
Exploration		60	60	60	60	60	60	60	60	60	60	-	-	600
Total Expenses	566	2,501	3,735	3,957	3,918	3,764	3,452	3,169	2,807	2,545	2,411	1,654	548	35,027
Gross Profit (Loss)	(566)	(368)	3,658	4,614	2,978	3,248	2,801	3,401	4,138	1,983	1,215	326	(4)	27,424
INGEMET & Labor 8.5%	-	-	-	311	392	253	276	238	289	352	169	103	28	2,411
Net Profit	(566)	(368)	3,658	4,303	2,586	2,995	2,525	3,163	3,849	1,631	1,046	223	(32)	25,013

PERU PROJECT - CASH FLOW

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	TOTAL
Source															
Net Income (loss)		(566)	(368)	3,658	4,303	2,586	2,995	2,525	3,163	3,849	1,631	1,046	223	(32)	25,013
Dep'n Amort'n		57	923	1,809	2,031	2,043	2,077	2,074	2,135	2,116	2,146	2,166	1,504	473	21,554
Loans		6,790	4,650	-	-	-	-	-	-	-	-	-	-	-	11,440
		6,281	5,205	5,467	6,334	4,629	5,072	4,599	5,298	5,965	3,777	3,212	1,727	441	58,007
Aplication															
Working Capital		675	400	250	250										1,575
Property, Plant	1,449	7,961	7,905	2,017	100	100	100	190	610	300	100				20,832
Preoperating	722														722
Debt Repayment						679	1,823	2,288	2,288	2,288	1,609	465			11,440
						779	2,013	2,898	2,588	2,388	1,709	465			34,569
	2,171	8,636	8,305	2,267	350										
Cash (required) Excess	(2,171)	(2,355)	(3,100)	3,200	5,984	3,850	3,059	1,701	2,710	3,577	2,068	2,747	1,727	441	23,438
Accum.		(4,526)	(7,626)												
84% Basis		(4,526)	(3,100)	2,688	5,027	3,234	2,570	1,429	2,276	3,005	1,737	2,307	1,451	375	18,473
Internal Pmtc. Return %															31.22
Provided by															
Loan			11,440	11,440	11,440	10,761									
Equity			7,626	7,626	7,626	7,626									
Operations			46	5,513	11,847	16,476									
			19,112	24,579	30,913	34,863									
For Work Cap-Constant			1,075	1,325	1,575	1,575									
Plant			17,315	19,332	19,432	19,532									
Preop.			722	722	722	722									
			19,112	21,379	21,729	21,829									
Excess Cash				3,200	9,184	13,034									
			19,112	24,579	30,913	34,863									

PERU PROJECT - LOANS AND INTEREST

	Loans			Interest		
	# 1	# 2	Total	# 1	# 2	Total
1985	6,790		6,790	509		509
1986	–	4,650	4,650	1,018	350	1,368
1987	–	–	–	1,018	698	1,716
1988	–	–	–	1,018	698	1,716
1989	(679)	–	(679)	967	698	1,665
1990	(1,358)	(465)	(1,823)	814	663	1,477
1991	(1,358)	(930)	(2,288)	610	558	1,168
1992	(1,358)	(930)	(2,288)	406	418	824
1993	(1,358)	(930)	(2,288)	203	278	481
1994	(679)	(930)	(1,609)	51	138	189
1995		(465)	(465)		35	35
				6,614	4,534	11,148

PERU PROJECT PROFITABILITY ANALYSIS - 100%

	EQUITY	LOAN	CASH	INTEREST	LOAN REPAY	TOTAL	TOTAL LESS LOAN
84	2,171					(2,171)	(2,171)
85	2,355	6,790		509		(8,636)	(2,355)
86	3,100	4,650		1,368		(6,382)	(3,100)
87			3,200	1,716		4,916	3,200
88			5,984	1,716		7,700	5,984
89			3,850	1,665	679	6,194	3,850
90			3,059	1,477	1,823	6,359	3,059
91			1,701	1,168	2,288	5,157	1,701
92			2,701	824	2,288	5,822	2,710
93			3,577	481	2,288	6,346	3,577
94			2,068	189	1,609	3,866	2,068
95			2,747	35	465	3,247	2,747
96			1,727			1,727	1,727
97			441			441	441
	7,626	11,440	31,064	11,148	11,440	34,586	
					IRR	24.89%	33.82%

PROFITABILITY - 84%

–	– LOAN	+ CASH	+ INTEREST	+ LOAN REPAY	TOTAL	TOTAL LESS LOAN
2,171					(2,171)	(2,171)
2,355	6,790		509		(8,636)	(2,355)
3,100	4,650		1,368		(6,382)	(3,100)
		2,688	1,716		4,404	2,688
		5,027	1,716		6,743	5,027
		3,234	1,665	679	5,578	3,234
		2,570	1,477	1,823	5,870	2,570
		1,429	1,168	2,288	4,885	1,429
		2,276	824	2,288	5,388	2,276
		3,005	481	2,288	5,774	3,005
		1,737	189	1,609	3,535	1,737
		2,307	35	465	2,807	2,307
		1,451			1,451	1,451
		375			375	375
7,626	11,440	26,099	11,148	11,440	29,621	
				I.R.R.	22.03%	28.32 %

Recent developments and the advice of counsel indicate that it will not be prudent to commit major funds to the Madre de Dios project in 1984.

Assume dredge one will start on 15 December 1985 or another day.

Estimate needed delivery times on site for various dredge components to permit start-up date selected(a D-Day minus x)

Anticipate ordering of certain patterns ahead of components orders to avoid delop in delivering.

Component	Delivery at Site	Latest date Start-up 15 Dec.85
Buckat line & pins	D-20	25 Nov
Lower tumbler	D-45	1 Nov.
Upper tumbler	D-60	15 Oct.
Main Drive & Gearing	D-60	15 Oct.
Ladder rollers	D-40	5 Nov.
Stacker rollers	D-40	5 Nov.
Stacker Belt	D-30	15 Nov.
Screen Plates	D-60	15 Oct.
Pumps	D-90	15 Sept.
Jigs	D-120	15 Aug.
Piping	D-90	15 Sept.
Pump box screens	D-120	15 Aug.
Trommel	D-180	15 June
Trommel Drive	D-180	15 July
Winches LH & Man.	D-150	15 Jul.
Ladder	D-90	15 Sept.
Ladder castings	D-150	15 July
Superstructure	D-210	15 MaY
Housing	D-150	15 July
Stacker	D-60	15 Oct.
Motores	D-60	15 Oct.
Electrical Controls	D-60	15 Oct.
Compressor	D-210	15 May
Pontoons	D-240	15 Apr.

Preliminary for review with GAB. Assume construct this Dredge I 8 months (GAB estimates 7 months); Second dredge 6 months (GAB estimates 5 months).

VII PROYECCIONES FINANCIERAS

7.1 Ingresos

Los supuestos utilizados para los ingresos proyectados reflejan una actitud muy conservadora respecto a:

- Producción, por cuanto (a) los cursos de dragado han sido programados sin tomar en cuenta la posibilidad de explotar mayores volúmenes de gravas auríferas de buen tenor adyacentes a los cursos escogidos y (b) no sería necesario incrementar la la capacidad extractiva ni de tratamiento para la citada mayor explotación;

- Recuperación de oro, por cuanto se ha utilizado 90% a pesar que los resultados de muestreo de la planta piloto han sido consistentemente mayores al 95% (ver Anexo A4).

- Fineza del oro, por cuanto se ha utilizado 0.92 a pesar que pruebas recientes han dado valores mayores;

- Precio, por cuanto se ha utilizado US$ 375 por onza troy para la vida del proyecto, precio significativamente menor al promedio registrado en los últimos cinco años.

- Gastos de realización, por haberse utilizado un 10.5% (*) de la venta bruta que incluye tributos tales como el canon al Departamento de Madre de Dios que puede ser sustancialmente reducidos por legislación aprobada en el Senado y pendiente de ratificación en la Cámara de Diputados (ver Anexo A6). y gastos de comercialización que podrían verse reducidos de

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(*) Esta cifra se desagrega de la siguiente manera:

. Canon Madre de Dios	2.8%
. Ensayes y refinación	2.0%
. Flete y seguro	0.4%
. Comisiones Banco Minero	1.5%
. Impuesto de Exportación	2.9%
. Impuesto a la Venta de Moneda Extranjera	0.9%
	10.5%