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UNITED STATES
DEPARTMENT OF THE INTERIOR
J. A. KRUG, SECRETARY

BUREAU OF MINES
R. R. SAYERS, DIRECTOR

REPORT OF INVESTIGATIONS

MERCURY DEPOSITS OF SOUTHWESTERN ALASKA

BY

BURR S. WEBBER, STUART C. BJORKLUND, FRANKLIN A. RUTLEDGE, BRUCE I. THOMAS, AND WILFORD S. WRIGHT

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By Burr S. Webber[2/], Stuart C. Bjorklund[3/], Franklin A. Rutledge[4/], Bruce I. Thomas[5/], and Wilford S. Wright[2/]

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1/ The Bureau of Mines will welcome reprinting of this paper, provided the following footnote acknowledgment is used: "Reprinted from Bureau of Mines Report of Investigations 4065."

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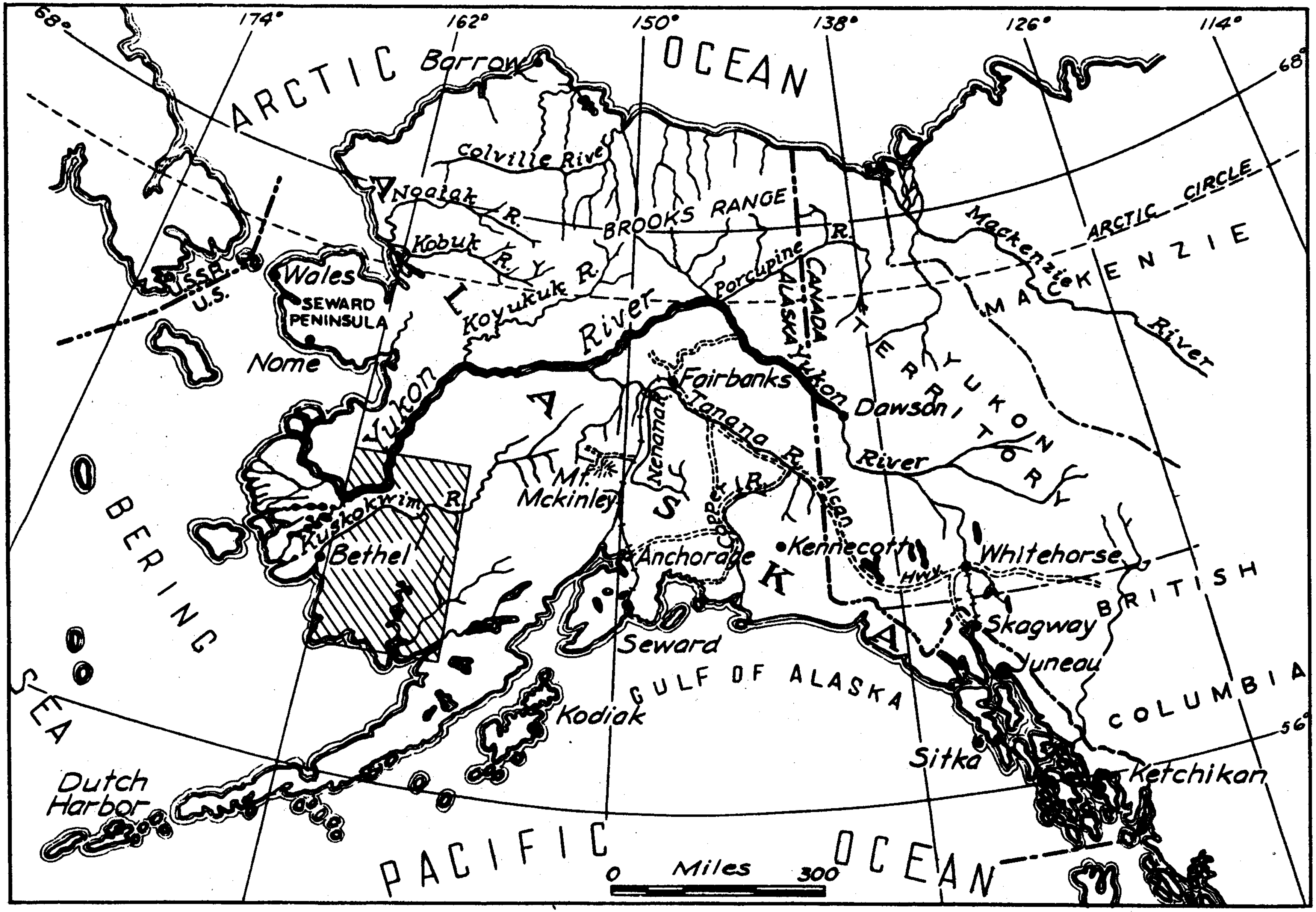

FIG. 1 INDEX MAP ~ MERCURY AREA OF SOUTHWESTERN ALASKA

ILLUSTRATIONS - Continued

INTRODUCTION

Mercury deposits discovered in the United States have never been large enough to make this country self-sufficient with respect to quicksilver ore reserves, as is Spain with its vast Alamedan and Idria mines.

The Red Devil mine in the Sleitmut area was in the early stages of development when, in the summer of 1942, the senior author made a preliminary examination and started surface exploration. Since discovery of the lode in 1933, Red Devil ores, including mined and float material, had yielded 419 flasks. Exploration by bulldozer trenching and sampling went on at the Red Devil mine through the summer of 1942 and was followed that winter by shaft sinking and drifting under the direction of Norman Ebbley, Jr., and Robert L. Thorne, engineers of the Bureau of Mines. In the course of this exploration, four other deposits were examined by trenching and sampling - the Alice and Bessie, formerly known as the Parks property, the Barometer, the Willis, and the Fairview, all within an area of approximately 10 square miles.

In the summer of 1942, representatives of the Geological Survey 6/ made a preliminary investigation of the DeCoursey deposits, where previous production amounted to less than 200 flasks. The results of the examination, together with a report by a Reconstruction Finance Corporation engineer, 7/ were sufficiently encouraging to justify extensive surface trenching and mapping by the Bureau of Mines. The work started June 1, 1943, under the Bureau's supervision, and ended October 1, 1943.

6/ W. M. Cady and E. J. Webber.
7/ L. C. Doheny, supervising engineer R.F.C., Fairbanks, Alaska.

In the same summer, a field party of the Geological Survey[8] spent 4 weeks mapping and investigating mercury deposits in the upper Holitna River region, from which Russell Schaefer had brought out, by boat to Sleitmut, 2,300 pounds of high-grade cinnabar ore. At the close of the season's field operations by the Geological Survey, a report of the work led the Bureau of Mines to send a party to examine and sample the deposits further. This party was in the area from September 20 to 27, and spent most of the time in sampling the Lucky Day lode, though the Redskin lode claim and the placer deposits on Cinnabar Run were examined cursorily.

The Alaska Department of Mines, the Federal Geological Survey, and Frank H. Waskey supplied the Bureau with data that justified an examination of cinnabar lode and placer deposits on Marsh Mountain in the vicinity of Lake Alegnagik, Nushagak District, Alaska. The deposits were examined by Aner W. Erickson, an engineer of the Bureau, in May 1943 and, on the basis of subsequent information, were re-examined in October 1943 by one of the authors.

In 1914, the Geological Survey reported quicksilver deposits on the right limit of the Kuskokwim River 18 miles above Aniak at Kolmakof, a settlement established in 1829 by the Russian explorer of that name. The senior author examined the deposits in July 1944.

Recovery of cinnabar concentrates from a gold placer on Rainy Creek, a tributary of Eek River, was reported to the Bureau by Al. Jones, of Bethel, Alaska, the operator, and the location of realgar-cinnabar lodes was reported by prospectors familiar with the region. This deposit was examined in September 1944 by the senior author.

ACKNOWLEDGMENTS

In its program of exploration of mineral deposits, the Bureau of Mines has as its primary objective the more effective utilization of our mineral resources to the end that they make the greatest possible contribution to national security and economy. It is the policy of the Bureau to publish the facts developed by each exploratory project as soon as practicable after its conclusion. The Mining Branch, Lowell B. Moon, chief, conducts preliminary examinations, performs the actual exploratory work, and prepares the final report. The Metallurgical Branch, R. G. Knickerbocker, chief, analyses samples and performs beneficiation tests.

Special acknowledgment is extended to Harold Schmidt and Glen Franklin of the Kuskokwim Mining Co. for contributing valuable information on mining and ore reduction at the Red Devil mine; to R. F. Lyman for submitting detailed data regarding mine and plant operations at the DeCoursey Mountain mine; to L. C. Doheny of the Reconstruction Finance Corporation for cooperating with Bureau of Mines engineers in initiating projects in the Sleitmut mercury district; to Al Jones for bringing to the attention of Bureau's engineers the Rainy Creek deposits and for assisting in their examination; to James Crowdy, manager of the New York Alaska Gold Dredging Corp., who submitted results of his company's

8/ Cady, Wallace M., Preliminary Report on the Quicksilver Deposits in the Cinnabar Creek area, Alaska: Geological Survey.

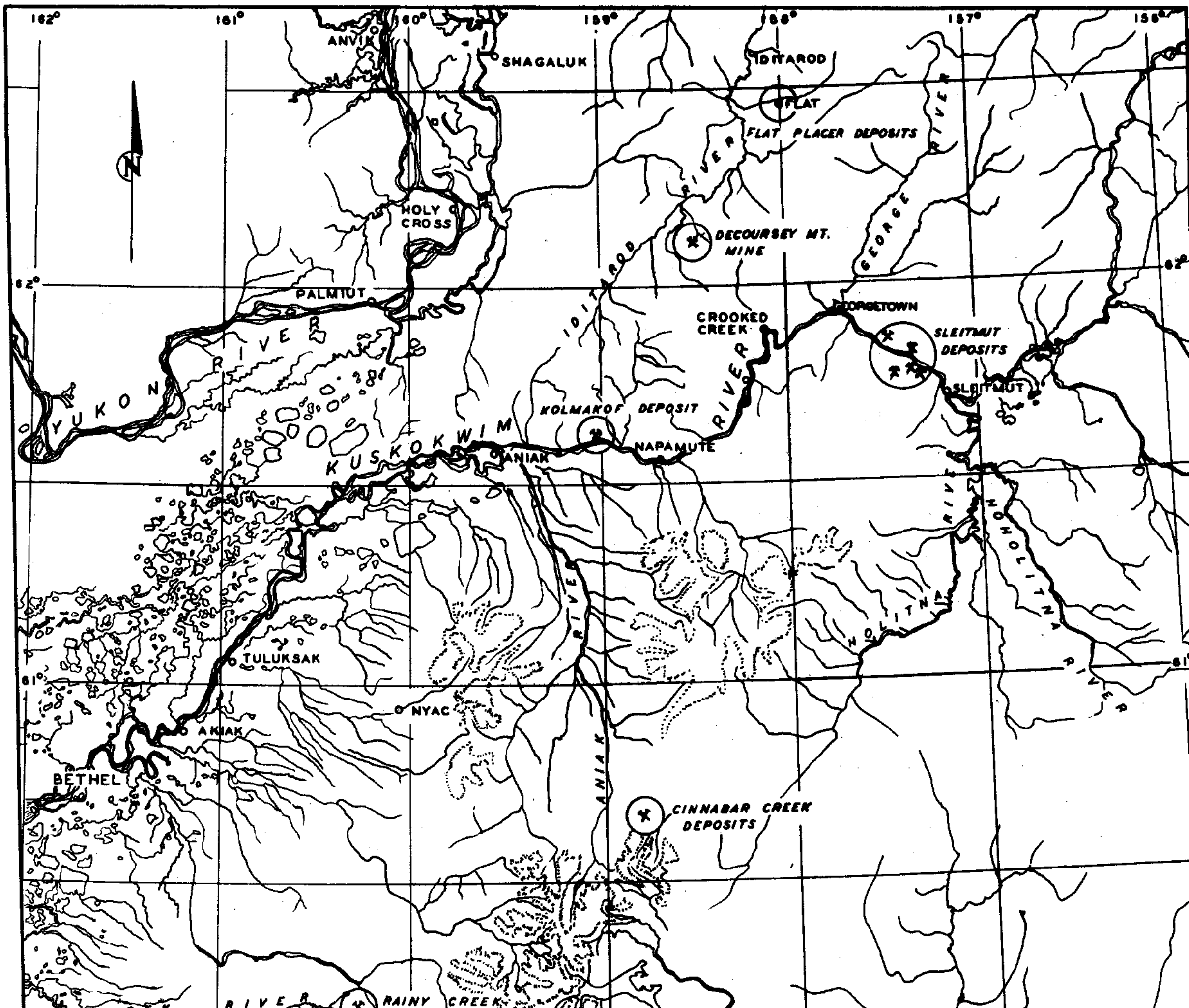

FIG. 2 MERCURY DEPOSITS IN SOUTHWESTERN ALASKA

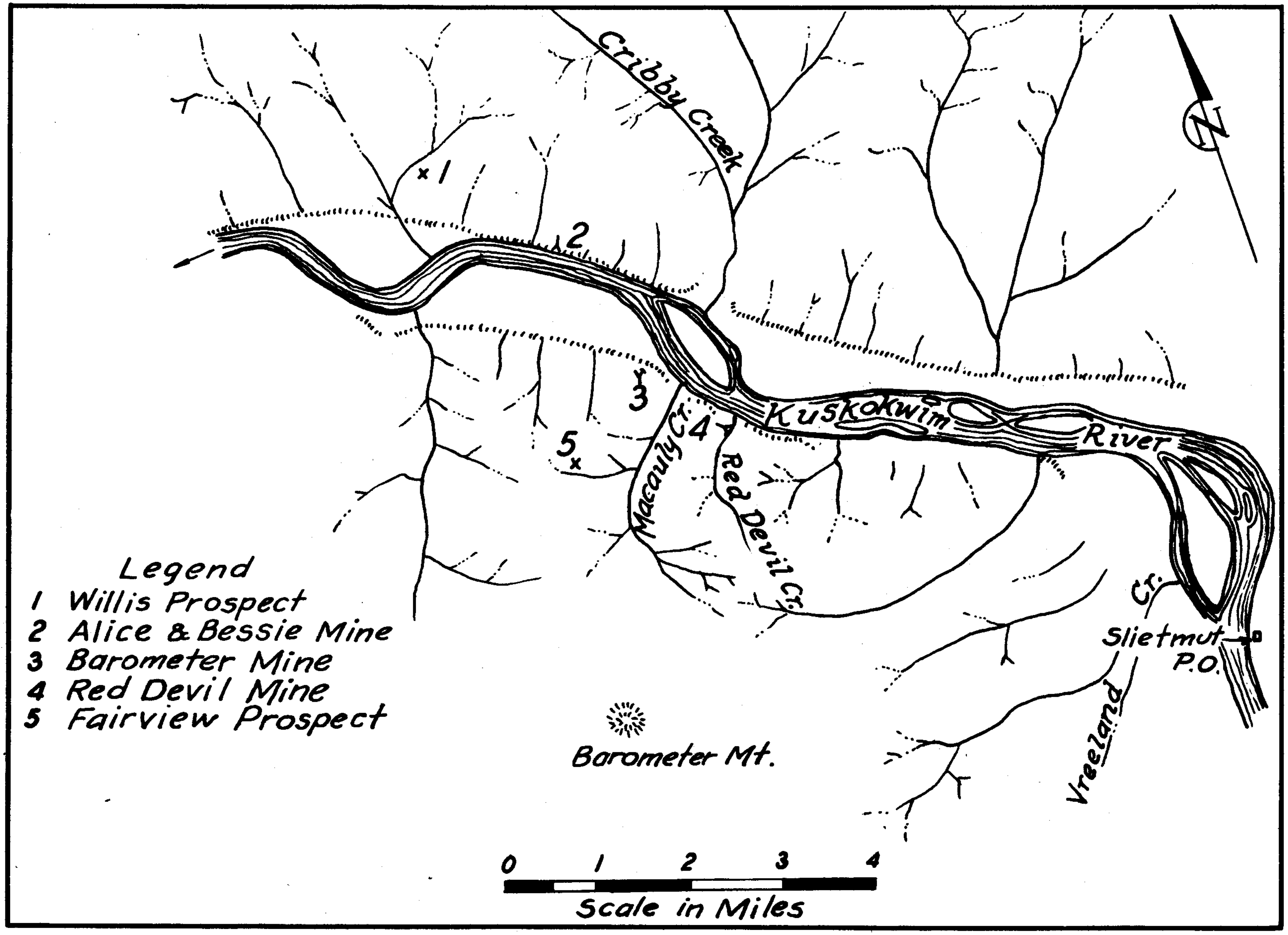

FIG. 3 LOCATION OF MERCURY MINES & PROSPECTS-SLEITMUT AREA

prospecting in the Upper Holitna River region; to Tony McDonald and Clyde Larabee, who assisted in obtaining transportation into the same area; and to Frank H. Waskey for contributing information leading to the examination of the Marsh Mountain deposits. Acknowledgment is also due Norman E. Ebbley and Robert L. Thorne, who directed Bureau of Mines underground exploration at the Red Devil mine in the winter of 1942-1943; Aner W. Erickson, who conducted the original examination of the Marsh Mountain deposit; Harold C. Pierce, who assisted in the Cinnabar Creek examination; and Robert S. Sanford, acting chief of the Alaska Division of the Bureau of Mines, who supervised all exploration and rendered much assistance in the compilation of this report.

LOCATION AND ACCESSIBILITY

Known cinnabar occurrences in Southwestern Alaska are situated within a rectangle 250 miles long by 130 miles wide, extending from latitude 59° N. to 62° 30' N. and from longitude 157° W. to 160° 40' W. Within this area are seven known zones of cinnabar mineralization situated approximately as follows:

Marsh Mountain,	59° 15' N. lat.,	158° 30' W. long.
Rainy Creek,	60° 12' N. lat.,	160° 20' W. long.
Cinnabar Creek,	60° 40' N. lat.,	158° 45' W. long.
Kolmakof.	61° 30' N. lat.,	159° 00' W. long.
Sleitmut,	61° 46' N. lat.,	157° 20' W. long.
DeCoursey Mt.,	62° 15' N. lat.,	158° 10' W. long.
Flat Placer area,	62° 30' N. lat.,	158° 01' W. long.

All except the Marsh Mountain and the Flat Placer deposits lie within the Kuskokwim drainage area, as shown in figure 2. Five deposits within a 4-mile zone lie 7 to 12 miles downstream from the village of Sleitmut in the Georgetown mining district. This zone, in which are located the Red Devil mine, Barometer mine, Alice and Bessie mine, Willis prospect, and Fairview prospect, is the most important mercury discovery in Alaska to date. (See fig. 3.)

The DeCoursey Mountain deposits, situated 63 miles northwest of the Sleitmut zone, 23 miles northwest of Crooked Creek, and 43 miles southwest of Flat in the Iditarod mining district, contributed materially to Alaska's mercury production during World War II.

The Kolmakof deposits are on the right limit of the Kuskokwim River about 18 miles above the village of Aniak and 12 miles below Napamute.

Quicksilver has been recovered from gold placers on Iditarod Creek near the village of Flat. Cinnabar has also been found in some of the placers in the Iditarod and McGrath districts, notably on Happy and Candle Creeks 9/.

The Rainy Creek quicksilver prospect is on the south side of Arsenic Creek, 1/8 mile above its junction with Rainy Creek and 2 miles above the junction of Rainy Creek with the north fork of Eek River, a tributary of the Kuskokwim River. The location is shown in figures 2 and 22.

9/ Joesting, Henry R., Strategic Mineral Occurrences in Interior Alaska: Territory of Alaska, Department of Mines, May 1942.

Cinnabar Creek deposits consist of the Broken Shovel lode, near the headwaters of Cinnabar Creek, and Redskin and Lucky Day lodes on Beaver Creek. Cinnabar and Beaver Creeks unite to join the Gemuk River, which flows into the Chukawan River; that stream, in turn, flows into the Holitna River, a tributary of the Kuskokwim. Figure 18 shows the location of the cinnabar deposits with respect to these streams.

Marsh Mountain mercury deposits are on the south side of the mountain after which they are named and 4 miles east of Aleknagik, a native village on the southeast end of Lake Aleknagik, which discharges into Wood River 20 miles north of Nushagak Bay. (See fig. 25.)

Shallow-draft ocean-going vessels ascend the Kuskokwim River about 80 miles from its mouth to Bethel, where freight is transferred to river boats that serve the villages as far inland as McGrath. The minimum freight rate by steamship from Seattle to Bethel is $22.50 a ton. River-boat upstream freight rates from Bethel are based at $30 a ton, and down-river at $15 a ton.

Freight rates from Seattle to Sleitmut, including a $5 handling charge at Bethel, will average about $65 a ton. The rate is higher for bulky items.

Sleitmut is a native village lying along both banks of the Kuskokwim, about midway between Bethel and McGrath, and has a population of about 75 persons during the salmon run (from July through August) and about half that number during trapping months. In normal times, adequate stocks of living essentials, including gasoline and oil, can be obtained from any of several trading posts that serve the lower Kuskokwim area.

Established mining camps of the area are ordinarily equipped with radio transmitting sets, by means of which telegraphic communication is established with the Alaska Communication System at Flat, Bethel, or McGrath. Telegraphic service at Sleitmut, as an accomodation, by the Alaska Native Service is available only during the regularly scheduled periods of transmission of their official messages.

Travel into the area is almost entirely by airplane. Scheduled flights are made several times weekly by six Alaska airlines from Anchorage and Fairbanks to McGrath, Flat, Aniak, and Bethel.

A mail plane equipped with floats in summer and skis in winter makes weekly stops at villages along the Kuskokwim, such as Sleitmut, Crooked Creek, Georgetown, and Aniak. Wheel-equipped planes make scheduled flights to Flat and charter trips to the Red Devil and DeCoursey Mountain mines. A landing field is situated on the south side of the Kuskokwim just across from the Parks (Alice and Bessie) property and 2 miles downstream from the Red Devil mine.

PHYSICAL FEATURES AND CLIMATE

The Lower Kuskokwim Valley in Southwestern Alaska comprises a vast expanse of unsurveyed terrain characterized by swampy lowlands, tundra-covered plateaus, and uplands. The large streams of the area originate in the uplands of the Alaska Range and in the plateau region to the west. The Kuskokwim River, by far the most important, receives many ice-fed tributaries and flows southwest in a wide, meandering channel to the Bering Sea. The stream basins form a vast lowland area comprising a greater part of the coastal region and much of the broad unexplored hinter-land. The ground surface rises gradually from the river basins into wide plateaus, which in turn merge into the rolling foothills. Taken as a whole, the area is one of moderate relief, with low, rounded mountains, plateaus, broad lowlands, lakes, and rivers.

Tundra is so prevalent in the area that few rock exposures are visible to the prospector. The lower valleys and hillsides are covered with scrub birch alder, and spruce, whereas the ridges are clear. Ox-bow ponds and marshes have been left in the river valleys by the shifting of meandering stream channels. Cut-off loops have been filled by decayed moss and scrubs that are buried each year by new growth and water-born silts. Thin peat beds formed thus are exposed at places along the banks where the river has rechanneled the old stream bed.

Fair stands of spruce grow along the river banks and for short distances up the tributaries. The larger spruce trees afford material for structural timbers and lumber up to 10 inches in width. Quaking aspen, balsam poplar, white birch, and shrubby maple, abundant in that order, are little suited to structural or mining use. Wood for fuel is available at most known mercury prospects.

Up to 1941, United States Weather Bureau statistics show the annual average precipitation at Bethel to be 17.98 inches. In 1944, precipitation at Bethel was 25.68 inches, whereas at McGrath, 500 miles inland, it was 20.01 inches. The average annual snowfall at Bethel, according to Weather Bureau records, is 39.9 inches.

During midsummer the climate is mild, with moderate, nearly constant winds and frequent light rains. The rainy season begins about July 15 and usually continues until September, with scarcely a day without some precipitation. Prior to the rainy season, the weather is ideal for field work, days are long, and the temperature is moderate. Snow usually comes about mid-October and the winter freeze-up shortly thereafter.

From June to October, it is necessary to protect the workman from mosquitoes and flies, which seriously impair working efficiency.

Records at Bethel show a temperature range from 90° to -46° F. The mean temperature for Bethel in 1944 was 30.2° F.; for McGrath it was 27.6° F.

In the interior, subzero temperatures are prevalent through December and January, with annual minimums of -30 to -40° F. Low temperatures and abundant snowfall virtually eliminate outside work in winter except intermittent logging, wood cutting, and freighting.

In the coastal area, the climate is disagreeable much of the time because of fog, mist, and wind.

HISTORY AND PRODUCTION

For many years, cinnabar has been noted in the gold-bearing gravels of several placer-mining districts in Alaska, and, though they have not yielded mercury in commercial quantities, some of these deposits have led to the discovery of valuable lode deposits. Occurrences of placer cinnabar in the Yukon and Tanana regions have been reported from the Marshall, Bonnifield, Rampart, Hot Springs, Circle, Seventy-mile, and Forty-mile districts. In most of these the mineral is scarce. In the Tolovana district, large amounts of placer cinnabar have been found on Olive Creek and smaller amounts on Lillian and Ruth Creeks. One lode occurrence was discovered on Olive Creek in 1917, but after considerable underground development it was abandoned.

There is a lode deposit at Bluff, east of Nome; but the region extending from Bristol Bay northward to include the central Kuskokwim valley is the only part of Alaska where, up to the present time (1946), quicksilver lode prospects have attracted serious attention.

The first known report authentically giving the regional location of quicksilver in Alaska is by Ivan Petrof[10], who relates that in the Kuskokwim region are "well-defined veins of cinnabar, antimony and silver-bearing quartz. Cinnabar has also been discovered on the Kuskokwim, and assays made of the ore in San Francisco indicate a very valuable discovery there. * * *. The mountains eastward of the Redoute Kalmakovsky are high, heavily timbered around the base, and give ample evidense of the presence of mineral deposits, veins of quartz, cinnabar, and other ores being easily traced wherever the slopes and bluffs are exposed to view."

In 1898, J. E. Spurr,[11] of the Federal Geological Survey, made a reconnaissance examination in southwestern Alaska and reported cinnabar on the Kuskokwim 5 miles downstream from Kolmakof.

The same deposit was investigated by A. G. Maddren, of the Federal Geological Survey, during the course of a general examination of the Kuskokwim and adjacent regions in the summer of 1914.

The first real development work on a quicksilver lode in the region was done at the Parks prospect (now known as the Alice and Bessie claims) on the north bank of the Kuskokwim, about 15 miles upstream from Georgetown. Development work was started shortly after its discovery in 1906 and continued in a small way for several years thereafter. Philip S. Smith, of the Federal Geological Survey, examined and reported[12] on the deposit in 1914. Seven hundred

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10/ Petrof, Ivan, Report on the Population, Industries, and Resources of Alaska: 1884, pp. 13, 77, 90.

11/ Spurr, J. E., A Reconnaissance in Southwestern Alaska in 1898: U. S. Geol. Surv., Twentieth Ann. Rept., 1900, pt. 17, p. 261.

12/ Brooks, A. H., et al, Mineral Resources of Alaska Report on Progress of Investigation in 1914: U. S. Geol. Survey Bull. 622, 1915, p. 274.

pounds of mercury had been produced from the property up to that time and constituted virtually the total Alaskan production during that period.

Several years later the DeCoursey Mountain prospect was discovered, and in 1921 Hans Halverson discovered the Barometer lode on the south side of the Kuskokwim. Halverson made the first Red Devil claim locations in 1933.

Up to July 1943, the total mercury produced from the lower Kuskokwim area amounted to about 800 flasks. In that year, under the stimulus of war demand and high prices, quicksilver producers became seriously interested in cinnabar deposits in Southwestern Alaska. In 1943, production from the Territory rose to 786 flasks, most of which came from the Red Devil mine. Several hundred feet of drifting was completed, and a 36-inch by 40-foot rotary kiln was installed at this property. At the DeCoursey mine, 30 miles southwest of the village of Flat, a block of high-grade ore was mined.

Activity increased through 1944 and 1945 at these properties, and renewed interest in cinnabar lode deposits was shown by prospectors in other parts of Alaska.

RED DEVIL MINE

History

In 1933, Hans Halverson, finding cinnabar float in a small stream bed on the left limit of the Kuskokwim 8 miles downstream from Sleitmut, traced it to its source, about 1,000 feet southwest of the river and made the original Red Devil claim locations. A few years later, a half interest was acquired by Nick Mellick and additional claims were jointly staked. Nine unpatented claims comprise the Red Devil property - Red Devil Nos. 1, 2, 3, and 4, Kusko Nos. 1 and 2, and Eurica Nos. 1, 2, and 3. They are within the Georgetown district in the Fourth Judicial Division of Alaska.

Halverson and Mellick started production of mercury in a small way from creek-bed float and detritus material in the vicinity of the lode. Eleven flasks of mercury were retorted from selected ore with several used Johnson-McKay tubes operated singly and without the addition of lime to the ore. The installation of two "D" retorts on the property in 1940 increased production to 158 flasks for that year. Production in 1941 was 135 flasks, and during the first part of 1942 it was 117 flasks. During these years, the partners sluiced the overburden from the southeastern extremity of the ore zone, leaving, however, a considerable depth of bedrock rubble. It was ore from this loose material that yielded much of the early product.

An adit at an altitude of 311 feet was next driven from the open cut a distance of 90 feet northwest along an ore lens. This furnished the remainder of Red Devil production prior to the midseason of 1942. The backs over this adit are negligible.

A second adit was started in 1941 at a point 70 feet north of the portal of the 311-foot adit and at an altitude of 325 feet. The location of the two adits is shown in figure 4. The 325-level adit was driven 130 feet northwest along the strike of the formations. No ore was encountered, but a showing of cinnabar 40 feet from the portal encouraged the owners to drive a crosscut 50 feet southwest. Also, a crosscut at a point 106 feet from the portal was driven 40 feet S. 57° W. Both penetrated barren sandstone.

The owners started the Red Devil shaft 55 feet southeast of the portal of the 311-foot adit and sank it to a depth 30 feet on a 62-degree incline. At that depth the shaft appeared to be leaving the ore in its hanging wall.

In the fall of that year, Harold Schmidt and C. J. Stampe, of Fairbanks, obtained a lease on the property. The New Idria Quicksilver Mining Co. became interested in the property, also, and entered into the lease agreement jointly with Schmidt and Stampe. The New Idria-Alaska Quicksilver Mining Co. was formed with Harold Schmidt as superintendent.

The new company brought in mining and furnacing equipment and in 1943 completed more than 500 feet of drifting and crosscutting. Production was resumed on a larger scale and continued until the spring of 1944, when a discouraging mercury market caused the New Idria-Alaska Quicksilver Co. to curtail operations and eventually to sublease the property to the Kuskokwim Mining Co., consisting of Harold H. Schmidt, Glen Franklin, Earl Ellingen, and E. J. Stampe.

Production in 1944 was 1,090 flasks of mercury from 2,652 tons of ore. In 1945 the plant was operated 127 days from April to September, and 962 flasks were produced from 1,514 tons of ore. A dropping market price and difficulty in obtaining prompt notice of price changes caused the Kuskokwim Mining Co. to suspend operations early in the fall of that year.

Work done by the Bureau of Mines

Exploration of the Red Devil deposits was started by the Bureau of Mines in August 1942 about the time that Halverson and Mellick found it necessary to curtail their small-scale operation. A bulldozer was rented from Dan McDonald, and trenching in heavy overburden was started northwest of the open cut. Trenching in shallow overburden near the open cut was done by hand. Nineteen trenches with a combined length of more than 2,000 feet were cut at intervals of 30 to 150 feet across the strike of the mineralized zone. The dimensions of these excavations ranged in cross section from 2 by 3 feet to 24 by 10 feet and averaged 6 by 10 feet.

Figure 4 shows the location of trenches and samples. Table 2 gives the mercury and antimony content of samples collected.

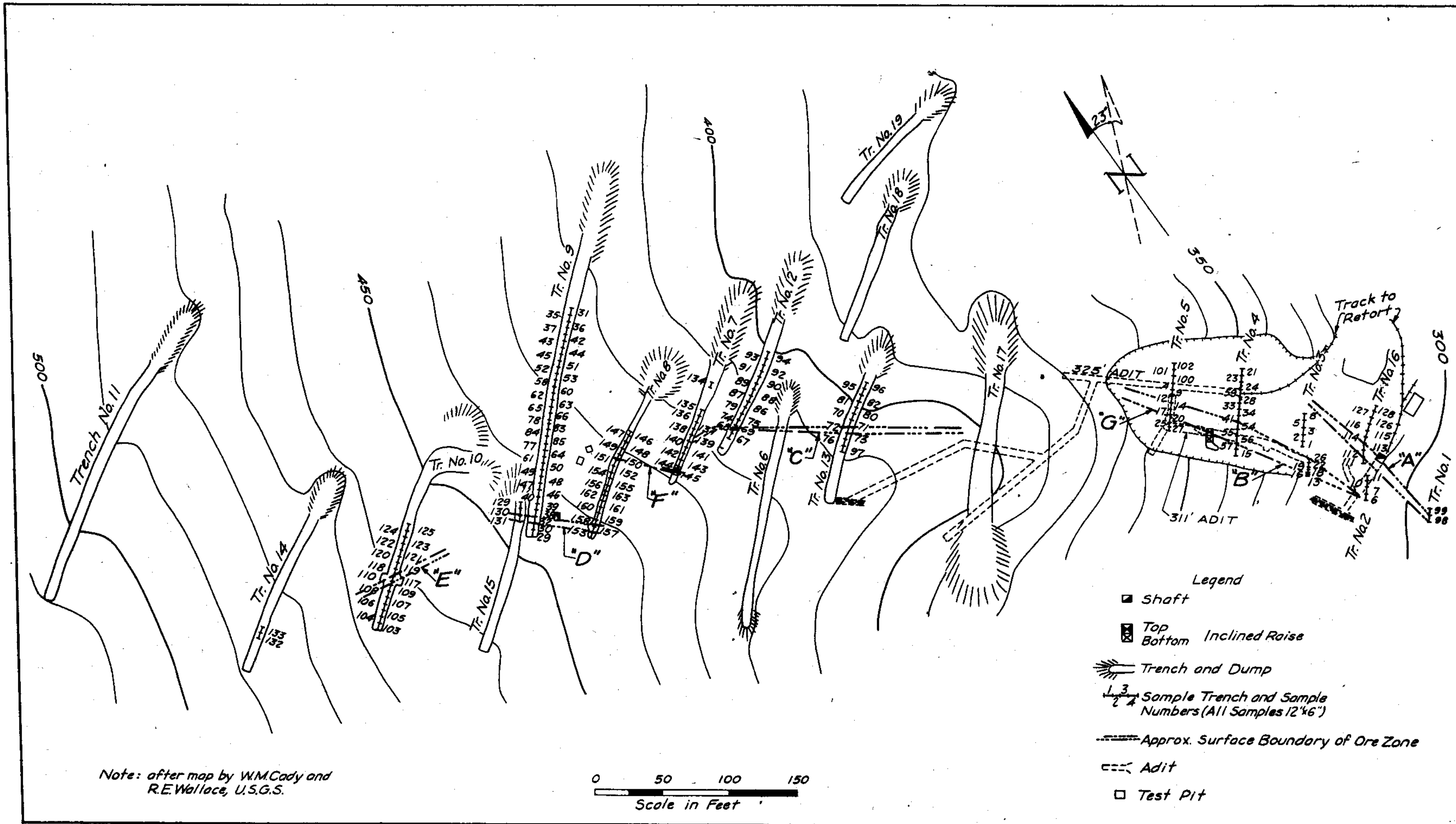


FIG. 4, TOPOGRAPHIC AND MINE MAP, RED DEVIL MINE

TABLE 2. - Analyses of samples from Red Devil trenches

Sample	Trench	Lb. Hg per ton	Percent Sb	Sample	Trench	Lb. Hg per ton	Percent Sb
1......	3	0.1		48......	9	0.1	
2......	3	0.7		49......	9	0.1	
3......	3	0.8		50......	9	0.1	
4......	5	0.2	0.05	51......	9	0.1	
5......	3	0.2		52......	9	0.2	
6......	2	0.1		53......	9	0.1	
7......	2	0.1		54......	4	34.4	0.91
8......	3	0.1		55......	4	23.2	0.13
9......	5	0.1		56......	4	19.0	
10......	2	1.1		57......	4	0.1	
11......	2	0.5		58......	9	0.1	
12......	5	0.4	0.05	59......	4	0.2	
13......	3	4.2		60......	9	0.1	
14......	5	0.1	0.05	61......	9	0.1	
15......	4	0.1		62......	9	0.2	
16......	3	53.8	5.47	63......	9	0.2	
17......	5	23.3	0.60	64......	9	0.1	
18......	3	11.8	0.95	65......	9	0.1	
19......	3	28.5	1.13	66......	9	0.1	
20......	5	15.0	0.45	67......	12	0.5	
21......	4	0.5		68......	12	1.1	
22......	3	80.8	0.75	69......	12	110.4	15.10
23......	4	0.8		70......	13	6.7	
24......	4	0.4		71......	13	2.5	0.08
25......	5	7.2		72......	13	27.9	
26......	3	89.0		73......	13	4.5	0.27
27......	5	15.4	1.75	74......	12	4.1	
28......	4	0.5		75......	12	0.4	
29......	9	0.1		76......	13	2.2	
30......	9	0.5		77......	9	0.1	
31......	9	0.4		78......	9	0.2	
32......	9	3.7	0.05	79......	12	0.3	
33......	4	0.8		80......	13	0.2	0.04
34......	4	1.5	0.07	81......	13	0.1	
35......	9	0.2		82......	13	0.9	
36......	9	0.7	0.10	83......	9	0.3	
37......	9	0.1		84......	9	0.1	
38......	9	0.1		85......	9	0.3	
39......	9	0.1		86......	12	0.2	
40......	9	0.2		87......	12	0.1	
41......	4	1.5		88......	12	0.1	
42......	9	0.3		89......	12	0.2	
43......	9	0.2		90......	12	0.2	
44......	9	0.1		91......	12	0.1	
45......	9	0.1		92......	12	0.2	
46......	9	0.1		93......	12	0.2	
47......	9	0.1		94......	12	0.1	

TABLE 2. - Analyses of samples from Red Devil trenches - continued

Sample	Trench	Lb. Hg per ton	Percent Sb	Sample	Trench	Lb. Hg per ton	Percent Sb
95.....	13	0.2	......	130.....	15	1.6	0.33
96.....	13	0.2	......	131.....	15	1.4	0.16
97.....	13	3.3	......	132.....	14	0.3	......
98.....	1	4.9	0.05	133.....	14	0.2	......
99.....	1	0.4	0.07	134.....	7	0.1	......
100.....	5	0.5	......	135.....	7	0.4	......
101.....	5	0.3	......	136.....	7	0.2	......
102.....	5	0.5	......	137.....	7	0.2	0.05
103.....	10	0.2	......	138.....	7	0.4	......
104.....	10	0.5	......	139.....	7	8.6	0.05
105.....	10	0.1	......	140.....	7	0.9	0.30
106.....	10	0.1	......	141.....	7	0.1	......
107.....	10	0.5	......	142.....	7	0.1	0.10
108.....	10	0.1	......	143.....	7	0.1	......
109.....	10	0.8	......	144.....	7	0.1	......
110.....	10	21.8	0.10	145.....	7	0.2	12.40
111.....	16	0.5	......	146.....	8	0.1	......
112.....	16	32.1	0.13	147.....	8	0.2	......
113.....	16	26.1	0.15	148.....	8	0.1	......
114.....	16	3.6	0.10	149.....	8	0.1	......
115.....	16	0.4	0.08	150.....	8	0.1	......
116.....	16	0.4	......	151.....	8	0.1	......
117.....	10	52.8	0.46	152.....	8	0.1	0.23
118.....	10	6.2	......	153.....	8	0.1	......
119.....	10	0.1	......	154.....	8	0.8	......
120.....	10	0.2	......	155.....	8	0.6	......
121.....	10	0.1	......	156.....	8	0.2	......
122.....	10	0.2	......	157.....	8	0.2	2.45
123.....	10	0.7	0.12	158.....	8	0.1	......
124.....	10	1.3	......	159.....	8	0.1	......
125.....	10	0.1	......	160.....	8	0.2	......
126.....	16	1.6	......	161.....	8	0.1	......
127.....	16	0.9	......	162.....	8	0.1	......
128.....	16	0.5	......	163.....	8	0.1	......
129.....	15	0.6	......				

Seven mineralized lenses were exposed by surface trenches and were designated A, B, C, D, E, F, and G, as shown in figure 4. Lenses D and F were occurrences of weak mineralization; the others represent commercial ore bodies.

The Bureau also conducted underground exploration in the winter of 1942-43. The inclined shaft was sunk and timbered from 30 feet to a depth of 55 feet, but pump failure and inability to obtain repair parts prevented further advance. Ore was not found in the shaft below the 30-foot depth. A station was cut at 41 feet, and a crosscut was driven into the hanging wall to lens B. A drift was driven in this lens 22 feet northwest and was later extended by the operators. At this stage of the development, both faces of the drift were in high-grade ore.

From the 41-foot station, a heading was driven 26 feet around the hanging wall of the shaft to find the projection of lens A at that depth. Ore was not found, however.

The Bureau explored on the 325-foot level, also. The crosscut 106 feet from the portal was extended from 40 feet to 166 feet. The advance was S. 86° W. through 126 feet of almost barren sandstone.

Ore Deposits

The sediments in the Sleitmut area consist of graywacke, sandstones, and shales. At most places on the Red Devil property their strike is about N. 45° W.; dips are not uniform but average about 55 degrees southwest. The formations are predominantly shales in a part of the Red Devil property, but to the northwest these pass successively into intercalated shales, graywackes, and sandstones. In places, thin andesite intrusions in the form of sills separate the sedimentary beds. The intrusions are in the form of lenses and occur "en echelon" successively to the northwest.

Cinnabar and stibnite lenses occur principally along hanging-wall contacts within both the small sills and the adjacent sediments. In mining the Red Devil ore, it has been found that the lenses cut off sharply after being followed a short distance along their strike, and that they abutt a cross-trending joint plane. These planes are the loci of very weak mineralization with or without narrow, perhaps discontinuous andesitic material. They are believed not to extend beyond the zone of disturbance, which corresponds to the Red Devil ore zone with an average width of 30 feet. This structure is characteristic of the Red Devil deposits and has been found very useful in following the ore.

Six cinnabar-stibnite deposits have been found along a mineralized zone more than 800 feet in length. Five of these lie parallel to the bedding, or about N. 45° W., whereas, the trend of the sixth is across the bedding at N. 75° W. The deposits occur in various lengths and widths from 3 inches to 10 feet.

An approximate antimony:mercury ratio of 1:1 is indicated in the Red Devil ore by the following 17 determinations:

TABLE 3. - Mercury:antimony ratio in Red Devil ore

Sample	Trench	Hg, lb.	Sb, lb.
4	5	0.2	1.0
16	3	53.8	109.4
12	5	0.4	1.0
17	5	23.3	12.0
18	3	11.8	19.0
19	3	28.5	22.6
20	5	15.0	9.0
22	3	80.8	15.0
27	5	15.4	35.0
54	4	34.4	18.2
55	4	23.2	2.6
69	12	110.4	302.0
110	10	21.8	2.0
112	16	32.1	2.6
113	16	26.1	3.0
117	10	52.8	9.2
139	7	8.6	1.0
		538.6	564.6
Arithmetical av.		31.7	33.2

Mine Development

After the organization of the New Idria-Alaska Quicksilver Co., a program of systematic development of the Red Devil mine was begun. The inclined shaft was put down from 55 feet to 100 feet. A crosscut at 231 feet above sea level was driven from the shaft 50 feet southwest to penetrate the ore zone where drifts led northwest and southeast. A total of 390 feet of drifting and crosscutting was completed on this level.

The 30-foot crosscut driven from the shaft on the 270-foot level by the Bureau of Mines was extended 50 feet southwest by the company, though no ore was encountered. On this same level, 30 feet from the shaft, a drift was driven 100 feet northwest; then, at 60 feet from the crosscut, a meandering branch to the left was driven westerly 104 feet. Two short crosscuts were driven 12 feet each side of the branch drift at 25 feet from the main drift. A considerable amount of ore averaging 50 pounds of mercury a ton was mined from stopes above the main drift on the 270-foot level.

Following the Bureau of Mines exploratory program of crosscutting on the 325-foot level, the operators started a drift 71 feet from the adit, drove 60 feet N. 45° W., and then turned the heading N. 80° W. After advancing 95 feet in this direction, an ore lens corresponding to the Bureau's "C" ore lens at the surface was encountered.

Further development, including drifting and crosscutting, by the New Idria-Alaska Quicksilver Co. amounted to 580 feet. This work, most of which was completed in 1943, was a continuation of the 325-foot adit along the strike of the mineralized zone. Figure 5 shows the plan of the Red Devil mine at its present stage of development.

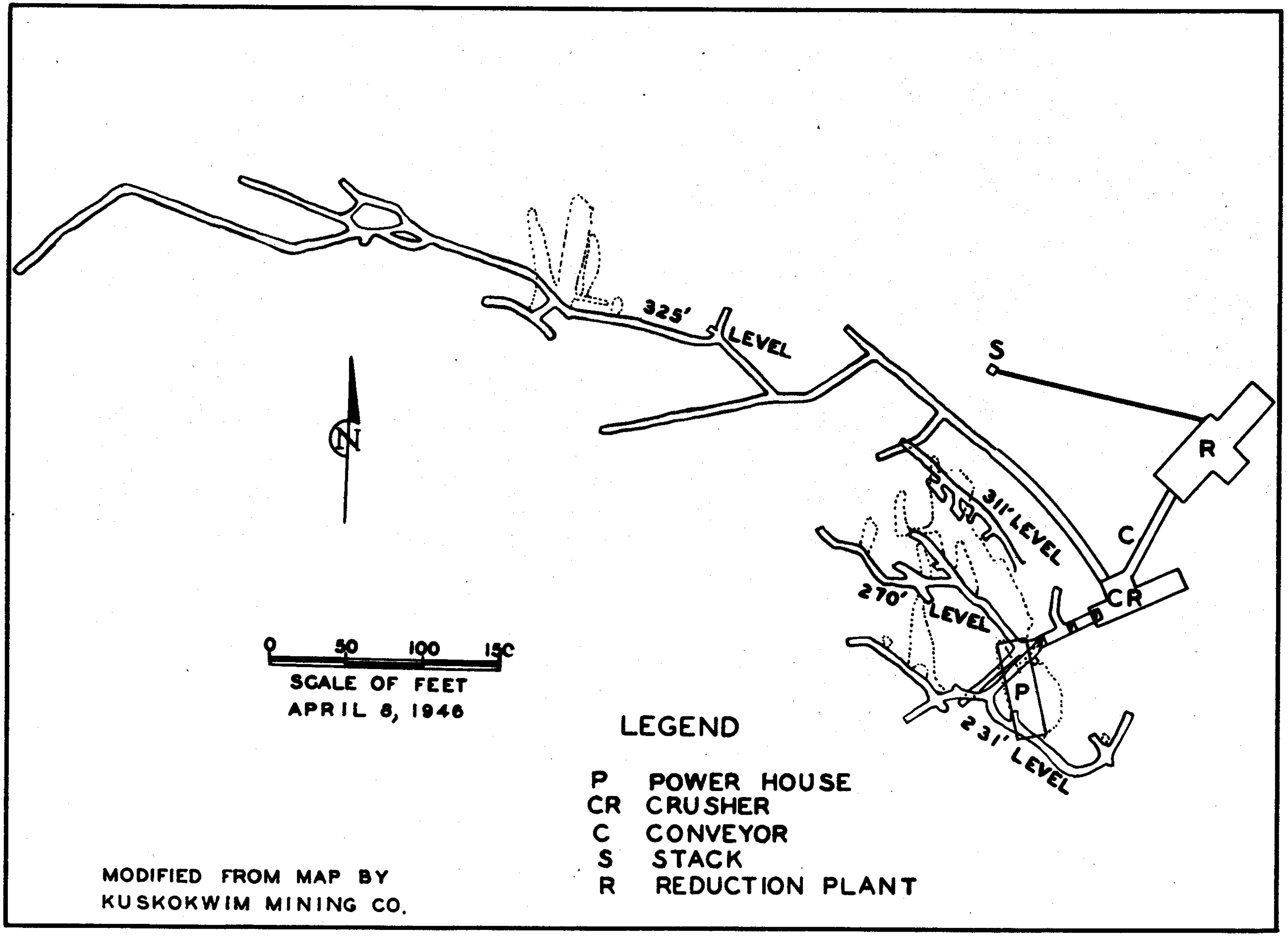


FIG. 5 PLAN OF RED DEVIL MINE, SLEITMUT, ALASKA.

Mining

The ore is soft and friable and breaks free from the walls. The country rock is weak and requires close spacing of stulls for support of stope walls and drifts. All ore is mined from stulled stopes, the holes being drilled in the ore from stull-supported staging. Broken ore is trammed to the shaft on the 270-foot level and to the storage bin on the 375-foot level.

Water is pumped from the mine at a rate of about 100 gallons a minute.

The amount and grade of ore extracted from the various parts of the mine are given in table 4.

TABLE 4. - Red Devil ore summary

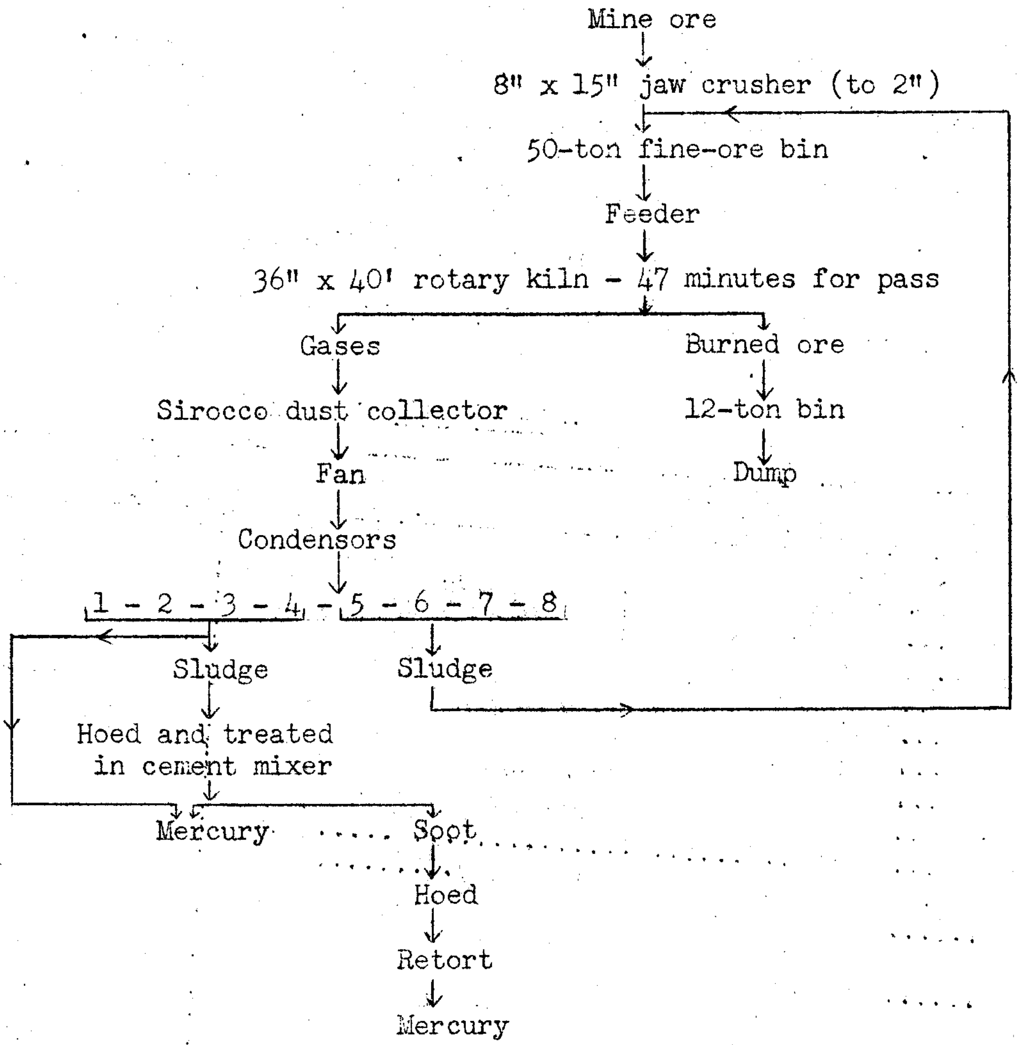
Season	Level	Width, feet	Stope No.	Tons	Est. grade, lb./ton	Recovered, lb./ton
1943-44...	325	3	72	550	60	
1943-44...	325	5	72 HW	522	25	
1943-44...	50' shaft	3	1	350	80	
1943-44...	50' shaft	3	2	300	40	
1943-44...	50' shaft	8	3	450	18	
1943-44...	50' shaft	3	4	250	50	
1943-44...	50' shaft	3	5	80	40	
1943-44...	50' shaft	$2\frac{1}{2}$	Sublevel	100	25	
1943-44...			Sublevel crosscut	50	18	
1943-44...	Total..............................			2,652		
1943-44...	Mercury recovered (flasks)..........			1,090		
1945......	325 to surface	4	F	400	40	23
1945......	325 to surface	3	72 FW	200	20-25	?
1945......	325 to surface shaft	4	Exploratory stope	114	20	?
1945......	100' level shaft	4	1	400	95	70
1945......	100' level shaft	4	2	150	70	66
1945......	100' level	3	3	250	60	57
1945......	Total and average..................			1,514		48.3
1945......	Mercury recovered (flasks).........			962		

NOTE: 270-ft. level designated 50-ft. shaft; 231-ft. level, 100-ft. shaft.

Six miners and two hoistmen are employed two shifts a day, 7 days a week during the operating season.

Furnacing and Retorting

In 1943, a New Idria-Alaska Quicksilver Mining Co. installed modern equipment for furnacing and retorting the Red Devil ore. The reduction plant was equipped with a 50-ton fine-ore bin, a 12-ton burned-ore bin, a 36-inch by 40-foot rotary kiln, Sirocco dust collectors, fan, condensors, and redwood tanks. Ore is reduced by the following flow sheet.



Power for the reduction plant and mine is furnished by two caterpillar 46-30 Deisel-electric units. The plant is operated three shifts a day, 7 days a week, by a crew consisting of three firemen, two retort operators, and two helpers, whose duties include cleaning up soot. A plan and profile of the conveyor room and condensor system are shown in figure 6.

The plant was placed in operation in 1944 to treat the 2,652 tons mined in 1943 and 1944. The yield in that year was 1,000 flasks of mercury from the kiln operation and 90 flasks from the retorts. Operations were resumed in April 1945. The rate of charge to the furnace, as shown by table 5, was more than 25 tons a day, and the recovery of mercury was less than 24 pounds a ton. By June, the rate was reduced to $6\frac{1}{2}$ tons a day, and recovery had increased to 66.6 pounds of mercury a ton. The mercury content of the raw ore was not determined, but according to the operators there was no great difference in the ore fed to the furnace during the two periods. They concluded that the passage of a heavy bed of crushed material through the kiln prevented air from circulating freely between the ore particles, retarded the formation of sulfur dioxide, and thus allowed only a partial reduction of the cinnabar ore.

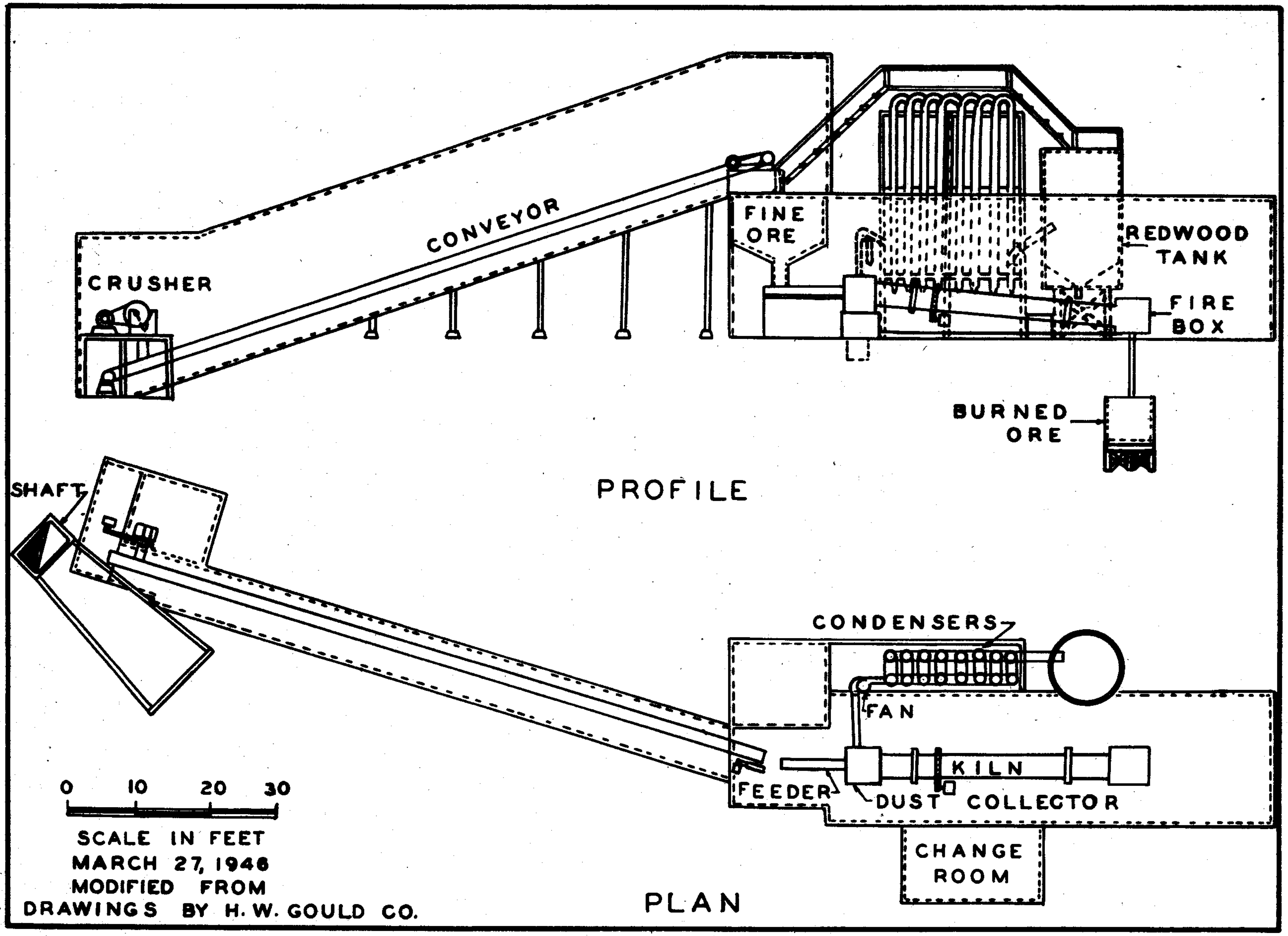


FIG. 6 LAYOUT OF RED DEVIL REDUCTION PLANT

TABLE 5. - Reduction plant record, 1945

Month	Tons	Days	Flasks	Recovery, lb./ton
April	387	15	108	23.8
May	311	20	113	27.6
June	194	30	173	66.6
July	324	30	300	70.3
August	265	27	200	57.3
September	33	5	56	-
Total	1,514		950	48.3

Note. - Additional flasks recovered from soot - 12.

The antimonial content of the Red Devil ore is nearly as great as that of mercury. Very little arsenic is present.

Stibnite sublimes at temperatures over 300°C., and the resultant oxides become volatile at about 500°C. The vapor pressure of cinnabar rises rapidly above 450°C. and reaches atmospheric pressure at 580°C. At furnace temperatures around 700°C., antimony vapors will accompany those of mercury into the condensing system. Vapor pressures of the oxides of antimony are much less than that of mercury, and in the decreasing temperatures of the condensing system, the oxides of antimony precipitate before the dew point of mercury is reached. Hence, it is apparent that in furnacing Red Devil ores, a close control of temperatures is essential, and at best considerable antimony is carried over into the condensers. Improvements might be gained through experiments with design, draft, regulation, rate of temperature decrease, and character of feed. Antimony oxides passing into the condensing system are eliminated in the soot by extra hoeing and retorting. Little effort has been made to produce an antimony concentrate because of the high cost of transporting such a product to market.

Mercury flasks are shipped down the Kuskokwim by river boat to Bethel, thence to market at San Francisco by ocean steamer.

Costs

Costs at the Red Devil mine and reduction plant for the 5-month operating period in the summer of 1945 are shown in the following table:

TABLE 6. - Operating costs at the Red Devil mine in 1945

(Published by permission of Harold Schmidt, president, Kuskokwim Mining Co.)

Flasks produced - 962
Tons mined - 1514

	Per ton ore mined	Per flask mercury	Total	
Mining and development				
Breaking	$ 5.644	$ 8.882	$8544.94	
Tramming and hoisting	2.021	3.180	3058.78	
Shop work	1.485	2.338	2248.93	
Caterpillar and misc	1.227	1.932	1858.29	
	10.377	16.332		$15,710.94
Reduction-plant operation				
Firing	3.809	5.995	5767.05	
Wood	2.029	3.193	3072.00	
Clean-up of soot	1.899	2.989	2875.76	
Shop work	0.561	0.882	848.92	
Misc. labor and supplies	3.102	4.882	4696.10	
	11.400	17.941		17,259.83
Undistributed miscellaneous				
Cook house	4.486	7.061	6792.30	
Shop operation and supplies	3.948	6.214	5977.40	
Camp operation	0.089	0.140	135.04	
Retort operation	1.526	2.401	2310.00	
Depreciation of equipment	0.351	0.553	531.85	
Marketing	2.113	3.326	3200.00	
	12.513	19.695		18,947.23
Total	34.290	53.968		51,918.00

In addition to the 8 men employed at the mine and 7 at the reduction plant, there is a superintendent, a blacksmith, a cook, and a flunky, making an average crew of 19 men.

Dry, seasoned wood is used as fuel in the furnace and is consumed at the rate of one-tenth cord per ton of ore. The consumption in retorting is about eight-tenths cord per ton. Power units require about thirty-five 55-gallon drums of Deisel oil a month.

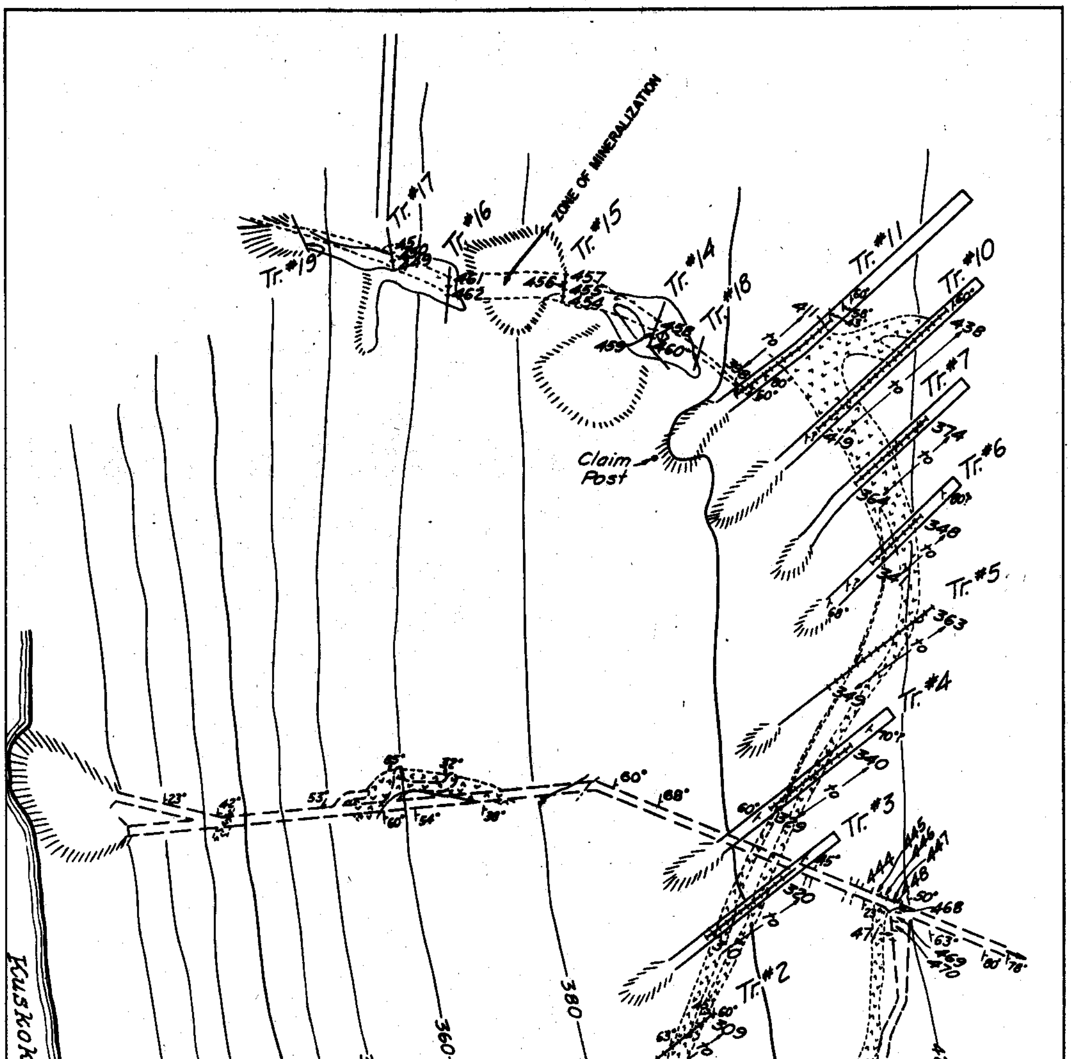


FIG. 7, ALICE AND BESSIE MINE

ALICE AND BESSIE MINE

History and ownership

The Alice and Bessie deposit on the north bank of the Kuskokwim River, 2 miles below Red Devil landing and 8 miles downstream from Sleitmut, as shown in figure 3, is believed to be the first known occurrence of mercury in the area. This first location consisted of two claims staked in 1906 by E. W. Parks. Six more claims were added to the group but were subsequently relinquished.

The ownership of the two unpatented claims, Alice No. 1 and Bessie No. 1, is distributed as follows:

	Percent
Daniel B. Trefethen, Dexter-Horton Building, Seattle, Wash.	40
Estate of E. W. Parks, Trustee, Bank of California, Seattle, Wash.; Alaskan Administrator, Nick Mellick, Sleitmut, Alaska.............	30
Edith R. Parks, Sacramento, Calif.	20
W. Delbar, Seattle, Wash.	10

Over a period of years, Parks prospected the property and occasionally retorted a little mercury in conjunction with his occupation of trader. Successively, he is reported to have used in retorting a steel drum, a small Scott furnace, and a Johnson-McKay furnace. Park's operation was apparently designed to supply the mercury requirements of the Georgetown and Iditarod gold placers, and toward meeting this demand he produced about 120 flasks up to and including 1923. There has been no production from the property since 1924.

Shallow pits and irregular surface excavations furnished the ore for this intermittent operation. His first production is reported to have been derived from an outcrop near the top of the river bluff. Later he mined ore from open cuts and a shallow short adit presumably in that portion of the main ore body represented by Bureau of Mines trenches 14 to 17 or in an offshoot extending westerly from the main ore body. (See fig. 7.)

He also obtained a considerable amount of this ore from shallow pits over the main ore body in the vicinity of Bureau of Mines trenches 4 and 5.

Parks had driven a crosscut adit for about 200 feet and encountered mineralization reported by the U. S. Geological Survey in 1914. In 1936, following the death of Parks, W. E. Dunkle leased the property and extended the adit to an over-all length of 525 feet. The main ore zone was encountered 450 feet from the portal, and a 240-foot drift was driven within the ore zone to the southeast.

Development

An adit driven by Parks and Dunkle is usable in its present condition, though it is without timber over most of its length.

The track has been removed from both the adit and drift, and no mining equipment remains at the property.

Two principal buildings, built by Parks, are on the river bank near a small permanent side stream and about 1,500 feet downriver from the adit. Both could be made habitable with the expenditure of a small amount of time and money.

Ore deposits

The graywackes and shales of the Alice and Bessie property strike northwest and dip to the northeast. It is believed that they are on the northeast limb of an anticline whose crest coincides with the Kuskokwim River for several miles.

The andesite on this property, wherever observed, has been altered from a buff to a white rock readily distinguishable from the unaltered, dark, biotite-andesite outcrop along the river bank below Parks' camp. Cinnabar mineralization has been found consistently in association only with the altered andesite, and the latter thus serves as a guide in prospecting. There is much more andesite in evidence at the Alice and Bessie than at the Red Devil property. As a rule, these intrusions are thin and parallel the bedding of the sediments, though they often cut across the bedding. The increasing areal extent of the andesite from the river northwestward to the Willis group of claims suggests the possibility that the parent igneous mass occurs at less depth here than on the opposite limb of the anticline.

Three separate ore bodies exist on the Alice and Bessie property: (1) The main deposit, exposed in the Bureau of Mines trenches and also in the drift driven from the crosscut adit; (2) a deposit that outcropped on the river bank above the adit at an altitude of 340 feet; and (3) an occurrence outcropping in the river bed.

The zone in which the main ore body occurs has been explored by a series of trenches. It has also been developed by a drift to the southeast from the crosscut adit about 160 feet vertically below the outcrop. Using the calculated average dip of 56°, the average dip interval between these exposures is 193 feet.

It is believed that the present underground exposures serve to prove the continuation of mineralization to that depth, but that they are insufficient to be considered in an estimation of reserves.

On the basis of the apparent N. 45° W. strike of the zone at the adit level, the trenches were excavated due north and south to cut the zone at an angle of 45 degrees. It had been observed underground that mineralization occurred as small veinlets generally oriented in a direction normal to that of the andesite contact. This structure was not discernable at the surface, possibly because the detail was obscured by the muddy smear resulting from almost continual rain.

Trenching proved that the andesite had been intruded as a sill between trenches 1 and 5, a distance of 340 feet. Over this length, the andesite is divided by several feet of sediments into two thin, roughly parallel bodies, both of which contain visible cinnabar in trenches 2 and 5. Cinnabar was observed in all but one trench within this strike interval, and although the principal concentration appeared to be within the andesite, it also extended into the enclosing sediments.

Southeast of this portion of the ore zone, the andesite swings easterly through trenches 8 and 9, both of which contain visible cinnabar in the andesite as well as in the sediments. Further to the southeast, traversing trenches 12 and 13, the andesite again conforms to the strike of the country rock, but is without observed mineralization. It is possible, however, that a branch from the sill may occur east of trench 9 and beyond the north limits of trenches 12 and 13. This possibility would be in keeping with its proved general structure.

Northwest of trench 5 the andesite sill turns rather sharply to the west through trenches 6, 7, 10, and 11. Mineralization, mostly within the andesite, was observed in all except trench 11. The form of the instrusive there was not determined, and the fingering toward the east, suggested by observations made in trenches 10 and 11, presents two other possibilities: First, the more northerly of the andesite occurrences in trench 11 may extend southeasterly, roughly paralleling the known mineralized body. It would traverse an area wholly unprospected at the surface and only approached underground by the face of the crosscut adit. Second, it is possible that in the neighborhood of trench 11 the andesite intrusive as a whole swings sharply southwest through trench 14 to trench 19.

Through this latter section, from which a considerable portion of the ore extracted by Parks is believed to have been taken, the rock is highly altered. At the shallow depths reached in hand trenching between the old filled pits, the presence of andesite was not definitely determined. The press of time and lack of equipment and men prevented adequate surface exploration of this strike length, though a definite zone of mineralization was determined. Its relationship to the main ore zone is not clear at the present stage of exploration.

According to Halverson, who was formerly employed by Parks, a small production was made from an open cut near the top of the cut-back directly over the adit. This cut, now filled by sloughing and soil creep, was not investigated by the Bureau. In 1914, the Geological Survey reported a short adit that, near its face, showed cinnabar mineralization. Though no cinnabar was observed here in 1942, the circuitous course of the original adit, 200 feet from the portal or near its face in 1914, suggests that an attempt had been made to develop the reported cinnabar. It is probable that this represented the downward extension of the ore taken from the open cut.

The third occurrence is reported by Halverson to occur in the river bed. According to his information, this deposit shows considerable strength. The river bed consists of closely compacted shales.

Exploration by the Bureau of Mines

The 19 trenches excavated by the Bureau of Mines in the course of the investigation are shown on figure 7. The average depth of the overburden along the main ore zone was from 3 to 6 feet, and rapid excavation of trenches with a D-2 caterpillar and bulldozer was possible. Eight of the nineteen trenches were excavated by hand.

Table 7 shows the mercury content of all samples and the antimony and arsenic content in certain composites.

TABLE 7

Sample	Trench	Lb. Hg per ton	Percent Sb	Percent As	Sample	Trench	Lb. Hg per ton	Percent Sb	Percent As
301......	2	0.6			337.....	4	0.2		
302......	2	2.4)			338.....	4	0.2		
303......	2	11.8)			339.....	4	0.2		
304......	2	1.2)	Tr.	Tr.	340.....	4	0.4		
305......	2	1.6)			341.....	6	0.2		
306......	2	15.0)			342.....	6	0.2		
307......	2	1.0)			343.....	6	0.4		
308......	2	0.2)	0.27	Tr.	344.....	6	0.2)		
309......	2	2.4)			345.....	6	16.4)	0.04	0.031
310......	3	0.4			346.....	6	1.8)		
311......	3	0.2			347.....	6	0.6		
312......	3	0.4			348.....	6	0.2		
313......	3	Tr.			349.....	5	0.4		
314......	3	0.2			350.....	5	0.2)		
315......	3	0.4			351.....	5	0.4)	0.13	0.036
316......	3	0.4			352.....	5	24.8)		
317......	3	0.8			353.....	5	0.6)		
318......	3	Tr.			354.....	5	0.4		
319......	3	2.2			355.....	5	0.2		
320......	3	0.2			356.....	5	0.2		
321......	1	0.2			357.....	5	0.4		
322......	1	0.2			358.....	5	0.2		
323......	1	7.0)			359.....	5	0.2)		
324......	1	39.0)	0.29	0.04	360.....	5	0.4)	Tr.	Tr.
325......	1	1.2)			361.....	5	0.6)		
326......	1	0.8)			362.....	5	2.8		
327......	1	Nil			363.....	5	0.4		
328......	1	0.4			364.....	7	0.8		
329......	4	0.2			365.....	7	0.2		
330......	4	0.2			366.....	7	0.2		
331......	4	0.2			367.....	7	11.0)		
332......	4	1.2			368.....	7	0.8)	Tr.	Tr.
333......	4	8.4)			369.....	7	1.0)		
334......	4	16.8)	0.22	0.048	370.....	7	0.6		
335......	4	1.30)			371.....	7	0.2		
336......	4	0.4)			372.....	7	0.2		

TABLE 7 - Continued

Sample	Trench	Lb. Hg per ton	Percent Sb	Percent As	Sample	Trench	Lb. Hg per ton	Percent Sb	Percent As
373.....	7	Nil			423.....	10	0.4		
374.....	7	0.2			424.....	10	0.2		
375.....	9	4.6			425.....	10	0.6		
376.....	9	0.6			426.....	10	0.2		
377.....	9	4.4)			427.....	10	0.4		
378.....	9	32.4)	0.06	Tr.	428.....	10	0.4		
379.....	9	1.30)			429.....	10	0.4		
380.....	9	0.4			430.....	10	0.4		
381.....	9	0.6			431.....	10	0.2		
382.....	9	0.4			432.....	10	Tr.		
383.....	9	0.8			433.....	10	Tr.		
384.....	9	0.2			434.....	10	6.6)		
385.....	8	Tr.			435.....	10	5.0)	Tr.	Tr.
386.....	8	0.2			436.....	10	0.2)		
387.....	8	1.0			437.....	10	0.2		
388.....	8	3.6)			438.....	10	Nil		
389.....	8	7.6)	Tr.	0.10	439.....	Undergr.	0.4		
390.....	8	8.8)			440.....	Undergr.	Nil		
391.....	8	1.2			441.....	"	0.2)		
392.....	8	7.0			442.....	"	0.2)	0.36	Tr.
393.....	8	1.4)			443.....	"	9.4)		
394.....	8	0.2)	0.02	0.02	444.....	"	Nil		
395.....	8	1.8)			445.....	"	Nil		
396.....	8	2.6)			446.....	"	Nil		
397.....	8	0.4			447.....	"	0.2		
398.....	11	0.4			448.....	"	0.4		
399.....	11	0.4			449.....	17	Nil		
400.....	11	0.2			450.....	17	0.6		
401.....	11	0.4			451.....	17	0.4		
402.....	11	0.4			452.....	Undergr.	0.2		
403.....	11	0.4			453.....	"	0.4		
404.....	11	0.4			454.....	15	3.4		
405.....	11	0.2			455.....	15	4.0		
406.....	11	0.2			456.....	15	9.2		
407.....	11	0.6			457.....	15	1.6		
408.....	11	0.2			458.....	14	0.2		
409.....	11	0.2			459.....	14	11.0		
410.....	11	0.2			460.....	14	0.4		
411.....	11	0.2			461.....	16	0.4		
412.....	12	0.2			462.....	16	0.6		
413.....	12	0.2			463.....	Undergr.	3.2		
414.....	12	Nil			464.....	"	8.6		
415.....	12	Tr.			465.....	"	3.0		
416.....	12	Nil			466.....	"	1.0		
417.....	12	0.2			467.....	"	0.4		
418.....	12	Nil			468.....	"	0.4		
419.....	10	0.6			469.....	"	4.0		
420.....	10	0.4			470.....	"	1.0		
421.....	10	0.2			471.....	"	10.0		
422.....	10	1.6							

BAROMETER MINE

Introduction

The Barometer property lies two claim lengths northwest of the Red Devil deposit and about one mile from the south bank of the Kuskokwim River. (See fig. 3.) It consists of six unpatented claims, the Barometer 1 to 6, inclusive, and is part of what is known as "Parks Property," being held jointly by the same individuals and in the same ratio as the Alice and Bessie claims. A slough about half a mile in length between the property and the river effectually prevents access direct from the river during the summer months. A landing from the river is made just below the mouth of Macauley Creek, and the brows of the hills facing the river are followed three-quarters of a mile to the Barometer deposits.

History and Production

Like most of the known deposits of cinnabar in the Sleitmut area, the Barometer lode was found by tracing pieces of float ore found along a small creek. Two occurrences in close proximity were discovered in 1921 by Hans Halverson, the first to be made in the area on the south side of the Kuskokwim River.

Both occurrences were opened by pits, and during the following year Halverson drove an adit 122 feet in length, which exposed the upper deposit at a dip depth of 46 feet. In 1923, E. W. Parks, trader and owner of the Alice and Bessie property, purchased the Barometer claims from Halverson and prospected both properties by means of additional surface work.

A retort made from one Johnson-McKay pipe was erected at the lower deposit, and a very small production was made, principally from the detrital material below the deposit.

In 1931, Otto Rohlphs, mining engineer, of Seattle, examined the Barometer mine. The property was leased in 1931, and a crosscut was driven across the upper deposit from Halverson's adit. This option was relinquished the following year, and the claims were leased by the E. W. Parks estate to A. C. Skidmore in 1938. Skidmore retorted 10 flasks of mercury from float ore and from ore obtained in a pit at the lower deposit. No development was undertaken, and the lease was surrendered at the close of the season.

In conjunction with annual assessment work in 1939 and 1940, a few flasks were retorted from ore taken from both the upper and lower deposits. The mine has since been inactive.

Ore Deposits

The succession of sediments at the Barometer property, in the immediate vicinity of the two deposits developed to date, is predominantly of shale. Graywacke or sandstone is increasingly in evidence in a westerly direction from the lower deposit. Although the strike of the sediments at the upper deposit

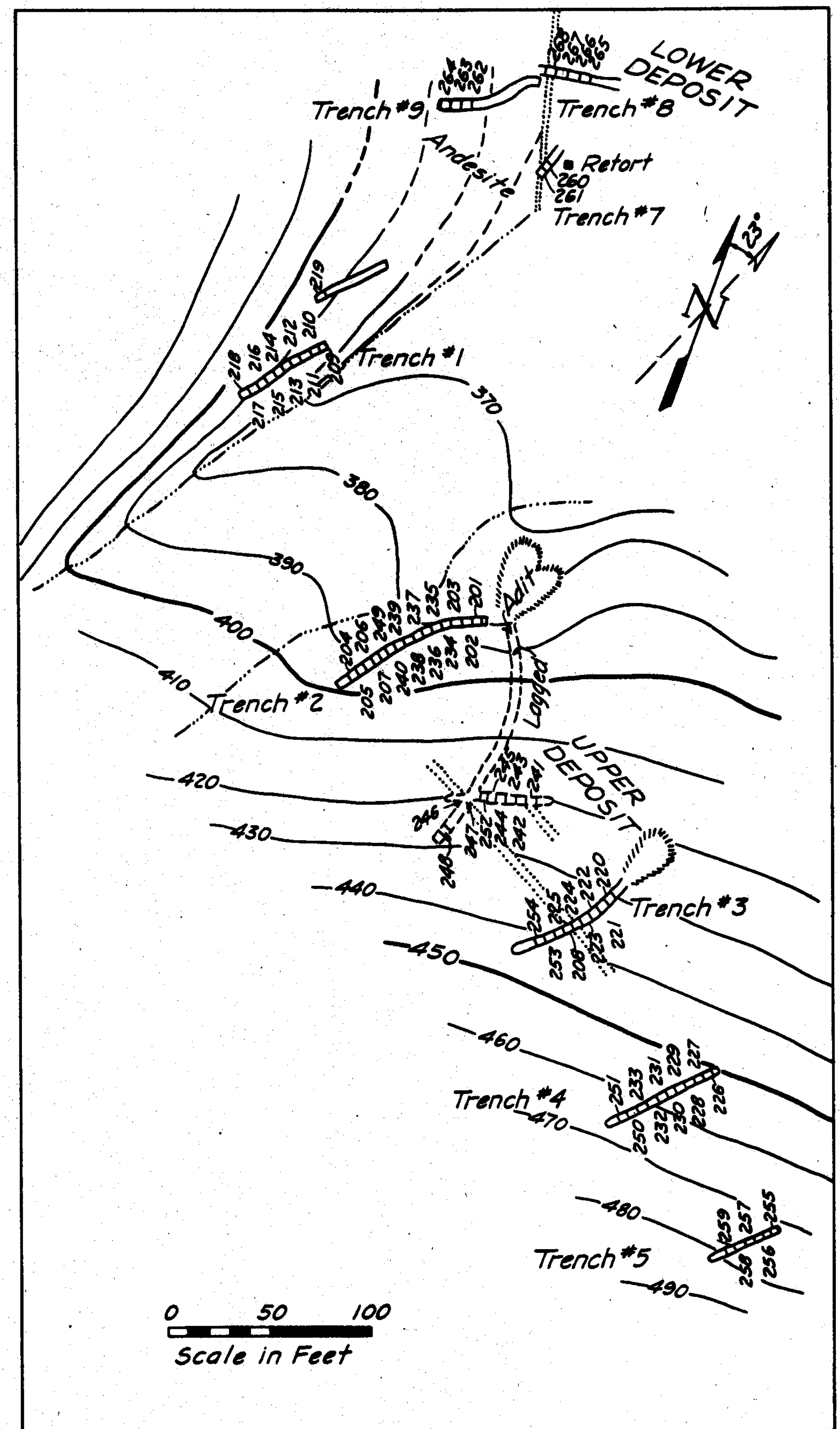


FIG. 8, THE BAROMETER MINE

is variable between limits of N. 20° W. and N. 60° W., that at the lower deposit appears to be consistently about N. 10° W., probably as a result of faulting within these incompetent beds.

The area containing both deposits, as known at the present stage of exploration, is small and is characterized by evidences of faulting to a degree not observed on any other property in the Sleitmut area. Both deposits are undoubtedly dependent upon associated altered andesites for mineralization, though the structural relationship is not clear at either.

The upper deposit is the only property investigated in the Sleitmut area that contains an appreciable amount of arsenic. On the basis of 13 comparisons, the relative amounts of mercury, antimony, and arsenic are, respectively, 4.6 : 9.7 : 5.4. Antimony occurs as stibnite, and arsenic occurs principally as realgar with some orpiment.

Exploration by the Bureau of Mines

The property was explored by trenching and sampling. The locations of trenches, samples in trenches, and underground workings are shown in figure 8. The results of analyses are shown in table 8.

TABLE 8

Sample	Trench	Lb. Hg per ton	Percent		Sample	Trench	Lb. Hg per ton	Percent	
			Sb	As				Sb	As
201.....	2	0.1			226.....	4	0.1		
202.....	2	0.1	2.50	.01	227.....	4	0.1		
203.....	2	0.8			228.....	4	0.1		
204.....	2	0.2			229.....	4	0.1		
205.....	2	0.2			230.....	4	0.1		
206.....	2	0.5	0.05	.07	231.....	4	0.1		
207.....	2	0.1			232.....	4	0.1		
208.....	3	1.8			233.....	4	0.1		
209.....	0	0.1			234.....	2	0.2		
210.....	1	0.1			235.....	2	0.2		
211.....	1	0.1			236.....	2	0.8		
212.....	1	0.3			237.....	2	0.1		
213.....	1	0.3			238.....	2	0.2		
214.....	1	0.1			239.....	2	0.3		
215.....	1	0.1			240.....	2	1.5	0.07	0.21
216.....	1	0.1			241.....	Adit	9.3	0.12	0.40
217.....	1	0.1			242.....	"	2.5	1.19	0.07
218.....	1	0.2			243.....	"	2.8	0.28	0.23
219.....	1	0.1			244.....	"	0.3	0.05	0.12
220.....	3	0.1			245.....	"	2.1	0.21	0.44
221.....	3	0.2			246.....	"	8.6	0.87	0.58
222.....	3	0.1			247.....	"	9.4	0.55	0.67
223.....	3	3.0	0.10	0.18	248.....	"	0.1		
224.....	3	16.5	0.18	0.30	249.....	2	3.1	0.17	0.26
225.....	3	0.2			250.....	4	0.2		

TABLE 8 - Continued

Sample	Trench	Lb. Hg per ton	Percent Sb	Percent As	Sample	Trench	Lb. Hg per ton	Percent Sb	Percent As
251.....	4	0.1			260.....	7	0.4	0.05	
252.....	Adit	1.5			261.....	7	12.4	Tr.	
253.....	3	0.2			262.....	9	5.2	Tr.	
254.....	3	0.1			263.....	9	0.4	Tr.	
255.....	5	0.1			264.....	9	1.8	Tr.	
256.....	5	0.1			265.....	8	1.6	Tr.	
257.....	5	0.3			266.....	8	1.6	Tr.	
258.....	5	0.1			267.....	8	1.4	Tr.	
259.....	5	0.1			268.....	8	13.2	0.71	

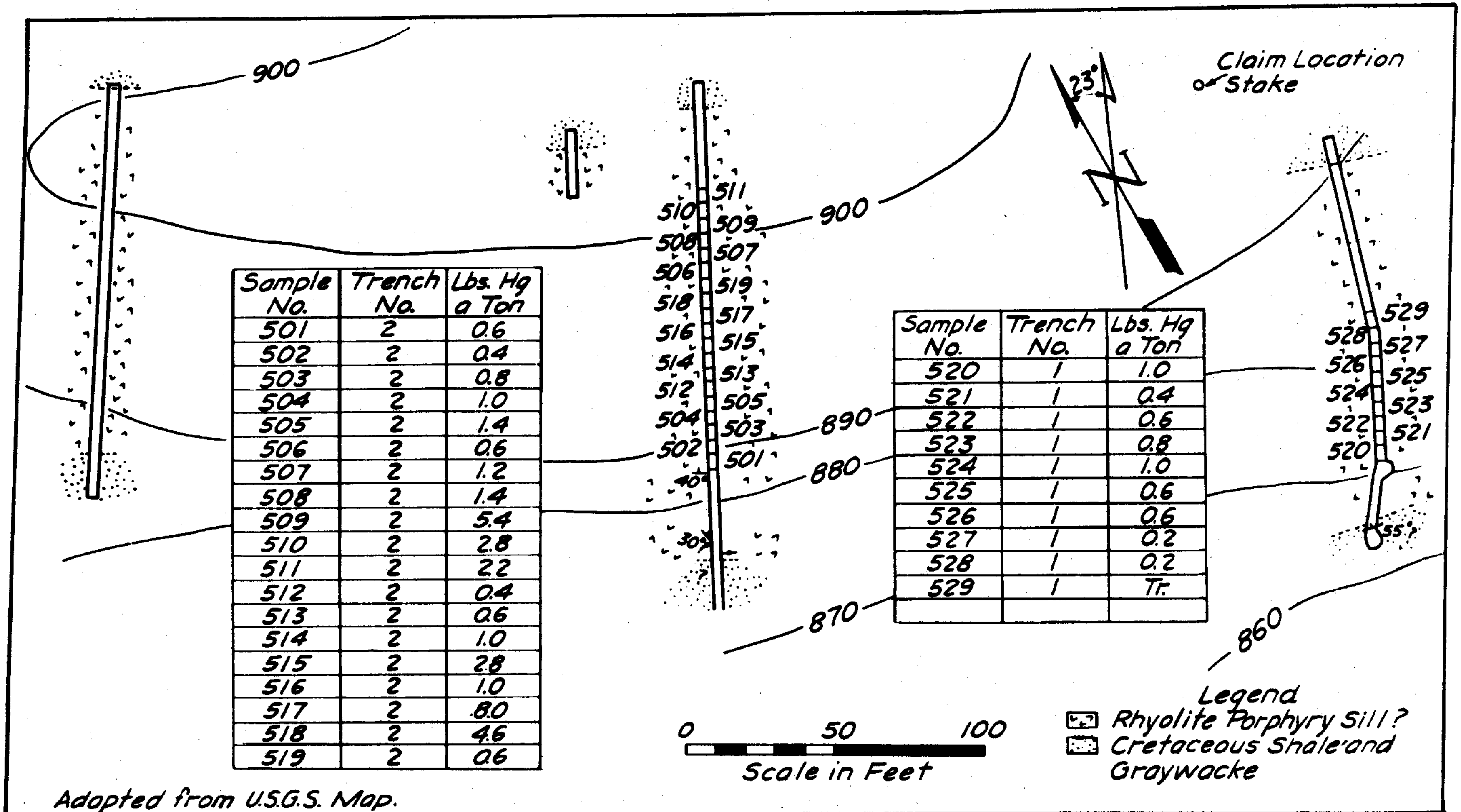
Trenching on this property was accomplished by hand through overburden 2 to 9 feet in depth. The shale at the surface is thoroughly loosened by frost and exfoliation, so that it was necessary to carry the excavations well into bedrock. The detail of mineralization was largely masked by the products of oxidation and by shale slime carried in by the frequent rains. All samples cut were 5 feet in length. The upper deposit has been traced at the surface over a strike length of 165 feet determined by visible cinnabar in trenches 2 and 3 and an unsampled pit over the adit area. It may reasonably be considered as being not less than 200 feet in length. Mineralization was observed in three contiguous 5-foot samples in trench 2. The shales, though in place, have been frost-broken and shattered by faulting and folding to a degree precluding accurate determination of strike and dip. Some oxidation has taken place, and the megascopic recognition of cinnabar in the presence of realgar is difficult. A second small concentration 30 feet to the northeast in the trench was observed. Analyses of the above 4 samples show that the material is not of minable grade.

The continuation of this zone of mineralization to the northwest cannot be tested by trenching because of a low swampy area 125 feet in width. Trench 1, designed to intersect the occurrences appearing in trench 2, failed to reveal mineralization.

Two contiguous 5-foot sections in trench 3 contain concentrations of cinnabar, stibnite, and realgar, one of which is of retort grade. Trench 4, 90 feet southeast of trench 3, failed to show concentrations.

Of the six 5-foot samples containing cinnabar taken from trenches 2 and 3, andesite was observed in only one. This appeared to be a small faulted segment.

The strongest observed development of this mineralized zone is in the crosscut from Halverson's adit. The major portion of this zone is cut by the adit itself just back of the crosscut, but close lagging prevents its inspection. At the junction of the adit and crosscut, mineralization occurs within a shatter zone resulting from the intersection of the fault and the ore zone at a high angle. A short crosscut continued across the adit to the west contains the highest concentration of realgar observed. Additional evidence of



Sample No.	Trench No.	Lbs. Hg a Ton
501	2	0.6
502	2	0.4
503	2	0.8
504	2	1.0
505	2	1.4
506	2	0.6
507	2	1.2
508	2	1.4
509	2	5.4
510	2	2.8
511	2	2.2
512	2	0.4
513	2	0.6
514	2	1.0
515	2	2.8
516	2	1.0
517	2	8.0
518	2	4.6
519	2	0.6

Sample No.	Trench No.	Lbs. Hg a Ton
520	1	1.0
521	1	0.4
522	1	0.6
523	1	0.8
524	1	1.0
525	1	0.6
526	1	0.6
527	1	0.2
528	1	0.2
529	1	Tr.

FIG 9 SAMPLE LOCATIONS & ANALYSES, FAIRVIEW PROSPECT

faulting is furnished by the presence of fragments of altered andesite within this shatter zone. Three sample sections, each 5 feet in length, contain an amount of cinnabar approaching furnace grade. Two of these samples are within the hanging-wall zone, and one is near the footwall.

The lower deposit, 250 feet N. 15° W. from the portal of the Halverson adit, is shown in figure 8. This occurrence is associated with an andesite intrusion but does not contain an appreciable amount of realgar. The structural relationship between the andesite and the ore was not disclosed by the Bureau's exploration, nor was the form and attitude of the andesite determined.

The sediments dip to the southwest at about 40° and strike approximately N. 10° W. It appears that a bedding fault has cut and displaced the andesite, and that cinnabar mineralization has been localized along this zone. A second weak zone of mineralization paralleling the strike of the sediments was encountered 50 feet to the west.

FAIRVIEW PROSPECT

Introduction

The Fairview claims are about 1¼ miles south of the south bank of the Kuskokwim River near the headwaters of Macauly Creek at an altitude of approximately 900 feet, as shown in figure 3. There is no marked trail to the property, the usual approach being along the western side of Macauly Creek.

History

This occurrence was found by tracing back detrital material containing cinnabar. It was first staked in 1935 or 1936. There has been no production of any consequence from the property.

Ore Deposits

Shales and sandstone constitute the country rock in this area. They have been intruded by a dike of fresh-appearing rhyolite striking N. 60° W. and dipping toward the northeast. The apparent width of the dike is about 120 feet, and its length is at least 1,000 feet. To the northwest of trench 3, shown in figure 9, is evidence of cross faulting of the dike.

Cinnabar and stibnite mineralization in the area explored is confined to a zone of fracturing cutting across the dike at a small angle. The strike of the mineralized fractures parallels that of the fracture zone.

Exploration by Bureau of Mines

The locations of trenches excavated by the Bureau of Mines and the results of analysis of samples are shown in figure 9.

Three narrow trenches were excavated by hand across the dike and were carried to a depth sufficient to expose rock essentially in place, though frost-broken. The three trenches were located without reference to previous small test pits, except that trench 1 started from an open cut at the footwall contact.

Trench 1 is normal to the strike of the dike and revealed a 35-foot width of material containing an average of 0.7 pound of mercury a ton. The maximum degree of mineralization occurring in any one 5-foot width was 1.0 pound of mercury a ton.

Trench 2 is parallel to trench 1 and is 225 feet northwest of it. A 50-foot zone intersected by this trench contains an average of 2.88 pounds of mercury a ton. Two contiguous 5-foot samples in this zone contain 8.0 and 4.6 pounds of mercury a ton, respectively. A second zone 5 feet wide is 35 feet (measured normal to the strike) from the first and contains 5.4 pounds of mercury a ton.

The third trench, parallel to trenches 1 and 2 and 205 feet northwest of trench 2, contained no observed seams of cinnabar and was not sampled. Probably this trench was too far from trench 2 to intersect the zone of mineralization found in that trench.

WILLIS GROUP

Introduction

The Willis group of 16 unpatented claims is $1\frac{1}{4}$ miles north of the Kuskokwim River at a point 2 miles below the Alice and Bessie property and 12 miles downstream from Sleitmut, as shown on figure 3. The claims are above timber line at an altitude of 700 feet just within the Kuskokwim drainage. A foot trail leads from the mouth of Willis Creek on the Kuskokwim River to the property, and a caterpillar trail has been established directly from the Alice and Bessie mine.

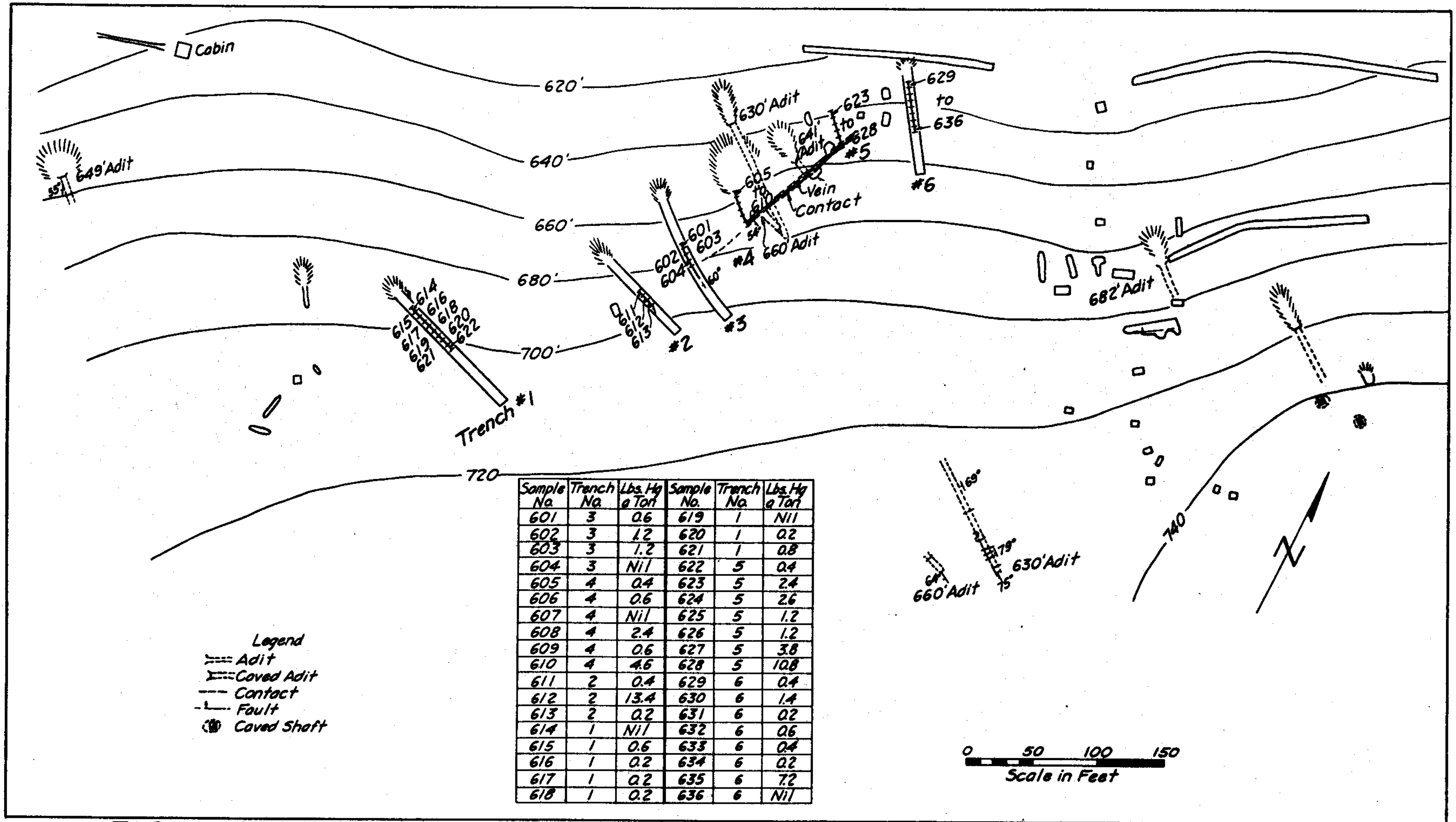
History

This mineralized area was discovered by Willis and Fuller in 1909, and the mining rights are now held by Willis, the surviving member of the partnership. Development work consists of numerous test pits and trenches as well as several short adits that are now caved. The greater part of this work has been done to comply with annual assessment requirements. A few flasks of mercury retorted from ore taken from this deposit constitute the only production from the property.

Ore Deposits and Development

As at other mineralized areas in the locality, the country rocks of graywacke, sandstone, and shale have been intruded by andesite, which is now buff to white as the result of hydrothermal alteration. The Willis property is unique in that the andesite occurs only as well-developed dikes. Cinnabar and stibnite mineralization is largely confined to the hanging-wall contacts of these dikes, though to a lesser degree it occurs along slips and fractures within the intrusions.

Four dikes containing mineralized zones have been discovered to date. The dikes are roughly parallel, and present exposures indicate an echelon pattern. Their limits have not been determined.



Sample No.	Trench No.	Lbs. Hg a Ton	Sample No.	Trench No.	Lbs. Hg a Ton
601	3	0.6	619	1	Nil
602	3	1.2	620	1	0.2
603	3	1.2	621	1	0.8
604	3	Nil	622	5	0.4
605	4	0.4	623	5	2.4
606	4	0.6	624	5	2.6
607	4	Nil	625	5	1.2
608	4	2.4	626	5	1.2
609	4	0.6	627	5	3.8
610	4	4.6	628	5	10.8
611	2	0.4	629	6	0.4
612	2	13.4	630	6	1.4
613	2	0.2	631	6	0.2
614	1	Nil	632	6	0.6
615	1	0.6	633	6	0.4
616	1	0.2	634	6	0.2
617	1	0.2	635	6	7.2
618	1	0.2	636	6	Nil

FIG. 10, SAMPLE LOCATIONS AND ANALYSES, WILLIS GROUP

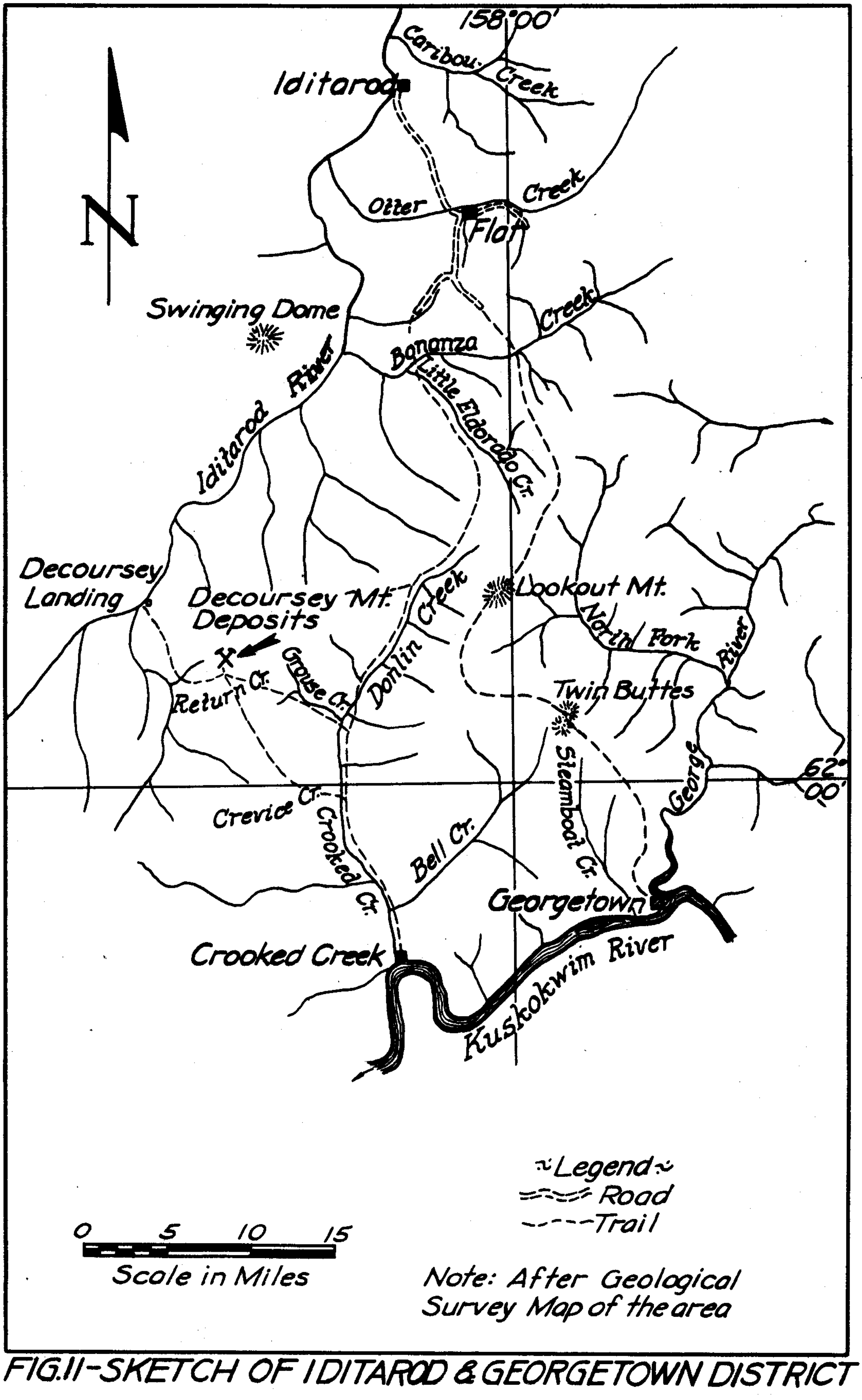


FIG.11-SKETCH OF IDITAROD & GEORGETOWN DISTRICT

The most northwesterly of these occurrences has been opened by a short adit at an altitude of 650 feet. No noteworthy concentration of cinnabar was observed in these limited exposures. Most attention has been given to a mineralized zone about 500 feet southeast of the adit mentioned above. Here mineralization has occurred along the hanging wall of a dike and within the dike. The dike, about 30 feet thick, strikes N. 30° W. and dips steeply toward the southwest. Mineralization is strongest along the hanging wall but continues less strongly along fractures within the dike.

This dike has been explored by six Bureau of Mines trenches, as shown in figure 10. Mineralization occurs in five of these trenches localized in a zone along the hanging wall of the andesite dike. A small amount of mercury has been produced from an ore lens cut by trenches 4 and 5 and bounded on the southwest by the barren trench 3. This portion of the deposit had been explored previously by an adit, which is now caved but which at one time reached a depth of 30 feet beneath the outcrop. The reported findings in the adit were confirmed by trenching. Because only weak cinnabar mineralization was noted in both trenches 2 and 6, it is probable that metacinnabarite is present in samples 612 and 635. The mineralized zone may be extended to the southeast and northwest. Trench 3 may represent a lean area within this deposit rather than a separate lens to the southwest.

The sampled section across the entire dike in trench 4 contained an average of 1.6 pounds of mercury a ton, and a like section 30 feet wide, in trench 5, contained an average of 3.7 pounds of mercury a ton.

Two other dikes to the east of the Bureau's trenches were prospected previously by means of trenches and open cuts. These openings are now badly caved, but minor amounts of cinnabar were noted. The analyses of samples taken during the investigation are shown in figure 10.

DECOURSEY MOUNTAIN MINE

Introduction

This property can be reached by trails from the native village of Crooked Creek on the Kuskokwim River or from Flat. It is 23 miles northwest of Crooked Creek and 43 miles southwest of Flat. Both routes traverse swampy, muskeg country which makes foot travel difficult in summer. Heavy mining equipment supplies for a season's work are freighted to the property by tractor and sled in winter. When rainfall is abnormally heavy, Crooked Creek can be ascended to within 8 miles of the property by means of an outboard motor boat; from Flat, the Iditarod River is navigable by such a boat to within 7 miles of the property. (See fig. 11.)

Freight on mining machinery routed from Seattle to Bethel by ocean steamer, from Bethel to Crooked Creek by Kuskokwim River boat, and from Crooked Creek to the property by tractor and sled costs about $75 a ton.

A more costly freight route to the DeCoursey property is via St. Michael and Flat, Alaska. For example, a barrel of Deisel fuel oil costs $26.50 at Flat, as compared to $16.50 at Crooked Creek.

During the summer of 1943, an airplane landing strip 1,040 feet long was completed by the DeCoursey Mountain Mining Co. with the cooperation of the Bureau. This places the property within 20 minutes flying time from the mining community and supply center of Flat, Alaska. From June to October 1943, approximately 25 tons of air express was handled from this landing strip. Air service from Flat to DeCoursey, available only on a charter basis, costs $30 a trip for a plane capable of carrying 800 pounds.

The Bureau of Mines established radio communications with the Alaska Communications System at Flat in June 1943. This service was discontinued when the Bureau's program was completed but can be resumed by the mine operators if desired.

History and Production

The DeCoursey prospect was located prior to 1920 by a prospector named DeCourcy. The property bears his name today under a different spelling. DeCourcy's original location was made about ¼ mile southwest of the present operations. In 1921, the Thrift Mining Co. installed a four-tube retort, and a small amount of quicksilver was produced.

From 1924 to 1926, C. F. Lindfors and associates retorted ore taken from the upper veins system, but it is believed that production was inconsequential. During this period, the Johnson and Lindfors adits were driven.

In 1927, three claims, the Last Chance 1, 2, and 3, were located by John Brink, and a year later five claims, the Snowbird 1, 2, 3, 4, and 5, were located by Harry Brink, brother of John.

On May 16, 1942, R. F. Lyman acquired a lease with option to purchase the property by monthly and annual payments over a 4-year period. On August 14, 1942, Lyman formed a partnership with Kenneth M. Johnston and Franck C. Rocheleau to operate the DeCoursey property with Lyman as manager. In October 1942, Lyman and Rocheleau purchased Johnston's interest in the copartnership. Later, Lyman bought the interest of the remaining partner, Rocheleau, and is now (1946) sole owner of the property.

Eight claims comprise the present property of the DeCoursey Mountain Mining Co. Amended locations were filed for these claims during October 1943 by Harry Brink.

In 1942, eighty flasks of mercury were produced from surface float, and in 1943 the New DeCoursey adit was begun. At this time the Bureau of Mines initiated a program of surface trenching and sampling.

Geology

The country rock of the DeCoursey Mountain area consists of sandstone, shales, and graywacke. These sedimentaries, striking northeasterly and dipping westerly, are intruded by diabase dikes and sills. Silicification has taken place near the cinnabar lenses and veins.

Numerous small faults have affected the ore bodies, and slickensided surfaces are common. Displacements, however, have been slight, and no difficult mining complications have been encountered.

Stripping and trenching uncovered ore throughout a horizontal range of 1,800 feet and a vertical range of 345 feet. Within these range limits five individual zones of enrichment occur. According to Webber,[13]

> The ore bodies are in or near hydrothermally altered sills of diabase porphyry. The fresh sill rock is pearl gray and very fine-grained, with varying amounts of ferromagnesian phenocrysts. The diabase contains much silica and some carbonate and weathers to a yellowish brown. The ore bodies are localized in shaly beds, much fractured zones in diabase and enclosed sediments, or along igneous sedimentary contacts. The ore bodies parallel the strike of the sediments and are at variance to the strike no more than 15 or 20 degrees. Their dip may conform with the sedimentary beds or cut across the bedding. Apparent fault displacements in the vein amounting to 10 feet or less are the result of the filling of irregular fractures. Post-ore faulting is limited to displacements of less than one inch. The ore bodies pinch and swell both vertically and horizontally from a few inches to over a foot. The wider portions comprise from 40 to 60 percent of the exposed lengths. In some places the abundant phenocrysts in the diabase porphyry have been entirely replaced with cinnabar, forming small, irregular bodies of "cinnabar porphyry." Fissure and pore-space filling have been the predominant processes in ore formation, but these are modified by extensive replacement in some places. The veins dip, for the most part, from 55 degrees to 80 degrees.

Evidence of possible structural control of the ore deposition was observed in the Tunnel ore body. The body is cut by a series of nearly parallel transverse faults throughout its entire length. The dips of the faults vary considerably, indicating in some instances a possible merging at depth and in others a divergence. This irregularity in dip may form a series of triangular fault blocks. Lenses of cinnabar occur between some but not all of these transverse faults.

Field observations indicate that the offsets in continuity of the vein are not the result of post-ore movement. Detailed study of large-scale maps of this body suggests that the transverse faults have controlled the deposition of the cinnabar. It is logical to assume that originally a main fault structure or fracture trended roughly in a northwesterly direction. The fracture zone was interrupted by the transverse faulting prior to the introduction of the rising mineralizing solutions. Certain of these transverse faults, the movement of which resulted in breaking the continuity of the original fracture, served as

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13/ Webber, E. J., and Hoare, J. M., Quicksilver-Antimony Deposits Near DeCoursey Mountain, Iditarod District, Southwestern Alaska: U. S. Geol. Survey Unpublished Report, December 1943.

dams to the mineralizing solutions. This allowed the deposition of cinnabar only in certain fault blocks, which were not closed off at depth by the intersection of transverse fault.

The above supposition, based upon geological observation, may serve as a criterion for future development work on this body.

Occurrence of Deposits

The Tunnel ore body has been exposed by trenching and stripping for a strike length of 204 feet through a vertical range of 70 feet. (See fig. 12.)

The cinnabar is deposited unconformably to the bedding planes of the graywacke and shale formation. The strike of the graywacke averages about N. 4° E. and dips approximately 50 degrees northwest. The cinnabar occurs as a series of small irregular lenses trending in a northerly direction and dipping to the northeast. The individual lenses, which swell and pinch along their strike lengths, have a maximum width of 1.1 feet at the southern end of the body.

The strikes of the individual lenses of ore range from N. 8° W. to N. 5° E. The dip of the cinnabar varies throughout the entire exposure from 52 degrees northeasterly at the southern end to nearly vertical at the northern end of the ore body.

During 1943, the Tunnel ore body was partly developed at an altitude of 871 feet by the New DeCoursey adit. Ore was encountered 66 feet from the portal at a point 25 feet below the surface. The total length of the tunnel is 168 feet, the face being 55 feet below the surface. A slight decrease in vein width was observed between the surface and the adit.

The "A" vein system is one-fourth mile northwest of the DeCoursey Mountain mining camp. The ore body was exposed by trenching for a strike length of 148 feet and through a vertical range of 30 feet. The cinnabar occurs as more or less continuous lenses in the shale and graywacke just west of the diabase contact and in places merges with the contact. Additional cinnabar lenses were observed and sampled, within the shale and graywacke west of the main contact vein, but no noteworthy occurrences were found within the diabase.

The main vein of this system ranges in width from 0.6 foot to 2.3 feet; the average grade is 15 pounds of mercury per ton. This vein is continuous for 120 feet with an average strike of N. 5° W. Dip observations varied from vertical to 83 degrees to the northeast. This vein appears strong.

The DeCoursey ore body is 350 feet south of the Tunnel ore body. The vein has been exposed by trenching for a strike length of 110 feet and through a vertical range of 31 feet.

This occurrence consists of a series of narrow, irregular, nearly vertical veins striking approximately N. 30° W. and diverging in a southwesterly direction. These veins are entirely within the igneous formation and in this respect differ from the Tunnel and "A" ore bodies. Mineralization appears to have followed a small fracture zone.

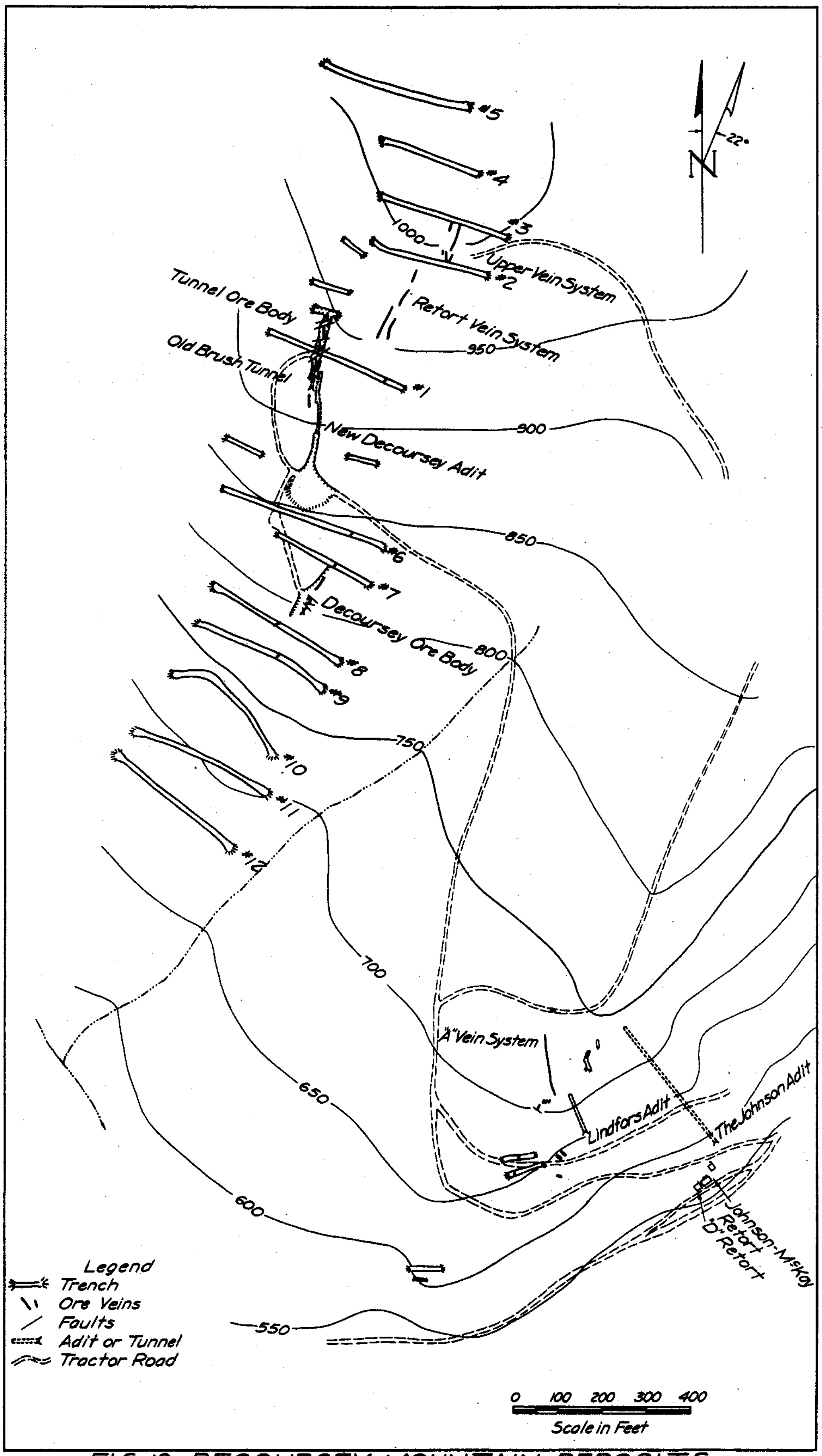


FIG. 12-DECOURSEY MOUNTAIN DEPOSITS

The upper vein system, at an elevation of 1,000 feet, was uncovered for a strike length of 90 feet. The vertical range of the occurrence is about 12 feet. The mineralized zone consists of a series of small, nearly parallel, steeply dipping veins exposed over a width of 30 feet. One main vein measuring 0.5 foot in width strikes N. 20° E. and can be traced for 60 feet.

Test pits sunk in an old trench established weak mineralization at a horizon 11 feet lower than sample 259.

The Retort ore body occurs 100 feet east of the Tunnel ore body and just south of the upper vein system. Mineralization is evident through a vertical range of 250 feet and has been exposed for a strike length of 230 feet.

The cinnabar occurs in small lenses and blebs of medium-grade ore (10 to 40 pounds of mercury per ton) trending in a northeasterly direction. The mineralized portion of the body is confined to two well-defined narrow zones. The zones are terminated at the northern limit by a fault of considerable displacement. Field observations indicate that the upper vein system may be the northern extension of this body.

The shallow blebs and bunches of cinnabar of this body are contained within the graywacke-shale and diabase formations. During stripping operations it was necessary at times to bulldoze as much as 5 feet of bedrock in order to prepare a suitable sampling surface. Several times during stripping exposures of high-grade ore would disappear upon further stripping.

The graywacke has been intruded by a series of diabase sills. No definite relationship between the diabase sills and the mineralized zones of the ore body could be formulated.

Although the strikes and dips are erratic, the general trend of the dips are toward the northwest. This condition may indicate the joining of this body with the Tunnel ore body at depth.

In addition to the above ore bodies, occurrences of small stringers of ore were sampled in nearly all of the bulldozer trenches. These small lenses will add materially to the indicated ore reserves.

Character of the Ore

Massive high-grade cinnabar ore occurs in lenses measuring as much as 1 foot in width and 15 feet in length. The highest-grade sample contained 654 pounds of mercury per ton and 0.86 percent antimony. The metallic minerals of the ore include cinnabar, stibnite, cerventite, and arsenopyrite. The nonmetallic minerals are compounds of siliceous material and small amounts of carbonate and kaolin.

Chemical analyses indicated that objectionable components, such as antimony and arsenic, are not present in sufficient quantities to cause metallurgical complications.

Work done by Bureau of Mines

The five individual ore bodies of the DeCoursey deposit were trenched at intervals ranging from 5 to 50 feet. On all important deposits, bulldozer trenching was completed into bedrock along the strike of the occurrence, and sample channels were cut across the entire zone width at maximum intervals of 20 feet. All samples consisted of 6- by 12-inch grooves cut normal to the general strike of the ore lenses. Sample lengths ranged from 0.3 to 5 feet, conforming to changes in grade or formation occurring along any one sample section.

All samples were crushed in a 5- by 9-inch, Blake, power-driven jaw-crusher and split to a shipping size of 20 pounds with a Jones-type sample riffle.

Figures 13, 14, 15, 16, and 17 show location of samples collected from the Tunnel ore body, "A" vein system, DeCoursey ore body, upper vein system, and Retort vein system, respectively.

A total of 435 channel samples was taken from the DeCoursey property and shipped to the Territorial Assay Office. All samples were pulped by employees of the Bureau of Mines, and duplicate pulps were filed for check purposes. Sample analyses for the respective vein systems are shown in tables 9, 10, 11, 12, and 13.

Exploration by DeCoursey Mountain Mining Co.

Additional surface exploring by means of mechanical trenching and stripping was done by the DeCoursey Mountain Mining Co. during the summer of 1944.

About 200 feet southwesterly on the projected strike of the DeCoursey vein, cinnabar mineralization was exposed along a strike interval of 20 feet. Some 400 feet farther to the southwest, measured down the slope of the hill, and about 300 feet west, normal to the strike of the DeCoursey vein, a new vein was exposed in a crosscut trench. At this point the vein is about 6 inches wide and is below retort grade. It has not been tested along its projected strike in either direction.

Trenching has also revealed two other new veins paralleling the DeCoursey vein, 30 and 70 feet, respectively, west of it. Stripping along a strike interval of 150 feet did not reveal ore of retort grade, but this exploration is considered insufficient to indicate definitely their potentialities.

Trenching and stripping were halted by tractor failure in 1944 and have not been resumed.

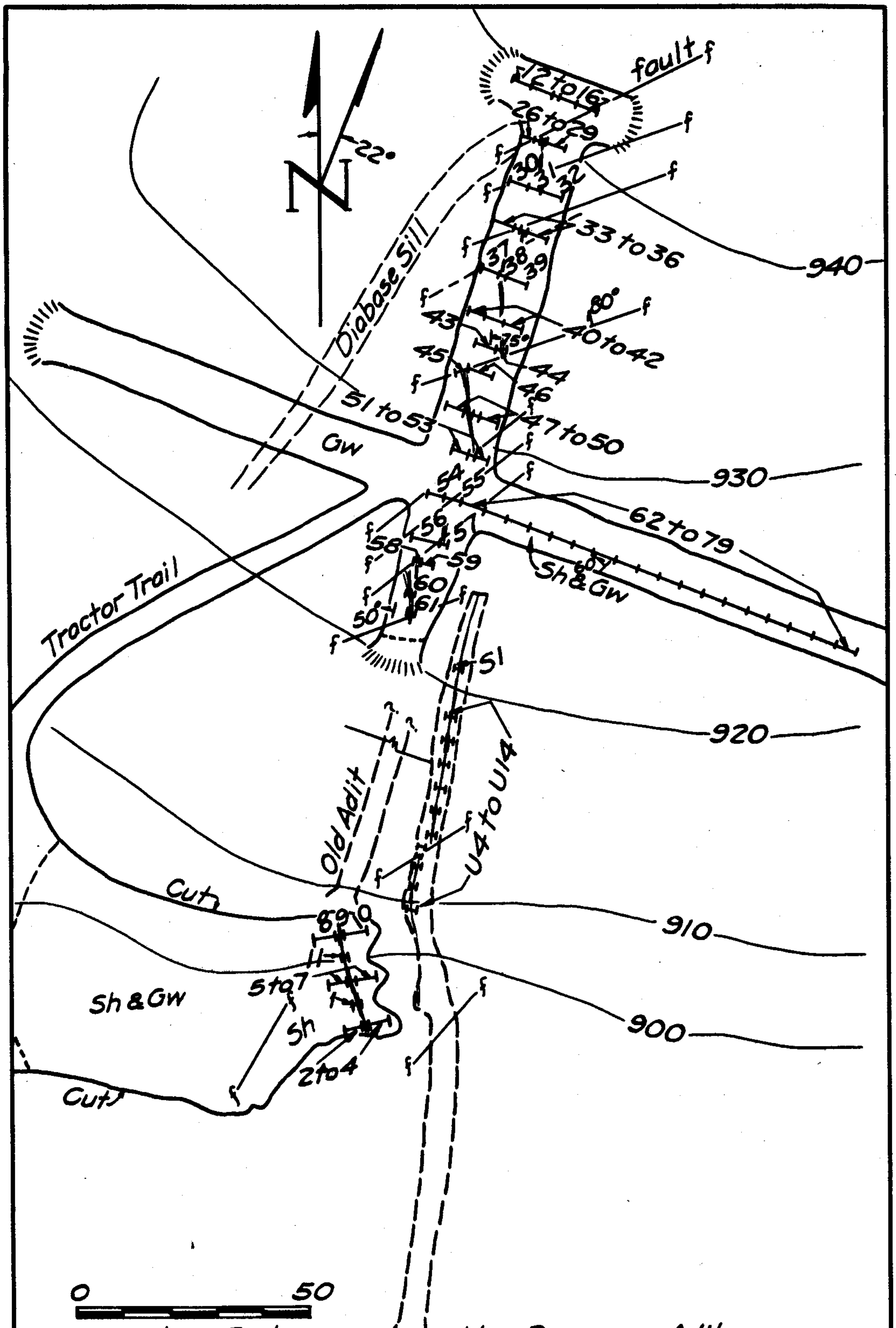


FIG.13–TUNNEL ORE BODY

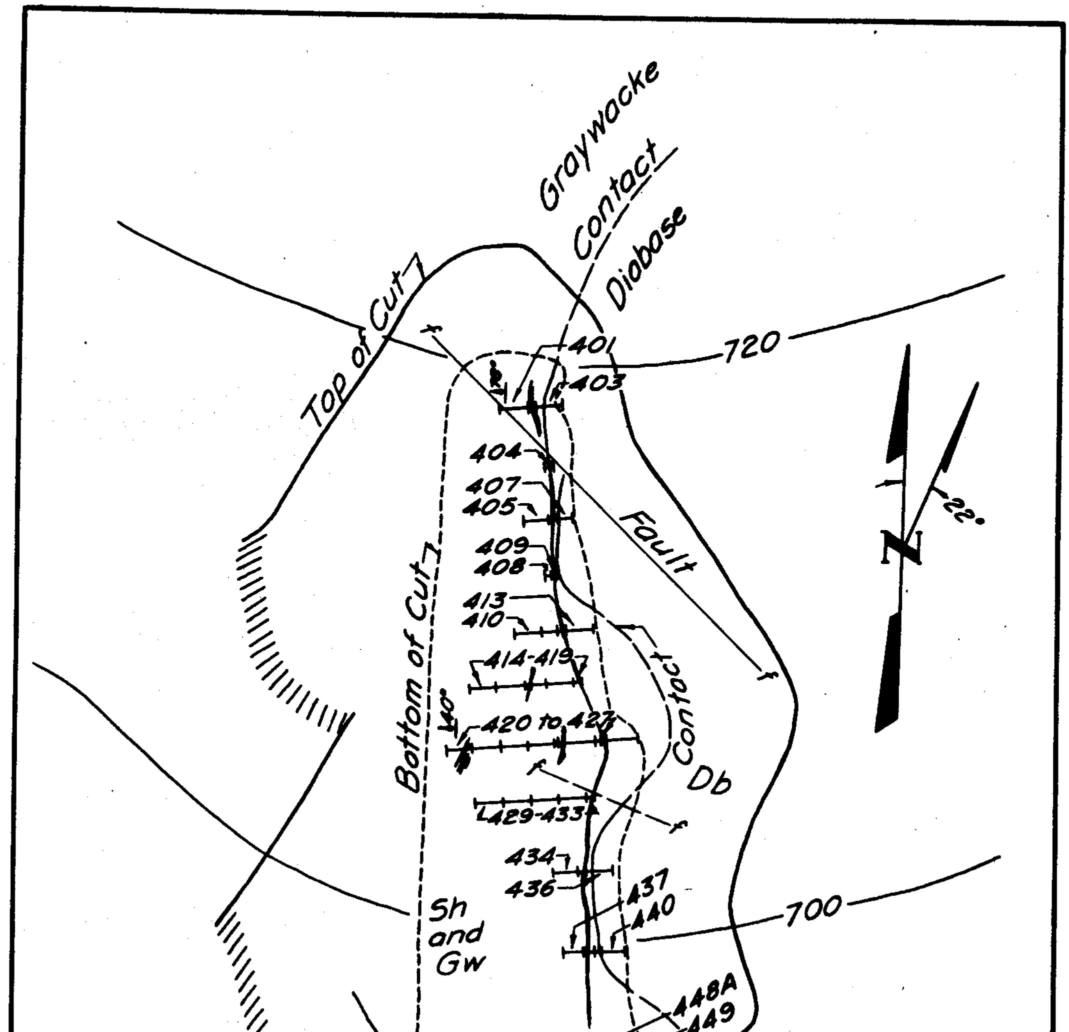


FIG.14-"A" VEIN SYSTEM

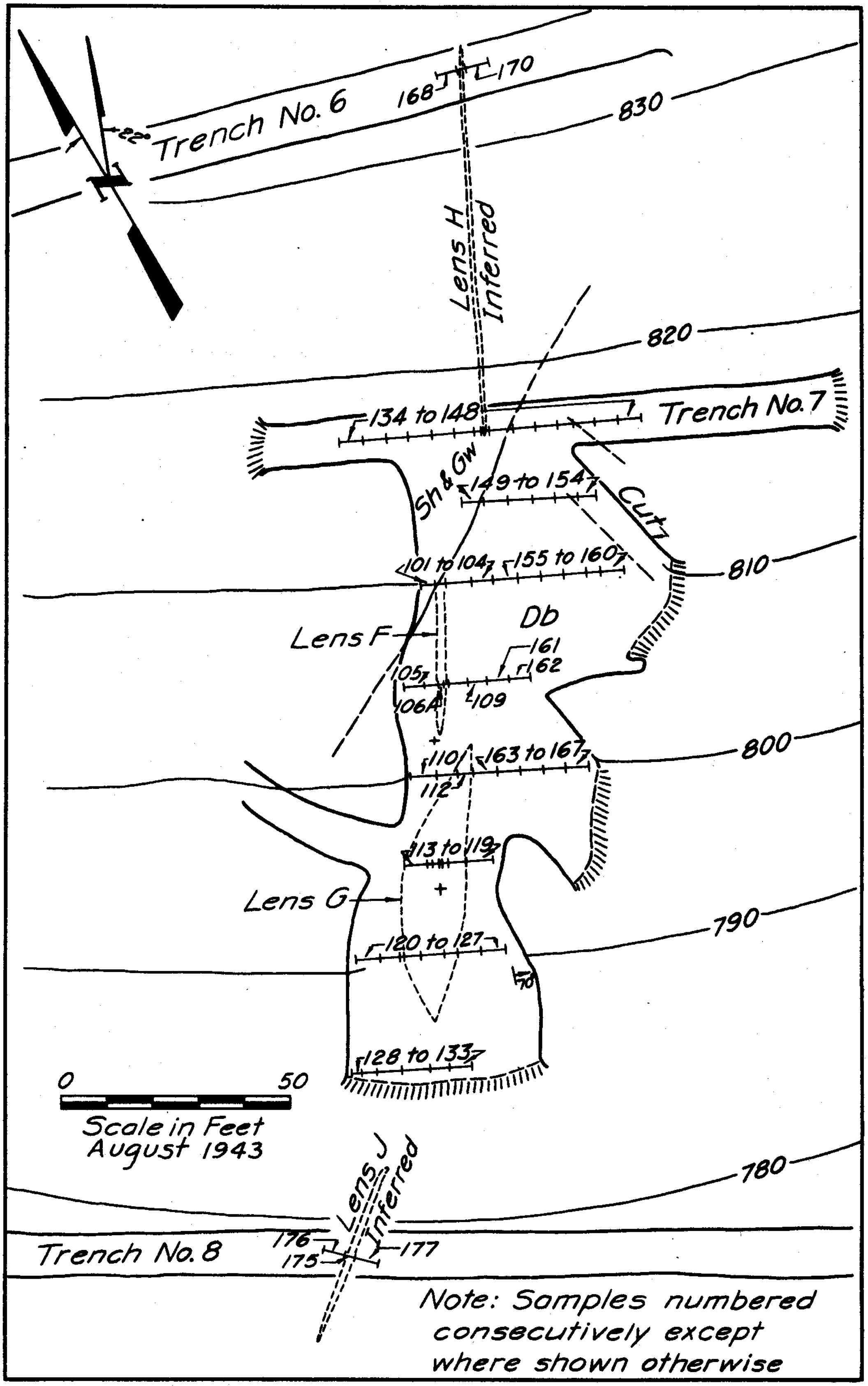


FIG. 15 - DECOURSEY ORE BODY

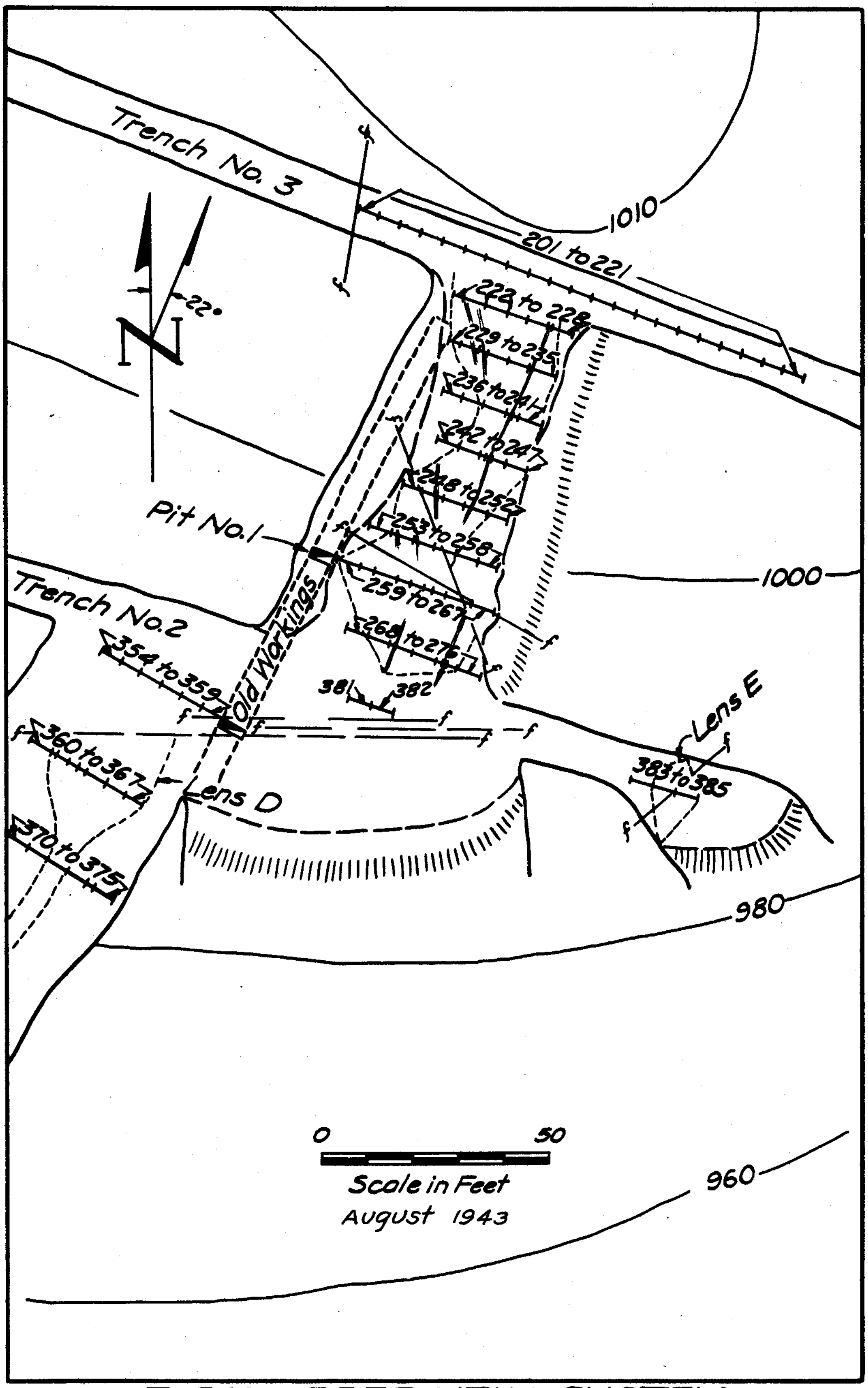


FIG. 16 - UPPER VEIN SYSTEM

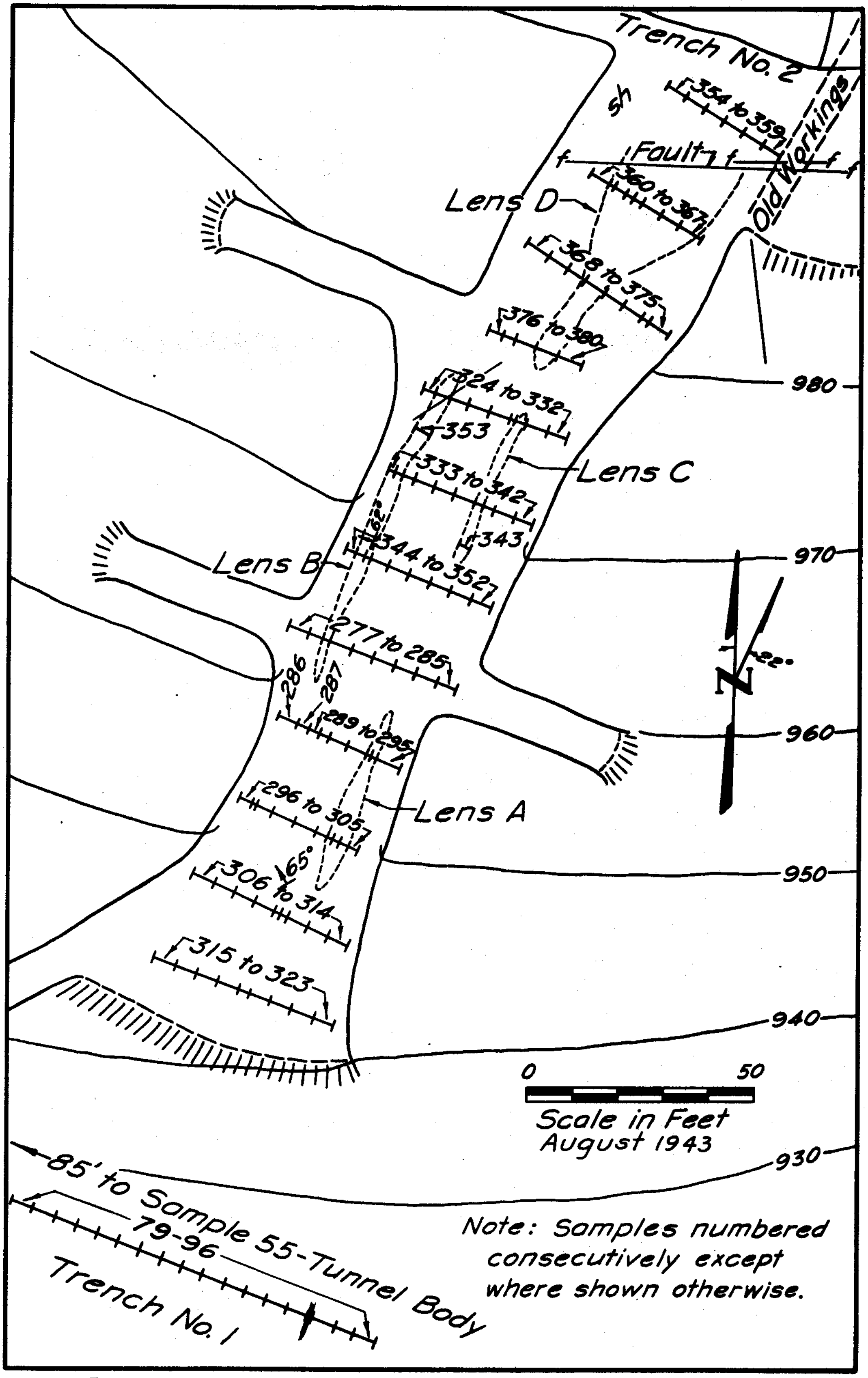


FIG.17-RETORT VEIN SYSTEM

TABLE 9. - Analyses of sample, Tunnel ore body. (Refer to figure 13.)

Sample	Length of sample, feet	Pounds mercury per ton	Percent antimony	Sample	Length of sample, feet	Pounds mercury per ton	Percent antimony
1.....	1.3	620.8	0.73	41.....	3.0	35.4	0.59
2.....	5.0	0.4		42.....	4.5	0.6	
3.....	0.8	340.8	0.29	43.....	5.5	1.2	
4.....	4.5	1.8		44.....	1.0	156.0	0.59
5.....	5.0	2.4		45.....	1.3	89.6	
6.....	1.3	615.2	0.20	46.....	5.5	1.0	
7.....	5.0	2.0		47.....	5.5	4.8	
8.....	5.0	1.8		48.....	1.0	246.4	
9.....	1.0	2.2	0.10	49.....	1.1	79.0	0.59
10.....	5.0	0.4		50.....	5.5	4.6	
11.....	1.2	53.6		51.....	4.0	4.6	
12.....	5.0	1.0		52.....	1.2	59.0	0.78
13.....	5.0	1.2		53.....	3.3	0.2	
14.....	0.8	1.2		54.....	5.0	1.6	
15.....	5.0	0.8		55.....	3.2	0.4	
16.....	5.0	0.6		56.....	7.5	1.0	
17.....	5.0	0.8		57.....	0.8	100.8	0.25
18.....	5.0	1.2		58.....	1.7	9.4	
19.....	1.3	0.4		59.....	1.5	35.6	
20.....	5.0	1.2		60.....	1.8	67.8	0.16
21.....	4.0	1.0		61.....	1.0	169.2	0.42
22.....	0.8	1.2		62.....	5.0	Tr.	
23.....	5.0	1.2		63.....	5.0	0.6	
24.....	5.0	0.8		64.....	5.0	0.6	
25.....	5.0	2.2		65.....	5.0	0.4	
26.....	3.5	12.8		66.....	5.0	0.4	
27.....	1.5	1.8		67.....	5.0	0.4	
28.....	0.5	136.0	0.59	68.....	5.0	0.4	
29.....	5.0	4.2		69.....	5.0	0.4	
30.....	4.5	0.2		70.....	5.0	0.4	
31.....	2.4	9.8		U-4....	0.6	653.6	0.86
32.....	5.0	0.2		U-5....	0.5	412.0	0.09
33.....	5.0	0.2		U-6....	1.2	236.0	0.29
34.....	1.3	20.6		U-7....	1.2	5.6	Nil
35.....	0.5	61.6	0.59	U-8....	1.4	1.0	
36.....	5.0	2.0		U-9....	2.2	0.6	
37.....	5.0	1.4		U-10...	2.2	109.0	
38.....	0.9	375.4		U-11...	2.5	143.6	
39.....	5.0	10.2	0.59	U-12...	2.3	5.6	
40.....	5.0	1.0		U-13...	2.1	160.8	
				U-14...	3.0	6.8	
				S-1....	0.3	605.6	

TABLE 10. - Analyses of samples, "A" vein system. (Refer to figure 14.)

Sample	Length of sample, feet	Pounds mercury per ton	Percent antimony	Sample	Length of sample, feet	Pounds mercury per ton	Percent antimony
401....	5.0	0.4	.....	436....	5.0	0.4	.....
402....	0.8	6.0	Tr....	437....	3.5	0.2	.....
403....	5.0	0.8	.....	438....	0.5	132.6	.....
404....	0.7	2.0	Tr....	439....	1.6	0.4	Tr....
405....	5.0	1.0		440....	1.0	11.2	
406....	0.7	25.4	Tr....	441....	5.0	0.6	.....
407....	3.8	0.2	.....	442....	5.0	0.6	.....
408....	1.2	1.2	Tr....	443....	0.8	30.0	0.11..
409....	0.6	14.4	Tr....	444....	5.0	0.4	.....
410....	5.0	0.6		445....	5.0	0.4	
411....	3.0	0.6	.....	446....	5.0	0.4	.....
412....	0.7	143.2	0.02..	447....	5.0	0.4	.....
413....	5.0	0.6	.....	448....	5.0	1.6	.....
414....	5.0	0.2	.....	448-A..	1.0	1.2	.....
415....	5.0	1.0		449....	5.0	0.8	
416....	.5	59.8	0.02..	450....	5.0	2.6	.....
417....	2.5	0.8	.....	451....	2.5	1.0	.....
418....	5.0	1.0	.....	452....	1.2	106.0	0.11..
419....	1.8	59.0	0.02..	453....	1.3	14.6	.....
420....	5.0	8.8	0.02	454....	1.3	25.8	.....
421....	5.0	64.2	.....	455....	1.8	0.8	.....
422....	5.0	0.8	.....	456....	5.0	0.8	.....
423....	5.0	0.4	.....	457....	2.0	29.8	0.11..
423-A..	0.8	0.4	.....	458....	2.7	0.8	.....
424....	1.7	0.4	.02	459....	5.0	0.8	
425....	5.0	0.2	.....	460....	5.0	0.8	.....
426....	1.5	24.2	.02	461....	5.0	3.8	.....
427....	0.7	25.4	.....	462....	5.0	0.4	.....
428....	5.0	4.0	.....	463....	5.0	0.4	.....
429....	5.0	0.4					
430....	5.0	Tr..	.....				
431....	5.0	0.6	.....				
432....	5.0	0.4	.....				
433....	0.6	20.2	Tr....				
434....	5.0	5.0					
435....	0.7	44.8	Tr....				

TABLE 11. - Analyses of samples, DeCoursey ore body. (Refer to figure 15.)

Sample	Length of sample, feet	Pounds mercury per ton	Percent antimony	Sample	Length of sample, feet	Pounds mercury per ton	Percent antimony
101.....	3.3	0.2		141.....	0.7	62.2	
102.....	2.5	75.6	Nil	142.....	5.0		....
103.....	5.5	0.2	....	143.....	5.0	2.0	....
104.....	4.3	0.4	....	144.....	5.0	0.4	....
105.....	4.5	2.2	....	145.....	3.3	0.4	....
106.....	3.3	1.4	....	146.....	5.0	0.6	....
106-A...	1.2	222.0	....	147.....	5.0	Tr.	....
107.....	1.0	167.4	....	148.....	5.0	0.2	....
108.....	4.0	0.2	....	149.....	5.0	0.4	....
109.....	4.3	0.4	....	150.....	5.0	0.2	....
110.....	5.6	2.8	....				....
111.....	5.0	1.0	....	151.....	5.0	0.2	....
112.....	3.8	13.2	....	152.....	5.0	0.2	....
113.....	5.7	13.4	....	153.....	5.0	0.2	....
114.....	0.6	51.0	Nil	154.....	5.0	0.4	....
115.....	1.9	0.8	Nil	155.....	5.0	0.4	....
116.....	0.5	35.8	Nil	156.....	5.0	11.4	....
117.....	3.3	0.2	....	157.....	5.0	0.8	....
118.....	0.9	194.6	....	158.....	5.0	0.2	....
119.....	5.6	0.6	....	159.....	3.0	0.4	....
120.....	5.0	2.2	....	160.....	5.0	Tr.	....
121.....	4.8	3.6	....	161.....	5.0	0.4	....
122.....	0.7	49.2	....	162.....	5.0	1.4	....
123.....	3.8	0.4	....	163.....	5.0	0.6	....
124.....	5.0	1.4	....	164.....	5.0	0.2	....
125.....	1.4	27.6	0.5	165.....	5.0	0.2	....
126.....	4.7	0.2	....	166.....	5.0	0.2	....
127.....	5.2	0.8	....	167.....	5.0	0.2	....
128.....	2.5	Tr.	....	168.....	5.0	0.6	....
129.....	3.0	2.0	....	169.....	2.0	9.6	....
130.....	5.6	1.0	....	170.....	5.0	1.4	....
131.....	6.0	0.2	....	171.....	5.0	Tr.	....
132.....	4.2	0.6	....	172.....	0.7	45.0	0.03
133.....	4.3	0.4	....	173.....	5.0	1.2	....
134.....	5.0	Nil	....	174.....	5.0	0.4	....
135.....	5.0	0.2	....	175.....	1.0	17.2	0.04
136.....	5.0	Nil	....	176.....	5.0	0.6	....
137.....	5.0	Nil	....	177.....	3.0	0.2	....
138.....	5.0	Nil	....				....
139.....	4.0	Nil	....				....
140.....	2.2	0.4	....				

TABLE 12. - Analyses of samples, upper vein system. (Refer to figure 16.)

Sample	Length of sample, feet	Pounds mercury per ton	Percent antimony	Sample	Length of sample, feet	Pounds mercury per ton	Percent antimony
201....	5.0	0.4	.....	241....	5.0	29.4	.....
202....	5.0	0.4	.....	242....	5.0	1.8	.....
203....	5.0	0.4	.....	243....	5.0	13.4	.....
204....	5.0	0.4	.....	244....	2.0	15.6	.....
205....	5.0	0.4		245....	1.3	100.8	0.04
206....	5.0	0.6	.....	246....	3.0		.....
207....	5.0	0.6	.....	247....	5.0	20.2	.....
208....	5.0	0.6	.....	248....	5.0	5.0	.....
209....	5.0	0.6	.....	249....	5.0	9.0	.....
210....	5.0	0.6		250....	5.0	9.8	.....
211....	5.0			251....	5.0	12.6	0.03
212....	5.0		.....	252....	5.0	0.6	.....
213....	5.0		.....	253....	5.0	1.8	.....
214....	5.0		.....	254....	5.0	5.0	.....
215....	5.0	0.4	.....	255....	5.0	7.4	.....
216....	5.0	Tr.		256....	5.0	5.2	
217....	5.0	Tr.	.....	257....	5.0	0.8	.....
218....	5.0	Tr.	.....	258....	5.0	2.6	.....
219....	5.0	Tr.	.....	259....	5.0	19.8	.....
220....		Tr.	.....	260....	3.0	20.6	.....
221....	5.0	0.8		261....	5.0	13.6	.....
222....	2.6	12.0	.....	262....	3.0		.....
223....	5.0	13.6	.....	263....	3.0		.....
224....	5.0	16.0	.....	264....	2.0	39.0	.....
225....	5.0	36.0	.....	265....	2.5	10.4	.....
226....	5.0	3.6	.....	266....	5.0	6.8	.....
227....	0.5	144.6	0.42	267....	5.0	4.8	
228....	5.0	0.6	.....	268....	5.0	1.4	.....
229....	3.0	33.6	.....	269....	5.0	11.8	.....
230....	4.0	13.6	.....	270....	1.3	87.8	0.09
231....	1.8	22.6	.....	271....	3.8	14.4	.....
232....	5.0	6.6		272....	5.0	13.8	
233....	5.0	0.8	.....	273....	2.0	18.2	.....
234....	0.8	49.4	0.74	274....	0.8	16.2	0.44
235....	5.0	51.2	.....	275....	2.2	3.0	.....
236....	5.0	1.0	.....	276....	5.0	1.2	.....
237....	5.0	0.2		381....	5.0	0.4	
238....	5.0	44.8	.....	382....	5.0	0.6	.....
239....	1.4	83.2	0.04	383....	5.0	0.8	.....
240....	1.0	4.4		384....	5.0	28.8	0.04
				385....	5.0	13.8	0.04

TABLE 13. - Analyses of samples, Retort ore body. (Refer to figure 17.)

Sample	Length of sample, feet	Pounds mercury per ton	Percent antimony	Sample	Length of sample, feet	Pounds mercury per ton	Percent antimony
277....	5.0	5.0		316....	5.0	Nil	
278....	3.8	1.0		317....	5.0	Nil	
279....	1.8	34.2	0.08	318....	5.0	0.4	
280....	5.0	20.2		319....	2.0	6.2	
281....	5.0	0.4		320....	5.0	-	
282....	5.0	0.2		321....	5.0	0.4	
283....	5.0	0.6		322....	5.0	0.4	
284....	5.0	Tr.	0.08	323....	5.0	0.4	
285....	5.0	Tr.		324....	3.5	0.6	
286....	5.6	1.6		325....	3.0	18.2	0.04
287....	2.8	0.2		326....	4.0	0.8	
288....	No sample	-		327....	5.0	Tr.	
289....	2.3	1.0		328....	5.0	0.4	
290....	2.0	0.2		329....	1.3	1.0	0.04
291....	5.0	0.2		330....	1.5	10.8	0.04
292....	5.0	0.2		331....	5.0	0.4	
293....	0.5	4.8		332....	5.0	0.6	
294....	2.8	11.8		333....	2.0	75.8	
295....	5.0	Nil		334....	1.5	22.2	
296....	3.3	5.0		335....	3.0	1.6	
297....	0.5	0.6		336....	5.0	0.6	
298....	4.0	Nil		337....	5.0	0.4	
299....	5.0	Nil		338....	5.0	Tr.	
300....	5.0	0.2		339....	0.7	35.8	0.08
301....	3.8	0.4		340....	2.3	0.4	
302....	0.9	39.6		341....	5.0	Tr.	
303....	1.8	22.0		342....	4.0	0.4	
304....	1.3	17.4		343....	3.0	22.8	0.08
305....	5.0	Tr.		344....	2.8	0.4	
306....	5.0	Tr.		345....	2.8	7.4	
307....	5.0	0.4		346....	0.9	3.4	
308....	5.0	Tr.		347....	3.6	0.8	
309....	5.0	0.4		348....	5.0	Tr.	
310....	1.0	1.2		349....	5.0	0.4	
311....	1.3	5.0		350....	5.0	0.4	
312....	5.0	3.8		351....	5.0	0.4	
313....	5.0	0.2		352....	5.0	0.2	
314....	5.0	Tr.		353....	0.8	33.8	0.08
315....	5.0	Nil		354....	5.0	Tr.	

TABLE 13. - Analyses of samples, Retort ore body. (Refer to figure 17.)-Cont'd.

Sample	Length of sample, feet	Pounds mercury per ton	Percent antimony	Sample	Length of sample, feet	Pounds mercury per ton	Percent antimony
355....	5.0	Tr.		380....	5.0	Tr.	0.04
356....	5.0	Tr.		79....	5.0	Tr.	
357....	5.0	Tr.		80....	5.0	Tr.	
358....	5.0	2.0		81....	5.0	0.4	
359....	5.0	2.0		82....	5.0	0.4	
360....	5.0	2.0		83....	5.0	0.4	
361....	0.6	112.0	0.06	84....	5.0	0.4	
362....	3.0	22.4		85....	5.0	0.4	
363....	2.0	13.0	0.05	86....	5.0	Tr.	
364....	2.0	38.6		87....	5.0	Tr.	
365....	5.0	11.6		88....	5.0	Tr.	
366....	5.0	19.4		89....	5.0	Tr.	
367....	5.0	10.8		90....	5.0	0.4	
368....	5.0	0.4		91....	5.0	Tr.	
369....	5.0	0.2		92....	5.0	1.4	
370....	5.0	0.4		93....	0.3	20.8	
371....	5.0	9.0	0.04	94....	5.0	0.8	
372....	5.0	0.2		95....	5.0	-	
373....	5.0	0.4		96....	5.0	0.4	
374....	1.8	0.2					
375....	5.0	0.4					
376....	3.8	5.8					
377....	2.8	3.0					
378....	5.0	13.6					
379....	5.0	20.4					

Development and Mining

During the summer of 1943, 100 tons of high-grade ore was extracted from the Tunnel vein through the New DeCoursey adit. This adit had been extended to a total length of 168 feet by the close of the 1943 season, and development yielded 40 tons of sorted ore. Sixty tons was mined from stopes 1 and 2. Stope 1, beginning 66 feet from the portal of the adit, was mined to the surface, a distance of about 30 feet. Stoping was also started on the adjoining block 2.

In 1944, the New DeCoursey adit was advanced 50 feet beyond the cross fault terminating block 2 to the end of block 3, marked by a fault trending east of north. The latter was followed 40 feet along a zone of weak and erratic cinnabar mineralization.

From its portal, the New DeCoursey adit is timbered for 40 feet through loose ground. The succeeding 20 feet is in firm ground and is untimbered. The adit is timbered through stopes 1, 2, and 3, but the final 40 feet did not require timber.

A total of 125 tons of sorted ore of retort grade was mined in 1944. The Tunnel vein yielded 80 tons from stopes 2 and 3, plus development ore from the adit below stope 3. No. 2 stope was mined to the surface. Spotty ore was encountered in the lower part of stope 3, from which 12 tons estimated to contain 200 pounds of mercury to the ton was hand-sorted. The surface of this block was stripped over its strike length of 60 feet, and underhand stoping was carried to a depth of about 15 feet. It is expected that the remaining portion of this block will prove to be of retort grade.

During the 1944 season, 15 and 20 tons of sorted ore was taken from open cuts on the Top vein and the DeCoursey veins, respectively. In addition, 10 tons was recovered from the overburden below and west of the DeCoursey vein.

The following tabulation indicates the average amount of retort ore sorted from each square foot of vein area during the 1944 mining operation:

Tunnel vein.....	80 tons from	2,750 sq. ft.,	or 58 lb. per sq. ft.
Top vein........	15 tons from	500 sq. ft.,	or 60 lb. per sq. ft.
DeCoursey vein..	20 tons from	600 sq. ft.,	or 67 lb. per sq. ft.

No mining was done in 1945.

The average width of ore recovered for retorting is about 8 inches, and resuing is followed in the stopes where possible. It is also necessary to hand-sort a considerable part of the ore to produce a product of retort grade. Stopes are left filled with rejected lower-grade material. Except for stope 1, all of which is close to the surface, very few stulls have been required to maintain the stope walls.

In the Tunnel vein, the ore does not break free from the walls, although in general it cuts off rather sharply. Some high-grade ore has been left in the stopes as well as on the waste dump. No attempt has been made to determine the average quicksilver content of the stope fill or of the waste dump.

Retorting

Two D retorts were installed by the DeCoursey Mountain Mining Co. in the summer of 1943, and the ore mined during that season was retorted the following winter. Four hundred flasks of quicksilver was produced; in addition, 12 tons of soot containing a substantial amount of secondary mercury sulfide was stock-piled.

In the following fall, shortly after retorting of 1944-mined ore was begun, it was found that one of the D retorts was cracked, and the work was discontinued until a new retort could be obtained and installed. A production of 320 flasks was made from the 125 tons of ore mined in 1944 and the soot stock-piled in the previous year.

The practice of retorting without the addition of lime or other oxidizing agent to the raw ore is being continued. Pans are not used. Before charging, a strip of boiler plate is placed upon the bottom of the retort and is gradually withdrawn as the charge is emplaced. This is for the purpose of reducing abrasion of the floor of the retort.

The soot is worked dry with lime to remove as much free quicksilver as possible, and the residue is then refired repeatedly until a satisfactory over-all recovery has been made. The soot is not mixed into charges of raw ore.

Attention is now being given by the company to the possibility of milling the substantial reserves of sub-retort-grade ore to produce a concentrate.

Operating Costs

Direct costs of producing 100 tons of retort ore in 1943 (furnished by the DeCoursey Mountain Mining Co.) are as follows:

	Development ore (adit)	Stoping	Total	Per ton
Labor (based at $1.40 per hour).......	1982.13	1216.02	3198.15	31.98
Powder (18 cs. @ $21, 2 cs. @ $12)....	336.00	66.00	402.00	4.02
Fuse (3,500 ft. @ about 1-1/2¢).......	37.44	9.36	46.80	0.47
Caps (2,000 @ about 2.9¢)............	46.50	11.00	57.50	0.57
Timber (8 cords @ $14)...............	98.00	14.00	112.00	1.12
Supplies (jack bits, jackrods, carbide, track spikes, fishplates)...	53.00	15.20	68.20	0.68
Freight..............................	121.66	121.65	243.31	2.43
Fuel (gas & oil for compressor).......	156.00	39.25	195.25	1.95
Depreciation on equipment............	175.00	75.00	250.00	2.50
Total cost per ton, $45.73.	3005.73	1567.48	4573.21	45.73
Days worked, 108.				
Av. daily production, 0.92 flask				

In 1945, retorting costs per ton were as follows:

Retort men, 2 man-shifts @ $13.00...	$26.00
Hand crushing......................	3.00
Fuel, 3/4 cord wood @ $18.00........	13.50
Depreciation of retort..............	13.00
	55.50

Depreciation of the two D retorts is calculated as follows:

	Cost per ton
2 D retorts will handle 200 tons at this operation and installed cost..$2,000..................	$10.00
Brickwork and ironwork are estimated to serve five sets of retorts and cost..$3,000..............	3.00
Cost per ton..............................	13.00

Direct mining costs in 1943 and retorting costs of 1945 totaling $101.23 a ton of high-grade ore are believed to be representative of this operation. These costs total $43.39 a flask of quicksilver produced in 1945, if it is assumed that the mercury content of the soot retorted was comparable to that of the ore.

Additional costs include royalties, freight, and insurance on marketed quicksilver, commission charges, and the purchase of empty flasks. These have totaled $10.50 per flask of mercury.

To the total of direct mining, retorting, marketing, and royalty costs, which has been approximately $54 per flask, must be added a moderate charge for incidental expenses, development work, prospecting, and boarding-house losses.

CINNABAR CREEK DEPOSITS

Introduction

The Cinnabar Creek mercury deposits are in the Georgetown mining district on the divide between the Aniak and Holitna Rivers, tributaries of the Kuskokwim. The mineralized area is in the upper Holitna River region, 85 miles by air southwest of Sleitmut or 200 miles by water route on the Holitna River and its upper tributaries. (See fig. 2.)

At ordinary stages of water during the summer, the Holitna and its upper tributaries leading into the area are navigable by small power boats to within 20 miles of the deposits. At moderately high stages of water, the tributaries can be navigated to within 5 miles of the deposits by using a poling boat and outboard motor. The upstream trip from Sleitmut to the deposit requires from a week to 10 days, and the return trip about 4 days.

There are no airplane landing strips in the area. A small lake within 8 to 10 miles of the deposits is probably large enough for landing aircraft equipped with pontoons, but none have ever landed there. Planes equipped with skis have landed in the area in winter. Another means of access into the area is a winter tractor trail that extends approximately 76 miles nearly due east from Nyac. Nyac is on Bear Creek, a tributary of the Tuluksak River, which enters the Kuskokwim about 50 miles above Bethel. The route from Nyac is the best available for transportation of large quantities of supplies and machinery into the Cinnabar Creek area. Dredges of the New York Alaska Gold Dredging Corp. operate at Nyac, and this company transports all supplies from Bethel to its property by water, followed by 10 to 30 miles of tractor transportation, the distance depending on the stage of the Tuluksak River.

The area is characterized by low, moderately rolling hills, but sharp, rocky peaks are conspicuous at a few of the crests. These hills are covered with a mantle of moss, which overlies residual rock material of various thicknesses. The creek valleys and gulches that drain the area are well above timberline but support a thick growth of alders and scrub willows.

Spruce suitable for lumber and mine timbers can be obtained along the divide between Beaver Creek and Gemuk River 1 to 2 miles east of Lucky Day lode. Most of the trees are 1 to 1-1/2 feet in diameter and 30 to 40 feet in height. Heavily branched and tapering rapidly, the trees are poor for lumber but would meet most requirements for developing and operating a small mine.

History and Production

No organized party had done geological reconnaissance work in the area prior to the summer of 1943, and the upper Holitna River region is virtually unexplored with respect to its mineral resources.

Russell Schaefer and Harvey Winchell located and sampled the Lucky Day lode in Canary Gulch in the summer of 1941 and also located placer claims on Cinnabar Run. Herschel Landru discovered and located the Broken Shovel lode claim on Broken Shovel Creek in September 1941 and also located placer claims on Cinnabar Creek. During October of the same year, Kenneth Deleray, engineer for the Bristol Bay Mining Co., sampled the placer deposits of Cinnabar Gulch and the Lucky Day lode deposits. The local names Cinnabar Creek, Cinnabar Run, and Cinnabar Gulch designate, in order, the main creek, the main northern tributary, and its eastern tributary. These creeks are shown on figure 18.

During 1942, Schaefer recovered 2,300 pounds of cinnabar ore from detrital material from the Lucky Day lode and from it retorted 15 flasks of mercury. In the spring of 1943, the New York Alaska Gold Dredging Corp. spent a short time prospecting and sampling the placer deposits on Cinnabar Run and Cinnabar Gulch. In the summer of the same year Schaefer recovered an additional 1,300 pounds of cinnabar ore from the residual material associated with the Lucky Day lode, which yielded 11 flasks of mercury. No ore has been taken from the lode itself, nor has exploration to date revealed ore in place having a grade that can be considered commercial in this high-cost isolated area.

Property and Ownership

The mining rights of all the claims staked in this area are held by three individuals, two of whom are partners. The following tabulation shows the ownership of these claims and their locations:

Claims staked by Russell Schaefer and Harvey Winchell, partners, Sleitmut, Alaska.

Lode claims (600 by 1,500 feet)	Location
Lucky Day Discovery	Canary Gulch
Lucky Day No. 1	Canary Gulch
Redskin	Alder Gulch
Placer claims (20 acres)	
Discovery	
1 below Discovery	Cinnabar Gulch
2 below Discovery	Cinnabar Run
3 below Discovery	Cinnabar Run
4 below Discovery	Cinnabar Run
5 below Discovery	Cinnabar Run

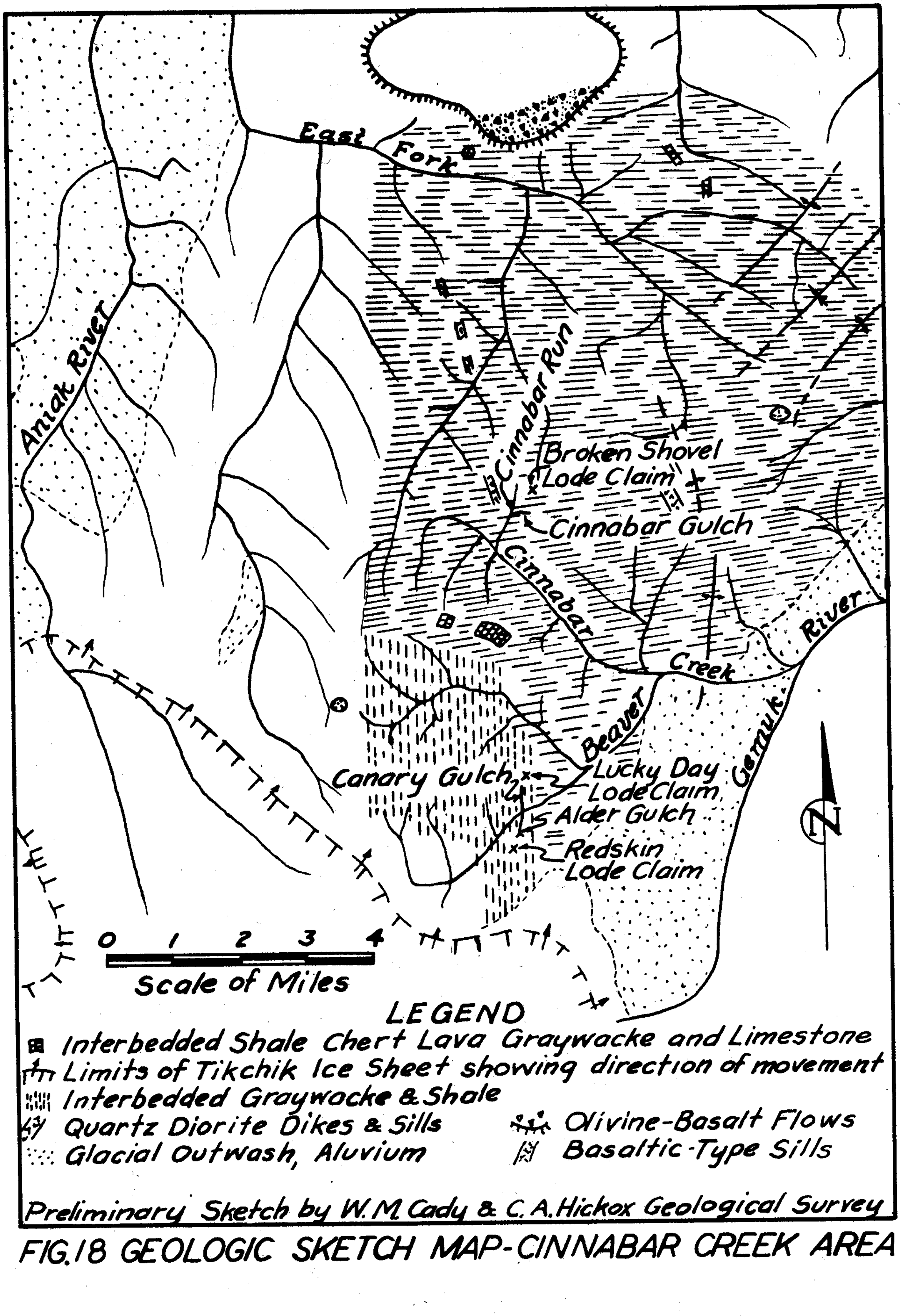


FIG. 18 GEOLOGIC SKETCH MAP-CINNABAR CREEK AREA

Claims staked by Herschel Landru, Fairbanks, Alaska.

Lode claim (600 by 1,500 feet)	Location
Broken Shovel....................	Broken Shovel Creek

Placer claims (20 acres)	
6 below Discovery................	Cinnabar Creek
7 below Discovery................	Cinnabar Creek

All these claims are recorded at the office of the U. S. Commissioner at Aniak, Alaska. The New York Alaska Gold Dredging Corp., 120 Broadway, New York, had all this property under lease in 1943.

The Deposit

The following discussion of the geology of the area is quoted from a report by Cady[14].

> The bedrock of the Cinnabar Creek area includes a succession of interbedded graywackes and shales, possibly of late Paleozoic age. Certain stratigraphic zones contain considerable amounts of chert and in one such zone a few strata of limestone are interlaminated. The sedimentary rocks are intruded by sills, and interlayered with lava flows, of igneous origin, probably Tertiary in age. Most of the igneous rocks, both in the sills and in the flows, appear on field inspection to be largely of the basaltic type, commonly porphyritic. Quartz diorite dikes and sills are found in a few outlying parts of the area although not in the vicinity of the prospects. Certain of the basaltic sills are hydrothermally altered to a light pearl-gray rock which weathers yellow-brown, forming the typical "yellow rock porphyry" of the prospectors in the Sleitmut area; some of the graywacke appears to be altered also. The altered rocks are distributed through the area in a north-south trending belt about 1 mile wide and at least 6 miles long. There appears to be a greater volume of altered porphyritic sill rock at higher elevations, although this may be the effect of more favorable exposure on the hill tops. The strike of the bedrock formations ranges from north-northwest to north in the belt of alteration, although the regional strike is more to the northeast; the formations dip steeply west. Frost-broken rock fragments cover the bedrock on the hills with a mantle ranging in depth up to 5 feet; the fragments are not so far removed from their points of origin as to produce discontinuities of more than a foot in tracing "yellow rock" or float ore. Alluvial deposits ranging up to a greater depth are found in the valley bottoms. Prospectors report cinnabar concentrates from all alluvial deposits in the belt of altered porphyritic sills. The topography of the area has developed during at least two cycles of erosion, the earlier of which reached the late mature stage producing a more subdued upland surface and

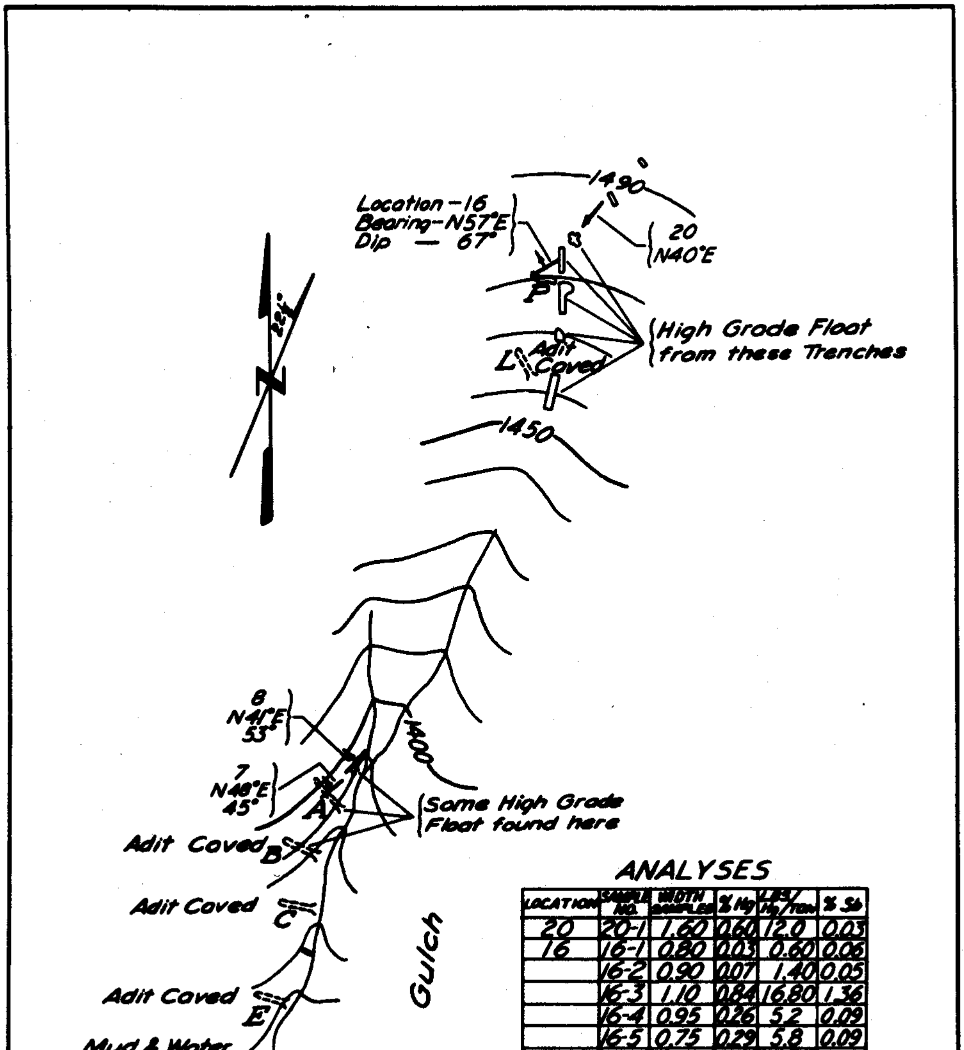
14/ See footnote 8.

the latter, which is yet in youth, forming the steeper-walled gulches which cut into the upland surface.

Cady describes the mineral occurrences of the area as follows:

> Cinnabar closely associated with small amounts of stibnite and a minute quantity of native quicksilver is localized in bedding joints and in small cross joints and breccia openings along the bedding, lined with vein quartz. The openings along the bedding joints, with which the dense, finely crystalline, high-grade ore is associated, appear to have been the largest, although some of the mineral here may replace the wall rock. The ore associated with the cross joints and breccia openings is of lower grade, more coarsely crystalline, and contains more quartz. At the few places where ore in place has been exposed, the mineralized zone, which is at or near the hanging wall of altered porphyritic sills, strikes roughly north-northwest and dips steeply west. The highest-grade ore, relatively devoid of wall-rock fragments, is found in the uppermost openings at or not far below the upland surface; the lower-grade ore is more common at lower elevations, in the gulches. An undetermined amount of the upper parts of all the ore bodies has been eroded.
>
> The placer cinnabar in Cinnabar Gulch, Cinnabar Run, and Cinnabar Creek is an alluvial concentration of higher-grade ore nuggets such as have probably been eroded from most of the lodes in the area. The pay streak that heads in Cinnabar Gulch is probably typical of several others in creeks not yet tested. At what appears to be the head of the pay streak, the nuggets, averaging about the size of a walnut, are angular, but one claim length downstream, where Cinnabar Gulch enters Cinnabar Run, they are rather well-rounded; thus, the bedrock source of the ore was not far from the pay streak. Remnants of a bench 40 feet above the bottom of Cinnabar Run appear to have held parts of a pay streak that was the immediate source of several large, well-rounded cinnabar nuggets slumped to the rim of the present creek bottom. The lode from which mineral in the pay streaks heading in Cinnabar Gulch was eroded has not yet been found, although the head of the gulch was prospected, from which prospectors inferred that the lode may have been eroded off. The latter rather prevalent conception of the cinnabar lodes associated with placer deposits in southwestern Alaska needs more thorough testing.

Beds of shale and graywacke, which are the sedimentary country rocks near the Lucky Day lode, strike roughly north and south and dip steeply to the west. The deposit occurs in a fractured zone within yellow-brown graywacke. The strike of this zone is about N. 50° E., and the dip is vertical at the north end and about 45° to the northwest at the south end. This deposit is a breccia filling in the highly jointed and fractured graywacke. A fine sandy gouge material averaging about 1 foot in width separates the



ANALYSES

LOCATION	SAMPLE NO.	WIDTH SAMPLES	% Hg	LBS/ Hg/TON	% Sb
20	20-1	1.60	0.60	12.0	0.03
16	16-1	0.80	0.03	0.60	0.06
	16-2	0.90	0.07	1.40	0.05
	16-3	1.10	0.84	16.80	1.36
	16-4	0.95	0.26	5.2	0.09
	16-5	0.75	0.29	5.8	0.09
	16-6	2.35	0.66	13.2	0.06
8	8-1	1.50	0.42	8.4	0.06
7	7-1	2.30	0.13	2.6	0.04

FIG 19 SCHAEFER-WINCHELL PROPERTY, LUCKY DAY LODE

fracture zone from the hanging-wall rock. Within the fracture zone, small, irregular, lenticular masses are mineralized. The mineralized zone grades into the graywacke and has no definite footwall.

The mineralized body of the Lucky Day lode contains the two sulfides, cinnabar and stibnite. Both massive and crystalline cinnabar intergrown with stibnite and quartz form small, irregular, lenticular masses disseminated through fractured, altered graywacke. Gangue minerals observed in the surface exposures are quartz and small amounts of calcite, together with sand, clay, gouge and altered graywacke.

Along the known strike length of the Lucky Day lode, erosion presents an inclined cross section over a vertical distance of 130 feet. Except for one sample, which was taken about 20 feet above the base of this cross section and was reported to contain 26.6 pounds of mercury a ton, the higher concentrations are found at or close to the top of the section. The source of the bulk of the high-grade ore in the detritus was probably the upper portions of the lenses exposed in the sampled trenches. A preliminary geologic sketch map of the Cinnabar Creek area is shown on figure 18.

The Redskin lode claim at the head of Alder Gulch was examined during the investigation, but no cinnabar occurrences were found. The time available before the freeze-up was too short to permit examination of the Broken Shovel lode claim on Broken Shovel Creek.

Work done by Bureau of Mines

The impending freeze-up limited the amount of time available and made a comprehensive sampling program impractical. After a rapid survey of the area to determine which property had the most merit, it was decided that sampling should be limited to the Lucky Day lode.

The owners of the Lucky Day lode have partly explored the property by trenching and driving short adits through the overburden, which ranges in depth from 6 to 10 feet, to locate the deposit in place. The location of this work is shown on figure 19. When the property was examined by the Bureau of Mines, all the trenches were caved and some were filled with water. All of the adits except one were caved. Because neither of the owners of the property was present to point out the exact locations where the deposit had been encountered, it was necessary to do considerable excavating to expose the deposit. It is possible that the Bureau of Mines excavation did not expose the better mineralized zones.

It was possible to channel sample the deposit in four places, designated in figure 19 as 7, 8, 16, and 20, at each end of a strike length of 632 feet. The intervening strike length of about 450 feet has not been prospected. Each channel sample was 6 inches wide by 3 inches deep and was cut through a fresh, cleaned surface at right angles to the strike and normal to the dip of the deposit.

A weighted average of the 9 samples from the Lucky Day lode indicates a possible mineralized zone 632 feet long and 3.2 feet wide, containing 10.5 pounds of mercury per ton. This includes the unprospected central segment about 450 feet in length, but excludes approximately 250 feet of strike length sampled by Schaefer.

Placer Deposits

The narrow valleys of Cinnabar Run and Cinnabar Gulch, which are upper tributaries of Cinnabar Creek, were prospected by the New York Alaska Gold Dredging Corp. in the spring of 1943.

Both of these tributaries have narrow valley floors 100 to 150 feet across the bottoms, with relatively steep sloping walls. The alluvium is composed of slide rock and washed gravels and averages 5 to 10 feet in depth with the cinnabar concentrated on bedrock.

By using information from the pit logs supplied by the company, a block of ground 2,100 feet in length, 74 feet in width at the lower end, and 10 feet in width at the upper end has been outlined as minable ground. The average mercury content is estimated as 0.26 pound a cubic yard. The gravel between the discovery at pit 40 and line 1-22-2, shown on figure 20, has not been explored.

Table 14 shows the sampling results of the New York Alaska Gold Dredging Corp. in prospecting placer deposits on Cinnabar Run.

TABLE 14. - Sample results of placer deposits on Cinnabar Run

Line	Hole	Distance, feet	Depth, M. S., feet	Mercury per cubic yard, lb.
2-20-1	14		9.0	0.32
		28.0		
	42		5.0	0.40
		8.0		
	50		6.0	0.00
		38.0		
	88		5.5	0.21
2-20-6	16		5.0	0.27
		24.0		
	40		6.0	0.36
		30.0		
	70		5.0	0.40
1-21-2	25		8.0	0.42
		20.0		
	45		7.0	0.00
		20.0		
	65		5.0	0.00
1-21-7	25		13.00	0.54
		28.0		
	53		10.0	0.00
1-22-2	45	10.0 (assumed)	14.0	0.34
Lode -24-05	40	10.0 (assumed)	10.5	0.84

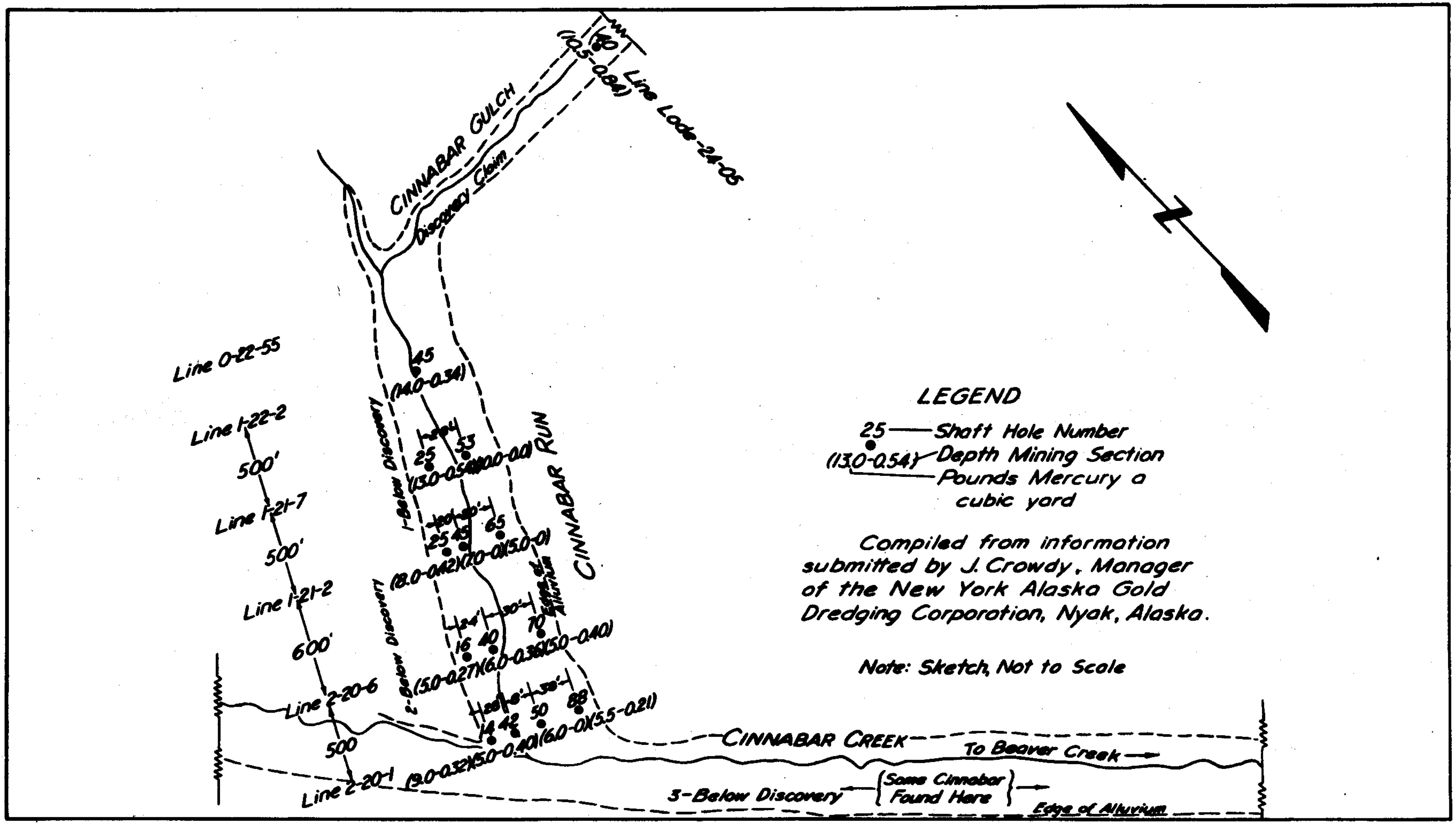


FIG. 20 SKETCH MAP OF CINNABAR RUN SHOWING LOCATION PROSPECT SHAFTS

Development

The Lucky Day lode was prospected by the owners by trenches and short adits, using hand labor. The depth of the overburden is 5 to 10 feet. Eleven trenches were dug in the shallower overburden, and five adits were driven in the deeper sections, following the contact of the overburden and bedrock. No underground development work has been done.

No equipment is on the property, and no mechanical equipment is available nearer than Nyac. At that place, the New York Alaska Gold Dredging Corp., lessee of the mercury properties, has bulldozers, a compressor, and pneumatic drills.

KOLMAKOF PROSPECT

Introduction

The Kolmakof property, on the right limit of the Kuskokwim River 18 miles above Aniak, consists of two lode claims owned by Willie Rabidoux.

The occurrence of cinnabar in the area was known at the time of the Russian occupation. In 1898, J. E. Spurr, of the Geological Survey, made a reconnaissance of southwestern Alaska and reported a vein of cinnabar in a cliff on the right side of the Kuskokwim River about 5 miles below Kolmakof. In the summer of 1914, A. G. Maddren[15/] investigated this deposit in the course of general surveys of the Kuskokwim and adjacent regions. No other recorded investigation was made of the deposit until it was examined by the senior author in July 1944.

In the vicinity of Kolmakof, the north bank of the river is made up chiefly of hard-rock bluffs 100 to 400 feet high. The bluffs consist principally of alternate beds of sandstones and shales that have been intruded by rhyolite dikes and sills. The bluff where the cinnabar mineralization occurs shows sandstone beds 2 feet to 20 feet in thickness and shale beds from a few inches to 2 or 3 feet thick. Strikes of the sedimentary beds are N. 30° to 80° E., and dips range from 30° to 70° N. W.

Work done by Bureau of Mines

The occurrence investigated by the Bureau of Mines is situated downstream and eastward about 200 feet from the section examined by Maddren. The more promising deposit described by the Geological Survey in 1914 is not now in evidence and has probably been removed by the rapid erosion to which the bluff is subjected.

This more easterly deposit was found by trenching along the face of the bluff above pieces of cinnabar found at the foot of the talus slope. Twenty-nine hand-made trenches and open cuts aggregating about 600 feet in length

15/ Brooks, A. H., et al, Mineral Resources of Alaska, Report on Progress of Investigation in 1914: U.S. Geol. Survey Bull. 622, 1915, p. 272.

have been spaced across the strike of the deposit and across other sections of the bluff. The trenches were irregularly spaced along a strike length of 350 feet as shown on figure 21.

The Deposit

Cinnabar mineralization exists in association with a prominent rhyolite sill and occurs in three structures:

(a) A very narrow, persistent stringer of cinnabar lies within the rhyolite sill. It has been traced along its strike a distance of 250 feet and through a vertical interval of 100 feet. Its average width is about 1/2 inch, but, as small kidneys, it reaches widths up to 3 inches. Sample KM-1 was composited from this stringer and contains 404 pounds of mercury per ton.

(b) A narrow shear zone roughly parallels the hanging wall of the sill along the eastern two-thirds of its explored strike length. Intermittent cinnabar mineralization, in small pods, occurs within or adjacent to this structure. Sample KM-2, containing 191.2 pounds of mercury per ton, represents a pod 5 inches in maximum width and 6 feet in length and depth. A smaller and weaker pod occurs in trench 26, 30 feet to the west. See figure 21.

Along a very short strike length, the footwall section of the shear zone in No. 14 open cut is slightly mineralized across a width of 2 feet. This mineralization does not extend laterally into adjacent trenches. Trenching across the shear zone toward the northeast failed to disclose mineralization. The junction of the shear zone and hanging wall of the sill is mineralized.

(c) In open cut No. 14, a series of cross fractures extends from the shear zone to the hanging wall of the rhyolite sill. A thin wall of cinnabar occurs on one set of fractures.

Two additional sills in the immediate vicinity of the deposit showed no evidence of cinnabar mineralization. About half a mile upstream, a trench and test pit were excavated in an unsuccessful attempt to trace to their origin several pieces of cinnabar float found at the base of the river bluff.

RAINY CREEK PROSPECT

Introduction

This deposit is situated on Rainy Creek at the western base of the Kilbuck Mountains opposite Mt. Oratio, at the headwaters of Eek River, a tributary of the Kuskokwim River. (See fig. 2.) A winter tractor trail estimated to be 120 miles in length has been established between Rainy Creek and Bethel. Freighting of general supplies and placer equipment from Bethel has averaged about $40 a ton.

It would be possible to reach this area during stages of high water by ascending Eek River from the Kuskokwim, yet it would not be practicable

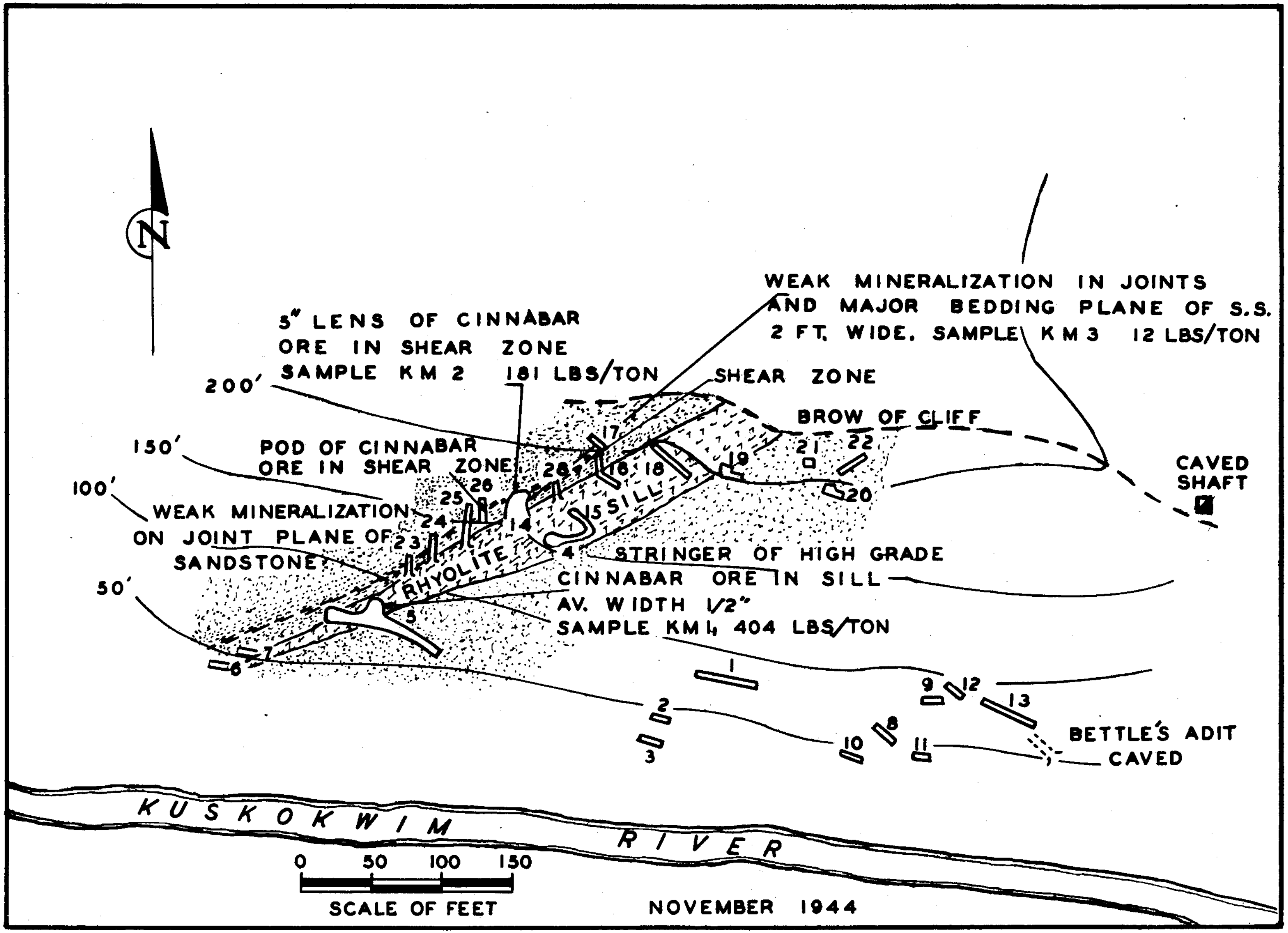


FIG. 21 KOLMAKOF MERCURY DEPOSIT SOUTHWESTERN ALASKA

because of the time required and the necessity of using a canoe or small poling boat on the upper reaches of the river. The exact distance has not been determined, but it is estimated to be not less than 200 miles.

An emergency landing strip in the valley of the North Fork of Eek River is about 2 miles from the Rainy Creek camp. Ordinarily, it is necessary to charter airplane service from Bethel to Rainy Creek at a minimum of 2 hours flying time. Charter rates range from $60 to $75 an hour for 4- to 6-passenger planes.

Rainy Creek and its tributaries drain the rolling highland below the foothills flanking the western side of the Kilbuck Mountains. Though peaks in the vicinity reach altitudes exceeding 2,000 feet, the area generally is about 400 feet lower. Drainage lines often coincide with contacts between sand or conglomerates and softer sediments, and the peaks are composed of the coarse, resistant clastics.

Except for numerous thickets of willows along the streams, vegetation consists solely of the usual tundra plants. Spruce suitable for mine use could be obtained in the Eek and Kwethluk River basins about 30 miles west of Rainy Creek. These trees do not attain saw-log dimensions.

History and Production

The deposits are believed to have been discovered in the decade 1910-20 by Ed McCann of Bethel, Alaska, who sampled the outcropping massive realgar at that time. During the following decade, a little attention was given deposit I by Neal Corrigal, of Bethel, in connection with his exploration of placer-gold deposits in the region. Corrigal staked the deposit and excavated a small cut in the face of the stockwork which forms the central part of that deposit. Subsequently, he allowed the location to lapse, and it is now a part of the public domain.

Production of quicksilver from the area has been solely from cinnabar recovered during the course of the gold-placer operation along Rainy Creek. All but a small fraction of the 2,000 pounds of high-grade concentrate shipped was obtained from that part of Rainy Creek below the mouth of Arsenic Creek.

General Geology

Sediments ranging from conglomerate through sandstone to black shale constitute the observed country rock in this area. The regional strike is north of east, and dips are usually high and toward the southeast.

Upon the basis of similarity with a succession of clastics in the nearby Goodnews Bay region, tentatively assigned to the Permian by the Federal Geological Survey,[16] a like age is suggested for the sediments in the Rainy Creek area.

16/ Smith, P. S., Areal Geology of Alaska: U.S. Geol. Survey Prof. Paper 192, 1939, p. 33.

The Deposits

Examination of the area has disclosed the presence of three roughly parallel lodes mineralized by cinnabar and realgar and spaced approximately 100 feet apart. Each of these occurrences is in sandy or shaly sediments and in association with strong faulting. Exposures along a short strike interval occur in the bluffs that form the south bank of Arsenic Creek, a tributary of Rainy Creek, which in turn drains into Eek River. (See fig. 22.) In addition to these deposits, and within the same area, are three well-developed parallel faults about 10 feet apart. Minor concentrations of cinnabar were observed along these fault planes. The small intrusives usually found accompanying cinnabar mineralization in southwestern Alaska are absent in the present limited exposures. The projected strike of the deposits is covered toward the southwest by the tundra upland and in the opposite direction by the alluvium-filled valley of Arsenic Creek.

Deposit I outcrops at creek level and is partly exposed through a vertical range of 10 feet. Above, it is mantled by brush-covered talus to the edge of the tableland, 150 feet above creek level.

Mineralization by realgar, cinnabar, and quartz occurs within and between two parallel shear zones separated by 16 feet of thoroughly fractured sandstone. (See fig. 23.) Shearing trends S. 20° W. and dips 70° to the northwest. Mineralization of the enclosed sandstone has a stockwork structure, and the individual seams of quartz and arsenic sulfide generally conform in attitude to the bedding or the shearing. No mineralization was observed in the footwall sandstone, but an 8-inch width of the hanging-wall sandstone adjacent to the upper shear zone contains 1.6 pounds of quicksilver per ton and 0. 2 percent arsenic. (Sample RC-14.)

Mineralization within the footwall shear zone and the stockwork is uniformly weak. Samples RC-7 to RC-10, inclusive, represent this 17.6-foot section, which has an average mercury content of 1.8 pounds per ton and 0.9 percent arsenic. The lower 4 feet of the upper shear zone contains numerous pods of massive realgar and is represented by sample RC-11, which contained 9.4 pounds of mercury per ton and 9.4 percent arsenic. The succeeding 2-foot section of the upper shear zone is lightly mineralized, containing 1.4 pounds of mercury a ton and 0.4 percent arsenic. (Sample RC-12.) A 4-inch seam of sandy and shaly material marks the hanging wall of the upper shear zone. (Sample RC-13.) This contains 35.4 pounds of mercury per ton and 0.2 percent arsenic. A weighted average of this 6.33-foot cross section of the upper shear zone (samples RC-11, 12, and 13) is 8.22 pounds of mercury per ton and 6.08 percent arsenic.

An attempt was made to obtain additional data by trenching across the strike of the deposit projected southwesterly. This was unsuccessful because of the depth of overburden and the presence of permanent frost. Toward the northeast, several hundred feet of strike interval are occupied by the valley of Arsenic Creek. Mineralization was not observed in the mantle of detritus over the gradually sloping banks north of this creek.

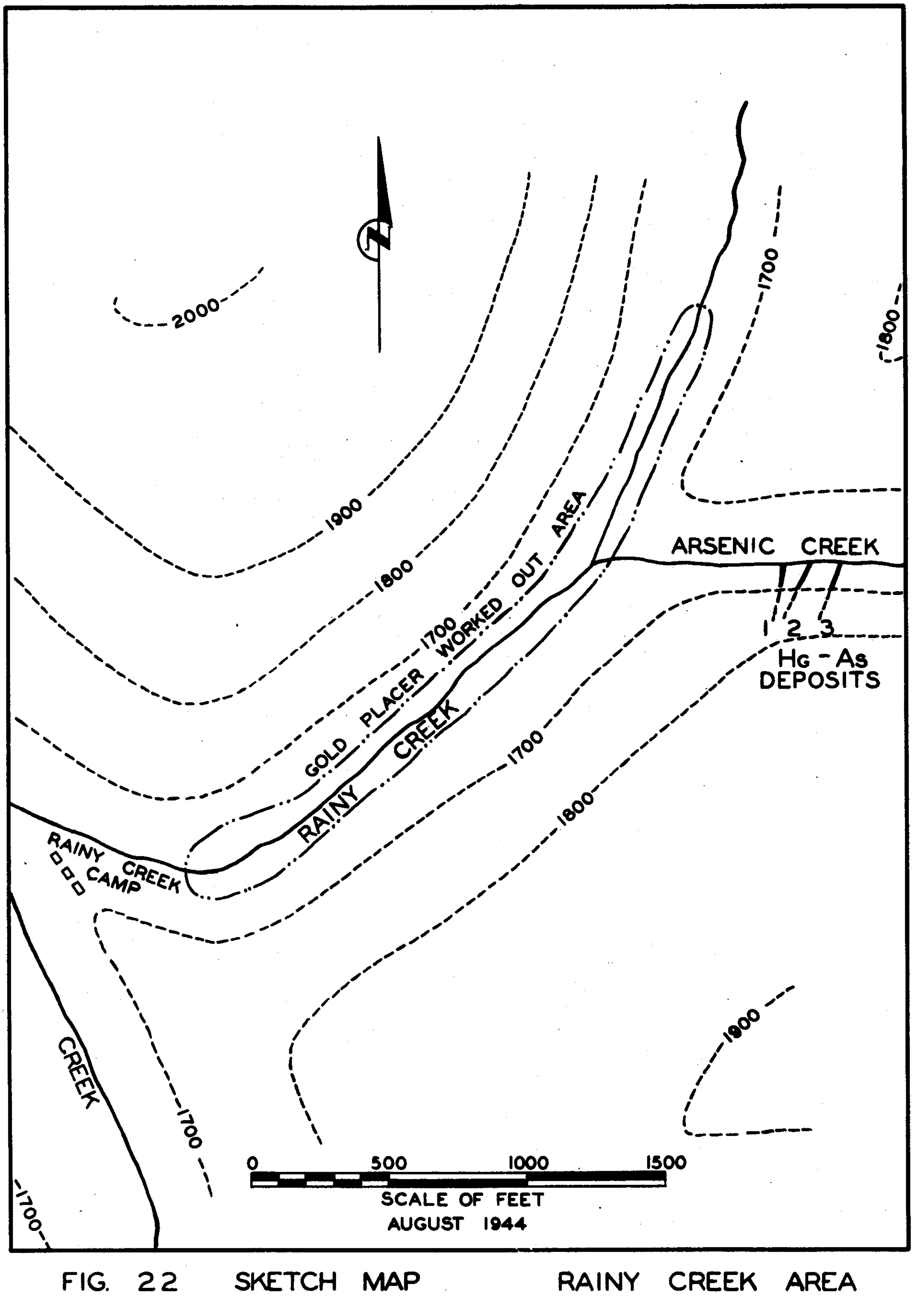
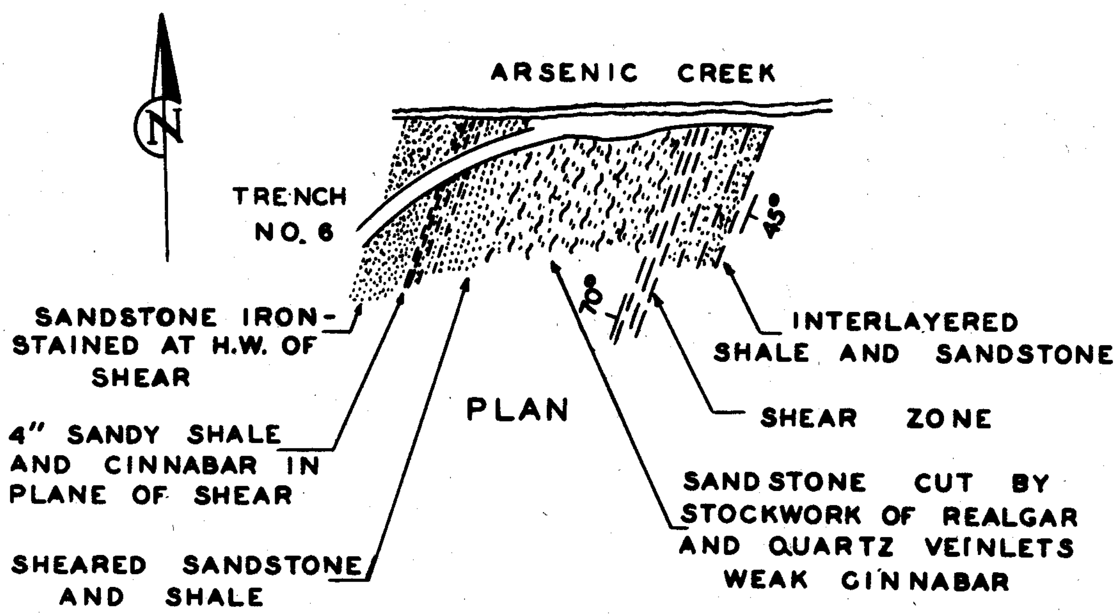
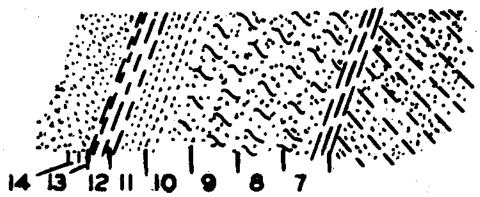


FIG. 22 SKETCH MAP RAINY CREEK AREA



PLAN



E-W SECTION
LOOKING NORTH

SAMPLE NO.	TRUE WIDTH
7	4.4
8	4.4
9	4.4
10	4.4
11	4.0
12	2.0
13	0.33
14	0.7

0 10 20 30
SCALE IN FEET
AUGUST 1944

FIG. 23 DEPOSIT I RAINY CREEK AREA, ALASKA

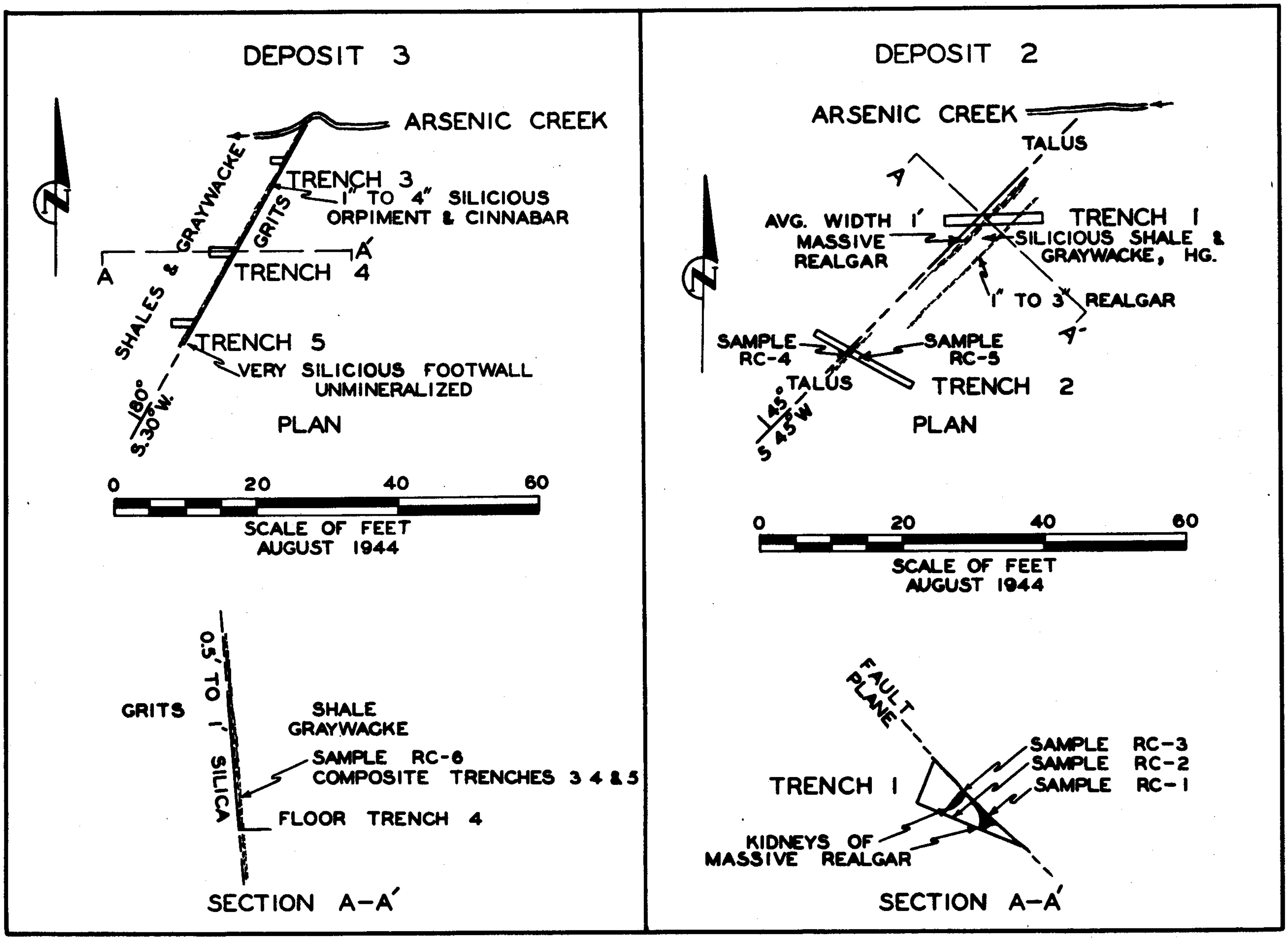


FIG. 24 DEPOSITS 2 AND 3 RAINY CREEK AREA

Deposit 11 occurs approximately 100 feet east of deposit I and is marked by a single very strong fault, which strikes S. 45° W. and dips at about 45° to the northwest. Mineralization appears to have been localized by a series of slips that trend southwest and dip to southeast.

At trench 1 (fig. 24), a central mineralized zone is 3 feet in width and is bounded on each side by kidneys of realgar. From the kidneys of realgar marking the footwall of this deposit, a narrow band of realgar extends just beneath the fault plane toward the pods at the hanging wall. Both the hanging and the footwall segregations of realgar terminate in depth within a few feet of the fault plane, and neither extends southwestward to trench 2, which is 25 feet distant.

Sample RC-3 was cut in sandy shale along the 3-foot cross section between and beneath the realgar zones and contained 1.6 pounds of mercury per ton and 0.2 percent arsenic. At a slightly higher elevation, about 1 foot beneath the fault plane, samples RC-1 and 2 represent the foot- and hanging-wall realgar zones, respectively. Sample RC-1, taken across a 1.2-foot width, contains 5.6 pounds of mercury per ton plus 18.3 percent arsenic, and sample RC-2, representing a width of 3 inches, contains 22.8 pounds of mercury per ton plus 9.8 percent arsenic. This mineralized zone is not well-defined structurally along its downward projection. The results obtained by panning at levels about 10 and 20 feet below trench 1 indicates sparse cinnabar mineralization at these horizons.

In trench 2, a 6-inch width of shale at the footwall of the deposit has been silicified and is well-mineralized by cinnabar. Sample 4, representing this section, contains 44.6 pounds of mercury per ton and 0.6 percent arsenic. The adjacent 3-foot section (sample RC-5) is sandy shale containing 1.2 pounds of mercury a ton and 0.4 percent arsenic. The tundra covered upland lies immediately to the southwest of trench 2, and is not amenable to hand trenching.

Deposit III is situated 100 feet east of deposit II and consists of a narrow seam of sandy to opaline mineralized material within a strong fault trending S. 30° W. and dipping 80° to the northeast. The fault appears to mark the contact between a coarse sandstone and much finer sediments. An unmineralized quartzose zone has been developed within the footwall sandstone adjacent to the fault. Along an exposed strike interval of 35 feet, the deposit has an average width of only 3 inches. (See fig. 24.) Composite sample RC-6 represents the deposit along this interval and contains 45.8 pounds of mercury per ton plus an undetermined amount of arsenic as orpiment.

The very limited exploration accomplished during this examination has not shown a consistent relationship to exist between the intensities of arsenic and quicksilver mineralization. In deposit I, a 6.33-foot width of material averaging 8.22 pounds of mercury per ton includes samples RC-11 and RC-13, which, respectively, contain the greatest and smallest percentages of arsenic of the eight sample lengths comprising the 24.63-foot width of this deposit. In trench 1 across deposit II, samples RC-1 and RC-2 represent shallow segregations of realgar in which the cinnabar has been concentrated. However, in trench 2, also across deposit II, sample RC-4 contains 44.6 pounds of mercury per ton and only 0.6 percent arsenic.

MARSH MOUNTAIN DEPOSITS

Introduction

The Marsh Mountain property lies in a horseshoe-shaped basin formed by a group of peaks comprising Marsh Mountain. The basin is drained by Arcana Creek, which flows southeast 3-1/2 miles and then west for 2-1/2 miles to its confluence with Wood River. The deposits can be reached by regular plane flight from Anchorage to Naknek on the southeast shore of Kvichak Bay and then by chartered flight in a float plane from Naknek to Lake Aleknagik. The plane may be chartered by sending a radio message to Dillingham across the bay from Naknek. Scheduled flights are made from Naknek to Dillingham on Fridays, Saturdays, and Sundays. A 4-mile trail 1-1/2 miles downstream from the village of Aleknagik leads northeast to the property. The deposits can also be reached by ascending Wood River in a boat from Snag Point to the 4-mile trail 1-1/2 miles downstream from Aleknagik. (See fig. 25.) The distance is 24 miles, and the river is navigable from June until mid-October by shallow draft boats and barges.

Transportation of equipment and supplies to the property would be difficult. Ships call infrequently at Snag Point, as there are no docking facilities, and cargo must be lightered ashore. Furthermore, ships must follow a circuitous route through Unamak Pass in order to reach Snag Point.

A tract of treeless and fairly level land on the gravel terrace above Wood River, just south of Marsh Mountain, could be converted into an airfield suitable for small planes. The cost of air freight from Anchorage to this vicinity would be 38 cents a pound.

The present trail from Wood River to Marsh Mountain could be converted into a tractor road as far as the base of Marsh Mountain. From there, supplies would have to be packed up the mountain, as the cost of building a road up the steep slopes would be prohibitive. A tractor road following Mr. Waskey's present dog trail might be feasible. This trail leaves Wood River a short distance north of the mouth of Arcana Creek and angles up the south spur of Marsh Mountain.

Most of Arcana Creek and the streams emptying directly into it occupy U-shaped valleys, though post-glacial erosion has cut V-shaped valleys along many of their tributaries. Vegetation is abundant on the flats around Marsh Mountain. Spruce trees attaining a diameter of 8 inches at the butt are found within 2 miles of the prospect on lower Arcana Creek. Alder brush is plentiful and could be used as firewood if supplemented with spruce.

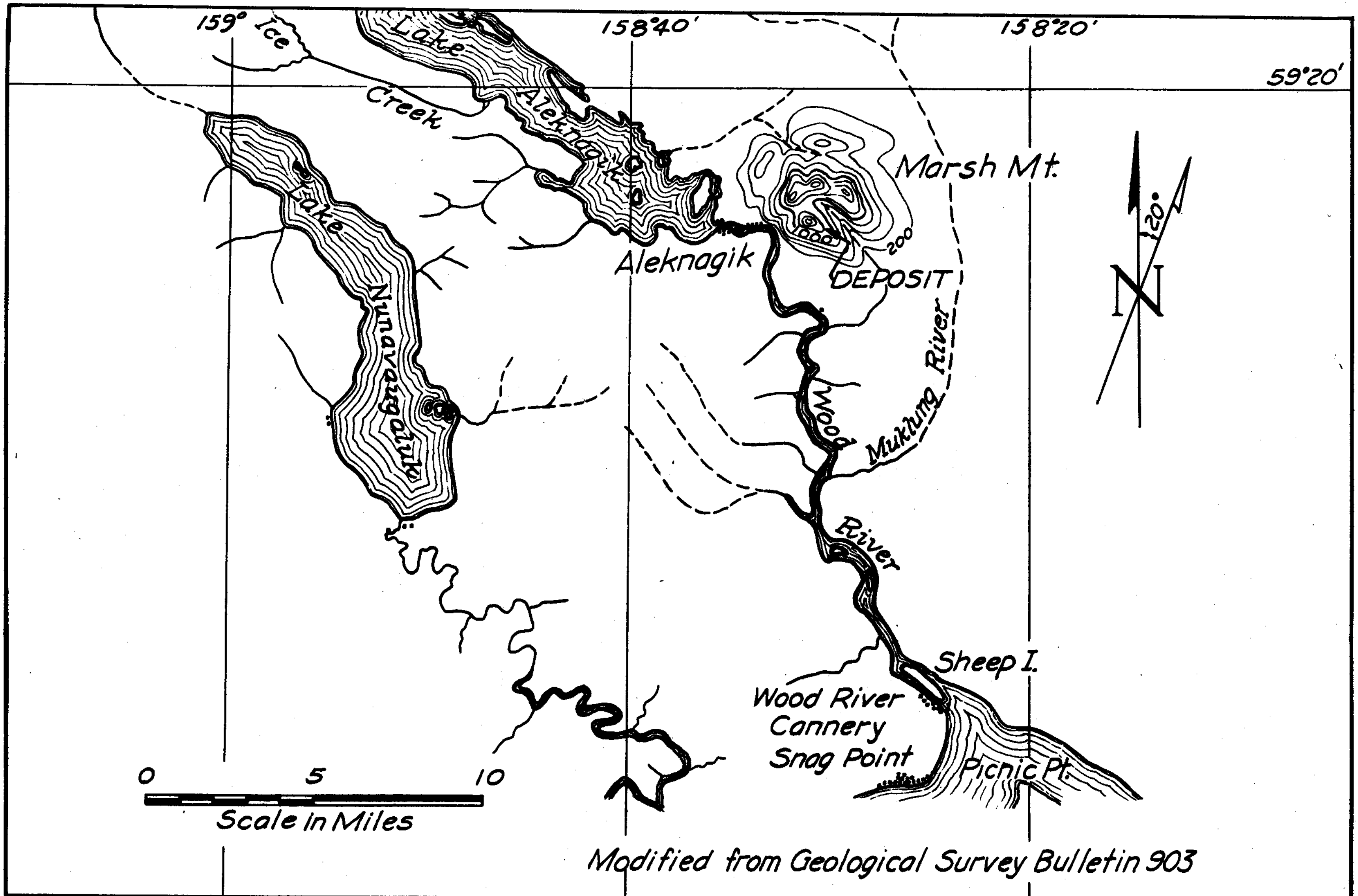


FIG. 25, MARSH MOUNTAIN CINNABAR AREA

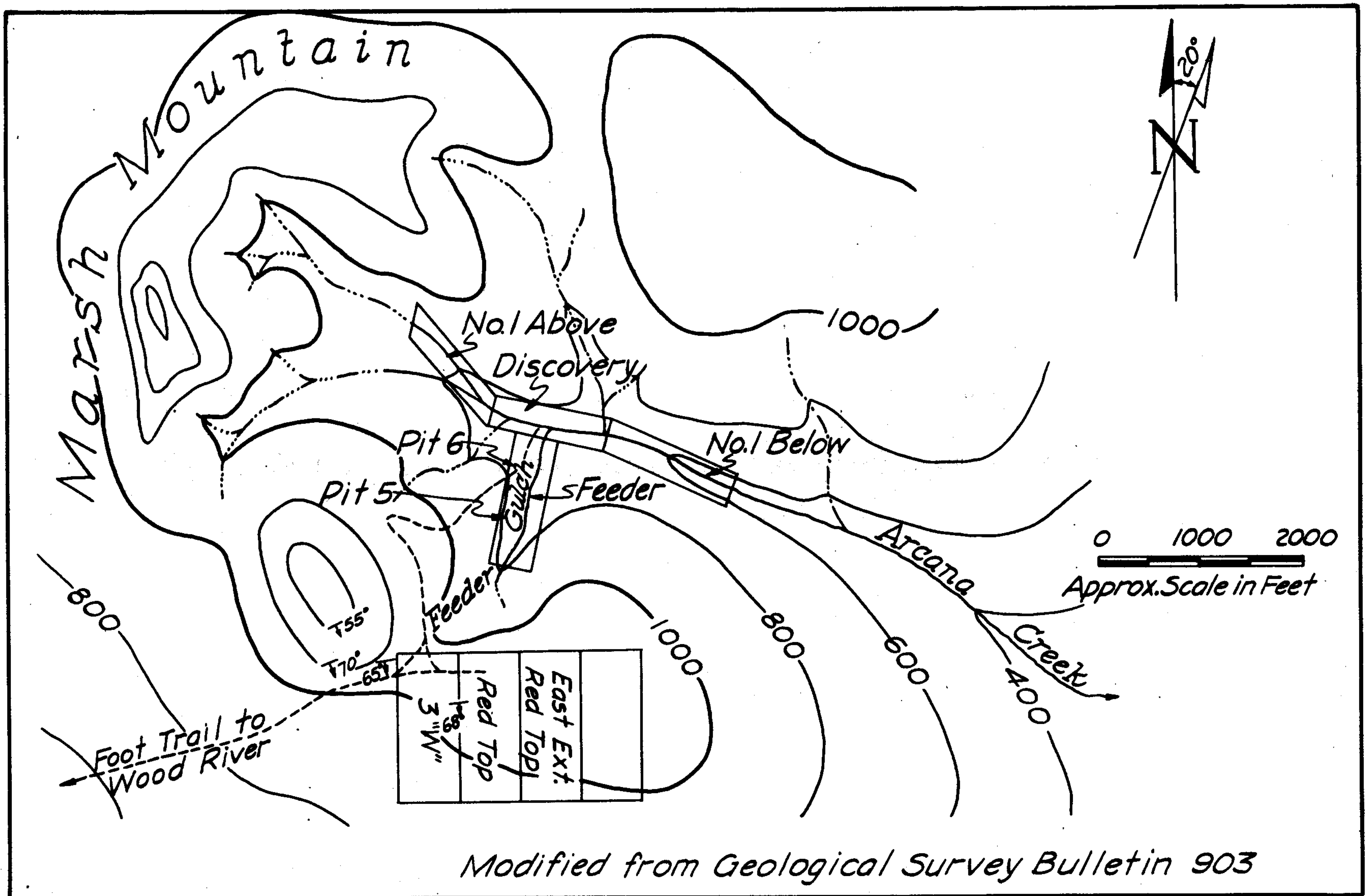


FIG. 26, MARSH MOUNTAIN SKETCH MAP

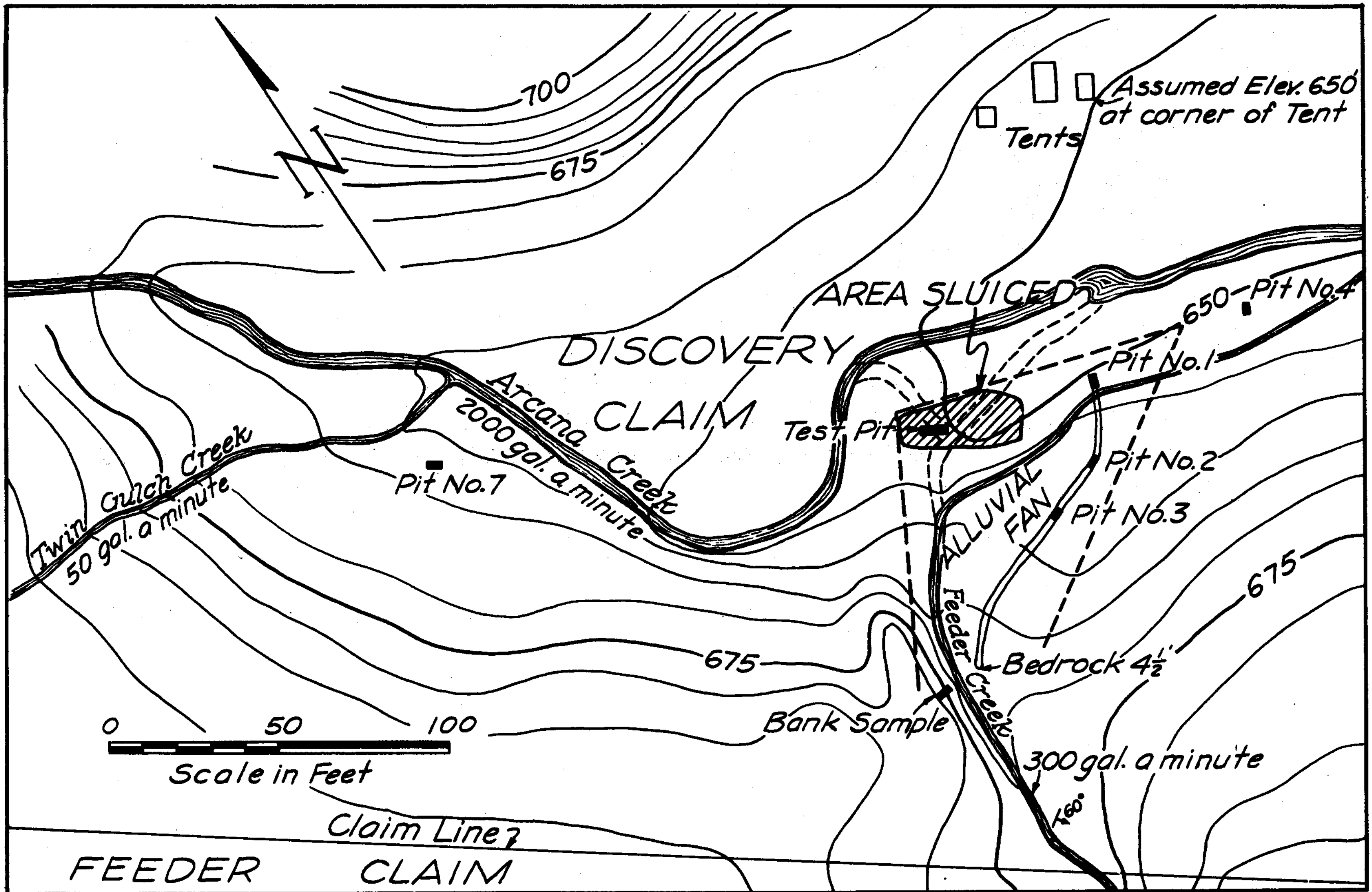


FIG. 27, PLACER DEPOSIT, MARSH MOUNTAIN, ALASKA

History and Ownership

During the summer of 1941, Frank H. Waskey, while prospecting for placer gold, noted cinnabar in his pannings along Arcana Creek. Four placer claims were staked by Waskey - Discovery, No. 1 Above, No. 1 Below, and Feeder. (See fig. 26.)

Charles Wolfe and Clarence Wren, at the suggestion of Waskey, traced the cinnabar float up Feeder Creek and discovered the lode. Four lode claims - 3 "W", Red Top, East Extension Red Top, and one unnamed claim - were staked in the names of Waskey, Wren, and Wolf in 1942. Fifteen hundred pounds of ore was removed during the summer of 1942 from two of the prospect pits, and, after careful sorting, 470 pounds of high-grade ore was shipped to Washington for retorting. The ore contained 2.65 percent moisture and analyzed 1,287 pounds of mercury per ton, dry basis.

In the spring of 1943, John E. Ryan, of Anchorage, and associates obtained an option to lease three of the placer claims - Discovery, No. 1 Above, and No. 1 Below - and were endeavoring to obtain a lease on the lode. After examining the prospect during the last week in May 1943, they released the placer option and stopped negotiating for a lease on the lode.

The Deposits

The placer deposits on Marsh Mountain are of the creek type, appear to be very shallow, and show no evidence of resorting. Neither do the deposits appear to be well-washed, as evidenced by the muddy pans obtained.

The area of highest-grade placer, as indicated by Waskey, was a small alluvial fan at the intersection of Feeder and Arcana Creeks. (See fig. 27.) Preliminary panning indicated a low concentration of cinnabar particles ranging in size from fine colors to a few weighing half an ounce. The cinnabar particles were well-rounded, free from gangue, and of various sizes. The Bureau of Mines extended a test trench through the most favorable portion of this fan, and pits were sunk at regular intervals within it as deeply as the inflow of ground-water would permit. A maximum of 3 feet of tightly frozen ground was encountered, and in no case was the frost less than a foot and one-half deep. Almost directly below the frost, groundwater was found.

Large representative samples were cut from the sides of the pits and trenches. Each sample was weighed and panned. The concentrate was then panned dry, and as much as possible of the black sands was removed.

The three pits sunk within the trench contained very little cinnabar. The floor of the trench was almost level along the middle of its length and reached bedrock toward its southern end. From the third pit to the south end of the trench, representative samples were taken from the sides, yielding only colors or occasionally barley-size pieces of cinnabar. Across the stream from the upper end of the trench, moss was stripped from the bank, and tests were run on the exposed alluvium. Only occasional colors were found.

Pit 4 was dug along Arcana Creek 50 feet below the fan. Only very fine colors were obtained in the 4-1/2 feet that this pit penetrated. (Fig. 27.)

A site of moderate gradient was chosen for pit 5, which tested the gravels along Feeder Creek above the influence of Arcana Creek. (See fig. 26.) This pit reached a depth of 6 feet before groundwater prevented further sinking. The clayey appearance of the last 6 inches of material excavated and the general topography indicated that the pit was approaching bedrock. The upper 5-1/2 feet yielded only colors, but the bottom 6 inches produced 15.5 grams of concentrates from 200 pounds of material, i.e., 0.38 pound of mercury per cubic yard. Pit 6 was sunk in an old stream channel in Feeder Creek Valley, which is now about 15 feet above the creek level. Only colors were found by panning.

Pit 7, shown in figure 27, tested the possibility of appreciable amounts of cinnabar occurring in the Arcana Creek gravels. A very few colors were found in the 3 feet of gravel penetrated.

The results of this sampling are given in table 15.

TABLE 15. - Placer samples, Marsh Mountain

Pit	Depth, feet	Weight, pounds	Concentrates plus sand, oz.	Concentrates minus sand, oz.	Pounds Hg per yard[1/]
1.....	3-3-1/4	147	0.426	Not separated	0.29
1.....	3-1/4-4	144	0.724	0.565	0.59
1.....	4-4-1/2	78	1.121	0.883	1.66
2.....	0-6-1/2	174	Colors only	-	-
3.....	0-1-1/2	39	0.176	0.114	0.38
3.....	1-1/2-3-1/2	50	0.035	Not separated	0.07
4.....	0-4-1/2	80	Colors only	-	-
5.....	0-5-1/2	160	Colors only	-	-
5.....	5-1/2-6	200	0.635	0.547	0.38
6.....	0-4-1/2	40	Colors only	-	-
7.....	0-3	40	Colors only	-	-

1/ Assuming 1 cubic yard gravel weighs 3,000 pounds.

During the summer of 1943, Frank Waskey stripped 16 cubic yards of barren overburden from an area 11-3/4 by 36 feet at the intersection of Feeder and Arcana Creeks. Three feet of cinnabar-bearing gravel, representative of the best placer, remained above a false bedrock of clay. This material, amounting to 47 cubic yards, was washed in sluice boxes and produced 40 pounds of clean concentrates. Assuming the concentrate contains 75 percent mercury, this indicates 0.64 pound of recoverable mercury in each cubic yard of the material washed.

A test pit was then sunk near the west end of the area through the false bedrock of clay to test the gravel beneath. Panning of the samples obtained to a maximum depth of 2-1/2 feet beneath the false bedrock failed to show colors of cinnabar. This would appear to limit the placer material to that above the false bedrock and would materially reduce the available yardage.

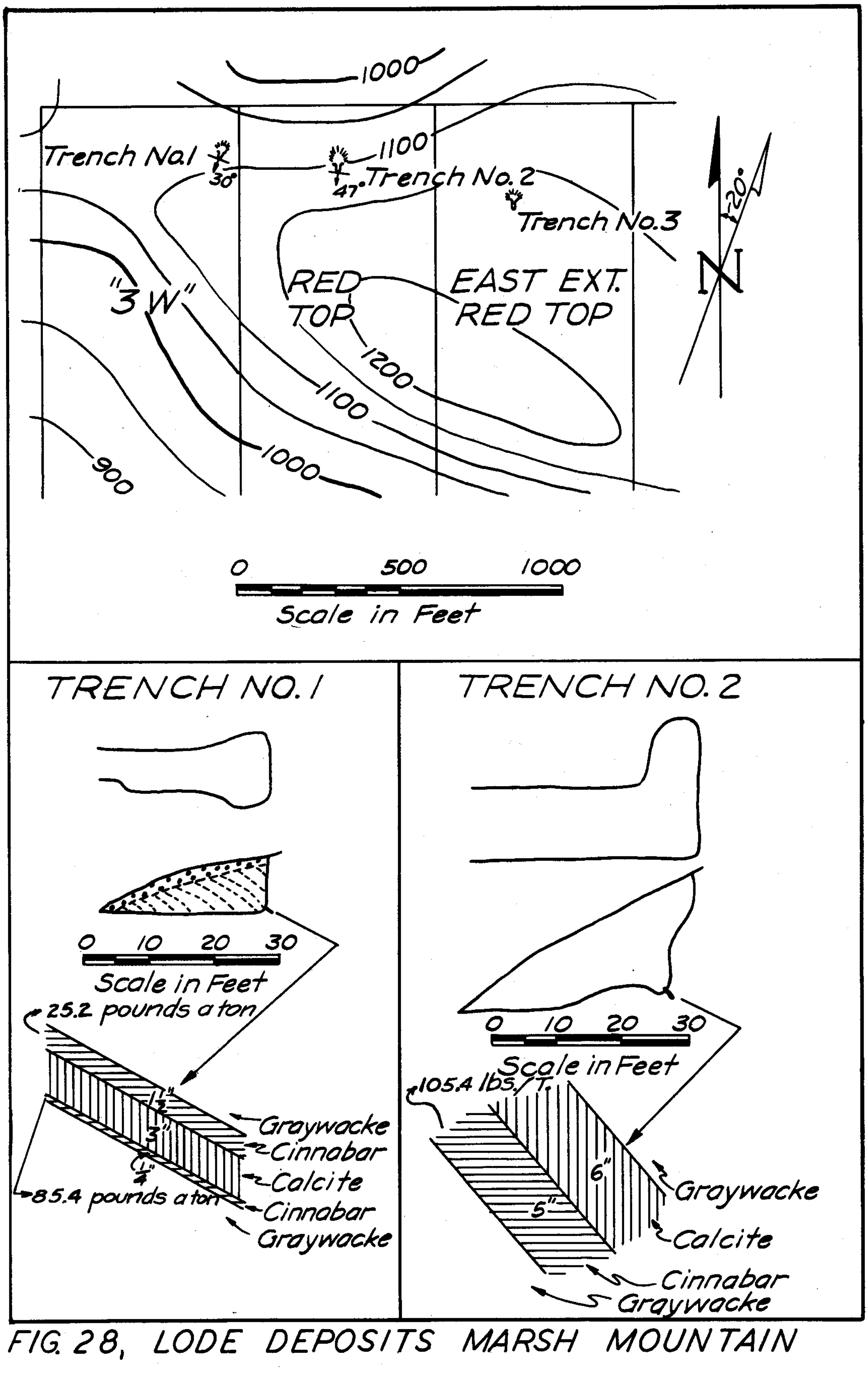


FIG. 28, LODE DEPOSITS MARSH MOUNTAIN

The cinnabar lode deposit appears to occupy bedding planes in a graywacke series having an average strike of N. 75° E., as determined at four outcrops in the vicinity. The average dip is 64° S. Only two trenches, Nos. 1 and 2, have been excavated deep enough to expose the ore zone, and in these the effects of frost and sidehill creep are evident. (See fig. 28.) The dip of the ore in trenches 1 and 2 is 30 and 47 degrees, respectively, but it is probable that the dip of the ore zone in place will approximate the dip of the sediments. Ore is not exposed in trench 3, but pieces of float are plentiful, and the ore zone should be found by extending this trench. Numerous barren test pits were dug in attempting to follow the float up the hillside. These are not shown in the sketch of the lode deposit.

The section across the ore zone in trench 1 is as follows: Hanging wall of barren graywacke; 1-1/2 inches of cinnabar, graywacke, and calcite containing 25 pounds of mercury per ton; 3 inches of calcite; 1/4 inch of cinnabar and crushed graywacke containing 85.4 pounds of mercury per ton, and a barren foot-wall of graywacke.

Trench 2 is 375 feet east along the regional strike from trench 1. Here the ore zone contains 6 inches of calcite along the hanging wall underlain by 5 inches of 105-pound-a-ton ore, with a footwall of graywacke. The gangue consists of calcite and crushed graywacke. Several small high-grade lenses of cinnabar were noted in this 5-inch vein, and a specimen taken from one contained 922 pounds of mercury per ton. The occurrence of these small lenses is erratic, and they are believed to be the source of the ore sorted from the overburden.

Work on the property has been inadequate to permit conclusive evaluation of the ore deposit.

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