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Short Paper 24

The Almeda Mine
Josephine County, Oregon

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WITH APPENDIXES:

1. Abstracts of Published Reports on the Almeda Mine.

2. Geochemical Investigations of Stream Sediments in the Almeda Mine Area, Oregon; by R. G. Bowen, State of Oregon Department of Geology and Mineral Industries.

3. Tectonic Framework of Mineralization, Upper Jurassic Rocks; by M. A. Kays, Department of Geology, University of Oregon.

Aerial view of the Almeda mine on the Rogue River, looking northeasterly along the contact between the Rogue volcanics and slates of the Galice Formation, the latter showing plainly in the bank of the river to the right of the oxidized mine dumps. The hillside in the left background above the river shows masses of the dacite porphyry exposed in the green vegetation. Photographed in July, 1967.

FOREWORD

At the present time, world mineral resources are being used at an unprecedented rate and local authorities in all countries are weighing carefully the value of their mineral deposits to their own people. They are allowing foreign operators to mine such deposits only if maximum benefits accrue to their own countries, and they appraise these benefits both in the light of present-day values and by means of projections well into the future. Our own mining companies, which have sought and invested in large foreign mineral reserves, are finding it increasingly difficult to operate profitably and independently in many foreign countries because of imposition of new taxes and other burdensome laws. Expropriation of property and what amounts to confiscation of huge capital investments have become commonplace.

Therefore, American mining companies are stepping up exploration in their own country, where private property rights still have a preferred status and where future plans for their operations may still be made with a feeling of confidence.

The accompanying report on the Almeda mine in southwestern Oregon is planned to provide basic information on a possible exploration project -- a prospect that was worked rather sporadically under conditions as they were 50 or more years ago. Operating costs in dollars were, of course, much lower than they are now, as also were the market prices of metals. Certain engineering and economic truths, however, were the same then as they are today.

This study will present evidence on the geology of the deposit, the kind and quality of the ore explored, and the history of pertinent operating events. It is believed that, by intelligent application of geologic knowledge and modern methods of prospecting, additions to known ore horizons will be found and that the chances of discovering new commercial deposits along the strike of the extensive Almeda structure are excellent.

The author of this report, F. W. Libbey, is a registered consulting mining engineer in Portland. He was Director of the Oregon Department of Geology and Mineral Industries from 1944 to 1955, and was a mining engineer on the staff from 1937 to 1944. Mr. Libbey has had much experience in mine examination, operation, and management, largely in Arizona. The Department is most fortunate to have had his careful analysis and selection of data and experienced review on the Almeda mine.

Hollis M. Dole
State Geologist

June 1967

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The Almeda Mine
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Introduction

A large, light-colored rock capping, known locally as the Big Yank Lode, crosses the Rogue River just north of Galice, Josephine County, Oregon. It is a conspicuous landmark, especially from the air. The feature is the subject of several geologic studies such as those by J. S. Diller (1914), A. N. Winchell (1914), and P. J. Shenon (1933), abstracts of which will be found in the Appendix of this volume.

These reports describe the extensive mineralized contact along which the Big Yank was formed and ore bodies of the Almeda mine were emplaced. The Diller report, especially, relates some early history of the underground exploration and mining of ore by operators of the Almeda mine in their attempts to develop a producing property. Other reports of examinations of the Almeda mine have been made available to the Oregon Department of Geology and Mineral Industries, including those of the Alaska Copper Corp., which, in 1952, made the latest examination of the property.

Some of the most recent work in the Almeda area has been performed by geochemical and geophysical methods. The Department's stream-sampling program in southwestern Oregon, with R. G. Bowen in charge, has included analysis for copper, zinc, molybdenum, and mercury of sediments along the Rogue River and its tributaries. A report on the results of stream sampling in the Almeda area is included in the Appendix.

A gravity survey conducted in the Galice quadrangle by M. A. Kays and J. L. Bruemmer (1964) demonstrates the usefulness of this method for obtaining structural data. Dr. Kays has also made a petrographic-structural study of southwestern Oregon which pertains to mineralization at the Almeda. His report will be found in the Appendix.

All pertinent information relating to the Almeda mine in the files of the Department and from other sources has been organized and studied by the author in order to present the accompanying report for public use. This type of study represents a statutory duty of the Department in making available to the public information on the economic geology of Oregon.

Acknowledgments

The author wishes to express sincere appreciation for assistance in the preparation of this report to the following: Miss Margaret Steere, Department geologist, Miss June Roberts, and Mrs. Miriam Roberts, Department staff members, who gave valuable help in organizing, typing, and editing the material; Mr. John Newhouse, Department cartographer, who cooperated generously in drafting and map composition; Mr. R. E. Corcoran, Department geologist, who prepared the geologic summary and helped select pertinent information for the geologic map of the mine area; Mr. Richard Bowen, Department geologist, who supplied geochemical information; and Mrs. Perry R. Wickham, wife of the former mine manager, and Mr. Wesley Pieren, present owner of the key Almeda mining claims, each of whom loaned old files of mine records, especially those of the Wickham-Holdsworth era.

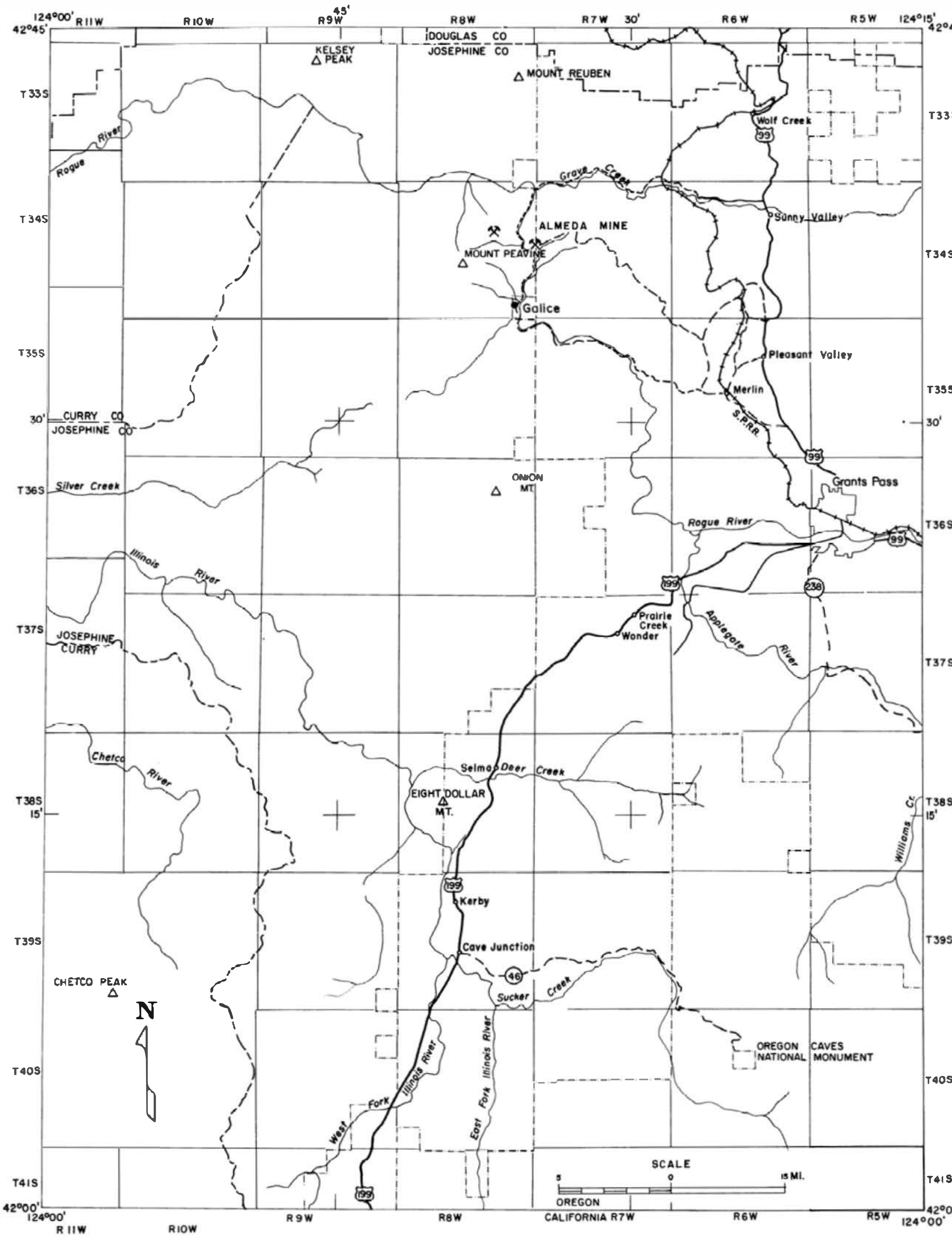


Figure 1. Index map of part of southwestern Oregon showing location of Almeda mine.

Special gratitude is extended to Mr. C. F. Herbert for maps, drill logs, and assay records covering exploration work done by the Alaska Copper Corp. at the Almeda mine in 1953 under his supervision.

The author is indebted to Dr. M. A. Kays, Department of Geology, University of Oregon, for his report on structural and gravity data for the Almeda mine area.

Location

The Almeda mine is situated in the SE$\frac{1}{4}$ sec. 13, T. 34 S., R. 8 W., on the north bank of the Rogue River at elevations of from 600 to 1,600 feet above sea level. The mine is about 30 miles by road northwest of Grants Pass and 17 miles from Merlin, which is on the Southern Pacific Railroad (see figure 1).

Geology and Mineralization

The Almeda mine lies within the Galice quadrangle, the geology of which has been mapped by Wells and Walker (1953). The following description of this area is derived mainly from their report.

All of the rocks which underlie the quadrangle are of Mesozoic age, except for small patches of Quaternary gravels and stream alluvium. The entire sedimentary and volcanic section strikes northeasterly and dips steeply to the southeast (figure 2).

The Dothan Formation is exposed in the western third of the quadrangle and is the oldest rock unit. It consists largely of sandstone, siltstone, and shale, together with a few chert lenses, lenticular beds of conglomerate, and a few lava flows. No fossils have yet been found within the Dothan, but regional studies of Taliaferro (1942), Wells and Walker (1953), and Dott (1965) indicate that the Dothan is probably of Middle or Upper Jurassic age. It has been correlated with the Amador Formation in the Sierra Nevada by Taliaferro (1942) and with part of the Franciscan Formation by Irwin (1960).

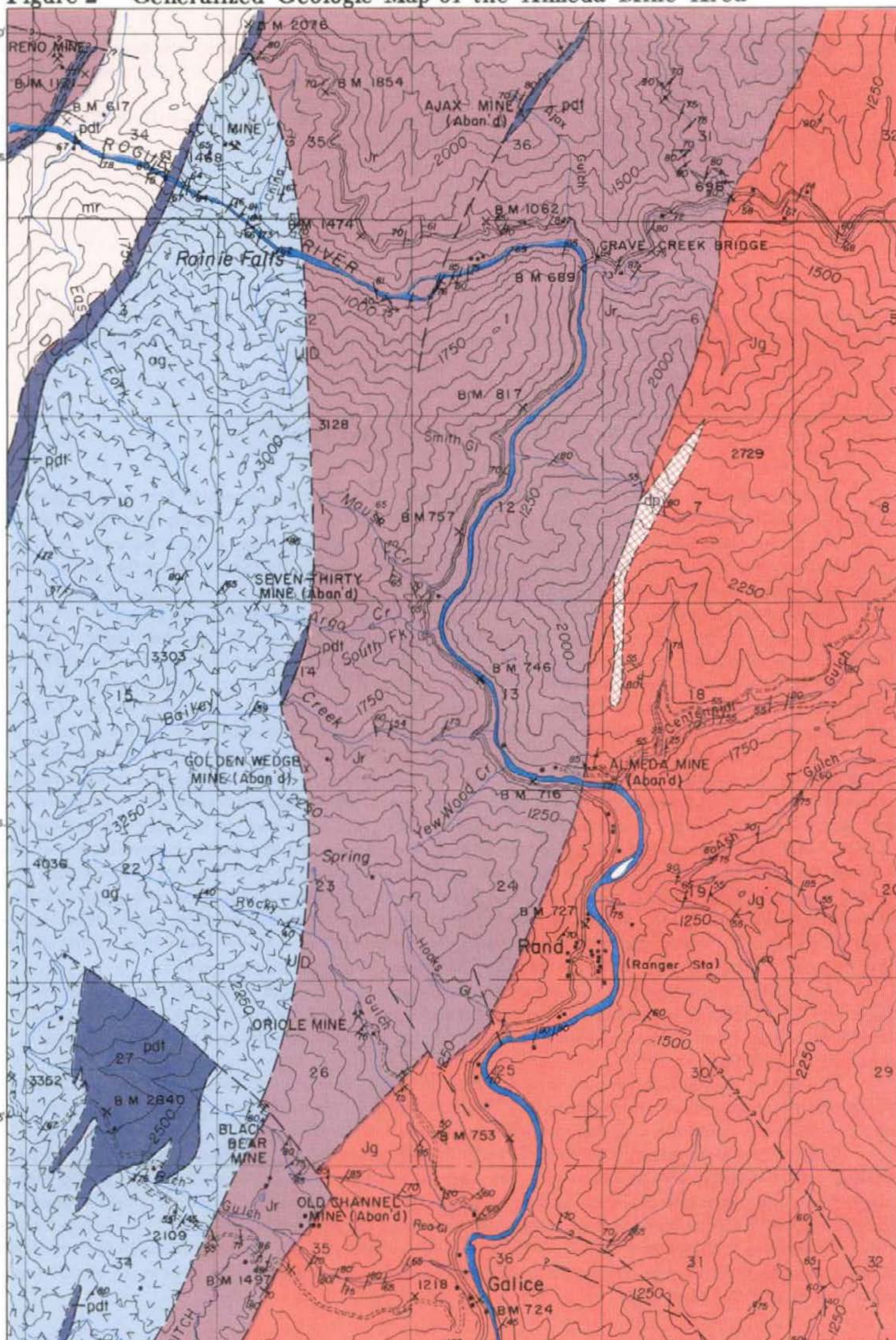
The Rogue Formation is a sequence of agglomerates, pillow lavas, flows, and volcanic breccias of predominantly andesitic composition, and fine- to coarse-grained tuffs of siliceous to intermediate composition. In the northern part of the quadrangle, soda-rich igneous rocks identified as spilite, and quartz keratophere are associated with metagraywacke and argillite. In the northern and eastern area of outcrop, the Rogue Formation is only slightly metamorphosed and the rocks retain most of their original textural features. Farther to the south and west, however, the section has been altered to a quartz and amphibole gneiss. Helming (1966) has recently completed a field and petrographic study of the Rogue Formation. He concludes that the gneissic zones were developed at depth under conditions of high-grade metamorphism and were subsequently brought to a higher level in the crust where they are now in fault contact with the less altered Rogue Formation volcanic rocks.

The Galice Formation lies to the east of the Rogue volcanics and consists of black to dirty-gray slaty shale with subordinate amounts of sandstone and intercalated volcanic rocks. The volcanics are characterized by thick andesitic flows and flow breccias overlain by tuffs and thin flows of dacitic to rhyolitic composition.

The age of the Galice Formation in this area is based on one fossil locality on Grave Creek in the northeastern corner of the quadrangle. The Late Jurassic clam, <u>Buchia concentrica</u> (Sowerby), occurs in a block mudstone near the mouth of Rock Creek in the SE$\frac{1}{4}$ sec. 31, T. 33 S., R. 7 W.

The sedimentary-volcanic section of the Dothan-Rogue-Galice Formations was intruded by peridotite, quartz diorite, and dacite porphyry in Late Jurassic or Early Cretaceous time. Along high-angle faults the peridotite has been altered to serpentine or "slickentite." Dacite is best exposed in the vicinity of the Almeda mine near the contact between the Rogue volcanics and the Galice Formation. According to Wells and Walker (1953), the dacite bodies are commonly 20 to 40 feet thick and a few hundreds of feet long, but the largest mass exposed at the Almeda mine is as much as 400 feet wide and almost two miles long.

Figure 2 Generalized Geologic Map of the Almeda Mine Area



Explanation

dp

Dacite porphyry

White to buff rock containing phenocrysts of feldspar and hornblende. Occurs in dikes and sills.

pdt

Peridotite and serpentine

Dark-green, medium-grained rock containing olivine and other mafic minerals in varying amounts. Weathered rock buff to rust colored. Locally serpentinized and sheared.

mr

Mixed rocks

Sheared rocks containing patches of amphibole gneiss, amphibole schist, amphibolites of gabbroic habit, feldspathic metaquartzite, and recrystallized metavolcanics. Complexly intruded by peridotite.

Jg

Galice Formation

Dark-gray to black, fine-grained thinly layered mudstones, commonly with slaty cleavage. Some interbeds of dark-gray or buff, medium-grained sandstone and a few thin beds of grit.

Jr

Rogue Formation

Massive light- to dark-gray green, altered lava flows, tuffs, agglomerates and flow breccias, mostly of dacitic and andesitic composition. contains some nearly contemporaneous intrusive rocks.

ag

Amphibole gneiss

Banded, medium-grained rocks consisting of dark-colored hornblende-rich layers and light-colored siliceous layers. Derived from altered Rogue Formation.

Contact

Dashed where approximately located

U

D

Fault, showing dip

Dashed where approximately located. U, upthrown side; D, downthrown side

? ?

Probable fault

Dotted where concealed

Highly sheared rock

Dashed lines indicate direction of shearing

80

Strike and dip of beds

75

Strike and dip of overturned beds

90

Strike of vertical beds

50

Strike and dip of foliation

Strike of vertical foliation

25

Strike and dip of joints

90

Strike of vertical joints

Mineralization at the Almeda mine occurs at the contact between the Rogue volcanics and the Galice Formation, and is characterized by barite, abundant pyrite and chalcopyrite, a little sphalerite, and a little galena. Dole and Baldwin (1947) attempted to trace this mineralized zone northeastward toward the Silver Peak mine, a distance of approximately 20 miles. They found, however, that it is difficult to prove that the ore bodies farther north are a direct continuation of the Big Yank Lode. Instead, the mineralization appears to be developed along "... independent shear zones located in an echelon arrangement and situated progressively westward in the greenstone mass when traced northward to Silver Peak where they are in the Dothan Formation....As was shown in the California (Wheeler) tunnel, several shear zones exist, few of which were mineralized. Thus it may be the location of the intrusive at depth, rather than the shear zone, that determines the location and extent of mineralization."

Early History

It is reported by Walling (1884) that the Yank ledge, also known as the Big Yank Lode, was discovered by prospectors in 1874, although this conspicuous outcrop must have been known to placer miners long before that. Here the Rogue River cuts through an extensive gossan, near what is now the town of Galice in Josephine County, and the yellow hills show prominently on both sides of the rushing river. In that year a boom seems to have developed and prospectors swarmed into the area. A town named Quartzville, later Galice City, was established. Another boom town called Yankville, a mile farther south, was laid out along the river. Some people from Ashland, Oregon, formed the Almeda Mining Co. to work mining claims which they had either located or otherwise acquired. The boom subsided rather quickly, but prospecting and placer mining on the Rogue and its tributaries in the vicinity continued.

Records in the Josephine County Clerk's office show that in July, 1906, four lode claims and two placer claims composing the Almeda Mining Co. holdings were conveyed to the Almeda Consolidated Mining Co. The lode claims were as follows: Monte Cristo, located January 18, 1900, by John F. Wickham; Bonanza Lode, located January 18, 1900, by Reece C. Kinney; Live Yankee, located December 2, 1898, by J. C. Mattison; and Yankee Doodle, located January 1, 1899, by J. C. Mattison. The claims listed probably were only a part of the holdings of the Almeda Mining Co. At the time of the conveyance, O. M. Crouch was President and R. C. Kinney was Secretary of the Almeda Mining Co. Officers of the Almeda Consolidated Mining Co. were O. M. Crouch, President; L.B.M. Simmons, Vice President; R.C. Kinney, Secretary and Treasurer; John F. Wickham, Manager; and L. E. Crouch, Attorney. Perry R. Wickham was appointed Superintendent. The head office was in Portland.

Records of Activity, 1905 - 1917

The period of greatest mining activity was from 1905 to 1915. P. R. Wickham was Superintendent from 1905 to 1911. P. H. Holdsworth succeeded Wickham as Superintendent in 1911. According to Diller (1914), Holdsworth had made a special survey of the mine for the company in the summer and fall of 1911. Diller's examination of the mine as described in his report (1914, p. 73) was made on July 10 and 11, 1911, "just as the management changed." Presumably this change was in superintendents only, since the records do not indicate any change of officials at the head office. As shown below, there were other changes in management and on August 21, 1913, the mine went into the hands of a receiver on petition of the State Corporation Commissioner and by order of the Josephine County Court.

Burley receivership

The petition in 1913 for appointment of a receiver states that the Corporation Commissioner believes that the corporation is in imminent danger of insolvency; that current assets are $8,260.55 with a floating indebtedness of $126,439.95; and that "the corporation is conducting its business in an unsafe, inequitable, and unauthorized manner and jeopardizing the interest of its stockholders and creditors." The petition recommends the appointment of Thomas S. Burley of Tacoma, "who is one of the largest stockholders and was recently elected president of the corporation," as Receiver.

Mr. Burley was duly appointed and in turn appointed A. C. Hough, attorney of Grants Pass, as the receiver's attorney.

A petition to the Josephine County Court by the newly appointed receiver states: "...your petitioner has found upon examination that the mining property of the said defendant corporation is of great richness and value and upon being operated by your petitioner as receiver can be made to pay a considerable sum in profit over and above the cost of operation whichsaid sums can be applied upon the indebtedness of said defendant corporation." Burley says further in his petition that the corporation has only $28.38 on hand, and that in order to carry on business affairs and mining operations he must borrow not to exceed $10,000, which amount he is willing to loan at 8 percent interest. He states in his petition that he has already advanced $40,000 and requests that he be allowed by the court to issue receiver's certificates at 8 percent interest in payment of his loans and that they be a first lien against the property "prior only to statutory liens." He also petitions that he be allowed to sell 150,000 shares of stock at $1.00 per share and to pay 15 percent brokers' commissions.

All of these petitions were allowed by the court.

According to records in the mine files, events during the next few years of receivership had to do in large part with law suits brought by creditors of the corporation and by dissident stockholders; also various plans were advanced and attempts made by the management to refinance operations as well as to sell the property. These appear to have had negative results and the corporation become continually more involved in financial difficulties. On May 2, 1916, newspapers published a notice of Receiver's Sale, proceeds from which were to pay off indebtedness aggregating about $259,000. A court order confirmed the sale of property and all assets to Nat P. Ellis and C. M. Huddle*, trustees for the reorganization committee, as of July 26, 1916. The creditors of the corporation, including the receiver, his attorney, and holders of receiver's certificates and other claims, offered to pay "into the receiver for all of the property and assets of the defendant corporation in cash or, in lieu thereof, legal claims with interest against defendant corporation the sum of $232,007.77...."

Financial report

A first financial report to the stockholders by Thomas S. Burley, Receiver, in the mine files covers operations from July 18, 1905, to August 20, 1913, the date of the report. It contains a balance sheet and details of receipts and expenditures as well as assets and liabilities, current accounts, and capital stock accounts. Some of the important items are as follows:

Stock sales (297,261 shares) . . . . $ 373,380.81

This includes conditional stock sales, stock options paid up (43,789 shares), option contracts not completed ($41,774.06) and cash received on stock "pending adjustment" ($20,000).

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* Nat P. Ellis had been President of the Iowa Association of Almeda Stockholders, and C. M. Huddle had been President of the companion Ohio Stockholders Association.

Receipts	$ 44,615.50
From matte ($44,488.99) and placer gold ($126.51).	
Rents, transfer fees	689.20
Donations[1] by officers of the company . . .	52,490.00

Some of the expense items were:

Direct matte production costs	53,116.84
Other direct operating costs	70,798.98
General expenses[2].	132,524.26
Labor	208,533.00
Total all expenses (except stock discounts) . . .	519,661.21
Excess of all expenses over income (Not including stock discounts).	421,866.51

Smelting Almeda ore and matte shipments

In 1908 a small matting furnace, 36 by 72 inches at the tuyeres, was installed ondwas operated intermittently from 1911 to 1917. At first the operators had difficulty in smelting the baritic ore. Later, apparently, they were able to produce matte by semi-pyritic smelting. Holdsworth reported (Diller, 1914, p. 80) that he could put through 100 tons of ore a day and that copper loss in the slag was "usually from 0.15 percent to 0.2 percent." Further evidence of losses is given in a report to company officials dated September 1914 submitted by Thomas S. Burley, Receiver, and P. B. Wickham, Engineer, in which it is stated that flue dust lass was about 6 percent of the charge. In this report a summary of furnace operations is included which covers shipments of motte from September 8, 1911, to November 5, 1913 (see table 1). These shipments total 346.423 tons, having a gross value at the Kennett, Calif., and Tacoma, Wash., smelters of $63,065.95 and net value to the shipper of $60,190.21. During this period the Almeda furnace operators were listed in the report as follows: P. H. Holdsworth from September 8 to November 14, 1911; Chambers and Ramer from December 13, 1911, to January 31, 1912; P. B. Wickham from October 3, 1912, to September 15, 1913; and Ross and Chambers from October 17 to November 5, 1913. Assays of the ore furnaced are recorded only for the operation of P. B. Wickham; they are given as Au = 0.091 oz.; Ag = 2.87 oz.; Cu = 1.085 percent from 5,504 tons (compare with summary of assays in table 4).

Smelter settlement sheets

In P. B. Wickham's files some other smelter settlement sheets appear to supplement the above summary and show that the furnace operations extended through 1917 (see table 2). From the meager information now available, it appears that Holdsworth left the Almeda Consolidated Co. in late 1911

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(1) Not explained.

(2) Includes salaries of general officers ($28,420.00), commissions ($44,977.50), traveling expenses ($17,073.65), rent ($4,184.40), advertising, etc. ($4,138.75), legal expenses ($21,285.83), taxes ($1,863.43), and insurance ($5,151.45).

TABLE 1. Summary of motte shipments (Wickham report, 1914).

Dote	Operator	Motte Produced (Tons)	Gross Value (Dollars)	Discounts (Dollars)	Net Value (Dollars)	Smelter
Sept. 8, 1911- Nov. 14, 1911	Holdsworth	102.894	$11,686.02	$689.40	$10,996.66	Kennett
Dec. 13, 1911 - Jan. 31, 1912	Chambers & Ramer	66.278	12,760.17	420.72	12,339.45	Tacoma
Oct. 3, 1912 - Sept. 15, 1913	Wickham	119.387	28,704.82	371.39	27,833.43	Tacoma
Oct. 17, 1913 - Nov. 5, 1913	Ross & Chambers	57.864	9,914.94	399.27	9,020.67	Tacoma
Total		346.423	$63,065.95		$60,190.21	

and that thereafter Chambers and Romer were the furnace operators until the Receiver took charge in mid-1913, when P. B. Wickham again become the operator, since he reports his shipments in 1912 and 1913. A financial report by the Receiver in the Wickham files mentions Mr. Ross as Manager and the above summary of motte shipments gives Ross and Chambers as shippers to Tacoma in 1913.

The smelter settlement sheets now available show that motte was shipped to the Tacoma and the Kennett smelters from January 31, 1912, to July 28, 1917, by the following: Almeda Consolidated Mining Co., P. B. Wickham, Wickham and Wickham, and Josephine County Bank.

In addition to the matte shipments, one car of ore was shipped on October 30, 1916 to Tacoma by P. B. Wickham.

Concerning the summary of shipments of matte from the Wickham report (table 1), no smelter settlement sheets were found for:

Holdsworth shipments in 1911 (102.894 tons)
The first two Chambers & Ramer shipments in 1911 (55.483 tons)
One shipment of P. R. Wickham September 15, 1913 (26.7265 tons)
Three shipments by Ross & Chambers in 1913 (57.864 tons)

The total in the Wickham report for which no smelter sheets were found is 242.9675 tons valued at $38,131.70. Those shipments listed in both the Wickham report and smelter sheets ore the first five shipments of the smelter sheet tabulation (table 1) totaling 103.455 tons valued at $23,733.96.

Total production, 1911 - 1917

The total production of matte (plus one car of ore) estimated from the Wickham report plus the smelter sheets (minus shipments listed twice) is 553.0615 tons valued at $103,990.43. Motte alone is 502.3295 tons valued ot $103,185.82 by the smelters.

No estimate of the total amount of ore mined during the furnace-operating period (1911-1917) appears in the various records. However, P. R. Wickham stated in his report of September 1914 that during the time he operated the furnace (1912-1913) he produced 119.387 tons of matte from 5,504 tons of ore. If it is assumed that this ratio of ore to motte may be used for the total production of matte (approximately 500 tons), the amount of ore mined up to and including 1917 was about 23,000 tons; ond 46 tons of ore was required to produce one ton of matte. Using figures from the smelter settlements, approximately $64,000 was received for 260 tons of matte, or $246 per ton of matte. Therefore, for a

TABLE 2. Almeda mine smelter settlement sheets (1912 - 1917).

Date	Shipper	Smelter	Weight (tons)	Assays: Au (oz.)	Assays: Ag (oz.)	Assays: Cu (%)	Net Value Per Ton (dollars)	Total Value (dollars)	Freight & Sampling Charge*	Net Value (dollars)	Payee
1/31/12	Company	Tacoma	10.795 (matte)	4.08	123.76	40.45	239.10	2,581.08	144.00	2,437.08	Chambers & Romer
10/3/12	Company	Tacoma	24.528	3.61	106.01	30.52	219.71	5,389.05) }-	287.52	6,802.50	P.B. Wickham
10/3/12	Company (in sacks)	Tacoma	5.351 (matte)	4.68	190.37	38.37	317.85	1,700.97)			
12/28/12	Company	Tacoma	26.457 (matte)	4.68	118.08	33.83	258.65	6,843.10	287.17	6,555.93	P.B. Wickham
3/20/13	Company	Tacoma	36.324 (matte)	3.68	96.19	32.52	198.76	7,219.76	306.35	6,913.41	P.B. Wickham
12/2/15	Wickham & Wickham	Tacoma	18.202 (matte)	4.58	171.22	34.75	294.31	5,357.03	196.78	5,160.25	Wickham & Wickham*
4/1/16	Sam H. Baker Cashier	Tacoma	15.009 (matte)	4.26	144.11	34.28	322.05	4,833.65) }-	201.52	5,055.69	Grants Pass Bank Agt.**
	(Sacks)	Tacoma	.9265	6.14	229.66	44.88	457.16	423.56)			
6/22/16	Josephine County Bank	Tacoma	37.628 (matte)	2.49	66.36	22.39	192.95	7,260.32	315.76	6,944.56	Grants Pass Bank Agt.**
7/3/16	Wickham & Wickham	Kennett	29.094 (matte)	2.66	79.1	23.43	147.91	4,303.29	236.84	4,066.45	Josephine County Bank
8/23/16	Wickham & Wickham	Kennett	20.7745 (matte)	4.13	138.80	30.15	330.64	6,868.88	169.29	6,699.59	Josephine County Bank
10/30/16	P.B. Wickham	Tacoma	50.732 (ore)	Trace	Trace	4.58	15.86	(804.61)	178.19	(626.42)	
1/20/17	Wickham & Wickham	Kennett	32.8475 (matte)	2.47	139.38	17.45	203.35	6,879.54	280.54	6,399.00	Returns to Geo. W. Lewis, Sheriff
7/28/17	P.B. Wickham	Tacoma	1.425 (matte)	2.03	118.42	15.39	179.69	256.06	35.31	220.75	
	TOTALS (Matte and ore)		310.0935					$64,659.39			

* Smelter deducted 5 percent of settlement check and remitted to L. E. Crouch, Portland, indicating lease by Wickham & Wickham.
** Payment to bank, possibly on a bank loan.

total of 500 tons of matte as estimated, a total of approximately $123,000 was received. Converting these figures from matte to ore, they show that the ore returned about $5.35 gross per ton at the smelters.

Final matte shipments, 1916-1917

According to records in the Wickham files, a condition of the Wickham and Wickham lease, mentioned in smelter settlement sheets tabulation, was that the company, through the trustee, Thomas S. Burley, was to furnish the lessees a cash fund of $2,500 for supplies and labor as required by them. Up to October 15, 1915, the trustee paid them $1,100. The furnace was blown in and an attempt made to operate, but the coke supply ran out and they closed down November 8. The smelter sheets, however, show that Wickham and Wickham shipped some matte in 1916 and early in 1917. The final small shipment was made by P. B. Wickham in July 1917.

Records show that L. A. Levensoler, field engineer for the American Smelting & Refining Co., visited the mine in 1915 and was guided over the property by P. R. Wickham. It will be seen later in this report that Mr. Levensoler was a partner of P. H. Holdsworth in some shipments of gold ore from the Almeda property.

Mine assays from Wickham report, 1914

The report of P. B. Wickham to the company dated September 1914 listed many assays for gold, silver, and copper in samples taken by the mine superintendents (and one examining engineer, W. H. Bradley of Chicago) from 1910 to 1913 in the mine tunnels and from bin storage. Except by tunnel name, locations of samples are not fixed either by sample description or on the mine assay maps, also sample widths are not recorded. Thus these assay results may be used only qualitatively. They are grouped in tables 3, 4, and 5. It will be seen that some samples from No. 3 level (below river level) taken by Holdsworth in 1911 are much higher in gold than other samples. This discovery of high gold values is mentioned by Diller (1914, p. 76-77), who quotes correspondence with Holdsworth telling of the gold ore body. The occurrence will be referred to later in this report, particularly under Holdsworth's work in 1941-1942, also the explorations by Alaska Copper Corp. in 1953.

In tables 3, 4, and 5 the samples are grouped* according to the sampler and his classifications --that is, "base ore, siliceous ore, second grade, and low grade." Arithmetical averages have been calculated* both with and without the highest gold values from No. 3 level. (It should be mentioned that the terms "low grade" and "second grade" by Wickham are arbitrary. "Base ore" as used in the report is sulfide ore usually with barite gangue.)

Development

All of the tunnels at the Almeda were driven northerly to explore the contact between Galice slates on the east and dacite porphyry on the west. The ore occurs as shoots or enrichments, mainly in the porphyry along and near the contact.

Some confusion has been caused by the difference in naming of mine tunnels on different maps. Originally, as described in the Wickham report, the adit tunnels started with Tunnel A at elevation 620 with two adit entrances, east and west. Tunnel A is reported by Wickham to have been driven 792 feet along the contact, with three crosscuts toward the west and two raises on the contact. This work "exposed an almost continuous body of low-grade and second-grade ores and three distinct shoots of base ore."

Tunnel B was started at elevation 712, although Wickham said it was 100 feet above Tunnel A. Tunnel B was said to have been driven "into the mountain 372 feet along the contact with two crosscuts to the west and one raise from Tunnel B to Tunnel C exposing an almost continuous body of base ore."

Tunnel C is at elevation 794; Wickham describes it as "100 feet above Tunnel B" and as "driven into the mountain 316 feet exposing second-grade and base ore."

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* By F. W. Libbey

TABLE 3. Almeda mine assays - arithmetical average, 1910 - 1913. (From P. B. Wickham's report, 1914.)

Date	Sampled by	Assay Group (See Table 4)	Number of Samples	Sources of Samples (Tunnels, Levels)	Sample Description	Average Assays Au (oz.)	Average Assays Ag (oz.)	Average Assays Cu (%)	Remarks (Note: Metal prices - Au $20 oz.; Ag 50 cents oz.; Cu 12 cents lb.)
1910	Wickham	1	25	Tunnel A,B,C Level No. 1	Base ore 2nd grade	0.174	4.04	1.228	One sample from Tunnel C. Ore classifications by Wickham.
1911	Wickham	2	10	Level No. 3	Base ore	0.102	3.39	3.970	Contains 1 sample 11.5% Cu. 7 samples called "Base ore."
1911	Holdsworth	3	27	Tunnel A,B,C Levels 1 & 3	Base ore	0.154	5.43	1.804	1 sample 0.81 Au 1 sample 10.47 Ag
1911	Holdsworth	4	23	Tunnel A,B,C Levels 1 & 3	Base ore	0.154	5.73	1.800	1 sample Tunnel C 1 sample Levels 1 & 3
1911	Holdsworth	5	21	Tunnel A,B,C Levels 1 & 3	2nd grade	0.148	3.78	0.795	1 sample Level No. 3
1912	Holdsworth	6	20	Tunnel A,B,C Level No. 2	Low grade	0.105	0.84	0.470	7 Cu assays missing 12 samples from Tunnel C
1911	Holdsworth	7	27	Level No. 3	Siliceous ore	1.787	2.74	0.50	High grade ore found in west crosscut Only 6 Cu assays
1911	Holdsworth	8	28	Level No. 3	Siliceous ore	1.538	1.59	No assays	1 Au assay missing No. Cu assays
1911	Holdsworth	9	15	Level No. 3	Siliceous ore	0.305	2.85	No assays	Only 1 high grade Au sample (4.5 oz.) No. Cu assays
1911	Chambers	10	15	Tunnel A & B Level No. 3	Base ore & 2nd gr. ore Sil. ore	0.152	3.40	1.960	Only 1 sample Tunnel B Level 3, 3 samples only, no Cu assays
1912	Wickham	11	11	Tunnel A,C,D	Base ore 2nd grade	0.178	2.63	1.327	3 samples "Low Grade" from Tunnel C

1913	Bradley	12	9	Tunnel A, Level No. 1	Base ore 2nd gr. ore	0.118	3.87	1.605	Exam. by Chicago engineer Only 9 samples reported
1913 1914	Ross	13	27	Tunnel A,B,C Level No. 1	Base ore	0.120	7.44	2.065	4 Cu assays missing 1 Au assay missing
1913 1914	Ross	14	16	Tunnel A,B,C Level No. 1	Base ore, 2nd gr. & Low grade	0.127	7.38	0.653	5 Cu assays missing Tunnel A Base ore, some high Ag
1911	Holdsworth	15	27	Bin lots	Base ore	0.170	3.80	1.678	Probably ore mined for furnacing
1911	Holdsworth	16	6	Bin lots	2nd gr. & sil. ore	0.696	2.21	0.483	1 sample 2nd grade siliceous ore from Level No. 3
1911	Chambers	17	25	Bin lots	Base ore 2nd gr. ore sil. ore	0.175	4.28	1.800	6 - 2nd gr. ore; 2 sil. ore from Level No. 3; 1 - low gr.; 3 Cu missing
1912 1913	Wickham	18	27	Bin lots	Base ore 1 dump ore	0.115	2.96	1.572	18 samples 1912 9 samples 1913
1913	Wickham	19	9	Bin lots	Base ore Dump & Mine	0.113	5.17	1.244	
1912 1913	Wickham	20	27	Bin lots	2nd gr.; low gr. sil. ore, spar & Fe	0.106	5.08	0.851	2nd grade 1912 and 1913, low grade 1912; Spar & Fe ore 1912 and 1913
1913	Ross	21	12	Bin lots	Base ore & 2nd gr. ore 50/50	0.074	4.83	0.972	6 samples base ore 6 samples 2nd grade, 1 Cu missing
TOTALS						6.611	83.44	26.777	
Averages						0.315	3.97	1.409	
Taking out two high Au assays from No. 3 Level Total						3.286			

Average mine and bin lots: Au, 0.173 oz.; Ag, 3.97 oz.; and Cu, 1.409 percent. Value today's prices, $20.44.

TABLE 4. Almeda mine assays.
Averages weighted according to number of samples (P. B. Wickham report).

Assay Group	Number of Samples	Au (oz.)	Ag (oz.)	Cu (%)	Product Assay x Number: No. of Samples x Au	No. of Samples x Ag	No. of Samples x Cu	Remarks
1	25	0.174	4.04	1.23	4.350	101.00	30.75	Mine samples
2	10	0.102	3.39	3.97	1.020	33.90	39.97	
3	27	0.154	5.43	1.80	4.158	146.61	48.60	
4	23	0.154	5.73	1.80	3.542	131.79	41.40	
5	21	0.148	3.78	0.80	3.108	79.38	16.80	
6	20	0.105	0.84	0.47	2.100	16.80	9.40	
7	27	1.787	2.74	0.50	48.249	73.98	13.50	High Au Samples From Level No. 3
8	28	1.538	1.59	No assays	43.064	44.52	- -	High Au Samples from Level No. 3
9	15	0.305	2.85	No assays	4.575	42.75	- -	
10	15	0.152	3.40	1.96	2.280	51.00	29.40	
11	11	0.178	2.63	1.33	1.958	28.93	14.63	
12	9	0.118	3.87	1.61	1.062	34.83	14.49	
13	27	0.120	7.44	2.07	3.240	200.88	55.89	
14	16	0.127	7.38	0.65	2.032	118.08	10.40	
Weighted Averages	274	0.455	4.03	1.19	124.738	1104.45	325.23	
Av. Au & Ag without 7 & 8	219	0.153	4.50	- -	33.425	985.95	- -	
15	27	0.170	3.80	1.68	4.590	102.60	45.36	Bin lots
16	6	0.696	2.21	0.48	4.176	13.26	2.88	
17	25	0.175	4.28	1.80	4.375	107.00	45.00	
18	27	0.115	2.96	1.57	3.105	79.92	42.39	
19	9	0.113	5.17	1.24	1.017	46.53	11.16	
20	27	0.106	5.08	0.85	2.862	137.16	22.95	
21	12	0.074	4.83	0.97	0.888	57.96	11.64	
Weighted Averages	133	0.158	4.09	1.36	21.013	544.43	181.38	

The average of 274 mine samples taken by superintendents 1910-1913 (including 9 by examining engineer, Bradley) is Au 0.455 oz.; Ag 4.03 oz.; Cu 1.19 percent. Not including the two high gold samples (7) and (8), the average is Au 0.153 oz.; Ag 4.50 oz.; Cu 1.19 percent.

The average of 133 samples in bin lots is: Au 0.158 oz.; Ag 4.09 oz.; Cu 1.36 percent.

Average of all samples, except 55 high Au samples, weighted according to number of samples is Au 0.155; Ag 4.34; Cu 1.25 percent. Value today's prices, $20.02.

TABLE 5. Almeda mine assays.
Average of mine samples, plus bin lots weighted according to number of samples.

	No. of Samples	Au (oz.)	Ag (oz.)	Cu (%)	Products: Au	Ag	Cu
Mine	219	0.153	4.50	1.19	33.507	985.50	260.61
Bin lots	133	0.158	4.09	1.36	21.014	543.97	180.88
	352	0.155	4.34	1.25	54.521	1529.47	441.49
Total		$5.42	$5.60	$9.00	= $20.02		

Tunnel D, the highest, is at elevation 881 feet, and again it is described as "100 feet above Tunnel C" and "driven into the mountain 344 feet crossing the contact diagonally and exposing a continuous body of low-grade and second-grade ore and one shoot of base ore."

A vertical shaft with the collar at the Tunnel A level was sunk "to a depth of 535 feet" (below 620). The bottom 185 feet is said by Wickham to be in slate east of the vein.

A distinction is made in the Wickham report between tunnels and levels. Level No. 1, in places called the River Level, also the 100-foot level, is at elevation 520 feet and is said to be "100 feet below Tunnel A opening both to the surface and to the shaft with one raise from Level No. 1 to Tunnel A." It is said to explore the east contact for a distance of 540 feet and exposes an "almost continuous body of low-grade and second-grade and two shoots of base ore."

Level No. 2 is said to be 200 feet below Tunnel A and a "direct cross-cut from the shaft into the vein exposing a body of low-grade and second-grade ore." This is the first level below the river.

Level No. 3 is said to be 300 feet below Tunnel A and "a direct cross-cut from the shaft to the vein exposing a shoot of base ore on the contact. A crosscut continuing across the vein exposed 15 feet of second-grade ore and an enrichment 30 feet in width within the low-grade zone. A drift north upon the contact for 104 feet exposes a continuous body of second-grade and base ore, and a drift south upon the contact for 138 feet exposes a continuous body of second-grade and one shoot of base ore." The high-grade gold ore was not mentioned here.

Level No. 4 is said to be 400 feet below Tunnel A and a "direct crosscut from the shaft into the vein exposing second-grade ore."

Level No. 5 is said to be 500 feet below Tunnel A and "a direct crosscut not completed from the shaft to the ore body."

Further duplication of names or in numbering of levels is found in the maps of the Alaska Copper Corp. referred to in a later chapter of this report. On these maps the numbers, beginning with 520 (River) Level, or No. 1 on the Wickham and Holdsworth maps, are lower with reduction of elevation. Thus the levels from the vertical shaft are successively 620 at the collar, 520 at river level, 420, 320, and so forth. The 320 is the same in either case but, of course, the other levels are in descending numbers for the Alaska Copper Corp. maps and ascending numbers for the Wickham and Holdsworth maps.

The total amount of underground development is reported by Wickham as 7,339 feet including shaft.

Diller (1914, p. 74-75) discusses the underground development briefly. It will be noted that the map in the Diller report was prepared by Holdsworth in 1911 (figure 3) and that the tunnels are numbered, not lettered as in the company mine maps of 1915, author unknown (figures 4 through 9). The Yates maps (described farther on) have the adits numbered like the Holdsworth map. The adits in the Wickham report are designated by letters; numbers are given to the levels for the River Adit and those below that level.

Dormant Period, 1917 - 1937

Efforts to revive operation

Judging by the smelter settlement sheets (table 2) the last shipment under the receivership was made July 28, 1917. Subsequently, P. B. Wickham's files show that efforts were made by Wickham and Wickham (father and son) to refinance the Almeda operation, to obtain new working capital, and to equip the mine with a concentrating mill and new furnace capacity designed to treat 200 tons of ore per day. A short time later, in 1918, these plans envisioned a reduction plant of 350-400 tons per day capacity. At first, new capital in the amount of $100,000 was planned, and then for the increased capacity estimated capital needs were doubled. The plan evidently was based on a lease to be granted by the Almeda Consolidated Mines Co. to the Western Metal Mines Co., which would finance the new plant and operate it. The sample contract, copy of which is in the Wickham files, is dated March 1, 1918. No mention is made of royalty but the contracting parties are stated to be the Almeda Mines Co. (not Almeda Consolidated Mines Co.) and the Western Metal Mines Co. which, according to the Oregon State Department of Geology and Mineral Industries Metal Mines Handbook (Bulletin 14-C) was a combination of nine separate groups of claims in the Galice district. At least one of these groups was owned by P. B. Wickham and some were, or had been, producers. The one which would seem to be of importance to the Almeda is the Independence claim, said to be the north extension of the Almeda mine. The contract required the Western Metal Mines to furnish $200,000 of capitol ond to purchase and install the necessary reduction plant capable of treating 350-400 tons of ore a day. Apparently the plan was for Western Metal Mines to issue and sell stock to provide the capital, in return for which they could mine, treat, and sell sufficient ore to repay capital expenditures. The plan foiled, as did various other plans to rejuvenate the mine, and it lay dormant for many years.

On August 20, 1917, a petition by the Almeda Consolidated Mines Co. was filed in the Josephine County Court to appoint an associate receiver of the corporation, because Thomas E. Burley had volunteered for service in the U.S. Navy and desired to leave as soon as possible. The petition requested that the court appoint C.M. Huddle of Portland as the additional receiver, since Huddle had been associated with Burley as an assistant, and reportedly was conversant with all details of the affairs of the corporation. The affidavit asserted the immediacy of Burley's call into service had prevented him from filing a final financial statement of his receivership. The order appointing C. M. Huddle as associate receiver was signed by A. M. Crawford, Attorney General, August 20, 1917.

From 1917 on there ore several gaps in the Almeda history as recorded in the mine records now available. Seemingly a new company called the Weorca Mining Corp. was formed to succeed the Almeda Consolidated Mines Co. The Wearco had as officers George L. Nye, President; Phillip J. Lonergan, Vice President; and C. M. Huddle, Secretory-Treasurer. Somewhat later the President is O. F. Braeger, and Harry Sordy, mine owner and long-time resident of Galice, appears prominently in correspondence concerning the mine's affairs. He seems to have been concerned with assessment work and urged the company to potent the claims. Deals for the sale of the property ore continually mentioned in correspondence. On June 9, 1929 Sordy wrote Huddle concerning a letter or letters received from A. B. Yates, engineer for the Homestake Mining Co., regarding a request by Yates for inspection samples from the mine, especially from the 300 level.

About 1931 or 1932, an examination of the Almeda property was mode by A. B. Yates. His maps are discussed later in this report.

Lawsuits by creditors continued to plague the company. Early in 1931 the Almeda management learned that Roy Hillis had relocated the mining claims which covered the Almeda property. Litigation ensued and finally a suit in equity to quiet title came to trial in Grants Pass in December 1931, in which Robina Hillis was plaintiff and Almeda Mines Co. (not Almeda Consolidated Mines Co.) was defendant. A. C. Hough was plaintiff's attorney and the complaint asserted that Roy Hillis relocated the mining claims in April 1930. Seemingly, the representative of the defendant corporation failed to appear, and judgment was for the plaintiff by default. Thus Hillis became the legal owner of the subject mining claims in 1931. Later records indicate that A. C. Hough was a partner. As for the Almeda Mines Co., the corporation was dissolved by proclamation of the Governor on December 30, 1933, for failure to pay license fees.

In June 1934 the Hillises gave an option to purchase the property to the Brittonia Mining & Smelting Co. of British Columbia. Whether an examination of the mine was made is not of record. Only copies of the option and its relinquishment are in the files.

Mayotte report

Following the Yates examination, not very much pertinent history of the Almeda is of record for the late 1930's. A copy of a "summary report" on the mine by Charles Mayotte, a mining engineer presumably from San Francisco, is in the Almeda mine files. It is dated August 15, 1935, but he states that he first visited the property in 1934 and was impressed "by the great width of the deposit." He took some samples underground and noted that he "spotted them on the accompanying map," but no map is attached to the copy of his report. He wrote that he studied mining files in San Francisco and found some operating data and several reports of engineers, but that this information was based on company figures and not on independent engineers' reports. "Therefore," he wrote, "I went to the mine and picked the more representative crosscuts, and from these I cut six channel samples, as above stated. These were all long cuts, ranging from 18 to 28 feet, and the results showed from .08 to .18 oz gold, and to my mind would indicate that the mine is worthy of further investigation and a thorough sampling, since all these samples gave fair assays in precious metal values." He added that one of the best assays come from a crosscut farthest removed from the eastern contact. Mr. Mayotte recounts the information of higher grade gold assays on the 300-foot shaft level, which he obtained from old reports. These were presumably from the P.R. Wickham report, made under the receivership, or possibly from Diller's report. Mayotte further writes that he made a composite sample of the material he cut from the six crosscut samples and had flotation tests made by the Pan American Corp. "The results from these tests indicate that the copper and gold can be recovered by selective flotation, and about 50 percent of the silver, the remainder of the silver evidently being intimately associated with the iron pyrite or as a silver mineral that does not float readily."

Mayotte's report appears to have been designed to encourage his principals (not identified) to do further examination work, but no other information is of record. Mayotte wrote that the owners' purchase price was $150,000.

Finley-McNeil letter

It may be observed that during the years just after the increase in the price of gold, individuals and companies were seeking gold deposits assiduously, and were not showing equal interest in other metallic deposits. This is emphasized by several deals planned for the Almeda as mentioned in the mine files of that period. One of these is shown by correspondence with M. R. Finley of the Finley-McNeil Co. of San Francisco, whose letter of July 2, 1936 to A. C. Hough says: "We have just completed our examination of the property and we hereby advise we will purchase same under terms set forth in agreement." Apparently nothing developed from this attempt to make a deal. It is of interest to point out that corespondence indicates that identical deals were being set up at the same time between Finley-McNeil and the Hillises on the one hand and Finley-McNeil and Harry Sordy on the other. The only difference was in the stated purchase price, and the difference was rather substantial. In one, the price was set at $62,500 and in the other $25,000. This was the time of lawsuits to quiet title. In 1937 Finley & McNeil (Libbey, 1963) were lessees of the Greenback mine, an old lode-gold mine on Tom East Creek, tributary of Grave Creek, roughly 25 miles east of the Almeda mine.

Yates Examination, 1931 - 1932

The C. F. Herbert (Alaska Copper Corp.) files have a copy of assay maps of the underground workings made by A. B. Yates, engineer for the Homestake Mining Co. (figures 10 through 15). The maps are not dated, but a penciled notation on one level map indicates that Yates used $20 an ounce for gold, 27 cents an ounce for silver, and 6 cents per pound for copper in figuring unit values. These prices are evidence that the time of his examination was about 1931-32, when metal prices reached an all-time low. The price of gold was raised from $20 to $35 in 1934. It is unknown whether or not these assay maps represent all of the underground openings sampled by Yates, since there are no maps in the files by him of the levels below the river level, which were inaccessible at the time if theshaft was not unwatered.

Table 6 summarizes and compares three groups of mine assay results: (1) the Wickham report; (2) assay maps in files of Almeda Consolidated Mining Co. dated 1915; and (3) assay maps of A. B. Yates. For comments on the sampling under group (1), refer to discussion on Wickham report, page 11. Under group (2), the mine maps, as shown in figures 4 to 9, are deficient in sample descriptions so that it is difficult to be sure of sample widths; and, also, it is uncertain whether the samples were taken across the ore zone or along the walls, possibly partly in waste. Most of the stope samples as shown in the longitudinal elevation are evidently in the ore zones. In group (3) there are penciled notes on the Yates maps which help to clarify the sample results. These notes, of course, were for his

TABLE 6. Summary of average assay results*.

Sampler and Year	Where Recorded	Number of Samples	Au (oz.) Average	Ag (oz.) Average	Cu (%) Average	Dollar Value 1964	Remarks
Supts. 1910-13	Wickham report	352	0.155	4.34	1.25	20.02	Includes 9 samples by an examining engineer. Results mainly arith. averages (see Tables 3, 4, &5).
Unknown Map dated 1915	Almeda Cons. assay maps	86	0.057	2.49	0.71	9.75	Assay maps indicate some samples were taken in walls. Stope samples are higher than plan samples.
Yates 1931(?)	Assay maps	Many but number unknown	0.102	3.00	1.01	13.78	Assay values are mainly those shown on Yates' vertical section.

* Compare with Wickham's average assays in Tables 3, 4, and 5.

own use and not to help any future investigator who might be at a disadvantage at times in translating dollar values into ounces of gold and silver and pounds of copper. However, it is believed that the results obtained from the Yates maps are sufficiently reliable to use in estimating present values, since it is reasonably certain that his work was done capably and objectively. No report by Yates is available. The assay maps are reproduced herein with the penciled notes indicated.

Note: Yates recorded some of his samples in terms of the 1932 dollar without giving separate gold, silver, and copper values. The writer has converted the 1932 values into present-day equivalents by proportion, using average assays as recorded on Yates' assay maps wherever he listed separate values for gold, silver, and copper.

As for evidence relating to quantity of ore shown by underground development, Yates has some interesting penciled notes on his maps showing dimensions of stopes. These probably do no more than indicate width of ore bodies and the possible quantity of ore left. On the River adit (520' elevation) he notes on his vertical section "Av. 8' stoped $7.31," also "Av. 80' wide $2.33." At the tunnel level he has "Av. stope 12' wide, aver. $6.10." The stope scales 110 feet long on the bottom. On his No. 1 Level (620' elevation) he notes "5.11 about 20' wide." This stope scales about 125 feet long at the greatest dimension at the tunnel level. On this level there is a second stope beginning 280 feet farther north and scaling 115 feet long (and about 20 feet above the level) on which is the notation "4.62 about 10' wide."

On his No. 2 Level (712' elevation) Yates has a stope above the level 160 feet long and 35 feet high beginning 140 feet from the portal (no plan available.) The notation reads "3.12 about 17' wide." There is also an underhand stope, about 115 feet long and 25 feet deep beneath the level, beginning 180 feet from the portal.

The No. 3 Level (794' elevation) has a stope which scaled about 100 feet long and 20 feet above the level, beginning 210 feet from the portal. Yates' notation here is "3.64 aver. 25' wide." No stope is shown on Yates' No. 4 Level at elevation 881, but his plan map of this level gives locations of two samples, one about 180 feet from the portal and showing only very low assays, and the second about 300 feet from the portal with sample representing about 10 feet in width and returning Au = $2.80 per ton, Ag = $0.23, and Cu = $1.40. Applying the market values Yates used, these assays translate into Au = 0.14 oz., Ag = 0.85 oz and Cu = 1.17 percent or $14.41 per ton at 1965 prices. Results from this sample were included to obtain averages in table 6. On the 1915 Almeda Consolidated assay map, this tunnel shows a single assay result, probably from about the same location, of Au = 0.10 oz, Ag = 1.40 oz, and Cu = 0.81 percent. The value at today's prices would be $11.13 a ton.

Holdsworth Lease, 1940

Mine reactivated

P. H. Holdsworth, Seattle, who had been closely connected with activities at the Almeda at several different times and who found the high gold ore body on the 300 Level as described previously, made plans in the late 1930's to capitalize on his knowledge of the mine. According to Almeda mine records, he leased the mine in 1940 and in association with L. A. Levensaler, formerly well-known field engineer for the American Smelting & Refining Co., Tacoma, did considerable exploration work, seemingly concentrated underground at or near the 320 Level. They drilled at least 15 diamond drill holes as shown on figure 16. In addition, they raised about 85 feet from the 320 to the 200 Level and sank a winze in ore about 50 feet below the 320. Also, according to the mine maps, they did a large amount of channel sampling in the gold ore body on the 320.

Notes by C. F. Herbert in the Alaska Copper Corp. files indicated that Holdsworth's exploratory drilling was probably done during at least two separate periods and represents at least two drilling campaigns, in one of which the actual drilling was done mainly on the 300 Level by Hillman Drilling Co. of Seattle and the separate holes were designated by letters instead of numbers. These holes are shown on the map (figure 16), which also includes a tabulation of the assays in which no distinction is made in the assay reports between cores and sludges; only gold values are reported. No logs of these holes are available; however, approximate strikes and dips may be obtained from the map and it is estimated that eight holes were drilled in the gold ore shoot, as follows:

Hole	Thickness sampled, ft.	Average Assays Au - dollars	Assay x thickness
A	60	5.95	357.00
D	50	3.22	161.00
G	30	2.91	87.30
L	50	48.57	2,428.50
M	30	21.88	656.40
N	100	9.52	952.00
R	100	7.35	735.00
S	100	42.00	4,200.00
Av.	65	18.42	9,577.20

Herbert's notes state: (1) That the rake of the shoot is approximately 70°; (2) that the probable cross section of the shoot is about 60 by 60 feet; (3) that 354 tons removed from the small stope and crosscut returned $24.50 per ton; (4) that the balance of ore stoped amounted to approximately 450 tons and averaged $16.32 per ton, according to company records; and (5) that the present stope faces sampled $12.84 per ton. In the Holdsworth letter mentioned on page 20 of this report, he states that "L" hole was drilled down from the west at an angle of 45°.

According to U.S. Bureau of Mines records, in 1942, they shipped ore to Tacoma as follows:

	Ore (Tons)	Gold (oz.)	Silver (oz.)	Copper (lbs.)
Levensaler	245	554	213	600
Holdsworth	42	48	60	-
TOTAL	287	602	273	600
Average		2.1 oz.	0.95 oz.	2.6 lbs. 0.13 percent

Incidentolly, the Bureau's record credits the Almeda mine with production of lead of 6,928 tons, 52,617 tons, and 11,652 tons in 1913, 1915, and 1916 respectively. No lead is mentioned in the smelter sheets of Almeda shipments, but neither Tacoma nor Kennett would have recovered lead from copper ore shipments. However, a shipment of Almeda ore made in 1915 was classed by the smelter as lead ore. Winchell (1914) includes lead and zinc minerals in the ore in his descriptions of the geology and mineralogy of the deposit (see Appendix for résumé of Winchell report).

In the shipments as reported above, the evidence in the mine files is that the 42 tons shipped by Holdsworth came from the 300-stope raise and the balance of 245 tons credited to Levensaler came from the winze.

Mine closed

After War Production Board Order L-208 become effective, the Almeda must have been classified as a gold mine and was obliged to close down. In 1943 Levensaler was employed by the War Production Board in Washington, D.C., and canceled his operating contract with Holdsworth. These events caused Holdsworth serious trouble. He had a lease-and-bond contract with the Hillises which required him to make regular payments, and although he appears to hove obtained extensions of time on his payments, these only postponed the difficulties. There was considerable correspondence between the parties involved and apparently some ill feeling was generated. Finally the contract was canceled, according to a letter in the mine files dated April 3, 1946 from A. C. Hough to the First National Bank of Grants Pass.

A copy of an unidentified letter dated June 22, 1944 to Roy Hillis in the Herbert (Alaska Copper Corp.) files, seemingly written by Holdsworth, states that the writer had tried to get a serial number from the War Production Board* in order to reopen the mine. He was unsuccessful and decided to quit, and concludes his letter with the following sentence: "I have thought the situation over from every angle I know, and to me two things are evident: 1. There is not enough shipping ore in sight to poy for reopening of the mine. 2. There is not nearly enough milling ore to justify the installation of o mill."

Whether he includes the entire mine in this opinion or only the gold ore body is certainly not clear, but since he had been so concerned with the gold ore on the 320 Level to the exclusion of all other parts of the mine in his most recent work, it is probable that he was thinking only of the gold ore.

Copper values ignored

Holdsworth(?), in the letter of June 22, 1944, describes various drill-hole and channel sampling results, but makes no mention here or elsewhere (subsequent to 1911-12) of the copper ore referred to by Diller (1914, p. 76-77). Diller states: "Rich copper ore was noted near the indurated slates on the 300-foot level, a short distance north of the crosscut from the shaft." Further, Diller gives an analysis of this ore by Chase Palmer of the U.S. Geological Survey made of a sample collected by Diller (1914, p. 76), and compared it with a description of the some ore by Holdsworth who, in his correspondence with Diller, is enthusiastic about the copper-ore showing as well as the gold ore farther west. Yet, as stated above, Holdsworth appeared to have given little or no attention to the copper ore in his exploration during 1942-43. However, o small, longitudinal section of Holdsworth's map shown by Diller, 1914, p. 73) indicates two small stopes on the 300 Level at the copper-ore location given by Diller. A penciled tracing in the Herbert file showing o plan of the 300 Level and the contoct between the slate and porphyry has been incorporated in Herbert's level mop (figure 17). It shows a stope about 45 feet long at the contact called "old stope." In addition, it contains the plan of the stope at the end of the west cross-cut where Holdsworth and Levensaler drilled and mined the gold ore, and it shows traces of some of their diamond-drill holes which will be referred to later.

Evidence concerning the grade of the copper ore on the 300 Level is found in the tabulotionsof assays in the Wickham report as used in this report to obtain averages of ore developed and mined in

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* Under war-time regulations, a War Production Board serial number was essential in order to operate.

the early operations (tables 3 and 4). Samples of copper ore from the 300 Level as given in the Wickham report are segregated in table 7. No samples of the siliceous gold-silver ore are included, insofar as known, although one sample by Holdsworth has high values in both gold and copper.

TABLE 7. Wickham report samples of base ore from the 300 level.

Year	Sampled By	Description		Au (oz.)	Ag (oz.)	Cu (%)	Remarks
1911	P. B. Wickham	Base ore	Hand samples*	0.14	3.50	4.0	The copper ore as
1911	" "	" "	" "	0.20	8.00	11.5	described by Diller
1911	" "	" "	" "	0.10	5.62	5.8	was high in barite
1911	" "	" "	" "	0.08	3.88	4.2	and very low in
1911	" "	" "	" "	0.08	2.92	2.8	silica.
1911	" "	" "	2nd grade	0.04	1.56	2.2	(See Appendix.)
1911	" "	" "	" "	0.04	.52	1.0	
1911	" "	" "	Mine samples	0.10	1.30	2.1	
1911	" "	" "	" "	0.16	5.57	4.9	
1911	" "	" "	Hand samples 2nd grade	0.08	1.04	1.2	
1911	P.H. Holdsworth	" "		0.81	9.66	5.3	
1911	" "	" "		0.03	6.39	3.4	
1911	" "	" "		0.02	4.81	2.4	
1911	" "	" "		0.14	3.06	2.3	
			Averages	0.14	4.13	3.8	(Gross value at 1965 prices is $37.58 per ton.)

* "Hand samples" is an indefinite term and probably could mean specimen samples, but not necessarily picked samples of high grade. Diller's sample of this ore returned Au, 0.10 oz.; Ag, 7.78 oz.; and Cu, 6.02 percent.

At this distance, the seemingly good average values in copper, gold, and silver on the 300 Level warrants Diller's opinion (see Appendix for résumé of Diller report), and it is, therefore, unclear why Holdsworth and Levensaler concentrated their drilling on the gold ore to the exclusion of the copper ore when, at the time, copper began to assume great importance as a war metal. It is probable that they hoped to find sufficient high-grade gold ore to pay off their liabilities quickly under their contract.

Space considerations do not permit a discussion of Holdsworth's many drill holes; moreover, the author does not have complete logs of these holes and, even if they were available, it is doubtful they would add very much to the over-all picture.

Investigation by Alaska Copper Corp., 1953

In March 1953, the Alaska Copper Corp. optioned the Almeda property from the owner, Roy Hillis, in the name of a newly formed Washington corporation called the Almeda Mining Co., and began an investigation which, according to their records, extended at least into October 1953 (figures 17 through 22). C. F. Herbert was in charge for the Almeda Mining Co.

A progress report by Herbert doted June 1, 1953, for the period April 7 to May 30 gives information on rehabilitotion work in order to get diamond drilling started on the 520-foot level (No. 1 [River] Level of Holdsworth map as reproduced in Diller [1914]), and various other activities incident to the exploration work including geologic mapping, sampling in old workings, and interpretation of ore possibilities. It is indicated by Herbert that the purpose of the investigation was to determine the extent of the better grade of gold ore, and diamond drilling of the copper ore bodies was not at the time planned. However, he states in the progress report that the study and sampling of the copper ore would be continued and that a milling test of typical ore would be made.

Herbert's diamond-drilling campaign included nine holes started on the 520 Level approximately 150-160 feet west of the main shaft as shown on figure 18. They were drilled and numbered consecutively and were logged as shown in table 8. Figure 19 shows the 420 Level, figures 20 and 21 show cross sections through A-A and B-B. Figure 22 is a composite plan and longitudinal section of mine levels.

A brief description of the holes and assay results follows:

Hole No. 1, with coordinates N. 1030 - W. 1197, started at elevation 525 at the northwest corner of stope No. 1, had bearing N. 35° W., an inclination of -35°, and was drilled to a depth of 231 feet. Core recovery was 76.8 percent. Some difficulty was reported from 225 to bottom in drilling a crushed and faulted zone and the hole was abandoned because of continually plugged bits. Assays were not significant except between 138 and 148, where the core (recovery for this interval 79 percent) assayed Au, 0.05 oz and the sludge Au, 0.045 oz; and between 190 and 201, where the core (recovery close to 100 percent) averaged Au, 0.08, Ag, 4.88, Cu, 0.72 percent based on the core assay alone. The sludge assayed Au, 0.02, Ag, 0.30, and Cu not reported. No weights of core and sludge samples are given. Three 5-foot chip samples by Herbert on wall of Hole No. 1 drill station returned an arithmetical average of Au, 0.037 oz; Ag, 4.27 oz; Cu, 0.04 percent, and Zn, 1.00 percent.

Hole No. 2, with coordinates N. 1031 - W. 1197, started at elevation 528, had bearing N. 38° W., was horizontal and was drilled to a depth of 92 feet. The log, as given in the Appendix, shows the minerals encountered. No significant assays were recorded.

Hole No. 3, with coordinates N. 1030 - W. 1199, started at elevation 528, had bearing N. 47° W., was horizontal and reached a depth of 90 feet. Only very low gold and silver values were reported.

Hole No. 4, with coordinates N. 1024 - W. 1176, started at elevation 522, had bearing N. 80° W., inclination of - 65°, reached a depth of 95 feet, and went into old workings. Core recovery was slightly better than 80 percent. From 4 feet to 25 feet the core had a weighted average assay of Au, 0.014 oz, Ag, 8.69 oz, with Cu showing only 0.06 percent between 22.5 and 25 feet. The sludge samples from 0 to 30 feet averaged Au, 0.013 oz, Ag, 7.02 oz, Cu, 0.06 percent. The log as reported in table 8 shows penetration of the contact at about 40 feet and 1.5 feet of solid barite at 15 feet.

Hole No. 5, with coordinates N. 965 - W. 1201, started at elevation 520, had bearing N. 35° W., inclination of -60° and reached a depth of 190 feet. Core recovery was 45.2 percent. Significant gold, silver, and copper values were obtained from near surface down to 40 feet. However, no copper assays are available from the sludge samples. The core recovery from 0 to 40 feet was 56.6 percent and weighted overage assays of the core samples were Au, 0.066 oz, Ag, 2.56 oz, Cu, 0.92 percent (not including interval 30 to 40 sludge, in which Cu assays are missing). Arithmetical average of sludge assays was Au, 0.02 oz, Ag, 3.30 oz (no Cu assays). The balance of the hole showed very low gold and silver values. The 210 to 125 interval assayed Au, trace and Ag, 4.02 oz for the core; no Cu assays were reported for sludge samples of the hole.

Hole No. 6, with coordinates N. 1030 - W. 1190, started at elevation 525, had bearing due north and was horizontal. Total depth was 215 feet. Core recovery was 34.3 percent and there was no sludge return. From 10 feet to bottom the log shows a fault zone. The first five feet of core showed quartz, barite, pyrite, and chalcopyrite with assays of Au, 0.04 oz, Ag, 1.16 oz, Cu, 1.42 percent.

Hole No. 7, with coordinates N. 1030 - W. 1190, started at elevation 525, had bearing due north and had an inclination of -32°. It bottomed at 230 feet. Core recovery was 25.5 percent and sludge was reported lost at and below 60 feet, where a crushed zone was penetrated. Low gold and silver values were reported in the sludge down to 45 feet, with the 0- 10-foot interval returning Au, 0.04 oz and Ag, 2.46 oz. No copper assays were reported, but the log records show pyrite, chalcopyrite, and bornite in the first 15 feet; also quartz and barite. At depths below 55 feet, values were lower than above except 97 to 105 feet, where the core assayed Au, 0.06 oz.

Hole No. 8, with coordinates N. 1030 - W.1192, started at elevation 525, had bearing N. 18° W. and inclination - 30°. Depth was 250 feet. Core recovery was 49.3 percent. No sludge return was obtained below 20 feet. The only significant assays were from 185 to 205, where for 20 feet the core, with recovery of 32.5 percent, averaged Au, 0.34 oz and Ag, 1.27 oz. From 200 to 205 the core assayed Au, 1.16 oz. In this 20-foot interval the log records quartz, pyrite, chalcopyrite, and bornite. From 200 to 205, 2.2 feet of core assayed Au, 1.16 oz and Ag, 1.54 oz. Sparse bornite was noted but no assay for copper is given. From 245 to 250, 1.7 feet of core assayed Au, trace, and Ag, 3.80 ounces.

Hole No. 9, with coordinates of N. 1030 - W. 1192, started at elevation 526, had bearing N. 18° W., and was horizontal. Depth was 218 feet. Core recovery was 42.7 percent. There was no sludge return below 40 feet. The only significant values were in 1.7 feet of core between 205 and 207 feet, where the assays were Au, 0.08 oz, Ag, 0.48 oz, and Cu, 0.62 percent.

At this point drilling shifted to the 320 level (figure 17).

Hole No. 10, with coordinates N. 1032 - W. 1218, started at elevation 323, had bearing N. 24° W., and was horizontal. Core 0 to 10 was lost when wall caved and covered core box. Hole was abandoned because of excessive caving in hole.

Hole No. 2 (320 Level), with coordinates N. 1023 - W. 1266, started at elevation 272, had bearing S. 75° W., inclination +45° and depth of 30 feet. Herbert's note in log states that this hole was drilled from old winze and located from old map by Holdsworth and is shown in Herbert's map (figure 22). Core recovery was 84 percent over all, but only 1.3 feet was recovered from last 5 feet which was in sheared and crushed quartz, pyrite, and barite and no sample for assay was obtained. The average assay 0 to 25 feet was Au, 0.923 oz, Ag, 3.36 oz. It may be observed that this drilling done by Herbert was after ore mined in the winze was shipped by Holdsworth and Levensaler. It also may be noted that Herbert's core sample from 10 to 20 feet returned Au, 1.58 oz, and Ag, 6.53 oz, and the core from 10 to 25 feet averaged Au, 1.36 oz and Ag, 4.81 oz.

Hole No. 11 (Herbert, as distinguished from No. 11 of Holdsworth) with coordinates N. 1036 - W. 1240, started at elevation 323, had bearing N. 24° W., was horizontal and reached a depth of 140 feet. Core recovery was 46.60 percent. It had low gold and silver assays to a depth of 60 feet; below that they were of no significance. Core assays were reported only from 30 to 60 feet and averaged (arithmetical) Au, 0.027 oz, Ag, 2.12 oz. Sludge assays from 0 to 60 feet averaged Au, 0.047 oz, Ag, 1.58 oz.

Hole No. 12 (Herbert) with coordinates N. 1030 - W. 1213, started at elevation 323, had bearing No. 24° W. and was horizontal. It reached a depth of 140 feet. Core recovery was 37.3 percent. No core assays are reported. Sludge assays were all low. The highest reported was Ag, 2.86 oz between 95 and 100. At this horizon the ground was crushed and core recovery especially low.

Hole No. 13 (Herbert) with coordinates N. 1030 - W. 1213, started at elevation 321, had bearing N. 24° W. and inclination of - 25°. Depth was 90 feet and core recovery was reported worse than in previous hole and no core assays were recorded. Sludge assays were all low, the highest assaying Ag, 1.96 oz at the bottom.

The last three holes in Herbert's logs, numbered A-3, 9, and 11, were recorded by Herbert from samples obtained by Holdsworth in his last work at the mine. Herbert used old records and maps and also core samples which Holdsworth had left. No sludge samples were available and, therefore, only core sample assays for these three holes are reported in the logs as shown in table 8. They were among many drilled by Holdsworth in his exploration of the gold ore on the 320 Level and are not described here because of lack of detailed information. A fourth hole by Holdsworth, No. 16, is logged by Herbert but is not described because of uncertainties in the available record.

Considering the smelter shipments of the gold ore by Levensaler and Holdsworth as reported by the Bureau of Mines in 1942, and the large amount of drilling and other sampling by Holdsworth, the quality of the gold ore body was fairly well established. The question of possible extension of this ore is uncertain. It seems probable that the higher grade part of the shoot, that is the plus one-ounce

TABLE 8. ALASKA COPPER CORP. LOGS OF ALMEDA MINE.

From	To	Core	Remarks	From	To	Core Au	Core Ag	Core Cu	Sludge Au	Sludge Ag	Sludge Cu
				Co-ordinates		N 1030 W 1197			May, 1953		
				Bearing		N 35° W					
Diamond Drill Hole No. 1				Dip		- 35°					
Core AX				Elevation		525					
0	3½	0	Muck & shattered rock.								
3½	11	7.0	min. qtz barite	3½	11	0.015	0.30				
11	16	5.0	ditto, recement fract. at 50°	11	16	0.01	0.10				
16	21	3.7	ditto, with bands soft pyrite	16	21	Tr.	nil				
21	26	4.3	ditto to 21, then qtz pyrite	21	26	0.015	0.10		0.015	0.30	
26	31	4.8	qtz barite pyrite						"	"	
31	36	3.2	broken qtz pyr. at 31, blotchy qtz barite with much pyr.		36				"	"	
36	41	4.7	ditto, fract. at 37	36					0.01	Tr.	
41	46	4.2	ditto to 42½, then hard qtz-pyr - low barite		46				"	"	
46	51	4.8	hard qtz. fine pyr. bands 25° at 48 & 50, fault	41	51	Tr.	nil		0.015	Tr.	
51	56	3.9	ditto to 55		56				"	"	
56	61	4.2	qtz barite, carbonate seams at 59	56					0.01	Tr.	
61	66	4.0	ditto, qtz-pyr. seams at 63 and 64		66				"	"	
66	71	4.2	qtz barite pyr.	66					0.005	0.05	
71	76	1.1	fault zone		76				0.005	0.05	
76	81	4.2	qtz barite pyr, fault	79	76				0.01	0.10	
81	86	2.9	ditto, fault 81-83		86				0.01	0.10	
86	91	2.0	ditto, crushed	86					0.01	Tr.	
91	96	4.4	qtz barite pyr.						"	"	
96	101	4.5	ditto						"	"	
101	106	3.0	ditto, qtz stringers		106				"	"	
106	111	2.5	qtz barite pyr. fault at 106-108	106					0.01	Tr.	0.11
111	116	4.2	ditto, fractures at 50°		116				"	"	"
116	123	5.5	water course at 121, alt. diorite dike (drains 620 level from No. 3 X cut W)	116					0.015	Tr.	
123	125	2.8?	alt. diorite dike?		126				"	"	
125	130	4.3	ditto (with pyr., chlorite)	(spec. shows Cu; Ni; Cr;Co; Pb;Zn;Va;Sr;Mn;K higher than Na)					0.01	Tr.	
130	135	3.6	ditto, at 133½ seam of qtz barite with heavy pyrite		135				"	"	
135	141	5.7	fault contact at 138	135					0.045	Tr.	
141	143	2.2?	mostly qtz, sm. pyr.	138	143	0.06	Tr.		"	"	
				143	148	0.04	Tr.				

From	To	Core	Remarks	From	To	Core Au	Core Ag	Core Cu	Sludge Au	Sludge Ag	Sludge Cu
Diamond Drill Hole No. 1, continued:											
143	146	1.7	broken qtz pyr. barite		146				"	"	
146	151	3.7	qtz pyr. fault at 150	146					0.02	"	
151	156	4.0	ditto		156				"	"	
156	161	4.9	ditto	156					0.015	Tr.	
161	167	5.8	ditto		166				"	"	
167	177	4.0	", fault zone 168-175	166	176				0.01	nil	
177	180	2.3	", many barite seams	176					0.015	Tr.	
180	185	5.0	qtz barite pyr.		186				"	"	
185	190	5.0	ditto	186					0.015	Tr.	
190	195	5.0	Fault 190; irreg. bands barite to 192, then qtz Pyr cement breccia; bornite	186	196				0.015	Tr.	
				190	195	0.08	4.88	0.98			
195	201	6.3?	contorted bands qtz pyr.	195	205	0.08	1.22	0.46	0.025	0.30	
201	205	3.4	qtz to 203 then qtz barite to 204, then cement qtz breccia bands at 60°								
205	208	2.7	breccia, fault at 208	205					0.015	0.10	
208	215	4.7	broken, less siliceous		215				0.015	0.10	
215	218	0.5	crushed faulted	215							
218	224	4.9	qtz barite pyr		224				0.01	Tr.	
224	231	2.7	crushed and faulted from 225. Hole abandoned because of continually plugged bits	224	231				0.005	Tr.	
Diamond Drill Hole No. 2				Co-ordinates		N 1031 W 1197			June 1953		
				Bearing		N 38°W					
				Dip		0					
				Elevation		528					
2	7	4.2	qtz pyr barite High pyr	0							
7	12	4.7	" " " " "		12	(Zn - 0.21)			Tr.	nil	0.02
12	17	4.8	ditto, incr. in barite	12					0.01	0.10	
17	22	4.7	ditto, less shearing						"	"	
22	27	4.6	ditto, hvy pyr. more qtz, flow struct.	17	27	Tr.	nil		"	"	
27	34	4.6	ditto, fault at 28	26	36	0.02	0.10		0.02	0.10	
34	36	1.3	ditto, blotches qtz	30	35	Tr.	nil				
36	46	9.1	ditto, stringers qtz	36	46	nil	nil		0.015	nil	
46	55	7.5	ditto, fault at 54	46	56				0.015	nil	
55	66	10.0	qtz pyr barite, breaks at 62 and 64	55	56½	Tr.	nil				
				56	66				0.01	nil	
66	76	2.5	crushed, high qtz	66	76				0.01	nil	
76	80	0.4	crushed altered dike	76					0.005	Tr.	
80	85	1.2	crushed altered dike		86				"	"	
85	90	1.2	crushed altered dike	86	90				Tr.	nil	
90	92		less altered dike								

TABLE 8 (continued).

Diamond Drill Hole No. 3

Co-ordinates	N 1030 W 1199	June 1953
Bearing	N 47° W	
Dip	0	
Elevation	528	

From	To	Core	Remarks	From	To	Core Au	Core Ag	Core Cu	Sludge Au	Sludge Ag	Sludge Cu
0	10	8.8	qtz barite hvy barite	0	10				0.015	0.10	
10	20	10.0	ditto wavy str. barite	10	20				0.01	0.10	
20	30	9.5	ditto few qtz. str.	20	30				0.01	0.10	
30	40	9.1	ditto, higher qtz	30	40				0.015	0.52	
				35	40	0.02	0.12				
				40	45	0.02	0.22				
40	50	10.0	qtz, cement breccia	40	50				0.03	1.05	
50	60	8.2	qtz pyrite sm barite	50	60				Tr.	nil	
60	65	4.3	barite pyr. low qtz	60	65				Tr.	nil	
65	70	4.6	ditto, coarse breccia	65	70				Tr.	nil	
70	75	1.8	sheared at 45° to 71, then alt. dike	70					Tr.	nil	
75	80	1.7	alt. dike		80				Tr.	nil	
80	85	1.6	alt. dike to 83	80	85				Tr.	0.10	
85	90	0.7	crushed qtz pyr. hole caving badly	85	90				0.01	Tr.	

Diamond Drill Hole No. 4

Co-ordinates	N 1024 W 1176	June 1953
Bearing	N 80° W	
Dip	-65°	
Elevation	522	

From	To	Core	Remarks	From	To	Core Au	Core Ag	Core Cu	Sludge Au	Sludge Ag	Sludge Cu
0	6	1.8	sil. greenstone, fault	0	10				Tr.	4.12	nil
6	10	3.7	barite pyr.								
10	15	4.8	ditto ($1\frac{1}{2}$' pure barite)	4	15	Tr.	6.34	nil			
15	20	5.0	mostly pyrite	10	20				Tr.	9.88	0.04
20	$22\frac{1}{2}$	2.5	" " , fault	15	$22\frac{1}{2}$	0.04	14.94	nil			
$22\frac{1}{2}$	25	2.0	green chlorite ?, qtz. fine sulfides	$22\frac{1}{2}$	25	Tr.	0.72	0.06			
25	30	4.3	greenish rock to 26, then alt. red shale	20	30				0.04	7.06	0.08
30	35	4.8	alt. red shale	25	35	nil	nil				
35	40	4.0	ditto, green at 39	30	40				nil	0.88	
40	45	3.3	green to 42, alt red sh.	40							
45	47	1.0	alt red sh., fault 46								
47	50	1.0	fault, serpentinized	40	50				nil	0.38	
50	55	2.2	barite pyr. broken	50							
55	60	1.3	qtz. pyr. broken		60				nil	0.60	
60	65	1.7	qtz. pyr. broken	60							
65	70	1.0	" " "		70				Tr.	0.46	
70	75	3.6	" " "	70							
75	80	2.7	" " "		80				Tr.	0.32	
80	85	1.7	" higher quartz	80							
85	90	0.5	broken qtz pyr barite		90				Tr.	0.16	
90	95	0.0	lost in old works (recovered in drift)	90	95	Tr.	0.32				

Note: At 25; 40-50; 80-90 unidentified reddish-yellow malleable mineral panned.

Diamond Drill Hole No. 5

Co-ordinates	N 965 W 1201	July 1953
Bearing	N 35° W	
Dip	-60°	
Elevation	520	

From	To	Core	Remarks	From	To	Core Au	Core Ag	Core Cu	Sludge Au	Sludge Ag	Sludge Cu
0	$\frac{1}{2}$	0.5	gouge								
$\frac{1}{2}$	2	1.5	hvy pyr barite	$\frac{1}{2}$	2	0.06	8.78	2.04			
2	6	2.9	pure barite to 4	2	10	0.04	3.64	0.56			
6	10	3.7	pyr barite	0	10				0.04	5.40	
10	15	2.7	pyr barite sm chalco	10	15	0.08	3.52	1.68			
15	20	0.7	alt broken, pyr.	15	20	0.06	3.30	0.24			
				10	20				Tr.	2.50	
20	25	3.3	qtz pyr barite	20	25	0.06	1.10	1.64			
25	30	0.7	sheared and altered	25	30	0.12	1.64	0.42			
				20	30				Tr.	2.74	
30	35	3.5	barite qtz pyr	30							
35	40	3.8	barite qtz pyr altered (sericite ?)		40	0.06	1.10		0.04	2.54	
40	50	5.2	ditto, soft	40	50	0.04	0.32		0.04	1.44	
50	60	1.6	crushed qtz barite	50	60	0.02	0.16		0.04	1.00	
60	70	lost	broken core barrel	60	70				Tr.	0.64	
70	75	3.0	qtz pyr.	70							
75	80	4.2	qtz pyr barite		80				nil	1.12	
80	90	4.2	ditto broken	80	90				nil	0.48	
90	100	4.0	ditto	90	100				nil	0.52	
100	110	0	badly broken	100	110				Tr.	0.36	
110	120	3.4	broken qtz sm. barite	110	120				Tr.	0.56	
120	125	4.2	qtz barite pyr with 3 qtz bands at 90°	120	125	Tr.	4.02				
				120							
125	130	2.0	broken qtz barite pyr.		130				0.04	0.44	
130	135	2.5	broken qtz bar pyr	130							
				135	140	0.05	0.30				
135	140	3.2	ditto, increase in silica		140				0.02	0.72	
140	145	3.7	ditto	140	145	Tr.	1.16				
145	150	4.7	ditto		150				0.04	0.32	
150	155	2.8	qtz pyr sm. chalco, crush		150						
155	160	2.2	qtz pyr		160	Tr.	0.36	0.24	0.02	0.70	
160	165	2.7	soft altered, gypsum	160	165	Tr.	nil	nil			
165	170	1.6	qtz crushed to sand		170	nil	nil	nil	0.02	0.48	
170	175	2.5	highly altered	170							
175	180	2.5	" " qtz at 180		180	nil	nil	0.06	0.02	0.80	
180	185	1.7	" "	180	185	nil	nil	nil			
185	190	0.5	crushed qtz, wood		190				0.04	0.94	

Diamond Drill Hole No. 6

Core EX

Co-ordinates	N 1030 W 1190
Bearing	North
Dip	0
Elevation	525

From	To	Core	Remarks	From	To	Core Au	Core Ag	Core Cu	Sludge Au	Sludge Ag	Sludge Cu
0	5	4.8	qtz pyr bar, chalco	0	5	0.04	1.16	1.42	(No sludge return)		
5	10	3.5	qtz pyr bar, chalco	5	10	0.02	0.16	nil			
10	15	0.8	fault zone, water back from DDH No. 1								
15	$17\frac{1}{2}$	0.3	ditto	10	$17\frac{1}{2}$	Tr.	0.20				

TABLE 8 (continued).

Diamond Drill Hole No. 6, continued:

From	To	Core	Remarks	From	To	Core			Sludge		
						Au	Ag	Cu	Au	Ag	Cu
17½	20	1.1	qtz pyr	17½	20	Tr	0.16		(No sludge return)		
20	25	3.7	qtz pyr qtz stringers	20							
25	30	3.4	ditto		30	nil	0.12				
30	35	3.6	qtz pyr	30							
35	40	4.7	ditto		40	nil	0.18				
40	45	3.2	qtz pyr fault at 41	40							
45	50	3.8	" " blotchy qtz. rare dark sulfide (zinc?)		50	nil	0.08				
50	55	2.2	broken qtz sparse pyr	50	55	0.14	0.11				
55	60	1.4	ditto	55							
60	65	1.0	ditto		65	nil	nil				
65	70	3.0	qtz pyr barite	65	70	nil	0.12				
70	75	1.7	ditto – broken	70							
75	80	1.8	ditto		80	Tr.	nil				
80	85	2.2	ditto	80							
85	90		ditto – fault zone		90	Tr	nil				
90	95		ditto – gouge		95						
95	100	1.2	ditto – gouge		100	Tr	nil				
100	105	3.5	qtz pyr barite	100	105	0.02	nil				
105	110		gouge								
110	115	0.8	sm. broken qtz pyr	110							
115	120	1.0	ditto								
120	125	1.0	ditto		125	Tr.	nil				
125	130	0.3	ditto								
130	140	2.2	broken qtz pyr	130	140	Tr.	nil				
140	145	0.7	ditto								
145	150	1.8	qtz sparse pyr broken	145	150	Tr.	nil				
150	155	1.5	ditto								
155	160	5.0	qtz pyr sm glassy string	155	160	Tr.	nil				
160	170	3.1	qtz pyr broken	160	170	Tr.	nil				
170	185	1.2	badly broken qtz pyr	170	185	Tr.	nil				
185	200	1.2	ditto	185	200	Tr.	nil				
200	215	1.0	ditto	200	215	nil	nil				

Diamond Drill Hole No. 7

Co-ordinates N 1030 W 1190
Bearing North
Dip -32°
Elevation 525

From	To	Core	Remarks	From	To	Core			Sludge		
						Au	Ag	Cu	Au	Ag	Cu
0	5		crushed qtz pyr & red shale chalco & bernite	0							
5	10	0.8	pyr bar, chalco		10				0.04	2.46	
10	15	3.2	hvy pyr, bar, qtz 13-15	10	15	0.04	0.92				
15	20	2.5	qtz pyr bar broken	15	20	Tr.	nil				
				10	20				0.06	1.00	
20	25	1.7	ditto	20	25	Tr.	nil				
25	30	3.2	qtz sparse pyr		30				0.02	0.64	
30	35	3.0	ditto	25	35	Tr.	nil				
35	40	1.6	ditto broken	35	40	Tr.	nil				
				30	40				0.02	0.40	
40	45	0.9	ditto broken	40							
45	50	1.0	" " pons silvery mineral		50				0.04	0.46	

Diamond Drill Hole No. 7, continued:

From	To	Core	Remarks	From	To	Core			Sludge		
						Au	Ag	Cu	Au	Ag	Cu
50	55	1.0	qtz sparse pyr broken	40	55	Tr	nil				
55	60	3.0	soft shaly, gypsum pyr then qtz pyr.	55					lost sludge		
60	65	2.3	qtz sparse pyr crushed		65	nil	nil				
65	67½	2.7	qtz sparse pyr	65	67½	Tr.	nil				
67½	77	3.4	" " " crushed	67½	77	nil	nil				
77	87	2.8	ditto	77	87	nil	nil				
87	97	1.7	ditto	87	97	nil	nil				
97	105	3.7	ditto	97	105	0.06	0.30				
105	112	2.8	ditto	105	112	nil	nil				
112	120	1.3	qtz pyr chalco	112	120	nil	nil				
120	130	3.2	qtz pyr	120	130	Tr.	0.08				
130	140	4.7	qtz sparse pyr	130	140	nil	nil				
140	150	3.9	ditto	140	150	nil	nil				
150	155	4.7	qtz sparse pyr.	150	155	nil	nil				
155	162	1.9	ditto crushed	155	162	Tr.	nil				
162	172	3.6	ditto	162	172	Tr.	nil				
172	182	7.9	qtz pyr	172	182	Tr.	nil				
182	192	7.8	ditto w/sm chalco	182	192	Tr.	nil	0.08			
192	205	4.5	qtz sparse pyr, qtz seams w/chalco at 200	192	205	Tr.	nil				
205	215	3.2	qtz. crushed	205	215	Tr.	nil				
215	225	1.3	qtz crushed	215	225	Tr.	nil				
225	230	0.9	ditto w/gouge	225	230	nil	nil				

Diamond Drill Hole No. 8

Co-ordinates N 1030 W 1192
Bearing N 18° W
Dip -30°
Elevation 525

From	To	Core	Remarks	From	To	Core			Sludge		
						Au	Ag	Cu	Au	Ag	Cu
0	5	3.3	qtz. pyr. sm chalco	0							
5	10	4.9	qtz. pyr.		10	nil	nil		nil	nil	
10	15	4.8	" "	10							
15	20	4.2	" "		20	nil	nil		no sludge return		
20	25	4.6	" "	20							
25	30	2.6	qtz. sparse pyrite		30	nil	nil				
30	34	2.3	" " "	30							
34	39	1.9	" " "		39	nil	nil				
39	45	1.5	" " "	39							
45	50	1.5	" " "		50	nil	nil				
50	55	1.1	" " "	50	55	nil	nil				
55	60	4.0	" " "	55	60	nil	nil				
60	65	0.3	qtz. badly broken	60							
65	67½	0.3	" " "		67½	Tr.	0.60				
67½	72	5.0	qtz. pyr.	67½							
72	77½	4.9	qtz. pyr. barite		77½	Tr.	nil				
77½	80	1.8	qtz. pyr.	77½							
80	85	0.5	badly broken qtz.		85	Tr.	nil				
85	89	0.9	" " "	85							
89	95	1.9	" " " pyr		95	Tr.	nil				
95	100	0.4	" " "	95							

TABLE 8 (continued).

From	To	Core	Remarks	From	To	Core Au	Core Ag	Core Cu	Sludge Au	Sludge Ag	Sludge Cu

Diamond Drill Hole No. 8, continued:

From	To	Core	Remarks	From	To	Core Au	Core Ag	Core Cu	Sludge Au	Sludge Ag	Sludge Cu
100	105	0.7	badly broken qtz		105	nil	nil				
105	107	1.2	qtz pyr	105							
107	110	0.7	" "								
110	115	2.3	" "		115	Tr.	nil				
115	120	2.1	qtz pyr sm chalco	115							
120	125	1.7	" "		125	0.04	nil				
125	130	1.8	" "	125							
130	135	0.7	badly broken qtz pyr		135	Tr.	nil				
135	137	0.4	" " "	135							
137	140	0.5	" " "								
140	145	0.2	" " "		145	0.02	0.20				
145	148	2.7	qtz sparse pyr qtz stringers at 147	145	148	Tr.	5.64				
148	153	2.9	qtz sparse pyr cherty bands	148							
153	158	3.5	ditto		158	Tr.	1.42				
158	161	2.9	ditto								
161	165½	4.1	ditto	161							
165½	169	2.0	" broken and altered at 168		169	Tr.	Tr.				
169	173	2.8	qtz spare pyr	169							
173	175	1.7	" " "								
175	180	2.2	qtz pyr		180	0.02	1.30				
180	185	4.4	" " qtz veinlets	180	185	0.04	0.86				
185	190	1.9	broken qtz pyr	185							
190	195	0.6	broken qtz pyr		195	0.10	1.14				
195	200	1.8	qtz pyr sm chalco and bornite	195	200	Tr.	1.26				
200	205	2.2	qtz veinlets sparse bornite	200	205	1.16	1.54				
205	210	4.3	qtz pyr veinlets	205	210	0.04	Tr.				
210	215	4.7	qtz pyr with barite and celestite (?)	210	215	Tr.	1.54				
215	220	4.2	qtz pyr gouge at 218	215	218	0.02	0.46				
220	225	1.5	gouge 220-222, broken qtz barite pyr	220							
225	230	1.9	broken qtz pyr, barite		230	Tr.	1.02				
230	235	1.2	ditto	230							
235	240	1.2	ditto		240	0.02	1.04				
240	245	2.0	ditto	240							
245	250	1.7	ditto		250	Tr.	3.80				

Diamond Drill Hole No. 9

Co-ordinates	N 1030 W 1192
Bearing	N 18W
Dip	0
Elevation	526

From	To	Core	Remarks	From	To	Core Au	Core Ag	Core Cu	Sludge Au	Sludge Ag	Sludge Cu
0	5	4.5	qtz pyr	0							
5	10	3.9	qtz pyr		10	nil	nil				
10	15	3.2	qtz pyr	10							
15	20	3.2	qtz pyr		20	0.02	nil		0.02	nil	
20	25	2.4	qtz pyr	20							
25	30	4.0	qtz sparse pyrite		30	nil	nil		0.02	nil	

Diamond Drill Hole No. 9, continued:

From	To	Core	Remarks	From	To	Core Au	Core Ag	Core Cu	Sludge Au	Sludge Ag	Sludge Cu
30	35	4.5	qtz pyrite	30							
35	40	4.8	qtz pyrite		40	0.02	nil				
40	45	3.0	qtz pyrite, abundant white qtz	40	45	Tr.	nil		No sludge return		
45	50	1.4	qtz sparse pyrite	45							
50	56	2.0	qtz sparse pyrite		56	Tr.	nil				
56	60	0.6	broken qtz pyrite	56							
60	65	0.9	" "		65	Tr.	nil				
65	70	0.8	" "	65							
70	75	0.6	" "		75	0.02	0.12				
75	80	0.6	" "	75							
80	85	1.1	" "		85	Tr.	nil				
85	90	2.7	qtz pyr	85							
90	95	2.1	" "		95	Tr.	nil				
95	100	1.7	" "	95							
100	105	1.0	broken qtz pyr		105	nil	nil				
105	110	1.4	broken qtz pyr	105	110	Tr.	nil				
110	115	0.1	v soft altered material								
115	119	1.6	alt qtz diorite dike	115							
119	124	0.8	alt qtz diorite dike		124	Tr.	nil				
124	129	1.4	alt qtz diorite dike to 126	124							
129	133	nil									
133	135	0.3	qtz pyr		135	Tr.	nil				
135	140	1.6	broken qtz pyr	135							
140	145	1.8	broken qtz pyr		145	0.02	nil				
145	148	2.4	qtz pyr splotchy qtz sm chalco	145							
148	151	0.8	qtz pyr broken								
151	154	2.2	qtz sparse pyr.		154	Tr.	nil				
154	157	0.7	qtz sparse pyr.	154							
157	160	1.2	qtz sparse pyr.								
160	165	2.6	qtz sparse pyr.		165	Tr.	nil				
165	170	1.6	qtz pyr white qtz vein 167 to 167½	165							
170	175	2.2	qtz sparse pyr		175	Tr.	nil				
175	180	1.0	sheared qtz sparse pyr								
180	182½	0.9	ditto								
182½	186	2.5	qtz barite pyr fault at 185	182½	186	Tr.	nil				
186	188	0.3	fault material								
188	195	5.1	qtz pyr v. little barite	188	195	0.04	0.12				
195	200	1.5	ditto, crushed	195							
200	205	1.2	ditto		205	Tr.	nil				
205	207	1.7	qtz pyr sm chalco, bornite	205	207	0.08	0.48	0.62			
207	208½	0.9	qtz pyr v. little chalco	207							
208½	213½	4.0	qtz pyr		213½	0.02	0.14				
213½	216½	2.4	qtz pyr, rare bornite	213½							
216½	218	1.0	qtz pyr crushed		218	Tr.	nil				

TABLE 8 (continued).

From	To	Core	Remarks	From	To	Core Au	Core Ag	Core Cu	Sludge Au	Sludge Ag	Sludge Cu
Diamond Drill Hole No. 10				Co-ordinates N 1032 W 1218; Bearing N 24°W; Dip 0; Elevation 323							
0	10		Core was lost when wall caved in on core box. Hole abandoned as sloughing from walls made it impossible to hold casing for recovery of sludge.	0	10				0.04	Tr.	
Diamond Drill Hole No. 2 (Drilled from flooded winze, not located except as from old map by Holdsworth)				Co-ordinates N 1023 W 1266; Bearing S 75°W; Dip +45°; Elevation 272							
0	5	4.2	qtz pyr barite w/ sm wavy qtz stringers	0	5	0.18	0.72				
5	10	5.0	ditto	5	10	0.36	1.64				
10	15	5.0	ditto	10							
15	20	4.8	ditto		20	1.58	6.53				
20	25	4.6	ditto, broken at 23	20	25	0.93	1.37				
25	30	1.3	sheared and broken qtz pyr barite								
Diamond Drill Hole No. 11				Co-ordinates N 1036 W 1240; Bearing N 24° W; Dip 0; Elevation 323							
0	5	1.7	soft altered qtz pyr	0							
5	10	1.8	ditto		10				0.04	3.74	
10	15	0.8	ditto, with gouge	10							
15	20	0.4	ditto		20				0.02	0.74	
20	25	2.5	qtz, sparse pyr, some gouge	20							
25	30	2.1	qtz pyr		30				0.07	1.42	
30	35	2.7	ditto	30	40				0.03	0.58	
				30	35	0.03	2.26				
35	40	4.2	qtz pyr with qtz stringers	35	40	Tr.	1.80				
40	45	4.1	talc to 42, then qtz pyr cal	40	50				0.08	1.30	
				40	45	0.05	1.22				
45	50	2.6	qtz pyr	45	50	Tr.	2.50				
50	55	1.5	soft altered qtz pyr	50	60				0.04	1.72	
				50	55	0.08	2.20				
55	60	2.6	soft altered with calcite	55	60	Tr.	2.74				
60	65	0.8	ditto	60							
65	70	0.7	ditto		70				0.02	0.08	
70	75	1.5	ditto	70							
75	80	2.9	qtz pyr sheared		80				Tr.	1.30	
80	85	0.8	ditto	80							
85	90	2.7	soft alt. w/gypsum calcite veinlets		90				Tr.	0.72	

From	To	Core	Remarks	From	To	Core Au	Core Ag	Core Cu	Sludge Au	Sludge Ag	Sludge Cu
Diamond Drill Hole No. 11, continued:											
90	95	4.7	ditto	90							
95	100	2.7	ditto to 98, then pyr chlorite etc.		100				0.02	0.50	
100	105	3.0	fine-grained altered rock	100							
105	110	3.2	ditto		110				0.02	0.72	
110	115	1.2	fine-grained altered rock	110							
115	120	3.2	ditto w/gypsum		120				0.03	1.60	
120	125	3.6	qtz pyr, less chlorite, sm gypsum	120							
125	130	2.9	ditto		130				Tr.	0.94	
130	135	2.7	hvy pyr w/qtz to 132, then qtz pyr and calcite	130							
135	140	1.6	qtz pyr calcite		140				Tr.	0.86	
Diamond Drill Hole No. 12				Co-ordinates N 1030 W 1213; Bearing N 24° W; Dip 0; Elevation 323							
0	5	3.5	qtz pyr	0							
5	10	1.9	qtz pyr sheared		10				Tr.	1.48	
10	15	1.6	ditto	10							
15	20	2.4	ditto		20				Tr.	1.24	
20	25	0.8	gouge, broken qtz pyr	20							
25	30	1.7	qtz sparse pyr		30				Tr.	0.32	
30	35	2.2	ditto	30							
35	40	2.7	qtz pyr sheared		40				Tr.	0.68	
40	45	2.1	ditto	40							
45	50	3.5	qtz pyr		50				Tr.	0.74	
50	55	1.6	qtz pyr broken	50							
55	60	1.2	ditto w/gouge		60				Tr.	2.08	
60	65	2.9	qtz pyr calcite sheared	60							
65	70	2.3	ditto, altered		70				Tr.	Tr.	
70	75	2.3	qtz pyr calcite	70							
75	80	2.0	soft altered w/carbonates & green transparent mineral	80					0.01	1.04	
80	85	1.9	qtz pyr broken	80							
85	90	0.8	gouge, broken qtz pyr carbonates		90				0.01	0.62	
90	95	1.5	ditto	90							
95	100	1.5	ditto		100				Tr.	2.86	
100	105	0.5	badly broken qtz pyr carbonates	100							
105	110	0.8	ditto		110				0.02	1.40	
110	120	0.5	ditto	110	120				Tr.	Tr.	
120	125	2.8	soft altered carbonates gypsum	120							
125	130	2.8	ditto		130				Tr.	2.30	
130	135	3.4	soft carbonate rock with gypsum	130							
135	140	1.0	ditto		140				Tr.	0.46	

TABLE 8 (continued).

From	To	Core	Remarks	From	To	Core Au	Core Ag	Core Cu	Sludge Au	Sludge Ag	Sludge Cu
Diamond Drill Hole No. 13				Co-ordinates		N 1030 W 1213					
				Bearing		N 24° W					
				Dip		-25°					
				Elevation		321					
0	10		Core recovery considerably worse than in Hole No. 12, possibly due	0	10				Tr.	0.40	
10	20		to new driller. Broken qtz pyr to 65 feet.	10	20				Tr.	Tr.	
20	65			20	30				Tr.	Tr.	
				30	40				Tr.	0.52	
				40	50				Tr.	0.66	
				50	60				Tr.	1.14	
				60	70				Tr.	0.24	
65	90		Soft carbonate rock	70	80				Tr.	1.96	

RECORD FROM HOLDSWORTH SAMPLES

From	To	Core	Remarks	From	To	Core Au	Core Ag
Diamond Drill Hole No. A-3 (Holdsworth)				Co-ordinates	N 1247 W 1290		
				Bearing	S 75° E		
				Dip	-55°		
				Elevation 320			
0	5.7	4.7	qtz pyr	0	5.7	0.15	0.25
5.7	10.7	5.2	qtz pyr with qtz stringers	5.7	10.7	0.11	0.49
10.7	17.4	7.0	ditto	10.7	17.4	0.11	0.59
17.4	22.9	5.4	ditto	17.4	22.9	2.17	0.73
22.9	26.3	3.5	ditto w/ cherty band 22.9 - 23.5	22.9	26.6	3.79	1.11
26.6	31.7	3.2	qtz pyr sm barite	26.6	31.7	0.11	0.29
Diamond Drill Hole No. 9 (Holdsworth)				Co-ordinates	N 1020 W 1285		
				Bearing	N 25° W		
				Dip	-55°		
				Elevation	320		
0	10	Core lost					
10	15	5.0	qtz pyr barite, coarse recement breccia	10			
15	20	3.8	qtz pyr barite with wavy stringers, crushed Fe stain		18.4	3.25	0.95
			qtz 18.4 - 20	18.4	20	0.16	0.24
20	24.7	4.7	qtz pyr barite, coarse recement breccia	20			
24.7	29.7	4.9	ditto w/ wavy stringers		29.7	0.20	0.50
29.7	34.7	4.8	ditto, fewwavy stringers	29.7	34.7	0.14	0.66
34.7	39.2	0.7	gouge and broken qtz pyr				
39.2	44.2	2.5	mostly barite with sm pyr				

From	To	Core	Remarks	From	To	Core Au	Core Ag
Diamond Drill Hole No. 11 (Holdsworth)				Co-ordinates	N 1015 W 1282		
				Bearing	N 55° E		
				Dip	-45°		
				Elevation	320		
0	5	4.4	qtz pyr barite w/ wavy qtz stringers	0			
5	10	4.9	ditto		10	0.11	0.70
10	15	5.0	ditto	10			
15	19½	4.2	ditto		19½	0.14	0.96
19½	24½	4.9	ditto, fewer stringers	19½			
24½	29½	4.8	ditto, v. few stringers		29½	0.09	0.81
29½	34½	2.1	broken qtz pyr barite fault at 33	29½	34½	0.05	Tr.
Diamond Drill Hole No. 16 (Holdsworth)				Co-ordinates	N 1044 W 1273		
				Bearing	S 10° W		
				Dip	-50°		
				Elevation	320		
0	8½	*	qtz barite, broken 8 to 8½	0	8½	2.46	9.68
8½	13		qtz pyr barite broken	8½	13	0.22	3.26
13	23		qtz pyr sm qtz stringers	13	23	0.26	3.14
23	33½		qtz pyr many qtz stringers	23	33½	0.14	2.54
33½	43½		qtz pyr sm qtz stringers	33½	43½	0.03	2.08
43½	53½		ditto, fault zone 46-49	43½	53½	0.05	1.78
53½	63½		mostly barite with dis. pyrite	53½	63½	Tr.	2.26
63½	73½		ditto	63½	73½	Tr.	2.86
73½	93		ditto				
93	93½		fault				
93½	115		qtz barite pyr				

* Core not measured, but very good all through the hole.

grade, was mined out in the winze and raise at the 320 horizon, but also it is probable that extensions of lower grade material may be found both above and below this level. The extent of the copper ore on this level remains uncertain, even though the quality of the material appears to be good.

Conclusion

Unfavorable results of the early attempts to operate the Almeda mine profitably should not be taken as evidence that the ore is difficult to treat successfully or that normal practices of wet concentration would not be applicable. The record does not state why a matting furnace was selected as the preferred method of concentrating values for shipment to a smelter, or if any testing work was done before purchasing the furnace. It is possible that the operators wanted to show quick results to stockholders, many of whom lived in the Midwest and were not experienced in mining operations.

The high unit treatment cost, plus high overhead expense, were too much of a burden on a small tonnage producer and the result was inevitable. Failure to develop the ore in advance to a point where the most economical systems of mining, ore treatment, and proper production rate could be planned were serious obstacles in the way of obtaining the strong financing essential to the success of the project.

The extensive outcrop, the persistence of the contact along which ore shoots have formed, and the evidence that large tonnage of lower grade ore may be developed are all favorable conditions which warrant investigation by experienced mining companies, especially at a time when metal prices are high and business conditions appear healthy. Such an investigation would comprise surface studies, including geochemical and geophysical work, in addition to test pitting, exploratory drilling, and check sampling of underground workings. The information provided by the Holdsworth-Hillman drill holes (page 19) points to the desirability of further exploration in areas west of the contact. Possibly other gold shoots or extensions of the Holdsworth discovery on the 300 level could be found. If values prove to be disseminated widely in the wall rock, as seems possible, the favorable topography might point to the feasibility of a surface mining operation, which could allow large tonnage handling and low mining costs.

The presence of barite in the gangue of the higher grade ore has been mentioned in several places in various reports. The possibility that barite might prove to be of future value as a by-product is self evident and would, of course, be considered and investigated by an experienced operator. Excerpts from a Holdsworth letter to the author, dated January 13, 1942, are quoted as follows*:

> "We have given no thought to the production of a pyrite concentrate, other than as a waste product or tailing from the concentration of the copper-gold ore in the Alameda. At the present moment, I doubt that such a concentrate would be suitable for the purpose mentioned as it would probably be contaminated by small amounts of lead and zinc. Probably some pyrrhotite as well.
>
> "We are however, very much interested in the production and sale of a remarkably pure barite product. During the early smelting operations the barite content of the ore was a serious problem. In fact the barite content was so high that even with selective mining, the ore exclusive of fluxes, would run 50% and higher in barite, as it went to the furnace.
>
> "Along the hanging wall there are sections from two to over six feet in width of practically pure barite. This was left in place as much as possible. The result today is that there is available for immediate production these widths of barite, many analyses

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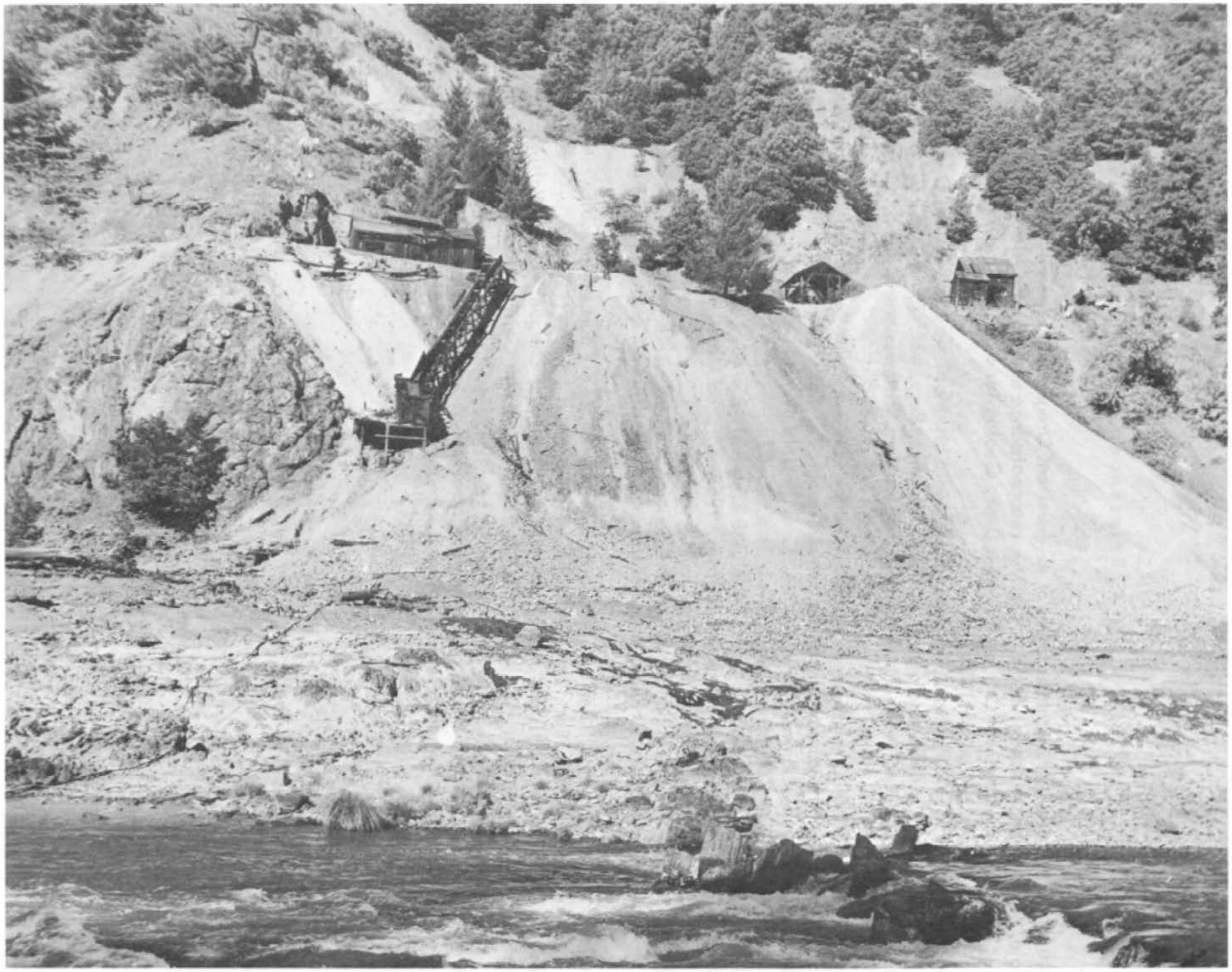
* During World War II, elemental sulfur was in short supply for use in Northwest pulp mills, and natural resource agencies, including the Oregon Department of Geology and Mineral Industries, investigated availability of pyrite from which SO_2 could be obtained. Hence the inquiry by the author directed to Holdsworth.



Almeda mine dump at river level, photographed about 1957.

of which show 99% and better $BaSO_4$. There is also a much greater width of ore which will give a low grade copper-gold concentrate (but commercial at that) and from this same ore a very high grade barite concentrate can be produced."

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* * * * *

APPENDIXES

APPENDIX 1

ABSTRACTS OF PUBLISHED REPORTS ON THE ALMEDA MINE

1. Diller, J. S., 1914, Almeda mine (in Mineral resources of southwestern Oregon): U.S. Geol. Survey Bull. 546, p. 72-81.

Development. The mine is developed by underground openings more than 1,000 feet in length on the strike and 800 feet in depth by adit tunnels above the river and by a vertical shaft reaching about 400 feet below the river with crosscuts and levels every 100 feet, as shown on the Holdsworth map.

Geology. The property is "near the southwest border of the Galice Formation (dark slates) along its contact with an igneous rock on what is generally known in the region as the Big Yank Lode." The igneous rock is closely related to quartz porphyry or aloskite. It has a dark gray color when fresh but is stained variously gray, green, yellow, or red in places, especially when influenced by surface conditions. Texture is sparingly porphyritic; phenocrysts are quartz and plagioclase feldspar in a fine granular groundmass of quartz and feldspar. It is cut by shearing planes and is deeply oxidized. As it is highly siliceous, it does not disintegrate readily, and forms ridges or ledges on the surface.

Faults are common in the slates near the contact. Two small parallel overthrust faults on the road east of the shaft house displaced a dike in the slates with an underthrust of 4 feet to the northwest. The faults strike N. 15° E. and dip 50° NW.

Slates near the contact are sometimes indurated by the quartz porphyry. On the 300-foot level within a foot of the contact the slates, usually dark, are baked light gray and are very hard. Calcite seams occur, especially on the shearing planes.

The contact between the slates and the igneous rock may be traced for more than 20 miles N. 30°E. from Briggs Creek valley to Cow Creek at Reuben Spur. It dips to the southeast in the same direction as the slates. The plane of contact is a fault and is followed by the lode. The contact is most irregular in the vicinity of the ore bodies.

500 level. Diller says: "According to Mr. Holdsworth, the 96-foot crosscut west from the 500-foot level traverses 'metamorphosed slate' and the contact is still farther west beyond the end of the crosscut."

Diller sampled on this 500-foot crosscut at both ends and two intermediate points. Near the shaft the rock is in places heavily impregnated with pyrite; sometimes as much as 25 percent is FeS_2. At 12 feet from the shaft and from that point to the end of the crosscut FeS_2 is less "conspicuous."

Gypsum was found in this crosscut in veinlets and bunches, and seems to increase toward the western end.

The samples taken on the 500-foot level were assayed by Burlingame & Co. and returned gold, $0.20, and silver, trace. Copper is not mentioned. These samples were (1) "near the shaft" and (2) "12 feet west of the shaft."

Diller said that the contact between quartz porphyry and slates on the 500-foot level appeared to be at the foot of the shaft, and that the crosscut for 96 feet west of the shaft was highly siliceous. He considered the rock quartz porphyry, not metamorphosed slate as described by Holdsworth. Diller confirmed his opinion by petrographic study of thin sections, which showed that the rock still retained much of the original structure of the quartz porphyry impregnated with pyrite and strongly contrasted with samples of indurated slate found elsewhere in the mine. He expressed the opinion that the ore horizon is on the contact near the foot of the shaft at the 500-foot level.

Ore deposits. Diller describes the character of the ore as of two types - one type copper sulphides with barite as the principal gangue mineral, and the second type siliceous gold-silver ore reported by Holdsworth but not examined by Diller. "The copper ore is rich in pyrite and barite, usually having a smaller percentage of intermingled chalcopyrite and in places some bornite. Gray copper ore, tetrohedrite, has been reported, but its presence could not be demonstrated."

300 level. "Rich copper ore" was noted by Diller near the indurated slates on the 300-foot level a short distance north of the crosscut from the shaft.

The ore throughout is a replacement type and is in general on altered and mineralized porphyry. A sample by Diller taken just north of crosscut on the 300-foot level gave Cu, 6.02 percent; $BaSO_4$, 68.21 percent (USGS analysis). The same sample gave Au, 0.10 ounce and Ag, 7.78 ounces as assayed by Burlingame. Diller says "the sample was evidently one of the best of the baritic ore."

Holdsworth reported to Diller concerning the siliceous gold-silver ore: "The 300-foot level was driven 120 feet farther to the west after you were here, and all in commercial ore. No footwall yet. The 'porphyry' at this point has been entirely replaced by the siliceous ore, but comes in again on the south drift on this level." Holdsworth reports that the average analysis of the siliceous gold-silver ore in the "upper levels" showed Cu, 0.3 percent, Au, 0.14 ounce per ton, Ag, 6.40 ounces per ton; also "In the lower levels this ore gives about the same analysis, but the gold content is very much higher. In fact, the muck from the 120-foot crosscut west from the 300-foot level, where you saw it, was all run through the smelter, and though the shoot proper at this point is only about 60 feet wide the muck from the 120 feet averaged: Au, 0.90 ounce; Ag, 3.2 ounces; Cu about 0.3 percent. In fact, the ore body at this point has the greatest showing that I ever saw in any property."

At the time of this correspondence with Diller, Holdsworth sent him high-grade gold-ore samples - one, No. 9, labeled "300-foot level, gold 18.64 ounces per ton; silver, 5.90 ounces per ton"; another, No. 10, labeled "300-foot level, gold 9 ounces per ton, silver 5.96 ounces per ton." Diller had the No. 9 sample assayed by Burlingame, who returned 16.88 ounces of gold and 10.92 ounces of silver per ton.

Siliceous ore. Diller reports, "Practically all the samples of ore I collected in the Almeda mine comparable with those sent me by Mr. Holdsworth are of the baritic type. The only siliceous material I collected was taken from the crosscut west from the 500-foot level, and thin sections show this to be quartz porphyry impregnated and partly replaced by a very low-grade pyritic ore." He does not mention copper in this material. Diller says that he believes that this low-grade material lying immediately west of the copper ore and contact is fairly representative. He says it is "well exposed on the surface by the river and up the slope by the mine especially on the road near 'the smithy' where the quartz porphyry is impregnated with pyrite more or less irregularly for more than a hundred feet from the contact, but the great body of impregnated rock, judging from its physical aspects, does not appear to carry important ore."

Ore bodies. Diller says that the ore occurs in "bunches," in miner's terminology, with longest dimension up and down and the shortest directly across the contact. The ore is lenticular in form, with greatest extent in the plane of the contact and pitch southwest approximately parallel to the slope of the surface, where it may have a continuity of about 600 feet from the shaft crosscut on No. 1 level (520 feet elevation) to the stopes in tunnel No. 3 (794 feet elevation) and beyond to the gossan on the surface, nearly 400 feet above the level of the river. "The greater prominence of the gossan on the upper slope northeast of the shaft is evidence that ore shoots rise in that direction." It is probable that a second ore shoot occurs farther northeast, judging from a letter by Holdsworth to Diller which states that extensions of tunnel No. 1 and level No. 1 show a second shoot of ore parallel to that in the stopes and "lying approximately with the slope of the hill." Diller comments that "the rich ore body on the 300-foot level would appear to belong to a deeper shoot." He thought possibly this would be the "second shoot" mentioned by Holdsworth, in which event the ore deposit on the 500-foot level would be 200 feet or more south of the shaft. Therefore, according to Diller, "the ore should be looked for in the contact along the 500-foot level south of the shaft."

Diller says that definite walls limiting the ore body appear chiefly, if not wholly, on the east side, adjoining the slates "...but on the west side, as far as observed, the ore appears to grade into country rock richly impregnated with pyrite."

The gossan was well exposed to Diller's view by an open cut 12 feet wide and 15 feet deep. It was stained yellowish and brown by limonite and composed largely of barite in small crystals or porous tufa-like masses. This baritic gossan may be 20 to 50 feet thick but could not be thicker than 80 feet below the gossan opening, for at that level tunnel 3 on the strike of the ore shows fresh pyrite. A zone of enrichment is not exposed. The porous barite gossan is a secondary deposit derived directly from the pyritic material.

Origin of ore. Diller says, concerning origin of the ore, that the quartz porphyry is impregnated with pyrite more or less irregularly for more than a hundred feet in places from the contact, and the amount of pyrite increases generally toward the contact where locally the quartz porphyry was completely replaced and pyritic ore formed. Dikes of dacite porphyry cut the slates near the contact. Several of these dikes are exposed in the road bluff by the shaft house. One that is greatly altered and full of vein quartz with disseminated pyrite may be seen in the slates on the 100-foot crosscut to the 100-foot level.

The dacite porphyry dikes mark the final stage of the ore deposition. The intrusives caused heated solvents to circulate through the rock, dissolving some minerals and depositing others in their stead.

In conclusion, Diller briefly describes the small matting furnace and its operations.

2. Winchell, A. N., 1914, Petrology and mineral resources of Jackson and Josephine Counties, Oregon: Oregon Bureau of Mines and Geology, Mineral Resources of Oregon, Vol. 1, No. 5, p. 207-214.

History. A brief history of the Galice district is given in leading up to a description of the mine proper. Placer mining on Galice Creek began about 1854 and continued with diminishing activity. By 1880 the small placers were in the hands of Chinese. In 1883 Galice Creek district had an output estimated at $8,000. In 1886 quartz-mining activity increased in this area and in the nineties became prominent also in the Mount Reuben district. "In 1905 the Almeda mine was already in course of development and in 1908 a 100-ton matting furnace was built at the mine." In 1908, 3,000 feet of development was done at the Almeda. In 1912 the Almeda smelter was operated for 30 days and for about the same length of time in 1913. (This was the year of Winchell's examination.)

Geology. The ore deposit was especially valuable for its copper content, according to Winchell. A zone of faulting occurred along a contact between dacite porphyry and argillite assigned to the Galice Formation of the Jurassic on the basis of fossil evidence found about 100 feet east of the mine. He refers to the Diller report in describing the extent of the contact and also the amount of underground development at the mine. Winchell says that Diller classified the porphyry footwall as quartz porphyry or alaskite. "However, the rock contains phenocrysts of plagioclase and quartz in a matrix of plagioclase, quartz, epidote, chlorite, magnetite (ilmenite), and possibly a little orthoclase, but clearly not much. Mineralogically it is therefore a dacite porphyry."

Development. Winchell describes the underground development as follows, beginning with the highest adit:

No. 4 adit begins in porphyry. At 40 feet it intersects the vein which strikes N. 48° E. The first crosscut to the west terminates in the vein which here strikes N. 4° E. and dips 86° W. The crosscut eastward ends in a porphyry dike in argillite. This dike strikes N. 30° W. and dips 60° N.E. At 150 feet from portal the adit again enters the vein with normal argillite hanging wall. The same vein probably is continuous to the breast, although it is not followed all of the way.

Adit No. 3 is in vein material on much of its course. Twenty feet from the breast it cuts a fault with 2 to 3 feet of soft gouge which strikes N. 36° W. and dips 60° N.E. The crosscut west is in vein material and mineralized porphyry all the way. The crosscut east cuts 40 feet of porphyry and then intersects vein material which grades into a stoped ore body. Adit 3 east passes from argillite to porphyry at 55 feet from the portal. The contact here strikes N. 20° E.

Adit 2 is in vein material which opens into stoped ground 140 feet from the portal and 120 feet beyond this adit cuts the argillite hanging wall after intersecting a fault striking N. 50° W. and dipping 55° N.E. At a point 75 feet farther, the hanging wall is offset 20 feet to the east by a fault striking

N. 68° W. and dipping 36° N.E. At the breast the hanging wall of the "main vein" strikes N. 30° E. and dips 75° E.

Adit 1 W. begins in porphyry; then is in "low grade ore" between 40 and 75 feet from the portal; passes a fault which cuts off the porphyry at 195 feet from the portal. Here the hanging wall strikes N. 15° E. and dips 40° E. At 120 feet beyond this the drift turns to follow a fault striking N. 42° W. and dipping 55° N. E. offsetting the hanging wall 125 feet N. W. as measured on the fault plane. Crosscuts west are in altered porphyry, probably somewhat mineralized. The longest one shows a vertical wall at the breast striking N. 4° W. The south crosscut to the east cuts porphyry and goes into "low-grade ore" 15 feet from the main entry. The next crosscut to the east enters argillite hanging wall striking N. 10° E. about 30 feet from the main drift. Adit 1 E. cuts ore at 70 feet from portal by penetrating the argillite hanging wall which strikes N. 12° E. and dips 70° E.; 150 feet farther on the adit passes into the hanging wall and into vein material at 350 feet from the portal. North of a raise here the hanging wall dips only 48° E. It is evident that, judging by stopes, the ore shoot rakes south and is roughly parallel to the surface.

"Level No. 1 on the river adit" (note change in naming from "adit" to "level") is in argillite and slate generally. At 50 feet from the portal it cuts the hanging wall and follows it to the breast except for two "stretches" of 60 feet and 120 feet respectively in argillite. On this level the hanging wall dips 80° E. but near the breast it dips 60° W. The average strike is N. 10° E. varying from N. 50° E. to N. 30° W. "Very little stoping on this level."

(Note: Winchell visited the Almeda in September 1913 and the mine workings below the No. 1 level or river adit were inaccessible. Since he could not see these lower levels, he quotes Diller concerning them, as has been done previously in this report.)

Ore deposits. Winchell concludes his reports thus: "The copper ore near the hanging wall has a gangue of barite with very little quartz and occasional seams of calcite. The ore contains pyrite, chalcopyrite, bornite, chalcocite, sphalerite (pyrrhotite), galena, malachite, azurite, melaconite (?), native copper, native gold, barite, quartz, calcite, sericite, serpentine (?), and celestite (?).

"The barite copper ore is in masses lying near the hanging wall and generally 6 to 15 feet thick. But pyrite has penetrated the porphyry to much greater distances and in some places it contains enough gold to make a low-grade ore. Such ore is quite different from the baritic copper ore, being a siliceous pyritic gold-silver found west of the former, and more irregular in occurrence. If the whole mass of pyritized porphyry could be mined at a profit, the future of the Almeda would be assured, because the pyrite extends in places at least 150 feet into the porphyry but most of this material is too low grade to work."

3. Shenon, P. J., 1933, Copper deposits in the Squaw Creek and Silver Peak districts and at the Almeda mine, southwestern Oregon: U.S. Geol. Survey Circular 2.

Production. Under the heading "History and production," Shenon reports that from 1911 to 1916 the mine produced 16,619 tons of ore that yielded 1,539.87 ounces of gold, 48,387 ounces of silver, and 259,800 pounds of copper. (These amounts mean assays of 0.092 ounce gold, 2.91 ounces silver, and 15.6 pounds of copper for recovered values [F.W.L.].) In addition, Shenon reports 7,197 pounds of lead was produced from 5,189 tons of ore during 1913, 1915, and 1916. No lead was reported in 1911, 1912, and 1914. Gross value according to these figures was estimated (by Shenon) as $108,000.

These production figures are the same as reported to the Department by the U.S. Bureau of Mines and are at variance with those calculated from the mine files as estimated on page 9 of this report. Parts of Shenon's report are omitted here, since they refer to Diller and Winchell which have previously been covered.

Geology. "The mine is near the contact of the Galice Formation and a thick series of greenstone rocks. Near the contact both formations have been intruded by sill-like bodies of porphyritic dacite. At least six of these bodies are found in the Galice beds within a distance of 800 feet to the east of tunnel 1, and several of them are exposed in the greenstone rocks west of the Almeda mine. All of the formations strike approximately north and are vertical or dip at very steep angles east or west....

"The greenstones consist of greatly altered even-grained and fragmental igneous rocks containing much secondary chlorite and epidote.

"The porphyritic dacite, where fresh, is a dark-colored rock with abundant large phenocrysts of dark-green hornblende, less abundant and smaller crystals of plagioclase, and a few scattered quartz phenocrysts which are noticeably rounded. The appearance of the porphyritic dacite changes gradually, depending upon the amount of mineralization, from the fresher rock just described to a rock in which the feldspars have been altered almost entirely to sericite, from that to a rock composed almost entirely of silica and fine-grained pyrite but retaining shadow outlines of the original texture, and finally to the sulphide ore, a rock composed essentially of fine-grained quartz, barite, and massive sulphides in varying proportions. The microscope shows that the feldspar of even the fresher appearing porphyritic dacite is mostly altered to a mass of saussurite, calcite, zoisite, and epidote. Unaltered areas remaining here and there have the composition of andesine. In the fresher-appearing rocks the hornblende is only slightly altered, but near areas of mineralization it has been changed to masses of chlorite, epidote, and zoisite, and finally in the silicified rock it has been almost entirely replaced by fine-grained quartz. The groundmass of the fresher rock is composed of very finely granular feldspar and quartz, sausseritic material, and chlorite....

"Although classified by Diller as a quartz porphyry or alaskite, the porphyritic rock described above is both mineralogically and chemically a porphyritic dacite."

Ore bodies. Shenon says that the richer ore shoots are in silicified rock that has been partly or wholly replaced by barite and sulphides. The mineralized zone varies in width but at the Almeda mine is about 200 feet wide. Two types of ore have been described by Holdsworth and Diller, "siliceous gold-silver ore" and "copper ore with barite." The first class is in the dacite and is essentially quartz but retains pseudomorphic relics of the original texture as shown in thin sections. Two and possible three generations of quartz are found. One and possibly two preceded the sulphides and one clearly cuts the sulphides. Barite is sparingly present and was introduced after the older quartz but before the sulphides.

Shenon reports that he cut three samples of the "siliceous gold-silver ore" believed to be representative of the places sampled, but they returned only very low values. The samples were taken in west adit of level 1 and represented widths of 10 feet for one sample and 20 feet for the other two. Concerning the "copper ore with barite" Shenon says that "a longitudinal section of the mine workings above the Rogue River indicates that two mineralized zones have been partly mined but that most of the production has come from one that is more or less parallel with and from 20 to 50 feet below the surface.... The shoots of better grade ore range in thickness from a few feet to 60 feet and in length from less than 100 feet to over 200 feet. The greatest known width is exposed on level 1 where the main ore shoot is 60 feet thick and 220 feet long. On the river level the greatest visible thickness is 15 feet but the entire thickness is probably not exposed."

In describing the higher grade shoots, Shenon says, "Some specimens clearly show veinlets of sulphides cutting coarse-grained barite. The sulphides include pyrite, chalcopyrite, galena, sphalerite, chalcocite, and covellite. Pyrite is by far the most abundant. It occurs throughout the mineralized zone but is concentrated as massive bodies in the richer ore shoots. The pyrite is cut and replaced by all the other hypogene sulphides and the covellite, which is clearly supergene. In the better grade ore exposed in the accessible stopes tiny veinlets containing covellite are plainly visible cutting the other sulphides and the gangue minerals."

Shenon says that "numerous faults cut both types of ore. Strike faults are made evident in places by gouge seams and shattering in the ore. Other faults, particularly those striking about N. 50° W., have offset the ore in many places.

"Both siliceous and copper-barite ores have greatly leached outcrops. The siliceous ore at the surface is a white rock, resembling quartzite. It contains many spots that are porous, owing to removal of pyrite. The outcrop of the copper ore is strongly stained yellowish and brown by iron oxides and is composed largely of porous aggregates of barite and quartz. Oxidation is not abundant, however, in either type of ore at depths exceeding 50 feet below the surface. Sulphide enrichment is made evident in the stopes by the presence of tiny veinlets of covellite cutting both gangue and primary sulphide minerals."

Origin of the ore. Shenon states that other bodies of dacite have intruded argillite beds, but so far as known the only contact that has been extensively mineralized is the one at the Almeda mine. "Faulting along the contact probably caused the development of fracturing through which the quartz has so plainly penetrated the rocks. Replacement occurred near the contact in both porphyritic dacite and argillite, but in the argillite to a much lesser degree. After intense silicification and possibly pyritization, the brittle silicified rocks were again fractured. Barite and probably additional quartz were introduced along the fractures and particularly along the zones of greatest shattering. After the barite, sulphides were introduced - pyrite first, and then the other sulphides, apparently as an overlapping series. Like the barite, the sulphides tended to follow the zones of most intense shattering, which, as shown by the concentration of barite and sulphides developed close to the contact of porphyritic dacite and argillite, thus forming the higher grade ore shoots....Ultimately erosion brought the ore bodies close to the surface, and oxidation attacked the sulphides....However, erosion has nearly kept pace with oxidation so that today there is but a thin zone of oxidized minerals."

Economic considerations. In his discussion of economic considerations Shenon stated that two possibilities seemed to be evident: (1) Development of "an enormous tonnage of very low grade ore that would be minable when metal prices recover," and (2) developing and working smaller shoots of higher grade ore. [(2) could, of course, be combined with (1). FWL]

Shenon writes, "Without question there is at the Almeda mine, an enormous deposit of silicified rock containing variable mounts of pyrite and some silver and gold. This is the 'siliceous gold-silver ore' mentioned by Diller. When conditions are favorable for the exploitation of large low-grade deposits containing silver, gold, and copper, consideration should be given to the mineralized zone at the Almeda mine....

"Mining has demonstrated the occurrence of good-sized bodies of the richer ore. At least two have been partly developed. The larger and higher grade body has been partly blackout out for a pitch length of about 800 feet. The smaller body lies about 250 feet north of the larger one and has been only slightly developed. It is not known to the writer whether the continuations of these bodies were found on the levels below the river.

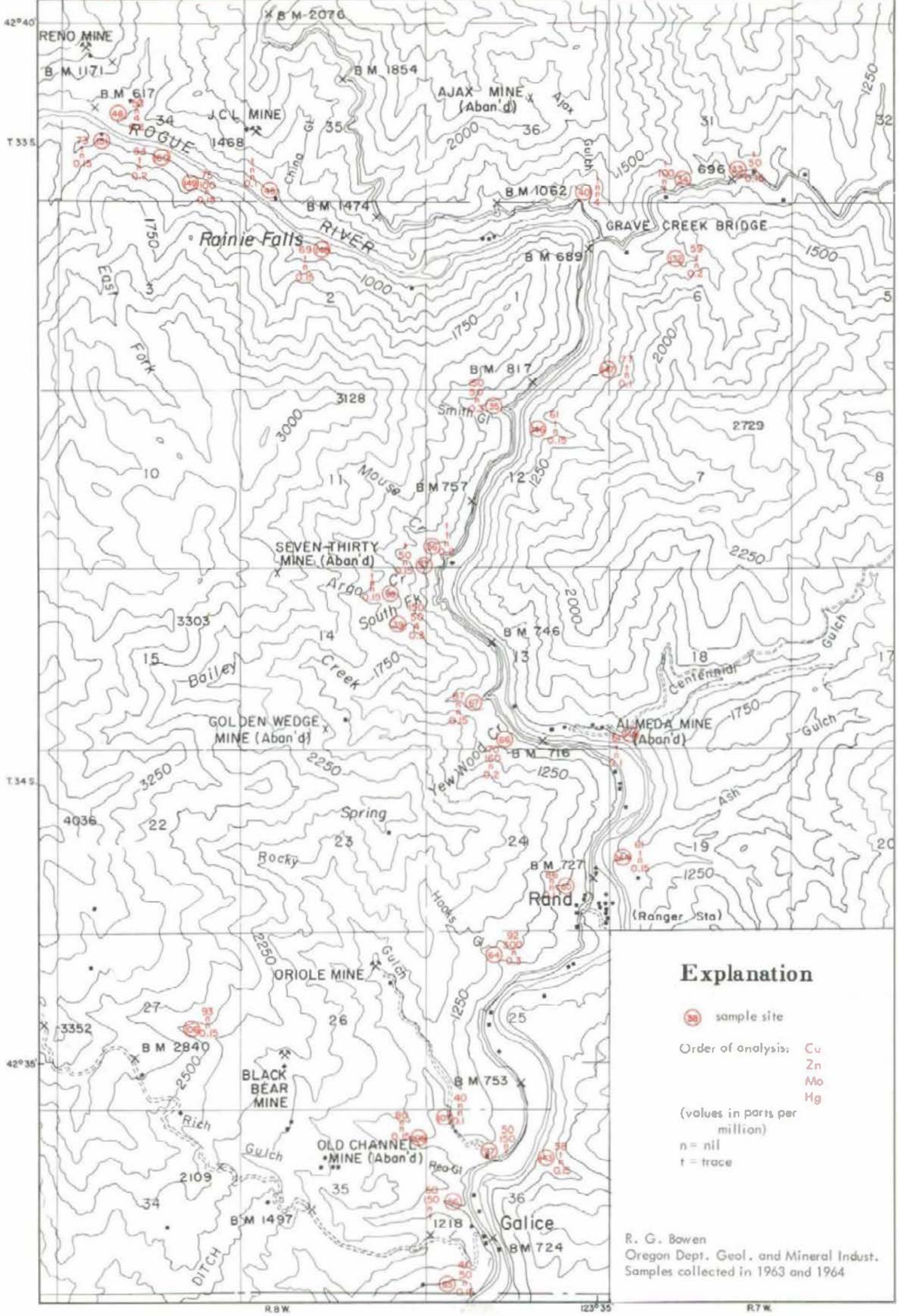
"The south ore body is practically as long on the river level as on level 1, a hundred feet above, and if it has not been found on the 300-foot or shallower levels below the altitude of the Rogue River, the reason is probably that prospecting has not been carried far enough to the south. The north ore body has not been developed sufficiently to determine its pitch. However, it apparently has not been found on the river level. Diller has suggested that the ore found near the shaft on the 300-foot level might be the extension of this body. However, if the pitch is approximately constant, it should have been intersected by the river level. Therefore, it seems probable that the north ore body has a steeper pitch than the south ore body, and that the ore body on the 300-foot level may be a separate one. This inference is in accord with the interpretation of the origin of the ore - that is to say, the higher grade shoots might be expected along the argillite contact wherever intense shattering formed permeable openings for the ore-bearing solutions to follow.

"The shoots of richer ore have been found at or very close to the contact of argillite, and there is a possibility that careful study might reveal undiscovered shoots along the contact of the Big Yank lode. The outcrops of the better ore differ considerably from those of the lower grade siliceous ore.

Secondary enrichment. "Sulphide enrichment undoubtedly increased the metallic content of theore near the surface. Tiny seams filled with supergene covellite are plainly visible in all the stopes examined. It is clear, however, that sulphide enrichment has not been the chief factor in the formation of the better grade ore shoots. Most of the minerals of the shoots are of hypogene origin, and hence their development was not dependent on surface agencies. The supergene minerals have affected the shoots only by adding somewhat to their metallic content, particularly to the copper and possibly the silver."

* * * * *

Analyses of Stream Sediment Samples from the Almeda Mine Area, Oregon



APPENDIX 2

GEOCHEMICAL INVESTIGATION OF STREAM SEDIMENTS IN THE ALMEDA MINE AREA, OREGON

By R. G. Bowen*

The accompanying geochemical map of the Almeda mine area represents a small part of the stream-sampling program which is currently being conducted in southwestern Oregon by the State of Oregon Department of Geology and Mineral Industries. The purpose of the Department's geochemical project is to collect basic data concerning the distribution of economic mineralization in the entire state. The procedure for sampling and analysis is summarized as follows:

> The sites sampled generally represent drainage basins from 1 to 5 square miles in area. Analysis of the sediment collected indicates the presence of mineralization in less than normal, normal, or greater than normal amounts in that particular basin. A deliberate effort is made at all times to obtain truly representative samples, and to take samples upstream from any visible sources of contamination.
>
> After the samples have been collected, they are dried, sieved, and sent to the geochemical laboratory in Portland. Here analysis is made by standard colorimetric methods. Metal concentration is expressed as parts per million of copper, zinc, molybdenum, and mercury. These particular elements were chosen for analysis because they represent indicators for most of the types of mineralization that might be expected in Oregon and also because the analytical methods for these elements are relatively uncomplicated. Because the analytical methods can detect extremely small amounts of metal, great care is taken to reduce the possibility of contamination, both at the sample site and in the laboratory.

The Almedo mine area has been extensively explored over the past 100 years, and there are numerous diggings on every mineral prospect. This introduces more metal into the drainage systems than normal, and probably gives several anomalies in copper and zinc that are due to contamination rather than to mineralization. Under such circumstances, the only way to determine the source of any particular anomaly is to perform extensive field checking.

The molybdenum and mercury background in the Almeda area is quite low, so the presence of more than 4 ppm molybdenum and 0.5 ppm mercury is anomalous. However, in an area such as this, the mercury anomalies could well be produced by old gold mills where amalgamation was used.

To make use of the analytical data given on the accompanying map, the first step would be to locate the areas of known mineralization and eliminate the anomalies that can be attributed to them. The anomalous sites should then be revisited and additional samples collected in the drainage area to see if the anomaly can be reinforced. After an anomaly is assured, the next step is to make a detailed search for surface expression. If none is found, a soil-sampling grid could be set up to localize the mineralization prior to using more conventional, but expensive, methods such as drilling and trenching.

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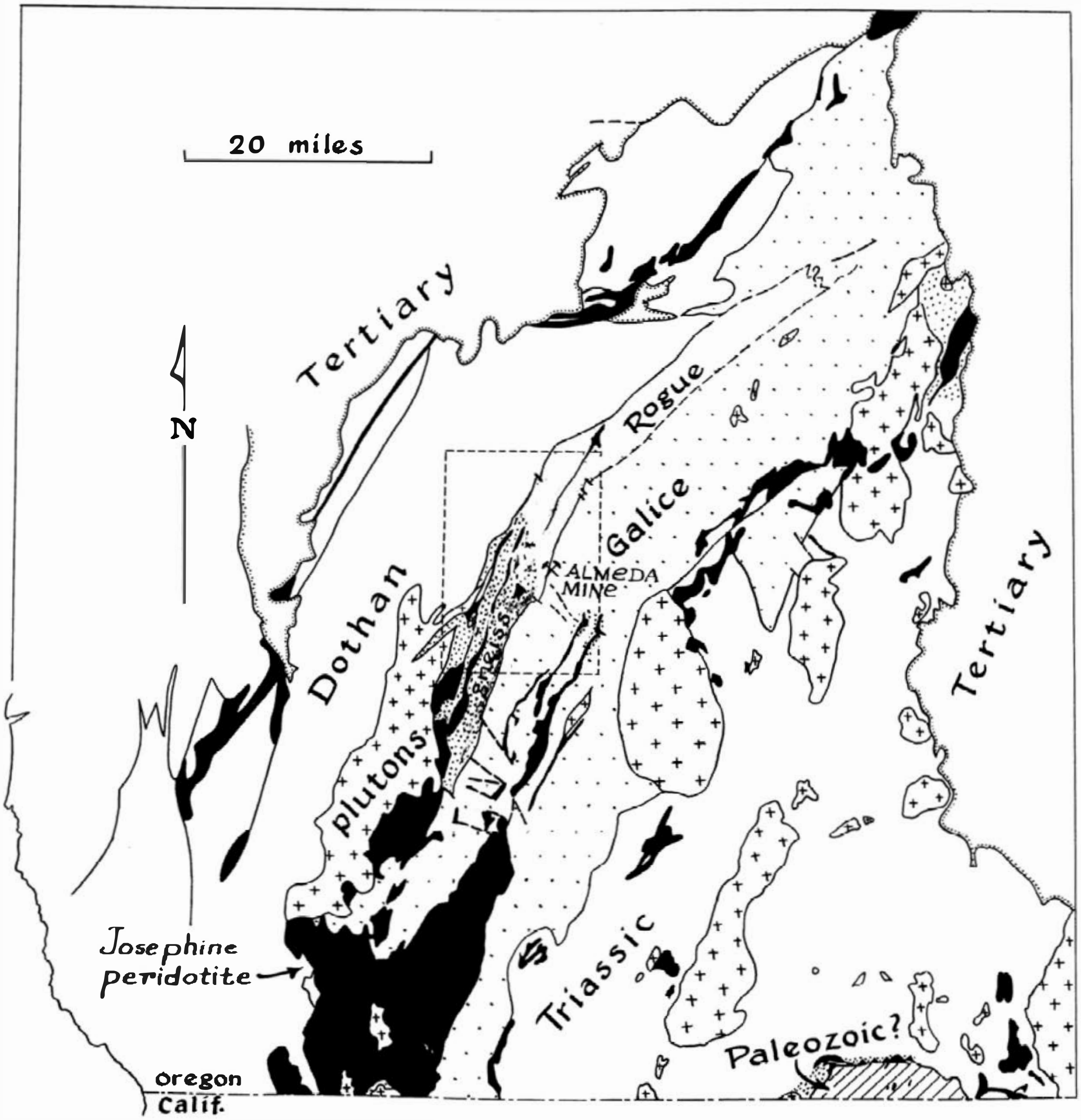

Figure 1. General geologic map of southwestern Oregon, modified from Wells and Walker (1953), Wells, Hotz, and Cater (1949), and Wells and Peck (1961), showing area of figure 2.

APPENDIX 3

TECTONIC FRAMEWORK OF MINERALIZATION, UPPER JURASSIC ROCKS, SOUTHWESTERN OREGON

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ABSTRACT

Epithermal veins in Upper Jurassic rocks in the Klamath Mountains of southwestern Oregon follow closely structural features associated with Late Jurassic Nevadan tectonism and post-Nevadan events. Geophysical studies indicate that gravity reflects directly the Nevadan tectonic pattern and is only slightly affected by later tectonic elements. Nevadan structures are characterized by northeast-trending folds and faults and largely conformable bodies of ultramafic rocks. As the gravity pattern indicates, northwest- to east-west-trending, post-Nevadan structures modify only slightly the Nevadan structural grain. Evidence from structural and petrographic studies points to Nevadan and post-Nevadan minerolization.

Introduction

The object of this paper is to define the major trends of mineralization within the framework of Upper Jurassic rocks in a relatively small region of the Klamath Mountains of southwestern Oregon (fig. 1). The results of mesoscopic* structural analysis, gravity observations and petrographic studies are employed to define the major structural features. In the Galice area, basic regional geologic mapping has been completed (Wells and Walker, 1953), as well as more detailed studies of individual mineral deposits (Ramp, 1961; Shenon, 1933; Wells, Page, and James, 1940; and Youngberg, 1947). Although all mining activity of significance ceased prior to 1943, the area is notable for its former production of free gold, both placer and lode, some silver, and sulfides of copper, lead, and zinc. In addition, numerous chromite deposits and prospects occur in association with the ultramafic masses.

The host rocks, mainly Upper Jurassic metavolcanic and metasedimentary strata, are typical of eugeosynclinal rocks of similar age found elsewhere in the orogenic zones of the circumpacific region (Barth, 1962; Turner and Verhoogen, 1960). The tectonic pattern of these and older rocks in southwestern Oregon is characterized by arcuate, northeast-trending lithic belts and generally concordant intrusive ultramafic-mafic masses and later intrusions of granitic** rocks. The ultramafic and gabbroic rocks are a part of the alpine ultramafic belt which trends through the Klamath Mountains of northern California and southwestern Oregon. Intrusion was nearly contemporaneous with deformation and

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* The term mesoscopic refers to scale and was introduced by Weiss (1959) to include bodies that can be effectively studied in three dimensions by direct observation; they range from hand specimens to large, continuous exposures.

** Granitic is used in this paper largely as a field term which includes all late phase dioritic, granodioritic, and related plutonic intrusive rocks.

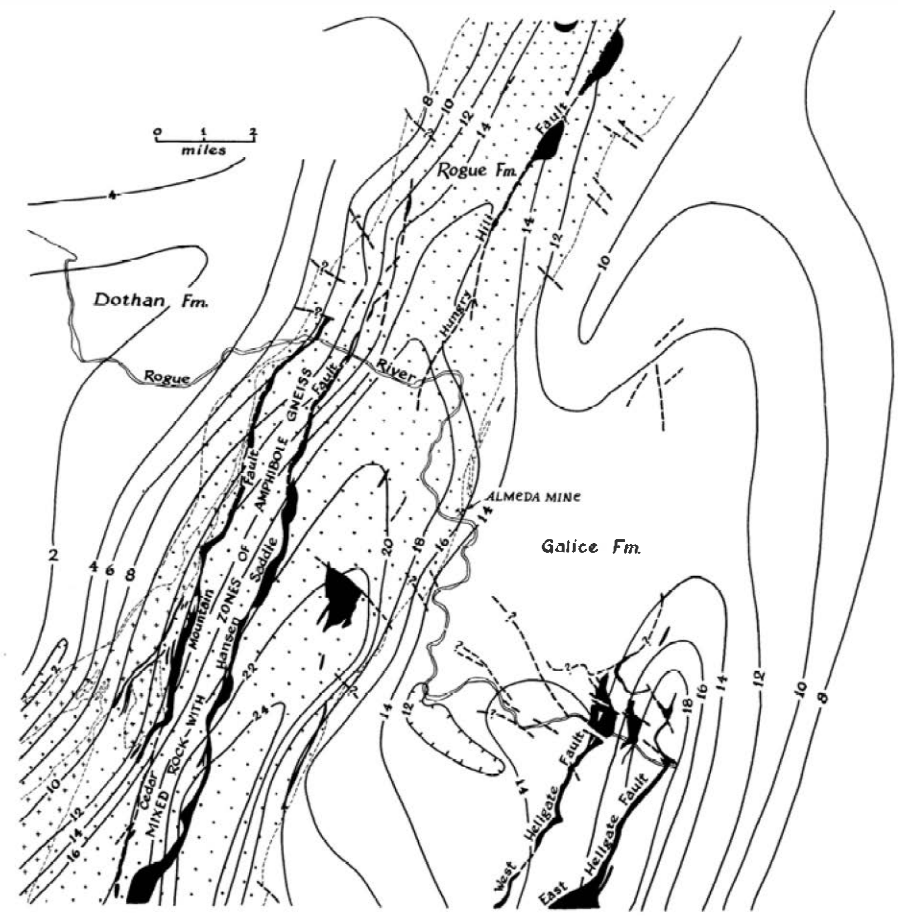

Figure 2. Bouguer gravity map of the Almeda mine region. Gravity from Kays and Bruemmer (1964), geology from Wells and Walker (1953).

metamorphism during Late Jurassic Nevadan orogeny (Irwin, 1964). The Coast Range orogeny in northern California, which probably began during Late Cretaceous, also influenced the structure of the Klamath Mountains but to a much lesser degree than did the Nevadan (Dott, 1965; Irwin, 1964). The Nevadan orogeny was responsible for the northeast-trending pattern of folds and faults, whereas later orogeny produced a pattern of west- to northwest-trending faults with only minor folding. Mineralization is associated with both patterns; recognition of these patterns is crucial to further exploration and development.

Character of Nevadan Deformation

The tectonic framework and gravity observations

The gravity map shows several significant features (figure 2); the most important is the fact that gravity appears to reflect directly the Nevadan tectonic pattern and to be only slightly affected by later tectonic elements. Of particular note are the two narrow, elongate, northeast-trending gravity maxima which correspond to more dense (2.85-2.97 g/cc) recrystallized metavolcanic strata of the Rogue and Galice Formations. The more intensely metamorphosed metavolcanic rocks are marked by centrolineal belts of intrusive ultramafic and gabbroic rocks, a feature which is characteristic of other more highly metamorphosed assemblages elsewhere in pre-Tertiary rocks of southwestern Oregon. Also apparent from the gravity map is the gentle northward "plunge" of the gravity maxima. The effect on the gravity distribution by adjacent less dense (2.64-2.69 g/cc) metasedimentary rocks of the Dothan and Galice Formations is noticeable in the steepness of the gravity gradient as these units are approached. Thus gravity minima occur over the less dense metasedimentary strata; the minima also trend northeastward and their values give an indication of closure and thus "plunge" similarly to the adjacent maxima. In the case of the Dothan Formation, closure is toward the north, whereas in Galice Formation strata closure is toward the south.

Summary of tectonic elements

Mesoscopic structural analysis indicates three deformations, two of which are Nevadan and one post-Nevadan. This is not to say that other deformations have not occurred, but only that these three are strongly developed and can be identified in other localities outside the area of this investigation. Nevadan deformations are identified as D_{n1} and D_{n2}. D_{n1} is correlated with deformation which produced isoclinal folds in the schistose and gneissic rocks in the southern and central portions of the Rogue antiformal zone. In the southern part of the Rogue Formation, planar and linear elements of the isoclinally folded ultramafic rocks and enclosing gneissic, amphibole-rich gabbroic rocks are conformable with those in the surrounding metavolcanic rocks. Axial plane cleavage and foliation surfaces of this type or generation are considered S_{n1}; fold axes and fold axis lineations are considered B_{n1}.

The staurolite and biotite zone assemblages in the southern part of the Rogue Formation are sheared along planes roughly conformable with the axial planes of folds. Chlorite zone assemblages supersede higher grade biotite and staurolite zone schists and gneisses and are associated with shearing and cataclasis. Shearing is more pronounced northward and toward the margins of the Rogue antiformal zone. Planar shear surfaces and linear features associated with them (elongated sheared clasts or elongated sheared aggregates of minerals) are considered S_{n2} and B_{n2}, respectively. B_{n2} is clearly representative of tectonic transport and is not to be confused with fold axes which result from plastic deformation. Cataclastic lineations coincide, however, with fold axis lineations of earlier D_{n1} folds and may be considered the sheared-out extensions of B_{n1} axes in the deeper fold systems. Cataclasis and shearing in metavolcanic rocks of the Galice Formation are also considered D_{n2}, but were not preceded by plastic deformation. The adjacent, less competent mudstones in the Galice Formation are in many places drag-folded along their faulted contacts with the more competent metavolcanic rocks. These structures are also considered D_{n2} and are largely conformable with those of D_{n1}.

Although it is difficult to decipher the chronology of mineralization on the basis of field studies alone, it is possible to show their relation with the major structural elements identified in this paper.

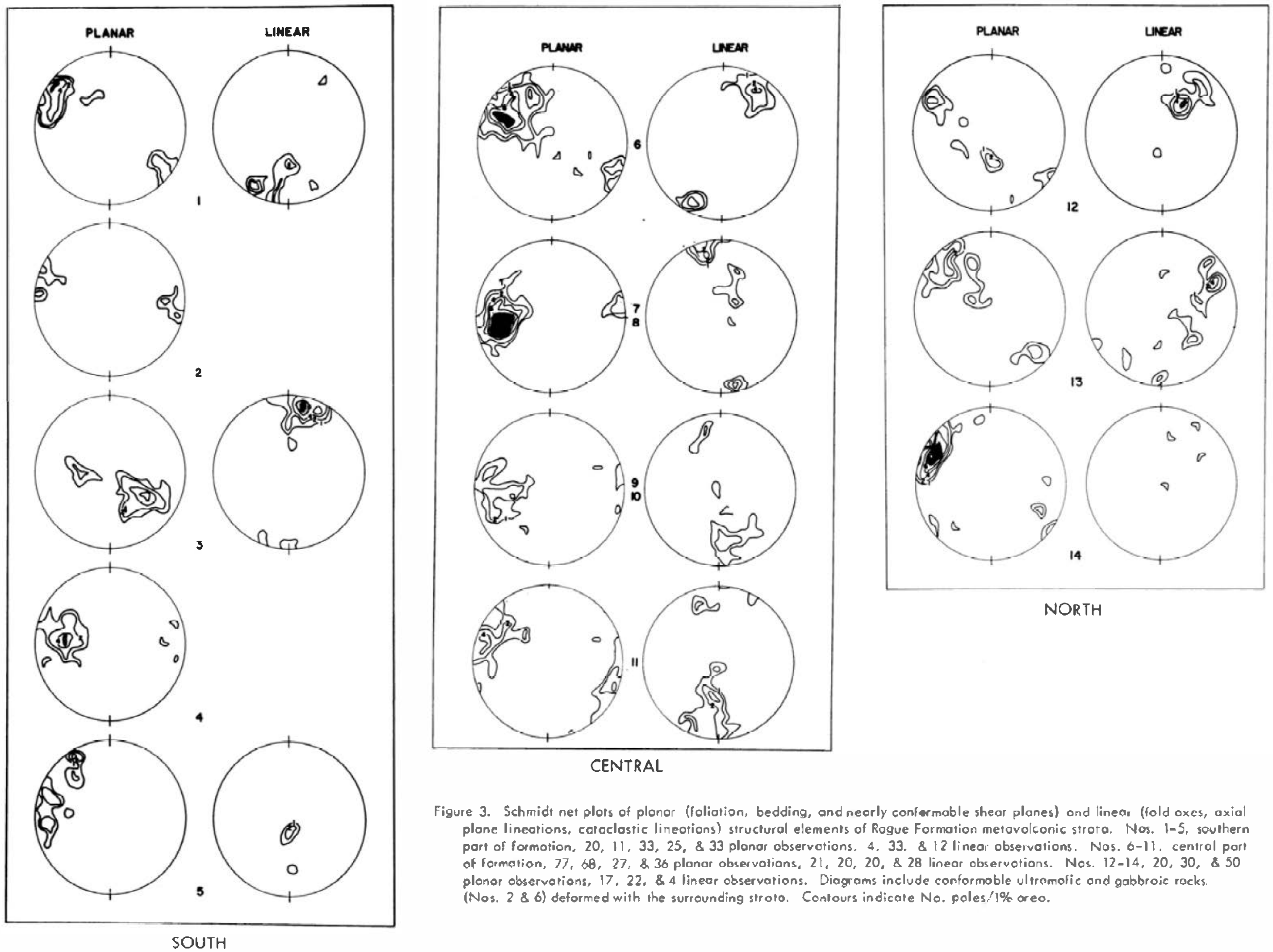

Figure 3. Schmidt net plots of planar (foliation, bedding, and nearly conformable shear planes) and linear (fold axes, axial plane lineations, cataclastic lineations) structural elements of Rogue Formation metavolcanic strata. Nos. 1-5, southern part of formation, 20, 11, 33, 25, & 33 planar observations, 4, 33, & 12 linear observations. Nos. 6-11, central part of formation, 77, 68, 27, & 36 planar observations, 21, 20, 20, & 28 linear observations. Nos. 12-14, 20, 30, & 50 planar observations, 17, 22, & 4 linear observations. Diagrams include conformable ultramafic and gabbroic rocks (Nos. 2 & 6) deformed with the surrounding strata. Contours indicate No. poles/1% area.

Veins and zones of mineralization, are, therefore, shown to follow closely planar and linear elements of D_{n1} and D_{n2} structures as well as later cross-cutting fault zones (post-Nevadan). It is suggested, on the basis of gangue mineralogy, that mineralization is both Nevadan and post-Nevadan.

Nevadan antiforms and facies assemblages

Rogue Formation: The major gravity high reflects the distribution of tight, isoclinally folded metavolcanic rocks of the Rogue Formation; the folds are reclined to the southeast and plunge largely north. The character of the folding is summarized on contoured Schmidt net diagrams* of structural localities along traverses at right angles to the strike of the Rogue Formation and extending 20 miles or so along strike (figure 3). The character of deformation changes from predominantly plastic to brittle from south to north and from the medial portions to the margins of the formation. These changes are also consistent with changes in facies assemblages from staurolite zone to chlorite zone in the same directions. All changes, therefore, are compatible with an elongate, northeast-trending and gently north-plunging macroscopic antiform**. Of particular note is the deformation and metamorphism of concordant intrusive ultramafic and gabbroic rocks with the surrounding silicic and basic Jurassic metavolcanic strata. Cretaceous granitic plutons are undeformed and unmetamorphosed.

Galice Formation: The other gravity maximum reflects the distribution of Galice metavolcanic rocks along a northeast-trending fault system. Although deformation of metavolcanic and ultramafic rocks has been largely affected by brittle cataclasis (crushing) and mylonitization (fine-grained brecciation), the combined results of mesoscopic structural analysis, gravity, and petrographic studies suggest that the major structural form is a northeast-trending antiform. Thus the structure appears to be similar to that of the Rogue Formation but of shallow-seated, brittle character. The cataclasized chlorite zone assemblages and centralized ultramafic intrusions mark the faulted axis of the brittle antiform. The intensity of deformation and the grade of metamorphism decrease away from axial zone of the structure; chlorite zone semi-schistose or phyllitic metasedimentary rocks and cataclasized metavolcanic rocks of the same grade change to essentially unaltered shales and graywackes and incipiently or incompletely metamorphosed "greenstones," respectively. Furthermore, near their faulted contacts with more intensely deformed and metamorphosed metavolcanic rocks, metasedimentary strata

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* Schmidt Net. The Schmidt equal-area net is used in this paper to show the orientation in space of directions of linear and planar features in the rocks. The net is one kind of representation of the surface of a sphere or globe on a plane surface. The coordinates of the net are meridians and parallels. The meridians, or north-south lines, are great circles which pass through the north and south poles and project through the center of the sphere; the equator is also a great circle. The parallels are small circles which project from parallel circular sections but do not pass through the center. The net is constructed in such a way that areas of intersection in the center are equal to those near the margins. Orientations of planar and linear features plot as points; planar orientations plot as lines. For ease in interpretation and in the mechanics of recording planar data, the normals or poles to planar surfaces may be plotted. The poles plot as points 90° from planar lines.

After the point diagrams have been prepared they may be converted into contour diagrams which show more clearly the areas on the hemisphere where the points are concentrated. The following contour diagrams figs. 3 through 8) are lower hemisphere, equal-area plots of planar (bedding, bedding-plane cleavage, foliation) and linear (fold axes and axial plane lineations) structural measurements in a restricted outcrop area or station. A large number of measurements at successive stations along a traverse provides insight as to the manner in which structural patterns change as a result of varying degrees and directions of deformation.

** Antiform. An arch of sedimentary or volcanic rocks folded upward, but in which the stratigraphic relationships are not clear, that is, it may be a normal anticline or an overturned syncline. In this paper antiformal zones are identified on the basis of mesoscopic structural data, gravity data, and petrographic information. Thus, an antiform is a tectonic element which has petrologic implications.

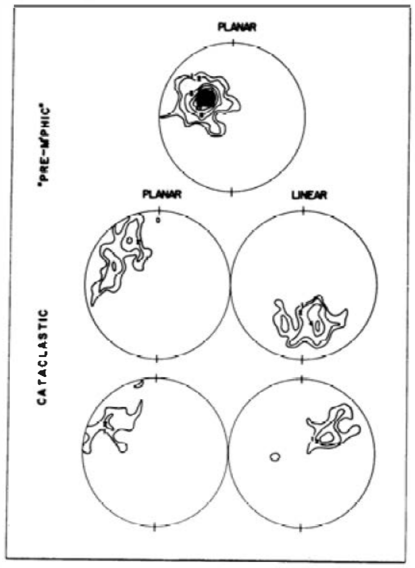


Figure 4. Schmidt net plots of planar and linear structural elements of Galice Formation metavolcanic strata and their change with progressive cataclastic deformation. Uppermost diagram represents initial layering of relatively undisturbed Galice metavolcanic rocks (112 observations); lower two diagrams represent cataclastic modification of layering in metavolcanic rocks (30 and 12 planar observations, 35 and 18 linear observations, respectively).

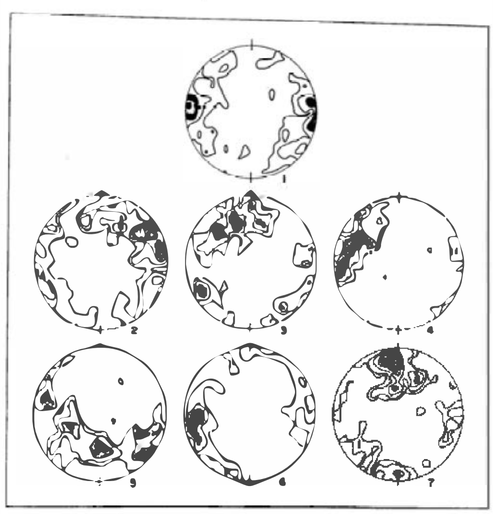


Figure 6. Schmidt net plots of progressively deformed reticulate joint system of ultramafic bodies. Nos. 1-5 indicate progressive change of ultramafic mass which intrudes Galice metavolcanic sequence. Nos. 6-7 further deformed during post-Nevadan events. No. 6 contact metamorphosed adjacent to granitic intrusion; reticulate joint system elongated parallel to contact. No. 7 folded and subsequently sheared along east-west axis. Nos. 1-7, 420, 235, 169, 139, 328, 125, and 92 poles, respectively. Contours indicate No. poles/1% area of net.

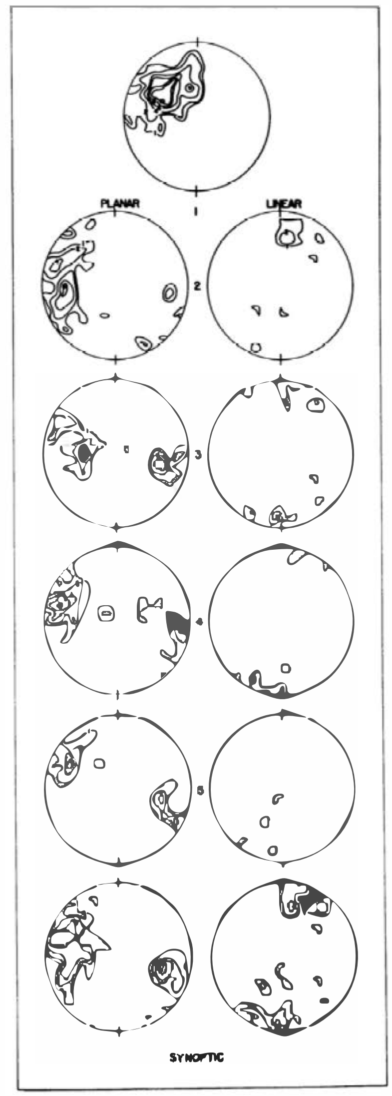


Figure 5. Schmidt net plots of planar and linear structural elements of Galice Formation metavolcanic strata and their change with progressive deformation. No. 1 represents relatively undeformed bedding (97 poles). Nos. 2-5 are folded along faults with more competent metavolcanic strata (65, 45, 49, & 31 planar observations; 11, 17, 11, & 4 linear observations). Synoptic, 190 planar, 43 linear. Contours indicate No. poles/1% area.

are folded and in some cases plicated. The sequence of partial diagrams of figures 4 and 5 indicates the progressive nature of change due to cataclasis in the metavolcanic rocks and to folding in the less competent metasedimentary strata, respectively.

Nevadan faults

High-angle faults are widespread and numerous throughout the Galice area, and, for that matter, throughout the whole region. Three major variants have been distinguished: (1) faults between lithic units of differing competencies, as for example, between metasedimentary mudstones and more brittle metavolcanic rocks; (2) faults along the axial zones of macroscopic fold structures which, in addition, are intruded by masses of serpentinized ultramafic rock; (3) movement along bedding or bedding-plane cleavage with attendant mylonitization and chlorite zone recrystallization.

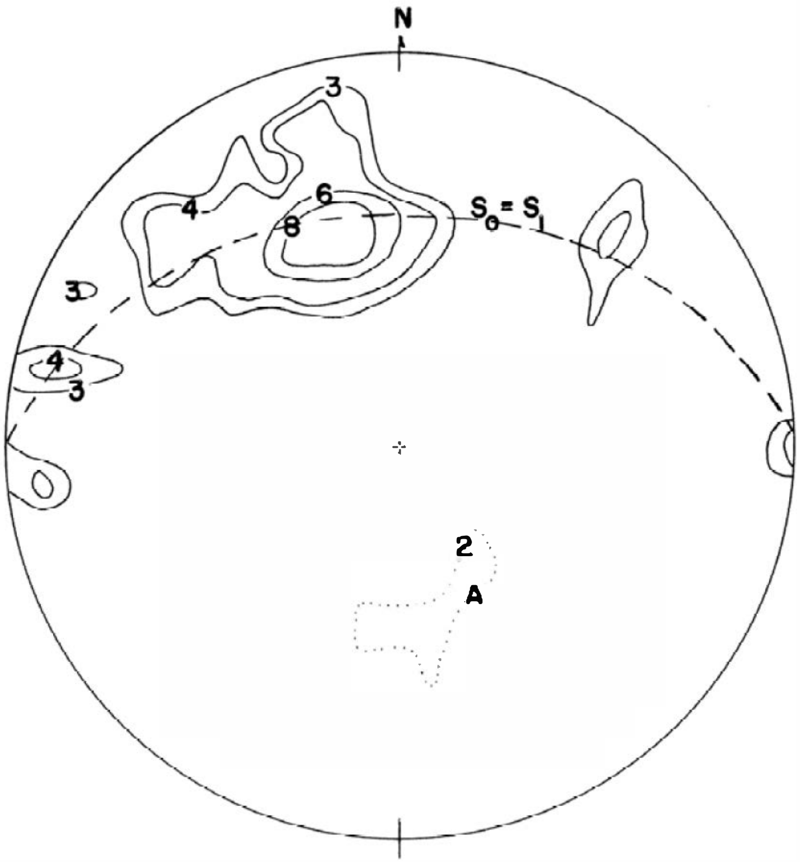
Although there are few, if any, examples of lithic units with unfaulted contacts, the best examples are between less competent mudstones and more competent metavolcanic rocks. Along the Rogue-Galice contact, for example, relatively incompetent Galice mudstones have been plicated against metavolcanic rocks of the Rogue Formation. The high-angle fault which separates the two units is nearly conformable to the foliation and folded bedding planes of both (compare structural patterns of localities 11 and 14, figure 3, with those of localities 4 and 5, figure 5). Although it is not possible to determine the amount of displacement along the fault, the character of folds in the Galice mudstones progresses from broad and open to tight toward the fault. Such a tendency implies progressive tightening due to movement along the fault.

Serpentinized peridotite, abundantly intruded along the axial zones of the major antiforms, is deformed with the surrounding rocks. In tracing the patterns of deformation in certain areas, it was observed that the least deformed and essentially unserpentinized masses of peridatite are commonly jointed in a reticulate or rhombic pattern. The pattern changes progressively and the character of change is of particular significance. For one, the initial or "primitive" well-formed reticulate joint system appears to reflect the initial diapiric character of intrusion which, in turn, is consistent with deformation along antiformal axes (see Hafner, 1951). Further movement along faulted antiforms tends to modify the joint system by shearing; shear planes in serpentinite and planar structures of the surrounding metavolcanic and metasedimentary rocks are largely conformable. The character of this change is described in the following summary:

(1) In general, the intersecting reticulate joints dip steeply east or west and trend northerly conforming roughly to the regional trend of the surrounding rocks; this pattern is especially well developed in the larger masses (No. 1, figure 6). In the pattern, three joint sets may be distinguished. Two are symmetrically disposed about the inferred stress axes (fold axes) and strike approximately N. 35° E. and N. 10° W., dipping 85° east and west, respectively. A third joint set strikes approximately N. 10° E. and dips 85° W. The first two joint sets may be considered first order formed at acute angles to the direction of maximum stress, the third joint set may be considered a product of tension parallel to the direction of maximum stress (de Sitter, 1964).

(2) As the ultramafic mass narrows, generally toward zones of cataclasis and shearing, the outcrop pattern is elongated parallel to the plane of shearing. In this case, the three-dimensional geometry of individual rhombs formed by intersecting reticulate joints tends toward two-dimensional or planar. Poles to sheared joints form crude girdles with local point maxima indicating the dominant joint set (Nos. 2 and 3, figure 6).

(3) As the extent of cataclasis increases, joint surfaces are slickensided and individual rhombs are subrounded through abrasive movement. In this manner, the central reticulated core decreases in size and there is a corresponding increase in the amount of planar, sheared serpentinite (No. 4, figure 6).



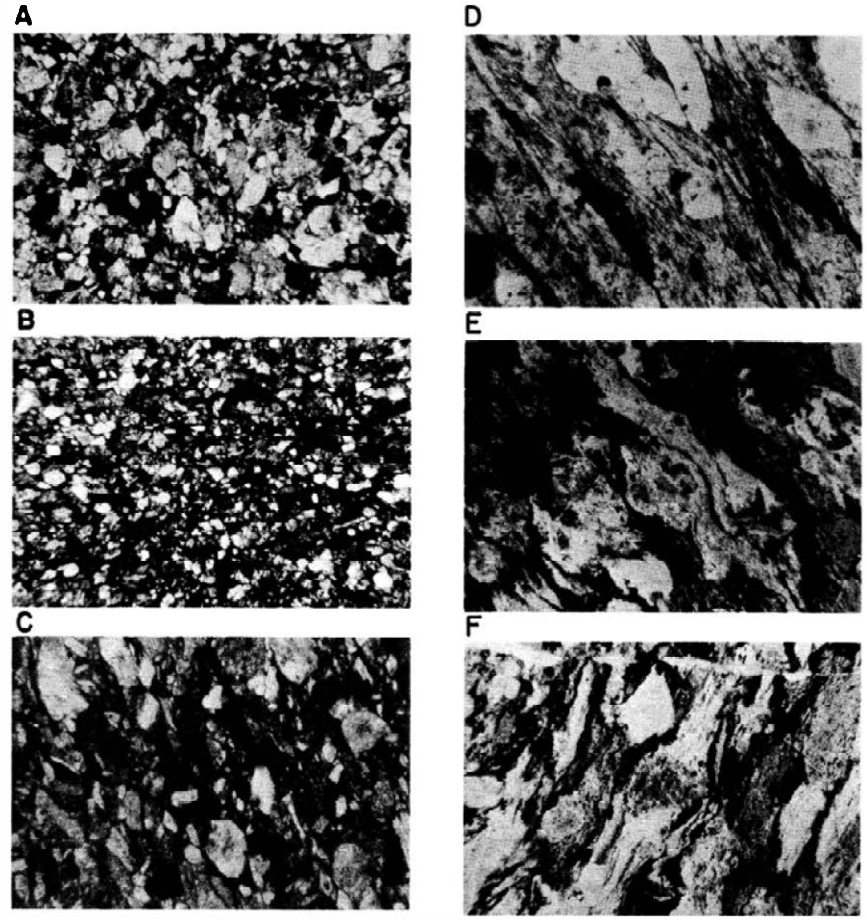


Figure 7. Schmidt net plot of foliation ($S_0 = S_1$) and fold axes (A) of isoclinally folded sequence of Galice Formation metasedimentary rocks. Rotation from the predominant Klamath Mountain trend is due to post-Nevadan deformation. Contours indicate No. poles/1% area; 117 poles to planar foliation, 13 fold axes.

The sequence of photomicrographs (A-F) shows the nature of progressive deformation-recrystallization in Galice metasedimentary rocks. Photomicrographs A and B are relatively undeformed and mildly deformed graywackes, respectively. Photomicrographs C through F are mylonitized-recrystallized rocks of the isoclinally folded sequence; recrystallization is closely related to progressive mylonitization by slip along bedding and bedding-plane cleavage. Magnifications are all 29x except for D which is 112x.

(4) In some cases, the shear planes occur wrapped around boudin-like, subrounded blocks of sheared serpentinite forming folds conformable with the shape of the enclosed mass (No. 5, figure 6).

These relations are summarized from observations along the faulted axial zone of the Galice antiform, beginning in the northern end of the Josephine peridotite sheet (Wells and others, 1949) and continuing north into the Galice quadrangle. In the foliated metavolcanic rocks of the Rogue antiform, planar sheared serpentinite and foliation of the adjacent schists and gneisses are largely conformable (No. 6, figure 3); the attitude of the planar sheared serpentinite is essentially that of the fault.

In all units, but particularly in the metasedimentary sequences, there is evidence for movement or slippage along bedding or cleavage planes. In a number of cases slippage appears concurrent with progressive tightening of folds resulting in mylonitization nearly parallel to bedding and bedding-plane cleavage. A series of photomicrographs illustrates the textures which result from such movement (figure 7); the Schmidt net plot of sheared bedding planes and fold axes indicates the isoclinally folded character at this locality. The mylonitization invariably results in chlorite zone recrystallization, and in particular the growth of chlorite and fine-grained sericite parallel to bedding-plane cleavage. Calcite, epidote, actinolite, quartz, and albite may also occur, depending on the initial rock composition.

Post-Nevadan deformation

The northeast-trending Klamath Mountain (Nevadan) tectonic pattern is slightly offset by generally steeply dipping, northwest- to east-west-trending faults and fractures. These structures are probably of several generations and may correlate in part with Late Cretaceous Coast Range orogeny (Irwin, 1964) and Tertiary Cascadan orogeny (Dott, 1965). Dott indicates that northwest-trending faults in pre-Tertiary rocks along the southwest Oregon coast have important lateral components of slip; the same is true in the Coast Ranges of northern California. In these two areas, movement is generally expressed in shear zones and the local occurrence of scattered patches of glaucophane schist. In both the California Coast Ranges and along the southwest Oregon coast, however, the more intense pattern of northwest-trending faults is far from homogeneous.

In the area of this investigation, although of similar trend, post-Nevadan deformation differs in many respects from that of the Coast Ranges of Oregon or northern California. In particular, thoroughgoing faults of northwest trend have not been mapped, and exotic blocks and scattered patches of glaucophane schist are not observed. Locally, less competent metasedimentary strata and serpentinite are broadly folded and sheared along northwest-trending axes (No. 7, figure 6). A later generation of faults and fractures appears to be largely tensional. The earlier set of shear zones is in some cases associated with chloritization, epidotization, and silicification. Such recrystallization appears to accompany mild cataclasis. In general, however, post-Nevadan deformation has only slightly modified the Nevadan tectonic pattern and recrystallization is strictly local.

Patterns of Mineralization

The most active areas of gold mining in the district were the Almeda mine, located along the nearly conformably faulted Galice-Rogue contact, and numerous localities along the Rogue River and northward toward Mount Reuben. Those in the Rogue River-Mount Reuben district are wholly within Rogue Formation metavolcanics and associated gabbro gneiss, and later quartz diorite which intrudes the Rogue sequence. Gold occurs free in quartz veins and in chemically combined form in sulfides (pyrite and chalcopyrite), and locally contains low values in silver (Youngberg, 1947). The veins occur mainly as shear zones in metavolcanic rocks and gabbro, but one important group (Benton Group mines) is wholly within broken and sheared quartz diorite. The veins are of two generations and possibly three.

The earliest set of veins occurs as shear zones parallel to foliation and planar banding in the Rogue metavolcanic rocks. In some cases, recrystallization in the veins is consistent with, or a logical extension of, recrystallization in the host metavolcanic rocks. The veins trend north or northeast and generally dip steeply east or west. On a Schmidt net, poles to the planar dimensions of the veins plot on the steeply dipping parts of the planar girdle in folded rocks (figure 8, compare I with Nos. 12 and 13, figure 3), or plot conformably with the shear planes in cataclastically deformed rocks (figure 8, compare I with No. 14, figure 3). In thin sections of vein material, two generations of quartz are commonly observed. The first generation is associated with chlorite, actinolite, epidote minerals, sericite, and albite. The second generation of quartz is usually associated with mineralization in veins of this structural type, although sulfide mineralization appears in some cases to be closely related to the first generation of quartz. Quartz of both generations is of the replacement type.

A later set of veins, largely of the Nevadan trend, plot off the girdle of poles to planar foliation and banding in Rogue metavolcanic rocks (figure 8). These veins are apparently the result of repeated movements late during Nevadan orogeny. Two generations of quartz are also found in these shear zones. The first is consistent with partial recrystallization of the host metavolcanic rocks, resulting in a chlorite-zone assemblage. The second generation is strain free, also of the replacement type and associated with sulfides which carry gold and also free gold (Youngberg, 1947). In this set of veins, as well as the earlier, scattered patches of sheared serpentinite occur along the shear zones and probably served to lubricate the faults.

A third set of veins plot largely as northwest to east-west trending and dip moderately to steeply south (figure 8). These veins also occur along shear zones, but cataclastic recrystallization is strictly local and post-Nevadan. Two generations of quartz are observed, the latter generation invariably associated with mineralization.

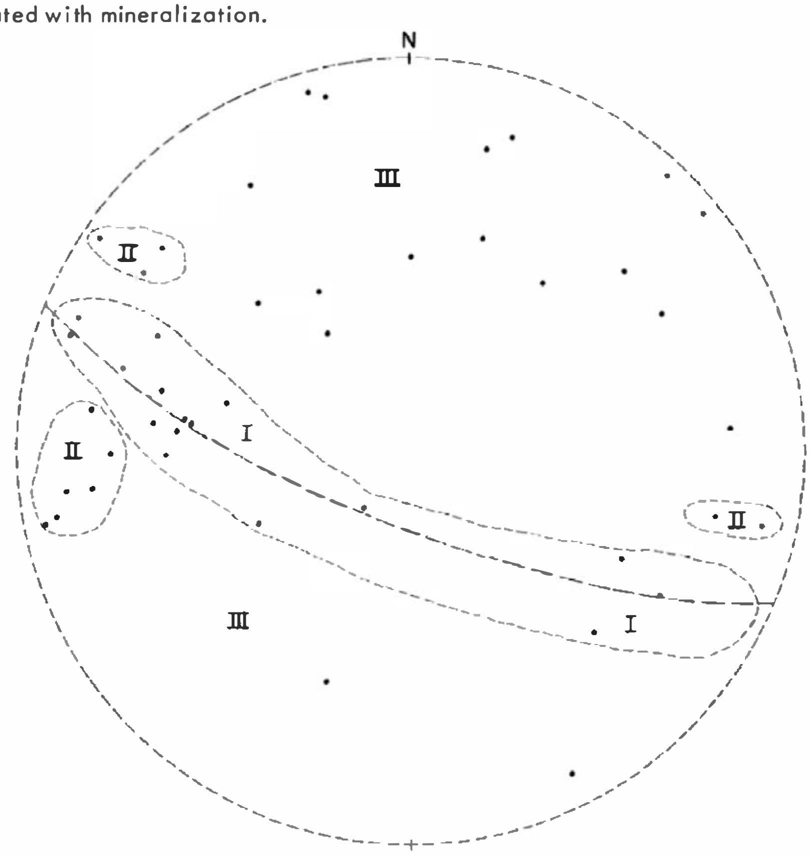


Figure 8. Schmidt net plots of poles to mineralized veins. I indicates vein system conformable with "primary" Nevadan structures; II indicates vein system conformable with remobilized (late) Nevadan structures; III indicates post-Nevadan vein system.

The dichotomy of quartz generation has been noted elsewhere (Mackie, 1947, in Turner and Weiss, 1963, p. 432) and attributed to post-tectonic recrystallization under essentially hydrostatic stress, either by annealing or under the influence of pore fluids. Although not conclusive, petrofabric diagrams for (0001) axes of quartz suggest that its post-tectonic growth was structurally controlled under the local influence of pore fluids. The suggestion that quartz recrystallization was locally controlled is strengthened by diagrams of some samples which show scattered maxima but no obvious girdles, and diagrams of other samples which show a better concentration of maxima with good indication of two girdles. In the latter case, however, neither girdle coincides with the foliation. It would appear that more detailed investigations of preferred orientation of quartz would provide a wealth of information concerning the character and chronology of mineralization of epithermal vein systems in this part of the Klamath Mountains.

Acknowledgments

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Figure 3

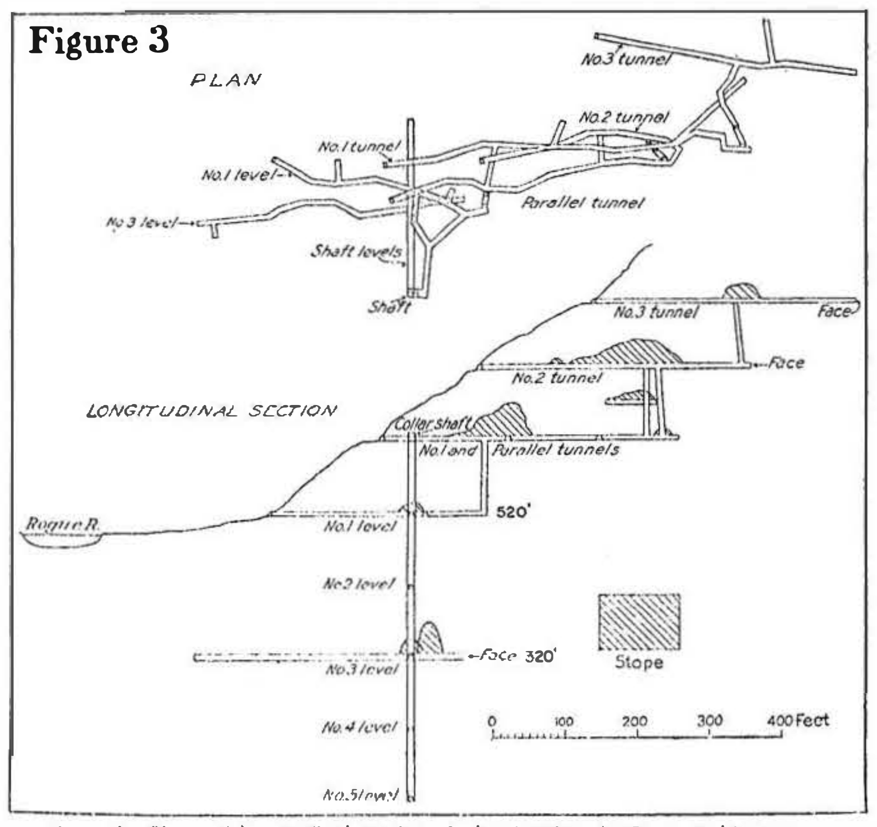


Figure 3. Plan and longitudinal section of Almeda mine, by P. H. Holdsworth, November 28, 1911 (reprinted from Diller, 1914).

Figure 4

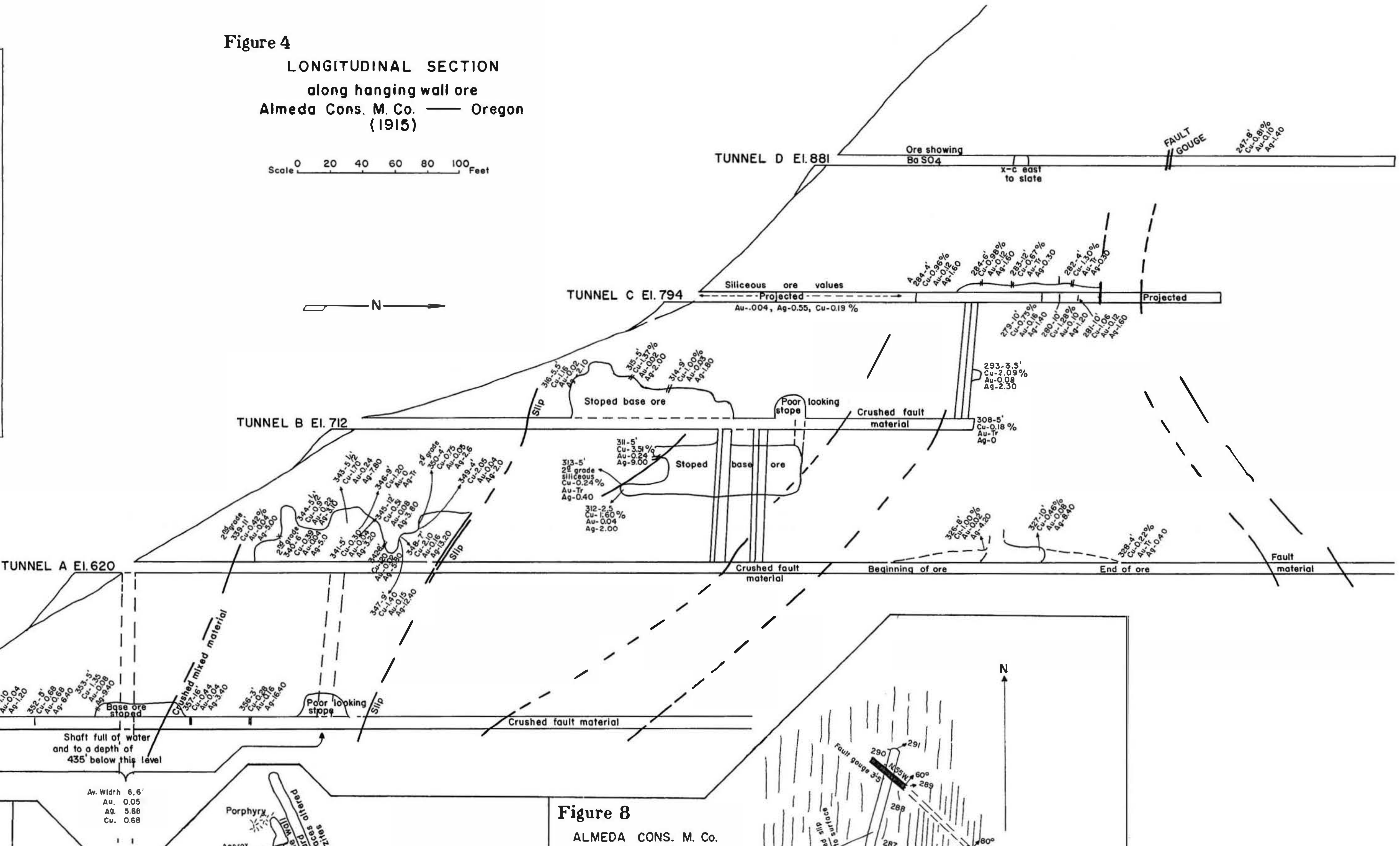


Figure 5

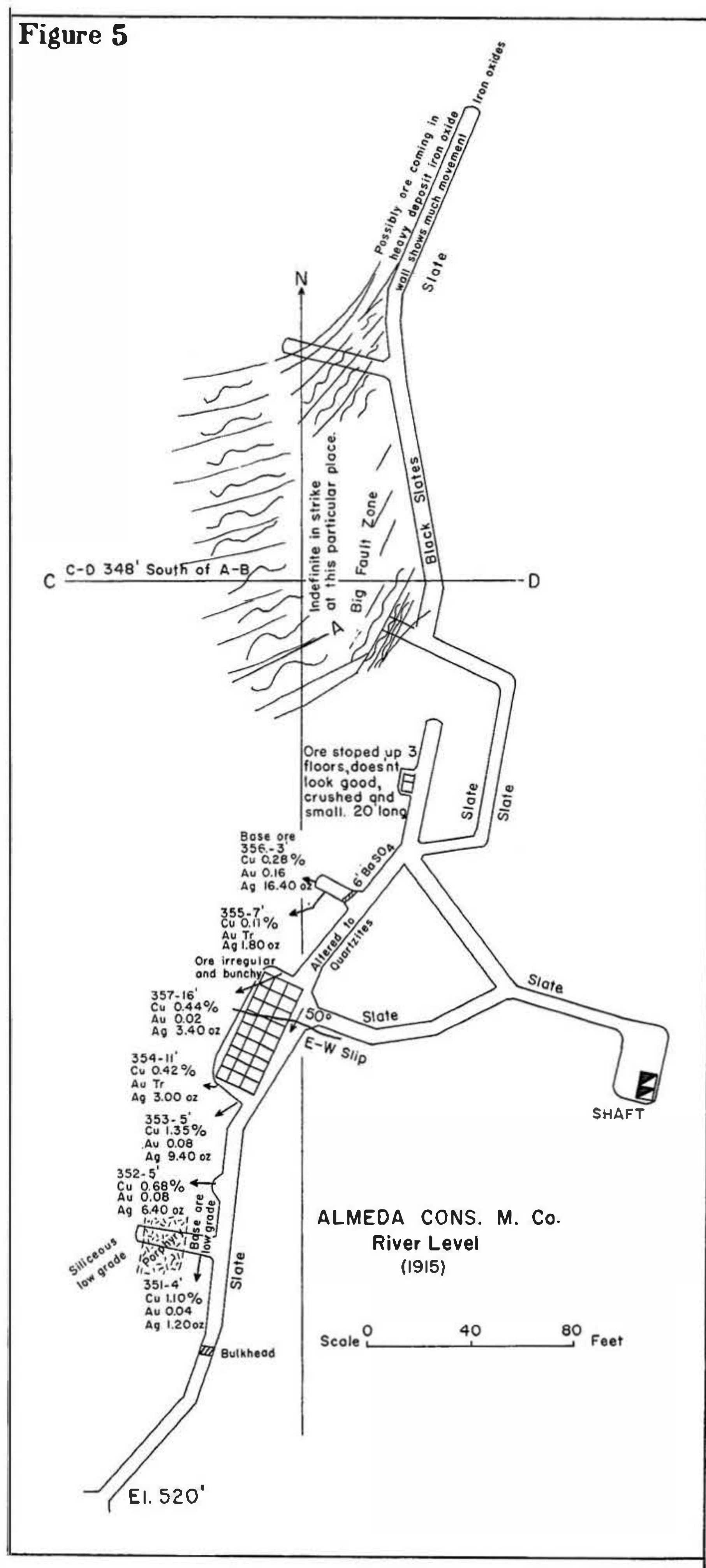
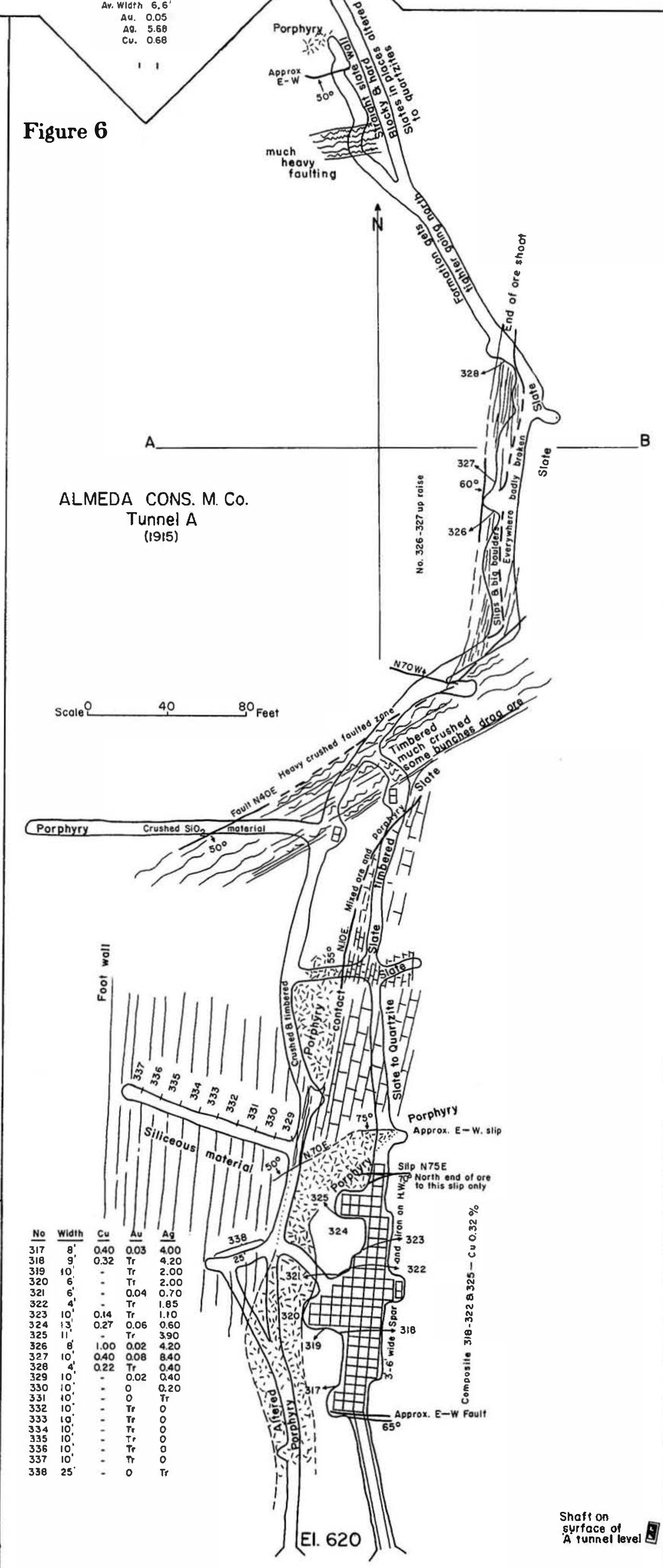
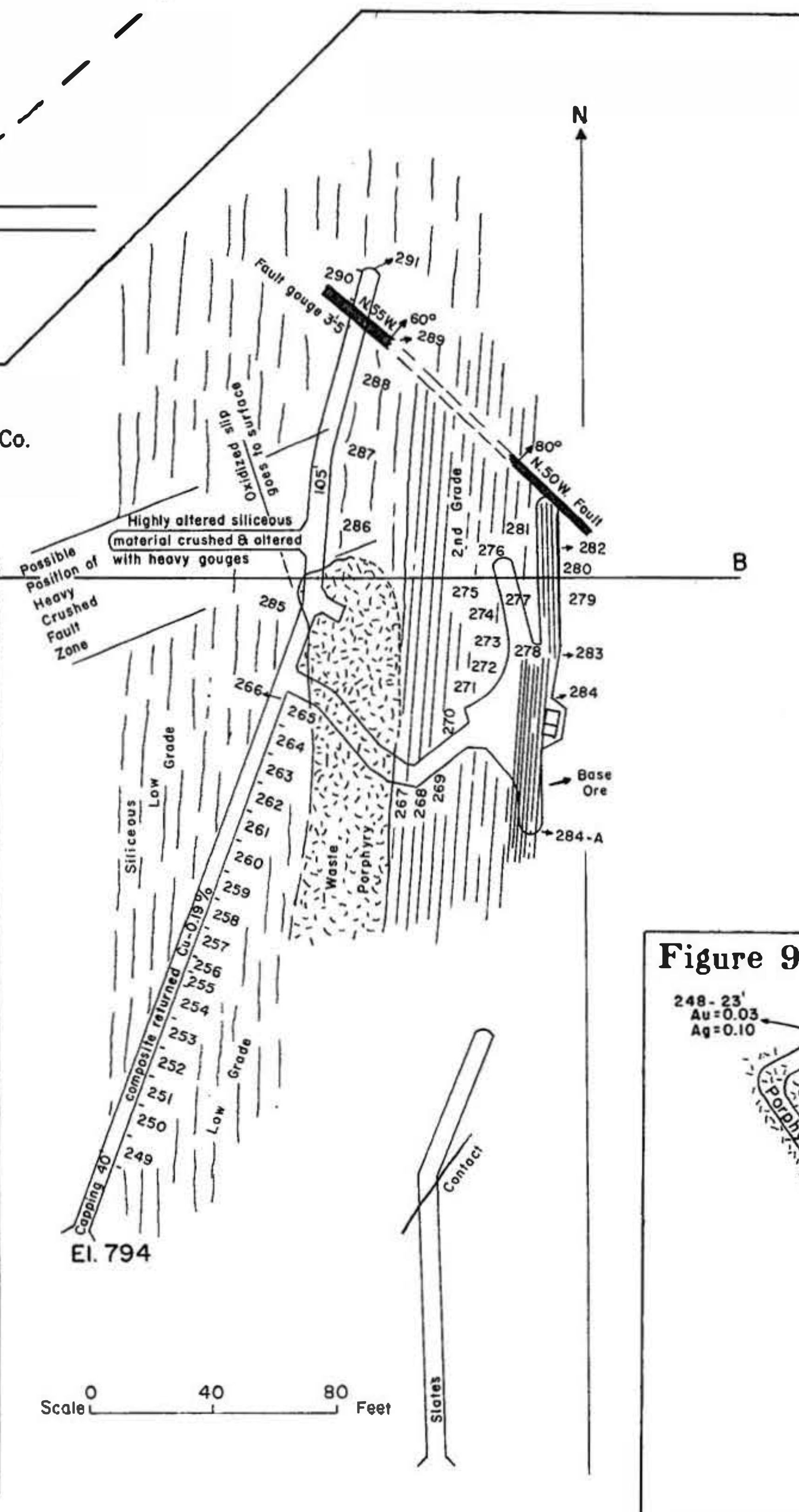


Figure 6



No	Width	Cu	Au	Ag
317	8'	0.40	0.03	4.00
318	9'	0.32	Tr	4.20
319	10'	-	Tr	2.00
320	6'	-	Tr	2.00
321	6'	-	0.04	0.70
322	4'	-	Tr	1.85
323	10'	0.14	Tr	1.10
324	13'	0.27	0.06	0.60
325	11'	-	Tr	3.90
326	8'	1.00	0.02	4.20
327	10'	0.40	0.08	8.40
328	4'	0.22	Tr	0.40
329	10'	-	0.02	0.40
330	10'	-	0	0.20
331	10'	-	0	Tr
332	10'	-	Tr	0
333	10'	-	Tr	0
334	10'	-	Tr	0
335	10'	-	Tr	0
336	10'	-	Tr	0
337	10'	-	Tr	0
338	25'	-	0	Tr

Figure 8



No.	Width	Cu	Ag	Au
249	10'	0	.04	.25
250	10'	0	.04	1.10
251	10'	0	.08	.80
252	10'	0	.10	.40
253	10'	0	.12	.80
254	10'	0	.08	.60
255	6'7"	0	.14	.50
256	5'5"	0	Tr	0
257	10'	0	.05	1.70
258	10'	0	Tr	.45
259	10'	0	.04	.76
260	10'	0	.05	.66
261	10'	0	Tr	.50
262	10'	0	0	.25
263	10'	0	Tr	.20
264	10'	0	Tr	.20
265	10'	0	Tr	.20
266	11'	0	Tr	.30
267	10	0.35	.12	.80
268	6'6"	.28	.04	1.30
269	10'	.39	0	0
270	6'7"	.29	Tr	.80
271	6'	.33	.08	.64
272	8'	.60	.08	1.60
273	10'	.55	.02	1.00
274	10'	.42	.02	.55
275	10'	.43	Tr	.60
276	5'6"	.26	Tr	.60
277	7'3"	.68	.12	1.20
278	10'	.81	.12	1.10
279	10'	.75	.16	1.40
280	10'	1.28	.10	1.20
281	10'	1.06	.12	1.60
282	4'	1.30	Tr	.30
283	12'	.67	Tr	.30
284	4'	.96	.12	1.60
284A	6'	.96	.12	1.60
285	7'	0	Tr	.20
286	7'	0	Tr	.20
287	7'	0	Tr	.20
288	7'	0	0	r
289	7'	0	0	Tr
290	9'	.17	.05	.50
291	4'6"	.37	Tr	.90

Figure 7

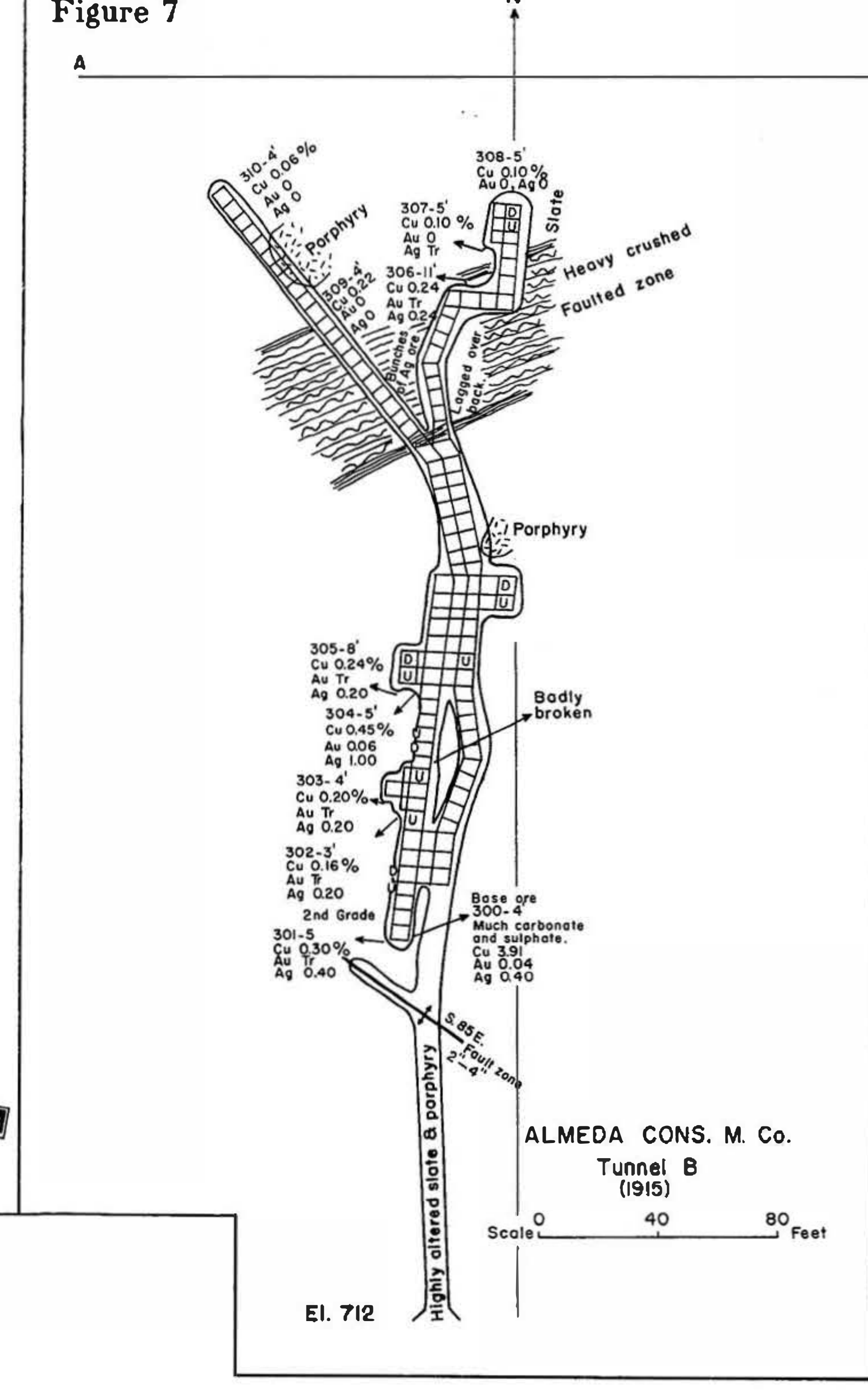


Figure 9

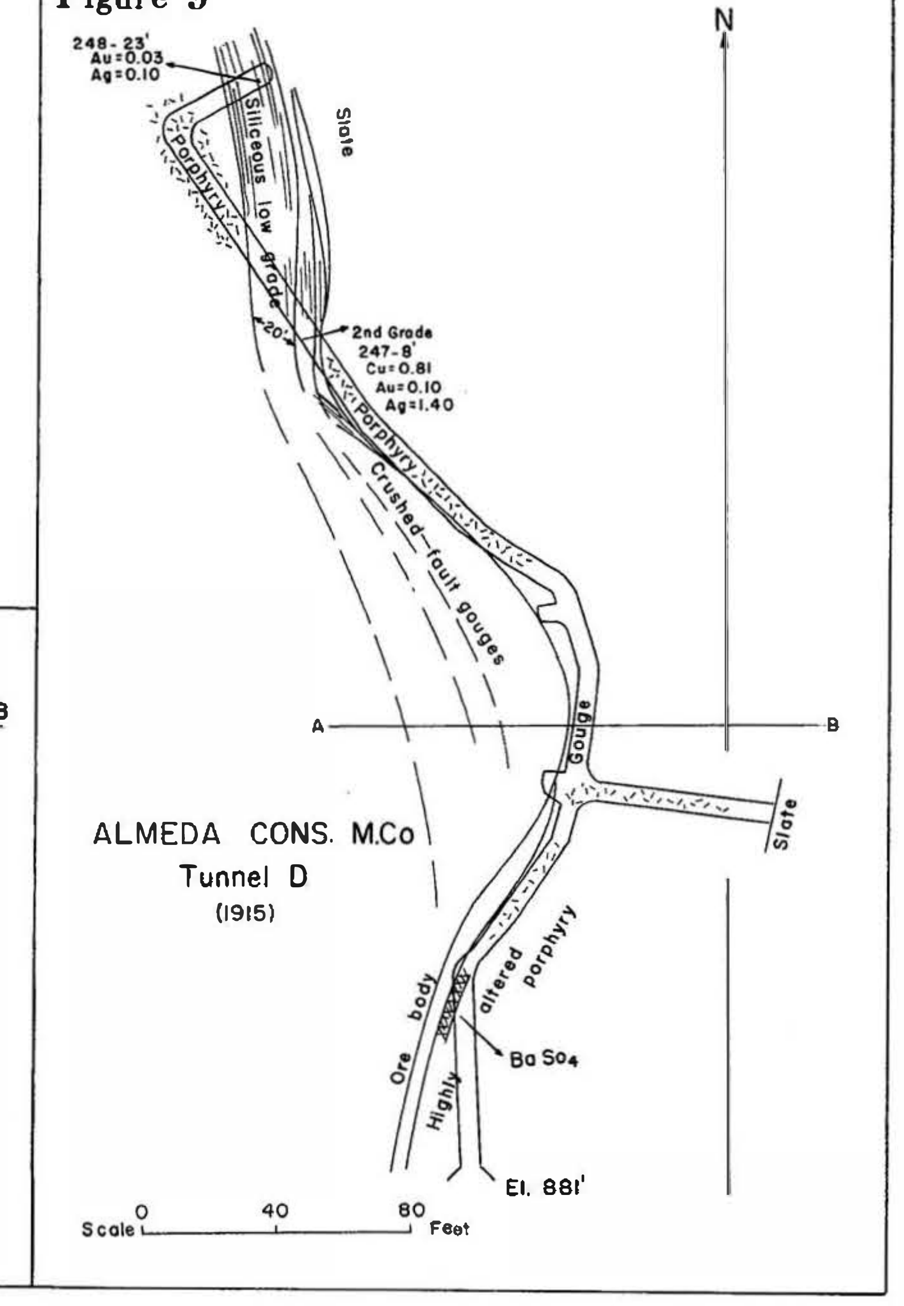


Figure 10

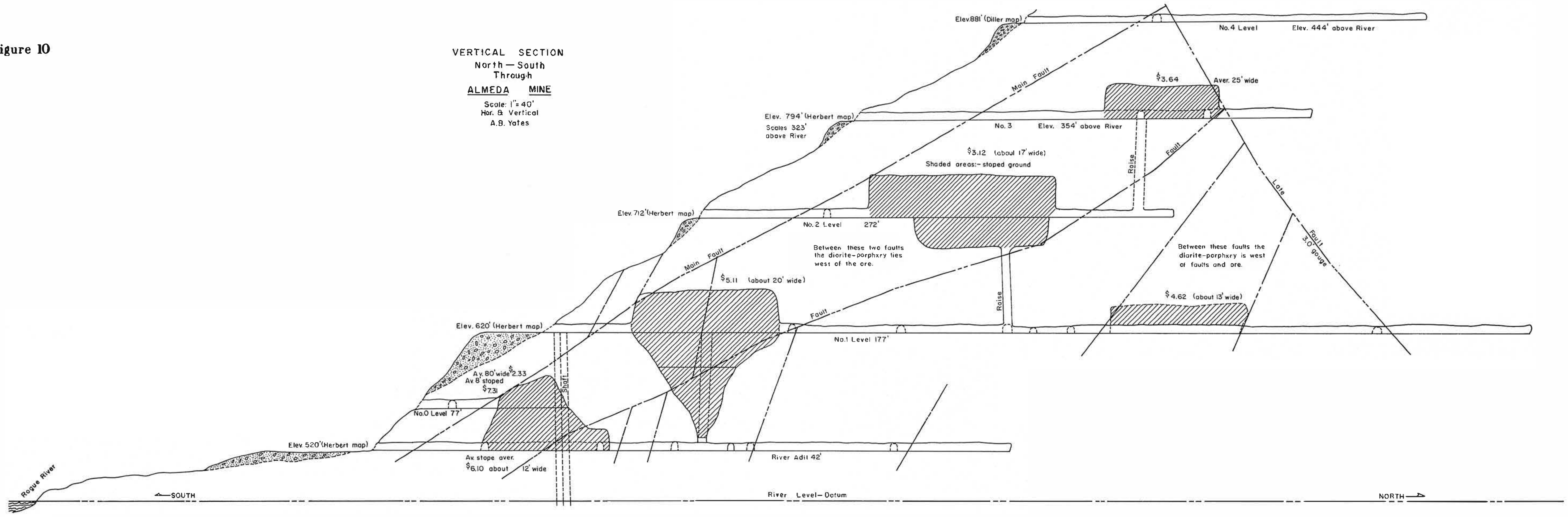


Figure 11

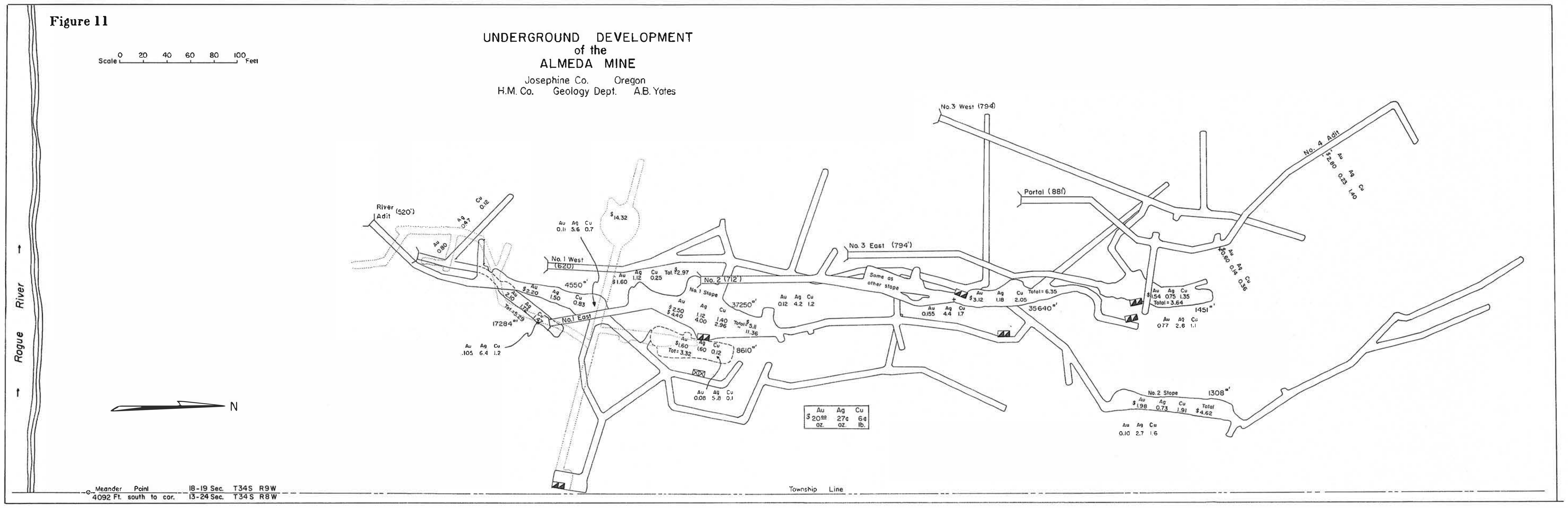
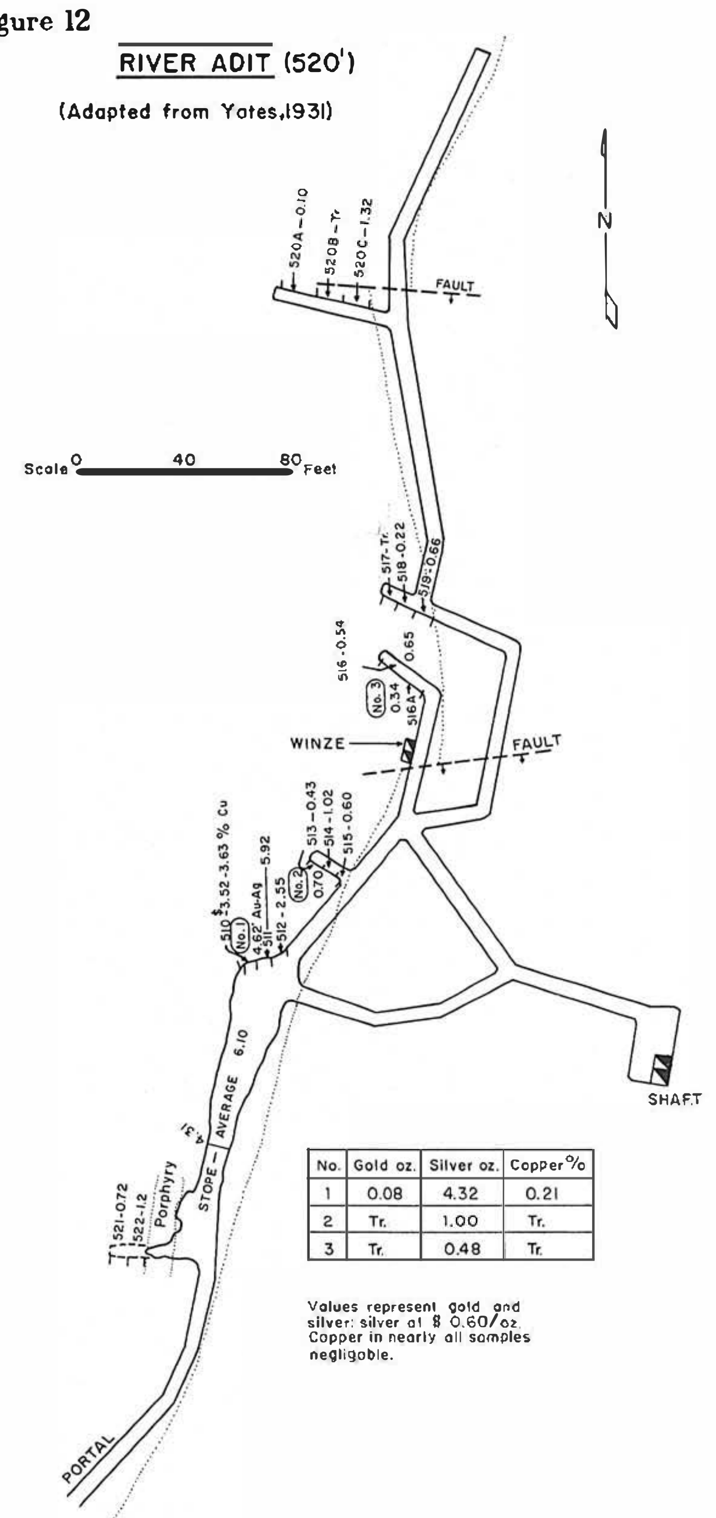


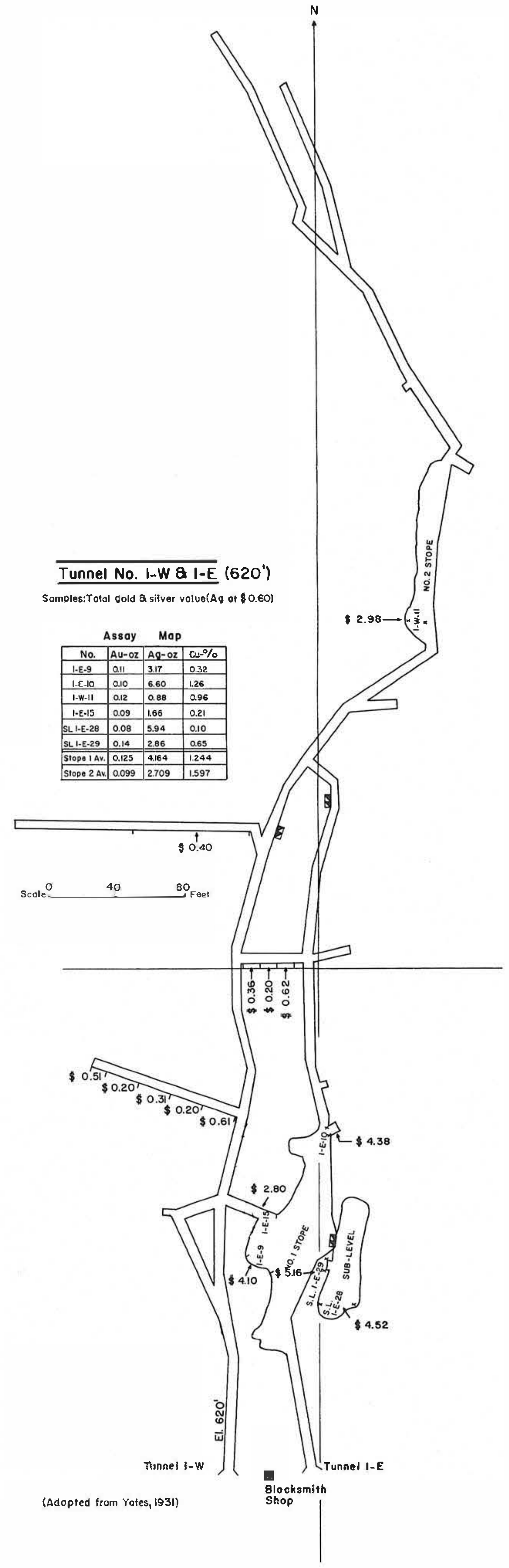
Figure 12



No.	Gold oz.	Silver oz.	Copper %
1	0.08	4.32	0.21
2	Tr.	1.00	Tr.
3	Tr.	0.48	Tr.

Values represent gold and silver: silver at $ 0.60/oz. Copper in nearly all samples negligible.

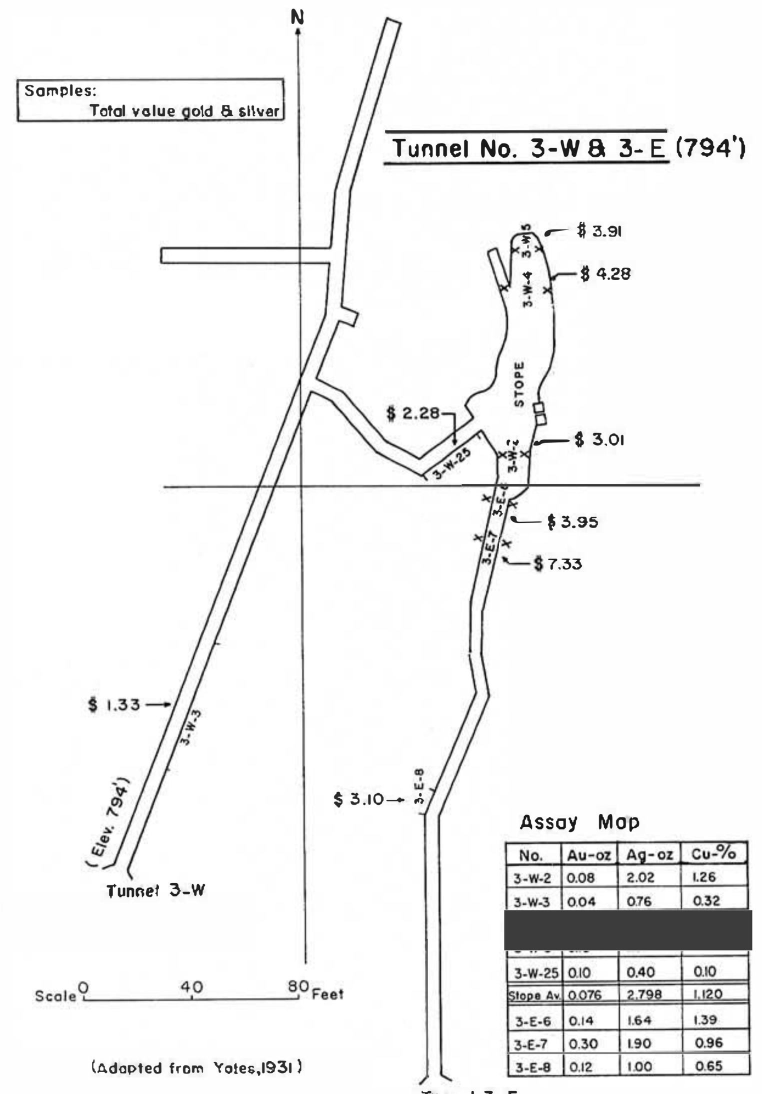
Figure 13



Assay Map

No.	Au-oz	Ag-oz	Cu-%
1-E-9	0.11	3.17	0.32
1-E-10	0.10	6.60	1.26
1-W-11	0.12	0.88	0.96
1-E-15	0.09	1.66	0.21
SL 1-E-28	0.08	5.94	0.10
SL 1-E-29	0.14	2.86	0.65
Stope 1 Av.	0.125	4.164	1.244
Stope 2 Av.	0.099	2.709	1.597

Figure 14



Assay Map

No.	Au-oz	Ag-oz	Cu-%
3-W-2	0.08	2.02	1.26
3-W-3	0.04	0.76	0.32
[redacted]			
3-W-25	0.10	0.40	0.10
Stope Av.	0.076	2.798	1.120
3-E-6	0.14	1.64	1.39
3-E-7	0.30	1.90	0.96
3-E-8	0.12	1.00	0.65

Figure 15

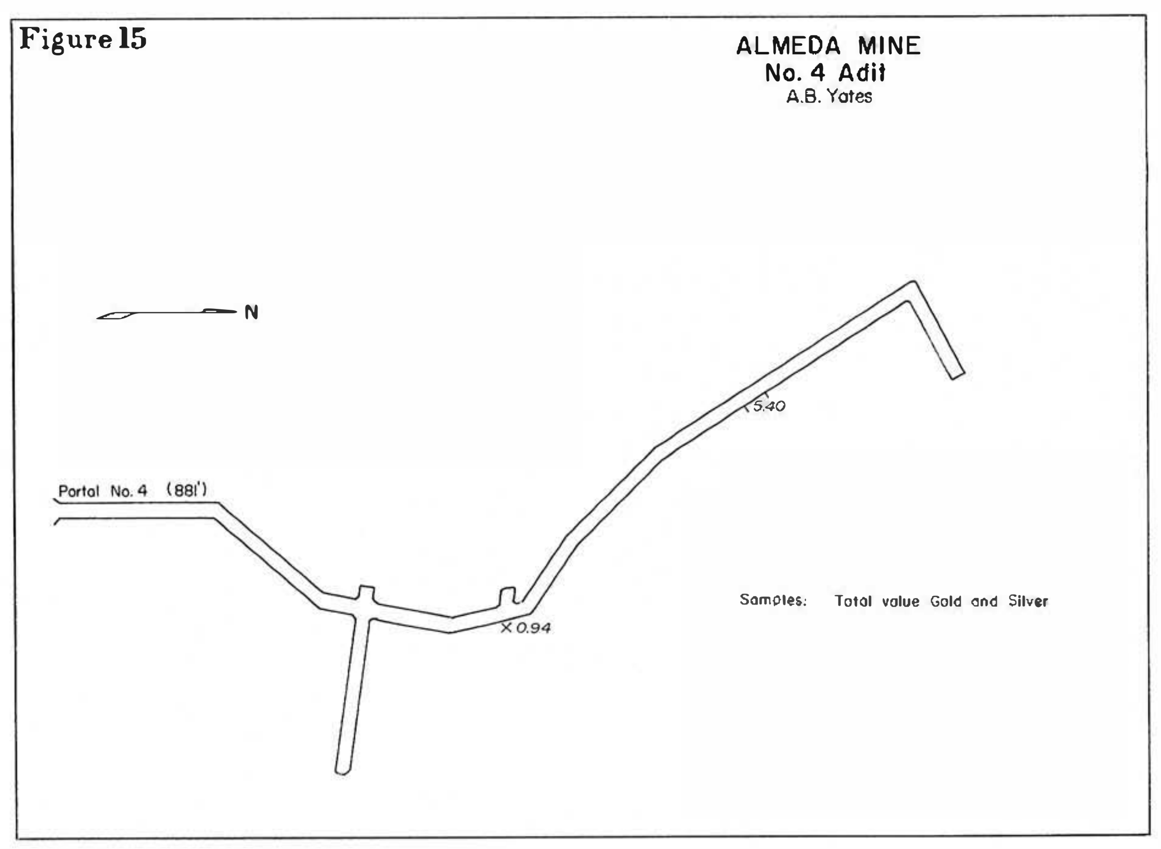
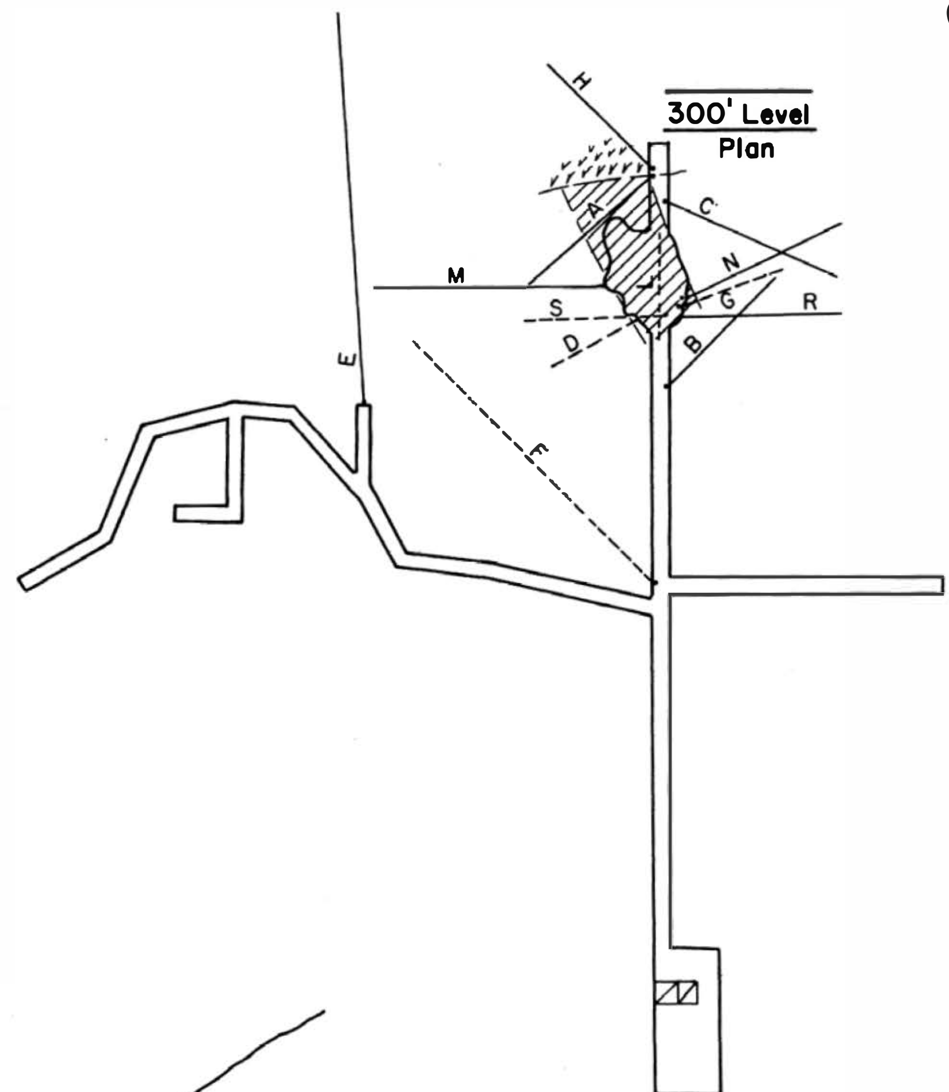
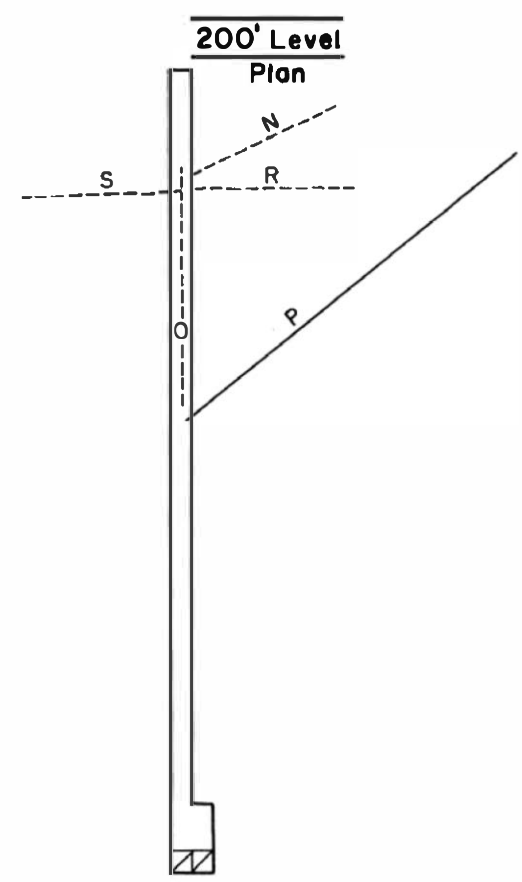


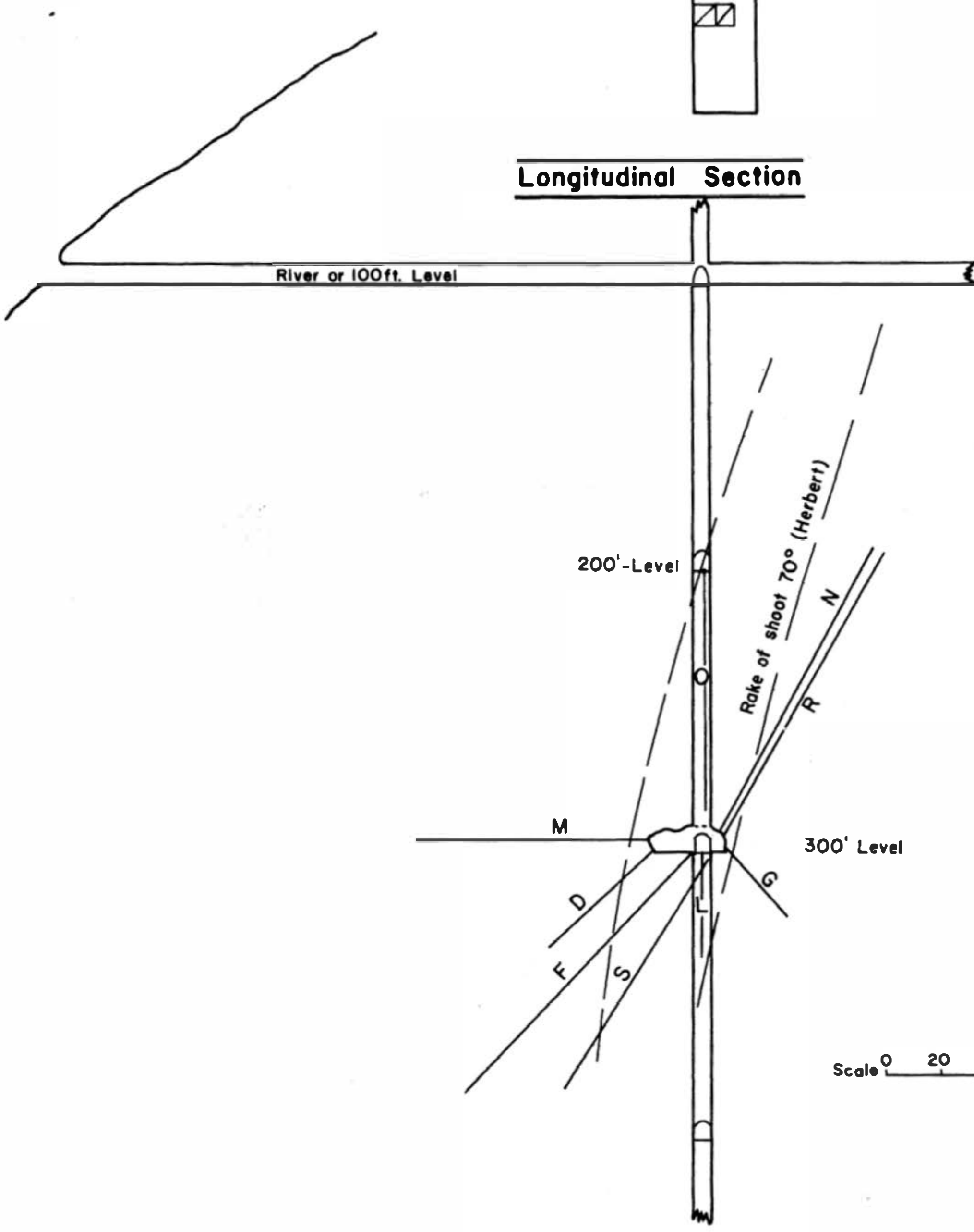
Figure 16

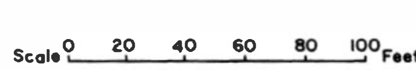
—DIAMOND DRILL HOLES—

(Holdsworth—Hillman)









——— 10 Ft. Samples— Gold only - Value $ per ton ———

	0-10'	10'-20'	20'-30'	30'-40'	40'-50'	50'-60'	60'-70'	70'-80'	80'-90'	90'-100'	100'-110'	110'-120'	120'-130'	130'-140'	140'-150'
A —	11.55	9.45	5.25	3.50	3.50	2.45	0.35								
B —	1.05	2.80	2.10	1.05	1.75										
C —	1.05	0.35	0.35	0.35	0.35	0.35	1.05								
D —	4.55		3.50	1.75	1.75										
E —	0.70	1.40	0.70	Tr.	Tr.	Tr.	0.70	1.05	0.70	Tr.	0.35	Tr.	0.35		
F —	0.70	0.35	0.35	Tr.	0.35	0.35	Tr.	Tr.	-	-	-	-	0.35	1.75	Tr.
G —	2.80	3.85	2.10												
H —	Tr	Tr	0.70	Tr	Tr										
L —	8.40	3.15	109.50	113.05	8.95										
M —	12.80	30.75	2.10	0.35	0.35	Tr	0.35	Tr	1.05						
N —	55.30	14.70	9.10	5.60	2.80	1.05	0.70	1.05	3.85	1.05	0.70				
O —	0.35	Tr	Tr	Tr	Tr	Tr	0.35	Tr	Tr	Tr	0.35	1.05			
P —	Tr	0.35	0.35	0.35	0.35	Tr	Tr	Tr	0.35	0.35	0.35	0.35	0.35	0.35	0.35
R —	29.75	4.90	1.40	30.45	1.40	1.40	1.05	0.70	1.05	1.40					
S —	361.90	13.65	21.70	3.15	2.00	6.30	2.10	0.70	2.45	1.05					

Figure 17

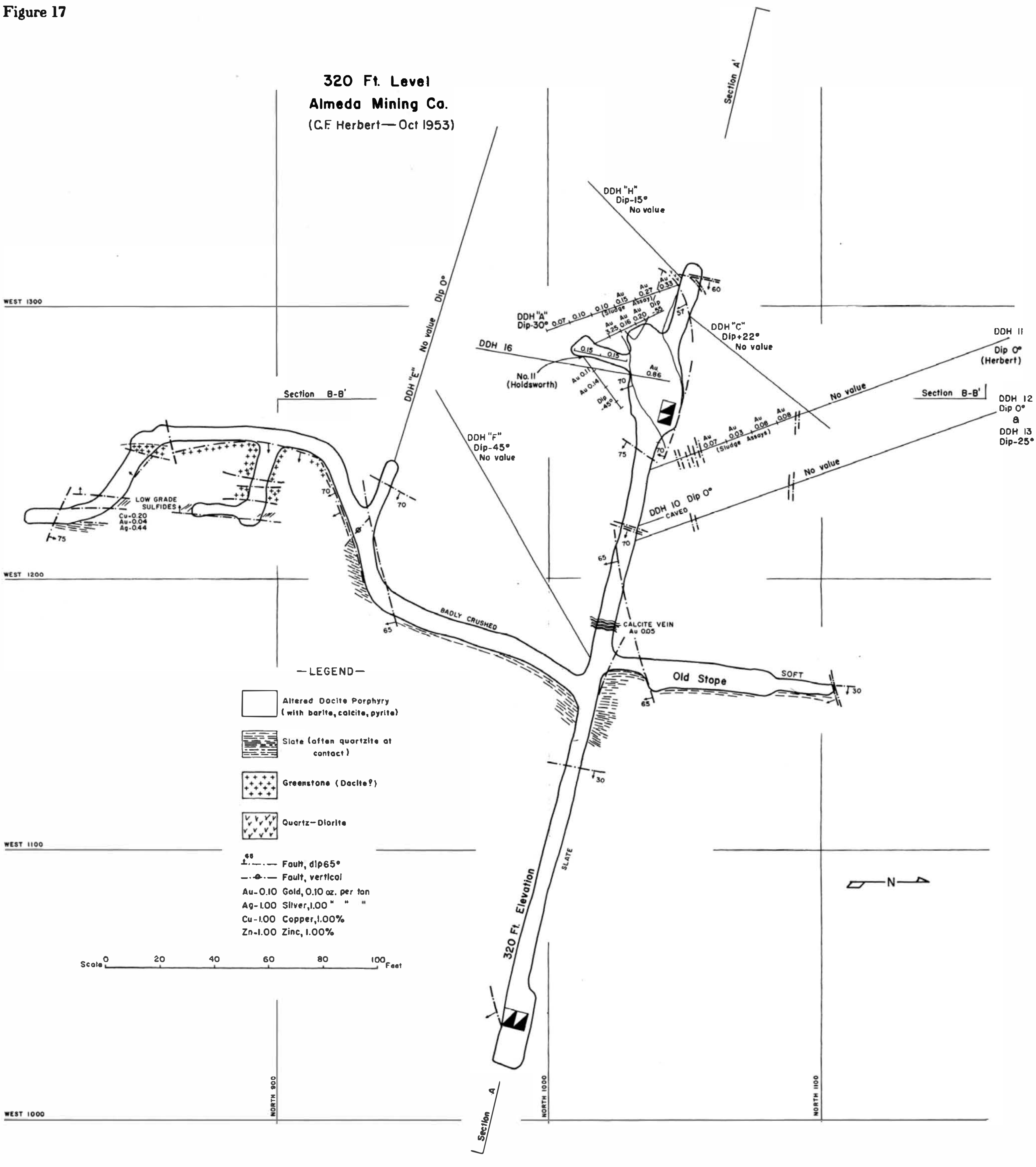

320 Ft. Level
Almeda Mining Co.
(C.F. Herbert—Oct 1953)
—LEGEND—
Altered Dacite Porphyry (with barite, calcite, pyrite)
Slate (often quartzite at contact)
Greenstone (Dacite?)
Quartz-Diorite
Fault, dip 65°
Fault, vertical
Au-0.10 Gold, 0.10 oz. per ton
Ag-1.00 Silver, 1.00 " "
Cu-1.00 Copper, 1.00%
Zn-1.00 Zinc, 1.00%
Scale 0 20 40 60 80 100 Feet
Section A'
Section A
Section B-B'
DDH "H" Dip-15° No value
DDH "A" Dip-30°
DDH 16
No. 11 (Holdsworth)
DDH "C" Dip+22° No value
DDH 11 Dip 0° (Herbert)
DDH 12 Dip 0° & DDH 13 Dip-25°
DDH "E" Dip 0° No value
DDH "F" Dip-45° No value
DDH 10 Dip 0°
CAVED
No value
(Sludge Assays)
LOW GRADE SULFIDES
Cu-0.20
Au-0.04
Ag-0.44
BADLY CRUSHED
CALCITE VEIN Au 0.05
Old Stope
SOFT
SLATE
320 Ft. Elevation
WEST 1300
WEST 1200
WEST 1100
WEST 1000
NORTH 900
NORTH 1000
NORTH 1100
N

Figure 18

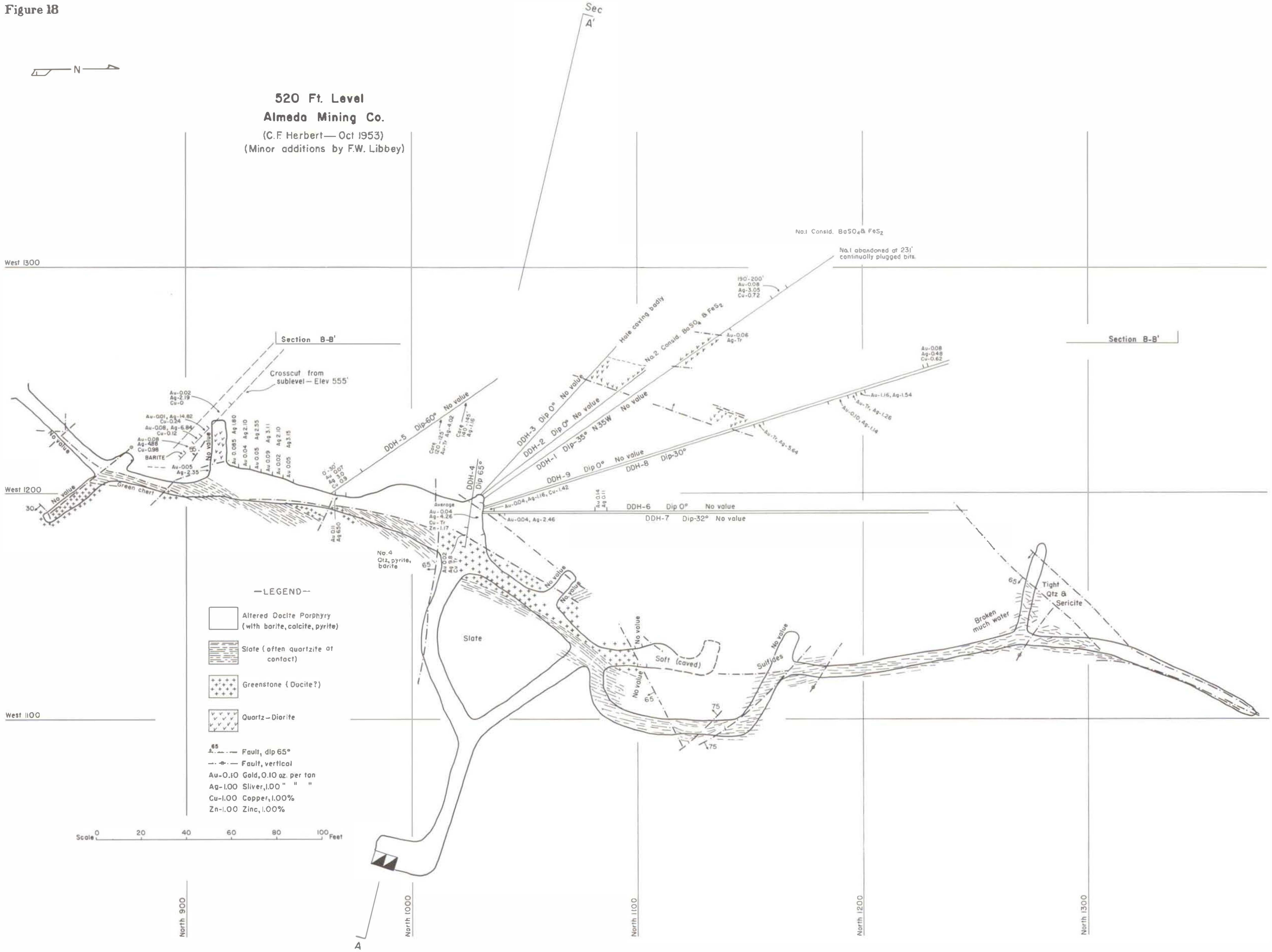

520 Ft. Level
Almeda Mining Co.
(C.F. Herbert— Oct 1953)
(Minor additions by F.W. Libbey)
N
Sec A'
West 1300
West 1200
West 1100
North 900
North 1000
North 1100
North 1200
North 1300
Section B-B'
Crosscut from sublevel — Elev 555'
DDH-5 Dip 60° No value
DDH-4 Dip 65°
DDH-3 Dip 0° No value
DDH-2 Dip 0° No value
DDH-1 Dip-35° N35W No value
DDH-9 Dip 0° No value
DDH-8 Dip-30°
DDH-6 Dip 0° No value
DDH-7 Dip-32° No value
Hole caving badly
No.2 Consid. BaSO4 & FeS2
No.1 Consid. BaSO4 & FeS2
No.1 abandoned at 231' continually plugged bits.
190'-200' Au-0.08 Ag-3.05 Cu-0.72
Green chert
BARITE
No value
Slate
Soft (caved)
Sulfides
Broken much water
Tight Qtz & Sericite
No.4 Qtz, pyrite, barite
Average Au-0.04 Ag-4.26 Cu-Tr Zn-1.17
—LEGEND—
Altered Dacite Porphyry (with barite, calcite, pyrite)
Slate (often quartzite at contact)
Greenstone (Dacite?)
Quartz–Diorite
Fault, dip 65°
Fault, vertical
Au-0.10 Gold, 0.10 oz. per ton
Ag-1.00 Silver, 1.00 " "
Cu-1.00 Copper, 1.00%
Zn-1.00 Zinc, 1.00%
Scale 0 20 40 60 80 100 Feet
A

Figure 19

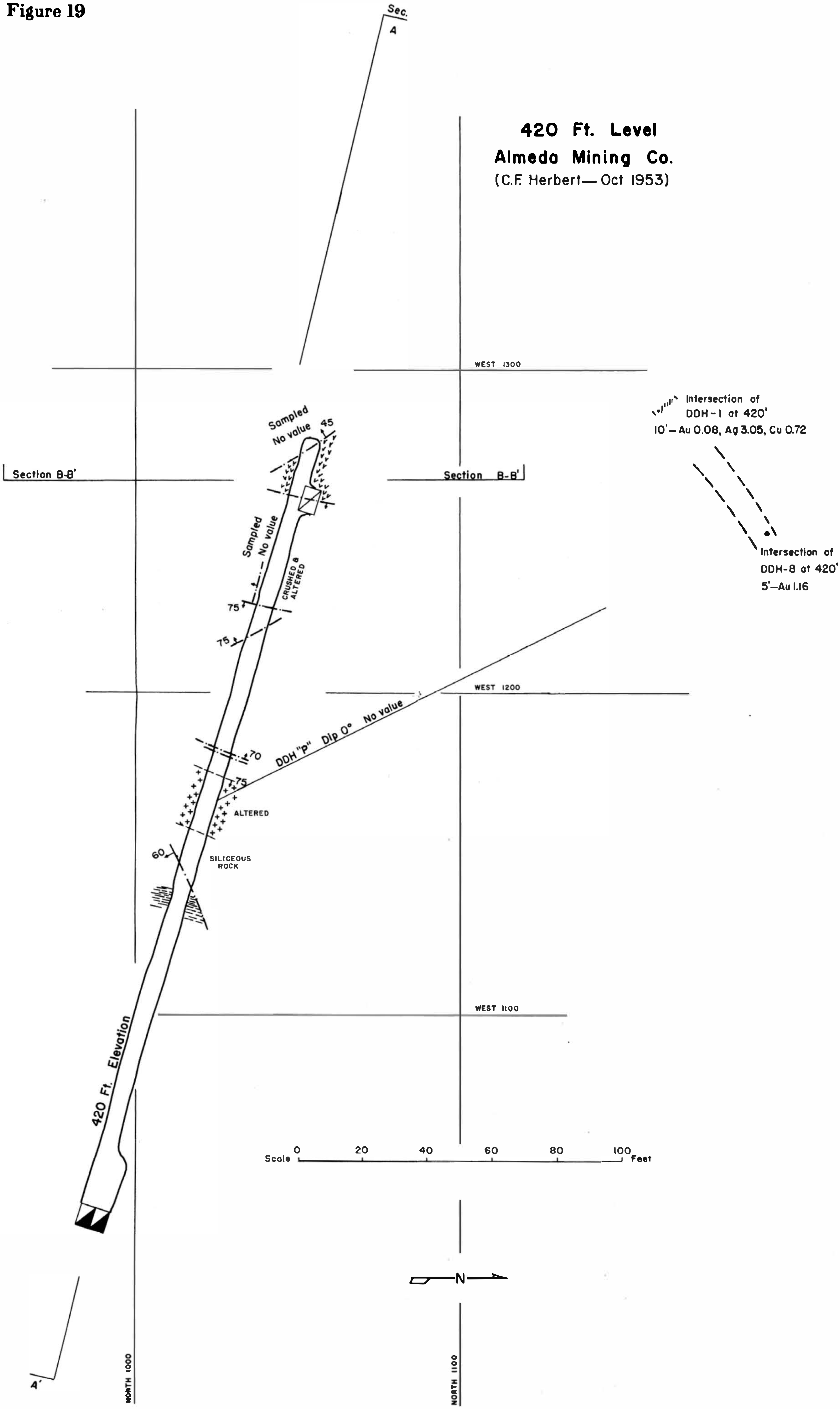
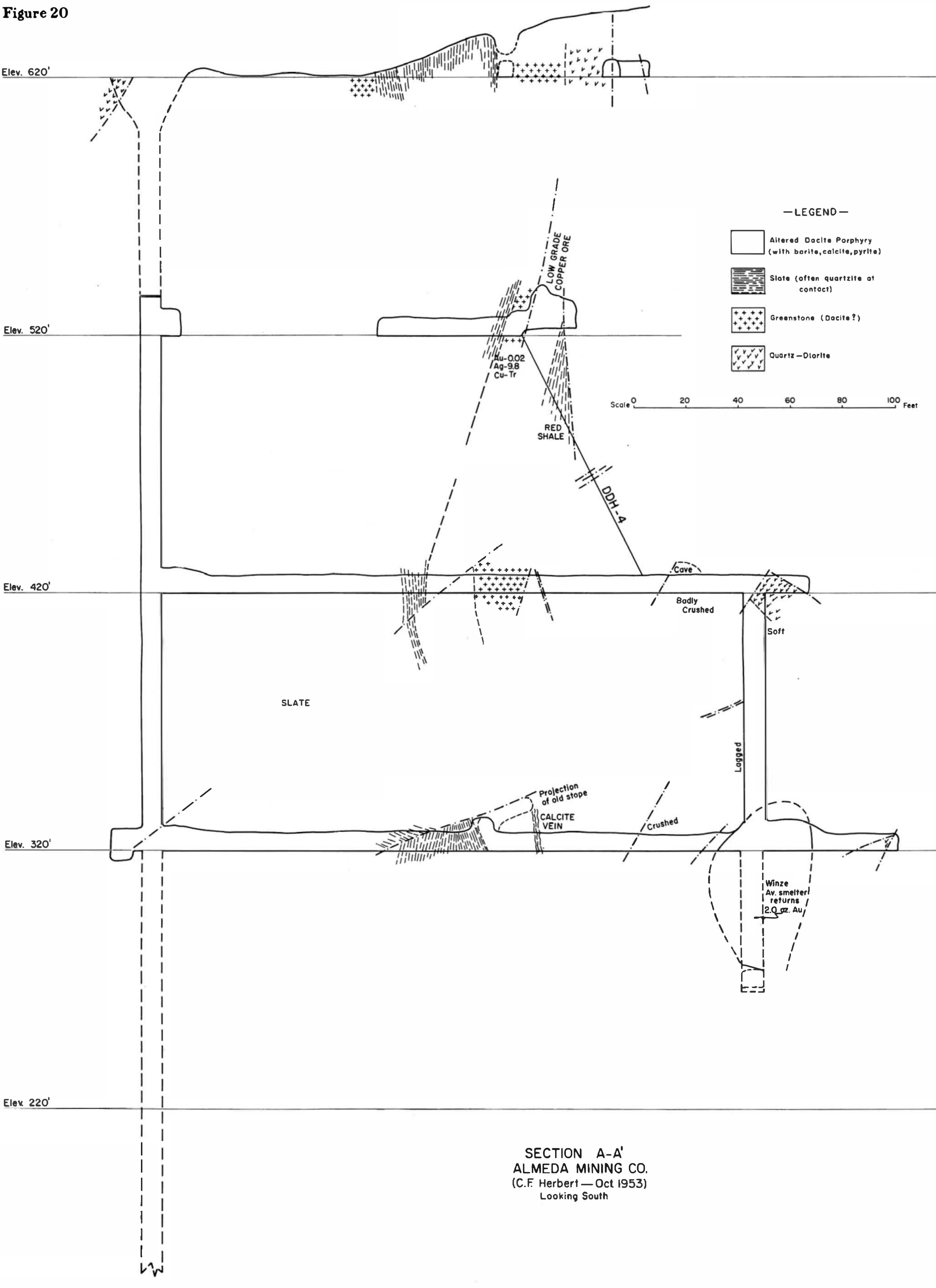
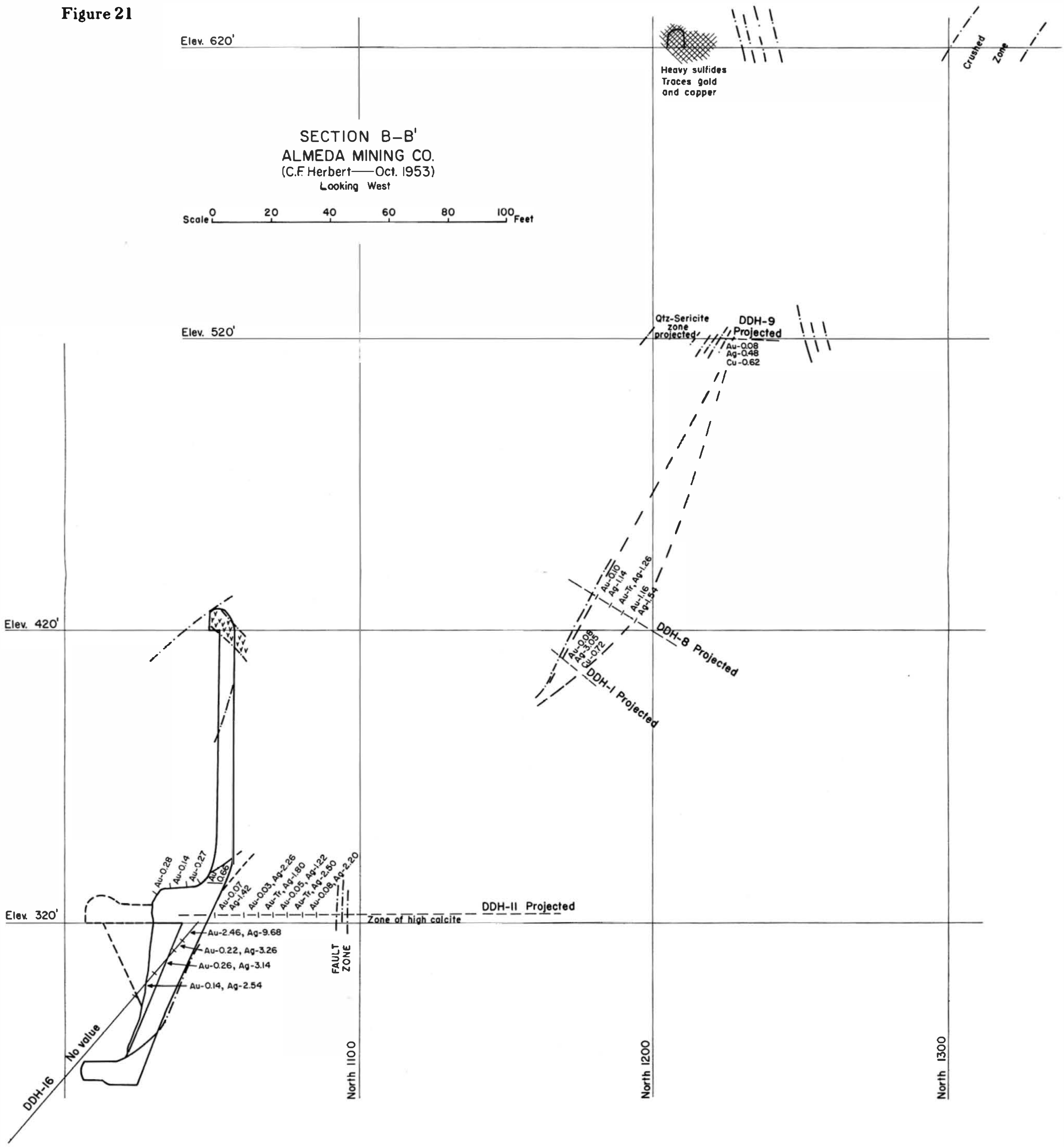

420 Ft. Level
Almeda Mining Co.
(C.F. Herbert— Oct 1953)
Sec.
A
A'
WEST 1300
WEST 1200
WEST 1100
NORTH 1000
NORTH 1100
Section B-B'
Section B-B'
Intersection of
DDH-1 at 420'
10'— Au 0.08, Ag 3.05, Cu 0.72
Intersection of
DDH-8 at 420'
5'—Au 1.16
Sampled
No value
45
Sampled
No value
CRUSHED & ALTERED
75
75
DDH "P" Dip 0° No value
70
75
ALTERED
60
SILICEOUS ROCK
420 Ft. Elevation
Scale
0
20
40
60
80
100
Feet
N

Figure 20



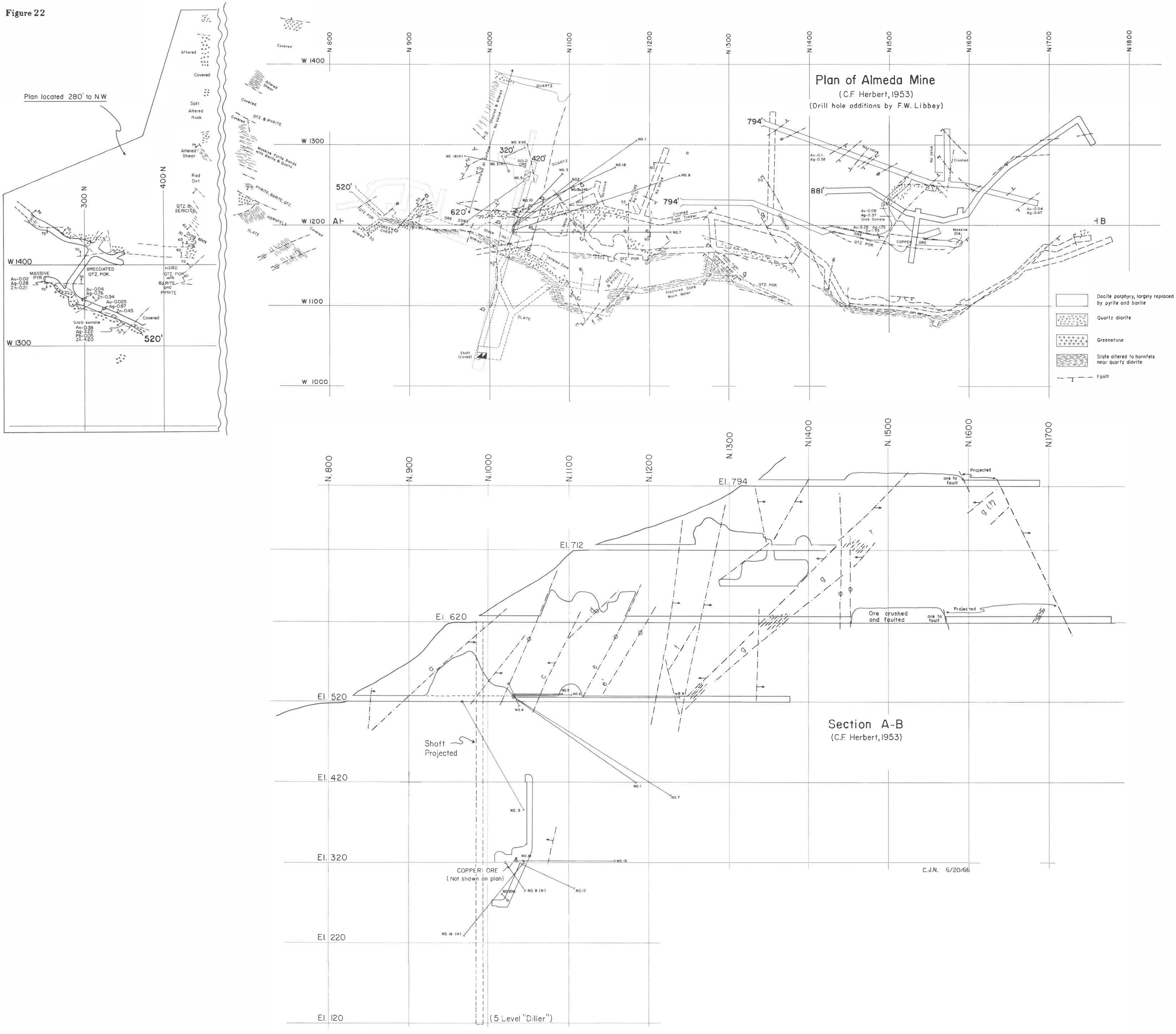
SECTION A-A'
ALMEDA MINING CO.
(C.F. Herbert — Oct 1953)
Looking South

Figure 21



SECTION B–B'
ALMEDA MINING CO.
(C.F. Herbert—Oct. 1953)
Looking West
Scale 0 20 40 60 80 100 Feet
Elev. 620'
Elev. 520'
Elev. 420'
Elev. 320'
Heavy sulfides
Traces gold
and copper
Crushed
Zone
Qtz-Sericite
zone
projected
DDH-9
Projected
Au-0.08
Ag-0.48
Cu-0.62
DDH-8 Projected
DDH-1 Projected
DDH-11 Projected
Zone of high calcite
FAULT ZONE
Au-2.46, Ag-9.68
Au-0.22, Ag-3.26
Au-0.26, Ag-3.14
Au-0.14, Ag-2.54
Au-0.28
Au-0.14
Au-0.27
DDH-16
No value
North 1100
North 1200
North 1300

Figure 22


Plan located 280' to N.W
Plan of Almeda Mine
(C.F. Herbert, 1953)
(Drill hole additions by F.W. Libbey)
Dacite porphyry, largely replaced by pyrite and barite
Quartz diorite
Greenstone
Slate altered to hornfels near quartz diorite
Fault
Section A-B
(C.F. Herbert, 1953)
El. 794
El. 712
El. 620
El. 520
El. 420
El. 320
El. 220
El. 120
Shaft Projected
COPPER ORE
(Not shown on plan)
(5 Level "Diller")
Ore crushed and faulted
C.J.N. 6/20/66