Arthur Lakes, President
James H. Wren, Sec.-Treas.

Office:
702 Forest Street
Reno, Nevada 89502
Phone: 323-8910

LAK-REN VENTURES, INC.

Mining Enterprises

1055 Curti Drive,
Reno, Nevada 89502.
Phone : 322-4840.

Mr. David Baker,
Reno, Nevada.

August 4, 1970

Dear Dave :

This will act as supplemental to the "East Tybo Properties Report of June 22, 1967". Hindsight being what it is vs foresight designates certain changes in the exploration-development section of the report. Then the economics have changed to some extent with regard to higher smelting fees, contractor cost and labor under this drastic inflation period United States is undergoing.

EXPLORATION-DEVELOPMENT :

No additional underground work should be done at this time in the No. 2 Level of the East Tybo Mine. Prior to June 22, 1967 Ronald S. Allison, major owner had reported that the No. 2 Level face ore of mill grade. The face at that time was not open for scrutiny as it was blocked off by a muckpile out of a raise. We subsequently found out that the face was in waste a few feet beyond a post mineral fault.

The No. 3 Level was cleaned out, enlarged and a new portal timbering arrangement made in about November of 1967. A few feet of additional advance was made on the 2-G Vein. The face now has over 3' of highly pyritized vein and is within about 100' of a highly leached ore shoot showing on the surface. As iron pyrite is a zoning influence at Old Tybo as well as many other silver,lead-zinc properties I have seen, it might be a good idea to run about 150' in the No. 3 Level on the strike of the vein.

Trackless development adits at the time the June 22, 1967 report was written could have been done for $40 per foot. At this time it would be about $55 per foot, after the Nevada State Industrial Commission grants permission to use diesel power with scrubbers and forced ventilitation.

The 1,000 feet of Bx or larger diameter diamnond drill footage should now be at least three holes , which will amount to a total of some 3,000'. The $10 per foot cost estimate formerly is now about $12 per foot plus overhead and company technical man to sample and classify core or core barrel material. Location of holes I'd drill is :

BAKER EAST TYBO SUPPLEMENTAL DATA OF AUG. 4, 1970 :

Mr. Gilbert R. Schwarz told me last evening via telephone that he chiefly wanted your opinion of their proposed diamond drilling program ahead of metallurgical study of the Tybo Tailings Pond. I did, however, ask him to return a copy of the Nevada Bureau of Mines bulletin on the "Tybo Mine Concentrator", which included tailings grade and minerals percentage content. It is a very good paper that required voluminous technical metallurgy to set up.

Lak-Ren Ventures, Inc. is a successful Nevada Corporation owned 50% by Arthur Lakes and 50% by me. It is setup under Sub-Chapter "S" of the Internal Revenue Code whereby we do not pay corporation taxes but pay on income as one would in a limited partnership individually, and at the same time enjoy personal non-liability in a number of instances. We granted an option to Gilbert R. Schwarz, Lawrence Stevens, Warren Couglin and Associates , some nearly two years ago on our East Tybo Patented Properties Mining Lease With Purchase Option. They have a $100,000 payment to make to us on or before October 1, 1970. However, they have asked for a six months extension beyond that date. We are agreeable to grant an extension but if it'll be a full six months, we have not yet decided to-date. At the same time a tentative offer from the optionees has been made to buy our rights to East Tybo for $10,000 cash on or before August 15, 1970. We probably will accept that offer if they consumate it at the time they said they might.

As soon as I have all of the tailings data will compile it in one file and lend it to you.

I will deliver on loan the complete office copy I have on the East Tybo Mine. Anyone you wish can evaluate it, however, I particularly stress that it not leave your hands, and be returned to me when you have digested its material. You can print any part or all of it, if you so desire. The report is voluminous, with much reference data, my report and one by Arthur Lakes. Will have a map of the No. 2 Level, the rest are in a file of technical maps I have stored. Can get them if you want to scrutinize that file as well as a large file of Old Tybo maps, assay charts, etc.

Sincerely yours,
LAK-REN VENTURES, INC.,

BY Tim
James H. Wren.

1 Print : Arthur Lakes.
Gilbert R. Schwarz.

Baker East Tybo Supplemental Data of Aug. 4,1970 :

a). 1,000' hole to cross the 2-G Vein at about 600' below the No. 2 Adit ore shoot, after calculating the probable rake.

b). 1,000' hole to cross the 2-G Vein at 500 to 600 feet below the No. 3 Adit elevation. Old Tybo ore shoots did not commence swelling until depth was attained to the 300' level. The Old Tybo 2-G Shaft Collar is near the elevation of the No. 3 Adit at East Tybo. Therefore, if East Tybo conditions are similar to Old Tybo, a good mining width cannot be expected before some 300' below the No. 3 Adit . Old Tybo's ore shoot widths went out to nearly 30' in a number of the stopes below it's 300' level. However, their widths above the 300' level were 1' to about 3' average as shown on assay maps which I have. At one time I owned 20% of the Old Tybo Mine's 14 patented mining claims, townsite lots and located claims, so have an excellent technical file concerning the property.

c). 1,000' hole in an area showing obvious leached mineral on the 2-G Vein between the No. 2 and No. 3 East Tybo Adits.

If the East Tybo Mine does not have similar ore shoot swells like Old Tybo Mine had at depth, it is doubtful that it can be worked at this time profitably.

The Old Tybo Mine water stands at seasonal variations between the 300' level and the 400' level. Excessive water volume was not experienced until the mine was some 1,000' deep, worked through the three compartment Hales Shaft. That shaft attained a total depth of 1,560' with the last undeveloped level being the 1,510' Level. The 1,310' Level was the last developed level. Over 1,000 gallons per minute was pumped from that elevation in the middle 1930s.

ECONOMICS :

All economics have changed quite a bit since my report of June 22, 1970. While metals on the whole have a better market, particularly silver and it's apparent potential, all costs have raised. Example : Until the general smelters' strike during the fall of 1967 I had been consistently shipping ore of the Old and East Tybo character to AS&R at Selby, California. The strike lasted some six months. To Fall of 1967 I had a maximum smelting schedule of $15.00 per ton of crude ore treated @ 50 Ozs. silver, 15% lead and about $3.00 gold. That schedule was changed 50% when the smelter resumed operation in about May 1968. From that time my rate was $22.50 per treated ton for my Nevada Silver Producers, Inc. crude ore.

Arthur Lakes, President
James H. Wren, Sec.-Treas.

Office:
702 Forest Street
Reno, Nevada 89502
Phone: 323-8910

LAK-REN VENTURES, INC.

Mining Enterprises

1055 Curti Drive,
Reno, Nevada 89502.
Phone : 322-4840.

Mr. Gilbert R. Schwarz,
Alahambra Jay Bldg., Suite No. 100,
Sacramento, California.

August 4, 1970

Dear Gil :

Mr. Baker, who I've known for many years,spent a couple hours with me this morning. I gave him an explanation of your East Tybo Mine project and my office copy of the formal East Tybo Report on loan. There's a great deal of geology in the report which will take him some time to digest.

You'll find Baker a high type of engineer with the very best of background record. He also is extremely well versed in metallurgy which might be helpful concerning the Tybo Tailings. If subsequently he does any work on them for you, by all means make available the 1931 Nevada State Bureau of Mines bulletin as well as the R. E. Simpson report. The Nevada State Bureau of Mines metallurgical report can be acquired again at the University of Nevada but I gave Mitchell my last copy of the Simpson report.

If Mr. Baker , at any time,wants to look over the complete Old Tybo Mine reserve file including the voluminous map file, it'll be available to him.

With regard to the tentative offer by you to pick up the Lak-Ren Ventures, Inc. lease-option on the East Tybo Mine for $10,000 on or before August 15th, Lakes and I will accept.

Concerning your mention last evening of more specific mention of my delivery to you on our in force " Conditional Assignment Sale Agreement" you can add in addendum whatever clarification you wish , providing it don't change the intent of the agreement. I thought I covered the assignment delivery, however, in the SIXTH section labeled " ASSIGNMENT DELIVERY" on page three, as follows :"At the time of the herein described FINAL PAYMENT for the assignment, when paid on or before October 1, 1970, SELLER will execute a proper receipt in acknowledgement of said FINAL PAYMENT and this CONDITIONAL ASSIGNMENT SALE AGREEMENT will be considered satisfied by both of the parties hereto and the BUYERS shall be the OWNERS all right and privileges delivered by this agreement " .

Mr. Gilbert R. Schwarz Letter of Aug. 4, 1970 :

In the event that I happen to be out of town next Thursday when you and Stevens make a proposed trip to Reno, any business we have pending about East Tybo Option can be taken up with Arthur Lakes.

Sincerely yours,
LAK-REN VENTURES, INC.,

BY ______________________
James H. Wren.

1 Print : Mr. Arthur Lakes.
Lawrence Stevens.
David Baker.

P. S. Included herewith is a print of a memo I gave Dave Baker concerning the East Tybo Mine Report of June 22, 1967. JHW

MINE MANAGEMENT
OPERATIONAL CONSULTING

MINE EXAMINATIONS
MINING ENGINEERING

INVESTOR'S REPORTS
EFFICIENCY STUDIES

J. H. WREN & CO.

CONSULTING MINING ENGINEERS

CABLE ADDRESS
WRENCO

REPLY TO:
P. O. BOX 2021
RENO, NEVADA
PHONE 322-4840

P. O. BOX 132
SACRAMENTO, CALIF.

CONTENTS

MAPS :

The East Tybo Engineering and Geologic Maps accompany this report. Due to their voluminous file, they are only available in the James H. Wren, Reno, Nevada office.

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PHONE 322-4840

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SACRAMENTO, CALIF.

EAST TYBO MINE REPORT OF JUNE 22, 1967 :

CONCLUSIONS :

The East Tybo Mine has excellent technical data support compiled by professionals with outstanding leadership records in their respective fields.

Without question the property would have been exploited during the period , 1929 through 1937 on the strength of the Old Tybo 2-G Vein's over 500,000 tons of production, excepting that during the "Depression " years, gold was first $20.67 per ounce, silver was averaged at less than .55¢ per ounce, lead and zinc markets averaged 3.5¢ to 4.5¢ and at all times those markets were weak.

An entirely different marketing outlook is now in effect which will be very advantageous to any operator of the East Tybo Mine. Silver is now $1.301 per ounce, and even gold may eventually be raised in price or have a domestic subsidy. It appears as though silver may reach $2.00 per ounce.

The 2-G Vein has produced practically all of the Tybo Mining District ore to-date. Most of the 2-G Fault Block is on the East Tybo ground. The actual production record to-date from the 2-G Vein is nearly $10,000,000. That figure would be close to $30,000,000 at 1967 market prices. The rake of Old Tybo ore shoots physically proves that at depth their continuation will be on East Tybo Patented Ground.

The fact that the prospective production zone on the 2-G Vein on East Tybo Property is patented property is now very important. The Federal Government is already causing located property owners trouble, and the writer believes that within a few years what now constitutes located property ownership on public domain will require being leased from the government, whereby there'll be few if any small to middle class operators.

In view of the objectives potential of the East Tybo Mine and its proven merits, leads the writer to believe that this is an unusual opportunity to capitalize upon former activities and factual knowledge gained during previous production accomplishment out of the 2-G Vein. The outlook is made particularly attractive by the quite small investment necessary to drive the ore haulage entry.

Mine Management
Mine Production

Licensed
Bonded

Development
Exploration

J. H. WREN & COMPANY

Mining Contracting Engineers

Cable Address
WRENCO

Post Office Box 2021
Reno, Nevada 89505
Phone (702) 322-4840

OCTOBER 30, 1967

TO : J. Tingley

DEAR JOE :

The following is some supplemental data with regard to the East Tybo Mine Project :

1. During the past month we've spent about $5,000 rehabilitating roads, making trailerhouse pads, cutting new roads, and about 700' of bulldozer-ripper work on the 2-G Vein between the No. 2 and No. 3 Tunnels. In places we've cut down on the vein some 15' to 18'. Some carbonate lead ore was opened but the croppings and into the cut into the vein high and in many instances complete leaching is present. The No. 3 Tunnel in some 125' is in a sulphide zone, however, as it is highly pyriti pyritized, sometimes a zoning influence in these types of ore occurrences.

2. It is my belief that depth below the No. 3 Level is important relative to longer and thicker ore shoots. That was the case of Old Tybo. The No. 3 Tunnel is about the same elevation as the 2-G Shaft Collar at Old Tybo.

3. Our plans are to run in about 700' on the No. 3 Level and 150' on the No. 2 Level. In the case of the latter I don't think they have crossed the "core"of the Larsh Ore Shoot. If not expect to get some shipping ore there.

4. Tentatively we would consider granting an option on the operating rights of the property for deep drilling, probably Bx with 600' to 750' holes crossing the projected ore shoots' centers about 400' below the No. 3 elevation. At the same time we'd be drifting out the No. 3 and doing the above mentioned work in the No. 2, trading all technical data gained with whatever company is doing the deep level drilling. Incidentally, I have all of the Old Tybo Mine maps, assay charts, confidential office correspondence with management, etc., as well as some drill hole logs. I owned 20% of it one time. In later years promotional activities obligated titles and now it is in a legal mess. However, if and when it's straighed out there'll be a real expensive rehabilitation job at Old Tybo. By the way the last production level at Old Tybo was the 1310' Level and the Shaft (Hales) is 1560' deep but not connected with the vein although they cut a pocket in Sept. '37 the month the mine closed.

Regards,

JAMES H. WREN.

EAST TYBO MINE REPORT OF JUNE 22, 1967 :

CONCLUSIONS, Continuation :

The Old Tybo Mine did not suspend operations during September of 1937 for lack of ore. The falling metal prices at that time dictated the closing of the property. That project proved the 2-G Vein Ore Shoot System to have at least 1,310 feet of depth below the 2-G Shaft Collar. The operating company, Treadwell-Yukon, a highly experienced mining production firm had confidence of even greater depth as the Main Shaft, the Hales, was sunk to a depth below the 1,500' level. The shaft was sunk 17' during September 1937, the month the mine was shut down.

With regard to the East Tybo Mine's proposed exploration-development project, the element of capital risk is practically nil vs the normal factors involved in most mining enterprises.

Yours very truly,
J. H. WREN & COMPANY,

BY James H. Wren
James H. Wren,
Mining Engineer.

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PHONE 322-4840

P. O. BOX 132
SACRAMENTO, CALIF.

EAST TYBO MINE REPORT

June 22, 1967

LOCATION :

The East Tybo Mine is situated in the Hot Creek Range in the North-Easterly part of Nye County, Nevada. The property is some 70 miles North-Easterly from Tonopah, Nevada via U. S. Highway No. 6. The accompanying Area Maps will designate the exact geographical position. Of the above 70 miles ten of which is over good graveled road access from the highway to the mine. Recent road construction has been accomplished to the proposed Number Three Tunnel Portal. Highway access is also available from Eureka, Ely and Caliente, Nevada.

The property's elevation above sea level is 6,000 to 7,000 feet and an all year working season has been established by the working records of the district.

PROPERTY EXTENT :

The East Tybo Mine holdings consist of three patented mining claims and three lode mining claims held by location.

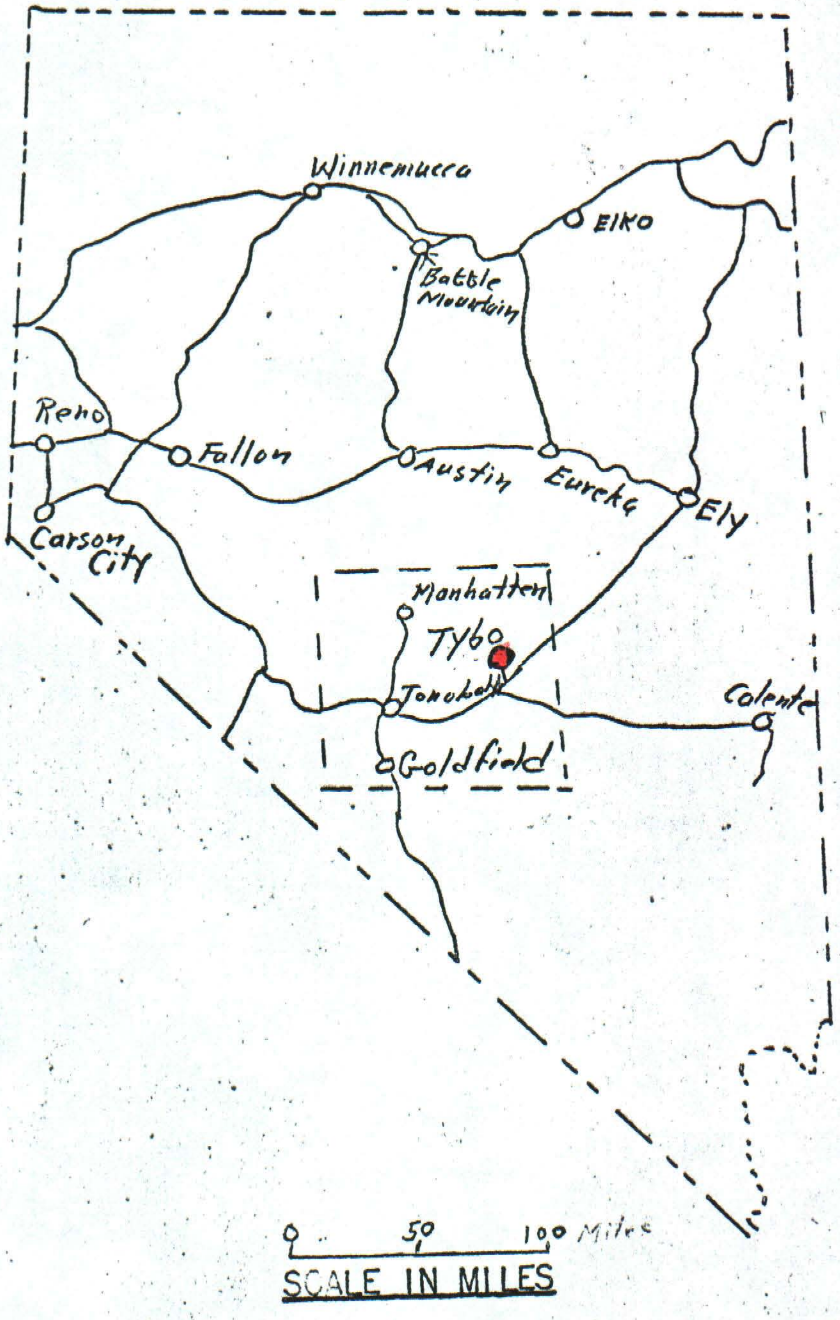
OWNERSHIP :

The patented and unpatented properties are free and clear of obligation and are owned by the East Tybo Mining Company, Inc. , a closed Nevada corporation organized in 1928. The East Tybo Mining Company, Inc. is wholly owned by, Mrs. Elizabeth De Cou Larsh and Ronald S. Allison, mother and son, of P. O. Box No. 96, Carson City, Nevada.

On the fifteenth day of June 1967, a binding option with specific terms of a "Mining Lease With Purchase Option" was granted to James H. Wren, Mining Engineer of P. O. Box 2021 Reno, Nevada and Arthur Lakes, Geologic-Engineer of 702 Forest Street, Reno, Nevada.

REPORT

MAP OF NEVADA SHOWING TYBO LOCATION



EAST TYBO MINE REPORT OF JUNE 22, 1967 :

LEASE-OPTION TERMS :

The "Mining Lease With Purchase Option" terms optioned are as follows :

a). Lease-Option period = Five Years with a renewal option at the election of the Lessees-Optionees for an additional five years after the first five years period runs out.

b). The lease-option and the existing option are assignable by the Lessees-Optionees.

c). A sixty day free examination period, from June 15, 1967, has been granted.

d). After sixty days from June 15, 1967, a minimum royalty of $250.00 per month is charged for any month in which royalty returns are below that amount. All minimum royalties and royalties amounts are applicable towards paying out an option price of $250,000 for free and clear title delivery by the East Tybo Mining Company, Inc.

e). Nine months from the begining date of the described monthly minimum royalty payments, those payments shall be raised to $500.00 per month.

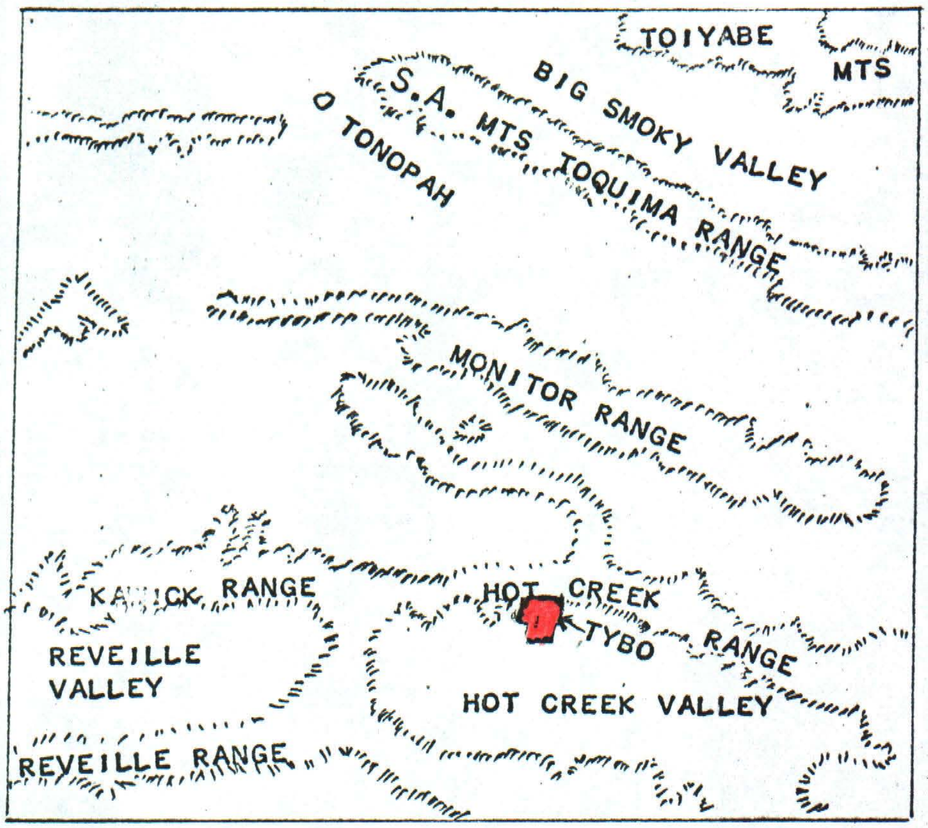
f). All project production income will carry a net-to-the-mine-bin royalty payable to the East Tybo Mining Company, Inc. , which is applicable against the optioned purchase price.

HISTORY :

Practically all of the production from the Tybo Mining District has resulted from the "TWO-G " Fault. The East Tybo holdings cover some 2,800 feet of that mineralized zone and the balance is on the Tybo Mine ground which has been proven to a depth of 1,310 feet below the portal elevation of the No. 3 Tunnel portal of the East Tybo Company. Upwards of $10,000,000 has been produced out of the 2-G Fault since 1869, at former metal prices, the bulk of which was sold at less than 60¢ per ounce silver, 3-1/2¢ to 5¢ lead and 3-1/2¢ to 5¢ per pound zinc. The former production, at present market quotations would be valued at near $30,000,000.

During early East Tybo Mine work from 1910, Mr. Larsh a very capable mining engineer, (father of Mrs. Larsh, one of the owners), along with Mr. Hunt who amased an immense mining fortune, carried on exploration, sevelopment and some production out of the 2-G Fault zone.

GEOGRAPHICAL AREA



AREA OUTLINED ON STATE MAP

J. H. WREN & COMPANY

J. H. Wren & Company
Post Office Box No. 2021
Reno, Nevada 89505

GEOLOGY :

This section will cover the geology of the Tybo Mining District in general, and in particular, geologic detail associated with the 2-G Fault in both the East Tybo and the Tybo Mines.

The specific detailed studies herein described were accomplished by :

a). The writer of this report at one time owned twenty percent of all of the Tybo Mine Properties. During his interim of ownership detailed studies of the geology, mineralogy and metallurgy of the rocks and mineralization gradation were made over a period of three years. In view of the economic aspects, these studies were necessarily confined to the 2-G Fault Area.

b). Complete Tybo Mine Maps and diamond drill logs to the 1, 540 level of the Hales Shaft. It was found that the Tybo Mine Ore Shoots raked towards the East Tybo Property and those most South-Easterly would be on East Tybo ground at about 700 feet of depth below the 2-G Shaft Collar. Maps available in the writer's files are : Tybo Mine 2-G Fault Longitudinal Vertical Section. Every level plan to the 1, 310 ' Level. Assay maps. Mineral gradation maps compiled from data gain by over 500, 000 tons of gold, silver, lead and zinc ore treatment, may 1929 through September 1937.

c). Other detailed geologic information herein is the result of observations by : Dr. Henry G. Ferguson, Dr. Edwin Kirk, and Dr. Francis Church Lincoln.

d). <u>REFERENCE</u> :

T. B. Nolan, Nevada University Bulletin, Vol. 24, pp. 10-13-1930.
E. Blackwelder, Geology Journal, Vol. 36, pp 289 381 - 1928.
J. E. Spurr, U. S. G. S. Bul. No. 208, pp. 87-88 - 1903.
U. S. B. M. Information Circular No. 6430, March 1931.
John B. Farish, Tybo Mining District Geology, dated October 1910.
W. H. Blackburn, Gen'l. Supt. Tybo Mine, 1928 through 1937, report.

Geologic maps herewith : Plate 1, Plate 1-A, Plate 2 , Plate 3, and Plate 4 .

The rocks include marine sediments of Cambrian, Ordovician, and Silurian age, two nonmarine formations of probable Tertiary Age, and dikes and lava flows also regarded as Tertiary.

The Cambrian sediments have been mapped as three units. To these units new formation names, (Swarbrick, Tybo, and Hales), have been given. The oldest, the Swarbrick formation consists principally of chert and thin-bedded limestone and has an exposed thickness of twenty-five hundred to 3, 000 feet.

GEOLOGY - Continuation

2,500 or 3,000 feet. Succeeding the Swarbrick is the Tybo shale, consisting dominantly of shale with a thickness of about 1,600 feet. The uppermost Cambrian unit, the Hales limestone, consists almost wholly of limestone. Its upper contact is not exposed, but a probable thickness of 3,000 feet is present.

The Ordovician and Silurian formations are lithologically similar to those of the Eureka district, and the same nomenclature is therefore employed.

The Pogonip is dominantly limestone, but near the top contains slate and quartzite members. Both lower Pogonip (Beekmantown) and upper Pogonip (Chazyan) are present. No complete section was found, but it is estimated that no less than 500 feet of the lower Pogonip and 3,000 feet of the upper Pogonip are present.

The Eureka Quartzite overlies the Pogonip limestone, but is lacking in places. Its maximum thickness does not exceed 150 feet.

The Ordovician limestone, which at Eureka overlies the Eureka quartzite, is lacking at Tybo and the quartzite itself suffered erosion before the deposition of the Silurian. The silurian consists of several hundred feet of massive dolomite with a little limestone near the base. The formation is lithogically similar to the Lone Mountain limestone of Eureka.

The Gilmore Gulch formation consists of sandstone, shale, and siliceous tuff. On lithologic evidence it is thought to be of Tertiary age.

The Gilmore Gulch and older formations are cut by numerous dikes of quartz latite porphyry, and at least 500 feet of similar quartz latite, probably a flow, overlies the Gilmore Gulch formation.

After weathering and erosion of the rhyolite about 150 feet of dominantly tuffaceous sediments were laid down. These sediments are similar in character to those of the Esmeralda formation of upper Miocene age, and are herein designated Esmeralda (?) formation.

Overlying the Esmeralda (?) formation are flows of andesite, dacite, and rhyolite.

The structure of the district is complex. The Paleozoic rocks in the central part of the area have been strongly folded, the principal

EAST TYBO MINE REPORT OF JUNE 22, 1967 :

HISTORY

The Tybo Mining District is one of the older State of Nevada mining areas. Like others of its type it was first worked for its surface ores, which carried high amounts of silver.

The earliest discovery of ore in the Tybo Mining District was made in 1869 according to reliable historical information. The 2-G Lode was discovered in 1871, and the Tybo Consolidated Mining Company erected a smelter in 1872. Charcoal burned from nearby native timber was used as smelting fuel. During the period from 1872 to 1879 total reported tons of ore from the Tybo Mine was 61,439, and only 156 tons from other properties were smelted. Yield out of the produced tonnage of crude ore was: 7,100 tons of lead bullion, which contained 1,743,000 ounces of silver and 15,330 ounces of gold. Average recovery was: 11 percent lead, 27.5 ounces of silver and 0.24 ounce of gold. The earliest smelter slag was resmelted, indicating a high original loss. The present slag pile at Tybo holds values from $12 to $21 per ton.

Mining continued at the Tybo Mine and nearby properties until 1888 under different owners after 1879. A 20-stamp mill was in operation, and the silver content only of the oxidized ores was treated by the "Reese River" process, pan amalgamation followed by chloridizing roast. By that method about 80 percent of the silver value was reported to have been recovered. The reported production for the period, 1879 to 1888, all from the Tybo Mine was: 834,000 ounces of silver and 5,030 ounces of gold from 42,000 tons of ore.

Minor attempts were made to reopen the mine in 1901, 1906 and 1917. This latter attempt erected a straight flotation plant and lead smelter but was unsuccessful as there was no means of separating the lead sulphide from the zinc sulphide at the time. The plant closed in 1920.

The various properties included in the entire Western part of the District and along the 2-G fault line as far as the point where it crosses the ridge South of Tybo Canyon as well as some ground along the Eastern front of the range, were acquired in 1925 by the Treadwell Yukon Co., Ltd. After extensive exploration, construction of a 300-400 differential flotation plant was commenced in November of 1928 and started treating Tybo Mine ore on May 13, 1929. This company produced over 500,000 tons of ore to September 30, 1937 which had a gross value at depression prices of over $7,000,000. The total Tybo Mine production figure is well over $10,000,000. Selective flotation was a new process when the mill first started and many improvements have been made in lead-zinc selective flotation metallurgy since suspension of milling treatment at Tybo in 1937. Underground mining methods and equipment have become more efficient

HISTORY - **Continuation**

	TONS	VALUE	
1867	158	$19,648	
1868	89	11,537	
1969	2	239	
1870	33	3,576	
1871	10	751	F
1872	4	223	I
1874	1,763	56,013	R
1875	4,947	179,854	S
1876	12,384	430,370	T
1877	22,551	644,320	
1878	17,936	513,329	C
1879	12,202	302,981	Y
1880	7,727	177,760	C
1881	2,000	38,000	L
1882	3,776	98,901	E
1883	2,700	50,525	PAN MILLING
1884	783	16,082	
1885	52	3,364	CHARCOAL
1 1886	8	1,480	
1887	990	31,155	SMELTING
1888	2,007	26,726	
1889	11	1,441	
1890	1	97	
1891	5	1,202	
1917	491	22,942	SECOND
1918	277	10,665	CYCLE
1920	415	3,685	BULK FLOTATION
1929	54,148	615,876	
1930	74,271	833,074	T C
1931	71,676	716,419	H Y
1934	43,266	1,069,926	I C
1935	106,086	1,535,556	R L
1936	73,317	1,071,739	D E
1937	51,814	916,560	SELECT-FLOTATION
1938	1,079	22,219	MINOR
1939	5,671	60,843	LESSEE
1940	7,726	90,734	TONNAGE
TOTAL TO END 1940			
	582,377	**$9,570,848**	

The above total recovery value @ present market prices would exceed $25,000,000. All of the production income and tonnages were mined out of the 2-G FAULT. With 2,800 feet of the 2-G Fault Strike owned by the East Tybo Company, that length is much greater than the strike length on the Old Tybo Property.

GEOLOGY - Continuation - Rock Formations

Swarbrick Formation

The Swarbrick formation derives its name from the Swarbrick prospect, in the eastern part of the district where it forms the hanging wall of the ore-bearing fissure. The formation crops out only in the eastern part of the district, where an anticline gives an elliptical area of outcrop about 3,000 feet wide along the creek, truncated on the south by the 2-G fault and extending northward from the 2-G fault for about a mile. The base of the formation is not present, and in the area exposed there is much minor folding and crumpling, which makes impossible any close estimate of thickness. However, about 2,500 or 3,000 feet is probably exposed.

The formation consists in large part of gray chert. The individual bands do not exceed a few inches in thickness. Interbedded with the chert is a varying amount of bluish-gray limestone, also in thin bands. The limestone appears to increase in amount below the top of the formation, and at the Swarbrick upper tunnel near the crest of the anticline the limestone exceeds the chert in volume. Near the top of the formation, shale is interbedded with the chert, and the contact with the overlying Tybo shale is gradational. The uppermost chert beds were included in the Swarbrick formation, and thus, as mapped, the uppermost 200 or 300 feet is in places dominantly shale, containing more or less chert.

The formation is prevailingly thin-bedded, and the topography in the area in which it crops out is consequently less rugged and lacks the prominent cliffs that mark the higher Cambrian and Ordovician limestones. On the other hand, it is much more resistant than the shales of the Tybo formation, which immediately overlie it; consequently there is a marked steepening of the canyon walls within the area occupied by this formation.

Tybo Shale

The Tybo shale, named for its exposures in Tybo Canyon near the camp of Tybo, consists dominantly of fissile olive-gray to dark shale. The lithologic differences between the basal part of the Tybo formation and the underlying Swarbrick formation are not sharp. For purposes of mapping, the base is taken as the top of the highest chert bed of the Swarbrick formation. Thin beds of limestone and calcerous shale with concretions of dense gray limestone appear near the top of the formation, and the transition between shale and the overlying thinbedded limestone of the Hales formation is gradual, though sharper than the transition at the base of the formation.

GEOLOGY - Continuation

axis of folding trending a little north of west. The major anticline is overturned to the south and southwest and is broken by a large reverse fault. The rocks to the south of this fault are relatively undisturbed. The folding apparently did not involve the Gilmore Gulch formation, and it is assumed that it took place within Mesozoic or early Tertiary time.

Several stages of faulting are shown by relations of the faults to each other, to the dikes of quartz latite porphyry, and to the later lavas. The oldest major fault, the 2 G-Dimick fault, cuts the southern limb of the overturned anticline and is considered to have been formed at the time of folding. The displacement is in the reverse direction and may exceed 6,000 feet. Thrusting may have taken place along low angle faults in the eastern part of the district during the same period of compression.

The first period of normal faulting was prior to the intrusion of the quartz latite porphyry dikes. The principal fault formed at this time cut and displaced the earlier reverse fault, but there was also motion along the reverse fault. There was also movement later than the quartz latite intrusion along both faults. Normal faults along the range front are later than the lavas that overlie the Esmeralda (?) formation.

Although the faults along the range front are comparatively recent, the present relief of the range is probably not directly due to faulting, but to erosion of the less durable formations to the west.

ROCK FORMATIONS

Summary

The rocks of the Tybo district include sediments of early Paleozoic age, from Cambrian to Silurian, a sedimentary formation of unknown age, possibly Tertiary, and dikes, lava flows, and sediments of probable Tertiary age. The Paleozoic formations have been closely folded and extensively faulted, but the younger formations though tilted and faulted, are not folded.

Cambrian

The Cambrian of the Tybo district was divided on a lithologic basis into three units, to which, as they were not closely comparable with the nearest known section, that of the Eureka district, local names have been given.

GEOLOGY - Continuation - Hales Limestone

the canyon about 2,500 feet above the base of the formation, a bed about 200 feet thick is present. Three quartzite beds, each about 50 feet thick, were found in the block adjoining the Uncle Sam Fault in the northern part of the district, but here the interpretation of the structure is uncertain and it may be that a single bed is repeated by folding or faulting. As the quartzite occurs above the horizon at which Cambrian fossils are present it may possibly belong to the overlying Pogonip linestone, perhaps marking the base. However, as its relation to the undoubted Pogonip is unknown and the lithogology of the limestone is the same above and below, it is included on the map with the Hales limestones.

As the Hales is lithologically similar to the overlying Pogonip limestone, and as no single block of the fault-block mosaic of the district contains both Cambrian and Ordovician fossils, the position of the upper boundary could not be determined. As mapped, the entire thickness of thin-bedded gray limestone in the fault block north of the 2-G fault and east of the Uncle Sam fault is assumed to belong to the Hales formation, giving a probable thickness of about 3,000 feet. The thickness from the base to the highest bed in which Cambrian fossils were found is about 1,300 feet.

The principal area of outcrop of the Hales limestone is north of the 2-G fault, bordering the area of the Tybo shale. As it is more resistant it forms an upland around the more easily eroded shale. On the west, where the dips are generally steep, the formation crops out in a ridge between the Tybo formation and the Uncle Sam fault. On the north the gently dipping limestones form the prominent cliff-walled ridge that forms the north wall of the Tybo Canyon. The formation is not continuous on the eastern limb of the anticline, as it is broken by the faults that parallel the front of the range, but it forms the crest and eastern slope of the ridge facing the valley south of the canyon and is also present on the corresponding ridge north of the canyon.

Dr. Charles E. Resser reported as follows on the fossils collected from the Hales formation:

> Lot 30.73 contains a new species of Pterocephalia, which together with some smaller trilobites indicates the same formation as the one that occurs in the Eureka district, but unfortunately this formation is not placeable in any determined section. At present we consider this bed as situated either in the upper

GEOLOGY - Continuation - Tybo Shale

The exposures are not as good as those of the other formations, and as the shales are much crimpled no close estimate of the thickness is possible. As measured across the strike of the formation on the basis of average dips observed and the dips of the underlying and overlying formations it appears probable that the total thickness is about 1,600 feet.

The principal area in which the formation is exposed is a belt between 1,000 and 3,000 feet wide bordering the Swarbrick formation north of the 2-G fault, principally north of the canyon. In the eastern part, near the mouth of the canyon, the apparent thickness is probably increased through partial repetition by faulting along the extension of the northerly fault that borders the hills of the canyon.

The same formation also crops out south of the canyon in the lowlands bordering the range between the range front and the valley fill.

As the Tybo shale is less resistant than the overlying limestone and underlying chert, it tends to form lowland areas. On the north side of the canyon it crops out in an area of gentle slope, largely covered by talus of limestone. South of the canyon the formation is repeated by faulting. The northward-trending canyon that enters Tybo Canyon near its mouth is cut along one belt, and the other occupies the pediment bordering the upland area.

Hales Limestone

The uppermost Cambrian formation is here named Hales limestone from the Hales shaft of the Tybo mine, which is almost entirely within this formation. The formation consists almost entirely of limestone. At the base there is about 50 feet of brown shaly limestone transitional from the underlying calcareous shale of the upper part of the Tybo formation. In places, however, as in the areas near the east front of the range, these transitional beds are missing, and the fissile shale of the Tybo lies directly below the limestone. It may be, however, that the absence of the transitional beds is due to faulting.

The formation consists chiefly of bluish-gray limestone, for the most part thin bedded but containing a few massive members. Lenses and nodules of dark chert are abundant near the base but are absent from the upper part of the formation.

The upper part of the formation, as mapped, contains one or more beds of quartzite. On the north slope of the ridge north of the

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GEOLOGY - Continuation

> part of the Secret Canyon shale or a little higher in the section. Lot 30.72, which you say is just below 73, contains trilobites that are altogether new. The remainder of the material appears to be approximately the same, but the type of brachiopod that is present is not confined to any particular zone but ranges widely throughout the Upper Cambrian. However, such trilobites as I have been able to uncover would place this material also at about the same horizon as the preceding lot, making all of it Upper Cambrian.

ORDOVICAN

Two formations of the Ordovician section of the Eureka district, the Pogonip limestone and the Eureka quartzite, are present in the Tybo district, but no Ordovician formation higher than the Eureka quartzite is present, and the Eureka quartzite and to a minor extent the underlying Pogonip limestone appears to have been eroded before the deposition of the next higher formation, the Lone Mountain dolomite of Silurian age.

Pogonip Limestone

As fossils characteristic of the Pogonip formation, which is widespread over eastern Nevada, were found at many different horizons below the Eureka quartzite, the accepted name is used in the description of this formation.

Both the lower Pogonip (of Beekmantown age) and the upper Pogonip (of Chazyan age) are present in the district, but as no certain dividing line could be established they are not separated on the geologic map.

The rock occupying the wedge between the two eastern branches of the 2-G fault contains fossils of lower Pogonip age. Here the rock consists almost entirely of blue-gray limestone with well-marked bedding planes from 6 inches to 5 feet apart. A thin bed of quartzite, apparently not continuous, crops out near the northern branch of the fault in about the middle of the exposed section. The thickness of the formation, as exposed between the two branches of the 2G fault, is at least 500 feet. Fossils from this locality were identified by Dr. Edwin Kirk as Orthis sp. and Lingulella sp.

GEOLOGY - Continuation

Ordovician

Fossils of lower Pogonip age were also collected at the south end of the ridge just north of the mouth of the canyon. Here the relations with the neighboring rocks are uncertain. The gray limestone containing the Ordovician fossils is in fault contact with shaly limestone similar to that which crops out elsewhere at the base of the Hales formation and which carries Cambrian fossils. The north end of the ridge is capped by quartzite lithologically similar to the Eureka, but the ridge is crossed by one or more faults.

Dr. Kirk identified the following fossils from this locality:

29-99 Base of limestone at mouth of Tybo Gulch, north of gulch.
Lingulella cf. L. pogonipensis (Walcott).
Orthis sp.
Cystid plates
Fragments of asaphoid trilobite
Annelid trails.

Fossils of upper Pogonip age were found within a much larger territory, but it is possible that in these areas there may also be lower Pogonip beds, or there may be a gap of unknown extent between the recognized upper and lower Pogonip exposures.

The thickest section exposed is in the area north of the Dimick fault and west of the 2-G fault. Here the lower portion, exposed on Air Shaft Ridge and in the lower part of Bunker Hill Canyon, consists of about 1,000 feet of medium to thin bedded blue-gray limestone that weathers to smooth surfaces of light gray. Above this is a bed of impure quartzite, conglomeratic in places, which is nowhere over 50 feet thick. This bed can be traced from the south side of Air Shaft Ridge to a point a short distance south of the Bunker Hill fault, but is not found farther north. About 700 feet of thin-bedded limestone overlies the quartzite. Above this limestone is a persistent zone of shale 400 feet in thickness. The shale is in part brown and calcareous, but particularly at the north, near the head of Bunker Hill Canyon, it is in part micaceous, with red iron oxide staining on the partings. The 900 to 1,000 feet of limestone that overlies the shale is more massively bedded than the lower limestone members. In the area south of the 2-G fault the limestone at this horizon forms prominent cliffs above the bench cut on the shale, but north of the Dimick fault, where the dips are generally steep, the more massive members tend to form sharp ridges.

GEOLOGY - Continuation

Ordovician

At this horizon there appears to be at least one bed of dolomite, apparently continuous and independent of the sporadic dolmitization found in places along the faults. Just beneath the Eureka quartzite a little splintery black shale was seen in places. This bed is probably not over 20 feet thick and is rarely observable owing to the heavy talus from the overlying quartzite. The total thickness of the Pogonip beds exposed in the area north of the Dimick fault is about 3,000 feet. The ridge south of the 2-G fault and east of the Uncle Sam fault shows the same general lithologic sequence, though, perhaps through errors in location on the topographic map, the apparent thickness of the different members is not quite the same. From the 860-foot level of the Tybo mine to the crest of the ridge the total thickness of the beds exposed is about 2,200 feet.

The principal fossil collections from the upper part of the Pogonip came from the ridge south of the 2-G fault. Dr. Kirk identified the following fossils from collections made on the ridge southeast of the Tybo mine. Of these the first two lots were collected from the limestone below the shale and the last immediately above it.

29-18 Orthis sp.
Orthis type of O. tricenaria Conrad.
Rafinesquina sp.
Maclurites sp.
Cameroceras sp.

29-19 About 100 feet above 29-18
Receptaculites mammiliaris Newberry
Maclurites sp.
Illaenus sp.
Small subspherical algae (?)

29-20 Overlying slate
Indeterminable bryozoan.
Orthis ef. O. lonensis Walcott.
Orthis type of O. tricenaria Conrad.
Calcareous algae (?)

Collections made south of the 2-G fault on the east front of the range yielding the following:

29-103.
Interminable bryozoan.
Valcourea (?) sp.
Liospira sp.
Trochonema sp.
Leperditia bivia White

GEOLOGY - Continuation

Ordovician

30-101 Undescribed bryozoan.
Orthis sp.
Eotomaria sp.
Maclurea sp.
Leperditia bivia White.

Dr. Kirk comments as follows on the upper Pogonip collections:

The foregoing lots may be correlated with the Chazyan of the East. The horizon is not known in Colorado or Texas, but an approximately equivalent horizon is found in the Swan Peak of northern Utah.

Fossils of upper Pogonip age were also found on Air Shaft Ridge and the hill to the north, but in this area they are poorly preserved.

Eureka Quartzite

The Eureka quartzite, characteristically a dense white quartzite, overlies the Pogonip limestone. In a few places where cementation is not complete, generally near the base, it is grayish in color, and faint bedding and rarely cross-bedding can be distinguished. It differs from the thin quartzite beds within the Pogonip formation in being purer and more massive.

As no fossils were found in the formation, the correlation with the standard Eureka section is based on its lithologic character and stratigraphic position. Where it lies between the Pogonip limestone and Lone Mountain dolomite, as in the hills west of the Bunker Hill fault, its position together with its lithologic character serve to distinguish it with certainty. In the eastern part of the district the overlying Lone Mountain dolomite is eroded, and the quartzite occurs as isolated masses capping ridges of Pogonip limestone. Its nearly purewhite color, greater degree of cementation, and greater thickness serve to distinguish it from the quartzite within the Pogonip limestone. Two small wedgelike masses of what is believed on lithologic evidence to be the Eureka quartzite occur along the Bunker Hill fault north and south of Tybo Canyon.

The maximum thickness as exposed in the Tybo district is only about 150 feet. On the hills north of the Cunningham project the Eureka is present as a series of discontinuous lenses, of unequal thickness, the result of erosion prior to the deposition of the overlying Lone Mountain dolomite.

GEOLOGY - Continuation

Silurian

Lone Mountain dolomite -- Above the Eureka Quartzite in the western part of the district is a thick formation consisting of several hundred feet of massive dolomite with some limestone near the base, which is correlated with that part of the Lone Mountain limestone of the Eureka district which is of Silurian rather than of Ordovician age.

The formation is readily distinguishable from the underlying Pogonip limestone by its more massive appearance and characteristically rough surface. Well-defined bedding planes are rare, especially in the dolomitic portion. Dolomite forms the bulk of the formation, in contrast to the dominant limestone of the underlying Pogonip limestone. There is, however, a small amount of dark limestone near the base and, as noted above, there is in places a little dolomite, apparently unconnected with faulting, in the upper part of the Pogonip limestone.

The western part of the hill north of Tybo Canyon and west of the Bunker Hill fault contains the principal exposure of this formation. Here it rests for the most part on the eroded and channeled surface of the Eureka quartzite and, where this is missing, directly on the Pogonip limestone. At the base is dark limestone of variable thickness, generally not over 100 feet, much more massive than the underlying Pogonip limestone and with a rougher surface, and above this is massive dolomite, lighter in color and characteristically weathering to a rough irregular surface. In places the dolomite contains white chert.

Massive dolomite, which is considered to ba a part of this formation, although the underlying Eureka quartzite is not exposed, crops out in the triangular area bounded by the Dimick, Gilmore, and Uncle Sam faults.

The only determinable fossils from this formation were obtained from the dark limestone near the base of the formation a short distance north of the Cunningham prospect. Dr. Edwin Kirk reports on them as follows:

This lot is of middle Silurian age.

Conchidium sp.
Plectatrypa ? sp.
Coenites sp.
Pachypora sp.
Striatopora sp.

GEOLOGY - Continuation

Silurian

In the Eureka district the limestone directly overlying the Eureka quartzite is of Ordovician age. This limestone is absent in the Tybo district. As the Eureka quartzite was eroded prior to the deposition of the Silurian limestone, it may be that post-Eureka Ordovician limestone, if deposited in this area, was removed during this period of erosion.

Tertiary (?)

Gilmore Gulch formation -- The Gilmore Gulch formation, named from its exposures in Gilmore Gulch, consists of sandstone, dark shale, and siliceous tuff. It occupies a low-lying area in the southern part of the district. The rocks are less resistant than others of the region, and the area in which they crop out is largely covered by talus from the quartz latite hill on the west and the cliffs of Pogonip limestone on the east; consequently exposures are poor.

The base of the formation is not exposed; the probable thickness of the exposed portion between the Uncle Sam fault and the rhyolite to the west is 400 to 500 feet.

The area in which the Gilmore Gulch formation is exposed is separated from the older formations on the north and east by faults. On the west the formation is overlain by a thick flow of quartz latite. No indication of its age is therefore evident from the areal geology other than the fact that the structural relations indicate that it is younger than the Lone Mountain dolomite and older than the thick series of dominantly volcanic rocks that overlie it.

In the neighborhood of the Eureka district, particularly in the area shown on the Roberts Mountain topographic map, west and northwest of Eureka, there is an undescribed formation of probable Carboniferous age consisting dominantly of dark shale and sandstone and containing at least one flow of a basic amygdaloidal lava. It was at first supposed that the Gilmore Gulch formation of the Tybo district was the equivalent of this formation, and specimens of the shales contain possible fragmentary plant remains that suggest fragments of Stigmaria.

Field work in 1930 threw doubt on the probability of Carboniferous age. Except near the Uncle Sam fault the rocks are less dense and compact than the Paleozoic formations elsewhere. As additional

GEOLOGY - Continuation

Tertiary (?)

outcrops were studied it was seen that bedded tuffs, derived from siliceous igneous rocks, constitute a considerable part of the formation, and that these tuffs show a lack of alteration more consistent with a Tertiary than a Carboniferous age. The tuffs and lavas of Triassic and Jurassic age in the central part of the Tonopah quadrangle, 60 miles to the west, are highly altered. In the southern part of the Tybo district, just south of the area shown onthe map, there was found a flow of quartz latite or dacite, similar in general appearance to the thick lava flow overlying the Gilmore Gulch formation. This flow is apparently interbedded with the sediments of the formation and is succeeded by a few feet of sandstone before the base of the large quartz latite flow is reached.

The observations obtainable on the attitude of the beds show that although dips are steep close to the Uncle Sam fault, owing to drag on the fault, there are apparently no folds within the formation, and the attitude of the higher beds is the same as that of the base of the overlying lava. However, the Pogonip limestone just east of the Uncle Sam fault likewise shows only gentle tilting.

The Tonopah formation of the Tonopah district consists of at least 1,000 feet of largely water-laid material and is older than the Esmeralda formation. Although it is more tuffaceous than the Gilmore Gulch formation, its presence in approximately the same stratigraphic position is perhaps additional though slight evidence for a possible Tertiary age of the Gilmore Gulch formation. The Tertiary deposits of the Elko region contain, according to Chaney, a flora indicating a middle miocene age. It is therefore thought that, notwithstanding the absence of definite fossil evidence in the Tybo district an early Tertiary age (older than upper Miocene) is not unlikely.

Tertiary

Rocks to which a Tertiary age can be rather definitely assigned, although no fossils were found in them, occur in the western part of the district and cover the western slope of the range. These rocks are dominantly volcanic flows but also include sediments, and rocks of identical lithologic character occur in places along the eastern front of the range, east of the faults that parallel the range front. Porphyritic dikes similar in composition to the oldest of the flows are intrusive into the older sediments, particularly along the faults. Although there is no essential difference in composition between these dikes and the quartz latite flow, it is convenient to

GEOLOGY - Continuation

Tertiary

emphasize the difference in geologic occurrence by retaining the local distinction implied by the term "porphyry" and referring to the dikes as quartz latite porphyry and the effusive rock as quartz latite.

Quartz Latite Prophyry

A large number of small masses of porphyry occur throughout the area covered by the older formations. For the most part these masses have been intruded along preexisting fault planes, but in the relatively weak and thin-bedded shale of the Tybo formation there are numerous small sills parallel to the bedding. Small dikes that are not related to known faults are also found in the Pogonip limestone, particularly in areas where it has been strongly folded. The more massive Lone Mountain dolomite is free from porphyry, except along the faults at its boundaries.

The greater number of the dikes are alike in texture and composition, and nearly all show more or less hydrothermal alteration. The rock is white and fine grained and carries abundant small quartz phenocrysts. In a few places, as in one of the dikes north of the Bunker Hill shaft and on the 800-foot level of the Tybo mine, there is a well-marked banding parallel to the walls.

In most of the dikes the only readily recognizable mineral is quartz, which occurs in phenocrysts as much as 3 millimeters in diameter, for the most part deeply embayed by the matrix. Close inspection usually reveals also feldspar and a little bleached biotite. Study under the microscope shows that oligoclase, about Ab_{80} in composition, generally in part replaced by calcite in sericite, forms most of the small phenocrusts and much of the feldspar in the groundmass. Phenocrysts of orthoclase, similarly altered, and also present, and in some specim ens the amount of orthoclase exceeds that of the oligoclase. Biotite is sparingly present and is inconspicuous. It is commonly altered to chlorite or sericite or a mixture of both minerals. The groundmass consists of a very fine grained aggregate of quartz and feldspar, the individual grains ranging from 0.02 to 0.05 millimeter. In one or two of the thin sections examined the groundmass shows a poorly developed spherulitic texture.

A few dikes similar in general composition are characterized by large feldspar phenocrysts. Some show oligoclase phenocrysts as much as two centimeters in length, sparsely scattered through the rock. Others show more abundant smaller phenocrysts of feldspar three millimeters or less in length and somewhat larger phenocrysts of quartz. The

GEOLOGY - Continuation

Quartz Latite Prophyry

smaller feldspars are mostly untwinned. Biotite, largely altered to chlorite and sericite, is present in rather rare small phenocrysts. Dikes of this variety of porphyry were noted in the Tybo mine near the 2-G shaft and on the surface near the Bunker Hill shaft. The relative age of the two varieties was not determined.

There is no perceptible metamorphism of the sedimentary rocks adjacent to the dikes other than a slight induration of the soft shale of the Gilmore Gulch formation, but near the Rescue prospect, on the east front of the range, south of the 2-G fault, there is a small area in which the gently tilted limestone of the upper Pogonip has been altered to finely crystalline white marble. No igneous rocks crop out in the immediate vicinity, but the marbelized area may be the result of contact metamorphism by an underlying intrusive.

Quartz Latite

A large mass of quartz latite forms the high peak west of the Uncle Sam fault and south of the Dimick fault and crops out over a considerable area west, south, and north of this peak. Similar quartz latite is also found along the east front of the range, south of Tybo Canyon and east of the range-front fault. In the principal area the lava shows flow banding at the base. This flow banding has approximately the same dip and strike as the underlying Gilmore Gulch formation. Near the top of the peak there is marked columnar jointing.

The upper part directly below the overlying sediments is deeply weathered, as if it had been long exposed prior to the deposition of the later (Esmeralda ?) sediments. In this upper deeply weathered part the iron of the biotite is largely oxidized. This, together with oxidation of probable pyrite, gives brown and reddish outcrops.

The total thickness of the quartz latite exceeds 500 feet.

The flow banding at the base and the presence of similar quartz latite in two widely separated parts of the district suggest that the rock is a flow, but it might also be interpreted as a large intrusive mass from which the cover was removed by erosion prior to the deposition of the later sediments.

The quartz latite does not differ essentially from the porphyry dikes just described. The grain is finer, and the phenocrysts are generally smaller and less prominent, though in places they form a greater

GEOLOGY - Continuation

Quartz Latite

proportion of the rock than in the dikes. Biotite appears to be much more abundant in the rhyolite than in the dikes. This abundance is in part due to its generally less complete alteration. Quartz is present in small embayed phenocrysts not exceeding two millimeters in diameter and generally less than one millimeter. Feldspar phenocrysts are of the same size and equal abundance. As in the dikes, oligoclase and orthoclase are both present; their relative abundance is uncertain, but oligoclase is apparently more abundant than orthoclase.

In general the groundmass is more minutely crystalline than that of the dikes, spherulitic texture is much more common, and glass is present in specimens collected near the base of the flow.

The close petrologic similarity of the flow to the porphyry dikes suggests that they are essentially contemporaneous and that the dikes may represent conduits through which the lava passed to the surface. The apparent difference between the two rocks is largely due to the greater abundance of biotite in the quartz latite and its comparative lack of alteration.

Esmeralda (?) Formation

Resting on the quartz latite mass just described is a series of light-colored water-laid sediments, dominantly tuffaceous. At the base is a conglomerate containing pebbles of rhyolite. Nothing was found to indicate the age of these sediments, but they resemble the Exmeralda formation, of upper Miocene age, which is present in the Manhattan district, 50 miles to the west, and at Tonopah, 65 miles to the southwest, and as this formation is widespread over central and western Nevada, it is thought that the correlation is justified, although confirmatory fossil evidence is lacking. Similar sediments also overlie the quartz latite on the east front of the range, south of Tybo Canyon. As they are younger than the quartz latite, they are believed to be also younger than the mineralization. The faults in the western part of the district do not cut these sediments or the overlying lavas, but they are cut by the faults that parallel the east front of the range.

The maximum thickness in the western area is about 150 feet, but the formation appears to thin out to the south, as if deposited on an uneven surface of the quartz latite, so that on the high ridge a mile south of the mapped area and in the hills north of the area andesite appears to rest directly on the quartz latite.

GEOLOGY - Continuation

Andesite and Dacite

Above the youngest sediments (Esmeralda formation?) lies a series of andesite and dacite flows, several hundred feet in thickness. These flows differ somewhat in texture and composition in different places and were not studied in detail. At one point, close to the power-line road, the succession of lava flows is broken by a bed of white tuff. A single outcrop of similar tuff, showing a steep dip, was found in the extreme southeast corner of the area mapped, near the fault that marks the eastern front of the range. The dip of the andesite flows in the western part of the district is less than that of the underlying Esmeralda (?) formation, indicating an unconformity.

Rhyolite

On the west edge of the district the crest of the range is formed by a thick flow of rhyolite. This rock is platy and shows flow structure at the base and columnar jointing in the upper part. As far as could be seen from the road at the summit, this rhyolite forms the west slope of the range.

STRUCTURE

Summary

The structure of the Tybo district is complex, and the writer is by no means satisfied that in the short time available for the work he has been able to make an adequate explanation of all the facts observed. The most significant dips of the beds in the portion studied in detail are shown on the geologic map (Plate 1), but no attempt was made to work out minor details of the structure. From the available data, however, it is believed that the best interpretation of the structural history of the region is as follows:

In the area surrounding the districe the Paleozoic rocks are relatively undistrubed, but within the district they are sharply folded in a narrow zone having a general northwesterly trend. In places the principal fold was overturned to the southwest. The first faulting took place within and consequent upon this overturned fold and was presumably the result of regional compression. The steeply dipping reverse fault was thus formed. Minor thrust faulting within the area of folding may have occurred at this time also. Later normal faulting took place at

STRUCTURE - Continuation

several different periods. The old fault was cut and displaced by one of these younger faults, but there was also later movement along this older fault in the reverse direction.

FOLDING

As far as known the Paleozoic rocks elsewhere in the Hot Creek Range, though faulted and tilted, are not highly folded. The sharp fold of the Tybo district appears to be a local feature. Even within the district pronounced folding is confined to that portion north of the 2-G and Dimick faults and south of the high ridge that lies north of Tybo Canyon. This folding has produced an irregular anticline.

As outlined along the upper boundary of the lowest Cambrian formation, the Swarbrick, the axis of the central part of the anticline trends north and south. The beds present steep dips and in places both limbs in the southern portion are overturned. Within the area of the Swarbrick formation the rocks are locally much contorted and show sharp subordinate folds. As outlined by the upper boundary of the next higher unit, the Tybo shale, the anticlinial area shows two distinct anticlinal axes which trend northwest. The northern of these axes is just south of the cliff that forms the top of the canyon rim. To the north and northeast the dips are gentle, but on the south and west they are steep and in part overturned. The crest of the southern anticline is just north of the 2-G fault. Here also the overturn is to the south, so that although the Tybo shale is cut by the 2-G fault on the surface south of the Hales shaft, the mine workings directly below to a depth of nearly 900 feet show the stratigraphically higher Hales limestone against the fault.

The area west of the Uncle Sam fault and north of the Dimick fault presents a similar structure. The belt of dark shale within the Pogonip limestone outlines an anticline whose axis trends northwest. On the crest and northern limb the dips are moderate, but on the southern limb, in the portion north of Tybo Canyon, nearly vertical dips prevail. Overturned beds are found south of the canyon, close to the Dimick fault. Similarly the Eureka quartzite has vertical and overturned dips against the Dimick fault on the west end of Air Shaft Ridge, but progressively more moderate northward dips beneath the Lone Mountain dolomite north of the valley.

Outside this narrow belt of sharp folding there are only gentle flexures.

In the triangular area about 3,000 feet long that lies between the 2-G fault and the Uncle Sam fault the beds of Pogonip limestone dip gently

FOLDING - Continuation

to the north and northwest, but farther south, close to the Uncle Sam fault, on the ridge south of Fairbanks Canyon, southerly dips prevail. Eastward, near the Swarbrick prospect, the dips are steeper and dominantly to the northwest. The steeper dips (over 40°) are nearly everywhere close to faults and suggest drag, but the general attitude of the beds as outlined above suggests that south of the 2-G fault there may be a parallel but less pronounced anticline.

On the high ridge north of Tybo Canyon the sediments, though broken by faults, show prevailing rather gentle dips, apparently becoming less steep to the north. However, west of the crest, close to the area of porphyry that has been intruded along the Uncle Sam fault, steeper westerly to northwesterly dips prevail.

The folding involved the Lone Mountain dolomite, but although the relation of the Gilmore Gulch formation to the folds is uncertain, it is thought likely that the folding was completed before the Gilmore Gulch formation was deposited, for the dips of this formation correspond to the flow banding of the overlying flow. The younger lavas are likewise tilted to the southwest but at a smaller angle. The only definite evidence as to the date of the folding, therefore, is that it is later than upper Silurian. It is, however, presumably post-Paleozoic and contemporaneous either with the revolution that affected the rocks of the Sierra Nevada and western part of the Basin and Range province in late Jurassic or post-Jurassic time or with that which had its maximum intensity in the Rocky Mountains in early Tertiary time and extended into the eastern part of the Basin and Range province.

FAULTING

General Features

Several stages of faulting are shown by the relation of the faults to one another and by the relation of the intrusive porphyry, the quartz latite flow, and the later lavas to the different faults. It is believed that during each of these episodes renewed movement took place along the earlier faults.

It is suggested that the oldest major fault of the district, of which the present 2-G, Dimick, and Gilmore faults are segments, was formed as a result of the folding described above, along the oversteepened southwest limb of the southern anticline. This origin is indicated by the position of the fault relative to the crest of the overturned anticline

FAULTING - Continuation

General Features

and by the fact that the movement on this fault is in the reverse direction.

A possible alternative explanation of the 2-G fault and its continuation in the Dimick and Gilmore faults is that it represents a traverse fault of similar character to those studied by Nolan in the Gold Hill district, Utah. On the assumption that rather localized pressure was exerted from the east, it might be supposed that the fault developed early in the period of regional compression and that the folding, accompanied by minor thrusting (as in the gently dipping fault separating the Swarbrick and Tybo formations on the eastern ridge south of the canyon) was localized to the north of the fault. The relatively unfolded area to the south may either have remained stable or moved westward without folding along an overthrust fault whose plane is below the depth reached by mining developments on the 2-G fault.

Study of an area larger than that included in the present investigation would be necessary to determine which of these hypotheses to adopt, but the northerly dip of the fault and its position on the overturned limb of the fold incline the writer to prefer the first one.

It is possible that two other faults were formed at the same time. The fault along the ridge north of the canyon in the eastern part of the area mapped dips 30° - 45° and does not involve Tertiary volcanics. The relations shown in Section E E', plate 1, might be interpreted as the result either of normal faulting or of thrusting. The fault that crops out just west of the crest of the eastern ridge south of the canyon (Section A A', plate 1), does not continue south of the 2-G fault nor north of the fault that follows the east slope of the ridge and may be the result of thrusting from the east.

Probably at some time in the early Tertiary -- before the beginning of the upper Miocene, if the sediments above the rhyolite are correctly correlated with the Esmeralda formation, and probably before the deposition of the Gilmore Gulch formation -- there was widespread normal faulting throughout the region. To this period belong the Uncle Sam and Bunker Hill faults and other minor faults in the western and central parts of the district.

The Uncle Sam fault cuts the earlier 2-G fault, probably with approximately vertical downthrow to the west, so that the western segment of the original fault, the present Dimick fault, which, like the 2-G, dips

FAULTING - Continuation

General Features

steeply to the north, crops out south of the intersection of the Uncle Sam and 2-G fault.

There are porphyry dikes along the Uncle Sam, 2-G, Dimick, and Gilmore faults. The Dimick fault, however, cuts the quartz latite flow, and the quartz latite mass west of the Uncle Sam fault is depressed relative to the area on the east. Therefore additional faulting must have taken place after the intrusion of the dikes along the faults and the outflow of the quartz latite, to which they may have been conduits. This faulting must have been earlier than the final period of faulting, for the quartz latite flow and the overlying Esmeralda (?) formation are tilted toward the northwest to a greater degree than the later lavas.

The final stage of faulting developed new faults along the eastern front of the range and presumably blocked out the range in its present form. Lavas similar in composition to those of the higher western part of the range are present on the pediment along the eastern front.

These eastern faults appear to be a series of echelon faults rather than a single fault, and although the amount of displacement as indicated by the juxtaposition of the Tertiary lavas and Cambrian sediments is of the magnitude of several thousand feet, the individual faults cannot be traced for long distances and are lost where they pass into the area covered by the outcrop of weak Cambrian shales.

The eastern faults may have been as late as early Paeistocene, and they have determined the present outline of the range, but the present relief is probably in part the result of erosion of the downfaulted and on the whole less resistant formations east of this zone of faulting, and the worn-back scarp parallel to the range front is very likely a fault-line scarp rather than an original fault scarp.

There is evidence of movement later than the mineralization, which is itself later than the quartz latite, along the faults of the western part of the area, but it is not certain whether this can be correlated with the development of the range-front faults. Evidence of later movement on the 2-G fault is seen in the presence of post-mineral gouge in the workings of the Tybo mine. Apparently the amount of gouge increases to the west, which suggests that such late movement as took place along this fault was a consequence of renewed movement on the

Faulting - Continuation

General Features

Uncle Sam fault. Along the Uncle Sam fault there has also been movement later than the porphyry dikes that follow the fault plane. The Gilmore Gulch formation dips away from the Uncle Sam fault, steeply close to the fault and more gently farther west, and the quartz latite and the overlying Esmeralda (?) formation have the same inclination as the western part of the Gilmore Gulch formation. The lavas above the Esmeralda (?) sediments, however, dip at lower angles. This fact seems to indicate that the renewal of movement along the Uncle Sam and probably the Dimick fault also took place in two stages, for the presence of an old topography on the crest of the range renders it unlikely that the northwestward dip of the younger lavas is a regional tilt consequent upon the faulting along the range front.

The net result of these different periods of faulting was to leave the central part of the district as a horst of older formations bounded on the east and west by relatively depressed younger rocks. On the east the bounding faults were newly developed and dip to the east, with the younger rocks on the hanging-wall side, but on the west the planes of the older faults were followed by the renewed movement, thus bringing the younger rocks in places below the older.

The degree to which movement later than mineralization affected the area west of the Uncle Sam fault naturally has an important bearing on the future mining development in this area, for it may be that along the Dimick fault the zone of productive mineralization has been depressed below that of the Tybo mine on the east. Data are lacking, however, for any estimate of the magnitude of such movement.

Individual Faults

2-G Fault -- The 2-G fault is a reverse fault formed along the overturned southern limb of the southern of the two anticlines outlined by the Tybo shale. The position of this fault and its displaced segment, the Dimick fault, relative to the overturned southern limb of this anticline suggests that it was formed as a result of the oversteepening of this fold. An alternative explanation is that it is a transverse fault along which movement was largely horizontal -- to the west north of the fault -- and that the folding and minor thrusting to the north, as contrasted with the slight deformation of the sediments to the south, was confined to the westwardmoving northern block, whereas the southern block either remained stationary or moved westward without folding.

FAULTING - Continuation

Individual Faults

The fault is certainly traceable for 8,000 feet, from the Uncle Sam fault eastward to the Swarbrick prospects on the east side of the ridge overlooking Hot Creek Valley. It carries the ore bodies of the Tybo mine and has been developed underground in that mine for a horizontal distance of about 2,400 feet and a depth of nearly 900 feet below the collar of the 2-G shaft. The average strike is about N. 68° W. and the dip is 70° - 80° N. On the south the Pogonip limestone, with relatively gentle dips, forms the foot-wall for the entire distance. The northern or hanging wall consists of Cambrian strata. The limestone of the Hales formation forms the hanging wall at the eastern and western ends, with the lower formations, the Tybo and Swarbrick, in the middle part. Below the 300-foot level in the Tybo mine the overturned dips north of the fault cause the Hales Limestone to be the hanging-wall rock of the mine workings, although shale of the underlying Tybo formation forms the hanging wall at the surface.

Porphyry is present in places along the fault plane itself, and cross cuts in the Tybo mine show that dikes also occupy parallel fissures close to the main fault. The largest mass is near the intersection of the two branches that diverge eastward.

At the western end there are two distinct branches with Pogonip limestone between them. These branches apparently unite on the surface near the 2-G shaft and are about 200 feet apart close to the Uncle Sam fault. What are apparently the same faults have also been developed on the 300-foot level of the mine. But the intersection, which pitches to the west, is presumably above the point where the 710-foot level intersects the Uncle Sam fault. Another branch from the 2-G fault diverges in the opposite direction from a point about 2,000 feet east of the intersection of the 2-G and Uncle Sam faults and where it crosses the ridge is about 1,000 feet from the 2-G fault.

Fossils of lower Pogonip (Beekmantown) age were collected from the wedge that lies between the main fault and the branch that diverges to the southeast; the presence of lower Pogonip indicates that the displacement is divided between these two branches, with the greater amount on the northern branch.

As no complete stratigraphic section could be worked out in the district the apparent vertical displacement on this fault is not measurable, but it may exceed 6,000 feet. On the north side the lowest stratigraphic

FAULTING - Continuation

Individual Faults

unit in contact with the fault, the Swarbrick formation, which has a thickness of at least 2,000 feet above the lowest point at the fault contact, is succeeded by 1,600 feet of the Tybo shale and this by at least 1,300 feet of the Hales limestone. To the south fossils identified by Kirk as belonging to the upper (Chazyan) part of the Pogonip were collected close to the fault, and in all considerably more than 1,000 feet of the upper and lower parts of the Pogonip must be present on the south side.

Dimick and Gilmore Faults

The Dimick and Gilmore faults are regarded by the writer as the continuation of the two western branches of the 2-G fault displaced by the Uncle Sam fault. Their intersections with the Uncle Sam F ult are south of those of the two western branches of the 2-G fault. This would be the expected situation of two faults with northerly converging dips displaced approximately vertically by a fault nearly at right angles to their strikes.

The Dimick fault for about 2,000 feet westward from the Uncle Sam fault strikes about west and dips steeply to the north, probably about 80°. Along this portion it has Pogonip limestone, which dips moderately toward the southwest, on the north, and massive dolomite, presumably of Silurian age, whose attitude could not be determined, on the south. Porphyry is present in places along the fault plane. Beyond this point, which probably about coincides with the junction of the Dimick and Gilmore faults, the strike is about N. 60° W. and the dips average 55° to 60° N.E. Across the western end of Air Shaft Ridge the Eureka quartzite and for a short distance Silurian (Lone Mountain) dolomite, both with overturned steep northeasterly dips, occur on the hanging-wall side against quartz latite on the footwall. It is probable that there is a branch fault on Air Shaft Ridge north of Eureka quartzite, for the apparent thickness of the upper part of the Pogonip, as measured from the band of impure quartzite that extends from the central part of the ridge northward to the Bunker Hill fault, is less than 1,000 feet, as contrasted with about 1,900 feet on the north side of the valley. The Dimick fault can be followed for about 1,000 feet north of the valley until it is lost under the wash. In this section it truncates the strike of the upper part of the Pogonip limestone, the Eureka quartzite, and the lower part of the Lone Mountain dolomite on the hanging-wall side. Quartz latite continues along the foot-wall. At the northern border of the area covered by the geologic map a fault contact between quartz latite and Silurian (Lone Mountain dolomite

FAULTING - Continuation

Dimick and Gilmore Faults

shows parallel strike and dip. If this is the same fault as the Dimick it must have been displaced to the northeast by another fault, for the projection of its strike to the southeast brings it against the Silurian dolomite.

The Gilmore fault can be followed with certainty westward from the Uncle Sam fault for a distance of about 2,000 feet. Farther west surface exposures are obscure, but it probably joins the Dimick fault near the west end of Air Shaft Ridge. As the fault crosses the steep hill west of the Uncle Sam fault the trace on the surface is curved, but the strike is about west and the dip averages about 65° N. On the hanging-wall side occurs massive Silurian dolomite, and on the foot-wall are the sandstone and shale of the Gilmore Gulch formation, showing steep dips close to the fault plane but gentle southwesterly dips a short distance away.

The combined displacement on the Dimick and Gilmore faults cannot be even as roughly estimated as that on the 2-G fault, because the total thickness of the Gilmore Gulch and Lone Mountain formations is unknown, and there is no clue to the thickness of strata that may intervene between the Lone Mountain dolomite and the Gilmore Gulch formation. In view of the vastly different ages of the formations involved it is a reasonable assumption that the displacement of the two faults is of the same order of magnitude as that of the 2-G fault. It is certain that the apparent throw on the Dimick fault alone, where the Lone Mountain dolomite is in contact with the Pogonip limestone, represents a stratigraphic displacement of at least 2,000 feet. To this amount must be added whatever displacement may be indicated by the juxtaposition of the Gilmore Gulch and Lone Mountain formations along the Gilmore fault.

Uncle Sam Fault

The Uncle Sam fault sections A A', B B' and C C', Plate 1) crosses the entire district, and as far as could be seen from the ridges on the north and south continues in both directions for a considerable distance. South of the Gilmore fault the upper part of the Pogonip limestone on the east is in contact with the Gilmore Gulch formation on the west. Between the Gilmore and Dimick faults the Lone Mountain dolomite is in fault contact with the Pogonip limestone. North of the Dimick and 2-G faults Cambrian limestone occurs on the west and the upper part of the Pogonip limestone on the east. The strike is north from a point a mile or more south of the southern border of the mapped area in

FAULTING - Continuation

Uncle Sam Fault

Tybo Canyon; on the north side of the canyon it is about N 30° W. Surface observations on the hill south of Tybo Canyon indicate an eastward dip of 75° to nearly vertical. What is apparently the same fault on the 300-foot level of the Tybo mine dips 80° W., and the position of the outcrop relative to the fault on this level likewise indicates a steep westerly dip. If the assumption is correct that the fault near the west end of the 710-foot level is also the Uncle Sam fault, there must be a reversal in the direction of the dip between these levels, for the dip in that place is 85° NE. and the position of the fault about 100 feet to the northeast of its position on the 300-foot level.

If, as seems likely, the regional northwesterly dip of 10° to 15°, shown by the lavas younger than the Esmeralda (?) formation, is a result of tilting of the whole area consequent upon the late faulting along the range front, the original dip of the Uncle Sam fault may have been steep to the west. The Uncle Sam fault is therefore regarded as a normal fault later than the 2-G fault, which it displaces.

The displacement is large, but the lack of a complete stratigraphic section prevents accurate measurement. It is possibly of the order of magnitude of 2,000 feet.

Porphyry has been intruded in places along the fault plane. In the southern segment the dikes are narrow, but larger masses, with a maximum width of 1,000 feet, are present along the northern segment.

A branch of the Uncle Sam fault extends northwestward with nearly parallel strike across the east end of the high ridgenorth of Tybo. Limestone regarded as belonging to the Hales formation borders the fault on both sides, but on the southwest side it contains narrow bands of impure quartzite or perhaps a single bed repeated by minor faults. As the Hales and Pogonip formations are lithologically similar, it is possible that this limestone belongs to the Pogonip limestone. No fossils were found in the segment between the two faults.

A peculiar feature of the Uncle Sam fault is the presence of two narrow slivers of quartzite, each less than 100 feet in width, in the plane of the fault, one south and one north of Tybo Canyon. (See map and section C C', Plate 1.) This quartzite is of the same dense white variety as the Eureka quartzite and has been mapped as Eureka, but on lithologic evidence alone. The southern mass, which forms a narrow wedge between the upper part of the Pogonip limestone and the

FAULTING - Continuation

Uncle Sam Fault

Gilmore Gulch formation, can be interpreted as the result of distribution of displacement between two branches of the fault, for its position implies a drop of 600 or 700 feet below the projected position of the Eureka quartzite in the area east of the fault, and it is at a considerable but unknown distance above the horizon at which the quartzite should be present in the area west of the fault. The northern mass of quartzite, however, lies stratigraphically below the projected position of the Eureka quartzite on both sides of the fault -- several hundred feet below west of the fault and much farther below east of it. Therefore, if it is indeed the Eureka quartzite it must be a keystone-like wedge dropped down to a greater extent than the amount of displacement on the fault itself.

An alternative explanation for the northern mass is that it represents not the Eureka quartzite but a quartzite bed within the Pogonip limestone which, because of secondary silification along the fault plane, now closely resembles the Eureka. Against such an explanation are the facts that silicification was nowhere else observed along other fault planes and that the other outcrops of quartzite within the Pogonip limestone do not bear any close resemblance to the Eureka quartzite.

Bunker Hill Fault

The Bunker Hill fault has a northwesterly strike and diverges from the Uncle Sam fault at a point near the old Bunker Hill shaft. It is a normal fault with relatively small vertical displacement, which, as measured by the offset of the shale in the Pogonip limestone, is not over 300 feet.

Range-Front Faults

Insufficient time was devoted to the east front of the range to work out the structure in detail, and along the pediment that borders the range the exposures are not as good as elsewhere in the district. Along certain of the faults there has been comparatively recent movement because rocks similar to the quartz latite, Esmeralda (?) formation, and andesite of the western part of the district are faulted down along the east front. Two of them, however, which do not involve the Tertiary rocks, may be older and may have formed during the period of folding and compression.

A fault with comparatively low dip to the northeast -- from less than 30° to not over 45° -- crops out just west of the crest of the ridge that borders the district north of the canyon. On the hangingwall side

FAULTING - Continuation

Range-Front Faults

is the upper part of the Pogonip limestone, with only a few feet intervening between the fault plane and the Eureka quartzite, which caps the hill. As the Paleozoic rocks are here folded, the structural relations (section E E' Plate 1.) are explanable either on the assumption of a normal fault or a thrust, which has moved the crest of another fold southwestward.

A similar fault, for which the evidence of a greater age is stronger, lies west of the crest of the eastern ridge south of the canyon. Slate of the Tybo formation lies to the west, and limestone that is assumed to belong to the Hales formation, though no fossils were found, to the east. The fault is approximately parallel to the strike of the beds on both sides, and its recognition was due to the thinning of the outcrop of the Tybo shale to the south and to minor discordance in structure here and there along its course. The dip is unknown, but the trace of the outcrop suggests that it is fairly gentle to the east. The fault is cut off on the north by the fault that follows the eastern face of the ridge. On the south it is traceable as far as a mass of porphyry along the 2-G fault. It does not cut this porphyry or the 2-G fault, but on the other hand no corresponding fault was observed south of the 2-G fault to the west. The structural relations (section A A', Plate 1) can be explained on the basis of either a normal or a thrust fault, as it cuts the limb of the anticline obliquely. If it is a normal fault it is presumably older than the porphyry. It does not cross the 2-G Fault, and this assumption therefore requires that the downthrow of the hanging-wall block must have been accompanied by movement on that part of the 2-G fault east of the intersection. If it is a thrust fault it is best explained by supposing that the 2-G fault is a transverse fault along which the north side movement to the west, and that this fault developed as a minor thrust in conjunction with this westward movement.

Near the extreme southeast corner of the area shown on the geologic map is a small outcrop of limestone from which Cambrian fossils were obtained. This limestone dips to the north below the shale of the Tybo formation, but it could not be determined whether this relation was due to an overturned fold or a thrust fault, or whether the limestone might be a bed within the Tybo formation not found elsewhere in the district.

The other faults along the eastern border of the range appear to be comparatively young normal faults, because they involve the Esmeralda (?) formation and younger lavas and no porphyry has been intruded along them. These faults have strikes between north and northwest,

FAULTING - Continuation

Range-Front Faults

and the dips in the few localities where they could be determined showed a range of from 35° to 70° E. None of the faults could be traced far, and all were lost northwards in the shale of the Tybo formation, possibly dying out as flexures, although the magnitude of the displacement at their south ends, as shown by the downfaulting of the Tertiary lavas, makes this explanation doubtful.

The best-exposed fault of this group follows the eastern base of the ridge south of the mouth of the canyon. Along most of its courst it separates the Cambrian Hales and Tybo formations. South of the point where it cuts off the 2-G fault Pogonip limestone lies on the footwall side, and still farther south dacite, similar to that which occurs above the Esmeralda (?) formation in the western part of the district, comes in on the footwall side along an eastward-tending fault.

The east-west fault, which dips steeply to the north, possibly marks the position of the 2-G fault as displaced by the fault just described. If so, it is to be supposed that the fault was at one time covered by the later flows and that when the faulting along the range front took place the old fault broke through this cover, and the block of andesite now exposed is the result of gravitative downfaulting along these two faults, normal with respect to the north-south fault but reverse to the steep dip of the rejuvenated east-west fault. The other faults that lie to the east seem to form a definite zone rather than a single fault and appear to be in echelon arrangement. The outcrops, however, are poor in this part of the area, and the distance from definite fixed points has rendered their exact position uncertain. In the few localities where the actual fault plane is exposed there is abundant gypsum in large crystals in the fault gouge. This mineral was not seen in connection with any of the western faults.

The position of the quartz latite relative to the dacite and andesite in the extreme southwest corner of the area mapped suggests thrust faulting along the range front, but the field relations are obscure. It appears from the contact of the quartz latite and dacite to the west of the fault that the surface of the quartz latite was irregular. Therefore, if there is some horizontal component the major direction of faulting may be normal. The dacite, as shown by the dip of the interbedded tuff, is strongly tilted, and other faults may be present. Certainly the relation of the quartz latite to the older rocks to the north indicates normal faulting.

GEOMORPHOLOGY

No geomorphic study of this portion of the Hot Creek Range was made, and the following notes are consequently of less value than if the conclusions had been checked by observations made over a wider area.

The high ridges north of Tybo Canyon show remnants of an older topography at altitudes slightly greater than 8,000 feet. The contrast is abrupt between the rolling upland and the steep walls of the present canyon. The southern ridge, though reaching nearly to the same altitude and showing a fairly even skyline, is narrower and no longer preserves the remains of the old topography. This mature surface is also preserved along the crest of the range. A little waterworn gravel was found on the divide west of Tybo, at the point where the road following the power line crosses the range, at the height of about 8,000 feet.

The western slope of the range coincides with the dip of the hryolite flows, but as this old topographic surface cuts across the rhyolite as well as the older rocks, this slope cannot be directly the result of the tilting of the range consequent upon faulting toward the east, but must be a dip slope revealed by the erosion of less resistant overlying material. For the same reason no major movement can have taken place on the Uncle Sam fault or other faults in the central part of the district since the development of this surface.

Similar old topographic surfaces are found on other ranges in Nevada and probably represent remnants of widespread early Pleistocene or late Pliocene surfaces of low relief. On the Toquima Range, about 30 miles to the northwest, an old erosion surface is preserved at a general altitude of about 10,000 feet. This surface was broken up by renewed faulting during the Pleistocene epoch, but it is uncertain whether the ranges that resulted from this recent faulting were formed as independently uplifted blocks in an area of low relief, or whether, as is more commonly assumed, there was first a regional uplift followed by gragen faulting, which outlined the present valleys. The presence of postmature surfaces on nearly all the basin ranges at greatly different altitudes is suggestive of the first hypothesis, but on the other hand the old surface is not a peneplain, so considerable original differences in altitude are possible, and if the region were one of interior drainage the old topography might have been dependent on base-levels at different altitudes.

Blackwelder has emphasized the difference between the ranges of the Great Basin which follow faultline scarps and those which have a

GEOMORPHOLOGY - Continuation

relief that is directly due to faulting and which are bordered by fault scarps, more or less worn back according to the resistance of the rock, and the interval since the activity of the fault. It seems probable that the eastern front of the Hot Creek Range is a faultline scarp rather than a primary fault scarp a nd that the present relief of the range is due to erosion of material east of the range-front fault s rather than directly to faulting.

As far as can be seen from the road along the valley the range is bordered by Tertiary lavas for some distance south of the Tybo district. Spurr crossed the range at Hot Creek about 10 miles north of Tybo, and his section shows lavas along the eastern front at that point. Between Tybo Canyon and Hot Creek, however, Paleozoic rocks form the range front. These rocks, as shown by the exposures in the pediment south of the canyon, are faulted and are in fault contact with the Tertiary formations.

The Esmeralda (?) formation, overlying the quartz latite, and the quartz latite itself, where weathered and fissured, are more susceptible to erosion than the later lavas. Where the Esmeralda (?) formation, of which traces yet remain in the pediment along the range front, was originally present in considerable thickness, as at the mouth of Tybo Canyon, the Tertiary formations east of the present range may have been removed by erosion, giving the present faultline scarp. Farther south, where the more durable later lavas rested directly on the rhyolite, these lavas form the front of the range, possibly bounded by other faults. There were two distinct stages in the sculpture of the range. At the close of the first stage a rather wide valley was formed in the present Tybo Canyon; later erosion carried away the valley fill, deposited during the earlier stage, thus revealing the pediment that fronts the range and cut the canyon to a greater depth. Traces of the older valley remain in gravel-covered spurs at heights of several hundred feet above the present canyon floor. The wide bench of altered quartz latite southwest of the Dimick fault was probably developed in this stage, aided by the stripping of its cover of weak tuffaceous sediments of the Esmeralda (?) formation. A remnant of the valley fill of the early state is preserved in the huge gravel ridges that project into the valley a short distance north of the mouth of the canyon.

The cause of this lowering of base-level was not determined but on looking southeast from the hills fronting the range a marked gap appears in the hills at the south end of Hot Creek Valley. Perhaps there has been a capture of drainage from Hot Creek Valley by Reville Valley, which lowered the base-level and laid bare the pediment of Tertiary ro cks that fronts the range east of the Tybo district.

MINERAL, METAL
ECONOMICS

EAST TYBO MINE REPORT OF JUNE 22, 1967 :

MINERALOGY

Detailed Mineralogy forecast of the E. TYBO can be assumed to be accurate from the technical knowledge gained by the exploration, development and production in the 2-G Vein to 1546' of depth as, apparently, the mineral gradation E. Tybo-Old Tybo is exactly the same.

The last 60 tons produced out of the E. Tybo M[illegible] contained secondary enriched silver values as well as lead sulphide (galena) encountered in zones which resisted oxidation. Zinc had, for the most part, leached out of the oxidized ore.

The collar elevations of the 2-G shaft, Hales Shaft and the Dimick Shaft are, respectively: 6700, 6820 and 6888.1. Access was made to the last produced E. Tybo ore out of the #[illegible] Tunnel level. According to reports the ore came from 10' to 20' below the #2 Tunnel level. It is reasonable to expect production of direct smelting crude ore on the 2-G Vein to about a depth of 300' below the #3 Tunnel Level. Advancement in metallurgical procedure will, no doubt, allow successful concentration of oxide gold, silver and lead ores well above the sulphide zones. Commercial sulphidizing of cerussite ores (Pb CO_3) (Pb 83.5, CO_2 16.5%) has been proven to be economic since the last differential flotation mill was at Tybo. The first production tonnage from the mine will probably go to a lead smelter, however, as crude.

1929 to 1931 MINERALOGY STUDIES:

NOTE: Now greater beneficiation to some considerable extent is possible.

The primary sulphide minerals are pyrite, sphalerite, galena, chalcopyrite, pyrrhotite, and arsenopyrite. In the Tybo ores which are amendable to differential flotation, galena and sphalerite are the major pay minerals. Varying amounts of sulphide non-pay minerals are present, pyrite predominating. Mineralized zones, during the 1929-1937, inc. productive period which were below the then existing economic cut-off point were found to have greater pyrite percentage and lesser amounts of galena and spiralerite. Of the two minerals, galena and sphalerite, galena ratio is slightly higher. A typical ratio example is: 7.38% lead to 5.55% zinc in the ores. The galena carries the greater amount of silver. Assays of pure mineral gave a content of 110 to 130 ounces of silver with the galena to the ton, as against a maximum of 20 ounces for sphalerite and 11 ounces for the pyrite. A typical month mill run showed a total saving of 74.9% of the assay of silver with 65.4% being in the lead concentrates and only 9.5% in the zinc concentrates. A good portion of the silver in the Tybo Mine tailings is contained in the iron pyrite, including pyrrhotite and marcasite. Modern metallurgy would recover well up into the 90% bracket of the ores at this time.

MINERALOGY - Continuation

The sphalerite is dark brown to almost black. Analyses of specimens show 10-15% of iron but according to the studies of M. N. Short, U. S. G ological Survey, polished sections included specks of chalcopyrite and arsenopyrite. A part of the iron may be due to those inclusions. The sphalerite is more coarsley crystalline than the galena and, though mostly is intimately mixed with the galena, has been proven to occur in nearly pure coarsely crystalline masses several feet in diameter.

Pryite is the most abundant of the sulphide minerals. The porphyry in the district is impregnated with pyrite to a greater or lesser extent. In places where the ore minerals have replaced limestone instead of porphyry, pyrite occurs in poorly defined layers, separated by similar layers of Galena, Sphalerite and gangue. This occurrence is rather rare and might represent outlines of the original bedding planes of the limestone but could also be rhythmic banding. The writer saw evidence at the Tybo Mine indicating that the pyrite is a zone influence mineral with the greater percentage ratio against the pay minerals on the boundary lines of the ore bodies.

Arsenopyrite is widespread but in minor amounts. Assayed ore specimens have shown a content of 0.59%.

Chalcopyrite is of very minor percentage and associated with the sphalerite. Specimens have shown a content of but 0.02%.

Pyrrotite is sporadic in occurrence, limited in abundance and is probably quantitatively unimportant.

Below the oxide-sulphide line of demarcation between differential flotation products and the upper direct smelting crude ore, the ore bodies consist of largely sulphides. Please note, Figure No. 3, a vertical section of 2-G vein mineral gradation. No doubt, improvement in the selective flotation process during the past 23 years will allow better overall recovery kand more acceptance of partly oxidized lead mineral areas into the daily treatment tonnage than was possible when the pioneering concentrator was in movement, 1929 to 1937. This probably will release tonnage that is developed but early operators could not take on account of combined sulphides with the oxides and Treadwell could not balance it on account of the oxides.

Ore specimens have assayed 32.05% silica but quartz probably constitutes only a small part of the percentage. The greater part of the silica content being contained in the sericite and other silicates of the altered porphyry.

MINERALOGY, Continuation.

Coarsely crystalline calcite is a common gangue mineral.

Rock alterations along the 2 G Vein is mostly confined to the porphyry In places the limestone along the vein is silicified to a slight extent. The porphyry alteration, however, is widespread. Near the ore, the porphyry is so altered that quartz phenocyrsts are the only remaining remnants of the original minerals. Calcite occurs more frequently close to the ore and mineralized areas. Specimens taken near the ore bodies show that the porphyry has been altered to a combined mixture of calcite and sericite.

The ore deposition origin is definitely related to the intrusive porphyry, which for the most part followed the pre-existing faults.

The other principal faults along which there have been intrusions of porphyry are the Gilmore, Dimick and Uncle Sam. All of these faults have been extensively prospected to some considerable depth and have shown some ore. However, todate all production volume has been produced by the 2-G Vein. However, there is evidence that the Uncle Sam Fault's post mineral movement depressed the Bunker Hill Fault Area and mineral may be found at a greater depth than was experienced along the 2-G Fault.

The East Tybo Mine's 2,800 feet of 2-G Vein holds the better economic grade ore volume potential than any other part of the district. The previous work on the Old Tybo Section of the 2-G Vein has resulted in much light being thrown upon ore occurrence of the area. It's possible ore reserves are practically unlimited and a series of ore shoots along the mineralized zone, where they have been indicated in leached gossan minerals, pods of partly leached oxidized ore and zones of combined oxide-sulphide ore. The East Tybo Mine's No. 3 tunnel is calculated to be at sufficient depth below the leached croppings to be in secondary ore, zones of secondary enrichment and primary ores. In the Tybo Mine's oxide zone, the zinc had been practically all leached out. The concentrated silver values, along with the gold and lead resulted in very good tonnage value. The oxide zone's values were higher to some considerable extent than the subsequent primary ores at Tybo. Therefore, the East Tybo Mine will have the oxide and secondary enrichment zones' production tonnages intact whereas they have been depleted almost completely at the adjoining property. The mineral gradation chart herewith is based upon the collar elevation of the 2-G Shaft. Therefore, as mining was accomplished above that elevation and East Tybo will have several hundred feet of production backs above that level, those factors should be noted.

METALLURGY :

The metallurgy of the 2-G Vein's ores has been worked out in detail. Advancement since 1937 in sulphidization, selective-flotation, etc. will assure very good recovery of values in what now is a simple ore character to handle. Complete flow sheets are available on the 2_G Vein's oxide, oxide-sulphide and straight sulphide ores, as a result of previous mill tests made.

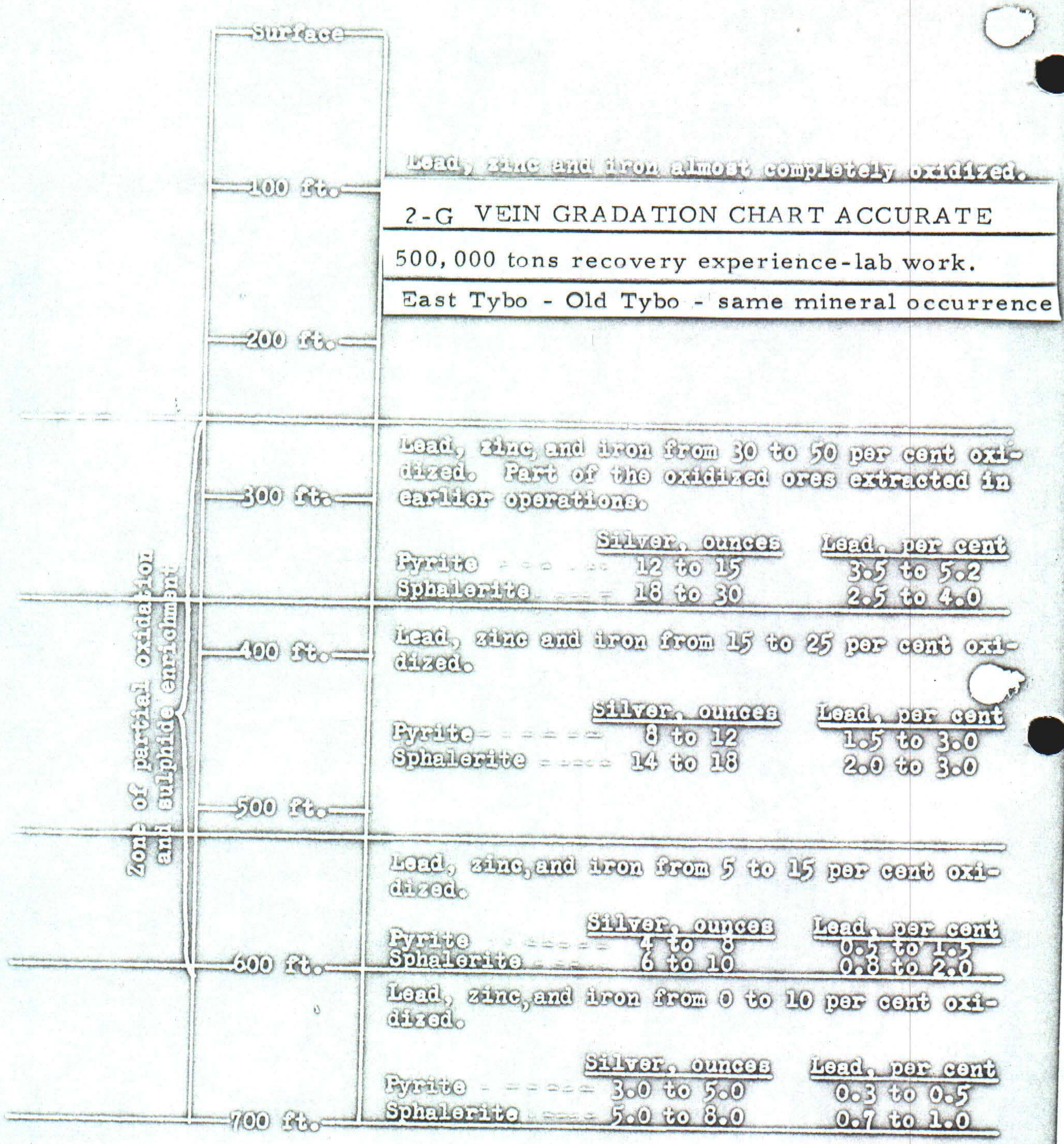


Figure 1.--Vertical section of the Tybo vein, showing approximate degrees of oxidation of the ore body, and varying amounts of lead and silver associated with the pyrite and sphalerite in the different horizons

E & M J Annual Average Metal Prices—1898 to 1961

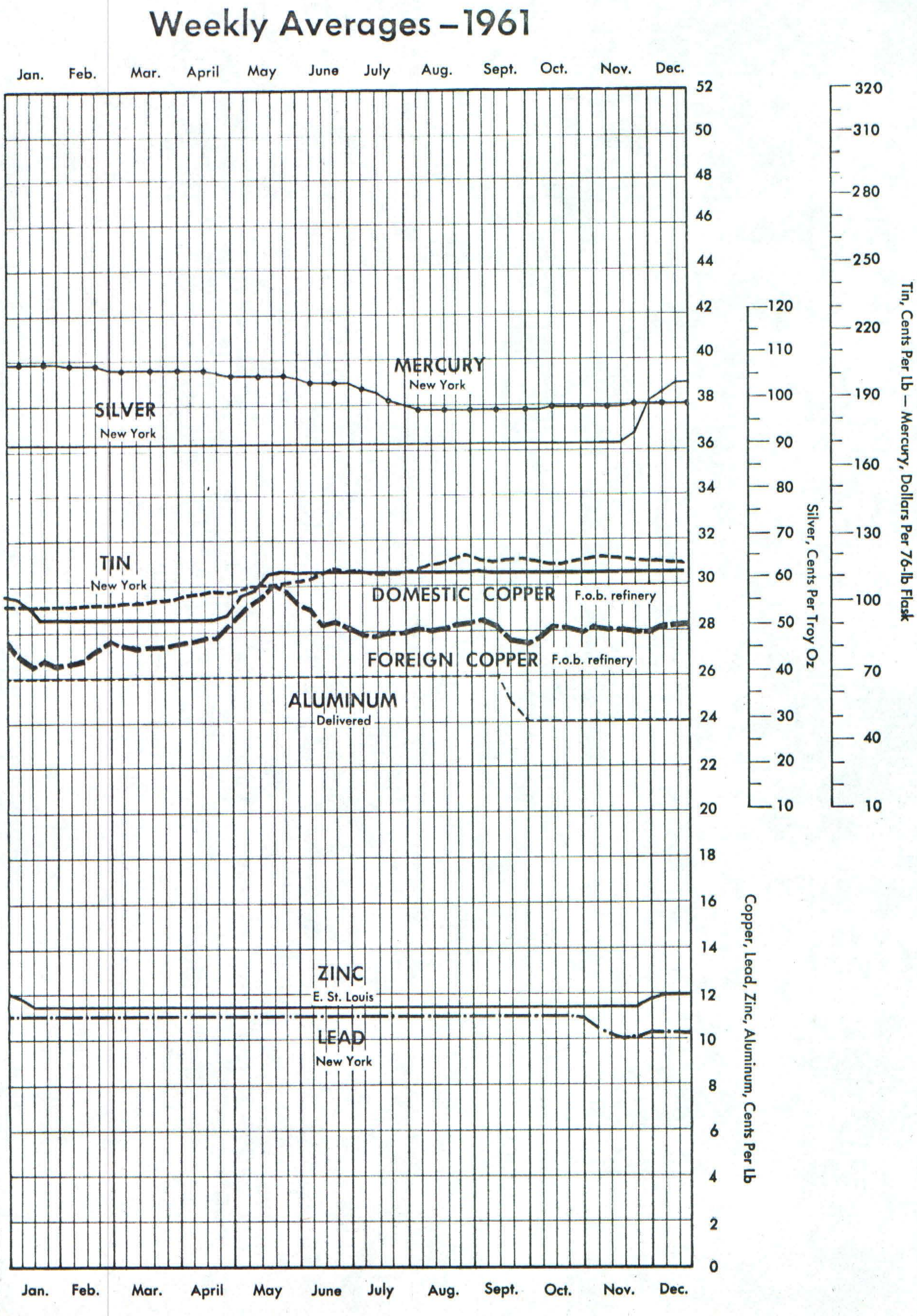
Year	COPPER (a) Domestic Refinery	COPPER Foreign Refinery	LEAD Common N. Y.	ZINC Prime Western (b) E. St. Louis	TIN (c) N. Y.	SILVER (e) N. Y.	MERCURY (f) N. Y.	ALUMINUM Ingot
1898.......	12.03	......	3.780	4.570	15.70	58.260	40.70	30.58
1899.......	16.67	......	4.470	5.750	25.12	59.580	43.63	32.72
1900.......	16.19	......	4.370	4.390	29.90	61.330	51.00	32.72
1901.......	16.11	......	4.330	4.070	16.74	58.950	47.00	33.00
1902.......	11.026	......	4.069	4.840	26.79	52.160	48.03	33.00
1903.......	13.235	......	4.237	5.191	28.09	53.570	41.32	33.00
1904.......	12.823	......	4.309	4.931	27.99	57.221	41.00	35.00
1905.......	15.590	......	4.707	5.730	31.358	60.352	38.50	35.00
1906.......	19.278	......	5.657	6.048	39.819	66.791	40.90	35.75
1907.......	20.004	......	5.325	5.812	38.166	65.237	41.50	45.00
1908.......	13.208	......	4.200	4.578	29.465	52.864	44.84	28.70
1909.......	12.982	......	4.273	5.352	29.725	51.502	46.30	22.00
1910.......	12.738	......	4.446	5.370	34.123	53.486	47.06	22.25
1911.......	12.376	......	4.420	5.608	42.281	53.304	46.54	30.07
1912.......	16.341	......	4.471	6.799	46.096	60.835	42.46	22.01
1913.......	15.269	......	4.370	5.504	44.252	59.791	39.54	23.64
1914.......	13.602	......	3.862	5.061	34.301 (d)	54.811	48.31	18.63
1915.......	17.275	......	4.673	13.054	38.590	49.684	87.01	33.98
1916.......	27.202	......	6.858	12.634	43.480	65.661	125.49	60.71
1917.......	27.180	......	8.787	8.813	61.802	81.417	106.30	51.59
1918.......	24.628	......	7.413	7.890	88.750	96.772	123.47	33.53
1919.......	18.691	......	5.759	6.988	63.328	111.122	92.15	32.14
1920.......	17.456	......	7.957	7.671	48.273	100.900	81.12	32.72
1921.......	12.502	......	4.545	4.655	29.916	62.654	45.46	21.11
1922.......	13.382	......	5.734	5.716	32.554	67.528	58.95	18.68
1923.......	14.421	......	7.267	6.607	42.664	64.873	66.50	25.41
1924.......	13.024	......	8.097	6.344	50.176	66.781	69.76	27.03
1925.......	14.042	......	9.020	7.622	57.893	69.065	83.13	27.19
1926.......	13.795	......	8.417	7.337	65.285	62.107	91.90	26.99
1927.......	12.920	......	6.755	6.242	64.353	56.370	118.16	25.40
1928.......	14.570	......	6.305	6.027	50.427	58.176	123.51	24.300
1929.......	18.107	......	6.833	6.512	45.155	52.993	122.15	24.300
1930.......	12.982	......	5.517	4.556	31.694	38.154	115.01	23.787
1931.......	8.116	......	4.243	3.640	24.467	28.700	87.35	23.300
1932.......	5.555	......	3.180	2.876	22.017	27.892	57.93	23.300
1933.......	7.025	6.713	3.869	4.029	39.110	34.727	59.23	23.300
1934.......	8.428	7.271	3.866	4.158	52.191	47.973	73.87	23.300
1935.......	8.649	7.538	4.065	4.328	50.420	64.273	71.99	20.000
1936.......	9.474	9.230	4.710	4.901	46.441	45.087	79.92	20.000
1937.......	13.167	13.018	6.009	6.519	54.337	44.883	90.18	19.917
1938.......	10.000	9.695	4.739	4.610	42.301	43.225	75.47	30.000
1939.......	10.965	10.727	5.053	5.110	50.323	39.082	103.94	10.000
1940.......	11.296	10.770	5.179	6.335	49.827	34.773	176.86	18.691
1941.......	11.797	10.901	5.793	7.474	52.018	34.783	185.02	16.500
1942.......	11.775	11.684	6.481	8.250	52.000	38.333	196.35	15.000
1943.......	11.775	11.700	6.500	8.250	52.000	44.750	195.21	15.000
1944.......	11.775	11.700	6.500	8.250	52.000	44.750	118.36	15.000
1945.......	11.775	11.700	6.500	8.250	52.000	51.928	134.89	15.000
1946.......	13.820	14.791	8.109	8.726	54.544	80.151	98.24	15.000
1947.......	20.958	21.624	14.673	10.500	77.949	71.820	83.74	15.000
1948.......	22.038	22.348	18.043	13.589	99.250	74.361	76.49	15.733
1949.......	19.202	19.421	15.364	12.144	99.336	71.930	79.46	17.000
1950.......	21.235	21.549	13.296	13.866	95.539	74.169	81.26	17.713
1951.......	24.200	26.258	17.500	18.000	127.077	89.368	210.13	19.000
1952.......	24.200	31.746	16.467	16.215	120.473	84.941	199.097	19.410
1953.......	28.798	30.845	13.489	10.855	95.845	85.188	193.032	20.931
1954.......	29.694	29.889	14.054	10.681	91.838	85.250	264.386	21.784
1955.......	37.491	39.115	15.138	12.299	94.735	89.099	290.348	23.668
1956.......	41.818	40.434	16.013	13.494	101.409	90.826	259.923	24.032 (g)
1957.......	29.576	27.157	14.658	11.399	96.261	90.820	246.978	25.416
1958.......	25.764	24.123	12.109	10.309	95.127	89.044	229.057	24.790
1959.......	31.182	28.892	12.211	11.448	102.053	91.202	227.484	24.738
1960.......	32.053	29.894	11.948	12.946	101.438	91.375	210.760	26.000
1961.......	29.920	27.919	10.871	11.542	113.311	92.449	197.605	25.458

(a) Lake copper 1897–98: domestic market since 1932. (b) New York delivery 1898–1902. (c) 99% in 1897 to 1920, inclusive: Straits quality thereafter. (d) Average for 11 months. (e) New York market. . . . All quotations in cents per lb, except for silver, which is in cents per troy oz, and (f) mercury, which is in dollars per flask of 76 lb. See opposite page and reverse for weekly average prices for 1961. (g) Unalloyed ingot beginning 1956.

l Prices

&MJ Metal and Mineral Markets

:., New York



As national and international silver markets near a historic price break-out, NOW IS THE TIME, to tie up worthy silver reserves. The herewith economic silver graphs are part of the AMERICAN INSTITUTE OF MINING AND METALLURGICAL ENGINEERS' Paper No. 6711" February 20, 1967.

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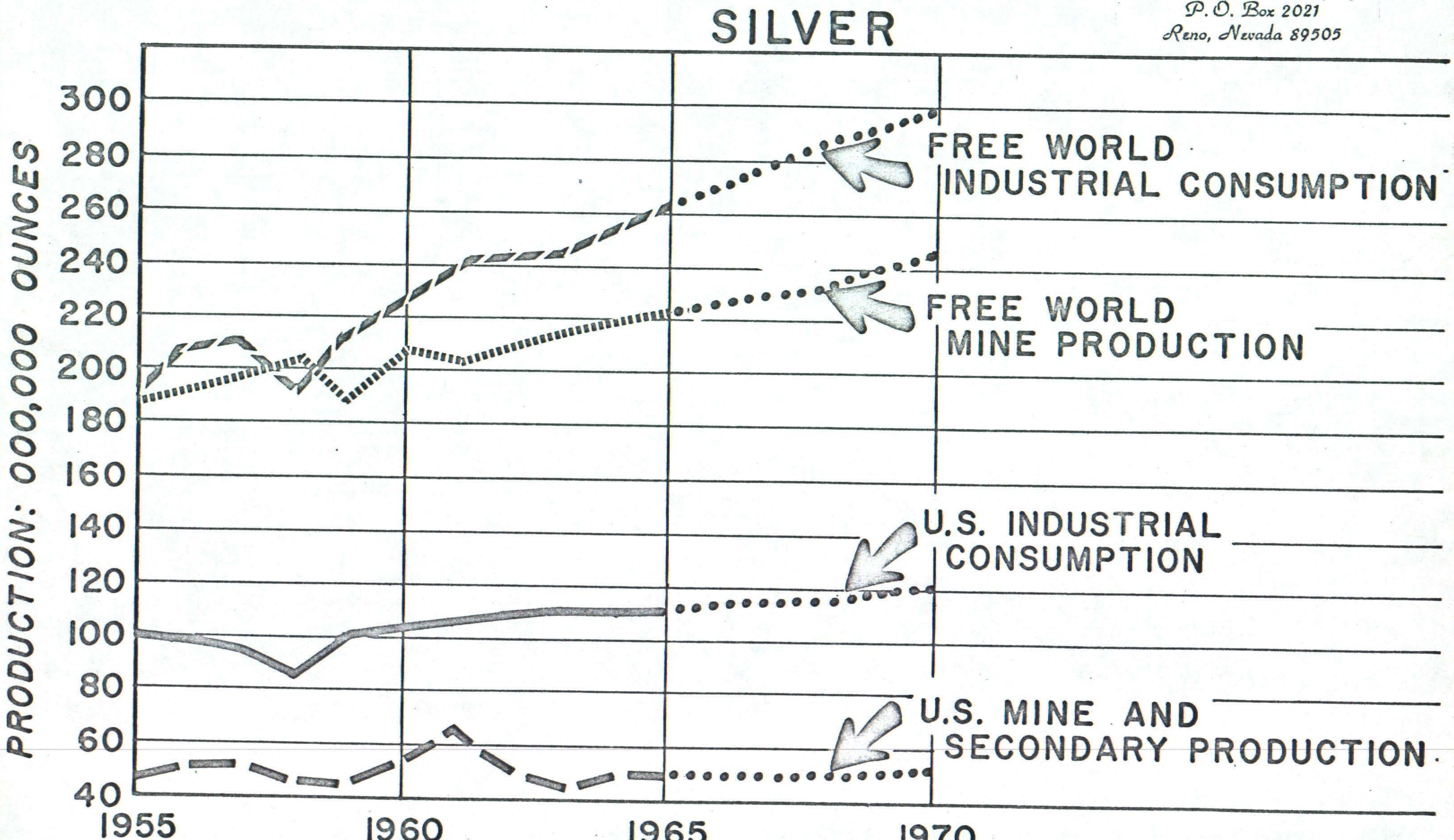

Figure I. Production & Industrial Consumption

NOTE : Silver price average during 1935 was 0.64¢ per ounce. By 1941 the average world price had dropped to 0.34¢ per ounce.

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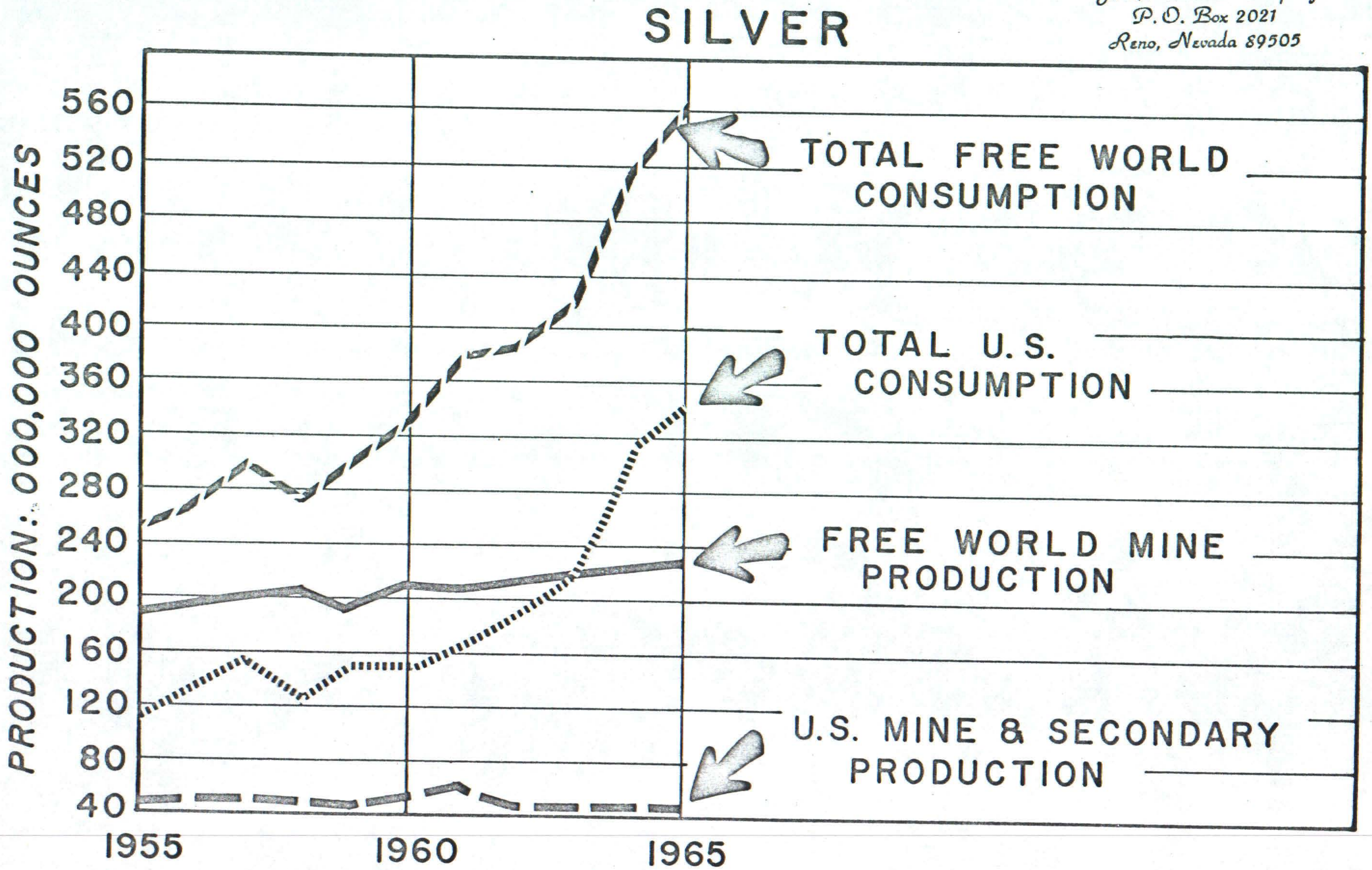

Figure 2. Production & Total Consumption

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SILVER

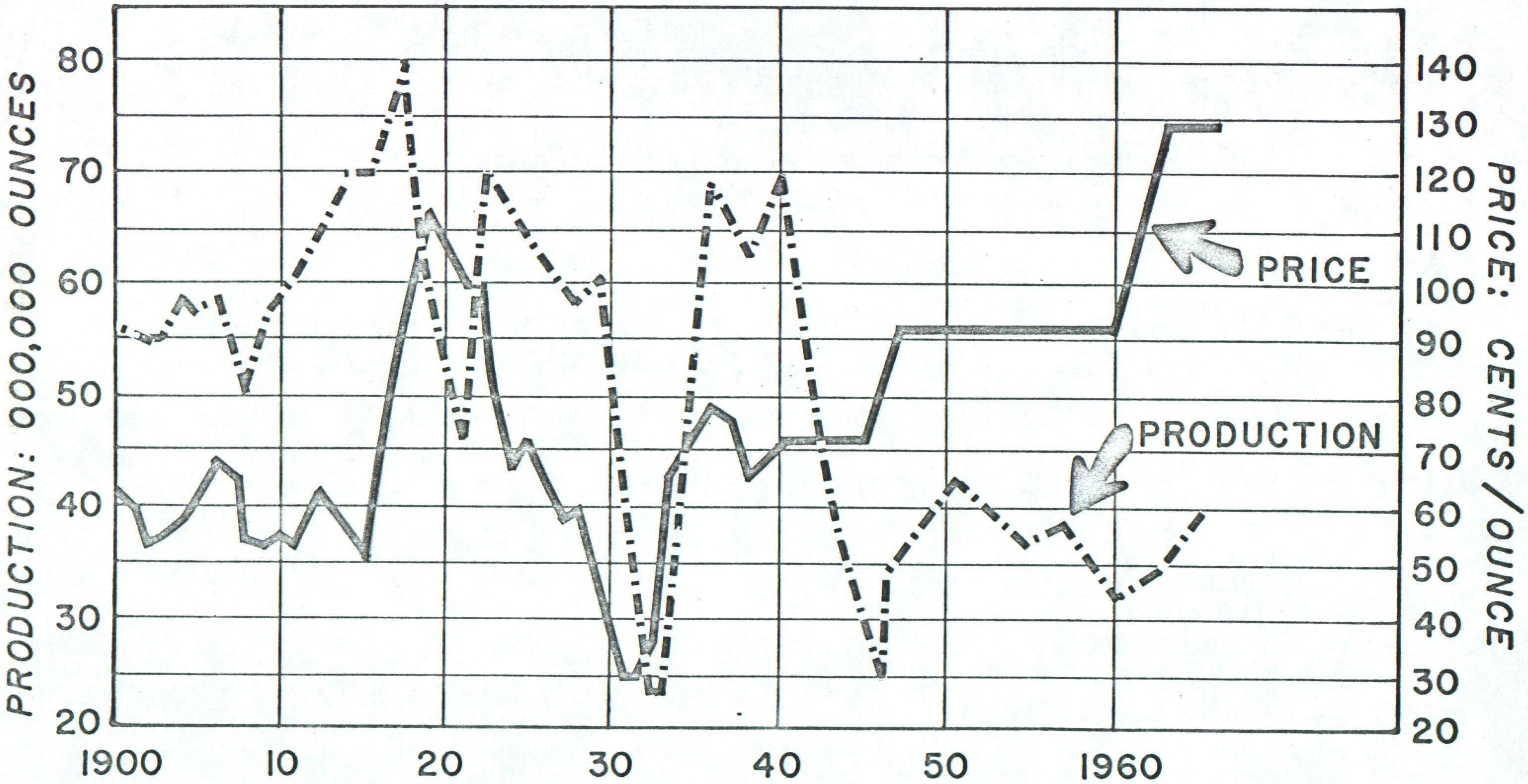

Figure 4. U.S Production & Price

MINING METHODS, MECHANIZED PRODUCTION EQUIPMENT AND TREATMENT METALLURGY HAS ADVANCED TO SUCH AN EXTENT THAT MUCH OF THE INFLATED COST (1967 LABOR-SUPPLIES) CAN BE ABSORBED BY THE ADDED ECONOMIC EFFICIENCY AND PRODUCE AT LESS PER TON COST NOW AT $1.293 PER OUNCE THAN IN 1941 @ 0.34¢ PER OUNCE . . . .

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SILVER

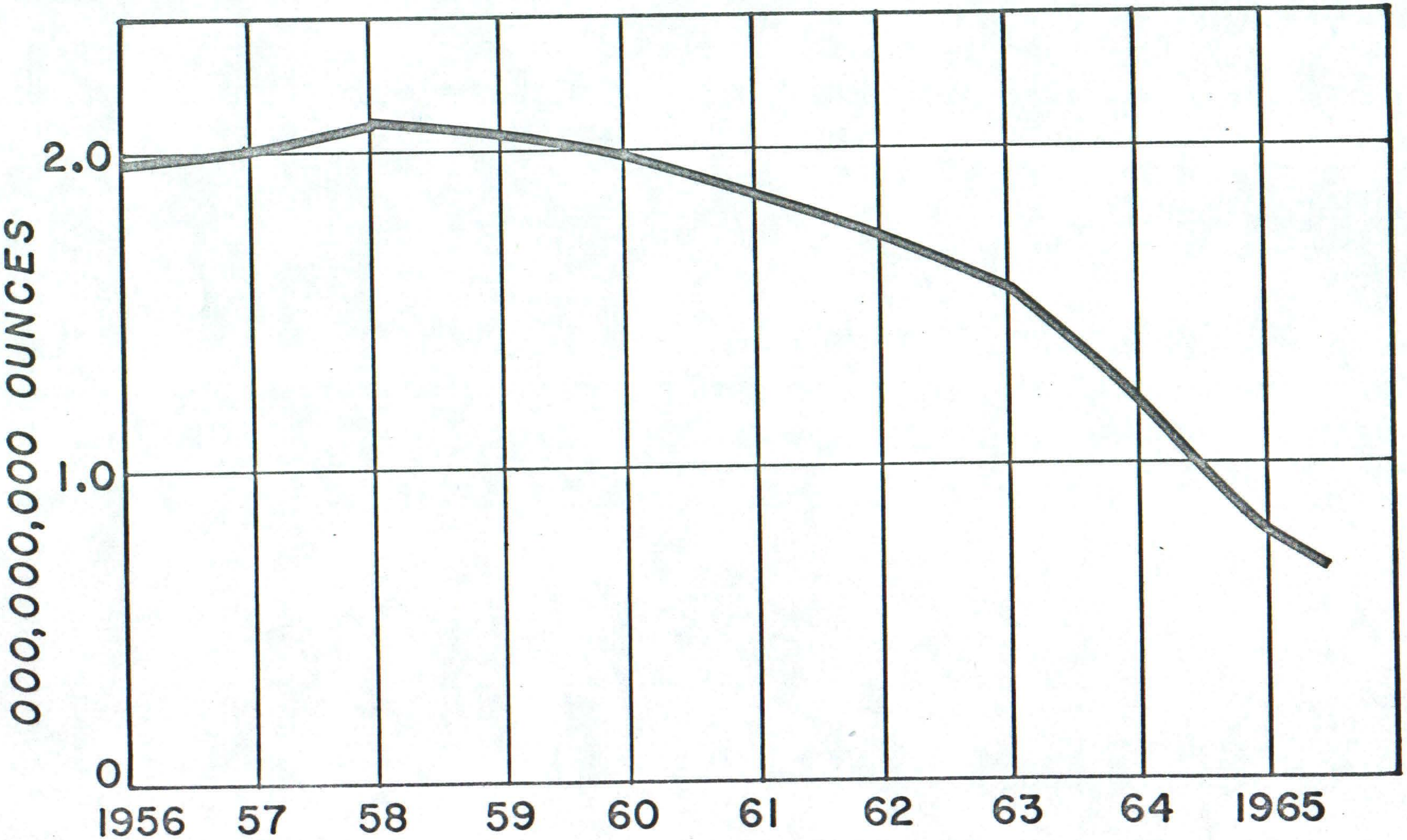

Figure 3. U.S. Treasury Silver Stocks

(AS OF END OF YEAR)

Silver's industrial use is rising. Legislation with regard to a government controled price would defeat the purpose of greater U. S. production.

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SILVER

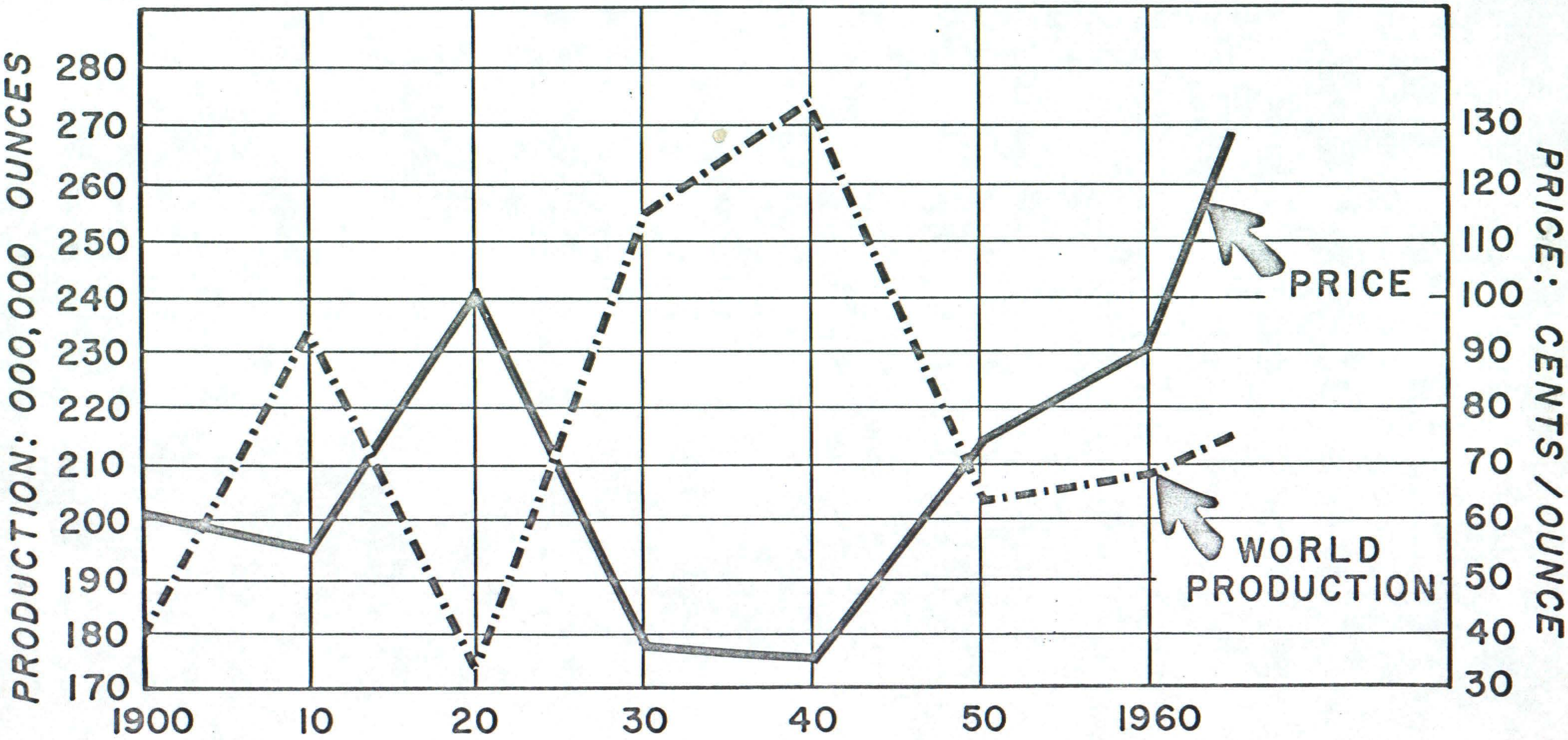

Figure 5. World Production & Price

U. S. GOVERNMENT STOCKS OF SILVER ARE NOW THREATENED BY TOTAL DEPLETION. SILVER POTENTIAL IS BY FAR THE BETTER PRODUCTION ECONOMIC OUTLOOK OF ALL METALS.

6711
9

EAST TYBO MINE REPORT OF JUNE 22, 1967 :

DEVELOPMENT :

East Tybo Mine existing development in good condition consists of:

a). Mine access roads.

b). Various surface pits and cuts. The Larsh Cut has exposed 18' of oxidized ore.

c). No. 1 Tunnel showing oxidized , leached mineral values = 50' long.

d). No. 2 Tunnel from which practically all the production to-date has been derived @ $75.00 to over $100.00 PT = 952' long.

e). No. 3 Tunnel on the 2-G Vein is 125' long and is some 300' verticle feet below the No. 2 Tunnel. It's portal elevation is within a few feet of the collar elevation of the Tybo Mine 2-G Shaft.... = 125' long.

f). Replacement cost of existing underground development = $44,000.00

g). Well over $75,000 has been spent to-date on physical work on the property, not inclusive of engineering, and laboratory fees.

RECOMMENDED EXPLORATION-DEVELOPMENT :

The No. 3 Tunnel should be scheduled to be driven 1,200' past the present face. This will cut at least five known ore shoot zones. a). 120' from the present face. b). 300' from the present face, c500' from the present face.d). 700' from the present face and e). 800' from the present face. Several additional ore shoots are probable in the remaining 400'. This entry, when finished, will open up to 700' of mining backs above the No. 3 Tunnel.

It is proposed that the above 1,200' be driven in two stages : a). 800', and b). 400'. The first 800' overall cost will be $32,000 for 8' X 8' haulage tunnel, = $40 per foot. The second stage's 400' of 8' X 8' x-section = $50 per foot or $20,000. Total of the proposed haulage tunnel footage is : $52,000. Part of this cost may be paid out of expectable direct smelting crude ore shipments. During the driving of this entry, it would be possible to run the haulage tunnel on one shift for daily advance and do production stoping on another shift.

It is further recommended to do 1,000' of Bx diamond drilling in an ore shoot area to prove ore at 500' below the No. 3 Tunnel elevation. The drilling will cost $10 per foot = $10,000.

EAST TYBO MINE REPORT OF JUNE 22, 1967 :

ECONOMICS, FIRST STAGE :

The first ore production at the East Tybo Mine will probably be direct smelting crude. The last 67 tons of ore shipped out of the No. 2 Tunnel Winze was paid for @ : 18.49 Ozs. silver, .04 Oz. gold, and 12% lead = $1.40 gold, $24.05 silver @ $1.30 per ounce and $31.20 for 240 pounds of lead @ .13¢ per pound., totaling $56.65 per dry ton. The present economic cutoff point for No. 3 Tunnel production, inclusive of royalty and amortization of the subsequently to be described preliminary capital requirement would be $35 per ton. Therefore, the above shipment grade should average $21.65 per ton net profit.

The five proven ore shoot zones in line of the proposed No. 3 Tunnel advance should produce an ore grade of at least the above 67 tons shipment value, as the grade character of other shipments was much higher. The first zone is about 120' from the present face. A $55 direct smelting crude grade would net $20 per ton or $1,000 per day from any stoping section where only 50 tons per day was produced. Each of the herein outlined proven ore shoot zones, at the No. 3 Tunnel elevation will qualify as "Possible Ore ". Therefore it is a definite possibility that the proposed exploration-development cost could be paid out of production income. However, as it is vitally important to cross all of the herein mentioned ore shoot zones, a direct , on call, capital subscription for that work would be :

800' of 8' X 8' tunnel @ $40 per Ft. =	$32,000
10% contingency.................. =	3,200
	$35,200

The total cost of the proposed exploration-development program will run some $75,000 inclusive of overhead and diamond drilling. It is quite definitely expected, however, that by the time of the development completion, at least part and perhaps all of the preliminary investment will be amortised out of direct smelting crude ore sold. Therefore, the direct preliminary subscription on call, to be paid out by written disbursement through a public accountant's office, will be $35,200 plus overhead. It is suggested to defer the diamond drilling until the longer range aspects can be capitalized upon.

ECONOMICS , SECOND STAGE :

Eventually, volume production from the East Tybo Mine, in interest of economy , will have to be treated on the property. The average value of the 2-G Vein Ore Shoot System of the 500,000 tons milled, at present markets would be over $40 per ton = $15 per ton net profit X 200 TPD = $3,000 per day or a 27 day month net of $81,000. 200 tons per day production out of the 2-G Vein on the East Tybo Mine, is quite nominal potential in view of the herewith following proof of the vein's productivity. The evolution of 2-G Vein production economics are accurate, factual and substantiated production ststistics. The East Tybo Mine will still have the oxide and secondary enriched ores not depleted.

SECOND;
ECONOMICS - Continuation

The herein net profit is definite by grade control, contract mining and purchase of the equipment along lines set down herein. They can be increased as fast as ground is opened up.

An example of the Tybo Mine evolution from 1867 will illustrate advantages the E. Tybo property has in view of the fact that the ground is virgin below the 200' level but the mineralized fault line has had some considerable technical support from outstanding men in the mining field as being part and the same break system as the 2-G which produced some $10,000,000, to the 1310 foot level in less than one full mining claim.

Following are the interpretations of the production cycles shown on the attached output sheet.

1ST CYCLE:

1867-1872, Inc., total tons: 296. Value: $35,974. Av. Val. $121.53

This was the first Tybo Mine production resulting from very crude mining methods. Gold, silver oxide ore mining in Nevada had been pioneered in the croppings of the Virginia City, Nevada area in the 1850s making prospectors conscious of the ore characters involved. No doubt Virginia City metallurgy indicated in 1872 at Tybo that some means of concentration was in order as well as more efficient means of smelting on the property.

1874-1888, Inc., Total tons: 91,826. Value: $2,570,860 recovered.

The average value per ton in gold, silver and lead recovered was $26.78 per existing data. The Comstock Mines of Virginia City had much richer croppings and underground ore bodies than Tybo yet its average per ton recovery from 1859 to 1882 was only $40.72 out of 7,189,430 tons. Subsequently $27,000,000 was recovered from the above Comstock Lode 1859-1882 tailings which gives one an idea about the original Tybo tailings as the same milling methods were used at each property of the Comstock's ore as was in the case of Tybo, in the early period. Mill concentrate reduction at Tybo was somewhat different than that used for the Comstock concentrates, in the later stages of the 1800's.

SECOND STAGE,

ECONOMICS - Continuation

1889-1916, Inc., period produced only 17 tons from Tybo. Total recovered value of that tonnage was: $2,740, at an average ton value of: $161.18.

This period constituted an interim between when the better grade oxide ores, in leached zones, had been exhausted and the advent of simple flotation. It was not a production period, at Tybo.

2ND CYCLE:

1917-1920, Inc. Total tons: 1,184. Value: $37,292. Av. Val. $32.35 per ton.

One of the early simple flotation mills was built during this period and a new smelter was constructed. At that time even simple flotation was in its preliminary process proving stages. Oxide ores could not be treated and combined lead-zinc sulphides could not be separated. As a result, if the flotation mill's concentrates had been shipped to a zinc plant, penalty for the lead would have been experienced and if the concentrates went to a lead smelter, the zink would have brought prohibitive penalty. Tybo Mine operation in this 2nd cycle proved unprofitable directly due to inadequate metallurgical advance.

3RD CYCLE:

1929-1937 Inc.:

Tons: 474,578 University of Nevada report but actually there were something over 500,000. Nevada report will be used here, however, for benefit of illustration.

Value: $6,759 with no zinc sales included, although zinc recovered was sold.

Average value per ton: $14,04. Please note that this recovery was based upon no zinc payment, on;y 75% of the gold and silver due to early stages of differential flotation under 4¢ per pound average lead, part $20.67 gold and less than 50¢ per silver ounce! The same head

SECOND STAGE,

ECONOMICS - Continuation

value now would be over $40. Also bear in mind that any combined oxides-sulphides would upset the balance of the pioneer differential flotation plant. The U.S. Bureau of Mines Circular #1.C. 6430, March 1931, consisting of eighteen pages of detailed Tybo Mine Milling procedure, will conclusively prove to any metallurgist acquainted with modern selective flotation, that the pioneer plant was very primative, to say the least. The underground mining methods were also primative as no mucking machines were used, no slushers were used, and modern methods of drilling, blasting and tonnage cost saving procedure were unknown. The 3rd Cycle operators were severely limited by methods, depression markets, $1 per ton production power cost, necessity of many thousands of feet of development cost, etc.

The pioneer selective flotation plant commenced treatment on May 13, 1929. However, the operating company had done several years of examination, evaluation, exploration, development before production commencement.

The 1926 assay maps, sampled for the then existing economic cut-off point relative to production ore, have very little to do with up-to-date economics. Differential flotation was still in the laboratory experimental stages when the Treadwell-Yukon Company did the 1926 summary. Areas that are accessible prove that mining widths taken, produced and milled were many times greater than the 1926 assay maps in many instances. Oxide ores and combined oxide-sulphide ores were left unmined as a matter of necessity. Sulphidizing and other means of handling cerussite lead-silver ores was never used at the Tybo Mine.

POTENTIAL 4TH CYCLE:

Please see attached modern selective flotation plant flow sheet plan. The original Tybo selective flotation mill was primative to this flow sheet's equipment and modern reagent control, sulphidizing, etc., will not only make available better overall recovery but release many thousands of tons of developed ore that previously

SECOND STAGE,

ECONOMICS - Continuation

could not be handled at all.

Upper levels of the Tybo Mine hold considerable tonnage of straight oxide lead-silver-gold ore with a low oxide zinc ratio. Sulphidizing of cerussite (lead carbonate, $PbCO_3$, PbO 83.5, CO_2 16.5 percent) carrying silver and gold values has been proven operationally, to be sound. Developed tonnage available in form of pillars, unmined sections, and other salvage, above the 400 level will require modern selective flotation to utilize all possible recovery in an economical manner.

In view of metallurgical advancement since the operational suspension of 1937, existing development in form of shafts, drifts, raises, ore passes, representing several hundred thousands of dollars of access inventory, after nominal rehabilitation cost, will allow Cargold Mining and Development Corp. to capitalize upon the original investment. Mechanized mining methods, modern drilling and blasting methods, all tending towards Hi-tonnage output, lo-manshifts, create a very favorable cost outlook of the known ore, relative to underground production.

Marketing acceptance is available for the Tybo Mine products as both lead and zinc concentrates lack penalty elements.

COPY TYBO MINE PRODUCTION FROM UNIVERSITY OF NEVADA BULLETIN, NOVEMBER 1, 1943.

Vol. XXXII, No. 4, Nevada's Metal and Mineral production, 1859-1940, inc.

By Bertrand F. Couch, Secretary and Jay A. Carpenter, Director, Nevada State Bureau of mines.

TYBO MINE SILVER, LEAD, GOLD - NO ZINC INCLUDED:

The second stage of the economics seemed necessary to include as the 2-G Vein on the East Tybo Ground enjoys much more favorable outlook now than the Tybo Section of the 2-G Vein ever had. Silver price outlook is probably the better of any metal, lead-zinc will not drop and even gold may eventually have a subsidy. Modern mechanized mining methods, much better selective flotation controls are now available than in 1937 and sulphidizing lead-silver oxide ore is now a successful metallurgical fact. On long range perspective, not only are East Tybo Ore Shoots likely to go to great depth but some of the Old Tybo Ore Shoots , that have been proven are raking into East Tybo Mine ground across it's North-Easterly Patented endline.

JAMES H. WREN
P.O. Box 2021
Reno, Nevada 89505
Area Code 702, 322-4840

Date and Place of Birth: January 22, 1912 - San Francisco, California

Nevada resident; listed with the Nevada Credit Rating Bureau.

Engineering Education: Post graduate studies, knowledge of the Spanish language, hold valid U.S. passport, member of the American Institute of Mining and Metallurgical Engineers, licensed, bonded, Nevada contractor, author of technical papers.

PROFESSIONAL RECORD

September 1, 1947, to date

Individual fee basis mining engineering and short-term management assignments, specializing in production problems and the alignment of mechanization. Projects: Open pit production to 10,000 tons per day. Underground production to 1,400 tons per day. Metallics and non-metallics. Dredging to 7,000 cubic yards per day. Treatment by gravity, sink-float, selective flotation, bulk flotation and amalgamation. Project locations: Domestic U.S., Alaska, Mexico, Central America, and most countries of South America. Consulting mining engineer to Industrial Development Corp., Washington, D.C.

Reference: J. M. Van Patten, 1714 Fletcher Avenue, South Pasadena, California.

September, 1945, to September, 1947

General Superintendent and Utah Manager for Metal Producers, Inc. Chief operation: Horn Silver Mine, Milford, Utah. This was Southern Utah's largest gold, silver and lead operation during the above interim. Production was raised from 50 tons per day to 400 tons in form of three products. They were complex selective flotation ore, direct shipment crude ore and a beneficiated shipment tonnage. By mechanization was able to pay off a $400,000.00 deficit within the first six months and show a consistent profit thereafter. Activities were suspended August 11, 1947, as a direct result of Metallic Premiums termination and the economic grade of existing reserves.

Reference: J. W. Mangram, 243-1/2 South Elm Drive, Beverly Hills, California.

February, 1944, to September, 1945

Superintendent of Tungstar Mine, Bishop, California. Project produced a monthly average of 3,000 $W\,0_3$ units per Mo., grossing $90,000.00, leaving $60,000.00 profit.

May, 1941, to December, 1943

Supervisory duties connected with military construction on heavy earth moving projects in foreign fields.

For eight years prior to 1941, worked as a miner, millman, shiftboss, shaftboss, mine foreman, engineer and superintendent at various Western U.S. mines.

LAKES REPORT

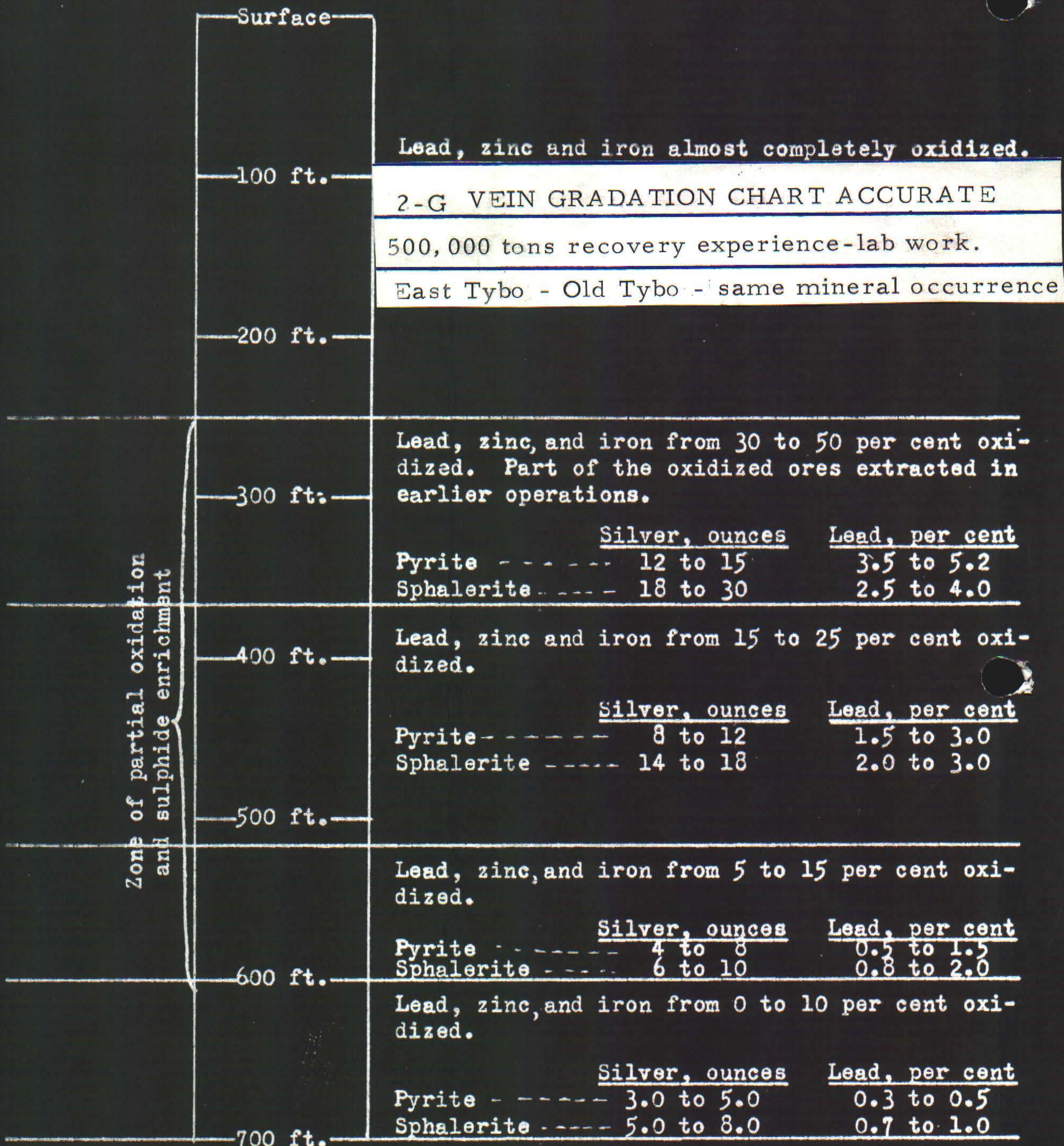

Figure 1.--Vertical section of the Tybo vein, showing approximate degrees of oxidation of the ore body, and varying amounts of lead and silver associated with the pyrite and sphalerite in the different horizons

ARTHUR LAKES
MINING ENGINEER
700 FOREST STREET
RENO, NEVADA
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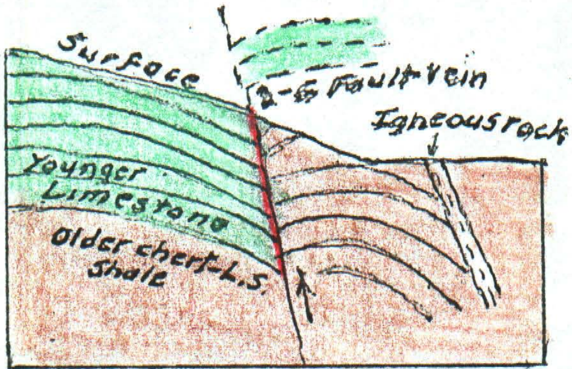
DESCRIPTIVE OUTLINE OF THE TYBO AND EAST TYBO MINES

Tybo Mining District, Nye County, Nevada

The following outline is based upon voluminous geologic, assay, and operational data detailed in Tybo Mine records acquired by J. H. Wren from the mine's most extensive operator Treadwell Yukon Ltd., Data applicable to East Tybo is from recent report by Ron. Allison whose family has owned East Tybo for many years. Wren also had close association with East Tybo during the three years of his connection with Tybo Mine. The information is far too extensive for reproduction and is here summarized to accompany June 26, 1967 Report on East Tybo Mine by J. H. Wren. The details can be viewed at Reno office by anyone interested. The accompanying Diagrammatic Longitudinal Section is presented to aid translation of points discussed.

Present concern is with exploration-mining probabilities in, and above, horizon of East Tybo's No. 3 Tunnel. The important long range development by shafting down deeper in oreremains for later consideration after success of present project. At that time a more extensive financing could be undertaken or the property's showings capitalized and the venture turned over to a major company at long time capital gains to the owners.

Practically all of Tybo District's $10,000,000 plus production (approximately $30,000,000 at today's metal prices) came from 2-G Fault-vein that extends 8200-feet southeasterly . It is truncated on the NW by major Uncle Sam cross fault and on the southeast by Juno fault as shown on Longitudinal Section and Sketch 1-B herein. The effects of these cross faults has been to elevate 2-G vein and environs as shown on Sketch B. The 2-G vein occupies a steeply NE dipping reverse fault whereby older shale-chert-limeston complex has been elevated opposite to younger limestone as shown on Sketch 1-A. These relationships are favorable for the deposition of gold-silver-lead-zinc ores constituting the district's orebodies.



Sketch 1-A (No Scale)

Sketch 1-B (No Scale)

The preponderant Tybo mine production came from the northwest part of 2-G Vein as shown on Longitudinal Section. This mine was opened by 2-G and Hales shafts, the latter sunk 1560-feet deep developing economic ore 1300-feet below shaft collar, the 1516-station not having been crosscutted into the vein. However there appears little doubt that economic ore should extend down to or beyond the 2000-shaft depth which would provide upward of 2800-feet of backs under the vein's higher out-outcrops. The thickness of the ore-favorable footwall limestone is reported at about 3000-feet in government reports.

The upper 300-400-feet of 2-G Vein has been oxidized which resulted in gold increase, some silver decrease, and practical elimination of zinc within the oreshoots which sometimes contain boulders of galena which resisted oxidation. The underlying secondary enrichment zone(transitionary between zones of oxidation and primary sulphide ore) brought up silver and lead contents whilst depressing gold content. Thus early day selective mining 61,439-tons of oxidized ore recovered an average 27.5-oz. silver, 0.24-oz. gold and 11% lead, zinc nil. vs. Treadwell Yukon's more general mill ore production of about 500,000-tons in the sulphide zone averaged 10.75-oz. silver, 0.024-oz. gold, 6.75% lead and 5% zinc. The above metal recovery probably represents less than 75% of the original ore's metallic content account of processing deficiency now overcome by modern metallurgy. The Reported $10,000,000 production also represents much lower returns than applicable today whereby the product was sold at from 55¢-60¢ per silver ounce, vs. $1.30 today; 3½¢ to 5¢ per pound of lead vs. 13¢ today ; $20 per gold ounce vs. $35 today; and 3½¢ to 5¢ per pound of zinc vs. 13¢ today.

Tybo Mine's stoped area extended over 1400-horizontal feet, comprising a number of independent ore shoots varying from 170-feet to 700-feet horizontal length, swelling from 2-feet to 30-feet thickness and raking in a southeasterly direction about 65° from horizontal, as showing at east part of Tybo property and applied to the oreshoots at East Tybo Mine on the Longitudinal Section. It will be understood that the East Tybo ore designations are illustrative of position and probable attitude for projection into No. 3 Tunnel and are not indicative of the full length of individual oreshoots which may be greater or lesser than depicted.

<u>EAST TYBO MINING PROPERTY</u> comprises three patented and three unpatented claims on the southeast extension of Tybo Mining area. The three (Juno, Victory No. 1, and Victory No. 2) patented claims cover 2-G Vein outcrop, in identical geologic setting as Tybo mine, for 2800-horizontal feet over a vertical range of 972-feet from high 7288' at the NW to low 6316' at Juno SE vein end as shown on Longitudinal Section. The three (Laura, Betty, and Nancy) unpatented claims lie to the north and east as shown on accompanying Claim Map.

The 2-G vein averages 4-5-feet width pinching to a few inches and swelling to 18-feet or more as witnessed by the important Larsh Cut (El 7101) where 18-feet of mineralization occurs maintaining width where Larsh oreshoot is apparently being approached at face of No. 2 Tunnel 421-vertical feet lower.

WORKINGS The East Tybo (2-G) vein outcrop and all of East Tybo workings are essentially in the oxidized zone with localities containing boulders of galena (primary silver-lead ore) and areas of local enrichment providing good mill ore and zones of shipping ore as noted in No. 2 Tunnel.

Tybo mine's mineral occurrence and ore habit provides expectancy that as No. 2 and No. 3 Tunnels progress NW along the vein into the mountain they will pass through the upper oxide zone and penetrate into the zone of secondary enrichment with high grade shipping ore and thence penetrate into the important sulphide zone with extensive bodies of shipping and milling ore. Note In the following the metal prices used are: Gold $35 per ounce; Silver $1,30 per ounce; Lead 13¢ per pound; Zinc 13¢ per pound.

TUNNEL No. 1 (El. 6877) is 50-feet long in oxidized material. There is no point in extending this tunnel which would probably remain in oxidized zone to East Tybo's western endline according to the sketched zone on accompanying Diagrammatic Section.

TUNNEL No. 2 (El. 6680) is East Tybo's most extensive and presently most important development. It has been driven 952-feet mostly in oxidized material which provide three zones of ore: (A) 25-tons shipped from 40-130-feet from portal: 89.6-oz. silver ($116.48) 50.3% lead ($130.00), Total $246.48 per ton. (B) Sixtyseven tons from 515-590-feet past portal 18.49-oz. silver ($24.04), 12% lead ($31.20) Total $55.24 per ton (gold not reported).. Streaks of high grade 110-oz silver ($143 per ton) 52% lead ($148.20) Total $291.20. (C) Last 95-feet of No. 2 Tunnel to face in ore wider than the drift, drilled out approximately to 18-feet width. Mill ore 4.99-oz. silver ($6.48), 5% lead ($13) estimated gold $2.00, Total $21.48. Streaks & bunches of high grade 71-oz. silver ($92.30), 44.7% lead ($116.24) Total $218.50 (gold not reported but estimated about $2 per ton of ore). Allison reports 10-tons of shipping ore in No. 2 Orebin and about 2000-tons of mill ore on No. 2 dump.

The wide ore at No. 2 Tunnel face is probably beginning of downward continuation of Larsh orebody 421-vertical feet below Outcrop at Larsh Cut. The presence of bunches and boulders of high grade strongly indicates that No. 2 Tunnel may be entering into the rich core. The indications are that No. 2 Tunnel affords exceptional opportunity for early disclosure and development of shipping ore. The wide mill ore would prove adaptable to flotation by use of sulphadizing reagents.

TUNNEL NO. 3 (El. 6400, 280-feet below Tunnel No. 2) has been extended 125-feet along oxidized vein, presently low grade . By application of the observed SE rake of Tybo Mine's oreshoots and account of various surface and No. 2 Tunnel ore showings the extension NW of No. 3 Tunnel should encounter mineable oreshoots at approximately the following localities as measured from the tunnel's present face; (1) about 120-feet, (2) about 300-feet, (3) about 500-feet, (4) about 700-feet, (5) about 800-feet and within 1200-1300 feet the downward continuation of the Larsh orebody about 700-feet below its outcrop. In accord with ore habit at Tybo mine (in identical geologic setting) it is believed that as the tunnel advances NW into the zone of secondary enrichment and thence into the sulphide zone important shipping and milling ore will be gotten to put the mine into profitable operation sufficient to defray project costs and yield handsome profits. It is quite possible that shipping ore from the oxide zone alone will provide a good cash surplus prior to mill installation for exploitation of the more extensive primary ore tonnage ahead of present tunnel faces. The expected success here would lead to the mine's major shaft development with chances of making East Tybo one of Nevada's major gold-silver-lead-zinc mines.

RECOMMENDATIONS It is recommended that about $75,000 be envisaged to provide funds for: (1) Extending No. 2 Tunnel 100-150 feet (or more as conditions warrant) into the presently disclosed ore zone. As the tunnel is already equipped with track, pipe, mucking machine etc. its costs will be minimum. The probabilities of opening a shipping orebody appear good and fully warrant this procedure. (2) Drive No. 3 Tunnel 1200-1300-feet NW progressively getting farther into zone of secondary enrichment where shipping orebodies are to be expected and thence into the more extensive primary ore zone with its much greater mill ore tonnage and good possibility of opening considerable high grade shipping ore. This tunnel work would be conducted by trackless mining method described in Wren's June 26th. Report to which this is an accompaniment.

The tunnel work should be performed by contract, the contractor providing machinery and equipment as well as services.

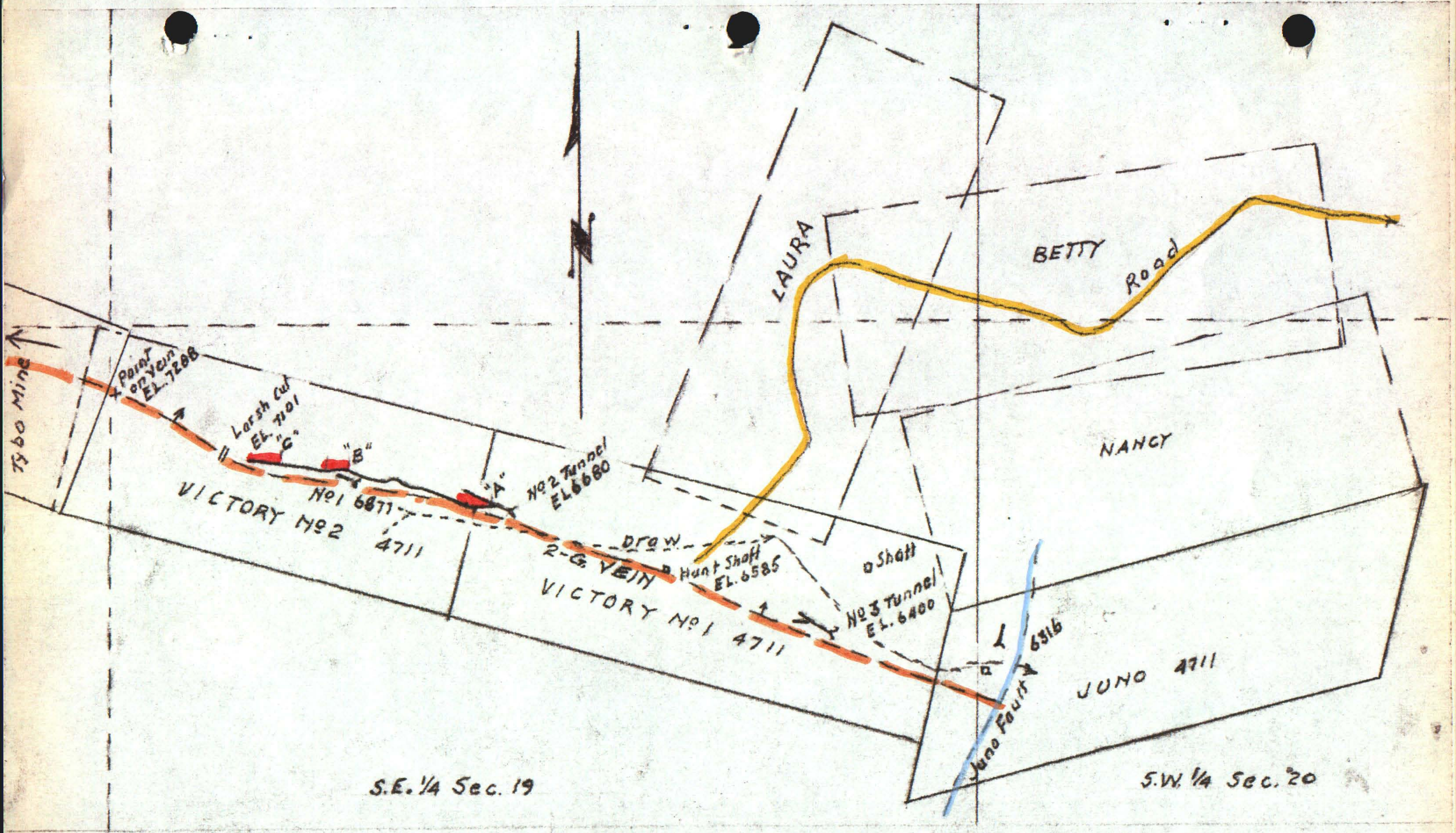
I recommend East Tybo as a superior mining proposition that may shortly provide good profit and may prove to be one of Nevada's outstanding gold-silver-lead-zinc mining operations.

Reno, Nevada
July 7, 1967

Arthur Lakes

Arthur Lakes

Nevada Registered Engineer No. 1408
Life Member British Columbia Association of Professional Engineers



EAST TYBO MINING PROPERTY

SCALE: 400-ft. to 1-in.

From Company Maps by Arthur Lakes, 1967

2-G VEIN OUTCROP — Ore showing — Fault

Numbered Claims are patented

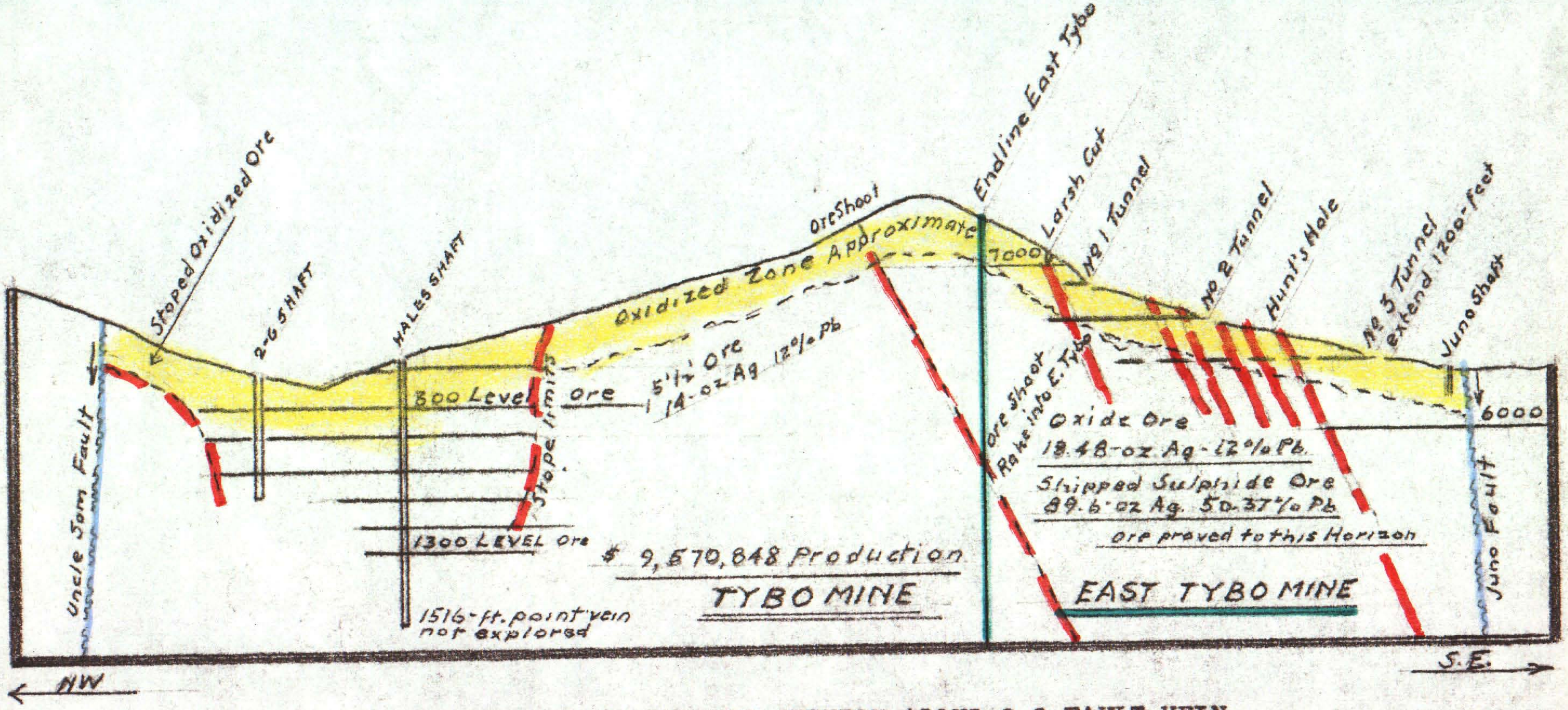
make copies

Most Recent

EXPERIENCE PROFILE
ARTHUR LAKES

Registered Nevada Professional Engineer, License No. 1408
Life Member Association of Professional Engineers of British Columbia

Miner-timberman-sampler-surveyor-assayer
Student assistant in geological and mining examinations
Assayer-chemist Stephen Rickard Laboratories, Denver, Colorado
Exploration engineer for Colorado Gold Dredging Co a subsidiary to General Development, New York, sampling, mapping placer ground prior to installation of two gold dredges
Editor of Mining Science monthly magazine, Denver, Colorado
Manager & Engineer for Alturas Mining Co. Hailey, Idaho Small development to producing silver-lead property
Manager Ymir-Wilcox Dev. Co. Ymir, British Columbia. Production from Wilcox gold mine
Formed partnership Larson & Lakes Consulting Mining Engineers and Geologists, Spokane, Washington
Two years in United States Army from 1st. Lieutenant to Major and sent overseas
Resumed partnership Larson & Lakes. Geologist and engineer in apex lawsuits. Conducted successful operations at Lucky Jim zinc mine and Whitewater Deep lead-zinc mine into outstanding British Columbia producers.
Conducted geologic survey and mapping of Sheep Creek gold camp, Salmo, British Columbia resulting in discovery of Gold Belt mine successfully exploited by North American Mines Co., Boston, Mass. Similarly with Reeves McDonald zinc-lead mine from prospect to an outstanding lead-zinc mine later sold to Pend Oreille Mining Co.
Manager & Engineer for Emerald mine, Sheep Creek District, B. C. explored and developed extensions of lead-zinc ore zones with my brother the late Harold Lakes into 1800-tons per diem producer and discovered and opened the large high grade scheelite deposits that made this mine one of the largest tungsten producers of North America.
Conducted geologic and geophysical survey of Texada Island, B. C. copper and iron deposits and examined and reported on numerous mines and prospects in Canada and United States. Discovered and opened Wesko gold mine, Ymir, B. C.
Established Consulting office at Spokane, Washington and directed early exploration and development of Lucky Friday mine, Coeur d'Alene, Idaho to 1200-level before leaving for Nevada. Property has developed into one of America's outstanding silver-lead-zinc mines with its stock price expanding from 10¢ per share in 1945 to nearly ~~$75~~ per share today (Hecla Mining Co. gave 1½-shares of Hecla stock for 1-share of Lucky Friday. Hecla is selling around ~~$50~~ 39 today).
Member of three men Advisory Board to adjust extra lateral conflicts at Coeur d'Alene District mining properties.
Conducated three season geologic survey in Slocan District, B. C. Geologic mapping easterly extension of Emerald tungsten area, Salmo, B. C. and north extension of Pend Oreille mining district, Washington and British Columbia.
Came to Nevada to open Tungsten Mountain Mine into production and established Consulting Engineer Service in Nevada.

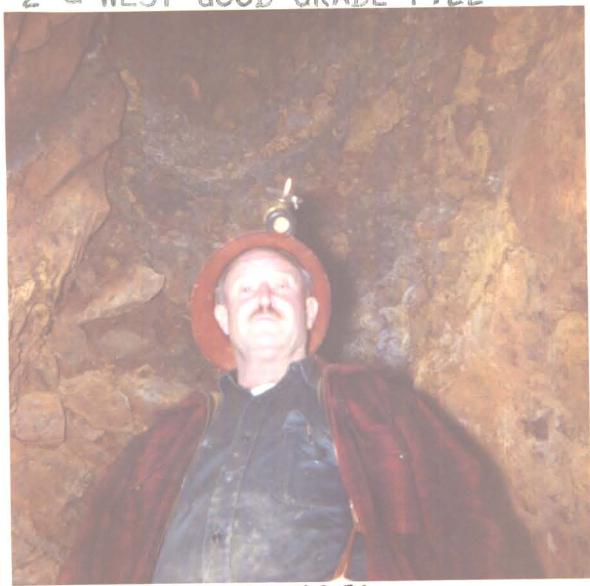


DIAGRAMMATIC LONGITUDINAL SECTION ALONG 2-G FAULT VEIN
Showing relation of EAST TYBO to TYBO MINE
SCALE 1000-feet to 1-inch

Fault — Ore showing & expectancy — Tunnel

Arthur Lakes-1967

2-G WEST GOOD GRADE FILL



DEC. 31, 1961

W. T. CARSON, SR. AT

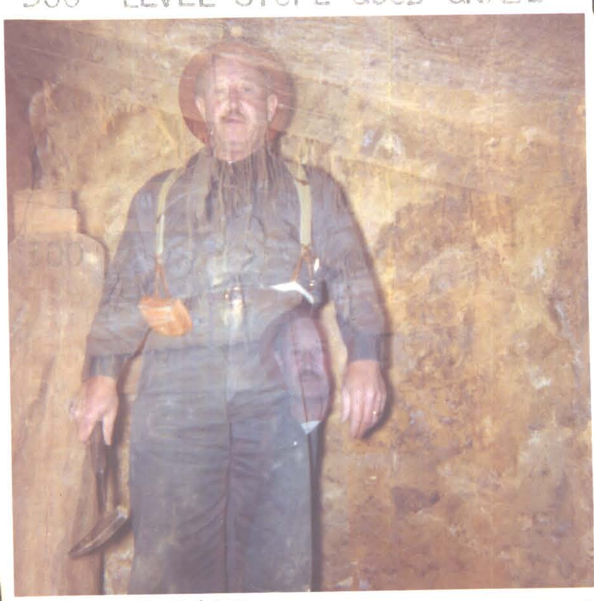
TYBO MAIL BOX 12/31/61

TYBO MINE TURNOFF MAIN

HIGHWAY

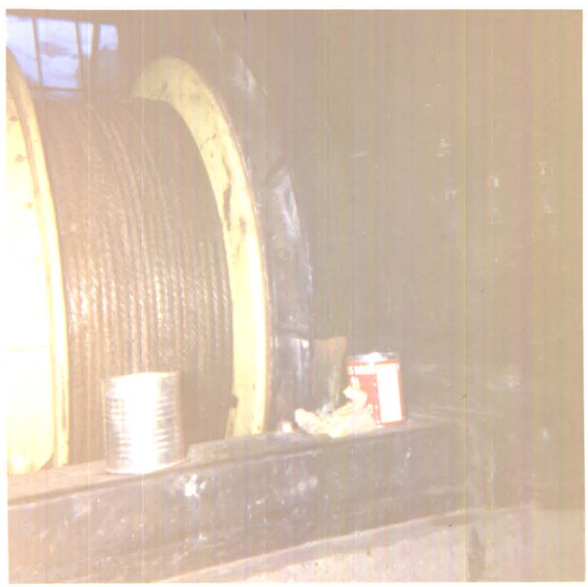
300' LEVEL STATION 2-G

300' LEVEL STOPE GOOD GRADE

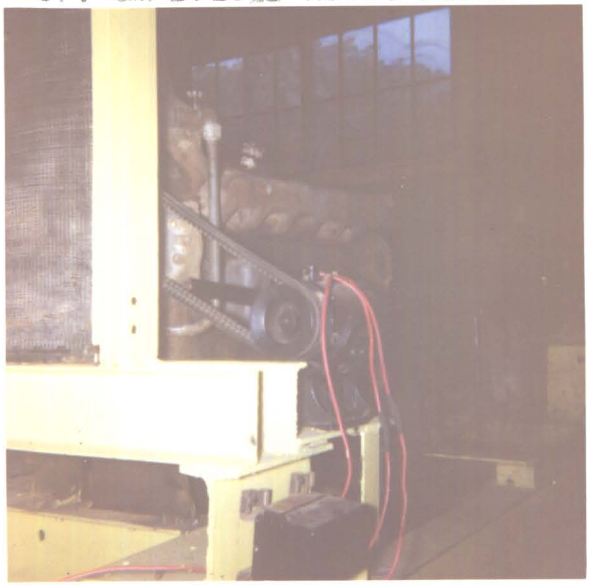


OR IN BACK.

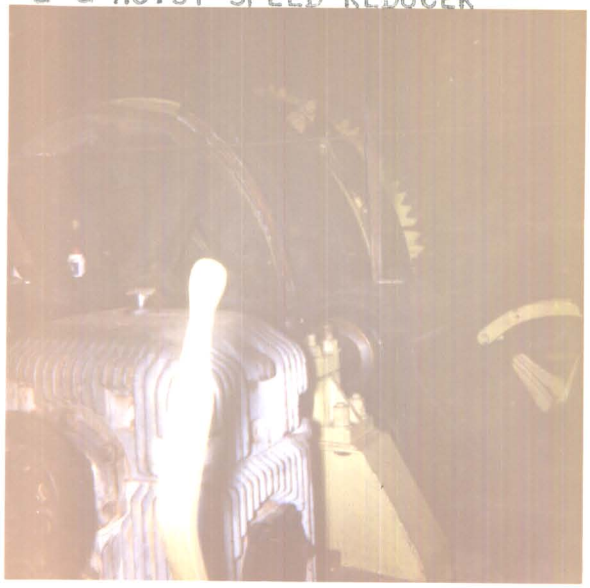
2-G SHAFT HOIST DRUM



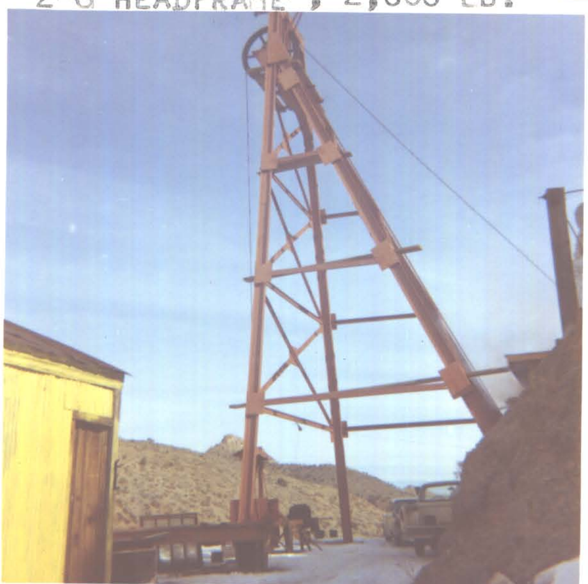
671 GM DIESEL HOIST POWER



2-G HOIST SPEED REDUCER



2-G HEADFRAME, 2,000 LB.

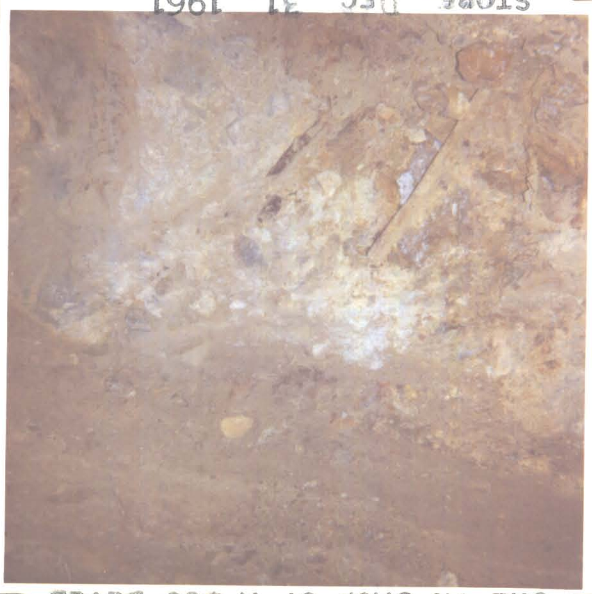


SHEAVE WHEEL 6' DIAMETER

2-G HEADFRAME, HEAVY

CONSTRUCTION

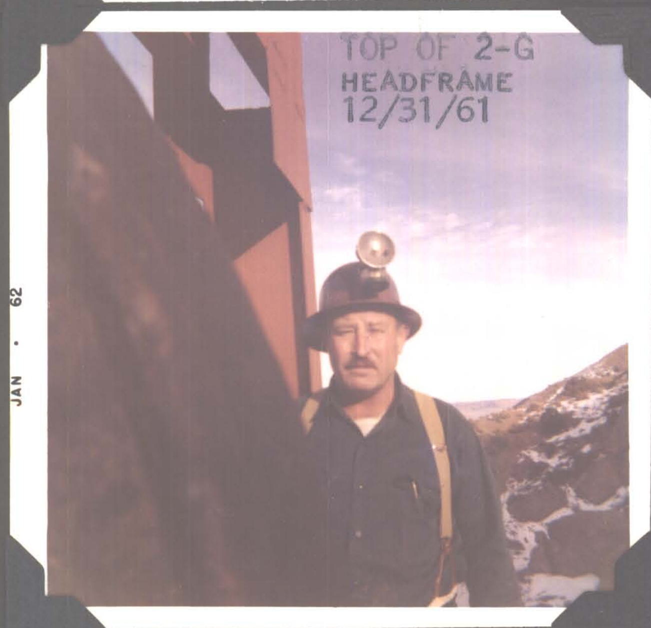
ORE IN BACK OF A 300 LEVEL



STOPE, DEC. 31, 1961


WREN NEXT TO SHEAVE
WHEEL 2-G SHAFT
21/31/61
JAN • 62


TEMPORARY
CAGE
2-G SHAFT
JAN • 62


TOP OF 2-G
HEADFRAME
12/31/61
JAN • 62


JAN • 62