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November 24, 1952

Mr. M.H.Link
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<u>To Edward Wisser, Dr.</u>

To professional services,preparation of report on
Bunker Hill mine, Inyo Co.,Calif.................... $125.00
Paid on account.................................. 25.00
Balance due...................................... $100.00

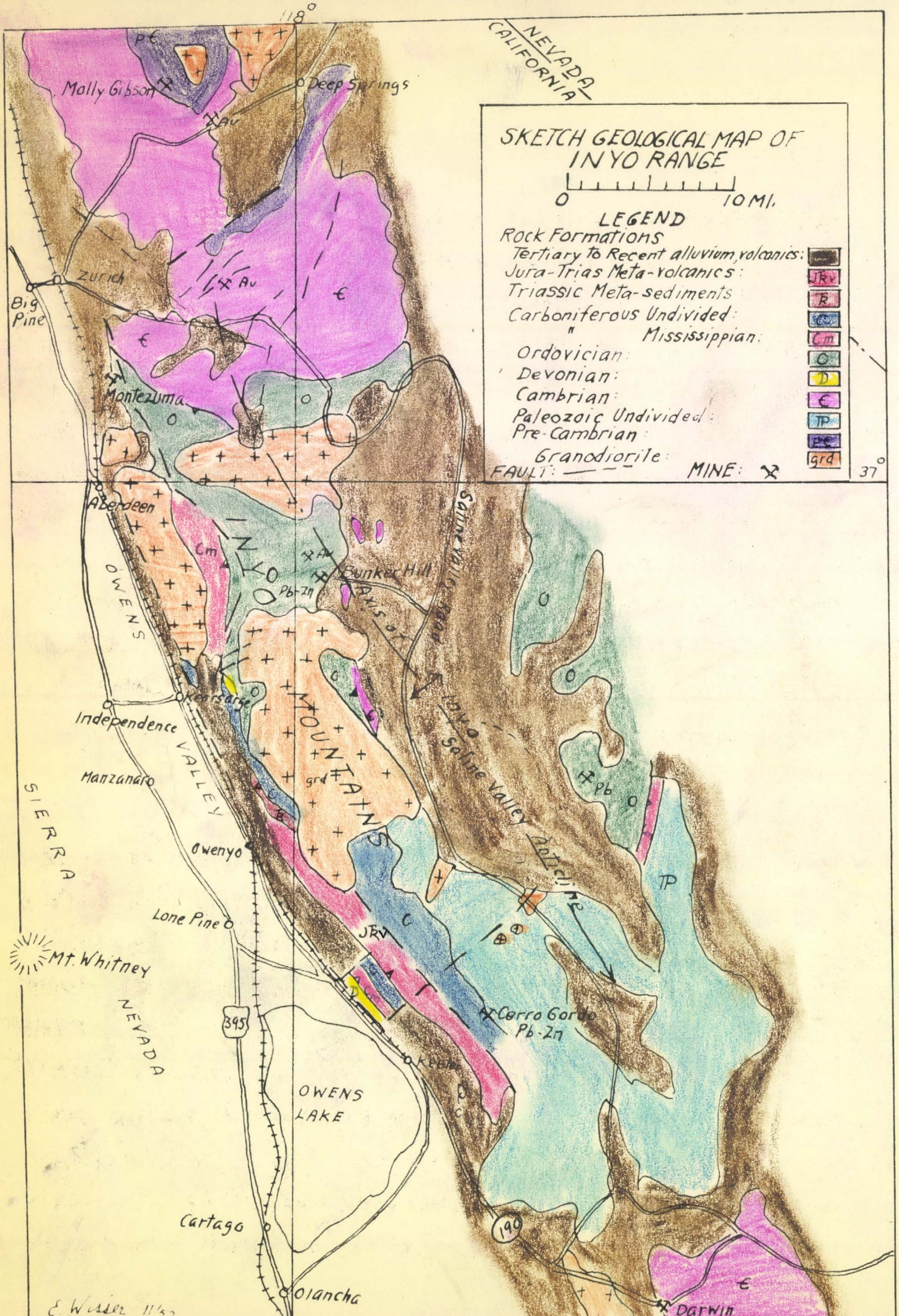
OFFICE REPORT ON

BUNKER HILL LEAD-ZINC-SILVER MINE

INYO COUNTY, CALIF.

Edward Wisser

November 23, 1952



SKETCH GEOLOGICAL MAP OF
INYO RANGE
0
10 MI.
LEGEND
Rock Formations
Tertiary to Recent alluvium, volcanics:
Jura-Trias Meta-volcanics: JRv
Triassic Meta-sediments: R
Carboniferous Undivided: C
" Mississippian: Cm
Ordovician: O
Devonian: D
Cambrian: Є
Paleozoic Undivided: TP
Pre-Cambrian: PЄ
Granodiorite: grd
FAULT:
MINE:
118°
37°
NEVADA
CALIFORNIA
Molly Gibson
Deep Springs
Au
Zurich
Big Pine
Montezuma
Aberdeen
INYO
MOUNTAINS
Bunker Hill
Pb-Zn
Axis of
Saline Valley Syncline
Inyo
Saline Valley Anticline
OWENS
VALLEY
Kearsarge
Independence
Manzanaro
Owenyo
Lone Pine
Mt. Whitney
SIERRA
NEVADA
395
Cerro Gordo
Pb-Zn
Keeler
OWENS
LAKE
Cartago
Olancha
190
Darwin
Pb-Zn
Pb
E. Wisser 11'3?

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OFFICE REPORT ON BUNKER HILL LEAD-ZINC-SILVER MINE, INYO COUNTY, CALIF.

INTRODUCTION

The writer has not himself visited the Bunker Hill property, but is somewhat familiar with the general region in which the mine lies. A report by Edward W.Brooks, geologist,dated August 1, 1919, is the chief source of information on the mine. An attempt is made in the pre sent report to evaluate the property, not only in the light of Brooks data,but in that of the general geology and ore occurrences of the Inyo Mountains. (See Sketch Geological Map of Inyo Range,facing this page). Sources for this map are (1) Geologic Map of California,State Division of Mines,1938; (2) Plate II, Geologic Reconnaissance of the Inyo Range etc.,by Adolph Knopf, U.S.Geol.Survey Prof.Paper 110, 1918.

LOCATION. COMMUNICATIONS.

The Inyo or White Mountains trend nearly north and are separated from the Sierra Nevada on the west by the Owens Valley. The locatior of the Bunker Hill mine shown on the accompanying plan is approxi- mate only,since no map is at hand showing the position of the proper- ty;but the mine lies well down the eastern flank of the range,roughl in the position shown. The principal highway is U.S.395 (San Diego t Reno),which in this area traverses the Owens Valley;other known roads are shown on the map. Brooks mentions a road from Big Pine that was extended a mile to the mine after his report was written(Supplementa Report, January 10,1924). Evidently this approach roads branches fro the Saline Valley road, as shown on the map.

The railroad shown on the map is the Southern Pacific branch line from Mojave. Some of this has been abandoned, but I believe it still operates at least as far north as Keeler.

Since the elevation of the mine is about 5000', I assume that operations would be somewhat hampered during the winter.

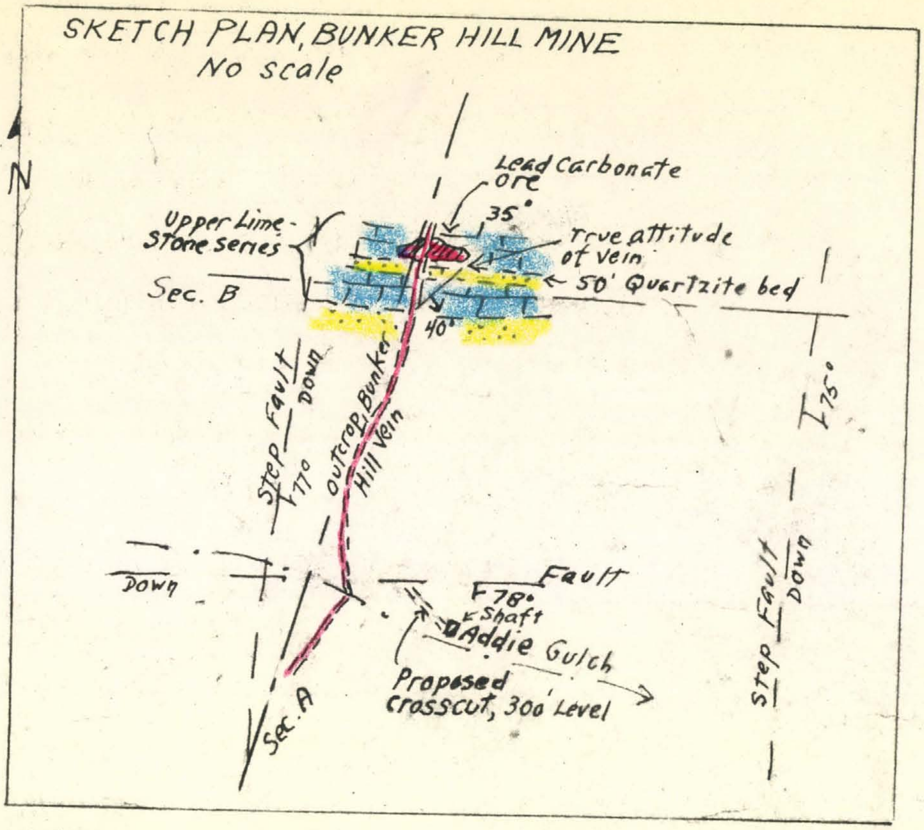
GEOLOGY AND STRUCTURE OF INYO RANGE

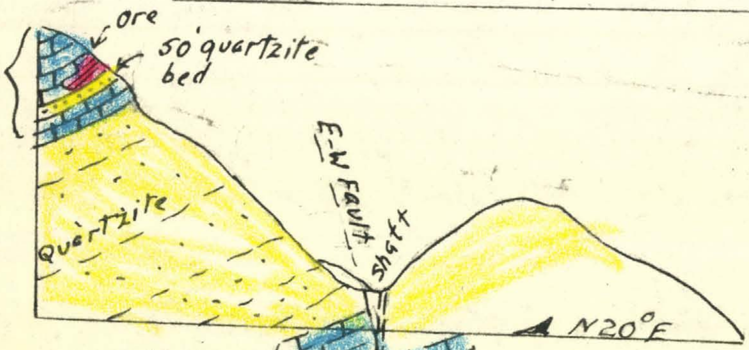
While the present range owes its shape to late uplift and faulting, the earlier structure of the Paleozoic and Mesozoic rocks making up the range is that of a broad anticline, with a complementary syncline on the west. Anticline and syncline trend more to the northwest than does the nearly north-south range, so that the axis of the anticline, as shown on the map, leaves the range for the east not far from the Bunker Hill mine. The position of the syncline is marked by the belt of Jurassic and Triassic rocks shown north of Keeler.

The core of the anticline is undoubtedly composed of granodiorite similar in type and age to the main granodiorite mass of the Sierra Nevada on the west. Large intrusions of this rock are exposed north, south and west of Bunker Hill which have invaded and thrust up the Paleozoic sediments; northeast of Cerro Gordo, granodiorite, part of a large intrusive mass, is exposed in the deeper canyons.

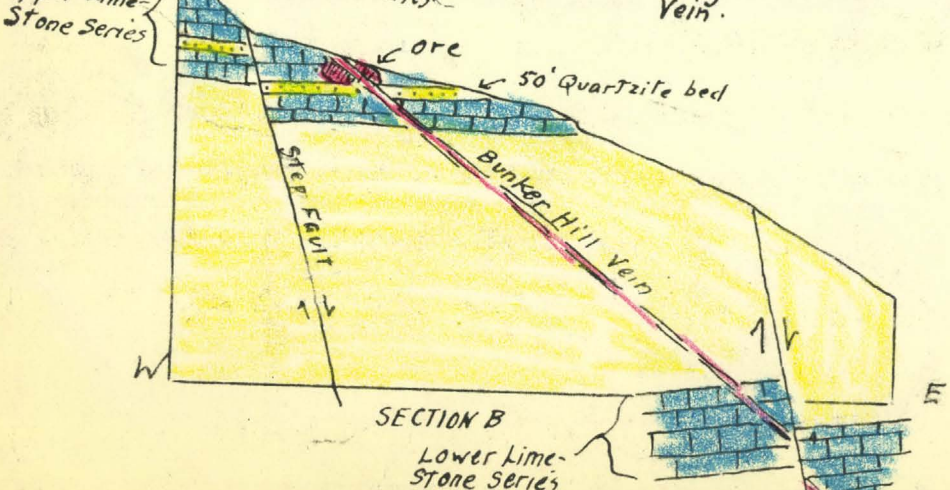
ORE DEPOSITS OF THE INYO RANGE.

Chief source of information on the ore deposits is the paper by Knopf cited on page 1. The chief ore deposits occur in the southern portion of the range, that shown on the accompanying map; their distribution coincides with that of the granodiorite intrusions mentioned. Zinc, lead-silver and copper deposits occur as replacements in limestone, while gold deposits are found mainly around the margins of





SECTION A
Along Bunker Hill Vein.



SECTION B

the granodiorite masses.

The chief lead-zinc producers of the region are Cerro Gordo and Darwin, the latter mine lying south of the Inyo Range but apparently along the same metalliferous zone, which flanks the southern Sierra Nevada on the east. Lead-zinc-silver ores are presently being mined at Darwin by the Anaconda Copper Mining Co.

At Cerro Gordo, which had produced over $7,000,000 prior to 1918, the lead-zinc-silver ore bodies occur as replacements in Devonian marble with interbedded quartzite. These beds are folded into a sharp minor anticline trending N30°W and overturned to the west. A north-south master fault separates the Devonian beds, east of the fault, from Mississippian black shales and limestones west of the fault. Some of the rich ore chimneys were controlled by minor fractures parallel to the master fault and by local bedding features of the limestone-quartzite series.

Smaller mines and prospects of the Inyo Range are of the same general type, namely replacement deposits in limestone and marble.

BUNKER HILL MINE

No map of this property accompanies the Brooks report; the sketch map facing this page has been concocted from Brooks' vertical sections and from his description of the property.

The country rock of the area consists of limestone with interbedded quartzite; these were considered Ordovician by Knopf and are so shown on the regional map; but their lithology so closely resembles that of the Cerro Gordo series that the Bunker Hill sediments may well be Devonian also.

The sediments at Bunker Hill have been folded into a local east-west anticline (see Brooks Section D, not reproduced). The mine lies on the north flank of this anticline, as shown in Section A.

A series of north-south step faults breaks the east-west anticline into fault blocks which are successively downthrown from west to east as shown on Section B.

To complicate the picture further, several east-west normal faults parallel the anticline on its northern flank; one of these appears on the Sketch Plan and on Section A, facing page 3.

According to Brooks, dikes and a sheet of quartz porphyry are exposed not far west of the mine, the dikes trending east-west, parallel to the anticline and to the normal faults just mentioned. Brooks believes that a large mass of quartz porphyry underlies the sediments of the anticline, and that the mass uplifted the sedimentary beds to form the anticline. The north-south step faults he thinks came later, faulting quartz porphyry as well as sediments.

Some doubt exists as to the attitude of the Bunker Hill vein, with which the known ore deposits were associated. Brooks states that the vein strikes N60°E (p.7) but his Section A "along the vein", trends N20°E. On Section C (not reproduced) the strike of the vein is given as "N20° to N60°E ". Obviously the course of the vein as shown on my Sketch Plan is pure guesswork. The average dip of the vein is 40°E.

Presumably the vein is younger than the east-west normal fault cropping out in Addie Gulch, and is therefore not displaced by that fault; but the relative ages of the vein and the north-south step faults are unknown to me; I should guess the step faults younger, in which case they would displace the vein.

<u>Ore Occurrence:</u> The sediments at the mine consists of an upper and a lower limestone series separated by several hundred feet of quartzite and quartzitic shale (Sections A, B.) Only the upper limestone is exposed at Bunker Hill. In that series, and above the

50 ft. bed of quartzite shown in Sections A and B, lead carbonate rich in silver made out from the Bunker Hill vein along the limestone beds. The ore shoots occurred within a vertical range of abo 75 ft., and a horizontal range of about 300 ft. (probably along the strike of the Bunker Hill vein).

Apparently the ore occurrence was governed primarily by the Bunker Hill vei lying mainly along that vein but making out into the limestone xxx for limited distances away from the vein, largely along minor fractures.

Brooks points out (page 6) that the 50-100 ft. of the Upper Limestone lying below the 50 ft. quartzite bed has not been explored. Th real hope for the mine however lies in the Lower Limestone, below th thick quartzite series shown on Sections A and B. Brooks argues th the ore solutions which deposited the lead-zinc ores in the Upper Limestone series, the only ore bodies known to date, must have passed through the Lower Limestone series, and that the solutions, being hotter and more active chemically at that lower horizon, in all probability deposited there larger and richer ore bodies than were formed in th Upper limestone above the thick series of unfavorable quartzite. The known ore bodies therefore represent mere "leakage" ore.

Assuming that Brooks' data are essentially correct (and his report to me has the stamp of truth), I heartily subscribe to the notion just outlined as applied to the Bunker Hill mine. It has been my experience with limestone replacement deposits in Mexico and the U.S. that the lowest favorable limestone bed in a mineralized area is xxx frequently the best mineralized, the solutions dropping the bulk of their metals there, and depositing in higher favorable beds only that amount of their load which was "left over".

Exploration at Bunker Hill: Brooks recommended sinking of a 300' shaft in Addie Gulch, to intercept the Lower Limestone series at a point some 200' from the Bunker Hill vein at that horizon, with a crosscut of that length from the bottom of the shaft to reach the vein. From the crosscut drifting was to be done, north and south along the vein.

In his Supplementary Report of January 10, 1924, Brooks states that the shaft was sunk as recommended, and had entered the Lower Limestone series as anticipated. The proposed crosscut to the Bunker Hill vein had not yet been driven. So far as I know, operations ceased at about this time.

CONCLUSIONS. RECOMMENDATIONS.

The Bunker Hill mine produced rich lead carbonate-silver ore, and some zinc carbonate ore, occuring in an Upper Limestone series along a persistent vein. Some 700 ft. stratigraphically below this horizon occurs a Lower Limestone series, presumably cut by the same vein or ore channel. A shaft cut this lower series, but no crosscut was driven to the vein where the latter cuts the Lower Limestone. Chances seem good for ore in the Lower Limestone adjacent to the vein.

The Bunker Hill mine occurs in the same mineralized zone that contains the highly productive Cerro Gordo and Darwin mines. The sedimentary series at Bunker Hill is strongly suggestive of that at Cerro Gordo, and the structural control, that of fracturing plus favorable sedimentary beds, appears to be the same in the two camps.

Chances for lead-zinc-silver sulphide ore at depth seem to me exceptionally good at Bunker Hill. To any one interested in possibly duplicating Anaconda's profitable operation at Darwin, I recommend detail geologic mapping of the Bunker Hill area. If the mapping confirms the ideas of Brooks, the shaft may be repaired, if this seems possible, and the crosscut to the vein driven. Possible steps that x might be taken before undertaking this are diamond drilling, if results from the geologic study indicate its feasibility, and geophysical exploration. Massive sulphide deposits in limestone should be made manifest by geophysical techniques provided they do not lie too deep. Geochemical prospecting, determination by chemical analysis of minute quantities of base metals above ore bodies, has also been used with success in similar cases. Only a detail geologic study can tell whether the above exploration methods might apply to Bunker Hill.

E. W.

Berkeley, Calif.
November 23, 1952

Edward Wisser
Mining Geologist