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TRANSACTIONS OF THE AMERICAN INSTITUTE OF MINING AND METALLURGICAL ENGINEERS [SUBJECT TO REVISION]

No. 1341-M. Issued with MINING AND METALLURGY, June, 1924.

Some Geological Features and Court Decisions of the Utah Apex—Utah Consolidated Controversy, Bingham District

Orrin P. Peterson, Brookline, Mass.

(New York Meeting, February, 1924)

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Bingham District, Utah.
Notes from Visit of Sept., 1931.

General. (W. R. Landwehr) The boundaries of the Utah Copper Stock appear vertical so far as explored. The general trend of the Last Chance stock, Utah Copper Stock and the dikes is about N45°E. The dominant fissuring also has this trend, as far NE as the NE boundary of the U.C. stock. The most prominent fissures in camp are in the U.S. mine, the biggest there being the Holden and the Last Chance. This series is represented in the U.C. stock, where they carry chalcocite.

The main sedimentary structure is that of a syncline plunging NW or W: nearly normal to the trend of the stocks and the fissuring.

Faulting. The principal faults trend N-S. The Occidental fault bounds the productive area on the W, just W of the Highland Boy. Strikes N-S and dips W. It has considerable displacement. There are other N-S faults; they are not mineralized. E.g. the Niagara fault in the U.S. mine. One mineralized fissure, in the Highland Boy and the Utah Apex, trends N-S. The Roll Fault in the U.S. area, is the earliest. It strikes E-W and dips flatly S. Normal. It is faulted by the N-S faults. In the U.S. Mine, Utah Metal, and probably the Boston Consolidated. Comes just south of the Highland Boy.

General Distribution of the Ores. Ore is found on all sides of the U.C. stock except the NE. This may be because the larger limestone beds are too deep here. Note: The Commercial and Jordan limestones of the U.S. Mine are now considered the equivalents, respectively, of the Yampa and Highland Boy limestones of the Apex and Higland Boy mines.

On the S side of the U.C. stock the beds dip into the porphyry (U.S. Mine) but on the NW side they dip away (Apex and Highland Boy)

Lead and Copper Ores.

Copper: In the U.C. stock, and some along the contact. In the nearby limestone beds (same beds as the lead ores and same structural control), but as massive pyritic replacements, unlike the lead ores. Maximum grade 2-2.5%. Gangue minerals in these limestone ores are hematite, magnetite and massive garnet. In the NE part of the district, far from the stock, this massive cupriferous pyrite extends on the contacts of sills that have replaced limestone beds in the quartzite. On both upper and lower sill contacts. Non-commercial.

Lead-Zinc: These occur in the same limestone beds, beyong the copper zone (further away from the stock) with decided overlap. Where studied in such places, the lead and zinc are later than the copper. The lead ore lies about 3000' away from the contact

Manganiferous Silver Ore.

Found 1.5 mi. SE of the stock contact. In strong NE fissuring in the quartzite and limestone. (Alapabetical lime series). A further indication of continued zoning is found in the Lark mine, and the Bingham Prospect. The Lark is on the NE continuation of the U.S. beds; the NE fissures of the U.S. would pass NW of the Lark. The Bingham Prospect adjoins the

Bi

Lark on the N: the same beds turn and strike N.

Utah Copper Co. The disseminated ore is largely primary. For 1929, the concentrates were made up as follows:

Chalcopyrite	80%	of contained copper.
Chalcocite	9%	" " "
Covellite	7%	" " "
Bornite	4%	" " "

General. (Paper by Hunt, Utah Section, AIME, Jan., 1928.) The syncline plunges NW. Two types of fissures are important, as they carry minable ore and localize the orebodies in the limestone. One set strikes NE and dips steeply NW or SE; the others are bed or contact slips (generally limestone-qtzite contacts.

Zoning.

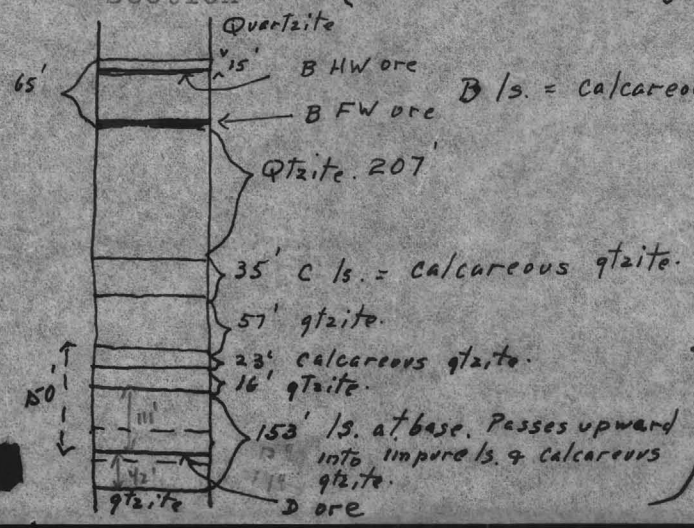
a. 1.1% Cu in the U.C. stock.
b. In the limestone abutting the stock are copper replacement ores, in areas of intense limestone alteration and widespread pyritic mineralization. Many such copper orebodies grade outward into masses of pyritic material i in a lime-silicate gangue. Beyond these copper orebodies are the lead orebodies, in limestone still altered. Beyond the lead ores the limestone is unaltered. (the normal color is dark gray to black). While the lead areas raely yield copper ore, the copper areas often contain lead fissures.

The mineralizing solutions welled up thru and near the U.C. stock, and worked out into the adjoining area. This was a continuous process, which reached a maximum and then subsided until in the final stages the solutions could no more than bathe the walls of the fissures and trunk channels in the very heart of the district, producing there the same lower T conditions which made the great lead bodies in the marginal areas at the height of the mineralization process.

The fact that the U.C. stock and not the Last Chance is the center of mineralization is considered accidental. The magmas and the ore solutions had a common origin below. As both were impelled upward bybrelated forces, both followed more or less the same upward path. Hence the association of ores with intrusive masses. Since the mineralizing solutions were lesser in quality (sic-quantity) and energy than the monzonitic magmas, they could not be coextensive with them.

U.S. Mine.

Section (Ore-beds now being mined.)



Accompanying plan of 600' level shows position of these lettered beds with respect to the Highland Boy ls., productive in the upper levels.

The mine lies S

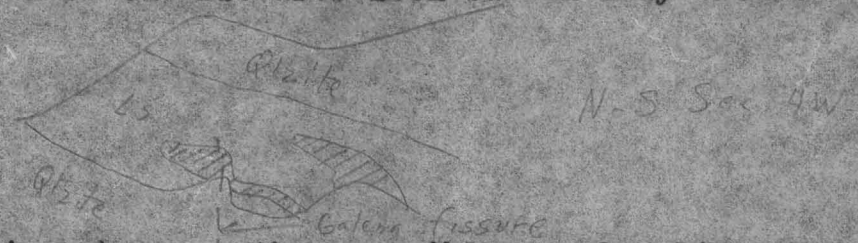
The mine lies S and SW of the Utah Copper stock, and between the Utah and Last Chance stocks. I visited the contact of the Utah Copper stock and the U.S. mine quartzite on the Niagara, or main tunnel level. The porphyry seems to show some chilling at the edge. The qtzite shows considerable fine-grained silica, especially along fracture faces. The quartzite is copper-stained and contains pyrite-chalcocite stringers.

The beds, in the lower portion of the mine, strike about N70°W and dip 50-60°N. Below is a generalization of the mine sections, taken about N37°E, looking NW.

This indicates that these beds are probably on the N limb of an anticline which has been invaded by the Last Chance stock. The corresponding syncline to the north has been invaded by the Utah Copper stock. The sections also show that the Utah Copper stock tends to sill out along the beds at the N end of the U.S. mine, although there is also considerable transgression.

The earliest fault of the mine is the Roll fault, striking E-W and dipping about 30oS. It is a normal fault, cut out by the porphyry. It is faulted by both the NE fissures and the strike fissures. It is only exposed in the upper levels of the mine, appearing on the No. 2 level (550' above the Niagara tunnel), about 600' SW of the Niagara shaft. It dips, of course, into the Last Chance stock. Everything above the Niagara tunnel level is complicated b this fault, owing to its displacement of the favorable beds. But in general the fault appears to have had no effect on ore deposition, tho' it is p re--mineral and is itself mineralized in a few places.

Localization of Ore. The principal orebodies below the Roll fault are shown on the accompanying plan of the 600' level. Pre-mineral strike faults are supposed to have influenced ore deposition most strongly. The B limestone was favorable because of the two strong strike faults, one 15' below the top, and the other along the bottom contact. The B ls. is also relatively pure. The A limestone is poor: silicified, and with weak strike faulting. The NE fissures also strongly controlled deposition, as shown on the accompanying 600' level plan. In the Utah Apex area the strike fissures are more important than at the U.S. mine, and NE fissures less important. Same for the Lark mine, where the fissures look barren away from the favorable beds.



The above section shows another possible ore localizer-humps in the FW quartzite. This is from the upper part of the mine, above the Roll flt.

There has been considerable stoping on the Holden and Last Chance fissures, and mostly in the Last Chance porphyry above the Niagara tunnel level. Where the stoping on these fissures is in limestone, the pitch of the orebody was observed closely to follow the bedding. The important Niagara fault carries pyrite as well as lead and zinc sulphides, but no commercial ~~xxxxxx~~ orebodies. This stoping on the fissures was of lead-zinc ore, as far as I know similar to the main lead-zinc orebodies.

General. The bed orebodies were seen to have good slick walls. The ore contain abundant quartz. The original limestone was probably pretty well silicified. Distinct faulting seen along the HW and FW of the A limestone probably offset NE fissures.

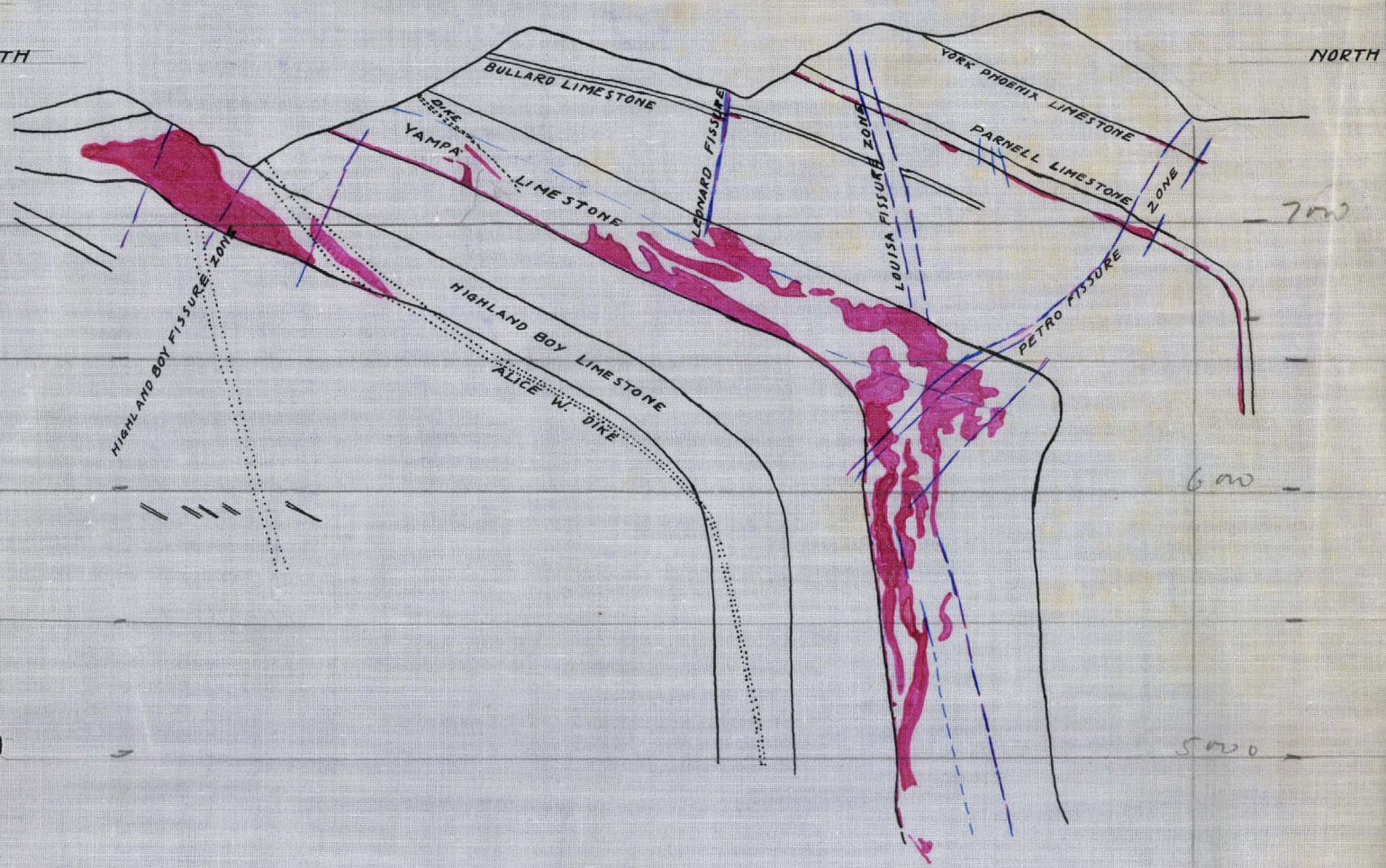
Lark Mine. The beds strike N35°E and dip 15-40°NW.

Commercial ls.
Quartzite
Jordan ls.

The Lark vein is in a calcareous bed intercalated in the quartzite. The "mineralizers" strike slightly more NE than the beds, and dip a little more steeply NW. Most of the ore lies along the intersections of these mineralizing fractures with the Lark bed. Post-mineral faults, with moderate displacements, strike about N40°W.

cipally for its copper production from Last Chance, Commercial, Old Jordan, penetrate the stocks themselves. Others

feed stopers, are spaced at 3-ft inter



AMERICAN SMELTING & REFINING CO.
WESTERN MINING DEPARTMENT

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NORTH-SOUTH SECTION
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SUMMARY OF TYPES AND VARIETIES OF MICA AND CLAY MINERALS RECOGNISED IN SAMPLES FROM THE LARK AND U. S. MINES, THEIR PRINCIPAL OCCURRENCES, AND MINERAL ASSOCIATES

MICA MINERALS

Dioctahedral mica:

A- Relatively high temperature thermal breakdown:
3-layer and combined 3-2 layer forms: Small veins in Utah Copper stock; pyrite, quartz, enargite (?).

B- Relatively low temperature thermal breakdown:
2-layer forms (with 1-layer forms): Fissures in limestone with Pb-Zn ore and in Pb-Zn orebodies; pyrite, galena, sphalerite, quartz.
Dominantly 1-layer and 1-layer disordered forms: Fissures in Last Chance porphyry and limestone with abundant pyrite, and minor Pb-Zn sulfides, and in pyrite bodies; pyrite, quartz, chlorite, carbonate.

Trioctahedral mica:

1-layer (twinned and untwinned) pale brown mica: Altered quartzite and quartzite fragments in breccia pipe; quartz, feldspar, trioctahedral montmorillonoid.
Undifferentiated gray and green micas: (lower thermal breakdown than above); fissures in limestone with pyrite and Pb-Zn ore; chlorite, vermiculite, talc.

MONTMORILLONOID MINERALS

Dioctahedral montmorillonoids:

Montmorillonite: In fissures in limestone with or without pyrite; opal, gypsum.
"Blue" montmorillonoid: In fissures in limestone with abundant pyrite, carbonate, pyrite.

Trioctahedral montmorillonoids:

Saponite: With diopside, or garnet, or talc in altered limestone; in veinlets cutting altered limestone; around chert nodules in lightly altered limestone; in fissures in limestone; in a pod within Pb-Zn ore (1 occurrence); rare with sulfides of any type; calcite, quartz, diopside, wollastonite, garnet, and Mg-kaolin-like clay, talc.
Undifferentiated green montmorillonoids: In fissures in limestone with pyrite, chlorite, calcite, quartz, abundant pyrite.

KAOLIN AND KAOLIN-LIKE MINERALS

Aluminous kaolin clay:

Halloysite.nH_2O: At the surface with opalized limestone and within chertz nodules in partially marbleized limestone; opal.
Kaolinite-dickite clay: Small white pods in Pb-Zn ore; (1 sample).

Mg-bearing kaolin-like clay:

Mg-kaolin-like clay found only in small amounts in saponite clay; saponite, quartz, calcite, diopsidic pyroxene.

CHLORITE AND CHLORITE-LIKE MINERALS

Type A: In fissures in porphyry and limestone with pyrite and lead-zinc sulfides and in Pb-Zn orebodies; pyrite, dioctahedral mica, trioctahedral mica, talc, vermiculite, trioctahedral montmorillonoids.

Type B: Altered green "limestones"; east of the Utah Copper Stocks; quartz, pyrite, specularite, montmorillonoid clay (?).

Type C or "chlorite-like" mineral: In altered gray-green limestone; southwest of Utah Copper Stock; pyrite, epidote, tremolite-actinolite. (1 sample)

VERMICULITE MINERALS

Vermiculite-chlorite: Fissure in limestone with pyritic mineralization; pyrite, calcite, trioctahedral mica, vermiculite (undifferentiated). (3 samples).

OBSERVED RELATIVE AGE RELATIONS WHICH ARE CONSIDERED SIGNIFICANT

1) Montmorillonite with pyrite along small fractures cutting Pb-Zn orebody containing quartz and 1 and 2-layer dioctahedral mica. (1 occurrence).

2) Veinlet of green trioctahedral montmorillonoid clay (with pyrite and calcite) within fissure containing chlorite (type A), dioctahedral mica, and pyrite. (1 occurrence).

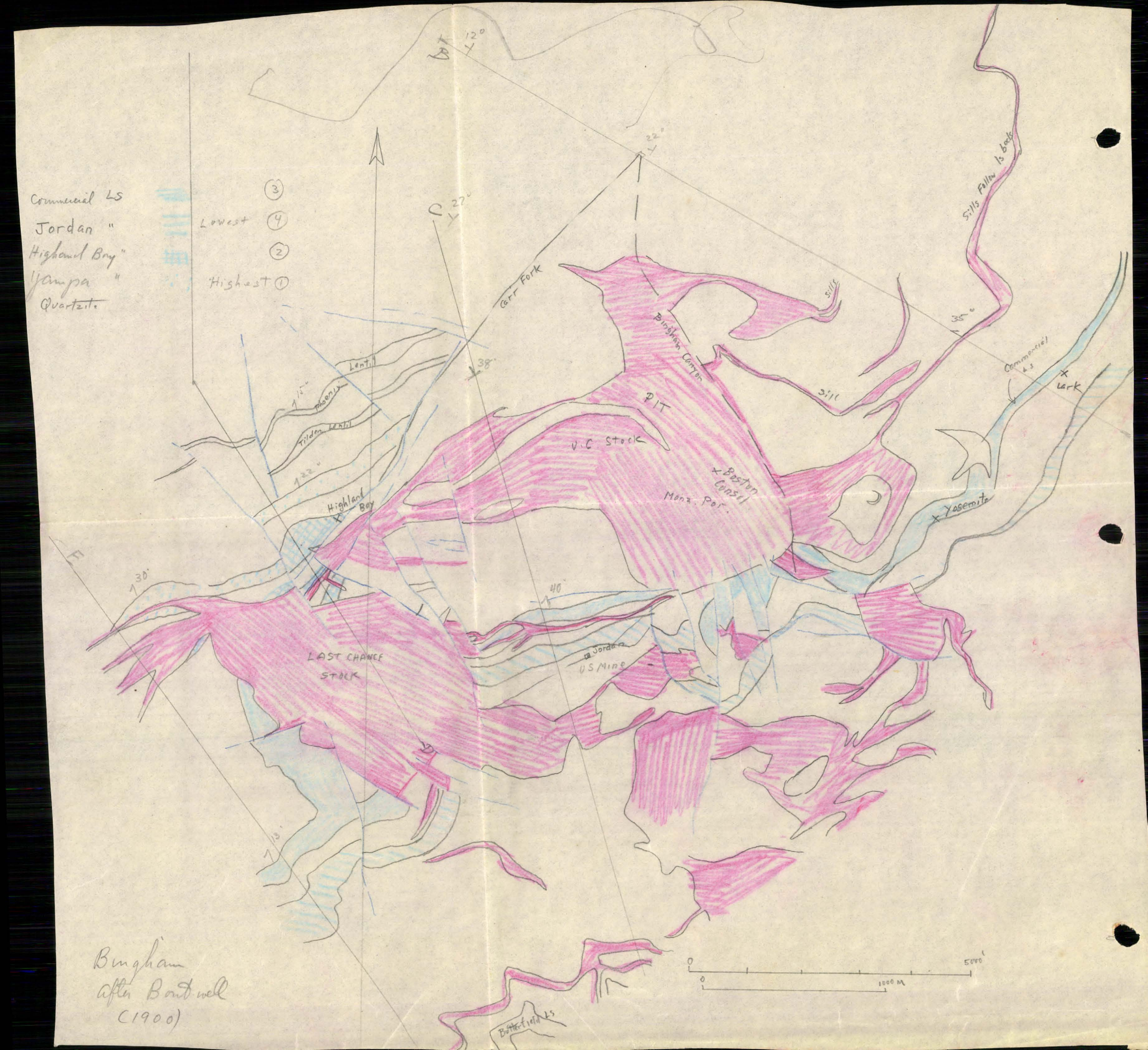
3) Veinlets of saponite clay cutting silicated limestone, altered limestone xenoliths in Last Chance porphyry, and dark and light colored limestone in marbleized limestone areas. (numerous occurrences).

4) Calcite veinlets cutting pyrite and lead and zinc sulfides in Pb-Zn ore. (1 occurrence).

5) White carbonate veinlets cutting dark (relatively little altered) limestone. (numerous occurrences).

6) Lead and zinc sulfides along fissures deep in the Utah Copper pit cutting the Utah Copper stock. (Occasionally reported by local geologists,(1 occurrence seen).

January 3, 1957 John P. Hunt



Bingham after Boutwell (1900)