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THE GOLD-SILVER VEINS OF OPHIR, CALIFORNIA.

Waldemar Lindgren: USGS 14th A.R.,1892-3, Pt.II,243-284.

Production: 1849-1892...About $3,000,000.

General Geology: Granodiorite coarse-grained,easily decomposed and crumbling. Normally = qtz.,plagioclase, orthoclase, biotite and hbl; biotite usually less prominent near contacts,rock approached more closely normal diorite. Granodiorite always massive; intrudes the surrounding schistose rocks. Post-Mariposa (Mariposa ~~r~~either Jurassic or early Cretaceous).

Eastern part of small map is mainly schistose amphibolites,striking NW, dipping steeply east. Dark green, f.g.,showing many minute hbl.xx. Consists of hbl.,flds.,s.t. qtz.,with less chlorite, epidote,titanic Fe ore. Schistose structure often nor so noticeable in fresh rock,is very apparent in the weathered OCs. N of Auburn areas of massive diabasic rocks occur with the amphibolite in a manner that shows the amphibolite was derived from the diabase by dynamo-metamprphism. The db. is intrusive into Carboniferous seds.,some small areas of latter remain.

Vein Systems: Thickness of the qtz veins from a few inches to 10 or 20'; ave. 1'. Several veins may be traced for 1.5 mi.plus. Four systems.

1. In amphibolite and db. about Auburn. NW-NNW,± parallel strike of schists;dip west @45-70°. (Schists dip E). Pocket veins:pay shoots narrow and rich,mass of vein qtz.very poor. Very rich pockets in Rock Creek and Black Ledge veins. (Small map). Gold mostly free;little Ag.

2. Belmont vein. Good milling ore. N.-S. (strip)
3rd and 4th systems described in detail,subject of paper.
3. N80W to N65W,dip 40-80S. Strong, continuous.

4. Less strong. N70E-N50E,dip 20-60SE. Two systems thus meet at angle of about 45°.

Camptonite Dikes: Cut Gd and amphibolite. In Gd,the dikes,seldom over 1-2' thick,form HW of quartz veins, as at Hathaway,New Era, Brushfence, Saint Lawrence and Gold Blossom. At the first and last mines, the dikes are schistose,resembling the amphibolite schist. Such dikes, fresh,cut the well altered amphib. schists(tunnel on Flat Ledge on Duncan Hill; Calif.and Belleview veins). Carry much hbl.,less feldspar. S.t. granular, mainly markedly porphyritic.

Iron Belts. Pyritic impregnations pre-quartz;app. contemp. with formation of schist from basic intrusives. Ccpy as well as py. Sulphides seem to contain small amounts gold and silver; OCs worked for gold. All the richest OBs of the quartz veins in amphibolite occur where the veins cross the iron belts. (Rich pockets of Moore, Conrad,Centennial; Mina Rica; Green; Good Friday.) The iron belts fellow more or less the schistosity,dipping 70-80E; veins dip S,45 plus. Henceline of intersection dipsE at varying angles. Pay shoots,which are narrow and rich,follow this line of intersection. These iron belts are Fahlbaende.

Southern Vein Systems: For data on California, Pine Tree etc. see map. Between the Erie (New Era?) and the Kirkland several strong and barren N-S veins appear to cut off the other veins.

Hathaway-Kirkland vein:1.5-2'. E end NG. Hathaway mine had ore shoot 1200' long. Qtz carries 2% galena and pyrite,which,concentrated mebbe assayed $230/ton. No rich pockets or narrow shoots,in contrast to mines in the amphibolite; OBs are extensive, although low grade. Ore high in silver:bullion s.t.only 500 fine. Non-continuous amphibolitic dike in HW. Schistose at Hathway mine. In tunnel to W of Hathaway it encloses the 16" vein on both sides as a 6" casing.

Duncan Hill: Centennial-Conrad-Hope system. Dip 45S at east end,gets steeper to W. Two flat ledges cut across this system. C+C+H system had rich pockets; flat ledges had pockets too, but far less rich. Latter veins 1-2' thick.

SW Veins: See map.

Green and Bullion Systems: Bullion 6"-30" wide. Green 6"-36".

Mineralogy:Gangue qtz. Drusy cavities common. Milky white. Some comb structure; some chalcedony. At Spanish mine,chalcedony dep. on earlier qtz. xx.

Lustre of the milky white qtz. is glassy,often somewhat greasy. Made up of relatively large grains,not IG,but forming a rather coarse mosaic. Some grains show crystallographic outlines. Gas and fluid inclusions,irregular outlines, fill the grains;s.t. quite irregularly arranged,but usually show banded or parallel appearance, the bands often continuing across different grains.

Veins usually ribboned; two types. (1) primary, due to deposition. Strong Gold Blossom vein-symmetric crustified banding. In fact most of the Ophir veins represent once open fissures filled with gradually depositing material. (2) Sheeting movements along the vein. No examples given here.

In thin sections the quartz which has not been subjected to strong pressure subsequent to deposition shows between crossed nicols that the individuals exteinguish uniformly and normally. ~~But often the strong pressure which~~ .."very frequently, though, the strong pressure which had formed the fissures continued or recurred after the deposition of the quartz,and the gangue subject to such pressure became optically deformed, broken, crushed and comminuted." Gold Blossom ore: large qtz. grains still visible,but each either shows strong undulous extinction or is broken into many veinswith somewhat different optical orientation. Some qtz. comminuted. Galena,pyrite and blende have also been pressed and squeezed in between the quartz grains. Especially in such pressed quartz the irregularly shaped fluid inclusions become extremely abundant.

HT Alteration: Along veins, from a few inches to a few feet wide. Process and end products similar in amphibolite and Gd:aggregate of white mica,carbonates, pyrite. Amphibolite changed to grayish or white FG rock,with greasy lusrte and feeling on cleavage planes. Usually has small pyrite cubes,more abundant in the altered wall rock than in the veins. White mica is sericite ~~and~~ muscovite. Pyrite cubes sharply imbedded in the felted aggregate of wavy or straight fibres of sericite. Gd altered same way becomes grayisg green,slightly greasy rock. Foils of green chlorite.

The extensive carbonatization of the Ophir wall rocks is remarkable, considering the subordinate calcite in the veins.

Distribution of Gold and Silver in the Veins: Gold:silver rationl:1 tO 1:10 or more.

Richer ore in pay shoots nearly always accompanied by more sulphides than usual. Galena is a good marker. The very crystalline and bright quartz in which no sulphides occur is considered poor;probably true in general; but a specimen of such quartz gave 0.187 Oz.Au.,0.263 Oz. Ag.

Ore shoots in granodiorite are of considerable extent,and their dimensions not always known;spme, as Crater hill ore shoot,which dip E in plane of vein. Amphibolitic dike rock accompanies many ore shoots, but not all. Probably simply means that recurrent fissure openings were taking place. In amphibolite the chimneys vary from a few feet to 60' wide. Dip E in plane of vein;richest shoots found at crossings with iron belts. Depth of chimnees rarely exceeds 100'.

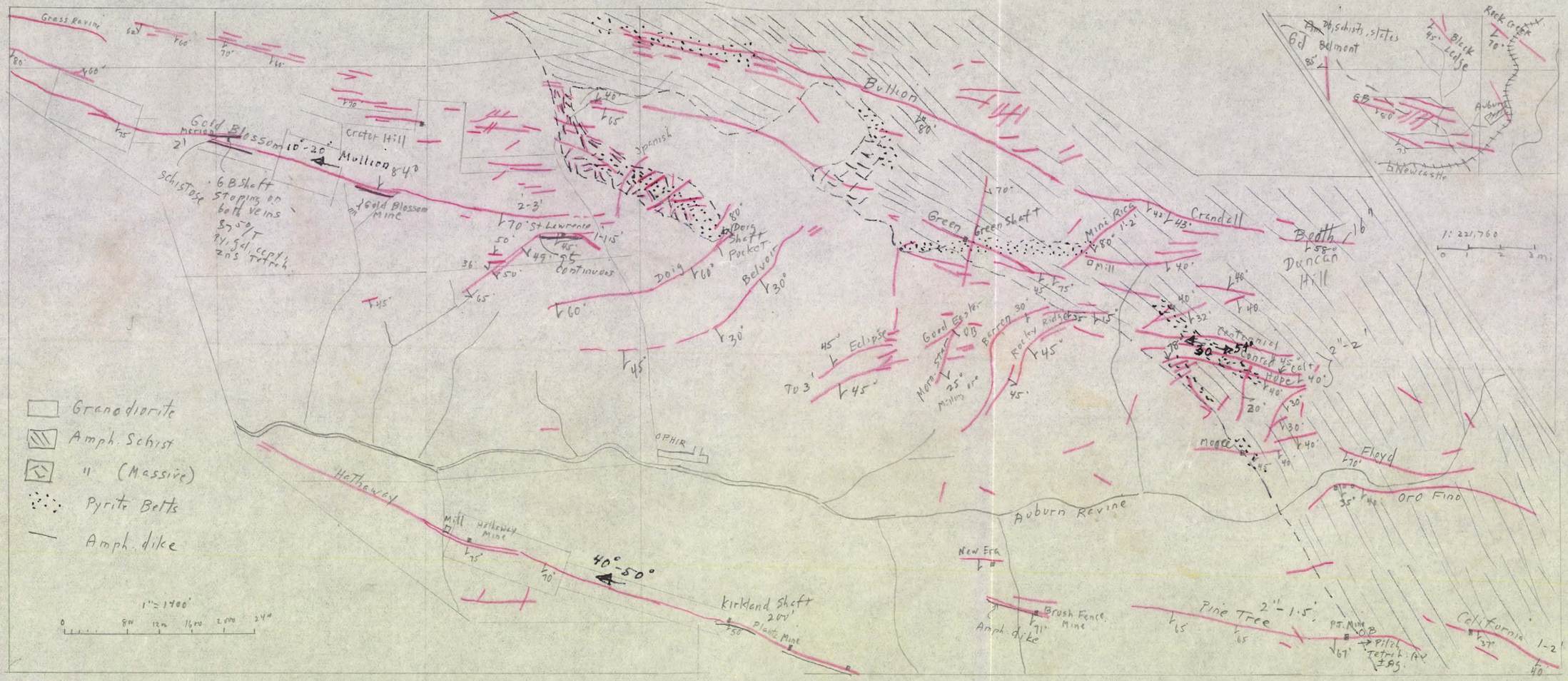
Movements along the Veins. Relative Age and Genesis of the Vein Systems: The N80-65W system,and the N70-50E system thought to have formed at same time. Do not fault each other. Two veins at their crossing often pinch out without faulting. Veins approaching each other simply join. N+S veins said to cut off the E-W veins. Flat Morning Star vein is cut and faulted a few feet by a steep stringer trending NNE.

Striae are very common on the veins usually not far from horizontal. But such movements not great:many veins cross Gd contact without displacing it to any notable extent. Near main vein systems adjoining rock often divided in sheets 1' or more wide. Amphibolite thus sheeted in Auburn Ravine near Floyd and Oro Fino veins.

Striae usually best developed on vein HW. Veins sheeted, brecciated, recemented. Considerable depth below then surface thought needed.

Thinks systems (3) and (4) due to compression.

Misc.: % sulphides in milling ore 1.5-3. Ag with tetrahedrite,gal.and ZnS;Au with pyrite. Galena as crysals in small vugs of quartz. Arsenop. and molybdenite occur.


Granodiorite
Amph. Schist
" (Massive)
Pyrite Belts
Amph. dike
1" = 1400'
Grass Ravine
Gold Blossom
Crater Hill
Mullion
Schistose
GB Shaft
Stoping on both veins
Gold Blossom Mine
St. Lawrence
Continuous
Spanish
Doig
Doig Shaft
Pocket
Belvoir
Bullion
Green
Green Shaft
Mini Rica
Mill
Crandall
Booth
Duncan Hill
Eclipse
Good Easter
Barren
Rocky Ridge
Centennial
Conrad
Hope
Moore
Floyd
Oro Fino
Auburn Ravine
OPHIR
Hathaway
Mill
Hathaway Mine
40°-50°
Kirkland Shaft
Plantz Mine
New Era
Brush Fence Mine
Amph. dike
Pine Tree
California
Sulphs - Surface wkgs
Belmont
Black Ledge
Rock Creek
Newcastle
1: 221,760