CONTACT INFORMATION
Mining Records Curator
Arizona Geological Survey
416 W. Congress St., Suite 100
Tucson, Arizona 85701
602-771-1601
http://www.azgs.az.gov
inquiries@azgs.az.gov

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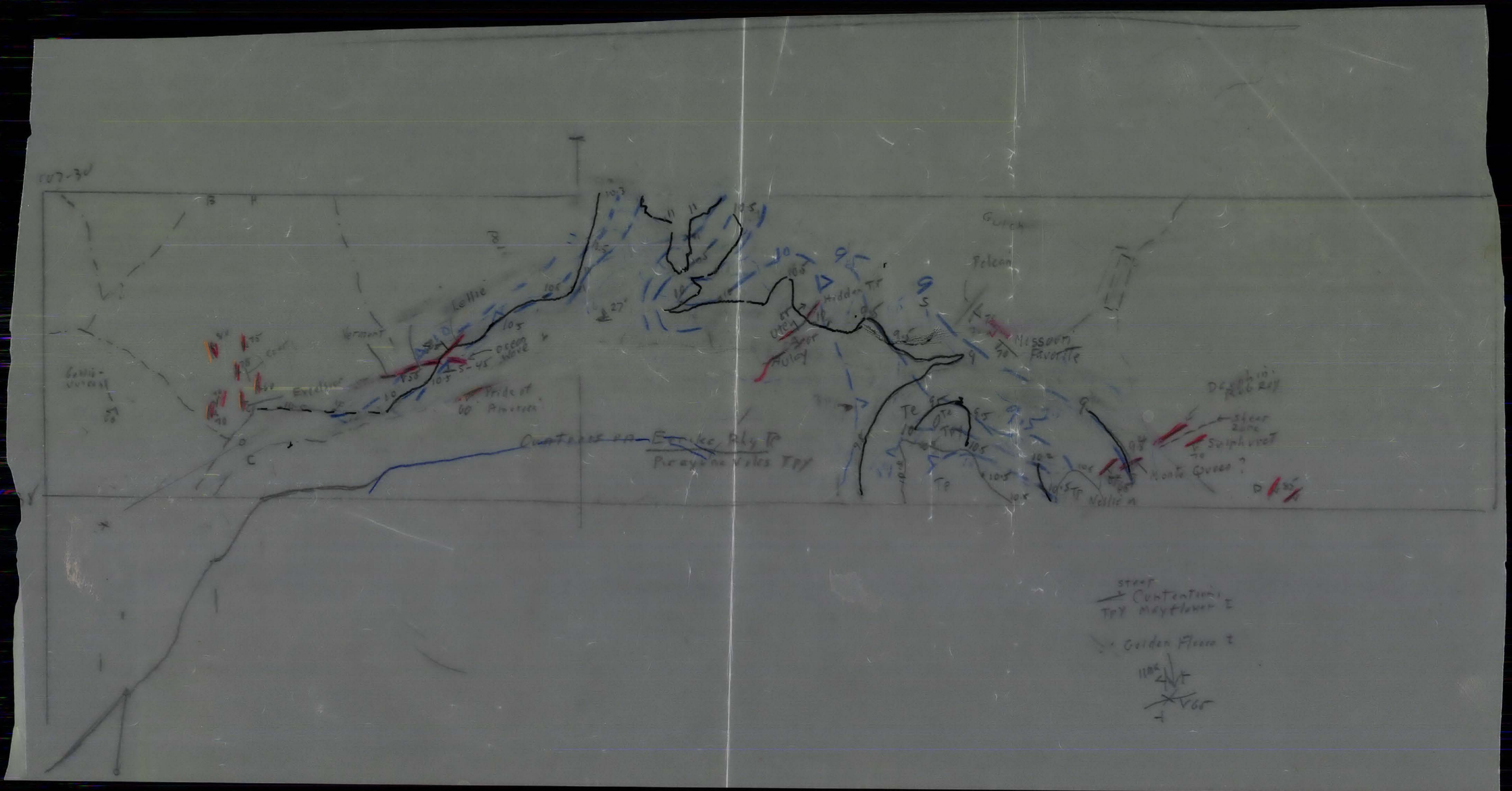


Lellie
Vermont
Ocean Wave
Pride of Amerson
Excelsior
Hidden Tr
Utey
Hulay
Pelican
Missouri Favorite
Dauphin Rug Ray
Shear Zone
Sulphuret
Monte Queen ?
Nellie M
Contours on Eureka Rhy TP
Picayune Volcs TPY
Steep Contentions
TPY Mayflower I
Golden Fleece I

GEOLOGY AND ORE DEPOSITS NEAR LAKE CITY,COLO.

John Duer Irving and Howland Bancroft:USGS Bul.478,1911.

Country rock mostly Silverton series,from bottom,Picayune andesite,latite,rhyolite,Eureka rhyolite,flows;Burns latite tuff,bedded ss and breccia,mainly of latite;Pyroxene andesite,flow and sheets; Henson tuff (sandy andesitic beds). Above is the Potosi rhy.,latite, andesite flows with tuff,and above this the Hinsdale rhy.,andesite, basalt flows.

Ore Deposits: Veins,or parts of same vein,vary from simple filled fissures,with little or no replacement,to sheeting,breccia zone where most of vein matter due to replacement, Veins are narrow,maximum widths ave.perhaps 4.5'. Continuity in general remarkable for this figure: Ute-Hidden Treasure,4' wide,2700'plus long,1400' plus deep;More Hendrison,1.2' to 2.5' wide,2000' long,500' deep. (Seems to bottom). Ave.width of all veins about 18". Lellie, Ulay,Black Crook,Golden Fleece,Vermont veins gradually narrowed with depth.p.41:"Practically all veins explored by deep workings have pinched out almost entirely". In terminating in depth the veinseither narrow to a single small fissure (Lellie,Black Crook, Golden Fleece) or divided into a number of stringers which finally disappear. Latter usual mode of terminating along strike.

Some of the veins formed along two intersecting lines of weakness as in sketch. According to Ekkernkamp,this implies fissuring by arching where two older fracture sets served as notches.

Of the two regional directions of vein strike,NE and NW ,the richest lodes trend NE. The prominent jointing directions are about the same as those of the fissures.

Slickensides,selvage are common,but apparently not strong;included breccia frags.are abundant. Veins thought to have formed during a single period of fissuring and mineralized during a single period.

Silification and sericit.main forms of HT alteration. Result in a f.g. jasperoid material extending in places 4 or 5' from the vein filling. Dense black. WR frags.esp.affected,called "black qtz.". Pyrit.extends farther. These 1st stage of mineralization. While the veins are banded,crustified banding not seen; bands grade into each other.

Repeated movements and min.in Gallic mine: (1) gangue and ore; (2) faulting and fissuring,brecciation of CR and vein matter;(3) cementation by quartz with various ore minerals;(5) post-min.gouge.

Three groups of vein types:(1) tet-rhodochr.,(2) qtz-gal.-Zns; (3) telluride.

1.Tet-rhodochr. galena,arg.tet.dominant,with considerable ZnS, some py.,gangue qtz.,rhodochr.,barite. Copy subordinate. Gold always low,veins produce lead and silver,with copper as byproduct. Mines:

Hidden Treasure,Missouri Favorite,Ute,Ulay, Pride of America,Casino, Lellie,Vermont,Ocean Wave,Wave of the Ocean,Black Crook,Contention, Silver Chord Extension.

2. Quartz-gal.-Zns. Gal.,ZnS dominant,ccpy -, quartz. Little or no barite;tet.often present but not prom. A little more Au than (1). More pyrite in (2). Evidently ruby silver,but he slurs it as secondary. Mines: Ute vein,most productive,tends toward (2) in Ute ground,but in Hidden Treasure groundiss (1). Some~~y~~ shoots in a vein (1),some (2).

3. Telluride. Tellurides disseminated thru a f.g. qtz.gangue (Golden Fleece) with subordinate gal.,ZnS,py.,ccpy.,tet.,hinsdalite and barite. Except for telluride,same as (1). Both Au and Ag tels. Golden Fleece ratio by value 1:1. (Far above ave.in gold).

Mineralogy.- Main ruby silver is pyrargyrite. Irving is amusing with his "secondary sulphide enrichment". Bonanza confined to upper levels. Most of silver derived from ruby. Some proustite. Both dark and light ruby silver occur in crevices and cracks in the sulphide ore;as crystals in vugs,or as irregular masses along cracks and fissure Rare deep occurrences along fissures: 1200',Golden Fleece,1300',Ilma.

The tet.contains all proportions~~o~~ of silver;much of it is very rich. Always massive,commonly intimately IG with gal.

Galena very spotty;always present to some extent. Associated eithe with ZnS or tet. Seems to owe its silver content to tet.IG. (or native)

Blende is most abundant sulphide next to pyrite. Esp.abundant in Capitol City group (w end of mapped strip). Nearly absent in Golden Fleece telluride ore. ZnS an early mineral,pre-much white qtz. Ute, ZnS increases with depth.

Ccpy esp.abundant in veins that carry no tellurides nor much tet.

Tellurides:present only in Golden Fleece and Gallic-Vulcan. Distr ibuted as minute specks in vugs in white qtz.at Gallic-Vulcan. Prob. calaverite,sylvanite,krennerite,petzite ,hessite. At Golden Fleece,main tel.petzite,s.t. in irreg.bunches,often fairly large,in white,dense, granular quartz;no regular xx. Or extremely fine-dossem.thru chalced. qtz.,to which it gives a dark-gray color.

Pyrite:universally present in variable am't. Commonly most abundant at depth,low grade. When galena abundant and qtz the gangue, py-. Coarsely xx py.uncommon;no large,massive bodies either.

Complex bismuth sulphur compounds Monte Queen mine;contains high silver (so it must be secondary, esp.as it lies close to the oxidized zone) and considerable Zn.

Qtz.most abundant vein mineral. (1) Jasperoid, black through gray to porcelain. Much is banded,open space dep?;replacement type has small qtz.xx lined druses. Fine tel.,tet.s.t. (2) White crystalline;well-developed comb structures in places,lining vugs. Without question more than one generation,but "bulk younger than any of the metallic minerals for it cuts ZnS,gal.,tet.,py.,even rhodoch.s.t. Veinlets of white qtz. often cement masses of the metallic mins.

Barite abundant in galena-sphal.veins,esp.in those with tet (central part,and S of Lake City,Lake San Cristobal);less common at Capitol City,where qtz. predom. Much less barite in tel veins.Barite earlier than qtz.,(cf.Moehlman).

Rhodochrosite,spotty;makes up bulk of vein filling in N end of the Hidden Treaure. Very fine-grained aggregate,individual cleavage faces less than 1.5 mm. One of later minerals. Tet.more often ass'ted with rhod,than with any others.

Calcite,dolomite very rare.

Ore Shoots.- Shoots of occurrence the most common. Monte Queen (see also below) 3 vertical shoots due to swelling in plan;between, only a few sheeting planes with some qtz.stgrs. Shoots 1 and 3, chiefly py.,some gray tet.,poor in Ag;No.2 resin blende mixed with fine steel galena 75 oz.Ag,1-20% Bi. Fourth shoot,massive f.g. rhodoch.

Inside No.2 shoot cross shoots occur,pitch 15°SE. Lenticular in cross-section,vert.range only 3-20',sep.by 3-12' barren qtz.(See sketch below).

Ute Vein,Hidden Treasure,uniform,nearly all ore for 3000'. (Cf. Smuggler).

Second type of shoot,segregation of ore minerals within a barren gangue. Golden Fleece (see below).

Gangue bodies also show localized distribution. Monte Queen, rhodochrosite rare in 1st 3 shoots,almost only mineral in 4th shoot.

Capitol City Group. Gallic-Vulcan.Production small. CR Silverton andesite. Vein fissure shows pre- and post-mineral movement. Galena surfaces show striae;much movement notable thruout vein. Ore shoot pinches and swells. Ore:gal.,Zns,py.ccpy,gray Cu.hessite,sylvanite, native Ag,na.Te,na.Au;qtz,barite,cal.,flu- apatite-. In order of abundance. Qtz sugary,full of cavities. xx of apatite,fluorite occur within cavities in the altered CR,with py.,ZnS.Both ore and gangue mins show remarkably crystallization. Original vein probably a small one qtz-gal-blende-py-tet. Next severe deformation,very thorough brecciation;frags. of CR and vein cemented by qtz.carrying py,gal.,sphal., ccpy, tellurides,free Au,silver. "This second deposition of qtz.and ore minerals did not completely fill the cavities,however,and the resulting vein is spongy and porous throughout." The similarity in the minerals of the two generations shows closely-linked time relations.

IM Fltg.

Excelsior,one of the veins just N of Capitol City,N11W,65E. Ave.only 9" wide.ZnS plus,ccpy consid.,some gal.,tet-,much py.Qtz. only gangue.

Chord Ext.,seldom more than 4" wide,ore seam 1/2"-2". (1) dep.of qtz.,ccpy,tet.,gal., then movement and (2) ccpy in barite. Vein carries inclusions of sil.CR,ans flu-. Slick.plus in CR near vein.but latter frozen.

Henson Creek Mines.- Lellie or Red Rover. CR Picayune,andesitic and rhyolitic flow breccias; small N dip to 45. At far N end of workings sheeting planes of vein coincide with bed planes (45N). Upper

workings,1-4' wide,frozen. Vein irreg.in lower workings, 8-;14" wide, or zone of parallel and intersecting stgrs.sep.by irreg.sheets CR. Vein dips 60NW,but in bottom level parallels stratification of flow-breccia,45N. Vein in general comprises small irregular stgrs.sep.by layers of highly alt. andes. Qtz.,rhodoch.,barite,py,gal.,sphal.,tet., some cepy at depth. Mainly arg.,in tet. 2nd type of shoots:ore shoots pitch 30NE (suggesting trapping under some impervious layer of the Picayune) and they are sep.by gangue areas (qtz.).

Ute and Ulay. S Ext.of Hidden Treasure. A vein zone; Ulay and Annie lie SE of the SW extension of the Ute-Hidden Treasure. Ulay 500' SE of Ute. Ute and Ulay produced $11,000,000 gross in Ag,Pb. Hidden Treasure $700,000 plus.

CR Picayune andesite,except at NE end,Hidden Treasure vein closely approaches overlying Eureka rhyolite. Picayune dense gray,almost glassy,flow breccia,matrix same as frags. "The rock is brittle and rather easily fractured,so that regular veinshave formed in it (as in the breccia of the San Juan formation in the Ouray district),whereas in other tougher types of rock,such as the coarse even-grained andesites in the vicinity of Capitol City, the veins are more discontinuous and constricted." Also many frags.in vein.

Ute and Ulay and Hidden Treasure veins result of open-fissure filling. Silic.in CR and frags. Ute main vein of district. Arc concave side toward NW.Ave.dip 58NW;but the NW concavity is increased by flattening of dip in center of arc. Vein seat of but little faulting. Ave, width 4',pinches and swells, knife edge to 20'. In Ute mine vein between 2 good simple walls;NE,in Hidden Treasure,it splits. One of widest and best OBs at such a split: 1 branch 10' wide,other 4', and main vein for 40' SW of split,20' wide. Junction between the 2 branches pitches NE in plane of vein.

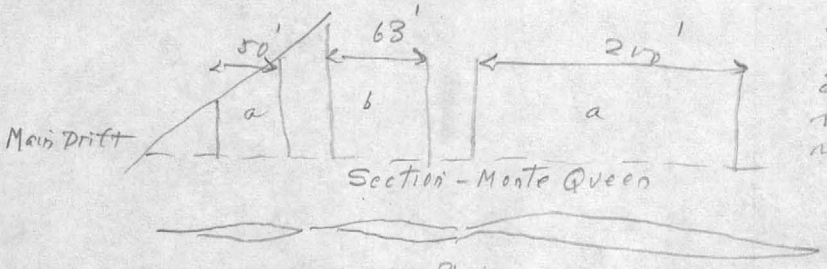
Steps in formation of Ute-Hidden Treasure OBs: (1) rupture of CR with slight brecciation and little or no separation of the walls from one another.(2) entry of silicifying waters,CR sil. Then walls separated (3) and moved slightly past one another,making pinches and swells,and brecciating WR. (4) vein filling:qtz (first);rhodochros.,
IM move. tet.,gal.; then qtz again. (4) more movement, with first qtz.,then barite,gal-,then qtz. once more.

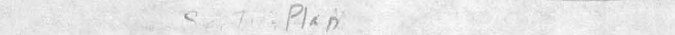
Ulay ore: arg-gal.,with some tet.,sphal.,py, ruby silver,na.silver. 11th level,ZnS increased,Ag,Pb fell off.

Ute ore: gal.,py,sub.tet.,qtz,sub.barite. Banding. Sphal.,gal., barrite pre-white qtz.

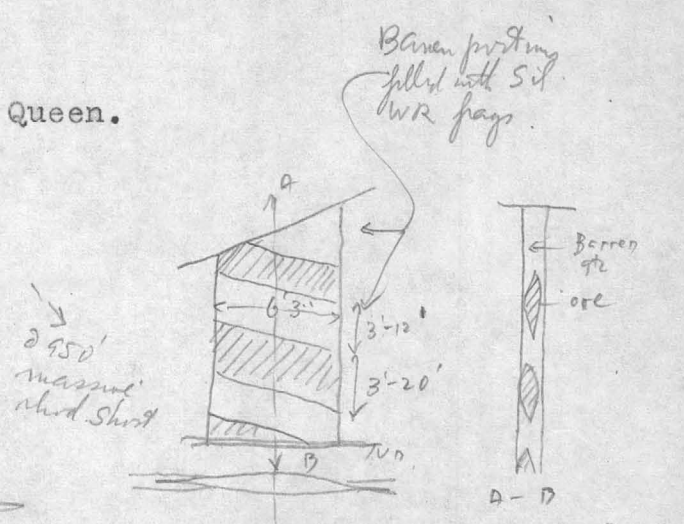
From SW end to point well within Hidden Treasure ground,where arc bends to N,or is a banded aggregate of arg.-gal.,sphal.,qtz.,barite; tet-, no rhodoch. No of here,barite increases,also tet.and rhodoch. Finally nearly whole vein is rhod.,with abund.tet.and bar.,gal-. Qtz sub. Throughout whole course,gangue and ore minerals mingled together with remarkable uniormity;vein stoped for nearly 3000'. Hence no pay
Trapping shoot. In Hidden Treasure section,top of ore pitches 15N,due to pinching. See section. Suggests trapping by unfavorable volcanic bed.

San Cristobal Group. Monte Queen.

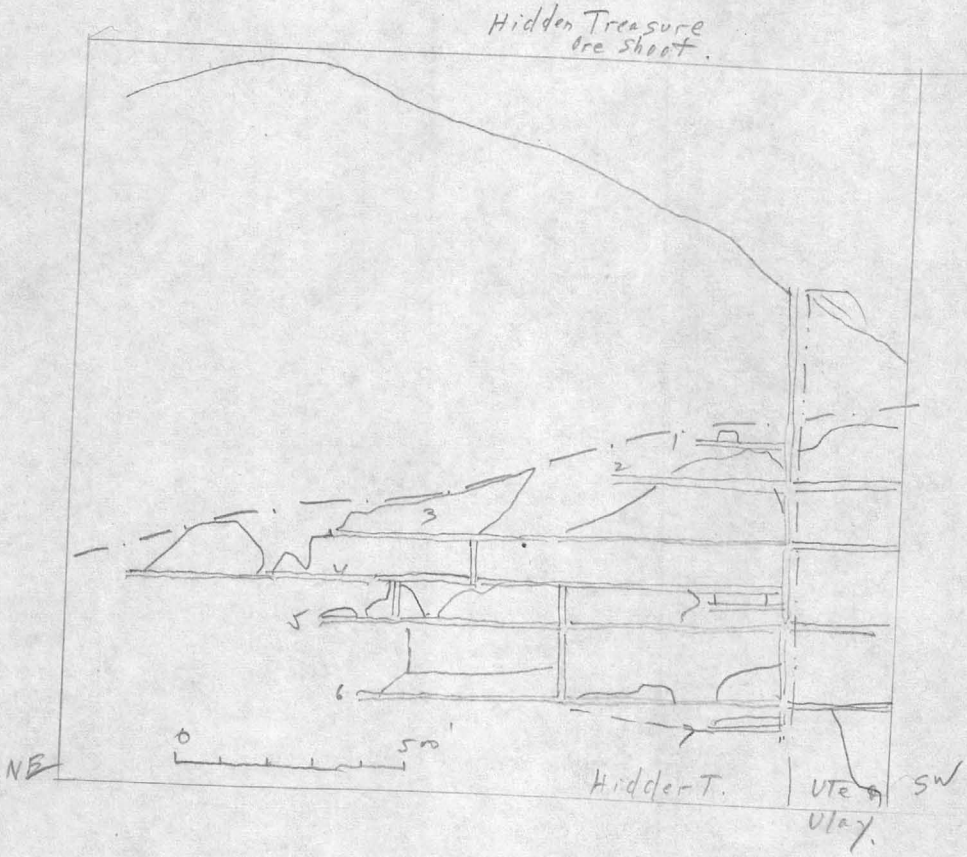




a = Tet. & py. b. gal. & Zn.
Low Ag
Not commercial
75 oz. Ag. -(Bi).



Shoots within shoots - Monte Queen
(b Short)

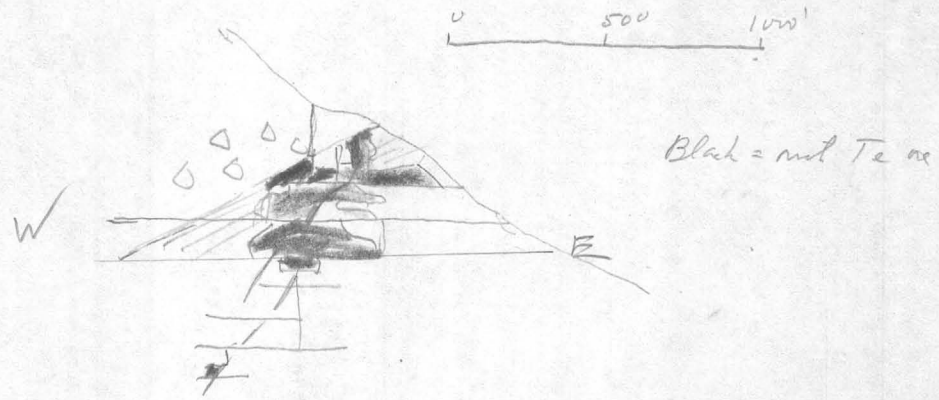


Monte Queen.- 3' wide,vert. Often well-defined walls,in places carrying strong selvage seams. Vein in such places has a granular texture, massive. Vertical ore shoots are shoots of occurrence see plan. Sheeting planes,qtz.stgrs.only between the shoots.

Golden Fleece.- CR,productive portions of mine,fine-bedded tuffs and flow breccias. Conformably above these,extremely coarse tuffaceous agglomerates;boulders,many several feet in diam.,constitute most of the rock. Irving thinks contact a bed fault.p/108: "The vein throughout all of the upper workings,where explored,terminates against this contact as a roof and nowhere enters the aggolomerate itself." Rickard, Across the San Juan Mountains, E.M.J.,76,1903,307-308: thinks contact not a fault..."The contact existed before the vein was formed. The fracture,followed by the ore,passed easily through the finer-grained rock, but ceased abruptly when it met the beds of coarse breccia, because the force of fracturing was not only insufficient to overcome the resistance of the harder fragments contained in the latter, but it must have been dissipated by the encounter with a loose-textured body of rock,much in the way that the power of a diamond drill becomes wasted in passing into a shifting mass of loose conglomerate. As a consequence the energy of shattering was diverted along the contact, the vein fracture ceased,and the later ore-depositing waters were barred from further advance into the coarse breccia,save as a scattering confined to the neighborhood of the contact. At the third level the ore body,occurring in the fine-grained country,was notably wider immediately at the 'contact',and in examining the outcrop of the vein I noticed that it was difficult to decide upon the exact line of separation between the two formations, because the mineralization extended from the fine into the coarse breccia so as to obscure the divisional plane."

Trapping

Golden Fleece vein a mass or very irreg. broken CR,interstices filled with dense granular gray and white qtz.and frags. intensely alt. to a hard f.g. siliceous rock impregnated with petzite,tet.etc. 8-10' wide. No definite walls in upper levels. Main tunnel however, narrow but distinct filled fissure with fairly definite walls. Vein here main rhodoch. Ore was petzite,pyrite,arg-tet.,gal.,pyrargyrite, in f.g. gray and white qtz,some rhodoch. Gray color of qtz:s.t. due to fine grains of petzite. Gold-silver ratio: 1:32.



Black Crook.- N-S, ave.60W;thin-bedded flow breccias and tuffs dip 27 E,so vein perp. to beds. FW often carries heavy gouge; normal movement feather joints in HW. Vein a series of sheeting planes,in many places brecciated,which habe been replaced by ore and gangue minerals.
Repl.vs. (In contrast to radial Golden Fleece:replacement minor there). Min.zone
open sp. 4-8' wide,but pay streak ave.19" (wider in rich upper parts).

E-W Black Crook fault reverse fault,offsets vein 35',N side west. Fault carries some ore. Ore of main vein,Ilma,ZnS,gal.,tet-,py, ccpy--irreg.bunches of pyargyrite,in qtz.,barite, rhodoch. Vein py sparse,WR well pyrit. ZNS most constant ore min. Samples taken on all levels gave 15% Zn, 3.2% Pb in ore. Pyrargyrite in bunches thru the ore;coats cracks and fractures in the ore,esp.ore high in arg.-tet. Banding,not well developed,is where it does occur result of replacement of sheeted rock. Bonanza ore, gold-silver ratio,1:7.

Moro 1.5. mi.S60W of Capitol City. CR lower Picayune banded flow-breccias. Seems to strike about S15-25W. In upper level,vein between well-defined,smooth HW and FW;many angular frags.CR. Parallel thin qtz. stgrs, in WR. with depth vein divides into many stringers.Dip of vein 66-78E. On lowest level vein consists of a series of veinlets en echelon:

In strike the vein zigzags,suggesting two preexisting fracture sets (NE,NW, about 30° between).

Ore galena,ZnS,ccpy,py,tet.in white glassy cryst.qtz. with bar-. Galena chief product;cse;everywhere much crushed,shows stress twinning. Cccpy IG with ZnS. Metallic sulphs often shattered,cut by white glassy qtz. veinlets,with perfect comb structure. Vugs. The galena carried 10-17 oz.Ag. Gold very sparse. . Ccpy,py,ZnS increase with depth,gold also. In upper levels vein carries 1/2-3" gouge,HW and FW. This vein,like the others, shows marked impoverishme nt in the 500' of vert.development,and tends to fray out and disappear.

LAKE CITY, COLORADO

Source: J.D. Irving and Howland Bancroft, 1911, Geology and ore deposits near Lake City, Colo. USGS Bull.478.

Regional Setting: Within the San Juan volcanic plateau, northeast of Ouray. Within the province of repeated major domical uplift.

Country Rocks: Premineral

Potosi Volcanic Series: Quartz latites, andesites.

Major erosion

Silverton Volcanic Series:

Henson Tuff: Debris of andesite, in places, fragments of rhyolite, latite, andesite.

Pyroxene Andesite: Massive; to 800 ft.

Erosion

Burns Latite Tuff: Mainly sandstones, grains volcanic. Minor layers of shale, limestone

ore Eureka Rhyolite: Felsitic few phenocrysts. Fluidal texture.

Picayune Volcanic Group: Andesites, dacites, quartz latites; some rhyolite. Cliff-making.

Main ore

All are considered Miodene.

Intrusives

Rhyolite, quartz latite, andesite, quartz monzonite porphyry. Strtural relations not described; some look like sheets, others appear trangressive. No reltion to ore deposits.

Structure: The accompanying structural map shows contours drawn on the contact between the Eureka rhyolite and the Picayune group. These suggest the northern flank of an irregular dome. Whitman Cross and E.S. Larsen, 1935 (A brief review of the geology of the San Juan region of southwestern Colorado, USGS Bull.843) state that the body of Picayune volcanic group (the north end of which is shown on the structural map) is about 10 x 12 miles across and represents a volcanic dome. (P.60). Irving and Bancroft state that the Picayune griup once formed a great volcano, the center of which was once a few miles south of the area of the structural map.

Also that center for whole Silverton series was there

The following facts suggest that this dome, although possibly also a dome of accumulation, was tectonic:

1. Irving snd Bancroft record northerly dips up to 45. Too steep.

(2. The overlying Eureka rhyolite shares in the doming. (Omit)

2. In the SW portion of the structural map, the Potosi volcanics dip E or NE off the satellitic dome shown; Irving and Bancroft state that the Potosi volcanics dip northwatds, like the Picayume group, but at gentler angles (p.23).

3. Plate I of Cross and Larsen show the mass of Picayine volcanics more partly less bounded, on the N, W and S, by a semicircular fault. The

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norhtern segment of this fault is shown on the structural map. The Tectonic Map of United States shows displacement on ths concentric fault down toward the center of curvature, caldera-fashion. The relation between caldera collapse and doming is well established.

4. All the structural contours showing doming on thesstrucural map lie north or east of the concentric fault. As will be shown, most of the vein-fractures are so oriented as to suggest tension fissures produced by domical uplift.

Relation of Vein-fractures to Domical Structure: At the western end of the district, the north-trending fractures (Gallic-Vulcan, Excelsior etc. show no relation to the domical structure. Production was small. The Ocean Wave and Pride of America fractures parallel in strike the structural contours, and dip and dip southeastward into the dome. They suggest tension fissures formed by crustal stretching. The Lellie fracture dips northwestward with the strata. ~~It might be along a bedding fault, or a synthetic fault aiding the uplift.~~ Follows bedding in flow-breccia on bottom level, dip 45 N.

The Ute and Ulay veins of the Hidden Treasure mine (largest producer) lie either along fractures radial with respect to the doming, or along antitheric faults longitudinal with respect to a northeast-trending nose off the main dome.

The northeast-trending fractures in the eastern part of the district appear to be radial with respect to the dome, except the Missouri favorite, which parallels the structural contours & dips SW into the dome.

Metallization.-

Character of the Veins

37 Two types of veins: simple filled fissures and zones of sheeting and brecciation where most of the vein material was formed by replacement of the country rock. Both types are common in the same lode. Included rock fragments in all the lodes; many are highly altered but some are simply surrounded by vein matter, with little alteraion. Replacement minor

41 Average width of veins is 18". Widths of 8-10' are very occasionally reached. Lelley, Ulay, Vermont, Black Crook, Golden Fleece and others were wider toward surface, gradually narrowed with depth. Practically all veins explored by deep workings have pinched out ~~xxxxxxx~~ almost entirely-Lellie, Black Crook, Golden Fleece narrowed into a single small fissure; others divide into a number of stringers which finally disappear. Along the strike, veins usually split into many branches which finally disappear.

There is a conformity between jointing and vein directio: Ute vein, main producer, was more regular but also had Pinches and swells. In general the veins seem to pinch between ore shoots.

Most veins carry selvages and are probably along minor faults.

Vein Texture

Crustified banding is absent, but drusy cavities, some lined with projecting barite crystals, exist. White crystalline quartz seems to be latest vein mineral (except for ruby silvers, thought to be secondary).

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Paragesis

45 Serictization, silicification of wall rock.
Pyritization of wall rock
Rhodochrosie-galena-sphalerite;variable pyrite. Galena argentif.
Tetrahedrite (arg.)
White crystalline quartz
Pyraggyrite-proustite;probably argentite.

Ruby silvers gave the bonanza ores in the upper levels; ores containing only arg-galena and arg-tetrah.were low-grade.

The ruby silvers occurred filling cracks or crevices in the earlier sulfides,or as crystals lining vugs.

Ore Shoots

63 Many ore shoots simply swellings in the vein,which pinches away from the shoot. Second type=segregation of valuable minerals within a barren gange.

Au:Ag ratio for district 1:62;at Golden Fleece, ~~1:1~~ 1:23 to 1:40.(Petzite).

Notes from Mine Descriptions.-

Gallic-Vulcan

74 Original vein small,carried quartz,galena,sphalerite,pyrite,tetrahedrite. Brecciation of vein and adjacent rock;fragments cemented by qtz .,pyrite, galena,sphalerite,ccpy,tellurides (hessite),free gold,silver. Did not completely fill the interstices.

Hidden Treasure

90 Ute vein by far the most productive in the district. Arcutate strike, convex to NW;also dip flattens in center of cup.Ave,dip 56-60NW.

91 Sverage width 4';minimum width 0,mere fracture;max .,at one place,20'. Wide places due (1) to splitting of vein;(2) movement of walls brings two concavities together. Where convex surface are in contact-mere slip.

Paragenesis.- Fracturimg,minor brecciation,little or no separation of walls.Alteration of rock into hard,greenish silicified material for a short distance from vein fracture. Next,separation of walls,slight movement, one past the other,produding pinches,swells,some brecciation. 1st period of vein filling:1,qtz,2,rhodochrosite,teyrahdritemgalena;3,qtz. Shattering, then 1 qtz;2,barite with minor galena;3,qtz. This is based on lower levels, below ruby silver bonanza zone. Toward N end of vein,latter consists almost wholly of rhodochrosite with considerable terahedrite and barite,minor galena and qtz.

Pelican

See sketch on p.2. Average width 1',but reaches 4'. A quartz-cemented rock breccia,in places with "ghost fragments". Paragenesis: 1.Block dense silica.2.barite,gslrns,freibergite,barite,white qtz,pyrite,sphalerite. 3.Pyragyrite,galena.Silica and barite are the most abundant. Sparse rhodochrosite. Drusy cavities lined with white qtz.crystals.

Missouri Favorite

The vein may be along a strong fault-thick gouge and slickensides on HW. Gangue almost entirely barite,with a little qtz.;galena,tetrahedrite, ccpy.ZnS.

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DEPARTMENT OF MINERAL TECHNOLOGY
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Monte Queen

3 ft.vein;walls carry selvage in places. 3 small ore shoots;vein pinches between;a few sheeting planes with quartz stringers. Pyrite-tetrahedrite sho ts low in silver. The third shoot,resin ZnS and steel galena,75 oz.Ag/ton,notable bismuth. Gangue qtz.,vein all rhodochrosite in one face. Vein pinches on dip also,forming small shoots within the pay shoot. Or rather,vein turns down dip to barren rubble-filled fissure, fragments highly silicified but barren.

Golden Fleece

Country rock of vein fine-bedded tuffs and flow breccias,overlain by coarse agglomerate. Vein quits abruptly at this. Rickard thought the contact depositional, authors think it a bedding fault. Vein a mass ofvery irregular country rock cemented by dense granular gray and white qtz;some fragments highly silicified,impregnated with petzite,tetrahedrite etc. 8-10' wide. Upper levels,no definite wlls-vein faded out into less broken and mineralized rock. In lowest tunnel,vein is narrow but distinct filled fissure with fairly definite walls. Here at one place was mainly rhodochrosite. Branches in lower level (subparallel).

Ore was petzite,pyrite,freibergite galena,pyragyrite;gange f.g. white and gray qtz.and rhodochroite.

Black Crook

Here the same tuffs and flow-breccias dip 15-40 E;veins cut them normal to this dip. Main vein the Ilma,strike N;dip W,70 at surface,then 45, at bottom 58(1300' down). Vein has small feather joint branches in the tuff. FW more regular,carries selvage but not everywhere. Vein not a simple filled fissure but a series of sheeting planes,in many places brecciated; replaced by vein matter. Width 4-8' but pay streak only 20".

Ore:qtz-barite-rhodochroiste gangue;ZnS,PbS, a little terahedrite, pyrite,minor ccpy;irregular bunches of pyrargyrite. Au*Ag ratio 1:7.

Conclusions.- The vein-fractures mostly lie parallel or n rmal to the structural contours of the dome. All but one of the concentric fractures dip toward the apex. Intramineral movements were common,producing brecciation which goes with tension. Since both the concentric and the radial fractures exhibit these,persistent though slight doming is suggested. Brecciation and tension were greatest toward the surface and diminished with depth.This also goes with tension fissures due to arching,and ~~radiaxx~~ concentric stretching due to enlargement of a dome.

The district is exceptional in that in places almost the entire gangue consists of rhodochroiste or barite.

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Note - Emmons, Enrich. OD's, p. 485, says that in some veins of great vert. extent barite abundant in the higher portions but absent at greater depths. Could not find this in original - See Ransome p. 121.

Geology & Ore Deposits near Lake City, Colo.

J. D. Irving & H. Bancroft.

USGS Bull. 478, 1911.

Lake City veins at NE corner S. Juan radial pattern

Veins simple filled fissures Transition to zones of shearing & brecciation where most of the V.M. produced by alteration of inclosing rock. Each type of mineraly. may occur, in different parts of the same lode.

Veins in places QCB.

White crystl. qtz. is usually latest mineral deposited. It commonly cements shattered gal. & sphal. or cpy, etc. Coats barite xx which project into cavities.

p. 53. Barite abundant in gangue of gal - sphal. veins, esp. in the variety carrying Ag - Tetr. (Henson Creek & near Lake S. Cristobal.)

Barite less common in Capitol City Type veins, in which qtz. predominates. Also less common in the Telluride veins, where sil. is predom. gangue. Barite as interlocking network of thin plates whose interstices are filled with f-g sil. or met. mins. Gives massive appr. to ore - little banding. In many vugs it shows as large, transparent xx. The barite. In a few veins barite predominates - these low grade. Barite earlier than qtz. - latter coats bar. druse xx.

Mostly commonly associated with jasperoid.

p. 57 ZnS - most abundant met. mineral, & most universally distrib., next to py. Where most abundant (Capitol City lodes) it is cse xx light-colored. F-g Type rare, but notably in Monte Queen mine - extremely f-g, very dark, high Ag, notable % Bi. Hi Bi means high Ag.

ZnS belongs to earlier mineral surges. Shattered ZnS cut by white qtz.
Vert. range – from lowest workings in decreasing quantities toward surface.

Qtz – Present everywhere – probably most abundant vein mineral.
2 varieties – (1) f-g aphanitic – from nearly black thru gray to porcelain. Banded – open-space dep? But some shows small druses – replacement.
(2) Ordinary white cryst. Most common type – usually shows comb-struct., lines vugs. More than one generation, but bulk younger than any met. min.

p. 68 Much low-grade silver ore in sight, "associated with which is an enormous amount of zinc blende."

p. 92. Paragenesis, Vte – Hidden Treasure OBs
I (1) qtz. (2) rhodochrosite, tet., gal.; (3) qtz II Later movement shattered this vein matter & deposited (1) qtz (2) barite with galena – (3) qtz

Ores – Vlay vein upper levels – arg-gal with some tetrah., ZnS & py + ruby.
Na Ag. 11th level (lowest) ZnS increased, Ag, Pb fell off.
Vte vein – thru 3000', gangue & ore minerals mingled together with remarkable uniformity – vein stoped nearly the whole length.
No pay shoots.

p. 114. Black Crook mine – ZnS, PbS, tetrah. – py in gangue of qtz., barite, rhodo.

general – Tension cracks – "veins that terminate in depth [i.e. exposed in mines] either narrow into a single small fissure.... or divide into a no. of stgrs. which finally disappear entirely. Terminations along the strike usually show a division into many which finally disappear..." p. 41

p. 118. Moro vein – clean walls, filled fissure, upper levels, irregular, stgr. – like in depth.