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DOME- LACCOLITHIC

NEIHART, MONTANA.

I. W.H.Weed: Geology of the Little Belt Mountains, Montana. 20th AR, USGS, III, 257-595. 1900

General Structure of Little Belt Mountains.- A low flat-topped arch, 20 miles wide on W, narrows to a point on the E. Rocks nearly horizontal on summit; on the flanks or shoulders they dip away from the uplift. Great fracture (radial) extending 13 mi. NE from Yogo Pk., filled with post-Cretaceous syenite and monzonite. N flanks of range, great igneous intrusions came in between p-C crystalline schists and gneisses and over;ying Paleozoics. Laccolithis, arched up beds; extend into low plains to N of range. Whole range an uplift, See map for rock formations. The Neihart crystalline schists are gneisses, not the wrinkled, puckered schists so common elsewhere. While foliated, they are not sufficiently fissile to be called schists. They are meta-porphyries. Cambrian: important-determined character of folding and loci of intrusions. Base, Flathead ss. Middle part, fissile, impure, shaly, is frequent locus for sills, often syenite. Total thickness about 180'. (should include syenite sill, 70'?)

Above the Flathead are shale, 150', ls., thin-bedded, then 800' Park shale, then ls. conglomerates with shale, then shale and ls.

Siluro-Devonian, 2-6' ls., beds, shaly ls. and shale above.

Carboniferous rocks are the mountain forming beds of the range. Determine rough and craggy scenery. Lower series, 1000' ls. (Madison). Over this, shales, ss., ls. (Quadrant). ~~Basal~~ Tops not Madison ls. is Castle. Very massive. 375'.

Geology of Neihart District.- Archean rocks, meta-igneous, well-banded, dip 45°S. S of Neihart, schistose, fissile; N, hard gneisses. Intruded by large, irregular Pinto diorite, made gneissoid by later stresses. (Schists were schistose when it intruded).

Non-schistose and therefore later are rhyolite porphyry with flow banding, intrudes Pinto diorite and gneisses; Neihart porphyry, also cuts Pinto diorite and gneisses. Dikes and irregular bodies. Minette dikes connected with Yogo peak igneous activity. Since ore deposits are later than these, ore deposits are certainly post-Jurassic and probably Tertiary.

Neihart region seat of dynamic disturbances from very earliest time. The period of igneous activity that accompanied the uplift of the range was the 3rd. Ore deposition accompanied or closely followed this. Probably post-Cretaceous.

p. 384 Little Belt Mts structurally connected with Castle Mt. on S. & thru it with the end of the Big Belt Rge

Structural Features of Little Belt Range.- Little Belt V-shaped uplift a unit. Flat-topped, steep-sided anticline. S border formed by a secondary fold, pitches E, passes into a fault that outlines margin of uplift farther W. This onlt imp. fault; all others due to laccolithic doming. On N and S of the range-great depositional troughs.

Minor igneous domes accompaniedmajor uplift. Sheets-extremely numerous; in softer shales-mainly Cambrian. Fissile beds between massive ls. most favorable. Basic sheets much thinner thana cidic ones. Intruded before folding. (Or during-E.W.) Weed agrees: injected contemp. with uplift and folding, position due to latent cavities.

Thom

Laccoliths. All prominent mt. masses. Most of the laccoliths along N border of uplift. In part transgressive. Main type assymmetric; steep side the outer side, next to the plains, away from the mts. Steep side coincides with steep dip marking flank of uplift. Granite porphyry. Laccoliths probably rest on pre-Cambrian basement. None are present in Algonkian area (S of Neihart); i.e. they are absent where sed. cover greater than 4000'; they were not formed under a cover of great thickness

Dikes mainly missing; intrusive sheets common, surrounding the laccoliths.

Stocks.- Vertical contacts transgress beds. These on the contrary show encircling sheets and radial dikes. That Yogo stock dynamic force was an uplifting one shown by quantity of intruded sheets. Latter generally parallel to bedding. Beds not greatly uptilted by Yogo mass. Radial fissuring, less well developed than at Crazy Mts., because of harder, more resistant Paleozoic beds. Soft Cretaceous beds, at Crazy and Highwood mts. Main Yogo stock syenite, monzonite, shonkinite. Radial dikes, late minette. Shows that final forces fissured the rocks adjacent to the stock. (Renewed uplift on the hard scholle).

Ore Deposits of Neihart.- Mainly silver-lead ores. Some Au. Zn ass. with Pb. Vein pyrite. Polybasite crystals in open cavities. Crusts upon the original galena-py ore in small open fissures, or fills minute fractures in older ore. Some argentite, pyragyrite - in vugs. Wire of native Ag.

Quartz abundant. Coarse grained, slightly turbid or white, but not typical milky quartz. Interlocking grains with transition to comb structure. Prisms line the frequent drusy cavities. Lines of vugs. CR sericitized. Barite common. Ankerite most abundant gangue mineral; coarsely crystalline. Not true ankerite; gradation, siderite, dolomite, rhodochrosite.

A numner of generations of minerals; some fill fractures in others. Crustal arrangement not common, except where vein consists of CR frags., cemented by vein matter. (Caracol structure). From crusted ores:

1. Crystalline qtz., radially fibrous, crystalline, with a little scattered py.

2. Massive blende layer, some py.

3. Mixtures of galena, ~~xxxxx~~ pyrite, qtz., scattered blende grains. Rude banding. Galena crystals project into layer above.

4. Frosting of opaque white qtz. in stout xx.

5. Polybasite, s. ty with pyrargyrite. Fills interstices between qtz. xx.

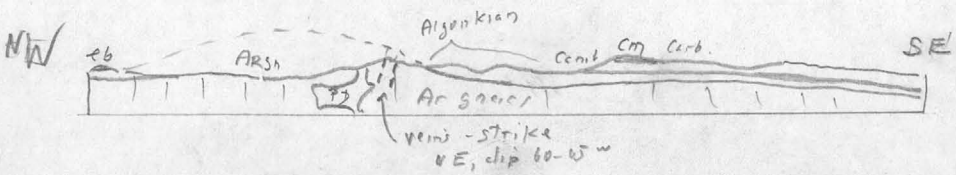


Fig. 53.

Fig. 57

Thin sections show barite in fractures of the original ankerite spar;such fractures,cutting across spar crystals and shattering pyrite grains, s.t. show one part filled by barite, with qtz. filling beyond on the same line.

Sphal.in xx in some vugs,latest mineral.

Galena (shipping) ore, from 65 oz.Ag to 11. Rich silver ores ran to hundreds of ounces. Gold low.

Veins.- Adjacent to Neihart. Cut gneiss and the various igneous rocks that intrude it. Mainly confined to the supposed Archean gneisses and schists,in a few places penetrating the overlying quartzite.

Ancient rocks are banded,dip S 40-65. Sheeting, well-defined,nearly at right angles to banding. Not uniform sheeting-fractures occur in groups or zones of sheeting. Fissubes not open cracks,but mere fracture planes,esp.in more massive rocks. UG marked by thin selvages are an almost imperceptible fracture. Vein thus sheeted,consists of highly altered CR enclosed by walls that limit the intense rock alteration. In some places such veins show areas where instead of sheeted CR the vein matter is brecciated,the fragments being held in the firmer breccia or cemented by quartz and other minerals. Veins with from 60' down; as worked,this veib,the Galt,seldom exceeds 8'.

Ave,vein trend N15E. Dip mainly W 60-65.

p 415 Fractures connected with range uplift.

In gneiss, well-defined,clean-cut fractures;in schist,wider,less defined. In passing from gneiss into Pinto diorite,pronounced narrowing, 5-8' to 3-4; loss of ore. In rhy porphyry of Snow Creek vein splits to a network of fractures,shattering the rock;indefinite zone. Veins replacement here.

Where vein meets black gneiss or amphibilite (Paracale) it is commonly spoken of as faulted. Really deflected, see below.

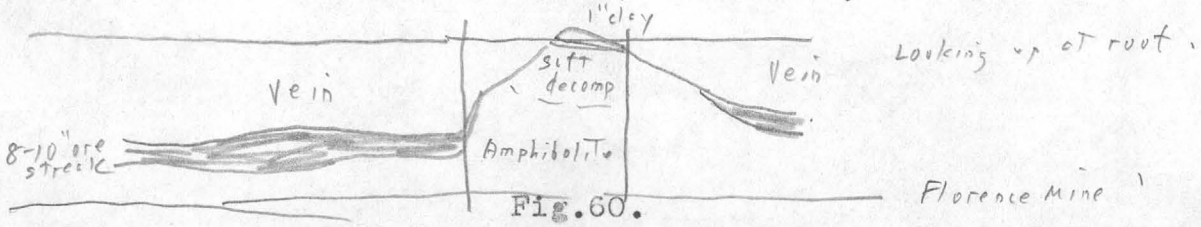


Fig.60.

Vein Structure.- Altered rock in the vein consists of sericite, carbonates, pyrite etc. Banding of two types:(1) Sheeted rock with parallel cracks occupied by vein filling. (2) More common,vein near ore bodies banded due to streaking of ore minerals in the gangue.In nearly solid galena,striping due to alternations of finer and coarser grained galena. In shoots, alternate layers galena and blende. Banding also due to lines of spar,non-persistent;often line of vugs down center. Spar itself often spotted with grains of galena,blende, pyrite,in a general banded arrangement. p.417:"Such banding is in fact a common and almost constant feature of the ore bodies,even the ore itself being banded when seen in cross section in the ore shoots." As result of later fracturing.ore shows lines of vugs or open fissures;such places often partly fillied, only broader parts remaining open. True crustifi-

cation about such cavities. Commonly the vein does not show a filling of successive crusts of mineral. Rarely the vein matter is a CR breccia cemented by filling. Minerals about these frags.in concentric bands showing true crustification;open cavities between adjacent frags.common.

Ore show a very plain "secondary fracturing". The fractures cross the vein at a considerable angle,although they do not fault or greatly disturb it,but merely crack it and leave minute crevices in part filled by later minerals. p.417: Where such fissuring is inmparallel planes a banded structure is produced by reopening. These openings are usually small, are a common feature of the ore, and affordthe opportunity for processes of secondary concentration of silver sulphides."

Ore Distribution.- Between shoots sulphides occur on streaks in the gangue minerals. Ore bodies composed essentially of galena and ass. mins. They occur in long, narrow lenticular bodies, that wedge out into streaks;or they may end abruptly and another lens occur in the vein, the end overlapping. Broadwater stope section shows roughly equant ore shoots with steep N pitch,in marked contrast to flat Camp Birdt type.

Veins productive where they cross feldspathic gneisses;barren in amphibolites and dark gneisses.

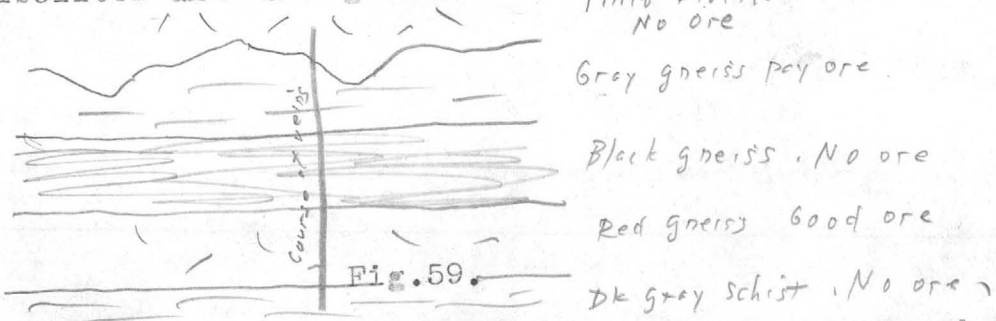


Fig.59.

No ore bodies in Pinto diorite;none in dense and very tough amphibolites.

NOTES.

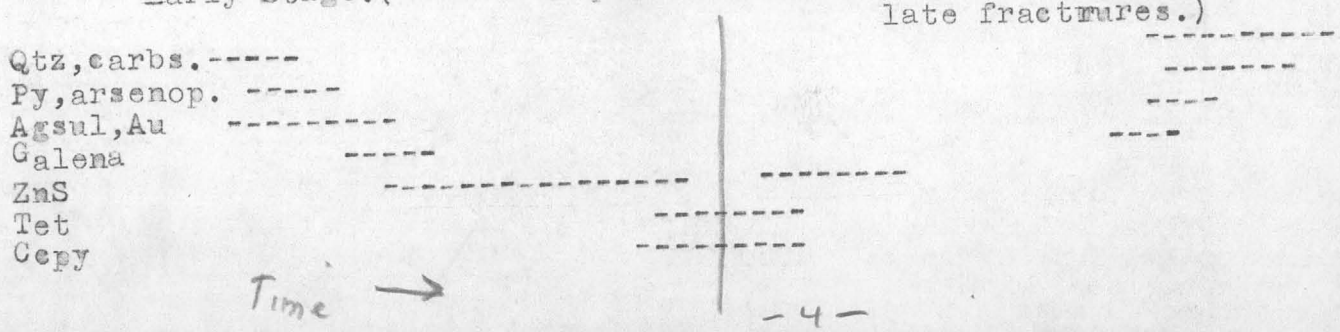
Map, plate XLI, not reproduced. Archean near Neihart about at crest of uplift. Thunder Mt. laccolithic mass NW of this area shows concentric dikes around it.

II. GEOLOGY AND ORE DEPOSITS OF THE NEIHART MINING DISTRICT,CASCADE COUNTY,MONTAN. Paul A. Schafer: Montana Bureau Mines & Geology,Mem.13, 1935.

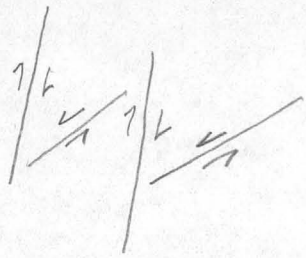
Total production about $17,000,000.

Paragenesis.- Early massive ore formed to considerable extent by replacement; not true of late stage minerals.

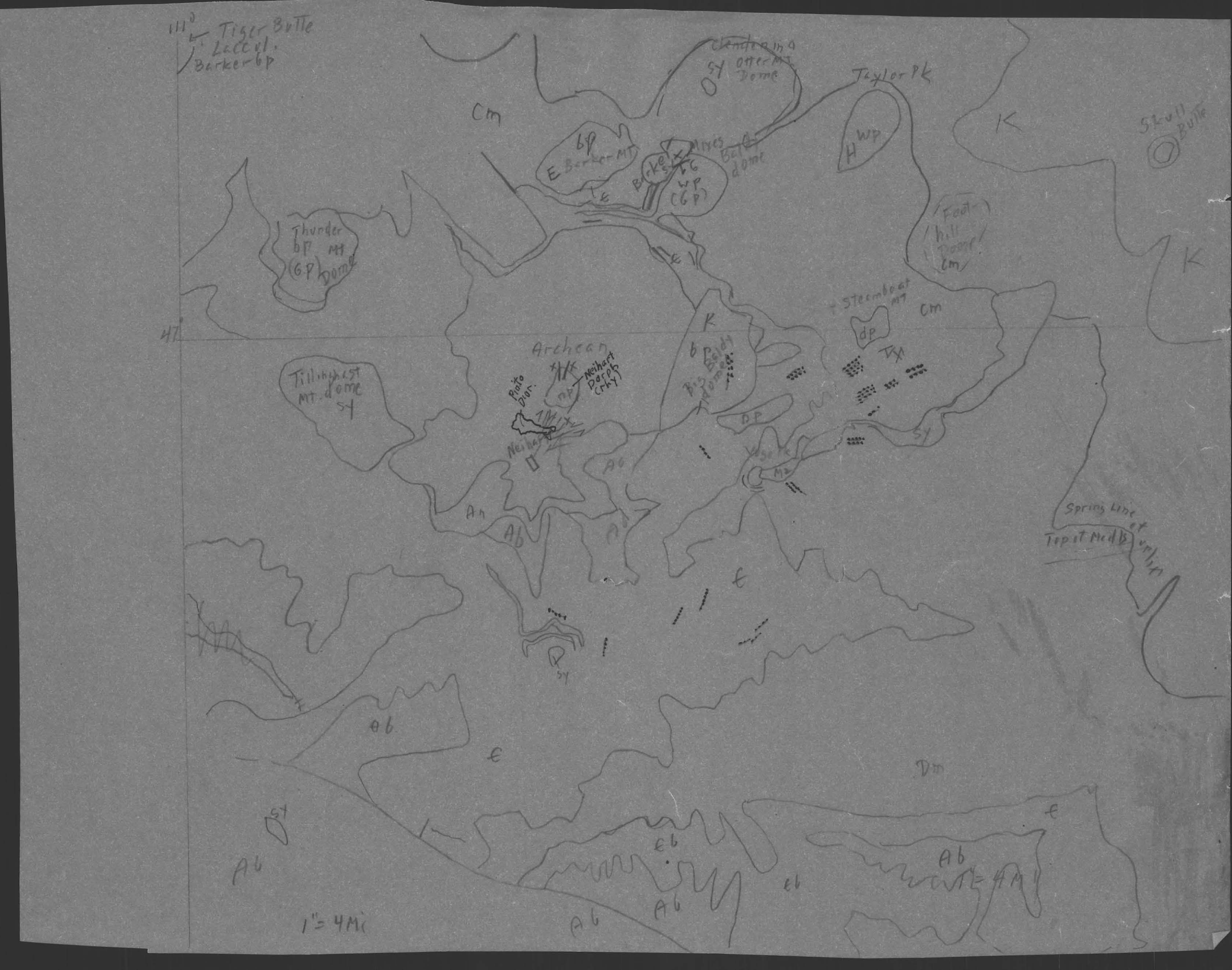
Early Stage.(Massive replacement ore. Late Stage (crusts,druses, late fractrures.)



Vein Structure.- Two vein sets (1) N10E, (2) N30-50E. Merge into each other as splits, or merely change direction from course of one set to that of the other. Nset show horiz.displ. W side N. NE set, the opposite: W side S. Produced shortening N-S, extension E-W. Gives zigzag ore control.



Ref. - Whitman Cross - Laccolithic Mt. Groups, USGS 14 AR II, 236 1896.


111°
Tiger Butte
Lacc'l.
Barker bp
Clendenin
Sy
Otter Mt
Dome
Taylor Pk
Cm
K
Skull Butte
bp
E
Barker Mt
Miles Butte dome
Barker
Sy
bp
WP
(bp)
H
WP
Foot hill Dome
Cm
Thunder bp Mt (bp) Dome
Steamboat Mt
Cm
dp
Tx
47°
K
bp
Big Body Dome
Archean
Pluto Dior.
Neihart porph Cry
Tillinghast Mt. dome
Sy
Neihart
Ab
An
Ab
Ab
Ab