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ORE ON MARGINAL THRUSTS AT EDGE OF CIRCULAR STOCK;ON RADIAL FISSURES. ON ANTICLINE,IN CROSS-JOINTS AND ON LIMB DIPPING INTO STOCK.NE LATE DEFORMATION-INTRUSION CROSSING OLDER NW FOLS(BINGHAM).INTRAMINERAL MOVTS.

ORE DEPOSITS OF THE NORTHWESSERN PART OF THE GARNET RANGE,MONT.
J.T.Pardee, USGS Bull.660-F, 1918.

For location see Tectonic Map of W.U.S.

For straigraphic columns,see accompanying plan.

Contacts of granodiorite advance up gulches,retreat arouhd spurs;flattish tops,probably all exposures are parts of a single buried mass, Howver all offshoots of this mass may not have intruded at same time. E.g.the body in SW part of area,which blots out the diabase sill,while it lies lower topographically than the others,is much finer-grained and probably crystallized under a very thin cover;must have been marked erosion after earlier intrusions. Magmatic theory: no strong metamorphism,no ore deposits around this stock.Possible that rapid solidification did not give time for mineralizing solutions to,collect or escape.

Structure: Note tightly-squeezed canoe-shaped synclines,SE part,Rocks are high in section,mainly shale,ss. Intervening anticlines also tightly compressed in SE.To NW folds broaden,and since pitch is to SE, Cambrian and Algonkian only are exposed. This opening of the folds NW marks transition from intense deformation ofnRocky Mt.Paleozoic province to broad,simple structure of pre-Cambrian region of the NW.

The thrust shown may be continuous with that of Phillipsburg,20 mi.to SE. Trace of fault accompanied by as much as 100' of crushed or disturbed rocks NE faulting,steep,seen in Garnet mines and elsewhere.Small displacements. Gypsy prospect may be on related or branch thrust.

Ore Deposits:

Garnet District

Produced bulk of regional production. Garnet district priduced $950,000 since 1897,95% Au,rest Cu,Ag. Total $1,400,000 plus.

L916 only Dewey mine was shipping;others closed for litigation and other reasons,but none of mines thought to be worked out. Referring to map of Red Cloud area,the qtzites,shale and ls.are folded into an anticline plunging N. NE flank dips down into granodiorite.

Garnet ore bodies are veins that in part filled open ~~fixxxxxx~~ spaces along fractures or bed planes,in part formed by replacment,,
Nancy Hanks Zone,see general map. Note concenyric curvature,flat dip inwards towward core of granodiorite,Probably a marginal thrust,minor, or possibly s Streckflaeche. Narrow zone of veins.Individald do not persist in length or depth more than a few hundred ft. Each either ends on a fault or splits into stringers,to be succeeded by another en echelon vein,to one or the other side. Width of vein from mere seam to 4';workable portions 1-3',

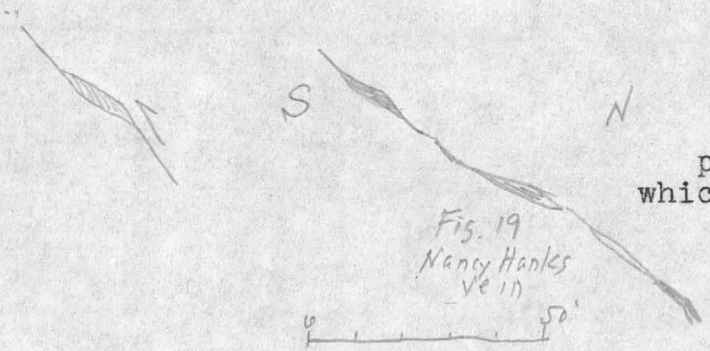
South of Nancy Hanks zone are 1st Magone & Anderson and next,the Red Cloud vein,each on a bed plane in schist or quartzite,dips 30°NE. (NE flank of anticline). Each only 2 or 3' wide but persistent for ½ mi.plus.

Nancy Hank zone vein-fractures doubtkess faults;M & A and Red Cloud bed planes opened by faulting or fissuring. After fracture oOenings were filled movements renewed alongnfractures in ancy Hanks zone,ore crushed. Veins of

this zone also cut by transverse and strike minor faults,normal,or rather, inclined slip.

In M and A and Red Cloud,fewer faults but bigger displacements.NE strike, dip steep NW. One has dropped M and A vein 200'mplus (see plan). 4th of July vein dropped segment of Red Cloud,200'?

Ore Shoots:Few parts of the veins wide enough to be stopable are barren, esp.in middle part of Nancy Hanks zone. Here flatter parts of vein form stopable lenses, zigzag control corresponding to reverse fault movement as guessed above:



These pods 2-3' thick,25'to 50' in breadth and length. Biggest 150' in stope & pitch lengths,2-3' wide.Most shoots pitch steeply W, Pinched portions, which oocupy about as mauh of the fracture area (iopenings?) as the swelled portions(lenses) conta contain 1" or less of gouge or cr crushed ore.

As a rule,the wider parts of M and A and Red Clouod are rich enough to b be ore.

Nancy Hanks sulphide ores $80 per ton,80-90% in Au. Most of ore produce
(M & A) was oxidized,ave.$60.Red Cloud oxidized ore $27.Remaining sulphide ore est.at $15 to $25, Seems to be progress ve decrease in richness of ore,N t to S.

Gangue qtz.m50-90% of vein matter.Coarse textured barite abundant but sporadic. Ankerite(?)carb.of Ca,Mg,Fe) in many veins. Calcite-/ Py,tetrahedrite,ccpy,PbS.All widely distrib.Py most abundant,as massive coarse-textured aggregates,also dissem,grains. Tetrah.,galena and ccpy irr egularly distributed;tetrah.the most common of the 3. Rare Au,Ag,Bi tellur ides,and moly.

Paragenesis:1.qtz-barite-py contemp.
2.Calcite-ankerite,filled spaces left by others,replacing WR,
3. Ccpy,py-
4.Tetrah.-galena with new qtz.,fill small cfacks in older minerals and replacing them.esp.py.

Dewey Mine: Post-mineral movement also suggests reverse faulting like Mother Lode. Ore crustified-banded in places. Opening as solutions came in. Sulphides in cener of banded vein.

Nancy Hanks:Some of the banding due to replacement of sheeted zone. Vein fissure contains inclusions of ls.,showing nearness of grd.to s eds, These blocks dolomitized,recrystallizee,chlorizoed,have vein calcite stringers carring py,galena. Little or no exploration below 100'.

Cascade:Tetrah.fills cracks and cavities in the qtz.

Magone & Anderson: CR qtzite and schist,dips 30N. Vein matter qtz.,barite,ankerite calcite,with grains and masses of sulphides.Banded by replacement of schist.Py main sulpide,

Red Cloud: Vein along a bed plane in the qtzite and schist.Width from a mere seam to 4',considerable stretches ave.2' plus. Vein between the two shoots shown..Red Cloud OB has flat lenses like Nancy Hanks,suggesting rerverse fault zigzag control. Walls smooth,well-defined,but ore by replacement of schist.PM movements slight.

Vein matter is qtz,varying barite,ankerite,and py,ccpy,tetrah.,galena. Gold seems to be independent of tetrah or PbS but cloely related to py which occurs as dissem.grains.

Coloma district,

Veins in fractures in the grd.close to contact with Cambrian ls. ENE or perp.to contact,dip 30S. Not over 1' wide. Mineralogy like Nancy Hanks zone. Olympiad(Comet) vein OCs 700'mlower than Mammoth;barren of Au-bearing pyrite.Tetrahedrite later generation,may persist below the 700'. Notable that Mammoth vein does not cross the grd-ls contact. A similar vein however follows the contact which here strikes SE,dips steep E

Head of Elk Creek.(Atea of Grd.Mass SE of Garnet).

Continuation of Garnet arch,here broad, Qtz-py-Au veins in fractures that cut qtzite-shale-schist also grd. Most are persistent tho narrow,dip steep NW (cross-joints on anticline plunging SE).

Dandy is main mine. Here Au-pyrite concentrated in a middle streak. In other veins py in small veinlets irreg.distributed thru the qtz.(p.201),

Top O'Deep District.

Circular grd mass probably connected with main mass at depth,and probably originally extended only a few hundred ft.higher than its present top. Cambrian ls.marbleized for several hundred ft.around contact; portions on top and upper slopes turned to skarn:garnet,magmetite etc. Here are the CM bodies.

Masses of tactite coextensive with low-grade Cu bodies. One has form of a crexcent(Pilares oval) 3000' long,500' extreme width;tapers down as blunt wedge. Another 10-50' wide,at least 300' deep. May have ½ mi.leng

Boundaries very irreg.in detail but ate sharp;no gradual change from rk.chiefly tactite to grd or ls. Greatest dimensions of these masses usually paralle contact.Seem to occur both in grd and ls. Py,ccpy generally but sparingly distrib.thru the tactite masses.

Gold-qtz.veins very narrow;resemble Nancy Hanks.

Copper Cliff District.

Graben is downfaulted Camn.ls.;frame, AG ss.,sh. Whole graben block well fractured,brecciated,some breccia loose,other breccia very hard, cemented by qtz with some sulphides;frags are qtzite and silic.sh. Fg

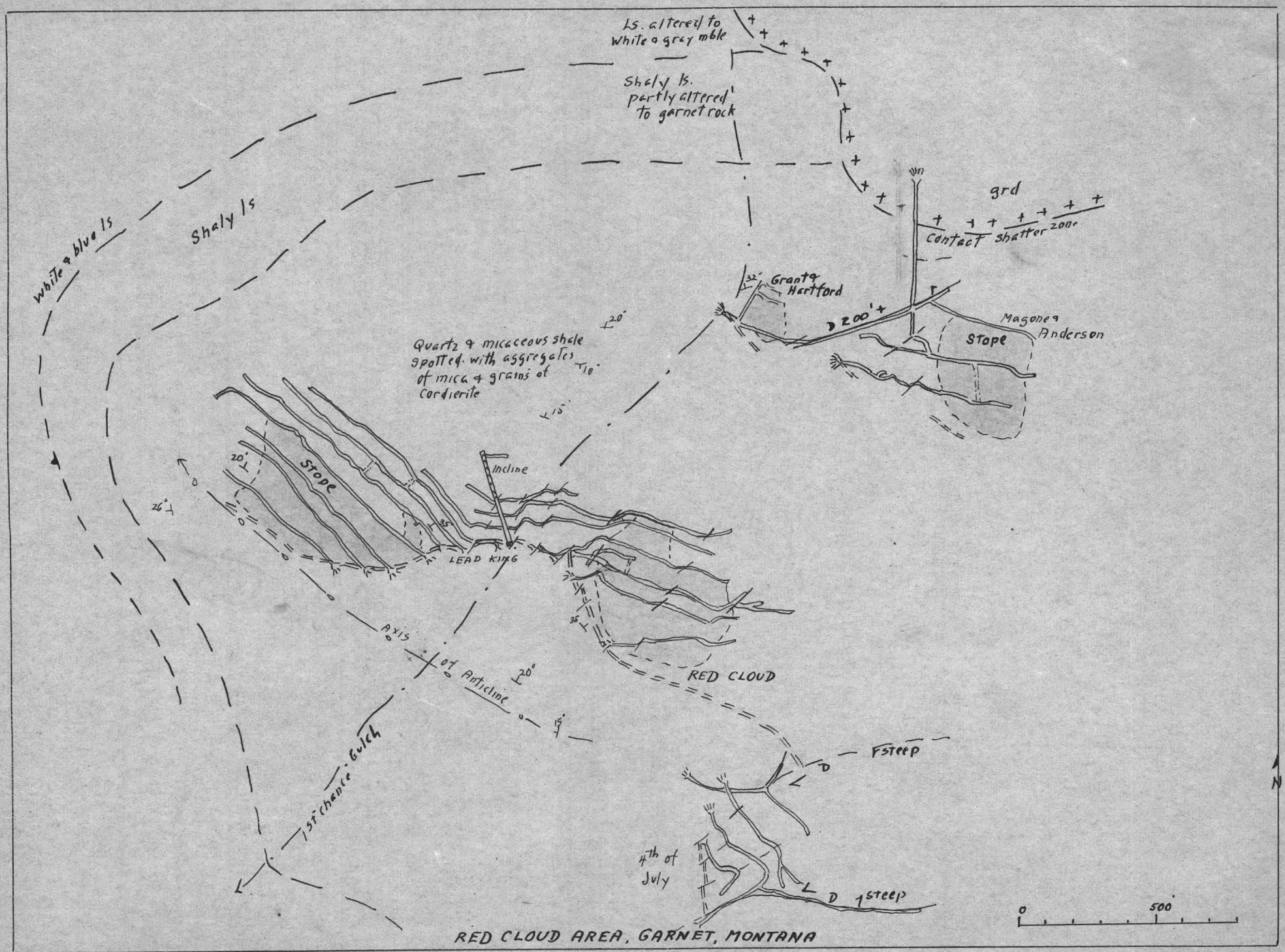
cryst.qtz. Ghost frags.in it. p.218: Pyrite most abundant sulphide;part is moderately coarse and after it deposited "it was broken and penetrated by veinlets of the flinty qtz and the other sulphs.,enargite (arsenical CuS) and famatinite (antimonial CuS). Sulphs so fine ore looks like cloudy-black chalcedony. Ore low-grade,sporadic.

Clinton District

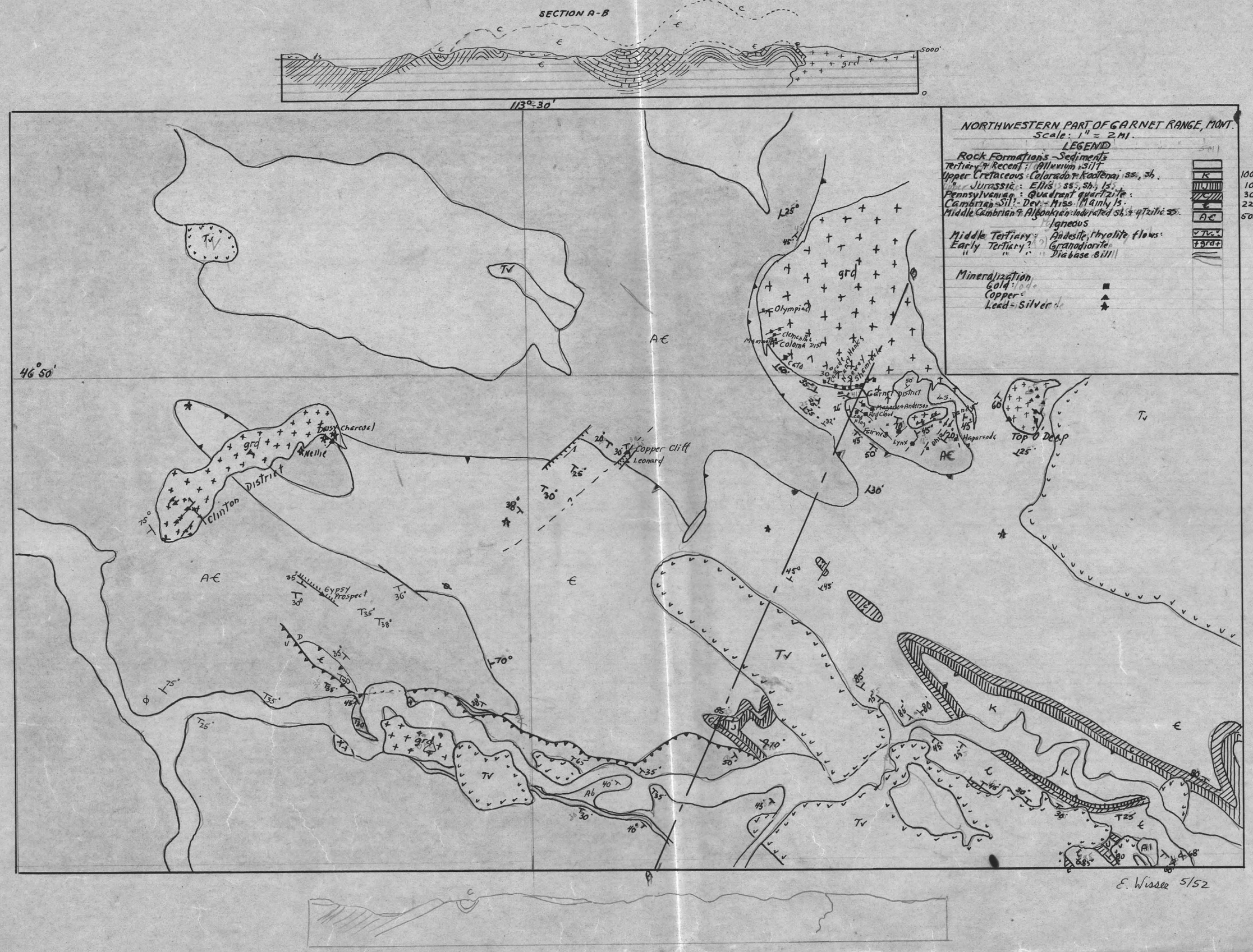
Grd. ex ands downward shown by gulches and ridges. But margin is porphyritic:may be it is a cupola. Qtzite,sh ls. of AG meta:mica in qtzite;sh s.t. to hnst.Ls crystallized,cse mble.500' zone. Crosses sharp NW plinging synlcine which brings G ls against grd. Minor wrinkles on steep limbs of this fold.

Lodes in grd are sheeted zones,width 1-20' plus.N40E,dip steep NW. Ore is where seams are numerous,closely-spaced. These are copper,1.5 60 6%,with $2*$10/ton in Au,Ag.Cccpy,bornite,spec.ankerite calcite.Barite.Bi min.

Lodes in seds,Ag-Pb,ZnS-Gangue calcite,qtz. Galena most abundant in high places,either at to of grd mass or in C.1000' down in intrusion ccpy is most abundant ore mineral,no Pb.



RED CLOUD AREA, GARNET, MONTANA


SECTION A-B
5000'
0
113°-30'
46°50'
NORTHWESTERN PART OF GARNET RANGE, MONT.
Scale: 1" = 2 MI.
LEGEND
Rock Formations - Sediments
Tertiary & Recent: Alluvium, silt
Upper Cretaceous: Colorado & Kootenai ss., sh. 1000'+
Jurassic: Ellis ss., sh., ls. 100'
Pennsylvanian: Quadrant quartzite: 300'
Cambrian Sil.? - Dev. - Miss. Mainly ls. 2200'
Middle Cambrian & Algonkian: Indurated sh. & qtzitic ss. 5000'+
Igneous
Middle Tertiary: Andesite, rhyolite flows:
Early Tertiary? Granodiorite
" " " Diabase sill
Mineralization
Gold:
Copper:
Lead - Silver
Olympiad
Clementine
Coloma Dist.
Cato
Garnet District
Magoda & Anderson
Red Cloud
Fairview
Lynx
Haparanda
Top O Deep
Daisy Charcoal
Nellie
Clinton District
Copper Cliff
Leonard
Gypsy Prospect
grd
Tv
AЄ
Є
K
Ab
Al
E. Wissee 5/52