Labbe Mine, Central Spring Mountains, Clark County, Nevada

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Acknowledgement and Disclaimer

The information in this paper is taken largely from published and public sources. I have reproduced this material and present it pretty much as we found it, not trying to harmonize discrepancies in mine or geologic descriptions. I have changed verb tenses for readability and have used some paraphrase. I have expanded abbreviations or special characters with full text (e.g. feet instead of ft., inches instead of ") Italics indicate quotations. Authors of the original information are indicated at the end of each paragraph. Paragraphs without a citation are our own materials. The maps in this report have been compiled and rectified from digital and paper copies of original sources that were made at different scales and in different geographic projections. Therefore, many of the maps had to be adjusted or stretched. They do not fit perfectly. Most are accurate to within 100 feet, but reproduction and projection errors can be as much as 300 feet for some maps. PLSS means Public Land Survey System. That survey data was obtained from the U.S. Bureau of Land Management website.

MRDS, 2011, Mineral Resources Data System, U.S. Geological Survey, https://mrdata.usgs.gov/mrds/. This database relies on records that, in many cases, are inaccurate or imprecise. For example, if a report describes a mine as being in "Section 9", with no other information, MRDS plots the mine location in the center of the section. If a mine is reported in "SW ¼" of a section, MRDS plots the mine in the center of that SW quarter-section. Where I could confidently adjust a MRDS location of a mineral deposit to features identifiable in aerial photographs or topographic maps, I did so.

Help me make this report better. If you have any photographs, memories or reports for this mine that you can share, please send them to yosoygeologo@gmail.com so that I can incorporate that information and material into this paper.

LOCATION (MRDS, 2011)

T.17S R.53E Sec 30	36.45248	-116.0583
T.17S R.53E Sec 30	36.45248	-116.0583

The Labbe Mine is in the Johnnie mining district which is located on the north-west flank of the Spring Mountains, 3 miles northeast of Johnnie in T. 17 S., R. 53 E. It is the second largest gold-producing district in southern Nye County (Cornwall, 1972:38).

Wheeler (1872) included the Johnnie area in his large Timber Mountain district which also included the Charleston district (Tingley, 1998).
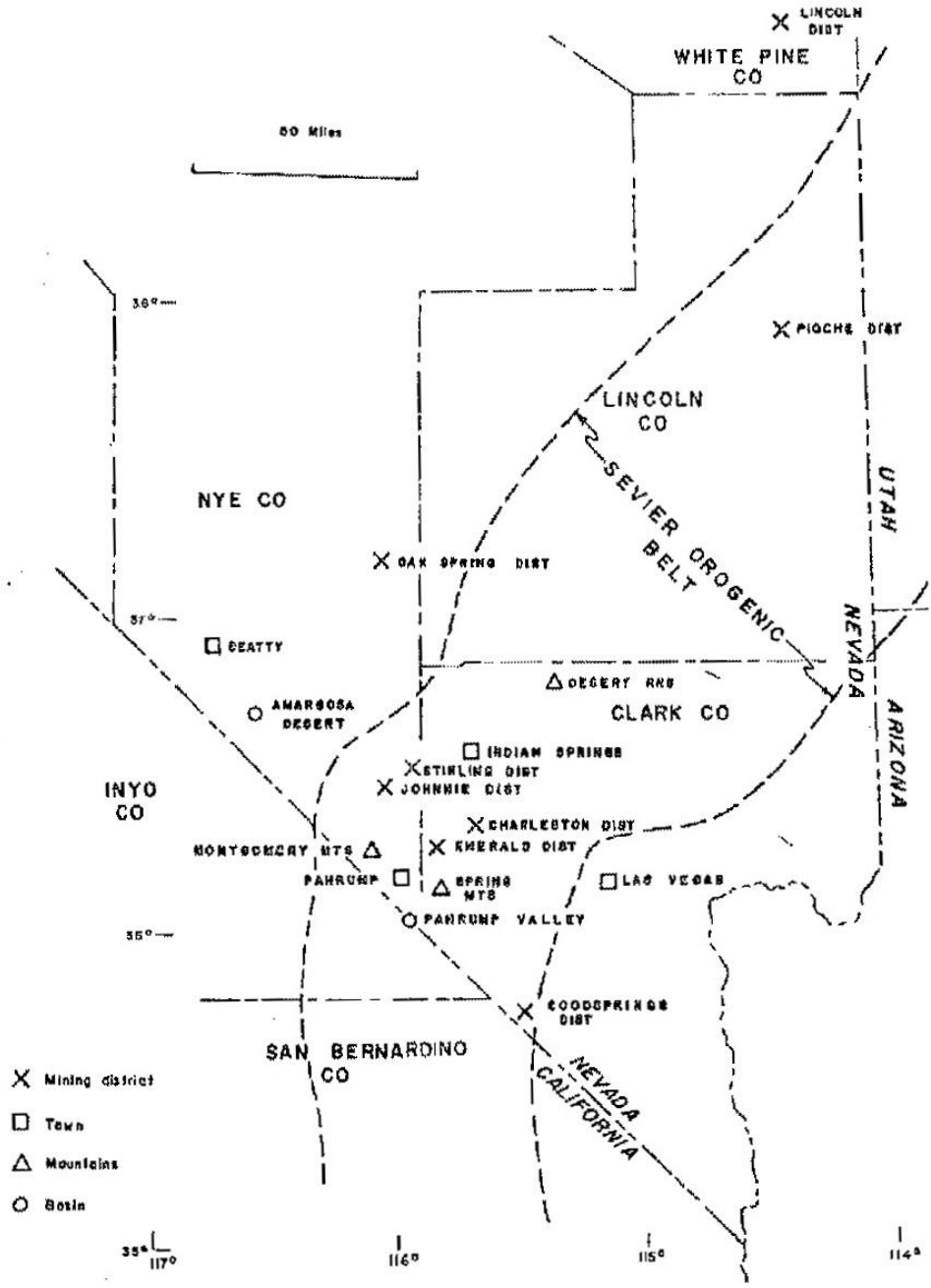
Figure 1. Index map of southern Nevada and adjacent areas showing
locations of areas discussed in this report. Position of
Sevier orogenic belt after Armstrong (1968) and Fleck (1970).

Figure 1. Location map of the mines in the Sevier Orogenic Belt. From Ivosivic,. 1976, p. 2. Open source for educational purposes. No copyright.

PREVIOUS NAMES

HISTORY AND OWNERSHIP

*Charles H. Labbe acquired the Labbe mine from the Bullfrog-Johnnie Mining Company in 1910 and sold it to George E. Warner, the present owner, in 1964. There are no records of production from this gold property, but apparently production was small (*Ivosevic, 1976:74)

The [Johnnie District] deposit *is reported to have been discovered in 1890* (Cornwall, 1972:38).

The early history of the Labbe Mining property (pl. 2) is unclear. The original claims, Bluebell, Golden Eagle, Primero, Howitzer, and Annam, apparently were located in 1902 and 1903. These were sold by the Bullfrog-Johnnie Mining Company to Charles H. Labbe in 1910. Labbe amended and renamed the claims, respectively, the Broadway, Doris A. L., Westend, Hillside, and Digman' in 1926 and patented all but the Digmore in 1928. Subsequently, he added the Marge and Reef claims to the group. George E. Warner acquired the property from Labbe in 1964 and added the David and Dyke claims to the group. (See pl. 2.) (Isosevic, 1976:179).

There is no record of the history of the development of the Labbe mining property. The 1928 plat of the patent survey indicates that the Broadway, Doris, and Bluebell mines were in existence by that time. The open cut on the Westend claim is a relatively recent development (Isosevic, 1976:179).

Sometime between 1923 (Lincoln, 1923) and 1940 (Hott, 1940) a ten stamp mill, which is operable presently, was installed on the property. Lincoln (1923) mentions a two-stamp mill installed and operated by a Eureka-Johnnie concern in 1917-1919, and this may be another mill which is present also on the Labbe property. It is not certain with which property the latter mill was associated at the time (Isosevic, 1976:179).

REGIONAL GEOLOGY

The regional geology of the central Spring Mountains is described in the overview paper for this report series. It can be accessed at

http://www.greggwilkerson.com/uploads/1/0/6/5/106585235/geology_and_mining_history_of_the_central_spring_mountains.pdf

STRATIGRAPHY

The host rock at the Labb Mine is Cambrian or Proterozoic Wood Canyon Formation.

Icosevic's 1976 stratigraphic tables for the Labbe District are reproduced from the Nevada Bureau of Mines and Geology website below:

Table 1. Stratigraphic units present in the Johnnie district showing, in parentheses, subdivisions recognized by Stewart (1966, 1970).

Age	Name	Thickness (feet)	Character
Holocene	Alluvium	0-20 ± (0-6 m)	Colluvium, talus, stream bedloads
Late Pleistocene to Holocene	Younger fanglomerate	0-100 + (0-30 m)	Inactive alluvial fans of compact sand and gravel
Late Pliocene to Middle Pleistocene	Older fanglomerate	0-200 + (0-60 m)	Dissected, consolidated to caliche-cemented sandy gravel; includes a 50'-thick unit of volcanic sediments
	Megabreccia unit	300 ± (90 m)	Tabular body of slabs of upper unit of Wood Canyon Formation, quartz-veined Zabriskie Quartzite, and lower part of Carrara Formation
	Unconformity		
Middle Cambrian	Papoose Lake member (Bonanza King Formation)	1,200 ± (365 m)	Massive dolomite with lamellar texture
Early and Middle Cambrian	Carrara Formation	700-1,300 (210-400 m)	Thin- to medium-bedded shaly rocks near base; thick-bedded limestone predominates near top
Early Cambrian	Zabriskie Quartzite	115-240 (35-73 m)	Medium-bedded to massive quartzite

Table 1. (continued)

Age	Formation	Member/Unit	Thickness	Description
Late Precambrian and Early Cambrian	Wood Canyon Formation	Dolomite bearing unit (upper member, in part)	175–310 (53–94 m)	Medium-bedded dolomite and thin-bedded quartzite and siltstone
		Lower unit (lower member; middle member; upper member, in part)	1,680 (510 m)	Medium-bedded quartzite and siltstone with some dolomite
Late Precambrian	Stirling Quartzite	Upper unit (C member; D member; E member)	2,160 (659 m)	Medium-bedded quartzite and dolomitic quartzite; shale at base; thick, massive quartzite near top
		Lower unit (A member; B member)	2,080 (634 m)	Medium-bedded to massive quartzite; thick, massive unit near base
	Johnnie Formation	Upper unit (middle unit, in part; Rainstorm Member)	850–1,300 (260–395 m)	Thin- to medium-bedded shale and quartzite with several layers of brown-weathering dolomite and dolomitic quartzite
		Lower unit (lower unit; middle unit, in part) – base not exposed	2,900– 3,300 (800– 1002 m)	Medium- to thick-bedded shale and quartzite; layer of gray dolomite 650' below top

DISTRICT GEOLOGY

[In the Johnnie District] *the gold occurs in prominent and persistent quartz veins along faults in sandstone, shale, and limestone of the Wood Canyon and Carrara Formations. The largest ore shoots are in the Johnnie mine, where the vein follows a fault between the two formations. The Overfield mine, adjoining the Johnnie mine on the southwest, has a vein that strikes N. 45 ° E., dips 60 ° SE., and may join or be a continuation of the Johnnie vein. This property has no recorded production. The Labbe mine is located 1 mile southwest of the Johnnie mine, also on a vein near or along the Carrara-Zabriskie contact but separated from the block containing the Johnnie mine by a cross fault with an apparent right-lateral horizontal displacement of more than half a mile. Kral (1951, p. 89) reports that no production has been recorded, but surface workings indicate much stoping* (Corwall, 1972:38).

Stanley Wayne Ivosevic's abstract for the Jonnie District is reproduced below:

The Johnnie district, in the northeastern Spring Mountains, Nye County, Nevada, may have produced a little under 100,000 troy oz of gold, since the discovery of the district in 1890 (Ivosevic, 1976, p. ii).

An approximately 13,000-ft-thick (4,000 m) section of east dipping upper Precambrian through Middle Cambrian miogeosynclinal clastic and carbonate rocks is exposed in the district. The strata are, in order of decreasing age, the Labbe Formation, Stirling Quartzite, Wood Canyon Formation, Zabriskie Quartzite, and Carrara and Bonanza King Formations. These are overlain by Cenozoic units which include an older unit and a younger unit of fanglomerate, the older containing a megabreccia deposit, and Quaternary alluvium (Ivosevic, 1976, p. ii).

The rocks were deformed by the Late Cretaceous Sevier orogeny and by subsequent tectonic events, which include Basin-and-Range faulting, of Miocene age, The oldest structures, formed in conjunction with Sevier tectonism, are disharmonic folds in the Johnnie Formation, which folds underwent rotation by later (Sevier orogeny) eastward tilting of the district during larger scale folding. Simultaneously with the later folding, competent rocks were translated across less competent ones along zones of tectonic readjustment; the most notable zone is at the top of the Johnnie Formation in the western part of the district. High-angle fractures--in extension, conjugate, and pressure-release orientations--developed at about the same time and were the ancestors for most younger high-angle structures, including quartz veins (Ivosevic, 1976, p. ii,iii).

Longitudinal faulting occurred at the end of the Sevier orogeny; and concurrently, the related Congress low-angle normal fault developed. The district was dropped down to the west along the Grapevine fault system during Basin-and-Range normal faulting at the west face of the Spring Mountains. Throughout the structural development of the district, displacement occurred along transverse faults in secondary readjustment to displacement along other features and also low-angle faults transposed younger rocks across older ones (Ivosevic, 1976, p. iii).

Some of the tectonism caused local carbonatization of the Bonanza King Formation (Ivosevic, 1976, p. iii).

The district was eroded in a series of stages during Basin-and-Range faulting. Finally, sometime between latest Miocene to middle Pleistocene times, pediments developed at the edges. of the resultant basins, then were buried by bajadas of older fanglomerate. Later, parts of the pediments were exhumed by erosion (Ivosevic, 1976, p. iii).

High-angle and concordant quartz-bearing structures were emplaced during hydrothermal activity, probably between the Paleocene and early Miocene epochs High-angle quartz veins, the average of which strikes ENE and dips north, dominate and are the hosts for most economic, mesothermal mineralization in the district. Three ore mineralogic suites ·are present: gold-chalcopyrite-pyrite, chalcopyrite-galena, and galena-calcite. Additionally, chalcopyrite occurs with specularite in stratabound quartz-poor lodes of apparent hydrothermal origin; these oxidize to low-grade malachite deposits. Placer gold deposits formed in the older fanglomerate during post Basin-and-Range faulting erosion of the district. The characteristic wall-rock alteration mineralogic suites in the hypogene deposits are sericite and pyrite in clastic rocks and also sericite, alone, in dolomite; the alteration minerals, chlorite, calcite, and specularite, occur locally. The ore mineralogic suites define a district-wide pattern of hypogene mineralogic zonation about gold centers at the Johnnie and Congress mines, the main producers in the district (Ivosevic, 1976, p. iii,iv).

The fundamental control which admitted the hydrothermal fluids into the district is obscure. However, trains of quartz veins are concentrated within 2.5-mi-long (4 km), ENE-trending principal mineralized structures which lie astride an inferred 13-mile·long (21 km) N.-35°-E. trending major longitudinal structure, which may be a manifestation of the fundamental control. The gold mineralization is localized in the Zabriskie Quartzite and the dolomitic rocks near the top of the Wood Canyon Formation, in part, by the retention of hydrothermal fluids beneath a blanket of shaly rocks at the base of the Carrara Formation. The base of the dolomitic rocks is also the base of the Cambrian section, which is recognized as a favorable stratigraphic site for ore deposition at other places in the southern Great Basin (Ivosevic, 1976, p. iv).

Although this report develops a theme in which the hydrothermal fluids were introduced from a remote source below the district, as the broad concepts of ore genesis change with time, it may become accepted that many of the constituents of the hydrothermal fluid were derived from local, syngenetic sources (Ivosevic, 1976, p. iv).

The gold [in the Johnnie District] *occurs in prominent and persistent quartz veins along faults in sandstone, shale, and limestone of the Wood Canyon and Carrara Formations. The largest ore shoots are in the Labbe mine, where the vein follows a fault between the two formations* (Cornwall, 1972:38).

MINE GEOLOGY

The Labbe mine is located 1 mile southwest of the Johnnie mine, also on a vein near or along the Carrara-Zabriskie contact but separated from the block containing the Labbe mine by a cross fault with an apparent right-lateral horizontal displacement of more than half a mile. Kral (1951, p. 89) reports that no production has been recorded, but surface workings indicate much stoping (Cornwall, 1972:38).
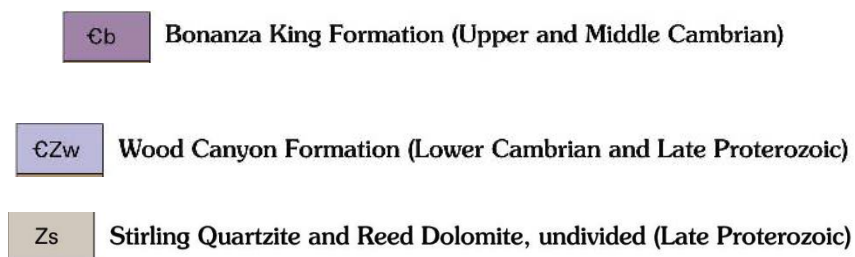
MAPPING

1:250,000

Workman and others (2002) mapped the area of the Labbe mine as being in a block of Cambrian and Proterozoic Wood Canyon Formation. This block is between two north-trending high angle faults. To the north and west of this block is Proterozoic Stirling Quartzite and Reed Dolomite (Zs). To the east of the block is Cambrian Bonanza King Formation (Єb).

Figure 2. Portion of geologic map by Workman and others, 2022. Open source for educational purposes. No copyright.

| Єb | Bonanza King Formation (Upper and Middle Cambrian) |

| ЄZw | Wood Canyon Formation (Lower Cambrian and Late Proterozoic) |

| Zs | Stirling Quartzite and Reed Dolomite, undivided (Late Proterozoic) |

1:100,000

Cornwall (1972) mapped the area of the Labbe mine as Cambrian Wood Canyon Formation at a point where a north-west trending fault meets a east-west trending one. To the north of the mine is PreCambrian Sterling Quartzite. To the east is Cambrian Bonanza King Formation and Cambrian Carrara Formation
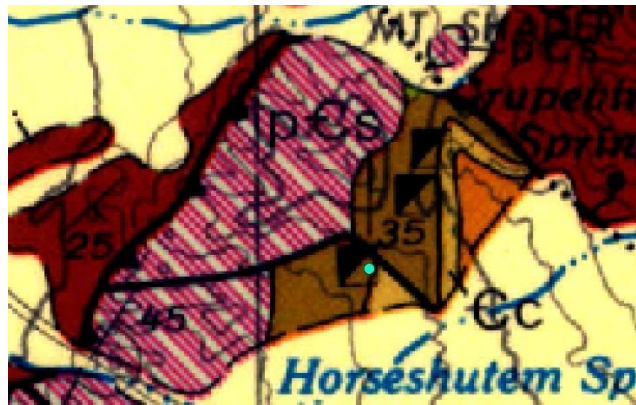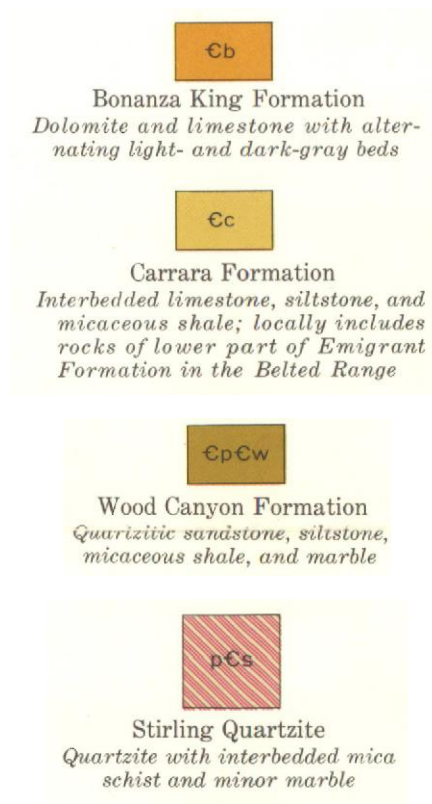
Figure 3. Portion of geologic map by Corwall, 1972. Open source for educational purposes. No copyright.

Bonanza King Formation
*Dolomite and limestone with alter-
nating light- and dark-gray beds*

Carrara Formation
*Interbedded limestone, siltstone, and
micaceous shale; locally includes
rocks of lower part of Emigrant
Formation in the Belted Range*

Wood Canyon Formation
*Quartzitic sandstone, siltstone,
micaceous shale, and marble*

Stirling Quartzite
*Quartzite with interbedded mica
schist and minor marble*

1:24,000

Ivosevic (1976) mapped the area of the Labbe mine as Cambrian Upper Wood Canyon Formation (Єwu), PreCambrian Lower Wood Canyon Formation (pЄwl) and Cambrian Zabrinski Quartzite (Єz).
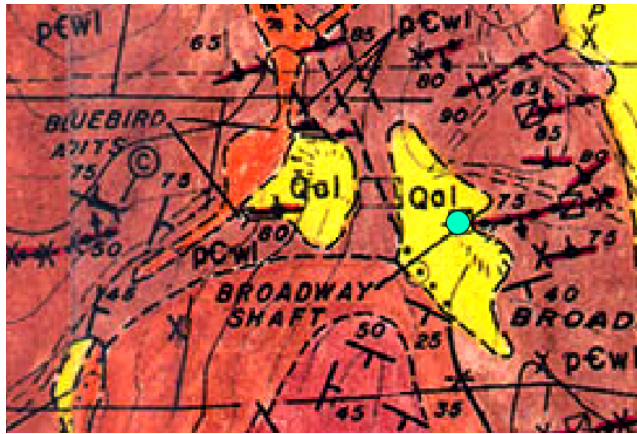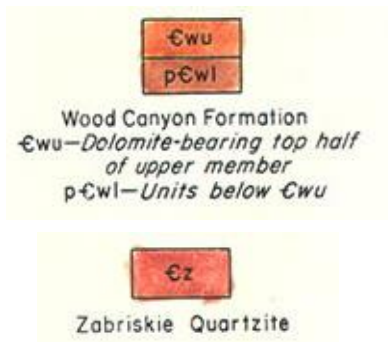
Figure 4. Portion of geologic map by Ivosevic, 1976. Open source for educational purposes. No copyright.

Wood Canyon Formation
€wu—*Dolomite-bearing top half
of upper member*
p€wl—*Units below €wu*

Zabriskie Quartzite

STRUCTURE

The Labb Mine occurs in Cambrian-Proterozoic Wood Canyon Formation at a point where a north-west trending fault meets a east-west trending one.

Ivosevic's `1976 structural maps and cross sections for the Johnnie District are reproduced below:
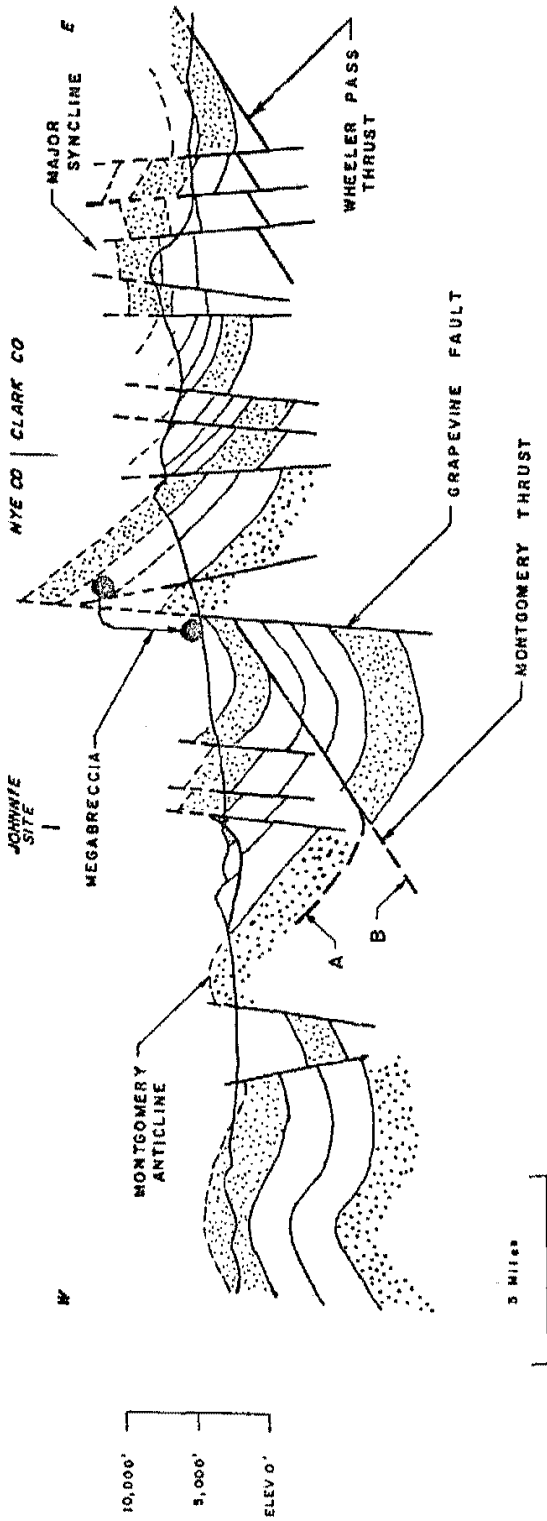
Figure 3. Geologic section — locally diagrammatic — through northwestern Spring Mountains along 18th parallel S., M. D. B. & M. showing large-scale folding, some possible thrust relations (A and B) beneath the Johnnie district, and probable origin of megabreccia deposit. Heavy stipple -- Johnnie Formation; light stipple -- Bonanza King Formation and younger Cambrian rocks. Compiled from Longwell and others (1965), Hamil (1966), Cornwall (1972), and mapping, this report.

Figure 5. . Geologic section through the Spring Mountains (Ivosevic, 1972). Open source for educational purposes. No copyright.
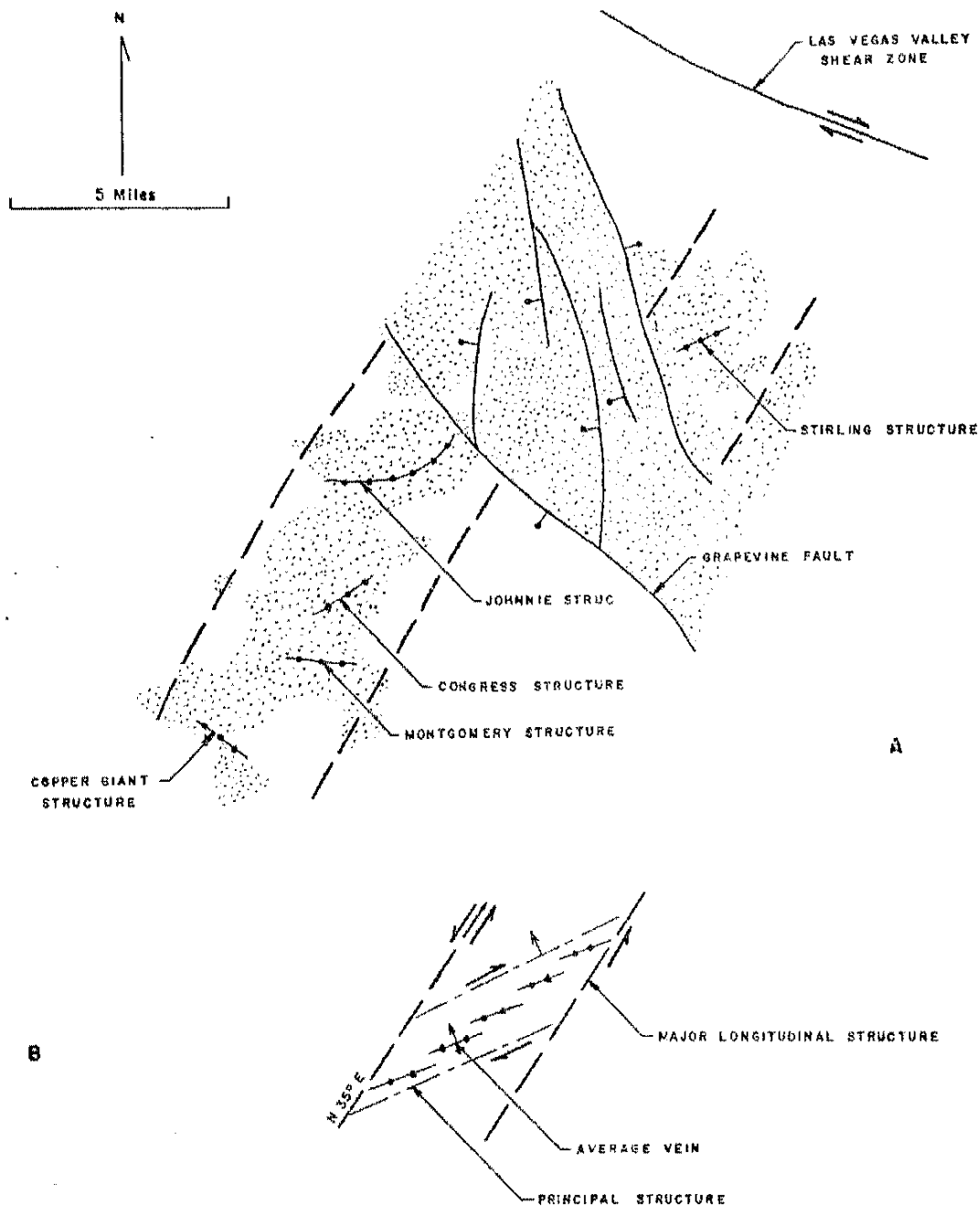
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Figure 20. (A) Map of principal structures, showing inferred offset
of major longitudinal structure (broken line). Faults from
Cornwall (1972, pl. 1); ball on downthrown side. (B) Diagram
illustrating relations among mineral localizing structures,
showing inferred directions of strike separation.

Outcrop areas in (A) stippled.

Figure 6. Map of principal structures. From Ivosevic, 1976, p. 119. Open source for educational purposes. No copyright.

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MINERALOGY

Additionally, chalcopyrite occurs with specularite in stratabound quartz-poor lodes of apparent hydrothermal origin; these oxidize to low-grade malachite deposits. Placer gold deposits formed in the older fanglomerate during post Basin-and-Range faulting erosion of the district (Ivosevic, 1976, p. iii).

Ivosevic's mineralogical paragenesis interpretation for the Johnnie District is reproduced from the Nevada Bureau of Mines and Geology website below:

EVENT	MINERAL	SEQUENCE OF DEPOSITION
WALL-ROCK ALTERATION	Sericite Pyrite (cubic) Specularite Chlorite Calcite	
QUARTZ VEINING	Quartz	
METALLIZATION	Chalcopyrite Galena Pyrite (pyritohedral) Gold	

Figure 15. Paragenesis of hypogene ore deposits in the Johnnie district.

Figure 7. Paragenesis chart. From Ivosevic, 1976, p. 84. Open source for educational purposes. No copyright
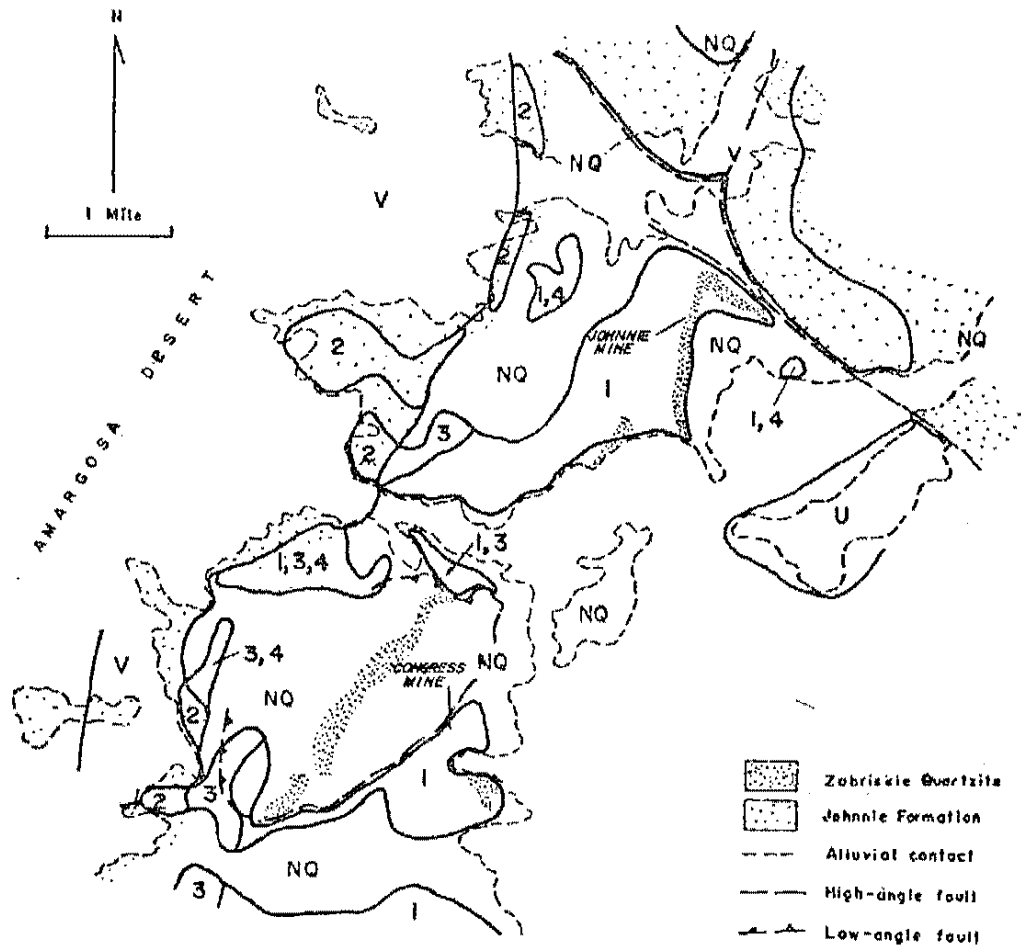
Figure 16. Map showing areas of hydrothermal activity and
distribution of types of quartz-bearing structures in the
Johnnie district.

1-4, outcrop areas of quartz-bearing structures: (1) high-angle
quartz veins; (2) concordant quartz veins; (3) concordant quartz
stringer lodes; (4) concordant quartz-poor lodes.

V, area of small outcrops containing numerous quartz veinlets.

U, allochtonous megabreccia deposit; type of quartz-bearing
structure not classified.
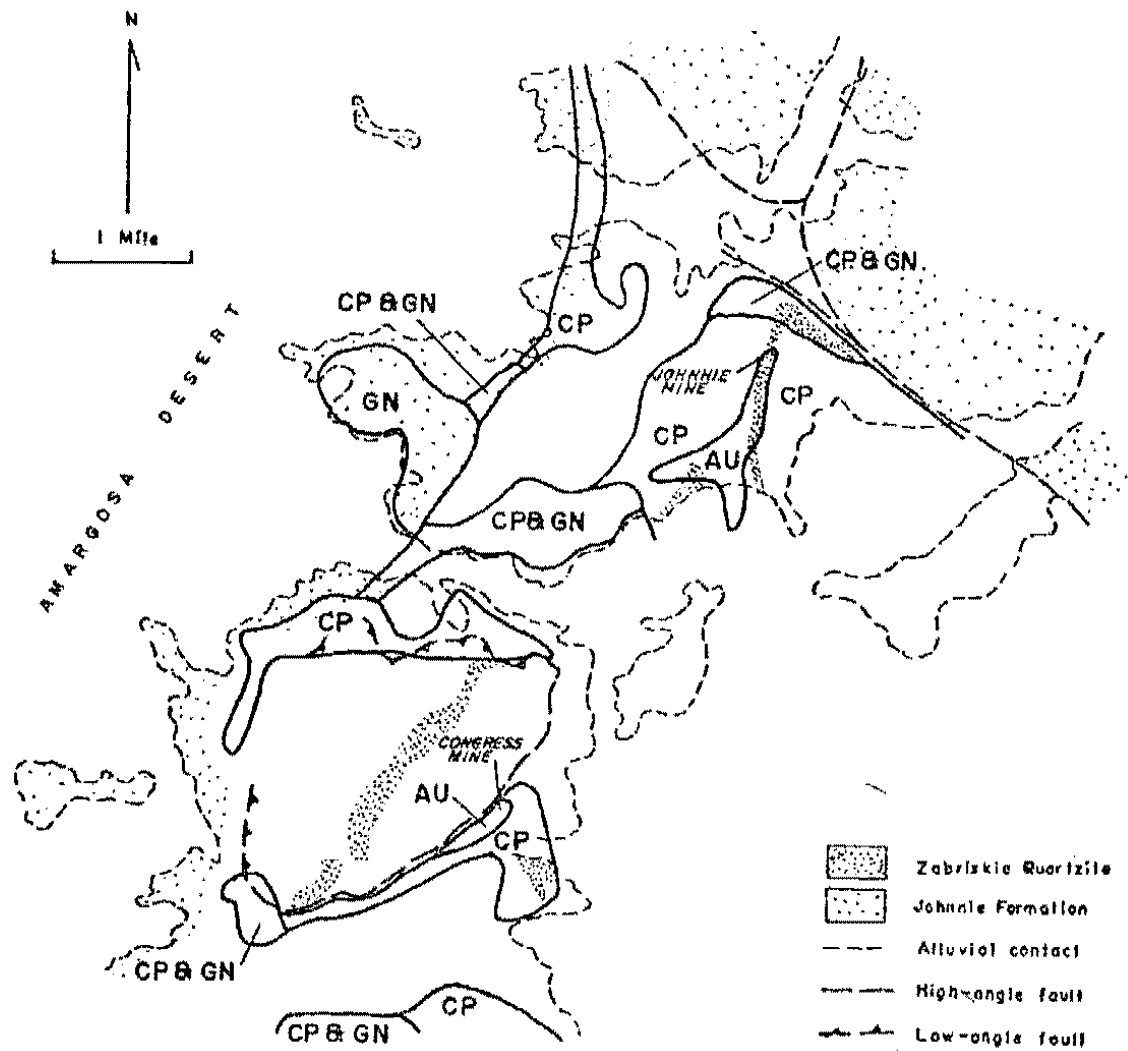
NQ, areas essentially devoid of quartz-bearing structures.

Figure 8. Map of hydrothermal activity. From Ivosevic, 1976, p. 89. Open source for educational purposes. No copyright

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Figure 17. Map showing distribution of hydrothermal minerals in the Johnnie district, literally portraying areas in which ore minerals occur and locally showing general regions in which some gangue minerals occur (chlorite east of Grapevine fault; calcite in southwest part of district). Sub-zones with characteristic gangue minerals shown in parentheses.

Au-Cp-Py, gold-chalcopyrite-pyrite; Cp, chalcopyrite; Cp-Gn, chalcopyrite with subordinate galena; Gn-Cp, galena with subordinate chalcopyrite; Gn-mCp, galena with minor chalcopyrite; Gn, galena; Sp, specularite; Py, pyrite; Cal, calcite; Chl, chlorite; B, area of barren quartz veins.

(©), malachite deposit or group of closely spaced malachite deposits.

Based upon data from approximately 210 locations.

Figure 9. Mineralogic distribution map. From Ivosevic, 1976, p. 93. Open source for educational purposes. No copyright.

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Figure 18. Map showing restricted interpretation of hypogene
mineralogic zonation in the Johnnie district.

Au, gold zone; Cp, chalcopyrite zone; Cp and Gn, chalcopyrite-
galena zone; Gn, galena zone.

Figure 10. Mineralogic zonation. From Ivosevic, 1976, p. 112. Open source for educational purposes. No copyright.
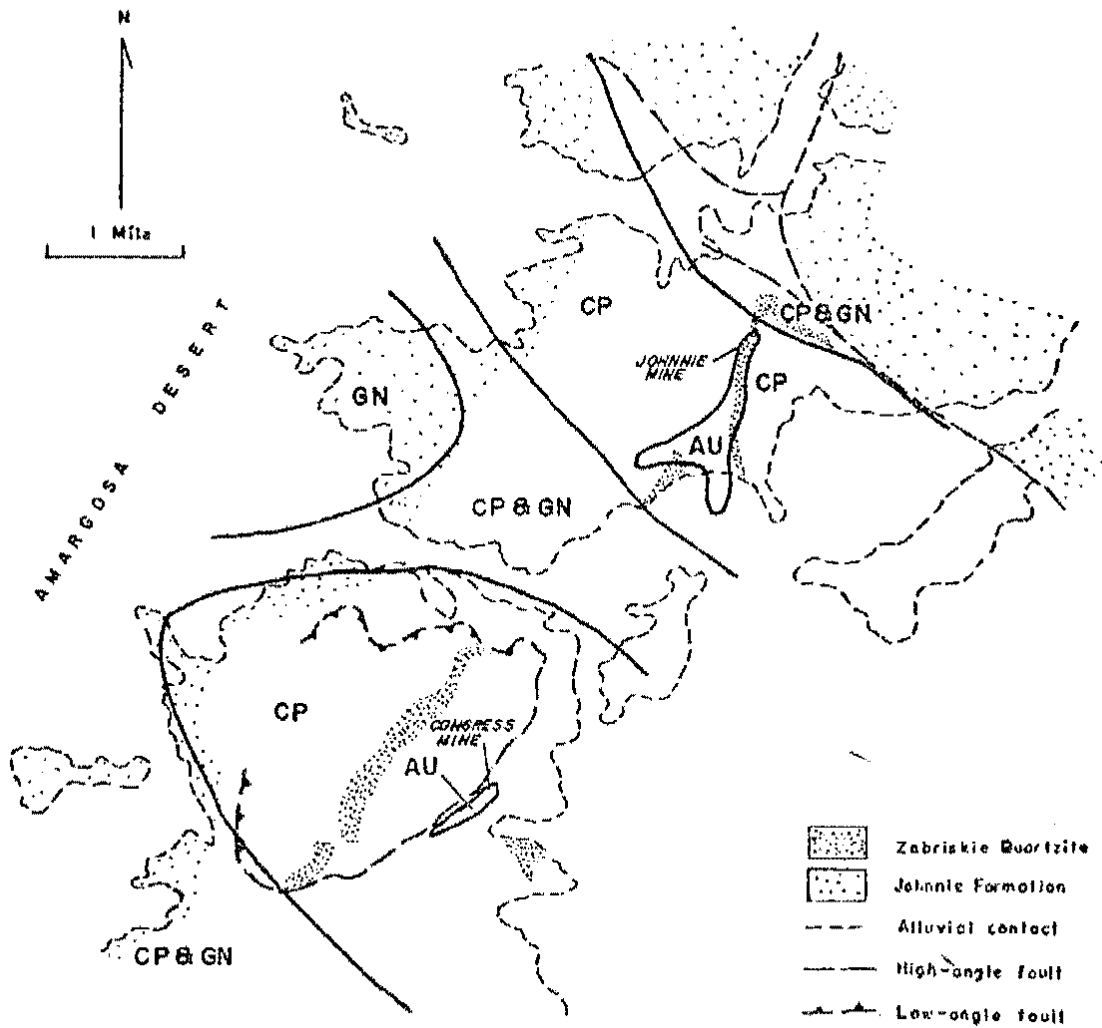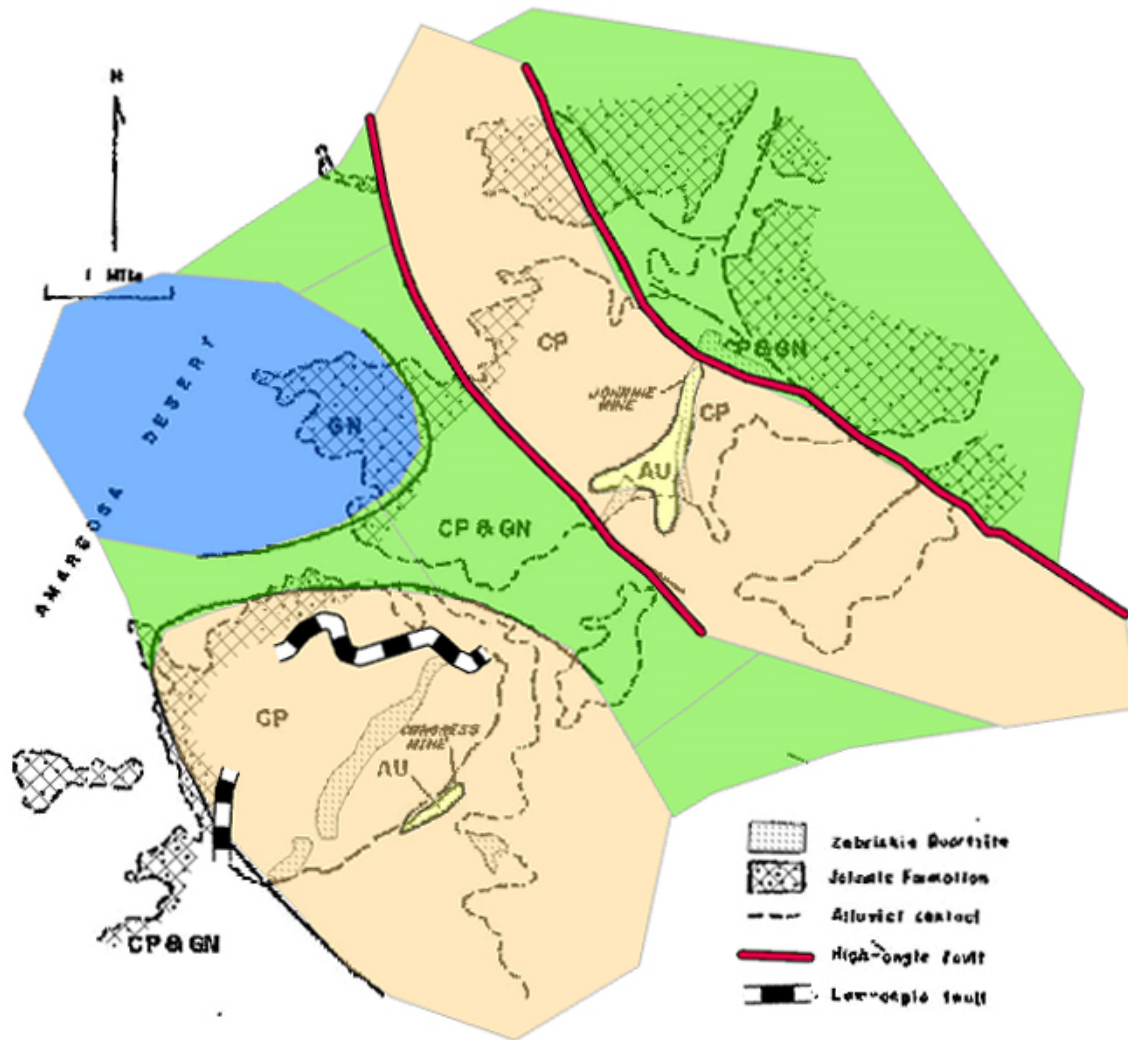
Figure 19. Map showing broad interpretation of hypogene mineralogic zonation in the Johnnie district.

Au, gold zone; Cp, chalcopyrite zone; Cp and Gn, chalcopyrite-galena zone; Gn, galena zone.

Figure 11. Generalized map of mineralogic zonation. From Ivosevic, 1976, p. 114. Open source for educational purposes. No copyright.

Figure 19. Map showing broad interpretation of hypogene mineralogic zonation in the Johnnie district.

Au, gold zone; Cp, chalcopyrite zone; Cp and Gn, chalcopyrite-galena zone; Gn, galena zone.

Figure 12. Modified from Ivosevic, 1976, p. 114. This map shows that high grade gold mineralization is associated with chalcopyrite. Open source for educational purposes. No copyright.

ALTERATION

The main wall-rock alteration products [In the Johnnie District] *are widely distributed sericite and pyrite. Locally, specularite, chlorite, and calcite occur as alteration products or as cogenetic gangue minerals in uncommon host rocks whose original mineralogies*

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[sic] furnished the reactants necessary to produce these three products. This permits the further subdivision of the hypogene mineralogic zones on the basis of gangue mineralogy. Thus, the chalcopyritic lodes, apparently inherent to the ferruginous parts of the Stirling Quartzite, include specularite.; and the major galena-quartz veins, simultaneously falling in the galena zone and the dolomitic upper part of the Johnnie Formation, characteristically contain calcite (Ivosevic, 1976:71).

Wall-rock alteration, at temperatures below 200"C, added hydrogen, potassium, aluminum, iron, and sulfur to the rocks; and CO_2, sodium, magnesium, and calcium were released to the hydrothermal fluid. Quartz veining removed silica from the fluid; and metallization, at temperatures around 250°C, required the addition of gold, copper, lead, iron, and sulfur, from the hydrothermal fluid (Ivosevic, 1976:72).

ORIGIN

The main gold-chalcopyrite-pyrite-quartz veins and most other prominent veins in the [Johnnie] district are localized in the Zabriskie Quartzite and underlying dolomitic rocks near the top of the Wood Canyon Formation. This was caused by a combination of mechanical and chemical qualities intrinsic to these rocks and by ponding of hydrothermal fluids beneath an impermeable blanket of sericitized shale gouge at the base of the Carrara Formation above the Zabriskie Quartzite. Significantly, correlative rocks, at the presently recognized base of the Cambrian section, host important ore deposits in other mining districts in the southern Great Basin (Ivosevic, 1976:71-72).

Quartz veins and most other quartz-bearing structures in the Johnnie district are in trains within ENE-trending, north-dipping principal mineralized structures into which were funneled, through a series of other structures, hydrothermal fluids ascending from depth. These principal mineralized structures, four--or possibly five--in number, are aligned within a 15-mi-long (24 km) inferred major longitudinal structure, which trends N. 35° E. and also dips north. The major longitudinal structure, if real, is probably the surface .. expression of the fundamental control which guided heat and, maybe, metal-bearing hydrothermal fluids into the area to localize the Johnnie district (Ivosevic, 1976:72).

The hydrothermal fluids may have originated from lower crust or upper mantle sources or were derived from interstitial connate brines in the miogeosynclinal rocks in or below the district. In either case, the metals in the fluids then could have been leached from the miogeosynclinal rocks transgressed by the fluids (Ivosevic, 1976:72).

The term "fissure" is used hereforward as a convenience in discussing various aspects of quartz-bearing structures. I do not believe that open voids, as such, existed at any time. Widening of the fissures…was accompanied simultaneously by filling by quartz (Ivosevic, 1976:72).

The chalcopyritic precursors of the malachite deposits developed in concordant quartz-poor lodes in porous host rocks in areas where quartz veins are thin and sparsely

distributed and possibly were under compression at the time of chalcopyrite mineralization. This deprived the copper-bearing hydrothermal fluids of established conduits of migration and of dilatant fractures in quartz veins for the precipitation of chalcopyrite. The relatively porous coarser grained, lightcolored (hence, pure) quartzites in both the Stirling Quartzite and the Wood Canyon Formation offered suitable alternative conduits for the passage of hydrothermal fluids, favoring formation of quartz-poor lodes rather than quartz veins. These quartzites are porous because they contain many interstitial spaces incompletely filled with diagenetic quartz overgrowths and lack closely packed shaly matrix minerals (Ivosevic, 1976:104).

Therefore, quartz-poor chalcopyritic lodes developed in preference to the chalcopyrite-quartz veins which are the characteristic hosts for copper mineralization in the rest of the Johnnie district. The chalcopyritic lodes in the area south of Route 16 facing the Amargosa Desert are transitional northward along strike into the more typical quartz vein type of deposit (Ivosevic, 1976:104).

The most prominent malachite deposits occur in beds within the B member of the Stirling Quartzite throughout an interval which also contains most of the specularite-quartz veins in the district. The deposition of the specularite, as well as sericite, as wall-rock alteration products were doubtlessly triggered by the passage of the hydrothermal fluid through local iron-rich, dark-colored shaly quartzite beds in the B member. Analyses show that these rocks normally contain an average of 3 percent iron, 100 times more than do the light-colored quartzites nearby (Ivosevic, 1976:104-105).

Significant amounts of pyrite are lacking from the areas where malachite lodes occur; but, pyrite is present as a wall-rock alteration product in the specularite-bearing quartz stringer lodes and quartz veins in two areas where chalcopyrite is absent (fig. 17)…. Consequently malachite was precipitated near its hypogene source; because, during supergene leaching, the absence of pyrite in the chalcopyrite lodes inhibited the production of excess sulfuric acid required to disperse the dissolved copper (Ivosevic, 1976:105).

The role of sericite in malachite precipitation was not clarified during this study. The sericite-filled fractures in the host rocks of the malachite lodes in the Stirling Quartzite provided porous conduits for the migration of supergene solutions and may have provided free surfaces for the deposition of malachite. In 'addition, possible reaction of the copper laden supergene solutions with the surfaces of the sericite grains may have facilitated the nucleation of malachite crystals there in preference to the apparently less reactive surfaces of quartz grains. A reaction on the surfaces of minerals of sericitic affinity is suggested in the apparent preferential deposition of malachite on shaly rocks elsewhere in the stratigraphic section (Ivosevic, 1976:105).

These deposits are intriguing, because three observations suggest that they are syngenetic, bedded copper deposits rather than being epigenetic as has been implied so far: (1) the deposits are concordant; (2) most are apparently confined to a single stratigraphic interval within the basal clastic series of a stratigraphic assemblage; and

(3) they are widespread laterally throughout that interval. From personal observations and discussion, I know or infer that similar deposits are situated on the Copper Giant property (Appendix D; fig. 2), in the Stirling district (figs. 1 and 2), and maybe elsewhere in the region. At least some of the similar deposits are in the same stratigraphic interval (Ivosevic, 1976:106).

Bedded copper sulfide deposits with affiliated iron oxides occur in Idaho, Montana, and British Columbia (Wedow, 1975) in the Belt-Purcell Supergroup (McGill, 1970) of younger Precambrian age (Obradovich and Peterman, 1968). The Belt-Purcell Supergroup is a lowest or, pre-, miogeosynclinal sequence of sedimentary rocks, which is stratigraphically equivalent to the pre-Johnnie Formation sedimentary rocks in southern Nevada and southern California (Crittenden and others, 1971) (Ivosevic , 1976:106).

The syngenetic appearance of the chalcopyritic lodes in the Johnnie district may be misleading. The stratigraphic restriction of these may have resulted from the presence of iron required for the hydrothermal formation of the specularite which is allied with the chalcopyrite and from the presence of the apparently unique local imbalance between fracture dilatancy and rock porosity, which imbalance was conducive to the formation of quartz-poor lodes. The diverse mineralogic and morphologic types of ore deposits in the Johnnie district are united by their mutual commonality of origin. To ascribe a syngenetic, hence uncommon, origin to a particular type of deposit is a departure from the rationale of unity, which departure further argues against there being syngenetic deposits here (Ivosevic, 1976:106-107).

The possibility is broached in later sections that the ore deposits in the Johnnie district originated by a combination of syngenetic and epigenetic events. So, it may be that the chalcopyritic lodes are syngenetic deposits modified by later hydrothermal activity (Ivosevic, 1976:107).

Summary of Ore Genesis

Hydrothermal activity and attendant ore deposition occurred in the Johnnie district during early to middle Tertiary times after the structural preparation of the area by the Late Cretaceous Sevier orogeny and subsequent tectonism of lesser magnitude. The subsequent tectonism included inception of movement on the ancestral Grapevine fault system. After hydrothermal activity, the district was disturbed by Basin-and- Range normal faulting which offset some veins and thoroughly fractured the quartz in all of them. Although some erosion probably preceded hydrothermal activity, the remainder, most after Basin-and-Range faulting, exposed the district at its present level in a series of geomorphologic events culminating in the deposition of gold placers (Ivosevic, 1976:155).

The sources of the heat, water, and contained elements in the hydrothermal system were not established by this study; but they probably came from some combination of remote and local sources (Ivosevic, 1976:155).

The Basin and Range province is an area of high heat flow which was considerably higher in the Miocene (DeAngelo, 1922). This high flow of 6 degrees per hundred feet (25oC/km) can create hydrothermal fluids without volcanism in hydrological systems only a few thousand feet deep. There are not many volcanic or plutonic rocks in the central Spring Mountains.

Hydrothermal activity occurred at estimated temperatures of 150oC, later having risen to 250°C, and pressures of approximately 1,000 atm. The depth of burial corresponding to this is 15,000 ft (4,600 m) (Ivosevic, 1976:150).

This hydrothermal event occurred in Paleocene to early Miocene time (Ivosevic, 1976:156).

The hydrothermal fluid may have been derived from a remote source in the upper mantle or lower crust or from a pluton (considered remote for discussion purposes) emplaced at depth below the district. Alternatively, the source could have been local: connate water expelled from the miogeosynclinal rocks in or below the district during or after diagenesis; groundwater transported downward along the ancestral Grapevine fault system; or water in wet surficial or near surface materials overridden by the upper plate of the Montgomery thrust (Ivosevic, 1976:155).

The heat, only, of the hydrothermal system may have been derived from remote sources or the heat was generated locally by the geothermal gradient. In either case, hydrothermal convection of local fluids, if such was their source, would have resulted (Ivosevic, 1976:155-156).

The hydrothermal fluid, with its metals and silica, could have originated from a remote source or, the metals and silica originated by the leaching action of a hydrothermal fluid, from any source, migrating through the miogeosynclinal rocks in or below the district. If the fluid was a connate brine it would have provided the halogens considered necessary to enter into the complexes required to transport some of the metals, or the halogens carne from evaporite units, since removed by leaching, in the miogeosynclinal stratigraphic section (Ivosevic, 1976:156).

The hydrothermal fluid probably ascended along a gravity-controlled pressure gradient within a tabular, vertical dilatant zone now manifest as the inferred major longitudinal structure and/or the principal mineralized structures. The fluid either entered this zone by migrating directly from a remote upper mantle, lower crust, or plutonic source or by migrating essentially laterally from a local source. Fluid from a remote source may have migrated directly along the major longitudinal structure, if it is the upward propagation of a basement ligament; or the fluids from a remote source migrated from depth along a poorly defined front until they were collected and canalized along the Montgomery thrust

or Grapevine fault system to ultimately enter the major longitudinal structure or principal mineralized structures (Ivosevic, 1976:156).

Whether the major longitudinal structure exists or not, once the hydrothermal fluid entered the mineralized area it was canalized at the base of the Stirling Quartzite, by the sole of the Congress low-angle normal fault, and possibly canalized by the Grapevine fault system and Montgomery thrust. From those sites, the fluid was diverted into the principal mineralized structures, which were the loci of fractures and faults made dilatant, by shear, under the influence of the local stress system in effect at the time. Finally in the fractures and faults, the hydrothermal fluids caused--sequentially-- wall-rock alteration overlapped by quartz veining, and--after minor fracturing of the quartz-- metallization (Ivosevic, 1976:156-157).

A Fanciful Hypothesis for Ore Genesis

I am fascinated by the possibility that the hydrothermal ore deposits in the Johnnie district originated from syngenetic materials in the vicinity (Ivosevic, 1976:157).

Concepts of ore genesis change with time. The once popular belief that all of the components of ore fluids originate' from magmatic sources has been modified greatly, in the last decade, by studies demonstrating that the aqueous phase of the fluids can arise from a variety of non-magmatic sources (for example, Gross, 1975; Guy, 1975; Skall, 1975). Another trend, which has roots in the same studies, points to examples (such as Carpenter and others, 1974; Gross, 1975) of the enrichment of metals in potentially hydrothermal subsurface waters in which the metals have been concentrated by solution of trace elements from country rock. As this trend takes conceptual form in terms of ore genesis, it will not be unreasonable to interpret the origins of deposits, such as those in the Johnnie district where there is no obvious magmatic source, in terms of lateral secretion (Ivosevic, 1976:157).

Among other phenomena, the apparent affinity of some metals for certain stratigraphic horizons in the Johnnie district may be more than a series of coincidences; the affinities are galena in the upper unit of the Johnnie Formation, chalcopyrite in the B member of the Stirling Quartzite, gold in the Zabriskie Quartzite, and the affinity of concordant quartz stringer lodes for particular stratigraphic horizons. The lack of an obvious magmatic source for the hydrothermal system and lack of obvious relations between the ore deposits and deeper structures cause one to seek alternate interpretations for their origins (Ivosevic, 1976:157-158).

Perhaps unimaginatively, this report explains these features on structural and lithologic grounds in light of currently prevailing concepts of ore genesis. However, if contradicting details of current concepts of ore genesis--which concepts are, in part, the outgrowth of contemporary geologic prejudices--are ignored, a case could be made for a syngenetic method of origin modified by lateral secretion processes (Ivosevic, 1976:158).

This report demonstrates…that, although not necessarily true, most of the constituents of the hydrothermal fluid could have been derived from local sources. Perhaps the profusion of quartz veinlets in the Johnnie Formation does not represent the paths of hydrothermal fluids ascending across a broad front, from below, before canalization into overlying structures to form quartz veins; perhaps the profuse veinlets are a system of collectors of hydrothermal fluids migrating laterally from adjacent rocks (Ivosevic, 1976:158).

Then all that is required for a lateral secretion origin is a lateral temperature and pressure differential to initiate hydrothermal activity and concentrate it along the controlling structures. The requisite heat could have been generated by the geothermal gradient, and the necessary low pressure conditions would have prevailed along the controlling structures at the time of the dilatancy which permitted the ingress of hydrothermal fluids (Ivosevic, 1976:158-159).

The following speculation, one of a number possible, is appealing because it unites a lot of observations. If, conveniently, the Johnnie district is above a narrow, longitudinal basin or basinal sequence of younger Precambrian sedimentary rocks below the base of the Paleozoic miogeosynclinal section, as suggested earlier in this report, several aspects of the district can be accounted for: (1) the ore deposits would lie within an elongate, northerly trending area; (2) ignoring the ramifications of thrust faulting for simplicity, the geothermal gradient might have been higher than in adjacent rocks, localizing hydrothermal convection and negating the requirement for a magmatic source; (3) high lithostatic pressures (Secor, 1962, 1965) -would have localized hydraulic fracturing and the simultaneous collection of connate fluids within these fractures, thus making it, at least in part, a case of lateral secretion (Ivosevic, 1976:159).

Additional isotope studies are necessary to: determine the source of the aqueous phase and other components of the hydrothermal fluid in the Johnnie district; and to define the temperature and age of ore deposition, which incidentally permits the deduction of depth and pressure. These studies, along with ones meant to prove or disprove the regionality--suggested here--of possible syngenetic copper deposits, would contribute greatly to assessing the validity of this fanciful hypothesis in the district and might give new direction to mineral exploration in the region (Ivosevic, 1976:159).

DEVELOPMENT

Bonham (1967a) estimates production [of the Johnnie District] at between 10,000 and 100,000 oz. of gold. Kral (1951, p. 86) reports a recorded production through 1913 of $382,681 from 64,582 tons Cornwall, 1972:38)

Table 3. Analyses of ore samples from gold-producing zone in North mining area, showing estimated original volume percentages of metallic minerals contained therein[*] and showing informative metal ratios.

Sample	Johnnie mine[**]		Buldosa mine	Near Doris mine
	With visible gold	Without visible gold		
Weight (lb)	0.62	0.69	3.97	1.76
Gold (oz/T)	1.13	0.95	0.25	0.15
Silver (oz/T)	0.89	0.60	0.53	0.57
Copper (%)	0.35	0.5	0.49	0.47
Lead (%)	0.4	0.36	7.02	3.34
Zinc (%)	0.02	0.02	0.14	0.80
Ag/(10Au+Pb)	0.08	0.06	0.06	0.12
Zn/Pb	0.05	0.06	0.02	0.24
Gold (volume %)	<0.001	<0.001	<0.001	<0.001
Chalcopyrite (vol. %)	15	10	2	1
Pyrite (volume %)	15	10	?	1
Galena (volume %)	<1	<1	2	1

[*]Estimated from examination of limonite etc. in leached specimens

[**]From pocket at surface near Johnnie shaft

Figure 13. From Ivosevic, 1976, p. 97. Open source for educational purposes, no copyright.

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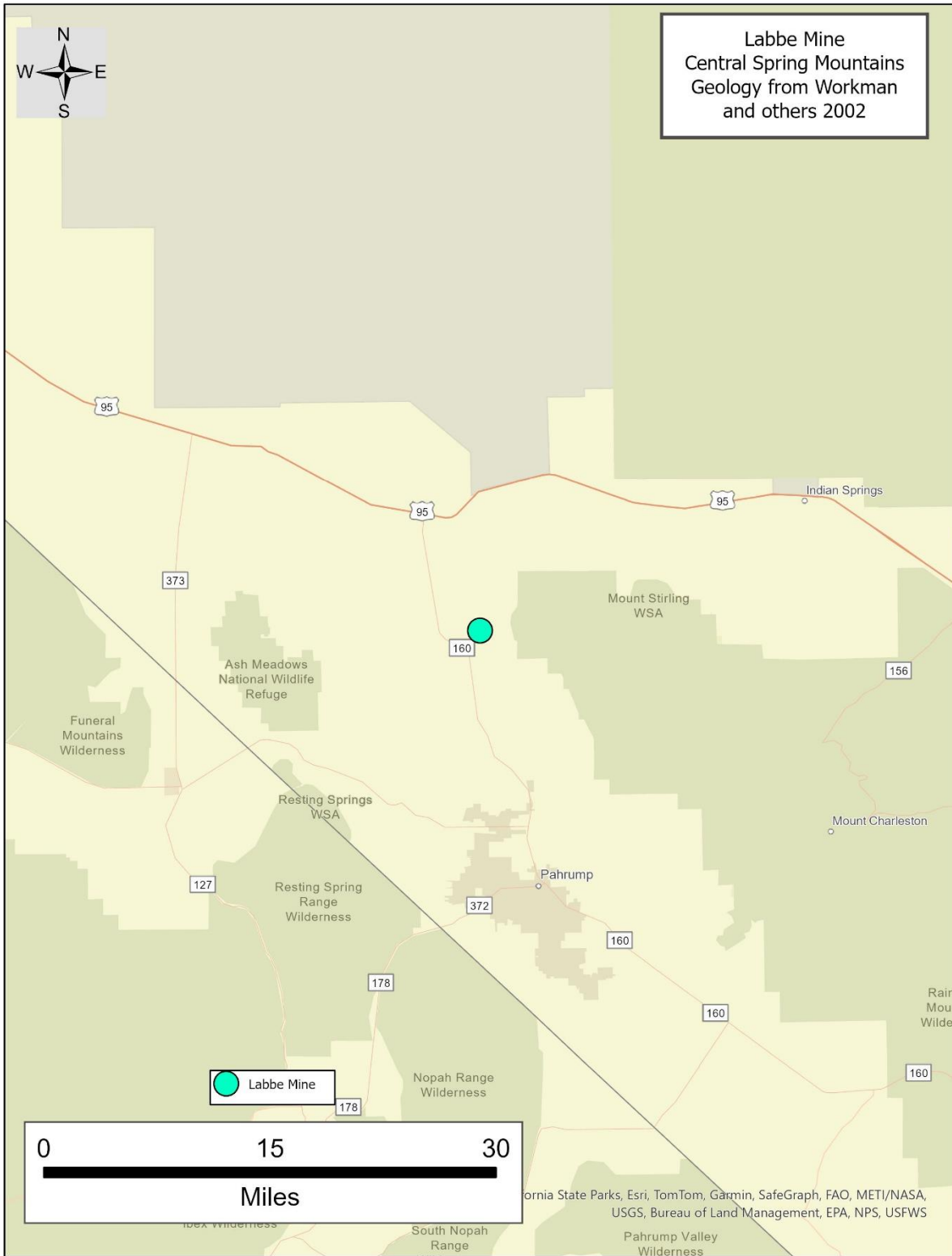
MAPS

Figure 14. Location map for the Labbe Mine. Open source for educational purposes. No copyright.
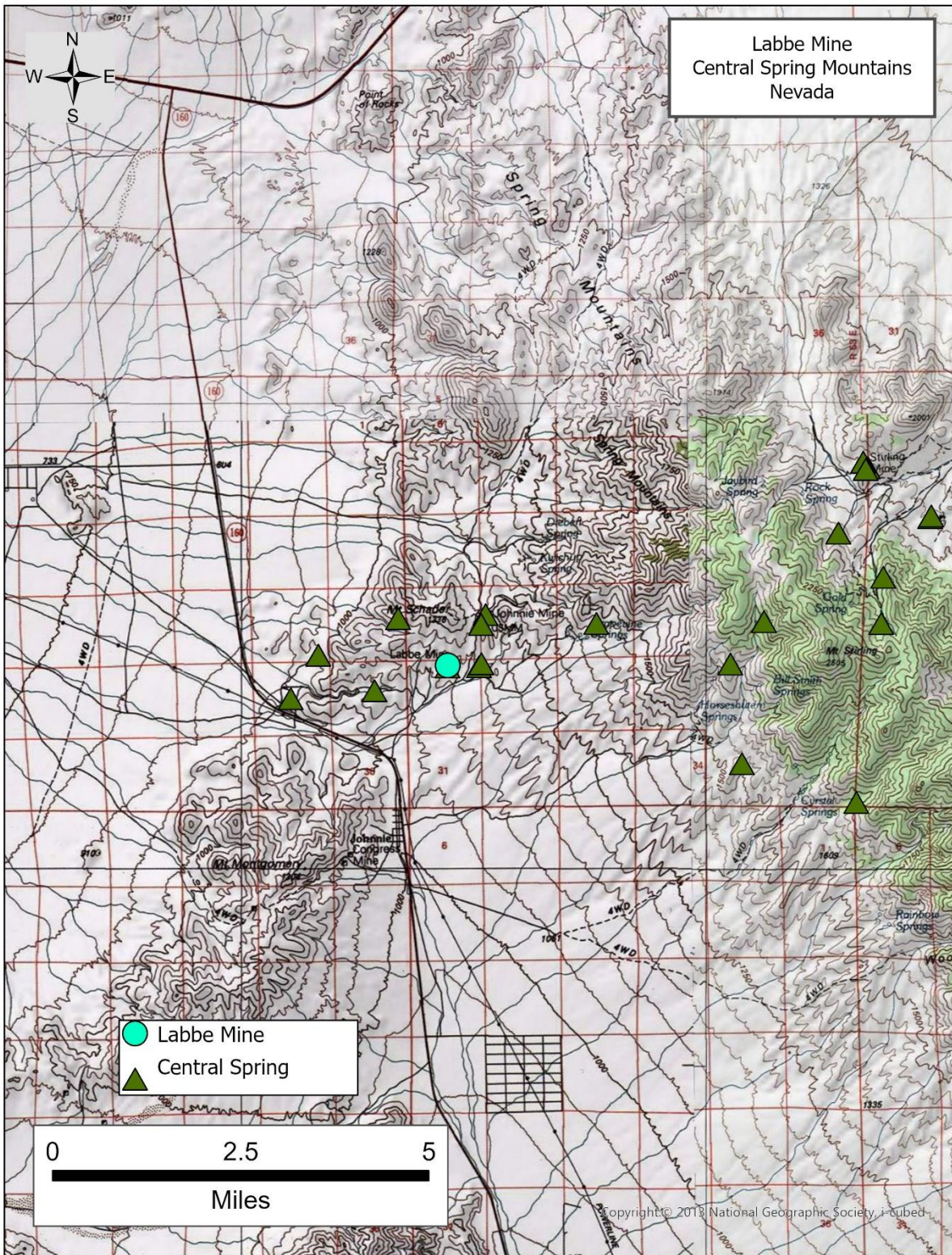
Figure 15. Regional topographic map of the Labbe Mine. Open source for educational purposes. No copyright.
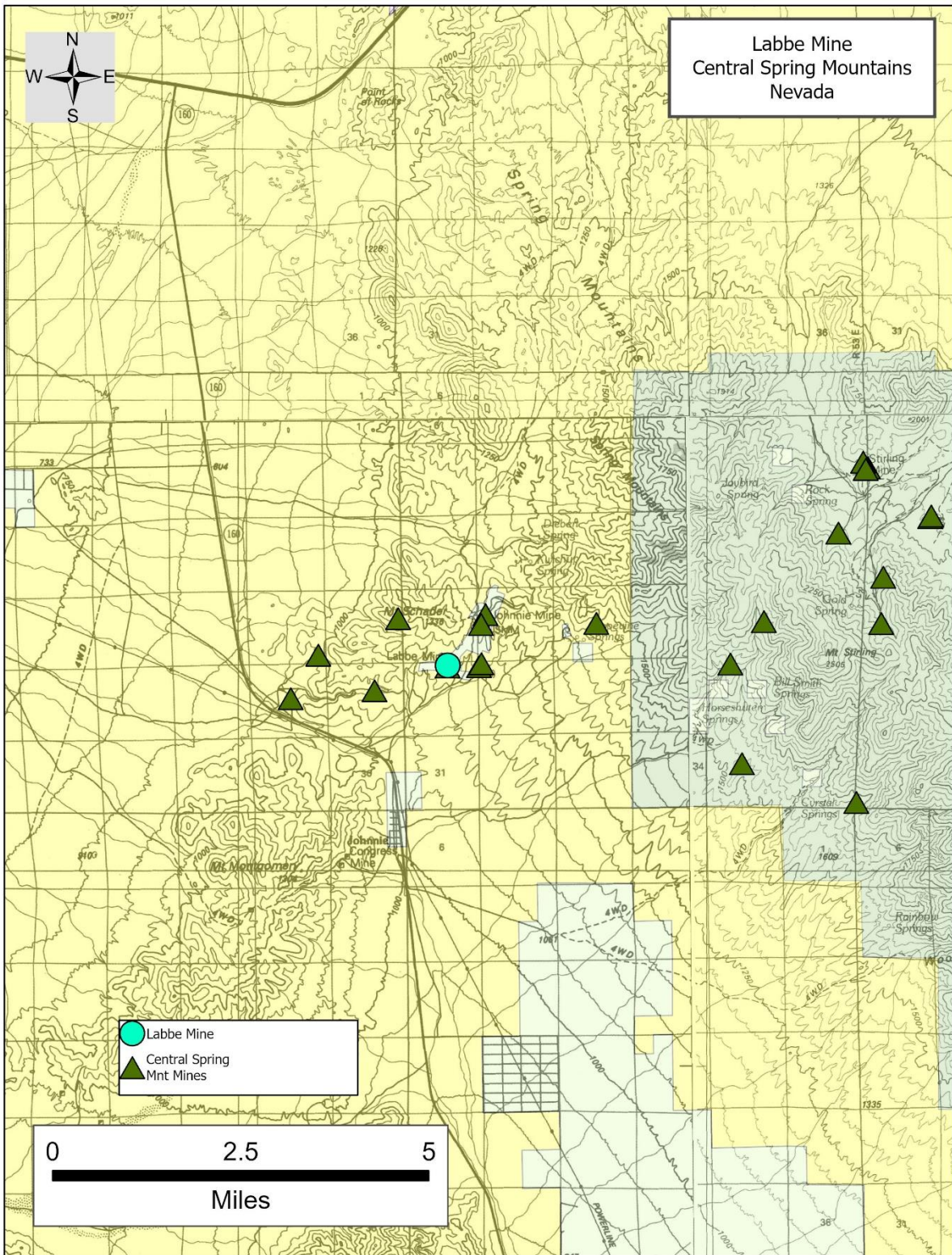
Figure 16. Land status map of the Labbe Mine. Green is U.S. Forest Service. Yellow is U.S. Bureau of Land Management. Blue is private land. Purple is military lands. Open source for educational purposes. No copyright.
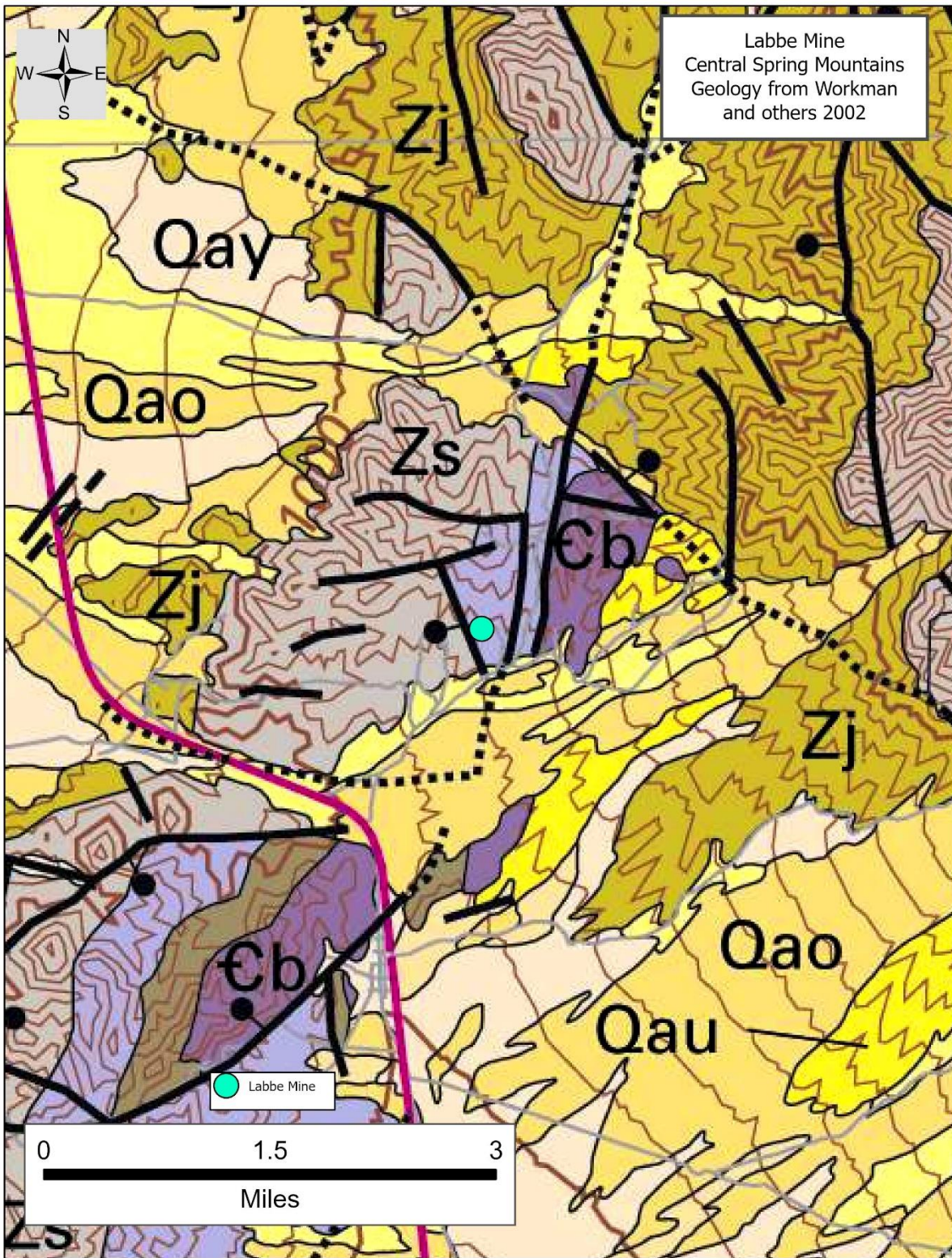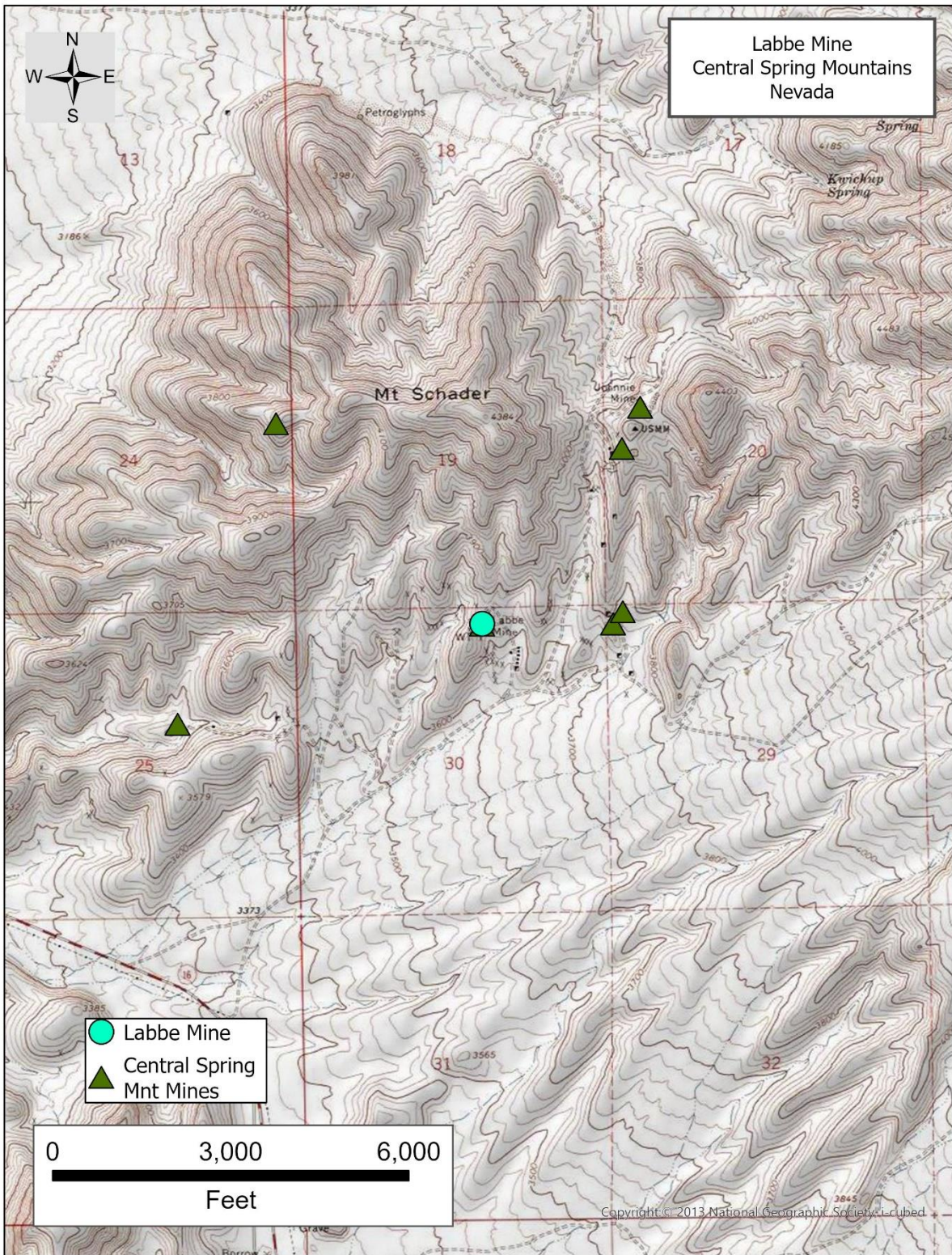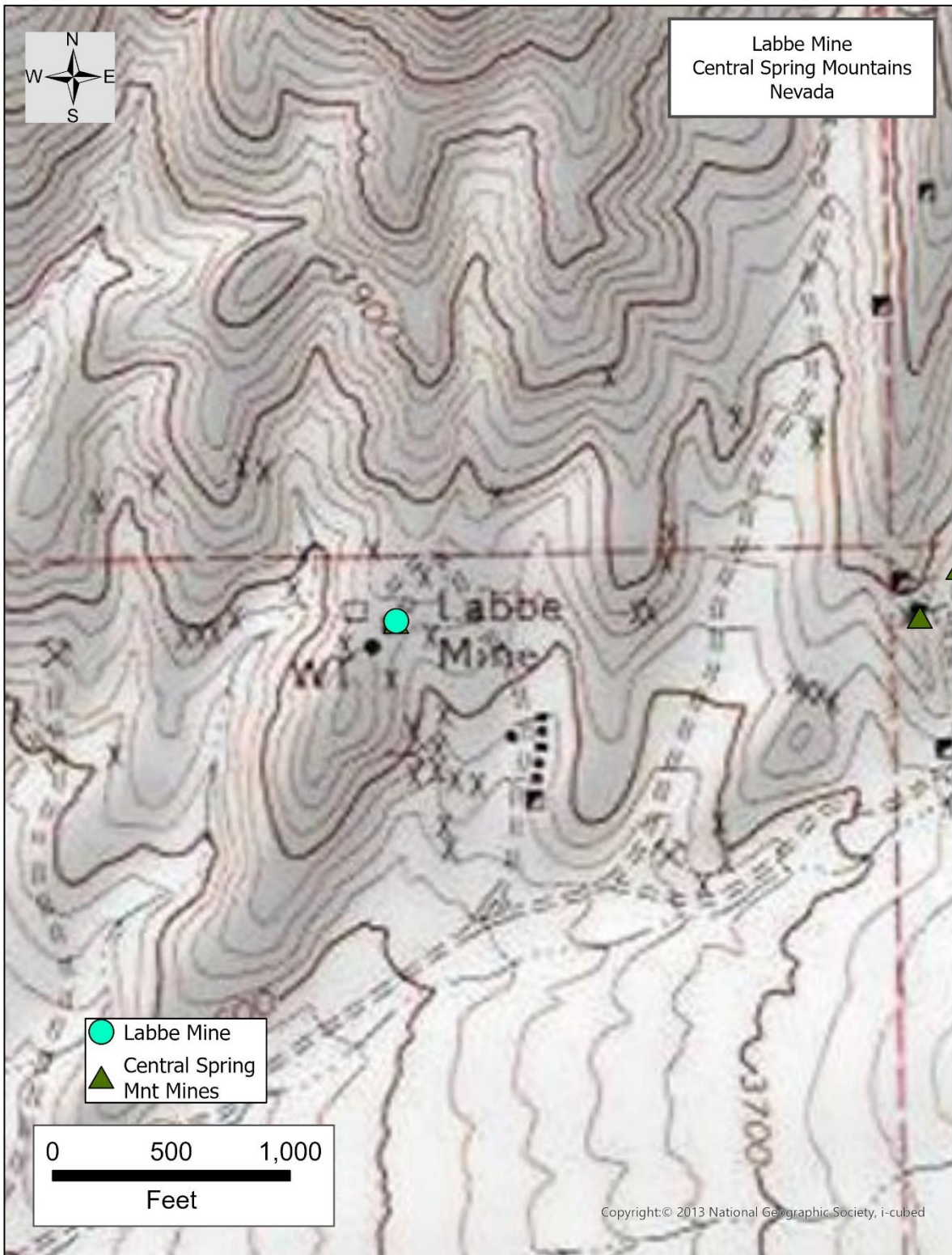
Figure 17. Regional geologic map of the area surrounding the Labbe Mine. Open source for educational purposes. No copyright.

Figure 18. Area geologic map of the Labbe Mine. Open source for educational purposes. No copyright.

Figure 19. Area topographic map of the Labbe Mine. Open source for educational purposes. No copyright.

Figure 20. Site topographic map of the Labbe Mine. Open source for educational purposes. No copyright.
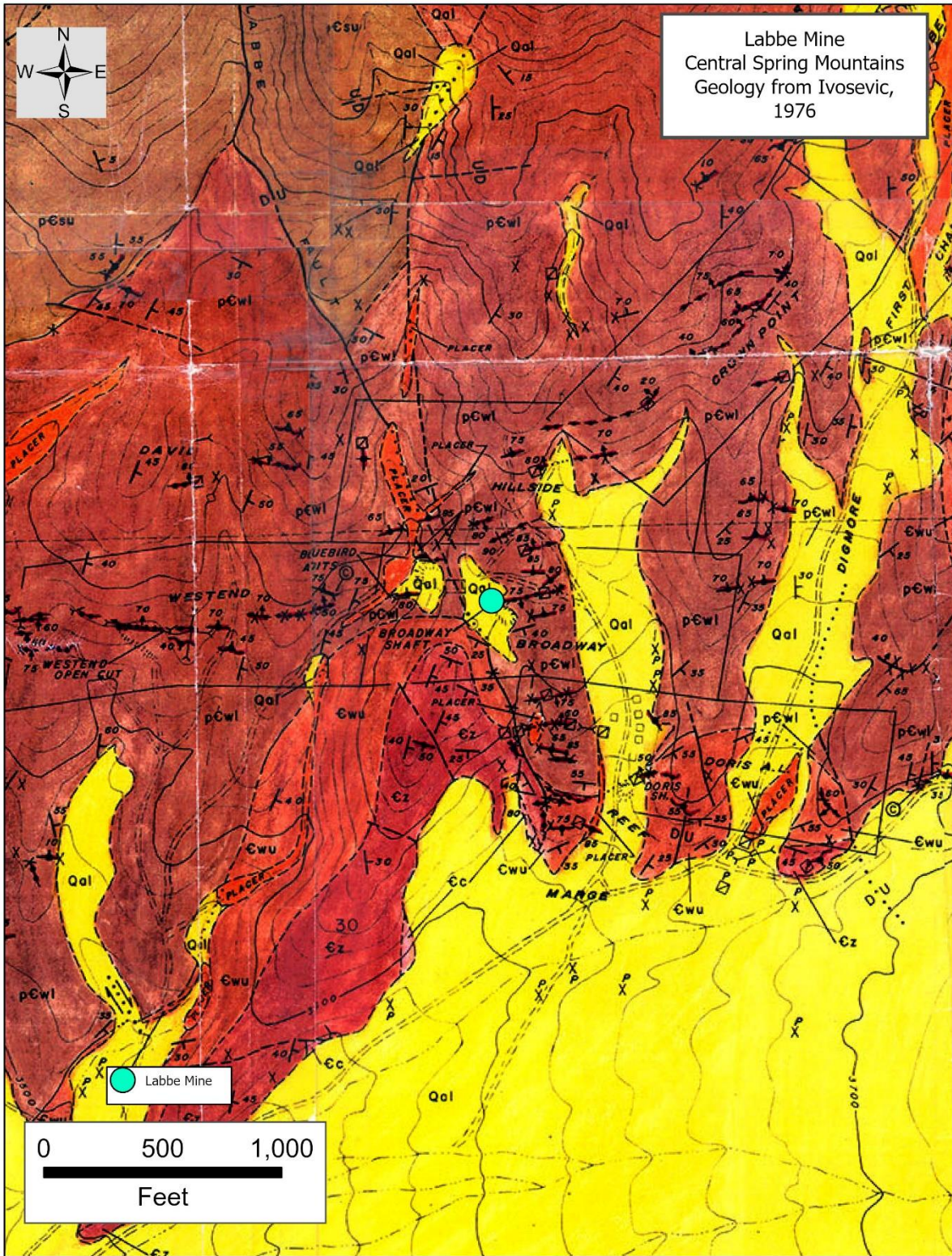
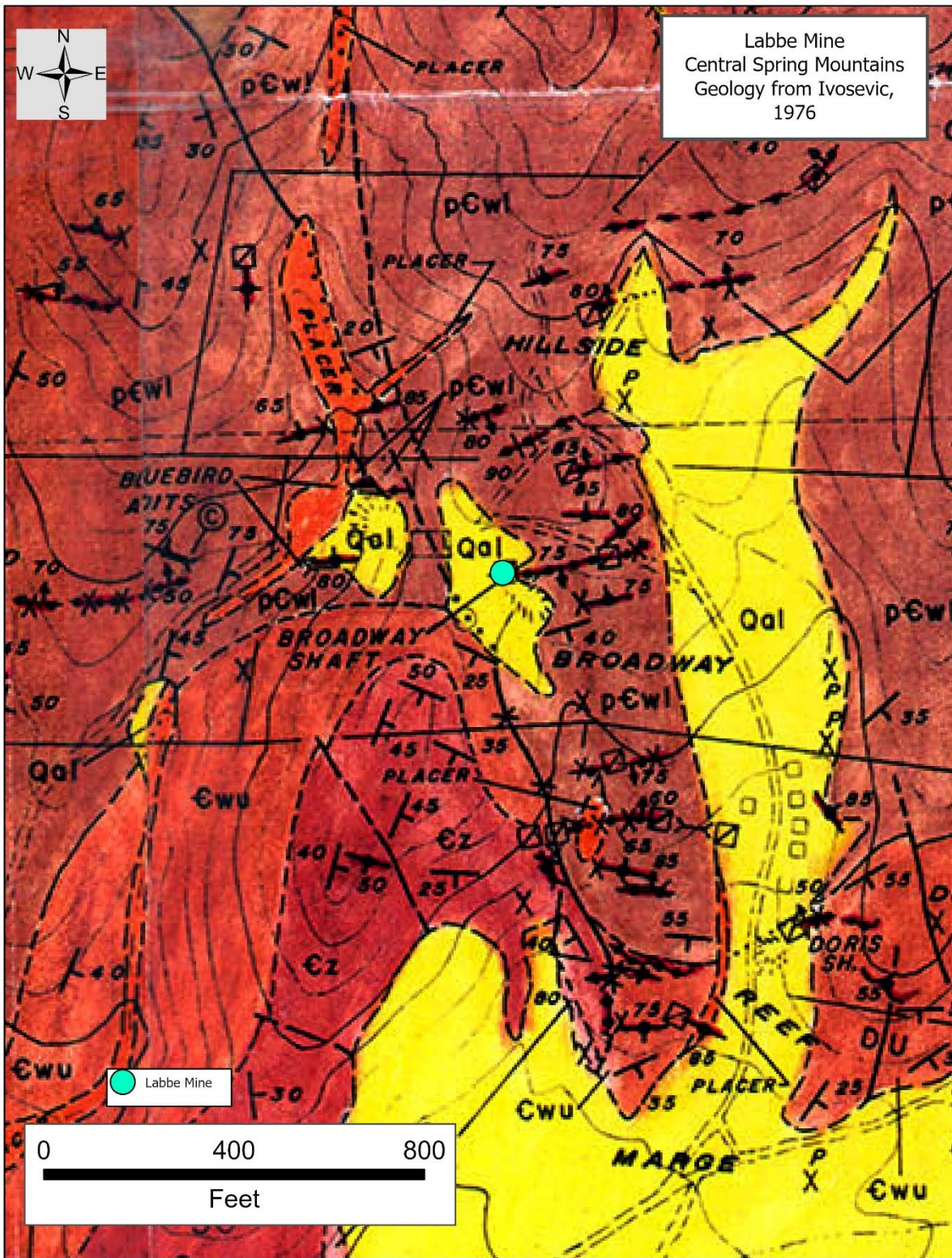*Figure 21. Site geologic map of the Labbe Mine. Open source for educational purposes. No copyright.*

Figure 22. Detailed geologic map of the Ladde Mine. Open source for educational purposes. No copyright.
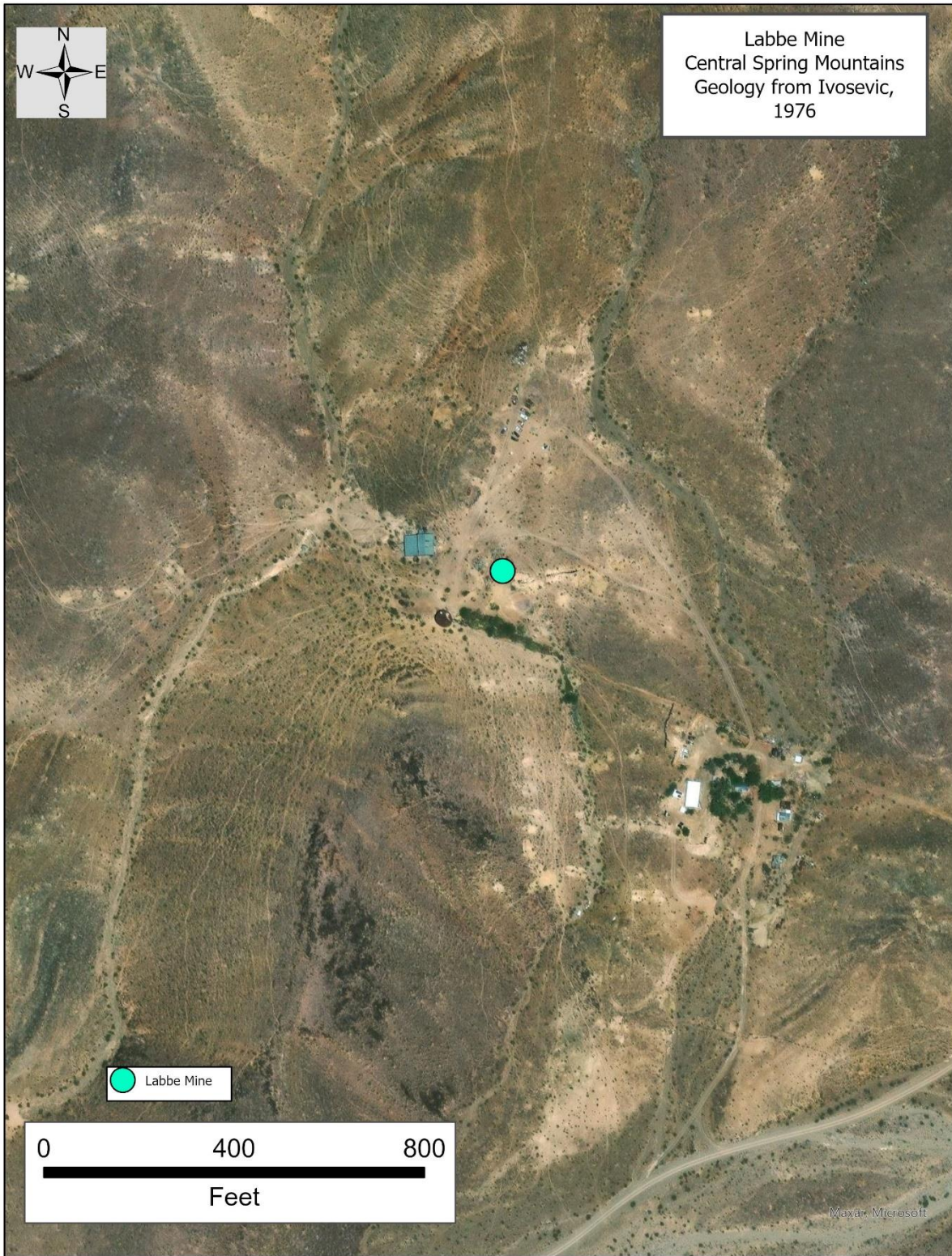
Figure 23. Detailed aerial photograph of the Labbe District. Open source for educational purposes. No copyright.

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