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GEOLOGICAL PROSPECTUS FOR THE CABRON PROPERTY RED MOUNTAIN MINING DISTRICT ESMERALDA COUNTY, NEVADA

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by

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ABSTRACT

The Red Mountain District has production and reserves totalling about 14,500,000 ounces of silver and 45,000 ounces of gold from three mines on epithermal veins that strike northeast. The known or eastern part of the district is about 4 miles long and 1.5 miles wide, and its west end lies in the Silver Peak caldera while most of it lies eastward from the caldera. The long axis of both the district and the oval caldera trend northwesterly.

The caldera is a resurgent one and after doming, it, and the country around it for as far as two miles, collapsed. The collapse was in trap-door fashion, with little or no movement at the northwest edge of the caldera which acted as a pivot or hinge, but with several thousand feet aggregate downward displacement on the caldera side of a group of northeast-striking faults that cross through the southeast end of the caldera.

Northwest of the known Red Mountain district, along the northeast rim of the caldera and specifically on the Cabron property, are some two dozen northeast-striking structures. Alteration and trace element mineralization suggest that they are manifestations of epithermal veins exposed well above any ore deposition and close to the ground surface that existed at the time of mineralization.

The area in which these zones occur, about two miles wide and three miles long, is adjacent to, and directly along the

projection of, the known Red Mountain district. If the zones do indeed represent high-level epithermal veins, then this is essentially an extension of the district that about doubles its area and, because the veins are so numerous, far more than doubles its mineral potential.

We reason that the trap-door collapse of the caldera dropped this western part of the district well below the effective (not today's) elevation of the eastern part of the district. Then, while post-mineralization erosion was stripping a thousand feet or more of rock off the eastern part to expose the veins there at nearly the ore-deposition horizon, the western part was subjected to much less intense erosion so that much higher horizons of the veins are now exposed.

We conclude that there is excellent potential for silver ore similar in content to that of the eastern part of the district on the Cabron property at depths of probably not more than a thousand feet. Some of this ore should be in veins similar to those of the eastern part of the district. There is also a possibility of larger, non-vein ore bodies where the vein zones pass through tuffs or through shattered blocks of rock that slid from the caldera rim before the caldera was filled with flows and sediments.

PROLOGUE

This prospectus for the Cabron group of claims is based on interpretation of published geological maps and reports, aerial photos, and geochemical analyses and petrographic study of samples collected essentially randomly from mineralized-appearing outcrops. The presentors have made numerous unrecorded observations of the geology of the property during the staking process but have done no geological mapping.

There are no known exposures of precious metals on the claims that approach ore grade; the best have trace amounts of silver. The potential of the property lies in the geological and geochemical interpretation that the numerous erosion-resistant zones represent the upper parts of epithermal veins related to the Silver Peak caldera.

INTRODUCTION

Red Mountain District

The Red Mountain district is in the Silver Peak Mountains, a few miles west of the village of Silver Peak in Esmeralda County, Nevada.

As it is presently known, the district is about four miles long and one and a half miles wide, with its long axis trending about N 60 W. It contains three mines with known production or reserves. At the extreme east end is the Nivloc Mine which produced about 350,000 tons of ore averaging about 0.05 oz. Au and 11 oz. Ag per ton in the period 1937 to 1943. Near the west end is the Mohawk Mine, thought to have produced about 100,000 tons of ore at about 20 oz. Ag per ton with very little or no gold. About midway between them is the Sixteen-to-One Mine, reported to have reserves of 750,000 tons at 0.035 oz. Au and 11.5 oz. Ag, which is presently being developed by Sunshine Mining Company. At the west end, north of the Mohawk, are the Sanger and Silver Queen properties, both of which have been explored to some extent but have made essentially no production. All of the deposits are epithermal quartz-calcite veins, and the Mohawk ore contains appreciable amounts of manganese oxides, though neither the Nivloc nor the Sixteen-to-One do.

The country northwest of the Mohawk-Sanger-Silver Queen is covered by claims for a distance of about a mile and a half along the trend of the known district. Most of these are held by Sunshine Mining Company. So far as we can determine, there has been no attempt to explore these claims except for one or two drill holes. The Cabron property begins at the northwest end of these claims and extends another two and a half miles northwestward along the trend of the known district. The only indication of prior work we found on the Cabron claims was the location notice for the Surprise No. 5 claim, located in 1922 when the Red Mountain district was being intensively prospected.

Henceforward in this report the term "district" as applied to the Red Mountain district will include both the known, or older, district which will be so referred to, and the westward extension that includes the Cabron property and the claims that lie between it and the older district. The district as so defined is about 7 miles long and 2 miles wide, with the northwest trend established by the older district.

About two miles west of the Cabron property is the east edge of Wilderness Study Area NV-050-0338.

Cabron Property

The Cabron property consists of the 93 Cabron unpatented lode claims, located between October 10 and November 6, 1981 and between March 11 and April 24, 1982. The outline of the claim block is shown on Plate I, and the block with individual claims indicated is shown on Figure 1. Recordation data is presented in Appendix A.

The only road access to the property is a jeep trail along Argentite Canyon, on the northeastern claims. This trail, which is passable to a two-wheel drive pickup, connects with good

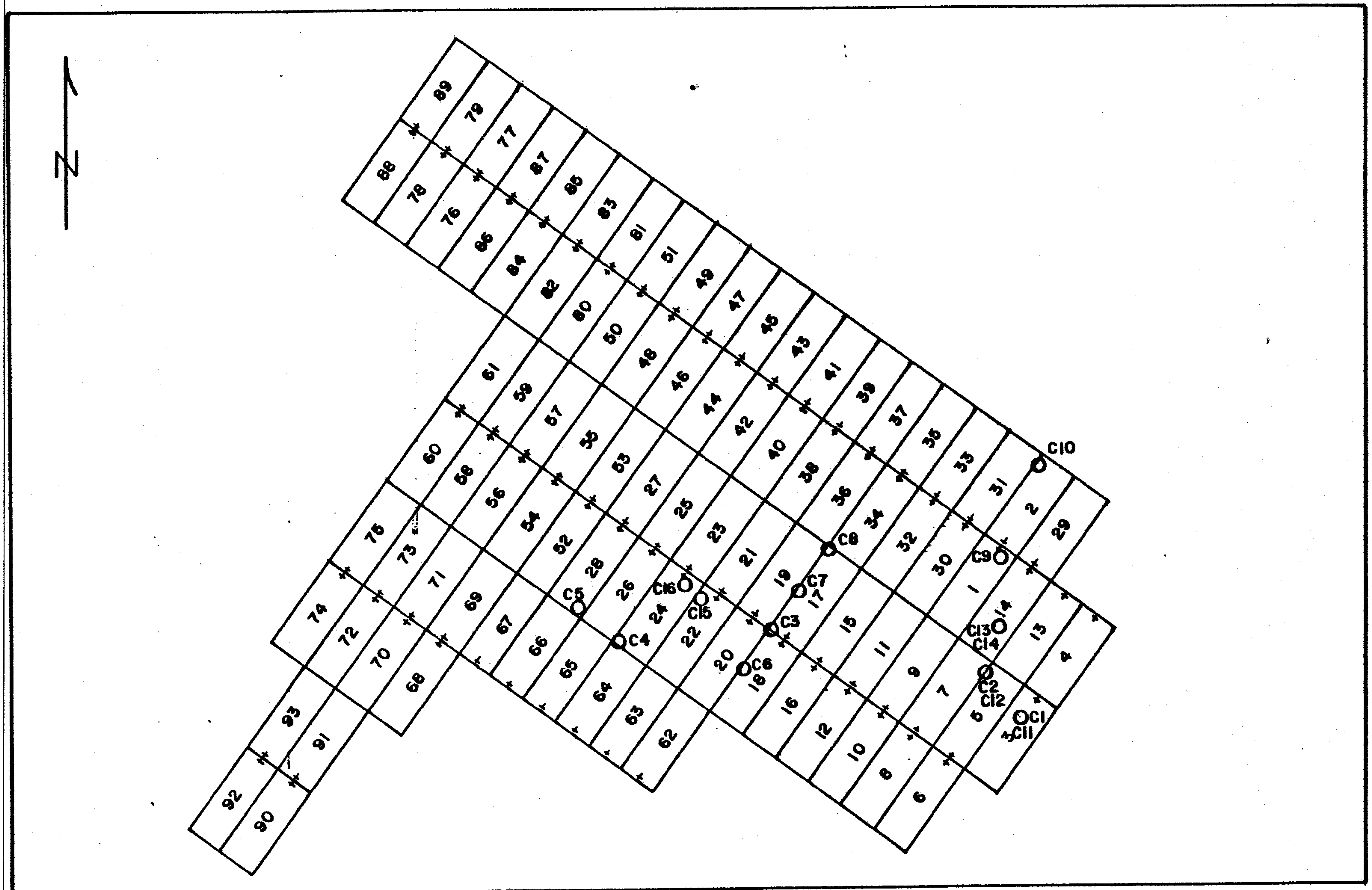

Figure 1. Cabron claim group showing locations of analyzed samples.
(+) denotes location monuments. (o) indicates sample locations.
Scale 1" = 2,000'

county roads at Cave Spring to the north and near the Silver Queen Mine to the south.

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ANNOTATED BIBLIOGRAPHY

Albers, J. P. and Stewart, J. H., 1972, "Geology and mineral deposits of Esmeralda County, Nevada", Nevada Bureau of Mines and Geology Bulletin 78. Good regional geology with a very brief description of the Silver Peak/Red Mountain District.

Benson, W. T., 1950, "Investigation of Black Rock manganese deposits, Esmeralda County, Nevada", USBM Report of Investigations 4717. Report on test pitting of low-grade manganese deposits in intra-caldera lake beds that overlie most other rocks in the caldera. The area tested lies between the older part of the district and the Cabron property.

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Robinson, P. T., Stewart, J. H., Moiola, R. J., and Albers, J. P., 1976, "Geologic map of the Rhyolite Ridge Quadrangle, Esmeralda County, Nevada", USGS Map GQ 1325. 1:62,500 geologic map with brief rock descriptions. Covers the north half of the Silver Peak caldera and the area of the Cabron property.

Stewart, J. H., Robinson, P. T., Albers, J. P., and Crowder, D. F., 1974, "Geologic map of the Piper Peak Quadrangle, Nevada-California", USGS Map GQ 1186. 1:62,500 geologic map with brief rock descriptions. Covers the south half of the Silver Peak caldera and the known Red Mountain district. Geology within the district does not entirely match that as mapped by Keith.

REGIONAL GEOLOGY

Basement rocks in the Silver Peak range are Paleozoic sediments intruded by Mesozoic plutons. These rocks are not exposed in the part of the range under consideration here, although they are reported to have been encountered at a depth of 300 feet in the Nivloc Mine and to have formed the host rock for much of the ore there.

In Mineral Ridge, a few miles northeast of the district, the Paleozoic sediments form a syncline trending about N 50 W, with an elongate pluton intruded about at the axis of the syncline. In the southern part of the Silver Peak Mountains, a few miles southwest of the district, no fold is identified in the sediments but here, too, their strikes are northwesterly and plutons are elongated in the same direction. Between these two major exposures of basement rocks are a few small exposures at the west edge of the range.

The oldest Tertiary rock is an ash-flow tuff dated at 22 m.y. exposed toward the north end of the range. Overlying this is a series of late Miocene to middle Pliocene sediments mostly deposited as very thick accumulations in the intermontane basins such as Clayton Valley east of the Silver Peak Range and Fish Lake Valley to the west. This series of rocks, although highly variable from basin to basin and within basins, is lumped together under the name Esmeralda Formation, the oldest date on which is 13 m.y. Robinson, et.al. recognize two periods of deposition of these sediments, separated by a period of deformation. From the presence of sediments of the younger period in the central part of the Silver Peak range they conclude that at that time, probably late early to middle Pliocene, there was a trough connecting the Clayton and Fish Lake basins (Robinson, et.al., 1968, p. 607). Judging by the distribution of these sediments, it seems likely that the trough trended northwesterly and occupied a substantial part of the area between the basement rocks now exposed to the northeast and southwest of the central part of the range.

Covering most of the space in the central part of the range, between the areas of basement rocks, is a large pile of tuffs and flows extruded from the Silver Peak caldera. The caldera is located about midway between the basement rock areas, and has dimensions of about 8 miles by 4 miles. Its long axis trends northwesterly, parallel to the folding of the basement rocks and to the inferred axis of the Pliocene trough. The outline of the caldera on the GQ maps is rather irregular, suggesting that those who did the mapping had quite close control on its location, but none of the published works suggests there was this good control -- so the true location of the caldera wall at any point on its circumference must be considered not well established.

Robinson (1972, pp. 1693-1696) provides an excellent description of the sequence of volcanic events, except that our interpretation of the latest events, including mineralization, differs somewhat from his. The earliest eruptions were of rhyolite tuff and tuff breccia, which were followed by collapse of the caldera. Rhyolite domes and flows were then extruded along the ring fractures and elsewhere outside the caldera, and subsequently latite (and trachyandesite) flows, also from the ring fractures, largely filled the caldera. According to our interpretation, sediments including some lake beds were then deposited within the caldera together with some small basaltic flows, and later resurgence of the caldera formed a dome in the central part; Robinson reverses this sequence. By our interpretation, the final structural event was collapse of the resurgent dome and adjacent rocks outside the caldera, principally by displacement on a set of northeaster faults that extends some miles beyond the margins of the caldera.

According to Robinson, mineralization in the district occured before deposition of the sediments; but according to our interpretation it occured after that and perhaps after doming.

The rhyolite tuffs of the earliest eruptions are dated at 6.1 m.y. and the youngest basaltic rocks at 4.8 m.y., so the volcanic activity is both very young and very short-lived, though Robinson estimates that about 25 cu. mi. of lava were erupted. The mineralization, which is in these rocks, also then must be very young.

DISTRICT GEOLOGY

Plate I is a generalized geologic map of the caldera area, taken from GQ 1186, GQ 1325, and Keith's Plate I and enlarged to 1:24,000 scale. Most of the following discussion will refer to this map and its derivatives. The Red Mountain district as defined for this report extends from somewhat east of the Nivloc Mine near the east edge of the map, northwestward through the Sixteen-to-One, Mohawk, Sanger and Silver Queen mines (the "older" or "known" part of the district) at least to the northwest end of the Cabron property beyond the mouth of Argentite Canyon.

Stratigraphy

The western two thirds of the district, from about the Mohawk Mine through the Cabron property, lies within and along the northeast edge of the caldera. The eastern one third, with the Sixteen-to-One and Nivloc mines, extends eastward from the caldera. In the western two thirds, the dominant rock type is the latite flows, with some exposures of underlying rhyolite and rhyolite tuff and overlying intracaldera sediments. In the eastern one third, the rock types are more variable, perhaps partly because of more careful mapping since this is known mineralized country and has been mapped in more detail. There are some remnants of latite flows and several categories of older Tertiary rocks (Keith, 1977, Plate I), the latter of which for Plate I of this report have been generalized, like the rhyolites and tuffs farther west, as pre-latite rocks (Trt on the map).

The eastern pre-latite rocks do not, for the most part, appear in the Cabron area, nor are they expected at reasonable depth except for rhyolite and rhyolitic tuff, so they will not be further treated here except for a couple of points. One is that the Nicloc ore, as mentioned, was in basement host rocks, while the Sixteen-to-One ore is, according to a comment by a Sunshine employee, in andesite and the other rocks are considered by Sunshine to be unfavorable as host rocks. The other is that the latite in the eastern area is a relatively thin (a few hundred feet at most) flow that presently dips gently eastward (Plate II, Section A-A'). However, at a number of places there are sediments, including lacustrine limestones, at the base of the latite so the flow must have been extruded onto a relatively flat and flat-lying surface and subsequently tilted.

In the western part of the district the oldest rocks are the rhyolitic tuffs representing the earliest part of the caldera eruptive cycle. As we saw them they are simply light-colored poorly bedded rocks, seldom exposed. Overlying the tuffs are rhyolite flows, which are also light-colored and are frequently flow banded. We can say no more about their nature.

The thickness of the tuffs and flows varies greatly around the caldera, from zero to perhaps as much as 1,000', and presumably the necks that fed the flows extend much deeper. The rhyolite tuff is dated at 6.0 or 6.1 m.y.

Overlying the rhyolitic tuffs and flows is the latite, Tl, that followed them in eruptions from the caldera rim. This is a dark rock with abundant plagioclase phenocrysts up to 1 cm. in diameter. It is clearly made up of a number of eruptive units which may or may not be mappable; some are flows and others flow breccias with the latter appearing to predominate. Some units weather very cavernous. The present thickness is extremely erratic, ranging from 0' to at least 1,000' outside the caldera. A rather unsatisfactory attempt to draw isopachs suggests that the original thickness was equally erratic, though not following the present day pattern. The thickness of the latite within the caldera, which as a depression presumably received the bulk of the latite, is unknown. The Sections of the GQ maps indicate thicknesses mostly greater than 1,000', and again, the necks that fed the flows presumably extend very deep. The latite is dated at 5.9 m.y.

In the south-central part of the caldera are latite porphyry flows described as much like the latite referred to above and apparently only slightly younger, which we have not seen. South and southwest of the caldera are andesite porphyry flows (Piper Peak andesite), also indicated as only slightly younger than the latite (age dating puts them slightly older; presumably it is field relations that cause them to be shown as younger on GQ 1186) which we also have not seen.

Within the caldera the youngest rocks are sediments with local basalt and basaltic andesite flows, together shown as Tsb on our map, that are at least in part interfingered with the sediments (Ts5 and Tba of the GQ maps). They overlie latite, the latite porphyry, and along part of the northern rim they lie upon tuffs and rhyolites just outside the caldera. The latter relationship indicates that here, at least, the caldera was completely filled with latite, and that an outlying ridge of rhyolite served to contain the lake. The sediments are described as pebble to boulder conglomerates with some sandstone, limestone and chert near the base. We traversed some areas mapped as these materials but saw no outcrops. The thickness of sediments plus flows appears to be several hundred feet. The basalt in this unit is dated at 4.8 m.y.

About a mile north of the west end of the caldera is the southern end of Tertiary sediments, Ts6, that were deposited in a north-trending trough several miles long along the northern west edge of the Silver Peak range and out into Fish Lake Valley. These are shown on GQ 1325 as the youngest Tertiary rocks in the area (Ts6), younger than the intracaldera sediments, but it appears there is no firm evidence for this specific dating -- they may be of essentially the same age as the intracaldera sediments.

Larger valleys in the area are filled with Quaternary alluvium, which is shown on Plate I where it was so mapped on the GQ maps. Many lesser valleys and draws also have appreciable thicknesses of alluvium. Most ridge tops and slopes are largely covered by colluvium or scree, so that outcrops overall are poor except where resistant zones crop out boldly.

Structure

On the GQ maps there are a few faults that strike due north to a little west of north, which might be quite young structures related to Basin and Range type faulting. There are only a couple within the district and they seem to have no bearing on other structure or on mineralization so we will have no further comment on them.

There are somewhat more numerous faults that strike a little east of north, which may be bent continuations of north-easterly faults. These will be considered in that context.

All the other recognized structural features in the area fall into one or the other of two major categories, which are themselves probably interrelated. The older of these is a set of foldforms -- synforms and antiforms -- that may have been partially developed after eruption of the rhyolites and before eruption of the latites, but certainly were developed after sediments and younger flows covered some of the latite surface. Four of them trend north to somewhat northeast, while the fifth trends almost due west. The younger category is a set of northeast striking faults that affects all the rocks within the caldera and those for several miles outside it.

Foldforms

The presence of these features can be inferred from the geological maps but they can be defined only on structure contour maps, two of which have been drawn; one on the base of the latite unit (Plate IA), and one on the top of the latite unit (Plate IB). Unfortunately, control for structure contouring -- contacts between the latite and underlying rocks or between the latite and slightly younger overlying rocks -- is limited to a few areas. In some other places we have drawn "permissive" structure contours -- ones that enclose all present-day outcrops of the contoured type, but have no control to establish that they are in the correct position. Thus, the permissive contours defining the dome in the top of the latite in the north center of the caldera (Plate IB) are drawn assuming that the present topographically highest points of the latite represent the original top of the latite, and that overlying sediments as well as latite between the high points have been eroded away.

Two synforms and two antiforms have axes that trend north to somewhat northeast, and the fifth structure, a synform, trends northwest. These will be considered individually and in some detail because their existence and definition have important bearing on the hypothesis that structures on the Cabron property have ore at depth.

Northwestern synform

This synform, in the northwestern part of the map area of Plates I, IA and IB, is a divided one, with a northern segment outside the caldera and a southern segment inside it, separated by a structural ridge in which permissive contours show a shallow saddle. Both segments trend essentially due north.

On the base of the latite (Plate IA) the northern segment is clearly defined by well-controlled contours that run straight into the caldera wall, with the synform axis along the axis of the present-day canyon. Taken by itself, this trough in the base of the andesite could be considered simply a pre-latite canyon that was filled with latite.

On the top of the latite, most of the contouring in the northern segment is permissive. At the north end, however, the curvature of the contact of post-latite sediments (Ts6) with underlying older rocks, as well as opposing dips in the sediments, provide controlled structure contours indicating a trough. Such a trough in the top of the latite, essentially directly above the trough in the base of the latite, suggests post-latite downwarping of the entire unit.

In the southern segment of the synform, there are not enough exposures of the base of the latite to permit even permissive contouring. There is clear evidence, however, of a pronounced downwarp in the top of the latite and the overlying intracaldera sediments and flows. A syncline in the sediments and flows is demonstrated by the rather steep easterly dip they have at the west edge of the large outcrop area at the west edge of the map, and the reversal of dips near the east edge of this outcrop area. The synform has a breadth of at least two miles as is shown by the remnants of sediments and basalt flows a mile east of the large outcrop area and several hundred feet higher (Plates I and IB, and Section B-B' on Plate II). The synform has a depth of 1,000' or more.

The structural ridge between the two deeper segments of the synform coincides with the approximate location of the caldera ringwall. It may be that latite was erupted along this segment of the ringwall and the resulting volcanic neck acted as a relatively stiff beam that did not sag when the adjacent sequences of layered rocks did.

Southward in the caldera the synform is lost beneath alluvium.

Eastern antiform

This antiform is at the east edge of the caldera, with its axis in the vicinity of the Mohawk Mine and its eastern limb extending to the Nivloc. It appears only on the base of the latite (Plate IA) because there are no post-latite rocks in this area.

The axis of the antiform is quite well defined by the pattern of the contacts of latite surrounding the window of underlying rhyolite east of the Mohawk; the base of the latite clearly slopes east and west from the eastern part of this window. The short segment of axis that is exposed strikes north or a very little east of north as the structure contours have been drawn, but the contours on the east limb, with fairly good control, strike more easterly. The west limb of the antiform is quickly lost under complete cover of latite, but the east limb is defined by remnants of latite flows to and beyond the Nivloc Mine, three miles east.

The axis or crest of the antiform could be at least in part depositional; an early rhyolite ridge formed by a dome erupted here at the caldera ringwall may have been buried in latites that were erupted in the same general vicinity. The rather gentle dip of the eastern limb of the antiform, however, must represent post-depositional tilting of flows erupted onto a fairly flat surface, since immediately underlying terrestrial sediments, and some lakebeds that must have been deposited horizontally, slope parallel to the latite base.

Southern antiform

This antiform appears on the base of the latite (Plate IA) and also on the top of the latite (Plate IB). For the latter plot, Piper Peak andesite (Tap of GQ 1186) is the unit overlying the latite, rather than sediments of which there are none in this region. The andesite is indicated on GQ 1186 as being but very little younger than the latite.

The crest of the antiform is at the bulge near the western end of the southern wall of the caldera. It is ill-defined at both the base and the top of the latite, partly because of permissive contouring and fault offsets, and partly because it crosses the caldera wall. As the structure contours are drawn, the axis of the crest strikes somewhat east of north.

The eastern limb appears as a two-mile gentle eastward slope of both the bottom and the top of the latite, comparable in its grade to the eastern antiform. The contours on both top and bottom of the latite, though their trends are largely permissive, have enough control to indicate a trend somewhat east of north, similar to that of the axis of the crest and to the trend of contours on the east limb of the eastern antiform.

The eastward dip of the sediments along the north-central edge of the caldera suggests that this area, too, is part of the east limb of the southern antiform, the axis of which passes through the structural dome to the west and ends against the crosswise northern synform.

Logically, this eastern limb of the southern antiform should somewhere meet the western limb of the eastern antiform -- if that antiform is long enough. The distribution and bedding dips of a latite ash-flow tuff, shown on GQ 1186 south of the area of Plate I, suggest that this might be the case southward, at least. The axis of the apparent synform lies along the valley in which runs the county road to Silver Peak, in a south-southeast direction.

The permissive contours on the top of the latite in the vicinity of Piper Peak bend just enough to suggest the beginning of the western limb of the antiform. It is possible that there was a now-unrecognizable synform, probably narrow, a short distance west of Piper Peak. If so, that synform might well have been the southern continuation of the northwestern synform -- making it a throughgoing regional structure that passes through and beyond the caldera, rather than a limited, caldera-related structure. The presence of the Ts6 trough at the north end of the northwest synform a mile beyond the caldera wall indicates the synform is extensive in this direction.

Northern synform

This synform lies just outside the northern edge of the caldera and is occupied by, and exposed by, the lower part of Argentite Canyon, and is defined by well controlled contours on the bottom of the latite. It trends about N 65 W, parallel to the local trend of the ringwall and half a mile north of it. It is about a mile and a half long, apparently ending eastward where the structure contours make a sharp turn to cut it off. Westward it disappears under alluvium at the mouth of Argentite Canyon.

There are no post-latite rocks to define this synform in the top of the latite, except for one small patch at the extreme east end. The one structure contour that this patch permits suggests the synform but does not define it by any means. On the basis of other evidence -- the distribution of the tops of silicified zones, which will be discussed later -- we believe that the top as well as the bottom of the latite was folded down, and thus was essentially synchronous with the north-trending folding and a part of the same event.

Ts4 synform

Just north of the mouth of Argentite Canyon structure contours suggest the beginning of a north-trending synform. About a mile farther north is the south end of a trough shown on GQ 1325, in which were deposited sediments of the Ts4 unit, which the GQ description indicates as but slightly younger than the latite. The trough -- or synform -- is about four miles long by one mile wide, and has the same north-northeast trend as parts of the foldforms farther south. Presumably it is part of the same post-latite folding system.

It appears likely that the northern synform and the Ts4 synform join at the mouth of Argentite Canyon.

A curious feature of the Ts4 synform is that it lies directly along the axial trend of the southern antiform, but on the north side of the northern synform. Something about the northern synform allowed it not only to disrupt the pattern of the north-northeast folding in itself, but also to cause displacement of the pattern from one side to the other of it.

Foldform general considerations

Although the 200' interval used for the structure contours tends to give the impression that the foldforms are quite sharp, steep-walled features, in actuality all of them are broad, shallow features, as may be seen on Sections B-B' and C-C'. There are a few small areas where well-controlled contours are very closely-spaced, indicating steep irregularities -- such as on the base of the latite near the north end of the northwest synform and near the middle of the northern synform. These may well be irregularities introduced by fault offset or even recent gravity sliding of the blocks of rock that provide the contour control. Overall, despite the coarseness of the control for the structure contouring, the foldforms bear no resemblance to the steep gorges and ridges to be expected on the young erosional surfaces that might have developed in the total 1.3 million year interval of deposition of all the rocks involved. Instead, they have the appearance of warps in what were originally more or less smooth planes.

Several of the modern-day drainages follow the axes of synforms. The most noticeable of these is Argentite Canyon, the lower two miles of which lie along the axis of the northern synform, while the north-trending valley into which Argentite Canyon empties follows the axis of the Ts4 synform. Southward from the edge of the caldera, off of Plate I, the valley in which the county road to Mohawk runs follows the inferred axis of the synform between the eastern and the southern antiforms. At the west edge of the caldera a major unnamed canyon and one of its tributaries lie along the axis of the western synform. The upper part of this major canyon, which drains much of the caldera, runs easterly through the middle of the caldera across the trend of the southern antiform; if there is a synform on the south side of the caldera dome, comparable to the northern synform (there is no evidence for or against such a synform), it might well lie in this position. The implication of this coincidence of modern drainages with structural synforms is that the synforms were expressed as downwarps of the ground surface at the time of their formation, and thus immediately became the major valleys which in turn were the forefathers of the modern canyons.

The conclusion we draw is that the latite and the overlying sediments were deposited on surfaces that were more or less flat and together they were folded in an episode later than sediment deposition. This folding had surface expression, so that the synforms became valleys that established the present-day major drainage pattern.

The north to north-northeast trends of four of the foldforms -- the northwestern and Ts4 synforms and the eastern and southern antiforms -- suggests that they formed in response to east-west or eastnortheast-westnorthwest compression. The fact that they are recognized only in and near the caldera may mean that they are related to the caldera, but we have not looked for foldforms elsewhere -- perhaps they are to be found throughout the Silver Peak range. If they are indeed restricted to the vicinity of the caldera, both within and outside it, it may be because the presence of a fluid magma below permitted its relatively thin cover of rocks to flex under weak or moderate compression while elsewhere solid rock close to the surface did not respond to the compression at all.

Within the caldera the net effect of the folding was to produce a pronounced dome with its crest along the northern rim as is seen in the structure contours on Plate IB. We attribute this doming to resurgence of the caldera, facilitated somewhat by the folding that helped to lift the crest of the southern antiform across the middle of the caldera, but also resulting from positive upward pressure from molten magma below that disrupted the fold pattern to produce the northern synform and change the sequence of the folds.

Northeast faults

As seen on the GQ maps, these faults are concentrated around the southeastern and eastern edges of the caldera, extending several miles out from its rim, and around the northeastern rim extending a couple of miles into and a couple of miles out of the caldera. The western half of the caldera is nearly free of them, except for two at the western edge.

The two at the western edge strike more nearly east than do the others. They have relatively minor displacement -- no more than a few hundred feet -- and tend to neutralize each other since one has the west side down and the other the west side up.

In the eastern group all the faults strike northeast, with about N 45 E being the most common strike though some bend to a more northerly strike toward their south ends. Nearly all dip moderately or very steeply west and the west sides are down. It is possible to measure displacement on some of them by offsets of the base of the latite or of the post-latite sediments. In the northeastern part of the caldera the Bop and AC faults each have displacement of about 500' and the Mohawk about 1,000', while the County Road fault probably has displacement greater than 1,500' and possibly as much as 3,000'. East of the Mohawk are only a few faults with relatively small displacement (see Section A-A', Plate II).

The northeaster faults are not recognized in the center of the caldera, probably for lack of distinctive rock units that would reflect their presence. They reappear again beyond the southern rim, where they appear to have similar overall downward displacement on the west side.

The effect of the northeast faulting, then, has been to drop the middle of the caldera, and the ground for some miles north and south, in steps that altogether aggregate several thousand feet. At the western edge of the caldera there has been only a few hundred feet of displacement at most; this edge essentially did not move but stood firm as a pivot around which the top of the caldera dropped in a sort of trap-door style.

We interpret this dropping effect to be due to collapse of the resurgent dome of the caldera, but caused by shifting of a great deal more magma than that which occupied the dome itself, so that it affected the ground not only within the caldera but also for several miles around.

Mineralization

Older Part of the District

In the older or known part of the Red Mountain district there are several areas of alteration as much as half a mile in diameter. One of these lies east of the Mohawk vein, another east of the Sixteen-to-One, another along the Nivloc vein and another east of the Nivloc (Keith, Plate I). Except in the case of the Nivloc occurence, these altered areas appear to be not particularly related to known veins or to recognized structures. They are irregular areas and the alteration affects essentially all the rock types present. There is almost no alteration associated with the Sixteen-to-One vein. Most of the alteration is bleaching, iron staining and argillization of the rocks, but in some areas there is quite intense silicification. We do not know what significance there is, if any, to the alteration or its distribution.

The veins are vuggy, irregularly banded quartz and calcite, with the silver as native silver or argentite. Oxidation extends some hundreds of feet deep but below the oxidized zone, at least in the Sixteen-to-One, there are small quantities of galena and sphalerite. In the Mohawk Mine near the west end of the district barite is abundant in the ore, locally forming bands two or three feet thick, and manganese in an unidentified oxide mineral is abundant enough to interfere with cyanidation treatment. We do not have information about barite and manganese in the nearby Sanger and Silver Queen mines. Barite is sparse in the ore of the eastern mines, the Sixteen-to-One and Nivloc, and manganese has not been reported.

All of the veins strike northeasterly and dip steeply either northwest or southeast. They are irregularly distributed in this older part of the district (see Plate I). Near the middle are the Sixteen-to-One and several other short veins (which have the usual composition but have not yet been shown to contain ore-grade silver) in a space about 2,000' long. About a mile to the east is the long Nivloc vein and widely-scattered very short veins, none closer than 1,000' to another, making up the eastern part of the district. For about three quarters of a mile west of the Sixteen-to-One there are no known veins. Beyond this barren stretch is the group of long northeaster faults spaced a few hundred feet apart and all at least locally silicified or otherwise mineralized; the Mohawk, Sanger and Silver Queen veins are in this group, forming the western part of the known district.

All the veins in the western cluster of the known district are in latite, the only rock type exposed here. In the middle and eastern parts of the known district the veins are all exposed in pre-latite rocks of various kinds. As has been mentioned, the ore in the Nivloc is said to have been in the part of the vein that was in pre-Tertiary rocks, and apparently at Sixteen-to-One andesite is the favorable host rock.

It seems clear from the distribution of remnants of latite that latite flows originally overlaid all the central and eastern parts of the known district. The Sixteen-to-One structure has about 150' of displacement. The present-day outcrop of the Sixteen-to-One vein is about 400' below the projected base of the latite in the down-thrown side (see Section A-A', Plate II), and the top of the ore is about 200' below that or 600' below the base of the latite. Judging by the height of the latite ridge just to the west, the latite was originally at least 250' thick over the vein, and the 9376' latite knob a mile north of Sixteen-to-One suggests a possible original thickness of as much as 800' for the latite. If, then, the vein was formed while the entire original thickness of latite was still present above it, and if there were no younger rocks above the latite, then the Sixteen-to-One ore was deposited at least 850' and perhaps 1,400' below the ground surface at the time of its deposition. If the thickness of the latite was greater than the minimums represented by the present elevations of outcrops, or if there were other younger rocks overlying it, the depth of ore deposition would, of course, be correspondingly greater.

The Nivloc structure has about 300' of displacement. The outcrop of the vein is apparently very close to the base of the latite on the down-thrown side of the structure (see Section A-A', Plate II), and the top of the ore is about 300' below the present surface. There is no information that permits an estimate of the thickness of rock above the base of the latite at the time of ore deposition.

The Mohawk vein lies in latite about 100' in the hanging-wall of the Mohawk northeaster fault, which has normal displacement of about 1,000'. Part of the main ore body outcrops but part does not, and lesser ore bodies do not outcrop, which suggests that the present-day surface, at elevation of about 8,400', is about at the top of ore deposition. The latite ridge a mile northeast of the mine, reaching an elevation of about 9,000' in the hangingwall of the Mohawk fault, suggests at least 600' of rock above the top of the ore zone at the time it was deposited.

New Part of the District

There has been only one systematic investigation of mineralization on the new or western part of the district; the 1942 U.S. Bureau of Mines sampling of manganese occurences in the post-latite sediments just east of the Cabron claims, as reported in USBM RI 4717. The USBM analyzed only for manganese and most of their samples contained less than 10% Mn but a few contained more than 20% Mn. Hewitt (Econ. Geol., vol. 58, 1963, p. 35) presents a complete analysis of a sample from this site, showing 0.003% Ag (0.9 oz. Ag/ton) and trace amounts of other metals. We consider these occurences to be hydrothermal and conclusive evidence that the mineralization here, and everywhere else in the district, is younger than the post-latite sediments.

Other than this work on the manganese occurrences there has been no systematic investigation of alteration or mineralization in the western part of the district. None of the published papers address these subjects and we ourselves have not attempted such studies. Everything that we know or think we know about alteration and mineralization comes from: 1) incidental observations we made while staking claims; 2) analyses of 16 samples collected while staking; 3) petrographic examination of 16 specimens also collected while staking, by Mr. Donald Hudson of the Mackay School of Mines; and 4) interpretation of aerial photos.

Except for rare pieces of vein quartz float we saw no veins or vein material similar to those of the older part of the district. With one exception the largest veins we saw were perhaps half an inch wide and a few feet long, with chalcedony, calcite and some manganese staining. The exception is a vein of chalcedonic quartz, as much as 4' wide and at least 300' long, on the Cabron 1 and 2 claims.

We did see, both on the ground and on the aerial photos, numerous ribs of resistant rock projecting out of the steep hillsides. One of these, on Cabron 7, 8 and 14, can be traced for a length of 3,500'; others are traceable for shorter distances, and many others line up to indicate that they are discontinuous exposures of a single long structure. From the aerial photos, it appears there are a couple of dozen such structures on the Cabron property that have lengths of a thousand feet or more if aligned ribs are connected. The ribs all strike northeast and appear to dip about vertically. They are from a few feet wide to about fifty feet wide, with some wider zones that probably represent the coalescing of several ribs.

The ribs outcrop on the tops of ridges or partway down their steep sides; at the bottoms of ridge slopes they are buried in talus and very few are to be seen on the aerial photos on valley floors. Many of the ribs that outcrop on slopes come to an end abruptly upslope for no visible reason. On the aerial photos it can be seen that within a fairly small area, such as around a single ridge, these rib tops all lie at about the same elevation (see stereo pair of aerial photos BLM NV80BC-7-14-16 and 7-14-17). On Plate I the rib tops and rib outcrops in the vicinity of Cabron, where they are numerous, have been transferred from the photos to the topographic map (a procedure subject to some error since it was done by eyeball). As can be seen on Plate IC, it proved possible to contour the rib tops to some extent. The 7,900' and 7,500' contours, in particular, have quite good control. It should be noted for future discussion that the 7,500' contour defines a trough in the rib top contours that coincides with the northern synform defined by the base of the latite.

The elevations of the scattered rib tops seen away from the Cabron property suggest that if there were enough rib tops it would be possible to draw rib-top contours on a gently-undulating surface throughout the caldera.

Few of the ribs extend downslope to an elevation more than 400' below the elevation of their tops, even where the slopes continue steeply downward so that one would expect the rib not to be buried in talus. It seems possible that there is a rib-bottom surface about 400' below the rib-top surface.

In outcrops the ribs are hard, often greenish, latite with more or less abundant fractures. In some the fractures appear to be a network of interweaving cracks more or less parallel to the northeast trend of the rib zone. In others there are these cracks and also one or more fairly straight and continuous fractures that can be traced for a few tens of feet along the outcrop. In some places the fractures are filmed with manganese oxides and occasionally there are narrow chalcedonic quartz and/or calcite stringers. These latter are most often along the more continuous fractures. At a very few places we encountered pockets a foot or so wide and a few feet long of intensely altered and ironstained material with some quartz and calcite within it. The larger (a few inches in diameter) float fragments of vein quartz that we found were down-slope from the rib zones.

The specimens we collected for study were taken hastily during staking and were deplorably poorly documented, so that Mr. Hudson's prtrographic work provides only some generalities concerning the nature of the rocks and the alteration. He prepared a brief petrographic description of each of the 16 specimens and a brief summary of the categories of alteration he found and his tentative thinking about the significance of this alteration. This summary forms Appendix B of this report.

To summarize Mr. Hudson's summary: two specimens are intensely silicified which suggests formation in a very near-surface environment; several specimens have albite, minor illite or montmorillonite, and kaolinite that suggests a somewhat deeper origin; and several other specimens contain celadonite, suggesting a still deeper zone. He concludes that there is no proof that the hydrothermal system was boiling at depth, but expresses the opinion that "the samples from the Cabron property appear to be from a zone above a boiling level".

Our imprecise notations for the specimens, tied to the claim grid rather than to geology, permit fairly close spotting of the sample locations on the air photos and topographic map, which in turn permit a rough estimate of where the specimens were collected in terms of elevation with respect to the tops of the resistant ribs. One of the silicified specimens was apparently collected from above the tops of the ribs, while the other seems to be within the elevation range of the ribs but is from a geologically confused area and may be from above the rib tops. All of the albitized and kaolinized specimens appear to have been collected at elevations within about the range of elevation of the upper 200' of the ribs. Most of the celadonite-bearing specimens appear to have been collected within about the range of elevation of the lower 200' of the ribs.

The implication of this attempt at locating specimens is that, to the extent that our plotting and estimation of elevations is correct, Mr. Hudson's interpretation of depth zoning of alteration fits with the sites from which the specimens were collected: the deeper celadonite alteration is found in specimens from deep within the rib zones; the shallower albite-kaolinite alteration is found in specimens from high in the rib zones; and at least one of the two intensely silicified specimens comes from above the rib zones. One pair of specimens, collected from within a few feet of each other, suggest there is lateral zoning of alteration as well: one has albite-kaolinite alteration, while the other has celadonite.

Table 1 presents analyses of 16 samples collected during the staking program and Figure 1 shows the locations of the samples on the claim grid. The samples were collected from mineralized-looking outcrops, mostly ribs -- either manganese-filmed, or iron-stained, or containing chalcedony or calcite or both and with or without manganese and iron staining. No attempt was made to sample systematically, so these samples must be considered simply as indicative of the general spread of metal contents that might be encountered in a systematic sampling program.

Judging by a rough estimate of background trace element contents as indicated by the sampling, 7 of the 16 samples can be considered anomalous. Sample C3 lies near the middle of the claim group, but Samples C9, C10, C11, C12, C13, and C14 all are near the eastern end of the group. This may mean that the eastern part of the property is better mineralized than the western end. Another possibility is that, since most of the samples of the C9-14 cluster were collected at low elevations, the deeper parts of the silicified ribs generally have higher trace element concentrations than the higher parts. However, C3 and C11 were collected at high elevations and are anomalous.

The elevation -- either absolute or with respect to the rib tops -- at which geochemical samples are collected on this property may have real bearing on their significance. Most geochemical sampling programs are concerned with metal distributions in veins or wall rocks at about the height in the original geochemical system at which ore was deposited, and variations of a couple of hundred feet in height along the system may cause little inherent variation. At Cabron, however, we are concerned with very high, near-surface regions of the hydrothermal system where the pressure-temperature gradients presumably were very steep and could cause major differences in deposition of trace elements over a relatively short vertical range. It seems likely, also, that the trace element distribution at this height could be radically different from that at the deeper ore-deposition horizon, so that interpretations that work well in the ordinary geochemical program no longer apply here.

TABLE I

CABRON PROPERTY

Tabulation of Trace Element Analyses

Sample	Lead ppm	Bismuth ppm	Gold oz/T	Gold ppm	Silver oz/T	Silver ppm	Arsenic ppm	Mercury ppb	Antimony ppm
C- 1			tr.*		0.110*				
2			tr.*		0.190*				
3	90	-5	-.044**	-0.05	0.372**	1	7	9,400	1
4	20	-5	tr**	-0.05	tr**	-1	11	340	-1
5	20	-5	tr**	-0.05	tr**	-1	-5	140	2
6	20	-5	tr**	-0.05	tr**	-1	-5	100	1
7	15	-5	tr**	-0.05	tr**	-1	-5	160	-1
8	25	-5	tr**	-0.05	tr**	-1	-5	100	-1
9	185	-5	tr**	-0.05	tr**	1	42	2,500	3
10	30	-5	tr**	-0.05	tr**	-1	28	430	9
11	30			-0.05		0.4	65	270	5
12	20			-0.05		0.1	40	240	5
13	250			-0.05		3.2	72	870	11
14	30			-0.05		0.3	60	980	18
15	20			-0.05		0.1	8	160	3
16	25			-0.05		0.9	-5	230	5

* Assays by Fred Yarcho, Darwin, California

** Assays by Brownstone Mining Co., Lone Pine, California

All other determinations by Hunter Mining Laboratory, Reno, Nevada

Summary of District Geology

The Red Mountain district, as it is defined here, lies in and near the Silver Peak caldera. Its eastern or known part lies partly within the northeast corner of the caldera and partly in the rocks eastward beyond the caldera. The western or new part lies along the northeast edge of the caldera, partly inside it and partly outside it. Both the caldera and the district are elongated in a direction approximately N 50 W, parallel to the regional trend of Paleozoic basement-rock fold axes and of a late Tertiary, pre-volcanism, downwarp that was filled with Esmeralda Formation sediments.

The oval-shaped caldera is a small one, about 4 miles by 8 miles, and it has been estimated that about 25 cubic miles of material was erupted from it. After initial formation of the caldera, latite flows from the ring fractures filled much of the depression and flowed over some of the surrounding rocks, and sediments with some basaltic flows were then deposited in the caldera and immediately outside it. Structure contours drawn on the base of the latite flows outside the caldera and on the base of the overlying sediments inside it demonstrate that the sediments were domed, with the apex of the dome lying near the northeastern edge of the caldera rather than in its center. Thus, the caldera is resurgent. Besides the dome, the sediments and the latite base have shallow folds trending a little east of north that traverse the caldera and extend some distance bayond it -- at least a mile for some, and possibly several miles for one. One of the anticlines lies at the east end of the caldera, a syncline lies at the west end, and between are another syncline and anticline. The folding was apparently synchronous with doming, since the dome disrupts the order of the folds.

After doming and folding, the center of the caldera and the country for at least two or three miles to the northeast and southwest, beyond the caldera, collapsed. The collapse took place along a swarm of northeast-striking faults -- at least the Bop, AC, County Road and Mohawk faults -- that have on the aggregate several thousand feet of normal displacement, with their west sides, toward the caldera center, being down. There was not similar displacement at the west side of the caldera, which acted somewhat as a pivot so that the collapse was a trap-door effect.

Mineralization seen in the older or eastern part of the district is in the rocks beyond the trap door, that did not collapse. This is typical epithermal mineralization: vuggy veins of quartz and calcite with some barite and other gangue minerals, silver and gold values that in some cases are worth mining, minor base metals, and in the case of the Mohawk appreciable manganese. Evidence within the district indicates that the ore bodies in these veins were deposited at least several hundred feet to a thousand feet below the surface at time of mineralization. The commonly-accepted model for epithermal mineralization supports deposition at this depth or a somewhat greater depth. While the Mohawk ore body essentially outcrops, the ore bodies of the Sixteen-to-One and the Nivloc have two or three hundred feet of weakly-mineralized vein above them. The latter two veins, though not ore-bearing at their outcrops, are obviously epithermal veins with substantial dimensions and therefore were deemed worthy of the exploration that found the blind ore bodies.

In the western part of the district, at least on the Cabron property, there are no veins resembling those of the eastern district. Instead, there are numerous linear, erosion-resistant ribs or zones that trend northeasterly like the veins of the eastern part of the district. Locally they have irregular very narrow veinlets of chalcedonic quartz and/or coarse calcite, and many of them have manganese films on fractures. Some of them contain anomalous traces of antimony, arsenic, lead and/or mercury. The petrographic work done by Mr. Hudson indicates that chalcedonic quartz tends to be concentrated at the tops of these ribs or above them; the upper couple of hundred feet tend to have albite/kaolinite alteration with some illite and montmorillonite; and the lower parts of them tend to represent a celadonite alteration phase. There is no widespread obvious alteration on most of the Cabron property.

On Cabron all the resistant ribs are in the caldera latite or in the older rhyolitic rocks just outside the caldera. East of Cabron some zones extend through the latite into the overlying post-latite, intra-caldera sediments, where there are rather extensive bodies of low-grade manganese mineralization. On Cabron the tops of the zones in many cases do not continue upward indefinitely, but instead come to a rather abrupt halt upward even though there is still rock above them in the ridges. The topping-out of the ribs is so consistent and obvious that it is possible to draw structure contours on them where they are numerous, (Plate IC), and on the Cabron property the structure contours define a shallow warp in the surface of the rib tops, approximately coinciding with the warp in the base of the latite that marks the northern edge of the caldera dome.

The anomalous trace element content of some of the ribs indicates that they are some kind of manifestation of mineralization. Their linear nature, striking northeast parallel to the known veins of the district, suggests that they are veins similar to those elsewhere in the district but with a different nature of mineralization. The alteration phases identified by Mr. Hudson, and their vertical zoning indicates that they are epithermal veins exposed at a very high level -- close to the surface at the time mineralization. The essentially flat, though somewhat warped, surface of topping-out of the ribs is probably parallel to the essentially flat surface of the intracaldera sediments at the time of mineralization and thus probably represents a surface-related stage in the temperature and pressure gradients, below which the mineralizing solutions altered the wall rocks of their passegeways to produce resistant rocks, while above this stage they did not.

CONCLUSIONS AND CABRON PROPERTY ORE POTENTIAL

From these geological observations -- some our own but mostly those of others -- and interpretations of them -- mostly our own -- we draw the following conclusions:

1) While the Silver Peak caldera itself is a relatively small one, it is a resurgent one and is the product of a magma body much larger than the outline of the caldera. The resurgence is demonstrated by the well-defined doming of the sediments deposited in the caldera. The size of the magma chamber below is suggested by the fact that folding of the sediments and the base of the slightly-older latite affects not only the caldera but also the rocks for at least a couple of miles beyond its rim. The significance of this in connection with the magma size is based on the assumption that the folding is local, and took place because here the relatively thin cover of rocks above the fluid magma folded easily under mild compression while rocks farther away, not underlain by magma, did not fold. This may be an invalid assumption.

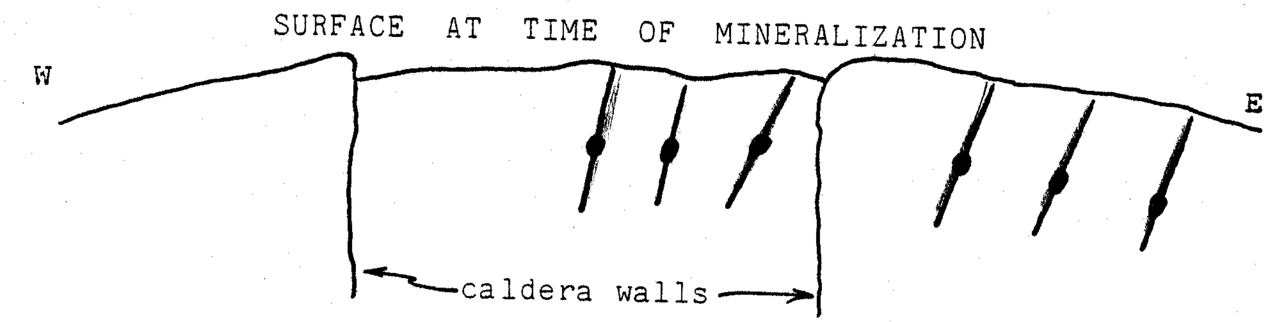
2) Mineralization in the Red Mountain district was a late phase of caldera activity and took place at some time after the intra-caldera sediments were deposited, as witness the manganese mineralization in these sediments.

3) Final collapse of the caldera and the rocks for at least a couple of miles to the northeast and southwest (further evidence of the size of the magma chamber) took place by displacement on several northeast faults that pass through the eastern

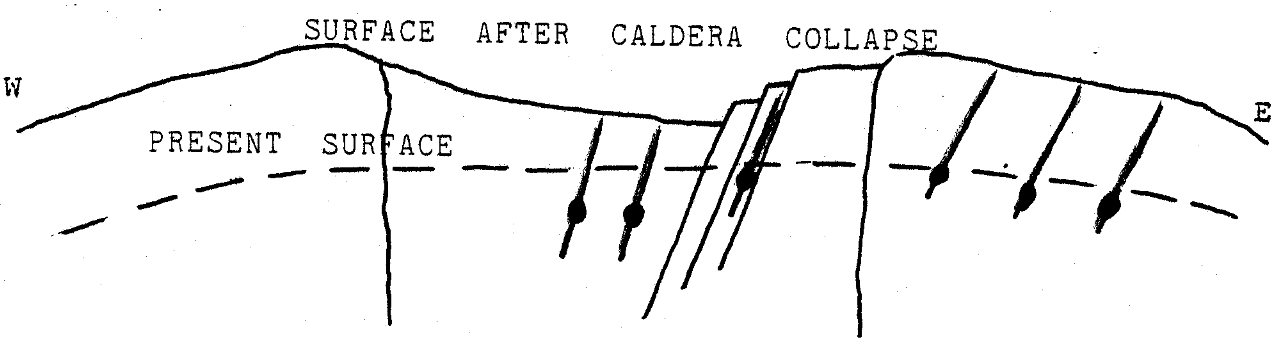
end of the caldera, while the west edge of the caldera underwent little faulting. Thus, the top of the magma chamber dropped several thousand feet on the east side -- the displacement on the BOP, AC, County Road and Mohawk faults -- while pivoting around the west side like a trap door. The collapse was probably post-mineralization, although the fault system existed earlier and many of the northeast-striking structures were mineralized.

4) The effect of the caldera collapse was to drop the western or new part of the Red Mountain district down to a position where it was relatively protected from erosion, while leaving the eastern or known part high and hence subject to rapid erosion, as is indicated in the sketch sections of Figure 2. In the eastern part of the district, therefore, the veins are exposed not far above the horizon at which ore was deposited, because a thousand feet or more of rock has been eroded away to reach this level of mineralization. In the western part of the district the veins are exposed at a much higher level of mineralization characterized by chalcedonic quartz, albite-kaolinite, and celadonite alteration phases with anomalous trace amounts of antimony, arsenic, lead and mercury, because much less rock -- probably less than 500' -- has been eroded away from the original surface.

5) The final conclusion, drawn from this series of conclusions, is that at least some of the veins on the Cabron property must have deposits of precious metals ore at some depth below their outcrops.



Caldera and district cross section
after mineralization but before collapse.



Caldera and district cross section
after collapse and (dashed line) after
erosion to present surface.

Figure 2. Sketch sections illustrating effect of caldera collapse.
Red lines represent mineralization channels,
red balls represent ore bodies.
No scale

It seems overly optimistic to think that all of the two dozen or so veins on the property have ore bodies. Which ones might have ore bodies is impossible to say at this time; probably geochemical surveying would indicate which ones are favorable. The kind of ore, too, cannot be predicted at this time. In view of the fact that all the known ore in the district is predominantly silver, this is the most likely metal.

Most of the veins on the property outcrop in latite, and those that lie within the caldera probably remain in latite to depths beyond any expectation of ore since they presumably will be in the volcanic necks along the rim or in the thick intra-caldera flows. Probably the only ore bodies to be expected in them are steep tabular masses along the planes of the veins, like most epithermal deposits, localized largely by pressure-temperature relationships. The veins outside the caldera rim will, at some depth, pass into the rhyolitic flows and tuffs that underlie the latite. The change in rock type offers the possibility of ore localized in favorable units, not only within the veins but also as mass bodies in tuff units. The vicinity of the caldera rim itself also offers the possibility of mass ore bodies in thoroughly shattered bodies of rock that presumably slid from the caldera walls soon after caldera formation and before extrusion of the latites.

RECOMMENDATIONS

The property should be geochemically surveyed in moderate detail, with attention concentrated on rock sampling of the erosion-resistant ribs. The objective of this survey is to determine which of the ribs are most likely to have ore at depth, and which are least likely to.

Assuming that the geochemical work permits differentiation between more-promising and less-promising structures, at least two of the better and two of the poorer structures should be tested by diamond drilling. The initial drilling should be a vertical fan of three or four holes on one structure aimed to reach the vein at depths of about 300, 600, 1,000, and 1,500' below the lowest outcrop, to determine how the character of this vein -- and presumably the others -- changes with depth. If no typical epithermal vein mineralization -- not necessarily ore grade -- is encountered, the remainder of the program may not be worth carrying out.

If typical epithermal vein mineralization is encountered, this will guide the drilling in the other structures. Presumably ore bodies on these veins, as on all epithermal veins, will be erratically distributed and these few initial holes may not encounter ore. Whether or not ore is encountered, it will now become necessary to map the geology in detail and make a much more detailed geochemical survey of at least some veins, in an effort to learn how to predict where ore bodies will lie. The geological mapping should also help in predicting where rocks favorable for mass ore bodies might lie.

APPENDIX A

Cabron claim recordation data

Claim Numbers	Esmeralda County Book and Page	USBLM Serial Number
Cabron 1 through Cabron 29 consecutively	69 634 through 70 12 consecutively	N MC 228389 through N MC 228417 consecutively
Cabron 30 through Cabron 93	72 590-653 ~~Not yet recorded~~	NMC 241171 — 241234 ~~Not yet assigned~~

APPENDIX B

Summary notes by Mr. Donald M. Hudson on petrographic study of Cabron specimens (Transcribed from hand-written text)

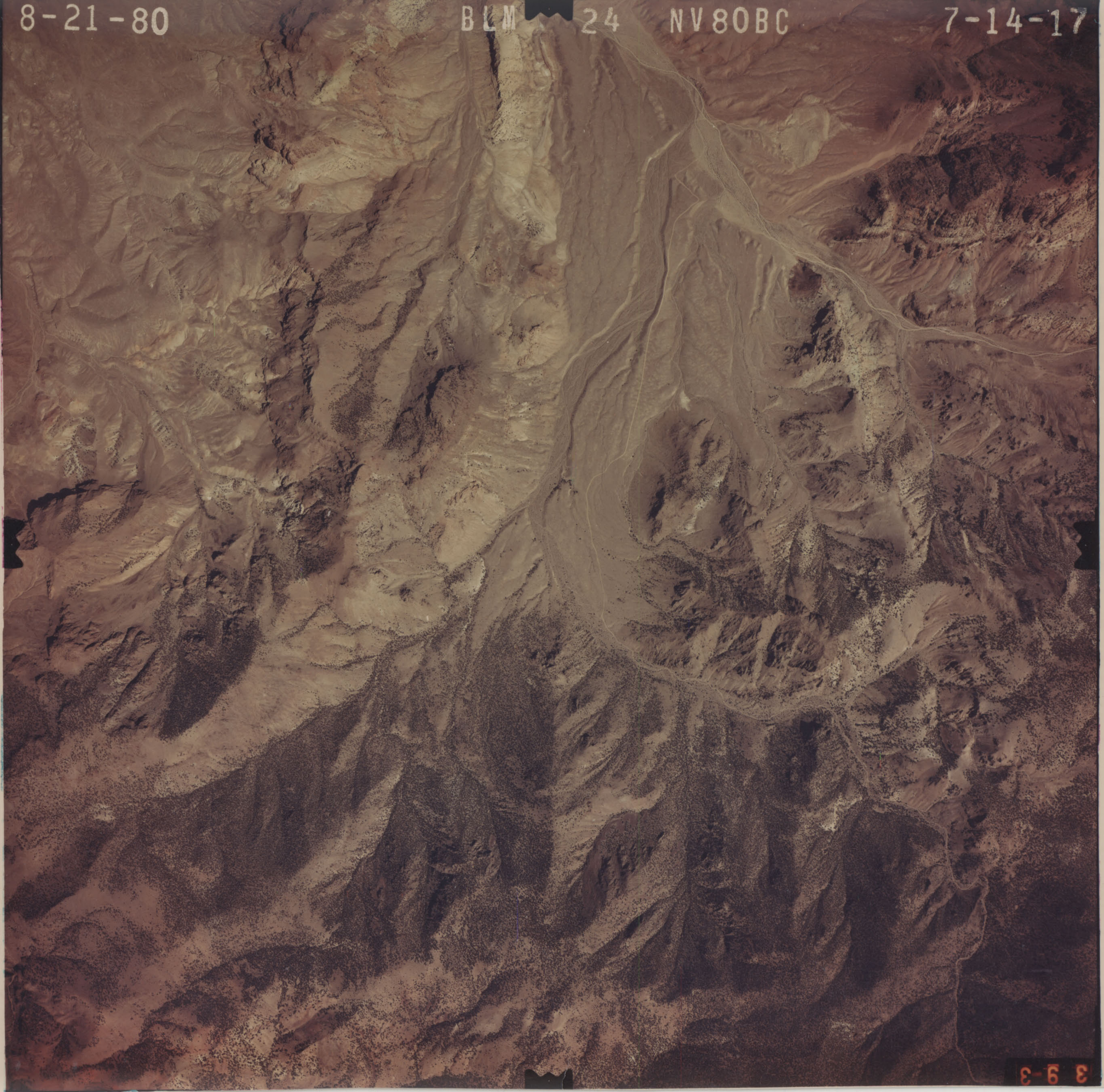
General Characteristics of Alteration

Samples CS-7 and CS-14 are strongly silicified and brecciated. The silicification consists of chalcedonic quartz, probably opal and cristobalite originally. This mineralogy is typical of the highly leached zone above the water table and would thus indicate a very near surface environment. The occurrence of epidote in CS-14 indicates a temperature about $230^{o}C$ or above. Normally such temperatures occur below about 300 meters from the surface. The samples are highly brecciated, probably the result of hydrothermal brecciation. These samples either come from a zone of near surface silicification or along a vein structure above a zone of boiling.

Samples CS-3, CS-4, CS-5, CS-6, CS-10 and CS-15 appear to come from a zone beneath or lateral to CS-7 and CS-14. This group contains albite, minor illite or montmorillonite, and kaolinite. Assuming the clays are of hypogene origin, the kaolinite indicates acid leaching, although not strong leaching, by sulfuric acid. This may be produced by near surface oxidation of H_2S and downward leaching of sulfuric acid or by condensation of vapors containing H_2S above a zone of boiling creating dilute sulfuric acid which alters the rocks to kaolinite. Albite and minor montmorillonite or illite commonly accompany kaolinization. This zone normally occurs beneath the water table underlying the silicified zone but may also occur laterally from vein structures, usually above boiling zones, in close proximity to the veins.

Samples CS-1, CS-2, CS-8, CS-9, CS-11, CS-12, and CS-16 come from a zone dominated by celadonite. CS-12 may come from a transitional zone between kaolinite and celadonite with strong albitization. CS-2, CS-8 and CS-11 probably come from a somewhat deeper or more peripheral zone with a low activity of CO_2 to account for calcite but a high activity of ferric iron in an oxidized environment to account for celadonite. CS-9 comes from the same zone as the above with high celadonite content but is brecciated and contains chalcedonic quartz thus probably very close to a structure. CS-16 is similar to the above but is very weakly altered indicating it is peripheral to the major zones of alteration. CS-1 may come from a slightly deeper zone since it lacks celadonite and thus may have not been in as oxidizing environment as the rest of this group.

There is no proof that the system was boiling at depth and the alteration could have formed from a non-boiling system. The presence of celadonite does indicate a very high oxygen fugacity and suggests boiling beneath this zone. Celadonite is not described from modern geothermal systems, most of which are non-boiling. The occurrence of epidote with chalcedonic quartz and opaline silica also suggests a boiling system. Strong silicification is normally associated with a vapor-dominated zone, usually above a permanent water table. The epidote in CS-14 indicates temperatures above 230°C which are only plausible at depths greater than about 300 meters. This apparent conflict may indicate an area of formation above a boiling zone. Although there is no absolute assurance, the samples from the Cabron property appear to be from a zone above a boiling level.



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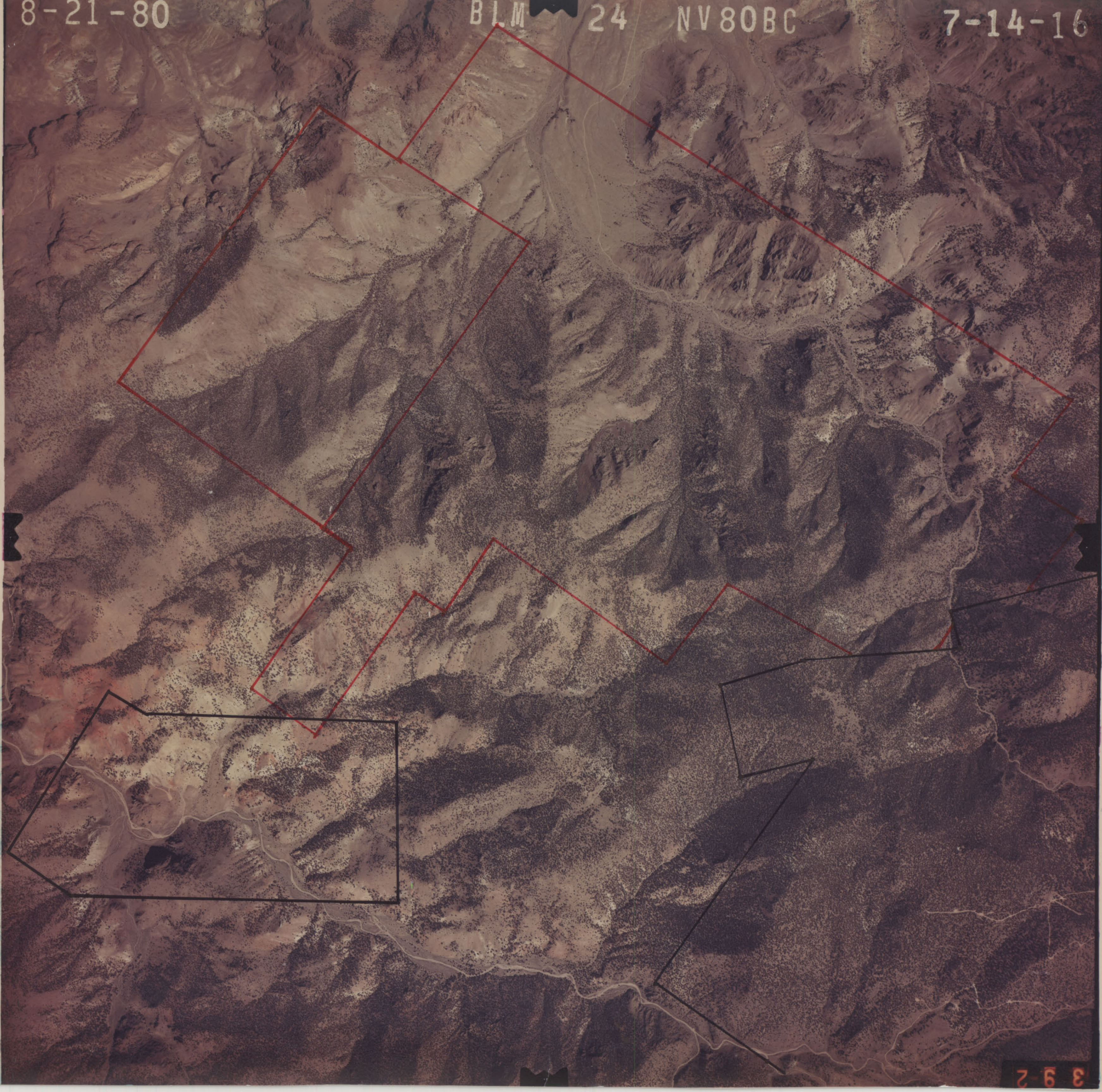
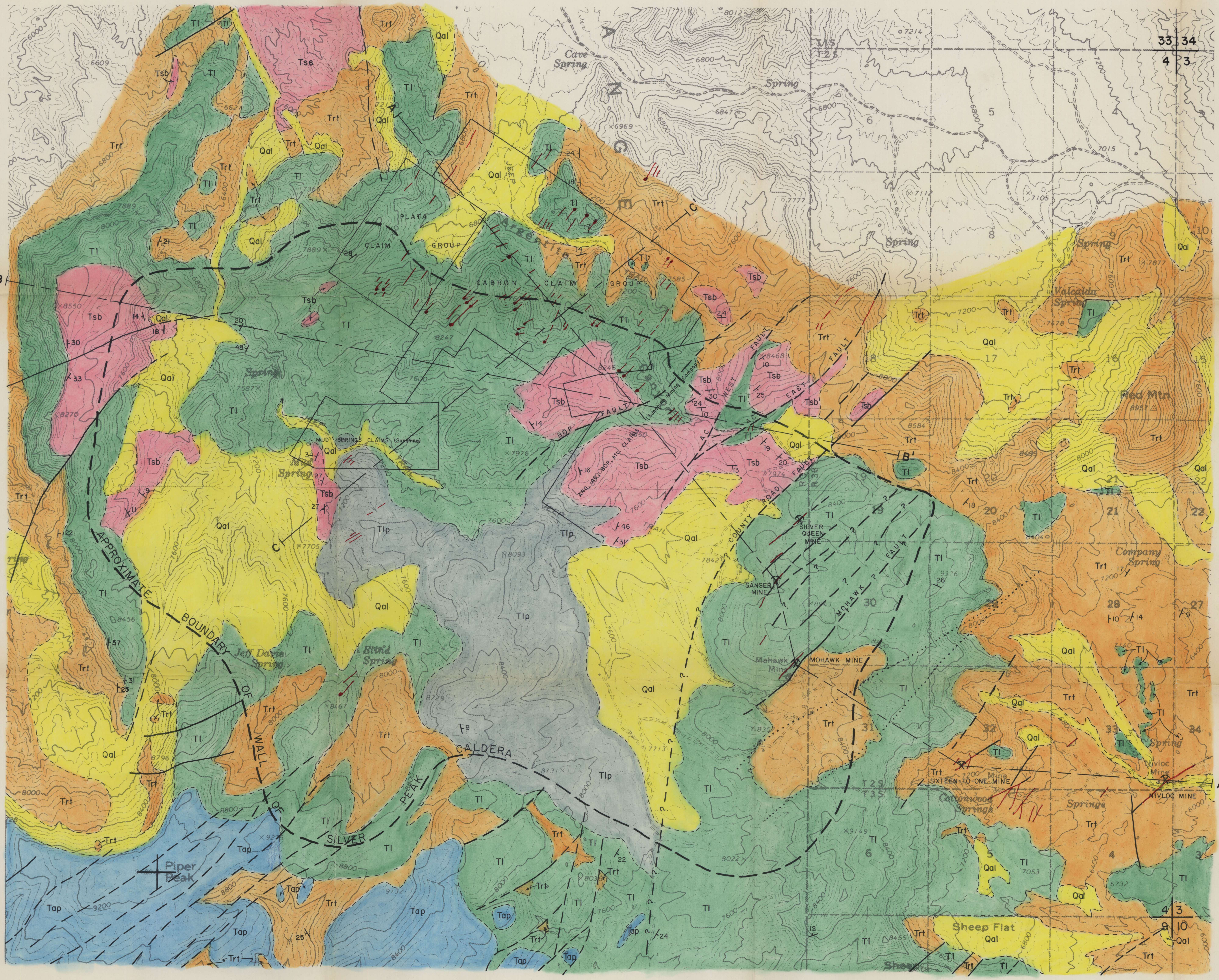
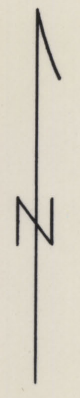


— CABRON PROPERTY, RED MTN. DISTRICT, ESMERALDA COUNTY, NEV.
— OTHER PROPERTIES

3860 0036





USGS GQ 1325
USGS GQ 1186 — USGS BULL. 1423, PLATE I

Geology transfered and enlarged from geologic sources above, by eyeball work

Qal	Quaternary alluvium
Ts6	Ts6 unit of GQ 1325, sediments north of caldera
Tsb	Ts5 and Tb units of GQ maps, intracaldera sediments and basalt
Tlp	Tlp unit of GQ maps, porphyritic latite
Tap	Tap unit of GQ 1186, Piper Peak andesite. Includes Tlpt at south edge of map
Tl	Tl unit of GQ maps, latite flows. Includes Tlb at south edge of map
Trt	All pre-Tl units of GQ maps, rhyolitic flows and tuffs in Cabron area

Resistant ribs seen in western part of district on aerial photos. Ball represents rib-top

Veins known in eastern part of district

Fault. Dotted faults are not from original geologic maps, but are inferred from air photos & struc. contours

23 Bedding or layering attitude

Claim group boundaries are plotted from County MT plats. Cabron group is plotted by topography.

2,000' 0 2,000' 4,000' 6,000'

SCALE 1:24,000

CABRON PROPERTY, RED MOUNTAIN DIST. ESMERALDA COUNTY, NEVADA

PLATE I

SILVER PEAK CALDERA – RED MOUNTAIN DISTRICT

GENERALIZED GEOLOGIC MAP

BY: AB III and SRB — MAY 1, 1982

CABRON PROPERTY, RED MOUNTAIN DIST.
ESMERALDA COUNTY, NEVADA

PLATE IA

SILVER PEAK CALDERA – RED MOUNTAIN DISTRICT

STRUCTURE CONTOURS ON BASE OF LATITE UNIT (OVERLAY FOR PLATE I)

BY: AB III and SRB — MAY 1, 1982

(101) Item 122 Plate 6 of 7

CABRON PROPERTY, RED MOUNTAIN DIST.
ESMERALDA COUNTY, NEVADA

PLATE IB

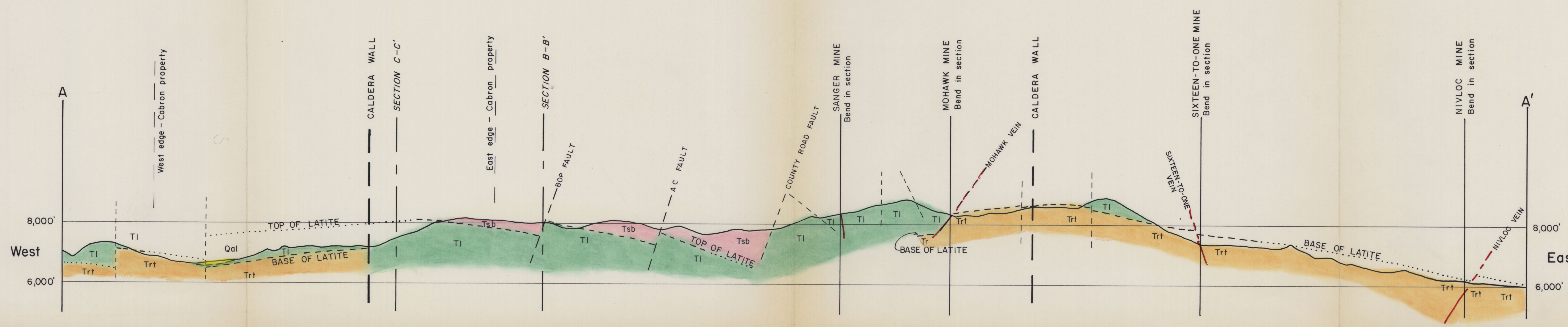
SILVER PEAK CALDERA – RED MOUNTAIN DISTRICT

STRUCTURE CONTOURS ON TOP OF LATITE UNIT (OVERLAY FOR PLATE I)

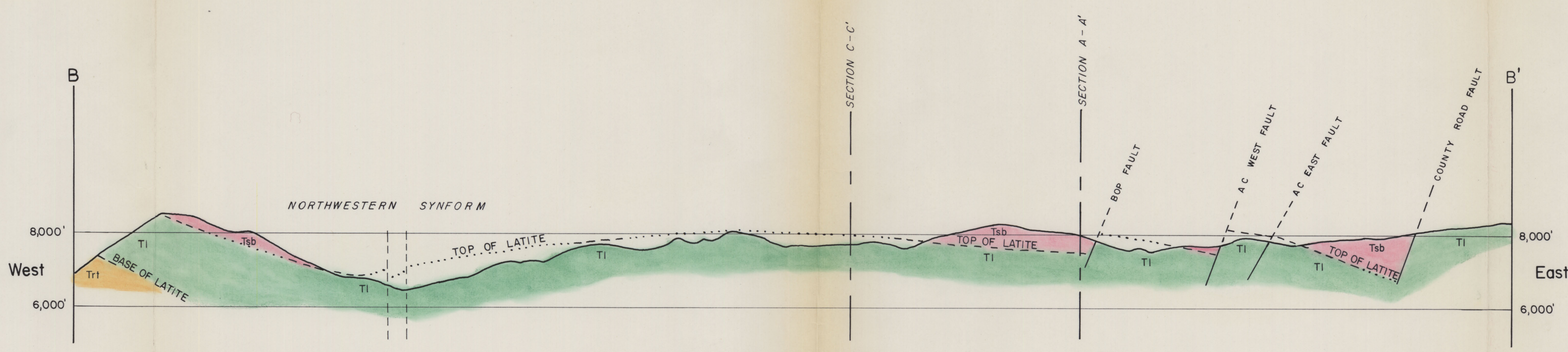
BY: AB III and SRB 38460036 MAY 1, 1982

(101) Item 122 Plate 7 of 7

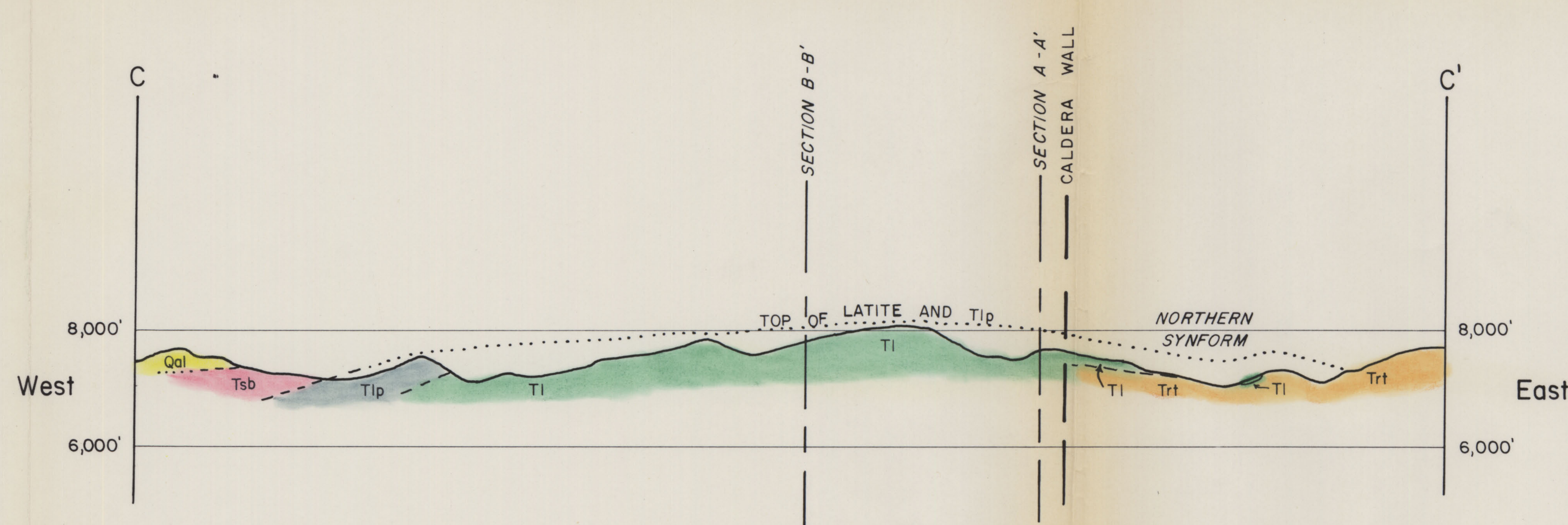
161 Item 122 Plate 2 of



SECTION A-A'



SECTION B-B'



SECTION C-C'

SEE PLATE I FOR LEGEND

SCALE 1 : 24,000

CABRON PROPERTY, RED MOUNTAIN DIST.
ESMERALDA COUNTY, NEVADA

PLATE II

SILVER PEAK CALDERA - RED MOUNTAIN DISTRICT

SECTIONS THROUGH CALDERA AND DISTRICT

BY: AB III and SRB 28460 00316 MAY 1, 1982