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THE ELK MOUNTAIN DISTRICT.

GEOGRAPHY.

LOCATION.

The Elk Mountain district comprises a small area a few miles south of the Idaho State line. As shown on Plate I (p. 10), it is about midway between the northern boundaries of the Jarbidge and Contact districts, from each of which it is distant about 10 miles. It is about 25 miles southwest of Rogerson, Idaho, the nearest railway station on the Oregon Short Line. The nearest post office is Three Creek, Idaho, 9 miles distant on the northwest. With both of these places there are good wagon road connections. By trail the district is 30 miles from Contact and about the same distance from Jarbidge. From Contact, however, a wagon road extends to the Helsley ranch, a good stopping place within 8 miles of the district on the southeast.

TOPOGRAPHY.

The long, gently sloping, lava-covered ridge already described as extending from the Jarbidge district northeastward to the dam on Salmon River, near the middle part of its course, near the point where it crosses the State line at the 115° meridian, culminates in an elliptical group of mountains or elongated dome-shaped mass studded with low peaks that trend northeast and southwest for about 7 miles, with a maximum height of about 8,500 feet southwest of the State line. From the rounded, unit-like appearance of the mass on the north, the group is locally known as Elk Mountain, but from its dissected and composite character on the south it is more frequently called the Elk Mountains. According to J. F. O'Byrne, the State line crosses the northeast shoulder of the group.

On the southeast the mountains meet the surrounding lava plateau or plain of the Salmon River valley at an elevation of about 6,700 feet, above which their summit rises 1,800 feet. The mountains as a whole probably represent up-doming by a granodiorite stock, batholith or laccolith, similar to that in the Contact district. The granodiorite is exposed only in the southwestern part of the mountains, where they are most deeply dissected.

The Elk Mountain district here described is located at the southwest end of the group, on the headwaters of Salmon River, on the upper south slope of the divide that separates these waters on the

southeast from the drainage of the East Fork of Bruneau River on the northwest, between elevations of 7,000 and 8,000 feet. The topography is mountainous and rough (Pl. XXVI), being of the same type as that of the Contact district, and is produced by deep erosion in the folded Paleozoic sedimentary rocks, which have been uplifted and tilted by plutonic masses covered by lava and subsequently denuded. The topography is mostly of the ridge and gulch type and trends south-southeasterly, at right angles to the axis of the mountains. The district is drained chiefly by Fall, Lime, and Willow creeks, small streams that flow eastward into Wilson Creek, which joins Salmon River below the Helsley ranch. Pole Creek, a larger stream, flows near by on the southwest.

GEOLOGY.

Geologically and mineralogically the Elk Mountain district, as indicated on Plate I (p. 10), is a replica of the Contact district, already described. It consists of a central intrusive granodiorite core, surrounded by a zone of Paleozoic sedimentary rocks, and an outer field of Tertiary lavas underlying the surface of the surrounding plateau.

It lies in the Nevada Plateau, which is underlain by the Tertiary lavas and lake beds resting upon the folded and eroded Paleozoic sedimentary rocks. The Paleozoic rocks seem to consist of the same formations that appear in the Contact district, namely, limestone, quartzite, shale, slate, etc. They have been similarly domed up by a stock or mass of intrusive granodiorite, which apparently so shattered the beds in the crown of the dome that it soon became the seat of active erosion, which stripped back the quaquaversally dipping beds down the sides of the dome to the points where their upturned truncated edges now form a rim overlooking the still more deeply eroded granodiorite of the central area. The dip, which is fairly uniform, varies from 40° to 70°, the maximum observed being on the north. On the east it is about 50°, with decrease toward the south end. On the southeast the rim has been removed by erosion, which seems to be also the cause of the elongation of the central granodiorite area to a length of 1½ miles, against three-fourths of a mile in width.

The granodiorite is similar to that of the Contact batholith, except that it seems on the average to contain more bisilicates, notably hornblende, as at the Johnson mine. It consists essentially of plagioclase, orthoclase, quartz, hornblende, and biotite, with the accessories titanite or sphene, magnetite, and apatite. In the slide examined, which was obtained not far from the contact, calcite, pyrite, and much garnet are also present. The plagioclase seems to be oligoclase, about the same as that in the Contact batholith, but

owing to its altered condition the determination was not wholly satisfactory. The rock is regarded as of the same age (Cretaceous or near Cretaceous) as the Contact batholith. It is deeply oxidized, with the hornblende and feldspars much altered and sericitized, and, like the Contact rock, it is intruded by quartz syenite and quartz monzonite dikes, of which a dike of the aplitic phase occurs in the northwest slope of White Elephant Mountain.

The limestone in association with the deposits is chiefly the whitish or light-gray, finely crystalline, closely banded or straticulate rock, well shown in the west spur of Red Elephant Mountain along the road between the Austeon camp and tunnels.

About the middle of the east side of the granodiorite area is a low peak of white limestone known as the White Elephant, which reaches an elevation of about 8,070 feet, and of which the upper part is shown at the right in Plate XXV, *A*. About one-third of a mile to the northwest is a similar but less prominent swell known as Red Elephant Mountain, shown in the center of the same plate. Half a mile east of Red Elephant and separated from it by a narrow valley or gulch nearly 1,000 feet deep is a prominent outlying parallel short ridge or peak, shown at the left in Plate XXV, *A*, and at the right in Plate XXVI, which from its color and the scrub trees upon it is known as Mahogany Elephant. It seems to consist mostly of dark slate-colored thin-bedded blue limestone, slate, and shale, which dip outward (east) at angles of about 40°. In a similar but longer and larger mountain mass about a mile farther east, beyond Lime Creek, whose valley here seems to occupy a syncline, the dip is at about the same angle in the opposite direction, or west. In a similarly prominent mountainous outlier known from the rocks composing it as Quartzite Butte, which culminates in a sharp-crested ridge or peak (Pl. XXVI, at right of center), about a mile to the north of the one last described, the beds seem to dip 40° NW. toward the axis of the mountains.

If the dip of the rocks continues the same in the intervening valley as in Red Elephant and Mahogany Elephant, which seems probable, these two mountains, including the valley, expose a section about 1,300 feet in thickness; and in case the quartzite of Quartzite Butte, on the trend of whose strike the section is located, occurs at the base of the section, as seems likely, the total thickness of the Paleozoic rocks must be considerably greater than 1,300 feet, probably 1,600 feet or more.

On the west side of the area, which lies largely in the Fall Creek valley, the geologic section seems to be in descending order as follows: Rhyolite; light-colored limestone, 600 feet; quartzite (?), 300 feet; granodiorite.

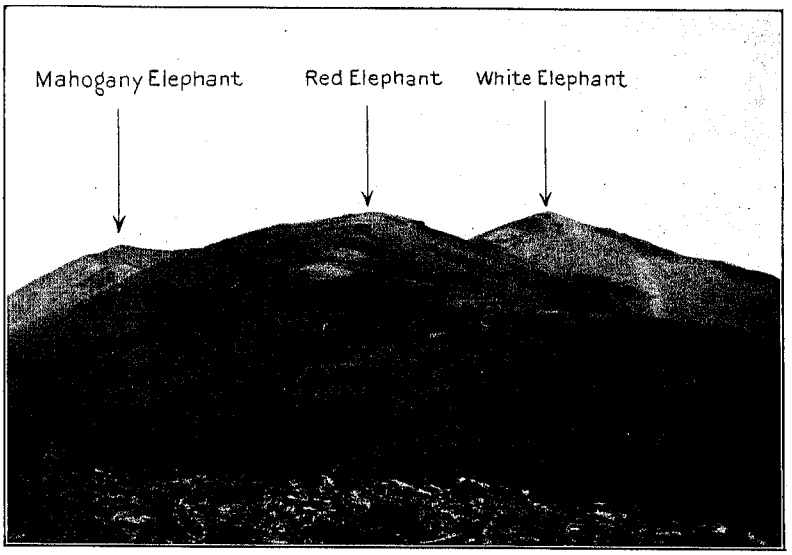
The lava encircling the limestone zone and underlying the plateau on the outer side seems to be the young rim-rock lava of the Jarbidge district, with which it is apparently continuous, though in places débris or small exposures of rock resembling the old rhyolite of the Jarbidge district were also observed. It does not appear to exceed a few hundred feet in maximum thickness. It caps in scarp fashion the limestone to the west of the district, and with gentle dip it laps upon the west and northwest slopes of the mountains, reaching for the most part to the crest. Commencing at their north base it underlies the expansive plain, declining in long, gentle slopes toward Snake River on the north, as described in the section on the Jarbidge district. At a mile or more to the northwest of the Elk Mountain district the piedmont tributary valley of the East Fork of Bruneau River, several hundred feet deep, is seemingly cut through the lava into the underlying limestone. From the base of the mountains and limits of the Paleozoic rocks on the southeast the lava underlies a benched valley plain or mesa, several miles in width, which slopes southward or downstream, with the valley of North Salmon River, and seems to be continuous with the similar lava mesa in the southwestern part of the Contact district. From the base of the mountains the lava also inclines at a low angle laterally toward the river and the Helsley ranch, near which it breaks off abruptly in steep scarps or bluffs 100 feet or more in height overlooking the younger portion of the valley now occupied by the river. As a result of these conditions the tributary streams, which near the mountains flow almost upon the surface of the plain, emerge at the foot of the scarp through narrow, deeply cut notches or passes, affording in most places the only means of access to the plains from the valley side.

MINERAL DEPOSITS.

GENERAL FEATURES.

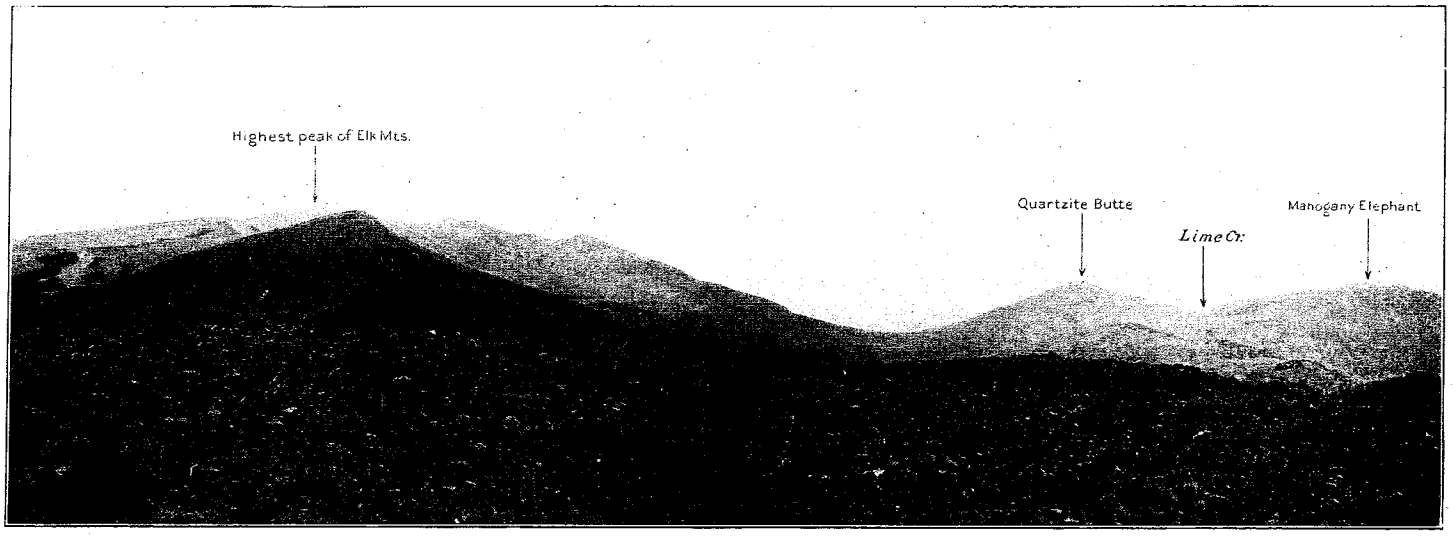
Mineral was known in the Elk Mountain district at least as early as 1890, since which date W. H. Austeon, a pioneer of Silver City, Idaho, as well as of this district, has annually carried on work here. His cabin and buildings, located in the northwestern part of the district at an elevation of about 7,600 feet on the head of Fall Creek, seem to be about the only permanent camp. The district, however, as a whole is still in the prospect stage, its most extensive openings not exceeding 200 feet in depth. At present ground is held and assessment work is being done on it by a dozen or more persons.

As in the Contact district, the deposits occur principally in association with the contact zone of the intrusive granodiorite and the Paleozoic limestone and are regarded as of Cretaceous or near Cre-



A. EAST PRONG OF ELK MOUNTAIN MINERAL-BEARING HORSESHOE, LOOKING SOUTHEAST.

B. MAMMOTH VEIN IN CUT AND ORE, LOOKING NORTH.



VIEW OF ELK MOUNTAINS, CHIEFLY PALEOZOIC SEDIMENTARY ROCKS.

Left half is looking along crest of range, which extends 7 miles north-northeast to the Idaho State line.

taceous age. They seem to be mostly of the contact-metamorphic type, with more or less massive garnetiferous chloropal and siliceous ferruginous matter in the gangue.

The metal of the district is chiefly copper, with which, however, is associated also gold and silver. A tin can placed in the creek at the foot of the mountains, it is said, soon becomes copper plated. The gangue here is not so ferruginous as in the Contact district, nor is the garnet so massive. Some of it shows well-developed crystal forms of garnet. The minerals observed in association with the deposits are as follows:

Aragonite.	Flint.	Molybdenite(?).
Argentite(?).	Garnet.	Pyrite.
Axinite(?)	Gold.	Quartz.
Calcite.	Hematite.	Silver(?).
Chert.	Limonite.	Stibnite.
Chloropal.	Manganese.	

The ore minerals are malachite, azurite, chalcopyrite, bornite, chrysocolla, gold, and silver.

The deposits are mostly on the arms of a horseshoe-shaped belt along the east and west sides of the granodiorite area, the toe portion on the north being apparently more deeply buried or less favorable for the occurrence of mineral and its exploitation.

The outcrops or "copper cap rock" as shown on the Austeon property, on the west spur ridge of Red Elephant Mountain near the west arm of the horseshoe, seems to consist mainly of reddish-brown, greenish, and blackish iron, copper, and manganese stained, altered, and in part mineralized granodiorite and limestone. Locally they are seemingly brecciated and here and there they constitute fair-grade ore.

AUSTEON TUNNELS PROSPECT.

A little farther down the slope from the outcrops just referred to, the Austeon tunnels ground is opened principally by a 130-foot tunnel and a 200-foot tunnel, spaced about 200 feet apart vertically, and both driven northward in the granodiorite to strike the Austeon 6-foot transverse vein, which is said to average about 3 per cent in copper and $7 in gold to the ton and to contain some beads or small nuggets of native copper. The granodiorite is mostly altered and barren or only slightly mineralized. At about 190 feet in from the portal of the lower tunnel, however, which is at an elevation of about 7,150 feet, firm, hard granodiorite is encountered, which is darker, with more green hornblende, than the average of this rock and contains also pyrite and calcite.

O'NEIL PROSPECT.

Near the south end of the west arm of the horseshoe is the O'Neil property, owned by O'Neil Bros. It seems to be one of the best showings in the district, and is said to be located on a good-looking persistent ledge, much of which carries about 16 per cent of copper.

RED ELEPHANT INCLINE.

The Red Elephant incline is located on ground owned by W. H. Austeon at the east contact, on the upper southwest slope of Red Elephant Mountain, at an elevation of about 8,180 feet. Following the granodiorite contact, which dips 30° to 40°, it extends N 30° E. for 155 feet in massive white fine to medium grained crystalline limestone and exposes the following section, which seems not only to be coextensive with the incline, but to continue beyond it in depth.

Section in Red Elephant incline.

	Feet.
Crushed and partly silicated and mineralized brownish and mottled limestone, containing flint or chert and manganese oxide and running from 1 to 2 per cent of copper, mostly in malachite, oxide, and chrysocolla	8
Garnetiferous, finely banded reddish, brownish, greenish, and bluish mottled altered limestone and garnetiferous chloropal gangue with malachite, azurite, chalcopyrite, and bornite, averaging as a whole about 3 per cent in copper and small values in gold and silver	6½
Bedrock granodiorite.	

There seems to be here a 14½-foot bed or body of low-grade ore which, if it continues in extent and depth, as appears to be the case, will probably be some day profitably worked.

GOLD PROSPECT.

A few hundred yards southeasterly of the incline opening just described and somewhat higher up the slope, on the same Austeon ground and in the same limestone country rock, occurs a parallel 2-foot impure quartz ledge or bed said to carry fair values in antimonial gold. The ledge, which is opened by a small pit or cut and shows portions resembling breccia, seems to be a replacement in the limestone along a fault plane. The outcrops are mostly reddish and dark-brown iron-stained siliceous material. The antimony is present as stibnite in the massive form, in impure dark-gray or blackish submetallic-looking small sheets or veinlets, films, and irregular bodies. Associated with the deposit is also considerable iron oxide and some yellowish material, apparently lead, and dark argentite.

ESTES PROSPECT.

The Estes prospect lies on the upper northerly slope of White Elephant Mountain, at an elevation of about 8,050 feet, on the contact between silicified garnetiferous limestone and granodiorite, with well-developed crystalline garnet in the gangue. The principal deposit consists of a bed 1 foot wide containing numerous pockets of good-grade copper ore.

OTHER PROSPECTS.

At the south end of the east contact, at the base of White Elephant Mountain, is the Robinette prospect, said to present a good showing.

On the northeast or outer side of the contact zone are also a number of outlying prospects in the limestone and quartzite, which were not visited in the course of this investigation.