

## 4730 0001 Boyer Copper Deposits, Nevada

By ARTHUR HOWE CARPENTER

The Boyer property was located by Alva Boyer, a pioneer ranchman and prospector of Nevada. He has disposed of interests to others, but still retains the control. This deposit occurs near the contact of a flow of andesitic porphyry over an earlier mass of green andesite. The earlier mass is provisionally classified as 'melaphyre,' more in the sense of meaning black or dark porphyry, a use of the term proposed by Chamberlain and Salisbury. It is a dark greenish andesite with rather abundant white crystals of feldspar. Magnetite, augite, and olivine occur. The overlying eruptive was called an 'obscure trachyte' by Clarence King, whose Fortieth Parallel Survey passed over the property. Following the proposed scheme of classification, this might properly be called 'leucophyre.' It is not trachyte. It has a rough fracture, the ground-mass is even and uniform to the eye, and the only crystals certainly visible are clear tabular sanadine.

The contact lies flat, dipping about 20° to the northwest. The white porphyry is the base upon which the thick series of basalt flows make a long high table-land called Table mountain. These flows of basalt have the same dip as the contact, suggesting that the white andesite was intruded after the basalt flows, but the dip of these old lava beds is more probably due to faulting and folding. The mass of white porphyry outcrops for about four or five miles in an easterly direction, and the dark melaphyre outcrops below it for the same distance. There are a number of copper prospects along this contact and near it in addition to the Boyer group, which is near the west end, and some of these deposits near the eastern end might repay prospecting. Chalcopyrite and chalcocite intermingled occur, almost at the surface. However, on the Boyer, the deposits seem to be the strongest and most abundant. Near the eastern end of this white andesite belt the nickel and cobalt mines of Cottonwood canyon occur, which are described by F. L. Ransome on pp. 55 to 58 of Bulletin 414, U. S. Geological Survey. These mines attracted a great deal of attention thirty years ago by producing rich cobalt ores, which were shipped to Swansea. At the prices then paid, some of the ore brought over \$1000 per ton. At either end these andesitic flows disappear against massive rhyolite hills and mountains, while several miles farther south a similar outcrop occurs with copper veins capped with pure hematite.

The main workings at present on the Boyer property are on Treasury Box hill, about 200 ft. below the contact and in the altered zone in the melaphyre. The copper was evidently deposited at the time of the eruption of the white andesite. The heat and steam accompanying this flow altered the upper two hundred feet of the underlying melaphyre, forming at the base of the altered zone a hard and impervious layer with a peculiar banded structure. This forms the foot-wall of the copper deposits, which lie in the 200 ft. of altered material above, and below the contact with the overlying andesite. In many places throughout the altered zone, small dikes of the white porphyry occur, shooting off from the main body. In places just above the contact, small iron-capped veins are seen coming up through the leucophyre. When followed these veins lead to massive chalcocite disseminated in a gangue of breccia, pieces of the pure black sulphides half as large as a man's hand having been occasionally found. Massive bornite, tenorite, and cuprite occur also, mixed with the two carbonates, melachite and azurite, making small rich deposits of ore. If followed, it is thought that these ore-shoots will lead to the larger deposits that may lie at the contact and in the altered zone below it. At one place, from a deposit occurring at the surface (almost exactly at the contact), several large wagon-trains were loaded with rich copper sulphides and oxides, in 1861, and taken to Sacramento overland. The old shallow pits are still to be seen, surrounded with the piles of refuse, where was cobbled

out the richer ore. Samples of these piles assay 29% copper. These rich ores carry 5 oz. of silver and traces of gold. Every other occurrence of copper ore on the property, when carefully assayed, seems to carry about 20c. gold per ton for every per cent of copper present.

The main work on Treasury Box hill was done in a bed of copper-bearing andesite about 100 ft. or more in thickness. The ore is chalcopyrite disseminated through the melaphyre, and the lower 30 ft. of the bed averages from samples obtained, wherever it has been opened, nearly 5% in copper and \$1 in gold and traces of silver. Owing to lack of funds, it has been impossible to continue the development work as far as the contact, which dips in the direction the prospecting adits have been driven, but when this development work is done, interesting results may be obtained.

About a mile of the contact is included within the limits of the property, and throughout this distance it is possible to find ore in the altered zone in the melaphyre below the contact. At three other places besides on Treasury Box hill the surface indications are promising, and, in fact, at few of the well known copper properties of the West are the outcrops of copper-bearing rock more extensive. Large masses of carbonate ore exist assaying about 1.5% copper, and in places it is much richer.

The ground explored by the adit is badly faulted, so that it has not been possible to develop a continuous bed of ore, but it is thought that a bed of copper ore once existed over 100 ft. thick, 200 ft. wide, and, measured along the line of the dip, 500 ft. or more in length. Owing to the many faults, however, there are only blocks of ore lying at different levels, and not all of them have been opened. The dimensions given are simply the limits of the present exploratory work, and there is not so much ore actually developed. It is only possible ore. But there is reason to believe that the lower 30 to 50 ft. of each of these broken blocks will average over 4% copper. There is also reason to hope that the beds will continue down along the plane of the contact in the altered zone. The richer beds may be wider than this, but this is a matter of speculation. Naturally it is not thought that all of the altered zone beneath the contact is as rich in copper as this bed. The whole of it, however, seems to be copper-bearing, but most of it will be too low grade for profitable mining. Other beds will likely be found as rich and extensive as the one opened on Treasury Box hill, and the ore-bearing zone should continue as far down as the contact between the two porphyries and the beds of value ore prove strong and permanent. This ore zone lies that several thousand feet of it, perhaps, underneath the white porphyry and back from the outcrop, could be prospecting with churn-drills, though many of the holes farther back would have to go quite deep.

The ores are primary, and there is little or no secondary enrichment, nor has there been much chance for it. Large areas of the copper-bearing rock have been leached barren near the surface. The ground-water line does not seem to lie very deep now, however, and springs come to surface in the contact and near it, and in places above. In his general description of these properties Mr. Ransome refers to the occurrence of pyrite, but, so far as known to me, after a residence of nearly a year at the property no pyrite occurs, all the sulphide ore consisting of chalcopyrite. This carries almost the theoretical content of copper, several pure specimens having been carefully analyzed. The general trend of the belt described by Ransome is the same as that described here, but it is not over 200 ft. wide.

Chalcopyrite is hard to concentrate, as it is slim in crushing. Several concentration tests made with tables, however, gave a recovery of 70 to 80% of concentrate assaying over 20% copper, which is high for an ore. It is therefore apparent that no difficulty like those encountered at Yerington. The ore is one for oil flotation processes, and a test in a laboratory machine gave the wonderful result of 30% recovery in concentrate assaying 30% copper.

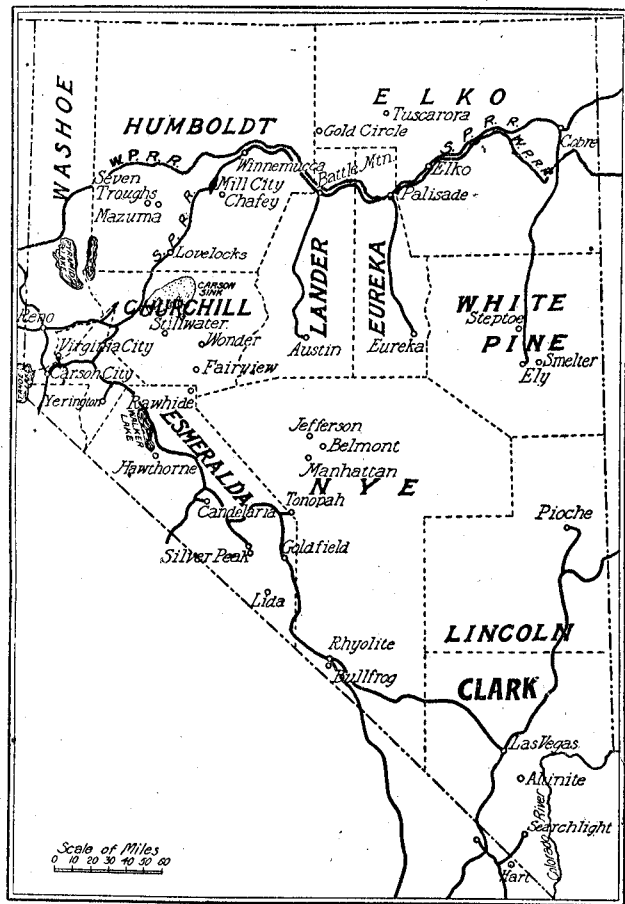
There are over 1000 acres in the group of claims, and in Dixie valley, two or three miles from the property, mill-sites are held. Plenty of water can be had in this flat or valley, and it is probable that artesian water could be developed. In the centre of the flat a number of springs come to the surface. In the next valley to the east, flowing artesian wells thirty years old exist. That valley is said to be 500 ft. higher than Dixie valley, which is the lowest in Nevada, and, according to King, the point in front of the property is the lowest in the interior basin, so that water cannot get away. Everywhere in the centre of the flat water seems to stand permanently about 6 ft. below the surface. At the old borax plant, formerly operated there, they were not able to lower it below this point in a well, using a 4-in. triplex pump operated with a gasoline engine. The lower portion of this flat is occupied by the great Ossobb salt marsh, fully described by King. The whole valley is really a rock-bound lake, full of rock, silt, and clay of Quaternary times, and covered with the debris from the old lake floor. Water stands on the salt beds most of the year. The springs are fresh water. It is about 75 or 80 miles to either Battle Mountain or Winnemucca, both on the Southern Pacific railway. In going to either place there are no mountains or other barriers to cross. Winnemucca would probably make the better point for shipping and serving this section.

On Treasury Box hill about 500 ft. of work has been done, adits, drifts, raises, and winzes. Other parts of the group have received less attention. At one point about one-half mile north of the Treasury Box workings a shaft was put down into the melaphyre at the contact. They intended to drive from the bottom of this shaft back into the contact. This shaft cannot be explored now. It is supposed to be 170 ft. deep and passed through a bed of copper ore said to be 17 ft. thick, of oxides and carbonates. A sample taken from the ore piled on the dump assayed 15% copper with a little silver. The story among the local miners is that they actually drove toward the contact from the bottom of the shaft, but when they approached it, the ground got soft and, owing to the use of too few timbers, forty feet or more of the drift suddenly caved, becoming filled with decomposed rock, mud, and water. It is said that this water coming from the breast of the adit was greenish from copper salts, and that picks and shovels left standing in it became coated with metallic copper. An adit was then started farther down the hill to cut under the shaft and meet the contact lower. It was never finished, though about 800 ft. was driven. This could be cleaned out and driven through, but it was not laid out with any idea of future work and is on the wrong side of the hill, so that any ore developed would be inaccessible and costly to move. A shorter adit from the opposite side would cut the contact more quickly and develop more promising territory.

The property is a promising prospect. There is no large tonnage of ore blocked out at present. Probably 70,000 tons is all that can be counted as probable ore so far developed in the sulphide zone on Treasury Box hill, and much of this is low-grade concentrating ore. The adit through this zone averages 1.70% copper. This was driven at the time the porphyry copper mines were so fashionable, and this is a 'porphyry copper mine' in the sense that the gangue of the ore is an eruptive rock and the sulphides are disseminated through the rock. But it is chalcopyrite, not chalcocite, and while the grade compares well with the copper content of the ores at Ely and Bingham canyon, in America at least, no one has so far attempted to exploit primary ore deposits of this character. At present it is remote from railroads. However, local conditions are favorable for cheap mining operations, once a railroad reaches the district. There is reason to expect that the Southern Pacific company will build a line or 'cut-off' from Battle Mountain to Hazen through this valley. This will shorten the distance across Nevada by the present route 49.3 miles, but necessitates the construction of a long tunnel, about six miles. There would be no other mountain ranges to cross and an almost level grade can be had. The

estimated cost of this construction is much less than the cost of the Lucin 'cut-off' across Salt Lake, and the distance saved would be much greater.

The copper belt of the Piute range of mountains is about ten miles long and a number of other prospects occur farther south. On one group a vein or deposit outcrops about 100 ft. wide. An adit has been driven to cut this, but, so far, has only entered the foot-wall. The breast of the adit is in decomposed rock, badly stained with iron oxide. It will cut the vein about 200 ft. below its outcrop, and, I believe, will open a valuable deposit. There are a number of veins or zones extending the whole length of the ten miles, easily noticeable from a distance out on the flat, on cloudy days, as dark bands along the mountains. These are silicious iron outcrops, 50 to 100 ft. wide, and the zone in which they occur is 2000 or 3000 ft. wide. Whenever closely examined, copper sulphide, oxide, and carbonates are found, and it is likely that im-



MAP OF WESTERN NEVADA.

portant deposits of copper will be discovered below. However, the ore of this region is chalcopyrite, and, until the secondary ores of Bingham, Ely, and the great Arizona 'porphyry' copper mines become scarcer, it is not likely that attention will be turned to these primary ores. But, sooner or later, the disseminated chalcopyrite ores that occur in large masses will attract attention, and it is from these deposits that future copper supplies of the world will be drawn. When that time comes, with the advent of a railroad, this region will become a copper producer of no mean importance.

THE Straits Settlements Land Office returns show that during 1910 the area alienated for mining in Perak amounted to 10,464 acres. These figures show a considerable advance on those of the preceding year. There was some activity in mining in the Kinta district. In face, however, of the increased area alienated for mining in the year, the total area held under mining titles is said to have been reduced by about 3000 acres; the labor conditions have been enforced with some stringency, and there have been fairly numerous applications for the conversion of mining titles into agricultural.