The Father Lode of California. [FROM A STAFF CORRESPONDENT.]

The importance of the effects of physiography in mining has long been understood, but the absolute dependence, not only of the methods of working, but also of the very discovery of the mines, upon the physiographic condition of the country is seldom better exemplified than in the northeastern mining counties of California.

The geological history of the region has been complex, and represents a long period of marine sedimentation succeeded by uplift and intrusion by various plutonic rock masses. Then ensued periods of erosion, the effects of which were mantled by various volcanic flows. Further lapse of time reduced the country to a peneplain, which, being upraised, forms the present Sierra Nevada mountains. In recent times this peneplain has been dissected by erosion into deep canyons with high ridges between.

The importance of this stream erosion in revealing the ancient gold-bearing river channels has long been appreciated and commented upon, but the almost equal importance of disclosing numerous quartz veins, the possible source of the placer deposits, has received less attention.

The region under special discussion embraces eastern Nevada county, northeastern Placer county and southern Sierra county. The eastern portion of these counties consists largely of intrusive granite. West of this lies an area of schists and slates of 6 miles average width. This in turn is bordered on the west by a continuous ledge of serpentine, probably metamorphosed from the old basic plutonics on the west. While the granite and serpentine on either side of this slate belt contain gold, yet special attention is here to be called to the economic value of the deposits in this belt of slates.

This belt consists largely of clay slates, black and fissile, and of a fine-grained, dark green sandstone containing abundant quartz grains. The strike is north-south, and the dip is characteristically to the east, but is reversed in many instances, giving evidence of much movement. The angle of dip is very high, being seldom less than 75° and is often vertical. These slates are probably of Carboniferous age.

The broad belt of serpentine, already mentioned as lying west of the slates, extends almost continuously from northern El Dorado county, through Placer and Nevada counties into Sierra county. It occurs with old basic rocks, probably intrusive, in the Carboniferous slates, and is possibly derived from peridotite. The slates are also intruded by small dikes of amphibolitic and chloritic schists, probably derived from dioritic rocks.

This altered diorite, or "greenstone," carries innumerable quartz stringers and veins. Free gold and sulphurets are found, not only in the quartz, but also throughout the greenstone. The foot and hanging walls are also slightly mineralized. The veins vary from mere stringers to broad zones 16 feet ormore in width. In addition to these mineralized schists or greenstones, which are being profitably worked in a number of cases, notably the Bonnie Bee mine in Bear valley, Placer county, there are quartz veins in fissures in the slates, carrying free gold and sulphurets. The ore is usually found in elongated "kidneys," or ore shoots of steep dip, several such shoots occurring in a single vein.

As previously stated the relief of the country is strongly marked. The streams are torrential and have cut their way in abrupt rocky canyons, 1500 to 2500 feet deep. These streams, the various branches and tributaries of the American and Yuba rivers, are separated by narrow ridges. The caps of these ridges consist chiefly of fragmental andesite, and massive and fragmental rhyolite, which have preserved the underlying slates from denudation. "The veins cannot be traced continuously because of this lava cap, yet the occurrence of similar ore bodies on either side of successive canyons suggests the continuity of the veins.

The mines located on these belts will be briefly described, the main object being to show the methods employed due to the great relief in the topography. In the first place no elaborate and expensive

hoisting works are necessary. The veins may be worked rapidly and economically by crosscutting and drifting. The ore can be readily trammed to the mouth of the tunnel and run to the mill by gravity. There is no difficulty in finding suitable millsites on the canyon sides with good foundations and ample fall. There is an abundance of dump room. The ridges and slopes are covered with a luxuriant growth of timber, chiefly yellow and sugar pine, together with spruce and fir, which insures an ample supply for underground timbering. Water power is cheap and abundant, and converted to compressed air or electricity, forms a convenient agent for milling and mining. The application and utilization of these advan tages is well illustrated in the installations of a number of mines. Starting at the southern end of the belt is the Pioneer, on the south bank of the North Fork of the American river. This mine is not worked at present, but consists of well defined normal quartz veins carrying free gold with a small proportion of sulphurets. The mine has been opened by three crosscut tunnels. The lower one is 1400 feet long, the vein having been followed 2500 feet along this level. The Dorer crops on the canyon side north of Humbug Bar. The vein has a clay slate hanging and a quartzitic sandstone footwall.

The Southern Cross mine is on the North Fork of the American river in Placer county. The main tunnel is in 800 feet on the vein and is connected by a raise with the upper tunnel, which is in 600 feet. The mine is equipped with a 10-stamp mill, containing the latest improvements and one of the best built in the county. Mortar blocks are in place and everything is ready for the installation of an additional ten stamps. The foundations are especially noteworthy, excavation having been made in the schist bedrock, and concrete walls and bases put in. Wooden mortar blocks are used, each 18 feet long, and 5x2½ feet cross section, two for each battery. While but 6 miles by trail from the Southern Pacific station of Towle, yet the country is such that it was found cheaper to haul all material 35 miles from Colfax over a wagon road, and then drag it down a 2½-mile slide to the mine. Eight horses were required to drag each of the 2½ -ton mortar blocks.

Power House of the Southern Cross mine, Placer County, Cal.

The river is dammed 2600 feet above the mouth of the tunnel by a timber and stone dam 35 feet high. Its location and construction is shown in the accompanying engraving. This furnishes an ample water supply throughout the year for a 350 H. P. Rodney-Hunt turbine wheel belted to a 350 H. P. Westinghouse alternating current generator, 2000 volts, three-phase, 7200 alternations. This furnishes power to run a 15 H. P. induction motor belted to a 10x14 Blake crusher, a 50 H. P. induction motor running the stamps and concentrators, and a 50 H. P. Rix air compressor. It also furnishes power for lighting and is intended to furnish power for heating, as electric heaters are to be put in. The mill was installed by the Risdon Iron Works, of San Francisco, Cal., and has four 6-foot Johnson concentrators. It is intended to put in additional compressor capacity. This property has been running nearly continuously since Nov. 19, 1903. It is owned by the International Mining & Securities Co. R. J. Trimble is president and acting superintendent, Towle P. O.

The Soldan, or Rawhide mine, lies over the next ridge on the North Fork of the North Fork of the American river. The tunnel mouth is located several hundred feet above the river bed, and the ore is conveyed to the 10-stamp mill by a Hallidie tramway 2400 feet long with 900 feet difference in elevation between terminals. The lower tunnel has been driven 610 feet. A 95-foot head of water is available the year round. At present the dam is being built higher, being 20 feet high, 10 feet through at the top and 50 feet across. A 15-inch Rix air compressor run by a Pelton wheel has just been installed; 3000 feet of 3-inch pipe carries ore to the mine. H. W. Morris is superintendent at the mine.

Blue canyon gives the next exposure of the slates. A number of mines and prospects throughout its length attest the continuity of, mineral bearing veins, but these were not visited or examined by the writer. The slate belt is next exposed by the canyon of Bear river. Numerous quartz ledges occur below Bear valley, but the Bonnie Bee and Ziebright mines on either side of the river are the only ones being worked at present. At the Bonnie Bee mine water under 422 feet head is used as power. A 5-stamp prospecting mill with a 6-foot Frue vanner and a Blake crusher handles all the ore. A 5-foot Pelton wheel runs the 14x20 double cylinder, compound, Giant air compressor.

J. L. Waggoner, the superintendent, has displayed great ingenuity and originality in meeting certain problems connected with this property. The main tunnel had originally been driven near the bottom of the canyon without regard to obtaining a sufficient fall for a subsequent mill. In order to get the necessary height and drop, the rock breaker and ore bin had to be placed 60 feet above the tunnel mouth. In order to raise the ore to the breaker, a three-rail track with a turnout in the middle was built from the tunnel to the top of the mill. Two platform tanks, mounted on trucks, are run on the tracks. A loaded car is run onto the lower platform, and the upper one filled with water. When full the weight is greater than that of the lower one, consequently the upper one descends and pulls the loaded car to the top, the two being attached by a cable controlled by a brake. The water is run on out the lower one, and the operation repeated. The arrangement can best be understood from the accompanying picture. As water is very cheap, this forms a simple, rapid and convenient hoist.

Considerable difficulty has been experienced in the past in saving all the free gold in the ore. Superintendent Waggoner spent the entire winter in experimenting and finally succeeded in rearranging the mortar and stamps so as to obtain almost perfect battery amalgamation. The gold occurs in silica grains, and formerly would not amalgamate. By removing the H-inch cast liners from the mortar, and replacing them by J-inch boiler plate, he enlarged the interior of the mortars. The 1000-pound stamps were given an 8-inch drop at about eighty per minute, with a 7-inch discharge. The scouring action is avoided by a trough placed at the lower end of the back plate and by a front riffle formed by the inside liner placed } inch above the lower chuck block plate. The interesting feature of this arrangement is that it works. Most of the gold is caught inside the mortar, the plates catching but little. Formerly much of the gold was lost.

Water under pressure is carried all through the mine for drilling. The company expects to install an additional fifteen stamps at their earliest convenience, and a new water- wheel is to be added to run the rock breaker separately, and four new machine drills are to be put in. Use of the present 700-foot main drift is to be discontinued and a new one driven 60 feet above so that the ore can be handled by gravity. J. L. Waggoner, Dutch Flat, Cal., is superintendent.

The Ziebright mine is similar in most respects to the Bonnie Bee. A new 10-stamp mill has been completed and is running It is equipped with W. H. .Marlins new wedge-stem guide, which does away with many bolts in the frame. The tramway from the mouth of the tunnel to the mill is covered to keep off the snow. The drift is in 260 feet. Henry Fuller is superintendent at the mine.

On the South Fork of the Yuba the Washington and Cooley mines form a probable continuation of the belt. Farther north the National and Culbertson, with the mines at Minnesota and Alleghany, mark the probable limit of the belt.

.Much remains to be done in tracing the continuity of this great belt. But enough has been done to show that there is a section of country offering great opportunity to the prospector and capitalist. While it is not claimed that this is a part of the Mother Lode of California, yet there is undoubtedly a great mineralized zone running nearly parallel with the range. One prominent Nevada county miner has named this the "Father Lode of California." So far but little attention has been paid to the sulphurets, most of the miners being satisfied with the returns from the free gold. Experiments with regard to the adaptability of the cyanide process are being carried on, but the commercial solution to the question lies in the establishment of a ready and cheap means of transportation. Mountain trails do not offer ideal inducements for moving material and' it is perhaps to this cause that the slow progress of the past may be due.

Mill and Compressor House of Bonnie Bee Mine, Placer County, Cal.

Dam of Southern Cross Mine, North Fork American River, Placer County, Cal.

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