

The principal vein minerals are quartz, tourmaline, hematite, magnetite, pyrite, marcasite, chalcopyrite, pyrrhotite, and rarely galena and sphalerite.

The old Excelsior group of patented claims, upon which the first discovery of gold was made in the district, and which has produced considerable bullion from the oxide ores near the surface, was bonded to Worcester, Massachusetts, people last spring, and will be worked under the name of the Excelsior Consolidated Mining Co. During the past five months this Company has had a force of men at work erecting camp buildings, placing machinery, constructing a water-power line from Meadow lake to the mine, and getting ready generally for a heavy development campaign. The property is now equipped so that operations can be carried on during the winter months regardless of weather. In the meantime the metallurgical details will be worked out, and a mill will be erected as soon as ore reserves justify. Maurice M. Johnson, representing Samuel Newhouse, recently secured a bond on the High Grade property from the owners, John P. Clark and Harry D. Ramsay. A small force of men will be worked on this property until spring, when, it is understood, machinery will be installed and development on a large scale commenced. Among other promising claims in the district are the Oro Grandes, Cash In Sight, Gray Eagle, Three Johns, and the Freeman.

The development work done in the district has been limited. Although properties have been held and attempts at mining have been made here for over 50 years, it is safe to say that 2000 ft. would cover all the work done on all the claims combined. And this work, done by the early operators in quest of the oxidized or free-milling ores, is of a superficial character. Work was always stopped when sulphide ore was reached. Frequently, trenches from two to six feet deep along the outcrop of a vein were evidently enough to satisfy the owner that he had reached the bottom of the free-milling ore. The deepest shaft in the district is 115 ft. At this depth a good grade of sulphide ore is exposed; this is also true in the deepest workings of other properties in the near vicinity. The district, therefore, is not without inducements for deeper explorations of its lodes.

With the advent of new operators, combined with the growing tendency of the claim-owners to offer more attractive terms to capital, it is to be hoped that the district is entering upon a period of development which will result in proving the worth and merit of the claims to full satisfaction of the owners who have held on so tenaciously all these years, as well as to those who invest their money in them, and that prosperity will spring anew from the ashes and ruins of former efforts.

VALUE of all the gold produced in the United States from 1792 to January 1, 1914, is estimated by the U. S. Geological Survey at \$3,549,799,400; the value of the silver at \$1,709,517,600.

BANK CLEARINGS in New York in 1914 totaled \$83,018,580,015, compared with \$94,634,281,984 in 1913.

The Boss Mine, Good Springs, Nevada

By SEELEY W. MUDD

*Both daily and technical press have erroneously stated that I had purchased this property. I have never been in the district, but I can, however, give some facts with regard to the property, based on a statement by an engineer who is familiar with it.

The Boss claim was located about 30 years ago. The property was originally opened as a copper mine, the gold value at that time not being considered of great importance. Some years later an unsuccessful leaching plant was built to treat the copper ores from this and other properties.

The country rock in the immediate vicinity is a thick-bedded limestone, probably of Carboniferous age, dipping approximately south 60° west at an angle of 10 to 20°. A fault zone, having a direction approximately north 30° east, passes through the main workings on the Boss claim. This fault zone is from 20 to 30 ft. wide, and in it the known orebodies of the Boss mine occur. About 600 ft. northwest of the mine workings a large intrusion of quartz monzonite appears. No igneous rocks have been identified in the mine proper.

The orebody of chief interest may be called a pipe, which outcrops at the surface. Its axis dips to the northeast at an angle of from 5 to 10° from the horizontal. Several cross-faults have caused slight lateral and vertical displacements.

Part of the orebody is quartz, which is generally thoroughly disintegrated and of a light gray color. In places the quartz is nearly black, sometimes vesicular and sometimes rather compact, but nowhere does it occur in large unfractured masses. The quartz body is surrounded by an irregular shell composed principally of hard and soft hematite, although limonite is present, especially near the surface. This shell of hematite is from a few inches to 6 or 7 ft. in thickness. The hematite shell, in turn, is enclosed by malachite, usually about 4 in. thick, but varying from a thin seam to 10 or 20 inches.

The black or greenish yellow talcy material accompanying the quartz core is said to be the richest ore, and the gold content is said to be somewhat higher, in ounces, than the combined platinum and palladium contents. The light-gray quartz ore is considered richer than the compact black quartz ore. It is only in this black quartz ore that metallic gold is noted in hand specimens, although the black ore does not horn so well as the ore previously referred to. The hematite varies greatly in its content of precious metals, but gold predominates in value; the silver varies from an ounce or two upward, and the quantity of platinum and palladium is small, usually negligible. The outer shell of

*Remarks to the San Francisco section of the Min. and Met. Soc. of America.

malachite usually carries from 20 to 30% of copper.

At some points near the orebody the limestone is heavily stained and in part replaced by the oxides and carbonates of copper mixed with iron oxides. A little chrysocolla and chalcocite were noted. The hematite shell sends out little streaks or fingers into the surrounding fractured limestone. The limestone is usually rather coarsely crystalline, light colored, and, while broken by the faulting, has not been brecciated. The orebody is very irregular in size, but one point was noted where a cross-section of the quartz included in the hematite showed an area as great as 70 ft. square. Detached lenses of hematite were noted in several of the adits, and, as a general rule, those of larger diameter than 3 ft. contained a core of disintegrated quartz similar to the main ore pipe.

It is claimed that at one point, a mile or more distant, some ore has been discovered in limestone, which contains platinum and palladium. It may be of interest to note that the discovery of platinum and palladium was made by an assayer who was at first puzzled by the fact that his assay buttons were ragged and irregular rather than round and smooth.

H. F. Bain has referred to a European platinum mine where the ore was reported to occur in graywacke. In the literature on the subject, other than that concerning placers, I have been unable to find any reference to an occurrence of platinum except in connection with rocks of igneous origin, usually peridotite or serpentine. The occurrence of these ores in limestone is exceedingly interesting.

Prospecting Dredging Ground at Pato, Colombia

*Where gravel deposits extend several feet below the permanent water-level, as those of the dredging areas of Pato, there is no means commercially available for accurately determining their gold content. Drilling, which under these circumstances is the most accurate, gives only approximate results, which are subject to wide variations owing to the personal variation of method, carelessness in drilling and panning, varying physical properties of the deposit, and to the economic impracticability of drilling holes sufficiently close together. Having driven a tube and pumped the gravel out of it foot by foot to bedrock, and panned the gravel so extracted, and weighed its gold content, it is desirable to know just what proportion of the displaced gravel and gold entered the tube and subsequently the pump, and what proportion was pushed aside by the tube in entering the ground, and how much was pushed out of the tube in pumping. This proportion varies in different parts of the hole, and also in the different holes, more especially where the physical character of the deposit is different. Many other variable quantities common to all types of drills enter into the process, but

suffice it to say that one can only assume an average factor or proportion which is reliable to within perhaps 50% of the true average figure on any individual drill-hole.

In the early drilling of the Pato property, a theoretical factor arrived at in an entirely different field was necessarily used. For this examination, we had the advantage of a dredge in operation and under our own direction, dredged over an area where we had previously drilled 17 holes. Carefully calculating the area and cubic yards represented by each hole, and knowing the actual yardage and gold yield by the dredge, we determined mathematically the factor for the drill-holes which would give the actual value recovered by the dredge. This factor works out at 387 ft. of hole for one cubic yard of gravel removed. This factor or proportion was then used for all of the holes drilled under my supervision on the Pato property.

Six drill-holes were further checked by sinking shafts alongside. In this checking, the dry weight of the gravel from the shaft and drill-holes was compared, and the drill factor for each case was determined on that basis. In those shafts where there were no water difficulties, the factor obtained in this way checked up closely with the factor obtained by dredging. In consequence, the drill results that have been obtained on the Pato ground during this examination are figured more scientifically than is usually possible or considered necessary.

In calculating the present dredging area of Pato, I have used the results of 89 holes drilled under my supervision, 38 drilled under C. H. Munro, six drilled by A. P. Rogers, and one drilled by E. B. Kimball. In estimating the yardage, a circle of uniform size was drawn on the map about each hole, and the area included in the polygon, formed by joining the points of intersection of the circles, was taken as the area corresponding to that hole. That area and the depth and value of that hole were used for determining the cubic yardage and gross value corresponding to the hole. These figures thus obtained separately for each hole were then summed up to obtain the total area, yardage, and value. In this manner, errors of calculating results are not introduced by varying distances between drill-holes of widely different values and depths. The examination showed a total of 22,419,490 cu. yd., worth \$7,092,100.

By assay of the gold recovered from the drill-holes it was found that the bullion fineness varied from 848 to 937.

TRANSACTIONS on the New York Stock Exchange in January totaled 5,028,113 shares and bonds valued at \$56,967,500. In December and January of 1914 the business was 1,847,982 shares and \$35,327,000 bonds, and 10,012,404 shares and \$88,823,600 bonds respectively.

TRANSACTIONS at the New York Assay Office in January amounted to \$3,795,795, against \$8,957,563 in that month of 1914.

*Abstract of report of W. A. Prichard to Oroville Dredging Co., December 24, 1914.

Cyaniding Tailing in the Willow Creek District, Alaska

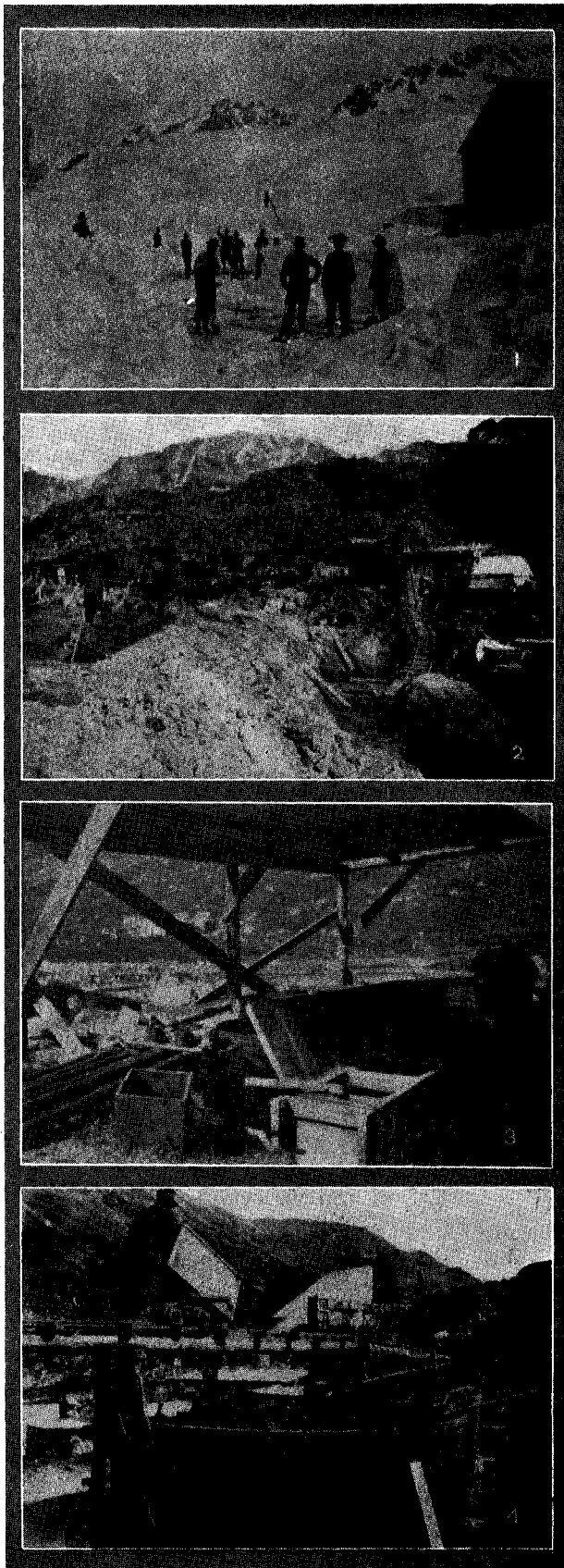
By J. T. TERRY, Jr.

The centre of the Willow Creek district, is about 35 miles northeast of Knik, a small town of approximately 200 population, situated on the northeast shore of Knik arm, a long narrow strip of water stretching northeasterly from the head of Cook's inlet. The country rock is a quartz diorite intrusive in a mica schist, and there are three sets or systems of veins. Those in the diorite strike almost at right angles to the schist-diorite contact. Those apparently parallel to the contact but in the diorite, and those in the schist strike at right angles to the contact. The latter are of the greater magnitude, but are barren or of low value so far as known.

The mines of proved value are on the first mentioned set of veins. The diorite is blocky and the fissures seem to traverse it for great lengths with small cross-fissures coming in from both hanging and foot-wall side. The quartz is usually accompanied by a gouge and vein filling and is from a white to bluish tint with reddish and green streaks due to arsenic and iron minerals. Many specimens show free gold, but the greater portion of the gold is finely divided and not visible till the ore is pulverized and panned. The veins in the diorite are from a seam to 12 ft. wide, averaging about three feet. The lodes that up to the present time have been profitably worked are near the summits of the divides between Craigie, a tributary of Willow, and Willow creek, and between Willow and Fishhook, a creek that flows south-east into the Little Susitna river which empties into Cook's inlet. The mountain ranges are steep and precipitous as a result of glacial erosion. The bottoms of the valleys and cañons are covered with detritus of boulders and gravel from terminal moraines.

The Gold Bullion mine where I erected and operated the first sand leaching cyanide plant in the territory, is the best equipped property in the district. It is situated near the top of the divide between Craigie and Willow creeks. The vein is of the blanket type and shows outcrops on both sides of the mountain. At several points where rich outcrops were opened, cuts were run or stopes driven to get out the ore, which stoped about two feet. The ore is transferred from the mine to the mill by two aerial jigback trams, the distance to the transfer or intermediate bin being 1300 ft., and from that to the mill 3800 ft. The drop between the mine and mill is approximately 1500 feet.

The ore is crushed in a five and a two-stamp battery to 50 mesh, the pulp going over plates to a Wilfley table, thence to tailing ponds, and is subsequently cyanided. The cyanide plant consists of six leaching vats, sump, storage, and solution tanks, and has a daily capacity of 45 tons of tailing. The tanks, pipe, solution pump, etc., were furnished by the Pacific Tank & Pipe Co., and shipped from its Portland factory to Seattle, thence by steamer to Knik, and hauled in on double-end sleds



GOLD BULLION MINE AND CYANIDE PLANT.

drawn by horses shod with wooden snow shoes, during the winter of 1913. There is no road to the property. The equipment was transported over 2500 miles from the factory to the mine and arrived in perfect condition.

The plant was erected last May, the site at the time being buried under six feet of snow that had to be shoveled. Leaching operations began June 7, 1914. An extraction of 86.6% of the gold was attained from sand averaging \$13.50 per ton. The cyanide consumption was 0.8 lb. sodium cyanide (129%), 2 lb. lime, and 0.57 lb. zinc shavings. The product assayed \$34 per pound in gold, and about \$4 per pound in silver. The product from the extractor boxes was roasted in a cast-iron pan without stirring, cooled, screened, sacked, and shipped to the Selby Smelting & Lead Co., San Francisco. The lime used was slacked by mixing one bucket of lime with three-fourths of a bucket of water, producing a dry powder which was screened, and a measured portion added to the cars.

The tailing, a 40 to 50-mesh sand fairly free from slime, was shoveled from the dam below the mill into cars holding two-thirds of a ton, dry weight, by two men, and run to the foot of a tramway 85 ft. long with a 30% grade, which then extends on a down grade of 2 in. in 16 ft. over the leaching vats. The cars are elevated by a water-wheel hoist. This power also drives the solution pump. The water is conveyed through 130 ft. of 8, 7, and 6-in. slip-joint pipe from the mill penstock, and applied under a 35-ft. head through a 2½-in. nozzle to a 36-in. wheel to which 24 iron elevator buckets are bolted. A loose belt and tightener operated by a lever is used as a control on the hoist. The water-wheel equipment was furnished by Meese & Gottfried Co., from their Seattle stock, and being light was easily transported; which is a very important factor in Alaska.

There is about 2000 tons of slime in the ponds which will be treated next summer by agitation and decantation. Agitation is to be accomplished by mechanical stirrers driven by water-power. The milling season in the Willow Creek district is from June 1 to October 1.

A Platinum-Gold Lode Deposit in Southern Nevada

By ADOLPH KNOFF

*The ore of the Boss gold mine in the Yellow Pine mining district, Nevada, has recently been shown to contain considerable platinum. The deposit occupies a vertical zone of shattering in dolomite of Carboniferous age. The gangue consists mainly of fine-grained quartz, but streaks of plumbojarosite are found carrying as high as 111 oz. gold, 99 oz. platinum, and 16 oz. palladium. Some 600 ft. from the mine is a small intrusion of granite porphyry, but no basic intrusives occur; in fact, none are known to occur in the whole district, which is the most productive lead and zinc district in Nevada.

*Abstract of a paper read before the Geological Society of America, Philadelphia, December 29-31.

Palladium: Its Characteristics, Uses, and Discovery in the Boss Mine

*Palladium is one of the rare metals belonging to the platinum group and occurring almost invariably associated with platinum or other metals of this group. The metal was discovered in 1803 by Wollaston, and named for the planetoid Pallas in honor of its discoverer, Olbers. The other members of the platinum group are platinum, iridium, osmium, rhodium, and ruthenium.

These metals collect in the lead button formed in the regular course of a fire assay for gold and silver. When this button is cupelled, the metal osmium is driven off, but all the other metals collect in the gold and silver button. If they are present to the extent of 2½% of the weight of the button, their presence is made apparent by a frosting and darkening of the button, while smaller proportions usually make themselves known in the course of the operation of parting.

Palladium is a ductile, malleable, white metal, which looks like platinum and is distinguished from the other metals of the platinum group by the ease with which it dissolves in nitric acid. It is strongly resistant to oxidation by atmospheric oxygen and moisture and to the effect of sulphur-bearing gases. For this reason it is employed for the inner mechanism of chronometers and watches, for the construction of fine balance beams, for the divided scales of delicate apparatus, and for surgical instruments. Like platinum, it is employed in the preparation of toning baths for use in photography. Another property of palladium which renders it valuable in some of the newer chemical processes is that of absorbing hydrogen. The price of palladium is practically the same as that of platinum, or more than twice that of gold, although on account of the somewhat lighter demand, it occasionally falls lower.

Most of the palladium comes from the placer mines of the Urals, Russia. Until recently the only mine in which palladium was found in this country was the Rambler mine, in Wyoming, where it is associated with platinum and copper. That it occurs elsewhere in minute quantities associated with copper ores is known from the fact that it is found in electrolytic copper.

A sample of ore from the Boss mine, Yellow Pine district, Clark county, Nevada, has just been analyzed by Walter S. Palmer in the state mining laboratory at the Mackay School of Mines with the following results: Palladium, 60.4 oz.; platinum, 12.28 oz.; gold, 38.92 oz.; and silver, 10.96 oz. per ton. A carload of 56,267 lb. from the mine, shipped to the American Smelting & Refining Co., gave the following returns: Palladium, 5.47 oz.; platinum, 1.1 oz.; gold, 8.752 oz.; silver, 9 oz.; copper, 0.97%; insoluble, 80.7%; sulphur, 0.5%; and iron, 6.7%. An assay made by Ledoux & Co., of New York, of a 340-lb. sample, gave the following results: Palladium, 16 oz.; platinum, 99.08 oz.; gold, 111 oz.; and iridium, a trace, per ton.

*Press Bulletin 4, Mackay School of Mines, Nevada.