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SOME GEOLOGICAL ASPECTS of the GRANTS PASS QUADRANGLE

by

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In selecting the subject for this paper, it was not my purpose to enter into an exhaustive dissertation on the geology of the region under consideration. This has been covered generally and in greater or lesser detail by the various members of the U.S. Geological Survey and later amplified by the State Department of Geology and Mineral Industries. My purpose is, rather, to call attention to certain salient aspects which develop and become of interest and more or less self-evident to the economic geologist and engineer who has occasion to do detailed work within the district.

The features to which I intend to refer are of primary interest to the gold miner and to the gold mining industry. This section of southern Oregon, from the time of its first settlement, has been and is essentially a gold-producing locality. I am inclined to think it will continue to be so long after our learned exponents of fiat money are but unpleasant memories.

Now, by the foregoing, I do not mean to imply that gold is the only economic mineral (and I use the word "economic" advisedly) which is peculiar to the Grants Pass area. The contributions of chrome to the war effort are well known, and these deposits are far from being exhausted. There are copper deposits which have produced in the past and will probably do so again. The possibilities of the production of mercury are not to be overlooked if we again reach that stage of rationalism in our international affairs when we cease to sacrifice our own industries to starry-eyed idealism. In the nonmetallics field, the lime and silica deposits, together with their various processing plants, are of increasing importance, and the potential value of the various types of clays are not to be overlooked. At the present time, the lime and silica industries represent the most important mining operations in the district. The predominant economic mineralization of the region, however, is gold, and I am convinced that, as a mining district, the region will either stand or fall by its production of that metal.

Now, of course, when we speak of the economic production of gold, we must do so relative to the conditions of the past or to what we hope they may be in the future. As for the present, perhaps the least said, the better. Certainly, if we adhere to T. A. Rickard's time-honored definition of an ore, as applied to gold ores, that is, "A metal-bearing rock which can be exploited at a profit," the term must be entirely relative. We must return to the economic conditions of the past, or there must be an increase in the price of gold together with an open market, or we must confine ourselves to the exploitation of deposits sufficiently high in grade as to comply with the definition of the term. Since the latter

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*Annes Engineering Company, Grants Pass, Oregon. Talk given at meeting of Oregon Section, American Institute of Mining and Metallurgical Engineers, May 24, 1947.

type of deposit is becoming as scarce as the proverbial "hen's teeth", revival of the gold mining industry must depend upon one or the other of the first two postulates. Let us hope that day is not too far distant.

For the benefit of those who are not familiar with the general geology of this part of Oregon, a brief resumé will probably not be out of place.

A study of the region was carried on intermittently by Diller and Kay of the U. S. Geological Survey from 1908 to 1924; their work is covered in U. S. Geol. Survey Bulletins 380 and 546 and by the Geological Atlas of the Riddle Folio, No. 218, published in 1924. In 1913, Dr. A. N. Winchell, working under the auspices of the Oregon Bureau of Mines and Geology, made a study of the petrology and mineral resources of Jackson and Josephine Counties. This report was published in 1914. In 1939, a preliminary geological map of the Medford quadrangle by Francis B. Wells of the U. S. Geological Survey was published by the Oregon Department of Geology and Mineral Industries, and this was followed in 1940 by a similar map of the Grants Pass quadrangle by the same geologist as a cooperative project between the Federal Geological Survey and the Oregon Department. These two maps, together with Diller's map of the Riddle quadrangle, are being used to illustrate the present paper, for the reason that both the Medford and Riddle quadrangles are closely related, both economically and geologically, to the Grants Pass quadrangle.

The oldest rocks of the region are a series of schists which occupy an area of about 30 square miles in the extreme southeastern corner of the Grants Pass quadrangle and the southwestern corner of the Medford sheet. These rocks have been placed in the Paleozoic age or older and are believed to have been derived from both volcanic and sedimentary rocks.

Next in age is a thick series of Paleozoic or Mesozoic rocks, consisting of altered volcanics interbedded with argillites, cherts, quartzites, and limestones. This formation underlies about half of the Grants Pass and Riddle quadrangles and a small portion of the Medford quadrangle. The series has been classified by Wells as meta-volcanics and meta-sedimentaries, but Diller referred to the meta-volcanics as greenstone, a term which, as applied to this formation, is one which covers a multitude of sins.

Economically, the meta-sedimentaries of this formation are particularly important for their limestones, especially as related to the cement industry, paper manufacture, agricultural lime, etc. As a source of commercial silica, they are also of considerable importance.

The meta-sedimentaries, including the limestone, in the Grants Pass quadrangle have been grouped by Diller into four northeasterly trending belts as follows: The first, farthest northwest, includes several masses extending south of Cheney Creek to about 10 miles southwest of Grants Pass. The second, which contains the most limestone, nearly follows the northeasterly trending diagonal of the quadrangle. It includes the ledges west of Gold Hill, passes near the Oregon Bonanza mine, and contains the Oregon Caves. The third includes several ledges on Kane Creek, four miles southeast of Gold Hill, and others on the southwest slopes of Wellington Butte and Steamboat and Whisky peaks. The fourth appears on Little Applegate River, and on the upper Applegate River at Seattle Bar. Diller tentatively dated the first two belts as Devonian and the third and fourth as Carboniferous. It remains to be seen whether this classification will stand in the light of new evidence now available but not yet fully studied.

A formation which extends along the northern half of the western boundary of the Grants Pass quadrangle and thence northeasterly across the Riddle quadrangle, where it is known as the Galice formation, has been placed in the Jurassic by both Wells and Diller. Wells, however, observes both sedimentary and volcanic rocks within the formation in the Grants Pass quadrangle, whereas Diller classifies it almost entirely as sedimentary within the Riddle quadrangle. Economically this formation has so far proved to be unimportant.

Diller has also mapped several areas of later sedimentary and meta-sedimentary rocks within the Riddle quadrangle. The May Creek formation he places provisionally in the Devonian; the Galice and Dothan formations in the Jurassic; the Knoxville, Horsetown, and Chico formations in the Cretaceous, and the Umpqua formation in the Tertiary. Most of the formations show unconformable relations. Correlation of these formations with those of the Grants Pass quadrangle are not clear, and as they are of little more than academic importance as related to this paper, no further detail will be attempted.

In the Medford quadrangle northeast of the Southern Pacific Railroad, a belt of Eocene sediments of the Umpqua formation, several miles in width, extends northwesterly across the area. Northeasterly from this belt, the remainder of the quadrangle is covered by 3000 to 5000 feet of volcanic flows and breccias known as the volcanics of the Western Cascades.

The rock formations of greatest interest economically, in that they probably represent the source of the major metallic mineralization of the district, are the late Jurassic to early Cretaceous intrusives. The earliest of these are the serpentines derived from peridotites and pyroxenites of probable late Jurassic age. These intrusives are widely exposed in all three quadrangles, as well as to the westward, and range from less than an acre to many square miles in extent. They not only represent the source and locale of the chromite deposits, but also, in all probability, are source rocks of platinum which is to be found in various placer deposits of the region.

Next in point of time and of major importance economically was the intrusion and consolidation of what is termed by Winchell "the great Siskiyou tonalite batholith" which, in turn, was followed by minor intrusions of dacite and auganite or augite-andesite and by the various gabbroid, aplitic, porphyritic, and pegmatitic dikes.

Within the area of the three quadrangles which we are considering, the granitoid intrusion is exposed in three main localities and in numerous other smaller patches or tracts between. The largest of these occupies the south central portion of the Medford quadrangle forming a part of the main Siskiyou Range. Another occurs in the southwestern portion of the Grants Pass quadrangle and forms the mass of Grayback Mountain, over 7000 feet in elevation; a third covers a considerable area to the south, west, and north of Grants Pass, whereas the fourth exposure extends from near the town of Rogue River northeasterly, the full length of the Riddle quadrangle. Wells has suggested the Grayback stock and the Merlin stock as appropriate names for the second two mentioned and admits the probability that all the areas, large and small, represent one great batholith underlying much of the southeastern part of the quadrangle at a rather shallow depth. This is probably true, but I think the observation may be extended to include also considerable areas within the Medford and Riddle areas. Wells also observes a wide variation in the rock types of the intrusives both in the Medford and Grants Pass quadrangles but states that quartz diorite is probably the prevalant variety and that granodiorite is common.

I am inclined to like the term tonalite as used by Winchell and as applied not only to the prevalent rock type of the batholith but also to a direct association, if not origin, of the gold mineralization of the district which includes the three quadrangle maps which we have before us. Winchell uses the term tonalite in accordance with the following definition: "Tonalite is a plutonic rock consisting essentially of sodic plagioclase feldspar, quartz and more or less hornblende or biotite or both." While I am quite aware that generalizations are often dangerous, it has been my observation that many of the more productive gold deposits of the district are associated either directly or indirectly with the soda-lime plagioclase feldspar rocks. I am inclined to believe that this association will be more definitely established as development at depth takes place within the district.

The gold-bearing lodes of the district have prevalent strikes of from N. 60° W. to N. 30° E. and dips ranging from 40° to vertical. They usually contain several lenses of quartz a few hundred feet long and averaging 3 to 4 feet in width. Longer and wider ore

shoots have been noted in several mines which have attained depth. The vein fillings are mineralized quartz and crushed rock; the walls are well-defined and their composition apparently has little or no influence on the character of mineralization. From 60 to 90 percent of the gold is free milling and the balance accompanied by or associated with sulphides. Of these, pyrite and pyrrhotite are the most common with minor percentages of galena and sphalerite. Rarely does oxidation extend below 100 feet.

As this region is the original habitat of the pocket hunter or at least where the technique reached its highest degree of efficiency, any paper of this nature would be incomplete without mention of the so-called "pocket occurrences" which are peculiar to the district. The term is used to describe high-grade segregations of free gold which occur in a restricted space. Though both supergene and hypogene processes were undoubtedly influential in their formation, it is probable that the largest ones, such as the Gold Hill and Steamboat pockets, were largely epigenetic in origin.

Winchell draws the inference that the mineralization of the district, including not only the gold ores but those of mercury and antimony as well, is directly attributable to the tonalite and its magmatic solutions. Later and more detailed observations lend considerable support to this inference and tend to warrant the conclusion that such is the fact.

The general pattern of the lode gold deposits, both mines and prospects, has a distinct areal relationship to the batholithic intrusions. Very few of them are within the actual boundaries of the exposed stocks. Of the few mines which do lie within these boundaries, however, at least two, the Ashland mine in the south, which has attained a depth of over 900 feet, and the Granite Hill mine toward the north, which attained a depth of over 400 feet, consist of true fissure veins in the tonalite as much as 12 or 14 feet in width on the lower levels and carrying values in gold sufficient for profitable mining even under present restrictive economic conditions.

Two type examples of this nature should be sufficient to enable one to refute any statements which may have been made or impressions which may have been gained to the effect that lack of depth, continuity, or value characterize the occurrence of the gold quartz veins within the underlying intrusives of the district.

In the Riddle quadrangle, the most noted producer has been the Greenback mine which is credited with a production of about $3\frac{1}{2}$ million dollars. The vein, as explored to date, occurs in greenstone and has an average width of about 3 feet. Operations have attained a depth of 1000 feet along the dip, which is about 60 degrees. It is probable that the underlying dioritic or tonalitic intrusive is at no great distance.

Another type of gold mineralization which is of considerable interest and probable importance is to be found in the serpentine gold ores of King Mountain and vicinity within the Riddle quadrangle. The source and mechanics of this mineralization are still somewhat obscure but evidence to date seems to indicate that it also is directly associated with the Jurassic intrusives. The ores, which are among the most spectacular of the district, are to be found over a considerable area. While as yet they have not been commercially developed, they offer one of the most interesting possibilities of the district.

Placer mining in southwestern Oregon has followed the history of practically every gold placer field of the continent. The original discoverers devoted their efforts to the rich and highly concentrated deposits and when these were exhausted, drifted on to other fields. These men were followed, probably to a lesser degree in this district than in many others, by the Chinese, who, by their more economical methods of working and living, were able to work at substantial profits many of the lower grade gravels left untouched by the original stampeders. The third stage to be reached was that of the exploitation of the larger areas of still lower grade gravels, first by hydraulic mining methods and secondly by the various types of gold dredging. Placer mining development in southwestern Oregon is now in the last stage, or may I say hopes to be again, when economic conditions permit.

Areas suitable to large dredges of the bucket-line type are probably limited in extent, but there is considerable ground available and adaptable to shovel, dragline, and bulldozer operation, provided of course, that the industry is not further handicapped by restrictive legislation.

It has been estimated that a section of rock from 1000 to 3000 feet thick has been removed by erosion in the area under discussion, and the resultant concentration of the gold into the creek and river gravels has given rise to the rich placer fields which have in the past made southwestern Oregon famous as a gold-producing section. The placer gravels, in all cases, reflect the locale of the lode deposits and, in my opinion, are indicative of large untouched low-grade lode deposits rather than comparative exhaustion of the small high-grade occurrences as has been intimated in some of the technical literature published on this section of Oregon.

The reputation of southwestern Oregon as a gold-mining district has been adversely affected by a number of contributing factors. Impressions have been formed in mining circles to the effect that the lode deposits do not extend to appreciable depths and that, within the depths which they do attain, both veins and enclosing formations are so badly broken up that successful mining is impractical, if not impossible. This impression still exists in many quarters in spite of the records of the Ashland mine to the south, the Greenback to the north, and the Benton mine to the west of the Grants Pass quadrangle. This impression may probably be attributed directly to a statement made by G. F. Kay referring to the Grants Pass quadrangle in U. S. Geol. Survey Bulletin 380, Contributions to Economic Geology, 1908, which I quote verbatim from his conclusions: "Of the many veins and veinlets on which work has been done, few have developed into profitable mines, and the outlook for profitable gold-quartz mining in the region is not encouraging." By both inference and reference, this same statement has been made applicable to the Medford quadrangle to the east and the Riddle quadrangle to the north. J. S. Diller's subsequent reports served to modify this statement somewhat but not to a great extent. In any event, the impression went abroad to this effect and the mining industry in this area must still cope with it.

Now, Diller and Kay did some very excellent pioneer work in southwestern Oregon, and it is not my intention to attempt to belittle either their work or that of the U. S. Geological Survey. I do, however, with all respect to these workers, wish to take issue with the above statement and with others of a similar nature. I do not believe that sufficient criteria exist even today to justify such a generalization. On the contrary, I think that there is considerable evidence to support exactly the opposite conclusion and that future development will prove this to be the case.

Another factor which has adversely affected the reputation of the district has been that of wild reports of high values which have been given wide publicity and which have usually been based on some new and mysterious method of assaying or revolutionary metallurgical process, one or both of which purported to show phenomenal gold values where little or no value was indicated by standard procedure. It has seemed that whenever an individual or a group has something of this kind to try out, they come to Grants Pass and the surrounding area to commercialize the experiments. Since at least 99 percent plus of these abortive attempts are due to fail before they start, the effect on an area which has been selected as a proving, or shall I say disproving, ground is not too salutary.

Still a third factor has been the propensity of unskilled operators and owners (and this is not confined to southwestern Oregon alone) to place the cart before the horse or to design and build the mill before the ore body is developed. In many cases, where ore was developed, the flow sheet which was adopted was designed to recover only those free gold values which respond to straight amalgamation or cyanidation. In many of these instances, grinding to minus 30 mesh was considered fine. As the difference between profit and loss of many of these operations was contained in the values which might have been liberated and recovered by finer grinding and improved metallurgy, and as this latter procedure was not adopted, eventual failure of such operations was inevitable.

The aforementioned factors, while only a few of those referred to, are sufficient to indicate my point. I have a great deal of faith in the future of southwestern Oregon as a gold-producing district when economic conditions so readjust themselves so that profitable gold mining may be carried on to any extent in this country. What is needed for the industry, both now and in the past, are mining companies and individuals with sufficient capital and vision to carry exploration and development to depth, and in doing this to utilize to the fullest extent a combination of modern geophysical equipment, the core drill and improved metallurgical, geological, and managerial practice, carried out under the guidance of highly trained and efficient engineering personnel. When this point is reached, I believe that southwestern Oregon will again resume its place among the leading gold-producing districts of the country.

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Portland, Oregon
May 29, 1947

Editor
The Ore.-Bin
Portland, Oregon

Dear Sir:

I was interested in the last paragraph of the current issue of the "Ore.-Bin" concerning the metallic concentrates at a placer mine in southwestern Oregon. When I first visited Bonanza Creek in the Klondike, in the fall of 1897, I found that every claim above "ten below" discovery to the "forks" had several whiskey barrels filled nearly full of black sand shot through and through with small particles of yellow gold, the heavier gold having been recovered. The miners, practically all of whom had learned all they knew of placer mining right there, had tried every expedient to save that gold. It, too, refused to amalgamate. Some thought that their quicksilver had grease on it, and redistilled, but this did not help the amalgamation. I bought two especially good looking casks of the sand for $100.00 and tried diligently to pan my money out with no practical result. The next spring I built a small pipe boiler (I think the first one of the thousands eventually used there for "thawing machines") took a steam pipe over, put six cans of concentrated lye into each cask and gave it a thorough cooking. That did the trick, the gold was cleaned and amalgamated instantly on contact. The lye was put in with the sand and water cold and the whole well heated. After it was hot, I could make enough steam to give the sand and water a rolling boil. Then I borrowed a small duplex air compressor from a neighbor who had no steam and got a further agitation. My cleanup weighed out a little more than $3,200 (at $16.00 an ounce) and I got nearly twice that for the steam boiler after I found out that everyone on the creek knew how, and that barrels of black sand were no longer to be had at bargain prices. Those two were all that I ever got.

In that case, too, I decided that the trouble was iron oxide as the "coarse gold" in the district was similarly coated so distinctly, in fact, that, with a jeweler's loup, one could see that the gold had a coat of reddish-brown substance that could be cleaned off with yellow soap, water, and a toothbrush.

The use of six cans of lye per barrel was not the result of any computation but merely an equal division of the available supply at the time.

Yours very truly,

/s/ G. F. McDougall

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MINES BUREAU SUPERVISOR DIES AT DENVER

George Ensor Woodard, 35, supervising engineer of the Metal Economics Division's Denver office, Economics and Statistics Branch, Bureau of Mines, who died in Denver on April 28 following an operation, had returned temporarily from Japan where he was serving as a scientific consultant on loan to the staff of Gen. Douglas MacArthur. He had been directing the compilation of data on Japanese mineral production and reserves for the occupation forces and the reparations mission, and had just begun the reorganization of statistical practices in the Japanese Bureau of Mines.

Dr. R. R. Sayers, Director of the Bureau of Mines, has designated Samuel A. Gustafson as acting supervising engineer at Denver. With the Bureau since 1940, Gustafson also is a graduate of the Colorado School of Mines. He served as Captain of Engineers during World War II and, prior to entering Federal service, worked for several mining companies and the State of Colorado as engineer, surveyor, foreman, and accountant.

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NEW CHIEF TOPOGRAPHIC ENGINEER

Mr. T. P. Pendleton has retired as Chief Topographic Engineer of the U. S. Geological Survey following a prolonged illness. He was largely responsible for adaptation and development of the "multiplex" method of topographic mapping and is an outstanding authority on photogrammetry, surveying, and mapping.

Mr. Gerald Fitzgerald who succeeds Mr. Pendleton was born in Burns, Oregon, and has long been connected with the Geological Survey on surveying and mapping assignments. In World War II he was commanding officer of Aeronautical Chart Service. He returned to the Survey from the army in 1945.

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ONLY FEW DAYS LEFT

In order to hold their claims under the wartime exemption act, owners of unpatented mining claims should file a notice of their desire to hold their claims prior to July 1, 1947. Filing should be made in the office of the County Recorder of the county in which the claims are located.

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O.S.C. FIELD CAMP

The summer field camp of the Department of Geology, Oregon State College, has been established at the Mascall Ranch west of Dayville in the John Day Valley. Dr. W. D. Wilkinson is in charge. He has 19 students who will study the geology of the Dayville quadrangle. Two of the students are doing graduate work leading to degree of Master of Science.

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OREGON GEOLOGY MAPPED

Dr. Thomas P. Thayer, geologist with the U. S. Geological Survey, is continuing geologic mapping in the John Day, Mt. Vernon, and Aldrich Mountain quadrangles. He was recently joined by Mr. Allan B. Griggs of the Survey who will assist in the mapping work for the balance of the field season.

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NEWS OF SOUTHERN OREGON DREDGES

Stearns and Owens have moved their dragline operation from Poormans Creek to the Applegate River near the town of Applegate. This is a resumption of an operation started before the war. Part of the dredged ground will be resoiled. A 2½-yard dragline will be used.

The W. E. Pantle Gold Dredging Company which has been working ground near Jacksonville has suspended operations because of lack of water supply. This company is testing ground at the town of Rogue River. If the testing work is sufficiently encouraging, leveling and resoiling will be practiced after dredging.

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ALUMINUM

The following quotation is from Mineral Resources of the United States for the year 1887, and shows strikingly the progress in production, uses, and cost of metallic aluminum during the past 60 years (price of ingot aluminum now 15 cents per pound).

"No progress in the methods of extracting aluminum appears to have been made in this country since the last report. The Castner process of manufacturing sodium cheapens the production of that metal to such an extent that by its employment in the process of extracting aluminum it is said that the latter metal can be produced for less than $5 per pound. A company has been formed in England to use this process, but no advantage appears to have been taken of it in this country. The patents for extracting aluminum issued within the past year, cover processes which have not yet been put into successful operation. Notices of new processes for the same purpose, and of new enterprises, supported by companies with large capital, have appeared from time to time in the newspapers, but the returns received from dealers and workers in aluminum do not show that there is any real production of the metal in the United States.

"The price of metallic aluminum during the past year varied from 90 cents to $1.25 per troy ounce, according to the dealers and workers, and was quoted as low as $11 per avoirdupois pound in the trade journals. In considerable quantities it was sold for less than $10 per pound. Its applications were confined, as before, to small articles, such as dental plates, parts of surgical, electrical, optical, and surveying instruments, beams of fine assay balances, apothecaries' weights, tobacco boxes, spoons, etc., it was used in the form of foil, and leaf for lettering, and for various other articles where lightness and strength are desired. Its use seems to be extending in this direction, but its price and limited production prevent its application on a large scale."

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COPPER IMPORT TAX SUSPENDED

(Public Law 42 - 80th Congress)

AN ACT

To suspend certain import taxes on copper.

BE IT ENACTED BY THE SENATE AND HOUSE OF REPRESENTATIVES OF THE UNITED STATES OF AMERICA IN CONGRESS ASSEMBLED, That the import tax imposed under section 3425 of the Internal Revenue Code shall not apply with respect to articles (other than copper sulphate) entered for consumption or withdrawn from warehouse for consumption during the period beginning with the day following the date of the enactment of this Act and ending with the close of March 31, 1949.

Approved April 29, 1947.

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CLEARING HOUSE NO. 94

CH-94: W. D. Bowser, P.O. Box 162, Grants Pass, Oregon, wishes to buy two tanks having a capacity of 500 barrels each, and two tanks having a capacity of 250 barrels each, suitable for use in cyanidation. Second-hand tanks would be satisfactory.

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