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BOHEMIA DISTRICT MINES

(Continued From Fifth Page.)

lated, apparently, to that of the Roseburg region, which was emptied in the later part of the Eocene.

The deposit, bearing fossil plants on Coal Creek, is chiefly sandstone, with some conglomerate and shale, disturbed in places by the extrusion of igneous rocks like diabase. The pebbles of the conglomerate are all of igneous material, largely of a rhyolitic character. The sandstone contains considerable feldspar, but is composed chiefly of grains of igneous rocks. The sandstones strike north 85 degrees east, and dip in some places to the southwest and elsewhere to the northeast. The thickness of the whole mass may be as much as 1000 feet.

In a district of active volcanoes the lava flows frequently interrupt local drainage, and thus produce lakes. The strata in which the fossil leaves are inclosed were deposited most likely in a lake developed under such conditions. The position of the beds at the bottom of a deep ravine of Coal Creek, beneath several thousand feet of volcanic material, shows that a large part of the Cascade Range has been emptied since the leaves were buried. Among the fossils from this locality F. H. Knowlton, of the United State Geological Survey, recognized with more or less doubt three species, only one of which has been seen elsewhere, and then in the Miocene.

One mile north of Comstock, near the western end of the Calapooias, a section of rocks about 50 feet in thickness is exposed on the western side of the track. Conglomerate above, it contains pebbles of volcanic rocks and sandy layers below, with white shaly beds between, and numerous leaf impressions. Half a mile southwest of Comstock the sandstones and shales contain characteristic eocene fossils. These strata dip gently to the west and northwest, and have a wide distribution in the Coast Range. In some places the plant beds appear also to dip gently to the northwest, conformally to the eocene, but at other exposures the position is different and it is possible that the plant beds are unconformable on the eocene.

Eocene and Miocene Strata.

That the upbuilding of the Calapooia Mountains belongs to the later eocene or early miocene, is suggested by the distribution of eocene and miocene strata about their base. At the southern base of the Calapooia Mountains, about 12 miles northeast of Oakland, and also near its western end, in the neighborhood of Comstock, characteristic eocene fossils are found in the sandstones and shales, while at the northern base of the mountain the nearest fossils now known are miocene, which occur a few miles southeast of Cottage Grove. From their distribution it appears that the Calapooia Mountains were the southward extension of the sea that deposited the miocene so widely in the Willamette Valley.

The rocks of the Bohemia region are known to the miners generally as syenite, but they are wholly volcanic, and are generally lava flows, although tuffs are quite common. Among the lavas andesites are by far the most abundant. A few of them are more or less conspicuously porphyritic and contain phenocrysts of quartz, and are classed as dacite-porphyries. Basalts occur sparingly.

One of the best examples of dacite-porphyry occurs on the ridge southeast of Bohemia Mountain. It is light gray in color, with many white spots, due to small phenocrysts of feldspar, with a few rounded grains of quartz. The large angles of symmetric extinction in the thin section show that the lime-soda feldspars are about labradorite in composition. The small grains, which appear as a black pepper-like sprinkling, are composed chiefly of chlorite or greenish hornblende, with some epidote, and represent some ferromagnesian silicate, probably pyroxene, that has disappeared. The ground mass, which is not very sharply distinguished from the phenocrysts, is composed chiefly of clear grains of quartz, with clouded grains of feldspar. Some of the latter show crystallographic outlines, but the quartz grains have irregular outlines.

A similar dacite-porphyry occurs in the Mystery, one of the Musick's group of claims. The feldspar phenocrysts are more numerous and fresh, with decided zonal structure. Some of the feldspars are surrounded by a granophyric border. The ground mass is holocrystalline, often granophyric and microporphyritic, with much plagioclase. In this rock there are some patches of pyroxene, but it is much less abundant than the plagioclase. Most of it is monoclinic, and looks like augite, but a portion of it may be orthorhombic.

The most sharply defined outcrop of decite-porphyry lies near the eastern border of the region, where it occurs in the form of a dike, cutting through a thick set of tuffs near the Buckhorn opening upon the western slope of Hismatite Mountain. The rock, although not distinctly porphyritic, contains some quartz and feldspar phenocrysts in a granophyric ground mass. The ferromagnesian silicate has been replaced by chlorite and carbonates.

The andesite is not often so porphyritic as to warrant its being called andesite-porphyry, but is so in one case on the northern portion of the divide between Grizzly and Grouse Mountains. The phenocrysts of plagioclase have a symmetric extinction of nearly 25 degrees, and probably belong to labradorite. They are larger and much more abundant than the irregular grains of augite. The ground mass is granular, chiefly feldspar. Each grain contains numerous smaller ones of different minerals, which render it microporkilitic, and in some cases granophyric, as in the dacite-porphyries, but in this case no quartz phenocrysts were discovered.

With very few exceptions, all of the rocks of the Bohemia region might be included under this heading, for the dacite-porphyries are only porphyritic quartz-bearing andesites. The tuffs, too, and most of, the basalts are andesitic. In several of the andesites hornblende is present, but generally pyroxene is the only characterizing ferromagnesian silicate. Although widely distributed, the andesites are much altered.

On the Champion trail, one-fourth mile southeast of the Musick mine, is a gray, minutely porphyritic pyroxene-andesite, in which, besides the crystals of plagioclase, there are dark spots of pyroxene or chlorite derived from it. Most of the pyroxene is certainly augite, but some of the altered forms suggest hypersthene. The ground mass is chiefly plagioclase, the minute lath-shaped crystals of which, with the pyroxene, give a somewhat ophitic structure. A few dark-bordered spots suggest the former presence of hornblende, and irregular grains of magnetite are scattered rather abundantly throughout the mass.

Below the trail the country rock about the Galena Spur opening of the Wall Street claim is closely related to the andesite last noted, but contains scarcely any plagioclase crystals visible to the unaided eye. Pyroxene is present, and also dark-bordered patches from which most of the hornblende has disappeared. The feldspar has a large angle of symmetric extinction and is most likely labradorite. This is the only distinctly hornblende-bearing pyroxene-andesite seen in Bohemia district.

To the northward, in Elephant Mountain and Fairview, and in the ridge between them, the dark-gray porphyritic andesite prevails, but is somewhat altered, containing considerable carbonate of lime, epidote and chlorite.

Andesite on Bohemia.

In the south base of Bohemia Mountain, at the head of Petersburg Canyon, the andesite is arranged in layers, seven of which make up the upper 500 feet of the mountain. The lower layer has well-developed columnar structure, and the dense andesite of which it is composed contains between the minute plagioclase crystals, besides numerous grains of augite, a great deal of yellowish, partly devitrified glass.

The top of Grizzly Peak is composed of a compact, dark-gray, nonporphyritic andesite of basaltic habit, but consisting chiefly of plagioclase in small, squarish, and a few oblong crystals with considerable magnetite and a trace of pyroxene. Epidote, chlorite and carbonates replace most of the pyroxene. Another similar rock, but even finer-grained, occurs on the Noonday mine, near the boarding-house. Feldspars are abundant in the ground mass, and the microphenocrysts are rich in crystals and grains of magnetite.

The basalts of the district are few and andesitic. One of the best marked forms the southern edge of the summit of Bohemia Mountain. Microphenocrysts of feldspar, pyroxene and serpentine are abundant, and so decreased in size that the distinction between groundmass and phenocrysts is not sharply drawn. The serpentine has the net structure characteristic of that derived from olivine. The groundmass is composed chiefly of lath-shaped plagioclase and granular augite, with considerable magnetite and a small amount of secondary quartz. These rocks are cut by veins of quartz, and were evidently in place before the development of the auriferous veins. At the northeastern end of Bohemia Mountain the lava sheets are cut by a vein of bright-red chert. In a specimen collected by the United States Geological Survey, this chert looked very much like that of organic origin found at many points in the Coast Range of Southern Oregon and California.

Tuffs are abundant, especially in the eastern part of the region. They are well exposed also at several points in the central and western portions. As the region is approached by the Sharp Creek trail the stratified tuffs are first seen under Judson Rock, where the fine gray-banded tuff is well exposed. Well-stratified tuffs also occur in the reservoir on the western slope of Elephant Mountain. A coarser variety of larger distribution is visible on the White Ghost claim near the right-hand bank of City Creek. At this point the component lapilli are a centimeter or so in diameter, and the fragmental character is visible to the eye. Here, too, it is associated with the interesting tourmaline hornfels. The rock is in places gneissoid in structure and is composed chiefly of tourmaline, with much quartz and minute scales of clear mica. This appears to be a product of contact metamorphism with tuff on one side, but on the other side of a 10-foot ledge of hornfels nothing was exposed.

In the tunnel to No. 2 level of the Noonday mine tuff is well exposed in sheets interstratified with lavas. They are all of fine material. It is a matter of surprise to find no coarse fragmental material of volcanic origin in the region. It furnishes evidence that the explosive outbreaks were outside of the district, possibly to the eastward, for in that direction the tuffs become coarser and much more massive. On the trail from the Noonday to Riverside a good view is obtained of the slope east of Horseheaven Creek as far south as Hematite Mountain. This slope is made up chiefly of light-colored, well-stratified tuffs.

Very few, if any, of the rocks of the region are entirely unaltered, although the alteration is usually so small as not to affect the general appearance of the lavas. Near the veins, however, the alteration is greater, and it is to be supposed that this alteration was effected in connection with the development of the veins. While the general alteration of the lavas consisted chiefly in the chloritization and carbonatization of certain minerals, the changes which were brought about closer to the veins are different, in that sericitization and silicification are the most important processes, and these are accompanied or followed by the deposition of sulphides, especially pyrite.

Within a few feet of one of the branches of the Musick vein, near the eastern part of Bohemia Mountain, the original character of the andesite has entirely disappeared. The general appearance of the rock is not greatly changed, but, under the microscope, it is found to have been completely altered and to be composed of sericite, carbonate of lime and quartz, with a small amount of pyrite. The distance to which this process extends from the veins has not been accurately determined, but there are indications that at times it extends 50 feet or more. One specimen of such altered material was found at the mouth of the 120-foot tunnel on the Wall Street vein, its distance from the nearest vein appears to be over 50 feet, but this is not certain; for there may be others concealed near by. Several hundred feet farther up the slope is the comparatively fresh hornblende-bearing andesite of the Galena Spur.

The Broadway and Champion are adjoining properties upon the same vein. In the Broadway the wall rock upon the north side, a few feet away from the vein, although fresh looking, is much altered. It is composed very largely of fine granular quartz, with many films of sericite and considerable pyrite. The original ferromagnesian silicates have been entirely removed. The only trace of original structure is marked by an occasional patch of sericite scales resulting from the larger crystals of feldspar. Upon the south side, at the same distance from the vein, much of the feldspar, in both large and small crystals, is still preserved, although much is altered, and granular quartz is abundant. There is much chlorite and some epidote and sericite, representing the pyroxene and feldspar, which have disappeared. Pyrite is not present.

On the north side of the Champion, 12 feet from the vein, as in the Broadway, there is much silicification. Pyrite is common, and the carbonates are present quite as abundantly as the sericite. The pyrite appears to find its place most commonly in the porphyritic feldspars. On the south side of the Champion, five feet from the vein, the rock is highly silicified, with the development of granophyric structure. Traces of chlorite remain, and the oxides of iron are present, instead of the sulphides. As this lies near the surface, the sulphides have been oxidized.

In the Noonday, at the west end of level No. 2, where the vein pinches out, the south wall retains nearly all its feldspars, and there has been but little silicification. Chlorite, carbonates and a little epidote represent the minerals that have disappeared. Upon the north side, near by, there has been much silicification and sericitization, accompanied by the development of considerable pyrite. Locally, one process prevails over the other, and when this is the case silicification is usually the most prominent. The north wall rock of the Little Maud is highly silicified, but in the south wall silicification has produced scarcely as important changes as those due to carbonatization and sericitization.

Veins Well Defined.

The veins of Bohemia district are unusually well defined. The veins are irregular and vary from a mere film to sheets 12 feet thick. A vein may be simple, as in the case of the Champion, where there is but one ore body, or it may be composed of several parallel veins only a few feet apart, as locally in the Musick. When simple the veins attain a thickness at times of four feet, but when compound they are as much as 12 feet thick. None of the veins has been followed to a greater depth than 320 feet beneath the surface, and they have been traced on the surface for comparatively short distances.

There is a wide range in the course of the veins—from north 40 degrees west, to south 70 degrees west—although for short distances the local trend may fall outside of these limits, as, for example, the Ophir, on which the strike is north 15 degrees west. The average course of 21 observations made for the United States Geological Survey is north 72 degrees west, approximately the general course of the Calapooia Mountains, and it seems probable that the formation of the veins may have been connected with the axial uplift of that crest. The dip of the veins is always at a high angle, and generally to the southwest, although in a number of places it is to the northwest. The same vein, as, for example, the Noonday, is inclined in different directions in different portions of the mine.

The veins follow sets of joint planes, of which there are two—one lying between north 30 degrees west and north 70 degrees west, and the other nearly at right angles to this, a little west of south. The joints of the first set are most abundant and occur generally in the neighborhood of the veins. Those of the second set are not common. The best examples are seen about Grouse Mountain.

It is evident from the relations of the joints and veins that the joints determined the position of the veins, and aided in affording an opportunity for the circulation of the mineral-bearing solutions by which the ores and gangue were deposited. The development of the veins, however, cannot be ascribed to the presence of simple joints alone, but to a crushed and porous belt of rock, in which there may be many irregular joints. The crushed condition of the rock is well displayed in the faces of some of the drifts. Occasionally the walls or inclosed fragments show well marked polish or striae of slickensides due to faulting. These appear more abundant about the Noonday mine than anywhere else in the district. The existence of faults of at least small extent cannot be doubted. It is possible that the evidence of faulting was once more general, and that it has been to some extent obscured or obliterated by subsequent deposition of vein matter. The country rocks are wholly volcanic and much alike, so that it was not possible for Mr. Diller in a preliminary survey to determine the amount of displacement.

Quartz the Principal Gangue.

The principal gangue mineral is quartz, which is more or less abundant throughout the veins, and is in many of the small veins the sole constituent. Such veins are of milky quartz, fresh, bright and solid, but the larger veins contain quartz that is more or less porous and cavernous, and the larger openings are lined with quartz crystals. While the crystal-lined cavities which occur more or less abundantly in all the large veins are positive evidence that the deposition took place in a cavity, yet the absence of banding indicates entire irregularity in the shape and order of deposition in the cavities. By the oxidation of the inclosed iron pyrities near the surface the porous quartz is deeply stained red, yellowish or black, the color depending upon the degree of oxidation and hydration of the iron.

Next to quartz, the most important gangue material in the vein is a white, clayey substance resembling kaolin. When treated with nitrate of cobalt solution and ignited, it becomes blue, like kaolin similarly treated, but between crossed nicols its interference colors are in part high instead of low, as are those of kaolin, and it has a finely foliated structure with parallel extinction, like sericite. George Steger determined that it contains 6 per cent of water. Kaolin contains 11 per cent or more of water, while sericite contains less than 5 per cent. It is evident, therefore, that the white argillaceous matter contains only a small portion of kaolin, and is made up chiefly of sericite. The material is referred to as kaolin, partly because some of it is kaolin and partly because the miners will more readily recognize it by that name. Mr. Lindgren showed the importance of sericite in the veins of the mining districts of Idaho Basin, and at the same time called attention to the scarcity of kaolin under such conditions. One of the vein minerals of rather local distribution and of little importance is epidote. In some places, as, for example, the southern end of the Mystery, it forms considerable masses and contains large scales of red hematite.

Another mineral which should be considered with the gangue minerals is carbonate of lime. It is rare and of but little importance. There was found at the mouth of the Helena a large fragment of yellowish and pale green, somewhat stalactitic mineral, which, upon investigation, proved to be allophane. It is said to have come from the tunnel on the vein. Although allophane was seen at only one place in the mining district, it is not of rare occurrence elsewhere in mines containing copper ores.

In the deeper portions of the veins the ores are pyrite, sphalerite, galenite, chalcopyrite, oxids of iron and cerusite. Excepting the last, they usually occur irregularly intermingled. When found together, they are in general of approximately equal quantities, although there is much variation. Pyrite is the only one which occurs alone, and is much more widely distributed than the others, extending far into the adjacent country rock. The iron oxide intermingled with the sulphides is red hematite, and its presence is generally considered an indication that the ore is rich in gold. The dark-brown to black oxide of iron is sometimes associated with a partially weathered form of good sulphide ore. The sphalerite (zinc sulphide), galenite (lead sulphide) and chalcopyrite (copper and iron sulphide) are almost absent from the rock in the zone of oxidation, where yellow to black oxide of iron derived from the pyrite is most abundant and lead carbonate (cerusite) derived from the galenite occurs in a few places. The metal sought is gold, which near the surface is native, finely filamentous, and distributed through iron-stained quartz; but at greater depths, about 200 feet, beyond the reach of surface influences, the gold is largely contained in the sulphides.

Old-Fashioned Cutworm.

GREENLEAF, Or., July 29.—The worms which have been so destructive to vegetation on Deadwood have appeared about the head of Lake Creek. In places they have eaten everything green. Some say they are the old-fashioned cutworm.

Postoffice to Be Discontinued.

WASHINGTON, July 28.—On August 15 the Postfloce at Homevalley, Skamania County, Washington, will be discontinued, and mail for that point will be sent to Stevenson.

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