ART. XXXI.—*On an Occurrence of Copper in Western Idaho*; by R. L. PACKARD.

THE Seven Devils is the name (of rough frontier origin) given to a range or group of mountains on the extreme western border of Idaho where that state is separated from Oregon by the Snake River on its northerly course to empty into the Columbia. The river runs through a deep gorge as it passes the mountains, the east side of which is formed by members of the Seven Devils group, while the western side or wall, which is very precipitous, is formed by a range on the Oregon side called the Eagle Mountains. The few sharply pointed, precipitous peaks which are the Seven Devils proper and have given their name to the whole group have an altitude of over seven thousand feet. They are of igneous origin and attracted the attention of prospectors many years ago, who found gold in the streams issuing from their domain and copper in the mountains adjoining them.

The only occurrence of copper of importance which has so far been exploited is found in the southern part of the range and is confined to the neighborhood of a body of whitish granitic rock of very considerable but not yet determined extent. The copper occurs as bornite and the principal mine of the locality is named the Peacock, from the nature of the ore. The igneous rock, which evidently has a genetic relation to the copper deposits, has the general appearance of a granite and has always been so called. It is grayish white in color, and in hand specimens does resemble a biotite granite without muscovite. It weathers into rounded blocks which are sometimes met with in isolated groups, and at one point on the wagon road leading up from the Snake River to the copper mines, and about a mile from the latter, the head of a small ravine is filled with boulders of this rock several feet in diameter which give the appearance of having been purposely rolled into the place. Water runs down among these rocks at some distance out of sight.

The whitish rock, where exposed, and in the boulders, is seen to contain areas of a darker color which vary in size from two or three inches to as many feet in diameter and impress one at first as being inclusions of some other rock.

This igneous rock, one would say, was evidently the cause, if not the source, of the copper deposits found on its contact and in veins in its substance, and it became a matter of curiosity to examine its mineralogical and chemical character. Specimens were, accordingly, procured from points about a

mile and a half apart, one on the wagon road leading to the mines (at the White Monument hill), and the other at the Victoria mine on the northern limit of the mines where the mountain descends abruptly to form one side of Deep Creek cañon. The slightly darker appearance of the rock at the latter place indicates that its composition varies somewhat from point to point. It is also an assumption that the whole mass is continuous for the distance mentioned. Indeed a flow of basalt intervenes at one place, but the extent of the flow is undetermined.

The thin sections from these specimens show that the rock has the following structure and composition. The structure is that of granite. The stout, tabular, triclinic feldspars largely predominate. Many of them are turbid. Interstitial quartz is present. The ferromagnesian minerals are hypidiomorphic, green, pleochroic hornblende, and some brown biotite, also limited by the adjoining feldspars. Apatite crystals, zircons, and some isometric granules of ore were also observed. A section from one of the inclusions described above showed the same mineralogical composition as the lighter-colored rock but the structure shows cataclastic areas. Green hornblendes, with inclusions, and triclinic feldspars, appear in the midst of the comminuted crystals. The section also shows biotite, with inclusions, limited by the adjoining feldspars, and the ore particles are much more numerous than in the lighter-colored rock. Zonal structure of the feldspars was noticeable in both sections.

The rock, therefore, as shown by these sections, is a diorite. Its analysis gave :

Ignition	·90
SiO ₂	53·98
Al ₂ O ₃ , Fe ₂ O ₃	27·64
CaO	7·03
MgO	4·63
Na ₂ O	4·51
K ₂ O	1·75
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	100·44

The analysis, although only partial, is sufficient to show the basic character of the rock ; and the excess of soda over potash, together with the high percentage of lime, confirms the microscopical determination of the predominance of the soda-lime feldspars over orthoclase.

The specimen from the Victoria mine was taken within a foot or two of a copper vein (bornite), and the section, viewed without the analyzer, shows fissures stained bluish-green by

copper solution. In the thin section brown biotite and quartz are much more abundant than in the specimens just described, but the predominating plagioclase feldspars and the fragments of green hornblende indicate the dioritic character of the rock. The biotite is seen undergoing bleaching and an alteration to a green mineral.

Diorite must also occur in the mountains north of the copper mines, for a specimen taken from a mass of rocky *débris* on the trail which passes through the Seven Devils, and perhaps eight miles from the mines, proved to be diorite when examined in thin section.

The diorite of the copper locality is bounded on its western side by a zone of a garnet-epidote rock and the bornite is found in this rock in kidneys and larger masses. At the Peacock mine the ore and garnet rock appeared to dip towards the diorite. West of the garnet rock appears an igneous rock the character of which is yet undetermined. Crystalline limestone accompanied with garnet rock crosses the diorite to the north-east at about a mile south of the Peacock mine. Mines are established at this contact also. The distance from end to end of the copper belt may be three miles or more in a direct line. The copper ore, except at the Victoria mine, is associated with the metamorphic- or metamorphosed-garnet rock, which is, in some places, more than a hundred feet thick, but at the Victoria mine the bornite occurs in a vein which is in the body of the diorite although near its contact with an eruptive rock and outside of the garnet belt.

Copper and iron (as sulphides forming bornite) are not the only metals due to the diorite. The bornite carries silver, sometimes up to twenty ounces per ton, and native gold is occasionally found in it. The gravel of the diorite is washed for gold, and a quartz vein carrying a little gold is "located" near the contact of diorite and basalt. A little galena has been noticed. It was at this place that the molybdate of lime, described as powellite,* was found four years ago.

* This Journal, xli, 138, 1891.