

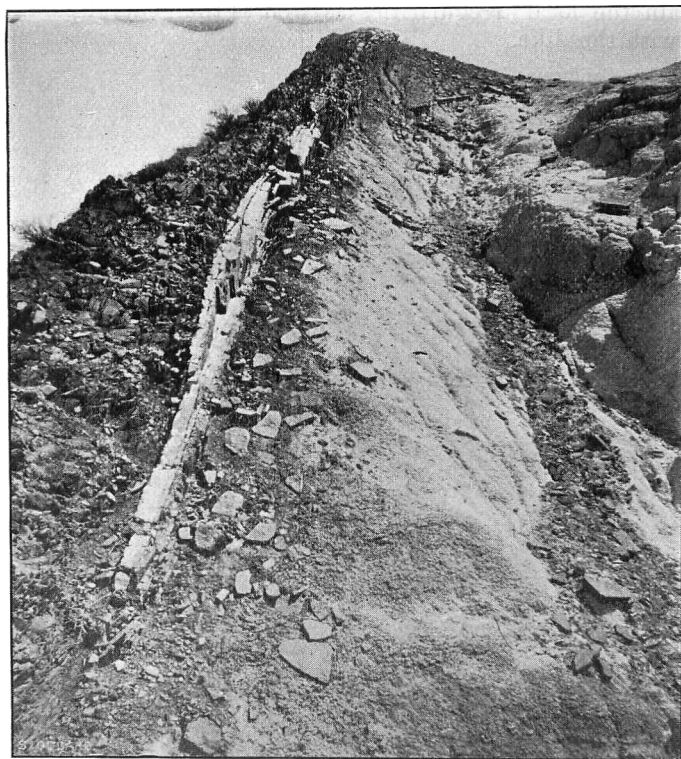
ART. V.—*An Interesting Case of Contact Metamorphism*;
by H. W. FAIRBANKS.

BLACK Mountain is the highest peak of the El Paso range, a spur of the Sierra Nevada mountains extending easterly into the Mojave desert. The mountain owes its name to the mantle of dark lavas which covers it. The underlying rocks constitute a part of an extensive series of sedimentary beds exposed for many miles along the northern slope of the El Paso range. They consist of sandstones, clays and conglomerates and contain in places much fragmental volcanic material as well as occasionally interstratified flows. Last Chance gulch and its tributaries drain the western slope of Black Mountain and in the cañons the character of the sedimentary beds, as well as their relation to the volcanic flows, is often finely shown. The sedimentary beds here have a light yellowish or pinkish color and exhibit in places a finely banded appearance. In the field they were thought to be wholly of volcanic origin, but a microscopic examination revealed the fact that the light-colored paste in which the more distinct fragments were embedded consists of an amorphous kaolin-like substance. The small partly-rounded pebbles and grains appear to be of many kinds, but those of a volcanic nature predominate.

The strata have been considerably disturbed and faulted, and in one of the cañons have been intruded by two dikes. One of these has a diameter of less than one foot while the other is 14 feet across. The larger one cuts vertically through the sedimentary rocks which dip at an angle of about 25 degrees. This dike appears very fine-grained, but a microscopic examination shows that it is holocrystalline. The feldspar is probably labradorite and occurs in long laths. The augite has a pale brown color and gives an ophitic structure to the rock. Abundant grains of a reddish color and presenting the appearance of having resulted from the alteration of olivine are scattered through the rock. Owing to the absence of a glassy base the rock is then an olivine diabase. The surface of the outcrop is quite decomposed and weathers away as rapidly as the soft and slightly tufaceous beds.

The remarkable feature connected with the intrusion is the striking manner in which the adjoining rock has been metamorphosed. The thickness of the band of altered tufa is about two feet where it is best exposed. The light colored-soft rock has been baked to a dark hard and very firm one, the slabs of which give forth a ringing sound when struck. A microscopic examination does not reveal any new minerals, but only the fact that the alteration has brought out more clearly the vol-

canic nature of the most of the fragments. The metamorphosed layer weathers out more strongly, as the photograph shows, than either the dike or the unaltered tufa, forming a prominent and sharply defined band extending up the side of the cañon.



Contact metamorphism in the El Paso range, California. The soft tufa lies on the right of the picture, the slaty contact zone in the middle, the diabase dike on the left.

In addition to the pronounced manner in which the rock has been baked there is another striking feature. The hardened layer is not massive, but on the contrary, breaks up into thin and regular slate-like slabs parallel to the wall of the dike. The photograph shows the main lines of fissility and the slabs broken off and strewn over the side of the cañon. An examination of any one of these slabs shows that it also is thickly penetrated by fine parallel seams which are slightly irregular and discontinuous, but which under the action of the weather

would develop into further parting planes. Where these cracks pass through the larger pebbles the latter do not appear to be faulted in the least, so that we cannot attribute their origin to the action of a shearing stress. The most probable explanation which has occurred to the writer is that the partings are due to contraction on cooling. This theory would explain the local irregularities as well as the general parallelism with the dike.

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