

gewonnenen Ergebnisse, so muss jede unbefangene Diskussion die Tatsache anerkennen: dass die marinen Ablagerungen der oberen Kreide von Patagonien eine starke, successive Abnahme von mesozoischen Charakterformen aufweisen, dass aber andererseits diese letzteren sich zum Teil erhalten, dass mithin die Elemente der Kreidefauna teils unverändert, teils modifiziert in die patagonische Formation übertreten und dass keine Discordanz zwischen der Kreide und den Ablagerungen der patagonischen Formation besteht."*

So far as New Zealand is concerned, then, it appears to be probable that at the close of Cretaceous times a great movement of epirogenic depression took place. The land area was reduced to the dimensions of a few small islands. Over much of the present land area deep-sea oozes were deposited for a great lapse of time. Marginal deposits were restricted and small. When elevation again commenced the Upper Cretaceous fauna had been replaced by one of Tertiary characteristics.

ART. XXVIII. — *Notes on the Geology of the Tubuai Islands and of Pitcairn.*

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THE scattered islands which constitute the Tubuai Group are situated near 23° south latitude and 150° west longitude. Little geological information has been published about them except in regard to their general configuration and the nature of the coral reefs by which they are encircled.

A visit has lately been made to the group by Professor J. Macmillan Brown in connection with his anthropological studies, and he has been good enough to give me chips from implements that he obtained from Tubuai and Rapa. In addition, the Chief Magistrate of Pitcairn sent me several specimens from that island. I have previously published a note on rock-specimens from Rurutu Island, another member of the Tubuai Group.†

Stone Axe, Tubuai Island.—A dense black rock in hand-specimens. In section the structure is dominated by an abundance of small laths of feldspar with the extinction angle of labradorite. There are a few large crystals of olivine much serpentinized. There is also a little olivine in the groundmass. Augite is very plentiful in the groundmass in small colourless grains. Magnetite very abundant. The rock must be classed as a dense, rather acid basalt.

Stone Axe, Rapa Island.—In hand-specimens a dark fine-grained rock without any crystals that can be distinguished macroscopically. In section fine laths of feldspar are very abundant. They appear to be an acid labradorite or andesine. Augite is very plentiful, but the grains seldom have any crystalline outline, and they are quite colourless. A little olivine is present in very irregular-shaped grains. Magnetite is very plentiful in crystals up to 0.2 cm. in diameter. A little apatite can be distinguished. This rock is also an acid feldspathic basalt, and, like the specimen from Tubuai, it has an unusual quantity of magnetite.

* VON IHERING, *Remsta do Museu Paulista*, vol. 1, Fasc. 3, p. 130 Sao Paulo, 1914.

† *Trans. N.Z. Inst.*, vol. 46, p. 283, 1914.

Poe Pounder, from Rapa Island.—In hand-specimens a coarse rock in which feldspar, augite, and olivine can be easily distinguished. In section the feldspar is found to have occasionally a large angle of extinction—as much as 40° —and thus is a basic type of labradorite. The great majority of the crystals, however, have very narrow lamellae, and extinguish at angles below 20° . The species apparently varies from andesine to basic labradorite, which is confirmed by the low index of refraction. Augite is present in large ophitic plates with the pleochroism that is so common in the titaniferous varieties. Olivine is present in large irregular grains slightly serpentinized, and it is often associated with minute flakes of brown mica. Iron-ore is abundant. It is mainly ilmenite, as shown by the shape of the crystals and by the frequent border of leucoxene. There is much apatite, especially as inclusions in the plates of augite.

I have lately received from Mr. G. R. B. Christian, the Chief Magistrate of Pitcairn, a box of rock-specimens from that remote spot. He states that the specimens sent represent the various kinds of rock that are to be found on the island so far as can be judged by external appearance. My only previous reference to rocks of this island is a statement that a specimen given to me by Mr. G. W. Card was a glassy hypersthene andesite.* The rock-specimens that I have now received cause me to correct the previous classification. I now recognize the rock as a glassy basalt. In the specimen previously examined only one small crystal could be seen. It was thought to be hypersthene, but subsequent specimens now show that it was olivine stained slightly with iron oxide. The more numerous specimens that I now have are all fine basalts, many of which are glassy. The feldspar is an acid labradorite. Olivine, usually in idiomorphic crystals, is usually more plentiful than the colourless augite, which is always granular. The fineness and frequently glassy nature of the rocks suggest that they have a submarine origin. So far as these rock-specimens are concerned, they indicate that on several of the islands of the Tubuai Group a similar rock type occurs. Tubuai, Rapa, Rurutu, and Pitcairn at least have highly feldspathic basalts. In general all of the rock-specimens that I have examined are so similar that they all might have occurred on the same island. The specimens from Tubuai and Rapa are types that have been selected by the natives for the manufacture of weapons, and hence they may possibly be unusual types on the islands, selected because of their special fineness or toughness. The specimens from Rurutu and Pitcairn, however, appear to be typical of the rock occurrences on those islands. Generally it may be said that the rocks of the Tubuai Group appear to be less basic than those of Tahiti and the Cook Islands, and the specimens so far examined show none of the alkaline characters found in many of the rocks from those groups.

* *Handbuch der regionalen Geologie*, Bd. vii, Abt. 2, p. 14, 1912. MICHEL LEVY (Examination petrographique de quelques roches volcaniques des îles Tuamotu et de l'île Pitcairn, *C. R. Acad. Sci. de Paris*, cxli, p. 895-97, 1905) writes as follows: "En résumé il existe à Pitcairn et à Mangareva deux séries de roches basaltiques: une plus acide de basaltes andésitiques passant à des andésites à olivine et à des tachylites (Pitcairn): une autre plus basique composée de basaltes labradoriques quelquefois très augitique d'autrefois très riche en olivine du premier temps: cette dernière paraît être la plus fréquente. Il faut noter en outre l'existence à l'île Pitcairn de ponces trachitiques presque entièrement vitreuses et par suite peu intéressantes au point de vue minéralogique." The more basic type mentioned by Michel Levy was not represented in my specimens.