ART. LVIII.—*Notes on the Age and Subdivisions of the Sedimentary Rocks in the Canterbury Mountains, based upon the Palæontological Researches of Professor Dr. C. Baron von Ettingshausen in Gratz (Austria).*

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FOR many years past a great diversity of opinion has prevailed concerning the age and relative position of the Mount Potts beds in the Rangitata River, containing only fossil shells and saurian remains in one, and some plant remains in another, locality, not far distant from each other; and the Clent Hill beds in the Upper Ashburton District, in which only fossil plant remains have hitherto been found.

Whilst Professor McCoy, in Melbourne, as far as 23 years ago, assigned the Mount Potts beds to the Lower Carboniferous or Upper Devonian, and the fossil plants of the Clent Hills to Jurassic times, I always maintained, based upon the stratigraphical relations of those two groups of beds to each other, that they were of the same age, having shown at the same time, and as I hope conclusively, that both occur near the base of the whole series. Since then, the Geological Survey of New Zealand has repeatedly examined these localities, the result being that the shell-beds were first called Liassic, then Triassic, and now Permian; and the plant-beds in the Clent Hills, Jurassic, with which those of the Malvern Hills and some other localities were associated.

The principal point of difference between Professor McCoy and myself on the one hand, and the Geological Survey of New Zealand on the other, was not the real age of the Mount Potts and Clent Hills beds, but the great difference of age assigned to them.

In a paper on the "Geological Structure of the Southern Alps of New Zealand,"* I once more reiterated my views on the subject; and my researches for the last twenty years have amply confirmed this. Dr. Hector, however, has continued to defend his own views, of which his attempted refutation of my paper in the same volume† is a proof.

For many years past, together with other New Zealand geologists, I have waited in vain for a reliable description of our fossil plants by a competent palæontologist, so that the data upon which the different views were based could be verified. I

* "Trans. N.Z. Inst.," vol. xvii., p. 322.

† "Notes on the Geological Structure of the Canterbury Mountains," etc., *l.c.*, p. 337.

availed myself, therefore, gladly of the kind offer of Professor von Ettingshausen, an eminent Austrian palæontologist, who has made palæo-botany his special study, to describe our fossil flora, and to bring light into the chaos which hitherto has reigned. I sent to him not only all the fossil plants collected by myself in New Zealand, but Professor Parker forwarded all those contained in the Dunedin University Museum, so that ample material was in the hands of Professor von Ettingshausen to go carefully into the whole subject. This eminent palæo-botanist has just finished his labours, for which he had not only to go repeatedly to Vienna, but had also to pay a visit to London to study and compare the material there.

His paper, illustrated with numerous plates, will appear in the "Transactions" of the Imperial Academy of Science in Vienna, but in the meantime he has kindly favoured me with a short *rēsumé* of the results of his labours, of which I hasten to lay a translation before you.

Professor von Ettingshausen states as follows:—

"In the first instance, you will doubtless like that I should place together all the localities according to the flora contained in them:—

"*To the Trias belong:* Mt. Potts, Clent Hills (Haast Gully), Malvern Hills (older series), Mataura, and Waikawa.

"*To the Cretaceous period belong:* Grey River, Pakawau, Wangapeka.

"*To the Tertiary period belong:* Shag Point, Malvern Hills (younger series), Murderer's Creek, Radcliff Gully.

"Now some few observations on the characteristic plants of each locality, and the flora in general:—

"*Mt. Potts* offered only very few distinguishable plant remains. However, I could recognise amongst them with certainty *Asplenium hochstetteri, Tæniopteris pseudo-vittata,* which belong also to the other Triassic beds. I found amongst them also a *Baiera,* which confirms the age of the locality as Triassic, A fragment, though rather defective, is doubtless a *Thinnfeldia,* which again does not militate against such a designation, which however excludes older beds, like Permian for instance.

"*Clent Hills* (*Haast Gully*).—These shales contain very interesting plant remains, and appear to promise still a greater harvest of valuable things. To the leading and characteristic remains belong four species of *Tæniopteris, Asplenium hochstetteri* and *palæo-darea, Palissya podocarpites* and two species of *Thinnfeldia.* A very peculiar *Comptopteris* and an *Equisetum* are closely allied to Triassic forms.

"*Malvern Hills* (*older beds*).—*Tæniopteris,* analogous to other Triassic species, *Asplenium hochstetteri, Thinnfeldia,* a *Podozamites,*

and a *Pecopteris*, are the most remarkable plant remains from this locality.

"*Mataura and Waikawa.*—The *Tæniopteridæ*, *Zamites*, *Pterophyllum*, *Nillsonia*, altogether in forms analogous to Triassic genera, with *Asplenium ungeri*, of such universal occurrence, prove the identity with the last-mentioned beds.

"*Grey River*, *Pakawau*, and *Wangapeka* contain a flora which is well distinguished from that of other localities of the Cretaceo-tertiary formation, and which decidedly ought to be placed with the Cretaceous formation. However, the material at my command will not allow me to state at present with certainty to which of its subdivisions these remarkable beds belong.

"The flora contains four *Filices*, amongst them one form, *Martensia*, specially characteristic of Cretaceous beds; one *Dammara;* one new genus of *Taxinea;* four species of *Podocarpium;* one *Dacrydium;* one most interesting genus uniting the genera *Ginkgo* and *Phyllocladus;* two *Gramineæ;* one *Musacea;* one *Palma*, closely allied to a Cretaceous species; one *Casuarinea;* three species of *Quercus;* one *Dryophyllum;* two species of *Fagus*, *Nemophylon;* one genus of *Ulnacea*, uniting *Ulnus* and *Planera;* one *Ficus*, *Cinnamomum haasti*, two *Proteaceæ;* and several *Dialypetalæ*.

"From the Tertiary deposits, Shag Point and the Malvern Hills furnished the most interesting plant remains.

"The flora contains three *Filices*, amongst them one form closely allied to European Tertiary species, a *Sequoia*, closely allied to the European *Sequoia couttsia;* *Araucaria haasti;* two species of *Dammara;* two of *Podocarpus;* one *Dacrydium;* one *Najadea;* one *Palma;* one *Casuarinea;* three species of *Myrica* (!), amongst them one almost identical with a European Tertiary species; one *Alnus* (!), most remarkably near a European Tertiary form; four species of *Quercus;* three of *Fagus;* one *Ulmus;* one *Planera;* one *Ficus;* one *Hedycarya;* three *Laurineæ;* one *Santalacea;* one *Protacea;* three forms of *Gamopetalæ;* and several *Dialypetalæ*."

I need scarcely point out that this information is very valuable, and will gladly be received by New Zealand geologists; and I have no doubt that, if once in possession of Baron von Ettingshausen's interesting paper, a great step towards the elucidation of many obscure questions in our stratigraphical geology will have been accomplished.