

including 107 figures, roughly drawn, but characteristic. They show most of the common and seemingly capricious forms assumed by stalagmitic deposits. Certain of the observations are somewhat trivial, such as the reference to the "profile of Gladstone" in the centre of one stalactite, and the comparison with the "hind-quarters of an elephant" in another. The author has not availed himself of the assistance which would have been obtained by examining thin sections of the deposits under the microscope.

Botanical Charts and Definitions. By Miss A. E. Brooke and Miss A. C. Brooke. (London: G. Philip and Son, 1894.)

It is notorious that examinations in elementary practical chemistry are frequently little more than tests of capacity for remembering analytical tables. This little book will serve the same purpose in botany that tables of analysis do in chemistry. In thirty-four pages the authors summarise the work required for the South Kensington (Elementary) and the Oxford and Cambridge Junior Local Examinations in Botany. Charts and definitions are given of sub-kingdoms, classes, orders, and floral whorls; of root, stem, leaf, inflorescence, and fruit. These, with definitions of terms of cohesion and adhesion, enable the student to classify a plant on the lines of the table of analysis with which the book concludes. We are afraid that the compilation will induce cramming for the examinations for which it is intended; but if this be avoided, and the charts are only used as supplementary to oral teaching and demonstration, they will help students to acquire a clear view of the relation and arrangement of the parts of a plant.

The Great Globe: First Lessons in Geography. By A. Seeley. (London: Seeley and Co., 1894.)

A SIMPLY worded and instructive primer of geography, printed in clear type, and illustrated with numerous cuts and diagrams. The book does not merely consist of lists of lengths of rivers, heights of mountains, populations of cities, and similar statistics, but is a compendium of facts calculated to interest the young reader, and, at the same time, to add considerably to his knowledge. There is a little too much of the goody-goody style of writing about missionary enterprises, but that is the only point we are inclined to criticise. Tales of the torturing of converts and murdering of missionaries are apt to create in children a morbid state not at all desirable, and they can very well be omitted without making a work on geography any the less interesting.

LETTERS TO THE EDITOR.

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Trituberculy and Polybun.

IN all the speculations on the original type of the mammalian molar, beginning from Rüttimeyer (1863), we find that a simple cusp or cone is, with perfectly logical reasoning, considered to be the primitive form from which all others are derived. The error, fatal in its consequences, consisted in the fact that all the teeth possessing such a simple form, whether recent or fossil, high or low in the system, have for a long time likewise been considered to be primitive; so that the only problem remaining to be solved, seemed to be to trace back the intermediate stages between the more or less complicated molars of recent mammalia and the "simple reptilian cone."

The cretaceous deposits having long failed to throw light upon the obscure relations between the comparatively scanty mesozoic mammalian teeth and the tertiary and existing forms, we were reduced to make the best of the oldest tertiary faunas. It is from the discovery of the lower eocene Puerco beds that the establishment of the tritubercular theory dates, Cope having

traced the superior molars of placentalia to a "tritubercular," and their inferior molars to a "tubercular sectorial" type, both of which he found to be of overwhelming preponderance in the Puerco beds, the oldest known deposits of tertiary mammalia.

I have elsewhere¹ raised objections to the inferences drawn from the Puerco fauna, and now one of the most strenuous defenders of trituberculy has, with his own hands, undermined the stronghold of the theory, by denying the Puerco fauna the claim to be in ancestral relation with later faunas, for he considers this old fauna to be merely "an independent radiation of placentals, like the Australian radiation of marsupials."²

Owing especially to the perseverance of Prof. Marsh, cretaceous mammalia were discovered in due time. The principal characters of their molars can be grasped at once by a single glance at the two beautiful and highly instructive plates published by Prof. Osborn, in December last.³

Whoever examines with an unbiased mind the molars figured in the latter plate, must receive the impression that the term "trituberculate" applied to them can stand only upon the *lucus a non lucendo* principle. Speaking for myself, I cannot consider to be tritubercular, molars which consist of from five to ten tubercles; therefore the teeth represented on Pl. viii. in my opinion are polybunous (multitubercular), as well as those of Pl. vii., though in a different manner. Prof. Osborn informs us that the former "include a variety of forms just emerging from the primitive tritubercular stage" (the italics are mine), "lending overwhelming proof, if any more were needed, of the unity of origin of the molar types of the higher mammalia, from a tritubercular stem instead of from a multitubercular, as Forsyth Major has suggested."⁴ I suppose that by "primitive tritubercular molar" we are intended to understand a molar which is in fact tritubercular *sensu strenuo*, namely, composed of no more and no less than three cusps arranged in a triangle; but I fail to discover in the pages which follow the above quotation, the proofs for the various assertions it contains.

In order to explain why for such complicated molars as those on the precited Pl. viii., the designation *tritubercular* is maintained, it must be recorded that this name is said to be meant to imply that the two outer cusps (paracone, metacone) and the single inner one (protocone) in upper molars, as well as the three anterior cusps (two inner and one outer) in lower molars, generally the best developed of all the cusps, are to be considered as typical, primitive; whilst the remainder, namely, the intermediate and all the others of superior molars supposed to play a subordinate part, as well as those composing the heel of inferior molars, are considered to be later additions to the crown.

It has not, however, been shown, and I deny, that the predominant cusps have always been such, and that the intermediate ones, as well as the inferior heel (talonid), are of later origin than the former, and have always been in a subordinate position with regard to them. Without searching farther than what is to be seen on Pl. viii., I state that the figures F are not in favour of the assumption that two of the supposed primitive cusps, the paracone and metacone, are always the best developed; externally to them, we have here two superadded cusps, the "parastyle" and "metastyle,"⁵ which are in a much better state of development than the reduced two "primitive" cusps. The latter, as the other figures of the plate suggest, may only gradually have acquired their predominance by supplanting the "styles," which in other patterns have become more or less obsolete. On the whole, the superior molars of these "tritubercular" cretaceous mammalia can best be compared with those of *Didelphyida*, as was done by Marsh, or to speak more guardedly, rather with the *Polyprotodontia* in general, the principal differences between the two consisting in the fact that the cretaceous forms are more complicated.

From the seemingly subordinate condition of the "heel" of lower molars, as compared with their anterior portion, it does not follow that the former is of later origin; the difference between the two in vertical extension obviously depends on one or more of the cusps of the so-called trigonid having secondarily become more elongated, for brachydonty and not hypsodonty is the original condition. If the heel were a later addition to the

¹ P.Z.S. 1893, p. 198-199.

² H. F. Osborn, "The Rise of the Mammalia in North America," pp. 30-31. (Boston, 1893.)

³ H. F. Osborn, "Fossil Mammals of the Upper Cretaceous Beds." (*Bull. Am. Mus. Nat. Hist.* v. 1893, pp. 311-330, pl. vii.-viii.)

⁴ *Id.* p. 320.

⁵ Of their homologues, by the way, may be found traces in the molars of many existing mammals; see e.g. H. Winge, Om Pattedyrenes Tandskifte, 1832, Table III.