other alveoli for single-rooted teeth; these occupy the anterior 26 centimetres of the jaw. The next tooth is *in sitû*; its anterior border is 32 cm. from the tip of the jaw. The crown is high and conical, somewhat compressed from side to side, with sharp anterior and posterior edges and slightly curved backwards. On the anterior edge near the base of the tooth there are five or six blunt, upwardly directed denticulations, while on the posterior edge there are four or five larger ones. The height of the tooth crown was 6·5 cm., the length of its base 5 cm. The next tooth, separated from the last by an interval of about 5 cm., was broad and double-rooted; its crown is somewhat broken, but it can be seen that on its anterior and posterior edges there were several large and sharp denticulations. The length of the tooth at its base was about 6·6 cm. The next tooth, which is separated from the last by an interval of 4·5 cm., is similar, as also is the next, which is in contact with that in front. The last three teeth (the molars) differ considerably from those just described. They are closely crowded, and have a nearly straight anterior border, denticulations occurring on their posterior edge only. On the whole the dentition closely resembles that of *Zeuglodon osiris* as figured by Stromer.[1]

A number of very large vertebræ have also been found; the dimensions of one of these are:—Length of centrum, 23·5 cm.; transverse diameter, 17·7 cm.; vertical diameter, 15 cm.

P.S.—In reference to my account of the teeth of *Arsinoitherium* given in the last part of these notes, my attention has been drawn to the fact that in a footnote to one of his geological papers Blanckenhorn has mentioned the similarity between this dentition and that of *Coryphodon*.

CAIRO, *April*, 1904.

NOTICES OF MEMOIRS, ETC.

I.—PALÆONTOLOGY IN THE NATIONAL MUSEUM, MELBOURNE.

THE following Report of the Palæontologist of the National Museum, Melbourne, Mr. Frederick Chapman, has recently been issued, and gives a good general idea of the material available for study in that Institution:—

After the preliminary work of unpacking and generally inspecting the collections of fossils placed in my charge, the work of selecting a series of specimens to illustrate Australian, and particularly Victorian, palæontology was commenced. This has been progressing, in conjunction with other necessary work, with the result that there are now on view 15 table-cases of typical Australian fossils, including the Cambrian, Ordovician (Lower and Upper), and the Silurian. I have introduced certain noteworthy features, such as explanatory diagrams and illustrations, into the arrangement of these cases, in order to make them more interesting, both to students

[1] Op. cit., pl. viii, fig. 2.

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and the public. Our collections of Palæozoic fossils have been considerably enriched by the purchase of the valuable series formed by the Rev. A. W. Cresswell, M.A., and Mr. F. Spry respectively, and the donation by Mr. G. Sweet, F.G.S., of the entire series of Cambrian fossils now on exhibition. The large fossils and casts have been repaired and repainted, and the whole labelled in accordance with the latest nomenclature. These exhibits are arranged in the Upper Gallery of the Museum on the north-east side, which was thrown open to visitors last November.

I have prepared and hung in the Gallery two long, coloured geological sections, one illustrating the geology of Victoria, running through the State in a west to east direction, and the other taken through Melbourne from Brunswick to Ormond Point, near St. Kilda. Every care has been taken to render these correct according to the latest information, and in working out these details I have been greatly assisted by the friendly help of Professor Gregory, F.R.S., and Mr. T. S. Hall, M.A. One thousand and thirty-seven fossils have been determined, most of which are now exhibited.

Since a large number of the Palæozoic fossils of Victoria are still awaiting description, this work has been taken in hand, and I have figured and described (Proc. Roy. Soc. Vict., vol. xv, pt. 2) fourteen fossils in the National Museum, ten of which are new to science; two new genera have also been established to receive two of these fossils.

The very comprehensive and valuable collection of fossils in the Museum, brought together under the direction of the late Sir Frederick McCoy, was a distinct and agreeable surprise to one who, although familiar with the English national collection, did not anticipate meeting with anything at all comparable in the southern hemisphere; and these, chiefly the foreign specimens, will be most valuable for purposes of comparison with those of Victoria.

II.—Various Short Notices.

1. The subject of "Clastic Dikes" is dealt with by Mr. J. F. Newsom (Bull. Geol. Soc. America, xiv, 227, 1903). He describes a number of sandstone dikes in San Luis Obispo and Santa Cruz counties, California. The rocks of San Luis Obispo are Cretaceous sandstones, overlain by Miocene shales, which are cut by sandstone dikes. These dikes occur near the axis of a low synclinal fold, where former conditions were probably favourable to great hydrostatic pressure. The author is of opinion that soft sands were forced up from below along joint planes, and that the sands were afterwards firmly cemented by calcium carbonate. Near Santa Cruz there are dikes of sandstone, varying from mere films along joint planes to intruded masses several feet thick. These cut the Miocene shales at various angles on the western side of a faulted monoclinal fold. The smaller films are usually bituminous. In the author's opinion there is evidence that the underlying sandstones were formerly oil-bearing, and that the oil-bearing sands were forced into joints in the shales. The larger dikes formed the avenues of escape for the

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petroleum, and subsequently for water which carried the oil and oil residues from the intrusions. The author concludes with a very full summary of the literature of Clastic Dikes.

2. Dr. F. H. Hatch has written a brief description of "The Boulder Beds of Ventersdorp, Transvaal" (Trans. Geol. Soc. S. Africa, vi, 95, 1904). The boulder ('banket') beds consist of pebbles and large masses of slate, conglomerate, and quartzite, identical with rocks occurring on the Rand and belonging to the Witwatersrand Beds; and they include also various igneous rocks. Some of the banket boulders have been found to contain gold in payable quantity, but these occurred amid many non-auriferous masses, the fact being that the boulder beds have been derived chiefly from the Witwatersrand Beds upon which they rest unconformably. Dr. Hatch remarks that the boulder beds include not only conglomerates but igneous breccias, and the formation appears to have been initiated by the outpouring of vesicular lavas known as the Klipriversberg Amygdaloid. For the group he applies the term "Ventersdorp Beds."

3. "The Geological History of the Gouritz River System" is the title of an essay by Mr. A. W. Rogers (Trans. S. African Phil. Soc., xiv, 375, 1903). This river system drains the country southwards from the Nieuweveld Ranges, and the principal rivers, after crossing a broad tract of less elevated ground, traverse in succession the mountainous tracts of the Zwartebergen and Langebergen. The author describes the physical changes to which the area has been subjected, and which have led to the present drainage system.

4. An Index to Geological Papers.—Many valuable papers on the geology of Devonshire are scattered through the first thirty-four volumes of the *Transactions* of the Devonshire Association for the Advancement of Science, etc. Vol. xxxv (1903) contains a continuous alphabetical index to these, by Mr. J. G. Hamling, who has placed each paper under three headings, viz., subject, locality, and author. Geologists will be grateful to the compiler, and it is only because he asks for intimation of any mistakes or omissions that we venture to suggest the desirability for an extension of the subject entries; for example, there are only eight entries under 'Caverns' and only eight under 'Fossil,' although the number of papers dealing with those subjects is vastly greater.

5. "Devonshire in the time of the Lower Chalk" is the title of a paper by Mr. Jukes-Browne (Trans. Devon Assoc., xxxv, 787, 1903). An accompanying map shows the probable geography of the south-west of England and north-west of France in the Cenomanian (Lower Chalk) age. Exmoor is represented as an island, while the country south-west of Tintagel and Dartmoor is regarded as part of "the Western Land" connected with Brittany and Normandy.

6. In another paper on "The Geology of the Country around Chard" (Proc. Somerset Arch. and Nat. Hist. Soc., xlix, 1903)

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Mr. Jukes-Browne gives a particular account of the Selbornian Sands (Upper Greensand) and Chalk, with an excellent photographic view of the quarry at Snowdon Hill, Chard, famed for its rich fossil-bed at the base of the Chalk.

7. In an article on "The Cotteswold Hills" (Proc. Cotteswold Club, xiv, 205, 1903) Mr. S. S. Buckman discusses the area of the Cotteswolds, the spelling of the name, and other matters of topographical interest—entering fully into the literature of the subject. A map on the scale of an inch to 4 miles accompanies the article, and on it he has marked the limits he is led to assign to the Cotteswold Hills and the names of the bordering vales. To aid in his decision he has sought the best advice from residents and others. The greatest difficulty in fixing a boundary was in the region east of Burford, a tract sometimes spoken of as the Oxford or Oxfordshire Downs. With regard to this term Lord Moreton writes that it is not a geographical expression, but "simply means the sheep of Oxfordshire of a down character." The Cotteswold Hills as now marked out extend from Ebrington Hill on the north to Lansdown by Bath on the south. The western limit is naturally bounded by the escarpment of the Oolites. The eastern limit is taken to include Badminton (but not Malmesbury), Tetbury, Cirencester, Fairford (but not Witney), Leafield, and the western side of the Vale of Moreton. Names of places where the Cotteswold Club has held field-meetings are marked on the map, showing plainly that the Club has trespassed far and wide into bordering tracts. A full list of the field-meetings, drawn up by Mr. L. Richardson, is appended. —H. B. W.

8. Labelling of Objects in the Geological Department, British Museum of Natural History.—Much attention has been paid of late years to the question of explanatory labels for the exhibition cases, and among those who have given special thought to this important subject is Dr. F. A. Bather, M.A., F.G.S., the Assistant Keeper of Geology. The subjoined is a specimen of a recently printed label prepared by him for the Echinoderm case, which serves to show how much information may be imparted to the student of geology and to the public at large by this means.

"*How Sea-Urchins are turned into Flint.*

Silica, the substance of which flints are made, is scattered through the Chalk formation in very minute particles, which are dissolved to some extent by water, especially if it be slightly alkaline. Consequently, as rain-water sinks into the Chalk it dissolves the silica and carries it with it through the Chalk. When the sea-urchins died and were buried in the chalky ooze, the inside of their shell or test was sometimes filled with the ooze, but sometimes it remained empty. In the latter case, when the Chalk became hardened and raised out of the sea, a cavity was left, into which flowed the dissolved silica. It may have been deposited on the walls of this cavity (i.e. the inside of the urchin's test) as

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minute crystals of quartz (rock-crystal); or, as was more usually the case, it filled the cavity with a formless mass of the impure chalcedony that we call flint. So was fashioned in silica a cast of the inside of the sea-urchin test; and later on, as the Chalk was worn away by rain and rivers, and as its fossils thus came out on the surface, then the relatively soft and soluble test was worn or dissolved off. Therefore it is that many of these flint casts turn up on the surface of the downs or in gravel-pits. In some cases, however, the test itself became impregnated with silica; for the limy substance, of which the test is made, is very porous. The pores usually are filled in fossil specimens with crystalline carbonate of lime; but sometimes the silica got in first. When the flint was once deposited in this way, so long as it remained in the Chalk there was a tendency for further flint to be deposited round it, and so the sea-urchins are occasionally found embedded in masses of flint. Sometimes one finds only this surrounding flint with the impression of the outer surface of the urchin."

REVIEWS.

I.—The Atoll of Funafuti. Borings into a Coral Reef and the Results. Being the Report of the Coral Reef Committee of the Royal Society. 4to; pp. xiv and 428, with 6 plates at end of text and folding chart of soundings, 69 cuts in text, also with 19 plates in a separate portfolio. (Published by the Royal Society, 1904.)

THE much-discussed question as to the origin of Atolls has, of late years, been left a moot point, because the adherents to this theory or to that have recognised that no satisfactory conclusion can be come to without much further evidence, particularly that which would probably be supplied by a deep boring into an atoll. Such an undertaking, advocated by Charles Darwin, who first made the question of the origin of atolls notorious, has at last been accomplished by expeditions during three consecutive years, sent out under the control and at the expense of the Royal Society and the Government of New South Wales, and aided by private donations.

The Report of the Coral Reef Committee of the Royal Society on these expeditions occupies the pages of the volume under consideration. It has been edited by Professor T. G. Bonney, D.Sc., F.R.S., who became responsible for passing the volume through the press, and was also Chairman of the Coral Reef Committee. In the preface he gives a brief history of the various stages of the enterprise from its inception in 1893 to its completion. Its primary object, as defined in the instructions to its first leader, Prof. Sollas, was to investigate, by means of a boring, the depth and structure of a coral-reef, and all other work undertaken in furtherance of natural knowledge was to be considered as secondary to this object, whilst

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