

unaltered rocks, which we have thus recently discovered, stand related to the remarkable breccias and boulder beds of the Permian and Trias of the Birmingham neighbourhood, is not yet fully worked out. That they are overlain upon their flanks by representatives of all the subformations of the Silurian, as developed upon the Malverns, has recently been determined by the author and his students. That from these local ridges (many of which are now buried from sight by more recent accumulations), and not from distant Welsh rocks, the supposed Permian glacial boulders might originally have been derived, may now be suspected, and one of the most vital difficulties in the interpretation of the rocky structure of the district will thus disappear from sight. That they afforded the majority of the innumerable quartzite pebbles found in the boulder-beds of the Trias of the Midlands is even more probable, and thus another and even more important fact becomes naturally accounted for.

NOTICES OF MEMOIRS.

ON THE STRUCTURE OF THE HEAD OF ARCHÆOPTERYX. By W. DAMES.¹

THE *Archæopteryx* in the possession of the Royal Mineralogical Museum of this kingdom [Prussia] will be made the subject of a detailed description accompanied by figures. By uncovering some bones hitherto imbedded in matrix, a better knowledge has been gained of the structure of the head. When the specimen was acquired for this collection, the skull showed on its exposed right side two large apertures. The posterior hole, situate under the roof of the skull, was easily identified as the orbit of the eye; a view the more evident since the cavity contains a well-preserved sclerotic ring, which is formed of a single row of overlapping scale-like, bony plates, as in so many living birds. The anterior edge of this eye-cavity is formed by a small bone, which, turning somewhat backwards, reaches to the base of the skull. This bone is now regarded as the lachrymal. It forms the hinder boundary of a second aperture which is large and of rounded triangular form. In the middle of this cavity lies a crushed fragment of bone which has no natural connexion with the adjacent parts of the skull. This aperture has been determined as the nasal cavity by Vogt and Marsh, in their accounts of the head of *Archæopteryx*. The specimen, however, shows that the anterior part of the skull then laid imbedded in the rock, and the contour of the head has only been shown by carefully clearing away the matrix. This development yields the remarkable result that in front of the opening hitherto considered nasal, lies a third opening which is 9mm. long, of sharp elliptical form and placed oblique to the long axis of the skull. It is separated posteriorly from the middle opening by a small bony bridge. It is

¹ Communicated by Herr Ewald, 27 July, 1882, to the Berlin Academy. Translated by Professor H. G. Seeley from a separate copy, extracted from the *Sitzungs-berichte*, vol. xxxviii. p. 817. 1882.

bounded above and in front by a very thin bone, which is a part of the premaxillary, which does not reach the extremity of the skull. In front of it lies another portion which is about 4mm. longer which is triangular, equal-sided, and forms the end of the beak.

This opening, which is entirely surrounded by the premaxillary, is affirmed to be the nasal aperture. By its discovery the resemblance of the skull to that of living birds is shown to be much greater than was formerly believed. As in the bird, three apertures lie on the side of the skull. The hinder one is the orbit; the middle one is surrounded by the lachrymal behind and the premaxillary and maxillary in front and below; while more forward is the nasal aperture, entirely in the premaxillary bone. Having established this analogy with living birds, the study of other parts of the skull becomes much clearer. Thus the crushed portion of bone in the middle aperture is seen to be the inner ascending process of the maxillary bone. And a longer bone running back to the base of the skull and forward, beneath the orbit, is a part of the vomer. Further, the quadrate bone, though not clearly determined by its characteristic form, is recognized by its position. And immediately in front of it is a small bone only just projecting from the matrix which from its position can only be the pterygoid.

There is little preserved of the roof of the skull, only broken fragments of the frontals, and the brain cavity filled up with calcareous spar. The back of the head is wanting. A further result from clearing away the matrix is the exposure of the dentition. Two small teeth standing under the middle opening were already visible in the natural exposure. Besides these there are now ten teeth in all to be seen in the jaw. The most forward is about 2 mm. from the end of the beak; yet there are traces that one or two teeth stood in advance of this, so that the dentition reached to the extremity of the beak. The teeth are about one mm. long, conical, very sharp, and as far as a single small place with well-preserved upper surface lets one see it, shining, smooth, and without perpendicular furrows or ridges. The interspace between the separate teeth is scarcely 1 mm. long. Marsh considered that the teeth were limited to the premaxillary bone, since the last occurred under the nasal opening. But according to the interpretation now brought forward, the aperture formerly termed nasal is the middle hole of the three on the side of the skull, and it is considered that the dentition is not limited to the premaxillary, but also extends to the maxillary bone, or at least to its anterior part. Marsh further put forward the conjecture that the teeth were placed in a groove, but the present examination gives no support to that view, and it rather appears that every tooth stood in its own alveolus. The lower jaw is still in its natural position, *i.e.* in its union with the quadrate bone with the upper margin lying close to the skull which incloses it. It shows a postarticular process, curved behind as in the existing genus *Anser*. The position of the lower jaw as well as the closed beak prevents one from seeing whether the lower jaw contained teeth, but I think, with Marsh, this was probable. Under the lower jaw lies a portion

of a needle-shaped hyoid bone comparable to that of living birds in its entirely similar form. Those many very weighty resemblances which the *Archæopteryx* shows to the form of skull in the *Pterosauria* will come under discussion in the detailed description. In conclusion, it may be mentioned that the excavation of the shoulder girdle, which is not yet finished, on further investigation may prove that the portion which Vogt considered to be the coracoid is really matrix, so that so far as can be judged from its preservation, the form of the shoulder girdle must be removed from things known. And it has yet to be proved whether the form of this part of the skeleton will support the relation of the *Archæopteryx* to birds or reptiles.

R E V I E W S.

I.—GUIDE TO THE EXHIBITION GALLERIES OF THE DEPARTMENT OF GEOLOGY AND PALÆONTOLOGY, BRITISH MUSEUM (NATURAL HISTORY), CROMWELL ROAD, SOUTH KENSINGTON. 8vo. 56 pages. With a Plan, and 31 Woodcuts. Printed by Order of the Trustees. (London, October, 1882. Price threepence.)

THE Galleries containing the Mammalian and Reptilian remains having been completely arranged, and most of those set aside for the fossil Fishes, Molluscs, Crustaceans, etc., having received their palæontological treasures, though not yet in every case fully developed, the Trustees of the British Museum have without delay published their first *illustrated* Guide for the use of both scientist and amateur, as well as for the general public, desirous of knowing what these things are,—how they bear on the notions and thoughts of to-day,—and how far Nature to-day resembles herself in the Past.

Much valuable and precise information is given in a condensed form in this "Guide," especially about the higher Vertebrates, with numerous good woodcuts. Several of these are original, and others have been borrowed from first-class books. The classification of the animals, vertebrate and invertebrate, and their distribution in time and space, are points well kept in view; and, except that the special notice of the Corals, Sponges, and some other low or simple animals, which have not yet been arranged in their cases, is postponed for the present, both student and general observer will find this "Guide" a useful little manual for practical, and to a great degree for philosophical zoology recent and fossil (palæontology). J.

II.—THE GEOLOGICAL CHART. By JOHN MORRIS, M.A., F.G.S., Emeritus Professor of Geology and Mineralogy in University College, London. New and Enlarged Edition. Large Sheet. (Reynolds and Son, Strand, London.)

THE Chart, originating many years ago, has been revised and improved from time to time, keeping up with the progress of geological knowledge, and thus enabling the Student and the Amateur to catch at a glance the main points and chief features of his subject. In the present edition the proposed recognition of the