former of these genera in having one of the anterior thoracic legs enlarged and strongly spinose; it is said to differ in having no thoracic exopodites, but even if this should prove to be the case it would not outweigh the important points of resemblance.

A PROVISIONAL DIAGNOSIS of the genus *Pleurocaris* may be given as follows:—Eumalacostraca without a carapace, with at least seven of the thoracic somites distinct and provided with horizontally expanded pleural plates; with at least seven pairs of the thoracic appendages not greatly differing in size; with the abdomen longer than the thorax; with the telson and uropods forming a tail-fan, the former distinct from the last somite and tapering to a sharp point, the latter with long narrow rami. Probably belonging to the division Syncarida and closely allied to the genus *Acanthotelson*, Meek & Worthen.

It is perhaps deserving of mention that the transversely ridged body-somites of *Pleurocaris* give it a superficial resemblance to certain Myriopods (Diplopoda) occurring in the same strata, and one occasionally finds fragments, destitute of appendages, which can with difficulty be referred to one or the other.

IV.—ON THE STRUCTURE OF THE ROOF OF THE SKULL AND OF THE MANDIBLE OF *PELONEUSTES*, WITH SOME REMARKS ON THE PLESIO-SAURIAN MANDIBLE GENERALLY.

By C. W. ANDREWS, D.Sc., F.R.S. (British Museum, Natural History).¹

IN the course of the preparation of the second part of the *Catalogue of the Marine Reptiles of the Oxford Clay* in the Collection at the British Museum, it has been necessary to examine in detail the structure of the skull and mandible of the Pliosaurs, especially of *Peloneustes philarchus*, several excellent specimens of which are included in the Leeds Collection. In the course of this examination several peculiarities have been observed, which on the one hand tend to reconcile the conflicting views as to the structure of the skull roof that have been put forward, and on the other serve to correct the interpretation of the elements of the mandible given in the first part of the Catalogue.

In the Plesiosaurian skull one of the most difficult points to determine is the precise position of the suture between the parietals and frontals, and the relationship of those bones to the pineal foramen. In *Muraenosaurus*, *Cryptocleidus*, and *Tricleidus* this suture runs across the front of the pineal foramen, the parietal overlapping the frontal in such a way that while the former may completely enclose the foramen on the outer surface of the skull (as in *Muraenosaurus* and *Cryptocleidus*), the frontals extend back beneath the parietals, and form the anterior border of the opening on the cranial surface. In the type-specimen of *Tricleidus seeleyi*, in which the various elements are disarticulated from one another, it can be seen that the anterior part of the border of the pineal foramen is formed by the frontals alone. In *Peloneustes* the arrangement of these bones is very different. In this case the forward extension of the parietals over the frontals anterior to the

¹ Published by permission of the Trustees of the British Museum.

pineal opening is much greater than the *Elasmosaurs*, and indeed is carried to such a degree that their anterior angle reaches the posterior ends of the facial processes of the premaxillæ, thus excluding the frontals from the middle line on the outer surface of the skull. On the cranial face (Fig 1) it can be seen that the parietals meet in front of the pineal foramen (*p.f.*) and run forwards in the form of a wedge (*par.*) between the frontals, which, though excluded from the pineal foramen, run back as far as about the middle of that opening. In front of the ventral wedge-like prolongation of the parietals the frontals (*fr.*) appear to meet at least for a short distance in the middle line beneath them. The posterior region of the frontal unites extensively with the post-frontal (*po.f.*), which extends back to the

FIG. 1. Inner face of the middle portion of the skull roof of *Peloneustes philarchus*. (About one-third nat. size.) *fr.* frontals; *l.* lachrymal; *mx.* maxilla; *o.c.* channel enclosed by the downgrowths of the frontals; *par.* parietals; *p.f.* pineal foramen; *po.f.* post-frontal; *pr.f.* pre-frontal.

level of the middle of the pineal foramen, and has a short contact with the parietal; externally the post-frontal unites with the post-orbital. In front of the post-frontals the ventral surface of each frontal is raised into a high cristiform ridge, which curves downwards and inwards towards the middle line, where it just meets its fellow of the opposite side for a short distance, thus enclosing a deep channel (*o.c.*), probably for the olfactory nerves. Anteriorly these ridges die away a little in front of the anterior angle of the orbit. Antero-laterally the frontal unites with the pre-frontal (*pr.f.*), and these again on their outer side join the element which is here regarded as the lachrymal (*l.*).

Professor Williston,¹ in his account of the structure of the skull in

¹ *North American Plesiosaurs*, pt. i (Field Columbian Museum, Geological Series, vol. ii, No. 2 (1903), pl. iv, fig. 1). Also Proc. U.S. Nat. Mus., vol. xxxii (1907), p. 478, pl. xxxvii.

Dolichorhynchops osborni and *Brachauchenius lucasi*, both from the Cretaceous beds of Texas, describes the parietals as separating the frontals, and extending between them to meet the posterior ends of the facial processes of the premaxillæ. Possibly in these cases also the overlap of the parietals may be mainly superficial, and the frontals actually extend back to the level of the parietal foramen, in front of which they may either meet in the middle line on the inner surface of the skull, or at least be separated by a small interval only. If this is the case the structure of the skull in these American Plesiosaurs would fall into line with that seen in the European forms.

The Leeds Collection contains some very complete specimens of the mandible of *Pliosaurus* and *Peloneustes*, and examination of these, particularly of some belonging to *Peloneustes philarchus*, shows firstly that the structure of this part of the skeleton differs considerably from that occurring in the Elasmosaurs, and secondly that the description of the Elasmosaurian mandible given in the first part of the *Catalogue of the Marine Reptiles of the Oxford Clay* is wrong in several particulars, and I take this opportunity of making the necessary corrections.

FIG. 2. Inner face of the left ramus of the mandible of (A) *Peloneustes philarchus* (about one-eighth nat. size) and (B) of *Murænosaurus* (a smaller specimen). ang. angular; cor. coronoid; d. dentary; d.sym. symphises of dentaries; g. dental groove; s.ang.art. united surangular and articular; spl. splenial; spl.sym. symphises of the splenials.

Each half of the mandible of *Peloneustes* is composed of five pieces. These are (1) the fused articular and surangular, (2) the angular, (3) the dentary, (4) the coronoid, (5) the splenial. Of these, as usual, the dentary (d.) is much the largest, extending from the coronoid angle to the anterior end of the jaw. It bears about forty teeth, of which about fourteen are in the symphysial region. The whole symphysial surface is formed by the dentary except a narrow ventral strip (s.sym.) formed by the extension forwards of the splenials. The anterior ends of the coronoids, though just extending into the symphysis, do not seem to have actually united with one another in the middle line. On the outer face of the jaw the posterior end of the dentary overlaps the surangular above and the upper part of

the angular below the complex suture between them running downwards from the coronoid angle. The lower part of the angular is prolonged forward beneath the dentary, forming the ventral border of the jaw, to a point a little behind the symphysis. On its inner face the upper part of the dentary is covered to a large extent by the closely adherent coronoid, which extends from the coronoid angle, in the formation of which it shares, to just within the symphysis, though, as already noted, it is doubtful whether the coronoids themselves actually united with one another. The coronoid (*cor.*) is in turn itself overlapped on its inner face by the splenial (*spl.*), which roofs in the dental groove (*g.*) and unites by its ventral edge with the upper border of the angular, fitting into a deep groove in the upper border of that bone posteriorly and overlapping it anteriorly, where it runs down and forms the ventral border of the jaw. At its anterior end the splenial extends some distance in to the symphysis, uniting with its fellow in the middle line (*spl.sym.*). At its posterior end it forms the inner and lower edge of the opening of the dental canal (*g.*), and extends back as a narrow strip of bone along the upper edge of the angular to a point only a little in front of the articular surface for the quadrate. The surangular and articular (*s.ang.art.*) are represented by a single element: this forms the upper part and the rounded posterior end of the post-articular process: it also bears the articular surface for the quadrate, consisting of an outer and an inner concavity. In front of this the upper border rises towards the coronoid angle, and is broad and flattened. At the coronoid angle the bone is overlapped on its outer side by the posterior end of the dentary, and on the inner side at the same level it joins the coronoid; the lower edge is united with the angular throughout. The angular (*ang.*) forms the whole of the lower part of the posterior half of the mandible, and it sends forward a prolongation, overlapped externally by the dentary and internally by the splenial, to within a few centimetres of the symphysis. Its upper edge is deeply grooved and forms the floor of the dental canal, and receives the lower edge of the splenial at least in the posterior portion of that bone.

In a species of *Plesiosaurus* from the Uitenhage Beds of South Africa the general arrangement of the elements of the jaw are very similar, except that the coronoid is much shorter and does not reach the symphysis, and it is doubtful whether the splenial does so either. In the Liassic Plesiosaurs also the structure, so far as can be made out, is similar: in the longer-snouted forms at least the splenial extends into the symphysis. In the jaws of the Elasmosaurs of the Oxford Clay the case is different, and it is necessary here to correct some errors in the account of the structure of the lower jaw in these reptiles, given in part i of the *Catalogue of the Marine Reptiles of the Oxford Clay*, examination of the Pliosaurian mandibles and other material having thrown new light on the subject. In the account there given the coronoid is said to be entirely wanting, while the splenial extended from the coronoid angle to the symphysis, closely adherent to the inner face of the dentary above the dental groove. As a matter of fact the coronoid (Fig. 2, *B*), though lost in nearly all

cases, was present, and formed a prominent coronoid angle: at its posterior end it unites in suture with the surangular-articular, and extends forward for a short distance closely adherent to the inner face of the dentary: it is shown in text-fig. 48 of the Catalogue, where it is marked *spl.*; in the text-figure 46B it is nearly correctly shown, but is described as the coronoid process of the splenial. The splenial, so far as is known, is entirely wanting in the mandibles of *Muraenosaurus* and *Cryptocleidus*, in which the dental groove remains open throughout its length. In a specimen of the mandible of *Tricleidus* (*R.*) there are traces of a very thin layer of bone crushed down into the groove; this may perhaps represent the remains of a very thin splenial element. Of course, in *Muraenosaurus* and *Cryptocleidus* a similar structure may have been present and have been lost in the process of fossilization. The difficulty of determining the position of sutures in the more or less crushed mandibles which were examined must be the excuse for the error here corrected.

V.—THE NEOLITHIC REMAINS OF COLONSAY, IN THE WESTERN ISLES OF SCOTLAND.¹

By W. B. WRIGHT and the late ANGUS M. PEACH.

- I. Introduction.
- II. Former Investigations in Colonsay.
- III. The Colonsay Axe-heads.
- IV. The Newly Discovered Neolithic Floor.
- V. Description of the Flint Implements.
- VI. Conclusions.

I. INTRODUCTION.

THE more exact investigation of the distribution and mode of occurrence of Neolithic remains has received a much needed stimulus from the publication of Professor Brögger's memoir² dealing with the position of the strandlines in South-Eastern Norway during the stone age of that country. It has been clearly demonstrated in this important work that it is possible to distinguish, even in the relatively short-lived Neolithic culture, certain phases of chronological value, and to correlate these phases, by means of the distribution of the implements which characterize them, with the successive stages in the elevation of the land which affected Scandinavia in postglacial times. It has become clear, therefore, that the careful registration and description of Neolithic relics may lead to the most important scientific results, and it will be realized by all who indulge in archæological collecting that an exact determination of the locality of any find and of the relations it bears to the superficial deposits of the neighbourhood, more especially to the old shorelines which border the coasts of the British Isles, is of the utmost importance.

It must not be forgotten, however, that in Scandinavia conditions were peculiarly favourable for such investigations. The amplitude of

¹ Published by permission of the Director of the Geological Survey of Great Britain.

² W. C. Brögger, "Strandliniens Beliggenhed under Stenalderen i det Sydøstlige Norge": Norges Geol. Undersøgelse, No. 41, 1905.