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PROCEEDINGS OF THE PALEONTOLOGICAL SOCIETY

SECOND REPORT OF THE COMMITTEE ON THE NOMENCLATURE OF THE CRANIAL ELEMENTS IN THE PERMIAN TETRAPODA *

BY WILLIAM K. GREGORY, *Secretary of the Committee*

WITH APPENDICES BY R. BROOM, D. M. S. WATSON, AND S. W. WILLISTON

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INTRODUCTION

On June 29, 1915, Prof. H. F. Osborn requested Prof. S. W. Williston to act as chairman of a committee consisting of Messrs. S. W. Williston, E. C. Case, R. L. Moodie, D. M. S. Watson, and W. K. Gregory, the object of the committee being to consider and revise the names of the cranial elements of the earliest Tetrapoda. Dr. R. Broom was later appointed by the chairman. The committee has never been able to assemble and discuss the matter together, but each member has expressed his own views in correspondence with the Secretary and has had opportunity to consider the views of the other members of the committee. The first report of the committee was made by the Secretary at the Washington meeting of the Paleontological Society in December, 1915.

It is not yet possible to secure entire unanimity in the committee either as to the principles which must be followed in the adoption of names for

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the cranial elements or, in many cases, as to which term is to be preferred among several synonyms; and although substantial progress has been made toward this end, it is recognized that much further investigation and discovery is required in order to settle the difficult questions of homology between the various elements in amphibians, reptiles, and mammals, on which the final nomenclature must largely rest.

List of approved Names

The names approved and used by all members of the committee cover the majority of the cranial elements and are as follows:

Angular
Articular
Basioccipital
Basisphenoid
Coronoid
Dentary
Ectopterygoid
Epipterygoid
Ethmoid
Exoccipital
Frontal
Intercoronoid
Interfrontal
Intertemporal (see also sphenotic)
Jugal
Lacrimal (not lacrimal of Gaupp and von Huene)
Maxilla
Nasal
Palatine
Parietal
Postfrontal
Parasphenoid
Postorbital
Prearticular
Precoronoid
Prefrontal
Premaxilla
Prevomar
Proötic
Pterygoid
Quadrate
Quadratojugal
Septomaxilla
Stapes
Squamosal
Supratemporal
Surangular (Supra-angular)
Supraoccipital
Tabular

List of Names as to which there is Divergence of Opinion

Names as to which there is some divergence in the committee, either of usage or of opinion as to homology, are as follows:

"Alisphenoid" of reptiles.
- **Postoptic Cope (Williston).**
- **Laterosphenoid (von Huene).**
- **Otosphenoid (Broom).**

Dermosupraoccipital.
- **Prior term, used by Williston, Case, Gregory.**
- **Postparietal Broom, Watson, Moodie.**
- **Interparietal (when opposite pair are fused) Broom.**

Epiotic (Miall) of crocodile.
Not "epiotic" of fishes (= tabular). See Watson's and Williston's remarks below.

Infradentary (Watson).
Anterior splenial of Broom.

Intertemporal, Williston, Case, Broom, Moodie, Gregory.
Watson believes a new name necessary, but provisionally uses intertemporal.

Opisthotic (see Paroccipital).
Paroccipital Owen, a prior term (Williston).

Petrosal of mammals.
Said to arise from four centers; commonly believed to represent fused proötic and opisthotic (or paroccipital).

Parasphenoid of authors.
Probably gave rise to mammalian vomer, as held by Broom; but practically all authors continue to use parasphenoid unless wishing to emphasize homology with mammalian vomer.

Postparietals, Broom, Watson, Moodie.
See dermosupraoccipitals (Miall).

Preangular, Broom.
Williston and Gregory are inclined to believe this is homologous with the true splenial of the crocodile.

Preparietal.
Recorded in many Therapsida, but not elsewhere.

Postoptic (see "alisphenoid").

Sphenethmoid.—The primitive brain-trough, as in the sturgeon and the frog. Later divides into orbitosphenoid and postoptic ("alisphenoid" of reptiles).

Splenial.—The typical splenial of the crocodile articulates with the angular, coronoid, surangular and dentary. The "splenial" of *Trimerorhachis* enters the symphysis and is separated from the angular by the "postsplenial" (see Watson and Williston below).

Supratemporal, the dorsal element, above the squamosal and lateral to the parietal.

Temporal of Ichthyosaurs, Cuvier (the lateral element, often called supratemporal, lateral to the quadrate-carrying squamosal).

Appendix A.—Comments by R. Broom

While uniformity in the nomenclature of the cranial elements is desirable, it is quite impossible that it can come about till the homologies of the elements found in the different vertebrate types has been completely established, which will not be for many years.

In the meantime what I think ought rather to be aimed at is the use of

terms which will give rise to no confusion and the gradual elimination of synonyms as homologies become unquestionably established.

While priority in naming an element should have considerable weight in the choice of the term finally agreed on, it is not advisable that it should be at all strictly adhered to, as in many cases it would result in needless confusion.

The suggestion made by Moodie that the B. N. A. terminology be adopted is, in my opinion, an unwise one. The bones of the human skull are in many cases complex, and to use the name which has been applied to a complex for a part of the complex in a lower form will give rise to hopeless confusion. For example, "maxilla" is the approved B. N. A. term for a bone which in the human subject bears incisors, canines, premolars, and molars. It is doubtless homologous with the premaxilla and maxilla of the lower forms, but not strictly homologous with either one, and if Moodie's suggestion were agreed to it would at once be necessary to rename the maxilla in the lower forms the "postmaxilla." Or, if the name maxilla is to be retained for only one part of the complex in the lower forms, why should not the name os temporale be applied to the squamosal in lower forms, or os sphenoidale to the basisphenoid, or os occipitale to the basioccipital?

The human anatomists have in the last two hundred years done singularly little toward the determination of the homologies of the cranial elements. Almost all the work has been done by the comparative anatomists and paleontologists. Some early human anatomist discovered the little bone in the ear called the incus, but it was the comparative anatomist that showed that it was homologous with the large "quadrate" bone which supports the jaw in most lower forms. And if the preservation of a name is to be in any way a complement to careful work, the comparative anatomist has at least a claim. In any case, I feel confident that the name "incus" will never be applied to the birds' quadrate. It would be much wiser if one term only is to be used to call the human incus the quadrate.

With regard to the majority of names approved by the majority of the committee I am in agreement. There are one or two concerning which I should like to make a note.

Dermo-supraoccipital.—This term of Miall's is approved by Williston, Case, Gregory, Moodie. Watson and I have used a term proposed by me in 1903—"postparietal." As, however, there is now no doubt that the element is the homologue of the mammalian "interparietal," there is no need for a new term at all. The interparietal has long been known in mammals and we can trace every step of it back to the Stegocephalian. Sometimes it is paired; sometimes single.

Ectopterygoid.—I have no objections at all to this term, though I have generally used the term "transpalatine."

Epipterygoid and *Alisphenoid.*[1]—I regard the reptilian epipterygoid as homologous with the mammalian alisphenoid, and if this is ultimately conclusively proven the name alisphenoid might quite well be applied to the reptilian element. In the Crocodilia, Aves, Dinosauria, and Ophidia there is an element which has usually been referred to as "alisphenoid," but which is probably not homologous with the mammalian "alisphenoid." This element is also met with in some Therapsida. Believing that it is not the Alisphenoid, I have [Croonian lecture, 1913 (1914)] named it otosphenoid.

Epiotic.—Concerning this bone I can say nothing. It certainly does not occur in the Therapsida nor in any group I am familiar with at first hand.

Interfrontal.—This name, first proposed by Watson, must, I think, be continued at present. It is not any part of the ethmoid, as I convinced myself by sections of the skull of *Eryops.* It is a pure membrane bone. The only doubt that arises is whether it may be homologous with the preparietal found in so many Therapsids. Not improbably the two elements are distinct.

Lacrimal and *Prefrontal.*—There is, I think, no question that the lower element is the mammalian lacrimal. It can be traced right back through the Therapsida to the Stegocephs.

Opisthotic or *Paroccipital.*—Till recently I used the former, as it seemed the term most generally used; but a couple of years ago I adopted the latter, as it seemed to have the better claim.

Preangular or *Postsplenial.*[2]—These two names are synonyms for the element which lies behind the first lower element in the Stegocephalian jaw. During August, 1913, I was working at the jaw of *Eryops* and *Trimerorhachis* in the American Museum and discovered a new element. On September 9 I posted to the Anatom. Anz. a paper describing the jaw and naming the element "preangular." During August, Professor Williston independently discovered the same element and had photographs taken of drawings, in which he named it "postsplenial." When my paper was posted, I had not seen Williston's photographs, nor was I aware that he was working at the Stegocephalian jaw. I first knew of Williston's discovery on the 24th or 25th of September, two weeks after my paper had been posted. That both Williston's drawing and mine were made quite independently will be manifest from the fact that each has some

[1] Compare Watson's views below, p. 980.—EDITOR.
[2] Compare Williston's remarks below, p. 986.—EDITOR.

correct characters which the other omits. By the distribution of his photographs to various workers, certainly before the end of September, Williston's name of postplenial had at least some degree of publication a month before my paper appeared.

Prearticular.—This term of Williston's has undoubted priority over goniale, and I fail to see any objection to it.

Prevomer.—This name was proposed by me for the "dumbbell-shaped bone" in *Ornithorhynchus* in 1895. This bone is certainly no part of the premaxilla in front or the vomer behind. It may be a neomorph or it may be, as I believe, the homologue of the paired "vomers" of the lower forms. It is unnecessary here to enter into the discussion. The matter may be regarded as still *sub judice*. The Cynodonts, which I thought would settle the question, are already too mammal-like. We must look to a slightly more primitive form for a settlement. In any case the mammalian prevomer is a distinct cranial element.

Splenial.[3]—The structure of the mandible in the Plesiosaur shows, I think, pretty conclusively that the anterior-inferior element, which forms part of the symphysis, is the homologue on the one hand of the anterior element in the Stegocephalian and Therapsid jaw and also of the splenial of the Crocodilian jaw.

Supratemporal, Suprasquamosal, Supramastoid.—I am quite willing to adopt any term agreed on by the majority. Suprasquamosal is not a new term of mine, having been used by Owen at least as early as 1859—certainly before supramastoid of Cope.

It is very desirable that some one should undertake a careful study of the ossification of the cranial elements in the human skull by modern methods. There is very much that yet remains unknown or obscure. For example, what are the sphenoidal conchæ (bones of Bertin)? In *Chrysochloris* I have discovered a pair of membrane bones probably homologous with these situated below the back part of the nasal capsules. Are they neomorphs? Again, in the most up-to-date text-book of human anatomy I have at hand, the petrosal is stated to be formed from four centers of ossification: 1, the opisthotic; 2, the proötic; 3, the pterotic, and 4, the epiotic, "often double." A little careful research would easily settle the homologies of these structures, and until it is done I fear some confusion will remain in the terminology of this region. If once we had a full knowledge of the human condition it will not be difficult to work down the vertebrate series.

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[3] Compare Williston's remarks below, p. 986.—EDITOR.

Appendix B.—Comments by D. M. S. Watson

Nomenclature of skull elements of Permian tetrapods

Principles.—Whenever possible, a bone is to bear the name which it has in the human skull under the B. N. A. list.

When a bone is not represented in the human skull, it is to be found in the crocodile and there named either after Cuvier or Owen, one or other of whose names will be in common use. When there is any doubt about the identification of a reptilian bone, it should not be called by a mammalian name. The most ineradicable errors are those which depend on the mixing of characters of two animals under one name, and to call the bone in the side of the brain-case of a crocodile alisphenoid deludes the unsophisticated student into believing that it is certainly homologous with the mammalian bone of that name. The use of a new term can *mislead* nobody. In other words, I object to Professor Williston's remark: "(I) am therefore disposed to retain the name alisphenoid until such time as it is certainly shown to be something else." Much prefer to substitute: "I refuse to call it alisphenoid until it is definitely shown to be homologous with the mammalian bone of that name."

Ethmoid.—Three bones are known which include ethmoid as part of their title:

1. The Mesethmoid.—This is a cartilage bone replacing the cartilaginous nasal septum in Mammalia.

2. The Ethmoturbinate.—A cartilage bone replacing the cartilaginous scrolls developed from the middle of the paries nasi in mammals.

3. The Sphenethmoid (W. K. Parker).—A cartilaginous ossification in the front half of the orbitotemporal region and the posterior parts of the planum antorbitale, septum, tectum, and solum nasi—only in frogs and toads. The "ethmoid" of Cæcilia is a general ossification of the whole anterior part of the cartilaginous skull, with many extensions into membrane.

From this it will appear that any bone which is to be called ethmoid (either plain or modified) must be a *cartilage* bone in the anterior part of the skull.

The Interfrontal and Internasal, terms of my invention, are dermal elements occurring not only in Stegocephalia, but in *Osteolepis* and *Dipterus*. Any section across the top of the head of *Eryops* will show that the interfrontal is quite distinct from the sphenethmoid, which lies below it.

The Internasal is equally a skin bone. They are to be distinguished from the similar-looking bones on the top of the head of some frogs and

Apoda, which I believe are real exposures of the sphenethmoid in the one and of the "ethmoid" in the other case.

Orbitosphenoid and *Alisphenoid.*—The orbitosphenoid of a mammal is a cartilage ossification in the ala orbitalis; the pair of ossifications either spread down into the lamina infra-cribrosa and through the basal plate of the orbitotemporal region or there is an independent center of ossification for the presphenoid in this region. In Monotremes the ala orbitalis lies entirely in advance of the optic nerves. In some types—for example, *Sus* and *Perameles*—the basal plate of the orbitotemporal region and the presphenoidal area is largely formed by the posterior end of the septum nasi. When this is the case, it is apparently obvious that the ala orbitalis is homologous with Gaupp's planum supraseptale of the lizard skull, which is connected with the tectum synoticum by the tænia marginalis, just as the ala orbitalis is by the commissura orbitoparietalis.

Professor Williston's lizard bone[4] was correctly described by Cuvier, who says that it is the only representation in lizards of the orbito- and alisphenoids of mammals. I do not yet know exactly how and when it ossifies, but it does seem to be a cartilage bone, perhaps ossifying in the bar separating the fenestræ metoptica and optica. If so, although analogous, it will not be homologous with the orbitosphenoid. As a matter of fact, there are usually three other calcifications in this region of the lizard skull—one in the septum, extending up to the brain-case, the others in the wall of the brain-case—but these are not apparently real bones. There is no evidence extant as to the mode of ossification of the "alisphenoid" of the crocodile, but I fancy from its relations it is probably homologous with Williston's lizard bone.

Bland Sutton many years ago showed that the cranial cavity of a mammal is not homologous with that of a lizard, because in the first case the Gasserian ganglion is inside the skull and in the other it lies outside, between the skull wall and the epipterygoid. Gaupp rediscovered this and called the space in which the ganglion lies in mammals the cavum epiptericum. In Monotremes there is a strong membrane separating this cavity from that for the brain—the tænia clinoorbitalis—and a cartilaginous nodule lying in front of the proötic notch, which I found in *Platypus,* lies in this membrane. It therefore follows that this membrane and its included cartilaginous elements is the original wall of the reptilian cranial cavity, with which it agrees in all relations, including the general distribution of nerve exits.

Hence the mammalian alisphenoid can not be homologous with any

[4] Am. Jour. Anat., vol. x, p. 79.

ossification in the cranial wall of a reptile. In *Crocodilus* the Gasserian ganglion lies outside the cranial cavity in a small chamber, widely open back and front and included by the pterygoid and "alisphenoid." In Belodonts this cavity is exactly similar, but its outer wall is formed entirely by an epipterygoid.

Whether, as Oken (1811?), Parker, Baur (at one time), Broom, and Fuchs believe, the epipterygoid is homologous with the alisphenoid is much more doubtful. In my Monotreme skull paper, to be published very soon [Phil. Trans. Roy. Soc. London, ser. B, vol. 207, 1916, pp. 311-374, 3 pls.], I have gone into the question very fully, and concluded that the obvious reading adopted by these authorities is wrong in part.

The mammalian alisphenoid is an ossification of the ala temporalis, which spreads into the membranous cranial wall, which is not homologous with the cranial wall of lizards, but lies outside it. Gaupp has shown that part, at any rate, of the ala temporalis (great wing of the sphenoid of human anatomy) is homologous with the processus basipterygoideus of reptiles, amphibia, and fish. Broom shows that its outer end is homologous with the pars palatina of the palato-quadrate cartilage. Hence, from other reasoning to that above, the Crocodile "alisphenoid" can not be homologous with the true alisphenoid of a mammal.

Hence I accept v. Huene's name laterosphenoid for the "alisphenoid" of the Crocodile and all bones shown to be homologous with it.[5]

The skull of the living Amphibia differs from that of Reptiles in being extremely platybasic—that is, in having no interorbital septum—the lengthy brain-case extending forward to the nasal region and filling the whole space between the parasphenoid and the roof of the skull.

This condition in Amphibia is plainly secondary, depending on the dorso-ventral flattening of the head, which is a characteristic amphibian advance.

In the Carboniferous *Pteroplax* there is a large interorbital septum, which supports the anterior end of the brain-case, just as does the largely membranous interorbital septum of the lizards and teleosts. The gradual flattening of the skull in large Amphibia (even in, say, *Eryops* and *Capitosaurus*), together with some enlargement of the brain cavity, leads to the gradual loss of the interorbital septum, the whole brain-case being floored by the parasphenoid.

Hence the characteristic "os en ceinture" form of the frog's spheneth-moid depends on the actual shape of the skull, which is purely secondary, and in types with a distinct interorbital septum we should expect the

[5] Compare Williston's remarks below, p. 985.—EDITOR.

sphenethmoid, which is a rather general ossification of the cartilages of the front of the brain-case and the back of the nasal capsule, to include a large ossification in the septum.

This is my justification for styling the bone surrounding this anterior end of the brain in *Pariasaurus*, sphenethmoid.

The pair of small cartilage ossifications in the anterior part of the brain-case of Urodeles, commonly called orbitosphenoids, obviously correspond with the hinder part of the frog's sphenethmoid, and broadly with the alisphenoids of the crocodile and Professor Williston's lizard bone. It is impossible to be certain of a strict homology with either, on account of the very complete chondrification of the anterior part of the brain-case in Amphibia and the lack of knowledge of the site and mode of ossification of the reptilian bones. For similar reasons there can be no certainty in their identification with the true mammalian orbitosphenoids, although the two bones are homologous in a general sense.

Difficulty arises in the name to be applied to the ethmoid of the Dicynodonts. This bone is very similar in its relations to the sphenethmoid of *Pariasaurus*, and had perhaps best bear that name, but its lower septal part, which forms a great deal of it, is homologous with the "ethmoid" of *Diademodon*, itself homologous with the mesethmoid of a mammal.

Perhaps the best way is to use ethmoid as a general term for any cartilage ossification in the posterior part of the nasal and anterior cranial regions; to restrict sphenethmoid to bones which have ossified partly in the nasal capsule and partly in the brain-case; and to use mesethmoid for all ossifications of the nasal septum alone. A new term is then needed for the "orbitosphenoids" of Urodeles.

The *Preparietal* (E. T. Newton) of Dicynodonts and Gorgonopsids is a membrane bone distinct from the sphenethmoid, and must be recognized as a *nomen conservandum*.

Petrosal.—The name Petrosal comes from the "petrous portion of the temporal" of human anatomy, and really means that bone, less the tympanic and squamosal; it is, in fact, identical with the periotic.

If I understand rightly, Professor Williston wishes to use this as equivalent to Proötic in reptiles.[6] This usage seems to me undesirable for the following reasons:

The labyrinth of reptiles is included by three bones on each side: the paroccipital, which surrounds the posterior parts of the posterior vertical and horizontal semicircular canals and the posterior parts of the vestibule, sacculus, and lagena; the supraoccipital, which surrounds the upper parts

[6] See Professor Williston's later comments below, p. 985.—EDITOR.

of the anterior and posterior semicircular canals, and the proötic, which includes the anterior parts of the anterior vertical and horizontal semicircular canals and vestibule, sacculus, and lagena.

The mammalian petrosal surrounds the whole labyrinth.

In *Platypus* there are two ossifications known agreeing in all features with the proötic and paroccipital, and the supraoccipital does not include any part of the labyrinth. The Monotreme petrosal is plainly homologous with that of man, which hence includes the reptilian proötic and other things. The name petrosal can not, in consequence, be used for any reptilian bone.

Epiotic.—The Epiotic is said to be an element surrounding the upper parts of the vertical semicircular canals. W. K. Parker claimed to have seen it in *Crocodilus* and the chick. In the chick, Doctor Ridewood (B. M. N. H.), who spent some weeks looking for it, assures me it does not occur. I have never met anybody who could say that he had seen one. I am thus doubtful of its actual existence. On the other hand, it is not improbable that there really is an epiotic in *Pteroplax,* and I find that the supraoccipital of *Sphenodon* begins as a paired double perichondral ossification, so that it might be regarded as a fused pair of epiotics and not a supraoccipital formed in the tectum synoticum.

Septomaxilla.—This bone is a membrane ossification on the dorsal surface of the paraseptal (Jacobson's) cartilage; it hence has nothing to do with the Ethmoid, from which it is separate, even in *Siphonops,* where the "Ethmoid" is most extensively ossified.

Postsplenial.[7]—The problem is, which of the two anterior infradentaries of the Amphibia (Stegoceph) jaw becomes the splenial of reptiles. The term infradentary has always been applied to all the elements of the angular-splenial row in Osteolepids, and it seems undesirable to now restrict it to any individual member of that row. Professor Williston's reasons for homologizing the "postsplenial" of Stegocephs with the splenial of reptiles is that in advance of that bone there is a small foramen (the anterior mandibular), which seems to agree with the foramen in the symphysis in advance of the splenial in reptiles. This argument is good, but Professor Williston has overlooked the fact that a precisely similar foramen in the symphysis in advance of this anterior element does occur in Amphibia, I believe in all Stegocephalia.

Hence there is just as much evidence in favor of the homology of the anterior bone in Stegocephs as the posterior, and I prefer to retain Splenial and Postsplenial.

[7] See Williston's remarks below, p. 986.

Palate, Prevomer, Vomer, and Parasphenoid.—Vomer is by definition—that is, occurrence in man—an unpaired membrane bone lying below the basis cranii and stretching from the region of the pituitary to the region of Jacobson's cartilages. In man it arises as a pair of small elements below the nasal septum, with which a lot of other ossifications coalesce; in most mammals—for example, *Platypus, Perameles, Dasyurus, Talpa*—it arises by a single center under the posterior part of the nasal septum.

The lizard vomer and those of Crocodiles, *Sphenodon,* Frogs, Urodeles, and Cæcilia, arise as a pair of membrane bones surrounding the lower and mesial surfaces of the paraseptal cartilages, or what appear to be their homologues in the Amphibia. The single vomer of Chelonia arises from a pair of splints associated in the normal reptilian way with the paraseptals; it is hence different in origin to the vomer of mammals.

The parasphenoid of *Sphenodon, Crocodilus,* Urodeles, and Frogs is a membrane element arising in the ventral surface of the basis cranii in the hypophysial region, and running forward from here sometimes as far as the nasal region. In lizards this median splint fuses with a pair of small membrane ossifications lying below the basipterygoid processes and forming with them the Vidian foramina.

It will be seen that the mode of origin of the mammalian vomer is much more like that of the reptilian parasphenoid than that of the reptilian vomer.

Every one must admit that the classical view of the homologies of these bones is open to grave doubts. Their discussion takes a large part of recent paleontological and embryological literature, and to retain all three terms can not possibly lead to any confusion and reminds every one that the problem is still open.

The vomers of tortoises and birds are, of course, prevomers.

Supratemporal and Intertemporal.—With regard to the terms Supratemporal and Intertemporal I am quite willing to accept these on the score of current usage.

Dermosupraoccipital is a mouthful. Is it quite certain that Miall's bones in the Crocodile are really the right thing, and not perhaps scutes fused in?[8] I have never been able to see them, and can not at the moment get at his description. In any case, could we not shorten it to Dermoccipital, which is long enough?

However, if the rest of the committee are satisfied as to the identity of the bones I will gladly accept it, particularly as Miall's book on the Crocodile is an excellent one.

[8] See Professor Williston's remarks below, p. 985.

Lower Jaw.—For the lower jaw I prefer Owen's terms for the bones: Dentary, Angular, Surangular, Coronoid, Splenial, with Prearticular, Postsplenial of Williston, and Pre- and Inter-coronoid.

Appendix C.—Comments by S. W. Williston

B. N. A.—I agree with Broom that a too close adherence to the B. N. A. will tend to retard the advance of comparative anatomy. I do urge, however, that wherever practicable the system should be followed, in order that we may have greater uniformity.

"Alisphenoid."—I have given no especial attention to the homology of the mammalian sphenoid bone in the reptiles. Inasmuch as those who have are more or less convinced that the so-called alisphenoid of the reptiles is not homologous with the "greater wing of the sphenoid," I am willing to adopt provisionally another name for the element. But why select "laterosphenoid" or "otosphenoid," when Cope long ago proposed the name "postoptic" for it?

Interparietal.—I can not accept the term interparietal,[9] because the term is misleading and false when applied to the early tetrapods. In all such forms known to me, the bone is not only paired, but *never* interparietal in position. To use a descriptive term that conveys an error is objectionable, as was justly urged against Jaekel's postnasal for adlacrimal.

Proötic.—The name proötic is in wide use (I have used it myself for years), and nothing will be lost by retaining it. I therefore reverse my vote.

Opisthotic.—I can not say the same for opisthotic. Since we must, I am sure, abandon epiotic for any reptilian or amphibian element, I can see no reason why Owen's original term, paroccipital, should be given up.

Prevomer.—I shall use the term prevomer for the paired and unpaired bones back of the premaxillæ in the Reptilia and Amphibia. I think, however, that their homologies are not yet satisfactorily solved.

Dermosupraoccipitals.—I have examined the dermosupraoccipitals in *Gavialis* and see no reason to doubt their cranial nature.[9]

Interorbital septum.—I can not accept Mr. Watson's statement that the absence of an interorbital septum in the modern Amphibia is secondary. "The lengthy brain-case extending forward to the nasal region and filling the whole space between the parasphenoid and the roof of the

[9] Professor Williston has lately adopted "interparietals" instead of dermosupraoccipitals.—Editor.

skull" is the condition in the early reptiles and temnospondyl amphibians of the Permocarboniferous of America.

"Epiotic."—I am glad to see that both Watson and Broom are skeptical about the epiotic of Huxley. I have long agreed with Baur[10] that there is no such bone in the reptilian skull.

"Anterior Splenial."—I am growing still more skeptical about the identity of the anterior splenial of the amphibians and *Pantylus* with the true splenial of crocodiles, but will so call it until there is more evidence. Is not Mr. Watson just a bit inconsistent in the face of his statement that "when there is doubt about the identification of a reptilian bone it should not be called by a mammalian name?" Unfortunately, the term presplenial has a sort of preoccupation, or I would suggest that the two bones in the amphibian mandible be called presplenial and postsplenial.

[10] Journal of Morphology and Zoology. Anzeiger, 1889.

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