ON *BAURIA CYNOPS* BROOM

By A. S. Brink

Abstract

Descriptions of this genus and species, the type of an infraorder, have thus far been based on three individuals. The type in the South African Museum, Cape Town is a complete skull, but somewhat unsatisfactorily preserved and cleaned. The second specimen in the American Museum of Natural History, New York, is a good skull with a portion of the skeleton, but the skull has been damaged in the course of preparation. The third specimen is in the Bernard Price Institute. It is an exceptionally fine specimen, but was only superficially cleaned when described. This specimen also includes a portion of the skeleton. Two additional complete skulls, one somewhat crushed, have since been added to the Bernard Price Institute's collection. This paper describes *Bauria cynops* Broom on information derived from all five specimens. Illustrations are based on the three specimens in this Institute. Attention is also given to the position of this infraorder relative to other related groups.

Introduction

Bauria cynops Broom is a classic Karroo therapsid, the type of the important infraorder Bauriamorpha. The name was introduced by Broom in 1909 and for half a century the infraorder enjoyed a great deal of attention, despite the fact that the type genus is still rather inadequately known. There would appear to be little excuse for this peculiar situation when it is considered that past descriptions have been based on three different specimens which could pass as complete or relatively complete skulls, two with partial skeletons. To these three individuals a fourth and a fifth skull are now added.

The type specimen, described by Broom in 1909, is in the South African Museum, Cape Town, and is a reasonably complete skull, but according to the first description somewhat poorly preserved, and apparently equally poorly prepared. The description of this specimen bears a strong relationship to its physical condition.

In 1911 Broom added further notes to his type description which he thought had been adequate and "at considerable length." The specimen had apparently been further developed and could reveal "one or two points not previously noted". An improved lateral view was figured, as well as a good dorsal view. The lateral view appeared again in publication in 1913 and 1915.

A second good specimen, a complete skull with a portion of the skeleton, found its way in 1913 to the American Museum of Natural History in New York where, according to Boonstra (1938), Broom apparently endeavoured to clean it one morning and describe it the same afternoon. As a result the specimen suffered appreciable mutilation and the description (1914) was based largely on two cross sections obtained with the assistance of a hammer and an emery wheel while the bulk of the specimen was still encased in matrix.

Boonstra's (op. cit.) account of previous descriptions does not show clearly which of the two specimens were featured. Where he refers to Broom's papers of 1911, 1913 and 1915, in which the type is further dealt with, it could be interpreted as references to descriptions of the second specimen.

In 1936 Boonstra visited the United States and with careful preparation salvaged as much as he could of the New York specimen, but he could do little about portions that had been turned into dust on the emery wheel. He prepared an account as detailed as the condition of the specimen permitted, but by submitting his manuscript, on his return, from South Africa to Germany for publication, some time elapsed before his results appeared in print in 1938. In the meantime Broom had passed through New York and issued a new description of the same specimen after it had been cleaned by Boonstra and his description was published first, in 1937.

While Broom's descriptions can be looked upon as important contributions to our knowledge of this interesting form, Boonstra's (op. cit.) description still remains the only comprehensive treatment of the genus.

An additional good specimen was added to the list in October 1952. It was discovered by J. W. Kitching in the Matyantya basin and is housed in the Bernard Price Institute under the field number 1180 and museum number 317. It was described by Brink and Kitching in 1953, when mention was also made of a good isolated dentary which was found four miles away. In this description the locality is adequately dealt with and it was pointed out that the three specimens known to date came from exactly the same level in the *Cynognathus*-zone, suggesting that *Bauria* could be an accurate zone fossil.

This third specimen, which includes a portion of the skeleton, has a very complete skull, only slightly distorted but otherwise well preserved, but it was not extensively cleaned when described. In its superficially cleaned state it could not serve as the subject for a comprehensive description, but it did reveal some significant information which supplemented some of Boonstra's interpretations. It was borne in mind that Boonstra's description was based on a specimen which had previously been damaged and that the new specimen was only superficially cleaned.

Subsequently Crompton borrowed this specimen and cleaned it rather excellently, in places in elaborate detail, but he only used some of the newly revealed information for comparison and reference in a paper dealing with *Ictidosuchops* (1955).

Until recently, therefore, *Bauria* had not been completely studied. Specimens which can readily pass for good, or even excellent, by comparison with most Karroo material, had been mutilated physically and, as a result, not much less so in descriptions. The information now available in publication would appear to be, in some respects, quite confusing.

In April 1955 Mr. J. W. Kitching discovered a fourth specimen in the same horizon which yielded the other three, on the farm Grootdam, otherwise known as Berseba, some 10 miles due west of Burghersdorp. This is also a rather complete skull, but badly crushed over the dorsal surface of the snout. It was given the museum number 230 (field number 1679) and was left unprepared until very recently.

In March 1962 Mr. Kitching made a rather interesting discovery on the farm Cragievar, about 5 miles due south of Burghersdorp. Here the upper surface of the hard coarse grey horizon which had yielded all other *Bauria* specimens is exposed and it forms the surface of a small plateau. In an area about two yards square he found 12 specimens in completely enclosed nodules protruding through and above the exposed upper surface of this locally intact stratum. One of these specimens turned out, on preparation, to be a good *Bauria* skull, the fifth on record. Most of the other associated specimens are immature *Diademodon* skulls of various sizes and ages.

The latest specimen is used as a basis for both the present description and the figures, but information is freely derived from the other two specimens at hand, as well as from previous descriptions. Most of the detailed information is obtained from the third specimen which is the best preserved and which had been cleaned so excellently by Crompton.

Bauria cynops Broom 1909

(Figs. 6—9)

1909, Broom, R., *Ann. S. Afr. Mus.*, vi, p. 272, fig. 1 (Type)
1911, Broom R., *Proc. zool. Soc. Lond.*, pl. 895, figs. 168, 169; p. xlvi, 6-8 (Type).
1913, Broom, R., *Amer. Mus. J.*, xiii, p. 346 (Type).
1914, Broom, R., *Phil. Trans.*, B.206, p. 43, pls. iv, 44; vi, 68 (2nd specimen).
1915, Broom, R., *Bull. Amer. Mus. nat. Hist.*, xxv, pt. ii, p. 155 (Type).
1932, Broom, R., *Mammal-like Reptiles*, p. 98, fig. 32A-C (Type).
1937, Broom, R., *Amer. Mus. Novit.*, No. 946, figs. 1-3 (2nd specimen).
1938, Boonstra, L.D., *Palaeobiologia*, vi, p. 164, figs. 1-8 (2nd specimen).
1941, Schaeffer, B., *Amer. Mus. Novit.*, No. 1103, figs. 1-4 (2nd specimen).
1948, Gregory, W. K., Broom Com. Vol. *Roy. Soc. S. Afr.*, p. 24, fig. 6 (2nd specimen).
1953, Brink, A. S. and Kitching, J. W., *Palaeont. Afric.*, i, p. 34, fig 32-35 (3rd specimen).
1955, Crompton, A. W., *Res. Nas. Mus.*, i, p. 176, fig. 10 (3rd specimen).

Type. Fair skull in the South African Museum, Cape Town (Cat. No. 1333) from a middle *Cynognathus* zone horizon on the farm Vaalbank, near Burghersdorp.

2nd *Specimen.* Skull and portion of the skeleton (No. 5622) in the American Museum of Natural History, New York, from the same horizon on the farm Winnaarsbaken in the Burghersdorp district.

3rd *Specimen.* Excellent skull and portion of skeleton in the Bernard Price Institute (F1180/M317) from the same horizon in the Matyantya basin near Lady Frere.

4th *Specimen.* Somewhat crushed skull in the Bernard Price Institute (F1679/-M230) from the same horizon on the farm Grootdam, 10 miles west of Burghersdorp.

5th *Specimen;* Good skull in the Bernard Price Institute (F3770/M358) from the same horizon on the farm Cragievar about 5 miles south of Burghersdorp.

6th *Specimen.* An isolated dentary (F2523/M321) found four miles away from the third specimen, at the same level, in McKays neck on the road to Lady Frere.

Throughout this paper specimens are referred to in accordance with the above list.

TABLE OF MEASUREMENTS

	Type Specimen	*2nd Specimen*	*3rd Specimen*	*4th Specimen*	*5th Specimen*
Maximum length of skull	127	140	115	124	118
Maximum breadth of skull	77	89	77	78	82
From premaxillaries to occipital condyle ..	120	132	115	115	114
To back of interpterygoid boss		84	70	68	73
To posterior border of secondary palate ..		52	43	39	40
To interparietal notch..	115	122	106	112	109
To level of lateral tips of postorbitals.. ..	89	91	77		85
To level of anterior borders of orbits.. ..	59	62	51	50	53
Breadth of snout across canines	29	31	28	30	27
Interorbital width	27	29	19	28	26
Distance between lateral tips of postorbitals	53	57	45		46
Minimum breadth across parietal roof	11	10	8		10
Breadth across pterygoid processes		50	45	51	46
Breadth across paroccipital processes.. ..		56	50	54	58

All measurements are in millimeters.

All measurements in the case of the 4th specimen are approximate.

Structure of the Skull

From the accompanying table of measurements it can be seen that the five skulls agree very well in general proportions. Conspicuous deviations are the narrower interorbital width in the 3rd specimen, and the squamosals in this specimen not reaching farther back than the level of the occipital condyle. The latter three specimens have more prominent "cheek" bulges and the parietal roof is narrowest at a level farther back than in the type and 2nd specimen.

The *basioccipital* contributes in the typical therocephalian-scaloposaurid manner to the occipital condyle. The contribution is smaller than in *Ictidosuchops* (Crompton, 1955) and the bone does not reach as far back; there is a slight suggestion of a double condyle. In *Ictidosuchops* the basioccipital contribution is as large as those of the exoccipitals put together, but in *Bauria* the three elements are of equal size. The whole condyle has more distinctly a trilobed appearance, as in the scaloposaurids, with the three sections sharply demarcated, contrary to the procynosuchid-cynodont condition where a smooth crescent is normally formed.

The shape of the rest of the basioccipital as displayed in ventral view does not differ greatly from that of other related forms. It is more square in outline than in *Ictidosuchops* where it fans out forward underneath the fenestrae ovales. In *Bauria* the opisthotic contribution to the fenestra ovalis is visible in ventral view. In cynodonts the basioccipital is more constricted at the middle of its length and the bone is generally longer, while in therocephalians and ictidosuchoids it is shorter and triangular. In the latter group, as in *Bauria*, the ventral surface of the basioccipital is not as deeply excavated as in therocephalians, procynosuchids and cynognathids.

The *exoccipitals* extend across the basioccipital condyle on the floor of the foramen magnum to within a millimeter's reach of each other. Their condyles are each as large as that of the basioccipital and reach slightly farther back. They extend outward along the posterior faces of the paroccipital processes to a level beyond the lateral borders of the jugular foramina, but there would appear to be individual variation in this respect, as well as in the extent to which they reach dorsally around the foramen magnum. This individual variation is also noticeable in *Ictidosuchops* and it is, therefore, inadvisable to contrast the bauriamorphs with the ictidosuchoids on characteristics in this fundamental part of the skull.

Boonstra (1938) records the presence of bosses on the exoccipitals, dorsally and laterally. These, no doubt, mark the areas of contact or articulation of the proatlas. Broom (1937) does not refer to these or indicate them in his figure. They are also not apparent in the specimens at hand. In the 3rd specimen the surface of the bone in these areas is intact and the absence of bosses seems to be natural, but in the 5th specimen the areas had been damaged artificially. The presence or absence of these bosses may depend on age, or it could also be a phenomenon of individual variation.

The *supraoccipital* is interpreted differently by Broom (op. cit.) and Boonstra (op. cit.), and Crompton's (op. cit.) interpretation of this bone is also different in two *Ictidosuchops* specimens. The new *Bauria* specimens do not assist greatly in clarifying the matter; preservation is somewhat unsatisfactory. This bone is

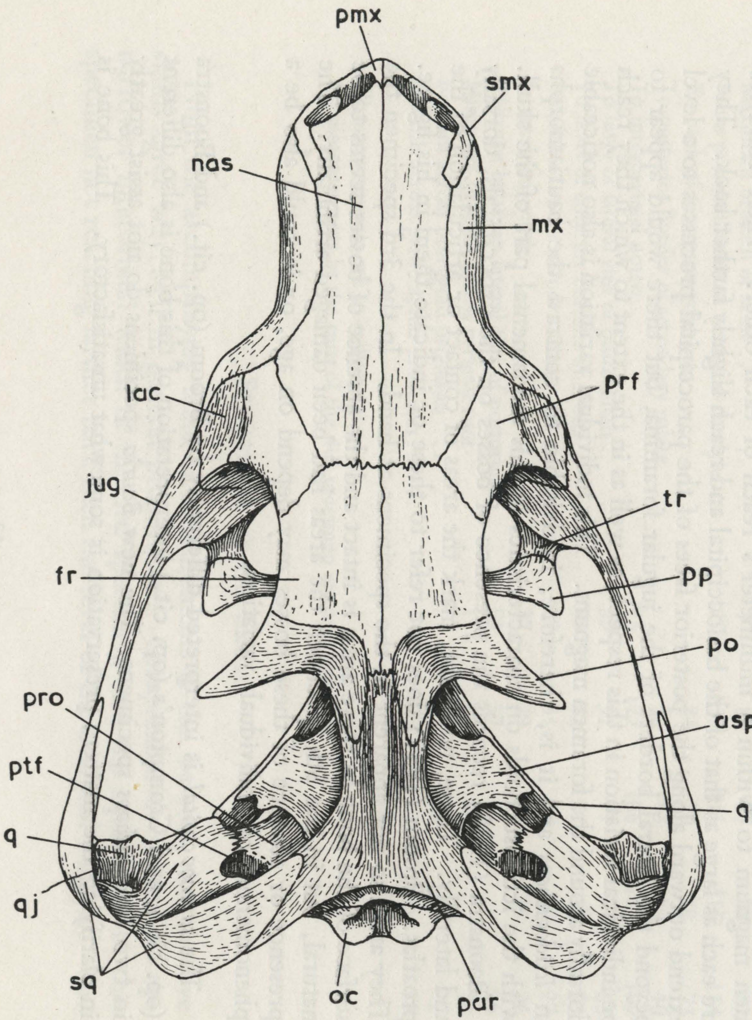

Fig. 6—Dorsal view of the skull of *Bauria cynops* Broom, x-l. For abbreviations see end of article.

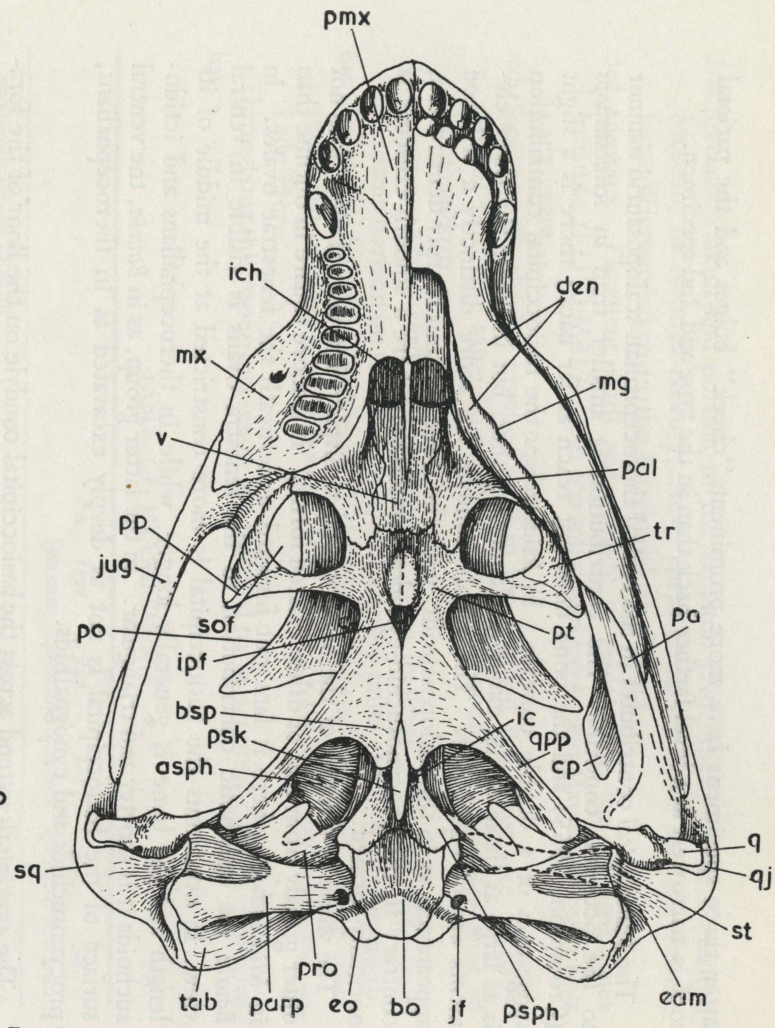

Fig. 7—Ventral view of the skull of *Bauria cynops* Broom, xl. For abbreviations see end of article.

figured (fig. 9) as near as possible to the average condition conveyed by specimens 3 and 5. This interpretation agrees with that of Boonstra in so far as contribution to the margins of the post-temporal fossae is concerned, contrary to Broom's interpretation. In this bone too there appears to be considerable individual variation and outline shape seems to depend on the degree of overlap of the dermal occipital bones, the interparietal and tabulars, which could vary with age,

The *opisthotics* also seem to be somewhat variable, but they have in addition been differently interpreted. In general shape and proportions the 5th specimen agrees with the 2nd, but in the 3rd, as described by Crompton (op. cit.), the opisthotics are conspicuously different. While the 5th specimen is only slightly larger than the 3rd (see table of measurements) the distance between the lateral extremities of the paroccipital processes is 58 mm. compared with 46 mm. (as preserved) in the 3rd specimen. The greatest distance is also across the mastoid processes, while in the 3rd specimen it is across the quadrate processes. The greatest anteroposterior measurement across the lateral expanded ends of the paroccipital processes is 15 mm., exactly as in the 2nd specimen, but in the 3rd specimen it measures only 10 mm. In the 3rd specimen the ventral surfaces of these processes are not concave; in fact, as preserved, these surfaces are more definitely convex, both transversely and longitudinally. In the 5th specimen the ventral surfaces are very deeply excavated and these excavated areas, forming the roofs of the middle ears, are very well demarcated. The condition seems to be the same in the 2nd specimen but, judging from both Broom's and Boonstra's figures, the excavations seem to cover the whole ventral surface areas, while in the 5th specimen these areas are more localised and restricted to the broader lateral halves.

It is quite clear that the lateral extremities of the paroccipital processes in the 3rd specimen are badly damaged.

The *prootics* are unsatisfactorily preserved in the latest specimen. Only the basal portion is present. It is in firm articulation with the prootic process of the squamosal laterally, and medially it penetrates underneath the posterior margin of the alisphenoid, but well separated from it. While these are the only portions of the two prootics preserved in the 5th specimen, they are the only portions missing both sides in the 3rd specimen. Here the actual body of the bone lies intimately in front of the fenestra ovalis, resting on the basisphenoid laterally to the sella tursica, and it would appear as if the foramen for the seventh nerve passes through the sutural contact. There had apparently been a distinct anterior dorsal process as in *Ictidosuchops*, but this had been damaged on the exposed left side. Besides this small indefinitely shaped body building the anterior parts of the inner ear, with its anterior process and basal squamosal process, there is also a plate extending upward to form part of the side wall of the brain case at this far posterior level. The whole prootic is virtually contracted underneath the occipital flange of the parietal, the only portion visible in dorsal view being the basal section articulating with the prootic process of the squamosal and the anterior ventral process extending forward underneath the alisphenoid.

The *tabulars* are interpreted in the new specimens as more comparable with those of *Ictidosuchops*. Both Broom and Boonstra had figured these bones as covering large areas, as in cynodonts. Although reduced to a somewhat crescent shape, they are not as small as in *Ictidosuchops*. They extend inward and around the roofs of the post-temporal fossae.

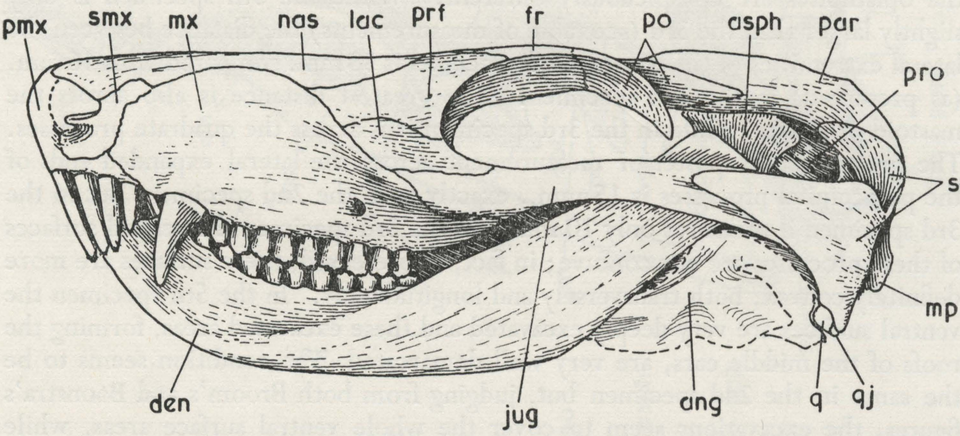

Fig. 8—Lateral view of the skull of *Bauria cynops* Broom, xl. For abbreviations see end of atricle.

The *interparietal* reaches up to the occipital crest as suggested by Boonstra and unlike Broom's interpretation of the same specimen. In *Bauria* this region covered by the interparietal is deeply depressed, in spite of the insignificant occipital crests. In ictidosuchoids this occipital area is, by contrast, very little depressed.

The *parietals* form a parietal crest, in contrast with the slightly broader, more rounded ictidosuchoid condition. The crest is not high, but fairly sharp, and there is hardly a trace of a suture dorsally between the two parietals. The crest starts abruptly a short distance behind the level of the postorbital bars and terminates a short distance in front of the occipital notch. The pineal foramen is quite definitely absent, a feature of considerable significance at this critical level near the threshold of homoiotherm mammals. It is a feature which could add support to the contention that the range thus far represented by the Bauriamorpha should be divided into two separate infraorders, the Ictidosuchoidea and Bauriamorpha. With this subdivision in mind, some reserve should be exercised over the actual relationship of certain later forms which have thus far been associated with *Bauria*.

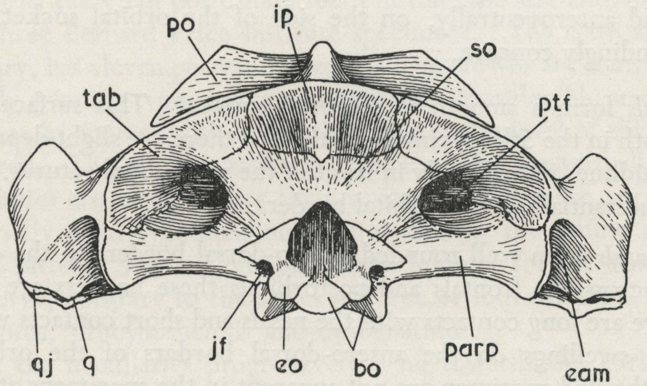

Fig. 9—Posterior view of the skull of *Bauria cynops* Broom, x. For abbreviations see end of article.

The parietals form a very narrow skull roof. In Boonstra's interpretation the narrowest level is farther forward than in the 5th specimen. In the 3rd specimen this level is even farther back, immediately in front of the occipital flanges. In the three specimens at hand, the occipital flanges are very narrow in dorsal view and their surfaces are nearly in the horizontal plane. Boonstra (op. cit.) illustrates these flanges (including the squamosal contributions) as broader than the narrowest transverse measurement across the skull roof. In the three specimens at hand it is narrower.

The *postorbitals* are very characteristic. It would be possible to identify a *Bauria* on one isolated postorbital bone. The posterior extensions flanking the parietals do not extend upward, bordering the crest, as is more typical in cynodonts. Their dorsal margins drop backward, but the ventral margins of these posterior extensions are also above the level of the ventral margins of the parietals (see fig. 8).

In most cynodonts the interorbital surface is bordered on the margins of the temporal fossae by ridges of greater or lesser prominence. The postorbital-frontal sutures normally extend forward of these ridges. In ictidosuchoids these ridges are absent. In *Bauria* there are no ridges, but sharp edges separate the sloping planes of the postorbitals from the horizontal plane of the frontal surface (see fig. 6). The postorbital-frontal sutures extend along these edges with a gentle curve. The edges become smooth before they reach the orbital borders.

The postorbital bars are incomplete. The lateral extensions of the postorbitals reach horizontally outward as freely projecting processes. These processes are more powerful than in the ictidosuchoids and of more characteristic shape. They taper to sharp points; as a whole they are thin blades with a peculiar curve or twist. Medially the blades are nearer the horizontal plane and laterally the tips come nearer the vertical plane. The postero-dorsal surfaces are convex in all directions and anteroventrally, on the side of the orbital socket, the surfaces are correspondingly concave.

The *frontals* form a smooth interorbital surface. This surface is absolutely flat and smooth in the 5th specimen; in the 3rd there are slight depressions either side of the midline, immediately in front of the postorbital sutures. The frontals contribute substantially to the orbital borders.

The *prefrontals* form well rounded antero-dorsal borders to the orbits. More posteriorly across the frontals and postorbitals these borders are exceptionally sharp. There are long contacts with the nasals and short contacts with the maxilaries. The swellings on the antero-dorsal borders of the orbits noted by Boonstra in the 2nd specimen are not apparent in the specimens at hand.

The *lachrymals* are smaller, but they extend farther forward and upward across the preorbital surface than in *Ictidosuchops*. These areas are somewhat concave and clearly visible in dorsal view as they extend across the upper surfaces of the prominent "cheek" projections.

The *nasals* reach far forward and the external nares are hardly visible in dorsal view. In shape they are normal, with the posterior portions well broadened, unlike the condition in *Ictidosuchops*.

The nasal surfaces are also quite level and smooth. In the 3rd specimen there is, however, a very conspicuous depression posteriorly, so different from the condition in other specimens that it could be interpreted as the result of distortion.

The *septomaxillaries* are not as extensively exposed on the snout surface dorsally as in the second specimen. In the specimens at hand they do not penetrate as deeply between the nasals and maxillaries and these extensions terminate quite bluntly. The septomaxillaries spread more widely around the external nares than in cynodonts. Otherwise the structure is typical of carnivorous therapsids.

The *premaxillaries* form the usual internarial bridge but dorsally they do not penetrate deeply between the nasals. This would appear to be a typical scaloposaurid feature and it stands in strong contrast to the cynodont line. Otherwise the premaxillaries are of normal build. Each carries four incisors of approximately equal size, except in the 5th specimen where the fourth tooth either side is conspicuously smaller. *Bauria* is characterised by the fact that the incisors are large; they are, in fact, almost as large as the canines. The four incisors occupy a distance of 16 mm. in the 5th specimen and 15 mm. in the 3rd. The diastema behind the last incisor is 5 mm. in both specimens. The premaxillaries are not exposed on the side of the palate, the lower jaws being in situ in all three specimens at hand.

The *maxillaries* carry ten postcanine teeth in the type and 2nd specimens, and nine in the three Bernard Price Institute specimens. The sixth specimen, the isolated dentary, has eleven postcanine teeth. The crowns are transversely ovate, of the typically grinding type, and normally show a considerable amount of wear. The crowns are in contact with each other, but at the level of their necks they are more spaced. The canines are fairly small and slope forward slightly.

The maxillaries are smooth over their surfaces. There are no glandular depressions dorsally as in cynodonts and the areas over the canine roots are not conspicuously pitted. There is one prominent foramen for the maxillary branch of the fifth nerve, contrary to the series of three or four foramina usually found in ictidosuchoids, procynosuchids and cynognathids.

Posteriorly the maxillaries progressively bend towards the horizontal plane, laterally to the posterior cheek teeth, where they cover the whole ventral surfaces of the prominent "cheek" bulges.

The palates of the three Bernard Price Institute specimens are somewhat obscured by the presence in situ of the lower jaws. Enough is exposed to show that the palatal plates of the maxillaries form the posterior border of the secondary palate. The arrangement farther forward between the maxillaries and premaxillaries in the secondary palate cannot be seen, but this area has been described by Boonstra (1938) and Broom (1937). Unfortunately these descriptions do not agree. Broom figures the palate with the vomer visible anteriorly and he indicates the presence of the usual foramina in this region, while Boonstra specifically emphasises the peculiarity of their absence. From both descriptions it is clear that the premaxillaries reach far back across the anterior palate and that the excavations for the lower jaw canines are not deep. Broom sees these excavations far laterally, virtually on the alveolar border and this arrangement is confirmed by the 3rd specimen. In the 5th specimen the lower canines close more on the inside of this border.

The *transverse bones* are large and contribute largely to the anterior slopes of the pterygoid processes. They form the lateral borders of the large suborbital vacuities. Their relationship with the jugals and palatines anteriorly is not clear as these areas are covered by the mandibles in the specimens at hand. The arrangement is figured by deduction from conditions in other nearly related forms.

The *jugals* are by therapsid standards quite elementary. They form, in fact, only simple straight rods. There is no sign of a postorbital projection as is normally found in the scaloposaurids. In the middle of its length, at the postorbital level, each rod is delicate and slightly higher than broad. It expands slightly backward, in the vertical plane, while forward it broadens in the horizontal plane. It reaches forward to beyond the level of the anterior border of the orbit, penetrating deeply between the lachrymal above and the maxillary below. On the side of the orbit it forms a shelf, the ventral surface of which communicates with the transverse bone.

The *squamosals* are equally elementary by normal standards. On the temporal arches they overlap the jugals laterally with delicate tapering processes. At the postero-lateral angles of the skull they suddenly reach some significant height as they curve around the quadrates. There is an abrupt constriction between the quadrates and the lateral ends of the paroccipital processes to form the external auditory meatus grooves posteroventrally and the squamosal notches anterodorsally. The latter are broad gentle valleys as in the ictidosuchoids and procynosuchids and not deeply V-shaped as in the cynognathids. From the constriction a thin fold spreads backward over the blunt end of the parocciptal process, while on the side of the temporal vacuity there are the usual parietal process and two prootic processes reaching inward, one above and one below the post-temporal fossa. On the whole the structure is quite typically scaloposaurid.

The *quadratojugal* and *quadrate* have been well described by Crompton (1955). The quadrate forms virtually the whole of the articulation surface of the condyle, and it had a footplate reaching upward along the anterior face of the squamosal, far laterally within the deepest corner of the squamosal bend. The dorsal margin of this footplate is loosely seated in a fold half way up in the squamosal and the impression created is that of a loose articulation. The quadratojugal is intimately wrapped around the lateral and posterior face of the quadrate and it separates the quadrate from the squamosal almost completely.

The quadrate on the left side, described by Crompton (op. cit.) is, however, damaged. The medial portion is broken off and the fracture surface has been interpreted by Crompton as the facet against which the damaged quadrate process of the paroccipital could have made contact. While the quadrate process of the paroccipital is, in fact, damaged, it had not extended this far outward. The missing portion of the quadrate reached inward and presented a face for the stapes to abut against. This missing portion apparently also had an elongated process reaching farther inward and forward to the quadrate process of the pterygoid. What Crompton describes as the pterygoid process of the quadrate is a small projection reaching forward at a level above the articulation facet and it merely marks the level where there is a slight constriction more ventrally, dividing the facet into two lobes.

The *stapes* reaches outward and slightly forward and abuts straight against the quadrate. This attitude is displayed in the 2nd specimen, confirmed by the 4th specimen which has the left stapes preserved; the 3rd specimen had a right stapes in the same position, but it was removed in the process of preparation. The stapes extends, therefore, at a level forward of the excavation on the ventral side of the paroccipital process and if the latter is to be regarded as the roof of the middle ear, the stapes had not passed through this chamber. It is suggested that the distal ends of the stapes had consistently been dragged forward as a result of the collapse of the soft tissues shortly after death. In figure 7 the stapes is indicated in the position it is felt it actually occupied during life.

The *vomer* forms the normal ventral partition through the ventral part of the nasal cavity. Broom (1937) interprets it as visible anteriorly between the canines, while Boonstra (1938) noted that it was not visible in the same specimen. Not one of the specimens in the Bernard Price Institute lends itself for confirming either of the two interpretations; each has the lower jaw firmly closed over this area. Behind the secondary palate the partition is high and at the level of the dorsal margin of this partition flanges spread out either side across the ventral surfaces of the palatines. These two flanges have jointly a dumb-bell shape. The anterior margins of these flanges contribute to the dorsal free margins of the choanae which extend at a level behind that of the posterior border of the secondary palate.

The *palatines* do not contribute to the secondary palate. They border the suborbital fossae anteriorly and medially and reach boldly back below the pterygoids. They fold down broadly either side of the choanae as though to support the inner alveolar borders of the maxillaries. Laterally they contact the transverse bones on the anterior borders of the suborbital fossae.

The *pterygoids* form delicate transverse processes behind the suborbital fossae. Laterally they do not bend down conspicuously. This is a peculiar scaloposaurid feature in contrast with the condition along the cynodont line. These delicate processes are strongly supported from the front and above, around the suborbital fossae, by the transverse bones.

In the 3rd specimen the ventral margins of these processes extend straight transversely and horizontally and they meet mesially in a prominent boss on the anterior margin of the interpterygoid fossa. In the 4th specimen this boss is appreciably larger and more isolated from the ventral borders of the transverse processes. In both specimens the pterygoids are not extensively exposed in the area between the suborbital fossae.

The basisphenoid processes are broad and spread extensively. They are firmly fused on the midline in the 5th specimen, where the interpterygoid fossa is well constricted. In the 3rd specimen they do not meet on the midline, the parasphenoid keel intervening posteriorly, while anteriorly the interpterygoid fossa is elongated and less constricted.

The quadrate processes are strong. Posteriorly they expand suddenly in a dorso-medial direction.

The *alisphenoids* are very broad dorsally, and quite high. The present interpretation is rather different from that of Boonstra (1937).

The *orbitosphenoids* are barely visible in the 3rd specimen and they are inadequately preserved for description. In general there appears to be no substantial difference compared with the normal cynodont arrangement.

The *parasphenoid* encases the *basisphenoid* ventrally. The latter has been exposed from above through magnificent preparation work on the part of Crompton. It forms an elongated hollow scoop rising forward towards the rostrum while backward preparation could penetrate to the level of the sella tursica. At the level of the internal carotid foramina the basicranial axis is extremely narrow. At this level, too, there is a short but deep keel. Behind the constriction the parasphenoid broadens out towards the fenestrae ovales.

Structure of the Lower Jaw

The *dentary* is peculiarly curved; it is quite characteristic of this genus. On its shape alone, without the assistance of the dentition, the isolated dentary (6th specimen) could be identified as belonging to this genus. The peculiar twist is designed to swing the posterior lower cheek teeth inward to ensure proper occlusion on the upper teeth.

The symphysis is large and the splenials apparently do not make a substantial contribution. The "chin" is not conspicuous in side view, but in ventral view the fold below the meckelian canal swings sharply inward.

The dentary is greatly thickened, both internally and externally along the series of cheek teeth, much more than the transversely broadened teeth and their roots demand. The posterior part of the dental row is displaced inward so that the dorsal margin of the coronoid process descends some distance laterally to the hindmost teeth and is continued down and forward across the lateral face of the dentary virtually to the "chin". The margin passes the last tooth at a higher level than the crown surface in the case of the isolated dentary. In the other specimens at hand this margin is at a lower level.

This arrangement gives the dentary a very mammal-like or ictidosaur appearance, but the coronoid process is by contrast typically scaloposaurid. It reaches far back and high through the temporal vacuity, but as a long slender extension, somewhat square terminally. There are no signs of additional angular or articular projections.

The meckelian canal is wide posteriorly where it accommodates the prearticular. It continues forward to the symphysis as a narrow deep slit with a prominent fold of the dentary endeavouring to cover it, not from the dorsal margin as in cynodonts but from the ventral margin. This fold extends directly inward, not upward, because the canal runs across the broadly expanded ventral face of the dentary.

There are three large incisors, one short canine only slightly larger than the incisors, and it would appear that the cheek teeth normally count one more than in the upper jaw. The isolated dentary has eleven postcanine teeth and apparently belonged to an individual with ten upper postcanines as in the type and 2nd specimen. In the three Bernard Price Institute specimens there are nine upper teeth, as far as can be seen, while the lower jaws seem to have ten teeth in each case. In the isolated dentary there is a tooth immediately behind the canine which cannot oppose the first tooth in the upper jaw, as it lies at the level of the upper canine.

The lower teeth are narrower than the upper teeth, but are nevertheless still distinctly transversely ovate. All the teeth in the series are twice as wide as their antero-posterior measurement. Crown structure cannot be ascertained as all the teeth are considerably abraded.

The *splenial* lies virtually inside the very narrow meckelian groove. It is very delicate and thin, almost thread-like, and if it does reach its fellow of the opposite side on the symphysis this cannot be seen in ventral view as the fold of the dentary at the "chin" reaches too broadly inward across this region.

The *coronoid* is not clearly displayed. In the 5th specimen it can vaguely be seen, but its exact shape cannot be ascertained. It is confined to the area covered by the pterygoid process when the jaw is closed.

The *anterior coronoid* is almost definitely absent. If present it would be very elementary and intimately associated with the coronoid far back. It certainly did not cover the inner alveolar border.

The *articular*, *prearticular*, *angular* and *surangular* are not well enough displayed for description in any of the specimens at hand. From what can be seen in a rather fragmentary way, there would appear to be no substantial deviation from the typical scaloposaurid arrangement.

Summary

Bauria is a therapsid sufficiently different from *Scaloposaurus* and its allies to warrant distinction at the infraorder level. It is suggested that a suborder be recognised level with the Gorgonopsia, Therocephalia, Cynodontia and Ictidosauria and that this suborder be called the Scaloposauria. This is, of course, only possible if the Synapsida as a whole is elevated to class status, as propagated in an article (Brink: The taxonomic position of the Synapsida, in press, *S. Afr. J. Sci.*,) presented at a Karroo Symposium in Cape Town in 1962.

The suborder Scaloposauria is then divided into two infraorders, the earlier Ictidosuchoidea and the later Bauriamorpha, a natural branch separate from the suborder Cynodontia, comprising the two infraorders Procynosuchia and Cynognathia (Brink: A new skull of the procynosuchid cynodont, *Leavachia duvenhagei*, page 57 of this issue of Palaeontologia Africana).

The suborder Scaloposauria is more closely related to the Therocephalia than to the Cynodontia.

Reserve should be exercised over the actual relationship of certain forms thus far associated with *Bauria*. In the following analysis *Bauria* alone is contrasted with *Scaloposaurus*, *Ictidosuchops* and specific forms *definitely* assignable to the infraorder Ictidosuchoidea.

A. *The Bauriamorpha contrasted with the Ictidosuchoidea.*

	Bauriamorpha (*Bauria* alone)	*Ictidosuchoidea* (*Scaloposaurus*, *Ictidosuchops*, etc.)
(1)	Upper Beaufort.	Lower to Middle Beaufort.
(2)	Closed secondary palate.	Open secondary palate.
(3)	Single canines.	Multiple canines.
(4)	Molariform postcanines.	Conodont postcanines.
(5)	Pineal absent.	Pineal present.
(6)	Powerful postorbitals.	Weak postorbitals.
(7)	Parietal crest.	No parietal crest.
(8)	Strong contrast between parietal breadth and interorbital breadth.	No significant contrast.
(9)	Strong occipital crests.	Weak occipital crests.
(10)	Short, blunt snout with prominent cheeks.	Long, slender snout without cheek bulges.
(11)	Occiput deeply concave.	Occiput not deeply concave.
(12)	No postorbital processes on jugals.	Postorbital processes on jugals.
(13)	Dentary peculiarly twisted, thickened and robust.	Dentary straight, elongated and slender.

B. *The Scaloposauria contrasted with the Therocephalia.*

	Scaloposauria	*Therocephalia*
(1)	Parietal crest inconspicuous or absent; parietal region then fairly wide.	Very prominent parietal crest.
(2)	Postorbital bars incomplete.	Postorbital bars complete.
(3)	Secondary palate tending to close, or closed.	No comparable secondary palate.
(4)	Anterior canines of incisor size.	If multiple, canines are of equal importance.

C. *The Scaloposauria contrasted with the Cynodontia.*

	Scaloposauria	*Cynodontia*
(1)	Insignificant parietal crest.	Very significant parietal crest.
(2)	Secondary palate tending to close or closed, but palatines do not participate.	Secondary palate closed to a further extent or completely closed, palatines participating.

(3)	Large suborbital fossae.	Absent.
(4)	Large posttemporal fossae.	Small posttemporal fossae.
(5)	Weak tabulars.	Large tabulars.
(6)	Occipital condyle trilobed.	Crescent shaped.
(7)	Postorbital bars incomplete.	Incomplete only in some silphedestids.
(8)	Frontals contribute to orbital borders.	Frontals do not contribute to orbital borders.
(9)	Prefrontal-maxillary contact.	Lachrymal-nasal contact.
(10)	Zygomatic arch weak.	Zygomatic arch strong.
(11)	Premaxillaries do not penetrate deeply between nasals.	Deep penetration of premaxillaries between nasals.
(12)	Pterygoid processes weak and horizontal.	Strong and vertical.

Besides the more conspicuous differences tabulated above, there are some interesting points of agreement at various levels. The advanced or more specialised Therocephalia (Whaitsiidae, Moschorhinidae and Euchambersidae) stand in strong contrast to the advanced Scaloposauria (Bauriamorpha) and the advanced Cynodontia (Cynognathia). But the earlier or more primitive Therocephalia (*Lycideops*), the earlier Scaloposauria (*Scaloposaurus*, *Ictidosuchops*) and the more primitive Cynodontia (*Silphedocynodon*, *Leavachia*) stand much closer together. At the earlier levels these three suborders indicate a recent divergence from a common ancestry, but while the scaloposaurids stand closer to the therocephalians at this earlier level, they converge conspicuously on the cynodonts at the later level. The lower jaws remain primitive posteriorly in the later therocephalians and scaloposaurids, but become advanced in the ictidosaurian-mammalian direction in the later cynodonts. The lower jaw in later scaloposaurians (*Bauria*) becomes advanced anteriorly in the dentary only, in shape and dental characteristics.

Abbreviations

ang	Angular.	ipf	Interpterygiod fossa.
asph	Alispheniod.	jug	Jugal.
bo	Basioccipital.	jf	Jugular foramen.
bsp	Basispheniod process of the pterygiod.	lac	Lachrymal.
cp	Coroniod process.	mg	Meckelian groove.
den	Dentary.	mp	Mastoid process.
eam	External auditory meatus groove.	mx	Maxillary.
eo	Exoccipital.	nas	Nasal.
fr	Frontal.	oc	Occipital condyle.
ich	Internal choanae.	op	Opisthotic.
ic	Internal carotid foramen.	pa	Palatine.
ip	Interparietal.	par	Parietal.

parp	Paroccipital process.	qj	Quadratojugal.
pmx	Premaxillary.	qpp	Quadrate process of the pterygoid.
po	Postorbital.	smx	Septomaxillary.
pp	Pterygoid process.	so	Supraoccipital.
prf	Prefrontal.	sof	Suborbital fossa.
pro	Prootic.	sq	Squamosal.
psk	Parasphenoid keel.	st	Stapes.
psph	Parasphenoid.	tab	Tabular.
pt	Pterygoid.	tr	Transverse bone.
ptf	Postemporal fossa.	v	Vomer.
q	Quadtrate.		