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ON NANOPARIA Broom

By A. S. Brink

Abstract

New information on the types of *Nanoparia pricei* and *Nanoparia luckhoffi* are given in this paper. Differences between the two species recognised previously are disputed and a number of different distinguishing characteristics is suggested.

The new information could be revealed as a result of further development of the specimens. The type of *N. pricei* includes a portion of the skeleton, developed after the skull was described. This portion reveals an interesting arrangement of dermal scutes.

When Broom and Robinson described the tiny Pareiasaurian skull in the Collection of the Bernard Price Institute in 1948 as *Nanoparia pricei*, they mentioned that the specimen includes much of the postcranial skeleton. They did not describe the postcranial skeleton as it was at that time still completely encased in matrix and they thought it would take quite some time to clean. This portion of the specimen is now cleaned and although it is not quite as satisfactory as we had hoped, there are nevertheless some points of interest worthy of record.

At the same time two small Pareiasaurian skulls, borrowed from Dr. S. H. Rubidge of Graaff Reinet, were additionally cleaned. One of these is the type of *Nanoparia luckhoffi*, on which little more can be said to supplement Broom's description of 1936. The other is a very similar, somewhat larger and rather unsatisfactory skull which I refer to the same species.

Nanoparia pricei Broom and Robinson

Type: Skull and much of the postcranial skeleton in the Bernard Price Institute for Palaeontological Research (Cat. No. 6), from Sondagsriviershoek, Graaff Reinet.

Horizon: Lower part of *Cistecephalus* zone.

1948. Broom, R. & Robinson, J. T., *Ann. Transv. Mus.*, xxi, p. 51, figs. 1-3.

When Broom and Robinson described the skull its dorsal surface was beautifully cleaned, but the ventral surface was still encased in matrix. Recently Mr. J. W. Kitching attempted to clean the ventral surface, but he found the matrix harder than the delicate palatal structures. Nevertheless, he managed to display the ventral surface, only to find that it conforms perfectly with that of *Nanoparia luckhoffi*. The teeth-bearing ridges were unfortunately all damaged. Farther back a substantial layer of matrix was left to support the occipital crest. Preparation could be carried out with more success in this area on the *Nanoparia luckhoffi* specimens, where this crest is less delicate and more complete.

Of the two supernumarary temporal bones described for *N. luckhoffi*, Broom and

Robinson could clearly trace the "A" element and expressed their doubt over the presence of the "B" element. Admittedly this region is much damaged and the "B" element is a rather superficial bone in *N. luckhoffi*, but there is a slight indication on the left side that this element was also present in *N. pricei*.

Broom and Robinson listed a number of differences between *N. pricei* and *N. luckhoffi* which I find carry very little weight. I can see and measure no difference in the proportions of the parietals, postorbitals and tabulars in the two species. There is a proportional difference in the size of the pineal foramen, but in the three specimens at hand this foramen does not differ in actual size, although the skulls differ appreciably in size. It appears, therefore, that the pineal foramen does not increase in size as the skull grows larger, so that it is dangerous to base conclusions on its relative size.

Besides proportional differences, Broom and Robinson also mention an important structural difference. They found that in *N. pricei* the postorbital meets the quadratojugal, thus separating the jugal from the squamosal, while in *N. luckhoffi* the jugal and squamosal meet, separating the postorbital and quadratojugal. Admittedly the sutures are very difficult to trace and most deceptive, but with the aid of diluted hydrochloric acid it was possible to bring the sutures out more clearly and it was found that Broom and Robinson misinterpreted the suture between the quadratojugal and squamosal in *N. pricei*. This suture runs some 6 to 10 mm. farther laterally, joining the jugal suture, and producing a sutural pattern not at all different from that of *N. luckhoffi*.

Broom and Robinson also describe the horn-like bosses on the lateral margin of the quadratojugal. These consist of two dorsoventrally flattened triangular protrusions, the posterior one directed horizontally outward and to some extent backward, while the anterior boss is directed slightly downward and forward. In front of the anterior boss there are two smaller pointed protrusions directed more forward than sideward. Behind the posterior large boss two small pointed protrusions, similar to the anterior ones, are directed straight back. I have little doubt that these apparently ornamental protrusions served the purpose of protecting the external ear openings, which were located slightly below and to the back of the large protrusions. This quadratojugal margin is missing on both sides in the type skull of *N. luckhoffi*, but in the second skull which I refer below to this species enough is preserved on the right side to illustrate an exactly similar arrangement.

Besides general size and the number of teeth, there appear to be no features on which a distinction between the two species can be based, and as these features are related to age, they are quite unreliable. Nevertheless I have little doubt that *N. pricei* is a species distinct from *N. luckhoffi*, and I would like to mention the following as possible distinguishing characteristics: (1) the orbits of the former are distinctly round, while in the latter they are conspicuously elongated posterodorsally — antero-ventrally; (2) the antorbital region is not proportionally broader in the former than in the latter, as Broom and Robinson mentioned, but in the latter the distance from the anterior border of the orbit to the postero-lateral border of the external naris is proportionally considerably shorter. Regarding this feature, the existing illustrations are very misleading. In Broom and Robinson's drawing of *N. pricei* this distance is too short. The actual distance is 22 mm. In Broom's illustration of *N. luckhoffi* this distance is too long. The actual distance is 29

mm. in both the type and the larger second specimen. *N. pricei* is exactly half the size of the second *N. luckhoffi* specimen and a difference of 7 mm. in actual size does effect a rather conspicuous proportional difference, considering that with possibly five additional maxillary teeth to come, (should *N. pricei* be immature) this region's increase in size could not have been relatively much slower than other regions of the skull; (3) the skull of *N. pricei* is considerably more rugose than in both the *N. luckhoffi* specimens. One normally finds that rugae and pits become exaggerated with advancing age. The central bosses of each bone are more distinct in *N. luckhoffi* than in *N. pricei;* (4) the shape of the external nares differ, as illustrated in the existing figures.

The skeleton is somewhat disappointing in that it is not as complete as we had originally hoped. The skeletal portion consists of all the vertebrae and ribs of the trunk, lacking the cervicals, the caudals, the girdles and the limbs. It is not possible to define where the cervicals pass over to the thoracic and posteriorly the series is discontinued apparently shortly in front of the sacral region. The series is made up altogether of thirteen vertebrae of which perhaps only the first could

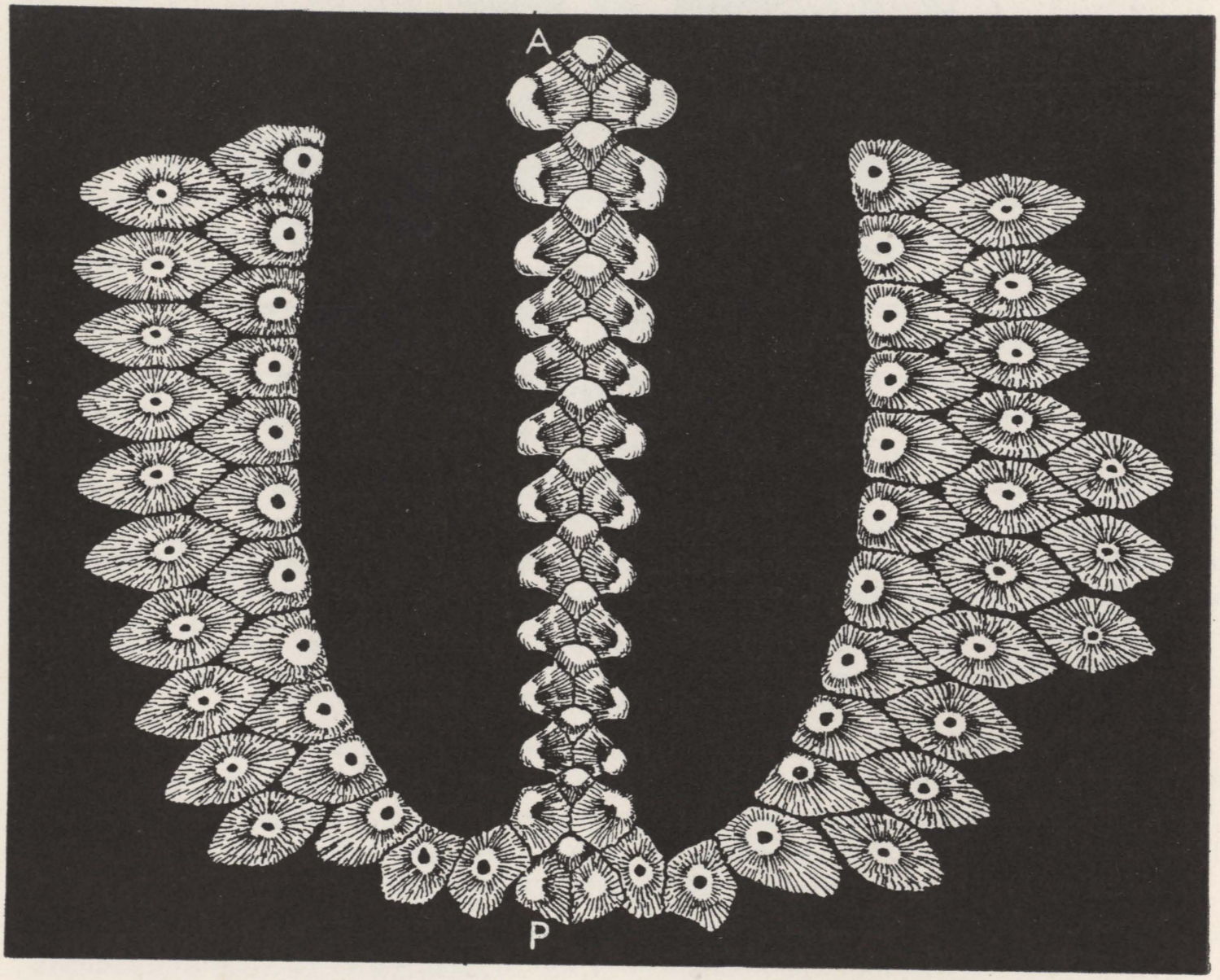


Fig. 17.—Diagrammatic restoration of the apparent arrangement of the dermal scutes on the back and sides of the trunk of *Nanoparia pricei,* figured as though stretched out in one plane, ½ natural size. A, Anterior; P, Posterior.

be a cervical. The rib belonging to the second is at least 75 mm. long and therefore most unlikely a cervical. The centra average some 14 mm. in length and they appear to be longer towards and in the cervical region. The nature of the rib articulations is most indistinct.

The vertebrae and ribs are exposed ventrally. On the dorsal surface preparation could not be carried successfully further than exposing interesting series of dermal scutes. The ribs are most interesting in that they are peculiarly broad and massive. It appears quite likely that normally during life there could have been some degree of contact (not overlapping) between all the ribs throughout the trunk region. They average in breadth some 12 mm., slightly less than the lengths of the centra,

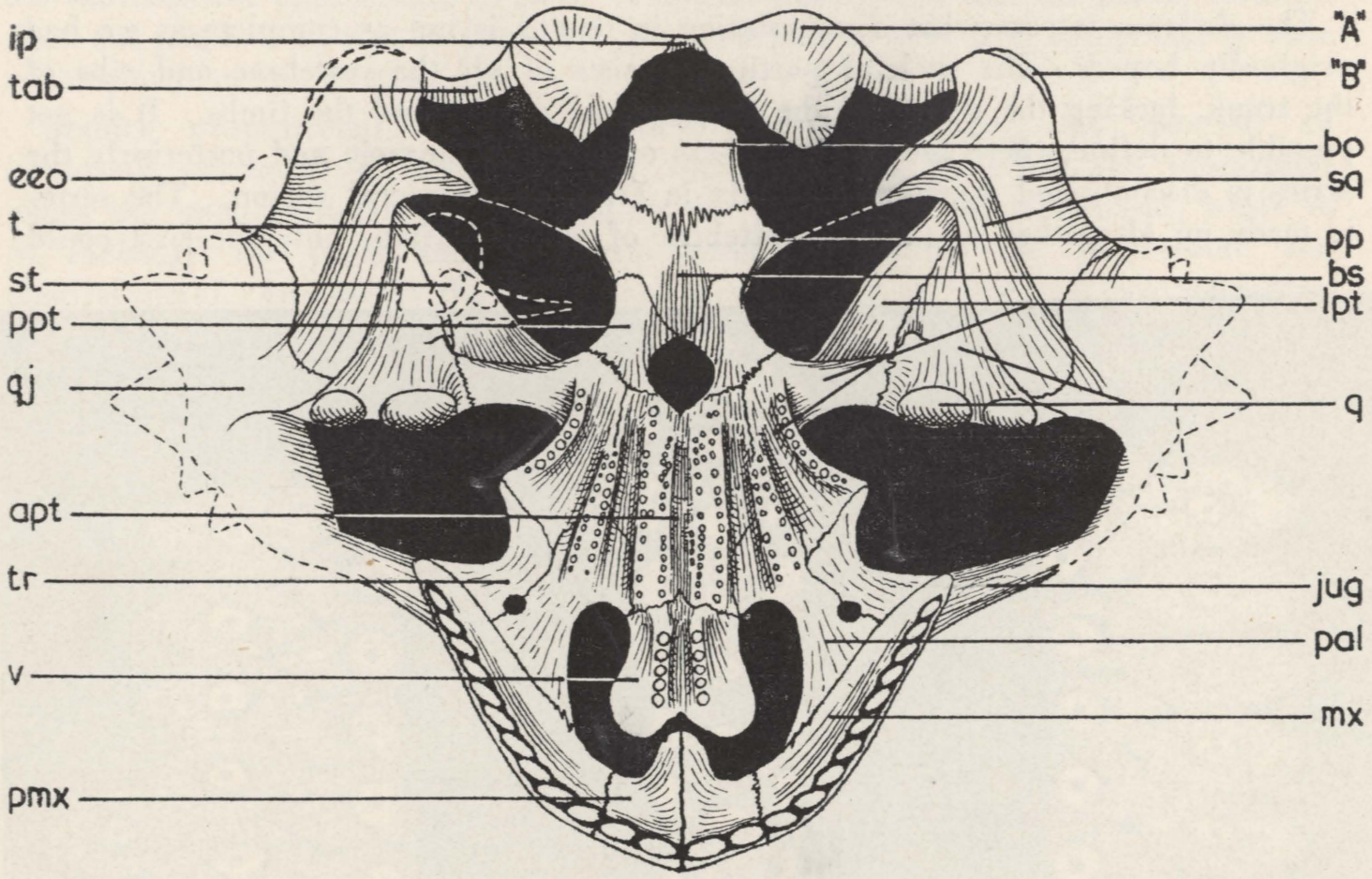


Fig. 18.—Ventral view of the skull of *Nanoparia luckhoffi*, No. LI in the Rubidge collection, quadratojugals restored after *Nanoparia pricei*, ½ natural size.
Abbreviations: "A" and "B", dermal scute elements; apt, anterior pterygoid; bo, basioccipital; bs, basisphenoid; eeo, external ear opening; ip, interparietal; jug, jugal; lpt, lateral pterygoid; mx, maxillary; pal, palatine; pmx, premaxillary; pp, paroccipital process; ppt, posterior pterygoid; q, quadrate; qj, quadratojugal; sq, squamosal; st, stapes; t, tympanum; tab, tabular; tr, transverse bone; v, vomer.

but as the anterior ribs are inclined more backward than the posterior ribs, the distance between the ribs on the sides of the body could have been less than 2 mm.

The proximal portions of the ribs are narrower (8-9 mm.), but only for a distance of about 10 mm. They broaden out rather suddenly. The narrow portion is evidently fairly thick vertically; the broader portion flattens out to a thickness of 3 mm. distally. The longest rib measures 100 mm. and appears to be complete. As preserved all the ribs are straightened, but several series of fractures indicate that the ribs were originally normally curved with their flattened outer surfaces parallel to the surface of the trunk. Overlapping appears to have been possible when the body was twisted sideways.

On the dorsal surface a rather good series of scutes mark the position of the vertebral column below (see fig. 17). These scutes are perfectly in situ and groups of three can be distinguished as belonging to particular vertebrae. Each unit of three scutes forms a triangle with the apex directed anteriorly. The apical scute is smaller and appears to cap the dorsal process of the vertebra. The three scutes in the unit are in sutural contact with each other and freely articulate with the units in front and behind. Each scute rises in a prominent tubercle on an angle of the triangle, fanning out towards its suture with its two fellows in the unit. A depression occurs medially to the tubercle of each of the two lateral scutes. There is no trace of a depression in the apical scute.

For a distance of about 50 mm. on each side of the series of vertebral scutes there appear to have been no other dermal scutes. The few odd traces of scutes in these areas appear to be dislocated members of the vertebral or lateral series. The lateral series start some 60 mm. from the midline (as preserved in one plane) with a well definable row of tubercles rising quite an appreciable height above the general surface formed by the fan portions of the scutes. In this proximal row the scutes, with their high tubercles, fan out only in a lateral direction, except posteriorly where they approach the vertebral series. In the second row, farther laterally, the scutes are transversely elongated with their tubercles centered and they articulate alternately with the scutes in the proximal row. More rows of scutes follow farther laterally, but on the right side the specimen extends to include only a part of the third row. The majority of the scutes in the lateral series are in situ. Those of the proximal row are situated intercostally.

Each tubercle of the scutes in the lateral series is penetrated centrally by a fairly large foramen. The proximal row of the lateral series approaches the vertebral series posteriorly and to a lesser extent anteriorly. The lateral scutes average some 25 mm. in length (transversely) and 15 mm. in breadth (antero-posteriorly). In the vertebral series the base of each triangular unit in the middle of the trunk measures 25 mm. This measurement increases sharply anteriorly and decreases slowly posteriorly. Towards the sacral region it appears to increase again sharply and the pattern becomes obscured by the scutes of the lateral series joining in. The sides of the triangles measure less than the base. The apical scute increases slowly in size forward and very suddenly in the cervical region. Anteriorly it is situated farther back, relative to its partners in the unit, than posteriorly.

Nanoparia luckhoffi Broom

Type: Skull in the Rubidge Collection (Cat. No. L.1.), from the Oudeberg Plateau, Graaff Reinet.

Horizon: Lower part of *Cistecephalus* zone.

Second specimen: Skull in the Rubidge Collection (Cat. No. 310), from the farm Bulberg, Richmond.

Horizon: Lower part of *Cistecephalus* zone.

1936. Broom, R., *Ann. Transv. Mus.*, xviii, p. 349, fig. 1.

The type skull was recently additionally cleaned by Mr. J. W. Kitching, but little new information was revealed.

As stated above, the rugose nature of the surfaces of the individual skull bones differs rather conspicuously from that of *N. pricei.* Each bone on the dorsal surface, that is excluding the quadratojugal, maxillary and premaxillary, develops a large boss rising an appreciable height above the surface. Over the rest of the surface the rugae and pits are small and insignificant, with only slight indications that they form a radiating pattern around the main boss. The bosses are centered on each bone, except the postorbital, postfrontal and prefrontal, where they occur on the margin of the orbit. The nasals appear to develop a cluster of medium sized bosses above and behind the dorsal margin of the external nares. The more conspicuous bosses belong to the tabulars, parietals, postorbitals, postfrontals and lachrymals. The frontal bosses are worn away and it is doubtful whether the interparietal developed a boss at all. According to the second specimen the jugal developed bosses not unlike those of *N. pricei,* on the lateral margin of the temporal region.

The ventral surface of the occipital crest could be cleaned properly in the second specimen, but it is virtually impossible to trace sutures. Only enough of the ventral surface of this crest could be cleaned in the type to show that the "B" element in this crest is an extremely superficial bone, entirely underlain by the squamosal ventrally. The "A" element, on the other hand, penetrates to the ventral surface of the occipital crest and expands laterally. In the type the suture formed by this bone with the tabular ventrally is marked by a distinct ridge. In the second specimen this bone extends farther sideward beneath the tabular, for a distance of about 10 mm.

From the type it appears that the external ear opening was situated directly behind the posterior quadratojugal boss, apparently along the free margin of the squamosal, extending also along a small portion of the free margin of the quadratojugal. Inward and forward the squamosal and quadratojugal form a longitudinal depression extending anteroventrally to the lateral side of the quadrate, and posterodorsally to a level below the squamosal-tabular suture, where the squamosal forms a bulge and turns inward, evidently marking the dorsal border of the tympanum. If the structure of this region is correctly interpreted, the tympanum must have been very large, perhaps twice or three times the size of the external ear opening, and it must have formed part of the antero-dorsal wall of a chamber, rather than the end of a tube (see figure 18).

Broom was not certain about the homology of the "A" and "B" elements in the skull of *Nanoparia* when he described the type of *N. luckhoffi.* It appears now that the two "A" elements could represent the lateral scutes of a unit in the vertebral series, the place of the apical scute being taken here by the interparietal. The "B" elements then represent the anterior scutes of the proximal row of the lateral series of scutes.

The second specimen is a larger and flatter skull, but its flatness is evidently due to compression. As far as the rather indistinct sutural pattern can be made out, there is no difference between the new specimen and the type. It is quite certain that the "A" elements are present and, if correctly interpreted, the "B" elements appear to be less superficial. The central bosses of the individual skull bones on

the dorsal surface are not very large. This specimen may still prove to be a different species, but in the absence of convincing distinguishing characteristics it is provisionally best referred to as belonging to the species *N. luckhoffi.*

The skull measures 180 mm. from the premaxillaries to the interparietal, and 112 mm. to the anterior border of the pineal foramen. The total actual breadth, reconstructed, but the distortion not corrected, is 235 mm. The interorbital breadth is 77 mm.