

# THE MAMMAL-LIKE REPTILE *RECHNISAUROS* FROM THE TRIASSIC OF INDIA

by S. BANDYOPADHYAY

**ABSTRACT.** *Rechnisaurus cristarhynchus* from the Yerrapalli Formation (Middle Triassic) of the Pranhita-Godavari valley of India was described as a stahleckeriid dicynodont on the basis of its blunt snout and lack of a high parietal crest. Another large Triassic dicynodont, but with a pointed snout, from the N'tawere Formation of Zambia was also designated as *Rechnisaurus cristarhynchus*, while a skull from the Omingonde Formation of Namibia was named *Kannemeyeria simocephala*. Keyser and Cruickshank considered all these three species to be examples of *K. cristarhynchus*. A re-examination of the Indian *R. cristarhynchus* shows that this species is quite distinct from the other kannemeyeriid and stahleckeriid genera. Because of its incomplete nature the cranial measurements used for the classification of large Triassic dicynodonts cannot be applied to it. Until complete material of this species is found, *R. cristarhynchus* from India should be considered as *incertae sedis*.

THE dicynodonts are a group of mammal-like reptiles which attained a world-wide distribution during the Late Permian and the Triassic. These terrestrial herbivorous animals were quite successful in the Permian and a large number of genera are known, but the number of both genera and species declined in the Triassic.

Roy-Chowdhury (1970) briefly described the skulls of two large Triassic dicynodonts from the Yerrapalli Formation of the Pranhita-Godavari valley, Deccan, India. *Wadisasaurus indicus* was identified as a kannemeyeriid dicynodont while *Rechnisaurus cristarhynchus* was designated as a stahleckeriid. However, much confusion has been created regarding the nomenclature as well as the status of the genus *Rechnisaurus* (Keyser 1974; Keyser and Cruickshank 1979; Cox and Li 1983; Cruickshank 1986). An attempt is made here to re-examine the status of *R. cristarhynchus* in the light of the recent family diagnosis of the Triassic dicynodonts (Cox and Li 1983).

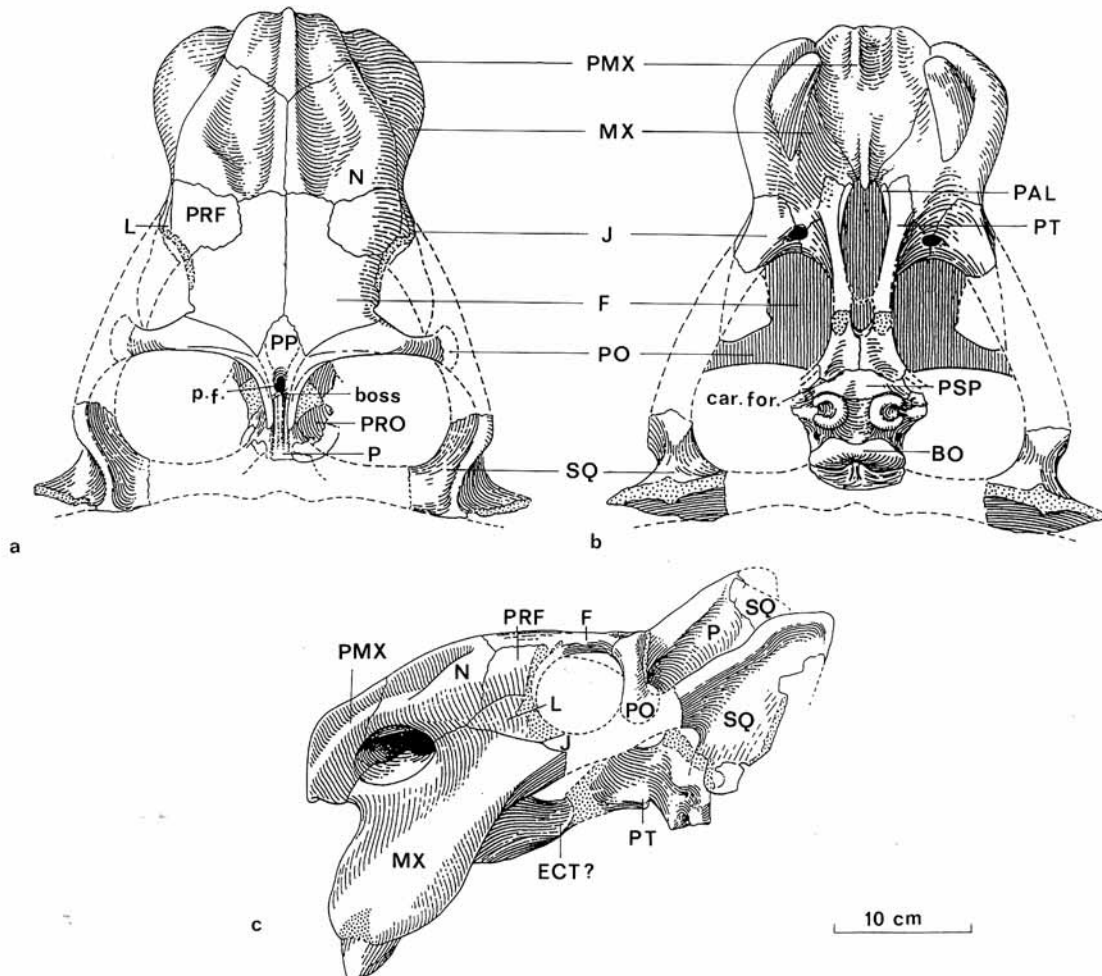
The family Stahleckeriidae was established by Cox (1965) who first classified the Triassic dicynodonts into four families: Kannemeyeriidae, Stahleckeriidae, Shansiodontidae, and Lystrosauridae. The family Stahleckeriidae was distinguished by its blunt snout, wide and low occiput, short temporal opening, and lack of a parietal crest, and included *Stahleckeria* and *Dinodontosaurus*. Cox and Li (1983), while reviewing anew all the Triassic dicynodonts known so far, proposed modified and enlarged family diagnoses, but basically adhered to the family arrangement of Cox (1965). According to the Cox and Li (1983) family diagnosis, the family Stahleckeriidae includes medium to large dicynodonts characterized by the following features: the snout is wide, blunt, and pronouncedly elongated, nearly 37-56% of the skull length, and bent in some genera; the jaw articulation lies posteriorly; the occiput is almost vertical; the ratio of the skull length in the palatal view to the dorsal skull length is usually more than 100%. The genera included in this family by Cox and Li (1983) are *Dinodontosaurus*, *Parakannemeyeria*, *Dolichuranus*, *Rhinodicynodon*, *Stahleckeria*, *Sinokannemeyeria*, and *Zambiasaurus*. The present author follows their classification except for a few alterations (Table 1).

## THE STATUS OF *RECHNISAUROS CRISTARHYNCHUS* ROY-CHOWDHURY

*R. cristarhynchus* from the Yerrapalli Formation was designated as a stahleckeriid by Roy-Chowdhury (1970) who came to this decision following Cox's (1965) family diagnosis. The sole

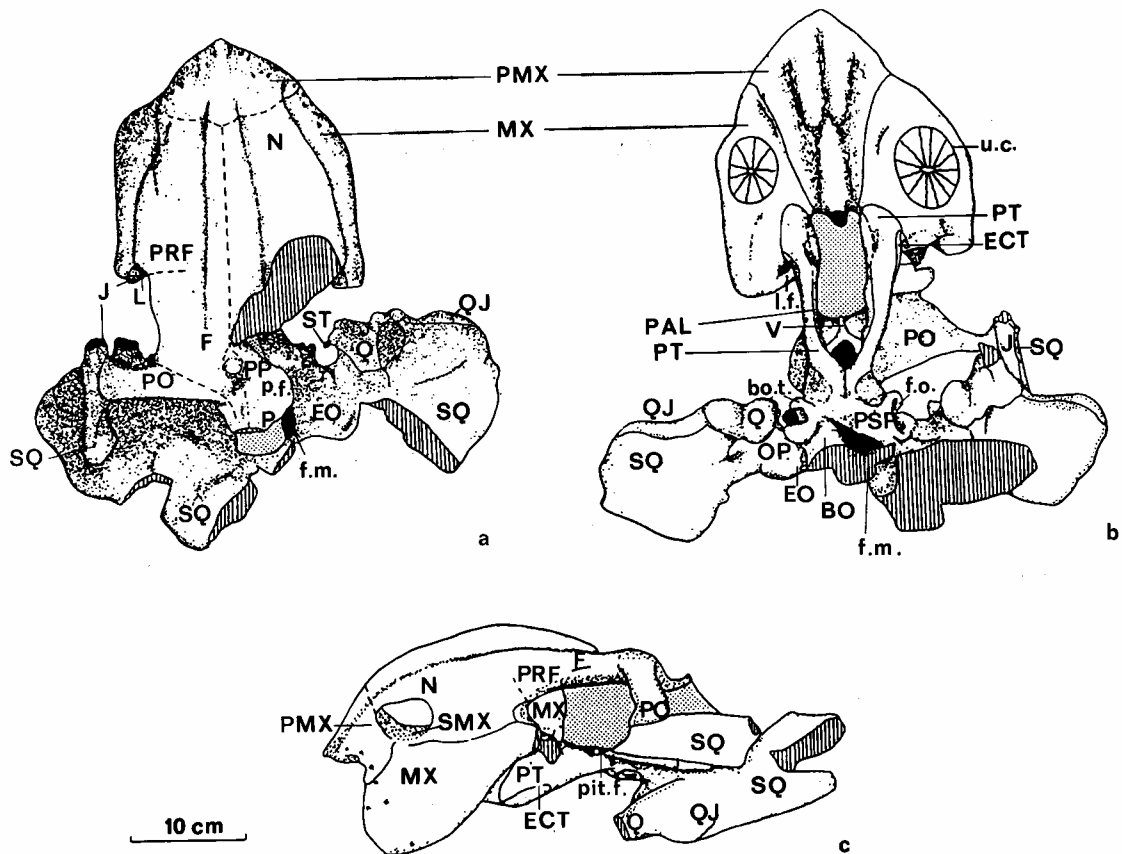
TABLE 1. The revised classification of Triassic dicynodonts (modified after Cox and Li 1983).

Family	Kannemeyeriidae <i>Kannemeyeria</i> , <i>Uralokannemeyeria</i> , <i>Shaanbeikannemeyeria</i> , <i>Rhadiodromus</i> , <i>Rabidosaurus</i> , <i>Ischigualastia</i> , <i>Placerias</i> , <i>Moghrebeeria</i> , <i>Wadisasaurus</i> .
Family	Stahleckeriidae <i>Dinodontosaurus</i> , <i>Parakannemeyeria</i> , <i>Dolichuranus</i> , <i>Rhinodicynodon</i> , <i>Stahleckeria</i> , <i>Sinokannemeyeria</i> .
Family	Shansiodontidae <i>Shansiodon</i> , <i>Tetragonias</i> , <i>Angoniasaurus</i> , <i>Vinceria</i> (?)
<i>Incertae sedis</i>	<i>Barysoma</i> , <i>Elephantosaurus</i> , <i>Jachalaria</i> , <i>Sangusaurus</i> , <i>Zambiasaurus</i> , <i>Rechnisaurus</i> .

TEXT-FIG. 1. *Rechnisaurus cristarhynchus*. ISI R37 (after Roy-Chowdhury 1970). Restoration of the skull in a, dorsal, b, ventral, and c, side views. Scale bar 100 mm.

holotype skull (text-fig. 1) (ISIR37 in the collection of the Geological Museum, I.S.I., Calcutta) has a wide and blunt snout which bears a strong midnasal ridge running from the anterior part of the premaxilla, gradually broadening backwards, and dying out behind the nasofrontal suture. The ridge is flanked on each side by a deep depression which widens posteriorly as the snout broadens and terminates where the nasal meets the frontal and the prefrontal. The skull also possesses a pair of powerful canines curving slightly inwards and placed quite posteriorly in the maxillae. The interorbital area is quite wide and the temporal openings are apparently broad and short, evidenced by the short and narrow intertemporal bar formed mostly by the paired parietals. Presence of a boss immediately behind the pineal foramen and lack of a parietal crest were also considered as important characters of the species. Roy-Chowdhury (1970) compared the genus with other genera of the stahleckeriids, known at that time, and found that *Rechnisaurus* was closer to *Dinodontosaurus* 'but differs in having a high median nasal ridge and a boss behind the pineal foramen' (Roy-Chowdhury 1970, p. 137).

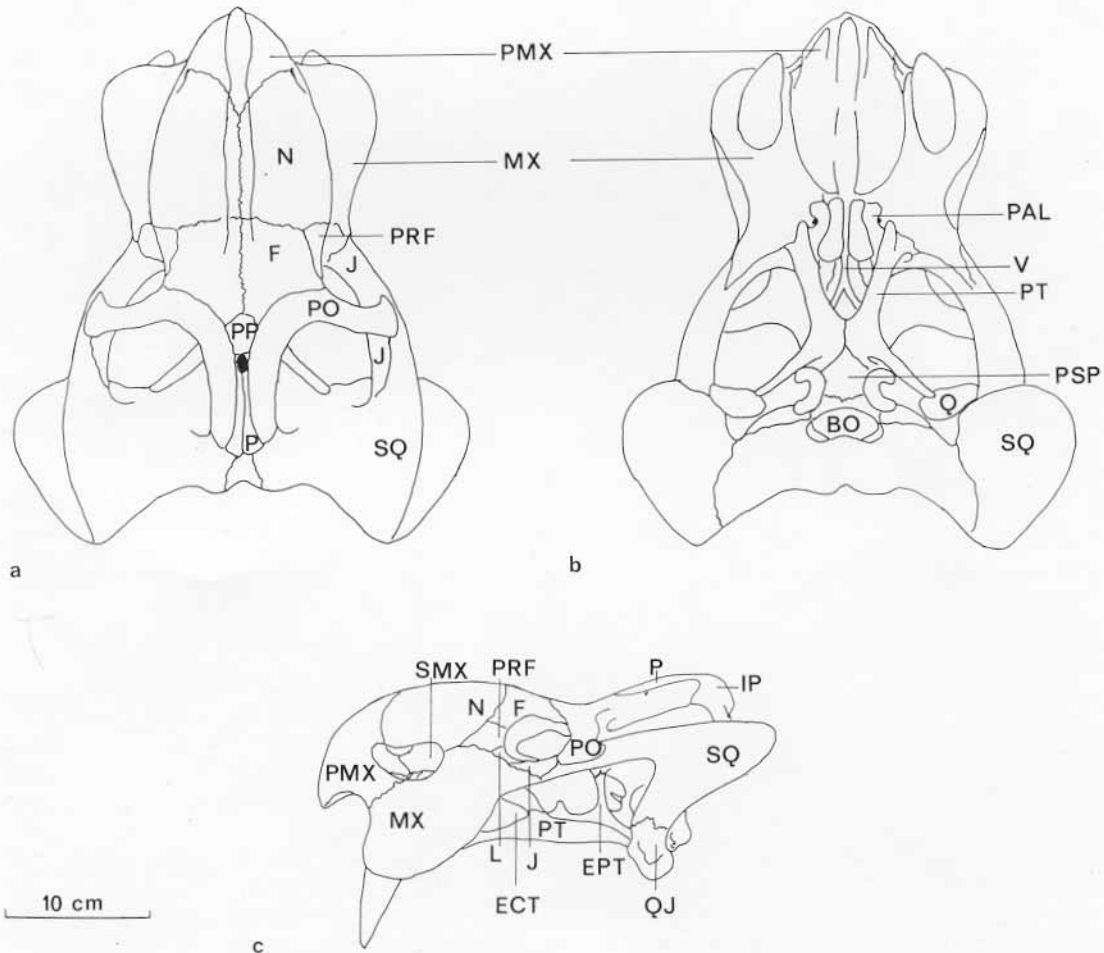
In the same year another dicynodont skull from the N'tawere Formation of Zambia was also designated as *R. cristarhynchus* (text-fig. 2) by Crozier (1970), who identified it on the basis of the presence of a strong midnasal ridge flanked by depressions and short and broad temporal openings. The Zambian skull (no. 421, Bernard Price Institute for Palaeontological Research, also



TEXT-FIG. 2. *Rechnisaurus cristarhynchus*. BPI 3638 (after Crozier 1970) in *a*, dorsal, *b*, ventral, and *c*, side views of the skull as preserved. (Dots represent matrix; hachings represent broken bones). Scale bar 100 mm.

mentioned as BPI 3638 after its field number) is rather incomplete as the intertemporal bar, the right orbital region, and a good part of the zygomatic arches are missing. While noting the presence of a pointed snout in the *Zambian* skull, Crozier (1970) stated that the blunt snout of the holotype skull (ISIR37) was due to 'a fracture or erosion, notwithstanding a definite statement to the contrary of Dr. P. L. Robinson' (Crozier 1970, p. 39). Crozier (1970) further amplified her statement by mentioning that 'the palatal ridges of the type are not bounded anteriorly by any marked rim as they are in the specimen here . . . which is the more normal condition'. It must be reiterated here that the snout region of the holotype skull from India is *devoid of any 'fracture or erosion' whatsoever* (text-fig. 1) and consequently the basis of assigning the *Zambian* specimen to *R. cristarhynchus* was founded on inadequate characterization and erroneous assumption which later created confusion in the identification of other material.

Keyser (1973) described a kannemeyeriid skull (text-fig. 3) from the Omingonde Formation of Namibia as *Kannemeyeria simocephala* (no. R313 in the collection of the Geological Survey, RSA). He described the form as having a medium to large-sized skull with tusks in both sexes, zygomatic arches parallel or subparallel in dorsal view, high and narrow parietal crest with no extensive



TEXT-FIG. 3. *Kannemeyeria cristarhynchus*. R313 (after Keyser and Cruickshank 1979) in a, dorsal, b, ventral, and c, side views of the skull. Scale bar 100 mm approximately.

exposure of interparietal on the dorsal surface. Subsequently, Keyser and Cruickshank (1979) compared the skulls of *K. simocephala* from the Omingonde Formation of Namibia and the supposed *R. cristarhynchus* from Zambia and found a great resemblance between the two (Table 2). They observed that both the forms (R313 and BPI 3638) has strong midnasal ridges flanked by depressions, strong caniniform processes, and short temporal openings but 'their parietal crests not being as high as might be expected in a typical *K. simocephala*'. From this comparative study they made two conclusions. First, *K. simocephala* of Namibia (R313) was specifically distinct from *K. simocephala* Weithofer. They renamed the Namibian specimen *K. cristarhynchus*. Secondly, *R. cristarhynchus* of Zambia (BPI 3638) not only belonged to the genus *Kannemeyeria*, but was also conspecific with the Namibian form. Both forms, therefore, were included in *K. cristarhynchus*.

TABLE 2. Comparison of skull measurements (in mm) of *Kannemeyeria cristarhynchus* from the Omingonde Formation (R 313) and *Rechnisaurus cristarhynchus* from the N'tawere Formation (BPI 3638) (after Keyser and Cruickshank 1979).

	R313	BPI 3638
Length: a, palatal midline	355	365
b, dorsal midline	409	450*
c, over squamosal wings	444	465*
Width over squamosal	406	454*
Interorbital distance	140	150
Internasal distance	150	160
Width of parietal crest at level of pineal	59	53*
Length behind postorbital on dorsal mid-line	130	140*
Length in front of postorbital on dorsal mid-line	279	310*
Length of internal nares	82	105
Length of fenestra mediopalatinalis	29	18
Diameter of tusks	40 × 29	36.5 × 31
Horizontal diameter: orbit	68	95
Horizontal diameter: nares	55	55
Depth: caniniform process	150	145
Interpterygoid × 100	35%	17.6%
Internal nares Preorbital length × 100	69%	69%
Total mid-line length		

\* Estimate on damaged or distorted region.

Keyser and Cruickshank (1979), following an earlier suggestion by Keyser (1974), also concluded that the generic status of *Rechnisaurus* was untenable and relegated it to a junior synonym of *Kannemeyeria*. This conclusion cannot be accepted as the analysis is based on the characters of the Zambian skull (BPI 3638) only. The holotype *Rechnisaurus* (ISI R37) was not taken into account by Keyser and Cruickshank (1979) and the real difference between *Kannemeyeria* and *Rechnisaurus* remains unexplored.

Unfortunately this erroneous conclusion (which started originally from a misconception) has been followed by other workers such as Cox and Li (1983). Cruickshank (1986) described a kannemeyeriid from the Manda Formation of Tanzania and named it as *Sangusaurus parringtoni*. The holotype *S. edentatus*, collected from the N'tawere Formation of Zambia, was recognized on the basis of some fragmentary skull material by Cox (1969), but later Cox and Li (1983) considered it as *incertae sedis* probably because of its indefinite characters. Nevertheless, Cruickshank (1986)

related *S. parringtoni* to '*K. cristarhynchus* (Chowdhury)' on the basis of 'broad open groove on parietal mid-line, and a boss immediately behind the pineal opening'. The species might be similar to *S. edentatus* but definitely differs from the Indian *R. cristarhynchus* in having a sharply pointed snout and lacking a deep depression beside the midnasal ridge. Cruickshank (1986), because of the incomplete nature of the skull, kept his decision open and stated 'when more material is known this decision may have to be reversed'. However, in the same paper, in the discussion of the evolution of the kannemeyeriid dicynodonts, he used *K. cristarhynchus* (Roy-Chowdhury) as a key species. It is interesting to note that the figures he used to illustrate *K. cristarhynchus* show lobe-like bars in the intertemporal region (Cruickshank 1986, fig. 4A). However, the Indian specimen of *R. cristarhynchus*, although having a somewhat incomplete parietal crest, does not show any indication of forming any long bars behind (text-fig. 1), nor do the Zambian or Namibian specimens, so whether the structure of the intertemporal region is a good guide to taxonomic affinity remains doubtful.

An examination of the holotype skull of *R. cristarhynchus* (ISI R37) reveals that this form is quite distinct from other dicynodont genera belonging to the Family Kannemeyeriidae. Its wide and blunt snout indicate an affinity with stahleckeriids. However, the only skull available for study is incomplete; most of the occiput, zygomatic arches, and interparietal are missing. In the description of the material, Roy-Chowdhury (1970) mentioned 'The zygomatic arches are broken a little behind the maxillae, but the well preserved post-orbital bar helps in restoring the continuation of the suborbital bar up to the orbit and also indicates the position of the more posterior extension of the zygomatic bar. . . . In the occiput, only the condyle, the foramen magnum and the median part of the supraoccipital are preserved, with a minor break above the condyle. The squamosals are missing save for an isolated piece near the dorsal part of the lateral wing of the right squamosal.' Because of this incomplete nature of the skull many of the measurements used by Cox and Li (1983) for taxonomic characterization are not available. Moreover, to ascertain the definite familial status of *R. cristarhynchus*, better material will have to be obtained. Until then *Rechnisaurus* should be considered as *incertae sedis* showing some affinity to the Family Stahleckeriidae Cox 1965.

#### SYSTEMATIC PALAEOLOGY

In the light of the above discussion a revised systematics of the three specimens under consideration is given below.

##### Family KANNEMEYERIIDAE

##### Genus KANNEMEYERIA Weithofer 1888

##### *Kannemeyeria cristarhynchus* (Crozier 1970; Keyser and Cruickshank 1979)

*Synonyms.* ?*Rechnisaurus cristarhynchus* Crozier 1970, N'tawere Formation, Zambia; *Kannemeyeria simocephala* Keyser 1973, Omingonde Formation, Namibia.

*Type specimen.* R421/BPI 3638, a partial skull 620 mm long and complete lower jaw 320 mm long, in the collection of the Bernard Price Institute of Palaeontological Research.

*Locality and horizon.* Locality no. 16 of the Lower Fossiliferous horizon in the N'tawere Formation, Zambia.

*Referred specimen.* R313 in the collection of the Geological Survey, RSA.

*Locality and horizon.* Between the lower and middle arenaceous horizons of the Lower Etjo Beds, Omingonde Formation, Namibia.

*Diagnosis.* Skull dorsally triangular in outline with very large canine tusks; maxillary process with exceedingly wide lateral flanges. Wide interorbital region. Midnasal ridge on the anterior and dorsal surface and shallow depression on either side extending from tip of the snout to the interorbital region. No postfrontal. Preparietal with low boss in front of pineal foramen. Short and broad temporal opening. Jugal occupies most of the length of the zygomatic arch. Premaxilla

short. Septomaxilla forms posterior wall and floor of the nostril. Distinct ectopterygoid. Behind the pituitary foramen a small boss consisting of part of the epipterygoid fused to pterygoid. Secondary palate, with three parallel grooves, the central one running into the vomerine ridge. The two anterior ridges meet the ridge around the rim of the premaxilla. Moderate-sized labial fossae at the junction of the maxilla, pterygoid, and the jugal. Maxilla enters the internal narial passage. Palatine extends the entire length of the pterygoid ramus to meet the maxilla. Low, broad occiput. Deep quadrate fossa on anterior face of occiput. Lower jaw with massive dentary. Deep central and shallow lateral grooves on dorsal surface on the dentary. Surangular with short lateral face. Long S-shaped Meckel's fossa. Reflected lamina of the angular meets the horizontal flange of the lateral condyle leaving an oval opening dorsally between the angular and the reflected lamina. Long and broad shallow condyle allowing longitudinal and lateral movement of the jaws (after Crozier 1970).

Taxon tentatively assigned to Family STAHLCKERIIDAE

Genus *RECHNISAUROS* Roy-Chowdhury 1970

*Rechnisaurus cristarhynchus* Roy-Chowdhury 1970

*Type specimen.* ISI R37, an incomplete skull about 380 mm long, in the collection of the Geological Museum, Indian Statistical Institute, Calcutta.

*Locality and horizon.* 1 km south of Rechni village in the Yerrapalli Formation of the Pranhita-Godavari valley, Andhra Pradesh, India.

*Diagnosis.* Moderately large-sized skull, about 380 mm long. Large canine teeth. Wide interorbital region. Blunt snout. Strong median ridge on anterior and dorsal surfaces of premaxilla continuing up to the dorsal side of the nasal and flanked by a pair of deep depressions. Powerful anteroventrally directed caniniform process bearing rugose rounded flange on its posteroventral edge. Short postorbital region. Short and wide temporal opening. Fairly narrow intertemporal bar, dorsally concave in cross-section. Parietal crest not high. Low boss immediately behind pineal foramen. Parietal forms most of the intertemporal bar. Sharp transition between dorsal and occipital surface (after Roy-Chowdhury 1970).

## CONCLUSIONS

The case of the identification and naming of *Rechnisaurus* highlights problems in several areas:

1. Classification of the Triassic dicynodonts has proved particularly refractory mainly because the type specimens are distributed in several continents; the majority of Permian types are in South Africa. Personal observation of specimens is essential in order to produce a consistent and coherent classification, which makes it unlikely that any one worker will be able to see all specimens. This makes accurate description in the literature of paramount importance. The present study is a contribution towards this.

2. Several studies of the functional morphology of Triassic dicynodonts have appeared recently (Walter 1986; Bandyopadhyay 1988). Snout morphology in particular has often been used as a pointer to skull function in these animals, so it would be interesting to have the state of the snout in *Rechnisaurus* confirmed.

3. The Indian fauna is comparable with dicynodont faunas from other continents from broadly the same time span and the accurate classification of *Rechnisaurus* will eventually add to the knowledge of this fauna.

*Acknowledgements.* I thank Professor T. K. Roy-Chowdhury of the Indian Statistical Institute for discussion. I am grateful to Dr G. M. King of the University Museum of Oxford for her suggestions and comments and critical appraisal of the manuscript.

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Manuscript received 11 February 1988

Revised manuscript received 17 June 1988

## ABBREVIATIONS USED IN THE TEXT FIGURES

BO	Basioccipital	PAL	Palatine
bo.t.	basioccipital tubera	p.f.	pineal foramen
car.for	carotid foramen	PMX	Premaxilla
ECT	Ectopterygoid	PO	Postorbital
EO	Exoccipital	PP	Preparietal
EPT	Epipterygoid	PRF	Prefrontal
F	Frontal	PRO	Prootic
f.m.	foramen magnum	PSP	Parasphenoid-basisphenoid complex
f.o.	fenestra ovalis	PT	Pterygoid
IP	Interparietal	pit.f.	Pituitary foramen
J	Jugal	Q	Quadrate
L	Lacrimal	QJ	Quadratojugal
l.f.	labial fossa	SMX	Septomaxilla
MX	Maxilla	SQ	Squamosal
N	Nasal	ST	Stapes
OP	Opisthotic	u.c.	upper canine
P	Parietal	v	Vomer