

# A new reptile from the lower Permian of Brazil (*Karutia fortunata* gen. et sp. nov.) and the interrelationships of Parareptilia

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## Character modifications and deletions

**Postorbital posterior process shape in lateral view:** Slender, anteroposterior length is at least twice its dorsoventral width (0); increased width, length is less than twice its width (1). (Macdougall et al. 2017 #21, Modified from deBraga & Reisz 1996 #14). The character was deleted. A posterior process of the postorbital is not always clearly defined and its delimitation is subjective in most taxa in this study.

**Premaxillary dorsal process:** Broad, narial opening faces predominantly laterally (0); narrow, narial opening faces anteriorly (1). (Macdougall et al. 2017 #28; deBraga & Reisz 1996 #1). This character was modified. The new character considers the orientation of the external naris regardless of the premaxillary dorsal process thickness (character 28).

**Region of skull posterior to the orbit, anteroposterior length:** Equals anteroposterior extension of orbit (0); shorter than anteroposterior extension of orbit (1); longer than anteroposterior extension of orbit (2). (Macdougall et al. 2017 #47; Modified from Laurin & Reisz 1995 #32). The character was deleted. This character is problematic because several parareptiles (e.g. procolophonoids, bolosaurids, nycteroleters) possess greatly enlarged orbits, a condition that is strongly correlated with the states considered herein. The posterior extent of the orbits is already represented by character (52).

**If dermal sculpturing is present, it is in the form of:** tuberosities (0); round pits (1); honeycomb pattern of ridges and pits (2). (Macdougall et al. 2017 #54; Modified from Laurin & Reisz 1995 #38). This character has been replaced by new characters (182) and (183) that consider additional states.

**Snout shape:** broad, wider mediolaterally than tall dorsoventrally and nasal primarily on dorsal surface of skull (0); taller than wide, nasal contributes to lateral surface of snout (1). (Macdougall et al. 2017 #175; Benson 2012 #3). The modified character does not take into consideration the position of the nasal: broad, wider mediolaterally than tall dorsoventrally (0); taller than wide (1). (Character 173). Accordingly, it was rescored in *Bashkyroleter* spp. and *Nycteroleter*.

**Maxilla:** lateral surface orientation: vertical or slopes weakly dorsomedially (0); slopes dorsolaterally, overhanging tooth row (1). (Macdougall et al. 2017 #176; Benson 2012 #21). The character was redefined: not overhanging tooth row (0), overhanging tooth row (1). The definition is more inclusive, now considering dentition that is inset from the maxillary wall (e.g. procolophonids).

## New characters

**(177) Premaxilla contribution to lower margin of external naris in lateral view:** nearly half of the margin or more (0); minimal or absent (1).

**(178) Greatly enlarged tooth on premaxilla:** absent (0), present (1). “Greatly enlarged” is here defined as being at least 100% taller than the remaining teeth in the bone.

**(179) Septomaxilla:** Curled in external naris (0), forming a sagittal wall that contacts the nasal (1), forming a sagittal wall, no nasal contact (2), splint-like, confluent with skull roof, no sagittal wall (3), absent (4). (Modified from Modesto 1994 #8, Reisz et al. 2009 #10).

**(180) Snout length:** calculated as the ratio between the anteroposterior length of the antorbital region and the anteroposterior length from the anterior border of the orbit to the posterior edge of the skull roof at the midline: Snout “long” (ratio  $\leq 1$ ) (0); snout “medium” (ratio  $>1 \leq 1,5$ ) (1); snout “short” (ratio  $>1,5 \leq 2$ ) (2); snout “very short” (ratio  $>2$ ) (3).

**(181) Fluting on upper marginal teeth:** absent (0), present (1).

**(182) Pits on skull roof:** absent (0), or present (1).

**(183) Ridges on cranial roof sculpturing:** anastomosed (including 'honey-comb pattern') (0), weak or absent (1), radiating from ossification centres, not anastomosed (2).

**(184) Orbit exposure predominantly:** laterodorsal (0), lateral (1), dorsal (2).

**(185) Vomerine dentition:** shagreen-like/multiple tooth rows (0), concentrated along one or a double anteroposterior ridge (1), absent (2).

**(186) Palatine dentition:** shagreen-like/multiple tooth rows (0), concentrated along one diagonal ridge (1), absent (2).

**(187) Postfrontal morphology in dorsal view:** pseudo-rectangular (0), trirradiate (1), thin and elongated, with a main oblique axis (2), strongly recurved (3).

**(188) Postfrontal posterior border:** does not reach the pineal foramen (0), contacts or falls within level of pineal foramen (1), surpasses posterior border of pineal foramen (2).

**(189) Posterolateral edge of skull roof:** protruding, spine-like (0), does not protrude (1).

**(190) Occiput:** low (0); high (1). “High” is when the ratio of max. vertical dimension between ventral surface of quadrate condyles to dorsal surface of posterior border of the skull roof at midline (postparietals or parietals) divided by the maximum transversal dimension between quadrate condyles is equal or larger than 0,5.

## References

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