

ON SOME CRANIAL FEATURES OF THE LIVING ASIAN GENERA OF
THE FAMILY RHINOCEROTIDAE (MAMMALIA : PERISSODACTYLA)

S. CHAKRABORTY

Zoological Survey of India, Calcutta

TWO TEXT-FIGURES

ABSTRACT

Based on the material present in the Zoological Survey of India, a comparative study of the cranial features of the two living Asian genera, *Rhinoceros* Linnaeus and *Dicerorhinus* Gloger, of the family Rhinocerotidae, has been made. The genus *Rhinoceros* is distinguished from *Dicerorhinus* chiefly by having united post-glenoid and post-tympanic processes, very deep fronto-parietal sulcus and shorter orbitonasal length than orbitoaural length. Most of the cranial differences between the two genera may be attributed to the number of horn present.

INTRODUCTION

Rhinoceroses, the only living representatives of an once important group of odd-toed hoofed mammals, have attracted the attention of scientists for a long period by their massive built, one or two horns on the top of long low skulls, short and stumpy legs, thick skin thrown into deep folds giving the appearance of being covered with rivetted plates of armour, and alleged bad temper. Voluminous works have been accumulated on the ecology, populations, life-cycle and osteology of these curious animals. The skull being important in the study of phylogeny, special attention on their cranial features were paid by Blyth (1862), Flower (1876, 1880), Carter and Hill (1942), Colbert (1942), Pocock (1944, 1945, 1946), Finlayson (1950), Groves (1967), and several others. While examining the skulls of this group present in the Zoological Survey of India collection, it was found that the previous descriptions regarding cranial features of the two living Asian genera of Rhinocerotidae are not complete; and that some of the characters are often subject to individual variations. An attempt has, therefore, been made to study afresh and compare the cranial features of the genus *Rhinoceros* Linnaeus with that of the genus *Dicerorhinus* Gloger, the only two living Asian genera of Rhinocerotidae.

The genus *Dicerorhinus* is represented in Asia by a single living species *D. sumatrensis* (Fischer), and the genus *Rhinoceros* by *R. unicornis* Linnaeus and *R. sondaicus* Desmarest.

MATERIAL AND METHOD

Eighteen unsexed skulls present in the Zoological Survey of India collections, as detailed below, have been examined:

<i>Dicerorhinus sumatrensis</i>	6 adults, 1 juvenile
<i>Rhinoceros unicornis</i>	5 adults, 1 juvenile
<i>Rhinoceros sondaicus</i>	5 adults

All measurements have been taken with a pair of spreading calipers and expressed in centimetres. The following measurements have been taken. (Abbreviations used in the Table 1 are given in parentheses):

(1) Occipitonasal length (*Onl.*): From the anterior tip of the nasal to the back of the occiput.

(2) Zygomatic width (*Zw.*): Maximum width between the zygomatic arches.

(3) Naso-occipital length (*No.*): From the anterior tip of the nasal to the tip of the occipital.

(4) Orbitoaural length (*Oa.*): From the anterior edge of the orbit to the point immediately behind the auditory orifice.

(5) Orbitonasal length (*On.*): From the anterior edge of the orbit to the tip of the nasal.

(6) Depth of the fronto-parietal sulcus (*Dfp.*): Maximum depth of the fronto-parietal sulcus from the naso-occipital plane.

(7) Infraorbital width (*Iw.*): Minimum distance between the two infra-orbital foramen.

(8) Suprabasioccipital length (*Sb.*): Maximum distance between the supra- and basioccipital bones lining the foramen magnum.

(9) Exoccipital length (*Ex.*): Maximum distance between the two exoccipital bones lining the foramen magnum.

OBSERVATIONS

The skull of *Rhinoceros* is large, robust, stout and has rough, spiculated nasal area, while in *Dicerorhinus* it is relatively small, narrow and with less spiculated nasal area.

In *Rhinoceros* the occipital surface has a tendency to incline forward at the upper end while in *Dicerorhinus* it is not so (Text-fig. 1). As a result the naso-occipital length in relation to the occipitonasal length is less in the former genus than in the latter (Table 1).

The fronto-parietal sulcus is very deep in *Rhinoceros*, the concavity of the upper surface of the skull being nearly double that of *Dicerorhinus* (Text-fig. 1). This concavity in relation to the naso-occipital plane is on an average 6.1 cm in *R. unicornis* and 5.7 cm in *R. sondaicus*, as against 3.5 cm in *D. sumatrensis* (Table 1).

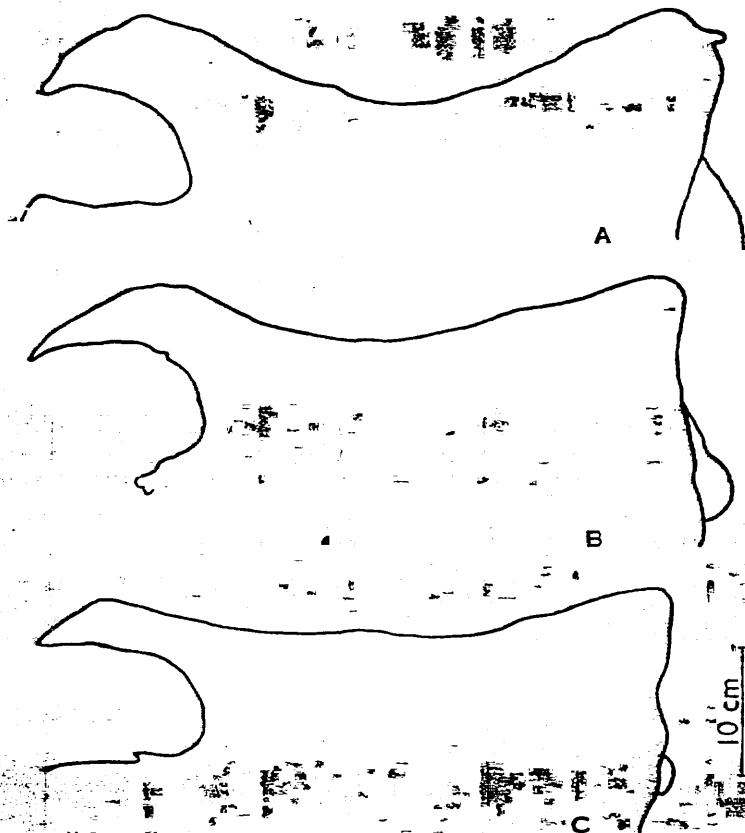
In *Dicerorhinus*, the frontal area is thickened and enlarged while the parietal

CRANIAL FEATURES OF ASIAN RHINOCEROCES

TABLE 1.—Cranial measurements of three living Asian species of *Rhinocerotidae*.

Species	Onl.	No.	No. as % of Onl.	Zw.	On.	Oa.	Iw.	Iw. as % of Onl.	Dsp.	Sb.	Ex.
<i>R. unicornis</i>	57.5-62	51-7-56 (53)	88%-90% (89%)	34.3-36 (35)	25.2-28.2 (27)	30-32.6 (31.2)	9.5-10.5 (10)	16%-17% (16.6%)	5-7 (6.1)	4.5-5.2 (4.6)	5-5.7 (5.2)
<i>R. sondaicus</i>	54.8-59.5	50.8-54.2 (51.6)	89%-91% (90.6%)	34.1-37.2 (35.2)	24.5-27.5 (25.6)	27-28.3 (27.7)	8.6-10.2 (9.5)	17.8%-18.4% (18.3%)	4.4-6.2 (5.7)	4.4-9 (4.3)	4.6-5.1 (4.8)
<i>D. sumatrensis</i>	52.5-7.4	50.1-56.7 (52.8)	96.8%-98.7% (97.7%)	26.7-29 (28)	24.8-29.8 (27.2)	23.1-26 (25)	10.2-11.2 (10.5)	19.6%-20.4% (20%)	2.2-4.2 (3.5)	3.9-4.9 (4.4)	3.7-4.1 (3.8)

* Figures in parenthesis indicate mean values.



TEXT-FIGURE 1.—Lateral view of skulls of rhinoceroses showing inclination of occipital surface and depth of fronto-parietal sulcus. A, *Rhinoceros unicornis*; B, *Rhinoceros sondaicus*; C, *Dicerorhinus sumatrensis*.

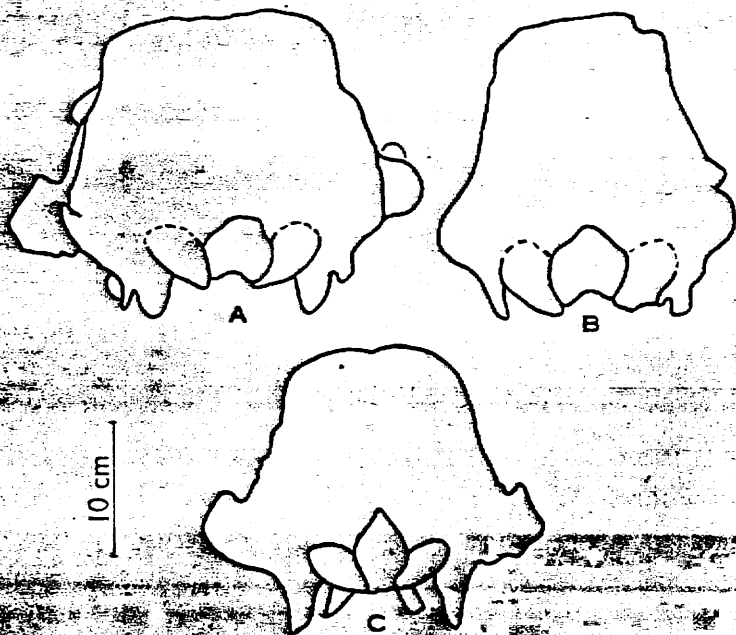
is reduced. The reverse of these is true for *Rhinoceros*. As a result, the orbitonasal length which includes the frontal, is greater than the orbitoaural that includes the parietal in *Dicerorhinus*, but lesser in *Rhinoceros* (Table 1). In correlation to this, the muzzle of *Dicerorhinus* is relatively broader and stouter than that of *Rhinoceros*. The infraorbital width in relation to occipitonasal length is, therefore, greater in *Dicerorhinus* than in *Rhinoceros* (Table 1). The zygomatic arch is very wide and expanded in both the genera, but more so in *Rhinoceros*. The average zygomatic width of *Dicerorhinus* is about 28 cm while it is about 35 cm in *Rhinoceros*.

In *Rhinoceros*, the post-glenoid and post-tympanic processes of the squamosal unite below the auditory meatus to form a closed channel, but in *Dicerorhinus* these two processes do not unite.

The foramen magnum in *Rhinoceros* is nearly triangular, while in *Dicerorhinus* it is somewhat pear-shaped with the upper end abruptly produced into a narrow prolongation (Text-fig. 2). In a specimen of *R. sondaicus*, however, it is like that of *Dicerorhinus*. As a result of the upward prolongation of the foramen magnum, the suprabasioccipital length in *Dicerorhinus* is always greater than the exoccipital length, but in *Rhinoceros* the former is either equal to or less than the latter (Table 1).

DISCUSSION

Most of the differences in the cranial features between the two genera of Rhinocerotidae may be attributed to the number of horn present. The greater development of the frontal region in relation to the parietal in *Dicerorhinus* is to support and bear the second horn in that region, which is not at all necessary in one-horned *Rhinoceros*. The lesser depth of the fronto-parietal sulcus in *Dicerorhinus* is due to much thickened frontal bone. This thickening is also to give extra strength for bearing the second horn. The slight prominence at the site of the second horn, a little anterior to the centre of the conjoined frontal



TEXT-FIGURE 2.—Posterior view of skulls of rhinoceroses showing the shape of foramen magnum.
A, *Rhinoceros unicornis*; B, *Rhinoceros sondaicus*; C, *Dicerorhinus sumatrensis*.

bone, has been regarded as a diagnostic feature of *Dicerorhinus* by Flower (1876). However, this is present only in three out of seven specimens of my material of *Dicerorhinus*.

Formation of the closed sub-aural channel in *Rhinoceros* by the union of the post-glenoid and post-tympanic processes of the squamosal was first noted by Flower (1876). As stated above these two processes remain free in *Dicerorhinus*. From the observation of a number of skulls of *Dicerorhinus*, however, Pocock (1945, p. 438) stated that 'in a youngish adult ♂ skull from Mogok, Upper Burma.....the channel at its lower end is about 15 mm wide, whereas in an old ♂ from Mount Ophir, Malay Peninsula.....it is only 2 mm wide. Possibly in some old skulls, post-tympanic and post-glenoid processes may meet and close the channel for a short distance'. But from an examination of the material at my disposal, it is found that even in the oldest skull of *Dicerorhinus* with all the teeth greatly worn out, these two processes remain widely separated from one another. This character may, therefore, be regarded as the most important distinctive cranial feature between the two genera. The significance of the union of these two processes in *Rhinoceros* is not understood.

ACKNOWLEDGEMENTS

My sincere thanks are due to the Director, Zoological Survey of India, for providing facilities for this work. I have great pleasure in expressing my indebtedness to Dr B. Biswas for encouragement, many valuable suggestions and for critically going through the manuscript.

LITERATURE CITED

- BLYTH, E. 1862. A memoir on the living Asiatic species of *Rhinoceros*. *J. Asiat. Soc. Beng.*, 31 : 151 - 157.
- CARTER, T. D. and HILL, J. E. 1942. Notes on the Lesser One-horned Rhinoceros, *Rhinoceros sondaicus*. 1. A skull of *Rhinoceros sondaicus* in the American Museum of Natural History. *Am. Mus. Novit.*, (1206) : 1 - 3.
- COLBERT, E. H. 1942. Notes on the Lesser One-horned Rhinoceros, *Rhinoceros sondaicus*. 2. The position of *Rhinoceros sondaicus* in the phylogeny of the genus *Rhinoceros*. *Am. Mus. Novit.*, (1207) : 1 - 6.
- FINLAYSON, H. H. 1950. Notes on the cranial and dental characters of a specimen of *Rhinoceros sondaicus* Desm. *Proc. zool. Soc. Lond.*, 120 : 151 - 154.
- FLOWER, W. H. 1876. On some cranial and dental characters of the existing species of *Rhinoceros*. *Proc. zool. Soc. Lond.*, 443 - 457.
- FLOWER, W. H. 1880. On the skull of a Rhinoceros. *Proc. zool. Soc. Lond.*, 69 - 70.
- GROVES, C. 1967. On the rhinoceroses of south-east Asia. *Säugetierk. Mitt.*, 15 : 221 - 237.
- POCOCK, R. I. 1944. The premaxillae in the Asiatic rhinoceroses. *Ann. Mag. nat. Hist.*, (11) 11 : 834 - 842.
- POCOCK, R. I. 1945. Some cranial and dental characters of the existing species of Asiatic rhinoceroses. *Proc. zool. Soc. Lond.*, 114 : 437 - 450.
- POCOCK, R. I. 1946a. External and cranial characters of some rare Asiatic mammals recently exhibited by the society. *Proc. zool. Soc., Lond.*, 115 : 310 - 318.
- POCOCK, R. I. 1946b. A sexual difference in the skulls of Asiatic rhinoceroses. *Proc. zool. Soc. Lond.*, 115 : 319 - 322.