

## On a Rhinocerotid Skull from Isa, Yamaguchi Prefecture, Japan

By

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On June 15, 1966, some fossil specimens of rhinocerotid skull were found by K. FUJIHARA of the Ube Kōsan Company at a limestone quarry of the Company at Isa, Yamaguchi Prefecture. OKAFUJI observed the stratigraphy of the site. Hitherto some fragmental fossils were found from the limestone fissure deposits at Ikumo, Atō-chō, Abu-gun, Yamaguchi Prefecture and at Kuzuū, Tochigi Prefecture; this is the second record of upper jaw with cheek teeth series in fine preservation. In 1967, Dr. H. OZAKI brought the specimens to the National Science Museum, Tokyo for study and the two senior writers could describe them under the permission of the authorities of the Company.

The specimens in question were found from a limestone fissure deposit at a site 70 m above ground surface and the fissure is 80 m long, 15 m wide and trends N 50°W. The deposit is composed of red, brown and yellow clay. In 1958, *Panthera youngi* (PEI), *P. cf. pardus* (L.) and *Stegodon orientalis* OWEN were found from the red clay of the Lower Isa bed at the same quarry. The rhinocerotid specimens now on hand may have also been derived from the same bed. Here the writers extend their cordial thanks to Messrs. N. UCHIDA and K. FUJIHARA for their kind help and generosity. Also their gratitude are due to Dr. H. OZAKI.

### ***Dicerorhinus nipponicus* SHIKAMA, sp. nov.**

(Pl. 1, figs. 1, 2; Pl. 2)

1953 *Rhinoceros cf. mercki* JAGER, NAGASAWA. Jour. Geol. Soc. Jap., vol. 59, no. 694, p. 326.

1961 *Rhinoceros* sp. NAGASAWA. Trans. Pal. Soc. Jap., N.S., no. 42, pp. 63-67, textfigs. 1-3.

Type: Right upper jaw with cheek teeth (P4-M3) and left horizontal ramus with roots of cheek teeth (P4-M3) stored at the Ube Kōsan Company in Isa, Yama-

guchi Prefecture.

Locality: Isa quarry of the Ube Kōsan Company, Isa-chō, Mine-shi, Yamaguchi Prefecture.

Horizon: Lower Isa bed; Middle Pleistocene.

### Description

#### *Upper jaw.*

Bones very hard, well lithified, filled with and covered partly with calcareous brown hard clay. Palate and buccal surface of middle part of skull exposed, which is cracked and bearing many cleavages. Maxilla, lachrymal, large part of frontal and anterior part of jugal arch preserved, while premaxilla, nasal and squamosal not preserved. Upper jaw as preserved 281 mm long and 206 mm high. Anterior free margin of maxilla 80 mm long, corresponds with posterior margin of narial opening. There is a small foramen (infraorbital foramen) just behind the upper half of the free margin. The foramen oval formed and  $22 \times 13$  mm.

Surface of maxilla uneven, a little swollen at the portion anterior of jugal arch and undulated at alveolar sheath. Surface of the bone partly broken, greyish white with light brown tint. Maxilla seems to be relatively large. Although suture between maxilla and frontal-lachrymal is rather ambiguous, posterior margin of maxilla not much bent forward.

Frontal largely preserved before postorbital process and the surface may be a little rugose. Dorsal margin broken in lateral view. Postorbital process small and projected downward although damaged. Jugal arch preserved anteriorly runs posterior-dorsalward moderately and anterior margin widest; lower margin of arch curved more distinctly than upper one. Lachrymal sublanceolate with gently curved posterior margin and much convex anterior margin. Orbit suboval with longer axis of anterior-dorsal to posterior-ventral direction. When the skull restored, margin of anterior frontal may be not much inflated upward but nasal may project eminently forward. Dimensions are as follows:

Maximum height of maxilla .....	208 mm
Length of maxilla at alveole .....	275
Ditto at infraorbital foramen .....	134
Width of lachrymal at middle height .....	31+5
Height of lachrymal .....	66.8
Vertical width of jugal arch .....	92
Ditto of posterior margin as preserved .....	55
Length of jugal arch as preserved along lower margin ..	190
Height of orbit at anterior of postorbital process .....	89.2
Length of orbit as preserved at middle height .....	80

Length of palate as preserved .....	241
United length of cheek teeth at alveole .....	236

*Upper cheek teeth.*

Six teeth from P2 to M3 preserved closely set in alveole. P2 much broken and M2 partly broken but the other teeth all fine in preservation. Teeth moderately worn and grinding surface developed.

P2 very small and its anterior and posterior portions much broken; also upper portion of inner surface of root eminently cracked. Posterior inner corner of enamel wall preserved with a small median groove. Grinding surface of dentine irregularly trigonal. Postfossette oval with antero-posterior longer axis. Prefossette larger than wide, irregularly undulated with anterior portion of quadrate outline and two posterior valleys; crochet narrow, long and projected posteriorly. Crista very small.

P3 subquadrate in crown view, wider than long with relatively straight anterior and posterior margins; outer margin undulated and median portion of inner margin a little depressed retaining a basal portion of medifossette. At anterior inner corner of enamel wall, there is running a narrow fossa between anterior wall and basal ingulum (parastyle) which is almost straight but without tubercles. Postfossette small, subtrigonal and becomes wider posteriorly. Prefossette concave backward, wider than long, and posterior wall eminently undulated. Crochet broad and carries two obtuse projections. The fossette runs from posterior inner to anterior outer direction.

P4 similar to P3 in general outline, subquadrate in crown view, wider than long but almost as wide as long at grinding surface. Both anterior and exterior margins almost straight but posterior margin slightly and inner margin much undulated. Inner crown wall wide and bent inward. Postfossette subtrigonal and becomes wider posteriorly. Medifossette distinct and prefossette deep and runs from posterior inner to anterior outer direction. Crochet distinct, broad but short. There is a blunt ridge running between anterior and posterior portions of ectoloph; the former larger than the latter. Protoloph larger than metaloph. Also there are a narrow fossa and a basal cingulum (parastyle) with many tubercles on the anterior inner corner of crown.

M1 subquadrate in crown view, longer than wide at grinding surface and with undulated margins. Anterior outer corner much projected forward. A ridge between anterior and posterior portions of ectoloph tolerably sharp and the former much larger than the latter. Postfossette suboval, becoming wider posteriorly and a little opened at posterior margin of crown. Medifossette well developed, narrow, deep and undulated. Crochet large and blunt, while crista small and semicircular. Prefossette spatulate and deep. At the anterior inner corner of crown wall, there are a small fossa and a basal cingulum with many tubercles. Metaloph curved and

smaller than protoloph which is lanceolate, becoming narrower exteriorly. Anterior lobe of inner enamel wall larger than posterior one. In antero-posterior view, grinding surface of dentine much depressed at the middle. Tip of posterior outer lobe very acutely projected, while that of anterior one not so much projected as that of posterior and rather close to anterior end of enamel wall.

M2 largest of all teeth, subquadrate and longer than wide with moderately curved four margins. Anterior outer corner of crown wall eminently projected anteriorly and divided into two small lobes by shallow fossa. Protoloph largely broken but retaining basal cingulum with tubercles and a shallow fossa on its anterior margin. Metaloph rather small, narrow, elongate quadrate and running from posterior inner to anterior outer direction. Postfossette subtrigonal in crown view, widely opening backward and deepest at inner side of crochet, which is lanceolate and acutely projected forward and attaching posterior wall of protoloph. Crista very small and acute. Medifossette distinct and widely opened inward. General aspect of outer enamel wall resembles that of M1. Tip of posterior outer lobe acutely projected.

M3 trigonal in crown view, wider than long, with gently curved outer margin and undulated inner and anterior margins. There is no postfossette. Medifossette eminent, very wide, deep and with large tubercles on entrance of the fossette. Grinding surface of dentine V-shaped with distinct crochet which is trigonal and acutely projected forward. There are two small and narrow cristae. Metaloph small, narrow and curved forward, while protoloph elongate quadrate and running straight transversally. Anterior outer corner of enamel wall projected forward but not so much distinct as that of M2; it is also divided into two small lobes. Parastyle eminent with many uneven tubercles, and fossa between it and enamel wall rather deep and undulated. Inner enamel wall of protoloph broad and much sloped inward, while that of metaloph narrow and almost vertical to alveole. In outer view anterior and posterior ends of ectoloph acutely projected and median portion of ectoloph much depressed.

Dimensions are as follow:

	P2	P3	P4	M1	M2	M3
Maximum length of crown	22.2	40.4	43.6	53.2	56.6	32.2 mm
Length at inner crown base	21.5	30.5	32.6	38.4	40.6	50.0
Ditto of outer base	23.4±	36.4	37.2	45.7	50.4	53.4
Maximum width of crown	27.6+	42.7	54.4	58.2	58.2	41.5
Maximum height of crown						
at inner side	—	20.2	21.4	17.8	17.5±	20.2
Ditto at outer side	—	39.1	34.4	29.4	39.4	35.6

*Lower jaw.*

Two fragments of left lower jaw preserved but much broken and all cheek teeth retaining their roots only set in alveole. Anterior fragment corresponding to horizontal ramus 144 mm long, 55.2 mm wide and 82.7 mm high at inner side. It carries roots of P4, M1 and M2 which are set closely to inner side of ramus. Posterior fragment 131 mm long, 55.9 mm wide and 107.2 mm high at anterior outer portion. It is posterior end of horizontal ramus and basal portion of ascending ramus; at anterior end root of M3 retained in situ. When two fragments are joined, ramus in outer view elongate subquadrate as preserved; lower margin of ramus almost straight while upper margin gently bent forward. Basal portion of ascending ramus narrower than horizontal ramus.

*Lower cheek teeth.*

P4, M1, M2 and M3 only preserved in their roots set in alveole. Roots of P4 consist of anterior and posterior ones; the former small and trigonal, while the latter elongate sandglasslike; they are closely set with each other. Roots of M1 also consist of anterior and posterior ones which are set separately from each other. Both elongate sandglasslike and inner half of anterior one oblong and large. Roots of M2 known by anterior one and anterior alveolar wall of posterior one. Anterior one large and sandglasslike in outline. Roots of M3 known by posterior one which is small and sandglasslike in outline. Dimensions are as follows:

	P4		M1		M2	M3
	A	P	A	P	A	P
Maximum length as preserved	10.9	9.5	18.3	10.0	15.8	— mm
Maximum width as preserved	12.6	23.3	27.2	27.0	31.3	20.4

**Consideration**

In general aspect of skull, *Atelodus*, *Ceratorhinum*, *Diceros* or Tertiary rhinocericid such as *Diceratherium* or *Chilotherium* are all excluded from comparison. In that aspect, *Dicerorhinus choukoutiensis* WANG may be nearest to this species, but orbit and maxilla are higher in this species than in *D. choukoutiensis*. *D. yunchuchensis* CHOW is distinguished by its narrower maxilla and much bending jugal arch and orbit. *D. mercki* JAGER from Europe is separated by quadrate outline of M3 and insufficient crochet and crista. This species is also reported from Choukoutien Loc. 1 and Nihowan. M2 reported by CHIA and CHAI from Chihcheng, Hopei under the name of *D. mercki* is larger sized and carries antecrochet and better developed crochet, though rather allied to this specimen in general outline. *D. sinensis* OWEN from the *Stegodon-Ailuropoda* fauna of S. China is also separated by larger teeth and simple

construction of metaloph with deficient or lack of crochet-crista in M3. The distinct tubercle on entrance of medifossette in M3 may be characteristic to this species. *D. choukoutiensis* is also distinct by lacking the tubercle and crista in M3. Upper cheek teeth of *D. palaeosinense* RINGSTRÖM are smaller and more complicated in construction of crown. M3 of *Coelodonta* is clearly distinguished from that of this species by its far more complicated construction of crown. *Rhinoceros sondaicus* DESM. is distinguished by narrower maxilla, larger and more bent jugal arch, and more simple construction of M3 crown, etc. Be that as it may, this species is new although nearest to *D. choukoutiensis* WANG.

In 1961, NAGASAWA reported a right upper jaw with P3-M2 in situ and broken P2 and M3 and a detached upper right P2 from the Ogano quarry, Kuzuü, Tochigi Prefecture, under the name of *Rhinoceros* sp. The general outline of teeth and aspect of fossette, crochet, crista and ectoloph, etc. are similar to those of this specimen, although dimensions of each tooth do not precisely coincide to those of this specimen. Probably the both specimens belong to the same species. NAGASAWA, comparing it with *R. mercki* from Choukoutien and *D. sinensis* from Szechwan, regarded it to be a closely related species with the Choukoutien *R. mercki*, though he included *D. choukoutiensis* into *D. mercki* following the opinion of Teilhard de CHARDIN.

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**Explanation of plates 1-2****Plate 1**

*Dicerorhinus nipponicus* SHIKAMA, sp. nov.

Fig. 1. Right outer side of skull ( $\times 1/2.6$ )

Fig. 2. Occlusal side of ditto ( $\times 1/2$ )

**Plate 2**

*Dicerorhinus nipponicus* SHIKAMA, n. sp.

Right mandible of holotype ( $\times 1/3$ )

Fig. 1. Occusal side.

Fig. 2. Buccal side.

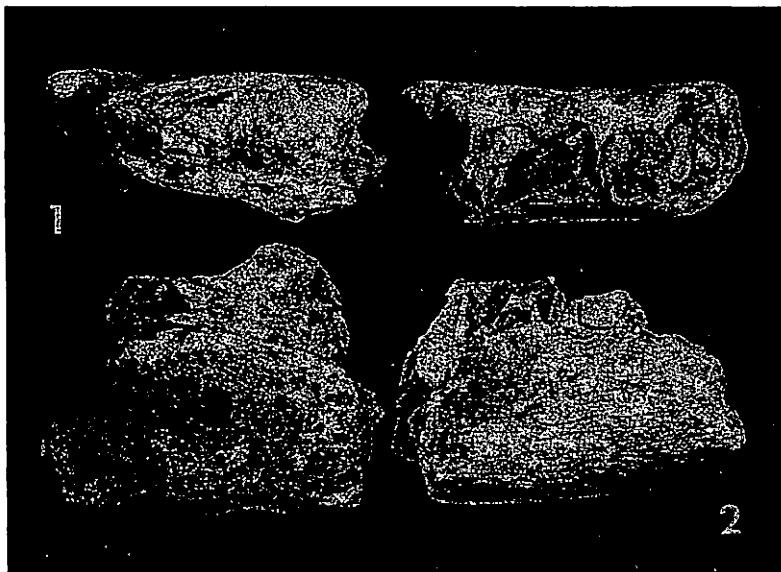




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