

## Redescription and Neotype Designation of *Pelochelys bibroni* from Southern New Guinea (Testudines: Trionychidae)

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**ABSTRACT.** – The type material of *Pelochelys bibroni* is no longer in existence, and the type locality (“Australian”) is possibly in error. *Pelochelys bibroni* is one of the most wide-ranging of freshwater turtles, distributed from India to China and to New Guinea. Up to the present it has been treated as a single species. However, since geographic variation is recognizable (at least populations of *Pelochelys* in southern New Guinea are distinctive), it is prudent to designate a name-bearing type specimen. A neotype designation restricts the name *P. bibroni* to the distinctive population in southern New Guinea, geographically the closest to the alleged original type locality. All other populations of *Pelochelys*, including mainland Asiatic forms, are referred to *P. cantorii* Gray, 1864, pending further study. *Pelochelys bibroni* is redescribed and compared with the population of *P. cantorii* in northern New Guinea.

**KEY WORDS.** – Reptilia; Testudines; Trionychidae; *Pelochelys bibroni*; *Pelochelys cantorii*; Chitra; turtle; taxonomy; neotype description; geographic variation; Indonesia; Papua New Guinea

The Asiatic giant softshell turtle, *Pelochelys bibroni* (*sensu lato*), is widely distributed in southeastern Asia from India to southern China (including Hainan), the Philippines, south through Thailand and Vietnam into Malaysia, western Indonesia (including Java and Borneo), and New Guinea (Iverson, 1992; Rhodin et al., 1993). The populations in New Guinea, as currently understood, are apparently isolated with no documented localities in the Indonesian archipelago between Borneo and New Guinea. Only one living species of *Pelochelys* (*P. bibroni*) is currently recognized. I concur with Farkas (1992) who regarded the recently described *P. taihuensis* (Zhang, 1984), based on living and subfossil material from Zhejiang Province, China, as a synonym of *Rafetus swinhoei*.

*Pelochelys bibroni* occurs in the rivers and associated lakes of both southern and northern New Guinea. These populations are largely separated by the east-west trending Central Highlands, but they may meet in the isthmus area south of Geelvink Bay in western Irian Jaya. Recent study of New Guinea *Pelochelys* indicates substantial morphological differentiation between the northern and southern populations. Rhodin et al. (1993) reviewed and supplemented information on the distribution of *Pelochelys* in Papua New Guinea, described the differences in color pattern between the northern and southern populations, and suggested that the two forms differed taxonomically. The relationships of the two New Guinea taxa to Asiatic mainland populations are under study by the author; the data are not yet sufficient to warrant definitive taxonomic conclusions but indicate significant differences between some populations. For purposes of this report only the New Guinea populations are treated in any detail. In view of this geographic variation, it is necessary to allocate the name *Pelochelys bibroni* (*sensu stricto*) to a specific geographic population and to

restrict its type locality. As described below, the original type material of *P. bibroni* is lost and its original type locality possibly in error.

### Original Holotype of *Pelochelys bibroni*

The original description of *Pelochelys bibroni* (as *Trionyx (Gymnopus) bibroni* Owen, 1853) was based on a skull and other skeletal parts (numbers 954–959 and 1093–1094) of one specimen that is considered the holotype. The specimen was housed with the osteological collections in the Hunterian Museum of the Royal College of Surgeons of England (RCS). Elizabeth Allen (RCS, Hunterian Museum, *in litt.*) related that many of the RCS specimens, especially in the osteological series, were destroyed in 1941 during the bombing of London in World War II, that some surviving comparative anatomy and osteological specimens were transferred to the British Museum of Natural History (BMNH) in the late 1940s and 1950s, and that she is “fairly certain the chelonid types did not survive.” Anders G.J. Rhodin (*pers. comm.*), who visited both the Hunterian Museum and the BMNH in London in March 1995, made a special but unsuccessful effort to search out the missing holotype. The holotype of *P. bibroni* is thus apparently no longer in existence.

Owen (1853) provided no figure and reported no original measurements of the holotype, but Baur (1891) subsequently recorded some measurements of its skull: preorbital arch (from nasal opening to orbit), 7.5 mm; interorbital arch, 11 mm; and postorbital arch, 14 mm. The skull of the holotype of *P. bibroni* is estimated to have had an approximate basicranial length of 75 mm (extrapolated from data for other *Pelochelys* skulls). Descriptive comments confirm its identification as a specimen of *Pelochelys*, as currently

understood. Smith's (1930) comparison of the type of *Pelochelys cantorii* Gray, 1864 (stuffed, plastral length, 215 mm. with skull removed, basicranial length, 55.5 mm. from the Asiatic mainland), with Owen's type of *P. bibroni* (skull and bony carapace "of a somewhat larger individual") did not elicit any differential comments, and he regarded the two taxa as synonymous.

#### Original Type Locality of *Pelochelys bibroni*

The type locality of *Pelochelys bibroni* was originally described as "Australian" (Owen, 1853:185). Although of possible occurrence in northern Australia, owing to the well-known estuarine and occasional marine habits of *Pelochelys* (Rhodin et al., 1993), the species is as yet unrecorded there. The scant fossil trionychid material from Australia is not referable to *Pelochelys* (Gaffney and Bartholomai, 1979), although definitive generic allocation remains uncertain (Gaffney, 1991).

The holotype of *P. bibroni* was received by the Royal College of Surgeons (RCS) from Captain Sir James Everard Home (1798–1854). He was the son of Sir Everard Home (1756–1832), a prominent surgeon and pupil of John Hunter. Home, as a captain in the Royal Navy, commanded the HMS *Racehorse* and toured coastal waters of North America, the West Indies, and South America in the years 1834–1837, and was in China (Shanghai River) in July 1842 (Chinese specimens were sent by Home to the RCS in 1844). The RCS records do not indicate Home having been in Australia (E. Allen, *in litt.*). However, in Home's obituary, the Earl of

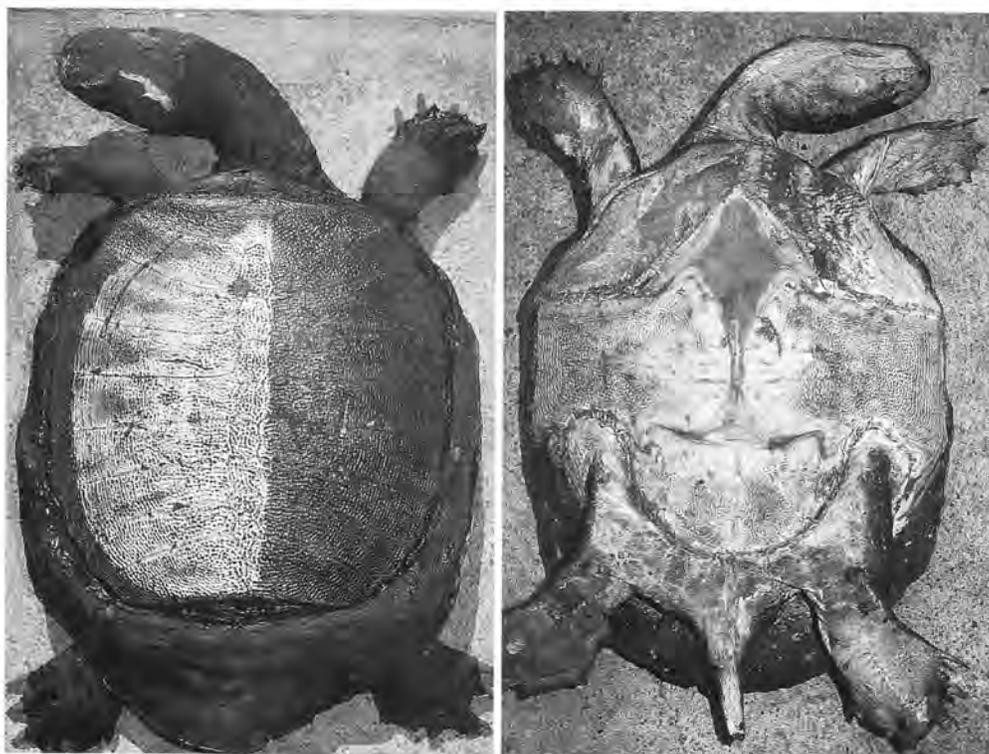
Ellesmere (1854) noted that Home died at Sydney and mentioned "services he had rendered to the colony while stationed in its waters." The original type locality of "Australian," coupled with Home's activities in Australia in his later years, provides at least circumstantial evidence that the holotype may have indeed come from Australia, or from nearby New Guinea, as suggested by Bourret (1941: "mais devent venir plutôt de Nouvelle-Guinée"). Gray (1864, 1870) stated that "it is not unlikely that the specimen [holotype] was obtained from Singapore," a possibility not supported by any data.

Since the holotype of *P. bibroni* is no longer in existence and its history suggests that its provenance may have been either northern Australia or nearby southern New Guinea, the neotype designation below restricts the type locality to southern New Guinea.

#### Neotype Designation and Type Locality Restriction

##### *Pelochelys bibroni* (Owen, 1853) Bibron's Giant Softshell Turtle

*Neotype.*— A large adult female from the Laloki River, Astrolabe Range, 40 miles [ca. 65 km] from its entry into Redscar Bay (9°20'S, 147°14'E), Central District, Papua New Guinea, consisting of AMS 3425, stuffed; AMS 3426, viscera, including ovaries and eggs in fluid; and AMS 131315 (recatalogued), skull with lower jaw and hyoid apparatus. The neotype, the first *Pelochelys* reported in the



**Figure 1.** Neotype of *Pelochelys bibroni*, Laloki River, Central District, Papua New Guinea. Dorsal and ventral views of AMS 3425, stuffed adult female (total carapace length, curvature, about 600 mm. photographs by A.G.J. Rhodin).



**Figure 2.** Neotype of *Pelochelys bibroni*. Dorsal, ventral, and close-up views of skull (AMS 131315) of same animal as Fig. 1 (basicranial length, 133 mm).

literature from New Guinea (Waite, 1903), is the only preserved large adult of *P. bibroni* (*sensu stricto*) known to me. Waite (1903) noted the circumstances of capture on 3 September (probably 1902), reporting that Anthony Musgrave sent the neotype (that had died 10 September) from Port Moresby to Sydney. Musgrave in Waite (1903) noted that "A.C. English kindly preserved the skin," and that he "superintended the preservation of all the contents of the ovary." Waite (1903) noted that "the external parts were in good condition, the cervical, pelvic, caudal and limb bones had been removed; the skull had fortunately been preserved." He provided brief descriptive comments, an illustration of the plastron (schematic outline drawing), and measurements received from Musgrave when the neotype was alive (weight, 68 lbs [= 31 kg]). Waite did not mention any color pattern features.

The large stuffed female (AMS 3425) (Fig. 1), seemingly long-forgotten when recently discovered in a warehouse, was totally covered in black soot and grease until partly cleaned (A.G.J. Rhodin, *in litt.*). The dorsal soft body parts are still blackened and without visible pattern. The skin covering the bony carapace has been removed on the left side where eight neurals are visible, but it is brownish on the right side with faded paler bands and markings barely visible; small pale markings are more distinct on the black, posteriormost leathery part of the carapace. The total leathery carapace length (now dried and shrunken, measurements by A.G.J. Rhodin, original measurements by Waite, 1903, in parentheses) along the curvature is about 608 (650) mm, the straight-line length of the bony disk 420 (420) mm, and the width of the bony disk 437 (425) mm. The plastral length is about 420 mm (Waite, 1903).

The skull (AMS 131315) (Fig. 2), which also bears the original number S.888 (= old skeletal collection), has a basicranial length of 133.2 mm and is discussed below in more detail.

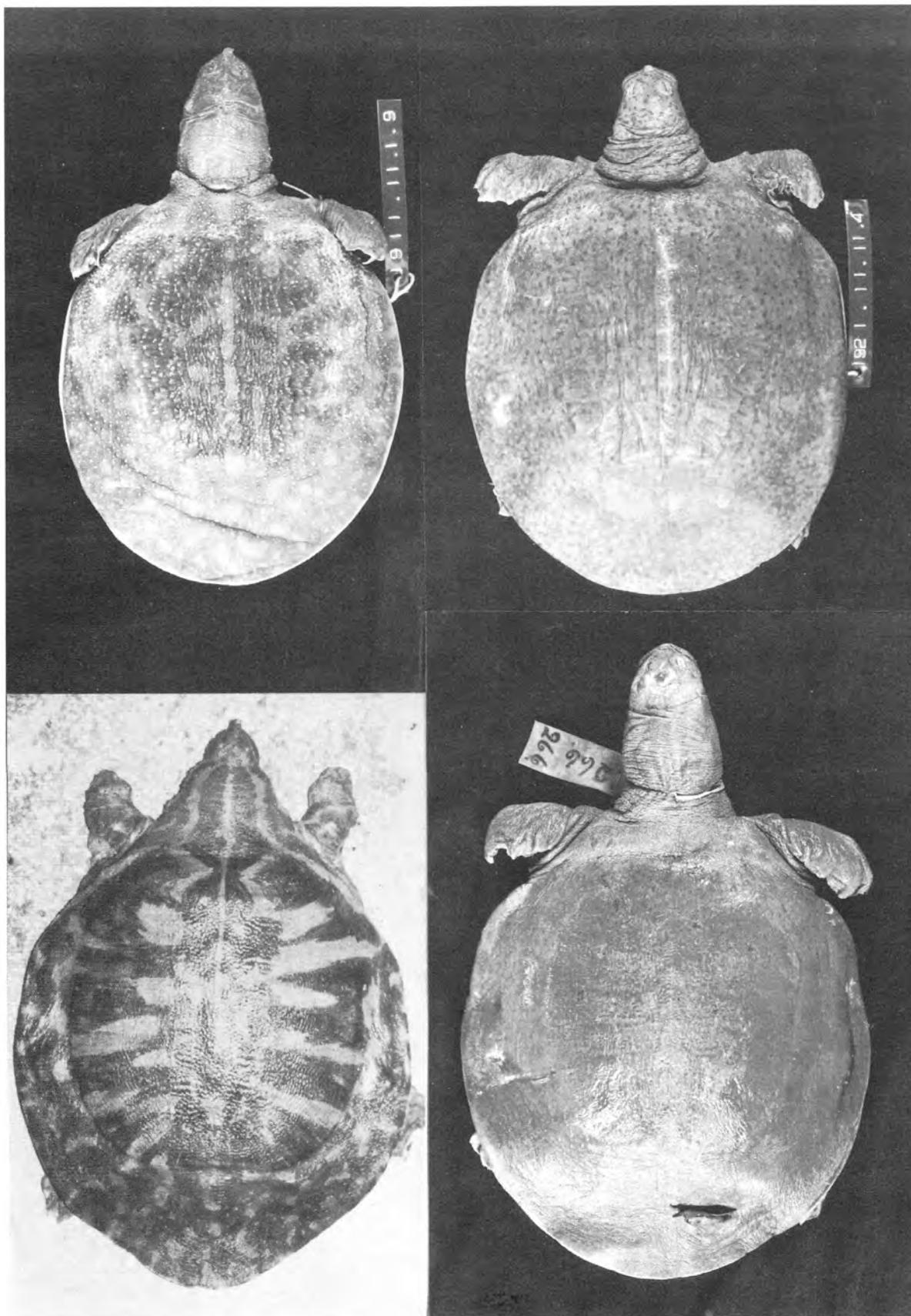
#### Description of Restricted *Pelochelys bibroni*

*External Features.* — Juvenile features of pattern and tuberculation are based on AMS 14558 (color photographs), BMNH 1911.11.1.9, MCZ 120354, and UF 49425. Adult patterns are based on specimens of which color photographs are available but which are not represented by voucher specimens. All specimens are from southern New Guinea. Measurements of the carapace are maximal along the curvature of the entire leathery carapace.

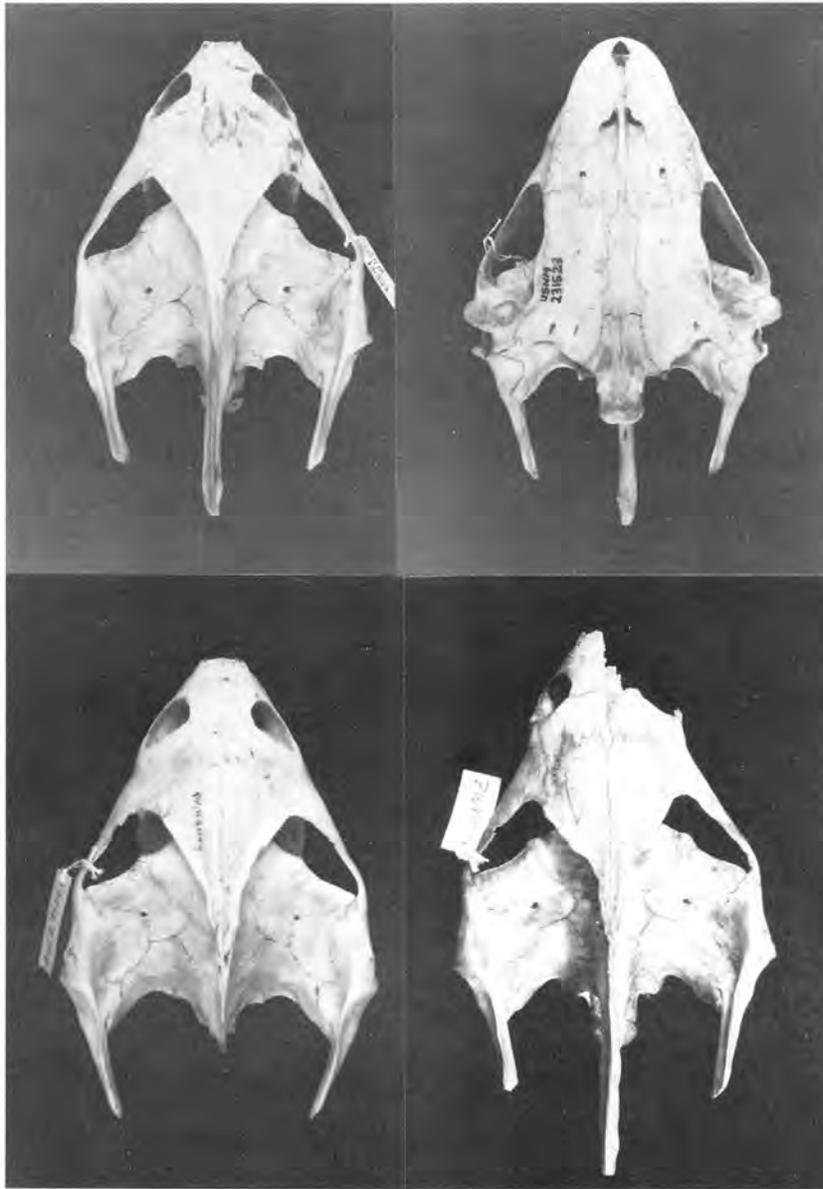
Juveniles of *P. bibroni* are patternless with a rough-textured, tuberculate carapace, whereas adults are brightly patterned with yellow neck stripes and a smooth carapace with yellow markings.

Hatchlings and small turtles probably are uniformly pale brown, since the smallest specimen (MCZ 120354, carapace length 83 mm, plastral length 62 mm) has a uniformly brownish carapace, except for some pale marginal spots posteriorly and two dark blotches at the rear of the head. A slightly larger specimen (BMNH 1911.11.1.9, carapace length 105 mm, plastral length 77 mm, Fig. 3) is overall brownish but shows the advent of the adult pattern. In this BMNH specimen the top of the head is dotted with dark brown. The upper lips have some dark brown markings mixed with a few pale markings on a pale brown background. The lower lips, chin, and throat have an irregular pale and dark, spotted and marbled pattern (mixed with a few dark brown marks); this pattern (most intense on the chin) is less distinct on the underside of the neck. The integument is corrugated, mostly pleated and furrowed in the parietal-interorbital region, and tuberculate on the snout (at magnification 10x). The top of the head is mostly dark brown; the rear of the head and neck have alternating, longitudinal pale and dark areas (the incipient striped pattern of adults). Limbs are brownish and not conspicuously patterned. The carapace has a narrow, pale yellow rim that lacks a sharply defined inner border. The carapace is pale brownish but has scattered pale marks (oblong, roundish, irregular shape) that form a subdued pale and dark marbled pattern. Pale spots (best observed under fluid) occur in some places. Plastral surfaces are whitish and unmarked. Another similar-sized specimen (AMS 14558, carapace length 107 mm) lacks a carapace pattern and has indistinct dark blotching on the rear of the head. A larger specimen (UF 49425, carapace length 200 mm, plastral length 155 mm) seems to be abnormally darkened (ground color near black) with the carapace lacking the narrow yellow rim and having only subtle pale areas as observed under fluid. Dark pigment obscures the neck pattern posteriorly, although dark blotches are present at the rear of the head.

Young of *P. bibroni* have prominent tubercles on the carapace as well as fleshy appendages at the base of the neck



**Figure 3. Left:** *Pelochelys bibroni* – **upper:** BMNH 1911.11.1.9, Setakwa River, Irian Jaya, Indonesia, carapace length 105 mm; **lower:** no voucher specimen, photograph by A.G.J. Rhodin [AGJR P-353], Lake Murray, Western District, Papua New Guinea, carapace length 770 mm. **Right:** *Pelochelys cantorii* – **upper:** BMNH 1921.11.11.4, Wanggar River, Irian Jaya, Indonesia, carapace length 111 mm; **lower:** UMMZ 68808, Wanggar River, Geelvink Bay, Irian Jaya, Indonesia, carapace length 174 mm.



**Figure 4.** Skulls of *Pelochelys bibroni*. **Upper:** dorsal and ventral views of USNM 231523, Balimo, Aramia River, Western District, Papua New Guinea (basicranial length 119 mm). **Lower: left,** dorsal view of LSUMZ 44754, Agu River, Western District, Papua New Guinea (basicranial length about 110 mm); **right,** dorsal view of LSUMZ 44755, Komovai, Fly River, Western District, Papua New Guinea (basicranial length about 130 mm).

and on the adjacent soft body parts. Soft, pliable, some flat (not conical), equilateral to isosceles-shaped tubercles occur posteriorly on the dorsal and lateral surfaces of the neck, extending onto the anterior surface of the forelimbs (absent distally). Other scattered integumental appendages, mostly on the side of the neck and between the base of the neck and insertion of the forelimb, are elongate and vermiform (Winokur, 1982). These soft, pliable, fingerlike structures interdigitate with low, rounded tubercular prominences of varying size along the anterior part of the carapace. These close-set, wartlike, circular or ovoid to elongate tubercles may have blunted tips subdivided into two or more tines. The entire carapace is rough-textured to touch owing to this tuberculate integument. These tubercles are loosely arranged in linear fashion and are reduced in size or absent

along the lateral edges of the carapace, especially posteriorly. The larger tubercles that cover the bony disc tend to be coalesced into longitudinal ridges. The posterior part of the carapace is adorned with minuscule, close-set tubercles that anteriorly are interspersed among the larger tubercles. [This description of tubercles is based on a magnification of about 10–15x]. These aspects of tuberculation are present in turtles at least as large as 200 mm in carapace length (UF 49425) but are lost with increasing size and are absent in adults.

Large adults of *P. bibroni* have prominent patterns of yellow or buff longitudinal stripes on the neck and irregular markings on the carapace and limbs. The preserved condition of AMS 3425 (see discussion of neotype) precludes a thorough assessment of its color pattern. The pattern of adults is based on two large turtles from Western District,

Papua New Guinea, depicted in color photographs (no voucher specimens, photographs by A.G.J. Rhodin and P.M. Hall); carapace lengths of these turtles are 770 and 410 mm (the former is illustrated here in Fig. 3, and in Rhodin et al., 1993, Fig. 7; a color photograph of this living specimen is also on the front cover of *Chelonian Conservation and Biology*, Volume 1, Number 1). Dorsal soft body parts and carapaces overall are dark brown to blackish. The carapaces appear smooth, except for low tubercles in the nuchal region and on the adjoining skin of the neck. Patterns on the neck and carapace generally are continuous. The carapaces have narrow yellow edges and irregular patterns of distinct radiating yellow or buff markings, the largest on the central disc. Limbs are marked with yellow. The rear of the head has anastomosing yellow stripes that continue posteriorly on the neck as prominent vertebral and paravertebral stripes. The vertebral stripe may continue onto the anterior part of the carapace. The paravertebral stripes may continue onto the anterolateral edges of the carapace. A lateral neck stripe may be present. Ventral surfaces are white and unpatterned.

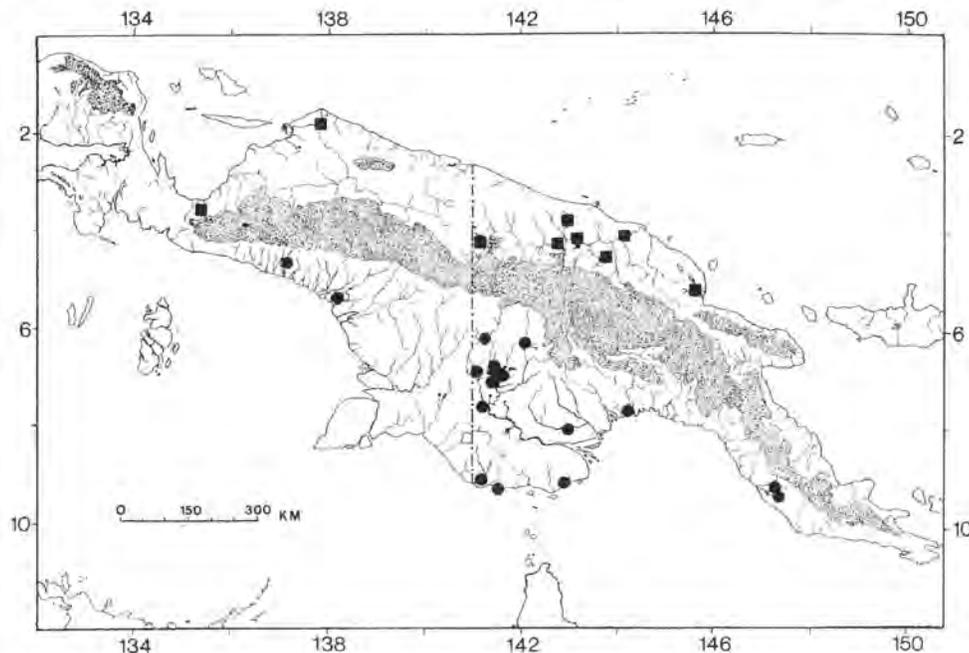
Two photographs of another large *P. bibroni* are reproduced in Whitaker et al. (1982). Jones (1950) commented on a large specimen from the Laloki River "three feet long and two feet wide" but did not mention pattern features; however, his accompanying photograph (dorsolateral view of only the anterior portion) partly shows the characteristic neck markings.

The antebrachial scalation ("scales" on the anterior surface of the forelimb) along the upper margin consists of two completely smooth scales and a proximal smooth, but partly cusp-edged, scale; vertical cusp-edged scales along the lower margin are usually absent in *P. bibroni* (one on both forelimbs in UF 49425).

The leathery carapace of both young and adult *P. bibroni* is generally circular, the length slightly exceeding the width (Fig. 3). The carapace width-length ratios of the AMS, UF, MCZ, and BMNH juvenile specimens mentioned above are respectively 90, 90, 92, and 93%. The leathery carapace length of the largest known specimen of *P. bibroni* (Komovai, near Obo, Fly River, Papua New Guinea; no voucher specimen) was 1020 mm (Rhodin et al., 1993).

**Skulls.** — Of four skulls of *P. bibroni* only one (USNM 231523, recorded as female, Fig. 4), including the lower jaw, is complete. The skull of the neotype (AMS 131315, female, Fig. 2) lacks zygomatic arches and a small part of the articulating surface of the right quadrate; the alveolar surfaces of both upper and lower jaws are covered by the epidermal rhamphotheca. In two other skulls, one (LSUMZ 44754) lacks a supraoccipital spine, most of the occipital condyle, and the articular surfaces of the right quadrate; the other dark-stained, larger skull (LSUMZ 44755, Fig. 4), with accompanying lower jaw, lacks the right side of the snout and tip of the left squamosal. Terminology follows Gaffney (1979) and Meylan (1987).

The skulls are widest posteriorly at the level of squamosal flaring just behind the otic cavity (AMS 131315, LSUMZ 44755) or at the level of the articulating surfaces of the quadrates (USNM 231523). The premaxilla is present in AMS 131315 but is absent in the other two skulls in which this region is preserved (a small medial maxillary notch in LSUMZ 44754 suggests loss of the premaxilla during skull preparation). The maxillae are in contact above the premaxilla. All these skulls have vomer–prefrontal contacts resulting from V-shaped struts of the vomer. The upper and lateral margins of the apertura narium externum are straight (not emarginate). Low, blunted, longitudinal ridges occur on



**Figure 5.** Map of island of New Guinea (broken line separates Papua New Guinea to the east and the Indonesian province of Irian Jaya to the west), neighboring islands, and parts of northern Australia. The Central Highlands are shaded above the approximate 1000 m (3281 ft) contour. Locality records are noted for *Pelochelys bibroni* in southern New Guinea (circles) and *P. cantorii* in northern New Guinea (squares).

each maxilla of the USNM skull. The broad crushing surfaces of the maxillae are mostly flat, gradually sloping from the slightly elevated, sharp, labial ridges to the primary palate (no longitudinal palatal groove). The vomer either completely separates the maxillae (AMS 131315, LSUMZ 44754) or the maxillae are only in narrow contact anteriorly (USNM 231523). The length of the primary palate exceeds that of the anterior foramen intermaxillaris (which is about 50, 60, and 63% of the length of palate) and the apertura narium internum. The apertura narium internum is reduced, oblong, and diagonal, with the aperture directed mostly posteromedially. The paired foramina palatinum posterius are relatively small (near or at suture with maxillae); these foramina are directed laterally in LSUMZ 44754 and are not visible in overhead view. The paired palatines separate the vomer and basisphenoid; an unusual variant is vomer-basisphenoid contact separating the palatines (USNM 231523, noted by Meylan, 1987). The basisphenoid is broad throughout its length in all four skulls, not markedly constricted. The dorsal surface of the snout (forehead) is relatively flat. The interorbital region may be slightly concave (AMS 131315, LSUMZ 44755). The postorbitals, attenuated posteriorly (with irregular margins), may enter the fossa temporalis and broadly separate the jugals and parietals on the dorsal surface (USNM 231523), or they are either narrowly excluded from, or reach the edge of, the fossa temporalis. The prootics and squamosals are either narrowly separated (dorsal surface) by anterior extensions of the quadrates (LSUMZ 44754, USNM 231523), or these bones are in narrow contact (AMS 131315, left side; LSUMZ 44755). The posteriorly projecting processes of the opisthotics on the underside of the squamosals are relatively short, no more than half the length of the posterior projections of the squamosals. The fenestra postotica is somewhat narrowed, elongate, and unrestricted. The foramen posterius canalis carotici interni is housed between two parallel, horizontal, sharp ridges of the pterygoid just below the lateralmost part of the fenestra postotica. Narrowed indentations or emarginations of the ventral margin of the aperture can be observed in ventral view (both sides USNM 231523, rudimentary on right side LSUMZ 44755). The foramina nervi trigemini are partly restricted (varying degrees) by a descending spur from the dorsal margin. The foramen is completely divided (two apertures) by a complete bony strut on the left side of LSUMZ 44755. Both lower jaws examined (LSUMZ 44754, USNM 231523) have a narrow, rounded mandibular symphysis that is about the same width as the lateral part of each ramus.

The condition of both LSUMZ skulls precludes precise measurements of the basicranial lengths (tip of snout to occipital condyle), which are estimated at 110 mm (LSUMZ 44754) and 130 mm (LSUMZ 44755). Estimated maximal length (tip of snout to tip of supraoccipital spine) of LSUMZ 44755 is 164 mm. The basicranial and maximal lengths of AMS 131315 are 133 and 178 mm and of USNM 231523, 118.8 and 147 mm. Maximal widths are 105.6 mm (AMS 131315), 96.9 mm (LSUMZ 44755), and 94.1 mm (USNM 231523).

*Distribution.* — All records of *Pelochelys bibroni* are from southern New Guinea (Fig. 5), including the Fly River–Lake Murray system, east at least as far as the Brown–Laloki River system (Papua New Guinea), and as far west as the Setakwa River (Indonesia, Irian Jaya). The Central Highlands separate *P. bibroni* from the distinctive population in northern New Guinea. Data for material examined of both taxa are in the Appendix.

## DISCUSSION

### Comparison with *Chitra*

The yellow neck striping and bold, irregular yellow markings on the carapace of adult *Pelochelys bibroni* from southern New Guinea are pattern features that traditionally have distinguished *Chitra* and *Pelochelys*. Indeed, the presence of these patterns in New Guinea trionychid turtles initially suggested their possible identity as *Chitra*. However, other characters distinguish the two genera.

Nasal septal ridges are present in *Pelochelys* but absent in *Chitra*. The arrangement of the "scales" on the anterior surface of the forearms shows some intraspecific variation but differs consistently between the two genera. *Pelochelys* has two completely smooth scales along the upper margin, whereas *Chitra* has only one completely smooth scale (both also have a proximal, partly smooth, cusp-edged scale along the upper margin).

The skulls of *Chitra* and *Pelochelys* are readily separable (Meylan, 1987). The narrow, elongate skull of *Chitra* lacks vomer–prefrontal struts, has a minuscule foramen intermaxillaris (almost absent), and the width of the postorbital arch is at least twice the horizontal diameter of the orbit, reflecting extreme anterior placement of the orbits (Fig. 6).



**Figure 6.** Skull (dorsal and ventral views) of *Chitra chitra* (MCZ 29487, Ratburi [= Mae Klong] River, Thailand, basicranial length 112.4 mm). This same skull (dorsal view) is illustrated in Smith (1931, Fig. 37).

The relatively short and broad skull of *Pelochelys* has vomer–prefrontal struts, a relatively large foramen intermaxillaris, and a postorbital arch about the same width or slightly longer than (but less than twice) the horizontal diameter of the orbit. Three distinctive measurement ratios of skulls readily separate *Chitra* and *Pelochelys* (Fig. 7); ontogenetic change apparently occurs in *Pelochelys* but seems to be negligible in *Chitra*. All skulls used in these analyses are documented in the Appendix.

Furthermore, several aspects of both the upper and lower jaws of *Chitra* differ from those of *Pelochelys*. The alveolar or triturating surface of each maxilla in *Chitra* has a prominent, sharp-edged, continuous, longitudinal ridge posteriorly. This longitudinal ridge is blunted and indistinct (only slightly elevated) anterior to the apertura narium internum. The posterior part of the crushing surface of the maxilla of *Pelochelys* lacks a prominent, sharp-edged ridge. The medial surface of the dentary in *Chitra* has a prominent lingual ridge (Fig. 6), forming a longitudinal, horizontal shelf (best developed in large mandibles) which is indistinct anteriorly in the region of the mandibular symphysis. This sharp-edged ridge is lacking in *Pelochelys*.

In shell characters the anterior edge of the xiphiplastron is entire (excepting the medial and lateral projections) in *Pelochelys*, whereas the anterior edge (more lateral) has short projections or prongs that interdigitate with those of the hypoplastron in *Chitra*. This differentiating plastral feature is illustrated in Siebenrock, 1902 (Fig. 12, *Pelochelys*, and Fig. 18, *Chitra*).

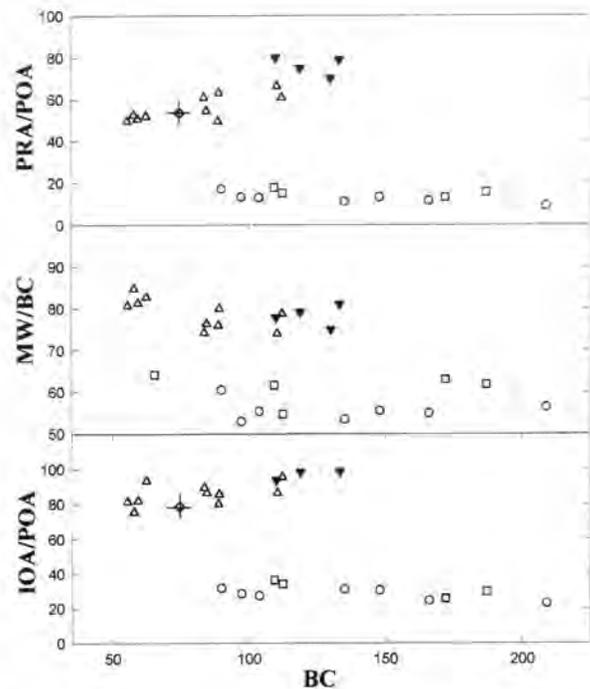
All of the above *Pelochelys* characters are present in the New Guinean material here described as *P. bibroni*.

#### Comparison with Other Populations of *Pelochelys*

*Pelochelys bibroni* in southern New Guinea is distinguished from all other populations of *Pelochelys* in that: (1) large adults have prominent longitudinal yellow stripes on the neck and yellow markings on the carapace, (2) young have scattered, pliable, sometimes vermiform tubercles on the dorsal and lateral posterior part of the neck, and (3) young have a rough-textured carapace with large tubercles, isolated or partly continuous in rows that extend peripherally beyond the bony carapace.

In all other populations of *Pelochelys*, adults have a mostly uniform olive to brownish neck and carapace (no definite pattern), young lack pliable tubercles, vermiform or otherwise, projecting from the posterior neck region, and the juvenile carapace is smooth to touch with continuous ridges only in the area of the bony carapace.

I have above restricted the name *bibroni* to the *Pelochelys* populations in southern New Guinea; therefore, the remaining different populations in northern New Guinea and southeast Asia must be known by another name. The oldest available names are *Pelochelys cantorii* and *Pelochelys cumingii*, both published simultaneously by Gray (1864:90). I choose *P. cantorii* (line priority) as having nomenclatural priority over *P. cumingii*. In addition, *P. cantorii* was de-



**Figure 7.** Measurement ratios ( $\times 100$ ) of skulls of *Pelochelys* (open triangles, *P. cantorii*; solid triangles, *P. bibroni* [largest specimen is neotype]; cross-hatched open square, original lost holotype of *P. bibroni*, BC length estimated), and *Chitra* (circles, *C. indica*; open squares, *C. chitra*). BC = basicranial skull length in mm; IOA = least width of interorbital arch; POA = least length of postorbital arch; MW = maximal width; PRA = least length of preorbital arch.

scribed from Malaysia on mainland southeast Asia, whereas *P. cumingii* was from the Philippines and may represent a different taxon. Günther (1865:108) designated *P. cantorii* as the type species of the genus *Pelochelys*. The name *P. cantorii* had been used for many years as the valid name, until Smith (1930) reverted to the older name, *P. bibroni*. Boulenger's (1889) initial use of *P. cantoris*, and subsequent use by some authors, is considered an unjustified emendation. Thus, *P. cantorii*, with existing holotype (BMNH 1947.3.6.21, stuffed sub-adult, 1947.3.6.22, skull) and type locality (Malacca, Malaysia), is used below in reference to all other *Pelochelys* populations, pending completion of a study of species-wide geographic variation in progress by the author.

#### Comparison with Northern New Guinea *Pelochelys cantorii*

Individuals of *P. cantorii* from northern New Guinea differ markedly from those of *P. bibroni* from southern New Guinea. In juveniles the carapace overall is grossly smooth in texture (but covered with tiny close-set tubercles seen in 20x magnification), except for longitudinal ridges (not large individual prominences) confined to the central bony carapace. The anteriormost part of the carapace is adorned with only tiny, close-set tubercles (no large, wartlike, pliable-tipped tubercles as in *P. bibroni*). The posterior neck region lacks the fleshy, pliable tubercles of *P. bibroni*.

The pattern on the carapace changes with increasing size in *P. cantorii*. Small turtles generally have dark spotted heads and carapaces; the description below is based on BMNH 1921.11.11.4 (carapace length, 111 mm, Fig. 3) and color slides of MCZ 153921 when alive (Rhodin et al., 1993, Fig. 8; small juvenile, no measurements available, now skeletal remains). Dorsal soft body parts and carapaces overall are olive or green-brown. The carapaces have narrow, yellow rims (except anteriorly) and a pattern of scattered, but close-set, small, grayish, dark brown, or black spots and bars; the intervening background pattern consists of a subtle pale-dark interweave that often forms roundish pale spots. The heads, including upper and lower lips, are patterned with small dark brown spots and markings, with few on the chin and throat. A black-spotted pattern at the base of the neck is reduced on the rest of the neck and limbs.

Larger specimens of *P. cantorii* from northern New Guinea lack dark-spotted patterns on the carapace. The smallest (UMMZ 68808, carapace length, 174 mm, Fig. 3) is overall brownish without any definite pattern but with subdued pale-dark shadings. A larger turtle (BMNH 1978.2179, carapace length about 315 mm) is "uniformly brown with very indistinct paler markings" (Andrew Stimson, *in litt.*). The two New Guinea taxa are compared in Figure 3. The ontogenetic pattern change on the carapace in *P. bibroni* (patternless in juveniles and yellow markings in adults) also differs from that in *P. cantorii* in northern New Guinea (dark-marked carapace pattern in juveniles and patternless in adults).

Carapaces generally are circular, the length usually slightly exceeding the width; carapace shape seems not to differ markedly with increasing size. The carapace width-length ratios for three *P. cantorii* (BMNH, UMMZ, BMNH, respectively, mentioned above) are 93, 97, and 102%. Andrew Stimson (*in litt.*) noted that the sides and rear of the carapace of BMNH 1978.2179 are "rather buckled" and that the bony part of the carapace measures 240 mm long and 245 mm wide.

Geographic variation in osteological features, if it exists, cannot as yet be demonstrated. Skulls representative of *P. cantorii* from northern New Guinea are not available. Rhodin et al. (1993) commented on the number of neurals and neural arrangement, noting a modal location at position 5/6 for neural bone reversal in New Guinea *Pelochelys* as compared to position 6 in Asian *Pelochelys* but no differences when comparing the two New Guinea species.

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#### APPENDIX

New Guinea specimens of *Pelochelys bibroni* and *P. cantorii* are listed below, and their localities plotted on the distribution map (Fig. 5). Museum acronyms follow Leviton et al. (1985). Specimens depicted in 35 mm color slides are referenced as "photos." Most records of occurrence in Papua New Guinea are cited in Rhodin et al. (1993), which is here abbreviated as "R-1993."

*Pelochelys cantorii*: **Indonesia, Irian Jaya**: Wanggar River (BMNH 1921.11.11.4, young in fluid, photos-author; Girgis, 1961); Wanggar River, Geelvink Bay (UMMZ 68808, subadult in fluid, photos-author); Mamberamo River (BMNH 1978.2179, large specimen in fluid). Rhodin et al. (1993) commented on an Ouwens (1914) specimen from "North New Guinea" that perhaps came from the Tami River area near Jayapura (not plotted on distribution map). **Papua New Guinea: East Sepik District**: Sepik River drainage at Maprik (MCZ 153921, young, photos-A, Rhodin P-354, now only skeletal parts; Rhodin and Rhodin, 1977, in R-1993); Ambunti region of the middle Sepik River (Cox, 1984, in R-1993); Yentchan and Angoram region of lower Sepik River (R-1993); Yamandin, Gonmai Creek, Karawari River (R-1993). **West Sepik District**: August River near Yapsiei Station [4°32'S, 141°06'E] (AMS 122887, adult in fluid). **Madang District**: Guman, Gogol River, 20 km W Madang [5°14'S, 145°36'E], (R-1993).

*Pelochelys bibroni*: **Indonesia, Irian Jaya**: Lorentz River (De Rooij, 1915); Setakwa River (BMNH 1911.11.1.9, young in fluid, photos-author; Boulenger, 1914). **Papua New Guinea: Central District**: Laloki River, Astrolabe Range, 40 miles [ca. 65 km] from entry into Redscar Bay [9°20'S, 147°14'E] (AMS 3425, neotype, stuffed adult, photos-A, Rhodin, AMS 3426, neotype, soft parts, gonads and eggs, in fluid, AMS 131315, neotype, skull, photos-A, Rhodin and author; Waite, 1903; De Rooij, 1915; R-1993); Laloki River [9°22'S, 147°14'E] (AMS 14558, subadult in fluid; R-1993); Laloki River (Jones, 1950; Whitaker et al., 1982; R-1993); Brown River near [just E.] Port Moresby (R-1993). **Gulf District**: Purari River delta (Liem and Haines, 1977, and Liem, 1983, in R-1993). **Western District**: Kiunga, Fly River drainage (MCZ 120354, young in fluid, R-1993); Baboa, Lake Murray (no voucher specimen, adult, photos-P.M. Hall, R-1993); Fly River area (UF 49425, young in fluid); Agu River, Mipan Village Camp (Wia Wia) on Muk Lake (LSUMZ 44754, skull, R-1993; Komovai, Fly River (LSUMZ 44755, skull, R-1993); Lake Murray (no voucher specimen, adult, photos-A, Rhodin P-353; Rhodin and Rhodin, 1977, in R-1993); Bafimo, Aramia River (USNM 231523, complete skeleton, R-1993);

Delvapare, upper Strickland River (R-1993); Tonda Wildlife Management Area, Bensbach River (Liem, 1977, in R-1993); Tureture (Rhodin and Spring, 1979, in R-1993); near Mari (in sea, between the Mai Kussa River and the Irian Jaya border), and Kaim River, Lake Murray (R-1993). An additional specimen (not examined, UU 10246) seems to be *P. bibroni* based on the "elongate, fingerlike tubercles at the base of the neck" (Winokur, 1982).

Skulls examined of *Pelochelys* and *Chitra* from which data in Fig. 7 are derived are listed below. The NMW and RMNH skulls of *Chitra* are assigned to *C. chitra* on the basis of locality (although data questionable). *Pelochelys cantorii*: AMNH 28341-42 (Hainan), AMNH 139335 (no data), BMNH 1947.3.6.22 (Malaysia, Pinang [holotype of *P. cantorii*]), FMNH 224103 (Malaysia, Perak), FMNH 224104 (Malaysia, Trengganu), MCZ 29489 (Thailand, "Paknampo"), MCZ 29490-91 (Thailand, Mae Klong drainage), RMNH [no number] (Borneo). *Pelochelys bibroni*: AMS 131315 (neotype, Laloki River, Papua New Guinea), LSUMZ 44754-55, USNM 231523 (Fly River drainage, Papua New Guinea). *Chitra indica*: BMNH 1887.3.30.11, 1926.12.16.1, FMNH 224228, SMF 52768-69, ZSI 1776 (India), NMW 163 ("Ganges"). *Chitra chitra*: MCZ 29486-88 (Thailand), NMW 162 ("N. Küste Sumatra"), RMNH 7054 ("Java").

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