

## The identity of *Varanus indicus*: Redefinition and description of a sibling species coexisting at the type locality

(Sauria, Varanidae, *Varanus indicus* group)

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Investigations of Pacific monitors lizards (*Varanus indicus* group, sensu Böhme et al. 1994) from Ambon (the type locality of *V. indicus*) revealed the sympatric existence of two different taxa. Because the holotype of *V. indicus* has to be regarded as lost (Brygoo 1987, Böhme et al. 1994, Sprackland 1994, 1997) the dark-tongued form with an irregularly light spotted dorsum in combination with the lack of a light temporal stripe herein is redefined as *V. indicus*, in accordance with the description of Daudin (1802) and with earlier concepts of *V. indicus*, thus serving the stability of zoological nomenclature, and a neotype is designated. The second form coexisting with *V. indicus* at Ambon and occurring furthermore on Seram, Buru, Obi, the Banda Islands and possibly also on New Guinea could not be referred to any of the other species of the *V. indicus* group known so far, nor to their available synonyms and is therefore described as a new species. *V. cerambouensis*, spec. nov. is characterized by the following character combination: a dark coloured dorsum with a banded pattern; the lack of blue pigmentation; a light temporal stripe; a light, unpatterned throat; a light coloured tongue with an ill-defined dark area on the upper side only in adults; a characteristic juvenile pattern consisting of dark, light-centered ocelli; low scale counts; only unilaterally differentiated paryphasmata on the outer genital organs that further bear more than 20 pointed tips, arranged in two rows at the apex of the inner, bigger hemibacula. We further comment on the systematic relationships and on life habits, habitat and distribution of both *V. indicus* and *V. cerambouensis*, spec. nov. For the first time we record *V. indicus* from Hermit Island (Papua New Guinea) and from the Japanese Bonin Islands.

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### Introduction

Several new species of Pacific monitors (*Varanus indicus* group) have been discovered and/or resurrected in the past few years (Böhme et al. 1994, Böhme & Ziegler 1997, Harvey & Barker 1998, Ziegler, Böhme & Philipp 1999, Ziegler, Philipp & Böhme 1999), so that this clade within the subgenus *Euprepiosaurus* consists now of the following eight *Varanus* species:

*caerulivirens* Ziegler, Böhme & Philipp, 1999 (Halmahera, Moluccas);  
*doreanus* (Meyer, 1874) (New Guinea and some offshore islands including the Aru Islands, North Australia);  
*finschi* Böhme, Horn & Ziegler, 1994 (Bismarck Archipelago, New Guinea and Australia);  
*indicus* (Daudin, 1802) (for distribution range see below);  
*jobiensis* Ahl, 1932 (New Guinea and some offshore islands);  
*melinus* Böhme & Ziegler, 1997 (some islands of the Sula, Banggai and Bowokan island groups: Lemm 1998, Ziegler & Böhme 1999, Bayless & Adragna 1999, Sprackland 1999, Ziegler unpubl.);  
*spinulosus* Mertens, 1941 (some Solomon Islands: Sprackland 1994);  
*yuvonoi* Harvey & Barker, 1998 (Halmahera, Moluccas).

*V. indicus* as the species described first and thus giving its name to the entire species group has by far the widest distribution: it ranges from Sulawesi in the west through the Moluccas, New Guinea and its offshore islands, the Bismarck Archipelago and the Solomon Islands to the Marianas, Caroline and Marshall Islands in the northeast, and reaching the northern coast of Australia in the south (Böhme et al. 1994, Eidenmüller 1997, Bennett 1998, Ziegler et al. in press).

Although Daudin's holotype of *V. indicus* has to be considered lost (Brygoo 1987, Böhme et al. 1994, Sprackland 1994, 1997), this taxon is defined by the combination of an entirely dark tongue and a whitish, unpatterned throat colouration with relatively low scale counts (Böhme et al. 1994): the so-called S (scales around midbody) and XY (transverse rows of dorsal scales from hind margin of tympanum to beginning of hindlegs) values ranging from 106-148\* and 106-155 respectively.

The dorsal pattern of *V. indicus* consists of small, irregularly arranged light spots on a dark background and is subjected to considerable variation over the vast distribution area (e.g. Eidenmüller 1997, Bennett 1998). In regard to genital morphology, *V. indicus* is characterized by a unilateral differentiation of paryphasma rows only, as well in the hemipenes as in the hemiclitores (Ziegler & Böhme 1997). About 11 sharp tips are arranged in one row apically on the inner hemibacula (Ziegler & Böhme l.c.).

In order to reassess the identity of *V. indicus*, we studied material from the type locality Ambon (= Amboine, Amboina), Moluccas, from some neighbouring islands and from various parts of the remaining distribution area.

## Material and methods

We used material from the following collections (in parentheses the respective acronyms): Natuurhistorisch Nationaal museum, Leiden (RMNH); Forschungsinstitut und Naturmuseum Senckenberg (SMF); Zoologisches Forschungsinstitut und Museum A. Koenig, Bonn (ZFMK); Zoologisch Museum, Universiteit van Amsterdam (ZMA); Museum für Naturkunde der Humboldt Universität Berlin (ZMB); Zoologisches Museum der Universität Hamburg (ZMH); Zoologische Staatssammlung München (ZSM); The acronym ZFMK (MZB) means a permanent loan of specimens by the Museum Zoologicum Bogoriense (MZB), Bogor, Indonesia, to the ZFMK.

Corresponding to the works by Brandenburg (1983), Böhme et al. (1994), Böhme & Ziegler (1997), Ziegler, Böhme & Philipp (1999) and Ziegler, Philipp & Böhme (1999), we took the following measurements, proportion indices and scale counts (the RMNH material was assigned by us morphologically in Leiden, the metric/meristic data were taken from Brandenburg l.c.):

### 1. Measurements (in mm):

SVL: snout vent length; D: head neck length (from tip of snout to gular fold); E: body length (from gular fold to cloaca); F: tail length (from cloaca to tail tip); TL: total length; A: head length (from tip of snout to anterior margin of tympanum); B: head width (maximum width between eyes and ears); C: head height (above the eyes); G: distance from anterior margin of eye to posterior edge of nostril; H: distance from anterior edge of nostril to tip of snout; I: distance from anterior margin of tympanum to anterior margin of eye;

### 2. Proportion indices:

1. relative tail length (F : [D + E]); 2: position of nostril between tip of snout and eye (G : H); 9: position of nostril to snout tip ([A - I] : G); 10: relative head length in relation to head width (A : B); 11: relative head length in relation to head height (A : C);

\* The aberrant specimen with an S value of 170 and an XY value of 182 listed by Böhme et al. (1994) proved to be a representative of a new species: *V. caerulivirens* Ziegler, Böhme & Philipp 1999.



Fig. 1. Daudin's figure of *Tubinambis indicus*. Photo: K. M. Philipp.

### 3. scale counts:

P: scales from rictus to rictus; Q: scales around tail base; S: scales around midbody; T: transverse rows of ventral scales from gular fold to beginning of hindlegs; X: transverse rows of dorsal scales from hind margin of tympanum to gular fold; XY: X + transverse rows of dorsal scales from gular fold to beginning of hindlegs; c: supralabials (right + left side); m: scales around neck before gular fold; n: ventrals from tip of snout to gular fold.

Note the slightly different definition of the measurements G and H of Brandenburg (1983), so that his indices 2 and 9 are not fully comparable with ours.

## Results and discussion

Our investigation of topotypic material from Ambon clearly revealed the sympatric existence of two markedly different Pacific monitor taxa, which differ in scalation, colour pattern and in tongue colouration:

**Taxon 1:** Tongue entirely dark pigmented. Temple without a light longitudinal band, but with irregularly set light, roundish spots (occupying the area of 4-6 scales each) instead. Dorsal pattern consisting of small, irregularly arranged light spots that comprise an area of 1-3 scales (exceptionally up to 5) only. Scale counts low.

**Taxon 2:** Tongue light, unpigmented, only in adults the tips of the tongue and a median, ill-defined area following the upper side of the bifurcation tend to become dark. From the lower eye lid to the upper margin of the tympanum a distinct, light, 1-4 scales wide temporal band, which is bordered on its upper and lower margins by dark, unpatterned areas. Dorsal pattern in juveniles consisting of light-centered ocelli, which may comprise 5-12 scales. In adults, a marked tendency to a cross-banded dorsal pattern. Moreover, particularly in the second half of the body and in the first third of tail the light scales are often arranged to form thin, oblique bars. Scale counts considerably increased as compared with taxon 1.



In order to decide on which of these two forms the name *V. indicus* (Daudin, 1802) can be applied – in the absence of the holotype: see above –, we tried to analyze the original description and the accompanying figure. According to Daudin (1802) the ground colour of his *Tupinambis indicus* (snout vent length 43 cm, tail length 53 cm) is basically black. The dorsal parts of neck, body and limbs, as well as of the cylindrical tail base, are covered by numerous whitish, irregularly scattered dots. The ventral side is of a shiny pale-grey. The tail is laterally compressed and bears a weakly expressed double keel on its upper margin. Daudin's (l.c.) description is supplemented by a figure, which we are reproducing here (Fig. 1). The dorsal pattern is drawn as consisting of small, irregularly scattered light spots, each covering an area of 1-2 scales. The head makes an angular impression and is illustrated without patterning. Also the text by Daudin (l.c.) does not refer to a particular head pattern, nor does it refer to the colouration of the tongue.

In view of this description and figure, we think that the less conflicting alternative is to relate Daudin's name to the first of the two taxa identified by us from the type locality Ambon (see above), viz. the dark-tongued form without a light temporal stripe (see also Harvey & Barker 1998), without light oblique body bands and bars and with the lower scale counts (Tab. 1, figs 2-4). This decision does not only fit the earlier concept of *V. indicus* (cf. Böhme et al. 1994), but also serves the main purpose of the ICZN (International Trust for Zoological Nomenclature 1985), which is anchored in its preamble, viz. stability. Therefore we redefine *Varanus indicus* (Daudin, 1802) within the meanwhile eight species of a clade of closely related forms by designating a neotype and supplementing the original description. The sympatric, second taxon occurring at its type locality Ambon and on some other neighbouring islands cannot be referred to any of the other 7 species (besides *V. indicus*) nor can it be identified with any of the available synonyms; therefore it is described below as a new species – the ninth! – within the *V. indicus* group.

### 1. *Varanus indicus* (Daudin, 1802)

Fig. 5

- 1802 *Tupinambis indicus* Daudin, Hist. nat. Rept., 3: 46. – Type locality: "Amboine" = Ambon, Moluccas.  
1831 *Monitor chlorostigma* Gray in Griffith, Anim. Kingd., 9 Synops.: 26. – Type locality: Rawack island, north of Waigeo.  
1883 *Varanus indicus* – Boulenger, Proc. zool. Soc. London, 1883: 386.  
1926 *Varanus indicus rouxi* Mertens, Senckenbergiana, Frankfurt/M., 8: 276. – Type locality: Durdjela, Wammer, Aru islands.  
1929 *Varanus tsukamotoi* Kishida, Lansania, Tokyo, 1: 13. – Type locality: Saipan, Caroline islands.  
1942 *Varanus (Varanus) indicus* – Mertens, Abh. Senckenb. naturf. Ges., Frankfurt/M., 465: 154; 466: 263.  
1985 *Euprepiosaurus rouxi* – Wells & Wellington, Aust. J. Herp. Suppl. Ser. (1): 21.  
1988 *Varanus (Euprepiosaurus) indicus* – Böhme, Bonn. zool. Monogr. 27: 139.

**Types.** Neotype: ZFMK 70650, juvenile, Ambon (3°42'S; 128°10'E), Moluccas, Indonesia; leg. Tropeninstituut, Amsterdam.

**Diagnosis.** *V. indicus* is distinguished from all other members of the *V. indicus* group (*V. caerulivirens*, *V. doreanus*, *V. finschi*, *V. jobiensis*, *V. melinus*, *V. spinulosus*, *V. yuwonoi* and the new species described below) by the following combination of character states: (1) dorsal colour pattern consisting of irregularly scattered, small whitish to yellowish spots, mostly smaller than an area covered by 5 scales, on a dark-brownish or blackish background; (2) absence of a light, dark-bordered postocular/supratemporal stripe; (3) light unpatterned throat; (4) entire dark tongue; (5) low scale counts (S: 106-137, XY: 105-140; n = 36); (6) outer genital organs with unilaterally differentiated paryphasmata only.

#### Description of neotype

Habitus slender. Total length 263 (108+155) mm, length of hindlimb 42 mm. Nostril closer to tip of snout than to eye. Canthal ridge weakly expressed. Nasal region slightly swollen, with a median, longitudinal shallow groove. 6/6 enlarged supraoculars. Scale covering the pineal organ likewise enlarged, irregularly heptagonal with a round whitish blotch in the center. Scales on nape smooth, obliquely oval, gradually passing into the longitudinally oval dorsal scales. These anteriorly smooth, but from the second half of body towards the tail with slight keels. Gular and ventral neck scales smooth, the former being longish-rectangular, the latter roundish-oval. Ventrals slightly keeled, long-

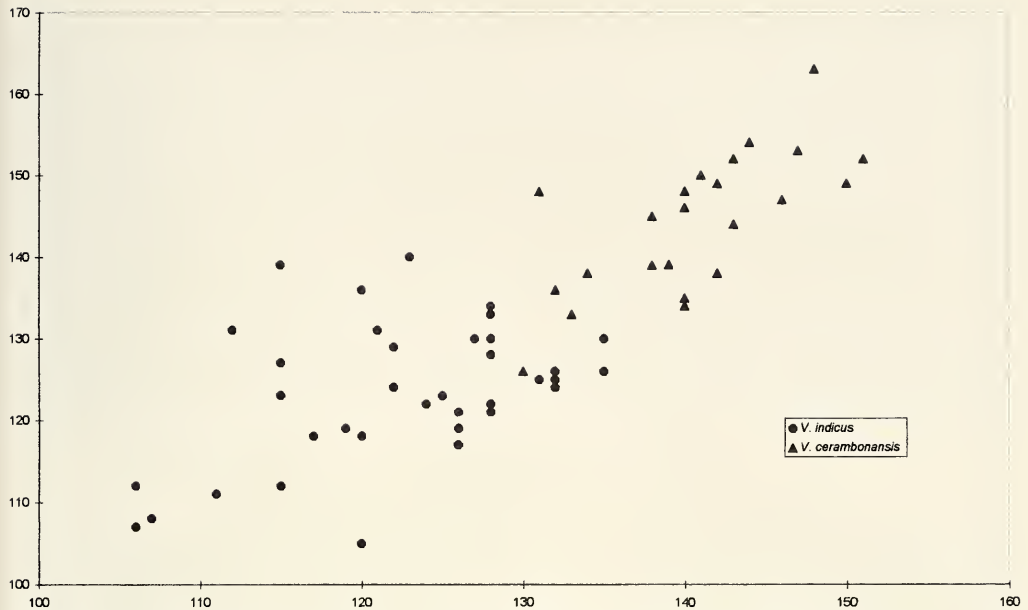


Fig. 2. Scale counts of *V. indicus* and *V. cerambonensis*, spec. nov.; x-axis: S value (scales around midbody); y-axis: XY value (transverse rows of dorsal scales). Same animals as in tab. 1.

ish rectangular. Limbs covered with smooth, roundish-oval scales which may bear slight keels only dorsally. Caudal scales keeled above and below; a ventral oblique row corresponds to two rows of lateral scales – similarly as in the body scales. The two median rows of dorsal tail scales are forming a double crest from the first sixth of the tail backwards. Next to the scales of palms and soles most other scales bear at least the apical pit posteriorly. The head scales have a considerable number of these pits which are scattered over the entire scale. Scale counts, measurements and proportion indices of the neotype are as follows: P: 38, Q: 68, S: 111, T: 82, X: 29, XY: 111, c: 52, m: 79, n: 70, A: 23.6, B: 13.4, C: 19.1, D: 44, E: 64, G: 6.0, H: 4.5; 1: 1.42, 2: 1.33, 10: 1.76, 11: 2.59.

Tab. 1. Comparison of scale counts of *V. cerambonensis*, spec. nov. and *V. indicus* (var: variation, m: mean, s: standard deviation; for other abbreviations see material and methods). For the statistical calculations of *V. cerambonensis*, spec. nov. we used the whole type series and all voucher material listed under further material. For the calculations of *V. indicus* we used the following voucher material, that due to the dark tongue pigmentation, the irregular dorsal pattern, the light unpatterned throat and the lacking of a light coloured temporal stripe could clearly be assigned to *V. indicus*:

RMNH 3151: Rawack; RMNH 3190 a-b: Ternate; RMNH 3800: Batjan; RMNH 7168: Aru Islands; RMNH 21045: Japen; SMF 11584: Aru Islands; ZFMK 19225-26: Aru Islands; ZFMK 70650 (neotype): Ambon; ZMA 10194/11-12: Nort river, Irian Jaya; ZMA 10202: Alkmaar, Irian Jaya; ZMA 11146 C: Ambon; ZMA 15414: Ternate; ZMA 15417: Ternate; ZMB 24869: holl. NG; ZMH R 04728: Hermit Island, PNG; ZMUC R 4266: Bonin Islands, Japan; ZSM 6/1970/43, ZSM 6/1970/49, ZSM 7/1970/224-225, ZSM 15/1970/195, ZSM 15/1970/221-223, ZSM 15/1970/288, ZSM 15/1970/290: all Aird Hill, PNG; ZSM 9/1970/331: Mt. Bosavi; ZSM 10/1970/323 and 328: Kikori, PNG; ZSM 12/1970/78: Papua Golf, PNG; ZSM 14/1970/129: Mt. Bosavi; ZSM 13/1970/113: St. Joseph river, PNG; ZSM 15/1970/315: Port Moresby, PNG.

|                         |     | P      | Q      | S       | T      | X      | XY      | c      | m      | n      |
|-------------------------|-----|--------|--------|---------|--------|--------|---------|--------|--------|--------|
| <i>V. cerambonensis</i> | var | 41-54  | 74-91  | 129-150 | 90-102 | 34-46  | 126-163 | 47-57  | 83-110 | 78-97  |
|                         | m±s | 48±3.9 | 83±4.9 | 140±5.9 | 96±3.1 | 39±3.2 | 145±8.2 | 53±2.7 | 98±7.6 | 86±4.7 |
| <i>V. indicus</i>       | var | 36-46  | 58-85  | 106-137 | 74-107 | 25-41  | 105-140 | 49-56  | 70-94  | 67-92  |
|                         | m±s | 41±2.5 | 76±6.0 | 123±7.9 | 88±6.1 | 34±4.1 | 124±8.7 | 53±1.6 | 82±5.7 | 79±5.5 |



**Fig. 3.** Comparison of dorsal pattern of adult *V. indicus*, above (ZSM 10/1970/1) and *V. ceranbonensis*, spec. nov., below (ZFMK (MZB) 70619 paratype). Photo: K. M. Philipp.

Colour (in preservative): Upper side of head, neck, back, limbs and tail basically dark-brownish/blackish; lower parts whitish-yellowish. Frenal region of head yellowish with dark greyish-brown vertical bars which continue down to the lower jaws. Eyelids whitish-yellowish. Tympanum anteriorly encircled by a whitish-yellowish line. Along the lateral skinfolds of the neck a narrow whitish-yellowish line. Upper parts of neck, back and limbs with numerous small, round spots covering ca. 1-3 scales (exceptionally up to 5), which tend to form irregular oblique rows mostly on the back. Sides of tail in the proximal third with vertical rows of whitish-yellowish roundish spots that increase their size posteriorly and fuse with each other. From the second third backwards the tail bears marked light and dark crossbands. The dark bands, being interrupted by a light stripe each, are approximately as double as wide as the light bands. Lower parts whitish-yellowish, with indistinct light brown crossbars on venter and tail that disappear medially. Throat only marginally with brown bars, medially whitish like the remaining lower side of the neck. No traces of blue colouration detectable. Outer genitals not prepared.





Fig. 4. Comparison of lateral head view of juvenile *V. indicus*, left (ZFMK 70650) and *V. cerambonensis*, spec. nov., right (ZFMK 70651). Photos: K. M. Philipp.



Fig. 5. Neotype of *V. indicus* (ZFMK 70650). Left: dorsal view; right: ventral view. Photos: K. M. Philipp.

**Distribution.** According to Böhme et al. (1994) *V. indicus* is distributed on Sulawesi, the Moluccan islands Morotai, Ternate, Halmahera, Obi, Buru, Ambon, Haruku and Seram, on the Kai Islands and on New Guinea with its offshore islands Salawati, Weigeo, Biak and Japen. Moreover, *V. indicus* occurs on the Bismarck Archipelago islands New Britain, New Ireland and Duke of York, and on the Solomon islands Bougainville (PNG) and Guadalcanal. *V. indicus* is also known from Ysabel Island, Solomons (Sprackland 1994). In the course of our present studies we were able to record true *V. indicus* also from Hermit Island (Papua New Guinea; ZMH R 04728), and from the Japanese Bonin Islands = Ogasawara gunto (ZMUC R 4266). The Bonin record represents the northernmost occurrence of *V. indicus* (and any other Pacific monitor), although in this case an anthropogenic transport cannot be excluded. There is

also a problem as to the occurrence of *V. indicus* on Sulawesi. Boulenger (1885) and Böhme et al. (1994) are listing voucher specimens for this island, however, some Indonesian herpetologists and animal dealers deny such an occurrence (Iskandar & Nio 1996, Yuwono 1998). Finally, the records given by Böhme et al. (1994) and listed above in this paper, were evaluated before the taxonomic recognition of the new species described below. Therefore, some of their Moluccan island records may actually be based on vouchers of this new species. In conclusion, we feel it necessary to continuously evaluate the vast distribution area of *V. indicus*, particularly at its periphery.

**Habitat and life habits.** First field observations unequivocally referring to *V. indicus* have been made by Philipp (1999) in Irian Jaya. The species proved to be rather eurytopic, occupying a wide variety of habitats, being most common in forest types influenced by saltwater: littoral bush, littoral forest and mangrove forest. It was less commonly observed in areas not influenced by saltwater, such as gallery forests or lowland rain forests. *V. indicus* proves to be well adapted to (salt)water, foraging often extremely close to water and fleeing even often into the water. Böhme et al. (1994) stress that *V. indicus* may be also associated with human settlements.

**Systematic relationships.** According to Ziegler & Böhme (1997) *V. indicus* is a member of the subgenus *Euprepiosaurus* (Fitzinger, 1843), above all by the asymmetrical sperm groove of its outer genitals which is highly autapomorphic for this taxon. Within *Euprepiosaurus* the *V. indicus* group (with *V. indicus* as the species described first and thus giving its name to the entire species group) is characterized by the autapomorphic reduced paryphasmata, which are however much more differentiated than in the *V. prasinus* group. The only unilateral development of the parapyphasmata in the outer genitals of *V. indicus*, as well as in those of *V. caerulivirens*, *V. melinus* and of the new species described below is clearly a reduced and therefore derived condition as compared with the bilaterally developed asulcal paryphasmata in the organs of *V. doreanus*, *V. finschi*, *V. jobiensis* and *V. yuwonoi* (see Böhme & Ziegler 1997, Ziegler & Böhme 1997, 1999, Ziegler, Böhme & Philipp 1999, Ziegler, Philipp & Böhme 1999). Furthermore the low scale counts of *V. indicus* have to be interpreted as derived (e. g. Mertens 1942, Böhme et al. 1994). Also the existence of a dark pigmented tongue (Fig. 6) could be interpreted as the derived condition, but further studies concerning possible adaptive influences are still required (see

**Tab. 2.** Measurements and proportion indices of *V. cerambonensis*, spec. nov. Abbreviations see material and methods.

|                  |             | 1    | 2    | 9    | 10   | 11   | SVL | D   | E   | F    | A    | B    | C    | G    | H   |
|------------------|-------------|------|------|------|------|------|-----|-----|-----|------|------|------|------|------|-----|
| ZFMK (MZB) 70617 | Seram       | –    | 1.5  | –    | 1.7  | 2.6  | 409 | 159 | 250 | 575+ | 72.9 | 42.1 | 27.9 | 21.7 | 15  |
| ZFMK (MZB) 70618 | Seram       | 1.7  | 1.6  | –    | 2.1  | 2.7  | 307 | 117 | 190 | 535  | 59.3 | 28   | 21.8 | 17.7 | 11  |
| ZFMK (MZB) 70619 | Seram       | 1.6  | 1.6  | –    | 1.8  | 2.5  | 283 | 113 | 170 | 445  | 55.5 | 30.3 | 22.4 | 17.2 | 11  |
| RMNH 3189        | Seram       | –    | 1.47 | 1.60 | 1.94 | 2.43 | –   | –   | –   | –    | –    | –    | –    | –    | –   |
| ZFMK 70651       | Ambon       | 1.52 | 1.17 | 1.77 | 1.88 | 2.61 | 98  | 41  | 57  | 150  | 23.4 | 11.9 | 8.7  | 5.6  | 4.6 |
| ZMA 11146 A      | Ambon       | 1.60 | 1.25 | 1.73 | 1.83 | 2.75 | 139 | 54  | 85  | 225  | 27.9 | 15.3 | 10.5 | 7.2  | 5.4 |
| ZMB 4848         | Ambon       | 1.49 | 1.40 | –    | 2.30 | 3.06 | 233 | 86  | 147 | 347  | 42.8 | 18.6 | 14   | 11.5 | 8.2 |
| RMNH 3150        | Ambon       | –    | 1.33 | 1.75 | 2.00 | 2.62 | –   | –   | –   | –    | –    | –    | –    | –    | –   |
| RMNH 3152        | Ambon       | 1.51 | 1.22 | 1.71 | 2.17 | 2.63 | –   | –   | –   | –    | –    | –    | –    | –    | –   |
| RMNH 7196        | Ambon       | –    | 1.38 | 1.70 | 1.89 | 2.87 | –   | –   | –   | –    | –    | –    | –    | –    | –   |
| RMNH 7297a       | Ambon       | 1.61 | 1.29 | 1.66 | 2.00 | 2.80 | –   | –   | –   | –    | –    | –    | –    | –    | –   |
| RMNH 7297b       | Ambon       | –    | 1.17 | 1.82 | 2.00 | 2.76 | –   | –   | –   | –    | –    | –    | –    | –    | –   |
| RMNH 7297c       | Ambon       | –    | 1.29 | 1.71 | 2.04 | 2.72 | –   | –   | –   | –    | –    | –    | –    | –    | –   |
| RMNH 7297d       | Ambon       | 1.43 | 1.31 | 1.76 | 2.00 | 2.94 | –   | –   | –   | –    | –    | –    | –    | –    | –   |
| RMNH 7297e       | Ambon       | 1.32 | 1.24 | 1.75 | 2.00 | 2.88 | –   | –   | –   | –    | –    | –    | –    | –    | –   |
| RMNH 7297f       | Ambon       | 1.54 | 1.36 | 1.72 | 2.00 | 2.83 | –   | –   | –   | –    | –    | –    | –    | –    | –   |
| RMNH 7297g       | Ambon       | –    | 1.32 | 1.70 | 1.92 | 2.79 | –   | –   | –   | –    | –    | –    | –    | –    | –   |
| RMNH 7297h       | Ambon       | –    | 1.35 | 1.79 | 2.07 | 2.88 | –   | –   | –   | –    | –    | –    | –    | –    | –   |
| ZMH R 04731      | Banda       | 1.3  | 1.1  | –    | 2.1  | 2.8  | 109 | 44  | 65  | 146  | 23   | 11.2 | 8.2  | 5.3  | 4.7 |
| RMNH 7223        | Buru        | 1.4  | 1.3  | 1.75 | 1.9  | 2.7  | –   | –   | –   | –    | –    | –    | –    | –    | –   |
| ZMA 15416        | Buru        | 1.5  | 1.3  | –    | 2    | 2.8  | 252 | 94  | 158 | 380  | 45   | 22.7 | 16   | 11.4 | 8.8 |
| RMNH 3184        | Obi         | 1.5  | 1.2  | 1.85 | 1.9  | 2.6  | –   | –   | –   | –    | –    | –    | –    | –    | –   |
| ZMB 53470        | “Neuguinea” | 1.4  | 1.2  | –    | 2    | 2.8  | 103 | 42  | 61  | 147  | 22   | 11.2 | 8    | 5.2  | 4.3 |



Böhme et al. 1994, Ziegler, Böhme & Philipp 1999). Also the lack of blue pigmentation especially on the tail of *V. indicus* seems to be derived (Böhme et al. 1994). All voucher specimens that could be unequivocally assigned to *V. indicus* by us are lacking any blue pigmentation in their colour pattern, particularly at the tail. Böhme et al. (1994) and Harvey & Barker (1998) refer to juvenile specimens of *V. indicus* with blue (tail) pigment, however, they do not refer to voucher material. At the moment, we believe that *V. indicus* is generally lacking blue pigment, even in juvenile tails, so that the specimens referred to by the above authors, may be representatives of other species.

However, further investigations including molecular ones are necessary to resolve the exact systematic relationships within the *V. indicus* group.

## 2. *Varanus cerambonensis*, spec. nov.

Fig. 10

**Types.** Holotype: ZFMK (MZB) 70617, adult male, Laimu (3°19'S; 129°44'E), south coast of Seram (= Ceram), Moluccas, Indonesia; lowland rainforest with adjacent gardens; leg. H. Kotter, 41./42. week 1996. – Paratypes: ZFMK (MZB) 70618-619, same locality data as holotype. RMNH 3189, Seram, Papoerik bay, leg. Ludeking 1863; ZFMK 70651, Ambon, leg. Tropeninstitut, Amsterdam; ZMA 11146 A, Ambon, leg. Tropeninstitut, Amsterdam; RMNH 7297 (seven specimens and one head), Ambon, leg. 1866; RMNH 3150, 3152 & 7196, Ambon, leg. S. Müller & H. Macklot 1827; ZMB 4848, Ambon, leg. Martens.

**Diagnosis.** A sibling species of *V. indicus* that can be distinguished from all other members of the *V. indicus* group by the following combination of characters:

- (1) A dark coloured dorsum, lacking any blue elements; (2) banded dorsal pattern in adults;
- (3) dorsal pattern of juveniles consisting of light-centered ocelli (light spots comprise 5-12 scales);
- (4) a light, 1-4 scales wide temporal stripe which is bordered above and below by dark bands; (5) a light, unpatterned throat; (6) lack of blue pigmentation on the tail; (7) entire light-coloured tongue in juveniles, in adults tips of tongue and a median, ill-defined area following the upper side of the bifurcation point dark, indicating an ontogenetic shift of tongue-pigmentation; (8) low scale counts (S: 129-150, XY: 126-163; n = 23); (9) genital organs with only unilaterally differentiated paryphasma

Tab. 3. Scale counts of *V. cerambonensis*, spec. nov. Abbreviations see material and methods.

|                  |             | P  | Q  | S   | T   | X  | XY  | c  | m   | n  |
|------------------|-------------|----|----|-----|-----|----|-----|----|-----|----|
| ZFMK (MZB) 70617 | Seram       | 45 | 90 | 138 | 97  | 38 | 139 | 53 | 88  | 97 |
| ZFMK (MZB) 70618 | Seram       | 41 | 79 | 132 | 94  | 35 | 133 | 54 | 90  | 85 |
| ZFMK (MZB) 70619 | Seram       | 41 | 88 | 129 | 90  | 34 | 126 | 47 | 87  | 82 |
| RMNH 3189        | Seram       | 53 | 91 | 150 | 96  | 35 | 152 | 53 | 100 | 91 |
| ZFMK 70651       | Ambon       | 53 | 85 | 150 | 102 | 41 | 149 | 51 | 96  | 89 |
| ZMA 11146 A      | Ambon       | 51 | 81 | 147 | 101 | 46 | 163 | 50 | 99  | 84 |
| ZMB 4848         | Ambon       | 50 | 86 | 143 | 99  | 34 | 144 | 48 | 89  | 90 |
| RMNH 3150        | Ambon       | 54 | 82 | 142 | 97  | 40 | 138 | 56 | 110 | 86 |
| RMNH 3152        | Ambon       | 51 | 89 | 143 | 100 | 43 | 154 | 55 | 110 | 90 |
| RMNH 7196        | Ambon       | 51 | 88 | 141 | 96  | 43 | 149 | 55 | 96  | 88 |
| RMNH 7297a       | Ambon       | 48 | 89 | 140 | 96  | 38 | 150 | 52 | 105 | 86 |
| RMNH 7297b       | Ambon       | 47 | 81 | 140 | 95  | 40 | 146 | 56 | 100 | 83 |
| RMNH 7297c       | Ambon       | 44 | 78 | 138 | 93  | 42 | 145 | 51 | 108 | 79 |
| RMNH 7297d       | Ambon       | 52 | 85 | 142 | 94  | 40 | 152 | 56 | 104 | 84 |
| RMNH 7297e       | Ambon       | 48 | 80 | 138 | 93  | 40 | 139 | 57 | 104 | 81 |
| RMNH 7297f       | Ambon       | 51 | 79 | 131 | 95  | 38 | 148 | 56 | 101 | 79 |
| RMNH 7297g       | Ambon       | 50 | 87 | 146 | 100 | 38 | 153 | 52 | 105 | 85 |
| RMNH 7297h       | Ambon       | 45 | –  | –   | –   | –  | –   | 55 | –   | –  |
| ZMH R 04731      | Banda       | 49 | 78 | 131 | 96  | 37 | 136 | 52 | 99  | 88 |
| RMNH 7223        | Buru        | 46 | 79 | 145 | 95  | 40 | 147 | 53 | 95  | 78 |
| ZMA 15416        | Buru        | 41 | 74 | 140 | 96  | 34 | 135 | 51 | 83  | 82 |
| RMNH 3184        | Obi         | 43 | 75 | 133 | 93  | 37 | 138 | 57 | 91  | 93 |
| ZMB 53470        | “Neuguinea” | 47 | 82 | 143 | 102 | 42 | 144 | 52 | 103 | 89 |



Fig. 6. Tongue-flicking adult *V. indicus* in its habitat, photographed in Kokas, Irian Jaya, Indonesia. Photo: K. M. Philipp.



Fig. 7. Adult *V. cerambonensis*, spec. nov. in its habitat (Mosso, Seram, Indonesia). Photo: H. Kotter.





Fig. 8. Juvenile *V. cerambonensis*, spec. nov. in its habitat (Seram, Indonesia). Photo: H. Kotter.

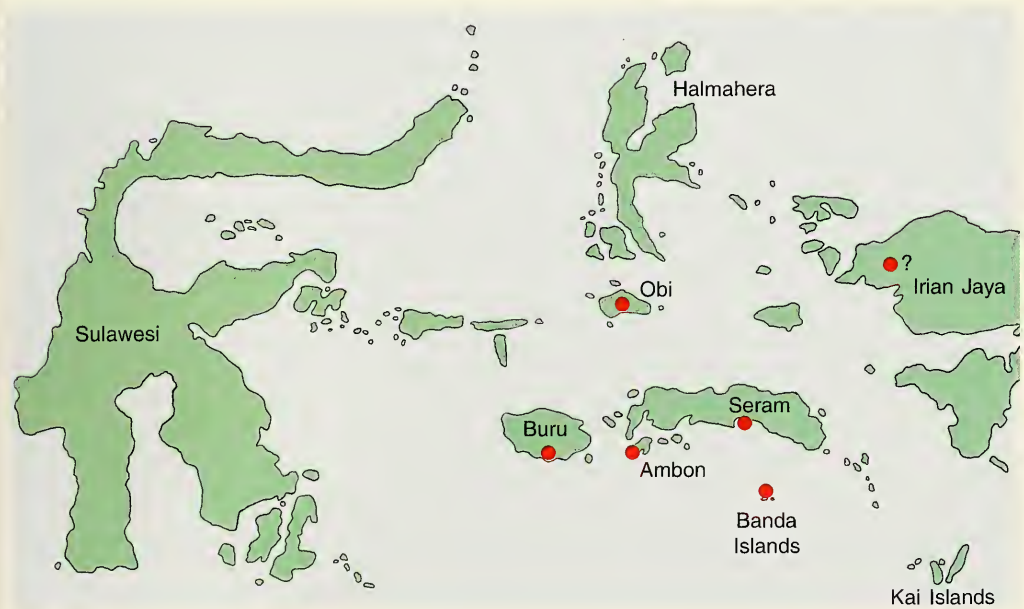


Fig. 9. Distribution of *V. cerambonensis*, spec. nov.



rows; (10) terminally on the inner, bigger hemibacula more than 20 pointed tips that are arranged in two rows.

*V. cerambonensis* spec. nov. differs from sympatric *V. indicus* mainly by the banded dorsal pattern, the light temporal stripe, the constantly different tongue colouration and the higher scale counts (in particular the S and XY values, see tab 1). Juveniles of *V. cerambonensis* spec. nov. differ from juveniles of *V. indicus* by the much larger light spots on the dorsal side (in *V. cerambonensis* spec. nov. the light spots comprise 5-12 scales, while in *V. indicus* they comprise 1-3 – exceptionally up to 5 – only), the light temporal stripe, the light tongue and the higher scale counts.

### Description of holotype

Habitus slender. Total length 940 mm (snout-vent-length 380 mm, tail length 580+x mm. Length of hindlimb 180 mm. Nostril closer to tip of snout than to the eye. Canthal ridge expressed. Nasal region swollen, with a median, longitudinal concave, shallow groove. Supraoculars 5 (left) and 6 (right), all distinctly broader than long, with the exception of the hindmost one on the left side which is almost as long as broad. Scale covering the pineal organ enlarged, pentagonal, darkened towards the margins with a yellowish-whitish centre. Dorsal neck scales anteriorly roundish to ovaly broadened, with a varying number of pits (commonly 3-6) concentrated on the posterior margin of each scale; posteriorly, the shape of the scales becomes more longish, surrounded by minute intercalary granules. Dorsal scales similar to posterior neck scales, but distinctly broader, with normally 1-3 posterior grooves. From midbody most scales with a weak keel that becomes more distinct towards the tail. Gular scales longish, oval, with generally 1-3 pits at their hindparts; chest scales larger, largest at the anterior part of the chest. Ventral scales longish, hexa- to octagonal, giving a rectangular appearance, with an ill-defined posterior pit; juxtaposed, so that interstitial granules can be observed at their hindmargins only. Around the cloaca, the number of pits increases drastically, up to 20 per scale. This is maintained on the ventral scales of the tail base, the number of pits per scale decreasing again towards the tail tip, where only 1 pit is observed. Dorsal part of tail covered with rectangular, weakly keeled scales, the keeling becoming more indistinct towards the tail. Upper crest of tail with a double, strong longitudinal keel. Limbs covered dorsally with oval to longish, high-domed scales with usually one pit each at their hindmargin. For further measurements, proportion indices and scale counts see tab. 2 and tab. 3.

Everted hemipenis ca. 3.5 cm long, club-shaped, apically strongly and asymmetrically broadened; lower truncal and pedicellar region weakly pigmented with melanophores. Sperm groove running obliquely towards the outer of the two apical lobes, where it terminates at the base of the outer hemibaculum. Outer sulcal lip stronger than the inner one. At the tips of the two apical lobes the two stiff, hardened hemibacula are emerging, covered by a thin layer of tissue. The inner, apically directed hemibaculum is concave towards the sulcal plane and apically broadened, bearing 23 sharp tips terminally, that are arranged in two rows. The outer, smaller and more laterally directed hemibaculum terminates in two pointed processes. Ca. 22 rows of paryphasmata are running to the outer lobe only, nearly encircling the outer hemibaculum. Truncal and pedicellar area smooth, without ornamentation (terminology after Ziegler & Böhme 1997).

Ground colour (in preservative) of the upper parts of head, neck, dorsum, limbs and tail dark brownish to black, with light, yellowish-whitish patterning. Underparts light yellowish-white, almost without any darker pattern. Only the marginal parts of throat, belly and underside of limbs with an indistinct greyish, clouded pattern. Head dark brown on the top and the sides, with irregular light spotting. A ca. 2 scales wide light stripe runs from the lower eyelid towards the upper margin of the tympanum, bordered by a dark, unspotted, 2-3 scales wide dark band on the upper and the lower margin. Tongue with a complex colour pattern: outermost tip of the tines yellow-brownish, passing dorsally to grey-brownish; tongue body dorsally grey-brownish to black, passing laterally by an irregular border to the yellowish-whitish underside of the tongue, which changes ventrally only at the tips of the tines towards a greyish-brown colouration. Nape very dark, with light spots which partly comprise only a part of one single scale. Towards the sides of the neck, the spots become more intensive, occupying entire scales. On the dorsum, the light spots are arranged in oblique areas of changing density, thus creating a cross-banded colour pattern; between fore- and hindlimbs five such lighter crossbands. Particularly in the second half of the body, the light spots are often arranged in thin crossbars, which can be traced also on the upper side of the tail. No blue pigmentation recognizable.

Variation of paratypes: The adult paratypes are largely corresponding to the description of the holotype. Also both hemipenes of ZFMK (MZB) 70618 agree with the respective character states

observed in the holotype. There are only 20 paryphasman rows surrounding the outer hemibacula, and the inner hemibacula bear terminally 24 tips being arranged in two rows.

The juvenile representatives of the new species are well agreeing among each other, but show some differences as compared with the adults. Their dorsal pattern consists of irregular oblique rows which are composed of round, black ocelli, which contain light, yellowish-whitish centers occupying 5 to 12 scales each. Their temples bear the characteristic light band which is ca. 4 scales wide and even more contrasting than in adults. Tongue colouration uniformly light. Both subadult specimens (ZMA 11146 A and RMNH 3189) have light tongues, where only the tips of the tongue and a thin median stripe on the tongue body are grey-coloured. This indicates an ontogenetic shift of the tongue colouration.

**Additional material.** Specimens assignable to *V. cerambonensis* spec. nov. are: RMNH 7223, Buru, leg. D.J. Hoedt 1863; RMNH 3184, Obi, leg. H.A. Bernstein 1862; ZMA 15416, Buru, leg. L.J. Toxopeus 1921; ZMH R04731, Banda Islands; ZMB 53470, "Neuguinea", "through Hamburg Museum". Moreover, we have some colour slides of living *V. cerambonensis* spec. nov. at our disposal (see figs 7, 8), made by H. Kotter on Seram, which give an impression of the colouration in life.

**Etymology.** The specific epithet is derived from the two southern Moluccan islands Ceram (= Seram) and Ambon, from where our type series is originating.

**Distribution.** *V. cerambonensis* spec. nov. is presently known from the Moluccan islands Seram (type locality), Ambon, Buru, Obi and from the Banda Islands. Moreover, there is one ZMB specimen from "Neuguinea" (see above) without specific locality data, which strongly needs confirmation (fig 9).

**Habitat and life habits.** There are only few preliminary data collected with the Seram vouchers of the type series. These have been collected in lowland rainforest with adjacent gardens (Kotter, pers. comm.). Photos taken by H. Kotter (ZFMK slide archives and figs 7, 8) show individuals closely associated with freshwater streams. At the same site, also *Hydrosaurus amboinensis* was recorded by him (ZFMK vouchers).

A coexistence with *V. indicus* has been proven for Ambon. It still has to be demonstrated for Seram where it would well be possible that also in the case of these two sibling species *V. indicus* is the one occupying the more coastal, saltwater-influenced niche, whereas *V. cerambonensis*, spec. nov. would be the species associated more with lowland rainforest and freshwater. Field studies are highly desirable.

**Systematic relationships.** Genital-morphological characters clearly relate *V. cerambonensis* spec. nov. to the subgenus *Euprepiosaurus* and, within this taxon, to the *V. indicus* group (see Ziegler & Böhme 1997). The only unilaterally developed paryphasmata link the new species with *V. caerulivirens*, *V. indicus* and *V. melinus*, whereas a bilateral presence of paryphasmata is observed in *V. doreanus*, *V. finschi*, *V. jobiensis* and *V. yuwonoi*. Clearly, the reduced, unilateral development represents the derived condition (Ziegler & Böhme 1997).

Also, the relatively low scale counts (S: 129-150, XY: 126-163) of *V. cerambonensis* spec. nov. argue for a derived condition, but not to such an extent as in *V. indicus* (Böhme et al. 1994, Böhme & Ziegler 1997). The same seems to be true for the lack of blue pigmentation and the partly pigmented tongue (Böhme et al. 1994, Böhme & Ziegler 1997, Ziegler, Böhme & Philipp 1999). Most probably, in *V. cerambonensis* spec. nov. it concerns the first case of an ontogenetic change in tongue colouration. The possible adaptive influence and therefore related taxonomic value of tongue colouration requires further investigation.

Further investigations, including a molecular approach, have to be carried out to resolve the systematic relationships of the new species and its many siblings within the Pacific monitor species group.

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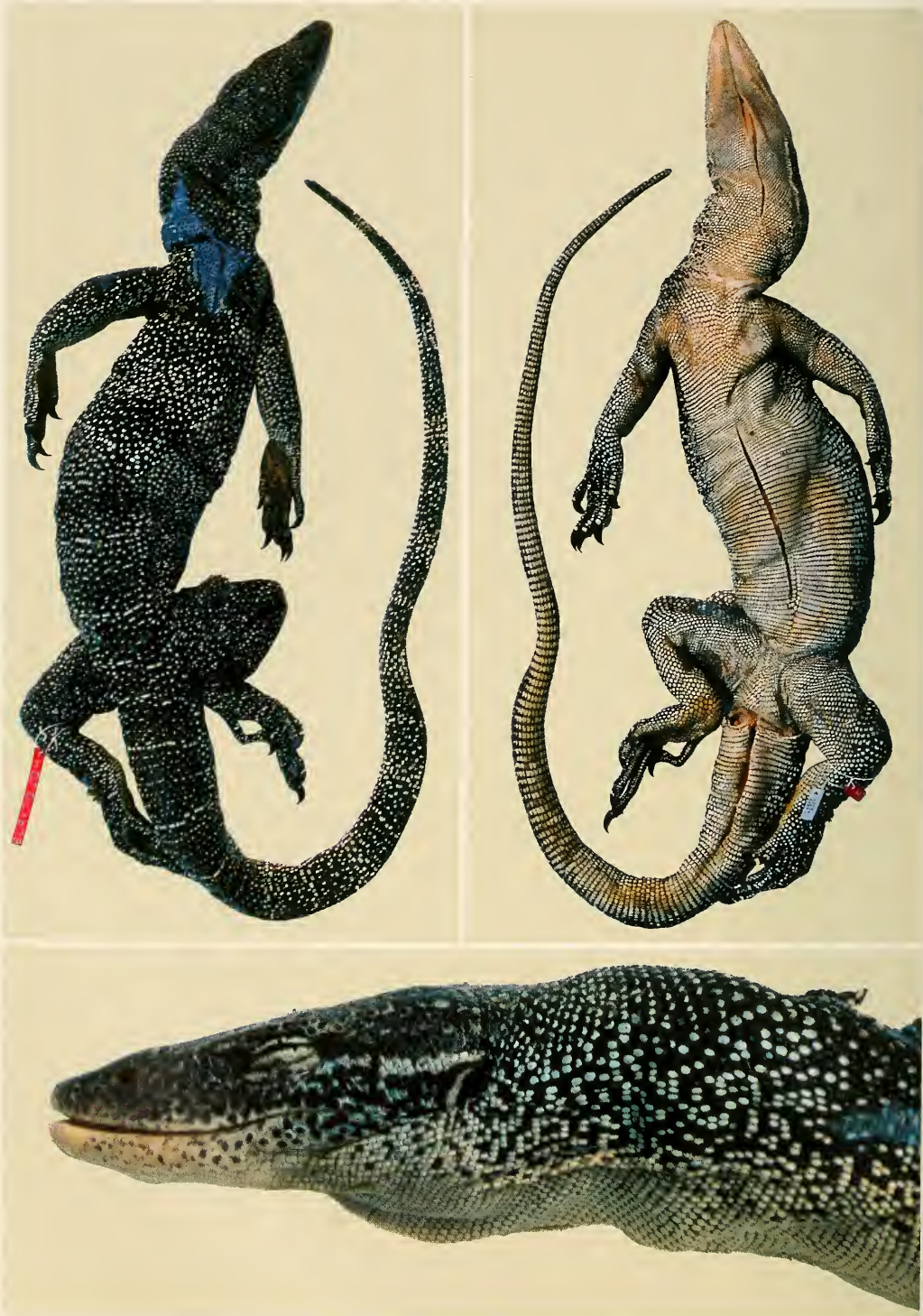


Fig. 10. Holotype of *V. cerambonensis*, spec. nov. (ZFMK (MZB) 70617). Left: dorsal view; right: ventral view; below: lateral view of head. Photos: K. M. Philipp.



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