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MEGABALANUS KRAKATAUENSIS (NILSSON-CANTELL, 1934)
(CIRRIPEDIA: BALANOMORPHA)
REVISED

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ABSTRACT

The species described by Nilsson-Cantell (1934) as *Balanus krakatauensis* and later assigned to *Megabalanus* has been reexamined and is redescribed, illustrated and transferred to *Austromegabalanus (Notomegabalanus)*.

INTRODUCTION

During our study of species of *Megabalanus* (Henry and McLaughlin, 1986), *Megabalanus krakatauensis* (Nilsson-Cantell) was the only species not available for direct examination. Although Nilsson-Cantell (1934) allied his taxon most closely to *Austromegabalanus algicola* (Pilsbry, 1916), its placement in *Megabalanus* by Newman and Ross (1976) appeared correct as Nilsson-Cantell (1934) has described the primary septa of the radii as denticulate on both sides. While his description of the animal is moderately complete, his figures of the opercular valves are extremely diagrammatic, making recognition virtually impossible. To date this taxon is known only from Nilsson-Cantell's description and figures.

During a visit to the Zoological Museum, University of Amsterdam (ZMA), in 1988, one of us (PMcL) had the opportunity to examine the holotype of *M. krakatauensis*. Subsequently an exchange of paratypic material of several species of balanomorph cirripeds was arranged between the National Museum of Natural

History, Smithsonian Institution (USNM) and the Zoological Museum. An examination of a paratypic clump of *M. krakatauensis*, part of that exchange, has given us the opportunity to redescribe, to more accurately illustrate (Fig. 1, Pl. 1), and to refute the assignment of this species to *Megabalanus*.

The abbreviation CR refers to the carinorostral diameter of the shell. Institutional abbreviations used are those proposed by Leviton *et al.* (1985).

Descriptive terminology follows that of Henry and McLaughlin (1975).

MATERIAL EXAMINED:

Holotype
ZMA CIR 100.328; CR 19 mm.

Paratypes
(10 specimens): USNM 244378; CR (largest) 11.4 mm.

Type locality
Krakatau, Sunda Strait, Malay Archipelago

REDESCRIPTION

Shell globulo-conical, conical or cylindrical, basis sometimes lengthened; parietes smooth or faintly ribbed, with single row of longitudinal tubes; orifice generally triangular; radii wide, summits usually level, primary septa denticulate on lower side only, alae with summits oblique, sutural edges denticulate on upper side.

Scutum very narrow; tergal segment markedly inflected; occludent margin strongly toothed; growth ridges prominent; longitudinal striae present, especially apparent on tergal segment; median longitudinal groove broad, usually deep and strongly pitted, particularly in upper half; articular ridge approximately two-thirds length of tergal margin; adductor ridge short, weak, well separated from articular ridge; adductor muscle pit well defined; lateral depressor muscle pit deep. Tergum considerably broader than scutum, with apex acute but not beaked; spur furrow open; spur short and very broad, separated from basiscutal angle by less than 1/2 spur width, often with prominent internal crests extending beyond truncate end; basal margin indented on scutal side, straight on carinal side, growth ridges moderately prominent; longitudinal striae faint; articular ridge long, reaching almost to basal margin; crests for depressor muscle weak or absent.

Labrum simple, with 2 or 3 teeth on each side of notch. Palpus with numerous setae on upper margin and labral face. Mandible with 4 or 5 teeth, upper 3 acute to blunt, 4th and/or 4 and 5th blunt, lowest confluent with inferior angle; inferior angle with few setae. First maxilla with very small notch below strong pair of upper spines, 7 or 8 spines between upper and lower pairs, lower pair removed from inferior angle by approximately basal width of lower spine; inferior angle with numerous setae. Second maxilla with numerous setae on both proximal and distal lobes. Cirrus I with anterior ramus 6 - 12 segments longer than posterior ramus; anterior margins of segments of posterior ramus protuberant. Cirrus II with anterior ramus 2 - 4 segments longer than posterior ramus; segments of both rami with very protuberant anterior margins. Cirrus III with anterior ramus 3 - 5 segments longer than posterior ramus; median segments (segments 6 - 12) each with row of prominent conic teeth on anterior margin and 1 or 2 rows of denticles submarginally;

posterior ramus with pinnate setae. Protopods of cirri IV to VI each with numerous simple spinules on anterior margin and outer face. Cirrus IV with 24 - 36 segments on anterior ramus, 24 - 26 on posterior ramus; posterior distal angles of all but proximal most segments each with 1 erect tooth, 2 or 3 simple spinules on posterior margin distally or at posterior distal suture; anterior margins each with 3 long and 1 short pair of pinnate or pectinate setae.

Cirrus V with 23 - 30 segments on anterior ramus, posterior ramus with 30 - 32 segments; proximal 6 or 7 segments each with 1 or 2 simple spinules on posterior distal sutures, median segments each with 1 or 2 erect teeth and 2-4 simple setae distally on posterior margins; anterior margins each with 3 long and 1 short pair of pinnate or pectinate setae. Cirrus VI with 24 - 35 and 25 - 36 segments on anterior and posterior rami, respectively; proximal 10 - 12 segments of anterior ramus each with simple spinules distally on posterior margin, median segments with additional erect tooth and 1 or 2 simple setae; anterior margins of proximal 10-18 and distal 4 or 5 segments each with 2 long and 1 short pair of pinnate or pectinate setae, remaining segments with 2 long, 1 or 2 moderately long and 2 short pair of pinnate or pectinate setae; posterior ramus similarly armed. Basidorsal point of penis well developed.

Color

Parietes with light to dark reddish longitudinal stripes on white background, stripes darkest and more closely spaced on carina and carinolaterals; radii white or pinkish. Scuta and terga white.

REMARKS

In a major revision of balanomorph barnacles, Newman and Ross (1976) elevated *Megabalanus* Hoek to generic rank and included *Balanus krakatauensis* and several fossil taxa, as well as species and species complexes cited by Pilsbry (1916) in *Balanus* (*Megabalanus*). Subsequently, Newman (1979) proposed the subfamily *Megabalaninae* to include *Megabalanus* sensu stricto and the new genera *Austromegabalanus* and *Notomegabalanus*. By implication, *B. krakatauensis* was retained in *Megabalanus* s.s. Citing greater ranges of variability among fossil species not considered by Newman, Buckeridge (1983) incor-

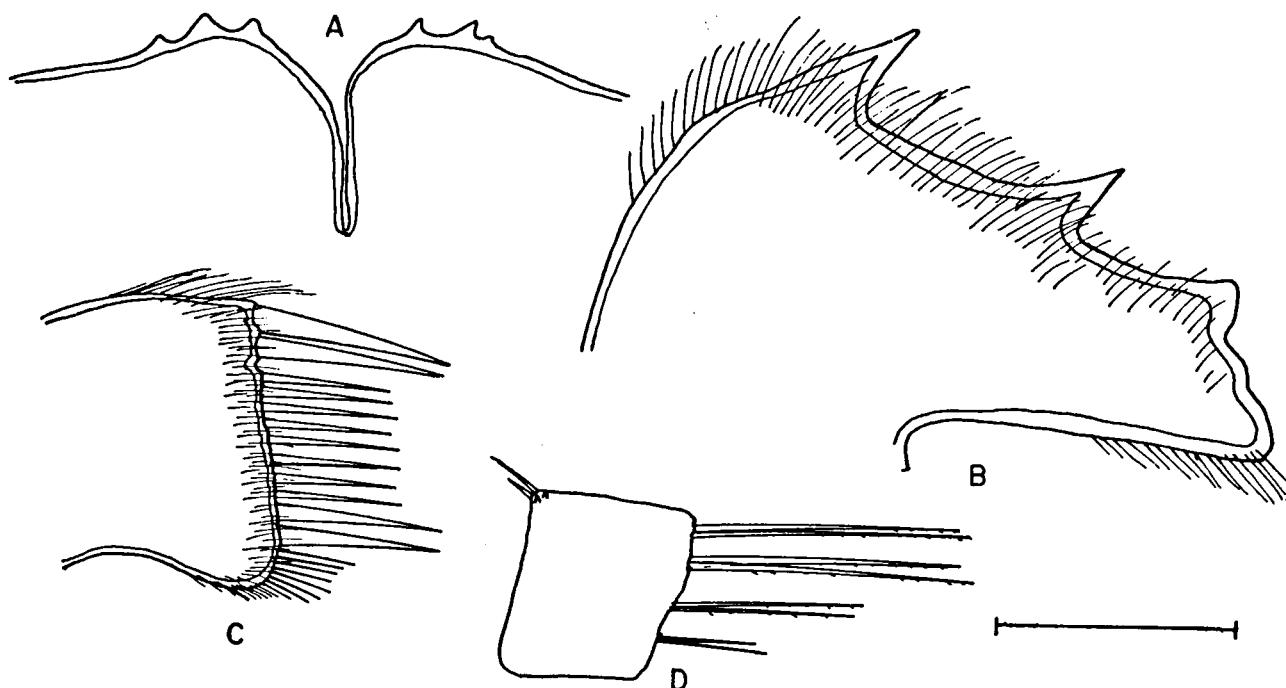


Figure 1. *Austromegabalanus (Notomegabalanus) krakatauensis* (Nilsson-Cantell) USNM 24438 (c). A, labrum; B, mandible; C, maxilla; D, median segment cirrus VI. Scale equals 0.25 mm.

porated *Notomegabalanus* into *Austromegabalanus* as a subgenus. Henry and McLaughlin (1986) also retained Nilsson-Cantell's species in *Megabalanus*, noting that although Nilsson-Cantell (1934) has related it most closely to *Austromegabalanus (Notomegabalanus) algicola*, the described denticulate radial septa excluded it from the latter genus. Our examination of paratypes of *M. krakatauensis* showed that the primary septa of the radii were not denticulate on both sides, but rather only on the lower side; therefore, this species is clearly assignable to *Austromegabalanus*. The absence of a tergal beak and open spur furrow place it in the subgenus *Notomegabalanus*.

At first glance, the furrowed and pitted scuta of *A. krakatauensis* suggest a similarity with *Megabalanus vesiculosus* (Darwin) (cf. McLaughlin and Lacombe, 1979; Henry and McLaughlin, 1986); however, marked differences in shell and tergal morphology readily distinguished the two taxa. In having a short, wide spur with open furrow, *A. krakatauensis* does exhibit some similarity to *A. algicola*; however, the spur of the former species is much closer to the basiscutal angle and usually has a series of short ridges

developed on the inner surface. The scuta of the two species are distinctly different. In *A. krakatauensis* the scutum is narrow with a broad, strongly inflected tergal segment, the longitudinal groove is deep and distinctly pitted; a short adductor ridge is well separated from the articular ridge. In contrast, the scutum of *A. algicola* is very broad, the tergal segment is relatively narrow and weakly inflected, the longitudinal groove is broad, usually shallow, and no distinct pits are present in the syntypes (USNM 15063) that we examined; the adductor ridge is obsolete or absent. Differences between the trophi of *A. krakatauensis* and those of *A. algicola* as described by Pilsbry (1916) also exist. Most notable is the number of pairs of setae on the segments of the rami of cirrus VI: 3 - 5 pairs in the former species, 6 - 8 in the latter.

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We wish to acknowledge, with thanks, the efforts of Dr. H.P. Wagner and the curatorial staff of the Zoological Museum that made it possible for one of us to examine the holotype of this species, and subsequently to arrange, with Dr. R.B. Manning, USNM, for the exchange the provided the paratypes for our exam-

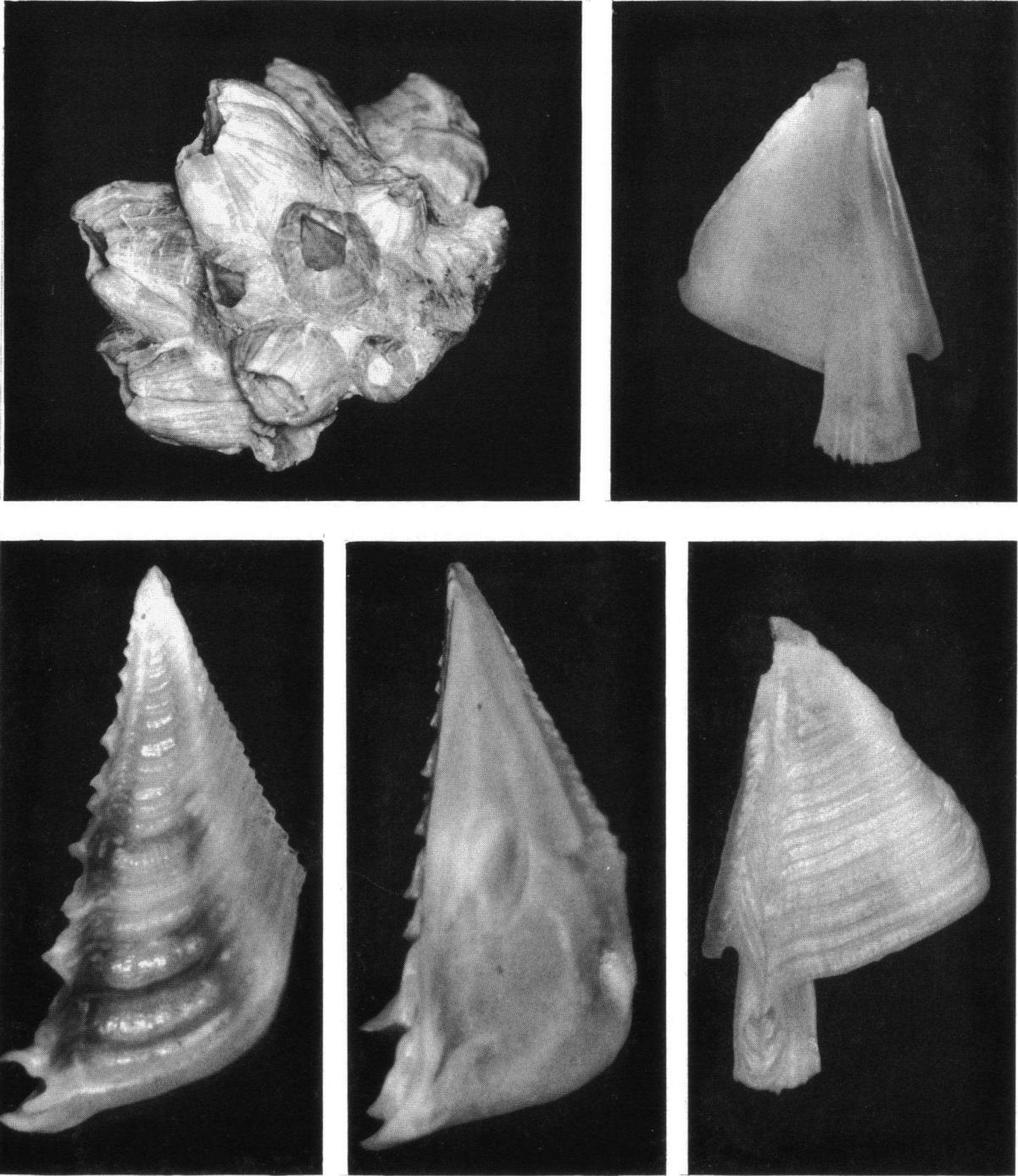


Plate 1. *Austromegabalanus* (*Notomegabalanus*) *krakatauensis* (Nilsson-Cantell) USNM 24438. upper left, paratypic clump (2.1X); upper right, tergum (specimen a), internal view (18.8X); lower left, scutum (specimen b) external view (14.4X); lower middle, scutum (specimen b) internal view (14.1 X); lower right, tergum (specimen b) external view (14.8X).

ination. We are indebted to Dr. Manning also for providing the type lot of *A. algicola* for comparison. Photographs were taken by E.J. McGeorge. This is a scientific contribution from the Shannon Point Marine Center.

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