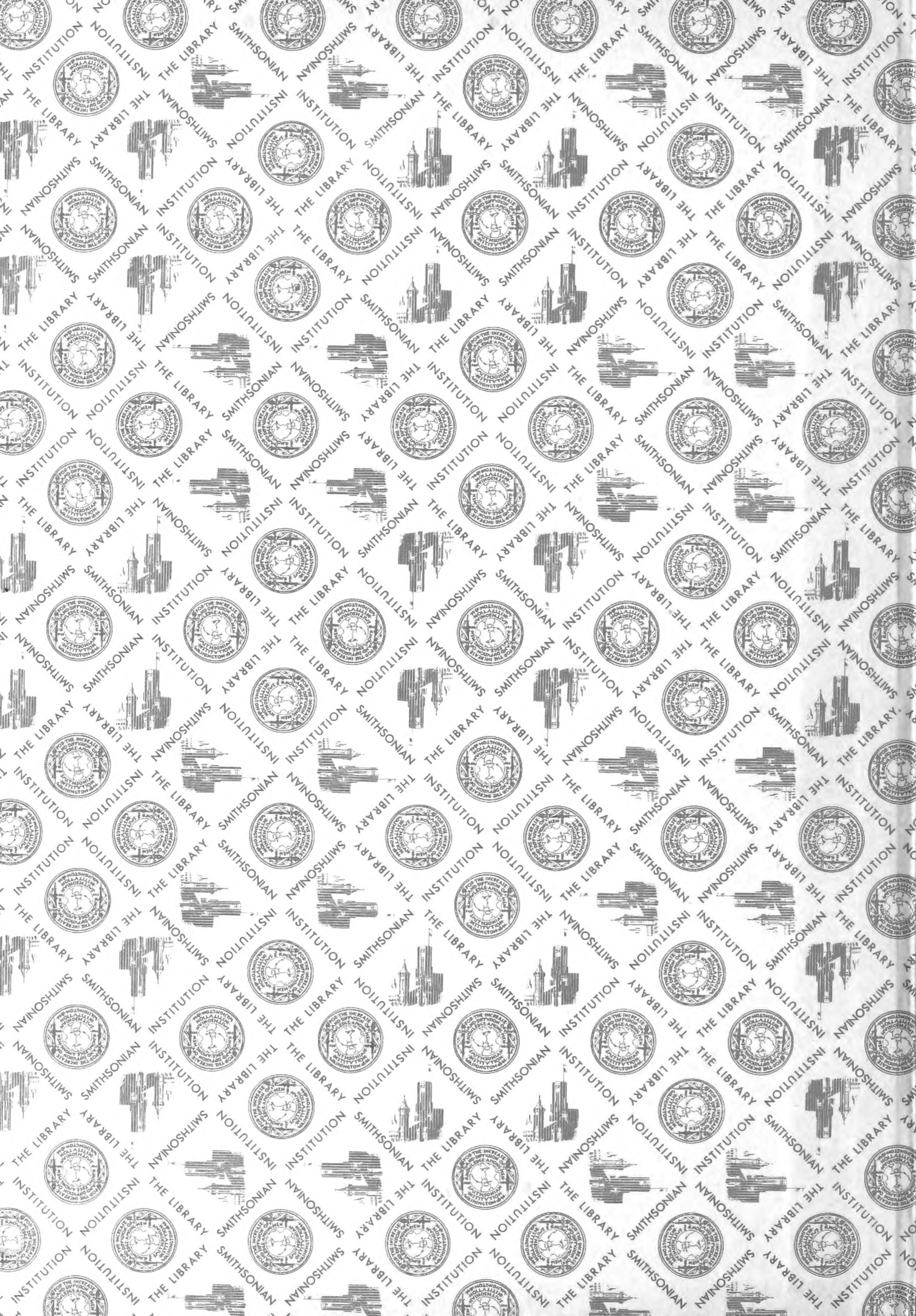
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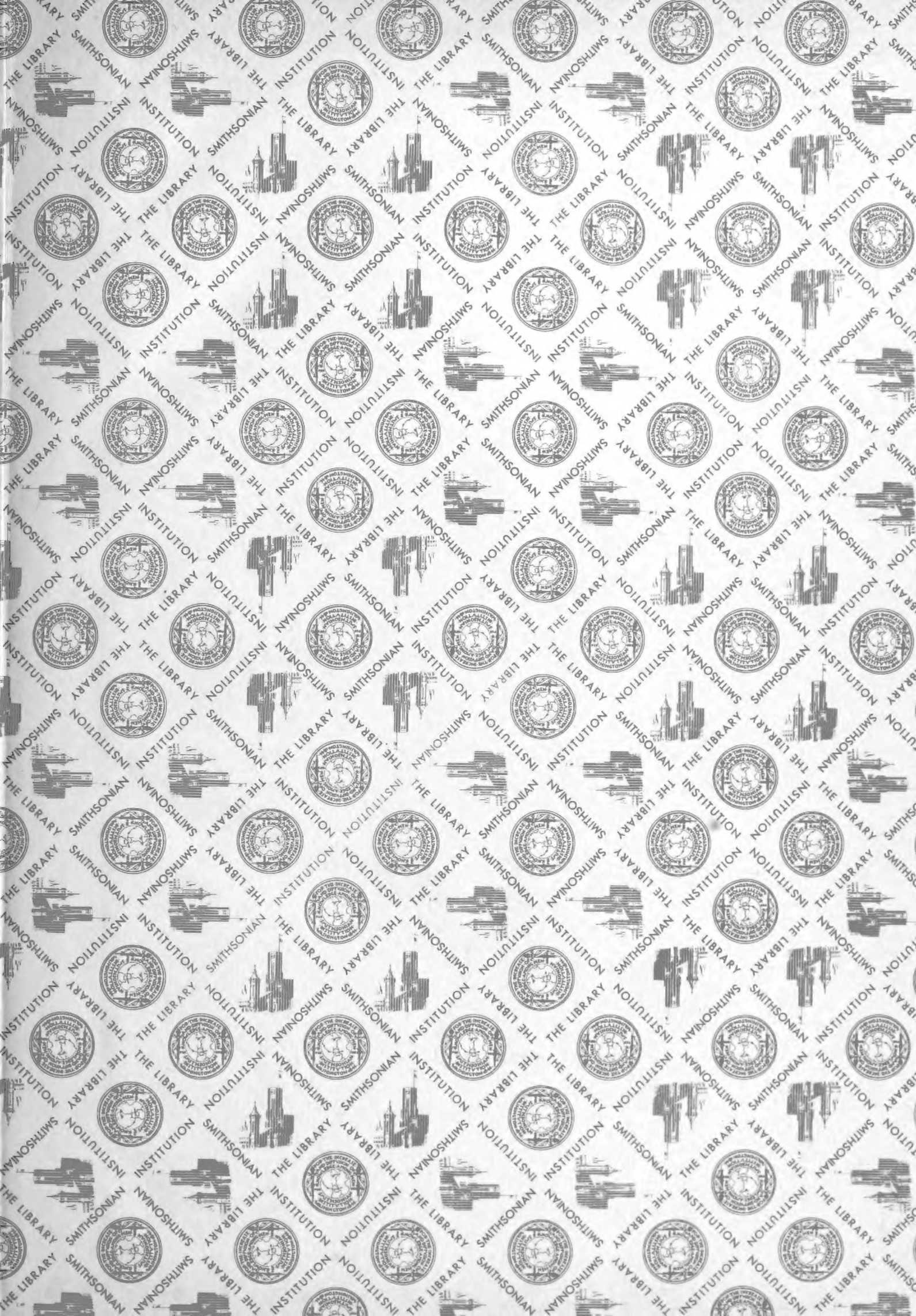
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Siboga-Expeditie

THE CIRRIPEDIA OF THE SIBOGA-EXPEDITION

BY

P. P. C. HOEK

B. CIRRIPEDIA SESSILIA

With 17 plates and 2 textfigures

Monographie XXXI*b* of:

UITKOMSTEN OP ZOOLOGISCH, BOTANISCH, OCEANOGRAPHISCH EN GEOLOGISCH GEBIED

verzameld in Nederlandsch Oost-Indië 1899—1900

aan boord H. M. Siboga onder commando van
Luitenant ter zee 1e kl. G. F. TYDEMAN

UITGEGEVEN DOOR

Dr. MAX WEBER
Prof. in Amsterdam, Leider der Expeditie

(met medewerking van de Maatschappij ter bevordering van het Natuurkundig Onderzoek der Nederlandsche Koloniën)

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BOEKHANDEL EN DRUKKERIJ
VOORHEEN
E. J. BRILL
LEIDEN

RÉSULTATS DES EXPLORATIONS ZOOLOGIQUES, BOTANIQUES, OCÉANOGRAPHIQUES ET GÉOLOGIQUES
ENTREPRISES AUX
INDES NÉERLANDAISES ORIENTALES en 1899—1900,
à bord du SIBOGA
SOUS LE COMMANDEMENT DE
G. F. TYDEMAN
PUBLIÉS PAR
MAX WEBER
Chef de l'expédition.

Publié Mai 1913

* Les numéros avec un astérique ont déjà paru; ceux marqués 1) seulement en partie

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De Maatschappij ter bevordering van het Natuurkundig Onderzoek der Nederlandsche Koloniën.

Het Ministerie van Koloniën.

Het Ministerie van Binnenlandsche Zaken.

Het Koninklijk Zoologisch Genootschap »Natura Artis Magistra" te Amsterdam.

De »Oostersche Handel en Reederij" te Amsterdam.

De Heer B. H. DE WAAL, Oud-Consul-Generaal der Nederlanden te Kaapstad.

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LATE E. J. BRILL
PUBLISHERS AND PRINTERS
LEYDEN — 1913

B. CIRRIPEDIA SESSILIA

Genus **Verruca** Schumacher

Of this genus GRUVEL, in 1905, knew 25 species, a very considerable number when we consider that, in 1883, before my Report on the Challenger Cirripedia was published, only four species were known.

The deep-sea exploration, however, added largely to that number:

6 new species were collected by the "Challenger" (HOEK[1]),

7 new species were collected during the cruises of the "Hirondelle" and "Alice" (AURIVILLIUS[2]),

and 8 new species were collected by the "Travailleur" and the "Talisman" (GRUVEL[3]).

The richness in species of this deep-sea genus seems by no means exhausted; according to the results of the dredgings published of late:

4 new species were collected by the "Investigator" (GRUVEL[4]),

1 new species was collected by the "Belgica" (HOEK[5]),

5 new species were collected by the "Albatross" (PILSBRY[6])

and 6 new species were collected by H. M. "Siboga" (HOEK) which will be described in this Report.

This augmentation has been especially important for the sixth province (Indian Archipelago and Eastern coasts of India), as proposed by me (l. c. p. 33) for the geographical distribution of the Cirripedia. Only one species of *Verruca* (*Verruca nitida*, collected by the "Challenger" to the South of Mindanao) was known from that region in 1883 and this number has been increased to eleven by the 4 species collected by the "Investigator" and 6 by the "Siboga".

All these species were taken from deep water, as can best be seen from the following table, in which they have been placed according to the depth at which they were found:

Verruca multicostata Gruvel, Strait Malacca, 160 m.

Verruca plana Gruvel, Andaman Islands, 380—465 m.

Verruca Koehleri Gruvel, Andaman Islands, 435 m.

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[1] HOEK, P. P. C., Cirripedia of the Challenger Expedition. 1883.

[2] AURIVILLIUS, CARL W. S., Cirrhipèdes nouveaux provenant des campagnes scientifiques de S. A. S. le Prince de Monaco. Bull. Soc. Zool. de France, XXIII. 1898. p. 189—198.

[3] GRUVEL, A., Cirrhipèdes des Expéditions scientifiques du "Travailleur" et du "Talisman". 1902.

[4] GRUVEL, A., Cirrhipèdes operculés de l'Indian Museum de Calcutta. Mém. Asiatic Soc. Bengal, II. 1907. p. 1—10, pl. I—II.

[5] HOEK, P. P. C., Cirripedia. Résult. Voyage Belgica. Zool. 1907. p. 1—9. 4 fig.

[6] PILSBRY, H. A., The Barnacles in the U. S. National Museum. Bulletin 60 of U. S. National Museum. 1907.

Verruca grex n. sp., Malay Archipelago at different places. 450—984 m.
Verruca conchula n. sp., South of Timor, 520 m.
Verruca conchula var. minor n. var., Kei Islands, 310 m.
Verruca capsula n. sp., Malay Archipelago at different places, 520—1300 m.
Verruca cristallina Gruvel, Andaman Isl. 768—785 m.
Verruca cassis n. sp., Malay Archipelago at different places, 794—1600 m.
Verruca nitida Hoek, Near Talaut Isl. and Strait of Makassar, 915—1300 m.
Verruca casula n. sp., Between Ceram and New Guinea, 924 m.
Verruca navicula n. sp., Malay Archipelago at two different places, 924—959 m.

Of the new species, one (*Verruca cassis*), was found at 4 Stations, two (*Verruca capsula* and *V. grex*) at 3, one (*Verruca navicula*) at 2, and two (*Verruca casula* and *conchula*) each at 1 Station. Of the last-named species, a variety was found at another Station. Some Stations seem to be very favourable for the growth and development of species of this genus, e. g. the Stations 88 and 170, where two, and the Station 297, where three, different species of *Verruca* were collected. One should be cautious, however, in attaching too much value to such particulars, since dredging, especially at great depths, is a haphazard way of exploring the bottom of the ocean. Our knowledge of the distribution of these species, in consequence, is as yet very imperfect.

All the species collected by H. M. S. "Siboga" are true deep-sea species; they were collected at depths varying from 310—1600 m. Shallow water forms, such as *Verruca strömia* O. Müller, do not seem to occur in the East Indian waters. Although most of the shallow water and shore species of this genus (*V. strömia*, *V. laevigata* and *V. Spengleri*) have depressed shells, the species collected in deeper water are not depressed, but have more or less perpendicular walls. Of the species described by DARWIN (l. c. p. 523) this is the case in *V. nexa* only. DARWIN obtained this species from the West Indies and found it attached to a *Gorgonia*, but the place and depth where it was collected is not mentioned. It can be said, however, that the genus *Verruca*, like *Scalpellum*, was introduced into the zoological system from specimens collected in shallow water and distributed over different seas of the world and that it was not until later that it was found to have a great bathymetrical range and to include many deep-sea species. It can now be considered best as a deep-sea genus, a few only of the species of which occur in shallow water.

The new species here described are, I think, very characteristic ones and will be easily recognised should they turn up again. *V. cassis* may, perhaps, be an exception which will be found later to be identical with *V. cristallina* Gruvel, or not to differ sufficiently to maintain it as a different species. *V. capsula* resembles *V. magna* Gruvel in several characters; there are, however, sufficient grounds to consider these two forms as different species.

1. *Verruca capsula* n. sp. Pl. XII, fig. 1—3. Pl. XIII, fig. 1—4.

Shell somewhat depressed, with the basis broad, irregularly circular; moveable valves nearly parallel to the basis. Moveable scutum and tergum each with three articular ridges. Second

articular ridge of the tergum about three-fourths the length of the axial ridge, hardly shorter than the first. Scutal margin of the rostrum and tergal margin of the carina forming together a straight line. Rostrum and carina nearly of the same size, articulating with one another with from six to eight interlocking ridges.

This characteristic species is the only species of *Verruca* collected by H. M. S. "Siboga" which belongs to those which have the moveable valves almost parallel to the basis and accordingly nearly perpendicular to the parietes (Pl. XII, fig. 1 and 2). It is the largest of the species collected by the Siboga, and at the same time one of the largest of the known species. Seen from the side of rostrum and carina it looks nearly symmetrical, seen from the side of the fixed scutum and tergum, in some specimens, the carinal side is more depressed than the rostral side, in other specimens this difference does not exist. The shells are dirty white; in some instances numerous specimens of very unequal size (and, no doubt, age) form groups, and are attached, partly to one another and partly so closely to one another, as to interfere with their normal growth and development.

The moveable scutum (Pl. XII, fig. 3*a*) is relatively large; its shape is irregularly triangular with the apex strongly beaked. The irregularity of its shape is caused by the tergal margin having an excrescence formed by the broadest of the articular ridges, which does not extend to the basi-tergal angle. The basal margin of the valve is perfectly straight, the occludent margin curved. Of the three articular ridges, the axial ridge is narrow, and runs from the apex to the basi-tergal angle; the second ridge increases strongly in breadth from the apex to its inferior extremity, and it has the outer or tergal margin distinctly hollowed out. The so-called first articular ridge is very narrow and not quite half as long as the second. It can be seen best when the valves of a larger specimen are isolated and looked at from the side. On the under side the surface of the scutum is furnished with a very distinct rim along the occludent margin; from this rim, at a short distance from the apex, runs a transverse rim, separating the depression for the adductor muscle from a small triangular depression in which fits part of the scutal shoulder of the tergum. The tergal margin along this triangular portion is double, the interior margin representing the first articular ridge as indicated above.

The moveable tergum (Pl. XII, fig. 3*b*) is less than twice as large as the moveable scutum; it is broad and its shape is irregularly rhomboidal. Its scutal margin is characterised by a deep, rounded excavation, its basal margin is perfectly straight, one of its occludent margins (the longer) is feebly curved, the other being slightly hollowed out; a bluntly beaked apex is formed, where the two occludent margins meet. Externally three ridges are seen: a rather prominent axial ridge fitting with its basis against the axial ridge of the scutum; a middle (second) articular ridge, broad at the basis and much shorter than the axial ridge and the so-called first articular ridge, the free margin of which forms the shorter occludent margin of the valve. The broad extremity of this first or upper articular ridge is covered by the scutum and forms what might be called the scutal shoulder of the tergum fitting in the triangular depression at the under side of the scutum. The under side of the moveable tergum (Pl. XII, fig. 3*b*) is flat and shows only two shallow grooves near the scutal margin. Along the two occludent margins the valve is bordered by distinct rims, which at the underside project over the surface.

Rostrum and carina are of nearly the same shape and size. From the middle of the front of the shell, where these two valves meet, they bend over to the sides of the same, where they overlap the margins of the fixed scutum and tergum with triangular portions growing broader towards the basis of the shell. Both valves have the upper margin of the front part perfectly straight and the umbo at the extremity of that margin; their basal margin is arched, each equalling about one fourth the circumference of a circle. From the upper margin where the nearly horizontal moveable valves are attached to the basis, the whole shell increases considerably in width and this is the case especially with that part of the wall which is formed by the rostrum and the carina. The strongly curved surface of both valves shows numerous irregular ridges of growth. The suture with which the two valves articulate is not straight, but shows numerous teeth growing smaller from the upper margin towards the basis. These teeth form the extremities of as many oblique ridges (interlocking folds) running from the apex of the valve to the rostral margin of the carina or to the carinal margin of the rostrum. The number of these ridges seems to increase with age: I counted from 6—8 of them in different specimens.

The fixed scutum and tergum form the remaining part of the wall. They do not increase so much in width from the upper margin downwards, and their position is much steeper in consequence. The fixed scutum is larger than the fixed tergum; it consists of a triangular middle part, the tip of which nearly touches the apex of the moveable scutum, and the basal margin of which is rather long and distinctly curved; of a broad triangular lateral part, the upper margin of which as occludent margin forms part of the edge of the shells orifice and the basis of which does not quite reach the basis of the shell. This lateral triangular portion is overlapped by the lateral margin of the rostrum, forming here a kind of a radius. The third part of the fixed scutum is narrow, it increases slightly in breadth from above downwards and overlaps the scutal margin of the fixed tergum. The structure of the latter valve is nearly the same: it also has a triangular middle part, the tip of which is opposed against the tip of the moveable tergum and two triangular lateral parts, one side of which as occludent margin forms part of the edge of the orifice of the shell. The triangular portion situated at the side of the fixed scutum is overlapped by the narrow radius-like part of that valve, that at the side of the carina is also overlapped by a triangular kind of a radius forming the lateral part of the carina. The surface of these valves is smooth and irregularly folded; distinct growth ridges are visible on the surface of the triangular parts, the upper margins of which form the occludent margins of these valves.

The form of the basis is irregularly circular, the transverse diameter (that which runs parallel to the basal margin of the moveable valves) is slightly longer than the diameter which is vertical to this direction.

The size of this species is relatively large: it seems to be one of the largest of the genus. In the specimen figured the dimensions are:

height about 10 mm.

greatest diameter of the basis 14.5 mm.

distance from the apex of the rostrum to that of the carina 10 mm.

In the largest specimen collected the corresponding measurements are: 11, 16.5 and 13 mm.

With regard to the structure of the animal's body, the following may be of interest:

Mouth flattened, at a considerable distance from the adductor scutorum muscle; crest of labrum with a row of over thirty small conical teeth; palpi rather narrow, elongately conical, slightly curved, with the tip rounded; numerous short hairs on the surface and a few longer ones, distinctly curved at and near the extremity, along the outer margins.

Mandible (Pl. XIII, fig. 1) with three teeth and the inferior angle narrow and pectinated at the extremity. The anterior or upper margin of the inferior angle is furnished with a row of eight teeth, growing stouter from above downwards. Distance between tips of first and second teeth between one and a half and twice the distance between second and third.

Maxilla (Pl. XIII, fig. 2) with a distinct notch beneath the three upper spines. The upper margin of the step-formed projection long, bearing five short spines. The edge of the same projection relatively short and bearing about seven longer and stouter spines, with a few shorter ones near the inferior angle.

Outer maxillae (Pl. XIII, fig. 3) with the inner surface indistinctly bilobed, the outer surface rounded and clothed with numerous hairs of which the inferior ones are the longest.

Cirrus of the first pair attached near to each side of the mouth, with nearly equal rami of 14 segments thickly clothed with spines.

Cirrus of the second pair with very unequal rami of 12 and 26 segments, the longer more than twice as long as the shorter ramus. All segments thickly clothed with spines; the segments of the shorter ramus broader, those of the longer ramus, especially the more distal ones, more elongated.

Rami of cirrus of the third pair slightly unequal: the shorter with 32, the longer with 34 segments. The lower segments have the anterior margin furnished with three pairs of spines, and the lateral face bears numerous spines as well as a group of two or three on the posterior margin near the extremity of the segment; the middle segments have the same pairs along the anterior margin, a row of spines along the upper margin, and also bear spines near the extremity of the segment at the posterior margin; the last segments have the spines only near the extremity and those along the anterior margin.

Rami of cirrus of the fourth pair equal, with 37—38 segments. Each segment has 3 pairs of spines along the anterior margin and a couple of bristles at the posterior near the extremity of the segment. The lower segments show a few very delicate hairs distributed over the lateral faces.

Rami of cirrus of the fifth pair equal, with 40—41 segments; hardly any bristles on the lateral faces of the segments, those along the anterior margin and at the extremity of the segments on the posterior margin as usual.

Rami of cirrus of the sixth pair equal, with 44 segments; spines as on the cirri of the fifth pair.

Of the spines along the anterior margin of the cirri of the 3rd—6th pair those forming the second and third pair are very long, those of the first or lowest pair, on the contrary, are as a rule short and very delicate.

Caudal appendage unusually short, having about half the length of the first

segment of the pedicel of the sixth cirrus. It has 8 quadratic segments; the first however, is more elongate, as are also the two last ones (Pl. XIII, fig. 4). Hairs disposed in a dense group at the inner side near the extremity of each segment and in smaller number at the outer side. The hairs at the inner side on the lower segments very long, those on the following segments not quite so long, the hairs disposed lower down reaching nearly as far with their extremities as those of the last segments. Last segment obliquely truncated, with a group of hairs on the tip.

Penis short, reaching as far as the middle of the second segment of the pedicel of the sixth cirrus. Narrow, bluntly pointed at the extremity. Here and there a single hair disposed on its surface. A young specimen was furnished with a very short penis, the length of which equalled two-thirds of that of the caudal appendage.

This species was collected by H. M. S. "Siboga" at the following places:

Stat. 88. June 20, 1899. Lat. 0° 34'.6 N., Long. 119° 8'.5 E. Depth 1301 m. Bottom: fine grey mud. About six specimens, some of them very large.

Stat. 262. December 18, 1899. Lat. 5° 53'.8 S., Long. 132° 48'.8 E. Depth 560 m. Bottom: solid bluish-grey mud. Two specimens, one attached to a *Hexelasma*, the other to a small stone.

Stat. 297. January 27, 1900. Lat. 10° 39' S., Long. 123° 40' E. Depth 520 m. Bottom: soft grey mud. One specimen, attached to the shell of a Gastropodous mollusc.

General Remarks. This species resembles *Verruca magna* Gruvel, from the Gulf of Gascogne. As the articular ridges of the moveable valves of the two forms are slightly different and as the rostrum and carina of the Siboga-animals are much larger than in *V. magna*, I have thought it better to describe the form occurring in the Malay Archipelago as a distinct species. It is certainly nearly related to the Atlantic form.

2. *Verruca navicula* n. sp. Pl. XII, fig. 4—6. Pl. XIII, fig. 5—7.

Shell not depressed, plan of the moveable valves vertical to the basis. Moveable valves large, the scutum with 5, the tergum with 7 articular ridges. Apex of the carina slightly produced, rounded, that of the rostrum hardly produced, but also rounded. Carina and rostrum having one longitudinal rim and articulating with one another with a single tooth. Fixed scutum and tergum relatively large, having a great elevation and articulating with one another by means of two articular ridges.

This beautiful species (Pl. XII, fig. 4 and 5) is characterised in the first place by the great number of articular ridges on the moveable valves, and in the second place by the high elevation of these valves and of the fixed scutum and tergum also. The rostrum and carina are on the contrary more developed in breadth than in height. On all the parts of the shell the lines of growth are very distinct; the surface of the fixed tergum and scutum and of the rostrum and carina is furnished, moreover, with very characteristic folds, the direction of which is perpendicular to that of the lines of growth.

This species is represented in the Siboga collection by two specimens, of which, however, one only can be considered as full-grown.

The moveable scutum has the apex distinctly beaked and projecting freely. Its shape

is elongately triangular, its height being almost twice the length of the basis. Its occludent margin is curved, its basal margin straight, its tergal margin straight also, yet furnished with numerous indentations. The outer surface shows numerous articular ridges, the most pronounced of which, the axial articular ridge, describes a distinct arch and runs from the basi-tergal angle to the apex. Four other ridges occupy the interspace between the axial ridge and the tergal margin, and run parallel to each other, and each following one is shorter and less strongly curved than the preceding one. Each ridge, moreover, grows slightly broader towards the under extremity and is distinctly divided by transverse lines corresponding with the growth ridges of the valve itself. The fourth of these ridges is the shortest; it is nearly straight and runs along the tergal margin of the valve.

The moveable tergum is large and quadrangular. Of the occludent margins the longer is feebly curved and the shorter slightly hollowed out; they meet at the apex which is distinctly beaked. The scutal margin is nearly straight, yet furnished with indentations in which fit the teeth of the tergal margin of the scutum; the basal margin is nearly straight, or, perhaps, feebly curved, but l. c. this could be decided only by isolating the different valves, which I have not thought desirable. The outer surface of the tergum shows a strongly developed and curved axial articular ridge, which widens considerably towards the scuto-basal angle; it has moreover a distinct marginal ridge along the shorter occludent margin and five intermediate ridges nearly filling up the whole interspace between the two first described. These five ridges run nearly parallel to the axial ridge and to each other; from the apex down to the scutal margin of the valve each ridge grows wider and slightly diverges; each of their extremities forms one of the teeth for the articulation of this valve with the moveable scutum. All these ridges are transversely divided by furrows which correspond with the growth ridges on the surface of the remaining part of the valve.

The carina and rostrum have both an irregular quadrangular shape, the carina being a little higher, the rostrum a little broader. The apices of both valves project freely, and slightly beyond the edge formed by the other valves. The carina is furnished with a distinct furrow, running at some distance from the tergal margin towards the apex of the valve. At the inferior extremity of this furrow an indentation is seen on the rostral margin, in which fits the tooth-like point of the rostrum at the scuto-carinal angle of that valve. For the rest the suture between the rostrum and carina is straight and has no teeth or indentations. The surface of the rostrum is divided into two triangular parts by a rim running from the basi-carinal margin to the apex: from this rim the lines of growth run parallel to the carinal margin in the upper part and parallel to the basal margin in the lower part. The surface of the latter, as also that of the part of the carina which lies beneath the furrow, and more distinctly so towards the basal margin of the valve, is not smooth, but folded, the folds being perpendicular to the growth ridges.

The fixed scutum and tergum have also a very characteristic structure. The fixed tergum is composed of two parts: a triangular portion which is very narrow at the apex and slightly broader in its inferior half where it articulates with the lateral margin of the carina, and a flat and broad part at the hinder portion of the shell. The latter part is irregularly quadrangular,

and again divided into two parts by a ridge running from the apex downwards. At a little distance from the apex this ridge begins to show traces of teeth and these grow more distinct downwards; at the same time a second row of teeth gradually shows itself along the outer row. These teeth form the lateral extremities of the growth ridges, which here generally run parallel to the basal margin. The same ridges run parallel to the scutal margin of the valve on the other part of the fixed tergum, viz. that part which lies between the ridge and the fixed scutum.

The fixed scutum has a pointed and distinctly beaked apex and is composed of a broader, nearly flat, triangular portion and a narrower inflected portion which only widens somewhat towards its inferior extremity. The tergal margin is hollowed out and furnished with a row of teeth, which project over the margin of the tergum and which stand at the place of the kind of radius developed at the tergal margin of the scutum in other species of *Verruca*. The ridges of growth are distinct, their direction is very irregular, yet they, generally, run parallel to the basal margin of the valve. In the inferior part of the valve these growth ridges are produced laterally into distinct teeth, forming together a row which runs nearly parallel to the row of teeth which was compared with the radius of the scuta of other species of *Verruca*. Here and there, and especially on the inferior half of the surface of the fixed tergum and scutum, are vertical folds, of varying width and of a very unequal distinctness.

The basis of the shell is elongately oval in shape and is, probably, membranous, as in the other species of the genus. The large specimen is attached to a bundle of presumably siliceous needles, the smaller to a single slightly stronger needle.

The size of the large animal can be judged from the following dimensions: height 11 mm., distance from the apex of the rostrum to that of the carina 9.5 mm. The young specimen has the same dimensions 2.9 and 3 mm. respectively.

A figure of the young specimen is given on Pl. XII, fig. 6. I think there can be no doubt but that it really is a young specimen of the species described above. The general shape of the shell and of the different valves is already much like that of the full-grown animal. The differences are to be considered as caused by the difference of age. Briefly, these differences are as follows:

1 the intermediate articular ridges of the tergum, i. e. those between the axial and the feebly indicated ridge along the shorter occludent margin are partly developed only: in fact their basal portions only can be made out;
2 the articular ridges of the scutum also are only partly developed;
3 the rim running over the rostrum from the carino-basal angle to the apex is still wanting, the lines of growth in the upper and lower triangular portions of the valve being still continuous; and
4 the furrow of the carina is represented by a rather indistinct line only.

For the study of the growth of the valves of species of this interesting genus, and for the determination of younger specimens also of other species, I thought it would be of interest to point out these differences for the present species.

I sacrificed the smaller specimen in order to investigate the structure of the animal's body and with regard to this the following may find a place here.

The body is much flattened and the distance between the mouth and the adductor scutorum muscle is large.

The mouth is not bullate; the crest of the labrum is surmounted by 40—50 extremely small conical teeth. Numerous delicate hairs, directed towards the mandibles, are disposed on the surface. Palpi rather short, conical, with numerous hairs on the outer side and at the extremity.

Mandible (Pl. XIII, fig. 5) with three teeth and inferior angle pectinated as usual. The upper margin of the third tooth has a couple of additional small teeth and the upper (or anterior) margin of the inferior angle is serrated with about five sharply pointed teeth, the size of which increases from above downwards. Distance between tips of first and second teeth about one and a half times the distance between second and third.

Maxilla (Pl. XIII, fig. 6) with the three relatively strong upper spines; the notch is not deep, but rather wide, and has one short spine at the upper margin near the three upper spines, and two short spines at the inferior margin, which is the upper margin of the step-formed projection. The latter has about 6 spines along the outer edge, one of which is longer and slightly stouter than the others.

The outer maxillae have the interior surface feebly lobed, the outer clothed with numerous rather long and curved bristles.

Cirri. Cirrus of first pair standing near the mouth at some distance from the other pairs. This distance, however, is smaller than in the other species of the genus. Rami very unequal in length: the shorter is considerably broader and has 8—9, the longer has narrower segments the number of which is 13—14.

Cirrus of second pair has the longer ramus about twice as long as the other; the latter has 6—7 somewhat broader, the former 13—14 slightly longer and narrower segments. The distal segments of the shorter ramus short and square at the tip.

The cirri of the posterior pairs have numerous slightly elongated segments; as a rule they are not protuberant in front; they bear at that side two pairs of slender spines and a third pair of much smaller spines. The dorsal tuft has one long and a few shorter and more delicate spines. The cirri of the 4th—6th pairs are longer than those of the third pair and still increase in length from the 4th to the 6th. The rami of the last pair are composed of 23—24 segments.

Caudal appendage very long, about half the length of the cirrus of the last pair. Number of segments 21. Length of last segments (Pl. XIII, fig. 7) more than six times their breadth. Numerous delicate spines are disposed at the extremity of each segment.

This species was dredged by H. M. S. "Siboga" at the following places:

Stat. 52. April 20, 1899. Lat. 9° 3'.4 S., Long. 119° 56'.7 E. Depth 959 m. Bottom: globigerina ooze. One specimen, attached to a bundle of siliceous needles of a sponge?

Stat. 170. August 26, 1899. Lat. 3° 37'.7 S., Long. 131° 26'.4 E. Depth 924 m. Bottom: fine grey mud. One smaller specimen, attached to a glass needle.

General Remarks. This is a very characteristic species. It is recognisable at once by

the height of the moveable tergum and scutum and the numerous ridges which serve for the articulation of these valves.

3. *Verruca cassis* n. sp. Pl. XI, fig. 1—6. Pl. XII, fig. 7—8. Pl. XIII, fig. 8—10.

Shell not depressed, moveable valves nearly perpendicular to the surface of attachment. Moveable tergum with five longitudinal ridges, moveable scutum also with five ridges, the fifth extending along the middle articular ridge on the side of the occludent margin of the valve. Carina with the apex rounded at the tip and slightly produced only, much smaller than the rostrum. Apex of rostrum rounded, not produced. Carina and rostrum articulating with 4 to 5 teeth which diminish in size towards the basal margin. Fixed tergum and scutum articulating with the aid of two narrow and somewhat indistinct ridges.

Several specimens of a *Verruca* were collected at different stations in the Malay Archipelago, at depths varying from 800 to 1600 m., and, although differing in certain characters from each other, must all be considered as belonging to one and the same species. The differences must be attributed, I think, partly to differences in age, partly to differences in the surface of attachment, which is very narrow for specimens attached to sponge-needles and broader for those attached to stems of a different nature.

The colour of the shell is white in young specimens and dirty-yellowish in older; traces of a chitinous membrane are here and there visible. The growth-ridges are not very distinct on the rostrum and carina but can distinctly be made out on the moveable valves as well as on the fixed scutum and tergum. The moveable valves are relatively large, the rostrum rather bulky and broad; the broken line of articulation between rostrum and carina is not near the middle of the front side of the shell but towards its carinal side (Pl. XII, fig. 7 and 8).

The moveable scutum (Pl. XI, fig. 1) is not very small, its area equalling about two-thirds of that of the moveable tergum. Its shape is triangular, the occludent margin strongly curved, the basal margin almost at right angles to the tergal margin and more than half as long as that margin. The tergal margin shows five rather blunt excrescences or teeth: the apex of the valve being the first, the extremity of the axial ridge the fifth of these teeth; the basal margin has two such blunt excrescences, one at the extremity of the axial ridge and one at the extremity of the fifth ridge which runs along the axial one. Of these ridges the first is short, narrow and indistinct: only visible when the valve is isolated; the second is much broader and extends to about half the length of the tergal margin; the third is slightly narrower than the second, distinctly curved, extending to within a short distance from the extremity of the fourth or axial ridge. This axial ridge is very prominent, curved and grows broader from the apex towards the basi-tergal corner, where it projects freely. The fifth is about as broad and strong as the axial ridge, but its extremity can hardly be said to project freely, though forming a little excrescence on the basal margin of the valve. This fifth ridge is hardly visible in the smaller, no doubt younger, specimen. The part of the valve which is enclosed between the last (fifth) articular ridge and the occludent margin is relatively narrow and shows, especially in the inferior part, distinct ridges of growth which run parallel to the basal margin.

The moveable tergum (Pl. XI, fig. 2) is rather broad and quadrangular. The axial ridge, which is to be considered as the fifth ridge, is beautifully curved, grows wider from the apex towards its inferior extremity and projects freely at the basi-scutal corner of the valve. The part of the valve between the axial ridge and the curved longer occludent margin is flat, has a triangular shape and shows distinct growth-ridges, which run parallel to the perfectly straight basal margin. The part of the valve between the axial ridge and the nearly straight shorter occludent margin has a triangular shape also, but its surface is not flat but divided into ridges separated by more or less distinct furrows. Of these ridges the first runs along the shorter occludent margin of the valve: it is narrow, slightly shorter than the second and can only be made out when the valve is isolated. The second is broader, especially towards its free extremity, which projects as a tooth on the scutal margin of the valve. The third is shorter than the second and the fourth, but, like the other ridges, it grows broader towards the scutal margin of the valve. The fourth is the broadest of all, it is distinctly curved and its surface is convex; its extremity projects slightly — not so strongly as the second and fifth ridges — on the scutal margin of the valve. The scutal margin shows altogether only three distinct excrescences or teeth, the extremities of the first and third articular ridges not projecting at all.

The rostrum (Pl. XI, fig. 3) is large, bulky, of a quadrangular shape. It is strongly convex, especially in its inferior part; it has the basal margin distinctly curved, the upper margin hollowed out. A rim along the upper margin is divided into two or three little teeth, which serve for the articulation of the scutum with this valve, and also to support the extremity of the big upper tooth of the carina. The carinal margin is furnished with five teeth (when fullgrown), four in the younger specimens; these teeth diminish in size from the upper towards the basal margin of the valve. Near the carinal margin the surface of the valve is distinctly undulated, the crests of the waves being only feebly prominent however, and not distinctly ringed. In other specimens more distinct prominent ridges could be made out, their direction being from the carinal margin to the scuto-lateral angle of the valve.

The carina (Pl. XI, fig. 4 and 4*a*) is parallelogram-shaped as far as the part of the valve situated at the side of the moveable valves is concerned; a smaller triangular part of the valve forms a sharp angle with the main part and bends over to the side of the fixed scutum and tergum. The upper margin of the main part is convex, its lateral margin nearly straight, its basal margin more or less irregular according to the convex surface of the object to which the shell is usually attached. The rostral margin has the same number of teeth as the carinal margin of the rostrum, their size corresponding with the excavations of the other valve. The undulations of the surface are, as a rule, slightly better developed than on the rostrum. The triangular part which bends over to the side of the fixed tergum shows distinct growth-ridges, and the upper margin rests against the basal margin of the carinal-lateral portion of the fixed tergum.

The fixed tergum (Pl. XI, fig. 5) has the ordinary shape: a well developed middle portion of triangular shape and two triangular lateral portions. One of these is situated at the carinal side of the valve: it has a rather long and convex occludent margin and a shorter and excavated basal margin; it describes a distinct angle with the middle portion, to which it is attached by a rather long and concave margin. The remaining lateral portion, which might be called the

scutal lateral portion, is smaller: it has a straight occludent margin, an excavated basal margin, and a convex lateral margin. The middle portion shows near its base and at the scutal margin of the valve two feebly developed rims, serving for the articulation of the valve with the fixed scutum. The upper part of the whole valve is reflected, so that its outer surface is distinctly concave.

The fixed scutum (Pl. XI, fig. 6) is broader, but perhaps not quite so high as the fixed tergum. Its shape is irregularly quadrangular, with the upper or occludent margin convex, the rostral margin nearly straight, the long basal margin irregularly convex, according to the surface of the object to which the shell is attached, the tergal margin is hollowed out and furnished with a kind of radius and a rim along the basal portion of the margin, both serving for the articulation with the fixed tergum. The outer surface of the valve shows distinct ridges of growth, the direction of which, however, is rather irregular. From the slightly beaked apex to the basi-rostral angle of the valve a feebly-undulating line divides the valve into two triangular portions which together make a very blunt angle; the whole valve is, moreover, not flat but laterally bent towards the side of the moveable valves.

The size of the shell as shown in the middle-sized specimen figured on Pl. XII figs. 7 and 8 is 4.5 mm. height measured from the basal margin of the rostrum to the apex of the tergum; 3.5 mm. distance from apex of carina to that of the rostrum. These measurements are slightly smaller in some of the other specimens. In the largest specimen of all, taken at Station 43, the height measured 5.2 mm., the distance between the apex of rostrum and carina more than 4 mm.

The study of the animal's body has given the following results:

The body as a whole is much flattened, the prosoma is slender, the cirri rather long.

Mouth laterally compressed, the anterior median line rounded but not bullate. Crest of labrum with more than 20 small teeth on each side; palpi elongately triangular, with the inner margin slightly hollowed out, the outer margin convex and the tip bluntly pointed. A row of short hairs is disposed along the inner margin, those at and near the extremity being a little longer and curved. Over the outer surface a few shorter hairs are scattered.

Mandible (Pl. XIII, fig. 8) as usual: with three teeth and the inferior angle terminating in a group of about 4 short spinelike, flattened teeth. The distance between the extremities of teeth 1 and 2 little more than twice as long as that between teeth 2 and 3. The first tooth long and pointed, teeth 2 and 3 shorter and not pointed at the extremity. The upper margin of tooth 2 shows an indication of an accessory tooth, that of tooth 3 is furnished with such an accessory tooth, and the upper or anterior margin of the inferior angle with a row of 5 or 6 of such accessory teeth, of which the most inferior one is the longest and stoutest. Inferior angle short, not produced.

Maxilla (Pl. XIII, fig. 9). Notch beneath the three upper spines hardly indicated, the lower part, however, distinctly projecting forward. In the interspace between the three upper spines and the projecting inferior part two spines are disposed. The inferior part bears half a dozen stronger spines and a group of about 5 shorter and more delicate spines near the inferior angle.

Outer maxillae with the inner face distinctly bilobed and numerous curved hairs disposed along the outer margin and over part of the outer surface.

Cirrus of the first pair situated very near the mouth with slightly unequal rami, both

composed of 11 segments. The terminal segments of the longer ramus are slightly longer than those of the shorter ramus. The six inferior segments thickly clothed with hairs, the remaining segments with few hairs on the surface but with a well developed row of stronger hairs near the extremity.

Cirrus of second pair has also slightly unequal rami: a shorter ramus composed of 11 broader and a longer ramus of 13 somewhat longer segments. Hairs scattered over the whole surface of the segments, more thickly disposed on the segments of the shorter ramus. The hairs of the longer ramus are longer and more delicate.

Cirrus of third pair has 15 and 17 segments in the slightly unequal rami. Hairs on the lower segments numerous, irregularly disposed; grouped in pairs along the anterior margin of the distal segments, one pair moreover being disposed on the posterior margin, near the extremity of each segment.

In the cirri of the fourth-sixth pairs the number of segments gradually increases. Those of the last pair have 28 segments in each ramus. The number of pairs of spines on the anterior side is 3 as a rule, those of the third or most inferior pair being always extremely delicate.

The caudal appendage is very long and slender. It has about 26 segments and reaches with its extremity beyond the extremity of the 12th segment of the sixth cirrus. Very long and delicate hairs form a wreath at the extremity of some of the segments and are almost entirely absent at the end of others: See Pl. XIII, fig. 10. Length of last segments about four times their breadth.

The penis is relatively thick at the base, much narrower at the extremity. Its surface is distinctly ringed and delicate hairs are scattered over the rings and grow more numerous towards the extremity.

This species was collected at the following Stations:

Stat. 45. April 6, 1899. Lat. 7° 24′ S., Long. 118° 15′.2 E. Depth 794 m. Bottom: fine grey mud. Five specimens in two lots, all of them attached to cylindrical black sticks of a nature unknown to me.

Stat. 46a. April 7, 1899. Lat. 8° 0′.5 S., Long. 118° 34′.7 E. Depth 1600 m. Bottom: mud. Two specimens attached to a black cylindrical stick.

Stat. 151. August 12, 1899. Lat. 0° 12′.6 S., Long. 129° 48′ E. Depth 845 m. Bottom: fine grey mud. Numerous specimens attached to a small bough or stem, which is hollow, and the nature of which is unknown to me.

Stat. 284. January 18, 1900. Lat. 8° 43′.1 S., Long. 127° 16′.7 E. Depth 828 m. Bottom: grey mud. One specimen attached to the needle of a glass-sponge.

General Remarks. The specimens from the different Stations and even those of one Station are slightly different from one another — yet there can be no question about their belonging to the same species. The most important differences are those in the distinctness of the line running parallel to the axial ridge, on that part of the scutum and tergum which lies between that ridge and the occludent margin; next, in the size and development of the teeth with which rostrum and carina articulate together, and finally in the greater or lesser distinctness of the grooves on the surface of the rostrum.

Of the known species, *V. cassis* comes nearest to *V. cristallina*, Gruvel, the main

difference being that the surface of the rostrum in the latter species shows very prominent articular ridges, whilst these are absent, hardly visible or slightly prominent only in *V. cassis*. The articular ridges of the fixed tergum, moreover, which are well developed in *V. cristallina*, show themselves only as feebly developed rims in *V. cassis*.

4. *Verruca grex* n. sp. Pl. XI, fig. 7—13. Pl. XIII, 11—13.

Shell not depressed, moveable valves nearly perpendicular to the surface of attachment, compartments broad, base also broad but very narrow. Moveable scutum and tergum each with four articular ridges. Rostrum, seen from the front, triangular and somewhat elevated, carina elongate and horizontally extended, articulating with the rostrum by means of one strong and three smaller teeth. Rostrum bending over to the side of the fixed scutum and tergum with a triangular part. Fixed scutum much larger than fixed tergum, the latter bending over to the side of the moveable valves with a triangular part.

This interesting species was collected at several Stations. As a rule, numerous specimens are attached to the same spine of an Echinid (Pl. XI, fig. 7). The shell is white, its form very characteristic, which is due partly to its obliqueness, the moveable valves overhanging more or less towards the side of the carina, partly to the shape of carina and rostrum and to the way in which these compartments are articulated together (Pl. XI, fig. 8 and 9).

The moveable scutum (Pl. XI, fig. 10) is relatively large, triangular, with the occludent margin very strongly curved, the basal margin nearly straight and the tergal margin with four shallow indentations in which fit the rounded extremities of the articular ridges of the moveable tergum. The apex is distinctly beaked; the part of the surface not occupied by the articular ridges shows very pronounced ridges of growth and is, moreover, longitudinally striped with shallow grooves. In this way a rather distinct fifth articular ridge is separated from the remaining part, close along the main or axial ridge. The latter ridge is the longest of all; it is strongly curved and runs from the apex to the basi-tergal angle, where its extremity forms a slightly projecting spur. The succeeding ridges are parallel to the main ridge, but each is shorter and slightly less curved than the preceding.

The moveable tergum (Pl. XI, fig. 11) is quadrilateral and nearly rhombiform. Its two occludent margins meet in a rather blunt angle; its basal margin is slightly convex and forms an obtuse angle with the extremity of the axial ridge. Its scutal margin shows indentations corresponding with the extremities of the articular ridges of the scutum. The main articular ridge is nearly straight, slightly curved only near the apex of the valve; it grows distinctly broader to the basi-scutal angle, where it forms a spur-like excrescence. The following articular ridges are all nearly straight, decreasing in length, so that the last one forms at the same time the shortest of the two occludent margins of the valve. The latter ridge is longitudinally furrowed and might in consequence be counted as two. The part of the valve between the axial ridge and the longest of the two occludent margins is triangular, shows distinct growth ridges and a few shallow grooves which run nearly parallel to the occludent margin.

The rostrum is rather stout; a large triangular part of it is situated at the side of

the moveable valves, a smaller part, also of triangular shape, is bent over to the side of the fixed compartments. The larger part is strongly developed longitudinally, its elevation surpassing considerably that of the carina. It might again be considered as composed of two parts: one between the basal margin of the valve and the crest of the angle formed with the part on the other side of the shell, and one between the carinal margin and the upper or scutal margin of the valve. These two parts are separated from each another by means of a stronger ridge, which runs almost longitudinally. Along this ridge two other less prominent ridges may be seen, each terminating in a slightly prominent tooth, serving for the articulation of this valve with the carina. A fourth articular ridge runs along the scutal or upper margin of the valve and forms at its basal extremity, i. e. at the scuto-carinal angle, a larger tooth, fitting in an excavation of the rostral margin of the carina. The surface of this valve has distinct growth-ridges and is, moreover, irregularly folded, the folds not reaching to the apex of the valve.

The carina is broad or wide, not high. Its surface is distinctly bowed longitudinally as well as transversely, its shape being in consequence elongately spoon-like. Its upper or tergal margin is short and concave, its basal margin is much longer and convex. The basal part of the valve is somewhat curved over the rounded-spine to which the shell is attached and thus a small part of its margin is seen when looking at the shell from the side of the fixed scutum and tergum. The lateral margin of the valve is short, and articulates with the triangular part of the fixed tergum, which bends over to the front of the valve. The rostral margin of this valve is long and shows four excavations in which fit the extremities of the four articular ridges of the rostrum. The widest of these excavations is that for the reception of the strong tooth of the rostrum at its scuto-carinal angle. The part of the valve along the rostral margin develops into a kind of articular ridge and running parallel to it are two other ridges, which, however, can best be seen at their extremities where they project as teeth, which fit between the teeth at the extremity of the articular ridges of the rostrum. The carina shows also growth-ridges, and the part of the surface near the lateral margin is, moreover, distinctly folded, the direction of the folds changing from longitudinal, near the lateral margin, to nearly transverse parallel to the growth ridges.

The fixed scutum (Pl. XI, fig. 12) is considerably larger than the fixed tergum. It is more than one and a half times as broad as high. Its basal margin is long, slightly convex and shows numerous shallow excisions corresponding to vertical folds at the outer surface of the valve. The tergal margin is short and shows at the outer side a narrow radius, overlapping the fixed scutum at its scutal margin. On the inner surface there is, near the distinctly beaked upper angle, an excavated part bordered by a ridge and serving for the reception of the upper angle of the fixed tergum. The occludent margin is concave and relatively long, the lateral margin is composed of a short upper part, which lies along the upper part of the scutal margin of the rostrum, and a longer under part along the lateral margin of the rostrum. The latter part of the margin has an irregular, sinuous course. The valve itself is divided into three parts: a large triangular part between the basal margin and a somewhat curved rim running from the basi-rostral angle to the apex; a triangular part along the occludent

margin, which cannot be seen when looking at the shell from the side of the fixed valves, but which is very distinct when the valve is isolated and looked at from the inner side (Pl. XI, fig. 12). The third part lies between the two, its shape is also triangular and it extends from the apex to the lateral margin of the valve. In this part the growth ridges run nearly longitudinally, but as the valve is here somewhat hollowed out longitudinally, the course of the growth ridges is not straight but undulating.

The fixed tergum is composed of two parts standing at right angles to one another: the part at the hinder portion of the valve, which is overlapped by the tergal margin of the fixed scutum, is the larger one, and has an irregular quadrangular shape. Its upper margin forms part of the occludent margin and is relatively short; its basal margin is considerably longer and distinctly undulating. It has a very irregular scutal margin (Pl. XI, fig. 13) and its fourth margin forms the edge of the angle with the other part of the valve. The shape of the latter is triangular, it has a short basal margin and its free lateral margin lies partly as occludent margin along the larger occludent margin of the moveable tergum, partly along the lateral margin of the carina. This part of the valve is like the other but is more strongly ribbed longitudinally, the ribs growing more prominent towards the base of the valve.

Size. The distance from the apex of the rostrum to that of the carina is in one of the largest specimens 6 mm.; the greatest height of the same shell is 4.5 mm., the greatest dimension of the base, measured along the spine to which it is attached, is 8.3 mm.

The study of the structure of the animal's body has given the following results:

Mouth much flattened laterally. Labrum rounded anteriorly but not bullate. Crest with a row of teeth, about 15 on each side; ten of these on each side from the middle have the apex with two or even three points, the remaining five at both extremities of the crest having the ordinary triangular shape, the most distal teeth being very small. Palpi rather large, broad at the base, bluntly pointed at the extremity, with a row of short bristles along the inner margin and a tuft of longer hairs at the extremity. A few short bristles scattered over the outer surface.

Mandible (Pl. XIII, fig. 11) much as usual in this genus; distance between tips of first and second teeth almost twice as long as that between second and third. Inferior angle moderately produced, terminating in a group of four small teeth. Teeth on the front side of the inferior angle at their bases fused together in a kind of crest, the tips of five or six of them emerging above the margin of the crest.

Maxilla (Pl. XIII, fig. 12) with short spines and a very shallow notch. Of the three upper spines the third is very delicate and lies against the second. 3 or 4 small spines are disposed in the notch, whereas the somewhat projecting inferior part bears half a dozen of spines, of which one is longer and slightly stouter; a group of numerous small spinelike hairs occupies the edge of the inferior angle.

Second maxillae small, outer margin rounded, inner margin with a shallow notch, and indistinctly bilobed. Surface with short hairs as usual.

Cirri. Cirrus of first pair with very unequal rami: the long ramus has 21 segments and is slender, the short one has 9—10 segments, and is broad and somewhat curved. Of the latter all the segments are densely clothed with hairs; of the long ramus the seven lower segments

have numerous hairs disposed on the surface, the more distal segments having hairs almost exclusively round the base of each following segment.

The second cirrus also has very unequal rami: the short ramus has 7 segments and looks as if it was truncated at the extremity; the long one has 20 segments, increasing slightly in length, but decreasing considerably in breadth towards the extremity of the ramus. Shorter ramus and lower 6—7 segments of the longer ramus thickly clothed with hairs.

The third cirrus has shorter rami than the 4th—6th cirri. Surface of the lower 10 segments densely clothed with hairs in both rami. Number of segments 16 in the shorter, 18 in the longer ramus.

The fourth-sixth cirri have slightly longer rami — but even these cannot be said to be very long. The number of segments seems to increase from the 3rd to the 6th: at least I found in a specimen the following numbers:

3rd cirrus . . .	16 and 18 segments
4th cirrus . . .	19 and 20 segments
5th cirrus . . .	22 and 22 segments
6th cirrus . . .	23 and 24 segments.

All the segments of the 4th—6th cirri bear at the anterior side two pairs of stronger and a third pair of delicate bristles; at the posterior side near the extremity of each segment a few delicate spines, which on the more distal segments are almost rudimentary.

The caudal appendage is very slender; I counted 25 segments in one of them. Length of last segments (Pl. XIII, fig. 13) about four times their breadth.

The penis is thick, broad at its base, tapering towards the extremity. It is distinctly ringed and bears delicate hairs scattered over its surface; at and near the extremity, the hairs are disposed much more densely.

This species was collected at:

Stat. 74. June 8, 1899. Lat. 5° 3'.5 S., Long. 119° 0' E. Depth 450 m. Bottom: Globigerina ooze (obviously a thin layer). Numerous specimens attached to the spines of *Cidaris (Histocidaris) elegans* Alex. Agassiz.

Stat. 267. December 20, 1899. Lat. 5° 54' S., Long. 132° 56'.7 E. Depth 984 m. Bottom: grey mud with a brown upper layer. Six specimens, two of them attached to a spine of *Cidaris misakiensis* Yoshiwara, the others loose; the latter have also been attached to a cylindrical object.

Stat. 297. January 27, 1900. Lat. 10° 39' S., Long. 123° 40' E. Depth 520 m. Bottom: soft grey mud with brown upper layer. One specimen attached to a spine of *Cidaris japonica* Döderlein.

General Remarks. This is a very peculiar species of *Verruca*. It shows some resemblance to *V. radiata* Gruvel in the structure of the moveable valves, although the articular ridges of the scutum, which in *V. radiata* are very narrow, are quite broad in *V. grex*. The shape of the fixed valves and of the rostrum and carina especially, is quite different from what we find in other species of the genus.

The number of specimens on the same spine of a *Cidaris* is sometimes considerable.

There are spines with one or two specimens only, there are others with 5 or 6 or more specimens, and there is even a spine with 12 specimens attached to it.

This species seems to range over a considerable depth: there are specimens found at 450, 520 and 984 m.

5. *Verruca conchula* n. sp. Pl. XI, fig. 14 and 15.

Shell not depressed, plan of the moveable valves in the same direction as that of rostrum and carina. Moveable tergum with three articular ridges, scutum also with three articular ridges as well as three prominent ridges between its axial ridge and its occludent margin. Carina small, with the apex projecting freely; rostrum large, with numerous and very prominent ridges, cup-shaped, turned over with its base to the side of the fixed valves. Fixed scutum laterally turned over to the side of the moveable valves.

This beautiful but curious species is represented by a single specimen only. It is a small shell, the largest diameter being under 6 mm. It is loose and has been attached, to judge from the form of its base, laterally against a cylindrical object, part of the outer surface of which is still to be seen adhering to the membrane representing the basis. The colour of the shell is dirty white, yellowish. It is recognisable at once by the numerous and prominent ridges, or ribs with rounded surface, especially on scutum and rostrum, and also on part of the fixed scutum and the carina (Pl. XI, fig. 14). The whole shell has an irregular globular shape, but the rostrum particularly is very distinctly convex, markedly bent over to the side of the fixed valves.

The moveable scutum is relatively small, triangular, with the occludent margin very strongly convex, the basal margin nearly straight but having three excavations, in which fit the extremities of as many ribs of the rostrum, and the tergal margin irregularly toothed and with excavations between the teeth. Besides the three ordinary, true articular ridges, the third of which is more strongly developed and represents the axial ridge, the surface of the scutum shows three other longitudinal and rather prominent ridges on that part which is between the axial ridge and the occludent margin. Of the articular ridges, the first extends to about the middle of the tergal margin, the second to where it meets the main articular ridge of the tergum, and the third to the basi-tergal angle of the valve.

The moveable tergum is rhomboidal in shape, and distinctly, though not sharply beaked. The longest occludent margin is convex, the shortest hollowed out, the scutal margin irregularly toothed, the basal margin straight. The part of the surface between the main articular ridge and the convex occludent margin shows distinct lines of growth running parallel to the basal margin; the rest of the surface is occupied by the three articular ridges: the main or axial, which is strongly convex and runs from the apex till the basi-scutal angle, the middle ridge, which is broad and also convex, and the first, which runs along the occludent margin and can hardly be distinguished from it.

The carina is rather small and has the apex projecting beyond the basi-carinal angle of the tergum. Its shape is triangular; its tergal margin is straight, the margin forming the

basal edge slightly sinuous, and the rostral margin irregularly toothed. The surface shows deep longitudinal furrows running from the apex to the rostral margin and separating from one another four prominent ridges, the one running along the tergal margin being by far the broadest.

The rostrum is patelliform and much larger than the carina; it might also be compared with a hand, the palm of which is small and the fingers numerous, narrow and strongly curved. The latter are represented by the prominent ridges, which extend to the scutal and carinal margins of the valve and fit between the extremities of the ridges on the surface of scutum and carina. I wished to keep the single specimen intact, and since the margins of the different valves can be made out with certainty only by isolating them, it is quite possible that figure 14 of Pl. XI is not absolutely correct with regard to the course of these margins — in the main, however, the figure will be found to represent them as they are.

The basal edge of the rostrum, like that of the carina, is inflected inwards and forms a kind of ledge round the basal aperture of the shell.

The fixed scutum is broad, its apex obtuse; it overlaps the scutal triangular part of the fixed tergum with a small radius. An important part of this valve is bent over to the side of the moveable valves, and in consequence the whole valve has somewhat the shape of a cap. The portion of the valve situated at the side of the moveable valves has on its surface several prominent ribs or ridges, running parallel to those on the moveable scutum. They extend further than these, however, and go beyond the basal margin of the moveable scutum. So the inferior parts of these ribs run for a short extent parallel to some of the ribs on the surface of the rostrum, which extend to the basal extremities of the ribs on the moveable scutum.

The fixed tergum is smaller than the fixed scutum. It consists of three parts: the triangular and distinctly beaked middle part, the scuto-lateral part, which is also triangular and is overlapped partly by the radius of the fixed scutum, and the occludent lateral part which is inflected towards the side of the moveable tergum, the free margin of which runs parallel to the occludent margin of that valve. The surface of the fixed tergum is nearly perfectly smooth, like that of the fixed scutum.

The membrane (fig. 15 *m*) representing the basis of the shell is partly seen in the oval basal aperture of the shell; at the side of the fixed scutum and tergum it still adheres to the outer surface of the object (ibid. *b*) to which it has been attached; at the side of the rostrum and carina part of the basal membrane is wanting and in consequence a view of the interior (part of the ovary (ibid. *o*) etc.) is possible.

Size. The height of the shell is about 5 mm., the distance from the apex of the rostrum to that of the carina 5.6 mm.

This specimen was collected by H. M. S. "Siboga" at

Stat. 297. December 27, 1899. Lat. 10° 39′ S., Long. 123° 40′ E. Depth 520 m. Bottom: soft grey mud with brown upper layer.

General remarks. The form of the scutum with its numerous ridges is rather like that of *V. nexa* Darwin. Yet the present species has the scutum slightly larger and shows a further longitudinal ridge. There seems to be some likeness between the two species

in other characters, as for example in the shape of the rostrum, but the differences are more obvious. The carina and the fixed valves do not at all resemble those of *V. nexa*.

Verruca conchula, var. *minor*, nov. var. Pl. XI, fig. 16 and 17.

In the Kei Islands Archipelago two small specimens of a *Verruca* were dredged. These show great resemblance to the *V. conchula* just described but differ, however, in certain characters from the specimen used for that description. I consider this form to be a variety, since I do not believe that the differences are caused by difference in age, as might be supposed, because the animals from the Kei Islands are considerably smaller, their largest diameter measuring 3 mm. only. Although the general shape corresponds fairly well, the carina has a somewhat different form, in consequence of the apex not only projecting beyond the basi-carinal angle of the tergum, but being also distinctly recurved. The rostrum is different also, since the ridges, which in *V. conchula* are disposed to a large extent on the circumference of a central part which I compared with the palm of a hand, in this variety can be followed, though not very distinctly, over the whole surface of the valve. Finally there is an important difference in the way in which the fixed scutum and tergum in the variety are interlocked, each valve having distinct articular ridges which interlock between the articular ridges of the other valve (fig. 17). Such indentations are not seen along the adjoining margins of the fixed scutum and tergum in *V. conchula*.

It is possible, that the variety described here may later be found to represent a different species, and I consider this to be more probable than its being regarded as a younger specimen of *V. conchula*.

This small species was collected at:

Stat. 254. December 10, 1899. Lat. 5°40′ S., Long. 132°26′ E. Depth 310 m. Bottom: fine grey mud. Two small specimens attached to a rounded stick of unknown nature. One specimen only is complete, the other has no moveable valves.

6. *Verruca casula* n. sp. Pl. XIII, fig. 14 and 15.

Shell white, walls perpendicular to the surface of attachment, moveable valves almost parallel to the walls. Moveable scutum with two articular ridges running close together, moveable tergum with two articular ridges also, but separated from one another by an interspace of triangular shape. Apex of the carina pointed, but hardly projecting freely; that of the carina neither pointed, nor projecting. Rostrum and carina articulating together by means of a well-developed and broad tooth on the rostrum, fitting between two feebly-indicated teeth of the carina. Basis narrow, oval.

This species is represented by a single specimen of small dimensions. Its perpendicular compartments are well-developed; in consequence the shell when seen from the side of the moveable valves has the shape of a quadrangular case with a triangular, pointed

roof above it. The growth-ridges on the different valves are not very prominent, on the rostrum only they are rather distinct and broad.

The moveable scutum has the apex pointed, the tergal margin hollowed out near the apex, and slightly protuberant at the basi-tergal angle; the basal margin is straight and the occludent margin strongly curved. The main articular ridge is distinctly curved, a second ridge runs closely to it, separated from the tergal margin by a flat, narrow part, without a trace of an articular ridge along the tergal margin.

The moveable tergum has the apex slightly produced, but obtuse and not pointed; its shape is nearly regularly rhomboidal with the longer occludent margin curved and the shorter slightly hollowed out. The basal margin is straight, the scutal straight also, with a feeble protuberance near the apex of the scutum and another near the basi-scutal angle. The main articular ridge extends from the apex to the basi-scutal angle and is rather strongly curved; another ridge extends along the shorter occludent margin.

The carina is narrower but perhaps a little higher than the rostrum, its apex is pointed but can hardly be said to project freely. The lateral margin is feebly curved and is visible at the side of the fixed scutum and tergum only; the rostral margin shows a distinct excavation near the upper extremity, for the reception of the rounded tooth on the carinal margin of the rostrum. A triangular portion of the surface of the valve near the tergal margin develops into a slight swelling which forms the continuation of the more pronounced swelling on the surface of the rostrum.

The rostrum has the lateral margin shorter than the carinal; while the former is perfectly straight, the latter has a distinct excrescence near the upper extremity, and forms the rather broad tooth with rounded circumference which fits in the excavation of the rostral margin of the carina. A flat semilunar part of the surface is to be seen along the scutal margin of the valve and is separated from the rest of its surface by a distinctly swollen part which grows broader and more prominent towards the carinal margin, where it terminates into the tooth already mentioned.

The fixed tergum is larger — broader as well as higher — than the fixed scutum. Its occludent margin consists of two parts which closely correspond to the two occludent margins of the moveable tergum; its apex is indistinctly beaked. The valve itself consists of a middle portion and two lateral portions. The middle portion is triangular and curved and terminates in the apex; the lateral portions are triangular also: their upper margins are each formed by one of the parts of the occludent margin of the valve. At the side of the carina the lateral portion is overlapped by a narrow strip of that valve, at the side of the fixed scutum by a kind of radius belonging to the latter valve.

The shape of the fixed scutum is irregularly triangular, broad at the base, pointed at the apex. It overlaps the fixed tergum with a triangular portion representing a radius. This portion of the valve is broadest near the upper extremity and very narrow at its base; its upper margin is hollowed out in a very characteristic manner. The remaining part of the valve consists of the curved and triangular middle part and a lateral part of triangular shape also, the free margin of which is attached to the lateral margin of the rostrum.

Basis. The form of the interspace left open between the basal edges of the parietes is elongated oval, about three times as long as broad.

Size. The height of the shell is 2.5 mm., the distance from the apex of the rostrum to that of the carina 2 mm.

The specimen was found attached to a small piece of stem of *Chrysogorgia flexibilis* which was dredged at

Stat. 170. August 26, 1899. Lat. 3° 37'.7 S., Long. 131° 26'.4 E. Depth 924 m. Bottom: fine grey mud.

General Remarks. This species comes near to *Verruca quadrangularis* Hoek from the South Atlantic, the main difference being that the rostrum of the present species articulates with the carina with one tooth only, and that of *V. quadrangularis* with two teeth; secondly the apex of the carina of *V. casula* does not project freely, while it generally does so in *V. quadrangularis*.

7. *Verruca nitida* Hoek.

Hoek, Cirripedia collected by H. M. S. "Challenger". 1883. p. 138, pl. XII, figs. 6—7.

Only a single specimen of this species was collected for the first time, by the Challenger near the Talauer Islands, between Mindanao (Philippines) and Halmaheira, at a depth of 915 m.

Another single specimen was found attached to one of the specimens of *Verruca capsula* n. sp., which H. M. S. "Siboga" dredged at:

Stat. 88. June 20, 1899. Lat. 0° 34'.6 N., Long. 119° 8'.5 E. Depth 1301 m. Bottom: fine grey mud.

This locality is situated at the northern entrance of the Strait of Makassar. The size of this specimen is: height about 9 mm., distance from the apex of the rostrum to that of the carina 8 mm. It is slightly larger than the specimen of the Challenger, which in other characters resembles it closely.

Genus **Balanus** Auct.

Darwin, in his Monograph (1854), enumerated 45 species of *Balanus*, 39 of which were living, and 6 fossil. In 1905 the number of living species had reached 49: 1 species being added to the list by Filhol [1] (*B. Campbelli*, 1885), 2 by Gruvel [2] (*B. Dybowskii* and *B. violaceus*, 1903), 5 by Hoek [3] (*B. corolliformis*, *hirsutus*, *rostratus*, *socialis* and *tenuis*, 1883), 1 by Lanchester [4] (*B. aencas*, 1902) and 1 by Fr. Müller [5] (*B. armatus*, 1867): in Gruvel's "Monographie" of 1905 this number (49) of species is given. From 1905 up to the present

[1] Filhol, A., Mission de l'Ile Campbell. Recueil de Mémoires etc. III. 2e partie. Zoologie. 1885. p. 487.

[2] Gruvel, A., Révision des Cirrhipèdes appartenant à la collection du Muséum (Operculés). Nouvelles Archives du Muséum. (4). V. 1903. p. 95.

[3] Hoek, P. P. C., Cirripedia of the Challenger Expedition. 1883.

[4] Lanchester, W. F., Crustacea of the Skeat-Expedition. Proceed. Zool. Soc. London. II. 1902.

[5] Müller, Fritz, Über *Balanus armatus* etc. Archiv f. Naturgeschichte. XXXIII. 1867.

(June 1912) 10 more species were added to the list, viz. 1 by BORRADAILE[1] (*B. maldivensis*, 1903), 1 by GRUVEL[2] (*B. carenatus*, 1907), 1 by KRÜGER[3] (*B. poecilotheca*, 1911) and 7 by PILSBRY[4] (*B. aquila*, *B. Evermanni*, *B. flos* and *B. orcutti* 1907; *B. peruvianus*, 1909; *B. callistoderma* and *B. hoekianus*, 1911). The number of living species known and described at present would thus amount to 59. It is proposed in the present report, to include in a new genus 4 of the species which hitherto were considered to belong to the genus *Balanus*: 2 of HOEK's species of 1883 (*B. corolliformis* and *B. hirsutus*) and 2 of PILSBRY's species of 1911 (*B. callistoderma* and *B. hoekianus*). The number of species of *Balanus* would therefore be reduced to 55. But, since I have now to propose for this genus 16 new species, the total number of known species would at present amount to 71.

According to his Monograph, DARWIN (1854) knew 9 species of *Balanus*, as occurring in the Malay Archipelago. The Challenger (1883) collected in this region two new species of this genus, so that in all 11 species were known from it. The dredgings carried out during the cruise of the Siboga produced specimens of 26 species of the genus *Balanus*. Of these 16 must be considered — as I have already said — as new to science; of the remaining 10, 6 have already been observed in that region, while 4, although known species, are stated for the first time here to occur in the said region: the total number of species known to occur there would thus amount to 31.

I here give a complete list of the species of *Balanus* hitherto collected in the 6th province which I proposed for the distribution of the Cirripedia, and which includes the Malay Archipelago and the eastern coasts of India. The names are given in alphabetical order. Those with an asterisk are species which, according to DARWIN, are found in this region, but which are not represented in the Siboga-collections. Those with a † are species already known for other regions, but which were collected in the Malay Archipelago by the Siboga for the first time.

**B. ajax* Darwin	Philippine Archipelago, attached to Milleporae.	Shallow water.
B. alatus n. spec.	Sulu Sea: Stat. 97.	564 m.
B. albus n. spec.	Bali Sea: Stat. 12; Kei Islands: Stat. 260; (? Sulu Sea: Stat. 95)	90, 289 (? and 522 m.)
B. amaryllis Darwin . . .	Different places: Stat. 50, 258, Jedan Islands. Also India: Mouth of the Indus, Moreton Bay and N. E. coast of Australia.	13—40 m.
B. amphitrite Darwin . . .	Several places throughout the Archipelago. Extremely common outside the Archipelago, e. g. Mouth of the Indus, Ceylon, Australia, etc.	0—56 m.
B. arcuatus n. spec. . . .	Banda.	9—36 m.
B. auricoma n. spec. . . .	Ternate: Stat. 136; (? Kei Islands: Stat. 260).	27 (and ? 90 m.).

[1] BORRADAILE, L. A., Marine Crustaceans (of the Maldive and Laccadive Archipelagoes). The Fauna and Geography of the Mald. and Lacc. Archipel. Part. IV—VII. VII. The Barnacles. 1903.

[2] GRUVEL, A., Cirrhipèdes operculés de l'Indian Muséum de Calcutta. Mém. Asiatic Soc. Bengal. II. 1907. p. 1—10. 2 pl.

[3] KRÜGER, PAUL, Beiträge zur Cirripedienfauna Ostasiens. Abhandl. d. math.-phys. Kl. d. Bayer. Akad. d. Wisschensch. II. Suppl. Bd. 6. Abhandl. 1911. 72 S. 4 Taf.

[4] PILSBRY, HENRY A., Cirripedia from the Pacific coast of North America. Bulletin of the Bureau of Fisheries. Washington. XXVI. 1907.

——, Report on Barnacles of Peru, collected by R. S. COKER and Others. Proceed. U. S. Nat. Museum. XXXVII. 1909. 12 p. 4 pl.

——, Barnacles of Japan and Bering Sea. Bulletin of the Bureau of Fisheries. Washington. XXIX. (1909). 26 p. 10 pl. 1911.

B. bimae n. spec.	Sumbawa, Bay of Bima: Stat. 47.	13—31 m.
†*B. calceolus* Ellis.	Halfway between Misool and New Guinea: Stat. 164. Also India: Tubicoreen, near Madras.	32 m.
B. carenatus Gruvel. . . .	Akyab, Burmah.	
B. ciliatus n. spec.	Molo Street, Westcoast of Flores; South of Rotti: Stat. 299; Between Adonara and Solor: Stat. 305.	34—113 m.
B. compressus n. spec. . .	Between Wowoni and Buton: Stat. 204; South of Timor: Stat. 289.	75—94—112 m.
* *B. concavus* Bronn.	Philippine Archipelago, Australia.	Shallow water.
B. cornutus n. spec. . . .	Halfway between Misool and New Guinea: Stat. 164.	32 m.
B. cymbiformis Darwin. .	Near Madras.	
B. hystrix n. spec.	Ambon-anchorage.	40 m. or less.
B. investitus n. spec. . . .	East of Sumbawa: Stat. 310; (? Kei Islands: Stat. 260).	73—90 m.
B. longirostrum n. spec. .	Anchorage off Dongola, Palos-bay: Celebes.	36 m.
B. maculatus n. spec. . . .	East of Sumbawa: Stat. 49[a]; Ibidem: Stat. 310.	70—73 m.
†*B. maldivensis* Borradaile.	East of Sumbawa: Stat. 49[a] and 310; Molo Street, Westcoast of Flores; South of Samau Isl.: Stat. 59; between Rotti and Timor: Stat. 302. Also: Maldive Archipelago.	54—390 m.
B. minutus n. spec.	North of Kwandang, Celebes: Stat. 117.	80 m.
†*B. navicula* Darwin	South of Halmaheira: Stat. 144. Also: Tubicoreen, Madras.	45 m.
* *B. patellaris* Spengler. . .	Philippine Archipelago; also: Bengal.	Shallow water.
B. pentacrini n. spec. . . .	West of Kei Islands: Stat. 251 and 253.	204—304 m.
B. proripiens n. spec. . .	Between Wowoni and Buton: Stat. 204.	75—94 m.
B. quadrivittatus Darwin.	East Indian Archipelago; Stat. 164. Also: Philippine Archipelago.	32 m.
B. quinquevittatus n. spec.	Halfway between Misool and New Guinea: Stat. 164.	32 m.
B. socialis Hoek.	Labuan Badjo; between Misool and Salawatti and New Guinea: Stat. 162 and 164; ? between Muna and Buton; Saleyer Islands. Also: Arafura Sea.	9—36 m.
* *B. stultus* Darwin	Singapore, attached to Milleporae.	Shallow water.
B. tenuis Hoek.	North of Sulu Islands: Stat. 105. Also: Philippine Archipelago.	275 m.
†*B. terebratus* Darwin . . .	Kei Islands: Stat. 257.	52 m.
B. tintinnabulum Linn. . .	Keel of H. M. "Siboga". Common on ships-bottoms coming from West-Africa, India, China etc.	Surface.
* *B. trigonus* Darwin	Java, East Indian Archipelago. Also: Australia.	Shallow water.

As was the case with species of *Scalpellum*, although mostly at other Stations, several places seem to be particularly attractive for species of the genus *Balanus*. Species of this genus were found at about 40 out of the 323 places or Stations, explored during the cruise of the Siboga. It happened no less than 8 times, however, that more than one species of *Balanus* was collected at the same place or with the same haul of the dredge. These cases were the following:

At Station 49[a]: *B. maldivensis* and *B. maculatus* n. sp.
At Station 50: *B. amaryllis* and *B. amphitrite.*
In Molo Strait (about Station 51) *B. ciliatus* n. sp. and *B. maldivensis.*
At Station 162: *B. amphitrite* and *B. socialis.*
At Station 164: *B. amphitrite*, *B. calceolus*, *B. cornutus* n. sp., *B. quadrivittatus*, *B. quinquevittatus* n. sp. and *B. socialis.*

At Station 204: *B. compressus* n. sp., and *B. proripiens* n. sp. At this Station two species of *Scalpellum* also were collected (See p. 56 of this report).
At Station 260: *B. albus* n. sp. *B. auricoma* n. sp., and *B. investitus* n. sp.
At Station 310: *B. investitus* n. sp., *B. maculatus* n. sp., and *B. maldivensis*.

All the species of *Balanus* were found in the neighbourhood of the coast. Several of them were caught in shallow water, some in rather deeper water, and only a few in water of greater depth than 100 m. The greatest depth found inhabited by a species of this genus was 564 m.; at depths of more than 600 m., at which 26 species of *Scalpellum* were collected, not a single species of *Balanus* was observed.

Several species seem to spread over a rather considerable range of depth: as for example *B. maldivensis*, which was observed at depths of 54—91 m., 70 m., 216 m., and even of 390 m., and *B. albus* at depths of 90 m., 289 m., and, probably, even at a depth of 522 m. The following table contains the species of *Balanus* collected during the cruise of the Siboga, arranged according to the depth at which they occurred:

B. tintinnabulum Linn. (in different varieties). . . . Surface.	*B. hystrix* n. sp. . . . 40 m. (or less)
B. amphitrite Darwin . . . . Surface—56 m.	*B. navicula* Darwin . . 45 m.
B. arcuatus n. sp. . . . . 9—36 m.	*B. terebratus* Darwin . 52 m.
B. socialis Hoek . . . . . 9—36 m.	*B. maldivensis* Borradaile 54—390 m.
B. bimae n. sp. . . . . 13—31 m.	*B. maculatus* n. sp. . . 70—73 m.
B. amaryllis Darwin . . . . . 13—40 m.	*B. investitus* n. sp. . . 73—90 m.
B. auricoma n. spec. . . . . 27 (and ? 90 m.)	*B. proripiens* n. sp. . 75—94 m.
B. calceolus Ellis . . . . . 32 m.	*B. compressus* n. sp. . 75—112 m.
B. cornutus n. sp. . . . . 32 m.	*B. minutus* n. sp. . . . 80 m.
B. quadrivittatus Darwin. . . 32 m.	*B. albus* n. sp. . . . . 90—289 (and ? 522 m.)
B. quinquevittatus n. sp. . . . 32 m.	*B. pentacrini* n. sp. . . 204—304 m.
B. ciliatus n. sp. . . . . 34—113 m.	*B. tenuis* Hoek . . . . 275 m.
B. longirostrum n. sp. . . . . 36 m.	*B. alatus* n. sp. . . . . 564 m.

A few remarks may be added with regard to the geographical distribution of these species of *Balanus*. That 16 species were collected, which were not observed before, does not prove, of course, that they do not occur outside the Malay Archipelago: the exploration of this region on this occasion has been a very careful one; therefore, it cannot be considered improbable, that at least some of these species will be found in other regions of Eastern Asia, should they be explored with the same care and thoroughness, as the Malay Archipelago has been. Of the species collected by H. M. S. "Siboga", which were already known, *B. amphitrite* and *B. tintinnabulum* seem to have the widest distribution, which no doubt is due partly to their being often found on ships-bottoms: they are sometimes associated with one another even on the same ship. *B. calceolus*, *B. navicula*, *B. amaryllis*, and *B. maldivensis* are known to occur in British India also, and *B. amaryllis* in Australia as well. *B. quadrivittatus*, *B. socialis*, and *B.*

tenuis were already known to inhabit the Malay Archipelago; they have not been observed outside that region so far I know. *B. terebratus* DARWIN was not known to occur in the Malay Archipelago: DARWIN reported, that the habitat of this species was unknown to him. In two recent papers (one [1] of BORRADAILE and one [2] of ANNANDALE) this species is mentioned, as probably occurring in the Maldive and Laccadive Archipelagoes and at Ceylon. This is, of course, by no means improbable; but as these specimens did not show the peculiar structure of the basis, which struck DARWIN and caused him to give the species its name and which is indeed very striking, some doubt remains whether the above-named authors really met with it.

There is, after all, to judge from our present knowledge, some reason to admit that the Malay Archipelago has its special fauna of species of *Balanus*. Of course this cannot be proved, since any species, which at present is known from that region only, may afterwards be found to occur outside it. And even the great number of species that have been observed in this region does not prove much in this respect. In this connection, I wish to point out also, before leaving the subject, that several species of *Balanus* have been observed in regions bordering on the Malay Archipelago, which seem to be absent in that region itself: namely *B. nigrescens* Lamarck from West-Australia, *B. cymbiformis* Darwin from Madras, *B. carenatus* Gruvel from Akyab (Burma), *B. allium* Darwin from Ceylon and Australia, *B. vestitus* Darwin and *B. imperator* Darwin from New South Wales, and *B. aeneas* Lanchester from Manaar. But here again the same must be kept in mind, namely that no matter how carefully a region may be explored, several species may still be found there which hitherto have escaped observation. In consequence of the difficulty of the determination, it is even possible that one or more of the species described as new in this report, may after all turn out to be identical with one of those described already. For example, my new *B. arcuatus* may be found to be the same as DARWIN's *B. allium*, as is explained by me in this report, where the description of my new species is given. The latest publications I have seen in which species of *Balanus* also were described, and which treat of the Cirripedes of East-Asia, are PAUL KRÜGER's paper (l. c.) which forms a part of DOFLEIN's contributions to the natural history of East India, and PILSBRY's paper on the Barnacles of Japan and Bering Sea. Both papers were published in the course of 1911. According to KRÜGER, *Balanus* is represented in East Asia by 13 species and in DOFLEIN's collections by 8, two of which only, viz. *B. tintinnabulum* and *B. amphitrite*, were collected also during the expedition of H. M. S. "Siboga", in the Malay Archipelago — but, as is well-known, and is said already (p. 153), these are both species with a world-wide distribution. Of the other six species of KRÜGER, one (*B. corolliformis*) may remain undiscussed here, it being one of those which I propose to include in a new genus; one (*B. trigonus*), which is represented by numerous samples collected in Japan waters, is, according to DARWIN, found also in the Malay Archipelago, and in Australia; three (*B. crenatus*, *B. rostratus* and *B. cariosus*) which were collected also in Japan, are species known hitherto from only temperate and colder

[1] BORRADAILE, l. c.

[2] ANNANDALE, N., On the Cirripedia (of the Gulf of Manaar). In HERDMAN's Report on the Pearl Oyster Fisheries, published by the Royal Society, 1906.

seas; finally one species (*B. poecilotheca*) remains, which is a new species, at present known from Japan only. Therefore the number of species occurring in the waters explored by DOFLEIN and in the Malay Archipelago at the same time, which really seem to correspond, is not very important. Neither is this the case with the species enumerated by PILSBRY for Japan and Bering Sea: he mentions four true species of *Balanus* together with a so-called subspecies (*B. rostratus*, *B. rostratus-apertus* Pilsbry (subspec.), *B. crenatus*, *B. cariosus*, and *B. Evermanni*), but none of these seem to occur in the Malay Archipelago.

The determination of a sample of Barnacles of the genus *Balanus* is often a difficult task, and is possible only if the material at hand is sufficiently rich to permit of a thorough investigation. This, however, is not very often the case with the samples of Barnacles collected with the dredge, this being a very haphazard method especially at great depths. Indeed several of the new species described in this report, are represented in the collection, submitted to me, by one or very few specimens only. With few exceptions, I could not at first go further than to say that the sample "probably" belonged to a certain species, and when I attempted to determine it more closely, I invariably found it necessary to consider the form as a new species. In such cases, I have endeavoured to describe it as fully as possible, and to give several accurate figures of itself and its parts, that it will be possible to recognize it readily, should it be collected again. I wish to add that, perhaps with a single exception, which I have already pointed out, I feel almost certain that the new species will be found to represent as many different forms. I think that it is only sufficient detail in description and illustration which gives us the right to introduce new species into science; unfortunately such detailed descriptions cannot often be given without destroying the specimen, and in those cases in which a new species is based on a single specimen, this should be avoided as carefully as possible.

A question of no smaller difficulty is that of the arrangement of the numerous species of this genus into a really natural system. I must confess, that in this respect my work has not given me sufficient satisfaction, this was not possible I think because so many typical previously described species were not represented in the collection submitted to me which, on the other hand, was found, to be rich in new species. The genus *Balanus* has a world-wide distribution, being found along the coasts of all the continents and islands of the different zones of the surface of the earth. It cannot be wondered at that the species inhabiting such a region as the Malay Archipelago form only a relatively small part of the total. For a careful study of the relations among the different species, even the material found in all the large Museums of Natural History of the world could hardly be judged rich enough. Therefore, what I have been able to do in this respect with the Siboga material, has been rather to criticise the existing system and to give some indications as to what I would consider a better classification of the species.

The material that DARWIN made use of for his classification of this and other genera of Cirripedia, came from all parts of the world, and although, as on good grounds can now be asserted,

numerous and even very interesting species were unknown in DARWIN's time, the collection he used was indeed to a high degree representative. Moreover, his knowledge of the subject was an extremely thorough one: with much better methods than were known in his time, some of the later workers may have been able to penetrate further into details of anatomy or embryology, but none of them have surpassed or even equalled him in sharpness of observation, and in acuteness of separating different forms and uniting what belonged together. It must have been extremely difficult for DARWIN to find out how the numerous species of *Balanus* were to be classified in natural groups; that these groups in the main are still used, nearly 60 years after the publication of DARWIN's Monograph, certainly proves that in several respects his classification was founded on a reasonable basis.

DARWIN, when separating the genus *Balanus* with its numerous species into sections, exclusively made use of the structure of the shell namely, the parietes, the radii, and the basis. The barnacles of his Section A have the parietes, basis, and radii permeated by pores; those of Section D have the parietes permeated, the basis and radii not permeated; those of Section F have the parietes and radii not permeated, the basis sometimes permeated, and sometimes not. His Section B embraces those species in which the basis and parietes are sometimes permeated and sometimes not, the radii not permeated, but with an elongated shell and a boat-shaped basis; and, finally, his Section E was instituted for those species which have a membranous basis. I put this classification in the form of a table, which may make the comparison easier:

I. Basis membranous (*Section E*)
II. Basis calcareous (Sections A, B, C, D and F)
  1. Shell elongated, basis boat-shaped (*Section B*)
  2. Shell not elongated, basis not boat-shaped (Sections A, C, D and F)
    a. Parietes not permeated (*Section F*)
    b. Parietes permeated (Sections A, C and D)
      α. Basis not permeated (*Section D*)
      β. Basis permeated (Sections A and C)
        * Radii not permeated (*Section C*)
        ** Radii permeated (*Section A*)

We see than, that to refer a species of the genus *Balanus* to one of these sections, a careful study of the structure of the different parts of the shell is necessary, but this structure was at the same time thought sufficient. Although DARWIN carefully investigated the structure of the animal's body, and especially the parts of the mouth and the cirri, he seems to have been impressed more by the general agreement of that structure in the different species, than by the differences shown. Of several and very interesting species (*B. declivis*, *B. navicula*, *B. terebratus* etc.) the animal's body was unknown to him, and this circumstance may have contributed to his not using these parts for purposes of classification. The fact is that in DARWIN's classification of the genus *Balanus* the division into sections rests on the structure of the shell,

and the distinction of the different species in each section primarily on the shape and structure of the opercular valves. And I think it is a fact also, that a comparative study of the known species, has shown that the structure of the animal's body can with advantage be used in dividing the said genus into such sections and for separating the species. In this connection, I think it is remarkable, that the structure of the anterior ramus of the 4th pair of cirri was pointed out by DARWIN, as an important character in separating *Acasta* from *Balanus*, and that later researches have shown that a similar structure occurs also in numerous species of the latter genus. Supposing he had known this peculiarity, DARWIN would certainly not have denied its value for subdividing this genus.

I will now, first of all, discuss a few species of *Balanus* for which new sections of the genus were proposed, as DARWIN's division seemed inadequate to include them. These cases I think after all, do not or not sufficiently prove the necessity for so doing.

The first instance is found in my own work. While studying the Cirripedia of the Challenger expedition, in 1882, I met with two species with a membranous basis, but which, by the absence of radii and by the structure of the animal's body, showed themselves to be quite different from the species of section E (to which section they in accordance with their membranous basis should belong), and also from any known species of the genus. I therefore thought there was good reason to propose a new section for the reception of these species. The Siboga material contains specimens of two new forms, which doubtless belong to the same group, and in the mean-time PILSBRY (1911) published descriptions of two other new species, which appear also to be closely related to the somewhat abnormal forms I described in the Challenger Cirripedia-report. On carefully going over the new material which came to hand however, I found, that there was sufficient reason to separate this whole group of species from the genus *Balanus* and to create for it a new genus. Therefore, my section G of *Balanus* is to be cancelled; for further particulars regarding the new genus I refer to what is to be found in the present report, when this new genus (*Hexelasma*) is described.

BORRADAILE (l. c.), in 1903, described a new species of *Balanus* (*B. maldivensis*), collected in S. Nilandu Atoll (Maldive Archipelago), and found its shell so peculiar, that it appeared to necessitate the founding for it of a new section of the genus. This had the following characters: "All parts of the shell present, heavy and without pores". The Siboga material, which contains this species also, gave me a good opportunity to study the form, and, as I will explain in further detail under the specific heading, made me doubt whether there was really sufficient reason for maintaining for it a new section. I think that its place is in DARWIN's section F, but there is on the other hand good reasons for subdividing that section.

In the same year (1903) GRUVEL (l. c.) proposed to establish a new section for a species from the Congo which he named *B. Dybowskyi*. He defined that new section as follows: "Parietes and basis with pores, no radii". I have never seen specimens of this species, so I only know it from the figures GRUVEL published in his "Monographie" of 1905. The chief character of the section is the absence of radii in GRUVEL's new species. Providing these are totally absent, then, I think we may ask if this species does really belong to the genus *Balanus*? We should not forget, however, that there are species in DARWIN's section F,

which have the radii narrow or absent (*B. flosculus*) or not developed at all (*B. vestitus*), and that DARWIN's section C contains also *B. perforatus*, which has the radii either not at all developed, or extremely, or only moderately narrow. GRUVEL's species might perhaps find a place in the latter section, which contains those species of *Balanus* which have the parietes and the basis permeated by pores, and the radii, if developed, not permeated.

Returning to the species represented in the collection brought home by H. M. S. "Siboga", I will not enter too much into details regarding my experience (and very great difficulties) in dividing the new species into the different sections of the genus. In several instances this was found to be quite impossible. But to go on as was done hitherto, and to create a new section for every species that did not enter so well into one of the sections previously proposed, seemed also unsatisfactory. The conclusion was that I adopted a somewhat new classification of the species of this genus, but without departing more than necessary from the original division as proposed by DARWIN. I think this classification must speak for itself. I only wish to add that as I was obliged to include some of the known species in other sections, and as the limits of these sections had to undergo some changes in consequence, and a few other sections were to be introduced and a few of the old ones to be cancelled, I have thought it better, to avoid confusion, to designate these sections in future with special names, as I did with those of the genus *Scalpellum*, instead of using the characters A, B, C, etc. as was done by DARWIN.

The sections I wish to propose are the following:

Section *Mega-Balanus* (corresponding with DARWIN's section A) is so-called, because it contains the largest forms of existing Balani. This section is represented in the Siboga-material by one well-known species only, so I have nothing to remark with regard to it.

Section *Ortho-Balanus* is a combination of DARWIN's Sections C and D; it contains Balani having the parietes permeated by pores, the basis sometimes permeated and sometimes not permeated, and the radii not permeated. Numerous species (DARWIN knew 14 living species) belong to this Section, which, however, in the Siboga collection is represented by few species only: *B. amphitrite* Darwin in different varieties, *B. alatus* n. sp. from a depth of over 500 m., and *B. minutus* from 80 m. To this section belongs *B. trigonus* Darwin, the third cirrus of which, according to KRÜGER, is furnished with curious thorns ("merkwürdige Dornen") along the anterior face[1]) of the segments. These curved hook-like teeth, as DARWIN called them and which he thought were peculiar to *Acasta*, are present also on the third cirrus of *B. amphitrite*, *B. alatus*, and *B. minutus*. None of the species of DARWIN's Section D are found in the Siboga-collection. I venture to propose to include it with Section C in my Section *Ortho-Balanus*, being of the opinion that the porosity or non-porosity of the basis is not of sufficient importance for separating these two sections. As DARWIN pointed out himself, some species of Section C (*B. improvisus*, *B. nubilus* of the living species) have the basis imperfectly porose, whereas a species of Section D (*B. patellaris*) has the basis "sometimes permeated by imperfect pores".

[1] KRÜGER also compares them — and of course he is right there — with the spines observed in *Acasta*; I do not quite understand, however, how he can say that they are found on the dorsal side („auf der Rückseite") of the segments. They are in all the species on the inner, anterior face of the segments.

For subdividing this section other reasous may be found later, I feel unable with the material at hand, to make a proposal in that direction.

Section *Striato-Balanus*. This section contains species that have no pores in the the parietes and radii (which belonged to DARWIN's Section F or might have been considered to belong to it). They show the common features of having the scutum striated longitudinally, and of having, as a rule, narrow radii. These species — *B. amaryllis* Darwin, *B. albus* n. sp., *B. bimae* n. sp., *B. maculatus* n. sp. — seem to form a very natural group. Several species belonging to it are of somewhat larger size. Whether *B. Hameri* Ascanius is to be placed in this section or into the next is difficult to say: it has the scutum feebly striated longitudinally, but its radii are not so narrow as is the case in the more typical species. *Balanus vestitus* Darwin, *B. imperator* Darwin, and *B. flosculus* Darwin have narrow radii also (they are even absent in *B. flosculus*) and might also be included in this section; they do not show, however, the characteristic feature of having the scutum striated.

Section *Solido-Balanus*. This section contains species which have the parietes, radii and scutum smooth, as a rule rather thick, the parietes and radii, moreover, without pores. They have also a solid basis, with crests running over the surface, or with narrow canals radiating from the circumference. The radii are rather broad and most of the species seem to be of small dimensions only. *B. socialis* Hoek, and *B. maldivensis* Borradaile belong to this section, which, embraces *B. auricoma* n. sp., *B. ciliatus* n. sp., and *B. compressus* n. sp., of the material collected by the "Siboga".

Section *Membrano-Balanus* corresponds to DARWIN's Section E and contains the species with a membranous basis. I am in doubt whether this is really a good section, that is, a natural group of species: like DARWIN himself I do not feel sure that the species really belong together. That the basis is membranous, or is non-calcareous, is a negative character only. But as only one species of the Siboga-material belongs to it, and is, moreover, a somewhat abnormal form, I had better not enter into discussion about this question. The new Siboga-species is *B. longirostrum*, which is nearly related to *B. declivis* Darwin; it has non-porose parietes and lives embedded in sponges. Numerous segments of both rami of the fourth cirrus, are, in this species, armed with transverse groups of triangular teeth, such teeth occurring also, but smaller, on most of the segments of the 2nd and 3rd cirri. This shows, perhaps, that the species is allied to some of the species of the Section *Armato-Balanus*.

Section *Armato-Balanus*. The species of this section have as a rule the parietes and radii without pores; some of its species, which were already known and which I propose to include in it, were considered by DARWIN to belong to Section F. This section emerges into the genus *Acasta*[1] by some of the segments of the anterior ramus of the 4th cirrus being armed with rows of teeth, and it is at the same time nearly related to the section

[1] DARWIN has pointed out already that some of the species of his Section F (*B. terebratus*, *B. allium*, *B. quadrivittatus*) can hardly be separated naturally from the genus *Acasta*. It is certainly very interesting that DARWIN's main reason for separating them — viz. the structure of the 4th cirrus in *Acasta* — has now been found not to exist: the structure of that cirrus in these species corresponds exactly with that of some species of *Acasta*.

Patella-Balanus: as we shall see, *B. proripiens* of that section has also small teeth on some of the segments of the 4th cirrus. Three of the new species collected by H. M. S. "Siboga" are placed in this section: *B. arcuatus*, *B. quinquevittatus*, and *B. hystrix*. The last named has the parietes permeated by pores; therefore by this species this section passes into the Section *Ortho-Balanus*, which, as it is here proposed, would correspond with DARWIN's Sections C and D.

Section *Patella-Balanus*. This section corresponds with DARWIN's Section B. It is represented in the Siboga-material by five species, two of which were known to DARWIN (*B. calceolus* Ellis, and *B. navicula* Darwin). The remaining three (*B. cornutus*, *B. investitus*, and *B. proripiens*) are new. The elongated shell and the boat-shaped basis form the main features to recognize the species of this section and which no doubt constitutes a very natural group. This section is nearly related to the foregoing section *Armato-Balanus*, in different respects, as also by the circumstance that some species have small teeth along the inner face of some of the segments of the third cirrus. In one of the species (*B. proripiens*) these are also observed on some of the segments of the fourth cirrus.

Section *Bathy-Balanus*. It is for a single, yet well-defined species, that I feel obliged to create this section, namely *B. pentacrini* n. sp. from 200 to 300 m. It has the parietes, radii, and basis without pores and therefore would belong to DARWIN's Section F, but, I think, it should form a section by itself, since it has the labrum without a notch, a small and shallow excavation indicating the place the notch occupies in the other species. Having well-developed radii and a calcareous basis, there is no reason to doubt its belonging to the genus *Balanus*. On the other hand it cannot be denied that it corresponds in the structure of its labrum to the species of my new genus *Hexelasma*: it can be considered as forming the transition from the genus *Balanus* to that of *Hexelasma*.

As will be easily understood, the classification here proposed aims only at bringing together in natural groups those forms or species which I think really belong together. It is not my opinion that the arrangement is a final one, and it is only with great reserve that I venture to propose putting it in the place of DARWIN's classification of 1854. And especially so, since I am not entirely satisfied that it will be possible to include all the species known at present, in the sections or divisions as they are here proposed. Yet DARWIN's sections must be revised in certain respects, and the sections added to the genus by later authors cannot be accepted. Several of the new species described since the publication of DARWIN's Monograph claim a place in the system, although they do not enter so well into one of the old sections. Therefore an attempt to improve the classification was I think fairly justified. If the one here proposed does not prove to be a good one, it need not be maintained — it may, however, turn out to be of use, at least in some respects, to a future monographer of the genus. The genus certainly needs to be thoroughly dealt with by a good specialist! He should, however, not begin his task before he has succeeded in bringing together sufficiently rich material of the existing species, and that in a good state of preservation — and he must not expect that his task will be a light one.

As has already been said, I propose to make use of the structure of the 3rd and 4th pairs of the cirri for the classification of the species of the genus *Balanus*. I think that FRITZ MÜLLER was the first to observe that such claw-like spines occurred on the cirri of a species of the genus *Balanus* (*B. armatus*): according to him, they are in that species strongly developed on the segments of the 3rd, and on the posterior ramus of the 4th pair, but, in less developed condition, on some segments of the 5th and 6th cirrus also. On the same occasion he recorded the presence of such spines on the cirri of other species of *Balanus*, of which he gave *B. improvisus*, var. *assimilis* as an example. Recently (1911), KRÜGER pointed out a similar peculiarity in the cirrus of the 3rd pair of *B. trigonus* Darwin, and in the mean time, the study of the species of *Balanus* collected by the Siboga has shown that such armature is a common feature of several other species of this genus. In some species it is the 3rd cirrus only which is armed, in others it is the fourth, and there are also species in which both cirri and sometimes the 2nd or the 5th also are furnished with these claw-like teeth. In other respects these species differ more or less considerably from one another, and so it has not been possible to include all of them in the same section of the genus *Balanus*. For, while some of these (*B. amphitrite* for an example) in every respect are true Balani, it cannot be denied that some of these species with armed cirri show resemblance to species of *Acasta*. Yet even the latter species, when we take all their characteristic features together, cannot be separated from *Balanus*. They must therefore remain in that genus but at the same time may be considered as forming the link between that genus and *Acasta*.

Besides the fact that it is not always the same cirrus (or cirri) which shows (or show) the armature, another difference must be pointed out with regard to the shape of the teeth themselves. They are of two different types: on the cirrus or cirri of some species they appear like small triangular spines, which are attached to the surface of the segment with a rather broad basis and, as a rule, at some distance from each other. The surface of attachment can distinctly be made out as a small place of oval shape, exactly as is the case with other spines, or hairs, which, as a rule, have a rounded surface of attachment. The other type consists of teeth, which are like little hooks slightly curved downwards, or (seldom) upwards, and form so many chitinous excrescences along the margin, which often stands off like a list or rim on the surface of the segment. These teeth are close together, and form a saw-like structure. Transitions from teeth of the one type to the other are, however, not infrequent.

I give here a list of the species of *Balanus* which I found furnished with armed cirri and which belong to the collection made by H. M. S. "Siboga":

Section *Ortho-Balanus*

B. amphitrite: 3rd cirrus, both rami with a row of downward-curving teeth along anterior face of numerous segments. One or more parallel rows of smaller teeth on the surface of the segments.

4th cirrus, both rami have a group of smaller teeth on each of the 12 lower segments.

B. alatus: 3rd cirrus, the longer ramus with a few teeth between the hairs near the extremity

along the anterior face of several segments; similar but smaller teeth, are also observed on a few segments of the shorter ramus.

B. minutus: 3rd cirrus, both rami with a few (2—3) very small teeth on the middle segments.

Section *Solido-Balanus*

B. ciliatus: 3rd cirrus, both rami with rows of recurved teeth along the anterior face of the segments; the last segment of the longer ramus, and the last three segments of the shorter excepted.

4th cirrus, anterior ramus, 2nd to 6th segment with small recurved teeth.

B. compressus: 3rd cirrus, both rami, numerous segments near anterior face, and upper extremity armed with groups of triangular and straight teeth.

Section *Membrano-Balanus*

B. longirostrum: 2nd cirrus, both rami, nearly all the segments armed near extremity with transverse rows of small triangular teeth.

3rd cirrus, both rami, as on second cirrus, but teeth slightly stronger.

4th cirrus, both rami with well-developed transverse rows along upper margin of most segments, and also of the two segments of the pedicel.

Section *Armato-Balanus*

B. arcuatus: 3rd cirrus, both rami, row of recurved teeth along nearly all the segments.

4th cirrus, with a few teeth along the anterior margin of some of the segments of the shorter ramus only.

B. terebratus: 3rd cirrus, longer ramus has a few small teeth along the lower segments.

4th cirrus, shorter ramus has a row of recurved teeth along anterior face of the lower segments.

B. quadrivittatus: 3rd cirrus, anterior ramus, on the segments 2—7, near the extremity, a row of extremely small teeth is disposed.

4th cirrus, second segment of pedicel, and lower segments of anterior ramus with a row of sharp recurved teeth.

B. quinquevittatus: as *quadrivittatus*, but spines on 3rd cirrus still smaller and the teeth along 2nd segment of pedicel of 4th cirrus forming a much longer row.

B. hystrix: 3rd cirrus, both rami, numerous rows of recurved teeth all over the surface, the strongest along the anterior margin of nearly all the segments.

4th cirrus, both rami, teeth along the anterior face and on the surface of numerous segments.

5th cirrus, both rami, teeth along anterior face and on surface of numerous segments.

Section *Patella-Balanus*

B. cornutus: 3rd cirrus, both rami have a row of small thorns or teeth along inner face of all the segments, with the exception of the last.

B. proripiens: 3rd cirrus, longer ramus has a group of 2—4 short strong teeth near anterior face, and upper extremity of all the segments.

4th cirrus, shorter ramus has the 5 to 6 lower segments armed with a group of from 2 to 4 small teeth.

Finally, a remark regarding the relations between the fossil and recent forms, and another regarding the species living at different depths, may find a place here.

Darwin[1] states that *Balanus* is the oldest genus of the Balanidae yet known; according to him, the extinct forms of the genus belong to the section that has the parietes not permeated by pores. He therefore seems to admit, that the oldest species were those that have no pores. Consequently, the fact that the oldest-known species — *B. unguiformis* from the Eocene — had the parietes almost as often as not permeated by pores is considered by Darwin as presenting to the systematist a most unfortunate peculiarity. However, when we consider that of the ten other fossil British species, which Darwin described, 6 have the walls permeated, and 4 have no pores in the walls, we may certainly ask whether this character has really the importance Darwin gives it. It may be true, that of these four species, three (*B. bisulcatus*, *B. dolosus*, and *B. inclusus*) are extinct forms, whereas all the other fossil species he describes are also found living. But this, I think, does not prove that these three species are really older or more primitive forms. The forms still existing are found along with the extinct ones throughout the same tertiary stages: special circumstances, which we need not consider here, may have caused the equally old or even older species to remain, and others as old or possibly not so old to become extinct. The fact that the oldest-known species of *Balanus* (*B. unguiformis*), sometimes has the parietes permeated by pores, goes far to prove that the permeated condition of the walls is as old as the genus itself.

In this connection it is interesting to observe that the species which inhabit deeper water have the walls as a rule thin, seldom thick or heavy, and sometimes longitudinally ribbed on the internal surface, sometimes not, but almost always solid, and without pores. At very considerable depths, no species of this genus seem to occur, but those found in rather deep water must, I think, be regarded as younger forms which have developed from shallow water species. It even seems possible, in some instances, to point out the shallow water species from which a form of the deeper sea may have developed: in such a case it may be a species with permeated parietes from which another with solid walls may have descended. The species living at greater depth do not want such strong shells as those that are continually exposed to the rolling waves near the coast; so the permeated condition of the walls, which is an ideal structure as regards strength and economy in the use of shelly matter, and which has its highest development in numerous true coastal forms, may have been lost by a series of forms gradually wandering into deeper water. I need hardly add that, according to my opinion, there is no reason to consider the species from deeper water as representing more primitive forms. On the other hand, species with solid walls are also observed in shallow water and, of

[1] Darwin, Ch., A Monograph on the fossil Balanidae and Verrucidae of Great Britain. London. 1854. p. 5.

course, species in deeper water may as well have developed from such forms: the species of *Balanus* occurring in deeper water (see the table p. 153) do not belong to one and the same section and, probably, had a very different descent.

1. Sectio: **Mega-Balanus**

1. *Balanus tintinnabulum* (Linn.).

DARWIN, CH., Monograph. Balanidae and Verrucidae. 1854, p. 194, pl. I. fig. *a—l*, pl. II, fig. 1*a—o*.

This species is represented by one sample only: a few specimens, which were found attached to the bottom of H. M. S. "Siboga", when the ship was docked on October 15th, 1899. The ship had been previously docked and cleaned on June 1st, of the same year: so the Balani, probably, developed in the period between the two dates.

The sample is composed of four specimens that caused me great trouble. One of the specimens can be determined at once as belonging to DARWIN's variety (3) *validus*; but the remaining three represent two forms, not only different from the first, but also different from all the varieties (11 in all) described by DARWIN. Therefore the case mentioned by DARWIN in which three most distinct varieties were taken from the bottom of the same vessel, is here repeated. The three specimens are relatively small, and I do not feel sure, therefore, that they are full-grown animals. Their form — of one especially — is so characteristic, that I really prefer to describe them as different varieties.

a. *B. tintinnabulum*, var. *validus* Darwin.

The specimen looks exactly like the figure (Pl. I, fig. *c*) given in DARWIN's Monograph. The coarsest and strongest specimens that DARWIN saw, were said to have been attached to a surface of iron: this holds good also for the one taken from the surface of the "Siboga"; parts of the outer surface of the basis are coloured red, from the ship's being painted with red-lead.

The shape of the shell is conical, slightly convex at the rostral side; it is coarsely ribbed, with some of the ribs flexuous and most of them rugged; the orifice is relatively large, rounded, angular, but at the rostral and carinal extremities, the basis is partly lost, the remaining part is flat and the whole must have measured 29 and 20 mm. in diameter. The tergum corresponds almost exactly to the figure given by DARWIN for his variety *communis*: it has a well-developed longitudinal furrow, which is quite closed, a prominent articular ridge, extending over three fourths of the length of the valve, the spur is produced for a considerable distance up the internal surface of the valve, the crests for the depressor muscle are only feebly developed. The scutum has rather prominent lines of growth, the general shape resembling that of DARWIN's var. *coccopoma*. The articular ridge is broad, much reflexed and slightly hooked at its base, it extends over half the length of the valve. The adductor ridge is well-developed and the cavity for the lateral depressor muscle rather deep.

DARWIN did not say where his specimens of this variety were collected. We now know for certain that it occurs in the Malay Archipelago.

b. *Balanus tintinnabulum*, var. *costatus* nov. var. Pl. XIV, fig. 5 and 6.

This form is represented by a fine specimen with very prominent ribs, the basal extremities of which extend beyond the elongated, rounded circumference of the basis. I do not know, of course, whether its shape would undergo changes during growth, and if so, what changes they would be — for the present I think it best to describe it as a distinct variety.

The shell has a very regular shape, flatly conical, with a large rhombiform orifice and triangular radii, the upper margin of which runs nearly parallel to the basis. The surface is distinctly ribbed, much stronger ribs alternating with groups of smaller and narrower ones. The radii are feebly striated in horizontal direction, the striae representing the very delicate canals which traverse them. The parietes as well as the basis have distinct pores. The outer surface of the ribs is white, the furrows between them being coloured pink or red, with here and there small spots coloured darker red. The greatest diameter of the basis is nearly 14 mm., the shortest not quite 10 mm.

The scutum (Pl. XIV, fig. 6*b* and *c*) has the broad and reflexed articular ridge like the other forms of this species, and the tergum looks very much like that of a typical *B. tintinnabulum*, its furrow being open, however, as is usual in young specimens. The spur is broad and flat, and cannot be said to be distinctly produced at the internal surface of the valve (Pl. XIV, fig. 6*a* and *d*): differences which, probably, will change when the animal grows older.

c. *B. tintinnabulum*, var. *plicatus* nov. var. Pl. XIV, fig. 7.

Two specimens of this new variety were collected along with the foregoing. They are, probably, young specimens. The smaller is attached to the larger and, perhaps, slightly older one.

The shape is conical, but the circumference of the basis is smaller, that of the orifice relatively larger, the whole shell, in consequence, more steep than the case is with the var. *costatus*. Corresponding ribs are present, but the stronger ones are by no means so prominent; their basal extremities hardly extend beyond the circumference of the basis. So this circumference is nearly circular, the extremities of the ribs forming small round festoons only round that circumference. The surface of the ribs, of the deeper furrows, and of the spots here and there along the margins of the valves, are coloured in the same way, though perhaps not quite so distinctly, as in the variety *costatus*. The size of the basis is about 10 mm. in diameter.

The shape of the opercular valves generally corresponds to that of the var. *costatus*. Both forms have the lines of growth on the scutum more prominent, than, according to Darwin's description, one might expect them; these lines of growth are slightly sinuous; their crests — especially those near the basal margin — are furnished moreover with a row of minute points, and consequently are slightly crenated. The tergum has the furrow open and relatively broad; the spur as a whole is, however, not quite so broad as in the variety *costatus*, its extremity is slightly more rounded. The crests for the tergal depressor muscle are, in this variety, not quite so strong as in the var. *costatus*.

This description applies to the larger of the two specimens. The smaller specimen, which is attached to the side of the larger one, (see fig. 7) no doubt belongs to the same form or variety.

For a study of the body included within the shell I used that of the specimen of the variety *validus*.

Mouth. Labrum: Crest divided by the notch into two nearly quadrangular parts with rounded edges; notch deep, with entrance widened; 3 small and blunt teeth, one of which only is distinct, on each side of notch; between the teeth and along the whole crest and entrance of notch microscopic hairs are disposed. The thickened sub-triangular shield, the whole of which may be considered as the chitinous labrum, terminates interiorly into a distinctly rounded off and on both sides broadened manubrium (Pl. XIII, fig. 16).

Palpi: Shape elongately oval, large, free extremity rounded. Upper margin nearly straight, under margin rounded. Internal surface produced to a well-developed crest which runs, when the palpi are in a downward position, parallel to the crest of the labrum. The upper margin is thickly clothed with short hairs, the under margin is quite hairless. On the external surface a conspicuous and very characteristic row of about 10 longer hairs is disposed, the row making an angle with the under margin. Towards the free extremity of the palpus this row is continued by a few longer hairs disposed along that extremity. For the rest the external surface bears a group of longer hairs near the outer extremity only. On the contrary, the internal surface bears a dense clothing of short and somewhat curling hairs over a large part of the upper half, which are longer along the crest running parallel to the upper margin: these latter hairs overhang the crest of the labrum (Pl. XIII, fig. 16 and 16′).

Mandible: 5 teeth and the inferior angle; the latter small, bifid. The 2nd and 3rd teeth are indistinctly double; the distance between the extremities of the 2nd and 3rd teeth about a fourth smaller than that between the extremities of teeth 1 and 2. The lower part of the mandible is well-developed; its surface, near the outer edge, is covered with numerous hairs, a few of which are seen along the upper margin. The inferior margin, from the extremity to more than one half, is covered by a dense row of rather stiff hairs (Pl. XIII, fig. 17).

Maxilla: The free edge is nearly straight, with a trace only of a notch under the upper pair of slightly larger spines. The length of the under large pair of spines slightly exceeds that of the upper pair. Number of spines between the upper and lower pair at least seven, six of which are disposed in a double row (3 pairs), one standing alone. The upper margin is strongly curved, the part near the free edge, however, is straight and runs parallel to the under margin. The apodeme is well-developed, its length corresponds to about that of the maxilla, measured from the tip of the triangular innermost part to the free extremity of the spines disposed along the edge (Pl. XIII, fig. 18).

Outer Maxillae: Outer lobe oval, slightly narrower towards free extremity, inner lobe represented by a semi-circular swelling on the inner and inferior half. The hairs, of which the longest are feathered or doubly serrated, as Darwin says, cover a large part of inner surface of outer lobe, but they are more densely disposed near the free extremity. A

single row of hairs is situated parallel to the inner margin, between the denser tuft of hairs of the extremity and the inner lobe. The inner lobe bears numerous long hairs on the semi-circular innermost half; these hairs are distinctly feathered and are directed inwards and downwards. The surface of the rest of the inner lobe shows numerous circular pits, looking like so many places where hairs might have been disposed (Pl. XIII, fig. 19).

Cirri. First pair: rami unequal, but not very strongly; the longer ramus has 17, the shorter 13 segments. The shape of the segments may be seen in the figure. The six or seven lower segments of the shorter ramus are distinctly protuberant on their inner face, the pigmentation of the outer half of the segments extending over the protuberances (Pl. XIV, fig. 1).

Second pair has the rami slightly unequal, the longer with 14, the shorter with 13 segments; the whole cirrus is a little shorter than that of the first pair. The inner faces of the segments of the longer ramus more protuberant than those of the shorter ramus. The protuberances of the segments of the longer ramus are furnished with very conspicuous and dense tufts of hairs (Pl. XIV, fig. 2).

Third pair has the rami also slightly unequal, of 13 and 12 segments respectively. The rami are more robust, but hardly longer than those of the first pair. The inner faces of the segments of the longer ramus are more protuberant than those of the other ramus. The tufts of hairs disposed on the protuberances not so strongly developed as is the case on the second cirrus. The projecting membranous plate fringed with fine bristles, which, according to DARWIN, is found on the thorax, on either side at the bases of third pair of cirri, was found well-developed in the specimen investigated (Pl. XIV, fig. 3*a*).

Fourth-sixth pairs equal in length and in number of segments. This number was found to be 29 — and to vary between 28 and 30. The shape of the segments, in general, is quadrate, the middle and lower segments being, however, broader than long, the outer segments about as broad as long. The segments (Pl. XIV, fig. 4) are slightly shield-shaped in front, and bear only two pairs of longer spines: these are wanting on five or six of the lower, and also on the last five segments of each ramus. Between the pairs of longer spines a group of delicate hairs or spines is regularly observed. The hairs or bristles disposed on the posterior side of the segments near the extremity are short.

Penis. Relatively short, cylindrical, distinctly ringed, tapering towards the extremity. Short hairs are scattered over its surface on the distal half, somewhat longer hairs being disposed near its extremity.

As I said already p. 164, the different forms or varieties of this species described here were taken at the same time from the bottom of the "Siboga" when the ship was in the dock, October 1899. As is well-known this species is common in all the warmer seas of the world.

2. Sectio: **Ortho-Balanus**

2. *Balanus amphitrite*, Darwin. Pl. XIV, fig. 8—17.

DARWIN, CH., Monograph. Balanidae and Verrucidae. 1854, p. 240, pl. 5, fig. 2*a*—2*o*.

This species was collected by H. M. S. "Siboga" at half a dozen Stations and at depths

varying from 13 to 56 m. The specimens, even those from the same station, often show considerable differences in colour; most of the specimens are small, and some of them at least may not be full-grown. I think it will be best to give short descriptions of the different sets.

I. Stat. 2. March 8, 1899. Lat. 7° 25′ S., Long. 113° 16′ E. Depth 56 m. Bottom: grey mud with some Radiolaria. Madura-strait. Half a dozen specimens attached to the shell of a Gastropodous mollusc.

Small specimens: greatest diameter of the basis of the largest specimen 5 mm., shell conical, greatest diameter of orifice 2.5 mm. Radii not very broad, with the summits very oblique. Colour dirty white, with reddish tinted longitudinal bands crossed by greyish horizontal stripes. Radii with distinctly reddish horizontal stripes on a lighter underground.

The scutum has prominent growth-ridges, finely and not very distinctly beaded. The adductor ridge is not very strongly developed.

The tergum has a moderately broad spur with a longitudinal depression, not a deep furrow. The two portions of the basal margin, on the opposite sides of the spur, lie in a nearly straight line. Basi-scutal angle sharp, spur scarcely extending beyond the basal margin, and the extremity not sharply pointed. Internally the articular ridge is prominent; the crests for the depressor muscles only feebly developed.

This set corresponds in several characters to DARWIN's var. (1) *communis*.

II. Stat. 50. April 16/18, 1899. Bay of Badjo, West coast of Flores. Depth up to 40 m. Bottom: mud, sand and shells, according to locality. Numerous (about 25) specimens.

Middle-sized specimens: attached to small sticks or stems, and therefore laterally flattened with the basis elongated, narrow, and excavated. Longest diameter of one of the larger specimens near the basis, 8 mm. Colour from nearly white to dark purple, the colour being mostly in longitudinal stripes and in dark patches, arranged in horizontal lines crossing the longitudinal ones. Orifice large, rhombiform, toothed. Radii with the summits never quite parallel to the basis, but slightly or strongly oblique, often somewhat excavated. The colour of the radii is often darker than that of the compartments, and in several specimens even dark purplish; always distinctly horizontally striped.

The scutum with the lines of growth developed into distinct ridges, showing, though not very distinctly, microscopical beads at the surface. Adductor ridge long, but not very prominent.

The tergum has the spur broad and the longitudinal furrow indicated by a very shallow depression only; extremity of the spur rounded; crests for the depressor muscles very distinct. Growth-ridges well-developed and beaded like those of the scutum.

This set shows some resemblance to DARWIN's var. (9) *cirratus*, but I think it best not to identify it with the same.

III*a*. Stat. 71. Makassar and surroundings. May 10—June 7, 1899. Depth 27—32 m.

Three specimens of very characteristic shape, only one of which, however, is complete: the second is an empty shell without the opercular valves, and the third is represented by a

broken shell. All the three specimens are strongly flattened laterally, of conical shape, and the basis strongly curved round the narrow sticks to which they are attached. The orifice is medium-sized and distinctly toothed. They are beautifully coloured light red, and striped and spotted with darker red. The radii are either quite white (those of the rostrum) or darker, shading into darkish purple; their summits are oblique.

Greatest diameter of the largest specimen, near the basis, 11.5 mm.

III*b*. Stat. Makassar, May—June 1899, Depth 27—32 m. (Place and bottom not further indicated).

Half a dozen beautifully coloured specimens, attached to pieces of corals and shells. The colours are from light rose-red to purple in horizontal and in longitudinal stripes or patches. Radii often white, in a few specimens red or even purple, summits slightly oblique. Orifice of the shell large, elongately pentagonal, entire or indistinctly toothed. General shape of shell cylindrical rather than conical. Largest diameter of the biggest specimen, near the basis, about 11 mm.

The scutum has the lines of growth not very prominent, and no beads along them. Articular ridge very prominent, adductor ridge long, not very prominent.

The tergum has the spur broad and rounded at the extremity. Growth-ridges not prominent; crests for the depressor muscles of unequal length and not prominent.

III*c*. Stat. Makassar, May—June 1899 (Place, depth and bottom not further indicated).

A few larger specimens, greatest diameter of basis 14 mm., and several smaller ones, all attached to shells of Gastropodous molluscs. Colour greyish-brown, with slightly darker longitudinal bands. Shell conical. Orifice entire, in the smaller specimens superficially toothed, rhombiform, with the rostral extremity rounded, and the carinal pointed. Radii with their summits oblique.

The scutum has narrow but rather prominent lines of growth, which are beaded in an extremely delicate way, and which give the outer surface, when seen with a strong lens, a longitudinally striated appearance. Adductor ridge very prominent.

The tergum has the spur broad and rounded at the extremity. The longitudinal furrow forms a shallow excavation, which is nearly as broad as the spur and terminates in a point towards the apex. Crests for the depressor muscles moderately prominent. Carinal half of basal margin nearly straight.

IV. Stat. 109. July 5/6 1899. Anchorage of Pulu Tongkil, Sulu-archipelago. Depth 13 m. Lithothamnium bottom.

One small specimen, beautifully striped-red on a somewhat lighter ground, the stripes running horizontally and longitudinally, and crossing each other. Radii triangular with oblique summits, uniformly coloured red. Shell irregularly developed on a somewhat narrower basis. Orifice moderately large, toothed. Two very small specimens were taken at the same place, and probably belong to the same variety.

This form probably corresponds to DARWIN's var. (7) *obscurus*.

V. Stat. 162. August 18, 1899. Between Loslos and Broken-islands, at the Westcoast of Salawatti. Bottom coarse and fine sand with clay and shells. Depth 18 m.

Numerous smaller and somewhat larger specimens attached to the shells of a species of *Avicula* (?), or small stems of doubtful nature. Several specimens are crowded together and attached to one another. They are mostly small specimens, the larger ones having a basis the length of which does not exceed 6 mm. They are more cubic than conical, the orifice being large and not distinctly toothed. Some of the specimens have the surface covered with Bryozoa (a *Flustra*-like species), others with a thick coat of a white felt of a nature quite unknown to me. The colour is different even in specimens attached to the same shell or stem: white, pale red, or darker, as a rule with longitudinal stripes of a somewhat darker colour, very often crossed by horizontal lines of darker reddish spots. The radii are coloured white, or pale reddish or darkish-purple; their summits are oblique.

Scutum with rather indistinct growth-ridges, and the adductor ridge only very feebly-developed.

Tergum with the spur broad and short and the extremity pointed, though not acutely. The crests for the depressor muscles not prominent and, on the outer surface, hardly a trace of a longitudinal furrow.

This variety in many respects corresponds to that from III *b*, Station Makassar. They probably do not differ much from DARWIN's var. (8) *variegatus*. Yet in the Siboga-specimens, the shell cannot be said to be conical, nor the walls very thin; and as the resemblance to the forms from various other localities is great, I prefer to group them and to consider them as a new variety.

VI. Stat. 164. August 20, 1899. Lat. 1° 42'.5 S. Long. 130° 47'.5 E.; Depth 32 m. Bottom sand, small stones and shells.

About two dozen specimens, some attached to the shell of *Avicula* (?), some to small stems of a different nature. Numerous specimens are totally covered by a species of a Polyzoon (somewhat like *Flustra*). The specimens attached to the stems are flattened laterally, and surround the stem with their strongly curved basis. The longest diameter of one of the largest specimens is about 1 cm. The colours of the various specimens are very different, like in those from III *b*, Makassar and V, Station 162. In some of the specimens the shell is more cylindrical with large orifice, in others more conical. Walls apparently robust rather than thin.

Scutum with the growth-ridges not prominent, and hardly a trace of beads or longitudinal striae. Adductor ridge long and well-developed.

Tergum with the extremity of the spur obtusely pointed or rounded off. Longitudinal furrow indicated. Crests for depressor muscles rather prominent.

These specimens in the main correspond to those from Station 162, and those from Makassar.

VII. Stat. 273. December 23/26, 1899. Anchorage of Pulu Jedan, East coast of Aru-Islands (Pearlbanks). Depth 13 m., Bottom sand and shells.

The specimens are attached to small sticks, to one another, and to the shell of an

Avicula (?); the last are beautifully coloured, with longitudinal and horizontal stripes of lighter or darker red, with white or somewhat darker interspaces. The radii with their oblique summits are, in almost all the specimens, of a dark purple. The group of specimens attached to a small stem is of a duller colour, brownish, spotted with darker longitudinal and horizontal stripes. The radii in some of these specimens are also dark-coloured. All the specimens are small-sized, the largest diameter of the basis measuring at the most 8 mm.

Scutum with the growth-ridges not very prominent, and no beads along them; the adductor ridge in some of the specimens is well-developed, in others much less.

Tergum with the spur broad and rounded at the extremity. The part of the basal margin between the spur and the basi-scutal angle very short. Crests for the depressor muscles not much developed.

These specimens also show great resemblance to those of Stations 162 and 164.

VIII. Merauke (South coast of New Guinea). "Dr. KOCH coll. 1904".

Numerous dry specimens attached to a piece of wood, which to a large extent is destroyed by the holes of a species of *Teredo*. The shells are (in dry condition) white, have a conical, or, where they stand close together, cylindrical shape, and a rather large rhombiform orifice. The radii are not very broad and have their summits oblique and rounded. The diameter of the largest specimen near the basis is 13 mm., but most specimens are much smaller. These specimens give one the impression of being very strong.

The scutum has the growth-ridges not very prominent, the articular ridge half as long as the tergal margin, and the adductor ridge well-developed. There is a shallow triangular pit for the lateral depressor muscle.

The tergum has a narrow and rather long spur; that part of the basal margin which lies between the spur and the basi-scutal angle is long. The crests for the depressor muscles are moderately developed.

IX. Batavia. Upon bambusa from Sero. "Dr. VAN KAMPEN misit 1908".

Numerous specimens, most of them white, with pale or dark violet or bluish-grey coloured longitudinal stripes, crossed by lighter horizontal bands. Shell strong, flat conical with the radii narrow and their summits very oblique, coloured greyish, with delicate slightly darker horizontal lines. Orifice pentagonal, nearly entire.

The scutum has broad, distinct, but not very prominent growth-ridges, the articular ridge very strongly developed, half as long as the tergal margin, almost hook-shaped. The adductor ridge remarkably prominent.

The tergum has the spur rather long and narrow, not pointed, but truncated at the extremity; no longitudinal furrow, and very well-developed crests for the depressor muscles.

This form shows great resemblance to DARWIN's var. (1) *communis*, as figured in his Monograph Pl. V, fig. 2 *e*.

The foregoing are the 9 (11) samples of specimens that had to be dealt with. After

long and careful consideration I came to the conclusion that the safest way was to consider them as belonging to two different varieties only: the one already described by DARWIN as var. (1) *communis*, the other different from those proposed by DARWIN, and now named var. (10) *malayensis*, from being, apparently, rather common in the Malay Archipelago. In some respects several of the samples approach to some of the other varieties, as described by DARWIN, but the resemblance was in no case complete, or so striking, as it was in that of sample IX, with DARWIN's figure and description of *B. amphitrite* var. *communis*. The samples can be best divided into the two varieties in the following way:

B. amphitrite, var. *communis* Darwin: the samples IX (certainly) and I, III*c* and VIII (probably).

B. amphitrite, var. *malayensis* n. var.: the samples II, III*a*, III*b*, IV, V, VI and VII.

The two varieties may be distinguished by the following characters:

Var. (1) *communis*: shape of the shell conical, with small orifice, or, where the specimens are crowded, cylindrical, with larger orifice. Radii narrow, with very oblique summits. Colour white, with regular longitudinal stripes of violet or blue-grey colour, crossed by horizontal lines of greyish-white. Scutum with a very prominent adductor ridge and the articular ridge also prominent and half as long as tergal margin only.

Var. (10) *malayensis*: shape of the shell cylindrical or flattened laterally, with large orifice. Radii broad at upper extremity, with somewhat oblique, often concave summits. Colour very variable, from almost white or light rose to dark red and purple; longitudinal stripes of darker colour, freckled with white or red in irregular horizontal rows. Radii often dark red or purple. Adductor ridge of the scutum not very prominent, and the articular ridge more than half as long as the tergal margin (Pl. XIV, fig. 8—17).

I investigated the structure of the body of numerous specimens of different stations. In many respects the specimens of different varieties show the same type, in other points, however, differences of some importance were observed. As might be expected, even specimens of the same locality often show small differences, and these are, of course, more striking when specimens from different stations, although belonging to the same variety, are compared. Not to be too extensive, I will give a general description of the different parts and I will add, for the two varieties, only the principal differences I observed.

Mouth. Labrum (Pl. XIV, fig. 12) with the notch deep, but not very wide at the entrance. The lateral parts are rather broad, with the angles rounded. The normal number of teeth is 4 on each side. They are, as a rule, rather strong and pointed, the innermost one is situated at, or in the entrance of the notch, the others all very close together. The sub-triangular, shield-like thickening, is broad, its vertical dimension considerably shorter than the breadth.

Palpi (Pl. XIV, fig. 12*) elongately oval, with the upper margin straight, or even slightly hollowed out, and the basal margin rounded. The spines on the outer surface are

numerous near the distal extremity; a number of them are placed in a longitudinal row which makes an angle with the basal margin. In the variety *communis* this row is composed of a few spines only, a dozen or there about, and these form a single row, almost giving the impression of separating a rounded and slightly swollen terminal part from the rest of the palpus. The same row is visible in the variety *malayensis*, but the spines are much more numerous and disposed in an incompletely double row; the part of the palpus to the exterior of this row, in the latter variety, is perfectly continuous with the remaining part of it. The inner surface of the palpus bears numerous shorter hairs or small spines, a row of them being disposed along a curved ridge, which runs almost parallel to the outer edge of the labrum, when the palpus is in rest. Very delicate hairs or ciliae are disposed along the under margin of the palpus.

Mandible (Pl. XIV, fig. 13). Teeth 1 and 2 pointed at the extremity, tooth 3 thick or broad; inferior part of mandible, in most specimens, slightly developed only, with teeth 4 and 5 and inferior angle rudimentary, the latter in some specimens quite wanting. Teeth 2 and 3 double at the extremity, teeth 4 and 5 triangular and pointed in some specimens.

Maxilla (Pl. XIV, fig. 14 and 14*). Notch under upper pair of spines absent or only slightly indicated. Inferior pair of spines sometimes on a distinct step-like projection, sometimes this step at the inferior angle is small, sometimes almost wanting. Its size is different; even in specimens from the same locality, yet, generally it can be said, that the step-like projection in the variety *communis*, is developed stronger than is the case in the variety *malayensis*. Between the two pairs of spines, the edge bears from 5 to 7 much shorter spines. They are placed in a single row, their free extremities diverging from the plane of the maxilla, alternatively upward or downward. In the outer part of the maxilla the upper and basal margins run quite parallel; whereas the upper margin is strongly curved towards the apodeme, the outer part of the maxilla is almost quadrate.

Outer maxillae (Pl. XIV, fig. 15). Outer lobe elongately oval, very densely clothed with hairs upon terminal part, and over the whole surface along the inner side; hairs feathered as usual; inner lobe narrow, also elongated, covered with numerous hairs, which are longer on the middle part, directed downward and inward, and much shorter on the inferior part of the lobe.

Cirri. First pair: rami unequal, the number of segments increasing with size or age. The greatest number of segments observed is 14 (15) in the shorter and 20 (21) in the longer ramus. The segments of the longer ramus — with the exception of the terminal ones — are indistinctly separated, those of the shorter ramus are strongly protuberant on their inner faces, and have dense tufts of hairs disposed on these protuberances. In a small individual, 8 (9) and 12 (13) segments only were counted in the two rami of this cirrus; between these two "extremes" all possible combinations were observed.

Second pair: rami slightly unequal, the number of segments varying from 9 in the shorter, and 10 in the longer ramus, to 13 and 14 segments. All the segments distinctly protuberant on their inner faces, and bearing dense tufts of hairs on these protuberances. Other nearly equally dense tufts of hairs are disposed on the outer face, and near the extremity of the segments.

Third pair (Pl. XIV, fig. 16): rami slightly unequal, the number of segments varying from 9 in the shorter and 10 in the longer ramus, to 13 and 14 segments respectively in the two rami. The segments are not very strongly protuberant, but only rounded, on their inner or anterior face. Numerous hairs are disposed on each segment; they do not form, however, such dense tufts as on the segments of the 2nd cirrus. Each segment, on its anterior face, is furnished with a row of small but well-developed teeth, a second row of still smaller teeth being ordinarily seen parallel to that along the margin, and at little distance only from it. In the larger specimens of the var. *communis* from Java, the surface is even covered with several rows of such small teeth, the size of which diminishes from the anterior face towards the other side of segment. In these specimens, a row of somewhat stronger teeth is disposed along the upper margin of each segment. Both rami show these teeth; they are nearly as strongly developed in one as in the other.

Groups of similar teeth are seen also on the lower segments of both rami of the 4th cirrus. I counted in one specimen, the 4th cirrus of which had over 20 segments, about a dozen segments furnished with such a group of teeth, disposed on the surface near the anterior and upper margins of the segment, but not on the anterior margin, as in the 3rd cirrus.

The 3rd cirrus has a dense tuft of long delicate hairs disposed at its basis on the thorax and directed backward.

Fourth-sixth pairs (Pl. XIV, fig. 17): have almost the same structure. In a large specimen the two rami of the 4th cirrus had respectively 22 and 24, of the 5th cirrus 25 and 27, and of the 6th cirrus 26 and 28 segments. In a somewhat smaller specimen the number of segments of the two rami of the 6th cirrus had 25 and 26 segments, in a much smaller specimen these numbers were 20 and 21 only. The segments are furnished on their inner faces with from 4—6 pairs of spines, the middle segments having 5, and sometimes even 6 pairs of such spines, whereas the terminal, as well as the lower segments, are furnished with 4 pairs only. The middle segments are as a rule from $1^1/_2$—2 times as long as broad, the inferior segments are about as long as broad and the terminal segments are over twice as long as broad. The sixth cirrus shows a transverse row of small triangular teeth disposed along the distal extremity of the lower segments. These teeth are developed much more strongly in the var. *communis* than in the var. *malayensis*; they probably grow somewhat stronger with the age of the animals. These rows are already present at the extremity of the segments of the pedicel, and here consist of 10 or more teeth; on the lower segments each row shows 6 to 7 teeth, the number decreasing, until on the middle segments of the cirrus, only 3 or 2 of these teeth are observed. The posterior margin of the segments of the pedicel is hirsute, a large number of extremely small teeth-like spines being disposed along it.

The penis bears a small pointed projection on the dorsal side near the basis. It is not very long, is broad or thick at the basis, and strongly tapering towards the extremity. Few hairs only are scattered over its surface.

Geographical and bathymetrical distribution. This species seems to be common in warm and tropical seas all over the world. In Darwin's Monograph the distribution of the species and also of the varieties is given; the species, according to him, inhabits

inter alia Ceylon, the Philippine Archipelago, the East Indian Archipelago, the east coast of Australia and New Zealand. Var. (1) *communis* occurs in the Philippine Archipelago, and in New South Wales; var. (2) *venustus* in Ceylon; var. (7) *obscurus* in Australia; var. (8) *variegatus* in New Zealand; var. 9 *cirratus* Mouth of Indus, Australia, Philippine Archipelago. WELTNER, (Verzeichniss, 1897) reports that the Berlin Museum possesses specimens of the species itself from Burma, from Singapore, and from Manila; and in the same Museum the var. (1) *communis* is represented by specimens from Singapore, from Manila, from Makassar, and from Surabaya, and the var. (9) *cirratus* from British Burma, Saygon and East India (or China). ANNANDALE (Cirripedia, Pearl Oyster Fisheries, Gulf of Manaar) observed specimens of the var. (1) *communis* and (2) *venustus*, on shells, ropes, and submerged baskets at Galle and in the Gulf of Manaar. Hence the variety (1) *communis* appears to be rather common in this part of the Pacific, and the new variety (10) *malayensis*, seems also to be fairly general. The species itself is found in shallow water, often attached to floating objects, ships-bottoms, etc. The Siboga collected it on different occasions, during shore-exploration, as well as when dredging. The most typical specimens of the var. (1) *communis* were taken from a piece of floating Bambusa; other specimens were taken from a piece of wood, which was perforated to a considerable extent by the tunnels of *Teredo*, and, perhaps, in floating condition only was occupied by the *Balanus*. The small specimens collected at Station 2, which show resemblance to the variety *communis*, were dredged at a depth of 56 m. The specimens of the var. (10) *malayensis* were found attached to small stems, various shells, etc. and these objects were dredged in water of depths varying from 13 to 40 m.

General Remarks. Two specimens of a *Balanus* were collected at Station 99, which, probably, belong also to this species; the smaller specimen only was furnished with opercular valves and these, though very small, look very much like the same valves of *B. amphitrite*. The other specimen is somewhat larger, is pink coloured, longitudinally striped with red, and its general appearance is much like that of the species here under consideration.

These specimens were collected at:

Stat. 99. June 28—30, 1899. Lat. 6° 7'.5 N., Long. 120° 26' E.; Depth 16—23 m. Lithothamnium-bottom. (Anchorage off North-Ubian).

3. *Balanus alatus* n. sp. Pl. XV, fig. 1—8.

Shell coloured red with darker red stripes; radii broad with the summits oblique and slightly hollowed out. Scutum with the external surface hollowed out in the middle, no adductor ridge, and an articular ridge extending over $^2/_3$ of the length of the tergal margin. Tergum with broad articular furrow, and the extremity of the spur bluntly pointed. Labrum with four teeth on each side of the notch; the hairs on the outer surface of the palpi limited downwards by a distinct row, making a sharp angle with the inferior margin.

This beautiful *Balanus* was collected in deep water. It is represented by two specimens, the larger of which is figured (Pl. XV, fig. 1). It is of conical shape, and has a relatively large orifice. The carino-lateralia are narrow, the lateralia triangular, and very broad towards

the basis. The rostrum is distinctly curved inward with its apical part. The radii are very broad, and their summits slightly hollowed out. The alae are broad also but have the upper margins somewhat convex. The shell is laterally compressed, and seems to have been attached to a narrow object with rounded surface. The basis is calcareous, and shows longitudinal canals running parallel to each other. The compartments have pores, which could not be discovered in the radii. (Pl. XV, fig. 3).

The shell is coloured beautifully red, with longitudinal and horizontal bands of a somewhat darker colour. The tips of the compartments and of the radii are of a lighter red. The radii are striated horizontally.

The scutum (Pl. XV, fig. 2*b* and *d*) has the basal margin longer than the tergal margin; its lines of growth are rather broad and not very prominent. The external surface is not flat, but somewhat hollowed out in the middle; in consequence, the marginal parts — along the tergal and occludent margins — are slightly uplifted. Internally, the articular ridge is prominent and extends over two thirds of the length of the tergal margin. The cavity for the adductor muscle is distinctly indicated, the pit for the lateral depressor muscle very shallow. No adductor ridge can be distinguished.

The tergum (Pl. XV, fig. 2*a* and *c*) has the articular ridge prominent, the articular furrow broad and rather deep. The spur is situated at some distance from the basi-scutal angle, and its extremity is bluntly pointed; the basal margin behind the spur is slightly hollowed out, the carinal margin is somewhat convex, the scutal margin straight. The crests for the depressores are strongly developed. The outer surface of this valve shows also a shallow excavation, the part which is somewhat hollowed out, being of triangular shape and lying between the apex and the middle part of the basal margin.

The following description can be given of the structure of the animal's body:

Mouth. Labrum (Pl. XV, fig. 4) has a shallow notch and four relatively strong teeth disposed on each side.

Palpi (Ibid. fig. 4*) are elongated, slightly broader towards the rounded extremity; the superior margin is almost straight, the inferior margin curved. Along the superior margin numerous hairs are disposed, which increase only slightly in length towards the free extremity of the palpus. Here they form a group with somewhat longer hairs disposed on the outer surface, as well as with the longest of those which form, on the outer surface also, a well-developed double row of hairs arranged along a line making a sharp angle with the inferior margin. The latter margin is occupied by a number of very delicate and short hairs, ciliae, arranged in small groups or brushes. The inner surface also is furnished with hairs, a row of the shortest being arranged parallel to, and at a short distance from, the superior margin.

Mandible (Pl. XV, fig. 5). Extremities of teeth 1 and 2 at a somewhat greater distance from one another than those of 2 and 3. Teeth 2 and 3 double, 4 and 5 small, but distinct. The inferior angle terminating in two extremely small points.

Maxilla (Pl. XV, fig. 6 and 6*). Shape triangular, spine-bearing edge rather long. There are 2 upper spines, but the two at the inferior extremity are combined on one side with

a third; at the other side, however, the two form a group as usual, and the third is of the size of the other spines of the middle part of the edge. There is a very small notch behind the upper pair and the number of spines on the middle part is 3 and 4 respectively.

Outer maxillae have the outer lobe elongated, and this lobe bears hairs only on the distal part of the surface. A single row of hairs is disposed in longitudinal direction on the outer lobe, running towards the outer margin of the inner lobe. Inner parts of inferior lobe furnished with numerous hairs directed inwards and towards the basis of the maxilla.

Cirri. First pair has unequal rami of 7 and 11 segments. The segments are not strongly protuberant on their inner face.

Second pair, rami slightly unequal of 6 and 7 segments.

Third pair (Pl. XV, fig. 7), rami somewhat unequal, of 7 to 8, and 8 to 9 segments. The segments are protuberant on their inner face. On most segments a few small teeth are seen between the hairs disposed on the protuberances. They seem to occur on both rami; they are more distinct, however, on the longer ramus.

Fourth pair, rami nearly equal of 10 and 11 segments: remarkably short.

Sixth pair (Pl. XV, fig. 8), has rami of 16 and 17 segments. Greatest number of pairs of spines on inner face of segments: five. Spines are disposed on the dorsal surface of each segment, and form a little tuft close to its upper margin. One of these spines is longer than the others, and about half as long as the segment.

Penis broken off, not seen.

Eggs in the interior of the shell-cavity rather numerous, egg-lamellae broken, present in both specimens. Larvae with Nauplius-appendices and eyes seen in the eggs. Greatest diameter of eggs about 0.24 mm.

The two specimens of this small species were observed at:

Stat. 97. June 28, 1899. Lat. 5° 48'.7 N., Long. 119° 49'.6 E. N. E. of Sulu-Archipelago. Depth 564 m. Bottom: coarse, coral-sand.

General Remarks. This species in several respects approaches *B. amphitrite*, but is distinguished at once from that species by the structure of the scutum, which, in this species, has no adductor ridge. The shape of the parts of the mouth and of the cirri resembles that of the same parts in *B. amphitrite*. There might be, perhaps, sufficient reason to consider this new species as the deep-sea form of DARWIN's species. Under *B. minutus* which seems to belong to the same group, I point out the differences between that species and the present one.

4. *Balanus minutus* n. sp. Pl. XV, fig. 9—16.

Shell of a pink colour with reddish stripes, radii broad, with their summits oblique. Scutum without adductor ridge, and with prominent articular ridge; tergum with the spur pointed at the extremity. Labrum with three teeth on each side of notch, palpi with the hairs on the outer surface not disposed in a distinct longitudinal series.

This almost microscopic species is represented by a single specimen. It is attached to a jointed thread which belongs to a Crinoid. Its shape (Pl. XV, fig. 9) is conical, and it

is somewhat flattened laterally. The carina reaches higher upward than the other valves. The carino-lateral is narrow, the lateral broad, with the surface divided by longitudinal folds into three parts. The colour is pink with red stripes, longitudinal and horizontal, all over the surface. The orifice is rather large and somewhat toothed. The radii are rather broad, and have oblique, slightly hollowed out, summits. They are of a light red colour, the alae being white and having the summits straight.

The structure of the compartments could not be investigated without destroying the small specimen; I presume the parietes to be with pores and the radii to be without pores.

The scutum (Pl. XV, fig. 10, *a* and *b*) is indistinctly furrowed, the growth-ridges being only slightly prominent. The outer surface is not flat but feebly hollowed out in the middle longitudinally. Internally, the articular ridge is not very elongated, but rather prominent. The pit for the depressor muscle is well-developed as also is the cavity for the adductor muscle. No trace of an adductor ridge can be seen.

The tergum (Pl. XV, fig. 10*c*), has the apex blunt, the scutal margin straight, the basal margin distinctly hollowed out, and the carinal margin slightly convex. There is no longitudinal furrow, but a shallow longitudinal depression parallel to the scutal margin. The spur is separated from the basi-scutal angle by a distinct excavation, and the posterior margin of the spur slopes into the basal margin; spur bluntly pointed at the extremity.

With regard to the structure of the animal's body the following may be of interest:

Mouth: labrum (Pl. XV, fig. 11) has a rather deep notch, and the lateral parts rather short. On each side of notch three stout, triangular, pointed teeth are seen.

Palpi (Pl. XV, fig. 11) of oval shape, not elongated, only one and a third times as long as broad. The hairs on the outer surface are not disposed in a row, but form a somewhat irregular group near the free extremity of the palpus. They do not reach farther over the outer surface than half way its length. No groups of short hairs along inferior margin. The inner surface is furnished with very numerous hairs, which are partly recurved.

Mandible (Pl. XV, fig. 12), has the first tooth sharp, and the distance between the extremities of teeth 1 and 2 greater than that between 2 and 3. Third tooth double, fourth small, but also double, fifth very small and the inferior angle rudimentary.

Maxilla (Pl. XV, fig. 13) of triangular shape, with a notch behind the two upper spines, three spines on the middle part, and two strong spines on a slightly elevated part near the inferior extremity of the edge. The length of the middle spines about three quarters of the length of the spines of the upper pair.

Outer maxillae (Pl. XV, fig. 14) have the outer lobe not very elongated, and with a rather broad basis; the outer margin is strongly convex, the inner margin nearly straight, the free extremity somewhat pointed. A distinct row of spines extends over the outer lobe, directed towards the rounded inner lobe.

Cirri. First pair has very unequal rami of 5 and 12 segments.

Second pair has the rami nearly equal, of 6 to 7, and 7 to 8 segments; each segment slightly protuberant only on its inner face.

Third pair slightly longer than the 2nd pair, number of segments 7 to 8, and 8 to 9,

in the other ramus. Few (2—3) and small teeth (Pl. XV, fig. 15) are disposed on the protuberant parts of the anterior face of some of the middle segments of both rami.

Fourth to sixth cirrus have the same, or nearly the same structure, the only difference being that the number of segments increases a little from the 4th to the 6th: the number of segments is 13 and 15 in the fourth, whereas the sixth pair has 16 and 17 segments. The greatest number of spines (Pl. XV, fig. 16) observed on the inner face of the segments was four pairs. The spines disposed on the dorsal surface of each segment, close to its upper margin, are very short in this species.

Penis not very long, narrow in the distal part. Hairs scattered over surface and forming a little tuft at the extremity.

The only specimen was collected at:

Stat. 117. July 12, 1899. Lat. 1° 0′.5 N., Long. 122° 56′ E. Kwandang-Bay-entrance. Depth (chart) 80 m. Bottom: sand and coral.

General Remarks. This species shows resemblance to my new species *B. alatus*; the shape of the opercular valves, and the structure of the parts of the mouth as well, is, however, different, and as the two forms, moreover, inhabit quite different depths (*B. alatus* living at a depth of 564 m. is a real deep-sea species) I think the safest way is to consider and to describe them as different species.

3. Sectio: **Striato-Balanus**

5. *B. amaryllis* Darwin. Pl. XV, fig. 17—21. Pl. XVI, fig. 1—4.

Darwin, Ch., Monograph, The Balanidae, Verrucidae etc. 1854. p. 279, pl. VII, fig. 6.

Of this species, which, according to Darwin is distinct and well-defined, samples were taken on different occasions:

I. Stat. 50. April 16/18, 1899. Bay of Badjo, West coast of Flores. Depth up to 40 m. Bottom: mud, sand and shells, according to locality.

A single beautiful specimen, attached to a shell of a small *Tridacna*-like oyster. The shape of the shell is conical, the orifice is large, pentagonal, toothed. The colour is rose-red, the inferior half, slightly darker than the upper half, and darker and lighter transparent stripes of the same colour run longitudinally over the surface. Radii very narrow, reddish, with the upper margins very oblique, while the alae are broader and of a lighter colour.

Size of the specimen: greatest diameter of the basis 17 mm., greatest height of the rostrum 14 mm.

II. Stat. 258. December 12/16, 1899. Tual-anchorage, Kei-islands. Depth 22 m. Bottom: Lithothamnium, sand and coral.

Numerous specimens of different size and shape. The larger, are nearly cylindrical specimens with a cylindrical cup-formed basis, the shell growing wider towards the orifice. The colour

of the basis is white, that of the compartments reddish, with longitudinal stripes, some of which are darker, others lighter than the rest of the surface. The narrow radii have very oblique summits, and are of a dirty white colour, the alae are broader, are of a darker colour and have their summits rounded. The sheath is as a rule of a dark purple. The smaller specimens are of a conical shape, and are mostly coloured more vividly than the longer: rose-red, with somewhat darker longitudinal stripes. The orifice, in the cylindrical specimens especially, is very large and distinctly toothed; the upper extremities of the compartments are — especially in the larger specimens — slightly curved inwards.

Size of the specimens: the largest specimen is 4.8 cm. high, half of which height is for the cupformed basis, the greatest diameter near the orifice is 2 cm. and that of the basis, near the lower extremity 13 mm. The specimens are crowded together and attached to pieces of calcareous stone.

III. Stat. 273. December 23/26, 1899. Anchorage of Pulu Jedan, East coast of Aru-islands (Pearl-banks). Depth 13 m. Bottom: sand and shells.

A single complete and larger specimen, attached to the shell of an oyster. Half-a-dozen smaller specimens, which are incomplete, being without opercular valves, are attached to the same shell.

The shape of the shell is cylindrical rather than conical, upper extremities of the rostrum, the lateralia, and the carina, slightly curved inwards. Orifice large, pentagonal, toothed. Colour greyish white, here and there yellowish, with slightly darker longitudinal lines on the main parts of the compartments. Radii have very oblique summits, are broadest at a little distance from the orifice, and grow narrower towards the basis. The alae are broader than the radii, and have their summits rounded.

Size of the specimen: the greatest height is 18 mm., the greatest diameter at the upper extremity 16 mm. The other specimens are much smaller, they are partly overgrown by a dark-greyish sponge-like creature, partly naked, coloured dirty white or reddish.

IV. Stat. Jedan-islands — about the same locality from which the specimens from Station 273 were taken.

Several small specimens, nearly all broken, apparently young, and certainly not full-grown animals.

The shape of the shell is more conical, the orifice is in consequence smaller, distinctly toothed in one, less distinctly in another specimen. The colour is pale red, with darker red longitudinal lines. The radii are narrow, their upper edges oblique.

These are small specimens: the greatest diameter of the largest specimen measures at the most 8 mm..

The shape and the structure of the opercular valves of the specimens of the different localities show great resemblance and correspond almost exactly to DARWIN's description.

The scutum (Pl. XV, fig. 17*a* and *c*) is plainly striated longitudinally, the striae dividing the prominent lines of growth into squarish beads. Internally, the articular ridge is

short and slightly prominent; the adductor ridge is more strongly developed than in DARWIN's figure and description. It can be traced to the apex of the valve, and it describes downwards a well-defined arch. The cavity for the lateral depressor muscle is rather distinct, that for the adductor muscle, in the larger specimens, has developed into a regular pit.

The tergum (Pl. XV, fig. 17*b* and *d*) in some of the larger specimens is distinctly striated longitudinally, in others no trace of such striae is seen. The longitudinal furrow is well-developed in most specimens. The length of the spur is rather unequal in different specimens, even in those from the same locality. Where it is long, its length surpasses that of the part of the basal margin situated between the spur and the basi-scutal angle. The spur is short in the specimen from Station 273. In the same specimen, the scutal margin of the tergum is much less curved than is the case in the specimens from other localities.

The structure of the parts of the mouth and of the cirri was found much as is described by DARWIN. For the comparison of these parts with the same parts in other species, it has, however, been thought useful to give here a more detailed description.

Mouth. Labrum (Pl. XV, fig. 18) with the notch wide at the entrance, but not very deep. Lateral parts rounded, with 3 small teeth on each side of notch. Shape of subtriangular shield-like thickening considerably broader than its longitudinal dimension.

Palpi broad, stout, strongly swollen in the distal part, their shape being quadrate, with rounded angles: the upper margin nearly straight, going over with a rounded angle into a distal margin, which, with a broader rounded angle, goes over into a much shorter basal margin. The outer surface bears numerous spines or bristles on a triangular portion, near the angle formed by the upper and distal margins, the lower spines being disposed along a curved line, the hollow side of which is directed towards the under margin. Hairs along upper margin and inner side numerous.

Mandible (Pl. XV, fig. 19) has the free edge long, in so far as the distance between the extremities of teeth 2 and 3 equals or even surpasses that between the extremities of teeth 1 and 2. The part behind the 3rd tooth rudimentary: 4th tooth represented by a triangular pointed knob, 5th tooth and inferior angle together represented by a blunt knob. Tooth 2 distinctly double-pointed, tooth 3 also double, but blunt.

Maxilla (Pl. XV, fig. 20) has a small notch behind the upper pair of spines, and has the inferior part of the edge developed into a very prominent step-like projection. Two long spines are situated on this projection, which, moreover, bears at the inferior angle a number of spine-like hairs. Between the notch and the step-like projection, the nearly straight edge bears 5—6 pairs of spines, and a single spine. Apodeme long. The step-like projection of one of the maxillae of the specimen from Station 273 was occupied by 3 spines, the middle one being somewhat thinner and shorter.

Outer maxillae (Pl. XVI, fig. 1) have the outer lobe elongately oval, a large part of the inner surface furnished with numerous hairs; a longitudinal group or row of hairs extends from the outer to the inner lobe. Inner lobe relatively large, of a somewhat quadrate shape with rounded angles. In the specimen from Station 273, the hairs on the outer lobe are more delicate and shorter, and are disposed at greater distances from one another.

Cirri. First pair (Pl. XV, fig. 21): rami unequal, sometimes very unequal. Number of segments observed: 13 and 24, 17 and 32, 17 and 25, 13 and 24, 12 and 18. The lower segments of the longer ramus are separated only indistinctly, those of the shorter ramus are very protuberant.

Second pair (Pl. XVI, fig. 2): rami slightly unequal. Number of segments observed: 15 and 16, 18 and 19, 16 and 17, 16 and 17, 14 and 16. Most of the segments are distinctly protuberant, with tufts of hairs placed on the tip of the protuberances.

Third pair (Pl. XVI, fig. 3): rami slightly unequal. Number of segments observed: 18 and 21, 29 and 30, 23 and 26, 18 and 20. Segments not protuberant, but having the anterior face rounded off. A tuft of hairs is situated on the extremity of this rounding, the surface of which, moreover, is furnished with several rows of extremely small teeth. The margin of the segment bears no teeth. The thorax bears a tuft of hairs or bristles at the basis of the 3rd cirrus.

Fourth and fifth pair with from 45—52 segments. Surface of pedicel of 5th cirrus rough, with numerous minute, spine-like teeth.

Sixth pair has 54 to 55 segments in one specimen, 70, 75, 59, 58 segments respectively in the other specimens. Segments in the middle part of the cirrus (Pl. XVI, fig. 4) as long as broad, towards the free extremity longer than broad, towards the basis shorter. As a rule each segment has two pairs of very long spines on its anterior face, but sometimes, and then not even in both rami, some of the middle segments have a 3rd pair of very small spines. Between the spines of each pair, and immediately beneath them, there is a dense brush of short hairs. These brushes are stronger, the number of hairs greater, at the basis of the distal pair of spines of each segment. Each segment bears a group of short hairs on the posterior face near the upper extremity. The surface of the lower part of the cirrus, to about the 15th to 20th segment, is rough with numerous microscopical spine-like teeth.

Penis not very elongated, much thicker towards the basis, tapering towards the extremity. It is furnished, dorsally, near the basis, with a recurved hook-like point.

Geographical and bathymetrical distribution. DARWIN knew this species only from the 3rd and 7th provinces, which he distinguished for the distribution of the Cirripedia: the Indian Archipelago and Australia. WELTNER (l. c. p. 270) mentions specimens from Shanghai, and the "Challenger" collected it near Kobe, Japan at two different places, where the depth varied between 14.5 and 90 m. Its occurrence at different places in the Malay Archipelago is proved again by the material collected by the Siboga. It has there been found in shallow water only: the greatest depth from which it was dredged during the cruise of H. M. S. "Siboga" was "up to 40 m.". The "Challenger" found it in Torres Strait at a depth of 14.5 m. According to LANCHESTER[1], a variety of this species is found at Khota Bharu, Kelantan.

6. *Balanus bimae* n. sp. Pl. XVI, fig. 5—11.

Shell conical, globular near the basis, with small and distinctly toothed orifice striped

[1] LANCHESTER, W. F., The Crustacea of the Skeat-Expedition. Proceed. of the Zoolog. Soc. London. II. 1902.

with light rose and red. Radii extremely narrow with oblique summits, alae narrow also and with oblique summits. Scutum plainly striated longitudinally; tergum with the spur broad, without a longitudinal furrow.

This species in several respects resembles *B. amaryllis*, and belongs no doubt to the same division of the genus. It is represented by two specimens.

The general shape of the shell (Pl. XVI, fig. 5) is conical, with the basal part, in the larger specimen especially, rather swollen, and a relatively small and deeply toothed orifice. The shell is slightly compressed laterally, in consequence of its being attached to a narrow and rounded surface. The basis is hollowed out, with the concavity directed towards the object (sponge?) to which it is attached; this basis is calcareous; I could not make out if it has pores. The compartments and radii have no pores. The radii are narrow, and have the summits very oblique; the alae are only slightly broader, they have the upper margins rounded and oblique. The colour of the shell and radii is pale red, with darker and lighter longitudinal stripes, crossed by a few horizontal and lighter-coloured bands. The alae are much lighter, almost of a white colour. The larger specimen measures 11 mm. (greatest breadth at the basis), and has a height of 9.5 mm. In the smaller specimen these measurements are 7 and 5.5 mm. respectively.

Scutum and tergum in general appearance resembling very much the same parts in *B. amaryllis*. The longitudinal striae on the scutum (Pl. XVI, fig. 6, *a* and *c*) of the present species are, however, still more distinct, hence the whole surface is divided into little squares in a more prominent way. The inner surface of the scutum is coloured purplish-red, and is distinctly furrowed longitudinally, especially in the basal part. The adductor ridge can be made out only in the superior half of the valve, the articular ridge is narrow, and about half as long as the tergal margin.

The tergum (Pl. XVI, fig. 6, *b* and *d*) has the scutal margin hollowed out, the apex beaked. There is no longitudinal furrow. The spur is short, and cut off in an oblique direction. Its length is a trifle longer than its distance from the basi-scutal angle. Crests for the depressor muscles few and not very prominent.

With regard to the structure of the animal's body, the following may be said:

Mouth. Labrum (Pl. XVI, fig. 7) with a rather deep notch, and three teeth situated close together on each side of notch. The two margins of the labrum on each side of the notch together make an angle; therefore the whole shape of the shield-like portion, is more quadrate than triangular. The teeth are triangular, pointed at the extremity.

Palpi with the basal margin strongly arched, hence the whole shape is swollen as in *B. amaryllis*. Numerous longer hairs are situated close together on a triangular portion of the outer surface at the free upper corner. Hairs along upper margin numerous; those of the inner surface are arranged above and along a distinct ridge, which runs parallel to the upper margin. When the palpi are at rest, a row of these hairs disposed along the ridge, falls over the edge of the labrum.

Mandible (Pl. XVI, fig. 8). Distance between extremities of teeth 1 and 2 about the same as that between 2 and 3. The latter teeth double. The 3rd somewhat thicker, the 4th small, 5th and inferior angle form together a blunt projection. The part of the mandible behind the 3rd tooth only slightly developed.

Maxilla (Pl. XVI, fig. 9 and 9*). Two superior and two inferior spines of about the same length; the latter situated on a step-like projection. A notch behind the two superior spines, and a smaller one at the basis of the step-like projection. Between the two, the edge bears 8 to 9 spines, some of them in pairs and together forming two indistinct rows.

Outer maxillae (Pl. XVI, fig. 10). Outer lobe oval, inner lobe somewhat quadrate, with rounded angles as in *B. amaryllis*. A large part of inner surface of outer lobe covered with hairs, a group of which runs longitudinally towards inner lobe. Hairs on inner lobe numerous, those placed near interior margin longer and directed towards the basis of the maxilla. The stronger hairs are as usual distinctly feathered.

Cirri. First pair: rami unequal of 10 and 20 segments; 7 lower segments of longer ramus only indistinctly separated. Segments 5—8 of shorter ramus with their inner faces strongly protuberant.

Second pair: rami nearly equal of 11 and 12 segments; segments 5—10 in both rami distinctly protuberant.

Third pair: rami have 16 and 17 segments, and most segments slightly protuberant. No teeth along the margin of the protuberances; their surface, however, is rough from the presence of short microscopical spines. The dorsal surface of the pedicel near the extremity, and of the lower segments of the rami, also rough in consequence of the presence of numerous very short spine-like teeth. A small tuft of long hairs is placed on the dorsal face of the 1th segment of the pedicel. A denser tuft of similar long hairs is seen on the thorax beneath and behind the pedicel of this cirrus.

Fourth-sixth cirrus of about the same structure.

Sixth pair: rami have 41 to 42 segments. The segments of the basal part — about 17 in all — are as long as broad or even shorter; the 15 middle segments gradually grow longer, till the last are twice as long as broad; the 10 terminal segments are more than twice as long as broad. The last 12 segments bear two pairs of spines on their anterior faces, these spines differing considerably in size. The middle segments (Pl. XVI, fig. 11) have three pairs: the outer pair more than twice as long as the segment, the middle pair about same length as segment, or a little longer, the lowest pair very short. Between the two spines of the two upper pairs a few — 2 to 3 — small hairs are situated, which are delicate and short, and do not form a distinct tuft as is the case in *B. amaryllis*.

Penis short, not quite $^1/_3$ the length of the sixth cirrus, strongly tapering towards the extremity. The basi-dorsal point is well-developed but shorter, with the extremity blunt and not recurved as in *B. amaryllis*.

Both specimens were found attached to a specimen of a sponge. They were collected at:

Stat. 47. April 8—12, 1899. Bay of Bima, near South fort. Depth 13 to 31 m. Two specimens.

General Remarks. This species no doubt comes very near to *B. amaryllis*. The general shape, the mode and the object of attachment, and several details in the structure of the animal's body, however, sufficiently justify my considering it a different species.

7. *Balanus albus* n. sp. Pl. XVI, fig. 12—13, Pl. XVII, fig. 1—6.

Shell white, striated longitudinally and, in older specimens, indistinctly folded horizontally. Radii narrow, with very oblique summits; alae broad, with the summits rounded. Scutum with very delicate longitudinal striae; tergum with the spur broad and without a longitudinal furrow.

This species in many respects resembles *B. amaryllis* and might be considered as the deep-sea form of that species.

The shell (Pl. XVI, fig. 12) is bulky, about as broad as high, with most of the compartments horizontally and longitudinally more or less convex, the orifice large, pentagonal and irregularly toothed, the basis either rounded, or if the object to which the shell is attached is narrow, ovate. The radii are narrow, broader towards the basis, with the summits very oblique, and either straight or feebly hollowed out. The alae are broader, their summits rounded and often partly broken off like the tips of the compartments. The upper parts of the compartments are often damaged, the inferior parts on the other hand are thick and strong, in older specimens especially. The colour is uniformly dirty white; the older specimens are striated longitudinally all over the surface, with a few horizontal growth-ridges. The smaller specimens are more hyaline-white. No epidermis is seen. The compartments have no pores, but longitudinal ribs, more strongly developed towards the basis, are seen on the inner side. The sheath is white and horizontally striped. The radii also have no pores; the basis is represented by an extremely thin calcareous plate, which shows numerous ridges extending from the centre towards the periphery; here and there they have the appearance of canals, but I failed to make out canals or pores in a transverse section of this basis.

Scutum (Pl. XVI, fig. 13, *a* and *c*) with distinct growth-ridges, and a pearly lustre over the surface, very delicately striated longitudinally. On the inner surface the adductor ridge is only feebly developed, and the adductor muscle cavity is indicated by two longitudinal grooves; the articular ridge is very prominent, and reaches as far as half the length of the tergal margin. The pit for the depressor muscle is rather deep.

Tergum (Pl. XVI, fig. 13, *b* and *d*) with the scutal margin only very feebly hollowed out, accordingly the apex can hardly be said to be beaked. No longitudinal furrow, but a distinct crest runs in a curved line almost from the apex to the extremity of the spur. Spur short, obliquely truncated at the posterior side. That part of the basal margin which lies between the basi-scutal angle and the spur is hollowed out, and not shorter than the anterior margin of the spur. Crests for the depressor muscle only feebly developed.

The investigation of the structure of the animals body gave the following results:

Mouth. Labrum (Pl. XVII, fig. 1) with the notch wide at the entrance, but not deep; 3 small, blunt teeth are situated close together on each side of notch. Edge of lateral parts slightly hollowed out, margin furnished with extremely small hairs, and a few more small indistinct teeth towards lateral extremity. The sub-triangular shield-like portion much broader than it is high. (In one of the specimens quite a row of small teeth is observable along the edge of the labrum).

Palpi stout, upper margin nearly straight, basal margin slightly arched, the two separated from each other by a nearly longitudinal distal margin. Hairs of the outer surface scattered

over large part of it, numerous, disposed in several rows and close together; the most distal ones form a slightly elongate tuft, with some of the hairs disposed along the upper margin. The hairs of the inner surface are short, curved and distinctly feathered; they form a kind of brush, falling over the edge of the labrum, when the palpi are not erect.

Mandible (Pl. XVII, fig. 2) with the third tooth broad or thick, the 4th and 5th well-developed and pointed, the inferior angle represented by a very small, rudimentary tooth, or almost quite obsolete. Teeth 2—4 double. Distance between extremities of teeth 1 and 2 considerably greater than that between teeth 2 and 3.

Maxilla (Pl. XVII, fig. 3 and 3*) with the edge nearly straight. The upper pair of spines well-developed, the inferior pair not so conspicuous as in many other species, and situated at a considerable distance from the inferior angle. The inferior part not developed into a step-like projection. Beneath the upper pair a very small notch is seen, with a few hairs disposed at the bottom. Between the two pairs of somewhat larger spines the edge bears 4 pairs and one or two single, or 5 pairs of well-developed spines of nearly equal strength. The part of the edge behind the inferior pair of spines is furnished with a series of spine-like hairs. Upper and basal margins of the maxilla nearly parallel towards the extremity, distal part almost quadrate in consequence.

Outer maxillae (Pl. XVII, fig. 4). Outer lobe relatively short and broad; a large part of its anterior surface is furnished, as a rule, with short hairs; no longitudinal series of hairs extends from the outer to the inner lobe. The latter bears feathered hairs, most of which are directed towards the interior and towards the basis of the maxilla.

Cirri. First pair has the two rami very unequal, the one having 11, the longer ramus having 16 segments (the same cirrus of the other side in this specimen has 11 segments in both rami). In another specimen the numbers of the segments were 11 and 15 respectively in the one, and in the other cirrus 11 and 16. The segments of the shorter ramus are strongly protuberant.

Second pair. Rami nearly equal, of 15 or 16 segments; segments very protuberant on their inner face, with dense tufts of hairs disposed on the protuberances. Both rami of this cirrus nearly straight.

Third pair. Rami unequal, distinctly curved at the extremity, of 19 and 21 segments respectively. Protuberances flattened, furnished with brushes of less numerous, but longer hairs than on second cirrus. No trace of teeth along the protuberant parts of the segments.

Fourth-sixth pair. Rami long: segments, although short, very numerous. In the sixth cirrus in one of the specimens, 50 segments can be counted in both rami. Their anterior margin is slightly protuberant and bears two pairs of long spines, the distal pair of which is longer than the other pair (Pl. XVII, fig. 5). Two to three short stiff hairs form a little brush between the two spines of the distal pair, a couple of delicate hairs are situated in the same way between the spines of the shorter pair. On some of the segments, a third pair of microscopical spines (hairs) could be made out — but not on all. The number of segments in the 6th cirrus of a smaller specimen is about 44.

Penis with characteristic point near basis well-developed. Basal part very thick, terminal part narrower, tapering towards the extremity. Length moderate.

H. M. S. "Siboga" collected about a dozen specimens of this characteristic species. The larger specimens have a basis of 17.5 × 14 mm., and the greatest height measures about 17 mm. They are found attached to shells of different Gastropodous Molluscs: a *Fusus*-like species, and others, all more or less broken. Some of the specimens are crowded together so as to hinder each other in their development, others are isolated. The species was collected at:

Stat. 12. March 14, 1899. Lat. 7° 15′ S., Long. 115° 15′.6 E. Depth 289 m. Bottom: mud and broken shells. 12 specimens of various sizes.

Stat. 95. June 26, 1899. Lat. 5° 43′.5 N., Long. 119° 40′ E. Depth 522 m. Bottom: stony. One small specimen.

Stat. 260. Decbr. 16 and 18, 1899. Lat. 5° 36′.5 S., Long. 132° 55′.2 E. Depth 90 m. Bottom: sand, coral, and shells. One small specimen, the largest diameter of the basis of which measures 6.5, the smallest 5 mm.

General Remarks. The structure of the labrum with the row of small teeth along the edge is interesting, in so far as such small teeth are likewise seen along the edge of other deep-sea species of the genus *Balanus*, and the nearly-related genus *Hexelasma*. The form and structure of the opercular valves makes it highly probable that the small specimen (Pl. XVII, fig. 6) collected at Station 260 also belongs to this species. This would be a new instance of the case already stated, that forms with deep-sea characters occur at depths of about 100 metres or even slightly less. The determination of the small specimen from Station 95 is not quite certain: it is a very incomplete specimen, without opercular valves. Its surface is corroded; the shell has no pores but distinct longitudinal ribs along the interior surface of the compartments, and as the shape of the radii and alae is the same, and the basis corresponds also, I think it is not too risky to place it here.

8. *Balanus maculatus* n. sp. Pl. XVII, fig. 7—13.

Shell conical, dirty white with longitudinal stripes of pale red and more or less numerous red spots. Carino-lateral very narrow. Radii extremely narrow, with the summits very oblique, alae somewhat broader, with the summits rounded. Scutum plainly striated longitudinally; tergum without longitudinal furrow, with the spur broad, its hinder margin rounded, sloping into the basal margin.

This species also resembles *B. amaryllis* in several respects. There is quite a number of specimens in the collection; most of them are attached to wood, a lot of smaller specimens were found attached to a piece of stone.

The general shape of the shell (Pl. XVII, fig. 7) is conical, with the rostrum slightly convex, and the carina straight. The orifice is toothed, but only superficially; it is medium-sized, pentagonal. Its largest diameter is not quite half the largest diameter of the basis. No chitinous membrane over the shell. It is smooth, dirty white, with more or less numerous longitudinal stripes of a greyish-red colour, and more or less distinct spots: either the surface is strongly or weakly spotted, or almost entirely white. The red colour is in several specimens more distinct along the margins of the compartments, and over the surface of the alae. Here and there the longitudinal stripes are crossed by horizontal ones, formed by red dots, which at

other places are mere spots of the longitudinal stripes, or, sometimes, together form regular horizontal stripes. In very young specimens the spots and stripes are often very distinct. The compartments are longitudinally ribbed along the inner side, and have no pores. Basis with delicate canals radiating from the centre. Radii very narrow, with the summits oblique, and no pores. Alae broader with the upper margins rounded.

The scutum (Pl. XVII, fig. 8, *a* and *c*) has narrow and numerous growth-ridges and longitudinal striae crossing the growth-ridges, delicate but distinct, in the larger specimens especially. The striae are more distinct than in *B. albus* and *tenuis*, but not quite so prominent as in *B. amaryllis* and *B. bimae*. The articular ridge is well-developed, extending slightly over half the length of the tergal margin; adductor ridge rather prominent, but only in the superior half of the valve; pit for the depressor muscle rather large and distinct.

The tergum (Pl. XVII, fig. 8, *b* and *d*) has the scutal margin distinctly hollowed out, and the apex beaked. The spur is short and broad; its extremity is cut off obliquely, its posterior margin going over almost insensibly into the basal margin of the tergum. The distance of the spur from the basi-scutal angle is shorter than the width of the spur. There is no longitudinal furrow. The crests for the depressor muscles are moderately developed; numerous longitudinal and parallel ridges occupy the interior surface between the occludent margin and the spur.

The larger specimens measure at the basis 10.5 to 12 mm.; their height is about 7 mm. Most specimens are, however, much smaller.

With regard to the structure of the animals body, the following may be of interest:

Mouth. Labrum (Pl. XVII, fig. 9) with the notch not very deep, wide at entrance and 3 well-sized teeth on each side, standing close together. In one instance, two teeth were seen on one side and three on the other. Lateral parts with the upper margin rounded; the interior terminal part of the sub-triangular portion relatively narrow.

Palpi nearly quadrangular, or elongately-quadrangular, with the upper margin straight, only slightly hollowed out in the middle, the inferior margin distinctly convex, gradually going over in the distal margin, which makes an angle with the upper margin. A dense row of short hairs disposed in several rows along the upper margin. The outer surface, near the angle where upper and distal margins meet, is furnished whith a dense group of longer hairs, which together form a tuft, extending far beyond the shorter hairs arranged along the upper margin. This group of longer hairs occupies an almost triangular corner of the outer surface, and terminates with a row of similar hairs, which make an angle with the basal margin of the palpus; the inferior part of the outer surface without hairs. The distal margin is furnished with only a few microscopical hairs. The inner surface is furnished with shorter and curled hairs; a longitudinal row of such hairs is inserted parallel to a fold or rim which, if the palpus is not elevated, extends along the free margin of the labrum.

Mandible (Pl. XVII, fig. 10) with the first and second teeth sharply pointed, the third slightly shorter and blunt. Teeth 2 and 3 indistinctly double at the extremity. The distance between the extremities of teeth 2 and 3 nearly equals that between teeth 1 and 2. Fourth tooth small, fifth rudimentary, the part of the mandible behind the 3rd tooth small.

Maxilla (Pl. XVII, fig. 11 and 11*) short, edge relatively long, shape triangular.

Upper pair of longer spines about as long as lower pair. Behind the upper pair, there is a distinct notch, which in one specimen is smaller than in the other. The inferior pair cannot be said to be placed on a special projection — yet it is situated somewhat above the level of the other spines, and a small notch, in some specimens, also separates these two spines from the middle ones. Between the upper and inferior pairs 5 to 6, spines are disposed along the edge. These are much shorter and thinner than those of the upper and inferior pairs.

Outer maxillae (Pl. XVII, fig. 12) with the outer lobe rather broad, certainly not much longer than it is broad, the extremity towards the interior side bluntly pointed. Hairs cover densely a large part of the inner surface towards the extremity and along the distal margin. A longitudinal group of hairs can be seen to extend over the middle of the said surface to the inner lobe. The latter bears several rows of hairs, of which those disposed along the inner margin are, as usual, directed towards the basis of the maxilla.

Cirri. First pair has unequal rami of 9 and 15—17 segments. The 7—8 lower segments of the longer ramus form a broader basal part, the 8 to 9 remaining segments are of a more elongate shape. The 3rd to 7th middle segments of the shorter ramus have the inner face distinctly protuberant, and dense tufts of hairs are disposed on these protuberances.

Second pair has 9 to 10, and 10 to 12 segments in the two rami, the lowest segment of each ramus being indistinctly composed of three segments. The segments are very protuberant on their inner faces, and the hairs disposed on these protuberances are long and form very dense tufts.

Third pair has the rami slightly more unequal of 11 (12) and 13—15 segments. The segments have the inner or anterior face rounded, but not distinctly protuberant; the tufts of hairs disposed on the anterior face less dense than on the 2nd cirrus. No teeth are observable on the surface of the rounded anterior face.

Fourth pair: number of segments 26 to 27. Three pairs of spines along inner face of middle segments.

Sixth pair: number of segments 27 to 29 — in several specimens, however, the cirri of the last pairs are broken off. The middle segments (Pl. XVII, fig. 13) are slightly longer than broad, with the inner face somewhat rounded and bearing four pairs of spines, the third of which is considerably shorter than the 1st (the most distal one) and the 2nd, the fourth (the basal one) being quite rudimentary. The hairs disposed on the dorsal face, close to the upper margin of each segment, form a group of two or three, one of which is longer and somewhat thicker than the others.

Penis has several hairs scattered over distal part, and a rather dense tuft at the extremity; near its basis the dorsal side bears a short blunt tooth.

This species was taken by the Siboga at two Stations, which are not very distant from one another:

Stat. 49a. April 14, 1899. Lat. 8° 23'.5 S., Long. 119° 4'.6 E. Depth 69 m. Sapeh-strait. Bottom: coral and shells. Numerous specimens, attached to pieces of wood that are much perforated by *Teredo*.

Stat. 310. February 12, 1900. Lat. 8° 30′ S., Long. 119° 7′.5 E. Depth 73 m. Bottom: sand with few pieces of dead coral. Half a dozen small specimens, some of them attached to the shell of a Lamellibranch (*Avicula*), others to a Bryozoan (like *Halodactylus*), others to a species of sponge.

General Remarks. This seems to be a rather common species at the places where it occurs. It doubtless belongs to the group of species of which *B. amaryllis* is the best known.

9. *Balanus tenuis* Hoek. Pl. XVII, fig. 14—19. Pl. XVIII, fig. 1.

Hoek, P. P. C., Report on the Cirripedia of the Challenger Expedition, 1883, p. 154, pl. XIII, fig. 29—33.

This species also belongs to the group of species with narrow radii, striated scuta, terga with the scutal margin hollowed out and relatively broad spur. When describing the species as a new one (1883), I pointed out that it corresponds in several details to *B. amaryllis*. Several other new species of the same group were collected during the cruise of the Siboga.

A pale-red-coloured specimen of considerable size was brought up with the dredge from a coral bottom and a depth of 275 m. It is an incomplete specimen, without opercular valves, and it broke into pieces before I had sufficiently investigated it. A small specimen of the same colour and with valves of corresponding shape, was found attached to one of the compartments of the larger specimen (Pl. XVII, fig. 14). The latter belongs no doubt to the same species.

The shell is conical, its orifice medium-sized, and distinctly toothed. The radii are extremely narrow, with their summits very oblique, in the smaller specimen visible only along inferior half of valves. The alae are considerably broader, wih their sumttmis rounded. The compartments are furnished on the inner surface with vertical ridges, which increase in size and strength towards the basis. Neither compartments nor radii have pores. Of the larger specimen the basis is wanting; the smaller one has a delicate calcareous basis, with ridges radiating from the centre. I could not see any canals in the basis. The diameter of the smaller specimen is 7.5 mm. near the basis, its height 4.5 mm.; the highest compartment of the larger specimen measures 32 mm.

The scutum (Pl. XVII, fig. 15*a* and *d*) is delicately but distinctly striated longitudinally. The inner surface is roughened on the upper part, the adductor ridge is feebly developed, the articular ridge is rather prominent, and extends over half the length of the tergal margin; the tergum (Pl. XVII, fig. 15, *b* and *d*) has the scutal margin only slightly hollowed out, the spur is rather broad, and extends to a distance from the basi-scutal angle, which is not greater than its own width. The valve is slightly beaked. Studying it with a strong lens, a trace of longitudinal striation is seen at the surface.

The description I gave of the animal's body in the Report on the Challenger-Cirripedia can be completed with the following remarks:

Mouth. Labrum (Pl. XVII, fig. 16) with the central notch shallow, wide at entrance, the three teeth on each side close together, the height of the sub-triangular shield-like portion about three-fourths of its breadth.

Palpi slightly elongate, with the upper margin nearly straight, and the basal margin

distinctly curved. Hairs on outer surface long, and distributed over a large portion, situated at some distance from one another, and consequently not very numerous. The tuft formed at the distal and upper angle not very dense. Numerous hairs are disposed along upper margin at small distances from one another, short curved ones are scattered near upper margin over the inner surface.

Mandible (Pl. XVII, fig. 17) has the third tooth stronger than the first and second. Distance between extremities of first and second teeth greater than that between extremities of 2nd and 3rd teeth. Fourth tooth small, fifth confluent with inferior angle, or, though small, separated from it.

Maxilla (Pl. XVII, fig. 18 and 18*) with the two inferior spines not on a step-like projection; notch behind upper spines very small and a spine-like hair inserted at its bottom. Between the two pairs 6 to 7 spines are disposed in a single row along the nearly straight edge.

Outer maxillae (Pl. XVIII, fig. 1) have the outer lobe broad, short, with the interior margin straight, exterior margin arched, the two meeting in an obtuse angle, which makes it look somewhat pointed at the extremity. The inner lobe is short and not distinctly separated from the outer lobe. Hairs are disposed on distal part of surface and along inner margin only of outer lobe, with a longitudinal series extending from the outer to the inner lobe. Hairs on inner lobe not very numerous, most of them directed inwards and downwards, and more distinctly feathered than the other hairs of this maxilla.

Cirri. First pair has unequal branches of 6 (7) and 12 segments respectively. The segments of the shorter ramus are only slightly protuberant, the last one bears a few spines which are stronger than those of the other segments. The last segment of the longer ramus has a few (3 to 4) very long hairs, which look somewhat like spines, disposed on its extremity.

Second pair has 9 (10) segments in each ramus; the somewhat shorter ramus has the outer segments protuberant and that part of the ramus recurved in a curious way.

Third pair has nearly equal rami of 10 to 11 segments; a few very strong and long spine-like hairs disposed at the extremity of the terminal segments. No trace of teeth along anterior face of segments.

Fourth-sixth pairs of cirri of about the same structure, the number of segments only slightly increasing from the 4th to the last.

Sixth pair has 21 segments in each ramus; the distal segments are longer than the basal, but all of them longer than broad. Most segments (Pl. XVII, fig. 19) bear three pairs of spines on their inner faces, two pairs of long ones, and a third (the lower) pair of rudimentary spines. A few spines (forming together a little tuft) are disposed between the two of each pair of longer spines. Hairs on the dorsal surface of each segment, close to its upper margin, not quite three-fourths of the length of the segment itself.

Penis broken off and lost in the specimen I investigated.

This species was observed at:

Stat. 105. July 4, 1899. Lat. 6° 8′ N., Long. 121° 19′ E. Depth 275 m. Coral-bottom. A large incomplete specimen and a small one attached to it.

Geographical and bathymetrical distribution. This species, which was founded

for specimens collected by the Challenger in the Philippine Archipelago at depths varying from 180 to 210 m., has now been found again at a little distance from the former locality, namely, 1 degree more to the West and 6 degrees more to the South. Its range of depth therefore lies between 180 and 275 m., and it must be considered as an inhabitant of deep water. Single or few specimens only were taken on each occasion — it is difficult, however, to judge whether it is common or rare from the results of dredgings.

4. Sectio: **Solido-Balanus**

10. *Balanus socialis* Hoek. Pl. XVIII, fig. 2—12.

> HOEK, P. P. C., Report on the Cirripedia of the Challenger Expedition. 1883, p. 150, pl. XIII, fig. 23—28.

At several stations, during the cruise of H. M. S. "Siboga", specimens of a form of *Balanus* were collected, doubtless belonging to the same species, and which certainly show the greatest resemblance to the species I described as *B. socialis* in the Challenger report. The Challenger-specimens were collected in the Arafura Sea at a depth of about 50 m.; they now appear to belong to a form rather common in the Malay Archipelago at depths varying from 9 to more than 69 m. (Pl. XVIII, fig. 2, 10 and 11).

I have not much to add to the description of the shell which I gave in my report of 1883. There is, however, one important difference that I will at once point out. I said with regard to the Challenger specimens, that the walls, as well as the basis, were permeated by pores; the numerous specimens I have now investigated, however, have the walls without pores, and the basis either indistinctly or not permeated. In smaller species of *Balanus* it is often difficult to arrive at a conclusion regarding this detail of the structure. I made figures of two sections of a specimen from Station 164 and I am certain that its walls were not permeated. The fig. 4*a* (Pl. XVIII) shows a section near the orifice, and here the rostrum especially presents, near the outer surface, a row of darker spots which could easily be confounded with pores "filled up with corium". The fig. 4*b* (Pl. XVIII) represents a section of the shell of the same specimen near the basis: there is no trace of pores, but the part representing the rostrum shows clearly that the wall is strengthened interiorly by vertical ribs. I examined specimens from different stations, but I never observed true open pores in the walls. With regard to the basis, I saw in a specimen from Station 164 a basis with pores or canals radiating from the centre; in another specimen, however, I found lists over the basis radiating from the centre and extending to the periphery, and shorter ones alternating with the longer ones, and extending from the periphery without reaching the centre. These lists look much like canals, and have a darker margin and a clearer longitudinal middle part: they are grooves, however, and not canals.

In most specimens the orifice is rather large, its shape elongately-pentagonal; the shell is white, but sometimes, however, dirty-white from mud-particles attached to a thin membrane. The radii are narrow, with rounded margins, the alae triangular, with the upper margin parallel

to the basis, and slightly convex. In some specimens the compartments show longitudinal and somewhat hyaline stripes; others have indistinct horizontal growth-ridges.

The scutum (Pl. XVIII, fig. 3 *a* and *c*) has the growth-ridges not very prominent; its articular ridge is well-developed, extending downwards more than half the length of the tergal margin. The adductor ridge is always visible, but never prominent. There is no trace of longitudinal striae on the outer surface.

The tergum (Pl. XVIII, fig. 3, *b* and *d*) has the spur short, with the extremity rounded or bluntly truncated, standing at less than the length of its free part from the basi-scutal angle; the two parts of the basal margin make together a very obtuse angle; the part between the spur and the carino-basal angle is rather long; the crests for the depressor muscles are numerous and well-developed.

All the specimens are small: the greatest diameter of the basis of one of the larger specimens measures about 4.5 m.

Concerning the structure of the animal's body, I can now give several details which complete the description given in the Challenger report:

Mouth. The labrum has a rather shallow notch, the entrance of which is widened, and three rather strong and pointed teeth on each side of the notch. Sometimes on one, or on both sides, one or even two of the teeth are rudimentary, or wanting — but as a rule three teeth are present on each side.

The palpi are short, broad, and of oval shape. A large part of the outer surface is covered by longer hairs, which develop into a tuft of still longer hairs towards the distal extremity. Along the upper margin numerous smaller hairs are disposed; short hairs, arranged in a distinct row on the inner surface, fall over the edge of the labrum, so long as the palpus is bent downwards.

The mandible (Pl. XVIII, fig. 6) has four nearly equal-sized teeth, the 2nd and 3rd teeth double as usual, and the 4th tooth with a characteristic nob. The 5th is sometimes short and blunt, and separated from the inferior angle, in other specimens it is quite confluent with that angle.

The maxilla (Pl. XVIII, fig. 7 and 7*) has 3 spines situated between an upper pair of the ordinary shape and size, and a lower pair the spines of which are somewhat longer than those of the upper pair. The latter two spines and the 3 intermediate ones have, moreover, a very characteristic shape, being broad, swollen at the basis, and sharply pointed at the extremity. Between the 2nd spine of the upper pair and the first of the three intermediate ones, a very small interspace represents the notch which in other species is much more distinct.

The outer maxillae (Pl. XVIII, fig. 2) have the outer lobe broadly-oval, with the angle at the free extremity rounded. The interior margin is nearly straight. A row of hairs runs parallel to the interior margin from the outer to the inner lobe. The latter bears the usual feathered hairs and is, moreover, characterised by being prolonged in the direction of the basis of the maxilla.

Cirri. First pair has unequal rami: as a rule the shorter ramus has 6, the longer from 9 to 11, ordinarily 10 segments. Of the longer, the five basal ones are only indistinctly separated.

Second pair is short and has slightly unequal rami of 6 and 7 segments; the inner surfaces of the different segments are rounded; they cannot be said to be protuberant.

Third pair has the rami unequal by one segment: 7 to 8, or 8 to 9. The inner margins, near the upper extremity of the segments, show here and there extremely small teeth in some specimens. In other specimens no teeth could be made out.

Fourth-sixth pairs of nearly the same structure; the greatest number of segments counted was 21 to 22. This number slightly increases from the 4th to the 6th, and seems also to increase with age. The smallest number seen in the 4th cirrus of one of the specimens was 16. The greatest number of pairs of spines on the anterior face of the segments (Pl. XVIII, fig. 9) is 4 pairs; the last pair, being that near the inferior extremity of the segments, is always extremely small.

Penis long, growing very narrow towards the extremity; with numerous curled hairs, especially on distal part.

This species was dredged at several stations, and seems to be rather common throughout the whole Archipelago.

Stat. 50. April 16/18, 1899. Bay of Badjo, West coast of Flores. Depth 27—36 m. Bottom: mud, sand, and shells, according to locality. Half-a-dozen specimens attached to a leaf (most probably of a tree). Surface of shell more or less distinctly striped longitudinally.

Stat. 51. April 19, 1899. Southern part of Molo-strait, Madura-bay. Depth from 69 to 91 m. Bottom: fine grey sand, coarse sand with shells and stones. Two specimens attached to a calcareous plate, probably a part of a thin valve of a Mollusc. Specimens beautifully striped longitudinally.

Stat. 162. August 18, 1899. Between Loslos and Broken-islands, West coast of Salawatti. Depth 18 m. Bottom: coarse and fine sand with clay and shells. Several specimens. Some of them attached to the surface of the shell of a *Pecten*. Round about a sponge (?) adheres also to that surface, the colony of *Balanus* extending more or less over the surface of the sponge.

Stat. 164. August 20, 1899. Lat. 1°42'.5 S., Long. 130°47'.5 E. Depth 32 m. Bottom: sand, small stones and shells. Numerous specimens attached to stones, shells of Gastropodous molluscs and other objects, calcareous plates, etc.

Stat. 213. September 26—October 26, 1899. Saleyer-anchorage and Surroundings. Depth 9 to 34 m. Bottom: coral-reefs, mud, and mud with sand. A single specimen attached to a piece of stone.

General Remarks. This species occurs at different depths, and is found attached to very different objects. It cannot be wondered at that it varies, like other species of the genus *Balanus*, not inconsiderably in accordance with the different surroundings midst which it lives. The figure 10 of Pl. XVIII shows a specimen (from Station 164) with a somewhat elongate and narrow carina, and with the other compartments more or less swollen in their basal parts. Fig. 2 of Pl. XVIII shows two specimens (from Station 51) of a more regular conical shape, the compartments of which are beautifully striped longitudinally. Fig. 11 represents a specimen which is very characteristic by the breadth and development of the alae. These parts are, moreover, conspicuous in this specimen because they give one the impression of lying on another plain, the whole surface of the shell being, in consequence, much less flat and regular than is the

case in the other specimens of this species. The specimens belonging to this latter form were found at Station 164. They are characterised also by the shape of the tergum, the scutal margin of which is not straight, but somewhat convex, which makes this valve much broader than in the ordinary form of the species (Pl. XVIII, fig. 2*a* and *b*). I intended at first to describe this form as a variety of this species; since I found afterwards, however, that some specimens from the same locality show these differences in a smaller degree, and others not at all, I prefer to point out the variability without proposing a special name for the form that seems to show this particularity in the highest degree.

There remains no doubt in my mind that this form really corresponds with the species I described in the Report on the Cirripedia of the Challenger as *B. socialis*. As regards the important difference between the definition given in the report of 1883, and the description given here, namely that I ranged the species there under those that have the parietes permeated, I now find that such pores are absent. I have already explained on p. 192, how this error may have arisen.

Further, at another Station, a few very small specimens of a *Balanus* were collected which I suppose to belong also to this species. Their opercular valves are wanting; the diameter near the basis of the largest specimen of the sample measures at the most 3 mm.; the shells are white, have large orifices; their alae and radii show the same shape as in *B. socialis*. They were found attached to small Gastropodous-shells (*Scalaria*?), which were collected at:

Stat. 205. Lohio-bay, Buton-strait. Depth 22 m. Bottom: sandy mud.

11. *Balanus maldivensis* Borradaile. Pl. XVIII, fig. 13—19.

BORRADAILE, L. A., Marine Crustaceans. Parts IV—VII in "The Fauna and Geography of the Maldive and Laccadive Archipelagoes". Vol. I. Part 4. 1903. p. 442, fig. 118.

This species, which according to BORRADAILE, occurs in S. Nilandu Atoll (Maldive or Laccadive Archipelagoes) seems to be a rather common species in the Malay Archipelago. BORRADAILE's description in the main is exact — a somewhat more extensive one, however, will not be judged superfluous.

It is a species (Pl. XVIII, fig. 13) with thick solid walls of a conical or steeply-conical shape; it is often somewhat compressed laterally; the surface of the parietes looks gnarled and often ringed, but not regularly ribbed. The radii are elongately-triangular, having the summits broad and nearly horizontal, and terminating downwards in a point. The summits of the radii are, moreover, straight or slightly concave, the alae, in the latter case, extending slightly beyond the radii. The outer surface of the radii is indistinctly striped horizontally, and lies somewhat deeper than that of the compartments, which gives a very typical appearance to the shell. Orifice oval when seen from above, with the carinal extremity pointed, and the rostral rounded or rhomboidal. Parietes and radii without pores, the inner side of the parietes strengthened by longitudinal ribs. Basis also without regular canals; at the circumference, however, shallow pores are seen beginning in the intervals between the bases of the ribs placed against the parietes. It is a small species: the diameter of the larger specimens measures from 6—7 mm. near the basis, their height from 4—5½ mm.

The scutum (Pl. XVIII, fig. *a* and *c*) has the occludent margin arched, and the tergal and basal margins of about the same length; there is no adductor ridge, and the articular ridge is feebly developed, not at all prominent. On the outer surface the growth-ridges are not very distinct, and no trace of striae can be observed. The whole surface is slightly arched, the apex curved inwards.

The tergum (Pl. XVIII, fig. *b* and *d*) has the scutal margin slightly convex, and the basal margin concave. The outer surface does not show the growth-ridges even so well as the scutum. The spur extends slightly beyond the basal margin, and is rather broad; its anterior margin is separated from the basi-scutal angle by a very short anterior part of the basal margin; in other specimens, however, it is confluent with the scutal margin. Crests for the depressor muscles well-developed. The chitinous membrane covering the tergum bears a distinct group of short hairs along the carinal margin, near the apex. The latter is blunt, not produced.

With regard to the structure of the animal's body, the following was observed:

Mouth. Labrum (Pl. XVIII, fig. 15). The normal number of teeth on each side of the wide notch seems to be 3. Often, on one, or on both sides, only two of these are developed, in which case one of the teeth may be double-pointed. The subtriangular portion representing the thickened part of the labrum terminates on the inside in a somewhat narrower part, looking like a handle.

Palpi with numerous hairs scattered irregularly over large part of outer surface. There is no distinct tuft of longer hairs disposed at the distal extremity of the palpus. Shape of the palpus oval, with the inferior margin distinctly rounded.

Mandible (Pl. XVIII, fig. 16) with teeth 2 and 3 double, and 3 thicker. Distance between extremities of teeth 1 and 2 slighty longer than that between the extremities of teeth 2 and 3. The part behind the 3rd tooth rudimentary: teeth 4 and 5 small, the inferior angle represented only by a minute point.

Maxilla (Pl. XVIII, fig. 17) with the edge nearly straight, a small and shallow notch behind the upper pair, and 3 to 5 somewhat shorter spines situated between this notch and the inferior pair. The notch is narrower in some specimens than in others; as a rule one or two hairs are seen at the bottom of the notch.

Outer maxillae (Pl. XVIII, fig. 18). Outer lobe relatively broad and short, obtusely pointed, and with the inner margin more or less straight. A moderate portion of the inner surface of the outer lobe is covered with hairs, from which a single or double row can be followed to the inner lobe. The latter is somewhat elongated towards the basis, the hairs disposed along its inner surface point towards the basis of the maxilla; they are more distinctly feathered than those of the remaining parts of the maxilla.

Cirri. First pair has the rami unequal, of 6 to 7, and 11 to 12 segments. Anterior faces of the segments of shorter ramus rounded, not protuberant.

Second pair has 7 to 8, and 8 to 9 segments in the two branches. The anterior faces of the segments protuberant, furnished with dense brushes of hairs.

Third pair has 9 to 10, and 10 to 11 segments. Brushes of hairs less dense than on the protuberances of the segments of the second cirrus. No trace of teeth on or along the

anterior margins of the protuberant parts. At the base of the third cirrus, the thorax bears a tuft of long and numerous hairs, the free extremity of which is directed backwards

Fourth to sixth cirri have from 15 to 18 segments in each branch. The anterior face of most segments bears four pairs of hairs (Pl. XVIII, fig. 19); in some specimens, a few segments, the 7^{th}—9^{th} from the end, even bear a 5^{th} pair of extremely minute hairs. Group of hairs disposed at the outer margin, and near the extremity of each segment; it has a single longer hair, which, however, is considerably less than the length of the segment.

Penis broad at the basis, growing narrow, and even very narrow towards the extremity. No projecting point on the dorsal side of the penis observed. Penis very long, much longer than the cirri.

Most specimens of this species, collected at different Stations, were found attached to the spines of, probably, different species of Echinida. Often numerous, most of them small, specimens are seen crowded together along the surface of the same spine. The species was collected during the cruise of the Siboga at the following Stations:

Stat. 49a. April 14, 1899. Lat. 8° 23′.5 S., Long. 119° 4′.6 E. Sapeh-strait. Depth 69 m. Coral and shells. Numerous specimens.

Stat. 51. April 19, 1899. Madura-bay and other localities in the southern part of Molo-strait. Depth 69—91 m. Bottom: fine grey sand, or coarse sand with shells and stones. Numerous specimens attached to the spines of an Echinid. (Another sample from the same locality: Strait Molo, is from a depth of 54—90 m.).

Stat. 59. April 26, 1899. Lat. 10° 22′.7 S., Long. 123° 16′.5 E. Western entrance Samau-strait. Depth 390 m. Bottom: coarse coral-sand with small stones. A few dry specimens.

Stat. 302. February 2, 1900. Lat. 10° 27′.9 S., Long. 123° 28′.7 E. Depth 216 m. Bottom: sand and coral-sand. 3 specimens without opercular valves.

Stat. 310. February 12, 1900. Lat. 8° 30′ S, Long. 119° 7′.5 E. Depth 73 m. Bottom: sand with few pieces of dead coral. Group of small specimens attached to the spine of an *Echinus*.

General Remarks. This species, according to Annandale's "On the Cirripedia" Supplem. Report XXXI of Herdman's Report on the Pearl Oyster Fisheries of the Gulf of Manaar, published 1906, Part V, p. 148, is found also in the Gulf of Manaar (Ceylon). It was found attached to a piece of dead coral. Neither Borradaile nor Annandale inform us at what depths their specimens were collected; I think we may conclude from this fact, that they did not come from considerable depths. The Siboga dredged it at depths varying from 54—90 m., and also in deep water, at depths of 216 and 390 m. I must point out, however, that these specimens from greater depths (from Stations 59 and 302) are small and incomplete (without opercular valves) and that their determination, in consequence, may always be considered as somewhat uncertain. Species showing such considerable variation with regard to the depth they inhabit, are not common in this genus; where it is the case we should ascertain if such forms from different depths, which look as if they belong to the same species, do not show more or less important differences in details of structure. In the present instance this was impossible by the incompleteness of the specimens from deep water.

Borradaile proposed for this species a new section of the genus *Balanus*. I explained on p. 157 of this report why I could not agree with this proposal and what in my opinion would be a better subdivision of the genus.

12. *Balanus auricoma* n. sp. Pl. XVIII, fig. 20—22, Pl. XIX, fig. 1—7.

Shell flatly-conical, colour reddish, with darker red longitudinal lines. Radii narrow, with slightly oblique summits. Opercular valves furnished with golden hairs along occludent margins. Scutum without adductor ridge, and with the articular ridge only slightly prominent, tergum narrow, with distinctly dentated scutal margin.

The shell is flatly-conical, the orifice rather small, of elongately-pentagonal shape and only very superficially toothed. The surface of the valves is feebly ribbed longitudinally, the outer margin at the basis, in consequence, not smooth, but superficially lobed. The specimens (Pl. XVIII, fig. 20) were found attached to the surface of calcareous stones in close proximity of each other. The colour is reddish, darker red lines running along the ribs from the orifice to the basis, red spots being, moreover, scattered over the surface. The radii are narrow, elongate, triangular, their summits slightly oblique. They are distinctly striated longitudinally. Parietes and radii without pores (Pl. XVIII, fig. 21), and no pores seen in basis.

The scutum (Pl. XVIII, fig. 22, *a* and *c*, Pl. XIX, fig. 1 *a*) has the occludent margin straight, and its tergal margin can hardly be said to be hollowed ont. The outer surface is only indistinctly ridged. The shell as a whole is not flat, but somewhat bowed: seen externally, the apical part is slightly lifted up. On the inner surface the articular ridge is not very prominent, but extends along a large part of the tergal margin; the adductor ridge is not to be seen, and the pit for the depressor muscle is triangular, rather broad and shallow.

The tergum (Pl. XVIII, fig. 22, *b* and *d*, Pl. XIX, fig. 1 *b*) is narrow, has the scutal margin straight and unusually distinctly dentated, and the carinal margin short and strongly convex. The basal margin slopes gradually into the posterior margin of the spur; although situated close to the basi-scutal angle, the spur forms a distinct angle with the anterior part of the basal margin. Externally there is a shallow furrow between the spur and the scutal margin; on the inner surface the articular furrow extends over a large part of the shell along the scutal margin. The crests for the depressores are strongly developed; a large part of the interior surface of the valve is coloured beautifully rose-red.

The epidermis covering scutum and tergum is very persistent and of a golden-yellowish colour; it is covered, especially along the occludent margins of both valves, with numerous long and rather stiff chitinous hairs of yellowish-golden colour.

The study of the animal's body yielded the following results:

Mouth. Labrum (Pl. XIX, fig. 2) with shallow notch, the margin of which is thickened, especially at the bottom. Three strong teeth on each side. Outer margin of lateral parts nearly straight, and furnished with very delicate hairs or ciliae.

Palpi: elongately-oval with the superior margin straight, and the inferior strongly curved. Long hairs on outer surface distributed over large part of surface, near the free extremity and along the inferior margin. Hairs on superior margin numerous, slightly increasing in length towards the free extremity. Hairs on inner surface disposed in a row which is parallel to the superior margin, and at a short distance from it, curling over free edge of labrum, when the palpus is not uplifted.

Mandible (Pl. XIX, fig. 3): distance between extremities of teeth 1 and 2 greater than that between 2 and 3. Tooth 3 thick, 4 distinct and double, 5 together with inferior angle represented by three short spine-like teeth, the last of which is somewhat longer. Hairs along inferior margin few, rather long. (The first of the three short spine-like teeth in some specimens is somewhat stronger, and represents in that case, tooth 5).

Maxilla (Pl. XIX, fig. 4 and 4*): with a broad notch behind the upper pair of spines. The remaining part of the edge forms an indistinct step-like projection and is furnished with 4 to 5 somewhat shorter and narrower, and 2 longer spines of about the same length as those of the upper pair.

Outer maxillae (Pl. XIX, fig. 5): the outer lobe short and broad, covered near the extremity with a tuft of — in comparison with other species — not very numerous hairs. A few hairs are disposed along a longitudinal line extending over the outer lobe towards the margin of the inner lobe. The latter has a somewhat quadrate form; towards the inner side it is furnished with not very numerous, but long and feathered hairs, which, most of them, point towards the basis of the maxilla.

Cirri. First pair has unequal rami of 6 and 10 segments. The segments of the shorter ramus have rounded protuberances covered with hairs; the segments 3—6 of the longer ramus show only indistinct protuberances.

Second pair has the rami slightly unequal only of 6 to 7, and 7 to 8 segments; segments with somewhat rounded inner faces, hardly protuberant, on which rather dense tufts of hairs are disposed.

Third pair has 8 and 9 segments in the two rami, tufts of hairs disposed on the rounded inner face near the extremity; hairs less dense on the lower segments of the longer ramus. No teeth to be seen along the inner faces of the segments.

Fourth pair has 13 and 15 segments in the two rami; the greatest number of spines on the inner face of the segments is 4 pairs.

Sixth pair (Pl. XIX, fig. 6) with 17 and 18 segments in the two rami; the greatest number of spines on the inner face of the segments is 5 pairs.

Penis long, tapering towards the extremity. Numerous hairs scattered over surface; a tuft of rather long and numerous hairs is situated at and near the extremity.

This species was dredged by the Siboga at:

Stat. 136. Between July 29 and August 3. Ternate-anchorage. Depth 27 m. Bottom: mud and stone. Numerous specimens on the surface of pieces of rock.

To the same species probably belong two very small specimens (Pl. XIX, fig. 7) which were dredged at:

Stat. 260. December 16 and 18, 1899. Lat. 5° 36'.5 S., Long. 132° 55'.2 E. N.W. from the North-point of Nuhu Jaan, Kei-islands. Depth 90 m. Bottom: sand, coral, and shells.

13. *Balanus ciliatus* n. sp. Pl. XIX, fig. 8—16.

Parietes, radii and basis without pores. Basis calcareous. Radii broad, summits oblique

in varying degree, coloured orange. Shell light-reddish, partly white, with vertical red stripes. Surface of compartments furrowed. Scutum with the apex sharply pointed, articular ridge not prominent, adductor ridge hardly visible. Tergum with a prominent articular ridge and a broad spur with rounded extremity. Labrum with three teeth on each side of notch; palpi with ciliae in groups along inferior margin.

The specimens are covered by a sponge-like coat. The shape of the shell is conical, in younger specimens more globular. All have the orifice rather large (Pl. XIX, fig. 8), the radii broad, with their summits oblique, slightly oblique, or even, in one of the specimens, quite parallel to the basis; the summits of the alae are rounded. The colour of the shell is dirty-white, striped longitudinally and spotted here and there with red; the rostrum is in most specimens almost perfectly white. The radii are more or less distinctly orange-coloured. The compartments and the radii have no pores. In the lower part of the shell longitudinal ridges are found on the interior surface; these touch each other at several places and also close to the basis, which causes a transverse section to sometimes look as if pores were present. The basis has no pores; the longitudinal ribs of the inner surface of the shell can be followed on the basis, where they radiate from the centre.

The scutum (Fig. 9, *a* and *c*) is of a regular triangular shape, with the tergal margin as long as the basal margin, or even slightly longer; it is pointed towards the apex. Occludent margin indistinctly toothed, basal margin not strongly convex. Lines of growth rather numerous, not very prominent. Surface indistinctly striated longitudinally. On the inner surface, the articular ridge not prominent, sloping towards basi-tergal angle; adductor ridge hardly to be distinguished, represented by a slight uplifting only of the internal surface. A small and shallow pit for the lateral depressor muscle and an indication only of the cavity for the adductor muscle.

The tergum (Fig. 9, *b* and *d*) has the apex not produced; the carinal margin is rounded, the scutal margin straight. The longitudinal furrow is represented by a slight depression, the spur is situated at a little distance from the basi-scutal angle; it is not very long and its width, measured at the height of the basal margin, is about two-fifths of the length of that margin. Its lower end is rounded; the basal margin makes an angle with the posterior margin of the spur. The articular ridge is prominent and the crests for the depressores are well-developed. On the inner surface a triangular part of the surface situated at the apex of the valve, is distinctly striated transversely.

With regard to the structure of the animal's body the following may be said:

Mouth. Labrum (Pl. XIX, fig. 10). Notch wide at entrance, three teeth on each side. In the specimen from Stat. 299 one tooth is situated half way along the margin of the notch, and one tooth is wanting at one side. Delicate hairs disposed along notch and between teeth 1 and 2.

Palpus: broad, stout, somewhat quadrangular, with the superior margin nearly straight and the inferior one arched. Hairs along superior margin numerous, but situated at some distance from each other. They combine near free extremity with the very numerous and longer hairs disposed on distal part of outer surface. A relatively large part of outer surface is covered with hairs. The inner surface bears a longitudinal group of shorter and curled hairs situated close together, the same sort of hairs being also seen on the part of the inner surface between that

longitudinal group and the superior margin. The inner surface near the free extremity, and the inferior margin, are furnished with microscopical hairs or ciliae. The latter stand in distinct little groups or bushes, especially in the specimen from Strait Molo.

Mandible (Pl. XIX, fig. 11): teeth 1 and 2 pointed, their extremities at somewhat greater distance from each other than those of 2 and 3. Teeth 2 and 3 distinctly double. Tooth 3 thick. Teeth 4 and 5 close together, rather thick. Inferior angle terminating in two small, pointed spines, or rudimentary teeth. In the specimen from Strait Molo, teeth 4 and 5 are less distinctly developed, tooth 5 being confused with inferior angle. The latter bears no spines or rudimentary teeth.

Maxilla (Pl. XIX, fig. 12 and 12*): Notch small. The inferior pair of longer spines situated on an indistinct step-like projection in the larger (older) specimen only. A group of smaller spines is situated on the edge behind the inferior pair of larger spines. Between the small notch and the inferior pair of spines 5 spines are arranged in a single row and alternately point with their extremities to one or the other side.

Outer maxillae (Pl. XIX, fig. 13): Outer lobe broad at the basis, the exterior circumference regularly rounded, and the apex somewhat pointed. Hairs on distal part numerous and delicate; the row of hairs extending from the outer lobe to the inner one partly double, these hairs standing off horizontally. Hairs on inner lobe not numerous, but disposed in several rows; a group of short spine-like hairs under and behind the longer feathered ones.

Cirri: First pair. Rami unequal of 7 to 9, and 14 segments. The three lower segments of the shorter ramus fused together. Middle segments distinctly protuberant, protuberances covered with dense bushes of hairs. Six inferior segments of longer ramus shorter than broad, segments 7—9 quadrate, and 10—14 longer than broad. In the specimen from Strait Molo, the lower segment of the shorter ramus consists of only two segments, the whole number being 8 to 9 in consequence. The longer ramus has three segments more: 17 in all.

Second pair. Shorter ramus has 7 segments, the basal one consisting of three segments. Longer ramus has 9 segments. All the segments furnished with dense groups of spine-like hairs situated on rounded protuberances. In the specimen from Strait Molo the number of segments is 10 and 11; here the spine-like hairs are extremely numerous, feathered, and arranged very densely.

Third pair. Number of segments 11 and 12, 11 in the shorter and 13 in the longer ramus in the specimen from Strait Molo. Bushes of hairs on the protuberances of the segments not so dense as on second cirrus. These protuberances (Pl. XIX, fig. 14) are furnished with quite a row of small recurved teeth, with the exception of only the last three segments in the shorter, and the last in the longer ramus. The teeth on the protuberances are partly recurved; about half of them are short and spine-like.

Fourth pair. Dorsal margin of basal segment of one ramus furnished with a double row of short tooth-like spines, such spines being seen also on the dorsal margin near the extremity of the 2nd segment. Inner face of 2nd—6th segments furnished along and near the margin with numerous but small recurved teeth (Pl. XIX, fig. 15) arranged in small groups along a longitudinal row of slightly stronger teeth; a few more of these are seen on 7th to 10th segments.

Hair-like spines disposed on the outer face near the extremity of the segments, and are unusually long and stout. In this specimen the tips of the rami of this cirrus were broken off, hence the number of segments is uncertain. The specimen from Strait Molo had 16 to 17, and 19 to 20 segments in the two rami. On outer face near the extremity, groups of 4 to 5 spines are disposed, two of which are very stout. On the inner face short, strong, tooth-like spines form groups at the basis of the longest pair of spines, on segments 2—14 of the one, and 2—12 of the other cirrus, but on the shorter ramus only.

Fifth pair (broken off in the specimen from Station 299) has nearly equal rami of 19 and 20 segments in the specimen from Strait Molo.

Sixth pair: Rami of 21 and 22 segments. Basal segments quadrate, middle segments twice as long as broad, distal segments longer still. Number of pairs of spines on inner face of segments as a rule 4; very exceptionally a 5th pair is seen (Pl. XIX, fig. 16). Hairs on outer face near extremity long and stout. In the specimen from Strait Molo one ramus has 24 segments, the other is broken off; all the segments, without exception, furnished with 4 pairs of spines on their inner face.

Penis not very long in the specimen from Station 299, much longer in that from Strait Molo. The basal or supporting part bears dorsally an excrescence that is not pointed however, but blunt at the extremity. The penis is somewhat tapering towards the extremity, and here is furnished with slightly stronger hairs, placed in two diverging groups.

This species was collected by H. M. S. "Siboga" at the following places:

Stat. 51. April 19, 1899. Strait Molo. Depth between 69 and 91 m. Bottom: fine grey sand or coarse sand with shells and stones. One somewhat larger specimen.

Stat. 299. Lat. 10° 52'.4 S., Long. 123° 1'.1 E. Buka- or Cyrus-bay, South-coast of Rotti-island. Depth 34 m. Bottom: mud, coral, and Lithothamnium. Half a dozen medium-sized specimens.

Stat. 305. Mid-channel in Solor-strait off Kampong Menanga. Depth 113 m. Bottom: stony. Four small specimens, with calcareous basis, covered with sponge-like coat; surface with longitudinal stripes. (Determination not quite certain, as the opercular valves are wanting).

14. *Balanus compressus* n. sp. Pl. XIX, fig. 17. Pl. XX. fig. 1—7.

Surface of shell smooth, orifice large, distinctly toothed. Radii broad with the summits very obligue, alae also broad with convex surfaces. Scutum with the articular ridge not prominent and without adductor ridge. Tergum elongate, placed very close to the basi-scutal angle. Opercular valves covered with short hairs, more distinctly so along occludent margin. Labrum with four teeth on each side of notch; outer surface of palpus covered with hairs over a large part.

The most typical example of this species is characterised by a large orifice, which is toothed (Pl. XIX, fig. 17) in consequence of the shape of the upper extremities of the compartments. The shell is somewhat globular, but flattened laterally, being attached to a rather narrow object, the tube of an Annelid; the surface is smooth, without ribs or ridges. The shell has a light reddish colour, but is beautifully striated with darker red longitudinal lines. The radii

have the summits very oblique and straight or slightly hollowed out, they are horizontally striated and broadest a little above the middle, growing narrower again towards the inferior extremity. The alae have the summits rounded (specimen from Station 204). Parietes not permeated, radii without pores. Basis calcareous.

The other specimens (from Station 289) are smaller and coloured white, or yellowish in consequence of adhering mud. They have the large and toothed orifice of the larger specimen, and the shape of radii and alae are the same. The opercular valves closely resemble those of the specimen from Station 204.

The scutum (Pl. XX, fig. 1, *a* and *c*) has the occludent margin somewhat convex towards the apex; its tergal margin is slightly hollowed out, and its basal margin is undulating. The ridges of growth on the outer surface are very feeble. On the inner surface the articular ridge is not prominent, its margin runs parallel to the tergal margin and extends almost to the basi-tergal angle. There is a shallow depression for the lateral depressor muscle, and a slight trace of an adductor ridge parallel to the articular ridge.

The tergum (Pl. XX, fig. 1, *b* and *d*) is narrow, elongated in the direction from the apex towards the tip of the spur. Its carinal margin is convex, its scutal margin almost straight, its basal margin makes only a very feeble angle with the posterior margin of the spur. The outer surface shows a very shallow depression at the place of the longitudinal furrow. The spur is placed close to the basi-scutal angle, its freely-extending part is not very long, it is about one third of the width of the valve. On the inner surface the articular ridge is separated from the scutal margin by a broad furrow; the crests for the depressores are distinct but short.

The epidermis covering scutum and tergum is slightly more persistent than in other species and bears very short yellowish hairs over the whole surface of the valves; they are disposed somewhat more densely along the opercular margins of these valves.

With regard to the structure of the animal's body the following is of interest:

Mouth. Labrum (Pl. XX, fig. 2) has a shallow notch and four larger teeth on each side of it. The notch is very wide at the entrance, the margin of the lateral parts is horizontal and quite straight.

Palpi are not very broad, elongately-oval. The free extremity is distinctly rounded, superior margin nearly straight, the inferior distinctly arched. The superior margin bears a continuous row of hairs, which grow longer towards the free extremity. A large part of the outer surface which extends along the inferior margin to half way the length of the palpus, is covered with rather long hairs. The hairs on the inner surface, near the superior margin, are reflected; most of them are short, bent downwards and feathered.

Mandible (Pl. XX, fig. 3 and 3*): distance between extremities of teeth 1 and 2 and that between 2 and 3 nearly equal; 2nd and 3rd teeth indistinctly double. Third tooth blunt, fourth not so strong, but with rudimentary additional tooth. The part behind the 4th tooth not much developed: at one side the whole inferior part consists of a few, nearly equally strong, flat teeth, at the other side, a rudimentary 5th tooth and two flat spines, the second of which is long and sharp can be readily distinguished.

Maxilla (Pl. XX, fig. 4): somewhat elongate; a small notch beneath the upper pair

of spines, then 4 spines, and on the maxilla of the other side 5 somewhat shorter spines, then two longer ones of the same size as those of the upper pair. The base of the middle-spines slightly overlap each other, these spines giving, in consequence, the impression of standing in two rows. The superior and inferior margins nearly parallel to each other.

Outer maxillae (Pl. XX, fig. 5): the outer lobe of trapezoidal form, the triangular distal part being about the only one which is covered with hairs. Few hairs only form the longitudinal row which runs from the outer to the inner lobe. The latter has a rounded surface, and bears not very numerous feathered hairs along the inner and inferior margins.

Note. The description of the parts of the mouth given above is for the specimen from Station 204. In one of the specimens from Station 289 the difference between the distances of teeth 1 and 2, and 2 and 3 of the mandibles is greater, and tooth 4 is not developed in the mandible of the right side. The maxillae have 3 and 4 middle-spines; the outer maxillae have the outer lobe somewhat shorter and broader, and the hairs disposed towards the inner lobe are less numerous.

Cirri. First pair. The cirrus of the one side has 7 and 11, that of the other 7 and 12 segments; the inner face of the segments is rounded, but cannot be said to be protuberant.

Second pair has nearly equal rami of 8 and 10 segments.

Third pair has 10 and 11 segments in the two rami. Segments 2—9 (Pl. XX, fig. 6) of the longer ramus, and 3—8 of the shorter bear well-developed groups of small, straight, and not recurved, triangular teeth along the inner face and between the spines on the distal half of that face. The teeth are situated on the face of the segments and at a little distance from the margin.

Fourth-sixth pairs. Number of segments slightly increases from the 4th to the 6th pair; the greatest number is not much over 20. Pairs of spines disposed on the inner face of the segments of the 4th cirrus, four only; on some of the segments of the 5th cirrus and on most of the 6th (Pl. XX, fig. 7) this number, however, is five. The middle segments are twice as long as broad, the basal ones shorter, the distal ones longer; the very last one is, however, short and slender.

Note. The cirri of the specimen from Station 289 correspond in general with this description. The number of segments, however, is smaller: the first cirrus has 5 to 6 and 10 segments, the second 7 and 8, the third 8 and 9, the fourth 16 and the sixth 19 segments. The teeth on the protuberant parts of the middle segments of the longer ramus of the 3rd cirrus are present — but they are very small. Three or four segments only of the 6th cirrus have 5 pairs of spines on their inner faces, all the others have at the most 4 pairs.

Penis long, curled; few hairs only scattered over the surface, a little tuft of hairs situated at the extremity.

This species was dredged by H. M. S. "Siboga" at two different Stations:

Stat. 204. Sept. 20, 1899. Lat. 4° 20′ S., Long. 122° 58′ E. Between islands of Wowoni and Buton; Northern entrance of Buton-strait. Depth from 75—94 m. Bottom: sand with dead shells. The *Balanus* is attached to the tube of an Annelid.

Stat. 289. January 20, 1900. Lat. 9° 0′.3 S., Long. 126° 24′.5 E. Depth 112 m. Bottom: mud, sand and shells. Group of 3 to 4 small specimens.

General Remarks: The specimens from the two stations correspond sufficiently to consider them as belonging to the same species. In minute details of size and colour, and in less important points of the structure of the animal's body, the correspondence, perhaps, is not complete; yet it is certainly great enough to put them together. Should the species, which, though not a true deep-sea species, inhabits deeper water (of about 100 m.), be collected again, so that richer material can be investigated, its relations with other species will have to be settled. With the present material this could not be done in a satisfactory way.

5. Sectio: **Membrano-Balanus**

15. *Balanus longirostrum* n. sp. Pl. XX, fig. 8—16.

Shell quite imbedded in a sponge; parietes solid; basis membranous; rostrum twice as long as carina, with the basal part narrow, and a longitudinal furrow over its whole length. Carino-lateral compartments very narrow. Scutum with two longitudinal folds. Tergum with the spur broad.

This species is nearly related to *Balanus declivis* Darwin from the West-Indies. Paying special attention to the little differences I found between this form from the Malay Archipelago and Darwin's description and figures, I thought better to describe the Siboga-species as new, although convinced that, in several respects, it corresponds with the West-Indian form.

The shell (Pl. XX, fig. 8) is thin, brittle, smooth and white; the membrane which covers *B. declivis* is not, or not so well-developed in the present species: only small parts of it are observed round the orifice; no bristles are seen clothing this membrane. The parietes are not porose, they are delicately striated longitudinally, much more distinctly in horizontal direction. The orifice is large and irregularly toothed. The carina and the rostrum are both strongly bowed; but, while the carina is only a trifle longer than the lateral compartments, the rostrum (Pl. XX, fig. 9) is about twice as long, the basal part extending far beyond the basal margin of the other compartments. This basal part is broader upwards, grows narrow downwards and terminates almost in a point. The exterior surface of the rostrum is longitudinally grooved by a furrow which extends almost to the pointed basis. The alae are broader and horizontally striated in the same way as the compartments; the radii are narrow, their summits are somewhat oblique, their sutural edges smooth. The carino-lateral segments are about the same length as the lateral compartments, which, however, are three times as broad as the former. One of the larger specimens I have examined has a basal diameter of about 4 mm. and a height of $2^1/_4$ mm. The length of the rostrum of this specimen was over 5 mm.

The scutum (Pl. XX, fig. 10, *a* and *c*) is distinctly convex, with very narrow lines of growth, very feebly crenated, so as to produce a hardly visible longitudinal striation. It shows two longitudinal furrows dividing it indistinctly into a broader middle, and two narrower lateral parts. On the inner surface there is no adductor ridge, and the articular ridge is moderately developed, broadest in the middle and sloping towards the inferior extremity. The pit for the depressor muscle can hardly be distinguished.

The tergum (Pl. XX, fig. 10, *b* and *d*) is beaked, with the scutal margin straight. The external surface shows distinct growth-ridges. The spur is situated close to the basi-scutal

angle and is of considerable breadth. The basal margin is slightly hollowed out, and no crests for the depressor muscles could be seen.

The structure of the animal's body shows the following peculiarities:

Mouth. Labrum (Pl. XX, fig. 11) with the notch wide at entrance and not very deep. The outer edge of the lateral parts rounded. Two teeth on each side of notch, short delicate hairs disposed along the edge. The whole shape of the thickened portion of the labrum more rhombiform than triangular.

Palpi elongate with distal extremity slightly turned up, hence the superior margin is somewhat hollowed out. Hairs numerous and delicate: a dense row of shorter ones along superior margin, and a great number of longer hairs scattered irregularly over outer surface.

Mandible (Pl. XX, fig. 12) with three well-developed teeth, and teeth 4 and 5 and inferior angle blunt and almost rudimentary. Distance between extremities of teeth 1 and 2 slightly longer than that between 2 and 3. Half way between the latter two teeth in both mandibulae a small additional tooth is observed. The inferior angle, which in the mandible of the one side ends bluntly, terminates into a short spine in the other.

Maxilla (Pl. XX, fig. 13 and 13*) has the free edge straight, a small notch under upper pair of spines, and 5 spines on the middle portion of the edge between the notch and the slightly longer inferior pair. Differences in length of the spines not very considerable.

Outer maxilla (Pl. XX, fig. 14) with the outer lobe of oval shape, the inner and outer margins rounded equally strongly. On the outer half of the inner surface this lobe is covered with numerous delicate hairs; while the other species have a single or double row of hairs, extending from the outer to the inner lobe, quite a broad group of numerous hairs is seen in this species. Inner lobe rounded, with longer hairs disposed as usual along inner margin.

Cirri. First pair has the two rami very unequal of 8 and 20 segments respectively. The segments of the shorter ramus very protuberant on the anterior face.

Second pair has the rami slightly unequal of 10 (11) and 12 segments. The segments are rounded, not protuberant, on their anterior faces. Hairs on different segments numerous, they do not form, however, such dense tufts as on the same cirrus of most other species of *Balanus*. On all the segments, of the outer as well as of the inner ramus, with the exception of the last segment, on the distal half of the exterior face, rows of small spine-like teeth are seen. These are of a peculiar form, and look like rounded scales bearing one, two, or three sharp spines on their margins.

Third pair has unequal rami of 12 and 15 segments. Similar, but slightly stronger rounded scales with small teeth on the margin, as on the second cirrus, form several transverse rows on the distal half and outer surface of the 8 to 9 lower segments of both rami. Anterior margin developed into a rounded protuberance.

The fourth pair has the rami slightly unequal, of 19 and 21 segments. Triangular spine-like teeth (Pl. XX, fig. 15 and 15*), stronger than the corresponding ones on the 2nd and 3rd cirri, form transverse comb-like rows and are disposed on both segments of the pedicel, near the extremity, and on about 10 of the lower segments of the outer ramus of this cirrus. They are also seen on the other ramus, but there they are much less strong.

The fifth and sixth pairs are nearly equal. They have respectively 25 and 26, and 26 and 28 segments in the two rami. The anterior face of most segments is furnished with four pairs of hairs (Pl. XX, fig. 16): one pair (the most distal one) is longer, the second is already much shorter, the third is short, the fourth extremely minute.

Penis long, longer than the cirri. Surface covered with numerous hairs, on the distal part especially. Hairs standing off transversely in a peculiar way. No sharp point observed dorsally on the basal part of the penis.

This species was discovered by Dr. G. C. J. Vosmaer in Sponges belonging to the species *Spirastrella purpurea* (Lmk.) Rdl., dredged at the following Stations:

Stat. 86. June 18/19, 1899. Anchorage off Dongola, Palos-bay, Celebes. Depth 36 m. Bottom: fine grey mud (river mud).

Stat. 313. February 14/16, 1900. Anchorage East of Dangar Besar, Saleh- (or Sapeh-)bay. Depth up to 36 m. Bottom: sand, coral and mud.

General Remarks. This species occurs in numerous specimens in the sponges it inhabits and will also be found, most probably, at other places in the Archipelago. Weltner (Verzeichniss, 1897, p. 270) mentions *B. declivis* Darwin as collected by Martens at Batjan (Molucca's), but I think it possible and even probable that it was not Darwin's species but the species here described. I think the difference in shape of rostrum and scutum, and, moreover, the narrowness of the carinal-latus, of sufficient importance for not considering the species of the West-Indies and that of the East-Indian Archipelago as identical, however nearly related they may be. I think that the Siboga-species differs also from Pilsbry's *B. orcutti* which was described (Pilsbry, Henry A., Notes on some Pacific Cirripedes. Proceed. Acad. of Sci. Philadelphia, 1907, p. 361), on specimens from San Ysidro, Lower California, and which Pilsbry considers as differing from *B. declivis* Darwin of the West Indies. The shape of the opercular valves, and that of the rostrum of Pilsbry's species, is certainly different from that of the same parts in my species. The three species, however, are no doubt nearly related: they may be found to be local forms of the same species after all.

Darwin considered his *B. declivis* as belonging to the section E (species with membranous basis). I pointed out, under the head of the Genus *Balanus*, that I consider this classification as more or less artificial. If we take into consideration, not one special character of the forms, but their whole structure — the shell as well as the animal itself — we can come to another arrangement of the species, and one which, perhaps, gives a better idea of their affinities, so far we can judge at present.

6. Sectio: **Armato-Balanus**

16. *Balanus terebratus* Darwin. Pl. XX, fig. 17—21. Pl. XXI, fig. 1—3.

Darwin, Ch., Monograph. Balanidae and Verrucidae. 1854, p. 285, pl. 8, fig. *2a—2b*.

Darwin gave a description of this species and proposed a name for it, without being able to examine the opercular valves; but, he said, the species here named is so peculiar that it would have been a fault to pass it over. There is but a single specimen in the

British Museum, DARWIN continued, and this without the operculum, as just stated, and, of course, without the animal's body.

Since this was written, the species was mentioned in two papers: in BORRADAILE's Marine Crustaceans of the Maldive and Laccadive Archipelagoes (1903), and in ANNANDALE's Cirripedia, in the "Ceylon Pearl Oyster Report" (1906). BORRADAILE, however, was unable to find in his specimens the rows of holes between the ridges of the basis as described by DARWIN and, therefore, thinks it possible that his species is different from DARWIN's. He gave a short description of the opercular valves of his species. ANNANDALE says about the species he has investigated that it agrees closely with BORRADAILE's description as regards the structure of the operculum; as for the apertures of the basis, which BORRADAILE was unable to see, ANNANDALE reports that they are absent in some samples he has examined. "In one individual, however, there appear to be indications that they have been present, but have been almost obliterated during growth".

Of course, it is possible that something of the kind has happened in the case of the specimens from the Gulf of Manaar — all I can say is, that the Siboga dredged several specimens of *Balanus* which no doubt belong to DARWIN's species, and the basis of which distinctly shows the remarkable structure mentioned by that author. The description of the opercular valves given by BORRADAILE, although agreeing in several respects with that of the Siboga specimens, is too short to be absolutely decisive. Yet, what BORRADAILE says about the tergum: "Apical tooth present, but broken in the specimen" seems to prove that his determination is right.

The Siboga-specimens have the shell (Pl. XX, fig. 17) white and strongly ribbed longitudinally; the ribs near the basis are produced into points or spikes, which correspond with such spikes at the circumference of the basis. The length of these spikes in the Siboga-specimens is, perhaps, not quite so great at it was in the specimen studied by DARWIN. The shape of the shell is conical, somewhat elongate in its rostro-carinal axis. The orifice is small, pentagonal, toothed. The radii are narrow and have oblique summits. The carino-lateral compartments are narrow.

The basis is distinctly concave and has the circumference produced into spikes as already mentioned. The internal surface has slightly prominent ribs radiating from the centre to the surface, and between these, rows of small openings are seen. These apertures are of somewhat irregular shape and unequal sizes; they are mostly placed in a single row, here and there, however, in an irregular double row. The shell is almost entirely covered by a thick yellowish coat which seems to be a sponge; the ribbed structure appears distinctly only after this has been taken away. The size of the shells in the larger specimens is: $3^1/_2$ mm. greatest diameter of the basis, and a height of $2^1/_4$ mm.

The scutum (Pl. XX, fig. 18, *a* and *c*) has prominent growth-ridges, terminating at the occludent margin in very prominent teeth. In larger specimens the upper part of the outer surface does not show these ridges so distinctly, nor are the teeth of the occludent margin so prominent here. At the inner side, the articular ridge is long but not very prominent; the adductor ridge is well-developed. At the basi-tergal corner there is a well-marked cavity for the lateral depressor muscle.

The tergum (Pl. XX, fig. 18, *b* and *d*, fig. 18*) has a rather broad spur, the anterior margin of which is separated from the basi-scutal angle by a minute part of the basal margin; in other specimens it is confluent with the scutal margin. The remaining larger part of the basal margin is distinctly hollowed out. The scutal margin is nearly straight, the carinal margin not very long. These two margins meet at the apex, which is produced into a sharp spine-like beak. This spine-like beak, however, is a yellowish chitinous structure that is kept in its place by means of the chitinous membrane covering the whole valve. If the valve is boiled with caustic potash this chitinous beak separates from the calcareous valve. (I suppose this is the structure meant by BORRADAILE when he says that (at the tergum) an apical tooth is present, but broken in the specimen).

Nothing was known hitherto about the structure of the animal's body, and I think it will be useful to give the following description:

Mouth. Labrum (Pl. XXI, fig. 1): notch rather deep, wide at entrance; lateral margins making together an angle, say of 135°, hence the thickened portion of the labrum, which in most species is sub-triangular, is in this species rhombiform, with its height only slightly shorter than its breadth. On each side of the notch three small teeth are seen, of which in one specimen, however, only two were developed; very short hairs are disposed along entrance of notch and between the teeth.

Palpi: oval, slightly recurved towards free extremity. Distal part a little narrower, but not pointed. Upper margin almost straight, slightly hollowed out; inferior margin convex. Hairs scattered over large part of outer surface, forming with some of those along upper margin a not very conspicuous tuft at the extremity. On inner surface numerous shorter hairs form a longitudinal group that is disposed at some distance from the upper margin and parallel to it.

Mandible (Pl. XX, fig. 19): extremities of teeth 1 and 2 a trifle farther distant from each other than 2 and 3. Tooth 2 double, 3 swollen, 4 small and triangular, 5 confluent with inferior angle, forming together a series of very small nobs. Inferior part only slightly developed. Surface with isolated hairs, and also with some hairs arranged in groups; shorter hairs and spine-like nobs on surface of inferior part.

Maxilla (Pl. XXI, fig. 2): edge long and almost absolutely straight; two spines near upper, two near inferior extremity of edge, the latter a trifle longer than the first. Between the two pairs, 7 spines are disposed. Hairs on surface are seen only near outer edge, those on superior margin as well as those along inferior margin very few only — 6 to 8.

Outer maxillae (Pl. XXI, fig. 3): outer lobe rather broad and not pointed towards extremity. Inner margin almost straight, outer margin rounded. Hairs scattered over inner surface perhaps not quite so numerous as in other species, a group, not a single row, descends from the outer to the inner lobe. Inner lobe elongate, furnished with numerous and partly very long and recurved hairs, the extremities of which are directed inwards and downwards.

Cirri. First pair has very unequal rami of 6 and 14 segments. Hairs at extremity of 6th segment of shorter ramus spine-like, slightly curved, strong and feathered.

Second pair has slightly unequal rami of 7 and 8 segments; shape of segments quadrate; last segments of both rami bear curved spine-like hairs on the extremity, much resembling those of the last segment of the shorter ramus of the 1st cirrus.

Third pair has rami of 8 and 10 segments respectively, which are somewhat more elongate than those of the 2nd cirrus. Pedicels also much longer. 3 or 4 lower segments of longer ramus with a few tooth-like spines disposed along anterior face near distal extremity of segments.

Fourth pair has also unequal rami of respectively 16, 17 and 20 segments. The lower segments 1—7 of the shorter ramus (Pl. XX, fig. 20), bear from 2 to 5 curved teeth at the anterior face, those situated near distal extremity being the longest, the others smaller, decreasing in size towards the base of each segment. Most segments, to begin with the 2nd, bear two to three pairs of spines, two of these pairs close together near distal extremity, and the third at some distance along the anterior margin. Hairs on posterior face of segments disposed at the distal extremity, rather long, especially those on the lower segments. Last segment of pedicel without any teeth along anterior face.

Fifth and sixth cirrus nearly equal, the sixth has one or two segments more in each ramus. In one of the specimens 26 and 30 segments were counted in the 6th cirrus. Length of segments increases from the basis towards the extremity: the last segments are nearly four times as long as broad. The anterior face of most segments bears three pairs of hairs (Pl. XX, fig. 21): the longest near the extremity, the third pair extremely minute about the middle of the anterior face, and the second pair, which is not very long, half-way between the two other pairs. The hairs on the posterior face, near the extremity of the segments, are short in the distal segments, much longer on the basal segments.

Penis long, much longer than the cirri of the 6th pair, tapering towards the extremity, uncommonly hairy near and at the extremity.

Eggs with embryos: Nauplii with black eye-spots, in the mantle cavity. Size of the eggs 0.25 × 0.15 mm.

The specimens were taken at:

Stat. 257. December 11, 1899. In Duroa-strait, Kei-islands. Depth down to 52 m. Bottom: coral. A single group of half-a-dozen specimens, most of them overgrown by a sponge-like organism, the surface of which shows numerous short spines or needles.

17. *Balanus arcuatus* n. sp. Pl. XXI, fig. 4—14.

Shell conical, dirty white, with corroded surface in some, tinged with red and distinctly ribbed in other specimens. Radii broad, with their summits parallel to the basis. Orifice entire, elongately pentagonal. Carino-lateral compartments extremely narrow. Basis flat, not imbedded, not porose. Scutum with the lines of growth crenated; tergum with the spur broad and confluent with the basi-scutal angle, the apex of the valve distinctly produced and the scutal margin deeply hollowed out.

Numerous specimens are attached to both surfaces of calcareous plates of a polypoid character, some of them very close together, others at some distance from each other. General shape (Pl. XXI, fig. 4) of the shell flatly-conical, with the surface dirty white and more or less corroded in some, and distinctly ribbed and tinged with a more or less vivid red in other specimens. Ribs in that case white or coloured less distinctly, intervals between the

ribs coloured more distinctly and transversely dotted with darker red. Radii rather broad, not very distinct, however, in the specimens with corroded surface; coloured white or faintly reddish in the specimens with ribbed surface, and being transversely striated in these specimens, more distinctly so in the upper half. Orifice small, elongately pentagonal, nearly entire, certainly not toothed; the recurved tips of the terga occupy the carinal angle of the orifice in a very peculiar way. Together with the extreme narrowness of the carino-lateral compartments, causing the radii of these valves and those of the rostro-lateral compartments nearly to touch each another, the characteristic appearance of the tips of the terga will always make it easy to recognize this species.

Parietes (Pl. XXI, fig. 7, *a*, *b* and *c*) solid, no pores, but with well-developed longitudinal ribs, forming so many septa, which are denticulate in their basal parts. The sheath is transversely ribbed. The radii of the carino-lateral and rostro-lateral compartments nearly touch each another, owing to the extreme narrowness of the carino-lateral compartment (Pl. XXI, fig. 5). The sutural edges are coarsely ribbed transversely. The basis is thin, attached firmly to the surface of the calcareous plate and has no pores; it adheres very firmly to the walls of the valve and is perfectly flat — not cup-shaped, and not imbedded in the coral at all. Its interior surface shows delicate ridges radiating from the centre.

Greatest diameter of the basis of one of the larger specimens about 7 mm.

Scutum (Pl. XXI, fig. 6, *a* and *c*) the lines of growth are very distinct and are beset with a number of small points making them look as if crenated; occludent margin distinctly and more or less irregularly toothed; articular ridge not very prominent and extending down from the apex to about two thirds of the length of the tergal margin; adductor ridge indistinct; cavity for the lateral depressor muscle well-developed; along the tergal margin the surface of the valve is uplifted, the growth-ridges being here very distinctly crenated or toothed.

Tergum (Pl. XXI, fig. 6, *b* and *d*): apex distinctly produced, beaked, carinal margin convex, scutal margin strongly hollowed out, basal margin sinuous. Ridges of growth not very distinct, external surface almost flat, without a longitudinal furrow; spur situated quite close to the scutal angle of the valve, its extremity being almost confluent with that angle, not very short, and not quite half as broad as the valve itself. Crests for the depressor muscles indicated, but not very prominent. Articular ridge distinct only in the uppermost part of the valve. Tergum extremely brittle — it is difficult to prepare a really faultless specimen of it.

With regard to the structure of the animal's body the following may be of interest:

Mouth. Labrum (Pl. XXI, fig. 8): The outlines of the lateral parts of the labrum together make an angle; the notch is deep and not very wide at the entrance. Three well-developed and sharp teeth on each side of notch.

Palpi elongate, nearly oval, not club-shaped. Hairs along upper margin form a dense and regular row. Those on outer surface long, and placed in rows which make angles with the inferior margin near distal extremity. On the inner surface a longitudinal series of shorter hairs is disposed and this runs parallel to the upper margin, the hairs overlapping the edge of the labrum when the palpus is directed downwards. Extremely delicate ciliae are disposed along part of inferior margin and rounded distal margin.

Mandible (Pl. XXI, fig. 9): distance between extremities of teeth 1 and 2, and 2 and 3 nearly equal. Tooth 1 pointed, 2 and 3 double, 3 somewhat broader, 4 and 5 small, but distinct, inferior angle represented by a rudimentary nob. The hairs on the surface towards the inferior part go over into tooth-like nobs. Few hairs only along the inferior margin.

Maxilla (Pl. XXI, fig. 10): notch behind the two superior spines very distinct, and 5, sometimes 4 somewhat shorter spines, between the notch and the two inferior spines. The latter a trifle larger than the upper pair. Of the middle spines, the 4th is longer and thicker than the others.

Outer maxillae (Pl. XXI, fig. 11): outer lobe grows slightly narrower towards extremity and has the apex somewhat curved inwards, conseqently the interior margin is a little hollowed out. Surface partly covered with hairs. These hairs are disposed more densely towards distal extremity, where they form a kind of a tuft. Downwards, in the direction of the inner lobe, a very conspicuous row of hairs is seen, most of which stand off in horizontal direction. Inner lobe of oval shape, not much elongated; in one of the specimens its shape is hardly longer than broad. Hairs disposed on inner lobe not so numerous and not quite so long and stout as in most other species of the genus.

Cirri. First pair has unequal rami of 6 and 12 segments in one, 6 and 13 in another specimen. Segments cylindrical, hardly protuberant, those of the shorter ramus are slightly broader than those of the longer ramus.

Second pair has short rami of 5 and 7 segments respectively; segments not protuberant, but having the anterior face rounded; shape of segments as a whole almost circular. Tufts of hairs along rounded anterior faces not very dense.

Third pair has somewhat longer rami of 6 to 7, and 8 segments, each segment being about one and a half times as long as broad. The anterior face of the segments swollen and bearing along that swelling or protuberance (Pl. XXI, fig. 12) a row of teeth, which from the base to the upper end increase in size. These rows of teeth are present along segments 2 to 5 in the one, and segments 2 to 6 in the other ramus; near the upper margin of the segments each row ends in a curious minute comb formed by a horizontal row of very small teeth. Last segment of pedicel shows very minute teeth along anterior margin, near the extremity.

Fourth pair has rami of 14 and 16 rather elongate segments; last segment of pedicel quite unarmed; the anterior face of the middle segments of the shorter ramus bears only two pairs of spine-like hairs, the lower segments have only one pair and a pair of much shorter hairs; the anterior face of the latter segments (Pl. XXI, fig. 13), near the distal extremity, is furnished, moreover, with 2 to 3 somewhat recurved teeth. The middle segments of the longer ramus always have three pairs of such spine-like hairs. None of the segments of the longer ramus are furnished with teeth.

Fifth pair has 20 rather long segments in each ramus and, in the middle of the ramus, each segment furnished with 4 pairs of hairs on anterior face.

Sixth pair has 21 and 23 long segments in the two rami, and 4 pairs of hairs on anterior face of the middle segments (Pl. XXI, fig. 14). The first segment of the pedicel of this cirrus has the posterior margin distinctly serrated.

Penis much longer in the one than in the other specimen. In both it tapers very considerably towards the extremity and it is furnished with only very few hairs. No point observed on the dorsal side near the basis.

This species was collected at Banda at a depth of 9—36 m. The specimens are numerous, and are attached to pieces of stone, probably of Madreporian origin. To one of these stones a piece of a rather thick membranous coat, containing numerous polyps, is still attached; the *Balani*, however, are found only on the surface of the calcareous mass, where this membrane is wanting. Some specimens show the structure of the shell, its colours, etc., as described, but others have the surface uniformly white, or look as if their surface was corroded and then resemble more or less the stoney matter to which they are attached. To one of these pieces of stone a specimen of *B. amphitrite* was also found attached, and another specimen of the latter species almost completely overgrows one of the specimens of *B. arcuatus*.

General Remarks. I think that this species is in general related to several species of my group. Yet it has in other respects — in the narrowness of the carino-lateral compartments, in the shape of the tergum, in the structure of the radii, etc., — much that is peculiar to it. It comes near to *B. allium* Darwin: I have been long doubting, whether it did not belong to that species. I finished with considering it as distinct, not so much because the basis of my species is perfectly flat — the basis of *B. allium* according to Darwin is concave, can be more or less cup-formed, and is more or less deeply imbedded in the coral — but for the very peculiar shape of the tergum in the Banda specimens. The very striking impression which the orifice with the white beaks of the terga makes would certainly have been noticed by Darwin, and in his description of *B. allium* he merely says, "Tergum with the apex somewhat produced or beaked". What Darwin reports on the structure of the mouth and the cirri corresponds fairly well to what is seen in my new species — there are differences, however, which make it more probable that the two forms are nearly related, than that they will prove to be identical.

18. *Balanus quadrivittatus* Darwin. Pl. XXI, fig. 15—20. Pl. XXII, fig. 1—2.

Darwin, Ch., Monograph. Balanidae, Verrucidae etc. 1854, p. 284, pl. VIII, fig. 1.

At Station 164, attached to stones, together with specimens of *B. socialis*, small specimens of a *Balanus* were collected, which turned out to belong to the above-named species.

In general the Siboga-specimens agree with Darwin's description of this species. The shell is conical (Pl. XXI, fig. 15), somewhat depressed, with a small irregularly rhomboidal or sometimes pentagonal orifice. The surface of the shell shows longitudinal folds extending from the orifice to the margin of the base. The radii are narrow and have oblique summits. Colour dirty white, surface covered, however, with a layer of yellowish mud. Some of the specimens — not all — show, on rostrum, carina and latera, the four brownish-grey bands, which suggested to Darwin the present name of the species. I saw other specimens without a trace of these bands. The basis is very thin, calcareous, brittle — I could not discover pores, either in the basis, or in the compartments or radii. The basal diameter of one of the larger specimens was at the most 3 mm.

The scutum (Pl. XXI, fig. 16, *a* and *c*) has distinct, but smooth lines of growth, a well-developed articular ridge which is broadest in the middle and slopes towards the lower extremity, and no adductor ridge. The cavity for the adductor muscle is slightly indicated. Basi-tergal angle rounded.

The tergum (Pl. XXI, fig. 16, *b* and *d*) has the apex produced into a minute, sharp point; scutal margin straight, spur broad; its anterior margin makes a hardly visible angle with the scutal margin. The chitinous membrane which covers this valve bears quite a row of small yellowish hairs along the carinal margin of the tergum.

The very short remarks DARWIN made regarding the structure of the animal's body may be completed with the following:

Mouth. Labrum (Pl. XXI, fig. 17): notch deep and narrow, not very wide at entrance. Lateral margins forming an angle of about 90° with each other and a sharp angle with the margin of the notch. Teeth small; in both the specimens examined by me, the sharp angle formed by lateral margin and margin of the notch terminates, on both sides, in a sharp tooth, a second one being situated close to the first in one specimen, and at a little distance from it in the other. In the latter specimen a few more rudimentary teeth can be distinguished. A small tuft of very short hairs is seen immediately below the larger tooth along the upper part of the margin of the notch. Shape of thickened portion of labrum almost rhombiform, its height corresponding with its breadth.

Palpi: elongate with the distal part growing narrower, and the extremity almost pointed. Inferior margin only feebly convex, upper margin almost straight. A few longer hairs only are scattered over inferior half of outer surface of the palpus, a dense row of shorter hairs is disposed along upper margin and over inner surface, especially over its superior half.

Mandible (Pl. XXI, fig. 18): distance between extremities of teeth 1 and 2 a little longer than that between teeth 2 and 3. Tooth 3 slightly thicker; teeth 2 and 3 indistinctly double. Teeth 4 and 5 small but distinct; inferior angle terminates into 3 or 4 flat, short, narrow, spine-like teeth.

Maxilla (Pl. XXI, fig. 19 and 19*): edge rather broad, shape of whole maxilla triangular, pointed towards the extremity, where the place of attachment of the apodeme is found. Upper pair of spines shorter than inferior pair. Between these pairs, 3 to 5 somewhat shorter spines are disposed. Between the two spines at the basis a very small and narrow notch is always observable. The notch behind the upper pair is small, yet distinct. (The one specimen has 3 and 3, the other 4 and 5 intermediate spines).

Outer maxillae (Pl. XXI, fig. 20): have the outer lobe rather broad and quadrate, with the upper extremity obliquely truncated, the lateral margins almost parallel. A large part of the inner surface covered with hairs, most of which are directed in a direction at right angles to the length of the maxilla. Inner lobe club-shaped, with the narrow part directed downwards. Surface furnished with few, inner margin with not very numerous and somewhat longer hairs, the strongest of which are directed to the basis of the maxilla.

Cirri. First pair: has very unequal rami of 7 and 18 to 19 segments in the one, and 6 to 7 and 19 to 20 segments in the other specimen. Segments of shorter ramus about

as long as broad and with the inner and outer faces rounded; lower segments of longer ramus broader than long.

Second pair: rami slightly unequal, of 7 and 8 to 9 segments in the one, and 6 and 8 in the other specimen. Stronger, distinctly feathered spines disposed on the extremity of the last segment.

Third pair: rami with 7 and 9 in the one, 7 and 8 segments in the other specimen. Segments of the pedicel very elongate; the first bears a tuft of long hairs directed backwards and quite a row of short, delicate, spine-like points along its posterior face. The anterior face of the segments 2 to 7 of the anterior ramus is furnished near its upper extremity with a row of extremely minute teeth-like spines.

Fourth pair: rami unequal, of 12, and 15 to 16 segments. Middle segments about two and a half times as long as broad. Segments bear on anterior face only one pair of well-developed hairs or spines, and either one or two pairs of much more delicate ones. Anterior face of last segment of pedicel with a row of four curved teeth near distal extremity (Pl. XXII, fig. 1). The first and second segments of the shorter ramus show one distinct tooth and a minute one, and the third to fifth segments have two well-developed teeth and a small one, the 6th segment, however, has again one distinct tooth and a small one. Longer ramus without teeth along anterior face of lower segments.

The other specimen has 14 and 18 segments in the two rami. The same cirrus has again 4 teeth on the anterior face of the last segment of the pedicel, and the five inferior segments of the shorter ramus are armed with 1 or 2 teeth respectively on the anterior face of each.

Fifth pair: the 14 lower segments of one of the rami are furnished on the anterior face, near the distal extremity, with a curved tooth. This tooth stands either alone, or it is accompanied by a small secondary tooth.

Sixth pair: rami equal, of about 20 segments; the distal segments more elongate than the lower ones. As a rule three pairs of hairs on the anterior face of each segment (Pl. XXII, fig. 2); only one of these pairs is longer: the second pair is already short, and the third not or hardly visible. The number of segments in the 6th cirrus of the other specimen is 26, and the third pair of hairs on the anterior face, as a rule, is only to be made out with difficulty in this specimen.

Penis broken off in the one specimen, and very long and tapering towards the extremity in the other specimen.

The specimens of this species collected by H. M. S. "Siboga" came from two Stations:

Stat. 164. August 20, 1899. Lat. 1° 42'.5 S., Long. 130° 47'.5 E. Depth 32 m. Bottom: sand, small stones and shells.

Stat. 299. January 27/29, 1900. Lat. 10° 52'.4 S., Long. 123° 1'.1 E. Rocks- or Cyrus-bay, South coast of Rotti-island. Depth 34 m. Bottom: mud, coral and Lithothamnium.

General Remarks. This is the first time that the species described by Darwin in 1854 has been re-examined. Darwin knew it from the East Indian Archipelago and from the Philippine Archipelago. Although Darwin's specimens were longer than mine ($^1/_4$ of an inch = 6.3 mm.), it is one of the smaller species, and as the specimens are, moreover, often

covered with mud, I think it is easily possible to overlook them: the species is perhaps more common than we suppose at present. In 1908, I received from Dr. VAN KAMPEN, who was at that time in Batavia, specimens of the same species, dredged at a depth of ± 45 m. in the Malay Archipelago: Lat. 6° 15′ S. and Long. 110° 50′ E.

19. *Balanus quinquevittatus* n. sp. Pl. XXII, fig. 3—10.

Shell conical, greyish-white, having five brownish spots on the rostrum, the latera and the carino-latera, and six small apertures immediately above the basis and between the sutures of the compartments. Scutum with the lines of growth smooth, tergum with the apex not produced.

This interesting form in certain respects approaches the genus *Acasta*; it belongs, no doubt, to the same group of species as *B. quadrivittatus*, *B. terebratus*, and several other species. It was found attached to the shell of a Gastropodous mollusc.

The general shape is conical (Pl. XXII, fig. 3), with the compartments smooth, not folded or ribbed. The orifice is pentagonal, small, hardly toothed. The carino-lateral compartments are narrow. The radii are very narrow and have oblique summits. The colour of the shell is dirty white and is not covered by a membrane. Near the orifice, all the compartments, the carina excepted, show a brownish spot, the colour of which corresponds with the bands observed in *B. quadrivittatus*. The basal margin of the different compartments is irregularly toothed; in the lower half the compartments are separated from each other by apertures of a longitudinal shape, about the same distance being occupied in the upper half by the radii. This gives the whole of the shell a very peculiar appearance and resembles, more or less, what is seen in *Acasta fenestrata*. The basis is thin, calcareous, and has no pores, so far as I could make out. The longest diameter of the basis measures 5.2 mm. in the largest specimen, slightly over 4 mm. in a smaller one.

The scutum (Pl. XXII, fig. 4, *a* and *c*) has the lines of growth only feebly indicated. It has the basi-tergal angle rounded, no adductor ridge, and the articular ridge narrow, not prominent.

The tergum (Pl. XXII, fig. 4, *b* and *d*) has the spur broad, bluntly pointed at the extremity. The basal margin is slightly hollowed out, the scutal margin straight, the apex pointed without being produced. The anterior margin of the spur makes an angle with the extremity of the basi-scutal margin.

With regard to the structure of the animal's body the following is to be noted:

Mouth. Labrum (Pl. XXII, fig. 5): notch deep and narrow, entrance only slightly wider. Lateral parts, on each side of notch, have an arched or curved outline. Three very small indistinct teeth are disposed between extremely short hairs on each side of notch. Shape of the thickened chitinous portion, which in other species of *Balanus* is sub-triangular, rhombiform: height and breadth nearly equal.

Palpi: of peculiar shape, with the upper margin straight and the lower margin convex, the two margins meeting in a rounded-off angle. The whole palpus rather narrow. Shorter hairs are disposed along upper margin, longer ones irregularly scattered over distal half of outer

surface, disposed somewhat more densely towards the distal extremity and along the inferior margin towards the rounded-off angle. The inner surface bears shorter curled hairs which form a longitudinal group almost parallel to upper margin.

Mandible (Pl. XXII, fig. 6): distance between extremities of teeth 1 and 2 about as long as that between teeth 2 and 3. Tooth 4 small, hardly to be distinguished, tooth 5 confluent with inferior angle, forming together a rudimentary knob. Part of mandible beneath 3rd tooth, small.

Maxilla (Pl. XXII, fig. 7): edge straight, two long spines at upper end and two slightly longer ones at the lower extremity of the edge. Between the two pairs a shallow notch and 5 spines arranged in a single row are seen (fig. 7*). Between the bases of each two spines an extremely small interspace is regularly seen.

Outer maxillae (Pl. XXII, fig. 8): outer lobe with nearly parallel and almost straight lateral margins, and with the summit obliquely truncated. Hairs scattered over large part of interior surface and many of them directed perpendicularly to longer axis of lobe. Inner lobe elongate, with numerous hairs which are relatively strong and more distinctly feathered than those of outer lobe.

Cirri. First pair: rami very unequal, of 6 and 14 segments respectively. Segments of the shorter ramus short, with rounded angles, the last segment with very strong spines situated on its extremity. Longer ramus has the lower segments broad and very short, the distal ones are almost quadrate.

Second pair: rami rather unequal, of 6 and 9 segments. A group of very strong spines is situated on the extremity of the last segment of each ramus.

Third pair: rami nearly equal, of 8 and 9 segments, spine-like hairs on anterior face of several segments of longer ramus extremely minute; pedicels very elongated. The first or basal segment of the pedicel has a dense row of curved hairs along its posterior face. The thorax bears a curved row of such hairs in continuation of those on the pedicel.

Fourth pair: second segment of the pedicel of each cirrus furnished with a row of about a dozen distinct teeth, which together form a saw-like longitudinal edge along the anterior face of the segment (Pl. XXII, fig. 9). The three lowest segments of the one ramus have a couple of such teeth, disposed on anterior face near the extremity of each segment. Number of segments in one of the rami 12, the other rami broken off. The middle segments bear two pairs of hairs on the anterior face; they are situated very close together and a large part of the anterior face of each segment is quite devoid of hairs in consequence.

Sixth pair: like the other cirri, broken off; therefore, number of segments undecided. The middle segments of the cirrus (Pl. XXII, fig. 10) have two pairs of hairs only, the upper pair longer, the more inferior one very short and situated at a distance from the upper pair, equalling about one fifth the length of the anterior side of the segment. Hairs on the posterior face disposed near the extremity not very long, groups formed of few hairs only.

Penis broken off, basal part rather broad; no sharp point is seen at the dorsal side near basis of penis.

Only a couple of specimens were taken; this happened at:

Stat. 164. August 20, 1899. Lat. 1°42′.5 S., Long. 130°47′.5 E. Depth 32 m. Bottom: sand, small stones and shells.

General Remarks. This species is no doubt closely related to *B. quadrivittatus*, which was dredged at the same station. I have been obliged to consider and to describe it as a distinct species, finding that not only the outward shape of the shell was different, but that the structure of the animal's body showed some very characteristic and remarkable differences. As already pointed out, the Station 164 is one of those where several species of *Balanus*, as well as other genera of Cirripedia were collected.

20. *Balanus hystrix* n. sp. Pl. XXII, fig. 11—18.

Shell dirty white, the other valves indistinctly, the carina distinctly ribbed longitudinally; orifice pentagonal, somewhat toothed. Radii triangular, with their summits oblique, striated horizontally. Scutum with a deep longitudinal groove parallel to the occludent margin, and with the articular ridge not prominent. Tergum with the longitudinal furrow open, and the basal margin forming a straight line on opposite sides of the spur. Inner faces of the middle segments of the cirri of the third, fourth and fifth pairs with several rows of teeth.

This small *Balanus* (Pl. XXII, fig. 11) has a rather depressed, globulo-cylindrical shell, being only slightly narrower at the large pentagonal orifice than at the basis. The orifice is indistinctly toothed, the surface is feebly-ribbed longitudinally, the carina, however, shows rather deep longitudinal ribs, the bottom of the furrows between these ribs being coloured dark blue or blackish. The radii have oblique summits, their surface is striated with lines parallel to the basis, their free edges are distinctly serrated. The summits of the alae are also oblique and are feebly rounded. The shell is thick and is strongly ribbed on the inner surface. It is perforated by a single row of rather wide quadrate canals, some of which seem to be open near the basis. The radii show traces of horizontal tubes or canals between the well-developed septa. The basis has numerous ridges radiating from its centre; they correspond with septa extending in the same direction and separating the canals of the basis from each other.

The colour of the shell is dirty white; here and there rudiments of a yellowish epidermis are seen attached to the surface. It seems to be a small species: the greatest diameter of the largest specimen collected measures 5 mm. at the basis.

The scutum (Pl. XXII, fig. 12, *a* and *c*), is of an elongately triangular shape and has the occludent margin strongly and sharply serrated; its tergal margin is feebly convex, its basal margin markedly so. The growth-ridges are not very prominent on the outer surface, but the rather deep longitudinal groove which extends parallel to the occludent margin is very characteristic, especially as there is a slight ridge or ledge between it and the occludent margin. As the growth-ridges pass transversely over the furrow, they divide it into a series of pits, which, however, are not very distinct. On the inner surface the articular ridge is not very prominent and extends over two-thirds of the length of the tergal margin. The cavity for the adductor

muscle is very shallow and the adductor ridge is very feebly indicated; the cavity for the lateral depressor muscle is somewhat more distinct.

The tergum (Pl. XXII, fig. 12, *b* and *d*) is short and rather broad. Its scutal margin is straight, its apex slightly, though not sharply pointed; its carinal margin is very feebly convex, and the two parts of the basal margin form together a straight line on opposite sides of the spur. Externally the tergum shows rather distinct growth-ridges and an open longitudinal furrow. The spur, which is obliquely truncated at the extremity, has a rather long free-extending part. Its width is about one fifth of the breadth of the entire valve. On the inner surface the articular ridge is long, but not very prominent, and the articular furrow is not very deep. The crests for the lateral depressor muscles are hardly visible.

With regard to the structure of the animal's body the following seems of interest:

Mouth. Labrum (Pl. XXII, fig. 13) with shallow notch, wide at entrance and three teeth on each side of it; the sub-triangular portion is not very broad but rather elongate.

The palpi are elongately oval, with the extremity rounded. The outer surface is furnished with a row of long and slender spine-like hairs standing at some distance from each other; near the free extremity the same surface is furnished moreover with a group of not very numerous hairs which pass imperceptably into the rather dense row of shorter hairs arranged along the upper margin. The hairs on the inner surface are short and delicate and grouped in the ordinary way: a longitudinal row is arranged in a line almost parallel to the upper margin and these hairs are directed towards the free edge of the labrum.

Mandible (Pl. XXII, fig. 14). Distance of the extremities of teeth 1 and 2 greater than that between 2 and 3, in the proportion as 4 to 3. Teeth 1 and 2 pointed, 3 thick and indistinctly double. Tooth 4 is small, tooth 5 and inferior angle are represented by small nobs.

Maxilla (Pl. XXII, fig. 15) with the edge straight, without a notch behind the upper pair of larger spines, and with five somewhat shorter spines on the middle part of the edge and two larger spines situated near the inferior angle, which itself bears a few shorter bristles. Several delicate hairs are observable between the spines.

Outer maxillae have the outer lobe elongately oval, and over a large part (the outer half) of the inner surface densely clothed with hairs, rather numerous ones being arranged in a row over the inferior half of the same surface; the inner lobe has the interior face rounded and furnished with not very numerous, but rather long and feathered hair-like spines.

Cirri. First pair with the rami very unequal, of 6 to 7 and 16 segments. Inferior segments with the inner faces somewhat protuberant.

Second pair with short rami, of 5 and 6 segments; the inner faces rounded and not protuberant, densely clothed with brushes of spine-like hairs.

Third pair considerably longer than cirri of second pair, having respectively 8 and 9 segments in the two branches. Second to penultimate segments (Pl. XXII, fig. 16) of both rami having the rounded inner faces armed with numerous teeth, grouped in rows, and diminishing in size from the front margin (where they appear like strong downwardly-curved teeth), over the surface, to the posterior margin.

Fourth pair has the rami unequal, having 11 and 15 segments respectively. The lower segments are shorter, the upper segments are more elongate, $2^1/_2$ to 3 times as long as broad This is the case in most species of *Balanus*; it is somewhat exceptional, however, that while the 3 distal segments of the shorter and the 5 distal segments of the longer ramus are furnished with only three pairs of spines of different size on their inner faces, the lower segments have, in addition, a row of downwardly-curved teeth developed along the anterior margin, rows of still smaller teeth being disposed on the inner face, in the same way as they are observed on the cirri of the third pair of this species. Of the shorter ramus, the first segment shows only one, and the second segment a few of these teeth, they are well-developed on segments 3 to 7, still represented by a few on segment 8, and not seen at all on segments 9 to 11. The longer ramus shows a few of them on segments 1 to 3 and 9 to 10, the segments 4 to 8 have them fully developed, and the segments 11 to 15 have none at all. Of the 3 pairs of spines observed on the upper segments, only two are seen on most of the lower segments. The tufts of spines on the dorsal surface of the segments, close to its upper margin, are only feebly developed.

Fifth pair has nearly equal rami of 16 and 17 segments. The lower segments are shorter, the upper segments elongate. The number of pairs of spines on the inner face of each segment is 3, a fourth pair of extremely short ones being already seen on several segments. The segments 5 to 9 are furnished in both rami of this cirrus with the same rows of teeth (Pl. XXII, fig. 17) which are seen on the middle segments of cirri 3 and 4. The teeth along the anterior margin of the segments of this cirrus are not so strong, however, as the corresponding ones of the preceding cirrus. The lower segments are furnished, on the dorsal surface, close to their upper margin, with a small tuft of spine-like hairs, one of which is nearly as long as the segment itself.

Sixth pair has nearly equal rami of 20 and 21 segments. Middle segments elongate, $2^1/_2$ to 3 times as long as broad, slightly broader towards distal extremity. Most segments are furnished on their inner face with four pairs of spines; the last pair of these is of greater length than the segment itself, the penultimate is a trifle shorter than the segment, the other two pairs being short and extremely short respectively. The rows of teeth which are observable on the inner faces of the middle segments of the 3rd to 5th cirri are completely wanting on the sixth cirrus (Pl. XXII, fig. 18). The tufts of spine-like hairs on the dorsal surface of each segment are only feebly developed.

On the pedicels of the 4th to 6th cirri on both segments, near the anterior face and the upper extremity, a group of small spine-like teeth of the same shape as those on the segments of the 4th and 5th cirri, but smaller, can be made out.

Penis of moderate length, tapering towards the extremity and with a few hairs scattered over the surface.

This species was collected during the cruise of H. M. S. "Siboga" at:

(± Stat. 231). November 14—18, 1899. Ambon-anchorage, Reef-exploration. The depth at the anchorage was 40 m., but it was not noted at the place where the small Balani were collected. Bottom: coral-sand.

General Remarks. This species, like several others of the genus *Balanus*, caused me great trouble, which was made greater by the scantiness of the material. I certainly would not have given a name to the species, nor undertaken a description of it but for the very special character of the species. I am quite sure that it will be possible to recognise it with the aid of the description given here, should it be found again. The shape and the structure of the opercular valves, of the scutum especially, show some resemblance to the valves of DARWIN's variety *vesiculosus* of *B. tintinnabulum*: the scutum shows a single row of square holes such as, according to DARWIN, are seen arranged in two or more rows radiating from the apex of the valve, on young specimens of the above-named variety. But this seems to be a somewhat accidental resemblance, the structure of the animal's body and of the cirri especially, being quite different. The very peculiar armature of the cirri of the 3rd pair, of the middle segments of the 4th cirrus (which in the present species is even repeated, though more feebly, on the cirri of the 5th pair), which DARWIN considered as characteristic for the genus *Acasta*, and which has now been observed by other investigators and myself in several species of *Balanus*, in no other species of this genus is so well-developed as in the present. The question as to the importance of this peculiar structure for the arrangement of the species of the genus *Balanus*, was discussed by me under the head of the genus itself.

7. Sectio: Patella-Balanus

21. *Balanus calceolus* Ellis. Pl. XXII, fig. 19—25.

DARWIN, CH., Monograph. The Balanidae, Verrucidae etc. 1854. p. 218, pl. III, fig. 3*a*—3*e*.

This species is represented by a single specimen in the Siboga-collection. Its shape and the structure of the opercular valves leave no doubt as to its really representing this species.

DARWIN's diagnosis of this species is a very short one: parietes and basis porose; scutum with the pit for the lateral depressor muscle small and deep. The description and the figures he gives, however, are much more explicit.

The shell (Pl. XXII, fig. 19) is elongate and attached to a small piece of a yellowish-coloured stem which perhaps belongs to a species of *Gorgonia*. The longest diameter of the basis is about 8.5 mm., the greatest height of the shell 4.5 mm. The colour of the shell is dull white, the basal parts of the compartments however, are brownish-purple, longitudinal stripes of that colour radiating in the direction of the orifice; the basal cup which almost quite encloses the little stem is coloured white.

With respect to the scutum (Pl. XXII, fig. 20, *a* and *c*) I must point out that the apical part is slightly produced and upturned, the occludent margin being somewhat hollowed out. This is not seen in DARWIN's figure. Nor is the pit for the lateral depressor muscle so distinct in the Siboga-specimen, as, according to DARWIN, it should be. The tergum (Pl. XXII, fig. *b* and *d*) has the apex slightly more produced, but the shape of the spur, with its very characteristic longitudinal crests extending as so many little teeth beyond the margin, is exactly as in DARWIN's description.

DARWIN did not know the soft parts of this species. Therefore I used thore of the Siboga-specimen to make up this deficiency.

Mouth. Labrum (Pl. XXII, fig. 21): notch very wide at entrance, triangular, not very deep. Lateral parts bear three teeth on each side of notch and have rounded corners. The height of the sub-triangular shield is considerable and almost equals its greatest width.

Palpi ovate, with the free extremity rounded, the upper margin slightly, the inferior margin strongly bowed. The outer surface bears a double row of longer hairs or bristles, beginning at the free extremity and making an angle with the inferior margin; the same surface shows a group of such longer hairs disposed near the free extremity of the palpus. The margin of the palpus at the extremity, and the inner surface near that extremity are bordered by a number of quite microscopic hairs or ciliae. The latter surface bears a row of curved hairs at some distance from the upper extremity, which hang over the edge of the labrum when the palpus is not uplifted. The hairs arranged along the upper margin are short and not numerous, and go over towards the basis of the palpus in a group of hairs of equal size, scattered over the inner surface.

Mandible (Pl. XXII, fig. 22): the free edge has five distinct teeth and an inferior angle. Teeth 1 and 2 strong and pointed, tooth 2 with additional tooth, 3 blunt, with small additional tooth, 4 small, distinctly double-pointed; 5 also small, pointed; inferior angle terminating in three delicate flat teeth.

Maxilla (Pl. XXII, fig. 23): the free edge is relatively long and bears 2, 4 and 2 spines, the upper pair consisting of a broader and a somewhat narrower spine which are situated close together. There is a small but distinct notch (Pl. XXII, fig. 23*) at the base of which a few delicate hairs are discovered; then four somewhat thinner and shorter spines, and two long and slightly flexuous spines, situated at some distance from the inferior angle, the remaining part of the edge bearing about 5 delicate and relatively short spines. Such a shorter spine is also seen at the base of the second spine of the upper pair. Upper and lower margins not parallel but together forming an angle, shape of maxilla triangular in consequence.

Outer maxillae (Pl. XXII, fig. 24): the outer lobe is oval, short and remarkably broad. The tuft of spines seen along the upper margin and over inner surface of superior half, rather dense; few hairs only scattered over inferior half of same surface. Inner lobe broad and rounded, covered with numerous hairs, the longer ones seen along inner margin, rather strong and feathered and bent downwards and inwards.

Cirri. First pair has the branches unequal in breadth and, probably, in length also. The longer branch, however, is broken off in both cirri. The shorter one has 8 to 9 segments, which are distinctly protuberant on their inner face. These protuberances are covered with a dense group of straight and relatively strong spines.

Second pair has the branches slightly unequal, of 8 and 9 segments respectively; the 5 to 6 inferior segments are protuberant on their inner face. The protuberances bear numerous short and relatively strong spines arranged in several rows.

Third pair different from second by the inner faces of the segments being less protuberant and by the protuberances bearing only a single transverse row of spines. The

whole cirrus only little longer than the 2nd and having 9 and 10 segments in the two rami.

Fourth pair has 16 to 18, fifth 18 to 19, 6th pair 19 to 20 segments. All the segments (with the exception of the two or three last ones, which have only two pairs of spines) are furnished on their inner face with three pairs of spines (Pl. XXII, fig. 25) of unequal size. Each segment has at the outer face near the extremity a tuft of spines, of which one is longer, its length nearly equalling that of the segment. The shield-like swellings at the base of the 3rd to 5th cirri are furnished with dense tufts of long hairs which are directed towards the hindermost part of the body.

Penis is rather short; hairs on distal part directed perpendicularly to the long axis, a rather dense tuft is situated at and round the extremity.

The specimen was furnished with eggs in the mantle-cavity. The eggs have an elongately oval shape, are not quite twice as long as broad or thick; their long diameter is about 0.17 mm.

The specimen was collected at:

Stat. 164. August 20, 1899. Lat. 1° 42'.5 S., Long. 130° 47.5 E. Depth 32 m. Bottom: sand, small stones and shells. Several other species of *Balanus* (see the list in the introductory part) were collected at this Station.

Geographical Distribution. According to Darwin this species is found on the West Coast of Africa, at Tubicoreen, near Madras and in the Mediterranean (?). According to Weltner (Verzeichniss, 1897), the Berlin Museum has specimens from Japan, from West-Australia (Mermaid Strait), and from Guinea. All the Berlin specimens are attached to Gorgonidae. It therefore seems to have a world-wide distribution, and we cannot be astonished that it was found also in the Malay Archipelago.

The depth at which it was collected on former occasions is not mentioned.

22. *Balanus navicula* Darwin. Pl. XXII, fig. 26. Pl. XXIII, fig. 1—3.

Darwin, Ch., Monograph. The Balanidae, Verrucidae etc. 1854. p. 221, pl. III, fig. *6a—6d.*

A very small *Balanus* attached to a small stem of a *Gorgonia*, looks much like the figure of the above-named species (Pl. XXII, fig. 26, *a* and *b*) given by Darwin. The narrowness of the carino-lateral compartments and an indication of striae on the surface of the scutum decided me to consider the specimen as belonging to this species.

The longest basal diameter, which according to Darwin is 0.4 of an inch — over 10 mm. — in the Siboga-specimen measures only 2.6 mm.: it is, probably, a very young specimen. The rostrum is elongate, but the basis does not enclose the branch of the *Gorgonia*, therefore it is not furrowed as the case is in *B. calceolus*.

The scutum (Pl. XXIII, fig. 1, *a* and *c*) corresponds well with Darwin's description, but the raised striae which should radiate from the apex in my specimen are indicated only by lines not very distinct. The adductor ridge is not developed, the articular ridge elongated. The tergum (Pl. XXIII, fig. 1, *b* and *d*) is slightly beaked, its scutal margin is nearly straight, whereas in Darwin's figure it is somewhat hollowed out. The tergum is extremely brittle and its spur was broken off in both valves, therefore I am not quite sure that the figure given is quite exact.

DARWIN did not have the material with which to investigate the body of this animal. The small specimen from the Malay Archipelago, which can hardly be considered full-grown, furnished me with the following details:

Mouth. Labrum (Pl. XXIII, fig. 2): with three teeth on each side of the wide, triangular notch. The thickened sub-triangular shield is high, its height equalling the width.

Palpi: ovate with the lower margin more strongly bowed than the upper margin. Longer hairs on outer surface very few: 4 or 5 arranged in a longitudinal row which makes a very sharp angle with the margin near the free extremity. The upper margin bears a series of not very numerous hairs, diminishing in size towards the attached basis of the palpus; the hairs seen on the inner surface short and not numerous.

Mandible: much like that of *B. calceolus*; five teeth and an inferior angle, the latter terminating in two extremely small flat teeth.

Maxilla (Pl. XXIII, fig. 3): same structure as in *B. calceolus*, free edge rather broad and furnished with 2, 3 and 2 spines. Notch small, has a single hair or delicate spine situated at its base. Upper margin of maxilla very strongly curved, shape of the whole triangular, apodeme relatively long.

Outer maxillae: as in *B. calceolus*, outer lobe slightly more elongate.

Cirri. First pair with very unequal rami, of 5 and 9 segments respectively.

Second pair with slightly unequal rami, of 5 and 6 segments respectively.

Third pair with somewhat more slender and also slightly unequal rami, of 6 to 7, and 7 to 8 segments; no trace of teeth to be seen along or near anterior face of the segments, or on the longer or the shorter ramus.

Fourth pair with unusually short rami, of 10 and 12 segments respectively.

Fifth and sixth pairs have the rami longer: although the number of segments is 11 to 12 only, the segments are more elongate. The greatest number of pairs of spines observable on the inner faces of the segments is three; in some of the middle segments, however, a fourth extremely minute pair can be distinguished. Hairs seen on outer surface of segments near the extremity forming a small group, one being much longer than the others. (The cirri show more distinctly, I think, than do the parts of the mouth, that the specimen is a young one.)

Penis very long, tapering towards extremity, and bearing only a few and very minute hairs.

The specimen was collected at:

Stat. 144. August 7/9, 1899. Near the Anchorage north of Salomakiëe-(Damar-)Island. Depth 45 m. Bottom: coral and Lithothamnium.

Geographical Distribution: DARWIN saw specimens of this species only from Tubicoreen, Madras. According to WELTNER, the Berlin Museum has specimens from Singapore, attached to *Suberogorgia suberosa*.

23. *Balanus investitus* n. sp. Pl. XXIII, fig. 4—11.

Parietes and basis with pores, radii without pores. Scutum with adductor ridge; tergum

with the apex slightly beaked and without a longitudinal furrow. Shell and cup-formed basis covered by a tissue or film of the Alcyonarian to which it is attached.

This remarkable species presents us with an interesting case of commensalism. The cup-formed basis is attached to a part of the bifurcating stem of an *Acanthogorgia*, which is covered by a substance composed of a tissue interwoven with calcareous spiculae and developing here and there into little calyces, from the surface of which numerous spiculae stand off (Pl. XXIII, fig. 4). The shell of the *Balanus* is covered by the same substance which here also develops into numerous such calyces.

This *Balanus* belongs to the same section of the genus as *B. calceolus*, *B. navicula* and others. Its shape (Pl. XXIII, fig. 5) is conical, the shell being elongate, however, in its rostro-carinal axis. In both specimens it is the rostrum that, by its protraction, causes the elongation of the shell. The orifice is rather large and rounded, somewhat heart-shaped owing to a little excavation at the rostral extremity. The carinal-latus is relatively narrow, the latus triangular, with the summit horizontally truncated. The radii are narrow, with the summits somewhat oblique, the alae have the summits nearly parallel to the basis. The basis is cup-formed, much elongated towards the rostral extremity of the shell; in the median line the rostral part of the basis has a deep furrow, which quite encloses the stem of the colony to which the *Balanus* is attached. The colour is pale-yellowish, that of the basis transparent white; the shell is very thin and brittle, and the compartments readily separate.

The scutum (Pl. XXIII, fig. 6, *a* and *c*) is rather thick and has very distinct growth-ridges. Its basal margin is distinctly sinuous. The articular ridge is prominent, the adductor ridge slightly, yet distinctly developed; the cavity for the adductor muscle is indicated.

The tergum (Pl. XXIII, fig. 6, *b* and *d*) has the apex slightly beaked, the articular ridge well-developed, and the spur rather broad, and obtusely pointed. There is no longitudinal furrow, but in its place the surface developes into a kind of longitudinal crest. The crests for the depressor muscles although not prominent are distinctly indicated. The scutal margin is nearly straight, the basal margin, between the spur and the basi-carinal angle, distinctly hollowed out.

With regard to the structure of the animal's body the following may be of interest:

Mouth. Labrum (Pl. XXIII, fig. 7) with rather deep notch, wide at entrance, closed near the bottom. Three small teeth on each side, one of these, however, is wanting in one of the specimens. The lateral margins on each side of notch not quite in a line but together making an angle. The sub-triangular shield-like thickening is about as long (or high) as it is broad.

Palpi ovate, with the upper margin straight, and the lower margin distinctly convex, the two margins meeting each other in a rounded angle. Spines and hairs on surface not numerous; those along the upper margin short; a group of from four to half-a-dozen longer hairs are disposed on the outer surface along a line forming an angle with the lowor margin near the free extremity. The free extremity, moreover, bears a few longer hairs forming a tuft with those of the outer surface and the upper margin.

Mandible (Pl. XXIII, fig. 8) has five teeth; teeth 2, 3, and 4 are double. Tooth 3 has the larger one broad and flat. Distance between extremities of teeth 1 and 2, one and

a half times the distance between the extremities of teeth 2 and 3. Tooth 5 pointed. Lower angle small, yet well-developed, and terminating in 2 or 3 very small, flat, pointed teeth. Lower part of the whole mandible well-developed.

Maxilla (Pl. XXIII, fig. 9) with a distinct notch behind the two upper spines, a few short hairs being disposed at the base of the notch. Between the notch and the two lower spines, the free edge bears only 2 or 3 spines; where there are three spines the first after the notch is represented by a pair. The upper two spines are longer, the others hardly differ in size. The shape of the maxilla is triangular, its upper margin strongly bowed; the apodeme is long, as long as the maxilla itself, the spines included.

Outer maxillae (Pl. XXIII, fig. 10) have the outer lobe short and broad, and the hairs on the surface and at the free extremity not very numerous. The tuft formed by them on the extremity is not very dense. The inner lobe has the surface that is directed to the interior rounded, and covered with several stronger and feathered hairs, part of which are directed towards the basis of the maxilla. The outer maxillae, like the other parts of the mouth, show great resemblance to the corresponding parts of *B. calceolus* and other species of the section.

Cirri. First pair: branches unequal, with 5 to 6, and 9 to 10 segments. Segments not strongly protuberant, those of longer ramus somewhat more so than those of shorter ramus.

Second pair: 7 and 8 segments respectively in the two rami; distinctly developed tufts of hairs disposed on the protuberant parts of the segments.

Third pair: with 8, and 9 to 10 segments respectively. Groups of hairs less-developed than on cirri of 2nd pair, standing off in all directions and forming no distinct tufts.

Fourth pair: with 14 and 16 segments respectively in the two rami.

Fifth pair: with 15 and 17 segments respectively.

Sixth pair: with 17 to 18, and 18 to 19 segments. Three pairs of spines on the inner face of the segments (Pl. XXIII, fig. 11); in a very few cases only, a trace of a fourth pair could be made out. On the outer face of each segment and near the extremity, a few spines are seen, one of which is much longer than the others, and exceeds the length of the segments.

Penis: long in the one, unusually long in the other specimen, tapering towards the extremity; very few hairs scattered over its surface.

This interesting species of *Balanus* lives attached to the branches of an Alcyonarian, which NUTTING has determined as *Acanthogorgia truncata* Studer.

It was collected at:

Stat. 310. February 12, 1900. Lat. 8° 30′ S., Long. 119° 7′.5 E. Flores-Sea. Depth 73 m. Bottom: sand with few pieces of dead coral.

General Remarks. This species shows relationship to *B. navicula* in some respects at least. It forms a very natural and at the same time characteristic group with the other species of the same section.

A small specimen of a *Balanus* collected by the Siboga at Station 260, belongs, probably, to the same species. It was found attached to a reddish-brown stick, its shape

was conical, with a rather small opening. The shell was almost entirely covered by a yellowish tough coat, which covered the stick also. The coat being taken off, a transparent white specimen appeared, which, however, fell to pieces on being touched; it must have been dead on being dredged: the animal itself is wanting and of the opercula, only one of the scuta was present. This resembles in shape and by its distinct growth-ridges the same valve of *B. investitus* from Station 310. This is also the case with the calcareous basis, the rather broad alae, and the narrow radii. The specimen was collected at:

Stat. 260. December 16 and 18, 1899. Lat. 5° 36'.5 S., Long. 132° 55'.2 E. 2.3 miles N.W. from the North point of Nuhu Jaan, Kei-islands. Depth 90 m. Bottom: sand, coral, and shells.

24. *B. cornutus* n. sp. Pl. XXIII, fig. 12—16.

Carino-lateral compartment wanting. Rostrum elongate. Lateral compartments and basis growing out into lateral horns, the cup-formed basis terminating in four excrescences.

This remarkable form is represented by a single specimen. It belongs doubtless to the same group or section as *B. calceolus* and *B. navicula*, and in outward shape comes nearest to *B. galeatus*.

The shell is conical, elongate in the rostro-carinal axis, yet at the same time broad in consequence of the lateral outgrowings of the lateral compartments (Pl. XXIII, fig. 12 and 13). The orifice is rounded, slightly elongate and pointed at the carinal end. The carino-lateral compartments are wanting; the four radii, with their broad summits, which are parallel to the basis, are white and stand off very distinctly from the beautifully yellowish-red-coloured parietes. The shape of the radii is triangular, the alae are narrow, with nearly parallel margins. The lateral compartments and the carina show darker red-coloured longitudinal stripes, the colour of the cup-formed basis is darker in the middle and lighter towards the circumference, with concentric lines in the central part which are crossed by somewhat darker stripes extending from the centre to the circumference. The carinal half of the basis is free, the rostral half has a longitudinal furrow which is occupied by the stem of the organism to which it is attached. Parts of a yellowish-coloured very hard and horny epidermis are here and there attached to the surface of the shell.

Scutum (Pl. XXIII, fig. 14, *a* and *c*) distinctly convex, with rather prominent growth-ridges. Basal margin sinuous. The articular ridge occupies two thirds of the length of the tergal margin, it is reflexed, but narrow. The adductor ridge is confluent with the articular ridge in the upper part and quite indistinct in the lower part.

Tergum (Pl. XXIII, fig. 14, *b* and *d*) with the apex pointed but not produced. There is no longitudinal furrow, and the spur, the width of which is about half that of the whole valve, has the lower end obliquely rounded. The scutal margin is nearly straight; there is hardly any distance between the basi-scutal angle and the spur. The basal margin is slightly hollowed out on the other side of the spur. Crests for the depressor muscle very feebly developed.

Regarding the body of the animal only the following can be said[1]:

[1] Mouth and first pair of cirri were lost through an accident (boiling-over of the solution of caustic potash).

Cirri. Cirrus of second pair has slightly unequal branches of 6 and 7 segments. Segments are not protuberant, but their surfaces are distinctly rounded near distal extremity. Dense tufts of hairs are disposed on these rounded surfaces.

Cirrus of third pair (Pl. XXIII, fig. 15) is slightly longer than that of 2nd pair, and has 8 and 9 segments in the two branches. The anterior margin of each segment is distinctly rounded near the middle, and furnished with a group of hairs which does not form a tuft and is considerably less dense than that on the corresponding segments of the 2nd cirrus. With the exception of the last ones, the segments of both rami show a longitudinal row of small teeth between the hairs. These are slightly more distinct on the segments of the longer ramus and somewhat smaller on the first or basal segment of each ramus. A few smaller teeth are disposed on the surface of most segments, forming indistinct rows, parallel to the main row along the margin.

Cirrus of fourth to sixth pairs have the number of segments varying from 15 to 17. Greatest number of pairs of spines (Pl. XXIII, fig. 16) seen on anterior face of segments is 4. Of the group of hairs on exterior face near the extremity of the segments, one hair as a rule is much longer and stronger than the others.

Penis very long, few hairs on the surface, and hardly any at the extremity; rather thick and stout at the basis, tapering towards the extremity, which is narrow, almost pointed.

The specimen was collected at:

> Stat. 164. August 20, 1899. Lat. 1°42′.5 S., Long. 130°47′.5 E. Depth 32 m. Bottom: sand, small stones and shells. It was found attached to a small piece of a brown stem, which, perhaps, is that of a species of *Gorgonia*.

General Remarks. In outward shape this species comes nearest to *B. galeatus* Linn., from which it is distinct, however, by the horn-like transverse excrescences of the laterals and by the absence of the carino-laterals. I think this is the first instance of a species of *Balanus* really showing only four compartments

25. *Balanus proripiens* n. sp. Pl. XXIII, fig. 17—21. Pl. XXIV, fig. 1—3.

Carino-lateral narrow, rostrum elongate. Basis with a longitudinal furrow. Scutum with the articular ridge well-developed and reflexed. Tergum broad with a very wide spur.

This new species is proposed for a form from rather deep-water (75—94 m.) that no doubt shows some resemblance to several species of Darwin's section B, but which, however, I think best to describe as a new species. It is represented by a single specimen: so as not to injure the specimen I refrained from investigating the structure of its parietes and basis. Its nearest relation, to judge by the shape of the opercular valves (the only parts of that species figured in Darwin's Monograph), seems to be *B. cymbiformis* Darwin.

The shape (Pl. XXIII, fig. 17) is elongate, lateral and rostrum, appear to creep along the thread-like stem of the *Gorgonia*. The shell is flattened laterally, the colour of the parietes and basis is white, with the exception of the carina, carino-lateral and adjacent parts of the lateral, which are pale-reddish, with slightly darker reddish longitudinal stripes. The

parietes and basis meet in an elegant flexuous line. The margins of the different valves and the colour of the surface appear only after the *Gorgonia* is taken away from the surface.

The carina is narrow at the upper extremity and much broader below; the carino-lateral is narrow, its breadth even diminishes from the basis to the upper end; the lateral is triangular, the rostrum is much elongated, as can best be seen from the figure. The radii are well-developed, increasing in width from the basis upwards, striated horizontally, their summits almost parallel to the basis; the alae seem to have oblique summits.

The scutum (Pl. XXIII, fig. 18, *a* and *c*), is narrow, its basi-tergal angle not so much rounded off, as, according to description and figure, is the case in that of *B. cymbiformis*. The articular ridge is well-developed and extends over half the length of the valve; it is distinctly reflexed. Pit for lateral depressor muscle hardly visible, cavity for adductor muscle somewhat more distinct. The teeth of the occludent margin are strongly developed.

The tergum (Pl. XXIII, fig. 18, *b* and *d*) is broad, the outer surface beautifully and delicately furrowed horizontally, and not flat but flexuous. The spur is broad, its basis obtusely pointed. It is limited by an extremely shallow longitudinal furrow towards the scutal side of the valve. Crests for the depressor muscle hardly visible.

The investigation of the animal's body gave the following results:

Mouth. Labrum (Pl. XXIII, fig. 19): notch triangular, wide, lateral parts nearly quadrangular, breadth of the sub-triangular shield greater than its height. Three teeth on each side of notch, and these are not pointed, but somewhat rounded at the extremity. On one side a tooth is wanting.

Palpi: oval, the upper margin not quite so strongly convex as the lower. Hairs on the outer surface not very numerous, forming an irregular group, some of them uniting to form a tuft, with hairs seen along free extremity. Hairs along upper margin rather numerous, those on inner surface also numerous and well-developed.

Mandible (Pl. XXIII, fig. 20): with five teeth, and the lower angle rounded off. Third tooth massive, 4th and 5th rudimentary, with rounded extremities. Distance between extremities of teeth 1 and 2 hardly greater than that between the extremities of teeth 2 and 3.

Maxilla (Pl. XXIII, fig. 21 and 21*): small notch below upper large pair of spines; a delicate spine situated at the bottom of the notch. Upper spines stronger than lower pair; between the two pairs 3 somewhat shorter spines are seen along the edge in the one maxilla, and 4 in the other. The latter spines diverge from the plane of the maxilla.

Outer maxillae (Pl. XXIV, fig. 1): outer lobe with straight inner and curved outer margin and the extremity obtusely pointed. Numerous hairs on distal half, a single row extending towards inner lobe, which is covered on its inner half with a group of feathered hairs which are directed inwards and downwards.

Cirri. First pair, branches very unequal, of 7 and 14 segments. The shorter ramus has five of its segments distinctly protuberant, the longer ramus has about 8 such protuberant segments. Protuberances bear dense tufts of hairs.

Second pair, branches slightly unequal, of 8 (indistinctly 9) and 10 segments. Hairs form dense tufts disposed perpendicularly on long axis of cirrus.

Third pair (Pl. XXIV, fig. 2), branches somewhat unequal, of 10 and 11 segments. Hairs do not form such dense tufts as on 2nd cirrus. Small but strong teeth along the anterior face of all the segments of the longer ramus. The teeth are arranged in groups of 2 to 4 on the distal half of the segments near the anterior margin, and in several rows. One of the spines situated on the tip of the last segment of this ramus is much stronger and looks almost like a claw.

Fourth pair has 19 and 20 segments respectively in the two branches. The 5 or 6 lower segments of the slightly shorter branch (with 17 to 19 segments) bear small teeth, either single, or double, or in groups of 3 or 4 near the anterior face (Pl. XXIV, fig. 3). These teeth are not situated exactly on the margin of the segments, but at a short distance from it, on the surface of the segments.

Fifth pair has 18 and 19, sixth 19 and 20 segments. Middle segments about twice as long as broad. Greatest number of pairs of spines on inner face 4 pairs. One of the hairs of the small group seen on exterior face of the segments, near the extremity, very long.

Penis: long, tapering towards extremity, hardly any hairs on surface.

The specimen of this species belonging to the collection of the Siboga, was found attached to a very long thread-like organism (a Gorgonacean) with distinct swellings at regular intervals. This seems to be *Scirpearella gracilis*. The substance covering the stem of the Gorgonacean is continued — as I pointed out above — over the surface of the *Balanus*; only after taking it away, I found that the said stem was quite enclosed in a longitudinal furrow of the slightly cup-formed basis.

The animal was dredged at:

Stat. 204, September 20, 1899. Lat. 4° 20′ S., Long. 122° 58′ E. The Station lies between the islands of Wowoni and Buton, northern entrance of Buton-strait. Depth 75—94 m. Bottom: sand, with dead shells.

8. Sectio: **Bathy-Balanus**

26. *Balanus pentacrini* n. sp. Pl. XXIV, fig. 4—10.

Shell white, surface of valves more or less distinctly furrowed longitudinally. Orifice large, toothed. Radii broad, summits oblique, alae with rounded summits. Scutum distinctly furrowed horizontally, articular ridge prominent, no adductor ridge. Tergum with the surface somewhat undulating and the spur situated near the basi-scutal angle. Parietes, radii and basis without pores. Labrum without notch.

This interesting deep-sea species connects the true Balani with the forms without radii, for which I propose to create the new genus *Hexelasma*. In the present species the outer surface of the shell is white and smooth; in the older (larger) specimens it is distinctly furrowed longitudinally (especially so towards the basal margin), in the smaller ones, however, either not or only indistinctly so. It is, moreover, feebly striated horizontally. The radii are rather broad and have the summits oblique, they are distinctly striated horizontally; the alae are also broad and have the summits rounded. The orifice is toothed. The whole shell (Pl. XXIV, fig. 4), especially

in the larger specimens and in the basal parts, is flattened laterally, which is caused by its being attached to the surface of a narrow object: the cirrus of a *Pentacrinus*. In some specimens moreover, the shell is distinctly unsymmetrical. Neither the compartments, nor the radii have pores. The basis, which is represented by an extremely thin, calcareous layer (so thin and transparent that the structure of the surface of the cirrus of the *Pentacrinus* can be seen through it) also devoid of pores.

Scutum (Pl. XXIV, fig. 5, *a* and *c*). The growth ridges on the outer surface are very distinct, broad, not very numerous, hence the surface looks distinctly furrowed. Its apex is pointed. On the inner surface it shows no trace of an adductor ridge and no cavity for the adductor muscle; the articular ridge, however, is prominent and extends over three quarters the length of the tergal margin. The cavity for the lateral depressor muscle is indicated, but only feebly developed.

Tergum (Pl. XXIV, fig. 5, *b* and *d*). The general shape of the tergum is triangular, with the scutal margin straight, the carinal margin slightly arched, and the basal margin distinctly hollowed out. The basal margin merges imperceptibly into the exterior margin of the spur; the latter is rather broad and its anterior margin is separated only by a very short distance from the basi-scutal angle. In the larger specimens, the interior margin of the spur is almost confluent with this angle. Externally the surface is undulating: the part along the scutal margin and that along the carinal margin being separated from each other by a triangular middle part, which lies on a somewhat deeper plane. On the inner surface the articular ridge is long and well developed, and this is also the case with the crests of the depressor muscles.

With regard to the structure of the animal's body the following may be pointed out:

Mouth. Labrum (Pl. XXIV, fig. 6 and 6*) without a central notch, a very shallow and rounded excavation being seen in its place. Teeth either small or not to be seen; in one of the specimens five small teeth could be made out on each side. Of the sub-triangular portion of the inner fold of membrane of the labrum, the basal margin can be seen as a crescent-shaped thickening, corresponding to the nearly horizontal chitinous list in other species of *Balanus*.

Palpi: of elongately-oval shape, with the free extremity rounded. The upper margin is nearly straight, the lower distinctly arched. A series of longer hairs disposed on the outer surface near the lower margin extend from the free extremity to about the middle of the palpus.

Mandible (Pl. XXIV, fig. 7) with five teeth, regularly decreasing in size from the first to the fifth. Distance between extremities of teeth 1 and 2 about one and a half times the distance between 2 and 3. Teeth 2 and 3 with small additional teeth. A little tooth representing the lower angle is confluent with tooth 5.

Maxilla (Pl. XXIV, fig. 8). A rather broad but shallow notch beneath upper pair of larger spines; edge beneath the notch slightly produced, armed with 4 to 5 somewhat shorter spines and the lower pair of longer ones. Numerous rather long hairs are seen between the spines, in the notch, beneath the lower pair, and round the lower angle.

Outer maxillae (Pl. XXIV, fig. 9) with the outer lobe short and broad; hairs on that lobe very numerous, forming dense tufts at the free extremity and round the convex outer margin. Hairs disposed on the inner surface delicate; those along the inner margin and

on the inner part of the surface of the inner lobe not much stronger and indistinctly feathered. The whole maxilla short and broad, the two lobes, however, very distinctly developed.

Cirri. First pair has the two rami very unequal and consisting of respectively 6 and 10 segments in the three specimens examined. The segments of the shorter ramus are slightly swollen, rounded at their inner face, they cannot however be said to be protuberant. On the longer ramus the hairs disposed on the segments are directed parallel to each other and to the longitudinal axis of the ramus. Those on the shorter ramus stand off transversely. On the tip of the last segment of the shorter ramus, a few stronger spines are observable, and on that of the longer ramus a couple of very long, indistinctly feathered, spine-like hairs.

Second pair has slightly unequal rami, of 6 to 8 and 7 to 9 segments.

Third pair has the rami somewhat more unequal than in second cirrus, of 8 to 10 and 9 to 11 segments. No trace of teeth on inner face of segments of this cirrus.

Fourth to sixth pair. Number of segments only slightly different: increasing from 19 in the fourth pair to 22 in the sixth. These numbers, however, could not be so well determined in all the specimens, as the tips of several cirri were broken off. Greatest number of pairs of spines seen on the inner faces of the segments: 4 (Pl. XXIV, fig. 10). On the exterior surface, close to its upper margin, each segment bears a group of usually three hairs, two of which are as long as the segment, the third being shorter.

Penis, long, as long as the cirri, or even longer, growing gradually narrower towards the extremity. Hairs on the surface very few, a few more at the extremity.

This species was collected by H. M. S. "Siboga" at two Stations, viz.:

Stat. 251. December 8, 1899. Lat. 5° 28′.4 S., Long. 132° 0′.2 E. Depth 204 m. Bottom: hard coral sand. (The trawl brought up pieces of grey clay, and manganese nodules, the interior of which consisted of dry clay). Two groups of specimens.

Stat. 253. December 10, 1899. Lat. 5° 48′.2 S., Long. 132° 13′ E. Depth 304 m. Bottom: grey clay, hard and crumbly. Numerous, most of them small specimens attached to the arms, cirri, etc. of a *Pentacrinus*.

General Remarks. This deep-sea species is, I think, especially remarkable by the structure of its mouth. It is a very distinct species, as shown by the shape of its shell and its opercular valves. But, it occupies a place of its own by the structure of the labrum, which has no notch. In this respect it approaches those deep-sea species that are characterised by the absence of radii as well, and which for this reason I think best considered as forming a new genus, for which the name *Hexelasma* is proposed in this Report.

Genus **Acasta** Leach

Darwin (1854) knew of nine species of this genus, and four species, so far I know, have been added to this list in the 58 years since elapsed. The new species are:

Acasta scuticosta Weltner[1], 1887, from Carthagena (Spain).

Acasta striata Gruvel[2], 1901, Atlantic Ocean, depth 400 m.

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[1] Weltner, W., Die von Dr. Sander 1883—85 gesammelten Cirripedien. Archiv für Naturgesch. LIII. S. 98—117. Taf. III—IV. 1887.

[2] Gruvel, A., Cirrhipèdes des Expéditions du Travailleur et du Talisman. 1902.

Acasta funiculorum Annandale[1], 1906, Gulf of Manaar, Ceylon.
Acasta Dofleini Krüger[2], 1911, East-Asia.

One of the species described by DARWIN (*A. undulata*) is known as occurring only in a fossil condition, viz. in Coralline Crag (Sutton). The number of known living species, therefore, at present would be twelve, or fourteen with the two described as new in the present paper.

In the 6th province, including the Malay Archipelago, this genus is richly represented; nine species are now known from this region:

Acasta sulcata Lamarck: Philippines, collected by CUMING, according to WELTNER[3].
Acasta laevigata J. E. Gray: Philippine Archipelago (DARWIN, WELTNER).
Acasta glans Lamarck: Pepela Bay, Rotti Island; Java Sea.
Acasta fenestrata Darwin: Philippine Archipelago (DARWIN).
Acasta purpurata Darwin: Philippine Archipelago, Sumatra (DARWIN).
Acasta sporillus Darwin: Sooloo (Sulu?) Islands, East Indian Archipelago (DARWIN).
Acasta funiculorum Annandale: Gulf of Manaar, Ceylon.
Acasta conica n. sp.: Spermonde Bank, Macassar.
Acasta nitida n. sp.: Java Sea.

Of the other known species, *A. cyathus* Darwin, according to WELTNER[3], occurs on the coast of Australia, and *A. Dofleini* Krüger in East-Asian waters. These species, or one of them, may perhaps, be found also in the East Indian Archipelago. As most of the species live quite embedded in sponges, they are, of course, easily overlooked; a careful examination of sponges to see if they are inhabited by species of this genus might show that more forms of it are still living, and that the known species have a wider geographical range than is at present supposed.

Very little is known of the geographical range of most species and several are known to occur at only one particular locality. *A. spongites* Poli is said to occur on the South Coast of England, in the Mediterranean, near the Cape of Good Hope, and, according to WELTNER, is found also at Hakodate (Northern Japan). Of late (1911), PILSBRY has described a so-called subspecies of this species as occurring off Kagoshima Gulf, Japan, at 185 meters. This species would therefore be a fair instance of world-wide distribution as occurring in this genus. But it would be necessary to settle, by comparative study of sufficiently rich material, that the specimens from these different localities really belong to the same species.

Most species seem to live only in shallow water. *A. striata* Gruvel is the only known deep-sea species of this genus: it is an Atlantic species collected by the French cruiser "Travailleur" at a depth of 400 m. PILSBRY's subspecies of *A. spongites* Poli would represent, however, another case of an *Acasta*-species occurring in deep water (185 m.). ANNANDALE does not say at what depth his new Ceylon species (*A. funiculorum*) was collected, but, most probably, it was found near the coast and in shallow water (coral reefs off Ceylon, on

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[1] ANNANDALE, N., On the Cirripedia (of the Report on the Pearl Oyster Fisheries of the Gulf of Manaar) Ceylon Pearl Oyster Fisheries. Supplement. Report. N° XXXI. 14 pag. 1906.

[2] KRÜGER, PAUL, Beiträge zur Naturgeschichte Ostasiens. Beiträge zur Cirripedien-fauna Ostasiens. Abhandl. Akad. Wiss. München. Math.-phys. Kl. Supplement-Bd. 2. N° 6. 72 S. 4 Taf. 1911.

[3] WELTNER, W., Verzeichnis der bisher beschriebenen recenten Cirripedienarten. Arch. f. Naturgesch. 1897, Bd. I.

Turbinaria). The new species from the Malay Archipelago, which will be described in this report, are also inhabitants of shallow water.

According to DARWIN, *Acasta* is always embedded in sponges, or in the sponge-like outer layer of the skeleton of *Isis*. ANNANDALE took his new species from the surface of *Turbinaria*, a Madreporarian coral. KRÜGER does not inform us from what host his new *A. Dofleini* was taken. WELTNER's *A. scuticosta* was found living in a sponge: *Tethya lyncurium* Johnst. GRUVEL, with regard to his new species, *A. striata*, only says that it was "ramenée d'une profondeur de 400 mètres". With regard to the Siboga-species, *A. glans* from Pepela-Bay, Rotti-island, was handed to me disengaged from the sponge in which, presumably, it was originally found embedded; the other specimens of this species, which were collected by the Dutch Fishery Inspection-Steamer "Gier", are still partly covered by pieces of sponge. *A. conica* n. sp. came into my hands with the sponge in which it is embedded. The surface of the latter shows almost quite globular excrescences, with a small oval opening at the tip, and the *Acasta* is found in this excrescence, the aperture of its opercular valves corresponding exactly to the opening of the sponge. The specimens of *A. nitida* n. sp. were taken out of the sponge and even quite clean when they came into my possession.

A few words may be said here on the peculiar position of the genus *Acasta* in the classification of the Sessile Cirripedes. DARWIN considered it as a Sub-Genus, without saying exactly what he meant by that term and "hoped" he might stand excused for admitting it as such. According to him the species of this genus, in the structure of the shell, and in all the characters derived from the opercular valves and animal's body, cannot properly be distinguished generically from some species of *Balanus*. He pointed out that some species of the latter genus (*B. navicula* and *B. cymbiformis*) agree in all essential respects with *Acasta*, and differ only in the shell being more elongate and in being attached to *Gorgoniae* instead of to sponges; *Acasta purpurata*, however, lives embedded in the outer layer of the skeleton of *Isis*, so that even the habit of living embedded in sponges fails in that species. There are, on the other hand, species of *Balanus* (*B. spongicola*, *B. declivis*) that inhabit sponges .... DARWIN finished by saying that the most important character of *Acasta* probably consists in the anterior ramus of the fourth pair of cirri differing slightly in the arrangement of its spines, and in some other points, from the rami of the posterior pairs of cirri, and considered this as a character not as yet observed in any other Cirripede.

As I pointed out when discussing the difficulties of subdividing the genus *Balanus*, this very same character is observed, however, in further species of *Balanus*, and, certainly, the validity of the genus *Acasta* has not been strengthened by this discovery. But, on the other hand, the present known species of *Acasta* seem together to form a very natural group, characterized by the thinness of the parietes in which pores are absent, by the great development of the radii, by the cup-formed basis and by their living — with a single exception — embedded in sponges. Therefore I would not consider it an advantage to cancel this genus and to include its species in the genus *Balanus*, however closely related the two genera may be. Perhaps a thorough study of sufficiently rich material of those species of *Balanus*

that I propose to include in the sections *Patella-Balanus* and *Armato-Balanus*, and at the same time of the known species of *Acasta*, might lead to a somewhat different conclusion — but with our present knowledge I think the best we can do is to bear in mind the near relationship existing between the two genera, and at the same time to avoid bringing together too closely what after all, perhaps, should be kept apart.

1. *Acasta conica* n. sp. Pl. XXIV, fig. 11—16.

Carino-lateral parietes narrow, hardly one tenth of width of lateral parietes; inner surface of parietes distinctly ribbed, outer surface smooth in the lower half and looking as if covered with scales in the upper half. Scutum broadly triangular, the outer surface delicately striated longitudinally, the articular ridge feebly developed; tergum with a deep longitudinal furrow and the spur obliquely-truncated, not quite one fourth of width of valve. Basis conical, its edge feebly crenated. Upper segment of pedicel of 4th cirrus with a row of well-developed teeth, lower segments of anterior ramus of same cirrus with groups of such teeth near the extremity of their inner faces.

This species (Pl. XXIV, fig. 11) belongs, no doubt, to the same group of species as *A. spongites* Poli and *A. sulcata* Lamarck. All the specimens I have seen were very small. Their colour is greyish-white, the occludent margin of the scuta having a black colour. The orifice is rather large and distinctly toothed, the tips of the compartments being pointed, and the summits of the alae and radii very oblique. These tips are somewhat curved inwards — but not so strongly as is the case in *A. nitida*. The surface of the parietes is smooth in the lower half, covered in the upper half with rounded scale-like patches, the exact nature of which I have not been able to discover. I can only say that the rounded patches on being examined with the microscope turn out to represent thinner parts of the wall. Small calcareous projections are disposed here and there on the surface; they seem to occur more generally and in greater numbers on the rostrum and carina than on the lateral valves. The inner surface of the valves is distinctly ribbed; these ribs do not quite reach to the basal margin of the valve. The edge of the basis is delicately crenated, but the little teeth of that edge do not correspond to the ribs of the valves, the latter being much less numerous. The radii extend down to the basis, but their summits are very oblique and their free edge is in contact with the adjoining latus over less than half the length of that latus. The surface of the radii shows feeble horizontal lines crossed by still less distinct oblique striae. The alae are about the same width as the radii, but they do not extend down to the basis. The basis is not very deep but distinctly conical.

The size of one of the larger specimens is: total height 4.5 mm., of the capitulum without the basis over 3 mm. Greatest basal diameter 3.5 mm.

Scutum (Pl. XXIV, fig. 12, *a* and *c*) triangular with the basal margin strongly convex, the basi-tergal angle much rounded off. Growth ridges very prominent, distinct till close near the apex. Outer surface moreover, distinctly striated longitudinally, the striae extending from the apex down to the basal margin. The upper part of the occludent margin is coloured

dark-purple; the teeth along that margin are sharp and prominent in the lower half. The articular ridge is only slightly developed, it does not terminate abruptly downwards, but it merges insensibly into the tergal margin. At the place of the adductor ridge, a longitudinal crest which is slightly prominent is observable, but this can be traced from the apex down to the basal margin of the valve. The cavities for the musculi depressores are only faintly indicated.

The tergum (Pl. XXIV, fig. 12, *b* and *d*) is elongate and slightly beaked, the spur is truncated, obliquely cut off, its width not quite one-fourth of width of valve. The outer surface has a well-developed longitudinal furrow, which is narrow at the apex of the valve and increases in width towards the extremity of the spur. Growth-ridges distinctly developed, narrow and numerous. On the inner surface the articular ridge is well-developed, while the crests for the musculi depressores can hardly be made out. The same dark-purple that is seen along the upper part of the occludent margin of the scutum, is observable also along the inner side of the articular ridge, and along the carinal margin of the tergum.

The study of the structure of the animal's body yielded the following results:

Mouth. Labrum with the notch not very deep, wide at entrance. Three small teeth on each side of notch. Shape of rhombiform shield-like portion much as in the other species.

Palpi somewhat square, not strongly swollen towards the extremity, hairs less numerous than in *A. glans*, but the general arrangement is the same.

The mandible (Pl. XXIV, fig. 13) has five teeth, and the lower angle truncated. The free edge is rather elongate, the lower part narrow. The second and third teeth are double, the free margin of the fourth is dentated, the fifth is short and pointed at the extremity. The truncated lower angle bears two short spines.

The maxilla has the upper and lower margins almost parallel — it does not in consequence grow much broader towards the free edge. This edge is nearly straight and the notch under the upper pair of larger spines is hardly to be distinguished. A double row of five spines, all of about the same length, is arranged between the upper and under pair of spines.

The outer maxillae (Pl. XXIV, fig. 14) have the outer lobe short, much shorter than in the other species of *Acasta* I was able to compare; the inner lobe seems to be somewhat more elongate than is the case in the other species. The hairs are distributed over the inner surface of the lobes in the same way as in the other species; those observed on the line extending from the outer to the inner lobe do not form a regular double row, and those on the inner lobe are less numerous than in *A. glans* on the same part.

Cirri. First cirrus has very unequal rami of 6 to 7 and 16 segments in an older specimen, and of 5 and 13 segments in a younger one. Those of the shorter ramus are somewhat broader, yet not protuberant on the inner face. Most segments of the longer ramus are of an almost quadrate shape. Spine-like hairs on the inner face of the segments of the shorter ramus, numerous ones at the extremity of the last segment of that ramus, but a few only at the tip of the last segment of the longer ramus.

Second cirrus also with strongly unequal rami of 6 and 9 segments in a younger specimen and 6 and 7 segments in an older one. The segments are a little longer than broad;

they are furnished with hairs in the ordinary way, with stronger spines on the inner face of the segments and on the extremity of the last segments, but the tufts are perhaps not quite so dense as in the other species of *Acasta* I examined.

Third cirrus (Pl. XXIV, fig. 15) not inconsiderably longer than second, the segments of the pedical being much longer. Rami slightly unequal, of 9 and 10, 8 and 9 segments respectively. The segments 1—5 of the anterior ramus are furnished on their inner face, near the upper margin, with a group of short spine-like teeth. The segments 2 and 3 are furnished, moreover, with a somewhat stronger tooth-like spine situated beyond the middle of the inner margin and standing off quite horizontally. These spines were not seen, however, in a younger specimen.

Fourth cirrus (Pl. XXIV, fig. 16): the inner margin of the last segment of the pedicel is furnished with a row of 12 pointed teeth, which increase in size from the basis to the extremity of the segment. A few smaller teeth are disposed along the main row, increasing in number and size towards the extremity of the segment. The lower segments of the anterior ramus are furnished with a group of strong and partly very strong spine-like teeth on their inner face and near the upper margin, the teeth standing with their basis up and near each other. In all, 9 of the 14 segments of the anterior ramus were found furnished with such groups of spines, which on the 15 segments of the posterior ramus are completely wanting. The segments of the latter ramus are furnished on their inner face with three pairs of spines: one pair of long ones near the outer extremity, a pair of extremely minute ones about the middle of the segment, and a pair not quite so small half way between the two other pairs.

Fifth and sixth pairs of cirri almost equal, of about 20 segments, which towards the extremity increase in length and at the same time grow narrower. The longest and narrowest segment is about five times as long as broad. The three pairs of spines are of the same size, and are distributed over the inner face of the segments in the same way as described for the posterior ramus of the fourth cirrus. Some of the segments of the 5th cirrus bear, moreover, a short tooth-like spine, which stands off horizontally from the distal part of the inner face of the segment.

Note. The description of the 4th to 6th cirrus is given from a smaller specimen; in the somewhat larger one I examined, these cirri were broken off, only three or four of the lower segments being present.

The penis is long and does not taper so strongly towards the extremity as in *A. nitida*. It is distinctly ringed; its distal part is covered with longer and more numerous hairs than in the other species of the genus.

This species was collected by H. M. S. "Siboga" at:

Stat. 73. Pulu Barang. Macassar, Spermonde-bank. The depth at which the Sponge containing the *Acasta* was taken is not given. According to the list of Stations the depth ranges from 45 m. to surface, at 2 miles W. of edge of Spermonde-bank.

2. *Acasta nitida* n. sp. Pl. XXIV, fig. 17—19. Pl. XXV, fig. 1—3.

Carino-lateral parietes about one fourth of width of lateral parietes; all the parietes

curved inwards towards upper extremity. Orifice rather small and distinctly toothed. Longitudinal rims furnished with small teeth, which in the younger specimens are more distinct and in the older ones less distinct, extend from the upper extremity of the parietes downwards. Scutum very broad, with short but strongly developed articular ridge. Tergum with the apex beaked, a broad obliquely truncated spur, a deep longitudinal furrow, and the surface between the furrow and the carinal margin beautifully decorated with crossing horizontal and longitudinal lines. Basis conical, with the edge almost quite smooth. Fourth cirrus with rows of teeth along inner face of pedicel and numerous segments of anterior ramus, fifth cirrus with similar teeth along inner face of several segments of anterior ramus.

This beautiful and very characteristic species (Pl. XXIV, fig. 17) is coloured orange-pink in the smaller and lighter pink in the larger specimens. The shape of the younger ones is more globular, that of the older ones somewhat more elongate, the height of the capitulum as a rule slightly surpassing that of the cup-formed basis. The upper parts of all the parietes are curved inwards, and the tips enclose a moderate sized orifice of curious shape (Pl. XXIV, fig. 18). The outer surface of the parietes is — in the younger specimens — furnished with small spine-like points arranged on longitudinal ribs and decreasing in number and size from the upper extremity downwards. These ribs and the points disposed on them are much less prominent in the older specimens. There are five of these ribs on the rostrum, four on the laterals, three on the carina, while the carino-laterals have a series of such points along each longitudinal side. For the rest, the outer surface is smooth, the inner surface being strongly ribbed in longitudinal lines. These ribs on the lower half are crossed by transverse ribs, the inner surface having there a reticulated aspect. The radii are not very broad and do not extend down to the basis; no apertures are left in the lower half, between the compartments. The summits of the radii are very oblique, their edges are not crenated. The outer surface is feebly marked by horizontal lines of growth and also by oblique lines running parallel to the lower half of the lateral margin. The alae are about half the length of the parietes, they are slightly broader than the radii, have more distinct horizontal lines of growth, and like the radii have very oblique summits.

The size of a large specimen was: total height 8.5 mm., height of the capitulum 5.5 mm., greatest basal diameter 6 mm.

The scutum (Pl. XXV, fig. 1, *a* and *c*) is relatively broad and short: the occludent and basal margins are long, the tergal margin relatively short. The occludent margin is almost straight and only superficially toothed; the basal margin is undulating, the lateral parts of the outer surface being somewhat lifted up. The tergal margin is distinctly convex. Lines of growth well-marked, longitudinal lines feebly indicated and only on the apical part of the valve. Articular ridge short, broad, with rounded circumference, articular furrow deep. Cavity for the musculi depressores indicated, but shallow.

The tergum (Pl. XXV, fig. 1, *b* and *d*) is also broad, nearly as large as the scutum and as strong or thick. Its carinal margin is curved, hence the angle it makes with the feebly excavated scutal margin is somewhat produced: beak-like. The spur is short and broad, more than one third of the width of the whole valve. Its base is truncated and extends parallel

to the basal margin. A broad longitudinal furrow separates the scutal part of the valve from the part along the carinal margin. On the latter part, the horizontal lines or ridges of growth are crossed by very distinct longitudinal ridges, the surface being divided into small squares each of which is distinctly excavated. The inner surface shows a short, strongly-curved articular ridge and a deep articular furrow; the crests for the musculi depressores are not visible, the valve, however, is somewhat excavated at that place.

The structure of the animal's body may be judged from the following details:

Mouth. Labrum much like that of *A. glans*, but the notch less deep and only two small teeth on each side of it. The rhombiform shield-like portion nearly as high as broad. The palpi are swollen towards the extremity, with a somewhat longer distal margin; outer and inner surface and upper margin covered with hairs in the same way as in the above-named species.

The mandible (Pl. XXIV, fig. 19) has five teeth and the lower angle rudimentary. Teeth 2, 3 and 4 are double. As in other species of *Acasta*, the free margin extending from the 1st to the 2nd teeth is quite straight and that between the second and third teeth is an exact prolongation of that between the two foregoing teeth. The fifth tooth and the lower angle are quite reduced and rudimentary; the inferior part of the mandible is not so strongly elongate as is the case in *A. conica*.

The maxilla grows broader towards the free edge and has this edge rather long in consequence. No notch under the upper pair of larger spines; about nine spines are seen between this upper and the lower pair of larger spines. Of the intermediate spines 4 are directed with their free extremity to one side, 5 to the other.

The outer maxillae (Pl. XXV, fig 2) have the outer lobe of an oval shape, rather long, slightly shorter, however, than in *A. glans*. The hairs on the inner surface are numerous and delicate and form a dense brush at the extremity and along the upper part of the inner margin of the lobe. Each hair of this brush is distinctly bent near the extremity. There is a row of hairs along the inner margin which stand off horizontally, and this can be followed to the upper margin of the inner lobe. The inner lobe has its surface, which is directed towards the interior, rounded, and is furnished along the interior margin with numerous hairs, which are directed towards the basis of the maxilla. These hairs are delicate, most of them are very delicately feathered.

Cirri. First pair has very unequal rami of 8 and 18 segments; those of the shorter ramus are not broader than those of the longer ramus; they have the inner face rounded, only slightly protuberant. The hairs seen on these rounded parts and those on the extremity of the last segment are a little stronger than the remaining ones, but the difference is not so striking as in *A. glans*.

The cirrus of the second pair has unequal rami of 8 to 9, and 12 segments; all the segments have the inner face somewhat rounded and furnished with dense groups of delicate hairs. The spine-like hairs on the extremity of the last segment of each ramus are distinctly stronger than the other hairs.

The third cirrus is only slightly more slender and elongate than the second; its rami are nearly equal and have 11 and 12 segments respectively. Tufts of hairs on the rounded inner

face of each segment, and those situated at and near the upper extremity of the outer surface of the segments not so dense as those on second cirrus.

The fourth cirrus (Pl. XXV, fig. 3) has 24 segments in the shorter (anterior) ramus and perhaps a few more in the other — this ramus being broken off in both cirri. Last segment of pedicel with a row of teeth along the front margin, which looks perfectly like a saw in consequence. The teeth increase only very slightly in size from the base of the segment towards the tip. A large number of segments of the anterior ramus show a series of such teeth along the inner margin, the number of these teeth varying from 4 to 6 on the 12 lower segments of this ramus. The teeth are somewhat claw-like and directed downwards, growing somewhat smaller from the lower towards the upper segments. The 12th segment has only 4 of these teeth; the segments 13 to 15 have also 4, but they are directed upwards with their tips. The segments 16 to 19 have 3, 2, 2 and 1 respectively of these teeth, which, moreover, grow gradually smaller. The posterior ramus has no teeth on the 10 lower segments, and has rows of 4 to 6 teeth along the inner face of the 9 following segments. These teeth are generally somewhat smaller than those on the anterior ramus and are, as a rule, directed upwards. The distal part of the inner face of each segment, in both rami, is furnished with a group of spines which represent the pairs of spines seen on the segments of the other cirri: the lower segments have only one pair, the following two to three pairs, placed so close together as to touch each other at the basis.

The cirrus of the fifth pair has elongate rami of 26 to 28 segments. Several segments of the anterior ramus — in the specimen I investigated more carefully, segments 3 to 24 — have the inner face or front margin furnished with a row of teeth, of the same shape but a little smaller and less numerous than those along the segments of the 4th cirrus. As a rule each row has three such teeth, sometimes, however, four or even five. They are completely wanting on the posterior ramus. They are as a rule curved downwards. The segments of the posterior ramus are furnished on their inner face with three pairs of spines. They are inserted along the upper half of the inner margin, yet not crowded together. On the outer face of each segment, close to its upper margin, a small group of delicate spines is situated: these are longer on the lower than on the upper segments.

The cirrus of the sixth pair has nearly equal rami of about 30 segments. The segments grow — as in the other cirri — somewhat longer and more slender, from the basis to the tip of the cirrus; they become, even where they are most slender, not longer than three times their breadth.

Penis long, rather thick at the basis, growing very narrow towards the extremity. Surface furnished with numerous short hairs which stand off perpendicularly from the surface.

This interesting species is not represented in the collection of H. M. S. "Siboga". It was sent to me with other Cirripedia taken in the Western part of the Malay Archipelago. As it was studied by me along with other species of the same genus collected by the Siboga in those waters, I think its description can be usefully inserted at this place. The exact locality of its occurrence was:

H. M. S. "Gier", N^0 12, Experiment 13. Lat. 6° 15′ S., Long. 110° 50′ E. Depth 40—50 m.

3. *Acasta glans* Lamarck. Pl. XXV, fig. 4—11.

DARWIN, Ch., Monograph. The Balanidae, Verrucidae, etc. 1854. p. 314, pl. IX, fig. 5*a*—5*c*.

According to DARWIN, this species is characterized by parietes which on the inner surface are quite smooth, and which have the lateral margins of each compartment inwardly prominent. The basis has the edge not (or only rarely) crenated, but furnished with six inwardly prominent teeth. The scutum is strongly striated longitudinally.

The Siboga collected a small specimen of an *Acasta* at Station 301 (Pepela-Bay, East-Coast of Rotti island), which at first I considered to be different from the known species of that genus. As I did not wish to disunite the specimen, I could not examine the inner structure of the compartments etc., and so doubt remained regarding its determination. I received afterwards numerous specimens of an *Acasta*, collected in the Java-Sea by the exploration-vessel "Gier"; I found that it corresponded to the smaller specimen from Pepela-Bay, but also, that there was sufficient ground for determining it as *A. glans* Lamarck. Since DARWIN's description of this species is rather short, and as it is not sufficiently illustrated (the figures given on DARWIN's Pl. IX illustrate only the basis seen from within, the compartments seen from within, and the tergum, internal view), it has been difficult to come to a conclusion — for several reasons, however, I think the one I arrived at is well-founded.

The inner structure of the parietes is exactly as in DARWIN's definition, the basis shows the six inwardly prominent teeth, and the scutum is striated longitudinally. The small specimen from Pepela-Bay (Pl. XXV, fig. 4) came in my hands detached from the object (sponge?) in which it had been embedded. But the specimens taken by the "Gier" are embedded in an open and porose sponge. The greatest diameter of the basis of the specimen from Pepela-Bay is 8 mm., the height of the shell 9 mm. Those taken by the "Gier" are larger: diameter of the basis from 10 to 13 mm., height of the shell from 15 to 17 mm.

The colour of the shell is dirty white to pale pink, with, in some specimens, the upper part reddish, the sheath being coloured slightly darker and transversely ribbed. The outer surface of the parietes shows distinct horizontal growth-ridges. In the younger specimens and in that of Pepela-Bay especially, the outer surface is studded with short calcareous points, irregularly distributed but disposed in transverse rows and somewhat more densely a little above the basis. The basis itself is almost quite flat in some specimens, in others irregularly cup-shaped, but never very deep; the central part sometimes forms a semi-globular excrescence.

The shape of the shell is somewhat flattened laterally, the tips of the parietes are curved inwardly, the orifice is medium-sized and distinctly toothed. The tips of the parietes are — in the older and larger specimens especially — often broken off. The radii have very obligue summits, the free margin being somewhat undulating; they are broadest about the middle and grow very narrow towards the basis; they are distinctly striated horizontally, the striae being crossed — in the larger specimens — by very faint longitudinal lines. The alae are about as broad as the radii; their free lateral margin is strengthened by a longitudinal rim. Rostrum and carina are broader than the lateral compartments, the carino-lateral compartments are about one-fourth the width of the parietes of the lateral compartments. The radii, where they are broadest,

are about three-fifths of the width of the lateral compartment at its basis. The inner structure of the parietes corresponds well to DARWIN's description.

The scuta (Pl. XXV, fig. 5 *a*, fig. 6 *a*) are elongate, narrower and thicker than in several other species of the genus. They are distinctly convex, the outer surface being hollow: bowed from the basal margin to the apex. The surface is strongly striated with longitudinal lines, the transverse growth-ridges are also prominent, the occludent margin is distinctly toothed in consequence. The longitudinal striae are much more prominent in younger (smaller) specimens than in larger ones. The part of the valve along the tergal margin makes an angle with the remaining part; it is obliquely truncated at the basi-tergal angle. The articular ridge is not very strongly developed, in older specimens, however, relatively more prominent than in smaller ones; the adductor ridge cannot be distinguished, but the cavity for the lateral depressor muscle is — in older specimens — well-developed.

The terga (Pl. XXV, fig. 5 *b*, 6 *b*) are flat and in younger specimens narrow: they seem to grow broader with age. The part corresponding to the spur is about half the width of the whole valve, it is obliquely truncated, its basal edge being parallel to the basal margin of the valve. The scutal margin is distinctly hollowed out, in younger specimens, however, the apex is more strongly produced than in older ones. The growth-ridges of the outer surface are only feebly developed. The articular ridge is slightly developed in the younger specimen, in full-grown specimens, however, it is somewhat more prominent. The crests for the depressor muscles can hardly be made out. The spur is confluent with the basi-scutal angle in the smaller specimens, in the larger and older ones, the basi-scutal angle is separated from the anterior margin of the spur.

The description DARWIN gives of the structure of the animal's body of the present species, is not very extensive. I therefore insert here the following details for comparison with other species.

Mouth. Labrum (Pl. XXV, fig. 7) with a not very wide, rather deep, triangular notch, and two or three teeth on each side of notch. When only two are present, the one nearer the notch may be stronger and bifid. The margins of the notch are furnished with delicate hairs or ciliae. The thickened chitinous portion that overhangs the oesophagus and represents the true labrum is quite rhombiform in this species. Its height nearly equals its breadth. Palpi strong, broad, of almost quadrate shape, only slightly swollen towards extremity and with the angles rounded off. When in rest the tips nearly touch each other in the median line. Outer surface furnished with a group of long delicate hairs, on distal part; hairs more dense towards the extremity, and reaching not quite half the length of the palpus. Upper margin with a row of shorter hairs, inner surface furnished with curved spine-like hairs which, when the palpus is not uplifted, partly overhang the crest of the labrum.

The mandible (Pl. XXV, fig. 8) has the lower part elongate and the inferior angle pointed. The 4th and 5th teeth are broad at the basis and somewhat rudimentary, the third is well-developed and double, the second also double and sharply pointed. In one of the specimens, the outer margin of the 4th tooth is dentated as in *A. conica* — but it is not so

elongate as in that species. The upper margin is more strongly convex than in the other species, the whole mandible being narrower in consequence.

The maxilla (Pl. XXV, fig. 9) is short and grows broader towards the free edge — hence this edge is rather long. There is a distinct notch under the upper pair of large spines, and there is another distinct pair of larger spines near the inferior angle. Between these two pairs, as a rule, about seven spines of smaller dimension are observed. Exceptions to this rule seem not to be rare, however: I saw a maxilla of which one (the first) of the spines of the upper pair was not developed, another with three spines of equal size at the inferior angle, a third in which the free edge was furnished with three large spines and very few smaller ones between these.

The outer maxillae (Pl. XXV, fig. 10) have the outer lobe elongate and of lanceolate shape, the inner lobe short, oval. The length of the outer lobe, in this species, is greater than in the other species I was able to compare. The hairs on the surface are delicate and numerous; those on the outer lobe form a denser tuft on the inner surface, towards the extremity and along the upper half of the inner side; a well-developed and irregularly double row of hairs extends, moreover, over the inner surface from the extremity to the upper margin of the inner lobe. The hairs seen on the inner lobe are directed towards the interior and fall over the margin of the quadrate shield-like plate with rounded angles, to which both lobes are attached. The hairs are, as a rule, very delicate, but many of them are distinctly feathered.

Cirri. Cirrus of first pair has the rami very unequal: the number of segments was found to be 9 and 21 in the smallest specimen, in a somewhat larger specimen 10 and 20, and in a much larger specimen 12 and 30. In both rami the segments are tapering towards the extremity. Those of the shorter ramus are almost all broader than long; in the longer ramus those of the basal part are broader than long, the middle ones are of a quadrate shape, the terminal ones even slightly longer than broad. The segments of the shorter (posterior) ramus have the inner face distinctly protuberant, each protuberance bearing a tuft of stronger hairs or spines on the extremity. The other hairs, disposed on the segments of both rami in the ordinary way, are rather delicate.

The cirrus of the second pair is shorter than that of the third; the rami are somewhat different in length and have 9 and 11 segments in a smaller specimen, and 12 and 16 in a larger one. Each segment bears a row of hairs along the upper margin and a tuft of such hairs on the extremity of its somewhat protuberant inner face.

In the third cirrus both rami are elongate; they have 14 and 16 segments in a smaller specimen, and 18 and 21 segments in a larger one. All the segments are nearly quadrate; those of the shorter ramus have a row of rather long hairs along the upper margin, and those of the longer ramus, a group of 3 to 4 long hairs with a few shorter ones disposed on the inner face of each segment near the extremity. The segments of the latter ramus are somewhat protuberant and on these protuberances, between the hairs, a few teeth-like pointed spines are observable.

The cirrus of the fourth pair (Pl. XXV, fig. 11) has 38 segments in the anterior ramus, and 46 in the posterior and somewhat longer ramus in the largest specimen I examined. These

segments are not very elongate, the terminal ones being only thrice as long as broad. Near the extremity the inner face of each segment is somewhat swollen; this swollen part is furnished with a group of longer hairs, representing the 2 to 3 pairs of hairs seen on the inner face of the segments of the other cirri; some of these hairs are rather long, some medium-sized, some short; each segment, moreover, bears a small group of not very long hairs on the outer face near the extremity. Finally, all the segments of both branches, with the exception of the 7 to 9 last ones, are furnished, on the somewhat swollen part of the inner face near the extremity, with a row of minute tooth-like pointed spines, which point upwards, and which are strongest on the lower segments of the anterior ramus. The second segment of the pedicel of this cirrus shows a group of 3 to 4 such teeth on the inner face near the extremity. Outer face of lower segments of both branches rough through short spines being disposed along the margin.

The cirri of the fifth and sixth pairs have the rami very elongate and composed of very numerous segments. Each segment bears a group of 3 to 5 delicate hairs on the outer face, near the extremity. The number of pairs of hairs arranged along the inner face of the segments is two in the lower and three in the upper segments. Only here and there, a fourth pair of extremely minute hairs could be seen. The teeth-like spines on the swollen parts of the segments of the 4th cirrus are represented on the 5th and 6th cirri by much smaller spines of the same shape. The outer margin of the lower segments of the 5th and 6th cirrus is distinctly rough, being furnished with one or more longitudinal rows of extremely small teeth-like spines which point upwards.

The penis is very long, distinctly ringed, tapering towards the extremity. A group of short hairs is situated at a short distance from the extremity, very few hairs only are scattered over the surface.

The only specimen of this species collected during the cruise of H. M. S. "Siboga" was taken at Station 301. Numerous and larger specimens of the same species were found by me in a collection of Cirripedia made during the fishing trips of the Inspection-Steamer "Gier" in the Western half of the Malay Archipelago. The accurate positions of these places are as follows.

Stat. 301. January 30, 1900. Lat. 10° 38′ S., Long. 123° 25′.2 E. Pepela-bay, East coast of Rotti-island. Depth 18—45 m. Bottom: mud, coral, and Lithothamnium.

H. M. S. "Gier", N° 14, Experiment 4. December 16, 1908. Lat. 3° 12′ S., Long. 116° 38′ E. Depth 25—35 m. Bottom: mud.

H. M. S. "Gier", N° 14, Experiment 7. December 17, 1908. Lat. 3° 24′ S., Long. 116° 37′ E. Depth 27—33 m. Bottom: mud.

Genus **Hexelasma** nov. gen.

Compartments six; carina, carino-lateral and lateral compartments with alae, but without radii, the rostrum having neither radii nor alae. Parietes not porose and without longitudinal ribs on their inner surfaces; basis membranous. Opercular valves sub-triangular.

Mouth with the labrum not notched in the middle; mandibles with 4 to 5 sharply

pointed teeth; maxillae with numerous spines beneath the notch; third pair of cirri resembling more those of the fourth than of the second pair. No caudal appendages. Species living in deep water.

I described, in my Report on the Cirripedia of the Challenger-Expedition[1], two species of *Balanus* (*B. corolliformis* and *B. hirsutus*), which were collected in deep water and which differed in several important points from the hitherto known species of the genus. These differences concerned partly the structure of the shell, and partly the animal's body. Since this report was issued, PILSBRY[2] published descriptions of two other species (*B. callistoderma* and *B. hoekianus*), and he pointed out that they belonged to the same section of the genus as the above-named species collected by the Challenger. The one (*B. callistoderma*) was found in Japan-waters, at a depth of 140 m., the other (*B. hoekianus*) in Behring Sea, at a depth of 77.5 m. Although PILSBRY's description with regard to the structure of the mouth, of the labrum especially, is incomplete, his species, to judge from the structure of the shell, certainly belong also to the same section of the genus *Balanus*.

I now propose to give to this section the rank of a separate genus and to give it the name of *Hexelasma*. The Siboga-material furnished me with two other species of the same group and all these species correspond in an essential point: the absence of radii and, so far as my investigations show, in a second point: viz. the shape of the labrum. The structure of the cirri of the 3rd pair, moreover, is different from that in *Balanus*; altogether, the new genus is so far a very natural one, as all the species seem closely allied in structure, in general appearance, and in the habit of living in deeper water. The relation between my new genus and *Balanus* seems to be further removed than that between *Acasta* and *Balanus*: the absence of radii in the first place, the structure of the compartments in the second, distinguishing it sharply from the true species of *Balanus*. The diagnosis given by DARWIN for the latter genus, when it comes to the point, is not applicable to these new forms; therefore we have to choose: either to extend that diagnosis, or to separate those forms from the old genus, and to establish a new genus for them. I have chosen the latter way. DARWIN, already in 1854, spoke of the large extent of the genus *Balanus* — and we have now still greater right to speak of that: if we look at the question from a practical point of view, what reason can there be to enlarge such a genus by extending its diagnosis? The very peculiar structure of the labrum and of the 3rd pair of cirri, which characterizes these new forms, shows, moreover, that the differences affect the body of the animal as well as its shell.

With respect to the differences in the animal's body, there exists a certain resemblance between the species of my new genus *Hexelasma* and those of DARWIN's Sub-Family *Chthamalinae*. The latter never have the labrum notched in the middle, and their third pair of cirri always resembles much more closely in external structure the fourth than the second pair — exactly as I found it in *Hexelasma corolliforme* and *H. hirsutum*, and as is shown in the description of the two new Siboga-species. In three species of the *Chthamalinae* belonging to two genera, there are, however, caudal appendages, and these are not found in *Hexelasma*. The corres-

[1] HOEK, P. P. C., Challenger Report. 1883.

[2] PILSBRY, H. A., Barnacles of Japan and Bering Sea. Bulletin Bureau of Fisheries. XXIX. (1909). 1911.

pondence, so far as the animal's body is concerned, is not complete, in consequence; as *Hexelasma* has the rostrum without alae, and as the *Chthamalinae* have the rostrum with alae, while it has radii rule in the *Balaninae*, the question of the position of this new genus is decidedly interesting. I feel unable, however, to settle it in a satisfactory way with the material at my disposal — perhaps younger stages of the shell of *Hexelasma* would go far to show, that its relation to one of those Sub-families was by no means so doubtful. For the present, for practical reasons only, it may remain, like *Acasta*, in the neighbourhood of the genus *Balanus*, the two genera certainly showing in several respects superficial correspondence.

This is again one of these difficult points, which the zoologist working up the material belonging to a certain group and brought home by a scientific expedition may discuss, but which can be settled only by monographical study of the whole group, and with the aid of the whole material of the group at present available. The task of a reporter, as is my case, is to give good descriptions and accurate figures: for more theoretical considerations the material handed over to him, although rich as in the case of the Siboga-Cirripedia, is obviously far too incomplete.

To judge from the six species that are at present known, the new genus has a world-wide distribution: *Hexelasma corolliforme* Hoek was dredged by the Challenger near Kerguelen (at a depth of 270 m.) and was collected again by Doflein (fide Krüger[1]) in the Bay of Sagami near Misaki; *H. hirsutum* Hoek was dredged by the Triton in the Faroe Channel (at a depth of 930 m.); *H. callistoderma* Pilsbry was collected in Japan waters (at a depth of 140 m.) and *H. hoekianum* Pilsbry in Behring-Sea (at a depth of 77.5 m.). The new species *H. velutinum* and *H. arafurae* come from the Malay Archipelago where they were found at depths varying from 204—560 m.

1. *Hexelasma velutinum* n. sp. Pl. XXVI, fig. 1—16.

Shell white, covered by a thin velvety epidermis. Alae triangular, with their summits obliquely rounded off. Orifice large, pentagonal. Inner surface of scutum and tergum white. Scutum with two longitudinal furrows, one of which is less distinct than the other; adductor ridge and cavity for adductor muscle hardly visible. Tergum only very indistinctly beaked and with the extremity of the spur truncated.

H. M. S. "Siboga" collected this species at three different Stations; unfortunately, at each station a single specimen, or one and an incomplete specimen only were dredged. The specimens from the different stations differ from one another in appearance: those from Station 59 and 201 being of a conical shape (Pl. XXVI, fig. 3 and 4), that from Station 105, however, being more cylindrical (Pl. XXVI, fig. 1), with the circumference at the basis hardly larger than at the orifice. The latter specimen is, however, unsymmetrical, the shell being considerably higher at the one than at the other side. Although there is also a small difference in the shape of

[1] Krüger, Paul, Beiträge zur Cirripedienfauna Ostasiens. Abhandl. der Math. phys. Klasse der K. Bayer. Akad. d. Wissensch. II Suppl. Bd. 6. Abhandl. 1911. p. 55.

the tergum between the specimens from the different stations, there could be no doubt that they belonged to the same species.

The shell is white and covered by a greyish membrane with a velvety surface. This membrane is quite persistent round the basal part of the shell, the surface round the orifice being almost quite bare. The orifice is large, of a pentagonal shape; it is toothed in consequence of the oblique summits of the alae. This is more distinctly the case in the specimen of cylindrical shape from Station 105. The oblique summits of the alae are delicately crenated, their surface is horizontally striated. The carina and the carino-lateral compartment have the alae, in the cylindrical specimen especially, very broad at the summit. The ala of the lateral compartment is also of a triangular shape, but it is much narrower in the upper part. The rostrum has neither radii nor alae; it is of a triangular shape, bluntly pointed at the tip, broad at the basis and very broad in the specimens from Stations 59 and 251. The outer surface of all the

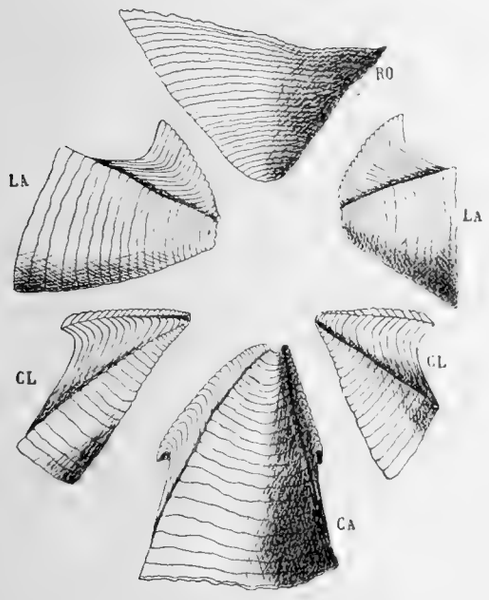

Fig. 1. Outer view of the valves of *Hexelasma velutinum* gen. et spec. nov. *RO*, Rostrum; *CA*, Carina; *LA*, Lateral; *CL*, Carino-lateral compartment.

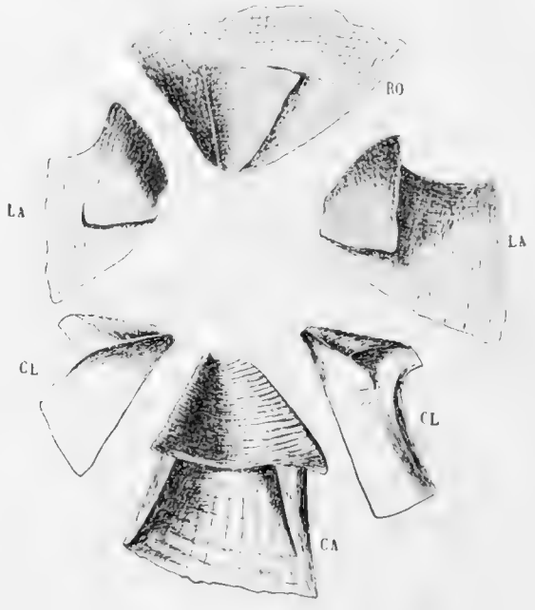

Fig. 2. Inner view of the valves of *Hexelasma velutinum* gen. et spec. nov. *RO*, Rostrum; *CA*, Carina; *LA*, Lateral; *CL*, Carino-lateral compartment.

valves is striated horizontally, the striae being more distinct on the rostrum and the carina than on the lateral compartments. On the inner surface the compartments show very delicate longitudinal lines, but these are not to be confounded with longitudinal ribs or septa, of which there is no trace. The sheath of the rostrum (Pl. XXVI, fig. 6) is developed in the middle of the valve only, the part of the valve on each side of it being slightly excavated for the reception of the alae of the rostro-lateral compartments. The compartments seem to hang together in a very loose way: on manipulating a specimen it easily falls to pieces. The basis is membranous.

With the aid of the specimen from Station 59, I was enabled to study the shape of the different valves more in detail. The accompanying figures show these, 4 times enlarged.

Rostrum almost symmetrical, moderately convex transversely, flat longitudinally; bluntly pointed at the apex and irregularly rounded at the basal margin; triangular in shape. On the inner surface, the middle part is thicker and lined on each side by a strong ridge; it reaches over the half of the height of the valve and it is distinctly striated horizontally. The lateral parts of the rostrum are also striated at the inner side, the striae are much more superficial here: these lateral parts are for the reception of the alae of the lateral compartments, the free margin of which abuts against the longitudinal ridge at the inner side of the rostrum.

Lateral compartment has an ala on the rostral side, making an angle with the valve itself, the whole being, in consequence, slightly convex transversely. Longitudinally it is nearly flat. Parietal portion about twice as wide as in the carino-lateral compartment and of a triangular shape with the basal margin straight or feebly curved, and the apex truncated. The two lateral margins of the alae form a rather sharp angle, the apex of which is only feebly truncated; the lower margin is distinctly concave and extends downwards to the basis of the compartment. The growth-lines on the alae are closely-set, extend obliquely upwards and make a curve before reaching the free margin. On the inner surface, almost at the middle of the parietal portion, a prominent longitudinal ledge extends from the apex over the middle on the one side, and not quite to the middle (on the other side) of the height of the compartment. It makes an angle with a horizontal ledge, the two ledges enclosing the part which on this valve represents the sheath.

Carino-lateral compartment has also an ala on the rostral side, which makes a very feeble angle with the valve itself. For the rest, both parts are nearly flat. The parietal portion, which is less than or a little over half as wide as that of the lateral compartment, is of an elongate-triangular shape with the apex pointed, and the basal margin almost straight. The ala has almost the same shape as that of the lateral compartment and is about as broad as the parietal portion. The free margin of the ala develops into a very characteristic rim, the growth-lines on this rim making an angle with those on the remain part of the ala. On the inner surface the part representing the sheath does not extend over the parietal portion of the valve. The growth-lines of this part are the continuation of those seen on the narrow rim along the free margin at the outer surface. The narrow continuation of the ala which goes down to the base of the valve is distinctly thickened.

Carina is nearly flat in longitudinal direction, only slightly curved outwards at the apex; it is, however, strongly bent in transverse direction. Towards the base this curvature is not so strong, the surface is here rounded in consequence; but towards the apex the lateral halves meet in a decided angle. The alae have almost the same structure and the same disposition as those of the carino-lateral compartments; they extend to the base of the valve; the latter, when seen from the inner side, presents on each side a well-developed thickened portion or rim. On that inner side the part representing the sheath is well-developed and extends over the parietal portion and over the alae as well. It is very regularly and distinctly striated horizontally. It stands off, in a very marked way, from the rest of the inner surface of the compartment.

The scutum (Pl. XXVI, fig. 2, *a* and *c*; fig. 5, *a* and *c*) is triangular, with prominent, sinuous growth-ridges and with two shallow furrows radiating from the apex of the valve. Of these the

one extending over the middle of the valve is somewhat more distinct, the other, at a little distance from the tergal margin, is faint. Basal margin slightly sinuous. On the inner surface the articular ridge is not very prominent, the depression for the adductor muscle is very superficial, and that for the depressor muscles represented only by a very shallow excavation.

The tergum is somewhat narrower than the scutum; the growth-ridges are distinct, narrower and less prominent, however, than those on the scuta. The scutal margin is straight, the carinal margin feebly curved, the basal margin distinctly hollowed out in the specimens from Stations 59 and 251 (Pl. XXVI, fig. 5, *b* and *d*) and almost straight in the specimen from Station 105 (Pl. XXVI, fig. 2, *b* and *d*). On the latter, the scutal margin of the spur is at a very short distance only from the basi-scutal angle, this distance being a trifle greater in the specimens from Stations 59 and 251. On the inner surface the articular ridge is rather prominent in the upper part, the crest for the depressor muscles, although not very prominent, is well developed. The apex of the valve develops into a very minute beak, which is a little more prominent in the specimen from Station 105.

The size of the specimens can be judged from the following:

the specimens from Station 105 are high: the largest one measures 13 mm. at the one side, and 6 mm. at the other. Its greatest diameter at the basis is 10 mm.

the specimen from Station 59 is 8 mm. high, and the greatest diameter of its basis is 12 mm.

one of the specimens from Station 251 is 7 mm. high, and the greatest diameter of its basis is 12 mm.

As regards the structure of the animal's body, I call the attention to the following points:

Mouth. Labrum somewhat thicker than in the genus *Balanus*, but it cannot be said to be bullate. No trace of notch, the upper margin being only very superficially hollowed out. This margin is armed with a row of from 45 to 60 small knob-like teeth. These teeth are of an irregular shape: they were short, conical with the apex blunt in the specimen from Station 251 (Pl. XXVI, fig. 8—10), and indistinctly double crowned (Pl. XXVI, fig. 7) in that from Station 105.

Palpi of elongately-oval shape, with the free extremity rounded. The upper margin is furnished with numerous short hairs, the outer surface with numerous longer ones, especially near the lower margin and towards the free extremity. The latter hairs form a distinct double row along — but at a certain distance from — the lower margin, extending in one of the specimens over three-fourths of its length, or, as is the case in another specimen, almost over the whole length of the palpus. The outer surface is, moreover, furnished near the distal extremity, with groups of extremely small hairs or ciliae.

Mandible (Pl. XXVI, fig. 11) has 4 sharply pointed teeth, diminishing in size from the first to the fourth, and an inferior angle terminating in 2 or 3 teeth, one of which is somewhat stronger. The distance between the extremities of teeth 1 and 2 is double that between 2 and 3, or 3 and 4. In one specimen, the space between the 4th tooth and the inferior angle is furnished with two additional pointed teeth; the dorsal or upper margin of the 3rd tooth bears in this specimen, moreover, a secondary tooth. In the second specimen (Pl. XXVI, fig. 11*) the lower margin of tooth 4 is furnished with an additional tooth. In the third, there

is a spine-like tooth in the interval between the 4th tooth and the inferior angle, and the upper margin of tooth 4 is, moreover, delicately serrated in this specimen.

Maxilla (Pl. XXVI, fig. 12) with the notch behind the upper pair of spines broad and shallow and occupied at the bottom by 4 to 5 short spine-like hairs. The part of the edge beneath the notch is somewhat oblique and furnished with 6 to 8 spines gradually increasing in length, and 4 to 6 smaller ones at and round the inferior angle (Pl. XXVI, fig. 12*).

Outer maxillae (Pl XXVI, fig. 13) have the outer lobe rounded at the extremity, its whole shape being short and broad. Hairs numerous over distal half of inner surface, and also forming a longitudinal group directed downwards. In none of the specimens a distinct separation between outer and inner lobe could be made out: so there seems to be one lobe only, which, however, at its inner and basal surface is furnished with the longer and feathered hairs that are characteristic of the inner lobe in *Balanus*.

Cirri. First pair. Rami not very unequal:

in the specimen from Station 59, number of segments 9 and 12,
in the specimen from Station 105, number of segments 8 and 14,
in the specimen from Station 251, number of segments 8 to 9, and 13.

Segments not protuberant, those of the shorter ramus with the inner faces rounded. Surface of most segments densely clothed with delicate hairs: those on the longer ramus directed mostly along the long axis of the cirrus, those of the shorter ramus standing off in different directions. A couple of spines are seen on the tip of the last segment of both rami.

Second pair. Rami nearly equal and relatively short:

in the specimen from Station 59, number of segments 11 to 12, and 11,
in the specimen from Station 105, number of segments 10 and 12,
in the specimen from Station 251, number of segments 11 and 14.

Inner faces of segments rounded, without being protuberant. Delicate hairs stand off in all directions and grow stronger towards the extremity; a few of them disposed on the extremity of the last segment look more like spines.

Third pair. Rami very unequal, the cirrus, and the longer ramus especially, looking much more like an ordinary cirrus of the 4th — 6th pairs:

in the specimen from Station 59, number of segments 16 and 21,
in the specimen from Station 105, number of segments 20 and 23,
in the specimen from Station 251, number of segments 22 and 28.

The distal part of the longer ramus is very slender; each of its segments is armed with two pairs of spines on its inner face. The lower segments bear dense bushes of spine-like hairs.

Fourth pair. Rami hardly unequal, having in the specimens from the three Stations 27 and 29, 31 and 33, and 37 and 39 segments respectively.

Fifth pair. Numbers of segments in the same specimens 29 and 31, 40 and 40, 40 and 43 respectively.

Sixth pair. Number of segments 32 and 33, 41 and 41, 42 and 43 respectively. The dorsal surface of the pedicels of the last three cirri, and that of the lower segments of the cirri also, are, in the older specimens especially, hirsute, in consequence of the presence of short

spine-like hairs all over the surface. All the segments of these cirri bear two pairs of very long spines on their inner face (Pl. XXVI, fig. 14). Between the spines of the lower pair a few very short hairs are disposed, and between those of the distal pair of spines a few somewhat longer hairs. The hairs on the dorsal surface near the extremity of each segment are relatively short.

Penis (Pl. XXVI, fig. 15) in all the three specimens examined extremely short, its free extremity not extending to the end of the pedicel of the sixth cirrus (Pl. XXVI, fig. 16). It is broad at the basis and much narrower at the extremity; this narrower part seems to be somewhat longer in the specimens from Stations 59 and 105 than in that from Station 251. The penis is finely-ringed and bears only a few hairs. A tuft of hairs is seen round the tip. No projecting point was observed at its dorsal basis.

The specimens of this interesting species were collected at the following stations:

Stat. 59. April 26, 1899. Lat. 10° 22'.7 S., Long. 123° 16'.5 E. Western entrance Samau-strait. Depth 390 m. Bottom: coarse coral-sand with small stones. One specimen, which was separated from its bottom.

Stat. 105. July 4, 1899. Lat. 6° 8' N., Long. 121° 19' E. Depth 275 m. Bottom: coral (a very short haul, dredge almost immediately caught in the bottom). Two beautiful white specimens attached to the surface of a piece of shell.

Stat. 251. December 8, 1899. Lat. 5° 28'.4 S., Long. 132° 0'.2 E. Depth 204 m. Bottom: hard coral-sand. Trawl brought up pieces of grey clay and manganese nodules, the interior of which consisted of dry clay. Two specimens, one of which was broken and loose, the other being attached to a piece of brown stone.

General Remarks. As I have pointed out already, the resemblance of the different specimens of this species collected by H. M. S. "Siboga" is not complete. There can be no doubt, however, that they belong together and that they represent a species different from those already described by Pilsbry and myself.

2. *Hexelasma arafurae* n. sp. Pl. XXV, fig. 12—16.

Alae broadly-triangular with their summits oblique. Shell with very wide orifice, dirty white, without epidermis, with obscure longitudinal stripes. Inner side of scutum and tergum orange-coloured. Scutum indistinctly folded longitudinally, with the articular ridge slightly prominent and a deep pit for the adductor muscle; tergum beaked, with prominent articular ridge and the extremity of the spur broadly rounded.

Shell (Pl. XXV, fig. 12) dirty white, compartments rather thick, massive, standing nearly vertical, hence orifice very large, diamond-shaped, somewhat narrower towards the carinal end. Outer surface of shell with horizontal and not very distinct lines of growth, slightly more distinct on the surface of the rostrum. No radii present. Alae of the carina, the carino-lateral and lateral compartments broad, triangular, with strongly marked lines of growth and the upper margin irregular, partly broken off, giving the orifice a toothed appearance. The rostrum when seen from the inner side has the sheath developed only in the middle part — whether the lateral parts represent rostral-lateral compartments cannot be made out. Parietes not porose, nor furnished with ribs at the inner side. Basis not distinct, membranous.

Scutum triangular (Pl. XXV, fig. 13 *a* and *c*) elongate, with the growth-ridges very prominent and a distinct, rather broad longitudinal furrow. On the inner surface the articular ridge is rounded, narrow, not prominent, the adductor ridge only feebly indicated and the depression for the adductor muscle very distinct, and forms a rather deep oval pit.

Tergum (Pl. XXV, fig. 13, *b* and *d*) slightly smaller than the scutum, with the apex distinctly beaked and the carinal margin rounded; the growth-ridges are much less distinct than on the scutum. On the inner surface the articular ridge is not very prominent and the crests for the depressor muscles, though distinct, not very conspicuous, nor extending beyond the basal margin. Spur broad, not very distinct, flat and rounded at the extremity. Both scuta and terga coloured brick-red on the inner surfaee.

Mouth: labrum (Pl. XXV, fig. 14) swollen, especially laterally where the palpi are attached; edge hollowed out but without a central notch. It is furnished with very delicate hairs in the middle and has small teeth on both sides; of these, several are bifid or even trifid at the apex. Palpi large, broad, rounded at the apex, with long curved hairs disposed along the margin and on the outer surface, and numerous shorter ones along the upper margin. The palpi nearly touch one another in the middle of the labrum.

The mandible (Pl. XXV, fig. 15*b*) has four teeth, and the inferior angle armed with a single point and a series of short hairs — not pectinated as it commonly is. The upper or dorsal side of the 3rd and 4th teeth and of the inferior angle with 2 or more very small accessory teeth; (the mandible of the other side (fig. 15*a*) somewhat abnormal in the specimen which was examined: the four teeth pointed, and standing close together, the inferior angle longitudinally extended with two steps and a terminal angle.

The maxilla (Pl. XXV, fig. 16) can hardly be said to have a notch beneath the upper pair of spines. Beneath these two upper spines, 4—5 smaller spines are observable and beneath them there is an indication of a notch, being the upper limit of the somewhat step-formed projection which represents the remaining part of the edge of the maxilla. This part of the edge is furnished with 16—20 nearly equally stout spines, of which the 4—5 last ones are somewhat shorter and less strong.

The outer maxillae have the inner surface bilobed, but only very indistinctly.

Cirri. First pair short, with the rami distinctly unequal in length: the longest having 14 segments, the shorter 10. The lowermost segments of the longer ramus are broader than the uppermost, as are also those of the shorter ramus. All the segments have the surface thickly clothed with spines, the upper ones, however, in a less degree than the lower segments.

Second pair, with the anterior ramus having 12 slightly broader segments, and the posterior 15 slightly narrower segments, all thickly covered with spines.

Third pair, with the rami very unequal, composed of 19 and 43 segments respectively. In both rami, the 14—15 lower segments thickly covered with spines. The four remaining segments of the anterior (shorter) ramus have two (or three) pairs of spines on their inner face and a group of two or three spines at the posterior margin near the extremity. The posterior (longer) ramus shows the same two pairs of spines, with the small bristles situated between the two of each pair, which are seen on all the segments of the 4th—6th cirrus, only on the

15th—24th segments. The 25th—43rd segments are not furnished with these spines, but their armature consists of 6—8 bristles situated near the extremity of each segment and giving the extremity of this ramus the appearance, more or less, of an antenna.

The 4th—6th cirri have long rami of nearly equal size, of numerous but not elongate segments. In the specimen that was examined the number of segments was 30 and 37 in the 4th cirrus, 38 and 40 in the 5th, and 39 and 41 segments in the 6th cirrus. The segments are almost without exception furnished with two pairs of very long, stiff, needle-like spines along their inner face, at the base and between which two or three very short bristles are regularly inserted.

The penis is very short, distinctly ringed, considerably broader near the basis, with the terminal part cylindrical, recurved and rounded at the extremity. Delicate hairs are scattered over its surface; they form a dense group of minute bristles near the extremity.

The specimen that served for the above description was taken at:

Stat. 262. December 18, 1899. Lat. 5° 53'.8 S., Long. 132° 48'.8 E. Depth 560 m. Bottom: solid bluish grey mud.

The specimen was found attached to a piece of grey granitic stone; a small specimen of *Verruca capsula* was found attached to the surface of one of the parietes (the left-hand carino-lateral compartment).

General Remarks. This species, though in several respects approaching the new species *H. velutinum*, is easily distinguished from that and other species of the genus observed in the Malay Archipelago and elsewhere by the thickness and bareness of its shell, and the shape and colour of the opercular valves.

Genus **Tetraclita** Schumacher

The species of this genus inhabit the tropical and warmer temperate seas, and are found attached to tidal rocks, shells, pieces of stone, wood, etc. They live only in shallow water: dredging in deeper water has never yielded any form belonging to this genus.

The eight species of this genus which Gruvel enumerates in his "Monographie" (1905) are exactly the same as those of Darwin's Monograph (1854). Nor has our knowledge regarding the distribution of these species been greatly enlarged since Darwin's work appeared, although, on several occasions, one or more species were collected by different naturalists.

Also in the Malay Archipelago and adjacent waters various species have since been met with; I give here a list which, though perhaps not quite complete, may fairly well summarize our knowledge at the present time.

Tetraclita porosa (Gmel.), according to Weltner[1], was collected at different places in the Indo-Polynesian Region, the Berlin Museum has specimens from Singapore, Amboina, Zamboanga, Borneo, etc.

[1] Weltner, W. Verzeichnis der recenten Cirripedienarten. Arch. f. Naturgesch. Jahrgang 1897. Bd. I. S. 227—280.

Tetraclita porosa var. (1) *communis*, according to GRUVEL [1], is represented in the Calcutta Museum by specimens from Muscat (Arabia).

Tetraclita porosa var. (3) *viridis*, according to BORRADAILE [2], was collected by STANLEY GARDINER at Rotuma, N.N.W. of the Fiji Isds.

Tetraclita porosa var. (4) *rubescens*, according to WELTNER [3], is found at Nagasaki.

Tetraclita porosa var. (7) *patellaris*, according to GRUVEL [1], was collected in the Bay of Bengal, near the Andaman Isds.

Tetraclita serrata Darwin, according to ANNANDALE [4], was found off Ceylon, on a dead *Heteropsammia*.

Tetraclita rosea Darwin, according to WELTNER [3] and myself (Challenger-Cirripedes) occurs on the coast of New South Wales.

Tetraclita purpurascens (Wood), according to WELTNER [5], was collected by SCHAUINSLAND in Cook Strait (New Zealand) and is also represented in the Berlin Museum [3] by specimens from Auckland and New South Wales.

Tetraclita costata Darwin, according to WELTNER [3], was collected at Larentuka.

Tetraclita vitiata Darwin, according to the same author [3], was also collected at Larentuka.

Tetraclita coerulescens (Spengler) which the Challenger collected at Zamboanga (Philippines), occurs also, according to WELTNER [3], at Amboina, Larentuka and Singapore.

If we take the sixth Province with the limits as proposed in my Challenger publication, the number of species there occurring would be five: *T. porosa*, *serrata*, *costata*, *vitiata* and *coerulescens*. *Tetraclita porosa* would, moreover, be represented in the said province by the var. (7) *patellaris*, this variety being found in the Bay of Bengal.

This genus is represented by four species in the collections made during the cruise of H. M. S. "Siboga": *T. porosa* (Gmelin), *T. costata* Darwin, *T. vitiata* Darwin and *T. coerulescens* (Spengler). They were collected on tidal rocks, during reef exploration, etc.

1. *Tetraclita porosa* (Gmel.).

DARWIN, CH., Monograph. The Balanidae, Verrucidae, etc. 1854. p. 329, pl. X, fig. 1*a*—1*m*.

This is a very common species with a wide distribution. It varies greatly in external appearance and DARWIN therefore distinguished eight varieties, some of which, however, differ only in the colour of the preserved portions of the outer lamina of the shell. As this colour no doubt suffers considerably under the influence of the spirits in which the objects are preserved, in many cases it is hopelessly difficult to make out whether they belong or not to one of these varieties.

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[1] GRUVEL, A., Cirrhipèdes operculés de l'Indian Museum de Calcutta. Memoirs of the Asiatic Society of Bengal. II. N° 1. p. 1—10. 1907.

[2] BORRADAILE, L. A., On some Crustaceans from the South-Pacific. Part V. Proceed. of the Zoolog. Soc. of London. 1900. p. 795—799.

[3] WELTNER, W., Verzeichnis der recenten Cirripedienarten. Arch. f. Naturgesch. Jahrgang 1897. Bd. I. S. 227—280.

[4] ANNANDALE, N., On the Cirripedia. In: W. A. HERDMAN's Report on the Pearl Oyster Fisheries of the Gulf of Manaar. 1906.

[5] WELTNER, W., Cirripedien der Ergebnisse einer Reise nach dem Pacific. Zoologische Jahrbücher. XII. 1899. S. 441—447.

The specimens collected by H. M. S. "Siboga" are from three different Stations, and have a greenish-grey colour in the preserved condition. The outer lamina are only partly removed in the younger specimens, much more so in the larger specimens. The size and shape of the shells is rather different, radii are distinct in some specimens and hardly distinguishable in others; some have very small orifices, others much larger ones. But the shape and structure of the opercular valves is the same or nearly the same in the different specimens; they closely resemble the figures and correspond to the description given by DARWIN.

The most typical specimens among those of H. M. S. "Siboga" were collected at Station 152 during reef-exploration. According to the list, the depth at that Station was 32 m. and the bottom was covered with *Lithothamnium*. The shape of these specimens is conical, their colour greenish-grey, the exposed parietal tubes dark, nearly black. The orifice is irregularly rounded and large, the sutures of the compartments are not quite distinct, much more distinct, however, in one of the specimens, than in the others. A narrow but distinct radius is represented almost at every suture in this specimen. The diameter of the largest specimen was 38.5 mm. at the basis; the thickness of the wall was here about 8 mm. The opercular valves of one of these specimens were carefully cleaned, and found in perfect agreement with DARWIN's description, not considering little differences in colour, and in the degree in which the basi-tergal angle of the scutum is rounded off, etc. In this specimen, the adductor ridge of the scutum extends quite to the apex of the valve, as DARWIN says it does in some specimens. Its tergum has a distinct beak, the spur is quite close to the basi-scutal angle and its extremity is pointed, perhaps not quite so sharply as DARWIN says it is in one of the varieties, but sharper certainly than in the two forms figured by DARWIN.

This form comes nearest to *T. porosa* var. (3) *viridis* of DARWIN; the inner surface of the opercular valves, however, is not "clouded green" as DARWIN said, but rather bluish-black. These specimens were collected during reef-exploration at Wunch-bay, N.W.coast of Waigeu-island [Station 152, August 12/13, 1899.] (Note. A sample of specimens collected during the New-Guinea-Expedition of 1903 (February 13th) in the Bay of Mawi corresponds in most respects to those of Station 152.)

In the second place, there are specimens from Station 131. They are much smaller than those from Waigeu-island and form two clusters of 7 to 9 specimens each. Their shape is not conical, but some are depressed, others rather globular with relatively small orifices. The surface is irregularly ribbed, the ribs more or less distinctly serrated near the base. The outer lamina of the shell is quite preserved in some specimens, in most removed near the orifice; the colour of the specimens (in preserved condition) is greyish-green and the parietal tubes are blackish where exposed. Radii and sutures very indistinct. Size: largest diameter of the basis 12 to 16 mm., height 7 to 9 mm. The opercular valves are much like those of the specimens from Station 152, the scutum having the adductor ridge extending to the apex of the valve, and the tergum being beaked and having the spur quite close to the basi-scutal angle. The extremity of the spur, however, is more bluntly pointed.

This form resembles *T. serrata* Darwin, to a certain extent; on the other hand it is so much like a true *T. porosa* that it seems impossible to separate it from that species.

DARWIN pointed out that his *T. serrata* was more closely related to *T. porosa* than to any other species. He would not, perhaps, have separated the two forms from each other as distinct species, if he had met with the specimens collected by the Siboga. They were found at the anchorage of Beo, Karakelang-islands (Station 131, July 24/25, 1899) when the reef was explored.

The third lot of specimens belonging to this species is from the neighbourhood of Station 225. It consists of only two individuals: one loose, one attached to a piece of calcareous rock. The shape of these shells is conical, the colour greenish-grey. The surface is irregularly ribbed and shows the extremely narrow parietal tubes extending from the orifice almost to the base. The shape and structure of the opercular valves of these specimens correspond in general to those of the specimens of the other lots; yet the tergum has the spur relatively larger, and the curved carinal margin shorter than is the case in the other specimens. According to the label, this lot was taken near Station 225, 5700 m. to the N.E. of Southpoint of South Lucipara island. Here the depth was 894 m. The specimens of *Tetraclita porosa* were not taken at that depth, but were found attached to a piece of coralline stone taken from the reef.

2. *Tetraclita costata* Darwin.

DARWIN, CH., Monograph. The Balanidae, Verrucidae etc. 1854. p. 339, pl. XI, fig. 2*a*—2*c*.

Four to five small specimens of this species were found attached to a piece of stone collected on Banda Reef, at the end of November, 1899. DARWIN knew it from the Philippine Archipelago, and WELTNER saw specimens from Larantuka.

The specimens from Banda Reef are no doubt young ones. The greatest diameter of the basis of the largest specimen measured only 7 mm.

3. *Tetraclita vitiata* Darwin.

DARWIN, CH., Monograph. The Balanidae, Verrucidae etc. 1854, p. 340, pl. XI, fig. 3*a*—3*c*.

A single specimen was collected on the reef of South Lucipara island. It has the irregular surface, the very irregular parietal tubes, and the moderately wide radii as in DARWIN's definition of the species. The shape of the tergum and scutum is, moreover, exactly as in the figures given in DARWIN's Monograph. In the carina, some of the tips of the upfilled parietal tubes are exposed and these give a reddish-purple tinge to the uppermost part of that valve. The only specimen is medium-sized, the dimensions of the basis being $14 \times 12^1/_2$ mm., the height measuring 7 mm.

This species, which was described by DARWIN from specimens from the Philippine Archipelago and from Barrier Reef (Raine's Islet), Australia, was, according to WELTNER, collected also at Larantuka. The Siboga collected it on the Lucipara-islands (about Station 225), which lie in the Banda Sea, during reef-exploration.

4. *Tetraclita coerulescens* (Spengler).

DARWIN, CH., Monograph. The Balanidae, Verrucidae etc. 1854, p. 342, pl. XI, fig. 4*a*—4*d*.

A depressed-conical, rather large specimen of this species was taken at Banda when the reefs were explored. Its surface is strongly corroded, the longitudinal ridges are here and there visible, and a good deal of the infilled parietal tubes are exposed. The colour is greenish-blue, and whitish between the darker spots and ribs. The shape of the basis is irregularly oval, its longest diameter measures about 40 mm.

The structure of the inner side of the scutum is so characteristic that no doubt remained as to which species the much-corroded specimen belonged.

This species seems to occur at different places in the tropical Eastern Seas: Pacific Ocean and Philippine Archipelago (DARWIN and "Challenger"), Amboina, Larentuka and Singapore (WELTNER), Banda ("Siboga").

Genus **Pyrgoma** Leach

DARWIN (1854) enumerates and describes 9 species of this genus, and no new species have been added to the list since the publication of his Monograph. WELTNER[1] (1897) pointed out that a *Pyrgoma* collected (in 1874) by HILGENDORF in the Bay of Yeddo (Japan), though nearly related to *P. cancellatum* (Leach), differs from that species in several respects, and was, in consequence, considered by him as forming a variety for which he proposed the name *P. cancellatum* var. *japonica* Weltner. The author intended to give a full description with figure of this variety, but, so far I know, it has not as yet been published.

Nor has our knowledge with regard to the geographical distribution of the other species of this genus made great advances, the different cases mentioned by WELTNER in his "Verzeichnis" being the only ones which came to my knowledge.

Therefore we only know of the following species as occurring in the 6th Province, including the Malay Archipelago:

Pyrgoma anglicum Sowerb. Singapore, according to WELTNER.

Pyrgoma grande (Sowerb. Jr.) Singapore and East Indian Archipelago (DARWIN), Birara (Neu Pommern) (WELTNER).

Pyrgoma milleporae Darwin. Philippine Archipelago (DARWIN), Birara (Neu-Pommern) (WELTNER).

Pyrgoma crenatum Sowerb. Philippine Archipelago, Singapore (DARWIN), New Guinea (WELTNER).

Pyrgoma monticulariae J. E. Gray. Singapore (DARWIN).

During the cruise of H. M. S. "Siboga" specimens of three species of *Pyrgoma* were collected in the Malay Archipelago: one sample consists of numerous specimens of *Pyrgoma*

[1] WELTNER, W., Verzeichnis u. s. w. Archiv f. Naturgeschichte. 1897. Bd. I. S. 227—280.

grande Sowerb. Jr., but the exact place where they were collected is not given; the second is represented by two specimens and is a new species for which I propose the name *P. kuri* after the island in the neighbourhood of which, at a depth of 200 m., it was collected: so far as I know this is the first instance of a species of this genus being found at such a great depth. The third species of the Siboga collection is also new to science. I wish to introduce it into the system under the name of *P. jedani*, again after the island where it was collected. Both new species are very characteristic, and will be easily distinguished from DARWIN's species, should they again be found.

The number of species occurring in the Malay Archipelago has now increased to seven; some of them at least seem to have only a local distribution, and perhaps other species may still be found should more remote parts of the Archipelago be carefully explored.

About the bathymetrical range of the species of this genus, we are not well informed at present. Most specimens were collected during coast-exploration, most species seem only to occur in shallow water. Probably this is also the case with two of the species represented in the Siboga-collection: viz. *P. grande* Sowerb. Jr., and *P. jedani* n. sp. The third (*P. kuri* n. sp.) was dredged at a depth of 204 m., which certainly shows that their occurring in shallow water is a rule not without an exception.

1. *Pyrgoma grande* (Sowerby Jr.).

DARWIN, CH., Monograph. The Balanidae, Verrucidae etc. 1854. p. 365, pl. XIII, fig. 1*a*—1*d*.

About half-a-dozen specimens of this species were collected during the cruise of H. M. S. "Siboga". Unfortunately the station where this species was collected has not been noted, the label bearing only a query— a very great exception in the case of this expedition.

The appearance and structure of shell and basis much resemble the description as given by DARWIN. DARWIN, however, complained that the internal organs of most species of *Pyrgoma* are badly preserved, and, in consequence, has only been able to investigate the structure of the mouth and the cirri of *P. anglicum*, *P. milleporae* and *P. crenatum*. Just to compare the structure of these parts in *P. grande* with those of my new species *P. kuri*, I dissected one of the specimens; and as the structure of the said organs was found to be of some interest, I will insert here the following description:

Mouth. Labrum deeply and widely notched; a large number of small triangular and pointed teeth arranged in several rows on both sides at the entrance of the notch. Palpi stout, broad, short, with the tip rounded and with numerous shorter hairs disposed along the inner surface, longer ones at the tip, and very long but not very numerous ones near the extremity of the upper margin.

Mandible with four teeth, and the inferior angle not produced; the latter has a series of small triangular, partly blunt and partly pointed teeth along the anterior margin; in the mandible of the left side, one of these teeth is developed somewhat more strongly and might be considered as a fifth mandibular tooth. The first tooth is single, relatively short and pointed,

teeth 2 and 3 are laterally double, and tooth 4 which is single has two smaller teeth situated near its base.

Maxilla with the edge nearly straight, a rudimentary notch in which two hairs are disposed under the two larger upper spines, and a dozen somewhat smaller spines varying in length, along the remaining part of the edge; near the lower angle a group of half-a-dozen hairs occupy the lowermost part of the edge. Numerous hairs are disposed on the surface of the maxilla and near the outer edge, extending to between the spines along that edge.

Outer maxillae distinctly bilobed; upper lobe broadly-oval, with a very dense tuft of curved hairs disposed at the tip and over the inner half of the surface; inferior lobe elongate, with the inner margin convex and hairs covering only the inner half of the surface.

Cirri. Cirrus of first pair with very unequal rami, the longer ramus having 19, the shorter only 7 segments; in both rami the lower segments are much broader than the more distal ones: hence the shape of the whole ramus is elongately-conical. The segments of the longer ramus are in general short, only slightly increasing in length towards the extremity; those of the shorter ramus are all of about the same length. The length of the shorter ramus is more than half the length of the longer. A great number of the spines, on the 4 to 5 lower segments, are disposed in both rami on a swelling of the surface situated near the distal extremity of each segment.

Cirri of the second and third pairs of about the same structure, which is quite different from the 4th to 6th cirrus. The second has 8 and 9, the third 10 and 13 short quadrate segments which are slightly swollen near the distal extremity, and are somewhat narrower near their basis. A group of larger spines is situated on the swelling at the inner side and near the upper margin, a very dense bush of shorter and stronger spines on the swelling at the outer side of each segment.

The 4th to 6th cirri have elongate segments; only one of the pairs of spines disposed in the ordinary way along the inner margin of each segment is well developed: the spines of this pair are long but relatively delicate. Yet a second pair of very small spines and a third pair of quite rudimentary ones can be made out as a rule. The number of segments is very large: 29 and 33 for example in the 6th cirrus of the specimen I dissected.

The penis is very long and grows narrower towards the free extremity; it is composed of numerous short rings, and it has short hairs scattered nearly over the whole length.

The small straight projecting point at the dorsal basis of the penis is relatively large, curved at its dorsal side and has a blunt, not pointed tip.

2. *Pyrgoma kuri* n. sp. Pl. XXVII, fig. 1—2.

Shell short-cylindrical, with the upper part feebly conical, coloured greenish-brown; orifice elongately-oval, narrow; scutum and tergum calcified together, a suture showing their limits; scutum with a prominent occludent ledge and a well-defined adductor plate, tergum well-developed, with the spur longer than the remaining part of the valve.

Surface of the shell granulated (Pl. XXVII, fig. 1), with indistinct furrows which extend irregularly over the lower, wider and cylindrical part of the shell, and which radiate from the orifice in the upper, slightly narrower part. In consequence, the orifice is surrounded by a circle of small areas, which are separated from each other by the furrows and which are of a lighter colour, the remaining part of the shell being of a darker, greenish-brown colour. The orifice is elongately-oval, not quite three times as long as broad, small; its carinal extremity rounded, the rostral one being pointed.

Shell thick, having small and not very distinct pores at irregular distances in the outer layers and having the internal surface strengthened by vertical septa. Sheath not large, extending only to the point where the conical and vertical parts of the compartments meet. Basal part of shell only very superficially embedded in the surface of the coral in one specimen, and much more distinctly, especially at the carinal extremity of the shell, in the other.

Size of the largest specimen 10 mm. in its longest diameter, of the smallest 7 mm.

The scutum and tergum (Pl. XXVII, fig. 2) are closely united, and even calcified together in the specimen I dissected. The line of junction between the two makes a not very sharp angle with the strongly curved occludent margin of the scutum. This valve is not very elongate, being slightly more than twice as long as the height near the line of junction. The scutum narrows towards the rostral end, where the basal and occludent margins meet in a somewhat produced angle. Along the occludent margin there is a strong ridge or ledge which bends inwards. The basal margin is concave, the adductor ridge developed into a rather broad plate, which projects considerably below the basal margin.

The tergum is relatively large, its surface being hardly smaller than that of the scutum; spur well-developed, with the extremity bluntly pointed. Crests for the attachment of the tergal depressor muscles distinct and projecting beyond the basal margin.

The study of the structure of the animal contained within the shell has yielded the following results:

Mouth. Labrum deeply and widely notched; a pair of very small triangular teeth, and numerous short and stiff hairs on both sides of the notch. Palpi stout, short and broad, with the lower margin straight and the upper rounded; along the lower margin shorter hairs are observable, longer ones at the tip, and very long and strongly curved hairs at and near the upper margin; the hairs at the tip are so densely disposed as to form a distinct tuft.

Mandible with five teeth, and quite a rudimentary inferior angle terminating in a group of very small, pointed teeth. The first tooth is relatively short and single, the second and third teeth are distinctly double, teeth four and five standing close together, short, broad and blunt. Hairs along the posterior margin of the inferior angle not very numerous, standing close together and being relatively strong.

Maxilla short, with the edge rather long and perfectly straight and with the upper and lower margins nearly parallel. Nine spines are seen along the edge; only the two superior ones are broader and slightly longer than the others; a very rudimentary notch is observed under the two superior spines; between the spines a number of delicate hairs are seen.

Outer maxilla distinctly bilobed; upper lobe broad, almost quadrate, outer margin rounded, inner margin straight; hairs situated near the extremity and over the inner half of the surface; inner lobe short, with not very numerous hairs over the inner half of its surface; opening of the segmental-organ not at the end of a projection, but at the surface of the basal part of the maxilla.

Cirri. Cirrus of first pair situated near the mouth and having the longer ramus twice as long as the shorter; the latter has 6, the former 11 segments. The form of the segments is nearly quadrate, with the inner margin rounded. The relatively long spines are arranged on the longer ramus in two transverse rows, near the extremity of each segment; they are distributed on the shorter ramus in more irregular groups over the whole surface of each segment.

Cirrus of second pair with slightly unequal rami of 7 and 8 segments; all the segments distinctly protuberant at the inner side. The whole surface of the segments is covered with rather long and thin straight spines, those at the outer side near the extremity of the distal segments and at the tip of the last segments of both rami being somewhat stronger.

Cirri of third pair of the same type as those of the first and second pairs. Number of segments in the two rami 8 and 9. Inner side of segments less protuberant than in the cirrus of the second pair. Hairs on the surface of most segments numerous and thin, forming a more dense central tuft, and radiating from there in all directions.

Cirri of fourth-sixth pairs not very elongate and composed of

16—17 segments in the fourth cirrus,
18—19 segments in the fifth cirrus, and
20—21 segments in the sixth cirrus.

Most segments bear, on their inner face, three pairs of spines, the lowest of which is much smaller, and as a rule a fourth pair of quite rudimentary spines. The segments grow longer and narrower towards the distal extremity of the ramus, the longest being about two and a half times as long as broad.

Penis remarkably long, more than three times as long as the sixth cirrus, tapering towards the extremity, with short hairs here and there, and a circle of such hairs round the extremity.

The small and straight projecting point at the dorsal basis of the penis, known to DARWIN already as occurring in the species of this genus, is well-developed also in the present species. Its apex is sharply pointed.

Two specimens of this species were found attached to a coral (*Caryophyllia* sp.) which was collected at:

Stat. 251. December 8, 1899. Lat. 5° 28′.4 S., Long. 132° 0′.2 E. Depth 204 m. Bottom: hard coral-sand.

General Remarks. Although it has not been possible, from want of material, to give the description of this species so detailed and so accurate, as might be desired, especially as regards the structure of the shell, the sheath, the basis etc., there can be hardly any doubt as to its being different from any of the species described by DARWIN.

It is, moreover, the first instance of a species of *Pyrgoma* being found at a somewhat considerable depth.

3. *Pyrgoma jedani* n. sp. Pl. XXVII, fig. 3—8.

Shell irregularly conical, orifice oval, with a somewhat swollen border; basis irregularly cup-formed and attached to the surface of the ramifications of an Alcyonarian; scutum and tergum triangular, not calcified together; spur of tergum feebly developed.

Of this very interesting new species (Pl. XXVII, fig. 3), numerous specimens are attached to an Alcyonarian from Station "Jedan". They look as if they formed one organism together with the Alcyonarian; the smaller specimens of the Cirripede especially can hardly be distinguished from swollen parts of the branches of the Alcyonarian. The large specimens have their surfaces also quite merged into that of the organism to which they are attached, and the ramifications of the latter seem to loose themselves in the surface of the Cirripede.

Some of the Cirripedes are attached to one another, and in this state have a very irregular shape. Most specimens show more or less distinctly a somewhat laterally flattened conical shell and an irregularly cup-formed basis. Where shell and basis unite, a more or less prominent border or margin can be distinguished, and, in some of the specimens, rims or lists run from that border to the orifice of the shell. This orifice is moderately large and has a swollen border, which is distinctly divided into parts or lobes in some of the specimens. In several specimens, more or less deep furrows extend over the surface of the shell, parting from the orifice, and dividing the shell into parts which at first sight might be compared with the compartments of other sessile Cirripedes. The surface is irregular, moreover, through the presence of numerous tubercles or knobs, which, however, are also much more numerous and prominent on some of the specimens, than on the others.

The opercular valves are not calcified together and, in many regards, resemble those of *Balanus*. The scutum (Pl. XXVII, fig. 4, *a* and *c*) is rather thick, triangular, with the apex pointed but not produced, and with the basal margin distinctly curved; the articular ridge is strongly developed and extends to the basi-tergal angle of the valve; the part of the valve along the tergal margin is distinctly reflexed. This is also the case with the part of the valve along the occludent margin. The inner surface of the valve is almost perfectly smooth, no trace of an adductor pit or adductor ridge being visible; a lateral depressor pit, however, can be seen at the basi-tergal corner of the valve. The outer surface of the scutum shows prominent growth-ridges; the whole valve is not flat, but distinctly bowed along a line extending from the apex to a point near the middle of the basal margin.

The tergum (Pl. XXVII, fig. 4, *b* and *d*) is almost quite flat, thin, triangular. Its apex is rounded and not beaked; growth-ridges on the outer surface very indistinct. The scutal margin is nearly straight, the carinal bowed, the basal sinuous. The spur is only feebly developed and represented by a part with rounded circumference which projects a little beyond the basi-scutal angle of the valve. On the inner side the growth-ridges are slightly more distinct than on the outer surface. There is a slightly-prominent articular ridge and furrow,

and traces of crests for the attachment of the tergal depressor muscle can be seen near the basi-carinal angle of the valve.

The study of the structure of the animal contained within the shell has given the following results:

Buccal process not very prominent; at its side the cirri of the first pair are attached; labrum (Pl. XXVII, fig. 5) widely and also deeply notched, with three small triangular teeth on each side of the notch. Palpi broad, rounded, with numerous and not very long, partly curled hairs disposed on the inner surface and along the upper margin.

Mandibles (Pl. XXVII, fig. 6) with five teeth and the inferior angle not distinctly separated from the fifth. Distance between tips of first and second teeth slightly surpassing that between those of second and third teeth. The third tooth is the most massive, the fourth and fifth are smaller than the others. The second and third teeth are laterally double.

The maxilla (Pl. XXVII, fig. 7) has a straight edge; below the two larger upper spines there is a rudimentary notch; on the part of the edge below this notch 7 to 8 spines are disposed, one or two of which are almost as strong, and only a trifle shorter than the two upper ones.

The outer maxillae (Pl. XXVII, fig. 8) are bilobed; the inner lobe is small, the outer rather broad and of an oval shape. Numerous hairs are disposed along the inner margin and on a part of the surface, towards the interior of the mouth.

Cirri. Those of the first pair have very unequal rami of twelve and six segments. In both rami hairs are disposed in dense groups at the front side on the upper half of the surface of each segment. That part of the surface of the segments of the shorter ramus on which the hairs are disposed is slightly protuberant.

The cirri of the second and third pair have about the same structure, the latter being only slightly longer than the former. The rami of the second cirrus have 6 and 8 segments, the longer ramus having its segments slightly more protuberant than the six segments of the shorter. The hair-like spines on the segments of the 2nd cirrus are much longer and form denser bushes than those of the 3rd cirrus. The latter has 7 segments in the shorter ramus and 8 in the longer.

The cirri of the 4th to 6th pairs have the rami rather short. Those of the 6th pair have eleven and twelve segments, the first of which is very long, the following being about two and a half times as long as broad. The number of pairs of spines on the inner face of each segment is three, the first or lowest pair being extremely small.

The penis is extremely long, tapering towards the extremity, with delicate hairs scattered over its surface and a few more disposed near the extremity.

The straight projecting point at the dorsal basis of the penis is well developed; it is slightly curved, but its apex is not pointed, but blunt.

One of the specimens I examined was furnished with eggs. As far as could be made out, they were united into a cluster (and only in one) and did not form true lamellae. The eggs are not very numerous (about 60 to 80 altogether) and relatively small: they measure only 0.27×0.14 mm.

This species was collected at Station Jedan. As the figure (Pl. XXVII, fig. 3) shows, the Cirripedes are attached to a much ramified Alcyonarian Polyp, the name of which I have not been able to make out.

General remarks. This is a very peculiar species: in the first place it is a *Pyrgoma* with the opercular valves of a *Balanus*. In three of the hitherto known species of *Pyrgoma* (*P. conjugatum*, *P. grande* and *P. monticulariae*) the scuta and terga are perfectly calcified together, and this is also the case with the opercular valves of *P. kuri*; in a fifth species (*P. milleporae*) these valves are slightly calcified together, the scutum being, moreover, much elongated; the scutum of *P. dentatum* and *P. crenatum* is much elongated all the same; an abnormal long spur — four times as long as the upper part of the valve — characterizes the tergum of *P. cancellatum*; sub-triangular scuta and terga, like those of *Balanus*, occur only in *P. anglicum* and *P. Stokesi*, two species approaching each other closely and both belonging to the Atlantic region. Comparing these valves of *P. anglicum* with those of *P. jedani*, we see at once that the scutum of the latter, with its feebly developed ridges and the indentation of the basal margin representing the cavity for the lateral depressor muscle, is quite different, and that the spur of the tergum which is well-developed in *P. anglicum*, can hardly be made out in the new species.

In the second place, the general shape of the shell and the way in which it is attached to the Alcyonarian is also quite peculiar. In this respect also it comes perhaps nearest to *P. anglicum*, but nothing can be made out in the new species of the pores which permeate the basis in that species.

Thirdly, I must point out that its attachment to an Alcyonarian and not to a coral is, so far I know, characteristic for the present species, all the others living, as DARWIN says, "imbedded in corals".

Genus **Creusia** Leach

DARWIN thought best to describe the different forms of Cirripedes belonging to this genus, not as different species, but as so many varieties of a single species. According to him the variations are local, the greater number of specimens embedded in the same coral resembling each other. Of these varieties, to which DARWIN has given no names, and of which he distinguished no less than eleven, according to him several inhabit the Malay Archipelago: Java, the Philippines, Singapore, etc.

This species lives attached to or embedded in corals, and has not been observed hitherto at any considerable depth. It is distributed "throughout the tropical seas" (DARWIN); but, partly in consequence of the insufficiency of the available material, our knowledge of the distribution of these different forms is still a very incomplete one. WELTNER[1] gives a list of the localities from which the Berlin Museum has received samples of *Creusia spinulosa* — but as he does not say to which varieties or forms these samples belong, his list does not enlarge our knowledge very much.

[1] WELTNER, W., Verzeichnis u. s. w. Archiv f. Naturgeschichte. 1897. Bd. I. S. 255.

The genus is represented in the collections of the expedition of H. M. S. "Siboga" by only two samples, and each consists of only a single specimen, being one moreover, incomplete.

1. *Creusia spinulosa* Leach, var. (11).

DARWIN, CH., Monograph. The Balanidae, Verrucidae etc. 1854. p. 376, pl. XIII, fig. 6, pl. XIV, fig. 6.

I refer to this species, although with some hesitation, a specimen of a Sessile Cirripede attached to and partly embedded in a piece of plate-like coral which was dredged at:

Stat. 257. December 11, 1899. In Du-roa-strait, Kei-islands. Depth till 52 m. Bottom: coral.

There is one specimen only, and this is incomplete as the opercular valves are wanting. Its orifice is small diamond-shaped, it has four compartments and distinct white radii, the remaining part of the shell being pale lilac-coloured. Its surface is not very distinctly marked with ribs, but shows numerous calcareous points which are disposed, somewhat irregularly however, on rows radiating from the orifice to the edge of the basis. The shell is of a conical shape and small, the greatest diameter of the basis being about 6 mm.

2. *Creusia spinulosa* var. *sumbawae* n. var. Pl. XXVII, fig. 9—16.

This variety is different from those described by DARWIN; it is not embedded in a coral, but was found attached to a specimen of *Heteropsammia* (Pl. XXVII, fig. 9). Its shape is conical, its orifice small, elongately rhombiform; the surface of the compartments is rough (Pl. XXVII, fig. 10) through numerous small pointed tubercles being scattered over it. The colour is yellowish-brown, the radii and the basal parts of the ribs being white; the small tubercles on the surface are also of a white colour. The radii are rather broad at the summits, which are horizontal, not oblique. The surface shows the ribs round the basis much more prominent on one side than on the other: whilst they can hardly be seen on one side, they are distinctly projecting round the basal border on the other side. The basis is distinctly cup-formed, and its outer surface shows ribs, which radiate from the centre and whose extremities correspond with those of the ribs on the outer surface of the compartments. Like those of the compartments, they are much more prominent on the one side of the basis than on the other. The interior surface of the shell and the basis have not been investigated.

The scutum (Pl. XXVII, fig. 11, *a* and *c*) is nearly rectangular; it has the growth-ridges prominent and lightly crenulated, especially in the basal part of the valve; the surface of the part near the apex is almost perfectly smooth. The tergal margin is straight; a small part of the outer surface along that margin is reflexed and this reflexed part on the right side-scutum extends farther towards the basal margin than on the scutum of the other side. It terminates in the right side-scutum in a distinct tooth at the basi-tergal angle. The inner surface shows a very prominent articular ridge and a hardly less prominent adductor ridge, extending high up towards the apex. The cavity for the lateral depressor muscle is distinct, even rather strongly developed.

The tergum (Pl. XXVII, fig. 11*b*) is thin and very brittle; its beak is not produced, its scutal margin nearly straight, its spur is about half the width of the valve. The basal end of the spur is rounded off, the basal margin of the tergum slightly hollowed out. The whole valve is about two-thirds of the width of the scutum, this valve like the scutum resembling in many respects the corresponding parts of DARWIN's var. (1).

DARWIN did not give a description of the mouth and cirri of this genus. He pointed out in the description of the genus only that in the characters derived from these parts there are no generic differences between the genera *Pyrgoma* and *Creusia*. I think it of some importance to give here a short description of these parts in the present variety, so far as I have been able to study them.

Mouth. Labrum (Pl. XXVII, fig. 12). Lateral margins on both sides of notch make an angle; notch rather wide at entrance and not very deep. There are found 3 to 4 teeth on either side of the notch, one of these on either side being much smaller. No hairs are observable on the margins of the notch or along the edge of the labrum.

Palpi oval, the upper and lower margins nearly parallel, the free extremity broadly rounded off. Delicate hairs are disposed along the lower margin; the stronger hairs along the upper margin are developed only on the distal part of that margin. The outer surface is furnished with a group of longer spines or spine-like hairs, which also occupy only the distal extremity and which meet downwards with a double row of such spines, making an angle with the lower margin. The inner surface is covered with numerous shorter and curled hairs, part of which fall over the free edge of the labrum so long as the palpus is not lifted up.

Mandible (Pl. XXVII, fig. 13). Distance between extremities of teeth 1 and 2 greater than that between teeth 2 and 3. One and two of about the same size, 3 somewhat shorter; 2 and 3 are indistinctly double at the extremity. Tooth 4 represented by a blunt triangular knob, larger at the mandible of the one side than at the other. Tooth 5 and inferior angle form together a small truncated projection. Row of hairs along inferior margin rather elongate.

Maxilla (Pl. XXVII, fig. 14). Edge straight, making a rectangle with the inferior margin. Spines of the upper and lower pairs of about the same size. Between these two pairs, five intermediate ones are disposed, the 2nd and 4th of which are slightly longer than the other three. There is no notch behind the upper pair, but all the spines are disposed at small distances from each other. Among the spines numerous long hairs are inserted. Apodeme long and slender.

Outer maxillae (Pl. XXVII, fig. 15). Outer lobe broken off, lost; inner lobe somewhat elongate, covered over inner surface with several rows of partly feathered hairs. These stand off horizontally or are directed towards the basal part of the maxilla.

Cirri. Cirri 1 to 3 lost.

Cirrus 4 has slightly unequal rami of 13 to 14 and 14 to 15 segments. The middle segments are less than four times as long as broad, and bear 2 pairs of spines on their inner faces. On the outer side, each segment bears a few hairs at the extremity, one of which is rather long, nearly as long as the segment itself. No trace of teeth on inner face of lower segments.

Cirrus of 5th pair has unequal rami of 16 and 20 segments. The middle segments bear three pairs of spines on the inner face: a pair of very small ones disposed about the middle of the anterior margin, a pair of long ones near the extremity, and a pair of small ones half way between both pairs. Hairs on outer face near extremity of segments rather long.

Cirrus of 6th pair (Pl. XXVII, fig. 16). Rami not very unequal, of 20 and 22 segments. Greatest number of spines on the inner face of the middle segments 3 pairs — as on the segments of the 5th cirrus. Spine-like hairs disposed at the extremity of the segments on outer face nearly as long as the segments themselves.

Penis long, growing narrower towards the extremity. Very few hairs only are seen scattered over surface, hardly any hairs at the extremity.

The only specimen of this species that the Siboga collected was dredged at:

Stat. 313. February 14/16, 1900. Anchorage East of Dangar Besar, Saleh- (or Sapeh-)bay. Depth up to 36 m. Bottom: sand, coral, and mud.

Genus **Chthamalus** Ranzani

Darwin described eight species of *Chthamalus* in his Monograph (1854). The "Challenger" collected a Cirripede belonging to this genus which I introduced into science as a ninth species. So far as I know, no other forms or species of this genus have been collected, nor has our knowledge of the habits, distribution etc. of the known species greatly increased since Darwin published his Monograph.

Only two of these species have been observed in the Malay Archipelago (*Ch. stellatus* Poli and *Ch. intertextus* Darwin); two other forms, however, were collected in "adjacent" waters: *Ch. antennatus* Darwin at New South Wales and van Diemensland and *Ch. challengeri* Hoek taken from the screw of the frigate, after having remained for some time in the waters of Japan. (Gruvel[1] says that *Ch. antennatus* occurs also in Chili, but he does not mention the author who observed it there.)

Ch. stellatus is the only species that is widely distributed: it lives on the coast-rocks of Southern Europe, of the Southern United States, also at Woodshole (Sumner), on the coasts of Brazil, of the Red Sea, coast of Bengal, the Philippine Archipelago, coast of China, of California etc. So far as our knowledge goes, all the other species — with the exception of the somewhat problematic case of *Ch. antennatus* mentioned above — have only a much more limited or even local distribution. Yet *Ch. stellatus* was not observed attached to floating objects, as was the case with *Ch. dentatus* and *Ch. challengeri* which were taken from ships' bottoms. Like most of the other species, *Ch. stellatus* lives attached to littoral rocks, none of the species having been observed at any important depth.

H. M. S. "Siboga" brought home specimens of two species belonging to this genus.

1. *Chthamalus stellatus* Poli. Pl. XXVII, fig. 17—22.

Darwin, Ch., Monograph. The Balanidae, Verrucidae etc. 1854. p. 455, pl. XVIII, fig. 1*a*—1*h*.

[1] Gruvel, A., Monographie des Cirrhipèdes. 1905. p. 203.

Half-a-dozen small specimens, attached to a piece of blackish stone, were collected in the Bay of Pidjot, Eastcoast of Lombok, when H. M. S. "Siboga" paid a visit to that island. The specimens were in dry condition when I investigated them; their peculiar appearance may be partly due to this circumstance.

The shell was much depressed, the walls folded, sutures partly obliterated, orifice broadly oval (Pl. XXVII, fig. 17).

The scutum (fig. 18, *a*) has the tergal margin much shorter than the other margins and deeply notched in the lower half near the basi-tergal angle. Occludent and carinal margins are both furnished with rather strong rims, the whole valve being unusually thick.

The latter is the case in a still higher degree with the tergum (fig. 18). Its scutal margin is deeply notched for the reception of the broad process of the tergal margin of the scutum, and has a strong nearly quadrangular tooth fitting in the deep notch of the tergal margin of the scutum. Its apex is rounded, its carinal margin curved, the crests for the depressor muscle very strongly developed, its basal margin nearly straight and terminating in a small triangular process, which seems to represent the spur. The shape of the tergum somewhat resembles that of var. *communis* Darwin; but the scutum is quite different, being nearly equilateral in var. *communis*, and having the tergal margin relatively short in the present form.

The structure of the mouth and of the cirri corresponds with DARWIN's description. As no figures of these parts of a species of *Chthamalus* have been published before, I think it not superfluous to give a few figures for the present form.

The crest of the labrum (Pl. XXVII, fig. 19) is not only hairy, but furnished with a row of teeth as well. The palpi are quadrate, with rounded edges, and are furnished with numerous and partly very long hairs.

The mandible (Pl. XXVII, fig. 20) has three main teeth, the fourth is very small, laterally double and confluent with the lower pectinated angle.

The maxilla (Pl. XXVII, fig. 21) has two larger spines above the notch and a few very delicate spines between these two larger ones and in the notch. The spines disposed along the outer edge are not very strong, those at the lower angle very delicate.

The outer maxillae have the outer margin rounded and the inner margin sinuous. A strong tuft of bristles is disposed at the tip and along the outer side of this maxilla. The part representing the inner lobe is not prominent.

Cirri. The first pair are situated close to the mouth; its branches are relatively short, with broad segments. The shorter and broader branch has five, the other, which is slightly more elongate and less broad, has six not very distinct segments. All the segments of both branches are furnished with numerous hairs, which form a continuous row along the outer margin of the shorter branch and dense groups on the surface of the segments. The lower segments of the longer ramus bear 3 to 4 short strong spines of conical shape which are about three times as long as broad at their basis and which are disposed on the side directed towards the shorter branch.

The cirri of the second pair are slightly longer than those of the first pair. Each ramus has 6 segments and is thickly clothed with spines. The outer segments of both branches bear

a dense tuft of pectinated spines (Pl. XXVII, fig. 22) which DARWIN sometimes observed in this species also and which according to him occur in specimens from La Plata. The outer surface of the pedicel of this cirrus bears the tuft of long spines as described by DARWIN.

The cirrus of the third pair has rami of nearly equal length, both composed of 14 segments. The number of pairs of spines on the inner side of the segments is four, the length of the spines greatly diminishing from the upper to the lower pair. The third pair of cirri have exactly the same structure as the fourth, the latter, however, are slightly longer and have 16 segments in each ramus in the specimen which was examined. The sixth pair has 18 segments in both rami.

The penis is very long, more than twice as long as the cirri of the last pair. It is distinctly ringed, broad at the basis and much narrower towards the extremity. A few delicate hairs are scattered over its surface, the last segment bearing a tuft of such hairs disposed on both sides of a somewhat elongate slit-like opening.

To this species, most probably, belong also a few small specimens of a *Chthamalus* attached to a piece of rock or stone, found on the reef at Sapek-Bay, East-coast of Sumbawa. They are very small specimens and they are slightly different from each other. The largest has a diameter at the basis of about 5 mm., the smaller ones of 2.5 and 3 mm. respectively. Whilst the smaller ones have the orifice of an elongate shape, that of the larger specimen is about as long as broad. Of the latter specimen the opercular valves were examined. Its scutum is triangular, with the basal and opercular margins long, the tergal margin relatively short. It is feebly folded in the direction from the apex to the middle of the basal margin, the latter being distinctly hollowed out about the middle. The tergum is small; it has a very prominent articular ridge, the part corresponding with the spur of other species rather broad and rounded at the extremity; it has the opercular margin short and distinctly arched, and it is furnished with very prominent crests for the adductor muscle, the extremities of which reach distinctly beyond the basal margin. The colour of the smaller specimens is dirty olive-greenish, that of the larger one blackish-blue. The basis of the larger specimen is on one side, and partly overgrown by the shell of a Lamellibranchiate Mollusc — a circumstance that does not make it easier to give a good description. The alae of the rostrum are well-developed, broad at the upper extremity and terminating downwards into a point; the radii of the rostro-lateral compartments are indistinct, but certainly very narrow. The little stone with these small Barnacles was collected on the reef along the coast of Sumbawa during shore-exploration, and was found, probably, at a very inconsiderable depth.

2. *Chthamalus intertextus* Darwin.

DARWIN, CH., Monograph. The Balanidae, Verrucidae etc. 1854. p. 467, pl. XIX, fig. 1*a*, 1*b*.

At Station 16 a single specimen was collected, in very defective condition, and I think that it belongs to this species. The oblique interfolding laminae of the parietes, the

shape of the scutum and tergum, the strongly marked crests for the depressor muscles, extending beneath the basal margin of the tergum, are so characteristic that I could have no doubt as to its specific nature.

Yet, in some respects the "Siboga" specimen differs from DARWIN's description. The scutum and tergum were so intimately joined together that only a trace of a suture could be seen externally. By boiling these valves with caustic potash I easily separated them from each other, but I think this would not have been the case if they were "completely calcified together" as DARWIN says they are. The inner basal edges of the parietes, moreover, were not inflected inwards, as DARWIN says is the case in all full-grown specimens. So far as can be made out with the incomplete object at my disposal, it is probably full-grown, measuring 11 mm. (the largest diameter of the basis), whilst the largest specimen that DARWIN saw was 0.35 of an inch (about 8 mm.) in basal diameter.

The only specimen collected by the "Siboga" was taken at:

Stat. 16. March 15/16, 1899. Lat. 6° 59′ S., Long. 115° 24′.7 E. [Bay of Kankamaraän, S. coast of Kangeang.] Depth 22 m. Bottom: mud.

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The figures in dark type indicate the pages on which the species are described.

Note. The name *Scalpellum ventricosum* used in this Index and in the Introduction to the Report is to take the place of *Scalpellum arcuatum*, used p. 98, as the latter was preoccupied by DARWIN for a fossil species (Pal. Soc. Mon. Foss. Lepadidae. 1851. p. 40).

PLATE XI

Fig. 1—6. *Verruca cassis* n. sp.

Fig. 1. Moveable scutum; magnified 16 diameters.
Fig. 2. Moveable tergum; magnified 16 diameters.
Fig. 3. Rostrum; magnified 16 diameters.
Fig. 4. Carina, external view; magnified 16 diameters.
Fig. 4*a*. Carina, internal view; magnified 16 diameters.
Fig. 5. Fixed tergum; magnified 16 diameters.
Fig. 6. Fixed scutum; magnified 16 diameters.

Fig. 7—13. *Verruca grex* n. sp.

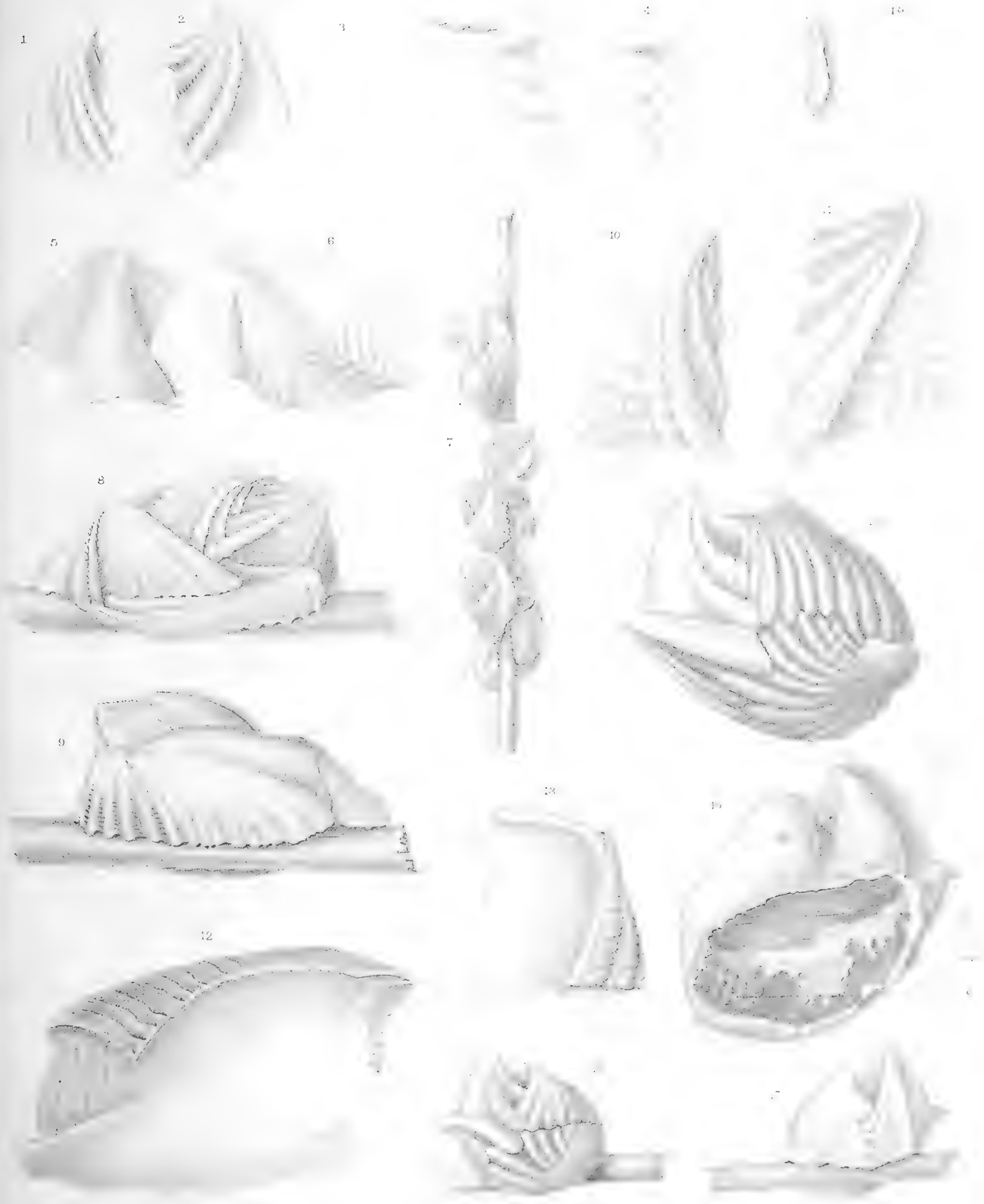
Fig. 7. Group of specimens; magnified 3 diameters.
Fig. 8. Specimen, seen from the side of the moveable valves; magnified 7,6 diameters.
Fig. 9. Specimen, seen from the side of the fixed valves; magnified 7,6 diameters.
Fig. 10. Moveable scutum; magnified 16 diameters.
Fig. 11. Moveable tergum; magnified 16 diameters.
Fig. 12. Fixed scutum; magnified 16 diameters.
Fig. 13. Fixed tergum; magnified 16 diameters.

Fig. 14—15. *Verruca conchula* n. sp.

Fig. 14. Specimen, seen from the side of the moveable valves; magnified 11 diameters.
Fig. 15. Specimen, seen from the side of the fixed valves; magnified 11 diameters. *m.* part of membranous basis; *b.* part of the outer surface of the object to which the shell was attached; *o.* part of the ovary.

Fig. 16—17. *Verruca conchula* var. *minor* n. var.

Fig. 16. Shell, seen from the side of the moveable valves; magnified 10 diameters.
Fig. 17. Shell, seen from the side of the fixed valves; magnified 10 diameters.



P. P. C. Hoek del.

VERRUCA.

Fa. P. W. M. Trap impr.

PLATE XII

Fig. 1—3. *Verruca capsula* n. sp.

Fig. 1. Shell, seen from the side of the moveable valves; magnified 5 diameters.

Fig. 2. Shell, seen from above; magnified 4 diameters.

Fig. 3. Moveable scutum (left-hand figure), and moveable tergum (right-hand figure), internal view; magnified 8 diameters.

Fig. 4—6. *Verruca navicula* n. sp.

Fig. 4. Shell, seen from the side of the moveable valves; magnified 7 diameters.

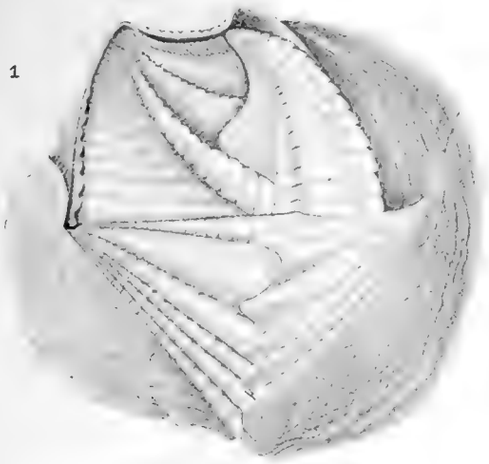
Fig. 5. Shell, seen from the side of the fixed valves; magnified 7 diameters.

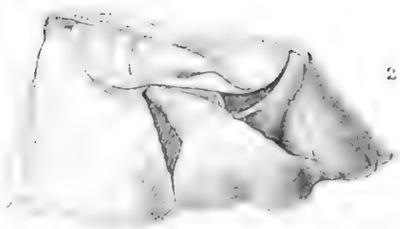
Fig. 6. Shell of younger specimen, seen from the side of the moveable valves; magnified 30 diameters.

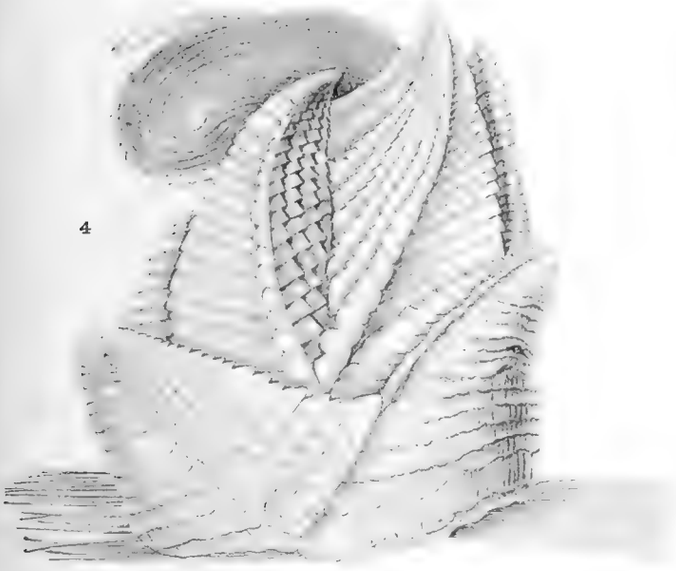
Fig. 7—8. *Verruca cassis* n. sp.

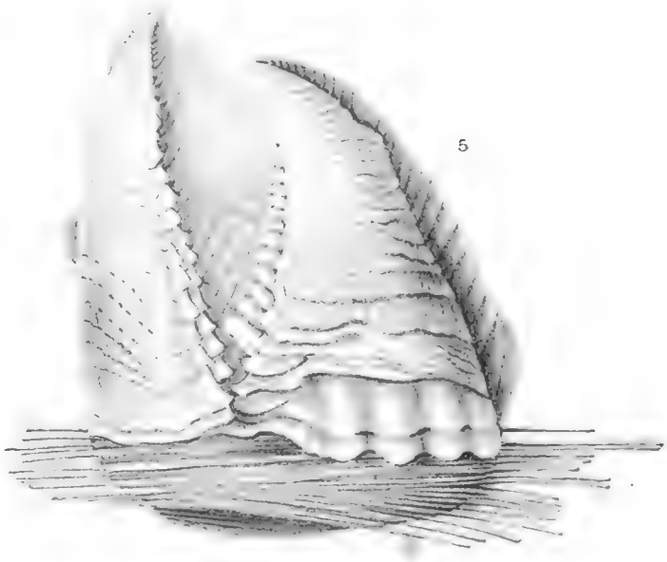
Fig. 7. Shell, seen from the side of the moveable valves; magnified 8,5 diameters.

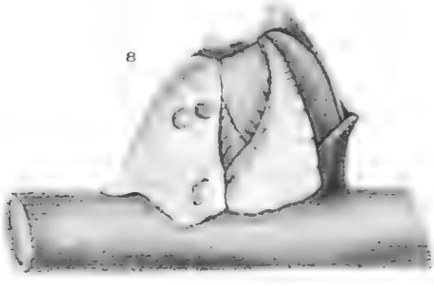
Fig. 8. Shell, seen from the side of the fixed valves; magnified 8,5 diameters.











P. P. C. Hoek del.

VERRUCA.

Fa. P. W. M. Trap impr.

PLATE XIII

Fig. 1—4. *Verruca capsula* n. sp.

Fig. 1. Mandible; magnified 52,5 diameters.
Fig. 2. Maxilla; magnified 52,5 diameters.
Fig. 3. Outer maxilla; magnified 52,5 diameters.
Fig. 4. Caudal appendage, last segments; magnified 180 diameters.

Fig. 5—7. *Verruca navicula* n. sp.

Fig. 5. Mandible; magnified 180 diameters.
Fig. 6. Maxilla; magnified 180 diameters.
Fig. 7. Caudal appendage, last segments; magnified 180 diameters.

Fig. 8—10. *Verruca cassis* n. sp.

Fig. 8. Mandible; magnified 180 diameters.
Fig. 9. Maxilla; magnified 180 diameters.
Fig. 10. Caudal appendage, last segments; magnified 180 diameters.

Fig. 11—13. *Verruca grex* n. sp.

Fig. 11. Mandible; magnified 180 diameters.
Fig. 12. Maxilla; magnified 180 diameters.
Fig. 13. Caudal appendage, last segments; magnified 180 diameters.

Fig. 14—15. *Verruca casula* n. sp.

Fig. 14. Animal seen from the side of the moveable valves; magnified 14 diameters.
Fig. 15. Animal seen from the side of the fixed valves; magnified 14 diameters.

Fig. 16—19. *Balanus tintinnabulum* (Linn.) var. *validus* Darwin.

Fig. 16. Labrum with left-hand palpus, internal view; magnified 30 diameters.
Fig. 16*a*. Right-hand palpus, external view; magnified 30 diameters.
Fig. 17. Mandible; magnified 30 diameters.
Fig. 18. Maxilla; magnified 30 diameters.
Fig. 19. Outer maxillae; magnified 30 diameters.

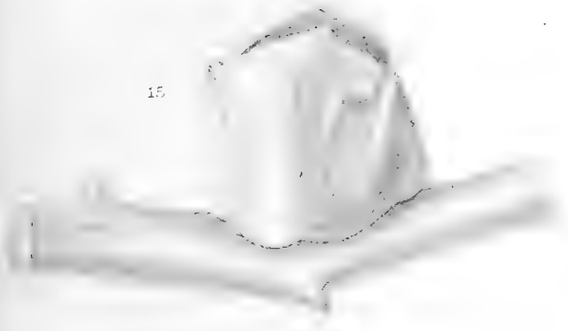


PLATE XIV

Fig. 1—4. *Balanus tintinnabulum* (Linn.) var. *validus* Darwin.

Fig. 1. Cirrus of first pair; magnified 14 diameters.

Fig. 2. Cirrus of second pair; magnified 14 diameters.

Fig. 3. Cirrus of third pair. *a.* Membranous plate fringed with fine bristles; magnified 14 diameters.

Fig. 4. Segments 12 and 13 of the cirrus of the sixth pair; magnified 30 diameters.

Fig. 5—6. *Balanus tintinnabulum* (Linn.) var. *costatus* n. var.

Fig. 5. Animal seen from above; magnified 4,1 diameters.

Fig. 6. *a.* tergum, internal view; magnified 8 diameters.

b. scutum, internal view; magnified 8 diameters.

c. scutum, external view; magnified 8 diameters.

d. tergum, external view; magnified 8 diameters.

Fig. 7. *Balanus tintinnabulum* (Linn.) var. *plicatus* n. var.

Fig. 7. Animal seen from above, with smaller specimen attached to it; magnified 4,1 diameters.

Fig. 8—17. *Balanus amphitrite* Darwin.

Fig. 8—11, 12*, 13, 14, 15, and 17: var. *malayensis* n. var.

Fig. 8. Animal, lateral view; magnified 4 diameters.

Fig. 9. Same specimen, seen from below; magnified 4 diameters.

Fig. 10. *a.* scutum, internal view; magnified 10 diameters.

b. tergum, internal view; magnified 10 diameters.

c. scutum, external view; magnified 10 diameters.

d. tergum, external view; magnified 10 diameters.

Fig. 11. Transverse sections of lateral compartment; magnified 20 diameters.

a. about the middle of the height.

b. near the upper extremity.

Fig. 12*. Right-hand palpus, external view; magnified 64 diameters.

Fig. 13. Mandible; magnified 64 diameters.

Fig. 14. Maxilla, with 7 spines between upper and lower pair; magnified 64 diameters.

Fig. 15. Outer maxillae; magnified 44,5 diameters.

Fig. 17. Inner face of middle segment of cirrus of 6th pair; magnified 206,5 diameters.

Fig. 12, 14*, and 16: var. *communis* Darwin.

Fig. 12. Labrum, external view; magnified 140 diameters.

Fig. 14*. Maxilla, with 5 spines between upper and lower pair; magnified 140 diameters.

Fig. 16. Inner face of 4th and 5th segments of cirrus of third pair; magnified 206,5 diameters.

P. P. C. Hoek, del.

BALANUS.

Fa. P. W. M. Trap, impr.

PLATE XV

Fig. 1—8. *Balanus alatus* n. sp.

Fig. 1. Animal, lateral view; magnified 10,5 diameters.
Fig. 2. *a* and *b*, tergum and scutum, united, external view; magnified 13 diameters.
c, tergum and *d*, scutum, internal view; magnified 13 diameters.
Fig. 3. Transverse section of carina; magnified 44,5 diameters.
Fig. 4. Labrum, with right-hand palpus, external view; magnified 42 diameters.
Fig. 4*. Left-hand palpus, external view; magnified 144 diameters.
Fig. 5. Mandible; magnified 144 diameters.
Fig. 6 and 6*, Right- and left-hand maxilla; magnified 144 diameters.
Fig. 7. Fifth segment of longer ramus of third cirrus; magnified 206,5 diameters.
Fig. 8. Middle segment of sixth cirrus; magnified 206,5 diameters.

Fig. 9—16. *Balanus minutus* n. sp.

Fig. 9. Animal, lateral view; magnified 7 diameters.
Fig. 10. *a*. scutum internal view; magnified 14,5 diameters.
b. scutum external view; magnified 14,5 diameters.
c. tergum external view; magnified 14,5 diameters.
Fig. 11. Labrum with right-hand palpus, external view; magnified 64 diameters.
Fig. 12. Mandible; magnified 64 diameters.
Fig. 13. Maxilla; magnified 206,5 diameters.
Fig. 14. Outer maxillae, outer lobe; magnified 64 diameters.
Fig. 15. Third cirrus, fourth segment; magnified 206,5 diameters.
Fig. 16. Sixth cirrus, middle segment; magnified 64 diameters.

Fig. 17—21. *Balanus amaryllis* Darw.

Fig. 17. *a*, scutum, *b*, tergum, internal view; magnified 5 diameters.
c, scutum, *d*, tergum, external view; magnified 5 diameters.
Fig. 18. Labrum, with right-hand palpus, external view; magnified 30 diameters.
Fig. 19. Mandible; magnified 30 diameters.
Fig. 20. Maxilla; magnified 30 diameters.
Fig. 21. First cirrus; magnified 14 centimeters.

P. P. C. Hoek, del.

BALANUS.

Fa. P. W. M. Trap impr.

PLATE XVI

Fig. 1—4. *Balanus amaryllis* Darwin.

Fig. 1. Outer maxillae; magnified 30 diameters.

Fig. 2. Cirrus of second pair; magnified 14 diameters.

Fig. 3. Cirrus of third pair; magnified 14 diameters.

Fig. 4. Cirrus of sixth pair, two segments about the middle of the cirrus; magnified 44,5 diameters.

Fig. 5—11. *Balanus bimae* n. sp.

Fig. 5. Animal, lateral view; magnified 4 diameters.

Fig. 6. *a* and *b*, scutum and tergum, internal view; magnified 8 diameters.
c and *d*, scutum and tergum, external view; magnified 8 diameters.

Fig. 7. Labrum with palpi; magnified 44,5 diameters.

Fig. 8. Mandible; magnified 44,5 diameters.

Fig. 9. Maxilla; magnified 44,5 diameters.

Fig. 9*. Maxilla, edge with spines; magnified 144 diameters.

Fig. 10. Outer maxillae; magnified 44,5 diameters.

Fig. 11. Cirrus of sixth pair, two of the middle segments; magnified 64 diameters.

Fig. 12—13. *Balanus albus* n. sp.

Fig. 12. Animal, lateral view; magnified 3,2 diameters.

Fig. 13. *a* and *b*, scutum and tergum, internal view; magnified 4,6 diameters.
c and *d*, scutum and tergum, external view; magnified 4,2 diameters.

P. P. C. Hoek, del.

BALANUS.

Fa. P. W. M. Trap, impr.

PLATE XVII

Fig. 1—6. *Balanus albus* n. sp.

Fig. 1. Labrum and right-hand palpus; magnified 30 diameters.
Fig. 2. Mandible; magnified 30 diameters.
Fig. 3. Maxilla; magnified 30 diameters.
Fig. 3*. Edge of maxilla with spines; magnified 64 diameters.
Fig. 4. Outer maxillae; magnified 30 diameters.
Fig. 5. Cirrus of 6th pair, 26th and 27th segments; magnified 44,5 diameters.
Fig. 6. Smaller specimen, lateral view; magnified 4,5 diameters.

Fig. 7—13. *Balanus maculatus* n. sp.

Fig. 7. Animal, lateral view; magnified 3 diameters.
Fig. 8. *a* and *b*, scutum and tergum, internal view; magnified 10 diameters.
c and *d*, scutum and tergum, lateral view; magnified 10 diameters.
Fig. 9. Labrum, with right-hand palpus; magnified 44,5 diameters.
Fig. 10. Mandible; magnified 44,5 diameters.
Fig. 11. Maxilla; magnified 44,5 diameters.
Fig. 11*. Edge of maxilla with spines; magnified 64 diameters.
Fig. 12. Outer maxillae; magnified 44,5 diameters.
Fig. 13. Cirrus of 6th pair, one of the middle segments; magnified 64 diameters.

Fig. 14—19. *Balanus tenuis* Hoek.

Fig. 14. Animal, attached to part of shell of larger specimen; magnified 3,2 diameters.
Fig. 15. *a* and *b*, scutum and tergum, internal view; magnified 10 diameters.
c and *d*, scutum and tergum, external view; magnified 10 diameters.
Fig. 16. Labrum, with right-hand palpus; magnified 64 diameters.
Fig. 17. Mandible; magnified 64 diameters.
Fig. 18. Maxilla; magnified 64 diameters.
Fig. 18*. Edge of maxilla, with spines; magnified 206,5 diameters.
Fig. 19. Cirrus of 6th pair, one of the middle segments; magnified 64 diameters.

P. P. C. Hoek, del.

BALANUS.

Fa. P. W. M. Trap impr.

PLATE XVIII

Fig. 1. *Balanus tenuis* Hoek.

Fig. 1. Outer maxillae; magnified 64 diameters.

Fig. 2—12. *Balanus socialis* Hoek.

Fig. 2. Two specimens attached to a piece of shell; magnified 10 diameters.

Fig. 3. *a* and *b*, scutum and tergum, internal view; magnified 10 diameters.
c and *d*, scutum and tergum, external view; magnified 10 diameters.

Fig. 4. *a* and *b*, two sections through the walls: *a*, near the orifice and *b*, near the basis; magnified 15 diameters.

Fig. 5. Labrum, with right-hand palpus; magnified 64 diameters.

Fig. 6. Mandible; magnified 64 diameters.

Fig. 7. Maxilla; magnified 64 diameters.

Fig. 7*. Edge of maxilla with spines; magnified 206,5 diameters.

Fig. 8. Outer maxillae; magnified 64 diameters.

Fig. 9. Sixth cirrus, two of the middle segments; magnified 64 diameters.

Fig. 10. Specimen with swollen compartments and elongated carina; magnified 10 diameters.

Fig. 11. Specimen with very broad alae; magnified 10 diameters.

Fig. 12. Tergum of the specimen with very broad alae: *a*, internal, *b*, external view; magnified 10 diameters.

Fig. 13—19. *Balanus maldivensis* Borradaile.

Fig. 13. Specimen attached to the spine of an Echinid; magnified 10 diameters.

Fig. 14. *a* and *b*, scutum and tergum, internal view; magnified 10 diameters.
c and *d*, scutum and tergum, external view; magnified 10 diameters.

Fig. 15. Labrum, with left-hand palpus; magnified 144 diameters.

Fig. 16. Mandible; magnified 144 diameters.

Fig. 17. Maxilla; magnified 144 diameters.

Fig. 18. Outer maxillae; magnified 64 diameters.

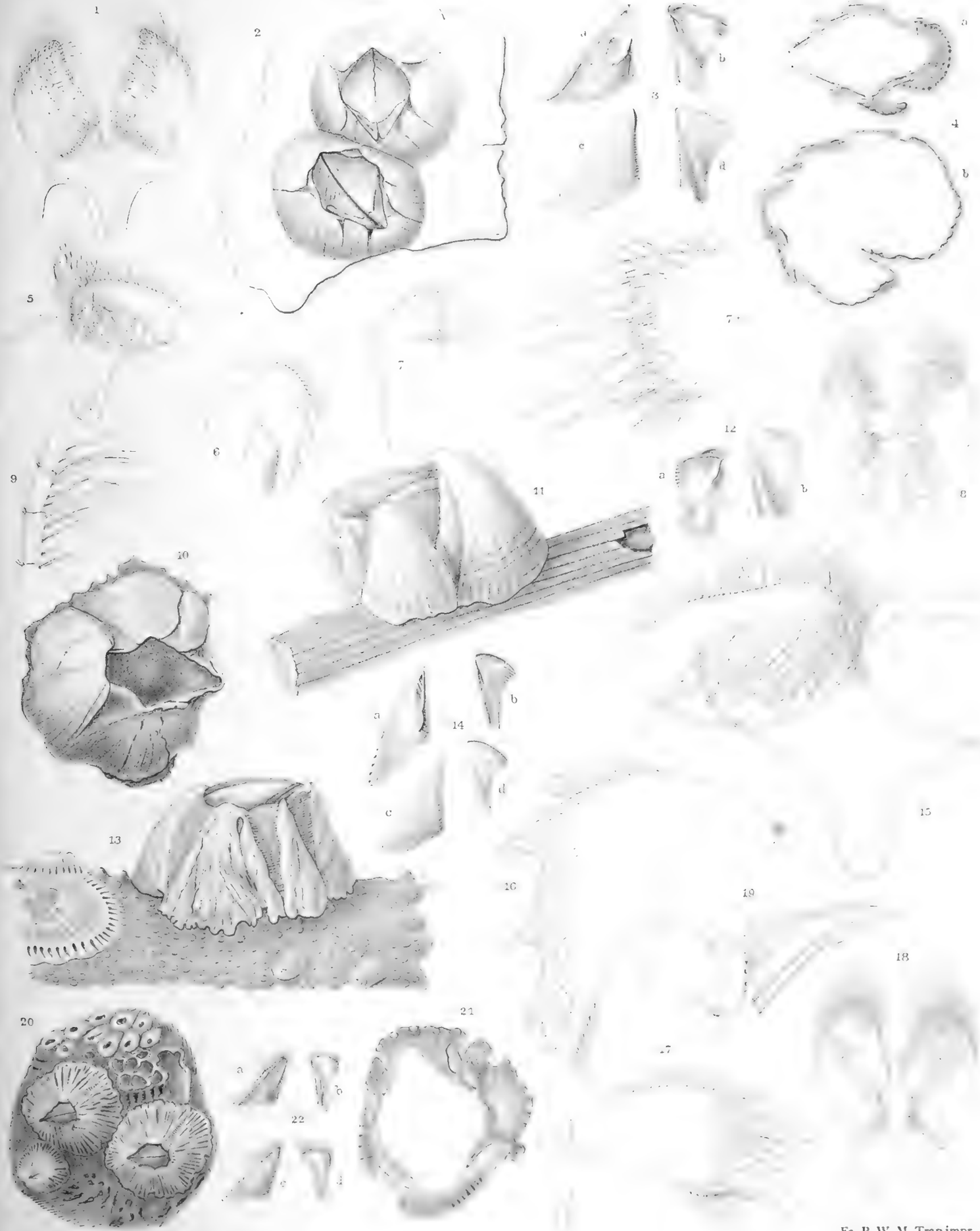
Fig. 19. Sixth cirrus, last segment but 7^{th}; magnified 64 diameters.

Fig. 20—22. *Balanus auricoma* n. sp.

Fig. 20. Group of specimens attached to a stone; magnified 10 diameters.

Fig. 21. Horizontal section through the valve near the basis; magnified 14 diameters.

Fig. 22. *a* and *b*, scutum and tergum, internal view; magnified 8,2 diameters.
c and *d*, scutum and tergum, external view; magnified 8,2 diameters.



P. P. C. Hoek del.

BALANUS.

Fa. P. W. M. Trap impr.

PLATE XIX

Fig. 1—7. *Balanus auricoma* n. sp.

Fig. 1. *a*, scutum, *b*, tergum, internal view; magnified 44,5 diameters.
Fig. 2. Labrum; magnified 64 diameters.
Fig. 3. Mandible; magnified 64 diameters.
Fig. 4. Maxilla; magnified 64 diameters.
Fig. 4*. Edge of maxilla with spines; magnified 206,5 diameters.
Fig. 5. Outer maxillae; magnified 64 diameters.
Fig. 6. Sixth cirrus, one of the middle segments; magnified 206,5 diameters.
Fig. 7. Small specimen, from Station 260; magnified 8,5 diameters.

Fig. 8—16. *Balanus ciliatus* n. sp.

Fig. 8. Group of specimens; magnified 6 diameters.
Fig. 9. *a* and *b*, scutum and tergum, internal view; magnified 10 diameters.
c and *d*, scutum and tergum, external view; magnified 10 diameters.
Fig. 10. Labrum, with left-hand palpus; magnified 44,5 diameters.
Fig. 11. Mandible; magnified 45,5 diameters.
Fig. 12. Maxilla; magnified 44,5 diameters.
Fig. 12*. Edge of maxilla, with spines; magnified 144 diameters.
Fig. 13. Outer maxillae; magnified 44,5 diameters.
Fig. 14. Third cirrus, longer ramus, 5th segment; magnified 144 diameters.
Fig. 15. Fourth cirrus, 5th segment; magnified 144 diameters.
Fig. 16. Sixth cirrus, 12th segment; magnified 144 diameters.

Fig. 17. *Balanus compressus* n. sp.

Fig. 17. Specimen attached to the tube of an Annelid; magnified 4 diameters.

P. P. C. Hoek del. Fa. P. W. M. Trap impr.

BALANUS.

PLATE XX

Fig. 1—7. *Balanus compressus* n. sp.

Fig. 1. *a* and *b*, scutum and tergum, internal view; magnified 8 diameters.
c and *d*, scutum and tergum, external view; magnified 10 diameters.
Fig. 2. Labrum; magnified 64 diameters.
Fig. 3. Mandible; magnified 144 diameters.
Fig. 3*. Edge of mandible of the other side; magnified 144 diameters.
Fig. 4. Edge of maxilla, with spines; magnified 206,5 diameters.
Fig. 5. Maxillae; magnified 44,5 diameters.
Fig. 6. Third cirrus, 5th segment; magnified 144 diameters.
Fig. 7. Sixth cirrus, one of the middle segments; magnified 44,5 diameters.

Fig. 8—16. *Balanus longirostrum* n. sp.

Fig. 8. Animal, lateral view; magnified 10 diameters.
Fig. 9. Rostrum, external view; magnified 10 diameters.
Fig. 10. *a* and *b*, scutum and tergum, internal view; magnified 13 diameters.
c and *d*, scutum and tergum, external view; magnified 13 diameters.
Fig. 11. Labrum, with right-hand palpus; magnified 64 diameters.
Fig. 12. Mandible; magnified 64 diameters.
Fig. 13. Maxilla; magnified 64 diameters.
Fig. 13*. Maxilla, edge with spines; magnified 206,5 diameters.
Fig. 14. Outer maxillae; magnified 64 diameters.
Fig. 15. Fourth cirrus, lower part; magnified 64 diameters.
Fig. 15*. Same cirrus, segments of pedicel and 3 segments of cirrus; magnified 144 diameters.
Fig. 16. Sixth cirrus, 16th segment; magnified 64 diameters.

Fig. 17—21. *Balanus terebratus* Darwin.

Fig. 17. Group of specimens; magnified 10 diameters.
Fig. 18. *a* and *b*, scutum and tergum, internal view; magnified 10 diameters.
c and *d*, scutum and tergum, external view; magnified 10 diameters.
Fig. 18*. Tergum, internal view; magnified 30 diameters.
Fig. 19. Mandible; magnified 144 diameters.
Fig. 20. Fourth cirrus, 4th segment; magnified 206,5 diameters.
Fig. 21. Sixth cirrus, one of the middle segments; magnified 144 diameters.

P. P. C. Hoek del.

BALANUS.

Lv. P. W. M. Trap imp.

PLATE XXI

Fig. 1—3. *Balanus terebratus* Darwin.

Fig. 1. Labrum, with left-hand palpus; magnified 144 diameters.
Fig. 2. Maxilla; magnified 144 diameters.
Fig. 3. Outer maxillae; magnified 144 diameters.

Fig. 4—14. *Balanus arcuatus* n. sp.

Fig. 4. Animal seen from above; magnified 10 diameters.
Fig. 5. Carino-lateral and lateral compartments, internal view; magnified 15 diameters.
Fig. 6. *a* and *b*, scutum and tergum, internal view; magnified 10 diameters.
c and *d*, scutum and tergum, external view; magnified 10 diameters.
Fig. 7. Transverse sections through compartments: *a*, not far from the orifice, *b*, halfway the height, *c*, near the basis; magnified 10 diameters.
Fig. 8. Labrum, with left-hand palpus; magnified 144 diameters.
Fig. 9. Mandible; magnified 64 diameters.
Fig. 10. Maxilla, outer part with spines; magnified 144 diameters.
Fig. 11. Outer maxillae, right-hand outer lobe; magnified 144 diameters.
Fig. 12. Third cirrus, fifth segment; magnified 206,5 diameters.
Fig. 13. Fourth cirrus, fourth segment; magnified 206,5 diameters.
Fig. 14. Sixth cirrus, tenth segment; magnified 206,5 diameters.

Fig. 15—20. *Balanus quadrivittatus* Darwin.

Fig. 15. Shell seen from above; magnified 7,6 diameters.
Fig. 16. *a* and *b*, scutum and tergum, internal view; magnified 7,6 diameters.
c and *d*, scutum and tergum, external view; magnified 7,6 diameters.
Fig. 17. Labrum; magnified 64 diameters.
Fig. 18. Mandible; magnified 64 diameters.
Fig. 19. Maxilla; magnified 64 diameters.
Fig. 19*. Maxilla, edge with spines; magnified 206,5 diameters.
Fig. 20. Outer maxillae; magnified 64 diameters.

P. P. C. Hoek del.

BALANUS.

Fa. P. W. M. Trap impr.

PLATE XXII

Fig. 1—2. *Balanus quadrivittatus* Darwin.

Fig. 1. Fourth cirrus, pedicel and lower segments; magnified 64 diameters.
Fig. 2. Sixth cirrus, one of the middle segments; magnified 64 diameters.

Fig. 3—10. *Balanus quinquevittatus* n. sp.

Fig. 3. Shell attached to shell of Gastropodous mollusc; magnified 4 diameters.
Fig. 4. *a* and *b*, scutum and tergum, internal view; magnified 7,6 diameters.
c and *d*, scutum and tergum, external view; magnified 7,6 diameters.
Fig. 5. Labrum, with left-hand palpus; magnified 64 diameters.
Fig. 6. Mandible; magnified 64 diameters.
Fig. 7. Maxilla; magnified 64 diameters.
Fig. 7*. Edge of maxilla, with spines; magnified 206,5 diameters.
Fig. 8. Outer maxillae; magnified 64 diameters.
Fig. 9. Fourth cirrus, pedicel and lower segments; magnified 144 diameters.
Fig. 10. Sixth cirrus, one of the middle segments; magnified 144 diameters.

Fig. 11—18. *Balanus hystrix* n. sp.

Fig. 11. Shell, side-view; magnified 7,5 diameters.
Fig. 12. *a* and *b*, scutum and tergum, internal view; magnified 10 diameters.
c and *d*, scutum and tergum, external view; magnified 10 diameters.
Fig. 13. Labrum, with left-hand palpus; magnified 144 diameters.
Fig. 14. Mandible; magnified 144 diameters.
Fig. 15. Maxilla, edge with spines; magnified 144 diameters.
Fig. 16. Third cirrus, 5th segment; magnified 206,5 diameters.
Fig. 17. Fifth cirrus, 5th segment; magnified 206,5 diameters.
Fig. 18. Sixth cirrus, 10th segment; magnified 206,5 diameters.

Fig. 19—25. *Balanus calceolus* Ellis.

Fig. 19. Shell, side-view; magnified 4,5 diameters.
Fig. 20. *a* and *b*, scutum and tergum, internal view.
c and *d*, scutum and tergum, external view.
Fig. 21. Labrum, with right-hand palpus; magnified 44,5 diameters.
Fig. 22. Mandible; magnified 44,5 diameters.
Fig. 23. Maxilla; magnified 44,5 diameters.
Fig. 23*. Edge of maxilla, with spines; magnified 144 diameters.
Fig. 24. Outer maxillae; magnified 44,5 diameters.
Fig. 25. Sixth cirrus, one of the middle segments; magnified 64 diameters.

Fig. 26. *Balanus navicula* Darwin.

Fig. 26. *a* and *b*, Shell, seen from right and left side; magnified 7,5 diameters.

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BALANUS.

Fa. P. W. M. Trap impr.

PLATE XXIII

Fig. 1—3. *Balanus navicula* Darwin.

Fig. 1. *a* and *b*, scutum and tergum, internal view; magnified 42,5 diameters.
c and *d*, scutum and tergum, external view; magnified 42,5 diameters.

Fig. 2. Labrum, with right-hand palpus; magnified 144 diameters.

Fig. 3. Maxilla; magnified 144 diameters.

Fig. 4—11. *Balanus investitus* n. sp.

Fig. 4. Animal seen from above, attached to an *Acanthogorgia*, which also covers the *Balanus*; magnified 9 diameters.

Fig. 5. Shell, lateral view; magnified 9 diameters.

Fig. 6. *a* and *b*, scutum and tergum, internal view; magnified 10 diameters.
c and *d*, scutum and tergum, external view; magnified 10 diameters.

Fig. 7. Labrum, with right-hand palpus; magnified 144 diameters.

Fig. 8. Mandible; magnified 144 diameters.

Fig. 9. Maxilla; magnified 144 diameters.

Fig. 10. Outer maxillae; magnified 144 diameters.

Fig. 11. Sixth cirrus, one of the middle segments; magnified 64 diameters.

Fig. 12—16. *Balanus cornutus* n. sp.

Fig. 12. Shell seen from above; magnified 8 diameters.

Fig. 13. Shell, lateral view; magnified 8 diameters.

Fig. 14. *a* and *b*, scutum and tergum, internal view; magnified 10 diameters.
c and *d*, scutum and tergum, external view; magnified 10 diameters.

Fig. 15. Third cirrus, longer ramus, 4th segment; magnified 206,5 diameters.

Fig. 16. Sixth cirrus, eigth segment; magnified 64 diameters.

Fig. 17—21. *Balanus proripiens* n. sp.

Fig. 17. Animal, lateral view; magnified 4 diameters.

Fig. 18. *a* and *b*, scutum and tergum, internal view; magnified 10 diameters.
c and *d*, scutum and tergum, external view; magnified 10 diameters.

Fig. 19. Labrum, with right-hand palpus; magnified 64 diameters.

Fig. 20. Mandible; magnified 64 diameters.

Fig. 21. Maxilla; magnified 64 diameters.

Fig. 21*. Edge of the maxilla, with spines; magnified 206,5 diameters.

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BALANUS.

PLATE XXIV

Fig. 1—3. *Balanus proripiens* n. sp.

Fig. 1. Outer maxillae, with left-hand lobes; magnified 64 diameters.
Fig. 2. Third cirrus, longer ramus, last segments; magnified 144 diameters.
Fig. 3. Fourth cirrus, segments II—IV; magnified 206,5 diameters.

Fig. 4—10. *Balanus pentacrini* n. sp.

Fig. 4. Shell, lateral view; magnified 10 diameters.
Fig. 5. *a* and *b*, scutum and tergum, internal view; magnified 10 diameters.
c and *d*, scutum and tergum, external view; magnified 10 diameters.
Fig. 6. Labrum, with left-hand palpus; magnified 64 diameters.
Fig. 6*. Labrum of other specimen; magnified 144 diameters.
Fig. 7. Mandible; magnified 64 diameters.
Fig. 8. Maxilla; magnified 64 diameters.
Fig. 9. Outer maxillae; magnified 64 diameters.
Fig. 10. Sixth cirrus, 11th segment; magnified 64 diameters.

Fig. 11—16. *Acasta conica* n. sp.

Fig. 11. Shell, lateral view; magnified 10 diameters.
Fig. 12. *a* and *b*, scutum and tergum, internal view; magnified 10 diameters.
c and *d*, scutum and tergum, external view; magnified 10 diameters.
Fig. 13. Mandible; magnified 144 diameters.
Fig. 14. Outer maxillae; magnified 44.5 diameters.
Fig. 15. Third cirrus, lower segments; magnified 206,5 diameters.
Fig. 16. Fourth cirrus, pedicel and lower segments; magnified 144 diameters.

Fig. 17—19. *Acasta nitida* n. sp.

Fig. 17. Shell, larger specimen, lateral view; magnified 4 diameters.
Fig. 18. Shell, smaller specimen, front view; magnified 10 diameters.
Fig. 19. Mandible; magnified 44.5 diameters.

P. P. C. Hoek del.

BALANUS—ACASTA.

Fa. P. W. M. Trap impr.

PLATE XXV

Fig. 1—3. *Acasta nitida* n. sp.

Fig. 1. *a* and *b*, scutum and tergum, internal view; magnified 10 diameters.
c and *d*, scutum and tergum, external view; magnified 10 diameters.

Fig. 2. Outer maxillae; magnified 44,5 diameters.

Fig. 3. Fourth cirrus, pedicel and lower segments; magnified 100 diameters.

Fig. 4—11. *Acasta glans* Lamarck.

Fig. 4. Shell, young specimen, lateral view; magnified 4 diameters.

Fig. 5. *a* and *b*, scutum and tergum of full-grown specimen, internal view; magnified 4 diameters.

Fig. 6. *a* and *b*, scutum and tergum of young specimen, external view; magnified 4 diameters.

Fig. 7. Labrum, with right-hand palpus; magnified 44,5 diameters.

Fig. 8. Mandible; magnified 44,5 diameters.

Fig. 9. Maxilla; magnified 44,5 diameters.

Fig. 10. Outer maxillae; magnified 44,5 diameters.

Fig. 11. Fourth cirrus, part of pedicel and lower segments; magnified 70 diameters.

Fig. 12—16. *Hexelasma arafurae* n. gen. n. sp.

Fig. 12. Shell, lateral view; magnified 3,25 diameters.

Fig. 13. *a* and *b*, scutum and tergum, internal view; magnified 3,6 diameters.
c and *d*, scutum and tergum, external view; magnified 5,2 diameters.

Fig. 14. Labrum with palpi, central part; magnified 44,5 diameters.

Fig. 15. *a*, right-hand-, *b*, left-hand-mandible; magnified 44,5 diameters.

Fig. 16. Maxilla; magnified 58 diameters.

P. P. C. Hoek del.

ACASTA—HEXELASMA.

Fa. P. W. M. Trap impr.

PLATE XXVI

Fig. 1—16. *Hexelasma velutinum* n. gen. n. sp.

Fig. 1. Shell, cylindrical form, lateral view; magnified 4 diameters.

Fig. 2. *a* and *b*, scutum and tergum, internal view; magnified 5,6 diameters.
c and *d*, scutum and tergum of the specimen of Fig. 1, external view; magnified 5,6 diameters.

Fig. 3. Shell, conical form, lateral view; magnified 4 diameters.

Fig. 4. Same specimen seen from above; magnified 4 diameters.

Fig. 5. *a* and *b*, scutum and tergum, internal view; magnified 5,6 diameters.
c and *d*, scutum and tergum of the specimen of fig. 3 and 4, external view; magnified 5,6 diameters.

Fig. 6. Rostrum, internal view; magnified 5,2 diameters.

Fig. 7. Labrum, central part, with right-hand palpus; magnified 144 diameters.

Fig. 8. Labrum with palpi; magnified 44,5 diameters.

Fig. 9. Triangular shield-formed central part of labrum; magnified 44,5 diameters.

Fig. 10. Part of border of labrum; magnified 206,5 diameters.

Fig. 11. Mandible; magnified 44,5 diameters.

Fig. 11*. Inferior angle of mandible of other specimen; magnified 206,5 diameters.

Fig. 12. Maxilla; magnified 44,5 diameters.

Fig. 12*. Edge of maxilla of other specimen; magnified 144 diameters.

Fig. 13. Outer maxillae; magnified 44,5 diameters.

Fig. 14. Sixth cirrus, one of the middle segments; magnified 44,5 diameters.

Fig. 15. Penis and lower segment of pedicel of sixth cirrus; magnified 44,5 diameters.

Fig. 16. Sixth cirrus and penis, to show the size of the latter; magnified 10 diameters.

P. P. C. Hoek del. Fa. P. W. M. Trap impr.

HEXELASMA.

PLATE XXVII

Fig. 1—2. *Pyrgoma kuri* n. sp.

Fig. 1. Shells attached to the coral; magnified 4,75 diameters.

Fig. 2. *a* and *b*, scutum and tergum, internal view; magnified 16 diameters.
c and *d*, scutum and tergum, external view; magnified 16 diameters.

Fig. 3—8. *Pyrgoma jedani* n. sp.

Fig. 3. Colony of animals; magnified 2 diameters.

Fig. 4. *a* and *b*, scutum and tergum, internal view; magnified 13,5 diameters.
c and *d*, scutum and tergum, external view; magnified 13,5 diameters.

Fig. 5. Labrum with palpi; magnified 44,5 diameters.

Fig. 6. Mandible; magnified 44,5 diameters.

Fig. 7. Maxilla; magnified 44,5 diameters.

Fig. 8. Outer maxillae; magnified 44,5 diameters.

Fig. 9—16. *Creusia spinulosa* Leach var. *sumbawae* n. var.

Fig. 9. Shell attached to a specimen of *Heteropsammia*; magnified 3,5 diameters.

Fig. 10. Same specimen seen from above; magnified 10,5 diameters.

Fig. 11. *a* and *b*, scutum and tergum, internal view; magnified 10 diameters.
c, scutum, external view; magnified 10 diameters.

Fig. 12. Labrum, with right-hand palpus; magnified 64 diameters.

Fig. 13. Mandible; magnified 64 diameters.

Fig. 14. Maxilla; magnified 64 diameters.

Fig. 15. Outer maxillae, inner lobes; magnified 64 diameters.

Fig. 16. Sixth cirrus, two of the middle segments; magnified 64 diameters.

Fig. 17—22. *Chthamalus stellatus* Poli.

Fig. 17. Shell seen from above; magnified 4 diameters.

Fig. 18. *a* and *b*, scutum and tergum, internal view; magnified 18 diameters.

Fig. 19. Labrum with palpi; magnified 80 diameters.

Fig. 20. Mandible; magnified 80 diameters.

Fig. 21. Maxilla; magnified 80 diameters.

Fig. 22. Pectinated spines from the last segments of the cirrus of the 2nd pair; magnified 214 diameters.

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PYRGOMA—CREUSIA—CHTHAMALUS.

SIBOGA-EXPEDITIE

Siboga-Expeditie

UITKOMSTEN

OP

ZOOLOGISCH, BOTANISCH, OCEANOGRAPHISCH EN GEOLOGISCH GEBIED

VERZAMELD IN

NEDERLANDSCH OOST-INDIË 1899—1900

AAN BOORD **H. M. SIBOGA** ONDER COMMANDO VAN

Luitenant ter zee 1e kl. G. F. TYDEMAN

UITGEGEVEN DOOR

Dr. MAX WEBER
Prof. in Amsterdam, Leider der Expeditie

(met medewerking van de Maatschappij ter bevordering van het Natuurkundig Onderzoek der Nederlandsche Koloniën)

BOEKHANDEL EN DRUKKERIJ
VOORHEEN
E. J. BRILL
LEIDEN

Siboga-Expeditie
XXXI

THE

CIRRIPEDIA OF THE SIBOGA-EXPEDITION

BY

P. P. C. HOEK

With 27 plates and 2 textfigures

LATE E. J BRILL
PUBLISHERS AND PRINTERS
LEYDEN — 1913

The first part (XXXI *a*) was published October 1907.

The second part (XXXI *b*) was published May 1913.

INTRODUCTION

A large and interesting collection of Cirripedia was made during the cruise (1899—1900) of H. M. S. "Siboga" in the Malay Archipelago. The collection is rich in species; they were brought together, partly during coast- and reef-exploration, and partly when the bottom of the sea was explored with the dredge, the naturalist's trawl, and other apparatus. A relatively large number of the species were found to be new to science; several of the species already known were particularly interesting since they were described in DARWIN's Monograph, but have not or not very carefully been observed since the publication of that work.

The material has been worked up to a large extent for the determination of the species, and secondly for the study of their geographical and bathymetrical distribution. Although the collection was a rich one, only very few species, and not always the more interesting ones, were represented by specimens sufficiently numerous to provide materal for anatomical research; moreover, although the state of preservation of the material was generally good for microscopical, histological and other research, it could not, of course, be compared with fresh material, as this can now be had and investigated in marine stations all over the world. Consequently, details of the animal's structure were examined and the results inserted in the report, only in such cases in which this was useful or necessary for the identification of the species.

The greater part of the collection was handed over to me towards the end of 1900, the rest, in the beginning of 1901. A first instalment of the report (containing the description of the Cirripedia Pedunculata) was ready for the press at the end of the year 1906, and was published in October 1907; the second part of the report (containing the description of the Cirripedia Sessilia: Verrucidae and Balanidae) was finished towards the end of September 1912, and sent to the press in October of that year.

During the cruise through the Malay Archipelago, H. M. S. "Siboga" explored that part of the Archipelago which is situated to the East of Java, Madura, Bawean Island and Borneo, and extends as far north as the Sulu Sea and Talaut Islands, as far east as the Aru Islands, and as far south as Rotti Island. The first station was visited on March 7, 1899, the last (N° 323) on February 25, 1900. At about 100 of the 323 stations, and, moreover, at a dozen coast-places, where shore-exploration was carried out, species of Cirripedia were found and collected.

The total number of species of Cirripedia represented in the Siboga-collection amounts

to 114, 75 of which are to be described as new species. They belong to 18 different genera, two of which are introduced to science as new. They can be arranged in the following way:

NAME OF GENUS	Number of species	Number of new species
Lepas Linn.	2	—
Poecilasma Darwin	7	3
Dichelaspis Darwin	5	4
Megalasma Hoek	2	1
Alepas S. Rang	5	5
Microlepas n. gen.	1	1
Ibla Leach	2	1
Scalpellum Leach	38 (1 spec. with 2 var.)	32
Pollicipes Leach	1	—
Lithotrya G. B. Sowerby	4	1
Verruca Schumacher	7	6
Balanus Auctor	26 (2 spec. with numerous var.)	16
Acasta Leach	2 (3)	1 (2)[1]
Hexelasma n. gen.	2	2
Tetraclita Schumacher	4	—
Pyrgoma Leach	3	2
Creusia Leach	1 (2 var.)	—
Chthamalus Ranzani	2	—
Total	114	75

Here follows a list of all the species collected, arranged according to the depth at which they were found to occur:

NAME OF SPECIES	Depth at which collected
Lepas anserifera Linn	Floating objects, keel of H.M.S. "Siboga", etc.
Lepas fascicularis Ell. & Soll.	Floating objects.
Balanus tintinnabulum Linn. var. *validus* Darw.	Keel of H. M. S. "Siboga".
Balanus tintinnabulum Linn. var. *costatus* n. var.	
Balanus tintinnabulum Linn. var. *plicatus* n. var.	
Alepas lithotryae n. sp.	Reef-exploration.
Ibla Cumingi Darwin	Reef- and shore-exploration.
Ibla sibogae n. sp.	Shore-exploration.
Pollicipes mitella Linn.	Shore-exploration.
Lithotrya conica n. sp.	Reef-exploration.

[1] The present report contains the description of a third (a second new) species of *Acasta* which was also collected of late in the Malay Archipelago, but which was not represented in the Siboga collection.

NAME OF SPECIES	Depth at which collected
Lithotrya nicobarica Rhdt.	Reef-exploration.
Lithotrya pacifica Borrad.	Shore-exploration.
Lithotrya truncata Quoy & Gaimard.	Shore-exploration.
Tetraclita porosa (Gmel.)	Reef-exploration.
Tetraclita costata Darwin	Reef-exploration.
Tetraclita vitiata Darwin	Reef-exploration.
Tetraclita coerulescens Spengler	Reef-exploration.
Chthamalus stellatus Poli	Shore-exploration, reef-exploration.
Scalpellum Peroni (Gray)	Coast- or shore-exploration.
Poecilasma fissum Darwin	Shore.
Pyrgoma grande G. B. Sowerby jun.	Shore.
Balanus arcuatus n. sp.	9—36 m.
Dichelaspis Tydemani n. sp.	10—25 m.
Pyrgoma jedani n. sp.	—13 m.
Balanus bimae n. sp.	13—31 m.
Balanus amaryllis Darwin	13—40 m.
Balanus amphitrite Darwin	13—56 m.
Scalpellum rostratum Darwin	13—94 m.
Acasta glans Lamarck	18—45 m.
Balanus socialis Hoek	18—91 m.
Dichelaspis Nierstraszi n. sp.	18—120 m.
Chthamalus intertextus Darwin	22 m.
Balanus auricoma n. sp.	27—90 m.
Dichelaspis Versluysi n. sp.	32 m.
Balanus quinquevittatus Darw.	32 m.
Balanus calceolus Ellis	32 m.
Balanus cornutus n. sp.	32 m.
Balanus quadrivittatus Darwin	32—34 m.
Scalpellum uncus n. sp.	34—296 m.
Balanus ciliatus n. sp.	34—113 m.
Creusia spinulosa Leach var. *sumbawae* n. var.	—36 m.
Microlepas diademae n. gen. n. sp.	36 m.
Balanus longirostrum n. sp.	36 m.
Balanus hystrix n. sp.	—40 m.
Poecilasma eburneum Hinds	40—90 m.
Dichelaspis orthogonia Darwin.	40—120 m.
Acasta conica n. sp.	—45 m.
Balanus navicula Darwin	45 m.
Creusia spinulosa Leach var. (11) Darwin	—52 m.
Balanus terebratus Darwin.	—52 m.
Scalpellum pollicipedoides n. sp.	57 m.
Balanus maculatus n. sp.	69—73 m.
Balanus maldivensis Borrad.	69—390 m.
Dichelaspis orthogonia (forma dubia)	73—88 m.

NAME OF SPECIES	Depth at which collected
Balanus investitus n. sp.	73—90 m.
Scalpellum aries n. sp.	75—94 m.
Balanus proripiens n. sp.	75—94 m.
Balanus compressus n. sp.	75—112 m.
Balanus minutus n. sp.	80 m.
Alepas intermedia n. sp.	90 m.
Balanus albus n. sp.	90—522 m.
Alepas tenuis n. sp.	204 m.
Scalpellum imbricatum n. sp.	204 m.
Scalpellum diota n. sp.	204 m.
Scalpellum candidum n. sp.	204 m.
Pyrgoma kuri n. sp.	204 m.
Poecilasma dubium n. sp.	204—304 m.
Poecilasma obliquum n. sp.	204—304 m.
Balanus pentacrini n. sp.	204—304 m.
Scalpellum Stearnsi Pilsbry var. *robusta* n. var.	204—330 m.
Hexelasma velutinum n. gen. n. sp.	204—390 m.
Megalasma striatum Hoek.	204—984 m.
Balanus tenuis Hoek	275 m.
Poecilasma excavatum n. sp.	289—304 m.
Verruca conchula n. sp.	310—520 m.
Scalpellum hamulus n. sp.	397 m.
Scalpellum pellicatum n. sp.	397—450 m.
Scalpellum polymorphum n. sp.	397—794 m.
Scalpellum praeceps n. sp.	411 m.
Scalpellum Stearnsi Pilsbry var. *gemina* n. var.	450 m.
Verruca grex n. sp.	450—984 m.
Megalasma lineatum n. sp.	450 m.
Scalpellum fissum n. sp.	462—472 m.
Verruca capsula n. sp.	520—1301 m.
Poecilasma gracile Hoek.	521 m.
Alepas morula n. sp.	538 m.
Dichelaspis Weberi n. sp.	560 m.
Hexelasma arafurae n. gen. n. sp.	560 m.
Balanus alatus n. sp.	564 m.
Scalpellum deforme n. sp.	655 m.
Scalpellum proclive n. sp.	655 m.
Scalpellum crinitum n. sp.	794 m.
Scalpellum curiosum n. sp.	794 m.
Verruca cassis n. sp.	794—1600 m.
Scalpellum chitinosum n. sp.	794—1788 m.
Scalpellum incertum n. sp.	798 m.
Poecilasma carinatum Hoek	828—1633 m.
Scalpellum acutum Hoek.	845—1264 m.

NAME OF SPECIES	Depth at which collected
Scalpellum poculum n. sp.	918 m.
Verruca casula n. sp.	924 m.
Verruca navicula n. sp.	924—959 m.
Alepas ovalis n. sp.	984 m.
Scalpellum javanicum n. sp.	1018 m.
Scalpellum humile n. sp.	1158 m.
Scalpellum gracile n. sp.	1158 m.
Verruca nitida Hoek.	1301 m.
Scalpellum distinctum Hoek	1301—2218 m.
Scalpellum sessile n. sp.	1570 m.
Scalpellum formosum n. sp.	1570—2081 m.
Scalpellum moluccanum Hoek	1788 m.
Scalpellum inflatum n. sp.	1788 m.
Scalpellum elegans n. sp.	1886 m.
Scalpellum virgatum n. sp.	2050 m.
Scalpellum ventricosum n. sp. [1]	2050 m.
Scalpellum ciliatum n. sp.	2081 m.
Scalpellum trapezoideum n. sp.	2796 m.
Scalpellum hexagonum n. sp.	2798 m.
Scalpellum sculptum n. sp.	2798 m.
Scalpellum discolor n. sp.	2798 m.

We see at once from this list that the bathymetrical distribution of the Cirripedia follows the same rules in the Malay Archipelago as it does in other parts of the world, or in the world's oceans in general. In this respect a comparison of this list with the one published on pp. 21—22 of my report on the Cirripedia of the Challenger-expedition may be instructive. The number of species collected during shore-exploration, or when exploring coral reefs is important in the present list, whilst only very few species were collected in that way during the cruise of the Challenger. Such is the case with the Cirripedia from shallow water, which are also much more numerous in the Siboga-collection. The two collections, however, agree in so far as both the coast- and shallow-water forms belong to numerous and very different genera, this not being the case with the species occurring in deeper water, let us say, of more than 200 m. depth. Although the "Subclass" is there still represented by numerous species, the number of genera diminishes considerably until we come to still greater depths, where practically only two genera are represented: *Verruca* and *Scalpellum*. Of the 77 Challenger-Cirripedia, 31 were collected at depths less than 500 mm., and 46 in deeper water. Of these, 41 belong to the two genera *Verruca* and *Scalpellum*, 2 to *Poecilasma*, 1 to *Alepas*, 1 to (*Balanus*) *Hexelasma* and 1 to *Dichelaspis*. Of the 114 species collected by the Siboga 79 come from depths less than 500 m., 35 from deeper water. Of these, 28 belong to *Verruca* and *Scalpellum*, 7 to other genera: 2 to *Poecilasma*, 2 to *Alepas*, 1 to *Dichelaspis*, 1 to

[1] This name is to take the place of *Sc. arcuatum*, used already by DARWIN for a fossil species.

Hexelasma and 1 to *Balanus*. The latter genus seems to occur only exceptionally so far down as 564 m. (*B. alatus* n. sp.) and can safely be considered a true shallow-water genus. *Hexelasma*, which is nearly related to *Balanus*, represents the deep-water form of that species; *Poecilasma*, *Alepas* and *Dichelaspis* are shallow-water genera, some species of which occur at considerable depths. This is, after all, also the case with the genera *Verruca* and *Scalpellum*, the difference being that the number of deep-sea species of these latter genera is much more considerable, and, in the second place, that they occur at much greater depths. In both respects *Scalpellum* still greatly surpasses *Verruca*: when we descend, in the Malay Archipelago, to depths of more than 1300 m., the only species of Cirripedia we meet with belong to the genus *Scalpellum*. The Cirripedia of the Challenger-expedition showed the same peculiarity, although a species of *Verruca* was still collected at a depth of 3400 m., *Scalpellum* was the only genus occurring at still greater depths, from 3600—5000 m.

On the other hand, we must not forget that these genera, *Scalpellum* and *Verruca*, although inhabiting great depths, are represented also in shallow water, and are found even on the shore in single species (*Sc. Peroni* (Gray), *Verruca strömia* (Müller)). We may therefore conclude that these genera occur at any depth, but that the number of species increases if we proceed from less deep into deeper parts of the sea, while the other genera either have no species at all in deeper water (*Pollicipes*, *Pyrgoma*, *Tetraclita* etc.), or, although showing the greatest distribution in shallow water, are represented also in much deeper water (*Alepas*, *Dichelaspis*, *Poecilasma*, *Balanus* etc.) with a few or a single species. In this respect the genera *Megalasma* and *Hexelasma* seem to occupy a special position: though they have not been observed at very great depths, say of more than 1000 m., all the species we know are found in deeper water, ranging from about 100 to 900 m. So when it comes to the point they would be the only true deep-sea genera of Cirripedes at present known.

With few exceptions, the deep-sea species were met with only once: the greater the depth, the more seldom is a species collected that was already found at another station. Most of these deep-sea species are, moreover, represented only by a single or few specimens. This is partly explained by the way in which the material from the bottom of the sea is collected, and may be partly due to the fact, that these species live somewhat isolated, not forming dense aggregations as do commonly the floating species of *Lepas* and the shallow-water-species of *Balanus* and other genera. But, perhaps, our opinion on this point would be different if we could investigate the depths of the ocean in the same way as we can explore a meadow, counting if we like the specimens of wild plants occurring there. When discussing the geographical distribution of the Cirripedia of the Malay Archipelago we will have to return to this subject. With regard to the true deep-sea species of *Scalpellum*, it may here be pointed out that the size of the Siboga-specimens was by no means so remarkable as was the case with the species collected by the Challenger. The latter could truly be said to show that the conditions of life in the deep-sea by no means exercised a dwarfing effect upon these animals, for they contain the largest forms of pedunculate Cirripedia observed. On the contrary, the species of *Scalpellum* from the greatest depths collected by H. M. S. "Siboga", are all of medium size or even small species. The only really large form of *Scalpellum* represented is *Sc. Stearnsi*, and this has a

capitulum of from 45 to 52 mm. in length and was dredged at depths varying from 204 to 450 m.

As contributing to our knowledge of the geographical distribution of the Cirripedia, it is certainly a remarkable fact that so many as 75 new species should be collected during the cruise of the Siboga. With the addition of these new species and of those which, although already known, were not yet observed in that region, the Sixth Province, which I proposed for the East Indian Archipelago and eastern coasts of India (Challenger-Report p. 33), has become by far the richest in species. In the said report, I gave a list of the species known at the time (1883) to occur in that province; here follows a list of the genera now known to be represented in that region, showing at the same time how the number of species for each genus has increased since the former list was composed.

List of the genera of Cirripedia, with number of species, hitherto observed in the East Indian Archipelago and in the waters of South-Eastern Asia.

GENERA	1883, Hoek, Challenger Report p. 33	Species to be added to the list, on the authority of:															Species added to the list by H. M. S. "Siboga"		Total number hitherto observed
		Fischer, 1886	Hoek, 1887	Aurivillius, 1893	Weltner, 1894	Weltner, 1897	Borradaile, 1900	Gruvel, 1902	Lanchester, 1902	Gruvel, 1903	Borradaile, 1903	Gruvel, 1904	Annandale, 1905	Annandale, 1906	Gruvel, 1907	Annandale, 1909	known species	new species	
Lepas	4	—	—	—	—	—	—	—	—	1	—	—	—	1	—	—	—	—	6
Poecilasma . .	2	—	—	4	—	—	—	1	—	—	—	—	—	(1)	—	—	(2)	3	13
Dichelaspis . .	1	—	(1)	7	—	—	—	—	1	1	(1)	—	—	—	—	—	(1)	4	17
Oxynaspis . .	—	—	—	—	—	(1)	—	—	—	—	—	—	—	—	—	—	—	—	1
Conchoderma	—	—	—	—	—	—	—	—	—	—	(1)	—	—	—	—	—	—	—	1
Megalasma . .	1	—	—	—	1	—	—	—	—	—	—	—	—	1	—	—	—	1	4
Alepas	—	—	—	1	—	—	—	1	—	—	—	—	2	1	—	—	—	5	10
Microlepas . .	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	1
Ibla	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	2
Scalpellum . .	15	—	—	—	1	—	—	—	—	—	—	—	2 & (3)	5 & (1)	—	1	(3)	32	63
Pollicipes . . .	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
Lithotrya . .	2	—	—	—	—	—	1	—	—	—	(1)	—	—	—	—	—	—	1	5
Verruca . . .	1	—	—	—	—	—	—	—	—	—	—	—	—	—	4	—	—	6	11
Balanus . . .	13	—	—	—	—	(3)	—	—	1	—	1 & (1)	(1)	—	—	1 & (1)	—	—	16	38
Acasta	4	—	—	—	—	(1)	—	—	—	—	—	—	—	1 & (1)	—	—	(1)	2*	10
Hexelasma . .	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	2
Tetraclita . .	4	—	—	—	—	—	—	—	—	—	—	—	—	(1)	—	—	(1)	—	6
Pyrgoma . . .	4	—	—	—	—	(1)	—	—	—	—	1 & (1)	—	—	—	—	—	—	2	9
Pyrgopsis . .	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1
Creusia	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
Chelonobia . .	—	—	—	—	—	—	—	—	—	—	(2)	—	—	—	(1)	—	—	—	3
Stephanolepas	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
Chthamalus .	2	—	—	—	—	(1)	—	—	—	—	—	—	—	—	—	—	—	—	3
Octomeris . .	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
Total number of species																			210

Note. The numbers in brackets refer to species already known, but new to the fauna of the province.

* One of these species is described in the present report, although it was not collected during the cruise of the Siboga

The publications to which this list refers, are the following:

1883. HOEK, P. P. C., Report on the Cirripedia collected by H. M. S. "Challenger" 1873—1876. Reports Zoology. Vol. VIII. Part. XXV.

1886. FISCHER, P., Description d'un nouveau genre de Cirrhipède. Actes Société Linnéenne de Bordeaux. XL. p. 193—196.

1887. HOEK, P. P. C., On *Dichelaspis pellucida*, Darwin. Journ. Linn Soc. (Zool.) XXI. p. 154.

1894. AURIVILLIUS, C. W. S., Studien über Cirripedien. K. Svensk. Vetensk. Akad. Hand. XXVI. N° 7.

1894. WELTNER, W., Zwei neue Cirripedien aus dem Indischen Ozean. Sitzungsber. d. Gesellsch. naturforschender Freunde zu Berlin. 1894. N° 2. S. 80.

1897. ——, Verzeichnis der bisher beschriebenen recenten Cirripedienarten. Arch. f. Naturgeschichte. Jahrg. 1897. I. S. 227.

1900. BORRADAILE, L. A., On some Crustaceans from the South Pacific. V. Proceed. Zool. Soc. London. 1900. p. 708.

1902. GRUVEL, A., Sur quelques Lépadides nouveaux de la collection du British Museum. Transact. of the Linnean Soc. of London. (2). Zoology. VIII. Part. 8. p. 277.

1902. LANCHESTER, W. F., Crustacea of the Skeat-Expedition. Proceed. Zool. Soc. London. 1902.

1903. GRUVEL, A., Révision des Cirrhipèdes appartenant à la collection du Muséum (Pedonculés). Nouvelles Archives du Muséum. (4). IV. p. 215.

1903. BORRADAILE, L. A., Marine Crustaceans. (Parts IV—VII, in: The Fauna and Geography of the Maldive and Laccadive Archipelagoes). I. Part 4. p. 440.

1904. GRUVEL, A., Révision etc. (Operculés). Nouv. Arch. d. Muséum. (4). V. p. 95.

1905. ANNANDALE, N., Malaysian Barnacles in the Indian Museum. Memoirs of the Asiatic Society of Bengal. I. N° 5. p. 73.

1906. ——, Stalked Barnacles in the Colombo Museum. Spolia Zeylanica. III. Part XI. p. 193.

1906. ——, Natural History Notes from the R. I. M. S. Ship "Investigator". Ann. and Mag. of Nat. History. (7). XVII. p. 389.

1906. ——, On the Cirripedia. Supplem. Report XXXI of W. A. Herdman's Report on the Pearl Oyster Fisheries of the Gulf of Manaar. Part V. p. 137.

1907. GRUVEL, A., Cirrhipèdes operculés de l'Indian Museum de Calcutta. Memoirs of the Asiatic Society of Bengal. II. N° 1. p. 1.

1909. ANNANDALE, N., Description of a Barnacle of the genus *Scalpellum* from Malaysia. Records of the Indian Museum. III. Part. III. N° 19. p. 267.

Most of these papers report on species of Cirripedia collected in Indian waters, outside the Malay Archipelago. The studies of AURIVILLIUS of 1894 are an exception, since his material was to a large extent of Javanese origin. This is also the case with numerous samples of Cirripedia found in the Berlin Museum, being those used by WELTNER for his List (Verzeichnis) of 1897. The latter, however, added no new species to the fauna of the Malay Archipelago, while AURIVILLIUS contributed twelve new species to the said region: 4 species belonging to *Poecilasma*, 7 to *Dichelaspis* and 1 to *Alepas*. To the same region belong also 3 species (1 *Lepas*, 1 *Dichelaspis* and 1 *Poecilasma*) described as new by GRUVEL, and 5 of ANNANDALE's new species (2 *Alepas*, 3 *Scalpellum*).

A complete list of the species of Cirripedia at present known to occur in the Malay Archipelago and in the waters along the Eastern coasts of India is here given. For sake of convenience, species attached to floating or swimming objects are also included.

NAME OF SPECIES	Where observed *in* the province	Depth in m.	Where observed *outside* the province
Lepas anatifera Linn.	Indian Ocean	Surface	Cosmopolitan
Lepas anserifera Linn.	Malay Archipelago; Indian Ocean	Surface	Cosmopolitan
Lepas denticulata Gruvel 1903.	Honda Bay (Philippines)	Surface	
Lepas fascicularis Ell. & Sol.	Malay Archipelago	Surface	Cosmopolitan
Lepas Hilli (Leach)	Indian Ocean	Surface	Atlantic Ocean, Australia
Lepas tenuivalvata Annandale 1906	Coast of Ceylon	Surface	
Poecilasma amygdalum Aurivillius 1894.	Java Sea; Andaman Isl.	?	
*Poecilasma carinatum Hoek	Ceram Sea; S. of Timor	702–828–1633	West Indies; South Atlantic
*Poecilasma dubium n. sp.	S. of Kur Isl.; S. of Taam Isl.	204—304	
Poecilasma eburneum Hinds.	New Guinea; Borneo-bank	40—90	Red Sea
*Poecilasma excavatum n. sp.	S. of Kangeang Isl.; S. of Taam Isl.	289—304	
Poecilasma fissum Darwin.	Philippine Archipelago; Ternate anchorage	Shore	
*Poecilasma gracile Hoek	Near Paternoster Isl.; S. of Timor	521	Off Sydney, Australia
Poecilasma Kaempferi Darwin (Annandale 1906)	Ceylon: Gulf of Manaar	774	Japan (probably also: Madeira; Mexico)
Poecilasma lenticula Aurivillius 1894	Java Sea	?	
Poecilasma minutum Gruvel 1902	Singapore	Surface	—
*Poecilasma obliquum n. sp.	S. of Kur Isl.; S. of Taam Isl.	204—304	
Poecilasma tridens Aurivillius 1894.	Philippines.	?	
Poecilasma vagans Aurivillius 1894.	? East India (on Nautilus)	?	
Dichelaspis alata Aurivillius 1894	Java Sea	?	—
Dichelaspis angulata Aurivillius 1894.	Id.	?	—
Dichelaspis aperta Aurivillius 1894.	Id.	?	
Dichelaspis bullata Aurivillius 1894	Id.	?	
Dichelaspis cuneata Aurivillius 1894	Id.	?	
Dichelaspis equina Lanchester 1902	Trengganu; Ceylon; Ganjam coast	Shore	—
Dichelaspis ? Grayi Darw. (Borradaile 1903)	Maldives	?	Pacific
Dichelaspis Maindroni Gruvel 1903.	Sumatra	?	—
*Dichelaspis Nierstraszi n. sp.	Numerous places in the Malay Archipelago	18—120	
*Dichelaspis orthogonia Darwin.	Borneo-bank; S. coast of Timor	40—120	—
Dichelaspis pellucida Darwin (Hoek 1887)	Indian Ocean; Mergui Archipelago; Ceylon	Surface	—
Dichelaspis sinuata Auriviltius 1894	Java Sea	?	
Dichelaspis trigona Aurivillius 1894	Java Sea	?	
*Dichelaspis Tydemani n. sp.	Saleyer anchorage	10—25	
*Dichelaspis Versluysi n. sp.	S. of Salawatti; Tual anchorage	32	—
Dichelaspis Warwicki Gray	Off Borneo; Maldives; Java Sea	?	
*Dichelaspis Weberi n. sp.	Kei Isl. Archipelago	560	Sagami-Bay (Japan)
Oxynaspis celata Darwin (Weltner 1897)	Luzon	?	Madeira: Japan; West-Australia
Conchoderma Hunteri (R. Owen) (Borradaile 1903)	Laccadives	Surface	Pacific Ocean; Japan
Megalasma carino-dentatum Weltner 1894	Indian Ocean	3146—3200	
*Megalasma lineatum n. sp.	E. of Makassar	450	
Megalasma minus Annandale 1906.	Andaman Sea	290—871	
Megalasma striatum Hoek.	Off Luzon; S. of Taam Isl.: S. of Kur Isl.; E. of Kei Isl.; Philippine Archipelago	204—984	
Alepas gigas Annandale 1905	Bali Straits	308	
Alepas indica Gruvel 1902	Singapore; Nicobars	Surface	[illegible]
*Alepas intermedia n. sp.	N.W. from Key Isl.	90	
*Alepas lithotryae n. sp.	Near South Lucipara Isl.	Shore	
Alepas malaysiana Annandale 1905.	Gaspar Straits	54	
*Alepas morula n. sp.	Between Borneo and Lombok	538	
*Alepas ovalis n. sp.	W. from the Key Isl.	984	
Alepas quadrata Aurivillius 1894.	Java Sea		Japan: Formosa
*Alepas tenuis n. sp.	S. of Ceram	204	

* The species marked with an asterisk have not been observed before in this region.

NAME OF SPECIES	Where observed *in* the province	Depth in m.	Where observed *outside* the province
Alepas xenophorae Annandale 1906	Off S.W. coast of India	333	—
*Microlepas diademae n. sp. n. gen.	Bay of Nangamessi (Sumba)	36	—
Ibla Cumingi Darwin	Philippine Archipelago; Strait Molo off Dongola	Shore	—
*Ibla sibogae n. sp.	Bay of Badjo; West coast of Lombok, Bay of Bima; Kwandang Sea	Shore	—
Scalpellum acutum Hoek (Annandale 1905)	Andaman Sea; Malay Archipelago	845—1264	Atlantic Ocean; Pacific, off Kermadec
Scalpellum album Hoek	South of Mindanao	900	— [Isl.
Scalpellum alcockianum Annandale 1906	Gulf of Manaar; Andaman Sea	1546—1728	—
*Scalpellum aries n. sp.	North of Buton	75—94	—
Scalpellum australicum Hoek	Between New Guinea and Australia	2520	—
Scalpellum balanoides Hoek	Banda Sea	232	—
Scalpellum bengalense Annandale 1906	Bay of Bengal	180	—
*Scalpellum candidum n. sp.	Near Kei Isl.	204	—
*Scalpellum chitinosum n. sp.	N. of Sumbawa; W. of Aru Isl.	794—1788	
*Scalpellum ciliatum n. sp.	S. of Ambon	2081	—
Scalpellum compressum Hoek	Celebes Sea	3870	—
*Scalpellum crinitum n. sp.	N. of Sumbawa	794	—
*Scalpellum curiosum n. sp.	N. of Sumbawa	794	—
*Scalpellum deforme n. sp.	Near Palos Bay, Celebes	655	—
*Scalpellum diota n. sp.	Near Kei Isl.	204	—
*Scalpellum discolor n. sp.	Banda Sea	2798	—
Scalpellum distinctum Hoek	N. entrance of Strait of Malacca; W. of Buton Isl.	1301—2218	East of New Guinea (New Brittannia Archipelago)
Scalpellum dubium Hoek	Between New Guinea and Australia	2520	—
*Scalpellum elegans n. sp.	W. of Buton Isl.	1886	—
*Scalpellum fissum n. sp.	W. of Halmaheira; S. of Celebes	462—472	—
*Scalpellum formosum n. sp.	S. of Ceram; S. of Ambon	1570—2081	—
*Scalpellum gracile n. sp.	E. of Saleyer	1158	—
Scalpellum Gruveli Annandale 1906	Laccadives; Gulf of Manaar; Andaman Sea	1546—1840	—
*Scalpellum hamulus n. sp.	Kei Islands	397	—
*Scalpellum hexagonum n. sp.	Banda Sea	2798	—
Scalpellum hirsutum Hoek	Moluccan Sea	1485	—
*Scalpellum humile n. sp.	E. of Saleyer	1158	—
*Scalpellum imbricatum n. sp.	Near Kei Isl.	204	—
*Sculpellum incertum n. sp.	Between Kofiau and New Guinea	798	—
Scalpellum indicum Hoek	Banda Sea	232	—
Scalpellum inerme Annandale 1905	Bali Straits	308	—
*Scalpellum inflatum n. sp.	W. of Aru Isl.	1788	—
Scalpellum japonicum Hoek (Annandale 1906)	Gulf of Manaar	1000—1077	Japan: S. of Niphon. 1000—1071 m.
*Scalpellum javanicum n. sp.	N. of Bali	1018	—
Scalpellum Kampeni Annandale 1909	S. of Bintang	23—29	—
Scalpellum laccadivicum Annandale 1906	Laccadives	2077	—
Scalpellum marginatum Hoek	North of New Guinea	3600	—
Scalpellum moluccanum Hoek	Banda Sea; West of Aru Isl.	1788—2565	—
Scalpellum novae-zelandiae Hoek (Annandale 1905)	Andaman Sea	882—1260	Australia: off Auckland
Scalpellum ovatum Hoek	North of New Guinea	3600	—
*Scalpellum pellicatum n. sp.	Kei Isl.; E. of Borneo.	397—450	—
Scalpellum Peroni (Gray)	Jedan Isl.	Shore	Australia: Swan River, Bass-straits
*Scalpellum poculum n. sp.	Near Rotti, S. of Timor	918	—
*Scalpellum pollicipedoides n. sp.	East of Kei Isl.	57	—
*Scalpellum polymorphum n. sp.	Kei Isl.; N. of Sumbawa	397—794	—
*Scalpellum praeceps n. sp.	Between Halmaheira and New Guinea	411	—
*Scalpellum proclive n. sp.	Near Palos Bay, Celebes	655	—
Scalpellum rostratum Darwin	Bay of Bima, Sumbawa; N. of Buton; W. of Saleyer; S. of Timor; Philippine Archipelago	13—94	—
Scalpellum rubrum Hoek	Off Luzon	180—207	—
*Scalpellum sculptum n. sp.	Banda Sea	2798	—
*Scalpellum sessile n. sp.	S. of Ceram	1570	—
Scalpellum sociabile Annandale 1905	Bali Strait	308	—

NAME OF SPECIES	Where observed *in* the province	Depth in m.	Where observed *outside* the province
Scalpellum squamuliferum Weltner 1894	Indian Ocean; Andaman Isl.	3200—3312	—
*Scalpellum Stearnsi Pilsbry	Near Kei Isl.; Madura Sea; W. of Makassar	204–330; 450	Japan
Scalpellum subflavum Annandale 1906 .	Gulf of Manaar; Andaman Sea	234—1260	—
Scalpellum tenue Hoek (Annandale 1905)	Bay of Bengal	1000—1071	South Indian Ocean: between the Crozets and Prince Edward Island
*Scalpellum trapezoideum n. sp.	South of Celebes	2796	—
Scalpellum trispinosum Hoek	Basilan Strait, Philippine Archipelago	147—184	Japan
Scalpellum truncatum Hoek	Between New Guinea and Australia; ? Gulf of Manaar	? 1002—2520	—
*Scalpellum uncus n. sp.	S. coast of Timor; Bay of Bima, Sumbawa	34—296	
*Scalpellum ventricosum n. sp.	S. of Timor	2050	—
Scalpellum villosum Sowerby	Eastern Seas	?	?
*Scalpellum virgatum n. sp.	S. of Timor	2050	—
Pollicipes mitella (Linn.)	Philippine Archipelago; Madura Bay; Bay of Badjo (W. coast of Flores)	Shore	East-Asia: Japan; Madagascar; Hawaii
*Lithotrya conica n. sp.	Reef near Lucipara Isl.; Reef near Kur. Isl.	Shore	—
Lithotrya dorsalis (Ellis) var. (Borradaile 1903)	Maldives	Shore	West-India (the species itself)
Lithotrya nicobarica Rhdt.	Timor; Nicobar Isl.; Reef near Lucipara Isl.; Reef near Kur Isl.	Shore	—
Lithotrya pacifica Borradaile 1900 . . .	Reef of Funafuti; E. coast of Lombok	Shore	—
Lithotrya truncata (Quoy & Gaim.) . . .	Philippine Archipelago; Samau Isl., Timor	Shore	Pacific Ocean
*Verruca capsula n. sp.	Strait of Makassar; Kei Isl. Archipelago; E. of Rotti Isl.	520—1301	—
*Verruca cassis n. sp.	Near N. coast of Sumbawa; W. of Waigeu Isl.; S. of East point of Timor	794—1600	—
*Verruca casula n. sp..	Between Ceram and New Guinea	924	—
*Verruca conchula n. sp.	? Kei Isl. Archipelago; E. of Rotti Isl.	310—520	—
Verruca cristallina Gruvel 1907	Andamans Isl., Cape Bluff; Cinque Isl.	768—785	—
*Verruca grex n. sp.	E. of Makassar; E. of Kei Isl.; E. of Rotti Isl.	450—984	
Verruca Koehleri Gruvel 1907.	Andaman Isl.	435	
Verruca multicostata Gruvel 1907 . . .	Malacca Strait	160	
*Verruca navicula n. sp.	Between Flores and Sumba; between Ceram and New Guinea	924—959	—
Verruca nitida Hoek	S. of Mindanao; Strait of Makassar	900—1301	—
Verruca plana Gruvel 1907	Andaman Isl. passage	380—465	—
Balanus aeneas Lanchester (Annandale 1906)	Malacca; Ceylon	?	—
Balanus ajax Darwin	Philippine Archipelago	?	—
*Balanus alatus n. sp.	Sulu Sea	564	
*Balanus albus n. sp.	S. of Kangeang Isl.; Sulu Sea; Kei Isl.	90—522	
Balanus allium Darwin (Weltner 1897) .	Ceylon	Shore	Australia, Rainet's Islet, Barrier Reef; Red Sea
Balanus amaryllis Darwin.	East Indian and Philippine Archipelago	0—40	Australia, North East Coast; Moreton Bay; Kobe, Japan; Shanghai. Attached to ships'-bottoms.
Balanus amphitrite Darwin	Different places in the East Indian Archipelago	0—56	Cosmopolitan: warmer temperate and tropical seas; common on ships'-bottoms
*Balanus arcuatus n. sp.	Banda	9—36	
*Balanus auricoma n. sp.	Ternate; Kei Isl. (?)	27—90	—
*Balanus bimae n. sp.	Bay of Bima (Sumbawa)	13—31	
Balanus calceolus Ellis (Weltner 1897) .	Guinea; S. of Salawatti (W. of New Guinea)	32	West coast of Africa; Australia; Japan
Balanus carenatus Gruvel 1907	Akyab, Birma	?	—
Balanus cariosus Pallas (Gruvel 1904). .	Cochin China	?	Alaska; Japan; Behrings Straits; Kurile Islands; W. coast of North America
*Balanus ciliatus n. sp.	Between Adonara and Solor (E. of Flores)	34 113	
*Balanus compressus n. sp.	Between Wowoni and Button; S. of Timor	75 112	
Balanus concavus Brown	Philippine Archipelago	?	California; Panama; Peru; Australia
*Balanus cornutus n. sp.	S. of Salawatti (W. of New Guinea)	32	
Balanus cymbiformis Darwin.	Near Madras	?	—
Balanus eburneus A. Gould (Weltner 1897)	Manila; Indian Ocean	Surface	United States; West-Indies; attached to floating wood, ships'-bottoms, etc.; Europe

NAME OF SPECIES	Where observed *in* the province	Depth in m.	Where observed *outside* the province
*Balanus hystrix n. sp.	Ambon	- -40	—
*Balanus investitus n. sp.	E. coast of Sumbawa	73—99	—
*Balanus longirostrum n. sp.	Off Dongola (N.W. Celebes); ? Batjan	36	—
*Balanus maculatus n. sp.	Sapeh Strait; E. coast of Sumbawa	69—73	—
Balanus maldivensis Borradaile 1903	Maldives; Ceylon; Malay Archipelago	69—390	—
*Balanus minutus n. sp.	Kwandang-Bay entrance (N. coast of Celebes)	80	—
Balanus navicula Darwin	Madras; near Damar Isl. (S. of Halmaheira)	45	—
Balanus patellaris (Gmel.) Spengler.	Bengal; Philippine Archipelago	?	Malabar coasts; Ganges
*Balanus pentacrini n. sp.	S. of Kur Isl.; S. of Taam Isl.	204—304	—
Balanus perforatus Brug. (Gruvel 1907).	Andaman Isl.	Shore	Atlantic; Mediterranean
*Balanus proripiens n. sp.	Between Wowoni and Button (S.E. of Celebes)	75—94	—
Balanus quadrivittatus Darwin.	East Indian Archipelago; Maldives; Philippine Archipelago	32—34	—
*Balanus quinquevittatus n. sp..	S. of Salawatti (W. of New Guinea)	32	—
Balanus socialis Hoek	Arafura Sea; numerous other places in the East Indian Archipelago	18—91	—
Balanus stultus Darwin	Singapore	?	? West-Indies
Balanus tenuis Hoek	Off Luzon; Philippine Archipelago	180—275	—
Balanus terebratus Darwin (Borradaile 1903)	Maldives; Ceylon; Kei Isl.	—52	—
Balanus tintinnabulum Linn.	Different places in the East Indian Archipelago	Shore and Surface	Almost cosmopolitan; common on ships'-bottoms
Balanus trigonus Darwin	Java; East Indian Archipelago	?	Atlantic; Red Sea; North and South pacific; Japan
*Acasta conica n. sp.	Pulu Barang (near Makassar)	—45	—
Acasta cyathus Darwin (Annandale 1906)	Gulf of Manaar	?	Madeira; West Indies
Acasta fenestrata Darwin	Philippine Archipelago	?	—
Acasta funiculorum Annandale 1906	Gulf of Manaar	?	—
*Acasta glans Lamarck	Pepela-Bay (Rotti Isl.); Java Sea	18—45	Southern Australia
Acasta laevigata Gray	Philippine Archipelago	?	Red Sea
*Acasta nitida n. sp.	Java Sea	40—50	—
Acasta purpurata Darwin	Sumatra; Philippine Archipelago	?	—
Acasta sporillus Darwin.	Sooloo Isl.	?	—
Acasta sulcata Lam. (Weltner 1897)	Philippine Archipelago; Maldives	4	Australia; Japan
*Hexelasma arafurae n. gen., n. sp.	Kei Isl. Archipelago	560	—
*Hexelasma velutinum n. gen., n. sp.	W. Entrance of Samau Strait (near Timor) N. of Sulu Isl.	204—390	—
Tetraclita coerulescens (Spengler)	Philippine Archipelago; Banda	Shore	Attached to a ships'-bottom from the Pacific
Tetraclita costata Darwin	Philippine Archipelago; Banda	Shore	—
Tetraclita porosa (Gmelin)	Philippine Archipelago; off Beo; Waigu Isl.; Lucipara Isl.	Shore	West-Indies; Galapagos Archipelago; China; Japan; Australia; Red Sea
Tetraclita radiata de Blainv.	(On a ship) from Sumatra	Surface	West-Indies; New South Wales; attached to ships
Tetraclita serrata Darwin (Annandale 1906)	Off Ceylon	Shore	Cape of Good Hope; Algoa Bay
Tetraclita vitiata Darwin	Philippine Archipelago; S. of Lucipara Isl.	Shore	Australia: Barrier Reef (Raine's Islet)
Pyrgoma anglicum Sowerby (Weltner 1897)	Singapore	22—72	Atlantic; Mediterranean
Pyrgoma cancellatum Leach (Borradaile 1903)	Maldives	47	? West-Indies
Pyrgoma conjugatum Darwin (Weltner 1897)	Ceylon	Shore	Red Sea
Pyrgoma crenatum Sowerby	Singapore; Philippine Archipelago; New Guinea	?	—
Pyrgoma grande G. B. Sowerby Jr.	Maldives; Singapore; East Indian Archipelago	Shore	—
*Pyrgoma jedani n. sp.	Jedan Isl., S. of New Guinea	—13	—
*Pyrgoma kuri n. sp.	S. of Kur Isl., Kei Isl.	204	—
Pyrgoma madreporae Borradaile 1903.	Maldives	?	—
Pyrgoma milleporae Darwin.	Philippine Archipelago	?	—
Pyrgoma monticulariae J. S. Gray	Singapore	?	—
Pyrgopsis Annandalei Gruvel 1907.	Andaman Isl.	90	—
Creusia spinulosa Leach	Singapore; Philippine Archipelago; Coast of Sumbawa	—36; —52	Throughout the tropical seas, in numerous varieties

NAME OF SPECIES	Where observed *in* the province	Depth in m.	Where observed *outside* the province
Chelonobia caretta (Spengler) (Borradaile 1903)	Minikoi, Maldives	Surface	W. coast of Africa; northern Australia
Chelonobia patula Ranz. (Gruvel 1907).	Akyab, Birma	Surface	Mediterranean; Gambia; W. Africa; Brazil; Jamaica; Australia
Chelonobia testudinaria (Linn.) (Borradaile 1903)	Minikoi, Maldives	Surface	Mediterranean; W. coast of Africa; coast of Australia; Pacific; Japan; W. coast of Mexico
Stephanolepas muricata P. Fischer 1886.	Cochin China		
Chthamalus dentatus Kraus (Weltner 1897)	Singapore	Shore	S. and W. Africa; West-Indies; attached to ships'-bottoms
Chthamalus intertextus Darwin.	Philippine Archipelago; near Kangeang Isl., N. of Bali	22	—
Chthamalus stellatus Poli spec.	Philippine Archipelago; coast of Lombok; coast of Sumbawa	Shore	Atlantic; Mediterranean; West-Indies; Brazil; Red Sea; China; Gulf of Korea; California
Octomeris brunnea Darwin	Philippine Archipelago	?	—

This list contains the names of 210 species. Of these, however, 30 have not been observed as yet in the Malay Archipelago. It seems certain that at least part of them will be found there eventually, for these species inhabit the south-eastern part of Asia, which has numerous species in common with the said Archipelago. Of course, the same is the case, at least to a certain extent, with the Malay Archipelago and the seas of Eastern-Asia (China, Japan, etc.) to the North of the region, and of Australia to the South of it. Yet there is an important difference between the latter regions and the Malay Archipelago: while they both extend from the tropical and sub-tropical regions far into the temperate zone, and, in consequence, are also inhabited by several species which are peculiar to the latter, the whole of the Malay Archipelago lies below the tropics. Nevertheless, the list of species representing the fauna of the latter region combined with that of Southern-Asia contains the names of several species, the distribution of which can be followed either into Australia or into the waters of China, Japan, etc.

When discussing the geographical distribution of the species of Cirripedia, we commonly leave out of consideration those species that always are found to live attached to floating objects, drift wood, ships'-bottoms, and the like. Their distribution is generally supposed to be a very wide one, if not always a cosmopolitan one. In fact, some of these species are observed all over the world's surface, as for example several species of *Lepas* and *Conchoderma*; but other species of the genus *Lepas* have a more or less limited distribution, so far as our knowledge goes at present. This seems to be the case also with several species of Cirripedia that are sometimes found attached to floating objects, but which live also on rocks, stones, shells, etc. and are collected even at not quite unimportant depths: *Balanus tintinnabulum* Linn., *B. amphitrite* Darwin, and *B. amaryllis* Darwin are good examples of this case. They have no doubt a wide distribution, yet they are observed only in warmer, temperate, and tropical seas. Again, we know species that are found on ships'-bottoms, which are also dredged either in shallow or in relatively deep water, and have a wide distribution in the temperate zone, but which do not seem to be altogether absent from warmer seas. Such species are *B. improvisus*

Darwin, and *B. crenatus* Brug., of which the latter ranges even into the Arctic Ocean. Altogether, the distribution of these species is not only a wide one, but at the same time a peculiar one, both species having the capability of resisting extreme conditions.

Coming now to those species that are always found attached to objects — stones, rocks, shells, corals — of the sea-bottom, we are strongly impressed by the facts, (1) that by far the greater part have only a very limited distribution, and (2) that only very few species are known which inhabit this East Indian region, and are found also in the Atlantic Ocean.

With regard to the limited distribution of the majority of the species, we must not forget that the species from deeper water form a high percentage of our list, and that, to say the least, we are not so well informed with respect to the distribution of those species. If we take the genus *Scalpellum*, represented in this province — so far as our knowledge goes at present — by 63 species, we know of only 8 of these species occurring also outside the province. Three of these were observed in Japan waters, and three in Australia, one was taken in the southern part of the Indian Ocean (between the Crozets and Prince Edward Island), and only one quite outside the region: at different places in the Atlantic, etc. This latter species is *Scalpellum acutum* mihi. It is a small species — but an interesting one. The "Challenger" dredged it at:

Station 78. Near the Azores at a depth of 1800 m.
„ 170. Near Kernadec Isl., Pacific, at depths of 936 and 1134 m.

The "Talisman" took it:

near the coast of Portugal at a depth of 1923 m.

The "Investigator" found it:

Andaman Sea, at a depth of 882 m.

and finally the "Siboga" met with it again at:

Station 122. North of Menado (Celebes), at a depth of 1165—1264 m.
„ 151. W. of Waigeu Island, at a depth of 845 m.
„ 211. N. of Saleyer Islands, at a depth of 1158 m.

It is the only species of *Scalpellum* known to have such a world-wide distribution, and it is a true deep-sea species. The only other deep-water Cirripedia that were observed in the Malay Archipelago and in the Atlantic Ocean as well, are two species of *Poecilasma*. The first is *Poecilasma carinatum* Hoek. The "Challenger" collected it on two occasions, viz.

Station 24. Off Culebra (West Indies). Depth 700 m.
„ 344. Off Ascension Island (South Atlantic). Depth 756 m.

GRUVEL mentions specimens taken at a depth of 600—900 m. near the coast of Cuba.

The "Michaël Sars" (Atlantic Expedition of 1910) met with the same species at:

Station 53. S. of the Azores. Depth 2615—2865 m.

The "Siboga" collected it at the following stations:

Station 177. Ceram Sea. Depth 1633 m.
„ 284. S. of Timor. Depth 828 m.

The other species of *Poecilasma* that seems to inhabit both oceans is DARWIN's *Poecilasma*

Kaempferi. DARWIN gave this name to a species from Japan which was found attached to *Inachus Kaempferi* de Haan, a crab "probably from deep water". But the same author, when describing *P. aurantium* from Madeira, pointed out that this species "has the closest general resemblances to *P. Kaempferi* and is evidently a representative of it". "On close examination, however", DARWIN says, "almost every part differs slightly" and his Monograph contains an enumeration of these differences. Thereupon GRUVEL, 1903, when investigating specimens of a *Poecilasma*-species, collected at depths varying from 355—782 m. near Cape Bojador, at a short distance from Madeira, found that some of these corresponded to DARWIN's *P. Kaempferi*, and the others to his *P. aurantium*, but that the differences between the specimens of the two sets were unimportant and not sufficient to justify the maintenance of two different species. He investigated specimens of *P. Kaempferi* of the British Museum-collections (whether they were DARWIN's types from Japan, or came from Japan at all, he does not say) and his conclusion was that the Japan and the Madeira forms belong to the same species, the latter form developing moreover into an orange-coloured variety: *P. Kaempferi* var. *aurantium*. Hence *Poecilasma Kaempferi* Darwin would also be a species found in both great oceans of the world.

But these are the only specimens of deep-sea Cirripedes that I know to be observed in the Malay Archipelago or eastern seas in general and in the Atlantic Ocean as well: all the other deep-sea species of *Scalpellum*, of *Verruca*, and other genera, are peculiar to one region, or only inhabit, if they are found in any other province, the adjacent one — Australia, China Sea, etc.

A few of the species collected at moderate depths in the region now under consideration, but which were never observed attached to floating objects, have also a wide distribution. I found them to be the following:

Oxynaspis celata Darwin	Luzon	and also:	Madeira
Pollicipes mitella (Linn.)	Malay Archipelago	„	„	: Madagascar
Lithotrya dorsalis Ellis	Maldives	„	„	: West-Indies etc.
Balanus calceolus Ellis	Malay Archipelago	„	„	: West coast of Africa.
„ *concavus* Bronn	Philippine Archipelago	„	„	: California; Panama; Peru
„ *perforatus* Brug.	Andaman Isl.	„	„	: Mediterranean; Atlantic
„ *trigonus* Darwin	Malay Archipelago	„	„	: Atlantic; Peru; California
Acasta cyathus Darwin	Gulf of Manaar	„	„	: Madeira; West-Indies
Tetraclita porosa (Gmelin)	Philippine Archipelago	„	„	: West-Indies; Galopagos etc.
„ *serrata* Darwin	Off Ceylon	„	„	: Cape of Good Hope; Algoa Bay
Pyrgoma anglicum Sowerby	Singapore	„	„	: Atlantic; Mediterranean
Chthamalus stellatus Poli	Philippine Archipelago	„	„	: Atlantic; West-Indies, Brazil.

Perhaps *Balanus stultus* Darwin from Singapore, and *Pyrgoma cancellatum* Leach, which according to BORRADAILE inhabits the Maldives, and are both recorded by DARWIN from the West-Indies, but with a point of interrogation, must be added to this list. This may be also the case with *Balanus declivis* Darwin: DARWIN instituted the species for a barnacle living embedded in sponges at the West-Indies, and WELTNER determined as belonging to the same species specimens from Batjan, which MARTENS collected, and which lived with *Acasta*,

in a sponge. Now, the Siboga collected a species of *Balanus* at different places in the Malay Archipelago, living also in sponges, and certainly showing great resemblance to *B. declivis* Darwin. I have thought better, however, observing some differences between DARWIN's description of *B. declivis* and the Siboga-specimens, to describe the latter as a new species, and I proposed for it the name *Balanus longirostrum*. For the present, however, this species may be considered as a representative of *B. declivis* from the West-Indies.

But even if we add the latter species to the above list, the number of species found to be distributed so very widely remains a small one, small at least, if we compare it with the great number of species that are known only from the region under consideration. And this warrants us to consider this region as a special province — and this is, as we are well enabled to say now — an especially rich province in the geographical distribution of the Cirripedia. It is certainly true that even a larger number of species, each, however, represented only by few specimens, cannot exercise such a strong influence on the character of a fauna, as a much smaller number of forms that occur in larger quantities will do. Whether from that point of view the barnacles of the coastal region of the Malay Archipelago may stand comparison with those of most other regions of the earth surface, I had no opportunity to make out. But certainly it has been proved, by the investigations of AURIVILLIUS, BORRADAILE, and ANNANDALE, and of myself with the aid of the Siboga-material, that "India" is much richer in species than DARWIN thought it was, and that coral-reefs are not so unfavourable to Cirripedes as formerly was supposed.

Before leaving this subject I may be permitted to repeat here what I said already in a provisional paper[1] regarding some results of the investigation of the Cirripedia collected during the voyage of the Siboga. To show that where the depth is more considerable, relatively large distances probably separate the places from each other where the animals of a certain species occur, or, that specimens of such a species are never numerous and not to be found at all at very many places, I pointed out that the "Siboga" brought back specimens of only two species of *Scalpellum* out of the ten that were collected by the "Challenger" in the Malay Archipelago[2]. That the "Siboga" brought back the only species of *Verruca* which the "Challenger" brought home from deeper water in that area, would, I said, not be in accordance with this observation — in both instances, however, the species was represented only by very few specimens. In this connexion I pointed out, that it was astonishing that in several cases, representatives of two and three species of *Scalpellum*, sometimes, moreover, accompanied by a single specimen of a species of *Verruca*, were obtained with the same haul of the dredge, from the very same locality in consequence. Such stations seemed to be very favourable to the occurrence of these animals; however, of the species found there the same holds good: viz., that they were always collected only in very few specimens. In a footnote I pointed out that the condition of the bottom must be considered of importance in this respect;

[1] Read before the Amsterdam Royal Academy of Sciences at the Meeting of May 30, 1908.

[2] DARWIN (A Monograph of the fossil Lepadidae, 1851, p. 6) made the same observation with regard to the fossil species of *Scalpellum*, *Pollicipes*, etc.: he said "one would naturally have expected, that where circumstances favoured the existence of numerous species of a genus, they would likewise have favoured the multiplication of the individuals in all or most of such species; but this, as we here see, has not always been the case".

on the other hand that its importance was by no means so apparent for the distribution of the Cirripedia as might be expected, was shown by the fact that whilst many species of *Scalpellum* were found at places with a muddy bottom, several other species were obtained from a bottom of hard sand, of coarse sand, or of coral-sand, etc.

So far as our knowledge goes, we must consider most species of *Scalpellum* and *Verruca* as living solitary; as the number of species of these genera (and of *Scalpellum* especially) is very large, they may furnish valuable evidence for the theories about the influence of isolation on the origin of new species, which were brought forward originally by MORITZ WAGNER[1] and were criticised, and adopted, but only in a much modified form, by WEISMANN[2]. It is well-known that, whilst WAGNER defended the hypothesis that the formation of a new species took place only in consequence of migration and the isolation caused by it, WEISMANN tried to demonstrate that not only might a species, while remaining at the same locality, very well divide into two or more forms, but also that isolation did not necessarily lead to the development of varieties. So migration alone, even if it caused a complete isolation, was inadequate as the sole cause of mutation. On the other hand, WEISMANN agreed that isolation could be one of the factors causing the origin of new forms, in the first place, because the isolation prevented the crossing with individuals of the same species from the original habitat, and secondly, because it transferred the migrant and its descendants to new surroundings. From this point of view, looking at so many places at the bottom of the ocean, most of which present special conditions of life, depth, bottom, etc., and must indeed be considered as practically isolated from others, we are compelled to agree that circumstances there have been favourable to the developing of new forms. And then, we certainly cannot wonder that a genus like *Scalpellum*, which has survived from the Cretaceous period down to the present time, being represented in numerous secondary and tertiary deposits, and which as a recent genus is found living almost in all the seas and oceans of the world, has yielded excellent material for mutation and so for the development of new forms or species under the influence of isolation.

On the same occasion I pointed out that, with respect to the relation of the deep-sea forms to the extinct Cirripedes of which fossil remains have been preserved, the "Siboga" material fully confirmed the conclusions arrived at by the working up of the "Challenger"-Cirripedia. So I have not much to add to the views I have expressed already. I wish only to emphasize, that, so far as the evidence goes, the different genera show very remarkable differences with respect to that relation. It seems, as though we should consider this relation as belonging to the properties peculiar to each genus, although we are unable for the present to understand why the different genera differ so much in this respect. What I mean by these differences may be shown by the following comparison of some of the more important genera.

Genus *Pollicipes*, one of the oldest-known genera of the Lepadidae and of the Cirripedia in general, is represented in secondary and tertiary strata by numerous species. It still exists, but the number of recent species is small, 6 in all, and they occur only in warmer temperate and tropical seas, and are all coastal forms.

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[1] WAGNER, MORITZ, Die Darwin'sche Theorie und das Migrationsgesetz der Organismen. Leipzig, 1868.

[2] WEISMANN, AUG., Ueber den Einfluss der Isolirung auf die Artbildung. Leipzig, 1872.

Genus *Scalpellum*, almost as old as *Pollicipes*, but not quite, not being represented in the Lower Oolite; it is represented by numerous species, however, in secondary and tertiary strata. Number of recent species very large, at least 125 being at present known; distributed through all the seas and oceans of the world. Bathymetrical distribution a very wide one: the different species range from the coast down to the greatest depths inhabited by Cirripedes (± 5000 m.).

Genus *Verruca*. The oldest known species dates back to secondary times. A species that is still existing ranges from the Coralline Crag through different tertiary deposits. Number of recent species considerable, 36 being at present known. Found in all the seas of the world, being more numerous, however, in deeper water. Bathymetrical distribution a wide one, ranging from the coast down to 3400 m., not quite so wide, however, as was found for the genus *Scalpellum*.

Genus *Balanus*. The earlier species appeared during the deposition of the Eocene beds, no secondary species of this genus being known. Species very numerous in tertiary formations. Number of living species very considerable: more than 70 being at present known. Distribution all over the world's surface, numerous species inhabiting tidal rocks, coastal and shallow waters. Some go down into a more considerable depth, a few only are true deep-sea species. The greatest depth inhabited by a species of *Balanus* was found to be 564 m.

To close this introduction, the following list enumerates the Stations where species of Cirripedia were collected, indicating the place of the Station, its depth and the character of the bottom, and mentioning the name of the species that were collected. Places between the stations where Cirripedia were collected during shore-exploration are mentioned in the list.

Nr. of Station	Place of Station	Depth in meters	Bottom	Species collected at each Station
2	Madura Strait [1]	56	Grey mud	*Balanus amphitrite* Darw.
5	Near Java's East coast	330	Mud	*Scalpellum Stearnsi* Pilsbry var. *robusta* n. var.
12	S. of Kangeang Isl.	289	Mud and shells	*Poecilasma excavatum* n. sp.; *Balanus albus* n. sp.
16	Near Kangeang Isl.	22	Mud	*Chthamalus intertextus* Darw.
18	North of Bali	1018	Fine grey mud	*Scalpellum javanicum* n. sp.
19	West coast of Lombok	—	(Shore-exploration)	*Lepas anserifera* Linn.; *Ibla sibogae* n. sp.
19a	East coast of Lombok	—	(Shore-exploration)	*Lithotrya pacifica* Borrad.
19b	Bay of Pidjot, East coast of Lombok	—	(Shore-exploration)	*Chthamalus stellatus* Poli
38	Near Paternoster Isl.	521	Coral	*Poecilasma gracile* Hoek
45	North of Sumbawa	794	Fine grey mud	*Scalpellum polymorphum* n. sp.; *curiosum* n. sp.; *crinitum* n. sp.; *chitinosum* n. sp.; *Verruca cassis* n. sp.
46a	Near North coast of Sumbawa	1600	Mud	*Verruca cassis* n. sp.
47	Bay of Bima	55	Mud	*Dichelaspis Nierstraszi* n. sp.; *Scalpellum rostratum* Darw.; *Balanus bimae* n. sp.
	Bay of Bima	—	(Shore-exploration)	*Ibla sibogae* n. sp.

[1] The place of each Station is only roughly indicated. The exact position of the Stations is given with the descriptions of the species.

Nr. of Station	Place of Station	Depth in meters	Bottom	Species collected at each Station
47[b]	Entrance Bay of Bimae	296	Fine sand and mud	*Scalpellum uncus* n. sp.
49[a]	Sapeh Strait	69	Coral and shells	*Balanus maldivensis* Borrad.; *maculatus* n. sp.
50	Bay of Badjo	up to 40	Mud, sand, shells	*Balanus amphitrite* Darw.; *amaryllis* Darw.; *socialis* Hoek
	Bay of Badjo	—	(Shore-exploration)	*Ibla sibogae* n. sp.; *Pollicipes mitella* Linn.
51	Strait Molo	69—91	Fine grey sand	*Poecilasma eburneum* Hinds; *Balanus socialis* Hoek; *maldivensis* Borrad.
	Madura Bay	—	(Shore-exploration)	*Ibla Cumingi* Darwin; *Pollicipes mitella* Linn.
52	Between Flores and Sumba	959	Globigerina ooze	*Verruca navicula* n. sp.
53	Bay of Nangamessi (Sumba)	up to 36	Coral sand	*Microlepas diademae* n. gen. n. sp.
59	West entrance Samau Strait	390	Coarse coral-sand	*Balanus maldivensis* Borrad.; *Hexelasma velutinum* n. gen. n. sp.
60	Haingsisi, Samau Isl., Timor	23	Lithothamnium	*Dichelaspis Nierstraszi* n. sp.
	Haingsisi, Samau Isl., Timor	—	(Shore-exploration)	*Lithotrya truncata* (Quoy et Gaimard)
65[a]	South of Saleyer Isl.	120	Grey mud	*Dichelaspis Nierstraszi* n. sp.
71	Makassar and surroundings	up to 32	Mud and sand	*Dichelaspis Nierstraszi* n. sp.; *Balanus amphitrite* Darw.
71[a]	Lighthouse "de Bril" (Makassar)	Surface	On drift-wood	*Lepas anserifera* Linn.
71[b]	Pulu Barang (Makassar)	?	—	*Acasta conica* n. sp.
71[c]	Near Makassar	?	—	*Balanus amphitrite* Darw.
74	East of Makassar	450	Globigerina ooze	*Megalasma lineatum* n. sp.; *Scalpellum Stearnsi* Pilsbry var. *gemina* n. var.; *Verruca grex* n. sp.
77	Borneo-bank	59	Fine grey coral-sand	*Dichelaspis Nierstraszi* n. sp.; *orthogonia* Darw.
79	Borneo-bank	41—54	Fine coral-sand	*Poecilasma eburneum* Hinds
79[a]	Borneo-bank	54	Fine coral-sand	*Poecilasma eburneum* Hinds
80	Borneo-bank	40—50	Fine coral-sand	*Poecilasma eburneum* Hinds; *Dichelaspis Nierstraszi* n. sp.; *orthogonia* Darw.
86	Anchorage off Dongola	36	Fine grey mud	*Balanus longirostrum* n. sp.
	Dongola, Palos-Bay	—	(Reef-exploration)	*Ibla Cumingi* Darw.
87	Strait of Makassar	655	Fine grey mud	*Scalpellum proclive* n. sp.; *deforme* n. sp.
88	Strait of Makassar	1301	Fine grey mud	*Scalpellum distinctum* Hoek; *Verruca capsula* n. sp.; *nitida* Hoek
94	Sulu Sea	450	Sand and stone	*Scalpellum pellicatum* n. sp.
95	Sulu Sea	522	Stony bottom	*Balanus albus* n. sp.
97	Sulu Sea	564	Coarse coral-sand	*Balanus alatus* n. sp.
99	Anchorage off North-Ubian	16—23	Lithothamnium-bottom	*Dichelaspis Nierstraszi* n. sp.
105	North of Sulu Isl.	275	Coral-bottom	*Balanus tenuis* Hoek; *Hexelasma velutinum* n. gen. n. sp.
109	Sulu Archipelago	13	Lithothamnium-bottom	*Balanus amphitrite* Darw.
110	Celebes Sea	Surface	—	*Lepas anserifera* Linn.
115	Kwandang-Bay	Reef	—	*Ibla sibogae* n. sp.
10/VII'99	Keel of H. M. S. "Siboga"	—	—	*Lepas anserifera* Linn.
117	Kwandang-Bay-entrance	80	Sand and coral	*Balanus minutus* n. sp.
122	North of Menado (Celebes)	1264—1165	Stone	*Scalpellum acutum* Hoek
125	Anchorage off Sawan, Siau Isl.	27	Stone	*Dichelaspis Nierstraszi* n. sp.
131	Anchor. off Beo, Karakelang Isl.	—	(Reef-exploration)	*Tetraclita porosa* (Gmelin)
133	Anchor. off Lirung, Salibabu Isl.	up to 36	Mud, and hard sand	*Dichelaspis Nierstraszi* n. sp.
136	Ternate-anchorage	23	Mud, and stone	*Poecilasma fissum* Darw.; *Balanus auricoma* n. sp.
137	Between Makjan and Halmaheira	472	Muddy sand	*Scalpellum fissum* n. sp.
144	Anchorage North of Damar Isl.	45	Coral bottom	*Dichelaspis Nierstraszi* n. sp.; *Balanus navicula* Darw.
151	West of Waigeu Isl.	845	Grey mud	*Scalpellum acutum* Hoek; *Verruca cassis* n. sp.
152	North-West coast of Waigeu Isl.	—	(Reef-exploration)	*Tetraclita porosa* (Gmel.)
159	Halmaheira Sea	411	Coarse sand	*Scalpellum praeceps* n. sp.
161	Between Kofiau and Salawatti	798	Muddy sand	*Scalpellum incertum* n. sp.

Nr. of Station	Place of Station	Depth in meters	Bottom	Species collected at each Station
162	West coast of Salawatti	18	Sand with clay	*Balanus amphitrite* Darw.; *socialis* Hoek.
164	South of Salawatti	32	Sand	*Dichelaspis Nierstraszi* n. sp.; *Versluysi* n. sp.; *Balanus amphitrite* Darw.; *socialis* Hoek; *quadrivittatus* n. sp.; *quinquevittatus* n. sp.; *calceolus* Ellis; *cornutus* n. sp.
165	East coast of Misool	Surface	—	*Lepas anserifera* Linn.; *fascicularis* Ell. & Sol.
170	Between Ceram and New Guinea	924	Fine grey mud	*Verruca navicula* n. sp.; *casula* n. sp.
172	Near East point of Ceram.	18	Coral and Lithothamnium	*Dichelaspis Nierstraszi* n. sp.
175	Between Ceram and Misool	1914	Fine grey and green mud	*Scalpellum distinctum* Hoek.
177	Ceram Sea	1633	Dead coral and stones	*Poecilasma carinatum* Hoek.
204	Between Wowoni and Buton	75—94	Sand	*Scalpellum aries* n. sp.; *rostratum* Darw.; *Balanus compressus* n. sp.; *proripiens* n. sp.
205	Lohio Bay, Buton Strait	22	Sandy mud	*Balanus socialis* Hoek.
21/IX '99	Buton Strait	Surface	—	*Lepas anserifera* Linn.
208	South of Muna Isl.	1886	Solid green mud	*Scalpellum elegans* n. sp.; *distinctum* Hoek.
211	East of northern extremity of Saleyer Isl.	1158	Grey mud	*Scalpellum humile* n. sp.; *gracile* n. sp.; *acutum* Hoek.
212	West of Saleyer Isl.	462	Grey and green mud	*Scalpellum fissum* n. sp.
213	Saleyer anchorage	up to 36	Coral reefs, mud	*Dichelaspis Nierstraszi* n. sp.; *Tydemani* n. sp.; *Balanus socialis* Hoek; *Scalpellum rostratum* Darw.
15/X '99	Keel of H. M. S. "Siboga"	—	—	*Lepas anserifera* Linn.; *Balanus tintinnabulum* Linn. var.
214	Between Celebes and Flores	2796	Grey and green mud	*Scalpellum trapezoideum* n. sp.
	Between Celebes and Flores	Surface	—	*Lepas anserifera* Linn.
221	Banda Sea	2798	Bluish grey mud	*Scalpellum sculptum* n. sp.; *hexagonum* n. sp.; *discolor* n. sp.
(225)	Reef at Lucipara Isl.	—	—	*Tetraclita vitiata* Darw.; *porosa* (Gmel.)
(225c)	Reef at Lucipara Isl. South point	—	—	*Alepas lithotryae* n. sp.; *Lithotrya nicobarica* Rhdt.; *conica* n. sp.
227	Between Lucipara and Ambon	2081	Grey mud	*Scalpellum ciliatum* n. sp.; *formosum* n. sp.
(228)	S. of Ceram	Surface	—	*Lepas anserifera* Linn.
231	Ambon-Anchorage	40	Coral-sand	*Balanus hystrix* n. sp.
240	Banda-Anchorage	9—45	Black sand	*Balanus arcuatus* n. sp.
	Banda-Anchorage	—	(Reef-exploration)	*Tetraclita costata* Darw.; *coerulescens* Spengler.
241	Banda Sea, South of Ceram	1570	Dark sand	*Scalpellum sessile* n. sp.; *formosum* n. sp.
250	Anchorage off Kilsuin, Kur Isl.	—	(Reef-exploration)	*Lithotrya nicobarica* Rhdt.; *conica* n. sp.
251	South of Kur Isl.	204	Hard coral-sand	*Poecilasma dubium* n. sp.; *obliquum* n. sp.; *Megalasma striatum* Hoek; *Alepas tenuis* n. sp.; *Scalpellum imbricatum* n. sp.; *diota* n. sp.; *candidum* n. sp.; *Stearnsi* Pilsbry var. *robusta* n. var.; *Balanus pentacrini* n. sp.; *Pyrgoma Kuri* n. sp.; *Hexelasma velutinum* n. g. n. sp.
253	South of Taam Isl.	304	Grey clay	*Megalasma striatum* Hoek; *Poecilasma excavatum* n. sp.; *obliquum* n. sp.; *dubium* n. sp.; *Balanus pentacrini* n. sp.
254	Kei Isl. Archipelago	310	Fine grey mud	*Scalpellum Stearnsi* Pilsbry var. *robusta* n. var.; *Verruca conchula* n. sp. var. *minor* n. var.
256	Kei Isl. Archipelago	397	Greyish green mud	*Scalpellum hamulus* n. sp.; *polymorphum* n. sp.; *pellicatum* n. sp.
257	Kei Isl. Archipelago	till 52	Coral	*Dichelaspis Nierstraszi* n. sp.; *Creusia spinulosa* Leach var. (11); *Balanus terebratus* Darw.
258	Tual-anchorage, Kei Isl.	22	Sand and coral	*Dichelaspis Nierstraszi* n. sp.; *Versluysi* var. n. var.; *Balanus amaryllis* Darw.
260	Near Kei Isl.	90	Sand, coral, and shells	*Alepas intermedia* n. sp.; *Balanus albus* n. sp. ? *auricoma* n. sp.; *investitus* n. sp.

Nr. of Station	Place of Station	Depth in meters	Bottom	Species collected at each Station
262	Kei Isl. Archipelago	560	Bluish grey mud	*Dichelaspis Weberi* n. sp.; *Verruca capsula* n. sp.; *Hexelasma arafurae* n. g. n. sp.
267	East of Kei Isl.	984	Grey mud	*Alepas ovalis* n. sp.; *Verruca grex* n. sp.; *Megalasma striatum* Hoek.
271	West of Aru Isl.	1788	Bluish green mud	*Scalpellum inflatum* n. sp.; *moluccanum* Hoek; *chitinosum* n. sp.
273	Anchorage off Pulu Jedan	13	Sand and shells	*Balanus amphitrite* Darw.; *amaryllis* Darw.
	Anchorage off Pulu Jedan	—	(Shore-exploration)	*Scalpellum Peroni* (Gray); *Pyrgoma jedani* n. sp.
274	Near Jedan Isl.	57	Sand, shells, stones	*Dichelaspis Nierstraszi* n. sp.; *Scalpellum pollicipedoides* n. sp.
282	Anchorage between Nusa Besi and North-East of Timor	27—54	Sand, coral, Lithothamnium	*Dichelaspis Nierstraszi* n. sp.
284	South of East point of Timor	828	Grey mud	*Poecilasma carinatum* Hoek; *Verruca cassis* n. sp.
285	Anchorage South coast of Timor	34	Limit between mud and coral-sand	*Scalpellum uncus* n. sp.
289	South coast of (Portug.) Timor	112	Mud, sand, shells	*Dichelaspis Nierstraszi* n. sp.; *orthogonia* Darw.; *Balanus compressus* n. sp.
294	South coast of (Dutch) Timor	73	Soft mud with sand	*Dichelaspis orthogonia* Darw. (?); *Scalpellum rostratum* Darw.
295	South of Batu Patih (Timor)	2050	Fine grey mud	*Scalpellum virgatum* n. sp.; *ventricosum* n. sp.
297	East of Rotti Isl.	520	Soft grey mud	*Verruca capsula* n. sp.; *grex* n. sp.; *conchula* n. sp.
299	Boeka- or Cyrus-bay South coast of Rotti Isl.	34	Mud, coral, Lithothamnium	*Balanus quadrivittatus* Darw.
300	Near East coast of Rotti Isl.	918	Fine grey mud	*Scalpellum poculum* n. sp.
301	Pepela-bay, East coast of Rotti Isl.	22	Mud, coral, Lithothamnium	*Acasta glans* Lamarck
302	Between Timor and Rotti Isl.	216	Sand and coral-sand	*Balanus maldivensis* Borrad.
305	Between Adonara and Solor	113	Stony	*Balanus ciliatus* n. sp.
310	East coast of Sumbawa	73	Sand with dead coral	*Balanus maculatus* n. sp.; *maldivensis* Borrad.; *investitus* n. sp.
311	Sapeh-bay, East coast of Sumbawa	—	(Shore-and reef-exploration)	*Chthamalus stellatus* Poli
313	Anchorage East of Dangar Besar, Saleh-bay	up to 36	Sand, coral, mud	*Balanus longirostrum* n. sp.; *Creusia spinulosa* Leach var. *Sumbawae* n. var.
315	Anchorage East of Sailus Besar, Paternoster Isl.	up to 36	Coral and Lithothamnium	*Dichelaspis Nierstraszi* n. sp.
316	Bali Sea, North of Lombok	538	Fine dark mud	*Alepas morula* n. sp.
318	Java Sea, North-West of Kangeang Isl.	88	Fine grey mud	*Dichelaspis orthogonia* Darw. (forma dubia)

Haarlem, October 1912

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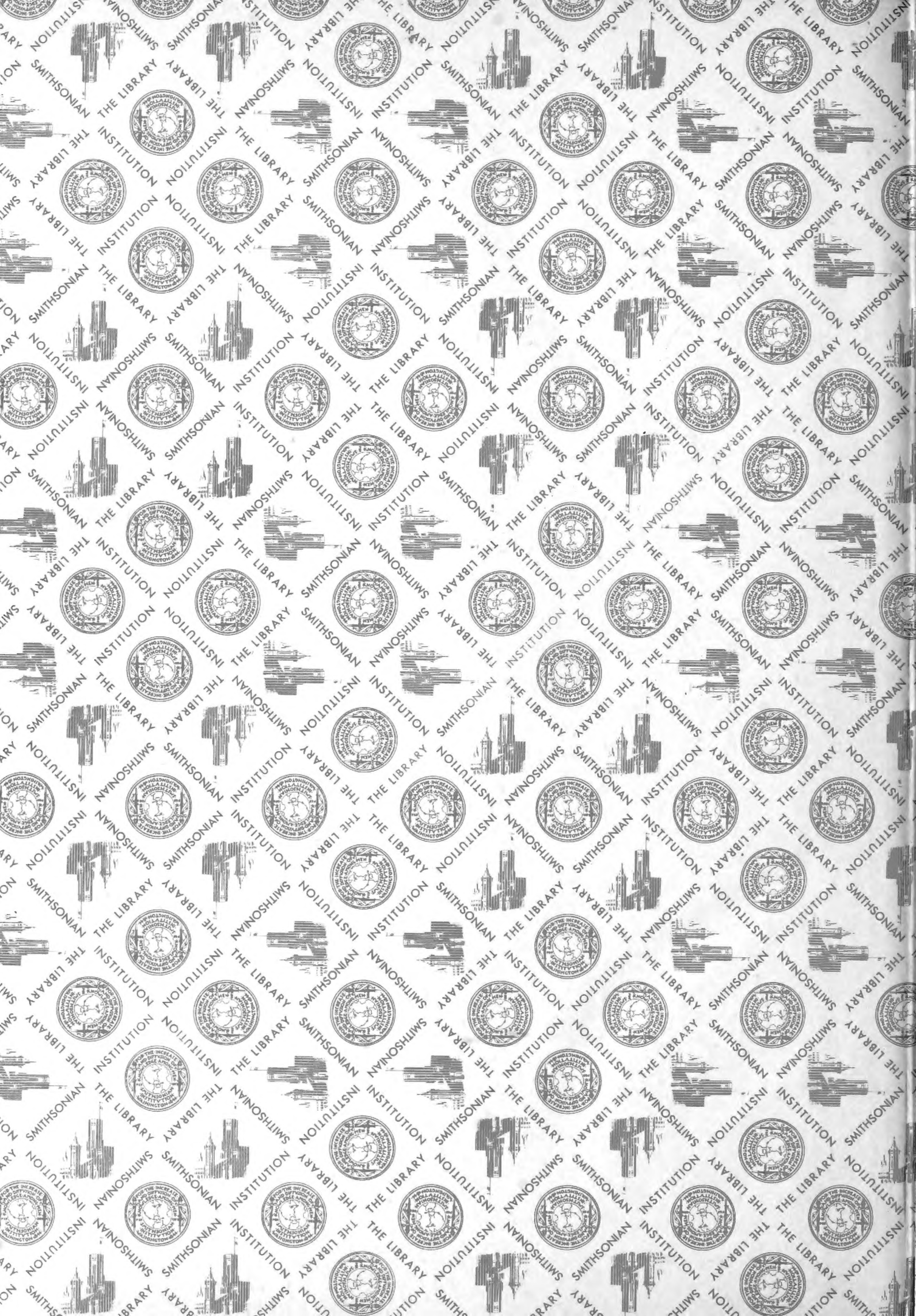
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