

**Systematic Studies on the Cirripeds (Crustacea) from Korea.**  
**I. Balanomorph Barnacles (Cirripedia, Thoracica, Balanomorpha)**

**Il Hoi Kim and Hoon Soo Kim**

(Department of Zoology, Seoul National University)

韓國產 蔓脚類 (甲殼類)의 系統分類學的 研究

I. 따개비類 (完胸目, 따개비亞目)

金 一 會 · 金 熙 洙

(서울대 大學院 動物學科)

(Received May 5, 1980)

적 요

저자들은 1963년부터 1978년 사이에 남한의 38개 지점으로부터 채집되어 서울대 자연대학 동물학과에 보관된 따개비류물 동정·분류한 결과 15종, 2아종이 밝혀졌다. 이들을 모두 기재하여 보고한다. 이들중 다음의 2종 1아종은 한국내 미기록종 및 아종이다: *Chelonibia patula*, *Chirona (Striatobalanus) amaryllis*, *Solidobalanus (Hesperibalanus) hesperius hesperius*.

**INTRODUCTION**

Korean balanomorph barnacles have been little investigated as in the case of other barnacle groups. Only a few papers dealing partly with Korean balanomorph barnacles were published, therefore, up to now there has been a great lack of knowledge of Korean species.

Utinomi (1967) reported *Balanus uliginosus* (= *B. kondakovi*) from southwestern coast of Korea. In his paper, Utinomi (1970) recorded collecting data of South Korean thoracic barnacles in which 7 species of balanomorphs were listed as follows: *Chthamalus challengerii*, *Tetraclita squamosa japonica*, *Tetraclitella chinensis*, *T. darwini*, *Balanus albicostatus albicostatus* (= *B. albicostatus*), *B. amphitrite amphitrite*, *B. uliginosus* (= *B. kondakovi*).

Recently, Kim and others, as native investigators, have reported common barnacle species of Korea in their collecting data (Kim & Rho, 1969; Kim, 1973; Kim,

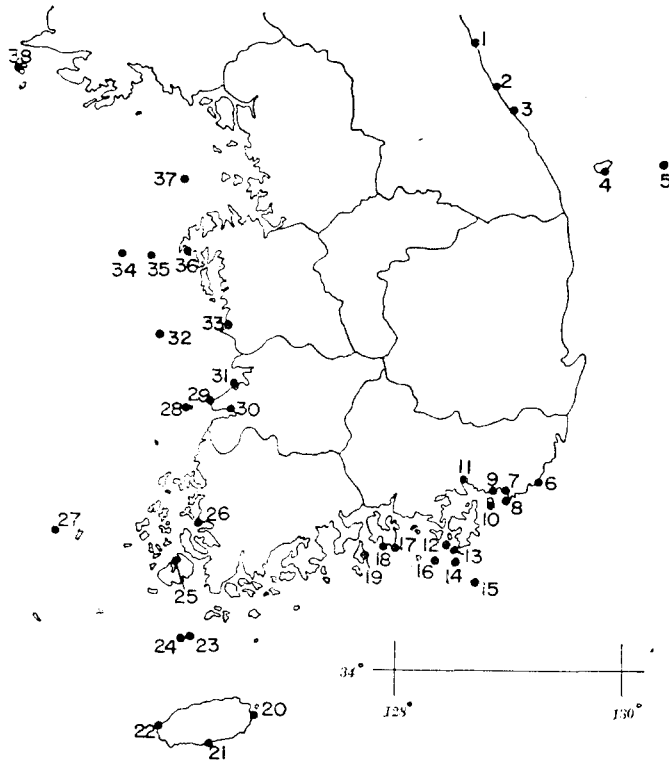


Fig. 1. A map showing localities where the material was collected.

- |                                   |                              |
|-----------------------------------|------------------------------|
| 1. Nagsansa (洛山寺)                 | 20. Seongsanpo (城山浦)         |
| 2. Aninjin (安仁津)                  | 21. Seogwipo (西歸浦)           |
| 3. Mugho (墨湖)                     | 22. Hanrim (翰林)              |
| 4. Ulreung I. (鬱陵島)               | 23. Hoenggan I. (橫看島)        |
| 5. Dog-do I. (獨島)                 | 24. Sangchuja I. (上楸子島)      |
| 6. Haeundae (海雲台)                 | 25. Gahag, Jin-do I. (珍島 加鶴) |
| 7. Myeongjidong, Busan (釜山 鳴旨洞)   | 26. Mogpo (木浦)               |
| 8. Jangja I. (長子島)                | 27. Hong-do I. (紅島)          |
| 9. Songjeongri (金浦郡 松亭里)          | 28. Wi-do I. (蟬島)            |
| 10. Gadeog I. (駕德島)               | 29. Gyeogpo (格浦)             |
| 11. Masan (馬山)                    | 30. Gomsu (晉土)               |
| 12. Bijin I. (比珍島)                | 31. Gyehwa I. (界火島)          |
| 13. Yeonhwa I. (蓮花島)              | 32. Eocheong I. (於青島)        |
| 14. Gug-do I. (國島)                | 33. Biin (庇仁)                |
| 15. Hong-do I. (鴻島)               | 34. Gyeogryeolbi I. (格列飛島)   |
| 16. Gal-do I. (葛島)                | 35. Gungsi I. (弓矢島)          |
| 17. Mijori, Namhae I. (南海島 彌助里)   | 36. Anheung (安興)             |
| 18. Sangjuri, Namhae I. (南海島 尙州里) | 37. Deogjeog I. (德積島)        |
| 19. Dolsan I. (突山島)               | 38. Baegryeong I. (白翎島)      |

& Lee, 1978; Kim, 1978; Kim *et al.*, 1979; Kim *et al.*, 1979). Following species were reported in their lists: *Chthamalus challengerii*, *Euraphia pilsbryi*, *Octomeris sulcata*, *Tetraclitella darwini*, *Tetraclita squamosa japonica*, *Megabalanus rosa*, *M.*

*volcano*, *Balanus rostratus*, *B. albicostatus*, *B. kondakovi*, *B. reticulatus*, *B. trigonus*.

The present paper covers intertidal and sublittoral balanomorph barnacles which are commonly found in Korean seas.

## MATERIALS AND METHODS

The materials are the collections deposited in the Department of Zoology, College of Natural Sciences, Seoul National University after collecting them from 1963 to 1978. The majority of materials comprise the collections from intertidal zones of mainland and its adjacent islands of Korea, and others from fish nets or collected by woman divers (Fig. 1). The materials which were examined previously by Dr. Kim and his co-workers are reexamined in this study. All the specimens are preserved in 70 percent methyl alcohol.

For examination, specimens were boiled in 10 percent sodium hydroxide solution for several minutes, then washed in clear water. Calcareous parts were dried and observed under the dissecting microscope, and soft parts were mounted on the microscope slide and observed under the light microscope. All the figures of plates were drawn using the camera lucida in various magnifications.

Descriptions are concerned about morphological characteristics of plates, operculum, labrum, mandible and first maxilla, if necessary, the other structures are described.

Systematics are based on Newman and Ross (1976), and Henry and McLaughlin (1975) in part.

## RESULTS

### Systematic List

Subclass Cirripedia 蔓脚亞綱

Order Thoracica Darwin, 1854 完胸目

Suborder Balanomorpha Pilsbry, 1916 따개비亞目

Superfamily Chthamaloidea (Darwin, 1854)

Family Chthamalidae Darwin, 1854

Subfamily Euraphiinae Newman and Ross, 1976

Genus *Octomeris* Sowerby, 1825

1. *Octomeris sulcata* Nilsson-Cantell, 1932 팔각따개비 (신칭)

Genus *Euraphia* Conrad, 1837

2. *Euraphia pilsbryi* (Hiro, 1936) 큰조루래기따개비 (신칭)

Subfamily Chthamalinae Darwin, 1854

Genus *Chthamalus* Ranzani, 1817

3. *Chthamalus challenger* Hoek, 1883 조무래기 따개비  
 Superfamily Balanomorphoidea Newman and Ross, 1976  
 Family Coronulidae Leach, 1825  
 Subfamily Chelonibiinae Pilsbry, 1916  
 Genus *Chelonibia* Leach, 1817
- \*4. *Chelonibia patula* (Ranzani, 1818) 깨등따개비 (신칭)  
 Family Tetracitidae Gruvel, 1903  
 Subfamily Tetracitellinae Newman and Ross, 1976  
 Genus *Tetracitella* Hiro, 1939
5. *Tetracitella chinensis* (Nilsson-Cantell, 1921) 구멍따개비 (신칭)
6. *Tetracitella darwini* (Pilsbry, 1928) 사각따개비 (신칭)  
 Subfamily Tetracitinae Gruvel, 1903  
 Genus *Tetracitella* Schumacher, 1817
7. *Tetracitella squamosa japonica* Pilsbry, 1916 검은큰따개비  
 Superfamily Balanoidea (Leach, 1817)  
 Family Archaeobalanidae Newman and Ross, 1976  
 Subfamily Archaeobalaninae Newman and Ross, 1976  
 Genus *Chirona* Gray, 1835  
 Subgenus *Striatobalanus* Hoek, 1913
- \*8. *Chirona (Striatobalanus) amaryllis* (Darwin, 1854) 꽃따개비 (신칭)  
 Genus *Solidobalanus* Hoek, 1913  
 Subgenus *Hesperibalanus* Pilsbry, 1916
- \*9. *Solidobalanus (Hesperibalanus) hesperius hesperius* (Pilsbry, 1916) 주름따개비 (신칭)  
 Family Balanidae Leach, 1817  
 Genus *Balanus* Da Costa, 1778
10. *Balanus rostratus* Hoek, 1883 봉우리 따개비
11. *Balanus albicostatus* Pilsbry, 1916 고랑따개비 (신칭)
12. *Balanus amphitrite amphitrite* Darwin, 1854 주걱따개비 (신칭)
13. *Balanus kondakovi* Tarasov and Zevina, 1957 줄따개비
14. *Balanus reticulatus* Utinomi, 1967 사방줄따개비 (신칭)
15. *Balanus trigonus* Darwin, 1854 삼각따개비 (신칭)  
 Genus *Megabalanus* Hoek, 1919
16. *Megabalanus rosa* (Pilsbry, 1916) 빨강따개비
17. *Megabalanus volcano* (Pilsbry, 1916) 큰빨강따개비 (신칭)

The asterisks (\*) indicate the animals which are new to Korean fauna.

#### Key to the genera of Korean balanomorph barnacles

1. Wall composed of 8 plates.....*Octomeris*  
 Wall composed of 6 plates.....2

- Wall composed of 4 plates.....3
2. The rostrum is overlapped by rostrolaterals; plates are solid;  
 carinolateral absent.....4  
 The rostrum overlaps laterals; carinorostral present .....5
3. Plates have wide radii.....*Tetreaclitella*  
 Radii are obsolete or absent.....*Tetraclita*
4. Mandible tridentoid; scutum high .....*Euraphia*  
 Mandible quadridentoid; scutum usually low.....*Chthamalus*
5. Plates are solid .....6  
 Plates are porous .....7
6. Basis porous; radii narrow, with its summits steeply oblique.....*Chriona*  
 Basis solid; radii wide.....*Solidobalanus*
7. Operculum small, covering only a small part of orifice;  
 rostrum united by three rudimentary compartments .....*Chelonibia*  
 Operculum covers orifice wholly.....8
8. Radii are solid.....*Balanus*  
 Radii are porous transversely .....*Megabalanus*

### Description of species

#### Subclass Cirripedia

#### Order Thoracica Darwin, 1854

#### Suborder Balanomorpha Pilsbry, 1976

#### Superfamily Chthamaloidea (Darwin, 1854)

#### Family Chthamalidae Darwin, 1854

#### Subfamily Euraphiinae Newman and Ross, 1976

#### Genus *Octomeris* Sowerby, 1825

#### 1. *Octomeris sulcata* Nilsson-Cantell, 1932

(pl. I, figs. 1-6)

*Octomeris sulcata* Nilsson-Cantell, 1932, p. 8; Hiro, 1939b, p. 254, figs. A, 6C-D; 1939c, p. 207; Utinomi, 1949, p. 21; Utinomi & Kikuchi, 1966, p. 5; Utinomi, 1970, p. 345, figs. 3-4, pl. 18, figs. 3, 4; Rosell, 1973, p. 75, figs. 2h-1, 3m-q; Newman & Ross, 1976, p. 40; Kim *et al.*, 1979, p. 109; Kim, Lee and Kim, 1979, p. 293.

#### Material examined :

- 14 specimens, Hoenggan I., Aug. 9, 1969, H. S. Kim;  
 59 specimens, Uireuhg I., Aug. 14, 1976, K. S. Lee;  
 6 specimens, Myeongjidong, May 8, 1978, I. H. Kim;  
 8 specimens, Bijin I., Jul. 19, 1978, I. H. Kim;  
 39 specimens, Sangchuja I., Aug. 5, 1978, I. H. Kim.

**Description :** Shell with 8 plates, depressed conic, light brownish-white; surface furnished with many prominent longitudinal ribs; orifice very toothed, broad;

sutures between parietes smooth; sutures between rostrum and rostromeritics obscure, only can be seen internally; inner surface with many small tubercles near the basis. Basis calcareous, without radial tube. Rostrum with radii well developed.

Scutum with height longer than its basal margin; occludent ridge well developed; articular ridge short; adductor ridge wanting.

Tergum without spur; basiscutal angle grows longer as an individual grows older; depressor muscle pit distinct, crenulate, projecting below basal margin; articular furrow wide and deep.

Labrum without central notch, but concave centrally; crest with many small denticles. Mandible with three teeth; intervals of each tooth crenulated by small, acute denticles; lower angle with 2-3 pointed spines; margin between third tooth and inferior angle pectinate. First maxilla with distinct notch below upper pair of spines; notch with small spines; no distinguishable lower pair of spines.

**Remarks:** This species is found on rocky region from lowest tide level to shallow water where the warm current washing. Young individuals are hardly distinguishable from *Balanus tringonus* in the ribbed ornamentation of the shell, but can be distinguished by examining the wall structure.

**Range:** Southern Japan, Formosa, Philippines and Korea (Busan and Geoje I.)

### **Genus *Euraphia* Conrad, 1837**

#### **2. *Euraphia pilsbryi* (Hiro, 1936)**

(pl. I, figs. 12-14)

*Chthamalus pilsbryi* Hiro, 1936b, p. 227, fig. 3; 1937b, p. 429; Utinomi, 1949, p. 21; Utinomi & Kikuchi, 1966, p. 5; Utinomi, 1970, p. 345; Kim *et al.*, 1979, p. 109.

*Euraphia pilsbryi*: Newman & Ross, 1976, p. 41; Yamaguchi, 1979, p. 41, fig. 2.4.

#### **Material examined:**

7 specimens, Seogwipo, Jul. 31, 1978, I. H. Kim.

**Description:** Shell flat; surface smooth, light gray colored; longitudinal ribs restricted to the near the basis; orifice large, diamond shaped, with about 1/2 of basis in diameter; inner surface of parietes smooth; no parietal tubes and sheath.

Scutum wider than high, with tergal margin longer than that of *Chthamalus challengerii* and typically with 3 projections on the tergal margin; outer surface without distinct growth lines.

Tergum high, typically with 3 projections on the scutal margin; spur wider than that of *C. challengerii*; depressor muscle pits more or less than 7 in number, well developed; below the depressor muscle pits two small pits are shown.

Labrum without central notch, with many small teeth on the crest. Mandible with three teeth; lower part of third tooth crenulate; in the lower angle 1-3 rather long and thick spines beared. First maxilla with notch below upper pair of spines and with many small spines below the notch; a few spinules are in the

notch.

**Remarks:** Seven specimens were found in high tide level at Seogwipo, Jeju Island. Largest specimen sized 15 mm in carinorostral diameter.

**Range:** Japan (Kyusyu) and Korea (Hong-do I., South Sea).

**Subfamily Chthamalinae Darwin, 1854**

**Genus Chthamalus Ranzani, 1817**

**3. *Chthamalus challenger* Hoek, 1883**

(pl. I, figs. 7-11)

*Chthamalus challenger* Hoek, 1883, p.165, pl.13, figs. 35-38; Krüger, 1911, p.460; Pilsbry, 1916, p.307; Broch, 1927, p.136; Hiro, 1932, p.546, figs.1,2; 1935, p.215; 1937b, p.429; 1939c, p.207; Broch, 1947, p.5; Utinomi & Kikuchi, 1966, p.5; Utinomi, 1970, p.345; Kim, 1973, p.430; Kim & Lee, 1978, p.99; Kim, 1978, p.14; Kim et al., 1979, p.109; Kim, Lee and Kim, 1979, p.293; Yamaguchi, 1979, pp.39,40, fig.2.1.

**Material examined:**

185 specimens, Hoenggan I., Aug. 9, 1969, H. S. Kim;

34 specimens, Seongsanpo, Aug. 10, 1970, H. S. Kim;

91 specimens, Wi-do I., Apr. 13, 1972, H. S. Kim;

74 specimens, Baegreong I., Jul. 17, 1973, H. S. Kim;

210 specimens, Sangjuri, Aug. 3, 1974, H. S. Kim;

151 specimens, Gahag, Aug. 3, 1974, H. S. Kim;

89 specimens, Ulreung I., Aug. 16, 1976, H. S. Kim;

66 specimens, Aninjin, Jun. 3, 1978, I. H. Kim;

numerous specimens, Gal-do I., Jul. 21, 1978, I. H. Kim.

**Description:** Shell variable in shape according to the crowding conditions; in the case of isolated form, shell flat and with longitudinal ribs well developed; when crowded, longitudinal ribs seen only near the basis. Externally radii not be seen, but sutures typically curved, easily observed. Both sutures of both sides of rostro-laterals closed near the apex. Pariests solid, thick; inner surface smooth.

Scutum long laterally; tergal margin with two projections typically; articular ridge prominent; adductor muscle pit rather large, distinct; lateral depressor muscle pit obscure.

Tergum thick, with two projections on the scutal margin; depressor muscle pits 4 or 5 in number; no spur, only with long basiscutal angle.

Labrum slightly depressed, densely with small teeth on both crests. Mandible with 4 teeth; fourth tooth small or vague; lower part of fourth tooth crenulate. First maxilla with small notch below upper pair of spines; in the notch a few spinules beared; no lower pair of spines.

**Remarks:** This species is the most dominant barnacle in Korean seas. The largest specimen has its basal diameter of 12mm.

**Range :** Korea and Japan.

**Superfamily Balanomorphoidea Newman and Ross, 1976**

**Family Coronulidae Leach, 1825**

**Subfamily Chelonibiinae Pilsbry, 1916**

**Genus *Chelonibia* Leach, 1817**

**4. *Chelonibia patula* (Ranzani, 1818)**

(pl. II, figs. 1-4)

*Chelonibia patula*: Darwin, 1954, p.396; Pilsbry, 1916, p.268; Broch, 1927, p.136; 1935, p.3; 1947, p.7; Daniel, 1955, p.32; Utinomi, 1958, p.309; Stubbings, 1961, p.38; 1967, p.297; Southwayd & Crisp, 1963, p.26; Newman & Ross, 1976, p.43.

**Material examined :**

43 specimens, Gomso, Sep. 24, 1978, I. H. Kim.

**Description :** Shell oval, very smooth and light, rather flattened, fragile, steeply conical, but low; orifice large, hexagonal, with width more than 1/2 basal diameter, mainly occupied by opercular membrane. Raddi wide, smooth, only slightly sunken; its summits round. No separated sheath. Inner and outer lamina ribbed finely; no tranverse septum; each tube with one subsidiary rib.

Operculum elongated; scutum slightly wider than tergum.

Labrum with many densely arranged large teeth and with deep notch. Mandible with 5 distinct teeth; second and third teeth with extra denticles; short spines are on inferior angle.

**Remarks :** These barnacles were taken from the carapace and legs of the crab, *Portunus (Portunus) trituberculatus* (Miers) from Gomso.

**Range :** Tropical Atlantic to Indo-West Pacific.

**Family Tetracitidae Gruvel, 1903**

**Subfamily Tetracitellinae Newman and Ross, 1976**

**Genus *Tetracitella* Hiro, 1939**

**5. *Tetracitella chinensis* (Nilsson-Cantell, 1921)**

(pl.II, figs. 5-10)

*Tetracitella purpurascens chinensis*: Hiro, 1939b, p.273, Fig.14.

*Tetracitella (Tetracitella) chinensis*: Utinomi, 1949, p.24; 1962, p.231; Utinomi & Kikuchi, 1966, p.8.

*Tetracitella chinensis*: Utinomi, 1970, p.347, pl.18, fig.5; Newman & Ross, 1976, p.46.

**Material examined :**

3 specimens, Seogwipo. Aug.1, 1978, I. H. Kim.

**Description :** Shell moderately flat, with many distinct longitudinal ribs; intervals between longitudinal ribs deeply grooved; parietes very thick in comparison with the body part; orifice small, pentagonal; tergum concealed in the shell in upper



view. Rostrum and carina have two holes respectively; each lateral has one hole.

Scutum long laterally; basiocludental angle expanded to the rostral side, but not pointed; articular ridge long, projected; articular furrow narrow but deeply grooved; lateral depressor muscle pit wanting.

Tergum with deep articular furrow; articular ridge projected vertically; depressor muscle pit short but wide, closed to the basiscutal angle; no spur furrow.

Labrum slightly depressed centrally, rather smooth; a few small teeth are on the crest irregularly. Mandible with 4 teeth; third and fourth teeth with small denticles; lower part of fourth tooth crenulate. First maxilla without distinct notch, but with 2-3 small spinules below upper pair of spines; 5-7 spines arranged between upper and lower pair of spines; lower part of lower pair of spines pectinated.

**Remarks :** This species characterized by six large holes formed on the shell, two holes in each carina and rostrum, one in each lateral, but in young individuals the holes are less prominent. It is difficult to find out this animal because it has hypobiotic habitats as the other tetracitellan species.

**Range :** Southern Japan, Formosa and Korea (Jeju I.).

#### 6. *Tetracitella darwini* (Pilsbry, 1928)

(pl. II, figs.11-17)

*Tetracitella* (*Tetracitella*) *darwini*: Hiro, 1939b, p. 277; 1939c, p. 214; Utinomi, 1949, p. 24; 1958, p. 304; 1962, p. 237; Utinomi & Kikuchi, 1966, p. 8; Kim & Rho 1969, p.84.

*Tetracitella darwini*: Utinomi, 1970, p.348; Newman & Ross, 1976, p. 47.

#### **Material examined :**

12 specimens, Gahag, Aug. 3, 1974, H. S. Kim.

**Description :** Shell depressed conic; growth lines of the surface very faint; longitudinal ribs very thin and narrow, 4 parietes are same sized, very thick, numerous parietal tubes arranged characteristically protuberant upwards, more highly positioned than the orifice.

Scutum very thick, longer than wide, many arrays of small pits are arranged externally; occludent margin thin; articular ridge and adductor ridge weak; interval between articular and adductor ridge deeply sunken.

Tergum wide and thick basally; articular furrow wide and deep; depressor muscle pit well developed; articular ridge long and distinct; spur wide but short.

Labrum with central notch shallow and wide; each crest with 3 small teeth near the central notch. Mandible with 5 teeth; lower angle acutely pointed. First maxilla with relatively large notch below large upper pair of spines, usually with 5 spines between upper and lower pairs of spines.

**Remarks :** The largest specimen sized 21mm in basal diameter.

**Range :** Japan, Formosa and Korea (Jeju I. and Chuja I.).

**Subfamily Tetracelitinae Gruvel, 1903****Genus *Tetracelita* Schumacher, 1817****7. *Tetracelita squamosa japonica* Pilsbry, 1916**

(pl. III, figs. 1-8)

*Tetracelita squamosa japonica* Pilsbry, 1916, p.252; Hiro, 1932, p.551; 1937b, p.469; 1939c, p.213; Utinomi, 1949, p.23; 1958, p.304; Kim & Rho, 1969, p.83, fig. 2-1; Utinomi, 1970, p.347; Newman & Ross, 1976, p.48; Kim & Lee, 1978, p.99; Kim, 1978, p.14; Kim *et al.*, 1979, p.109; Kim, Lee and Kim, 1979, p.293; Yamaguchi, 1979, p.42, fig. 3.2.

**Material examined :**

- 6 specimens, Hong-do I. (Yellow Sea), Nov. 16, 1964, H. S. Kim;
- 5 specimens, Eocheong I., May 31, 1969, H. S. Kim;
- 5 specimens, Mijori, Jun. 8, 1974, H. S. Kim;
- 18 specimens, Ulrcung I., Aug. 16, 1976, H. S. Kim;
- 57 specimens, Dog-do I., Aug. 27, 1976, H. S. Kim;
- 5 specimens, Gyeogreolbi I., Jul. 30, 1977, H. S. Kim;
- 8 specimens, Gungsi I., Jul. 30, 1977, H. S. Kim;
- 32 specimens, Gyeogpo, Jul. 14, 1978, I. H. Kim;
- 4 specimens, Hong-do I. (South Sea), Jul. 20, 1978, I. H. Kim;
- 7 specimens, Gug-do I., Jul. 21, 1978, I. H. Kim;
- 10 specimens, Hanrim, Jul. 29, 1978, I. H. Kim;
- 7 specimens, Seongsanpo, Aug. 3, 1978, I. H. Kim;
- 6 specimens, Sangchuja I., Aug. 5, 1978, I. H. Kim;
- 10 specimens, Sangjuri, Oct. 8, 1978, I. H. Kim.

**Description :** Shell conic; surface usually dark gray colored; orifice small, circular; apex of the tergum usually projected beyond the orifice; wall thick; externally many small ridges arranged irregularly on the surface; parietal tubes small, numerous. No radius visible; only crevices between parietes are restricted to the near the orifice. Inner surface of parietes white, smooth; sheath dark purple, with a half length of parietes.

Scutum triangular; 3-4 large, distinct occludent ridges are developed on the occludent margin; adductor ridge long, distinct, well separated from articular ridge; articular ridge short and weak; articular furrow small; lateral depressor muscle pit 3-5; growth lines of the surface well developed.

Tergum slender, with apex pointed and recurved; articular furrow very wide; crests for depressor muscle faint but long; spur long, positioned near the basiscutal angle.

Labrum slightly notched centrally; each crest with 0-5 small teeth. Mandible with 4-5 teeth; lower part of last tooth crenulate. First maxilla with small notch below upper pair of spines; small spinules beared in the notch; intermediate spines

numerous, rather long; lower angle with small spinules pectinate.

**Range:** Korea and Japan.

**Superfamily Balanoidea (Leach, 1817)**

**Family Archaeobalanidae Newman and Ross, 1976**

**Subfamily Archaeobalaninae Newman and Ross, 1976**

**Genus *Chirona* Gray, 1835**

**Subgenus *Striatobalanus* Hoek, 1913**

**8. *Chirona (Striatobalanus) amaryllis* (Darwin, 1854)**

(pl. III, figs. 9-15)

*Balanus amaryllis* Darwin, 1854, p.279, pl. 7, fig. 6a-6c; Hoek, 1883, p.153, pl. 7, figs. 4,5; Krüger, 1911, p.460; Hiro, 1936a, p.624; Stubbings, 1936, p.41; Hiro, 1939a, p. 243; Pope, 1945, p.354, pl. 28, fig. 7, pl. 30, figs. 17-20; Utinomi, 1962, p.216.

*Balanus amaryllis* forma *euamaryllis*: Nilsson-Cantell, 1931, p.11; Daniel, 1955, p.25, pl. 14, figs. 17-21.

*Balanus amaryllis* forma *nivea*: Daniel, 1955, p.26, pl. 7, figs. 1-2.

*Chirona (Striatobalanus) amaryllis*: Newman & Ross, 1976, p.50.

**Material examined:**

3 specimens, Anheung, Jul. 30, 1977, H. S. Kim.

**Description:** Shell steeply conic; surface smooth, ornamented by pink colored longitudinal stripes, which are intersected by same colored tranverse stripes alternatively on the white colored ground, sometimes white totally; orifice small, rounded. Raddi very narrow; summits steeply oblique. Alae white, distinctly shown externally; its summits nearly horizontal to the basis. Parietes solid; inner surface strongly ribbed. Sheath dark brown colored. Basis calcareous, with radial tubes and tranverse septa.

Scutum with longitudinal grooves externally; the grooves are intersected by growth lines, therefore, many square beads are arranged; adductor ridge weak, not distinctly separated from articular ridge; articular ridge short; lateral depressor muscle pit deep, variable in shape.

Tergum arched, longer than wide, with beaked apex; spur long and slender, with truncated end, raised above inner surface of the tergum; spur furrow very deep, infolded into both sides of furrow; depressor muscle pit shallow and long.

Labrum with central notch rather shallow, with 0-3 small teeth on each crest. Mandible with 5 teeth; fourth and fifth teeth small; from second to fifth teeth usually with extra denticles. First maxilla with upper and lower pairs of spines extremely long, with deep notch below upper pair of spines; lower prominence weak.

**Range:** Indo-West Pacific, East Africa to Philippines, Northeast Australia and Japan.

**Genus *Solidobalanus* Hoek, 1913****Subgenus *Hesperibalanus* Pilsbry, 1916****9. *Solidobalanus (Hesperibalanus) hesperius hesperius* (Pilsbry, 1916)**

(pl. IV, figs. 1-6)

*Balanus (Hesperibalanus) hesperius* Pilsbry, 1916, p.163; Hiro, 1935, p.225; 1939c, p.212.*Balanus (Solidobalanus) hesperius*: Henry & McLaughlin, 1967, p.47; Utinomi, 1970, p.359.*Solidobalanus (Hesperibalanus) hesperius hesperius*: Newman & Ross, 1976, p.51.*Solidobalanus (Hesperibalanus) hesperius*: Yamaguchi, 1977, p.187, text-fig. 22, pl. 27, figs. 1-18.**Material examined :**

21 specimens, Mugho, Jun. 6, 1978, I. H. Kim.

**Description :** Shell small, conic, snowy white; surface smooth or ribbed longitudinally; no parietal tube. Inner surface of parietes strongly ribbed. Radii wide, with moderately oblique summits, without radial tube. Alae wide. Sheath short. Basis thin, calcareous, solid.

Scutum with articular ridge high, reflexed; adductor ridge very short; lateral depressor muscle pit small, weakly depressed.

Tergum with external surface flat, smooth, slightly depressed along the spur; carinal margin round; articular ridge well developed; spur short, with truncated end, positioned near the basiscutal angle; crests for depressor muscle short but distinct.

Labrum with 1-3, usually 3 teeth on each side of deep notch. Mandible with 5 teeth; fourth and fifth teeth short but wide; fifth tooth nearly fused with inferior angle. First maxilla with anterior margin nearly straight; notch small, with 2-3 spinules below upper pair of large spines; of the lower two spines, upper one is very large and lower one small and slender; intermediate spines 3-5; inferior angle with small spinules.

**Remarks :** This species is a boreal form, new to Korea. All were found attaching to gastropod shells in East Sea (Sea of Japan).**Range :** North Pacific (northern Japan, Bering Sea and Alaska).**Family Balanidae Leach, 1817****Genus *Balanus* Da Costa, 1778****10. *Balanus rostratus* Hoek, 1883**

(pl. IV, figs. 1-14)

*Balanus rostratus* Hoek, 1883, p.152, pl. 13, figs. 16-22; Krüger, 1911, p.460; Hiro, 1935, p.217; Utinomi, 1970, p.357; Newman & Ross, 1976, p.61; Kim *et al.*, 1979, p.109; Kim, Lee and Kim, 1979, p.293; Yamaguchi, 1977, p.178, text-fig. 19, pl. 23, figs. 1-13, pl. 24, figs. 1-3, 7-8; 1979, pp.41,42, fig. 3.4.*Balanus rostratus eurostratus*: Hiro, 1932, p.550; 1939c, p.210.

*Balanus rostratus dalli* Pilsbry, 1916, p.147; Hiro, 1935, p.218, pl. 10, figs. 1,2; 1939c, p.211.

*Balanus rostratus alaskensis* Pilsbry, 1916, p.141; Cornwall, 1955, p.29.

*Balanus rostratus apertus*: Krüger, 1911, p.460; Utinomi, 1958, p.295, fig. 5.

*Balanus rostratus heteropus* Pilsbry, 1916, p.142.

**Material examined :**

19 specimens, Dolsan I., Jun. 4, 1968, H. S. Kim;

15 specimens, Anheung, Jul. 30, 1977, H. S. Kim;

6 specimens, Myeongjidong, May 8, 1978, I. H. Kim;

1 specimen, Yeonhwa I., Jul. 19, 1978, I. H. Kim;

4 specimens, Gal-do I., Jul. 21, 1978, I. H. Kim;

6 specimens, Sangjuri, Oct. 8, 1978, I. H. Kim.

**Description :** Shell variable in shape, generally steeply conic; surface snowy white, without longitudinal rib, either smooth or coarse; orifice large or small, usually small; carinolaterals typically narrow; rostrum wide. Radii very narrow, with summits round and slightly oblique. Parietal tubes in single row, quadrangular, large. Inner surface of parietes strongly ribbed longitudinally. Sheath with about a half length of parietes.

Scutum with distinct growth lines, which are intersected by longitudinal lines, therefore, many square beads are made; articular ridge long but faint; adductor ridge prominent, well separated from articular ridge; adductor muscle pit distinct; lateral depressor muscle pit deep.

Tergum with scutal margin concave; spur with length same as its width, with its end truncated, with or without spur furrow; crests for depressor muscle weak; adductor ridge long but faint.

Labrum with deep central notch, with 3-4 teeth on each crest. Mandible with 5 teeth; fourth and fifth teeth truncated, often fused each other. First maxilla with small notch below upper pair of spines, with lower large single spine; intermediate spines relatively short. Fourth cirri with inner rami ornamented by teeth-like spinules.

**Remarks :** This species has various habitats; on shells, in sponges, on the bottoms of ships and on floating timbers, but not found on the rocks. The largest specimen sized 39mm in basal diameter and 50mm in height.

**Range :** Japan, Bering Sea, Alaska, Siberia and Korea (Busan and Geoje I.).

**11. *Balanus albicostatus* Pilsbry, 1916**

(pl. V, figs. 1—7)

*Balanus amphitrite albicostatus* Pilsbry, 1916, p.90; Hiro, 1937b, p.432; 1939b, p.261, fig. 8; 1919c, p.209; Utinomi, 1949, p.22; 1962, p.216.

*Balanus albicostatus albicostatus*: Utinomi & Kikuchi, 1966, p.5; Utinomi, 1967, p.209,

text-figs. 4,5; 1970, p.356; Newman & Ross, 1976, p.62.

*Balanus albicostatus*: Henry and McLaughlin, 1975, p.108, text-figs. 20, 20a, pl. 2, figs. m,n, pl. 10, figs. h-k; Kim, Lee and Kim, 1979, p.293; Yamaguchi, 1977, p.176, text-fig. 16, pl. 19, figs. 3-4, pl. 20, figs. 2, 6, 10, pl. 21, fig. 2, pl. 22, figs. 1-5; 1979, p.42, fig. 2.7.

**Material examined :**

- 18 specimens, Mogpo, Aug. 5, 1969, H. S. Kim;
- 26 specimens, Biin, Jul. 25, 1971, H. S. Kim;
- 15 specimens, Deogjeog I., Jul. 17, 1973, H. S. Kim;
- 5 specimens, Baegryeong I., Jul. 17, 1973, H. S. Kim;
- 2 specimens, Masan, Jul. 24, 1976, H. S. Kim;
- 53 specimens, Songjeongri, May 24, 1978, I. H. Kim;
- numerous specimens, Gyehwa I., Jun. 11, 1978, I. H. Kim;
- 16 specimens, Seogwipo, Jul. 31, 1978, I. H. Kim;
- 141 specimens, Jangja I., Oct. 29, 1978, I. H. Kim;
- 94 specimens, Songjeongri, Oct. 31, 1978, I. H. Kim.

**Description :** Shell tubloconic; orifice slightly toothed; surface with longitudinal ribs prominent, wider than interspace between longitudinal ribs. Raddi wide, transversely striated; summits slightly oblique; sutural edge crenulate. Parietal tubes usually in double rows. Sheath vesicular. Basis thin, with radial tubes and transverse septa.

Scutum flat; articular ridge with length  $\frac{2}{3}$  of tergal margin; articular furrow wide; adductor ridge short but distinct, well separated from articular ridge; lateral depressor muscle pit faint or absent.

Tergum thin, with carinal margin protuberant in upper part; spur slightly longer than its width, with its terminal blunt; spur furrow shallow but wide; basal margin nearly straight or slightly concave on scutal margin and slightly convex on carinal margin; articular furrow deep; articular ridge highly located; crest for depressor muscle usually projecting below basal margin.

Labrum usually with 3 teeth on each side of notch. Mandible with 5 teeth; from second to fifth tooth usually with extra denticles; fifth tooth nearly fused with basiscutal angle. First maxilla with small notch below upper pair of spines; notch with 0-3 small hairy spines; usually 3 intermediate spines are beared; lower prominence distinct.

**Remarks :** This species is an intertidal form restricted to brackish waters and is very common in west and south coast of Korea, chiefly in ports or mouth of rivers.

**Range :** Korea (Gunsan, Busan and Jeju I.), Japan and China.

**12. *Balanus amphitrite amphitrite* Darwin, 1854**

(pl. V, figs. 8-16)

*Balanus amphitrite* var. *communis* Darwin, 1854, p.240; Krüger, 1911, p.460; Barnard, 1924, p.70; Stubbings, 1936, p.41.

*Balanus amphitrite hawaiiensis*: Hiro, 1937b, p.432; 1939b, p.260; 1939c, p.209; Utinomi, 1949, p.22; 1962, p.215.

*Balanus amphitrite communis*: Hiro, 1939b, p.263; 1939c, p.208; Kolosvary, 1947a, p.424, fig. 1; 1947b, p.425; Utinomi, 1949, p.22; Daniel, 1955, p.20, pl. 4, figs. 15-21; Utinomi, 1962, p.216.

*Balanus amphitrite amphitrite*: Broch, 1947, p.5; Utinomi & Kikuchi, 1966, p.5; Utinomi, 1967, p.200, pl. 6, fig. 1; 1970, p.355; Zullo, Beach & Carlton, 1972, p.65, figs. 1-4; Foster, 1974, p.47, fig. 8A-G; Henry & McLaughlin, 1975, p.30, text-fig. 10, pl. 1, pl. 5, fig. 8, pl. 9, figs. b,c; Southward, 1975, p.6, text-fig. 1a, pl. 1, figs. 1-3; Bacon, 1976, p.18.

*Balanus amphitrite*: Yamaguchi, 1977, p.174, text-fig. 15, pl. 19, figs. 1-2, pl. 20, figs. 1,5,9, pl. 21, fig. 1; 1979, pp.41,42, fig. 2.6.

**Material examined :**

121 specimens, Scogwipo, Aug.1, 1978, I. H. Kim.

**Description :** Shell conic or subcylindric; orifice slightly toothed, with width usually more than 1/2 carinorostral diameter; carina curved posteriorly; surface smooth. Radii moderately wide; summits slightly oblique. Sheath solid; lower margin overhanging. Parietal tubes in single row, variable in size. Basis with radial tubes and fine transverse septa.

Scutum flat; articular ridge slightly curved; adductor ridge thick, long, well separated from articular ridge; adductor muscle pit distinct; lateral depressor muscle pit small and shallow, occasionally absent.

Tergum with carinal margin protuberant in upper part; spur furrow shallow, moderately wide; spur width nearly equal to own length, about 1/3 length of basal margin; spur with its angle truncate; basal margin straight on both sides of spur or slightly concave on carinal side; internally, articular ridge prominent, reflexed; articular furrow wide; crests for depressor muscle short, but distinct, not projecting below basal margin.

Labrum multidenticulate, with more than 8 teeth on each side of deep notch. Mandible with 5 teeth and spinose inferior angle; second tooth bifid. First maxilla without notch below upper pair of spines, with about 7 intermediate spines.

**Remarks :** This species has longitudinal purple stripes on the surface. The interface between longitudinal stripes is wider than stripe. Basal diameter is more or less than 1cm. Many specimens were collected from the bottom of a ship at Scogwipo.

**Range :** Tropic, subtropic and temperate waters of the world.

### 13. *Balanus kondakovi* Tarasov and Zevina, 1957

(pl. VI, figs. 1-8)

*Balanus amphitrite krugeri*: Hiro, 1939b, p.263; Utinomi, 1949, p.22; 1962, p.216; Utinomi & Kikuchi, 1966, p.5; Rosell, 1973, p.86, text-fig. 7a-g.

*Balanus uliginosus* Utinomi, 1967, p.202, figs. 1,2, pl. 6, figs. 4-6; 1970, p.356; Kim, 1973, p.430.

*Balanus amphitrite kondakovi* Tarasov and Zevina, 1957, p.191; Rosell, 1973, p.88, text-fig. 8c-j; Newman & Ross, 1976, p.63.

*Balanus kondakovi*: Henry and McLaughlin, 1975, p.114, text-figs. 21, 22b,c,f, pl.11, figs. a-m; Lee and Kim, 1979, p.293; Yamaguchi, 1977, p.176, text-fig. 18, pl. 19, figs. 6-7, pl. 20, figs. 4,8,12, pl. 21, fig. 4, pl. 22, figs. 13-18; 1979, pp.41,42.

#### Material examined :

Numerous specimens, Biin, Jul. 25, 1971, H. S. Kim;

4 specimens, Masan, Jul. 24, 1976, H. S. Kim;

numerous specimens, Myeongjidong, May 8, 1978, I. H. Kim;

19 specimens, Songjeongri, May 24, 1978, I. H. Kim;

numerous specimens, Jangja I., Oct. 29, 1978, I. H. Kim.

**Description :** Shell tubuloconic or tubular; surface smooth or coarse, with or without longitudinal stripes; orifice usually large and crenulate. Raddii wide; summits steeply oblique. Sheath vesicular. Inner surface of parietes ribbed longitudinally. Parital tubes in single row. Basis very thin, with radial tubes and transverse septa.

Scutum with articular ridge distinct, reflexed, about 1/2 length of tergal margin; articular furrow shallow; adductor ridge protuberant, well separated from articular ridge; lateral depressor muscle pit faint.

Tergum with scutal margin crenulate; scutal angle sharply pointed; carinal margin convex; spur typically slender and with sharply pointed end; basal margin steeply concave on both sides of spur, especially carinal side deeper characteristically; spur furrow well separated from both sides; articular furrow deep; crests for depressor muscle long and distinct, with its number 5-6.

Labrum with 4 teeth large and sharp. Mandible with usually 5 teeth; from second tooth with extra denticles. First maxilla with small notch below upper pair of spines, with 1-3 small spines in the notch, with 5 or more spines between upper and lower pairs of spines; lower prominence poorly developed.

**Remarks :** Externally, the parietes marked with dark purple, narrow longitudinal stripes closely, never crossed by any horizontal band. When corroded, this species has very large orifice and shell represent tubular form. Large individual usually has its surface coarse and longitudinal stripes erased. This species is found in brackish waters, on shells, shore installations, especially in muddy regions.

**Range :** Southeast Asia, Japan and Korea (Gunsan, Mogpo, Busan, Baegryeong I.).



**14. *Balanus reticulatus* Utinomi, 1967**

(pl. VI, figs. 9-15)

*Balanus reticulatus* Utinomi, 1967, p.216, figs. 9-12; 1970, p.356; Southward, 1975, p.11, pl. 1, figs. 4-15; Henry & McLaughlin, 1975, p.88, text-fig. 11,18, pl. 7, fig.d, pl. 9, figs.a-c; Newman & Ross, 1976, p.64; Kim, Lee and Kim, 1979, p.293; Yamaguchi, 1977, p.176, text-fig. 17, pl. 19, fig. 5, pl. 20, figs. 3,7, 11, pl. 21, fig. 3, pl. 22, figs. 6-12; 1979, pp.41,42.

**Material examined :**

- 14 specimens, Biin, Jul. 21, 1971, H. S. Kim;
- 26 specimens, Wi-do I., Apr. 13, 1972, H. S. Kim;
- 148 specimens, Gomsu, Jun. 10, 1975, H. S. Kim;
- 37 specimens, Myeongjidong, May 8, 1978, I. H. Kim;
- 3 specimens, Jangja I., Oct. 29, 1978, I. H. Kim.

**Description :** Shell conic; orifice rather small, rhomboidal and strongly toothed; rostrum roundly convex externally and about twice longer than carina; carina with its apex turned outwards; surface quite smooth, with purple longitudinal stripes alternately. Radii narrow, with summits very oblique; sutural edges transversely septate, each septum being denticulate downwards. Sheath solid, lower margin overhanging. Inner lamina ribbed from basis to sheath. Parietal tubes large in single row, without transverse septa.

Scutum with basal margin rather straight, but occasionally slightly convex on carinal side; articular ridge with  $2/3$  length of carinal margin; adductor ridge short, well separated from articular ridge.

Tergum with basal margin straight, occasionally slightly concave on scutal side; articular furrow very broad; spur much longer than its own width, the latter with about same length as the distance from the basiscutal angle to the spur; spur with end truncate; spur furrow shallow; crests for depressor muscle well developed, projecting below basal margin.

Labrum usually with 3 teeth on each crest. Mandible with 4-7 teeth; from the second tooth usually with extra denticles. First maxilla with lower prominence, without notch below upper pair of spines, with 7 intermediate spines.

**Remarks :** This barnacle species is subtidal form, occurring in stenohaline habitats only. According to Utinomi (1962), this species is most abundant at 5 m deep. The largest one sized 13mm in basal diameter.

**Range :** Cosmopolitan in temperate waters.

**15. *Balanus trigonus* Darwin, 1854**

(pl. VII, figs. 1-7)

*Balanus trigonus* Darwin, 1854, p.223, pl.3, figs. 7a-7f; Hoek, 1883, p.149, pl.12, fig.20; Pilsbry, 1909, p.70; Krüger, 1911, p.460; Weltner, 1922, p.85; Barnard, 1924, p.68;

Nilsson-Cantell, 1928, p.34; Hiro, 1932, p.551; Stubbings, 1936, p.41; Hiro, 1937b, p.439; 1939b, p.263; 1939c, p.210; Stubbings, 1940, p.390; Henry, 1943, p.369; Pope, 1945, p.361, pl.29, fig. 6, pl.30, figs.9, 10; Broch, 1947, p.6; Utinomi, 1949, p.22; 1958, p.294; Stubbings, 1961, p.31, text-fig. 7; Utinomi, 1962, p.216; Utinomi & Kikuchi, 1966, p.6; Stubbings, 1967, p.267; Utinomi, 1970, p.357; Southward, 1975, p.14; Bacon, 1976, p.23; Newman & Ross, 1976, p.66; Kim *et al.*, 1979, p.109; Kim, Lee and Kim, 1979, p.293; Yamaguchi, 1979, pp.41, 42, 44, fig. 3.7.

**Material examined :**

207 specimens, Haeundae, Jul. 21, 1976, K. S. Lee;  
 20 specimens, Ulreung I., Aug. 14, 1976, K. S. Lee;  
 54 specimens, Gadeog I., May 22, 1978, I. H. Kim;  
 4 specimens, Mugho, Jun. 6, 1978, I. H. Kim;  
 numerous specimens, Sangjuri, Oct. 8, 1978, I. H. Kim.

**Description:** Shell conic; orifice large, triangular; surface with longitudinal ribs; interface between longitudinal ribs occupied by purple or pink colored longitudinal stripes. Raddi wide, not porous; summits slightly oblique. Parietal tubes in single row. Basis with radial tubes.

Scutum thick, much longer than wide, externally with prominent growth lines and typically with array of rounded small pits arranged in 1-5 longitudinal rows; articular ridge weak; adductor ridge short; lateral depressor muscle pit deep but narrow.

Tergum flat, very thin; spur short, but wider than a half of basal margin; spur end truncate; distance from basiscutal angle to spur very short; crests for depressor muscle well developed.

Labrum with deep central notch, usually with 3 teeth on each crest. Mandible with 4-5 teeth; fourth and fifth teeth weakly projected. First maxilla without notch; lower pair of spines very long; intermediate spines rather long.

**Remarks:** This species has various habitats, easily found on bottoms of ships, on floating timbers, on shells and attaching to fish nets. The basal diameter is usually less than 10mm.

**Range:** Cosmopolitan in warm seas.

**Genus *Megabalanus* Hoek, 1913**

**16. *Megabalanus rosa* (Pilsbry, 1916)**

(pl. VII, figs. 8-14)

*Balanus* (*Megabalanus*) *tintinnabulum rosa* Pilsbry, 1916, p.61; Hiro, 1932, p.549, text-fig. 3; 1939c, p.208; Utinomi, 1949, p.21; 1958, p.294; 1962, p.215; Utinomi & Kikuchi, 1966, p.5; Utinomi, 1970, p.349, pl.18, fig.7; Kim *et al.*, 1979, p.109; Kim, Lee and Kim, 1979, p.293.

*Balanus* (*Megabalanus*) *rosa*: Yamaguchi, 1973, pp.115-133, text-figs. 1-7, 9-10, pl.6, figs. 1a-j, 3,6,7, pl.7, figs. 3a-4b, pl.8, figs. 1-2b.

*Megabalanus rosa*: Newman & Ross, 1976, p.68; Yamaguchi, 1977, p.184, pl.26, figs. 11-13; 1979, pp.41,42, fig. 3.6.

**Material examined :**

- 2 specimens, Haeundae, Jul. 12, 1969, H. S. Kim;
- 10 specimens, Nagsansa, Sept. 30, 1975, H. S. Kim;
- 21 specimens, Ulreung I., Aug. 14, 1976, H. S. Kim;
- 30 specimens, Myeongjidong, May 8, 1978, I. H. Kim;
- 23 specimens, Gadeog I., May 22, 1978, I. H. Kim;
- 3 specimens, Aninjn, Jun. 3, 1978, I. H. Kim;
- 5 specimens, Mugho, Jun. 6, 1978, I. H. Kim;
- 2 specimens, Yeonhwa I., Jul. 19, 1978, I. H. Kim;
- 10 specimens, Sangjuri, Oct. 7, 1978, I. H. Kim.

**Description :** Shell conic, rather large, diamond shaped; surface smooth, red or pink colored, sometimes white wholly. Raddi colored deeper than parietes, red as deep as go up to summits. Raddi wide, with summits horizontal to the basis, overlapping the alae wholly, transversely striated, with radial tubes; inner surface of parietes weakly ribbed longitudinally near the basis. Parietal tubes large, in single row. Basis thick, with radial tubes in many layers, irregularly arranged.

Scutum with prominent growth lines; adductor muscle pit well developed; lateral depressor muscle pit deep, distinct; adductor ridge weak but stretched below articular ridge; articular ridge prominent, sometimes with its terminal rounded.

Tergum with depressor muscle pit weak; articular furrow deep; adductor ridge long, distinct; spur shovel shaped, with terminal truncate, with its length as twice long as its width; spur width never beyond 1/4 length of basal margin; spur furrow well developed, strongly infolded into both sides, being cylindrical form, protuberant internally.

Labrum with 0-4 teeth on each crest, variable in position. Mandible with 5 teeth; from second tooth with extra denticle; fourth and fifth teeth vague. First maxilla with notch below upper pair of spines; intermediate spines 7-10; without lower prominence.

**Remarks :** This species is found in warm clear waters usually attaching to pelecypod shells and fish nets. The largest specimen sized 47 mm in basal diameter and 29mm in height.

**Range :** Japan, Formosa and Korea (Bijin I., Yeonhwa I. and Gadeog I.)

**17. *Megabalanus volcano* (Pilsbry, 1916)**

(pl. VIII, figs. 1-7)

*Balanus* (*Megabalanus*) *tintinnabulum volcano* Pilsbry, 1916, p.60; Hiro, 1937b, p.430; 1939c, p.208; Utinomi, 1949, p.21; 1958, p.293; 1970, p.350, pl.18, fig.6; Kim *et al.*, 1979, p.109.

*Balanus (Megabalanus) volcano*: Yamaguchi, 1973, pp.115-130, 133-135, text-figs. 1-7, 11, pl.6, figs. 2a-j, 4,5, pl.7, figs. 1a-2b, pl.8, figs. 1-2b.

*Megabalanus volcano*: Newman and Ross, 1976, p.69; Yamaguchi, 1977, p.187, pl.26, figs. 1-10, 15; 1979, pp.41, 44, fig. 3.5.

**Material examined :**

31 specimens, Hong-do I. (South Sea), Jul. 20, 1978, I. H. Kim.

**Description :** Shell subcylindric; orifice large; surface purple or pale pink colored, typically with acute projections irregularly scattered and downwardly projecting. Rarii wide, porous, transversely striated; summits horizontal to the basis. Alae overlapped wholly by rarii. Parietal tubes quadrangular in single row.

Scutum flat, strongly ribbed longitudinally on the growth lines; adductor ridge high, rather massive.

Tergum with narrow growth lines; spur rather straight, with length about twice its own width.

Mandible with fourth and fifth teeth more acute than *M. rosa*. First maxilla without notch; anterior margin rather straight.

**Remarks :** This is the largest surf-loving upper subtidal barnacle species in Korea and is rather pelagic form.

**Range :** Japan and Korean (Hong-do I., South Sea)

### SUMMARY

1. The authors examined intertidal and sublittoral balanomorph barnacles which were collected from 38 localities in South Korea during the period from 1963 to 1978.
2. Identified and classified materials are composed of 15 species and 2 subspecies, all of which are described, under 10 genera and 5 families, of which 2 species and 1 subspecies are new to Korea as follows: *Chelonibia patula*, *Chirona (Striatobalanus) amaryllis*, *Solidobalanus (Hesperibalanus) hesperius hesperius*.
3. As dominant species, *Chthamalus challengerii* and *Tetraclita squamosa japonica* are widely distributed in Korea through East Sea, South Sea and Yellow Sea.
4. *Balanus albicostatus* and *B. kondakovi* are commonly found in intertidal brackish waters of Yellow Sea and South Sea, whereas, *B. trigonus* and *Megabalanus rosa* are typical sublittoral forms.

### REFERENCES

- Bacon, P. R., 1976. The Cirripedia of Trinidad. Studies on the fauna of Curacao and other Caribbean Islands, 50 (163) : 1-55.
- Barnard, K. H., 1924. Contribution to the crustacean fauna of South Africa. No. 7. Cirri-

- pedia. *Ann. South African Mus. Cape Town* 20 : 1-103.
- Broch, H., 1927. Report on the Crustacea Cirripedia. Cambridge Expedition to the Suez Canal, 1924. *Trans. Zool. Soc. London* XXII, Part II(1) : 133-138.
- , 1935. Cirripeds. The fishery grounds near Alexandria, III. *Notes Mem. Fish. Res. Directorate Cairo* 10 : 1-6.
- , 1947. Cirripedes from Indo-Chinese shallow waters. *Avh. Utgitt. Nor. Vidensk. Acad. Oslo Mat. naturvidenski. K1.* 1947, 7 : 1-32.
- Cornwall, I.E., 1955. The barnacles of British Columbia. *Brit. Columbia Provincial Mus. Dept. Education, Handbook* No. 7 : 1-69.
- Daniel, A., 1955. The Cirripedia of the Madras coast. *Bull. Madras Gov. Mus. (Nat. Hist. Soc.)* n.s., 6(2) : 1-40.
- Darwin, C., 1854. A monograph on the subclass Cirripedia. II. The Balanidae, Verrucidae, etc. Ray Society, London, 684 pp., 30 pls..
- Foster, B.A., 1974. The barnacles of Fiji with observation on the ecology of barnacles on tropical shores. *Pac. Sci.* 28(1) : 35-56.
- Henry, D.P., 1943. Notes on some barnacles from the Gulf of California. *Proc. U.S. Nat. Mus.* 93(3166) : 367-373.
- Henry, D.P. and P.A. McLaughlin, 1967. A revision of the subgenus *Solidobalanus* Hoek (Cirripedia Thoracica) including a description of a new species with complementary males. *Crustaceana* 12(1) : 43-58.
- , 1975. The barnacles of the *Balanus amphitrite* complex (Cirripedia, Thoracica). *Zool. Verhandl.*, 141 : 1-254, pls. 1-22.
- Hiro, F., 1932. Report on the biological survey of Mutsu Bay. No. 25 : Cirripedia. *Sci. Rep., Tohoku Imp. Univ., Sendai, Japan*, ser. 4 (Biol.), 7 : 545-552.
- , 1935. The fauna of Akkeshi Bay. II. Cirripedia. *J. Fac. Sci. Hokkaido Imp. Univ. ser. VI (Zool.)*, 4(4) : 213-229.
- , 1936a. Report on the Cirripedia collected in the Malayan waters by the ship "Zuihōmaru". *Japan J. Zool.* 6(19) : 621-636.
- , 1936b. Descriptions of three new species of Cirripedia from Japan. *Bull. Biogeogr. Soc. Japan* 6(23) : 221-230.
- , 1937a. Cirripeds of Palao Islands. *Palao Trop. Biol. Stn. Stud.* 1 : 37-72.
- , 1937b. Studies on cirripedian fauna of Japan. II. Cirripeds found in the vicinity of the Seto Marine Biological Laboratory. *Mem. Coll. Sci. Kyoto Imp. Univ.*, ser. B, 12 (3)(17) : 383-478.
- , 1939a. Studies on the cirripedian fauna of Japan. III. Supplementary notes on the cirripeds found in vicinity of Seto. *Mem. Coll. Sci. Kyoto Imp. Univ.*, ser. B, 15(2) : 237-244.
- , 1939b. Studies on the cirripedian fauna of Japan. IV. Cirripeds of Formosa (Taiwan), with some geographical and ecological remarks on the littoral forms. *Mem. Coll. Sci. Kyoto Imp. Univ.*, ser B, 15(2) : 245-284.
- , 1939c. Studies on the cirripedian fauna of Japan. V. Cirripeds of the northern part of Honsyu. *Sci. Rep. Tohoku Imp. Univ.*, ser. 4 (Biol.), 15(2-3) : 201-218.

- Hoek, P.P.C., 1883. Report on the Cirripedia collected by H.M.S. Challenger, 1873-76. *Rep. Sci. Res. Challenger, Zool.* **8**(25) : 1-169.
- Kim, H.S., 1973. Report on a collection of animals from Baegryeong I. and Daechyeong I. College Review, College of Liberal Arts and Sciences, Seoul National University, **19** : 427-436 (in Korean with English summary).
- , 1978. Report on the collection of coastal marine invertebrates. *The Conservation of Nature and Natural Resources*, **23** : 13-15 (in Korean with English summary).
- Kim, H.S. and B.J. Rho, 1969. The seashore marine fauna of Chuja Islands, Korea. A Report on the Floral and Faunal Survey of Chuja Islands, Bureau of Cultural Property, Ministry of Culture and Information, Republic of Korea: 67-103 (in Korean with English summary).
- Kim, H.S. and K.S. Lee, 1978. Report on a collection of marine animals from Donggyeogryeolbi I., Seogdo I. and Gungsi I. *The Report of the KACN*, **12** : 97-101 (in Korean with English summary).
- Kim, H.S. *et al.*, 1979. The marine invertebrates fauna in the southern part of Geoje Island and its adjacent five islands. *The Report of the KACN*, **14** : 103-126 (in Korean with English summary).
- Kim, H.S., K.S. Lee and I.H. Kim, 1979. A faunal and ecological study on the crustaceans in the lower reaches of the Nagdong River where migratory birds come flying. *Bulletin of the KACN*, **1** : 287-325 (in Korean with English summary).
- Kolosvary, G., 1947a. A study of cirripedes in the collection of the Hungarian National Museum, Budapest. *Pro. Zool. Soc. London* **117**(2-3) : 424.
- , 1947b. A study of cirripedes associated with corals in the collection of Hungarian Museum, Budapest. *Proc. Zool. Soc. London* **117**(2-3) : 425-428.
- Krüger, P., 1911. Cirripedenfauna Ostasiens. *Zool. Anz.* **38**(20-21) : 459-464.
- Newman, W.A. and A. Ross, 1976. Revision of the balanomorph barnacles; including a catalog of the species. *San Diego Soc. Nat. Hist., Mem.* **9** : 1-108.
- Nilsson-Cantell, C.A., 1928. Studies on cirripeds in the British Museum (Nat. Hist.). *Ann. Mag. Nat. Hist.*, ser. 10, **2**(7) : 1-39.
- , 1931. Cirripeds from the Indian Ocean and Malay Archipelago in the British Museum (Nat. Hist.), London. *Ark. Zool.* **23A**(18) : 1-12.
- , 1932. Cirripeden aus Japan. *Ark. Zool.* **24A**(6) : 1-18.
- Pilsbry, H.A., 1909. Report on barnacles of Peru, collected by Dr. R. E. Coker and others. *Proc. U.S. Nat. Mus.* **37**(1700) : 63-74.
- , 1916. The sessile barnacles (Cirripedia) contained in the collection of U.S. National Museum; including a monograph of American species. *Bull. U.S. Nat. Mus.* **93** : 1-366.
- Pope, E.C., 1945. A simplified key to the sessile barnacles found on the rocks, boats, wharf piles and other installations in Port Jackson and Adjacent water. *Rec. Australian Mus* **21**(6) : 351-372.
- Rosell, N.C., 1973. Some thoracic barnacles (Crustacea: Cirripedia) of Manila Bay. *Kalibasan, Phil. J. Biol.* **2** : 69-95.
- Southward, A.J., 1975. Intertidal and shallow water Cirripedia of the Caribbean. *Stud.*

- Fauna Curacao Caribbean Is.* 46(150) : 1-53.
- Southward, A.J. and D.J. Crisp, 1963. Barnacles of European waters. In: Catalogue of Main Marine Fouling Organisms, Volume 1, Barnacles, 46 pp. Organisation for Economic Cooperation and Development, Paris.
- Stubbings, H.G., 1936. Cirripedia. John Murray Expedition, 1933-1934. *Sci. Rep.* 4(1) : 1-70.
- , 1940. Cirripedia (Additional Part). John Murray Expedition, 1933-1934. *Sci. Rep.* 7(3) : 383-339.
- , 1961. Cirripedia Thoracica from tropical West Africa. *Atlantide Rep.* 6 : 7-41.
- , 1957. The cirriped fauna of tropical West Africa. *Bull. Brit. Mus (Nat. Hist.) Zool.* 15(6) : 223-319.
- Tarasov, N. I. and G.B. Zevina, 1957. Cirripedia. Fauna SSSR. *Zool. Inst. Akad. Nauk, SSSR.* (n.s.) 69 : 1-268.
- Utinomi, H., 1949. Studies on the cirripedian fauna of Japan. VI. Cirripeds from Kyusyu and Ryukyu Islands. *Publ. Seto Mar. Biol. Lab.* 1(2) : 19-37.
- , 1955a. Studies on the Cirripedia of Japan. II. Geographical distribution. *Bull. Biogeogr. Soc. Japan* 16-19 : 113-123.
- , 1955b. Studies on the Cirripedia of Japan. III. Ecological evidences. *Bull. Biogeogr. Soc. Japan.* 16-19 : 124-134.
- , 1958. Studies on the cirripedian fauna of Japan. VII. Cirripeds from Sagami Bay. *Publ. Seto Mar. Biol. Lab.* 6(3) : 281-311.
- , 1962. Studies on the cirripedian fauna of Japan. VIII. Thoracic cirripeds from western Kyusyu. *Publ. Seto Mar. Biol. Lab.* 10(2) : 211-239.
- , 1967. Comments on some new and already known cirripeds with emended taxa, with special reference to the parietal structure. *Publ. Seto Mar. Biol. Lab.* 15(3) : 199-237.
- , 1970. Studies on the cirripedian fauna of Japan. IX. Distributional survey of thoracic cirripeds in the southeastern part of the Japan Sea. *Publ. Seto Mar. Biol. Lab.* 17(5) : 339-372.
- Utinomi, H. and T. Kikuchi, 1966. Fauna and flora of the sea around the Amakusa Marine Biological Laboratory. Cirriped Crustacea. *Amakusa Mar. Biol. Lab.* 6 : 1-11.
- Weltner, W., 1922. Cirripedia der deutschen Tiefsee-Expedition. *Wiss. Ergebnisse der deutschen Tiefsee-Exped. auf dem Dampfer Valdivia 1895-1899*, 23(2) : 59-112.
- Yamaguchi, T., 1973. On *Megabalanus* (Cirripedia, Thoracica) of Japan. *Publ. Seto Mar. Biol. Lab.*, 21(2) : 115-140, pls. 6-8.
- , 1977. Taxonomic studies on some fossil and recent Japanese Balanoidea (part 2). *Trans. Palacont. Soc. Japan, N. S.*, (108) : 161-200, pls. 23-27.
- , 1979. A guide to identification of principal fouling organisms (2) notes on some littoral cirripeds of Japan. *Marine Fouling*, Tokyo, Japan, 1(1) : 37-44 (Review, in Japanese).
- Zullo, V.A., D.B. Beach and J.T. Carlton, 1972. New barnacle records (Cirripedia, Thoracica). *Proc. California Acad. Sci.*, ser. 4, 39(6) : 65-74.

## EXPLANATION OF PLATES

## Plate I

**Figs. 1-6.** *Octomeris sulcata* Nilsson-Cantell:

1. upper view ( $\times 3.6$ ); 2. tergum, inner view ( $\times 7.1$ ); 3. scutum, inner view ( $\times 7.1$ ); 4. first maxilla ( $\times 89$ ); 5. mandible ( $\times 89$ ); 6. labrum and palpus ( $\times 89$ )

**Figs. 7-11.** *Chthamalus challengerii* Hoek

7. upper view ( $\times 3.6$ ); 8. scutum, inner view ( $\times 10.7$ ); 9. tergum, inner view ( $\times 10.7$ ); 10. first maxilla ( $\times 62.4$ ); 11. mandible ( $\times 62.4$ )

**Figs. 12-14.** *Euraphia pilsbryi* Hiro

12. mandible ( $\times 62.4$ ); 13. scutum, inner view ( $\times 7.1$ ); 14. tergum, inner view ( $\times 7.1$ )

## Plate II

**Figs. 1-4.** *Chelonibia patula* (Ranzani)

1. upper view ( $\times 3.7$ ); 2. mandible ( $\times 45.8$ ); 3. first maxilla ( $\times 45.8$ ); 4. labrum ( $\times 45.8$ )

**Figs. 5-10.** *Tetraclitella chinensis* (Nilsson-Cantell)

5. upper view ( $\times 3.7$ ); 6. scutum, inner view ( $\times 10$ ); 7. tergum, inner view ( $\times 10$ ); 8. labrum ( $\times 64.1$ ); 9. first maxilla ( $\times 64.1$ ); 10. mandible ( $\times 64.1$ ).

**Figs. 11-17.** *Tetraclitella darwini* (Pilsbry).

11. side view ( $\times 2.3$ ); 12. scutum, inner view ( $\times 8.2$ ); 13. tergum, inner view ( $\times 8.2$ ); 14. tergum, outer view ( $\times 8.2$ ); 15. labrum ( $\times 64.1$ ); 16. first maxilla ( $\times 64.1$ ); 17. mandible ( $\times 64.1$ )

## Plate III

**Figs. 1-8.** *Tetraclita squamosa japonica* Pilsbry

1. side view ( $\times 0.9$ ); 2. scutum, inner view ( $\times 3.6$ ); 3. scutum, outer view ( $\times 3.6$ ); 4. labra ( $\times 25.3$ ); 5. first maxilla ( $\times 25.3$ ); 6. mandible ( $\times 25.3$ ); 7. tergum, inner view ( $\times 3.6$ ); 8. tergum, outer view ( $\times 3.6$ )

**Figs. 9-15.** *Chirona (Striatobalanus) amaryllis* (Darwin)

9. side view ( $\times 3.6$ ); 10. tergum, outer view ( $\times 8.1$ ); 11. tergum, inner view ( $\times 6.3$ ); 12. labra ( $\times 25.3$ ); 13, 14. mandibles ( $\times 25.3$ ); 15. first maxilla ( $\times 63.2$ )

## Plate IV

**Figs. 1-6.** *Solidobalanus (Hesperibalanus) hesperius hesperius* Pilsbry

1. upper view ( $\times 4.4$ ); 2. tergum, inner view ( $\times 13.2$ ); 3. scutum, inner view ( $\times 13.2$ ); 4. mandible ( $\times 88$ ); 5. labrum ( $\times 88$ ), 6. first maxilla ( $\times 88$ )

**Figs. 7-14.** *Balanus rostratus* Hoek

7. side view ( $\times 0.9$ ); 8. tergum, inner view ( $\times 3.5$ ); 9. tergum, outer view ( $\times 3.5$ ); 10. scutum, inner view ( $\times 3.5$ ); 11. inner ramus of fourth cirri ( $\times 24.7$ ); 12. first maxilla ( $\times 24.7$ ); 13, 14. mandibles ( $\times 24.7$ )

## Plate V

**Figs. 1-7.** *Balanus albicostatus* Pilsbry



1. upper view ( $\times 3.7$ );
2. scutum, inner view ( $\times 11.1$ );
3. tergum, inner view ( $9.3$ );
4. tergum, outer view ( $\times 9.3$ );
5. first maxilla ( $\times 26$ );
6. labrum ( $\times 26$ );
7. mandible ( $\times 26$ )

**Figs. 8-16.** *Balanus amphitrite amphitrite* Darwin

8. upper view ( $\times 3.7$ );
9. side view ( $\times 3.7$ );
10. labra ( $\times 26$ );
11. first maxilla ( $\times 26$ );
12. mandible ( $\times 26$ );
13. scutum, outer view ( $\times 8.3$ );
14. scutum, inner view ( $\times 8.3$ );
15. tergum, inner view ( $\times 8.3$ );
16. tergum, outer view ( $\times 8.3$ )

**Plate VI**

**Figs. 1-8.** *Balanus kondakovi* Tarasov and Zevina

1. side view ( $\times 3.5$ );
2. tergum, outer view ( $\times 4.4$ );
3. tergum, inner view ( $\times 4.4$ );
4. labrum ( $\times 24.8$ );
5. first maxilla ( $\times 24.8$ );
6. mandible ( $\times 24.8$ );
7. scutum, outer view ( $\times 4.4$ );
8. scutum, inner view ( $\times 4.4$ )

**Figs. 9-15.** *Balanus reticulatus* Utinomi

9. side view ( $\times 2.7$ );
10. first maxilla ( $\times 62$ );
11. labrum ( $\times 24.8$ );
12. tergum, outer view ( $\times 7.1$ );
13. tergum, inner view ( $\times 8$ );
14. scutum, inner view ( $\times 7.1$ );
15. mandible ( $\times 24.8$ )

**Plate VII**

**Figs. 1-7.** *Balanus trigonus* Darwin

1. upper view ( $\times 1.4$ );
2. scutum, inner view ( $\times 7.6$ );
3. scutum, outer view ( $\times 7.6$ );
4. tergum ( $\times 7.6$ );
5. mandible ( $\times 66.7$ );
6. first maxilla ( $\times 66.7$ );
7. labrum ( $\times 66.7$ )

**Figs. 8-14.** *Megabalanus rosa* (Pilsbry)

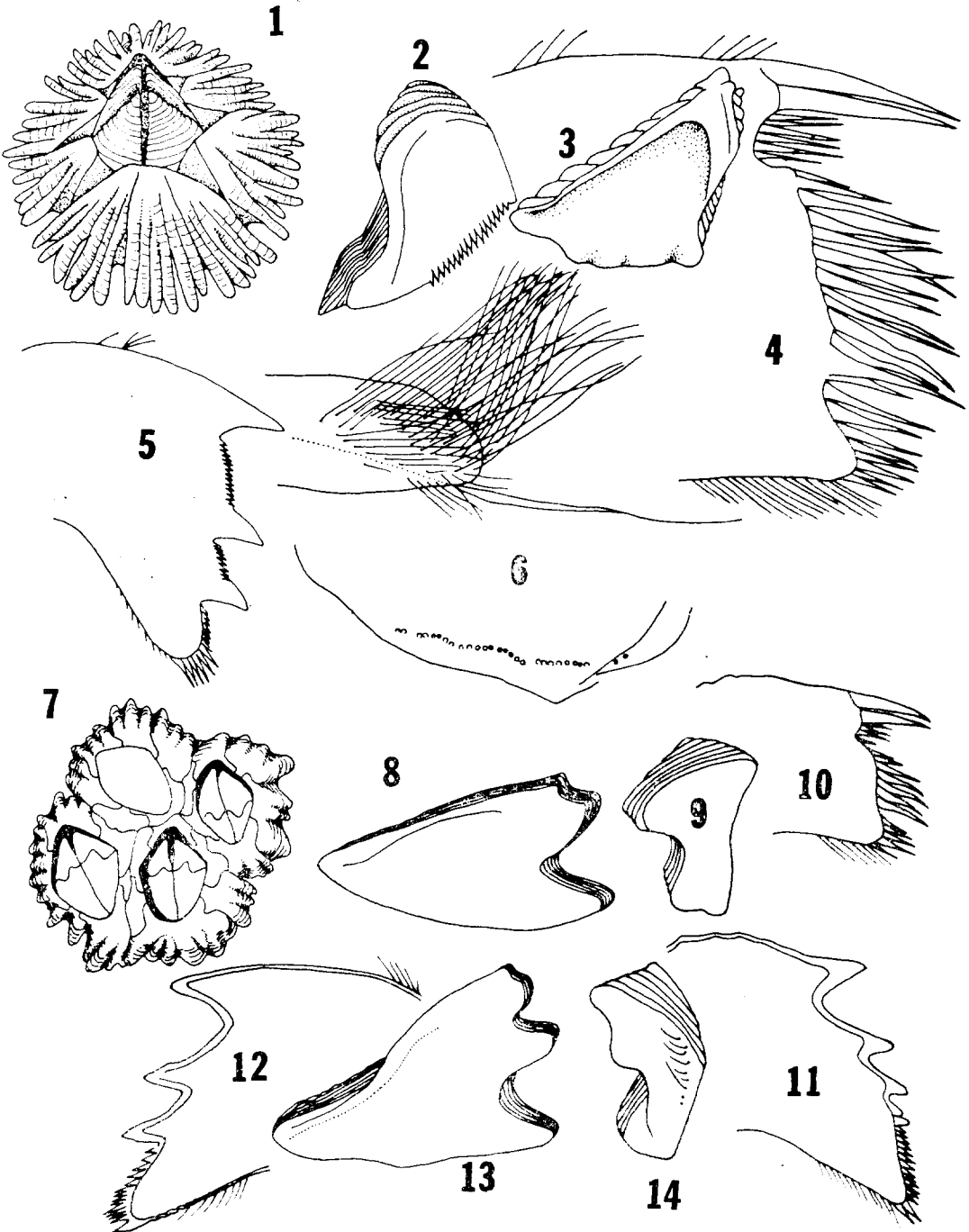
8. side view ( $\times 1.4$ );
9. scutum ( $\times 3.8$ );
10. tergum, inner view ( $\times 3.8$ );
11. tergum, outer view ( $\times 3.8$ );
12. mandible ( $\times 26.7$ );
13. labrum ( $\times 26.7$ );
14. first maxilla ( $26.7$ )

**Plate VIII**

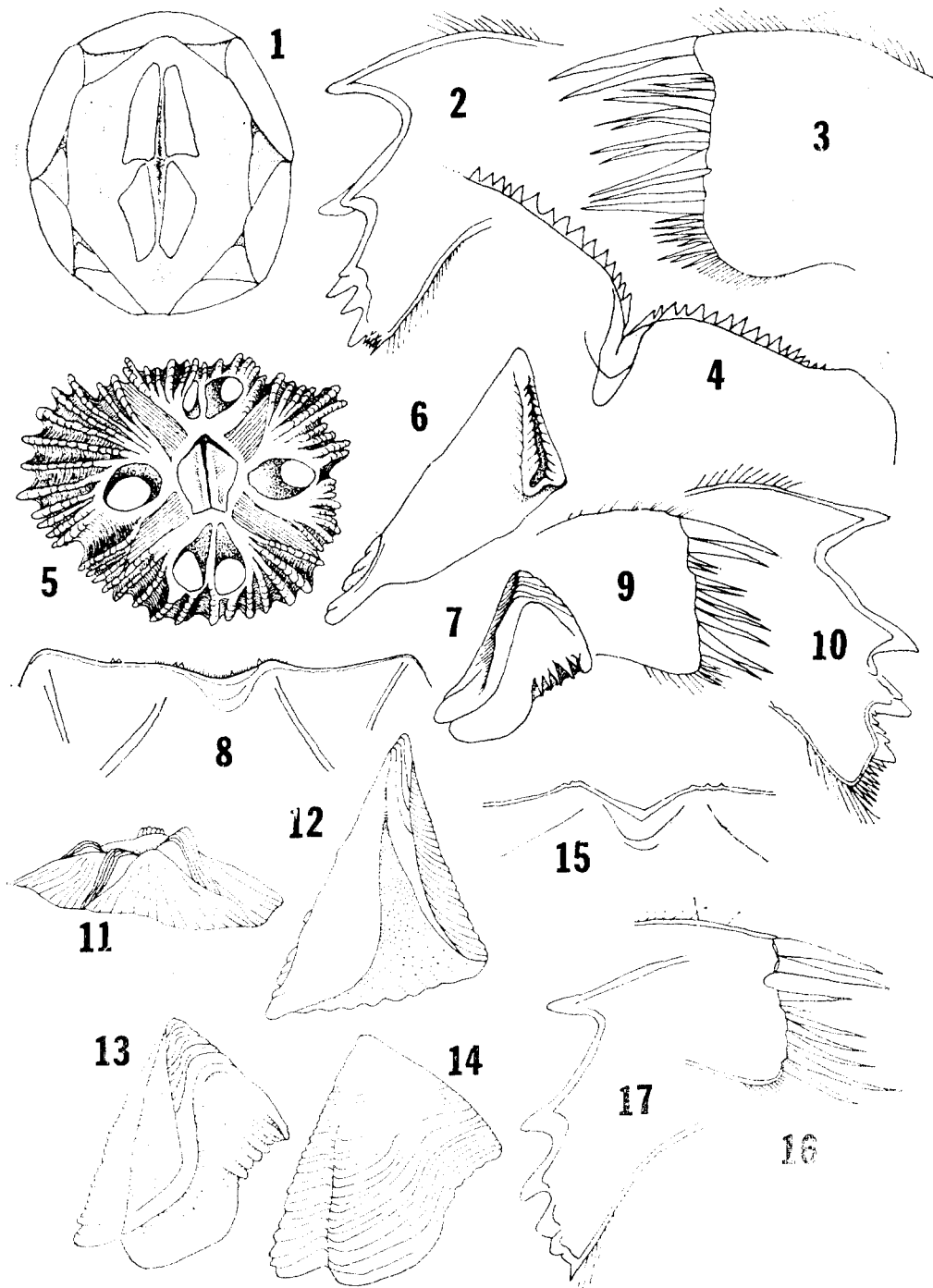
**Figs. 1-7.** *Megabalanus volcano* (Pilsbry)

1. side view ( $\times 1$ );
2. tergum, inner view ( $\times 2.5$ );
3. tergum, outer view ( $\times 2.5$ );
4. scutum, inner view ( $\times 2.5$ );
5. labrum ( $\times 14$ );
6. first maxilla ( $\times 14$ );
7. mandible ( $\times 14$ )

# Plate I



# Plate II



# Plate III

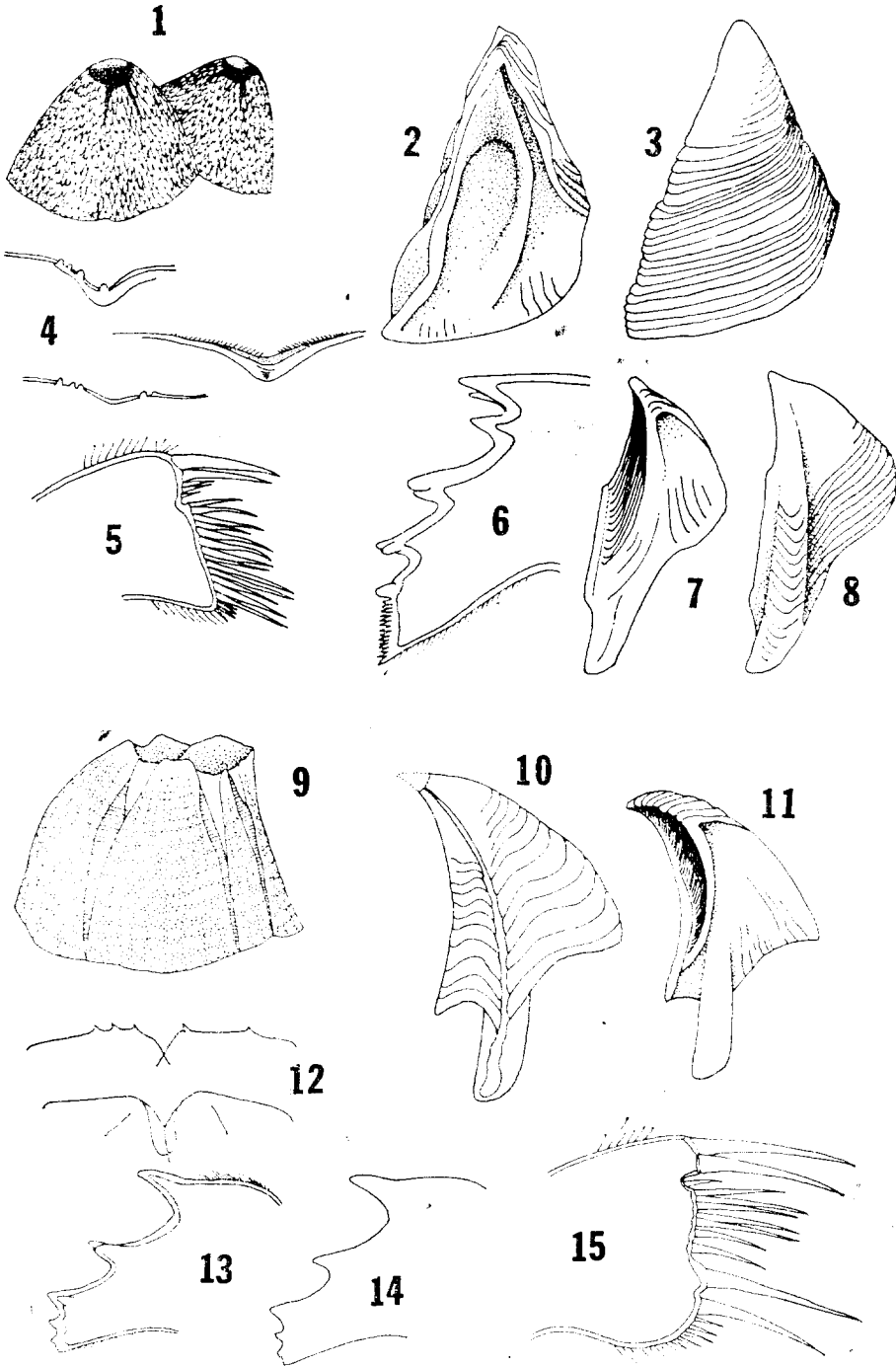
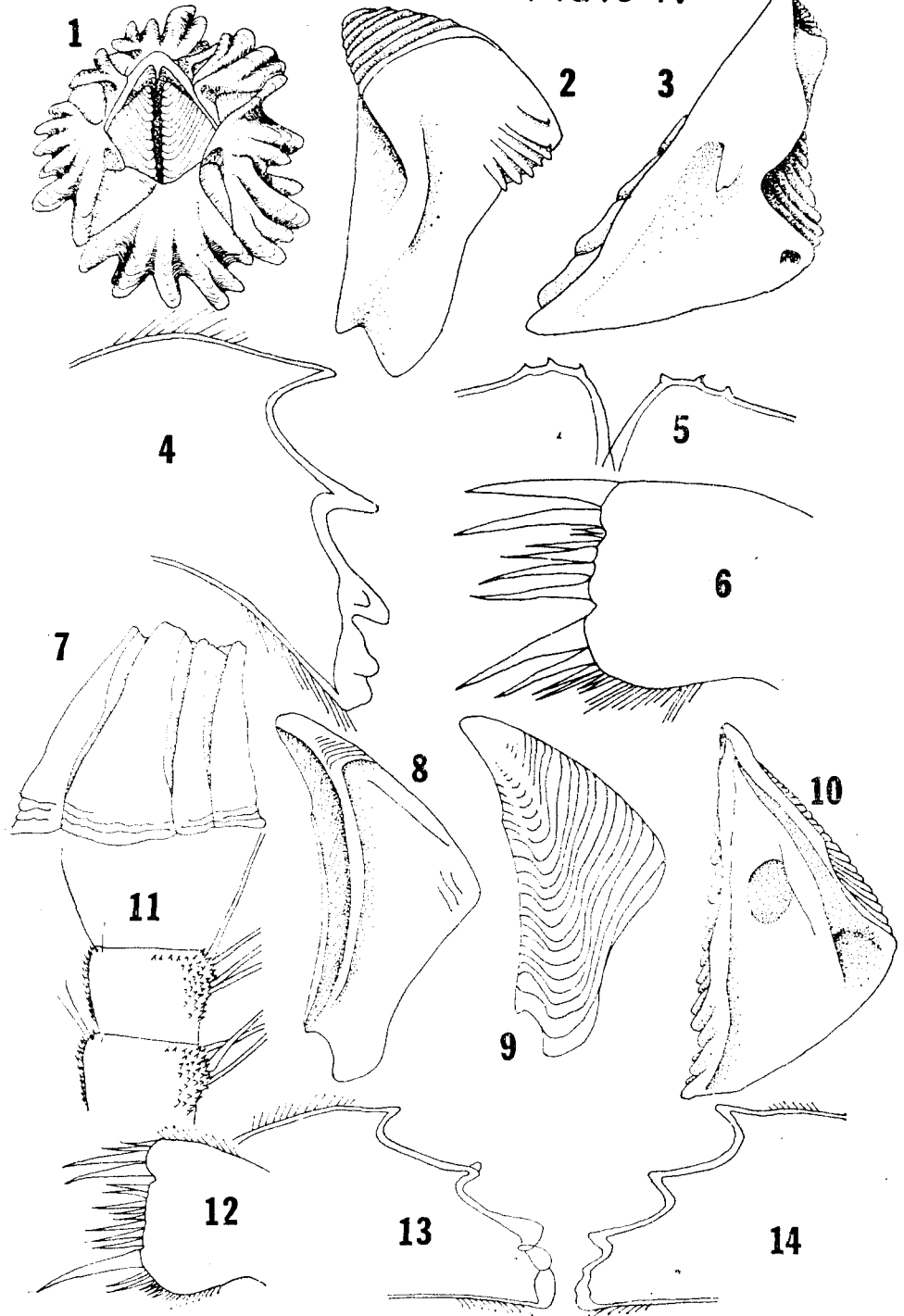
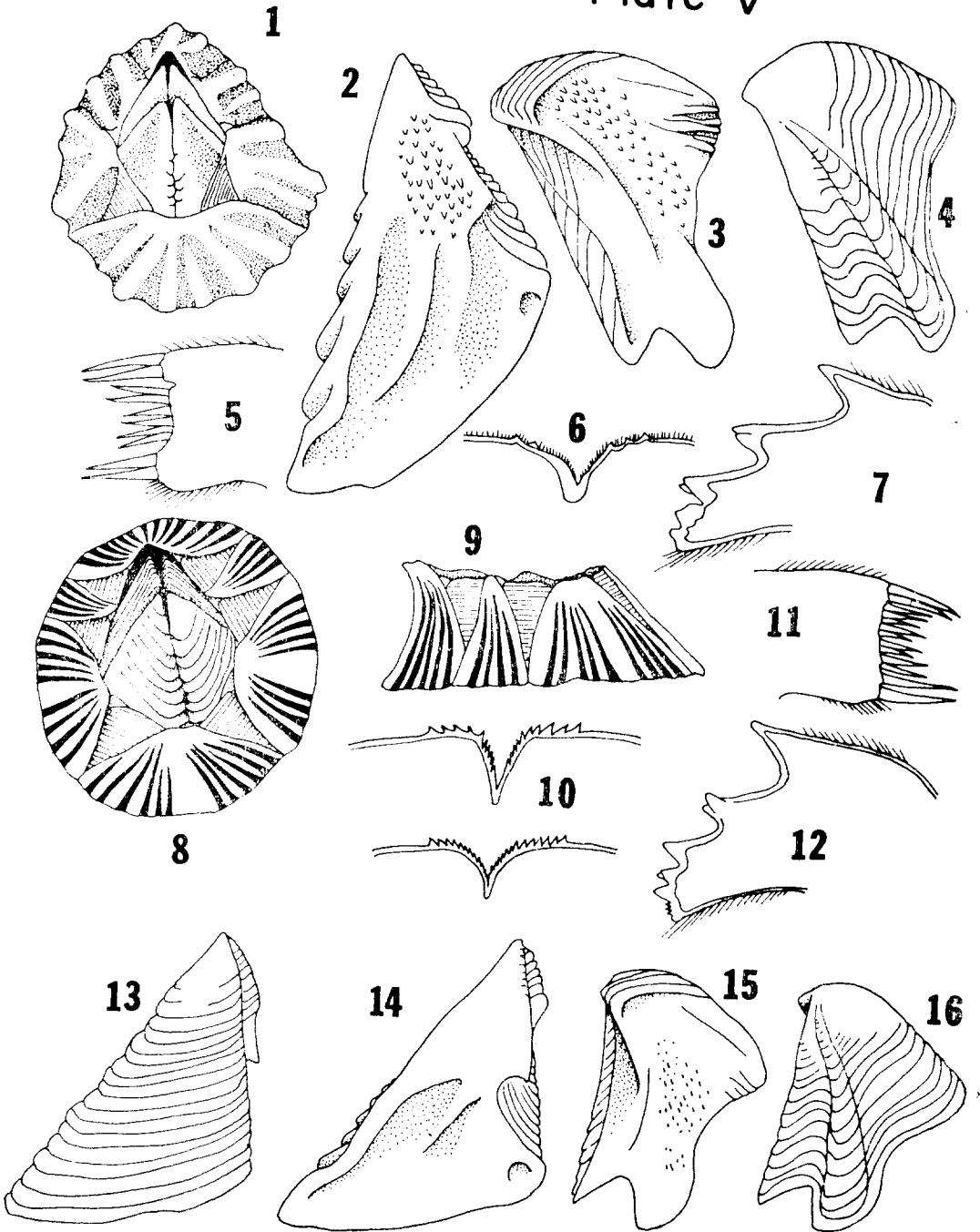


Plate IV



# Plate V



# Plate VI

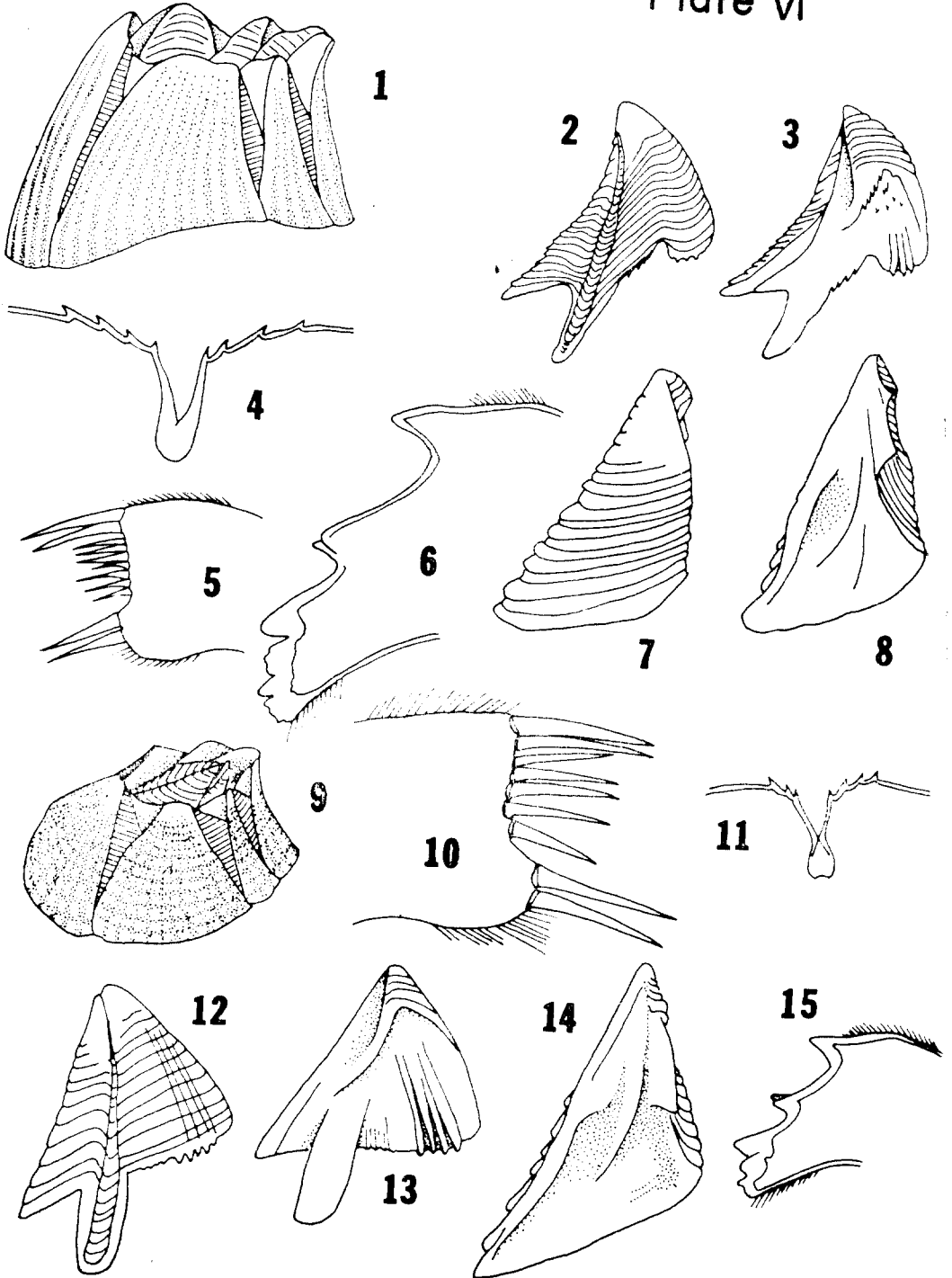


Plate VII

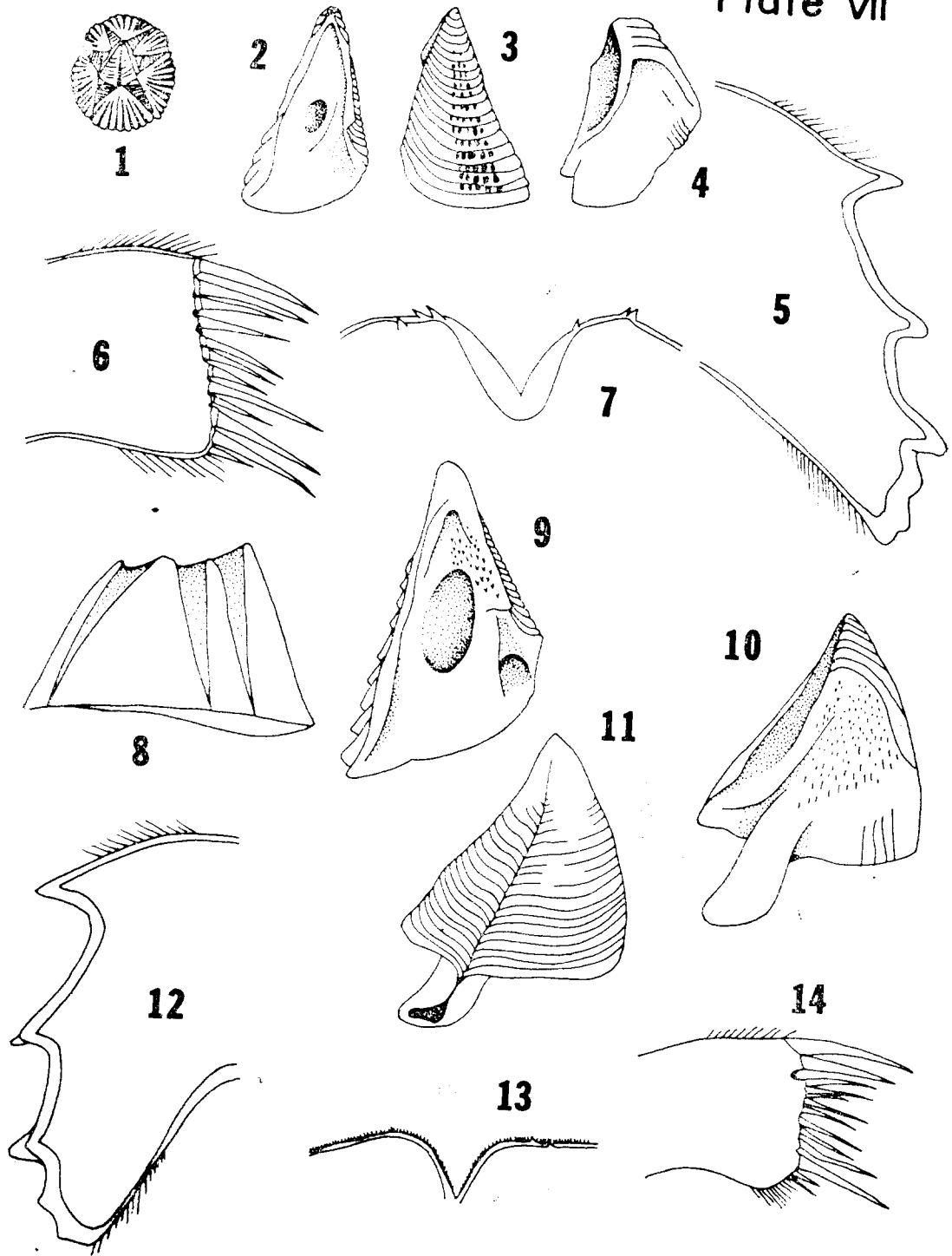




Plate VIII

