

Some Jurassic Trigoniids from Peru

by

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Introduction

In 1973 and 1979, the geological and palaeontological reconnaissance surveys on the Mesozoic group of Los Andes Cordillera, Central Peru were carried out by the members of Palaeontological Party of Chiba University and of Instituto de Geologico, Minero y Metalurgico, Ministerio de Energia y Minas, INGEMMET, as the cooperative study supported by the Overseas Scientific Research Funds, Ministry of Education, Government of Japan. The Jurasso-Triassic marine sediments are distributed widely on the western foot and the midst of Los Andes Cordillera in the southern part of Peru. Some Jurassic trigoniids from this part are described in this paper as one of the results obtained by the cooperative study. The fossils treated in this paper were collected by the geologists of INGEMMET through the geological survey for making the geological sheet map of the southern part of Peru. Their fossils are buried generally in the light or dark gray, medium-grained sandstone or in the dark impure hard limestone. The fossil localities are shown in text-figure 1.

In the present study, the writers wish to express their hearty thanks to Ing. Dr. Director Francisco SOTILLO PALOMINO, Ing. late Josefa RAMIREZ, Ing. Eva VILLAVICENSIO de DAVILA, Ing. Mandel ALDANA ALVAREZ, Instituto de Geologico, Minero y Metalurgico, Ministerio de Energia y Minas, INGEMMET, Jesús Maria, Lima, Peru, for their kind advices and discussions about fossils. Thanks are also due to Professor Sumio SAKAGAMI of Chiba Undversity, Professor Nobuo YAMAGIWA of Osaka Kyoiku University for their kind helps in many ways. Photographs were prepared by Messrs. Naomi OYAMA, Jun-ichi TAMAI and Makoto OZAWA of Chiba University.

Description of Species

Family Trigoniidae LAMARCK, 1819

Subfamily Trigoniinae LAMARCK, 1819

Genus *Trigonia* BRUQUIÈRE, 1789

Trigonia A sp. indet.

Plate 1, Figure 1.

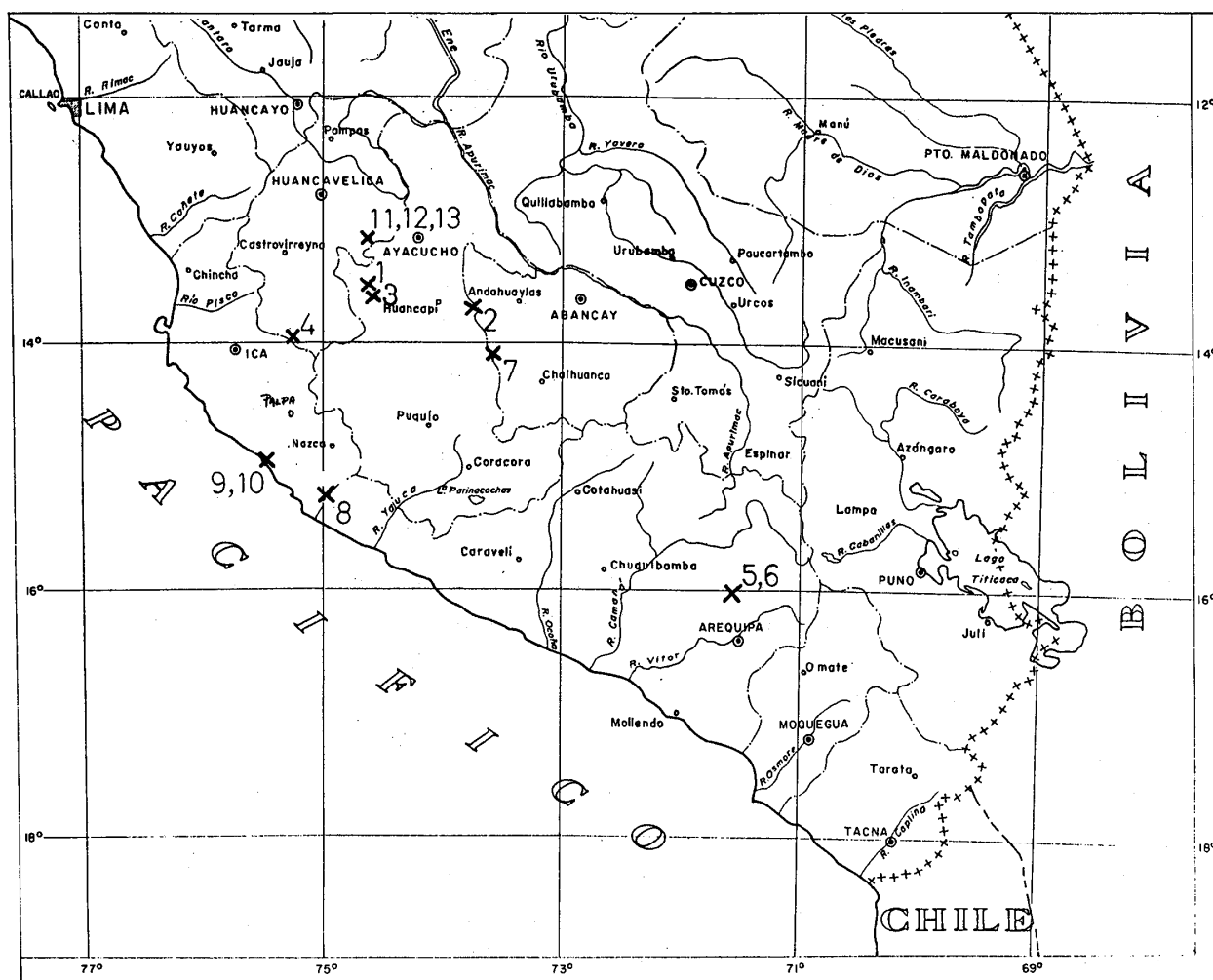
Shell small, subtrigonal, well convex; convexity attaining the maximum on disk at

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Text-figure 1: Fossil localities (1~13) in Peru

about one-third the height below umbo; test rather thick; anterior margin gently rounded; marginal carina not distinct. Disk ornamented with about 10 costae which are fairly strong, gently arcuated. Umbonal 4 of them rather slender. Intervals of them wider than each costae; ante-carinal groove distinct; area provided with 4 radial fine costae.

The present specimen is fragmentary and lacks the umbonal and postero-ventral portions. Therefore it is difficult to determine the species.

Occurrence: — Light gray sandy limestone, Pucara Group, Peru.

Repository: — Rg.No. SGM 913-4, INGEMMET, Peru.

Trigonia B sp. indet.

Plate 1, Figure 2.

Shell small, trigonal, gently convex; umbo comparatively large, located at about one-third from the front; anterior margin well-rounded; siphonal margin slightly

arcuate; marginal carina nearly straightened, somewhat sharp; ante-carinal groove distinct, shallow; area fairly large, provided with 4 radial ribs; disk ornamented with concentric costae which are parallel to ventral margin, narrower than interspace and counted about 10.

The present specimen is fairly broken in antero-ventral and posterior portions. Therefore it is specifically indeterminable. This specimen differs distinctly from *Trigonia* A sp. in this article by the costation on the surface.

Occurrence: — Gray sandstone, Pucara Group, Ayacucho, Peru.

Repository: — Rg.No.SGM 704-4, INGEMMET, Peru.

Genus *Vaugonia* CRICKMAY, 1930

Vaugonia chunumayensis (JAWORSKI)

Plate 1, Figure 3.

1925. *Trigonia chunumayensis* JAWORSKI, *Argent. Dir. Gen. Min. Hydr., Sec. Geol.*, Pub.4, pl.1, fig.4.

Description: — Shell small, subtrapezoidal, gently convex; convexity attaining the maximum on disk at about one-third the height below umbo. Umbo located at about one-fourth from the front; anterior margin rounded; anterior and ventral margins disposed with an angle of about 110 degrees between them; ventral margin broadly arched, sharply angulated with siphonal margin which is slightly arcuated; postero-dorsal margin long, nearly straight, oblique to ventral margin. Marginal carina sharp, distinct near umbo, but obtuse postero-ventrally; ante-carinal groove distinct near umbo; area somewhat wide, provided with fine growth lines; escutcheon ill-defined; disk ornamented with about 12 costae, umbonal 3 or 4 of them concentric, others forming Vs at about median portion on disk.

Measurements (in mm) :

Rg. Number	Valve	Length	Height	Width
Rg.No. SGM 903	Right	34+	25+	60+

Remarks: — Although the present specimen lacks the umbonal portion and shows ill-preservation in the escutcheon and area portions, it resembles most closely to JAWORSKI's form illustrated in fig.4 on plate 1 of his report in 1925.

Occurrence: — Dark gray sandstone, Pucara Group, Ayacucho, Peru.

Repository: — Rg.No. SGM 903, INGEMMET, Peru.

Vaugonia A sp. indet.

Plate 1, Figure 4.

An incomplete specimen (19 mm+ long, 18 mm+ high) is regarded as a left valve of *Vaugonia* owing to the characteristic of V-shaped structure on the disk. The angles of Vs are fairly acute and the interspaces are broader than the ribs.

Occurrence : — Dark gray tuffaceous medium-grained sandstone, Cercaeupio, Peru.

Repository : — Rg.No. SGM 734, INGEMMET, Peru.

Vaugonia B sp. indet.

Plate 1, Figures 5-6.

Shell small, subtrigonal, nearly as long as high, gently convex; convexity attaining the maximum on disk at about one-third the height below umbo; umbo a little large, located at a half from the front; anterior margin gently rounded; marginal carina nearly straightened; ante-carinal groove not distinct; area provided with fine growth lines. Disk ornamented with about 17 costae, umbonal 5 of them concentric, others forming V-shaped structure at about median portion on disk.

Two specimens which are collected from Socosani Formation in the Arequipa district were observed. Although the specimens at hand are fragmental, they differ from that of Cercaeupio treated in this article. The present specimens are allied to *Vaugonia chunumayensis* from the Pucara Group, treated in this paper, but the former differs from the latter in outline of the shell and the costation on disk.

Occurrence : — Dark gray sandstone, Socosani Formation, Arequipa, Peru.

Repository : — Rg.No. SGM 562 (A), 562 (B), INGEMMET, Peru.

Vaugonia C sp. indet.

Plate 1, Figures 9-10.

Shell medium in size, subovate in outline, nearly as long as high, gently rounded in front, well inflated; umbo located at about one-third from the anterior extremity; postero-dorsal margin relatively long, oblique to ventral margin; siphonal margin truncated and bent into ventral margin with an obtuse angle; ventral margin long, very broadly arched, gradually going over into the anterior margin. Area provided with median furrow; marginal carina prominent near umbo, but obscure postero-ventrally. Disk ornamented with about 9 costae which form Vs at about one-fourth from the front.

The present specimen is an imperfect internal mould which is more or less deformed by rock pressure.

Occurrence : — Calcareous sandstone, San Francisco, Ica, Peru.

Repository : — Rg.No. SGM 1064-1, INGEMMET, Peru.

Genus *Frenguelliella* LEANZA, 1942

Frenguelliella sp. indet.

Plate 1, Figure 7.

Shell small, subtrigonal or subovate, a little longer than high, convexity attaining

the maximum on disk at about one-third the height below umbo; test thick. Umbo somewhat large, located at about one-third from the front; anterior margin gently rounded; ventral margin broadly arched; siphonal margin truncated, more or less long and rounded; hinge typical of *Trigoniae*; marginal carina gently arcuated, obscure; escutcheon carina somewhat distinct; escutcheon and area provided with concentric costellae; disk ornamented with 10 or more concentric costae which are narrower than the interspace and parallel to ventral margin.

The present species is represented only by an incomplete specimen (Rg.No. SGM 658-4) which lacks the umbonal and anterior parts on disk. It is probably a left valve of an unnamed species of *Frenguelliella*, judging from the shell-outline and mode of costation on the disk, area and escutcheon.

Measurements (in mm) :

Rg. Number	Valve	Length	Height	Width
Rg.No. SGM 658-4	Right, Left	25+	16+	7+

Occurrence : — Cherty rock, Pucara Group, Apurimac, Peru.

Repository : — Rg.No. SGM 658-4, INGEMMET, Peru.

Genus *Myophorella* BAYLE, 1878

Subgenus *Promyophorella* KOBAYASHI and TAMURA, 1955

Myophorella (*Promyophorella*) sp. indet.

Plate 1, Figure 8.

Shell small, subtrigonal, gently convex; umbo somewhat small, located at about one-fourth from the front; beak opisthogyrous; anterior margin gently rounded. Marginal carina arcuated and weak; area provided with transverse costellae; disk ornamented with about 8 costae which are subconcentric in the umbonal region, strongly arcuate in the middle region making an acute angle with the marginal carina, diagonal and subvertical in the later region; tubercles on them rather small.

This species is represented by imperfect single right valve specimen (Rg.No. SGM 628-4). In view of the subtrigonal shell-outline, costation on the disk which is tuberculated, and characteristic of marginal carina, the present specimen is allied to *Promyophorella*.

Measurements (in mm) :

Rg. Number	Valve	Length	Height	Width
Rg.No. SGM 628-4	Right	7+	7	2.5

Occurrence : — Yura Group, near San Juan, Peru.

Repository : — Rg.No. SGM 628-4, INGEMMET, Peru.

Genus *Maoritrigonia* FLEMING, 1962

Maoritrigonia (?) sp. indet.

Plate 1, Figures 11-13.

Two imperfect specimen (Rg.No. SGM 845-A and B) are available for the present study. They lack the umbonal, anterior and ventral portions to determine the species. The shells are completely silicified by the diagenesis. The shell surface is ornamented by many strong, radial and concentric ribs which are intersected each other. Ante-carinal sulcus is shallow. Marginal carina is well marked and strong. Area and escutcheon are provided with transverse fine costellae. The species is more or less similar to *Myophorigonia paucicostata* (JAWORSKI) described by Cox in 1952 on ante-carinal sulcus and also similar to *Trigonia multicostata* described by KÖRNER in 1937, but it differs from the latters in the costation on disk. Judging from the characteristics of the ornamentation on disk, area and escutcheon, and of marginal carina the present species is certainly referable to *Minetrigoniinae*, but it is not sure to define the genus. Based on the aspect of the ante-carinal part, this species is allied probably to Genus *Maoritrigonia*.

Occurrence : — Chambara Formation, Upper Triassic Pucara Group, Huancavelica, Peru.

Repository : — Rg.No. SGM 845, INGEMMET, Peru.

References

- BOIT, B. (1940) : Lineas generales de la geologia estratigrafica de la región del Cerro de Pasco, Pts.1 and 2. *Rev. Ciencias (Univ. M. San Marcos, Lima)*, 42 d yr.,no. 431 and 432, pp.135-162 and 277-303.
- BOIT, B. (1953) : Origen y edad del "Conglomerado Calizo de Shuco" y de las "Calizas Colquijirca-La Calera (Cerro de Pasco). *Pub. Mus. Hist. Nat. "Javier Prado", Ser.C, Geol.*, no.3, pp.1-16.
- BOIT, B. (1962) : Revisión de la estratigrafia en varias regiones de las provincias de Pasco y Junin. *Memor. Mus. Hist. Nat. "Javier Prado"*, no.13, pp.3-41.
- BOIT, B. (1963) : Fenomenos magneticos en la cumbre del Cerro Jespijahua. *Pub. Mus. Hist. Nat. "Javier Prado", Ser.C, Geol.*, no.9, pp.1-6.
- COX, L.R. (1949) : Upper Triassic mollusca from Peru. *Bol. Inst. Geol. Peru*, no.12, pp.1-50, pls.a,2.
- COX, L. R. (1965) : Jurassic bivalvia and gastropoda from Tanganyika and Kenya. *Bull. British Mus. (Nat. Hist.) Geol.*, pp.1-209.
- FLEMING, G. A. (1964) : History of the bivalve family Trigoniidae in the South-West Pacific. *Austral. Jour. Sci.*, vol.26, no.7, pp.196-204.
- HAYAMI, I. (1975) : A systematic survey of the Mesozoic bivalvia from Japan. *The University Museum, The University of Tokyo*, pp.1-228.
- HAYAMI, I., MAEDA, S. and FULLER, C. R. (1977) : Some Late Triassic bivalvia and

- gastropoda from the Domeyko Range of North Chile. *Trans. Proc. Palaeont. Soc. Japan*, N.S., no.108, pp.202-221, pls.28-30.
- JAWORSKI, E. (1916) : Beiträge zur Kenntnis der Jura in Süd Amerika. *Neues Jahrb. f. Min. Geol. Paläont., Beil.-Bd.*, pp.364-456, pls.5-8.
- JAWORSKI, E. (1922) : Die marine Trias in Südamerika. *Neues Jahrb. f. Min. usw., Beil.-Bd.*, vol.47, pp.93-200, pls.4-6.
- JAWORSKI, E. (1925) : Contribucion a la Paleontologia del Jurassico Sudamericano. *Argentina Dir. Gen. Min. Hidr., Sec. Geol.*, Pub.4. pp.1-160, pls.1-4.
- KOBAYASHI, T. (1954) : Studies on the Jurassic trigonians in Japan, pt.1. Preliminary notes. *Japan. Jour. Geol. Geogr.*, vol.25, nos.1-2, pp.61-80.
- KOBAYASHI, T. (1956) : Some Jurassic trigonians from Central and West Japan. Studies on the Jurassic trigonians in Japan, pt.5. *Japan. Jour. Geol. Geogr.*, vol.27, no. 1, pp.1-8, pl.1.
- KOBAYASHI, T. (1957) : Some trigonians from the Hida Plateau region, Central Japan. *Japan. Jour. Geol. Geogr.*, vol.28, nos.1-3, pp.43-46, pl.1.
- KOBAYASHI, T. and KASENO, Y. (1947) : A new Liassic species of *Trigonia* s. st. (i.e. *Lyriodon*) from the Kitakami Mountains in Nippon. *Japan. Jour. Geol. Geogr.*, vol.20, nos.2-4, pp.41-43, pl.10.
- KOBAYASHI, T. and MORI, K. (1954) : Studies on the Jurassic trigonians in Japan, pt.2. *Prosogyrotrigonia* and the Trigoniinae. *Japan. Jour. Geol. Geogr.*, vol.25, nos.3-4, pp.155-175, pls.15, 16.
- KOBAYASHI, T. and MORI, K. (1955) : The Vaugoniinae from the Kitami Mountains in North Japan. Studies on the Jurassic trigonians in Japan, pt.3. *Japan. Jour. Geol. Geogr.*, vol.26, nos.1-2, pp.73-88, pls.3-4.
- KOBAYASHI, T., MORI, K. and TAMURA, M. (1959) : The bearing of the trigoniids on the Jurassic stratigraphy of Japan. Studies on the Jurassic trigonians in Japan, pt. 8. *Japan. Jour. Geol. Geogr.*, vol.30, pp.273-292.
- KOBAYASHI, T. and TAMURA, M. (1955) : The Myophorellinae from North Japan. Studies on the Jurassic trigonians in Japan, pt.4. *Japan. Jour. Geol. Geogr.*, vol.26, nos.1-2, pp.89-103, pls.56.
- LEVY, R. (1966) : Revision de las trigonians de Argentina, 1. Una nueva especie de *Myophorella* del Lias de la pampa de Agnia (Chubut), con consideraciones acerca de la presencia de Myophorellinae en Ameghiniana. *Revista de la Asociacion Paleontologia Argentina*. Tomo.4, no.7, pp.237-241.
- MAEDA, S. (1963 a) : Some Jurassic trigoniids from the Tetori Group in the Kuzuzyu district, Central Japan. *Trans. Proc. Palaeont. Soc. Japan*, N.S., no.49, pp.1-7, pl.1.
- MAEDA, S. (1963 b) : Trigoniids from the Late Mesozoic Tetori Group, Central Japan. *Trans. Proc. Palaeont. Soc. Japan*, N.S., no.51, pp.29-85. pl.12.
- MAEDA, S. (1969) : Bibliography of Trigoniidae. *Ann. Rep. Foreign Student's Coll., Chiba Univ.*, no.4, pp.51-67.
- MAEDA, S. and KAWABE, T. (1963) : Two Jurassic trigoniids from the Tetori Group in

- the Arimine district, Central Japan. *Jour. Coll. Arts and Sci., Chiba Univ.*, vol.4, no.1, pp.55-58, pl.1.
- MAEDA, S. and KAWABE, T. (1966 a) : Some *Myophorella* from the Tetori Group in the Arimine district, Central Japan. *Ann. Rep. Foreign Student's Coll., Chiba Univ.*, no.1, pp.43-49, pls.2.
- MAEDA, S. and KAWABE, T. (1966 b) : Note on the ontogenetic change of *Myophorella* (*Promyophorella*) *orientalis*. *Ann. Rep. Foreign Student's Coll., Chiba Univ.*, no. 1, pp.51-55, pls.2.
- MAEDA, S., BELLIDO, E. B., MORALES, B. A., RANGEL, C. Z. and KAWABE, T. (1981) : On some Late Triassic molluscs and conodonts from the Cerro de Pasco area, Central Peru. *Palaeont. Study on the Andes* (II), *Geol. Lab., Fac. Sci., Chiba Univ.*, pp.1-18.
- NAKANO, M. (1960) : Stratigraphical occurrences of the Cretaceous trigoniids in the Japanese Islands and their faunal significances. *Jour. Sci., Hiroshima Univ., Ser.C*, vol.3, no.2, pp.215-280.
- NAKANO, M. (1961) : On the Trigoniidae. *Jour. Sci., Hiroshima Univ., Ser.C*, vol.4, no. 1, pp.71-94.
- PARNES, A. (1981) : Biostratigraphy of the Mahmal Formation (Middle and Upper Bajocian) in Makhtesh Raman (Negev. Southern Israel), *Geol. Sur. Israel Bull.* 74, pp.1-55, pls.2.
- SAVELIEV, A. A. (1960) : Jurassic Trigoniidae from Manghyschlack and Western Trukmen. *Leningrad*, pp.1-114.
- TAMURA, M. (1954) : A study on Jurassic trigoniids in Japan (in Japanese). *Jour. Geol. Soc. Japan*, vol.60, no.709, pp.455-456.
- TAMURA, M. (1959 a) : Trigoniidae, Bakevellidae, Pteriidae, Cardiidae and Astartidae from the Upper Jurassic Sakamoto Formation in Central Kyushu, Japan. *Trans. Proc. Palaeont. Soc. Japan*, N.S., no.33, pp.23-32, pl.5.
- TAMURA, M. (1959 b) : On the Torinosu pelecypod-fauna in the Jurassic Group of Soma in Fukushima Prefecture (in Japanese). *Jour. Geol. Soc. Japan*, vol.65, no. 764, pp.280-289.
- VOKES, H. E. (1946) : Contributions to the palaeontology of the Lebanon Mountains, Republic of Lebanon, Part 3. The pelecypod fauna of the "Olive Locality" (Aptian) of Abeih. *Bull. Amer. Mus. Nat. Hist.*, vol.87, art.3, pp.139-216, pls. 1-10.
- WESTERMANN, G.E.G., Riccardi, A.C., Palacion, O. and Rangel, C. (1980) : Jurasico Medio en el Peru, *Inst. Geol. Min. Met., Sec. Ener. Minas.*, Bol.9, Ser.D. Est. Esp. pp.1-47, pls.1-6.

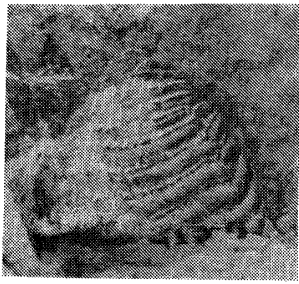
Explanation of Plate 1

- Fig. 1: Right valve of *Trigonia* A sp. $\times 1.3$, Rg.No. SGM 913-4
Fig. 2: Left valve of *Trigonia* B sp. $\times 1.3$, Rg.No. SGM 704-4
Fig. 3: Right valve of *Vaugonia chunumayensis* (JAWORSKI) $\times 1.3$, Rg.No. SGM 904
Fig. 4: Left valve of *Vaugonia* A sp. $\times 1.3$, Rg.No. SGM 734
Fig. 5: Right valve of *Vaugonia* B sp. $\times 1.3$, Rg.No. SGM 562 (A)
Fig. 6: Right valve of *Vaugonia* B sp. $\times 1.3$, Rg.No. SGM 562 (B)
Fig. 7: Left valve of *Frenguelliella* sp. $\times 1.3$, Rg.No. SGM 658-4
Fig. 8: Modeling cast of right valve of *Myophorella* (*Promyophorella*) sp. $\times 2.0$, Rg.No. SGM 628-4
Fig. 9: Right valve of *Vaugonia* C sp. $\times 1.5$, Rg.No. SGM 1064-1
Fig.10: Left valve of *Vaugonia* C sp. $\times 1.4$, Rg.No. SGM 1064-1
Fig.11: Right valve of *Maoritrigonia*(?) sp. $\times 1.5$, Rg.No. SGM 845
Fig.12: Right valve of *Maoritrigonia*(?) sp. $\times 1.5$, Rg.No. SGM 845
Fig.13: Areal view of *Maoritrigonia*(?) sp. $\times 1.5$, Rg.No. SGM 845

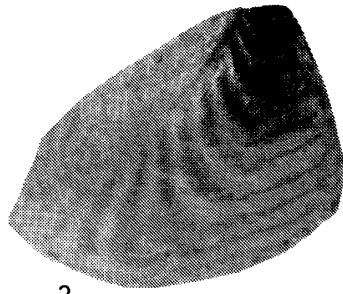
All of the illustrated specimens are kept in Instituto de Geologico Minero y Metalurgico (INGEMMET), Pablo Berumudez 211, Jesús Maria, Lima, Peru.

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Plate 1



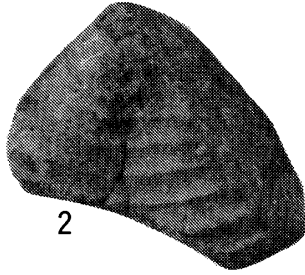
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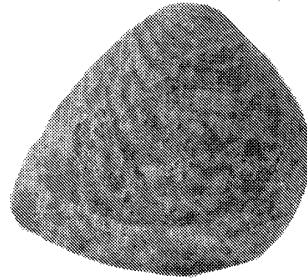
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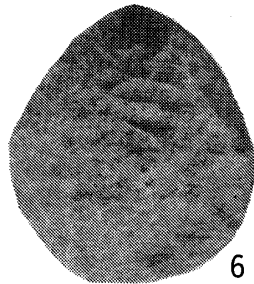
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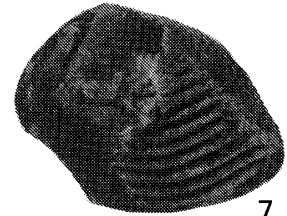
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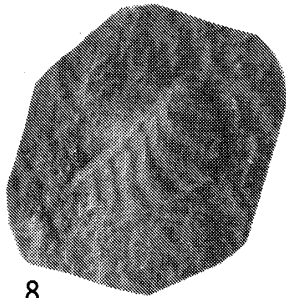
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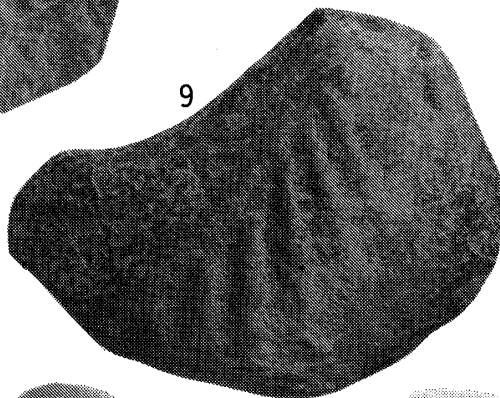
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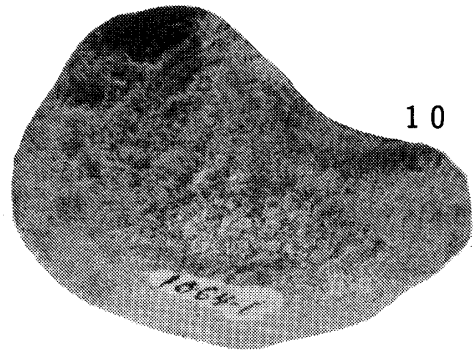
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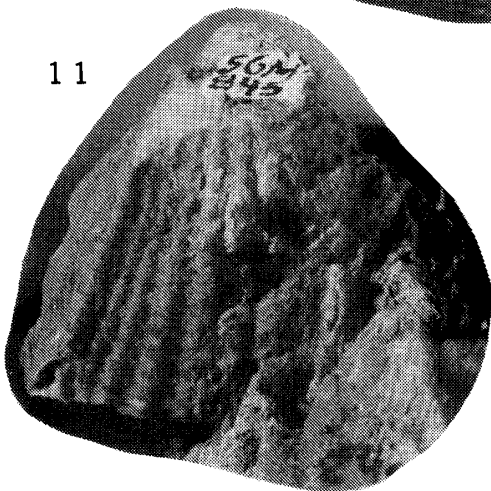
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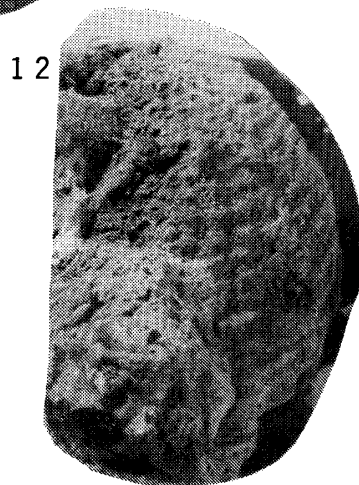
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