

Some Triassic Trigoniids from Peru

by

Shiro Maeda*, Hideo Ishikawa**

Tetsuya Kawabe*** and Luis Guillermo Morales Serrano****

Introduction

In the occasion of the geological and palaeontological reconnaissance survey on the Mesozoic group of Los Andes Cordillera, Central Peru, MAEDA and KAWABE visited Museo de Historia Natural "Javier Prado", Universidad Nacional Mayor de San Marcos, Lima, Peru in 1979. MORALES, one of the writers, collected systematically trigonian specimens from many localities of the Mesozoic group in the Peruvian Los Andes Cordillera. In the Peruvian Los Andes Cordillera including Cerro de Pasco area, the Triassic marine strata having the trend of NW—SE along the axis of Los Andes Cordillera is broadly distributed. Molluscan fossils from the Triassic System in Peru have been studied by several authors such as STEINMANN (1929), KÖRNER (1937), COX (1949), BOIT (1966), KOBAYASHI and TAMURA (1968) and MAEDA et al. (1981). This article is a report on some Late Triassic trigoniids from the Chambara Formation, lower part of the Pucara Group, in the Cerro de Pasco area, Central Peru. It emphasizes, in particular, on the similarity between these fossils studied herein and the trigonian faunas described by STEINMANN (1929) and so forth, and also on the occurrence of Late Triassic *Frenguelliella* which associated with Late Triassic Minetrigoniinae.

The writers express their cordial thanks to Professor Sumio SAKAGAMI of Chiba University, Professor Nobuo YAMAGIWA of Osaka Kyoiku University, palaeontological members of Museo de Historia Natural "Javier Prado" and Ing. Dr. César RANGEL Z. of Instituto de Geologico Minero y Metalurgico, INGEMMET for their kind suggestions. Thanks are also due to Sr. Yoshishige OKUYAMA, Sr. Masatsugu KIKUSHIMA for their kind helps in many ways. Photographic work was made by Messrs. Naomi OYAMA, Ken IMAMIYA, Yasuhiro HAYASHI, Katsumi HORIGUCHI and Makoto OZAWA of Chiba University.

Systematic Description

Family Trigoniidae LAMARCK, 1819

Genus *Perugonia* KOBAYASHI and TAMURA, 1968

Perugonia lissoni (STEINMANN)

Plate 1, Figures 1-5.

* % Department of Earth Sciences, Faculty of Science, Chiba University

** Department of Earth Sciences, Faculty of Education, Chiba University

*** Department of Earth Sciences, Faculty of Science, Chiba University

**** Museo de Historia Natural "Javier Prado", Universidad Nacional Mayor de San Marcos, Av. Arenales, Jesus Maria, Lima, Peru.

1929. *Myophoria lissoni* STEINMANN, *Geologie von Perú*, s.58, figs. 57A—B.

1968. *Perugonia lissoni* (STEINMANN) : KOBAYASHI and TAMURA, *Cont. Geol. Pal. Southeast Asia*, LX, pp.112-113, figs.1-4.

Description : — Shell rather large, subquadrate, nearly as long as high, well convex; convexity attaining the maximum on disk at about one-third the height from umbo; test thick. Postero-dorsal margin long, concave, nearly parallel to ventral margin, sloping into the posterior margin with an obtuse angle; posterior margin fairly long, feebly truncated, gradually bent forward into the ventral margin; ventral margin fairly long, arched; anterior margin gently rounded. Umbo more or less large, located anteriorly, somewhat projected above the hinge-margin; beak opisthogyrous, incurved. Escutcheon carina distinct, tuberculated; marginal carina arcuated and tuberculated; escutcheon narrow, smooth, arranged fine growth lines; area fairly large, divided by delicate median depression; disk ornamented with about 9 or 10 radial ribs which become nodes, intersected with concentric lines; anterior part lacking in radial rib, but provided with many distinct concentric costae which are strong as interspace in width. 3 of radial ribs including marginal carina in posterior part fairly weak and denticulate.

Measurements : — Broken two specimens selected from the collection were measured in mm as follows :

Rg. Number	Valve	Length	Height	Width
Rg.N.22733 A	Right, Left	81	76	37+
Rg.N.22733 C	Right	65+	72+	45+

Remarks : — Several imperfect specimens which are rather well-preserved, and calcareous by the diagenesis, were kept in the collection. With regard to the ornamentation of the surface of this species, the radial ribs are tuberculated at intersection with concentric lines as pointed out by KOBAYASHI and TAMURA (1968). The specimens at hand resemble most closely to STEINMANN's form illustrated in Fig.57 (A and B) of his description in 1929, but they slightly differ from the latter by the characteristics of radial ribs near the marginal carina. Namely in the posterior part of the disk the present specimens have fairly weak radial ribs as shown in Figs.1, 2 and 4 on plate 1. Nevertheless, none of these minor differences seems to have a value for specific distinction. It is emphasized that the similarity of the ornamentation in the anterior part between the present specimens and STEINMANN's form.

Occurrence : — Pucara Group, Cerro de Pasco, Peru.

Repository : — Rg.N.22733 A, B, C and D., Museo de Historia Natural "Javier Prado", Universidad Nacional Mayor de San Marcos, Lima, Peru.

Some Triassic Trigoniids from Peru

Perugonia jaworskii (STEINMANN)

Plate 2, Figures 1, 3, 4 and 5.

1929. *Myophoria jaworskii* STEINMANN, *Geologie von Perú*, s.58, figs. 55 A-B.

1966. *Myophoria jaworskii* STEINMANN: BOIT, *Pub. Mus. Hist. Nat. "Javier Prado"*, Ser. C, *Geol.*, no.11, p.8, pl.1, figs.1 and 2; pl.3, fig.1.

Description: — Shell small, subquadrate, somewhat longer than high, well convex, convexity attaining the maximum on disk at about one-third the height from umbo; test rather thick. Postero-dorsal margin fairly long, scarcely curved near the beak, gently sloping into the posterior margin; posterior margin more or less long, rapidly bent forward into the ventral margin with an acute angle; ventral margin long, arched, gradually going over into the well rounded anterior margin; antero-dorsal margin convex. Umbo comparatively large, located at about one-fourth from the anterior extremity; beak opisthogyrous, incurved, fairly elevated above the hinge margin. Escutcheon carina distinct, tuberculated; marginal carina rather obscure, but gently curved; escutcheon narrow, depressed; area broad, provided with fine growth lines and shallow median furrow; disk ornamented with about 9 radial tuberculated ribs, posterior two of them fairly weak, radial rib in the anterior part of disk lacking or obscured. Several remarkable concentric costae seen in the umbonal region.

Measurements: — 4 specimens, including fairly broken materials, are measured in mm as listed below:

Rg. Number	Valve	Length	Height	Width
Rg.N.22040 (1)	Right, Left	28	24	18
Rg.N.22040 (2)	Left	33	25+	8
Rg.N.22040 (3)	Right	31+	24+	9
Rg.N.40104	Right, Left	35	37	23

Remarks: — Several specimens including imperfect one were found in the collection. The specimens at hand closely resemble to the figures of *Myophoria jaworskii* given by STEINMANN (1929) from the Upper Triassic System in the Pisco Carniano area, Cerro Uliachi, near Cerro de Pasco, Central Peru in the characteristics such as the costation on the disk, fairly weak costation near marginal carina, feeble marginal carina and width of the area. This species is also related to *Perugonia lissoni* (STEINMANN) in the essential characteristics as pointed out by KOBAYASHI and TAMURA (1968), but they differ each other in features of the radial ribs near marginal carina and the outline of shell. In the ontogenetic view point, it is one of the remarkable characteristics that in the immature stage the concentric costae run on the surface from the anterior part to posterior one, but in the adult stage the costae become rather large nodes, intersecting with radial ribs.

Occurrence: — Pucara Group, Cerro de Pasco, Peru.

Repository: — Rg.N.22040 (1), (2), (3), (4) and Rg.N.40104. Museo de Historia

Natural "Javier Prado", Universidad Nacional Mayor de San Marcos, Lima, Peru.

Genus *Maoritrigonia* FLEMING, 1962

Maoritrigonia (?) sp. indet.

Plate 2, Figures 2 a-b.

Remarks : — The present specimen is only imperfect one, lacking in umbonal, anterior, ventral and posterior portions. With regard to the ornamentation on the disk and distinct marginal carina, this species is similar to *Myophoria baertli* figured on plate II by BOIT as new species in 1966 from Colquijirca, Cerro de Pasco area, but it cannot coincide with the latter, because the present species lacks in the posterior and umbonal portions. On the other hand BOIT's form, i.e., *Myophoria baertli* (1966) has the crenulated typical trigonian hinge structure as shown in figures 2 and 3 on plate III. Therefore this specimen is included to Trigoniidae instead of Myophoriidae. It is a remarkable fact that the present species much resembles the figures of *Myophoria pascoensis* STEINMANN given by L. R. COX in 1949 from the Upper Triassic deposits in the Cerro de Pasco area, Central Peru, but they cannot coincide each other, because the present species is fairly imperfect in preservation.

Selected References

- ABBASS, H. L. (1962) : A monograph on the Egyptian Cretaceous pelecypods. *Geol. Sur. Min. Res. Dept., Geol. Museum, Paleontological Series Monograph*, no.1, pp. 1-225, pls.1-24.
- AGASSIZ, L. (1840) : Etudes critiques sur les Mollusques fossiles. *Memoire sur les Trigonies*, pp.1-58, pls.1-10.
- ALÁNCASTER de CSERNA, C. (1961) : Fauna fosil de la Formacion Sasta Clara (Canico) del Estado de Sonora. *Paleontologia del Triasico superior de Sonora, Parte 3. Palaeont. Mexicana*, no.11. pp.1-38, pls.1-6.
- BARTHEL, K. W. (1958) : Eine marine faunula aus der mittleren Trias von Chile. *Neues Jahrb. f. Min. Geol. Palaont., Beil.-Bd.* 106, Ht.3, pp.352-382.
- BELLIDO, E., NARVÁEZ, S. and SIMONS, F. S. (1956) : Mapa geologica del Peru. *Inst. Nac. Inv. y Fom. Min. (Peru)* and *U. S. Geol. Survey*.
- BOIT, B. (1940) : Lineas generales de la geologia estratigrafica de la región del Gerro de Pasco, Pts.1 and 2. *Rev. Ciencias (Univ.May.San Marcos, Lima)*, 42 d yr, no. 431, and 432, pp.135-162 and 277-303.
- BOIT, B. (1945) : Geologia Post-Carbónica de Carhuamayo. *Act. Acad. Cienc. Exact. Fis. Natls., Lima*, vol.8, fasc.II.
- BOIT, B. (1949) : Sobre la edad de la Formacion Caliza Triasica del Peru Central. *Pub. Mus. Hist. Nat. "Javier Prado", Univ. Nac. May. San Marcos, Ser.C, Geol. y Pal.*, no.2, pp.1-13.
- BOIT, B. (1953) : Origen y edad del "Conglomerada Calizo de Shuco" y de las "Calizas

Some Triassic Trigoniids from Peru

- 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 estratigrafía en varias regiones de las provincias de Pasco y Junin. *Memor. Mus. Hist. Nat. "Javier Prado"*, no.13, pp.3-41.
- BOIT, B. (1963) : Fenómenos magnéticos en la cumbre del Cerro Jespijahua. *Pub. Mus. Hist. Nat. "Javier Prado", Ser.C, Geol.*, no.9, pp.1-6.
- BOIT, B. (1966) : Fauna de la facies occidental del Cerro Jespijahua. *Pub. Mus. Hist. Nat. "Javier. Prado", Ser.C, Geol.*, no.9, pp.1-6.
- BOIT, B. (1966) : Fauna de la facies occidental del Noriano al oeste de Colquijirca. *Pub. Mus. Hist. Nat. "Javier. Prado", Ser.C, Geol.*, no.11, pp.1-11.
- CECIONI, G. and WESTERMANN, G. E. G. (1968) : The Triassic/Jurassic marine transition of coastal Central Chile. *Pacific Geology*, vol.1, pp.45-71.
- COX, L. R. (1949) : Upper Triassic molluca from Peru. *Bol. Inst. Geol. Peru*, no.12, pp.1-50, pls.1,2.
- COX, L. R. (1952) : Notes on the Trigoniidae, with outlines of a classification of the family. *Proc. Malac. Soc. London*, vol.29, pts.2 & 3, pp.45-70, pls.1-2.
- FERUGLIO, E. (1933) : Fossili Liassic della valle del Rio-Genua (Patagonia). *Gior. di Geologia Ann. del R. Mus. Geol. di Bologna*, vol. 9, pp.1-64, pls.1-5.
- FLEMING, C. A. (1962) : Two new genera of Triassic Trigoniidae from New Zealand. *Proc. Malac. Soc. London*, vol.35, pt.1, pp.1-4, pl.1.
- FLEMING, C. A. (1963) : A new genus and species of Trigoniidae from the Middle Triassic of New Zealand. *N. Z. Jour. Geol. Geophy.*, vol.6, no.5, pp.843-846.
- FLEMING, C. A. (1964) : History of the bivalve family Trigoniidae in the South-West Pacific. *Austral. Jour. Sci.*, vol.26, no.7, pp.196-204, text figs.1-13.
- GROSE, L. T. and SZEKELY, T. S. (1968) : Upper Triassic-Lower Jurassic Pucara Group of Central Peru. *Geol. Soc. America, Abs. for 1968, Spec. Paper*, 121, p.119.
- HAAS, O. (1953) : Mesozoic invertebrate faunas of Peru. pt.1, pt.2. *Bull. Amer. Mus. Nat. Hist.*, vol.101, pp.1-328, pls.1-18.
- HARRISON, J. V. (1940) : A preliminary note on the geology, Central Andes of Peru. *Soc. Geol. del Perú Bol.*, vol.10, pp.31-53.
- HARRISON, J. V. (1944) : The geology of the Central Andes in part of the province of Junin, Peru. *Geol. Soc. London Quart. Jour.*, vol.99, pp.1-36.
- 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. (1922) : Die marine Trias in Südamerika. *Neues Jahrb. f. Min. Geol. Paläont., Beil.-Bd.*, vol. 47, pp.93-200, pls.4-6.
- JAWORSKI, E. (1925) : Contribucion a la paleontologia del Jurásico Sudamericano. *Argentina Dir. Gen. Min. Geol. Hidr., Sec. Geol.*, Pub.4, pp.1-160, pls. 1-4.
- JENKS, W. F. (1951) : Triassic to Tertiary stratigraphy near Cerro de Pasco, Peru. *Geol. Soc. America Bull.*, vol.62, no.2, pp.202-220, pls.1-3.
- KÖRNER, K. (1937) : Marine (Cassianer-Raibler) Trias am Nevado de Acrotambo (Nord-

- Peru). *Palaeontographica*, vol.86, pt.A, pp.145-237, pls.10-14.
- KAMBE, N. (1951) : On the myophorians from Kyoto Prefecture (Prov. Tango). *Trans. Proc. Palaeont. Soc. Japan*, N.S., no.2, pp.49-56, pl.4.
- KAMBE, N. (1957) : On the Myophorians from the Micaraiyama Group in Hyogo Prefecture. *Rep. Geol. Surv. Japan*, no.173, pp.1-19.
- 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. and KATAYAMA, M. (1938) : Further evidence as to the chronological determination of so-called Rhaeto-Liassic floras with a description *Minetrigonia*, a new subgenus of *Trigonia*. *Proc. Imp. Acad. Tokyo*, vol.14, no.5, pp.184-189.
- 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. pt.8. *Japan. Jour. Geol. Geogr.*, vol.30, pp.273-292.
- KOBAYASHI, T. and TAMURA, M. (1968) : *Myophoria* (s.l.) in Malaya with a note on the Triassic Trigoniacea. *Cont. Geol. Pal. Southeast Asia*, LX, pp.88-137.
- LEVY, R. (1966) : Revision de las *Trigonias* de Argentina, I. Una nueva especie de *Myophorella* del Lias de la pampa de Agnia (Chubut), con consideraciones acerca de la presencia de Myophorellinae en Argentina, Ameghiniana. *Revista de la Asociacion paleontologia Argentina*, Tom.4, no.7, pp.237-241.
- LEVY, R. (1967) : Revision de las *Trigonias* de Argentina, II. la presencia de *Myophorigonia* en el Lias Medio de Neuquen y Chubut, Ameghiniana. *Rev. Asoc. Paleont. Argentina*, Tom.5, no.1, pp.11-16.
- 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.1-12, pls.1-2.
- MÉGARD, F. (1968) : Geologia del cuadrángulo de Huancayo. *Serv. de Geol. y Min. Bol.*, vol.18, 123 pp.
- NAKANO, M. (1960) : Stratigraphic 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, tabs.23-30.
- Nanking Inst. Geol. Palaeont., Acad. Sinica (1976) : The Lamellibranch fossils of China, *Science Press, Peking*, pp.1-522, pls.1-150.
- NICOL, D. and ALLEN, W. T. (1953) : A new pelecypod genus from Upper Triassic strata in Peru. *Jour. Washington Acad. Sci.*, vol.43, no.11, pp.344-346.
- SAVELIEV, A. A. (1958) : [Lower Cretaceous Trigoniidae from Manghyschlack and Western Turkmen.] *Leningrad*, pp.1-516.
- SAVELIEV, A. A. (1960) : [Upper Jurassic Trigoniidae from Maghyschlak and Western Trukmen.] *Leningrad*, pp.1-114.
- SKWARKO, S. K. (1967) : Mesozoic mollusca from Australia and New Guinea. *Bur.*

Some Triassic Trigoniids from Peru

- Min. Resour., Geol. Geoph., Aust. Bull.*, no.75, pp.1-101.
- STEINMANN, C. (1929) : *Geologie von Perú. Heidelberg, Carl Winters*, pp.1-448, 9 pls.
- SZEKELY, T. S. (1967) : *Geology near Huallacocha Lakes, Central High Andes, Peru. Am. Assoc. Petroleum Geologists Bull.*, vol.51, no.7, pp.1346-1353.
- SZEKELY, T. S. and GROSE, L. T. (1972) : *Stratigraphy of the carbonate, black shale, and phosphate of the Pucara Group (Upper Triassic-Lower Jurassic), Central Andes, Peru. Geol. Soc. America Bull.*, vol.83, pp.407-428.
- TAMURA, M. (1959) : *On Kumatrigonia, a new subgenus of Frenguelliella, and a Tosapecten from the Carnic Tanoura Formation in Kyushu, Japan. Mem. Fac. Educ., Kumamoto Univ.*, vol.7, pp.212-218, pl.2.
- TOKUYAMA, A. (1960) : *On the pelecypod fauna of the Late Triassic Hirabara Formation in West Japan. Japan. Jour. Geol. Geogr.*, vol.31, nos.2-4, pp.201-217, pl.13.
- ZEIL, W. (1958) : *Marine mittlere Trias der Hochkordillera, Prov. Atacama. Neues Jahrb. f. Min. Geol. Paläont., Beil.-Bd.*, vol. 106, pp.339-351, pls.17,18.

Explanation of Plate 1

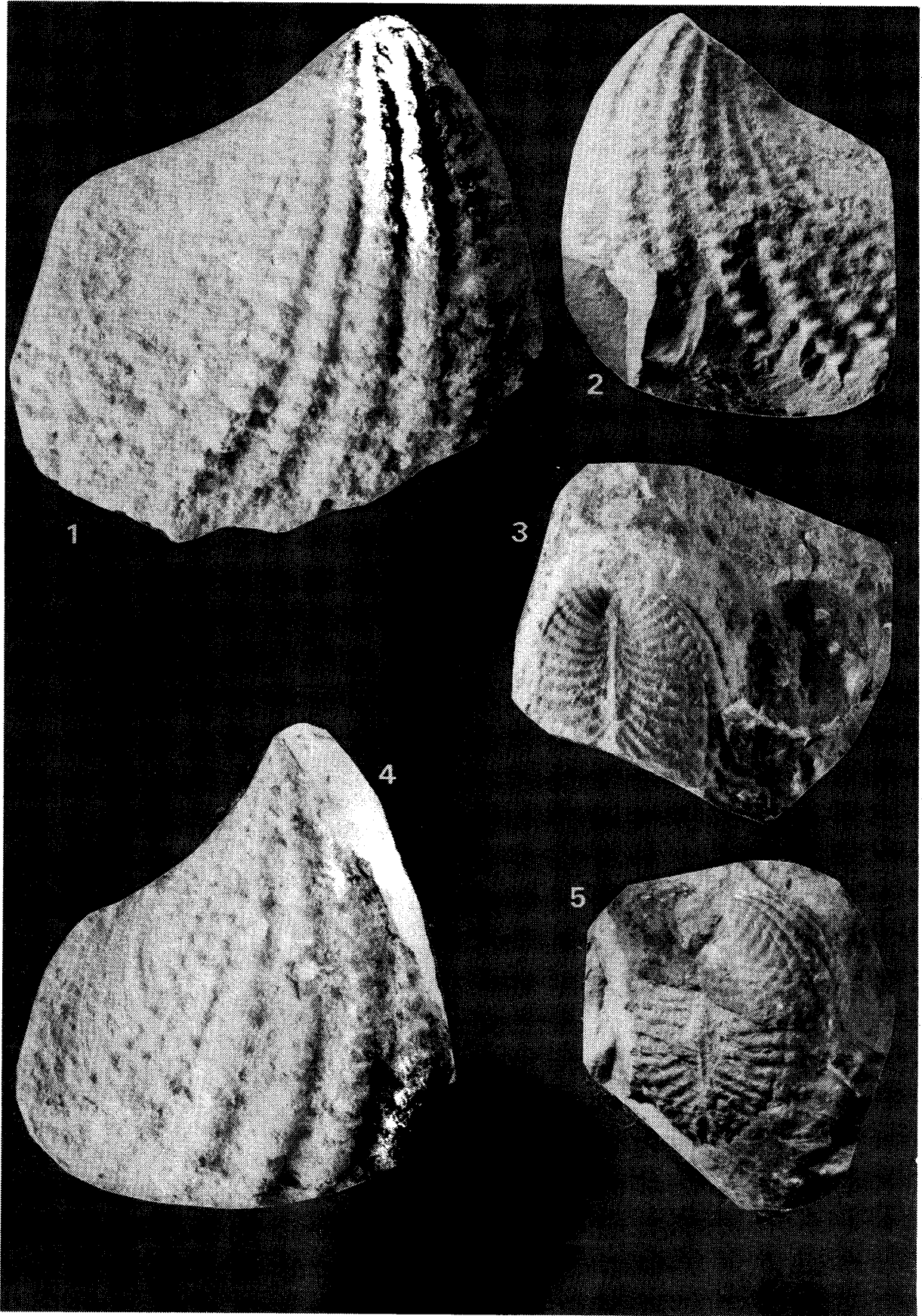
Perugonia lissoni (STEINMANN)

Fig.1: Right valve.	Rg.N. 22733 A
Fig.2: Left valve.	Rg.N. 22733 B
Fig.3: Anterior view of two valves.	Rg.N. 22733 C
Fig.4: Right valve.	Rg.N. 22733 C
Fig.5: Anterior view of two valves.	Rg.N. 22733 D

All figures are natural size.

Localities: Chambara Formation, Pucara Group, Cerro de Pasco, Peru.

All of the illustrated specimens are kept in Museo de Historia Natural "Javier Prado", Universidad Nacional Mayor de San Marcos, Lima, Peru.



Explanation of Plate 2

Perugonia jaworskii (STEINMANN)

Fig.1 a : Right valve.	Rg.N.22040 (1)	×1.2
Fig.1 b : Left valve.	Rg.N.22040 (1)	×1.2
Fig.1 c : Areal view of two valves.	Rg.N.22040 (1)	×1.2
Fig.1 d : Anterior view of two valves.	Rg.N.22040 (1)	×1.2
Fig.1 e : Posterior view of left valve.	Rg.N.22040 (1)	×1.5
Fig.3 : Left valve.	Rg.N.2240 (2)	×1.2
Fig.4 a : Left valve.	Rg.N.40104	×1.2
Fig.4 b : Right valve.	Rg.N.40104	×1.2
Fig.4 c : Anterior view of two valves.	Rg.N.40104	×1.5
Fig.4 d : Umbonal view of two valves.	Rg.N.40104	×1.5
Fig.5 : Right valve.	Rg.N.22040 (3)	×1.2

Maoritrigonia (?) sp.

Fig.2 a : Left valve.	Rg.N.22040 (4)	×1.2
Fig.2-b : Areal view of left valve.	Rg.N.22040 (4)	×1.2

Localities : Pucara Group, Cerro de Pasco area, Peru

Collector : B. BORT

All of the illustrated specimens are kept in Museo de Historia Natural "Javier Prado", Universidad Nacional Mayor de San Marcos, Lima, Peru.

