

# Some Fusulinids from the Copacabana Group at Ambo, Peru, South America<sup>1)</sup>

by

Shiro MAEDA

*Geological Institute, Faculty of Science, Chiba University, Chiba*

Nobuo YAMAGIWA

*Institute of Geoscience, Osaka Kyoiku University, Osaka*

Eleodoro BELLIDO Brado

*Geological Survey of Peru, Lima*

and

Cesar RANGEL Z.

*Geological Survey of Peru, Lima*

The five fusulinid species described in this article were collected by the writers from the Copacabana group at Ambo, Ambo Province, Huanuco Department, Peru.<sup>2)</sup>

In 1946, DUNBAR and NEWELL have proposed the Copacabana group as embracing the Lower Permian (Wolfcampian) of the Central Andes in Bolivia and Peru; they established the type sequence of the group at Tiquina Strait, Lake Titicaca, in Bolivia. Later NEWELL, CHRONIC and ROBERTS (1953) studied the Copacabana group in Peru and considered that the age of the group belongs not only to the Lower Permian (Wolfcampian) but also the Middle

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1) Read at the 113th meeting of the Palaeont. Soc. Japan in Osaka, June 15, 1974.

2) The Palaeontological reconnaissance of the Andes in Peru and Bolivia was performed by the members of Chiba University Palaeontological Expedition to the Andes in cooperation with the staffs of the Geological Surveys of Peru and Bolivia from September to December in 1973. The Members consisted of Prof. S. MAEDA of Chiba Univ., Assistant Prof. N. YAMAGIWA of Osaka Kyoiku Univ., Assistant Prof. I. HAYAMI of Tokyo Univ., Head Sci. Dept. H. TAZUKE of Chiba Pref. Education Center and Assistant K. KITAMURA of Meisei Univ. This article is a result of the joint works of the Chiba University Palaeontological Expedition to the Andes and the Geological Survey of Peru.

Permian (Early Leonardian) by their Palaeontological study. According to them, this group mainly consists of black bituminous shales and massive limestones with subordinate dolomites, siltstones and fine sandstones. At many places, the Copacabana group may rest disconformably on older rocks. The group is overlain by the Middle Permian (Late Leonardian or Post Leonardian) Mitu group unconformably in many areas.

A fusulinid species such as *Triticites* sp. A has been described by NEWELL, CHRONIC and ROBERTS (1953) from the Copacabana group at Ambo, Peru. According to them, it is very similar to

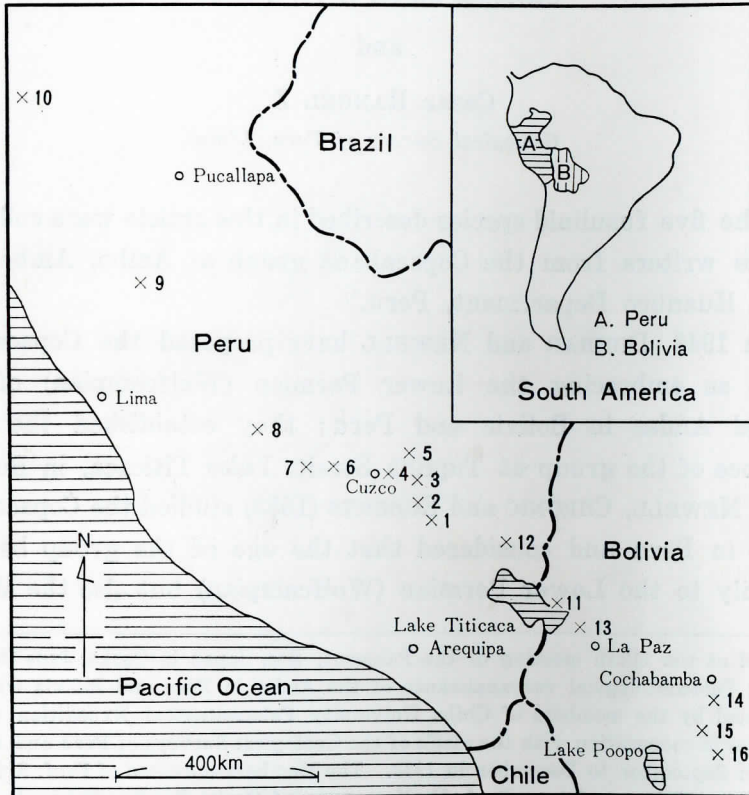


Fig. Main localities of the Copacabana group.

1. Mameura, 2. Tinta, 3. Pirhuate, 4. San Sarvador, 5. Pillahuara, 6. Ampáy,
7. Pasaje, 8. Huanta, 9. Ambo, 10. Caya Caya, 11. Tiquina, 12. Muñani,
13. Yaurichambi, 14. Capinota, 15. Apillapampa, 16. Carpacayma.

*Triticites secalicus* from the Upper Pennsylvanian in United States. Therefore, they considered that the Copacabana group at Ambo might be equivalent to the Upper Pennsylvanian in United States.

In this study, the following fusulinid species are found from the same locality that reported by NEWELL, CHRONIC & ROBERTS (1953) at Ambo.

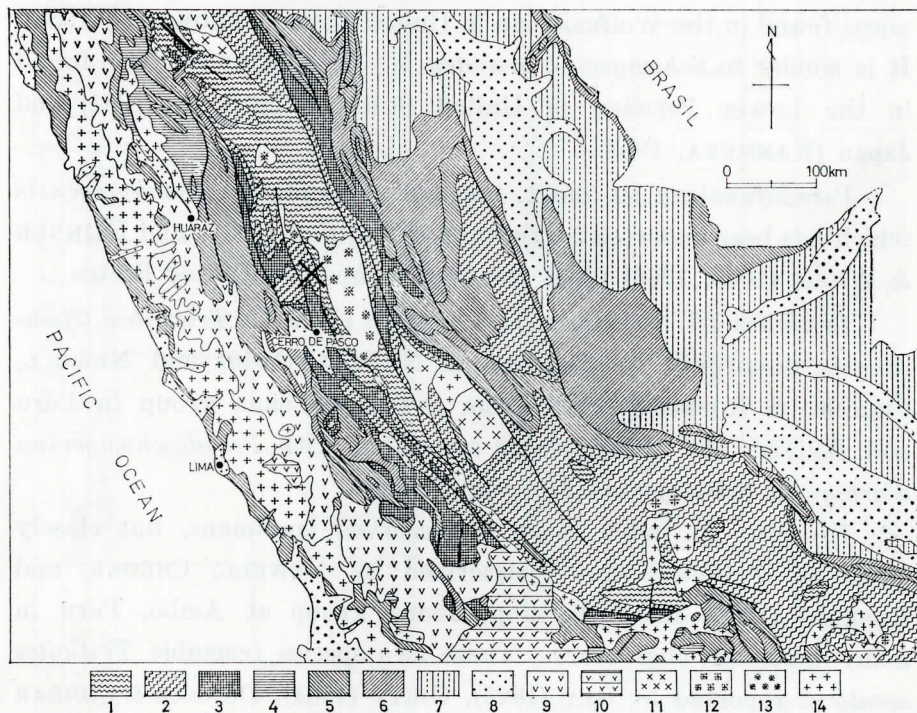


Fig. 2. Geological map on the central part of Peru (BELLIDO, 1969).

×....fossil locality

1. Pre-cambrian
2. Palaeozoic
3. Trassic~Lower Jurassic
4. Middle~Upper Jurassic
5. Cretaceous
6. Upper Cretaceous~Lower Tertiary (continental)
7. Miocen~Pliocene (continental)
8. Quaternary (continental)
9. Upper Cretaceous~Lower Tertiary pyroclastic rocks
10. Pliocene~Quaternary pyroclastic rocks
11. Pre-cambrian~Palaeozoic granites
12. Jurassic~Cretaceous granites
13. Intrusive rocks (no differential)
14. Upper Cretaceous~Lower Tertiary granites

*Schwagerina* cfr. *colemani*

*Pseudofusulina* sp. indet.

*Triticites* aff. *titicacaensis*

*Triticites* sp. indet.

*Leptotriticites* sp. indet.

*Schwagerina* cfr. *colemani* very resembles *Schwagerina colemani* found in the Wolfcampian in United States (THOMPSON, 1954). It is similar to *Schwagerina grandensis*. The latter has been found in the Lower Permian in United States (THOMPSON, 1954) and Japan (KANMERA, 1958).

*Pseudofusulina* sp. indet. resembles *Pseudofusulina huecoensis* which has been reported by DUNBAR & SKINNER (1931) and SKINNER & WILDE (1965, 1966) from the Wolfcampian in United States.

*Triticites* aff. *titicacaensis* is closely allied to *Triticites titicacaensis* discovered by DUNBAR & NEWELL (1946) and NEWELL, CHRONIC & ROBERTS (1953) from the Copacabana group in Peru and Bolivia; the latter occurs associated with *Pseudoschwagerina d'orbigny*, *Schwagerina berry* and others.

*Triticites* sp. indet. is an ill-preserved specimens, but closely allied to *Triticites* sp. A described by NEWELL, CHRONIC and ROBERTS (1953) from the Copacabana group at Ambo, Peru in many important characters. These two species resemble *Triticites secalicus* reported by SAY (1823), GIRTY (1904), DUNBAR & CONDAR (1927), WHITE (1932), BURMA (1942) and DOUGLASS (1966) from the Upper Pennsylvanian in United States, but differ from the latter in having more folded septa. They may be more advanced ones than the latter.<sup>3)</sup>

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3) In 1960, BELLIDO and NARVAEZ have reported some fusulinid species belonging to the genus *Triticites* from the Tarma group at Atico, Peru. According to them, the species resemble the Upper Pennsylvanian ones in United States and others. The data are very interesting, because the age of the Tarma group in Peru and Bolivia formerly studied by DUNBAR & NEWELL (1948) and NEWELL, CHRONIC & ROBERTS (1953) is the Middle Carboniferous from the Palaeontological evidence.



*Leptotriticites* sp. indet. is similar to *Leptotriticites gracilitatus* described by SKINNER & WILDE (1965) from the Wolfcampian in New Mexico.

The fauna assemblage of the above mentioned fusulinid species is very similar to that known from the Wolfcampian in United States and also closely resembles the Lower Permian fusulinids found in other localities of the Copacabana group in Peru and Bolivia. According to NEWELL, CHRONIC and ROBERTS (1953), *Triticites* sp. A occurs together with Brachiopod species such as *Phricodothyris guadalupensis peruensis* and *Hustedia sicuaniensis* in the same bed of the Copacabana group at Ambo, Peru. The latter two were reported from the lower part of the Copacabana group showing the age of the Lower Permian.

From the above Palaeontological data, the writers guess that the age of the Copacabana group at Ambo, Peru is probably equivalent to the Lower Permian as is the case with the other localities in Peru and Bolivia.

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## Description of Species

Superfamily Fusulinacea von MÖLLER, 1878

Family Fusulinidae von MÖLLER, 1878

Subfamily Schwagerininae DUNBAR &amp; HENBEST, 1930

Genus *Schwagerina* von MÖLLER, 1878*Schwagerina* cfr. *colemani* THOMPSON

Plate 1, figs. 1-2

*Compare*:—

1954. *Schwagerina colemani* THOMPSON, *Univ. Kansas Palaeont. Contr., Protozoa* 5, pp. 61, pl. 24, figs. 6-15.

Shell is medium in size, relatively elongate fusiform in shape, and slightly inflated in its middle part, with straight axis of coiling and bluntly pointed poles. Lateral slopes of mature shell are nearly straight. Mature shells of five to six volutions are 6.6 to 7.2 mm long and 2.5 to 2.6 mm wide; form ratio 2.6 to 2.8. Form ratios of the first to the fifth volution in a typical specimen (pl. 1, fig. 1) are 1.4, 1.9, 2.2, 2.3 and 2.7, respectively. Proloculus is subspherical in shape, with outside diameter of 0.20 to 0.22 mm. Height of chambers in the first to the fifth volution in the above mentioned one is 0.06, 0.10, 0.10, 0.20 and 0.24 mm, respectively. Spirotheca is moderately thick, composed of a tectum and a rather coarse alveolar keriotheca. Its thickness is 0.02, 0.04, 0.06, 0.08 and 0.08 mm, respectively in the first to the fifth volution. Septa are rather irregularly fluted throughout length of shell. Chomata occur throughout all except the last volution; they are asymmetrical, with steep tunnel sides and lower poleward slopes. Tunnel angles of the third to the fifth volution are 25, 28 and 30 degrees, respectively. Septal counts of the first to the fifth volution are 10, 18, 19, 20 and 23, respectively.

*Remarks*:—The distinct characters of the present specimens are their relatively elongate fusiform with slightly inflated in its

middle part, straight axis of coiling, rather distinct chomata, nearly straight lateral slopes, narrow tunnel angles, fluting form of septa and others. The features mentioned above almost agree with those of *Schwagerina colemani* THOMPSON (1954, pl. 61, pl. 24, figs. 6-15). However, the present ones have rather larger proloculus. It is similar to *Schwagerina grandensis* THOMPSON (1954, p. 59, pl. 24?, figs. 1-5, 16-24, pl. 29, figs. 15-16, pl. 32, figs. 10-18, pl. 33, fig. 15?; KANMERA, 1958, pp. 189-191, pl. 31, figs. 1-12), but differs from the latter, having its thicker spirotheca, smaller tunnel angles and asymmetrical chomata.

*Occurrence*:—The present specimens occur from the Copacabana group at Ambo, Ambo Province, Huanuco Department, Peru. The present form is associated with *Pseudofusulina* sp. indet., *Triticites* aff. *titicacaensis*, *T.* sp. indet. and *Leptotriticites* sp. indet..

*Repository*:—Reg. nos. Micropal. Coll. N. S. M. 833-834.

Genus *Pseudofusulina* DUNBAR & SKINNER, 1931

*Pseudofusulina* sp. indet.

Plate 1, fig. 3

Shell is large, elongate fusiform, but little inflated at the middle, and bluntly rounded at the poles. Mature specimen having 5.5 volution is 8.6 mm in length and 3.0 mm in width; form ratio about 2.9. Shell loosely coiled except for first two volutions. Inner two volutions are subspherical and beyond the second volution shell form resembles its mature stage. Height of chambers in the first to the sixth volution is 0.03, 0.06, 0.12, 0.22, 0.26 and 0.36 mm, respectively. Spirotheca is rather thick and composed of a tectum and a coarse keriotheca; its thickness is 0.02, 0.03, 0.06, 0.10, 0.12 and 0.12 mm, respectively, from the first to the sixth volution. Septa are strongly and irregularly fluted throughout shell. Proloculus is small, outside diameter of about 0.20 mm. Chomata weak,



present in first two volutions.

*Remarks*:—It is similar to *Pseudofusulina huacoensis* DUNBAR & SKINNER (1931, p. 257, pl. 1, figs. 3-6; SKINNER & WILDE, 1965, pl. 13, figs. 4-5; SKINNER & WILDE, 1966, pp. 1-6, pl. 1, figs. 1-6, pl. 2, figs. 1-3, pl. 3, figs. 1-3, pl. 4, figs. 1-3) in many respects, but differs from the latter in having smaller size, smaller form ratio and smaller proloculus.

*Occurrence*:—The present specimen was obtained from the Copacabana group at Ambo, Ambo Province, Huanuco Department, Peru. It is associated with *Schwagerina* cfr. *colemani*, *Triticites* aff. *titicacaensis*, T. sp. indet. and *Leptotriticites* sp. indet..

*Repository*:—Reg. no. Micropal. Coll. N. S. M. 835.

Genus *Triticites* GIRTY, 1904

*Triticites* aff. *titicacaensis* DUNBAR & NEWELL

Plate 1, fig. 4

*Compare*:—

1946. *Triticites titicacaensis* DUNBAR & NEWELL, *Am. Jour. Sci.*, vol. 244, pl. 479-481, pl. 11, figs. 1-6.

1953. *Triticites titicacaensis* ROBERTS in NEWELL, CHRONIC & ROBERTS, *Geol. Soc. America*, Mem. 58, pp. 182-183, pl. 36, figs. 19-20.

Shell is small in size, inflated fusiform, with bluntly pointed poles. Axis of coiling is almost straight. Lateral slop of mature shell is slightly convex and nearly straight. A specimen of 4.5 volutions is 2.4 mm in length and 1.4 mm in width; form ratio about 1.7. Inner two volutions are spherical or subspherical and beyond the second volution shell is inflated fusiform. Proloculus is small, spherical in shape, with outside diameter of 0.16 mm. Height of chambers above the tunnel in the first to the fifth volution is 0.03, 0.05, 0.08, 0.10 and 0.12 mm, respectively. Spiro-

theca consists of a tectum and a relatively finely alveolar keriotheca. Its thickness measures 0.03, 0.03, 0.04, 0.05 and 0.06 mm, respectively in the first to the fifth volution. Septa are rather strongly folded. Tunnel are narrow; they are 13, 17, 17 and 24 degrees, respectively for the first to the fourth volution. It is bordered by subquadrate or asymmetrical chomata, that commonly extend more than half distance to succeeding whorl.

*Remarks:*—It is represented by only one axial (somewhat oblique) section. It very resembles *Triticites titicacaensis* DUNBAR & NEWELL, 1946, pp. 479-481, pl. 11, figs. 1-6; ROBERTS in NEWELL, CHRONIC & ROBERTS, 1953, pp. 182-183, pl. 36, figs. 19-20) in having small inflated fusiform, small proloculus, rather strongly fluted septa, moderately thick spirotheca and others. However, the former's volutions are less numerous than the latter.

*Occurrence:*—It found in the Copacabana group at Ambo, Ambo Province, Huanuco Department, Peru; the associated fossils are *Schwagerina* cfr. *colemanni*, *Pseudofusulina* sp. indet., *Triticites* sp. indet. at *Leptotriticites* sp. indet..

*Repository:*—Reg. no. Micropal. Coll. N. S. M. 836.

*Triticites* sp. indet.

Plate 1, fig. 5

Shell is relatively small and fusiform; with bluntly pointed poles. Axis of coiling is straight. A few outer volutions are indistinct. A specimen illustrated as fig. 5 on plate 1 having 6? volutions is 5.2 mm in length and 2.0 mm in width, with form ratio of about 2.6. Proloculus is small, spherical in shape; its outside diameter is 0.20 mm. Spirotheca is composed of a tectum and a keriotheca; the thickness measures 0.02, 0.03, 0.03 and 0.04 mm in the first to the fourth volution, respectively. Height of chambers in the first to the fourth volution is 0.02, 0.04, 0.07 and 0.10 mm, respectively. Septa are relatively strongly fluted throughout shell.

Tunnel angles in the second to the fourth volution are 21-22, 23-25 and 30 degrees, respectively. Chomata are subquadrate or asymmetrical.

*Remarks*:—The present one specimen is incomplete. However, it almost agrees with *Triticites* sp. A described by ROBERTS in NEWELL, CHRONIC and ROBERTS (1953, pp. 192-193, pl. 38, figs. 1-2) in having its small fusiform, with bluntly pointed poles, straight axis of coiling, rather strongly fluted septa and others, but slightly differs from the latter, having slightly larger proloculus. It is similar to *Triticites secalicus* (SAY, 1823, pp. 146-152; REEDE, 1900, pp. 10-11, pl. 1, figs. 1, 1 b; GIRTY, 1904, pp. 234-240; DUNBAR & CONDRA, 1927, pp. 104-108, pl. 7, figs. 1-7, pl. 8, fig. 6, pl. 11, fig. 7; WHITE, 1932, pp. 67-69, pl. 6, figs. 10-12; BURMA, 1942, p. 751, pl. 118, figs. 11-12; DOUGLASS, 1966, pp. 71-78, pl. 1, figs. 1-18). However, it differs from the latter in having more strongly folded septa.

*Occurrence*:—It has been obtained from the Copacabana group at Ambo, Ambo Province, Huanuco Department, Peru. It is associated with *Schwagerina* cfr. *colemani*, *Pseudofusulina* sp. indet., *Triticites* aff. *titicacaensis* and *Leptotriticites* sp. indet..

*Repository*:—Reg. no. Micropal. Coll. N. S. M. 837.

Genus *Leptotriticites* SKINNER & WILDE, 1965

*Leptotriticites* sp. indet.

Plate 1, fig. 6

The present specimen is represented by only one tangential section. Shell is relatively large in size and elongate fusiform, with bluntly pointed poles and almost straight axis of coiling. Lateral slopes of mature shell are nearly straight and slightly convex. Shell having 8? volutions in the present one is 8.8mm in length and 2.3mm in width, giving form ratio of about 3.8. Proloculus is missing. Spirotheca is thin and consists of a tectum

and a finely alveolar keriotheca; its thickness of the third to the seventh volution is 0.02, 0.03, 0.04, 0.05 and 0.06 mm, respectively. Height of chambers in the third to the eighth volution is 0.05, 0.08, 0.10, 0.14, 0.20 and 0.26 mm, respectively. Septa are relatively strongly and regularly folded throughout shell. Tunnel angles are narrow. Chomata are asymmetrical; their tunnel sides are nearly vertical and their poleside are gentle.

*Remarks*:—It is characterized by its elongate fusiform, thin spirotheca, rather regularly fluted septa and others. These features may agree with those of *Triticites gracilitatus* SKINNER & WILDE (1965) from the Wolfcampian of New Mexico. However, it is represented by a incomplete and tangential section.

*Occurrence*:—A specimen was obtained from the Copacabana group at Ambo, Ambo Province, Huanuco Department, Peru. The associated fossils are *Schwagerina* cfr. *colemanni*, *Pseudofusulina* sp. indet., *Triticites* aff. *titicacaensis* and *T.* sp. indet..

*Repository*:—Reg. no. Micropal. Coll. N. S. M. 838.

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## Explanation of Plate I

- Figs. 1-2. *Schwagerina* cfr. *colemanni* THOMPSON
1. Axial section..... × 14 (M. C. N. S. M. 833)
  2. Sagittal section ..... × 14 (M. C. N. S. M. 834)
- Fig. 3. *Pseudofusulina* sp. indet.  
Axial section (somewhat oblique)..... × 14 (M. C. N. S. M. 835)
- Fig. 4. *Triticites* aff. *titicacaensis* DUNBAR & NEWELL  
Axial section (somewhat oblique)..... × 14 (M. C. N. S. M. 836)
- Fig. 5. *Triticites* sp. indet.  
Axial section..... × 14 (M. C. N. S. M. 837)
- Fig. 6. *Leptotriticites* sp. indet.  
Tangential section ..... × 14 (M. C. N. S. M. 838)

