Permian Ammonoids from the Loei area, Northeast Thailand

Ishibashi, Takeshi
Faculty of Sciences, Kyushu University

Fujikawa, Masayuki
Faculty of Sciences, Kyushu University

Nakornsri, Nikorn
Geological Survey Division, Department of Mineral Resources

https://doi.org/10.5109/1546072

出版情報：九州大学大学院理学研究院紀要 : Series D, Earth and planetary sciences. 29 (2), pp.175-196, 1996-12-25. Faculty of Science, Kyushu University
バージョン：
権利関係：

Mem. Fac. Sci., Kyushu Univ., Ser. D, Earth Planet. Sci., Vol.XXIX, No.2,
pp. 175-196. text-figs. 1-9, tables 1-5, plates 11-13, December 25, 1996

Permian Ammonoids from the Loei area, Northeast Thailand

Takeshi ISHIBASHI, Masayuki FUJIKAWA and Nikorn NAKORNSRI*

Abstract

The Paleozoic formations in Thailand are distributed at northern and peninsular parts of the country. The geological survey was carried around Loei, Changwat Loei, northeast Thailand and some Permian ammonoids and fusulinids were collected from the E-Lert Formation of the Saraburi Group and only the former systematically described in this paper. The ammonoid and fusulinid species recognized from silicious shale and limestone from 4 localities are as follows; *Agathiceras* aff. *suessi* GEMMELLARO, *Propinacoceras* sp., *Artinskia loeiensis* sp. nov., *Properrinites boesei* (PLUMMER and SCOTT), *Popanoceras* sp., *Parafusulina multiseptata* (SCHELLWIEN), *Pseudodoliolina ozawai* YABE and HANZAWA, *Monodiexodina* sp., *Chusenella* sp., *Schubertella* sp. and *Triticites* sp.

The geological age based on these fossils in the surveyed areas are considered as early Middle Permian. The exotic block or body of limestone and calcareous shale in the Huai I-Loet Formation indicates the same or older geological ages as follows; Locality 1-middle Early Permian (Sakmarian), Locality 2-early Middle Permian (Bolorian) and Locality 4-early (Asselian) to middle Early Permian (Sakmarian). The fusulinid fossils have been reported from a number of localities in Thailand, and the biostratigraphic correlation in the Upper Paleozoic has been depended on the fusulinid fossils. On the other hand, the ammonoid biostratigraphy is very useful for the international correlation of the non-calcareous sediments. Those ammonoids except for *Agathiceras* aff. *suessi* GEMMELLARO and *Propinacoceras* sp. are reported from Thailand for the first time. *Properrinites boesei* (PLUMMER and SCOTT) and *Artinskia loeiensis* sp. nov. are also reported from the Indochina regions for the first time.

Introduction

The Paleozoic sediments are widely destributed in Thailand, but almost all paleontological studies have been carried out on foraminifers, bryozoans, brachiopods and plant fossils. The Paleozoic cephalopods are only described from the Ordovician (KOBAYASHI, 1961; INGAVAT *et al.*, 1975). In the Upper Paleozoic the first paleontological report was the Carboniferous ammonoids from Khuan Din So, Phatthalung, Peninsula Thailand by REED (1920). The occurrence of the Permian ammonoids have been well known and *Agathiceras* aff. *suessi* GEMMELLARO and *Propin-*

Manuscript received September 30, 1996; accepted November 5, 1996
*Geological Survey Division, Department of Mineral Resources, Bangkok, 10400, Thailand

acoceras sp. have been described from north Thailand (*i.e.*, PITAKPAIVAN *et al.*, 1969). Recently *Agathiceras mediterraneum, Miklukhoceras* cf. *pamiricum*, and *Perrinites* cf. *hilli* were reported by GLENISTER *et al.* (1990) on the basis of the material deposited at Chulalongkorn University of Thailand, which had collected from Muaglek, Nakhon Ratchasima, south-central Thailand.

The biostratigraphy of the Paleozoic formations distributing around Loei (Fig. 1), northeast Thailand have been studied by one of junior author, N. NAKORNSRI for a long time and a few of well preserved specimens of ammonoids and fusulinids were collected around the city on the basis of his advice. The some fusulinids have already described by some authors (IGO, 1972 ; TORIYAMA, 1982) from about 20 km south, Wang Saphung area. In this paper we will only describe the Permian ammonoids, but fusulinids will be described in seperate paper.

The Permian stage terminology is proposed by many authors, it is divided into three stages on the one hand and into two stages on the other hand. Furthermore stage names are proposed on the basis on the each realm of world. We use here the three stage names in the Tethyian Permian proposed by LEVEN (1992), as the Permian stratigraphic correlation on the basis of fusulinids has been accepted in Thailand (TORIYAMA, 1984 ; INGAVAT, 1984)

We would like to express our cordial thanks to Dr. Phisit DEERADILOK, Director of the Geological Survey Division, Department of Mineral Resources (DMR), Thailand for his kind help in giving us every facility for field work. Our sincere thanks are due to staffs of the biostratigraphic research group in 1988 for their support in the field work. We wish to express our deep gratitude to Professor

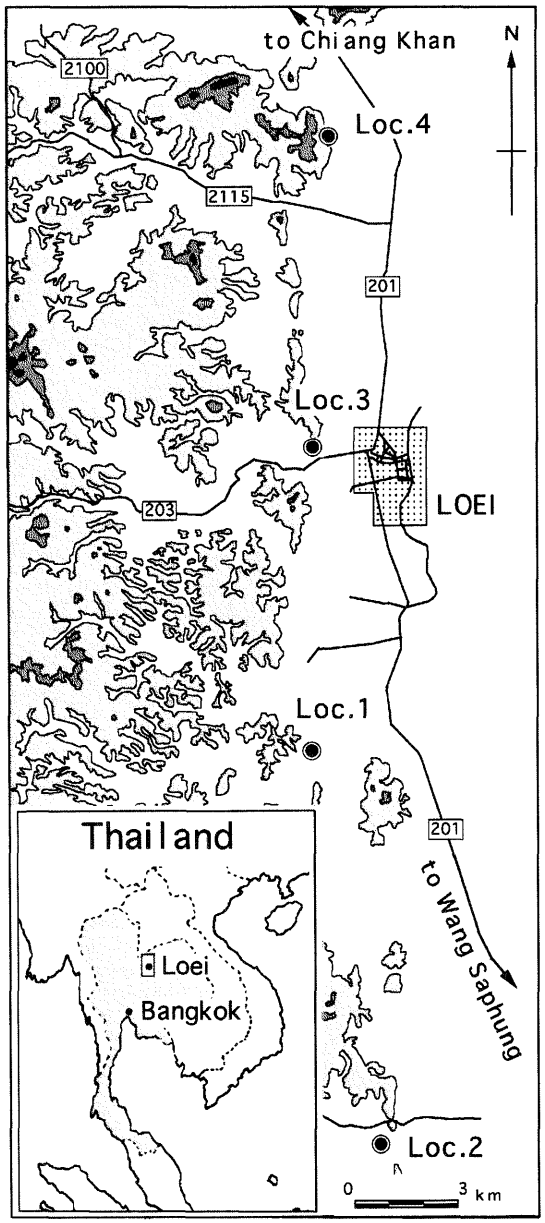


Fig. 1. Map showing sample localities in Loei district.

Tamio NISHIDA of Saga University for his valuable advice on the Permian ammonoids.

The specimens with a prefix TF are deposited at the Geological Survey Division, Department of Mineral Resources, Thailand.

Outline of Geology

The study area is situated at the northern and southern parts of Loei-City, Changwat Loei, north Thailand. The Carboniferous and Permian rocks, included as the Ratburi Group, seem to be rather extensively distributed in the Loei area and also further north along the Mae Khong River. The Lower Paleozoic sediments crop out sporadically in the former sediments and yield such fossil as brachiopods, corals and trilobites (YANAGIDA *et al.*, 1988 ; KOBAYASHI and SAKAGAMI, 1989) The Permian rocks consist mainly of dark gray to pale brown shale and thin intercalations of impure, well bedded, or massive, dark colored to almost white limestones. The Permian deposits distributed in the above-mentioned areas comprise white to pale gray, mas-

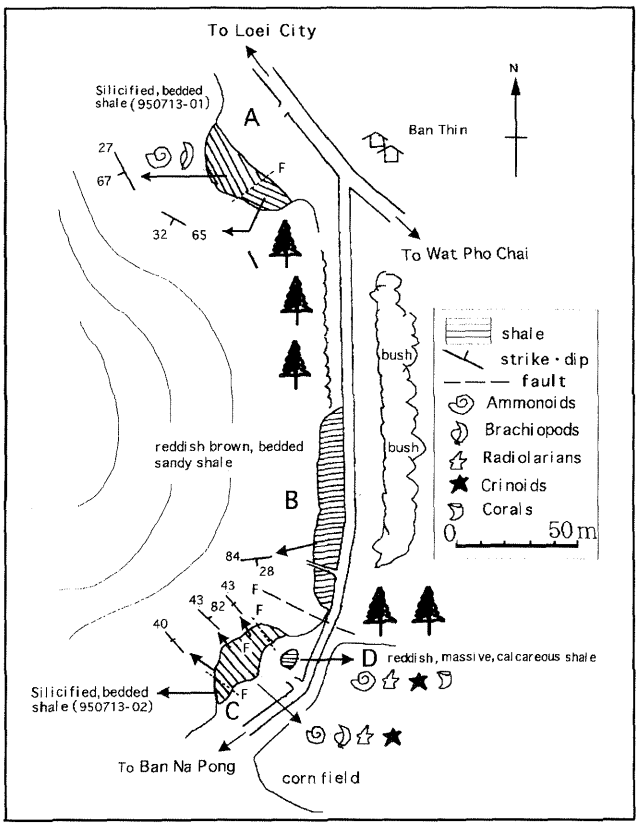


Fig. 2. Sketch map of locality 1.

Fig. 3. Photograph of outcrop at locality 1, silicified, bedded shale (950713-02).

sive to thickly bedded limestone (Ratburi Limestone) and argillaceous rocks. The limestone forms isolated hills surrounded by steep cliffs and argillaceous sediments distributed in lowland areas. Owing to heavy vegetation, detailed stratigraphic work is very difficult.

The occurrence of Permian ammonoids, *Agathiceras* aff. *suessi* and *Propinacoceras* sp. had been known around Loei (PITAKPAIVAN *et al.*, 1969), but the bearing specimens could not come to hand for a long time. In 1988 and 1995 we collected well preserved ammonoids from calcareous shale and fusulinids from intercalated or exotic blocks of limestone, which crop out along the Route 201 from south to north direction near Loei as follows (Fig. 1);

(1) Locality 1 (Ban Na Pong): Pale purple to pale gray, bedded shale about 5 to 15 cm thick is cropped out widely north to south(Fig. 2). This shale is very hard, siliceous and contains fragmental ammonoids, brachiopods and crinoid stems (Fig. 3). The reddish, massive, hard siliceous shale block about 2m thick is situated between those strata. These reddish shale contains well preserved ammonoids, crinoids, corals and brachiopods.

(2) Locality 2 (Huai I-Loet, Reservoir: Huai Sam Pot in PITAKPAIVAN, 1969): This outcrop is situated the east side of the reservoir. Width is about 50 m. Gray to pale gray, thin bedded limestone (Fig. 2) about 10 to 30 cm thick in which intercalated thin shale layers. Between the upper and lower parts of this calcareous sediment, pale yellowish shale crop out (Fig. 4). The gray limestone block (Fig. 5) are intercalated in the upper part of bedded calcareous limestone. This limestone contains some kinds of fusulinids as follows; *Parafusulina multiseptata* (SCHELLWIEN), *Monodiexodina* sp., *Pseudodoliolina ozawai* YABE and HANZAWA, *Chusenella* sp. and *Schubertella* sp.

(3) Locality 3 (Wat Chonlathararam): Pale gray bedded shale and black to gray bed-

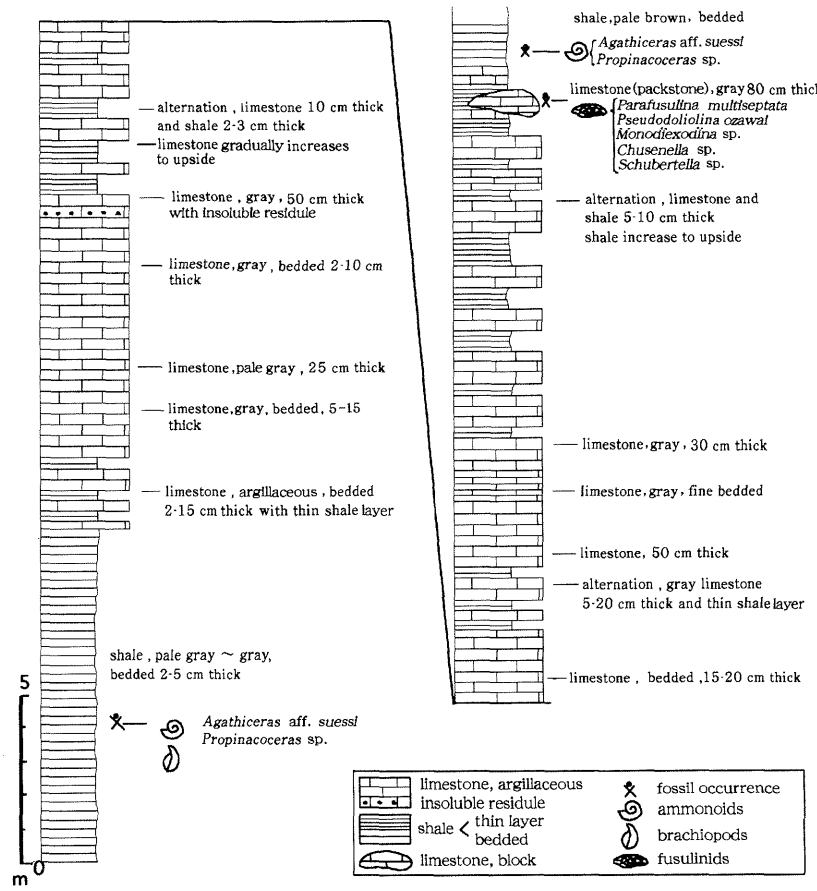


Fig. 4. Columnar section of loc. 2, Huai I-Loet Reservoir.
(Type locality of the Huai I-Loet Formation)

ded limestone. The shale contains ammonoids and brachiopods and the limestone contains calcareous algae and gastropods.

(4) Locality 4 (Wat Tham Pha Pu): The limestone and shale crop out around the Wat(=temple) Tham Pha Pu. The limestone is intercalating in the pale gray shale bed of the Huai I-Loet Formation, and estimated about 100m thick. The shale is considerably metamorphosed by intrusive rocks but yields some ammonoid fragments. The limestone contains indeterminable ammonoids but one species of fusulinid, *Triticites* sp., is recognized in it.

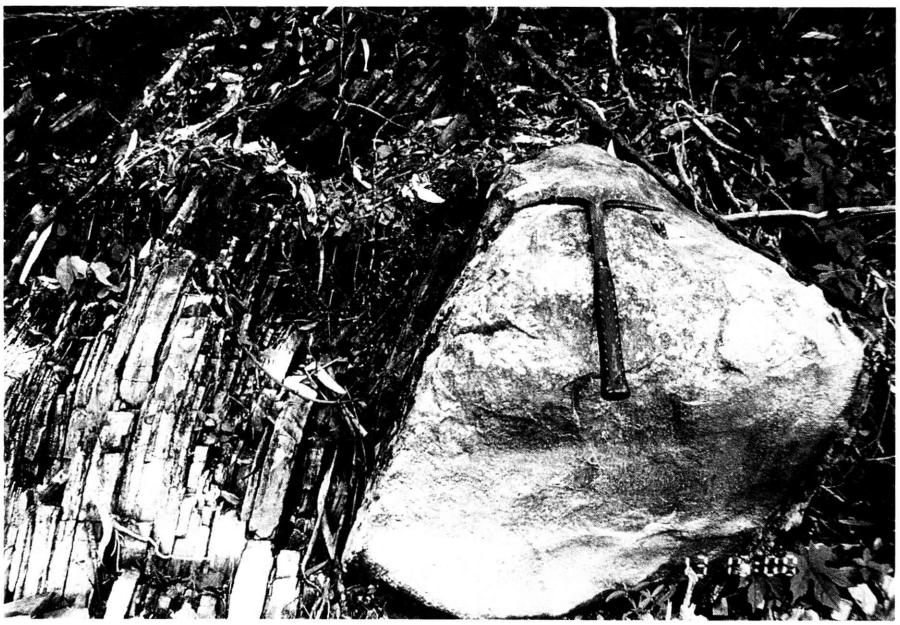


Fig. 5. Photograph of outcrop of limestone block in alternating beds at locality 2.

Permian ammonoids of Thailand

The Permian formations are widely distributed at Thailand and adjacent area, neverthless Permain ammonoids have scarecely reported from these areas for long time. The geological ages of the formations (Saraburi Series) in Thailand have mainly decided based on the fusulinid biostratigraphy (*i.e.*, TORIYAMA, 1975, 1978 ; INGAVAT *et al.*, 1978 ; INGAVAT, 1984).

The Permian ammonoids appeared in the publication of Fossils of Thailand 2 (PITAKPAIVAN *et al.*, 1969) and two species, *Agathiceras* aff. *suessi* GEMMELLARO and *Propinacoceras* sp., were described. GLENISTER *et al.* (1990) reported the Lower and Middle Permian ammonoids on the basis of the material deposited at Chulalongkorg University such as *Miklukhoceras* cf. *pamiricum* PAVLOV, *Agathiceras mediterraneum* TOUMANSKAYA, *Perrinites* cf. *P. hilli* (SMITH) and *Prostacheoceras* cf. *P. oshense* (TOUMANSKAYA) without illustrations. ISHIBASHI *et al.* 1990, 1994) described the Upper Permain (Dorashamian) ammonoids from Doi Pha Phlung, northern district of Lampang as follows; *Tapashanites yawalakae* ISHIBASHI *et al.*, *Paratirolites nakornsri* ISHIBASHI *et al.*, *Pseudogastrioceras* sp., *Pseudogastrioceras* aff. *szechuanense* CHAO et LIANG, and *Xenodiscus* ? sp.

The following ammonoids collected from four localities of Loei district are described below in this paper; *Agathiceras* aff. *suessi*, *Properrinites boesei*, *Popanoceras* sp., *Artinskia loeiensis* sp. nov. and *Propinacoceras* sp. of which *Properrinites* and *Artinskia* are reported from Indochina district as well as Thailand for the first time.

Systematic Paleontology

Class CEPHALOPODA CUVIER, 1797
Subclass AMMONOIDEA ZITTEL, 1884
Order GONIATITIDA HYATT, 1884
Suborder GONIATITINA HYATT, 1884
Superfamily AGATHICERATACEAE ARTHABER, 1911
Family AGATHICERATIDAE ARTHABER, 1911
Genus *Agathiceras* GEMMELLARO, 1887
Type species.—*Agathiceras suessi* GEMMELLARO, 1887
Agathiceras aff. *suessi* GEMMELLARO
[Pl. 11, Figs. 1-10, Text-fig. 6]

Compare.—

1887. *Agathiceras suessi* GEMMELLARO, *Giorn. Sci. Nat. Ed. Econ.*, **19**, pp. 79-80, pl. 6, figs, 1-4;pl. 7, fig. 36.
1888. *Agathiceras suessi*, GEMMELLARO, *Ibid., appendiche,* pp. 22-24, pl. C., fig. 20; pl. D, fig. 13.
1888. *Adrianites suessi,* MOJSISOVICS, *Acad. Imp. Sci., St.-Petersberg, Mem.* 7e, ser., t. **36**, (5), p. 19.
1927. *Agathiceras suessi*, DIENER. *Leitfossilien des marinen Perm.* p. 68,pl. XIII , fig. 2 ; text-fig. 6e (reproduced from GEMMELLARO, 1887)
1931. *Agathiceras suessi*, TOUMANSKAYA, *Geol. Surv., Palaeont. Stratigr.,* pp. 55-56, **103**, pl. 4, figs. 20-29; pl. 6, fig. 25, text-fig. 39A-b.
1937. *Agathiceras suessi*, PLUMMER and SCOTT, *Univ. Texas Bull.,* (3701), pt. 1, pl. 29, figs. 1-2. (reproduced from GEMMELLARO, 1887)
1939. *Agathiceras suessi*, MARTYNOV, *The atlas of leading forms of the fossil fauna, USSR,* VI, Permian, p. 178, pl. 44, fig. 1, text-fig. 73.
1940. *Agathiceras. suessi,* MILLER and FURNISH, *Geol. Soc. Amer., Spec. Pap.,* p. 118, pl. 31 , figs. 8-12
1957. *Agathiceras suessi*, GEMMELLARO *in* MOORE (ed), *Treatise on Invertebrate Paleontology* (L) , p. 51, fig. 57.
1957a. *Agathiceras suessi,* MILLER and FURNISH, *J. Paleont.*, **31**, (4), pp. 705-712, pl. 83.
1965 . *Agathiceras.* cf. *suessi,* HAYASAKA, *Trans. Proc. Palaeont. Soc. Japan,* N.S., (57), pp. 19-21, pl. 2, figs. 3, 4a-b., text fig. 2.
1969 . *Agathiceras* aff *suessi,* PITAKPAIVAN *et al., Fossils of Thailand* , 2, p. 57-59.
1980. *Agathiceras suessi*, LEE, *Geol. Palaeont. SE Asia,* **21**, p. 68, Pl. 3, figs. 13-15.

Material.—Ten specimens (TF2337-2346) are figured. They are mostly squashed, and fragmental.

Descriptive remarks.—The conch is thickly discoidal or subdiscoidal, strongly involute and well ornamented with fine spiral striation. The striation is counted about 34 on the flank which is considered fully exposed. The intercostal spaces between striations are somewhat narrower than the line toward ventral zone. The umbilicus

is very small, but not closed. The suture is simple, consisting of three lateral saddles at least and three lateral lobes in our matrial (Pl. 11 Fig. 7). The lateral saddles are rounded at the top, and lateral lobes are slightly pointed at the bottom. *Agathiceras* is is one of the famous genera in the Permian ammonoids and is widely distributed all the world over, almost exclusively in the Permian formations, being found only rarely in the Upper Carboniferous (RUZHENCEV, 1937).

The occurrence of *Agathiceras* have been known from the 1960's in Thailand. The Thai materials, 40 specimens, were collected from the Permian sediments distributing around Loei, of which ten specimens were examined here. PITAKPAIVAN *et al.* (1969) described *Agathiceras* aff. *suessi* from Loei and Khon Kaen districts in Thailand. The present specimens are very similar to those in lateral features and sutureline. These of *Agathiceras* aff. *suessi* are closely allied to *A. suessi* but its definite specific determination is not given till the better material comes to hand.

GLENISTER *et al.* (1990) described Lower Permian ammonoids, *Agathiceras mediterraneum* TOUMANSKAYA, deposited at the Chulalongkorn University, with registor numbers PTF2-4. These materials came from Amphoe Muaglek,* Changwat Nakhorn Ratchasima, approximately 150 km NE of Bangkok. They described another two species of ammonoid and regarded the Thai assemblage as representative of the upper

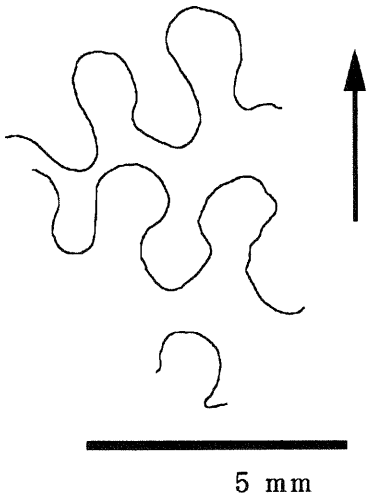
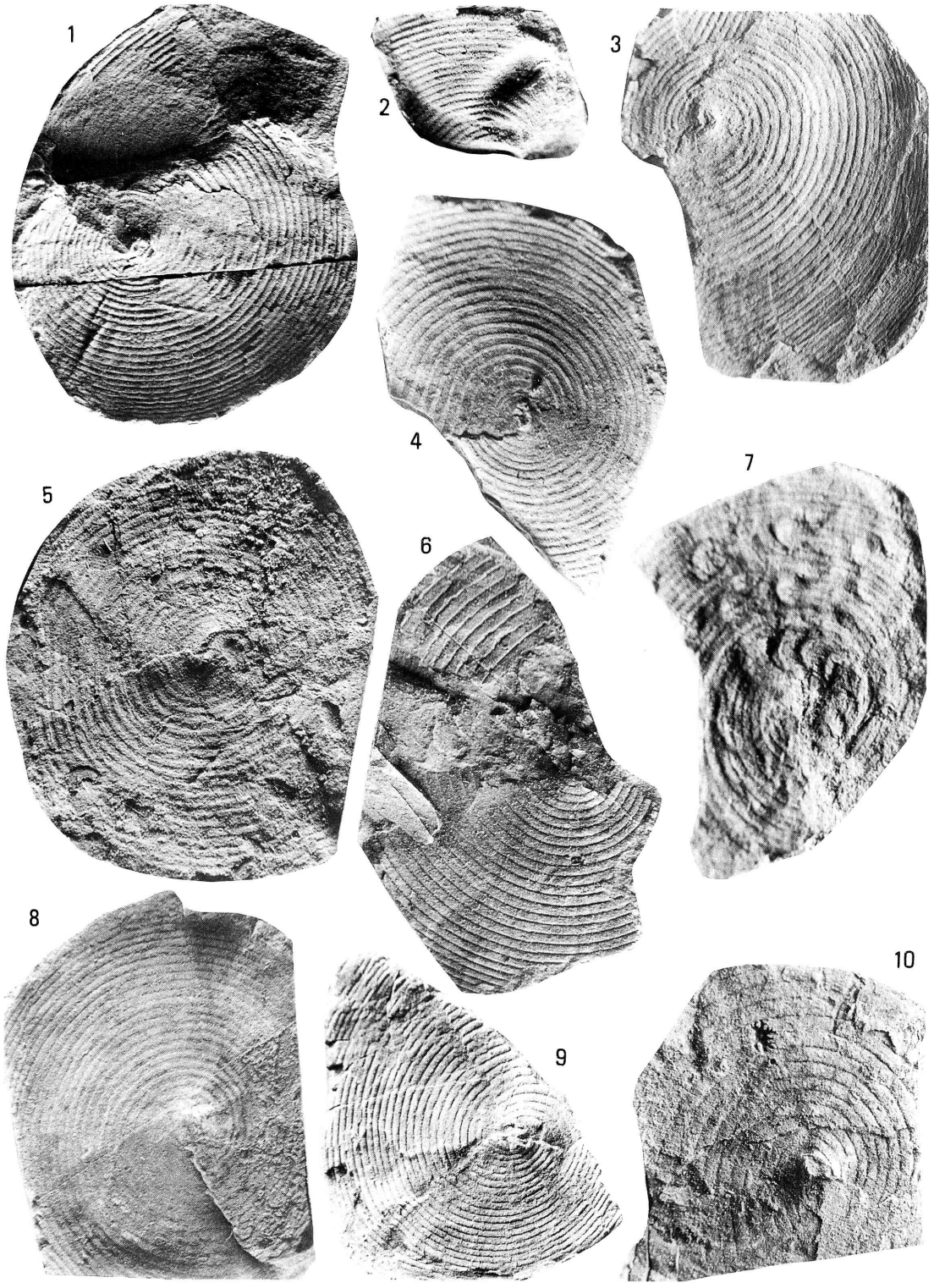


Fig. 6. Suture-line of *Agathiceras* aff. *suessi* GEMMELLARO.
Pl. 11, Fig 7.

Explanation of Plate 11

Figs. 1-10. *Agathiceras* aff. *suessi* GEMMELLARO
Figs. 1. (TF2337), 3-5 (TF2339-2341), 7 (TF2343) and 8 (TF2344). Loc. **3**
Figs. 2. (TF2338) and 10 (TF2346). Loc. **2**
Figs. 6. (TF2342) and 9 (TF2345). Loc. **1** (Figs. 1-6, 8-10×2 ; Fig. 7×4)

* The locality is not Amphoe Packchong but Amphoe Muaklek of Ch. Nakorn Ratchasima according to personal communication from Dr. Malai who collected these specimens.



T. ISHIBASHI *et al.* : Permian Ammonoids from Loei, Thailand

Artinskian Baigendzhinian Substage. *Agathiceras suessi* was described with *Popanoceras* cf. *scrobiculatum* GEMMELLARO and *Adrianites elegans* GEMELLARO from Paphang, Malaysia by LEE (1980). He considered this assemblage as an early Guadalupian (Wordian) age.

Occurrence.—*Agathiceras* aff. *suessi* occurs at the localities 1-4, around Loei City, Changwat Loei. The present species are associated with *Propinacoceras* sp. late Early Permian (Yahtashian)-early Middle Permian (Bolorian).

Table 1. Measurememt of *Agathiceras* aff. *suessi* GEMMELLARO

Pl.	Fig.	D	H	W	U	H/D	W/H	U/D
11	1	33.8	12.5	-	-	0.37	-	-

D : Diameter, H : Hight, W : Width, U : Diameter of Umbilicus (in mm)

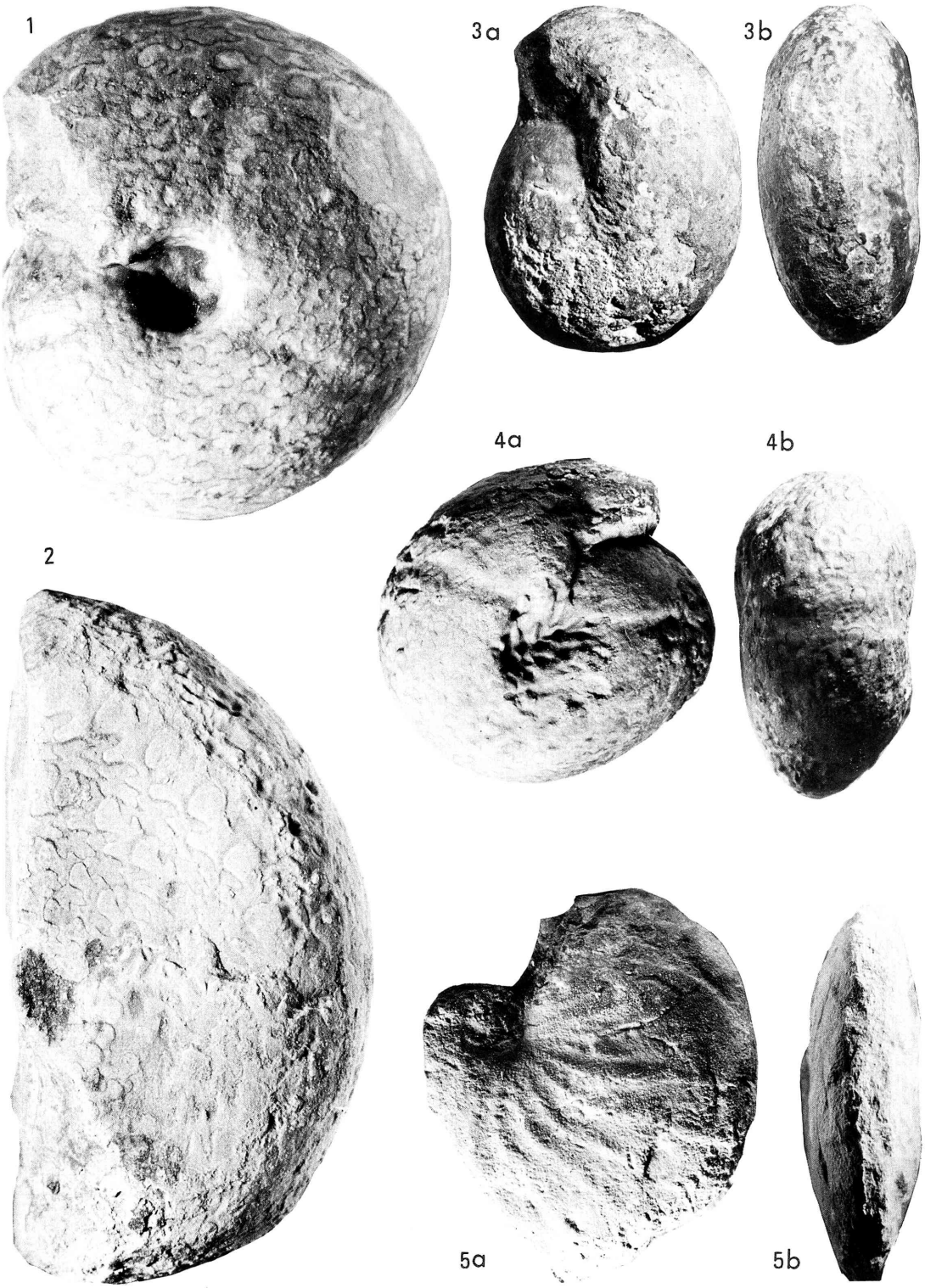
Family PERRINITIDAE MILLER and FURNISH, 1940
Genus *Properrinites* ELIAS, 1938
[= *Metaperrinites* RUZHENCEV, 1955]
Type species.-Perrinites boesei PLUMMER and SCOTT, 1937
Properrinites boesei (PLUMMER and SCOTT)
[Pl. 12, Figs. 1-4, Text-fig. 7]

Synonymy.—

1937. *Perrinites boesei* PLUMMER and SCOTT, *Texas Univ. Bull.*, (3701), p. 307-309, pl. 25, figs. 1-8, text-fig. 61g.
1938. *Properrinites boesei*, ELIAS, *J. Paleont.*, **12**, 101-104.
1940. *Properrinites boesei boesei*, MILLER and FURNISH, *Geol. Soc. Amer.*, Spec. Pap. (26), pp. 139-141 , figs. 39, 40.
1947. *Properrinites boesei boesei*, MILLER and YOUNGQUIST, *Univ. Kansas Paleont. Contr.*, Mollusca, **1**, pp. 13-15, pl. 3, figs. 1-5, text-fig. 4A.
1950. *Properrinites boesei*, RUZHENCEV, *Trudy Inst. Paleont., Pub.* 29, p. 164.
1957c. *Properrinites boesei* , MILLER, FURNISH and SCHINDEWOLF, *Treatise on Invertebrate Paleontology* (L) , pp. 52-53, fig. 61A.
1984. *Properrinites boesei*, THARALSON, *J. Paleont.* **58**, (3), pp. 804-833, figs. 1-24.

Explanation of Plate 12

Figs. 1-4. *Properrinites boesei* (PLUMMER and SCOTT)
Fig. 1. (TF2347) ×3; Figs. 2-4. (TF2348-2350)×2. Loc. **1**
Fig. 5. *Popanoceras* sp.
Fig. 5. (TF2351) ×1.5. Loc. **1**



T. ISHIBASHI *et al.* : Permian Ammonoids from Loei, Thailand

Material. — Five specimens were collected, of which four are examined here (TF2347-2350). They are well-preserved.

Description.-Shell moderately large, 59mm in diameter. Whorl strongly involute, subdiscoidal to subglobose, depressed in section; umbilicus moderate in size, its shoulder abruptly rounded, width about 14% to diameter; ventrolateral shoulder rounded; surface with three oblique, periodic constrictions cross over the ventral part, no striae and ribs; suture deeply digitate, having two well defined ventral and two dosal digitations in the first external lateral lobe.

Remarks. — The genus *Properrinites* is the first occurrence of in Thailand. This genus has been known from Lower Permian such as southern United States (MILLER and FURNISH 1940) , western United States (MILLER 1945; MILLER and FURNISH 1940), Pamir (LEONOVA, 1983), Urals (RUZHENCEV, 1950) and Timor (SMITH, 1927) etc.

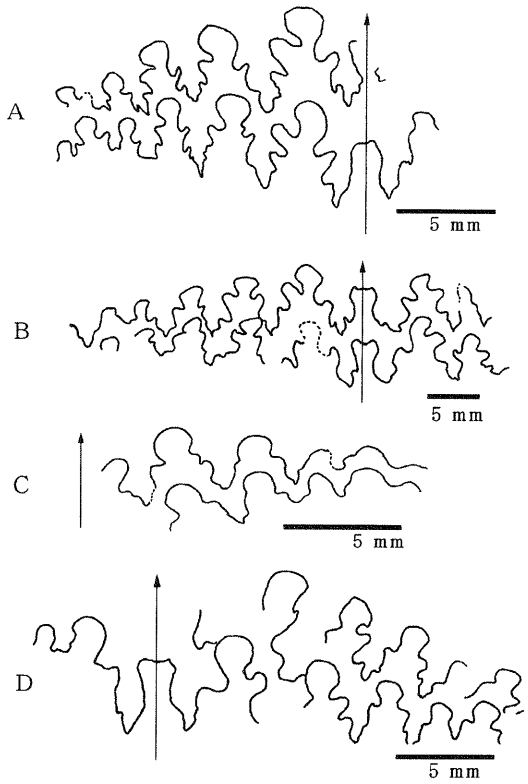


Fig. 7. Suture-lines of *Properrinites boesei* (PLUMMER and SCOTT)
A : Pl. 12, Fig. 1, B : Pl. 12, Fig. 2, C : Pl. 12, Fig. 3, D : Pl. 12, Fig. 4.

According to Elias (1938) who established *Properrinites* this genus has a gradational pattern of suture between *Shumardites* of Upper Carboniferous and *Perrinites* of Lower Permian. THARALSON (1984) revised the family Perrinitidae and then considered *Properrinites* comprised only two species as *P. boesei* and *P. cumminsi*. The mature shell (Pl. 12, Fig. 2) has flattened lateral sides, but indicates the similar ratio of H/D to those of other Thai specimens (Table 2) and a pattern of suture to that of *Properrinites boesei* group in having two ventral and two dosal digitations in the first external lateral lobe. The present specimens are almost certainly identified with *Properrinites boesei* described by PLUMMER and Scott (1937) from the Admiral Formation, north-central Texas, North America based on surface features, patterns of suture-line and conch proportions.

The suture of the present specimens is somewhat similar to that of immature stage of *P. cumminsi* (*i.e.*, *"P. deroeveri"* originally described by SMITH (1927) from Timor), but has more complex pattern than the latter in mature stage.

Occurrence.—Locality 1. Ban Na Pong, Changwat Loei, Northern Thailand. The material occurs in the reddish calcareous shale (D in Fig. 2) together with *Popanoceras* sp. and *Artinskia loeiensis* sp. nov. middle Early Permian [Sakmarian].

Table 2. Measurememts of *Properrinites boesei* (PLUMMER and SCOTT)

Pl.	Fig.	D	H	W	U	H/D	W/H	U/D
12	1	26.4	12.7	-	3.8	0.48	-	0.14
12	2	59.0	32.0	26.8	7.0	0.54	0.84	0.12
12	3	30.2	17.1	14.4	-	0.57	0.84	-
12	4	24.2	13.1	14.0	-	0.54	0.98	-

(in mm)

Superfamily CYCLOLOBACEAE ZITTEL, 1895
Family POPANOCERATIDAE HYATT, 1900
Subfamily POPANOCERATINAE HYATT, 1900
Genus *Popanoceras* HYATT, 1884
[=*Gemmellaroceras* TOUMANSKAYA, 1937 (*non* HYATT, 1900);
Tauroceras TOUMANSKAYA, 1938; *Neopopanoceras* SCHINDEWOLF, 1939]
Type species—*Goniaites sobolewskyanus* DE VERNEUIL, 1845
Popanoceras sp.
[Pl. 12, Fig. 5]

Material.—Only a single specimen is examined here. (TF 2351)

Descriptive remarks.—Popanoceratids are well known as cosmopolitan Permian ammonoids. The conch is discoidal or subdiscoidal, involute; flank is laterally compressed. The ribs are convex and the venter is narrowly rounded. The umbilicus is

very small. The suture-line is not visible.

It is reasonable to place this specimen in the genus *Popanoceras* on the basis of whorl characteristics and occurrence with *Properrinites boesei* and *Artinskia loeiensis* in the same block. *Popanoceras* cf. *sculobiculatum* GEMMELLARO described from the Middle Permian in Malaysia by LEE (1980) is different from the present specimen having broad ribs near ventrolateral shoulder. The present specimen is closely similar to *P. sololewskyanum* illustrated by MILLER and FURNISH (1940, pl. 32, figs. 1-2, not pl. 31, figs. 13-14) having broad and convex ribs on the flank. This species was originally described by DE VERNEUIL (1845) from the Artinskian of Gil-tau Hill, Aktubinsk district, Russia and was designated as the type species by Hyatt (1883). Unfortunately we could not available the original description.

Some species of *Popanoceras* have been known from western United States (MILLER *et al.*, 1947, 1957b), Tunisia (MILLER and FURNISH, 1957a), Australia (GLENISTER and FURNISH, 1961) and Urals (RUZHENCEV, 1956) etc.

Occurrence.—Locality 1, Ban Na Pong, Changwat Loei, Northern Thailand. The specimen was collected from the reddish calcareous shale (D in Fig. 2), together with *Properrinites boesei, Artinskia loeiensis* sp. nov. middle Early Permian [Sakmarian]

Table 3. Measurement of *Popanoceras* sp.

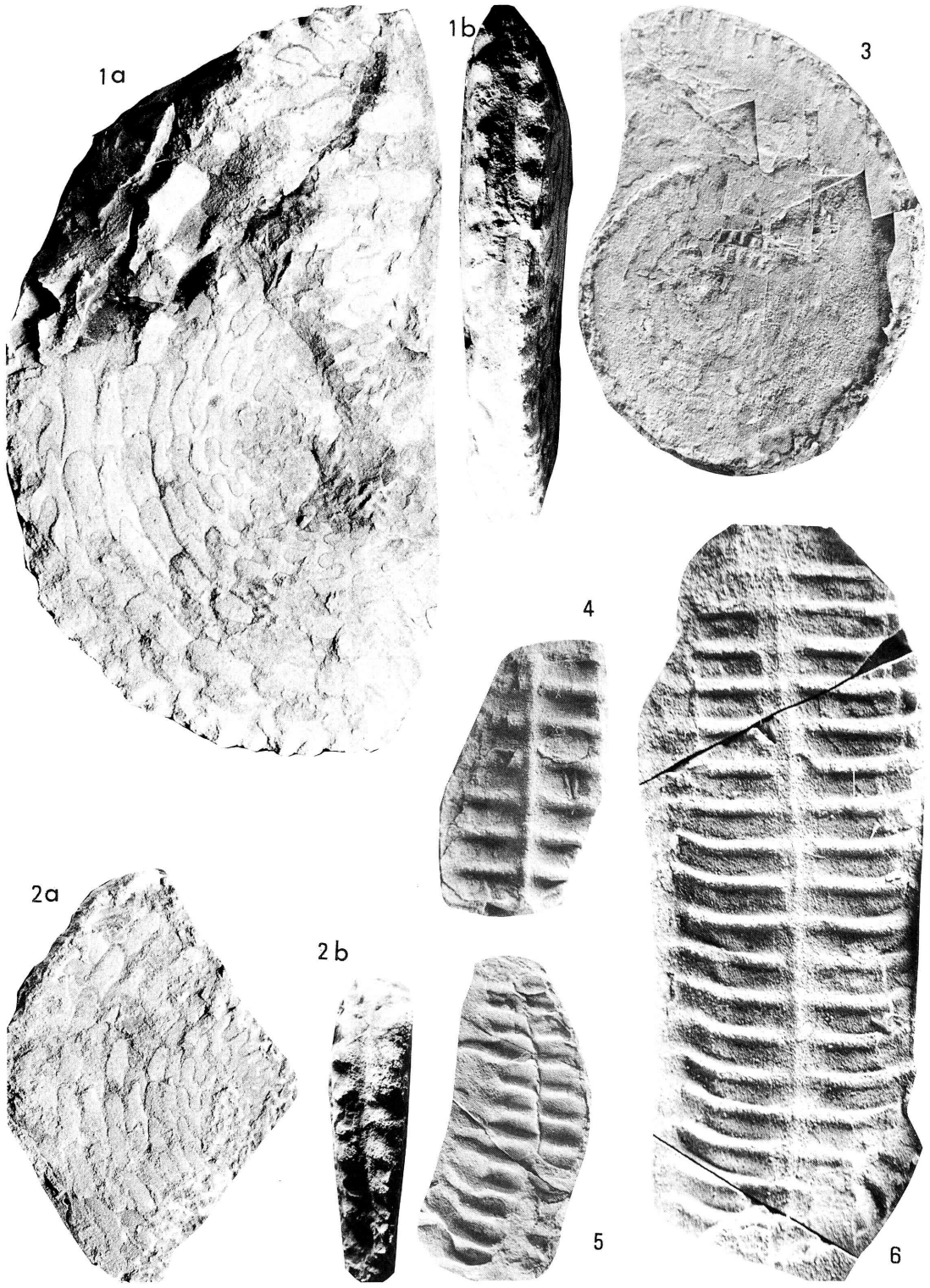
Pl.	Fig.	D	H	W	U	H/D	W/H	U/D
12	5	-	18.0	8.8	-	-	0.49	-

(in mm)

Order CERATITIDA HYATT, 1884
Suborder PROLECANITINA MILLER and FURNISH, 1954
Family MEDLICOTTIDAE KARPINSKY, 1889
Genus *Propinacoceras* GEMMELLARO, 1887
[=*Artioceras* RUZHENCEV, 1947]
Type species.— *Propinacoceras beyrichi* GEMMELLARO
Propinacoceras sp.
[Pl. 13, Figs. 3-6]

Explanation of Plate 13

Figs. 1 and 2. *Artinskia loeiensis* sp. nov.
Figs. 1 and 2. (TF2352-2353) ×2. Loc. **1**
Figs. 3-6. *Propinacoceras* sp.
Fig. 3. lateral view (TF2354) ×1. Loc. **1**
Fig. 4. ventral mould (TF2356) ×2. Loc. **1**
Fig. 5. ventral cast (TF2355) ×2. Loc. **3**
Fig. 6. ventral mould (TF2357) ×2. Loc. **2** (Fig. 3,×1 ; Fig. 4·6×2)



T. ISHIBASHI *et al.* : Permian Ammonoids from Loei, Thailand

Material.- Eleven specimens come to hand. Four of those are examined here (TF 2354-2357). The ventral parts consist of a ventral cast (TF 2355) and two moulds (TF 2356-2357).

Descriptive remarks.—The squashed specimen (Plate.13-fig.6) is barely distinguished by outline of venteral shoulder as *Propinacoceras*. The suture-line and surface ornament are not distinguished. Judging from lateral views, shell is involute and discoidal, whorl is strongly compressed. The short ribs like node sculpture are recognized at the ventrolateral area. The venter is almost flat with a furrow separating two rows of transversely elongate nodes.

Propinacoceras sp. had been already famous for the Permian ammonoid as the same as *Agathiceras* aff. *suessi* in Thailand (PITAKPAIVAN *et al.*, 1969). The specimens were collected from the same locality of them (Locality 2) and from the shale beds of other localities (Loc. 1, 3 and 4).

The present specimens are not well preserved ones, but are similar to that of *Propinacoceras simile* described by HANIEL (1915) from Timor on the sculpture around ventrolateral area, but its definite specific name is not given till the better material comes to hand. The genus *Propinacoceras* has been known from western Australia (TEICHURT, 1942), Japan (HAYASAKA, 1963, 1965), Pamir (LEONOVA 1984), Urals (RUZHENCEV, 1956), Australia (GLENISTER and MILLER, 1961), Timor (HANIEL, 1915) and so on.

Occurrence.- Silicified shale of locality 1 (Ban Na Pong), locality 2 (Huai I-Loet Reservor), locality 3 (Wat Chonlathararam) and locality 4 (Wat Tham Pha Pu), Changwat Loei, northern Thailand. This species coexists with *Agathiceras* aff. *suessi* GEMMELLARO. Late Early Permian [Yahtashian]—early Middle Permian [Bolorian].

Table 4. Measurement of *Propinacoceras* sp.

Pl.	Fig.	D	H	W	U	H/D	W/H	U/D
13	3	70.0	40.0	-	-	0.57	-	-

(in mm)

Genus *Artinskia* KARPINSKY, 1926
[=*Proscicanites* TCHERNOW, 1907 (*num. nud*).;
Proscicanites TOUMANSKAYA & BORNEMAN, 1937;
Synartinskia RUZHENCEV, 1939; *Akmilleria* RUZHENCEV, 1940;
Aktubinskia RUZHENCEV, 1947]
Type species.— *Goniatites falx* EICHWALD
Artinskia loeiensis sp. nov.
[Pl. 13, Figs. 1and 2, Text-fig. 8]

Holotype.—TF2352 (Pl. 13, Fig. 1a-b)
Derivation of name.—The specimen was collected from Loei, northeast Thailand,

where the Permian strata distribute widely.

Material.—Two specimens (TF2352-2353) are examined here.

Diagnosis.-Shell moderate in size, discoidal, involute, laterally compressed. Venter flattened with ventrolateral shoulder and a groove separating two rows of nodes. Sutures with first lateral saddle high and digitate.

Description.-Shell moderate in size, discoidal, involute. Flank laterally compressed, with flat lateral sides. Ventral side flat and divided by groove. Venter nearly flat, but bears a prominent median groove. The ventrolateral shoulders narrowly rounded. On each side of ventral groove separating two rows of prominent rounded nodes, which transversely elongate and extend on to the lateral zones. On the fragmental outer mould of the flank near the ventral shoulder, there remains sinuous growth lines. Umbilicus very narrow but not closed. Suture-forms missing ventral lobe. The first lateral saddles broad, and five to seven small lobes developed in its adoral portion. The first lateral lobe moderately small, asymmetrical, and divided. The second lateral saddle high, narrow and rounded. The second lateral lobe large and prominently bifid.

Table 5. Measurements of *Artinskia loeiensis* sp. nov.

Pl.	Fig.	D	H	W	U	H/D	W/H	U/D
13	1	63.0	38.0	8.7	-	0.60	0.23	-
13	2	-	-	5.5	-	-	-	-

(in mm)

Remarks.—The medlicottid ammonoids are known to occur in many regions of the world. They have similar sculptures on lateral sides, but can be distinguished on the characteristics of venter and suture-lines. The present specimens well bear the characters to identify the specific name.

Thai material has more simple structure of suture than that of *Propinacoceras* sp. described here. It is easy to define the present specimens belong to the genus *Artinskia* KARPINSKY. The species of *Artinskia* is only known from Urals of CCCR and USA. *Artinskia huecoensis* described by MILLER and FURNISH (1940) from the Guadalupe Mountain region of USA is similar to the present species on characters of ventral nodes and suture, but the latter has deeper groove, larger nodes and more simple suture pattern. The type-species, *Artinskia falx*, from the Urals differs from the Thai species in having more complex first saddle. *Artinskia* sp. was recently described by Ehiro (1995) from the Lower Permian of Kitakami Massif, northeast Japan, this specimen has a deep groove and stong nodes on venter, but other characters are not preserved.

Occurrence.— Locality 1. Reddish shale at Ban Na Pong , Changwat Loei, northern Thailand. This species is together with *Properrinites boesei* (PLUMMER and SCOTT), *Popanoceras* sp. middle Early Permian [Sakmarian].

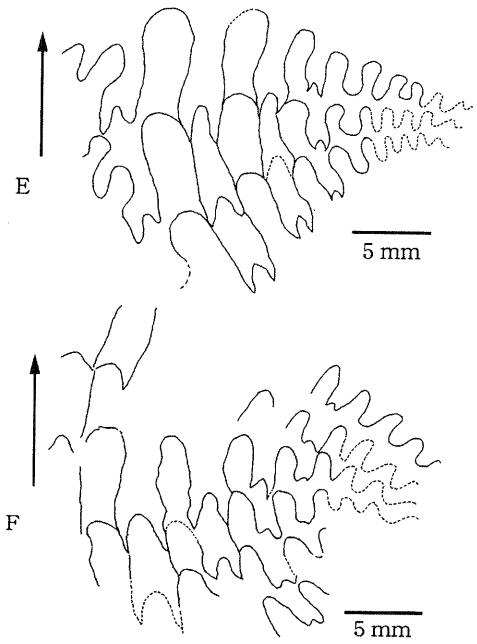


Fig. 8. Suture-lines of *Artinskia loeiensis* sp. nov.
E: Pl. 13, Fig. 1, F : Pl. 13, Fig. 2,

Concluding remarks

The ammonoid and fusulinid fossils collected from the surveyed area (Loc. 1-4) belonging to the Huai I-Loet Formation, Ratburi Group are identified as follows; *Agathiceras* aff. *suessi* GEMMELLARO, *Propinacoceras* sp., *Popanoceras* sp. *Properrinites boesei* (PLUMMER and SCOTT), *Artinskia loeiensis* sp. nov., *Parafusulina multiseptata* (SCHEL SCHELLWIEN WIEN), *Pseudodoliolina ozawai* YABE and HANZAWA, *Monodiexodina* sp., *Chusenella* sp., *Schubertella* sp., *Triticites* sp., of which *Properrinites* and *Artinskia* are reported from Thailand for the first time.

The geological age of the Huai I-Loet Formation in surveyed area is estimated as early Middle Permian (Bolorian) based on the occurrence of *Agathiceras* aff. *suessi* and *Propinacoceras* sp. The block of reddish calcareous shale of Locality 1 (D) are considered that *Properrinites boesei, Popanoceras* sp. and *Artinskia loeiensis* sp. nov. indicate the age of middle Early Prmian (Sakmarian) and is estimated as the exotic sediment. The limestone block in the Locality 2 yields some fusulinids and this assemblage indicates older geological age than that of alternation of bedded shale and limestone. It is early Middle Permian (Bolorian) of age. *Triticites* sp. collected from limestone body in the Locaity 4 is no doubt the Early Permian of age, so this was also secondary deposited in the Huai I-Loet Formation.

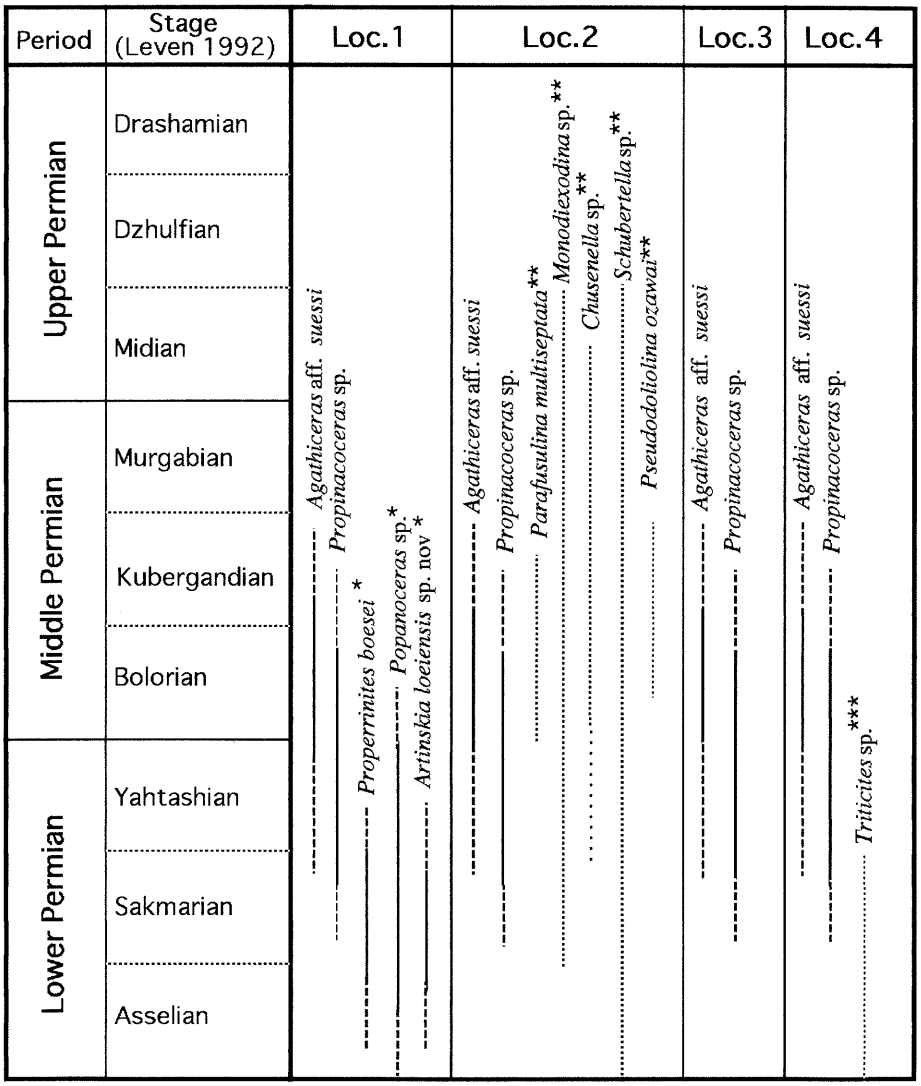


Fig. 9. Correlation chart of stratigraphic distribution of Ammonoids and Fusulinids at localities 1-4.

References

DE VERNEUIL, E. (1845): *Geologie de la Russie d'Europe et des Montagnes de l'Oural* (by MURCHISON, DE VERNEUIL and KEYSERLING), **2**, Paleontologie (by DE VERNEUIL), 1-512, pls. 1-43. (inaccesible)

DIENER, C. (1927) : *Leitfossilien des marinen Perm.* 84 p., pls. 14. Verg von Gebruder Borntraeger, Berlin.

EHIRO, M. (1995): Cephalopod fauna of the Nakadaira Formation (Lower Permian) in

the Southern Kitakami Massif, Northeast Japan. *Trans. Proc. Palaeont. Soc. Japan,* N.S., (179), 184-192, 6 figs.

ELIAS, M. K. (1938): Study of Late paleozoic ammonoids. *J. Paleont.*, **12**, 86-105, pls. 19-20.

GEMMELLARO, G. G. (1887): La fauna dei calcari con Fusulina della valle del fiume Sosionella provincia di Palermo. *G. Sci. Nat. Econ. Palermo,* **19**, 1-106, pls. 1-10

—— (1888): Appendice: La fauna dei calcari con Fusulina della valle del fiume Sosio nella provincia di Palermo, *Ibid.*, **20**, 9-36, pls. A-D.

GLENISTER, B. F. and Furnish, W. M. (1961): The Permian ammonoids of Australia. *J.Paleont.*, **35**, (4), 673-736, pls. 78-86.

—— ,——, ZUREN, Z. and POLAHAN, M. (1990) : Ammonoid cephalopods from the Lower Permian of Thailand. *J. Paleont.*, **64**, (3), 479-480.

HANIEL, C. A. (1915): Die Cephalopoden der Dyas von Timor. *Palaontologie von Timor,* **3**, (6), 1-153, pls. 46-56.

HAYASAKA, I. (1963) : Some Permian fossils from Southern Kitakami. (c), Ammonoidea *Proc. Japan Acad.*, **39**, 594-599

—— (1965) : Some cephalopods in the Permian faunule of Takakura-yama, Fukushima Prefecture, Japan (with a note on the Geology of the district, by Ichiro YANAGISAWA and Mamoru NEMOTO), *Trans. Proc. Palaeont. Soc. Japan,* N.S. , (57), 8-27, pls. 2-3.

HYATT, A. (1883): Genera of fossil cephalopods. *Boston Soc. Nat. Hist. Proc.,* **22**, 253-338.

IGO, H. (1972): Fusulinacean fossils from Thailand. Pt. 6, *Geol. Palaeont. Southeast Asia,* **10**, 63-116, pls. 9-19.

INGAVAT, R. (1984) : On the correlation of the Permian foraminiferal faunas of the western, central and eastern provinces of Thailand. *Mem. Soc. Geol. France,* N.S., (147), 96-100.

——, MUANLEK, S. and UDOMRATH, C. (1975): On the discoveries of some Permian fusulinids and Ordvician cephalopods at Ban Rai, west Thailand. *Jour. Geol. Soc. Thailand,* **1,** 81-89.

——, TORIYAMA, R. and PITAKPAIVAN, K. (1980) : Fusuline zonation and faunal characteristics of the Ratburi Limestone in Thailand and its equivalents in Malaysia. *Geol. Palaeont. Southeast Asia,* **21**, 43-56. Univ. Tokyo Press.

ISHIBASHI,T. and CHONGLAKMANI, C. (1990) : Uppermost Permian ammonoids from northern Thailand. *Jour. Southeast Asian Earth Sci.*, **4**, (3), 163-170.

—— , NAKORNSRI, N. and NAGAI, K. (1994) : Permian-Triassic boundary and fauna at Doi Pha Phlung , Northern Thailand. *Mem. Fac. Sci. Kyushu Univ. [D, Eath and Planetary Sci.],* **28**, (2), 23-40, pl. 3.

KOBAYASHI, T. (1961): On the occurrence of Ordovician Nautiloids in North Thailand. *Jap. Jour. Geol. Geogr.,* **32**, (1), 79-84, pl. 5.

—— and SAKAGAMI, S. (1989): A Permian trilobites from North Tahiland. *Proc. Jap. Acad.,* **65**, [B], (4), 67-69.

LEE, C. (1980) : Two new Permian ammonoid faunas from Malaysia.*Geol. Palaeont. Southeast Asia,* **21**, 63-72, pl. 3, Univ. Tokyo Press.

LEONOVA, T.V. (1983): Perrinitids (Goniatitida) of the Pamir region. *Paleontol. Zhur.,* (3), pp. 39-53. (*in Russian*)

—— (1984): The genera *Bamyaniceras and Miklukhoceras* (Ammonoidea) in the Pamir

region. *Ibid.*, (2), 40-50, pl. 4. (*in Russian*)

LEVEN, E. Ja. (1992) : Main events of Tethyan Permian history and fusulinids. *Permophiles* (A News Letter of SCPS), (20), 23-25.

MARTYNOV, A. (1939): The Atlas of the Leading forms of the fossil fauna USSR, VI, Permian, 1-182,

MILLER, A. K. (1945): Late Paleozoic ammonoids from the Chinati Mountains of Texas. *J. Paleont.*, **19**, 341-346.

—— and FURNISH,W.M. (1940) : Permian ammonoids of the Guadalupe Mountain Region and Adjacent Areas. *Geol. Soc. Amer. Spec. Paper* , **26**, 242 p., 44 pls.

—— and —— (1957a) : Permian ammonoids from Tunisia. *J. Paleont.*, **31**, (4), 705-712, pl. 83.

——, —— and CLARK,D.L. (1957b) : Permian ammonoids from western United States. *J. Paleont.*, **31**, (16), 1057-1058, pls. 133-134

——, —— and SCHINDEWOLF, O. H. (1957c) : Paleozoic Ammonoidea, L11-L79, *In* R. C. Moore (ed.) " *Treatise on Invertebrate Paleomtology* " , Part.L, Mollusca 4, Cephalopoda, Ammonoidea. Geol. Soc. Am & Univ. Kansa Press.

—— and YOUNGQUIST, W. (1947): Lower Permian cephalopods from the Texas Colorado River valley. Univ. Kansas Paleont. Contr. Mollusca, 1, 1-15. pls. 1-3.

MOJSISOVICS, E. (1888): Uber einige arktische Trias-Ammoniten des norlichen Sibirien. *Acad. Imp. Sci. St.-Petersbourg Mem.*, 7e, ser., tome **36**, (5), 1-21, pls. 1-3.

PITAKPAIVAN, K. INGAVAT, R. and PARIWATVORN, P. (1969) : Fossils of Thailand 2. SETHAPUT, V. (ed.), 57-60, pl.26, *Depart. Min. Res. Thailand, Geological Survay Memoir* 3, **2**, 69 p.

PLUMMER, F. B. and SCOTT, G. (1937): Upper Paleozoic ammonites in Texas (The Geology of Texas, Vol. 3, Pt. 1). *Texas Univ. Bull.*, (3701), 1-516, pls. 1-41.

REED, F. R. C. (1920): Carboniferous fossils from Siam. *Geol. Mag.*, **57**, 113-120, 172-178, pl. 2.

RUZHENCEV, V. E. (1937): Stratigraphical outline of the Upper Carboniferous and Lower Permian deposits in the Orenburg district (U.S.S.R.). *Soc. Nat. Moscow bull., sec.* Geol., **15**, (3), 187-214 (*in Russian*)

—— (1950): Upper Carboniferous ammonites of the Urals. *Acad. Sci. U.S.S.R., Paleont. Inst., Pub.*, **29**, 1-223, pls. 1-15. (*in Russian*)

—— (1956): Lower Permian ammonoids of the southern Urals-II: Ammonoids of Artinskian Stage. *Ibid.*, **60**, 1-275, pls. 1-39. (*in Russian*)

SMITH, J. (1927): Permian ammonoids of Timor. *Mijinw. Nederlandsch-Indie Jaarb.*, **55**, Verh. 1, 1-91, 16 pls.

TEICHURT, C. (1942): Permian ammonoids from Western Australia., *J. Paleont.*, **16**, 221-232, pl. 35.

THARALSON, D. B. (1984) : Revision of the early Permian ammonoid family Perrinitidae. *J. Paleont.*, **58**, (3), 804-833, text-figs. 1-24.

TORIYAMA, R. (1975) : Fusuline fossils from Thailand, Part.9, Permian fusulines from the Rat Buri Limestone in the Khao Phlong Phrab Area, Sara Buri, Central Thailand. *Mem. Fac. Sci, Kyushu Univ*, [D, Geology], **23**, (1), 1-116, pls. 1-21.

—— (1982): Fusuline fossils from Thailand. Pt. 15, Peculiar spirothecal structure of schwagerinid from east of Wang Saphung, Changwat Loei, central Thailand. *Geol. Palaeont. Southeast Asia*, **23**, 1-8, pls. 1-3, Univ. Tokyo Press.

—— (1984): Summary of the fusuline faunas in Thailand and Malysia. *Ibid.*, **25**,

137-146. Univ. Tokyo Press.

TOUMANSKAYA, (1931): The Permo-Carboniferous deposits of the Crimea, pt. 1, Cephalopoda, Ammonoidea. *Geol. Surv., Palaeont. Stratigr.*, 1-117, pls. 1-8.(*in Russian with English abstract*)

YANAGIDA, J. (ed.) (1988) : *Biostratigraphic Study of Paleozoic and Mesozoic Groups in Central and Northern Thailand*. Dev. Geol. Surv., Dept. Min. Res., Thailand, 113p.