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ADDITIONAL OCCURRENCES OF *URUSHTENOIDEA* (BRACHIOPODA) FROM THE PERMIAN OF ASIA

by

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(with 2 text-figures, 1 table and 3 plates)

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Abstract

Quite recently Jing* and Hu (1978) proposed two new brachiopod genera, *Urushtenoidea* and *Uncisteges*, in which they grouped certain species formerly included in the genus *Urushtenia* established by Licharew in 1935. As a matter of fact, Sarytcheva and Grunt (1969) documented the presence of some essential differences between *Urushtenia* and several species which were transferred to the newly presented genera by Jing and Hu, but no generic name for them was proposed by the Russian authors at that time. In the author's opinion, both *Urushtenoidea* and *Uncisteges* appear to be distinct from *Urushtenia* at least in generic rank. The former two, however, may be congeneric with each other, and the generic validity of *Uncisteges* must be denied in that case.

In addition to the morphological difference, the stratigraphic and geographic distributions between *Urushtenia* and *Urushtenoidea* are quite different. *Urushtenoidea* is restricted in its geographic distribution to Southeastern Eurasia and ranges in age from Artinskian through Guadalupian. In the present paper, several additional occurrences of certain species belonging to this genus known to exist in Japan, Cambodia and Laos are presented.

Introduction

The genus *Urushtenia* proposed by Licharew in 1935 with *Productus pseudomedusa* Tschernyschew from the Lower Permian of Ural as its type species is a rather small, very distinctive productoid, and under this generic name, about a dozen species from the Upper Carboniferous and Permian of Eurasia have been hitherto described. Later, the morphological character of this genus was well studied and presented by Sarytcheva and Grunt in 1969. At that time, the Russian authors suggested that such species as *Urushtenia maceus* Ching, *U. chaoi* Ching and *U. crenulata* (Ting) and *U. obscura* (Chao) described from the Permian of China might not be included in the category of the genus *Urushtenia*. Consequently, Jing and Hu (1978) recently established two new genera, *Urushtenoidea* and *Uncisteges* with *Urushtenia chaoi* Ching and *Marginifera crenulata* Ting as type species respectively.

The author is now of the opinion that both *Urushtenoidea* and *Uncisteges* have obvious affinities with *Urushtenia*, but differ significantly from it, as already pointed out by Sarytcheva and Grunt (1969) as well as by Jing and Hu (1978), but the former two genera must be regarded as synonymous with one another. Such being the case, *Uncisteges* proposed after *Urushtenoidea* in their paper may be denied its generic validity. These developments will be discussed under headings of "Brief discussions on the family Chonostegidae and the generic validity of *Urushtenoidea*".

* formerly Ching

Within a large collection of the Permian brachiopods from the Southern Kitakami Mountains, two specimens attributable to *Urushtenoidea* were found and specifically identified as *U. maceus* (Ching). Both were collected from the sandstone of the upper part of the Lower Kanokura Series at Imo, Rikuzen-Takada City, Iwate Prefecture. The upper part of the Lower Kanokura Series was recently designated as *Leptodus nobilis* zone by Minato et al. (1978), and mostly constitutes the zone of *Neoschwagerina* in fusulinid zonation. In the meantime, Mr. H. Koizumi kindly sent several specimens collected from the upper part of the Lower Kanokura Series at Matsukawa, Kesennuma City, Miyagi Prefecture, not very far from the above-mentioned locality, to the author. These specimens may be assigned to the genus *Urushtenoidea* and more specifically they may be referred to as *U. maceus* (Ching).

Recently the author had an opportunity to study the Permian brachiopods from the Sisophon limestone, West Cambodia, where the existence of the genus now concerned has been represented only by *Urushtenia khmeriana* H. and G. Termier, which was described by H. and G. Termier in 1970 from the collection made by Gübler there. However it is possible that *Productus carinatus* and *Strophalosia costulata*, first described by Chi-Thuan in 1961, may generically belong to it, as will be discussed later. The Lower and Middle Permian Sisophon limestone was lithologically and chronologically divided by Ishii (1966), and Ishii, Kato and the author (1969), into the four members of A, B, C and D in ascending order. *Urushtenoidea* is scarce both in the number of individuals and species in the A and B members. Only *Urushtenoidea maceus* (Ching) is known to occur in both members, and this species further extends its geologic occurrence to the C member which contains, on the contrary, rather numerous species as well as individuals belonging to the present genus. The species known from the C member are *Urushtenoidea crenulata* (Ting), *U. chaoi* (Ching) and *U. aff. costulata* (Chi-Thuan) in addition to *U. maceus* (Ching). As a matter of fact, *U. maceus* (Ching) is a single common species in the A, B and C members.

Mansuy (1913) once assigned a single specimen from Kham-Keut, Laos to *Urushtenia pseudomedusa* (Tschernyschew). According to Grant (1976), however, the specimen is too poor to make a specific assignment. In 1967, Ishii of Osaka City University and Kato of Hokkaido University made a field investigation in Laos and obtained a number of brachiopods in addition to fusulinids, corals, bryozoans etc. Within their collections several individuals generically assigned to *Urushtenoidea* are discriminately identified as *U. crenulata* (Ting) by this author. The formation in which these specimens are included is distributed near Luang Prabang, and can be roughly estimated as Middle Permian in age, although the precise stratigraphic position is still unknown.

To summarize, the genus *Urushtenoidea* can be generically separated from *Urushtenia* and is distributed only in the southeastern part of Eurasia and Japan, and stratigraphically occurs from Artinskian to Guadalupian.

It is a great pleasure for the author to dedicate this paper to Professor Masao Minato on the occasion of his retirement from the chair.

Geographic and stratigraphic distributions of the genus
Urushtenoidea in contrast with those of *Urushtenia*

Text-figure 1 shows the worldwide, geographic distributions of *Urushtenoidea* and

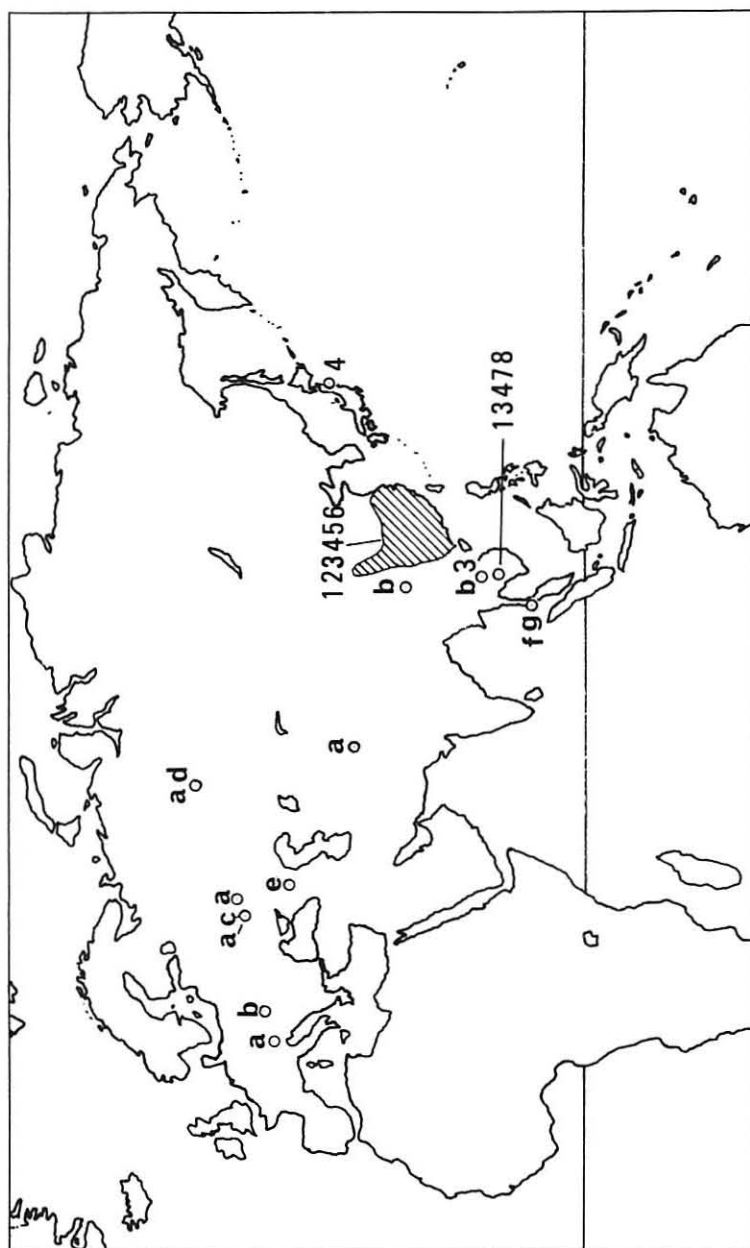
Urushtenia. First of all, the striking geographic separation of the *Urushtenoidea* and *Urushtenia* provinces is clearly indicated in this figure. The species referred to the genus *Urushtenia* are *U. pseudomedusa* (Tschernyschew), *U. dubia* Rotai, *U. tuberculatiformis* (Fredericks), *U. permica* Licharew, *U. arguta* Grant and *U. murina* Grant. The presence of these species has been recorded from various localities in Eurasia, such as U.S.S.R. (Pamir, Denetz Basin, Ural, Northern Caucasus, etc.), Hungary, Austria (Carnic Alps), China, Laos and Thailand, up until the present. Therefore, presently the geographic distributions of the representatives of the genus *Urushtenia* are never traced eastwards beyond 105° East Longitude. On the other hand, the genus *Urushtenoidea* is composed of the following species, *U. chaoi* (Ching), *U. chenansensis* (Chan), *U. crenulata* (Ting), *U. maceus* (Ching), *U. obscura* (Chao), *U. szechuanensis* (Ching), *U. khmeriana* (H. and G. Termier) and *U. aff. costulata* (Chi-Thuan). These species, conversely, occur for the most part in Central and Southeastern China, Indo-China (Laos and Cambodia) and Japan. Namely, their distribution is quite limited within South-East Asia and Japan.

Table 1. shows the stratigraphic distributions of *Urushtenoidea* and *Urushtenia* by species throughout the world. As indicated in this table, the separation of the stratigraphic occurrences between the two genera appears to be quite distinct. The stratigraphic age range of *Urushtenia* is considered to start from the Upper Carboniferous and to terminate in the Artinskian, with only one exception, the isolated occurrence of *Urushtenia permica* Licharew from the Upper Permian Urushten Formation of the Northern Caucasus. In this concern, either the geologic age of the Urushten Formation or the generic assignment of this species might need further examination. On the other hand, the known range of *Urushtenoidea* is from the Artinskian to the upper part of the Guadalupian, never extending upwards into the Upper Permian.

Brief discussions on the family Chonostegidae and the generic validity of *Urushtenoidea*

The subfamily Chonosteginae was first introduced in the family Aulostegidae by Muir-Wood and Cooper (1960) for the genus including *Chonosteges* Muir-Wood and Cooper, 1960, *Strophalosiina* Licharew, 1935 and *Urushtenia* Licharew, 1935: then the definition was given as "Specialized Aulostegidae having posteriorly rugose and anteriorly costate shells, with anterior projecting rim in one genus bearing a row of attachment spines. Brachial valve of same genus with row of anterior spines or funnels." The definition was slightly modified later by Muir-Wood in 1965 as "Specialized, posteriorly rugose and anteriorly costate; pedicle valve with anterior projecting ledge, bearing row of erect attachment spines, another spine row along hinge margin."

In 1963, Ching presented a detailed analysis of the genus *Urushtenia* and described *U. cf. pseudomedusa* (Tschernyschew), *U. obscura* (Chao), *U. chaoi* Ching, *U. chaoi szechuanensis* Ching, *U. maceus* Ching and *U. crenulata* (Ting) from the Permian of China. Then he excluded the genus *Urushtenia* from the present subfamily and referred it to the family Urushtenidae which was newly established by himself for the genus including *Plicatifera* Chao, 1927, *Jakutoproductus* Kashirtchew, 1959, *Spinomarginifera* Huang, 1932 and *Alexenia* E. Ivanova, 1935. In the meantime, Sarytcheva (1965) pointed out that



Text-figure 1 Geographic distribution of *Urushtenoidea* and *Urushtenia*.

Species belonging to *Urushtenoidea* and *Urushtenia* are indicated by numbers and by alphabet respectively.

1-*U. chaoi* (Ching), 2-*U. chenensis* (Chan), 3-*U. crenulata* (Ting), 4-*U. maceus* (Ching), 5-*U. obscura* (Chao), 6-*U. szechuanensis* (Ching), 7-*U. khmeriana* (H. and G. Termier), 8-*U. aff. costulata* (Chi-Thuan), a-*U. pseudomedusa* (Tschernyschew), b-*U. cf. pseudomedusa* (Tschernyschew), c-*U. dubia* Rotai, d-*U. tuberculatiformis* (Fredericks), e-*U. permica* Licharew, f-*U. arguta* Grant, g-*U. murina* Grant.

	Austria (Caric Alps)	U. S. S. R.		Thailand	Laos	West Cambodia	South China	Japan (Kitakami Mts.)
		N. Caucasus	Ural					
Dorashamian		Urushten Fm.	Tatarian				Changhsing Lst.	Nabekoshi Stage
Dzhulfian		Nikitin Fm.					Wuchiaping Lst.	Maehama Stage
Abadehian		Kutan Fm.					Loping Series	
Guadalupian						D Member		Iwazaki Stage
						13478 C Member	2346	
					3	B Member	Maokou Lst.	4 Kattisawa Stage
Kungurian Artinskian			Kazanian Ufimian			4 A Member	Yanghsing Series	
				fg Peninsular Rat Buri	b		1345 Chihhsia Lst.	Kanokura Series
Sakmarian			Kungurian Artinskian					Sakamotozawa Series
Asselian	Trogkofel Lst.		a Sakmarian					
			ad Asselian				b Chuanshan Lst.	

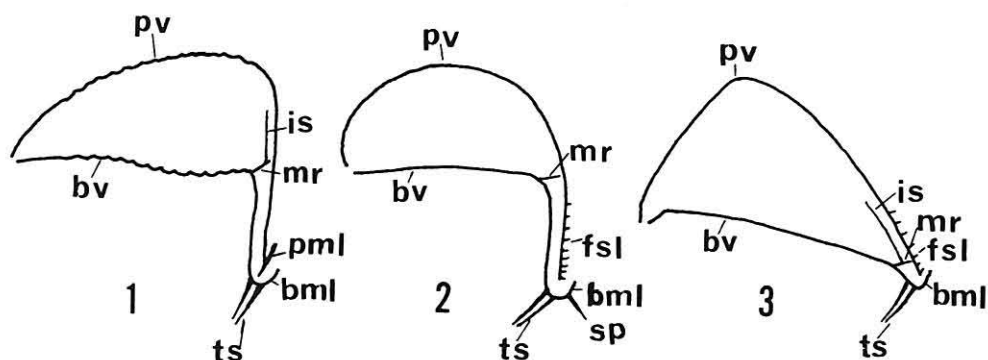
Table 1 Stratigraphic occurrences of Permian *Urushtenoidea* and *Urushtenia*. Correlation of the Permian is adopted from Nakazawa and Kapoor, 1977, and Minato et al., 1978. Symbols are the same as in text-figure 1.

Urushtenia was not phylogenetically associated with the rest of the genera grouped together in the Urushtenidae by Ching. Further, she proposed a new genus *Chonostegoides* with *Chonostegoides ogbinensis* Sarytcheva, 1965 from the Gnishik Formation of Trans-Caucasia as a type species and placed it in the subfamily Chonosteginae in addition to the three genera nominated by Muir-Wood and Cooper (1960). Afterwards, the subfamily was separated from the Aulostegidae and raised to a family by Sarytcheva and Grunt in 1969. At that time, they presented a detailed analysis of this family that includes an extended discussion on the difference between each genus included in the family Chonostegidae, which further suggested that most of the species described as *Urushtenia* from the Permian of China by Ching (1963) may be generically attributed to another.

Quite recently Jing and Hu (1978) described and analyzed the brachiopods from the Maokouan Kuhfeng Formation of South China. Then, they proposed two new genera, *Urushtenoidea* and *Uncisteges* with *Urushtenia chaoi* Ching, 1963 and *Marginifera crenulata* Ting, 1962 as type species respectively. Their proposals extended to the establishment of a new subfamily Uncisteginae in the family Chonostegidae with both the genera and the genus *Cinctifera*. But, *Cinctifera* was thought not to be related to aulostegids by Muir-Wood and Cooper (1960), because of the absence of interarea, teeth and sockets. The generic separation of *Urushtenoidea* and *Uncisteges* was proposed by Jing and Hu, based merely on the slight difference of the internal structure of the brachial valve. As to their procedure, the author now holds the view that the difference may not be of a generic character in this case and accordingly *Urushtenoidea* and *Uncisteges* are congeneric, although further detailed works are required in this concern. Between the two new taxa, *Urushtenoidea* seems to have priority.

To summarize, it is reasonably concluded that the family Chonostegidae may contain the following five genera, *Chonosteges*, *Urushtenia*, *Strophalosiina*, *Chonostegoides* and *Urushtenoidea*. The differences between the former four genera were pointed out in detail by Sarytcheva and Grunt (1969) and Grant (1976) as well. Although Jing and Hu cited the presence of a cincture, as a distinct character of *Urushtenoidea*, there seems to exist no definite cincture on the exterior of the both valves. Thus, this is not available in discriminating the present genus from the other genera. *Urushtenoidea* differs from both *Urushtenia* and *Chonosteges*, as Jing and Hu already noticed, in having several concentric festooned scalloped lamellae near the frontal margin of the pedicle valve exterior, and in lacking marginal thickenings of the pedicle valve. In these characteristics this genus resembles *Chonostegoides*, but differs from it in its ornaments. The pedicle valve of the former genus is posteriorly rugose with scattered spines and the trail is costate. In the latter the posterior surface of the pedicle valve is covered by abundant spines but is not costate. One of the characteristic features of this genus lies in its unusual shell form. Thus, the superficial differences between *Urushtenoidea* and these three genera are apparent. As shown in the text-figure 2, *Urushtenoidea* possesses a sharply geniculated pedicle valve with considerably long trail, and an almost flat or slightly concave brachial valve which mostly lacks a trail extension. The brachial valves of the other genera usually are geniculated to form a trail of moderate length and then extend to follow the curvature of the opposite valve. *Strophalosiina* is very much similar to the present genus in this characteristic, but can be

distinguished from it by the much better developed interarea in the pedicle valve.



Text-figure 2 Schematic longitudinal sections: *Urushtenia* (1), *Chonostegoides* (2) and *Urushtenoidea* (3). 1 and 2 are adopted from Sarytcheva and Grunt (1969).

pv-pedicle valve, bv-brachial valve, pml-reflexed marginal ledge of pedicle valve, bml-reflexed marginal ledge of brachial valve, fsl-festooned, scalloped line, ts-thick, tubular spine, is-internal spine, mr-marginal ridge, sp-small spine.

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The author wishes to record his deep gratitude to Professor Masao Minato of Hokkaido University who first introduced him to a brachiopod palaeontology. His thanks extend to Prof. Makoto Kato of the same university who gave him much useful information on available literature. Profs. Seiji Hashimoto, Satoru Uozumi and Masaru Matsui of the same university are deeply thanked for their helpful advice and encouragement. Profs. Ken-ichi Ishii of Himeji Institute of Technology and M. Kato, and Mr. Hitoshi Koizumi of Tokai Geological Survey Co., Ltd. who kindly supplied the materials used in this study and gave the author much useful information on the occurrences of the specimens. The author is also indebted to and thanks Mr. Sigeshi Ohta and Miss Chiaki Sato for preparation of the text-figures and typing the manuscript.

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Description of species *Urushtenoidea maceus* (Ching)

(pl.1, figs.1-4; pl.2, figs.1-3)

1934 *Marginifera* cf. *timanica*, Grabau, p.49, pl.III, figs.2-3.

1963 *Urushtenia maceus*, Ching, p.19, pl.II, figs.1-6.

1978 ? *Uncisteges maceus*, Jing and Hu, p.117, pl.II, figs.7-8.

Material: Seven specimens were available for study, four of which were collected from the upper part of the Lower Kanokura Series of the Kitakami Mountains, Japan, the remaining three were derived from the A and B members outcropping near Phn. Svai and from the C member at Phn. Lang K Tom in Sisophon, Cambodia respectively.

Remarks: The present species is characteristic of having a not sharply geniculated pedicle

valve with a relatively long trail. Moreover, the costae developing on the same valve are always fine and numerous.

Ching (1963) specifically identified a productoid described as *Marginifera* cf. *timanica* (Tschernyschew) by Grabau (1934) from the dark limestone of the Chihhsia age in Kueichow, South China with this species. This procedure is acceptable to the author, although the ears of the former are better developed than those of the latter.

Urushtenoidea crenulata (Ting)

(pl.1, figs.5-9; pl.3, figs.1-2)

1963 *Urushtenia crenulata*, Ching, p.20, pl.1, figs.17-24, pl.II, figs.9-10, 18-20, text-figure 6.

1974 *Urushtenia crenulata*, Nanking Institute of Geology and Palaeontology (ed.), p.309, pl.162, figs.1-3.

Material: Seven specimens are examined. Five of them were obtained from Laos, and the remaining two from the C member of the Sisophon limestone developed between Phn. Svai and Phn. Tup.

Remarks: This species very much resembles the preceding species. The pedicle valve of the latter is moderately or strongly geniculated to form a trail, and the surface of the valve is anteriorly costate and posteriorly spinose, as in the former. The former is, however, distinct from the latter in having a less sharply geniculated pedicle valve with a comparatively shorter and broader trail and less numerous costae developing on the surface of both valves. This species may be related to or identical with *Productus carinatus* described by Chi-Thuan (1961) from Cambodia. Such being the case, a specific name "*carinata*" has to be adopted in favour of "*crenulata*". However, as it is still uncertain whether *Productus carinatus* Chi-Thuan is generically attributed to *Urushtenoidea* or not, "*crenulata*" is hastily used as a specific name at this time.

Urushtenia chenanensis described by Chan in 1962 from the Maokou Formation of South China is also much allied to the present species. As a matter of fact, Ching described the former as a synonym with the latter in 1963. However, in his later work (Jing and Hu, 1978) these two species were generically separated, based on the difference of the internal structure of brachial valve, as has already been mentioned.

Explanation of plate 1

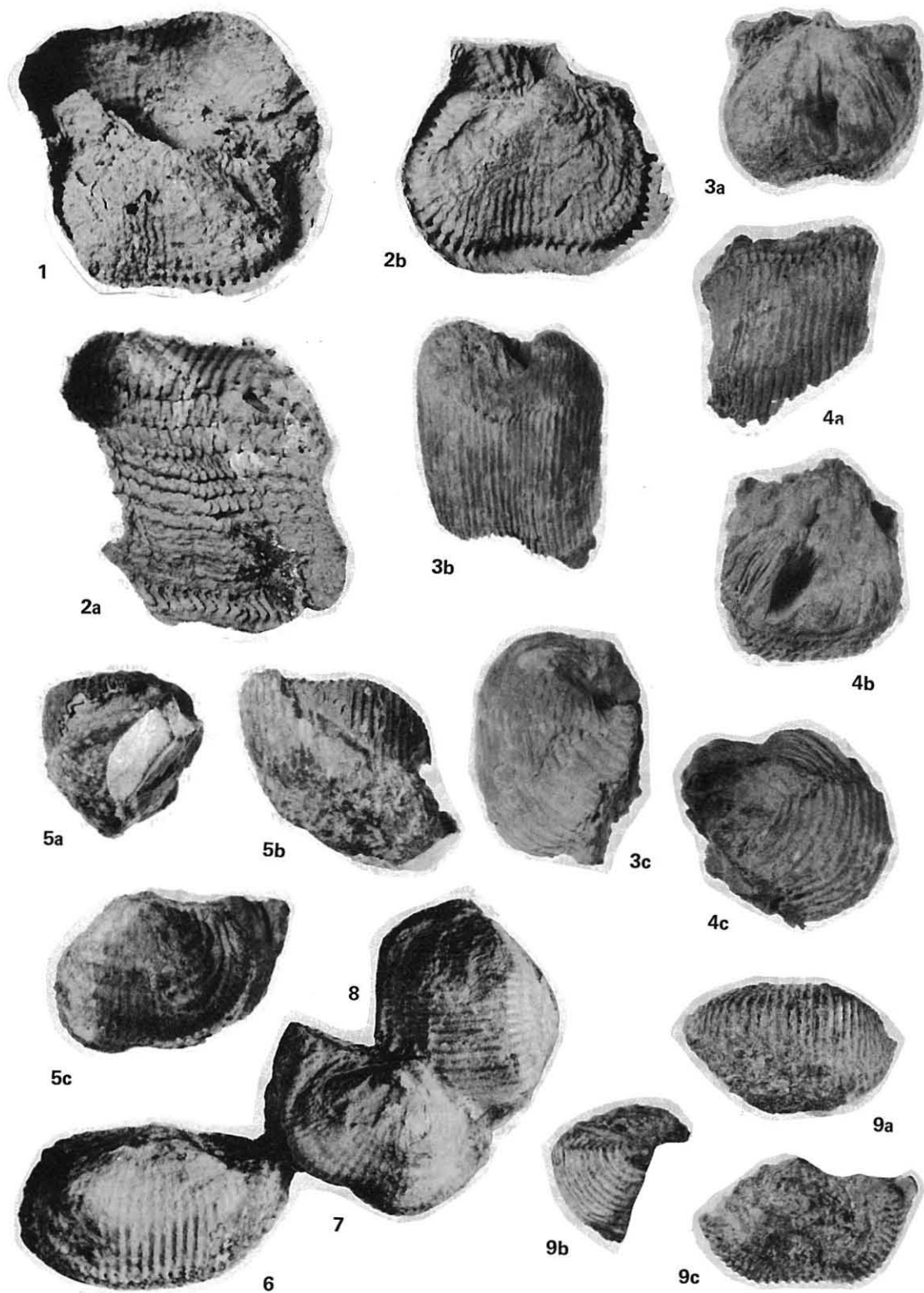
(All figures are twice natural size)

Figs. 1-4 *Urushtenoidea maceus* (Ching)

1. (UHR 30385), external mould of brachial valve together with mould of apical region of opposite valve.
 2. (UHR 30386), a – external mould of pedicle valve, b – external mould of brachial valve.
 3. (UHR 30387), a, b, c – posterior, frontal and lateral views of internal mould of pedicle valve.
 4. (UHR 30388), a, b, c – frontal, posterior and lateral views of internal mould of pedicle valve.
- Hor.: Lower Kanokura Series.
Loc.: figs. 1 and 2 – Imo, Rikuzen-Takada City, Iwate Prefecture, Japan, figs. 3 and 4 – Matsukawa, Kesenuma City, Miyagi Prefecture, Japan.

Figs. 5-9 *Urushtenoidea crenulata* (Ting)

5. (UHR 30389), a, b, c – lateral, frontal and posterior views of pedicle valve.
 - 6-8. (UHR 30390, 30391 and 30392), ventral, posterior and frontal views.
 9. (UHR 30393), frontal, lateral and posterior views of pedicle valve.
- Hor. and Loc.: *Parafusulina* – *Neoschwagerina* zone near Luang Prabang, Laos.



Urushtenoidea chaoi (Ching)

(pl.2, fig.4)

1963 *Urushtenia chaoi*, Ching, p.15, pl.I, figs.1-4, 9-12, 16; pl.II, figs.7-8, 11-17.1966 *Urushtenia chaoi*, Wang et al., fig.306, no.1.1978 *Urushtenoidea chaoi*, Jing and Hu, p.116, pl.II, fig.10.

Material: Only a single specimen obtained from the C member of the Sisophon limestone at Phn. Lang K Tom is available for study, but the external surfaces of the both valves are strongly exfoliated.

Remarks: The single specimen at hand is quite allied to that from the Hsiaokiang limestone of Anfu, Kiangsi Province described as D type of *Urushtenia chaoi* by Ching in 1963. Although the Cambodian specimens are slightly larger and broader than the D type of the Chinese specimens, the costae on the pedicle valve of the former are as many as those of the latter.

Urushtenoidea aff. *costulata* (Chi-Thuan)

(pl.3, figs.3-4)

Compare with: 1961 *Strophalosia costulata*, Chi-Thuan, p.283, pl.II, fig.9.

Material: Several specimens at hand are more or less well preserved, and were collected from the C member of the Sisophon limestone outcropping between Phn. Svai and Phn. Tup.

Remarks: The present form is very much comparable in certain external features to *Strophalosia costulata* first described from the Sisophon limestone by Chi-Thuan in 1961, which may be referred to the genus *Urushtenoidea*. The strongly arched visceral discs in the pedicle valves now examined quite agree with that of the Chi-Thuan's species. Moreover, the presence of a slightly convex hoop on the geniculated point of the pedicle valves is discernible in both. However, in this form the visceral disc of the pedicle valve is considerably shorter and more transverse, compared to that in *Strophalosia costulata*.

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Explanation of plate 2

(All figures are twice natural size)

Figs. 1-3. *Urushtenoidea maceus* (Ching)

1. (UHR 30394), a, b, c, d — posterior, lateral, dorsal and frontal views.
Hor. and Loc.: A Member at Phn. Svai, Sisophon, Cambodia.
2. (UHR 30395), a, b, c — posterior, frontal and lateral views of pedicle valve.
Hor. and Loc.: B Member at Phn. Svai, Sisophon, Cambodia.
3. (UHR 30396), a, b, c, d — frontal, lateral, posterior and dorsal views.
Hor. and Loc.: C Member at Phn. Lang K Tom, Sisophon, Cambodia.

Fig. 4 *Urushtenoidea chaoi* (Ching)

- (UHR 30397), a, b, c, d — posterior, frontal, lateral and dorsal views.
Hor. and Loc.: C Member at Phn. Lang K Tom, Sisophon, Cambodia.



1a



1b



1c



2a



2b



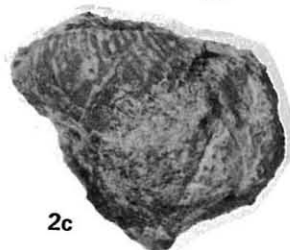
1d



3a



3c



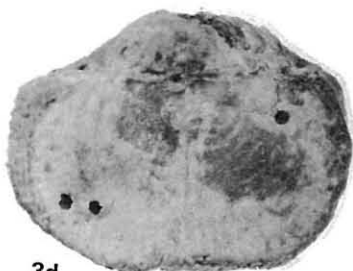
2c



3b



4b



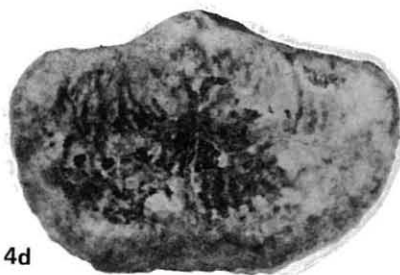
3d



4a



4c



4d

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Explanation of plate 3

(All figures are twice natural size)

Figs. 1-2 *Urushtenoidea crenulata* (Ting)

1. (UHR 30398), a, b, c, d — posterior, frontal, dorsal and lateral views.
 2. (UHR 30399), a, b, c, d — dorsal, lateral, posterior and frontal views.
- Hor. and Loc.: C Member between Phn. Svai and Phn. Tup, Sisophon, Cambodia.

Figs. 3-4 *Urushtenoidea* aff. *costulata* (Chi-Thuan)

3. (UHR 30400), a, b, c, d — posterior, lateral, frontal and dorsal views.
 4. (UHR 30401), a, b, c, d — posterior, frontal, lateral and dorsal views.
- Hor. and Loc.: C Member between Phn. Svai and Phn. Tup, Sisophon, Cambodia.



1a



1c



1d



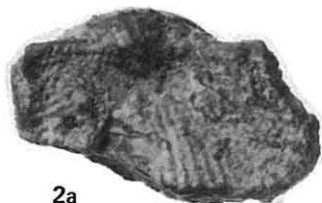
1b



2b



2c



2a



3b



2d



3a



4b



4c



3c



3d



4d



4a