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中国西南志留纪的豆海百合类

王 耀

(中国科学院南京地质古生物研究所,南京 210008)

内 容 提 要

描述了豆海百合类2属7种,它们是:*Pisocrinus*(*P.*) *pilula*,*P.* (*G.*) *kosovensis*,*P.* (*G.*) *bohemicus*,*Parapisocrinus ollula*,*P. sphericus*,以及 *Pisocrinus*(*G.*) *brevis* sp. nov. 和 *Parapisocrinus pateriformis* sp. nov.;并首次发现了 *P.* (*G.*) *bohemicus* 萼杯内腔的内部钙质骨胳构造。同时,还就波希米亚豆海百合种内变异和豆海百合类的对称性进行了研究。

关键词 豆海百合类 志留纪 中国西南

SILURIAN PISOCRINIDS FROM SOUTHWEST CHINA

Wang Yao

(*Nanjing Institute of Geology and Paleontology, Academia Sinica, Nanjing* 210008)

Abstract

Seven Silurian pisocrinids are described, including *Pisocrinus* (*Pisocrinus*) *pilula*, *Pisocrinus* (*Granulosocrinus*) *kosovensis*, *Pisocrinus* (*Granulosocrinus*) *brevis* sp. nov., *Pisocrinus* (*Granulosocrinus*) *bohemicus*, *Parapisocrinus ollula*, *Parapisocrinus sphericus*, and *Parapisocrinus pateriformis* sp. nov. Within *P.* (*G.*) *bohemicus*, eight intraspecific variations are recognized, with internal structures inside calyx illustrated and discussed. A symmetrical study is given to *Parapisocrinus pateriformis* sp. nov., which discloses an abnormal symmetrical axis.

Key words: pisocrinids, Silurian, Southwest China

1 Introduction

Mu was the first to study pisocrinids from Southwest China. In 1954, he recognized *Pisocrinus pilula* var. *yini* from the Ningqiang Formation. Consequently, Mu and Wu (1974), Chen and Yao (1993) reported the same species occurring in the Xiushan Formation (southwestern Sichuan) and the Renheqiao Formation (western Yunnan) respectively. The specimen described by Chen and Yao (1993) has radial processes which are round

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distally and therefore is regarded as a representative of *Pisocrinus* (*Granulosocrinus*). Recent investigations are made on the Ningqiang Formation, with the recognized pisocrinid taxa increased to 7, including 4 species of *Pisocrinus* and 3 species of *Parapisocrinus* described herein.

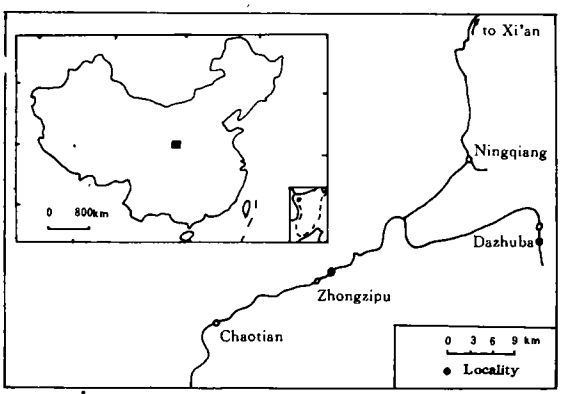
The terminology used here follows Ubaghs (1978). All new fossil material is deposited in the Nanjing Institute of Geology and Paleontology, Academia Sinica. Details of the internal structures were studied using JSM35-CF Automatic Scanning Electron Microscope (SEM), and the specimens studied were coated with gold.

2 Stratigraphy and Localities

A Sino-British joint program on Silurian correlation undertaken in the late 1980's assigned the Ningqiang Formation to the upper Llandoverian. For a general discussion on the lithologic and faunal association of the Ningqiang pisocrinids, see Chen Xu and others (1991).

The pisocrinids described in this paper were collected from the following two localities (Text-fig. 1).

Locality 1—— Lishizi village, about 2km south of Dazhuba. Exposures of the Ningqiang Formation cropped out along the highway from Dazhuba to Maobahe, but the sequences are difficult to distinguish due to small faults. Around Lishizi village, the rocks are mainly composed of yellowish brown limestone and purple bioherm limestone.



Text-fig. 1　Sketch map showing localities of the present study

Locality 2—— Xiaoshizuizi, 1km north of Zhongzipu. A small bioherm about 3m high and 7m wide is composed of purple (laterally yellowish brown) limestone from which specimens were collected on the surface of two beds.

3 Systematic Paleontology

Subfamily Pisocrininae Angelin, 1878

Genus *Pisocrinus* DeKoninck, 1858

Discussion　Mu (1954) divided the genus *Pisocrinus* into two subgenera, *Pisocrinus* and *Parapisocrinus* based on basal concavity. A phylogenetic study of North American species indicates that *Pisocrinus* was synonymous with *Parapisocrinus* (Ausich, 1977). Moore, Lane and Strimple (1978) adopted Mu's clssification and considered *Parapisocrinus*

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to be of a generic rank.

In a comprehensive study of the Pisocrinacea, Rozhnov (1981) used the same character proposed by Mu (1954) and Bouska (1956) to distinguish the genera *Pisocrinus* and *Parapisocrinus*. Furthermore, according to the width of radial facet, height of radials and shape of radial processes, he divided the genus *Pisocrinus* into three subgenera. In 1986, Ausich accepted Rozhnov's opinion. Here the author follows Rozhnov's classification.

Occurrence Silurian—Devonian; north America, Gotland, Bihemia, England, the Urals (Russia) and China.

Pisocrinus (*Pisocrinus*) *pilula* DeKoninck, 1858

(Pl. Ⅰ, figs. 1, 2)

1858 *Pisocrinus pilula* DeKoninck, p. 106, pl. Ⅰ, figs. 8—11.
1858 *Pisocrinus ornatus* DeKoninck, p. 106, pl. Ⅰ, figs. 12, 13.
1876 *Triacrinus gotlandicus* Quendtedt, Taf. 112, figs. 40—42.
1878 *Pisocrinus flagellifer* Angelin, p. 21, pl. Ⅳ, fig. 1.
1878 *Pisocrinus pilula*, Angelin, p. 21, pl. Ⅱ, fig. 4.
1893 *Pisocrinus pilula*, Bather, p. 27, pl. Ⅰ, figs. 1—5, 11.
1900 *Pisocrinus flagellifer*, Weller, p. 31, text-fig. 13, pl. 40, fig. 28.
1913 *Pisocrinus flagellifer*, Springer, p. 208, text-fig. 309a.
1926 *Pisocrinus pilula*, Springer, p. 60, pl. 25, figs. 1—6.
1943 *Pisocrinus pilula*, Bassler and Moodey, p. 612.
1944 *Pisocrinus pilula*, Moore and Laudon, p. 147, pl. 54; p. 331, pl. Ⅰ, figs. 1—5.
1956 *Pisocrinus pilula*, Bouska, p. 13, figs. 1—15.
1973 *Pisocrinus pilula*, Webster, p. 209.
1980 *Pisocrinus pilula*, Gupta and Webster, p. 6, pl. 2, figs. 5—9, 12—15.
1981 *Pisocrinus* (*Granulosocrinus*) *pilula* Rozhnov, p. 59, text-fig. a—b, pls. Ⅰ—Ⅱ; pl. Ⅳ, fig. 1.

Discussion Bouska (1956) recognized considerable variations in cup shape and relative height of the basal circle in the species, so that he identified it as *P. pilula* (Bouska, 1956, Pl. 1, figs. 1—15). Besides these, the writer believes that the depth of basal concavity and shape of radial processes show a great amplitude of variation. Specimens from Bohemia are all of shallow basal concavity, while SND0006 described here shows a deep basal concavity, nearly 1mm in depth. Specimens from Britain and Gotland, according to Rozhnov (1981, Pls. Ⅰ—Ⅱ), are either shallow or deep in a ratio of about 1 : 1.

The slender radial processes, which Bouska mentioned as characteristic of the species *P. pilula*, are prevalent among specimens collected from all over the world. Despite this typical form, there are still some specimens such as these described herein and those figured by Rozhnov which show relatively stout radial processes. The writer believes that an important characteristic of this species is the terminal process maintaining

Measurements (mm)

	SND0006	SND0007
height of cup	4	3
width of cup	5	4

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the same width as the process at the base.

Occurrence Locality 1, yellowish brown limestone, Llandoverian.

Pisocrinus (*Granulosocrinus*) *brevis* sp. nov.

(Pl. I, figs. 3, 4)

Holotype 123141 (SND0009).

Etymology *brevis*, Latin, short, Low.

Diagnosis A species of *Pisocrinus* (*Granulosocrinus*) with pentalobate outline, cup rather short, radial processes low and wide, round distally.

Description Dorsal cup rather short, with a pentalobate outline. Base marked by a shallow basal concavity. Five unequal basals curving out of the basal concavity and visible in side view of the cup. Of the five radials A-ray and D-ray radials large, B-ray and C-ray radials of about equal size, and E-ray radial the largest. Interradial medium-sized. Radial processes low and round distally; CD-interray process wide. Constriction of cavity obscure.

Discussion In *Pisocrinus* (*Granulosocrinus*), four species *P.* (*G.*) *gorbyi*, *P.* (*G.*) *varus*, *P.* (*G.*) *spatulatus* and *P.* (*G.*) *brevis* share the common characteristics of pentalobate outline, small cup and a granulated surface as compared in Table I.

Measurements (mm)

	SND0009	SND0102
height of cup	2	1.6
width of cup	4	3.3

Table I　A comparison of *P.* (*G.*) *gorbyi*, *P.* (*G.*) *varus*, *P.* (*G.*) *spatulatus* and *P.* (*G.*) *brevis* in characteristics

characteristic	*P.* (*G.*) *gorbyi*	*P.* (*G.*) *varus*	*P.* (*G.*) *spatulatus*	*P.* (*G.*) *brevis*
height of cup	high	high	short	low
end of pentalobate	round	round	sharp	round
radial process	high	low	low	low

The specimens from West Tennessee illustrated by S. A. Miller (1891, Pl. Ⅵ, figs. 21—23) are most probably *P.* (*G.*) *brevis* sp. nov. Miller (1891) noted that they have a rather shorter calyx and differ so far as can be ascertained from the typical calyx of *P. gorbyi*. He retained them in *P. gorbyi*, awaiting more information about them. In 1943, these specimens were removed from *P. gorbyi* and assigned to *P. quinquelobus* (Bassler and Moodey), which was placed in the genus *Parapisocrinus* in 1950's for its concealed basals. But those specimens from Tennessee do not carry this characteristic. Therefore this designation is regarded as inappropriate. When Rozhnov (1981) listed the synonyms of *P.* (*G.*) *gorbyi*, he was not aware of this fault.

Occurrence Locality 1, yellowish brown limestone of Llandoverian.

Pisocrinus (*Granulosocrinus*) *kosovensis* Bouska, 1956

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(Pl. Ⅰ, figs. 5, 6)

1981 *Pisocrinus* (*Granulosocrinus*) *kosovensis* Rozhnov, p. 75, pls. Ⅶ, Ⅷ, figs. 1—3, test-fig. 16a—e.

Discussion The cups collected from the Ningqiang Formation are barrel-shaped and broad upward, with granulated surface; basal concavity broad and shallow. Boundaries of calyx plates are obscure whereas specimens from Bohemia and the Urals have deep boundaries. E-ray plates of SND0030 are disarticulated and perfectly disclosed, with assymmetrical hourglass-shaped constriction. Projection of A-ray radial inside cavity lies higher than that of D-ray radial, and can be compared with the specimen described by Bouska (1956, Pl. Ⅰ, fig. 18).

Measurements (mm)

	SND0029	SND0030
height of cup	2.5	2.2
width of cup	4.8	4

Occurrence Locality 1, yellowish brown limestone, Llandoverian.

Pisocrinus (*Granulosocrinus*) *bohemicus* Bouska, 1956

(Pl. Ⅱ, figs. 1—7; Pl. Ⅲ, figs. 1—5; Pl. Ⅳ, fig. 1)

1956 *Pisocrinus bohemicus* Bouska, p. 20, pl. Ⅰ, figs. 10—12, text-fig. 4.

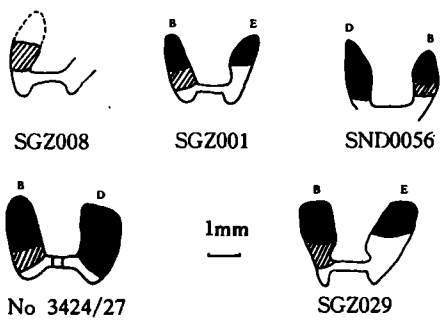
1973 *Pisocrinus bohemicus*, Webster, p. 207.

1981 *Pisocrinus* (*Granulosocrinus*) *bohemicus*, Rozhnov, p. 78, pl. XN; pl. XV, fig. 1, text-figs. 701, 8z, 17a—k.

Discussion The west Urals (Zhedensk beds of Lower Devonian), Russia is another locality of this species with large-sized pisocrinids after Bouska first reported the material from Bohemia (Rozhnov, 1981). Other areas such as the most famous Nigaran rock exposed in North America have not yielded any of this species. As to this species form of *Pisocrinus*, the writer believes that its occurrence in China is of biogeographic significance.

Bouska diagnosed the large-sized species with conical or barrel-shaped cup, high basal, broad radial facets and E-ray radial remaining in contact with basal plates, in addition to the granulated surface. Among the four specimens, Bouska (1956) recognized a teratological form, in which the C-ray radial directly rests on the infraradial, with only four radial processes protruding above oral surface. He interpreted it as result of losing one arm in its developing stage.

A comparison of specimens from China with those described by Bouska and Rozhnov, shows that intraspecific variations occurred in eight areas in the cup of *P.* (*G.*) *bohemicus*. Bouska's teratological specimen is regarded as a variation within the species rather than a dwarf adult (see Table Ⅰ, and text-fig. 2).



Text-fig. 2 Variations of constriction inside calyx cavity (radials black; infraradial oblique-ruled)

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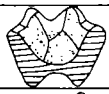
Table Ⅰ　Intraspecific variations of *Pisocrinus* (*G.*) *bohemicus*

Variations		Holo.	Para.	Tera.	3424/23	3424/27	3424/22	SGZ003	SGZ005	SGZ006	SGZ010	SGZ013	SGZ015	SGZ029	SGZ030	SND0056
Ornamentation					–	–	–	–	–		–	–	–			–
		–	–	–						–				–	–	
Basal concavity							–			–				–	–	
		–	–	–	?	–		–	–		–	–	–			?
E-ray											–				–	–
								–				–				
		–	–	–						–			–	–		
					–	–	–		–							
C-ray		–	–		?		?	–	–		–	–	–	–	–	–
				–		–				–						
Shape of radial process							–	–	–	–	–	–	–			–
		–	–	–	–	–								–	–	
Number of radial process		–	–		–	–	–	–	–	–	–	–	–	–	–	–
				–												
Interal structure		–	–	–	–	–	–	–	–		–	–	–			–
										?				–	–	

Holo. = holotype illustrated by Bouska; Para. and Tera. = paratype and teratological specimens in Bouska (1956, Pl. Ⅰ, figs. 10—12); 3424/23, 3424/27, 3424/22 = numbers of specimens illustrated in Rozhnov (1981, Pl. XW, Pl. XV, fig. 1); SGZ029 and SND0056 = numbers of specimens illustrated herein.

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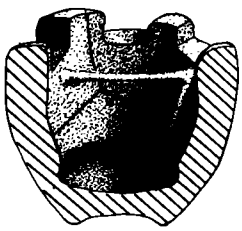
Internal structure The study of internal structure has hitherto only undertaken by limited researchers, such as Haugh (1973) and Ausich (1977). Their works mainly dealt with reconstruction of nervous, water vascular and digestive systems. Structures illustrated in Pl. Ⅲ (fig. 5a) and Pl. Ⅳ (fig. 1) are curious enough and obviously constructed by calcic material.

Inside the cavity of SGZ029, the calcic structures look like a pending bridge with both ends located at the center of C-ray radial and upper part of A-ray radial. Down the end of A-ray radial, a rod extends to EA-basal, forming a 90° angle with bridge. Ausich assumed this structure as part of constriction existing in calyx cavity of all pisocrinids. This kind of constriction is speculated to divide various soft parts. Text-fig. 3 shows a higher internal structure of SGZ029 than its constriction in normal sense.

Structures inside SGZ030 are more complicated, as shown in Pl. Ⅲ, fig. 5a. As in SGZ029, a calcic bridge occurs in SGZ030 but with both ends located at upper part of D-ray and C-ray radials respectively. This short bridges curves at middle, forming a semicircle. It is supported by a rod extending from CD interray position.



Text-fig. 3 Cross-section showing reconstructed internal structure

The function of the internal structures still remains unknown, which probably work as a constriction to separate soft parts inside the calyx cavity although they are not real constriction. This problem may be solved in future when more collections are available.

Occurrence Locality 2 and Locality 1, Llandoverian.

Parapisocrinus Mu, 1954

Parapisocrinus ollula (Angelin, 1878)

(Pl. Ⅳ, fig. 2; text-fig. 4)

1878 *Pisocrinus ollula* Angelin, p. 21, pl. 4, fig. 2.

1893 *Pisocrinus ollula*, Bather, p. 32, pl. Ⅰ, figs. 12—19.

1926 *Pisocrinus ollula*, Springer, p. 80, pl. 25, figs. 7—10

1943 *Pisocrinus ollula*, Bassler and Moodey, p. 612.

1956 *Pisocrinus* (*Parapisocrinus*) *ollula* Bouska, pp. 29, 79, 120, pl. Ⅲ, fig. 15; pl. Ⅳ, figs. 1, 5—7.

1963 *Pisocrinus* (*Parapisocrinus*) *ollula*, Strimple, p. 45, text-fig. 10, fig. k.

1973 *Pisocrinus ollula*, Webster, p. 208.

1980 *Parapisocrinus ollula grandis* Gupta et Webster, p. 7, pl. 1, figs. 2—5, 12—17.

1981 *Parapisocrinus ollula* Rozhnov, p. 86, pls. XVI, XVII, XIX.

Discussion Bather (1893) emended the diagnosis of this species as having a low cup with a height to width ratio of less than 2 : 3. Bouska (1956) divided this species into four subspecies: *P. ollula*, *P. ollula grandis*, *P. ollula elegans* and *P. ollula hlubocepensis*, based on some minor differences occurring on the cup. These differences may be inconstant characteristics derived from ancestors, and more probably only intraspecific variations within

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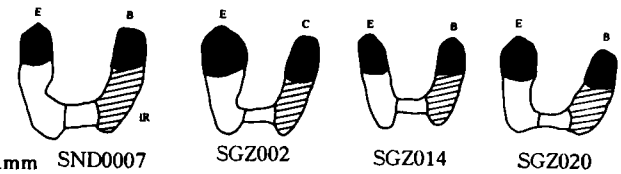
P. ollula. The division of four subspecies is regarded as not valuable in studying intraspecific variations.

Measurements(mm)

	SND0007	SND0016	SGZ002	SGZ014	SGZ020
height	3	1.4	2	2.3	2.6
width	5	4	6	4.8	5.8

The average height to width ratio is 0.44, much lower than 2 : 3. Those specimens from Ningqiang Formation share the same characteristics in appearance, such as the absence of ornamentation, the broad and shallow basal concavity, the low and wide radial process, with constriction existing inside four of the specimens (see text-fig. 4).

Occurrence Localities 1 and 2, yellowish brown limestone, Llandoverian.



Text-fig. 4　Constriction inside *Parapisocrinus ollula*

***Parapisocrinus sphericus* Rowley, 1904**

(Pl. Ⅳ, figs. 3, 4)

1904 *Pisocrinus globosus*? (*Pisocrinus sphericus*) Rowley, p. 270, pl. 16, figs. 8, 9.

1926 *Pisocrinus sphericus* Springer, p. 79, pl. 23, figs. 30—36.

1944 *Pisocrinus sphericus*, Moore and Laudon, p. 147, pl. 54, fig. 16.

1954 *Pisocrinus* (*Parapisocrinus*) *sphericus* Mu, p. 326.

1956 *Ollulocrinus sphericus* Bouska, p. 32.

1958 *Pisocrinus* cf. *sphericus* Ramsbottom, p. 113, pl. 21, fig. 1.

1963 *Ollulocrinus sphericus*, Strimple, p. 45.

1974 *Pisocrinus* (*Parapisocrinus*) *sphericus*, Webster, p. 208.

1981 *Parapisocrinus sphericus* Rozhnov, p. 85.

Discussion Traditionally, this species is characterized by its globular shape, and lanceolate radial processes (Moore and Laudon, 1994; Bouska, 1956). As in other species, some intraspecific variations also can be recognized in this species. For example, the basal concavity may be deeper or shallower, and even its globular shape may vary within a scope from spherical to barrel-like.

Measurements(mm)

	SGZ004	SGZ009	SGZ012	SGZ017	SGZ022
height	2.8	3	3.5	1.6	2.4
width	4.7	5.4	5.5	3.2	4.3

The average height to width ratio is 0.58. The processes are more often higher to form a globular shape.

Occurrence Locality 2, purple limestone and yellowish brown limestone, Llandoverian.

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***Parapisocrinus pateriformis* sp. nov.**

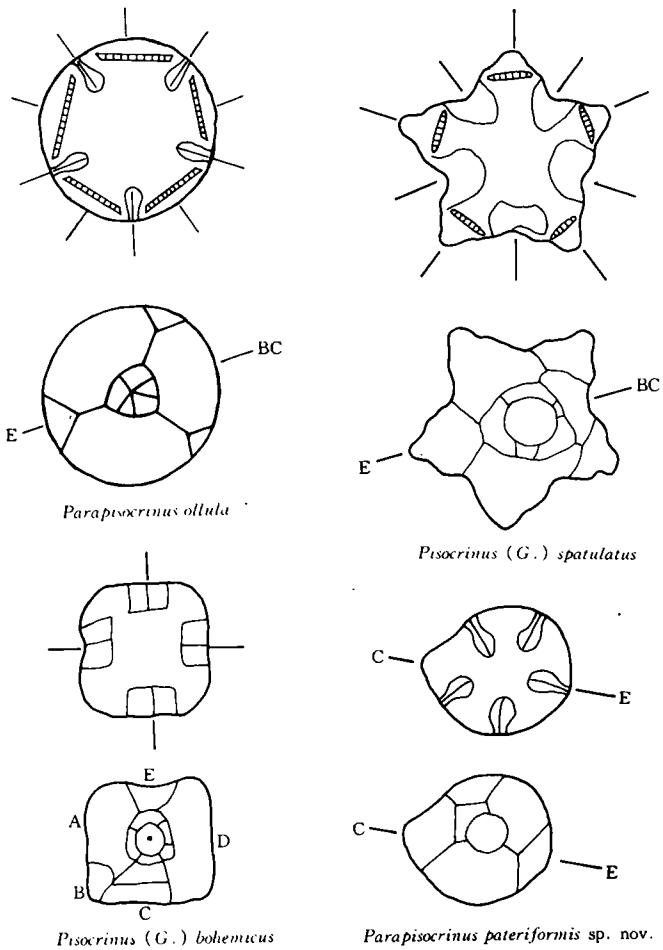
(Pl. Ⅳ, fig. 5)

Holotype SGZ011, a single cup.

Etymology *pateri*, Latin, dish.

Diagnosis *Parapisocrinus* with short cup; C-ray position spatulate, forming bilateral symmetry in ventral or basal view; all radials large, composing the edge of basal concavity.

Description Cup low, 2mm high by 8mm wide, dish-shaped in outline. Circular oral plane disrupted by C-ray protrusion, forming a bilateral symmetry with C-E axis. Basal flat, invaginated at the center; surface of cup smooth, with no ornamentation; lateral side of cup extending outward. Radial processes low, slender at base and stout at the end. Radial facet rather wide, subequal to radial in width. Basals concealed in concavity. Infraradial smaller than B-ray and C-ray radials, with only a small triangular part visible from side view. Three small radials large, occupying full height of cup, and reaching edge of basal concavity. A-ray and D-ray radials large. Stem and arms as well as calyx cavity unknown.



Text-fig. 5 Symmetrical axis of some pisocrinids from ventral and basal views

Discussion The new species discussed here is similar in some degree to *Parapisocrinus ollula*, both with low cup, wide radial facet and process, but the former is much shorter to form a dish-shaped cup. The unique character in C-ray position readily distinguishes the new species from any others belonging to the genus.

Text-fig. 5 shows an interesting phenomenon that *Pisocrinus* and *Parapisocrinus* usually have a pentamerous symmetry in ventral view. As an exception, *P. pateriformis* together with the teratological specimen illustrated by Bouska has a bilateral symmetry, al-

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though they are not actually the same. Basal view also reveals pisocrinids have bilateral symmetry with only one exception—— the teratological specimen. However, *P. paterifformis* has a special C-E axis that differs from these in most cases.

Occurrence Locality 2, purple limestone, Llandoverian.

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EXPLANATION OF PLATES

Plate I

1,2. *Pisocrinus* (*Pisocrinus*) *pilula* DeKoninck, 1858

1. SND006/NIGPAS123127, a. basal view, ×5; b. ventral view, ×5; c. BC-interray view, ×5; d. D-ray view, ×5.

2. SND0007/NIGPAS123138, a. basal view, ×5; b. E-ray view, ×10; c. BC-interray view, ×5; d. D-ray view, ×5.

3,4. *Pisocrinus* (*Granulosocrinus*) *brevis* sp. nov.

3. SND0009/NIGPAS123141, a. basal view, ×5; b. ventral view, ×5; c. BC-interray view, ×10; d. E-ray view, ×5.

4. SND0102/NIGPAS123142, a. basal view, ×5; b. ventral view, ×5; c. E-ray view, ×5.

5,6. *Pisocrinus* (*Granulosocrinus*) *kosovensis* Bouska, 1956

5. SND0029/NIGPAS123139, a. basal view, ×5; b. E-ray view, ×5.

6. SND0030/NIGPAS123140, a. ventral view, ×5; b. E-ray view, ×10; c. BC-interray view, ×5.

Plate I

1—7. *Pisocrinus* (*Granulosocrinus*) *bohemicus* Bouska, 1956

1. SGZ001/NIGPAS123153, basal view ×5; 2. SGZ003/NIGPAS123149, a. ventral view, ×5; b. E-ray view, ×5; 3. SGZ005/NIGPAS123148, E-ray view, ×5; 4. SGZ006/NIGPAS123146, a. C-ray view; ×10; b. D-ray view, ×5; 5. SGZ009/NIGPAS123141, basal view, ×5; 6. SGZ010/NIGPAS123151, a. E-ray view, ×5; b. BC-interray view, ×5; 7. SGZ013/NIGPAS123150, a. E-ray view, ×5; b. basal view, ×5.

Plate II

1—5. *Pisocrinus* (*Granulosocrinus*) *bohemicus* Bouska, 1956

1. SGZ015/NIGPAS123152, a. basal view, ×5; b. E-ray view, ×5; 2. SND0056/NIGPAS123156, a. ventral view, ×5; b. BC-intereay view, ×5; 3. SGZ018/NIGPAS123145, lateral view, ×5; 4. SGZ029/NIGPAS123143, a. basal view; b. E-ray view; c. A-ray view; d. BC-interray view, ×5; 5. SGZ030/NIGPAS123144, a. ventral view; b. BC-interray view;

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c. E-ray view, ×5.

Plate Ⅳ

1. *Pisocrinus* (*Granulosocrinus*) *bohemicus* Bouska, 1956

SGZ029/123143, ventral view of cup, showing detailed internal structures, with B-ray at bottom, ×20.

2. *Parapisocrinus ollula* (Angelin, 1878)

SGZ020/NIGPAS123160, a. basal view; b. ventral view; c. E-ray view, ×5.

3, 4. *Parapisocrinus sphericus* Rowley, 1904

3. SGZ019/NIGPAS123164, a. E-ray view; b. ventral view, ×5; 4. SGZ017/NIGPAS123166, E-ray view, ×5.

5. *Parapisocrinus pateriformis* sp. nov.

SGZ011/NIGPAS123157, a. basal view; b. ventral view; c. D-ray view; d. BC-interray view, ×5.

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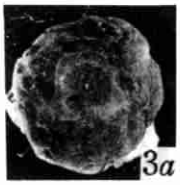
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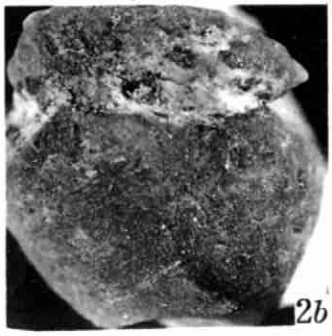
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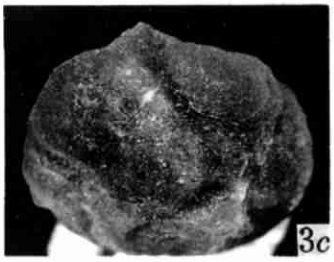
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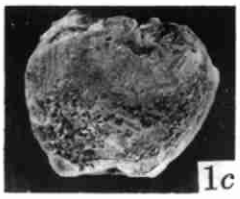
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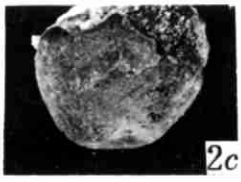
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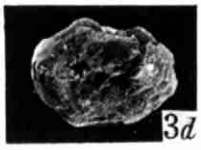
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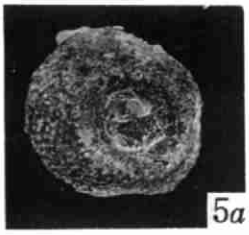
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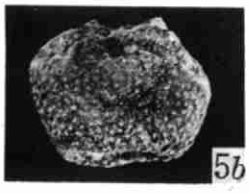
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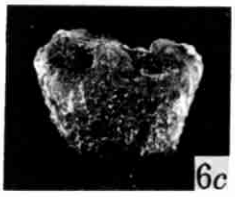
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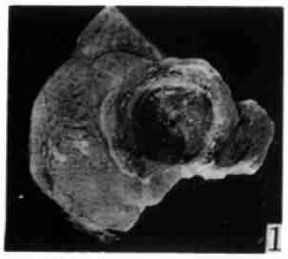
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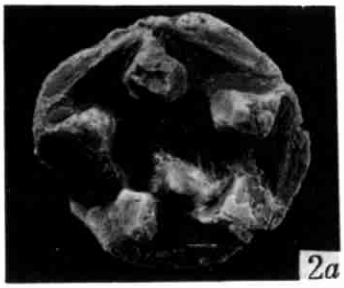
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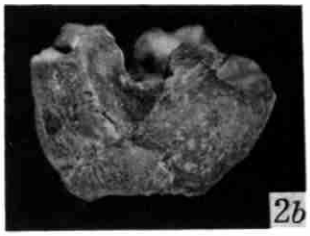
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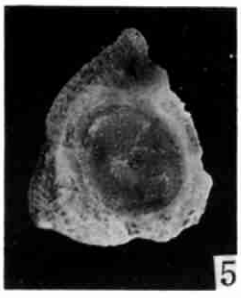
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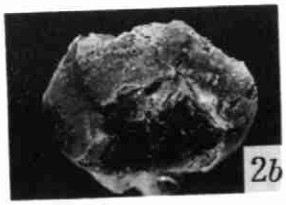
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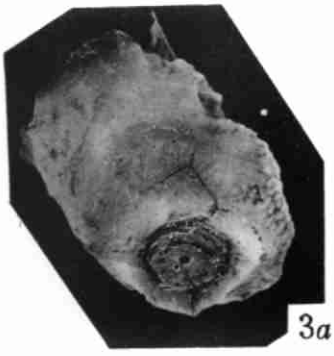
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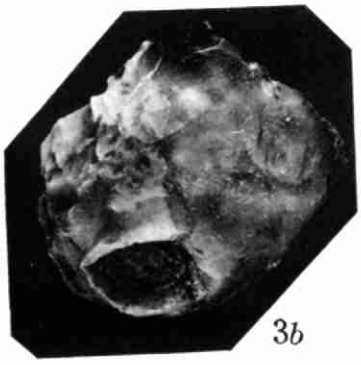
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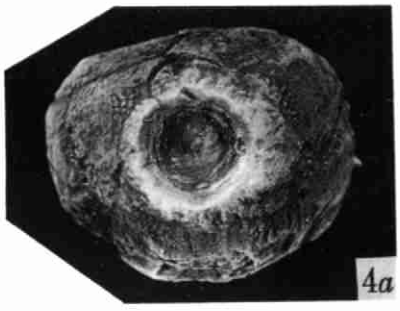
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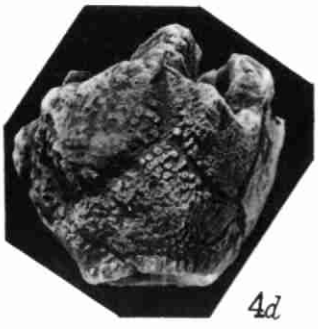
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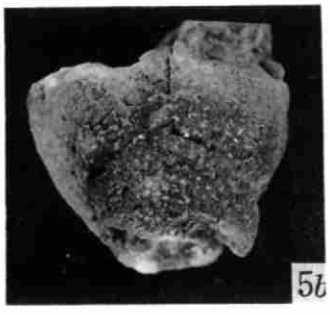
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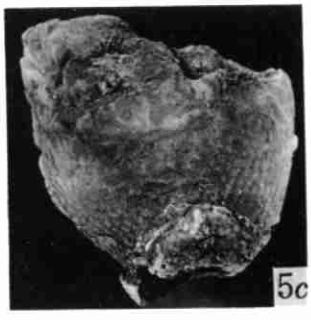
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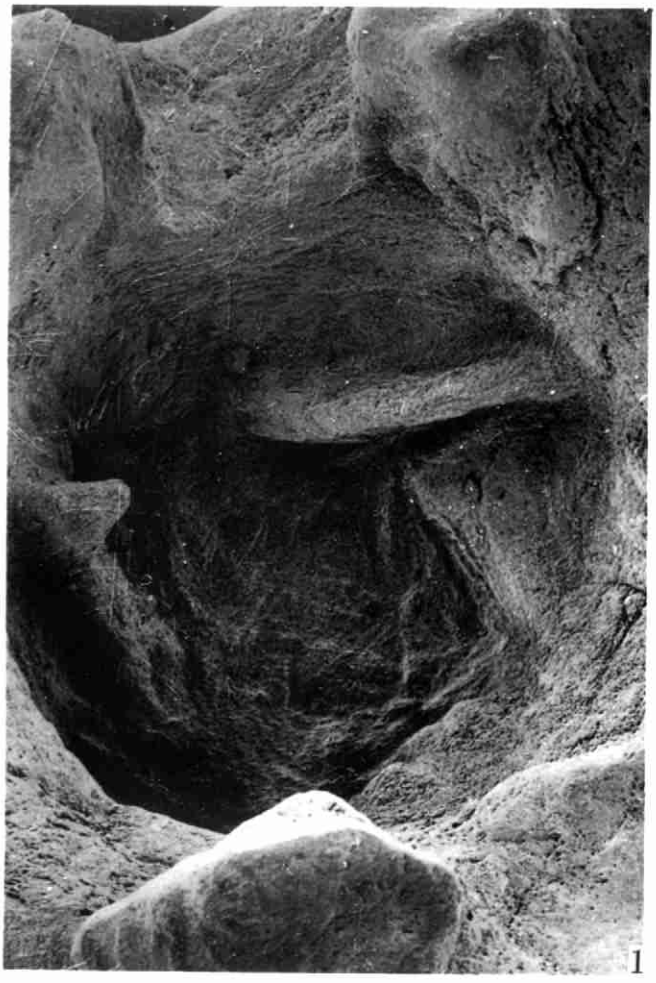
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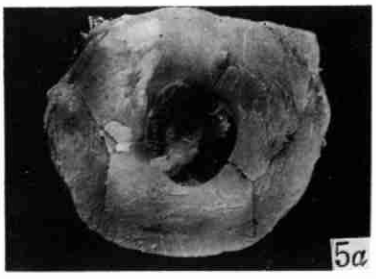
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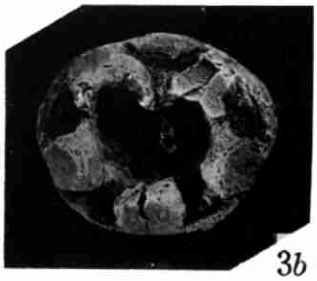
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