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NOTES ON THE PERMIAN BRACHIOPOD GENUS *CRYPTOSPIRIFER*

by

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(with 1 text-figure, 1 table and 3 plates)

Abstract

The Permian brachiopod genus *Cryptospirifer*, characterized by its fairly large shell size, is classified by certain Chinese palaeontologists into the Suborder Athyrididina. The category of this genus has covered the forms having both costate and non-costate shells. The authors hold a view, however, that the presence or absence of the costae is of generic importance in this case and that, accordingly, species with costate shells have to be excluded from the genus *Cryptospirifer* (s.s.), the designated type species of which is *C. omeishanensis* Huang with smooth shells.

It has been so far reported that the occurrence of this genus is confined only to the Maokou of South China. The present study, however, first clarified that several shells attributable to this genus are embedded in the upper part of the Middle Permian of Central and Northwestern Iran, and Central Turkey as well. The genus *Cryptospirifer* viewed from the newly limited standpoint comprises three species: *C. omeishanensis* Huang, *C. shawanensis* Jing, both from South China, and *C. iranica* n. sp. from the Near and Middle East.

Introduction and acknowledgements

During a part of the summer and autumn of 1972 an Iranian-Japanese research group including authors conducted a geological survey and sampled specimens in the Abadeh and Julfa regions of Iran. Having finished this field investigation and pursuing it further in Turkey, all the Japanese researchers moved to the Saimbeyli region of Turkey, where they worked with two Turkish geologists. This group made an additional investigation in the Abadeh region in 1975. Their main objective was, as a part of a research project on problems of the Permian-Triassic boundary in the Tethyan faunal realm, to obtain thorough information, stratigraphic and palaeontologic, about the Middle-Upper Permian and Lower Triassic rocks distributed in parts of Iran and Turkey.

Attention was called to the fact that several shells with a smooth surface were fairly large in shell size among a large number of brachiopod fossils collected from specific horizons of the Middle Permian in the three foregoing regions.

Thus, a careful taxonomic examination was made of these shells, whereby it became evident that they are generically assigned to *Cryptospirifer*, the occurrence of which had been considered to be strictly confined to the Maokou of South China. Accordingly, this finding turns out first on record of the presence of this genus outside of South China.

The genus *Cryptospirifer* has been treated to include both costate and non-costate forms. As will be discussed later, however, the authors intend to restrict the category of the genus *Cryptospirifer* to the non-costate form composed of three species at present.

The specimens collected from the three different localities may belong to a single species, for which a new specific name *iranica* is proposed by the present authors. The

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specimens described as *Martiniopsis inflata* Waagen from the Gnishik beds of Transcaucasia (Sarytcheva et al., 1965) may not be assigned to the named species, but may be conspecific with the species newly proposed here.

For cooperation during all or a part of their field work in Iran (1972, 1975) and in Turkey (1972), the authors would like to take this opportunity to express their cordial thanks to Professor K. Nakazawa of Kyoto Univ.; Dr. H. Taraz, then technical advisor of Geological Survey of Iran; Professors K. Ishii of Himeji Institute of Technology, Y. Bando of Kagawa Univ., M. Murata of Kumamoto Univ., Y. Okimura of Hiroshima Univ., S. Sakagami of Chiba Univ. and T. Tokuoka of Shimane Univ; Drs. D. Shimizu of Kyoto Univ., M. Hamdi of Geological and Mineral Survey of Iran; and Messrs. E. Göğər and A. Ozean of MTA, Turkey.

Special thanks are due to Professors T. Bamba and M. Kato of Hokkaido Univ., who gave them useful geologic information around the Saimbeyli region of Turkey and available literature respectively. To Professors S. Hashimoto, S. Uozumi and M. Matsui of the same university acknowledgements are expressed for their helpful suggestions and encouragement. Cordial thanks go to Mr. S. Ohta and Miss C. Sato for their valuable assistance in the preparation of the text-figure and manuscript.

Financial aids for their study were mostly granted by the Ministry of Education, Government of Japan, and the field work was also supported by the Geological Survey of Iran and MTA of Turkey.

It is a great pleasure for the senior author to dedicate this paper to Professor Seiji Hashimoto in commemoration of his retirement from the chair.

Occurrence of the specimens herein treated

Several specimens specifically assignable to *Cryptospirifer iranica* n. sp. were collected from the Permian rocks distributed in the Julfa and Abadeh regions of Iran as well as in the Saimbeyli region of Central Turkey.

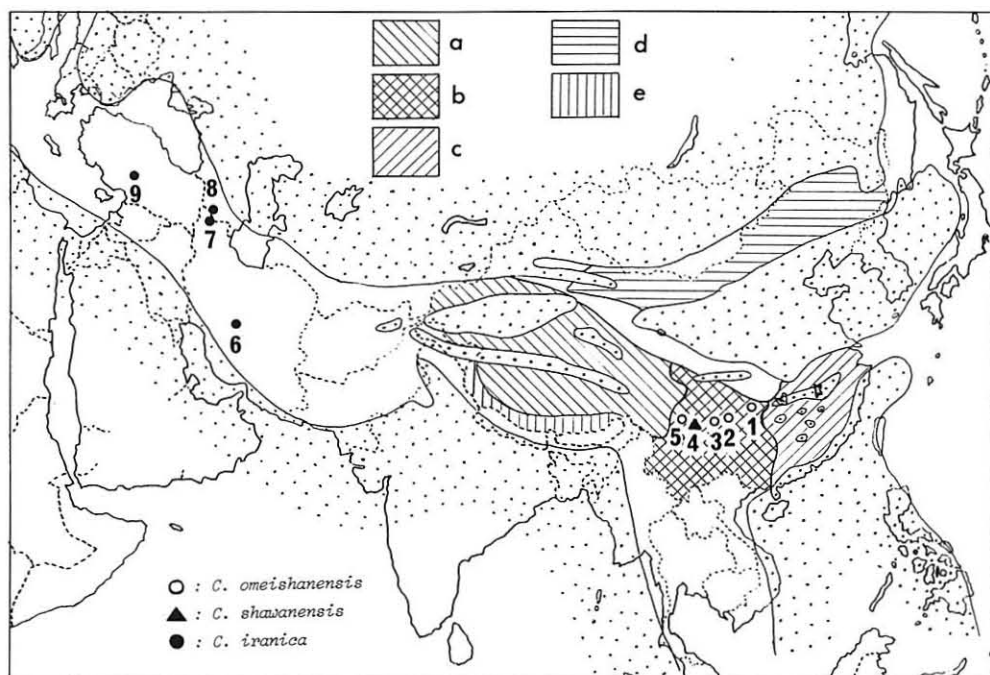
1) Julfa region, Northwestern Iran. The genus now under consideration is discovered from the upper part of the *Verbeekina-Chusenella* zone of Nakazawa and Kapoor (1977), in association with *Chonostegoides baissalensis*, *Septospirigerella baissalensis*, *Leptodus* sp., *Septospirigerella* sp. and *Crenispirifer* sp. The zone is considered to be correlated with the topmost part of the Gnishik beds of Ruzenchev and Sarytcheva (1965) in Armenia.

2) Abadeh region, Central Iran. The thick fossiliferous marine Permian exposed in the Abadeh region, Central Iran, was divided into units 1-7 based on lithologic characteristics in ascending order by Taraz (1971, 1973, 1974). The upper half of unit 3 of Taraz was, however, included in unit 4 by Nakazawa and Kapoor (1977). *Cryptospirifer iranica* is found from the topmost level of unit 3 of Nakazawa and Kapoor, which is attributable to the middle part of unit 3 of Taraz, in association with *Crenispirifer* sp., *Richthofenia lawrenciana*, *Phricodothyris* sp., *Chonostegoides armenicus*, *Spinomarginifera helica*, *Leptodus* sp., *Orthoethetina iljinae* and *Martiniopsis*? sp. The present unit is recently designated as *Orientoschwagerina abichi* zone in fusulinid zonation (unpublished data by Iranian-Japanese Research Group) and is correlated with the Gnishik beds of Ruzenchev and Sarytcheva, 1965 in Transcaucasia and the Gnishik equivalent of Iranian Julfa.

3) Saimbeyli region, Central Turkey. The whole Permian sequence in this region was studied by Mr. E. Göger of MTA, Turkey, and was named Yigilitepe formation. *Cryptospirifer iranica* was detected from the middle part of this formation with a brachiopod *Chonostegoides armenicus* and some bryozoans, the latter of them has been described by Sakagami in 1976. He correlated this bed at that time with the Gnishik beds of Transcaucasia.

Palaeogeographic and biostratigraphic distributions.

The Tethyan faunal realm in Early Permian Period was further divided into such three palaeozoologic provinces as East, Middle and West by Nakazawa and Kapoor (1977). The South China area was then comprised in the East Tethys province in association with Sikhote-Alin, Japan and Southeast Asia by them. It is deeply interesting to note that this province is, according to them, palaeozoologically related to the West Tethys province including North Afghanistan, Iran, Transcaucasia, Turkey and Greece. In both provinces, the



Text-fig. 1. Geographic distribution of *Cryptospirifer*. (Palaeogeographic map is adopted from Minato and Kato, 1965. Dotted area: land. Palaeozoogeographic division of Early Permian brachiopods in China is based on Research Group of Brachiopod of the Institute of Geology and Mineral Resources of the Chinese Academy of Geological Sciences and Northeast China Institute of Geology, 1977)

1: Changyang, Hupei; 2: Shizu, Szechuan; 3: Chiangpei, Szechuan; 4: Leshan, Szechuan; 5: Omeishan, Szechuan; 6: Kuh-e-Hambast, Abadeh; 7: Kuh-e-Ali Bashi, Julfa; 8: Vedi, Armenia; 9: Saimbeyli, Adana.

a: Chinghai-Tibet subprovince; b: Yangtze subprovince; c: Southeast subprovince; d: Northern faunal province; e: Himalaya faunal province

Permian rocks contain rather prolific fusulinids, colonial corals, bryozoans and calcareous algae, which suggest a tropical or subtropical climate. The fact that the genus *Cryptospirifer* was discovered from Northwest and Central Iran, Transcaucasia? and Central Turkey for the first time, in addition to South China seems to confirm the procedure offered by Nakazawa and Kapoor (1977).

Research Group of Brachiopod of the Institute of Geology and Mineral Resources of the Chinese Academy of Geological Sciences and Northeast China Institute of Geology (1977) discriminated within China the following three palaeozoogeographic provinces: the Northern, the Southern and the Himalayan province, based on the characteristics of the brachiopod assemblage in Early-Middle Permian Period. The second amongst them may be included in the East Tethys province of Nakazawa and Kapoor (1977). This province was further subdivided into three subprovinces: the Southeastern, the Yangtze and the Chinghai-Tibet subprovince, based on lithofacies and the presence or absence of certain typical brachiopod genera. Among them the second subprovince is so extensive that includes the greater part of Szechuan, Kueichow and Hupei Provinces, as well as parts of some other provinces. The Chinese species assigned to the genus *Cryptospirifer*, *C. omeishanensis*, and *C. shawanensis*, had been reported only from Szechuan and Hupei Provinces which belong palaeozoogeographically to the Yangtze subprovince. As a matter of fact, the Yangtze subprovince is, according to the Research group of Brachiopod etc (1977), characterized by the *Cryptospirifer-Tyloplecta* assemblage. *Cryptospirifer* may have migrated through the Chinghai-Tibet subprovince to the Middle East from South China, although no occurrence of this genus has been recorded in this subprovince.

In short, to the authors' knowledge the palaeogeographic distribution of the genus *Cryptospirifer* is extended at present from the Yangtze subprovince of South China in the east to the Saimbeyli region of Central Turkey in the west.

In the biostratigraphic point of view, on the other hand, the known range of the genus *Cryptospirifer* may be confined to "Guadalupian" in age and does extend to neither lower nor upper stage. In South China the stratigraphic boundary between the Maokou limestone and the underlying Chihhsia limestone is, according to Sheng and Lee (1974), drawn at the level of the first appearance of *Cryptospirifer* (including costate type). In general, the Maokou is further subdivided into the *Cancellina*, *Neoschwagerina* and *Yabeina* zone, on the basis of characteristics of the contained fusulinids in ascending order. *Cryptospirifer* has so far been found only in the lower two zones in South China.

In Iran and Turkey, this genus was discovered from the uppermost level of the Gnishik equivalent beds. The Gnishik beds of Ruzenchev and Sarytcheva (1965) may chronologically correspond to the entire or a part of the Maokou in South China. The *Cryptospirifer*-bearing beds in the Near and Middle East are correlated with the *Lepidolina multiseptata* zone of the Maokou developed in South China. This means that the occurrence of *Cryptospirifer* in South China is slightly older than in the Near and Middle East.

In the monograph edited by Ruzenchev and Sarytcheva (1965), *Martiniopsis inflata* was described from the Gnishik beds of Transcaucasia. Judging from the illustrations which appeared in that monograph, this generic as well as specific identification is considered to need revision. Although the authors find difficulties in identifying it, there is a high

possibility that it may not be assignable to the named species, but may be conspecific with the species newly proposed herein.

Brief discussion on the genus *Cryptospirifer*

A certain nomenclatorial confusion between this genus and a related genus *Lochengia* calls for a brief review of the history and present taxonomic status of this genus.

The generic name *Cryptospirifer* was first introduced by Grabau in 1931 with *Cryptospirifer lochengensis* Grabau from the Lower Carboniferous of Southwestern China as a type species. The content of the genus *Cryptospirifer* was, however, similar to that of the genus *Lochengia*, which had been already presented by Grabau and Yoh in 1928 for a Late Permian brachiopod. Huang (1933) described three species from the Permian limestone of South China under the generic name *Cryptospirifer*. Since then, the generic name *Cryptospirifer* has become very familiar for this form of brachiopods among Chinese palaeontologists and has preferably used as a generic name instead of *Lochengia* by them, despite that this procedure might violate the International Rule of Zoological Nomenclature.

Afterwards, in light of the uncertain identity of *Cryptospirifer lochengensis* Grabau, Wang et al. (1964) designated *C. omeishanensis*, which was firstly treated among the three species described in Huang's monograph, as a type species of *Cryptospirifer*, and placed *Cryptospirifer* in the family Spiriferidae King, 1846. At the same time, they suggested the possibility of the generic separation of the Permian and the Carboniferous form on the basis of the difference of internal structures of the valves. Two years later they removed *Cryptospirifer* from the Spiriferidae and referred it to the family Athyridae Davidson, 1884.

In 1977 Yang et al. established a new family Lochengiidae belonging to the Suborder Athyrididina with the following two genera, *Lochengia* and *Cryptospirifer*. The generic name *Lochengia* was then revived for the Carboniferous form of this type of brachiopods. The genus *Cryptospirifer* was emended to exclude the Lower Carboniferous species including *lochengensis* and *enteletiformis*, which are now generically assigned to *Lochengia*.

In short, *Cryptospirifer* is now interpreted as a Permian genus, while the name *Lochengia* is available only for Carboniferous representatives.

The genus has been thought by Chinese palaeontologists, notably by Huang (1933) and Wang et al. (1964), to be composed of both costate and non-costate types. The present authors, however, believe that the presence or absence of costae on the shell surface should be employed as a generic character in this case. As *Cryptospirifer omeishanensis* designated to be the type species of this genus has non-costated shells, all of costate *Cryptospirifer* including *C. striatus*, *C. semiplicatus* and *C. striatus pentagonalis* should be excepted from the category of the genus *Cryptospirifer* (s.s.).

In 1978 Tong described a new species "*Cryptospirifer*" *orbicularis* from the Maokou of Szechuan Province, South China. He doubtfully placed the species in the genus *Cryptospirifer*, because of the presence of a pair of dental plates in the pedicle valve. As a matter of fact, this species seems to have a possibility to be akin to *Septospirigerella baissalensis* Grunt. In 1979 the senior author illustrated, in a large book entitled *The Abean Orogeny* edited by Minato, Hunahashi, Watanabe and Kato, *Cryptospirifer* sp. from the Lower Kanokura formation (Middle Permian) of the Southern Kitakami Mountains, Northeast Japan. This

generic identification, however, is in need of revision. The present genus is eventually composed of the following three species, *C. omeishanensis*, *C. shawanensis* from South China and *C. iranica* n. sp. from the Near and Middle East.

Comparatively little is known on the characters of this genus even in the present day, because it had not long been found outside of South China. The non-strophic shell is thick, biconvex, large and almost circular or elongately semi-circular in outline. The pedicle valve spreads its beak over that of the opposite valve. Accordingly the beak of the brachial valve is always concealed under that of the opposite valve. Median sulcus is hardly discernible on the exterior of this valve. Internally hinge-teeth are developed but dental plates are entirely absent. Cardinal area of both the valves are obsolete or lacking. No median fold is present on the brachial valve, in which a relatively short but stout median septum is present. Further, the presence of large and complicated cardinal plates is ascertained. The posterior prolongation of the plates forms an elongate, semi-circular hypothryidid foramen. The surfaces of both the valves are mostly smooth and traced only by fairly faint concentric growth-lines.

Description of species

Cryptospirifer iranica n. sp.

(Pl.1, figs.1-2; pl.2, figs.1-2 and pl.3, figs.1-3)

? 1965 *Martiniopsis inflata* not Waagen; Sarytcheva, Sokolskaja and Grunt, pl.41, fig.1.

? 1969 *Martiniopsis inflata* not Waagen; Stepanov, Golshani and Stöcklin, pl.2, figs. 3a-d.

Material: Available for the present study were seven figured specimens, of which three were collected from the middle part of the Permian Yigilitepe formation at Saimbeyli, Turkey (UHR30428, 30429, 30430) and the remaining four were derived from the top layer of the Middle Permian Gnishik equivalent formations developing at the Julfa and the Abadeh region, Iran (Julfa: UHR30431, 30432; Abadeh: UHR30433, 30434).

Description: The biconvex shell is large in size and circular to semi-circular in outline. The hinge-line is curved and considerably shorter than the greatest width of the shell.

The pedicle valve is slightly wider than long or nearly equidimensional and nearly evenly convex in both longitudinal and transverse directions, except for the umbonal region where it is most strongly inflated. The greatest width lies anteriorly to the midlength of this valve. Although the posterior sector of the pedicle valve is usually unobserved, one specimen shows the presence of a hypothryidid foramen and a slightly inflated palintrope there. A median sulcus is almost absent, but the middle portion of this valve becomes flattish in some specimens. The pedicle valve interior lacks either dental plates or a median septum.

The brachial valve is nearly as large as the opposite valve. A median fold is not entirely developed. The brachial valve interior is provided with a short median septum which occupies nearly half of the entire length of the valve. A cardinal process is bilobated and

Explanation of plate 1

Figs. 1-2 *Cryptospirifer iranica* n. sp.

1. (UHR30431, Holotype): a, b-ventral and lateral views ($\times 1$); c, d-dorsal and posterior views ($\times 1/2$).

2. (UHR30432): a, b-ventral and lateral views ($\times 1$); c-dorsal view ($\times 1/2$).

Hor.: Uppermost part of the Gnishik equivalent beds, Loc.: Kuh-e-Ali Bashi, Julfa, Northwest Iran.



1a



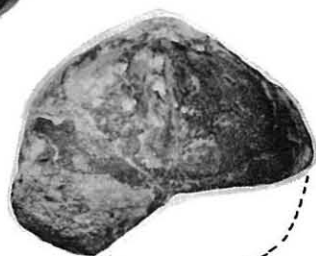
1c



1b



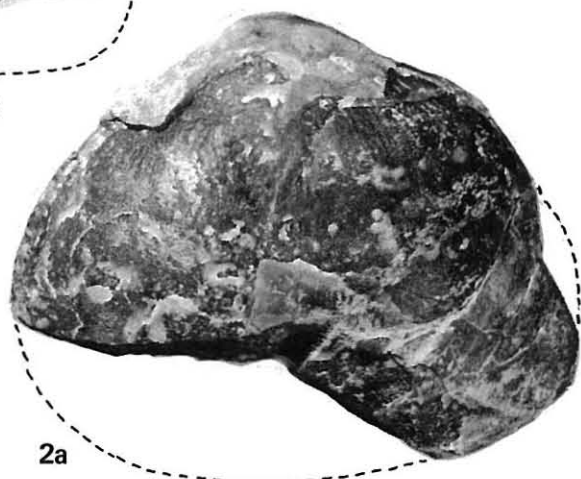
1d



2c



2b



2a

each lob has small, elongate, semi-circular muscle scars. The surface of both the valves is almost smooth and only marked by several concentric growth-lines, which are more or less concentrated on the anterior half of each valve.

Table 1 Measurements (in mm)

Specimens	Length	Width	Thickness	Remarks
UHR30431	76+	86	61	
UHR30432	67	77	50	
UHR30434	68	73	45	
UHR30433	68	87	43	deformed
UHR30428	83	88	54	
UHR30430	66	65		p. v. only
UHR30429	57	66		b. v. only

Remarks: None of the specimens of *Cryptospirifer iranica* n. sp. resembles the holotype of *C. omeishanensis* figured by Huang in 1933 from the Permian limestone of Omeishan, Szechuan, South China. The latter may attain a length of 130 mm, a width of 140 mm and a thickness of 50 mm, while the largest one of the former obtained from Turkey attains 83 mm, 88 mm and 54 mm respectively. This means that the Turkish specimen is much greater in its relative thickness, compared with the holotype of *C. omeishanensis*. The other Chinese specimens identified as *C. omeishanensis* (Jing et al., 1974; Yang et al., 1977; Tong, 1978) seem to be better transferred to *C. iranica* in this connection.

One of the specimens (UHR30430) figured in this paper from the Yigilitape formation of Saimbeyli, Turkey, has an elongate ovate outline, which strongly suggests that it is conspecific with *C. shawanensis* Jing. However, the shell of the latter is widest near the midlength, while the widest part of the former considerably comes up to the frontal margin.

As for the specimens described as *Martiniopsis inflata* Waagen from the Gnishik beds of Transcaucasia by Sarytcheva et al. in 1965 and from the Khachik equivalents of Iranian Julfa by Stepanov et al. in 1969, although it is not even certain they may belong to *iranica* or not, the authors included them only questionably in the synonymy.

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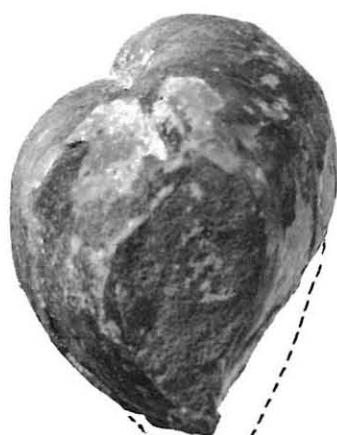
Explanation of plate 2

Figs. 1-2 *Cryptospirifer iranica* n. sp.

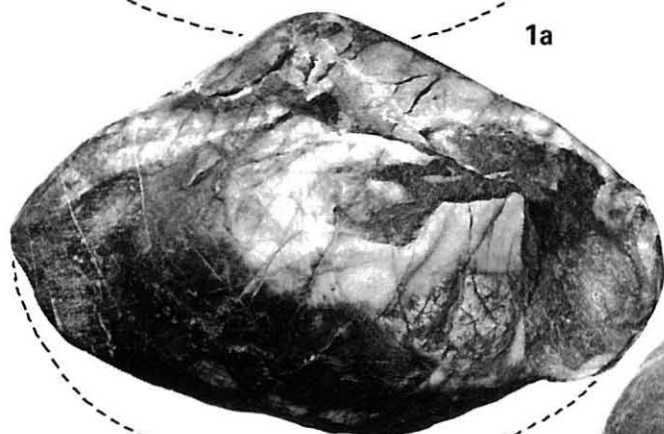
1. (UHR30433): a, b-ventral and dorsal views (×1).
 2. (UHR30434): a, b, c, d-ventral, dorsal, lateral and posterior views (×1).
- Hor.: Uppermost part of unit 3, Loc.: Kuh-e-Hambast, Abadeh, Central Iran.



1a



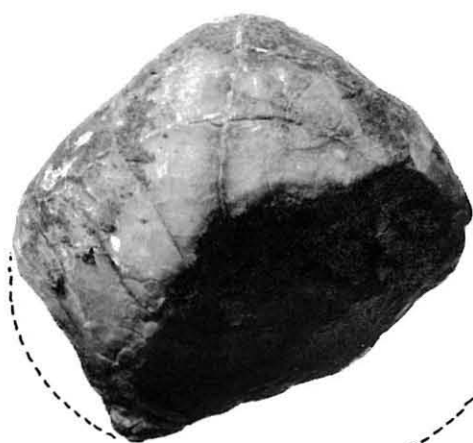
2c



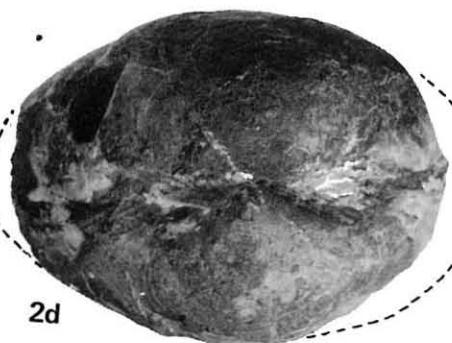
1b



2b



2a



2d

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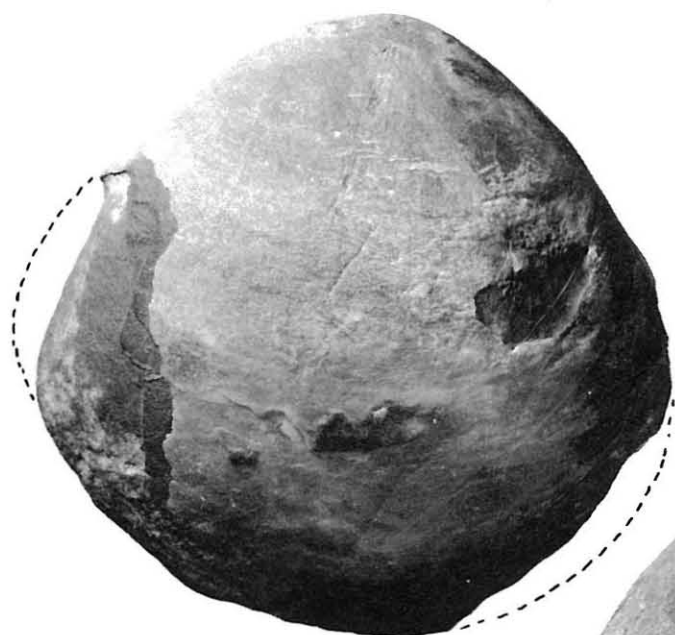
(Manuscript received on Oct. 30, 1980)

Explanation of plate 3

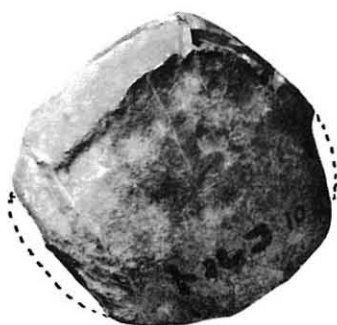
Figs. 1-3. *Cryptospirifer iranica* n. sp.

1. (UHR30428): a-ventral view ($\times 1$); b, c, d-dorsal, lateral, and posterior views ($\times 1/2$).
2. (UHR30429): dorsal view of brachial valve ($\times 1$).
3. (UHR30430): a, b-ventral and dorsal views ($\times 1$).

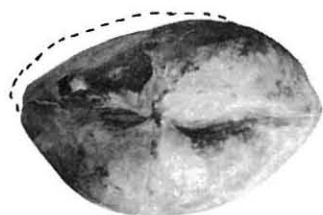
Hor.: Middle part of the Yigilitape formation, Loc.: Saimbeyli, Central Turkey.



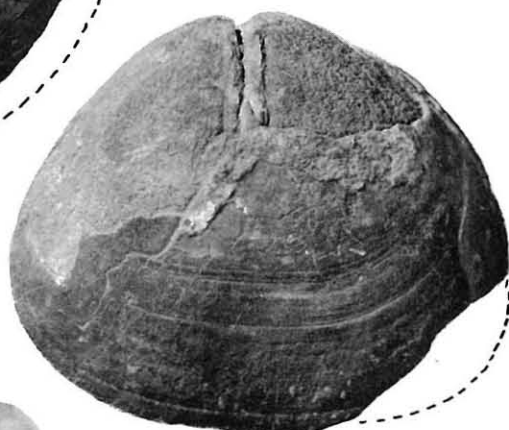
1a



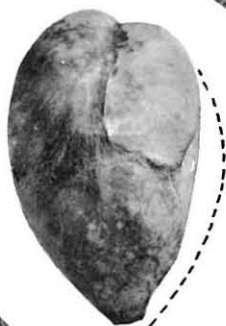
1b



1d



2



1c



3a



3b