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Upper Permian Fossils from Island of Salamis, Greece

By

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Abstract

The Upper Permian fossils are discovered from the southern coast of Kaki Vigla Bay in the Island of Salamis, Greece. They comprise twelve species of foraminifers (*Palaeofusulina* cf. *fusiformis*, *Reichelina* cf. *cribroseptata*, *Colaniella parva*, *C. inflata*, *Wanganella* sp., *Nodosaria longissima*, etc), six species of brachiopods (*Haydenella*? sp., *Wellerella* sp., *Hustedia* sp., *Reticulariina* cf. *netschaewi*, etc.), and three species of corals (*Pleramplexus leptoconicus*, "*Neozaphrentis*" *permicus*, and *Asserculina*? sp.).

The foraminiferal assemblage indicates the latest Permian Changhsingian age which is generally considered to be equivalent to the late Dzhulfian (Dorashamian), while the general characters of brachiopods and corals show the early Dzhulfian age (Araksian). The discrepancy of the age suggests some overlapping between the Changhsingian and the early Dzhulfian. Brief systematic descriptions are also given.

Introduction and Geological Note

In October of 1972, the Japanese research group on the Permian-Triassic sequences in Tethyan Province made a geological reconnaissance survey at several places in Greece. At that time, the members discovered some interesting Upper Permian fossils from the Island of Salamis lying off Piraeus harbor near Athens. The collection includes foraminifers, brachiopods, and corals which have subsequently been studied by ISHII and OKIMURA, KATO, and NAKAMURA, respectively. These materials are considered to be important for discussing the correlation between the upper Dzhulfian (Dorashamian) and the Changhsingian, both of which are generally referred to represent the latest Permian Stage or Substage in the world standard.

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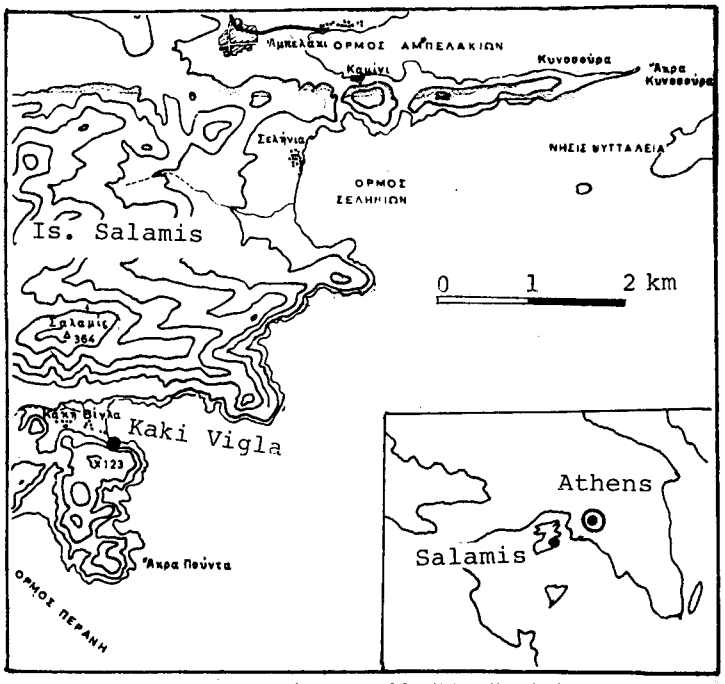

Figure 1. Index-map of fossil locality (●)
(adapted from TATARIS, 1967).

According to AUBOUIN (1965) and DOUNAS (1971), Attica and still wider eastern Central Greece belong to two "geotectonic zones"; the Attic-Cycladic (metamorphic) Mass of the Pelagonian zone eastwards and the Subpelagonian zone westwards. The Island of Salamis is in the latter zone some few kilometres west of the former mass.

The stratigraphy of the lowermost part of the sequences is as follows (DOUNAS, *op. cit.*):

Upper Triassic: black to gray, platy limestones with chert nodules, about 250 m thick, containing *Halobia* sp., *Involutina* cf. *communis*, etc.

Middle to Upper Triassic: white, thick-bedded to massive limestone and dolomitic limestone, broken and karstified, about 350 m thick, containing species of *Diplopora, Gyroporella,* and *Megalodon.*

.....slight unconformity.....

Lower to Middle Triassic: limestone, shale, sandstone, and tuff, about 60 m thick, containing *Maeandrospira iulia, Pilammina densa,* etc.

Upper Carboniferous to Permian: schist, sandstone, graywacke (in the German sense), conglomerate, vulcanite, and limestone, thickness unknown, containing species of *Fusulina, Schwagerina,* etc.

The fossils have been collected from the south coast of Kaki Vigla Bay situated in the southeastern part of the island (Textfig. 1). According to TATARIS (1967) the southern slopes of the hill 364 m to the north of the bay form a sequence of thin-bedded limestones containing filamental shells in cross section, chert nodules, and serpentinites to the east. Further west there is a transition of this sequence to the overlying Upper Triassic carbonates containing in their higher members Megalodons. So that, this sequence may occupy a rather lower part of the Triassic.

At the south coast of the bay the overlying reddish sedimentary rocks of the

Table 1. List of fossils and occurrence of the identical or allied species in other regions.

species	occurrence in other regions
Foraminifers	
Palaeofusulina cf. *fusiformis* SHENG	*Palaeofusulina* zone in south China
Reichelina cf. *cribroseptata* ERK	*Neoschwagerina* to *Polydiexodina* zone in Turkey
Dunbarula sp.	
Schubertella sp.	
Colaniella parva (COLANI)	*Palaeofusulina* zone in China, Japan, Pamir, Indochina, Sikhote-Alin, and northern Caucasus
C. cylindrica M-MAKLAY	Upper Permian in China associated with *Palaeofusulina* sp., Upper Permian in northern Caucasus
C. inflata (WANG)	Upper Permian in China associated with *Palaeofusulina* sp.
C. cf. *nana* M-MAKLAY	Upper Permian of northern Caucasus, middle Lopingian in China, *Lepidolina kumaensis* zone in Japan
Wanganella sp.	
Glovivalvulina cf. *cyprica* REICHEL	*Neoschwagerina* zone in Cyprus, *Palaeofussulina* zone in Pamir
Nodosaria longissima SULEIMANOV	Lower Permian in European Russia, Upper Permian in Urals
Dagmarita sp.	*D. chanakchensis* REITLINGER, Upper Permian in northern Caucasus
Brachiopods	
Rhipidomella sp.	
Haydenella? sp.	*H. minuta* SARYCHEVA, lower and upper Dzhulfian beds in Transcaucasia
Wellerella sp.	*W. arthaberi* (TSCHERNYSCHEW), Gnishik and lower Dzhulfa beds in Transcaucasia
Hustedia sp.	*H.* sp. describe by GRANT (1970) from white sandstone unit (uppermost Chhidru Formation) in Salt Range
Spiriferella sp.	*S. saranae* (de VERNEUIL), lower Upper Permian in Arctic Province
Reticulariina cf. *netchaewi* E. IVANOVA	Upper Permian in European Russia
Corals	
Pleramplexus leptoconicus (ABICH)	Lower (abundant) to upper Dzhulfa (common) beds in Transcaucasia and Iran
"*Neozaphrentis*" *permicus* ILYNA	Khachik beds in Transcaucasia
Asserculina? sp.	

Triassic are in tectonic contact to the underlying upper Paleozoic beds of platy, thin-bedded, black limestones and sandstones running along E-W or NE-SW direction and dipping to S or SE over 30 degrees. The fossils were obtained from black, 10–20 cm bedded limestone alternating with black, sandy shale with a bioturbated texture. The alternation is underlain by dark gray, 30–50 cm bedded sandstone. The identified species and the occurrences of the identical or allied species in other regions are shown in Table 1. There are many fragments of bryozoa and algae, but not yet determined.

Fossil assemblage and Correlation

The foraminiferal assemblage consisting of the advanced forms of *Colaniella*, such as *parva, cylindrica,* and *inflata,* and of *Palaeofusulina,* such as cf. *fusiformis* is characteristic. *Colaniella parva* is limited in stratigraphic range to the Changhsingian in China associated with *Palaeofusulina* sp. (WANG, 1966), and this association is found from the uppermost Permian in Japan higher than the *Lepidolina kumaensis* zone and the *Codonofusiella-Reichelina* zone. It occurs from the uppermost horizon of the Permian in Pamir in association with *Palaeofusulina pamirica* (LEVEN, 1967). The association of *Colaniella parva* and *Palaeofusulina prisca* is reported from the Parnes mountains and Mavrinora massif in Attica, Greece (RENZ and REICHEL, 1945; REICHEL, 1946) and Lang-Nac in North Viet-nam (COLANI, 1924). The occurrence of the latter association from the northern slope of hill, point 123.9 m near the west coast of Kaki Vigla Bay (RENZ and MISTARDIS, 1938) suggests that the fossil beds at the south coast extends westwards there. *Colaniella inflata* and *C. cylindrica* are found from the Upper Permian (Lopingian) in China, and the latter also from the Upper Permian in northern Caucasus (M-MAKLAY, 1954). Their exact horizon in the Upper Permian is not yet certain, but they are accompanied by *Palaeofusulina* sp., the genus of which is confined to the *Palaeofusulina* zone (Changhsingian) in China. Those assemblages stated above belong undoubtedly to the *Palaeofusulina-Reichelina* fauna of the Upper Dzhulfian of TORIYAMA (1973). Therefore, all those fossil-bearing beds are considered to belong to the Changhsingian, if based on the foraminiferal assemblage.

Brachiopod fossils are poorly preserved and are difficult to be specifically determined. The comparable species listed in the table seem to indicate the older age than the late Dzhulfian (Dorashamian) excepting *Haydenella minuta* which ranges from the early to late Dzhulfian.

Among the corals, *Pleramplexus leptoconicus* occurs throughout the Dzhulfian (ILYINA *in* RHUZENTSEV and SARYCHEVA, 1965; STEPANOV *et al.,* 1969; TEICHERT *et al.,* 1973), and is especially dominant in the lower Dzhulfian and the range of the other two forms of the genus may be extended further up. For *Asserculina,* the type species is from Basleo bed of Timor. Other related forms are from the Lower

Permian of Carnic Alps, Iran, USSR, and China. Another related form, "*Ufimia*" *alternata* of ILYINA (1965) is from Gnishik horizon of Caucasus. One more species, "*Neozaphrentis*" *permicus*, is known from the Khachik horizon in Dzhulfa region. Therefore, as a whole, the late Permian age but not the latest is deduced for these Greek corals from Salamis.

Little has been ascertained on the Permian corals of Greece. HERITSCH (1937) described from the Island of Euboea *Caninia trinkleri* SCHINDEWOLF and *Dibunophyllum renzi* HERITSCH. He considered them as Permian, but both would be in reality Carboniferous. HERITSCH (1941) also described *Polythecalis rosiformis* HUANG and *Dibunophyllum renzi* HERITSCH from Attica. *Polythecalis* is lower Permian, unless it is in fact a form related to such Upper Carboniferous "*Polythecalis*" as found in the Donetz basin. *Dibunophullum renzi* appears to be much close to Carboniferous forms. *Carithiaphyllum suessi* HERITSCH described by SCHOUPPÉ (1961) from Attica is lower Permian in age. Thus, so far no unquestionably Upper Permian corals have been turned up from Greece until present report.

In summary, the foraminiferal assemblage indicates the Changhsingian age which is generally correlated to the late Dzhulfian, while the assemblage of brachiopods and corals suggests older age, presumably, early Dzhulfian. How, then, can be explained such discrepancy?

The correlation of the Changhsingian with the upper Dzhulfian is based on the close similarity of the ammonoid faunae of the two and their stratigraphic situation. The Changhsingian is characterized by the "*Pseudotirolites*"-"*Pleuronodoceras*" fauna, and the upper Dzhulfian by the *Paratirolites* fauna. Furthermore, the representative ammonoids of the underlying Wuchiapingian are *Araxoceras* and *Prototoceras* that are common to the lower Dzhulfian. The similarity of the upper Dzhulfian and the Changhsingian faunae has been strengthened by the discovery of "*Pleuronodoceras*", "*Strigogoniatites*", and "*Pseudotirolites*" from the upper Dzhulfian (Ali Bashi Formation) in Iranian Julfa by TEICHERT *et al.* (1973). However, it should be mentioned that the Changhsingian ammonoids are usually found from the Talung Formation and those of the Wuchiapingian from the Lungtan Formation, both of which are considered to be lateral equivalent of the Changhsing limestone and the Wuchiaping limestone, respectively (CHAO, 1965). The Changhsing limestone is usually characterized by the *Palaeofusulina* fauna, and the Wuchiaping by the *Codonofusiella* (SHENG, 1964). On the contrary the upper Dzhulfian has no fusulinid, and the lower Dzhulfian contains very few *Reichelina*. The *Codonofusiella-Reichelina* bed, 2–5.5 m thick at Dorasham section near Dzhulfa, was referred to as the base of the Dzhulfian by RUZENTSEV and SARYCHEVA (1965), but this assemblage is commonly found in the underlying beds at Julfa and Abadeh sections in Iran (preliminary study of ISHII and OKIMURA), and the authors agree with STEPANOV *et al.* (1969) and WATERHOUSE (1972) who raised the lower boundary

of the Dzhulfian to the base of the overlying "*Tompophiceras*" bed. Therefore, there is some uncertainty in the correlation of the two provinces.

ROSTOVTSEV and AZARYAN (1973) considered that the *Palaeofusulina*-bearing Changhsing limestone is older than the "*Pseudotirolites*"-bearing Talung and Hoshan Formations referring to SUN (1947) who stated the Changhsing limestone is overlain by the Hoshan Formation. But CHAO (1965) clearly stated that *Palaeofusulina* cf. *sinensis, Reichelina changhsingensis, Oldhamina decipiens,* etc. are associated with Changhsingian ammonoids, and according to SHENG and LEE (1974) beautiful ammonoids characteristic of the Talung Formation occur abundantly in the Changhsing limestone at the type locality in Kiangsi. Furthermore, WANG (1965) reported the occurrence of "*Pseudotirolites*" *asiaticus* from a horizon below the *Palaeofusulina-Reichelina* in the Changhsing limestone at two localities in Anhwei. Accordingly it is out of question that the *Palaeofusulina* zone is at least partly coeval with the "*Pseudotirolites*" zone, and hence with the upper Dzhulfian.

According to SHENG (1964) the genus *Codonofusiella* does not occur in the Changhsingian, while the genus *Palaeofusulina* is unknown from the Wuchiapingian. On the other hand, WANG (1966) reported the association of *Codonofusiella* sp. with *Palaeofusulina* sp. and *Colaniella parva* in Hunan, the last of which is limited in distribution to the upper part of the Upper Permian, that is, the Changhsingian. In Japan, *Codonofusiella kueichowensis* is abundantly found in association with *Palaeofusulina* cf. *sinensis* in Kyushu (KANMERA and NAKAZAWA, 1973), and the latter species coexists with *Colaniella parva* in the Maizuru zone (ISHII *et al.*, in preparation). It is also noteworthy that a primitive form of *Palaeofusulina, P. minima* composes a characteristic assemblage together with primitive forms of *Colaniella,* such as *C. minima* and *C. nana* in the *Lepidolina kumaensis* zone in Japan. So that, the genus *Palaeofusulina* is not limited to the Changhsingian in vertical range but goes back to the Wuchiapingian, although such primitive forms of the two genera mentioned above survived into the Changhsingian.

It is open to question whether the lower boundary of the "*Pseudotirolites*"-"*Pleuronodoceras*" zone coincides with that of the *Palaeofusulina* zone or not. The authors presume the possibility that the *Palaeofusulina sinensis* fauna appeared earlier than "*Pseudotirolites*" and *Paratirolites* faunae*. Newly found fossils from Salamis constituted by *Palaeofusulina-Colaniella parva* assemblage associated with brachiopods and corals of the lower Dzhulfian affinity suggest the possibility. The fossil bed under consideration may be correlated to the lower Dzhulfian (Araksian), but it is not certain whether it is comparable to the lower part of the *Palaeofusulina* zone or to the upper part of the *Codonofusiella* zone in China at present.

* *Paratirolites* is not confined to the *Paratirolites* Limestone, the top of the Ali Bashi Formation, but is found from the most part of the formation. The species also occurs throughout the unit 7 in the Abadeh region which is correlated to the upper Dzhulfian (Dorashamian) in type Dzhulfa.

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Systematic description

The description of foraminifers is made by ISHII and OKIMURA, brachiopods by K. NAKAMURA, and corals by M. KATO. The described specimens are kept at the following institutions.

Foraminifers: Department of Geosciences, Faculty of Science, Osaka City University.

Brachipods: Department of Geology and Mineralogy, Faculty of Science, Hokkaido University,

Corals: Department of Geology and Mineralogy, Faculty of Science, Hokkaido University.

Phylum Protozoa
Class Rhizopoda
Order Foraminiferida
Family Collaniellidae
Genus *Collaniella* LIKHAREV, 1939
Colaniella inflata (WANG)
Pl. 1. figs. 1 and 2

1966, *Paracolaniella inflata* WANG, *Acta Palaeont. Sinica,* vol. 14, no. 2, p. 232, pl. 5, figs. 9–18

Types:– Although the holotype-specimen (fig. 9) is described as the longitudinal section, it may be a slightly oblique for the central line of the shell which corresponds to the C-axis of the Palaeotextulariidae, and the other figures of this

species consist of a lateral, three transverse, and six oblique sections. Therefore the character of apertural area in the early stage can not be exactly defined, and the shell-length is shorter than actual and bulging nature of additional chambers in adult stage is emphasized.

Materials:– Two nearly longitudinal and two oblique sections were examined. One of the nearly longitudinal sections closely resembles the illustrated fig. 2 by WANG.

Description:– Test small, conoidal, being blunt cuneiform in the early stage and dome-shape in the later stage. 10 to 11 chambers of bowl-shape moderate in height, uniserially and rectilinearly arranged, and strongly overlapped; height of chambers increasing very slowly, but width rapidly increasing; its central part flattened and both lateral parts of chamber gently and strongly inclined. Wall calcareous, consisting of two layers; outer layer thick and vitreous, and inner layer very thin, probably microgranular. Calcareous and vitreous plain partitions of three orders developed longitudinally on chamber floor, arranging radially throughout the growth stage. Interior of chambers subdivided into 15 chamberlets by plain partitions of the first order. Aperture single, opening on the central flattened part of the last chamber. Apertural nature of this species not given in the first definition, and also in our specimens it could not be observed.

Dimensions:– The maximum length 0.72 mm.; the maximum width 0.48 mm.; and form ratio 1.5 in the nearly longitudinal specimen figured with Pl. 1, fig. 2.

Remarks:– This species more closely resembles *C. leei* (WANG) than any other species of the genus *Colaniella*, but the former easily distinguished from the latter in its gradual and higher inclination of lateral part. Moreover, the present form is larger than the latter in the chamber height and the thickness of septal wall. Form ratio of this species is larger than all the other species of *Colaniella*.

Horizon:– *C. inflata* (WANG) is only recorded from the Upper Permian (Lopingian) of Xufuling of Jiangxi, Xikou of Shanxi, and Yinawuxiang of Guizhou, China.

Colaniella cylindrica M-MAKLAY
Pl. 1, figs. 3–7

1954. *Colaniella cylindrica* M-MAKLAY, *Trud. Vses. Nauch-Issled. Geol. Inst.* (VSEGEI), pp. 54–55, pl. 8, figs. 2–8

1966. *Colaniella cylindrica*, WANG, *Acta Palaeont. Sinica*, vol. 14, no. 2, p. 212, pl. 2, fig. 1

Types:– The holotype-specimen of this species (fig. 2) is a nearly longitudinal section. The morphologic characters of the early stage are more clearly shown by the nearly longitudinal section of fig. 5. The apertural character of this species

is neither described nor illustrated in the first definition.

Materials:– A nearly longitudinal, a cross, and two oblique sections were obtained, but they are poorly preserved.

Description:– Test relatively large, cylindrical, tapering uniformly toward the proloculum in the early stage; composed of 14 chambers which are uniserially and rectilinearly arranged; in the early stage chambers regularly increase in size, and uniformly in the later stage. Chambers fairly high, bowl-shape with flattened apertural part, overlapping deeply and lateral part highly inclined from edge of apertural part. Interior of chambers subdivided into 13 chamberlets by longitudinal plain partitions of the first order. Second ordered partitions may develope in the lateral part, but indistinctive due to poorly preserved cross section. Wall calcareous, composed mainly of thick and vitreous outer layer with very thin, discontinuous and dense inner layer. Aperture a single, having probably radial incisions formed by profection of the first ordered partitions.

Dimensions:– The maximum length 1.03 mm. and the maximum width 0.33 mm. in the figured specimen of nearly longitudinal section (Pl. 1, fig. 5), the characters of the early and adult stages can not be sufficiently observed.

Remarks:– This species is closely allied to the monotypic genus *Pseudocolaniella* WANG among all the species of Colaniellidae, in its cylindrical test-form of the later stage. However, the latter is characterized by the Nodosariid internal structure which have not the plain partitions in the later stage, and its chamber height is larger than that of the former.

Horizon:– This species was described from the Upper Permian Nikitin formation of the northern Caucasus, USSR, and from the upper part of the Upper Permian of Xikou of Shanxi, China, associated with *Colaniella xikouensis* WANG, *C. nana* M-MAKLAY, *C. inflata* (WANG) and *Palaeofusulina* sp.

Colaniella parva (COLANI)
Pl. 1, figs. 9 and 10

1924. *Pyramis parva* COLANI, *Indochine, Geol. Surv. Mem.*, vol. 11, fasc. 1–2, p. 181, pl. 29, figs. 2, 4–14, 15a–f, 16–17, 19, 21, 24
1939. *Colaniella parva,* LIKHAREV, *An atlas of the leading forms of fossil fauna of the USSR*; vol. 6, *Permian, Leningrad Cent. Geol. Prospect. Inst.*, pp. 25–31, pl. 1. figs. 10–13
1946. *Pyramis parva,* REICHEL, *Eclogae Geol. Helv.*, vol. 38, no. 2, pp. 542, 544, 547, pl. 19, figs. 13–14, p. 543, tf. 32a–h, p. 545, tf. 33, p. 546, tf. 34
1954. *Colaniella parva,* M-MAKLAY, *Trud. Vses. Nauch-Issled. Geol. Inst.* (VSEGEI), pp. 52–54, pl. 4, figs. 1–12
1966. *Colaniella parva,* WANG, *Acta Palaeont. Sinica,* vol. 14, no. 2, p. 214, pl. 4, figs. 13–18

Materials:– A nearly longitudinal, a cross, and four oblique sections were obtained, but their septal characters of the second and third orders are not clearly defined because of the poor preservation.

Description:– Test large, subovoid tapered toward a proloculum. Strongly overlapped 13 chambers of bowl-shape low in height, uniserially and rectilinearly arranged; increasing gradually in size. Central part of chamber slightly convexed and small, and lateral sides gently inclined with lightly convexed curve. Wall calcareous, composed of two layers; thick, vitreous, outer layer and very thin, microgranular, inner layer. Longitudinal plain partitions of radial arrangement, which is the same as outer layer of wall in structure, developed on the chamber floor; they may be subdivided into three order. 16 chamberlets comparted by plain partitions of the first order. A stellated aperture, which formed by central margin of partition of the first order, opens on the flattened central part of the last chamber.

Dimensions:– The maximum length along the longitudinal axis 1.01 mm.; the maximum width 0.49 mm; and form ratio about 2.0 in the nearly longitudinal section figured with pl. 1, fig. 9.

Remarks:– *Colaniella parva* (COLANI) and *C. media* M-MAKLAY, which represent the advanced form among the Colaniellids, resemble each other in shell-form, but the latter is characterized with broadly flattened apertural area, and larger form ratio than the former.

Horizon:– Occurrance of this species is limited to the upper part of the Upper Permian of the Eastern Mediterranean Region, Caucasus, Indochine and China.

Colaniella sp cf. *C. nana* M-MAKLAY
Pl. 1, fig. 8

Compare:–

1954. *Colaniella nana* M-MAKALY, *Trud. Vses. Nauch-Issled. Geol. Inst.* (VSEGEI), pp. 56–57, pl. 8, figs. 9–10

1966. *Colaniella nana*, WANG, *Acta Palaeont. Sinica.*, vol. 14, no. 2, pp. 214–215, pl. 4, figs. 1–6

Materials:– A nearly longitudinal and two oblique sections were examined, but these specimens are poorly preserved.

Description:– Test very small, conoidal with blunt cuneiform of the early stage and roughly trapezoid form of the later stage; composed of 7 chambers which are uniserially and rectilinearly arranged. Chambers bowl-shape, strongly overlapped, broadly flattened in the apertural part, increasing gradually in size; and its lateral part highly inclined. Additional angle of chambers about 45 degree,

each chamber equally subdivided into three parts of a flattened central. area and both lateral sides. A number of longitudinal plain partitions of radial arrangement developed on the chamber floor, but the number unknown because of abscence of the cross section. Wall calcareous, composed mainly of thick, vitreous outer layer, and indistinctive, thin, dense inner layer. Aperture single, round with radial incisions, opening on the central part of the last chamber.

Dimensions:– The maximum length along the longitudinal axis 0.32 mm.; the maximum width 0.17 mm; and form ratio 1.8 in the figured specimen (Pl. 1, fig. 8).

Comparison:– The specimens from the Salamis Island are smaller than those described by M-MAKLAY from the northern Caucasus, USSR, but closely resemble a specimen from the Upper Permian of China. This species is smaller in shell-size than all the other species of *Colaniella*.

Horizon:– *Colaniella nana* M-MAKLAY has been described from the Nikitin and Urshten formations (Upper Permian) of the northern Caucasus, USSR, and from the Upper Permian of the Xikou of Shanxi, China.

Genus *Wanganella* SOSNINA, 1956

Wanganella sp.

Pl. 1, fig. 11

Materials:– Only two oblique sections were examined, and there are not any sections available for the study on the morphologic characters of the early stage. However, it is described in this paper, because this genus is recognized as an important index-fossil of the Upper Permian.

Descriptive remarks:– Test large, cylindrical, slightly curved, and characterized with uniserial and nodosariid chamber-arrangement with weakly compressed sutures. Chambers very high, and squarish bowl-shape, fairly overlapping; interior subdivided by numerous plain partitions which longitudinally developped on the chamber floor, but the number unknown because of the abscence of the cross section. Plain partitions thickened in the central margin of apertural part. Wall calcareous, consisting of the outer thick vitreous and the inner thin dense layers. A round aperture, probably stellate, opens on the central part of the last chamber.

Both specimens from the Salamis Island are clearly distinguished from all the other colaniellid foraminifers in its elongate cylindrical test with nodosariid chambers and compressed sutures. And also this species is not referable to all the associated species of *Nodosaria* by the characters of chamber with numerous plain partitions.

Horizon:– All the species of the genus *Wanganella* have been described only from the Upper Permian (upper *Metadoliolina lepida* zone) of Primorskaya, USSR.

Family Nodosinellidae
Genus *Pachyphloia* LANGE, 1925
Pachyphloia sp. cf. *P. radiata* (M-MAKLAY)
Pl. 1, figs. 12 and 13

Compare:–

1954. *Pachyphloia radiata* M-MAKLAY, *Trud. Vses. Nauch-Issled. Geol. Inst.* (VSEGEI), pp. 58–59, pl. 9, fig. 2

Types:– As only a longitudinal section is illustrated in the first description of this species, the definit comparison is impossible.

Materials:– Four specimens were examined; a longitudinal, a cross, and two oblique sections. Their preservation is not necessarily fine for the complete definition.

Description:– Test moderately large, inflated ovate-form, composed of 7–9 chambers, tapering gently toward the proloculum, and doming in the terminal side. Chambers hemispherical in shape, uniserially and rectilinearly arranged, fairly overlapped; and the size gradually increased except for the uniform last stage. Wall calcareous, with fibrous structure, thickened by additional lamellae in the lateral sides, but the thickness assymetrical and uneven. Aperture single, round, opening on the central part of domed terminal chamber, which may have some radial grooves.

Dimensions:– The maximum length 0.51 mm.; the maximum width 0.32 mm. in the figured longitudinal specimen (Pl. 1, fig. 12), and the minimum width 0.12 mm. in the figured cross section (Pl. 1, fig. 13).

Comparison and horizon:– Although the cross section of this species is not given by the author, the longitudinal specimen from the Salamis Island, is closely allied in its morphologic characters to the specimen newly described from the Urshten formation (upper part of the Upper Permian) of the northern Caucasus, USSR, but the present species is smaller in size and less in number of chamber than the latter.

Family Nodosariidae
Genus *Nodosaria* LAMARK, 1812
Nodosaria longissima SULEIMANOV
Pl. 1, fig. 14

1949. *Nodosaria longissima* SULEIMANOV, *Trud. IGN. Acad. Nauk,* USSR, Byp. 105, Geol. Ser. (no. 35), pp. 238–239, pl. 1, fig. 9
1949. *Nodosaria longissima,* LIPINA, *Ibid.*, pp, 219, pl. 4, figs. 13–14, pl. 6, figs. 9 and 13

1962. *Nodosaria longissima,* POTIEVSKAYA, *Trud. Acad. Nauk, USSR, Kiev Inst. Geol. Sci. Ser. Strat. Paleont.,* no. 44, pp. 72–73, pl. 6, figs. 3 and 6

Materials:– A longitudinal and three oblique sections were examined. In some specimens, inner thin layer of microgranular calcite may have developed, but it is intermittent and indistinctive.

Description:– Test large, elongate cuneiform, tapering gently toward the proloculum, consisting of eleven chambers which are uniserially and rectilinearly arranged. Sutures fairly compressed between the chambers. Domed chambers gradually and regularly increase in size throughout the growth stage; the ratio of width to height of chamber 1.0 to 1.2 in the early stage, becoming gradually larger in the later stage. Wall relatively thick, composed mainly of radial laminated calcite. Aperture single, rounded with radial incisions, opening on the central part of the domed last chamber.

Dimensions:– The maximum length 1.46 mm. and the maximum width 0.38 mm. in the typical longitudinal section figured with Pl. 1, fig. 14.

Remarks:– This species is closely allied to *Nodosinella longissima* (M-MAKLAY) in respect that the shell of rectilinearly uniserial chamber-arrangement is elongate cuneiform. But the latter is characterized by two layered wall of the outer microgranular and inner fibrous calcite. *Nodosaria longissima* resembles *N. magna* POTIEVSKAYA, but the former is distinguished from the latter in its small size and strongly tapering test.

Horizon:– Although this species was originally recorded from the lower Permian (*Parafusulina lutugini* horizon) of Bashkirian Region, European Russia, subsequently the Upper Permian specimens were described from the Bredinsk Region of Ural, USSR.

Family Biseriamminidae

Genus *Globivalvulina* SCHUBERT, 1921

Globivalvulina sp. cf. *G. cyprica* REICHEL

Pl. 1, fig. 15

Compare:–

1946. *Globivalvulina cyprica* REICHEL, *Eclog. Geol. Helv.,* vol. 38, no. 2, pp. 553–554, fig. 39a–f

Materials:– A nearly apertural and a oblique sections were examined.

Description:– Test relatively small in size, ovoid in shape, slightly trocospiral in the early stage and planispiral in the later stage; and biserial succession of chambers arranged along an axis of biseriality that draws an open helicoid curve. Chambers five in number in each row, slightly overlapped; the ratio of height to

breadth of the chamber gradually enlarged in size throughout the growth stage, excepting the penulitimate and the last chamber. Wall moderate in thickness, microgranular, calcareous with inner thin fibrous calcite layer partially. Aperture probably lobate, opening on somewhat concave apertural face.

Dimensions:- The longest diameter 0.62 mm. and the maximum width 0.4 mm. in the figured specimen (Pl. 1, fig. 15).

Remarks:- The specimens from the Salamis Island are closely allied to *G. cyprica* REICHEL in its important character of the nearly apertural section, but the writers hesitate to identify completely so, because there is no sagittal section enough to refer.

Horizon:- In the first definition of *Globivalvulina cyprica*, the following foraminifers are listed up as the association; *Neoschwagerina craticulifera, Climacammina, Trochammina, Calcivertella, Pachyphloia, Padangia, Flondicularia* and *Hemigordiopsis*. The last two genera are the important foraminifers which indicate the Upper Permian.

Genus *Dagmarita* REITLINGER, 1965

Dagmarita sp.

Pl. 1, fig. 16

Compare:-

1965. *Dagmarita chanakchensis* REITLINGER, *Otd. Nauk Zenule, Geol. Inst. Bop. Mikropäleont.*, no. 9, p. 63, pl. 1, figs. 10–12 (holotype; 10)

Materials:- A tangential and a parallel sections were only examined, but they were comparable to the microphotographs of the monotypic genus *Dagmarita* (pl. 1, figs. 12a and b).

Descriptive remarks:- Test small in size, slightly curved, squarished cuneiform, and it may be characterized with trochospiral coiling in the early stage. Squarish chambers of biserial arrangement over three in each row, increasing gradually in size, and thickened with a hook-line projection in the adjacent part of chambers. Wall calcareous, composed mainly of microgranular calcite and accompanied with indistinctive vitreous layer. Aperture single, slit?, low opening at the base of slightly domed face of the last chamber.

The parallel section of this species resembles *Globivalvulina cyprica* REICHEL, but is clearly distinguished from the latter in most important characters of the former, such as septal thickening and projection.

Dimensions:- The maximum length 0.38 mm. and the maximum width 0.28 mm. in the tangential section figured with Pl. 1, fig. 16.

Horizon:- This genus is monotypic, and reported only from the Upper Permian (Gnishk-Khatisk-Dzhulfinsk) of the northern Caucasus, USSR.

Family Fusulinidae
Subfamily Schubertellinae
Genus *Palaeofusulina* DEPRAT, 1912
Palaeofusulina sp. cf. *P. fusiformis* SHENG
Pl. 2, figs. 1, 2, 3

Compare:–

1955. *Palaeofusulina sinensis* var. *fusiformis* SHENG, *Acta Palaeont. Sinica*, vol. 3, no. 4, pp. 296, 306, pl. 1, figs. 14, 15

1963. *Palaeofusulina fusiformis*, SHENG, *Palaeont. Sinica*, new ser. B, no. 10, pp. 51, 52, 176, pl. 10, figs. 5–9

Materials:– An axial and two tangential sections were examined, but their preservation is not so good.

Description:– Test small fusiform with straight axis of coiling and with bluntly pointed poles. Lateral slopes slightly concave. Number of volutions 4. Mature tests, 1.65–2.07 mm. long and 0.71–0.96 mm. wide, with form ratio 2.1–2.4. Test coils loosely. From third volution outward coiling expands rapidly. Proloculus indistinct; one specimen spherical in shape, about 0.07 mm. in outside diameter. Spirotheca thin, composed of a tectum and diaphanotheca, measuring 11 μ in thickness in outer volutions. Chomata not observed; in outer volutions they seem to be substituted by pseudochomata which are wall of chamberlets at outside tunnel. Tunnel well defined. Septal fluting throughout length of chamber.

Dimensions:–

specimen	L.	W.	R.	P.	Vol. no.	Radius vector (mm.) 1	2	3	4
pl.2, fig. 1	2.07	0.96	2.2	0.07	4	—	0.11	0.27	0.48
pl.2, fig. 2	1.65?	0.79	2.1	—	4	—	0.13	0.21	0.37
	1.75?	0.71	2.4	—	4	0.05	0.10	0.19	0.43

Ratio of Hl/Rv 1	2	3	4	Height of volution (mm.) 1	2	3	4
—	2.4	1.9	2.3	—	0.05	0.16	0.19
—	1.8	2.3	2.2	—	0.06	0.13	0.21
2.7	3.5	2.9	2.0	0.03	0.05	0.10	0.21

L., length (mm.); W., width (mm.); R., ratio of length to width; P., proloculus diameter (mm.); Hl, half length; Rv, radius vector

Remarks:– The present specimens resemble *Palaeofusulina fusiformis* SHENG from the Changhsing Limestone, Zhongliangshan, Chungking, Szechuan Province and the Liangfengpo shale, Kueichow Province in South China, in the test form, size and larger form ratio at maturity, but the former is more slender than the latter. The writers do not identify the present specimens with *Palaeofusulina fusiformis* by reason that the Salamis specimens are represented by slightly eccentric sections.

The present specimens also resemble *Palaeofusulina pull* SHENG from the Liangf-

egpo shale, Kueichow Province, South China, but differ from the latter in smaller size, larger form ratio and fewer number of volutions.

Horizon:– *Palaeofusulina fusiformis* occurs with *Palaeofusulina-Reichelina* fauna which are represented by *Palaeofusulina sinensis, P. prisca, Reichelina cribroseptata, R. changhsingensis,* etc. from the *Palaeofusulina* zone, Lopingian, South China

Dunbarula GIRTY, 1948
Dunbarula sp.
Pl. 2, figa. 4

Materials:– Only a slightly oblique and parallel sections were examined, but the preservation of the oblique section is not so good.

Description:– Test minute, fusiform with dome-like central portions and bluntly pointed poles. This specimens with 4 volutions, attaining 0.95 mm. long and 0.59 mm. wide, giving a form ratio 1.6. First volution discoidal, coiling at a large angle to later volutions. Inner two volutions tightly coiled and outer two volutions rapidly expanded. Proloculus minute, with outside diameter 0.06 mm. Spirotheca composed of a tectum and diaphanotheca, measuring 17 μ in thickness in third volution. Septa fluted at polar regions in inner volutions; septal fluting of last volution strong throughout length of chamber. Tunnel indistinct for secondary material. Fine mural pores only poorly visible in last volutions.

Dimensions:–

specimen	L.	W.	R.	P.	Vol. no.	Radius vector (mm.) 1	2	3	4
pl. 2, fig. 4	0.95	0.59	1.6	0.06	4	0.08	0.10	0.17	0.30

Ratio of Hl/Rv 1	2	3	4	Height of volution (mm.) 1	2	3	4
0.6	1.5	1.6	1.7	0.05	0.05	0.10	0.13

Remarks:– The above-mentioned feature of septal fluting and coiling at a large angle to axis of outer volution indicate that the present specimen belongs to the genus *Dunbarula*. Since this form is represented by only one slightly oblique section, and the preservation is very poor by secondary material, it is better to leave this specimen unnamed until more sufficient material becomes available.

Family Ozawainellidae
Genus *Reichelina* ERK, 1941
Reichelina sp. cf. *R. cribroseptata* ERK
Pl. 2, figs. 5, 6, 7

Compare:–

1941. *Reichelina cribroseptata* ERK, *Eclog. Geol. Helv.*, vol. 34, no. 2, p. 250, pl. 14, figs. 17–21

1954. *Reichelina cribroseptata*, M-MAKLAY, *Trud. Bses. Nauch-Issled. Geol. Inst.* (VSEGEI), p. 73, pl. 14, figs. 1, 2, 4

1963. *Reichelina cribroseptata*, SHENG, *Palaeont. Sinica*, new ser. B, no. 10, pp. 25, 26, 148, 149, pl. 1, figs 13–16

Materials:– Several axial and oblique sections were obtained, but they are poorly preserved.

Description:– Test minute, lenticular; axis of coiling short. Inner two volutions subdiscoidal with narrowly rounded periphery, outer two volutions lenticular with sharply angular periphery. Last volution expanded as a tail-like prolongation of shell. Number of volutions 4 1/2. Proloculus minute, spherical, about 0.03–0.04 mm. in outside diameter. Spirotheca thin, consisting of a tectum and diaphanotheca. Septa plane, closely spaced. Chomata weak, tapering poleward in outer volutions. Tunnel narrow and low.

Dimention:–

specimen	L.	W.	R.	P.	Vol. no.	Width of volution (mm.) 1	2	3	4
pl. 2, fig. 5	0.22	0.60	0.37	0.03	4 1/2	0.07	0.12	0.24	0.52
pl. 2, fig. 6	0.17	0.46	0.38	0.04	4 1/2	0.08	0.18	0.33	0.48

Ratio of L/W			
1	2	3	4
0.59	0.55	0.53	0.40
0.55	0.46	0.37	0.33

Remarks:– The present specimens closely resemble *R. cribroseptata* ERK from Turkey and identified specimens from South China and Northern Caucasus in the test form, number of volution and size of proloculus. The former, however, differs from the latter in smaller size and smaller form ratio.

More sufficient materials of this form are necessary before a definite identification can be made.

Horizon:– *Reichelina cribroseptata* was originally reported from Sarikaya, the central part of Diskaya mountain in the Bursa Province of Turkey. *Reichelina minuta, Codonofusiella paradoxica* and *C. nana* are accompanied there. In this place, *Neoschwagerina, Cancellina* and *Misellina* also occur, but the biostratigraphical relationship between *Reichelina-Codonofusiella* fauna and *Neoschwagerina-Misellina* fauna is not certain. The species is also reported from the Lpoingian in China and the Upper Permian Nikitinsk horizon of Northern Caucasus.

Phylum Brachiopoda
Order Orthida
Superfamily Enteletacea
Family Rhipidomellidae
Genus *Rhipidomella* OEHLERT, 1890
Rhipidomella sp.
Pl. 2, fig. 8

Remarks: One shell consisting of a broken pedicle valve shows the characteristic low convexity and numerous fine radial costellae of the genus *Rhipidomella*.

The generic determination is certain, but the material examined is too poorly preserved to allow specific identification or comparison.

Order Strophomenida
Superfamily Productacea
Family Margiferidae
Genus *Haydenella* F. R. C. REED, 1944
Hayadenella? sp.
Pl. 2, fig. 11

Remarks: A samll and finelly costellate pedicle valve of productoid is examined. The generic identification is uncertain, but the chacateristics of the surface ornamentation revealed are sufficient to place the specimen in the genus *Haydenella*.

Amongst several species belonging to the genus, *Haydenella minuta* SARYTCHEVA most closely resembles the present species. However, the strict comparison between these two species is almost impossible, because of the poorly preserved specimen at hand.

Order Rhynchonellida
Superfamily Rhynchonellacea
Family Wellerellidae
Genus *Wellerella* DUNBAR and CONDRA, 1932
Wellerella sp.
Pl. 2, figs. 10a,b

Remarks: Shell is small, uniformly biconvex, rounded and triangular. The comparatively few costae begin at some distance from the beak with an oval foramen.

The present species most resembles *Wellerella arthaberi* (TSCHERNYSHEW) in its shape and surface sculptures. However, the shell of the latter seems to be more globose and the developed costae are sharper than those of the former.

Order Spiriferida
Superfamily Retziacea
Family Retziidae
Genus *Hustedia* HALL and CLARKE, 1893
Hustedia sp.
Pl. 2, fig. 13

Remarks: A single brachial valve together with a part of pedicle valve is obtained. The shell is very small in size and elongately oval in outline. The surface is covered by rather few costae. In these respects, the present species is nearly identical with species of *Hustedia* described and figured by GRANT (1970, p. 139, pl. 2, figs. 10, 10a,b) from the white sandstone unit of the Chhidru Formation in the Salt Range, Pakistan.

Superfamily Spiriferacea
Family Brachythyrididae
Genus *Spiriferella* TSCHERNYSCHEW, 1902
Spiriferella sp.
Pl. 2, figs. 9a–c

Remarks: A single imperfect pedicle valve with short hinge is at hand. It is moderate in size for the genus and has strong and nonfasciculate plications. The elongately oval shell form of the present material reminds the author of *Spiriferella rajah* (SALTER) or *S. saranae* (de VERNEUIL). The distinction between *S. rajah* and *S. saranae* is based on both external and internal characteristics. Internally the former has thick muscle platform, while the pedicle valve of the latter is quite thin medially as suggested by NELSON and JOHNSON in 1968. But, unfortunately no internal structures of the present specimen are made visible.

The plications of *Spiriferella rajah* are typically fasciculate. On the other hand, those of *S. saranae* are rather simple and nonfasciculate. So far as the external surface sculptures are concerned, the present specimen is most allied to *S. saranae*.

Superfamily Spiriferinacea
Family Spiriferinidae
Genus *Reticulariina* FREDERICKS, 1916
Reticulariina cf. *netschaewi* E. IVANOVA
Pl. 2, fig. 12

Compare: *Reticulariina netschaewi* E. IVANOVA, 1960, pl. 64, figs. 17a–g.

Remarks.: Only a fragmental pedicle valve is available for study. Although the specimen now in concern is quite imperfect in preservation, the specimen retains

enough of the characteristics of the genus for generic identification.

The shell is small in size and almost triangular in outline. The surface of the valve is obviously punctate. The median sulcus is smooth and more or less broad. Each lateral slope has two or three plications.

In the external features described above the present species resembles *Reticulariina netschaewi* E. IVANOVA, but the imperfectly preserved pedicle valve does not permit its correct assignment.

Phylum Coelenterata
Class Anthozoa
Order Tetracorallia
Family Polycoeliidae
Subfamily Plerophyllidae
Genus *Pleramplexus* SCHINDEWOLF, 1940
Pleramplexus leptoconicus (ABICH)
Pl. 3, figs. 2a,b

1978. *Clisiophyllum leptoconicum* ABICH, S. 87, Taf. 2, Fig. 7, 7a.
1971. *Pleramplexus leptoconicus*, FLÜGEL, p. 117, pl. 5, figs. 1,2; pl. 6, figs. Bl-10 (for further synonymy see).
1973. *Pleramplexus leptoconicus*, TEICHERT & KUMMEL, p. 395, pl. 2, figs. 1,2,5,6.

Remarks: The species is said to have two different forms, according to Flügel (1971). He suggested that they might represent two different species. Difference lies mainly in respect to their sizes. But the present author is failed to detect any significant difference between these two alleged forms.

Greek specimen has ceratoid corallum with distinct septal groves on epitheca. It has the largest diameter of 15 mm and more than 26 mm long so far as preserved.

Internally 29 short major septa alternate with distinct but very short minors. The counter septum is slightly shorter than the other majors and presumably the cardinal one is slightly longer than the others.

The specimen is quite identical with *Pleramplexus leptoconicus*, which has been known from Julfian (*Araxilevis-Araxoceras* zone) to "Induan" (*Paratirolites* zone) in Armenia (ILYINA, 1965), from the Nesen formation of central Elburz (FLÜGEL, 1968), from the Ali Bashi formation as well as from Julfa beds in N. W. Iran (TEICHERT *et al.*, 1973). Ali Bashi formation is a name given to transitional bed from Permian to Triassic, but is still considered as Permian by TEICHERT *et al.*, 1973.

In short, therefore, the species is mostly, if not exclusively, uppermost Permian in age in the western Tethys.

Pleramplexus leptoconicus has larger corallite and distinct minor septa compared to *P. minimum* (sic) ILYINA. Both *Pleramplexus similis* and *dissimilis* SCHINDEWOLF

are provided with longer major septa than in the present form.

Family Hapsiphyllidae

Genus *Neozaphrentis* GROVE, 1935

"*Neozaphrentis*" *permicus* ILYINA

Pl. 3, figs. 1a,b

1965. *Neozaphrentis permicus* ILYINA, p. 76, pl. 16, figs. 5, 6; pl. 17, figs. 1,2; Text-figs. 32, 33.

Remarks: ILYINA (1965) described a new species of *Neozaphrentis* from Khachik horizon in Armenian Julfa. But whether her *Neozaphrentis* is a true member of that Mississippian genus or not needs to be more fully investigated. In "*Neozaphrentis*" *permicus* ILYINA, in mature stage, long minor septa are well developed leaning upon neighbouring majors. This is not the character found in genuine *Neozaphrentis*. The Julfian species has a thick, long counter septum and a cardinal fossula. So, at a glance, it looks as if it is a member of *Hapsiphyllum*. HERITSCH (1937) described *Hapsiphyllum djoulfense* from Julfa region (fide BASSLER, 1950), but for this the author unfortunately could not refer.

The Greek form has the diameter of 9 mm in calicular portion, 23–24 major septa, well bounded cardinal fossula with a short cardinal septum and a thick, long counter septum. Further, short minor septa alternate with the majors. And septa-like plates are present on the counter side of each major septum touching with it. This may probably be the sign of the presence of horizontal septal carinae on majors.

The Greek form is here identified as "*Neozaphrentis*" *permicus*, and is especially very similar to a stage illustrated by ILYINA as pl. 16, fig. 13. This species is found from Khachik horizon in Armenian Julfa as stated above.

A number of *Hapsiphyllum* established by GRABAU (1928) from China were assigned to *Neozaphrentis* by ILYINA (1965). All of them, except for "*Hapsiphyllum*" *magnolacunum*, do not resemble "*Neozaphrentis*" *permicus*. But "*H*". *magnolacunum* has minors leaning upon majors, although its counter septum is not quite long and thick, compared to the other majors.

Genus *Asserculina* SCHOUPPÉ & STACUL, 1959

The genus contains simple corals with long, radially arranged major septa with the development of horizontal carinae. The type species, *Asserculina prima* has a thick counter septum. But otherwise *Asserculina* looks similar to *Duplophyllum* which has long, contratingent minor septa.

Asserculina ? sp.
Pl. 3, figs. 3a–d

Remarks: A specimen of small conico-cylindrical corallite with prominent septal grooves (0.7 cm diameter, 20 cm long) reveals somewhat twisted, long, thin major septa with long minor septa. Twenty-two majors are present.

One of major septa (probably the counter septum) is longer than the others and swollen at the centre of corallite, while the opposite septum to this septum (possibly the cardinal septum) is short. All the minors are leaning upon the neighbouring majors on cardinal side. As longitudinal section does not definitely show the presence of carinae, the systematic position of the present Greek form must not be finally determined. It however, quite resembles *Asserculina* species.

From East Iran FLÜGEL (1962) described *Asserculina* ? sp., the horizon of which is said to be *Pseudofusulina* to *Parafusulina* Zone. This form is quite similar to the present form. *Tachylasma alternatum* HUANG is another ally to the present form. This species was originally found from Lower Permian of China, but was later assigned to *Ufimia* by ILYINA who described that form from the Gnishik horizon in Julfa. FLÜGEL (1972) questioned her assignment and suggested its inclusion in *Asserculina*. It may be, however, a member of *Duplophyllum* KOKER (YU *et al.*, 1963).

Forms of *Asserculina* are from lower Permian of USSR (SOSHKINA *et al.*, 1941), lower Permian of Carnic Alps (FELSER, 1937), Upper Permian of Timor (SCHOUPPÉ & STACUL, 1959), and lower to middle Permian of Iran (FLÜGEL, 1972). *Asserculina* is recently listed from the topmost Permian in China (SHENG and LEE, 1974). The genus is therefore known through the Permian.

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Postscript: The following species of smaller foraminifers should be added to the figured ones.

Agathammina sp., *Glomospira* sp., *Lunucammina* sp., *Robuloides*? sp., *Multidiscus*?

sp., palaeotextulariids, and tetrataxids, in addition to a fusulinid species of *Staffella*.

Explanation of plate 1

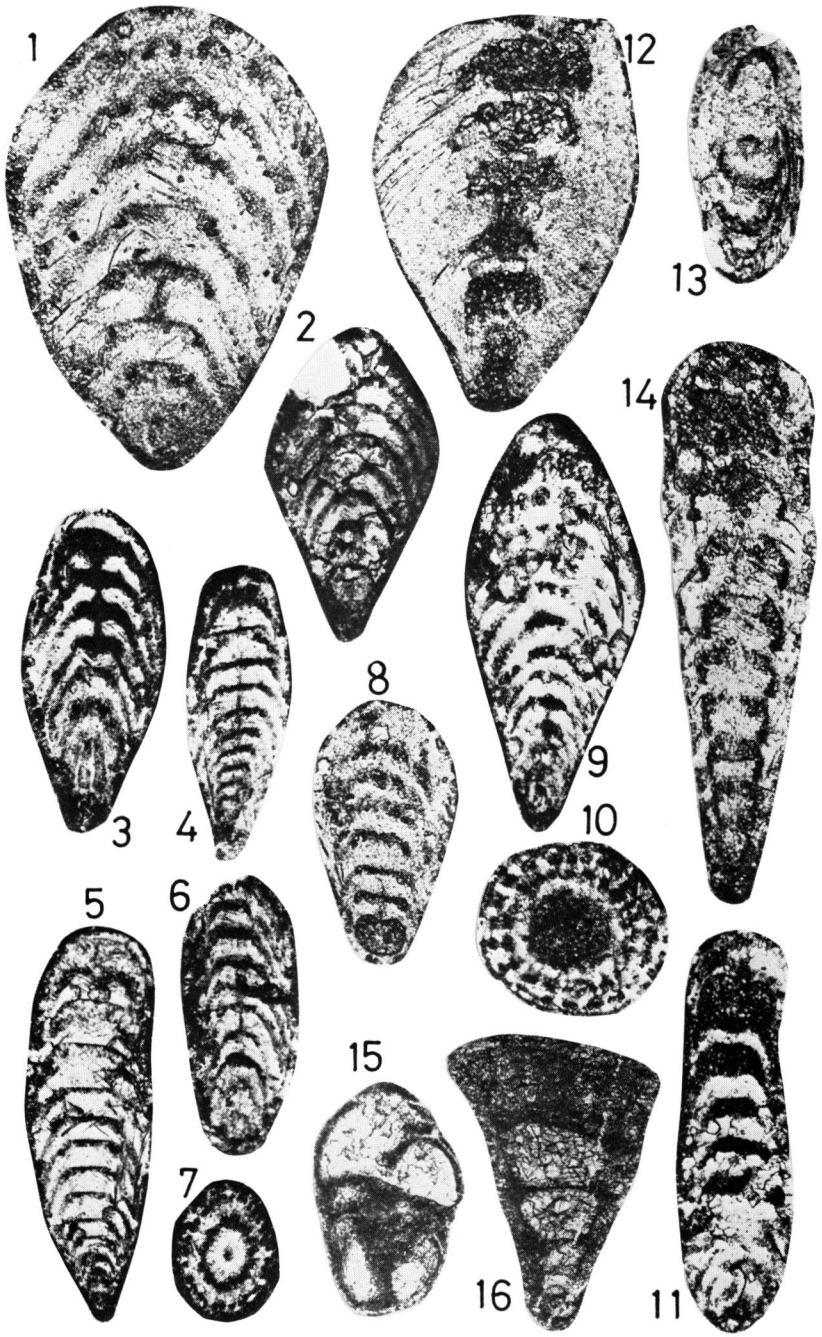
Fig. 1. *Colaniella inflata* (WANG), oblique section, ×110.
Fig. 2. *Colaniella inflata* (WANG), nearly longitudinal section, ×50.
Figs. 3 and 6. *Colaniella cylindrica* M-MAKALY, oblique sections, ×50.
Figs. 4 and 5. *Colaniella cylindrica* M-MAKLAY, nearly longitudinal sections, ×50.
Fig. 7. *Colaniella cylindrica* M-MAKLAY, cross section, × 50.
Fig. 8. *Colaniella* sp. cf. *C. nana* M-MAKLAY, nearly longitudinal section, ×110.
Fig. 9. *Colaniella parva* (REICHEL), nearly longitudinal section, ×50.
Fig. 10. *Colaniella parva* (REICHEL), cross section, ×50.
Fig. 11. *Wanganella* sp., oblique section, ×50.
Fig. 12. *Pachyphloia* sp. cf. *P. radiata* (M-MAKLAY), longitudinal section, ×110.
Fig. 13. *Pachyphloia* sp. cf. *P. radiata* (M-MAKLAY), cross section, ×110.
Fig. 14. *Nodosaria longissima* SULEIMANOV, longitudinal section, ×50.
Fig. 15. *Globivalvulina* sp. cf. *G. cyprica* REICHEL, nearly apertural section, ×110.
Fig. 16. *Dagmarita* sp., tangential section, ×100.

Explanation of plate 2

Figs. 1–3. *Palaeofusulina* sp. cf. *P. fusiformis* SHENG, 1; axial section, 2; tangential section, both ×50, 3; parallel section, ×100
Figs. 3–4. *Dunbarula* sp., oblique section, ×70.
Figs. 5–7. *Reichelina* sp. cf. *R. cribroseptata* ERK, 5, 6; axial sections ×100, 7; oblique section ×100.
Fig. 8. *Rhipidomella* sp., pedicle valve, ×2.
Figs. 9a–c. *Spiriferella* sp., a; ventral view of pedicle valve, b; dorsal view of the same, c; lateral view of the same, all natural size.
Figs. 10a, b. *Wellerella* sp., a; brachial valve, b; pedicle valve, both ×2.
Fig. 11. *Haydenella*? sp. indet., pedicle valve, ×2.
Fig. 12. *Reticulariina* cf. *netschaewi* E. IVANOVA, pedicle valve, ×2.
Fig. 13. *Hustedia* sp., brachial valve, ×2.

Explanation of plate 3

Figs. 1a, b. "*Neozaphrenties*" *permicus* ILYINA, serial cross sections.
Figs. 2a, b. *Pleramplexsus leptoconicus* (ABICH), a; cross section, b; longitudinal section.
Figs. 3a–d. *Asserculina*? sp., a,b,d; serial cross sections, c; longitudinal section.
(All figures, ×6, S. KUMANO photo)



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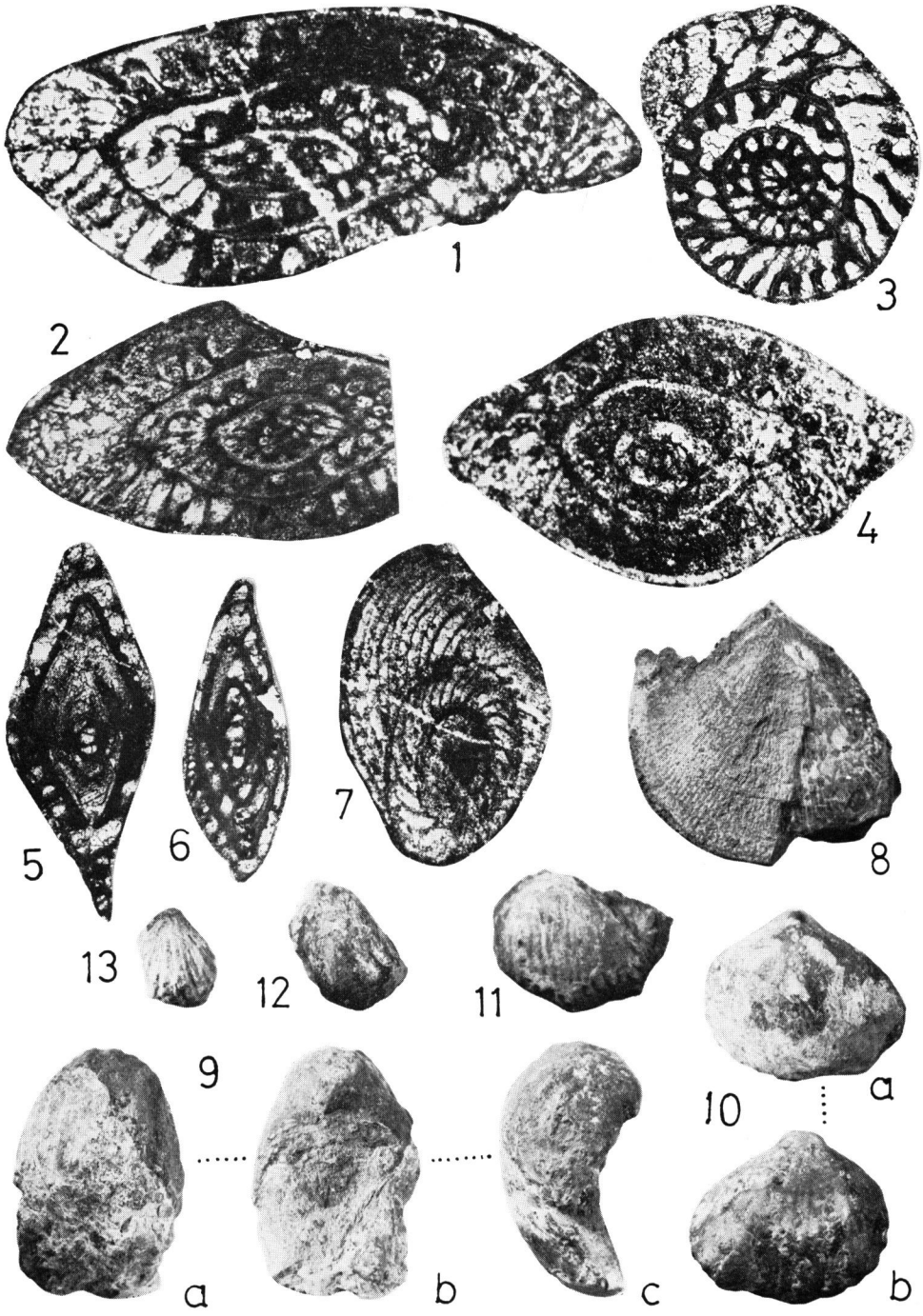

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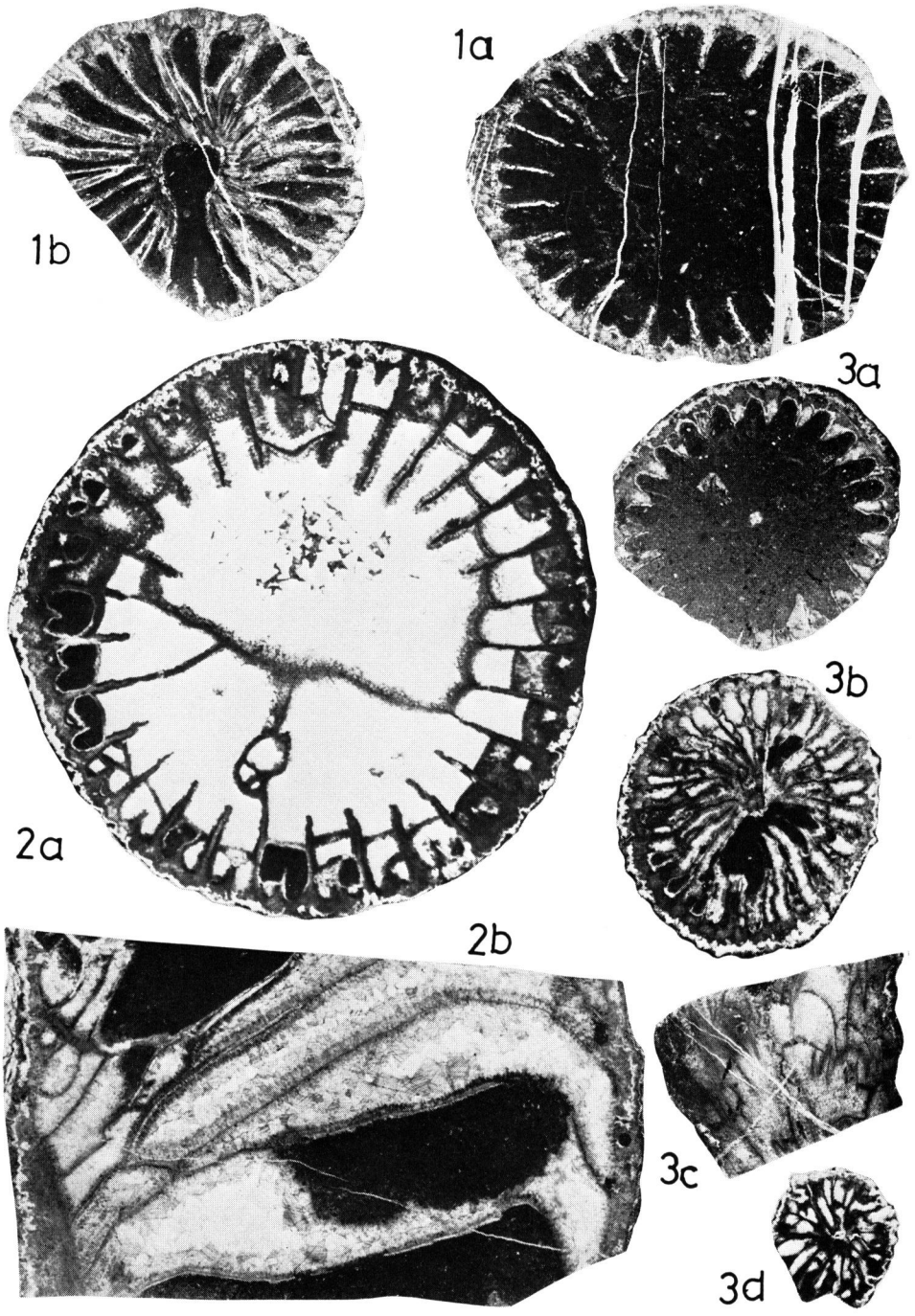

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