The Khuff Formation (Middle East) and time-equivalents in Turkey and South China: biostratigraphy from Capitanian to Changhsingian times (Permian), new foraminiferal taxa, and palaeogeographical implications

La Formación Khuff (Oriente Medio) y sus equivalentes cronológicos de Turquía y China del Sur: bioestratigrafía, nuevos taxones de foraminíferos e implicaciones paleogeográficas del Capitaniense al Changhsingiense (Pérmico Medio-Superior)

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GAILLOT, J. & VACHARD, D. 2007. The Khuff Formation (Middle East) and time-equivalents in Turkey and South China: biostratigraphy from Capitanian to Changhsingian times (Permian), new foraminiferal taxa, and palaeogeographical implications. *Coloquios de Paleontología*, **57**: 37-223.

Abstrac: A detailed biostratigraphic and microfacies study of the late Middle Permian to Early Triassic Khuff Formation was undertaken in three reference regions in the Zagros area (Iran), United Arabian Emirates (UAE) and Saudi Arabia. Comparisons done with traditional Lopingian reference sections, as such as Hazro (eastern Taurus, Turkey), and Laren and Tsonteng sections (Guangxi, southern China), allow sub-dividision of the Permian part of the Khuff deposits into six main biozones: (1) the late Midian is characterized by *Shanita amosi* associated with *Dunbarula nana*; (2) the early Wuchiapingian is characterized by the FAD of *Paraglobivalvulina mira* and *Pseudotristix solida* during a first flooding event, strongly restructuring the Middle Permian habitats; (3) the "middle" Wuchiapingian is defined locally with the appearance of the genus *Paradagmarita* with numerous regional markers and corresponds to maximal connection with an open marine system; (4) the late Wuchiapingian is characterized by an assemblage dominated by the biseriamminid *Charliella altineri* sp. nov. and the ozawainellid *Neomillerella mirabilis* gen. nov. sp. nov.; (5) the early Changhsingian corresponds to a "Biseriamminid bloom" event with *Paradagmacrusta callosa* gen. nov. sp. nov. as the main marker; and (6) the late Changhsingian is dominated by large miliolids such as *Crassiglomella* and *Glomomidiellopsis uenoi*. During the Late Permian, different foraminiferal morphogroups colonized and flourished in the various habitats of the inner carbonate shelf of the Arabian Platform, depending mainly on salinity, energy, depth, and presence of shallow meadows of gymnocodiaceans. A palaeoecological analysis will be presented in a second part of this work, together with the study of algae. The Late Permian foraminifers of the Khuff platform are typical of very shallow to restricted environments, and cannot cross through deep basins because of its shallow stenobath character. Hence, their geographical distribution can be used to reconstruct the continuity of the inner carbonate ramps. Numerous foraminifer genera were discovered in the different regions. Some biseriamminoid taxa are especially useful to identify the degree of connection and thus the approximative distance between carbonate platforms and/or tectonostratigraphic terranes. Hence, relationships are confirmed between the Taurus and Zagros but, surprinsingly, they are demonstrated between Zagros, southern China and some Japanese terranes. The best palaeobiogeographical markers are *Paradagmarita, Floritheca*, *Partisania* and *Paradagmaritopsis*. The new taxa described here are: (a) 2 subfamilies, Paradagmarininae and Paraglobivalvulininae; (b) 17 genera, *Floritheca*, *Neomillerella*, *Labioglobivalvulina*, *Retroseptellina*, *Labiodagmarita*, *Paradagmaritella*, *Paradagmacrusta*, *Paremiratella*, *Septigordius*, *Brunsispirella*, *Crassispirella*, *Crassiglomella*, *Uralogordius*, *Neodiscopsis*, *Glomomidiellopsis*, *Nestellorella*, and *Aulacophloia*; (c) 30 species: *Floritheca variata*, *Neomillerella mirabilis*, *Globivalvulina parascaphoidea*, *G. neglecta*, *Charliella altineri*, *Labioglobivalvulina baudi, L. fortis*, *Paremiratella robusta*, *Labiodagmarita vasleti*, *Louisettita extraordinaria*, *Paradagmarita simplex*, *P. zaninettiae*, *P. planispiralis*, *Paradagmaritella brevispira*, *Paradagmaritella surmehensis*, *Paradagmacrusta callosa*, *Paremiratella robusta*, *Palaeonubecularia iranica*, *Hoyenella laxa*, *Crassispirella hughesi, Glomomidiellopsis uenoi*, *G. tieni*, *G. lysitiformis*, *Neodiscopsis canutii*, *Rectostipulina syzranaeformis*, *Langella massei*, *Partisania sigmoidalis*, *Cryptomorphina hazroensis*, *Pachyphloia enormis*, and *Aulacophloia martiniae*; and (d) 9 emended genera: *Septoglobivalvulina*, *Louisettita,*

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nella, Neodiscus, Tauridia, *Polarisella*, *Pachyphloides/Cryptoseptida* and *Ichthyofrondina.*
Keywords: Foraminifers, Systematics, Permian, Middle East, Khuff, South-China, Biostratigraphy, Palaeobiogeography.

Resumen: El estudio detallado de la bioestratigrafia y de las microfacies de dos secciones de referencia en los montes del Zagros (Irán), asociada con los datos de subsuelo permiten subdividir la parte pérmica de la Formación Khuff en seis unidades principales: (1) el Midiense Superior, caracterizado por *Shanita amosi* asociado con *Dunbarula nana*; (2) el Wuchiapingiense inferior se distingue por la FAD (primera aparición) de *Paraglobivalvulina mira* y *Pseudotristix solida* durante un primer acontecimiento de "flooding", que modifica profundamente los hábitos del Pérmico Medio; (3) el Wuchiapingiense medio es definido aquí con la aparición del género *Paradagmarita* y de varios marcadores regionales; correspondiendo con la máxima conexión con el mar abierto; (4) el Wuchiapingiense superior es identificado gracias a una associación dominada por el biseriamínido *Charliella altineri* sp. nov. y el ozawainélido *Neomillerella mirabilis* gen. nov. sp. nov.; (5) el Changhsingiense Inferior se relaciona con un diversificación de los biseriamínidos con *Paradagmacrusta callosa* gen. nov. sp. nov. como marcador principal; (6) el Changhsingiense Superior es dominado por grandes miliólidos tales como *Crassiglomella* y *Glomomidiellopsis*. Durante el Pérmico Superior, varios morfogrupos de foraminíferos colonizaron y se diversificaron en diferentes habitats del litoral carbonatado interno de la Plataforma Arábica, dependiendo sobre todo de la salinidad, energía, profundidad y la presencia de praderas de gimnocodiáceas. El análisis paleoecológico será presentado en una segunda parte de este trabajo, con un estudio de las algas. Sin embargo, los foraminíferos estudiados indican ambientes muy someros o confinados. Por eso, su distribución geográfica es característica de una continuidad lateral de las rampas carbonatadas internas. Varios géneros han sido descubiertos en las diferentes regiones de nuestro estudio. Los géneros de biseriaminoídeos son especialmente útiles para identificar este tipo de interconexión de las plataformas calcáreas someras y demostrar de esta manera la proximidad geográfica en una época dada de diferentes "terranes" tectonoestratigráficos. Se confirman las relaciones entre Tauro y Zagros y se revelan comunicaciones directas entre Zagros, sur de China y algunos "terranes" japoneses, que, junto con datos de las floras terrestres, indican una gran proximidad de esas regiones al final del Pérmico. Los principales marcadores palaeobiogeográficos involucrados son *Paradagmarita*, *Floritheca* gen. nov., *Partisania* y *Paradagmaritopsis*. Son descritos los siguientes taxones : (a) 2 subfamilias, Paradagmarininae and Paraglobivalvulininae; (b) 17 géneros, *Floritheca*, *Neomillerella*, *Labioglobivalvulina*, *Retroseptellina*, *Labiodagmarita*, *Paradagmaritella*, *Paradagmacrusta*, *Paremiratella*, *Septigordius*, *Brunsispirella*, *Crassispirella*, *Crassiglomella*, *Uralogordius*, *Neodiscopsis*, *Glomomidiellopsis*., *Nestellorella*, and *Aulacophloia*; (c) 30 especies: *Floritheca variata*, *Neomillerella mirabilis*, *Globivalvulina parascaphoidea*, *G. neglecta*, *Charliella altineri*, *Labioglobivalvulina baudi, L. fortis*, *Paremiratella robusta*, *Labiodagmarita vasleti*, *Louisettita extraordinaria*, *Paradagmarita simplex*, *P. zaninettiae*, *P. planispiralis*, *Paradagmaritella brevispira*, *Paradagmaritella surmehensis*, *Paradagmacrusta callosa*, *Paremiratella robusta*, *Palaeonubecularia iranica*, *Hoyenella laxa*, *Crassispirella hughesi, Glomomidiellopsis uenoi*, *G. tieni*, *G. lysitiformis*, *Neodiscopsis canutii*, *Rectostipulina syzranaeformis*, *Langella massei*, *Partisania sigmoidalis*, *Cryptomorphina hazroensis*, *Pachyphloia enormis*, and *Aulacophloia martiniae*; y (d) se enmiendan 9 géneros: *Septoglobivalvulina*, *Louisettita, Hoyenella, Neodiscus, Tauridia*, *Polarisella*, *Pachyphloides/Cryptoseptida* e *Ichthyofrondina*.
Palabras clave: Foraminíferos, Sistemática, Pérmico, Oriente Medio, Khuff, sur de China, Bioestratigrafía, Paleobiogeografía.

INTRODUCCIÓN

Although not included within the type areas of the official Permian scale (JIN *et al.*, 1997) (Fig. 1), the Permian outcrops of Middle East (Turkey, Iran, Oman, Saudi Arabia and Afghanistan), associated with those of Tunisia, Greece, former the Yugoslavia, Caucasus and Transcaucasia exhibit a diversified Permian fauna, microfauna and microflora of carbonate algae, respectively. Moreover, the Permian hydrocarbon reservoirs are very important in southern Iran, U.A.E. (United Arabian Emirates) and Saudi Arabia (Fig. 2). The Permian-Triassic limestones and associated evaporites constitute the Khuff Formation, formely defined in Saudi Arabia (Fig. 3), but due to some lithostratigraphic peculiarities, local units were introduced in Iran: the Dalan and Kangan Formations (Fig. 4). The aim of this paper is to describe the microfossils and the biostratigraphy of the Upper Dalan Member in the Zagros-Fars area (Iran), in order to reconstruct the Middle/Late Permian history and geography of this area, and to compare or apply these data to various regions of UAE, Saudi Arabia, Turkey and South China (Fig. 2).

GEOLOGICAL SETTING

THE TYPE AREA (SAUDI ARABIA)

The Khuff Formation is well known in the type area owing to several recent syntheses (e.g., SHARLAND *et al.*, 2001, 2004; VASLET *et al.*, 2005; VACHARD *et al.*, 2005; GAILLOT, 2006). A synthet-

SUB-SYSTEMS	SUBCOMMISSION ON PERMIAN STRATIGRAPHY		Ma	UNITED STATES OF AMERICA		RUSSIA (URALS)	CENTRAL TETHYS	CHINA
			251					
LATE	Lopingian	Changhsingian					Dorashamian	Changhsingian
			255					
LATE	Lopingian	Wuchiapingian			Ochoian	Tatarian	Dzhulfian	Wuchiapingian
			260.5					
MIDDLE	Guadalupian	Capitanian			Capitanian	Tatarian	Midian	Maokouian
			265					
MIDDLE	Guadalupian	Wordian			Wordian	Kazanian	Midian / Murghabian	Maokouian
			268					
MIDDLE	Guadalupian	Roadian			Roadian	Ufimian	Kubergandian	Chihsian
			272.5					
EARLY	Cisuralian	Kungurian		Leonardian	Cathedralian	Kungurian	Bolorian	Chihsian
			279.5					
EARLY	Cisuralian	Artinskian		Leonardian	Hessian	Artinskian	Yakhtashian	Chihsian
			284.5					
EARLY	Cisuralian	Sakmarian		Wolfcampian	Lexonian	Sakmarian	Sakmarian	Mapingian
			290					
EARLY	Cisuralian	Asselian		Wolfcampian	Nealian	Asselian	Asselian	Mapingian
			296 Ma					

Figure 1.– Biostratigraphic table of the Permian System. Standard stages according to Jin *et al*. (1997), radiometric ages according to Gradstein *et al.* (2004). Modified from Gaillot (2006, fig. II.1, p. 35).

Figura 1.– Cuadro bioestratigráfico del Sistema Pérmico. Pisos internacionales según Jin et al. *(1997), con edades radiométricas según Gradstein* et al. *(2004). Modificado de Gaillot (2006, fig. II.1, p. 35).*

ic stratigraphical column of the eponymic Permian-Triassic Khuff Formation of the Arabian Plate is summarized below (Fig. 3).

Zagros (Iran)

The Zagros range is located in southwestern Iran (Fig. 2A), extending northwest-southeast from the Sirvan (Diyala) River to Shiraz, and is about 900 km long and more than 240 km wide. The mountains are divided into many parallel sub-ranges and are the results of the closing of Neotethys ocean and collision of the Eurasian and Arabian tectonic plates during the Alpine orogenesis. Structurally, the Zagros fold belt is a part of the Arabian Plate. It is separated to the north from the Sanandaj-Sirjan thrust belt by the "main Zagros thrust zone". At Kuh-e Surmeh, located about 120 km south of Shiraz, the Permian-Triassic succession crops out within a faulted, core-eroded anticline, reversed toward the southeast. The Kuh-e Dena Mountain sections, located about 200 km north of Shiraz, crop out as several-km-long cliffs along a NW-SE trend that parallels the main Zagros thrust zone.

The Khuff depositional system developed on margin of the Neotethys, an ocean separating the Gondwana supercontinent and the Gondwanan terranes (Cimmerian megablock). The Permian-Triassic Khuff Formation of the Arabian Plate (Fig. 3) and its equivalents Dalan and Kangan Formations of Iran (Fig. 4), are interpreted as showing a major tectono-eustatic

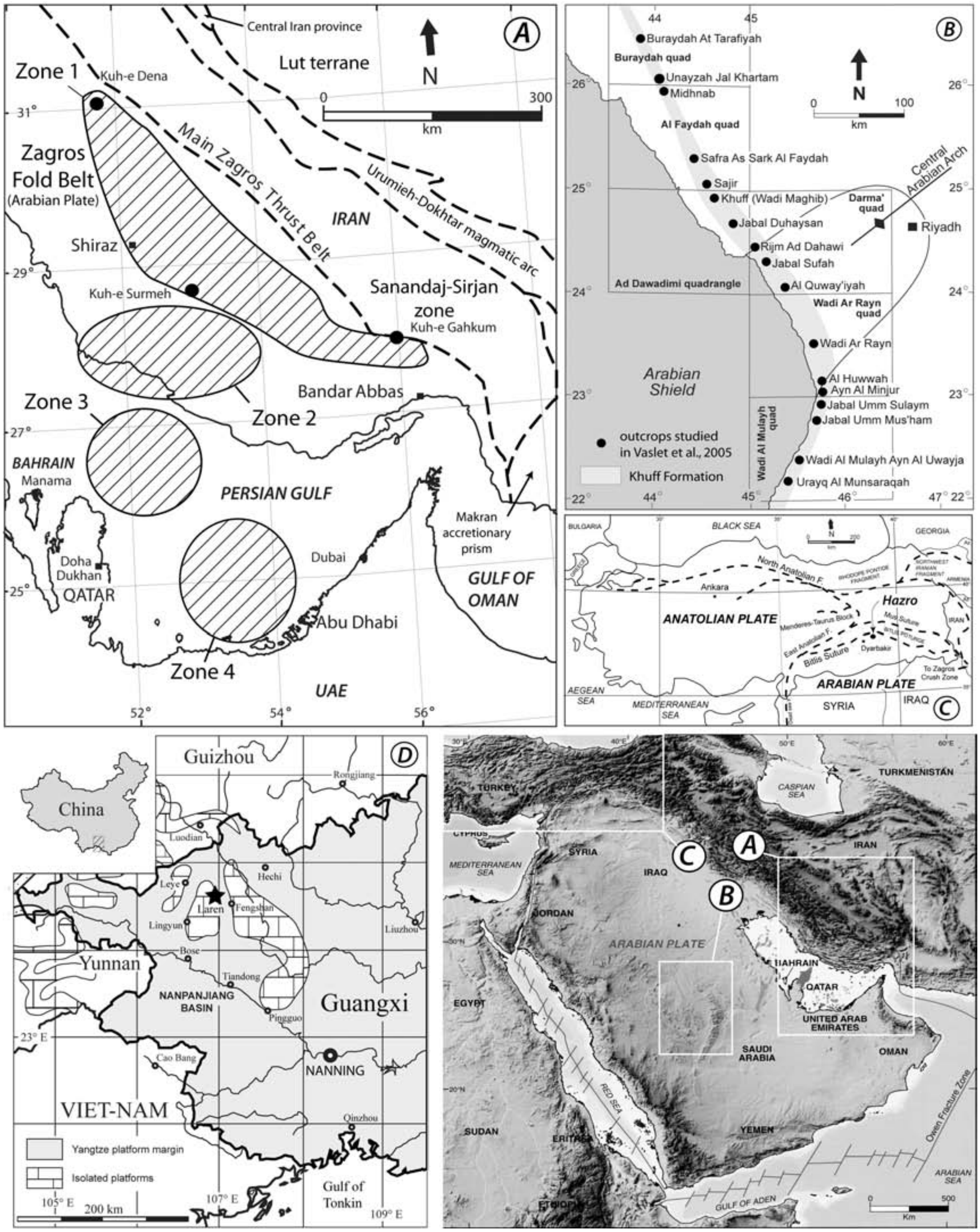

Figure 2.– Geographic locations of sections studied. A: Location of the Zagros outcrops and wells, Persian Gulf (Zone 1 to 4). Zone 1 corresponds to the Zagros outcrops studied, i.e. Kuh-e Surmeh, Kuh-e Dena and Kuh-e Gahkum. Zone 2 includes wells from the Nar-Kangan area (= Onshore Zagros). Zone 3 corresponds to the wells of the Offshore Fars area. Zone 4 represents the approximate location of the Abu Dhabi wells studied for comparison and where new taxa are described. B: Location of Saudi Arabia outcrops. Modified from Vaslet *et al.,* 2005. C: Location of the Hazro section (southeastern Turkey), Dyarbakir Province. D: Location of the Laren section (southern China).

event related to the onset of rapid thermal subsidence of the early Neotethys passive margin in Arabia and Iran and the drowning of its rift shoulders (Sharland *et al.*, 2001). This event has been interpreted as being coeval with the initiation of the Neotethys sea-floor spreading in the Middle Permian (Pillevuit, 1993; Sharland *et al.*, 2001), even as early as the Early Permian (late Sakmarian according to Angiolini *et al.* (2003b), or most probably early Artinskian if compared to the up-dated Afghanistan levels with brachiopods (Vachard, unpublished data). By the Late Permian, sea-floor spreading, thermal subsidence and the associated transgression led to the development of a very large epeiric platform shelf that stretched from southern Iran to Saudi Arabia. The system evolved in a marginal marine shelf setting with an inner platform that was very flat, ramp-like, with little topography (Al-Jallal, 1987, 1994; Sharland *et al.*, 2001), but with local depressions (Insalaco *et al.*, 2006).

Hazro (Turkey)

The Hazro section is traditionally investigated in Turkey (Fig. 2C) with reference to Permian-Triassic Boundary (PTB). During our investigations, the measured part of the Hazro section was newly divided into four time intervals: (a) late Capitanian (= late Midian in Tethys); (b) Wuchiapingian; (c) Changhsingian and PTB; (d) Early Triassic. This section is newly correlated with the sections studied in Zagros (southern Iran), UAE and Saudi Arabia.

Southern China

The Yangtze carbonate platform of southern China (Fig. 2D) constituted a stable palaeogeographic unit from Late Proterozoic to the end of Middle Triassic with deposition of shallow-water carbonates during most of this time (Enos, 1995). Middle and Late Permian reefal limestones are widely distributed and well preserved in China in eastern Yunnan, southwestern Guizhou and northwestern Guangxi (Sheng *et al.*, 1985; Rigby *et al.*, 1989a, b; Fan *et al.*, 1990).

The southern margin of the Yangtze platform was embayed by the Nanpanjiang Basin (see Lehrmann *et al.*, 1998 for a description of this basin) which was widely opened southward and extended into central Guizhou. Dominant deep-water deposits surrounded various carbonate platforms dispersed within the basin. The Laren section, the main locality on which this study focuses, lies on the margin of one of these isolated platforms.

The Laren section is located in the Fengshan District on the northwestern part of the Guangxi Province (Fig. 2D). In southern China, largely because of post-sedimentary faulting, complete Late Permian-Early Triassic sections are often rare, the Laren profile is an exception and is an excellent outcrop straddling the Permo-Triassic boundary apparently devoid of hiatuses. The Late Permian, which is mainly characterized by shallow-water reefal limestones, is overlained by a 7.5 m-thick calcimicrobial limestone (thrombolites) of earliest Triassic age (Griesbachian).

The foraminiferal assemblage enclosed within the beds preceeding the Permian-Triassic boundary allows attributing a late Changhsingian age, whereas the nearly total absence of index fossils immediately after the boundary does not consent to precisely date the microbial limestone.

In order to compare the foraminiferal associations of Laren with those of coeval limestones, we also collected samples in the Tsoteng region, located approximately 80 km south of Laren. At

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Figura 2.– Mapas esquemáticos de los afloramientos estudiados. A: Localización de los afloramientos y sondeos del Zagros, Golfo Pérsico (Zonas 1 a 4). La Zona 1 corresponde a los afloramientos estudiados del Zagros, es decir los montes ("kuh" en iranés) de Kuh-e Surmeh, Kuh-e Dena y Kuh-e Gahkum. La Zona 2 incluye los sondeos del área de Nar-Kangan). La Zona 3 corresponde a los sondeos del área del Offshore Fars. La Zona 4 representa la localización aproximada de los pozos de Abu Dhabi estudiados en comparación y donde se describen aquí taxones nuevos. B: Localización de los afloramientos de Arabia Seudita. Modificado según Vaslet et al.*, 2005. C: Localización de la sección de Hazro (sureste de Turquía), Provincia de Dyarbakir. D: Localización de la sección de Laren (Sur de China).*

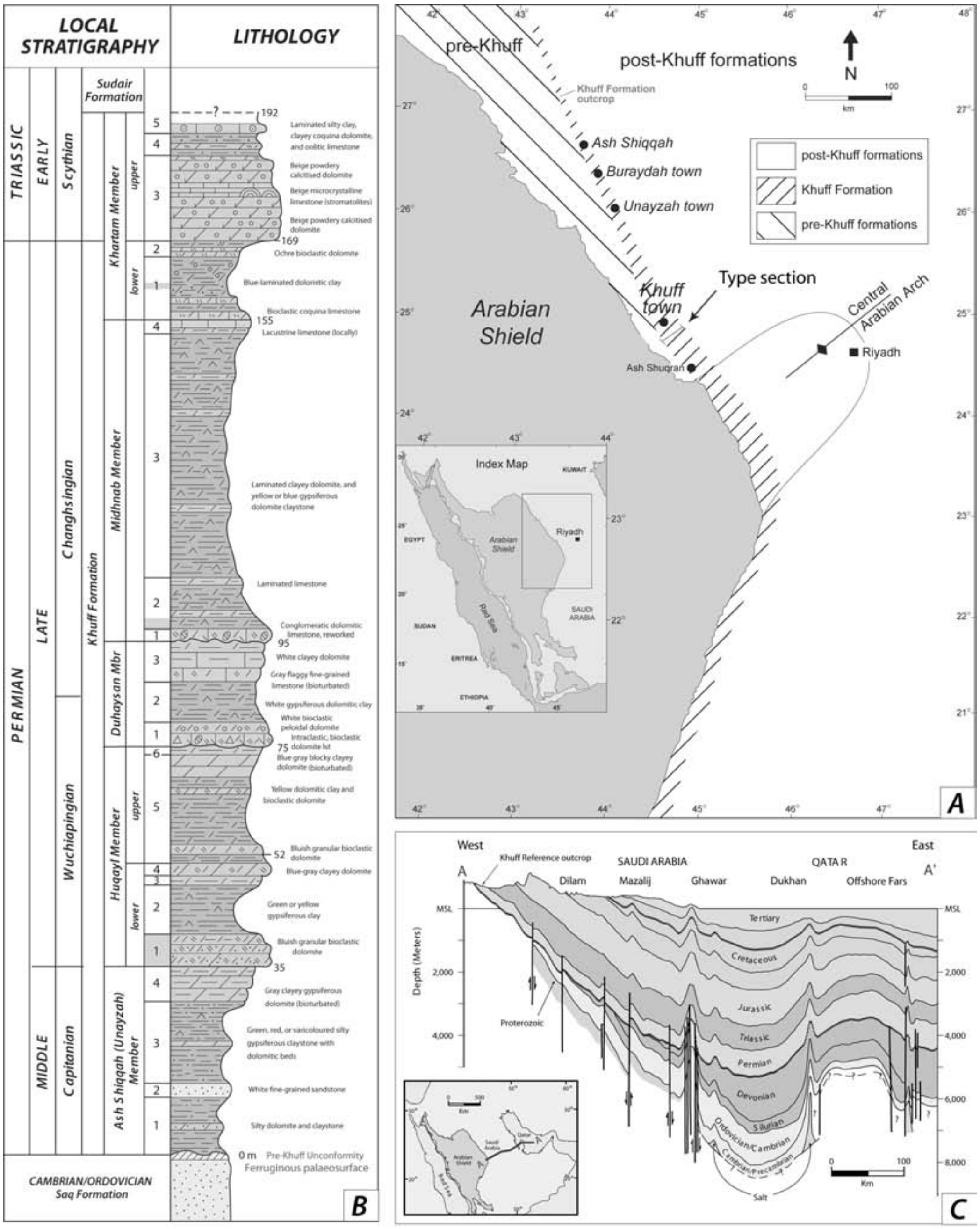

Figure 3.– The type Khuff Formation of Saudi Arabia. A: Simplified Khuff Formation outcrop, central Saudi Arabia. Modified after Vaslet *et al.* (2005). B: Composite type section of the Khuff Formation in the Ad Dawadimi quadrangle showing the five members of Delfour *et al.* (1982) and Vaslet *et al*. (2005): Ash Shiqqah (formerly Unayzah) Member, Huqayl, Duhaysan, Midhnab and Khartam members. Modified after Vaslet *et al.* (2005). C: Eastward structural cross-section across Arabia showing the outcropping of the type Khuff Formation to the West, its subsurface continuity to the East, and the major structures of Ghawar (Saudi Arabia) and Dukhan (Qatar). Formations are shown along with major bounding faults in solid lines and an approximate depth scale in meters (modified after Konert *et al*., 2001).

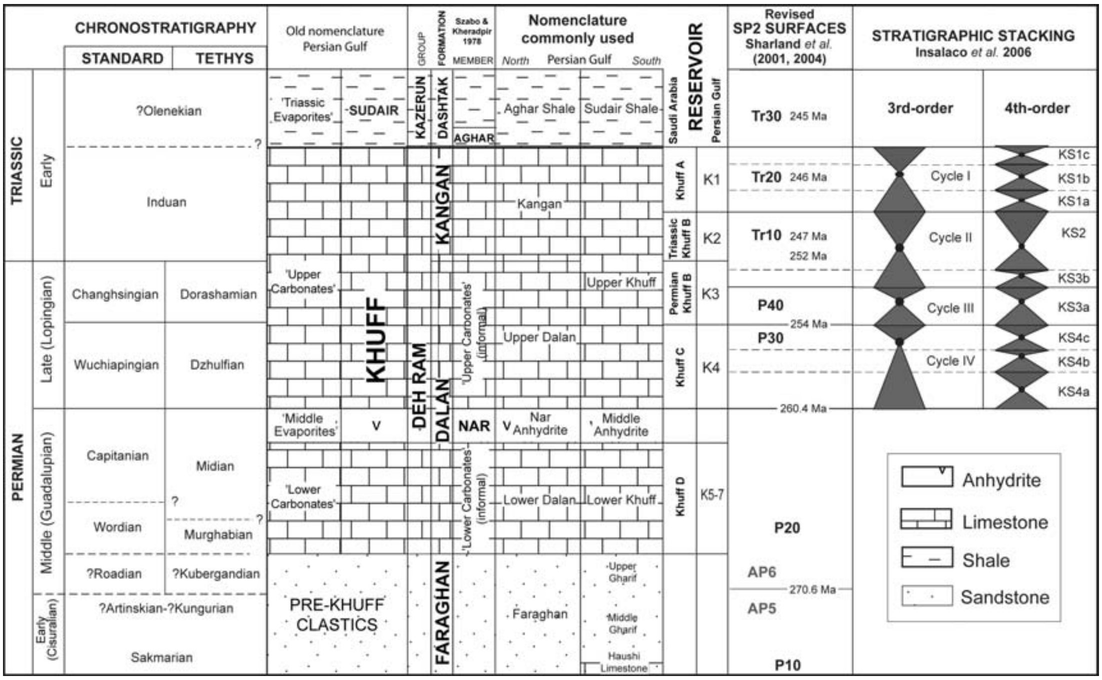

Figure 4.– General chronostratigraphy, sequence stratigraphic context, and nomenclature of the Khuff deposits in the Persian Gulf. Modified after INSALACO *et al*. (2006). Standard stages according to JIN *et al.* (1997). Correlations with Tethys stages after GAILLOT (2006). Age of the Haushi limestone (Oman) from ANGIOLINI *et al.* (2006). Ages and MFS for the Upper Dalan/Kangan Formations from SHARLAND *et al.* (2001, 2004), and INSALACO *et al.* (2006).

Figura 4.– Caracteres generales: cronoestratigráficos, del contexto de estratigrafía secuencial y de la nomenclatura de los depósitos de la Khuff en el Golfo Pérsico. Modificado según INSALACO et al. *(2006). Pisos según JIN* et al. *(1997). Correlaciones con los pesos de la Tetis según GAILLOT (2006). Edades de la caliza de Haushi (Oman) según ANGIOLINI* et al. *(2006). Edades y MFS la parte superior de las Formaciones Dalan/Kangan de SHARLAND* et al. *(2001, 2004), e INSALACO* et al. *(2006).*

this locality the latest Permian Heshan Formation is mainly composed of massive and thick-bedded bioclastic-rich limestones deposited in shallow-water settings. The overlying earliest Triassic microbialites contain the conodont *Hindeodus parvus* (see ZHANG *et al.*, 2005) and thus allows assigning a Griesbachian age for this unit, and we may assuming that the first microbial limestone of Laren section is early Griesbachian in age as well (see also KERSHAW *et al.*, 2002 and EZAKI *et al.*, 2003).

SYSTEMATIC PALAEONTOLOGY

Phylum Foraminifera d'ORBIGNY, 1826; nomen translat. DELAGE & HÉROUARD, 1896; *orth. mut*. CALKINS, 1909 (see LOEBLICH & TAPPAN, 1984, p. 2); *nomen re-translat.* CAVALIER-SMITH, 2002.

The classification used here was developed after LOEBLICH & TAPPAN (1987, 1992), VDOVENKO *et al.* (1993), RAUZER-CHERNOUSOVA *et al.* (1996), MIKHALEVICH (1998, 2004), and

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Figura 3.– La Formación Khuff en Arabia Saudita. A: Afloramientos esquemáticos de la Formación Khuff en la parte central de Arabia Saudi. Según VASLET et al. *(2005). B: Columna-tipo reconstituida de la Formación Khuff en el perímetro de Ad Dawadimi, con los cincos Miembros de DELFOUR* et al. *(1982) y VASLET* et al. *(2005): Ash Shiqqah (anteriormente Unayzah), Huqayl, Duhaysan, Midhnab y Khartam. Modificado según VASLET* et al. *(2005). C: Corte structural, orientado hacia el Este atravesando Arabia y presentando sucesivamente: en el Oeste el área-tipo de la Khuff, su extensión sub-superficie en dirección Este y las principales estructuras del Ghawar (Arabia Seudita) y Dukhan (Qatar). Se pueden ver las Formaciones a lo largo de la mayores fallas limitantes, con una escala aproximada de profundidades en metros (modificado según KONERT* et al.*, 2001).*

VACHARD (unpublished data) (Fig. 5). Nowadays, Foraminifera are generally interpreted as a phylum of Protista (CAVALIER-SMITH, 2002; MIKHALEVICH, 2004), and the traditional suborders of LOEBLICH & TAPPAN (1964) and orders of LOEBLICH & TAPPAN (1992) can be considered as classes. The classes studied below are principally the Fusulinata, Miliolata and Nodosariata. Many families of these previous classifications are considered here as superfamilies, allowing possible subdivisions into families and subfamilies. Some families and subfamilies are introduced because of the relative generic diversity, and according to some criticisms against the admitted phylogenies (for instance, Paradagmaritinae n. subfam.). The genera and/or species are created in a biostratigraphic point of view. They correspond to different stages in the evolution of the biota in the geologic record. If the classification in families and superfamilies is rather well established for the Fusulinata, these subdivisions are most controversial among the Miliolata and Nodosariata. The phylogenic links are generally questionable, and the subdivisions too numerous (especially among the Nodosariina). A preliminary revision is proposed. Illustrated and described specimens in this work are housed in the Centre Scientifique et Technique TOTAL, Pau, France, the Collection of Palaeontology of Lille 1, France and some of them in the BRGM (Orléans, France) or Natural History Museum, Geneva (Switzerland) collections.

Abreviattions used for the descriptions as follow: D.= diameter; D.c.p. = Diameter of coiled part; d.pi.= dimensions of pits; H= Height; H.u.p. =Height of uncoiled part; h.l.= height of the lumen; h.l.c.= height fo the last chamber; h.l.w.= height of the last whorls; i.d.= inner diameter; L= Total Lenght; L.f.= Length of fragment; L.t.c.= Lenght of tubublar chamber; M.d.= Maximum diameter; m.d.= minimum diameter; M.n.b.= Maximum number of bricks; n.c.= number of chambers; n.c.l.w.= number of chambers in the last whorl; n.c.c.p.= number of chambers in the coiled part; n.c.u.p.= number of chambers in the uncoiled part; n.w.= number of whorls; o.d.= outer diammeter; p.d.= proloculus diameter; s.t.= septum thickness; t.d.= tube diameter; t.t.= test thickness; w.= width; w/D= width/Diameter ratio; w/H= width/Height ratio; w.t.= wall thickness. Measures in brackets are unusual measures.

Class Fusulinata FURSENKO, 1958 *emend. nomen translat*. herein from superorder in RAUZER-CHERNOUSOVA *et al*., 1996

Fusulinata are the only major group of foraminifers with no living representatives (SEN GUPTA, 1999). Furthermore, it is almost exclusively composed of Palaeozoic representatives (see below the exceptions constituted by *Earlandia*, *Endoteba* and the Endotebidae). All Fusulinata possessed a homogeneously microgranular primary test wall of low-Mg calcite in which crystal units are optically unordered, more or less equidimensional, and only a few micrometers in size. Fusulinata is a name applied here to a complete class of Palaeozoic foraminifers composed of six orders (Fig. 5): (1) Parathuramminida BYKOVA *in* BYKOVA & POLENOVA, 1955 (monolocular Fusulinata, mainly homeomorphs of some modern monolocular Textularata); (2) Pseudoammodiscida CONIL & LYS *in* CONIL & PIRLET, 1970 *nomen translat*. herein (bilocular Fusulinata including Pseudoammodiscoidea, Earlandioidea, Caligelloidea, Archaediscoidea and Lasiodiscoidea); (3) Pseudopalmulida MIKHALEVICH, 1993 (to *emend.*) (for the short but fundamental episod of multilocular tests during the Devonian, i.e. Eifelian to Frasnian times); (4) Tournayellida DAIN *in* DAIN & GROZDILOVA, 1953 (for the main Tournaisian episod pointing by its incomplete septation to the both next suborders having a complete to re-inforced septation); (5) Endothyrida FURSENKO, 1958 (= Palaeotextulariina HOHENEGGER & PILLER, 1975); and (6) Fusulinida FURSENKO, 1958. In fact, this latter is the unique order designated in the vernacular language as fusulines, fusulinids, fusulinoideans or fusulinaceans. This order Fusulinida is constituted by seven superfamilies: Ozawainelloidea, Staffelloidea Schubertelloidea, Fusulinoidea, Schwagerinoidea, and Verbeekinoidea (prioritary upon Neoschwagerinoidea generally more commonly used). Only the three first superfamilies of Fusulinata have representatives in the

PHYLUM	CLASS	ORDER	SUPERFAMILIES	CHARACTERISTICS
FORAMINIFERA	FUSULINATA	PARATHURAMMINIDA	*Parathuramminoidea*	Monolocular
			Irregularinoidea	
		PSEUDOAMMODISCIDA	*Pseudoammodiscoidea*	Deuterolocular
			Earlandioidea	
			Caligelloidea	
			Archaediscoidea	
			Lasiodiscoidea	
		PSEUDOPALMULIDA	*Pseudopalmuloidea*	Plurilocular Givetian-Frasnian
			Nanicelloidea	
		TOURNAYELLIDA	*Tournayelloidea*	Pseudo-septation
			Lituotubelloidea	
			Chernyshinelloidea	
		ENDOTHYRIDA	*Endothyroidea*	Septation
			Bradyinoidea	
			Loeblichioidea	
			Palaeotextularioidea	
			Tetrataxoidea	
			Biseriamminoidea	
		FUSULINIDA	*Ozawainellidea*	Complex septation and/or complex endoskeleton
			Staffelloidea	
			Schubertelloidea	
			Fusulinoidea	
			Schwagerinoidea	
			Verbeekinoidea	
	MILIOLATA	NOT SEPARATED		Porcelaneous test
	NODOSARIATA			Radiate hyaline test
	TEXTULARIATA			Truly agglutinated test

Figure 5.– Table of classes, orders and superfamilies of the phylum Foraminifera present during the Palaeozoic.
Figura 5.– Subdivisiones en clases, ordenes y superfamilias del phylum de Foraminifera durante el Paleozoico.

Lopingian; the late occurrence of the two latter is located at the top of Midian/Capitanian with the well known disappearance of all the keriothecal Fusulinida (SHENG, 1992, and references in OTA & ISOZAKI, 2006). The Fusulinida are here considered as monophyletic and emerging from the Endothyrida as soon as the latest Tournaisian (CÓZAR & VACHARD, 2001); nevertheless, the superfamily Staffelloidea are usually recrystallized, suggesting that they secreted an aragonite or high-Mg calcite wall, and, according to the most common criteria of classification of Foraminifera, would be independently classified.

According to LOEBLICH & TAPPAN (1987), the class (order, in this book) comprises 418 genera. Fusulinata were the dominant group of calcareous secreted foraminifers of the Palaeozoic Era, with the main orders Endothyrida and Fusulinida achieving their peak diversities during Viséan and Cisuralian times, respectively. Initial decline of Fusulinida coincident with the end-Guadalupian extinction eliminated all large and morphologically complex forms assignable to the Schwagerinoidea and Verbeekinoidea, so that only 15 genera in the superfamilies Schubertelloidea and Staffelloidea persisted during Lopingian time. An additional 23 to 25 genera of smaller foraminifers among the Fusulinata are known

CLASS	ORDER	SUPERFAMILY	TAXON	ILLUSTRATIONS
TEXTULARIATA	TEXTULARIIDA	Ataxophragmioidea	Ataxophragmiidea indeterminate	Pl. 1, figs. 1-3
			gen. undet.	Pl. 2, figs. 2-3, 13
FUSULINATA	PSEUDO-AMMODISCIDA	Tuberitinoidea	*Eotuberitina reitlingerae*	Pl. 4, fig. 3; pl.5, fig. 2; pl. 6, fig. 13; pl. 15, figs. 1, 5
			Eotuberitina spinosa	Pl. 3, fig. 14; pl. 7, fig. 4; pl. 8, fig. 2; pl. 9, fig. 7; pl. 10, fig. 7
		Earlandioidea	*Earlandia* spp.	Pl. 4, fig. 4; pl.5, fig. 13; pl. 6, fig. 8; pl. 11, fig. 25, 27-34; pl. 12, fig. 11; pl. 13, fig. 5-7; pl. 14, fig. 5-7
		Lasiodiscoidea	*Pseudovidalina involuta*	Pl. 21, fig. 1; pl. 22, fig. 18
	ENDOTHYRIDA	Endothyroidea	*Neoendothyra reicheli*	Pl. 4,figs. 5?, 6?; pl. 19, fig. 3?; pl. 20, fig. 8
		Bradyinoidea	*Postendothyra micula*	Pl. 10, figs. 3-5
		Palaeotextularoidea	*Climacammina grandis*	Pl. 9, fig. 4, pl. 20, figs. 3-4
			Climacammina tenuis	Pl. 10, fig. 2
			Climacammina sp.	Pl. 11, fig. 16
			Cribrogenerina sumatrana	Pl. I1, fig. 17
		Tetrataxoidea	*Tetrataxis lata*	Pl. 7, fig. 3; pl. 10, fig. 8; pl. 25, fig. 6; pl. 28, figs 2, 14; pl. 34, fig. 4
	FUSULINIDA	Ozawainelloidea	*Eostaffella*? sp.	Pl. 6, fig. 7; pl. 13, figs. 8-10, pl. 14, fig. 14; pl. 23, fig. 11; pl. 24, fig. 4
			Reichelina simplex	Pl. 1, fig. 13; pl. 3, figs. 2, 18; pl. 7, fig. 1; pl. 10, fig. 6; pl. 12, fig. 2; pl. 19, figs. 1-2, 8; pl. 25, fig. 8; pl. 28, fig. 12, pl. 29, figs. 4-5 ; 17-19; pl. 30, fig. 12
			Reichelina changhsingensis	Pl. 3, fig. 10
		Staffellidae	*Staffella yaziensis*	Pl. 8, fig. 3; pl. 28, fig. 7; pl. 31, fig. 10
			Nankinella ex gr. *hunanensis*	Pl. 4, fig. 1; pl. 7, fig. 6, 15; pl. 8, fig. 7-8; pl. 20, fig. 5; pl. 28, fig. 1, 5, 8-10; pl. 29, fig. 8
			Nankinella minor	Pl. 9, fig. 1; pl. 12, fig. 23-24; pl. 28, fig. 13; pl. 29, fig. 1-2; pl. 32, fig. 8, 21; pl. 33, fig. 20
			Nankinella cf. *inflata*	Pl. 10, fig. 12
			Nankinella spp.	Pl. 13, fig. 4; pl. 14, fig. 15-20; pl. 31, fig. 6
			Sphaerulina croatica	Pl. 13, fig. 12; pl. 19, fig. 11; pl. 23, fig. 6, 9; pl. 25, fig. 4
			Sphaerulina sp.	Pl. 30, fig. 15
			Leella (= *Jinzhangia*) cf. *armenica*	Pl. 19, fig. 9, 10; pl. 20, fig. 9; pl. 24, fig. 3; pl. 29, fig. 21; pl. 31, fig. 18
		Schubertelloidea	*Dunbarula nana*	Pl. 3, fig. 13?, pl. 4, fig. 18-19; pl. 29, fig. 12, 22
			Nanlingella simplex	Pl. 7, fig. 9; pl. 20, fig. 7; pl. 25, fig. 7; pl. 26, fig. 5-7, 10; pl. 28, fig. 3
			Nanlingella minima	Pl. 5, fig. 7; pl. 9, fig. 11; pl. 11, fig. 15
			Codonofusiella aff. *kueichowensis*	Pl. 4, fig. 13?, 17?; pl. 12, fig. 4; pl. 29, fig. 23
		Schwagerinoidea	*Chusenella* aff. *sinensis*	Pl. 12, fig. 5
			Chusenella cf. *conicocylindrica*	Pl. 20, fig. 1-2
			Eoolydiexodina persica	Pl. 19, fig. 6

from Wuchiapingian and Changhsingian rocks, respectively. Of these, the most abundant and speciose belonged to the superfamilies Endothyroidea, Tetrataxoidea, Palaeotextularioidea and Lasiodiscoidea, but no yielded new forms (Fig. 6), whereas the Biseriamminoidea get more diversified, displaying new trends in size and morphology.

Groves & Altiner (2005) concur with Vachard *et al.* (1994), although they did not take into account this latter paper, and Rettori (1995), who recognized the Endothyrida with genera *Endoteba*, *Endotebanella*, *Endotriada* and *Endotriadella* as true Fusulinoida in Triassic strata in the Tethyan region. Bassoullet *et al.* (2001) even found *Endotriadella* in the Early Liassic of Morocco. Locally, some typically Permian Fusulinoida are present in the lowermost Triassic beds; in Kashmir (e.g., Sheng *et al.*, 1984, p. 156), Pakistan (e.g., Sheng *et al.*, 1984, p. 158). *Reichelina* is present at the base of the Dolomite Unit, Italy (Southern Alps; Cirilli *et al.,* 1998), Turkey (Ünal, 2004), and Hungary (Haas *et al.*, 2006, text-fig. 4).

To the list of the PTB survivors, Groves & Altiner (2005) added Triassic *Earlandia*, whereas Arnaud-Vanneau (1980, p. 290-295) found possible *Earlandia* and *Giraliarella* Crespin, 1958 up to the Early Cretaceous. Ünal (2004) reported supposedly in situ biseriamminid fusulinids from basal Triassic beds in the Hadim region of the Central Taurides, Turkey and considered them as reworked or local survivors. This observation was repeated in southern China (Gaillot *et al*., submitted). In fact, *Polarisella* and probably other nodosariids cross easily through the PTB (see below).

Order Pseudoammodiscida Conil & Lys *in* Conil & Pirlet, 1970 (*nomen translat*. here from family)

This order is composed of the various superfamilies with individed tubular, coiled or uncoiled representatives of Fusulinata (Fig. 6): Pseudoammodiscoidea (Cambrian-Permian, ?Triassic), Earlandioidea (Silurian-Triassic, ?Cretaceous), Caligelloidea (Silurian-Permian, ?Triassic), Archaediscoidea (late early Viséan-earliest Moscovian), and Lasiodiscoidea (late Viséan-latest Permian). The order is supposed monophyletic and originating from the Cambrian of northern Africa (see Culver, 1991, 1994). The order is known during all the Palaeozoic and might survive up to the Cretaceous with the *Earlandia*? and *Giraliarella*? of Arnaud-Vanneau (1980) (see above).

Superfamily Caligelloidea Reitlinger *in* Rauzer-Chernousova & Fursenko, 1959, *nomen translat*. herein from family
Family Insolentithecidae Loeblich & Tappan, 1986, *nomen translat*. herein from subfamily

This family was interpreted recently by Vachard & Cózar (2004) as constitued by advanced caligelloids, in the form of a permanent cyst composed of two kinds of components: a fundamental (primary collected test) and some additional bricks (other tests included to the cyst), linked together with a carbonate microgranular thin cement.

Genus *Floritheca* gen. nov.

Type species: *Floritheca variata* gen. nov. sp. nov.

Etymology: Flower-shaped, i.e. whose bricks are disposed as the petals of a flower.

Diagnosis: Insolentithecid genus with variable morphology, central cavity poorly individualized and groups of bricks, rounded, hollow and polygonal with smooth extremities. Inter-brick micritic cement and pseudoaperture apparently absent.

←

Figure 6.– List of the Fusulinata *s.l.* including the Fusulinida *s.s.*, encountered in this study (see the text for more details); excepted the superfamily Biseriamminoidea *emend*. Vachard *et al*., 2006 (see this publication).
Figura 6.– Lista de los Fusulinata s.l. *incluyendo las verdaderas Fusulinida* s.s.*, encontrados en este estudio con excepcion de la superfamilia Biseriamminoidea* emend*. Vachard* et al., *2006 (véase esta publicación).*

Remarks: *Floritheca* displays some sections relatively similar to *Insolentitheca* or *Ningbingellina* MAMET, 1998. The main difference with *Insolentitheca* is that the bricks are apparently always similar: reniform to ellipsoidal, and do not correspond to a cluster of foraminiferal tests. It differs from *Ningbingellina* by the non-spherical shape of the bricks (interpreted as pachyspherine calcispheres in *Ningbingellina*).

Occurrence: *Insolentitheca* is Carboniferous in age. *Floritheca* is from Lopingian strata of Zagros (Iran) , Fars (Iran) , Abu Dhabi (U.A.E.) and southern Chichibu Terrane (SW Japan).

Floritheca variata sp. nov.
(Pl. 5, fig. 4, Pl. 13, fig. 2, Pl. 15, figs. 1-3, Pl. 16, figs. 1-22, Pl. 17, fig. 10, Pl. 18, figs. 12, 14)

2004 *Globivalvulina* sp. – KOBAYASHI, fig. 6.41.
v. 2006 *Insolentitheca* (?) sp. – INSALACO *et al.*, pl. 1, fig. 21.
v. 2006 *Floritheca variata* sp. nov. – GAILLOT & VACHARD *in* GAILLOT, p. 39, Pl. I.6, fig. 3, Pl. I.7, figs. 1-3, Pl. I.8, figs. 7, 19, Pl. II.7, figs. 1-22, Pl. III.15, fig. 4, Pl. III.16, fig. 10, Pl. III.18, figs. 12, 14, Pl. IV.5, fig. 2 (*nomen nudum*, unpublished Ph.D.).

Etymology: Latin *variatus*, diversified, because of the diversity of the types of sections.

Type locality: Nar-Kangan area (Iran).

Type level: Changhsingian.

Diagnosis: As for the genus.

Description: The species is composed of several bricks arranged in a radiating series or in ribbon. Simplest forms are composed of 2 or 4 small egg-shaped elements (bricks, pseudochambers) with a tetrade-spore-shape without any connection (apertures) between them. Two elements are cemented between the top and the side of the egg-shaped elements (as meniscus cement), forming an apparently constant acute angle. This arrangement creates a semi-spherical (domal) empty? volume enclosed between elements. Wall of pseudochambers microgranular. One or generally two up to five bricks (maximum 13, see Pl. 18, fig. 12). Single-brick with two to four compartments are the most usually found in thinsection (see the "*Globivalvulina*" of KOBAYASHI, 2004).

Dimensions: M.d.= 0.200-0.570 mm, m.d.= 0.190-0.400 mm, M.n.b.: 3-10, dimensions of the bricks= 0.060-0.130 mm, w.t.= 0.010 mm. The KOBAYASHI's specimen corresponds exactly, with a diameter of 0.230 mm and 4 bricks.

Holotype: Pl. 5, fig. 4.

Type material: Approximately one hundred sections and thirty illustrated paratypes.

Repository of the types: CST TOTAL (Pau, France).

Comparison: No described or illustrated taxon is comparable, excepted a so-called *Globivalvulina* of KOBAYASHI (2004).

Occurrence: Late Wuchiapingian-early Changhsingian of Zagros and Fars. Late Permian of Japan.

Order Fusulinida WEDEKIND, 1937, *nomen translat*. FURSENKO, 1958
Superfamily Ozawainelloidea THOMPSON & FOSTER, 1937, *nomen translat*. SOLOVIEVA, 1978 from family
Family Eostaffellidae MAMET *in* MAMET *et al.*, 1970

Genus *Neomillerella* gen. nov.

Type species: *Neomillerella mirabilis* sp. nov.

Etymology: From *neo* which means new, and *Millerella*, related genus.

Synonyms: *Rectomillerella*? *sensu* INSALACO *et al.,* 2006; *Millerella* THOMPSON, 1942 (part); *Pseudoreichelina* LEVEN, 1970 (part); *Staffella sensu* HUGHES, 2005.

Diagnosis: Test relatively large, planispiral and lenticular. Broadly rounded periphery. Lateral sides flattened to biumbilicate. Rounded to slightly keeled periphery. Axis of coiling planispiral or weakly deviated. Terminal stage evolute or uncoiled (such as *Rectomillerella*), generally high. Wall thin, dark, microgranular, differentiated into clearer and darker zones (nevertheless without similarity of the tectum, tectoria, diaphanotheca or luminotheca of other genera of Fusulinida).

Composition: *Neomillerella mirabilis* sp. nov.; *Millerella gigantea* KANMERA, 1952; *M. hataii* SUYARI, 1962; *M. japonica* KANMERA, 1952; *M. kotakensis* Suyari, 1962; *M. tosaensis* Suyari, 1962; *M. yowarensis* Ota, 1971; *Pseudoreichelina nevadaensis* Douglass & Nestell, 1974.

Remarks: *Neomillerella* is considered to be homeomorph of *Millerella* due to particular adaptation to high-energetic shoal environment (uncoiled ''Permian aberrant fusulinaceans'' of Ueno, 1992a). Fundamentally, *Neomillerella* differs from *Millerella* by the type of wall (multilayered versus simple). Moreover, *Millerella* disappears in the early Moscovian (Groves, 1991) and no have any known descendence. *Eostaffella* differs by the whorls entirely involute. "*Eostaffella*?" *sensu* Vachard *et al.*, 2005 differs by less evolute test. True *Pseudoendothyra*, Permian false-*Pseudoendothyra* and *Kangvarella* differ by the type of wall and the involute tests. *Pseudoreichelina* Leven, 1970 and *Quasireichelina* Ueno, 1992b (which is probably only a deformed *Nankinella*) differ by their typical wall of staffellids, the more acute carina and the more frequent uncoiled specimens. Furthermore, *Pseudoreichelina* is more similar to *Palaeoreichelina* Liem, 1974 than *Neomillerella*, and the two former genera are always considered as different in the literature.

Occurrence: Late Carboniferous-Early Permian in Japan. Early Permian of Nevada (USA). The genus probably migrated from Japan after the Early Permian. Lopingian of Zagros, Fars and Abu Dhabi.

Neomillerella mirabilis gen. nov. sp. nov.
(Pl. 13, fig. 1, Pl. 23, figs. 1-5, 7, 8?, 10, Pl. 25, figs. 1-5, 9, 11, Pl. 26, figs. 2-4, 8-9, 11, Pl. 27, fig. 1)

2005 *Stafella* (*sic*) *hupehensis* Jing – Hughes, pl. 4, fig. 14-15.
v. 2006 *Rectomillerella* (?) sp. – Insalaco *et al.*, pl. 1, fig. 19.
v. 2006 *Neomillerella mirabilis* sp. nov. – Gaillot & Vachard *in* Gaillot, p. 43-44, Pl. II.3, figs. 1, 5, 9-11, Pl. II.4, figs. 2-4, 8-9, 11, Pl. II.5, figs. 1-5, 7, 8?, 10, Pl. II.31, fig. 1, Pl. II.33, figs. 11-12, Pl. III.2, figs. 1-3, 11-13, Pl. IV.5, fig. 1.

Etymology: Latin *mirabilis*, pretty to see.
Type locality: Offshore Fars area (Iran).
Type level: Late Wuchiapingian.

Diagnosis: As for the genus.

Description: Test minute, umbilicate, with a rounded pointed periphery. Adult specimens of 3 to 5 whorls, usually 4. First whorls involute, last volution becomes more highly evolute and embraces only about one-third of the preceeding whorls. Proloculus minute, external diameter 0.675-1.950 mm, averaging 1.310 mm. Test tightly coiled in inner whorls, becoming more expanded immediately over tunnel. Spirotheca thin, composed of a tectum. Septal structure similar to that of spirotheca. Septa slightly arcuate over tunnel, strongly arcuate anteriorly in polar regions. Septa unfluted throughout length of test. Tunnel about one-third as high as chambers. Chomata developed in all parts of test, about half as high as chambers.

Dimensions: D.= 0.675-1.950 (2.290) mm, w.= (0.320) 0.460-0.750 mm, w/D= 0.27-0.41 averaging 0.34, p.d.= 0.060 mm.

Holotype: Pl. 26, fig. 2.

Type material: Approximately one hundred sections and thirty illustrated paratypes.

Repository of the types: CST TOTAL (Pau, France).

Comparison: Relatively similar to *Pseudoreichelina nevadaensis* (same dimensions), it differs by more chambers in the coiled stage more compressed and biumbilicate.

Occurrence: Abundant in the late Wuchiapingian of Fars, less common at the base of the Changhsingian of Zagros and Fars.

Superfamily Biseriamminoidea Chernysheva, 1941 (*nomen translat*. Marfenkova, 1991 from family)

Diagnosis: A superfamily of class Fusulinoida order Endothyrida characterized by a sligthly trochospiral to planispiral biseriate coiling, eventually uncoiled. Wall very variable in microstructure and types of calcite, but without clearly established generic criteria. Aperture single terminal basal.

Composition: Three families: Biseriamminidae Chernysheva, 1941; Koktjubinidae Marfenkova, 1991; Globivalvulinidae Reitlinger, 1950 *nomen translat*. herein.

Remarks: The limits of the genera and families are generally poorly established. The type genus *Biseriammina* is especially poorly illustrated. Hence the "biseriamminoids" are especially discussed, from species to superfamilies (VACHARD *et al*., 2006).

Occurrence: Mississippian (Tournaisian)-latest Permian, cosmopolite.

Family Globivalvulinidae REITLINGER, 1950 (*nomen translat*. herein from subfamily)

Diagnosis: Test biserial, entirely planispiral or initially trochospiral, or entirely uncoiled, or trochospiral becoming planispiral. Wall thin, dark, microgranular, eventually differentiated into two, three or four layers, but this differentiation do not affect all the chambers and/or correspond to fossildiagenetic features, and is not admitted here as a generic criterion. Endoskeletal folds or partitions lead to the formation of chamberlets. Oral tongue often present, occasionally passing to a siphon. Aperture terminal simple.

Composition: Four subfamilies: Globivalvulininae REITLINGER, 1950; Paraglobivalvulininae. subfam. nov.; Dagmaritinae BOZORGNIA, 1973 (= Louisettitinae); Paradagmaritinae subfam. nov..

Occurrence: Mississippian Permian (latest Tournaisian-latest Changhsingian). The genera are either cosmopolite or restricted to the Neotethys.

Subfamily Globivalvulininae REITLINGER, 1950 (*sic* Globivalvulinae)

Diagnosis: Typical globivalvulinids entirely biserially coiled and with a relatively constant shape of chamber. Wall simple to differentiated.

Composition: *Dzhamansorina* MARFENKOVA, 1991; *Globivalvulina* SCHUBERT, 1921; *Verispira* PALMIERI, 1988; *Tenebrosella* VILLA & SANCHEZ DE POSADA, 1986; *Charliella* ALTINER & ÖZKAN-ALTINER, 2001, *Labioglobivalvulina* gen. nov.; *Retroseptellina* gen. nov.

Occurrence: As for the family.

Genus *Globivalvulina* SCHUBERT, 1921

Type species: *Valvulina bulloides* BRADY, 1876.

Diagnosis: Small, medium or large globivalvulinid test, entirely biseriate0 and planispiral. Subglobular with lobate periphery. Valvular projection well developed. Wall black, microgranular to differentiated: with a yellow pseudofibrous inner layer (see *G. mosquensis* REITLINGER, 1950), *Omphalotis*-like (VACHARD & BECKARY, 1991), granular with agglutinated particules (*G. granulosa* REITLINGER, 1950, with intermediary clear layer ("diaphanotheca" of authors): *G. bulloides* (BRADY) of the authors. Aperture simple protected by the valvular projection.

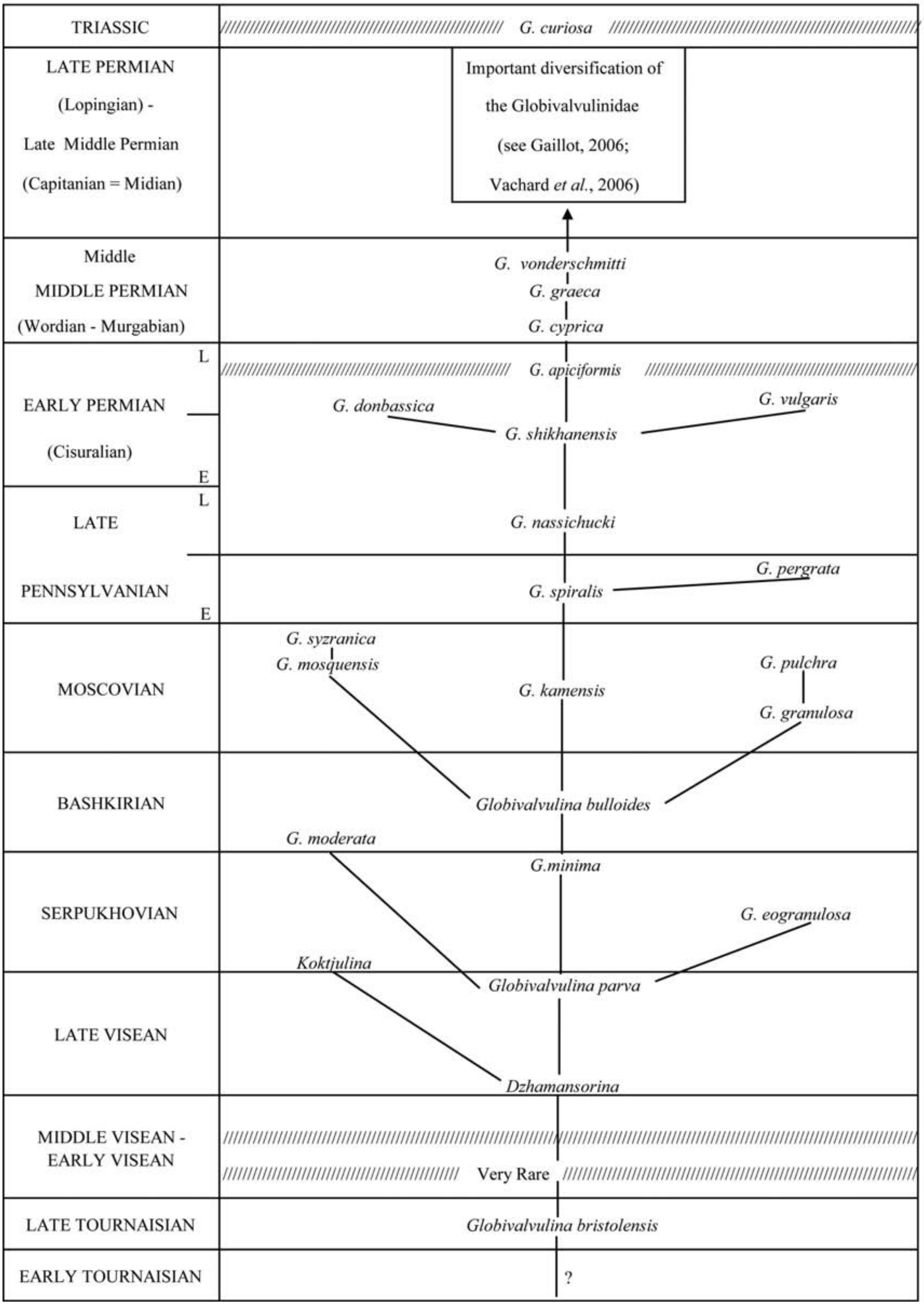
Remarks: The genus can be subdivided into seven groups of species (VACHARD *et al.,* 2006 and here Fig. 7). Only the new species are discussed here.

Occurrence: The Mississippian (from late Tournaisian) forms, only differing by the simple dark wall, are sometimes denominated "*Biseriella"*. Earliest Pennsylvanian-latest Permian. Presence for confirming in the Earliest Triassic

→

Figure 7.– Evolving trends of *Globivalvulina* and some related genera from the Late Tournaisian to the PTB (Permian/Triassic Boundary) and maybe the Earliest Triassic. The groups of species in each stage or subsystem are not necessarily genera or subgenera, because an evolution of the globivalvulinins different of that of the other groups of foraminifers (especially concerning the microstructure of wall). Numbers 1-4 in circles indicate the major events of this pylogeny. 1: Diversification of the primitive *Globivalvulina*. 2: Diversification of *Globivalvulina s.s*. 3: Start of the lineage of the advanced *Globivalvulina*. 4: Diversification of the Globivalvulinidae (see the details on Fig. 8).

Figura 7.– Tendencias evolutivas de las Globivalvulina *en grupos de especies, desde el Tournaisiense hasta el PTB (Límite Pérmico/Triasico) y quizás el Triásico basal. Estos grupos no corresponden necesariamente a géneros o subgéneros, ya que los globivalvulínidos parecen presentar variaciones individuales interpretadas como caracteres mayores de clasificación en los otros grupos (por ejemplo el tipo de pared). Los números 1 a 4 en los círculos indican los mayores acontecimientos en esta filogenía. 1: Diversificación de las* Globivalvulina *ancestrales. 2: Diversificación de las* Globivalvulina s.s. *3: Comienzo del linaje de las* Globivalvulina *más desarrolladas. 4: Diversificación de las otras Globivalvulinidae (véase detalles en la Fig. 8).*


TRIASSIC
G. curiosa
LATE PERMIAN (Lopingian) - Late Middle Permian (Capitanian = Midian)
Important diversification of the Globivalvulinidae (see Gaillot, 2006; Vachard et al., 2006)
Middle MIDDLE PERMIAN (Wordian - Murgabian)
G. vonderschmitti
G. graeca
G. cyprica
EARLY PERMIAN (Cisuralian)
L
E
G. apiciformis
G. donbassica
G. shikhanensis
G. vulgaris
LATE PENNSYLVANIAN
L
E
G. nassichucki
G. pergrata
G. spiralis
MOSCOVIAN
G. syzranica
G. mosquensis
G. kamensis
G. pulchra
G. granulosa
BASHKIRIAN
Globivalvulina bulloides
SERPUKHOVIAN
G. moderata
G.minima
G. eogranulosa
Koktjulina
LATE VISEAN
Globivalvulina parva
Dzhamansorina
MIDDLE VISEAN - EARLY VISEAN
Very Rare
LATE TOURNAISIAN
Globivalvulina bristolensis
EARLY TOURNAISIAN
?

[see *G. curiosa* GAILLOT, VACHARD, GALFETTI & MARTINI (submitted)].

Globivalvulina parascaphoidea sp. nov.
(Pl. 3, fig. 8, Pl. 8, fig. 1, Pl. 18, fig. 15, Pl. 32, fig. 24, Pl. 36, figs. 2-4, Pl. 40, figs. 9-10, Pl. 42, fig. 5)

v. 2006 *Globivalvulina parascaphoidea* sp. nov. – GAILLOT & VACHARD *in* GAILLOT, p. 62-63, Pl. I.3, fig. 4, Pl. I.10, fig.1, Pl. I.12, fig. 24, Pl. I.17, fig. 8, Pl. II.8, figs. 9-10, Pl. II.9, figs. 2-4, Pl. II.16, fig. 5, Pl. III.18, fig. 15, Pl. III.25, fig. 10 (*nomen nudum*).

Etymology: Greek *para*, almost, and *G. scaphoidea* REITLINGER, 1949, similar species.

Type locality: Offshore Fars area (zone 2 on Fig. 2A).

Type level: Late Wuchiapingian.

Diagnosis: Test large, height of chambers increasing rapidly. Wall thin, trapezoidal shape of the last chamber leading to a profile similar to *G. scaphoidea*.

Description: Test relatively large. The spire is plane and regular but the chambers increase rapidly in height and width. The last chamber of trapezoidal shape with a plane roof in axial section (Pl. 8, fig. 1), as well as in transverse section (Pl. 3, fig. 8). Thin wall and septa thinner than the wall, but apparently three layered. Oral tongues well developed in the last chamber and parallel to the apertural face (Pl. 32, fig. 24), or slightly curved outerwards (Pl. 3, fig. 8). This last chamber is also rectilinear in transverse section and contributes to give the profile of boat indicated by the name (scaphos in Greek means boat). Aperture typical for the genus.

Dimensions: H.= 0.525-0.975 mm, w.= 0.290-0.460 mm, w/H= 0.47-0.67, n.w.= fi-1fi, n.c.l.w.= 5 pairs, p.d.= 0.060 mm, h.l.c.= 0.200-0.390 mm, w.t.= 0.008-0.020 mm.

Holotype: Pl. 42, fig. 5.

Type material: 20 specimens, generally in transverse and tangential sections.

Repository of the types: CST TOTAL (Pau, France).

Comparison: *Globivalvulina parascaphoidea* sp. nov. differs from *G. kantharensis* REICHEL, 1946 and *G. scaphoidea* by the larger size and the multilayered, thinner wall.

Occurrence: Lopingian of Zagros, particularly abundant in the late Wuchiapingian-early Changhsingian.

Globivalvulina neglecta sp. nov.
(Pl. 4, fig. 14, Pl. 31, figs. 11, 13, Pl. 40, fig. 2)

1979 *Globivalvulina vonderschmitti* REICHEL – WHITTAKER *et al.*, pl. 1, figs. 13-14, 16, pl. 2, fig. 17.
v. 1991 *Globivalvulina* cf. *vonderschmitti* REICHEL – VACHARD & FERRIÈRE, pl. 1, fig. 9.
? 1994 *Globivalvulina vonderschmitti* REICHEL – FONTAINE *et al.,* pl. 21, figs. 4-6.
v. 2006 *Globivalvulina neglecta* sp. nov. – GAILLOT & VACHARD *in* GAILLOT, p. 62, Pl. I.37, figs. 11, 13, Pl. I.43, fig. 14, Pl. II.8, fig. 2 (*nomen nudum*).

Etymology: Latin *neglectus* = neglected because often confused with *G. vonderschmitti* REICHEL, 1946 or *G. graeca* REICHEL, 1946.

Type locality: Offshore Fars area.

Type level: Late Wuchiapingian.

Diagnosis: A large *Globivalvulina* with few a rounded, sutured chambers at the last whorl.

Description: Test planispiral, large for the genus. Chambers increasing rapidly and irregularly in height. Wall quite clear with a sporadic pseudofibrous internal layer.

Dimensions: H.= 0.615-0.810 mm, w.= 0.375-0.555 mm, w/H= 0.61-0.69, p.d.= 0.050-0.060 mm, n.w.= 1-1fi, h.l.c.= 0.280-0.330 mm, w.t.= 0.020-0.030 mm.

Holotype: Pl. 40, fig. 2 (sample 3135.86).

Type material: Form rare (10 specimens).

Repository of the types: CST TOTAL (Pau, France).

Comparison: Differs from *G. kamensis* REITLINGER, 1950 by the larger size and proportionally thinner wall. Differs from *G. graeca* and *G. vonderschmitti* by the shape of the chambers.

Occurrence: ?Late Midian of New Zealand. Late Wuchiapingian of Fars (Iran) and late Wuchiapingian-early Changhsingian of Zagros (Kuh-e Dena).

Globivalvulina curiosa GAILLOT, VACHARD, GALFETTI & MARTINI, submitted
(Pl. 30, figs. 16-21)

v. 2006 *Globivalvulina curiosa* sp. nov. – GAILLOT &

VACHARD *in* GAILLOT, p. 63-64, Pl. VII.3, figs. 16-20 (*nomen nudum*).

v. submitted *Globivalvulina curiosa* sp. nov. GAILLOT, VACHARD, GALFETTI & MARTINI, p. 15-16, fig. 7 (16-20).

Description: Proloculus ovoid measuring 0.011-0.033 mm of small axis and 0.033-0.055 of large axis. Coiling planispiral, relatively regular or with a tendency to uncoiling. Arrangement of chambers never regular. Shape of chambers very irregular, hemispherical to semi-ovoid, as in the tests affected today by marine pollutions (e.g., DEBENAY *et al.,*1996; ARMYNOT du CHÂTELET *et al.,* 2004). Sutures are deep with a lobate profile; inversely, there are no sutures. Abnormal chambers are located at the end of the coiling, at the beginning of the terminal whorl, or in the entire terminal whorl. h.l.c. = relatively constant although the variations in shape: 0.155 mm, 0.244 mm, 0.166 mm. Axial section and oblique sections are relatively similar to that of the other *Globivalvulina*; nevertheless, the tapering and the sutures of these sections are noticeable. Endoskeleton composed of an oral tongue relatively developed and incurved. Septa are locally prolonged by small expansions thinner and more undulate. Rare septa are slightly curved backwards. Rare calcified globules of unknown nature are visible in the chamber of deformed specimens. The wall is microgranular, dark, single layered, medium-thick (0.006-0.013 mm) (theoretically these specimens could be attributed to "*Biseriella*"). Aperture terminal at the base of the last chamber, wide and depressed.

Occurrence: Approximate PTB (latest Changhsingian?/earliest Triassic) of Tsoteng section, southern China.

Genus *Charliella* ALTINER & ÖZKAN-ALTINER, 2001

Type species: *Charliella rossae* ALTINER & ÖZKAN-ALTINER, 2001.

Synonyms: *Globivalvulina* (part), "*Crescentia*"*sensu* VACHARD & MICONNET, 1990, *Crescentia sensu* NESTELL & NESTELL, 2006.

Description: "A biseriamminid genus with a four-layered wall that thickens along the anterior side of the septa and partially occludes the chamber cavity" (ALTINER & ÖZKAN-ALTINER, 2001, p. 309).

Composition: *Charliella rossae*, *C. altineri* sp. nov., *Crescentia migrantis* NESTELL & NESTELL, 2006 (= *Charliella migrans emend.* and *orth. mut*.; see below).

Remarks: This genus differs from *Globivalvulina* by the relatively angular periphery of the chambers, and by the four-layered wall. It is however likely that this group has evolved from *G. vonderschmitti* (PRONINA-NESTELL, personal communication), developing the angular periphery and thicker wall due the high-energy tidal shoal environments during the late Wuchiapingian. This adaptation may have occurred at least twice during the Permian, firstly during the Midian with *Charliella rossae* and later during the Late Whuchiapingian, with *Charliella altineri* sp. nov..

This genus is palaeobiogeographically important since it is known on each border of the Palaeopacifica, from Cambodia-Sumatra to western Texas-central Mexico (see below, the paragraph "occurrence").

Occurrence: Midian of Turkey (northwest Anatolia), Italy (Monte Facito), Sumatra (as *Globivalvulina cyprica sensu* NGUYEN DUC TIEN, 1986b, pl. 13, fig. 5 only) and Cambodia (as *Globivalvulina cyprica* and *Globivalvulina* sp. B *sensu* NGUYEN DUC TIEN, 1986a, pl. 4, figs. 6-7), early Midian of Oman (VACHARD, unpublished data). Late Capitanian of central Mexico (VACHARD *et al*., 1992, as *Globivalvulina* ex gr. *cyprica*, pl. 6, fig. 7), late Guadalupian of western Texas (NESTELL & NESTELL, 2006, as *Crescentia migrantis*), late Permian of Thailand (VACHARD, unpublished data). Probably present in Japan (Taishaku, *Yabeina* zone) and Oman (Jebel Akhdar, "late Dzhulfian") seen by OKIMURA (1972) and LYS *in* MONTENAT *et al*., 1977 as mentioned in NGUYEN DUC TIEN, 1979. Late Wuchiapingian of Zagros, Fars and Abu Dhabi.

Charliella altineri sp. nov.

(Pl. 5, figs. 1, 5, Pl. 13, fig. 3, Pl. 15, fig. 5, Pl. 27, figs. 2-3, Pl. 34, fig. 5, Pl. 43, figs. 1-16, Pl. 44, figs. 1-15)

v. 2006 *Charliella* sp. – Insalaco *et al.,* pl. 2, fig. 8.
v. 2006 *Charliella altineri* sp. nov. – Gaillot & Vachard *in* Gaillot, p. 65 Pl. I.6, figs. 5-8, 12-14, Pl. I.7, fig. 5, Pl. I.8, fig. 8, Pl. II.10, figs. 1-16, Pl. II.11, figs. 1-15, Pl. II.31, fig. 2-3, Pl. II.33, figs. 7, 17, Pl. III.15, fig. 1, 5, Pl. III.22, fig. 5, Pl. IV.5, fig. 3 (*nomen nudum*).
v. 2006 *Charliella altineri* Gaillot – Vachard *et al.*, fig. 9(4) (*nomen nudum*:, no description).

Etymology: Dedicated to Prof. Demir Altiner, for his important work in the Permian biostratigraphy of Turkey.

Type locality: Offshore Fars area (zone 2, Fig. 2A).

Type level: Late Wuchiapingian.

Diagnosis: *Charliella* with an elongate test, medium to large size, slightly compressed.

Description: The species possesses all the morphological characteristics of *Globivalvulina graeca* with a typical wall of *Charliella*. Triangular chambers are also characteristic of this species (Pl. 43, figs. 1-2, 12, Pl. 44, figs. 3, 10, 12).

Dimensions: D.= 0.330-0.760 mm, w.= 0.330-0.540 mm, w/D= 0.58-0.97, n.w.= 1-1.5, p.d.= 0.035-0.100 mm, n.c.= 6-7 (8) pairs, h.l.c.= 0.170-0.280 mm, w.t.= 0.020-0.060 mm.

Holotype: Pl. 43, fig. 12 (sample 3091.03).

Type material: Approximately two hundred sections and fifty illustrated paratypes.

Repository of the types: CST TOTAL (Pau, France).

Comparison: It differs from *Charliella rossae* by the very smaller number of pairs of chambers compared with an identical diameter. It differs from the unpublished species denominated *Globivalvulina cyprica sensu* Nguyen Duc Tien 1979, 1986a, 1986b and *G.* ex gr. *cyprica sensu* Vachard *et al.* (1992) by the larger dimensions.

Remarks: The tests of the specimens from the Fars area are less elongate, with a thicker wall than the specimens from Kuh-e Surmeh area. This reflects possibly a morpho-functional adaptation to the high-energy zones of oolitic sandwaves complexes onto the platform top in the Fars area.

Occurrence: Diagnostic species of the late Wuchiapingian in Zagros, Fars and Abu Dhabi.

Genus *Labioglobivalvulina* gen. nov.

Type species: *Labioglobivalvulina baudi* sp. nov..

Etymology: Latin *Labia*: lip and *Globivalvulina*.

Diagnosis: Coiling planispiral to slightly trochospiral, similar to *Globivalvulina*. Wall relatively thick, single layered, dark brown, rather coarsely granular. Small, supplementary nodular formations develop on septa and form an elongate aperture looking like a lip, short and cylindrical, connecting the lateral part of the preceeding chamber with the base of the next chamber (compare for example with *Meidamonella* Loeblich & Tappan, 1986).

Composition: *Labioglobivalvulina baudi* sp. nov., *L. fortis* sp. nov.

Comparison: It differs from *Globivalvulina*, in axial section, by the different aperture with lip. In other sections, it differs by a more granular wall (see the misinterpreted illustrations of Kobayashi, 2006b, fig. 3). It differs from immature specimens of *Labiodagmarita* gen. nov. (see below), which wall can be similar, by the globivalvulinid profile in axial section (*Labiodagmarita* has a profile more acute, more elongate).

Occurrence: Late Midian-Lopingian. Zagros-Fars area (Iran) and Hazro (Turkey), ?Transcaucasia, Montenegro, Italy, Hungary, southern China, central Japan, northern Thailand.

Labioglobivalvulina baudi gen. nov. sp. nov.
(Pl. 4, figs. 2, 7?, 8-9, 11, Pl. 12, figs. 8-10, Pl. 28, figs. 4, 6, 11, Pl. 29, fig. 20, Pl. 31, fig. 8?, Pl. 35, fig. 13)

1970a *Globivalvulina bulloides* (Brady) – Pantic, pl. 8, fig. 5.
1978 *Globivalvulina bulloides* (Brady) – Berczi-Makk, pl. 2, fig. 9, pl. 3, fig. 2.
1978 *Globivalvulina bulloides* (Brady) – Lin, p. 27, pl. 5, fig. 3.
? 1981 *Globivalvulina* sp. – Altiner, pl. 36, fig. 20 (*non* figs. 18-19, 21= *G. bulloides*).
1984 *Globivalvulina bulloides* (Brady) – Lin, p. 126, pl. 3, figs. 12-14.
p.p. 1988 *Globivalvulina* sp. – Yanagida *et al*., pl. 5, figs. 1?, 2?, 3?, 4, 6, 11, 13?, 14? (*non* fig. 5= *Septoglobivalvulina*? sp.; *non* fig. 7 = *Retroseptellina globosa*; *non* figs. 8-10, 12= truly *Globivalvulina*).
? 1988a *Globivalvulina* sp. 1 – Pronina, pl. 2, fig. 5 (only,

no fig. 6 = ?*Paradagmarita simplex* sp. nov.).

? 1989 *Globivalvulina* sp. – KÖYLÜOGLU & ALTINER, pl. 7, figs. 11-12.

2006b *Globivalvulina cyprica* REICHEL – KOBAYASHI, figs. 3. 26-27.

v. 2006 *Siphoglobivalvulina baudi* gen. nov. sp. nov. – GAILLOT & VACHARD *in* GAILLOT, p. 66, Pl. I.3, figs. 9-10, 12?, 13?, Pl. I.5, figs. 4, 6, 11, Pl. I.37, fig. 8?, Pl. I.43, figs. 2, 7?, 8-9, 11, Pl.V.3, fig. 13, Pl. VI.4, fig. 20, Pl. VI.5, figs. 8-10, Pl. VI.6, fig. 15 (*nomen nudum*).

v. 2006 *Siphoglobivalvulina baudi* GAILLOT – VACHARD *et al.*, fig. 9(1-3) (*nomen nudum*: no description).

Etymology: Dedicated to Dr. Aymon BAUD, from Lausanne University (Switzerland), for his stratigraphic work in the Permian and the Triassic.

Type locality: Hazro (Turkey).

Type level: Early Wuchiapingian.

Diagnosis: Test small, externally homeomorph of *Globivalvulina bulloides* (BRADY, 1876). Coiling planispiral to slightly trochospiral. Wall finely granular. Aperture elongate, short and cylindrical, re-inforced by a granular smooth hook.

Description: Test small, biserial with planispiral to slightly trochospiral coiling. The aperture appears re-inforced by a smooth hook of the same structure as the wall. The siphon begins in the bottom right corner of the previous chamber and attains the center of the roof of the next chamber.

Dimensions: D.= (0.275)-0.420-0.750 mm, w.= (0.240) 0.330-0.500 mm, w/D= 0.64-0.89, p.d.= 0.080 mm, n.w.= 1, n.c.= 4-7 pairs, h.l.c.= 0.130-0.200 mm, w.t.= 0.010-0.030 (perhaps 0.070) mm, but probably due to a tangential section.

Holotype: Pl. 12, fig. 10 (sample 03HZ33).

Type material: 15 (perhaps 19) sections.

Repository of the types: Collection of Palaeontology of Lille 1 University (France).

Remarks: The populations of the new species in Hazro are remarkably homogeneous in size. *Labioglobivalvulina baudi* differs from *L. fortis* sp. nov., so that *G. bulloides* differs from *G. vonderschmitti*.

Occurrence: In Hazro the oldest specimens might be present since the latest Capitanian (Pl. 29, fig. 20), but the species is essentially characteristic of the Wuchiapingian. The new species has the same range in the Zagros and Fars areas. In the literature, the distribution of *L. baudi* in northern Thailand is poorly documented, probably it is in the Lopingian, and is, probably in the late Midian in central Japan.

Labioglobivalvulina fortis sp. nov.

(Pl. 1, fig. 14, Pl. 3, fig. 9, Pl. 9, figs. 2-3, 6, 9-10, Pl. 11, figs. 1, 20-21, Pl. 32, fig. 9, Pl. 45, figs. 6, 9-11, 13-16)

? 1960 *Globivalvulina* cf. *biserialis* CUSHMAN & WATERS – LORIGA, p. 52-53, text-figs. 4? p. 52-53, pl. 7, figs. 2a-b.

? 1960 *Globivalvulina* cf. *vonderschmitti* REICHEL – LORIGA, p. 56-57, text-fig. 9 p. 56.

? p.p.1964 *Globivalvulina* – GLINTZBOECKEL & RABATÉ, pl. 42, fig. 2, pl. 43, figs. 1-2, pl. 44, figs. 1-2, pl. 51, fig. 2b.

? p.p.1988 *Globivalvulina* sp. – YANAGIDA *et al.*, pl. 5, figs. 1?, 2?, 13?, 14? (young *L. fortis* or large *L. baudi* sp. nov.) [*non* figs. 3?, 4, 6, 11= *L. baudi* sp. nov. *non* fig. 5 = *Septoglobivalvulina*? sp.; *non* fig. 7 = *Retroseptellina globosa* (WANG) *non* figs. 8-10, 12 = truly *Globivalvulina*].

? 1988a *Paraglobivalvulina* sp. – FONTAINE *et al.,* pl. 2, fig. 4.

v. 2006 *Siphoglobivalvulina fortis* sp. nov. – GAILLOT & VACHARD *in* GAILLOT, p. 67, Pl. I.12, fig. 9, Pl. I.16, figs. 6, 9-11, 13, Pl. I.17, fig. 9, Pl. I.18, figs. 1, 6-7, 11,Pl. I.19, figs. 1, 20-21, Pl. III.3, figs. 1, 4-7, 14-15, Pl. III.4, figs. 6-10, 12, Pl. III.5, figs. 2-3, 6, 9-10, Pl. III.6, fig. 14, Pl. III.7, figs. 3-7, 10-11 (*nomen nudum*).

Etymology: Latin *fortis*, strong.

Type locality: Kuh-e Surmeh (Zagros, Iran).

Type level: Changhsingian.

Diagnosis: *Labioglobivalvulina* of medium-size and externally homeomorph of *Globivalvulina graeca* REICHEL, 1946.

Description: Test of medium-size to large for the genus. Coiling regular with a possible increasing of height in the two last chambers. Apertural face slightly depressed. Wall microgranular, thick, single layered. The costae are poorly developed around the apertures. Interseptal connections are present.

Dimensions: D.= (0.170) 0.415-1.000 mm, w.= (0.120) 0.420-0.800 mm, w/D ratio= 0.71-0.79 (0.95), p.d.= 0.044-0.100 (0.130) mm, number of whorl: 1-1.5, n.c.= 6-8, h.l.c.= (0.070)

0.140-0.300 mm, w.t.= 0.010-0.040 mm.

Holotype: Pl. 45, fig. 15 (sample KeS-224).

Type material: Approximately 50 specimens.

Repository of the types: CST TOTAL (Pau, France).

Remarks: See above *L. baudi* sp. nov.

Occurrence: Lopingian of Zagros, ?Italy, ?Tunisia, ?western Thailand.

Genus *Retroseptellina* gen. nov.

Type species: *Globivalvulina decrouezae* Köylüoglu & Altiner, 1989.

Synonyms. *Globivalvulina* (part), *Septoglobivalvulina*? *sensu* Vachard *et al.*, 2005, *Septoglobivalvulina* (part), *Paraglobivalvulina* (part).

Diagnosis: Coiling similar to *Globivalvulina*, with few whorls and few chambers in each whorl, with a tendency of the increasing of the width of the chambers during the growth. Septa strongly curvated backward. Chambers relatively rectangular in axial section. Wall single layered, microgranular.

Composition: *Globivalvulina globosa* Wang *in* Zhao *et al.,* 1981; *G. decrouzae* Köylüoglu & Altiner, 1989; *Paraglobivalvulina nitida* Lin, Li & Sun, 1990.

Comparison: Differs of *Globivalvulina* by the strongly curved septa and the shape of the chambers; from *Septoglobivalvulina* and *Paraglobivalvulina* by an increasing of the whorls in width more than in height, and the strongly backward curved septa.

Occurrence: Questionable in early Murgabian of Thailand (Ueno & Sakagami, 1993; in our opinion, it is Midian). Murgabian-Dzhulfian-Dorashamian of southern Turkey (e.g. Canuti *et al.*, 1970 up-dated by Gaillot, 2006; Koylüoglu & Altiner, 1989; Ünal *et al.*, 2003), Thailand and Malaysia (Yanagida *et al.*, 1988; Fontaine *et al.*, 1993, 1994). Midian of Batain Plain, Oman (Vachard *et al.*, 2002). Earliest Midian-earliest Dzhulfian of Transcaucasia (Kotlyar *et al.*, 1989; G. & M. Nestell, personal communication, 2007). Midian of New Zealand (Vachard & Ferrière, 1991). Late Midian of central Japan (Kobayashi, 2006b). Dorashamian of Greece (Altiner & Özkan-Altiner, 1998; Baud *et al.*, 1991; Grant *et al.*, 1991). Wuchiapingian-Changhsingian of southern China (Lin *et al.*, 1990). Wuchiapingian of northern Italy and Iran (Mohtat-Aghai & Vachard, 2005). Duhaysan Member of eponymic Khuff Formation in Saudi Arabia (Vachard *et al.*, 2005). Changhsingian of Hungary (Théry *et al.*, 2007).

Retroseptellina globosa (Wang *in* Zhao *et al.*, 1981)

(Pl. 4, fig. 16, Pl. 7, figs. 2, 13, Pl. 9, fig. 12, Pl. 12, figs. 6-7, Pl. 15, fig. 10, Pl. 29, figs. 9, 13-14, Pl. 32, figs. 6, 25, Pl. 35, figs. 5-6, Pl. 36, fig. 5, Pl. 40, fig. 4)

1981 *Globivalvulina globosa* sp. nov. – Wang *in* Zhao *et al*., p. 48 (in Chinese), 75-76 (in English), pl. 2, figs. 8-9.

p.p. 1988 *Globivalvulina* sp. – Yanagida *et al*., pl. 5, fig. 7 (*non* figs. 1-6, 11, 13-14 = various species of *Labiodagmarita* gen. nov.; *non* figs. 8-10, 12 = true *Globivalvulina*).

non 1990 *Globivalvulina globosa* Wang – Lin *et al.*, p. 162, pl. 11, figs. 26-29 [26-27 = *Retroseptellina decrouezae* (Köylüoglu & Altiner); 28-29 = *Globivalvulina bulloides* (Brady)].

v. 1993 *Paraglobivalvulina* – Baird *et al*., fig. 3. 4.

1995 *Globivalvulina* sp. – Berczi-Makk *et al.,* pl. 8, fig. 2.

? 1995 *Globivalvulina* cf. *graeca* Reytlinger – Berczi-Makk *et al.*, pl. 8, fig. 4 (or *R. decrouezae*).

non 2001 *Paraglobivalvulina globosa* (Wang) – Pronina-Nestell & Nestell, pl. 5, figs. 2-3 (= *Retroseptellina decrouezae*).

v.non2002 *Septaglobivalvulina* (*sic*) *globosa* (Wang) – Vachard *et al.,* pl. 1, figs. 13-14 [13 = *R. decrouezae*, 14 = ?*Septoglobivalvulina distensa* (Wang)].

2004 *Globivalvulina kantharensis* Reichel – Zhang & Hong, p. 70, pl. 1, figs. 22-23.

non 2004 *Globivalvulina globosa* (Wang) – Zhang & Hong, p. 70, pl. 1, figs. 24-26 (= *R. decrouezae*).

v. p.p.2005 *Septoglobivalvulina*? *decrouezae* (Köylüoglu & Altiner) – Vachard *et al*., p. 154-155, pl. 3, figs. 5-6 (illustrations only).

v. 2006 *Retroseptellina globosa* (Wang) – Gaillot, p. 68, Pl. I.4, figs. 2, 13, Pl. I.7, fig. 10, Pl. I.12, figs. 6, 25, Pl. I.43, fig. 16, Pl. II.8, fig. 4, Pl. II.9, fig. 5, Pl. III.3, figs. 2, 12, Pl. III.5, fig. 12, Pl. III.24, fig. 9, Pl. V.3, figs. 5-6, Pl. VI.4, figs. 9, 13-14, Pl. VI.5, figs. 6-7.

Description: Test small (0.500 mm as maximal width) ovoid to subquadrate, biserial, coiled *in* a trochoid spire incompletely involute, with relatively wide chambers (not high), and backward curved septa. Wall very thin, microgranular.

Dimensions: H.= 0.200-0.350 mm, w.= 0.300-0.510 mm, w/H= 0.61, p.d.= 0.030 mm, n.w.= 1-2, n.c.l.w.= 3-4, h.l.c.= 0.100-0.115 mm, w.t.= 0.007-0.015 mm.

Remarks: The name *Globivalvulina globosa* POTIEVSKAYA *in* MANUKALOVA-GREBENYUK *et al.*, 1969 (p. 237, pl. 9, fig. 7), seems to be a *nomen nudum*; hence, the WANG's name is valid.

Occurrence: Late Wuchiapingian-early Changhsingian of Hazro (Turkey). Late Wuchiapingian of Saudi Arabia. Late Changhsingian of southern China. Midian to Changhsingian of central Thailand. Lopingian of northern Thailand.

Retroseptellina decrouezae (KÖYLÜOGLU & ALTINER, 1989)

(Pl. 1, fig. 6, Pl. 12, fig. 26, Pl. 17, figs. 16-17, Pl. 31, fig. 12, Pl. 34, fig. 14, Pl. 37, fig. 5, Pl. 40, fig. 3)

p.p. 1970 *Globivalvulina graeca* REICHEL – CANUTI *et al.*, fig. 14.1 (*non* fig. 14. 3-4, 6 correctly interpreted)
p.p. 1970 *Globivalvulina* sp. – CANUTI *et al.*, fig. 14. 2, 5.
1989 *Globivalvulina* sp. – KOTLYAR *et al.*, pl. 3, fig. 21.
1989 *Globivalvulina decrouezae* sp. nov. – KÖYLÜOGLU & ALTINER, p. 479-481, text-figs. 8 A-H, J-K, pl. 7, figs. 13-16.
p.p. 1990 *Globivalvulina globosa* WANG – LIN *et al.*, p. 162, pl. 11, figs. 26-27 (*non* figs. 28-29= *Globivalvulina bulloides*).
v. 1991 *Paraglobivalvulina*? sp. – VACHARD & FERRIÈRE, pl. 2, fig. 2.
v. 1993 *Globivalvulina* or *Paraglobivalvulina*? – FONTAINE *et al.*, fig. 5E.
v. 1993 *Paraglobivalvulina mira* REITLINGER – FONTAINE *et al.*, fig. 6F.
v. 1994 *Paraglobivalvulinoides*? – FONTAINE *et al.*, pl. 47, fig. 7.
p.p. 1995 *Paraglobivalvulina mira* REITLINGER – BERCZI-MAKK *et al.*, pl. 6, figs. 1-3 [*non* pl. 7, figs. 1-2= *Retroseptellina nitida* (LIN, LI & SUN)].
1998 *Globivalvulina decrouezae* KÖYLÜOGLU & ALTINER – ALTINER & ÖZKAN-ALTINER, pl. 3, fig. 23.
2001 *Paraglobivalvulina globosa* (WANG) – PRONINA-NESTELL & NESTELL, pl. 5, figs. 2-3.
v. p.p.2002 *Septaglobivalvulina* (*sic*) *globosa* (WANG) – VACHARD *et al.*, pl. 1, fig. 13 (*non* fig. 14= *Septoglobivalvulina distensa*).
2004 *Globivalvulina globosa* WANG – ZHANG & HONG, p. 70, pl. 1, figs. 24-26.
v. 2005 *Septoglobivalvulina decrouezae* (KÖYLÜOGLU & ALTINER) – MOHTAT-AGHAI & VACHARD, pl. 2, fig. 17.
v. non2005 *Septoglobivalvulina*? *decrouezae* (KÖYLÜOGLU & ALTINER) – VACHARD *et al.*, p. 154-155, pl. 3, figs. 5-6 (with 25 references in synonymy; but too large synonymy, erroneously extended to *Paraglobivalvulina gracilis*).
v. 2006 *Septoglobivalvulina*? *decrouezae* (KÖYLÜOGLU & ALTINER) – INSALACO *et al.,* pl. 1, fig. 20.
p.p. 2006b *Globivalvulina* sp. – KOBAYASHI, figs. 3. 31, 35-36 (*non* figs. 3. 28-30, 32-34 = truly *Globivalvulina* spp.).
2006e ? *Septoglobivalvulina*? sp. – KOBAYASHI, pl. 2, figs. 9-12.
v. 2006 *Retroseptellina decrouezae* (KÖYLÜOGLU & ALTINER) – GAILLOT, p. 68-69, Pl. I.13, figs. 12-14, Pl. I.14, figs. 1-2, Pl. I.15, fig. 15, Pl. I.18, figs. 3-5, 9, Pl. I.37, fig. 12, Pl. II.8, fig. 3, Pl.III.2, fig. 5, Pl. III.3, fig. 13, Pl. III.4, fig. 13, Pl. III.6, fig. 6, Pl. III.7, fig. 2, Pl. III.16, figs. 16-17, Pl. III.22, fig. 14, Pl. VI.5, fig. 26, Pl. VII.2, fig. 5.
v. 2006 *Retroseptellina decrouezae* (KÖYLÜOGLU & ALTINER) – VACHARD *et al.*, fig. 9 (5).
v. submitted *Retroseptellina decrouezae* (KÖYLÜOGLU & ALTINER) – GAILLOT, VACHARD, GALFETTI & MARTINI, p. 19-20, fig. 6 (5).

Dimensions: D.= 0.510-0.825 (0.975) mm, w.= 0.480-0.700 (0.763) mm, w/D= 0.70-0.88, n.w.= 1.5-2. The diameter of the tests in the type material of KÖYLÜOGLU & ALTINER (1989) is smaller with a diameter of 0.520-0.640 mm.

Remarks: *Retroseptellina decrouezae* is characterized by the subrectangular to subspherical profile, the number of whorl is 2 or 3 (and always more than 1), the last whorl is not increasing in height, and larger test size (>0.500 mm). Its chambers are spacious, and the backward curvature of the septa forms of a hook. The test of *R. globosa* has smaller number of whorls, and the test of *R. nitida* is more evolute. In fact, the transition forms from *R. globosa* to *R. decrouezae* is progressive, as such as that from *R. decrouezae* to *R. nitida*.

Occurrence: Late Midian-Lopingian of Italy, Turkey, Thailand and Malaysia, Transcaucasia, New Zealand, Greece, southern China, central Iran, Saudi Arabia (see compilation in VACHARD *et al.*, 2005, p. 155). Changhsingian of northwestern Caucasus (PRONINA-NESTELL & NESTELL, 2001). Midian of central Japan (KOBAYASHI, 2006b). Changhsingian of Japan (KOBAYASHI, 2006e). Lopingian of Zagros-Fars-Abu Dhabi area. Early Wuchiapingian of Hambast region (central Iran) (MOHTAT-AGHAI & VACHARD, 2005). Hazro: late Wuchiapingian-early Changhsingian (Gaillot, 2006).

Retroseptellina nitida (Lin, Li & Sun, 1990)
(Pl. 11, fig. 18, Pl. 37, fig. 4, Pl. 40, fig. 7)

1990 *Paraglobivalvulina nitida* sp. nov. – Lin, Li & Sun, p. 166, pl. 12, figs. 20-21.
p.p. 1995 *Paraglobivalvulina mira* Reitlinger – Berczi-Makk *et al.*, pl. 7, figs. 1-2 (*non* pl. 6, figs. 1-3= *R. decrouezae*).
v. 2006 *Retroseptellina nitida* (Lin, Li & Sun) – Gaillot, p. 69-70, Pl. I.19, fig. 18, Pl. II.8, fig. 7, Pl. VII.2, fig. 4.
v. 2006 *Retroseptellina nitida* (Lin, Li & Sun) – Vachard *et al.*, fig. 9(6).
v. submitted *Retroseptellina nitida* (Lin, Li & Sun) – Gaillot, Vachard, Galfetti & Martini, p. 15-16, fig. 7(16-20).

Dimensions: The last chambers of *R. nitida* are evolute. Dimensions: H.= 0.500-0.580 mm, w.= 0.450-0.780 mm, n.w.= 2.5. The type material of Lin *et al.* (1990) is larger with 0.960-1.120 mm but for 3-4 whorls.

Occurrence: Lopingian of southern China (Lin *et al.*, 1990; Gaillot *et al.*, submitted), Hungary (Berczi-Makk *et al.*, 1995), and Zagros, Kuh-e Surmeh.

Subfamily Paraglobivalvulininae subfam. nov..

Diagnosis: Globivalvulinidae with entirely or almost entirely enveloping last chamber, i.e. tending to a spherical shape of the test, and some endoskeletal supplementary formations (for example, septal chamberlets and interseptal stolons). Wall microgranular single layered occasionaly differentiated with an *Omphalotis*-type.

Composition: *Septoglobivalvulina* Lin, 1978; *Paraglobivalvulina* Reitlinger, 1965; *Urushtenella* Pronina-Nestell *in* Pronina-Nestell & Nestell, 2001; *Paraglobivalvulinoides* Zaninetti & Jenny-Deshusses, 1985 (Fig. 8).

Occurrence: Midian-Changhsingian, Tethys.

Genus *Septoglobivalvulina* Lin, 1978 *emend.*

Type species: *Septoglobivalvulina guangxiensis* Lin, 1978.

Synonyms: *Globivalvulina* (part), *Paraglobivalvulina* (part).

Diagnosis: Test initially similar to *Globivalvulina* but differing by an ovoid to subspherical shape and a voluminous last chamber covering entirely the preceeding whorls. Endoskeleton as in *Globivalvulina*, i.e. reduced to an oral tongue. Wall thin dark microgranular single layered. Aperture terminal, basal, simple.

Composition: *Septoglobivalvulina guangxiensis* Lin, 1978 (D= 0.820-0.920 mm); *S. similis* Lin, Li & Sun, 1990 (D= 0.740-0.870 mm); *Globivalvulina distensa* Wang *in* Zhao *et al.*, 1981 (D= 0.500-0.700 mm); *Septoglobivalvulina* cf. *globosa sensu* Vachard *et al.*, 2002 (pl. 1, figs. 13-14) *non* Wang *in* Zhao *et al.,* 1981 (D= 0.660-0.800 mm); *S.* sp. 1 of this study (D= 0.555 mm); ?*Globivalvulina cyprica sensu* Nguyen Duc Tien, 1986b, pl. 6, fig. 14 only (*non* Reichel, 1946).

Comparison: *Septoglobivalvulina* differs from *Globivalvulina* by the increasing in height and width last chamber that envelops the preceeding coiled chambers. It differs from *Paraglobivalvulina* by not completely spherical test, thin wall and the more rudimentary endoskeleton (i.e., without chamberlets). *Septoglobivalvulina* also differs from *Retroseptellina* gen. nov. by not curved backward septa, and more increasing in height last chamber whereas the last chambers of *Retroseptellina* are wider than the previous ones. Although Ünal *et al*. (2003, pl. 1, figs. 9-11) re-assigned *Paraglobivalvulina gracilis* Zaninetti & Altiner, 1981 to *Septoglobivalvulina*, this species is here maintained as *Paraglobivalvulina* (see below).

Occurrence: Early?-late Midian to Changhsingian: Oman, southern China, ?Transcaucasia, Turkey (Hazro), Iran (Fars, Zagros), Abu Dhabi.

Septoglobivalvulina cf. *guangxiensis* Lin, 1978
(Pl. 7, fig. 14, Pl. 30, fig. 14)

1978 *Septoglobivalvulina guangxiensis* gen. nov. sp. nov. – Lin, p. 28, pl. 5, figs. 4-7.
1981 *Septoglobivalvulina guangxiensis* Lin – Zhao *et al.*, pl. 2, fig. 10.
? 1984b *Paraglobivalvulina gracilis* Zaninetti & Altiner

FAMILY	SUBFAMILIES	GENERA
GLOBIVALVULINIDAE	Globivalvulininae	*Biseriella, Globivalvulina, Tenebrosella, Charliella, Siphoglobivalvulina, Retroseptellina*
	Paraglovivalvulininae	*Septoglobivalvulina, Paraglobivalvulina, Urushtenella, Paraglobivalvulinoides*
	Dagmaritinae	*Sengoerina, Dagmarita, Bidagmarita, Siphodagmarita, Crescentia, Louisettita*
	Paradagmaritinae	*Paradagmarita, Paradagmaritella, Paradagmaritopsis, Paradagmacrusta, Paraemiratella*

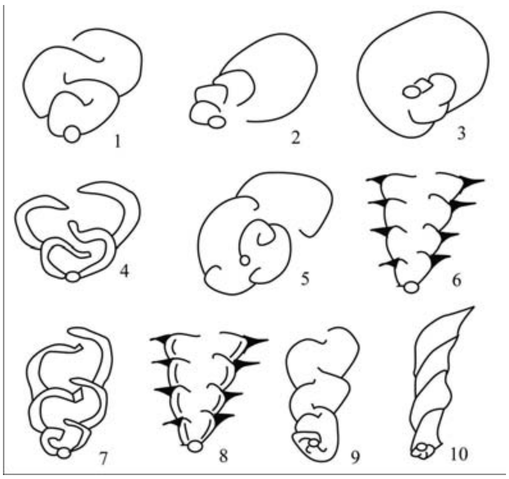


Figure 8.– New classification of the Biseriamminoidea subdivided into subfamilies, with some cartoons of the main genera of Globivalvulinidae. 1. *Globivalvulina*, 2. *Septoglobivalvulina*, 3. *Paraglobivalvulina*, 4. *Labioglobivalvulina* gen. nov., 5. *Retroseptellina* gen. nov. , 6. *Dagmarita*, 7. *Labiodagmarita* gen. nov., 8. *Louisettita*, 9. *Paradagmarita*, 10. *Paradagmaritopsis*.
Figura 8.– Classificación nueva de los Biseriamminoidea divididos en subfamilias con algunos dibujos de los principales géneros de Globivalvulinidae. 1. Globivalvulina*, 2.* Septoglobivalvulina*, 3.* Paraglobivalvulina*, 4.* Labioglobivalvulina*, 5.* Retroseptellina*, 6.* Dagmarita*, 7.* Labiodagmarita gen. nov.*, 8.* Louisettita*, 9.* Paradagmarita*, 10.* Paradagmaritopsis.

– Altiner, pl. 1, fig. 15 (the chamberlets of *P. gracilis* are not visible).
1987 *Paraglobivalvulina guangxiensis* Lin – Loeblich & Tappan, pl. 230, figs. 7-8.
1990 *Septoglobivalvulina guangxiensis* Lin – Lin *et al.*, p. 164-165, pl. 12, figs. 11-12, 13? (13 might belong to *Siphoglobivalvulina*).
? 1992 *Paraglobivalvulina mira* Reitlinger – Berczi-Makk, pl. 4, fig. 7.
? p.p.2005 *Paraglobivalvulina globulosa* (*sic*, probably: *globosa* Wang) – Hughes, pl. 2, fig. 21 (*non* figs. 22-23= ?*S. distensa*).
v. 2006 *Septoglobivalvulina* cf. *guangxiensis* Lin – Gaillot, p. 70-71, pl. I.4, fig. 14, pl. VII.3, fig. 14.
v. 2006 *Septoglobivalvulina* cf. *guangxiensis* Lin – Vachard *et al*., fig. 9(7).
v. submitted *Septoglobivalvulina* cf. *guangxiensis* Lin – Gaillot, Vachard, Galfetti & Martini, p. 20, fig. 7(1-4).

Remarks: Our material differs from the type material by its smaller size (D.= 0.820-0.900 mm) and thicker wall, but the chamber shape and the large proloculus are identical. Zagros material: D.= w.= 0.530 mm, n.w.: 1, n.c.= 3, h.l.c.= 0.275 mm, w.t.= 0.007 mm. southern China material: D.= 0.670 mm, w.= 0.680 mm, p.d.= 0.233 mm, n.w.: 1, n.c.= 2, h.l.c.= 0.130-0.330 mm, w.t.= 0.020-0.056 mm.

Occurrence: Wuchiapingian of Zagros (Kuh-e Surmeh). Changhsingian of southern China.

Septoglobivalvulina distensa (Wang *in* Zhao *et al*., 1981)

(Pl. 1, fig. 5, Pl. 3, fig. 12, Pl. 4, fig. 15, Pl. 5, fig. 14?, Pl. 7, fig. 5, Pl. 12, fig. 18, Pl. 15, fig. 12, Pl. 17, fig. 5, Pl. 27, fig. 4, Pl. 28, fig. 15, Pl. 29, figs. 10-11, 16, Pl. 31, fig. 9, Pl. 36, fig. 1, Pl. 37, fig. 2, Pl. 40, figs. 1, 5)

1981 *Globivalvulina distensa* sp. nov. – Wang *in* Zhao *et al*., p. 48 (in Chinese), 75 (in English), pl. 2, figs. 1-3.
1985 *Globivalvulina* sp. of *G. vonderschmitti* group – Okimura *et al*., pl. 1, fig. 10.
? 1988a *Paraglobivalvulina*? sp. – Pronina, pl. 2, figs. 8-9.
p.p. 1990 *Globivalvulina laxa* sp. nov. – Lin, Li & Sun, p. 163-164, pl. 11, fig. 36 only (*non* figs. 35, 37-38= globivalvulinid indet.).

? p.p.2005 *Paraglobivalvulina globulosa* (*sic*, probably: *globosa* WANG) – HUGHES, pl. 2, figs. 22-23 (*non* fig. 21= ?*S. guangxiensis*).

v. 2006 *Septoglobivalvulina distensa* (WANG) – GAILLOT, p. 71, Pl. I.4, fig. 5, Pl. I.5, fig. 5, Pl. I.7, fig. 12, Pl. I.17, fig. 12, Pl. I.37, fig. 9, Pl. I-43, fig. 15, Pl. II.8, fig. 1, 5, Pl. II.9, fig. 1, Pl. II.31, fig. 4, Pl. III.6, fig. 5, Pl. III.15, fig. 14?, Pl. III.16, fig. 5, Pl. VI.4, figs. 10-11, Pl. VI.5, fig. 18, Pl. VI.6, fig. 21, Pl. VII.2, fig. 2.

v. submitted *Septoglobivalvulina distensa* (WANG) – GAILLOT, VACHARD, GALFETTI & MARTINI, p. 21, fig. 6(2).

Dimensions: D.= 0.500-1.000 mm, w.= 0.960 mm, w/D= 0.96, p.d.= 0.060-0.160 mm, n.w.= 1, n.c.= 3-4, h.l.c.= 0.235-0.600 mm (i.e., more of the half of the total diameter), w.t.= 0.015-0.030 mm.

Comparison: Typical *Septaglobivalvulina distensa* are smaller (D.= 0.500-0.700 mm) and the last chamber occupies only one-third of the test diameter, but these variations are probably intraspecific. The specimens of *Paraglobivalvulina*? sp. (PRONINA, 1988a, pl. 2, figs. 8-9) might be immature.

Occurrence: Early?-late Midian to Changhsingian: Oman, southern China, Turkey (Hazro), Iran (Fars, Zagros), Abu Dhabi. Late Changhsingian of southern China and ?Transcaucasia.

Septoglobivalvulina sp. 1

(Pl. 32, figs. 1-2, Pl. 37, fig. 3, Pl. 39, fig. 9)

2006 *Septoglobivalvulina* sp. 1- GAILLOT, p. 71-72, pl. I.11, fig. 9, pl. I.12, figs. 1-2, pl. VII.2, fig. 3.

submitted *Septoglobivalvulina* sp. 1- GAILLOT, VACHARD, GALFETTI & MARTINI, p. 18-19, fig. 6(3).

Description: The specimen have the same size than *S. distensa* but more whorls and more chambers.

Dimensions: D.= 0.400-0.555 mm, p.d.= 0.060 mm, n.w.= 2, n.c.= 5 or 6, h.l.c.= 0.250-0.360 mm, w.t.= 0.015 mm.

Occurrence: Changhsingian of Zagros (Kuh-e Surmeh). Late Changhsingian of southern China.

Genus *Paraglobivalvulina* REITLINGER, 1965

Type species: *Paraglobivalvulina mira* REITLINGER, 1965.

Description: Medium-sized paraglobivalvulinins whose last whorls embraces completely the preceeding whorls. Additional interseptal stolons are present. Wall micrognanular relatively thick but undifferentiated.

Remarks: Although ÜNAL *et al.* (2003, pl. 1, figs. 9-11) re-assigned *Paraglobivalvulina gracilis* ZANINETTI & ALTINER, 1981 (D= 1.000-1.300 mm) to *Septoglobivalvulina*, this species is here maintained as *Paraglobivalvulina* because of its supplementary chamberlets and interseptal stolons. It differs from *P. mira* only by the smaller size and thinner wall.

Occurrence: Midian to Changhsingian. Tethyan. Lopingian of Transcaucasia, Turkey, Zagros, Fars, Alborz (Iran), NW Caucasus, Carnic Alps, Hungary, southern China, Phillipines, ?Cyprus, Salt Range, Japan, Thailand.

Paraglobivalvulina mira REITLINGER, 1965

(Pl. 1, fig. 4, Pl. 8, fig. 6, Pl. 17, figs. 18-19, Pl. 18, fig. 2, Pl. 32, figs. 3-5, 18-20, Pl. 34, figs. 8, 11-12, Pl. 36, figs. 7-10, Pl. 39, figs. 4-8)

1965 *Paraglobivalvulina mira* gen. nov. sp. nov. – REITLINGER, p. 65, pl.1, figs.13-14.

non 1973 *Paraglobivalvulina mira* REITLINGER – BOZORGNIA, p. 145, pl. 39, figs. 9-11, pl. 40, figs. 1-2 (= *Paraglobivalvulinoides*).

1978 *Paraglobivalvulina mira* REITLINGER – LYS & MARCOUX, pl. 1, figs. 7-8.

non 1981 *Paraglobivalvulina mira* REITLINGER – ZHAO *et al*., pl. 2, fig. 11 (= *Septoglobivalvulina*).

1981 *Paraglobivalvulina mira* REITLINGER – ZHAO *et al*., pl. 2, fig. 11.

p.p. 1981 *Paraglobivalvulina mira* REITLINGER – ZANINETTI *et al*., p. 11, pl. 10, figs. 1-3, 6-13 , 14 ? (or *Siphoglobivalvulina*) (*non* figs. 4-5, 9, 15= *Paraglobivalvulina gracilis*).

p.p. 1981 *Paraglobivalvulina mira* REITLINGER – ALTINER, p. 289-290, pl. 36, figs. 1-2, 4, 6 (*non* 7= *P. gracilis*) (with 9 references in synonymy).

1983a *Paraglobivalvulina mira* REITLINGER – JENNY-DESHUSSES, p. 266, 268-270, text-figs. 2-6.

1983b *Paraglobivalvulina mira* REITLINGER – JENNY-DESHUSSES, p. 116-127, pl. 7, figs. 1-2, 4, pl. 6, figs. 3-6.

? 1984 *Paraglobivalvulina mira* REITLINGER – KOTLYAR *et al.,* pl. 1, fig. 6, pl. 7, fig. 5 (wall thin).

1984b *Paraglobivalvulina mira* REITLINGER – ALTINER, pl. 1, figs. 16-18.

1985 *Paraglobivalvulina* sp. of *P. mira* group – OKIMURA

et al., pl. 1, fig. 11.
1985 *Paraglobivalvulina mira* REITLINGER – PASINI, pl. 61, figs. 7-8.
1986 *Paraglobivalvulina mira* REITLINGER – HAAS *et al.*, pl. 1, figs. 1-2.
1987 *Paraglobivalvulina mira* REITLINGER – NOÉ, p. 108, pl. 30, fig. 8.
1987 *Paraglobivalvulina mira* REITLINGER – LOEBLICH & TAPPAN, pl. 230, figs. 9-10.
1989 *Paraglobivalvulina mira* REITLINGER – KOTLYAR *et al.,* pl. 2, fig. 28, pl. 3, fig. 1.
1989 *Paraglobivalvulina mira* REITLINGER – KÖYLÜOGLU & ALTINER, pl. 7, figs. 1-2.
1990 *Paraglobivalvulina mira* REITLINGER – LIN *et al.*, p. 165-166, pl. 12, figs. 16-19.
non 1992 *Paraglobivalvulina mira* REITLINGER – BERCZI-MAKK, pl. 4, fig. 7 (= *Septoglobivalvulina*).
1993 *Paraglobivalvulina* sp. – BAGHBANI, pl. 6, fig. 2.
non 1993 *Paraglobivalvulina mira* REITLINGER – FONTAINE *et al.*, fig. 6F.
non 1995 *Paraglobivalvulina mira* REITLINGER – BERCZI-MAKK *et al.*, pl. 6, figs. 1-3, pl. 7, figs. 1-2 (= *Retroseptellina*).
1995 *Paraglobivalvulina* sp. of *P. mira* group – PARTOAZAR, pl. 1, fig. 11.
? 1995 *Paraglobivalvulina mira* REITLINGER – PARTOAZAR, pl. 2 (1), fig. 2, pl. 1 (2), figs. 6-7.
1996 *Paraglobivalvulina mira* REITLINGER – RAUZER-CHERNOUSOVA *et al.*, pl. 18, fig. 9.
? 1997 *Paraglobivalvulina mira* REITLINGER – NESTELL & PRONINA, pl. 1, fig. 5 (wall very thin).
2000 *Paraglobivalvulina mira* REITLINGER – KIESSLING & FLÜGEL, pl. 8, fig. 9.
2000 *Paraglobivalvulina mira* REITLINGER – MERTMANN, fig. 7. 3.
2004 *Paraglobivalvulina mira* REITLINGER – KOBAYASHI, fig. 7. 14.
v. 2006 *Paraglobivalvulina mira* REITLINGER – INSALACO *et al.*, pl. 2, fig. 6.
non 2006e *Paraglobivalvulina mira* REITLINGER – KOBAYASHI, pl. 2, fig. 14 (= *Paraglobivalvulinoides*).
v. 2006 *Paraglobivalvulina mira* REITLINGER – GAILLOT, p. 72-73, Pl. I.3, figs. 2, 14, Pl. I.10, fig. 6, Pl. I.11, figs. 4-8, Pl. I.12, figs. 3-5, 18-20, Pl. I.13, figs. 1-4, Pl. I.18, fig. 8, Pl. II.9, figs. 7-10, Pl. II.33, figs. 2, 9, 13, Pl. III.6, fig. 4, Pl. III.16, figs. 18-19, Pl. III.18, fig. 2, Pl. III.22, figs. 8, 11-12, Pl. III.24, figs. 10-12, Pl. III.25, fig. 11, Pl. VI.6, figs. 3, 23.
v. 2006 *Paraglobivalvulina mira* REITLINGER – VACHARD *et al.*, fig. 9(8).
? v. 2006 *Paraglobivalvulina* sp. 1 REITLINGER – VACHARD *et al.*, fig. 9(9).

Description: The test is large, globular, with the last chamber completely enveloping the preceeding ones. Interseptal stolons well developed. The wall is proportionally thick.

Dimensions: D.= 0.585-1.030 mm, w.= 0.560-0.900 mm, w/D ratio= 0.77-0.96, p.d.= 0.060-0.090 mm, n.w.= 1.5-2, n.c.= 3, h.l.c.= 0.360-0.500 mm, w.t.= 0.015-0.090 mm.

Remarks: The species is well known and generally not controversial, although the limit between *P. mira* and *P. gracilis* is very transitional.

Occurrence: As for the genus. Especially, Lopingian ("Dzhulfian") of Transcaucasia, Turkey, Zagros and Fars.

Genus *Paraglobivalvulinoides* ZANINETTI & JENNY-DESHUSSES, 1985

Type species: *Paraglobivalvulina*? *septulifera* ZANINETTI & ALTINER, 1981.

Diagnosis: Test large, spherical, biserially coiled, involute, chambers wide and strongly embracing. Oral chamberlets very developed with very complex tongues. Wall single layered, microgranular, proportionally thin.

Composition: *Paraglobivalvulina septulifer* ZANINETTI & ALTINER, 1981; *P. piyasini* SAKAGAMI & HATTA, 1982; and *Paraglobivalvulinoides spumida* LIN, LI & SUN, 1990.

Occurrence: Latest Changhsingian. Alborz, northern Iran (BOZORGNIA, 1973), ?Italy (PASINI, 1985), Greece (Attica) (VACHARD *et al.*, 1993b), Ladakh Himalaya (LYS *et al.*, 1980), southern China (LIN *et al.*, 1990; this work), Thailand (SAKAGAMI & HATTA, 1982; YANAGIDA *et al.*, 1988), NW Caucasus, Russia (PRONINA-NESTELL & NESTELL, 2001), Japan (KOBAYASHI, 1997, 1999, 2006e), and Malaysia (FONTAINE *et al.*, 1994). Changhsingian of Zagros.

Paraglobivalvulinoides septulifer (ZANINETTI & ALTINER, 1981)
(Pl. 10, fig. 1)

1973 *Paraglobivalvulina mira* REITLINGER – BOZORGNIA, p. 145, pl. 39, figs. 9-11, pl. 40, figs. 1-2.
1980 *Paraglobivalvulina mira* REITLINGER – LYS *et al.*, pl. 3, figs. 7-10.
1981 *Paraglobivalvulina ? septulifera* sp. nov. – ZANINETTI & ALTINER, p. 40-41, pl. 1, figs. 15-19.
1981 *Paraglobivalvulina* sp. – ALTINER, pl. 36, fig. 3.
1982 *Chrysanthemina* – JIANG *et al.*, pl. 2, fig. 10 (*nomen*

nudum, no description).
1982 *Paraglobivalvulina piyasini* sp. nov. – SAKAGAMI & HATTA, p. 10, pl. 5, fig. 1.
1983b *Paraglobivalvulina septulifera* ZANINETTI & ALTINER – JENNY-DESHUSSES, pl. 23, fig. 5.
1985 *Paraglobivalvulina septulifera* ZANINETTI & ALTINER – PASINI, pl. 61, fig. 11.
? 1987 *Paraglobivalvulina septulifera* ZANINETTI & ALTINER – NOÉ, p. 108, pl. 30, fig. 10.
? 1988 *Paraglobivalvulina piyasini* SAKAGAMI & HATTA – YANAGIDA *et al.,* pl. 2, figs. 28-29.
1990 *Paraglobivalvulina? septulifera* ZANINETTI & ALTINER – LIN *et al.,* p. 166, pl. 12, figs. 22-24.
v. 1993b *Paraglobivalvulinoides septulifera* ZANINETTI & ALTINER (*sic* without brackets) – VACHARD *et al.,* pl. 8, fig. 1.
1993 *Paraglobivalvulina* sp. – BAGHBANI, pl. 6, fig. 5.
1994 *Paraglobivalvulina septulifer* ZANINETTI & ALTINER – FONTAINE *et al*., pl. 47, fig. 6.
1996 *Paraglobivalvulinoides septulifera* (ZANINETTI & ALTINER) – RAUZER-CHERNOUSOVA *et al*., pl. 18, fig. 10.
1997 *Paraglobivalvulina piyasini* SAKAGAMI & HATTA – KOBAYASHI, fig. 2. 3, pl. 4, figs. 1-5.
? 1999 *Paraglobivalvulina piyasini* SAKAGAMI & HATTA – KOBAYASHI, text-fig. 1. 11, p. 281.
2001 *Paraglobivalvulinoides* sp. – PRONINA-NESTELL & NESTELL, pl. 5, figs. 6-7.
? 2001 *Paraglobivalvulina piyasini* SAKAGAMI & HATTA – PRONINA-NESTELL & NESTELL, pl. 5, fig. 8.
v. 2006 *Paraglobivalvulinoides* sp. – INSALACO *et al.*, pl. 2, fig. 24.
2006e *Paraglobivalvulina* sp. – KOBAYASHI, pl. 2, fig. 13.
2006e *Paraglobivalvulina mira* (REITLINGER) – KOBAYASHI, pl. 2, fig. 14.
v. 2006 *Paraglobivalvulinoides septulifer* (ZANINETTI & ALTINER) – GAILLOT, p. 73, Pl. I.19, fig. 19.
v. 2006 *Paraglobivalvulinoides septulifer* (ZANINETTI & ALTINER) – VACHARD *et al*., fig. 9(10).
v. submitted *Paraglobivalvulinoides septulifera* (ZANINETTI & ALTINER) – GAILLOT, VACHARD, GALFETTI & MARTINI, p. 22-23, fig. 5(1).

Dimensions: H.= 2.300-2.860 mm, w.= 2.300-2.800 mm, number of pairs of chambers: 4, w.t.= 0.050 mm.

Remarks: According to our material of Zagros and Thailand (collection H. FONTAINE), there are no objective differences between *Paraglobivalvulina piyasini* SAKAGAMI & HATTA and *P. septulifer*, although the individual differences can be numerous in both populations.

Occurrence: As for the genus.

Genus *Urushtenella* PRONINA-NESTELL *in* PRONINA-NESTELL & NESTELL, 2001

Type species: *Urushtenella latebrosa* PRONINA-NESTELL *in* PRONINA-NESTELL & NESTELL, 2001.

Diagnosis: Morphologically similar to *Paraglobivalvulina* but with a porous or alveolar wall, at least thicker when recrystallized.

Occurrence: Changhsingian of NW Caucasus and Zagros.

Urushtenella sp.

(Pl. 9, fig. 5, Pl. 18, figs. 8, 13)

v. 2006 *Urushtenella* (?) sp. – INSALACO *et al*., pl. 2, fig. 18.
v. 2006 *Urushtenella* sp. – GAILLOT, p. 74, Pl. III.5, fig. 5, Pl. III.18, figs. 8, 13.
v. 2006 *Urushtenella* sp. – VACHARD *et al*., fig. 9(11).

Dimensions: The specimens of PRONINA-NESTELL & NESTELL (2001): pl. 5, figs. 9-11 have a diameter of 1.300-1.690 mm; our Pl. 9, fig. 5 measures D= 1.150 mm (but it is broken).

Remarks: Our specimens display a three-layered wall with the "*Omphalotis*-like", pseudo-alveolar, medium layer with linear structures (pores?). The shape and dimensions are also compatible with those of specimens of PRONINA-NESTELL & NESTELL (2001) but other criteria are indiscernible to attribute the specimen to *U. latebrosa* or to a new species.

Occurrence: Late Changhsingian of NW Caucasus (PRONINA-NESTELL & NESTELL, 2001). Discovered in the Changhsingian of Zagros.

Subfamily Dagmaritinae BOZORGNIA, 1973 (*nomen translat*. herein from family)

Synonyms: Biseriamminidae CHERNYSHEVA, 1941 (part); Globivalvulinidae REITLINGER, 1950 (part); Louisettitinae LOEBLICH & TAPPAN, 1984; Louisettitidae *nomen translat*. RAUZER-CHERNOUSOVA *et al.*, 1996; dagmaritin-type biseriamminids *sensu* ALTINER (1997, text-fig. 1, p. 3).

Diagnosis: Uncoiled biserial Globivalvulinidae (or exceptionally biserially coiled: *Crescentia*). Undivided chambers (or divided on chamberlets: *Louisettita*), often with thornlike lateral projections. Aperture terminal, basal simple with a valvula.

Composition: *Sengoerina* ALTINER, 1999; *Crescentia* CIARAPICA, CIRILLI, MARTINI & ZANINETTI, 1986; *Dagmarita* REITLINGER, 1965; *Labiodagmarita* gen. nov.; *Bidagmarita* GAILLOT, VACHARD, GALFETTI & MARTINI (submitted); *Louisettita* ALTINER & BRÖNNIMANN, 1980.

Remarks: This subfamily corresponds to the lineage of *Dagmarita*, from the ancestor *Sengoerina* to the last descendent *Louisettita*. This evolution is remarkably straight from the loss of the coiling to the emergence of an endoskeleton; hence, the addition of a subfamily or family Louisettitinae or Louisettitidae appears as devoid of significance. The most primitive genus, *Sengoerina*, Wordian/Murgabian in age is transitional between *Globivalvulina cyprica* and *Dagmarita* (we agree with this part of the phylogeny reconstructed by ALTINER, 1997). Nevertheless, according to our observations, *Crescentia* does not belong to this first lineage, nor be transitional between *Dagmarita* and *Paradagmarita*, and it is considered here as a secondary return to a planispiral coiling. The group of *Paradagmarita* might represent a second derivation from *G. cyprica*. It is regarded below as an independent group: Paradagmaritininae subfam. nov..

Occurrence: Early Murgabian (i.e. early Wordian) to latest Changhsingian; Palaeotethyan and Neotethyan.

Genus *Crescentia* CIARAPICA, CIRILLI, MARTINI & ZANINETTI, 1986

Type species: *Crescentia vertebralis* CIARAPICA, CIRILLI, MARTINI & ZANINETTI, 1986.

Remarks: "*Crescentia*" "*migrantis*" (*sic*; the correct Latin name should be *C. migrans*) of western Texas (NESTELL & NESTELL, 2006) belongs for us to *Charliella* (see above).

Occurrence: The type species of *Crescentia* comes from a Triassic calciturbidite of the Monte Facito (Italy), where it is associated with abundant reworked Midian/Capitanian foraminifers and algae (e.g., VACHARD & MICONNET, 1990), but also rare Changhsingian ones (JENNY-DESHUSSES *et al*., 2000); consequently its exact dating is debatable. Rare specimens also exist in the Changhsingian of Himalaya (LYS *et al.,* 1980), Zagros (this study) and reinforce the age ambiguity.

Crescentia sp.
(Pl. 20, fig. 11)

v. 2006 *Crescentia* sp. – GAILLOT, p. 74-75, Pl. III.13, fig. 11.
v. 2006 *Crescentia* sp. – VACHARD *et al*., fig. 9(20).

Dimensions: D.= 0.500 mm, n.c.= 8 or 9, w.t.= 0.010 mm.

Remarks: We consider, after the re-examination of the type material in the Natural History Museum, Geneva (Switzerland), that *Crescentia* is a coiled *Dagmarita*. Our unique specimen is illustrated. It is noticeable that this specimen corresponds also to *Dagmarita* aff. *chanakchiensis sensu* LYS *et al.*, 1980, pl. 3, fig. 13, consequently, assigned here to *Crescentia*.

Comparison: Our specimen has more chambers than *C. vertebralis.*

Occurrence: Changhsingian of Zagros.

Genus *Dagmarita* REITLINGER, 1965

Type species: *Dagmarita chanakchiensis* REITLINGER, 1965.

Diagnosis: Test entirely biserial (excepted maybe the three initial chambers more or less globivalvulinid in coiling, or triserial). Chambers hemispherical to semi-ellipsoidal. Wall thin, with a development of the lateral thorn-like projections. Oral tongue located at the distal extremity of septum. Wall single microgranular mono-, double- or trilayered. Aperture terminal, basal, simple.

Composition: Many species are described with excessive synonymies. A pragmatic way is to consider two main homogeneous groups: *D. chanakchiensis* and *D. altilis*.

The following species were described: *D. chanakchiensis* REITLINGER, 1965; *D. elegans* SOSNINA *in* SOSNINA & NIKITINA, 1977; *D. cuneata* SOSNINA *in* SOSNINA & NIKITINA, 1977; *D.*

exilis SOSNINA *in* SOSNINA & NIKITINA, 1977; *D. oblonga* SOSNINA *in* SOSNINA & NIKITINA, 1977; *D. altilis* WANG *in* ZHAO *et al*., 1981; *D. elongata* WANG *in* ZHAO *et al*., 1981; *D. minuscula* WANG *in* ZHAO *et al*., 1981; *D. simplex* WANG *in* ZHAO *et al*., 1981; *D. liantanensis* HAO & LIN, 1982; *D. caucasica* VUKS *in* KOTLYAR *et al*., 1984; *D. minima* LIN, 1984; *D. shahrezaensis* MOHTAT-AGHAI & VACHARD, 2003.

Occurrence: Early Murgabian (VACHARD, 1980) and/or early Maokouan (LIN *et al*., 1990) to latest Changhsingian (ZHAO *et al*., 1981; LIN *et al*., 1990) of Palaeotethys and Neotethys, with the following detailed distribution from West to East: Middle Permian of the Appennines (PANZANELLI-FRATONI *et al*., 1987; VACHARD & MICONNET, 1990); Middle Permian of Montenegro, former Yugoslavia (PANTIC, 1970a); Late Permian of the Carnic Alps (NOÉ, 1987); Late Permian of Hungary (BERCZI-MAKK, 1992); Late Permian of western Turkey (ARGYRIADIS *et al*., 1976; LYS & MARCOUX, 1978); Late Permian of eastern Taurus, Turkey (ZANINETTI *et al*., 1981; ALTINER, 1981, 1984b; KOYLUÖGLU & ALTINER, 1989); Midian-Changhsingian of Hazro (CANUTI *et al*., 1970 as *Palaeotextularia* sp.; updated in this study); Midian-Dzhulfian of Transcaucasia (REITLINGER, 1965; KOTLYAR *et al*., 1984, 1989); Late Permian of Central Alborz, Iran (BOZORGNIA, 1973; JENNY-DESHUSSES, 1983b); late Wuchiapingian of central Iran (MOHTAT-AGHAI & VACHARD, 2003); Lopingian of Zagros and Fars, Iran (this study); Middle Permian of central Afghanistan (VACHARD & MONTENAT, 1981); Middle Permian of Salt Range, Pakistan (OKIMURA, 1988); late Changhsingian of Ladakh Himalaya (LYS *et al*., 1980); Maokouan-Changhsingian of southern China (ZHAO *et al*., 1981; LIN *et al*., 1990); Middle Permian of western Thailand (FONTAINE *et al*., 1988a) and Philippines (FONTAINE *et al*., 1986b); Midian-Dzhulfian of northwestern Thailand (CARIDROIT *et al*., 1990); Middle Permian of Malaysia (FONTAINE *et al*., 1988b); Middle-Late Permian of Cambodia (NGUYEN DUC TIEN, 1979, 1986a); Late-Middle Permian of Primorye, Russia (SOSNINA *in* SOSNINA & NIKITINA, 1977); Late Midian-Changhsingian of Japan (KOBAYASHI, 2006c, 2006e).

Dagmarita chanakchiensis REITLINGER, 1965
(Pl. 7, figs. 10-12, Pl. 15, fig. 4, Pl. 19, figs. 4-5, Pl. 29, fig. 6, Pl. 31, fig. 7, Pl. 34, fig. 7, Pl. 38, figs. 10-11, 15-16, Pl. 45, fig. 4, Pl. 46, figs. 1-7)

1965 *Dagmarita chanakchiensis* sp. nov. – REITLINGER, p. 63, pl. 1, figs. 10-12.
1970a *Dagmarita chanakchiensis* REITLINGER – PANTIC, pl. 9, figs. 6-9.
p.p. 1970 *Palaeotextularia* sp. – CANUTI *et al*., p. 38, fig. 15. 4-6, 7?.
1973 *Dagmarita chanakchiensis* REITLINGER – BOZORGNIA, p. 144-145, pl. 39, figs. 6-8.
1978 *Dagmarita chanakchiensis* REITLINGER – LYS & MARCOUX, pl. 1, fig. 1.
1979 *Dagmarita chanakchiensis* REITLINGER – NGUYEN DUC TIEN, p. 98-99, pl. 7, figs. 1-4 (with 4 references in synonymy).
non 1980 *Dagmarita chanakchiensis* REITLINGER – LYS *et al*., pl. 1, fig. 1 (possibly *Bidagmarita*).
1980 *Dagmarita chanakchiensis* REITLINGER – ALTINER & BRÖNNIMANN, pl. 1, figs. 11, 13-18.
1981 *Dagmarita chanakchiensis* REITLINGER – ZANINETTI *et al*., p. 6, pl. 2, figs. 11-12, 15, 18 (with 12 references in synonymy).
1981 *Dagmarita chanakchiensis* REITLINGER – ALTINER, p. 290-291, pl. 37, figs. 11-13, 18 (with 14 references in synonymy).
1981 *Dagmarita chanakchiensis* REITLINGER – ZHAO *et al*., pl. 1, fig. 19.
1983b *Dagmarita chanakchiensis* REITLINGER – JENNY-DESHUSSES, p. 109-110, pl. 7, fig. 6, pl. 23, fig. 4 (with 11 references in synonymy).
? 1984 *Dagmarita chanakchiensis* REITLINGER – KOTLYAR *et al*., pl. 1, fig. 7 (more similar to the group *D. altilis*).
1984b *Dagmarita chanakchiensis* REITLINGER – ALTINER, pl. 1, figs. 6-7.
non 1985 *Dagmarita* spp. of *D. chanakchiensis* group – OKIMURA *et al*., pl. 1, figs. 7-8. (possibly *Bidagmarita*).
1986a *Dagmarita chanakchiensis* REITLINGER – NGUYEN DUC TIEN, pl. 3, fig. 13.
1986b *Dagmarita chanakchiensis* REITLINGER – FONTAINE *et al*., pl. 22, figs. 1-2, pl. 23, fig. 15B.
1987 *Dagmarita chanakchiensis* REITLINGER – NOÉ, p. 108, pl. 30, figs. 6-7.
1987 *Dagmarita chanakchiensis* REITLINGER – PANZANELLI-FRATONI *et al*., pl. 7, figs. 9-10.
1987 *Dagmarita chanakchiensis* REITLINGER – LOEBLICH & TAPPAN, pl. 231, figs. 1-5.
1988a *Dagmarita chanakchiensis* REITLINGER – FONTAINE *et al*., pl. 2, fig. 1, pl. 7, fig. 1.
1988b *Dagmarita chanakchiensis* REITLINGER – FONTAINE *et al*., p. 66, 75, fig. 6. 4.
1988 *Dagmarita chanakchiensis* REITLINGER – OKIMURA, fig. 3. 1-2.

1989 *Dagmarita chanakchiensis* Reitlinger – Köylüoglu & Altiner, pl. 6, figs. 10-11, 13.
1989 *Dagmarita chanakchiensis* Reitlinger – Kotlyar *et al.*, pl. 1, figs. 19-20.
1990 *Dagmarita chanakchiensis* Reitlinger – Lin *et al.*, p. 84 (no illustration).
v. 1990 *Dagmarita chanakchiensis* Reitlinger – Vachard & Miconnet, pl. 2, fig. 13.
1992 *Dagmarita chanakchiensis* Reitlinger – Berczi-Makk, pl. 1, fig. 3, pl. 10, fig. 3.
p.p. 1994 *Dagmarita chanakchiensis* Reitlinger – Fontaine *et al.*, pl. 21, figs. 1-3 (*non* pl. 3, fig. 6= ?*Bidagmarita*).
1995 *Dagmarita chanakchiensis* Reitlinger – Berczi-Makk *et al.*, pl. 9, figs. 1-3.
p.p. 1995 *Dagmarita* spp. of D. *chanakchiensis* group – Partoazar, pl. 5, figs. 5-6, pl. 2, figs. 7, 10-11 (*non* pl. 1, figs. 7-8, the possible *Bidagmarita* of Okimura *et al.*, 1985).
1996 *Dagmarita chanakchiensis* Reitlinger – Leven & Okay, pl. 8, fig. 20, pl. 9, fig. 31.
1996 *Dagmarita chanakchiensis* Reitlinger – Rauzer-Chernousova *et al.*, pl. 18, figs. 12-13.
1997 *Dagmarita chanakchiensis* Reitlinger – Ueno & Igo, pl. 4, figs. 19-20.
1997 *Dagmarita chanakchiensis* Reitlinger – Kobayashi, pl. 4, figs. 14-18.
1999 *Dagmarita chanakchiensis* Reitlinger – Kobayashi, fig. 1. 13.
2000 *Dagmarita chanakchiensis* Reitlinger – Mertmann, fig. 7. 10.
2003 *Dagmarita chanakchiensis* Reitlinger – Ünal *et al.*, pl. 1, figs. 3-4.
2004 *Dagmarita chanakchiensis* Reitlinger – Kobayashi, fig. 7. 5-8, 10-12.
non 2005 *Dagmarita chanakchiensis* Reitlinger – Hughes, pl. 4, fig. 9 (= ? *D.*? *shahrezaensis*).
2006c *Dagmarita chanakchiensis* Reitlinger – Kobayashi, pl. 3, fig. 17.
2006e *Dagmarita chanakchiensis* Reitlinger – Kobayashi, pl. 2, fig. 28.
v. 2006 *Dagmarita chanakchiensis* Reitlinger – Gaillot, p. 75-76, Pl. I.4, figs. 10-12, Pl. I.6, figs. 1, 15, Pl. I.7, fig. 4, Pl. I.9, figs. 10-11, 15-16, Pl. I.16, fig. 4, Pl. I.36, figs. 4-5, Pl. I.37, fig. 7, Pl. II.12, figs. 1-7, Pl. III.22, fig. 7, Pl. III.23, fig. 7, Pl. VI.4, fig. 6.
v. 2006 *Dagmarita chanakchiensis* Reitlinger – Vachard *et al.*, figs. 9(12-13).

Diagnosis: Test rectilinear, tapering, and biserial. Chambers hemispherical to semi-ellipsoidal. Wall with a development of the lateral thornlike projections. Wall thin, microgranular, one to three layered.

Remarks: Altiner (1981) and Zaninetti *et al*. (1981) consider nearly all *Dagmarita* species as synonyms of *D. chanakchiensis*. Nevertheless, our material reveals at least three identifiable species according to the size, the tapering of the test, the shape of chambers and the development of the lateral thornlike projections: *D. chanackchiensis*, *D. altilis* and *D? sharezaensis.*

Occurrence: Midian-Dzhulfian of Transcaucasia (Reitlinger, 1965; Kotlyar *et al*., 1984, 1989), Middle Permian of Montenegro (Pantic, 1970a), Late Permian of Hazro, Turkey (Canuti *et al*., 1970 as *Palaeotextularia* sp.), Late Permian of Central Alborz, Iran (Bozorgnia, 1973; Jenny-Deshusses, 1983b), Late Permian of western Turkey, Turkey (Argyriadis *et al*., 1976; Lys & Marcoux, 1978), Late Permian of eastern Taurus (Zaninetti *et al*., 1981; Altiner, 1981, 1984b; Köylüoglu & Altiner, 1989), Late-Middle Permian of Primorye, Russia (Sosnina *in* Sosnina & Nikitina, 1977), Late-Middle Permian of Cambodia (Nguyen Duc Tien, 1979, 1986a), Late Changhsingian of Ladakh, Himalaya (Lys *et al*., 1980), Middle Permian of central Afghanistan (Vachard & Montenat, 1981), Changhsingian of southern China (Zhao *et al*., 1981; Lin *et al*., 1990), Middle Permian of western Thailand (Fontaine *et al*., 1988a) and Philipinnes (Fontaine *et al*., 1986b), Late Permian of the Carnic Alps (Noé, 1987), Middle Permian of the Appennines (Panzanelli-Fratoni *et al*., 1987; Vachard & Miconnet, 1990), Middle Permian of Malaysia (Fontaine *et al*., 1988b), Middle Permian of Salt Range, Pakistan, (Okimura, 1988), Late Permian of Hungary (Berczi-Makk, 1992). Late Midian-Changhsinghian of Japan (Kobayashi, 2006c, 2006e). Lopingian of Zagros and Fars, Iran.

Dagmarita altilis Wang *in* Zhao *et al*., 1981

(Pl. 1, figs. 10-11, Pl. 5, fig. 3, 8, 17, Pl. 15, fig. 15, Pl. 17, figs. 1, 8, Pl. 27, figs. 5, 9, Pl. 34, fig. 10, Pl. 37, fig. 19, Pl. 38, fig. 14?, Pl. 45, fig. 1, Pl. 47, figs. 12-13)

1981 *Dagmarita altilis* sp. nov. – Wang *in* Zhao *et al.*, p. 47, 74, pl. 1, fig. 21.
1984 *Dagmarita minima* sp. nov. – Lin, p. 112, pl. 1, figs. 18-19.
1988a *Dagmarita altilis* Wang – Pronina, pl. 2, figs. 10-11.
1989 *Dagmarita altilis* Wang – Pronina, pl. 1, figs. 10-11.
1990 *Dagmarita altilis* Wang – Lin *et al*., p. 84, p. 122,

pl. 2, figs. 20-22.

v. 2006 *Dagmarita altilis* WANG – INSALACO *et al*., pl. 2, fig. 2.

v. 2006 *Dagmarita altilis* WANG – GAILLOT, p. 77, Pl. I.7, fig. 15, Pl. I.8, figs. 1-3, 11, 21-22, Pl. I.14, figs. 5-6, 11, 13, Pl. I.16, fig. 1, Pl. I.9, fig. 14?, Pl. II.14, figs. 12-13, Pl. II.31, figs. 5, 9, Pl. III.6, figs. 10-11, Pl. III.15, fig. 3, 8, 17, Pl. III.16, figs. 1, 8, Pl. III.22, fig. 10, Pl. III.24, figs. 1-7, Pl. III.25, figs. 5-9, 15-18, Pl. VI.6, fig. 2, Pl. VII.2, fig. 19.

Remarks: Some specimens of *D. altilis* appear more or less similar to *D. simplex* WANG *in* ZHAO *et al*., 1981, by the simple wall thin dark microgranular, the initial end often truncated and the shape of chamber. These "*D. simplex*" probably correspond to juveniles and/or deformed specimens of *D. altilis*.

Occurrence: Early Maoukouan-Late Changhsingian of southern China (WANG *in* ZHAO *et al*., 1981; LIN *et al*., 1990; this study), Changhsingian (= Dorashamian) of Transcaucasia (PRONINA 1988a, 1989), Lopingian of Zagros and Fars (Iran), Hazro (Turkey), Abu Dhabi.

Dagmarita? shahrezaensis MOHTAT-AGHAI & VACHARD, 2003

(Pl. 12, figs. 1?,19, Pl. 31, fig. 16, Pl. 35, fig. 9, Pl. 37, fig. 18?)

? 1986 *Dagmarita* sp. – VUKS & CHEDIYA, pl. 9, fig. 10.

v. 2003 *Dagmarita shahrezaensis* sp. nov. – MOHTAT-AGHAI & VACHARD, p. 38, 40, 42, pl. 1, figs. 1-14 (with 4 references in synonymy).

? 2005 *Dagmarita chanakchiensis* REITLINGER – HUGHES, pl. 4, fig. 9.

v. 2005 *Dagmarita shahrezaensis* MOHTAT-AGHAI & VACHARD – MOHTAT-AGHAI & VACHARD, p. 211, pl. 2, figs. 21-22, pl. 3, fig. 5.

v.? 2005 *Dagmarita? shahrezaensis* MOHTAT-AGHAI & VACHARD – VACHARD *et al*., p. 155, pl. 3, figs. 9-10, 15?

v. 2006 *Dagmarita? sharezaensis* MOHTAT-AGHAI & VACHARD – GAILLOT, p. 77-78, Pl. I.8, fig. 6, Pl. I.37, fig. 16, Pl. V.3, fig. 9, Pl. VI. 5, figs. 1?,19, Pl. VII.2, fig. 18.

v. submitted *Dagmarita? sharezaensis* MOHTAT-AGHAI & VACHARD – GAILLOT *et al*., p. 25-26, fig. 6(18).

Dimensions: H.= 0.500-0.540 mm, w.= 0.400 mm, w/H ratio= 0.74, p.d.= 0.060 mm, number of pairs of chambers: 4-5, h.l.c.= 0.110-0.120 mm, w.t.= 0.010 mm.

Occurrence: Questionable in early Changsinghian of Saudi Arabia and late Changhsingian of Primorye. Late Wuchiapingian-?Changhsingian of central Iran, Himalaya, Transcaucasia, southern China and Malaysia. Late Wuchiapingian of central Iran. Late Midian-Changhsingian of Zagros (this study) and Hazro.

Genus *Bidagmarita* GAILLOT, VACHARD, GALFETTI & MARTINI (submitted)

Type species: *Bidagmarita sinica* GAILLOT, VACHARD, GALFETTI & MARTINI (submitted)

Diagnosis: Dagmaritin genus characterized by a large size and a two layered wall: microgranular outer layer, pseudofibrous inner layer, and slightly curved back septa.

Composition: *Bidagmarita sinica* sp. nov.; ?*Dagmarita chanakchiensis sensu* LYS *in* LYS *et al*., 1980 and *sensu* FONTAINE *et al*., 1994, pl. 3, fig. 6; ?*D. caucasica* VUKS *in* KOTLYAR *et al*., 1984; ?*Dagmarita* spp. of *D. chanakchiensis* group *sensu* OKIMURA *et al*., 1975, pl. 1, figs. 7-8.

Occurrence: ?Kalabagh Member, Salt Range, Pakistan; ?Abadeh Formation, central Iran. ?Nikitin Suite (Late Changhsingian) of NW Caucasus. ?Late Changhsingian of Lamayuru Block (Ladakh Himalaya). ?Late Changhsingian of Malaysia. Late Changhsingian of southern China.

Bidagmarita sinica GAILLOT, VACHARD, GALFETTI & MARTINI (submitted)

(Pl. 30, figs. 4-5)

v. 2006 *Bidagmarita sinica* gen. nov. sp. nov. – GAILLOT & VACHARD *in* GAILLOT, p. 78-79, Pl. VII.3, figs. 4-5 (*nomen nudum*).

v. 2006 *Bidagmarita sinica* GAILLOT – VACHARD *et al*., figs. 9(14-15) (*nomen nudum*: no description).

v. submitted *Bidagmarita sinica* gen. nov. sp. nov. – GAILLOT, VACHARD, GALFETTI & MARTINI , p. 26-27, fig. 7(4-5).

Diagnosis: As for the genus.

Description: Test large for a Dagmaritin, obviously tapering. Proloculus spherical moderately large. Sagittal axial section (sensu NEUMANN, 1968) showing a regular increasing in width and height of the chambers. The pairs of septa which have the typical form of the *Dagmarita* at the beginning: i.e. their end situated in the symmetry plane (which coincides with the axis of development), are progressively distant from each other and the volume without septa in the center increases. Thornlike projections are proportionally weak in comparison with the size of the test, reminding a palaeotextulariid representative. Nevertheless, the wall and the curvature of septa differ completely. Chamber subtrapezoidal in shape. Septa gently curved. A small oral tongue terminates the septa and reinforces the aperture (as in *Dagmarita*). Other endoskeletal elements are absent. Within the wall, the microgranular layer is very thin and the pseudofibrous inner layer is in three to four times thicker. In frontal axial section (*sensu* NEUMANN, 1968), excepted the generic differences, the differences with *Dagmarita* or *Louisettita ultima* are rather incipient. No transverse sections were observed.

Dimensions: H.= 0.835-1.025 mm, w.= 0.690 mm, test thickness= 0.465 mm, p.d.= 0.020 mm, n.c.= 8 pairs, h.l.c.= 0.167-0.222 mm, w.t.= 0.015 mm.

Occurrence: Late Changhsingian of Laren section (southern China).

Genus *Labiodagmarita* gen. nov.

Type species: *Labiodagmarita vasleti* sp. nov.

Etymology: A *Dagmarita* with a lip.

Diagnosis: Test rectilinear biserial, wall dark brown granular with more or less development of inner secondary deposits that progressively reinforced the structure of the test and reduced the chambers volume in the early part of the test. Aperture in form of lip-shaped communication.

Composition: Monospecific.

Comparison: *Labiodagmarita* gen. nov. differs from the coeval Palaeotextulariidae (especially the juvenile *Climacammina*) by the absence of the radial yellowish layer. It differs from *Labioglobivalvulina* by the rectilinear biserial test, and from *Dagmarita* by the type of wall and the absence of lateral thornlike projections; differs from *Dagmarita? sharezaensis* by the granular wall (not microgranular), the aperture with siphon (no oral tongue) and the development of secondary inner deposits.

Occurrence: Lopingian of Saudi Arabia (VACHARD *et al*., 2005), Zagros, Fars, Abu Dhabi and Turkey (this study).

Labiodagmarita vasleti gen. nov. sp. nov.

(Pl. 7, figs. 7-8, Pl. 11, figs. 4, 6, Pl. 27, fig. 6, Pl. 31, fig. 1, Pl. 34, fig. 9, Pl. 35, fig. 15, Pl. 46, figs. 8-16, Pl. 48, figs. 1-14)

v. p.p.2005 *Dagmarita? shahrezaensis* MOHTAT-AGHAI & VACHARD – VACHARD *et al*., p. 155, pl. 3, fig. 15 (the fig. 9 belongs probably to another species of *Labiodagmarita*; fig. 10 is probably a true *D.? shahrezaensis*).

? 2005 *Paradagmarita* sp. – HUGHES, pl. 4, figs. 7-8, 10.

v. 2006 *Siphodagmarita vasleti* gen. nov. sp. nov. – GAILLOT & VACHARD *in* GAILLOT, p. 79-80, Pl. I.4, figs. 7-8, Pl. I.19, fig. 4, Pl. I.37, fig. 1, Pl. II.12, figs. 8-16, Pl. II.13, figs. 1-14, Pl. II.31, fig. 6, Pl. II.33, figs. 6, 16, Pl. III.22, fig. 9, Pl. V.3, figs. 10, 15, Pl. VI.6, figs. 17, 22 (*nomen nudum*).

v. 2006 *Siphodagmarita vasleti* GAILLOT – VACHARD *et al*., figs. 9(16-17) (*nomen nudum*: no description).

Etymology: Friendly dedicated to Dr D. VASLET, of the BRGM (French Geological Survey) , for his contribution to the geology of the Near-East.

Type locality: Offshore-Fars (Iran).

Type level: Changhsingian.

Diagnosis: As for the genus.

Description: Test medium-sized, easy to confuse with a palaeotextulariid due to the granular wall, but without the radial yellowish inner layer. The aperture appears reinforced by lateral protuberances looking like chomata of fusulinids and reducing the aperture as a slit with lips. H.= 0.690-0.865 mm, w.= 0.375-0.555 mm, w/H ratio= 0.63-0.74, test thickness= 0.215 mm, p.d.= 0.060 mm, number of pairs of chambers: 4-7, h.l.c.= 0.110-0.215 mm, w.t.= 0.030-0.045 mm.

Comparison: Oblique sections of *Labiodagmarita vasleti* gen. nov. sp. nov. differ from those of *Labioglobivalvulina baudi* gen. nov. sp. nov. by the uncoiled larger test, from *D.*? *sharezaen-*

sis by the "chomata" and larger size. Relatively similar to a palaeotextulariid because of the granular wall, the axial sections of the species differ by the type of wall (absence of inner pseudofibrous yellow layer), and the different type of aperture. Here, the oral tongue which already constitutes a primitive type of siphon is reinforced by the "chomata", and the type of frontal axial section is unknown among the palaeotextulariids.

Holotype: Pl. 48, fig. 6.

Type material: 50 specimens.

Repository of the types: CST TOTAL (Pau, France).

Occurrence: As for the genus.

Genus *Louisettita* ALTINER & BRÖNNIMANN, 1980 *emend.* herein

Type species: *Louisettita elegantissima* ALTINER & BRÖNNIMANN, 1980.

Emended diagnosis: The shape is identical to *Dagmarita*, but some endoskeletal elements appear (the ''radial partitions'' of the original diagnosis) that, in advanced species, form small loops or equivalents to the phrenothecae of some schwagerinoid fusulinids (and not always radial and perpendicular partitions as indicated in the original diagnosis), or backward oriented septa. Wall microgranular, single layered. Aperture basal simple.

Composition: *Louisettita elegantissima*; *L. ultima* GAILLOT, VACHARD, GALFETTI & MARTINI (submitted); *L. extraordinaria* sp. nov.; ?*Paradagmarita dubreuilli* VACHARD, 1980 (*nomen nudum*) (= ? *Paradagmarita* sp. PRONINA, 1988a, pl. 2, fig. 14= PRONINA, 1989, pl. 1 fig. 14).

Occurrence: Changhsingian of Turkey, Zagros, and southern China; questionable in Afghanistan and Transcaucasia. First Appearance Datum (FAD) probably in the late Wuchiapingian in the Persian Gulf.

Louisettita elegantissima ALTINER & BRÖNNIMANN, 1980

(Pl. 8, fig. 3, Pl. 12, figs. 15-17, 21, Pl. 15, figs. 7-9, 11, Pl. 31, fig. 14, Pl. 33, fig. 19, Pl. 47, figs. 1-11, 14-15)

1980 *Louisettita elegantissima* gen. nov. sp. nov. – ALTINER & BRÖNNIMANN, p. 39-40, pl. 1, figs. 1-6, 7?, 8, 9?, 12, pl. 1, fig. 3.

1981 *Louisettita elegantissima* ALTINER & BRÖNNIMANN – ZANINETTI *et al*., p. 8, pl. 2, figs. 1-10, 13?, 14, 16?, 17?.

1981 *Louisettita elegantissima* ALTINER & BRÖNNIMANN – ALTINER, p. 292-294, pl. 37, figs. 1-6, 7?, 8, 9? 12.

1984b *Louisettita elegantissima* ALTINER & BRÖNNIMANN – ALTINER, pl. 1, figs. 8-11.

1987 *Louisettita elegantissima* ALTINER & BRÖNNIMANN – LOEBLICH & TAPPAN, pl. 231, figs. 6-7.

1989 *Louisettita elegantissima* ALTINER & BRÖNNIMANN – KÖYLÜOGLU & ALTINER, pl. 6, figs. 15-17.

1996 *Louisettita elegantissima* ALTINER & BRÖNNIMANN – RAUZER-CHERNOUSOVA *et al.,* p. 72, pl. 18, fig. 15.

v. 2006 *Louisettita elegantissima* ALTINER & BRÖNNIMANN – GAILLOT, p. 80, Pl. I.7, figs. 7-9, 11, Pl. I.8, figs. 12, 17, Pl. I.10, fig. 3, Pl. I.13, fig. 16, Pl. I.37, fig. 14, Pl. II.14, figs. 1-11, 14-15, Pl. VI.5, figs. 15-17, 21, Pl. VI.7, fig. 19.

Description: The authors of this species emphasize its form of ''elongate bell'' and the three-layered wall. The parameters of the type material are as follows: n.c.= 7-9 pairs, H.= 0.220-0.430 mm, t.t.= 0.080-0.140 mm, p.d.= 0.020-0.030 mm, h.l.c.= 0.050-0.110 mm, w.t.= 0.005-0.011 mm, partition thickness= 0.002-0.004 mm, distance between partition and wall= 0.010-0.020 mm. Our specimens are very similar to the type material with the following measurements: H.= 0.340-0.540 mm, w.= 0.240-0.330 mm, t.t.= 0.125-0.150 mm, n.c.= 6-7, w.t.= 0.005-0.010 mm.

Remarks: *Louisettita elegantissima* was described from the Sarpaka Tepe Formation, NW of Pinarbasi (Eastern Taurus, Turkey) together with *Paradagmarita monodi*, *Hemigordius renzi evolutus* LYS & MARCOUX, and *Hemigordius* gr. *renzi* REICHEL. The last two species belong, probably, to the new genus *Glomomidiellopsis*.

Occurrence: Changhsingian of Turkey.

Louisettita ultima GAILLOT, VACHARD, GALFETTI & MARTINI (submitted)

(Pl. 1, fig. 12, Pl. 9, fig. 8?, Pl. 11, fig. 14, Pl. 33, fig. 18, Pl. 37, figs. 20-25)

1981 *Dagmarita* sp. – WANG *in* ZHAO *et al*., pl. 1, fig. 26.

v. 2006 *Louisettita ultima* sp. nov. – GAILLOT & VACHARD *in* GAILLOT, p. 81, Pl. I.14, figs. 7-10, Pl. I.15, figs. 8, 16-17, Pl. I.19, fig. 14, Pl. III.5, fig. 8?, Pl. III.6, fig.

12, Pl. VI.6, figs. 9-14, Pl. VI.7, fig. 18, Pl. VII.2, figs. 20-25 (*nomen nudum*).

v. submitted *Louisettita ultima* sp. nov. – GAILLOT, VACHARD, GALFETTI & MARTINI, p. 28-29, fig. 6 (20-25).

Diagnosis: Test of medium size for the genus, wall thick single layered, endoskeletal loops few visible, backward curved septa present.

Description: The species is a little larger than *L. elegantissima*, and exhibits a thicker wall. The radial partitions are visible in conveniently oriented sections. The main criteria of this species is the development of a backward curved septa (as in *Retroseptellina*). Large and robust test with thick wall but thin septa. No specimen were observed with regular vertical partitions. Endoskeletal elements very irregularly arranged as small chamberlets at the base of septa or laterally, or loops or curvature of septa. The wall of the last chambers of the specimen (Pl. 37, fig. 21) is finely perforated; this particularity exists also in Turkey (ALTINER, unpublished data).

Dimensions: H.= 0.315-0.550 mm, w.= 0.145-0.220 mm, w/H= 0.40-0.46, p.d.= 0.025 mm, number of pairs of chambers: 5-6, w.t.= 0.012-0.020 mm, loop thickness= 0.002 mm.

Occurrence: Changhsingian of Zagros, southern Turkey (Hazro), and southern China.

Louisettita extraordinaria sp. nov.

(Pl. 33, figs. 6-14)

v. 2006 *Louisettita extraordinaria* sp. nov. – GAILLOT & VACHARD *in* GAILLOT, p. 81-82, Pl. I.15, figs. 2, 7, Pl. VI.7, figs. 6-14 (*nomen nudum*).

v. 2006 *Louisettita extraordinaria* GAILLOT – VACHARD *et al.*, figs. 9(18-19) (*nomen nudum*: no description).

Etymology: Latin *extraordinarius*, extraordinary, evidently associated with the genus *Louisettita*, dedicated to Prof. L. ZANINETTI from Geneva University (Switzerland).

Type locality: Hazro (Turkey).

Type level: Changhsingian.

Diagnosis: A *Louisettita* characterized by the thin wall, elongate test, the backward curved septa, the development of arcuate endoskeletal elements (loops), and its relative large size.

Dimensions: H.= 0.400-0.992 mm, w.= 0.210-0.490 mm, w/H= (0.22) 0.41-0.52, p.d.= 0.025 mm, number of pairs of chambers: 4-6, w.t.= 0.006-0.010 mm, loop thickness= 0.002 mm.

Holotype: Pl. 33, fig. 10 (sample 03HZ59).

Type material: 25 specimens.

Repository of the types: Collection of Palaeontology of Lille 1 University (France).

Comparison: *Louisettita extraordinaria* sp. nov. differs from *L. elegantissima* by the curved septa and from *L. ultima* by more developed endoskeletal loops. The population of the southern part of Central Mountains (Afghanistan) attributed to *Paradagmarita dubreuilli* VACHARD, 1980 (*nomen nudum*) is smaller (H.= 0.520-0.660 mm, w.= 0.380-0.450 mm, test thickness= 0.230-0.300 mm, h.l.c.= 0.064-0.120 mm, number of pairs of chambers in uncoiled part: 4-6, p.d.= 0.025 mm, w.t.= 0.010 mm).

Occurrence: Changhsinghian of Kuh-e Surmeh (Iran), Hazro (Turkey) and probably Afghanistan.

Subfamily Paradagmaritinae subfam. nov..

Diagnosis: A subfamily of Globivalvulinidae (i.e., with a biserially coiled growth and a microgranular wall, occasionally differentiated) characterized by an uncoiling more or less developed after an initial coiling generally slightly trochospiral (Figs. 9-10).

Composition: *Paradagmarita* LYS *in* LYS & MARCOUX, 1978; *Paradagmaritella* gen. nov.; *Paradagmaritopsis* GAILLOT, VACHARD, GALFETTI & MARTINI submitted; *Paradagmacrusta* gen. nov.; *Paremiratella* gen. nov.

Remarks: After several nomina nuda (GAILLOT, 2006, p. 82; VACHARD *et al.*, 2006 p. 475, figs. 8, 12; GAILLOT *et al.*, submitted, p. 29), Paradagmaritinae is formally described here for the first time. Paradagmaritinae differ from Globivalvulininae in the well developed uncoiled part of the test and an independent phylogeny; and differ from Dagmaritininae (= Louisettitinae) in the coiled part. No evidence of the phylogenic filiation between *Dagmarita* and *Paradagmarita* (as proposed by ALTINER, 1997) has been observed. A filiation from *Globivalvulina* seems to be more likely (see also the specimens of Okimura *et al*., 1985, pl. 1, fig. 16, and Berczki-Makk *et al*., 1995, pl. 6, fig. 4).

Occurrence: Lopingian, probably limited to western Neotethys (but quoted from southern Italy to Thailand).

Genus *Paradagmarita* Lys *in* Lys & Marcoux, 1978 *emend.* herein

Type species: *Paradagmarita monodi* Lys *in* Lys & Marcoux, 1978.

Emended diagnosis: Small to medium-sized paradagmaritin characterized by two stages of growth: initial stage is enrolled, biserial, involute, slightly trochospiral, and terminal uncoiled, also biserial, and relatively long. Wall dark, micro-granular to granular, relatively thin, single- or multilayered. Chambers inflated. Aperture simple, terminal, interio-marginal with a valvula.

Composition: *Paradagmarita monodi* Lys *in* Lys & Marcoux, 1978; *P.* cf. *monodi; P. simplex* sp. nov.; *P. zaninettiae* sp. nov.; *P. planispiralis* sp. nov.; *P.* cf. *planispiralis* sp. nov.; *P.* sp. indet. *sensu* this study.

Occurrence: According to Kotlyar *et al.* (1989, n° 24 of tabl. 1), the first representative of the subfamily appears in the latest Khachikian (top of Midian) of Transcaucasia. This unique data must be confirmed (see below). In our material, the range is late Wuchiapingian-Changhsingian. The subfamily is Palaeotethyan and Neotethyan, principally known in Turkey (Taurus; Altiner, 1984a, b), Iran (Zagros), Saudi Arabia (Vachard *et al*., 2005) and NW Caucasus (Pronina-Nestell & Nestell, 2001), but mentioned from Italy to Japan. The *Paradagmarita* from Afghanistan described by Vachard (1980) are *Louisettita*, those from Thailand and Pakistan are very atypical. The *Paradagmarita* of Japan (Kobayashi, 1997, 2004) belong to *Paradagmaritopsis*, a genus also observed in southern China (Gaillot *et al*., submitted; this study), but it seems likely that true *Paradagmarita* are present also in southern China (Gaillot *et al*., submitted; this study).

Paradagmarita simplex sp. nov.

(Pl. 5, fig. 6, 9-10, Pl. 12, figs. 12-14, 27, Pl. 34, fig. 6, Pl. 49, figs. 1-2)

? 1985 *Paradagmarita* sp. of *P. monodi* group – Okimura *et al*., pl. 1, fig. 16 (the magnification indicated seems to be erroneous).

? p.p.1988a *Globivalvulina* sp. 1 – Pronina, pl. 2, fig. 6 (*non* fig. 5= *Siphoglobivalvulina baudi*).

? 1988a *Globivalvulina* sp. 2 – Pronina, pl. 2, fig. 7.

v. 2006 *Paradagmarita simplex* sp. nov. – Gaillot & Vachard *in* Gaillot, p. 82-83, Pl. I.3, fig. 15, Pl. II.15, figs. 1-2, Pl. III.15, fig. 6, 9-10, Pl. III.22, fig. 6, Pl. VI.5, figs. 12-14, 27 (*nomen nudum*).

Etymology: Latin *simplex*, simple, primitive.

Type locality: Hazro (Turkey).

Type level: Wuchiapingian.

Diagnosis: A primitive species of *Paradagmarita* still similar to the *Globivalvulina* ancestor, but without sutures and triangular chambers.

Description: Test small, planispiral to trochospiral but the uncoiling of the test is not yet clearly marked. However, the aperture simple, terminal, interio-marginal with a valvula (V-shape) is clearly recognisable. Wall dark, micro-granular, three layered with a clear intermediary layer. Chambers inflated, and differ from an ancestral globivalvuline by more triangular to quadrate shape in transverse section (Pl. 12, figs. 12, 14, 27), and more angular shape in subaxial section (Pl. 12, fig. 13).

Dimensions: H.= 0.200-0.400 mm, w.= 0.220-0.240 mm, w/H ratio= 0.73, n.c.u.p.= 3-4 pairs, h.l.c.= 0.100-0.160 mm, w.t.= 0.010-0.020 mm.

Holotype: Pl. 12, fig. 14 (sample 03HZ35).

Type material: 9 illustrated paratypes (20 specimens observed).

Repository of the types: Collection of Palaeontology of Lille 1 University (France).

Comparison: *Paradagmarita simplex* sp. nov. differs from the *Globivalvulina* species by the shape of chambers, and from *P. zaninettiae* sp. nov. by smaller size, smaller w/H ratio, and smaller number of chambers.

Occurrence: ?Late Changhsingian ("Dorashamian") of Transcaucasia. Wuchiapingian of Zagros, Fars and Turkey.

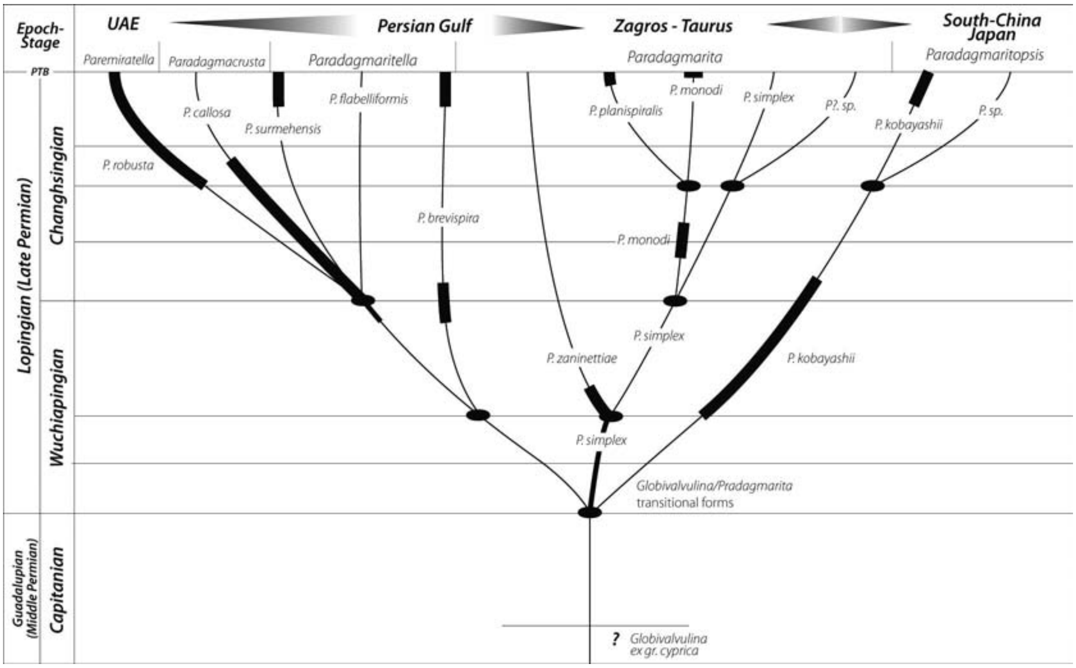


Figure 9.– Phylogeny of Paradagmaritinae n. subfam. The Persian Gulf area possibly acted as a radiative pole with a pool of initially endemic species that intermittently spread towards relatively closed palaeobiogeographic domains.
Figura 9.– Filogenia de los Paradagmaritinae n. subfam. El área del actual Golfo Pérsico quizás constituyó un centro de especiación con un grupos de especies inicialmente endémicas que, de vez en cuando, se extendieron a comarcas palaobiogeográficas vecinas.

Paradagmarita zaninettiae sp. nov.

(Pl. 8, figs. 4-5, 10-17, Pl. 11, fig. 2, Pl. 15, fig. 6, Pl. 32, figs. 14, 22, 26, Pl. 34, figs. 15-17, Pl. 39, figs. 2-3, Pl. 49, figs. 5, 9-11, 16)

v. 2006 *Paradagmarita zaninettiae* sp. nov. – Gaillot & Vachard *in* Gaillot, p. 83, Pl. I.6, figs. 9-11, Pl. I.7, fig. 6, Pl. I.8, figs. 13-16, 18, 20, Pl. I.10, figs. 4-5, 10-17, Pl. I.11, figs. 2-3, Pl. I.12, fig. 14, 22, 26, Pl. I.19, fig. 2, Pl. II.15, figs. 5, 9-11, 16, Pl. III.22, figs. 15-17 (*nomen nudum*).

v. 2006 *Paradagmarita zaninettiae* Gaillot – Vachard *et al*., figs. 10(18-19) (*nomen nudum*, no description).

Etymology: Dedicated to Prof. L. Zaninetti, Geneva University (Switzerland), author of fundamental studies about the Permian and Triassic foraminifers.

Type locality: Kuh-e Surmeh (Zagros, Iran).

Type level: Changhsingian.

Diagnosis: A primitive species of *Paradagmarita* but with generic characters relatively well developed (coiling, shape of chambers, axial profile).

Description: This small species is round to elliptical in transverse section, losangic in axial section and elongate in sagittal section. Sutures are slightly excavated. Some septal protuberances can appear.

Dimensions: H.= 0.225-0.600 mm, w.= 0.180-0.330 mm, w/H= 0.50-0.60, p.d.= 0.025-0.060 mm, h.l.c.= 0.075-0.240 mm, n.w.= 1-2, number of pairs of chambers: 7-8, w.t.= 0.004-0.060 mm.

Holotype: Pl. 8, fig. 14 (sample KeS-178).

Type material: 23 paratypes are illustrated from approximately one hundred specimens.

Repository of the types: CST TOTAL (Pau, France).

Remarks: *Paradagmarita zaninettiae* sp. nov. is probably the ancestral form of *P. monodi*, exhibiting less chambers, smaller size, and a more carinate periphery.

Occurrence: Late Wuchiapingian -Changhsingian of Zagros, Fars and Abu Dhabi.

Paradagmarita monodi Lys *in* Lys & Marcoux, 1978 *emend.* herein
(Pl. 1, figs. 7-9, Pl. 3, figs. 3, 6-7, 11, Pl. 6, fig. 11, Pl. 11, figs. 12-13, 22-24, 26, Pl. 17, fig. 15, Pl. 18, figs. 3-5, 7, 9-11, Pl. 27, figs. 7-8, Pl. 33, figs. 1-5, 15-17, Pl. 41, figs. 2, 6-7, 9-15, Pl. 42, fig. 15, Pl. 45, fig. 2, Pl. 50, figs. 7, 10, 12-13, Pl. 51, figs. 1-5, 7)

1970 "Probabli Valvulinidae" – Canuti *et al.*, fig. 15: 5-6.
1978 *Paradagmarita monodi* sp. nov. – Lys *in* Lys & Marcoux, p. 1419-1420, pl. 1, fig. 2.
1981 *Paradagmarita monodi* Lys *in* Lys & Marcoux – Zaninetti *et al.*, p. 6-7, pl. 2, fig. 6, pl. 3, figs. 9-23.
? p.p.1981 *Paradagmarita monodi* Lys *in* Lys & Marcoux – Altiner, p. 295-296, pl. 38, figs. 4-15 (*non* figs. 1-3 = ?*P. planispiralis* sp. nov.).
1984b *Paradagmarita monodi* Lys *in* Lys & Marcoux – Altiner, pl. 1, figs. 1-2.
non 1985 *Paradagmarita monodi* Lys *in* Lys & Marcoux – Okimura *et al.*, pl. 1, fig. 16 (probably a teratogenic *Globivalvulina* or a *Paradagmarita simplex* sp. nov., with erroneous magnification).
1987 *Paradagmarita monodi* Lys *in* Lys & Marcoux – Loeblich & Tappan, pl. 230, fig. 6.
1989 *Paradagmarita monodi* Lys *in* Lys & Marcoux – Köylüoglu & Altiner, pl. 6, figs. 1-8.
1996 *Paradagmarita monodi* Lys *in* Lys & Marcoux – Rauzer-Chernousova *et al.*, p. 72, pl. 18, fig. 14.
2003 *Paradagmarita monodi* Lys *in* Lys & Marcoux – Ünal *et al.,* pl. 1, figs. 1, 2.
v. ? 2005 *Paradagmarita* cf. *monodi* Lys *in* Lys & Marcoux – Vachard *et al.*, p. 156, pl. 3, fig. 11 (with 12 references in synonymy).
v. 2006 *Paradagmarita monodi* Lys – Insalaco *et al.*, pl. 2, fig. 11.
v. 2006 *Paradagmarita monodi* Lys *in* Lys & Marcoux, 1978 *emend.* – Gaillot, p. 83-84, Pl. I.15, figs. 3-5, Pl. I.16, fig. 2, Pl. I.17, figs. 3, 6-7, 11, Pl. I.19, figs. 12-13, 22-24, 26, Pl. II.16, fig. 15, Pl. II.18, figs. 7, 10, 12-13, Pl. II.31, figs. 7-8, Pl. III.3, figs. 3, 10, Pl. III.4, fig. 3, 5, Pl. III.6, figs. 7-9, Pl. III.7, fig. 8, Pl. III.16, fig. 15, Pl. III.17, figs. 2, 6-7, 9-15, Pl. III.18, figs. 3-5, 7, 9-11, Pl. III.25, fig. 14, Pl. IV.3, fig. 1, Pl. VI.6, figs. 4-8, 16, 18, Pl. VI.7, figs. 1-5, 15-17, Pl. VI.8, figs. 1-5, 7.
v. 2006 *Paradagmarita monodi* Lys *in* Lys & Marcoux – Vachard *et al.*, figs. 10(1-5, 23).

Emended diagnosis: Test losangic in outline. Coiled part relatively long with 1.5-2 whorls. Lobate chambers. Wall simple, microgranular. Some peripherical punctuations (callosities?) on the internal face of the wall were not described in the original diagnosis but are biostratigraphically important to notice (see below with *P*. cf. *monodi*).

Dimensions: H.= 0.270-0.675 mm, w.= (0.185) 0.240-0.340 mm, n.w.= 1-2, n.c.u.p.= (3) 8-10 pairs, h.l.c.= 0.200-0.260 mm, w.t.= 0.005-0.010 mm.

Remarks: The specimen from Oman, not illustrated by Montenat *et al*., 1977, is probably misinterpreted because its presence together with late Midian *Shanita* is biostratigraphically unlikely (Vachard *et al*., 2002).

Occurrence: Changhsingian of Taurus (Turkey), Saudi Arabia, Zagros and Fars.

Paradagmarita cf. *monodi* Lys *in* Lys & Marcoux, 1978
(Pl. 5, fig. 16, Pl. 6, fig. 9, Pl. 11, fig. 3, Pl. 12, figs. 20, 22, 28-29, Pl. 17, figs. 2-3, Pl. 32, fig. 7, Pl. 35, figs. 3, 11, Pl. 50, fig. 6, Pl. 52, fig. 6)

v. 2006 *Paradagmarita* cf. *monodi* Lys *in* Lys & Marcoux, 1978 *emend.* – Gaillot, p. 84, Pl. I.12, fig.7, Pl. I.13, figs. 9-10, Pl. I.15, figs. 6, 9-10, 12, 14, Pl. I.19, fig. 3, Pl. II.17, fig. 6, Pl. II.18, fig. 6, Pl. III.2, figs. 8-10, Pl. III.15, fig. 16, Pl. III.16, figs. 2-3, Pl. III.24, fig. 8, Pl. IV-3, fig. 9, Pl. V.3, figs. 3, 11, Pl. VI.5, figs. 20, 22, 28-29, Pl. VI.6, fig. 1.
v. 2006 *Paradagmarita* cf. *monodi* Lys *in* Lys & Marcoux – Vachard *et al*., figs. 10(22-23).
v. p.p.2006 *Paradagmaritella flabelliformis* (Zaninetti, Altiner & Çatal) – Vachard *et al*., figs. 10(11, 13).

Description: In the *Paradagmarita* Lopingian lineage, the species seems to be intermediate between *P. zaninettiae* sp. nov. and *P. monodi*. The test is losangic in outline but not elongate at the extremities, and the specimens do not display the peripherical punctuation typical of *P. monodi*.

Dimensions: D.= 0.240-0.450 mm, w.= 0.200-0.340 mm, n.w.= 1-2, n.c.u.p.= 6-7 pairs, h.l.c.= 0.030-0.080 mm, w.t.= 0.005-0.010 mm.

Occurrence: Late Wuchiapingian-Changhsingian of Zagros, Fars and Abu Dhabi. Changhsingian of Hazro.

Paradagmarita planispiralis sp. nov.
(Pl. 6, figs. 4, 10, 12, Pl. 9, figs. 13, 14, Pl. 11, figs. 8-9, Pl. 13, fig. 11, Pl. 18, fig. 6, Pl. 33, figs. 21-23, Pl. 41, fig. 3, Pl. 50, figs. 8-9, 11, Pl. 51, figs. 6, 8-13)

p.p.?1981 *Paradagmarita monodi* Lys – Altiner, pl. 38, figs. 1-3 (*non* figs. 4-15).
p.p.?1981 *Paradagmarita flabelliformis* Zaninetti, Altiner & Çatal – Altiner, pl. 39, fig. 6 (*non* figs. 1-5= true *flabelliformis*).
? 1981 *Paradagmarita* sp. (sp. nov.?) – Altiner, pl. 39, figs. 7-9.
? 1984b *Paradagmarita* sp. – Altiner, pl. 1, fig. 5.
v. 2006 *Paradagmarita planispiralis* sp. nov. – Gaillot & Vachard *in* Gaillot, p. 85, Pl. I.19, figs. 8-9, Pl. II.18, figs. 8-9, 11, Pl. III.3, figs. 17-18, Pl. III.4, figs. 1-2, 4, Pl. III.5, figs. 13, 14, Pl. III.7, figs. 12-15, Pl. III.17, fig. 3, Pl. III.18, fig. 6, Pl. IV.3, figs. 4, 10-12Pl. VI.7, fig. 21-23, Pl. VI.8, figs. 6, 8-13 (*nomen nudum*).

Etymology: Latin *planus* and *spira* due to the characteristic coiling.

Type locality: Hazro section (Turkey).

Type level: Changhsingian.

Diagnosis: *Paradagmarita* initially planispiral, with a relatively long uncoiled part.

Description: Test small, planispirally coiled and biserial. D.= 0.500-0.700 mm, w.= 0.325 mm, w/D ratio= 0.45, n.w.= 2-3, n.c.= 6-7 pairs, h.l.c.= 0.440-0.470 mm, w.t.= 0.020 mm.

Holotype: Pl. 51, fig. 10 (sample 03HZ92).

Type material: 50 specimens.

Repository of the types: Collection of Palaeontology of Lille 1 University (France).

Comparison: Differs from *P. monodi* by the planispiral coiling and the longer uncoiled part, and from *P. flabelliformis* Zaninetti, Altiner & Çatal, 1981 by the thinner wall and higher biserial chambers. As *P. flabelliformis* in southern Turkey, *P. planispiralis* seems to appear in the latest populations of *Paradagmarita*.

Occurrence: Discovered in the Changhsingian of Hazro, and illustrated in other outcrops of Taurus (Turkey). Changhsingian of Zagros and Fars.

Paradagmarita cf. *planispiralis*

(Pl. 3, fig. 4, Pl. 11, figs. 7, 10-11, Pl. 41, figs. 5, 8, Pl. 45, figs. 7-8, 12, Pl. 50, fig. 3)

v. 2006 *Paradagmarita* cf. *planispiralis* sp. nov. – Gaillot & Vachard *in* Gaillot, p. 85, Pl. I.16, figs. 7-8, 12, Pl. I.17, fig. 4, Pl. I.19, figs. 7, 10-11, Pl. II.18, fig. 3, Pl. III.3, figs. 11, 16, Pl. III.7, fig. 9, Pl. III.17, figs. 5, 8, Pl. III.25, figs. 12-13, Pl. IV.5, fig. 11.

Description: Test small, planispirally coiled and biserial. D.= 0.345-0.655 (0.830) mm, w.= 0.130-0.325 mm, w/D ratio= 0.45, p.d.= 0.025-0.045 mm, n.w.= 1-2, n.c.= 6-9 pairs, h.l.c.= 0.130-190 mm, w.t.= 0.005-0.010 mm.

Occurrence: Changhsingian of Zagros, Fars.

Paradagmarita sp. indet.

(Pl. 37, figs. 11, 17)

v. 2006 *Paradagmarita* spp. – Gaillot, p. 85-86, Pl. I.6, fig. 4, Pl. III.2, fig. 7?, Pl. VII.2, figs. 11?, 17?
submitted *Paradagmarita* sp. – Gaillot, Vachard, Galfetti & Martini, p. 30, fig. 6(11-17).

Remarks: In Laren section (southern China), two small cross sections of this taxon exhibit initially an arcuate coiling, trocho- or planispiral, and then, a planispiral coiling with chambers enveloping the apertural face. These characters evocate the genus *Paradagmarita*, but the shape of chambers looks like that of a peneroplid genus. D.= 0.300-0.355 mm, n.w.= 1-1.5, n.c.= 6-10.

Occurrence: Changhsingian of Zagros and southern China.

Genus *Paradagmaritella* gen. nov.

Type species: *Paradagmaritella surmehensis* gen. nov., sp. nov.

Etymology: From *Paradagmarita* similar genus; and ending *ella*.

Diagnosis: Paradagmaritin genus characterized by a small to median size test, elongate chambers and a differentiated wall: granular, three layered or microsparitized.

Composition: *Paradagmaritella surmehensis* sp. nov.; *P. brevispira* sp. nov.; *Paradagmarita flabelliformis* Zaninetti, Altiner & Çatal, 1981; *P.* sp. Pronina-Nestell & Nestell, 2001; ?*Paradagmarita*" *sensu* Kotlyar *et al.* (1989, pl. 4, fig. 10).

Comparaison. The new genus differs from *Paradagmarita* by the shape of chambers and the microstructures of wall. The first

"*Paradagmarita*" of Kotlyar *et al.* (1989, see above), appears in the latest Midian of Transcaucasia, looks like *Spireitlina* Vachard *in* Vachard & Beckary, 1991, and should be transitional between this genus and *Paradagmaritella*, or be the first representative of *Paradagmaritella*.

Occurrence: ?Latest Midian of Transcaucasia. Lopingian of Fars. Late Wuchiapingian of Zagros. Midhnab Member and lower Khartam Member of Saudi Arabia. Questionable in the Changhsingian of NW Caucasus. Latest Dzhulfian-Dorashamian of Turkey.

Paradagmaritella surmehensis sp. nov.

(Pl. 15, figs. 13-14, Pl. 49, fig. 4, Pl. 50, fig. 4)

v. 2006 *Paradagmaritella surmehensis* sp. nov. – Gaillot & Vachard *in* Gaillot, p. 86, Pl. I.7, figs. 13-14, Pl. II.15, fig. 4, Pl. II.16, fig. 3, Pl. II.18, fig. 4 (*nomen nudum*).

v. 2006 *Paradagmaritella surmehensis* Gaillot & Vachard sp. nov. – Vachard *et al*., figs. 10(14-15) (*nomen nudum*, no description).

Etymology: From Kuh-e Surmeh.

Type locality: Kuh-e Surmeh section (Zagros, Iran).

Type level: Late Wuchiapingian.

Diagnosis: Medium-sized paradagmaritin characterized by an initial stage enrolled, biserial, involute, slightly trochospiral, and a terminal stage uncoiled, biserial stage, relatively short. Wall monolayered, coarsely granular. Chambers inflated. Aperture simple, terminal, interio-marginal with a valvula.

Dimensions: H.= 0.225-0.635 mm, w.= 0.320 mm, w/D= 0.61, p.d.= 0.025-0.050 mm, D.c.p.= 0.160-0.425 mm, H.u.p.= 0.180-0.320 (0.455) mm, n.c.c.p.= 5-6 pairs, n.c.u.p.= 2-3 (5) pairs, h.l.c.= 0.100 mm, w.t.= 0.020-0.035 mm.

Holotype: Pl. 15, fig. 13 (sample KeS-131).

Type material: Rare form, all the material (5 specimens) is illustrated.

Repository of the types: CST TOTAL (Pau, France).

Remarks: The new species differs from the other *Paradagmaritella* by its relatively small size.

Occurrence: Lopingian of Fars. Late Wuchiapingian of Zagros.

Paradagmaritella brevispira sp. nov.

(Pl. 35, fig. 8, Pl. 38, fig. 13, Pl. 42, fig. 4, Pl. 49, figs. 12-14, Pl. 50, fig. 5, Pl. 52, fig. 5)

? 1978 *Paradagmarita* sp. 2 – Lys *in* Lys & Marcoux, p. 1420, pl. 1, fig. 5.

v. 2005 *Paradagmarita* sp. nov. – Vachard *et al*., p. 155-156, pl. 3, fig. 8

v. 2006 *Paradagmaritella brevispira* sp. nov. – Gaillot & Vachard *in* Gaillot, p. 86-87, Pl. I.8, fig. 4, Pl. I.9, fig. 13, Pl. II.15, figs. 12-14, Pl. II.16, fig. 4, Pl. II.17, fig. 5, Pl. II.18, fig. 5, Pl. V.3, fig. 8 (*nomen nudum*).

v. 2006 *Paradagmaritella brevispira* Gaillot sp. nov. – Vachard *et al*., figs. 10(16-17) (*nomen nudum*, no description).

Etymology: Latin *brevis* and *spira*, which means with a short coiled part.

Type locality: Saudi Arabia (Unayzah Jal Khartam section).

Type level: Midhnab Member (early? Changhsingian).

Diagnosis: A wide species of *Paradagmaritella* with a relatively trochoid uncoiled part, and a short initial coiled part.

Description: The chambers are low and elongate. The wall is thick and often granular. H.= 0.440-0.725 mm, w.= 0.260-0.580 mm, p.d.= 0.025-0.065 mm, h.l.c.= 0.100-0.130 (0.240) mm, n.c.c.p.= 4-7 n.c.u.p.= 3-4 (7), D.c.p.= 0.230-0.290 mm, H.u.p.= 0.225-0.415 mm, w.t.= 0.010-0.025 mm.

Holotype: Pl. 35, fig. 8 (sample JMA 83-131).

Type material: Eigth paratypes are illustrated from about 20 specimens.

Repository of the types: BRGM, Orléans (France).

Remarks: This species differs from *Paradagmaritella flabelliformis* by the wider and more trochoid uncoiled part, and the shorter initial coiled part.

Occurrence: Questionable in the Changhsingian of Turkey and NW Caucasus. Midhnab Member (early? Changhsingian) of Saudi Arabia. Lopingian of Zagros and Fars.

Genus *Paradagmaritopsis* Gaillot, Vachard, Galfetti & Martini, submitted

Type species: *Paradagmaritopsis kobayashii* Gaillot, Vachard, Galfetti & Martini, submitted.

Diagnosis: Coiled part very small reduced to the two first chambers, or to the curvature of the axis of coiling. Long uncoiled biserial part. Chambers subelliptical in shape, with oblique long axis.

Comparison. *Paradagmaritopsis* differs from *Paradagmarita* by the very short coiled part; from *Dagmarita* by the absence of lateral cameral protuberances; from the Palaeotextularioidea by the type of wall and the minute size; from *Globispiroplectammina* by the type of wall; and from *Paremiratella* gen. nov. by the large uncoiled part.

Occurrence: Late Wuchiapingian-Changhsingian of Zagros and Fars. Changhsingian of Japan (Kobayashi, 1997, 2004) and southern China (Gaillot *et al*., submitted and this study).

Paradagmaritopsis kobayashii Gaillot, Vachard, Galfetti & Martini, submitted
(Pl. 5, figs. 11-12, Pl. 32, fig. 23, Pl. 34, fig. 13, Pl. 37, figs. 6-8, 12-14, 15?, 16?, Pl. 38, figs. 1-9, Pl. 42, figs. 1-2, 6-14, Pl. 49, figs. 6-8, 15)

1997 *Paradagmarita* sp. – Kobayashi, pl. 4, fig. 19.
2004 *Paradagmarita* sp. – Kobayashi, p. 67, fig. 6.47-50.
v. 2006 *Paradagmarit*a sp. 2 – Insalaco *et al*., pl. 2, fig. 1.
v. 2006 *Paradagmaritopsis kobayashii* gen. nov. sp. nov. – Gaillot & Vachard *in* Gaillot, p. 87-88, Pl. I.9, figs. 1-9, Pl. I.12, fig. 23, Pl. II.15, figs. 6-8, 15, Pl. II.16, figs. 1-2, 6-14, Pl. III.15, figs. 11-12, Pl. III.22, fig. 13, Pl. VII.2, figs. 6-8, 12-15, 16? (*nomen nudum*).
v. 2006 *Paradagmaritopsis kobayashii* Gaillot & Vachard sp. nov. – Vachard *et al*., figs. 10(8-10) (*nomen nudum*, no description).
v. submitted *Paradagmaritopsis kobayashii* Gaillot – Gaillot, Vachard, Galfetti & Martini, p. 31, fig. 6(6-8, 12-14, 15?, 16?).

Diagnosis: As for the genus.

Description: Coiled part very small reduced to the two first chambers, or to the curvature of the axis of coiling. Long uncoiled biseriate part. Chambers subelliptical in shape, with oblique long axis. H.= 0.280-0.700 mm, w.= 0-160-0.460 mm, p.d.= 0.040-0.050 mm, number of pairs of coiled chambers: 2-3, number of pairs of uncoiled chambers: 3-4. The specimen Pl. 37, fig. 15 is exceptionally large with H.= 1.500 mm for 8 pairs of chambers, it is unique. The specimen Pl. 37, fig. 16 differs from the rest of the populations by a relatively long coiled part of one complete whorl, nevertheless, because the last chamber is similar to the chambers of the holotype on Pl. 37, fig. 6, it is provisionally considered as forming part of the species.

Occurrence: As for the genus.

Paradagmaritopsis sp.
(Pl. 37, figs. 9-10)

v. 2006 *Paradagmaritopsis* sp. – Gaillot, p. 88, Pl. VII.2, figs. 9-10.
submitted *Paradagmaritopsis* sp. – Gaillot, Vachard, Galfetti & Martini, p. 31-32, fig. 6(9-10).

Description: Two oblique sections in the Chinese material belong to *Paradagmaritopsis* but exhibit another shape of chambers than *P. kobayashii*. H.= 0.425-0.465 mm, w.= 0.190 mm, t.t.= 0.130 mm, p.d.= 0.030 mm, n.c.= 5 pairs, h.l.c.= 0.110-0.130 mm, w.t.= 0.010 mm.

Occurrence: Late Changhsingian of southern China.

Genus *Paradagmacrusta* gen. nov.

Type species: *Paradagmacrusta callosa* gen. nov. sp. nov.

Etymology: From *Paradagmarita* similar genus; and ending *crusta* due to this unique peculiarity in the group.

Diagnosis: Paradagmaritin genus characterized by the thick crust developed at the roof of the chambers (common among the Endothyroidea but unique in the Paradagmaritininae, this feature is moreover absent in all groups of globivalvulinids).

Composition: Monospecific.

Comparison: The new genus differs from *Paradagmarita* and *Paradagmaritella* gen. nov. by the roof crusta.

Occurrence: Changhsingian of Zagros and Fars.

Paradagmacrusta callosa sp. nov.
(Pl. 3, figs. 15-17, Pl. 11, fig. 5, Pl. 17, figs. 4, 6-7, 9, 11-14, Pl. 31, figs.15, 17, Pl. 32, figs. 10-13, 15-17, Pl. 35, figs. 4, 12, 14, Pl. 39, fig. 1, Pl. 41, fig. 1, Pl. 42, fig. 16, Pl. 45, fig. 3, Pl. 52, figs. 1-2, 7)

v. 2005 *Paradagmarita* "sp. 1" – VACHARD *et al*., p. 156, pl. 3, figs. 4, 12, 14.
v. 2006 *Paradagmarita* sp. 4 – INSALACO *et al*., pl. 2, fig. 14.
v. 2006 *Paradagmacrusta callosa* sp. nov. – GAILLOT & VACHARD *in* GAILLOT, p. 88-89, Pl. I.11, fig. 1, Pl. I.12, figs. 10-13, 15-17, Pl. I.13, figs. 6-8, Pl. I.14, fig. 12, Pl. I.15, fig. 11, Pl. I.16, fig. 3, Pl. I.17, figs. 15-17, Pl. I.19, fig. 5, Pl. I.37, figs.15, 17, Pl. II.16, fig. 16, Pl. II.17, figs. 1-2, 7, Pl. III.2, fig. 6, Pl. III.16, figs. 4, 6-7, 9, 11-14, Pl. III.17, fig. 1, Pl. V.3, figs. 4, 12, 14 (*nomen nudum*).
v. 2006 *Paradagmacrusta callosa* GAILLOT &VACHARD sp. nov. – VACHARD *et al*., figs. 10(20-21) (*nomen nudum*, no description).
v. p.p.2006 *Paradagmaritella flabelliformis* (ZANINETTI, ALTINER & ÇATAL) – VACHARD *et al*., fig. 10(12).

Etymology: Latine *callosus*, callous; because of the shape of the crusta.

Type locality: Kuh-e Surmeh section (Zagros, Iran).

Type level: Changhsingian.

Diagnosis: A species of *Paradagmacrusta* characterized by the strong development of secondary deposits under the form of crustae (crusts).

Description: The transverse section is losangic in outline. The axial section is elliptical. Septa are thicker than the walls. The wall is differentiated as in the type material of *Paradagmarita*, i.e. with a clear intermediate layer between two dark layers. A very thick micritic crust is developed at the roof of the chambers. The last pair of chambers increases abruptly in height and width. Wall relatively thick, single layered.

Dimensions: H.= 0.600-0.840 mm, w.= 0.340-0.400 mm, p.d.= 0.030-0.040 mm, D.c.p.= 0.360-0.400 mm, number of coiled whorls: 2, number of pair of chambers in uncoiled part: 1, h.l.c.= 0.240-0.400 mm, w.t.= 0.010 mm.

Holotype: Pl. 32, fig. 10 (sample KeS-179).

Type material: Locally common species with at least one hundred specimens.

Repository of the types: CST TOTAL (Pau, France).

Remarks: No taxa can be compared to the new species.

Occurrence: As for the genus.

Genus *Paremiratella* gen. nov.

Type species: *Paremiratella robusta* gen. nov. sp. nov.

Etymology: Prefix *Para* due to the similarity with *Paradagmarita*; found in the United Arabic Emirates, the type area, and ending *ella*, feminine name.

Diagnosis: Coiling planispiral to trochospiral similar to *Globivalvulina* at the beginning and to *Paradagmarita* in the last whorl. Wall single layered, dark brown, often recrystallized in whitish microsparite. Chambers very numerous. The last chamber is higher, with a beginning of uncoiling (Fig. 10).

Description: Medium to large size globivalvulinid. Test biserial with an initial "inner *Globivalvulina*", then with tendency to uncoiling.

Composition: Monospecific.

Comparison: *Paremiratella* gen. nov. differs from *Globivalvulina* by the larger size, more numerous chambers, and the rapid increasing of the last whorl, and from *Paradagmarita* by the very small uncoiled part.

Occurrence: Changhsingian of Zagros, Fars, Abu Dhabi. Questionable in the Changhsingian of Japan.

Paremiratella robusta gen. nov. sp. nov.
(Pl. 6, figs. 1-3, 5- 6, Pl. 13, figs. 13-15, Pl. 24, figs. 1-2, 5-12, Pl. 50, figs. 1-2, Pl. 52, figs. 3-4, 8-14)

p.p.? 2001 *Globivalvulina* sp. – KOBAYASHI, pl. 1, fig. 41 (*non* fig. 42= *Charliella*).
v. 2006 *Paradagmarita* (?) sp. 1 – INSALACO *et al*., pl. 2, figs. 9-10.
v. 2006 *Paremiratella robusta* gen. nov. sp. nov. – GAILLOT & VACHARD *in* GAILLOT, p. 89-90, Pl. II.17, figs. 3-4,

8-14, Pl. II.18, figs. 1-2, Pl. IV.2, figs. 1-2, 5-12, Pl. IV.3, figs. 1-3, 5- 6, Pl. IV.5, figs. 13-15 (*nomen nudum*).

v. 2006 *Paremiratella instabilis* GAILLOT &VACHARD sp. nov. – VACHARD *et al*., figs. 10(6-7), 11 (*nomen nudum*, no description).

Etymology: From Latin *robustus*, robust.

Type locality: Abu Dhabi (UAE).

Type level: Changhsingian.

Diagnosis: As for the genus.

Description: The initial coiling is similar to *Globivalvulina*. The last chamber increases rapidly in height and begins to take the form of a fan. Consequently, the axial section appear as an *Omphalotis* section with a *Globivalvulina bulloides*-like juvenarium. The transverse section exhibits numerous pairs of chambers and is similar to that of the Tournaisian genus *Biseriammina* (see LOEBLICH & TAPPAN, 1987, pl. 229, fig. 27). Wall monolayered dark brown, often recristallized in whitish microsparite. The truncature facets are numerous indicating a common transport of the specimens, in being often taphonomically reelaborated (in the sense of FERNÁNDEZ-LÓPEZ, 2000), word clearer than reworked or resedimented. The chambers are numerous in the last chambers; their septa and wall are relatively thick.

Dimensions: D= (0.220) 0.410-0.780 (1.080) mm, w.= (0.180) 0.320-0.500 (0.540) mm, w/D= 0.49-0.68 (0.78), p.d.= 0.050-0.066 (0.090) mm, s.t.= 0.010-0.050 mm, n.c.= 6-8 (11) pairs, h.l.c.= 0.220-0.375 (0.565) mm, w.t.= 0.010-0.040 mm.

Holotype: Pl. 6, fig. 5 (sample 12309).

Type material: 25 paratypes are illustrated, more than hundred specimens were observed.

Repository of the types: CST TOTAL (Pau, France).

Occurrence: As for the genus.

Class Miliolata LANKESTER, 1885 *nomen translat*. SAIDOVA, 1981 according to MIKHALEVICH, 1998 [= Hemigordiopsida MIKHALEVICH, 1988 *nomen translat.* PRONINA, 1994= Pseudoammodiscacea *nomen translat.* VDOVENKO *et al*., 1993 (part)= Cornuspirida *nomen translat.* VDOVENKO *et al*. 1993 (part)].

Miliolata are characterized by porcelaneous tests of high-Mg calcite in which small rod-like crystal are randomly oriented, in the middle layer. The tests are milky opaque in reflected light and brown in transmitted light. They first appeared at the beginning of Pennsylvanian time and then proliferated in Middle and Late Permian time following the Capitanian transgression in the Tethyan realm (ALTINER *et al*., 2003). The order includes many ecologic generalists and opportunists (KAUFFMAN & HARRIES, 1996) that normally existed in low numbers, but which bloomed during environmental crisis. These taxa are mainly cornuspirinids (*Cornuspira*, *Rectocornuspira*, *Agathammina*, *Agathamminoides*), meandrospirinids (*Streblospira*) and attached calcivertellinids (*Calcivertella, Palaeonubecularia*) (Figs. 11-12).

The most diverse Permian representatives are hemigordiopsids and cornuspirids. Among hemigordiopsids, forms with axially thickened tests and variable coiling (*Hemigordius*, *Neodiscus*, *Multidiscus*) gave rise in Middle Permian time to relatively larger forms with a reduced lumen of the tubular chamber (*Hemigordiopsis*, *Lysites*) and others whose the tubular chamber is occupied by pillars (*Shanita*). The sporadically occuring generalist/opportunist taxa, hemigordiopsids, and cornuspirids comprised at least nineteen genera in Capitanian time, the peak of miliolid diversity during the Palaeozoic Era (GROVES & ALTINER, 2005). The causes of end-Guadalupian extinctions (e.g., SHENG, 1992) appear to have affected the Miliolata, although there is uncertainty with respect to the stratigraphic ranges of certain genera. Morphologically complex genera, such as *Hemigordiopsis*, *Lysites*, *Shanita* and *Septigordius* gen. nov., seem to have been eliminated. Less complicated and ecologically more tolerant forms persisted. Wuchiapingian and Changhsingian miliolata associations exhibit stable and roughly equal generic diversity, except for the appearance of *Kamurana* in the Changhsingian (ALTINER, 1984b; KOBAYASHI, 1997; LYS *et al*., 1980). The end-Permian extinction then nearly eliminated the order, as almost all hemigordiopsids and cornuspirids disappeared (ALTINER,

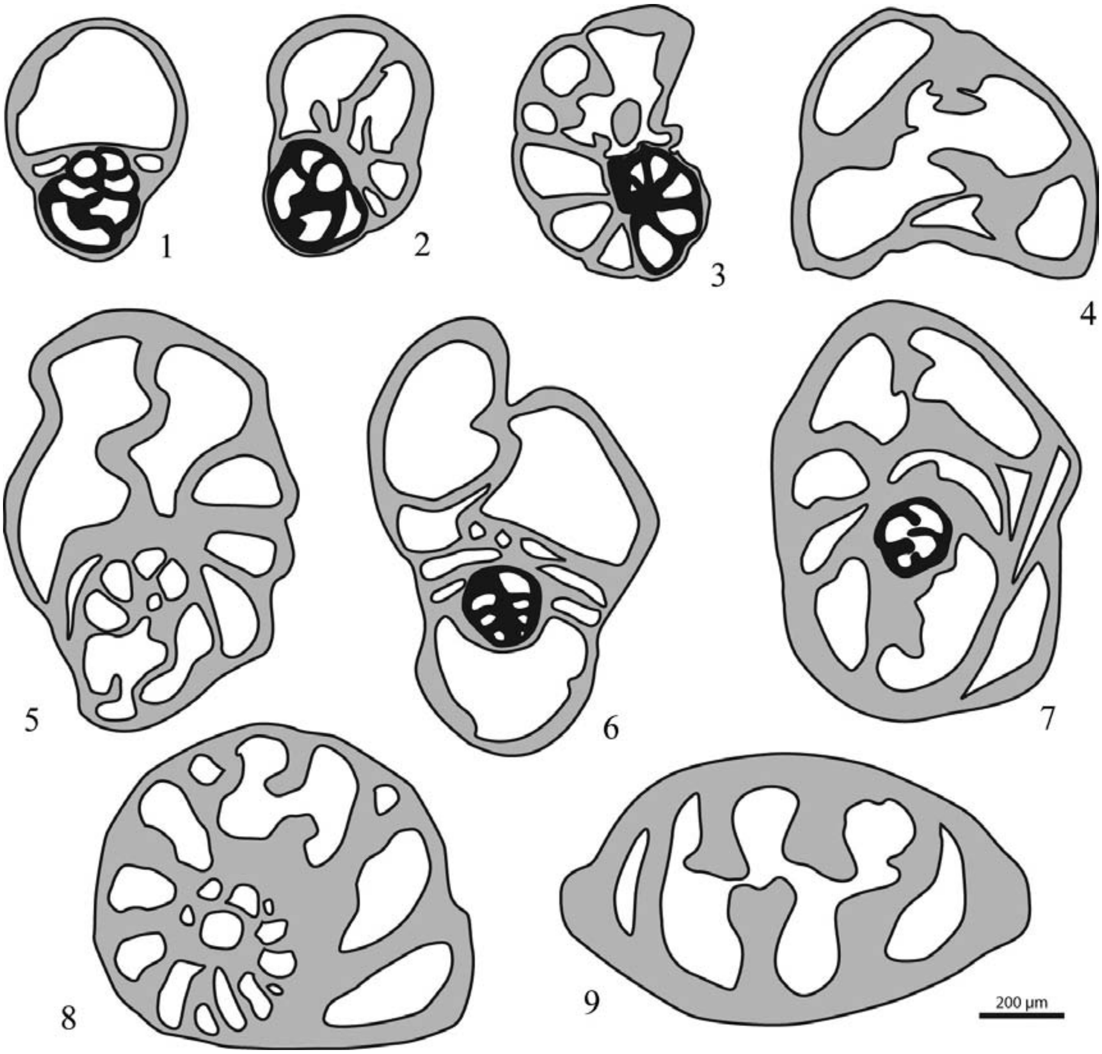


Figure 10.– 1-9. *Paremiratella robusta* gen. nov. sp. nov. Some paratypes showing the "inner globivalvulin" in black, whereas the adult test is in grey (Late Changhsingian of Zagros and United Arabian Emirates).
Figura 10.– 1-9. Paremiratella robusta *gen. nov. sp. nov. Algunos paratipos mostrando el "globivalvulínido interno", en negro, y las vueltas adultas están en gris. (Late Changhsingian de Zagros y Emiratos Árabes Unidos).*

1981, 1984b; CIRILLI *et al*., 1998, GARGOURI & VACHARD, 1988; HAAS *et al*., 1986; HALLAM & WIGNALL, 1997; JENNY-DESHUSSES, 1983b; KÖYLÜOGLU & ALTINER, 1989; NOÉ, 1987; RAMPINO & ADLER, 1998; ÜNAL *et al*., 2003). The palaeobiogeographic distribution of these forms is confined to the western Tethyan area including Italy, Hungary, former Yugoslavia, Bulgaria, Austria, Turkey and Iran (RETTORI, 1995). The Permian genus *Kamurana* survived in the Early Triassic of Bulgaria where it is represented by a single species (TRIFONOVA, 1984), which GROVES & ALTINER (2005) regard as a failed crisis progenitor taxon (KAUFFMAN & HARRIES, 1996).

Order Miliolida DELAGE & HEROUARD, 1896 (= Hemigordiopsina MIKHALEVICH, 1988)

Composition: In Pennsylvanian-Permian exist only the two superfamilies: Nubecularioidea and Cornuspiroidea.

Remarks: All Late Palaeozoic Miliolids are represented by diverse coilings of an undivided tubular chamber. We distinguish two superfamilies: Nubecularoidea (= attached) and Cornuspiroidea (= free). The Permian Nubecularoidea all belong to the family Calcivertellidae, except may be the puzzling case of *Tubiphytes emend.* (= *Shamovella auct.*). The Cornuspiroidea can be subdivided at least classically, into four families: Cornuspiridae (very simple: with only one stage of growth), Hemigordiidae (more advanced with two stages of coiling), Neodiscidae (homeomorphs of the preceeding ones, but repeating their evolutional trends), and Hemigordiopsidae (the most complex, with frequent flosculinisation or other modifications of the wall). We think that the Hemigordiidae given rise to the Involutinids, according to VACHARD *et al*., 1993a, who modified GARGOURI & VACHARD, 1988 (although, in their criticism, GROVES & ALTINER, 2005 ignored this latter correction).

The group derives from the Fusulinida Tournayellida *Scalebrina* at the end of Viséan. Attached Porcelaneous (here: Nubecularioidea) are common in the Serpukhovian-Bashkirian. The Cornupiroidea (with the typical well preserved, i.e. amber-coloured wall) appear only in the Bashkirian (VACHARD, unpublished data). The tests with more complex coilings and walls appear with *Brunsiella* and then *Hemigordius* in the Moscovian; the diversity becomes important as early as Early Permian, and increases gradually during the Middle Permian. The Changhsingian is an episode of considerable diversity for the group.

Occurrence: The Paleozoic groups could be limited to the latest Viséan-latest Permian and may be Early Triassic (see below). The order, of course, subsists to the Recent.

Superfamily Nubecularioidea JONES *in* GRIFFITH & HENFREY, 1875 *nomen translat.* MIKHALEVICH, 1988

Remarks: Some atypical developments exist in this superfamily under the form of oncoids or biopisoids (e.g., *Nubecularia* oncoid: FLÜGEL, 2004, pl. 11, fig. 6, *Osagia* TWENHOFEL, 1919 *emend.* VACHARD, 1980 *non* ROUX, 1985, French Jurassic "oolithes cannabines", or crusts of *Ellesmerella permica* (PIA, 1937) or *E. subparallella* (FLÜGEL & FLÜGEL-KAHLER, 1980), as emended by VACHARD & KRAINER, 2001b; in this latter case, the chamber of the nubeculariids is not higher than the tubes of the girvanellacean cyanobacteria).

Family Calcivertellidae LOEBLICH & TAPPAN, 1964 *nomen translat.* REITLINGER *in* VDOVENKO *et al*., 1993, *emend.* herein

Synonyms: ?Orthovertellinae MIKHALEVICH, 1988; Pseudocornuspiridae REITLINGER *in* VDOVENKO *et al*., 1993 (part); Meandrospirinae SAIDOVA, 1981 (part).

Emended diagnosis: Attached, undivided tubes, with initial coiling and terminal uncoiling more or less zigzagging. Wall porcelanous, simple or relatively complex (with pits) (see discussion in VACHARD & KRAINER, 2001b).

Composition: *Calcivertella* CUSHMAN & WATERS, 1928; *Calcitornella* CUSHMAN & WATERS, 1928; *Trepeilopsis* CUSHMAN & WATERS, 1928; *Orthovertella* CUSHMAN & WATERS, 1928 (part; e.g., *sensu* KOBAYASHI, 1988, pl. 2, figs. 20-21); *Planiinvoluta* LEISCHNER, 1961; *Carixia* MACFADYEN, 1941; *Palaeonubecularia* REITLINGER, 1950; *Hedraites* HENBEST, 1963; and *Pseudovermiporella* ELLIOTT, 1958.

Remarks: The composition of this family or subfamily is relatively stable in the literature (compare the composition indicated here with that of LOEBLICH & TAPPAN, 1987, p. 312-314). Here, we emendate the family for including the genera *Hedraites* and *Pseudovermiporella* (with pits in the wall) because in our material they evolve evidently from *Calcitornella*.

Occurrence: Late Mississippian (Serpukhovian)?-Early Pennsylvanian (Bashkirian) to Late Permian, cosmopolite.

Genus *Calcivertella* CUSHMAN & WATERS, 1928

Type species: *Calcivertella adherens* CUSHMAN & WATERS, 1928.

CLASS	SUPERFAMILY	FAMILY	GENERA
MILIOLATA	CORNUSPIROIDEA	HEMIGORDIOPSIDAE	*Hemigordiopsis, Shanita, Glomomidiellopsis, Kamurana*
		NEODISCIDAE	*Neodiscus, Crassiglomella* n. gen., *Graecodiscus, Neohemigordius, Uralogordius n. gen., Multidiscus, Brunsispirella* n. gen., *Crassipirella* n. gen., *Neodiscopsis* n. gen., *Septagathammina*
		HEMIGORDIIDAE	*Hemigordius, Septigordius* n. gen., *Midiella, Okimuraites, Nikitinella, Arenovidalina, Triadodiscus, Baisalina, Pseudobaisalina*
		CORNUSPIRIDAE	*Cornuspira, Rectocornuspira, Rectoglomus, Hemigordiellina, Pilammina, Hoyenella, Agathammina,* Glomospiroidinae
	NUBECULARIOIDEA	Other family (ies)	*Nubecularia, Ellesmerella, Tubiphytes, Ramovsia (=Dorudia)...*
		CALCIVERTELLIDAE	*Calcivertella, Calcitornella, Trepeilopsis, Orthovertella, Planiinvoluta, Carixia, Palaeonubecularia, Pseudovermiporella, Hedraites*

Figure 11.– New classification of Permian Miliolata.
Figura 11.– Nueva clasificación de los Miliolata del Pérmico.

Synonym: *Ammovertella* CUSHMAN, 1928 (part).

Calcivertella spp.
(Pl. 20, fig. 12, Pl. 53, figs. 2-3, Pl. 54, fig. 12?, Pl. 55, figs. 7-11)

v. 2006 *Calcivertella* spp. – GAILLOT, p. 92-93, Pl. II.24, fig. 2-3, Pl. II.26, fig. 12?, Pl. III.13, fig. 12, Pl. III.19, figs. 7-11, Pl. IV.4, fig. 9.

Description: Many fragments of minute, thin-walled calcivertellid tubes were observed during this study. They are generally assigned to the genus *Calcivertella* when a more precise attribution is not possible. The coiling of some specimens remains one of *Pseudagathammina* (Pl. 55, figs. 8-10) and *Baryshnikovia* (Pl. 55, fig. 11).

Occurrence: Late Midian to Changhsingian of the studied areas with an acme in the early Wuchiapingian.

Genus *Palaeonubecularia* REITLINGER, 1950

Type species: *Palaeonubecularia fluxa* REITLINGER, 1950.

Synonyms: *Ammovertella* CUSHMAN, 1928 (part); *Calcivertella* CUSHMAN & WATERS, 1928 (part); *Tolypammina* RHUMBLER, 1895 (part); *Nubecularia* DEFRANCE, 1825; *Apterinella* CUSHMAN & WATERS, 1928 (part); *Minnamodytes* HENBEST, 1963; *Osagia* TWENHOFEL, 1919 (part).

Diagnosis: Test attached, consisting of a single chamber with numerous whorls or of irregular aggregates of tubes; wall porcelaneous, compact, occasionally recrystallized. *Palaeonubecularia* is a homeomorph of *Tolypammina*, i.e. constituted by a single undivided chamber, attached, and affected by a zigzagging growth, but its wall is porcelaneous and not agglutinated. Furthermore, many *Tolypammina* of the literature, which have probably a porcelaneous wall, belong to *Palaeonubecularia*: e.g. *T. fortis* and *T. gregaria*.

Composition: *Palaeonubecularia fluxa* REITLINGER, 1950; *P. rustica* REITLINGER, 1950; *P. uniserialis* REITLINGER, 1950; *P. marginata* NESTELL & NESTELL, 2006; *Tolypammina fortis* REITLINGER, 1950; *Nubecularia permiana* JOHNSON, 1950; *Tolypammina gregaria* WENDT, 1969; ?*T. complicata* REITLINGER, 1950; ? *T. fraudulenta* LIPINA, 1949; ?*T.? communis* LIPINA, 1949.

Comparison: *Palaeonubecularia* differs from the other primitive Calcivertellidae, e.g. *Calcivertella, Ammovertella, Calcitornella* (i.e. without pits) by larger numbers of whorls and a more compact and thick wall.

Occurrence: Serpukhovian (BRENCKLE & MILKINA, 2003)-Changhsingian (this study), cosmopolite. ?Triassic of Europe and Taurus (Turkey).

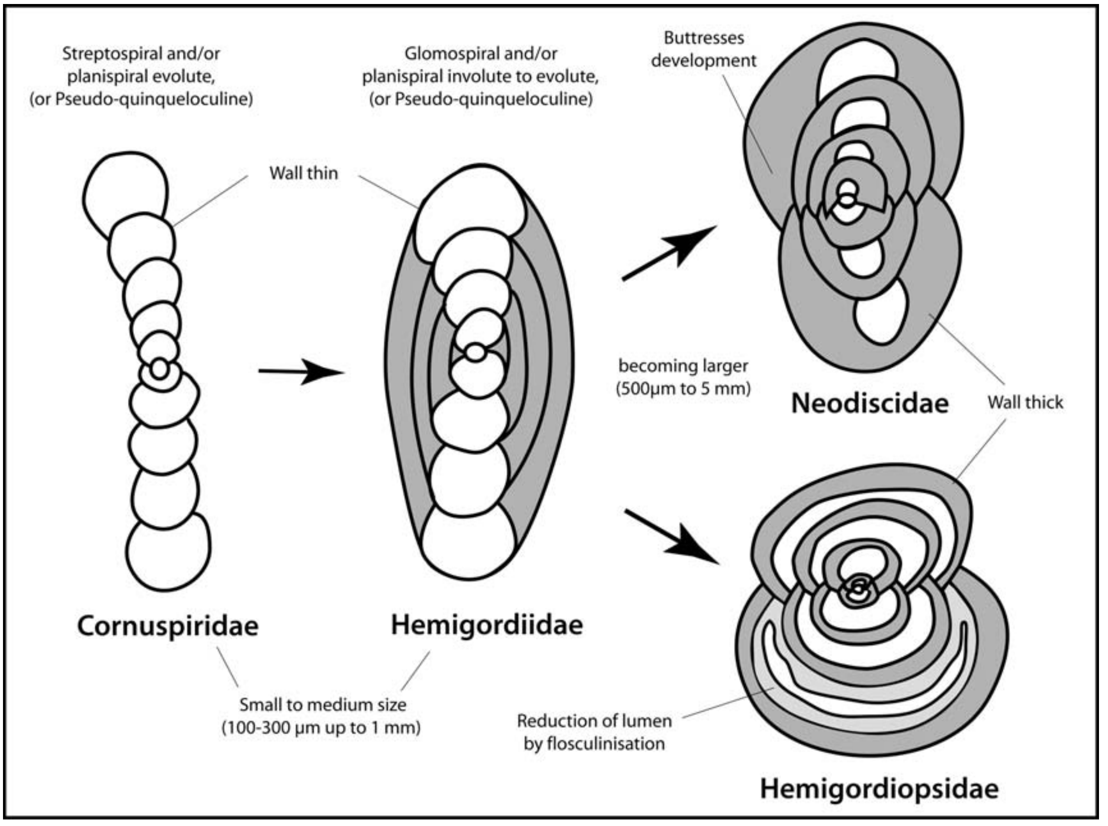


Figure 12.– Cartoons of families of Permian Miliolata.
Figura 12.– Esquemas de las diferentes familias de los Miliolata del Pérmico.

Palaeonubecularia ex gr. *fluxa* REITLINGER, 1950
(Pl. 4, fig. 20, Pl. 22, figs. 3, 10-11, 15-16, 21, Pl. 56, fig. 14)

1950 *Palaeonubecularia fluxa* sp. nov. – REITLINGER, p. 91, pl. 20, figs. 4-5.
1964 *Palaeonubecularia fluxa* REITLINGER – LOEBLICH & TAPPAN, p. C332, text-fig. 247, 4-5.
1993 *Palaeonubecularia fluxa* REITLINGER – VDOVENKO *et al.*, p. 62, 63, pl. 11, figs. 11-12.
v. 2001b *Palaeonubecularia fluxa* REITLINGER – VACHARD & KRAINER, pl. 1, fig. 13, pl. 4, fig.14.
v. 2003a *Palaeonubecularia fluxa* REITLINGER – KRAINER *et al.*, pl. 4, fig. 12.
v. 2006 *Palaeonubecularia* ex gr. *fluxa* REITLINGER – GAILLOT, p. 93, Pl. I.43, fig. 20, Pl. VI.9, figs. 3, 10-11, 15-16, 21, Pl. VI.10, fig. 14.

Dimensions: The measurements correspond to the REITLINGER's description of the species. L.f.= 0.460-0.540 mm, w.= 0.200-0.220 mm, t.d.= 0.025-0.040 mm, w.t.= 0.010-0.015 mm, n.w.= up to seven.

Occurrence: Bashkirian of southern Urals (Russia), Donbass (Ukraine), and Alborz (Iran). Moscovian of southern Pre-Timan (Russia). Pennsylvanian of Egypt. Orenburgian of the Carnic Alps and New Mexico. Late Midian to Changhsingian of southern Turkey (Hazro).

Palaeonubecularia iranica sp. nov.
(Pl. 14, fig. 18, Pl. 57, fig. 1)

v 2005 *Palaeonubecularia* sp. nov. – VACHARD *et al.*, p. 148, pl. 2, fig. 18.
v. 2006 *Palaeonubecularia iranica* – GAILLOT, p. 93-94, pl. I.25, fig. 1.

Etymology: Latin *iranicus*, from Iran.

Type locality: Kuh-e Surmeh section (Zagros, Iran).

Type level: Late Capitanian.

Diagnosis: A very large test, with a thick wall.

Description: A sessile test with a long, irregularly coiled deuteroloculus (second chamber). The dimensions of the deuteroloculus increase gradually in height and width during the growth. The most closely packed first whorls form a juvenarium.

Dimensions: L= 0.675-4.000 mm, L. of juvenarium= 0.265 mm, H. of deuteroloculus= 0.150-0.280 mm, w.t.= 0.085-0.200 mm.

Holotype: Pl. 57, fig. 1 (sample KeS-24).

Type material: 3 specimens.

Repository of the types: The holotype is housed in the CST TOTAL (Pau), the paratype illustrated by VACHARD *et al*. (2005) in the BRGM collection (Orléans, France), a not illustrated paratype is housed in the Collection of Palaeontology of Lille 1 University (France).

Comparison: *Palaeonubecularia iranica* sp. nov. differs from *P. rustica* by the coiled juvenarium, different size parameters and the stratigraphic distribution.

Remarks: The porcelaneous wall is often replaced by anhydrite. This species inhabits evaporitic environments and commonly builds some small foraminiferal boundstones.

Occurrence: Late Wuchiapingian-early? Changhsingian of Saudi Arabia (Midhnab Member). Late Midian of Zagros and Fars.

Genus *Pseudovermiporella* ELLIOTT, 1958

Type species: *Pseudovermiporella sodalica* ELLIOTT, 1958.

Remarks: As indicated as early as the work of HENBEST (1963), this genus is a miliolid foraminifer. Nevertheless, it is still recently considered as alga (GRANIER & DELOFFRE, 1994) or microproblematica (FLÜGEL, 2004). The type of development and the amber-coloured, well preserved test are characteristic of a Porcelaneous foraminifer. It is only after a microsparitic recrystallisation and an inner erosion of the tube, that this Porcelaneous can be confused with a dasyclad. Unlike *Palaeonubecularia*/“*Tolypammina*“, from Moscovian (DELVOLVÉ *et al*., 1987; pl. 1, fig. 11) to Triassic time (WENDT, 1969), microreefs with *Pseudovermiporella* are lacking, probably due to the biological function of the pits, which cannot be covered.

The FAD of *Pseudovermiporella* is probably in the Early Permian with *Pseudovermiporella graiferi* (BARYSHNIKOV *in* BARYSHNIKOV *et al*., 1982) *emend.* VACHARD & KRAINER, 2001b.

P. nipponica, with numerous synonyms appears cosmopolite*, P*. *sodalica* is more restricted to western Neotethys, and *P. elliotti* only known in Turkey and Oman (VACHARD *et al*., 2001a). The numerous other species described are probably all synonyms of these three ones.

Occurrence: Rare in late Asselian-Sakmarian. Early Artinskian-late Changhsingian. For the FAD see VACHARD & KRAINER (2001b). The specimens are very frequent in Middle Permian of Greece, Turkey and Iraq.

Pseudovermiporella nipponica (ENDO *in* ENDO & KANUMA, 1954)

(Pl. 58, fig. 16, Pl. 59, figs. 4, 19)

1954 *Vermiporella? nipponica* sp. nov. – ENDO *in* ENDO & KANUMA, p. 191, pl. 13, figs. 2-5.
1960 *Vermiporella nipponica* ENDO – KOCHANSKY-DEVIDÉ & HERAK, p. 73-75, pl. 2, figs. 7-9, pl. 3, figs. 1-6 (with 6 references in synonymy).
1963 *Vermiporella nipponica* ENDO – PRATURLON, p. 124-126, pl. 1, figs. 1-10 (with 10 references in synonymy).
1972 *Vermiporella nipponica* ENDO *emend.* KOCHANSKY & HERAK – HOMANN, p. 231-235, pl. 7, fig. 55 (with 33 references in synonymy).
1973 *Vermiporella nipponica* ENDO – BOZORGNIA, pl. 43, fig. 10.
1980 *Pseudovermiporella nipponica* (ENDO) – FLÜGEL & FLÜGEL-KAHLER, p. 156, pl. 10, fig. 8 (with 5 references in synonymy).
1986a *Vermiporella nipponica* ENDO – NGUYEN DUC TIEN, pl. 9, figs. 6-7.
1988 *Agathammina*? sp. – YANAGIDA *et al*., pl. 4, figs. 15-16.
non 1986b *Vermiporella nipponica* ENDO – NGUYEN DUC TIEN, pl. 15, fig. 1 (= true algae *Anthracoporella spectabilis*).
v. 2001b *Pseudovermiporella nipponica* (ENDO) – VACHARD & KRAINER, p. 191, pl. 4, fig. 26 (with 12 references in synonymy).
v. 2003 *Pseudovermiporella* ex gr. *nipponica* (ENDO) – VACHARD *et al*., p. 349, pl. 4, fig. 3.
v. 2006 *Pseudovermiporella nipponica* (ENDO *in* ENDO & KANUMA, 1954) – GAILLOT, p. 94-95, pl. II.21, fig.

16, Pl. II.22, figs. 4, 19.

Dimensions: L.t.c.= 1.835 mm, o.d.= 0.400-0.640 mm, i.d.= 0.100-0.440 mm, w.t.= 0.070-0.120 mm, d.pi.= 0.005-0.010 mm.

Occurrence: Late Early Permian? Middle-Late Permian, cosmopolite. Lopingian of southern Turkey (Hazro) and Zagros.

Pseudovermiporella sodalica ELLIOTT, 1958
(Pl. 34, fig. 18, Pl. 57, figs. 2-6)

1958 *Pseudovermiporella sodalica* sp. nov. – ELLIOTT, p. 419-422, pl. 1, figs. 1-6, pl. 2, figs. 2-6, pl. 3, figs. 1-4, 7.
1974 *Pseudovermiporella sodalica* ELLIOTT – WANG, p. 317, pl. 167, fig. 8.
1982 *Pseudovermiporella sodalica* ELLIOTT – MU, p. 232, pl. 8, figs. 1-2.
1984 *Pseudovermiporella sodalica* ELLIOTT – FLÜGEL *et al.*, pl. 29, fig. 13.
2004 *Pseudovermiporella sodalica* ELLIOTT – FLÜGEL, pl. 98, fig. 4.
v. 2006 *Pseudovermiporella sodalica* ELLIOTT – INSALACO *et al.*, pl. 1, fig. 12.
v. 2006 *Pseudovermiporella sodalica* ELLIOTT – GAILLOT, p. 95, Pl. I.25, figs. 2-6, Pl. I.42, figs. 1, 7, 10, Pl. III.8, figs. 7, 12-13, 17, Pl. III.22, fig. 18.

Dimensions: L.t.c.= 1.250-2.500 mm, o.d.= 0.325-0.960 mm, i.d.= 0.170-0.440 mm, w.t.= up to 0.260 mm, d.pi.= 0.015-0.036 mm.

Remarks: This species differs from *P. nipponica* by larger tubes and wider pits.

Occurrence: More endemic than *P. nipponica*. Late Capitanian-Lopingian of Zagros, Irak, Fars and Abu Dhabi. Abundance events occur during the late Wuchiapingian and late Changhsingian.

Superfamily Cornuspiroidea SCHULTZE, 1854 (*nomen translat*. JIROVEC, 1953 according to MIKHALEVICH, 1988)

Synonyms: Hemigordiopsidea NIKITINA, 1969; Shanitidea LOEBLICH & TAPPAN, 1986.

Diagnosis: Tests free with porcelaneous wall composed of a single undivided tube coiled in one or various planes.

Composition: Four Palaeozoic families: Cornuspiridae SCHULTZE, 1854; Hemigordiidae REITLINGER *in* VDOVENKO *et al*., 1993; Neodiscidae LIN, 1984 *nomen translat.* herein; Hemigordiopsidae NIKITINA, 1969. After the Palaeozoic, the group is reinforced by the septate Fischerinidae (see LOEBLICH & TAPPAN, 1987; GUDMUNDSSON, 2002).

Occurrence: ?Serpukhovian/Bashkirian to Recent; cosmopolite.

Family Cornuspiridae SCHULTZE, 1854

Synonyms: Pseudocornuspiridae REITLINGER *in* VDOVENKO *et al*., 1993 (part); Meandrospirinae SAIDOVA, 1981.

Diagnosis: Small porcelaneous undivided tubes with streptospiral, or planispiral evolute coiling, or a succession of both types, or quinqueloculine coiling.

Composition: Two subfamilies: Cornuspirinae SCHULZE, 1854; Agathammininae CIARAPICA, CIRILLI & ZANINETTI *in* CIARAPICA *et al*., 1987.

Remarks: Although occasionally synonymized with the Cornuspiridae, numerous homeomorphs belong in fact to Miliolida Neodiscidae, Fusulinida Pseudammodiscidae or Textulariida Ammodiscidae. This problem is general with the Russian classifications of SAIDOVA (1961), MIKHALEVICH (1988), and PRONINA (1994), if compared with the classification of LOEBLICH & TAPPAN (1964, 1987, 1992).

Occurrence: Latest Viséan-Recent, cosmopolite.

Subfamily Cornuspirinae SCHULZE, 1854

Synonyms: Meandrospirinae SAIDOVA, 1981; Pseudocornuspirinae REITLINGER *in* VDOVENKO *et al*., 1993 (part).

Diagnosis: Small porcelaneous undivided tubes with streptospiral, or planispiral evolute, or a succession of both types of coiling.

Composition: *Cornuspira* SCHULTZE, 1854; *Rectocornuspira* WARTHIN, 1930; *Rectoglomus* MALAKHOVA, 1980; *Hemigordiellina* MARIE *in* DELEAU & MARIE, 1961 *emend.* VACHARD *in* VACHARD & BECKARY, 1991; *Pilammina* PANTIC, 1965; *Hoyenella* RETTORI, 1994 *emend.* herein; the genera of Glomospiroidinae REITLINGER *in* VDOVENKO *et al*., 1993 and Meandrospiridae

SAIDOVA, 1981 *sensu* VDOVENKO *et al*., 1993.

Occurrence: Latest Viséan-Recent, cosmopolite.

Genus *Cornuspira* SCHULTZE, 1854

Type species: *Orbis foliaceus* PHILLIPPI, 1844.

Remarks: Test planispiral evolute. It is generally described with isolated specimens, rarely in thin sections. The Triassic *Ammodiscus* REUSS, 1862 of the authors (e.g., ZANINETTI, 1976; SALAJ *et al*., 1983) are more likely specimens of *Cornuspira*, as well as Triassic *Glomospirella* are *Hoyenella*, and *Glomospira* are *Hemigordiellina* (i.e., representatives of the class Miliolata and not Textulariata).

Occurrence: Late Serpukhovian-Recent, cosmopolite. The first forms are distinguished from the isomorphic *Pseudoammodiscus* by the amber coloured if well preserved, wall in the Late Serpukhovian of Jerada (Morocco) (VACHARD & BERKHLI, unpublished data).

Cornuspira kinkelini SPANDEL, 1898
(Pl. 14, figs. 9-10, Pl. 22, figs. 4-5, 24, Pl. 53, figs. 13-14, Pl. 60, figs. 7, 12)

1898 *Cornuspira kinkelini* sp. nov. – SPANDEL, p. 4, pl. 1, fig. 1.
non 1961 *Cornuspira* cf. *kinkelini* SPANDEL – DELEAU & MARIE, p. 73-74, pl. 5, figs. 1-3 (= *Hemigordius*).
1961 *Cornuspira* ex gr. *kinkelini* SPANDEL – GERKE, p. 152, pl. 19, figs. 1a-b, 2a-b, pl. 20, fig. 5.
1988a *Cornuspira* ex gr. *kinkelini* SPANDEL – PRONINA, pl. 1, figs. 3-4.
1988b *Cornuspira* ex gr. *kinkelini* SPANDEL – PRONINA, fig. 2. 5-6.
1989 *Cornuspira* ex gr. *kinkelini* SPANDEL – KOTLYAR *et al*., pl. 3, fig. 4.
? 1990 *Ammodiscus incertus* (D'ORBIGNY) – LIN *et al*., p. 81 (no illustration).
1999 *Pseudoammodiscus kinkelini* (SPANDEL) – GROVES & BOARDMAN, p. 248-249, pl. 1, figs. 20-27 (with 6 references in synonymy).
v. 2006 *Cornuspira kinkelini* SPANDEL – GAILLOT, p. 96, Pl. I.23, fig. 10, Pl. II.20, figs. 7, 12, Pl. II.24, figs. 13-14, Pl. IV.6, fig. 7, Pl. V.2, figs. 9-10, Pl. VI.9, figs. 4-5, 24.

Dimensions: All the specimens have 4-5 whorls for diameters of 0.200-0.250 mm.

Occurrence: See GROVES & BOARDMAN (1999), and add: late Capitanian of Turkey, Capitanian to Triassic of Zagros and Fars.

Genus *Rectocornuspira* WARTHIN, 1930

Type species: *Rectocornuspira lituiformis* WARTHIN, 1930.

Rectocornuspira kahlori BRÖNNIMANN, ZANINETTI & BOZORGNIA, 1972
(Pl. 54, fig. 17, Pl. 62, figs. 24-27)

1972 *Rectocornuspira kahlori* sp. nov. – BRÖNNIMANN, ZANINETTI & BOZORGNIA, p. 865-869, pl. 1, figs. 1-20, pl. 2, figs. 1-23, pl. 4, figs. 1, 3, 5-7, 12-15, text-fig. 1A-Z.
1981 *Rectocornuspira kahlori* BRÖNNIMANN, ZANINETTI & BOZORGNIA – ALTINER & ZANINETTI, pl. 78, figs. 1-18.
? 1981 *Rectocornuspira kahlori* BRÖNNIMANN, ZANINETTI & BOZORGNIA forma *grandis* n. f. – ALTINER & ZANINETTI, pl. 78, figs. 24-26.
1989 *Rectocornuspira kahlori* BRÖNNIMANN, ZANINETTI & BOZORGNIA – KÖYLÜOGLU & ALTINER, pl. 1, figs. 1-8.
1995 *Rectocornuspira kahlori* BRÖNNIMANN, ZANINETTI & BOZORGNIA – RETTORI, p. 104-106, pl. 19, figs. 7-14 (with 15 references in synonymy).
2005 *Rectocornuspira kahlori* BRÖNNIMANN, ZANINETTI & BOZORGNIA – GROVES & ALTINER, text-fig. 1.2-3.
2005 *Rectocornuspira kahlori* BRÖNNIMANN, ZANINETTI & BOZORGNIA – GROVES *et al*., text-fig. 9.2-3.
v. 2006 *Rectocornuspira kahlori* BRÖNNIMANN, ZANINETTI & BOZORGNIA – INSALACO *et al.,* pl. 2, fig. 26.
v. 2006 *Rectocornuspira kahlori* BRÖNNIMANN, ZANINETTI & BOZORGNIA – GAILLOT, p. 96-97, Pl. I.24, figs. 24-27, Pl. II.26, fig. 17, Pl. III.8, figs. 24-25.
2007 *Rectocornuspira kahlori* BRÖNNIMANN, ZANINETTI & BOZORGNIA – GROVES *et al.,* fig. 12.1.

Remarks: These forms represent uncoiled *Cornuspira*. They are diagnostic fossils for the earliest Triassic strata of the studied area but uncoiled specimens are extremely rare. Without insights of the end-Permian extinction event, the majority of the forms on this level would be assigned to the genus *Cornuspira*. This observation may suggest that the *Rectocornuspira* would correspond to *Cornuspira* with a morphological adaptation, more or less developed, depending on the local or regional ecological parameters.

Occurrence: The type material was collected in the earliest Triassic, lower Elika Formation near Tehran (Iran). The species is mentioned also in southeastern Turkey and eastern Europe (Rettori, 1995). The rare uncoiled specimens were found only in the earliest Triassic of the offshore Fars area, associated with the thrombolitic levels at the base of the K2 reservoir.

Genus *Hemigordiellina* Marie *in* Deleau & Marie, 1961 *emend.* Vachard *in* Vachard & Beckary, 1991 (= "*Glomospira*" *auct.*)

Type species: *Glomospira diversa* Cushman & Waters, 1930.

Synonyms: *Glomospira* (part); "*Palaeoglomospira*" (*nomen nudum* widespread among the petroleum geologists, see for example Hughes, 2005, pl. 2, fig. 8).

Hemigordiellina regularis (Lipina, 1949)
(Pl. 2, figs. 5-6, 7?, 8, 14, Pl. 4, figs. 21-22, Pl. 14, figs. 6, 8, Pl. 63, figs. 4-8)

1949 *Glomospira regularis* sp. nov. – Lipina, p. 205, pl. 2, fig. 6.
1978 *Glomospira regularis* Lipina – Lin, p. 11, pl. 1, fig. 8.
? 1984 *Glomospira regularis* Lipina – Zhao *et al*., p. 96, pl. 15, fig. 7 (or *Pseudoagathammina*).
1984 *Glomospira regularis* Lipina – Lin, p. 110, pl. 1, figs. 5-6.
1988 *Calcitornella* sp. – Kobayashi, pl. 2, figs. 13-14, 16-17.
1990 *Glomospira regularis* Lipina – Lin *et al*., p. 87, p. 119, pl. 1, figs. 36-38 (with 9 references in synonymy).
1992 *Glomospira regularis* Lipina – Trifonova, p. 14-15, pl. 1, figs. 14-15.
v. 2001b *Pseudagathammina? regularis* Lipina – Vachard & Krainer, pl. 4, figs. 16-17, 19-21.
2002 *Glomospira regularis* Lipina – Gu *et al*., p. 165, pl. 1, figs. 21-22 (with 4 references in synonymy).
2004 *Glomospira regularis* Lipina – Zhang & Hong, p. 67, pl. 1, figs. 1-3 (with 7 references in synonymy).
v. 2005 *Hemigordiellina regularis* (Lipina) – Vachard *et al*., p. 157, pl. 2, figs. 6, 8.
v 2006 *Hemigordiellina regularis* (Lipina) – Insalaco *et al*., pl. 1, fig. 8.
2006b *Glomospira* sp. A – Kobayashi, figs. 5. 25-27, 31.
v. 2006 *Hemigordiellina regularis* (Lipina) – Gaillot, p. 97-98, Pl. I.20, figs. 5-6, 7?, 8, 14, Pl. I.43, figs. 21-22, Pl. III.26, figs. 4-8, Pl. IV.4, figs.1-2, 8, Pl. V.2, figs. 6, 8.

Dimensions: D.= 0.240-0.512 mm, p.d.= 0.020-0.056 mm, h.l.w.= 0.050-0.075 mm, w.t.= 0.007-0.020 (0.030) mm.

Remarks: Small glomospiroid porcelaneous tests are here attributed to *Hemigordiellina* (*Glomospira* is truly agglutinated), but authors refuse this assignment (e.g., G. Pronina-Nestell, personal communications, November 2005, June, 2007). A new name might be introduced in the nomenclature.

Occurrence: From Early Permian (Lipina, 1949; Lin *et al*., 1990) to latest Triassic (Salaj *et al*., 1983). Typical specimens of *H. regularis* are mostly present in the Late Capitanian and abundant in the early Wuchiapingian of Persian Gulf. The genus can be sporadically found in the late Midian of southern Turkey and in the Changhsingian of Persian Gulf.

Genus *Pilammina* Pantic, 1965

Type species: *Pilammina densa* Pantic, 1965.

Pilammina? sp.
(Pl. 53, fig. 9)

v. 2006 *Pilammina*? sp. – Groves, p. 98-99, Pl. II.24, fig. 9, Pl. III.8, figs. 1-2.

Dimensions: D. up to 0.455 mm, p.d.= 0.020 mm.

Remarks: Some rare specimens look like Triassic *Pilammina*. Their stratigraphic position (late Wuchiapingian) suggests that they might be in fact juvenile of *Glomomidiellopsis* and/or other genus (see a similar explanation for the forms of Tunisia, by Gargouri & Vachard, 1988, p. 63). However, it suggests that the morphological trends in the Triassic Miliolata evolution probably already began during the Late Permian and continued through the Permian-Triassic transition.

Occurrence: Late Midian of Tebaga (Tunisia) (Termier *et al*., 1977). Late Wuchiapingian of Zagros.

Genus *Hoyenella* Rettori, 1994 *emend.* herein

Type species: *Glomospira sinensis* Ho, 1959.

Synonyms: *Glomospirella auct. non* Plummer, 1945; *Hemigordius* (part); *Glomospira* (part); *Pseudovidalina sensu* Kobayashi (2002, fig. 9. 1-5); *Raphconilia*? *sensu* Kobayashi (2002, fig. 9. 6-7).

Emended diagnosis: Test small discoid, firstly glomospiral, then planispiral with several evolute whorls. Wall porcelaneous often recrystallized into microsparite.

Comparison: *Hoyenella* is the small porcelaneous test homeomorphic of *Glomospirella* with agglutinated wall as described by its author (Plummer, 1945; with *Glomospira umbilicata* Cushman & Waters, 1927 as a type species) and e.g., Loeblich & Tappan (1987). Among the Miliolata, *Hoyenella* differs from small *Okimuraites* by several evolute last whorls (in *Okimuraites*, they are entirely involute, or exceptionally the last whorl is evolute), and it differs from *Brunsiella* Reitlinger, 1950 by the most regular last whorls and the very different age (*Brunsiella* is Moscovian in age). For the same reason, i.e. ultrastructure of the wall, *Hoyenella* differs from the microgranular (i.e. Fusulinata) taxa *Brunsia* ex gr. *spirilliniformis* and *Lapparentiscus* Vachard, 1980. Although these multiple isomorphs are criticized by Mikhailevich in her diverse publications, we advocate for this polyphyletism of the primitive forms, which are at the base of each class of foraminifers. Conversely, we don't understand why Mikhailevich, which prefers the morphological links between the foraminifers, don't place together the fusiform fusulinids and alveolinids in the same family.

Composition: *Glomospira sinensis* Ho, 1959; *Glomospira hemigordiformis* Cherdyntsev, 1914; *Glomospirella* aff. *ammodiscoides* (Rauzer-Chernousova, 1938) *sensu* Salaj *et al.*, 1983; *G. amplificata* Kristan-Tollmann, 1970; *G. facilis* Ho, 1959; *G. fatrica* Michalik, Jendrejaková & Borza, 1979; *Glomospirella hoae* Kristan-Tollmann, 1970 ; *G. hubiensis* Lin, 1978; *G.? kamaensis* Baryshnikov *in* Baryshnikov *et al.*, 1982; *G. lampangensis* Kobayashi, Martini, Rettori & Zaninetti *in* Kobayashi *et al.*, 2006; *G. minima* Michalik, Jendrejaková & Borza, 1979; *G. nyei* Crespin, 1958, *G. paucispira* Michalik, Jendrejaková & Borza, 1979; *G. shengi* Ho, 1959; *G. succinta* Zheng & Lin *in* Lin, 1978; *G. triphonensis* Baud, Zaninetti & Brönnimann, 1971; *G. vulgaris* Ho, 1959; *G.* sp. *sensu* Kobayashi *et al.* (2006, fig. 4.42); *Hemigordius ammodisciformis* Zolotova *in* Zolotova & Baryshnikov, 1980; *H. asimmetricus* (*sic*) Zolotova *in* Zolotova & Baryshnikov, 1980; *H. bipartitus* Zolotova *in* Zolotova & Baryshnikov, 1980; *H. spirollinoformis* Wang, 1982; *H.* sp. 584 (sp. nov.) Lys *et al.*, 1978, pl. 5, fig. 8; *H.* sp. Köylüoglu & Altiner, 1989, pl. 11, fig. 9; ?*H.*? sp. nov. *sensu* Groves, 1992, pl. 3, figs. 1-16.

Occurrence: Cosmopolite in the Permian (possible FAD in the early Sakmarian, see Vachard & Krainer, 2001b, pl. 5, fig. 24). Acme in the Early-Late Triassic (western Europe to China and Japan).

Hoyenella ex gr. *hemigordiformis* (Cherdyntsev, 1914)
(Pl. 2, fig. 4, Pl. 56, fig. 8, Pl. 59, figs. 1-2, 5, Pl. 60, figs. 2-6, Pl. 63, fig. 11, Pl. 64, fig. 1)

Compare with:

1914 *Glomospira hemigordiformis* sp. nov. – Cherdyntsev, p. 74, pl. 3, fig. 18.
1949 *Glomospira?* ex gr. *hemigordiformis* (Cherdyntsev) – Lipina, p. 209, pl. 3, fig. 5, pl. 7, fig. 3.
non 1961 *Hemigordiellina hemigordiformis* (Cherdynzew) – Deleau & Marie, p. 77-78, pl. 4, figs. 1, 4-6, 10 (more similar to *Hemigordius discoideus* Reitlinger, 1950).
v. p.p. 2005 *Glomospirella*? spp. – Vachard *et al.*, p. 157, pl. 1, fig. 1 (*non* fig. 2 another species).
v. 2006 *Hoyenella* ex gr. *hemigordiformis* (Cherdyntsev) – Gaillot, p. 99, Pl. I.20, fig. 4, Pl. I.23, fig. 20, Pl. I.39, fig. 1, Pl. II.20, figs. 2-6, Pl. II.22, figs. 1-2, 5, Pl. III.26, fig. 11, Pl. VI.10, fig. 8.

Description: D.= 0.305-0.435 mm, w.= 0.050-0.140 mm, w/D= 0.15-0.32, n.w.= 5-7, p.d.= 0.025 mm, h.l.= 0.045-0.050 mm, w.t.= 0.005-0.012 mm.

Occurrence: Sakmarian-Kazanian of central part of Russian Platform. Kazanian of Urals. Late

Midian-Lopingian of Zagros. Changhsingian of southern Turkey (Hazro).

Hoyenella laxa sp. nov.
(Pl. 53, fig. 15, Pl. 54, fig. 4, Pl. 56, fig. 3, Pl. 58, fig. 9, Pl. 64, figs. 11?, 13?, Pl. 65, fig. 16)

v. 2006 *Hoyenella laxa* sp. nov. – GAILLOT & VACHARD *in* GAILLOT, p. 99-100, Pl. I.21, fig. 16, Pl. I.39, figs. 11?, 13? Pl. II.21, fig. 9, Pl. II.24, fig. 15, Pl. II.26, fig. 4, Pl.VI.10, fig. 3 (*nomen nudum*).

Etymology: Latin *laxus*: wide.

Type locality: Hazro section (Turkey).

Type level: Late Wuchiapingian.

Diagnosis: *Hoyenella* with a wide lumen and strong oscillations of the axis of coiling leading to a relatively wide although compressed test.

Description: D.= 0.500-0.800 mm, w.= 0.160-0.400 mm, w/D ratio= 0.32-0.52, n.w.= 4-6, p.d.= 0.025-0.040 mm, h.l.= 0.095-0.110 mm, w.t.= 0.010-0.018 mm.

Holotype: Pl. 56, fig. 3 (sample 03HZ35).

Type material: 7 (perhaps 11) specimens.

Repository of the types: Collection of Palaeontology of Lille 1 University (France) and CST TOTAL (Pau, France).

Comparison: No Permian species of *Hoyenella* seems to be comparable. This species might be transitional to *Graecodiscus* (G. NESTELL, personal communication, June 2007); indeed, compare *Graecodiscus* sp. 2 *sensu* NESTELL & NESTELL, 2006, pl. 4, fig. 3 and our Holotype.

Occurrence: Wuchiapingian of Hazro and Zagros sections. Changhsingian of Fars.

Subfamily Agathammininae CIARAPICA, CIRILLI & ZANINETTI *in* CIARAPICA *et al.*, 1987

Genus *Agathammina* NEUMAYR, 1887

Type species: *Serpula pusilla* GEINITZ *in* GEINITZ & GUTBIER, 1848.

Diagnosis: Test with a coiling of an undivided tubular chamber similar to the eosigmoilinid archaediscids and not, as classically indicated, to miliolid chambers with a quinqueloculine coiling. Wall porcelaneous. Aperture terminal simple.

Remarks: The transitional form between *Hemigordiellina* and *Agathammina* seems to be *Glomospira parapusilliformis* BARYSHNIKOV *in* ZOLOTOVA & BARYSHNIKOV, 1980; Kungurian in age.

Occurrence: Permian. FAD and Last Appearance Datum (LAD) poorly known; the genus is relatively common from Midian to Dorashamian; many formerly admitted Triassic survivors are now assigned to another genera. The FAD could be Chihsian (LIN *et al.*, 1990, p. 81) or Kubergandian (VACHARD, unpublished data) in age. The LAD might be Rhaetian in Austrian Alps (SALAJ *et al.,* 1983).

Agathammina pusilla (GEINITZ *in* GEINITZ & GUTBIER, 1848)
(Pl. 2, fig. 18, Pl. 53, fig. 11, Pl. 66, fig. 14)

1848 *Serpula pusilla* sp. nov. – GEINITZ *in* GEINITZ & GUTBIER 1848, p. 6, pl. 3, figs. 3-6.
1865 *Trochammina pusilla* (GEINITZ) – JONES *et al.*, p. 386-392, pl. 13, figs. 2-6, 15 (with 7 references in synonymy).
1876 *Trochammina pusilla* (GEINITZ) – BRADY, p. 78-79, pl. 3, figs. 4-5 (with 8 references in synonymy).
1964 *Agathammina pusilla* (GEINITZ) – LOEBLICH & TAPPAN, p. C438, text-fig. 330, 1-5.
1964 *Agathammina pusilla* (GEINITZ) – GLINTZBOECKEL & RABATÉ, pl. 102, fig. 2?, pl. 103, figs. 1-2.
1978 *Hemigordius parvulus* sp. nov. – LIN, p. 39, pl. 5, figs. 18-19.
1984b *Agathammina pusilla* (GEINITZ) – ALTINER, pl. 2, fig. 5.
1986 *Agathammina* ex gr. *pusilla* (GEINITZ) – VUKS & CHEDIYA, pl. 9, fig. 18.
1986a *Agathammina pusulla* (*sic*) (GEINITZ) – NGUYEN DUC TIEN, pl. 5, fig. 5 (= *Crassiglomella*).
non 1986b *Agathammina pusulla* (*sic*) (GEINITZ) – NGUYEN DUC TIEN, pl. 13, figs. 24-25 (= *Hemigordiellina*? and *Glomomidiellopsis tieni* sp. nov.).
1988b *Agathammina elongata* sp. nov. – PRONINA, p. 60, fig. 3.10.
1989 *Agathammina pusilla* (GEINITZ) – KÖYLÜOGLU & ALTINER, pl. 11, fig. 10.
1990 *Agathammina pusilla* (GEINITZ) – LIN *et al.,* p. 81, p. 218, pl. 26, figs. 20-23.
non 2005 *Agathammina pusilla* GEINITZ – HUGHES, pl. 2, fig. 5 (probably *Neodiscus graecodisciformis* sp. nov.).
2006 *Agathammina pusilla* GEINITZ – NESTELL & NESTELL, p. 10, pl. 3, figs. 1-5 (with 11 references in

synonymy).

v. 2006 *Agathammina pusilla* (Geinitz *in* Geinitz & Gutbier) – Gaillot, p. 100-101, Pl. I.20, fig. 18, Pl. II.23, fig. 14, Pl. II.24, fig. 11.

Remarks: This species is large and elongate. Diameter up to 0.900 mm, width up to 0.350 mm, n.w.= up to 11-12.

Occurrence: See the distribution indicated by Nestell & Nestell (2006) and add: Midian of Turkey; Changhsingian of southern China and Primorye; late Wuchiapingian to Changhsingian of Zagros.

Agathammina cf. *rosella* Pronina, 1988b
(Pl. 67, fig. 1)

cf. 1988b *Agathammina rosella* sp. nov. – Pronina, p. 61-62, fig. 3. 11.

v. 2006 *Agathammina rosella* Pronina – Gaillot, p. 101, Pl. I.22, fig. 1, Pl. I.23, figs. 9, 11.

Remarks: This species, medium-sized, wide and asymmetrical, looks like *A. rosella* but our sections are too oblique to conclude definitively. D.= 0.290-0.700 mm, w.= 0.135-0.540 mm, w/D= (0.30) 0.40-0.44, n.w.= 5-8.

Occurrence: Midian (Khachik Formation) of Transcaucasia. Changhsingian of Zagros.

Agathammina ovata Wang, 1976
(Pl. 22, fig. 7, Pl. 55, fig. 6, Pl. 67, fig. 6)

1976 *Agathammina ovata* sp. nov. – Wang, p. 191, pl. 1, figs. 9a-d.

1990 *Agathammina ovata* Wang – Lin *et al*., p. 217-218, pl. 26, figs. 17-19.

2001 *Agathammina ovata* Wang – Pronina-Nestell & Nestell, pl. 1, fig. 24.

v. 2006 *Agathammina ovata* Wang – Gaillot, p. 101, Pl. I.22, fig. 6, Pl. I.23, fig. 15, Pl. III.19, fig. 6, Pl. VI.9, fig. 7.

Remarks: This species is identical to *A. pusilla* but smaller for the same number of chambers. D.= 0.470-0.660 mm, w.= 0.230-0.270 mm, w/D= 0.39-0.50, n.w.= 7-8, h.l.= 0.036-0.070 mm, w.t.= 0.009-0.023 mm

Occurrence: Changhsingian of southern China and NW Caucasus. Late Midian-Changhsingian of Zagros.

Family Hemigordiidae Reitlinger *in* Vdovenko *et al*., 1993

Diagnosis: Cornuspiroidea diversely coiled but having in common a small size and a thin wall, and a reniform or semicircular section of the tube. Test small, discoid to inflated, with thin porcelaneous wall. Undivided chamber showing generally two successive types of coiling which one at least which is planispiral and involute. Pseudosepta present in few genera. Coiling glomospiral to planispiral, sometimes agathamminoid or quinqueloculine.

Composition: Only one subfamily: Hemigordiinae Reitlinger *in* Vdovenko *et al*., 1993.

Comparison: Hemigordiidae differ from Cornuspiridae by the relatively large development of an involute stage, planispiral, aligned, oscillant or sigmoidal; from the Neodiscidae by the small size, thin wall and absence of buttresses (see below); and from the Hemigordiopsidae by the smaller size and the wider lumen of the tube.

Occurrence: Late Moscovian-Middle Triassic, cosmopolite.

Subfamily Hemigordiinae Reitlinger *in* Vdovenko *et al*., 1993 (*nomen translat.* Pronina, 1994 *pro* family).

Diagnosis: As for the family.

Composition: *Hemigordius* Schubert, 1908; *Septigordius* gen. nov. (= *Pseudomidiella sensu* Vachard *et al.,* 2005); *Midiella* Pronina, 1988b [= *Neodiscus auct.* (part) = *Neohemigordius auct.* (part)]; *Okimuraites* Reitlinger *in* Vdovenko *et al.,* 1993; *Nikitinella* Sosnina, 1983; *Arenovidalina* Ho, 1959 *emend.* herein (= *Multidiscus* of the authors, part); *Triadodiscus* Piller, 1983.

Occurrence: Late Pennsylvanian-Triassic, cosmopolite but especially Neotethyan.

Genus *Hemigordius* Schubert, 1908

Type species: *Cornuspira schlumbergeri* Howchin, 1895.

Synonyms: *Ondogordius* MARIE *in* DELEAU & MARIE, 1961; *Hemigordiella* MARIE *in* DELEAU & MARIE, 1961; *Conicocornuspira* MARIE *in* DELEAU & MARIE, 1961; *Cornuspira* (part); *Neohemigordius sensu* PINARD & MAMET, 1998) (part); *Midiella* (part); *Neodiscus* (part).

Diagnosis: Test small, discoidal. Proloculus spherical, followed by a tubular, undivided chamber, first streptospirally coiled, secondly weakly oscillating, aligned to planispiral, involute to evolute in the last whorls (maximum 1.5-2 evolute last whorls are admitted here as generic limit). Rare cases of irregularly coiled last whorls.

Comparison: *Hemigordius* is often confused with *Midiella*. *Midiella s.s.* differs by a sigmoidal to strongly oscillant coiling, and as emended here by the very proeminent plug giving therefore a rhombic profile. Other similar genera to *Hemigordius*, *Okimuraites* and *Neohemigordius sensu* PINARD & MAMET (1998), differ by the adult whorls strictly aligned to planispirally coiled. Compared with the wide stratigraphic range of *Hemigordius*, these latter morphological variations can appear repetitively in various epochs and apparently not be phylogenetically related together (see e.g., *H. discoideus* and *H. simplex* in the Moscovian, *H. saranensis* in the Artinskian, and *H. planus* and *H. minutus* in the Midian-Dzhulfian). *Septigordius* gen. nov. differs by the pseudosepta associated with the distinctive characters of *Midiella emend.* The genera *Arenovidalina emend.* and *Nikitinella* differ by the smooth-lenticular, inflated to rhombic profile and the planispiral second coiling (and pseudosepta for the second genus). *Brunsispirella* gen. nov. differs by a larger size, a thicker wall, the very short streptospiral initial part, and the strictly planispiral terminal part.

Occurrence: Moscovian to Changhsingian, cosmopolite. The FAD, in the Moscovian, is difficult to establish precisely because of transitional forms with *Hemigordiellina* and/or *Brunsiella* (VACHARD, unpublished data).

Hemigordius schlumbergeri (HOWCHIN, 1895)

(Pl. 14, fig. 11, Pl. 53, figs. 4-6, Pl. 59, fig. 15?)

1895 *Cornuspira Schlumbergi* (*sic*) sp. nov. – HOWCHIN, p. 195, 196, pl. 10, figs. 1-3.
1990 *Hemigordius schulumbergeri* (*sic*) (HOWCHIN) – LIN *et al*., p. 88, p. 212, pl. 24, fig. 22.
1996 *Hemigordius schlumbergeri* (HOWCHIN) – PRONINA, pl. 3, figs. 5-6.
1998 *Hemigordius schlumbergeri* (HOWCHIN) – PINARD & MAMET, p. 32-33, pl. 9, figs. 1, 2?, 3, 4?, 5, 7, 9-11, 14 (with 18 references in synonymy).
v. 2001b *Hemigordius schlumbergeri* (HOWCHIN) – VACHARD & KRAINER, pl. 9, figs. 8, 18, 19, 25.
p.p. 2003 *Hemigordius schlumbergeri* (HOWCHIN) – ALTINER *et al*., text-fig. 4.
v. 2003 *Hemigordius schlumbergeri* (HOWCHIN) – SHANG *et al*., p. 380, pl. 2, figs. 2-5.
v. 2005 *Hemigordius schlumbergeri* (HOWCHIN) – VACHARD *et al*., p. 161, pl. 2, fig. 11.
v. 2006 *Hemigordius schlumbergeri* (HOWCHIN) – GAILLOT, p. 102-103, Pl. II.22, fig. 15?, Pl. II.24, figs. 4-6, Pl. V.2, fig. 11.

Description: D.= 0.330 mm, w.= 0.095 mm, w/D= 0.29, p.d.= 0.030 mm, 2-5 adult whorls, (1-3 for the juvenarium), h.l.w.= 0.020-0.080 mm, w.t.= 0.005 mm.

Remarks: Medium-sized species for the genus, discoidal, with sides almost parallel, 1-2 streptospiral initial whorls (i.e., relatively developed part) followed by 3-4 aligned whorls, with the last or semi-last whorl evolute.

Occurrence: From Late Pennsylvanian (PINARD & MAMET, 1998) to Middle Permian (Kazanian) of Russia (PRONINA, 1996), and southern China (LIN *et al.,* 1990). Rare in late Changhsingian of southern China (SHANG *et al.,* 2003). Late Wuchiapingian-early Changhsingian of Fars. Early Wuchiapingian of Saudi Arabia (Huqayl Member).

Hemigordius baoquingensis WANG *in* ZHAO *et al*., 1981

(Pl. 61, figs. 19?, 20?, 21?, 22?, Pl. 68, figs. 1-2)

1981 *Hemigordius baoqingensis* sp. nov. – WANG *in* ZHAO *et al*., p. 47, 73-74, pl. 1, figs. 17-18.
1987 *Hemigordius* cf. *baoqingensis* WANG – NOÉ, p. 108, pl. 31, fig. 1.
v. 2005 *Hemigordius baoqingensis* WANG – VASLET *et al.,* p. 115 (no illustration).
v. 2005 *Hemigordius baoqingensis* WANG – VACHARD *et al.,* p. 161-162, pl. 5, figs. 4-6, 11.
2005 *Hemigordius schlumbergeri* (HOWCHIN) – HUGHES, pl. 2, fig. 13.
v. 2006 *Hemigordius baoqingensis* WANG – GAILLOT, p.

103, Pl. II.19, figs. 1-2, Pl. IV.6, figs. 19?, 20?, 21?, 22?

Dimensions: D.= 0.500-0.550 mm, w.= 0.170-0.220 mm, w/D= 0.30-0.40, p.d.= 0.035-0.040 mm, n.w.= 4-5, h.l.= 0.080-0.115 mm, w.t.= 0.015-0.030 mm.

Remarks: Large species of *Hemigordius*, discoidal to slightly biumbilicate crescentic with high lumen. Test of medium size, slightly asymmetrical and flattened on one side. Deuteroloculus with oscillating coiling. Wall often recrystallized in white microsparite.

Occurrence: Late Changhsingian of southern China (ZHAO *et al*., 1981; LIN *et al.,* 1990, p. 87). Late Changhsingian of Southern Alps (NOÉ, 1987). Duhaysan Member (late Dzhulfian) of Saudi Arabia. Early Wuchiapingian of Fars. Late Changhsingian of Abu Dhabi. Wuchiapingian of Saudi Arabia (Duhaysan Member).

Hemigordius irregulariformis ZANINETTI, ALTINER & ÇATAL, 1981
(Pl. 2, fig. 19, Pl. 21, figs. 2?, 6?, Pl. 22, fig. 27?)

1981 *Hemigordius irregulariformis* sp. nov. – ZANINETTI, ALTINER & ÇATAL, p. 9-10, pl. 4, figs. 1-18.
1988a *Hemigordius irregulariformis* ZANINETTI, ALTINER & ÇATAL – PRONINA, figs. 2. 14-15.
1988b *Hemigordius irregulariformis* ZANINETTI, ALTINER & ÇATAL – PRONINA, pl. 1, fig. 8.
1989 *Hemigordius irregulariformis* ZANINETTI, ALTINER & ÇATAL – KÖYLÜOGLU & ALTINER, pl. 11, figs. 7-8.
1989 *Hemigordius* (*Midiella*) *irregulariformis* ZANINETTI, ALTINER & ÇATAL – KOTLYAR *et al.,* pl. 4, fig. 4.
1990 *Hemigordius* (*Midiella*) *irregulariformis* ZANINETTI, ALTINER & ÇATAL – LIN *et al.,* p. 210-211, pl. 24, figs. 23-25.
1992 *Hemigordius irregulariformis* ZANINETTI, ALTINER & ÇATAL – BERCZI-MAKK, pl. 3, figs. 1, 6-11.
v. 2000 *Hemigordius* (*Midiella*) *irregulariformis* ZANINETTI, ALTINER & ÇATAL – HAUSER *et al.*, fig. 4. 12.
2003 *Hemigordius irregulariformis* ZANINETTI, ALTINER & ÇATAL – ALTINER *et al.*, text-fig. 5, p. 205.
v. 2006 *Hemigordius irregulariformis* ZANINETTI, ALTINER & ÇATAL – GAILLOT, p. 103-104, Pl. I.20, fig. 19.

Description: D.= 0.295 mm, w.= 0.105 mm, w/D= 0.35, p.d.= 0.025 mm, n.w.= 5, h.l.= 0.050 mm, w.t.= 0.006 mm.

Remarks: The species is characterized by its irregularly coiled last whorls.

Occurrence: Midian of Turkey, Hungary, Transcaucasia and Tunisia. Wuchiapingian of Oman (Batain Plain) and Zagros (Kuh-e Surmeh). Changhsingian of southern China.

Hemigordius longus GROZDILOVA, 1956
(Pl. 67, figs. 7?, 24)

1956 *Hemigordius longus* sp. nov. – GROZDILOVA, p. 524-525, pl. 1, figs. 3-4.
1990 *Neodiscus longus* (GROZDILOVA) – LIN *et al.,* p. 202, pl. 22, figs. 1-6.
v. 2001b *Hemigordius longus* GROZDILOVA – VACHARD & KRAINER, pl. 5, figs. 12-14.
2003 *Hemigordius longus* GROZDILOVA – ALTINER *et al.,* text-fig. 5 p. 205.
v. 2006 *Hemigordius longus* GROZDILOVA – GAILLOT, p. 104, Pl. I.22, figs. 7?, 24, Pl. I.23, figs. 5?, 12?, 13?, 14, 19, 21?, 23?, 24.

Dimensions: D.= 0.380-0.560 mm, w.= 0.170-0.260 mm, w/D= 0.36-0.46, p.d.= 0.010-0.020 mm, n.w.= 5-7, h.l.= 0.040-0.080 mm, w.t.= 0.007-0.010 mm.

Occurrence: Early Permian of Urals, Carnic Alps, southern China. Late Changhsingian of Zagros (Kuh-e Surmeh).

Genus *Midiella* PRONINA, 1988b

Type species: *Hemigordius broennimanni* ALTINER, 1978 (*orth. mut*. herein *pro bronnimanni*).

Synonyms: *Neodiscus* (part) *auctorum* no MIKLUKHO-MAKLAY, 1953; *Neohemigordius sensu* VACHARD *in* VACHARD & FERRIÈRE, 1991.

Diagnosis: Similar to *Hemigordius* but inflated and last involute whorls oscillating or sigmoidal.

Composition: *Hemigordius broennimanni* ALTINER, 1978; *H. zaninettiae* ALTINER, 1978; *H. regularis* WANG, 1982; *H. changxingensis* WANG *in* ZHAO *et al*., 1981; *H. reicheli sygmoidalis* LYS & MARCOUX, 1978; *H. reicheli globulus* ALTINER, 1981 (*nomen nudum*); *Multidiscus guangxiensis* LIN, 1978; *Neodiscus qinglongensis* WANG, 1976; *Hemigordius qinglongensis forma* LIN, LI & SUN, 1990; *H. q. laxa* LIN, LI & SUN, 1990; *H. q. minima* LIN, LI & SUN, 1990; *Midiella karinae*

PRONINA-NESTELL *in* PRONINA-NESTELL & NESTELL, 2001; *Neodiscus guangdongensis* HAO & LIN, 1982; *Hemigordius abadehensis* OKIMURA & ISHII, 1981; *H. ovatus* GROZDILOVA, 1956; *H. ovatus* var. *minima* GROZDILOVA, 1956; *Neodiscus plectogyraeformis* LIN, LI & SUN, 1990.

Comparison: Differs from *Neodiscus* by the smaller size and microstructure of the test (see below the analysis of family Neodiscidae), from *Hemigordius* by the inflated test due to oscillating-sygmoidal coiling, and from *Septigordius* gen. nov. by lacking of pseudosepta.

Occurrence: Early-Late Permian. Acme in Capitanian-Changhsingian, Palaeo- and Neotethys.

Midiella broennimanni (ALTINER, 1978) *orth. mut.*

(Pl. 21, fig. 7, Pl. 22, fig. 25, Pl. 59, figs. 18, 20, Pl. 66, fig.19, Pl. 71, fig. 4)

1978 *Hemigordius bronnimanni* sp. nov. – ALTINER, p. 27-28, pl. 1, figs. 1-6.
1981 *Hemigordius bronnimanni* ALTINER – ALTINER, pl. 43, figs. 1-6.
1984b *Hemigordius bronnimanni* ALTINER – ALTINER, pl. 2, fig. 2.
p.p. 1986 *Hemigordius* sp. 5 – VUKS & CHEDIYA, pl. 9, fig. 5 (*non* fig. 6: more or less similar to *Okimuraites*).
1988b *Hemigordius* (*Midiella*) *bronnimanni* ALTINER – PRONINA, fig. 2.16.
1989 *Hemigordius* (*Midiella*) *bronnimanni* ALTINER – KOTLYAR *et al*., pl. 3, fig. 5.
2001 *Midiella bronnimanni* (ALTINER) – PRONINA-NESTELL & NESTELL, pl. 1, figs. 12-13.
2003 *Hemigordius bronnimanni* ALTINER – ALTINER *et al*., p. 206, text-fig. 6.
v. 2006 *Midiella broennimanni* (ALTINER) *orth. mut*. – GAILLOT, p. 105, Pl. I.38, fig. 7, Pl. II.22, figs. 18, 20, Pl. II.23, fig.19, Pl. II.25, fig. 4, Pl. VI.9, fig. 25.

Dimensions: D.= 0.300-0.420 mm, w.= 0.160-0.245 mm, w/D= 0.50-0.58, n.w.= (4) 6-7, p.d.= 0.012-0.017 (0.060) mm, h.l.= 0.030-0.040 mm, w.t.= 0.008-0.010 mm.

The Hazro specimen measures: D.= 0.290 mm, w.= 0.195 mm, w/D= 0.67, n.w.= 6 or 7, h.l.w.= 0.030 mm, w.t.= 0.006 mm.

Remarks: Test small, ovoid, inflated, with short streptospiral stage followed by a sigmoidal coiling (compared with better known groups, it is homeomorphic to *Archaediscus moelleri*).

Occurrence: Midian of Turkey, Transcaucasia. Late Midian of Zagros. Late Wuchiapingian-Changhsingian of Fars. Late Changhsingian of NW Caucasus.

Midiella ex gr. *zaninettiae* (ALTINER, 1978)

(Pl. 14, fig. 12, Pl. 22, figs. 19-20, Pl. 27, fig. 17, Pl. 34, fig. 21, Pl. 67, fig. 2, Pl. 69, fig. 5)

1978 *Hemigordius zaninettiae* sp. nov. – ALTINER, p. 28, pl. 1, figs. 7-14.
1981 *Hemigordius changxingensis* sp. nov. – WANG *in* ZHAO *et al.,* p. 47, 73, pl. 1, fig. 16.
1981 *Hemigordius zaninettiae* ALTINER – ALTINER, pl. 43, figs. 7-14.
1988b *Hemigordius* (*Midiella*) *zaninettiae* ALTINER – PRONINA, fig. 2. 19, 20.
? 1989 *Hemigordius* (*Midiella*) *zaninettiae* ALTINER – KOTLYAR *et al.,* p. 32, tabl. 1 (no illustration).
1989 *Hemigordius zaninettiae* ALTINER – KÖYLÜOGLU & ALTINER, pl. 11, figs. 3-5.
1990 *Hemigordius zaninettiae* ALTINER – LIN *et al.,* p. 88 (no illustration).
1990 *Hemigordius changxingensis* WANG – LIN *et al.,* p. 212, pl. 24, fig. 36.
v. 1991 *Neohemigordius* cf. *zaninettiae* (ALTINER) – VACHARD & FERRIÈRE, p. 219, pl. 4, figs. 4-5 (with 7 references in synonymy).
? 1995 *Hemigordius zaninettiae* ALTINER – BERCZI-MAKK *et al.,* p. 209-210, pl. 19, figs. 1a, 2a, 3, pl. 20, figs. 1a, 2, 4a, 5, pl. 22 fig. 6a (with 14 references in synonymy) (perhaps *Multidiscus*).
1996 *Hemigordius zaninettiae* ALTINER – LEVEN & OKAY, pl. 9, figs. 22, 23.
1998 *Hemigordius zaninettiae* ALTINER – ALTINER & ÖZKAN ALTINER, pl. 4, fig. 17.
1999a *Midiella zaninettiae* (ALTINER) – KOTLYAR *et al*., p. 309 (no illustration).
2001 *Midiella karinae* sp. nov. – PRONINA-NESTELL *in* PRONINA-NESTELL & NESTELL, p. 213, pl. 1, figs. 14-16.
2001 *Midiella zaninettiae* (ALTINER) – PRONINA-NESTELL *in* PRONINA-NESTELL & NESTELL, pl. 1, fig. 17.
2003 *Hemigordius zaninettiae* ALTINER – ALTINER *et al.,* p. 207, text-fig. 6.
2003 *Hemigordius zaninettiae* ALTINER – ÜNAL *et al*., pl. 1, fig. 47.
v. 2005 *Neohemigordius* ex gr. *zaninettiae* (ALTINER) – VACHARD *et al.,* p. 163, pl. 2, fig. 12.
v. 2006 *Midiella* ex gr. *zaninettiae* (ALTINER) – GAILLOT, p. 105-106, Pl. I.22, fig. 2, Pl. I.23, fig. 18, Pl. II.31, fig. 17, Pl. II.34, fig. 5, Pl. III.22, fig. 21, Pl. V.2, fig. 12, Pl. VI.9, figs. 19-20.

Dimensions: D.= 0.260-0.450 (0.680) mm, w.= 0.090-0.200 (0.460) mm, w/D= 0.34-0.50

(0.90), p.d.= 0.020-0.035 mm, n.w.= 6 (8), h.l.= 0.040-0.075 mm, w.t.= 0.005-0.018 mm.

Remarks: Test small, ovoid, inflated, with small streptospiral stage followed by an oscillating coiling (homeomorphic to *Archaediscus chernoussovensis*). Small species of the group *zaninettiae*, apparently very similar to "*Hemigordius*" *changxingensis*, lenticular, characterized by its regularly oscillating coiling.

Occurrence: Capitanian-Changhsingian, Trancaucasia, Turkey, Tibet, NW Caucasus, Afghanistan, New Zealand, southern China (PRONINA, 1988b, completed).

Midiella aff. *quinglongensis* (WANG, 1976)
(Pl. 21, fig. 10, Pl. 34, figs. 19? 20?, Pl. 53, fig. 10, Pl. 62, figs. 1-8, 11, 13-17, 18?, 19?, Pl. 63, fig. 12, Pl. 70, fig. 1)

1976 *Neodiscus qinglongensis* sp. nov. – WANG, p. 191-192, pl. 1, figs. 11a-d.
? v. 1978 *Hemigordius* sp. 1 – ZANINETTI *et al*., pl. 85, figs. 26-31.
1990 *Hemigordius qinglongensis* (WANG) – LIN *et al.,* p. 214, pl. 25, figs. 14-15.
1997 *Hemigordius* sp. – KOBAYASHI, pl. 4, figs. 20-24.
p.p. ?1998 *Hemigordius* sp. – CIRILLI *et al*., pl. 2, figs. 17-18 (not figs. 15, 19= true *Hemigordius*).
? 2003 *Hemigordius*? sp. – ÜNAL *et al.,* pl. 1, fig. 46.
2004 *Hemigordius qinglongensis* (WANG) – ZHANG & HONG, p. 71, pl. 2, figs. 1-5 (with 5 references in synonymy).
v. 2005 *Neodiscus* aff. *qinglongensis* WANG – VASLET *et al.,* p. 116 (no illustration).
v. 2005 *Neodiscus* aff. *qinglongensis* WANG – VACHARD *et al.,* p. 162, pl. 5, figs. 3, 7-10.
v. 2006 *Neodiscus quinqlongensis* WANG – INSALACO *et al.,* pl. 1, fig. 9.
v. 2006 *Midiella* aff. *quinglongensis* (WANG) – GAILLOT, p. 106-107, Pl. I.24, figs. 1-8, 11, 13-17, 18?, 19?, Pl. I.38, fig. 10, Pl. I.40, fig. 1, Pl. II.24, fig. 10, Pl. III.8, figs. 9?, 10?, 11?, 16?, 18?, Pl. III.22, figs. 19? 20?, Pl. III.26, fig. 12, Pl. IV.4, fig. 5.

Dimensions: D.= 0.340-0.800 mm, w.= 0.200-0.480 mm, w/D= 0.60-0.73, p.d.= 0.050-0.070 mm (for specimens of 0.460-0.800 mm), n.w.= 5-7, h.l.= 0.065-0.115 mm, w.t.= 0.010-0.020 mm.

Remarks: Large species with a relatively high and regular initial coiling, and a second one oscillating, with oscillations of great amplitude tending to a sigmoidal coiling. Test thickly lenticular, involute, of median size, and with narrow coiling. Spherical proloculus passing into tubular undivided deuteroloculus coiled in two planes. 3-4 initial whorls (glomus) are streptospirally coiled; the following 1-2 whorls are slightly oscillating to aligned. Pseudosepta absent or very faint. Aperture terminal simple. Wall porcelaneous relatively thick, usually recrystallized in white microsparite.

Comparison: This taxon differs from *M. quinglongensis* type by less oscillating final whorls.

Occurrence: Wuchiapingian-Changhsingian type of southern China. Questionable in the Dorashamian of Turkey, Iran and Italy (see list of synonymy). Late Midian-Lopingian of Zagros. Wuchiapingian of Saudi Arabia (from Huqayl to Midhnab members).

Midiella ovata (GROZDILOVA, 1956)
(Pl. 65, figs. 9, 12, 14, Pl. 67, figs. 5, 8, 25)

1956 *Hemigordius ovatus* sp. nov. – GROZDILOVA, p. 526-527, pl. 1, fig. 5.
1984b *Hemigordius* aff. *ovatus* GROZDILOVA – ALTINER, pl. 2, fig. 4.
1989 *Hemigordius* aff. *ovatus* GROZDILOVA – KÖYLÜOGLU & ALTINER, pl. 11, fig. 6.
v. ? 2001b *Hemigordius ovatus* GROZDILOVA – VACHARD & KRAINER, pl. 5, figs. 20-21 (relatively different of the holotype).
2003 *Hemigordius ovatus* GROZDILOVA – ALTINER *et al*., text-fig. 5 p. 205.
v. 2006 *Midiella ovata* (GROZDILOVA) – GAILLOT, p. 107, Pl. I.21, figs. 9, 12, 14, Pl. I.22, figs. 5, 8, 25.

Description: Medium-sized species with a relatively high and wide crescentic lumen in the oscillating part of the coiling.

Dimensions: D.= (0.340) 0.415-0.710 mm, w.= 0.245-0.375 mm, w/D= 0.53-0.59, p.d.= 0.125 mm, n.w.= 6, h.l.= 0.050-0.150 mm, w.t.= 0.010-0.030 mm.

Occurrence: Artinkian of Urals. Midian of Tunisia. Lopingian of Zagros (Kuh-e Surmeh).

Genus *Septigordius* gen. nov.

Type species: *Baisalina turgida* SOSNINA, 1983.

Synonyms: *Baisalina* (part); *Pseudomidiella* (part: e.g. *sensu* VACHARD *et al*., 2005).

Diagnosis: Homeomorphic to *Pseudomidiella*, but smaller and without buttresses.

Composition: *Baisalina turgida* SOSNINA, 1983; *B. consueta* SOSNINA, 1983; *B. flangensis* SOSNINA, 1983; *B. orbicula* SOSNINA, 1983; *B. pressula* SOSNINA, 1983; *B.* aff. *hunanica* LIN *sensu* VACHARD *et al.,* 2002, pl. 6, fig. 4 (only); *B. pulchra* REITLINGER (of many authors; i.e. all the references without quinqueloculine coiled initial stages: e.g. HUGHES, 2005, pl. 2, fig. 9; *Baisalina* sp. of *B. pulchra* group: OKIMURA *et al*., 1985, pl. 1, fig. 9); *B.* sp. *sensu* NGUYEN DUC TIEN, 1986a, pl. 1, fig. 16.

Remarks: Many *Baisalina* of the literature correspond in fact to this genus.

Occurrence: Late Early Permian-latest Permian. Palaeotethyan and Neotethyan.

Septigordius turgidus (SOSNINA, 1983)
(Pl. 21, fig. 9)

1983 *Baisalina turgida* sp. nov. – SOSNINA, p. 30-31, pl. 1, figs. 4-5.
v. 2006 *Septigordius turgidus* (SOSNINA) – GAILLOT, p. 107-108, Pl. I.38, fig. 9.

Dimensions: D.= 0.500 mm, w.= 0.450 mm, w/D= 0.90, n.w.= 6, p.d.= 0.035 mm, h.l.w.= 0.175 mm, w.t.= 0.050 mm.

Occurrence: Late Midian of Primorye. Midian/Wuchiapingian boundary of Zagros (Kuh-e Dena).

Genus *Arenovidalina* HO, 1959 *emend.* herein

Type species: *Arenovidalina chialingchangensis* HO, 1959.

Synonyms: *Mutidiscus* (part); *Hemigordius* (part); *Neohemigordius* (part) *sensu* PINARD & MAMET, 1998; *Permodiscus* sp. (part) *sensu* MILANOVIC, 1982; *Hemigordius*? *sensu* GROVES, 1992; ?*Agerina* FARINACCI, 1991 (part); *Ophthalmidium? sensu* ALTINER & ZANINETTI (1981, pl. 82, figs. 10, 14-16, 20-21, 26?).

Emended diagnosis: Test small, entirely planispiral involute; i.e. the coiling of *Multidiscus* (see below the diagnosis of this genus) but without buttresses (see below the diagnosis of Neodiscidae).

Composition: *Arenovidalina chialingchangensis* HO, 1959; *A. amylovoluta* HO, 1959; *A. crassa* SOSNINA *in* SOSNINA & NIKITINA, 1977; *A. orienta* SOSNINA, 1978; *A. ovoidea* SOSNINA *in* SOSNINA & NIKITINA, 1977; *A. rotunda* SOSNINA *in* SOSNINA & NIKITINA, 1977; *A. umbilicata* SOSNINA, 1978; *A. umbilicata forma lata* SOSNINA, 1978; *A. vulgaris* SOSNINA *in* SOSNINA & NIKITINA, 1977; *A.* sp. *sensu* KOBAYASHI *et al.* (2006, fig. 5. 29); "*A.*" sp. 1 *sensu* VACHARD & KRAINER, 2001b, pl. 5, fig. 1; *Hemigordius paraoliviformis* LIN, LI & SUN, 1990; *H. rectus* KIREEVA, 1958; *H. tenuithecus* KIREEVA, 1958; *H. umbilicatus* KIREEVA, 1958; *Hemigordius* sp. 1 *sensu* NGUYEN DUC TIEN, 1986a, pl. 5, fig. 1; ?*H.* sp. nov. *sensu* GROVES, 1992, pl. 3, figs. 1-16. *Multidiscus angulatus* LIN, 1984*; M. oliviformis* HAN, 1982; *M. padangensis sensu* GU *et al*., 2002 (pl. 1, figs. 18-19); *M.*? sp. *sensu* ALTINER & ÖZCAN-ALTINER (1998, pl. 4, fig. 18); *Neohemigordius beauchampi* PINARD & MAMET, 1998; *N. sverdrupensis* PINARD & MAMET, 1998; *Nummulostegina schuberti* LANGE, 1925; *Permodiscus* sp. *sensu* MILANOVIC, 1982.

Comparison: *Arenovidalina* differs from *Multidiscus emend.* herein by the differences of wall existing between Hemigordiidae and Neodiscidae. Among the Hemigordiidae, *Arenovidalina emend.* differs from *Hemigordius* by the smooth lenticular, inflated to rhombic profile and the planispiral second coiling, and from *Nikitinella* by absence of septation.

Remarks: Strictly speaking the subfamily Arenovidalininae ZANINETTI & RETTORI *in* ZANINETTI, RETTORI, HE & MARTINI, 1991 could be prioritary upon Hemigordiinae REITLINGER *in* VDOVENKO *et al*., 1993 but his exact status must be confirmed.

Occurrence: Late Pennsylvanian-Late Permian, probably cosmopolite; Early-Late Triassic, Tethys (including *Agerina*, the taxon attains the Early Jurassic, Pliensbachian). Especially, Midian of Transcaucasia, late Midian of Sumatra, Murgabian of Oman, Turkey and Iran. Changhsingian of Greece and southern China. Late Permian of Italy. Late Midian to late Changhsingian of Zagros, Fars (Iran). Dorashamian of Saudi Arabia. Triassic of southern-China and Japan.

Family Neodiscidae LIN, 1984 *nomen translat.* (*pro* subfamily) *emend.* herein

Synonyms: Baisalininae LOEBLICH & TAPPAN, 1986 *nomen translat.* PRONINA, 1994; Septagathammininae MIKHALEVICH, 1988.

Emended diagnosis: Large Miliolida test composed of a spherical proloculus followed by an undivided tubular chamber, with a thick wall, diversely coiled but generally composed of an early glomospiroid stage followed by a planispiral stage, evolute or semi-evolute diversely coiled: entirely glomospiral (*Crassiglomella* gen. nov.), initially glomospiral and then planispiral (or aligned) involute (*Neodiscus emend.*), glomospiral becoming planispiral evolute or seminvolute (*Graecodiscus emend.* herein including *Hemigordius magnus* RAUZER-CHERNOUSOVA *in* AKOPIAN, 1974 and *Neodiscus mirabilis* UENO, 1992b), planispirally involute compressed ("*Arenovidalina*" *sensu* BARYSHNIKOV, ZOLOTOVA & KOSHELEVA, 1982 *non* HO, 1959) or inflated (*Multidiscus s.s.*, if slightly deviated at the beginning: *Neohemigordius* WANG & SUN, 1973), agathamminoid, i.e., quinqueloculine (*Septagathammina*). The chamber is semicircular in section (some flosculinisations are observable in advanced forms of *Neodiscopsis* gen. nov., see below), the thick wall is reinforced by buttresses at the contact with the preceeding whorl. Aperture terminal simple.

Composition: *Neodiscus* MIKLUKHO-MAKLAY, 1953 *emend.* herein; *Crassiglomella* gen. nov.; *Graecodiscus* VACHARD *in* VACHARD *et al.*, 1993a; *Neohemigordius* WANG & SUN, 1973; *Uralogordius* gen. nov. (= *Arenovidalina sensu* BARYSHNIKOV, ZOLOTOVA & KOCHELEVA, 1982 *non* HO, 1959, *emend.* herein); *Multidiscus s.s.*; *Brunsispirella* gen. nov.; *Crassispirella* gen. nov.; *Neodiscopsis* gen. nov.; *Septagathammina* LIN, 1984; *Baisalina* REITLINGER, 1965; *Pseudomidiella* PRONINA-NESTELL *in* PRONINA-NESTELL & NESTELL, 2001.

Remarks: The Neodiscidae appear as the homeomorphs of the Hemigordiidae. They evolve probably as soon as the Early Permian with "*Hemigordius*" *ovatus* GROZDILOVA, 1956 or "*H.*" *permicus* GROZDILOVA, 1956, they are poorly known in the late Early Permian and Middle Permian, excepted the *Uralogordius* gen. nov. from Urals or Mexico. Their acme is situated in the Lopingian (maybe restricted to the late Changhsingian). Consequently, it is possible to imagine that many similar trends can exist repetitively among the Permian miliolata, as they exist among the Carboniferous endothyrida or tournayellida.

Occurrence: ?Sakmarian, ?Artinskian-Lopingian with a late Changhsingian acme. Palaeotethys from Greece to southern China; Neotethys: Taurids (Turkey), Zagros (southern Iran), Oman (Batain Plain).

Genus *Neodiscus* MIKLUKHO-MAKLAY, 1953 *emend.* herein

Type species: *Neodiscus milliloides* MIKLUKHO-MAKLAY, 1953.

Synonyms: *Glomospira* RZEHAK, 1885 (part); *Archaediscus* BRADY, 1873 (part).

Emended diagnosis: Neodiscidae initially glomospiral and finally planispiral involute to semi-involute. Buttresses well developed. High lumen of the whorls of the undivided chamber.

Composition: *Neodiscus milliloides* MIKLUKHO-MAKLAY, 1953; *N. eximius* LIN, LI & SUN, 1990; *N. grandis* LIN, LI & SUN, 1990; *N. lianxianensis* HAO & LIN, 1982; *N. orbicus* LIN, 1984; *N. ovatus sensu* LIN, LI & SUN 1990 or *sensu* UENO, 1992b (*non* GROZDILOVA, 1956); *N. plectogyraeformis* LIN, LI & SUN, 1990; *N. quinlongensis* WANG, 1976 (*orth. mut.* herein; *sic*: *qinglongensis*); *N. scitus* LIN, 1984; *Sp. nov.* B *sensu* KOBAYASHI, 2006b, figs. 4.17-18; *Agathammina* sp. B *sensu* KOBAYASHI, 1988, pl. 2, figs. 15, 22 (probably transitional to *Crassiglomella* gen. nov.); *Glomospira guangxiensis* LIN, 1978; *Hemigordius reicheli* LYS *in* LYS & LAPPARENT, 1971; *H. reicheli sensu* NGUYEN DUC TIEN, 1986a, pl. 5, fig. 6; *H. reicheli globulus nom. nud.* ALTINER, 1981, pl. 44, figs. 11-13; *Kamurana* or

Neodiscus sp. *sensu* ALTINER & ÖZKAN-ALTINER, 1998, pl. 4, fig. 19; *Neohemigordius maopingensis* WANG & SUN, 1973 (part).

Comparison: It differs from the other Neodiscidae by the type of coiling. In fact, *Neodiscus emend.* is very polymorph and some specimens in the populations are difficult to separate from *Neohemigordius*, "*Glomospira*" *guangxiensis*, or *Multidiscus s.s.* (see also the illustrations of KOBAYASHI, 2006b, as "*Neodiscus padangensis*").

Occurrence: Changhsingian of NW Caucasus (MIKLUKHO-MAKLAY, 1953: indicated also as present in the Early Triassic). Midian of Oman (VACHARD *et al.,* 2002), Tunisia and central Japan, Changhsingian of Greece (VACHARD *et al.,* 1993a, 1993b), Turkey (discovered in Hazro, and Himmetli: VACHARD, unpublished data), and southern China.

Neodiscus milliloides MIKLUKHO-MAKLAY, 1953
(Pl. 21, fig. 3?, Pl. 27, figs. 14-15, Pl. 53, figs. 1, 7, Pl. 54, fig. 2?, Pl. 71, figs. 7?, 8?)

1925 *Glomospira milioloides* JONES, PARKER & KIRBY – LANGE, p. 250-251, pl. 2, fig. 52.
1953 *Neodiscus milliloides* sp. nov. – MIKLUKHO-MAKLAY, p. 129, pl. 6, fig. 6.
? 1985 *Multidiscus* sp. of *M. padangensis* group – OKIMURA *et al.,* pl. 1, fig. 18.
? 1988a *Neodiscus* aff. *milliloides* M.-MACLAY – PRONINA, pl. 1, fig. 15.
? 1988b *Neodicus* aff. *milliloides* M-MACLAY – PRONINA, fig. 2.21.
? 1990 *Neodiscus maopingensis* (WANG & SUN) – LIN *et al.,* p. 202, pl. 22, figs. 7-8.
2003 *Neodiscus milliolides* (*sic*) – ALTINER *et al.,* p. 205, text-fig. 5.
2006b *Neodiscus padangensis* (LANGE) – KOBAYASHI, figs. 4. 1-13, 21.
v. 2006 *Neodiscus milliloides* MIKLUKHO-MAKLAY – GAILLOT, p. 110, Pl. II.24, figs. 1, 7, Pl. II.25, figs. 7?, 8?, Pl. II.26, fig. 2?, Pl. II.31, figs. 14-15.

Description: *Neodiscus* ovoid, sligthly asymmetrical, last whorls aligned, involute to semi-evolute. D.= (0.640) 1.100-1.550 mm (type-material: 2.000-2.500 mm), w.= 0.730-0.910 mm (type material= 1.000-1.600 mm), w/D= 0.66-0.69, p.d.= (0.060) 0.090 mm, n.w.= 6-7, h.l.= 0.100-0.145 mm, w.t.= 0.050-0.060 mm.

Remarks: Although smaller (D= 0.990-0.997 mm), specimens of *N. maopingensis sensu* LIN *et al.,* 1990 seem to be similar to *N. milliloides*.

Occurrence: ?Murgabian of Transcaucasia. Late Midian of Sumatra and central Japan. ?Kalabagh Member of Salt Range (Pakistan). Late Changhsingian of NW Caucasus, southern China and Zagros.

Neodiscus lianxanensis HAO & LIN, 1982
(Pl. 56, figs. 15-16)

1982 *Neodiscus lianxanensis* sp. nov. – HAO & LIN, p. 27, pl. 3, figs. 25-26.
1990 *Hemigordius lianxanensis* (HAO & LIN) – LIN *et al.*, p. 87, p. 213, pl. 25, figs. 4-5.
v. 2006 *Neodiscus lianxanensis* HAO & LIN – GAILLOT, p. 110-111, Pl. VI.10, figs. 15-16.

Diagnosis: Initial whorls streptospiral or oscillating forming a poorly individualized glomus. One or two last whorls becoming planispiral or slightly sigmoidal.

Dimensions: D.= 0.750-0.915 mm, w.= 0.620-0.650 mm, n.w.= 6-8, h.l.w.= 0.185 mm, w.t.= 0.040 mm.

Remarks: This species is transitional between *Neodiscus* and *Crassiglomella*. The Hazro specimens are smaller than the Chinese material of LIN *et al*. (1990) but have less whorls.

Occurrence: Chihsian of southern China (LIN *et al.*, 1990). Changhsingian of southern China (LIN *et al.,* 1990) and Hazro (this study).

Genus *Crassiglomella* gen. nov.

Type species: *Glomospira guangxiensis* LIN, 1978.

Synonym: *Glomospira* RZEHAK, 1885 (part).

Diagnosis: Neodiscidae entirely glomospiral. Buttresses well developed. High lumen of the whorls.

Composition: *Glomospira guangxiensis* LIN, 1978; *Agathammina* sp. A *sensu* KOBAYASHI, 1988, pl. 2, figs. 7-12; *A. pusulla* (*sic*) *sensu* NGUYEN DUC TIEN, 1986a, pl. 5, fig. 5; *A. pusilla sensu* BERCZI-MAKK, 1978, pl. 1, fig. 1; Foram. Indet. sp. *sensu* BERCZI-MAKK *et al.,* 1995, pl. 15, figs. 1-3; ?*Baisalina pulchra sensu* BERCZI-

MAKK *et al.,* 1995, pl. 13, figs. 3-4, 6-7, pl. 14, figs. 4-5, pl. 15, fig. 6?

Comparison: It differs from the other Neodiscidae by the entirely glomospiral coiling, and from the *Glomospira auct.* (= *Hemigordiellina* MARIE *in* DELEAU & MARIE, 1961 *sensu* VACHARD *in* VACHARD & BECKARY, 1991) by the large size and the buttresses.

Occurrence: Midian of Oman (VACHARD *et al.,* 2002) and central Japan (KOBAYASHI, 1988, re-interpreted), Lopingian of Cambodia (NGUYEN DUC TIEN, 1986a). Changhsingian of Greece (VACHARD *et al.,* 1993a, b). Turkey (discovered in Hazro; also present in Himmetli, VACHARD unpublished data). southern China. Zagros and Fars (Iran).

Crassiglomella guangxiensis (LIN, 1978)
(Pl. 22, figs. 14, 17?, Pl. 54, figs. 14, 16)

1965 *Glomospira* sp. – KOCHANSKY-DEVIDÉ, pl. 13, figs. 7-8.
? 1973 *Hemigordius* sp. – BOZORGNIA, pl. 41, figs. 1, 3.
1978 *Glomospira guangxiensis* sp. nov. – LIN, p. 11, pl. 1, figs. 2-3.
? 1981 *Hemigordius reicheli* LYS – ALTINER, pl. 44, figs. 9-10.
? 1990 *Neodiscus maopingensis* (WANG & SUN) – LIN *et al.,* p. 202, pl. 22, figs. 7-8.
? 1990 *Glomospira guangxiensis* LIN – LIN *et al*., p. 86 (no illustration).
1991 *Hemigordius* – BAUD *et al.,* pl. 1, fig. 1, pl. 2, fig. 1?.
v. 1993a *Glomospira* [(?) ou *Kamurana* (?)] *guangxiensis* LIN – VACHARD *et al.,* pl. 8, fig. 3.
v. 1993b *Multidiscus* ex gr. *padangensis* (LANGE) – VACHARD *et al.,* pl. 6, figs. 1, 3.
v. 1993b *Neodiscus milliloides* MIKLUKHO-MACLAY (*sic*) – VACHARD *et al.,* pl. 6, figs. 4-7.
v. 1993b *Kamurana*? sp. – VACHARD *et al.,* pl. 6, fig. 6.
2001 *Kamurana*? sp. – UENO, pl. 2, fig. 10.
non 2002 *Glomospira guangxiensis* LIN – GU *et al.,* p. 165, pl. 1, fig. 23 (a *Hemigordiellina*).
v. 2002 "*Glomospira*" ex gr. *guangxiensis* LIN – VACHARD *et al.,* pl. 6, fig. 1.
v. 2006 *Crassiglomella guangxiensis* (LIN) – GAILLOT, p. 111-112, Pl. II.26, figs. 14, 16.

Diagnosis: Buttresses very important. Last whorl partially evolute. Diameter less than 1 mm for 5-6 whorls.

Dimensions: D.= 0.590-0.915 mm, w.= 0.450-0.650 mm, w/D= 0.71-0.85, n.w.= 5-6, h.l.= 0.095-0.185 mm, w.t.= 0.017-0.040 mm.

Remarks: The types of sections and/or growths of the individuals are very diverse. Hence, some sections can be interpreted as *Neodiscus* or *Multidiscus* (see BOZORGNIA, 1973; ALTINER, 1981; VACHARD *et al.,* 1993a or LIN *et al.,* 1990). The material of Harzo shows that the taxa *Glomospira guangxiensis*, *Multidiscus arpaensis* and *Neodiscus* cf. *milliloides* distinguished in Greece by VACHARD *et al.* (1993a) correspond to the unique species *Crassiglomella guangxiensis* as emended herein.

Occurrence: Midian of Oman, Midian of Yunnan (UENO, 2001, updated herein). Lopingian of Croatia and Hungary. Wuchiapingian of southern China. Changhsingian of Greece, Turkey, southern China. Late Changhsingian of Abu Dhabi. Latest Changhsingian of Offshore Fars.

Genus *Multidiscus* MIKLUKHO-MAKLAY, 1953 *emend.* herein

Type species: *Nummulostegina padangensis* LANGE, 1925.

Synonyms: *Hemigordius* (part); *Neohemigordius* WANG & SUN, 1973 *s.s.*.

Emended diagnosis: Test large, entirely planispiral involute. Buttresses and ogival-shaped to semi-circular section of the whorl.

Composition: *Nummulostegina padangensis* LANGE, 1925 (D.= 1.250 mm for 5.5 whorls); *Multidiscus padangensis sensu* MIKLUKHO-MAKLAY (*non* LANGE, 1925) = ?*M. obesus* LIN, LI & SUN, 1990 (D= 1.240 mm); *M. arpaensis* PRONINA, 1988b (D= 0.600 mm for 5-7 whorls); *M. guangxiensis* LIN, 1978 (D= 0.410 mm for 6 whorls); *M. guangxiensis* LIN, Li & SUN, 1990 *non* LIN, 1978 = *M. padangensis sensu* VACHARD *et al.,* 1993b; *M. obesus* LIN, LI & SUN, 1990; *M. robustatus* LIN, 1978; *M. semiconcavus* WANG, 1976; *M. talimuensis* HAN *in* ZHAO *et al.,* 1984; *M.? tauridiana* OKUYUCU, 1999; *M.*? sp. A *sensu* KOBAYASHI, 2006b, figs. 4. 14-16; *Hemigordius abriolensis* LUPERTO, 1966; *H. depressus* LUPERTO, 1966; *Neohemigordius maopingensis* WANG & SUN, 1973 (part); *Permodiscus* sp. *sensu* MILANOVIC, 1982.

Occurrence: ?Late Early Permian of southern China (LIN *et al.,* 1990, p. 89). Midian of Transcaucasia, late Midian of Sumatra, Murgabian of Oman, Turkey and Iran. Changhsingian of Greece. southern China. Late Permian of Italy. Late Midian to late Changhsingian of Zagros, Fars (Iran). Dorashamian of Saudi Arabia.

Multidiscus arpaensis PRONINA, 1988b
(Pl. 65, fig. 10, Pl. 66, fig. 13, Pl. 71, fig. 6?)

1988b *Multidiscus arpaensis* sp. nov. – PRONINA, p. 57-58, fig. 3.3.
1989 *Multidiscus arpaensis* PRONINA – KOTLYAR *et al.,* pl. 1, fig. 25.
v. 2006 *Multidiscus arpaensis* PRONINA – INSALACO *et al.,* pl. 1, fig. 11.
v. 2006 *Multidiscus arpaensis* PRONINA – GAILLOT, p. 112, Pl. I.21, fig. 10, Pl. II. 23, fig. 13, Pl. II.25, fig. 6, Pl. VI.10, fig. 13.

Dimensions: D.= 0.440-0.720 mm, w.= 0.270-0.420 mm, w/D= 0.57-0.62, p.d.= 0.050-0.070 mm, n.w.= 6.5-7, h.l.= 0.060-0.080 mm, w.t.= 0.010-0.020 mm.

Remarks: Test subrhombic with smooth periphery, coiling with slight deviations, and proloculus oval, relatively large.

Occurrence: Midian (Arpa Formation) of Transcaucasia. Capitanian-Lopingian of Zagros (Kuh-e Surmeh). Lopingian of Fars. Changhsingian of Hazro.

Multidiscus spp.
(Pl. 14, figs. 16-17, Pl. 21, fig. 5, Pl. 54, figs. 7, 10, 13, Pl. 56, figs. 13, 17-18, Pl. 59, figs. 13, 16, Pl. 66, figs. 3, 7, Pl. 67, figs. 12, 17-18, 22-23)

v. 2005 *Multidiscus* spp. – VACHARD *et al.,* p. 163-164, pl. 2, figs. 16-17.
v. 2006 *Multidiscus* spp. – Gaillot, p. 113, Pl. I.22, figs. 12, 17-18, 22-23, Pl. II.22, figs. 13, 16, Pl. II.23, figs. 3, 7, Pl. II.26, figs. 7, 10, 13, Pl. V.2, figs. 16-17, Pl. VI.10, figs.17-18.

Description: Three groups of specimens of *Multidiscus* were observed in my material. In Hazro section, the first one (*M*. sp. 1: Pl. 56, fig. 13) measures: D.= 0.440 mm and w.= 0.270 mm for 6 whorls. It might be transitional between *Multidiscus* and *Crassispirella*. The second one (*M*. sp. 3: Pl. 56, fig. 18) is comparable with *M. schuberti* (LANGE, 1925) or *M. talimuensis* HAN *in* ZHAO *et al.,* 1984 (with D= 0.550 mm, w.= 0.260 mm for 6 whorls). The third (*M*. sp. 2: Pl. 56, fig. 17) with D= 0.870 mm and w.= 0.400 mm for 6 whorls, has some similarities with *Multidiscus* sp. B of UENO & SAKAGAMI (1993, fig. 3. 6-11).

Occurrence: Late Wuchiapingian and late Changhsingian of Fars. Changhsingian of Zagros (Kuh-e Surmeh). Midhnab and lower Khartam members (Changhsingian) of Saudi Arabia. Changhsingian of Hazro.

Genus *Uralogordius* gen. nov.

Type species: *Arenovidalina novosjolovi* BARYSHNIKOV *in* BARYSHNIKOV *et al.,* 1982.

Synonyms: *Glomospira* RZEHAK, 1885 (part); *Arenovidalina sensu* BARYSHNIKOV *et al.,* 1982, VACHARD *et al.,* 2000 and VACHARD & BOUYX, 2001.

Diagnosis: Neodiscidae entirely planispispiral, lenticular, often biumbilicate. Buttresses welll developed. High lumen of the whorls. Porcelaneous wall generally well preserved.

Composition: *Arenovidalina novosjolovi* BARYSHNIKOV *in* BARYSHNIKOV *et al.,* 1982; *A. planispiralis* BARYSHNIKOV *in* BARYSHNIKOV *et al.,* 1982; *"A."* (*sic* for the inverted commas) cf. *planispiralis sensu* VACHARD & BOUYX (2001, pl. 10, fig. 7); *A. rhombiformis* BARYSHNIKOV *in* BARYSHNIKOV *et al.,* 1982; *A. schirjaevae* BARYSHNIKOV *in* BARYSHNIKOV *et al.,* 1982; *A. schirjaevae compressa* BARYSHNIKOV *in* BARYSHNIKOV *et al.,* 1982; *A. umbonata* BARYSHNIKOV *in* BARYSHNIKOV *et al.,* 1982; *Glomospira miranda* LIPINA, 1949; ?*Multidiscus*? sp. B *sensu* KOBAYASHI, 2006b, fig. 4.19; *Hemigordius magnus* RAUZER-CHERNOUSOVA *in* AKOPIAN, 1974; *Neodiscus mirabilis* UENO, 1992b.

Comparison: It differs from the other Neodiscidae by the entirely planispiral coiling and the parallel sometimes biumbilicate flanks, and from the "*Multidiscus*" *auct.* (= *Arenovidalina* HO, 1959 *emend.* herein) by the large size, and the buttresses.

Remarks: With *Uralogordius* the wall of the Hemigordiidae evolves to the wall of the Neodiscidae. The wall of the Hemigordiidae comes from the thin wall of the Cornuspiridae by adjonction of lateral plug at each whorl (see the views in 3D of some *Hemigordius* of the literature). The wall of the Neodiscidae differs by an involute development of buttresses from the lumen of the tube extending to the umbilicus of the test (particularly obvious in the type material of *Uralogordius nojolovski*). This type of development exists in the Neodiscidae and the Hemigordiopsidae and probably to the Triassic involutinids.

Occurrence: Early Permian of Urals (Lipina, 1949; Baryshnikov *et al.*, 1982) and Mexico (Vachard *et al.,* 2000). Early Permian of Armenia (Rauzer-Chernousova *in* Akopian, 1974). Kubergandian of northern Afghanistan (Vachard & Bouyx, 2001). Late Murgabian of Japan (Ueno, 1992b). ?Midian of Japan (Kobayashi, 2006b).

Genus *Brunsispirella* gen. nov.

Type species: *Glomospirella? linae* Vachard & Gaillot *in* Vachard *et al.,* 2005.

Etymology: Because of the morphological similarities with the genera *Brunsia* and *Crassispirella*.

Synonyms: *Glomospirella*? (part: *sensu* Vachard *et al.,* 2005); *Glomospirella* (part); *Hemigordius* (part); *Discospirella* (Okimura & Ishii); *Okimuraites*? *sensu* Ueno (2001).

Diagnosis: Test homeomorphic to *Brunsia* which consists of a proloculus followed by an undivided chamber, planispiral coiled, involute, rarely evolute in the last whorls. Some initial whorls are slightly glomospirally coiled. Aperture terminal simple. Proportionally medium-sized porcelaneous wall with buttresses.

Comparison: Test homeomorphic to *Brunsia* but fundamentally different by a porcelaneous and not microgranular wall (in fact this difference is very difficult to made, the control is essentially biostratigraphical, indirect, and of course very criticable, but *Brunsia* is Late Tournaisian-Viséan in age). *Brunsispirella* gen. nov. differs from *Okimuraites* or "*Neohemigordius*" *sensu* Pinard & Mamet, 1998, by the buttresses and the larger size. It differs from *Hemigordius* by a larger size, thicker wall, the very small streptospiral initial part, and the strictly planispiral terminal part. It differs from small species of *Arenovidalina emend.* by the discoidal and not inflated test, and from the most regular *Hoyenella* by the lateral thickenings.

Composition: *Glomospirella? linae* Vachard & Gaillot *in* Vachard *et al.,* 2005; *Hemigordius guvenci* Altiner, 1978; ?*H.* sp. 5 *sensu* Vuks & Chediya, 1986, pl. 9, fig. 6 (only); *H.* sp. 13 *sensu* Vuks & Chediya, 1986, pl. 9, figs. 13-14; "*H.* sp., forme aplatie et sans masse ombilicale" *sensu* Köylüoglu & Altiner, 1989, pl. 11, fig. 9; *Discospirella plana* (Okimura & Ishii) *sensu* Baghbani, 1993, pl. 6, fig. 3; *D. minima* (Okimura & Ishii) *sensu* Baghbani, 1993, pl. 6, fig. 4; *Hemigordius*? sp. A *sensu* Ueno, 2001, pl. 2, figs. 19-20; *Okimuraites*? cf. *O. guvenci* (Altiner) *sensu* Ueno, 2001, pl. 2, figs. 21-22, 24; *Hemigordius*? sp. B *sensu* Ueno, 2001, pl. 2, fig. 23. In general, the brunsiiforms of the Permian and Triassic (i.e. the species *regularis, spirillinoides, parallela*, etc.) belong to this genus. They are mentioned from the late Chihsian in southern China (Lin *et al.,* 1990).

Occurrence: Late Changhsingian in Saudi Arabia. Late Changhsingian of Primorye. Midian-Lopingian of central Iran (Abadeh). Lopingian in Persian Gulf. Late Changhsingian of southern China. Changhsingian of Turkey (Hazro).

Brunsispirella linae (Vachard & Gaillot *in* Vachard *et al.,* 2005)

(Pl. 22, figs. 28, 29?, 30-31, Pl. 56, figs. 1-2, 4-7, 12, Pl. 60, fig. 1, Pl. 68, figs. 6, 9-10, 13, 15-17, 20)

1978 *Glomospirella spirillinoides* Lipina – Lin, p. 12, pl. 1, figs. 11-12.
1981 *Glomospirella spirillinoides* (Grozdilova & Glebovskaya) – Zhao *et al.,* pl. 1, figs. 8, 9.
1993 *Discospirella plana* (Okimura & Ishii) – Baghbani, pl. 6, fig. 3.
1993 *Discospirella minima* (Okimura & Ishii) – Baghbani, pl. 6, fig. 4.
v. 2005 "*Glomospirella spirillinoides*" (Grozdilova &

GLEBOVSKAYA) – VASLET *et al.,* p. 115 (no illustration).

v. 2005 *Glomospirella*? *linae* sp. nov. – VACHARD *et al.,* p. 157, 159, pl. 4, figs. 3-17.

v. 2006 *Brunsispirella linae* (VACHARD & GAILLOT) – GAILLOT, p. 114-115, Pl. II.19, figs. 6, 9-10, 13, 15-17, 20, Pl. II.20, fig. 1, Pl. V.4, figs. 3-17, Pl. VI.9, figs. 28, 29?, 30-31, Pl. VI.10, figs. 1-2, 4-7, 12.

Description: The type species of *Brunsispirella* is characterized by its relative large size, small irregular initial stage, lumen of the tube hemicircular to bean-shaped, and wall relatively thick. Test discoidal, generally deeply biumbilicate. The irregularly coiled initial part consists of 1-2 oscillating whorls; the diameter of the initial part does not exceed 1/5 of the test diameter. The adult second part consists of 4-5 aligned to planispiral whorls. The width and height of deuteroloculus increases slowly. The transverse section of this deuteroloculus is hemicircular to bean-shaped. Proloculus is spherical and relatively large, but megalo- and microspheric specimens exist. Wall porcelaneous, relatively thick. Some well preserved specimens show the initial porcelaneous wall, i.e., amber-coloured becoming black.

Dimensions: D.= (0.350-0.435) 0.520-1.180 mm, w.= (0.100-0.110) 0.120-0.220 mm, w/D= 0.16-0.21 (0.22-0.26), n.w.= (4-4.5) 5.5-7, p.d.= 0.020-0.050 mm, h.l.= (0.040) 0.060-0.100 mm, w.t.= (0.005) 0.010-0.030 (0.050) mm.

Comparison: *Brunsispirella linae* differs from the Permian *Hoyenella* by the weakly deviation of the initial whorls and the numerous aligned involute whorls; it differs from the species of *Hoyenella* mentioned above by their dimensions or the number of whorls compared to the size; it differs from *Brunsia spirillinoides* (GROZDILOVA & GLEBOVSKAYA) by the porcelaneous wall and not microgranular (i.e. by the belonging to the class Miliolata and not to the class Fusulinata). It differs from *Okimuraites* by a larger size, thicker wall, very small streptospiral initial part, and the strictly planispiral terminal part.

Occurrence: Dorashamian (Midhnab and lower Khartam members) of Saudi Arabia. Changhsingian of southern China. Late Capitanian (Abadehian)-Lopingian of central Iran (Abadeh). Lopingian of Persian Gulf, Turkey.

Genus *Crassispirella* gen. nov.

Type species: *Crassispirella hughesi* sp. nov.

Etymology: Latin *crassus* (= fat), *spira* (= spire); i.e. thick-walled.

Diagnosis: Test similar to *Hoyenella emend.* herein, but larger, thick-walled and relatively small initial glomospiral stage. Test consists of a proloculus followed by an undivided chamber. Planispiral coiling evolute. Some initial whorls are faintly glomospirally coiled. Aperture terminal simple. Thick porcelaneous wall.

Comparison: *Crassispirella* gen. nov. differs from *Hoyenella* by its characters of Neodiscidae plus the large size and the thick wall. The proportions between *Hoyenella* and *Crassispirella* are more or less similar to those existing between the two tournayellid genera *Tournayella* and *Eoforschia*. The difference with *Graecodiscus* is the long evolute last stage.

Composition: *Crassispirella hughesi* sp. nov.; *Hemigordius*? sp. A *sensu* UENO, 2001, pl. 2, figs. 19-20; *H.*? sp. B *sensu* UENO, 2001, pl. 2, fig. 23.

Occurrence: Late Changhsingian of Saudi Arabia. Late Changhsingian of southern China. Changhsingian of Turkey (Hazro). Lopingian of Persian Gulf.

Crassispirella hughesi sp. nov.

(Pl. 55, fig. 3, Pl. 56, figs. 10, 11?, Pl. 58, figs. 17-19, Pl. 59, figs. 7-10, 12, Pl. 66, figs. 17-18, Pl. 68, figs. 7-8, 11-12, 14, 18-19, Pl. 69, fig. 4, Pl. 71, fig. 2?)

? 2005 *Hemigordius* sp. – HUGHES, pl. 2, fig. 10 (or maybe another species of *Crassispirella*).

2005 *Hemigordius* sp. – HUGHES, pl. 2, fig. 11.

2005 *Brunsiella concava* SPANDEL – HUGHES, pl. 2, fig. 12.

? 2005 *Hemigordius* sp. – HUGHES, pl. 2, figs. 14-15.

v. 2006 *Crassispirella hughesi* sp. nov. – GAILLOT & VACHARD *in* GAILLOT, p. 115-116, Pl. II.19, figs. 7-8, 11-12, 14, 18-19, Pl. II.21, figs. 17-19, Pl. II.22, figs. 7-10, 12, Pl. II.23, figs. 17-18, Pl. II.25, fig. 2?, Pl. II.34, fig. 4, Pl. III.19, fig. 3, Pl. VI.10, figs. 10, 11?

Etymology: Dedicated to Dr G.W. HUGHES, from Aramco, who first illustrated the species.

Diagnosis: Test very large, discoid to biconcave, with slightly developed initial glomus, followed by aligned whorls and a last evolute whorl. Wall with buttresses.

Dimensions: D.= 0.700-0.900 mm, w.= 0.150-0.280 mm, w/D= 0.32-0.47, n.w.= 5-6, h.l.= 0.070-0.170 mm, w.t.= 0.020-0.060 mm.

Holotype: Pl. 56, fig. 10 (sample 03HZ47).

Type material: 27 (perhaps 31) specimens.

Repository of the types: Collection of Palaeontology of Lille 1 University (France).

Comparison: The coiling is similar to that of the Viséan genus *Brunsia*, but the size is very larger and the wall is porcelaneous, not microgranular. It differs from *Brunsispirella* by the type of coiling, the numerous aligned involute whorls (and correlatively the rarity of evolute whorls) and the presence of buttresses.

Remarks: This species is probably one of the largest planispiral evolute tests in the history of the foraminifers. Because of the basic character of this planispiral evolute form (one of the most primitive from the Early Cambrian; see the specimens described by CULVER, 1991, 1994), and its repetitive re-appearances, often with an important change of mineralogy, after each mass-extinction crisis (Famennian, Hastarian, earliest Triassic), *Crassispirella* might become an important element for the foraminiferal evolution near the PTB.

Occurrence: Lopingian (apparently endemic of the Hazro-Persian Gulf-Saudi Arabia area).

Crassispirella sp.

(Pl. 2, fig. 20, Pl. 54, figs. 3, 5, 8-9, Pl. 61, figs. 16, 18, Pl. 63, fig. 9, Pl. 69, fig. 7)

v. 2006 *Crassispirella* spp. – GAILLOT, p. 116, Pl. I.20, fig. 20, Pl. I.38, fig. 3, Pl. II.26, figs. 3, 5, 8-9, Pl. II.34, fig. 7, Pl. III.8, figs. 5?, 6?, 8?, Pl. III.26, fig. 9, Pl. IV.4, fig. 1, Pl. IV.6, figs. 16, 18.

Remarks: These sections can belong to another species than *C. hughesi* gen. nov. sp. nov.

Occurrence: Late Capitanian-Lopingian of Zagros. Changhsingian of Fars. Late Changhsingian of Abu Dhabi.

Genus *Neodiscopsis* gen. nov.

Type species: *Hemigordius specialis* LIN, LI & SUN, 1990.

Diagnosis: Test inflated lenticular to discoid, large, in the initial part coiled as *Neodiscus* and terminal whorl, aligned, flosculinised, semievolute to evolute. Pseudosepta are sporadically present in the last whorl.

Remarks: Neodiscidae with numerous whorls initially sigmoidal or aligned and after tending to be oscillating or sigmoidal. The lumen is relatively high in the first whorls and can be invaded by flosculinisation in the last whorls. In this sense, the development of the tube is different to that of *Kamurana*, already described in the Lopingian of Turkey. The whorls are numerous; their number attains 8 for a diameter of 0.700 mm in the holotype of *N. specialis*.

Composition: *Hemigordius specialis* LIN, LI & SUN, 1990; *Hemigordius rotundus* WANG, 1982 and *sensu* LIN *et al.,* 1990; *H.* sp. *sensu* KOBAYASHI, 2006e, pl. 2, figs. 29-30; ?*Agathammina* spp. *sensu* KOBAYASHI, 2006b, figs. 22, 24-25, 26?; ?*A.* sp. *sensu* KOBAYASHI, 2006c, pl. 3, figs. 30-31 and KOBAYASHI, 2006e, pl. 2, figs. 22-23; *A.*? sp. *sensu* KOBAYASHI, 2006d, figs. 41, 43; *Multidiscus robustatus* LIN, 1978 (*non* LIN *et al.,* 1990); *Neodiscus paraovatus* LIN, LI & SUN, 1990; Sp. nov. B *sensu* KOBAYASHI, 2006b; *Neodiscopsis ambiguus* sp. nov.; *N. canutii* sp. nov.; *N. graecodisciformis* sp. nov..

Comparison: It differs from *Neodiscus* by the flosculinisation (i.e., the reduced lumen) at the end of the coiling; from *Multidiscus*, *Neohemigordius s.s.* and *Graecodiscus* by the long streptospiral initial stage; and from *Glomomidiellopsis* by the type of coiling and less developed flosculinisation.

Occurrence: ?Late Midian of Japan. Changhsingian of Japan, Late Capitanian-Lopingian of southern China, Hazro (Turkey), and Zagros.

Neodiscopsis specialis (LIN, LI & SUN, 1990) *emend.* herein

(Pl. 55, fig. 1, Pl. 58, figs. 3, 5-8, 11-12, 14, Pl. 59, fig. 3, Pl. 60, figs. 9-11, 14, 16, 18, Pl. 61, fig. 8, Pl. 66, figs. 4-6, 9, 11-12, 16, Pl. 69, figs. 3, 6?, Pl. 70, fig. 2)

1990 *Hemigordius specialis* sp. nov. – LIN, LI & SUN, p. 216, pl. 25, figs. 28-30.
v. 2006 *Neodiscopsis specialis* (LIN, LI & SUN) – GAILLOT, p. 116-117, Pl. I.40, fig. 2, Pl. II.20, figs. 9-11, 14, 16, 18, Pl. II.21, figs. 3, 5-8, 11-12, 14, Pl. II.22, fig. 3, Pl. II.23, figs. 4-6, 9, 11-12, 16, Pl. II.34, figs. 3, 6?, Pl. III.8, figs. 3-4, Pl. III.19, fig. 1, Pl. IV.6, fig. 8.

Emended diagnosis: Test large, compressed, with internal whorls aligned forming glomus at the penultimate whorl and followed by a semi-evolute deviated last whorl. Pseudosepta are sporadically present in the last whorl.

Dimensions: D.= (0.600-0.700) 0.910-1.400 mm, w.= (0.460-0.530) 0.600-0.700 mm, w/D= 0.45-0.53 (0.69-0.70), p.d.= 0.040-0.070 mm, n.w.= (5-6) 7-8 (10), h.l.= (0.090-0.100) 0.120-0.190 mm, w.t.= 0.020-0.030 (0.050) mm.

Comparison: The dimensions indicated for the type material are smaller (D.= 0.660-0.810 mm), but as important variations in size occur of the material of Zagros, the specific attribution to the Chinese taxon is nevertheless admitted.

Occurrence: Changhsingian of southern China. Wuchiapingian-early Changhsingian of Persian Gulf.

Neodiscopsis ambiguus sp. nov.
(Pl. 53, fig. 10, Pl. 64, figs. 3, 5-6, 12)

1997 *Hemigordius* sp. – KOBAYASHI, pl. 4, figs. 20-24.
v. 2005 *Hemigordius baoqingensis* WANG – VACHARD *et al.,* p. 161-162, pl. 5, figs. 4-6, 11.
v. 2005 *Neodiscus* aff. *qinglongensis* WANG – VACHARD *et al.,* p. 162, pl. 5, figs. 3, 7-10.
p.p.? 2006d *Agathammina*? sp. – KOBAYASHI, pl. 2, figs. 41, 43 (perhaps a distinct subspecies or species due to the more numerous semievolute last whorls) (*non* fig. 42= true *Agathammina*).
v. 2006 *Neodiscopsis ambiguus* sp. nov. – GAILLOT & VACHARD *in* GAILLOT, p. 117, Pl. I.39, figs. 3, 5-6, 12, Pl. II.24, fig. 10 , Pl. V.5, figs. 3-11 (*nomen nudum*).

Etymology: Latin *ambiguus*, ambiguous, because difficult to distinguish from *Hemigordius s.l.*, *Neodiscus* or *Pseudomidiella*.

Type locality: Kuh-e Dena (Zagros, Iran).

Type level: Early Wuchiapingian.

Diagnosis: Only 1 to 1.5 semi-evolute whorl after a initial sigmoidal coiled glomus. Last whorl with slight pseudosepta.

Description: The relatively large proloculus, ovate or spherical, is followed by a spire with a high and wide, reniform lumen. The initial whorls are sigmoidally coiled with a wall that increases progressively in thickness. The transverse sections are compressed and look like a *Hemigordius*. The axial to subaxial sections are difficult to distinguish from *Neodiscus* sections. The penultimate whorl forms a glomus. The last whorl is assymetrical, strongly deviated and semi-involute. Faint pseudosepta are sporadically present in this last whorl.

Dimensions: D.= 0.340-0.820 mm, w.= 0.200-0.480 mm, w/D= 0.37-0.46, p.d.= 0.050-0.070 mm, n.w.= 5-8.

Holotype: Pl. 64, fig. 3 (sample DN-095).

Type material: Approximately 50 specimens.

Repository of the types: CST TOTAL (Pau, France). and BRGM, Orléans.

Comparison: *N. ambiguus* sp. nov. differs from *N. graecodisciformis* sp. nov. by the smaller size, more compressed test, less semi-evolute last whorls and from *N. canutii* sp. nov. by the same criteria and mainly by the complete absence of flosculinisation. In Saudi Arabia, *N. ambiguus* sp. nov. seems to occupy the biotopes of diasappeared *Shanita* (i.e., intertidal, rather agitated, and colonized by cyanobacterial mats resulting in peloids linked by meniscus-cements).

Occurrence: Duhaysan-Midhnab (=late Wuchiapingian-early Changhsingian?) members of Saudi Arabia. Lopingian of Japan. Wuchiapingian of Zagros (Kuh-e Dena).

Neodiscopsis canutii sp. nov.
(Pl. 22, figs. 8-9)

1970 *Agathammina* sp. – CANUTI *et al.,* fig. 14.7-9.
1979 *Hemigordius* sp. – WHITTAKER *et al.,* pl. 2, fig. 14.
v. 2006 *Neodiscopsis canutii* sp. nov. – GAILLOT & VACHARD *in* GAILLOT, p. 118, Pl. VI. 9, figs. 8-9 (*nomen nudum*).

Etymology: Dedicated to Dr. P. CANUTI for his pioneer work in Hazro.

Type locality: Hazro section (Turkey).

Type level: Changhsingian.

Diagnosis: Test large, relatively inflated, with initial streptospiral coiling relatively regular and tending to a sigmoidal one, two last whorls poorly flosculinised and still relatively high.

Description: Penultimate whorl semi-evolute last whorl evolute. Incomplete microsparitization, and original wall relatively preserved. D.= 0.825-0.840 mm, w.= 0.245-0.415 mm, w/D= 0.30-0.49, p.d.= 0.60 mm, n.w.= 7, h.l.= 0.110-0.200 mm, w.t.= 0.033-0.055 mm.

Holotype: Pl. 22, fig. 9 (sample 03HZ05).

Type material: 13 (perhaps 17) specimens.

Repository of the types: Collection of Palaeontology of Lille 1 University (France).

Comparison: All the other species seem to be more advanced and further from the *Neodiscus*-ancestor (this work).

Occurrence: Late Midian of Hazro, Taurus, Iran and central Myanmar.

Neodiscopsis graecodisciformis sp. nov.
(Pl. 14, fig. 19, Pl. 55, fig. 12, Pl. 58, fig. 10, Pl. 59, figs. 6, 11, 17, 21, Pl. 60, fig. 8, Pl. 61, fig. 9, Pl. 63, figs. 7-9, Pl. 65, figs. 1-2, 8, 10, 15, Pl. 68, figs. 4-5, Pl. 69, figs. 1-2)

? 2005 *Agathammina pusilla* Geinitz – Hughes, pl. 2, fig. 5.
? 2005 *Palaeoglomospira* sp. – Hughes, pl. 23, figs. 6-8.
v. 2005 *Graecodiscus* cf. *kotlyarae* Pronina-Nestell & Nestell – Vachard *et al.,* p. 164, pl. 2, fig. 19.
v. 2006 *Neodiscopsis graecodisciformis* sp. nov. – Gaillot & Vachard *in* Gaillot, p. 118-119, Pl. I.39, figs. 7-9, Pl. II.19, figs. 4-5, Pl. II.20, fig. 8, Pl. II.21, fig. 10, Pl. II.22, figs. 6, 11, 17, 21, Pl. II.23, figs. 1-2, 8, 10, 15, Pl. II.34, figs. 1-2, Pl. III.19, fig. 12, Pl. IV.6, fig. 9, Pl. V.2, fig. 19 (*nomen nudum*).

Etymology: A *Neodiscopsis* with a coiling similar to that of *Graecodiscus*.

Type locality: Zagros zone 2 (see Fig. 2A).

Type level: Late Wuchiapingian.

Diagnosis: The central glomus is followed by 2.5-3 semi-evolute whorls. Buttresses well developed. No flosculinisation.

Dimensions: D.= 0.440-1300 mm, w.= 0.200-0.430 mm, w/D= 0.24-0.58, p.d.= (0.030) 0.050-0.085 mm, n.w.= (4-5) 6-8, h.l.= 0.060-0.200 mm, w.t.= 0.010-0.025 (0.070) mm.

Holotype: Pl. 59, fig. 21.

Type material: 30 to 40 sections.

Repository of the types: CST TOTAL (Pau, France).

Occurrence: Duhaysan Member (late Wuchiapingian) of Saudi Arabia. Wuchiapingian of Fars and Abu Dhabi. Early Wuchiapingian-early Changhsingian of Zagros.

Genus *Septagathammina* Lin, 1984

Type species: *Septagathammina hubeiensis* Lin, 1984.

Synonyms: *Agathammina* (part).

Diagnosis: Test similar in coiling to *Agathammina* but larger and with buttresses and pseudosepta.

Comparison: *Septagathammina* differs from *Agathammina* by the pseudoseptation and the characters of the Neodiscidae compared to those of the Hemigordiidae.

Composition: *Septagathammina hubeiensis* Lin, 1984; *S. pulchra* Lin, 1984; *S. xintanensis* Lin, 1984; *S.* sp. *sensu* Pronina & Nestell, 1997; *Fusulinella arenacea* Lange, 1925; *Septagathammina splendens* sp. nov.; *Baisalina elliptica* Lin, 1978; ?*Agathammina* sp. 2 *sensu* Vuks & Chediya, 1986 (pl. 9, figs. 16-17); *A. ampla* Lin, 1984; *Glomospira asymmetrica* Han, 1982; *Agathammina bella* Pronina, 1988b; *A. psebaensis* Pronina-Nestell *in* Pronina-Nestell & Nestell, 2001; *A.* spp. *sensu* Yanagida *et al.,* 1988, pl. 4, fig. 7-14; *A.*? sp. *sensu* Nguyen Duc Tien, 1986a, pl. 5, fig. 4.

Occurrence: Late Chihsian to Wuchiapingian of southern China (Lin *et al.,* 1990, p. 95). Late Midian of Sumatra, Cambodia and Transcaucasia. Lopingian of Crimea. Changhsingian of NW Caucasus, ?Hungary, Zagros, Thailand and ?Primorye.

Septagathammina splendens sp. nov.
(Pl. 54, fig. 1, Pl. 58, fig. 15?, Pl. 60, fig. 13, Pl. 71, fig. 1)

v. 2006 *Septagathammina splendens* sp. nov. – Gaillot & Vachard *in* Gaillot, p. 119, Pl. II.20, fig. 13, Pl.

II.21, fig. 15?, Pl. II.25, fig. 1, Pl. II.26, fig. 1 (*nomen nudum*).

Etymology: Latin *splendens* = splendid.

Diagnosis: Large species, moderately compressed, with a maximal number of chambers of 10. Pseudosepta rather poorly developed.

Dimensions: H.= 0.900-1.240 mm, w.= 0. 455-0.720 mm, w/H= 0.41-0.58, n.w.= 8-10, p.d.= 0.065 mm.

Holotype: Pl. 71, fig. 1 (sample 2968.80).

Type material: 12 specimens.

Repository of the types: CST TOTAL (Pau, France).

Comparison: This species is smaller than *S. ampla* and *S. asymmetrica*. It is more compressed than *S. bella* (PRONINA), and less than *S. psebaensis* (PRONINA-NESTELL & NESTELL, 2001).

Occurrence: Lopingian of Zagros-Fars.

Family Hemigordiopsidae NIKITINA, 1969 *emend.* herein

Synonyms: Kamuraninae TRIFONOVA, 1984, Shanitidae LOEBLICH & TAPPAN, 1986, ?Baisalinidae *sensu* LOEBLICH & TAPPAN, 1986 (part?).

Emended diagnosis: Test large, entirely streptospiral or initially streptospiral with a planispiral coiling in the terminal stage, involute. Undivided tube, or presence of pseudosepta or true pillars. Diagenetic features of the wall were interpreted as perforations but would correspond more to the "en dent de peigne" (comb teeth shaped) aspect of GARGOURI & VACHARD (1988).

Composition: *Hemigordiopsis* REICHEL, 1945 (= *Gansudiscus* WANG & SUN, 1973 = *Lysites* REITLINGER *in* VDOVENKO *et al*., 1993); *Shanita* BRÖNNIMANN, WHITTAKER & ZANINETTI, 1978; *Glomomidiellopsis* gen. nov.; *Kamurana* ALTINER & ZANINETTI, 1977.

Remarks: Ancestors of *Hemigordiopsis*, in Kubergandian-Murgabian, are not known. *Hemigordiopsis* is typically Midian in age (TERMIER *et al*., 1977 updated; PRONINA, 1988a). Observations made during this study suggest that during the Midian, *Hemigordiopsis* gave rise to *Glomomidiellopsis tieni* gen. nov. sp. nov. (late Midian in age in Cambodia, NGUYEN DUC TIEN, 1979, 1986a), which would be, in the early Wuchiapingian, the common ancestor of the two following lineages: (1) *Neodiscopsis-Kamurana*, and (2) *Glomomidiellopsis uenoi-G. lysitiformis*. The first lineage is morphologically very different from *Neodiscus*, and the second could be considered as homeomorphic to *Hemigordiopsis*. Nevertheless, true *Hemigordiopsis* remain present in the Changhsingian (VACHARD *et al.,* 2003), contrary to the PRONINA's (1995) opinion. Nevertheless, the absence of Wuchiapingian *Hemigordiopsis* in the literature is puzzling.

Occurrence: Midian-Changhsingian. The Triassic representatives of TRIFONOVA (1992) [*H. irregularis* (WANG & SUN, 1973) and *H. renzi* REICHEL, 1945] seem to be correctly identified at least at the family level; hence this latter could survive within the Early Triassic of Bulgaria (*Meandrospira cheni* Zone). *Kamurana* is also indicated as "Late Permian-Early Triassic" in range by PRONINA (1988b, p. 59).

Genus *Shanita* BRÖNNIMANN, WHITTAKER & ZANINETTI, 1978

Type species: *Shanita amosi* BRÖNNIMANN, WHITTAKER & ZANINETTI, 1978.

Diagnosis: Hemigordiopsidae coiled as *Hemigordiopsis* (i.e. initially tightly streptospiral and later planispiral involute with lumen extending to umbilicus but with flosculinisation well developed) but with complete partitions denominated more or less abusively pillars, while they are probably regularly spaced protuberances attaining the top of the tube. Aperture terminal simple.

Composition: *S. amosi*, *S. broennimanni* (*orth. mut*.) ZANINETTI, ALTINER, ÇATAL & DECROUEZ, 1982; *S. chagouensis* SHENG & HE, 1983; *S. intercalaria* BRÖNNIMANN, WHITTAKER & ZANINETTI, 1978; *S. pamirica* LEVEN, 1991.

Remarks: The *Shanita* of Zagros are known for many years, especially in Kuh-e Surmeh and Kuh-e Dena (e.g., BAGHBANI, 1997). Many *Shanita* of the literature could correspond in fact to *Hemigordiopsis*. Hence, the palaeobiogeographical distribution of this two-fold marker (stratigraphical and biogeographical) often compiled (SENGÖR *et al.*, 1988; NESTELL & PRONINA, 1997; JENNY & STAMPFLI, 2000; UENO, 2003) is difficult to really establish. Especially, *Shanita* is probably absent in Tebaga (Tunisia), contrary to the indications of NESTELL & PRONINA (1997), which have probably erroneously interpreted the specimen illustrated by GARGOURI & VACHARD (1988). This specimen, given by comparison with the Tunisian material, correspond to the material of MONTENAT *et al.* (1977), from the Jebel Akhdar (Oman). This absence of *Shanita* in Tebaga, which shares many Midian taxa with Taurus and Zagros (for instance, *Eopolydiexodina*), is besides puzzling and must be explained.

Occurrence: Midian/Dzhulfian boundary. Because of the association of *Shanita* with *Chusenella* in Oman (material in MONTENAT *et al.,* 1977) and *Neoschwagerina* in Iran (material of P. MASSE, unpublished data), apparently preserved in situ, we considered *Shanita* as preferentially latest Midian than earliest Dzhulfian (compare with VACHARD *et al.,* 2002). Characteristic of Cimmeria and Sibumasu terranes (see below the chapter palaeobiogeography).

Shanita amosi BRÖNNIMANN, WHITTAKER & ZANINETTI, 1978
(Pl. 21, fig. 11)

v. 1977 *Staffella zisonghengensis* SHENG – LYS *in* MONTENAT *et al.,* pl. 18, figs. 10-12.
1978 *Shanita amosi* sp. nov. – BRÖNNIMANN, WHITTAKER & ZANINETTI, p. 74-76, text-figs. 4, 5a-b, 6a-c p. 74-76, pl. 7, figs. 1-7, pl. 8, figs. 1-5, pl. 11, figs. 1-3, pl. 12, fig. 18.
1979 *Shanita amosi* BRÖNNIMANN, WHITTAKER & ZANINETTI – ZANINETTI *et al.,* p. 1-6, pl. 1, figs. 1-5, 8, pl. 2, figs. 1-11.
1981 *Shanita amosi* BRÖNNIMANN, WHITTAKER & ZANINETTI – ZANINETTI *et al.,* p. 10, pl. 7, figs. 1-15.
1981 *Shanita amosi* BRÖNNIMANN, WHITTAKER & ZANINETTI – ALTINER, pl. 45, figs. 9-12.
1982 *Shanita amosi* BRÖNNIMANN, WHITTAKER & ZANINETTI – ZANINETTI, ALTINER, ÇATAL & DECROUEZ, text-fig. 2, p. 33.
1983 *Shanita amosi* BRÖNNIMANN, WHITTAKER & ZANINETTI – SHENG & HE, p. 57, pl. 1, figs. 1-9, 27.
1984b *Shanita amosi* BRÖNNIMANN, WHITTAKER & ZANINETTI – ALTINER, pl. 2, fig. 6.
1985 *Hemigordiopsis* sp. of the group *H. renzi* group – OKIMURA *et al.,* pl. 1, fig. 17.
1987 *Shanita amosi* BRÖNNIMANN, WHITTAKER & ZANINETTI – LOEBLICH & TAPPAN, pl. 327, figs. 10-13.
v. 1988 *Shanita amosi* BRÖNNIMANN, WHITTAKER & ZANINETTI – GARGOURI & VACHARD, pl. 2, fig. 12.
1988a *Shanita amosi* BRÖNNIMANN, WHITTAKER & ZANINETTI – PRONINA, pl. 1, figs. 16-17 (probably a recrystallized *Hemigordiopsis*).
1988b *Shanita amosi* BRÖNNIMANN, WHITTAKER & ZANINETTI – PRONINA, fig. 2.25-26 (the specimens of 1988a).
1991 *Shanita amosi* BRÖNNIMANN, WHITTAKER & ZANINETTI – LEVEN, text-fig. 1d-e, p. 103.
1993 *Shanita amosi* BRÖNNIMANN, WHITTAKER & ZANINETTI – REITLINGER *in* VDOVENKO *et al.*, p. 91, 92, text-fig. 18a, b, v, pl. 15, figs. 5-6.
1993 *Shanita amosi* BRÖNNIMANN, WHITTAKER & ZANINETTI – BAIRD *et al.,* p. 249-250, figs. 4.2, 4.4.
1993 *Shanita amosi* BRÖNNIMANN, WHITTAKER & ZANINETTI – DAWSON *et al.,* fig. 4.1-4.
1995 *Hemigordiopsis* sp. of the group *H. renzi* group (…) (*Shanita* sp.) – PARTOAZAR, pl. 1, fig. 17.
v. 2006 *Shanita amosi* BRÖNNIMANN, WHITTAKER & ZANINETTI – GAILLOT, p. 120-121, Pl. I.38, fig. 11.

Dimensions: The specimens are remarkably similar to the Type material: D.= 2.880 mm, w.= 2.440 mm, w/D= 0.85, n.w.= 14 or 15, p.d.= 0.080 mm, h.l.= 0.040 mm, w.t.= 0.040-0.060 mm.

Remarks: The distribution is limited to two apparently distinct regions: (1) the Domain Taurus, Zagros and Oman (ZANINETTI *et al.,* 1979); (2) the Domain Myanmar (Shan States), Peninsular Thailand and Baoshan Block of SW China (FONTAINE *et al.,* 1998; UENO, 2003). Between the two domains, *Shanita amosi* and related species appear only in the central Pamir (LEVEN, 1991). Despite of the detailed investigations (VACHARD, 1980; VACHARD & MONTENAT, 1981; LEVEN, 1997), it remains unknown in Afghanistan. Apparently, it lacks also in south-eastern Pamir, Salt Range, Himalaya, central and eastern Thailand, Laos, Cambodia and Viet-Nam (FONTAINE *et al.,* 1998). So, *Shanita* constitutes one of the best biogeographic marker in the Permian (see below).

Occurrence: Latest Midian of Myanmar, Thailand, SW China, central Pamir, Transcaucasia, Oman, Zagros and Taurus.

Genus *Glomomidiellopsis* gen. nov.

Type species: *Glomomidiellopsis tieni* sp. nov. (= *Kamurana*? sp. *sensu* NGUYEN DUC TIEN, 1979, 1986a).

Etymology: Glomospiral coiling, FAD in the Midian, and ending *opsis* because of the similarity with *Hemigordiopsis*.

Diagnosis: Test free, large, bilocular, involute, medium to large, inflated to subspherical or discoid. Coiling entirely glomospiral, tending to be slightly planispiral in the 1-2 last whorls. A flosculinisation fills progressively the base of the lumen, hence there is a relative homeomorphy with *Hemigordiopsis*. Wall porcelaneous often microsparitized.

Composition: *Glomomidiellopsis tieni* sp. nov.; *G. uenoi* sp. nov.; *G. lysitiformis* sp. nov.; ?*Hemigordiopsis parvus* NIKITINA, 1969; ?*Hemigordius* sp. *sensu* WHITTAKER *et al*., 1979, pl. 2, fig. 14; ?*Neodiscus specialisaeformis* LIN, LI & SUN, 1990.

Comparison: *Glomomidiellopsis* gen. nov. differs from "*Glomospira*" by the large size and the reduced lumen of the chamber. It differs from *Kamurana* by different last whorls; from *Neodiscus* by the absence of terminal whorls with wide lumen; and from *Hemigordiopsis* by the absence of a long planispirally stage. This latter genus is generally Midian but Changhsingian forms exist (ALTINER, 1981, 1984b; VACHARD *et al*., 2003).

Occurrence: Late Midian of Cambodia. Changhsingian of Primorye (eastern Russia), Hazro (Turkey) and Zagros (Iran). Questionable in Manmyar (WHITTAKER *et al.,* 1979).

Glomomidiellopsis tieni gen. nov. sp. nov.
(Pl. 55, fig. 13, Pl. 58, figs. 1-2, 13, Pl. 62, fig. 12, Pl. 64, figs. 2, 4, 10, Pl. 65, figs. 1-6, 11, 13, 15, Pl. 67, figs. 14-15, 19-20)

1979 *Kamurana*? sp. – NGUYEN DUC TIEN, p. 104-106, pl. 12, figs. 1-10.
p.p. 1981 *Hemigordius* sp., forme en pelote – ZANINETTI *et al.,* pl. 6, figs. 1-5, 8?, 9.
p.p. 1981 *Hemigordius* sp. "en pelote"' – ALTINER, pl. 44, figs. 7-8 (*non* fig. 6: a true *Hemigordiopsis*).
1984 *Kamurana*? sp. A – FLÜGEL *et al*., pl. 34, fig. 7.
1984 *Kamurana*? sp. B – FLÜGEL *et al*., pl. 34, figs. 4-6.
1986a *Kamurana*? sp. – NGUYEN DUC TIEN, pl. 5, fig. 7.
1986b *Agathammina* sp. – NGUYEN DUC TIEN, pl. 13, fig. 23.
1986b *Agathammina pusulla* (*sic*) (GEINITZ) – NGUYEN DUC TIEN, pl. 13, fig. 25 (*non* fig. 24= *Hemigordiellina*?).
p.p. 1986 *Kamurana*? sp. – VUKS & CHEDIYA, pl. 9, figs. 8-9 (*non* fig. 7= ? *Neodiscus*).
1988 *Agathammina* sp. A – KOBAYASHI, pl. 2, figs. 7-12.
1988 *Agathammina* sp. – YANAGIDA *et al*., pl. 5, figs. 18-19.
1988 *Kamurana*? sp. – FONTAINE *et al*., pl. 2, fig. 10.
v. p.p.1988 *Baisalina* sp. nov. aff. *B. pulchra* REITLINGER – GARGOURI & VACHARD, pl. 2, figs. 3, 7 (*non* figs. 1-2, 8-9; other Miliolida).
v. 1991 *Kamurana*? sp. – VACHARD & FERRIÈRE, pl. 4, fig. 3.
1995 *Kamurana broennimanni* ALTINER & ZANINETTI – BERCZI-MAKK *et al.*, pl. 15, fig. 4.
1996 *Kamurana* (?) sp. – LEVEN & OKAY, pl. 8, fig. 10, pl. 9, fig. 37.
1997 *Kamurana* sp. – PRONINA & NESTELL, pl. 1, fig. 10.
? 1997 *Neodiscus grandis* LIN *et al.* – KOBAYASHI, pl. 4, figs. 11-12.
v. 2006 *Hemigordiopsis* (?) sp. – INSALACO *et al*., pl. 1, fig. 13.
p.p. 2006c *Kamurana*? sp. – KOBAYASHI, pl. 3, fig. 36 (*non* fig. 35, probably a calcivertellid).
v. 2006 *Glomomidiellopsis tieni* gen. nov. sp. nov. – GAILLOT & VACHARD *in* GAILLOT, p. 121-122, Pl. I.21, figs. 1-6, 11, 13, 15, Pl. I.22, figs. 14-15, 19-20, Pl. I.23, fig. 16, Pl. I.24, fig. 12, Pl. I.39, figs. 2, 4, 10, Pl. II.21, figs. 1-2, 13, Pl. III.19, fig. 13 (*nomen nudum*).

Etymology: Dedicated to Dr NGUYEN DUC TIEN, from TOTAL, who first mentioned the taxon.

Type locality: Kuh-e Surmeh (Zagros, Iran).

Type level: Wuchiapingian.

Diagnosis: Medium-sized *Glomomidiellopsis*, with narrow tubular chamber, and rough internal surface.

Description: Test subspherical to slightly ovate, with rounded periphery and protruding flanks. Involute, entirely glomospiral. Spherical proloculus, measuring 0.040-0.060 mm in outside diameter, followed by an enrolled pseudoseptate second chamber slowly enlarging in height through whorls, and proportionally always low. Peripheral margin broadly-rounded. Juvenarium consisting of 5-7 whorls, almost isodiametric, thin-walled, tightly coiled. In the mature part (4-6 whorls) the height of the chamber increases rapidly and can reach 0.060 mm. Mature specimens measure: D.= 0.600-1.300 mm, w.= 0.490-1.000 mm, w/D= 0.84-1.00, p.d.= 0.013-0.020 mm, h.l.w.= 0,056-0.094 mm, w.t.= 0.005-0.015 mm. The pseudoseptation produces a rough inner periphery. Wall calcareous, porcelaneous, preserved as a black layer. Aperture at the end of tubular chamber.

Holotype: Pl. 65, fig. 11 (sample KeS-92).

Type material: 100 specimens.

Repository of the types: CST TOTAL (Pau, France).

Occurrence: Late Midian of Cambodia, Sumatra, northern Thailand and Japan. Lopingian of Zagros. Wuchiapingian of Fars.

Glomomidiellopsis uenoi gen. nov. sp. nov.
(Pl. 53, figs. 8, 12, Pl. 55, figs. 14-15, Pl. 56, fig. 9, Pl. 61, figs. 10-11, Pl. 67, fig. 21, Pl. 70, figs. 5-7, 9-10, Pl. 71, figs. 3, 5, 9-10)

? 1986 *Kamurana*? sp. 1 – Vuks & Chediya, pl. 10, figs. 1-2 (transitional between *G. uenoi* sp. nov. and *Kamurana* due to the shape of the lumen).
v. 2006 *Hemigordiopsis* sp. 2 – Insalaco *et al.,* pl. 1, fig. 14.
v. 2006 *Glomomidiellopsis uenoi* gen. nov. sp. nov. – Gaillot & Vachard *in* Gaillot, p. 122-123, Pl. I.22, fig. 21, Pl. I.23, figs. 1-2, 6-7, Pl. I.40, figs. 5-7, 9-10, Pl. II.24, figs. 8, 12, Pl. II.25, fig. 3, 5, 9-10, Pl. III.8, fig. 19, Pl. III.19, figs. 14-15, Pl. IV.4, figs. 6, 11, Pl. IV.6, figs. 10-11, Pl. VI.10, fig. 9 (*nomen nudum*).

Etymology: Dedicated to Prof. Katsumi Ueno, for his excellent micropalaeontological work in the Permian.

Type locality: Hazro section (Turkey).

Type level: Changhsingian.

Diagnosis: Large spherical species. Numerous whorls, all flosculinised (i.e. with a reduced in height lumen).

Description: The shape is globulose with a millimetric size. The coiling is streptospiral, tightly coiled. Only the last and penultimate whorl tends to be planispiral, but never exhibit the regularity of a *Hemigordiopsis* section. In an oblique section as this choosen as holotype only a fourth of whorl is continuously visible, versus several whorls in *Hemigordiopsis* (e.g. Gargouri & Vachard, 1988). The wall is generally strongly microsparitized to sparitized. The subsisting lumen is filled by dark cement or micrite. The lumen of the tube is very narrow, because flosculinized at its base. H.= 0.800-1.650 (1.800-2.000) mm, w.= 0.730-1.260 mm, w/H= 0.65-1.00, p.d.= 0.060-0.110 mm, n.w.= 6-11 (12-13), h.l.w.= 0.050-0.125 mm, height of lumen= 0.020-0.070 mm, w.t.= 0.020-0.080 mm.

Holotype: Pl. 56, fig. 9 (sample 03HZ44).

Type material: 7 (perhaps 9) specimens.

Repository of the types: Collection of Palaeontology of Lille 1 University (France).

Comparison: *Glomomidiellopsis uenoi* gen. nov. sp. nov. differs from *G. tieni* sp. nov. (= *Kamurana*? sp. *sensu* Nguyen Duc Tien, 1979, 1986a) by a smaller size and from *G. lysitiformis* sp. nov. (= *Hemigordiopsis* gr. *renzi evolutus* Lys & Marcoux, 1978 *nom. nud.* see below) by a more compressed shape. The three species constitute in fact a continue spectrum, as well morphological than stratigraphical.

Occurrence: Doubtful in late Changhsingian of Primorye (because illustrated under the name of *Kamurana*?). Changhsingian of Hazro and Zagros.

Glomomidiellopsis lysitiformis gen. nov. sp. nov.
(Pl. 27, fig. 16, Pl. 52, figs. 6, 15, Pl. 59, figs. 23-24)

1978 *Hemigordiopsis* gr. *renzi evolutus* n. subsp.? Lys & Marcoux, pl. 1, fig. 10 (invalid due to absence of description).
1981 *Hemigordius renzi evolutus* Lys – Altiner, pl. 44, figs. 14-15.
? 1981 *Hemigordius* gr. *renzi* Reichel – Altiner, pl. 44, fig. 16.
1990 *Hemigordiopsis renzi* Reichel – Vachard & Miconnet, pl. 3, fig. 1.
v. 2006 *Graecodiscus* sp. – Insalaco *et al.*, pl. 1, fig. 10.
v. 2006 *Glomomidiellopsis lysitiformis*gen. nov. sp. nov. – Gaillot & Vachard *in* Gaillot, p. 123-124, Pl. II.26, figs. 6, 15, Pl. II.31, fig. 16, Pl. IV.4, fig. 20, Pl. IV.6, figs. 23-24 (*nomen nudum*).

Etymology: Morphology relatively similar to the genus *Lysites* indicated here above as a synonym of *Hemigordiopsis*.

Type locality: Zone 2 (Zagros, Iran; see Fig. 2A).

Type level: Late Changhsingian.

Diagnosis: Large spherical species, discoid. Numerous whorls, all flosculinised (i.e., with a reduced in height lumen).

Dimensions: H.= 1.460-2.275 mm, w.= 0.560-1.055 mm, w/H= 0.37-0.49, n.w.= 7-11, p.d.= 0.100-0.150 mm, h.l.= 0.090-0.160 mm, w.t.= 0.050-0,100 mm.

Holotype: Pl. 27, fig. 16.

Type material: 6 specimens.

Repository of the types: CST TOTAL (Pau, France).

Remarks: The true *Lysites* are probably a stage of *Hemigordiopsis*, but the first described species assigned to this genus (but not the type species) *Hemigordiopsis* gr. *renzi evolutus* LYS & MARCOUX, 1978, belongs clearly to the taxon described here. *Lysites* is typically a late-latest Midian genus, and it is often associated with *Shanita* (BRÖNNIMANN *et al*., 1978, pl. 10, fig. 2).

Comparison: *Glomomidiellopsis lysitiformis* gen. nov. sp. nov. differs from *G. uenoi* by the more regular last part of coiling and from *Hemigordiopsis* by the absence of planispiral whorls at the end of the coiling.

Occurrence: Late Changhsingian of Zagros, ?Changhsingian of Greece (the level described by VACHARD *et al.*, 2003 must be assigned to the Changhsingian by the recently admitted range of *Shindella*, see KOTLYAR *et al.,* 1999b).

Class Nodosariata MIKHALEVICH, 1993 (= order Lagenida LANKESTER, 1885)

Nodosariata are calcareous benthic foraminifers whose walls are composed of low-Mg calcite in which the optical c-axes of crystal units are normal to the outer surface of the test, and in which the primary septal wall is monolamellar. The group has been suggested to be monophyletic (VACHARD *in* VACHARD & MONTENAT, 1981; VACHARD, 1993; MIKHALEVICH, 1993; HOHENEGGER, 1997; GROVES *et al*., 2003, 2004), diverse and abundant in inner to middle neritic environments throughout the Tethyan region and northern higher palaeolatitudes during the Lopingian (GROVES & ALTINER, 2005). In the Lopingian, at least 35 genera were known. Among them *Geinitzina*, *Pachyphloia*, *Nodosinelloides*, *Protonodosaria* and *Robuloides* are especially widespread. Changhsingian strata in Turkey, Transcaucasia and China contain important occurrences of species that have been assigned to "*Dentalina*" and "*Nodosaria"* and likely correspond to the genus *Polarisella* (see emended diagnosis below). At least two species, *Polarisella hoae* (TRIFONOVA, 1967) and *Polarisella elabugae* (CHERDYNTSEV, 1914), are known also from older Changhsingian and younger Triassic strata.

The Palaeozoic Nodosariata are united here in one order Nodosariida and two superfamilies: Nodosarioidea and Robuloidoidea REISS, 1963 *nomen translat.* LOEBLICH & TAPPAN, 1984 (pro subfamily) (this name is especially wrong, but it has priority). The order Nodosariida consists of ten families: Syzraniidae VACHARD *in* VACHARD & MONTENAT, 1981; Protonodosariidae MAMET & PINARD, 1992; Geinitzinidae BOZORGNIA, 1973; Robuloididae REISS, 1963 *nomen translat.* LOEBLICH & TAPPAN, 1984; Partisaniidae LOEBLICH & TAPPAN, 1984; Frondinidae fam. nov.; Colaniellidae FURSENKO *in* RAUZER-CHERNOUSOVA & FURSENKO, 1959; Nodosariidae EHRENBERG, 1838; Pachyphloiidae LOEBLICH & TAPPAN, 1984; Ichthyolariidae LOEBLICH & TAPPAN, 1986 (Figs. 13-15). The two superfamilies are distinguished, according to us, by the presence of a primitive cylindrical aperture (Robuloidoidea) or a typical radiate aperture (Nodosarioidea). This apertural character evolves probably within the simple uniserial forms whose a part corresponds to *Nodosinelloides* (primitive aperture, eventually with two layers), and another part truly to *Nodosaria* (radiate aperture, monolayered fibrous wall).

Occurrence: Late early Moscovian-Recent, cosmopolite or endemic according to the genera.

Superfamily Robuloidoidea REISS, 1963 *nomen translat.* LOEBLICH & TAPPAN, 1984 *emend.* herein

Emended diagnosis: Test subcylindrical uniserial, rarely coiled, with a primitive round terminal aperture. Wall fibrous single layered, sometimes two layered (dark and poorly characterized and yellow and fibrous), rarely single layered dark (family Frondinidae fam. nov.).

Composition: In order of appearance and increasing complexity of the test (e.g., septation, chamber shape, endoskeleton), the superfamily can be subdivided into the following families: Syzraniidae VACHARD *in* VACHARD & MONTENAT, 1981; Protonodosariidae MAMET & PINARD, 1992; Geinitzinidae BOZORGNIA, 1973; Robuloididae REISS, 1963 *nomen translat.* LOEBLICH & TAPPAN, 1984; Partisaniidae LOEBLICH & TAPPAN, 1984; Frondinidae fam. nov.; and Colaniellidae FURSENKO *in* RAUZER-CHERNOUSOVA & FURSENKO, 1959. The exact status of the ancient family Nodosinellidae and its priority upon one of these names depends on a new revision of *Nodosinella*; those of CUMMINGS (1955) and PINARD & MAMET (1998) being too incomplete about the original composition of the clearly recrystallized wall of *Nodosinella* (see also FOSTER *et al*., 1985, p. 82).

Comparison: The base of the classification proposed here (primitive forms = Robuloidea and advanced forms= Nodosarioidea) is the replacement of the primitive single, round aperture by the advanced radiate (= stellate) aperture. Hence, we agree for this class with the Mikhalevich's systematic bases. Nevertheless, using this fundamental criterion of the aperture, we notice that many homeomorphs exist between the two superfamilies, and even within the same genus as described in the literature; see the "monster-genera", e.g., *Nodosaria*, *Dentalina* and *Lingulina*.

Occurrence: First fibrous forms (Syzraniidae) appear in the late early Moscovian, complete septation is Late Pennsylvanian in age, acme is Permian; the group subsists in the Triassic and even the Jurassic.

Family Syzraniidae VACHARD *in* VACHARD & MONTENAT, 1981

Diagnosis: Tubular Robuloidoidea without septation or with more or less developed pseudosepta.

Composition: *Syzrania* REITLINGER, 1950; *Syzranella* MAMET & PINARD, 1992; *Amphoratheca* MAMET & PINARD, 1992; *Rectostipulina* JENNY-DESHUSSES, 1985; *Tezaquina* VACHARD *in* VACHARD & MONTENAT, 1981 *non* VACHARD, 1980; ?*Vervilleina* GROVES *in* GROVES & BOARDMAN, 1999 (this latter is transitional between the Syzraniidae and Protonodosariidae by its nearly complete septation).

Occurrence: Late early Moscovian to late Changhsingian. Cosmopolite during the Pennsylvanian and Cisuralian; then, the Syzraniidae become limited to Neotethys and Palaeotethys. Exceptional representatives of *Syzrania* and *Tezaquina* were discovered in the early Triassic of Taurides (Turkey) by GROVES *et al*. (2005, fig. 18.1-10).

Genus *Rectostipulina* JENNY-DESHUSSES, 1985 *emend.* herein

Type species: *Rectostipulina quadrata* JENNY-DESHUSSES, 1985.

Synonym: *Stipulina* LYS *in* LYS & MARCOUX, 1978 (*nomen invalidum*, no type species designated nor described).

Emended diagnosis: Test tubular, small, undivided (or very rarely slightly divided), generally square in tranverse section. Wall hyaline yellowish. Proloculus are very rarely observed but present.

Remarks: Although criticized by GROVES (2000), the assignment of *Rectostipulina* to the Syzraniidae (VACHARD & MONTENAT, 1981) or Nodosariidae (NGUYEN DUC TIEN, 1989b) is confirmed by rare observations of proloculus (e.g., Pl. 85, fig. 10). Another proloculus of *Rectostipulina* was also published as "*Syzrania* sp." by PRONINA (1988a: pl. 2, fig. 1; 1989: pl. 1, fig. 1). Such as *Earlandia*, previously denominated *Aeolisaccus* in the Permian because of the apparent absence of proloculus, the proloculus of *Rectostipulina* is rarely observed, but this taxon possesses clearly a nodosariid wall, easily comparable with the representatives of this order always very common with the *Rectostipulina*. Two poorly known Permian foraminifers are homeomorphic to *Rectostipulina*: (a) *Giraliarella* CRESPIN, 1958 (theoretically agglutinated, but possibly also recrystallized); (b) *Chitralina*

CLASS	SUPERFAMILY	FAMILY	GENERA
NODOSARIATA	ROBULOIDOIDEA	Syzraniidae	*Syzrania, Syzranella, Amphoratheca, Tezaquina, Vervilleina, Rectostipulina*
		Protonodosariidae	*Nodosinelloides, Nestellorella, Polarisella, Tauridia, Protonodosaria, Langella, Pseudolangella*
		Geinitzinidae	*Geinitzina, Geinitzinita, Pachyphloides, Pseudotristix*
		Robuloididae	*Eocristellaria, Robuloides, Hubeirobuloides, Calvezina, Cryptomorphina*
		Partisaniidae	*Partisania, Xintania, Nodoinvolutaria*
		Frondinidae	*Frondina, Ichthyofrondina*
		Colaniellidae	*Colaniella, Pseudowanganella, Cylindrocolaniella*
	NODOSARIOIDEA	Nodosariidae	*Nodosaria*
		Pachyphloiidae	*Pachyphloia, Sosninella, Robustopachyphloia Aulacophloia*
		Ichtyolariidae	*Ichtyolaria, Frondicularia, Frondinodosaria*

Figure 13.– New classification of Permian Nodosariata.
Figura 13.– Nueva clasificación de los Nodosariata del Pérmico.

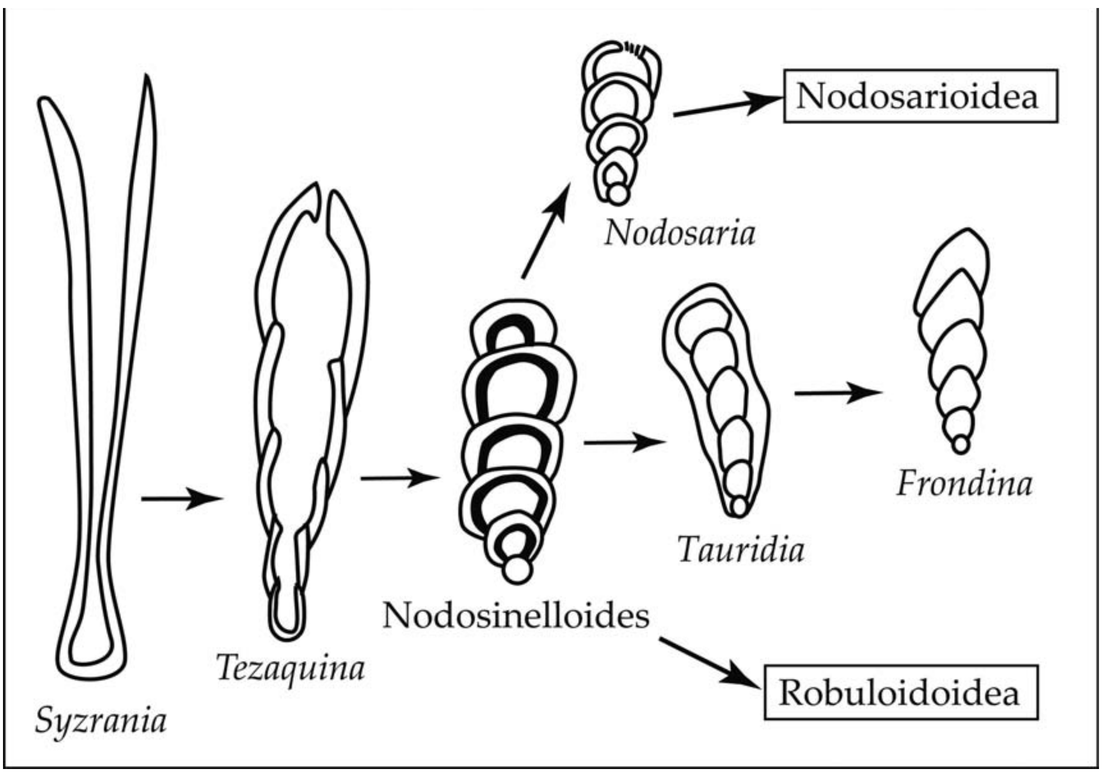


Figure 14.– Hypothetical phylogeny and cartoons of some primitive Permian Nodosariata.
Figura 14.– Filogenia hipotéticas y esquemas de algunos Nodosariata primitivos del Pérmico.

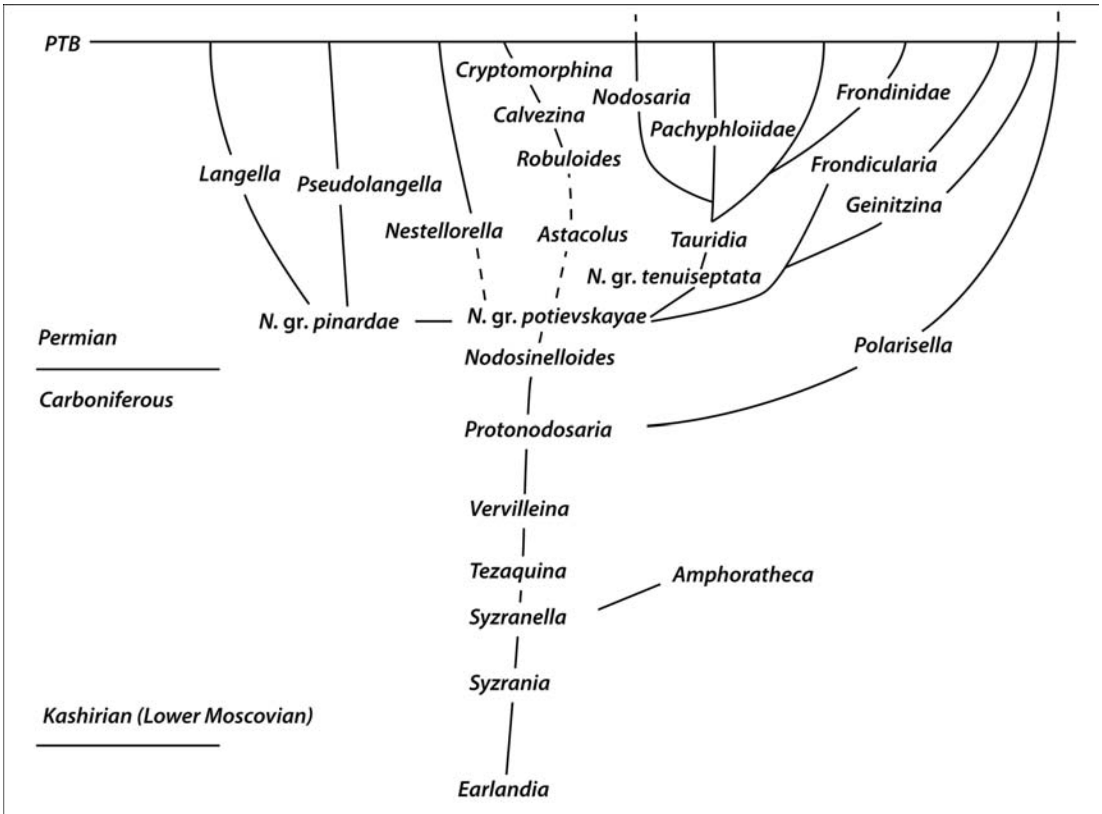


Figure 15.– An attempt of phylogeny of selected Permian Nodosariata.
Figura 15.– Reconstrucción de la posible filogenía de algunos Nodosariata pérmicos.

ANGIOLINI & RETTORI, 1994 [this latter possesses a microgranular wall and belongs probably to the earlandioids (assignment also proposed by ARNAUD-VANNEAU, 1980)]. A phylogenetic lineage was proposed by ANGIOLINI & RETTORI (1994) between *Chitralina* and *Rectostipulina*. We cannot admit this hypothesis; nevertheless we admit that the ancestor of the *Rectostipulina* was an earlandioid (VACHARD, 1994).

Composition: *Rectostipulina quadrata* JENNY-DESHUSSES, 1985; *R. pentamerata* GROVES, ALTINER & RETTORI, 2005; *R. syzranaeformis* sp. nov.

Occurrence: *Rectostipulina* is Midian-Lopingian in age in the Palaeotethys and Neotethys. PRONINA (1995) considered its FAD in the Dzhulfian/Wuchiapingian. This study document its presence from the late Midian in the studied areas. Until now, the genus was known in the Lopingian of Cyprus, Afghanistan, Turkey, Greece, Alborz, Zagros, Armenia, Ladakh, western Thailand (NGUYEN DUC TIEN, 1988; FONTAINE & NGUYEN DUC TIEN, 1989), Cambodia (NGUYEN DUC TIEN, 1986a), and Saudi Arabia (VACHARD *et al*., 2005).

Rectostipulina syzranaeformis sp. nov.
(Pl. 72, figs. 7-11)

1997 *Rectostipulina* sp. – NESTELL & PRONINA, pl. 1, figs. 29-30.
v. 2006 *Rectostipulina syzranaeformis* sp. nov. – GAILLOT & VACHARD *in* GAILLOT, p. 126-127, Pl. VI.11, figs. 7-11 (*nomen nudum*).

Etymology: Latin *formis* and *Syzrania*.

Type locality: Hazro section (Turkey).

Type level: Late Midian.

Diagnosis: Acute test, gently tapering, similar to a *Syzrania*, i.e., cylindrical in the lower part and costulate in the last part as a *Rectostipulina*.

Description: Test small, passing from cylindrical to quadrate costulate. No pseudosepta nor proloculus observed.

Dimensions: L.= 0.580-0.755 mm, o.d.= 0.080-0.125 mm, i.d.= 0.035-0.045 mm, inner D./outer D ratio= 0.30-0.41, w.t.= 0.025-0.045 mm.

Holotype: Pl. 72, fig. 7 (sample 03HZ11).

Type material: 22 (perhaps 29) specimens.

Repository of the types: Collection of Palaeontology of Lille 1 University (France).

Comparison: *Rectostipulina syzranaeformis* sp. nov. differs from *R. quadrata* by the circular transverse section, and the more tapering test in axial section.

Remarks: The incomplete sections of the new species are very difficult to distinguish of *Syzrania*, and, therefore, validate the assignment of *Rectostipulina* to Syzraniidae. Nevertheless, the proloculus of this genus is very rarely observed. Similarly, Permian *Earlandia* seem to lack of proloculus and were erroneously separated as the distinct genus *Aeolisaccus*, but they exist in approximately 2 for 1000 sections (this work). Proloculi of *Rectostipulina* were probably illustrated by PRONINA (1988a, pl. 2, fig. 1; 1989, pl. 1, fig. 1), from the late Changhsingian (= Dorashamian) of Transcaucasia, under the name "*Syzrania*" sp. Furthermore, the material presented here yields this intermediary form *Rectostipulina syzranaeformis* sp. nov. GROVES *et al*. (2005, p. 29) refuse the assignment of *Rectostipulina* to the Syzraniidae, because they consider the family is "invariabily circular in this section". This argument is definitively unvalidated by *R. syzranaeformis*, with its transverse sections initially circular becoming quadrate at the end of the test.

Occurrence: Late Midian of Cyprus (NESTELL & PRONINA, 1997). Late Midian of Hazro.

Rectostipulina quadrata JENNY-DESHUSSES, 1985
(Pl. 63, fig. 27, Pl. 73, fig. 17, Pl. 75, fig. 7, Pl. 76, figs. 1, 12, Pl. 77, fig. 14, Pl. 78, fig. 15, Pl. 79, fig. 12, Pl. 80, figs. 3, 13, Pl. 81, fig. 14, Pl. 82, figs. 4-5, Pl. 87, figs. 9, 11)

p.p. 1981 "*Stipulina*" – ZANINETTI, ALTINER & ÇATAL, p. 10, pl. 12, figs. 3, 7-9, 11-21.
1984b "*Stipulina*" sp. – ALTINER, pl. 2, fig. 14.
1986a *Stipulina* (?) – NGUYEN DUC TIEN, pl. 1, fig. 4.
1987 *Rectostipulina quadrata* JENNY-DESHUSSES – NOÉ, p. 109, pl. 32, fig. 10.
1988 *Rectostipulina* JENNY-DESHUSSES (*sic*; without name of species) – NGUYEN DUC TIEN, p. 109, pl. 9, figs. 1-6.
p.p. 1989 *Rectostipulina quadrata* JENNY-DESHUSSES – FONTAINE & NGUYEN DUC TIEN, p. 120, 122, pl. 1, figs. 1-10, 14, 18 (*non* figs. 11-13, 15-18 part = ?*Donezella lutugini*), pl. 2, figs. 1-6, 8-9 (part) (*non* figs. 7, 9 (part), 11-12, 14= ?*D. lutugini*) (with 5 references in synonymy).
1989 *Rectostipulina subquadrata* (*sic*) JENNY-DESHUSSES – KÖYLÜOGLU & ALTINER, pl. 11, figs. 24-27.
v. 1993a *Rectostipulina quadrata* JENNY-DESHUSSES – VACHARD *et al*., pl. 7, figs. 10-12.
1998 *Rectostipulina* sp. – CIARAPICA *et al*., pl. 2, fig. 9.
v. 2005 *Rectostipulina* sp. – VACHARD *et al*., p.166, pl. 6, fig. 8.
2005 *Rectostipulina quadrata* JENNY-DESHUSSES – GROVES *et al*., p. 29-30, fig. 23.5-12 (with 12 references in synonymy).
v. 2006 *Rectostipulina quadrata* JENNY-DESHUSSES – INSALACO *et al*., p. 142, pl. 2, fig. 12.
v. 2006 *Rectostipulina quadrata* JENNY-DESHUSSES – GAILLOT, p. 127-128, Pl. I.27, fig. 17, Pl. I.31, figs. 9, 11, Pl. I.41, fig. 7, Pl. II.27, figs. 1, 12, Pl. III.10, fig. 14, Pl. III.11, fig. 15, Pl. III.12, fig. 12, Pl. III.20, figs. 3, 13, Pl. III.26, fig. 27, Pl.III.27, fig. 14, Pl. V.6, fig. 8, Pl. VI.13, figs. 4-5.
2007 *Rectostipulina quadrata* JENNY-DESHUSSES – GROVES *et al*., fig. 6.9, fig. 7.1-3.

Dimensions: o.d.= 0.075-0.167 (0.260-0.315) mm, i.d.= 0.035-0.105 (0.130-0.150) mm.

Remarks: Proloculus in section and complete longitudinal sections are very rare. Hence, the argument of the absence of proloculus is not definitive to exclude this taxon from the foraminifers, compared to the type of microstructure, entirely similar to the well characterized nodosariids contained in the same thin sections.

Occurrence: Lopingian of Turkey, Cyprus, Greece, northern Italy, Alborz, Zagros, Armenia, Saudi Arabia, Afghanistan, Ladakh, western Thailand, Cambodia, New Zealand (e.g., NGUYEN DUC TIEN, 1986a, 1988; FONTAINE & NGUYEN DUC TIEN, 1989; VACHARD *et al*., 2005; GROVES *et al*., 2005, 2007).

Rectostipulina pentamerata GROVES, ALTINER & RETTORI, 2005
(Pl. 30, fig. 11, Pl. 75, fig. 5, Pl. 78, fig. 13, Pl. 83, fig. 3, Pl. 84, fig. 15)

2005 *Rectostipulina pentamerata* sp. nov. – GROVES, ALTINER & RETTORI, p. 31, figs. 23. 1-4 (with 5 references in synonymy).

v. 2006 *Rectostipulina pentamerata* GROVES, ALTINER & RETTORI – GAILLOT, p. 128, Pl. I.28, fig. 3, Pl. I.41, fig. 5, Pl. III.9, fig. 15, Pl. III.11, fig. 13, Pl. VII.3, fig. 11.

2007 *Rectostipulina pentamerata* GROVES, ALTINER & RETTORI – GROVES *et al*., figs. 7.4-6.

Dimensions: o.d.= 0.145-0.300 mm, i.d.= 0.090-0.130 mm.

Remarks: *Rectostipulina pentamerata* differs theoretically from *R. quadrata* by the pentagonal versus quadrate sections of the tube. Nevertheless, in the populations of Lopingian *Rectostipulina*, triangular and hexagonal transverse sections exist also. For example, in the type material of *R. quadrata* in the Natural History Museum of Geneva (Switzerland), some triangular and typical quadrate sections exist together. Our Pl. 30, fig. 11 shows a hexagonal section found in southern China. This peculiar morphology is still poorly understood and not necessarily correspond to a feature valid at the specific level. Therefore, we admit provisionally that *R. quadrata* has 3-4 sides and *R. pentamerata* 5-6 (too bad for the specific names)

Occurrence: Lopingian of Sumatra, Italy and Turkey. Changhsingian of southern China. Late Midian-Lopingian of Zagros.

Family Protonodosariidae MAMET & PINARD, 1992 *emend.* herein

Emended diagnosis: Robuloidoidea rectilinear to curved, tapering to cylindrical; i.e. with sagittal axial and frontal axial sections similar. Apertures simple, round. Wall single or two layered.

Composition: Two subfamilies: Protonodosariinae *nomen translat.* and Langellinae subfam. nov..

Occurrence: Latest Pennsylvanian-latest Triassic, partly cosmopolite, partly Tethyan.

Subfamily Protonodosariinae *nomen translat.* herein.

Diagnosis: Typical Protonodosariidae; i. e., regularly uniserial, cylindrical to palmate, regular growth of septa, and aperture poorly visible (compare with Langellinae n.subfamily, below) .

Composition: *Protonodosaria* GERKE, 1959 *emend.* SELLIER DE CIVRIEUX & DESSAUVAGIE, 1965; *Nodosinelloides* MAMET & PINARD, 1992; *Nestellorella* gen. nov.; *Polarisella* MAMET & PINARD, 1992 *emend.*; *Tauridia* SELLIER DE CIVRIEUX & DESSAUVAGIE, 1965 *emend.* herein (surprisingly, this genus in misspelled as *Taurida* in both articles: PINARD & MAMET, 1998, and GROVES, 2000); *Frondinodosaria* SELLIER DE CIVRIEUX & DESSAUVAGIE, 1965 (= *Lingulonodosaria* SILVESTRI *sensu* SELLIER DE CIVRIEUX & DESSAUVAGIE, 1965); *Dentalina* of the authors *non* D'ORBIGNY, 1826; *Lingulina sensu* SELLIER DE CIVRIEUX & DESSAUVAGIE, 1965 *non* D'ORBIGNY, 1826.

Occurrence: As the family.

Genus *Protonodosaria* GERKE, 1959 *emend.* SELLIER DE CIVRIEUX & DESSAUVAGIE, 1965 (*non emend.* PALMIERI *in* FOSTER *et al.,* 1985 *non* PINARD & MAMET, 1998)

Type species: *Protonodosaria proceraformis* GERKE, 1959.

Diagnosis: Cylindrical test, initially sligthly tapering. Chambers uniseriate, hemispherical, increasing slowly in height, with depressed sutures. Wall fibrous monolayered. Aperture rounded, simple, terminal.

Composition: *Protonodosaria proceraformis* GERKE, 1959; *P. rauserae* GERKE, 1959; *Nodosaria praecursor* RAUZER-CHERNOUSOVA, 1949; *P. globifrondina* SELLIER DE CIVRIEUX & DESSAUVAGIE, 1965, *N. tereta* CRESPIN, 1958, *P. irwinensis sensu* FOSTER *et al.,* 1985, non *sensu* CRESPIN, 1958, non? HOWCHIN, 1895); and possibly the group of species with rounded spherical polarly truncated and strongly sutured chambers: ?*Nodosaria conspecies* LIPINA, 1949; ?*N. dozenkoae* SOSNINA, 1978; ?*N. netschajewi rasik* (*sic*) BARYSHNIKOV *in* BARYSHNIKOV *et al.,* 1982; ?*N. usvaensis* CHUVASHOV *in* CHUVASHOV *et al.,* 1990.

 ISSN: 1132-1660

Occurrence: Late Pennsylvanian (Kasimovian)-Late Permian, probably cosmopolite.

Protonodosaria cf. *proceraeformis* GERKE, 1959
(Pl. 86, fig. 1)

cf. 1959 *Protonodosaria proceraformis* sp. nov. – GERKE, p. 8-13, pl. 11, figs. 1-5, pl. 2, figs. 1-6, pl. 3, figs. 1-4.
cf. 1961 *Protonodosaria proceraformis* GERKE – GERKE, p. 163, pl. 20, figs. 12, 13, pl. 21, figs. 8-10.
cf. 1979 *Protonodosaria proceraformis* GERKE – NGUYEN DUC TIEN, p. 92, pl. 6, figs. 13-17.
cf. 1988 *Protonodosaria proceraformis* GERKE – LOEBLICH & TAPPAN, pl. 434, figs. 28, 29.
cf. 1994 *Protonodosaria proceraformis* GERKE – FONTAINE *et al.,* pl. 19, figs. 1-2.
? 1999 *Protonodosaria proceraformis* GERKE – PRONINA, p. 183, 184 (no illustration).
v. 2005 *Protonodosaria* cf. *proceraeformis* GERKE, 1959 *orth. mut*. – VACHARD *et al.,* p.166-167, pl. 6, figs. 15?, 18, 35.
v. 2006 *Protonodosaria* cf. *proceraeformis* GERKE – GAILLOT, p. 137, Pl. I.29, fig. 1, Pl. V.6, figs. 15?, 18?, 35?

Dimensions: H.= 0.840-1.300 mm, w.= 0.270-0.375 mm, n.c.= 6-8.

Remarks: Median sized taxon (one of the largest lagenids in Saudi Arabia), with chambers increasing moderately in height and wide. Wall relatively thick. Many characters are shared with *P. proceraeformis*, but the apertures are rarely observed (Pl. 86, fig. 1).

Occurrence: Permian of Russia. Midian of Cambodia and Malaysia. Dorashamian of Saudi Arabia (Midhnab and lower Khartam members). Late Changhsingian of Zagros.

Genus *Nodosinelloides* MAMET & PINARD, 1992.

Type species: *Nodosinelloides potievskayae* MAMET & PINARD, 1996 (*nomen novum* for *Nodosaria gracilis* POTIEVSKAYA, 1962 preoccupied).

Diagnosis: Test subcylindrical, chambers generally hemispherical, not enveloping, increasing very slowly in height and width. Wall two layered with an ancestral microgranular inner layer and a typical fibrous outer layer (the corresponding evolutive stage of the archaediscids would be the concavus stage; e.g. VACHARD, 1988). Lateral wall and septal wall are equal in thickness. Aperture terminal, simple, rounded, often not observable in section.

Composition: *Nodosinelloides potievskayae* MAMET & PINARD, 1996; *Nodosaria postcarbonica* SPANDEL, 1901; *N. netschajewi* CHERDYNTSEV, 1914; *N. netschajewi* var. *ronda* LIPINA, 1949; *N. shikhanica* LIPINA, 1949; *N. bella* LIPINA, 1949; *N. longa* LIPINA, 1949; *N. longissima* SULEIMANOV, 1949; *N. magna* POTIEVSKAYA, 1962; *N. magna magnituda* BARYSHNIKOV *in* BARYSHNIKOV *et al.*, 1982; *N. aequiampla* ZOLOTOVA *in* ZOLOTOVA & BARYSHNIKOV, 1980; *Nodosinelloides pinardae* GROVES & WAHLMAN, 1997 (= *Nodosaria grandis* LIPINA, 1949 preoccupied).

Remarks: The species that belongs undoubetly to *Nodosinelloides* are indicated above, the unquestionable *Nodosaria* are mentioned below. The other species are more controversial. *Nestellorella* gen. nov. differs by an angulatus stage (see the archaediscid classification of VACHARD, 1988 and compare with the diagnosis of *Nodosinelloides*, above), *Polarisella emend.* has a frondiculariid sagittal axial section. *Tauridia emend.* differs by an unequal thickness of wall and septa, and *Nodosaria* is unilayered with a radiate aperture. *Nodosinelloides pinardae* is probably the ancestor of the Langellinae, due to its shape and its stratigraphic distribution.

Occurrence: Late Pennsylvanian-Late Permian.

Nodosinelloides shikhanica (LIPINA, 1949)
(Pl. 34, figs. 24, 27, Pl. 76, fig. 8, Pl. 77, fig. 3, Pl. 78, figs. 3, 19, Pl. 79, fig. 4, Pl. 80, figs. 6, 8- 9, Pl. 81, fig. 24, Pl. 83, figs. 12-13, 18-19, 23?, Pl. 85, fig. 5, Pl. 86, figs. 9, 17, 20, Pl. 87, fig. 2, Pl. 88, fig. 2)

1949 *Nodosaria shikhanica* sp. nov. – LIPINA, p. 217, 218, pl. 4, figs. 7, 8, pl. 6, figs. 3, 9.
1990 *Nodosaria shikhanica* LIPINA – LIN *et al*., p. 226, 227, pl. 28, fig. 13 (with 6 references in synonymy).
v. 1993b *Nodosaria shikanica* LIPINA – VACHARD *et al*., pl. 3, fig. 13.
p.p. 1998 ?*Nodosinelloides netschajewi* (CHERDYNZEV) (*sic*) – PINARD & MAMET, p. 20, pl. 5, figs. 1, 2 (with 35 ref-

erences in synonymy, including that of *N. shikhanica*).

v. 2003a *Nodosinelloides netschajewi* (CHERDYNTSEV) – KRAINER *et al*., pl. 3, fig. 12, pl. 4, figs. 3, 40, 49-50, 55, pl. 5, fig. 1, pl. 6, figs. 9-10.

2004 *Nodosaria netschajewi* TCHERDYNZEV (*sic*) – ZHANG & HONG, p. 72, pl. 2, figs. 17-19 (with 7 references in synonymy).

? 2005 *Polarisella sagitta* (MIKLUKHO-MAKLAY) – HUGHES, pl. 3, fig. 12.

v. ? 2005 *Nodosinelloides shikhanica* (LIPINA) – VACHARD *et al*., p. 166, pl. 6, fig. 16.

v. ? 2005 *Nodosinelloides* sp. nov.? – VACHARD *et al*., p. 166, pl. 6, fig. 17.

2005 *Nodosinelloides netchajewi* (CHERDYNTSEV) – GU *et al*., p. 166, pl. 1, fig. 20 (with 4 references in synonymy).

v. 2006 *Nodosinelloides netchajewi* (CHERDYNTSEV) – INSALACO *et al*., p. 142, pl. 2, fig. 15.

2006b *Nodosinelloides* sp. 3 – KOBAYASHI, figs. 5. 3-4.

v. 2006 *Nodosinelloides shikhanica* (LIPINA) – GAILLOT, p. 129, Pl. I.26, fig. 5, Pl. I.28, figs. 12-13, 18-19, 23, Pl. I.29, figs. 9, 17, 20, Pl. I.31, fig. 2, Pl. I.33, fig. 2, Pl. II.27, fig. 8, Pl. III.10, fig. 3, Pl. III.11, figs. 3, 19, Pl. III.12, fig. 4, Pl. III.20, figs. 6, 8-9, Pl. III.22, figs. 24, 27, Pl. III.27, fig. 24.

Description: Acute test with hemispherical chambers increasing in height, but not in width. Wall and septa with smooth surfaces. *Nodosinelloides shikhanica* (LIPINA) is often synonymized with *N. netschajewi*. This point is not admitted here, because (a) this species is poorly defined and needs revision, (b) the emendations of GROVES & WAHLMAN (1997) and PINARD & MAMET (1998) are contradictory. We use the name *N. shikhanica* well defined by LIPINA (1949) for the taxon described by PINARD & MAMET (1998) under the name *N.*? *netchajewi*, but very different of the initial description of CHERDYNTSEV (1914) and especially of the specimen pl. 2, fig. 3 of this author, which possesses a size of 0.700 mm and 6 chambers, whereas PINARD & MAMET (1998) indicate 0.210-0.350 mm for 7-9 chambers.

Dimensions: H.= 0.160-0.400 mm, w.= 0.040-0.120 mm, n.c.= 7-12, p.d.= 0.005-0.040 mm, h.l.c.= 0.040-0.056 mm, w.t.= 0.005-0.010 mm.

Occurrence: Mainly latest Pennsylvanian-earliest Permian, probably cosmopolite. Up to the Changhsingian in southern China (LIN *et al*., 1990, p. 91; GU *et al*., 2005). Dzhulfian-Dorashamian of Saudi Arabia. Lopingian of Zagros. Late Midian of Hazro.

Nodosinelloides ex gr. *shikhanica* (LIPINA, 1949)

(Pl. 73, fig. 11, Pl. 86, fig. 21, Pl. 89, figs. 7?, 12)

v. 2006 *Nodosinelloides* ex gr. *shikhanica* (LIPINA) – GAILLOT, p. 130, Pl. I.27, fig. 11, Pl. I.28, fig. 23, Pl. I.29, fig. 21, Pl. I.32, figs. 7?, 12.

Dimensions: The chambers are low and more numerous (10-12 versus 6-8). H.= 0.330-0.410 mm, w.= 0.095-0.140 mm, w/H ratio= 0.25-0.35, n.c.= 10-12, p.d.= 0.010-0.035 mm, h.l.c.= 0.040-0.050 mm, w.t.= 0.010-0.015 mm.

Occurrence: Lopingian of Zagros.

Nodosinelloides potievskayae MAMET & PINARD, 1996

(Pl. 74, figs. 11, 13, Pl. 80, fig. 7, Pl. 86, figs. 8, 10, 18, Pl. 87, fig. 7, Pl. 90, fig. 18)

1962 *Nodosaria gracilis* sp. nov. – POTIEVSKAYA, p. 69-70, pl. 5, figs. 13-15 (preocupied).

1962 *Nodosaria concinna* sp. nov. – POTIEVSKAYA, p. 70, 71, pl. 5, figs. 16, 17.

1990 *Nodosaria concinna* POTIEVSKAYA – LIN *et al*., p. 222, pl. 27, fig. 18.

1996 *Nodosaria potievskayae* nom. nov. MAMET & PINARD, p. 223 (*pro N. gracilis*).

1998 *Nodosaria potievskayae* MAMET & PINARD – PINARD & MAMET, p. 21, pl. 5, figs. 3?, 4?, 5-10, 11?, 12? (with 19 references in synonymy).

v. 2001a *Nodosinelloides potievskayae* MAMET & PINARD – VACHARD & KRAINER, pl. 4, figs. 39-40, 42-43, 45-46, 49.

v. 2001b *Nodosinelloides potievskayae* MAMET & PINARD – VACHARD & KRAINER, pl. 5, figs. 43-48, 56, pl. 6, fig. 3?, pl 8, fig. 17.

2004 *Nodosaria concinna* POTIEVSKAYA – ZHANG & HONG, p. 21, pl. 2, fig. 20 (with 4 references in synonymy).

2004 *Nodosaria gracilis* POTIEVSKAYA – ZHANG & HONG, p. 72, pl. 2, figs. 24-25 (with 4 references in synonymy).

v. 2005 "*Nodosaria*" *dzhulfensis* REITLINGER – VASLET *et al*., p. 115 (no illustration).

v. 2005 *Nodosinelloides* cf. *concinna* POTIEVSKAYA – VACHARD *et al*., p. 165, pl. 6, fig. 1.

2005 *Nodosaria concinna* POTIEVSKAYA – GU *et al*., p. 166, pl. 1, figs. 18-19.

v. 2006 *Nodosinelloides potievskayae* MAMET & PINARD – GAILLOT, p. 130, Pl. I.29, figs. 8, 10, 18, Pl. I.30, figs. 11, 13, Pl. I.31, fig. 7, Pl. III.20, fig. 7, Pl. V.6, fig. 1, Pl. VI.12, fig. 18.

Description: Test rectilinear, gently tapering. Arched chambers increasing slowly in height and width. Smooth surfaces of the wall and the septa. Our material, although Late Permian in age, is remarkably similar to the descriptions of PINARD & MAMET (1998) based on Early Permian specimens.

Dimensions: H.= 0.170-0.350 mm, w.= 0.085-0.150 mm, n.c.= 5-8, p.d.= 0.012-0.050 mm.

Remarks: The Changhsingian specimen of Saudi Arabia illustrated by VACHARD *et al.* (2005) is considered here as a typical *N. potievskayae*.

Occurrence: Early Permian of Ukraine (Donbass). Changhsingian of southern China (LIN *et al.*, 1990; ZHANG & HONG, 2004; GU *et al.*, 2005). Lower Khartam Member of Saudi Arabia. Changhsingian of Zagros.

Nodosinelloides mirabilis caucasica
(MIKLUKHO-MAKLAY, 1954) *emend.* herein
(Pl. 63, fig. 19?, Pl. 72, fig. 17, Pl. 74, fig. 24, Pl. 76, fig. 5, Pl. 77, fig. 11, Pl. 78, fig. 7, Pl. 79, figs. 11, 16, Pl. 84, figs. 2, 12-13, 17, Pl. 86, fig. 13, Pl. 87, figs. 1, 4, 16, Pl. 89, fig. 13, Pl. 94, fig. 3, Pl. 90, fig. 7, Pl. 91, fig. 3, Pl. 92, figs. 4, 11, Pl. 94, figs. 13-14)

1954 *Nodosaria mirabilis caucasica* n. subsp. MIKLUKHO-MAKLAY, p. 21, pl. 2, figs. 1-2.
? 1954 *Nodosaria longissima camerata* n. subsp. MIKLUKHO-MAKLAY, p. 22, pl. 2, figs. 3-4.
1978 *Nodosaria longissima camerata* MIKLUKHO-MAKLAY – LIN, p. 40, pl. 8, fig. 21.
? 1978 *Nodosaria mirabilis caucasica* MIKLUKHO-MAKLAY – LIN, p. 40-41, pl. 8, fig. 18.
1978 *Nodosaria netchajewi subquadrata* LIPINA – LIN, p. 41, pl. 8, figs. 12-13.
1984 *Nodosaria mirabilis caucasica* MIKLUKHO-MAKLAY – KOTLYAR *et al*., pl. 1, fig. 12.
? 1984 *Nodosaria mirabilis caucasica* MIKLUKHO-MAKLAY – LIN, p. 148, pl. 7, fig. 31.
? 1986 *Nodosaria liciuminiformis* SOSNINA – VUKS & CHEDIYA, pl. 10, fig. 11.
1988a *Nodosaria mirabilis caucasica* MIKLUKHO-MAKLAY – PRONINA, pl. 2, figs. 21-23.
1988a *Nodosaria* sp. 3 – PRONINA, pl. 2, fig. 19.
? 1988a *Nodosaria longissima camerata* M.-MACLAY (*sic*) – PRONINA, pl. 2, figs. 15-16 (or ?*Nestellorella*).
1989 *Nodosaria mirabilis caucasica* MIKLUKHO-MAKLAY – PRONINA, pl. 1, figs. 15-17.
1989 *Nodosaria* sp. 3 – PRONINA, pl. 1, fig. 19.
? 1989 *Nodosaria longissima camerata* M.-MACLAY (*sic*) – PRONINA, pl. 1, figs. 21-22 (or ?*Nestellorella*).
p.p. 1990 *Nodosaria mirabilis caucasica* MIKLUKHO-MAKLAY – LIN *et al*., p. 225, pl. 28, figs. 1, 2? (*non* figs. 3-6 = ?*Tauridia*).
p.p. 1990 *Nodosaria longissima camerata* M.-MACLAY – LIN *et al*., p. 224, pl. 27, fig. 30 only (*non* fig. 31= *Tauridia*).
? p. 1996 *Nodosaria caucasica* MIKLUKHO-MAKLAY – LEVEN & OKAY, pl. 10, fig. 11? (*non* fig. 16).
1997 *Nodosaria primoriensis* SOSNINA – PRONINA & NESTELL, pl. 1, fig. 12.
1997 *Nodosaria primoriensis* SOSNINA – NESTELL & PRONINA, pl. 1, fig. 13.
2001 *Nodosaria mirabilis caucasica* MIKLUKHO-MAKLAY – PRONINA-NESTELL & NESTELL, pl. 2, fig. 11.
? 2004 *Nodosaria mirabilis caucasica* MIKLUKHO-MAKLAY – ZHANG & HONG, p. 73, pl. 2, figs. 27-29 (with 8 references in synonymy).
v. 2006 *Nodosinelloides mirabilis* (LIPINA) – INSALACO *et al*., p. 142, pl. 2, fig. 16.
2006b *Nodosinelloides*? sp. A – KOBAYASHI, fig. 5.6.
2006e *Nodosinelloides* sp. A – KOBAYASHI, pl. 1, fig. 21.
v. 2006 *Nodosinelloides mirabilis caucasica* (MIKLUKHO-MAKLAY) – GAILLOT, p. 130-131, Pl. I.29, fig. 13, Pl. I.30, fig. 24, Pl. I.31, figs. 1, 4, 16, Pl. I.32, fig. 13, Pl. I.34, fig. 3, Pl. II.27, fig. 5, Pl. II.28, fig. 4, 11, Pl. III.9, figs. 2, 12-13, 17, Pl. III.10, fig. 11, Pl. III.11, fig. 7, Pl. III.12, figs. 11, 16, Pl. III.21, figs. 13-14, Pl. III.26, fig. 19?, Pl. VI.11, fig. 17, Pl. VI.12, fig. 7.
2007 *Nodosinelloides mirabilis caucasica* MIKLUKHO-MAKLAY – GROVES *et al*., fig. 10. 3, 10.
2007 *Nodosinelloides* cf. *camerata* MIKLUKHO-MAKLAY – GROVES *et al*., fig. 10. 11-15.

Description: The subspecies *N. m. caucasica* is characterized by 4-5 wide and low chambers without sutures, in the initial part of the test, followed by 7-10 chambers relatively inflated and relatively high with depressed sutures. According to these criteria, *N. mirabilis caucasica* is synonymized here with *N. longissima camerata*, as well as *N. primoriensis*. The Pl. 81, fig. 13 indicates the presence of a striation, not mentioned in the diagnosis.

Dimensions: H.= 0.320-0.800 mm, w.= 0.090-0.140 mm, w/H= (0.18) 0.20-0.27, n.c.= (7) 11-13, p.d.= 0.030-0.045 mm, h.l.c.= 0.075-0.100 (0.140) mm, w.t.= 0.008-0.025 mm.

Occurrence: Midian-Lopingian of NW Caucasus, Transcaucasia, central Japan, southern China, Primorye, Zagros and southern Turkey (Hazro). Bloom events are in the Wuchiapingian MFI (Maximum Flooding Interval) in Fars and during the late Changhsingian in Zagros.

Nodosinelloides longissima (Suleimanov, 1949)
(Pl. 83, fig. 33, Pl. 88, fig. 9)

1949 *Nodosaria longissima* sp. nov. – Suleimanov, p. 238-239, pl. 1, fig. 5.
1949 *Nodosaria longissima* Suleimanov – Lipina, p. 219, pl. 4, figs. 13-14, pl. 6, figs. 7, 13.
p.p. 1962 *Nodosaria longissima* Suleimanov – Potievskaya, p. 72-73, pl. 6, fig. 5 only (*non* figs. 3-4= *N. longa*, *non* fig. 6= *Tauridia*).
1978 *Nodosaria longissima* Suleimanov – Lin, p. 40, pl. 8, figs. 15-16.
1979 *Nodosaria longissima* Suleimanov – Nguyen Duc Tien, p. 93, pl. 6, figs. 6-7 (with 4 references in synonymy).
1986a *Nodosaria longissima* Suleimanov – Nguyen Duc Tien, pl. 3, fig. 3.
1990 *Nodosaria longissima* Suleimanov – Lin *et al*., p. 224, pl. 27, figs. 28-29 (with 9 references in synonymy).
2002 *Nodosaria longissima* Suleimanov – Gu *et al*., p. 165, pl. 1, fig. 8 (with 4 references in synonymy).
v. 2003b *Nodosinelloides* cf. *longissima* (Suleimanov) – Krainer *et al*., pl. 13, fig. 5.
? 2006b *Nodosinelloides*? sp. B – Kobayashi, fig. 5.6-7.
v. 2006 *Nodosinelloides longissima* (Suleimanov) – Gaillot, p. 131-132, Pl. I.28, fig. 33, Pl. I.33, fig. 9.

Dimensions: The limits of size is similar to that indicated by Nguyen Duc Tien (1979). H.= 0.470-0.840 mm, w.= 0.100-0.150 mm, w/H ratio= 0.18-0.23, p.d.= 0.030 mm, n.c.= 11 or 12, h.l.c.= 0.060-0.130 mm, w.t.= 0.010-0.020 mm.

Occurrence: Late Asselian to Changhsingian; Urals, Donetz, Spitsbergen, southern China, Cambodia, western Thailand, ?central Japan, Italy, Darvaz and Alborz. Late Changhsingian of Zagros.

Genus *Polarisella* Mamet & Pinard, 1992 *emend.* herein

Type species: *Polarisella blindensis* Mamet & Pinard, 1992.

Synonyms: *Dentalina* (part) *sensu* Ho, 1959 or Trifonova, 1967 or Berczi-Makk, 1996; *Nodosaria* (part) (see Mamet & Pinard, 1992; Berczi-Makk, 1996; Kobayashi *et al*., 2006); Nodosariidae *sensu* Altiner & Zaninetti (1981) and *sensu* Berczi-Makk, 1996 (part); *Pseudonodosaria sensu* Berczi-Makk, 1996; *Frondicularia* (part) (e.g., *sensu* Canuti *et al.,* 1970, fig. 12.10; *sensu* Pantic, 1970b, pl. 3, figs. 5-6); "*Nodosaria*" *sensu* Groves *et al*., 2005, p. 19-20, 22.

Emended diagnosis: See Mamet & Pinard, 1992, p. 377, for the frontal axial sections (nomenclature of Neumann, 1967, as indicated above), and add the following characters for the other planes of section. In sagittal axial sections, the palmate chambers are only high in the central part, then very low in the upper part. They communicate probably with the exterior by a lateral connection (sutural pores or gutters). This sagittal axial section corresponds to the name "*Frondicularia woodwardi* Howchin, 1895" often used for the Triassic *Polarisella* (e.g., Cuvillier & Sacal, 1951, pl. 1, fig. 2; Pantic, 1970b, pl. 3, fig. 6; Gazdzicki & Zawidzka, 1973, pl. 1, figs. 8-9, pl. 4, fig. 2; Salaj *et al*., 1983, pl. 82, figs. 2-7, 9-13; whereas the specimens of Berczi-Makk, 1996, pl. 14, fig. 4, are designed under the name of *Pseudonodosaria*). In frontal axial sections, the classical aspect emphasized by Pinard & Mamet is obvious, with the shape of chambers, lateral wall and deep sutures (probably interrupted).

Composition: *Polarisella blindensis* Mamet & Pinard, 1992; *P. lingulae* Nestell & Nestell, 2006; *Dentalina hoi* Trifonova, 1967; *Frondicularia woodwardi* Howchin, 1895 *auct.*; *Frondicularia* sp. *sensu* Pantic, 1970b, pl. 3, fig. 5, Canuti *et al*., 1970, fig. 12. 10; *Geinitzina*? spp. *sensu* Kobayashi, 2006c, pl. 3, figs. 23-25; ?*Nodosaria armeniensis* Efimova, 1961; *N. curta* Zheng & Lin *in* Lin, 1978; *N. elabugae* Cherdyntsev, 1914; *N. lanceolata* Zheng & Lin *in* Lin, 1978; *N. ordinata* Trifonova, 1965; *N. piricamerata* Efimova,1974; ?*N. transcaucasica* Vuks *in* Kotlyar *et al*., 1984; *N.* spp. *sensu* Adloff *et al*., 1985; *N.*? sp. *sensu* Gazdzicki & Smit, 1977, pl. 10, fig. 2; Nodosariidae *sensu* Altiner & Zaninetti (1981, pl. 88, figs. 5-7); see also the list of Mamet & Pinard (1992, p. 377), excep for *Nodosaria sagitta* Miklukho-Maklay; and some synonymies of Groves *et al*., 2005 for the "*Nodosaria*" species. In fact, two groups of *Polarisella* species can be easily distinguished in sagittal axial sections, the species with plane top of chambers (more or less quadratic in shape) as in *P.* ex gr. *elabugae* and these ones with acute top and ogival shape of chambers as in *P.* ex gr. *hoae*. The sagittal axial sections are necessary to determine accurately the taxa, hence almost all the available species of *Polarisella* are incompletely described.

Remarks: *Polarisella* must be added to the list of the survivors from the PTB, with *Endoteba* and *Earlandia* (VACHARD *et al*., 1994; RETTORI, 1995; GROVES & ALTINER, 2005; VACHARD *et al*., 2005).

Occurrence: Early Permian (MAMET & PINARD, 1992) to Middle Triassic (Anisian), cosmopolite; and up to the Jurassic of Germany (see the "*Frondicularia*" of FLÜGEL, 2004, pl. 69, fig. 11).

Polarisella ex gr. *elabugae* (CHERDYNTSEV, 1914)

(Pl. 82, figs. 14-15, Pl. 84, fig. 3, Pl. 95, figs. 2, 8)

Compare with:

1914 *Nodosaria elabugae* sp. nov. – CHERDYNTSEV, p. 34, pl. 2, fig. 2.
1953 *Nodosaria* ex gr. *elabugae* TSCHERDYNZEW (*sic*) – RAUZER-CHERNOUSOVA, text-fig. 32, p. 77.
1965 *Nodosaria armeniensis* EFIMOVA – REITLINGER, pl. 2, figs. 6, 7.
? 1970 *Frondicularia* sp. – CANUTI *et al.,* fig. 12. 10.
p.p. 1970 *Frondicularia* cf. *woodwardi* HOWCHIN – CANUTI *et al.,* fig. 12.11 (*non* fig. 12.12= *N. hoae*).
? 1970b *Frondicularia woodwardi* HOWCHIN – PANTIC, pl. 3, fig. 6.
? 1974 *Nodosaria ordinata* TRIFONOVA – EFIMOVA, pl. 5, fig. 4.
? 1974 *Nodosaria* aff. *ordinata* TRIFONOVA – EFIMOVA, pl. 5, fig. 3.
1978 *Nodosaria armeniensis* EFIMOVA – LYS & MARCOUX, pl. 1, fig. 15.
1981 *Nodosaria armeniensis* EFIMOVA – ALTINER, pl. 42, figs. 1, 2.
? 1982 *Nodosaria djulfensis* (*sic*) REITLINGER – DELFOUR *et al.,* fig. 16.
? 1983 *Nodosaria dzhulfensis* REITLINGER – VASLET *et al.,* p. 18 (no illustration).
1983b *Nodosaria armeniensis* EFIMOVA – JENNY-DESHUSSES, pl. 19, fig. 1.
? 1983 *Nodosaria ordinata* TRIFONOVA – SALAJ *et al.,* p. 118-119, pl. 80, figs. 9, 14, pl. 144, fig. 10.
? 1983 *Frondicularia woodwardi* HOWCHIN – SALAJ *et al.,* pl. 82, figs. 2-7, 9-13.
1984 *Nodosaria armeniensis* EFIMOVA – KOTLYAR *et al.,* pl. 6, fig. 13.
1985 *Nodosaria armeniansis* (*sic*) EFIMOVA – TRIFONOVA, pl. 3, fig. 7.
1986 *Nodosaria armeniensis* EFIMOVA – MARCOUX & BAUD, figs. 2, 4 (no illustration).
? 1989 *Nodosaria armeniensis* EFIMOVA – KOTLYAR *et al.,* tabl. 1, p. 33 (no illustration).
1992 *Polarisella elabugae* (CHERDYNZEV) – MAMET & PINARD, p. 377 (no illustration).
1996 *Nodosaria elabugae* TCHERDYNZEV (*sic*) – PRONINA, p. 251, pl. 3, fig. 14.
? 1996 *Cryptoseptida*? sp. – KOBAYASHI, fig. 5.24-25.
1998 *Nodosaria elabugae* TCHERDYNCEV (*sic*) – PRONINA, p. 167 (no illustration).
v. 2005 *Polarisella elabugae* (CHERDYNTSEV) – VACHARD *et al.,* p. 166, pl. 6, figs. 2-5, 10, 20-22, 23?, 24?, 31?, 32.
2005 *"Nodosaria" elabugae* CHERDYNTSEV – GROVES *et al.,* p. 19, figs. 19.11-17 (with 11 references in synonymy).
2005 *Nodosaria elabugae* (CHERDYNTSEV) – HUGHES, p. 103, pl. 3, figs. 19-20.
v. 2006 *Polarisella elabugae* (CHERDYNTSEV) – INSALACO *et al.,* p. 142, pl. 2, fig. 21.
2006 *Nodosaria* spp. – KOBAYASHI *et al.,* p. 321, figs. 6, 39-42, 45.
v. 2006 *Polarisella* ex gr. *elabugae* (CHERDYNTSEV) – GAILLOT, p. 133-134, Pl. V.6, figs. 2-5, 10, 20-24, 31-32.
2007 *"Nodosaria" elabugae* CHERDYNTSEV – GROVES *et al.,* fig. 8.18, 22-30.

Description: Test acute, gently tapering, with bridge-shaped septa, occasionally with rugosities protruding in the following chamber. The last chamber is often hemispherical. The species *P. elabugae* seems to be relatively similar to several Permian and Triassic taxa: *N. armeniensis*, *N. ordinata* and *Frondicularia woodwardi* of authors. The idea of a *P. elabugae* species group is therefore introduced here. Measured parameters are as follows: H.= 0.115-0.350 (0.385-0.450) mm, w.= 0.050-0.090 (0.110) mm, n.c.= 4-8.

Occurrence: Early-Middle Permian of former USSR. Dzhulfian of Turkey and Transcaucasia. Dzhulfian-Dorashamian of Saudi Arabia (Huqayl, Duhaysan, Midhnab, lower Khartam members of Khuff Formation). Lopingian of Zagros-Fars area (this study). Questionable presence in the Triassic (e.g., TRIFONOVA, 1965; PANTIC, 1970b; EFIMOVA, 1974; VACHARD & COLIN, 1994; GROVES *et al.*, 2005).

Polarisella ex gr. *hoae* (Trifonova, 1967)
(Pl. 27, fig. 13, Pl. 79, figs. 21-24, Pl. 83, fig. 7, Pl. 95, figs. 5-7, 9)

Compare with:

1967 *Dentalina hoi* sp. nov. – Trifonova, p. 7, pl. 2, figs. 3-9.
1970b *Frondicularia* sp. – Pantic, pl. 3, fig. 5.
1974 *Dentalina hoi* Trifonova – Efimova, p. 71 (no illustration).
1975 *Dentalina hoi* Trifonova – Styk, p. 518-519, pl. 36, fig. 14 (with synonymy).
p.p. 1970 *Frondicularia* cf. *woodwardi* Howchin – Canuti *et al.,* fig. 12.12 (*non* fig. 12.11= *N. elabugae*).
1981 Nodosariidae – Altiner & Zaninetti, pl. 88, figs. 5-7 (excellent sagittal axial sections).
1982 *Nodosaria armeniensis* Efimova – Delfour *et al*., fig. 16.
1983 *Dentalina hoi* Trifonova – Salaj *et al*., p. 121, pl. 81, fig. 1, pl. 83, fig. 5b, pl. 144, fig. 6, figs. 3-9 (with synonymy).
v. 2005 "*Dentalina*" *hoi* Trifonova – Vaslet *et al*., p.120 (no illustration).
v. 2005 *Polarisella? hoae* (Trifonova) – Vachard *et al*., p. 166, pl. 6, figs. 11, 12, 19.
2005 *"Nodosaria" hoae* (Trifonova) – Groves *et al*., p. 20, figs. 20.1-6 (with 12 references in synonymy).
? 2005 *Nodosaria suchonensis* Miklukho-Maklay – Hughes, p. 103, pl. 3, fig. 23.
2006 *Nodosaria expolita* Trifonova – Kobayashi *et al*., fig. 6.43-44.
v. 2006 *Polarisella* ex gr. *hoae* (Trifonova) – Gaillot, p. 134, Pl. II.31, fig. 13, Pl. III.12, figs. 21-24, Pl. V.6, figs. 11-12, 19.

Remarks: Test sometimes arcuate. Chambers ogival to pear-shaped. Wall relatively thick (diagenesis?) and chambers reduced to a conical or trapezoidal space. Because it is dedicated to Mrs Ho, the Latin genitive must be *hoae* and not *hoi*. The characters of *Dentalina* are not present in this species, therefore it is definitively attributed here to *Polarisella*. The rare specimens of Saudi Arabia must be incomplete or immature as they measure: H.= 0.265-0.315 mm, w.= 0.030-0.070 mm, n.c.= 5-6, whereas paratypic adult *P. hoae* measure: H.= 0.350-0.450 mm, w.= 0.070-0.100 mm for 8-9 or usually 6-7 chambers (Trifonova, 1967). These differences justify the name *P.* ex gr. *hoae*.

Occurrence: Late Permian of Hazro (Turkey). Triassic of central Europe (e.g., Salaj *et al*., 1983) and Turkey (e.g., Altiner & Zaninetti, 1981). Huqayl Member to the upper Khartam Member (Dzhulfian-Early Triassic) of Saudi Arabia. Lopingian of Zagros-Fars area.

Polarisella spp.
(Pl. 72, figs. 15, 22, 26, 29-30, Pl. 74 fig. 21, Pl. 78, fig. 2, Pl. 80, figs. 1, 15, Pl. 74, fig. 21, Pl. 88, fig. 20, Pl. 90, figs. 1-2, 4-5, 9-13, 19, Pl. 91, figs. 17, 23, Pl. 96, figs. 5, 10, 16, 18-19)

v. 2006 *Polarisella* spp. – Gaillot, p. 134, Pl. I.28, figs. 6-7, 34, Pl. I.30, fig. 21, Pl. I.33, fig. 20, Pl. I.34, figs. 17, 23, Pl. II.29, figs. 2, 5-9, 11, Pl. II.30, figs. 5, 10, 16, 18-19, Pl. III.9, fig. 3, Pl. III.11, fig. 2, Pl. III.20, figs. 1, 15, Pl. III.21, fig. 9, Pl. VI.11, figs. 15, 22, 26, 29-30, Pl. VI.12, figs. 1-2, 4-5, 9-13, 19, Pl. VI.13, figs. 14-15.

Remarks: Due to their description in frontal axial and not sagittal axial sections, the characterization of the described species of *Polarisella* is difficult, and all these specimens are maintained in open nomenclature.

Occurrence: Late Midian-Changhsingian of Hazro and Zagros.

Genus *Nestellorella* gen. nov.

Type species: *Pseudolangella pulchra* Pronina *in* Kotlyar *et al.,* 1989.

Synonyms: *Nodosaria* (part); *Frondinodosaria* (part; *sensu* Angiolini *et al.,* 2004); *Pseudolangella* (part) *sensu* Pronina *in* Kotlyar *et al.,* 1989; Pronina, 1996a; and Groves *et al.,* 2005 *non* Sellier de Civrieux & Dessauvagie, 1965.

Etymology: Dedicated to Dr. Ganelina Nestell and Prof. Merlynd Nestell, from Arlington, Texas, for their reference micropalaeontological work.

Diagnosis: Test small to medium-sized (H.= 0.100-0.440 mm), tapering to cylindrical. Chambers reniform. Septa curvated to angular and similar to the angulatus stage of the archaediscid foraminifers, i.e. evolute with suture marked along all the base of the chamber wall. Wall hyaline only present. Aperture absent in the first chamber, then of *Protonodosaria* type, and finally very large, with faint inner and outer thickenings of the wall.

Comparison: *Nestellorella* gen. nov. differs from *Nodosaria*/*Nodosinelloides*, *Pseudolangella*, *Protonodosaria* and *Frondinodosaria* by the type of aperture, and the terminal "angulatus" stage when all these latter genera, especially *Pseudolangella* are at a "concavus" stage (compare with VACHARD, 1988, and, above, the analysis of *Nodosinelloides*). Although introduced for the first time in another group than the archaediscids, the classification in stages seems to be very useful for reconstructing the evolution of several groups of Nodosariata. It is also necessary for the Lasiodiscoidea (PILLE *et al.*, 2007). Due to the "angulatus" character of the skeleton, *Nestellorella* gen. nov. might be considered as the ancestor of the important Triassic lagenid genus *Austrocolomia* OBERHAUSER, 1960 *emend.* OBERHAUSER, 1967, which phylogeny is not yet clearly established, and whose FAD can be Changhsingian in southern China (SHANG *et al*., 2003).

Composition: *Pseudolangella pulchra* PRONINA *in* KOTLYAR *et al.,* 1989; *P. acus* PRONINA, 1989; *P. doraschamensis* PRONINA, 1989; ?*P. dzhagadzurensis* PRONINA *in* KOTLYAR *et al.,* 1989; ?*P. fabaeformis* PRONINA *in* KOTLYAR *et al*., 1989; *P. filumiformis* PRONINA, 1989; *P. geranossensis* PRONINA *in* KOTLYAR *et al.,* 1989; *Frondinodosaria* sp. nov. aff. *plena sensu* ANGIOLINI *et al.* (2004, fig. 16.4); *Frondina sensu* ROSS & ROSS (1991, fig. 3.7); *Geinitzina pusilla sensu* ZHAO *et al.,* 1981 *non* GROZDILOVA; ?*Langella ocarina sensu* LEVEN & OKAY, 1996, pl. 10, fig. 2; *L. venosa sensu* BOZORGNIA, 1973, pl. 36, fig. 5; ?*Nodosaria longissima camerata* K.M.-MACLAY (*sic*) *sensu* PRONINA, 1988a (pl. 2, figs. 15-16), PRONINA, 1989 (pl. 1, figs. 21-22), and *sensu* PRONINA-NESTELL & NESTELL, 2001, pl. 2, fig. 9 only; *N. parva* LIPINA, 1949; ?sp. nov. 1 *sensu* PRONINA, 1988a (pl. 2, fig. 29), 1989 (pl. 1, fig. 24); ?sp. nov. 4 *sensu* PRONINA, 1988a (pl. 2, fig. 18), and 1989 (pl. 1, fig. 20); ?*Protonodosaria* aff. *P. proceraformis* GERKE *sensu* NGUYEN DUC TIEN (1979, 1986a); ?*Pseudoglandulina lepida* WANG, 1982; *Pseudonodosaria* sp. 3 *sensu* HE & CAI, 1991, p. 226, pl. 13, fig. 18.

Occurrence: Wordian? of southern Oman (ANGIOLINI *et al*., 2004). Midian-late Changhsingian of Transcaucasia (PRONINA, 1988a, 1989; KOTLYAR *et al*., 1989). Midian of Rushan-Pshart Pamir (DRONOV, 2004). Late Midian of Hazro. Lopingian of Zagros.

Nestellorella pulchra (PRONINA *in* KOTLYAR *et al.,* 1989)

(Pl. 78, figs. 18, 20, Pl. 91, fig. 19?)

1989 *Pseudolangella pulchra* sp. nov. – PRONINA *in* KOTLYAR *et al.,* p. 94-95, pl. 2, figs. 11-12.

v. 2006 *Nestellorella pulchra* (PRONINA) – GAILLOT, p. 135, Pl. I.34, fig. 19?, Pl. III.11, figs. 18, 20.

Dimensions: Medium sized species of the genus. H.= 0.345-0.450 mm, w.= 0.135-0.345 mm, w/H ratio= 0.39-0.77, n.c.= 7, p.d.= 0.036-0.054 mm, h.l.c.= 0.065-0.150 mm, w.t.= 0.017-0.018 mm.

Occurrence: Midian (Arpa Formation) of Transcaucasia. Late Wuchiapingian of Fars. Late Changhsingian of Zagros.

Nestellorella dorashamensis (PRONINA, 1989)

(Pl. 34, fig. 26, Pl. 72, fig. 18, Pl. 77, figs. 9, 13, Pl. 84, fig. 9, Pl. 91, fig. 12)

1988a *Pseudolangella doraschamensis* PRONINA – PRONINA, pl. 2, figs. 51-53 (*nomen nudum*).

1989 *Pseudolangella doraschamensis* sp. nov. – PRONINA, p. 33-34, pl. 2, figs. 32-35. (with 1 reference in synonymy).

v. 2006 *Nestellorella dorashamensis* (PRONINA) – GAILLOT, p. 135-136, Pl. I.34, fig. 12, Pl. III.9, fig. 9, Pl. III.10, fig. 9, 13, Pl. III.22, fig. 26, Pl. VI.11, fig. 18.

2007 *Pseudolangella doraschamensis* PRONINA – GROVES *et al*., fig. 10.5?, 6-8 (the fig. 5, questionable for these authors, is evidently another species).

Description: A very small species with 4-6 chambers and a spherical projected proloculus. H.= 0.160-0.240 mm, w.= 0.080-0.110 mm, w/H ratio= 0.42-0.60, n.c.= 4-6, p.d.= 0.020-0.035 mm, h.l.c.= 0.035-0.050 mm, w.t.= 0.005-0.015 mm.

Comparison: *N. acus* (PRONINA, 1989) has more chambers for a similar size.

Occurrence: Late Changhsingian (= Dorashamian) of Transcaucasia. Late Midian of southern Turkey (Hazro). Late Wuchiapingian-Changhsingian of Zagros.

Nestellorella acus (Pronina, 1989)
(Pl. 96, fig. 20)

1981 *Geinitzina pusilla* Grozdilova – Zhao *et al.,* pl. 2, fig. 36.
1988a *Pseudolangella acus* Pronina – Pronina, pl. 2, fig. 54 (*nomen nudum*).
1989 *Pseudolangella acus* sp. nov. – Pronina, p. 33, pl. 1, fig. 36.
2005 *Pseudolangella acus* Pronina – Groves *et al.,* p. 28, figs. 23.13-18.
v. 2006 *Nestellorella acus* (Pronina) – Gaillot, p. 136, Pl. II.30, fig. 20, Pl. III.10, fig. 13.

Dimensions: H.= 0.250 mm, w.= 0.115 mm, w/H= 0.46, p.d.= 0.010 mm, n.c.= 7, h.l.c.= 0.060 mm, w.t.= 0.008 mm.

Occurrence: Late Changhsingian of Transcaucasia and southern China. Late Changhsingian of Zagros and Fars.

Nestellorella sp.
(Pl. 87, fig. 14, Pl. 91, fig. 9)

v. 2006 *Nestellorella* sp. nov. – Gaillot & Vachard *in* Gaillot, p. 136, Pl. I.31, fig. 14, Pl. I.34, fig. 9.

Dimensions: H.= 0.350-0.442 mm, w.= 0.130-0.150 mm, w/H= 0.30-0.43, n.c.= 7-8, p.d.= 0.025-0.030 mm, h.l.c.= 0.050-0.060 mm, w.t.= 0.010-0.013 mm.

Occurrence: Late Changhsingian of Zagros.

Genus *Tauridia* Sellier de Civrieux & Dessauvagie, 1965 *emend.* herein

Type species: *Tauridia pamphyliensis* Sellier de Civrieux & Dessauvagie, 1965.

Emended diagnosis: Test uniserial, medium sized, similar to *Nodosinelloides*, i.e. two layered, but the fibrous layer is lacking on the top of the chambers. Aperture terminal simple.

Composition: *Tauridia pamphyliensis* Sellier de Civrieux & Dessauvagie, 1965; *Dentalina* cf. *ninae sensu* Chuvashov *et al.,* 1990 (or *Protonodosaria*); *Frondicularia* cf. *turae sensu* Vachard & Krainer, 2001b; ?*Langella longa* Baryshnikov *in* Baryshnikov *et al.,* 1982; *L.*? cf. *minima sensu* Krainer *et al.,* 2003b, pl. 7, figs. 8, 13; *Nodosaria bella kamensis* Baryshnikov *in* Baryshnikov *et al.,* 1982; *N. delicata* Wang, 1976; ?*N. decorosa* Wang *in* Zhao *et al.,* 1981 (or *Frondina*); *N. elegantissima sensu* Lin, Li & Sun, 1990, pl. 27, fig. 19 and *sensu* Vachard & Krainer, 2001b, pl. 6, fig. 31 (both non *sensu* Suleimanov, 1949= *Pseudolangella*); *N. falcata* Igonin *sensu* Kotlyar *et al.,* 1989, pl. 3, fig. 7; *N. farcimineformis sensu* Miklukho-Maklay, 1968 and Davydov, 1988 (*non* Miklukho-Maklay, 1965= *Frondinodosaria*); *N. galinae* Sosnina, 1978; *N. longissima sensu* Potievskaya, 1962 (part), pl. 6, fig. 6 only; and *sensu* Vachard & Miconnet, 1990, pl. 2, fig. 9; *N. longissima camerata* M.-Maclay *sensu* Lin *et al.,* 1990, p. 224, pl. 27, fig. 31 only; *N. mirabilis sensu* Vachard & Krainer, 2001b, pl. 6, figs. 6, 9, pl. 7, fig. 1 (only); *N. mirabilis caucasica sensu* Lin, 1978, 1984 and Lin *et al.,* 1990 (part); *N. planocamerata* Sosnina, 1978; *N.* cf. *sagitta sensu* Hughes, 2005, pl. 3, fig. 5; *N. tenuiseptata* Lipina, 1949; sp. nov. *sensu* Kobayashi, 1988, pl. 2, fig. 26; ?sp. nov. *sensu* Zhao *et al.,* 1981, pl. 2, fig. 28; *Nodosinelloides*? sp. *sensu* Kobayashi, 2006b, figs. 3. 43-44; *Sp. nov. sensu* Kobayashi, 2006d, pl. 2, fig. 37; *Protonodosaria "kamaensis" sensu* Vachard & Krainer, 2001b, pl. 6, figs. 13, 16, 23; *P.* aff. *longissima sensu* Vachard & Krainer, 2001a, pl. 4, figs. 53-54; *P. longissima* Vachard & Krainer, 2001b, pl. 6, figs. 17-19, 22, 24-25, 27?, 28, 29?, pl. 7, figs. 6?, 29; *P. proceraformis sensu* Fontaine *et al.* (1994, pl. 6, fig. 3 only); *P.* sp. *sensu* Köylüoglu & Altiner, 1989, pl. 9, figs. 18-19.

Comparison: Differs from *Nodosinelloides* and *Protonodosaria* by the absence of fibrous layer upon the inner septa, and the characters listed by Sellier de Civrieux & Dessauvagie, 1965, p. 69.

Occurrence: Latest Pennsylvanian, Early-Late Permian; cosmopolite. Tethyan.

Tauridia nudiseptata sp. nov.
(Pl. 83, fig. 31, Pl. 84, fig. 6, Pl. 90, fig. 14, Pl. 92, figs. 9-10, Pl. 95, fig. 3, Pl. 96, figs. 1, 7, 12)

1988 *Nodosaria* sp. – Kobayashi, pl. 2, fig. 26.

v. 2006 *Tauridia nudiseptata* sp. nov. – GAILLOT & VACHARD *in* GAILLOT, p. 138, Pl. I.28, fig. 31, Pl. II. 28, figs. 9-10, Pl. II.29, fig. 3, Pl. II.30, figs. 1, 7, 12, Pl. III.9, fig. 6, Pl. VI.12, fig. 14 (*nomen nudum*).

Etymology: Latin *nudus* and *septatus*; i.e. with naked septa, because the fibrous layer is very thin or absent on the septa.

Type locality: Kuh-e Surmeh (Zagros, Iran).

Type level: Late Changhsingian.

Diagnosis: Relatively large *Tauridia* with hemispherical chambers. Aperture not observed.

Description: Test slightly tapering, with chambers increasing slowly in width but more markedly in height. The chambers are few enveloping, hemispherical at the beginning to horse-shoe-shaped or subquadrate at the end. Aperture with an endoskeleton evocating that of *Frondina appressaria*.

Dimensions: H.= 0.460-0.730 mm, w.= 0.100-0.160 mm, w/H= 0.18-0.32, n.c.= 7-12, p.d.= 0.027-0.040 mm, h.l.c.= 0.080-0.140 mm, w.t.= 0.005 mm for the dark layer, 0.018 for the two layers.

Holotype: Pl. 83, fig. 31 (KeS-171).

Type material: 7 (perhaps 10) specimens.

Repository of the types: Collection of Palaeontology of Lille 1 University (France).

Comparison: Differs from *T.* sp. 1 by the size of the test and the shape of the chambers.

Occurrence: Changhsingian of Turkey, Japan, and Hazro (Turkey). Late Changhsingian of Zagros. Wuchiapingian of Fars.

Tauridia sp. 1

(Pl. 72, fig. 6)

v. 2006 *Tauridia* sp. 1 – GAILLOT, p. 138-139, Pl. VI.11, fig. 6.

Description: Small-sized *Tauridia* with low subquadratic chambers. Test slightly tapering, with chambers increasing slowly in width and height. The chambers are not enveloping, hemispherical at the beginning to rounded subquadratic at the end. Apertures not observed.

Dimensions: H.= 0.240 mm, w.= 0.110 mm, w/H ratio= 0.46, n.c.= 5, p.d.= 0.035 mm, h.l.c.= 0.050 mm, w.t.= 0.015 mm.

Occurrence: Late Midian of Hazro.

Tauridia spp.

(Pl. 72, fig. 25?, Pl. 76, figs. 6-7, Pl. 77, fig. 10, Pl. 78, fig. 16, Pl. 79, fig. 25, Pl. 81, fig. 6, Pl. 88, fig. 19, Pl. 90, fig. 6?, Pl. 92, figs. 3, 7, Pl. 96, fig. 4)

v. 2006 *Tauridia* spp.- GAILLOT, p. 139, Pl. I.33, fig. 19, Pl.II.27, figs. 6-7, Pl. II.28, figs. 3, 7, Pl. II.30, fig. 4, Pl. III.10, fig. 10, Pl. III.11, fig. 16, Pl. III.12, fig. 25, Pl. III.27, fig. 6, Pl. VI.11, fig. 25?, Pl. VI.12, fig. 6?.

Remarks: This material corresponds probably to several unpublished species of *Tauridia emend.* Only the Pl. 90, fig. 6 is questionable because it seems to be morphologically intermediary between true *Tauridia emend.* and *Nodosinella digitata* BRADY re-illustrated by CUMMINGS (1955, text-fig. 14) (i.e. large, incurvated, and with numerous chambers). An interesting, maybe new, taxon is illustrated Pl. 79, fig. 25: H.= 0.835 mm, w.= 0.100 mm, w/H ratio= 0.12, n.c.= 15-16, p.d.= 0.042 mm, h.l.c.= 0.090 mm, w.t.= 0.015 mm.

Occurrence: Wuchiapingian of Fars. Changhsingian of Zagros. Possibly present in the late Wuchiapingian of south Turkey (Hazro).

Subfamily Langellinae subfam. nov.

Diagnosis: Large uniserial tests, slightly tapering and then cylindrical. Wall thick to thin. Aperture simple or absent. Chambers globose few enveloping.

Composition: *Langella* SELLIER DE CIVRIEUX & DESSAUVAGIE, 1965; *Pseudolangella* SELLIER DE CIVRIEUX & DESSAUVAGIE, 1965; "*Pseudoglandulina*" CUSHMAN, 1929 (part); "*Rectoglandulina*" LOEBLICH & TAPPAN, 1955 (part).

Comparison: The new subfamily differs from Protonodosariinae by the large size and the types of wall.

Occurrence: Late Early Permian-latest Permian, Palaeo- and Neotethys.

Genus *Langella* SELLIER DE CIVRIEUX & DESSAUVAGIE, 1965

Type species: *Padangia perforata* LANGE, 1925.

Synonyms: *Padangia* LANGE, 1925 (preoccupied); *Cryptoseptida sensu* LOEBLICH & TAPPAN, 1987 (part).

Diagnosis: Test small, medium, large or very large (height from 0.3 to 1.7 mm according to SELLIER DE CIVRIEUX & DESSAUVAGIE (1965) and up to 3.0 mm in this study. From 4 to 11 chambers. Tapering cylindrical test, slightly compressed or not. Sagittal axial section oval, to triangular or bitriangular. Frontal axial section similar but more compressed. Tranverse section circular to ovate. Absence of test nor proloculus ornementation. Aperture generally does not observed in thin section or simple, cylindrical, without peculiar characteristics. Sutures absent. Chambers increase rapidly in height. Septa increase generally in thickness, except the last one generally thinner than the penultimate. Chambers curved, non-enveloping, relatively low at the beginning but becoming relatively high to high in the last part. Wall thick by covering of the successive layers, sometimes obviously lamellated. Some species seem to present an "angulatus" stage as observed in the genus *Nestellorella* [i.e. *Langella conica sensu* BOZORGNIA, 1973 (part), pl. 34, fig. 1, whereas p. 36, fig. 6 is really a *Nestellorella*].

Composition: *Padangia perforata* LANGE 1925; *Nodosaria sumatrensis* LANGE, 1925; *P. inculta* LIN, 1984; *P. lepida* LIN, 1984 [to rename because of the priority of the taxon of WANG, 1988 (see above) when transferred in *Langella*]; *P. palmosa* LIN, 1985; *P. progresa* LIN, 1985; *P. pulchra* LANGE, 1925; *P. quasiperforata* LIN, 1984; *P. venosa* LANGE, 1925; *P. xintanensis* LIN, 1984; *Padangia* GLINTZBOECKEL & RABATÉ, 1964, pl. 98, fig. 2; *Langella conica* SELLIER DE CIVRIEUX & DESSAUVAGIE, 1965; *L. cukurkoyi* SELLIER DE CIVRIEUX & DESSAUVAGIE, 1965; *L. delicata* WANG, 1988; *Langella elliptica* ZOLOTOVA *in* ZOLOTOVA & BARYSHNIKOV, 1980; *L. elongata* WANG, 1988; *L. gigantea* JENNY-DESHUSSES, 1983b (*nomen nudum*); *L. guangxiensis* LIN, LI & SUN, 1990; *L. kongshanensis* WANG, 1988; *L. lepida* WANG, 1988; *L. malabensis* PRONINA-NESTELL *in* PRONINA-NESTELL & NESTELL, 2001; *L. massei* sp. nov.; *L. minima* WANG, 1988 (preoccupied by *L. minima* BARYSHNIKOV *in* ZOLOTOVA & BARYSHNIKOV, 1980); *L. ocarina* SELLIER DE CIVRIEUX & DESSAUVAGIE, 1965; *L. ocarina* "var. géante" SELLIER DE CIVRIEUX & DESSAUVAGIE, 1965; *L. ocarina grandis* JENNY-DESHUSSES, 1983b (*nom. nud.*); *L. perforata armenica* RAUZER-CHERNOUSOVA *in* AKOPIAN, 1974; *L. perforata langei* SELLIER DE CIVRIEUX & DESSAUVAGIE, 1965; *L. planocamerata* WANG, 1988; *L. sumatrensis* (LANGE) *sensu* NGUYEN DUC TIEN, 1989b, pl. 28, fig. 7; *L. variabilis* LIN, LI & SUN, 1990; *L. zolotovae* BARYSHNIKOV & KOSHELEVA *in* BARYSHNIKOV *et al.,* 1982; *L.* sp. *sensu* GROVES *et al.,* 2005, figs. 22.18-20; *L.*? sp. *sensu* KOBAYASHI, 2006b, fig. 5. 15; ?*L. minima* BARYSHNIKOV *in* ZOLOTOVA & BARYSHNIKOV, 1980;? *L. minutissima* KOSHELEVA *in* BARYSHNIKOV *et al.,* 1982; ?*L. obdita* BARYSHNIKOV *in* ZOLOTOVA & BARYSHNIKOV, 1980; ?*L. seminula* ZOLOTOVA *in* ZOLOTOVA & BARYSHNIKOV, 1980; ?*L. seminula tenuimunita* ZOLOTOVA *in* ZOLOTOVA & BARYSHNIKOV, 1980 (the five latter are very atypical taxa for the genus). For the other species see *Pseudolangella*, below (or eventually *Tauridia*, above).

Occurrence: Rare in the Yakhtashian-Bolorian (= Longlingian of southern China = Kungurian of Urals), acme in southern China in the late Chihsian, LAD in the Changhsingian, Palaeo- and Neotethys (see VACHARD, 1990).

Langella ex gr. *perforata* (LANGE, 1925)
(Pl. 89, fig. 23, Pl. 94, fig. 5)

Compare with:

1925 *Padangia perforata* sp. nov. – LANGE, p. 228-229, pl. 1, fig. 21 a-b.

1983b *Langella perforata* (LANGE) – JENNY-DESHUSSES, p. 101, pl. 2, figs. 2-3, 8 (with 8 references in synonymy).

1984 *Padangia perforata* LANGE – LIN, p. 117, pl. 1, figs. 44, 45a-b.

non 1990 *Langella perforata* (LANGE) – LIN *et al.,* p. 237, pl. 30, fig. 22 (the shape of chambers is totally different; with 7 references in synonymy).

2003 *Langella perforata* (LANGE) – ÜNAL *et al.,* pl. 1, fig. 42.

v. 2006 *Langella* ex gr. *perforata* (LANGE) – GAILLOT, p. 140, Pl. I.32, fig. 23, Pl. III.21, fig. 5

Dimensions: By its dimensions and small

number of chambers, the specimens correspond to a small form of the group *L. perforata*. H.= 0.550-0.675 mm, w.= 0.265-0.285 mm, w/H= 0.42-0.48, p.d.= 0.085 mm, n.c.= 3-4, h.l.c.= 0.060-0.170 mm, w.t.= 0.026-0.035 mm.

Occurrence: Changhsingian of Zagros.

Langella aff. *ocarina* Sellier de Civrieux & Dessauvagie, 1965

(Pl. 85, figs. 13, 15)

aff. 1965 *Langella ocarina* sp. nov. – Sellier de Civrieux & Dessauvagie, p. 47-48, pl. 9, fig. 6, pl. 11, fig. 4.
aff. 1981 *Langella ocarina* Sellier de Civrieux & Dessauvagie – Altiner, pl. 41, fig. 7.
? 1986a *Langella* cf. *L. ocarina* Sellier de Civrieux & Dessauvagie – Nguyen Duc Tien, pl. 2, fig. 13.
aff. 1989 *Langella ocarina* Sellier de Civrieux & Dessauvagie – Kotlyar *et al.,* tabl. 1 p. 32.
v. 2004 *Langella* cf. *ocarina* Sellier de Civrieux & Dessauvagie – Angiolini *et al.,* fig. 16.3.
v. 2006 *Langella* aff. *ocarina* Sellier de Civrieux & Dessauvagie – Gaillot, p. 140-141, Pl. I.26, figs. 13, 15.

Dimensions: w.= 0.400-0.665 mm, w.t.= 0.100-0.115 mm.

Occurrence: ?Late Midian of Sisophon (Cambodia). Lopingian of Turkey, early Dzhulfian of Transcaucasia. Late Changhsingian of Zagros. Questionable in Oman, Cambodia, Sumatra, and Malaysia.

Langella cf. *sumatrensis* (Lange, 1925)

(Pl. 76, fig. 9)

cf. 1925 *Nodosaria sumatrensis* sp. nov. – Lange, p. 222-223, pl. 1, fig. 11.
cf. 1989b *Langella sumatrensis* (Lange) – Nguyen Duc Tien, pl. 28, fig. 7.
v. 2006 *Langella* cf. *sumatrensis* (Lange) – Gaillot, p. 141, Pl. II.27, fig. 9.

Dimensions: H.= 2.950 mm, w.= 0.830 mm, w/H ratio= 0.27, n.c.= 3 visible, h.l.c.= 0.650 mm, w.t.= 0.085 mm.

Remarks: The type material of *Langella sumatrensis* attains 2.700-3.000 mm large and 0.800-1.000 mm wide, with 5 visible to 9 chambers; our unique specimen is therefore, larger and more slender.

Occurrence: Late Midian in Sumatra. Wuchiapingian of Zagros.

Langella massei sp. nov.

(Pl. 74, figs. 7, 16, Pl. 79, fig. 13)

? 1984 *Padangia pulchra* Lange – Lin, p. 118, pl. 1, figs. 46-47.
? 1990 *Langella pulchra* (Lange) – Lin *et al.,* p. 238, pl. 30 figs. 25-26.
2004 *Langella pulchra* (Lange) – Zhang & Hong, p. 74-75, pl. 3, fig. 6.
v. 2004 *Langella* sp. nov. aff. *venosa* (Lange) – Angiolini *et al.,* fig. 16. 2.
v. 2006 *Langella massei* sp. nov. – Gaillot & Vachard *in* Gaillot, p. 141-142, Pl. I.30, fig. 7, 16, Pl. III.12, fig. 13 (*nomen nudum*).

Etymology: Dedicated to Dr. P. Masse (TOTAL Company), all-round and accomplished micropalaeontologist.

Type locality: Kuh-e Surmeh.

Type level: Late Changhsingian.

Holotype: Pl. 74, fig. 7 (KeS-202).

Type Material: 7 (perhaps 9) specimens.

Diagnosis: A large species of *Langella*, with a large proloculus, a rather compressed shape, crescentic chambers excepted the hemispherical last one.

Description: The test tapers rapidly and remains cylindrical. The proloculus is relatively large and protected. The increasing height and width of the chambers is very slow. Chambers are crescentiform, sometimes relatively hemispherical. The peripherical wall is generally thicker than the septa. The aperture is rarely obvious, but is terminal, central, and seems rounded and simple.

Dimensions: H.= 1.040-1.440 mm, w.= 0. 400-0760 mm, w/H= 0.38-0.53, p.d.= 0.140-0.180 mm, h.l.c.= 0.200-0.320 mm, w.t.= 0.020/0.030 mm, n.c.= 7. Dimensions of Chinese material (compiled from Lin *et al.,* 1990 and Zhang & Hong, 2004): H= 0.600-1.330 mm, w.= 0.290-0.440 mm, n.c.= 6-8.

Comparison: *Langella massei* sp. nov. differs from *L. venosa* by the lower last chamber; from *L. pulchra sensu* Lange by the absence of sutures, and from *L. perforata* by the cylindrical shape and the parallel lateral sides. *L. massei* sp.

nov. is very similar to *L. malabensis* PRONINA-NESTELL *in* PRONINA-NESTELL & NESTELL, 2001, from the late Changhsingian of NW Caucasus, but differs by a larger proloculus, a smaller H/w ratio, and the different shape of last chambers.

Occurrence: Wordian/Murgabian of southeastern Oman (Haushi-Huqf uplift). Late Changhsingian of Zagros. Questionable in southern China.

Genus *Pseudolangella* SELLIER DE CIVRIEUX & DESSAUVAGIE, 1965

Type species: *Pseudolangella fragilis* SELLIER DE CIVRIEUX & DESSAUVAGIE, 1965.

Synonyms: *Langella sensu* LIN *et al.* (1990) and *auctorum* (part); *Pseudonodosaria* BOOMGART, 1949 (part); "*Rectoglandulina*" LOEBLICH & TAPPAN, 1955 (part); ?*Nodosaria* (part); ?*Frondicularia* (part); "*Pseudoglandulina*" CUSHMAN, 1929 (part); indet. genus and species *sensu* GROVES *et al.,* 2005, fig. 23.28-29.

Diagnosis: Test similar to *Langella*, but with more embracing chambers, and septal, and wall thicknesses slight and constant in size (in this sense, *Langella cukurkoyi s.s.* is morphologically transitional between the two genera).

Composition: *Pseudolangella fragilis* SELLIER DE CIVRIEUX & DESSAUVAGIE, 1965; *P.* sp. *sensu* ALTINER & ÖZKAN-ALTINER, 1998, pl. 4, fig. 16; ?*Frondicularia turae* BARYSHNIKOV *in* BARYSHNIKOV *et al*., 1982; *Langella costa* LIN, LI & SUN, 1990; *L.* cf. *cukurkoyi sensu* WANG, 1988; *L. delicata* (LIN, 1984) *sensu* LIN *et al.,* 1990; *L. imbecilla* LIN, LI & SUN, 1990; *L. linguaeformis* (PAALZOW) *sensu* LIN, LI & SUN, 1990; *L. ovalis* BARYSHNIKOV *in* ZOLOTOVA & BARYSHNIKOV, 1980; *L. wufengensis* LIN, LI & SUN, 1990; *Nodosaria acantha* LANGE, 1925; ?*N. dizerae* GÜVENÇ, 1967, p. 39-40, pl. 1, fig. 10; *N. elegantissima* SULEIMANOV, 1949; *N. gerkei* GÜVENÇ, 1967 (preoccupied); ?*N. inflata* LIN, 1978, p. 39-40, pl. 8, fig. 10; *Padangia delicata* LIN, 1984; *Pseudoglandulina conica* MIKLUKHO-MAKLAY, 1954; ?*P.* aff. *gigantea* MIKLUKHO-MACLAY *sensu* MIKLUKHO-MAKLAY, 1954; *P. longa* MIKLUKHO-MAKLAY, 1954. (see also SELLIER DE CIVRIEUX & DESSAUVAGIE, 1965, p. 132), *Pseudonodosaria starotinaensis* SOSIPATROVA, 1972, pl. 12, figs. 36-37.

Occurrence: FAD probably Sakmarian-LAD Changhsingian. Palaeo- and Neotethys.

Pseudolangella cf. *conica* (MIKLUKHO-MAKLAY, 1954)

(Pl. 72, fig. 12, Pl. 75, fig. 4)

cf. 1954 *Pseudoglandulina conica* sp. nov. – MIKLUKHO-MAKLAY, p. 37, pl. 4, figs. 1, 3.
? 1967 *Nodosaria dizerae* sp. nov. – GÜVENÇ, p. 39-40, pl. 1, fig. 10.
non 1970b *Pseudoglandullina* (*sic*) *conica* M. MACLAY – PANTIC, pl. 2, fig. 8 (= *Austrocolomia*).
? 1978 *Nodosaria inflata* sp. nov. – LIN, p. 39-40, pl. 8, fig. 10.
non 1978 *Pseudoglandulina conica* M.-MACLAY (*sic*) – LIN, p. 42, pl. 8, fig. 25 (= *Frondina permica*).
non 1981 *Pseudoglandulina conica* MIKLUKHO-MAKLAY – ZHAO *et al*., pl. 3, figs. 4-5 (= *Frondina* ex gr. *permica*).
cf. 1984 *Pseudoglandulina conica* K.M.-MACLAY – LIN, p. 148, pl. 7, fig. 42.
? 1986a *Langella çukurköyi* SELLIER DE CIVRIEUX & DESSAUVAGIE – NGUYEN DUC TIEN, pl. 2, fig. 11.
1988 *Langella* cf. *cukurkoyi* SELLIER DE CIVRIEUX & DESSAUVAGIE – WANG, p. 279, pl. 1, figs. 16-17.
? 1988a *Rectoglandulina* sp. 1 – PRONINA, pl. 2, fig. 44.
? 1989 *Rectoglandulina* sp. 1 – PRONINA, pl. 2, fig. 18.
cf. 1989b *Pseudolangella conica* LANGE (*sic*) – NGUYEN DUC TIEN, pl. 28, fig. 11.
? 1990 *Pseudoglandulina conica* M.-MACLAY – LIN *et al.,* p. 227-228, pl. 28, figs. 31-32 (or *Frondina* or *Tauridia emend.*) (with 6 references in synonymy).
? 1996 *Geinitzina conica* M.-MACLAY (*sic* without brackets) – LEVEN & OKAY, pl. 8, fig. 26.
cf. 2001 *Pseudolangella conica* M.-MACLAY – PRONINA-NESTELL & NESTELL, pl. 2, fig. 13.
? 2004 *Pseudoglandulina conica* M.-MACLAY – ZHANG & HONG, p. 73, pl. 1, figs. 33-34 (with 7 references in synonymy).
v. 2006 *Pseudolangella* cf. *conica* (MIKLUKHO-MAKLAY) – GAILLOT, p. 142-143, Pl. I.41, fig. 4, Pl. VI.11, fig. 12.

Description: All the dimensions of our specimens are smaller than those of the type material of MIKLUKHO-MAKLAY (1954). H.= 0.300-0.420 mm, w.= 0.175-0.230 mm, w/H= 0.42-0.76, n.c.= 3-4, p.d.= 0.050-0.085 mm, h.l.c.= 0.070-0.075 mm, w.t.= 0.010-0.030 mm.

Occurrence: Questionable in the Early Permian of Sumatra and the Carnic Alps; Midian of Sumatra. ?Midian of northwestern Turkey. Midian-Lopingian of Taurus (Turkey), Italy, New Zealand. Nessen Fm. of Alborz. "Middle" Wuchiapingian-late Changhsingian of Zagros, Himalaya. ?Midian of northwestern Turkey. Late Changhsingian of NW Caucasus, Transcaucasia, and southern China. Late Midian of Zagros (Kuh-e Dena) and southern Turkey (Hazro).

Pseudolangella fragilis SELLIER DE CIVRIEUX & DESSAUVAGIE, 1965
(Pl. 73, fig. 10, Pl. 86, fig. 12, Pl. 87, figs. 13, 23, Pl. 94, fig. 15)

1965 *Pseudolangella fragilis* gen. nov. sp. nov. – SELLIER DE CIVRIEUX & DESSAUVAGIE, p. 56, pl. 10, fig. 2, pl. 12, fig. 2a,b,c, pl. 15, fig. 6, pl. 16, figs. 6, 9-11.
1973 *Pseudolangella fragilis* DE CIVRIEUX & DESS. – BOZORGNIA, p. 154, pl. 35, fig. 2.
1980 *Pseudolangella fragilis* SELLIER DE CIVRIEUX & DESSAUVAGIE – LYS *et al.,* pl. 4, fig. 14.
1981 *Pseudolangella fragilis* DE CIVRIEUX & DESSAUVAGIE – ALTINER, pl. 41, figs. 8-10.
1983b *Pseudolangella fragilis* SELLIER DE CIVRIEUX & DESSAUVAGIE – JENNY-DESHUSSES, p. 107, pl. 3, figs. 4, 8.
1984b *Pseudolangella fragillis* (*sic*) SELLIER DE CIVRIEUX & DESSAUVAGIE – ALTINER, pl. 2, fig. 10.
1987 *Cryptoseptida fragilis* (SELLIER DE CIVRIEUX & DESSAUVAGIE) – LOEBLICH & TAPPAN, pl. 431, figs. 9-13.
1989 *Pseudolangella fragilis* SELLIER DE CIVRIEUX & DESSAUVAGIE – KÖYLÜOGLU & ALTINER, pl. 9, fig. 14.
1989a *Pseudolangella fragilis* SELLIER DE CIVRIEUX & DESSAUVAGIE – NGUYEN DUC TIEN, pl. 11, fig. 7.
v. 1990 *Pseudolangella fragilis* SELLIER DE CIVRIEUX & DESSAUVAGIE – VACHARD & MICONNET, pl. 2, fig. 12.
v. 1991 *Pseudolangella fragilis* SELLIER DE CIVRIEUX & DESSAUVAGIE – VACHARD & FERRIÈRE, pl. 4, fig. 8.
v. 2006 *Pseudolangella fragilis* SELLIER DE CIVRIEUX & DESSAUVAGIE – GAILLOT, p. 143, Pl. I.27, fig. 10, Pl. I.29, fig. 12, Pl. I.31, figs. 13, 23, Pl.III.21, fig. 15.
2007 *Pseudolangella fragilis* SELLIER DE CIVRIEUX & DESSAUVAGIE – GROVES *et al.,* fig. 6.3-4.

Dimensions: H.= 0.520-0.920 mm, w.= 0.165-0.250 mm, w/H= 0.27-0.47, n.c.= 4-9, p.d.= 0.050-0.070 mm, h.l.c.= 0.130-0.135 mm, w.t.= 0.015-0.045 mm.

Remarks: *Pseudolangella longa* (MIKLUKHO-MAKLAY, 1954) is a similar species with wider and less numerous chambers, with H= 0.630-0.900 mm, w.= 0.340-0.400 mm, n.c.= 5-6. A synonymy with *P. fragilis*, with priority of *P. longa*, is nevertheless possible.

Occurrence: Questionable in the Early Permian of Sumatra and the Carnic Alps; Midian-Lopingian of Taurus (Turkey), Italy, New Zealand. Nessen Fm. of Alborz. Lopingian of Zagros, Himalaya.

Pseudolangella cf. *imbecilla* (LIN, LI & SUN, 1990)
(Pl. 73, figs. 1-2)

cf. 1990 *Langella imbecilla* sp. nov. – LIN, LI & SUN, p. 237, pl. 30, figs. 19-21.
? 2002 *Langella imbecilla* LIN (*sic*) – GU *et al.,* p. 165, pl. 1, fig. 15 (apertures and chamber shapes differ).
cf. 2004 *Langella imbecilla* LIN, LI & SUN – ZHANG & HONG, p. 75, pl. 3, figs. 9-10.
v. 2006 *Pseudolangella* cf. *imbecilla* (LIN, LI & SUN) – GAILLOT, p. 143-144, Pl. I.27, figs. 1-2.

Dimensions: H.= 0.430-0.615 mm, w.= 0.240 mm, w/H= 0.39-0.56, p.d.= 0.025-0.030 mm, n.c.= 5, h.l.c.= 0.088-0.104 mm, w.t.= 0.016-0.020 mm.

Remarks: Our specimens are very similar to *Langella imbecilla sensu* ZHANG & HONG (2004) but both seems not really identical to the type material of LIN *et al.,* 1990.

Occurrence: Changhsingian of southern China. Wuchiapingian of Zagros.

Family Geinitzinidae BOZORGNIA, 1973

Synonym: Lunucamminidae HAYNES, 1981.

Diagnosis: Robuloidoidea with sagittal axial and frontal axial sections differing in shape. Sagittal axial sections exhibiting geinitzinoid chambers; i.e. low, medially arched, and non-enveloping. Frontal axial sections are nodosarioid in shape. Aperture terminal, simple.

Composition: *Geinitzina* SPANDEL, 1901; *Geinitzinita* SELLIER DE CIVRIEUX & DESSAUVAGIE, 1965; *Reitlingeria* PRONINA *in* KOTLYAR *et al.,* 1989; *Pseudotristix* REITLINGER, 1965; *Pachyphloides* SELLIER DE CIVRIEUX & DESSAUVAGIE, 1965; *Frondicularia* DEFRANCE *in* D'ORBIGNY, 1826 *sensu* SELLIER DE CIVRIEUX & DESSAUVAGIE, 1965; *Frondinodosaria* SELLIER DE

CIVRIEUX & DESSAUVAGIE, 1965; *Gerkeina* GROZDILOVA & LEBEDEVA *in* SOSIPATROVA, 1969; *Howchinella* SELLIER DE CIVRIEUX & DESSAUVAGIE, 1965 *emend.* PALMIERI *in* FOSTER *et al*., 1985.

Occurrence: Latest Pennsylvanian to Triassic.

Genus *Geinitzina* SPANDEL, 1901

Type species: *Geinitzina postcarbonica* SPANDEL, 1901 (see SELLIER DE CIVRIEUX & DESSAUVAGIE, 1965, p. 33).

Remarks: See GROVES & WAHLMAN (1997, p. 776).

Occurrence: Latest Pennsylvanian (GROVES, 2000)-Permian, cosmopolite, up to Dorashamian (LIN *et al.,* 1990).

Geinitzina postcarbonica SPANDEL, 1901
(Pl. 63, fig. 20, Pl. 72, fig. 28, Pl. 78, figs. 8, 10, Pl. 81, fig. 28, Pl. 83, fig. 29, Pl. 84, fig. 25, Pl. 86, fig. 6, Pl. 87, figs. 10, 18, Pl. 89, fig. 9, Pl. 91, fig. 14)

1901 *Geinitzina postcarbonica* sp. nov. – SPANDEL, p. 189, text-fig. 8a-d.
1925 *Geinitzina postcarbonica* SPANDEL – LANGE, p. 226-227, pl. 1, fig. 18.
1949 *Geinitzina postcarbonica* SPANDEL – LIPINA, p. 26, pl. 7, figs. 8-9.
1962 *Geinitzina postcarbonica* SPANDEL – POTIEVSKAYA, p. 76, pl. 6, figs. 9-14.
1965 *Geinitzina postcarbonica* SPANDEL – SELLIER DE CIVRIEUX & DESSAUVAGIE, p. 34-35, pl. 1, figs. 1-13, 16-17, 20-25, 27-30, pl. 2, figs. 1-4, 7-10, pl. 3, figs. 1-4, pl. 8, fig. 2.
1973 *Geinitzina postcarbonica* SPANDEL – BOZORGNIA, p. 158-159, pl. 34, fig. 9.
1986a *Geinitzina postcarbonica* SPANDEL – NGUYEN DUC TIEN, pl. 2, fig. 2.
1989 *Lunucammina postcarbonica* (SPANDEL) – KÖYLÜOGLU & ALTINER, pl. 8, figs. 17?, 18-22.
1990 *Geinitzina postcarbonica* (SPANDEL) – LIN *et al*., p. 233-234, pl. 29, figs. 27-28 (with 9 references in synonymy)
1997 *Geinitzina postcarbonica* SPANDEL – GROVES & WAHLMAN, p. 776-777, fig. 9.14-9.17, 9.21-9.23 (with 10 references in synonymy).
p.p. 1998 *Geinitzina postcarbonica* SPANDEL – PINARD & MAMET, p. 24-25, pl. 7, figs. 1?, 3-7, 9, 11 (with 46 references in synonymy; most are erroneous).
1999 *Geinitzina postcarbonica* SPANDEL – GROVES & BOARDMAN, p. 257, 259, pl. 4, figs. 10-11, 15-16, 18-23 (with 10 references add to the synonymy of GROVES & WAHLMAN, 1997).
2000 *Geinitzina postcarbonica* SPANDEL – GROVES, p. 300, pl. 5, figs. 7-9, pl. 6, figs. 1-17 (with 34 references in synonymy).
v. 2006 *Geinitzina* sp. – INSALACO *et al.,* pl. 2, fig. 19.
v. 2006 *Geinitzina postcarbonica* SPANDEL – GAILLOT, p. 144-145, Pl. I.28, fig. 29, Pl. I.29, fig. 6, Pl. I.31, figs. 10, 18, Pl. I.32, fig. 9, Pl. I.34, fig. 14, Pl. III.9, fig. 25, Pl. III.11, figs. 8, 10, Pl. III.26, fig. 20, Pl. III.27, fig. 28, Pl. VI.11, fig. 28.
? 2007 *Geinitzina spandeli dolomitica* LORIGA – GROVES *et al*., fig. 8. 16-24 (apparently homeomorphic).

Dimensions: H.= 0.210-0.365 mm, w.= 0.130-0.250 mm, w/H= 0.67-0.81, n.c.= 7-8, p.d.= 0.025-0.045 mm, h.l.c.= 0.030-0.072 mm, w.t.= 0.010-0.013 mm.

Remarks: Small test (H= 0.320-0.360 mm) with relatively numerous chambers (7-8), consequently the chambers are low and increasing slowly in height, whereas the increasing in width is constant giving a regularly tapered test.

Occurrence: Earliest-latest Permian, cosmopolite (see GROVES, 2000).

Geinitzina spandeli CHERDYNTSEV, 1914
(Pl. 81, fig. 4, Pl. 82, figs. 2, 7, Pl. 83, figs. 27-28)

1914 *Geinitzina spandeli* sp. nov. – CHERDYNTSEV, p. 13-14, pl. 2, figs. 13-14.
1974 *Geinitzina spandeli* TCHERD. – WANG, p. 286, pl. 149, fig. 10.
1981 *Geinitzina spandeli* CHERDYNTSEV – ZHAO *et al.,* pl. 2, figs. 31-33.
1990 *Geinitzina spandeli* TCHERDYNZEV – LIN *et al.,* p. 234, pl. 29, figs. 31-35 (with 6 references in synonymy).
1998 *Geinitzina* sp. aff. *spandeli* CHERDYNZEV – PINARD & MAMET, p. 25, pl. 7, figs. 2, 8?, 10 (with 12 references in synonymy).
2004 *Geinitzina spandeli* TCHERDYNZEV – ZHANG & HONG, p. 74, pl. 43, fig. 1 (with 8 references in synonymy).
v. 2006 *Geinitzina spandeli* CHERDYNTSEV – GAILLOT, p. 145, Pl. I.28, figs. 27-28, Pl. III.27, fig. 4, Pl. VI.13, figs. 2, 7.
p.p. 2007 *Geinitzina* cf. *spandeli* CHERDYNTSEV – GROVES *et al*., figs. 8.10 (*non* fig. 8.15-17= another species).

Dimensions: *G. spandeli* is similar to *G. postcarbonica* but smaller. H.= 0.130-0.200 mm, w.= 0.095-0.150 mm, w/H= 0.71-0.85, n.c.= 5-7, p.d.= 0.018-0.040 mm, h.l.c.= 0.022-0.040 mm, w.t.= 0.005-0.010 mm.

Occurrence: Early Kazanian (Roadian) of Russia (G. Nestell, personal communication, 2007). Late Chihsian to Changhsingian of southern China (Lin *et al.,* 1990, p. 85). Late Midian-Changhsingian of southern Turkey (Hazro).

Geinitzina ichnousa Sellier de Civrieux & Dessauvagie, 1965

(Pl. 81, fig. 29, Pl. 84, fig. 22, Pl. 86, fig. 19, Pl. 89, figs. 3, 14, 19, Pl. 95, fig. 1)

1965 *Geinitzina ichnousa* sp. nov. – Sellier de Civrieux & Dessauvagie, p. 35-36, pl. 2, figs. 5-6, pl. 3, figs. 5 a-f.
1979 *Geinitzina ichnousa* Sellier de Civrieux & Dessauvagie – Nguyen Duc Tien, p. 86-87, pl. 5, figs. 8-9.
1986a *Geinitzina ichnousa* Sellier de Civrieux & Dessauvagie – Nguyen Duc Tien, pl. 2, fig. 3.
1988a *Geinitzina ichnousa* Sellier de Civrieux & Dessauvagie – Pronina, pl. 2, figs. 32-34.
1989 *Geinitzina ichnousa* Sellier de Civrieux & Dessauvagie – Pronina, pl. 2, figs. 3-5.
? 1989 *Geinitzina ichnousa* – Kotlyar *et al.,* tabl. 1 p. 32 (no illustration).
1989 *Geinitzina ichnousa* Sellier de Civrieux & Dessauvagie – Köylüoglu & Altiner, pl. 9, figs. 2-3.
v. 2001b *Geinitzina ichnousa* Sellier de Civrieux & Dessauvagie – Vachard & Krainer, pl. 6, fig. 33.
v. 2006 *Geinitzina ichnousa* Sellier de Civrieux & Dessauvagie – Gaillot, p. 145-146, Pl. I.29, fig. 19, Pl. I.32, fig. 3, 14, 19, Pl. II.29, fig. 1, Pl. III.9, fig. 22, Pl. III.27, fig. 29.

Description: The chambers are not numerous, relatively high and well arched in the middle part. H.= 0.250-0.400-0.600 mm, w.= 0250-0.340-0.360 mm, w/H= 0.57-1.0, n.c.= 6-7 (8), h.l.c.= 0.040-0.070 mm, w.t.= 0.012-0.015 mm.

Occurrence: Midian-Lopingian of Turkey, Cambodia. Dzhulfian of Transcaucasia. Changhsingian of southern China & Zagros. Late Changhsingian of south Turkey (Hazro).

Geinitzina cf. *lingulaeformis* Lipina, 1949

(Pl. 72, fig. 1, Pl. 83, fig. 35, Pl. 85, fig. 8)

cf. 1949 *Geinitzina*? *linguliformis* sp. nov. – Lipina, p. 226-227, pl. 5, fig. 7-8.
cf. 1962 *Geinitzina* (?) *linguliformis* Lipina – Potievskaya, p. 78-79, pl. 7, figs. 19-21.
cf. 1984 *Geinitzina* (?) *linguliformis* Lipina – Lin, p. 144, pl. 1, fig. 28.
? 1990 *Geinitzina*? *linguliformis* Lipina – Lin *et al.*, p. 233, pl. 29, fig. 26 (maybe *Pseudolangella*).
v. 2001b *Geinitzina* aff. *lingulaeformis* Lipina *orth. mut*. – Vachard & Krainer, pl. 7, fig. 30.
v. 2006 *Geinitzina* cf. *lingulaeformis* Lipina – Gaillot, p. 146, Pl. I.26, fig. 8, Pl. I.28, fig. 35, Pl. VI.11, fig. 1.

Dimensions: H.= 0.275-0.310 mm, w.= 0.150- 0.170 mm, w/H= 0.62, n.c.= 6-7, p.d.= 0.030-0.045 mm, h.l.c.= 0.055 mm, w.t.= 0.011-0.013 mm.

Occurrence: Sakmarian of Urals, late Chihsian of southern China. Wuchiapingian of Zagros (Kuh-e Surmeh). Late Midian of southern Turkey (Hazro).

Geinitzina ex gr. *chapmani* Schubert, 1915

(Pl. 79, fig. 7, Pl. 88, fig. 10, Pl. 89, fig. 18, Pl. 94, fig. 7, Pl. 95, fig. 16)

Compare with:

1915 *Geinitzina chapmani* sp. nov. – Schubert, p. 58, pl. 39, fig. 4.
non 1925 *Geinitzina* cf. *chapmani* Schubert – Lange, p. 227-228, pl. 1, fig. 20 (a palaeotextulariid).
1990 *Geinitzina chapmani* Schubert – Lin *et al.,* p. 232-233, pl. 30, figs. 7-8.
v. 2006 *Geinitzina* ex gr. *chapmani* Schubert – Gaillot, p. 146, Pl. I.32, fig. 18, Pl. I.33, fig. 10, Pl. II.29, fig. 16, Pl. III.12, fig. 7, Pl. III.21, fig. 7.

Remarks: Large species with more than 10 chambers, progressively and slightly tapering.

Dimensions: H.= 0.330-0.500 mm, w.= 0.185-0.200 mm, w/H= 0.42-0.60, n.c.= 10-13, p.d.= 0.013-0.030 mm, h.l.c.= 0.050-0.070 mm, w.t.= 0.010-0.015 mm.

Occurrence: Asselian of Donbass (Ukraine). Sakmarian-Artinskian of Urals Murgabian-Lopingian of Alborz. Late Changhsingian of Zagros. Late Wuchiapingian of Fars.

Geinitzina spp.

(Pl. 63, fig. 15, Pl. 74, fig. 25, Pl. 75, fig. 1, Pl. 76, fig. 2, Pl. 77, figs. 4, 8, 12, 19, Pl. 78, figs. 21- 22, 26, Pl. 79, fig. 1, Pl. 81, fig. 27, Pl. 84, fig. 26, Pl. 88, fig. 4, Pl. 89, figs. 11, 17, 20, Pl. 92, fig. 14, Pl. 93, figs. 14, 19, Pl. 94, fig. 1, Pl. 96, fig. 17)

v. 2006 *Geinitzina* spp.- Gaillot, p. 146-147, Pl. I.30, fig. 25, Pl. I.32, figs. 11, 17, 20, Pl. I.33, fig. 4, Pl. I.41, fig. 1, Pl. II.27, fig. 2, Pl. II.28, fig. 14, Pl. II.30, fig.

17, Pl. II.35, figs. 14, 19, Pl. III.9, fig. 26, Pl. III.10, figs. 4, 8, 12, 19, Pl. III.11, figs. 21- 22, 26, Pl. III.12, fig. 1, Pl. III.21, fig. 1?, Pl. III.26, fig. 15, Pl. III.27, fig. 27, Pl. V.6, fig. 14.

Remarks: According to the criteria of the literature, several "species" could be present, but the group *Geinitzina postcarbonica*, illustrated here, is the most frequent. A possible *Geinitzina* "*reperta*" BYKOVA is mentioned in Saudi Arabia by DELFOUR *et al*. (1982, fig. 16); nevertheless, the taxon *G. reperta* belongs to the Devonian genus *Eogeinitzina* (e.g., VACHARD, 1994), and the Permian specimens attributed to *Geinitzina* "*reperta*" must be re-named.

Occurrence: Dzhulfian-Dorashamian of Saudi Arabia (Huqayl, Duhaysan, Midhnab members). Midian-Lopingian of Persian Gulf.

Genus *Pseudotristix* MIKLUKHO-MAKLAY, 1960

Type species: *Tristix* (*Pseudotristix*) *tcherdynzevi* MIKLUKHO-MAKLAY, 1960.

Synonym: *Multifarina* LIN, 1984.

Diagnosis: Similar to *Geinitzina*, but with a uniseriate development becoming triserial or with three diverging series of chambers.

Remarks: It is possible that other "*Geinitzina reperta* BYKOVA" (see above) are oblique sections of *Pseudotristix*, for example that of NGUYEN DUC TIEN (1986a, pl. 2, fig. 5).

Composition: *Tristix* (*Pseudotristix*) *tcherdynzevi* MIKLUKHO-MAKLAY, 1960; *Pseudotristix solida* REITLINGER, 1965; *P. triangula* LIN, 1984; *P.* sp. 3 (introduced here below); *Geinitzina caucasica* MIKLUKHO-MAKLAY, 1954; *G. gigantea* MIKLUKHO-MAKLAY, 1954; *G. postcarbonica sensu* KOBAYASHI, 2006d, pl. 2, fig. 34; *G. senkinensis* SOSNINA, 1967; *G*. sp. A *sensu* KOBAYASHI, 2006b, fig. 3.41; *G.*? sp. *sensu* KOBAYASHI, 2006b, fig. 3.38; *Lunucammina* sp. *sensu* YANAGIDA *et al.,* 1988, pl. 3, fig. 11; *Multifarina xintanensis* LIN, 1984; ?*Geinitzina pluscula* LIN, 1985; *Langella pluscula* (LIN) *sensu* LIN *et al*., 1990.

Occurrence: The taxa is generally cited in the Wuchiapingian/Dzhulfian, from Turkey to southern China (including *Multifarina* where it is indicated as Maokouan in age by LIN *et al*., 1990, p. 89). Its FAD seems to be late Midian in Sumatra, central Japan and Primorye, and its LAD is Changhsingian in age in Transcaucasia, Italy, Cambodia, southern China, northern Thailand, Japan, and Zagros.

Pseudotristix solida REITLINGER, 1965
(Pl. 10, fig. 10?, Pl. 30, fig. 3, Pl. 88, fig. 17)

1965 *Pseudotristix solida* sp. nov. – REITLINGER, p. 66, pl. 2, figs. 1-5.
1984b *Pseudotristix solida* REITLINGER – ALTINER, pl. 2, fig. 15.
1985 *Pseudotristix* sp. of *P. solida* group – OKIMURA *et al.,* pl. 1, fig. 14.
1986a *Pseudotristix solida* REITLINGER – NGUYEN DUC TIEN, pl. 1, fig. 17.
1989 *Pseudotristix solida* REITLINGER – KOTLYAR *et al.,* tabl.1, p. 32 (no illustration).
v. 2006 *Pseudotristix solida* REITLINGER – GAILLOT, p. 147, Pl. I.33, fig. 17, Pl. VII.1, fig. 10?, Pl. VII.3, fig. 3.

Dimensions: H.= 0.545 mm, w.= 0.375-0.382 mm, w/H= 0.70, n.c.= 10 or 11, h.l.c.= 0.065 mm, w.t.= 0.023 mm.

Remarks: All the parameters correspond to the diagnosis of REITLINGER.

Occurrence: Dzhulfian of Transcaucasia. Lopingian of Turkey. Late Midian of Sumatra. Late Changhsingian of Zagros and questionably, southern China.

Pseudotristix caucasica (MIKLUKHO-MAKLAY, 1954) *emend.* herein
(Pl. 74, figs. 4, 6, Pl. 77, fig. 18, Pl. 81, figs. 13, 17?, 25, 26?, Pl. 85, figs. 1-4, 6, 11, Pl. 96, figs. 2, 13)

1954 *Geinitzina caucasica* sp. nov. – MIKLUKHO-MAKLAY, p. 46-47, pl. 3, fig. 3.
non 1960 *Geinitzina* cf. *caucasica* M.-MACLAY- LORIGA, p. 67, pl. 5, fig. 1 (probably a true *Geinitzina*).
1970 *Lunucammina* (= *Geinitzina*) – DONZELLI & CRESCENTI, p. 15, pl. 3, fig. 7.
non 1970a *Geinitzina caucasica* MIKLUKHO-MAKLAY – PANTIC, pl. 10, fig. 4 (a true *Geinitzina*).
1978 *Geinitzina caucasica* MIKLUKHO-MAKLAY – LIN, p. 13, pl. 1, fig. 21.
? 1981 *Geinitzina caucasica* MIKLUKHO-MAKLAY – ZHAO *et al.,* pl. 3, fig. 2, pl. 16, fig. 8 (or a true *Geinitzina*).
1986a *Geinitzina* (?) sp. – NGUYEN DUC TIEN, pl. 2, fig. 6.

2001 *Geinitzina caucasica* MIKLUKHO-MAKLAY – PRONINA-NESTELL & NESTELL, pl. 2, figs. 23-24.

? 2002 *Nodosaria patula* M.-MACLAY – GU *et al.,* p. 165, pl. 1, fig. 13.

v. 2006 *Pseudotristix caucasica* (MIKLUKHO-MAKLAY) – GAILLOT, p. 147-148, Pl. I.26, figs. 1-4, 6, 11, Pl. I.30, figs. 4, 6, Pl. II.30, figs. 2, 13, Pl. III.10, fig. 18, Pl. III.27, figs. 13, 17?, 25, 26?.

Emended diagnosis: Small *Pseudotristix* with numerous chambers compared to the size, and a trilobate periphery.

Description: Test tapering, with chambers increasing slowly in high but markedly in width. The chambers are covering but not enveloping (according to the nomenclature of SELLIER DE CIVRIEUX & DESSAUVAGIE, 1965), arched, completely geinitzinoid in shape.

Dimensions: H.= 0.250-0.360 mm, w.= 0.150-0.335 mm, w/H= 0.63-0.80, n.c.= 5-10, p.d.= 0.020-0.045 mm, h.l.c.= 0.030-0.055 mm, w.t.= 0.006-0.010 mm. The Caucasian type material of MIKLUKHO-MAKLAY (1954) measures: H.= 0.350-0.500 mm, w.= 0.300-0.450 mm, n.c.= 8-11, p.d.= 0.030-0.070 mm; h.l.c.= 0.054 mm, w.t.= 0.004 mm. Therefore, the dimensions are identical to our specimens, peculiarly similar to the pl. 2, fig. 24 of PRONINA-NESTELL & NESTELL (2001).

Comparison: *Pseudotristix caucasica* differs from *P. solida* by the size of the test and the shape of the transverse section; it differs from *P. triangula* LIN, 1984 by the second character. *P.* sp. 3 is considerably larger; it differs from "*Geinitzina*" *gigantea* (which belongs to *Pseudotristix* by comparison with the topotype of PRONINA-NESTELL & NESTELL, 2001, pl. 2, fig. 20) by the smaller size.

Occurrence: Changhsingian of NW Caucasus, Italy, Cambodia, and southern China. Late Guadalupian-early Wuchiapingian of Zagros. Late Wuchiapingian-early Changhsingian of Fars.

Pseudotristix sp. 3

(Pl. 76, fig. 14, Pl. 88, fig. 10, Pl. 91, fig. 26?, Pl. 93, fig. 10)

v. 2006 *Pseudotristix* sp. 3 – GAILLOT, p. 148, Pl. I. 34, fig. 26?, Pl. II.27, fig. 14, Pl. II.35, fig. 10.

Dimensions: (a) Pl. 91, fig. 26: H.= 0.720 mm, w.= 0.300 mm, w/H= 0.41, n.c.= 6, p.d.= 0.090 mm, h.l.c.= 0.125 mm, w.t.= 0.020 mm; (b) Pl. 76, fig. 14: w.= 0.740 mm, t.t.= 0.560 mm, w.t.= 0.040 mm; (c) Pl. 93, fig. 10: w.= 1.200 mm, t.t.= 1.100 mm, w.t.= 0.140 mm.

Remarks: The rare specimens of this taxon are extremely large but show the typical triangular shape of the genus in transverse section. Only the very large transverse sections are really typical, but it is possible that a sagittal axial section of this taxon is illustrated on Pl. 91, fig. 26. In this case, a morphological comparison with *Langella pluscula* (LIN) *sensu* LIN *et al.,* 1990 is also possible (this species has 4-7 chambers and a height of 0.440-0.740 mm; consequently, it is very different of the original description of taxon, under the name *Geinitzina pluscula* LIN, 1985, with 2-3 chambers for a height of 0.200-0.350 mm).

Occurrence: Lopingian of Zagros and Fars area.

Genus *Pachyphloides* SELLIER DE CIVRIEUX & DESSAUVAGIE, 1965

Type species: *Pachyphloides oberhauseri* SELLIER DE CIVRIEUX & DESSAUVAGIE, 1965.

Diagnosis: Test similar to *Pachyphloia* differing by less lateral thickennings and a round simple aperture, not stellate. Also similar to *Geinitzina*, but differing by the curved septa, *Pachyphloides* can appear as transitional between *Geinitzina* and *Pachyphloia*.

Occurrence: Late Permian to Jurassic.

Pachyphloides cf. *inflatus* (MIKLUKHO-MAKLAY, 1954)

(Pl. 4, fig. 25-26?, Pl. 74, fig. 22; Pl. 83, fig. 4?, Pl. 87, figs. 6, 8, 20)

cf. 1954 *Geinitzina inflata* sp. nov. – MIKLUKHO-MAKLAY, p. 31, pl. 3, fig. 4.

cf. 1984 *Geinitzinita*? *inflata* (MIKLUKHO-MAKLAY) – KOTLYAR *et al.,* pl. 7, fig. 17.

cf. 1984 *Geinitzina inflata* MIKLUKHO-MAKLAY – LIN, p. 114, pl. 1, fig. 29.

cf. 1990 *Pseudoglandulina inflata* (MIKLUKHO-MAKLAY) – LIN *et al.,* p. 228, pl. 28, fig. 35.

cf. 1996 *Geinitzina* cf. *inflata* MIKLUKHO-MAKLAY – LEVEN & OKAY, pl. 10, fig. 17.
cf. 2001 *Pachyphloides inflatus* (MIKLUKHO-MAKLAY) – PRONINA-NESTELL & NESTELL, pl. 3, fig. 28.
? v. 2001b *Geinitzina* aff. *inflata* MIKLUKHO-MAKLAY – VACHARD & KRAINER, pl. 6, fig. 7.
? 2004 *Pseudoglandulina inflata* (MIKLUKHO-MAKLAY) – ZHANG & HONG, p. 73, pl. 2, fig. 35 (primitive *Colaniella*?).
v. 2006 *Pachyphloides* cf. *inflatus* (MIKLUKHO-MAKLAY) – GAILLOT, p. 149, Pl. I.28, fig. 4?, Pl. I.30, fig. 22, Pl. I.31, figs. 6, 8, 20, Pl. I.43, figs. 25-26?

Description: This species is smaller than *P. inflatus* but shares many parameters with this species. H.= 0.230-0.430 mm, w.= 0.150-0.300 mm, w/H= 0.65-0.70, n.c.= 5-8, p.d.= 0.027-0.060 mm, h.l.c.= 0.046-0.100 mm, w.t.= 0.008-0.012 mm.

Remarks: In her review, G. NESTELL (personal communication, June 2007) considered that any illustrations presented here correspond to this species.

Occurrence: Maokouan of southern China. Dzhulfian? of NW Turkey. Changhsingian NW Caucasus and southern China. Changhsingian of Zagros.

Genus *Frondicularia* DEFRANCE, 1825 *sensu* SELLIER DE CIVRIEUX & DESSAUVAGIE, 1965

Type species: *Renulina complanata* DEFRANCE, 1824.

Diagnosis: Biconical test, with long lower cone and small upper cone. Chambers low, broad and palmate to horseshoe-shaped. Aperture terminal, central, radiate, sometimes with a small neck.

Composition: See PINARD & MAMET (1998, p. 29-30), which listed 68 species but many of them are *Ichthyolaria, Gerkeina* or *Frondina*. Add: *Frondicularia* sp. *sensu* KOBAYASHI, 1988, pl. 2, figs. 27-30.

Remarks: According to G. NESTELL (personal communication, June 2007), "we do not have true *Frondicularia* in the Permian!. The Permian species described under *Frondicularia* are now attributed to *Ichthyolaria* and *Howchinella*". In this case, the taxa illustrated here as *Frondicularia* spp. must be differently denominated.

Occurrence: Sakmarian to the top of Changhsingian (this study).

Frondicularia spp.
(Pl. 75, fig. 8, Pl. 76, fig. 3, Pl. 81, fig. 16, Pl. 92, fig. 8, Pl. 95, fig. 4, Pl. 96, fig. 8)

v. 2006 *Frondicularia* spp. – GAILLOT, p. 149-150, Pl. I.41, fig. 8, Pl. II.27, fig. 3, Pl. II.28, fig. 8, Pl. II.29, fig. 4, Pl. II.30, fig. 8, Pl. III.21, fig. 16.

Dimensions: The measurements of these specimens maintained in open nomenclature are as follows: Pl. 75, fig. 8: H.= 0.420 mm, w.= 0.260 mm, w/H= 0.62, p.d.= 0.065 mm, n.c.= 6, h.l.c.= 0.070 mm, w.t.= 0.015 mm. Pl. 76, fig. 3: H= 0.595 mm, w.= 0.250 mm, n.c.= 8-9, h.l.c.= 0.115 mm, w.t.= 0.015 mm. Pl. 92, fig. 8: H= 0.680 mm, w.= 0.220 mm, w/H= 0.32, p.d.= 0.050, n.c.= 9, h.l.c.= 0.078 mm, w.t.= 0.005 mm. Pl. 95, fig. 4: H= 0.370 mm, w.= 0.185 mm, p.d.= 0.033 mm, n.c.= 8, h.l.c.= 0.060 mm, w.t.= 0.010. Pl. 96, fig. 8?: H= 0.460, w.= 0.245 mm, w/H= 0.53, n.c.= 6, h.l.c.= 0.100 mm, w.t.= 0.015 mm. Pl. 81, fig. 16: H.= 0.480 mm, w.= 0.290 mm, n.c.= 8, h.l.c.= 0.100 mm, w.t.= 0.017 mm.

Occurrence: Late Midian and late Changhsingian of Zagros. Wuchiapingian of Fars.

Genus *Frondinodosaria* SELLIER DE CIVRIEUX & DESSAUVAGIE, 1965

Type species: *Frondinodosaria pyrula* SELLIER DE CIVRIEUX & DESSAUVAGIE, 1965.

Synomyms: *Lingulina auct. non* D'ORBIGNY, 1826; *Nodosaria* (part); *Lingulonodosaria* (*auct*.) (see discussion in SELLIER DE CIVRIEUX & DESSAUVAGIE, 1965, p. 133); add: *Frondinodosaria* (part); *Frondicularia* (part); *Ichthyolaria* (part); *Dentalina* (part); *Pseudonodosaria* (part).

Diagnosis: Test small to large (H.= 0.300-1.200 mm) elongate. Chambers relatively high and broad, and ogival to horseshoe-shaped. Aperture terminal, central, simple.

Composition: See SELLIER DE CIVRIEUX &

DESSAUVAGIE, 1965, p. 133. Add: *Dentalina* ex gr. *communis sensu* GERKE, 1961; ?*D. multicostata sensu* BRADY, 1876; *D. unguis* VORONOV *sensu* GERKE, 1961; *Frondicularia*? *arpaensis* PRONINA, 1989 (part); *Frondina* sp. *sensu* KOBAYASHI, 2006d, pl. 2, fig. 33; *Frondinodosaria densecamerata* SOSNINA 1977; *F. plana* SOSNINA, 1977; *"Ichthyolaria" primitiva sensu* ALTINER, 1981, pl. 40, fig. 5; *I.*? sp. *sensu* PRONINA, 1988a, pl. 2, fig. 62, and 1989, pl. 1, fig. 33; Indeterminate Ichthyolariidae *sensu* GROVES & WAHLMAN, 1997, fig. 9. 20; *Lingulina* ex gr. *elegantula sensu* OKIMURA *et al.,* 1985, pl. 1, fig. 15; *Nodosaria cuspidatula* GERKE, 1961; *N. damottae* GÜVENÇ, 1967; *N. eximia* LIN, LI & SUN, 1990; *N. farcimineformis* MIKLUKHO-MAKLAY, 1965 (*non sensu* MIKLUKHO-MAKLAY, 1968 and DAVYDOV, 1988 = *Tauridia*); *N. suchonensis* MIKLUKHO-MAKLAY, 1968 *non* 1965; *Pseudonodosaria lata sensu* MIKLUKHO-MAKLAY, 1965, pl. 1, figs. 13-16; *P. ventrosa* SCHLEIFER *sensu* SOSIPATROVA, 1972, pl. 13, fig. 28.

Occurrence: Sakmarian to the top of Changhsingian (this study).

Frondinodosaria aff. *semivelata* (CHERDYNTSEV, 1914)
(Pl. 72, fig. 4)

aff. 1914 *Lingulina semivelata* sp. nov. – CHERDYNTSEV, p. 17, pl. 1, fig. 1.
aff. 1996b *Lingulina semivelata* CHERDYNTSEV – PRONINA, p. 251, pl. 3, fig. 21.
aff. 1998 *Lingulina semivelata* TCERDYNCEV (*sic*) – PRONINA, p. 168 (no illustration).
v. 2005 "*Lingulina*" cf. *semivelata* CHERDYNTSEV – VACHARD *et al.,* p. 171, pl. 6, fig. 33.
v. 2005 *Lingulina semivelata* (CHERDYNTSEV) – HUGHES, pl. 3, fig. 4.
v. 2006 *Frondinodosaria* aff. *semivelata* (CHERDYNTSEV) – GAILLOT, p. 150, Pl. V.6, fig. 33, Pl. VI.11, fig. 4.

Dimensions: H.= 0.770 mm, w.= 0. 130 mm, n.c.= 7, proloculus= 0.070 mm.

Remarks: Subtriangular or horseshoe-shaped chambers. Septa and wall of same thickness.

Occurrence: Kazanian of Urals (Russia). Duhaysan Member (late Wuchiapingian) of Saudi Arabia. Discovered in the Midian of Hazro (Turkey).

Frondinodosaria sp. 1
(Pl. 78, fig. 28, Pl. 85, figs. 16?, 17, Pl. 92, fig. 6)

v. 2006 *Frondinodosaria* sp. 1 – GAILLOT, p. 150, Pl. I.26, figs. 16?, 17, Pl. II.28, fig. 6, Pl. III.11, fig. 28.

Dimensions: H.= 1.180-1.500 mm, w.= 0.310 mm, w/H= 0.21, n.c.= 5-6, p.d.= 0.090-0.100 mm, h.l.c.= 0.300 mm, w.t.= 0.018-0.025 mm.

Remarks: This form is a large *Frondinodosaria* relatively compressed ("*Lingulonodosaria*" of the authors). No exact equivalent was found in the literature. *Frondicularia aulax* CRESPIN, 1958 has the same dimensions, but the shape of the chambers is different.

Occurrence: Lopingian of Zagros.

Family Robuloididae REISS, 1963 *nomen translat.* LOEBLICH & TAPPAN, 1984

Synonym: Eocristellariidae LOEBLICH & TAPPAN, 1984 (although this latter family was originally assigned to the Fusulinida).

Diagnosis: Planispirally coiled Robuloidoidea, sometimes secondarily uncoiled.

Composition: *Eocristellaria* MIKLUKHO-MAKLAY, 1954; "*Astacolus*" *non* MONTFORT, 1808; *Calvezina* SELLIER DE CIVRIEUX & DESSAUVAGIE, 1965; *Cryptomorphina* SELLIER DE CIVRIEUX & DESSAUVAGIE, 1965 *emend.* GROVES, ALTINER & RETTORI, 2005; *Robuloides* REICHEL, 1946; ?*Gourisina* REICHEL, 1946; *Hubeirobuloides* LIN, LI & ZHENG *in* LIN, LI & SUN, 1990; ?*Astacolus auct*. (part); Ichthyolariidae gen. & sp. indet *sensu* KOBAYASHI, 2006b, fig. 5. 13-14.

Occurrence: Earliest to latest Permian. Palaeo- and Neotethys.

Genus *Eocristellaria* MIKLUKHO-MAKLAY, 1954 *emend.* herein

Type species: *Eocristellaria permica* MIKLUKHO-MAKLAY, 1954. (holotype re-illustrated as *Astacolus permicus* by PRONINA-NESTELL & NESTELL, 2001, pl. 4, fig. 5).

Synonymy: *Astacolus* (part: the Permian taxa without radiate aperture); *Calvezina* (part: the taxa without uncoiling).

Emended diagnosis: Test planispiral with elongate chambers. Periphery sligthly carinate. Wall two layered. Aperture simple (and not radiate as indicated in the initial diagnosis, as already remarked by LOEBLICH & TAPPAN, 1964, p. C342).

Occurrence: The genus is relatively poorly known, with an acme probably limited to the Late Permian, with a possible FAD in the Middle Permian (early Kazanian with *Astacolus oblongus* MIKLUKHO-MAKLAY *sensu* ZOLOTOVA *et al. in* GORSKII & KALMYKOVA, 1986, pl. 23, fig. 15 and *A. rotaliaeformis* (CHERDYNTSEV), *ibidem*, pl. 23, figs. 16a-b, pl. 24, fig. 15).

Eocristellaria aff. *quasisimplex* LIN, LI & SUN, 1990

(Pl. 72, fig. 13)

aff. 1990 *Eocristellaria quasisimplex* sp. nov. – LIN, LI & SUN, p. 247, pl. 33, figs. 6-7.

p.p.? 2005 *Calvezina ottomana* SELLIER DE CIVRIEUX & DESSAUVAGIE – GROVES *et al.,* figs. 23. 24 (*non*? figs. 23. 23, 25, 27, 30, but difficult to interpretate).

v. 2006 *Eocristellaria* aff. *quasisimplex* LIN, LI & SUN – GAILLOT, p. 151-152, Pl. VI.11, fig. 13.

Dimensions: The shape is relatively similar, but not all the parameters and the location of the proloculus (basal and not central). H.= 0.280 mm, number of whorl: 1, n.c.= 3, p.d.= 0.055 mm, h.l.c.= 0.090 mm, w.t.= 0.007 mm.

Occurrence: *E. quasisimplex* is late Chihsian in age in southern China. Late Midian of southern Turkey (Hazro).

Eocristellaria typica MIKLUKHO-MAKLAY, 1954

(Pl. 78, fig. 23, Pl. 79, fig. 2, Pl. 81, fig. 3, Pl. 83, fig. 21, Pl. 84, figs. 5, 27, Pl. 85, fig. 16, Pl. 88, fig. 1, Pl. 91, figs. 1)

1954 *Eocristellaria typica* gen. nov. sp. nov. – MIKLUKHO-MAKLAY, p. 68, pl. 10, fig. 13.

1980 *Calvezina ottomana* SELLIER DE CIVRIEUX & DESSAUVAGIE – LYS *et al.,* p. 87, pl. 4, fig. 1.

1981 *Astacolus* aff. *aphrastus* LOEBLICH & TAPPAN – ZHAO *et al.,* pl. 3, figs. 27, 29.

? 1981 *Eocristellaria* cf. *typica* MIKLUKHO-MAKLAY – ZHAO *et al.,* pl. 3, fig. 30.

1981 *Calvezina ottomana* SELLIER DE CIVRIEUX & DESSAUVAGIE – ALTINER, pl. 41, fig. 1.

1981 *Calvezina* sp. nov. – ALTINER, pl. 41, figs. 2-3.

1985 *Eocrystellaria* (*sic*) sp. of *E. typica* group – OKIMURA *et al.,* pl. 1, fig. 13.

1990 *Eocristellaria* cf. *permica* MIKLUKHO-MAKLAY – LIN *et al.,* p. 246-247, pl. 33, fig. 3.

p.p. 1990 *Eocristellaria typica* K. M.-MACLAY – LIN *et al.,* p. 247, pl. 33, fig. 4 only (*non* fig. 5 = *Aulacophloia* sp.).

v. 1993b *Calvezina* cf. *ottomana* SELLIER DE CIVRIEUX & DESSAUVAGIE – VACHARD *et al.,* pl. 8, fig. 15.

2001 *Astacolus typicus* (MIKLUKHO-MAKLAY) – PRONINA-NESTELL & NESTELL, pl. 4, figs. 6-7.

v. 2006 *Eocristellaria typica* MIKLUKHO-MAKLAY – GAILLOT, p. 152, Pl. I. 28, fig. 21, Pl. I.29, fig. 16, Pl. I.33, fig. 1, Pl. I.34, figs. 1, Pl. III.9, figs. 5, 27, Pl. III.11, fig. 23, Pl. III.12, fig. 2, Pl. III.27, fig. 3.

Dimensions: D.= 0.265-0.505 mm, w.= 0.150-0.210 mm, w/H= 0.48-0.57, p.d.= 0.010-0.050 (0.110) mm, n.w.= 1, n.c.= 4-8, h.l.c.= 0.070-0.180 (0.235) mm, w.t.= 0.007-0.020 mm.

Occurrence: Changhsingian of NW Caucasus, Ladakh (Himalaya), southern China and Zagros (this study).

Genus *Calvezina* SELLIER DE CIVRIEUX & DESSAUVAGIE, 1965

Type species: *Calvezina ottomana* SELLIER DE CIVRIEUX & DESSAUVAGIE, 1965.

Diagnosis: Test initially, planispiral, eocristellariiform, later uncoiled, uniseriate, with ogival chambers increasing rapidly in height. Aperture terminal simple. Wall relatively complex and poorly known.

Composition: *Calvezina ottomana* SELLIER DE CIVRIEUX & DESSAUVAGIE, 1965; *C.* sp. *sensu* KÖYLÜOGLU & ALTINER, 1989, pl. 9, fig. 13; ?*Nodosaria grandecamerata* SOSNINA, 1965; ?*Astacolus typicus* (MIKLUKHO-MAKLAY) *sensu* PRONINA-NESTELL & NESTELL (2001, pl. 4, figs. 6-7) and many questionable taxa in open nomenclature: for example Ichthyolaridae? gen. and sp. indet. *sensu* KOBAYASHI, 2006b (figs. 5. 9, 10?, 11?, 12), or Lagenina fam., gen. and sp. indet. *sensu* KOBAYASHI, 2006e, pl. 1, fig. 43.

Remarks: The sections of this genus are generally rare, and the successive stages of development are difficult to identify. Hence, many *Eomarginulinella* SOSNINA, 1969 and

Eocristellaria Miklukho-Maklay, 1954 of the literature could belong to this genus. Inversely, our definition do not correspond to *Calvezina sensu* Groves *et al.,* 2005. The phylogenic lineage of *Calvezina* also is unknown. *Eocristellaria* and *Cryptomorphina* seem to show some similarities. Due to the type of wall, its ancestor might be *Biparietata* Zolotova *in* Zolotova & Baryshnikov, 1980 from the Kungurian of Urals, but this taxon is unfortunately poorly defined.

Occurrence: FAD probably early Middle Permian. Acme in the Midian (Turkey, Greece, Alborz, Transcaucasia, Himalaya, Primorye, ?Italy, ?Hungary, ?Malaysia, ?Japan. LAD in the Changhsingian of Taurus, Turkey (Altiner, 1984b).

Calvezina ottomana Sellier de Civrieux & Dessauvagie, 1965
(Pl. 72, fig. 27)

1965 *Calvezina ottomana* sp. nov. – Sellier de Civrieux & Dessauvagie, p. 53-54, pl. 11, fig. 3, pl. 14, fig. 9.
1973 *Calvezia* (*sic*) cf. *C. ottomani* (re-*sic*) de Civrieux & Dessauvagie – Bozorgnia, pl. 35, fig. 10.
? 1975 *Eocristellaria* sp. – Ishii *et al.,* pl. 3, fig. 14.
? 1978 *Calvezina ottomana* Sellier de Civrieux & Dessauvagie – Lys & Marcoux, pl. 1, fig. 19 (different shape of chambers).
non 1978 *Calvezina ottomana* Sellier de Civrieux & Dessauvagie – Lys *et al.,* pl. 7, fig. 8 (another genus).
non 1980 *Calvezina ottomana* Sellier de Civrieux & Dessauvagie – Lys *et al.,* p. 87, pl. 4, fig. 1 (= *Eocristellaria typica*).
1981 *Calvezina* sp. – Vachard *in* Vachard & Montenat, pl. 14, fig. 12.
non 1981 *Calvezina ottomana* Sellier de Civrieux & Dessauvagie – Altiner, pl. 41, fig. 1 (= *Eocristellaria typica*).
? 1983b *Calvezina* aff. *ottomana* Sellier de Civrieux & Dessauvagie – Jenny-Deshusses, p. 92, pl. 3, figs. 16-19 (with 4 references in synonymy).
? 1984b *Calvazina* (*sic*) *ottomana* Sellier de Civrieux & Dessauvagie, – Altiner, pl. 2, fig. 16 (or an *Eocristellaria*?).
non 1987 *Calvezina ottomana* Sellier de Civrieux & Dessauvagie – Noé, p. 109, pl. 32, fig. 3 (= *Pachyphloia*).
1987 *Calvezina ottomana* Sellier de Civrieux & Dessauvagie – Loeblich & Tappan, pl. 436, figs. 1-5.
1989 *Calvezina ottomana* Sellier de Civrieux & Dessauvagie – Köylüoglu & Altiner, pl. 9, fig. 12.
? 1989 *Calvezina ottomana* Sellier de Civrieux & Dessauvagie – Kotlyar *et al.,* tabl. 1, n° 23, p. 32.
1989 *Calvezina* sp. 1 – Kotlyar *et al.,* pl. 3, figs. 15-16.
? 1992b *Ichthyolaria*? sp. – Ueno, fig. 10.9.
? 1992 *Calvezina* sp. – Berczi-Makk, pl. 1, fig. 1.
v.non1993b *Calvezina* cf. *ottomana* Sellier de Civrieux & Dessauvagie – Vachard *et al.,* pl. 8, fig. 15 (= *Eocristellaria typica*).
? 2005 *Calvezina ottomana* Sellier de Civrieux & Dessauvagie – Groves *et al.,* p. 31-32, figs. 23.23, 25, 27, 30, 24.1-2, 8-9 (with 12 references in synonymy) (all these specimens differ from the type material and seem to differ from each other).
v. 2006 *Calvezina ottomana* Sellier de Civrieux & Dessauvagie – Gaillot, p. 153, Pl. VI.11, fig. 27.
? 2007 *Calvezina ottomana* Sellier de Civrieux & Dessauvagie – Groves *et al.,* fig. 6.19- 23 (maybe similar to our *Nodosinvolutaria*? sp. see below).

Dimensions: H.= 0.735 mm, n.c.= 7, h.l.c.= 0.190 mm, w.t.= 0.020 mm.

Occurrence: Lopingian of Taurus. Middle Permian of Afghanistan. Early Dzhulfian of Transcaucasia. Late Midian of southern Turkey (Hazro).

Calvezina spp.
(Pl. 83, fig. 24, Pl. 89, figs. 4, 5?, Pl. 90, fig. 15?, Pl. 91, fig. 11)

v. 2006 *Calvezina* spp. – Gaillot, p. 153-154, Pl. I. 28, fig. 24, Pl. I.32, figs. 4, 5?, Pl. I.34, fig. 11, Pl. VI.12, fig. 15?.

Dimensions: Pl. 83, fig. 24: H.= 0.660 mm, w.= 0.200 mm, n.c.= 6, p.d.= 0.030 mm. Pl. 90, fig. 15: H= 0.964 mm, w.= 0.400 mm, w/H= 0.41, n.c.= 6 (with axis desviation between the 2 first and the 4 last), h.l.c.= 0.235 mm, w.t.= 0.070 mm. Pl. 89, fig. 4: H= 0.460 mm, n.c.= 2, h.l.c.= 0.140 mm, w.t.= 0.020 mm. Pl. 89, fig. 5: H= 0.845 mm, w.= 0.285 mm, w.t.= 0.022 mm.

Genus *Cryptomorphina* Sellier de Civrieux & Dessauvagie, 1965

Type species: *Cryptomorphina limonitica* Sellier de Civrieux & Dessauvagie, 1965.

Diagnosis: Test composed of a large subspherical proloculus, followed by few first ogival chambers uniseriate with an arcuate axis of growth with a thin wall. The last or the two last chambers are aligned, larger, inflated, and thick-walled. Aperture terminal simple. Wall relatively complex but poorly interpreted.

Composition: *Cryptomorphina limonitica* Sellier de Civrieux & Dessauvagie, 1965; *C. hazroensis* sp. nov.

Remarks: This genus is very poorly known (Sellier de Civrieux & Dessauvagie, 1965; Groves *et al.,* 2005; this study).

Occurrence: Late Midian of Hazro (Turkey). Wuchiapingian of Zagros (Iran). Changhsingian of central Taurides (Turkey).

Cryptomorphina limonitica Sellier de Civrieux & Dessauvagie, 1965

(Pl. 79, fig. 15)

1965 *Cryptomorphina limonitica* sp. nov. – Sellier de Civrieux & Dessauvagie, p. 51-52, pl. 11, fig. 6, pl. 23, fig. 4a-f.

p.p. 2005 *Cryptomorphina limonitica* Sellier de Civrieux & Dessauvagie – Groves *et al.,* p. 27, fig. 17 (*non* fig. 22.15-16: probably *Calvezina*) (with 1 reference in synonymy).

v. 2006 *Cryptomorphina limonitica* Sellier de Civrieux & Dessauvagie – Gaillot, p. 154, Pl.III.12, fig. 15.

2007 *Cryptomorphina limonitica* Sellier de Civrieux & Dessauvagie – Groves *et al.,* figs. 6, 5-8, 10, 12.

Description: Altough a little larger, this unique specimen is identified to the type species of *Cryptomorphina*, due to the particular coiling. H.= 0.470 mm, w.= 0.180 mm, w/H= 0.38, p.d.= 0.035 mm, n.c.= 5, h.l.c.= 0.155 mm, w.t.= 0.025 mm.

Occurrence: Changhsingian of Zagros.

Cryptomorphina hazroensis sp. nov.

(Pl. 72, fig. 3, Pl. 85, fig. 14)

v. 2006 *Cryptomorphina hazroensis* sp. nov. – Gaillot & Vachard *in* Gaillot, p. 154-155, Pl. I.26, fig. 14, Pl. VI.11, fig. 3 (*nomen nudum*).

Etymology: Latin, from Hazro.
Type locality: Hazro section (Turkey).
Type level: Late Midian.

Diagnosis: A species of *Cryptomorphina* characterized by its large size, elongate test, and irregular internal development of the septal walls.

Description: Test large, subcylindrical , without ornamentation nor suture. Proloculus very wide, not prominent, thick-walled, followed by two chambers ogival in shape. Conspicuous lamellation of the wall. L= 0.765-1.725 mm, w.= 0.375-0.520 mm, p.d.= 0.208-0.250 mm, n.c.= 4 visible, h.l.c.= 0.155-0.265 mm, w.t.= 0.025-0.040 mm.

Holotype: Pl. 72, fig. 3 (sample 03HZ09).

Type material: 2 (perhaps 3) specimens.

Repository of the types: Collection of Palaeontology of Lille 1 University (France).

Comparison: The new species differs from *C. limonitica* by larger dimensions, wall structure and shape of chambers different.

Occurrence: Late Midian of Hazro. Early Wuchiapingian of Zagros.

Genus *Robuloides* Reichel, 1946

Type species: *Robuloides lens* Reichel, 1946.

Remarks: The genus was originally described by Reichel (1946). The division in two genera, *Robuloides* and *Pararobuloides* Miklukho-Maklay, 1954 is possible but needs detailed discussion (apparently, compared with the Archaediscoidea, *Robuloides lens* or *R. acutus* look like *Neo*- or *Asteroarchaediscus*, and *R. gibbus* and *R. gourisiensis* like *Archaediscus s.s.*).

Occurrence: Midian-latest Changhsingian of Greece (Hydra, Attica), Cyprus, Hungary, Turkey, NW Caucasus, Transcaucasia, Afghanistan, Salt Range, southern China, Primorye, Japan, New Zealand.

Robuloides lens Reichel, 1946

(Pl. 73, figs. 5, 18, Pl. 77, fig. 1, Pl. 78, figs. 1, 5, 17, Pl. 79, figs. 5, 14, 18-20, 27-30, Pl. 81, fig. 15, Pl. 82, figs. 10-13, Pl. 84, fig. 24, Pl. 86, figs. 2, 7, Pl. 89, fig. 21, Pl. 88, fig. 18, Pl. 91, fig. 18, Pl. 93, fig. 12, Pl. 94, fig. 2, Pl. 96, fig. 21)

1946 *Robuloides lens* sp. nov. – Reichel, p. 536, fig. 21-26 in text, pl. 19, figs. 6, 7.

1946 *Robuloides acutus* sp. nov. – Reichel, p. 537, text-

figs. 27-29, pl. 19, figs. 8-9.
1976 *Robuloides acutus* Reichel – Wang, p. 192, pl. 1, figs. 13a-d.
1977 *Robuloides aequalis* sp. nov. – Sosnina, p. 27-28, pl. 2, figs. 7, 8.
v. 1981 *Robuloides lens* Reichel – Vachard & Montenat, pl. 15, fig. 6.
1981 *Robuloides lens* Reichel – Altiner, pl. 42, figs. 8-14.
non 1983 *Robuloides* aff. *lens* Reichel – Salaj *et al.,* p. 125, pl. 81, fig. 4.
1984 *Robuloides* aff. *lens* Reichel – Kotlyar *et al.,* pl. 6, fig. 18.
1984 *Robuloides acutus* Reichel – Kotlyar *et al.,* pl. 17, fig. 19.
1984 *Robuloides acutus* Reichel – Lin, p. 138, pl. 6, figs. 11-12.
1985 *Robuloides acutus* Reichel – Okimura *et al.,* fig. 3. 6.
1985 *Robuloides lens* Reichel – Pasini, pl. 61, fig. 12.
1985 *Colaniella* sp. – Trifonova, pl. 4, fig. 7.
1987 *Robuloides lens* Reichel – Loeblich & Tappan, pl. 437, figs. 6, 7.
1988a *Robuloides acutus* Reichel – Pronina, pl. 2, figs. 65-66.
1989 *Robuloides acutus* Reichel – Pronina, pl. 2, figs. 37-38.
1989 *Robuloides lens* Reichel – Köylüoglu & Altiner, pl. 10, figs. 16-17.
1989 *Robuloides aequalis* Sosnina – Köylüoglu & Altiner, pl. 10, figs. 4-15.
1990 *Robuloides lens* Reichel – Lin *et al.,* p. 193, pl. 19, figs. 19-21 (with synonymy).
1990 *Robuloides acutus* Reichel – Lin *et al.,* p. 193, pl. 19, figs. 10-14 (with 6 references in synonymy).
1991 *Robuloides lens* Reichel – Baud *et al.,* fig. 3 in text, p. 193 (no illustration).
1991 *Robuloides lens* Reichel – Grant *et al.,* tabl. 2 (no illustration).
v. 1991 *Robuloides acutus* Reichel – Vachard & Ferrière, pl. 4, figs. 10-12.
v. 1993b *Robuloides lens* Reichel – Vachard *et al.,* p. 97 (no illustration).
1995 *Robuloides lens* Reichel – Berczi-Makk *et al.,* pl. 9, fig. 5.
1996 *Robuloides lens* Reichel – Leven & Okay, pl. 9, figs. 29, 30.
1996 *Robuloides acutus* Reichel – Wignall & Hallam, text-fig. 4, p. 591 (no illustration).
1998 *Robuloides lens* Reichel – Altiner & Özcan-Altiner, pl. 4, fig. 14.
1999 *Robuloides lens* Reichel – Kobayashi, fig. 1.12.
2001 *Robuloides* cf. *lens* Reichel – Kobayashi, pl. 2, fig. 12.
2003 *Robuloides lens* Reichel – Ünal *et al.,* pl. 1, fig. 45.
2003 *Robuloides lens* Reichel – Wang & Ueno, table 1 (no illustration).
? 2004 *Robuloides acutus* Reichel – Zhang & Hong, p. 70-71, pl. 1, figs. 39-40 (last whorl semi-evolute).
2005 *Robuloides lens* Reichel – Groves *et al.,* p. 32-33, figs. 24.3-7, 10-13 (with 24 references in synonymy).
non 2006d *Robuloides lens* Reichel – Kobayashi, pl. 1, fig. 39 (other species).
non 2006e *Robuloides lens* Reichel – Kobayashi, pl. 1, figs. 24-26 (other species).
v. 2006 *Robuloides lens* Reichel – Gaillot, p. 155-156, Pl. I.27, figs. 5, 18, Pl. I.29, figs. 2, 7, Pl. I.32, fig. 21, Pl. I.33, fig. 18, Pl. I.34, fig. 18, Pl. II.30, fig. 21, Pl. II.35, fig. 12, Pl. III.9, fig. 24, Pl. III.10, fig. 1, Pl. III.11, figs. 1, 5, 17, Pl. III.12, figs. 5, 14, 18-20, 27-30, Pl. III.21, fig. 2, Pl. III.27, fig. 15, Pl. V.6, fig. 9, Pl. VI.13, figs. 10-13.
2007 *Robuloides lens* Reichel – Groves *et al.,* fig. 7.22, 25-27.

Dimensions: D.= 0.150-0.350 (0.410) mm, w.= 0.068-0.170 (0.210) mm, w/D= 0.44-0.70, p.d.= 0.005-0.030 mm, n.w.= 2-4, n.c.l.w.= 8, h.l.c.= 0.023-0.065 mm, w.t.= 0.003-0.012 mm.

Remarks: Small species with losangic outline, subcarinate, with partly diagenetically? recrystallized wall in the chamber (3 specimens in the same sample). As indicated by Groves *et al.* (2005, p. 33), *R. acutus* is considered here as synonym of *R. lens*, but also *R. aequalis* Sosnina, whose variations of shape and dimensions are included in the variability of *R. lens*.

Occurrence: Late Permian of Turkey, Greece (Attica), northern Italy, NW Caucasus, Transcaucasia, Iran, Salt Range, Japan, southern China, New Zealand (according to Groves *et al.,* 2005, p. 33). Duhaysan Member (late Dzhulfian) of Saudi Arabia.

Robuloides gourisiensis Reichel, 1946

(Pl. 74, fig. 8, Pl. 81, fig. 4, Pl. 87, fig. 5)

1946 *Robuloides gourisiensis* sp. nov. – Reichel, p. 538, figs. 19-20.
v. 1980 *Robuloides gourisiensis* Reichel – Vachard, pl. 30, figs. 9-10.
1981 *Robuloides gourisiensis* Reichel – Altiner, pl. 42, fig. 17.
1984 *Robuloides gourisiensis* Reichel – Lin, p. 138, pl. 6, fig. 10.
1985 *Robuloides* sp. of *R. gourishensis* (*sic*) group – Okimura *et al.,* pl. 1, fig. 12.
? 2002 *Robuloides* sp. – Gu *et al.,* p. 166, pl. 1, fig. 26.
2004 *Robuloides gourisiensis* Reichel – Zhang & Hong, p. 70, pl. 1, figs. 37-38 (with 2 references in synonymy).
v. 2006 *Robuloides gourisiensis* Reichel – Gaillot, p. 156,

Pl. I.30, fig. 8, Pl. I.31, fig. 5, Pl. III.21, fig. 4.

Dimensions: Medium to large species with spacious chambers. H.= 0.350-0.510 mm, n.w.= 1.5, n.c.= 7, p.d.= 0.025 mm, h.l.c.= 0.110-0.220 mm, w.t.= 0.017 mm. Pl. 81, fig. 4: H.= 0.635 mm, w.= 0.330 mm, n.w.= 1.5, h.l.c.= 0.140 mm, w.t.= 0.025 mm.

Occurrence: Changhsingian of Attica (Greece), Turkey and southern China. Dzhulfian of Afghanistan. Changhsingian of Zagros.

Robuloides gibbus Reichel, 1946
(Pl. 78, fig. 14, Pl. 79, fig. 9, Pl. 91, fig. 2)

1946 *Robuloides gibbus* sp. nov. – Reichel, p. 537-538, text-figs. 14-17, pl. 19, fig. 10.
1954 *Pararobuloides gibbus* (Reichel) – Miklukho-Maklay, p. 112 (translation), pl. 10, fig. 4.
1978 *Robuloides gibbus* Reichel – Lin, p. 29, pl. 5, figs. 13-14.
1980 *Robuloides* aff. *gibbus* Reichel – Lys *et al.,* p. 89, pl. 4, fig. 17.
1981 *Pararobuloides gibbus* (Reichel) – Zhao *et al.,* pl. 3, fig. 24.
1981 *Robuloides gibbus* Reichel – Altiner, pl. 42, figs. 15-16.
1984 *Robuloides gibbus* Reichel – Kotlyar *et al.,* pl. 1, fig. 17.
1984b *Robuloides gibbus* Reichel – Altiner, pl. 2, fig. 17.
1990 *Robuloides gibbus* Reichel – Lin *et al.,* p. 193, pl. 19, figs. 15-17, 18? (with 6 references in synonymy).
1992 *Robuloides* sp. 1 – Berczi-Makk, pl. 8, figs. 6, 9-11.
1998 *Robuloides gibbus* Reichel – Altiner & Özcan-Altiner, pl. 4, fig. 15.
2000 *Robuloides* cf. *gibbus* Reichel – Hauser *et al.,* figs. 4-10.
2001 *Robuloides gibbus* Reichel – Pronina-Nestell & Nestell, pl. 3, figs. 20-22.
2004 *Robuloides gibbus* Reichel – Zhao & Hong, p. 70, pl. 1, figs. 34-36. (with 8 references in synonymy).
v. 2006 *Robuloides* cf. *gibbus* Reichel – Insalaco *et al.,* p. 142, pl. 2, fig. 20.
v. 2006 *Robuloides gibbus* Reichel – Gaillot, p. 156-157, Pl. I.34, fig. 2, Pl. III.11, fig. 14, Pl. III.12, fig. 9.

Dimensions: Pl. 78, fig. 14: H.= 0.335 mm, w.= 0.182 mm, w/H= 0.54, n.w.= 4, p.d.= 0.025 mm, h.l.c.= 0.120 mm, w.t.= 0.007 mm. Pl. 91, fig. 2: H.= 0.390 mm, w.= 0.230 mm, w/H= 0.59, n.w.= 1, p.d.= 0.048 mm, h.l.c.= 0.160 mm, w.t.= 0.007 mm. Pl. 79, fig. 9: H.= 0.360 mm, w.= 0.230 mm, w/H= 0.63, n.w.= 2, p.d.= 0.022 mm, w.t.= 0.007 mm.

Occurrence: Changhsingian of Cyprus, Greece (Hydra), Taurus, NW Caucasus, Himalaya, southern China, Hungary, Oman, Salt Range. Late Changhsingian of Zagros.

Robuloides spp.
(Pl. 73, fig. 15, Pl. 78, figs. 6, 27, Pl. 79, fig. 26, Pl. 84, figs. 11, 28)

v. 2006 *Robuloides* spp. – Gaillot, p. 157, Pl. I.27, fig. 15, Pl. III.9, figs. 11, 28, Pl. III.11, figs. 6, 27, Pl. III.12, fig. 26.

Dimensions: Pl. 73, fig. 15: H.= 0.335 mm, w.= 0.128 mm, w/H= 0.50, n.w.= 3, p.d.= 0.030 mm, h.l.c.= 0.070 mm, w.t.= 0.012 mm. Pl. 84, fig. 11: H.= 0.175 mm, w.= 0.072 mm, w/H= 0.41, n.w.= 4, p.d.= 0.007 mm, h.l.c.= 0.035 mm, w.t.= 0.005 mm. Pl. 84, fig. 28: H= 0.115, w.= 0.055 mm, w/H= 0.48, n.w.= 2, p.d.= 0.015 mm. Pl. 78, fig. 6: H= 0.200 mm, w.= 0.082 mm, w/H= 0.41, p.d.= 0.018 mm, n.w.= 3, h.l.w.= 0.040 mm, w.t.= 0.007 mm. Pl. 78, fig. 27: H= 0.180 mm, w.= 0.077 mm, w/H= 0.43. Pl. 79, fig. 26: H= 0.340 mm, w.= 0.143 mm, w/H= 0.43, n.c.= 4, p.d.= 0.015 mm, h.l.c.= 0.078 mm, w.t.= 0.013 mm.

Remarks: Some specimens with the end of the coiling becoming evolute were observed (see also *Robuloides* sp. *sensu* Pronina, 1989, pl. 2, fig. 39 or *R. acutus* Zhang & Hong, 2004).

Occurrence: Lopingian of Zagros.

Family Partisaniidae Loeblich & Tappan, 1984

Diagnosis: Test biseriate, later becoming uniseriate. Early chambers spiralling about a long axis and/or arranged biserially but with successive chambers added slightly less than 180° apart, resulting in a more or less sigmoid arrangement seen in transerve section. Aperture terminal.

Composition: *Partisania* Sosnina, 1978, *Xintania* Lin, 1984, *Eoguttulina* Cushman & Ozawa, 1930 (part), ?*Nodoinvolutaria* Wang *in* Lin, 1978.

Genus *Nodoinvolutaria* WANG *in* LIN, 1978

Type species: *Nodoinvolutaria hunanica* LIN, 1978.

Occurrence: Maokouan to late Changhsingian of southern China (LIN *et al.,* 1990, p. 90; WIGNALL & HALLAM, 1996, text-fig. 4, p. 591).

Nodoinvolutaria? sp.
(Pl. 72, fig. 16)

v. 2006 *Nodoinvolutaria*? sp. – GAILLOT, p. 158, Pl. VI.11, fig. 16.

Dimensions: This incomplete specimen is tentatively assigned to *Nodoinvolutaria*. H= 0.583 mm, n.c.= 3, h.l.c.= 0.140 mm, w.t.= 0.017 mm.

Genus *Partisania* SOSNINA, 1978

Type species: *Partisania typica* SOSNINA, 1978.

Diagnosis: Test ovate in outline. First chambers in biseriate sigmoidal arrangement, later uniseriate and rectilinear. Wall hyaline. Aperture terminal, central (summary of LOEBLICH & TAPPAN, 1987, p. 393).

Remarks: *Xintania*, and the closely related genus *Partisania*, can be centered to the area: Primorye, southern China (Hubei), Japan, although they are sporadically cited in the Caucasus (KOTLYAR *et al.*, 1984, 1989), New Zealand (VACHARD & FERRIÈRE, 1991), Oman (PILLEVUIT, 1993), Cyprus (NESTELL & PRONINA, 1997), Crimea (PRONINA & NESTELL, 1997; KOTLYAR *et al.,* 1999a), Philippines (FONTAINE *et al.*, 1986b), and Thailand (CARIDROIT *et al.*, 1990).

Occurrence: Primorye, NW Thailand, southern China, Philippines, Japan, Transcaucasia, New Zealand, Oman, Cyprus, Crimea, Fars area.

Partisania sigmoidalis sp. nov.
(Pl. 76, figs. 4, 11, Pl. 93, fig. 16, Pl. 95, figs. 13-15, 17, Pl. 96, fig. 9)

1989 *Partisania* sp. – KOTLYAR *et al.,* pl. 17, fig. 14.
2004 *Partisania* sp. – KOBAYASHI, p. 68-69, fig. 6.52-6.55.
v. 2006 *Partisania sigmoidalis* sp. nov. – GAILLOT & VACHARD *in* GAILLOT, p. 158, Pl. II.27, figs. 4, 11, Pl. II.29, figs. 13-15, 17, Pl. II.30, fig. 9, Pl. II.35, fig. 16 (*nomen nudum*).

Etymology: Because of the well-marked sigmoid arrangement of the chambers in transverse section.

Type locality: Zone 3 of Zagros (see Fig. 2A).

Type level: Wuchiapingian.

Diagnosis: Small species slightly compressed. In transverse section, the numerous chambers exhibit a well-marked sigmoidal arrangement.

Description: *Partisania* sp. of KOBAYASHI (2004): H.= 0.800 mm; w.= 0.300 mm. w/H= 0.37, n.c.= 5. Material illustrated in this work: H.= 0.460-0.560 mm, w.= 0.200-0.300 mm, t.t.= 0.070-0.120 mm, p.d.= 0.030-0.033, n.c.= 8-9, w.t.= 0.003-0.005 mm.

Comparison: Although axial sections of *P. sigmoidalis* are similar to those of *P. typica* SOSNINA 1978, the transverse section displays a regular sigmoidal arrangement of the chambers (in *P. typica*, chambers are less numerous, larger, more globular and more enveloping). Furthermore, the specimen of *P. sigmoidalis* are twice smaller compared to *P. typica* (H= 1.370-1.550 mm for the specimen of SOSNINA, 1978). Regarding to these criteria, the species is more comparable to the *P.* sp. of KOBAYASHI (2004) in Japan.

Holotype: Pl. 95, fig. 14.

Type material: 11 specimens (7 are illustrated).

Repository of the types: CST TOTAL (Pau, France).

Occurrence: Wuchiapingian of offshore Fars area. Probably of the same age in Japan.

Family Frondinidae fam. nov.

Diagnosis: A family of Nodosarioidea relatively common during the Midian/Capitanian and the Late Permian. This family is characterized by is dark (microgranular?) wall and the embracing shape of the chambers. Aperture are smooth or accompanied by an internal neck.

Composition: *Frondina* SELLIER DE CIVRIEUX & DESSAUVAGIE, 1965 *emend*. here; *Ichthyofrondina* VACHARD *in* VACHARD & FERRIÈRE, 1991 *emend.*

Comparison: This new family differs from all other ones of the Nodosarioidea by the return to a dark wall (as the distant ancestor *Earlandia*; VACHARD, 1994), whereas the members of the family are rigorously homeomorph of some typical Nodosarioidea such as *Ichthyolaria* WEDEKIND, 1937. The link between Protonodosariidae and Frondinidae can be represented by the genus *Tauridia emend.* which exhibits a partial disappearance of the yellow external layer of the wall.

Occurrence: Capitanian-Changhsingian. Palaeo- and Neotethys.

Genus *Frondina* SELLIER DE CIVRIEUX & DESSAUVAGIE, 1965 *emend.* herein

Type species: *Frondina permica* SELLIER DE CIVRIEUX & DESSAUVAGIE, 1965.

Synonyms: *Ichthyofrondina* (part); *Lingulina* (part); *Pseudoglandulina* sp.; *Ichthyolaria* (part); *Frondicularia* (part).

Emended diagnosis: Test uniseriate with rectilinear axis of development. Chambers horseshoe shaped to semi-ellipsoidal, weakly enveloping to evolute. Wall hyaline but apparently dark. Aperture simple, terminal, central, with two inner oral tongues.

Composition: *Frondina permica* SELLIER DE CIVRIEUX & DESSAUVAGIE, 1965; *Frondina appressaria* SOSNINA, 1978; *Frondicularia lauta* LIN, LI & SUN, 1990; *Frondicularia laxa* LIN, LI & SUN, 1990; *Frondicularia ornata sensu* LIN, LI & SUN, 1990 *non*? MIKLUKHO-MAKLAY, 1954; *Frondina guangxiensis* LIN, LI & SUN, 1990; *Frondina turris* PRONINA *in* KOTLYAR *et al.,* 1989, *Frondina ovata* PRONINA, 1999; *Frondina* sp. *sensu* KOBAYASHI, 2006e, pl. 2, fig. 27; *Pseudoglandulina conica sensu* LIN, 1978 *non* MIKLUKHO-MAKLAY, 1954: *Pseudoglandulina conicula* WANG *in* ZHAO *et al.,* 1981; *Pseudoglandulina paraconica* MIKLUKHO-MAKLAY, 1954; *P.* aff. *pygmaeformis* MIKLUKHO-MAKLAY, 1954; *P. quasiconica* LIN, 1978, *P. fallax* (CHERDYNTSEV) *sensu* LIN *et al.,* 1990; *P. tumida sensu* LIN, 1978; *P.* sp. KOBAYASHI, 1986 (pl. 3, figs. 16-17); *Frondicularia*? *arpaensis* PRONINA, 1989; *Frondina parvula* PRONINA *in* KOTLYAR *et al.,* 1989; *Rectoglandulina* sp. 2 *sensu* PRONINA, 1988a (pl. 2, figs. 45-46) and 1989 (pl. 2, figs. 19-20); *Ichthyolaria primitiva* SELLIER DE CIVRIEUX & DESSAUVAGIE *sensu* PRONINA, 1988a, pl. 2, fig. 63, 1989, pl. 2, fig. 17; *Nodosaria decorosa* WANG *in* ZHAO *et al.,* 1981; *Pseudoglandulina* sp. *sensu* JIANG *et al.,* 1982, pl. 2, fig. 13.

Occurrence: Late Midian-Changhsinghian, Palaeo- and Neotethyan. (Turkey, Iran, NW Caucasus, Transcaucasia, NW Thailand, southern China, Japan, New Zealand).

Frondina permica SELLIER DE CIVRIEUX & DESSAUVAGIE, 1965
(Pl. 4, fig. 23, Pl. 74, figs. 1-2, Pl. 77, figs. 16, 22, Pl. 83, fig. 22, Pl. 84, fig. 23, Pl. 91, fig. 20)

1965 *Frondina permica* sp. nov. – SELLIER DE CIVRIEUX & DESSAUVAGIE, p. 59-60, pl. 5, figs. 17-18, 21-23, 26-28, 32-33, pl. 14, figs. 5, 8, 12, pl. 17, figs. 1, 3, 5-6.

1965 *Frondina permica* var. “allongée” n. var. SELLIER DE CIVRIEUX & DESSAUVAGIE, p. 60, pl. 5, figs. 34, 37, pl. 17, fig. 4.

1984b *Frondina permica* SELLIER DE CIVRIEUX & DESSAUVAGIE – ALTINER, pl. 2, fig. 13.

1986a *Frondina permica* SELLIER DE CIVRIEUX & DESSAUVAGIE – NGUYEN DUC TIEN, pl. 2, fig. 9.

1989 *Frondina permica* (SELLIER DE CIVRIEUX & DESSAUVAGIE) – KÖYLÜOGLU & ALTINER, pl. 9, figs. 4-8.

p.p. 2005 *Frondina permica* DE CIV. & DESSAUV. – HUGHES, pl. 3, fig. 18 (*non* pl. 3, figs. 9-11, 16-17; other nodosarioids: *Pseudolangella*? and *Frondinodosaria*? differering by the type of wall).

2005 *Frondina permica* SELLIER DE CIVRIEUX & DESSAUVAGIE – GROVES *et al.,* p. 27, figs. 21.12-20.

v. 2006 *Frondina permica* SELLIER DE CIVRIEUX & DESSAUVAGIE – INSALACO *et al.,* p. 142, pl. 2, fig. 22.

v. 2006 *Frondina permica* SELLIER DE CIVRIEUX & DESSAUVAGIE – GAILLOT, p. 159-160, Pl. I.28, fig. 22, Pl. I.30, figs. 1-2, Pl. I.34, fig. 20, Pl. I.43, fig. 23, Pl. III.9, fig. 23, Pl. III.10, figs. 16, 22.

? 2007 *Frondina permica* SELLIER DE CIVRIEUX & DESSAUVAGIE – GROVES *et al*., figs. 7.9-10, 15-17, 18?, 20, 21? (apparently, two-layered specimens).

? 2007 *Frondina* cf. *permica* SELLIER DE CIVRIEUX &

ISSN: 1132-1660

DESSAUVAGIE – GROVES *et al.*, figs. 7.7, 11-13 (apparently, two-layered tests and consequently, another genus).

Dimensions: H.= 0.200-0.490 mm, w.= 0.240-0.300 mm, t.t.= 0.120-0.170 mm, w/H= 0.60-0.75, p.d.= 0.030-0.080 mm, n.c.= 4-5, h.l.c.= 0.045-0.140 mm, w.t.= 0.007-0.010 mm.

Remarks: The specimen illustrated here are in the same range of dimensions that specimens described by SELLIER DE CIVRIEUX & DESSAUVAGIE (1965). The specimen illustrated Pl. 4, fig. 23 corresponds probably to *F. permica* var. "allongée", although it is sometimes difficult to distinguish sagittal axial sections of *F. permica* var "allongée" from frontal axial sections of typical *F. permica*. The specimens Pl. 74, figs. 1-2 are interpreted respectively as the axial sagittal and axial frontal sections of typical *F. permica*. The specimen of Pl. 77, fig. 22 would correspond to the type material of *F. permica* (pl. 16, fig. 5; pl. 17, fig. 1f of SELLIER DE CIVRIEUX & DESSAUVAGIE, 1965), more or less comparable to *Frondicularia ornata* MIKLUKHO-MAKLAY, 1954.

Occurrence: Lopingian of Turkey, Cambodia, and Zagros; and according GROVES *et al.* (2005, p. 27): northern Italy, Alborz, Koryak upland, NW Caucasus, Transcaucasia, Lamayuru Block (Himalaya, Japan and Indochina).

Frondina spp.
(Pl. 76, fig. 10, Pl. 78, figs. 3, 6, Pl. 81, fig. 22, Pl. 83, fig. 20, Pl. 84, figs. 1, 8, Pl. 91, figs. 6-7, 16)

v. 2006 *Frondina* spp. – GAILLOT, p. 160, Pl. I.28, fig. 20, Pl. I.34, figs. 6-7, 16, Pl. II.27, fig. 10, Pl. III.9, figs. 1, 8, Pl. III.12, figs. 3, 6, Pl. III.27, fig. 22.

Remarks: All the specimens are morphologically close to *F. permica*, but exhibit atypical characters for the species.

Occurrence: Wuchiapingian of Fars. Changhsingian of Zagros.

Genus *Ichthyofrondina* VACHARD *in* VACHARD & FERRIÈRE, 1991 *emend.* herein

Type species: *Ichthyolaria latilimbata* SELLIER DE CIVRIEUX & DESSAUVAGIE, 1965.

Synonyms: *Frondina* SELLIER DE CIVRIEUX & DESSAUVAGIE, 1965 (part); *Lingulina* (part), *Pseudoglandulina* (part); *Ichthyolaria* (part); *Frondicularia* (part).

Emended diagnosis: Test uniseriate. Chambers palmate, strongly enveloping, rarely evolute. Wall hyaline but apparently dark. Aperture simple, terminal, central, with two inner oral tongues, or absent.

Composition: *Ichthyolaria latilimbata* SELLIER DE CIVRIEUX & DESSAUVAGIE, 1965; *I. nessenensis* BOZORGNIA, 1973; *I. primitiva* SELLIER DE CIVRIEUX & DESSAUVAGIE, 1965; *Frondicularia*? *arpaensis* PRONINA *in* KOTLYAR *et al.,* 1989; *F. guangxiensis* LIN, 1978; *F. simplex* LIN, 1978; *F. palmata* WANG, 1974; *Frondina parvula* PRONINA *in* KOTLYAR *et al.,* 1989; *Frondina* sp. 1 *sensu* PRONINA, 1988a (pl. 2, figs. 47-48) and 1989 (pl. 1, figs. 23-24).

Occurrence: Late Midian-Changhsinghian, Palaeo- and Neotethyan (Turkey, Iran, Transcaucasia, southern China, Thailand, New Zealand). Changhsingian southern China, northern Caucasus and Transcaucasia.

Ichthyofrondina palmata (WANG, 1974)
(Pl. 10, fig. 11, Pl. 73, fig. 6)

1974 *Frondicularia palmata* sp. nov. – WANG, p. 287, pl. 149, fig. 11.
1978 *Frondicularia palmata* WANG – LIN, p. 43, pl. 8, fig. 30.
1981 *Frondicularia palmata* WANG – ZHAO *et al.,* pl. 3, figs. 17-18.
1988a *Frondina palmata* (WANG) – PRONINA, pl. 2, figs. 49-50.
1989 *Frondina palmata* (WANG) – PRONINA, pl. 2, figs. 21-22.
p.p. 1990 *Frondicularia palmata* WANG – LIN *et al.,* p. 85, p. 232, pl. 29, figs. 12-14 (*non* figs. 15-16= *Ichthyofrondina latilimbata*).
non 1997 *Lunucammina palmata* (WANG) – KOBAYASHI, pl. 3, figs. 13-14 (= *Nodosinelloides*? sp.).
non 2001 *Frondina palmata* (WANG) – PRONINA-NESTELL & NESTELL, pl. 2, fig. 19 (another species of *Ichthyofrondina*).
non 2001 *Lunucammina palmata* (WANG) – KOBAYASHI, pl. 1, figs. 23-24 (= *Nodosinelloides*? sp.).
non 2002 *Lunucammina* cf. *palmata* (WANG) – KOBAYASHI, pl. 3, figs. 13-14 (= *Frondina* or another species of *Ichthyofrondina*).
2005 *Ichthyofrondina palmata* (WANG) – GROVES *et al.,* p. 25, fig. 22. 1-5.

v. 2006 *Ichthyofrondina palmata* (WANG) – GAILLOT, p. 160-161, Pl. I.27, fig. 6, Pl. VII.1, fig. 11.

Description: Very small test. Palmate chambers, completely enveloping, except on the proeminent proloculus. Sutures absent. *I. latilimbata* (SELLIER DE CIVRIEUX & DESSAUVAGIE, 1965) and its probable synonym *Ichthyofrondina guangxiensis* (LIN, 1978) is larger, with less enveloping chambers. The specimens illustrated are exactly similar to the *I. palmata* described by LIN *et al*. (1990).

Dimensions: H.= 0.300 mm, w.= 0.180-0.200 mm, w/H= 0.60-0.67, n.c.= 6, p.d.= 0.020 mm, h.l.c.= 0.060 mm, w.t.= 0.005 mm.

Occurrence: Lopingian of southern China, Transcaucasia, Turkey, and Zagros.

Ichthyofrondina cf. *palmata* (WANG, 1974)

(Pl. 81, fig. 11)

v. 2006 *Ichthyofrondina* cf. *palmata* (WANG) – GAILLOT, p. 161, Pl. III.21, fig. 11.

Dimensions: H.= 0.270 mm, w.= 0.145 mm, w/H= 0.54, p.d.= 0.060 mm, n.c.= 4, h.l.c.= 0.060 mm.

Ichthyofrondina latilimbata SELLIER DE CIVRIEUX & DESSAUVAGIE, 1965

(Pl. 72, fig. 20, Pl. 73, fig. 16, Pl. 74, figs. 5, 26, Pl. 83, fig. 10, Pl. 84, fig. 19, Pl. 87, figs. 15,17, Pl. 89, figs. 6, 16, Pl. 91, fig. 25)

1965 *Ichthyolaria latilimbata* sp. nov. – SELLIER DE CIVRIEUX & DESSAUVAGIE, p. 75, text-fig. 25.31, pl. 5, fig. 41, pl. 14, fig. 11.

1984b "*Ichthyolaria" latilimbata* SELLIER DE CIVRIEUX & DESSAUVAGIE – ALTINER, pl. 2, fig. 12.

1986a *Ichthyolaria latilimbata* SELLIER DE CIVRIEUX & DESSAUVAGIE – NGUYEN DUC TIEN, pl. 2, fig. 8.

? 1989 "*Ichthyolaria" latilimbata* SELLIER DE CIVRIEUX & DESSAUVAGIE – KÖYLÜOGLU & ALTINER, pl. 9, fig. 10 (maybe true *Ichthyolaria*).

v. 2006 *Ichthyofrondina latilimbata* SELLIER DE CIVRIEUX & DESSAUVAGIE – GAILLOT, p. 161, Pl. I.27, fig. 16, Pl. I.28, fig. 10, Pl. I.30, fig. 5, 26, Pl. I.31, figs. 15,17, Pl. I.32, fig. 6, 16, Pl. I.34, fig. 25, Pl. III.9, fig. 19, Pl. VI.11, fig. 20.

2007 *Ichthyofrondina latilimbata* SELLIER DE CIVRIEUX & DESSAUVAGIE – GROVES *et al.,* figs. 7.23, 30, 8.31-34.

Dimensions: H.= 0.310-0.400 mm, w.= 0.140-0.310 mm, w/H= 0.40-0.70, t.t.= 0.130-0.150 mm, w/H= 0.40, n.c.= 3-5, p.d.= 0.040-0.090 mm, h.l.c.= 0.075-0.110 mm, w.t.= 0.005-0.013 mm.

Remarks: Palmate chambers.

Occurrence: Late Midian of southern Turkey (Hazro). Lopingian of Cambodia. Changhsingian of Zagros.

Ichthyofrondina primitiva (SELLIER DE CIVRIEUX & DESSAUVAGIE, 1965)

(Pl. 90, fig. 8)

1965 *Ichthyolaria primitiva* sp. nov. – SELLIER DE CIVRIEUX & DESSAUVAGIE, p. 74, pl. 5, fig. 30a-c.

1973 *Ichthyolaria primitiva* DE CIVRIEUX & DESS. – BOZORGNIA, p. 164-165, pl. 40, figs. 5-6.

non 1981 *"Ichthyolaria" primitiva* SELLIER DE CIVRIEUX & DESSAUVAGIE – ALTINER, pl. 40, fig. 5 (= *Frondinodosaria*).

1988a *Ichthyolaria primitiva* CIVRIEUX & DESSAUVAGIE – PRONINA, pl. 2, fig. 63.

1989 *Ichthyolaria primitiva* CIVRIEUX & DESSAUVAGIE – PRONINA, pl. 2, fig. 17.

p.p. 1995 *Ichthyolaria primitiva* CIVRIEUX & DESSAUVAGIE – PARTOAZAR, pl. 2, fig. 6 (*non* fig. 5, another genus).

v. 2006 *Ichthyofrondina primitiva* (SELLIER DE CIVRIEUX & DESSAUVAGIE) – GAILLOT, p. 161-162, Pl. VI.12, fig. 8.

Description: H.= 0.472 mm, w.= 0.192 mm, w/H= 0.41, n.c.= 6 or 7, p.d.= 0.010 mm, h.l.c.= 0.105 mm, w.t.= 0.010 mm.

Occurrence: Late Permian of Turkey. Changhsingian of central Alborz and Transcaucasia. Changhsingian of Hazro.

Ichthyofrondina ornata (MIKLUKHO-MAKLAY, 1954)

(Pl. 86, fig. 15, Pl. 88, figs. 7, 12)

1954 *Frondicularia ornata* sp. nov. – MIKLUKHO-MAKLAY, p. 42, pl. 4, fig. 8.

2005 *Ichthyofrondina ornata* (MIKLUKHO-MAKLAY) – GROVES *et al.,* p. 25, fig. 21. 21-26 (with 1 reference in synonymy).

v. 2006 *Ichthyofrondina ornata* (MIKLUKHO-MAKLAY) – GAILLOT, p. 162, Pl. I.29, fig. 15, Pl. I.33, figs. 7, 12.

Dimensions: Pl. 86, fig. 15: H.= 0.355 mm, w.= 0.200 mm, w/H= 0.56, n.c.= 5, p.d.= 0.062

mm, h.l.c.= 0.080 mm, w.t.= 0.007 mm. Pl. 88. fig. 7: H.= 0.300 mm, w.= 0.210 mm, w/H= 0.70, n.c.= 7, p.d.= 0.023 mm, h.l.c.= 0.090 mm, w.t.= 0.005 mm. Pl. 88, fig. 12: H.= 0.565 mm, w.= 0.180 mm, w/H= 0.32, n.c.= 7, p.d.= 0.025 mm, w.t.= 0.005 mm.

Occurrence: Late Chanhsingian of NW Caucasus and Turkey (GROVES *et al.,* 2005, p. 25). Changhsingian of Zagros.

Ichthyofrondina guangxiensis (LIN, 1978)
(Pl. 74, fig. 27, Pl. 91, fig. 13)

1978 *Frondicularia guangxiensis* sp. nov. – LIN, p. 43, pl.8 , fig. 29.
1981 *Frondicularia guangxiensis* LIN – ZHAO *et al*., pl. 3, figs. 15-16.
1990 *Frondicularia guangxiensis* LIN – LIN *et al*., p. 230, pl. 29, figs. 3-6 (with 2 references in synonymy).
v. 2006 *Ichthyofrondina guangxiensis* (LIN) – GAILLOT, p. 162, Pl. I.30, fig. 27, Pl. I.34, fig. 13.

Dimensions: H.= 0.356-0.380 mm, w.= 0.105-0.195 mm, w/H= 0.28, n.c.= 7, p.d.= 0.016 (0.100) mm, h.l.c.= 0.100 mm, w.t.= 0.003 mm.

Remarks: The shape of chambers is truncate trapezoidal, the wall is quite thin.

Occurrence: Changhsingian of Zagros.

Ichthyofrondina spp.
(Pl. 63, figs. 13, 21, 29, Pl. 77, fig. 23, Pl. 78, fig. 9, Pl. 79, fig. 17, Pl. 80, fig. 2, Pl. 83, figs. 8-9, 11, Pl. 84, fig. 16, Pl. 87, fig. 22, Pl. 88, figs. 8, 13, Pl. 89, fig. 22, Pl. 91, fig. 1, Pl. 92, fig. 16, Pl. 93, figs. 15, 17, Pl. 94, fig. 12, Pl. 95, fig. 11)

v. 2006 *Ichthyofrondina* spp. – GAILLOT, p. 162-163, Pl. I.28, figs. 8-9, 11, Pl. I.31, fig. 22, Pl. I.32, fig. 22, Pl. I.33, figs. 8, 13, Pl. I.34, fig. 15 , Pl. II.28, fig. 16, Pl. II.29, fig. 12, Pl. II.30, fig. 11, Pl. II.35, figs. 15, 17, Pl. III.9, fig. 16, Pl. III.10, fig. 23, Pl. III.11, fig. 9, Pl. III.12, fig. 17, Pl. III.20, fig. 2, Pl. III.26, figs. 13, 21, 29, Pl. V.6, fig. 30.

Dimensions: A specific attribution for these *Ichthyofrondina* is actually premature. The specimens were nevertheless measured in detail. Pl. 83, fig. 8: H.= 0.420 mm, w.= 0. 250 mm, n.c.= 7? Pl. 87, fig. 22: H= 0.272 mm, w.= 0.120 mm. Pl. I.32, fig. 22 : w.= 0.370 mm. Pl. 88, fig. 8: H= 0.370 mm, w.= 0.520 mm, n.c.= 5, h.l.c.= 0.070 mm, w.t.= 0.010 mm. Pl. 88, fig. 13: H= 0.323 mm, w.= 0.405 mm, n.c.= 5, h.l.c.= 0.070 mm, w.t.= 0.010 mm. Pl. 90, fig. 15: H= 0.185 mm, w.= 0.110 mm, n.c.= 4, p.d.= 0.030 mm, h.l.c.= 0.045 mm, w.t.= 0.003 mm. Pl. 92, fig. 16: H= 0.240 mm, w.= 0.155 mm, n.c.= 4, p.d.= 0.040 mm, h.l.c.= 0.080 mm. Pl. 95, fig. 12: H= 0.290 mm, w.= 0.145 mm, n.c.= 4, p.d.= 0.060 mm, h.l.c.= 0.080 mm, w.t.= 0.003 mm. Pl. 96, fig. 11: H= 0.700 mm, w.= 0.185 mm, n.c.= 8, h.l.c.= 0.115 mm, w.t.= 0.012 mm. Pl. 93, fig. 15: H= 0.200 mm, w.= 0.115 mm, n.c.= 4, p.d.= 0.037 mm, h.l.c.= 0.063 mm, w.t.= 0.003 mm. Pl. 93, fig. 17: H= 0.520 mm, w.= 0.275 mm, n.c.= 5, h.l.c.= 0.130 mm, w.t.= 0.016 mm. Pl. 84, fig. 16: H= 0.275 mm, w.= 0.175 mm, n.c.= 4, h.l.c.= 0.051 mm, w.t.= 0.002-0.005 mm. Pl. 77, fig. 23: H= 0.170 mm, w.= 0.115 mm, n.c.= 4, p.d.= 0.020 mm, h.l.c.= 0.040 mm, w.t.= 0.003 mm. Pl. 78, fig. 9: H= 0.265 mm, w.= 0.180 mm, n.c.= 4, h.l.c.= 0.077 mm, w.t.= 0.003mm. Pl. 79, fig. 17 (transverse): w.= 0.415 mm, t.t. =0.295 mm, n.c.= 3, w.t.= 0.013mm. Pl. 79, fig. 2: H= 0.630 mm, w.= 0.450 mm, n.c.= 4, h.l.c.= 0.140 mm, w.t.= 0.007 mm. Pl. 63, fig. 13: H= 0.460 mm, w.= 0.270 mm, n.c.= 4, p.d.= 0.105 mm, h.l.c.= 0.130 mm, w.t.= 0.020 mm. Pl. 63, fig. 21: w.= 0.260 mm, t.t.= 0.150, n.c.= 3, w.t.= 0.010 mm. Pl. 63, fig. 29: w.= 0.440 mm, t.t.= 0.250, n.c.= 2, w.t.= 0.005 mm. Not illustrated individual: H= 0,430 mm, w.= 0.230 mm, n.c.= 7, h.l.c.= 0.100 mm, w.t.= 0.004 mm.

Occurrence: Middle-Late Permian of Tethys. Huqayl Member (early Dzhulfian) of Saudi Arabia.

Family Colaniellidae FURSENKO *in* RAUZER-CHERNOUSOVA & FURSENKO, 1959

Genus *Colaniella* LIKHAREV, 1939

Type species: *Pyramis parva* COLANI, 1924.

Occurrence: Late Midian-Dorashamian (KOTLYAR *et al.,* 1989; JENNY-DESHUSSES & BAUD, 1989). Late Dzhulfian-Dorashamian (VACHARD *et al.,* 2002). Only mentioned in the Dorashamian of southern China (LIN *et al.,* 1990, p. 83).

Colaniella aff. *minuta* OKIMURA, 1988

(Pl. 73, figs. 12-13, Pl. 74, figs. 9-10, 18, Pl. 75, fig. 6, Pl. 78, fig. 11, Pl. 83, figs. 16-17, 30, Pl. 87, fig. 12, Pl. 91, fig. 5)

aff. 1988 *Colaniella minuta* sp. nov. – OKIMURA, p. 719, 721, fig. 6. 1-6. 4.

? 1988a *Colaniella*? sp. – PRONINA, pl. 2, fig. 64.

? 1989 *Colaniella*? sp. – PRONINA, pl. 2, fig. 40.

v. 2005 *Colaniella* sp. – VASLET *et al.,* p. 115 (no illustration).

v. 2005 *Colaniella* cf. *minuta* OKIMURA – VACHARD *et al.,* p.173, pl. 6, figs. 6-7.

v. 2006 *Colaniella* aff. *minuta* OKIMURA – GAILLOT, 163-164, Pl. I.27, figs. 12-13, Pl. I.28, figs. 16-17, 30, Pl. I.30, figs. 9-10, 18, Pl. I.31, fig. 12, Pl. I.34, fig. 5, Pl. I.41, fig. 6, Pl. III.11, fig. 11.

Dimensions: H.= 0.115-0.180 (0.360) mm, w.= 0.070-0.088 (0.165) mm, w/H= 0.45-0.60, n.c.= 4-9, p.d.= 0.016-0.072 mm.

Remarks: Very small and very primitive specimens present some similarities with *Colaniella minuta*, but still smaller. H.= 0.125-0.280 mm, w.= 0.105-0.220 mm, n.w.= 5-9, p.d.= 0.010-0.030 mm. The genus *Colaniella* is classically absent in Zagros, Taurus, Arabia or represented by primitive forms, for instance *C. bozkiri* ÇATAL & DAGER, 1974 in Turkey. The advanced *Colaniella* of other Neotethyan areas: Alborz, Transcaucasia, Oman Mountains, Himalaya, Salt Range, central Afghanistan, are unknown in the Taurus-Zagros-Arabia Province.

Occurrence: Late Changhsingian of Transcaucasia. Late Permian of Salt Range (horizons 3 and 4 of the Zaluch I section). Duhaysan Member (late Dzhulfian) of Saudi Arabia.

Colaniella spp.

(Pl. 34, fig. 22, Pl. 63, figs. 25-26, Pl. 81, figs. 1, 18-21, Pl. 88, figs. 3, 5, 14)

v. 2006 *Colaniella* spp. – GAILLOT, p. 164, Pl. I.33, figs. 3, 5, 14, Pl. III.21, fig. 6, Pl. III.22, fig. 22, Pl. III.26, figs. 25-26, Pl. III.27, figs. 1, 18-21, Pl. V.6, figs. 6-7.

Dimensions: Pl. 88, fig. 3: H.= 0.195 mm, w.= 0.180 mm. Pl. 88, fig. 5: H.= 0.270 mm, w.= 0.225 mm. Pl. 88, fig. 14: w.= 0.270 mm. Pl. 81, fig. 6: H.= 0.210 mm, w.= 0.110 mm, n.c.= 8, p.d.= 0.010 mm, h.l.c.= 0.020 mm, w.t.= 0.008 mm. Pl. 34, fig. 22: H.= 0.170 mm, w.= 0.045 mm, n.c.= 6, p.d.= 0.015 mm, h.l.c.= 0.015 mm, w.t.= 0.010 mm. Pl. 63, fig. 25: H.= 0.190 mm, w.= 0.150 mm, n.c.= 6, p.d.= 0.040 mm, h.l.c.= 0.030 mm, w.t.= 0.010 mm. Pl. 63, fig. 26: H.= 0.375 mm, w.= 0.150 mm, n.c.= 14, p.d.= 0.015 mm, h.l.c.= 0.050 mm, w.t.= 0.015 mm. Pl. 81, fig.1: H.= 0.290 mm, w.= 0.230 mm, n.c.= 9, p.d.= 0.020 mm, w.t.= 0.007 mm. Pl. 81, fig. 18: H.= 0.380 mm, w.= 0.265 mm, n.c.= 11-12, h.l.c.= 0.035 mm, w.t.= 0.005 mm. Pl. 81, fig. 19: H.= 0.475 mm, w.= 0.190 mm, n.c.= 11, p.d.= 0.035 mm, h.l.c.= 0.045 mm, w.t.= 0.020 mm. Pl. 81, fig. 20: H.= 0.655 mm, w.= 0.235 mm, n.c.= 12-13, h.l.c.= 0.070 mm, w.t.= 0.010 mm. Pl. 81, fig. 21: H.= 0.455 mm, w.= 0.365 mm. Two not illustrated specimens: H.= 0.160-0.170 mm, w.= 0.105 mm, n.c.= 6.

Remarks: The specimens display the characteristic bi-conical shape of the genus but a specific attribution is not attempted here since no characteristic transverse sections were found. A detailed measurement has been performed for further studies.

Superfamily Nodosarioidea EHRENBERG, 1838 *nomen translat.* LOEBLICH & TAPPAN, 1961
Family Nodosariidae EHRENBERG, 1838
Subfamily Nodosariinae EHRENBERG, 1838 *nomen translat.* REUSS, 1862

Composition: See LOEBLICH & TAPPAN, 1987, p. 394-398; in the Palaeozoic are present *Nodosaria* and *Pseudonodosaria* BOOMGAART, 1949 (=*Rectoglandulina* LOEBLICH & TAPPAN, 1955).

Genus *Nodosaria* LAMARCK, 1812

Type species: *Nautilus radicula* LINNÉ, 1758.

Composition: The following Permian *Nodosaria* are correctly assigned to this genus because they exhibit a radiate aperture: *Nodosaria conicodensestriata* PAALZOW *sensu* CRESPIN, 1958; *N. crassula* CRESPIN, 1958; *N. raggatti* CRESPIN, 1958; *N. spiculata* CRESPIN, 1958; *N. spring-*

surensis CRESPIN, 1945; *N. striatella* (PAALZOW) *sensu* CRESPIN, 1958.

Remarks: No *Nodosaria* were observed in our material.

Occurrence: Permian to Recent, cosmopolite.

Family Pachyphloiidae LOEBLICH & TAPPAN, 1984

Diagnosis: Test uniseriate, thick walled, with radiate (stellate) aperture. Sagittal and frontal axial sections are very different in aspect. Sagittal axial section with enveloping curvated septa, frontal axial section with thick wall.

Composition: *Pachyphloia* LANGE, 1925; *Sosninella* SELLIER DE CIVRIEUX & DESSAUVAGIE, 1965 *nomen imperfectum*; *Robustopachyphloia* LIN, 1980; *Aulacophloia* gen. nov.

Comparison: Differ from the Geinitzinidae and Protonodosariidae by the type of aperture, and from the Nodosariidae by the lateral thickening.

Remarks: Stratigraphically, the Pachyphloiidae can be the first Nodosarioidea with a radiate aperture. In this case, *Pachyphloia* is a likely ancestor for *Nodosaria* rather than *Nodosinelloides*.

Occurrence: Sakmarian to Jurassic. The FAD of *Pachyphloia* is discussed: probably Middle Permian according to PINARD & MAMET (1998), late Early Permian: Chihsian (LIN *et al.,* 1990) or Artinskian (GROVES, 2000), may be early Early Permian (Sakmarian) (VACHARD & KRAINER, 2001b). The LAD is Dorashamian (e.g. LIN *et al.,* 1990; PRONINA-NESTELL & NESTELL, 2001; WANG & UENO, 2003; SHANG *et al.,* 2003).

Genus *Pachyphloia* LANGE, 1925

Type species: *Pachyphloia ovata* LANGE, 1925 (see LOEBLICH & TAPPAN, 1987, *non* SELLIER DE CIVRIEUX & DESSAUVAGIE, 1965).

Occurrence: FAD in the Sakmarian. Acme and specific diversification: Midian-Lopingian (this study in Hazro, Turkey, and Zagros, Iran). LAD: latest Permian.

Pachyphloia ovata LANGE, 1925
(Pl. 72, figs. 5, 23, Pl. 73, figs. 4, 8)

1925 *Pachyphloia ovata* sp. nov. – LANGE, p. 231, pl. 1, fig. 24a-b.
1954 *Pachyphloia ovata* LANGE – MIKLUKHO-MAKLAY, p. 71-72, pl. 5, fig. 1.
non 1986 *Pachyphloia ovata* LANGE – KOBAYASHI, tabl. 1 p. 135, p. 138, pl. 2, figs. 14-18, 24-25, 27-30, 32 (several other species).
1986a *Pachyphloia cukurkoyi* S. DE CIVRIEUX & DESSAUVAGIE – NGUYEN DUC TIEN, pl. 2, fig. 1.
1988a *Pachyphloia cukurkoyi* CIVRIEUX & DESSAUVAGIE – PRONINA, pl. 2, figs. 51-58.
1989 *Pachyphloia cukurkoyi* CIVRIEUX & DESSAUVAGIE – PRONINA, pl. 2, figs. 28-31.
1989 *Pachyphloia ovata* LANGE – KÖYLÜOGLU & ALTINER, pl. 4, figs. 1-7.
1996 *Pachyphloia ovata* LANGE – WIGNALL & HALLAM, text-fig. 4 p. 591 (no illustration).
1998 *Pachyphloia ovata* LANGE – ALTINER & ÖZKAN-ALTINER, pl. 4, fig. 15.
? 2002 *Pachyphloia ovata* LANGE – GU *et al.,* p. 166, pl. 1, fig. 2 (too big for a *P. ovata*).
? 2002 *Pachyphloia paraovata* K.M. -MAKLAY – GU *et al.,* p. 166, pl. 1, fig. 5.
p.p. 2005 *Pachyphloia cukurkoyi* DE CIV. & DESSAUV. – HUGHES, pl. 3, fig. 25, pl. 4, fig. 3 (*non* pl. 3, fig. 24 or pl. 4, fig. 1 = *P. lanceolata*).
2005 *Pachyphloia* cf. *cukurkoyi* DE CIV. & DESSAUV. – HUGHES, pl. 3, figs. 1-2.
? 2005 *Pachyphloia iranica* BOZORGNIA – HUGHES, pl. 4, figs. 2, 4.
2005 *Pachyphloia ovata* LANGE – GROVES *et al.,* p. 22-23, fig. 20.15-27 (with 39 references in synonymy).
p.p. 2006c *Pachyphloia ovata* LANGE – KOBAYASHI, pl. 3, figs. 12, 19-22, 26-27 (*non* pl. 3, figs. 28-29 other species or genera).
2006d *Pachyphloia ovata* LANGE – KOBAYASHI, pl. 3, figs. 23-24, 30-31.
p.p. 2006e *Pachyphloia ovata* LANGE – KOBAYASHI, pl. 2, figs. 16-17, 20 (*non* fig. 15 = other species).
v. 2006 *Pachyphloia ovata* LANGE – GAILLOT, p. 165-166, Pl. I.27, figs. 4, 8, Pl. V.6, figs. 25-26, Pl.VI.11, figs. 5, 23.

Description: Test small, ovoid, with 5-7 chambers; hence, synonym of *P. cukurkoyi*. H.= 0.280-0.425 mm, w.= 0.125-0.200 mm, w/H= 0.42-0.55, p.d.= 0.040-0.060 mm, n.c.= 5-7, h.l.c.= 0.060-0.070 mm, w.t.= 0.010-0.016 mm.

Remarks: This population is especially similar in size with *P. paraovata* described by MIKLUKHO-MAKLAY (1954) in NW Caucasus, but this species can be considered as a synonym of *P. ovata* due to the lack of biostratigraphic significance. Similarly, we consider, with ALTINER and JENNY-DESHUSSES (see compilation in GROVES *et al.,* 2005), *P. cukurkoyi* SELLIER DE CIVRIEUX & DESSAUVAGIE as a synonym. *P. multiseptata* LANGE, 1925 and *P. angulata* MIKLUKHO-MAKLAY, 1954 have the same dimensions but differ by more chambers (respectively 10-12 and 7-11).

Occurrence: Late Midian of Sumatra. Changhsingian of Greece, Transcaucasia and southern China. Late Changhsingian of central Taurides (Turkey); Middle-Late Permian of Italy, the Balkans, Iran, NW Caucasus, Transcaucasia, Pakistan, Japan, Indochina and New Zealand (as compiled by GROVES *et al.,* 2005, p. 23). Late Midian of Hazro. Lopingian of Zagros.

Pachyphloia cf. *ovata* LANGE, 1925

(Pl. 73, fig. 19)

v. 2006 *Pachyphloia* cf. *ovata* LANGE – GAILLOT, p. 166, pl. I.27, fig. 19.

Description: It differs from true *P. ovata* by the ends more acute and more and lower chambers. It possesses the parameters of *P. paraovata* MIKLUKHO-MAKLAY, 1954, but differs by both acute peripheries.

Dimensions: H.= 0.385 mm, w.= 0.185 mm, w/H= 0.48, n.c.= 9, p.d.= probably 0.015 mm, h.l.c.= 0.040 mm, w.t.= 0.010 mm.

Occurrence: Early Changhsingian of Zagros.

Pachyphloia schwageri SELLIER DE CIVRIEUX & DESSAUVAGIE, 1965

(Pl. 63, figs. 22-23, Pl. 72, fig. 14, Pl. 73, fig. 7, Pl. 81, figs. 2, 11-12, 16, Pl. 83, figs. 26, 32, Pl. 87, fig. 19, Pl. 92, fig. 5, Pl. 96, fig. 3)

1965 *Pachyphloia schwageri* sp. nov. – SELLIER DE CIVRIEUX & DESSAUVAGIE, p. 38-39, pl. 4, figs. 4-16, pl. 5, figs. 1, 3-7, 10-16, 19, pl. 6, figs. 1-2, 5, 11, 13, pl. 7, figs. 2a-f-3a-f, pl. 8, figs. 1, 3-4, pl. 9, fig. 3, pl. 14, fig. 2, pl. 16, fig. 2.

1989 *Pachyphloia schwageri* SELLIER DE CIVRIEUX & DESSAUVAGIE – KÖYLÜOGLU & ALTINER, pl. 4, figs. 8-12.

p.p. 2005 *Pachyphloia iranica* BOZORGNIA – HUGHES, pl. 3, figs. 21-22, pl. 4, figs. 2, 4? (*non* fig. 5 = ? *Ichthyolaria* aff. *natella*).

2005 *Pachyphloia schwageri* SELLIER DE CIVRIEUX & DESSAUVAGIE – GROVES *et al.,* p. 23, fig. 21.1-11 (with 10 references in synonymy).

?v. 2006 *Pachyphloia* sp. – INSALACO *et al.,* pl. 2, fig. 23.

p.p. 2006b *Pachyphloia schwageri* SELLIER DE CIVRIEUX & DESSAUVAGIE – KOBAYASHI, fig. 5. 16-20 (*non* figs. 5. 21, 24= *Robustopachyphloia*, *nec* fig. 5. 22-23= other species of *Pachyphloia*).

v. 2006 *Pachyphloia schwageri* SELLIER DE CIVRIEUX & DESSAUVAGIE – GAILLOT, p. 166-167, Pl. I.27, fig. 7, Pl. I.28, figs. 26, 32, Pl. I.31, fig. 19, Pl. II.28, fig. 5, Pl. II.30, fig. 3, Pl. III.26, figs. 22-23, Pl. III.27, figs. 2, 11-12, 16, Pl. V.6, figs. 27-28, Pl. VI.11, fig. 14.

2007 *Pachyphloia schwageri* SELLIER DE CIVRIEUX & DESSAUVAGIE – GROVES *et al.,* fig. 8.7-9, 11-14, 20-21.

Description: Test small, compressed, with 8-12 chambers. H.= (0.320) 0.445-0.585 mm, w.= 0.130-0.255 mm, w/H= 0.26-0.44, p.d.= 0.010-0.060 mm, n.c.= 8-13, h.l.c.= 0.040-0.080 mm, w.t.= 0.008-0.015 mm.

Occurrence: Late Changhsingian of central Taurides (Turkey), Middle-Late Permian of Afghanistan, Japan and China (as compiled by GROVES *et al.,* 2005, p. 23). Late Midian-Lopingian of Hazro. Lopingian of Zagros-Fars. Late Dorashamian (Khartam Member) of Saudi Arabia.

Pachyphloia pedicula LANGE, 1925

(Pl. 10, fig. 9, Pl. 72, fig. 2, Pl. 73, fig. 9, Pl. 81, fig. 8, Pl. 82, fig. 3, Pl. 85, fig. 7, Pl. 90, fig. 3)

1925 *Pachyphloia pediculus* sp. nov. – LANGE, p. 232, pl. 1, fig. 25.

1960 *Pachyphloia pediculus* LANGE – SOSNINA, pl. 1, fig. 6.

1965 *Pachyphloia "pediculus"* LANGE – SELLIER DE CIVRIEUX & DESSAUVAGIE, p. 114-115 (no illustration).

1970a *Pachyphloia pedicula* LANGE – PANTIC, pl. 10, fig. 9.

1973 *Pachyphloia pedicula* LANGE – BOZORGNIA, p. 154-155, pl. 36, figs. 1-2, 4.

1978 *Pachyphloia pedicula* LANGE – LYS *et al.,* pl. 8, fig. 3.

1981 *Pachyphloia pedicula* LANGE – ALTINER, pl. 40, figs. 19-24.

1983b *Pachyphloia pedicula* LANGE – JENNY-DESHUSSES, p. 106, pl. 4, fig. 1 (with 4 references in synonymy).

1986a *Pachyphloia* sp. – NGUYEN DUC TIEN, pl. 1, figs. 19-20.

1990 *Pachyphloia pediculus* LANGE – LIN *et al.,* p. 243,

pl. 32, figs. 7-8.
1992 *Pachyphloia pedicula* LANGE – BERCZI-MAKK, pl. 1, fig. 2.
1995 *Pachyphloia pedicula* – BERCZI-MAKK *et al.,* pl. 2, figs. 6-8, pl. 9, figs. 6?, 7?
? 2002 *Pachyphloia laxa* LIN – GU *et al.,* p. 165-166, pl. 1, fig. 1 (too big for a *P. laxa*).
2004 *Pachyphloia pediculus* LANGE – ZHANG & HONG, p. 76, pl. 3, fig. 25 (with 2 references in synonymy).
v. 2006 *Pachyphloia pedicula* LANGE – GAILLOT, p. 167, Pl. I.26, fig. 7, Pl. I.27, fig. 9, Pl. III.27, fig. 8, Pl. VI.11, fig. 2, Pl. VI.12, fig. 3, Pl. VI.13, fig. 3, Pl. VII.1, fig. 9.

Dimensions: Test medium sized with relatively few chambers. H= 0, 625-0.960 mm, w.= 0.200-0.230 mm, w/H= 0.23-0.37, n.c.= 6-8, p.d.= 0.040-0.065 mm, h.l.c.= 0.080-0.090 mm, w.t.= 0.012-0.020 mm. The Chinese specimen (Pl. 10, fig. 9) measures: H.= 0.750 m, w.= 0.560 mm, w/H= 0.75, n.c.= 8 or 9, p.d.= 0.025-0.110 mm, h.l.c.= 0.120-0.145 mm, w.t.= 0.020 mm.

Occurrence: Late Midian of Sumatra. Late Changhsingian of NW Caucasus, Hungary, Alborz, Turkey, Transcaucasia and southern China. Late Midian-Lopingian of Hazro.

Pachyphloia enormis sp. nov.

(Pl. 75, fig. 2, Pl. 76, fig. 13, Pl. 77, figs. 5-7, Pl. 82, fig. 1, Pl. 90, fig. 16, Pl. 92, fig. 1, Pl. 93, fig. 18)

v. 2006 *Pachyphloia enormis* sp. nov. – GAILLOT & VACHARD *in* GAILLOT, p. 167-168, Pl. I.41, fig. 2, Pl. II.27, fig. 13, Pl. II.28, fig. 1, Pl. II.35, fig. 18, Pl. III.10, figs. 5-7, Pl. V.6, fig. 34, Pl. VI.12, fig. 16, Pl. VI.13, fig. 1 (*nomen nudum*).

Etymology: Latin *enormis*= huge.

Type locality: Hazro section (Turkey).

Type level: Late Changhsingian.

Diagnosis: Very large species, 1 mm larger than the maximum known dimensions of the genus.

Description: L= 2.280-2.550 mm, w.= 0.845-0.880 (1.000-1.100) mm, t.t.= 0.380-0.560 (0.720) mm, p.d.= 0.050 mm, n.c.= 6 visible (probably 11 or 12), h.l.c.= 0.240-0.300 mm, w.t.= 0.060-0.110 mm.

Holotype: Pl. 82, fig. 1 (sample 03HZ48).

Type material: 8 paratypes are illustrated, they represent approximately the third of the observed specimens.

Repository of the types: Collection of Palaeontology of Lille 1 University (France).

Comparison: The new species differs from *P. robusta*; *P. solida* or *P. consueta* by larger dimensions.

Occurrence: Late Changhsingian of Hazro. Midhnab Member of Saudi Arabia. Late Midian-Lopingian of Zagros (Bloom event in the Wuchiapingian MFI).

Pachyphloia cf. *robusta* MIKLUKHO-MAKLAY, 1954

(Pl. 20, fig. 6?, Pl. 73, fig. 3, Pl. 82, fig. 6, Pl. 83, fig. 15, Pl. 85, figs. 9?, 18)

cf. 1954 *Pachyphloia robusta* sp. nov. – MIKLUKHO-MAKLAY, p. 50, pl. 5, fig. 8.
v. 2006 *Pachyphloia* cf. *robusta* MIKLUKHO-MAKLAY – GAILLOT, p. 168, Pl. I.26, figs. 9?, 18, Pl. I.27, fig. 3, Pl. I.28, fig. 15, Pl. III.13, fig. 6?, Pl. VI.13, fig. 6.

Dimensions: The maximal dimensions of the type material of *P. robusta* are 1.500 x 0.500 mm for 7 chambers but the ratio is relatively identical (0.42) hence this identification. Compare also this taxon with *P. consueta* SOSNINA, 1978, with the same dimensions but for 12-14 chambers. H= (1.125) 1.280-1.375 mm, w= 0.325-0.400 (0.550-0.600) mm, wH= 0.25-0.30 (0.50), t.t.= 0.150 mm, n.c.= 8-9, p.d.= 0.040-0.130 mm, h.l.c.= 0.130-0.150 mm, w.t.= 0.010-0.040 mm.

Occurrence: Late Midian of Primorye. Changhsingian of NW Caucasus, Hazro. Lopingian of Zagros.

Pachyphloia spp.

(Pl. 34, figs. 23, 25, Pl. 63, figs. 17, 24, 28, Pl. 77, fig. 15, Pl. 80, fig. 14, Pl. 81, figs. 7, 9-10, Pl. 83, figs. 1-2, Pl. 84, figs. 7, 14, 18, Pl. 89, fig. 2, Pl. 93, figs. 2, 4, 11, Pl. 94, fig. 10)

v. 2006 *Pachyphloia* spp. – GAILLOT, p. 168, Pl. I.28, figs. 1-2, Pl. I.32, fig. 2, Pl. II.35, figs. 2, 4, 11, Pl. III.9, figs. 7, 14, 18, Pl. III.10, fig. 15, Pl. III.20, fig. 14, Pl. III.21, fig. 10, Pl. III.22, figs. 23, 25, Pl. III.26, figs. 17, 24, 28, Pl. III.27, figs. 7, 9-10.

Remarks: Several species differing principally by the size and the general morphology.

Occurrence: Late Midian-Lopingian of Zagros. Wuchiapingian of Fars.

Genus *Robustopachyphloia* Lin, 1980

Type species: *Robustopachyphloia annectena* Lin, 1980.

Comparison: *Robustopachyphloia* was initially regarded as characteristic of the Changhsingian. Its FAD is probably Middle Permian but some Early Permian specimens are relatively comparable [e.g., *Geinitzina magna kislovi* Kosheleva *in* Baryshnikov *et al.,* 1982, pl. 8 figs. 13?, 14].

Remarks: This genus is generally rare. In Neotethys, it was mentioned by Hauser *et al.* (2000) in the Batain Plain (Oman).

Occurrence: ?Midian of central Japan. Wuchiapingian of south Turkey (Hazro). Changhsingian of southern China and Zagros.

Robustopachyphloia sp.
(Pl. 72, fig. 24, Pl. 87, fig. 21, Pl. 88, fig. 6, Pl. 89, fig. 15?)

v. 2006 *Robustopachyphloia* sp. – Gaillot, p. 168-169, Pl. I.31, fig. 21, Pl. I.32, fig. 15?, Pl. I.33, fig. 6, Pl. VI.11, fig. 24.

Dimensions: Pl. 87, fig. 21: H.= 0,705 mm, w.= 0.170 mm, w/H= 0.24, n.c.= 10, p.d.= mm, h.l.c.= 0.120 mm, w.t.= 0.020 mm. Pl. 89, fig. 15?: H.= 0,380 mm, w.= 0.120 mm, w/H= 0.32, n.c.= 8, p.d.= 0.020 mm, h.l.c.= 0.065 mm, w.t.= 0.008 mm. Pl. 88, fig. 6: H.= 0,355 mm, w.= 0.132 mm, w/H= 0.37, n.c.= 7, p.d.= 0.045 mm, h.l.c.= 0.065 mm, w.t.= 0.013 mm. Pl. 72, fig. 24: H.= 0,665 mm, w.= 0.305 mm, w/H= 0.46, n.c.= 6 of "*Pachyphloia*" type and 4 hemispherical, p.d.= 0.075 mm, h.l.c.= 0.085 mm, w.t.= 0.017 mm.

Comparison: No complete section were observed. The most similar taxon is *R. iniqua* (Lin, 1978) but the dimensions are not exactly the same.

Occurrence: Wuchiapingian of south Turkey (Hazro). Changhsingian of Zagros (Kuh-e Surmeh).

Genus *Aulacophloia* gen. nov.

Type species: *Aulacophloia martiniae* sp. nov.

Etymology: Greek aulacos= furrow, because of the regular partitions in transverse sections, and ending *phloia* from *Pachyphloia* similar genus.

Diagnosis: Nearly identical to *Pachyphloia* but showing the successive chambers separated by a dark furrow line.

Composition: Monospecific.

Comparison: It differs from *Pachyphloia* by the limits of the successive chambers clearly indicated internally and from *Cryptoseptida* by the absence of recrystallization of the wall, the shape of the chambers and the presence of furrows. *Cryptoseptida* is a poorly known genus due to the absence of illustrated axial section of its type species *Cryptoseptida anatoliensis* (see also a part of the discussion in Loeblich & Tappan, 1987, p. 388). The trend of obvious limits of chambers seems to exist in some specimens of *Pachyphloia pedicula* Lange (e.g. pl. 36, fig. 1 of Bozorgnia, 1973 and pl. 40, fig. 23 of Altiner, 1981).

Occurrence: Lopingian of Turkey. Midhnab Member (early? Dorashamian) of Saudi Arabia.

Aulacophloia martiniae sp. nov.
(Pl. 27, figs. 10-12, Pl. 77, fig. 17, Pl. 86, figs. 3-5, Pl. 90, fig. 17, Pl. 96, figs. 14-15)

1970 *Robuloides* sp. – Canuti *et al.,* fig. 12.3 (*non* figs. 6, 8= *Pachyphloia*).

v. 2005 *Cryptoseptida*? sp. -Vachard *et al.,* p. 170, pl. 6, fig. 29.

v. 2006 *Cryptoseptida*(?) sp. – Insalaco *et al.,* pl. 2, fig. 13.

v. 2006 *Aulacophloia martiniae* sp. nov. – Gaillot & Vachard *in* Gaillot, p. 169-170, Pl. I.29, figs. 3-5, Pl. II.30, figs. 14-15, Pl. II.31, figs. 10-12, Pl. III.10, fig. 17, Pl. V.6, fig. 29, Pl. VI.12, fig. 17 (*nomen nudum*).

Etymology: Dedicated to Dr. Rossana Martini (Geneva University, Switzerland), for her contribution to the micropalaeontology of the Late Permian and Triassic.

Type locality: Hazro section (Turkey).

Type level: Early Changhsingian.

Diagnosis: Similar to *Pachyphloia* ex gr. *robusta* (see above) but with visible interstratifications.

Description: w.= 0.480 mm, t.t.= 0.160 mm, t.t./w= 0.32, n.w.= 6, h.l.c.= 0.065 mm, w.t.= 0.008 mm.

Holotype: Pl. 90, fig. 17 (sample 03HZ46).

Type material: 8 (perhaps 12) specimens.

Repository of the types: Collection of Palaeontology of Lille 1 University (France).

Comparison: Differs from *Cryptoseptida* (a poorly defined genus) by the type of wall; differs from *Pachyphloia* by the lineations corresponding to the special shape of the chambers.

Occurrence: Midhnab Member (early? Dorashamian) of Saudi Arabia. Early Changhsingian of Fars area and Zagros. Changhsingian of Hazro (S.E. Turkey).

Aulacophloia sp.
(Pl. 78, fig. 4, Pl. 80, figs. 12, 16?)

v. 2006 *Aulacophloia* sp. – Gaillot, p. 170, Pl. III.11, fig. 4, Pl. III.20, figs. 12, 16?

Dimensions: Pl. 78, fig. 4: w.= 0.365 mm, t.t.= 0.155 mm, p.d.= 0.035 mm. Pl. 80, fig. 12: w.= 0.540 mm, t.t.= 0.270 mm, w.t.= 0.020 mm. Pl. 78, fig. 16: H.= 0.600 mm, w.= 0.655 mm.

Occurrence: Changhsingian of Zagros.

Genus *Cryptoseptida* Sellier de Civrieux & Dessauvagie, 1965

Type species: *Cryptoseptida anatoliensis* Sellier de Civrieux & Dessauvagie, 1965.

Remarks: *Cryptoseptida* is a poorly known genus. It is interpreted here as a morphological variation of *Pachyphloia* with deeply arched chambers.

Occurrence: Described in the "Calcaires à Bellerophon" of Turkey; i.e. a composite unit probably late Midian-Lopingian in age, and never really re-found (the recently illustrated *C. anatoliensis* of Groves *et al.,* 2005, fig. 23.26 and 2007, fig. 6.1-2 looks like *Langella ocarina* Sellier de Civrieux & Dessauvagie, 1965; while the former species is illustrated pl. 11, fig. 1 by these latter authors, the other one appears pl. 11, fig. 2, maybe a confusion was possible in the relation with the illustrated specimen). Although perfectly unknown, *Cryptoseptida* is often identified in the literature. *Cryptoseptida*? sp. is mentioned by Wang & Ueno (2003) in the Changhsingian of southern China, and *Cryptoseptida* sp. in the Changhsingian of Japan by Kobayashi (2002, fig. 9. 40-41) perhaps corresponds to our definition of *Aulacophloia* gen. nov. Another *Cryptoseptida*? sp. is cited in the Midian of Japan, but its illustration (Kobayashi, 2001, pl. 2, fig. 14) corresponds more probably to the genus *Pseudolangella*. The Triassic (Anisian) *Cryptoseptida*? sp. of Kobayashi (1996) is more similar to *Polarisella elabugae*. *Cryptoseptida* is synonymized with *Pachyphloides* by Berczi-Makk (1996), as an alternative solution.

Cryptoseptida? sp.
(Pl. 75, fig. 3, Pl. 82, fig. 8)

v. 2006 *Cryptoseptida*? sp. – Gaillot, p. 170-171, Pl. I.41, fig. 3, Pl. VI.13, fig. 8.

Dimensions: H.= 0.400-0.430 mm, w.= 0.150-0.170 mm, w/H= 0.35-0.42, n.c.= 13.

Remarks: The two illustrated specimens could correspond to the generic diagnosis, or are atypical *Pachyphloia*.

Occurrence: Late Midian of Zagros (Kuh-e Dena) and Changhsingian of south Turkey (Hazro).

Family Ichthyolariidae Loeblich & Tappan, 1986

Diagnosis: Large Nodosarioidea with palmate to chevron-shaped chambers. Aperture radiate.

Composition: *Ichthyolaria* Wedekind, 1937. The other genera attributed to the family by Loeblich & Tappan (1987) belong in fact to Frondinidae fam. nov., Pachyphloiidae, Protonodosariidae, Partisaniidae, and Geinitzinidae.

Occurrence: Late Early Permian to Late Permian. Palaeotethys, Neotethys, Australia, USA.

Genus *Ichthyolaria* WEDEKIND, 1937 *emend.* SELLIER DE CIVRIEUX & DESSAUVAGIE, 1965

Type species: *Frondicularia bicostata* D'ORBIGNY, 1850.

Composition: See SELLIER DE CIVRIEUX & DESSAUVAGIE, 1965, p. 139. Add: *Ichthyolaria permotaurica* SELLIER DE CIVRIEUX & DESSAUVAGIE, 1965; (?) *Frondicularia*? *arpaensis* PRONINA, 1989 (part); *Nodosaria kolymica* MIKLUKHO-MAKLAY, 1960; *Cryptoseptida kanyosensis* KOBAYASHI, 1997; *Ichthyolaria cuneata* SOSNINA, 1978; *Ichthyolaria cuneata sensu* NESTELL & PRONINA, 1997, pl. 1, fig. 23; *Ichthyolaria latilimbata sensu* LYS & MARCOUX, 1978, pl. 1, fig. 17 and *auct.*.

Occurrence: Late Permian-Early Jurassic, Tethyan.

Ichthyolaria aff. *natella* (GERKE, 1961)
(Pl. 78, fig. 12, Pl. 80, fig. 10, Pl. 82, fig. 9, Pl. 86, fig. 11)

aff. 1961 *Frondicularia natella* sp. nov. – GERKE, pl. 56, figs. 1-4.
p.p.? 2005 *Pachyphloia iranica* BOZORGNIA – HUGHES, pl. 4, fig. 5 (*non* figs. 2, 4= ? *Pachyphloia* cf. *schwageri*).
? 2005 *Pachyphloia iranica colcheni* LYS – HUGHES, pl. 4, fig. 6.
v. 2006 *Ichtyolaria* aff. *natella* (GERKE) – GAILLOT, p. 171, Pl. I.29, fig. 11, Pl. III.11, fig. 12, Pl. III.20, fig. 10, Pl. VI.13, fig. 9.

Description: H.= 0.500-0.940 mm, w.= 0.300-0.500 mm, w/H= 0.46-0.69, n.c.= 7-13, p.d.= 0.020 mm, h.l.c.= 0.050-0.080 mm, w.t.= 0.015-0.025 mm.

Occurrence: Late Permian of Russia (GERKE, 1961). Wuchiapingian-Changhsingian of Hazro.

Ichthyolaria sp.
(Pl. 93, fig. 9)

v. 2006 *Ichthyolaria* sp.- GAILLOT, p. 171, Pl. II.35, fig. 9.

Dimensions: One specimen shows the typical shape of chambers, and seems to possess an apertural neck at the last chamber. H.= 0.570 mm, w.= 0.340 mm, w/H= 0.60, n.c.= 6, h.l.c.= 0.100 mm, w.t.= 0.010 mm.

BIOSTRATIGRAPHY

GUADALUPIAN-LOPINGIAN LARGE FUSULINIDS EXTINCTION

The disappearance of the large and giant fusulinids both with keriothecal at the end of the Midian (= Guadalupian) is traditionally known since the nineties (SHENG, 1992; JIN *et al.*, 1994, STANLEY & YANG, 1994). This disapparance, closely connected with an important fall in the carbonate productivity (WEIDLICH, 2002), affected many carbonate groups, e.g., the dasyclads and the rugose corals (and the reef biota in general). Other explanations are possible: area reduction or destruction of favourable habitats, disappearance of the symbiotic algae of the fusulines and/or corals (OTA & ISOZAKI, 2006), onset of the end-Permian anoxia and/or warming. The anoxia related to a rapid change in the plate movements is the most probable. These phenomena may have been active during all the Lopingian and are probably responsible for a great part of the mass extinction of the Permian/Triassic boundary (PTB). Nevertheless, all these long-term processes (at the scale of Ma) were probably too much progressive to produce the end-Lopingian mass extinction itself, which has been considered as lasting probably down to less than tens of thousands years (e.g., KAIHO *et al.*, 2001). Several Chinese and US colleagues are thus favourable to a meteoritic impact (see bibliography in THÉRY *et al.*, 2007).

ABSENCE OF PALAEOTETHYAN MARKERS

The two foraminifers considered as classical Changhsingian markers are *Palaeofusulina* and *Colaniella*, and inhabits rather more open seas. Hence, in the confined environments of the Arabian Platform, these markers are lacking. So, we have developed another scale based on smaller foraminiferal groups as such as globivalvulinids, hemigordiids, neodiscoids and robuloidids (Fig. 16).

Late Permian globivalvulinids

The biseriammininoids (i.e., Mississippian to Permian biserially coiled Fusulinida) are constituted by the biseriamminids, probably limited to the Tournaisian-Viséan, and the globivalvulinids (e.g., Vachard *et al*., 2006). Among the Lopingian globivalvulinids, (and as early as the early?-late Midian) four great evolutive trends are present: (1) Globivalvulininae: *Globivalvulina* subsists, with five differenciations giving the genera *Retroseptellina* (reversed curvature of the septa, no rapid increasing in height of the last chambers), *Septoglobivalvulina* (inversely the last chamber is very high and broad, heralding *Paraglobivalvulina*), *Charliella* (with wall and septation different), and *Labioglobivalvulina* (aperture different); (2) Paraglobivalvulininae: a tendency appeared with *Septoglobivalvulina* to gave a test completely spherical with endoskeleton, relatively medium-sized and simple in *Paraglobivalvulina*, very large and complicated in *Paraglobivalvulinoides*; (3) Dagmaritinae can derive from *Sengoerina*, this peculiar, transitional globivalvulin. Some forms without thornlike projections can be mentioned, especially one form well characterized by its aperture: *Labiodagmarita*. Finally, an endoskeleton appears in this group with *Louisettita*. (4) Paradagmaritinae which are very much more diversified in our material than in previous descriptions and studies. Several genera and species are created herein, without any splitting tendency, but according to a biostratigraphic point of view. Paradoxically, *Paradagmaritella flabelliformis* was not encountered in our material indicating that endemism is very important in this group. Furthermore, some illustrations of Transcaucasia and NW Caucasus can correspond to other unpublished taxa. The unique citation in Oman is doubtful, and *Paradagmarita dubreuilli* in Afghanistan is a *Louisettita* (see above). Consequently, true *Paradagmarita* is limited to Saudi Arabia, Transcaucasia, NW Caucasus, and of course southern Turkey and Zagros. Nevertheless, very closely related forms are present in our material of southern China (Gaillot, 2006; Gaillot *et al*., submitted). The most interesting genus is *Paradagmaritopsis* whose distribution is in the Zagros, southern China and Japan. Its palaeobiogeographic importance is underlined below.

The phylogeny of *Paradagmarita* begins in the early Wuchiapingian with *P. simplex*, which is unquestionably related to *Globivalvulina* (no with *Dagmarita*, unlike Altiner, 1997). The spire and the number of pairs of chambers increase in the following species: *P. zaninettiae*, which evolves progressively into *P.* cf. *monodi*, *P. monodi* (truly characteristic of Changhsingian) and *P. planispiralis*. This latter form is characteristic of the late Changhsingian and is associated with *Paradagmaracrusta callosa*, which exhibits crustae on the roof of the chambers, an exceptional criteria among the globivalvulinids. Two Lopingian species are rare *Paradagmaritella surmehensis* and *P. brevispira* (Fig. 17).

Late Permian Miliolata

According to the FAD of the group (Vachard, unpublished data), we propose to subdivide the Palaeozoic Miliolida, whose emergence is in the latest Viséan, into two superfamilies: Nubecularoidea and Hemigordiopsoidea. Nubecularoidea are attached forms, which represent a true lineage, as previously indicated by Vachard & Krainer (2001b). The Hemigordiopsoidea are the free forms derivated from the superfamily Nubecularoidea only in the early Bashkirian (e.g., Vachard & Maslo, 1996). The Hemigordiopsoidea can be subdivided into four families: Cornuspiridae, Hemigordiidae, Neodiscidae and Hemigordiopsidae.

The Cornuspiridae are poorly differentiated with planispiral evolute coiling: *Cornuspira* and *Rectocornuspira*, glomospiral coiling: *Hemigordiellina*= *Palaeoglomospira* (*nomen nudum*), or both coilings successively: *Hoyenella* (= *Glomospirella auct.*). The Hemigordiidae present some additional particularities of coiling and shape of tests. The Neodiscidae display the same type of coiling, but with a very larger size, common pseudosepta and different skeletal structures: the buttresses, which annunciate probably the types of wall of Involutinida. The Hemigordiopsidae also exhibit large to giant tests. The flosculinisation is widespread among them.

Late Permian Nodosariata

We consider that all the Nodosariata form a monophyletic suborder, whereas all the other hyaline-walled foraminifers, as indicated by Mikhalevich (e.g., 1998), constitute the class Rotaliata. Palaeozoic Nodosariata are subdivided into two superfamilies according to the presence or absence of the typical radiate aperture largely dominant from Jurassic to Holocene. The superfamily with radiate aperture is the Nodosaroidea; the other superfamily groups the forms with a simple round aperture, typical of the Syzraniidae and inherited from the *Earlandia* ancestors (Vachard, 1994).

PALAEOBIOGEOGRAPHY

Zagros-Fars and Taurus area

The Hazro area is part of the Southern Biofacies Belt of Turkey defined by Altiner *et al.* (2000). Some palaeobiogeographic data permit emphasis of the abundant similarities between Taurus, Zagros and Abadeh area (Iran), Oman, Tunisia and Transcaucasia (e.g., Théry *et al.*, 2007), whereas the opposite Turkish Northern Biofacies Belt is connected with the Crimea, Hungary, and NW Caucasus. The two belts or Subprovinces are correlatable respectively with the Perigondwan part of Afghanistan: such as the Central Mountains and the Kabul Block and the SE Pamir, and with the Perihercynian part of Afghanistan (i.e, Hindu-Kush) and northern Pamir (Darvaz) (Vachard, 1980). Between these two southern and northern domains extends a central domain (called Extragondwanan by Vachard, 1980 or Cimmerian *sensu* Ueno, 2003 *non* Sengör, 1979) which is represented by some parts of Anatolia in Turkey, Alborz and the Band-e Bayan zone in Afghanistan (Vachard, 1980). In Eastern Asia, the palaeogeography seems to be more complex, but Tibet-Xizang is Perigondwanian as well as West-Myanmar and western Thailand. Some large blocks are represented by northern China, southern China and Indochina. NE Thailand is directly related to Indochina. NW and central Thailand might correspond to two independent microplates; the western microplate is related to Gondwana by its assemblages, especially *Shanita*, and sediments such as glacial tillites, i.e., probably also Extragondwan; the eastern microplate has some relations with Indochina (presence of *Lepidolina*, *Palaeofusulina* and *Colaniella,* see Ferrari *et al.*, submitted).

Subprovince of Paradagmarita

The Subprovince of *Paradagmarita* has been defined by Sengör *et al.*, 1984 and Gaillot & Vachard, 2004. It is more or less similar to the province of *Shanita* (Sengör *et al.*, 1988; Ueno, 2003), but very distinct from the Subprovince of *Eopolydiexodina* (Sengör *et al.*, 1988; Vachard & Bouyx, 2002; Ueno, 2003). Other markers have also been proposed for this subprovince (e.g., Kobayashi, 1999), but they were not encountered in our study.

Especially concerning the complete phylogenetic lineage of *Paradagmarita*, the markers are obviously present in Taurus and Zagros. Other individuals assigned to this genus are apparently all different and belong to *Paradagmaritopsis*, *Louisettita*, or undescribed taxa more similar in fact to *Spireitlina* or *Charliella*.

Nevertheless, true *Paradagmarita* seems to exist in southern China and *Paradagmaritopsis* is present in Zagros and Japan, as well as two other new taxa described as *Partisania* sp. and *Globivalvulina* sp. (see Kobayashi, 2004 and Gaillot, 2006). Although poorly known, these taxa suggest the existence of a continuous platform allowing the dispersion of these smaller foraminifers restriicted to very shallow environments and devoid of all planktonic stages.

Other taxa still poorly known, which indicate close connections between Hazro and Zagros, must be systematically investigated in other areas in order to characterize or invalidate the proposed relations. These taxa are *Glomomidiellopsis* (probably neglected due to its similarity with *Hemigordiopsis*) and *Tauridia*-Frondinidae (generally considered as "*Nodosaria*" *s.l.*). Other endemic forms, newly described here, common to Hazro and Zagros, are probably also important: *Aulacophloia*, *Louisettita*, *Crassispirella*, *Neodiscopsis*, *Labioglobivalvulina* and *Labiodagmarita*. Several of them have yet to be observed by us in Saudi Arabia (see lists os synonymies, above, and unpublished data).

Surprisingly, the affinities with southern China are numerous (see Gaillot *et al.,* submitted): *Louisettita ultima*, *Robustopachyphloia*, the fusulines in general (*Reichelina*, *Chusenella*), indicating either a proximity or a preferential systems of marine shallow currents, but, due to the biological constraints of the larvae of foraminifers, a continuity of the carbonate platforms beween southern Neotethys and southern China. Because of the palaeomagnetic data (Besse *et al.,* 1998) and a combination of the Pangea A and Pangea B (according to the models proposed by the same authors), a real proximity is possible. Hence, the following reconstructions are proposed for the *Paradagmarita*, *Colaniella* and *Palaeofusulina* Subprovinces (Fig. 18).

Implications for the Latest Permian Neotethyan Palaeogeography.

Generally, the rifting of the Neotethys is considered as Early Permian in age followed by a rifting during the Middle Permian (e.g., Angiolini *et al.,* 2003a). Nevertheless, much published and unpublished data show that the opening was not synchronous, and seems to have taken place from East to West, from Australia to Turkey. A Carboniferous opening in northern Australia was indicated by Stampfli (2000). It is even likely that this opening occurs at the end of the Viséan stage (Early Mississippian; Vachard, unpublished data). The two principal Mississippian biogeographic markers are the foraminifers *Quasiendothyra* and especially the Viséan algae *Queenslandella*. Completely absent in the Gondwanan, Perigondwan and Cimmerian terranes (Vachard, unpublished data), *Quasiendothyra* existed in the Bonaparte Gulf in NW Australia. Its unique way of migration to NW Australia is from southern China or northern Vietnam, where *Quasiendothyra* has been occasionnally mentioned. *Queenslandella* described in Australia by Mamet & Roux (1983) was only re-found in the Indosinian (eastern) part of Thailand under the name *Windsoporella* (Vachard, 1990; Fontaine *et al.,* 2005). The opening of Neotethys in Thailand is difficult to establish during the Carboniferous, but this seaway is clearly functional during the Middle-Late Permian, due notably to the absence/presence of foraminifers *Shanita, "Lysites", Hemigordiopsis renzi, Eopolydiexodina* ex gr. *persica* in Baoshan and west-Thailand (= Sibumasu Blocks= Cimmerian blocks; see Ueno, 2003); versus *Lepidolina, Palaeofusulina, Colaniella* in eastern Thailand (= Indosinian and/or southern China block). Tillites are also characteristic of the Sibumasu Terrane (e.g., Fontaine *et al.,* 1986a). An important element of the microfauna in this terrane consist of the Tournaisian foraminifers mentioned by Fontaine & Vachard, 1989, but these foraminifers, even if generally known in Eurasia, Urals, southern China and Viet-Nam, might have been also present in the Cimmerian Alborz, where diversified Tournaisian foraminifers are known (e.g., Bozorgnia, 1973; Vachard, 1996).

In the Himalayas the rifting is Mississippian (e.g., Angiolini *et al.,* 2003b), and probably after the late Viséan with *Coelosporella* identified by Colchen & Vachard (1975), whereas the opening starts in the late Sakmarian (e.g., Angiolini *et al*., 2003b).

In the Central Mountains of Afghanistan, a terrane which is relatively located to the south due to the presence of periglacial influences (Vachard & Montenat, 1981), progresses to the north and exhibits palaeoclimates successively cold temperate, warm temperate and subtropical to tropical. Interpreting these modifications as related to the local opening of the Neotethys (a warming without displacement is an alternative hypothesis, it is possible that the rifting is Asselian with the beds containing *Tezaquina clivuli* Vachard *in* Vachard & Montenat, 1981, largely communicating with the opening during the late Sakmarian with a massive entry of oligotypic *Tastubella karapetovi* (Leven), erroneously interpreted as *Monodiexodina ferganica* by Lys & Lapparent, 1971; Vachard, 1980, Vachard & Montenat, 1981, coming probably from the central Pamir where the species was first described. Complete communication with SE Asia was established during the early Kubergandian with many *Skinnerella*, *Misellina*, *Neofusulinella*, and carbonate algae similar to the Indochina microfaunas (Vachard, up-dated, and unpublished data). Hence, the early Kubergandian (earliest Middle Permian) is the age of the Neotethys opening in southern Afghanistan.

In Oman and Abadeh, the first massive incursions of Indosinian Fusulinina starts in our samples from the late Artinskian; although Sakmarian eastern connexions are possible.

Contrary to some opinions, it is not well established that the Neotethys was developed east of the Transcaucasia, especially in the Taurus (Turkey) and as far as Djebel Tebaga (Tunisia). It is possible that the Transcaucasia constituted an isthmus separating Neotethys and Palaeotethys, or that Neotethys was not oceanic in Iran during the Permian in order to explain the presence of the genus *Shanita* in Zagros, Trancaucasia (Pronina, 1988a) and Alborz.

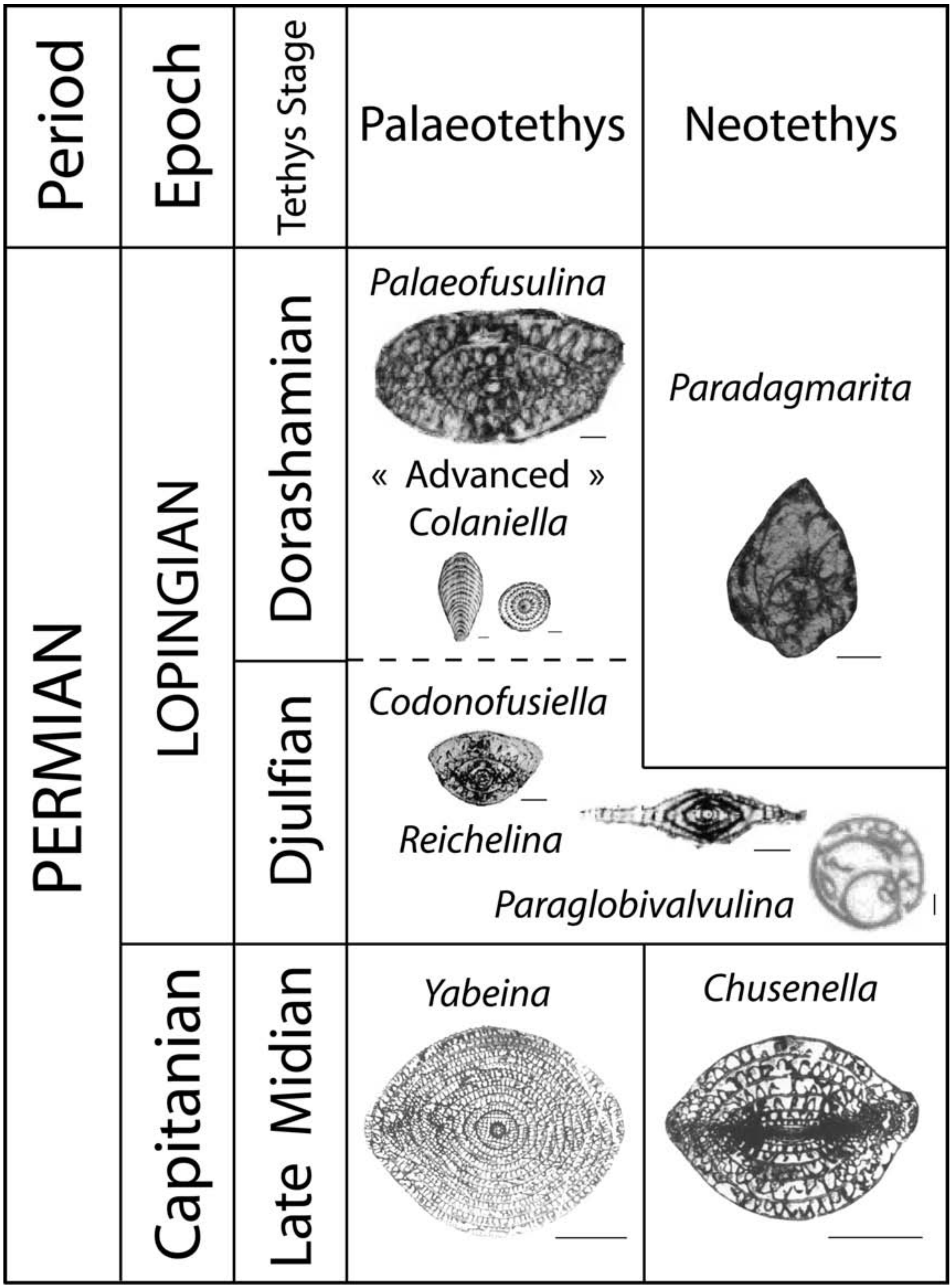
An important arm of the Neotethys starts from Zagros and Interior Oman to Madagascar and the Karoo; this seaway, probably oceanic, separated Africa and India. It is called herein the AMI Ocean (A for Africa, M for Madagascar and I for India). The opening of this ocean should have begun in the Carboniferous (e.g., Angiolini *et al.,* 2003b), but no precise dates are available because of too old geological references in Madagascar.

The outcrops of Haushi-Huqf in Eastern Oman show probably Asselian tillites, and late Sakmarian brachiopods, indicating that marine connections to the East, existed as soon as the earliest Permian. The warming, which is clearly indicated during the entire Middle Permian, is represented by the “Khuff Formation “ in this area (its Wordian date is controversial).

Nevertheless, if we agree with the principal phases of the opening of the Neotethys, we don’t believe that the Neotethys, as well as the Palaeotethys were broad oceans at the Murgabian-Midian boundary, i.e., at the period of maximal dispersion of the genus *Eopolydiexodina*. Reported on a generally admitted reconstruction, *Eopolydiexodina* appear relatively widespread (see the compilations of Vachard & Bouyx, 2002; Ueno, 2003). It is abundant in Tebaga (Glintzboeckel & Rabaté, 1964; Lys, 1988), known in Cyprus, Taurus, Transcaucasia, Zagros, Abadeh (Akopian, 1974, Gaillot, 2006) and rare in Thailand (Baird *et al.*, 1993), which are all Perigondwan and/or Cimmerian terranes. *Eopolydiexodina* is significantly absent in other terranes in these areas: southern Afghanistan (Vachard, 1980; Leven, 1997), Salt Range, Oman. It is entirely absent in the “Cathaysian” blocks: southern China, Indochina, Japan, eastern Thailand, Primorye, New Zealand. Nevertheless it exists in unquestionable northern Palaeotethyan areas: Croatia, Afghan Hindu Kuch, northern Pamir Darvaz and Chinese Kun Lun Mountains. We propose two explanations for these dis-

Figure 16.– Biostratigraphic correlation between Palaeotethys and Neotethys markers during the late Middle and Late Permian (after Altiner *et al.*, 2000, modified). Large fusulinids (*Yabeina* and *Chusenella*) disappear at end of the Midian. Only smaller foraminifers flourished during the Lopingian before their complete extinction around the Permo-Triassic Boundary (PTB). *Paradagmarita* was confined to shallow restricted environments of the southern Neo-Tethys border. *Colaniella* and *Palaeofusulina* were living in the more open-marine setting of the Palaeo-Tethys Ocean. Note that the Dzhulfian markers were present in both areas suggesting ephemerous connections between the two palaeogeographic systems. Scale bars for Lopingian foraminiferal markers are at 200 microns (100 microns for *Paradagmarita*) whereas scale bars for *Yabeina* and *Chusenella* are 2 mm.

Figura 16.– Correlaciones bioestratigraficas entre los marcadores del Palaeotethys y Neotethys durante el Pérmico Medio superior y el Pérmico Superior (según Altiner et al.*, 2000, modificado). Los grandes fusulínidos (*Yabeina *y* Chusenella*) desaparecieron a finales del Midiense, y sólo los pequeños foraminíferos se diversificaron durante el Lopingiense antes de su completa extincion cerca del límite Pérmico-Triasico* (PTB). Paradagmarita *estaba confinada a ambientes someros y restringida al margen sur del Neotethys.* Colaniella *y* Palaeofusulina *vivían en ambiente más abiertos del Oceano palaeotethysiano. Véase que los marcadores del Dzhulfiense estubieron presentes en ambas areas, lo que sugiere conexiones esporádicas entre los dos sistemas. La barra de escala para los foraminiferos del Lopingiense representa 200 micras, 100 micras para* Paradagmarita y *2 mm para* Yabeina *y* Chusenella*.*


Period
Epoch
Tethys Stage
Palaeotethys
Neotethys
PERMIAN
LOPINGIAN
Dorashamian
Palaeofusulina
« Advanced »
Colaniella
Paradagmarita
Djulfian
Codonofusiella
Reichelina
Paraglobivalvulina
Capitanian
Late Midian
Yabeina
Chusenella

tributions: (a) the Neotethys and Palaeotethys were not very broad during this period; (b) a continental bridge linked the two areas of distribution.

Another series of terranes contain numerous *Eopolydiexodina*; they are the olistolites of Crimea. It is probable that during this period the Crimea was close to the Transcaucasia and permited the spreading of the *Eopolydiexodina* pool from North to South or South to North. In fact, the ancestor of *Eopolydiexodina*, i.e., *Bidiexodina*, seems to have migrated from the northern Pamir, itself derived from a *Skinnerina* passed from North America to Eurasia. Due to the suturation of the Urals, and absence in this epoch of terranes permitting the contact between Eurasia and North America, *Eopolydiexodina* is lacking in North America. Nevertheless, another lineage evolving from *Parafusulina* (not directly from *Skinnerina*) gave rise to the vicariantly similar genus *Polydiexodina*, distinguished by a clear central tunnel and present only in North America.

After the paleoprovinces with *Eopolydiexodina* of the Murgabian/Midian boundary, the next interesting province is the *Shanita* Province (Late Midian). Compared to that of *Eopolydiexodina,* this Province is very limited. *Shanita* is absent not only from the "Cathaysian" microcontinent, but also from the northern Paleo-Tethyan border. Consequently, either the Palaeo-tethys was broader, or the Crimea has migrated and the connexion has disappeared (due to the absence of *Shanita* in Crimea, the second solution seems to be preferred). Finally, *Shanita* is known in the Taurus, Zagros, Alborz, Transcaucasia, Oman, Rushan-Pshart (central Pamir), Baoshan, Shan States in Myanmar (= Burma) and western Thailand. The palaeoecology of *Shanita* is probably strongly facies-controlled.

Although the direct connexion between Djebel Tebaga and the Taurus remained effective, and although the Tebaga outcrops were intensively studied (e.g., from the work of Glintzboeckel & Rabaté, 1964; and H. Termier *et al.,* 1977), no *Shanita* were mentioned in the series. Similarly, *Shanita* is absent in southern Afghanistan. Consequently, we propose that the central Pamir, the Baoshan-Shan States and western Thailand were located closer to Iran than today. They could have been separated by the Band-e Bayan area in Afghanistan, which has affinities with the Alborz from Frasnian to Middle Viséan times (Vachard, 1980, 1996), but neither Tibet nor Qiangtang were probably located between Iran and Sibumasu.

The absence of a similar Lopingian microfauna indicate the rupture of the connection after the Midian-Wuchiapingian boundary, and correlatively, a movement eastward or northward of the Sibumasu due to the impossibility of progress to the south (presence of India) nor the west (presence of Iran).

At the same time (i.e. Midian-Wuchiapingian boundary), it is important to notice that southern China, Indochina, Japan, Primorye, eastern Thailand and New Zealand were sharing the same fusulinid assemblage with *Lepidolina*. As these *Lepidolina* are also known in the exotic terranes of the U.S. Rocky Mountains, we can suppose that the principal terranes (southern China, Indochina and Primorye) occupied a location relatively similar to their modern location, i.e. circum Pacific or circum Panthalassa. Nevertheless, the recent publication of Nestell & Nestell (2006) prooves that some smaller foraminifers (e.g., *Charliella*, although denominated as *Crescentia*) and small Fusulinina (e.g., *Lantschichites* = *Paraboultonia*) exists in southern Asia and the North American craton, indicating carbonate platforms communicating almost continuously through the 17,000 km of the Permian Palaeopacifica!

Figura 17.– Primeros (FO)/últimos (LO) registros de taxones en Kuh-e Surmeh (Irán) y principales marcadores bioestratigraficos (foraminíferos y algas). Este método permite una zonación de unidades cronoestratigraficas (I a VIII) en el Dalan superior, así como presentar los principales FOs (izquierda), LOs (derecha) y eventos. Nótese la diferencia fundamental entre las unidades del Midiense Superior /Wuchiapingiense (I a IV) en las cuales la apariciones dominan, especialmente en la parte media, y las unidades del Changhsingiense (V a VIII) donde las desapariciones se vuelven más significatiovas. Cuatros acontecimientos sucesivos (LOs) carcterizan la unidad del Changhsingiense terminal (Unidad VIII). PFE = Extinción de la Fauna Pérmica. Thickness (m) = Espesores en metros.

ISSN: 1132-1660

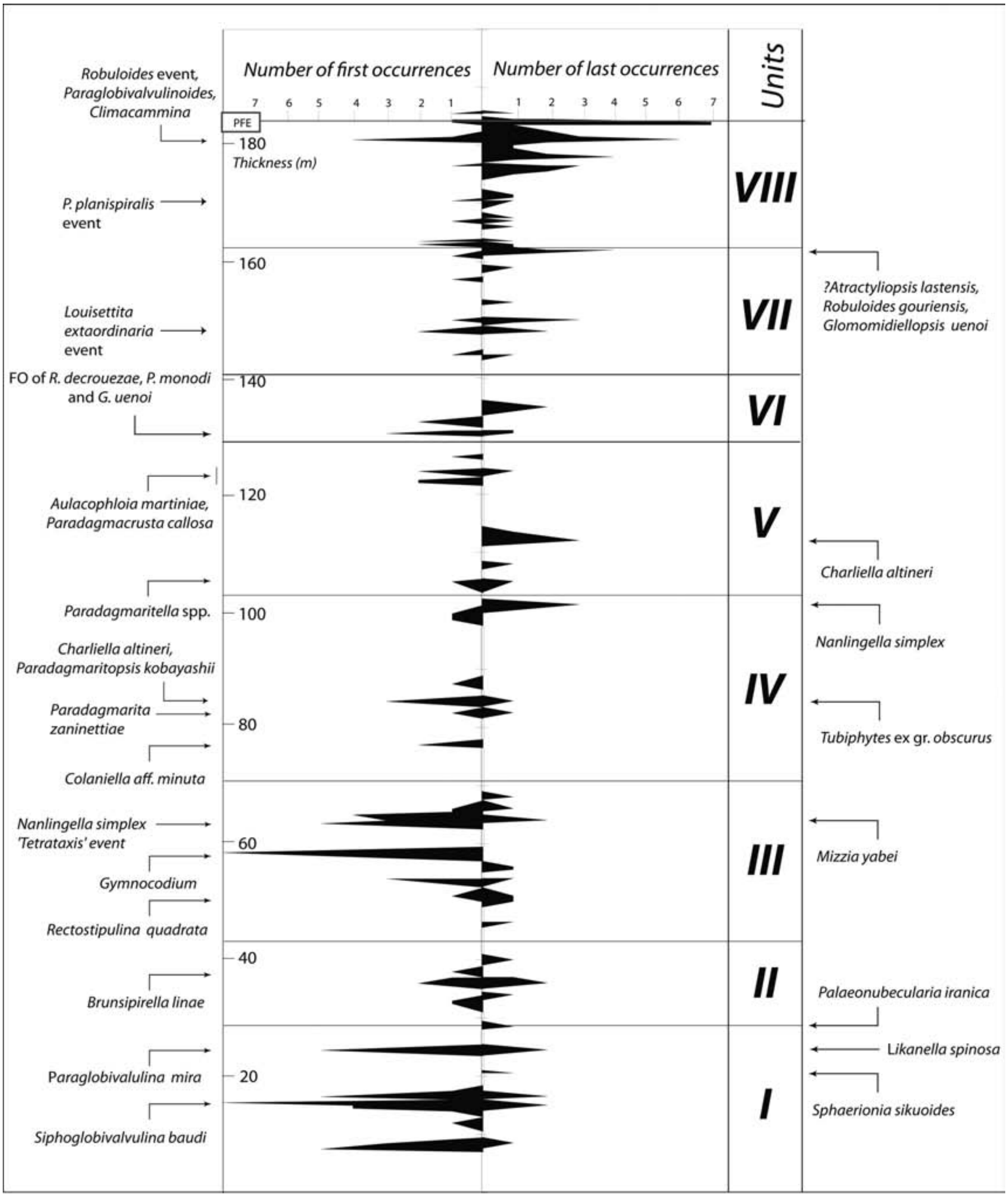


Figure 17.– First occurrences (FO)/Last occurrences (LO) patterns at Kuh-e Surmeh (Iran) and main biostratigraphic markers (foraminifers and algae). The Upper Dalan large-scale chronostratigraphic units defined in the text are reported as well as the main FOs (left), LOs (right) and events. Note the overall turnover betwen the Late Midian/Wuchiapingian units (I to IV) where appearances dominate especially in the middle part of the units and the Changhsingian units (IV to VIII) where disappearances get the upper hand. Also note that four successive events (LOs) characterise the latest Changhsingian unit (Unit VIII). PFE = Permian Fauna extinction.

The biotic similarities between southern China and Iran during Changhsingian times have been often suggested by many authors. Definitively, we admit here that these similarities are true, because southern China and Indochina have probably moved westward, and finally were very close to Iran from one side, and NW Caucasus from other side. Affinities between southern China, NW Caucasus and Greece have been listed by Théry *et al.* (2007). We have listed (Gaillot *et al*., submitted) the similarities between late Changhsingian forms. The location of southern China noted here permits also the simplification of the distribution maps of *Colaniella* and *Palaeofusulina*.

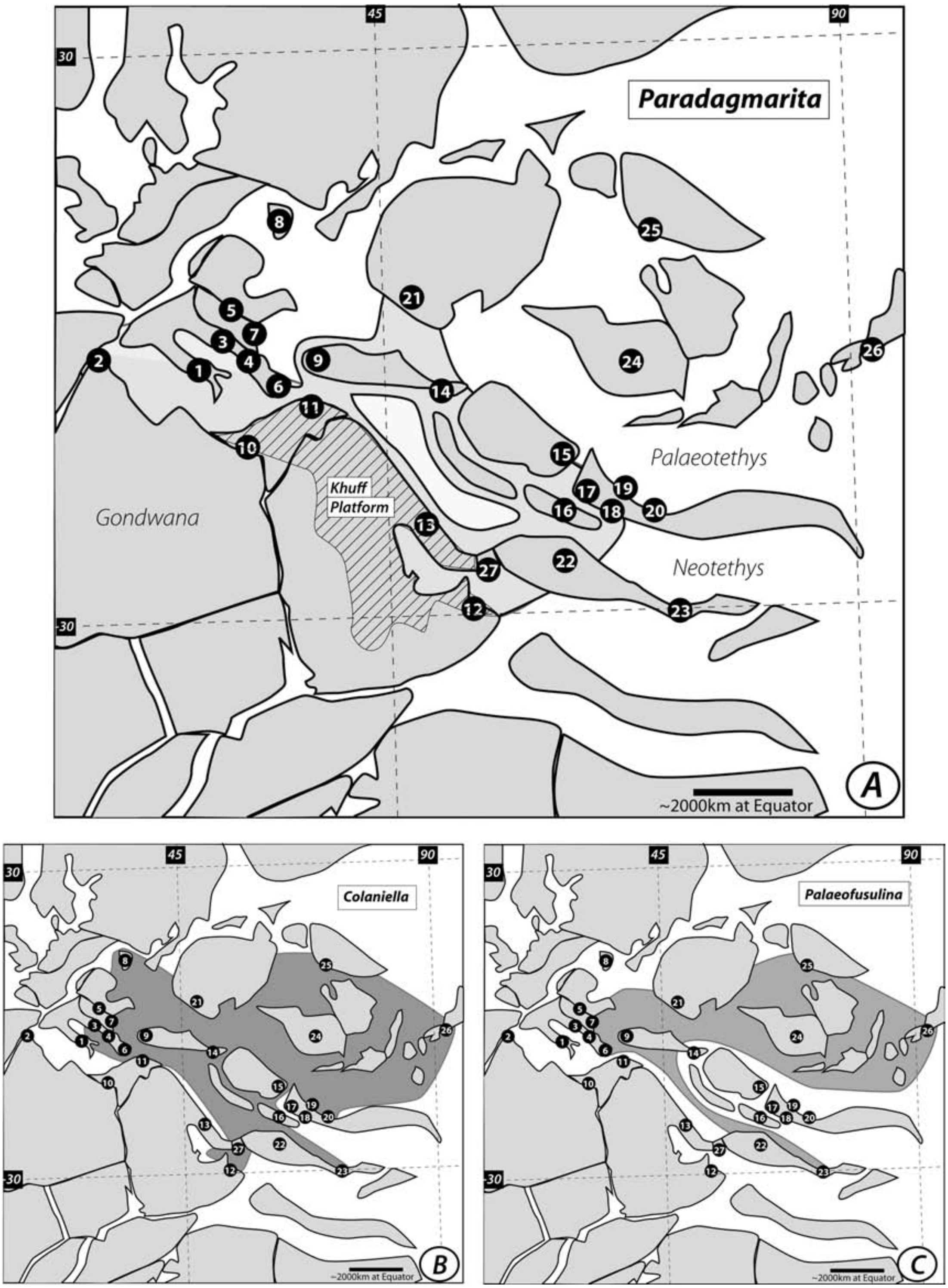
Most puzzling is that the assemblages of middle-late Wuchiapingian of the Zagros are extremely similar to the Japanese assemblage described by Kobayashi (2004), especially the presence of *Paradagmaritopsis kobayashii, Partisania sygmoidalis* and *Floritheca variata*.

Paradagmaritopsis is present in the late Changhsingian of southern China in our material, but the other forms were not found. Another similarity is constituted by the microbial level coevally developed at the base of the Triassic in Taurus, Zagros, Abadeh and in southern China (e.g., Gaillot, 2006). The Late Permian reefal bioconstructions are only known in Greek Islands, NW Caucasus and southern China (Théry *et al.,* 2007). Due to the presence of very particular late Changhsingian reefs and some foraminifers like *Parareichelina* (and its junior synonym *Baudiella*), the correlations of the NW Caucasus assemblages extend further towards the east in a large part of the Palaeotethys, up to southern China (Meishan section) and to the south up to Greece (Salamis Island). Late Changhsingian reefs are lacking in Transcaucasia and the foraminiferal microfaunas of the NW Caucasus and Transcaucasia differ significantly. Those of Transcaucasia have more relations with the assemblages from the Alborz and Abadeh areas (Iran), and suggest the discontinuity of the carbonate platform southwards, and consequently the independence of the blocks. The identity of the Permian biological assemblages can be extended from the Crimea to Alborz. This unit is the Permian Extragondwan Domain characterized by the homogeneity of populations and absence of Hercynian orogenesis. The series of the Bükk Mountains (Hungary) is probably only Changhsingian in age, and no evidence of Midian age can be provided. The Bükk Mountains appear as a transitional territory between the NW Caucasus and Transcaucasia, because they possess Changhsingian reefs, but their foraminifers likely belong to Perigondwan assemblages. In the studied areas, microspherules are often discovered at the PTB, and can provide arguments to the meteorite hypothesis. In our Nikitin samples, collected by J.M. Théry, agglomerates of microspherules consisting of Ni or Cr spinels were found at the top of the Urushtenian limestones. They can be due to the fusion at the surface of a giant meteorite such as the one known from Araguainha in Brazil, at Koursk in Russia or Bedout in Australia, and in this case the PTB is nearly instantaneous. Another common character is the location of carbonate bioaccumulations. The gymnocodiacean *Permocalculus* accumulations are common

→

Figure 18.– Palaeogeographic reconstruction and main palaeobiogeographic provinces during the Late Permian (± 255 Ma) (cartographic background according to Nestell & Pronina, 1997, and modified). A: *Paradagmarita* Subprovince. B: *Colaniella* Province. C: *Palaeofusulina* Province. 1= Italy; 2= Tunisia; 3= Ex-Yougoslavia; 4= Albania; 5= Hungary; 6= Greece; 7= Cyprus; 8= Crimea; 9= Transaucasia; 10= Anatolia; 11= Taurus; 12= Oman-Saudi Arabia; 13= Zagros; 14= Alborz; 15= Afghanistan; 16= Salt Range; 17= SE Pamir; 18= Himalaya; 19= Kashmir; 20= Tibet; 21= South-China; 22= Thailand-Burma; 23= Malaysia; 24= Indosina; 25= Primorye-Koryak; 26= Japan; 27= "Kobayashi block".

Figura 18.– Reconstrucción palaeogeográfica y principales provincias palaeobiogeograficas durante el Pérmico Superior (± 255 Ma). Las tierras emergidas están modificadas de Nestell & Pronina, 1997). A : Subprovincia con Paradagmarita*. B: Provincia con* Colaniella. *C : Provincia con* Palaeofusulina. *1= Italia; 2= Túnez; 3= Ex-Yugoslavia; 4= Albania; 5= Hungría; 6= Grecia; 7= Chipre; 8= Crimea; 9= Transcaúcaso; 10= Anatolia; 11= Tauro; 12= Omán-Arabia Saudita; 13= Zagros; 14= Alborz; 15= Afganistán; 16= Salt Range; 17= SE Pamir; 18= Himalaya; 19= Cachemira; 20= Tíbet; 21= China del Sur; 22= Tailandia-Birmania; 23= Malaysia; 24= Indosina; 25= Primorye-Koryak; 26= Japón; 27= "Bloque de Kobayashi".*


45
90
30
-30
Paradagmarita
Khuff
Platform
Gondwana
Palaeotethys
Neotethys
~2000km at Equator
A
Colaniella
B
Palaeofusulina
C

everywhere from the NW Caucasus to Hungary, and correspond to prolific carbonate production, relatively puzzling during a period of special crisis for limestone deposits. Comparison between the very littoral *Permocalculus* bioaccumulations of the Late Permian and the microbialites of the Early Triassic, allows the proposal of the hypothesis that during this very critical period only the innermost platforms remained favourable tocarbonate production. Consequently, the PTB should be only conventional along a sedimentological and geochemical continuum affecting the carbonate production and/or carbonate biomineralization. Palaeogeographical reconstruction indicates four groups of terranes in the studied area, from north to south: Peri-Hercynian Domain, Group Bükk-Greece, Extragondwanan Domain, and Perigondwanan Domain. The individuality of these areas is complete up to the PTB, and no element permits one to discriminate clearly between a Palaeotethys and a Neotethys in this area.

The NW Caucasus, which belongs to the Peri-Hercynian Domain (Vachard, 1980) is closely related with southern China in the late Changhsingian, but its algal and foraminiferal populations differ sensibly from those of Transcaucasia. These ones are correlable with southern Crimea and Alborz Mountains. Therefore, the whole unit, Transcaucasia-Crimea-Alborz, belongs to the Extragondwanian Domain (Vachard, 1980; equivalent to the Cimmerian blocks of the authors). The Bükk Mountains and Greece are poorly constrained but seem to belong to one or two independent microplates. The Perigondwanian Domain is considered here as interpreted by Vachard *et al.* (2005). It extends to Djebel Tebaga in Tunisia. The eastern border of the Palaeotethys/Neotethys suturation is made up of Italy and ex-Yugoslavia. Within the Peri-Hercynian Domain exist two confined seas: the Zechstein Sea and the Bellerophon Sea.

The proposed paleogeography is consistent with the distribution of the Permian markers firstly emphasized by Sengör *et al.* (1988), namely *Eopolydiexodina*, *Shanita*, *Palaeofusulina* and *Colaniella*.

Palaeobiogeographic affinities of southern China

The palaeogeographic distribution of the biseriamminoids is interpreted to be typically Neotethyan, ranging from southern Turkey (Hazro) to southern China, and even reaching Japan for some species (i.e. *Paradagmaritopsis*).

The paper of Kobayashi (2004) is very important because it indicates the presence of *Paradagmaritopsis* in Japan (under the name *Paradagmarita* sp.), and illustrates two other biogeographical markers (under the names *Globivalvulina* sp. and *Partisania* sp.). Consequently, many taxa that are supposed to be limited to the western Neotethys, may in fact have migrated toward Panthalassa (i.e., Japan).

Those taxa are apparently absent in relatively well known areas such as Oman, Afghanistan or Pakistan, as well as southern China or Thailand. The traditional solutions which could explain the lack of these taxa in the above mentioned areas are: (a) gaps in the geological record; (b) unfavourable facies: lithologies, dissolution, taphonomy; (c) absence of a MFS or precise parasequence, (d) unfavourable environments and/or substrates, (e) the favourable areas were destroyed and digested during obduction and or subduction phenomena, (f) lack of more precise data from boreholes. Nevertheless, some biomarkers can appear, for example: *Shanita* (e.g., Sengör *et al.,* 1988; Ueno, 2003), *Palaeofusulina* and *Colaniella* (e.g., Kobayashi, 1999), and *Paradagmarita* (Sengör *et al.,* 1988; Gaillot & Vachard, 2004). They indicate that the BaoShan Block (Yunnan) and Lhassa Block (Xizang) are related to the Perigondwan border and/or a plate more or less directly related to Gondwana. The northern Chinese Tarim Basin and Kun-Lun Mountains are related to the Perihercynian Block due to the Viséan foraminifers and calcareous algae palaeobiogeography, and the presence of *Eopolydiexodina* (e.g., Vachard & Bouyx, 2002). Intermediary plates of southern China and Indosinia are in the Extragondwanan (or Cimmerian: Sengör, 1979, or Extrahercynian new name) location. Well constrained in latitude, these two plates are not constrained in longitude and might be located in a more western location as generally reconstructed location and consequently almost in connection with Iran (see also the palaeomagnetic data of Besse *et al.,* 1998). That explains also the many similarities between Vietnam and Greece, both studied in the beginning of the nineteenth century by Deprat i.e., with new names: *Sphaeroschwagerina*, *Zellia*, *Neoschwagerina*, *Verbeekina*) (see also Théry *et al.*, 2007). If the blocks of northern China and Mongolia are similarly displaced to the west, we can obtain a Pangaea scheme (Fig. 18), valid for the Carboniferous and Permian distribution of foraminifers and calcareous algae.

ACKNOWLEDGMENTS

Galina and Merlynd Nestell, as well as Rossana Martini critically reviewed the manuscript. We thanks also Pedro Cózar, Thèrèse Vachard and Lucie Pille for technical help. We are grateful to TOTAL Company for authorizing the publication.

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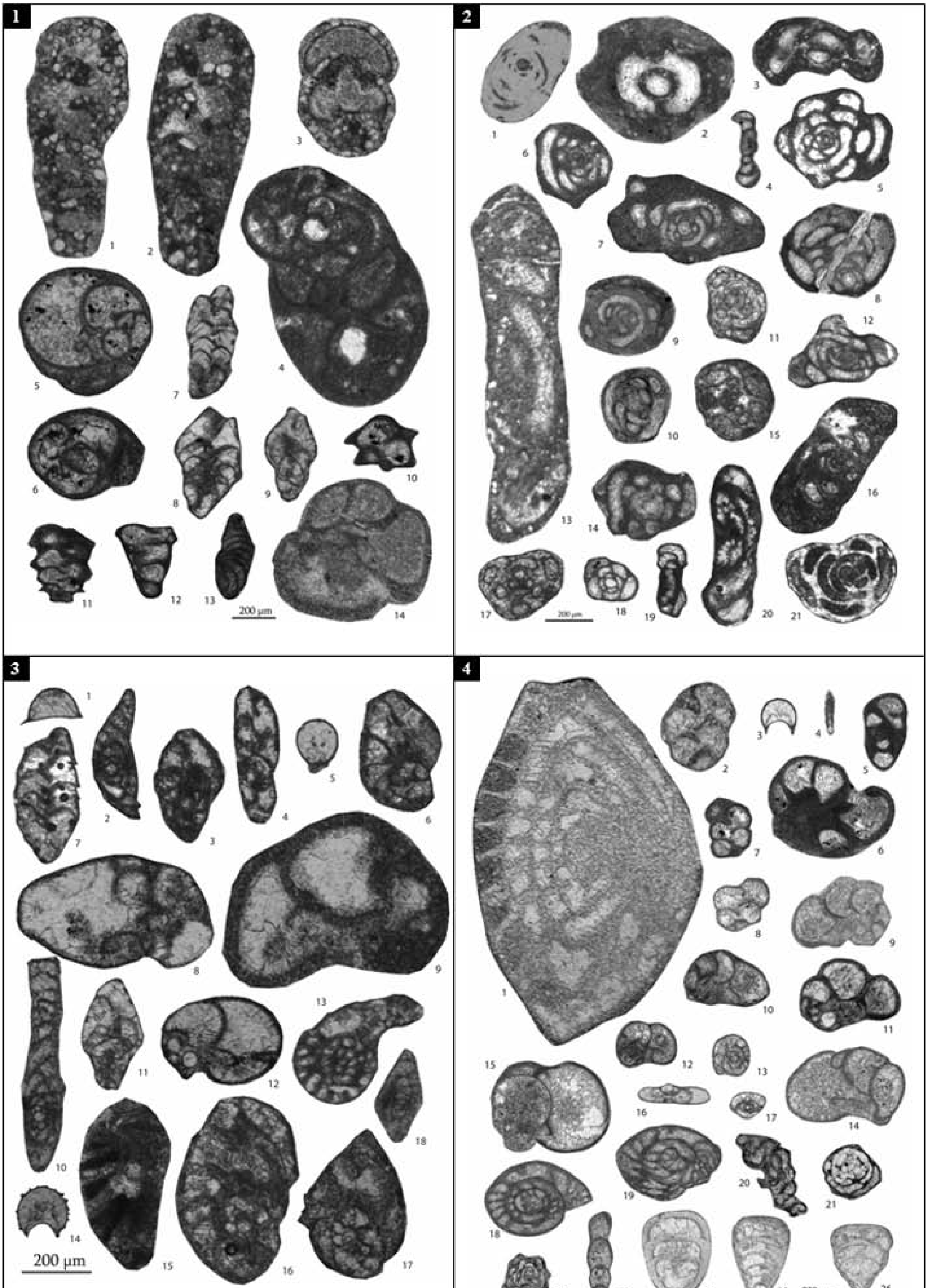
Note that all the specimens of each plate have the same magnification ; directly indicated on the plate by a scale bar which measures generally 0.200 mm. The locations of the studied areas (Zones 1 to 4) are shown on Fig. 2A. Well numbers and depths are confidential and cannot be indicated here.

PLATE 1. Changhsingian Textulariata and Fusulinata of Zagros (Zone 2).
Figs. 1-3.– Ataxophragmiidae gen indet. 1-2. Two axial sections. Note the coarse quartz agglutinate in the wall. 3. Oblique section.
Fig. 4.– *Paraglobivalvulina mira* Reitlinger, 1965. Transverse section.
Fig. 5.– *Septoglobivalvulina distensa* (Wang *in* Zhao *et al*., 1981). Transverse section.
Fig. 6.– *Retroseptellina decrouezae* (Koylüoglu & Altiner, 1989). Transverse section.
Figs. 7-9.– *Paradagmarita monodi* Lys *in* Lys & Marcoux, 1978. Three sagittal axial more or less oblique sections.
Figs. 10, 11.– *Dagmarita altilis* Wang *in* Zhao *et al.,* 1981. Two sagittal axial oblique sections.
Fig. 12.– *Louisettita ultima* sp. nov. Paratype. Subaxial sagittal to frontal section showing the supplementary small lateral arches.
Fig. 13.– *Reichelina simplex* Sheng, 1956. Subtransverse section.
Fig. 14.– *Labioglobivalvulina fortis* sp. nov. Paratype. Subaxial sagittal section.

PLATE 2. Changhsingian Fusulinata, Textulariata and Miliolata of Kuh-e Surmeh section (Zone 1).
Fig. 1.– *Glomomidiellopsis* sp. Strongly microsparitized axial section. Sample KeS-4.
Figs. 2, 3, 13.– Undeterminate Textulariata genus. 2. Subaxial section. Sample KeS-9.
Fig. 3.– Subtransverse section. Sample KeS-9. 13. Subaxial section. Sample KeS-48.
Fig. 4.– *Hoyenella* ex gr. *hemigordiformis* (Cherdyntsev, 1914). Axial section. Sample KeS-14.
Figs. 5, 6, 7, 8.– *Hemigordiellina regularis* (Lipina, 1949). Four indefinite sections. 5. Sample KeS-20. 6. Sample KeS-22. 7?. Sample KeS-22. 8. Sample KeS-23.
Figs. 9, 10.– *Neodiscus* sp. Two subaxial sections. Sample KeS-23.
Figs. 11, 15-17, 21.– *Midiella* sp. Five indefinite sections. 11. Sample KeS-44. 15. Sample KeS-61. 16. Sample KeS-67. 17. Sample KeS-67. 21. Sample KeS-88.
Fig. 12.– *Hemigordiellina* sp. Subaxial section. Sample KeS-48
Fig. 14.– *Hemigordiellina* cf. *regularis* (Lipina, 1949). Sample KeS-61.
Fig. 18.– *Agathammina pusilla* (Geinitz, 1848). Transverse section. Sample KeS-73.
Fig. 19.– *Hemigordius irregulariformis* Zaninetti, Altiner & Catal, 1981. Axial section. Sample KeS-73.
Fig. 20.– *Crassispirella* sp. Subtransverse oblique section. Sample KeS-84.

PLATE 3. Changhsingian Fusulinata of Kuh-e Surmeh section (Zone 1).
Figs. 1, 5.– *Eotuberitina reitlingerae* Miklukho-Maklay, 1958. Two axial sections. 1. Sample Kes-225. 5. Sample Kes-229.
Figs. 2, 18.– *Reichelina simplex* Sheng, 1956. 2. Axial section. Sample Kes-225. 18. Axial section. Sample KeS- 257.
Figs. 3, 6, 7, 11.– *Paradagmarita monodi* Lys *in* Lys & Marcoux, 1978. 3. Transverse section.
Kes-226. 6. Subtransverse section. Sample Kes-230. 7. Axial sagittal section. Sample Kes-230. 11. Subaxial sagittal section. Sample Kes-239.
Fig. 4.– *Paradagmarita* cf. *planispiralis* sp. nov. Paratype. Oblique subxial section. Sample Kes-226.
Fig. 8.– *Globivalvulina parascaphoidea* sp. nov. Paratype. Transverse section showing the valvula in hook and the trapezoidal shape of the last chamber. Sample Kes-234.
Fig. 9.– *Labioglobivalvulina fortis* gen. nov. sp. nov. Paratype. Subtranverse section. Sample Kes-236.
Fig. 10.– *Reichelina changhsingensis* Sheng & Chang, 1958. Axial section showing the characteristic important rectilinear last part (compare with *R. simplex* of fig. 2). Sample Kes-237.
Fig. 12.– *Septoglobivalvulina distensa* (Wang *in* Zhao *et al*., 1981). Transverse section. Sample Kes-239.
Fig. 13.– ? *Dunbarula nana* Kochansky-Devidé & Ramovs, 1955. Transverse section. Sample Kes-239
Fig. 14.– *Eotuberitina spinosa* (Lys *in* Lys *et al*., 1980). Axial section (to compare with Fig. 1). Sample Kes-241.
Figs. 15-17.– *Paradagmacrusta callosa* gen. nov. sp. nov. 15. Paratype. Oblique section. Sample Kes-250. 16. Paratype. Transverse section. Sample Kes-253. 17. Paratype. Transverse section. Sample Kes-253

PLATE 4. Wuchiapingian Fusulinata, Miliolata and Nodosariata of Kuh-e Gahkum (Zone 1).
Fig. 1.– *Nankinella* ex gr. *hunanensis* Chen, 1956. Subaxial oblique section, relatively poorly microsparitized and abraded. Sample LD2.
Figs. 2, 7, 8, 9, 11.– *Labioglobivalvulina baudi* gen. nov. sp. nov. 2. Holotype. Axial section showing the characteristic communication between chambers in the last per. Sample LD2. 7?. Subaxial sagittal section. Sample LD1. 8. Paratype. Subaxial sagittal section. Sample LD1. 9. Paratype. Equatorial transverse section. Sample LD2. 11. Paratype. Subaxial sagittal section. Sample LD1.
Fig. 3.– *Eotuberitina reitlingerae* Miklukho-Maklay, 1958. Axial section Sample LD1
Fig. 4.– *Earlandia* ex gr. *elegans* (Rauzer-Chernousova & Reitlinger, 1937). Axial section with proloculus. Sample LD1.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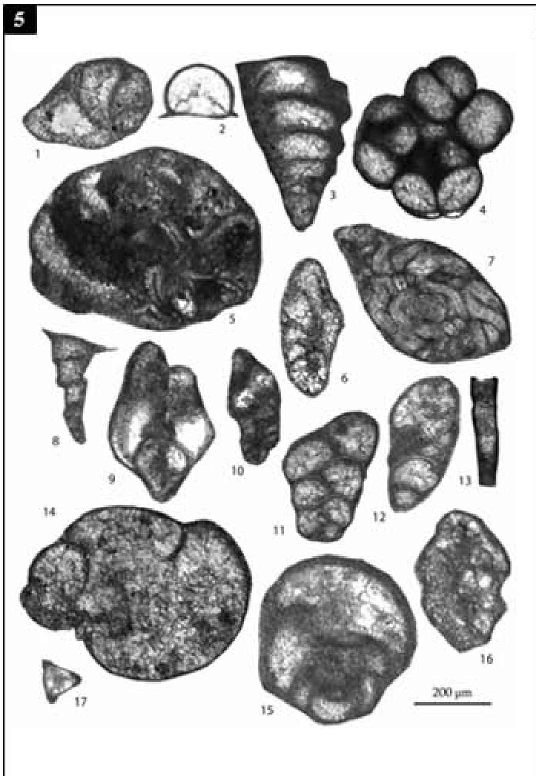
Figs. 5, 6.– ? *Neoendothyra reicheli* REITLINGER, 1965. 5. Subaxial section. Sample LD1.6. Subtransverse section. Sample LD1.
Fig. 10.– *Globivalvulina* cf. *parascaphoidea* sp. nov. Paratype. Subtransverse section of a possible immature specimen. Sample LD1.
Fig. 12.– *Globivalvulina bulloides* (BRADY, 1876). Subtransverse section, to compare with figs. 9, 10 and 14. Sample LD2.
Figs. 13, 17.– ? *Codonofusiella* aff. *kueichowensis* SHENG, 1963. 13. Axial section of a possible immature specimen. Sample LD1. 17. Axial section. Sample LD2.
Fig. 14.– *Globivalvulina neglecta* sp. nov. Paratype. Subtransverse section. Sample LD3.
Fig. 15.– *Septoglobivalvulina* cf. *distensa* (WANG *in* ZHAO *et al*., 1981). Subtransverse section. Sample LD1.
Fig. 16.– *Retroseptellina* ex gr. *globosa* (WANG *in* ZHAO *et al*, 1981). Subaxial section. Sample LD1.
Figs. 18, 19.– *Dunbarula nana* KOCHANSKY-DEVIDÉ & RAMOVS, 1955. Subtransverse section. Sample LD2. 19. Subaxial section. Sample LD2.
Fig. 20.– *Palaeonubecularia* ex gr. *fluxa* REITLINGER, 1950. Indefinite section. Sample LD1.
Figs. 21, 22.– *Hemigordiellina regularis* (LIPINA, 1949). 21. Indefinite section. Sample LD1. 22. Indefinite section. Sample LD2.
Fig. 23.– *Frondina permica* SELLIER DE CIVRIEUX & DESSAUVAGIE, 1965. Frontal axial section. Sample LD2.
Fig. 24.– ? *Pseudolangella* sp. Oblique section. Sample LD2.
Figs. 25, 26.– ? *Pachyphloides* cf. *inflatus* (MIKLUKHO-MAKLAY, 1954). 25. Sagittal axial section. Sample LD2. 26. Sagittal axial section. Sample LD2.

PLATE 5. Wuchiapingian Fusulinata (Zone 2).
Figs. 1, 5.– *Charliella altineri* sp. nov. Two paratypes. Two subtransverse sections.
Fig. 2.– *Eotuberitina reitlingerae* MIKLUKHO-MAKLAY, 1958. Axial section.
Figs. 3, 8, 17.– *Dagmarita altilis* WANG *in* ZHAO *et al*., 1981. 3. Subaxial sagittal section. 8. Axial frontal section. 17. Tranverse section.
Fig. 4.– *Floritheca variata* gen. nov. sp. nov. Holotype. Indefinite section.
Figs. 6, 9-10.– *Paradagmarita simplex* sp. nov. 6. Paratype. Transverse section. 9. Paratype. Axial section. 10. Paratype. Subtransverse section.
Fig. 7.– *Nanlingella minima* (SHENG & CHANG, 1958). Axial section.
Figs. 11, 12.– *Paradagmaritopsis kobayashii* GAILLOT, VACHARD, GALFETTI & MARTINI (submitted-a). 11. Axial sagittal section. 12 . Axial frontal section.
Fig. 13.– *Earlandia* ex gr. *elegans* (RAUZER-CHERNOUSOVA & FURSENKO, 1937). Subaxial section.
Fig. 14.– ? *Septoglobivalvulina distensa* (WANG *in* ZHAO *et al*., 1981). Transverse section.
Fig. 15.– *Globivalvulina graeca* REICHEL, 1946. Axial sagittal section.
Fig. 16.– *Paradagmarita* cf. *monodi* LYS *in* LYS & MARCOUX, 1978. Subtransverse section.

PLATE 6. Late Changhsingian Fusulinata (Zone 4).
Figs. 1-3, 5, 6.– *Paremiratella robusta* gen. nov. sp. nov. 1. Paratype. Subtransverse section looking like the Tournaisian genus *Biseriammina*. 2. Paratype. Subtransverse section. 3. Paratype. Axial sagittal section. 5. Holotype. Axial sagittal section showing the internal globivalvuline. 6. Paratype. Subaxial section.
Figs. 4, 10, 12.– *Paradagmarita planispiralis* sp. nov. 4. Paratype. Equatorial transverse section. 10. Paratype. Equatorial transverse section. 12. Paratype. Equatorial transverse section.
Fig. 7.– *Eostaffella*? sp. Subtransverse section.
Fig. 8.– *Earlandia* ex gr. *elegans* (RAUZER-CHERNOUSOVA & FURSENKO, 1937). Three different sections; oblique, transverse and axial, from left to right.
Fig. 9.– *Paradagmarita* cf. *monodi* LYS *in* LYS & MARCOUX, 1978. Equatorial transverse section.
Fig. 11.– *Paradagmarita monodi* LYS *in* LYS & MARCOUX, 1978. Subaxial section.
Fig. 13.– *Eotuberitina reitlingerae* MIKLUKHO-MAKLAY, 1958. Axial section, attached on an oolite.

PLATE 7. Changhsingian Fusulinata of Kuh-e Surmeh section (Zone 1).
Fig. 1.– *Reichelina simplex* SHENG, 1956. Axial section. Sample KeS-86.
Figs. 2, 13.– *Retroseptellina globosa* (WANG *in* ZHAO *et al.,* 1981). Subtransverse setion. Sample KeS-86. 13. Axial sagittal section. Sample KeS-88.
Fig. 3.– *Tetrataxis lata* SPANDEL, 1901. Subaxial section. Sample KeS-86.
Fig. 4.– *Eotuberitina spinosa* (LYS *in* LYS *et al*., 1980). Axial section of a diplospherine stage. Sample KeS-86
Fig. 5.– *Septoglobivalvulina distensa* (WANG *in* ZHAO *et al.,* 1981). Subtransverse section. Sample KeS-86.
Figs. 6, 15.– *Nankinella* ex gr. *hunanensis* (CHEN, 1956). Axial section. Sample KeS-87. 15. Subtransverse section. Sample KeS-88.
Figs. 7, 8.– *Labiodagmarita vasleti* gen. nov. sp. nov. 7. Paratype. Subaxial sagittal section. Sample KeS-87. 8. Paratype. Axial sagittal section. Sample KeS-87.
Fig. 9.– *Nanlingella simplex* (SHENG & CHANG, 1958). Transverse section. Sample KeS-88.
Figs. 10-12.– *Dagmarita chanackchiensis* REITLINGER, 1965. 10. Axial sagittal section. Sample KeS-88. 11. Axial frontal section.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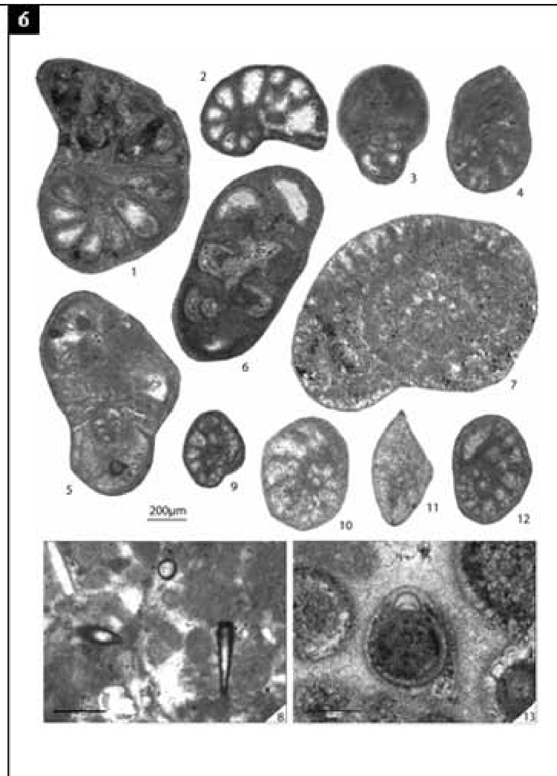
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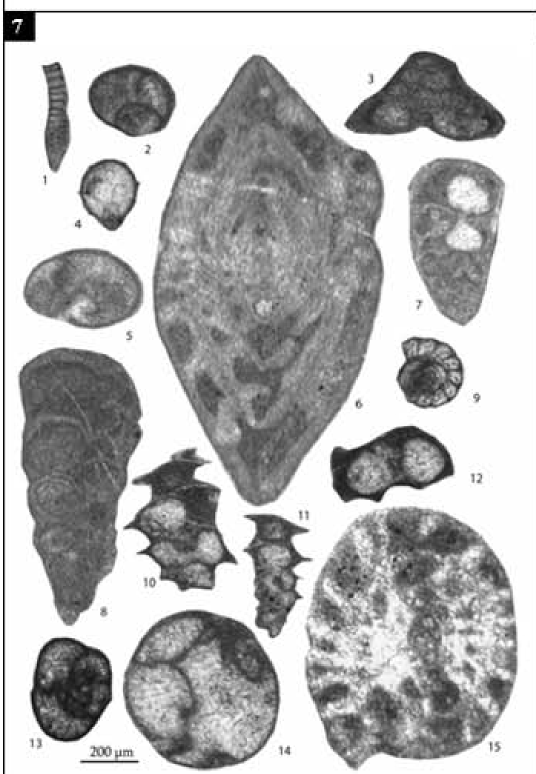
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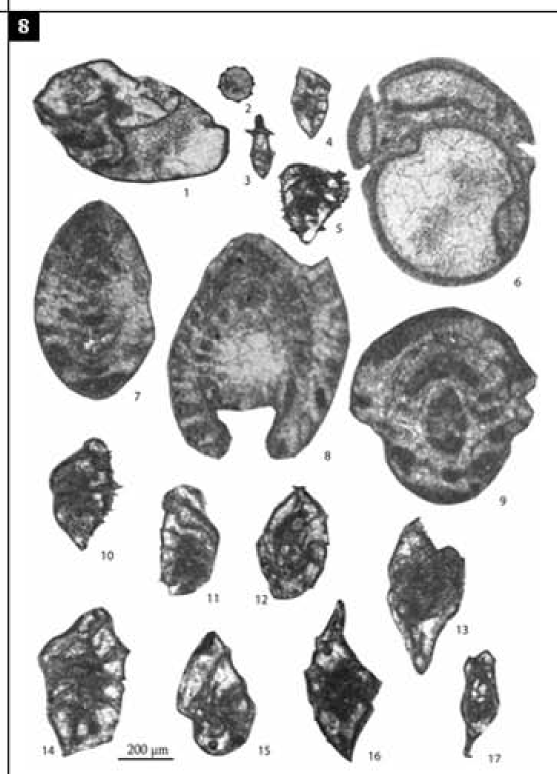
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Sample KeS-88. 12. Oblique transverse section. Sample KeS-88.
Fig. 14.– *Septoglobivalvulina* cf. *guangxiensis* LIN, 1978. Subtranverse section. Sample KeS-88.

PLATE 8. Wuchiapingian Fusulinata of Kuh-e Surmeh (Zone 1).
Fig. 1.– *Globivalvulina parascaphoidea* sp. nov. Paratype. Subtransverse section. Sample KeS-166.
Fig. 2.– *Eotuberitina spinosa* (LYS *in* LYS *et al*., 1980). Transverse section. Sample KeS-176.
Fig. 3.– *Louisettita elegantissima* ALTINER & BRÖNNIMAN, 1980. Axial frontal section. Sample KeS-167.
Figs. 4, 5, 10-17. *Paradagmarita zaninettiae* sp. nov. 4. Paratype. Subtransverse section. Sample KeS-168. 5. Paratype. Subtransverse section. Sample KeS-168. 10. Paratype. Subtransverse section. Sample KeS-169. 11. Paratype. Subtransverse section. Sample KeS-178. Paratype. Subtransverse section. Sample KeS-178. 13. Paratype. Subaxial section. Sample KeS-178. 14. Holotype. Subtransverse section. Sample KeS-178. 15. Paratype. Transverse section. Sample KeS-178.16. Paratype. Subaxial section. Sample KeS-178.17. Paratype. Oblique section. Sample KeS-178
Fig. 6.– *Paraglobivalvulina mira* REITLINGER, 1965. Subaxial section. Sample KeS-168.
Figs. 7, 8.– *Nankinella* ex gr. *hunanensis* (CHEN, 1956). Subaxial section. 8. Subtransverse section. Sample KeS-186.
Fig. 9.– *Staffella yaziensis* WANG & SUN, 1973. Subaxial section. Sample KeS-186.

PLATE 9. Late Changhsingian Fusulinata of Zagros, southern Iran (Zone 2).
Fig. 1.– *Nankinella minor* SHENG, 1955. Oblique section.
Figs. 2, 3, 6, 9, 10.– *Labioglobivalvulina fortis* sp. nov. 2. Paratype. Subaxial section. 3. Paratype. Subtransverse section. 6. Paratype. Equatorial transverse section.9. Paratype. Subaxial sagittal section. 10. Paratype. Transverse section
Fig. 4.– *Climacammina grandis* REITLINGER, 1950. Subaxial section.
Fig. 5.– *Urushtenella* sp. Oblique section.
Fig. 7.– *Eotuberitina spinosa* (LYS *in* LYS *et al*., 1980). Axial section.
Fig. 8.– ? *Louisettita ultima* sp. nov. Axial sagittal section.
Fig. 11.– *Nanlingella minima* (SHENG & CHANG, 1958). Transverse section.
Fig. 12.– *Retroseptellina globosa* (WANG *in* ZHAO *et al*., 1981). Subtransverse section.
Figs. 13, 14.– *Paradagmarita planispiralis* sp. nov. 13. Paratype. Equatorial transverse section. 14. Paratype. Subtransverse section.

PLATE 10. Changhsingian Fusulinata and Nodosariata of Laren (Guangxi, South China; Fig. 2D).
Fig. 1.– *Paraglobivalvulinoides septulifer* ZANINETTI & ALTINER, 1981. Axial section. Sample L6.
Fig. 2.– *Climacammina tenuis* LIN, 1978. Axial section. Sample L6.
Figs. 3-5.– *Postendothyra micula* (SOSNINA, 1977). 3. Axial section. Sample L3. 4. Subaxial section. Sample L6. 5. Transverse section. Sample L6.
Fig. 6.– *Reichelina simplex* SHENG, 1956. Subaxial section. Sample L3.
Fig. 7.– *Eotuberitina spinosa* (LYS *in* LYS *et al*., 1980). Transverse section. Sample L10.
Fig. 8.– *Tetrataxis lata* SPANDEL, 1901. Subaxial section. Sample L3.
Fig. 9.– *Pachyphloia pedicula* LANGE, 1925. Axial sagittal section. Sample L3.
Fig. 10.– ? *Pseudotristix solida* REITLINGER, 1965. Axial sagittal section. Sample L10.
Fig. 11.– *Ichthyofrondina palmata* (WANG, 1974). Axial sagittal section. Sample L6.
Fig. 12.– *Nankinella* cf. *inflata* (COLANI, 1924). Recrystallized axial section. Sample L10.

PLATE 11. Changhsingian Fusulinata of Kuh-e Surmeh section (Zone 1).
Figs. 1, 20, 21.– *Labioglobivalvulina fortis* gen. nov. sp. nov. 1. Paratype. Transverse section. Sample KeS-266. 20. Paratype. Transverse section. Sample KeS-277. 21. Paratype. Subaxial section. Sample KeS-277.
Fig. 2.– *Paradagmarita* cf. *zaninettiae* sp. nov. Paratype. Axial section. Sample KeS-268.
Fig. 3.– *Paradagmarita* cf. *monodi* LYS *in* LYS & MARCOUX, 1978. Transverse section. Sample KeS-268
Figs. 4, 6.– *Labiodagmarita vasleti* gen. nov. sp. nov. Paratype. 4. Axial sagittal section. Sample KeS-Fig. 269. 6. Paratype. Subaxial section. Sample KeS-269.
Fig. 5.– *Paradagmacrusta callosa* gen. nov. sp. nov. Paratype. Subtranverse section. Sample KeS-269.
Figs. 7, 10, 11.– *Paradagmarita* cf. *planispiralis* sp. nov. Paratype. Subtransverse section. Sample KeS-271. 10. Paratype. Transverse section. Sample KeS-272. 11. Paratype. Transverse section. Sample KeS-272.
Figs. 8, 9.– *Paradagmarita planispiralis* sp. nov. 8. Paratype. Transverse section. Sample KeS-271. 9. Paratype.Transverse section. Sample KeS-272.
Figs. 12, 13, 22-24, 26.– *Paradagmarita monodi* LYS *in* LYS & MARCOUX, 1978. 12. Axial section. Sample KeS-272. 13. Subtransverse section. Sample KeS-272. 22. Transverse section. Sample KeS-280. 23. Axial section. Sample KeS-280. 24. Axial section. Sample KeS-280. 26. Subtransverse section. Sample KeS-282.
Fig. 14.– *Louisettita ultima* sp. nov. Paratype. Axial frontal section. Sample KeS-275.
Fig. 15.– *Nanlingella minima* (SHENG & CHANG, 1958). Subaxial section. Sample KeS-275.
Fig. 16.– *Climacammina* sp. (juvenile form). Axial section. Sample KeS-275.

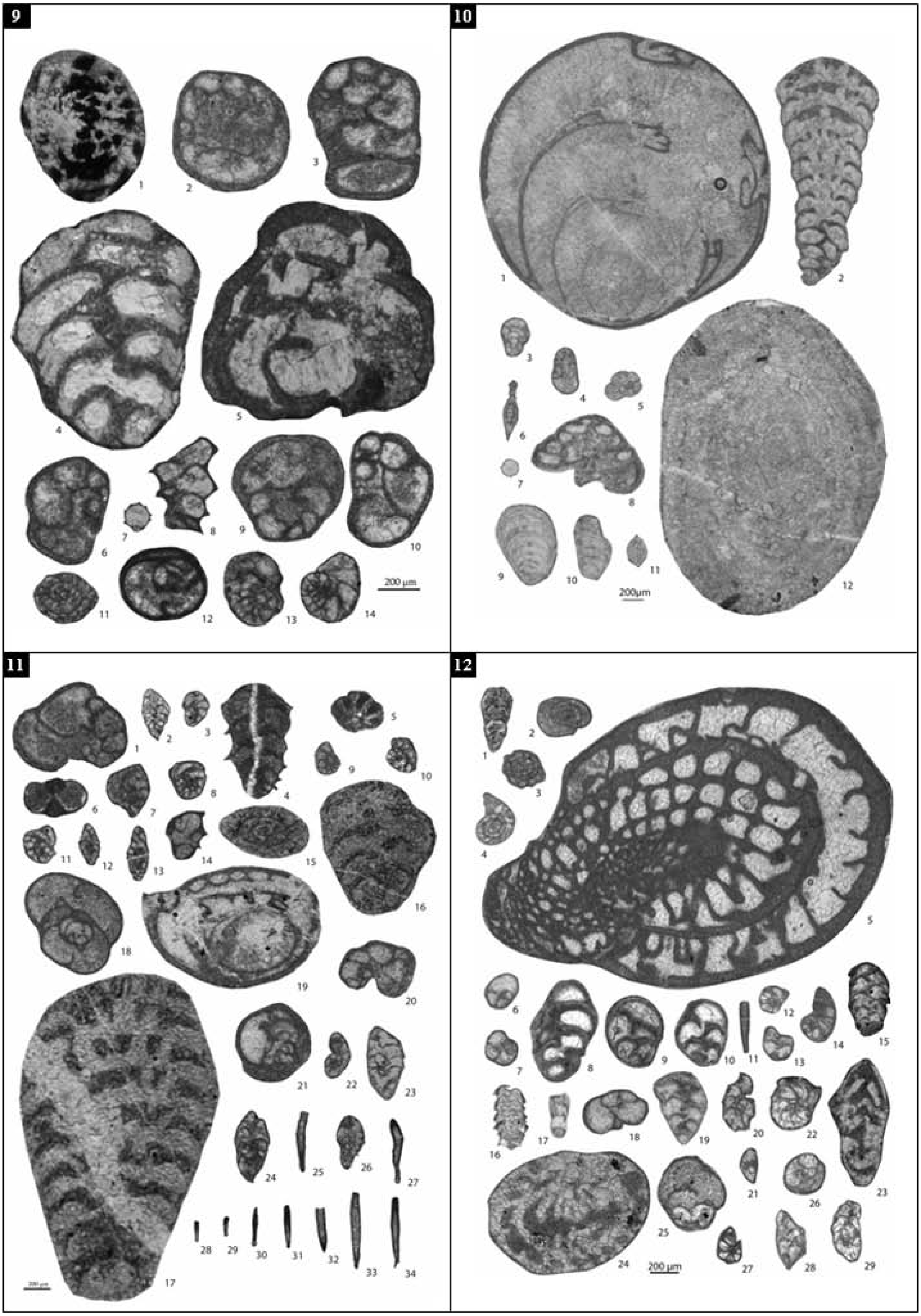
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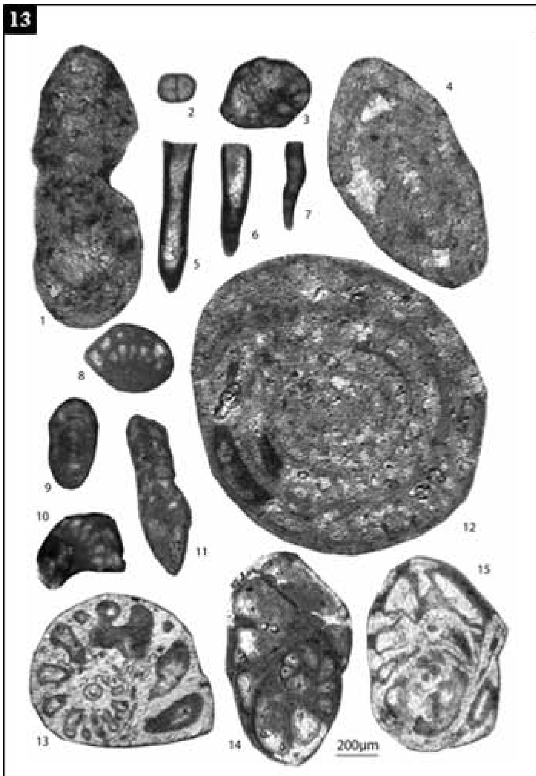
Fig. 17.– *Cribrogenerina sumatrana* (Volz, 1904). Axial section. Sample KeS-275.
Fig. 18.– *Retroseptellina nitida* (Lin, Li & Sun, 1990). Transverse section. Sample KeS-275.
Fig. 19.– *Paraglobivalvulinoides septulifer* Zaninetti & Altiner, 1981. Subaxial section. Sample KeS-276A.
Figs. 25, 27-34.– *Earlandia* ex gr. *elegans* (Rauzer-Chernousova & Reitlinger, 1937). 25. Axial section. Sample KeS-281. 27-31. Five axial sections. Sample KeS-283. 32-33. Two axial sections. Sample KeS-284. 34. Axial section. Sample KeS-285.

PLATE 12. Capitanian (= Midian) Fusulinata of Hazro (Taurus, Turkey; Fig. 2C).
Fig. 1, 19.– *Dagmarita*? *shahrezaensis* Mohtat Aghai & Vachard, 2003. Axial frontal section. Sample HZ-25. 19. Axial sagittal section. Sample HZ-39.
Fig. 2.– *Reichelina simplex* Sheng, 1956. Subtransverse section. Sample HZ-25.
Fig. 3.– *Chusenella*? sp. (juvenile stage). Transverse section. Sample HZ-25.
Fig. 4.– *Codonofusiella* aff. *kueichowensis* Sheng, 1963. Transverse section. Sample HZ-25.
Fig. 5.– *Chusenella* aff. *sinensis* Sheng, 1966. Oblique axial section. Sample HZ-25.
Figs. 6-7.– *Retroseptellina globosa* (Wang *in* Zhao *et al*, 1981). 6. Subtranverse section. Sample HZ-25. 7. Subtransverse section. Sample HZ-25.
Fig. 8.– *Labioglobivalvulina* sp. (transitional? to *Labiodagmarita* sp.). Subaxial sagittal section. Sample HZ-28.
Figs. 9, 10, 25.– *Labioglobivalvulina baudi* gen. nov. sp. nov. 9. Paratype. Subaxial sagittal section. Sample HZ-30. 10. Holotype. Axial sagittal section. Sample HZ-33. 25. Paratype. Axial sagittal section. Sample HZ-46.
Fig. 11.– *Earlandia* ex gr. *elegans* (Rauzer-Chernousova & Reitlinger, 1937). Axial section. Sample HZ-35.
Figs. 12-14, 27.– *Paradagmarita simplex* sp. nov. 12. Paratype. Subtransverse section. Sample HZ-35. 13. Paratype. Axial sagittal section. Sample HZ-35. 14. Holotype. Transverse section. Sample HZ-35. 27. Paratype. Subtransverse section. Sample HZ-48.
Figs. 15-17, 21.– *Louisettita elegantissima* Altiner & Brönnimann, 1980. 15. Axial sagittal section. Sample HZ-39. 16. Axial sagittal section. Sample HZ-39. 17. Axial frontal section. Sample HZ-39. 21. Oblique section. Sample HZ-42.
Fig. 18.– *Septoglobivalvulina distensa* (Wang *in* Zhao *et al*., 1981). Axial sagittal section. Sample HZ-39.
Figs. 20, 22, 28, 29.– *Paradagmarita* cf. *monodi* Lys *in* Lys & Marcoux, 1978. 20. Subtransverse section. Sample HZ-42. 22. Subtransverse section. Sample HZ-44. 28. Subaxial section. Sample HZ-48. 29. Subaxial section. Sample HZ-48.
Figs. 23, 24.– *Nankinella* ex gr. *minor* Sheng, 1955. 23. Subaxial section. Sample HZ-44. 24. Subtransverse section. Sample HZ-45.
Fig. 26.– *Retroseptellina decrouezae* (Köylüoglu & Altiner, 1989). Transverse section. Sample HZ-46.

PLATE 13. Late Changsinghian Fusulinata (Zone 4).
Fig. 1.– *Neomillerella mirabilis* gen. nov. sp. nov. Paratype. Poorly preserved subaxial section.
Fig. 2.– *Floritheca variata* gen. nov. sp. nov. Paratype. Very simple section with only two bricks.
Fig. 3.– *Charliella altineri* sp. nov. Paratype. Subtransverse section.
Fig. 4.– *Nankinella* sp. Axial section.
Figs. 5-7.– *Earlandia* ex gr. *elegans* (Rauzer-Chernousova & Fursenko, 1937). Three axial sections.
Figs. 8-10.– *Eostaffella*? sp. 8. Subtransverse section. 9. Axial section. 10. Subtransverse section.
Fig. 11.– *Paradagmarita* cf. *planispiralis* sp. nov. Paratype. Axial sagittal section.
Fig. 12.– *Sphaerulina croatica* Kochansky-Devidé, 1965. Axial section.
Figs. 13-15.– *Paremiratella robusta* gen. nov. sp. nov. 13. Paratype. Transverse section. 14. Paratype. Subtranverse section. 15. Paratype. Oblique section.

PLATE 14. Lopingian Radiospheraceae, Fusulinata and Miliolata from the type area of the Khuff Formation in Saudi Arabia (see Fig. 2B); plate already published by Vachard *et al*. 2005 but re-illustrated herein because many species in open nomenclature in this latter work are described here. Abbreviation: Mb = Member (of Khuff Formation).
Figs. 1, 2.– *Earlandia* ex gr. *minor* (Rauzer-Chernousova, 1948). 1. x 140. Huqayl Mb. Axial section. 2. x 95. Huqayl Mb. Subaxial section.
Figs. 3, 13.– *Earlandia amplimuralis* (Pantic, 1972). 3. x140. Huqayl Mb. Subaxial section. 13. x140. Huqayl Mb. Transverse section.
Fig. 4.– *Earlandia tintinniformis* (Misik, 1971). x140. Huqayl Mb. Subaxial section.
Figs. 5, 7.– *Radiosphaera* sp. nov. (see the second part of our study). x140. Duhaysan Mb. Numerous sections. 7. x140. Duhaysan Mb. Indefinite section.
Figs. 6, 8.– *Hemigordiellina regularis* (Lipina, 1949). 6. x140. Huqayl Mb. Indefinite section. 8. x140. Huqayl Mb. Inefinite section.
Figs. 9, 10.– *Cornuspira kinkelini* Spandel, 1898. 9. x140. Huqayl Mb. Axial section. 10. x140 Huqayl Mb. Transverse section.
Fig. 11.– *Hemigordius schlumbergeri* (Howchin, 1895). x140. Huqayl Mb. Axial section.
Fig. 12.– *Midiella* ex gr. *zaninettiae* (Altiner, 1978). x140. Midhnab Mb. Axial section.
Fig. 14.– *Eostaffella*? sp. x95. Midhnab Mb. Axial section.
Figs. 15, 20.– *Nankinella* sp. 15. Huqayl Mb. 15. x60. Subtransverse section. 20. x95. Axial section.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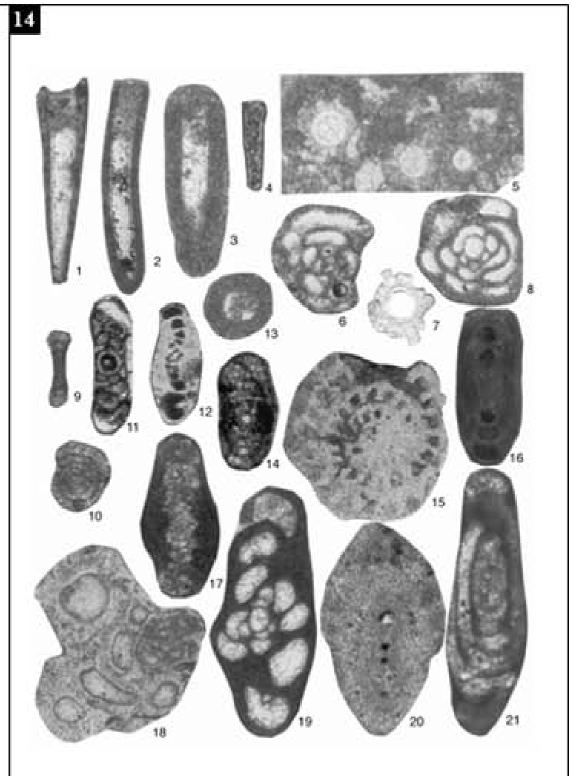
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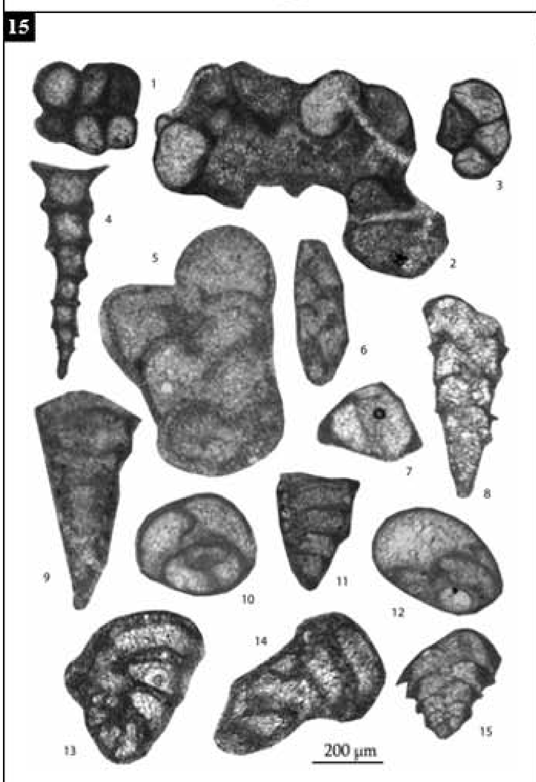
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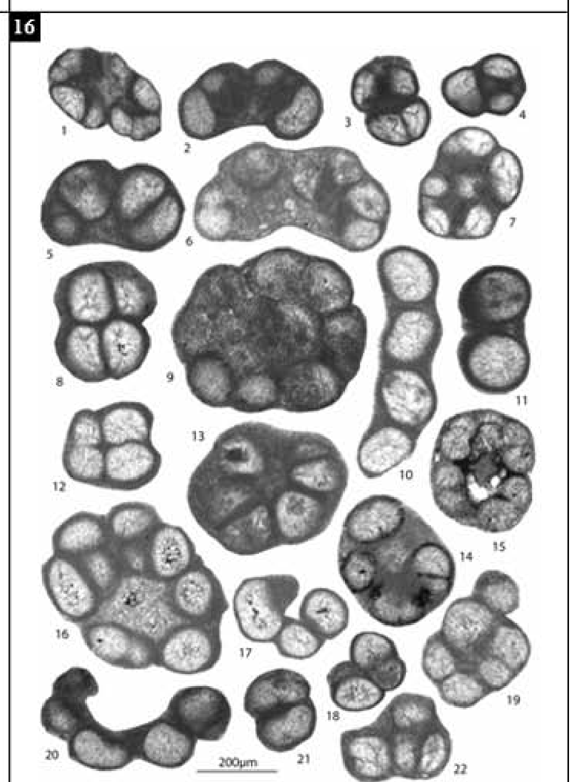
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Figs. 16, 17.– *Multidiscus* sp. 16. x140. Khartam Mb. Axial section. 17. x140 Midhnab Mb. Axial section.
Fig. 18.– *Paleonubecularia iranica* sp. nov. x95. Midhnab Mb. Paratype. Indefinite section.
Fig. 19.– *Neodiscopsis graecodisciformis* gen. nov. sp. nov. x95. Duhaysan Mb. Paratype. Axial section.
Fig. 21.– *Agathammina* sp. x140. Midhnab Mb. Subaxial section.

PLATE 15. Changhsingian Fusulinata of Kuh-e Surmeh (Zone 1).
Figs. 1-3.– *Floritheca variata* gen. nov. sp. nov. 3 paratypes. All in indefinite sections. 1-2: Sample Kes-123. 3.Sample Kes-124.
Fig. 4.– *Dagmarita chanackchiensis* REITLINGER, 1965. Axial frontal section. Sample KeS-124.
Fig. 5.– *Charliella altineri* sp. nov. Paratype. Subaxial sagittal section. Sample KeS-124.
Fig. 6.– *Paradagmarita zaninettiae* sp. nov. Paratype. Subxaial sagittal section. Sample KeS-124.
Figs. 7-9, 11.– *Louisettita elegantissima* ALTINER & BRÖNNIMAN, 1980. 7: Transverse section. Sample KeS-127. 8. Axial sagittal section. Sample KeS-127. 9. Subaxial frontal section. Sample KeS-127. 11. Subaxial frontal section. Sample KeS-130.
Fig. 10.– *Retroseptellina globosa* (WANG *in* ZHAO *et al*., 1981). Transverse section. Sample KeS-127.
Fig. 12.– *Septoglobivalvulina distensa* (WANG *in* ZHAO *et al*., 1981). Subtransverse section. Sample KeS-130.
Figs. 13, 14.– *Paradagmaritella surmehensis* gen. nov. sp. nov. Holotype. Equatorial transverse section. Sample KeS-131. 14. Subaxial frontal section. Sample KeS-131.
Fig. 15.– *Dagmarita altilis* WANG *in* ZHAO *et al*., 1981. Axial sagittal section. Sample KeS-139.

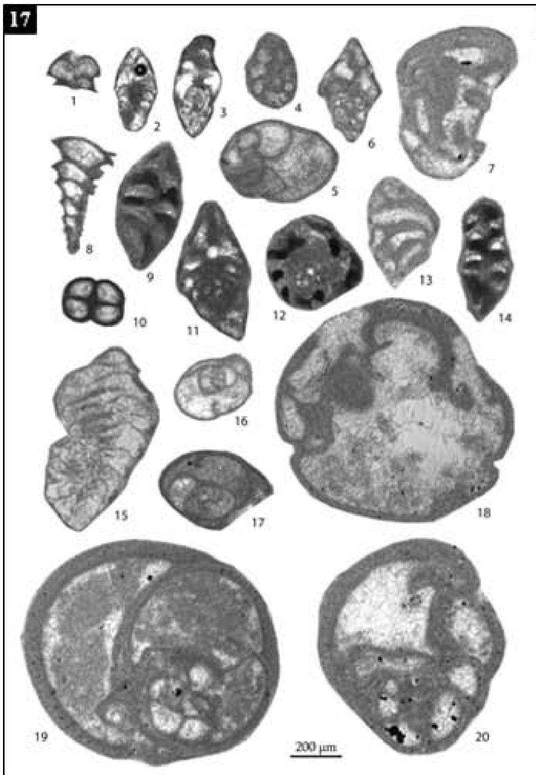
PLATE 16. Figs. 1-22.– *Floritheca variata* gen. nov. n.sp. All paratypes. Various indefinite sections. Lopingian (Zone 3). In this material, the foraminiferal aspect is poorly developed, whereas that of groups of calcified spores is more possible to admit. The diversity of sections is present here.

PLATE 17. Changhsingian Fusulinata (Zone 2).
Figs. 1, 8.– *Dagmarita altilis* WANG *in* ZHAO *et al*., 1981. 1. Sagittal axial section. 8. Frontal subaxial section.
Figs. 2, 3.– *Paradagmarita* cf. *monodi* LYS *in* LYS & MARCOUX, 1978. 2. Sagittal axial section. 3. Sagittal subaxial section.
Figs. 4, 6, 7, 9, 11-14.– *Paradagmacrusta callosa* gen. nov. sp. nov. 4. Paratype. Transverse section. 6. Paratype. Sagittal axial section. 7. Paratype. Transverse oblique section. 9. Paratype. Sagittal subaxial section. 11. Paratype. Subtransverse section. 12. Paratype. Transverse section. 13. Paratype. Oblique section. 14. Paratype. Sagittal subaxial section.
Fig. 5.– *Septoglobivalvulina distensa* (WANG *in* ZHAO *et al.*, 1981). Subtransverse section.
Fig. 10.– *Floritheca variata* gen. nov. sp. nov. Paratype. Indefinite section.
Fig. 15.– *Paradagmarita monodi* LYS *in* LYS & MARCOUX, 1978. Subtransverse oblique section.
Figs. 16, 17.– *Retroseptellina decrouezae* (KÖYLÜOGLU & ALTINER, 1989). Two subtransverse sections.
Figs. 18, 19.– *Paraglobivalvulina mira* REITLINGER, 1965. 18. Sagittal axial section, poorly preserved. 19. Very typical transverse section.
Fig. 20.– *Globivalvulina vonderschmitti* REICHEL, 1946. Subtransverse oblique section.

PLATE 18. Changhsingian Fusulinata (Zone 2).
Fig. 1.– *Globivalvulina vonderschmitti* REICHEL, 1946. Transverse section.
Fig. 2.– *Paraglobivalvulina mira* REITLINGER, 1965 (transition? to *Urustenella*, because of the finely porous wall). Transverse section.
Figs. 3-7, 9-11.– *Paradagmarita monodi* LYS *in* LYS & MARCOUX, 1978 (representatives of a stage with punctated periphery, see especially 3 and 5). 3. Subtransverse section. 4. Subtransverse section. 5. Sagittal axial section. 6. Equatorial transverse section. 7. Sagittal subaxial section. 9. Transverse section, 10. Subtransverse section. 11. Subtransverse section.
Figs. 8, 13.– *Urushtenella* sp. 8. Transverse section. 13. Subaxial section with the characteristic wall.
Figs. 12, 14.– *Floritheca variata* gen. nov. sp. nov. Two paratypes. 12. Broad specimen; 14. Smallest specimen.
Fig. 15.– *Globivalvulina parascaphoidea* sp. nov. Paratype. Transverse oblique section.

PLATE 19. Midian (= Capitanian) Fusulinata of Kuh-e Dena (Zone 1).
Figs. 1, 2, 8.– *Reichelina simplex* SHENG, 1956. Three subtransverse sections. 1-2. Sample DN-615. 8. Sample DN-35
Fig. 3?.– *Neoendothyra reicheli* REITLINGER, 1965. Subtransverse section. Sample DN-615.
Figs. 4-5.– *Dagmarita chanackchiensis* REITLINGER, 1965. Two sagittal axial sections. Sample DN-615.
Fig. 6.– *Eopolydiexodina persica* (KAHLER, 1933). Equatorial section showing the proloculus and the characteristic first whorls. Sample DN-609.
Fig. 7.– Undeterminated Staffelloidea. Subtransverse oblique section. Sample DN-15.
Figs. 9, 10.– *Leella* (= *Jinzhangia*) cf. *armenica* ROSOVSKAYA, 1965. 9. Subaxial section. Sample DN-39. 10. Subaxial section. Sample DN-39.
Fig. 11.– *Sphaerulina croatica* KOCHANSKY-DEVIDÉ, 1965. Transverse section. Sample DN-39.
Figs. 12, 13.– *Labioglobivalvulina baudi* gen. nov. sp. nov. 2 paratypes in sagittal subaxial sections. Sample DN-42.

PLATE 20. Midian (= Capitanian) Fusulinata and Miliolata (Zone 2).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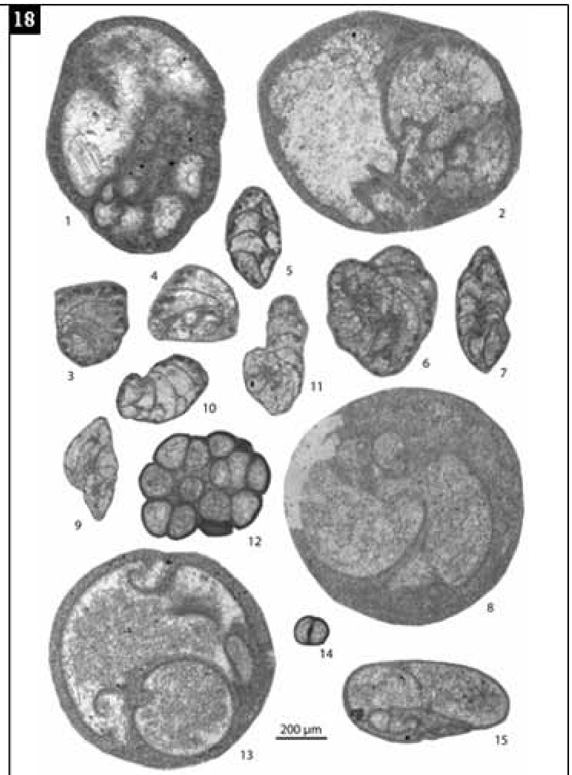
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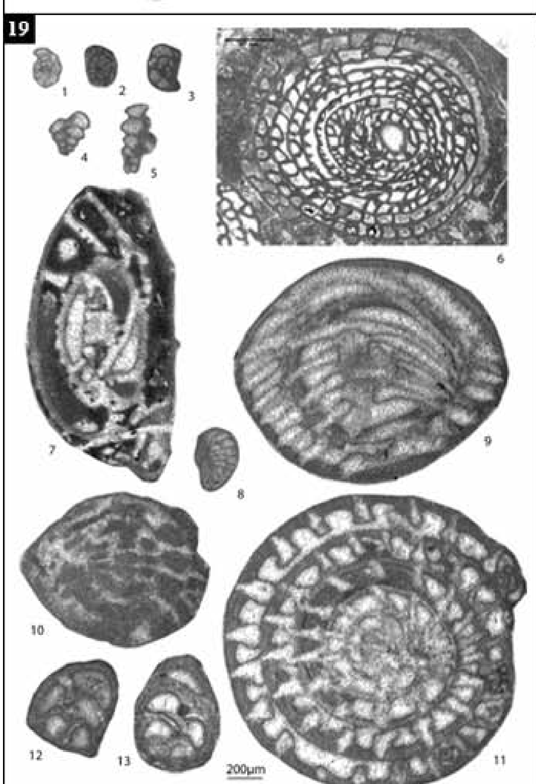
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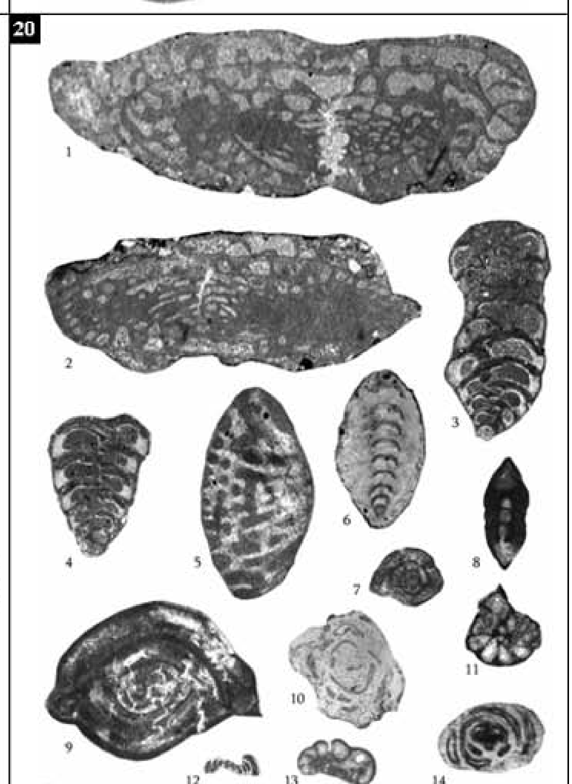
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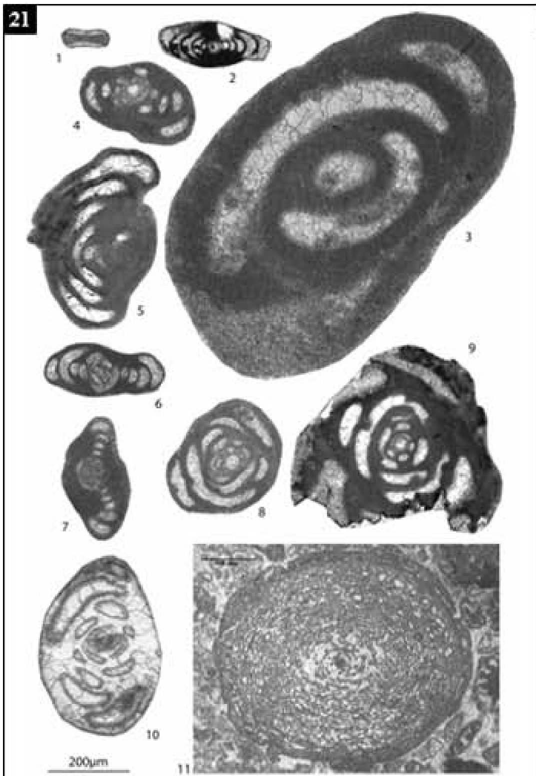
Figs. 1, 2.– *Chusenella* ex gr. *conicocylindrica* Chen, 1956. 1. Axial section. 2. Subaxial section.
Figs. 3, 4.– *Climacammina grandis* Reitlinger, 1950. 3. Axial section. 4. Axial section of an immature (i.e. palaeotextularioid) specimen.
Fig. 5.– *Nankinella* ex gr. *hunanensis* (Chen, 1956). Subaxial section.
Fig. 6.– ?*Pachyphloia* cf. *robusta* Miklukho-Maclay, 1954. Sagittal axial section.
Fig. 7.– *Nanlingella simplex* (Sheng & Chang, 1958). Subaxial section.
Fig. 8.– *Neoendothyra reicheli* Reitlinger, 1965. Axial section.
Fig. 9.– *Leella* (= *Jinzhangia*) cf. *armenica* Rosovskaya, 1965. Subaxial section.
Fig. 10.– *Glomomidiellopsis* sp. Indefinite section.
Fig. 11.– *Crescentia* sp. Transverse section.
Fig. 12.– *Calcivertella* sp. Axial section.
Fig. 13.– *Globivalvulina* cf. *kantharensis* Reichel, 1946. Transverse section.
Fig. 14.– *Midiella* sp. Axial section.

PLATE 21. Late Midian (= late? Capitanian) Fusulinata and Miliolata of Kuh-e Dena (Zone 1).
Fig. 1.– *Pseudovidalina involuta* Zaninetti, Altiner & Catal, 1981. Axial section. Sample DN-615.
Figs. 2, 6.– ?*Hemigordius irregulariformis* Zaninetti, Altiner & Catal, 1981. Atypical axial section looking like immature *Arenovidalina*. Sample DN-608. 6. Subaxial section looking like *Hoyenella*? sp. Sample DN-039.
Fig. 3.– ?*Neodiscus* sp. transitional to *Crassispirella* sp. Subaxial section. Sample DN-34.
Figs. 4, 8.– *Septigordius* sp. 4. Axial section. Sample DN-36. 8. Transverse section showing the pseudo-septa in last and penultimate whorls. Sampe DN-039.
Fig. 5.– ?*Multidiscus* sp. Subtransverse section. Sample DN-036.
Fig. 7.– *Midiella broennimanni* (Altiner, 1978). Axial section. Sample DN-039.
Fig. 9.– *Septigordius turgidus* (Sosnina, 1983). Transverse section, with its well developed pseudo-septa. Sample DN-041.
Fig. 10.– *Midiella* aff. *quinglongensis* (K. Wang, 1976) Axial section. Sample DN-047.
Fig. 11.– *Shanita amosi* Brönniman, Whittaker & Zaninetti, 1978. Axial section. Sample DN-048.

PLATE 22. Lopingian Fusulinata and Miliolata of Hazro (Taurus, Turkey).
Figs. 1, 2, 6, 8, 9, 22, 23.– *Neodiscopsis canutii* gen. nov. sp. nov. 1. Subtransverse section. 2. Subaxial section. Sample HZ-03. 6. Paratype, Transverse section. Sample HZ -03. 8. Paratype. Subaxial oblique section. Sample HZ-05. 9. Holotype. Axial section. Sample HZ-05. 22? Sample HZ-15. 23? Sample HZ-15.
Figs. 3, 10-11, 15-16, 21.– *Palaeonubecularia* ex gr. *fluxa* Reitlinger, 1950. Five indefinite sections. 3. Sample HZ-03.10. Sample HZ-06. 11. Sample HZ-06. 15. Sample HZ-13. 16. Sample HZ-13. 21. Sample HZ-15.
Figs. 4-5, 24.– *Cornuspira kinkelini* Spandel, 1898. 4-5. Two transverse sections. Sample HZ-03. 24. Transverse section. Sample HZ-24.
Fig. 7.– *Agathammina ovata* K. Wang, 1976. Axial section. Sample HZ-03.
Figs. 12, 26.– *Hoyenella* sp. Subtransverse section. Sample HZ-09. 26. Axial section. Sample HZ-32.
Fig. 27.– ?*Hemigordius irregulariformis* Zaninetti, Altiner & Catal, 1981. Axial section. With poorly deviated last whorls. Sample HZ-33.
Fig. 13.– *Agathammina* sp. Transverse section. Sample HZ-09.
Figs. 14, 17.– *Crassiglomella guangxiensis* (Lin, 1978). 14. Axial section. Sample HZ-11. 17? Subaxial section. Sample HZ-13.
Fig. 18.– *Pseudovidalina involuta* Zaninetti, Altiner & Catal, 1981. Axial section. Sample HZ-13.
Figs. 19, 20.– *Midiella* ex gr. *zaninettiae* (Altiner, 1978). Two subaxial sections. Sample HZ-14.
Fig. 25.– *Midiella broennimanni* (Altiner, 1978). Axial section. Sample HZ-25.
Figs. 28, 29, 30, 31.– *Brunsispirella linae* (Vachard & Gaillot, 2005). Axial section. Sample HZ-33. 29? Axial section. Sample HZ-33. 30. Axial section. Sample HZ-35. 31. Subaxial section. Sample HZ-35.

PLATE 23. Fusulinata Fusulinida (Ozawainelloidea) (Zone 3); essentially *Neomillerella* gen. nov. with three other specimens for comparison.
Figs. 1-5, 7, 8, 10.– *Neomillerella mirabilis* gen. nov. sp. nov. 1. Paratype. Subtransverse section. 2. Paratype. Subaxial section. 3. Paratype. Subaxial, uncoiled, section. 4. Paratype. Axial, uncoiled, section. 5. Paratype. Subtransverse oblique section. 7. Paratype. Axial section. 8. Subaxial section with atypically strong chomata. 10. Paratype. Oblique to tangential section.
Figs. 6, 9.– *Sphaerulina croatica* Kochansky-Devidé, 1965. 6. Subaxial section. 9. Oblique section.
Fig. 11.– *Eostaffella*? sp. Subaxial section.

PLATE 24. Late Changhsingian Fusulinata (Zone 4).
Figs. 1, 2, 5-12.– *Paremiratella robusta* gen. nov. sp. nov. 1. Paratype. Subtransverse section. 2. Paratype. Sagittal subaxial section. 5. Paratype. Subtransverse oblique section showing the two pairs of chambers. 7 Paratype. Oblique section. 8. Paratype. Transverse section with atypically strong chomata. 9. Paratype. Subtransverse section. 8. Paratype. Subaxial, uncoiled, section. 9. Paratype. Axial, uncoiled, section. 10. Paratype. Transverse section. 11. Paratype. Axial section. 12. Paratype. Oblique section.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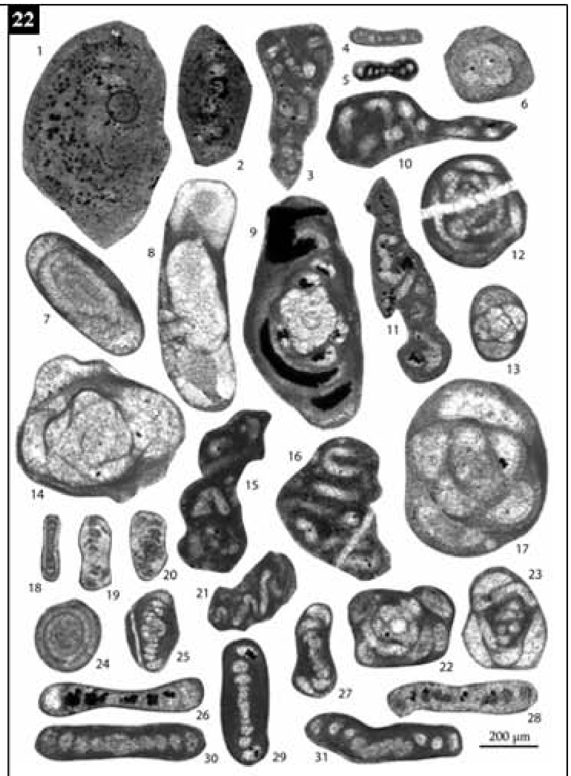
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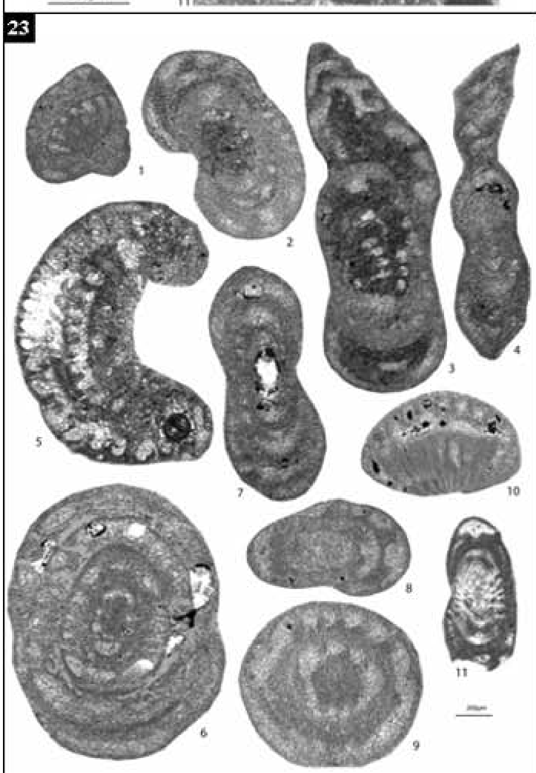
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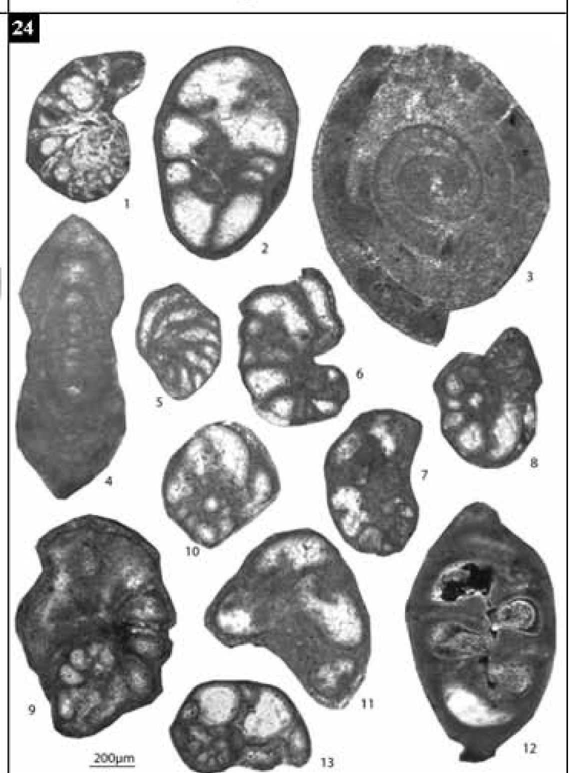
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Fig. 3.– *Leella* cf. *armenica* Rozovskaya, 1965. Axial section.
Fig. 4.– *Eostaffella*? sp. Axial section.
Fig. 13.– *Globivalvulina bulloides* (Brady, 1876). Equatorial transvers setion (to compare with figs. 8 and 10).

PLATE 25. Lopingian Fusulinata (Zone 3).
Figs. 1, 5, 9-11.– *Neomillerella mirabilis* gen. nov. sp. nov. 1. Paratype. Transverse section with long uncoiled part. 5. Paratype. Subaxial section. 9. Paratype. Axial section. 10. Paratype. Transverse section. 11. Paratype. Axial section.
Fig. 2.– *Nankinella*? sp. 1. Axial section.
Fig. 3.– *Nankinella*? sp. 2. Axial section.
Fig. 4.– *Sphaerulina croatica* Kochansky-Devidé, 1965. Oblique section.
Fig. 6.– *Tetrataxis lata* Spandel, 1901. Subaxial section.
Fig. 7.– *Nanlingella simplex* (Sheng & Chang, 1958). Axial section.
Fig. 8.– *Reichelina simplex* Sheng, 1956. Axial section.

PLATE 26. Lopingian Fusulinata (Zone 3).
Fig. 1.– *Nankinella*? sp. Axial section.
Figs. 2-4, 8, 9, 11.– *Neomillerella mirabilis* gen. nov. sp. nov. 2. Holotype. Transverse section exhibiting perfectly the uncoiling. 3. Paratype. Subaxial section with the shape of septa. 4. Paratype. Oblique section. 8. Paratype. Subaxial section. 9. Paratype. Axial section. 11. Paratype. Axial section.
Figs. 5-7, 10.– *Nanlingella simplex* (Sheng & Chang, 1958). 5. Subtransverse section. 6. Subtransverse section. 7. Subtransverse section. 10. Subaxial section.

PLATE 27. Changhsingian Fusulinata, Miliolata and Nodosariata (Zone 3).
Fig. 1.– *Neomillerella mirabilis* gen. nov. sp. nov. Paratype. Axial section.
Figs. 2, 3.– *Charliella altineri* sp. nov. 2 paratypes. Two subtransverse sections.
Fig. 4.– *Septoglobivalvulina distensa* (Wang *in* Zhao *et al.*, 1981). Subtransverse section.
Figs. 5, 9.– *Dagmarita altilis* Wang *in* Zhao *et al.*, 1981. 5. Frontal sagittal section. 9. Sagittal axial section.
Fig. 6.– *Labiodagmarita vasleti* gen. nov. sp. nov. Paratype. Frontal subaxial section.
Fig. 7.– *Paradagmarita monodi* Lys *in* Lys and Marcoux, 1978. 7. Subbtranverse section. 8. Subaxial section.
Figs. 10-12.– *Aulacophloia martiniae* gen. nov. sp. nov. 10. Paratype. Subtransverse section. 11. Paratype. Frontal axial section. 12. Subtransverse section.
Fig. 13.– *Polarisella* ex gr. *hoae* (Trifonova, 1967). Frontal axial section.
Figs. 14, 15.– *Neodiscus milliloides* Miklukho-Maklay, 1953. 14 Axial section. 15. Subaxial section.
Fig. 16.– *Glomomidiellopsis lysitiformis* gen. nov. sp. nov. Holotype. Axial section.
Fig. 17.– *Midiella* ex gr. *zaninettiae* (Altiner, 1978). Axial section.

PLATE 28. Lopingian Fusulinata of Kuh-e Surmeh (Zone 1).
Figs. 1, 5, 8-10. *Nankinella* ex gr. *hunanensis* (Chen, 1956). 1. Transverse section. Sample KeS-88. 5. Subaxial section. Sample KeS-89. 8. Axial section. Sample KeS-91. 9. Transverse section. Sample KeS-91. 10. Transverse oblique section. Sample KeS-91
Figs. 2, 14.– *Tetrataxis lata* Spandel, 1901. Subaxial section. Sample KeS-88. 14. Subaxial section. Sample KeS-92.
Fig. 3.– *Nanlingella simplex* (Sheng & Chang, 1958). Transverse section. Sample KeS-89.
Figs. 4, 6, 11.– *Labioglobivalvulina baudi* gen. nov. sp. nov. 4. Paratype. Sagittal subaxial section. Sample KeS-89. 6. Paratype. Sagittal subaxial oblique section. Sample KeS 90. 11. Paratype. Sagittal subaxial section. Sample KeS91.
Fig. 7.– *Staffella yaziensis* Wang & Sun, 1973. Axial section. Sample KeS-90.
Fig. 12.– *Reichelina simplex* Sheng, 1956. Subaxial section. Sample KeS-91.
Fig. 13.– *Nankinella minor* Sheng, 1955. Subaxial section. Sample KeS-92.
Fig. 15.– *Septoglobivalvulina distensa* (Wang *in* Zhao *et al*., 1981). Subtransverse section. Sample KeS-95.

PLATE 29. Lopingian Fusulinata of Hazro (Taurus, Turkey).
Figs. 1, 2.– *Nankinella minor* Sheng, 1955. Two transverse sections. Sample HZ-03.
Figs. 3, 7, 15.– *Globivalvulina bulloides* (Brady, 1876). 3. Sagittal axial section. Sample HZ-06. 7. Sagittal axial section. Sample HZ-09. 15. Sagittal axial sections. Sample HZ-13.
Figs. 4, 5, 17-19.– *Reichelina simplex* Sheng, 1956. 4.Transverse section. Sample HZ-09. 5. Axial section. Sample HZ-09. 17. Subtransverse section. Sample HZ-15. 18. Subtransverse oblique section. Sample HZ-15. 19. Oblique section. Sample HZ-16bis
Fig. 6.– *Dagmarita chanackchiensis* Reitlinger, 1965. Frontal axial section. Sample HZ-09
Fig. 8.– *Nankinella* ex gr. *hunanensis* (Chen, 1956). Transverse section. Sample HZ-09.
Figs. 9, 13, 14.– *Retroseptellina globosa* (Wang *in* Zhao *et al*., 1981). 9. Subtranbsverse section. Sample HZ-10. 13-14. Two subtransverse sections. Sample HZ-11.
Figs. 10, 11, 16.– *Septoglobivalvulina distensa* (Wang *in* Zhao *et al*., 1981). 10. Axial section. Sample HZ-11. 11. Transverse


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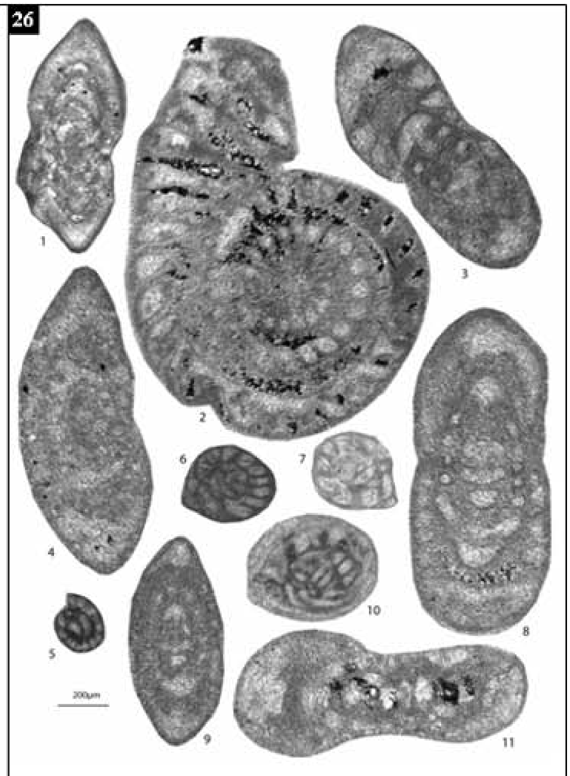
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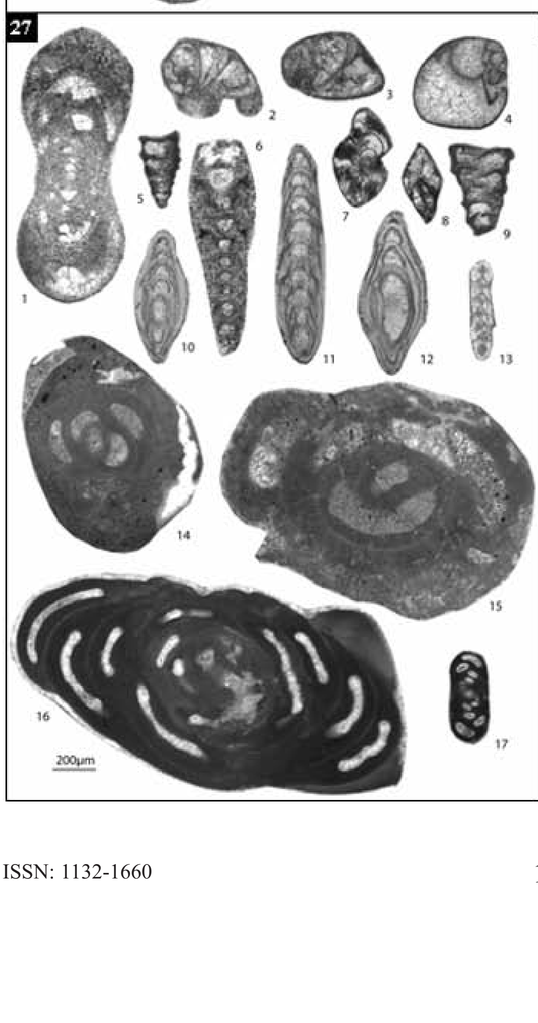
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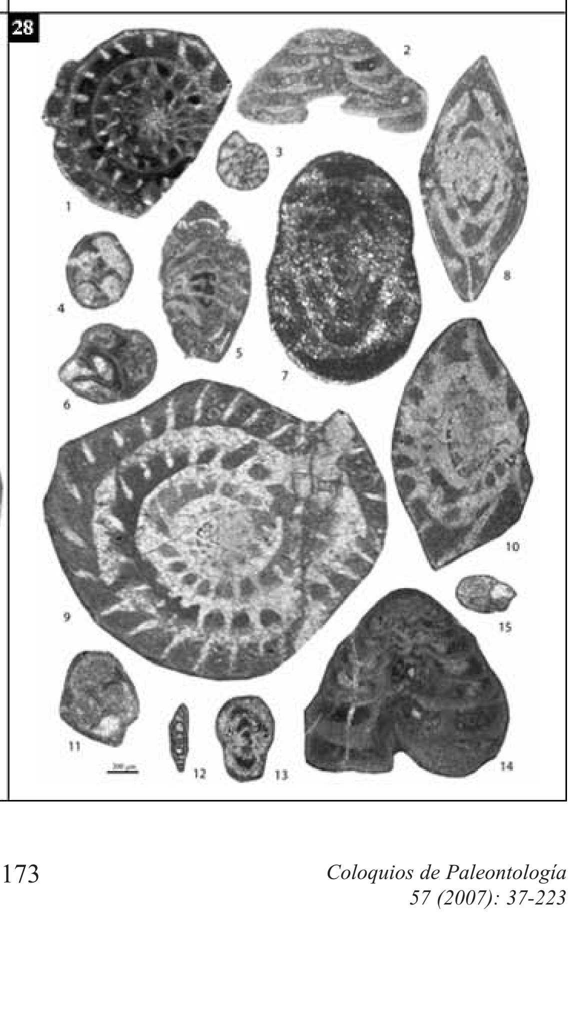
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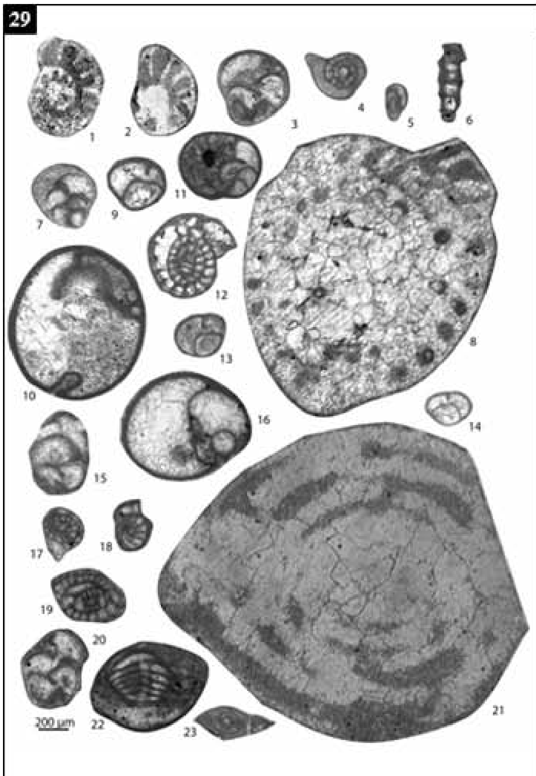
section. Sample HZ-11. 16. Transverse section. Sample HZ-15.
Figs. 12, 22.– *Dunbarula nana* Kochansky-Devidé & Ramovs, 1955. 12. Subtransverse section. Sample HZ-11. 22. Oblique subaxial section. Sample HZ-17.
Fig. 20.– *Labioglobivalvulina baudi* gen. nov. sp. nov. Paratype. Sagittal subaxial section. Sample HZ-16bis.
Fig. 21.– *Leella* (= *Jinzhangia*) cf. *armenica* Rosovskaya, 1965. Axial section. Sample HZ-16bis.
Fig. 23.– ? *Codonofusiella* aff. *kueichowensis* Sheng, 1963. Axial section. Sample HZ-23.

PLATE 30. Lopingian Calcisphaeraceans, Donezellaceans, Fusulinata and Nodosariata of Laren and Tsonteng sections (Guangxi, South China)
Fig. 1.– *Ramovsia*? sp. Longitudinal section. Sample L3.
Fig. 2.– *Ramovsia*? sp. Oblique section. Sample L3.
Fig. 3.– *Pseudotristix solida* Reitlinger, 1965. Transverse section. Sample L3.
Figs. 4, 5.– *Bidagmarita sinica* Gaillot, Vachard, Galfetti & Martini (submitted-a). 4. Holotype. Sagittal axial section. Sample L3. 5. Paratype. Frontal axial section. Sample L3.
Figs. 6, 8.– *Asterosphaera* sp. nov. 1. Two indefinite sections. Sample L6.
Fig. 7.– *Radiosphaera* sp. Indefinite section. Sample L3.
Fig. 9, 10.– *Asterosphaera* cf. *pulchra* Reitlinger, 1957. 9. Tangential section. Sample L6. 10. An exceptional group of two connected individuals. Indefinite section. Sample L3.
Fig. 11.– *Rectostipulina pentamerata* Groves, Altiner & Rettori, 2005. Transverse section. Sample T0.
Fig. 12.– *Reichelina simplex* Sheng, 1956. Axial section. Sample T0.
Fig. 13.– *Donezella* sp. Axial section. Sample L6
Fig. 14.– *Septoglobivalvulina* cf. *guangxiensis* Lin, 1978. Axial section. Sample T0.
Fig. 15.– *Sphaerulina* sp. Axial section. Sample T0.
Figs. 16-21.– *Globivalvulina curiosa* Gaillot, Vachard, Galfetti & Martini (submitted-a). 16. Holotype. Transverse section. Sample T1. 17. Paratype. Oblique subtransverse section. Sample T1. 18. Paratype. Oblique subaxial section. Sample T1. 19. Paratype. Oblique section. Sample T1. 20. Paratype. Sagittal subaxial oblique section. Sample T1. 21. Paratype. Transverse section. Sample T1.

PLATE 31. Lopingian Fusulinata of Kuh-e Dena (Zone 1).
Fig. 1.– *Labiodagmarita vasleti* gen. nov. sp. nov. Paratype. Sagittal subaxial section. Sample DN-114.
Figs. 2, 3.– *Globivalvulina bulloides* (Brady, 1876). 2. Sagittal axial section. 3. Oblique section. Sample DN-116.
Figs. 4, 5.– *Globivalvulina kantharensis* Reichel, 1946. Two subtransverse sections. Sample DN-116.
Fig. 6.– *Nankinella* sp. Axial section. Sample DN-123.
Fig. 7.– *Dagmarita chanackchiensis* Reitlinger, 1965. Sagittal axial section. Sample DN-132.
Fig. 8.– *Labioglobivalvulina? baudi* gen. nov. sp. nov. Subtransverse section. Sample DN-135.
Fig. 9.– *Septoglobivalvulina distensa* (Wang *in* Zhao *et al*., 1981). Subtransverse section. Sample DN-151.
Fig. 10.– *Staffella yaziensis* Wang & Sun, 1973. Axial section. Sample DN-162.
Figs. 11, 13.– *Globivalvulina neglecta* sp. nov. 11. Paratype. Subtransverse section. Sample DN-228. 13. Paratype. Sagittal subaxial section. Sample DN-233.
Fig. 12.– *Retroseptellina decrouezae* (Köylüoglu & Altiner, 1989). Subtransverse section. Sample DN-229.
Fig. 14.– *Louisettita elegantissima* Brönnimann & Zaninetti, 1980. Frontal axial section. Sample DN-244.
Fig. 15,17.– *Paradagmacrusta callosa* gen. nov. sp. nov. 15. Paratype. Oblique section. Sample DN-261. 17. Paratype. Sagittal axial section. Sample DN-288.
Fig. 16.– *Dagmarita*? *sharezaensis* Mohtat-Aghai & Vachard, 2003. Sagittal axial section. Sample DN-263.
Fig. 18.– *Leella* (= *Jinzhangia*) cf. *armenica* Rosovskaya, 1965. Subaxial section. Sample DN-298.

PLATE 32. Changhsingian Fusulinata of Kuh-e Surmeh (Zone 1).
Fig. 1, 2.– *Septoglobivalvulina* sp. 1. 1. Transverse section. 2. Subtranverse section Sample KeS-170.
Figs. 3-5, 18-20.– *Paraglobivalvulina mira* Reitlinger, 1965. 3. Subtransverse section. 4. Subaxial section. 5. Oblique section. Sample KeS-185. 18. Oblique subaxial section. Sample KeS-172. 19. Sagittal axial section Sample KeS-172. 20. Subtransverse section. Sample KeS-172.
Fig. 6.– *Retroseptellina globosa* (Wang *in* Zhao *et al.*, 1981). Sagittal axial section. Sample KeS-185.
Fig. 7.– *Paradagmarita* cf. *monodi* Lys *in* Lys & Marcoux, 1978. Sagittal axial section. Sample KeS-171.
Figs. 8, 21.– ?*Nankinella minor* Sheng, 1955. 8. Subtransverse transverse, abraded section. Sample KeS-187. 21. Subaxial section. Sample KeS-180.
Fig. 9. *Labioglobivalvulina fortis* sp. nov. Paraype. Subtransverse section. Sample KeS-171.
Figs. 10-13, 15-17.– *Paradagmacrusta callosa* gen. nov. sp. nov. 10. Holotype. Equatorial transverse section. 11. Paratype. Subtransvers section. 12. Paratype. Subtransverse oblique section. 13. Paratype. Transverse section. 15. Paratype. Subtransverse section. Sample KeS-179. 16. Paratype. Subtransverse section. 17. Paratype. Oblique subaxial section. Sample KeS-179.
Figs. 14, 22, 26.– *Paradagmarita zaninettiae* sp. nov. 14. Paratype. Transverse section. Sample KeS-179. 22. Paratype.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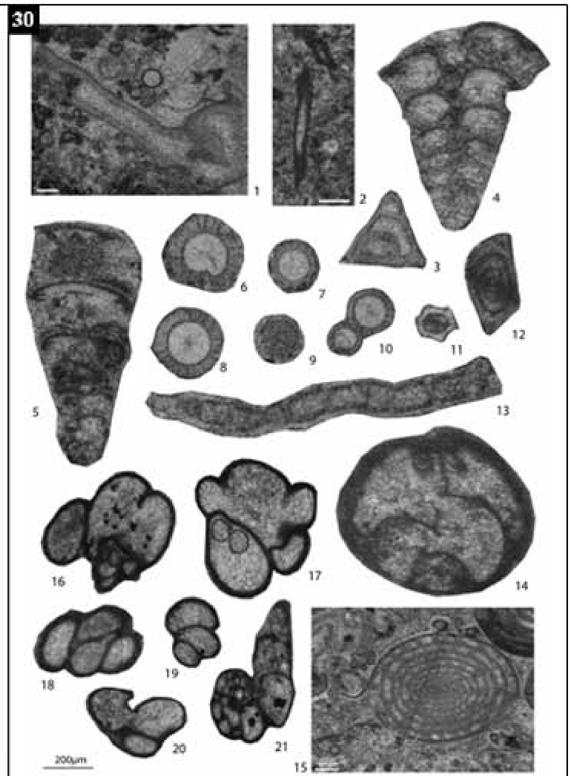
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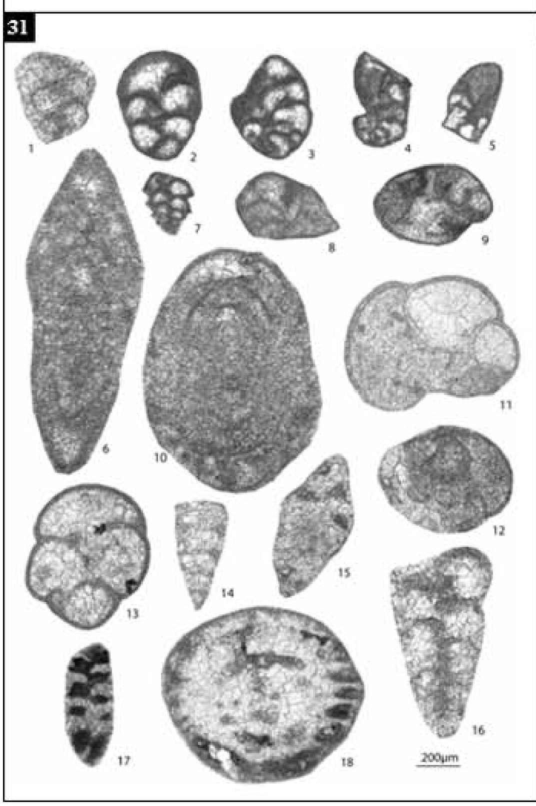
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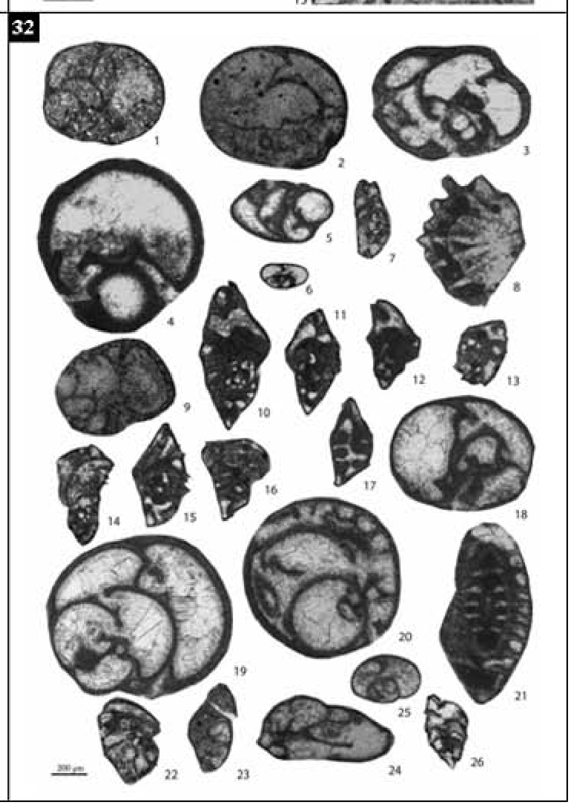
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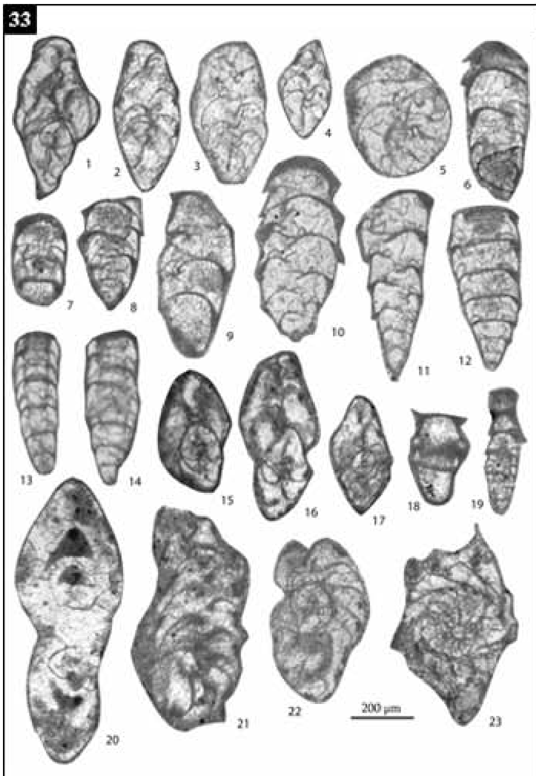
Subtransverse section. Sample KeS-188. 26. Paratype. Sagittal axial section. Sample KeS-188.
Fig. 23.– *Paradagmaritopsis kobayashii* GAILLOT, VACHARD, GALFETTI & MARTINI (submitted-a). Paratype. Sagittal axial section. Sample KeS-188.
Fig. 24.– *Globivalvulina parascaphoidea* sp. nov. Paratype. Subtransverse section. Sample KeS-188.
Fig. 25.– *Retroseptellina globosa* (WANG *in* ZHAO *et al.*, 1981). Transverse section. Sample KeS-188.

PLATE 33. Changhsingian Fusulinata of Hazro (Taurus, Turkey).
Figs. 1-5, 15-17.– *Paradagmarita monodi* LYS *in* LYS & MARCOUX, 1978. 1. Subtransverse section. 2. Sagittal subaxial section. 3. Sagittal section. 5. Transverse section. All 1-5 from sample HZ-59. 15. Subtransverse section. Sample HZ-60. 16. Oblique subaxial section. Sample HZ-61. 17 Sagittal subaxial section. Sample HZ-61.
Figs. 6-14.– *Louisettita extraordinaria* sp. nov. 6. Paratype. Sagittal oblique section. 7. Paratype . Oblique section showing the small, thin, lateral arches. 8. Paratype. Sagittal oblique section. 9. Paratype. Oblique subaxial section. 10. Holotype. Sagittal axial section. 11. Paratype. Sagitttal subaxial section; 12. Paratype; Oblique section. 13. Paratype. Oblique section. 14. Paratype. Oblique section. All from sample HZ-59.
Fig. 18.– *Louisettita ultima* GAILLOT, VACHARD, GALFETTI & MARTINI (submitted-a). Paratype. Oblique section. Sample HZ-64.
Fig. 19.– *Louisettita elegantissima* ALTINER & BRÖNNIMANN, 1980. Oblique section. Sample HZ-64
Fig. 20.– *Nankinella* ex gr. *minor* SHENG, 1955. Axial section. Sample HZ-64.
Figs. 21-23.– *Paradagmarita planispiralis* sp. nov. 21. Paratype. Subtransverse oblique section. Sample HZ-70. 22. Paratype. Subtransverse section. 23. Paratype. Equatorial transvesrse section. All from sample HZ-70.

PLATE 34. Lopingian algae, Fusulinata, Miliolata and Nodosariata (Zone 2).
Fig. 1.– *Mizzia yabei* (KARPINSKY, 1909) PIA, 1920. Transverse section.
Fig. 2.– *Gymnocodium bellerophontis* (ROTHPLETZ, 1894) PIA, 1920. Transverse section.
Fig. 3.– *Permocalculus solidus* (PIA, 1937). Transverse section.
Fig. 4.– *Tetrataxis lata* SPANDEL, 1901. Subaxial section.
Fig. 5.– *Charliella altineri* sp. nov. Paratype. Subtransverse section.
Fig. 6.– *Paradagmarita simplex* sp. nov. Paratype. Subtransverse section.
Fig. 7.– *Dagmarita chanackchiensis* REITLINGER, 1965. Oblique section.
Figs. 8, 11, 12.– *Paraglobivalvulina mira* REITLINGER, 1965. Sagittal axial section. 11. Oblique section. 12. Oblique section.
Fig. 9.– *Labiodagmarita vasleti* gen. nov. sp. nov. Frontal subaxial section.
Fig. 10.– *Dagmarita altilis* WANG *in* ZHAO *et al.,* 1981. Sagittal axial section.
Fig. 13.– *Paradagmaritopsis kobayashii* GAILLOT, VACHARD, GALFETTI & MARTINI (submitted-a). Frontal subaxial section.
Fig. 14.– *Retroseptellina decrouezae* (KOYLÜOGLU &ALTINER, 1989). Equatorial transverse section.
Figs. 15-17.– *Paradagmarita zaninettiae* sp. nov. 3 Paratypes. Three subtransverse sections.
Fig. 18.– *Pseudovermiporella sodalica* ELLIOTT, 1958. Oblique section.
Figs. 19, 20.– ? *Midiella* aff. *quinglongensis* (K. WANG, 1976). Two subaxial sections.
Fig. 22.– *Colaniella* sp. Sagittal axial section of a juvenile specimen.
Fig. 23.– *Pachyphloia* sp. Frontal axial section.
Figs. 24, 27.– *Nodosinelloides shikhanica* (LIPINA, 1949). Two subaxial sections.
Fig. 25.– *Pachyphloia* sp. Transverse section.
Fig. 26.– *Nestellorella dorashamensis* (PRONINA, 1989). Axial section.

PLATE 35. Lopingian Biseriamminoidea of Khuff Formation in its type-area in Saudi Arabia (after VACHARD *et al*., 2005, with new nomenclature). Mb = Member.
Fig. 1.– *Globivalvulina bulloides* (BRADY, 1876). Equatorial transverse section. x 140. Duhaysan Mb.
Fig. 2.– *Globivalvulina vonderschmitti* REICHEL, 1946. Axial section. x 75 Khartam Mb.
Fig. 3.– *Paradagmarita* cf. *monodi* LYS *in* LYS & MARCOUX, 1978. Oblique section. x 140. Lowest Khartam Mb.
Figs. 4, 7, 12, 14.– *Paradagmacrusta callosa* gen. nov. sp. nov. x 140. 4. Paratype. Subtransverse section. Lowest Khartam Mb. 7 Paratype. Oblique, abraded section. x 95. Lowest Khartam Mb. 12. Paratype. Oblique, abraded section. x 140. Lowest Khartam Mb. 14 Paratype. Subtransverse section. x 140. Lowest Khartam Mb.
Figs. 5, 6.– *Retroseptellina globosa* (WANG *in* ZHAO *et al*., 1981). 5. Subtransverse section. x 140. Duhaysan Mb. 6. Equatorial transverse section. x 140. Duhaysan Mb.
Fig. 8.– *Paradagmaritella brevispira* gen. nov. sp. nov. Holotype. Sagittal subaxial section. x 95
Midhnab Mb.
Fig. 9.– *Dagmarita*? *sharezaensis* MOHTAT-AGHAI & VACHARD, 2003. Sagittal axial section. x 75. Midhnab Mb.
Fig. 10.– *Labiodagmarita vasleti* gen. nov. sp. nov. Paratype. Sagittal axial oblique section. x 95. Lowest Khartam Mb.
Fig. 11.– *Paradagmarita* cf. *monodi* LYS *in* LYS & MARCOUX, 1978. Sagittal axial section. x 140. Lowest Khartam Mb.
Fig. 13.– *Labioglobivalvulina baudi* gen. nov. sp. nov. Paratype. Subtransverse section. x 95. Midhnab Mb.
Fig. 15.– *Labiodagmarita vasleti* gen. nov. sp. nov. x 95. Paratype. Frontal subaxial section. Lowest Khartam Mb.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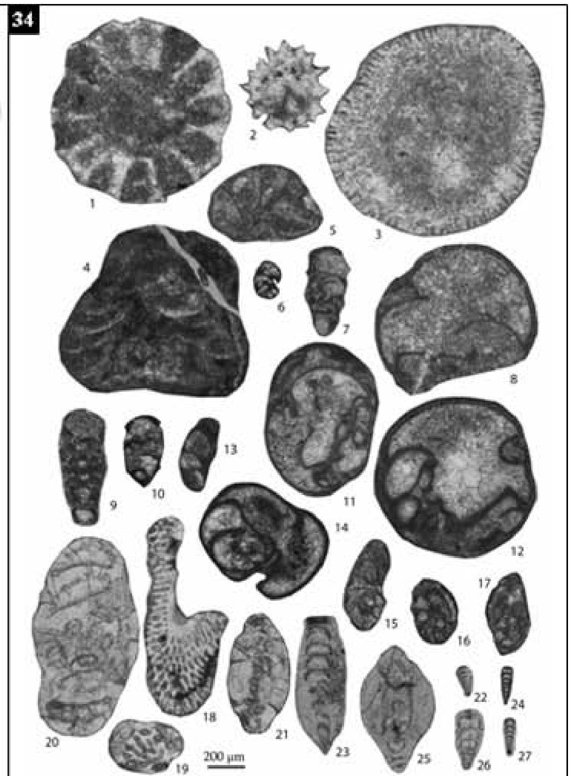
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35

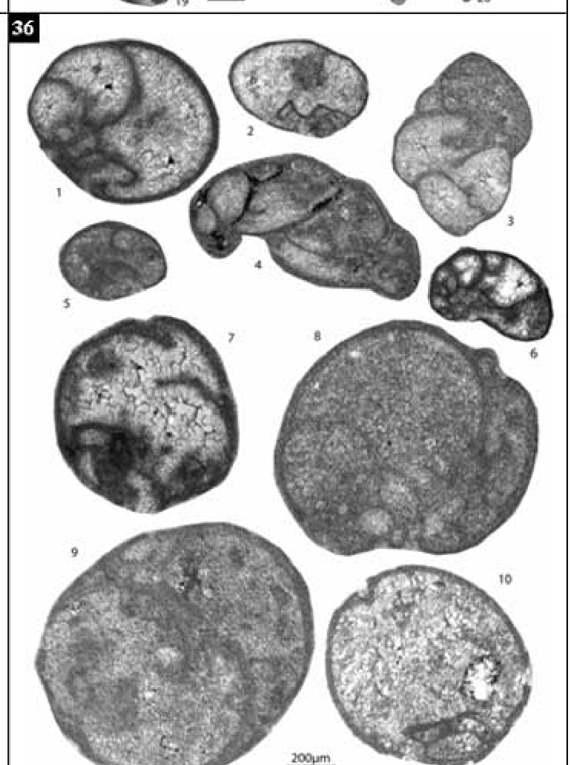

36
200µm

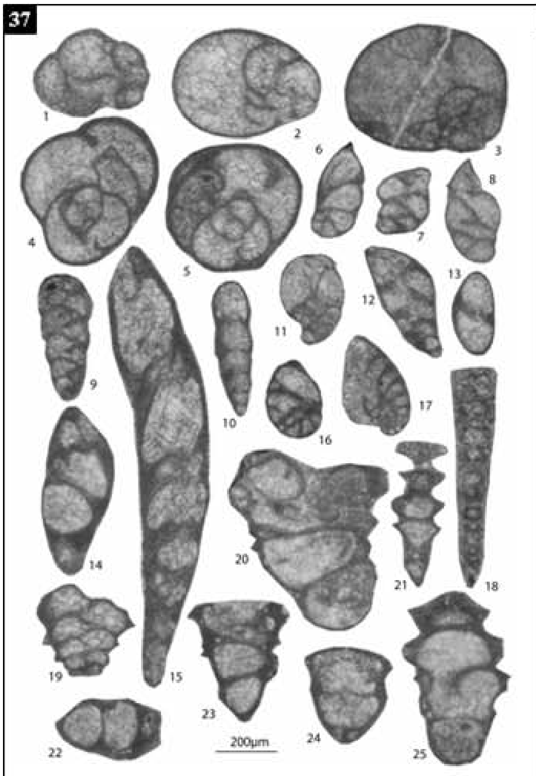
PLATE 36. Lopingian Biseriamminoidea of Zone 3 (see Fig. 2A).
Fig. 1.– *Septoglobivalvulina distensa* (WANG *in* ZHAO *et al*., 1981). Equatorial transverse section.
Figs. 2-4.– *Globivalvulina parascaphoidea* sp. nov. 2. Paratype. Subtransverse oblique section. 3. Paratype. Sagittal axial section. 4. Paratype. Transverse section.
Fig. 5.– *Retroseptellina globosa* (WANG *in* ZHAO *et al*., 1981). Subtransverse section.
Fig. 6.– *Globivalvulina kantharensis* REICHEL, 1946. Equatorial transverse section.
Figs. 7-10.– *Paraglobivalvulina mira* REITLINGER, 1965. 7. Subaxial section. 8. Transverse section. 9. Subtransverse section. 10. Oblique subaxial section.

PLATE 37. Late Changhsingian Biseriamminoidea of Laren section (Guangxi, South China).
Fig. 1.– *Globivalvulina kantharensis* (REICHEL, 1946). Subtransverse section. Sample L3.
Fig. 2.– *Septoglobivalvulina distensa* (WANG *in* ZHAO *et al*., 1981). Subtransverse section. Sample L3.
Fig. 3.– *Septoglobivalvulina* sp. 1. Transverse section. Sample L10.
Fig. 4.– *Retroseptellina nitida* (LIN, LI & SUN, 1990). Transverse section. Sample L10.
Fig. 5.– *Retroseptellina decrouezae* (KÖYLÜOGLU & ALTINER, 1989). Transverse section. Sample L3.
Figs. 6-8, 12-16.– *Paradagmaritopsis kobayashii* GAILLOT, VACHARD, GALFETTI & MARTINI (submitted-a). 6. Holotype. Equatorial transverse section. Sample L10. 7. Paratype. Sagittal subaxial section. Sample L3. 8. Sagittal subaxial section. Sample L6. 12. Sagittal section. Sample L10. 13. Transverse section. Sample L3. 14. Frontal subsagittal section. Sample L10. 15?. Frontal axial section of a possible another (larger) species. Sample L6. 16?. Transverse section of a possible thirth (larger coiled part) species. Sample L6.
Figs. 9, 10.– *Louisettita* sp. 2. 9. Sagittal axial section. 10 Frontal axial section. Sample L6
Figs. 11, 17.– *Paradagmarita* sp. indet. Two transverse sections. Sample L10.
Fig. 18.– *Dagmarita*? *sharezaensis* MOHTAT AGHAI & VACHARD, 2003. Frontal axial section. Sample L10.
Fig. 19.– *Dagmarita altilis* WANG *in* ZHAO *et al*., 1981. Sagittal axial section. Sample L3
Figs. 20-25.– *Louisettita ultima* GAILLOT, VACHARD, GALFETTI & MARTINI (submitted-a). 20. Holotype. Frontal subaxial oblique section. Sample L 10. 21. Paratype Tangential section. Note the wall finely porous in the two last chambers. Sample L10. 22. Paratype. Oblique section. Sample L6. 23. Paratype. Oblique section. Sample L10. 24. Paratype Oblique section. sample L6. 25. Paratype. Oblique section but showing the endoskeleton and the porous wall in penultimate and last chamber. Sample L10.

PLATE 38. Changhsingian Biseriamminoidea of Kuh-e Surmeh (Zone 1).
Figs. 1-9.– *Paradagmaritopsis kobayashii* GAILLOT, VACHARD, GALFETTI & MARTINI (submitted-a). 1. Paratype. Oblique section. 2. Paratype. Oblique section. 3. Paratype. Subtransverse section. 4. Paratype. Transverse section. 5. Paratype. Transverse section. 6. Paratype. Oblique section. 7. Paratype. Frontal subaxial section. 8. Paratype. Frontal axial section. 9. Paratype. Sagittal axial section. All from the same sample KeS-156.
Figs. 10, 11, 15, 16.– *Dagmarita chanackchiensis* REITLINGER, 1965. 10. Frontal axial section. Sample KeS-156. 11. Frontal axial section. Sample KeS-156 15. Frontal sagittal section. Sample KeS-161. 16. Sagittal axial section. Sample KeS-161.
Fig. 12, 17.– *Globivalvulina vonderschmitti* REICHEL, 1946. 12. Transverse section. Sample KeS-156. 17. Subaxial section. Sample KeS-162.
Fig. 13.– *Paradagmaritella brevispira* gen. nov. sp. nov. Paratype. Transverse section. Sample KeS-156
Fig. 14.– ? *Dagmarita altilis* WANG *in* ZHAO *et al*., 1981. Tangential section. Sample KeS-161.
Figs. 18, 19.– *Globivalvulina graeca* REICHEL, 1946. 18. Transverse section. Sample KeS-162. 19. Subtransverse section. Sample KeS-166.

PLATE 39. Changhsingian Biseriamminoidea of Kuh-e Surmeh (Zagros, southern Iran).
Fig. 1.– *Paradagmacrusta callosa* gen. nov. sp. nov. Paratype. Equatorial transverse section. Sample KeS-170.
Figs. 2, 3.– *Paradagmarita zaninettiae* sp. nov. 2. Paratype. Transverse section. Sample KeS-170. 3. Paratype. Equatorial transverse section. Sample KeS-170.
Figs. 4-8.– *Paraglobivalvulina mira* REITLINGER, 1965 4. Subtransverse section. Sample KeS-178. 5. Subtransverse section. Sample KeS-178. 6. Subtransverse section. Sample KeS-178. 7. Equatorial transverse section. Sample KeS-178. 8. Subaxial section. Sample KeS-178.
Fig. 9.– *Septoglobivalvulina* sp.1. Subtransverse section. Sample KeS-178.
Figs. 10, 11.– *Globivalvulina vonderschmitti* REICHEL, 1946. 10. Oblique section. Sample KeS-178. 11. Sagittal axial section. KeS-170.

PLATE 40. Lopingian Globivalvulinidae (Zone 3).
Fig. 1.– *Septoglobivalvulina distensa* (WANG *in* ZHAO *et al*., 1981). Sagittal axial section.
Fig. 2.– *Globivalvulina neglecta* sp. nov. Holotype. Equatorial transverse section.
Fig. 3.– *Retroseptellina decrouezae* (KÖYLÜOGLU & ALTINER, 1989). Transverse section.
Fig. 4.– *Retroseptellina globosa* (WANG *in* ZHAO *et al*., 1981). Transverse section (to compare with fig. 3).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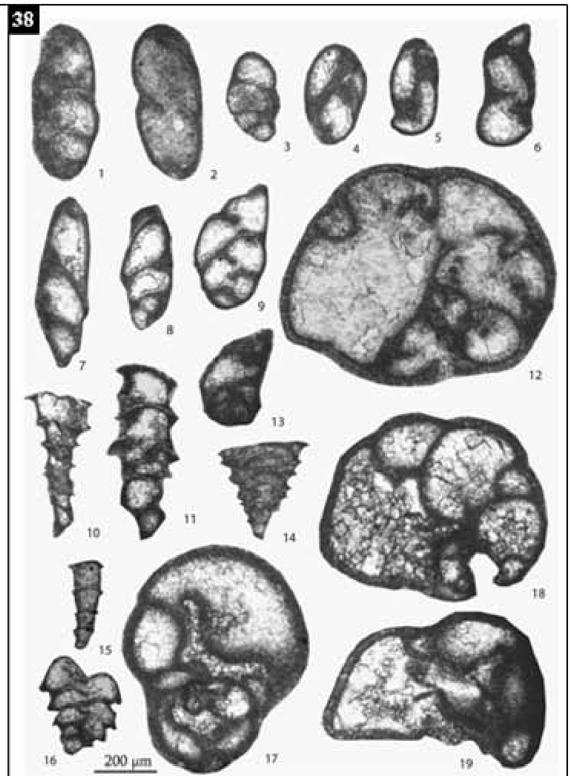
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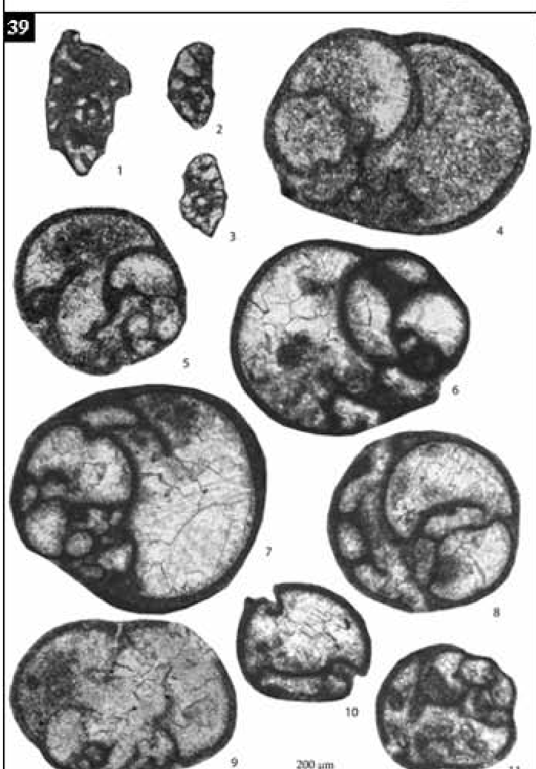
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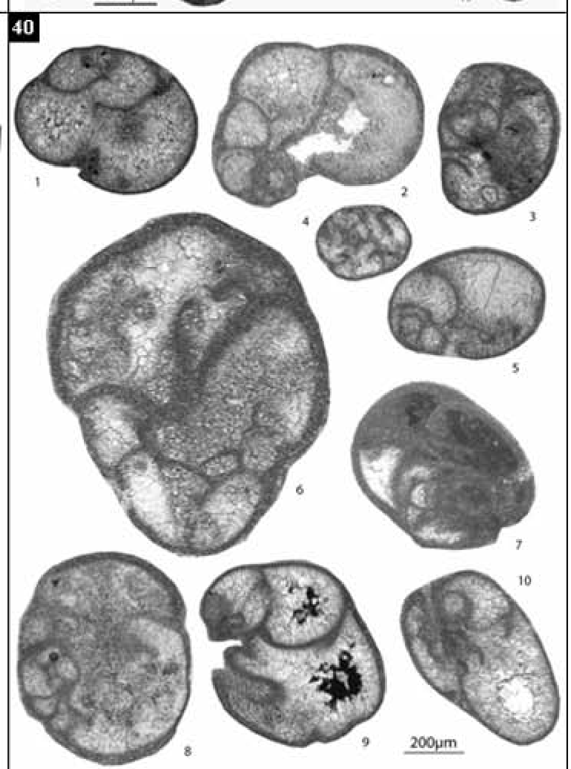

40
200µm

Fig. 5.– *Septoglobivalvulina distensa* (Wang *in* Zhao *et al*., 1981). Transverse section.
Figs. 6, 8.– *Globivalvulina vonderschmitti* Reichel, 1946. 6. Subaxial section. 8. Transverse section.
Fig. 7.– *Retroseptellina* cf. *nitida* (Lin, Li & Sun, 1990). Oblique section.
Figs. 9, 10.– *Globivalvulina* cf. *parascaphoidea* sp. nov. 9. Paratype. Subtransverse section. 10. Paratype. Oblique section.

PLATE 41. Lopingian Biseriamminoidea (Zone 2).
Fig. 1.– *Paradagmacrusta callosa* gen. nov. sp. nov. Paratype. Sagittal subaxial oblique section.
Figs. 2, 6, 7, 9-15.– *Paradagmarita monodi* Lys *in* Lys & Marcoux, 1978. 2. Sagittal subaxial oblique section. 6. Sagittal axial section. 7. Tangential section showing the punctuations. 8. Subtransverse section. 9. Sagittal axial section. 10. Sagittal, deformed, axial section. 11. Oblique section. 12. Subtransverse section with abundant punctuations. 13. Sagittal subaxial section. 14. Sagittal axial setion. 15. Oblique section.
Fig. 3.– *Paradagmarita planispiralis* sp. nov. Paratype. Equatorial transverse section.
Fig. 4.– *Globivalvulina vonderschmitti* Reichel, 1946. Oblique section.
Figs. 5, 8.– *Paradagmarita* cf. *planispiralis* sp. nov. 5. Paratype. Oblique section. 8. Paratype. Transverse section.

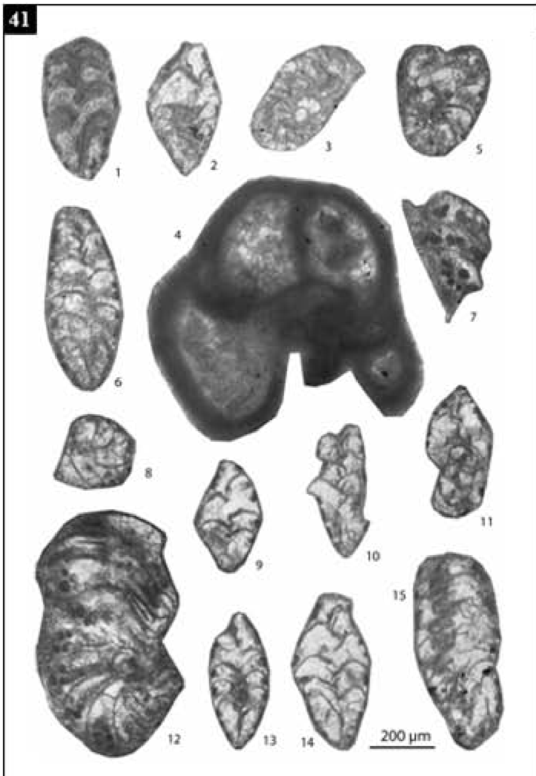
PLATE 42. Lopingian Biseriamminoidea of Zone 3 (see Fig. 2A).
Figs. 1, 2, 6-14.– *Paradagmaritopsis kobayashii* Gaillot, Vachard, Galfetti & Martini (submitted-a). 1. Paratype. Sagittal subaxial section. 2. Paratype. Oblique section. 6. Paratype. Sagittal subaxial oblique section. 7. Paratype. Sagittal subaxial section. 8. Paratype. Oblique section. 9. Paratype. Sagittal subaxial oblique section. 10. Paratype. Sagittal subaxial section. 11. Paratype. Oblique section. 12. Paratype. Sagittal subaxial oblique section. 13. Paratype. Frontal subaxial section. 14. Paratype. Oblique section.
Fig. 3.– *Paradagmaritella surmehensis* gen. nov. sp. nov. Paratype. Subtransverse section
Fig. 4.– *Paradagmaritella brevispira* gen. nov. sp. nov. Paratype. Subtransverse section
Fig. 5.– *Globivalvulina parascaphoidea* sp. nov. Holotype. Sagittal subaxial section
Fig. 15.– *Paradagmarita monodi* Lys *in* Lys & Marcoux, 1978. Equatorial transverse section.
Fig. 16.– *Paradagmacrusta callosa* gen. nov. sp. nov. Paratype. Oblique section.

PLATE 43. Lopingian *Charliella* (Zone 3).
Figs. 1-16.– *Charliella altineri* sp. nov. 1. Paratype. Oblique section. 2. Paratype. Oblique section. 3. Paratype. Sagittal subaxial section. 4. Paratype. Transverse section. 5. Paratype. Sagittal subaxial section. 6. Paratype. Subaxial oblique section. 7. Paratype. Axial section. 8. Paratype. Subtransverse section. 9. Paratype. Transverse section. 10. Paratype. Sagittal axial section. 11. Paratype. Sagittal subaxial section. 12. Holotype. Transverse section. 13. Paratype. Oblique subtransverse section. 14. Paratype. Sagittal axial section. 15. Paratype. Sagittal subaxial section. 16. Paratype. Oblique section.

PLATE 44. Lopingian *Charliella* (Zone 3).
Figs. 1-15.– *Charliella altineri* sp. nov. 1. Paratype. Oblique section. 2. Paratype. Transverse section. 3. Paratype. Subtransverse section. 4. Paratype. Subaxial section. 5. Paratype. Oblique section. 6. Paratype. Subtransverse oblique section. 7. Paratype. Subaxial section. 8. Paratype. Oblique section. 9. Paratype. Transverse section. 10. Paratype. Oblique section. 11. Paratype. Subtransversesection. 12. Paratype. Sagittal oblique section. 13. Paratype. Sagittal axial section. 14. Paratype. Subtransverse oblique section. 15. Paratype. Transverse section with large valvula.

PLATE 45. Changhsingian Biseriamminoidea of Kuh-e Surmeh (Zagros, southern Iran).
Fig. 1.– *Dagmarita altilis* Wang *in* Zhao *et al.*, 1981. Frontal axial section. Sample Kes-204.
Fig. 2.– *Paradagmarita monodi* Lys *in* Lys & Marcoux, 1978. Transverse section with punctated periphery. Sample Kes-205
Figs. 3, 5.– *Paradagmacrusta callosa* gen. nov. sp. nov. 3. Paratype. Subaxial section. Sample Kes-215. 5. Subtransverse section. Sample Kes-215.
Fig. 4.– *Dagmarita chanackchiensis* Reilinger, 1965. Frontal axial section (compare with fig. 1). Sample Kes-215.
Figs. 7, 8, 12.– *Paradagmarita* cf. *planispiralis* sp. nov.7. Paratype. Transverse section. Sample Kes-219. 8. Subtransverse section. Sample Kes-219. 12. Equatorial transverse section. Sample Kes-221.
Figs. 6, 9-11, 13-16.– *Labioglobivalvulina fortis* gen. nov. sp. nov. 6. Paratype. Transverse section. Sample Kes-218. 9. Paratype. Oblique section. Sample Kes-220. 10. Paratype. Transverse section. Sample Kes-220. 11. Paratype. Transverse section. Sample Kes-220. 13. Paratype. Transverse section. Sample Kes-222. 14. Paratype. Oblique subaxial section. Sample KeS-224. 15. Holotype showing the characteristic apertures. Sample KeS-224. 16. Paratype. Sagittal axial section. Sample KeS-224.

PLATE 46. Lopingian Biseriamminoidea (Zone 3).
Figs. 1-7.– *Dagmarita chanakchiensis* Reitlinger, 1965. 1. Sagittal axial section with irregular horns. 2. Sagittal axial section with regular thornlike projections. 3. Sagittal axial section of a juvenile specimen. 4. Frontal axial section. 5. Sagittal axial section. 7. Frontal axial section.
Figs. 8-16.– *Labiodagmarita vasleti* gen. nov. sp. nov. 8. Paratype. Sagittal axial section. 9. Paratype. Sagittal axial section. 10. Paratype. Frontal axial section. 11. Paratype. Sagittal axial section. 12. Paratype. Oblique section. 13. Paratype. Frontal axial sec-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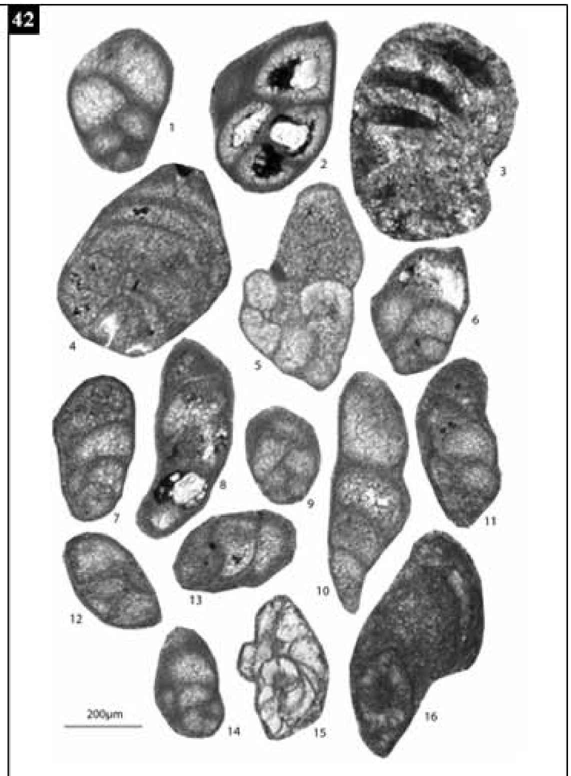
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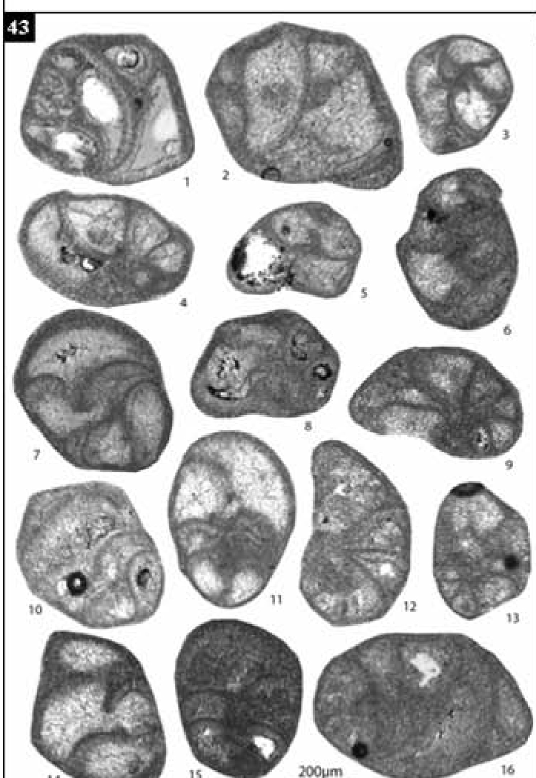
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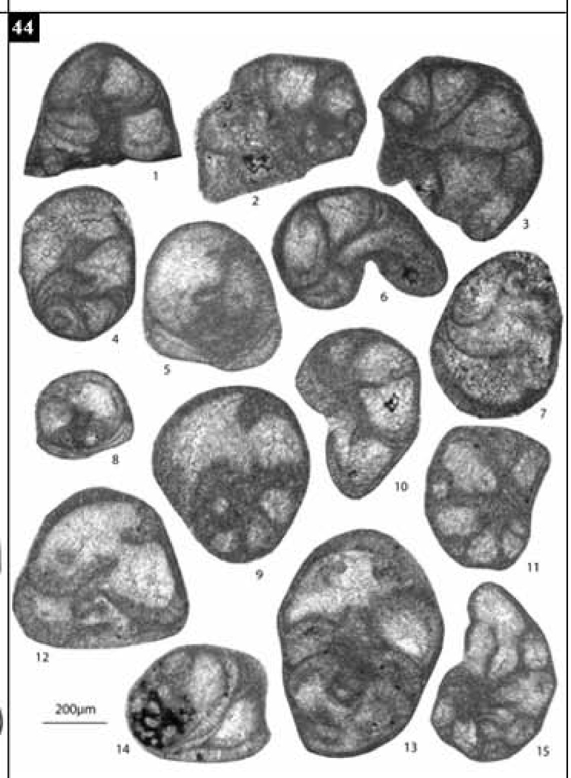

44
200µm

tion. 14. Paratype. Sagittal subaxial section. 15. Paratype. Frontal axial section. 16. Paratype. Frontal axial section.

PLATE 47. Lopingian Biseriamminoidea (Zone 3).
Figs. 1-11, 14-15.– *Louisettita elegantissima* ALTINER & BRÖNNIMANN, 1980. 1. Frontal subaxial oblique section. 2. Oblique section. 3. Oblique section. 4. Frontal subaxial section. 5. Frontal subaxial oblique section. 6. Frontal subaxial section. 7. Frontal subaxial oblique section. 8. Frontal subaxial section. 9. Frontal subaxial oblique section. 10. Sagittal axial section. 11. Sagittal subaxial oblique section. 14. Frontal axialsection. 15. Subtransverse oblique section.
Figs. 12, 13.– *Dagmarita altilis* WANG *in* ZHAO *et al*., 1981. Two oblique sections (to compare with *Louisettita*).

PLATE 48. Lopingian *Labiodagmarita* (Zone 3).
Figs. 1-14.– *Labiodagmarita vasleti* gen. nov. sp. nov. 1. Paratype. Frontal axial section. 2. Paratype Transverse section. 3. Paratype. Sagittal axial section. 4. Paratype. Abnormal sagittal axial section. 5. Paratype. Sagittal subaxial oblique section. 6. Holotype. Subaxial section. 7. Paratype. Frontal axial section. 8. Paratype. Sagittal subaxial oblique section. 9. Paratype. Oblique axial section. 10. Paratype. Sagittal axial section looking like a *Palaeotextularia*. 11. Paratype. Sagittal axial section. 12. Paratype. Frontal sagittal section. 13. Paratype. Frontal sagittal axial section. 14. Paratype. Frontal axial section through the apertures.

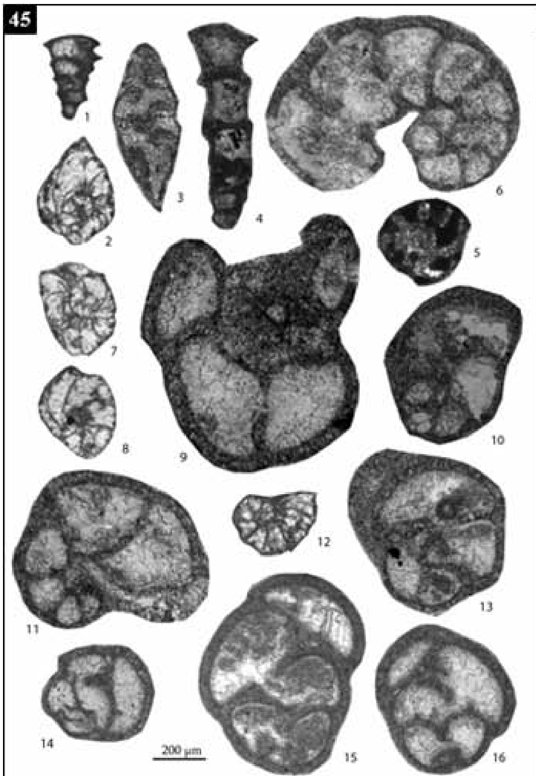
PLATE 49. Lopingian Biseriamminoidea (Zone 3).
Figs. 1, 2.– *Paradagmarita simplex* sp. nov. 1. Paratype. Sagittal axial section. 2. Paratype. Equatorial axial section.
Fig. 3.– *Globivalvulina* sp. Sagittal subaxial section.
Fig. 4.– *Paradagmaritella surmehensis* gen. nov. sp. nov. Paratype. Transverse section.
Figs. 5, 9-11, 16.– *Paradagmarita zaninettiae* sp. nov. 5. Paratype. Oblique subtransverse section. 9. Paratype. Sagittal subaxial, deformed, section. 10. Paratype. Sagittal axial section. 11.Paratype. Transverse section. 16?. Subtransverse oblique section.
Figs. 6-8, 15.– *Paradagmaritopsis kobayashii* GAILLOT, VACHARD, GALFETTI & MARTINI (submitted-a). 6. Paratype. Subtransverse section. 7. Paratype. Subtransverse section. 8. Paratype. Oblique section. 15. Paratype. Sagittal subaxial section.
Figs. 12-14.– *Paradagmaritella brevispira* gen. nov. sp. nov. Paratype. Sagittal axial section. 13. Paratype. Sagittal axial section. 14. Paratype. Sagittal subaxial oblique section.

PLATE 50. Lopingian Biseriamminoidea (Zone 3).
Figs. 1, 2.– *Paremiratella robusta* gen. nov. sp. nov. 1. Paratype. Oblique section. 2. Paratype. Subtransverse section.
Figs. 3, 8, 9, 11.– *Paradagmarita planispiralis* sp. nov. 3?. Sagittal axial section. 8. Paratype. Subtransverse section. 9. Paratype. Subtransverse, deformed, section. 11. Paratype. Subtransverse section.
Fig. 4.– *Paradagmaritella surmehensis* gen. nov. sp. nov. Paratype. Transverse section.
Fig. 5.– *Paradagmaritella brevispira* gen. nov. sp. nov. Paratype. Subtransverse section.
Figs. 6, 7, 10, 12, 13.– *Paradagmarita monodi* LYS *in* LYS & MARCOUX, 1978. 6. Equatorial transverse section. 7. Oblique section. 10. Sagittal axial section. 12. Subtransverse oblique section. 13. Sagittal subaxial oblique section.

PLATE 51. Changhsingian *Paradagmarita* of Hazro section (Taurus, Turkey).
Figs. 1-5, 7.– *Paradagmarita monodi* LYS *in* LYS & MARCOUX, 1978. 1. Subtransverse section. Sample HZ-91. 2. Transverse section. Sample HZ-91. 3. Sagittal subaxial oblique section. Sample HZ-91. 4. Sagittal axial section. Sample HZ-91. 5. Oblique section. Sample HZ-91. 7. Equatorial axial section. Sample HZ-92.
Figs. 6, 8-12.– *Paradagmarita planispiralis* sp. nov. 6. Paratype. Sagittal subaxial oblique section. Sample HZ-92. 8. Paratype. Subtransverse oblique section. Sample HZ-92. 9. Paratype. Subtransverse oblique section. Sample HZ-92. 10. Holotype. Transverse section. Sample HZ-92. 11. Paratype. Subtransverse oblique section. Sample HZ-92. 12. Paratype. Sagittal subaxial section. Sample HZ-92. 13. Paratype. Subtransverse oblique section. Sample HZ-92.

PLATE 52. Changhsingian Biseriamminoidea (Zone 3).
Figs. 1, 2, 7.– *Paradagmacrusta callosa* gen. nov. sp. nov. 1. Paratype. Sagittal subaxial section. 2. Oblique subaxial section. 7. Paratype. Subtransverse section.
Figs. 3, 4, 8-14.– *Paremiratella robusta* gen. nov. sp. nov. 3. Paratype. Equatorial transverse section. 4 Paratype. Subtransverse section, with the inner globivalvuline and the outer recrystallized and abraded part. 8. Paratype. Subtransverse section showing the pairs of chambers in the last whorl. 9. Paratype. Subtransverse section. 10. Paratype. Oblique subtransverse section. 11. Paratype. Subtransverse section. 12. Paratype. Subtransverse section. 13. Paratype. Sagittal subaxial section with the unique obvious Labion. 14. Paratype. Transverse section.
Fig. 5.– *Paradagmaritella* cf. *brevispira* gen. nov. sp. nov. Paratype. Transverse, circumcrusted section.
Fig. 6.– *Paradagmarita* cf. *monodi* LYS *in* Lys & Marcoux, 1978. Subtransverse section.

PLATE 53. Lopingian Miliolata of Zone 3 (see Fig. 2A).
Figs. 1, 7.– *Neodiscus milliloides* MIKLUKHO-MAKLAY, 1953. Two axial sections.
Figs. 2, 3.– *Calcivertella* sp. 2. Axial section. 3. Transverse section.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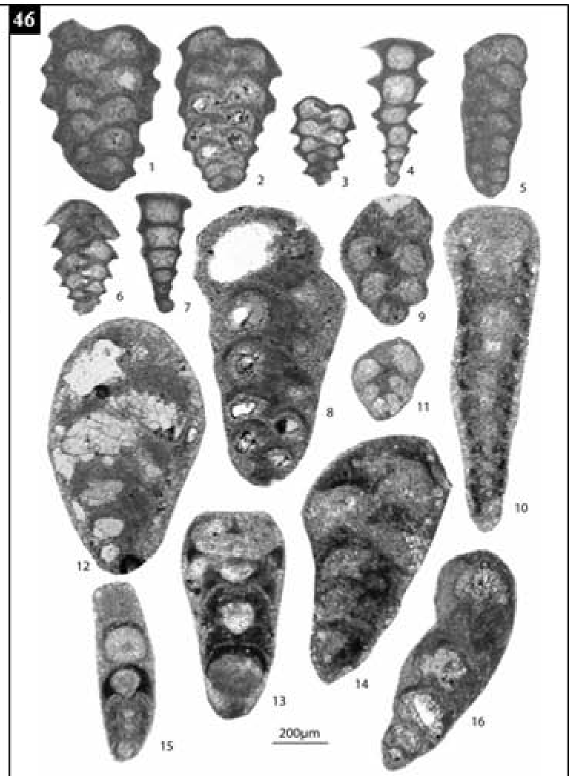
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200µm

Figs. 4-6.– *Hemigordius schlumbergeri* (HOWCHIN, 1895). Three axial sections.
Figs. 8, 12.– *Glomomidiellopsis uenoi* gen. nov. sp. nov. 8. Holotype. Axial section. 12. Paratype. Axial section strongly spartitized.
Fig. 9.– *Pilammina*? sp. Axial section.
Fig. 10.– *Neodiscopsis ambiguus* gen. nov. sp. nov. Paratype. Axial section.
Fig. 11.– *Agathammina pusilla* (GEINITZ, 1848). Axial section.
Figs. 13, 14.– *Cornuspira kinkelini* SPANDEL, 1898. Two axial sections.
Fig. 15.– *Hoyenella laxa* sp. nov. Paratype. Axial section.

PLATE 54. Lopingian Miliolata (Zone 3).
Fig. 1.– *Septagathammina splendens* sp. nov. Paratype. Axial section.
Fig. 2.– ? *Neodiscus milliloides* MIKLUKHO-MAKLAY, 1953. Axial section.
Figs. 3, 5, 8, 9.– *Crassispirella* sp. 3?. Axial section. 5. Subaxial section. 8. Subtransverse section. 9. Subaxial section.
Fig. 4.– *Hoyenella laxa* sp. nov. Paratype. Axial section.
Fig. 6.– *Glomomidiellopsis* cf. *lysitiformis* gen. nov. sp. nov. Paratype. Axial section.
Figs. 7, 10, 13.– *Multidiscus* sp. 7. Axial section. 10. Subtransverse section. 13. Axial section.
Fig. 11.– *Hemigordiellina* sp. Axial section.
Fig. 12.– *Calcivertella*? sp. Oblique section.
Figs. 14, 16.– *Crassiglomella guangxiensis* (LIN, 1978). 14. Axial setion. 16 Subaxial section.
Fig. 15.– *Glomomidiellopsis lysitiformis* gen. nov. sp. nov. Paratype. Subaxial section.
Fig. 17.– *Rectocornuspira kahlori* BRÖNNIMANN, ZANINETTI & BOZORGNIA, 1972. Microfacies with numerous sections.

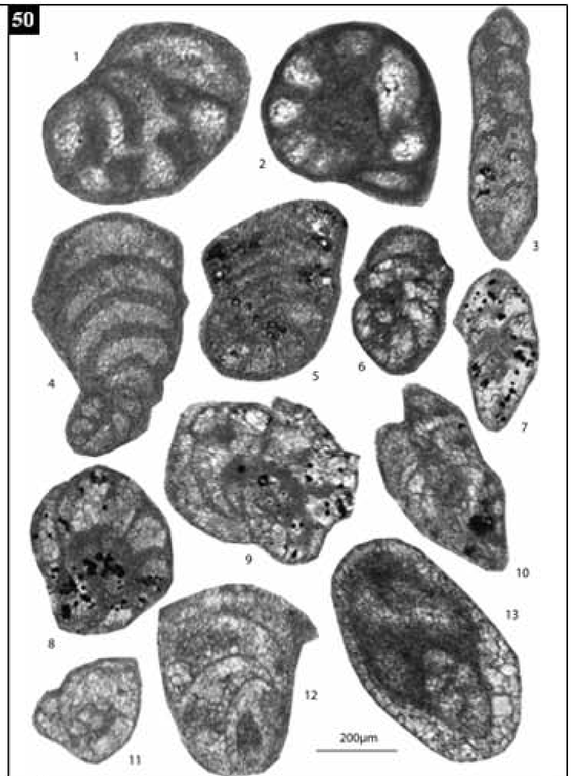
PLATE 55. Lopingian Miliolata (Zone 2).
Fig. 1.– *Neodiscopsis specialis* (LIN, LI & SUN, 1990). Axial section.
Figs. 2, 4.– *Midiella* sp. 2. Axial section. 4. Axial section.
Fig. 3.– *Crassispirella hughesi* gen. nov. sp. nov. Paratype. Axial section.
Fig. 5.– *Hoyenella* sp. Axial section.
Fig. 6.– *Agathammina ovata* Wang, 1976. Axial section.
Fig. 7.– *Calcivertella* sp. 1. Subtransverse section.
Figs. 8-10.– *Pseudoagathammina* sp. 3 subtransverse sections.
Fig. 11.– *Calcivertella* sp. 2. Subtransverse section.
Fig. 12.– *Neodiscopsis graecodisciformis* sp. nov. Paratype. Axial section.
Figs. 13-15.– *Glomomidiellopsis uenoi* gen. nov. sp. nov. 3 paratypes. Three axial sections.

PLATE 56. Changhsingian Miliolata of Hazro (Taurus, Turkey).
Figs. 1-2, 4-7, 12.– *Brunsispirella linae* (VACHARD & GAILLOT *in* VACHARD *et al.,* 2005). 1. Axial section. Sample HZ-35. 2. Oblique subaxial section. Sample HZ-35. 4. Oblique subaxial section. Sample HZ-35. 5. Subaxial section. Sample HZ-35. 6. Subaxial section. Sample HZ-35. 7. Subaxial section. Sample HZ-35. 12 Subaxial section. Sample HZ-47.
Fig. 3.– *Hoyenella laxa* sp. nov. Holotype. Axial section. Sample HZ-35.
Fig. 8.– *Hoyenella* ex gr. *hemigordiformis* (CHERDYNTSEV, 1914). Subaxial section. Sample HZ-44.
Fig. 9.– *Glomomidiellopsis uenoi* gen. nov. sp. nov. Paratype. Oblique, abraded section. Sample HZ-44.
Figs. 10, 11.– *Crassispirella hughesi* gen. nov. sp. nov. Holotype. Subaxial section. Sample HZ-47. 11?. Subaxial section. Sample HZ-47.
Fig. 13.– *Multidiscus* sp. 1. Axial section. Sample HZ-86 .
Fig. 14.– *Palaeonubecularia* ex gr. *fluxa* REITLINGER, 1950. Indefinite section. Sample HZ-69.
Figs. 15, 16.– *Neodiscus lianxanensis* HAO & LIN, 1982. Two axial sections. Sample HZ-86.
Fig. 17.– *Multidiscus* sp. 2. Axial section. Sample HZ-86.
Fig. 18.– *Multidiscus* sp. 3. Axial section. Sample HZ-86.

PLATE 57. Lopingian Miliolata of Kuh-e Surmeh (Zone 1).
Fig. 1.– *Palaeonubecularia iranica* sp. nov. Holotype. Indefinite section. Sample KeS-24.
Figs. 2-6.– *Pseudovermiporella sodalica* Elliott, 1958. 2. Transverse section. Recrystallized specimen looking like a dasycladale. Sample KeS-228. 3. Longitudinal section. Sample KeS-256. 4. Tangential section. Sample KeS-273. 5. Oblique section. Sample KeS-275. 6. Transverse section well preserved (compare with fig. 2). Sample KeS-275.

PLATE 58. Lopingian Miliolata (Zone 3).
Figs. 1, 2, 13.– *Glomomidiellopsis tieni* gen. nov. sp. nov. 1. Transverse section (transitional to *G. uenoi*). 3. Subaxial section. 13. Subaxial section.
Figs. 3, 5-8, 11, 12, 14.– *Neodiscopsis specialis* (LIN, LI & SUN, 1990). 3. Subaxial section with obvious glomus. 5. Subtransverse section. 6. Subaxial section. 7. Subaxial section. 8. Subaxial section. 11. Typical axial section. 12. Axial section. 14.


49
200µm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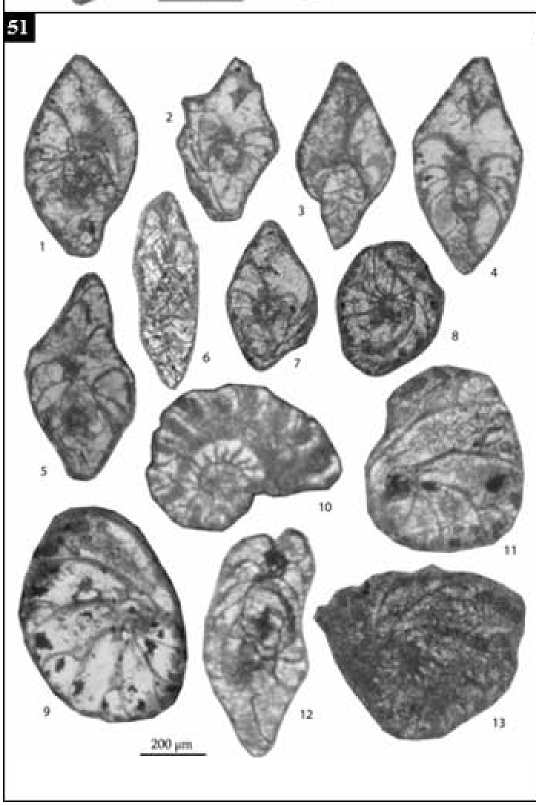
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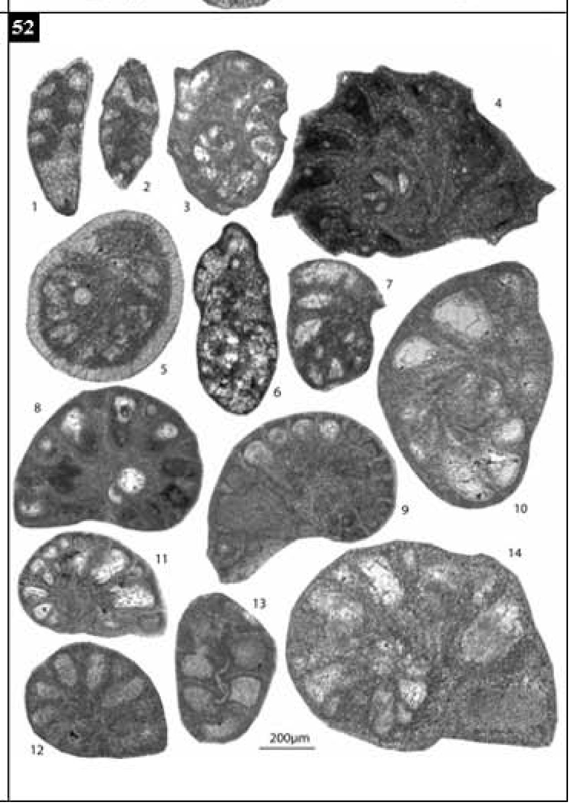
52
200µm

Subtransverse section.
Fig. 4.– *Glomomidiellopsis* sp. Axial section.
Fig. 9.– *Hoyenella laxa* sp. nov. Paratype. Axial section.
Fig. 10.– *Neodiscopsis graecodisciformis* sp. nov. Paratype. Axial section.
Fig. 15.– ? *Septagathammina splendens* sp. nov. Paratype. Axial section.
Fig. 16.– *Pseudovermiporella nipponica* (Endo *in* Endo & Kanuma, 1954). Oblique subaxial section.
Figs. 17-19.– *Crassispirella hughesi* gen. nov. sp. nov. 3 paratypes. Three subaxial sections.

PLATE 59. Lopingian Miliolata of Zone 3 (see Fig. 2A).
Figs. 1, 2, 5.– *Hoyenella hemigordiformis* (Cherdyntsev, 1914). 1. Axial section. 2. Transverse section. 5. Subaxial section.
Fig. 3.– *Neodiscopsis specialis* (Lin, Li & Sun, 1990). Subaxial section.
Fig. 4.– *Pseudovermiporella nipponica* (Endo *in* Endo & Kanuma, 1954). Oblique subaxial section.
Figs. 6, 11, 17, 21.– *Neodiscopsis graecodisciformis* sp. nov. 6. Paratype. Axial section. 11. Paratype. Subaxial section. 17. Paratype. Subaxial section. 21. Paratype. Axial section.
Figs. 7-10, 12.– *Crassispirella hughesi* gen. nov. sp. nov. 7. Paratype. Axial section. 8. Paratype. Transverse section. 9. Paratype. Axial section. 10. Paratype. Axial section. 12. Paratype. Subaxial section.
Figs. 13, 16.– *Multidiscus* sp. 13. Transverse section. 16. Subaxial section.
Fig. 14.– *Agathammina* sp. Subtransverse section.
Fig. 15.– ? *Hemigordius schlumbergeri* (Howchin, 1895). Axial section.
Figs. 18, 20.– *Midiella broennimanni* (Altiner, 1978). Two subaxial sections.
Fig. 19.– *Pseudovermiporella nipponica* (Endo *in* Endo & Kanuma, 1954).

PLATE 60. Lopingian Miliolata (Zone 3).
Fig. 1.– *Brunsispirella linae* (Vachard & Gaillot *in* Vachard *et al.*, 2005).
Figs. 2-6.– *Hoyenella hemigordiformis* (Cherdyntsev, 1914). 2, 4-6. Four subaxial sections. 3. Axial section.
Figs. 7, 12.– *Cornuspira kinkelini* Spandel, 1898. 7. Transverse section. 12. Axial section.
Fig. 8.– *Neodiscopsis graecodisciformis* gen. nov. sp. nov. Paratype. Axial section.
Figs. 9-11, 14, 16, 18.– *Neodiscopsis specialis* (Lin, Li & Sun, 1990). 9. Typical axial section. 10 Oblique subaxial section. 11 Subaxial section (transitional? to *Kamurana*). 14. Axial section. 16. Paratype. Subaxial, juvenile section. 18. Axial section. Paratype.
Fig. 13.– *Septagathammina splendens* sp. nov. Paratype. Axial section. Note the ovoid proloculus and the pseudo-septa.
Figs. 15, 17.– *Arenovidalina* sp. Two subaxial sections.

PLATE 61. Lopingian Miliolata (Zone 4).
Figs. 1-6, 12-14, 17.– *Hoyenella* sp. Various sections.
Fig. 7.– *Cornuspira kinkelini* Spandel, 1898. Axial section.
Fig. 8.– *Neodiscopsis specialis* (Lin, Li & Sun, 1990). Axial section.
Fig. 9.– *Neodiscopsis graecodisciformis* gen. nov. sp. nov. Paratype. Axial section.
Figs. 10, 11.– *Glomomidiellopsis uenoi* gen. nov. sp. nov. Two paratypes. Two axial sections.
Fig. 15.– *Neodiscus* sp. Axial section.
Figs. 16, 18.– *Crassispirella* sp. 16. Oblique subtransverse section. 18. Subaxial section.
Figs. 19-22.– ? *Hemigordius baoquingensis* Wang *in* Zhao *et al*., 1981 19. Subaxial section. 20. Subaxial section. 21. Oblique subtransverse section. 22. Axial section.
Figs. 23-24.– *Glomomidiellopsis lysitiformis* gen. nov. sp. nov. 23. Paratype. Subaxial section. 24. Paratype. Subtransverse section

PLATE 62. Lopingian Miliolata of Kuh-e Surmeh (Zone 1).
Figs. 1-8, 11, 13-17, 18, 19.– *Midiella* aff. *quinglongensis* (Wang, 1976). 1. Transverse section. Sample KeS-252. 2. Axial section. Sample KeS-253. 3. Subaxial section. Sample KeS-253. 4. Axial section. Sample KeS-253. 5. Subtransverse ection. Sample KeS-254. 6. Axial section. Sample KeS-255.7. Axial section. Sample KeS-255. 8. Axial section. Sample KeS-256.11. Subaxial section. Sample KeS-256. 13. Axial section. Sample KeS-260. 14. Axial section. Sample KeS-260. 15. Axial section. Sample KeS-260. 16. Subtransverse section. Sample KeS-260. 17. Axial section. Sample KeS-267. 18?. Axial section. Sample KeS-267. 19? Axial section. Sample KeS-267.
Figs. 9, 20.– *Midiella* sp. 9. Axial section. 20. Transverse section. Sample KeS-267
Figs. 10, 21.– *Hemigordius* sp. 10. Axial section. Sample KeS-256. 21. Subaxial section. Sample KeS-276A.
Fig. 12.– *Glomomidiellopsis tieni* gen. nov. sp. nov. Paratype. Axial section. Sample KeS-260
Figs. 22, 23.– *Hoyenella*? sp. Two axial sections. Sample KeS-281.
Figs. 24-27.– *Rectocornuspira kahlori* Brönnimann, Zaninetti & Bozorgnia, 1972. 24. Transverse section. Sample KeS-283. 25. Axial section. Sample KeS-284. 26. Transverse section. Sample KeS-284. 27. Various sections in microfacies. Sample KeS-284.

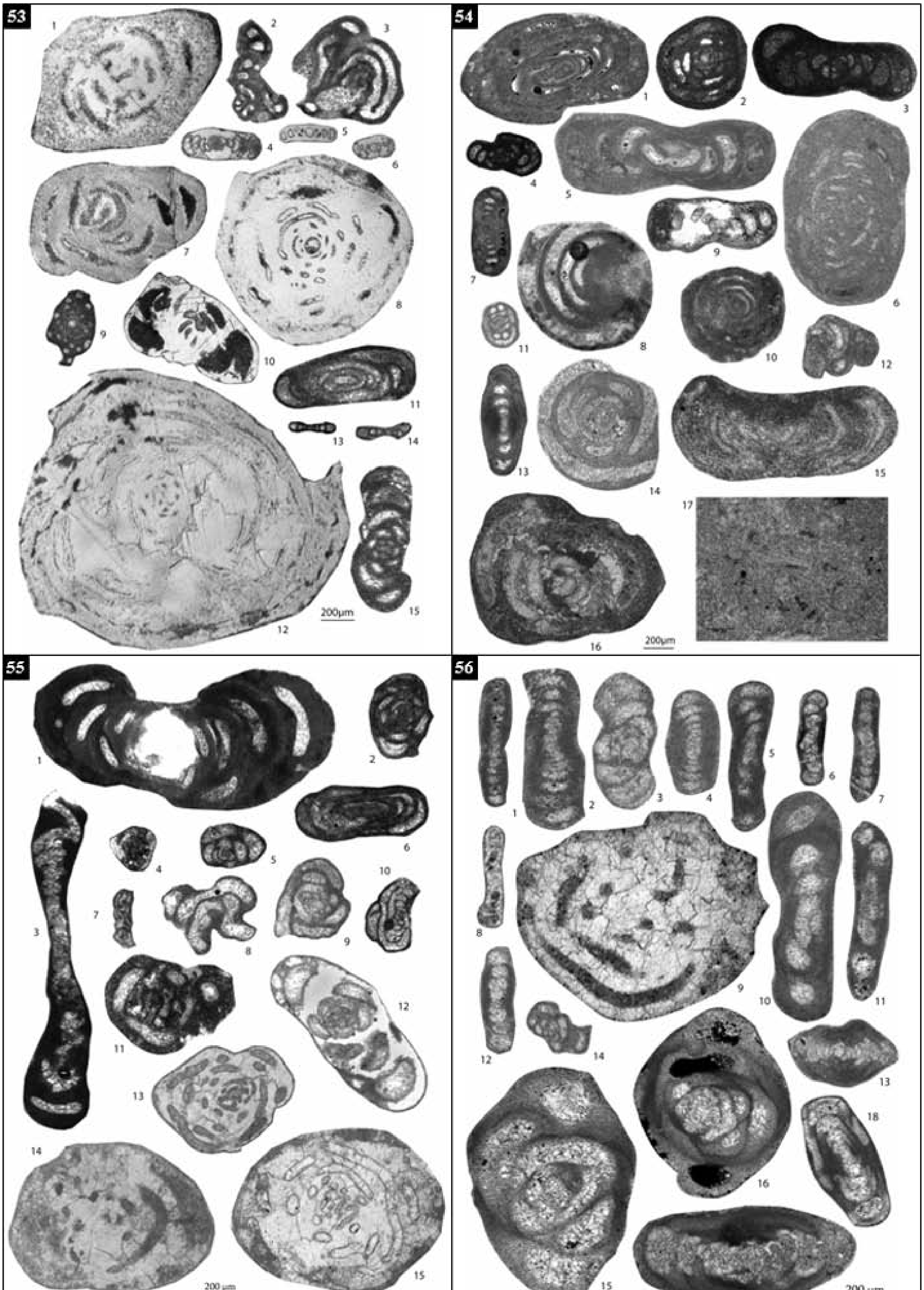
53
54
55
56
200µm
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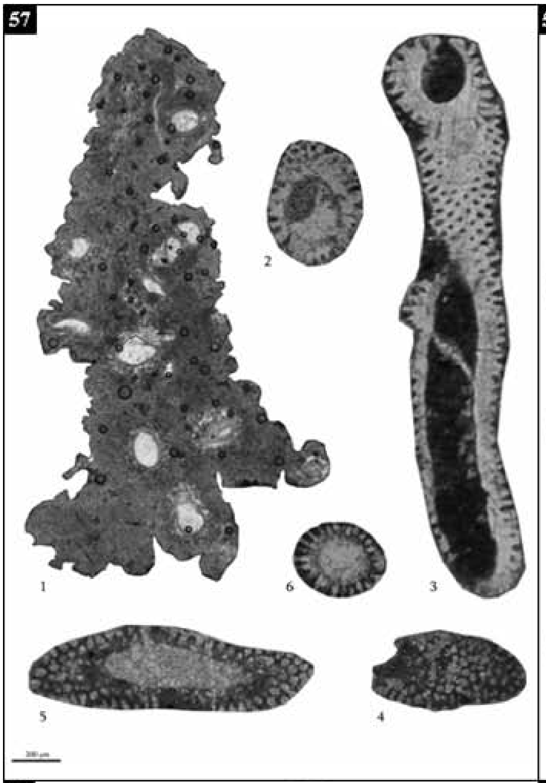
PLATE 63. Lopingian Miliolata and Nodosariata (Zone 2).
Figs. 1-3, 10.– *Hoyenella* sp. 1-2. Two subaxial sections. 3. Oblique subtransverse section. 10. Axial section.
Figs. 4-8.– *Hemigordiellina regularis* (Lipina, 1949). Various oblique sections.
Fig. 9.– *Crassispirella* sp. Subaxial section.
Fig. 11.– *Hoyenella* cf. *hemigordiformis* (Cherdyntsev, 1914). Subaxial section.
Fig. 12.– *Midiella* aff. *quinglongensis* (K. Wang, 1976). Subtransverse section.
Fig. 13.– *Ichthyofrondina* sp. Sagittal subaxial section.
Fig. 14.– *Nodosinelloides* sp. 1. Subaxial section.
Fig. 15.– *Geinitzina* sp. Subaxial section.
Fig. 16.– *Nodosinelloides* sp. 2. Subaxial section.
Fig. 17.– *Pachyphloia* sp. Oblique section.
Fig. 18.– *Frondinodosaria*? sp. Frontal axial section.
Fig. 19.– ? *Nodosinelloides mirabilis caucasica* (Miklukho-Maklay, 1954). Axial section.
Fig. 20.– *Geinitzina postcarbonica* Spandel, 1901. Axial section.
Fig. 21.– *Ichthyofrondina* sp. Transverse section.
Figs. 22, 23.– *Pachyphloia schwageri* Sellier de Civrieux & Dessauvagie, 1965. 22. Frontal subaxial section. 23. Frontal axial section.
Figs. 24, 28.– *Pachyphloia* sp. 24. Frontal axial section. 28. Frontal axial section.
Figs. 25, 26.– *Colaniella* sp. 25. Axial section. 26. Subaxial section.
Fig. 27.– *Rectostipulina quadrata* Jenny-Deshusses, 1985. Transverse section.
Fig. 29.– *Ichthyofrondina* sp. Oblique subtransverse section.

PLATE 64. Lopingian Miliolata of Kuh-e Dena (Zone 1).
Fig. 1.– *Hoyenella* ex gr. *hemigordiformis* (Cherdyntsev, 1914). Subaxial section. Sample DN-51
Figs. 2, 4, 10.– *Glomomidiellopsis tieni* gen. nov. sp. nov. 2. Paratype. Subtransverse section. Sample DN-87. 4. Paratype. Subaxial section. Sample DN-95. 10?. Subaxial section. Sample DN-122
Figs. 3, 5, 6, 12.– *Neodiscopsis ambiguus* gen. nov. sp. nov. 3. Paratype. Subtransverse section. Sample DN-95. 5. Paratype. Subaxial section. Sample DN-98. 6. Paratype. Transverse section. Sample DN-109. 12. Paratype. Axial section. Sample DN-148.
Figs. 7-9.– *Neodiscopsis graecodisciformis* gen. nov. sp. nov. 7. Paratype. Subtransverse section. Sample DN-110. 8. Paratype. Subaxial section. Sample DN-121. 9. Paratype. Oblique section. Sample DN-121.
Figs. 11, 13.– *Hoyenella* cf. *laxa* sp. nov. 11. Paratype. Subaxial section. Sample DN-125. 13. Paratype. Subaxial section. Sample DN-151.

PLATE 65. Lopingian Miliolata of Kuh-e Surmeh (Zone 1).
Figs. 1-6, 11, 13, 15.– *Glomomidiellopsis tieni* gen. nov. sp. nov. 1. Paratype. Indefinite section. Sample KeS-88. 2. Paratype. Indefinite section. Sample KeS-90. 3. Paratype. Indefinite section. Sample KeS-90. 4. Paratype. Indefinite section. Sample KeS-90. 5. Paratype. Indefinite section. Sample KeS-90. 6. Paratype. Indefinite section. Sample KeS-90. 11. Paratype. Indefinite section. Sample KeS-92. 13. Paratype. Indefinite section. Sample KeS-92. 15. Paratype. Indefinite section. Sample KeS-92.
Fig. 7.– *Midiella* sp. Indefinite section. Sample KeS-91.
Fig. 8.– *Agathammina* sp. Axial section. Sample KeS-92.
Figs. 9, 12, 14.– *Midiella ovata* (Grozdilova, 1956). 9. Axial section. Sample KeS-92. 12. Subaxial section. Sample KeS-92. 14. Subaxial section. Sample KeS-92.
Fig. 16.– *Hoyenella laxa* sp. nov. Paratype. Subaxial section. Sample KeS-127.

PLATE 66. Lopingian Miliolata (Zone 3).
Figs. 1, 2, 8, 10, 15.– *Neodiscopsis graecodisciformis* sp. nov. 1. Paratype. Subaxial section. 2. Paratype. Subaxial section. 8. Paratype. Axial section. 10. Subaxial section. 15. Axial section.
Figs. 3, 7.– *Multidiscus* sp. 3. Subaxial section. 7. Axial section.
Figs. 4-6, 9, 11-12, 16.– *Neodiscopsis specialis* (Lin, Li & Sun, 1990). 4. Axial section. 5. Subtransverse section. 6. Subaxial section. 11. Axial section. 12. Subaxial section. 16. Subaxial section.
Fig. 13.– *Multidiscus arpaensis* (Pronina, 1988b). Axial section.
Fig. 14.– *Agathammina pusilla* (Geinitz, 1848). Axial section.
Figs. 17, 18.– *Crassispirella hughesi* gen. nov. sp. nov. 17. Paratype. Axial section.18. Paratype. Subaxial section.
Fig. 19.– *Midiella broennimanni* (Altiner, 1978). Axial section.

PLATE 67. Lopingian Miliolata of Kuh-e Surmeh (Zone 1).
Fig. 1.– *Agathammina rosella* Pronina, 1988b . Axial section. Sample KeS-156
Fig. 2.– *Midiella* ex gr. *zaninettiae* (Altiner, 1978). Axial section. Sample KeS-162
Figs. 3, 4, 9-11, 13, 16.– *Midiella* sp. 1-2. Two axial sections. Sample KeS-177. 9-10. Two subaxial sections. Sample KeS-186. 11, 13, 16. Three axial sections. Sample KeS-186.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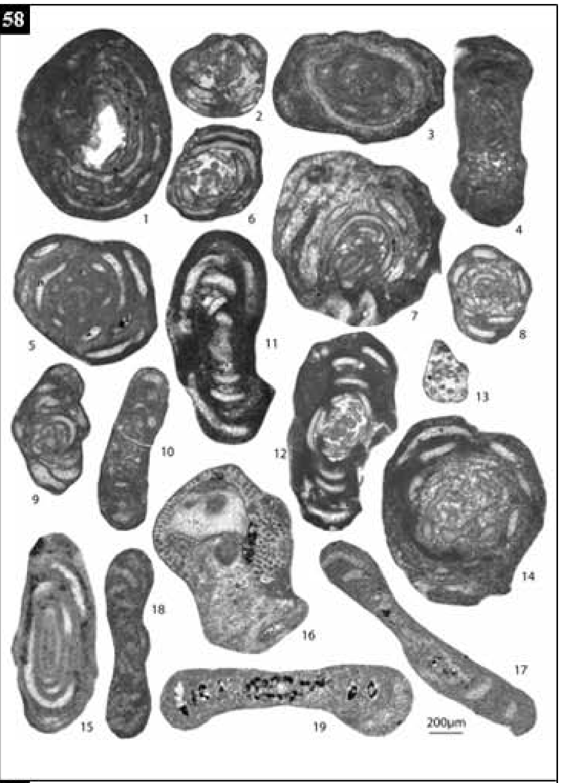
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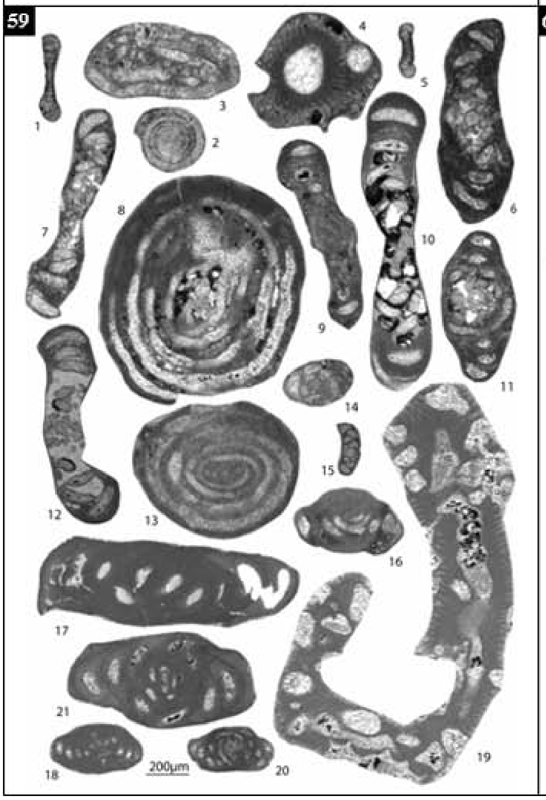
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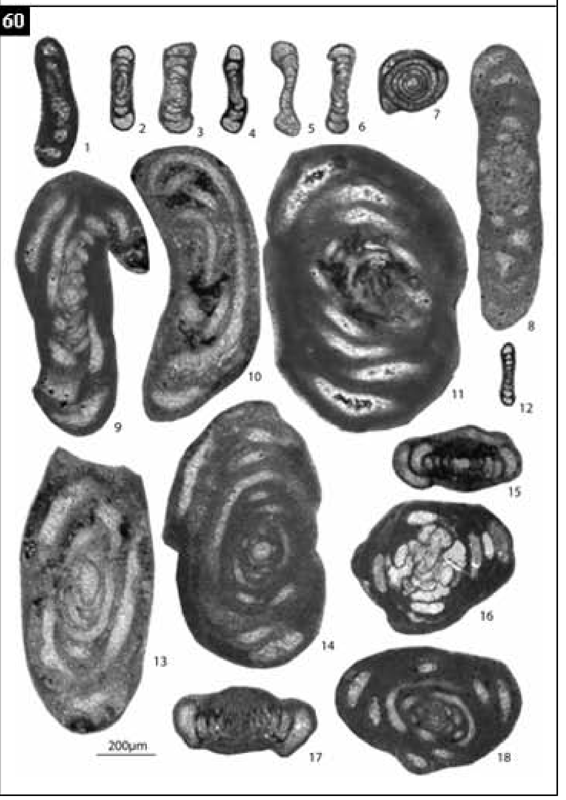
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200µm

Fig.s 5, 8, 25.– *Midiella ovata* (Grozdilova, 1956). 5. Subaxial section. Sample KeS-177. 8. Axial section. Sample KeS-186. 25. Subtransverse section. Sample KeS-187.
Fig. 6.– *Agathammina ovata* K. Wang, 1976. Axial section. Sample KeS-186.
Figs. 7, 24.– *Hemigordius longus* Grozdilova, 1956. 7? Subaxial section. Sample KeS-186. 24. Axial section. Sample KeS-187.
Figs. 12, 17-18, 22-23.– *Multidiscus* sp. 12, 17-18. Three subaxial sections. Sample KeS-186. 22-23. Two subaxial sections. Sample KeS-187.
Figs. 14, 15, 19, 20.– *Glomomidiellopsis tieni* gen. nov. sp. nov. 14. Paratype. Subaxial section. Sample KeS-186. 15. Paratype. Subaxial section. Sample KeS-186. 19. Paratype. Subaxial section. Sample KeS-186. 20. Paratype. Subaxial section. Sample KeS-186.
Fig. 21.– *Glomomidiellopsis uenoi* gen. nov. sp. nov. Paratype. Subaxial section. Sample KeS-186.

PLATE 68. Lopingian Miliolata of Zone 3 (see Fig. 2A).
Figs. 1, 2.– *Hemigordius baoquingensis* Wang *in* Zhao *et al*., 1981. 1. Axial section. 2 Transverse section.
Fig. 3.– *Septigordius* sp. Equatorial transverse section.
Figs. 4, 5.– *Neodiscopsis graecodisciformis* gen. nov. sp. nov. 4. Paratype. Transverse section.
Fig. 5. Paratype. Axial section.
Figs. 6, 9, 10, 13, 15-17, 20.– *Brunsispirella linae* (Vachard & Gaillot, 2005). 6. Oblique subaxial section. 9. Subaxial section. 10. Axial section. 13. Axial section. 15-17. Three subaxial sections. 20. Subtransverse section.
Figs. 7, 8, 11, 12, 18, 19.– *Crassispirella hughesi* gen. nov. sp. nov. 7. Paratype. Subaxial section. 8. Paratype. Axial section. 11. Paratype. Axial section. 12. Paratype. Axial section. 14. Paratype. Subaxial section. 18. Paratype. Axial section. 19. Paratype.Subtransverse section.

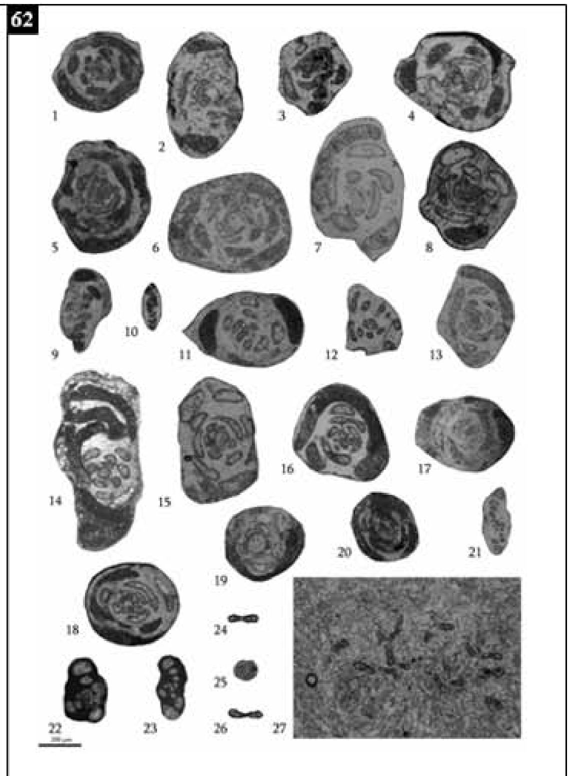
PLATE 69. Lopingian Miliolata (Zone 3).
Figs. 1, 2.– *Neodiscopsis graecodisciformis* sp. nov. 1. Paratype. Transverse section. 2. Paratype. Axial section. Sample OF-6.
Figs. 3, 6.– *Neodiscopsis specialis* (Lin, Li & Sun, 1990). 3. Axial section. Sample OF-6. 6?. Subaxial section. Sample OF-5.
Fig. 4.– *Crassispirella hughesi* gen. nov. sp. nov. Paratype. Axial section. Sample OF-6.
Fig. 5.– *Midiella* ex gr. *zaninettiae* (Altiner, 1978). Axial section. Sample OF-5.
Fig. 7.– *Crassispirella* sp. Axial section of a juvenile specimen. Sample OF-5.

PLATE 70. Lopingian Miliolata of Kuh-e Dena (Zone 1).
Fig. 1.– *Midiella* aff. *quinglongensis* (K. Wang, 1976). Transverse section. Sample DN-151.
Fig. 2.– *Neodiscopsis specialis* (Lin, Li & Sun, 1990). Subaxial section. Sample DN-151.
Figs. 3, 8.– *Agathammina* sp. Axial section. Sample DN-152. 8. Subaxial section. Sample DN-302.
Fig. 4.– *Arenovidalina* sp. Subaxial section. Sample DN-223.
Figs. 5-7, 9, 10.– *Glomomidiellopsis uenoi* gen. nov. sp. nov. 5. Paratype. Subaxial section. Sample DN-289. 6. Paratype. Subaxial section. Sample DN-298. 7. Paratype. Subaxial section. Sample DN-298. 9. Paratype. Subaxial section. Sample DN-302. 10. Paratype. Subaxial section. Sample DN-303.

PLATE 71. Lopingian Miliolata (Zone 3).
Fig. 1.– *Septagathammina splendens* sp. nov. Holotype. Axial section.
Fig. 2.– *Crassispirella hughesi*? sp. nov. Subtransverse section.
Figs. 3, 5, 9, 10.– *Glomomidiellopsis uenoi* gen. nov. sp. nov. Paratype. Axial section. 5. Paratype. Axial section. 9. Paratype. Axial section. 10. Paratype. Axial section.
Fig. 4.– *Midiella broennimanni* (Altiner, 1978). Axial section.
Fig. 6.– *Multidiscus arpaensis* (Pronina, 1988b). Axial section.
Figs. 7, 8.– ? *Neodiscus milliloides* Miklukho-Maklay, 1953. 7. Axial section. 8. Subaxial section.

PLATE 72. Midian Nodosariata of Hazro (Taurus, Turkey)
Fig. 1.– *Geinitzina* aff. *lingulaeformis* Lipina, 1949. Sagittal axial section. Sample HZ-03.
Fig. 2.– *Pachyphloia pedicula* Lange, 1925. Frontal axial section. Sample HZ-05.
Fig. 3.– *Cryptomorphina hazroensis* sp. nov. Holotype. Frontal axial section. Sample HZ-09.
Fig. 4.– *Frondinodosaria* aff. *semivelata* (Cherdyntsev, 1914). Frontal axial section. Sample HZ-09.
Fig. 5.– *Pachyphloia ovata* Lange, 1925. Frontal axial section. Sample HZ-09.
Fig. 6.– *Tauridia* sp. 1. Axial section. Sample HZ-10.
Figs. 7-11.– *Rectostipulina syzranaeformis* sp. nov. 7. Holotype. Subaxial section. Sample HZ-11. 8. Paratype. Axial section. Sample HZ-11. 9. Paratype. Transverse section. Sample HZ-11. 10. Paratype. Transverse section. Sample HZ-11. 11. Paratype. Transverse section. Sample HZ-11.
Fig. 12.– *Pseudolangella* cf. *conica* (Miklukho-Maklay, 1954). Sagittal axial section. Sample HZ-13.
Fig. 13.– *Eocristellaria* aff. *quasisimplex* Lin, Li & Sun, 1990. Transverse section. Sample HZ-14.
Fig. 14.– *Pachyphloia schwageri* Sellier de Civrieux & Dessauvagie, 1965. 14. Frontal axial section. Sample HZ-14.


61
200µm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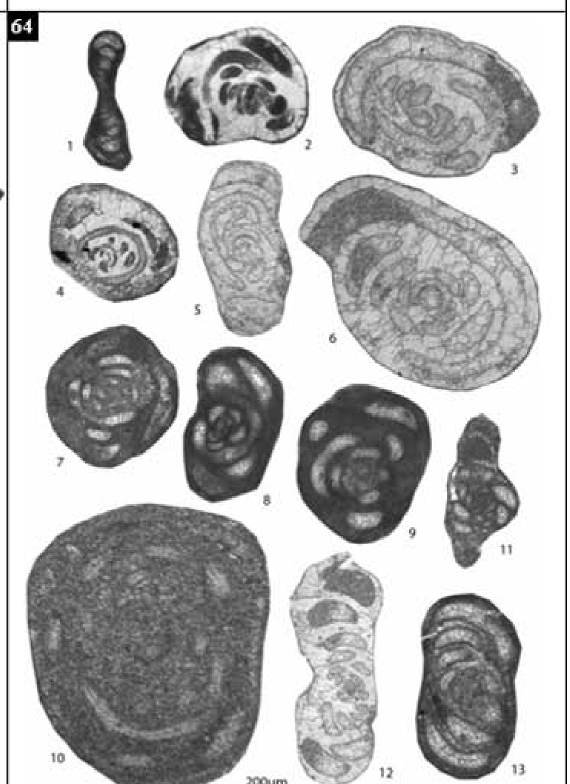
63
200 µm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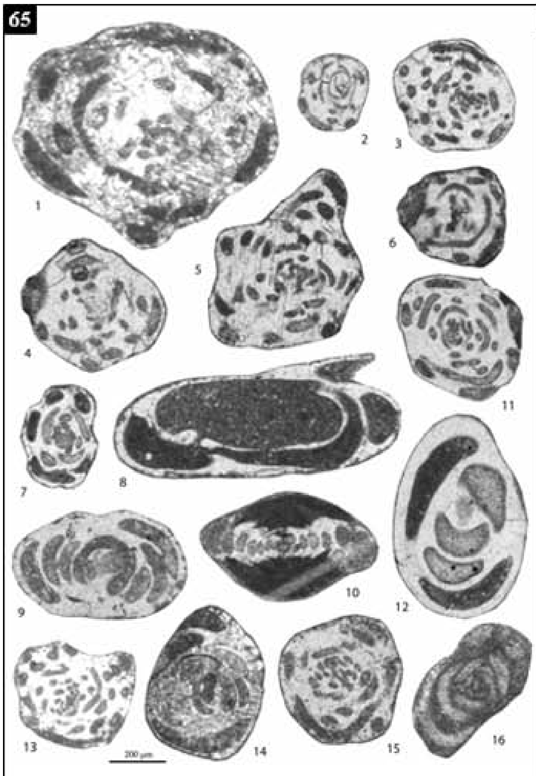
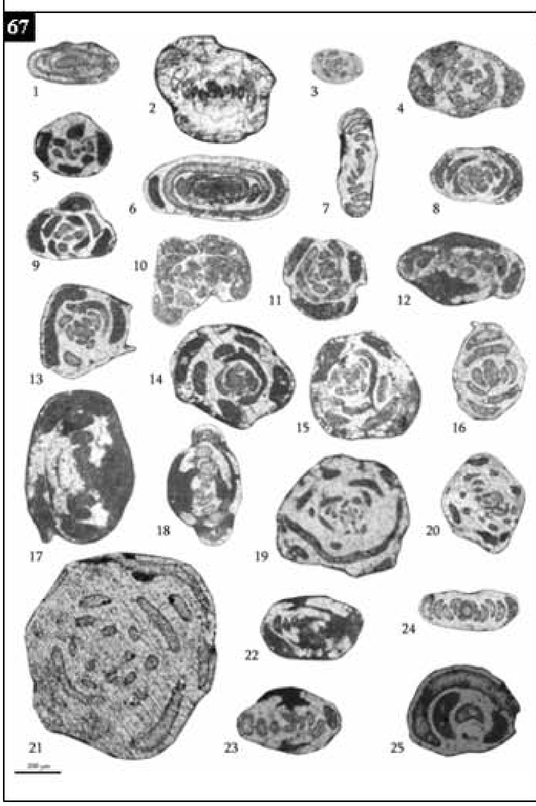
Figs. 15, 22, 26, 29, 30.– *Polarisella* sp. 15. Sagittal axial section. Sample HZ-14. 22. Frontal axial section. Sample HZ-21. 26. Oblique section. Sample HZ-26. 29. Frontal axial section. Sample HZ-33. 30. Frontal axial section. Sample HZ-33.
Fig. 16.– *Nodoinvolutaria*? sp. Frontal axial section. Sample HZ-14.
Fig. 17.– *Nodosinelloides mirabilis caucasica* (Miklukho-Maklay, 1954) (juvenile). Axial section. Sample HZ-16.
Fig. 18.– *Nestellorella dorashamensis* (Pronina, 1989). Axial section. Sample HZ-16ter.
Fig. 19.– *Tauridia* sp. 3. Subxial section. Sample HZ-16ter.
Fig. 20.– *Ichthyofrondina latilimbata* Sellier de Civrieux & Dessauvagie, 1965. Subtranverse section. Sample HZ-16bis.
Fig. 21.– *Pachyphloides*? sp. Sagittal axial section. Sample HZ-16bis.
Fig. 23.– *Pachyphloia ovata* Lange, 1925 . Frontal axial section. Sample HZ-25.
Fig. 24.– *Robustopachyphloia* sp. Sagittal axial section. Sample HZ-26.
Fig. 25.– *Tauridia*? sp. Axial section. Sample HZ-26.
Fig. 27.– *Calvezina ottomana* Sellier de Civrieux & Dessauvagie, 1965. Frontal axial section. Sample HZ-28.
Fig. 28.– *Geinitzina postcarbonica* Spandel, 1901. Sagittal axial section. Sample HZ-28.

PLATE 73.– Lopingian Nodosariata of Kuh-e Surmeh (Zone 1).
Figs. 1, 2.– *Pseudolangella* cf. *imbecilla* (Lin, Li & Sun, 1990) Two subaxial sections. Sample KeS-89.
Fig. 3.– *Pachyphloia* cf. *robusta* Miklukho-Maclay, 1954. Transverse section. Sample KeS-91.
Figs. 4, 8.– *Pachyphloia ovata* Lange, 1925. 4. Frontal axial section. Sample KeS-91. 8. Sagittal frontal section. Sample KeS-92.
Fig. 5.– *Robuloides lens* Reichel, 1946. Axial section. Sample KeS-91.
Fig. 6.– *Ichthyofrondina palmata* (Wang, 1974). Subaxial section. Sample KeS-91.
Fig. 7.– *Pachyphloia schwageri* Sellier de Civrieux & Dessauvagie, 1965. Sagittal axial section. Sample KeS-92.
Fig. 9.– *Pachyphloia pedicula* Lange, 1925. Frontal axial section. Sample KeS-92.
Fig. 10.– *Pseudolangella fragilis* Sellier de Civrieux & Dessauvagie, 1965. Subaxial section. Sample KeS-93.
Fig. 11.– *Nodosinelloides* ex gr. *shikhanica* (Lipina, 1949). Sample KeS-93
Figs. 12, 13.– *Colaniella* aff. *minuta* Okimura, 1988. Two sagittal axial sections. Sample KeS-106.
Fig. 14.– *Nodosinelloides* sp. Axial section. Sample KeS-122.
Fig. 15.– *Robuloides* sp. Axial section. Sample KeS-153.
Fig. 16.– *Ichthyofrondina latilimbata* Sellier de Civrieux & Dessauvagie, 1965. Subaxial section. Sample KeS-153.
Fig. 17.– *Rectostipulina quadrata* Jenny-Deshusses, 1985. Transverse section. Sample KeS-153.
Fig. 18.– *Robuloides lens* Reichel, 1946. Subaxial section. Sample KeS-156.
Fig. 19.– *Pachyphloia* cf. *ovata* Lange, 1925. Frontal axial section. Sample KeS-156.

PLATE 74. Lopingian Nodosariata of Kuh-e Surmeh (Zone 1).
Figs. 1, 2.– *Frondina permica* Sellier de Civrieux & Dessauvagie, 1965. 1. Sagittal axial section. Sample KeS-197. 2. Frontal axial section. Sample KeS-197.
Fig. 3.– *Frondinodosaria*? sp. Frontal axial section. Sample KeS-197.
Figs. 4, 6.– *Pseudotristix caucasica* (Miklukho-Maklay, 1954) 4. Sagittal axial section. Sample KeS-200. 6. Sagittal axial section. Sample KeS-201
Fig. 5.– *Ichthyofrondina latilimbata* Sellier de Civrieux & Dessauvagie, 1965. Subaxial section. Sample KeS-201.
Fig. 7.– *Langella massei* sp. nov. Holotype. Sample KeS-202.
Fig. 8.– *Robuloides gourisiensis* Reichel, 1946. Subtransverse section. Sample KeS-202.
Figs. 9, 10, 18.– *Colaniella* aff. *minuta* Okimura, 1988. 9. Sagittal axial section. Sample KeS-202. 10. Sagittal axial section. Sample KeS-202. 18. Sagittal axial section. Sample KeS-206
Fig. 11.– *Nodosinelloides potievskayae* Mamet & Pinard, 1996. Axial section. Sample KeS-202
Fig. 12.– *Frondinodosaria*? sp. Sagittal axial section. Sample KeS-203.
Fig. 13.– *Nodosinelloides potievskayae* Mamet & Pinard, 1996 Axial section. Sample KeS-204.
Figs. 14, 15.– *Eocristellaria* sp. Two oblique sections. Sample KeS-204.
Fig. 16.– *Langella massei* sp. nov. Paratype. Sample KeS-205.
Fig. 17, 19.– *Nodosinelloides* sp. Two costulate transverse sections. Sample KeS-205.
Fig. 20.– *Protonodosaria* sp. Axial section. Sample KeS-211.
Fig. 21.– *Polarisella* sp. Frontal axial section. Sample KeS-214.
Fig. 22.– *Pachyphloides* cf. *inflatus* (Miklukho-Maklay, 1954). Axial section. Sample KeS-217.
Fig. 23.– *Frondinodosaria*? sp. Axial section. Sample KeS-221
Fig. 24.– *Nodosinelloides mirabilis caucasica* (Miklukho-Maklay, 1954). Axial section. Sample KeS-222
Fig. 25.– *Geinitzina* sp. Axial section. Sample KeS-223.
Fig. 26.– *Ichthyofrondina latilimbata* Sellier de Civrieux & Dessauvagie, 1965. Transverse section. Sample KeS-224.
Fig. 27.– *Ichthyofrondina guangxiensis* Lin, 1978. Sagittal axial section. Sample KeS-225.


65


66
200µm


67

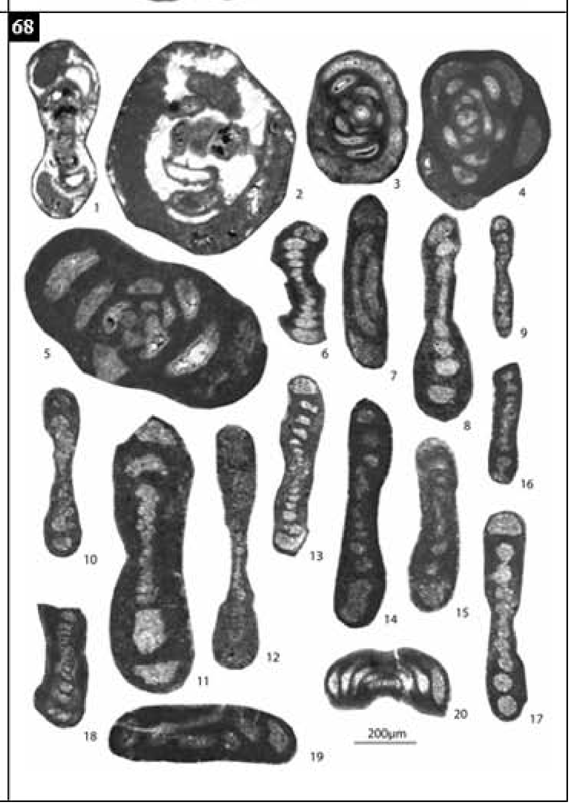
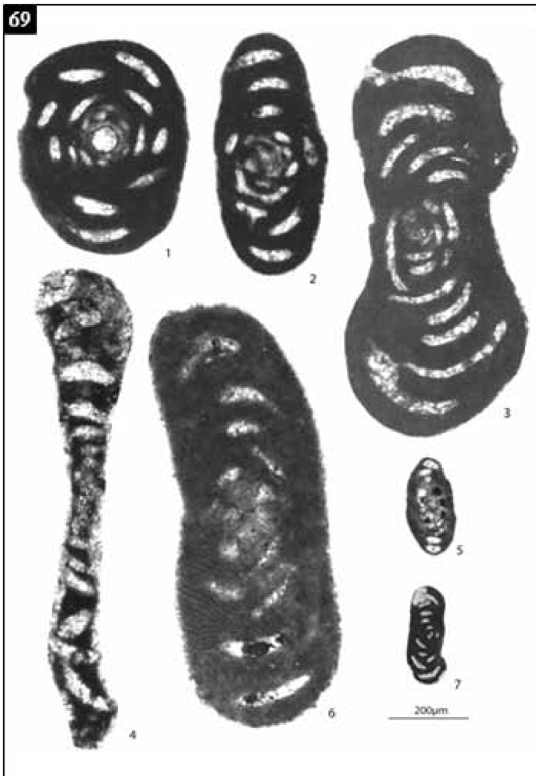

68
200µm

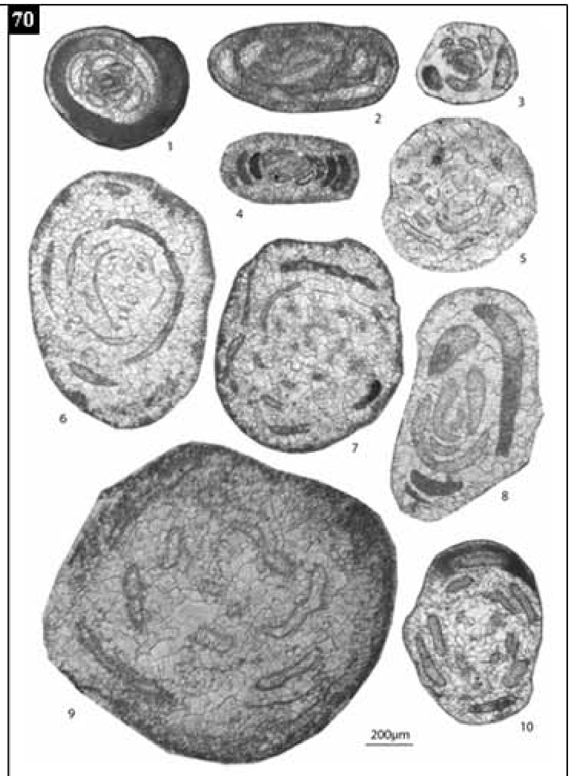
PLATE 75. Lopingian Nodosariata of Kuh-e Dena (Zone 1).
Fig. 1.– *Geinitzina* sp. Sagittal axial section. Sample DN-615.
Fig. 2.– *Pachyphloia enormis* sp. nov. Paratype. Sagittal subaxial oblique section. Sample DN-614.
Fig. 3.– *Cryptoseptida*? sp. section. Frontal axial section. Sample DN-612.
Fig. 4.– *Pseudolangella* cf. *conica* (Miklukho-Maklay, 1954). Axial section. Sample DN-605.
Fig. 5.– *Rectostipulina pentamerata* Groves, Altiner & Rettori, 2005. Transverse section. Sample DN-42.
Fig. 6.– *Colaniella* aff. *minuta* Okimura, 1988. Oblique section. Sample DN-121.
Fig. 7.– *Rectostipulina quadrata* Jenny-Deshusses, 1985. Transverse section. Sample DN-152.
Fig. 8.– *Frondicularia* sp. Sagittal axial section. Sample DN-223.

PLATE 76. Lopingian Nodosariata of OF-1 (Zone 3).
Figs. 1, 12.– *Rectostipulina quadrata* Jenny-Deshusses, 1985. Two transverse sctions.
Fig. 2.– *Geinitzina* sp. Sagittal axial section.
Fig. 3.– *Frondicularia* sp. Sagittal axial section.
Figs. 4, 11.– *Partisania sigmoidalis* sp. nov. 4. Paratype. Transverse section. 11. Paratype. Oblique section.
Fig. 5.– *Nodosinelloides mirabilis caucasica* (Miklukho-Maklay, 1954). Axial section.
Figs. 6, 7.– *Tauridia* sp. Two axial sections.
Fig. 8.– *Nodosinelloides shikhanica* (Lipina, 1949). Axial section.
Fig. 9.– *Langella* cf. *sumatrensis* (Lange, 1925). Subaxial section of a giant specimen.
Fig. 10.– *Frondina* sp. Sagittal axial section.
Fig. 13.– *Pachyphloia enormis* sp. nov. Paratype. Frontal subaxial oblique section.
Fig. 14.– *Pseudotristix* sp. 3. Broken subtransverse section.

PLATE 77. Lopingian Nodosariata of OZ-2 well (Zone 2).
Fig. 1.– *Robuloides lens* Reichel, 1946. Axial section.
Fig. 2.– *Pseudolangella*? sp. Axial section.
Fig. 3.– *Nodosinelloides shikhanica* (Lipina, 1949). Axial section.
Fig. 4.– *Geinitzina* sp. Subaxial section.
Figs. 5-7.– *Pachyphloia enormis* sp. nov. 5. Paratype. Subtransverse oblique section. 6. Paratype. Frontal subaxial section. 7. Paratype. Frontal subaxial section. Note the nice radiate aperture in the center.
Fig. 8.– *Geinitzina* sp. Axial section.
Figs. 9, 13.– *Nestellorella dorashamensis* (Pronina, 1989). 9. Frontal axial section. 13. Sagittal axial section.
Fig. 10.– *Tauridia* sp. Axial section.
Fig. 11.– *Nodosinelloides mirabilis caucasica* (Miklukho-Maklay, 1954). Typical axial section.
Fig. 12.– *Geinitzina* sp. Frontal axial section looking like a section of *Nodosinelloides*, but the shape of chambers differs.
Fig. 14.– *Rectostipulina quadrata* Jenny-Deshusses, 1985. Transverse section.
Fig. 15.– *Pachyphloia* sp. Frontal axial section
Fig. 16.– *Frondina permica* Sellier de Civrieux & Dessauvagie, 1965. Frontal axial section.
Fig. 17.– *Aulacophloia martiniae* gen. nov. sp. nov. Paratype. Transverse section, with a characteristic aperture in the center.
Fig. 18.– *Pseudotristix caucasica* (Miklukho-Maklay, 1954). Sagittal subaxial oblique section.
Fig. 19.– *Geinitzina* sp. Sagittal axial section.
Figs. 20, 21.– *Nodosinelloides* sp. Two axial sections.
Fig. 22.– *Frondina permica* Sellier de Civrieux & Dessauvagie, 1965.
Fig. 23.– *Ichthyofrondina* sp. Subaxial section.

PLATE 78. Lopingian Nodosariata (Zone 3).
Fig. 1.– *Robuloides lens* Reichel, 1946. Subaxial section.
Fig. 2.– *Polarisella* sp. Frontal axial section.
Figs. 3, 19.– *Nodosinelloides shikhanica* (Lipina, 1949). Two axial sections.
Fig. 4.– *Aulacophloia* sp. Transverse section.
Fig. 5, 17.– *Robuloides lens* Reichel, 1946. Two axial sections.
Fig. 6.– *Robuloides* sp. Axial section.
Fig. 7.– *Nodosinelloides mirabilis caucasica* (Miklukho-Maklay, 1954). Axial section.
Fig. 8.– *Geinitzina postcarbonica* Spandel, 1901. Axial section.
Fig. 9.– *Ichthyofrondina* sp. Axial section.
Fig. 10.– *Geinitzina postcarbonica* Spandel, 1901. Axial section.
Fig. 11.– *Colaniella* aff. *minuta* Okimura, 1988. Axial section.
Fig. 12.– *Ichthyolaria* aff. *natella* (Gerke, 1961) . Axial section.
Fig. 13.– *Rectostipulina pentamerata* Groves, Altiner & Rettori, 2005. Transverse section.
Fig. 14.– *Robuloides gibbus* Reichel, 1946. Subaxial section.


69
200µm


70
200µm


71
200µm

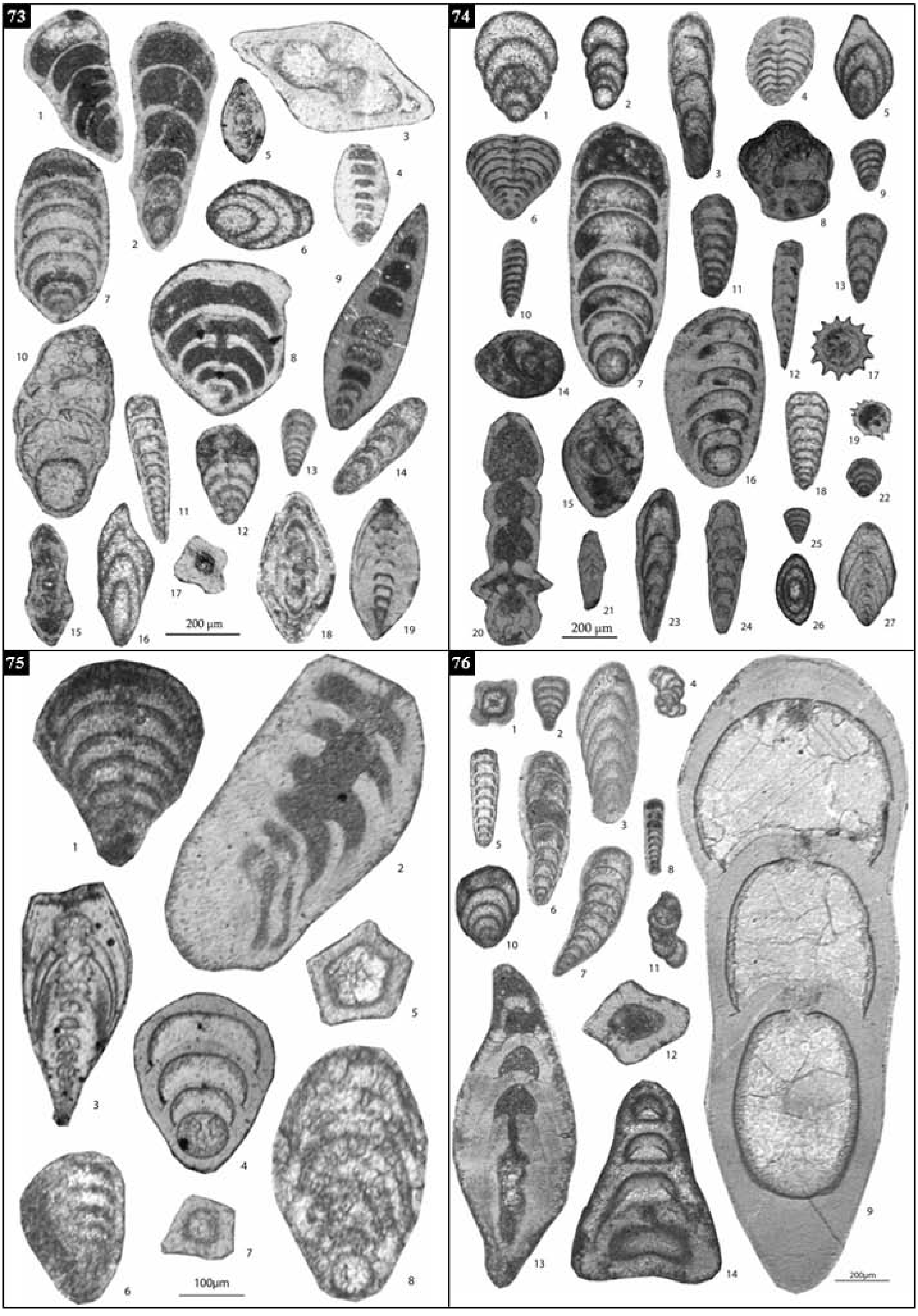

72
200 µm

Fig. 15.– *Rectostipulina quadrata* Jenny-Deshusses, 1985. Axial section.
Fig. 16.– *Tauridia* sp. Axial section.
Figs. 18, 20.– *Nestellorella pulchra* (Pronina *in* Kotlyar *et al*., 1989). 18. Frontal axial section. 20.– Sagittal axial section.
Figs. 21, 22, 26.– *Geinitzina* sp. 21, 22. Two sagittal axial sections. 26. Frontal axial section.
Fig. 23.– *Eocristellaria typica* Miklukho-Maklay, 1954. Subaxial section.
Fig. 24.– *Pseudolangella*? sp. Oblique section.
Fig. 25.– *Nestellorella* sp. Axial section.
Fig. 27.– *Robuloides* sp. Subaxial section.
Fig. 28.– *Frondinodosaria* sp. 1. Frontal axial section.

PLATE 79. Lopingian Nodosariata (Zone 2).
Fig. 1.– *Geinitzina* sp. Frontal axial section.
Fig. 2.– *Eocristellaria typica* Miklukho-Maklay, 1954. Transverse section.
Figs. 3, 6.– *Frondina* sp. Two sagittal axial section.
Fig. 4.– *Nodosinelloides shikhanica* (Lipina, 1949). Axial section.
Figs. 5, 14.– *Robuloides lens* Reichel, 1946. 5. Axial section. 14. Subtransverse section.
Fig. 7.– *Geinitzina* ex gr. *chapmani* Schubert, 1915. Sagittal axial section.
Fig. 8.– *Nestellorella* sp. Axial section.
Fig. 9.– *Robuloides gibbus* Reichel, 1946. Transverse section.
Fig. 10.– *Cryptomorphina limonitica* Sellier de Civrieux & Dessauvagie, 1965. *Calvezina* sp. Frontal axial section.
Figs. 11, 16.– *Nodosinelloides mirabilis caucasica* (Miklukho-Maklay, 1954). Two axial sections.
Fig. 12.– *Rectostipulina quadrata* Jenny-Deshusses, 1985. Transverse section.
Fig. 13.– *Langella massei* sp. nov. Paratype. Axial section.
Fig. 15.– *Pseudolangella* sp. Axial section.
Fig. 17.– *Ichthyofrondina* sp. Transverse section.
Figs. 18-20, 27-30.– *Robuloides lens* Reichel, 1946. Axial sections.
Figs. 21-24.– *Polarisella* ex gr. *hoae* (Trifonova,1967). Frontal axial sections.
Fig. 25.– *Tauridia* sp. Axial section.
Fig. 26.– *Robuloides* sp. Axial section.

PLATE 80. Lopingian Nodosariata of Zone 2 (see Fig. 2A).
Figs. 1, 15.– *Polarisella* sp. 1. Sagittal axial section. 15. Frontal axial section.
Fig. 2.– *Ichthyofrondina* sp. Sagittal axial section.
Figs. 3, 13.– *Rectostipulina quadrata* Jenny-Deshusses, 1985. Two transverse sections.
Figs. 4-5.– *Nodosinelloides* sp. Two subaxial sections.
Figs. 6, 8, 9.– *Nodosinelloides shikhanica* (Lipina, 1949). Three axial sections.
Fig. 7.– *Nodosinelloides potievskayae* Mamet & Pinard, 1996. Axial section.
Fig. 10.– *Ichthyolaria* aff. *natella* (Gerke, 1961). Sagittal axial section.
Fig. 11.– *Pseudolangella* sp. Axial section.
Fig. 12.– *Aulacophloia* sp. Transverse section.
Fig. 14.– *Pachyphloia* sp. Frontal axial section.
Fig. 16.– *Aulacophloia*? sp. Sagittal axial section.

PLATE 81. Lopingian Nodosariata (Zone 2).
Figs. 1, 18-21.– *Colaniella* sp. 1. Sagittal subaxial section. 18. Sagittal axial oblique section. 19. Sagittal subaxial oblique section 20. Sagittal subaxial oblique section 21. Sagittalaxial section.
Figs. 2, 11, 12, 16, 17.– *Pachyphloia schwageri* Sellier de Civrieux & Dessauvagie, 1965. 2. Frontal axial section.11. Frontal axial section. 12. Sagittal axial section.16. Sagittal axial section. 17. Macrospheric sagittal axial section.
Fig. 3.– *Eocristellaria typica* Miklukho-Maklay, 1954. Subtransverse section.
Fig. 4.– *Geinitzina spandeli* Cherdyntsev, 1914. Axial section.
Fig. 5.– *Nodosinelloide*s sp. Subaxial section.
Fig. 6.– *Tauridia*? sp. Axial section.
Figs. 7, 9, 10.– *Pachyphloia*? sp. 7. Frontal axial section. 9. Sagittal subfrontal section. 10. Sagittal subaxial section.
Fig. 8.– *Pachyphloia pedicula* Lange, 1925. Frontal axial section of a deformed specimen.
Fig. 13.– *Pseudotristix* sp. Sagittal subaxial section.
Fig. 14.– *Rectostipulina quadrata* Jenny-Deshusses, 1985. Transverse section.
Fig. 15.– *Robuloides lens* Reichel, 1946. Subaxial section.
Fig. 22.– *Frondina* sp. Sagittal axial section.
Fig. 23.– *Nodosinelloides*? sp. Axial section.
Fig. 24.– *Nodosinelloides shikhanica* (Lipina, 1949). Axial section.


73
74
200 µm
200 µm
75
76
100µm
200µm

Figs. 25, 26.– *Nestellorella*? sp. Two axial sections.
Fig. 27.– *Geinitzina* sp. Sagittal axial section.
Fig. 28.– *Geinitzina postcarbonica* Spandel, 1901. Sagittal axial section.
Fig. 29.– *Geinitzina ichnousa* Sellier de Civrieux & Dessauvagie, 1965. Sagittal axial section.

PLATE 82. Lopingian Nodosariata of Hazro (Taurus, Turkey).
Fig. 1.– *Pachyphloia enormis* sp. nov. Paratype. Transverse section. Sample HZ-48.
Figs. 2, 7.– *Geinitzina spandeli* Cherdyntsev, 1914. 2. Subxial section. Sample HZ-487. Axial section. Sample HZ-54.
Fig. 3.– *Pachyphloia pedicula* Lange, 1925 Frontal axial section. Sample HZ-49.
Figs. 4, 5.– *Rectostipulina quadrata* Jenny-Deshusses, 1985. 4. Transverse section. Sample HZ-49. 5. Transverse section. Sample HZ-51.
Fig. 6.– *Pachyphloia* cf. *robusta* Miklukho-Maklay, 1954. Frontal axial section. Sample HZ-52.
Fig. 8.– *Cryptoseptida*? sp. Frontal axial section. Sample HZ-64.
Fig. 9.– *Ichthyolaria* aff. *natella* (Gerke, 1961). Frontal axial section. Sample HZ-90.
Figs. 10-13.– *Robuloides lens* Reichel, 1946. Various sections. Sample HZ-90
Figs. 14, 15.– *Polarisella* sp. Two frontal axial sections. Sample HZ-92.

PLATE 83. Lopingian Nodosariata of Kuh-e Surmeh (Zone 1).
Fig. 1, 2.– *Pachyphloia* sp. 1. Frontal axial section. Sample KeS-156. 2. Transverse section. Sample KeS-156.
Fig. 3.– *Rectostipulina pentamerata* Groves, Altiner & Rettori, 2005. Transverse section. Sample KeS-156.
Fig. 4.– ? *Pachyphloides* cf. *inflatus* (Miklukho-Maklay, 1954). Subaxial section. Sample KeS-182
Fig. 5.– *Frondinodosaria*? sp. Frontal axial section. Sample KeS-182
Figs. 6, 7.– *Polarisella* sp. Two frontal axial sections. Sample KeS-163
Figs. 8, 9, 11.– *Ichthyofrondina* sp. Three sagittal subaxial sections. Sample KeS-176
Fig. 10.– *Ichthyofrondina latilimbata* Sellier de Civrieux & Dessauvagie, 1965. Sagittal subaxial section. Sample KeS-176.
Figs. 12, 13, 18, 19, 23.– *Nodosinelloides shikhanica* (Lipina, 1949). 12. Axial section. Sample KeS- 176. 13. Axial section. Sample KeS-168. 18. Subaxial section. Sample KeS-169. 19. Axial section. Sample KeS-169. 23?. Axial section. Sample KeS-178.
Fig. 14.– *Protonodosaria* sp. Axial section. Sample KeS-168.
Fig. 15.– *Pachyphloia* cf. *robusta* Miklukho-Maclay, 1954. Transverse section. Sample KeS-186
Figs. 16, 17, 30.– *Colaniella* aff. *minuta* Okimura, 1988. Two axial sections. Sample KeS-169. 30. Axial section. Sample KeS-171.
Fig. 20.– *Frondina* sp. Axial section. Sample KeS-169.
Fig. 21.– *Eocristellaria typica* Miklukho-Maklay, 1954. Axial section. Sample KeS-169
Fig. 22.– *Frondina permica* Sellier de Civrieux & Dessauvagie, 1965. Sagittal axial section. Sample KeS-178.
Fig. 24.– *Calvezina* sp. Frontal axial section. Sample KeS-178.
Fig. 25.– *Frondinodosaria*? sp. Frontal axial section. Sample KeS-170.
Fig. 26.– *Pachyphloia schwageri* Sellier de Civrieux & Dessauvagie, 1965. Frontal axial section. Sample KeS-185.
Figs. 27, 28.– *Geinitzina spandeli* Cherdyntsev, 1914. Two axial sections. Sample KeS-185.
Fig. 29.– *Geinitzina postcarbonica* Spandel, 1901. Axial section. Sample KeS-185.
Fig. 31.– *Tauridia nudiseptata* sp. nov. Axial section. Sample KeS-171.
Fig. 32.– *Pachyphloia schwageri* Sellier de Civrieux & Dessauvagie, 1965. Frontal axial section. Sample KeS-171.
Fig. 33.– *Nodosinelloides longissima* Lipina, 1949. Frontal axial section. Sample KeS-171.
Fig. 34.– *Polarisella* sp. Sagittal axial section. Sample KeS-179.
Fig. 35.– *Geinitzina* cf. *lingulaeformis* Lipina, 1949. Axial section. Sample KeS-180.

PLATE 84. Lopingian Nodosariata (Zone 2).
Fig. 1.– *Frondina* sp. Sagittal axial section.
Figs. 2, 12, 13, 17.– *Nodosinelloides mirabilis caucasica* (Miklukho-Maklay, 1954). Four axial sections.
Fig. 3.– *Polarisella* sp. Frontal axial section.
Figs. 4, 10.– *Pseudolangella* sp. Two axial sections.
Fig. 5.– *Eocristellaria* sp. Subtransverse section.
Fig. 6.– *Tauridia nudiseptata* sp. nov. Paratype. Sagittal axial section.
Figs. 7, 14, 18.– *Pachyphloia* sp. Three frontal axial section.
Fig. 8.– *Frondina* sp. Sagittal axial section.
Fig. 9.– *Nestellorella dorashamensis* (Pronina, 1989). Sagittal axial section.
Fig. 11.– *Robuloides* sp. (evolute form). Axial section.
Fig. 15.– *Rectostipulina pentamerata* Groves, Altiner & Rettori, 2005. Transverse section.
Fig. 16.– *Ichthyofrondina* sp. Oblique section.
Fig. 19.– *Ichthyofrondina latilimbata* Sellier de Civrieux & Dessauvagie, 1965.Sagittal axial section.


77
200 µm


78
200 µm


79
200 µm

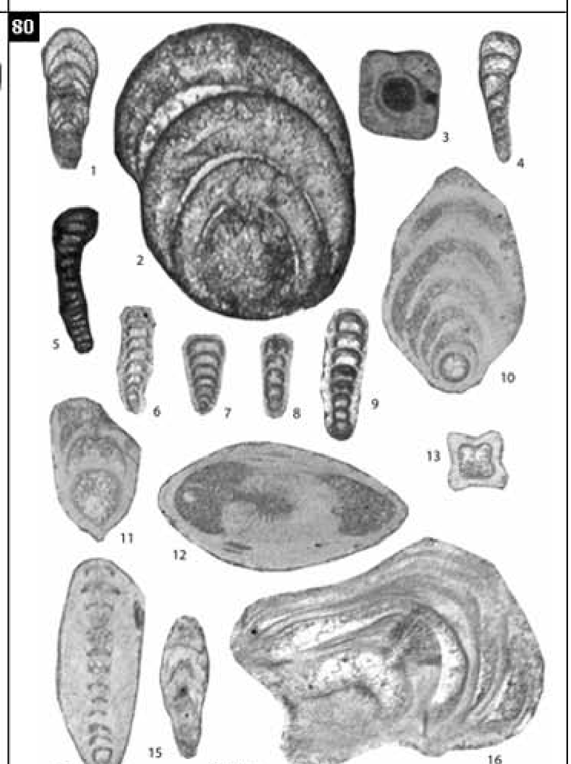
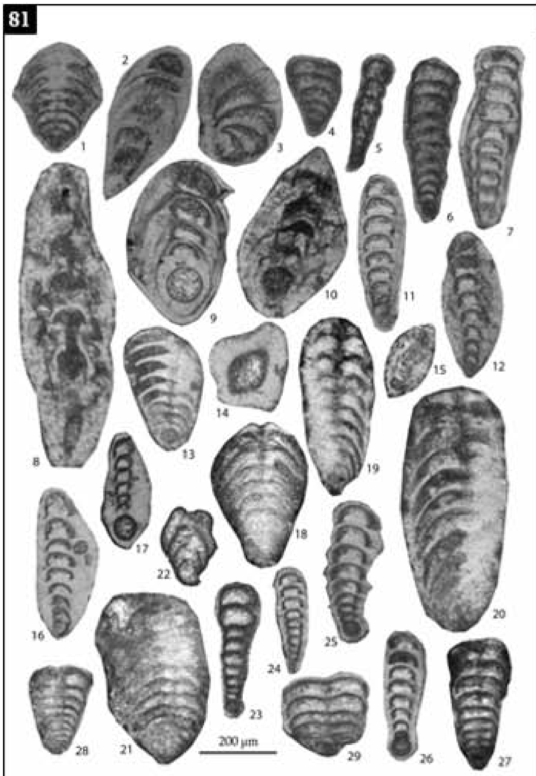

80
200 µm

Fig. 20.– *Frondinodosaria*? sp. Axial section.
Fig. 21.– *Pachyphloides* sp. Axial section.
Fig. 22.– *Geinitzina ichnousa* Sellier de Civrieux & Dessauvagie, 1965. Axial section.
Fig. 23.– *Frondina permica* Sellier de Civrieux & Dessauvagie, 1965
Fig. 24.– *Robuloides lens* Reichel, 1946. Axial section.
Fig. 25.– *Geinitzina postcarbonica* Spandel, 1901. Axial section.
Fig. 26.– *Geinitzina* sp. Axial section.
Fig. 27.– *Eocristellaria typica* Miklukho-Maklay, 1954. Subtransverse section.
Fig. 28.– *Robuloides* sp. Axial section.

PLATE 85. Lopingian Nodosariata of Kuh-e Surmeh (Zone 1).
Figs. 1-6, 11.– *Pseudotristix caucasica* (Miklukho-Maklay, 1954). 1. Sagittal axial oblique section. Sample KeS-11 2. Sagittal subaxial oblique section. Sample KeS-11. 3. Frontal section. Sample KeS-11. 4. Transverse section. Sample KeS-11. 5. Frontal axial section. Sample KeS-12. 6. Transverse section. Sample KeS-42. 11. Sagittal subaxial oblique section. Sample KeS-86.
Fig. 7.– *Pachyphloia pedicula* Lange, 1925. Frontal axial section. Sample KeS-61
Fig. 8.– *Geinitzina* cf. *lingulaeformis* Lipina, 1949. Axial section. Sample KeS-75.
Fig. 9.– ? *Pachyphloia* cf. *robusta* Miklukho-Maklay, 1954. Transverse section. Sample KeS-86.
Figs. 10, 12.– *Syzrania*? sp. 10. Subaxial section with proloculus. Sample KeS-86. 12. Transverse section. Sample KeS-86.
Figs. 13, 15.– *Langella* aff. *ocarina* Sellier de Civrieux & Dessauvagie, 1965. Two subtransverse oblique sections (see also some *Pseudoglandulina gigantea* of the literature). Sample KeS-86.
Fig. 14.– *Cryptomorphina hazroensis* sp. nov. Paratype. Frontal subaxial section. Sample KeS-87.
Figs. 16-17.– *Frondinodosaria* sp. 1. 16?. Frontal subaxial section. Sample KeS-88. 17. Frontal axial section. Sample KeS-88.
Fig. 18.– *Pachyphloia* cf. *robusta* Miklukho-Maklay, 1954. Frontal axial section. Sample KeS-88.

PLATE 86. Lopingian Nodosariata of Kuh-e Surmeh (Zone 1).
Fig. 1.– *Protonodosaria* cf. *proceraeformis* Gerke, 1959. Axial section. Sample KeS-188.
Figs. 2, 7.– *Robuloides lens* Reichel, 1946. 2. Axial section. Sample KeS-188. 7. Transverse section. Sample KeS-189.
Figs. 3-5.– *Aulacophloia martiniae* gen. nov. sp. nov. 3. Paratype. Tranverse section. Sample KeS-188. 4 Paratype. Transverse section. Sample KeS-181. 5. Paratype. Transverse section. Sample KeS-181.
Fig. 6.– *Geinitzina postcarbonica* Spandel, 1901. Axial section. Sample KeS-189
Figs. 8, 10, 18.– *Nodosinelloides potievskayae* Mamet & Pinard, 1996. 8. Axial section.Sample KeS-190.10. Subaxial oblique section. Sample KeS-191.18. Axial section. Sample KeS-196.
Figs. 9, 17, 21.– *Nodosinelloides shikhanica* (Lipina, 1949). 9. Axial section. Sample KeS-190. 17. Axial section. Sample KeS-194. 21?. Axial section.
Fig. 11.– *Ichthyolaria* aff. *natella* (Gerke, 1961). Sagittal subaxial section. Sample KeS-191.
Fig. 12.– *Pseudolangella fragilis* Sellier de Civrieux & Dessauvagie, 1965. Sample KeS-191.
Fig. 13.– *Nodosinelloides mirabilis caucasica* (Miklukho-Maklay, 1954). Axial section. Sample KeS-191.
Fig. 14.– *Frondinodosaria*? sp. Axial section. Sample KeS-191.
Fig. 15.– *Ichthyofrondina ornata* (Miklukho-Maklay, 1954). Axial section. Sample KeS-191.
Fig. 16.– *Eocristellaria typica* Miklukho-Maklay, 1954. Transverse section. Sample KeS-191.
Fig. 19.– *Geinitzina ichnousa* Sellier de Civrieux & Dessauvagie, 1965). Axial section. Sample KeS-196.

PLATE 87. Lopingian Nodosariata of Kuh-e Surmeh (Zone 1).
Figs. 1, 4, 16.– *Nodosinelloides mirabilis caucasica* (Miklukho-Maklay, 1954). Axial section. Sample KeS-225. 4. Axial section. Sample KeS-226. 16. Axial section. Sample KeS-230.
Fig. 2.– *Nodosinelloides shikhanica* (Lipina, 1949). Axial section. Sample KeS-225.
Fig. 3.– *Frondinodosaria*? sp. Axial section. Sample KeS-225.
Fig. 5.– *Robuloides gourisiensis* Reichel, 1946. Transverse section. Sample KeS-226.
Fig. 6.– *Pachyphloides* cf. *inflatus* (Miklukho-Maklay, 1954). Subxial section. Sample KeS-226.
Fig. 7.– *Nodosinelloides potievskayae* Mamet & Pinard, 1996. Axial section. Sample KeS-226.
Fig. 8.– *Pachyphloides* cf. *inflatus* (Miklukho-Maklay, 1954). Subaxial section. Sample KeS-227.
Fig. 9, 11.– *Rectostipulina quadrata* Jenny-Deshusses, 1985. Two transverse sections. Sample KeS-227.
Figs. 10, 18.– *Geinitzina postcarbonica* Spandel, 1901. 10. Frontal axial section. Sample KeS-227. 18. Sagittal axial section. Sample KeS-231.
Fig. 12.– *Colaniella* aff. *minuta* Okimura, 1988. Axial section. Sample KeS-228.
Fig. 13.– *Pseudolangella fragilis* Sellier de Civrieux & Dessauvagie, 1965. Axial section. Sample KeS-229.
Fig. 14.– *Nestellorella* sp. nov. Axial section. Sample KeS-229.
Figs. 15, 17.– *Ichthyofrondina latilimbata* Sellier de Civrieux & Dessauvagie, 1965. 15. Subaxial section. Sample KeS-230. 17. Subaxial section. Sample KeS-231.
Fig. 19.– *Pachyphloia schwageri* Sellier de Civrieux & Dessauvagie, 1965. Frontal axial section. Sample KeS-231.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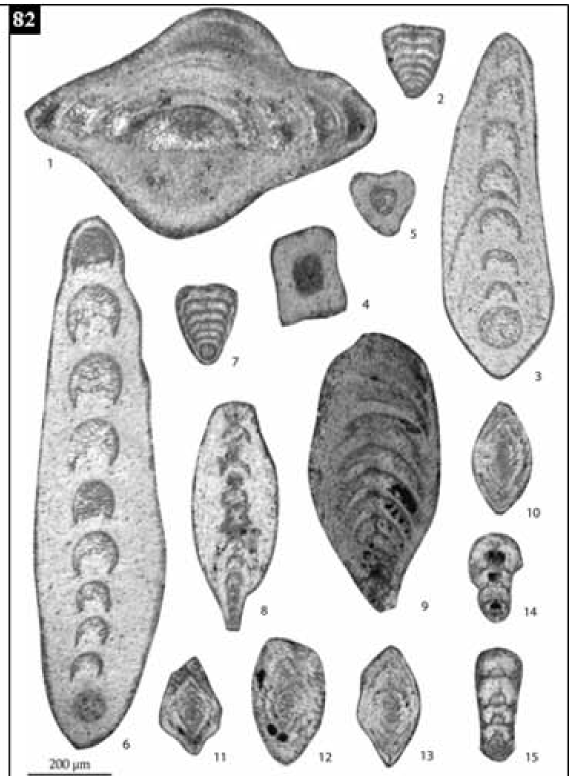
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Fig. 20.– *Pachyphloides* cf. *inflatus* (Miklukho-Maklay, 1954) . Axial section. Sample KeS-231
Fig. 21.– *Robustopachyphloia* sp. Frontal axial section. Sample KeS-231.
Fig. 22.– *Ichthyofrondina* sp. Subaxial section. Sample KeS-233.
Fig. 23.– *Pseudolangella fragilis* Sellier de Civrieux & Dessauvagie, 1965. Axial section. Sample KeS-234.

PLATE 88. Lopingian Nodosariata of Kuh-e Surmeh (Zone 1).
Fig. 1.– *Eocristellaria typica* Miklukho-Maklay, 1954. Subtransverse section. Sample KeS-259.
Fig. 2.– *Nodosinelloides shikhanica* (Lipina, 1949). Axial section. Sample KeS-259.
Figs. 3, 14.– *Colaniella* sp. 3. Axial section. Sample KeS-259. 14. Oblique section. Sample KeS-265.
Fig. 4.– *Geinitzina* sp. Axial section. Sample KeS-259.
Fig. 5.– *Colaniella* sp. Axial section. Sample KeS-259.
Fig. 6.– *Robustopachyphloia* sp. Axial section. Sample KeS-259.
Figs. 7, 12.– *Ichthyofrondina ornata* (Miklukho-Maklay, 1954). 7. Axial section. Sample KeS-259. 12. Subaxial section. Sample KeS-263.
Figs. 8, 13.– *Ichthyofrondina* sp. 8. Oblique section. Sample KeS-259. 13. Oblique section. Sample KeS-265.
Fig. 9.– *Nodosinelloides longissima* (Suleimanov, 1949). Axial section. Sample KeS-261.
Fig. 10.– *Geinitzina* ex gr. *chapmani* Schubert, 1915. Axial section. Sample KeS-261.
Figs. 11, 16.– *Pachyphloides* sp. 11. Axial section. Sample KeS-261. 16. Subxial section. Sample KeS-266.
Fig. 15.– *Pseudotristix* sp. 3. Subaxial section. Sample KeS-265.
Fig. 17.– *Pseudotristix solida* Reitlinger, 1965. Sagittal axial section. Sample KeS-267.
Fig. 18.– *Robuloides lens* Reichel, 1946. Axial section. Sample KeS-267.
Fig. 19.– *Tauridia* sp. Axial section. Sample KeS-268.
Fig. 20.– *Polarisella* sp. Frontal axial section. Sample KeS-268.

PLATE 89. Lopingian Nodosariata of Kuh-e Surmeh (Zone 1).
Fig. 1.– *Pachyphloides* sp. Axial section. Sample KeS-234.
Fig. 2.– *Pachyphloia* sp. Frontal axial section. Sample KeS-236.
Figs. 3, 14, 19.– *Geinitzina ichnousa* Sellier de Civrieux & Dessauvagie, 1965. 3. Axial section. Sample KeS-236. 14. Axial section. Sample KeS-250. Note the exception inclusion of the proloculus and the “endothyroid“ first chambers. 19. Axial section. Sample KeS-257.
Figs. 4, 5.– ? *Calvezina* sp. 4. Oblique section. Sample KeS-237. 5. Subaxial section. Sample KeS-237.
Figs. 6, 16.– *Ichthyofrondina latilimbata* Sellier de Civrieux & Dessauvagie, 1965. 6. Transverse section. Sample KeS-239. 16. Axial section. Sample KeS-253
Figs. 7, 12.– ? *Nodosinelloides* ex gr. *shikhanica* (Lipina, 1949). 7. Axial section. Sample KeS-241. 12. Axial section. Sample KeS-244
Figs. 8, 10.– *Frondinodosaria*? sp. Oblique section. Sample KeS-241.10. Oblique section. Sample KeS-243.
Fig. 9.– *Geinitzina postcarbonica* Spandel, 1901. Axial section. Sample KeS-243.
Figs. 11, 17, 20.– *Geinitzina* sp. 11. Axial section. Sample KeS-243. 17. Axial section. Sample KeS-253. 20. Axial section. Sample KeS-258.
Fig. 13.– *Nodosinelloides mirabilis caucasica* (Miklukho-Maklay, 1954). Axial section. Sample KeS-245.
Fig. 15.– *Robustopachyphloia*? sp. Axial section. Sample KeS-250.
Fig. 18.– *Geinitzina* ex gr. *chapmani* Schubert, 1915. Axial section. Sample KeS-256.
Fig. 21.– *Robuloides lens* Reichel, 1946. Axial section. Sample KeS-258.
Fig. 22.– *Ichthyofrondina* sp. Transverse section. Sample KeS-258.
Fig. 23.– *Langella* ex gr. *perforata* (Lange, 1925). Subxial section. Sample KeS-259.

PLATE 90. Lopingian Nodosariata of Hazro (Taurus, Turkey).
Figs. 1-2, 4, 5, 9-13, 19.– *Polarisella* sp. Various sections. 1, 2. Sample HZ-34. 4. Sample HZ-36. 5. Axial section. Sample HZ-37. 9-13. Sample HZ-41. 19. Sample HZ-46.
Fig. 3.– *Pachyphloia pedicula* Lange, 1925. Frontal axial section. Sample HZ-34.
Fig. 6.– *Tauridia*? sp. Axial section. Sample HZ-39.
Fig. 7.– *Nodosinelloides mirabilis caucasica* (Miklukho-Maklay, 1954). Axial section. Sample HZ-39.
Fig. 8.– *Ichthyofrondina primitiva* (Sellier de Civrieux & Dessauvagie, 1965). Axial section. Sample HZ-40.
Fig. 14.– *Tauridia nudiseptata* sp. nov. Axial section. Sample HZ-42.
Fig. 15.– *Calvezina* sp. Axial section. Sample HZ-43.
Fig. 16.– *Pachyphloia enormis* sp. nov. Frontal axial section. Sample HZ-45.
Fig. 17.– *Aulacophloia martiniae* gen. nov. sp. nov. Paratype. Transverse section. Sample HZ-46.
Fig. 18.– *Nodosinelloides potievskayae* Mamet & Pinard, 1996. Axial section. Sample HZ-46.
Fig. 20.– *Pachyphloides*? sp. Axial section. Sample HZ-46.

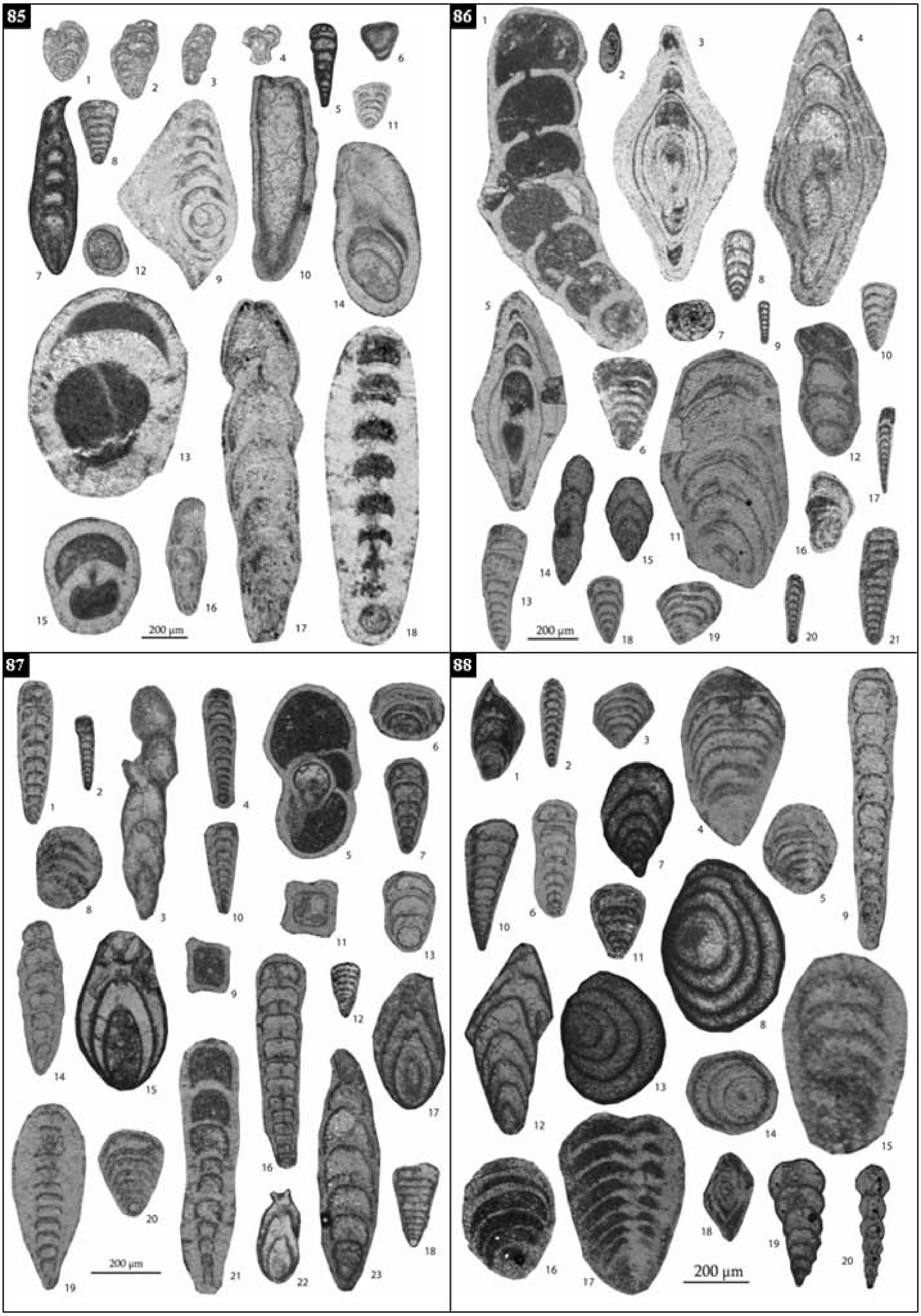
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PLATE 91. Lopingian Nodosariata of Kuh-e Surmeh (Zone 1).
Fig. 1.– *Eocristellaria typica* Miklukho-Maklay, 1954. Subtransverse section. Sample KeS-269.
Fig. 2.– *Robuloides gibbus* Reichel, 1946. Subaxial section. Sample KeS-269.
Fig. 3.– *Nodosinelloides mirabilis caucasica* (Miklukho-Maklay, 1954). Sample KeS-269.
Fig. 4.– *Nodosinelloides* sp. Axial section. Sample KeS-269.
Fig. 5.– *Colaniella* aff. *minuta* Okimura, 1988. Axial section. Sample KeS-270.
Figs. 6, 7.– *Frondina* sp. Two axial sections. 6. Sample KeS-270. 7. Sample KeS-271.
Fig. 8.– *Pachyphloides* sp. Axial section. Sample KeS-271.
Fig. 9.– *Nestellorella* sp. nov. Axial section. Sample KeS-271.
Fig. 10.– *Frondinodosaria*? sp. Axial section. Sample KeS-271.
Fig. 11.– *Calvezina*? sp. Oblique section. Sample KeS-271.
Fig. 12.– *Nestellorella dorashamensis* (Pronina, 1989). Axial section. Sample KeS-271.
Fig. 13.– *Ichthyofrondina guangxiensis* Lin, 1978. Axial section. Sample KeS-274.
Fig. 14.– *Geinitzina postcarbonica* Spandel, 1901. Axial section. Sample KeS-274.
Fig. 15.– *Ichthyofrondina* sp. Axial section. Sample KeS-274.
Fig. 16.– *Frondina* sp. Axial section. Sample KeS-275.
Fig. 17.– *Polarisella* sp. Axial section. Sample KeS-276A.
Fig. 18.– *Robuloides lens* Reichel, 1946. Transverse section. Sample KeS-276B.
Fig. 19.– ? *Nestellorella pulchra* (Pronina *in* Kotlyar *et al.*, 1989). Axial section. Sample KeS-276B.
Fig. 20.– *Frondina permica* Sellier de Civrieux & Dessauvagie, 1965. Frontal axial section. Sample KeS-276B.
Fig. 21.– *Nestellorella*? sp. Axial section. Sample KeS-277.
Fig. 22.– *Pseudolangella*? sp. Axial section. Sample KeS-277.
Fig. 23.– *Polarisella* sp. Frontal axial section. Sample KeS-278
Fig. 24.– *Frondinodosaria*? sp. Axial section. Sample KeS-279
Fig. 25.– *Ichthyofrondina latilimbata* Sellier de Civrieux & Dessauvagie, 1965. Axial section. Sample KeS-279
Fig. 26.– *Pseudotristix* sp. 3. Axial section. Sample KeS-280

PLATE 92. Lopingian Nodosariata (Zone 3).
Fig. 1.– *Pachyphloia enormis* sp. nov. Paratype. Transverse section.
Fig. 2.– *Nestellorella* sp. Axial section.
Fig. 3.– *Tauridia* sp. Axial section.
Figs. 4, 11.– *Nodosinelloides mirabilis caucasica* (Miklukho-Maklay, 1954). Two axial sections.
Fig. 5.– *Pachyphloia schwageri* Sellier de Civrieux & Dessauvagie, 1965. Frontal axial section.
Fig. 6.– *Frondinodosaria* sp. 1. Subaxial section.
Fig. 7.– *Tauridia* sp. Subaxial section.
Fig. 8.– *Frondicularia* sp. Axial section.
Figs. 9, 10.– *Tauridia nudiseptata* sp. nov. 2 paratypes. Two axial sections.
Fig. 12, 13.– *Pachyphloides* sp. Two axial sections.
Fig. 14.– *Geinitzina* sp. Axial section.
Fig. 15.– *Frondinodosaria*? sp. Axial section.
Fig. 16.– *Ichthyofrondina* sp. Axial section.

PLATE 93. Lopingian Nodosariata (Zone 3).
Fig. 1.– *Nodosinelloides* sp. (costulate). Subaxial section. Sample OF-5.
Figs. 2, 4, 11.– *Pachyphloia* sp. 2. Axial section. Sample OF-5. 4. Frontal axial section. Sample OF-5. 11. Subtranverse section. Sample OF-6.
Figs. 3, 5, 6, 13.– *Nodosinelloides* sp. 3?. Axial section. Sample OF-5. 5? (costulated) Transverse section. Sample OF-5. 6. (costulated). Transverse section. Sample OF-5. 13. (costulated). Axial section. Sample OF-6.
Figs. 7, 8.– *Protonodosaria* sp . Two axial sections. Sample OF-5.
Fig. 9.– *Ichthyolaria* sp. Axial section. Sample OF-5.
Fig. 10.– *Pseudotristix* sp. 3. Transverse section. Sample OF-6.
Fig. 12.– *Robuloides lens* Reichel, 1946. Axial section. Sample OF-6.
Fig. 14.– *Geinitzina* sp. Axial section. Sample OF-6.
Fig. 15.– *Ichthyofrondina* sp. Axial section. Sample OF-6.
Fig. 16.– *Partisania sigmoidalis* sp. nov. Paratype. Transverse section. Sample OF-6
Fig. 17.– *Ichthyofrondina* sp. Axial section. Sample OF-6.
Fig. 18.– *Pachyphloia enormis* sp. nov. Paratype. Frontal subaxial section. Sample OF-6
Fig. 19.– *Geinitzina* sp. Axial section. Sample OF-6

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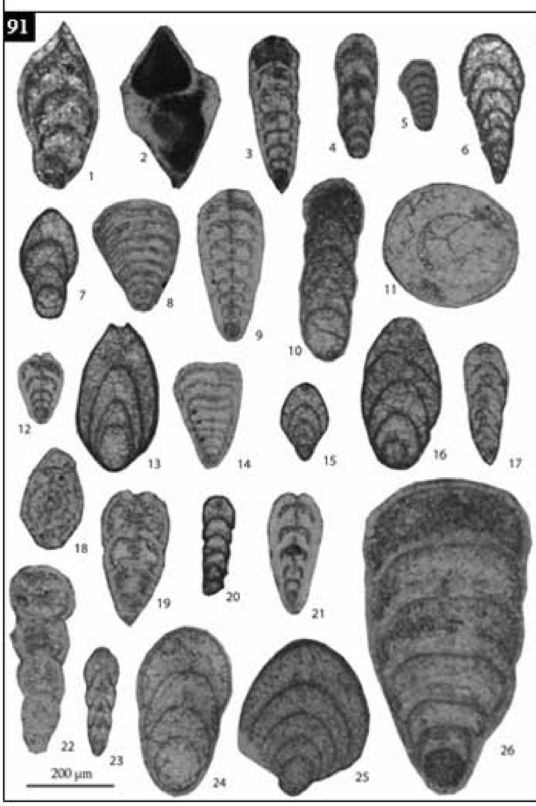

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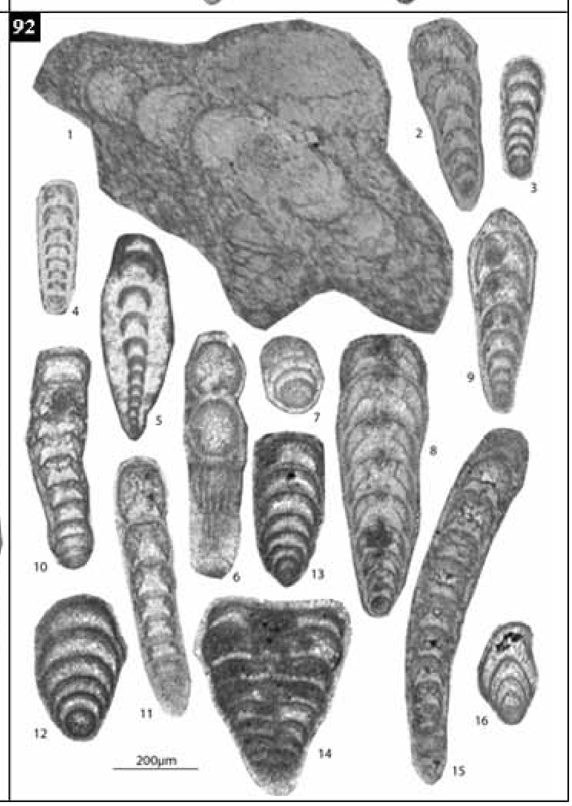
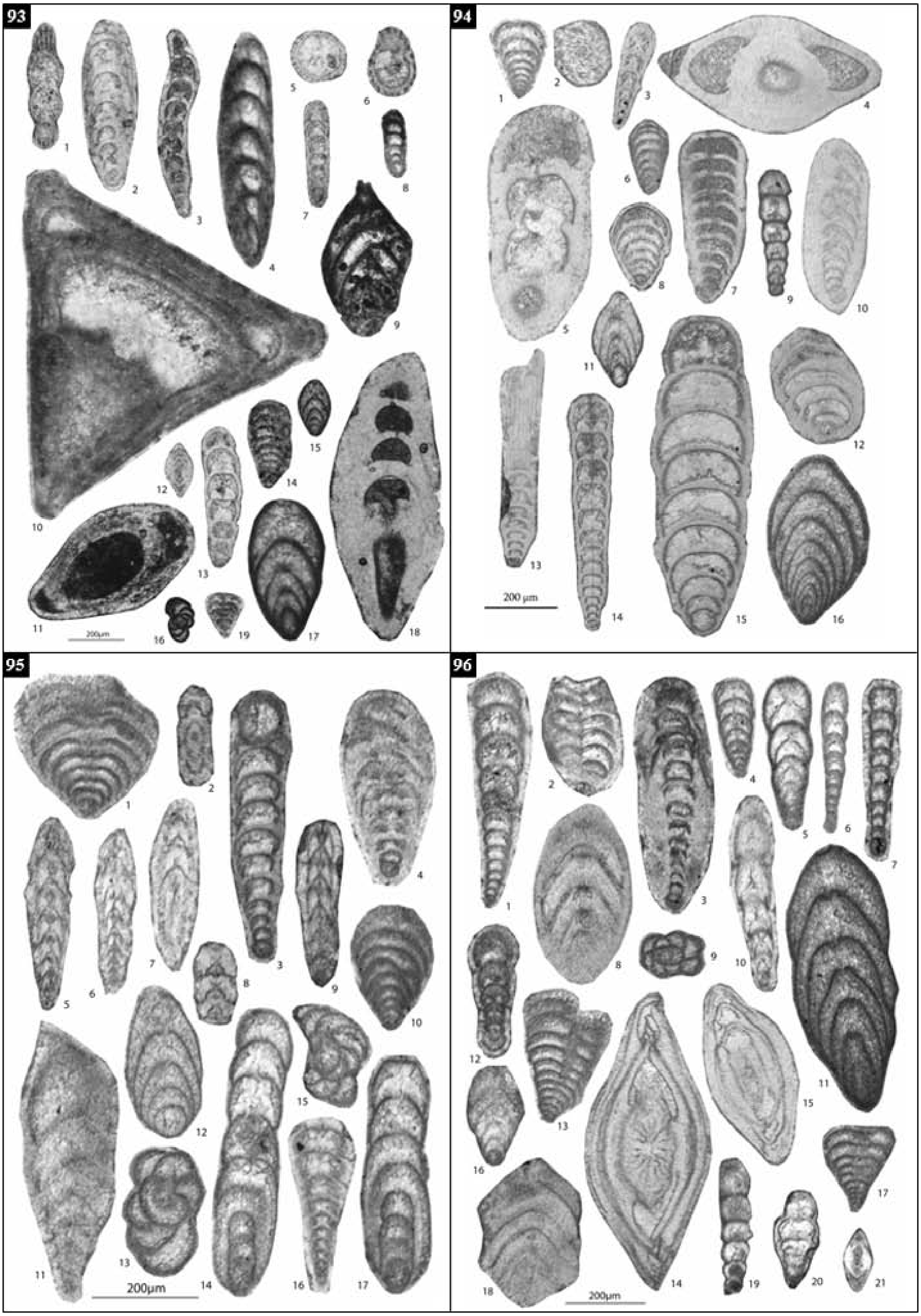


PLATE 94. Lopingian Nodosariata (Zone 2).
Fig. 1, 8.– *Geinitzina*? sp. Axial sections.
Fig. 2.– *Robuloides lens* REICHEL, 1946. Transverse section.
Fig. 3.– *Nodosinelloides* sp. Axial section.
Fig. 4.– *Robuloides gourisiensis* REICHEL, 1946. Transverse section.
Fig. 5.– *Langella* ex gr. *perforata* (LANGE, 1925). Axial section.
Fig. 6.– *Colaniella* sp. Axial section.
Fig. 7.– *Geinitzina* ex gr. *chapmani* SCHUBERT, 1915. Axial section.
Fig. 9.– *Polarisella* sp. Frontal axial section.
Fig. 10.– *Pachyphloia* sp. Frontal axial section.
Fig. 11.– *Ichthyofrondina* cf. *palmata* (WANG, 1974). Axial section.
Fig. 12.– *Pachyphloides* sp. Axial section.
Figs. 13, 14.– *Nodosinelloides mirabilis caucasica* (MIKLUKHO-MAKLAY, 1954). 13. Axial to oblique section; note the striation. 14. Axial section.
Fig. 15.– *Pseudolangella fragilis* SELLIER DE CIVRIEUX & DESSAUVAGIE, 1965. Axial section.
Fig. 16.– *Frondicularia* sp. Typical axial section.

PLATE 95. Lopingian Nodosariata (Zone 3).
Fig. 1.– *Geinitzina ichnousa* SELLIER DE CIVRIEUX & DESSAUVAGIE, 1965. Axial section.
Fig. 2, 5-9.– *Polarisella* sp. 2. Transverse section. 5-9. Five axial and subaxial sections.
Fig. 3.– *Tauridia nudiseptata* sp. nov. Paratype. Axial section.
Fig. 4.– *Frondicularia* sp. Axial section.
Fig. 10.– *Pachyphloides* sp. Axial section.
Fig. 11.– *Polarisella* sp. Axial section.
Fig. 12.– *Ichthyofrondina* sp. Axial section.
Figs. 13-15, 17.– *Partisania sigmoidalis* sp. nov. 13. Paratype. Subtransverse section. 14. Holotype. Sagittal axial section. 15. Paratype. Transverse section. 17. Paratype. Sagittal axial section.
Fig. 16.– *Geinitzina* ex gr. *chapmani* CHERDYNTSEV, 1914. Frontal axial section.

PLATE 96. Lopingian Nodosariata (Zone 3).
Fig. 1.– *Tauridia nudiseptata* sp. nov. Paratype. Axial section.
Figs. 2, 13.– *Pseudotristix caucasica* (MIKLUKHO-MAKLAY, 1954). 2. Subaxial section. 13. Axial section.
Fig. 3.– *Pachyphloia schwageri* SELLIER DE CIVRIEUX & DESSAUVAGIE, 1965. Frontal axial section.
Fig. 4.– *Tauridia* sp. Axial section.
Fig. 5.– *Polarisella* sp. Axial section.
Fig. 6.– *Frondinodosaria*? sp. Frontal axial section.
Fig. 7-12.– *Tauridia nudiseptata* sp. nov. 2 paratypes. Two axial sections.
Fig. 8.– *Frondicularia* sp. Sagittal axial section.
Fig. 9.– *Partisania sigmoidalis* sp. nov. Paratype. Transverse section.
Fig. 10.– *Polarisella* sp. Frontal axial section.
Fig. 11.– *Ichthyofrondina* sp. Axial section. Note the aperture of the antepenulimate chamber.
Fisg. 14, 15.– *Aulacophloia martiniae* gen. nov. sp. nov. 2 paratypes. Two transverse section. Note the stellate aperture in fig. 14.
Figs. 16, 18-19.– *Polarisella* sp. 16?. Axial section. 18. Subaxial section, 19. Frontal axial section.
Fig. 17.– *Geinitzina* sp. Axial section.
Fig. 20.– *Nestellorella acus* (PRONINA *in* KOTLYAR *et al*., 1989). Axial section.
Fig. 21.– *Robuloides lens* REICHEL, 1946. Axial section.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Manuscrito recibido el 15 de junio de 2007
Manuscrito aceptado el 4 de septiembre de 2007