人と自然 Humans and Nature 23: 101−128 (2012)

Material

Late Jurassic to Early Cretaceous (Kimmeridgian to Barremian) foraminifers of the Southern Jura and Salève Mountains, France

Fumio KOBAYASHI [1)] and Roland WERNLI [2)]

[1)] *Division of Natural History, Museum of Nature and Human Activities, Hyogo/Division of Earth Science, Institute of Natural and Environmental Sciences, University of Hyogo, Yayoigaoka 6, Sanda, Hyogo 669-1546, Japan*
[2)] *Département de Géologie et Paléontologie, Université de Genève, 13 rue des Maraîchers, 1211 Genève 4, Switzerland*

Abstract

Foraminifers distinguished in 18 limestone samples of the Kimmeridgian to Barremian of the Southern Jura and Salève mountains are listed along with supplementary biostratigraphic comments to them. Particularly important among them are the taxa not reported from Japan such as *Kurnubia palastiniensis* Henson, *Conicokurnubia orbitoliniformis* (Septfontaine), *Labyrhintina mirabilis* Weynschenk, and *Parurgonina caelinensis* Cuvillier, Foury and Pignatti-Morano in the Kimmeridgian, and various forms of latest Hauterivian to earliest Barremian orbitolinids such as *Valserina broennimanni* Schroeder, Conrad and Charollais and *Palaeodictyoconus cuvillieri* Foury. These French materials are available for better understanding of the Late Jurassic to Early Cretaceous foraminiferal faunas of Japan. Many microphotographs of them are illustrated sample by sample so as to develop the further studies of the coeval faunas in the Upper Jurassic/Lower Cretaceous Torinosu and Torinosu-type limestones, and the "*Orbitolina* limestone" of the Lower Cretaceous Ezo Group, Miyako Group, and others.

Key words: foraminifers, Late Jurassic, Early Cretaceous, southern Jura, Salève, France

Introduction

Jurassic/Cretaceous Torinosu and lithologically similar Torinosu-type limestones are characteristic in the Middle Chichibu (Kurosegawa) and Southern Chichibu terranes and partly in the Northern Shimanto Terrane of Southwest Japan. They are contained in the Tithonian to the Barremian siliciclastic rocks (e.g., Yao, 1984; Aita and Okada, 1986; Morino, 1993) as allochthonous blocks (olistoliths). The age of the Torinosu and Torinosu-type limestones has been traditionally determined as the Middle to Late Jurassic by stromatoporoids, hexacorals, and sclerosponges characteristic in them (Yabe and Sugiyama, 1935; Eguchi, 1951; Mori, 1963). Based on the foraminiferal microfaunas, on the other hand, Kobayashi and Vuks (2006) showed the consistent Tithonian to Berriasian age of the Torinosu-type limestones regardless of their distribution in the Southern Chichibu and Northern Shimanto terranes in the Southern Kanto Mountains.

F. Kobayashi, one of the authors had been eager for direct cross-checking Jurassic-Cretaceous limestone thin sections with foraminifers between the Japanese and European materials under the microscope during his micropaleontologic works of the Torinosu and Torinosu-type limestones. In the summer of 2008, he collected many valuable samples in the southern Jura and Salève mountains, west and south of Genève (Fig. 1) in cooperation with another author of this paper, R. Wernli who has long been working on the geology and paleontology of the Jura Mountains. The results from these samples are helpful for better understanding the foraminiferal faunas of the Japanese Jurassic/Cretaceous materials. Furthermore, these French materials are available for faunal consideration of the "*Orbitolina* limestone" sporadically distributed from Hokkaido to Kyushu and the faunal transition from the Late Jurassic to Early Cretaceous in Japan that have been remained

uncertain.

The main purpose of this report is to show many microphotographs of the Kimmeridgian to Barremian foraminifers of the southern Jura and Salève mountains sample by sample so as to develop the future studies of the coeval Japanese faunas. Stratigraphy of the Kimmeridgian to Barremian of the southern Jura is briefly introduced and some taxonomic remarks are given for some forms of the present faunas. All limestone thin sections of these French materials amounting to 345 are stored in the Museum of Nature and Human Activities, Hyogo, Japan (Fumio Kobayashi Collection, MNHAH).

Stratigraphy and material

Jurassic and Cretaceous carbonates deposited in the western Tethys are widely distributed in regions around the Mediterranean Sea and Middle East. Those and surrounding siliciclastic rocks developed in southeast France and northwest Switzerland are designated as the stratotypes of the Berriasian to Aptian (Lower Cretaceous). Limestone samples treated herein were collected in the Champfromier area of the southern Jura Mountains and the Salève Mountains south of Genève (Fig. 2).

Champfromier

The Upper Jurassic and the Lower Cretaceous formations in the Champfromier area are composed mostly of limestones and subordinate marls and dolostones. The Upper Jurassic is divided into the Oxfordian (J4 to J6), Kimmeridgian (J7 and J8) and Tithonian (J9), and the Lower Cretaceous into Berriasian and Valanginian (N1－2), Hauterivian (N3 and lower part of NU), Barremian (most part of NU), and Bedoulian (Aptian) and Albian (N5b－C1) (Fig. 3; Wernli, 1990; Wernli and Charollais in Donzeau et al., 1997; Donzeau et al., 1998).

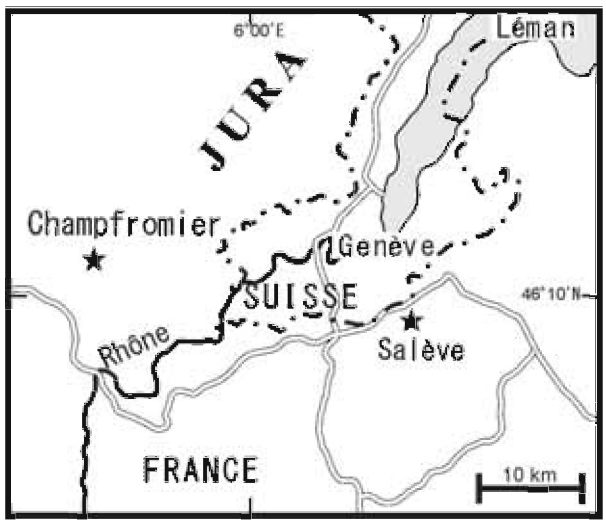

Fig 1. Schematic map showing the Champfromier area of the southern Jura Mountains and the Salève Mountains south of Genève from which limestone samples were collected

The following brief description is valid for the southern Jura Mountains as well as the Salève Mountains that show similar lithological series and micropaleontological contents. From late Kimmeridgian to Bedoulian all the foraminifers of the series are well dated essentially by dinoflagellates and also by some ammonites, dasyclad algae and rare calpionellids (Donzeau et al., 1997; Bernier, 1984; Clavel et al., 2009).

The Upper Kimmeridgian (J8) is represented by reefal and peri-reefal facies, partly dolomitized. The Calcaires plaquetés showing lagoonal facies in the J8 (Fig. 3) have not been sampled. At Champfromier outcrop the coral buildups are scarce and the majority of facies are mudmounts. The foraminifers are relatively rare and subordinate in dasycladale algae, calcareous sponges, cyanophycea and microbialitic formations. The uppermost Kimmeridgian unit (Calcaires de Landaize) consists of high energy grainstones topping the reefal facies. The larger complex foraminifers, dasycladales algae [*Clypeina jurassica* Favre, *Campbelliella striata* (Carozzi)] and also *Cladocoropsis mirabilis* Felix (stromatoporoids) are very abundant. The nerineids gastropod can form coquinas. These well stratified carbonated sands are deposited in back reef environment.

The Tithonian is represented by alternating beds of limestone and dolostone typical of tidal facies (Tidalites de Vouglans). The tidal facies is characterized by micritic limestones more or less dolomitic with dispersed larger complex foraminifers and dasyclad algae. At the base part, dolostones with Thalassinoids burrows are extremely reduced on this outcrop. Just below these facies, the palynological analysis indicates the earliest Tithonian age of the Calcaires de Landaize (Meyer, 2000).

The "Purbeckien" Formation (latest Tithonian-Early Berriasian) is suggestive to very shallow marine, brackish, emersive and lacustrine environments in all this area. Fresh water ostracods and Characea algae are diagnostic of this facies. The Pierre Châtel Formation (Middle Berriasian) shows various shallow marine facies, wackstones, packstone, biodetrital grainstones with complex foraminifers, dasycladacea and *Cayeuxia*. The

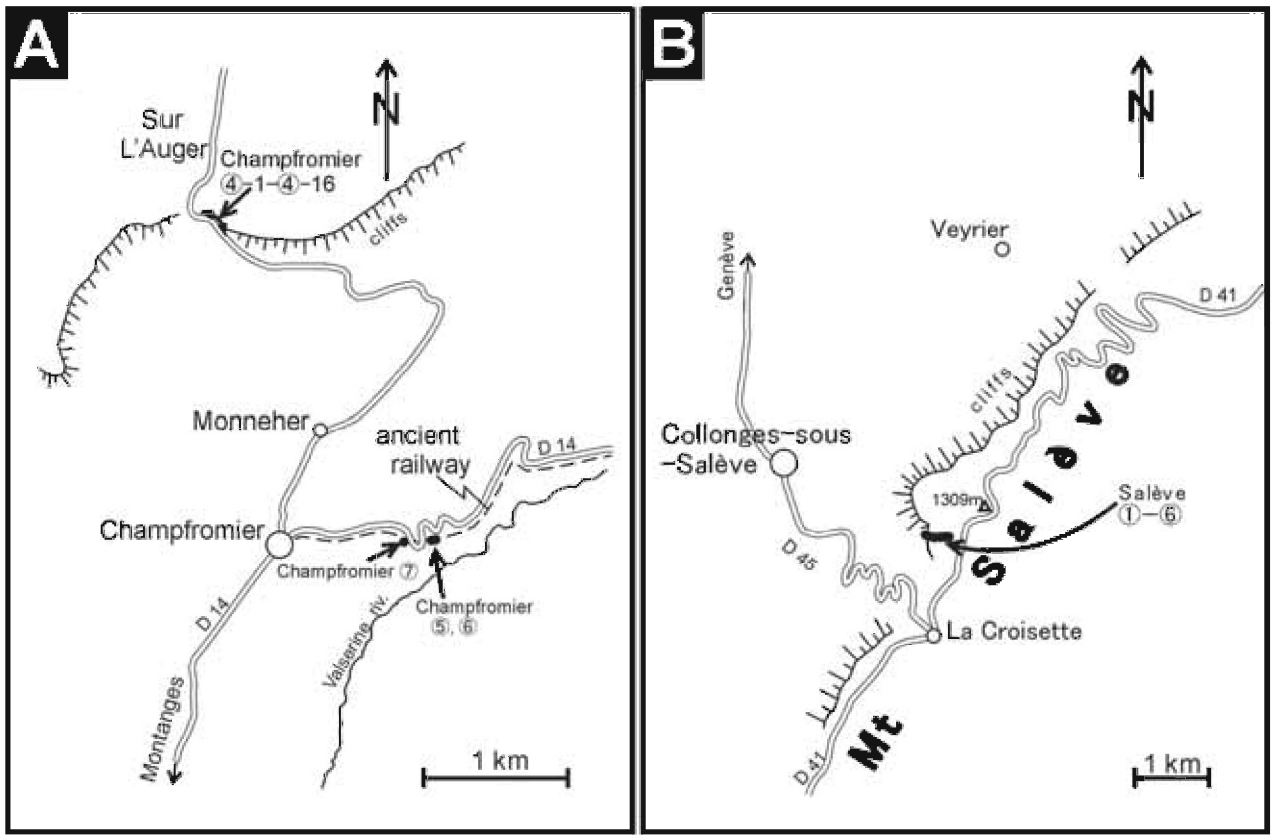

Fig 2. Sample localities in the Champfromier area (A) and the Salève Mountains south of Genève (B).

macro and microfacies resembles that of the Urgonian Formation (Barremian) but differs essentially by the micropaleontological content. *Pseudocyclammina lituus* (Yokoyama) are abundant besides *Protopeneroplis trochangulata* Septfontaine and the first representatives of the *Pseudotextulariella and Sabaudia.*

The Vions Formation (Late Berriasian) is represented by various shallow marine, brackish, estuarine to fresh water marly and calcareous facies. The detrital quartz is omnipresent and can form calcareous sandstones. Coal debris, roots plants, Thalassinoids bioturbations and emersive facies are frequent. In a shallow marine episode the unique ball shaped porcelaneous foraminifer *Pavlovecina* (*Keramosphaera*) *allobrogensis* (Steinhauser, Brönnimann, and Koehn-Zaninetti) forms a remarkable decimetric biomarker horizon. The other foraminifers are similar to those of the overlying Chambotte Formation.

The Chambotte Formation (terminal late Berriasien-early Valanginian) is composed of biodetritic and oolitic shallow water packstones and grainstones. The marker foraminifer *Pfenderina neocomiensis* (Pfender) is associated with diverse *Pseudotextulariella, Sabaudia,* the small *Haplophragmoides joukovskyi* Charollais, Brönnimann and Zaninetti, *Broeckinella magna* Septfontaine, and *Valdanchella* sp. The Valanginian is represented by chenalised, reddish-brown, more or less marly echinoderm sands. The foraminiferal content is similar to that of the Chambotte Formation plus the discoid complex species *Eclusia moutyi* Septfontaine.

The Lower Hauterivian shows deeper facies with sandy marls alternating with yellow, echinoderm-bryozoan, oolitic, chenalised limestones. All are glauconitic and display some rare ammonites and belemnites but sometimes abundant urchins (*Toxaster*). *Sabaudia minuta* (Hofker), *Cuneolina* spp. and some orbitolinids are characteristic of this stage.

The Urgonian Formation (upper Hauterivian-Barremian) is a thick calcareous series of shallow water perireefal facies. Small and larger foraminifers beside algae are abundant. Its age assignment is based on the key forms of orbitolinids (Clavel et al., 2009).

Sixteen samples were collected along the logging road Monneher to Sur L'Auger, 2 km north of the village of

Champfromier (Fig. 2 A). Among them, Samples Champfromier ④-1 to ④-7 are assigned to the upper part of the Kimmeridgian, ④-8 to ④-16 to the Tithonian. Well-preserved foraminifers are contained in samples Champfromier ④-1 to ④-9, ⑥ and ⑦ that are lithologically classified into packstone, grainstone, packstone/grainstone containing many and various kinds of bioclasts (Pl. 1, figs. 1, 2). However, they are almost or completely absent in ④-10 to ④-16 consisting of marl, pelloidal mudstone/wackestone, and wackestone and packstone with gastropods, bivalves, ostracods, algae, and other small fossils.

Samples Champfromier ⑤－⑦ were collected from the limestones exposed along the road D 14, 1 km east of the village of Champfromier (Fig. 2 A). Three these samples are highly fossiliferous grainstone and packstone (Pl. 1, figs. 3－5) and assigned to the middle Berriasian, Valanginian, and the Barremian (Urgonian blanc), respectively.

Salève

The Cretaceous strata of the Salève Mountains in the steep limestone cliff south of Genève are divided into eight stratigraphic units in ascending order: Purbeckien, Pierre-Châtel, Vions, Chambotte, members of Guiers and Calcaires roux (Brown red limestones), Hauterive Marls, Pierre jaune (Yellowish rocks) of Neuchâtel, and Lower Urgonian limestone (late Hauterivian-Barremian) (Charollais and Badoux, 1990; Donzeau et al., 1997). The lithological succession is very similar to that of the Champfromier area (Fig.3) and we can refer to the above description for more commentaries.

One sample Salève ① was collected from the upper part of the Chambotte Formation and other five samples Salève ②－⑥ from the Calcaires roux (Brown red limestones) and members of Guiers (Fig. 2 B). All samples are highly fossiliferous packstone, grainstone, and packstone/grainstone (Pl. 1, figs. 6－8). Foraminifers are common to abundant in Salève ①－④, and few and less diversified in Salève ⑤ and Salève ⑥ (Table 1). All these samples are assigned to the Valanginian based on Donzeau et al. (1997) and the stratigraphic intervals of them correspond to those of the Valanginian in the Champfromier area (Fig. 3).

Foraminiferal faunas

Biostratigraphy, and age and correlation of the Upper Jurassic and Lower Cretaceous formations are well established in the Jura and Salève mountains based on ammonites, dinoflagellates, pollens, and foraminifers (Charollais and Badoux, 1990; Donzeau et al., 1997), on which the age of our foraminiferal fauna at every sample is depended.

Foraminifers distinguished in 18 samples are listed (Table 1) and illustrated (Pls. 1－12). The Hauterivian limestone samples are absent in our present collection. The number of individuals and taxonomic diversity of foraminifers are more or less controlled to the limestone facies, especially in the Tithonian limestones, in which foraminifers are recognized in two samples and not in other seven ones.

We have confirmed the faunal independencies in the late Kimmeridgian (Samples Champfromier ④-1 to ④-7) and the Barremian (Champfromier ⑦) limestones (Table 1). They are largely different from the Tithonian, Berriasian and Valanginian ones. Species restricted to the upper Kimmeridgian samples are *Kurnubia palastiniensis* Henson, *Conicokurnubia orbitoliniformis* (Septfontaine), *Labyrhintina mirabilis* Weynschenk, and *Parurgonina caelinensis* Cuvillier, Foury and Pignatti-Morano. These species are abundant and very characteristic in limestones from the Callovian to Kimmeridgian around the Mediterranean Sea regions (Septfontaine, 1981; Clark and Boudagher-Fadel, 2002; Bucur et al., 2004; Bucur and Săsăran, 2005).

Various forms of orbitolinids represented by genera *Valserina, Dictyorbitolina* zand *Palaeodictyoconus* are completely absent in other samples from the late Kimmeridgian to Valanginian. They belong to early evolutionary members of orbitolinids, very important stratigraphic markers prolific in the upper Hauterivian to the lower Aptian Urgonian limestones of west Europe (Arnaud-Vanneau et al., 1987; Arnaud and Arnaud-Vanneau, 1991; Clavel et al., 1995, 2010; Becker, 1999; Schroeder et al., 2002). Among them, *Valserina broennimanni* Schroeder, Conrad and Charollais and *Palaeodictyoconus cuvillieri* Foury show the latest Hauterivian to earliest Barremian age of Sample Champfromier ⑦.

The late Kimmeridgian to Barremian faunas in the Champfromier and Salève are characteristic in four species of *Nautiloculina,* dominant *Redmondoides*

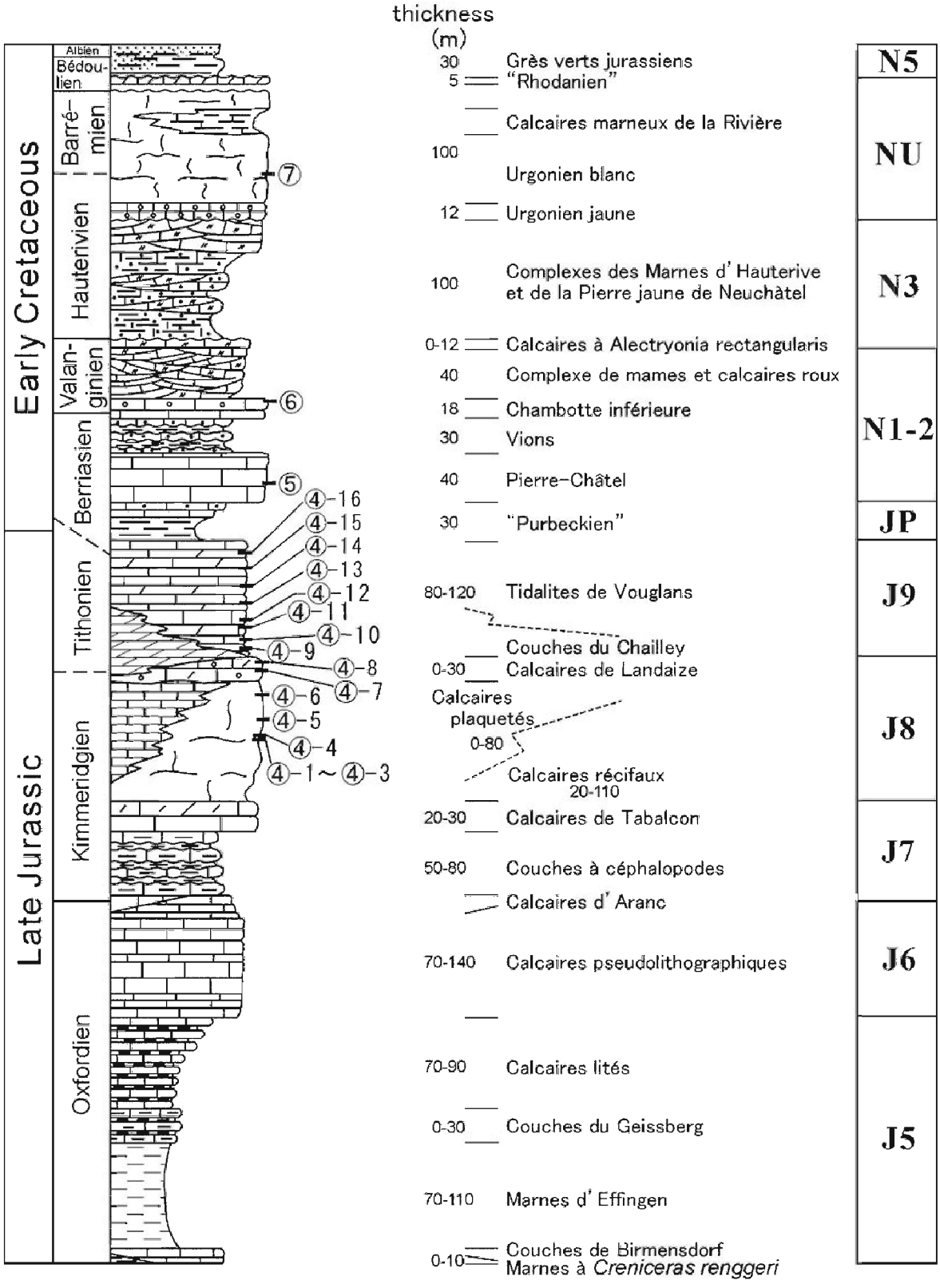

Fig 3. Stratigraphic level of samples plotted on the simplified stratigraphic column of the Upper Jurassic and the Lower Cretaceous in the Southern Jura Mountains (Donzeau et al., 1997; 1998).

	Champfromier												Salève					
	④									⑤	⑥	⑦	①	②	③	④	⑤	⑥
	1	2	3	4	5	6	7	8	9									
Glomospira? sp.													×		×			
Grochamminoides? sp													×					
Haplophragmoides joukowskyi															×			
Haplophragmoides sp.											×							
Nautiloculina oolithica	×	×		×	×	×	×	×	×									
Nautiloculina broennimanni													×		×	×	×	
Nautiloculina circularis										×				×				
Nautiloculina cretacea												×	×					
Nautiloculina sp.	×										×				×			
Ammobaculites spp.		×													×			
Ammobaculites? sp.																×		
Ammodiscidae indet.															×			
Charentia cuvillieri															×			
Acruliammina sp.																×		
Acruliammina? sp.																×		
Kurnubia palastiniensis		×		×		×	×											
Conicokurunubia orbitoliniformis		×																
Labyrhintina mirabilis				×		×	×											
Parurgonina caelinensis	×	×		×		×												
Everticyclammina sp.													×					
Pseudocyclammina sp.		×	×	×														
Rectocyclammina sp.				×								×			×			
Rectocyclammina? sp.											×							
Cribellopsis elongata												×						
Cribellopsis sp.												×						
Falsurgonina pileola												×						
Paracoskinolina cf. *sunnilandensis*												×						
Orbitolinopsis debelmasi												×						
Orbitolinopsis sp.												×						
Valserina broennimanni												×						
Valserina cf. *broennimanni*												×						
Paleodictyoconus cuvillieri												×						
Paleodictyoconus actinostoma												×						
Orbitolinidae indet.												×						
Spiroplectammina sp.										×								
Pseudolituonella gavonensis													×		×	×		
Pseudolituonella sp.											×							
Lituonella sp.												×						
Pseudotextulariella courtionnensis															×	×		
Conorbinella sp.																×		
Trogolotella incrustans		×																
Textularia spp.					×	×	×				×		×	×	×	×		
Textularia? sp.																×		
Vercorsella arenata												×						
Redmondoides lugeoni				×		×	×	×	×	×	×				×			
Redmondoides? sp.								×				×						
Trocholina alpina						×	×	×										
Trocholina campanella													×			×		
Trocholina cherchiae											×		×	×	×	×		
Trocholina delphinensis									×	×				×				
Trocholina elongata										×								
Trocholina? sp.								×							×			
Duotaxis? sp.											×							
Dobrogelina cf. *anastasiui*													×					
Dobrogelina spp.											×	×			×	×		
Belorussiella spp.									×		×		×		×	×		
Siphovalvulina spp.											×				×			
Istriloculina spp.										×	×		×		×	×		
Pfenderina? *aureliae*																×		
Pfenderina neocomiensis													×		×			
Pfenderina sp.											×		×	×	×			
Pfenerinidae indet.											×	×			×			
Verneuilinidae indet.																×		
Quinqueloculina robusta	×	×	×	×	×	×	×		×	×	×		×		×	×		×
Quinqueloculina spp.										×	×		×			×		
Miliolinidae indet.										×	×	×	×	×	×	×	×	
Mohlerina basiliensis		×																
Lenticulina spp.		×							×			×	×					×

Table 1. Kimmeridgian to Barremian foraminifers of the Champfromier area, Southern Jura Mountains and Salève Mountains south of Genève.

lugeoni (Septfontaine) and *Quinqueloculina robusta* Neagu. Absent in our material are diagnostic species in the Torinosu and Torinosu-type limestones such as *Pseudocyclammina lituus* (Yokoyama), *Charentia evoluta* (Gorbachik), *Melathrokerion spirialis* Gorbachik, and *Freixialina planispiralis* Ramalho. However, these species are very frequent in Jura and Salève mountains. *Broeckinella magna* Septfontaine characteristic and dominant along with *Pseudocyclammina lituus* in the type Torinosu limestone at Sakawa is also not recognized in our material.

It should be noted that the foraminiferal faunas of Torinosu and Torinosu-type limestones in Japan completely exclude the Kimmeridgian faunal elements represented by *Kurnubia palastiniensis* and others as recognized in samples Champfromier ④-1 to ④-7. Orbitolinids as found in Sample Champfromier ⑦ that are abundant and restricted to the upper Hauterivian to the lower Aptian of Europe are also absent in them. Absence of these characteristic taxa in the Kimmeridgian and late Hauterivian to early Aptian constrains the age assignment of the Torinosu and Torinosu-type limestones. The present results are also important in the faunal consideration of the *"Orbitolina"* limestone in Japan and the faunal transition from the uppermost Jurassic to Lower Cretaceous in Japan that has been remained uncertain.

Taxonomic Remarks

Diagnostic test characters and the stratigraphic range of eight species of the present material are summarized.

***Nautiloculina oolithica* Mohler** (Pl. 2, figs. 1－8, 17－19; Pl. 4, figs. 12, 13)

This well known species from the Bathonian is characterized by a rounded periphery, no alar extensions in axial section, and non lobate equatorial periphery. Thick (bilamellid) septa present in equatorial sections. This species was extinct during the Berriasian-Valanginian.

***Kurnubia palastiniensis* Henson** (Pl. 2, figs. 9－16)

Though difficult to decipher in detail because the test growth is frequently very irregular, this high trochospired species is easily recognizable in sections. The massive central columella is also trochospired and the subepidermal network with large meshes is characteristic. The test in the adult stage tends to become uniserial. This species ranges from middle Callovian to late Tithonian.

***Conicokurnubia orbitoliniformis* (Septfontaine)** (Pl. 2, figs. 22, 24, 31, 32)

From trochospired arrangement in juvenile stage the test rapidly becomes uniserial during adult stage showing an "orbitolinid" aspect. The aperture is areal and cribrate, and the subepidermal network similar to that of *Kurnubia palastiniensis*. Range of this species is from middle Callovian? to Kimmeridgian.

***Labyrhintina mirabilis* Weynschenk** (Pl. 2, figs. 23, 28－30)

The test is planispiral and unrolled subcylindrical or flabelliform. Putting a part of the test structure in the adult stage, this genus is quasi-homeomorphic with the Liassic genus *Lituosepta* Cati. Wall is simple, and radial vertical partitions and row of pillars are present in the median plane. Well-oriented equatorial sections of the flabelliform stage are uneasily prepared because of the buckled test of this species. This species is known from the latest Oxfordian to early Tihonian.

***Parurgonina caelinensis* Cuvillier, Foury and Pignatti Morano** (Pl. 2, figs. 20, 21, 25, 26)

The test is high conical, trochospiral, and pseudo-uniserial in the adult stage. The periferal "chamberlets" have spoon-like aspect and a pseudo-labyrhintine masse of pillars passes through the center of the test. The wall is micro-canaliculate and pseudo-keriothecal. This species ranges from Kimmeridgian to the earliest Tithonian.

***Redmondoides lugeoni* (Septfontaine)** (Pl. 3, figs. 17－27; Pl. 4, figs. 1－9, 16－23; Pl. 5, figs. 11－13; Pl. 11, figs. 18－20)

Initially attributed to the genus *Valvulina* by Septfontaine (1977), this species has been revised by Banner et al. (1991) and included in their new genus *Redmondoides*. The test is quadriserial throughout, with thick protocanaliculate wall. The chambers are low with thinner flap covering the aperture in the central part of the test. The junction of these flaps in axial part of the test shows typical figures in hooks or "floating plates" cut transversely these flaps. This species ranges from Bajocian to early Tithonian.

***Troglotella incrustans* Wernli and Fooks** (Pl. 3, figs. 28－30)

This strange foraminifer thought calcicavicole is always found in narrow cavities in biodetrital grains. The wall is dark microgranular, and the aperture is terminal with a lip. A frequent hyaline "outer wall" is due to the diagenesis. The first growth stage is uniserial, after becoming spreading at the surface of the grain with very irregular chambers like *Bacinella*. The last adult stage is not visible

on our material. Our three pictures (Pl. 3, fig.28－30) show that the form of the chambers follows the irregularities of the cavities and seem to indicate that the test growths in pre-existing microcavities. However, different interpretations have been proposed by Schmid and Leinfelder (1995) and also by Schlagintweit (2012). This species is known from middle Oxfordian to early Cenomanian (Bucur et. al., 2004; Schlagintweit, 2012).

***Mohlerina basiliensis* (Mohler)** (Pl. 3, fig. 33)

Wall of this well known piluriloculine, low trochospired foraminifer is similar to that of *Tetrataxis*. It is dark microgranular transitionally passing to a white hyalin radiate outer layer that often shows thickenings on the umbilical side. This species is known from the Bathonian to Valanginian and has no phyletic linkage with Paleozoic forms.

Acknowledgements

Sampling in the Southern Jura and Salève Mountains was supported by Drs. Rossana Martini and Jérôme Chablais (Genève, Switzerland) and financially by the Grant-in Aid for Japan Promotion of Scientific Research, 2008 (Project No. 19540497). We are deeply grateful to Dr. B. Clavel (Messery, Haute-Savoie, France) who kindly determined our orbitolonids fauna and to Mrs. Atsuko Ujimaru (Sanda, Hyogo, Japan) who helped image processing the microphotographs.

References

Aita, Y. and Okada, H. (1986) Radiolarians and calcareous nannofossils from the uppermost Jurassic and Lower Cretaceous strata of Japan and Tethyan regions. *Micropaleont.*, **32**: 97－128.

Arnaud, H. and Arnaud-Vanneau, A. (1991) Les Calcaires urgoniens des Massifs subalpins septentrionaux et du Jura (France): Age et discussion donnés stratigraphiques, *Géol. Alpine*, **67**: 63－79.

Arnaud-Vanneau, A., Arnaud, H., Adatte, T., Argot, M., Rumley, G. and Thieuloy, J.-P. (1987) The *Lower Cretaceous from the Jura Platform to the Vocontian Basin* (*Swiss Jura, France*). Field-guide Excursion D, Grenoble, France, in Third Intern. Creta Symp., Tübingen, 128 p.

Banner, F. T., Simmons, M. D. and Whittaker, J. E. (1991) The Mesozoic Chrysalidinidae (Foraminifera, Textulariacea) of the Middle East: the Redmond (Aramco) taxa and their relatives. *Bull. British Mus. Nat. Hist.* (*Geol.*), **47**: 101－152.

Becker, E. (1999) Orbitoliniden-Biostratigraphie der Unterkreide (Hauterive-Barrême) in den spanischen Pyrenäen (Profil Organyà, Prov Lérida). *Rev. Paléobiol.*, **18**: 359－489.

Bernier, P. (1984) Les formations carbonatées du Kimméridgien et du Portlandien dans le Jura méridional, stratigraphie, micropaléontologie, sédimentologie. *Doc. Lab. Géol. Lyon*, **92**, 1－803.

Bucur, I. I., Koch, R., Kirmaci, Z. and Tasli, K. (2004) Foraminifères du Jurassique supérieur et du Crétacé inférieur (Calcaire de Berdiga) de Kircaova (région de Kale-Gümüshane, NE Turquie). *Rev. Paléobiol.*, **23**: 209－225

Bucur, I. I. and Săsăran, E. (2005) Micropaleontological assemblages from the Upper Jurassic-Lower Cretaceous deposits of Trascău Mountains and their biostratigraphic significance. *Acta Palaeont. Romaniae*, **5**, 27－38.

Charollais, J. and Badoux, H. (1990) Suise lémanique, pays de Genève et Chablais.-Guides géologiques régionaux, Ed. Masson, Paris, 1－223.

Clark, G. N. and Boudagher-Fadel, M. K. (2002) Larger foraminiferal assemblages and stratigraphy of the late Jurassic Bhanness complex Central Lebanon. *Rev. Paléobiol.*, **21**: 679－695.

Clavel, B., Busnardo, R., Charollais, J., Conrad and Granier, B. (2009) Nouvelles données sur la répartition biostratigraphique des orbitolinidés à l'Hauterivien supérieur, au Barrémien et à l'Aptien inférieur dans le Sud-Est de la France et le Jura franco-suisse. *Arch. Sci.*, **62**: 125－145.

Clavel, B., Busnardo, R., Charollais, J., Conrad, M. and Granier, B. (2010) Répartition biostratigraphique des orbitolinidés dans la biozonation à ammonites (plate-forme urgonienne du Sud-Est de la France) Partie 1: Hauterivien superieur-Barrémien basal. *Carnets Géol., Art. 2010/06*, 1－30.

Clavel, B., Charollais, J., Schroeder, R. and Busnardo, R. (1995) Réflexions sur la biostratigraphie du Crétacé inférieur et sur sa complémentarité avec l'analyse séquentielle: exemple de l'Urgonien jurassien et subalpine. *Bull. Soc. Geol. France*, **166**: 663－680.

Donzeau, M., Wernli, R. and Charollais, J. (1998) Interprétation nouvelle de la géométrie de l'accident du Vuache dans le Jura méridional: le relais de fail

les transpressif sénestre Léaz-Champfromier (Ain). *Géol. France,* no. 2, 25−45.

Donzeau, M., Wernli, R., Charollais, J. and Monjuvent, G. (1997) Notice explicative de la carte géologique de la France (1/50000), feuille Saint-Julien-en-Genevois (653), BRGM, Orléans.

Eguchi, M. (1951) Mesozoic hexacorals from Japan. *Sci. Rep., Tohoku Univ., Ser.* 2, **24**: 1−96.

Kobayashi, F. and Vuks, V. Ja. (2006) Tithonian-Berriasian foraminiferal faunas from the Torinosu-type calcareous blocks of the southern Kanto Mountains, Japan: their implications for post-accretionary tectonics of Jurassic to Cretaceous terranes. *Geobios,* **39**: 833−843.

Meyer, M. (2000) Le Complexe récifal kimméridgien-tithonien du Jura méridional interne (France), évolution multifactorielle, stratigraphie et tectonique. *Terre et Environnement, Genève,* **24** : 1−179.

Mori, K. (1963) Geology and paleontology of the Jurassic Somanakamura Group, Fukushima Prefecture, Japan. Sci. *Rep. Tohoku Univ., Ser.* 2, **35**: 33−65.

Morino, Y. (1993) Depositional environments of the Lower Cretaceous Torinosu type limestone in the Monobe area, Kochi Prefecture. *Jour. Geol. Soc. Japan,* **99**: 173−183. (in Japanese).

Schlagintweit, F. (2012) New insights into *Troglotella incrustans* Wernli & Fooks, 1992, a fascinating Upper Jurassic-Upper Cretaceous foraminifer. *Studia UBB Geologia,* **57**: 17−26.

Schmid, D. and Leinfelder, R. (1995) *Lithocodium aggregatum* Elliot n'est pas une algue mais un foraminifère encroutant, commensalisé par le foraminifère *Troglotella incrustans* Wernli et Fookes. *Compt. Rend. Acad. Sci. Paris, ser. IIa,* **320**: 531−538.

Schroeder, R., Clavel, B., Cherchi, A., Busnardo, R., Charollais, J. and Decrouez, D. (2002) Lignées phylétiques d'Orbitolinidés de l'intervalle Hauterivien supérieur-Aptien inférieur; leur importance stratigraphique. *Rev. Paléobiol.,* **21**: 853−863

Septfontaine, M. (1977) Niveaux à Foraminifères (Pfenderininae et Valvulininae) dans le Dogger des Préalpes médianes du Chablais occidental (Haute-Savoice, France). *Eclog. Geol. Helv.,* **70**: 599−635

Septfontaine, M. (1981) Les foraminifères imperforés des milieux de plate-forme au Mésozoique: déetermination pratique, interpretation phylogénétique et utilisation biostratigraphique. *Rev. Micropaléont.,* **23**: 169−203.

Wernli, R. (1990) Stratigraphie de la série jurassique de la Haute-Chaîne (Jura méridional) entre Bellegarde et le col de la Faucille. *In,* Charollais, J. Badoux, H., Guide géologique régional ≪Suisse lémanique, Pays de Genève et Chablais≫, Ed. Masson, p. 62

Yabe, H. and Sugiyama, T. (1935) Jurassic stromatoporoids from Japan. *Sci. Rep. Tohoku Univ., Ser.* 2, **24**: 1−96.

Yao, A. (1984) Subdivision of the Mesozoic complex in Kii-Yura area, Southwest Japan and its bearing on the Mesozoic basin development in the Southern Chichibu Terrane. *Jour. Geosci., Osaka City Univ.,* **27**: 41−103.

(Received : June 20, 2012)
(Accepted : October 10, 2012)

Plate 1. Photomicrographs of the Kimmeridgian to Barremian limestone.

1. Poriferal pelloid packstone with *Cladocoropsis mirabilis* Felix, top: longitudinal section, right: transversal section, Upper Kimmeridgian, Champfromier ④-2,×6.5

2. Algal bioclastic grainstone with *Redmondoides lugeoni* (Septfontaine), Tithonian, Champfromier ④-9,×6.5

3. Algal bioclastic grainstone with *Redmondoides lugeoni* (Septfontaine), *Nautiloculina* and miliolids, Berriasian, Champfromier ⑤,×13

4. Algal foraminiferal grainstone with miliolids, Valanginian, Champfromier ⑥,×40

5. Bioclastic foraminiferal packstone with orbitolinids, Barremian, Champfromier ⑦,×13.

6. Algal pelloidal packstone with miliolids, Upper Berriasian, Salève ①.×13

7. Algal packstone/grainstone with miliolids, *Dobrogelina and Nautiloculina,* Valanginian, Salève ⑥,×13

8. Algal, crinoidal, brachiopod grainstone, Valanginian, Salève ⑥.×6.5

Plate 2. Late Kimmeridgian foraminifers from Champfromier (1).

Champfromier ④-1－④-7.

1－8, 17－19: *Nautiloculina oolithica* Mohler, **1**: D2-042627, ④-7; **2**: D2-042565, ④-2; **3**: D2-042614, ④-6; **4**: D2-042561, ④-2; **5**: D2-042589, ④-5; **6**: D2-042556; ④-2; **7**: D2-042537, ④-1; **8, 18**: D2-042564, ④-2; **17**: D2-042563, ④-2; **19**: D2-042575, ④-4; 1:×40, others:×50.

9－16: *Kurnubia palastiniensis* Henson, **9**: D2-043606, ④-6; **10**: D2-042548, ④-2; **11**: D2-042559, ④-2; **12**: D2-042580, ④-4; **13**: D2-042632, ④-7; **14**: D2-042460, ④-2; **15**: D2-042552, ④-2; **16**: D2-042634, ④-7; **9, 10, 14, 16**:×40; **11, 13**: ×30; **12**:×20; **15**:×50.

20, 21, 25, 26: *Parurgonina caelinensis* Cuvillier, Foury and Pignatti Moreno, **20**: D2-042576, ④-4,×40; **21**: D2-042565, ④-2, ×50; **25**: D2-042610, ④-6,×30; **26**: D2-042537, ④-1,×30.

22, 24, 31, 32: *Conicokurunubia orbitoliniformis* (Septfontaine), **22**: D2-042564, ④-2; **24**: D2-042565, ④-2; **31**: D2-042552, ④-2; **32**: D2-042551, ④-2; **22, 31**:×40; **24, 32**:×40.

23, 28－30: *Labyrhintina mirabilis* Weynschenk, **23**: D2-042607, ④-6,×30; **28**: D2-042632, ④-7,×20; **29**: D2-042630, ④-7,×25; **30**: D2-042582, ④-4,×30.

27: *Rectocyclammina* sp., D2-042582, ④-4,×30.

33, 34: *Everticyclammina?* sp., **33**: D2-042577, ④-4,×30; **34**: D2-042559, ④-2,×25.

35: *Ammobaculites* sp., D2-042564, ④-2,×50.

Plate 3. Late Kimmeridgian foraminifers from Champfromier (2).

Champfromier ④-1－④-7.

1－9, 11－16: *Quinqueloculina robusta* Neagu, **1, 3, 8**: D2-042592, ④-5; 2: D2-042551, ④-2; **4**: D2-042593, ④-5; **5**: D2-042558, ④-2; **6**: D2-042559, ④-2; **7**: D2-042534; ④-1; **9**: D2-042591, ④-5; **11**: D2-042622, ④-6; **12**: D2-042628, ④-7; **13**: D2-042635, ④-7; **14**: D2-042557, ④-2; **15**: D2-042598,④-5; **16**: D2-042605, ④-6; all ×50.

10: *Textularia sp.,* D2-042616, ④-6,×50.

17－27: *Redmondoides lugeoni* (Septfontaine), **17**: D2-042580, ④-4; **18**: D2-042624, ④-7; **19**: D2-042617, ④-6; **20**: D2-042616, ④-6; **21**: D2-042624, ④-7; **22**: D2-042623; ④-6; **23**: D2-042609, ④-6; **24**: D2-042621, ④-6; **25**: D2-042635, ④-7; **26**: D2-042625, ④-7; **27**: D2-042606, ④-6; **17, 18, 20, 22, 23, 25, 27**:×40; **19, 24**:×50; **21, 26**:×30.

28－30: *Troglotella incrustans* Wernli and Fookes, **28**: D2-042564,×30; **29**: D2-042559,×50; **30**: D2-042556,×40; all ④-2.

31, 32: *Lenticulina* spp., **31**: D2-042548, ④-2,×60; **32**: D2-042563, ④-2, ×50.

33: *Mohlerina basiliensis* (Mohler), D2-042561, ④-2,×40;

34－36, 40－42: *Redmondoides cf. lugeoni* (Septfontaine), **34**: D2-042609, ④-6; **35**: D2-042616, ④-6; **36**: D2-042632; ④-7; **40**: D2-042635, ④-7; **41**: D2-042594, ④-5; **42**: D2-042593, ④-5; **41**:×40, others: ×50.

37－39: *Trocholina alpina* Leupold, **37**: D2-042633, ④-7,×40; **38**: D2-042612,④-6,×50; **39**: D2-042604, ④-6, ×40.

Plate 4.

1−8: Late Kimmeridgian foraminifers from Champfromier (3). Champfromier ④-2−④-6.

1−8: *Redmondoides lugeoni* (Septfontaine), **1**: D2-042560, ④-2; **2**: D2-042622, ④-6; **3**: D2-042605, ④-6; **4**: D2-042623, ④-6; **5**: D2-042577, ④-4; **6**: D2-042576; ④-4; **7**: D2-042578, ④-4; **8**: D2-042603, ④-6; **1, 3, 5, 7**:×40; **2, 4, 7**:×50; **6**:×30.

9−31: Tithonian foraminifers from Champfromier. Champfromier ④-8, ④-9.

9, 16−23: *Redmondoides lugeoni* (Septfontaine), **9, 22**: D2-042649, ④-**8; 16**: D2-042645, ④-8; **17, 19**: D2-042648, ④-**8; 18**: D2-042640, ④-**8; 20**: D2-042641, ④-**8; 21**: D2-042660; ④-9; **23**: D2-042655, ④-**9; 9, 16, 21**:×30; **17−20, 22, 23**: ×40.

10, 11: *Quinqueloculina robusta* Neagu, **10**: D2-042658, **11**: D2-042659, both ④-9,×50.

12, 13: *Nautiloculina oolithica* Mohler, **12**: D2-042658,×50, ④-9; **13**: D2-042643, ④-8,×40.

14: *Lenticulina* sp., D2-042658, ④-9,×50.

15: *Belorussiella* sp., D2-042659, ④-9,×50.

24, 29−31: *Trocholina delphinensis* Arnaud-Vanneau, Boisseau and Darsac, **24**: D2-042659; **29**: D2-042660; **30**: D2-042650; ④-9; **31**: D2-042656, all ④-9,×50.

25, 26: *Redmondoides?* sp., **25**: D2-042639; **26**: D2-042646, both ④-8,×40.

27: *Trocholina* sp., D2-042646, ④-8,×40.

28: *Trocholina alpina* Leupold, D2-042653, ④-9,×50.

32−39: Valanginian foraminifers from Salève (1), All Salève ②.

32−34: *Nautiloculina circularis* (Said and Barakat), **32**: D2-042467,×40; **33, 34**: D2-042460,×50.

35: *Trocholina delphinensis* Arnaud-Vanneau, Boisseau and Darsac, D2-042463,×50.

36: *Pfenderina?* sp., D2-042467,×30.

37: *Trocholina cherchiae* Arnaud-Vanneau, D2-042463,×50.

38: Milioloidea indet., D2-042466,×50.

39: Foraminifera indet., D2-042465,×50.

Plate 5. Berriasian foraminifers from Champfromier.

All Champfromier ⑤.

1, 2: *Quinqueloculina robusta* Neagu, 1: D2-042701, 2: D2-042705, both×50.

3: *Istriloculina* sp., D2-042710,×60.

4: Milioloidea indet., D2-042716,×50.

5−8, 10: *Quinqueloculina* sp., **5**: D2-042712, **6**: D2-042713, **7**: D2-042698, **8**: D2-042710, **10**: D2-042714; all×50.

9: *Spiroplectammina* sp., D2-042713,×60.

11−13: *Redmondoides lugeoni* (Septfontaine), **11**: D2-042710,×50; **12**: D2-042698,×40; **13**: D2-042716,×50.

14, 15: *Trocholina elongata* (Leupold), **14**: D2-042716, **15**: D2-042711, both×50.

16, 19, 20: *Trocholina delphinensis* Arnaud-Vanneau, Boisseau and Darsac, **16**: D2-042705,×40; **19**: D2-042708, ×40; **20**: D2-042714,×50.

21−38: *Nautiloculina circularis* (Said and Barakat), **21, 32**: D2-042702; **22, 36**: D2-042712: **23**: D2-042710; **24**: D2-042709; **25, 30, 33, 37**: D2-042719; **26, 38**: D2-042695; **27**: D2-042714; **28**: D2-042707; **29**: D2-042700; **31**: D2-042708; **34**: D2-042716; **35**: D2-042720; **21, 24−27, 29, 32**:×40; **22, 23, 28, 30, 31, 33−38**:×50.

39: *Lenticulina* sp., D2-042720,×60.

Plate 6. Lower Valanginian foraminifers from Champfromier

All Champfromier ⑥

1: *Haplophragmoides* sp, D2-042745,×50.

2, 11: *Nautiloculina?* sp., **2**: D2-042740; **11**: D2-042735, both×50

3: *Nautiloculina* sp., D2-042724,×50

4, 5: *Istriloculina* sp., **4**: D2-042735; **5**: D2-042722, both×50

6－10, 12－17: *Quinqueloculina robusta* Neagu, **6**: D2-042728; **7**: D2-042721; **8**: D2-042740; **9, 15**: D2-042743; **10**: D2-042734; **12, 16**: D2-042732; **13**: D2-042727; **14**: D2-042737; **17**: D2-042729, all×50 except for **8b**:×80.

18－21, 24, 25, 28: *Quinqueloculina* sp., **18**: D2-042734; **19**: D2-042721, **20**: D2-042731, **21**: D2-042741, **24, 25**: D2-042735; 28: D2-042723, all×50.

22, 23, 26, 27, 29: Milioloidea indet., **22**: D2-042730, **23**: D2-042723, **26**: D2-042727; **27**: D2-042728; **29**: D2-042725; **22, 26, 29**:×40; **23, 27**:×50.

30: *Pfenderina* sp., D2-042732,×40.

31: *Rectocyclammina?* sp., D2-042726,×30.

32, 33, 35－37: *Redmondoides* cf. *lugeoni* (Septfontaine), **32**: D2-042744,×40; **33**: D2-042739,×40; **35**: D2-042722,×30; **36**: D2-042734,×30; **37**: D2-042727,×50.

34, 46: *Belorussiella* sp. A, **34**: D2-042722; **46**:D2-042741, both×50.

38: *Pseudolituonella* sp., D2-042745,×50.

39: Textulariidae indet., D2-042740,×20.

40, 43: *Dobrogelina* sp., **40**: D2-042743: **43**: D2-042742, both×50.

41: *Siphovalvulina?* sp., D2-042722,×50.

42, 51: Pfenderinidae indet., **42**: D2-042726; **51**: D2-042723, both×50.

44, 45: *Trocholina cherchiae* Arnaud-Vanneau, **44**: D2-042735,×50; **45**: D2-042739,×40.

47, 48, 50: *Duotaxis?* sp., **47**: D2-042727; **48**: D2-042723; **50**: D2-042743, all×50.

49: Trochamminidae indet., D2-042732,×40.

52－55, 57－62: *Textularia* spp., **52**: D2-042736; **53**: D2-042733; **54**: D2-042723; **55**: D2-042744; **57**: D2-042727; **58, 61, 62**:D2-042730; **59**: D2-042728; **60**: D2-042732; **57**:×40, others:×50.

56: *Belorussiella* sp. B, D2-042733,×50.

Plate 7. Barremian foraminifers from Champfromier (1)

(The Orbitolinids are determined by B. Clavel)

All Champfromier ⑦

1: Milioloidea indet. A, D2-042759,×50.

2: *Vercorsella arenata* Arnaud-Vanneau, D2-042764, ×40.

3: *Lenticulina* sp., D2-042770,×50.

4－6: *Dobrogelina?* sp., **4**: D2-042749; **5**: D2-042747; **6**: D2-042777, all×50.

7: Milioloidea indet. B, D2-042756,×40.

8, 9: Pfenderinidae indet., **8**: D2-042752,×40; **9**: D2-042765,×50.

10, 12－15, 18－20: Milioloidea indet. C, **10**: D2-042755; **12**: D2-042778; **13**: D2-042760; **14**: D2-042779; **15, 18**: D2-042770; 19: D2-042762; **20**: D2-042766, all×50.

11: *Rectocyclammina* sp., D2-042750,×30.

16, 17, 22: *Nautiloculina cretacea* Peybernnes, **16**: D2-042762, ×40; **17**: D2-042774, ×40; **22**: D2-042761,×30.

21: *Trocholina* sp., D2-042767,×40.

23: *Redmondoides?* sp., D2-042752,×30.

24, *Falsurgonina pileola* Arnaud-Vanneau & Argot, D2-042758,×40.

25, 29: *Lituonella* sp., **25**: D2-042764,×25; **29**: D2-042775,×30.

26: *Palaeodictyoconus cuvillieri* Foury, D2-042749,×40

27: *Paracoskinolina* cf. *sunnilandensis* Maync, D2-042752,×40.

28, 32－34: Orbitolinidae indet., **28**: D2-042748,×50; **32**: D2-042749,×50; **33**: D2-042758,×40; **34**: D2-042762, ×40.

30, 31: *Orbitolinopsis debelmasi* Moullade & Thieuloy, **30**: D2-042752,×30; **31**: D2-042768,×30.

Plate 8. Barremian foraminifers from Champfromier (2)
(The Orbitolinids are determined by B. Clavel)
All Champfromier ⑦

1, 2?,5, 6: *Valserina* cf. *broennimanni* Schroeder, Conrad and Charollais, **1**: D2-042764; **2**: D2-042756; **5**: D2-042777; **6**: D2-042747; **1,6**:×25; **2,5**:×30.

3, 4, 7－9, 11-21, 23: *Palaeodictyoconus cuvillieri* Foury, **3**: D2-042749; **4**: D2-042765; **7**: D2-042759; **8**: D2-042753; **9, 17**: D2-042771; **11**: D2-042763; **12**: D2-042752; **13**: D2-042758; **14**: D2-042758; **15**: D2-042770; **16**: D2-042777; **18**: D2-042762; **19**: D2-042775, **20**: D2-042747; **21**: D2-042777; **23**: D2-042750, **3, 4, 7－9, 12－14, 16, 17, 19, 21**:×30; **11, 20, 23**:×25; **15**:×40; **18**:×20.

10: *Cribellopsis elongata* (Dieni, Massari and Moullade), D2-042754, ×30.

22: *Palaeodictyoconus actinostoma* Arnaud-Vanneau and Schroeder, D2-042771, ×30.

Plate 9. Barremian foraminifers from Champfromier (3)
(The Orbitolinids are determined by B. Clavel)
All Champfromier ⑦

1, 4, 9, 14: *Valserina broennimanni* Schroeder, Conrad and Charollais, **1**: D2-042767; **4**: D2-042759; **9**: D2-042762; **14**: D2-042768; **1, 4, 9**:×30; **14**:×50.

2, 3, 5, 6, 8－18: *Valserina* cf. *broennimanni* Schroeder, Conrad and Charollais, **2, 3, 10**: D2-042753; **5**: D2-042778; **6**: D2-042758; **8**: D2-042748; **9**: D2-042762; **11**: D2-042777; **12, 17**: D2-042752; **13**: D2-042754; **14**: D2-042768; **15**: D2-042751; **16**: D2-042748, **18**: D2-042753, **2, 3, 5, 6, 8, 9, 11, 17a, 18**:×30; **10, 12, 15, 16**:×25; **13, 14, 17b**: ×50.

7: *Palaeodictyoconus actinostoma* Arnaud-Vanneau and Schroeder, D2-042746,×25.

19: Orbitolinidae indet., D2-042777,×20.

Plate 10. Late Berriasian foraminifers from Salève.
All Salève ① (basal part of the Chambotte Formation).

1, 2: *Grochamminoides?* sp., **1**: D2-042454; **2**: D2-042455, both×80.

3: *Glomospira?* sp., D2-042440,×80.

4－29: *Quinqueloculina robusta* Neagu, **4, 7, 15**: D2-042454; 5: D2-042439: **6**: D2-042440; **8**: D2-042450; **9, 18**: D2-042441; **10, 20**: D2-042446; **11**: D2-042437; **12, 24**: D2-042447; **13**: D2-042438; **14**: D2-042449; **16**: D2-042456; **17**: D2-042451, **19**: D2-042442; **21, 26**: D2-042443; **22, 25**: D2-042452; **23, 27**: D2-042444; **28**: D2-042459; **29**: D2-042444, all×50.

30－33, 35: Milioloidea indet., **30, 33**: D2-042440; **31**: D2-042435; **32**: D2-042459; **35**: D2-042442, **35**:×50, others:×40.

34, 42, 45－49: *Nautiloculina broennimanni* Arnaud-Vanneau and Peybernes, **34**: D2-042452,×50; **42**: D2-042441, ×40; **45**: D2-042440,×50; **46**: D2-042454,×50; **47**: D2-042439,×40; **48**: D2-042446,×40; **49**: D2-042450,×50.

36－41: *Istriloculina* sp., **36, 38**: D2-042444; **37**: D2-042447; **39**: D2-042445; 40, **41**: D2-042438, all×50.

43: *Everticyclammina* sp., D2-042451,×20.

44: *Pseudolituonella gavonensis* Foury, D2-042443,×40.

50, 51, 54－59: *Textularia* spp., **50**: D2-042445; **51**: D2-042452: **54, 59**: D2-042444; **55**: D2-042450; **56**: D2-042437; **57**: D2-042440; **58**: D2-042455, **50**:×40; 51, **54－58**:×50; **59**:×30.

52, 53: *Pfenderina* sp., **52**: D2-042442; **53**: D2-042457, both×50.

60, 67, 68: *Trocholina campanella* Arnaud-Vanneau, **60**: D2-042459,×50; **67**: D2-042444,×50; **68**: D2-042456,×40.

61: *Dobrogelina* cf. anastasiui Neagu, D2-042436,×40.

62: *Belorussiella* sp., D2-042453,×50.

63, 64, 66: *Pfenderina neocomiensies* (Pfender), **63**: D2-042438,×40; **64**: D2-042456,×50; **66**: D2-042437,×40.

65, 69－71: *Trocholina cherchiae* Arnaud-Vanneau, **65**: D2-042454; 69: D2-042435; **70**: D2-042448; **71**: D2-042438, all×40.

72: *Lenticulina* sp., D2-042439,×40.

Plate 11. Valanginian foraminifers from Salève (2).

All Saléve ③.

1: *Glomospira?* sp., D2-042475,×60.

2: Ammodiscidae indet., D2-042483,×60.

3, 5: *Nautiloculina* sp. 3: D2-042486; 5: D2-042469, both×60.

4: *Haplophragmoides joukowskyi* Charollais, Bönnimann and Zaninetti, D2-042487,×60.

6: *Nautiloculina broennimanni* Arnaud-Vanneau and Peybernes, D2-042477,×50.

7: *Charentia cuvillieri* Neumann, D2-042487,×40

8: *Ammobaculites* sp. A, D2-042468,×40

9: *Ammobaculites* sp. B, D2-042489,×50

10－12: *Pfenderina neocomiensis* (Pfender), **10**: D2-042469; **11**: D2-042471; **12**: D2-042490, all ×30.

13: Pfenderinidae indet., D2-042493,×50.

14: *Pseudotextulariella courtionnensis* Bönnimann, D2-042491,×50.

15: *Trocholina cherchiae?,* D2-042477,×48.

16: *Trocholina?* sp., D2-042493,×40.

17: *Rectocyclammina?* sp., D2-042486,×40.

18－20: *Redmondoides lugeoni* (Septfontaine), **18**: D2-042485; **19**: D2-042472; **20**: D2-042474, all×50.

21, 23, 24: *Textularia* sp., **21**: D2-042470; **23, 24**: D2-042474, all× 50.

22: *Pseudolituonella gavonensis* Foury, D2-042470,×50.

25, 33: *Dobrogelina* sp., **25**: D2-042474; **33**: D2-042475, both×50.

26: *Pfenderina* sp., D2-042483,×50.

27, 34－49: *Quinqueloculina robusta* Neagu, **27**: D2-042474; **34, 37, 46**: D2-042469: **35, 47**: D2-042483; **36**: D2-042486; **38**: D2-042493; **39, 42, 44**: D2-042489; **40**: D2-042470; **41**: D2-042487; **43**: D2-042488; **45**: D2-042472; **48**: D2-042473; **49**: D2-042477, all×50.

28, 29, 32: *Istriloculina* sp., **28**: D2-042488; **29**: D2-042479; **32**: D2-042489, all×50.

30: *Belorussiella* sp., D2-042471,×50.

31: *Siphovalvulina* sp., D2-042480,×40.

50－56: Milioloidea indet. A, **50**: D2-042470; **51**: D2-042481; **52, 55, 56**: D2-042486; **53**: D2-042473; **54**: D2-042482, all×50.

57: Milioloidea indet. B, D2-042493,×50.

Plate 12. Valanginian foraminifers from Salève (3).

11, 50: Salève ⑤; **35, 46. 47, 49**: Salève ⑥; others: Salève ④.

1, 11: *Nautiloculina broennimanni* Arnaud-Vanneau and Peybernes, 1: D2-042496; **11**: D2-042520, both×40.

2: *Pseudolituonella gavonensis* Foury, D2-042506,×40.

3: *Ammobaculites?* sp., D2-042504,×20.

4: *Acruliammina* sp., D2-042514,×30.

5: *Textularia?* sp., D2-042516,×40.

6: *Textularia* sp., D2-042513,×50.

7, 8, 10: *Pfenderina? aureliae* Neagu, **7**: D2-042502, ×50; **8**: D2-042500, ×60; **10**: D2-042513,×60.

9: *Conorbinella* sp., D2-042494, ×80.

12: *Ammobaculites?* sp., D2-042511, ×50.

13－15: *Dobrogelina* sp. A, **13**: D2-042507; **14**: D2-043509; **15**: D2-042495, all×50.

16, 28: *Trocholina campanella* Arnaud-Vanneau, **16**: D2-042515; **28**: D2-042531, both×50.

17－19: *Trocholina cherchiae* Arnaud-Vanneau, **17**: D2-042515; **18, 19**: D2-042506, all×50.

20: *Pseudotextulariella courtionensis* Brönnimann, D2-042516, ×50.

21－23: *Istriloculina* sp., **21**: D2-042495; **22**: D2-042497; **23**: D2-042509, all×50.

24－27, 42?: *Dobrogellina* spp., **24**: D2-042515; **25**: D2-042505; **26**: D2-042502; **27**: D2-042504; **42**: D2-042507, all×50.

29, 30, 34, 36: *Quinqueloculina* sp., 29: D2-042514; **30**: D2-042503; **34, 36**: D2-042495; all×50.

31－33, 35, 37?, 38, 44, 45, 48: *Quinqueloculina robusta* Neagu, **31**: D2-042504; **32**: D2-42494; **33**: D2-042503, **35**: D2-042530; **37**: D2-042506; **38**: D2-042515; **44, 45**: D2-042500; **48**: D2-042509; all×50.

39－41, 43: Milioloidea indet. A, **39**: D2-042497; **40, 43**: D2-042515; **41**: D2-042498; all×50.

46, 47, 49: *Lenticulina* sp., **46, 49**: D2-042529; **47**: D2-042531; all×50.

50, 53－56: Milioloidea indet. B, **50**: D2-042525; **53**: D2-042512; **54**: D2-042516; **55**: D2-042515; **56**: D2-042517, all×50.

51, 52: *Belorussiella* sp., 51: D2-042496, 52: D2-042499, both×50.

Plate 1.

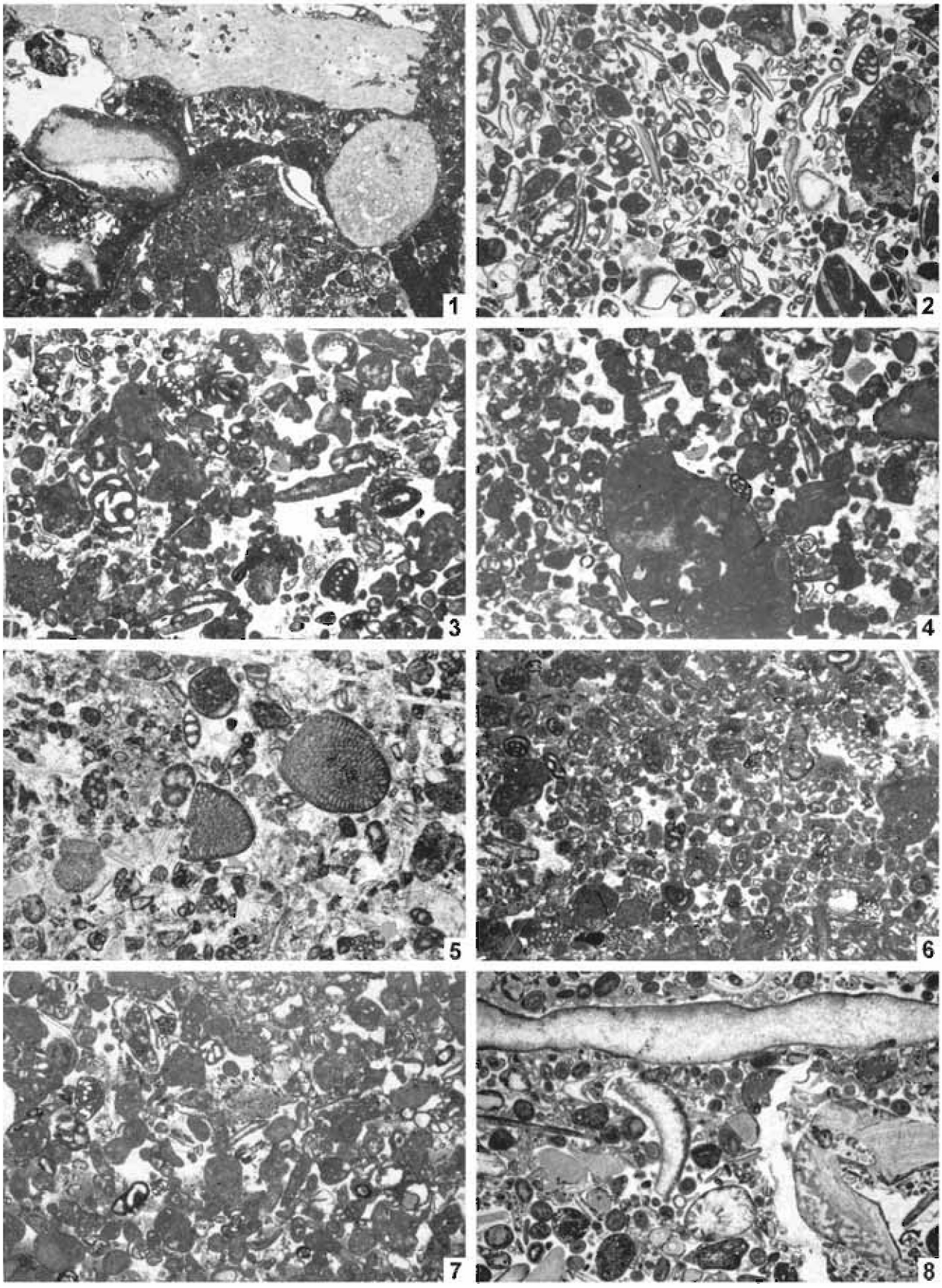

Plate 2.

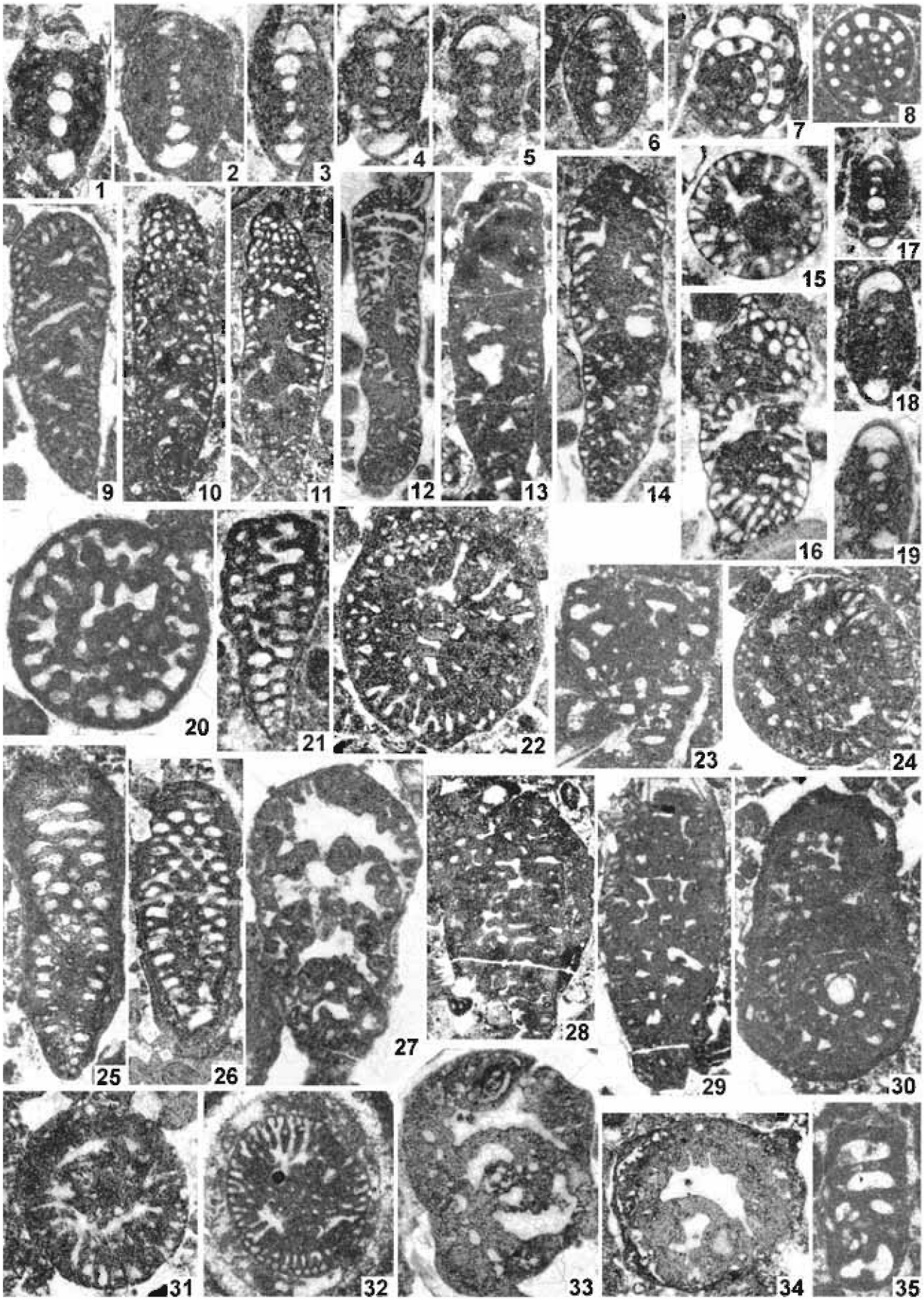
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35

Plate 3.

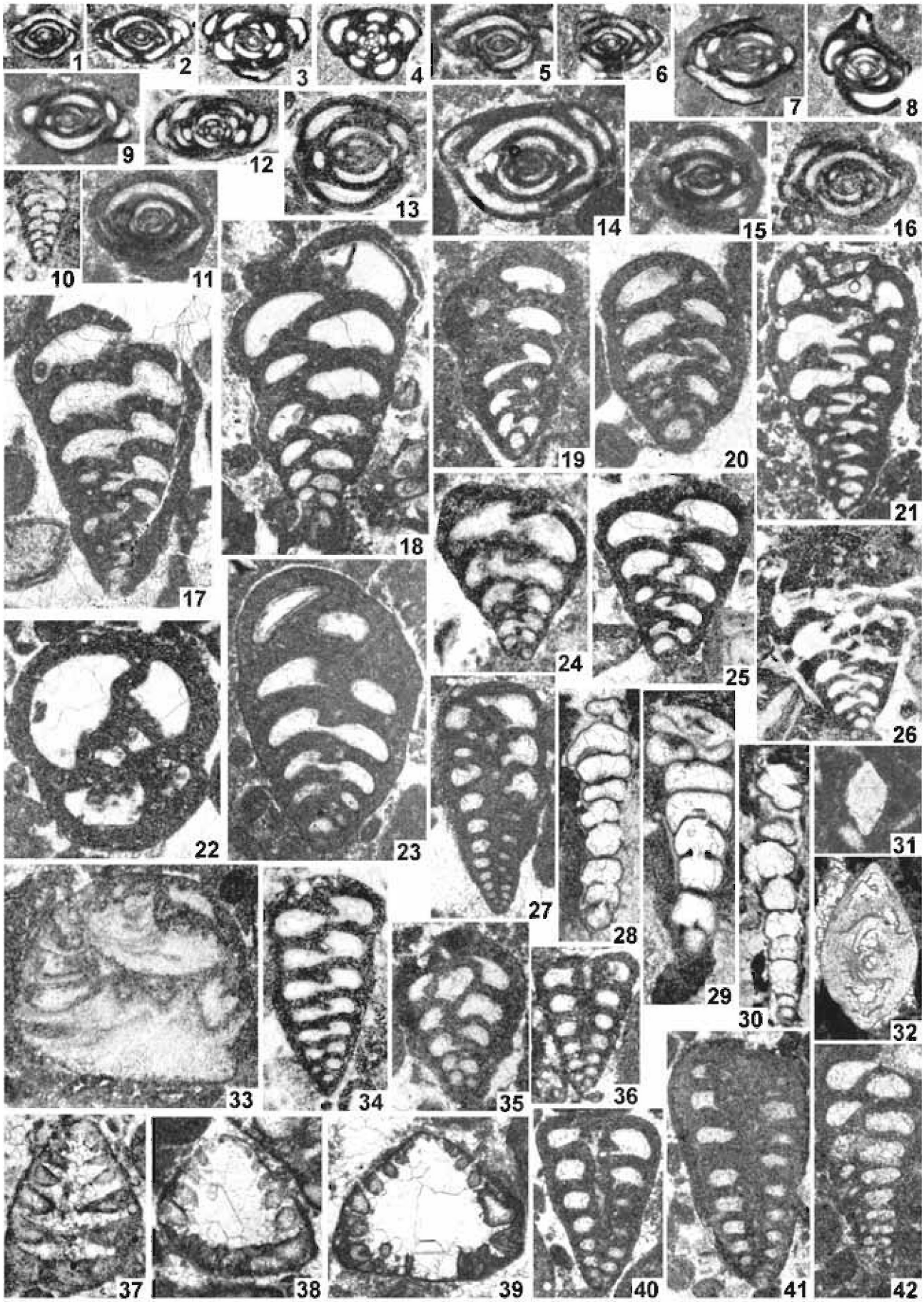
1
2
3
4
5
6
7
8
9
12
13
14
15
16
10
11
18
19
20
21
17
24
25
26
22
23
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42

Plate 4.

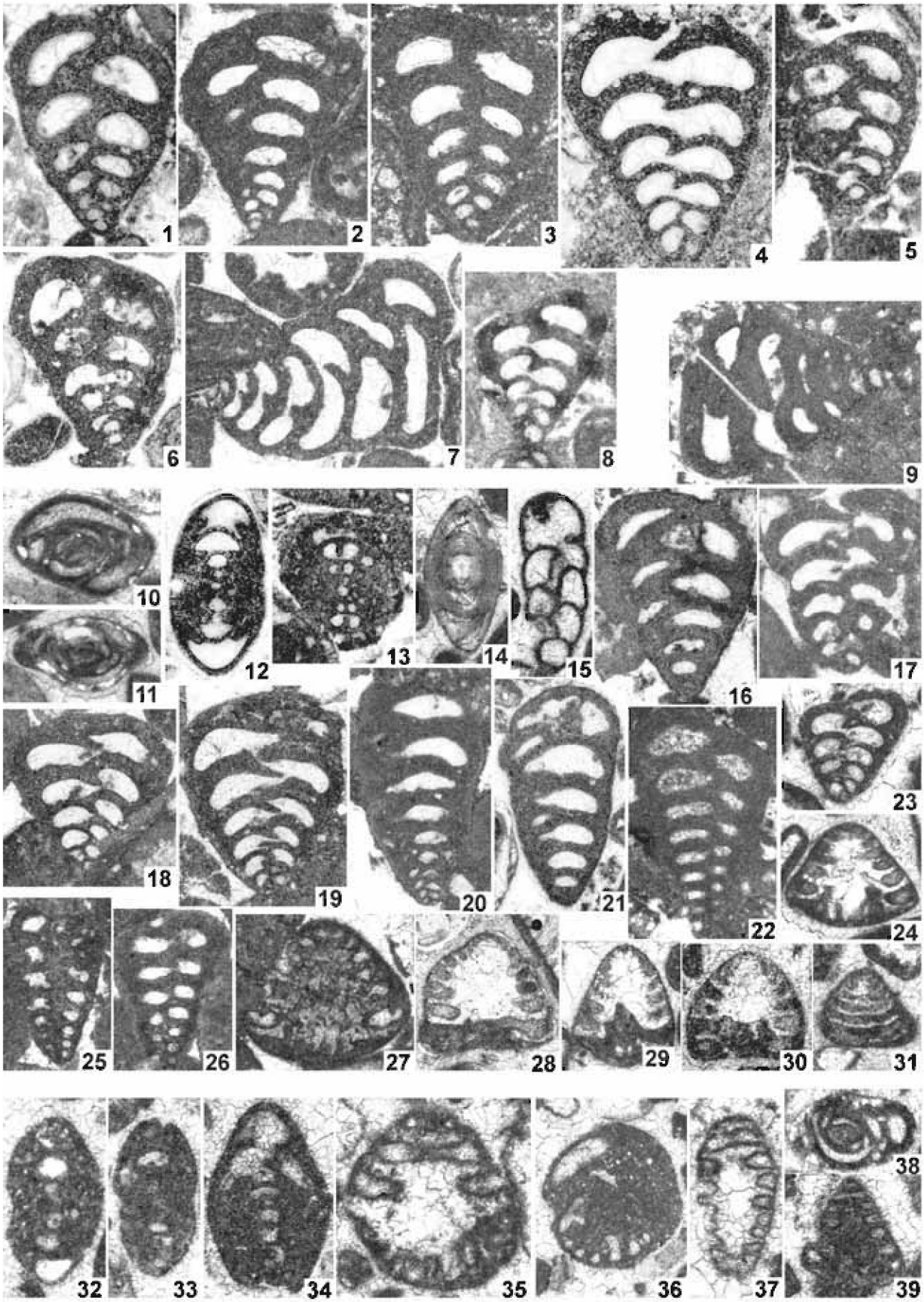
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39

Plate 5.

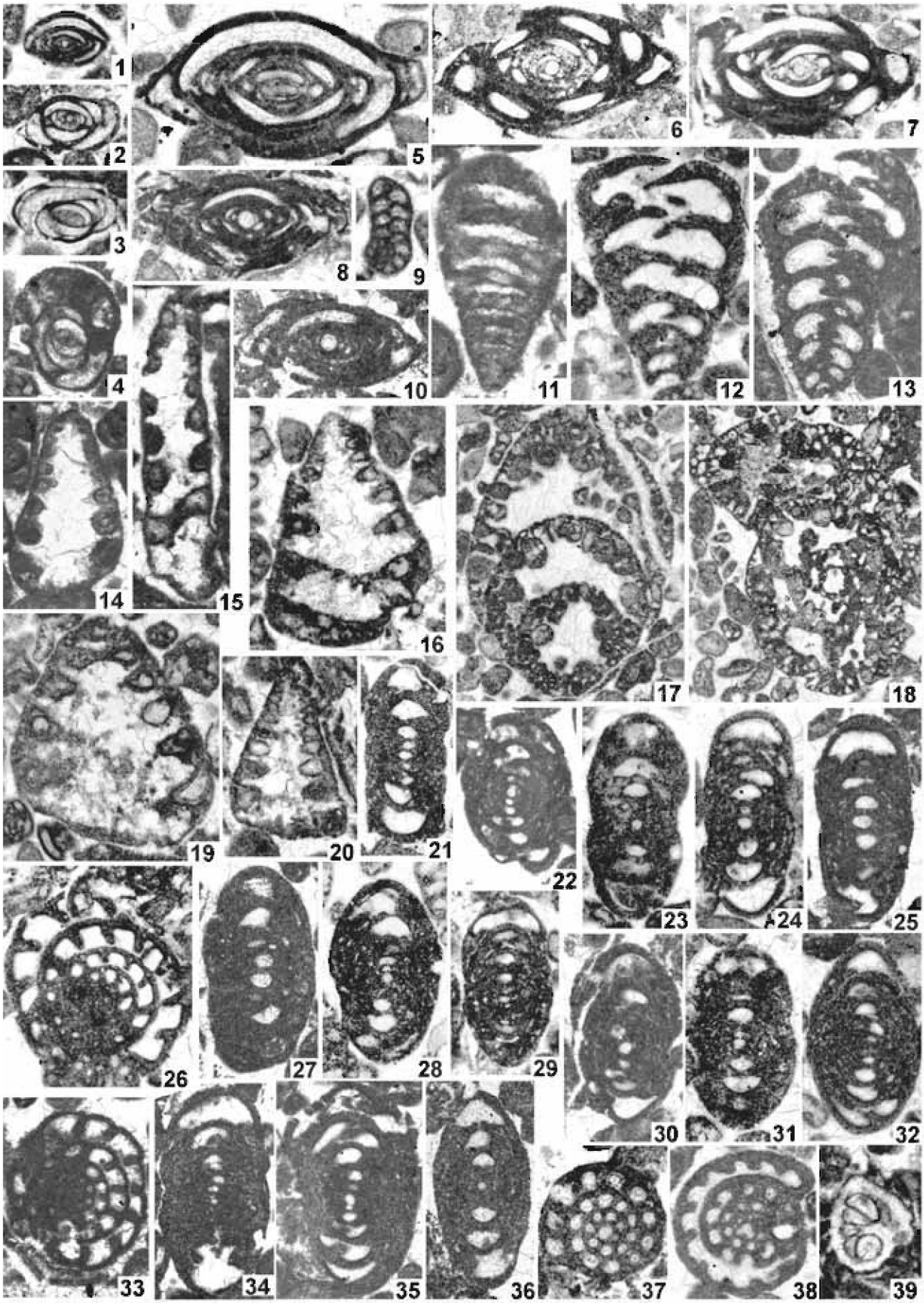
1
2
5
6
7
3
8
9
4
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39

Plate 6.

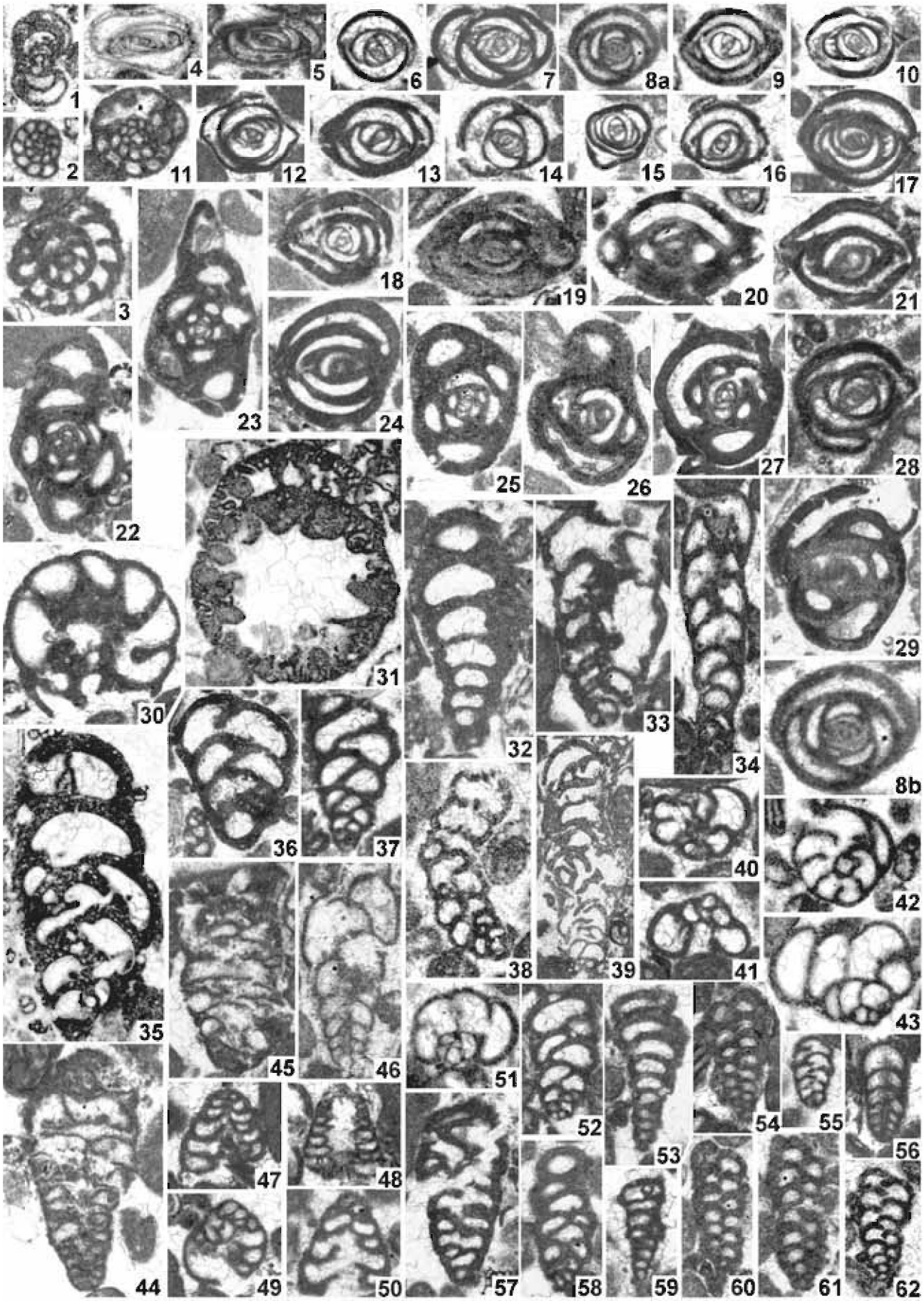
1
2
3
4
5
6
7
8a
8b
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
61
62

Plate 7.

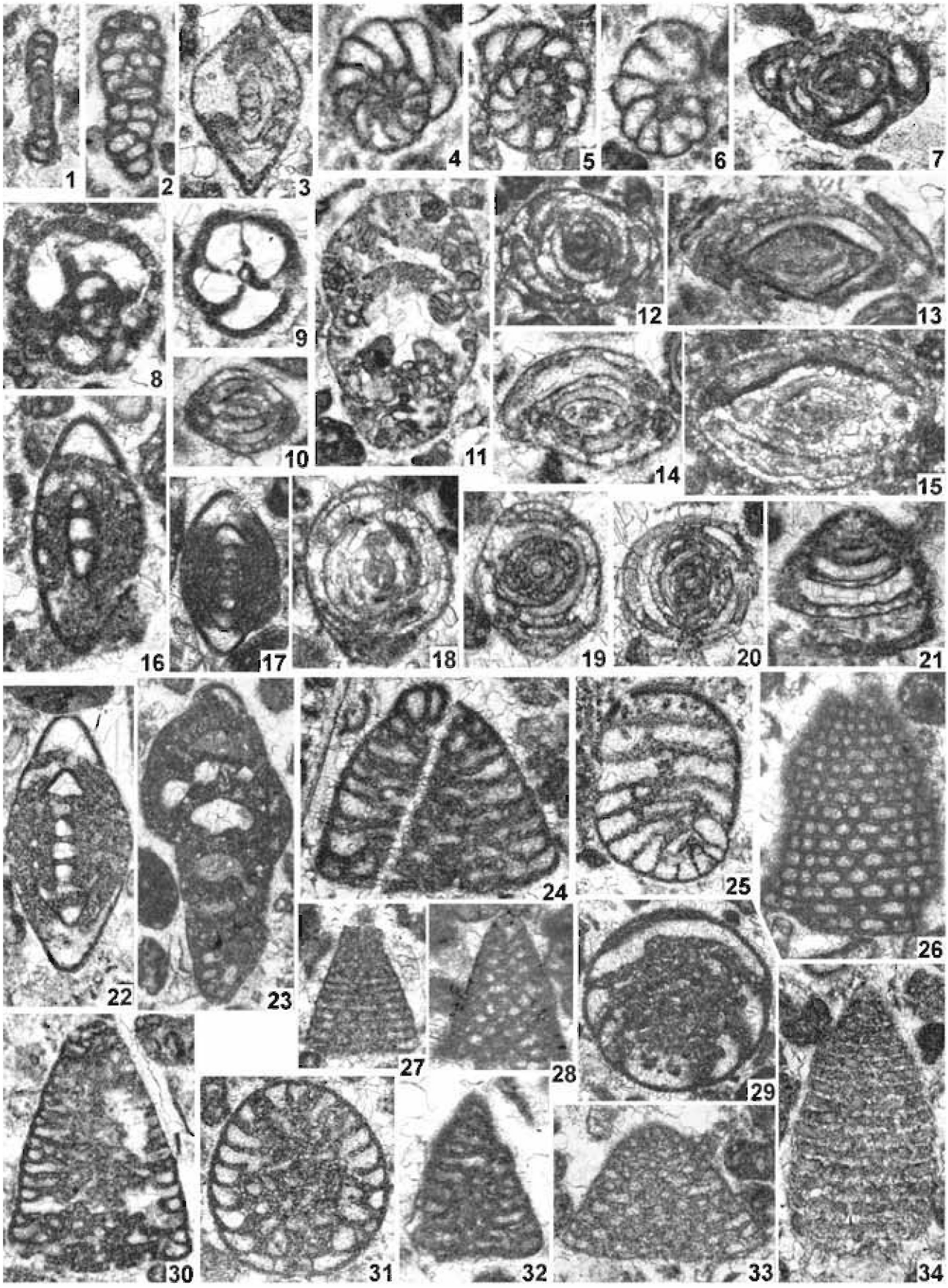
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34

Plate 8.

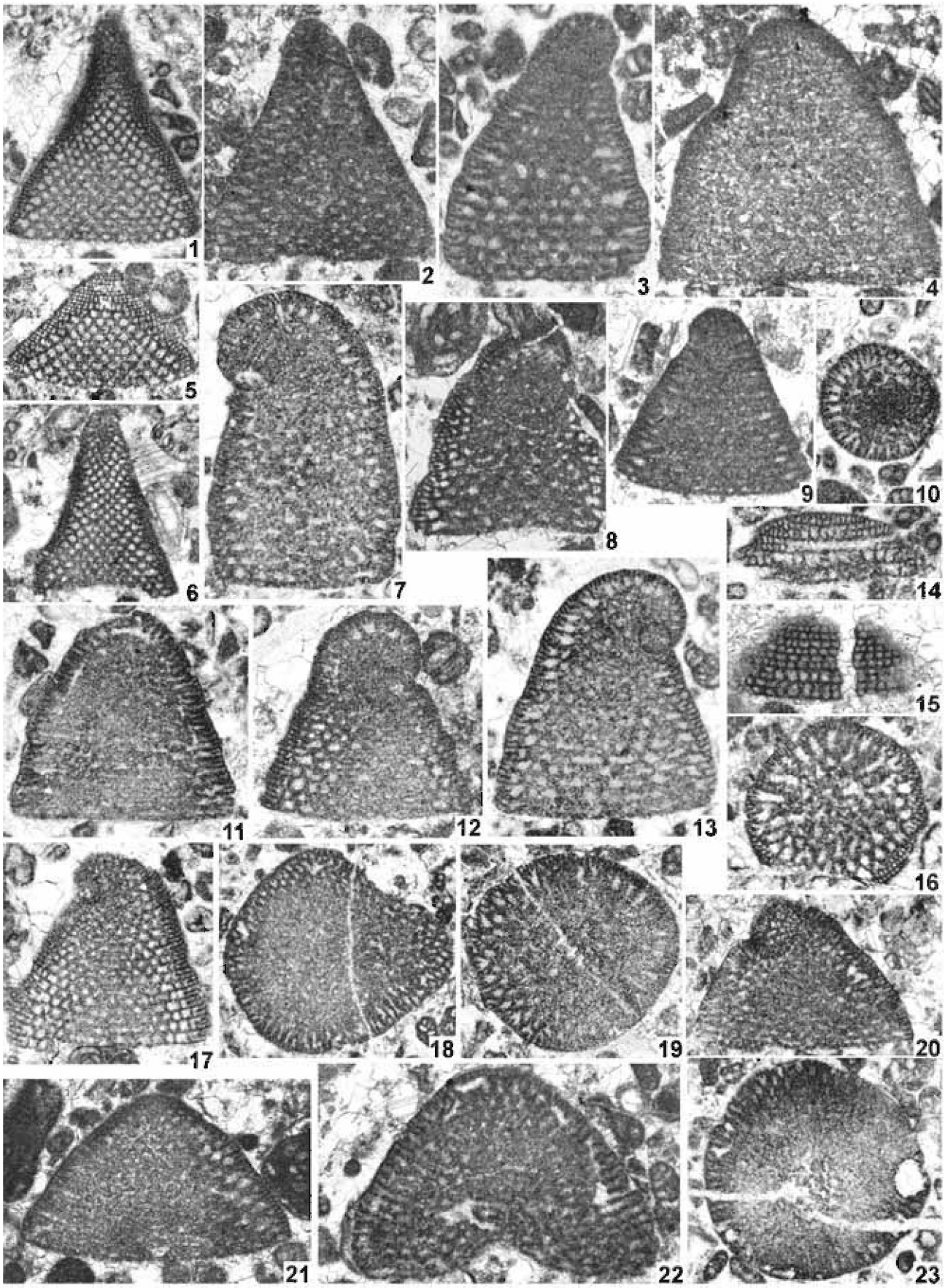

Plate 9.

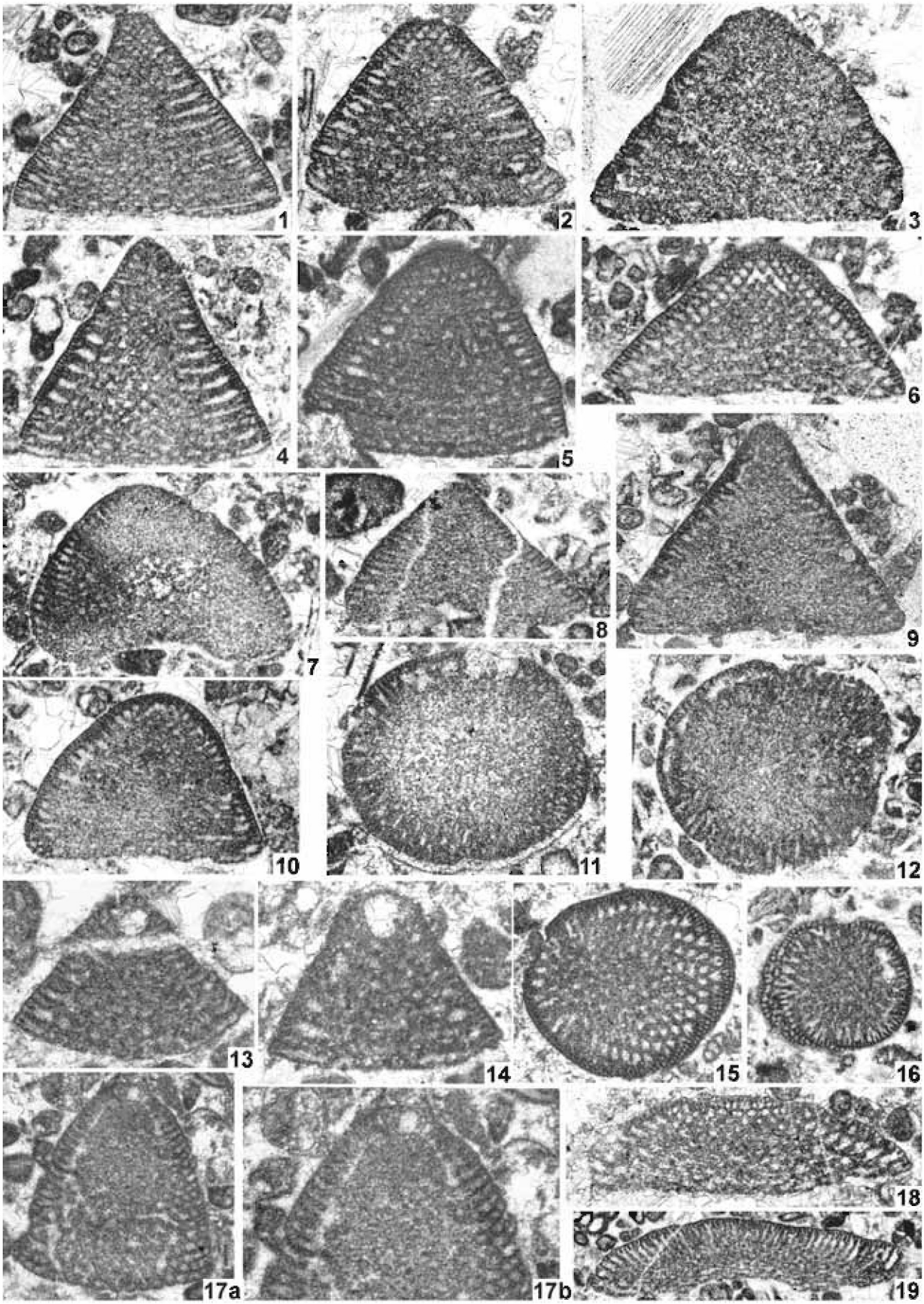

Plate 10.

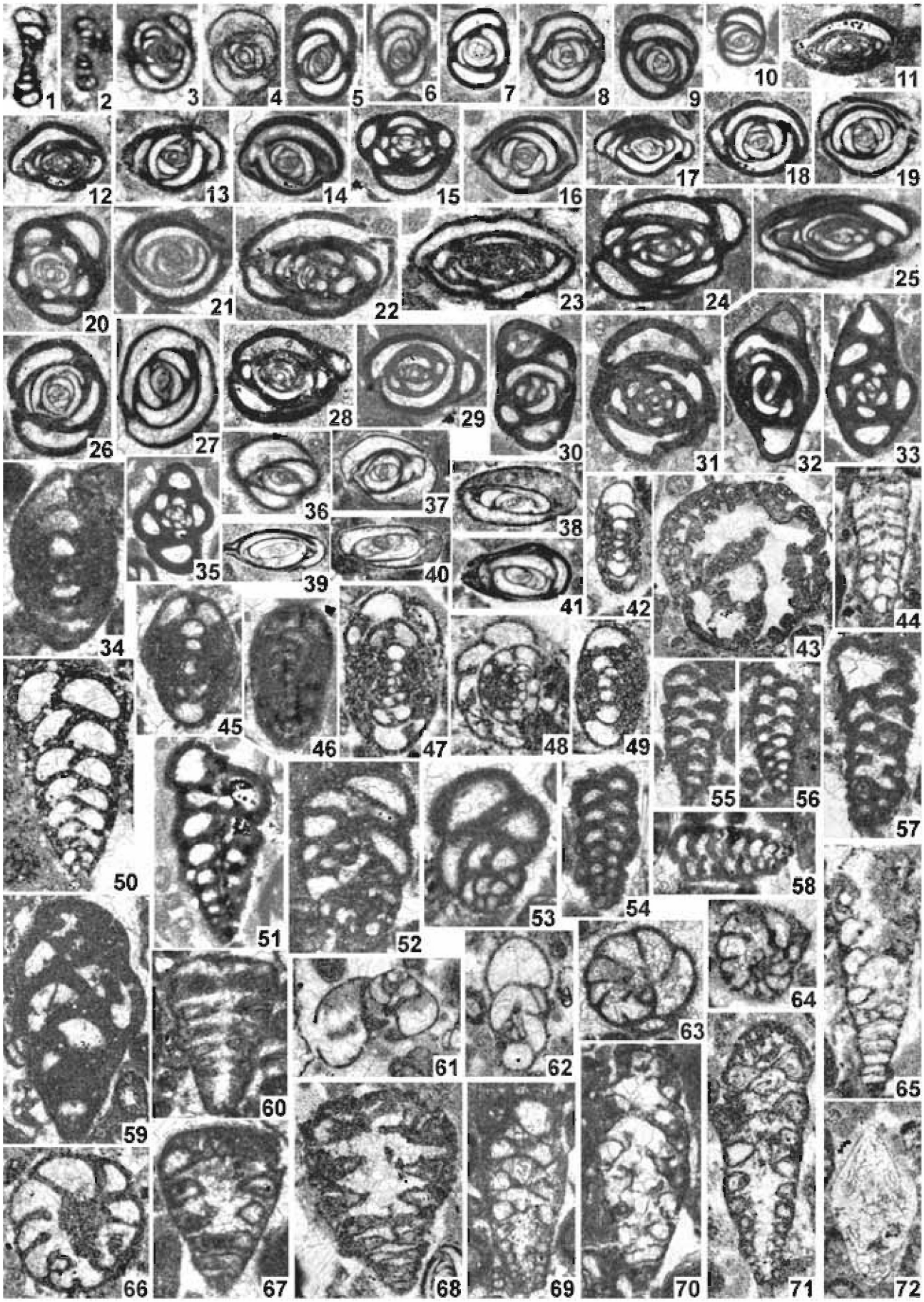
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65
66
67
68
69
70
71
72

Plate 11.

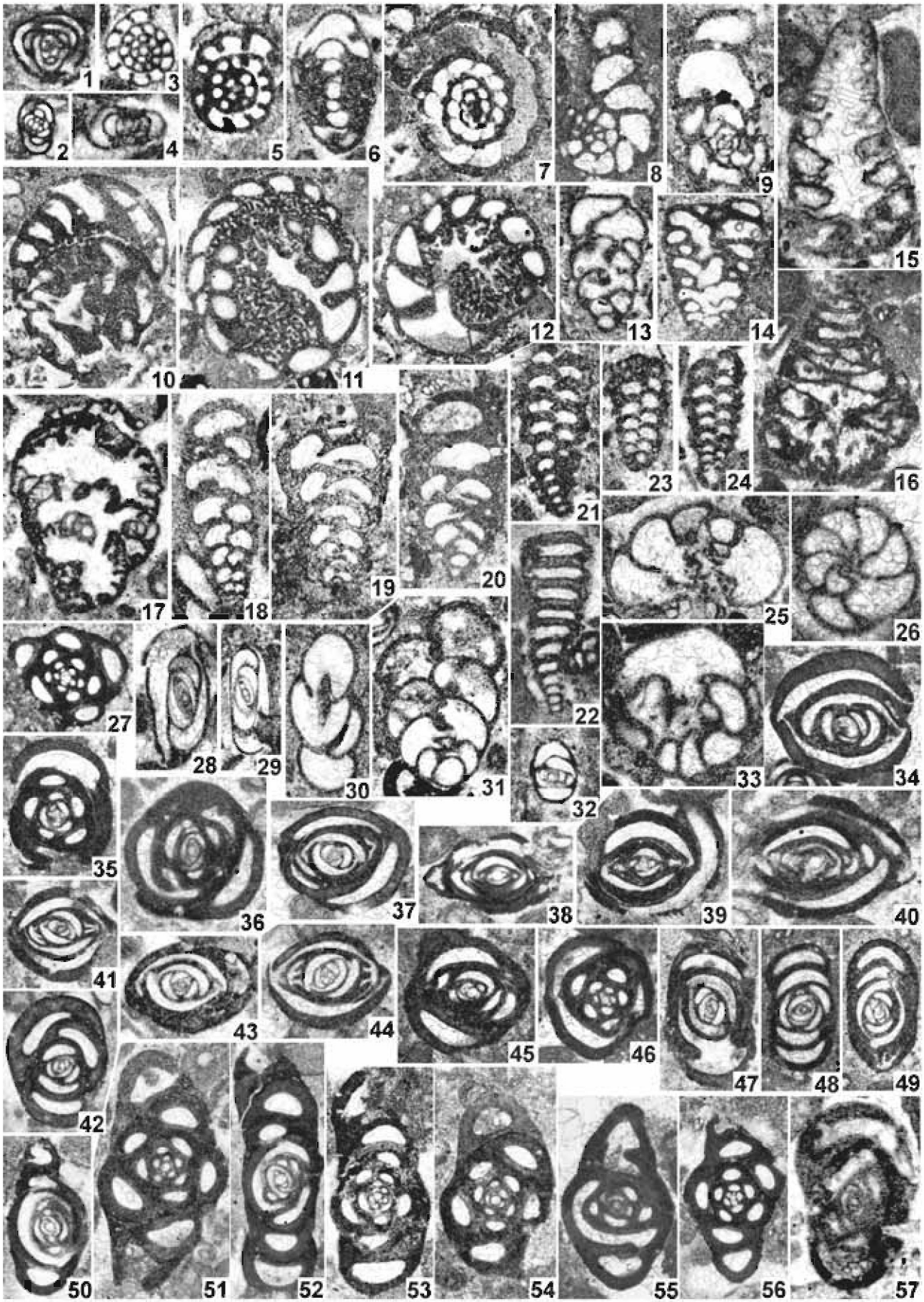
1
3
2
4
5
6
7
8
9
15
10
11
12
13
14
16
17
18
19
20
21
23
24
25
26
22
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
43
44
45
46
47
48
49
42
50
51
52
53
54
55
56
57

Plate 12.


1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56

ジュラ山地南部とサレーブ山地(フランス)のジュラ紀後期から白亜紀前期（Kimmeridgian期からBarremian期）の有孔虫化石

小林文夫・Roland Wernli

兵庫県立人と自然の博物館自然・環境評価研究部/兵庫県立大学自然・環境科学研究所　〒669-1546 三田市弥生が丘6・ジュネーブ大学地質学古生物学教室　13 rue des Maraîchers, 1211 Genève 4, Switzerland

ジュラ山地南部とサレーブ山地のKimmeridgianからBarremianの18試料で識別された有孔虫化石を試料ごとに図示し，それらの生層序学的所見を加えた．それらのなかで特に重要なものは日本では未報告の *Kurnubia palastiniensis* Henson, *Conicokurunubia orbitoliniformis* (Septfontaine), *Labyrhintina mirabilis* Weynschenk, *Parurgonia caelinensis* Cuvillier, Foury and Pignatti-Moranoなど Kimmeridgian 期の有孔虫類，*Valserina broennimanni* Schroeder, Conrad and Charollais, *Palaeodictyoconus cuvillieri* Fouryなど多彩なHauterivian最後期からBarremian最前期の orbitolinidの仲間である．これらフランスの試料はジュラ紀後期から白亜紀前期有孔虫類の分類，さらには鳥巣石灰岩ならびに鳥巣型石灰岩や蝦夷層群・宮古層群など日本の下部白亜系"*Orbitolina*石灰岩"のような異地性岩体の年代論に有用である．