

# Famennian ostracods from the İstanbul Zone (Gebze, Kocaeli, NW Turkey) and their paleogeographical relations

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**Abstract:** Famennian (Late Devonian) ostracods of the Thuringian Mega-Assemblage were recovered for the first time from three incomplete sections of the Ayineburnu Member of the Büyükada Formation in the Denizliköy area (Gebze, NW Turkey), which were sampled for conodonts. Conodont faunas define an interval extending from the Upper *rhomboidea*? or Lower *marginifera* Zone into the Middle *expansa* Zone of the standard Upper Devonian conodont zonation. The ostracod faunas found here consist of species mainly with thin-walls, long spines and often smooth surfaces such as *Rectonaria*, *Tricornina*, *Orthonaria*, *Triplacera*, *Beckerhealdia*, *Timorhealdia*, *Bohemina*, *Paraberounella* and *Acratia*. These taxa indicate faunal relationship with Thuringia and the Rhenish Massif in Germany, the Cantabrian Mountains and Pyrenees in Spain, Holy Cross Mountains in Poland, North Africa and China.

**Key words:** Ostracods, conodonts, Famennian, İstanbul Zone, NW Turkey.

## Introduction

The study area is in the İstanbul Zone of the Pontides (Fig. 1). The Paleozoic sequence of this zone has been the subject of much study including stratigraphy (Abdüselamoğlu 1963; Haas 1968; Kaya 1973; Göncüoğlu 1997; Gedik & Önalın 2001; Gedik et al. 2005), stratigraphy and sedimentology (Önalın 1987/1988, Yalçın & Yılmaz 2010), tectonics and global tectonics (Göncüoğlu & Kozur 1998, 1999; Yanev et al. 2006), conodonts (Çapkinoğlu 1997, 2000, 2005a,b; Göncüoğlu et al. 2004) and radiolarians (Noble et al. 2008). Some papers concentrate on the Devonian ostracods such as beyrichioideans (Paeckelmann & Sieverters 1932; Paeckelmann 1938; Nazik et al. 2007), Thuringian (Dojen et al. 2004), beyrichioideans and entomozoaceans (Yalçın et al. 2007; Nazik & Groos-Uffendorde 2008, 2009, 2011; Nalcıoğlu et al. 2009), entomozoaceans and Thuringian (Şeker 2011). The aim of the present paper is to analyse the first Famennian ostracods of the Thuringian Mega-Assemblage record from the Ayineburnu Member in İstanbul Zone, NW Turkey, and to correlate them with the Thuringian Mega-Assemblage ostracods and zonation of North Africa, Europe and China.

## Stratigraphy

The Paleozoic sequence of the İstanbul Zone comprises rock units ranging from Ordovician into Carboniferous. Its tectonic and stratigraphic features were investigated by different authors (Kaya 1973; Şengör et al. 1984; Göncüoğlu & Kozur 1998; Gedik et al. 2005; Yanev et al. 2006; Yalçın & Yılmaz 2010). In this research, the Famennian ostracods were determined from the Ayineburnu Member of the Büyükada Formation that was divided into the Bostancı (basal), Yörükali and Ayineburnu (top) Members by Kaya (1973).

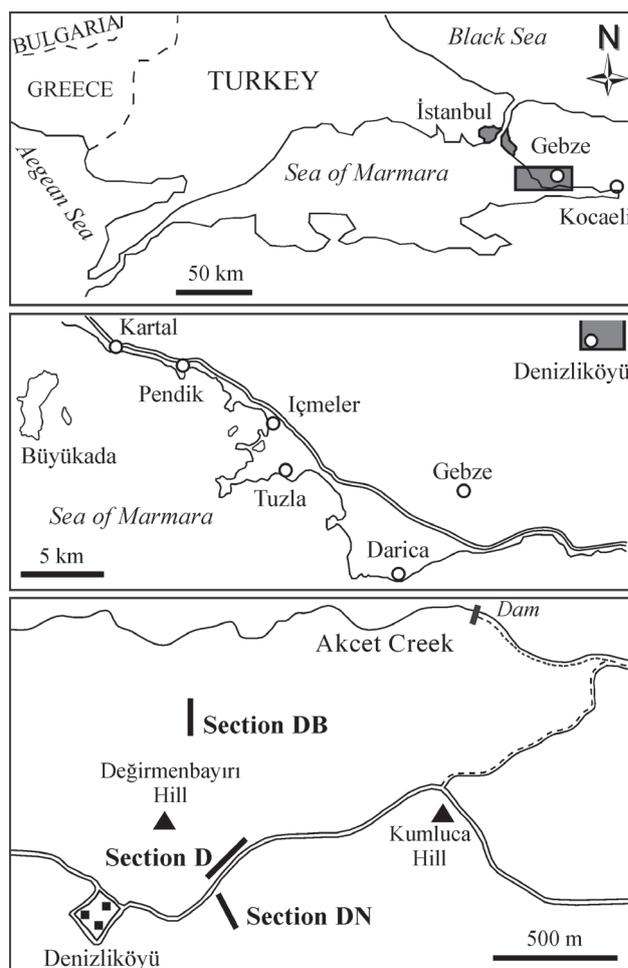


Fig. 1. Locality maps showing location of the studied sections (D, DN and DB) and adjacent areas (modified from Çapkinoğlu 2000).





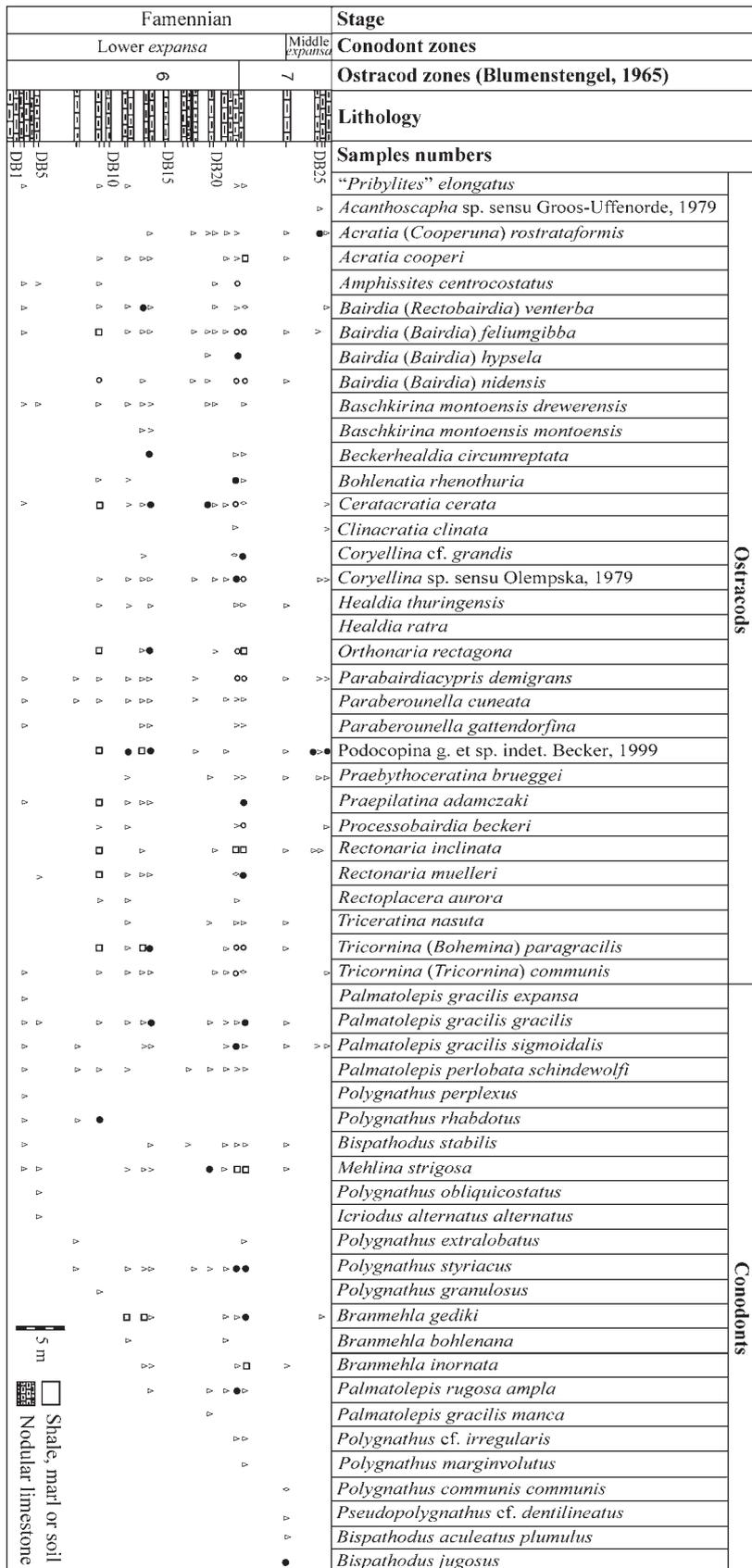


Fig. 4. Stratigraphical distribution of the Famennian ostracod and conodont species in the DB section.

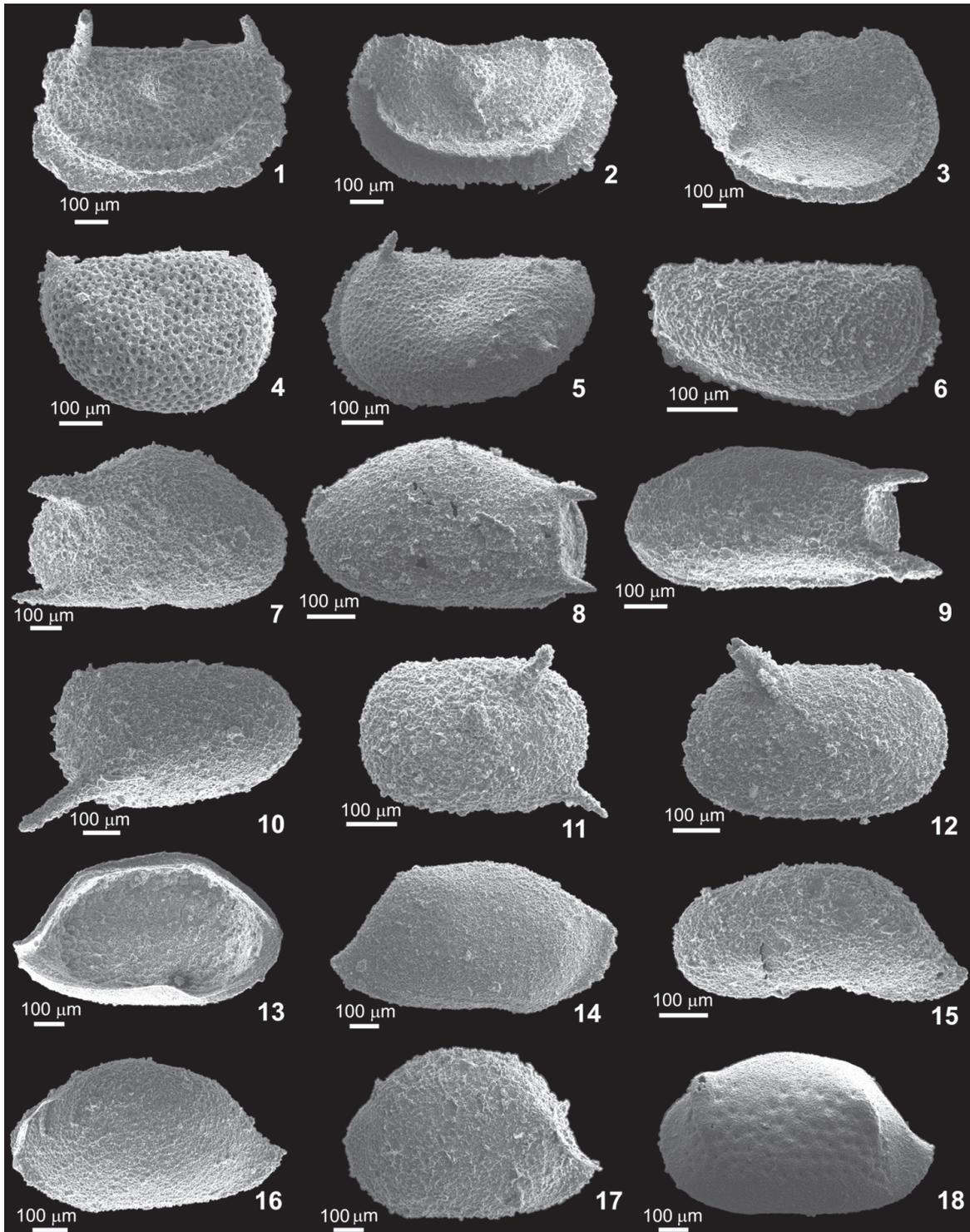
boidea Zone or the Lower marginifera Zone into the postera Zone of Famennian (Upper Devonian). The determined ostracods from this section are given in Fig. 3. Ceratacratia cerata Blumenstengel, 1965 and Rectonaria muelleri Gründel, 1961 and Tricornina (Bohemina) paragracilis Blumenstengel, 1965 are common species in this section and found from 5 to 7 ostracod zones of Blumenstengel, 1965. In addition, Beckerhealdia circumreptata Blumenstengel, 1994 and Clinacratia clinata Blumenstengel, 1965 are found in the upper part of this section. Higher samples after the sample DN7a have also been assigned to the postera Zone due to the lack of any taxa typical of younger zones by Çapkinoglu (2005a). Clinacratia clinata is the characteristic species for the ostracod 6-7 zones. Also, Beckerhealdia circumreptata Blumenstengel, 1994 is a key fossil for the ostracod 7 Zone. Therefore, these fossils indicate that the upper part of this section is younger than the postera Zone.

Section DB. This section, 31.50 meters thick, was measured on the north side of Değirmenbayırı Hill (Fig. 1). The conodont fauna points to the Lower and Middle expansa Zones. The range of determined ostracods in this section is shown in the Fig. 4. According to Beckerhealdia circumreptata Blumenstengel, 1994, Ceratacratia cerata Blumenstengel, 1965, Clinacratia clinata Blumenstengel, 1965 and Rectonaria inclinata Gründel, 1961, this section can be correlated with the ostracod 6 to 7 zones of Blumenstengel (1965).

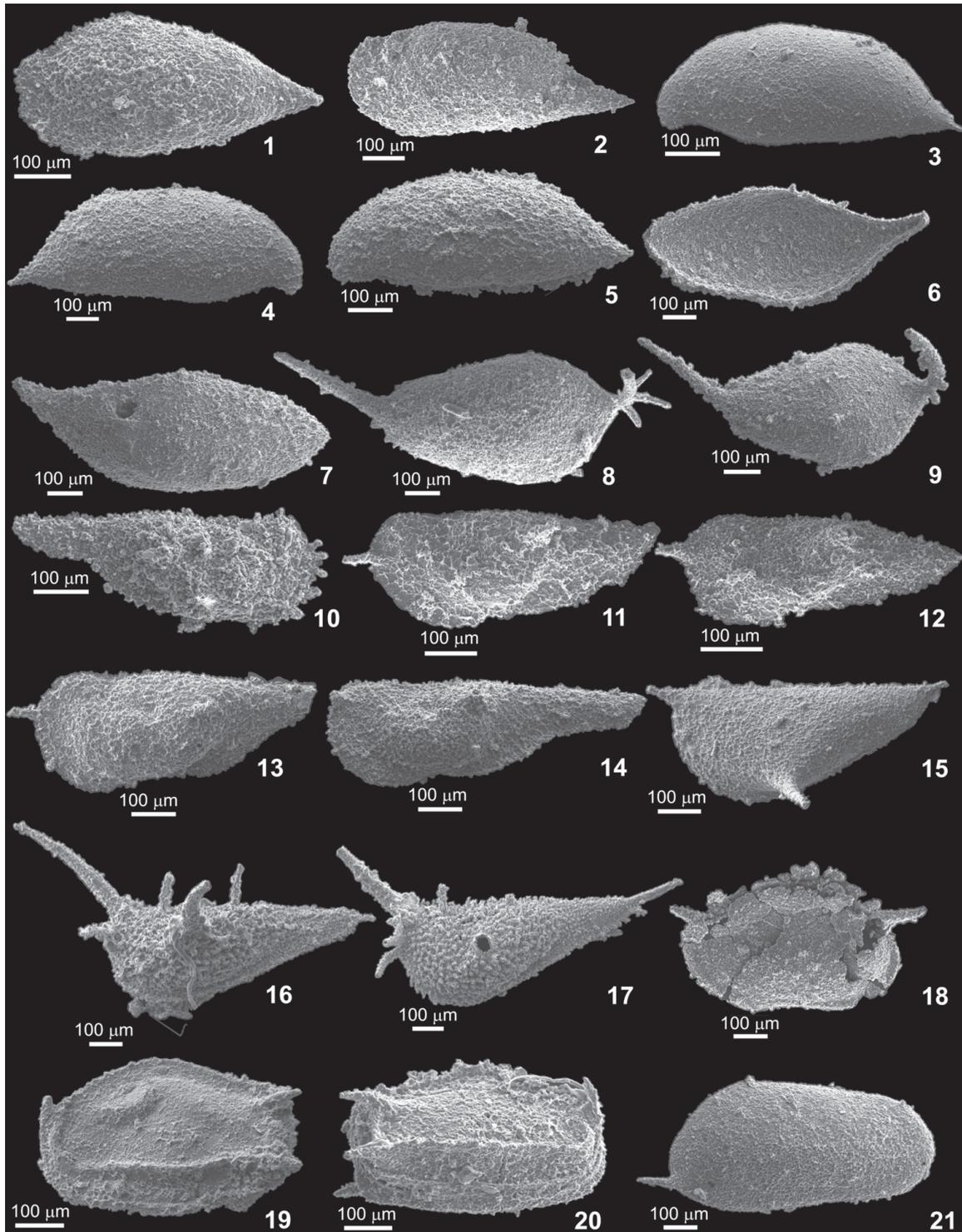
### Regional distribution and faunal relationship of the ostracod assemblage

In general, Thuringian ostracods are known from the Devonian to Early Carboniferous. These faunas are known in Thuringia/Germany (Gründel 1961, 1962; Blumenstengel 1965, 1993, 1994, 1995), Rhenish Massif/Germany (Becker 1988, 1999; Becker et al. 1993), Cantabrian Mountains/Spain (Becker 1982), Pyrenees/Spain (Sanchez de Posada et al. 2008), Montagne Noire/France (Lethiers & Feist 1991), Holy Cross Mountains/Poland (Olempska 1979, 1997), Algeria, Morocco/N Africa (Becker 1987) and China (1988).

The common species of this study can be correlated with the above mentioned works in alphabetic order (Table 1).



**Fig. 5.** 1 — *Amphissites bispinosus* Blumenstengel, 1965. Right valve, JB-O-D15/1. 2 — *Amphissites centrocostatus* Ulrich & Bassler, 1906. Left valve, JB-O-DB3/1. 3 — “*Selebratina*” aff. *angustocristata* Blumenstengel, 1965. Right valve, JB-O-DN3/1. 4 — *Coryellina* sp. sensu Olempska, 1979. Right valve, JB-O-DN1/1. 5 — *Coryellina* cf. *grandis* Robinson, 1978. Left valve, JB-O-DB22/1. 6 — “*Pribylites*” *elongatus* Blumenstengel, 1965. Right valve, JB-O-DB13/1. 7 — *Healdia thuringensis* Gründel, 1961. Right valve, JB-O-DN1/2. 8 — *Healdia ratra* Gründel, 1961. Left valve, JB-O-DB3/2. 9 — *Timorhealdia nitidula nitidula* (Reinh. Richter, 1869). Left valve, JB-O-DN1/3. 10 — *Rectoplacera aurora* Becker, 2000. Right valve, JB-O-DN1/4. 11–12 — *Rectonaria muelleri* Gründel, 1961; 11 — Left valve, JB-O-D6a/1, 12 — Right valve, JB-O-D6a/2. 13–14 — *Bairdia* (*Rectobairdia*) *venterba* Gründel, 1961; 13 — Left valve, inner view, JB-O-D13/2, 14 — Right valve, JB-O-DB3/3. 15 — *Bairdia* (*Bairdia*) *feliungibba* Becker, 1982. Left valve, JB-O-D15/2. 16 — *Bairdia* (*Bairdia*) *nidensis* Olempska, 1979. Left valve, JB-O-D5/1. 17 — *Bairdia* (*Bairdia*) *hypselia* Rome, 1971. Left valve, JB-O-DB22/2. 18 — *Processobairdia beckeri* Olempska, 1979. Left valve, JB-O-DB23/1.



**Fig. 6.** 1–2 — *Bohlenatia rhenothuria* Becker, 1993; 1 — Left valve, JB-O-DB22/3, 2 — Left valve, JB-O-D16/1. 3–4 — *Acratia cooperi* Gründel, 1962; 3 — Left valve, JB-O-DB14/1, 4 — Right valve, JB-O-DB22/4. 5 — *Acratia (Cooperuna) rostrataformis* Shevtsov, 1964. Left valve, JB-O-DB22/5. 6–7 — *Clinacratia clinata* Blumenstengel, 1965; 6 — Right valve, JB-O-DB14/2, 7 — Right valve, inner view, JB-O-DB21/1. 8–9 — *Ceratacratia cerata* Blumenstengel, 1965; 8 — Right valve, JB-O-DN5/1. 9 — Right valve, JB-O-DB12/1. 10 — *Praebythoceratina brueggeri* Gründel, 1973. Right valve, JB-O-DB21/2. 11–12 — *Paraberounella cuneata* Gründel, 1961; 11 — Left valve, JB-O-DB20/1, 12 — Left valve, JB-O-DB13/2. 13 — *Paraberounella gattendorffina* Gründel, 1973. Left valve, JB-O-DB13/3. 14 — *Triceratina nasuta* Gründel, 1961. Left valve, JB-O-DB21/3. 15 — *Tricornina (Tricornina) communis* Blumenstengel, 1965. Left valve, JB-O-DB22/6. 16–17 — *Tricornina (Bohemina) paragracilis* Blumenstengel, 1965; 16 — Left valve, JB-O-DB22/7, 17 — Left valve, JB-O-DB14/3. 18 — *Acanthoscapha* sp. sensu Groos-Uffenorde, 1979. Right valve, JB-O-DB26/1. 19–20 — *Beckerhealdia circumreptata* Blumenstengel, 1994; 19 — Left valve, JB-O-DB22/8, 20 — Right valve, JB-O-DB21/4. 21 — *Parabairdiacypris demigrans* Becker, 1982. Right valve, JB-O-DB8/1.

AGE	FAMENNIAN				
Chronology of Thuringian	Hemberg			Dasberg	
	doIII		doIV	doV	
Ostracod zones	5		6	7	
Conodonts zones	Lower marginifera	Upper & Uppermost marginifera	trachytera	postera	expansa
The Studied Sections	D			DB	
	DN				
<i>Beckerhealdia circumreptata</i>					
<i>Ceratacratia cerata</i>	—————				
<i>Clinacratia clinata</i>				—————	
<i>Healdia thuringensis</i>	—————				
<i>Paraberounella cuneata</i>				—————	
<i>Praebythoceratina brueggei</i>				—————	
<i>Rectonaria inclinata</i>					—————
<i>Rectonaria muelleri</i>	—————				
<i>Tricornina (Tricornina) communis</i>					—————
<i>Tricornina (Tricornina) paragracilis</i>					—————
<i>Triplacera triquetra</i>			—————		

Fig. 7. Stratigraphic ranges of the common taxa from this study applicable for Blumenstengel’s (1965 and 1994) assemblage zone determination.

Table 1: Paleogeographical correlation of the common species from this study with Europe, Africa and China.

The Thuringian Ostracod Species	REGIONS						
	Thuringia	Rhenish Massif	Pyrenees	Montagne Noire / France	Holy Cross Mountains / Poland	Cantabrian Mountains	China (Guangxi)
<i>Beckerhealdia circumreptata</i>	x						
<i>Ceratacratia cerata</i>	x	x	x		x	x	x
<i>Clinacratia clinata</i>	x	x					x
<i>Healdia thuringensis</i>	x	x		x	x		
<i>Praebythoceratina brueggei</i>	x	x				x	
<i>Rectonaria inclinata</i>	x	x		x	x	x	x
<i>Rectonaria muelleri</i>	x	x	x	x	x	x	x
<i>Tricornina (Tricornina) communis</i>	x	x				x	x
<i>Tricornina (Tricornina) paragracilis</i>	x	x	x			x	
<i>Paraberounella cuneata</i>	x	x		x		x	

*Beckerhealdia circumreptata* is described from the Upper Clymenia Beds (Upper Devonian) of Thuringia.

*Ceratacratia cerata* is found in Thuringia, the Rhenish Massif, Pyrenees, Cantabrian Mountains, Holy Cross Mountains, N Africa (Morocco) and ranges from doII to VI (Frasnian-Famennian).

*Clinacratia clinata* is known in Thuringia, the Rhenish Massif, N Africa (Algeria, Morocco) and its range is from doV to doVI (Famennian).

*Healdia thuringensis* is observed in Thuringia, Montagne Noire, the Rhenish Massif, Holy Cross Mountains. This species is known from doVI to cdII (Famennian-Early Carboniferous).

*Paraberounella cuneata* is known in Thuringian, the Rhenish Massif, Montagne Noire, Cantabrian Mountains, China (Guangxi). This species ranges from doI to cdI (Frasnian-Early Carboniferous).

*Praebythoceratina brueggei* is known in Thuringia, the Rhenish Massif and the Cantabrian Mountains from doIV to cdI (Famennian-Early Carboniferous).

*Rectonaria inclinata* is observed in Thuringia, the Rhenish Massif, Cantabrian Mountains, Holy Cross Mountains, Montagne Noire, N Africa (Algeria, Morocco) and ranges from doV to cdI (Famennian-Early Carboniferous).

*Rectonaria muelleri* is one of the most characteristic species

of the Thuringian Mega-Assemblage ostracods from Late Devonian to Early Carboniferous and known in Thuringia, Montagne Noire, the Cantabrian Mountains, Pyrenees, Rhenish Massif, Holy Cross Mountains, N Africa (Algeria, Morocco) and China (Guangxi).

*Tricornina (Tricornina) communis* is found in Thuringia, the Rhenish Massif, Cantabrian Mountains, N Africa (Morocco) and China (Guangxi). Its range is from doI to V (Frasnian-Famennian).

*Tricornina (Tricornina) paragracilis* is known in Thuringian, the Rhenish Massif, Pyrenees, Cantabrian Mountains and ranges from doI to V (Frasnian-Famennian).

**Conclusion**

Based on conodonts, the Ayineburnu Member ranges in age from Lower *rhenena* Zone to the *izosticha*-Upper *crenulata* Zone (Late Frasnian to Middle Tournasian) in previous works. The Thuringian Mega-Assemblage is described for the first time in the Famennian (Upper *rhomboides?* or Lower *marginifera* Zone into the Middle *expansa* Zone) from the Ayineburnu Member in İstanbul Terrane Zone, NW Turkey. The studied ostracod faunas contain genera and species typical of the “Thuringian Mega-Assemblage“. This assemblage shows similarities with ostracod zones 5 to 7 of Blumenstengel (1965, 1994). These species and genera are correlated from several part of the Europe, Africa and China. They show the closed affinities with the faunas of the Cantabrian Mountains (Spain), Thuringia and Rhenish Massif (Germany).

Conodonts of the palmatolepid-polygnathid biofacies and ostracods with spinous valves were recovered from the nodular limestone strata of the Ayineburnu Member. “The Thuringian Mega-Assemblage“ was originally considered indicative of basinal and low-energy environments. The associated faunas and lithological features suggest a deposition in a relatively deep basin for the Ayineburnu Member.

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