Mineral Res. Expl. Bull.. 126. 1-10. 2003

RECENT OSTRACODES OF THE YUMURTALIK GULF

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ABSTRACT.- In this study, 35 wash sample, recovered from shallow marine sediments in the Yumurtalık Bay, Sıddık Lake, Çökek watering trough and Adalar within the Yumurtalık Gulf and 25 wash sample from back the gulf, such as Çamlık Gulf, Darboğaz Dalyanı, Arap Gorge and Bayraklı Gorge were examined. *Cytherella vulgata* (Müller), *C. vandenboldi* Sissingh, *Cytherelloidea sordida* (Müller), *Leptoythere ramosa* (Rome), *Cythehdea acuminata neapolitana* Kollmann, *Tegmenia rugosa* Costa, *Celtia quadridentata* (Baird), *Basslerites berchoni* (Brady), *Pontocythere elongata* (Brady), *Neocytherideis cylindrica* (Brady), *N. faveolata* (Müller), *Carinocythereis carinata* (Roemer), *C. antiquata* (Baird), *Cistacythereis* pokcornyi(Ruggieri), *Aurila convexa* (Baird), *A. woodwardii* (Brady), *Urocythereis favosa* Roemer, *Cytheretta semiornata* (Egger), *Loxoconcha rhomboidea* (Fischer), *L. tumida* Brady, L. *concentrica* Bonaduce, Ciampo and Masoli, L. *parallela* Müller, *L. agilis* Ruggieri, *L. elliptica* Brady, *Paracythehdea depressa* Müller, *Semicytherura sulcata* (Müller), *Microcytherura* sp., *Xestolebehs depressa* Sars, *X. communis* Müller, *X. aurantia* (Baird), *X. ventricosa* Müller, *Cytherois fischeri* (Sars), *Argilloecia conoidea* (Sars), *Propontocypris dispar* Müller, *Aglaiocyphs complanata* Brady and Robertson, in general lagoonal and shallow marine ostracodes, were identified from the shallow marine sediments of the Yumurtalık Gulf. Ostracodes from these samples, such as *Cyprideis torosa* (Jones), which characterizes brackish environment and a few *llyocypris bradyi* Sars which characterizes freshwater environment explain the effect of ancient Seyhan river bed, and the development of freshwater swamps and mud flats. *Cyprideis torosa* (Jones) was the major ostracodes back the gulf whereas *Hirschmannia viridis* (Müller), *Loxoconcha elliptica* Brady were also identified. The geographical distribution of observed ostracodes types was correlated with the similar studies carried out in the region of the Mediterranean, Aegean Sea and the Atlantic.

INTRODUCTION

The survey area, Yumurtalık Bay locates at western side of the Gulf of iskenderun, westerly to the Yumurtalık township and that falls into the range of Mersin O35-d1 and d2 topographic quadrangles at 1/25 000 scale (Fig-1).

The goal of this study has been to scrutinize the ostracod assemblage at Yumurtalık Bay and to determine the depositional and living environments.

Schmidt (1961), Doruk (1975), Kelling et al. (1987), Gökçen et al. (1987), Uffenorde el al. (1990), Şafak (1993), Nazik (1994) and Şafak (2001) has surveyed the area enveloping the investigation site, either geologically or paleontologically.,

Besides those, Çukurova University, Faculty of Fisheries has executed a lot of studies in and arounds the Yumurtalık Bay. That group has comprised the ones for fishes by Avşar and Çiçek (1999a and 1999b), and Avşar, Çiçek and Akamca (1999) and that by Yüceer and Başıbüyük (1999), from Environmental Engineering Dept, to search the contamination in sea water.

The testing samples have been collected from Yumurtalık iniet, water mass westerly to the Yumurtalık town and the enclosing coastal zone, Çamlık lagoon, Darboğaz, Darboğaz fishpond, Arap Gorge, Arapboğazı lakelet, Dalyan passage, the Isles, Kokar Pass and Kokar Pond as washing samples by dredging. Then these grab samples has firstly been washed off as separately packages, each one

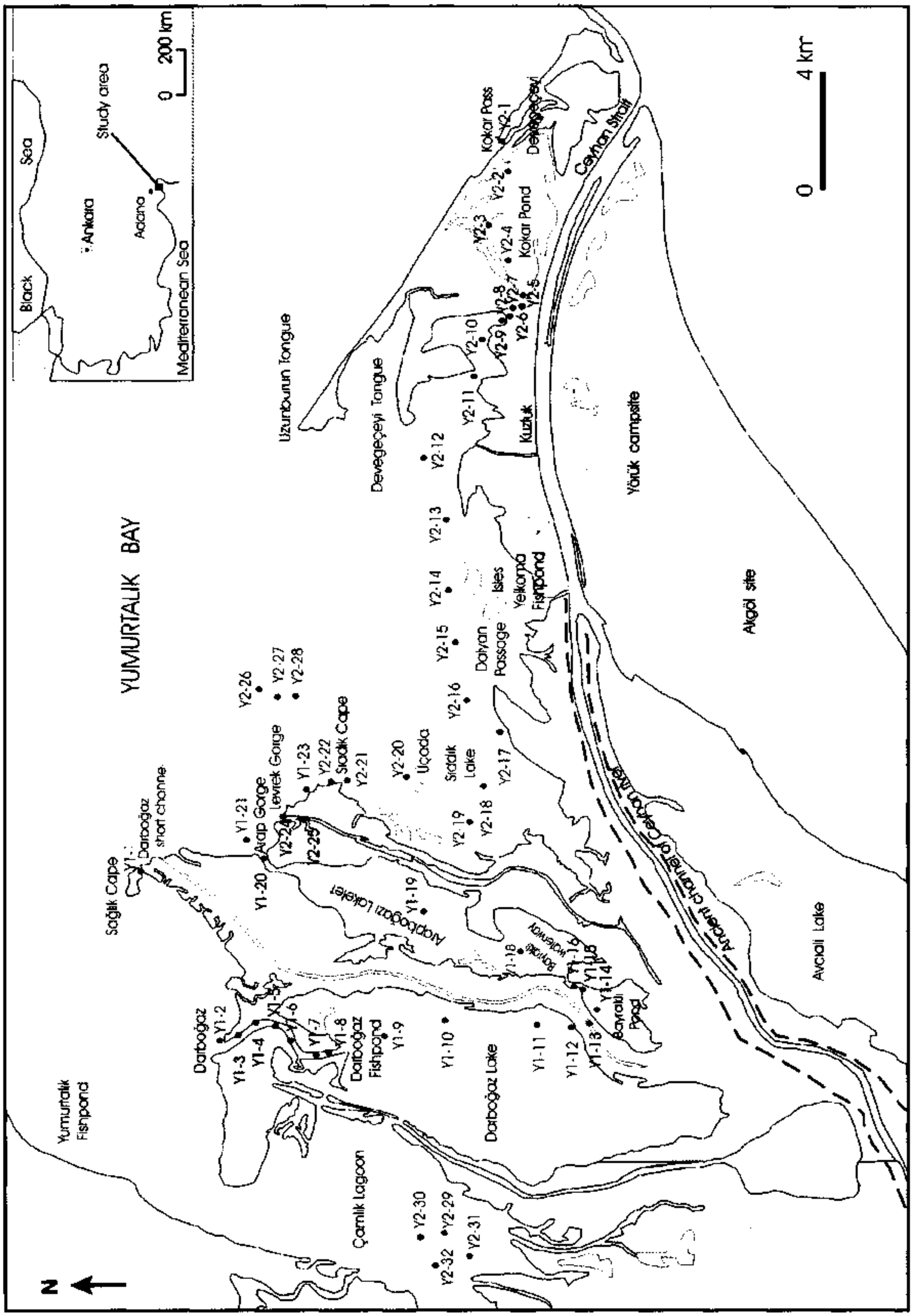

Fig. 1- The map, stretching survey area and sample sites

weighing 50 g and secondly been picked up; and got prepared to determine the ostracod species. Counting the ostracod genera and species gathered at microfossil files and subsequently to bring about the abundance and the frequency of occurrence both vertical and lateral sides have been the following steps. For depicting the varying abundance levels of ostracods, different symbols were used in the Frequency Chart.

CHARACTERISTICS OF YUMURTALIK BAY AND THE SAMPLING SITES

Yumurtalık Bay situates at the western side of Gulf of İskenderun and triangular in shape. As an inlet of the Gulf, stretching at the northeastern part of Cilicia Basin, the Bay has naturally undergone sub-tropic climatic conditions, predominating the whole region. Because of the shallow water depth and being intruded into the land considerably, the Bay is more affected from hot weather than surrounding regions. The average water-depth and areal extension for the surficial 0-10 m depth zone are 2.83 m and 53.12 square km, respectively; for the second depth zone, 10-20 m, those range to 13.88 m and 22.86 square km, and for the 20-50 m depth zone, the 35.32 m and 35.32 square km (Avşar, et. al., 1999).

The area between mouth of the Ceyhan river and Yumurtalık Bay characterizes itself by a huge wetland system constitutes of lagoons, salt marshes, freshwater swamps, mud flats, rushy areas, watered grasslands, dunes and a pine forest. That search has been executed at shallowest areas, namely in the area that settles between Kokar Pond, Kokar Pass and protruding of the watered troughs in the system, Çamlık lagoon. In contrast to the other wetlands in the system, that area depicts a changing shoreline, not an uniform type; and so, the area opens to the sea at several points. The ancient channel of Ceyhan river passes over the area. Yelkoma Pond is a shallow lagoon, bounded by salt marshes and as being dried partly up during the spring and summer seasons, vast mud flats occupy the area especially at the northern sect. There are rushy areas at places, where the freshwater from dunes trickles into the pond. As the water level rises in winter, the Çamlık lagoon and Darboğaz Pond, surrounded by salt marshes and mud flats, converge into a larger lake. The fishponds have been formed at the opening of Yelkoma lagoon, at mouth of the ancient channel of Ceyhan river and at the site, where the Çamlık lagoon opens into the Bay (Yarar and Magnin, 1997).

Besides that, through the surveys focused on pollution and vulnerability to pollution in the watery areas of the site and surrounding lagoons, it has been revealed that DCO (demand for chemical oxygen) exceeds 500 mg/lt, and DBO (demand for biochemical oxygen) is over 100 mg/lt. Moreover, the ratio of DCO/DBO reaches up about 5 and that implies the presence of dissolved organic material. not easily disaggregated.

Surface water temperatures range up from 17 ˚C in February to 26.9 ˚C in August; and so, as a result of densely evaporation, salinity reaches up its maximum levels in August (Yüceer and Başıbüyük, 1999).

Only 53 of the 60 washing samples, examined through that study has included ostracods. These specimens have been grabbed from the area stretching in Mersin O35 d_1-d_2 quadrangles at 1/25 000 scales and, from the sites and water depths depicted in Table 1. Table 1 displays the ostracod distribution at first sampling sites, those at secondary sampling sites. Photos of all the ostracod genera and species found, have been attached as Plate 1 and Plate 2.

Table 1- Sites and recovery depths of samples, collected from survey area

Sample No	Site	Water depth (cm)
Y1-1	Darboğaz short channel	150
Y1-2	Mouth of Darboğaz	150
Y1-3	Darboğaz	50
Y1-4	Darboğaz	15
Y1-5	Darboğaz	35
Y1-6	Darboğaz	90
Y1-7	Darboğaz	50
Y1-8	Darboğaz	100
Y1-9	Inside the Darboğaz Pond	100
Y1-10	Inside the Darboğaz Pond	110
Y1-11	Darboğaz Lake outflow	100
Y1-12	Darboğaz Lake outflow	60
Y1-13	Opening to Arapboğazı Lakelet	200
Y1-14	Northern sect of Bayraklı Pond	60
Y1-15	Bayraklı Waterway	100
Y1-16	Bayraklı Waterway	80
Y1-18	Inside the Arapboğazı Lakelet	80
Y1-19	Inside the Arapboğazı Lakelet	90
Y1-20	Arap Gorge	40
Y1-21	Off the Arap Gorge	70
Y2-1	Kokar Pass	70
Y2-2	Inside the Kokar Pond	40
Y2-3	NW sect of Kokar Pond	40
Y2-4	NW sect of Kokar Pond	80
Y2-5	Western coast of Kokar Pond	80
Y2-6	Western ashore of Kokar Pond	70
Y2-7	West ashore of Kokar Pond	70
Y2-8	West ashore of Kokar Pond	90
Y2-9	West ashore of Kokar Pond	70
Y2-10	Devegeçeyi southern trough	70
Y2-11	Devegeçeyi southern trough	40
Y2-12	Devegeçeyi southern trough	40
Y2-13	East of Isles	100
Y2-14	Off the Isles	70
Y2-15	Off the Isles	80
Y2-16	Dalyan Passage	80
Y2-17	Sıddık lakeshore	35
Y2-18	Inside the Sıddık Lake	30
Y2-19	Inside the Sıddık Lake	80
Y2-20	Üçada (on Sıddık Lake)	60
Y2-21	Sıddık Cape	100
Y2-22	Sıddık lakeshore	100
Y2-23	Sıddık lakeshore	100
Y2-24	Gateway to Levrek Gorge	60
Y2-25	Levrek Gorge	30
Y2-26	Yumurtalık Bay	500
Y2-27	Yumurtalık Bay	400
Y2-28	Yumurtalık Bay	400
Y2-29	Çamlık Lagoon	300
Y2-30	Çamlık Lagoon	500
Y2-31	Çamlık Lagoon	300
Y2-32	Çamlık Lagoon	400

Table 2- Distribution of ostracodes at sampling sites in Yumurtalık Bay Y1: The first sampling sites Y2: Seconday (repeated) sampling sites

Species / Site no.	Y1-1	Y1-2	Y1-3	Y1-4	Y1-5	Y1-6	Y1-7	Y1-8	Y1-9	Y1-10	Y1-11	Y1-12	Y1-13	Y1-14	Y1-15	Y1-16	Y1-17	Y1-18	Y1-19	Y1-20	Y1-21
Cytherella vulgata Ruggieri																					
Cytherella vandenboldi Sissingh						+														O	
Cytherelloidea sordida (Müller)																				O	
Leptocythere porcellanea (Brady)																				+	
Leptocythere ramosa (Rome)						+														X	
Leptocythere lacertosa (Hirschmann)									+												
Cyprideis torosa (Jones)	●	■	O	X	●	+		●	●		●		O	●	●	X		●		●	X
Cytheridea acuminata neapolitana Kollmann																					
Cushmanidea elongata (Brady)	+																				
Neocytherideis cylindrica (Brady)																				X	
Neocytherideis faveolata (Brady)																					
Carinocythereis carinata (Roemer)																					
Carinocythereis antiquata (Baird)																					
Costa edwardsii (Roemer)																				O	
Costa batei (Brady)																					
Cistacythereis pokornyi (Ruggieri)																				X	
Cella quadridentata (Baird)																					
Tegmenia rugosa (Costa)																					
Bassleries berchoni (Brady)						+														●	
Heterocythereis albomaculata (Baird)																					
Aurila convexa (Baird)																					
Aurila woodwardii (Brady)																					
Urocythereis favosa (Roemer)																				O	
Cytheretta semiornata (Egger)																					
Loculicytherella pavonia (Brady)																					
Hirschmannia viridis (Müller)	+							●	●	■	+			O	+			X		●	
Loxoconcha rhomboidea (Fischer)		+	+			■		O	O	X				●	●	●		X		O	
Loxoconcha tumida Brady								X	X					●				X		O	
Loxoconcha concentrica Bonaduce,Ciampo,Masoli	+																			O	
Loxoconcha parallela Müller						X												X		O	
Loxoconcha agilis Ruggieri	X	X	X		+	■								●	+			X		●	
Loxoconcha elliptica Brady	+				X			+	O	O				O	+					X	
Paracytheridea depressa (Müller)																				O	
Semicytherura sulcata (Müller)																					+
Mikrocytherura sp	+																			O	
Xestoleberis depressa Sars	O		+			●		+						X	X					●	
Xestoleberis communis Müller						●		+										X		■	
Xestoleberis aurantia (Baird)						X									+						
Xestoleberis ventricosa Müller						+								+							
Cytherois fischeri (Sars)	+							+												O	
Ilyocypris bradyi Sars																					
Argilloecia conoidea (Sars)	+																			O	
Propontocypris dispar Müller																					
Aglaiocypris complanata Brady-Robertson																				O	

Species / Site no.	Y2-1	Y2-2	Y2-3	Y2-4	Y2-5	Y2-6	Y2-7	Y2-8	Y2-9	Y2-10	Y2-11	Y2-12	Y2-13	Y2-14	Y2-15	Y2-16	Y2-17	Y2-18	Y2-19	Y2-20	Y2-21	Y2-22	Y2-23	Y2-24	Y2-25	Y2-26	Y2-27	Y2-28	Y2-29	Y2-30	Y2-31	Y2-32
Cytherella vulgata Ruggieri				X								+								+	X				+							
Cytherella vandenboldi Sissingh		O											X	O	O	X	O	O		+								X				
Cytherelloidea sordida (Müller)			X		X								X		X		O	O		X		+	O		X							
Leptocythere porcellanea (Brady)																																
Leptocythere ramosa (Rome)																X																
Leptocythere lacertosa (Hirschmann)														+																		
Cyprideis torosa (Jones)	O	O	+	●	●	X	●	●	X			●	X	O	●	O	■	●		●	O	■	■	X	●	X	X	●	●	●	●	●
Cytheridea acuminata neapolitana Kollmann												+		+			+															
Cushmanidea elongata (Brady)		X		X									+	+	X	O	O			O	X	+	O		X	O	+					
Neocytherideis cylindrica (Brady)																+				X	+											
Neocytherideis faveolata (Brady)																							+									
Carinocythereis carinata (Roemer)				+													X															
Carinocythereis antiquata (Baird)				+																												
Costa edwardsii (Roemer)				+										X	X	+	O															
Costa batei (Brady)															+																	
Cistacythereis pokornyi (Ruggieri)																	O															
Cella quadridentata (Baird)														X		+	O															
Tegmenia rugosa (Costa)														+		+	O			+	+	+	X		+							
Bassleries berchoni (Brady)		X												O			O	X		O		X	O		O							
Heterocythereis albomaculata (Baird)																										+						
Aurila convexa (Baird)		+											+		+		+	+										O				
Aurila woodwardii (Brady)		+	X									X			O	X		O										O				
Urocythereis favosa (Roemer)																				+	+	+	X		X	+				+		
Cytheretta semiornata (Egger)				+										X	+		X	+		O			X									
Loculicytherella pavonia (Brady)															+							X										
Hirschmannia viridis (Müller)		●	X	+	●							X			O			O		O			O		O							X
Loxoconcha rhomboidea (Fischer)		X	O		O									■	O	O	O					O	O		X							O
Loxoconcha tumida Brady		X	O														■	X			+		O					●				O
Loxoconcha concentrica Bonaduce,Ciampo,Masoli				X										X	+	O	X					+	O		+							
Loxoconcha parallela Müller			X										O	X	O	O	■	O		■			O		●							
Loxoconcha agilis Ruggieri		O		X	O							X	X	■	O	■	■			O	X	O			●			O		+		
Loxoconcha elliptica Brady		+			+							+		O		O									O			O		X		
Paracytheridea depressa (Müller)														+		+	X		+	■	+		X		+							
Semicytherura sulcata (Müller)													+	+		+			+		+				X							
Mikrocytherura sp														X	+	X	X			+	+	X	O		X							
Xestoleberis depressa Sars		■	O	■								O	X	●	O	O	■	●		■	■	■	●		■			●				
Xestoleberis communis Müller		■	O									O	X	■	X	O	●	O		X	O						+					
Xestoleberis aurantia (Baird)		O	O	X		X									O	X		O					X									
Xestoleberis ventricosa Müller															O										O							
Cytherois fischeri (Sars)				O									+	O	X	X		+		X					■	X	+					
Ilyocypris bradyi Sars		+		+																												
Argilloecia conoidea (Sars)				X										X			O			X	+	+	O									
Propontocypris dispar Müller														+																		
Aglaiocypris complanata Brady-Robertson																				O	+											

Frequency symbols: + uttermost sparsely **x** sparsely **o** common ■ frequent ● very abundant

RESEARCH FINDINGS

That survey, executed on 60 samples recovered from Yumurtalık Bay has revealed the presence of 29 genera and 43 species of ostracods.

Geographic distribution of the identified species has been designed by examining the different studies surveyed at Mediterranean Sea, at shores of Atlantic Ocean (Gulf of Gascony) and the ones at Sea of Marmara and the Aegean Sea (Morkhoven, 1963; Sissingh,1972; Uffenorde, 1972; Ruggieri, 1976; Bonaduce et al., 1979; Yassini, 1979; Guillaume et al., 1985; Stambolidis, 1985; Nazik, 1994; Kubanç, 1995; Tunoğlu, 1999; Şafak, 2001) (Table 3).

To determine the living environments of the ostracods, Morkhoven (1963) has been made in-effect. According to so-called criteria, the genus *Ilyocypris* represents a limnic environment, while the *Cyprideis* suggests a lagoonal environment, the *Leptocythere, Cytheridea, Heterocythereis, Hirschmannia and Loxoconcha* point out both lagoonal and littoral environments, the *Xestoleberis* littoral-epineritic, the genus *Cytherelloidea, Cushmanidea, Neocytherideis, Basslehtes, Aurila, Urocythereis, Cytheretta, Loculicytheretta, Paracytheridea, Semicytherura, Microcytherura, Cytherois* and *Aglaiocyphs* epineritic, the *Cytherella, Carinocythereis, Costa, Cistacythereis, Celtia, Tegmenia* and *Propontocypris* epineritic-infraneritic, the *Argilloecia* infraneritic setting. But when the water depths that the samples have been recovered, have been considered, a very shallow water marine fauna has been determined, including the ostracod genera reflecting mainly lagoonal-littoral and an epineritic environment as well.

Of the species identified through the survey the *Cytherella vulgata* Ruggieri, *Cytherella vandenboldi* Sissingh, *Cyprideis torosa* (Jones), *Cytheridea acuminata neapolitana* Kollmann, *Carinocythereis carinata* (Roemer), *Carinocythereis antiquata* (Baird), *Costa edwardsii* (Roemer), *Costa batei* (Brady), *Celtia quadridentata* (Baird), *Aurila convexa* (Baird), *Urocythereis favosa* (Roemer) and *Cytheretta semiornata* (Egger), have also been determined at surveys at Crete, Rhodes Island, Adriatic Sea, Italy, Tunisia, Algiers, Gulf of Gascony, Sea of Marmara and Aegean Sea, carried out by Sissingh (1972), Uffenorde (1972), Ruggieri (1975), Bonaduce et al. (1979), Yassini (1979), Guillaume et al. (1985), Kubang (1985) and Tunoğlu (1999).

The *Cushmanidea elongata* (Brady), *Basslehtes berchoni* (Brady), *Loculicytheretta pavonia* (Brady), *Loxoconcha rhomboidea* (Fischer), *Loxoconcha tumida* Brady, *Xestoleberis depressa* Sars, *Xestoleberis communis* Müller, *Cytherois fischeri* (Sars) and *Aglaiocyphs complanata* Brady-Robertson have also been revealed in surveys for Algiers, Gulf of Iskenderun, Aegean Sea, Sea of Marmara and Gulf of Mersin, realized by Yassini (1979), Stambolidis (1985), Nazik (1994), Kubanç (1985), Tunoğlu (1999) and Şafak (2001).

And the *Leptocythere lacertosa* (Hirschmannn), *Neocytherideis cylindrica* (Brady), *Xestoleberis depressa* (Müller) and *Xestoleberis aurantia* (Baird) have been determined in surveys for Gulf of Gascony, Italy, Gulf of İskenderun Gulf of Mersin and the Netherlands, by Guillaume et al. (1985), Nazik (1994) Şafak (2001) and Morkhoven (1963).

Table 3- Geographic distribution of ostracods found in Yumurtalık Bay and the living environments according to van Morkhoven, 1963.

Ostracod species	Spatial Extension														Environment			
	The Netherlands (Morkhoven, 1963)	Crete (Sissing, 1972)	Rhodes Island (Sissing, 1972)	Adriatic Sea (Uffenorde, 1972)	Italy (Ruggieri, 1975)	Tunisia (Bonaduce et al., 1979)	Adriatic Sea (Bonaduce et al., 1979)	Algiers (Yassini, 1979)	Gulf of Gascony (Guillaume et al., 1985)	Northern Aegean Sea (Stambolidis, 1985)	Gulf of İskenderun (Nazik, 1994)	Aegean Sea (Kubanç, 1995)	Gulf of Mersin (Şafak, 2001)	Sea of Marmara (Tunoğlu, 1999)	Lake	Lagoon	Littoral	Neritic
Cytherella vulgata Ruggieri		X	X									X	X					
Cytherella vandenboldi Sissingh		X										X	X	X				
Cytherelloidea sordida (Müller)					X			X			X							
Leptocythere porcellanea (Brady)									X			X						
Leptocythere ramosa (Rome)									X	X		X						
Leptocythere lacertosa (Hirschmann)									X									
Cyprideis torosa (Jones)		X		X				X		X		X						
Cytheridea acuminata neapolitana Kollmann		X	X	X						X	X	X	X					
Cushmanidea elongata (Brady)								X	X		X	X	X					
Neocytherideis cylindirica (Brady)					X						X		X					
Neocytherideis faveolata (Brady)								X										
Carinocythereis carinata (Roemer)		X	X	X	X			X	X	X	X	X	X					
Carinocythereis antiquata (Baird)		X		X	X			X	X		X	X	X					
Costa edwardsii (Roemer)		X	X	X	X			X	X	X		X						
Costa batei (Brady)			X		X			X	X		X		X					
Cistacythereis pokornyi (Ruggieri)																		
Celtia quadridentata (Baird)		X						X										
Tegmenia rugosa (Costa)		X									X		X					
Bassierites berchoni (Brady)				X	X			X		X	X		X					
Heterocythereis albomaculata (Baird)								X	X									
Aurila convexa (Baird)		X		X	X			X	X	X	X		X					
Aurila woodwardii (Brady)				X				X										
Urocythereis favosa (Roemer)		X	X				X				X		X					
Cytheretta semiornata (Egger)		X									X		X					
Loculicytheretta pavonia (Brady)								X			X		X					
Hirschmannia viridis (Müller)									X				X					
Loxoconcha rhomboidea (Fischer)				X				X	X	X	X	X	X	X				
Loxoconcha tumida Brady					X			X				X	X	X				
Loxoconcha concentrica Bonaduce, Ciampo, Masoli								X			X							
Loxoconcha parallela Müller										X								
Loxoconcha agilis Ruggieri										X		X		X				
Loxoconcha elliptica Brady										X								
Paracytheridea depressa (Müller)				X				X			X		X	X				
Semicytherura sulcata (Müller)				X			X	X					X					
Microcytherura sp.													X					
Xestoleberis depressa Sars	X										X		X					
Xestoleberis communis Müller								X		X		X	X	X				
Xestoleberis aurantia (Baird)	X										X		X					
Xestoleberis ventricosa Müller		X																
Cytherois fischeri (Sars)				X					X	X	X		X					
Ilyocypris bradyi Sars																		
Argilloecia conoidea (Sars)								X	X				X					
Propontocypris dispar Müller																		
Aglaiocypris complanata Brady-Robertson							X	X		X			X					

CONCLUSIONS AND DISCUSSION

That survey, executed on 60 washing samples recovered from Yumurtalık Bay has revealed the presence of 29 genera and 43 species of ostracods.

The samples subjected to examining have been taken from Yumurtalık Bay westerly to the Yumurtalık town and the surrounding large wetland constitute of lagoons, gorges, lakes and ponds such as Çamlık lagoon, Darboğaz, Darboğaz fishpond, Arap Gorge, Arapboğaz lakelet, Dalyan passage, the Isles, Kokar Pass and Kokar Pond and at water-depth as ranging from 15 to 500 cm. The ostracod species and genera included among the washing samples have generally depicted a lagoonal-littoral and shallow marine setting.

Yumurtalık Bay generally pictures a complex facial pattern, made of coastal lagoon sediments, small salt marshes on lagoonal elongations toward land, coastal swamps represented by clayey muds transported by weak streams, short gorges and channels produced by tidal currents, beaches and backward beach sands. The parts where the coastal lagoons, channels and gorges locate, hosted the shallow marine faunal assemblage.

Since they have been recovered from the part of coastal zone that most affected by Gulf of iskenderun, the samples Y1-20 (from Arap Gorge), Y2-2, 3 and 4 (from Kokar Pass and Kokar Pond, where the sediment income is actually both from the land and sea), Y2-13 and 17 reveal marine characteristics, and therefore, these specimen have been found to be reflecting neritic fades.

The samples Y1-8, Y1-9 and Y1-10 from Darboğaz Pond and the ones Y1-14, Y1-15 and Y1-16 from Bayraklı Pond have represented the littoral environment where the sea water entered into the lagoon as a consequent of Wave action. Therefore the ostracods from those sites have usually characterized the lagoonal and littoral conditions.

The specimen Y1-20 at the mouth of Arap Gorge has been affected by lagoonal and littoral conditions effective at the part toward Arapboğazı lakelet and revealed affection from shallow marine environment at the sect toward the Gulf of İskenderun, and that variability has been evidenced by the species identified in that sample.

A characteristic indicator for the changing from marine to land environment is the genus *Cyprideis* and the presence of that genus frequently at all the sampling sites has been consequent of ill-development of longshore barriers fronting the waves intruding oftenly the environment, opening of the short passages and channels at the coastal zone of the Bay because of the tidal currents and that the steady development of lagoons since the sea water has wasted away the arising land areas.

The genus *Ilyocypris,* found uttermost sparsely through Kokar Gorge and inside the Kokar Pond has yielded from the freshwater of small distributaries of the Ceyhan river, discharging into the pond.

ACKNOWLEDGMENT

This study has been carried out as no MMF2002BAP12 project of Scientific Research Projects Unit of Rectorate of Çukurova University.

I kindly respect to Presidency of Scientific Research Projects (Rectorate of Çukurova University) for its sponsorship both at initializing and developing stages of the survey.

I also wish to send my best regards to deanship of Faculty of Fisheries, Çukurova University for helpful efforts in sampling and Dr Nazmi Tekelioğlu, the director of College of Fisheries, to District Environmental Management (Çevre İl Müdürlüğü), Adana who has stretched all the accessible sources and surely to manager the office, Dr Hatice Aysan, to Professor Nuran Gökçen and Professor Cemal Tunoğlu for their constructive critiques, to postgraduate Gonca Eroğlu for sketching the drawings and to academics of Geology Department for unpriceable supports.

Manuscript received July 9, *2002*

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PLATES

PLATE-I

Fig. 1- *Cytherella vandenboldi* Sissingh
Right valve, external, x40, sample Y2-14

Fig. 2- *Cytherelloidea sordida* (Müller)
Right valve, external, x55, sample Y2-20

Fig. 3- *Leptocythere lacertosa* (Hirschmann)
Left valve, external, x35, sample Y2-20

Fig. 4- *Cyprideis torosa* (Jones)
Carapace, right external view, x40, sample Y2-18

Fig. 5- *Cushmanidea elongata* (Brady)
Carapace, right external view, x50, sample Y2-27

Fig. 6- *Neocytherideis cylindrica* (Brady)
Carapace, right external view, x30. sample Y2-4

Fig. 7- *Carinocythereis carinata* (Roemer)
Right valve, external, x45, sample Y2-17

Fig. 8- *Cistacythereis pokornyi* (Ruggieri)
Left valve, external, x55, sample Y2-17

Fig. 9- *Costa batei* (Brady)
Carapace, left external view, x55, sample Y2-15

Fig. 10- *Basslerites berchoni* (Brady)
Carapace, left external view, x60. sample Y2-22

Fig. 11- *Celtia quadridentata* (Baird)
Left valve, external, x70, sample Y2-14

Fig. 12- *Heterocythereis albomaculata* (Baird)
Left valve, external, x45, sample Y2-26

Fig. 13- *Aurila convexa* (Baird)
Left valve, external, x45, sample Y2-13

Fig. 14- *Aurila woodwardii* (Brady)
Left valve, external, x40, sample Y2-28

Fig. 15- *Urocythereis favosa* Roemer
Right valve, external, x85, sample Y2-20

PLATE-I

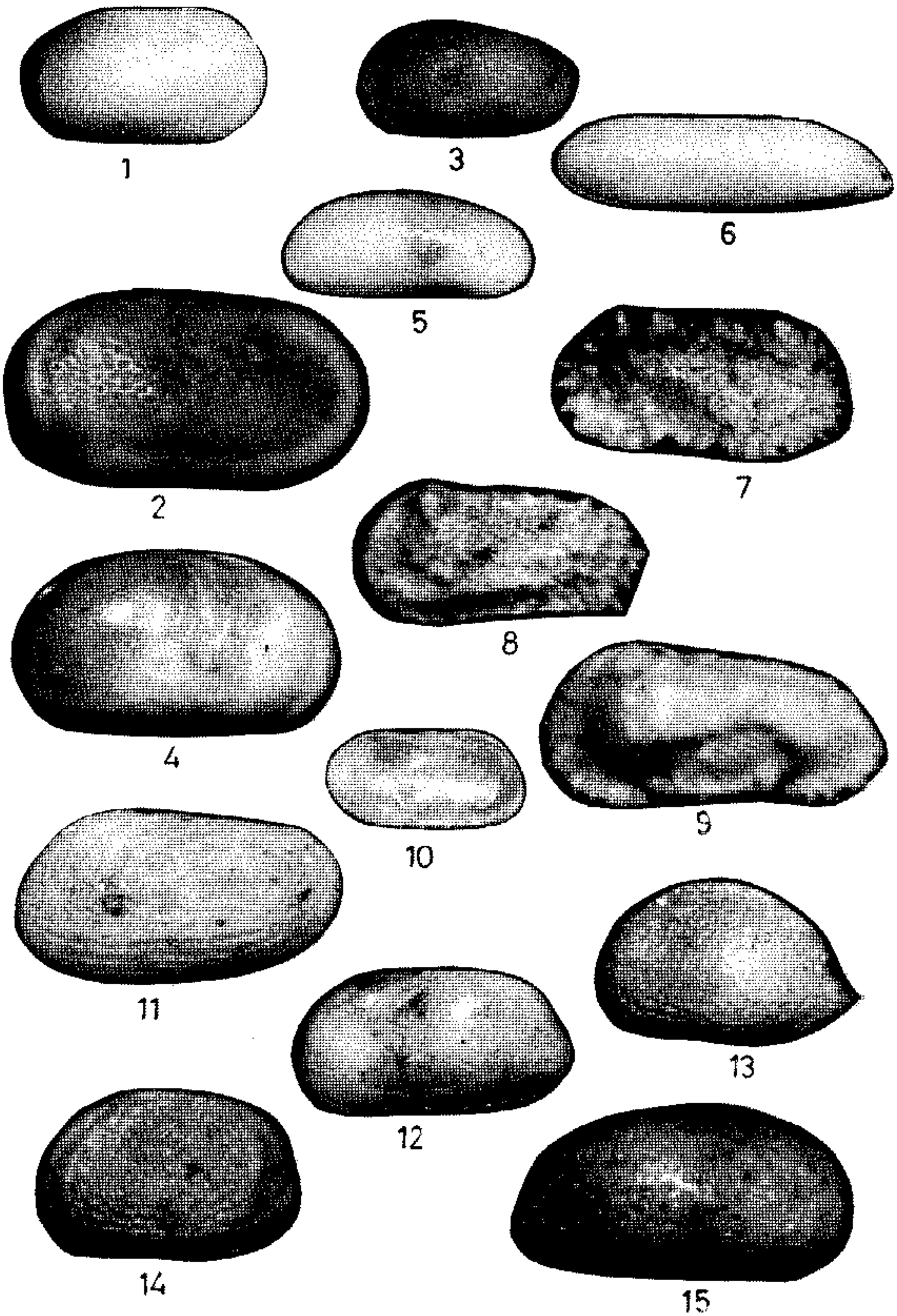


PLATE-II

Fig. 1- *Cytheretta semiornata* (Egger)
Left valve, external, x50. sample Y2-20

Fig. 2- *Loculicytherette pavonia* (Brady)
Left valve, external, x55, sample Y2-22

Figs 3-4 *Hirschmannia viridis* (Müller)
3. Carapace, left external view, x60, sample Y2-15
4. Carapace, left external view, x55, sample Y1-20

Fig. 5- *Loxoconcha rhomboidea* (Fischer)
Right valve, external, x70, sample Y2-20

Fig. 6- *Loxoconcha tumida* Brady
Left valve, external, x60, sample Y2-17

Fig. 7- *Loxoconcha concentrica* Bonaduce, Ciampo ve Masoli
Left valve, external, x50, sample Y2-17

Fig. 8- *Loxoconcha parallela* Müller
Carapace, right external view, x60, sample Y2-20

Fig. 9- *Loxoconcha elliptica* Brady
Carapace, right external view, x60, sample Y2-3

Fig. 10- *Paracytheridea depressa* Müller
Left valve, external, x65, sample Y2-14

Fig. 11- *Semicytherura sulcata* (Müller)
Right valve, external. x70, sample Y2-16

Fig. 12- *Microcytherura* sp.
Right valve, external, x70, sample Y2-14

Fig. 13- *Xestoleberis aurantia* (Baird)
Right valve, external, x65, sample Y1-6

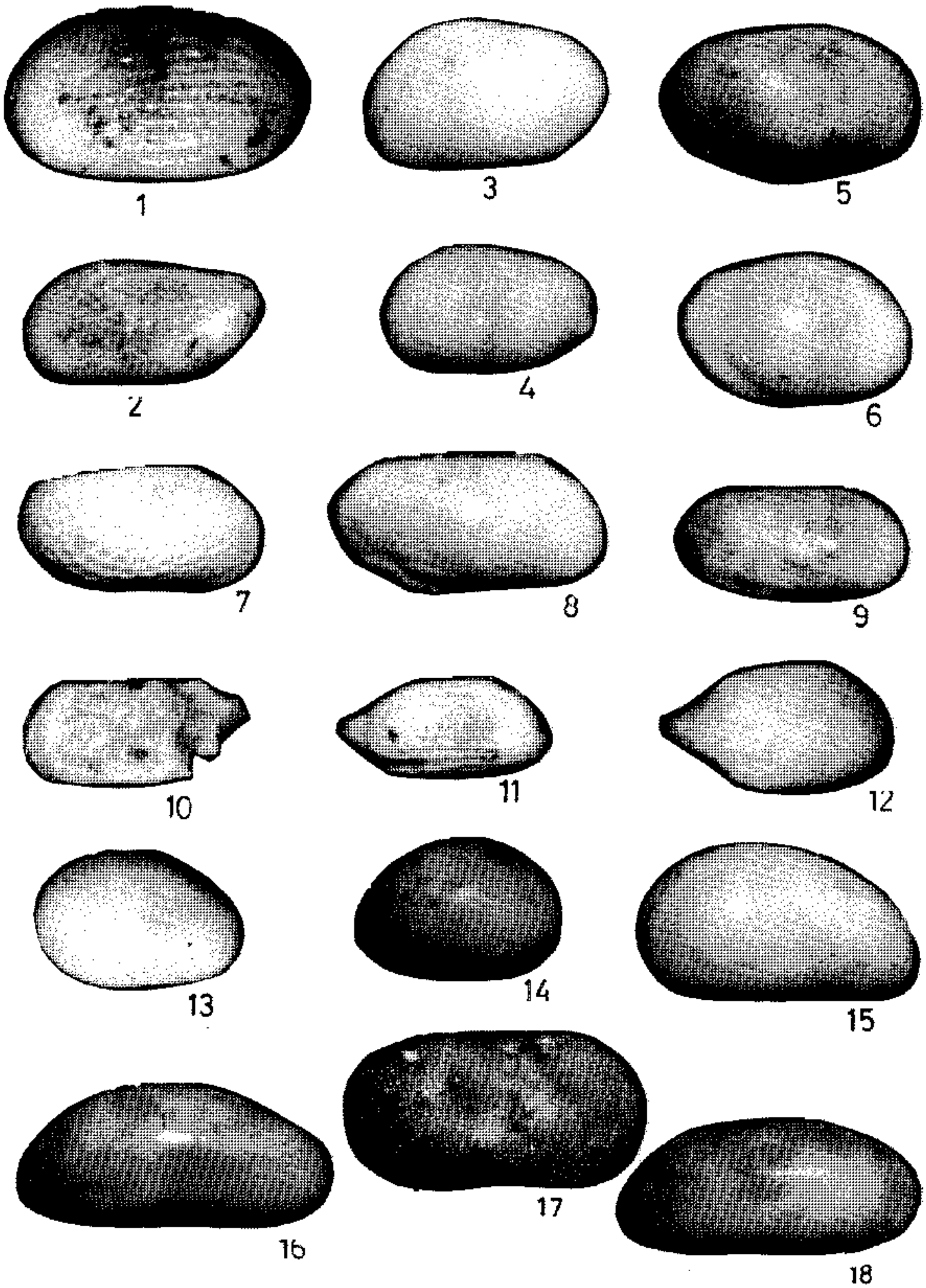
Fig. 14- *Xestoleberis communis* Müller
Left valve, external, x60, sample Y2-20

Fig. 15- *Xestoleberis depressa* Sars
Carapace, right external view, x55, sample Y2-25

Fig. 16- *Cytherois fischeri* (Sars)
Left valve, external, x40, sample Y2-27

Fig. 17- *llyocypris bradyi* Sars
Right valve, external. x30, sample Y2-4

Fig. 18- *Argilloecia conoidea* (Sars)
Right valve, external, x30, sample Y2-14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Mineral Res. Expl. Bull, 126, 11-42, 2003

THE PALEOGEOGRAPHIC AND PALEOECOLOGIC CHARACTERISTICS OF THE MIOCENE AGED MOLLUSCAN FAUNA IN ANTALYA AND KASABA BASINS (WEST-CENTRAL TAURUS, SW TURKEY)

Yeşim İSLAMOĞLU* and Güler TANER**

ABSTRACT.- Throughout this study, the paleogeographical and paleoecological characteristics of the samples of the Miocene aged molluscan fauna have been described which identified in Antalya and Kasaba basins, in west and central Taurus. In addition to the presence of the species belonging to Tethys realm such as *Cingula ventricosella* Cerulli-Irelli, *Cerithium appenninicum dertosulcata Sacco,* and *Xenophora infundibulum* (Brocchi), the *Hydrobia (Hydrobia) frauenfeldi (Hoernes), Pirenella gamlitzensis gamlitzensis* (Hilber), *Irus (Paphirus) gregarius* Partsch and *Glossus (Cytherocardia)* cf. *deshayesi* (Kutassy) type species known in marinal stages of Central Paratethys are also found. Similarly, in Kasaba basin; together with the presence of the *Turritella terebralis turritissima* Sacco, *Conus antiquus* Lamarck, *Conus clavatulus* d'Orbigny, *Pecten benedictus* Lamarck and *Pecten fuschi* Fontannes known only in the Tethys province, the *Cerithium zejsneri* Putsch, *Divaricella ornata subornata* Hilber, *Pitar (Paradione) lilacinoides* Schaffer and *Venus (Antigona) burdigalensis producta* Schaffer type species restricted to Central Paratethys are found. Besides, it is known that, in the investigated basins, the rest of the fauna as a whole is widespread in both provinces. In order to make contribution to the environmental interpretations, the geochemical analyses have been carried out on 14 and 16 fossil casts from Antalya and Kasaba basins respectively. In this way, the fossil casts with aragonite composition have low Mg content. The 1000 Sr/Ca ratios are propotional to salinity. Consequently, the salinity of seawater in Miocene aged Antalya basin is lower than that of Kasaba basin during Upper Burdigalian (Karpatian- Ottnangian). This result is completely in agreement with the known paleoecological characteristics of the fauna. The Antalya and Kasaba basins are similar to intermontane molasse basins in the Alps and situated in the same orogenic belt. The all paleogeographic and paleoecological results indicate that, during the evolution of the Tethys, the similar events and Paratethys like environmental conditions were developed. For this reason, the stage names have been used mutually for the investigated basins. The determination of regional stages seems to be a need for the region as having its own special conditions.

INTRODUCTION

The examined samples have been obtained from the Miocene Antalya and Kasaba basins located in the east of Western Taurus and west of Central Taurus respectively (Fig. 1). This study aims to discuss the previously identified and determined age intervals of Molluscan species (İslamoğlu, 2001-2002; İslamoğlu and Taner, 2002) together with their paleogeographic distributions and stratigraphical levels.

THE PALEOGEOGRAPHIC AND PALEOECOLOGICAL CHARACTERISTICS OF THE IDENTIFIED MOLLUSCAN FAUNA IN INVESTIGATED AREAS

Antalya Miocene basin

In this basin, 84 molluscan species were identified and detailed stratigraphy of the basin has been established (İslamoğlu 2001-2002). In this way, the paleogeographical and paleoecological characteristics of the species belonging to class Bivalvia and Gastropoda identified in the Sevinç conglomerate, Oymapınar limestone, Altınkaya formation and Aksu formation of the basin are as following:

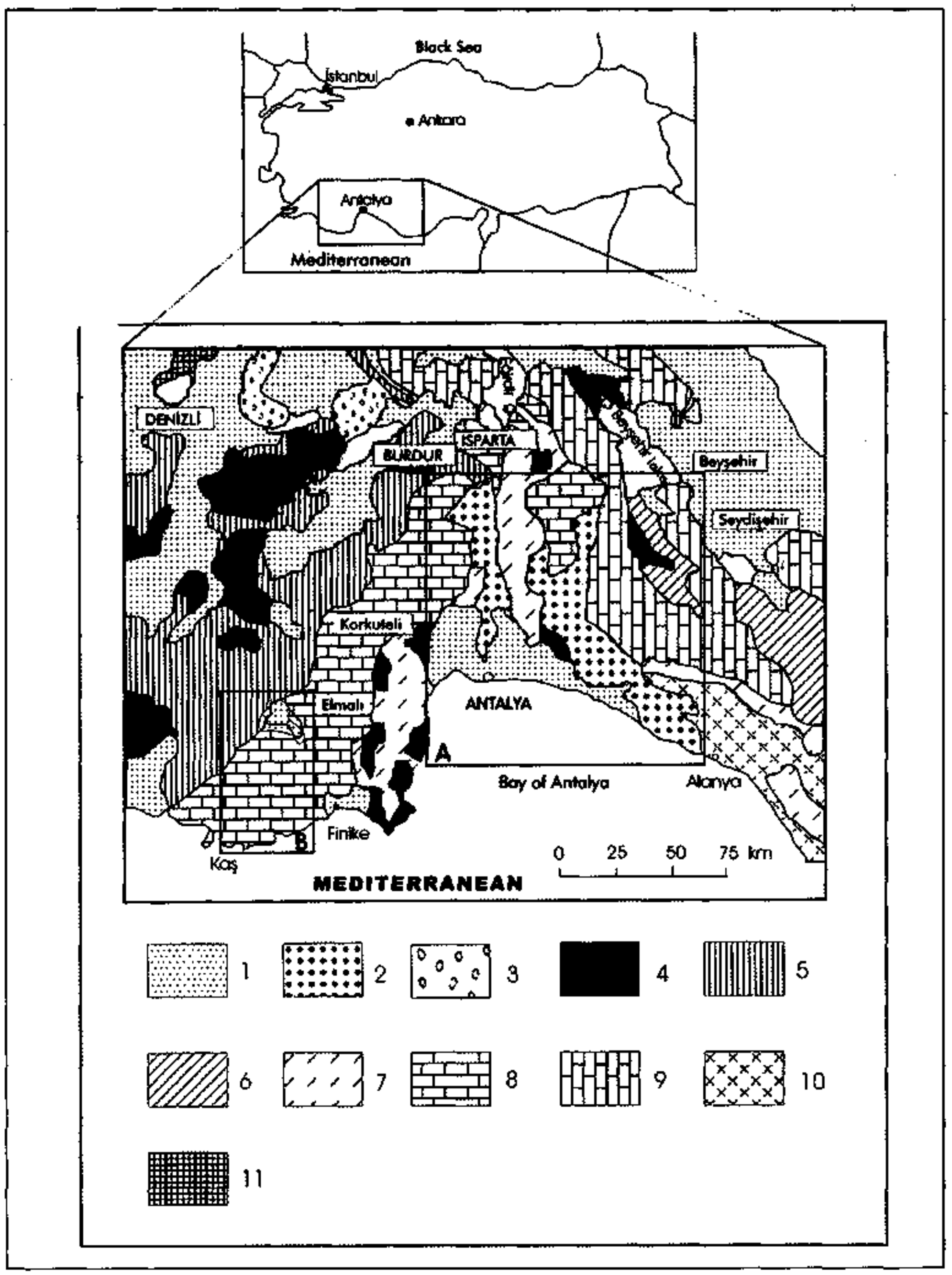

Fig. 1- Structural units in Antalya and Kasaba basins and in surrounding areas. A: Antalya Miocene basin, B: Kasaba Miocene basin, 1- Plio-Quaternary, 2- Miocene aged molasse basin, 3- Tavas- Burdur post-tectonic molasse basin, 4- Ophiolite nappes, 5- Lycian nappes, 6- Beyşehir -Hoyran - Hadim nappes, 7- Antalya nappes, 8- Beydağları autochthon, 9- Anamas- Akseki autochthon, 10- Alanya nappe, 11- Menderes massive (from Şenel, 1997).

The *Pecten (Aequipecten) scabrella bollenensis* (Mayer) yielding Upper Burdigalian age has been identified in Sevinç conglomerate and reflects the Tethys province and normal sea water salinity.

The *Pecten fuschi* Fontannes, *Anadara (Anadara) diluvii pertransversa* Sacco, *Carditamera (Lazariella) striatellata* (Sacco), *Cardiocardita* cf. *monilifera* (Dujardin), *Cardium kunstleri* Cossmann ve Peyrot, *Venus (Ventricoloidea) multilamella* (Lamarck), *Codakia leonina* (Basterot), *Athleta ficulina* (Lamarck), *Tellina (Peronaea) planata* Linne are found in Upper Burdigalian stage in Oymapınar limestone and they are also known to be present in Ottnangian and Karpatian stages of Central Paratethys. However, the *Pecten fuchsi* Fontannes, *Chlamys (Aequipecten) scabrella bollenensis* (Mayer) are only present in Tethys (Table 1a-b, 2 a-b and 4 a-b). The all identified fossil samples in this formation represent the environment having the normal sea water salinity.

The abundant molluscan fauna yielding Upper Burdigalian - Langhian (Ottnangian - Karpatian - Lower Badenian) age and refleo ting brackish water - marine environment has been found in Antalya Basin within the units of Altmkaya formation, the class Gastropoda including *Pirenella gamlitzensis gamlitzensis* (Hilber), *Terebralia bidentata cingulatior* Sacco, *Terebralia lignitara* (Eichwald), *Cerithium (Tiaracerithium) pseudotiarella* (d'Orbigny), *Nehtina picta* (Ferussac), *Hydrobia (Hydrobia) frauenfeldi* (Homes) and *Gastrana fragilis* (Linne), *Pelecyora (Cordiopsis) islandicoides* (Lamarck), *Irus (Paphirus) gregarius* Partscji of Bivalvia class have been found (Table 2 a b and 3 a-b). These species adapted an environment with relatively lower salinity than that of normal sea water. Of these fossils, *Pirenella gamlitzensis gamlitzensis* (Hilber), *Irus (Paphirus) gregarius* Partsch, *Hydrobia (Hydrobia) frauenfeldi* (Homes) like species are belonging to Central Paratethys (Table 3 a-b). The samples indicating normal sea water salinity are *Turritella (Turritella) turris* Basterot, *Turritella (Archimediella) bicarinata* Eichwald, *Triphora adversa miocenica* Cossmann ve Peyrot, *Conus conoponderosus* (Sacco), *Polinices (Polinices) redemptus* (Michelotti) which are wellknown both in Tethys and Central Paratethys facies (Table 3 a-b and 4 a-b). Most of the mollusc species in Altınkaya formation are present in both Lower - Middle Miocene stages of Tethys and marinal Ottnangian, Karpatian and Badenian stages of Central Paratehys. These are *Turritella (Turritella) turris* Basterot, *Tinostoma woodi* (Homes), *Nehtina picta* Ferussac, *Alvania (Alvania) venus* (d'Orbigny), *Terebralia bidentata cingulatior* Sacco, *Terebralia lignitara* (Eichwald), *Polinices (Polinices) redemptus* (Michelotti), *Natica millepunctata* Lamarck of class Gastropoda and *Pelecyora (Cordiopsis) islandicoides* Lamarck, *Gastrana fragilis* Linne, *Sanguinolaria (Soletellina) labordei* (Basterot), *Crassostrea gryphoides* (Schlotheim) of class Bivalvia (Table 1 a-b, 2 a-b, 3 a-b and 4 a-b). Except these species, the *Cerithium (Tiaracerithium) pseudotiarella* (d'Orbigny) and *Terebralia subcorrugata* d'Orbigny are only found in Lower Miocene in Tethys; whereas *Hydrobia (Hydrobia) frauenfeldi frauenfeldi* (Homes), *Irus (Paphirus) gregarius* Partsch, *Pirenella gamlitzensis gamlitzensis* (Hilber), *Glossus (Cytherocardia)* cf. *deshayesi* (Kutassy) are the species present in Ottnangian - Sarmatian epochs of Central Paratethys (Table 2 a-b and 3 a-b). Based on this, it is accepted that, it is better to use Upper Burdigalian together with Ottnangian - Karpatian stages for the age of the Altınkaya formation.

Table 1 a- The paleogeographic and stratigraphical distributions of the species of Class Bivalvia identified in Antalya and Kasaba Miocene basins. 1: Hoernes (1870), Schaffer (1910), Steininger (1963), Steininger et al. (1971); 2: Csepreghy- Meznerics (1954), Dulai (1996); 3: Kojumdgieva and Strachimirov (1960), Kojumdgieva (1969); 4: Moisescu (1955-1994), Hinculov (1968), Ionesi and Nicorici (1994); 5: Studencka (1986-1994), Studencka and Studencki (1988); 6: Hölzl (1958); 7: Tejkal et al. (1967), Ondrejickova (1972), Ctyroky et al. (1973); 8: Korobkov (1954), Nevesskaya (1993).

BIVALVIA	CENTRAL PARATETHYS							EASTERN PARATETHYS				
	Austria	Hungary	Bulgaria	Romania	Polonia	Germany	Slovakia	Ukrania	Georgia	Moldavia	Caucasia	Old S.S.S.R.
	1	2	3	4	5	6	7	8				
Barbatia (B.) cf. *barbata* (Linne)	Egb., K., Bd.	K.,Ott., Bd.	Bd.	Bd.	Bd.			G.Bd.		G.Bd.	Kon.	
Anadara (A.) diluvii (Lamarck)	Eg.- Bd.	E.Bd.	Bd.	Bd.	Bd.		Egb.	Tr.,Çk.	Sak.	G.Bd.		
Anadara (A.) diluvii pertransversa Sacco	Bd.	Ott.		G.Bd.								
Anadara (A.) fichteli (Deshayes)	Egb.	K.				Egb.	Egb.					
Anadara (A.) turonica (Dujardin)	Egb.-Bd.		Bd.	Bd.	Egb. -Bd.		Bd.	G.Bd.	Kon.	G.Bd.	Kon.	Sak.,Tr., Çk., Kon.
Glycymeris pilosa deshayesi (Mayer)	Bd.	Bd.	Bd.	Bd.	Bd.			Tr.,G.Bd.	Sak.			
Glycymeris (G.) bimaculatus (Poli)	Bd.			Bd.								
Glycymeris (G.) cor (Lamarck)	Egb.	Egb.				Egb.	Egb.					Sak.
Glycymeris (G.) inflatus (Brocchi)												
Amusium cristatum (Bronn)	K.- Bd.				Bd.							
Chlamys (A.) scabrella bollenensis (Mayer)												
Chlamys (M.) latissima praecedens (Sacco)												
Pecten benedictus Lamarck												
Pecten fuschi Fontannes												
Pecten zizinae Blanckenhorn												
Pecten (Flabellipecten) solarium Lamarck	Bd.	Bd.	Bd.	Bd.	Bd.							
Spondylus crassicosta ornatulina Sacco		Bd.										
Anomia (A.) ephippium rugulosostriata (Bronn)	Egb.- Bd.	Bd.	Bd.	Bd.	Bd.							
Pycnodonta germanitala (De Gregorio)												
Ostrea lamellosa Brocchi	Egb.	Egb., Bd.		Bd.								Tr.
Crassostrea gryphoides (Schaffer)	Egb., Bd.	Egb., Ott.,Bd.		Bd.	Bd.			Bd.- E.Sr.	Tr.			Tr., Kon.
Codakia leonina (Basterot)	Bd.	Bd.	Bd.				Bd.					
Linga (L.) columbella strictula Sacco				Bd.								
Loripes (L.) dujardini (Deshayes)	K.- Bd.		Bd.	Bd.	Bd.- Sr.		Bd.					Tr.- Çk.
Parvilucina (Microloripes) dentatus (Defrance)	Eg.- Bd.		Bd.- E.Sr.				Bd.	G.Bd.- E.Sr.		G.Bd.- E.Sr.	Tr., Çk., Kon.	
Megaxinus bellardianus (Mayer)		K., Bd.										
Megaxinus transversus rotundula Sacco												
Megaxinus (M.) ellipticus (Borson)					Bd.							

Table 1 b- Continue 1 a- 9: Dollfuss and Dautzenberg (1902), Deperet and Roman (1902-12), Cossmann and Peyrot (1914-1919), Roger (1939); 10: Sacco (1897-1898-1899-1901), Venzo and Pelosio (1963), Tavani and Tongiorgi (1963), Robba (1968), Sırna and Masullo (1978); 11 and 12: Malatesta (1960-1974); 13: Erünal-Erentöz (1958), 14: İslamoğlu (2001-2002) and 15: İslamoğlu and Taner (2002).

BIVALVIA	TETHYS								
	France	Italy	Portugal	Medit.	TURKEY				
					Karaman	Adana	Hatay	Antalya	Kasaba
	9	10	11	12	13			14	15
Barbatia (B.) cf. *barbata* (Linne)	B-O.M	G B T Pl							L (E.Bd)
Anadara (A.) diluvii (Lamarck)	G B	T	O M̈. T	Pl -Gun	G B			G B =Ott-K E T	G B-L (G Egb-E Bd)
Anadara (A.) diluvii pertransversa Sacco	O M	T - P	Pl		G B		Pl	G B (Ott-K)	
Anadara (A.) fichteli (Deshayes)	B	G B S T			G B				G B (G.Egb-K)
Anadara (A.) turonica (Dujardin)	A. B	G B	B		G B	T			L (E Bd)
Glycymeris pilosa deshayesi (Mayer)	G B.O M	G B	O M.						G B-L (G Egb-E Bd)
Glycymeris (G.) bimaculatus (Poli)	B	B T. Pl	T						G B (G Egb-K)
Glycymeris (G.) cor (Lamarck)		B - Pl	T Pl			T			G.B-L (G Egb-E Bd)
Glycymeris (G.) inflatus (Brocchi)	O M	B. Pl		Pl - Gun	G B				L (E Bd)
Amusium cristatum (Bronn)		G B Pl			G B		Pl		L (E Bd)
Chlamys (A.) scabrella bollenensis (Mayer)	B. T. Pl.							G B (Ott-K), E.T	
Chlamys (M.) latissima praecedens (Sacco)		G B							G B. (G Egb-K)
Pecten benedictus Lamarck	B								G B (G Egb-K)
Pecten fuschi Fontannes	B -O M	B						G B (Ott-K)	L (E Bd)
Pecten zizinae Blanckenhorn	B								G B. (G Egb-K)
Pecten (Flabellipecten) solarium Lamarck	B -O M				G B				L (E Bd)
Spondylus crassicosta ornatulina Sacco		Pl			G B			L (E Bd)	
Anomia (A.) ephippium rugulosostriata (Bronn)	A - Pl	A B S T	O M -Pl						L (E Bd)
Pycnodonta germanitala (De Gregorio)		T Pl			G B			L (E Bd)	L (E Bd)
Ostrea lamellosa Brocchi	G B - O M	Pl	O M -T	Pl				G B -L (Ott-E Bd)	
Crassostrea gryphoides (Schaffer)	A - B	B T Ms Pl			G B	T		L (E Bd)	
Codakia leonina (Basterot)	A. E B	B Pl	O M	Pl - Gun					L (E Bd)
Linga (L.) columbella strictula Sacco	G B -O M	T Pl						E T	
Loripes (L.) dujardini (Deshayes)	A - B	T Pl						E T	
Parvilucina (Microloripes) dentatus (Defrance)	B	G B T Pl						E T	
Megaxinus bellardianus (Mayer)	A O M	Ol A B S T Pl						G B (Ott-K) E T	
Megaxinus transversus rotundula Sacco		Pl	A					E T	
Megaxinus (M.) ellipticus (Borson)	Pl	T - Pl						E T	

Table 2 a- The paleogeographic and stratigraphical distributions of the species of Class Bivalvia identified in Antalya and Kasaba Miocene basins. 1: Hoernes (1870), Schaffer (1910), Steininger (1963), Steininger et al. (1971); 2: Csepreghy-Meznerics (1954), Dulai (1996); 3: Kojumdgieva and Strachimirov (1960); 4 : Hinculov (1968), Ionesi and Nicorici (1994); 5: Studecka and Studencki (1988), 6: Hölzl (1958), 7: Pfister and Wegmüller (1998); 8: Nevesskaya (1993).

BIVALVIA	CENTRAL PARATETHYS							EASTERN PARATETHYS				
	Austria	Hungary	Bulgaria	Romania	Polonia	Germany	Switzerland	Ukrania	Georgia	Moldavia	Caucasia	Old S.S.S.R.
	1	2	3	4	5	6	7	8				
Divaricella ornata subornata Hilber		Bd.										
Pseudochama gryphina taurolunata Sacco												
Carditamera (L.) striatellata (Sacco)	Bd.	K., Bd.	Bd.									
Cardiocardita cf. *monilifera* (Dujardin)												Sak.
Cardum kunstleri Cossman ve Peyrol					Bd.		Egb.					
Cardium praeaculeatum Hölzl						Egb.						
Acanthocardia (A.) turonica Mayer	Bd.											
Nemocardium spondyloides (Hauer)	Egb.	Bd.		Bd.	Bd.		Egb.		Sak.			
Nemocardium spondyloides herculeum D.C.G.	Ott.- Bd.											Sak.
Laevicardium (L.) oblongum (Chemnitz)												Sak.
Lutraria (P.) oblonga Chemnitz	Bd.	E. Bd.		Bd.	Bd.							
Tellina (Peronaea) planata Linne	Egb.- Bd.	Egb.	Bd.	Bd.	Bd.			Bd.	Sak.	Bd.	Kon.	
Gastrana fragilis (Linne)	Bd.	Bd.		Bd.	Bd.							Kon.-E.Sr.
Sanguinolaria (Soletellina) labordei (Basterot)		Ott,K,Bd										Kon.-E.Sr.
Glossus (C.) cf. *deshayesi perlongata* (Kulassy)					Bd.							
Venus (V.) excentrica Agassiz												
Venus (A.) burdigalensis producta Schaffer	Egb.											
Venus (Ventricoloidea) multilamella (Lamarck)	Eg. -Bd.	Eg.- Bd.		Bd.								Sak.
Pitar (P.) rudis (Poli)	K.-Bd.	Bd.	Bd.									Tr.- Çk.
Pitar (Paradione) lilacinoides (Schaffer)	Egb.					Egb.						
Callista (Callista) chione (Linne)		Bd.		Bd.	Bd.							Sak,Tr, Kon
Pelecyora (C.) islandicoides (Lamarck)	Egb.- Bd.	E.Bd.	Bd.	Bd.	Bd.			Sak,Bd.	Sak.	Bd.		Kon.
Pelecyora (C.) polytropa suborbicularis (Goldfuss)						Ol.-E.M.						
Dosinia lupinus (Linne)	Egb.- Bd.							Bd.	Sak., Çk.	Bd.	Kon.	
Irus (P.) gregarius gregarius Partsch	K.-E.Sr.	O.Sr.		E.Sr.	E.Sr.							O.Sr.
Corbula (Varicorbula) gibba (Olivi)	Eg.- Bd.											Ol., M.
Panopea (P.) menardi (Deshayes)	Egb.	Eg.			Bd.							Sak.- Tr.

Table 2 b- Continue 2 a- 9: Dollfuss and Dautzenberg (1902), Cossmann-Peyrot (1909-1912); 10: Sacco (1899, 1900-1901), Venzo and Pelosio (1963), Sırna and Masullo (1978); 11 and 12: Malatesta (1960 - 1974), 13: Erünal-Erentöz (1958), 14: İslamoğlu (2001-2002) and 15: İslamoğlu and Taner (2002).

BIVALVIA	TETHYS								
	France	Italy	Portugal	Meditt.	TURKEY				
					Karaman	Adana	Hatay	Antalya	Kasaba
	9	10	11	12	13			14	15
Divaricella ornata subornata Hilber									L (E.Bd)
Pseudochama gryphina taurolunata Sacco		B.,T.,Pl.							L (E.Bd)
Carditamera (L.) striatellata (Sacco)	A., E.B.	B.						G.B. (Ott-K)	
Cardiocardita cf. *monilifera* (Dujardin)	G.B.							G.B. (Ott-K)	
Cardum kunstleri Cossman ve Peyrot	G.B.	T.						G.B. (Ott-K)	
Cardium praeaculeatum Hölzl									G.B. (G.Egb.-E.Bd)
Acanthocardia (A.) turonica Mayer	G.B.	T., Pl.						G.B. (Ott-K)	
Nemocardium spondyloides (Hauer)	G.B., O.M.	G.B.	T.						G.B. (G.Egb.-E.Bd)
Nemocardium spondyloides herculeum D.Ç.G.	G.B.								L (E.Bd)
Laevicardium (L.) oblongum (Chemnitz)		T., Pl.	O.M.-T.					E.T.	
Lutraria (P.) oblonga Chemnitz	G.B.-O.M.	B.,T.,Pl.			G.B.	T.			G.B. (G.Egb.-E.Bd)
Tellina (Peronaea) planata Linne	B.- O.M.	T.- Pl.					Pl.	G.B=Ott-K; E.T.	
Gastrana fragilis (Linne)	B.- O.M.	Pl.						G.B. (Ott-K)	
Sanguinolaria (Soletellina) labordei (Basterot)	B.	Pl.						G.B. (Ott-K)	
Glossus (C.) cf. *deshayesi perlongata* (Kutassy)								G.B. (Ott-K)	
Venus (V.) excentrica Agassız	G.B., Pl.	T., Pl.						L. (E. Bd.)	
Venus (A.) burdigalensis producta Schaffer									G.B.(G.Egb.- K.)
Venus (Ventricoloidea) multilamella (Lamarck)	G.B.-O.M.	T., Pl.	T., Pl.	P.-Gün	G.B.		Pl.	G.B. (Ott-K)	G.B.-L. (G. Egb.-K)
Pitar (P.) rudis (Poli)	G.B.-O.M.	B., T., Pl.					Pl.	G.B. (Ott-K)	
Pitar (Paradione) lilacinoides (Schaffer)									G.B.-L. (G. Egb.-K)
Callista (Callista) chione (Linne)	G.B., O.M.	B., Pl.	Pl., P.						G.B.-L. (G. Egb.-K)
Pelecyora (C.) islandicoides (Lamarck)	O.M.	T., Pl.			G.B.			G.B. (Ott-K)	
Pelecyora (C.) polytropa suborbicularis (Goldfuss)								G.B. (Ott-K)	
Dosinia lupinus (Linne)	G.B.	Ol.-Pl.			G.B.			G.B. (Ott-K)	
Irus (P.) gregarius gregarius Partsch								G.B. (Ott-K)	
Corbula (Varicorbula) gibba (Olivi)	G.Eosen			Pl.-Gün					L (E.Bd)
Panopea (P.) menardi (Deshayes)		G.Ol.-T.							G.B. (G. Egb-K.)

Table 3 a- The paleogeographic and stratigraphical distributions of the species of Class Gastropoda identified in Antalya and Kasaba Miocene basins. 1: Hoernes (1856), Papp (1952), Steininger et al. (1978); 2: Strausz (1966), 3: Friedberg (1914 1954-55), 4: Moisescu (1955), Hinculov (1968); 5: Kojumdgieva and Strachimirov (1960); 6: Iliana (1993).

GASTROPODA	CENTRAL RARATETHYS					EASTERN PARATETHYS
	AUSTRİA	HUNGARY	POLONIA	ROMANIA	BULGARIA	Old S.S.S.R.
	1	2	3	4	5	6
Gibbula (G.) maga Linne						
Tinostoma woodi (Hoernes)	Ott.-Bd.		Bd.			
Astraea (Bolma) rugosa (Linne)						
Neritina picta (Ferussac)			Bd.	Bd.- O. Sr.		Kr., Kon., Sr.
Hydrobia (H.) frauenfeldi (Hoernes)	Ott.-O.Sr.	O. Sr.	Bd. -Sr.	O. Sr.	Sr.	Kr., Kon., Sr.
Cingula (P.) ventricosella (Cerulli-Irelli)						
Alvania ispartaensis n. sp.						
Alvania (Alvania) curta (Dujardin)						
Alvania (A.) venus (d'Orbigny)	Egb.- Bd.	Egb.-Bd.				
Alvania tanerae n. sp.						
Turritella terebralis turritissima Sacco						
Turritella terebralis subagibbosa Sacco						
Turritella (T.) tricarinata (Brocchi)						
Turritella (T.) turris Basterot			K.-Bd.			
Turritella (Haustator) striatellatus Sacco						
Turritella (H.) tricincta Borson	Bd.		Bd.			
Turritella (Zaria) spirata (Brocchi)	Egb.- Bd.	Bd.	Bd.			Tr.- Çk.- Kon.
Turritella (Z.) subangulata (Brocchi)	Bd.					
Turritella (A.) bicarinata Eichwald	E. Bd.	E. Bd.	E. Bd.		Egb., Pl.	Tr., Çk., Kon.
Turritella (Peyrotia) desmarestina Basterot						
Pirenella gamlitzensis gamlitzensis (Hilber)	K.	Bd.-O. Sr.		Bd.-O. Sr.		Kr., Kon., Sr.
Terebralia bidentata cingulatior Sacco						
Terebralia lignitara (Eichwald)	K., Bd., Sr.	Bd.	Bd.-Sr.		Bd.	Kon. Sr.
Terebralia lignitara lignitara (Eichwald)			Bd., Sr.	Bd., Sr.		
Terebralia subcorrugata d'Orbigny						
Cerithium appenninicum dertosulcata Sacco						
Cerithium zejsneri Pustch	Bd.		Bd.			
Cerithium (P.) turritoplicatum Sacco		Bd.				
Cerithium (T.) pseudotiarella d'Orbigny						
Cerithium (T.) europaeum graciliornata Sacco	K.-Bd.	Bd.	Bd.			
Cerithium (T.) vulgatum miocenicum Vignal						
Triphora adversa miocenica Coss. ve Pey.						
Chrysallida (Parthenina) interstincta (Mayer)		Bd.	Bd.			Tr., Çk., Kon.
Odostomia (Megastomia) conoidea (Brocchi)						
Turbonilla (Mormula) aturensis (Coss. ve Pey.)						
Xenophora deshayesi (Michelotti)	Eg.- Bd.	Bd.	Bd.	E. Bd.		
Xenophora infundibulum (Brocchi)						

Table 3 b- Continue 3 a- 7: Cossmann-Peyrot (1919 -1924), Vignal (1910); 8: Sacco (1895 -1896), Venzo and Pelosio (1963), Greco (1970); 9: Wenz (1938-44), Malatesta (1960-1974); 10: Erünal-Erentöz (1958); 11: İslamoğlu (2001-2002) and 12: İslamoğlu and Taner (2002).

GASTROPODA	TETHYS							
	FRANCE	ITALY	MEDİTERR.	TURKEY				
				Karaman	Adana	Hatay	Antalya	Kasaba
	7	8	9	10			11	12
Gibbula (G) maga Linne		T -P.	Gun.					
Tinostoma woodi (Hoernes)		G. B -T.					G.B. (Ott.- K.)	
Astraea (Bolma) rugosa (Linne)		T., Pl.		G. B.			E. T	
Nentina picta (Ferussac)	G.B	G. B					G B. (Ott.- K.)	
Hydrobia (H.) frauenfeldi (Hoernes)							G.B. (Ott - K.)	
Cingula (P.) ventricosella (Cerulli-Irelli)			Gün				E. T.	
Alvania ispartaensis n. sp							G.B. (Ott.- K.)	
Alvania (Alvania) curta (Dujardin)	B	T -E Ms					G.B. (Ott.-K). E T	
Alvania (A.) venus (d'Orbigny)	A -B						G.B (Ott.-K). E T	
Alvania tanerae n. sp.							E T.	
Turritella terebralis turritissima Sacco	E. B.							G B. (G.Egb-K)
Turritella terebralis subagibbosa Sacco		G. B						G.B. (G.Egb-K) .
Turritella (T.) incarinata (Brocchi)		G B - P	Gün				G.B. (Ott - K.)	G.B. (G.Egb-K)
Turritella (T.) turris Basterot	A - E. B							G.B -L (G. Egb.-E Bd)
Turritella (Haustator) striatellatus Sacco		G. B.						G.B (G.Egb-K)
Turritella (H.) tricincta Borson		T., Pl.		G. B.				G.B.-L (G. Egb.-E Bd)
Turritella (Zaria) spirata (Brocchi)		G. B.- P					G.B. (Ott.-K). E.T.	L. (E. Bd.)
Turritella (Z.) subangulata (Brocchi)	G B	G. B., Pl.			T.	Pl.		G B (G.Egb-K)
Turritella (A.) bicarinata Eichwald	G B	T		G. B			G B. (Ott -K). E.T	L (E. Bd.)
Turritella (Peyrotia) desmarestina Basterot	A.	G. B						G.B. (G Egb-K)
Pirenella gamlitzensis gamlitzensis (Hilber)							G.B. (Ott.- K.)	
Terebralia bidentata cingulatior Sacco		G B			G B		G.B. (Ott.- K.)	
Terebralia lignitara (Eichwald)	A.- T				O M.		G B. (Ott.- K.)	
Terebralia lignitara lignitara (Eichwald)							G B. (Ott.- K.)	
Terebralia subcorrugata d'Orbigny	A -B						G.B. (Ott.- K.)	
Cerithium appenninicum dertosulcata Sacco		T.					E T.	
Cerithium zejsneri Pusch								L (E. Bd.)
Cerithium (P.) turritoplicatum Sacco		G B					G.B. (Ott.- K.)	L. (E. Bd.)
Cerithium (T.) pseudotiarella d'Orbigny	A.- B.	G. B					G.B (Ott.- K.)	
Cerithium (T.) europaeum graciliornata Sacco		T., Pl.					G.B. (Ott.- K.)	
Cerithium (T.) vulgatum miocenicum Vignal	A.-B						G.B. (Ott.- K.)	
Triphora adversa miocenica Coss. ve Pey	B						G. B. (Ott. - K.)	
Chrysallida (Parthenina) interstincta (Mayer)	G.B	T . Ms.,P.	Gün.				G B. (Ott.-K). E T	
Odostomia (Megastomia) conoidea (Brocchi)		T , Pl.					E. T.	
Turbonilla (Mormula) aturensis (Coss. ve Pey.)	A							G B. (G.Egb-K)
Xenophora deshayesi (Michelotti)	G. B.	Ol., B., Pl.		G. B				G.B.-L (G. Egb.-E Bd)
Xenophora infundibulum (Brocchi)		T , Pl					E. T.	

Table 4 a- The paleogeographic and stratigraphical distributions of the species of Class Gastropoda identified in Antalya and Kasaba Miocene basins. 1: Hoernes (1856), Steininger et al. (1971); 2: Csepreghy-Meznerics (1954), Strausz (1966"), 3: Kojumdgieva and Strachimirov (1960); 4: Hinculov (1968); 5: Friedberg (1911-28, 1954), 6: Iliana (1993).

GASTROPODA	CENTRAL PARATETHYS					EASTERN PARATETHYS
	Austria	Hungary	Bulgaria	Romania	Polonia	Old S.S.S.R.
	1	2	3	4	5	6
Aporrhais pespelecani (Linne)	Bd.	Bd.	Bd.		Bd.	Tr.
Strombus coronatus Defrance	Eg., K., Bd.			E.Bd.		
Strombus coronatus compressonana Sacco						
Strombus bonelli Brongniart	Bd.	K.- Bd.	Bd.		Bd.	
Erato (E.) laevis elongata Sacco		K.- Bd.	Bd.		Bd.	
Cypraea (B.) fabagina Lamarck	Bd.	Bd.	Bd.		Bd.	
Cypraea (B.) fabagina mioporcellus Sacco						
Cypraea (A.) subamygdalum d'Orbigny						
Polinices (Polinices) redemptus (Michelotti)	Bd.	Bd.		Bd.	Bd.	
Natica millepunctata Lamarck	K.- Bd.	Bd.	Bd.	Bd.	Bd.	Tr., Çk., Kr., Kon.
Cassidaria tauropomum (Sacco)						
Cassis (C.) mamillaris postmammilaris S.						
Distorsio (Rhysema) tortuosa (Borson)			Bd.			
Charonia stefaninii (Monterosato)						
Ficus geometra (Borson)	Egb.				Bd.	
Murex (Bolinus) subtorularius Hoernes-Auinger	K.- Bd.	Bd.	Bd.	Bd.	Bd.	
Hadriana becki (Michelotti)						
Mitrella (M.) liguloides (Doderlein)						
Mitrella (M.) nassoides grateloupi Peyrot						
Galeodes cornutus (Agassiz)	K., Bd.		Bd.			
Arcularia (A.) ringicula (Bellardi)						
Hinia (Uzita) porrecta (Bellardi)						
Latirus (Dolichalatirus) dispar (Peyrot)	Ott.-Bd.	Ott.-Bd.	Ott.-Bd.		Ott.-Bd.	
Ancilla (B.) glandiformis (Lamarck)	Bd.	Bd.	Bd.	Bd.	Bd.	
Ancilla (B.) obsoleta (Brocchi)	Ott.-Bd.	Bd.			Bd.	
Vexillum (U.) pluricostata percostulata (Sacco)						
Mitra (M.) fusiformis (Brocchi)						
Athleta ficulina (Lamarck)						
Athleta (A.) rarispina (Lamarck)	Eg.- Bd.	Bd.	Bd.	Bd.	Bd.	
Voluta erentoezae n. sp.						
Gibberulina (G.) philippi (B.D.D.)	Bd.	Bd.			Bd.	
Clavatula asperulata (Lamarck)	Bd.	Bd.			K.	
Clavatula (C.) calcarata francisci (Toula)						
Mangelia cf. brachystoma (Philippi)						
Conus antiquus Lamarck						
Conus clavatulus d'Orbigny						
Conus conoponderosus (Sacco)						
Conus mercati Brocchi						
Conus striatulus Brocchi						
Conus (Chelyconus) fuscocingulatus Bronn		Bd.		Bd.		
Conus (Chelyconus) puschi Michelotti	K.- Bd.					
Conus (Conolithus) dujardini Deshayes	K. - Bd.	K. - Bd.	K. - Bd.	K. - Bd.		
Subula (Oxymeris) plicaria (Basterot)	Bd.	Bd.			Bd.	

Table 4 b- Continue 4 a- 7: Cossmann-Peyrot (1924), Peyrot (1928,1931,1932); 8: Malatesta (1960,1974); 9: Sacco (1891,1893,1904), Moroni (1953), Venzo and Pelosio (1966), Hall (1964), Robba (1968), Davoli (1972-1990); 10 and 11: Malatesta (1960,1974); 12: Erünal-Erentöz (1958); 13: İslamoğlu (2001-2002) and 14: İslamoğlu and Taner (2002).

GASTROPODA	TETHYS								
	France	Algeria	Italy	Portugal	Medit.	TURKEY			
						Karaman	Hatay	Antalya	Kasaba
	7	8	9	10	11	12		13	14
Aporrhais pespelecani (Linne)	G.B.-O.M.	Pl	O.M.-G.M						L. (E Bd)
Strombus coronatus Defrance	G B.	Pl	Pl			G B		E.T	
Strombus coronatus compressonana Sacco			Pl					E.T	
Strombus bonelli Brongniart	A.. E.B.		G B.					E.T	L (E Bd)
Erato (E.) laevis elongata Sacco			G.B., T.. Pl.					E.T.	
Cypraea (B.) fabagina Lamarck	E B.		G.B.			G.B.		E.T.	G.B-L (G Egb.-E.Bd)
Cypraea (B.) fabagina mioporcellus Sacco			T.					E T.	
Cypraea (A.) subamygdalum d'Orbigny	B.- O.M.		G.B.. T.					E.T.	
Polinices (Polinices) redemptus (Michelotti)	G.B		T			G.B		G.B (Ott-K)	L. (E.Bd)
Natica millepunctata Lamarck			G B . T . Pl.		Gun	G.B	Pl.	E T	G.B-L (G.Egb -E Bd)
Cassidaria tauropomum (Sacco)			Ol - B						G B. (G Egb-K)
Cassis (C.) mamillans postmammilaris S									
Distorsio (Rhysema) tortuosa (Borson)	A - O.M		G.B. - Pl.						L. (E.Bd)
Charonia stefaninii (Monterosato)			T.					E.T.	
Ficus geometra (Borson)		Pl	G.B.,T.,Pl.						G.B-L (G.Egb -E.Bd)
Murex (Bolinus) sublorularius Hoernes-Auinger						G.B			L (E.Bd)
Hadriana becki (Michelotti)			T.. Pl					E T.	
Mitrella (M.) liguloides (Doderlein)			T					E T	
Mitrella (M.) nassoides grateloupi Peyrot	B - O M								L (E Bd)
Galeodes cornutus (Agassiz)	B - O M.		G.B - T			G B.		E T	G B-L (G Egb -E Bd)
Arcularia (A.) ringicula (Bellardi)			T.					E T.	
Hinia (Uzita) porrecta (Bellardi)			T.					E.T	
Latirus (Dolichalatirus) dispar (Peyrot)	G.B.		T.					E.T.	L. (E.Bd)
Ancilla (B.) glandiformis (Lamarck)	B.- O.M.		G.B.- Ms.	O.M. - T.					G.B-L (G.Egb.-E.Bd)
Ancilla (B.) obsoleta (Brocchi)	G B.-O M		T . Ms.						G.B. (G.Egb-K)
Vexillum (U.) pluricostata percostulata (Sacco)			G..B.						G.B (G.Egb-K)
Mitra (M.) fusiformis (Brocchi)	Pl.		Pl			G B.		E T	
Athleta ficulina (Lamarck)	E B.		G.B.			G.B		G.B.(Ott-K). E.T.	G.B (G Egb-K)
Athleta (A.) rarispina (Lamarck)	B -O M		T.	T.			Pl.	E.T	G.B (G.Egb-K)
Voluta erentoezae n. sp								E.T	
Gibberulina (G.) philippi (B.D.D.)			T.- Gün.					E T.	
Clavatula asperulata (Lamarck)	A.- B.		G.B.						G.B-L (G.Egb.-E.Bd)
Clavatula (C.) calcarata francisci (Toula)						G.B.	Pl.		L. (E.Bd)
Mangelia cf brachystoma (Philippi)			T - Pl.		Gun			E.T.	
Conus antiquus Lamarck	B - O M		B. S T.						L (E.Bd)
Conus clavatulus d'Orbigny	B.- Pl		G B						L. (E Bd)
Conus conoponderosus (Sacco)			G B . T					G.B.(Ott-K). E T	L. (E.Bd)
Conus mercati Brocchi	G B.							E T	L. (E.Bd)
Conus striatulus Brocchi			G B.. T. Pl.					G.B.(Ott-K). E.T.	
Conus (Chelyconus) fuscocingulatus Bronn			T.					E.T.	
Conus (Chelyconus) puschi Michelotti	G B		G.B., S.. T.						G.B-L (G.Egb -E.Bd)
Conus (Conolithus) dujardini Deshayes	G B.- O.M.		G.B.. T., Pl.			G B.		E T.	G.B. (G.Egb-K)
Subula (Oxymeris) plicaria (Basterot)	A. - B.		Pl.			G B			

In Aksu formation, the *Gibbula (Gibbula) maga* Linne, *Hadriani becki* (Michelotti), *Mitrella (Mitrella) liguloides* (Doderlein), *Mangelia* cf. *brachystoma* (Philippi), *Cerithium appenninicum dertosulcata* Sacco, *Odostomia (Megastomia) conoidea* (Brocchi), *Xenophora infundibulum* (Brocchi), *Arcularia (Arcularia) ringicula* (Bellardi), *Charonia stefaninii* (Montarano), *Hinia (Uzita) porrecta* (Bellardi), *Cypraea (Bernaya) fabagina mioporcellus* Sacco, *Conus conoponderosus* (Sacco) of class Gastropoda and *Megaxinus transversus rotundula* Sacco of class Bivalvia are the species appeared at the beginning of the Tortonian only in Tethys (Table 1 a-b, 3 a-b and 4 a-b).

Apart from these, the species like *Alvania (Alvania) curta* (Dujardin), *Mitra (Mitra) fusiformis* Brocchi, *Conus mercati* Brocchi, *Astraea (Bolma) rugosa* (Linne), *Chrysallida (Parthenina) interstincta* (Montagu), *Linga (Linga) columbella strictula* (Sacco) have been appeared since Burdigalian. Of these *Astraea (Bolma) rugosa* (Linne), *Chrysallida (Parthenina) interstincta* (Montagu), *Linga (Linga) columbella strictula* (Sacco) are also identified in marinal Lower Badenian stage of Central Paratethys (Table 1 a-b and 3 a-b). Although some of the species identified in this formation have distribution in Lower and Middle Miocene of Central Paratethy, they can be totally correlated with Tethys in Upper Miocene. For this reason, the Lower Tortonian stage has only been used for the Aksu formation.

In fauna identified in Aksu formation, the presence of the species like *Strombus (Strombus) bonellii* Brongniart, *Strombus coronatus* Defrance, *Erato (Erato) laevis elongata* Sacco, *Cypraea (Bernaya) fabagina mioporcellus* Sacco, *Odostomia (Megastomia) conbidea* (Brocchi), *Gibberulina (Gibberulina) philippi* (Monterosato), *Gibbula (Gibbula) maga* (Linne) and *Alvania vehus* (d'Orbigny) indicate high sea water salinity and subtropical climatic conditions. Consequently, it can be deduced that, the climatic conditions were better and warmer in Antalya Miocene basin relative to Lower and Middle Miocene.

Kasaba Miocene basin

The total 68 mollusc species have been identified in Kasaba Miocene basin and the detailed stratigraphy of the basin has been established (İslamoğlu and Taner, 2002). The Upper Burdigalian - Langhian (Upper Eggenburgian - Karpatian) aged whole mollusc fauna identifed in Kasaba basin reflects normal sea water salinity in subtropical climate belt and shallow marine environmental conditions being different from Antalya Miocene basin. The stratigraphic and paleogeographic characteristics of the fauna are as follows:

In stratigraphic sections measured within Ucarsu formation the identified species which are *Turritella terebralis turritissima* Sacco, *Turritella terebralis subagibbosa* Sacco, *Turritella (Peyrotia) desmarestina* Basterot, *Cassidaria tauropomum* (Sacco), *Turbonilla (Mormula) aturensis* (Cossmann ve Peyrot), *Vexillum (Uromitra) pluricostata percostulata* (Sacco) of class Gastropoda and *Pecten zizinae* Blanckenhorn, *Cardium praeaculeatum* (Holzl) and *Pitar (Paradione) lilacinoides* (Schaffer) of class Bivalvia became totally extinct at the end of Burdigalian (Table 2 a-b, 3 a-b and 4 a-b). These species are absent in Langhian (Lower Badenian) aged Kasaba formation.

In Ugarsu formation, mostly, the *Turritella terebralis turritissima* Sacco, *Turritella terebralis subagibbosa* Sacco, *Clavatula (Clavatula) calcarata francisci* (Toula) and *Conus mercati* Brocchi of class Gastropoda and *Pecten zizinae* Blanckenhorn, *Glycymeris (Glycymeris) inflatus* (Brocchi) of class Bivalvia are found only Tethys (Table 1 a-b, 3 a-b and 4 a-b). However, the *Conus (Chelyconus) puschi* Michelotti, *Ancilla (Baryspira) glandiformis* (Lamarck), *Turritella (Haustator) tricincta* (Borson), *Cypraea (Bernaya) fabagina* Lamarck, *Natica millepunctata* Lamarck, *Turritella (Turritella) turns* Baste rot, *Cypraea (Bernaya) fabagina* (Lamarck) and *Athleta ficulina* (Lamarck) of class Gastropoda and *Anadara (Anadara) diluvii* (Lamarck), *Glycymeris (Glycymeris) cor* (Lamarck), *Glycymeris pilosa desh*ayes/ (Mayer), *Callista (Callista) chione* (Linne) and *Nemocardium spondyloides* (Hauer) of class Bivalvia type species are found in some or all marinal stages Eggenburgian, Karpatian and Badenian of both Tethys and Central Paratethys (Table 1 a-b, 2 a-b, 3 a-b and 4 a-b). In addition, a few species belonging to only the Eggenburgian stage of Central Paratethys such as, *Pitar (Paradione) lilacinoides* (Schaffer) and *Venus (Antigona) burdigalensis producta* Schaffer have been also found (Table 1 a-b). As far as the paleogeographical characteristics of the molluscan fauna are considered, it is necessary to use the Upper Burdigalian stage with Upper Eggenburgian- Karpatian stages.

In Kasaba formatipn, the species appeared firstly at the beginning of Middle Miocene are *Cerithium zejsneri* Pusch and *Divaricella ornata subornata* Hilber of class Gastropoda. These are the species which belonging to marinal Lower Badenian stage of Central Paratethys (Table 2 a-b and 3 a-b). The *Turritella (Turritella) turns* Baste rot, *Cypraea (Bernaya) fabagina* Lamarck, *Clavatula asperulata* (Lamarck) of class Gastropoda and *Nemocardium spondyloides herculeum* Dollfuss-Cotter-Gomez, of class Bivalvia became extinct at the end of Middle Miocene (Table 2 a-b, 3 a-b and 4 a-b).

The most of the species identified in Kasaba formation are present in marinal stages of Central Paratethys with Tethys fauna similar in Ugarsu formation. As mentioned above, except these, the only *Cerithium zejsneri* (Pusch) and *Divaricella ornata subornata* Hilber type species are found in lower Badenian stage of Central Paratethys (Table 2 a-b and 3 a-b). Based upon these data, the age of the Kasaba formation has been accepted as Langhian (Lower Badenian). Additionally, this fauna is typically in marine character and indicates the presence of a stable marine environment with normal salinity.

THE DISCUSSION OF THE CHRONOSTRATIGRAPHIC LEVELS AND PALEOGEOGRAPHICAL DISTRIBUTIONS OF THE USED STAGES

In order to discuss and understand better the paleogeographic interpretations of the mollusc fauna present in the basins, it is necessary to give some knowledge mentioned below.

Regional changes in terrain have been developed in Tethys realm and surrounding areas since the beginning of Cenozoic due to effect of neotectonism (Steininger et al., 1985). These changements have caused the seperation of the Tethys since Paleocene; as a result of this event, the new marine realms and gateways were developed (Steininger et al., 1985). The continuation of this event has been increased since the beginning of Neogene; consequently, the newly formed marine realms evolved differently and each of them became a distinct isolated small basin. At the same time, the connection of the marine realm, existed at the south, with (Tethys) Atlantic, Indo-Pasific and northern inland seas (Central and Eastern Paratethys) was continued by limited sea ways and later, disconnected firstly with Paratethys and the other oceans (Steininger et al., 1985; Rögl, 1998).

This geodinamic evolution in the region caused the development of paleobiogeographic and paleogeographic differences in three different regions within the Alpine - Caucasus orogenic belt. These regions are named as; Tethys in the south, Central Paratethys for Central Europe and Eastern Paratethys between eastern Europe and Caucasia (Nevesskaya et al., 1975; Papp, 1981; Steininger and Rogl, 1984; Steininger et al., 1985; Rogl, 1998).

It is necessary to research the causes of facies and faunal changes, their relationships and evolution developed in different regions. For this purpose, the detailed biostratigraphic and chronostratigraphical studies have been carried out in Tethys, Central Paratethys and Eastern Paratethys and the best stratotypes representing the regions were identified. The new stratotypes have also been suggested whenever the problems come to existence correlation. By using the biostratigraphy and magnetostratigraphy together with radiometric age methods, the correlation tables among regions were worked out and the time equivalents of stages and their relations were established (Cicha et al., 1969; Carloni et al., 1971; Nevesskaya, et al., 1979; Papp, 1981; Steininger and Rögl, 1984; Steininger et al., 1985).

The regional stage names used in preparation of correlation charts have allowed investigators to have different opinions and make discussions. Some of the stage names were left to use and instead the new stage names were suggested. Especially, before the Central Paratethys concept is established, The Tethys stages were used and later, it was understood that not only the facies and faunal content but also the stratigraphic levels and ages were inconsistent, for this reason, the regional new stages have been identified. The stage names previously used in the old literature and correlative regional new stage names are shown in Fig. 2.

For example, the new idea and discussions are suggested that the widely used and known Aquitanian and Burdigalian stages of Lower Miocene are not consistent for Tethys. The Carloni et al., (1971) claimed that, the Aquitanian and Burdigalian are local facies and not to have being a stratotype, also, Gelati and Robba (1975) pointed out that, the stratotypes in which these stages identified are not belonging to the Mediterranean, instead, related to the Atlantic and no marine gateway existed between two oceans during Early Miocene. They also claimed that, the type sections of the Oligocene - Miocene is somewhat problematic. Based on these, Gelati and Robba (1975) identified a new stratotype including the whole Lower Miocene in Piedmonte basin located at north of Italy in Tethys realm and suggested a new stage name as "Cortemilian".

The Helvetian stage stratotype is in Switzerland in Central Paratethys, known also western Paratethys. The Helvetian is known to represented typical mollusc species depicting brackish- marine facies (Rutsch, 1971). The Helvetian stage including endemic fauna and developed different facies, was widely used both in Tethys and Central Paratethys; however, due to correlation problems, it was decided not to be used for both realms and which stages could be used instead, was the subject of discussion (Steininger and Rögl, 1979).

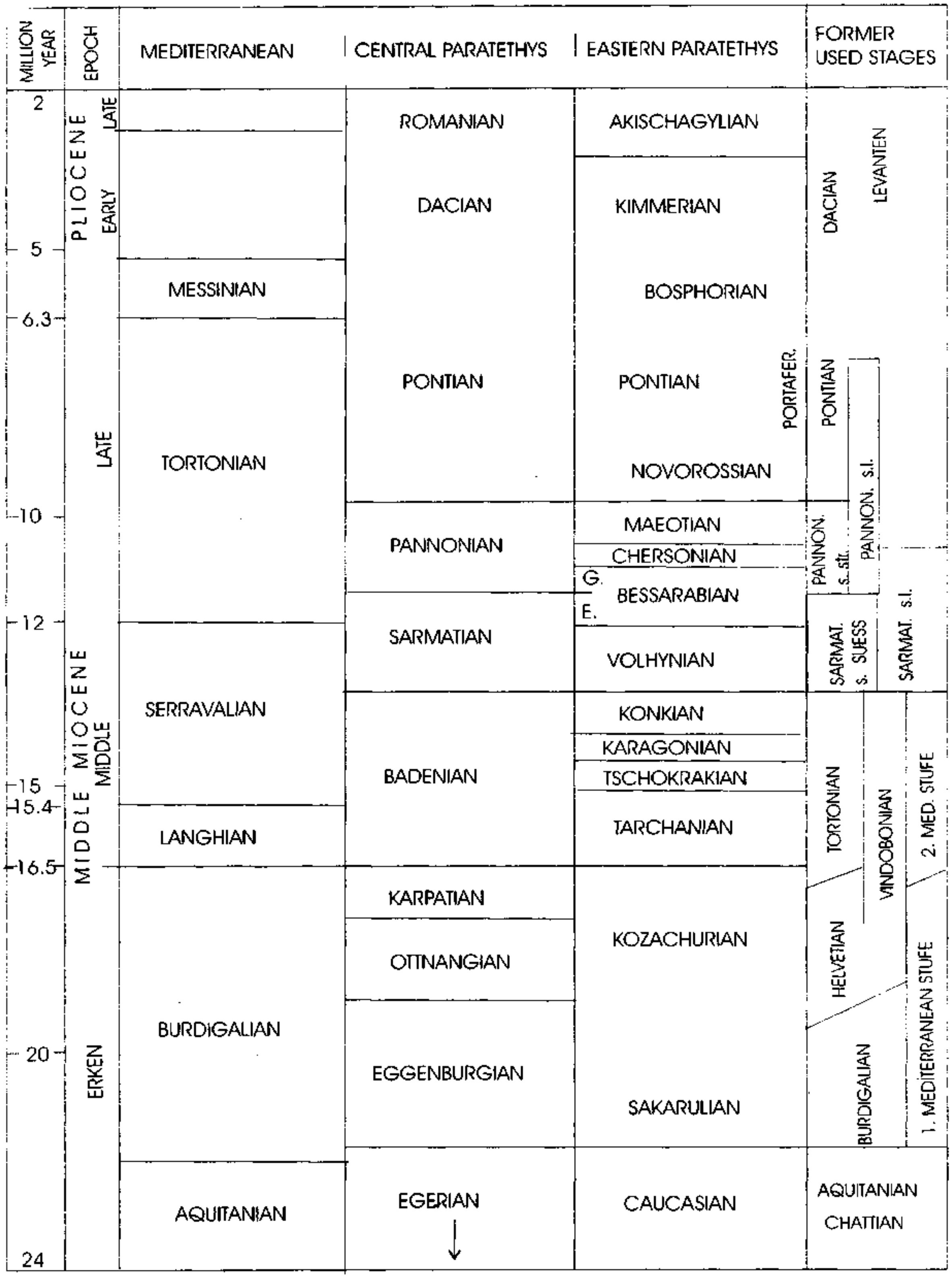

Fig. 2- The previously used stage names and theis new equivalants (Steininger and Rögl, 1979).

Before the establishment of Central Paratethys concept, the Tethyian stages or local stages were used. Throughout the progressive studies, it was deduced that, the most of the stage names were not consistent with paleogeographic and paleoecological characteristics of the region, and for each stage names the suitable stages were selected. Consequently, it has been decided that, the "Ottnangian" stage is suggested to be used for old Lower Helvetian which was transgressive and marinal character at the beginning, later became regressive and endemic brackish fauna in Central Paratethys. For the transgressive and marine fauna in old Upper Helvetian, the "Karpatian" stage is used (Steininger et al., 1976; Steininger and Rögl, 1979 and 1984; Nagymarosy and Müller, 1988; Steininger et al., 1988).

In previous studies in Tethys realm, the Helvetian stage of Western Paratethys was used for Italy and France countries. However, when given up the usage of this stage, the Langhian and Serravalian stages (Middle Miocene) were instead thought (Cita and Blow, 1969; Carloni et al., 1971; Later, it has been decided that, based on the developments in biostratigraphic correlations and changements in biozones, the Helvetian is corresponding to the Upper Burdigalian (Steininger et al., 1976; Steininger and Rögl, 1979; Harzhauzer, 1999, written communication; Robba, 2000, written communication; see Fig. 6.2).

The Badenian and Sarmatian stage names are used for Middle Miocene in Central Paratethys (Fig. 3). The Tortonian of Tethys was previously used in both regions for the Middle Miocene; later, it is concluded that, the true Tortonian is correlative of Upper Miocene and is suitable for Tethys (Nagymarosy and Müller, 1988; Steininger et al., 1988).

In the investigated basins, the most of the identified mollusc fauna has wide distribution both in Tethys and Central Paratethys. Furthermore, the specie's appeared only in Tethys or Central Paratethys and the newly identified a few species peculiar to the region are also present.

In Turkey, apart from the studied areas, the similar findings have been obtained by other investigators. Especially, in West Anatolia and Taurus, the faunal assemblages were detected reflecting the same environmental conditions similar to Central Paratethys. In contest, in northern Anatolia, the Eastern Paratethys fauna is found. Based upon this:

Bukowski (1983), in Rhodos Island, identified *Vivipara clathrala* Deshayes, *Melania tournouari* Fuch, *Planorbis trassylvanicus* Neumayr, *Bythinia meridionalis* Freundf. and *Hydrobia ventrosa* Montagu like mollusc samples and established the Levantine (Romanian) stage.

Oppenheim (1918) referred to Sarmatian - Pontian stages based on the *Bithynia pisidica* Oppenheim, *Vivipara bukowski* Oppenheim, *Valvata pisidica* Oppenheim and *Limnaeus meparensis* identified around Eflatun - Bunar (Yenice) at the east of Beyşehir lake.

A great number of samples of class Bivalvia and Gastropoda identified by Erünal - Erentöz (1958) in Karaman, Adana and Hatay were also detected in Antalya and Kasaba basins. The stage names used by Erünal - Erentöz (1958) especially the Helvetian was identified in Switzerland falls into the effective area of Central Paratethys as mentioned previously. When she interpreted the paleogeographic distribution of identified mollusc fauna in her study area, she also indicated that, they were widely distibuted in Vienna basin in

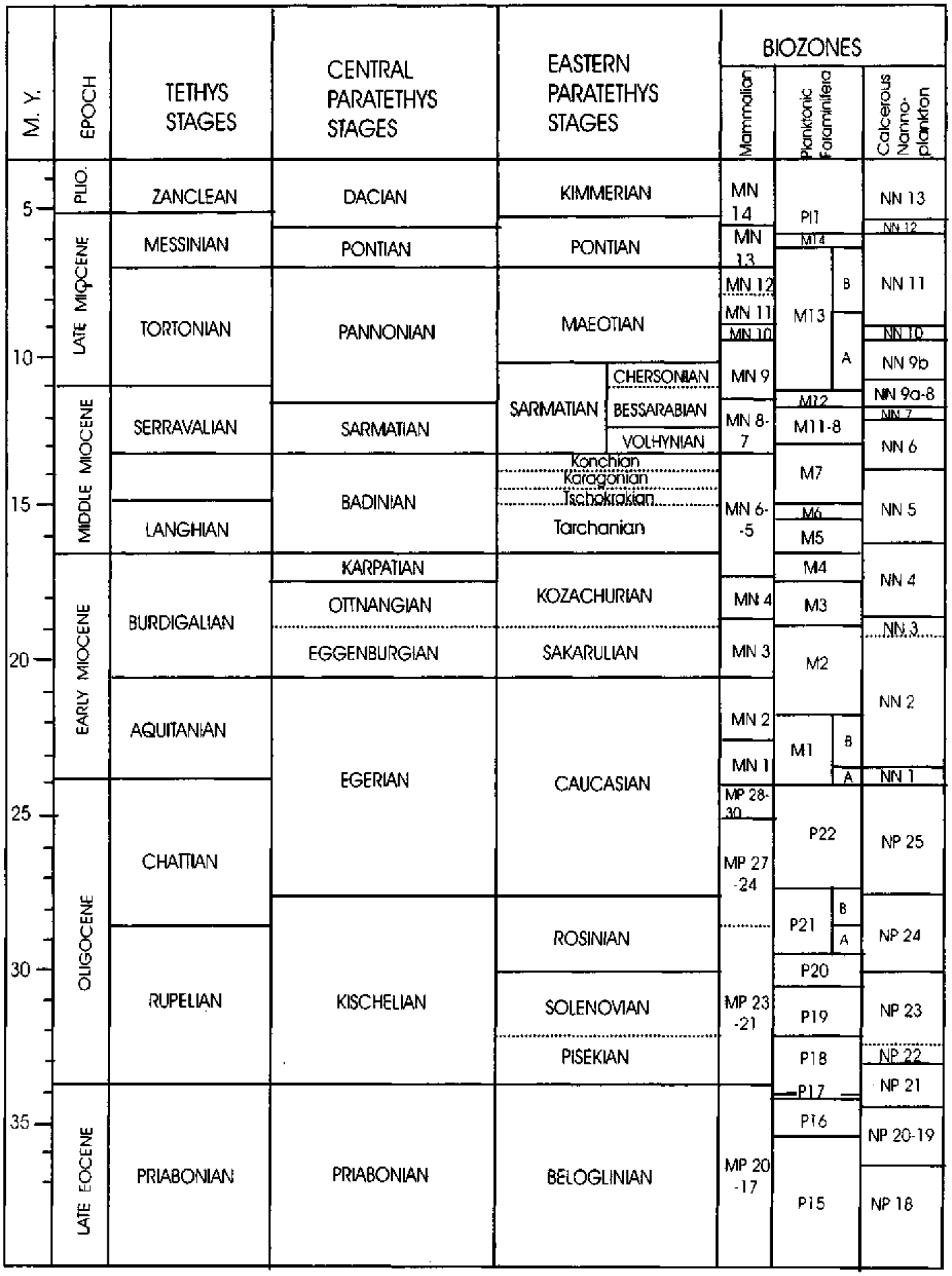

Fig. 3- Correlation of regional stages in Tethys, Central Paratethys and Eastern Paratethys (Rögl, 1998).

Central Europe and Polonia. Of the mollusc fauna, the important species are *Turritella (Haustator) tricincta* (Borson), *Turritella (Archimediella) bicarinata* Eichwald, *Terebralia lignitara* Eichwald, *Xenophora deshayesi* (MichelottL), *Cypraea (Bernaya) fabagina* (Lamarck), *Natica millepunctata* Lamarck, *Galeodes cornutus* (Agassız), *Ancilla (Baryspira) glandiformis* (Lamarck), *Mitra (Mitra) fusiformis* (Brocchi), *Volutilithes (Athleta) ficulina* (Lamarck), *Conus (Chelyconus) puschi* Michelotti, *Anadara (Anadara) fichteli* (Deshayes), *Anadara (Anadara) turonica* (Dujardin), *Amusium cristatum* (Bronn), *Pecten (Flabellipecten) solarium* Lamarck, *Crassostrea gryphoides* (Schlotheim), *Tellina (Peronaea) planata* Linne, *Venus (Ventricoloidea) multilamella* (Lamarck) and *Pelecyora (Cordiopsis) isladicoides* (Lamarck).

Taner (1975, 2001), established the Maeotian - Pontian stages in Denizli region based on the identified mollusc samples which are *Radix (A.) phrygica* Oppenheim, *Pseudocardita phrygica* Oppenheim, *Dreissena phrygica* Oppenheim, *Pseudocardita bukowskii* Oppenheim, *Paradacna denizliuense* Taner, *Prososthenia phrygica phrygica* Oppenheim, *Pyrgula conica conica* Taner and *Theodoxus (C.) karakovensis karakovensis* Taner.

Özsayar (1977) identified the mollusc fauna peculiar to Eastern Paratethys along Black Sea coast and based on this, the used Tarchanian, Tschokrakian, Karagonian and Bessarabian in Sinop area and Pontian stage in Bafra and Trabzon provinces. In addition, the author detected the presence of genus *Velapertina* sp., identified by Prof. Dr. Papp and special to Upper Badenian stage planktonic foraminiferas of Central Paratethys, and he also claimed that this genus was reached Jo the region by marine gateways.

Gökçen (1979) studied the ostracod fauna in the south of Denizli and north of Muğla, and based on this, she defined the Lower Aquitanian - Burdigalian stages between Kale - Yenişehir and Sarmatian, Pannonian and Pontian stages in Göktepe and Yatağan areas. She also pointed out that, the *Neomonceratina helvetica* Oertli and *Cyamocytheridea reversa* (Egger) detected especially around Kale area are together with Burdigalian consistent also with Eggenburgian and Ottnangian.

These data show us that, the Tethys and Paratethys stages have been detected in different parts of Anatolia. The mollusc samples that obtained from study area were correlated by detail examination of stratigraphic levels in Tethys, Central and Eastern Paratethys. As a result of this, it can be thought that, the Antalya and Kasaba basins depicted the evolutionary style similar to that of Tethys, since they are located in Taurids which is situated in the same orogenic belt with Alpine intermontane basins. Consequently, it is concluded that, the similar environmental conditions in the study areas could be developed as that of Central Paratehys. For this reason, it is decided that, the time-equivalent stage names of Tethys and Central Paratethys must be used together whenever the correlation is possible. The difficulties and geographic differences encountered during correlation of stratotypes in Europe have been also referred by Becker-Platen (1970) who studied in West Taurus. For this reason, a need appeared to define the regional stages peculiar to Turkey in the future.

THE MINERALOGICAL COMPOSITION, MAJOR AND TRACE ELEMENT VALUES OF THE MOLLUSC SHELLS

Material and method

In this study, the mineralogical and element compositions of the shells obtained from different locations are defined and it is tried to carry out the environmental interpretations on the shells with less effect of diagenesis. For environmental interpretations, the known paleoecological characteristics of the fauna are considered.

The analyses were carried out on 30 mollusc shells in total. These shells are belonging to species identifed in Kasaba and Antalya basins. The Kasaba basin includes *Turritella (Haustator) tricincta* (Borson), *Turritella terebralis turritissima* Sacco, *Turritella terebralis subagibbosa* Sacco, *Turritella (Turritella) turns* Basterot, *Turritella (Peyrotia) desmarejstina* Basterot, *Turritella (Archimediella) bicarinata* Eichwald, *Ancilla (Baryspira) glandiformis* (Lamarck), *Conus antiquus Lamarck and Conus conoponderosus* (Sacco) of class Gastropoda and *Pecten (Flabellipecten) solarium* Lamarck and *Nemocardium spondyloides* (Hauer) of class Bivalvia. The *Terebralia lignitara* (Eichwald), *Terebralia lignitara lignitara* (Eichwald), *Strombus coronatus* Defrance, *Cehthium appenninicum dertosulcata* Sacco, *Cerithium (Thericium) europaeum graciliornata* (Sacco), *Conus mercati* Brocchi and *Conus conoponderosus* (Sacco) of class Gastropoda and *Crassostrea gryphoides* (Schlotheim) and recent shell from Side beach *Glycymeris (Glcymeris) bimaculatus* (Poli) of class Bivalvia are obtained from Antalya basin.

Prior to applying analyses the shells are cleaned up, later they are grinded in agate mortar and prepared to powder. Each sample is cut into halves, one half for detected of mineralogical composition by X-Ray (X-Ray differaction) and the other for identification of major and trace elements by XRF Analyses and Technology Department of MTA.

The samples for X-Ray differaction analyses were induced between 2.5-60° where scanning speed is 8. The obtained mineral to the lesser one. The calcite coexis tence with aragonite is unclear whether it is Mg-Calcite or not. Hence, the values are considered only as calcite.

The major element analyses by XRF method have been carried out on the samples dried at 105°.

Antalya Miocene basin

By evaluating the mineralogical composition of the shells in the basin, while the Upper Burdigalian (Ottnangian -Karpatian) aged marinal shells in Altınkaya formation are in calcite or calcite-aragonite composition, the Lower Tortonian marine molluscs in Aksu formation are in aragonite composition (Table 5 a-b).

The *Crassostrea gryphoides* (Schlotheim) species of Langihian (Lower Badenian) Altınkaya formation adapted to brackish water environment are calcite in composition with lesser amount of quartz in their body. Due to the effect of burial conditions, the silicification can be developed in genus and species of order Ostreina and it takes place as SiO_2 quartz mineral within body of crust (Ozhigova, 1992).

When the major and trace element values of mollusc shells of Antalya basin are examined; it is shown that the Ca takes the values ranging between %35.02 and %38.95 as being the main component of the all shells in the region.

In Altınkaya formation, the species representing Upper Burdigalian (Ottnangian-Karpatian) yield 222 ppm Na, whereas the Langhian (Lower Badenian) aged *Crassostrea gryphoides* (Schlotheim) type species point a lower value of Na (74-148 ppm).

The Na content of the samples in Lower Tortonian age Aksu formation is at higher values relative to the others and changes between 222 and 296 ppm. By comparing these values with the recent shells, the Na content of *Glycymeris (Glycymeris) bimaculatus* (Poli) taken from Side beach depicts a 445 ppm value of Na (Table 5 a-b and 6 a-b). Consequently, the sea water salinity is proportional to Na content and it is concluded that the Na content of the Miocene sea was lower than that of the recent in the region.

In the case of Mg content of the shells (Table 5 a-b); the *Cerithium (Thericium) europaeum graciliornata* Sacco has Mg value of 362 ppm in Aşağıyaylabel section and between 301 and 603 ppm in Hocalarsırtı section, which both of them are Upper Burdigalian (Ottangian - Karpatian) in age in Altınkaya formation. The *Ostrea lamellosa* Brocchi yields a 241 ppm value of Mg in the Alarahan section of Upper Burdigalian Oymapınar limestone. The Mg values of Langhian (Lower Badenian) aged *Crassostrea gryphoides* (Schlotheim) species are between 301 and 422 ppm in Altınkaya formation. The samples in Lower Tortonian aged Aksu formation indicate the values ranging between 6 and 241 ppm of Mg. A 60 ppm value of Mg has been found in recent *Glycymeris (Glycymeris) bimaculata* (Poli) from Side beach. This last value is much lower than that of Miocene aged mollusc shells. The anomalous increase in Mg content is known to be related to the diagenesis (Kim et al., 1999). Based on this, it can be interpreted that, the samples with high value of Mg are more diagenetic and those with low value mean less diagenetic.

The Al and Si values are randomly distributed in the whole region. For the Sr, the all Langhian (Lower Badenian) aged *Crassostrea gryphoides* (Schlotheim) species from different localities of Altınkaya formation contain lower and constant values which is 84 ppm. The whole formation of this species from calcitic shells reveals that the original shell compositon has not changed (Ozhigova, 1992). The upper Burdigalian (Ottnangian- Karpatian) aged aragonitic gastropod shells, taken from under the *Crassostrea gryphoides* (Schlotheim) level have Sr contents ranging between 253 and 338 ppm in Altınkaya formation. It is known that, the Sr in sea water is proportional to the salinity (Turekian, 1955). Consequently, it can be interpreted that, the sea water salinity during Langhian (Lower Badenian) was much lower in the region.

When the 1000 Mg/Ca and 1000 Sr/Ca ratios of the shells are considered; firstly, the recent *Glycymeris (Glycymeris) bimaculata* (Poli) found in Side beach processed and the 1000 Sr/Ca= 6.60 and 1000 Mg/Ca= 1.60 ratios have been obtained. Later, the other data are correlated with this result.

Table 5 a- The stratigraphical levels and mineralogical compositions of mollusc fauna identified in Antalya Miocene basin**

FAUNA	Formation	MSS locality	Sample No	Stratigraphical level	Mineralogical comp.
Strombus coronatus Defrance	Aksu	Kargı	K17	Tortonian	Aragonite, Calcite
Cerithium appenninicum dertosulcata Sacco	Aksu	Kargı	K16	Tortonian	Aragonite, Calcite
Conus mercati Brocchi	Aksu	Kargı	K17	Tortonian	Aragonite,Calcite, Dolomite
Conus conoponderosus (Sacco)	Aksu	Kargı	K17	Tortonian	Aragonite, Calcite
Crassostrea gryphoides (Schlotheim)	Altınkaya	Altınkaya	S5	Langhian (Lower Badenian)	Calcite, rare Quartz
Crassostrea gryphoides (Schlotheim)	Altınkaya	Aşağıyaylabel	A15	Langhian (Lower Badenian)	Calcite, rare Quartz
Crassostrea gryphoides (Schlotheim)	Altınkaya	Aşağıyaylabel	A15	Langhian (Lower Badenian)	Calcite, rare Quartz
Crassostrea gryphoides (Schlotheim)	Altınkaya	Hocalarsırtı	H2	Langhian (Lower Badenian)	Calcite, Quartz, Illite
Crassostrea gryphoides (Schlotheim)	Altınkaya	Kesme yolu		Langhian (Lower Badenian)	Calcite, Quartz
Crassostrea gryphoides (Schlotheim)	Altınkaya	Kesme yolu		Langhian (Lower Badenian)	Calcite, Quartz
Terebralia lignitara (Eichwald)	Altınkaya	Hocalarsırtı	H1	Upp. Burd. (Ott. Egg.-Karp.)	Calcite, Aragonite
Terebralia lignitara lignitara (Eich.)	Altınkaya	Hocalarsırtı	H1	Upp. Burd. (Ott. Egg.-Karp.)	Calcite, Aragonite
Cerithium (T.) europaeum graciliornata (S.)	Altınkaya	Aşağıyaylabel	A10	Upp. Burd. (Ott. Egg.-Karp.)	Calcite, Aragonite
Ostrea lamellosa Brocchi	Oymapınar	Alarahan	A4	Upp. Burd. (Ott. Egg.-Karp.)	Calcite

** For explanations of formations, MSS localities and sample numbers, See: İslamoğlu 2001 - 2002

Table 5 b- Continue 5 a-

FAUNA	Ca %	Na (ppm)	Mg (ppm)	Al (ppm)	Si (ppm)	Fe (ppm)	Sr (ppm)	1000Sr/Ca	1000Mg/Ca
Strombus coronatus Defrance	38,23	222	60	53	93	69	338	9;07	9,72
Cerithium appenninicum dertosulcata Sacco	38,23	296	180	53	373	139	253	2,19	7,87
Conus mercati Brocchi	37,59	296	180	105	607	139	338	2,28	8,17
Conus conoponderosus (Sacco)	37,73	222	241	105	513	139	338	4,82	17,21
Crassostrea gryphoides (Schlotheim)	38,45	74	301	53	420	69	84	6,9	8,21
Crassostrea gryphoides (Schlotheim)	37,3	74	422	158	513	209	84	2,39	17,18
Crassostrea gryphoides (Schlotheim)	38,23	74	301	105	420	139	84	8,84	1,56
Crassostrea gryphoides (Schlotheim)	35,09	148	603	529	1915	839	84	6,61	4,7
Crassostrea gryphoides (Schlotheim)	37,45	74	422	211	1027	209	84	8,99	4,78
Crassostrea gryphoides (Schlotheim)	36,8	74	301	211	1401	279	84	8,95	6,38
Terebralia lignitara (Eichwald)	35,02	222	603	529	2569	909	169	2,16	6,18
Terebralia lignitara lignitara (Eich.)	36,66	222	301	317	1401	559	253	2,16	7,82
Cerithium (T.) europaeum graciliornata (S.)	37,23	222	362	158	747	419	338	2,25	11,31
Ostrea lamellosa Brocchi	38,95	74	241	53	607	69	84	2,24	11,26

Table 6 a- The stratigraphical levels and mineralogical compositions of mollusc fauna identified in Kasaba Miocene basin.**

FAUNA	Formation	MSS locality	Sample No	Stratigraphical level	Mineralogical comp.
Turritella (A.) bicarinata Eichwald	Kasaba	Ortabağ	Çb2	Langhian (Lower Badenian)	Calcite, Aragonite
Pecten (F.) solarium Lamarck	Kasaba	Ortabağ	Çb2	Langhian (Lower Badenian)	Calcite, Aragonite
Ancilla (B.) glandiformis (Lamarck)	Kasaba	Ortabağ	Çb2	Langhian (Lower Badenian)	Aragonite, Calcite
Turritella (T.) turris Basterot	Kasaba	Ortabağ	Çb2	Langhian (Lower Badenian)	Aragonite, Calcite
Conus antiquus Lamarck	Kasaba	Ortabağ	Çb2	Langhian (Lower Badenian)	Aragonite, Calcite
Nemocardium spondyloides (Hauer)	Kasaba	Ortabağ	Çb2	Langhian (Lower Badenian)	Aragonite, Calcitet
Conus conponderosus (Sacco)	Kasaba	Boyacıpınarı	Fd9	Langhian (Lower Badenian)	Calcite, Aragonite
Turritella (A.) bicarinata Eichwald	Kasaba	Boyacıpınarı	Fd9	Langhian (Lower Badenian)	Calcite, Aragonite
Turritella (H.) tricincta (Borson)	Kasaba	Boyacıpınarı	Fd8	Langhian (Lower Badenian)	Aragonite, Calcite
Ancilla (B.) glandiformis (Lamarck)	Kasaba	Boyacıpınarı	Fd2	Langhian (Lower Badenian)	Aragonite, Calcite
Turritella (T.) turritissima Sacco	Uçarsu	Uçarsupınarı	Uç1	Upp. Burd (Upp Egg.-Karp.)	Aragonite, Calcite
Turritella (T.) turritissima Sacco	Uçarsu	Sıradona	S1	Upp. Burd.(Upp Egg.-Karp.)	Aragonite, Calcite
Ancilla (B.) glandiformis (Lamarck)	Uçarsu	Bozgediktepe	Bgt2	Upp. Burd.(Upp. Egg.-Karp.)	Aragonite, Calcite
Turritella (T.) terebralis subagibbosa Sacco	Uçarsu	Bozgediktepe	Bgt4	Upp. Burd.(Upp. Egg.-Karp.)	Aragonite, Calcite
Turritella (T.) terebralis terebralis Lam.		Akçasupınarı	Ak1		Aragonit, Kalsit
Turritella (P.) desmarestina Basterot	Uçarsu	Akçasupınarı	Ak1	Upp. Burd.(Upp Egg.-Karp.)	Calcite, Aragonite
Glycymeris (G.) bimaculata (Poli)		Side Beach		Recent	Aragonite, rare Calcite

** For explanations of formations, MSS localities and sample numbers, See: İslamoğlu and Taner, 2002.

Table 6 b- Continue 6 a-

FAUNA	Ca %	Na (ppm)	Mg (ppm)	Al (ppm)	Si (ppm)	Fe (ppm)	Sr (ppm)	1000Sr/Ca	1000Mg/Ca
Turritella (A.) bicarinata Eichwald	36,6	148	784	105	1027	349	169	4,6	2,14
Pecten (F.) solarium Lamarck	37,37	296	603	53	654	209	169	4,5	16,1
Ancilla (B.) glandiformis (Lamarck)	37,73	222	241	53	373	139	338	8,95	6,38
Turritella (T.) turris Basterot	36,8	222	723	105	1027	349	253	6,87	19,6
Conus antiquus Lamarck	38,23	222	120	53	93	69	253	6,61	3,13
Nemocardium spondyloides (Hauer)	37,73	222	241	53	420	139	253	6,7	3,38
Conus conponderosus (Sacco)	38,02	222	241	53	233	139	338	8,89	6,33
Turritella (A.) bicarinata Eichwald	37,87	148	482	53	373	209	422	11,14	1,27
Turritella (H.) tricincta (Borson)	37,73	148	362	105	467	209	338	8,95	9,59
Ancilla (B.) glandiformis (Lamarck)	38,59	222	120	53	373	69	338	8,75	3,1
Turritella (T.) turritissima Sacco	37,87	222	301	53	373	69	338	8,92	7,94
Turritella (T.) turritissima Sacco	38,02	148	362	53	607	139	338	8,89	9,52
Ancilla (B.) glandiformis (Lamarck)	37,52	222	422	53	654	209	338	9	11,2
Turritella (T.) terebralis subagibbosa Sacco	37,52	222	241	53	607	139	338	9	6,42
Turritella (P.) desmarestina Basterot	37,16	222	482	158	887	279	253	6,8	12,9
Glycymeris (G.) bimaculata (Poli)	38,23	445	60	53	140	69	253	6,61	1,56

A general evaluation has been carried out on the comparison between mineralogical compositions and element ratios of the shells obtained from Antalya Miocene basin. As the following;

For aragonitic shells:

1000 Sr/Ca =2.16-9.07

1000 Mg/Ca = 7.87-17.21

Mg=60-241ppm

Sr=169-338ppm

For calcitic shells:

1000 Sr/Ca =2.39-8.99

1000 Mg/Ca= 1.56-17.18

Mg=301-603ppm

Sr = 84 ppm values have been determined.

Based on the results obtained from the basin, the all calcitic shells are pelecypods and the shells with aragonite+ calcitic composition are gastropods. Hence, the aragonitic shells have lower Mg content. This conclusion is also consistent with the studies Yalçın and Bozkaya (1995) on recent mollusc shells in Bay of İzmit (SE Marmara sea). The 1000 Sr/Ca ratio is much lower than 1000 Mg/Ca ratio in aragonitic shells. However, in calcitic shells, the 1000 Mg/Ca ratio may be the same . or a little bit more or less than 1000 Sr/Ca ratio. If an evaluation is fullfilled with respect to - the ages and localities of the shells;

For the shells of Upper Burdigalian (Ottnangian- Karpatian) age:

1000 Sr/Ca =2.16-2.25

1000 Mg/Ca = 6.18-11.31

For the shells of Langhian (Lower Badenian) age:

1000 Sr/Ca =2.39- 8.99

1000 Mg/Ca = 1.56- 17.18

For of Lower Tortonian shells:

1000 Sr/Ca =21.9- 9.07

1000 Mg/Ca = 7.87 - 17.21 ratios have been found.

Based on this, the 1000 Sr/Ca ratio was much lower than that of the recent, during Upper Burdigalian (Ottnangian- Karpatian) period. However, the 1000 Mg/Ca ratio is higher than the recent. By comparing the locations, *Cerithium (Thericium) europaeum graciliornata* (Sacco) in point A10 of Aşağıyaylabel section (Altınkaya formation) and *Ostrea lamellosa* Brocchi in point A4 of Alarahan section (Oymapınar limestone) have close values which are 224 and 225 ppm respectively. In Hocalarsırtı section, the two different samples *(Terebralia lignitara* Eichwald *and Terebralia lignitara lignitara* Eichwald) indicate the same 1000 Sr/Ca value (2.16). Although the 1000 Mg/Ca ratios of the same samples are nearly proportional to 1000 Sr/Ca, they are not very reliable.

The 1000 Sr/Ca ratio in Langhian (Lower Badenian) is lower than the recent in same samples and is close on much more in other samples. The all of the 1000 Mg/Ca ratios are much more than recent. A striking result is that, in all localities, the shells of *Crassostrea gryphoides* (Schlotheim) have 8.4 ppm Sr and 74 ppm Na which are very low. The Lower Tortonian 1000 Sr/Ca ratio is much lower than that of recent (2.19-4.82 ppm). The *Crassostrea gryphoides* (Schlotheim) species having only calcitic shell has the same Sr value, in the same age, but in different localities. The previous studies carried out on ostreas indicate that this group yields reliable results in paleoecological interpretations (Ozhigova, 1992). The data obtained from *Crassostrea gryphoides* (Schlotheim) depicts the environment with low salinity and is well consistent with its paleoecological characteristics itself.

Kasaba Miocene basin

By considering the mineralogical composition of the shells; in Ortabağ section of the Kasaba formation, the Langhian (Lower Badenian) aged *Ancilla (Baryspira) glandiformis* (Lamarck), *Conus antiquus* Lamarck, *Turritella (Turritella) turn's* Basterot and *Nemocardium spondyloides* (Hauer) are aragonite- calcite in composition, whereas in the same level, the *Turritella (Archimediella) bicarinata* Eichwald and *Pecten (Flabellipecten) solarium* Lamarck are calcite- aragonite in composition. Similarly, in Boyacıpınar, the Langhian (Lower Badenian) aged *Turritella (Haustator) tricincta* (Borson) is in the composition of aragonite - calcite, while the *Turritella (Archimediella) bicarinata* Eichwald and *Conus conoponderosus* (Sacco) are in calcite-aragonite composition (Table 6 a-b).

The all Upper Burdigalian (Upper Eggenburgian - Karpatian) aged shells in Uçarsu formation are composed of two minerals aragonite calcite or calcite aragonite. The, changements in aragonite - calcite ratios of the shells reflect the diagenetic effects after deposition (Kim et al., 1999). It can also be thought that, in Kasaba basin, the shells partly undergone diagenetic effects.

The major and trace element ratios of the shells are evaluated as; the Ca ratio changes between % 36.6 and % 38.59. The Na ratio withi no difference in Kasaba and Uçarsu formations is between 148-222 ppm values. The Mg ratios in the samples of the Kasaba basin are a little bit high relative to those of recent and in the values of 241-482 ppm in Upper Burdigalian (Upper Eggenburgian - Karpatian).

The Langhian (Lower Badenian) aged shells, although they are in the same locations, they indicate different compositions. For example, in the Çb2 sample point of Ortabağ section, as the *Turritella (Turritella) turris* Basterot is 723 ppm and *Turritella (Archimediella) bicarinata* Eichwald is 784 ppm in Mg values, the *Conus antiquus* Lamarck has 200 ppm and-the *Ancilla (Baryspira) glandiformis* (Lamarck) has 241 ppm values. The similar values are also present in Boyacıpınar section of the same period. The *Ancilla (Baryspira) glandiformis* (Lamarck) and *Turritella (Archimediella) bicarinata* Eichwald yield the 120 and 482 ppm values respectively. By comparison of the mineralogical compositions of the shells, it is seen that, the *Ancilla (Baryspira) glandiformis* (Lamarck) with low Mg ratio content has higher aragonite ratio (Table 6 a-b). This also confirms that, the Mg content in aragonitic shells is low as mentioned before.

There has been no consistency among the Si, Al and Fe ratios, mineralogical compositions and localities of the shells, similar to those in Antalya Miocene basin. However, the Al content of the all shells is nearly equal to the recent, while the Si and Fe contents are a little bit high in values.

When a comparison is full filled between the mineralogical composition and element ratios of the shells obtained from Kasaba Miocene basin;

For the shells with aragonite+ calcite composition:

1000 Sr/Ca =6.7-9.0

1000 Mg/Ca = 3.1 -11.2

Mg=120-723 ppm

Sr=253-338 ppm

For the shells having calcite+aragonite composition:

1000 Sr/Ca =4.5-11.1

1000 Mg/Ca = 2.1 -12.9

Mg=241-784ppm

Sr = 169 - 422 ppm values have been determined.

Based on this, in the shells of aragonite+calcite composition, the 1000 Mg/Ca ratio is lower than the 1000 Sr/Ca ratio. The same occurence is also valid for the shells having calcite+aragonite composition. Except this, there has not been any clear difference among the all ratios.

The shell of the recent pelecypod taken from Side beach (Antalya), indicates 6.61 value for 1000 Sr/Ca ratio and 1.56 for 1000 Mg/Ca ratio. The 1000 Mg/Ca ratio of this aragonitic shells is lower than 1000 Sr/Ca ratio. This conclusion also implies that, the aragonitic shells have low Mg content (Yalçın and Bozkaya, 1995). If the geochemical values of aragonitic pelecypoql in Side beach and the" shells with the same composition in İzmit Bay (SE Marmara sea) are compared, it is found that, the 1000 Sr/Ca ratio in sample of Side is 6.6 and that in İzmit. Bay is 3.60-5.72. The 1000 Mg/Ca ratios are 1.6 and 0.86-1.69 for Side and İzmit Bay respectively (Yalçın and Bozkaya, 1995; Yalçın and Taner, 1998). Since it is known that, the Mediterranean has a high salinity relative to the Marmara sea, it can be concluded that, the 1000 Sr/Ca ratios is propositional to the salinity.

Evaluating the shell localities and ages;

For the Upper Burdigalian (Upper Eggenburgian -Karpatian) aged shells:

1000 Sr/Ca =6.8- 9

1000 Mg/Ca = 6.4-12.9

For Langhian (Lower Badenian) aged shells:

1000 Sr/Ca = 4.5-11.1

1000 Mg/Ca = 2.1-19.6 values have been found. Based on this, the 1000 Sr/Ca ratio in Upper Burdigalian (Upper Eggenburgian -Karpatian) and Langhian (Lower Badenian) periods is nearly equal or a little bit high (Table 6 a-b).

CONCLUSIONS

Paleogeographic results

1. The paleogeographic distribution of mollusc fauna puts in evidence that, the Lower- Middle Miocene age formations in Antalya and Kasaba basins have correlative characteristics both with Tethys and Central Paratethys stages. Hence, the time equivalent stage names of these two provinces are used together.
2. Although some of the samples from studied regions are widely distributed in Eastern Paratethys, it is not advisable to use the time equivalent stages of this region.

3. In both regions, for the Lower- Middle Miocene, the *Hydrobia (Hydrobia) frauenfeldi* (Homes), *Pirenella gamlitzensis gamlitzensis* (Hilber), *Irus (Paphirus) gregarius* Partsch and *Glossus (Cytherocardia)* cf. *deshayesi* (Kutassy) type species peculiar to the only Central Paratethys were identified.

4. The Antalya and Kasaba Miocene basins are in the same character of the intermontane molasse basins in the Alps and located in the same orogenic belt. Consequently, the similar events during Tethyan evolution must have been occured in the study areas. The faunal development also reveals the environmental conditions similar to Paratethys, besides the Tethys. For this reason, it is normal that, the special bioprovinces similar to Central Paratethys could be developed in Turkey. In this study, although the stage names for the basins are used together, it is a need in the future to define the regional stages.

Paleoecological results

1. The Mg contents of aragonitic shells yield lower values relative to those of calcitic ones.

2. As a result of geochemical analyses of shells, it is concluded that, the Na and Sr trace element concentrations and 1000 Sr/Ca ratios are proportional to the salinity either increase or decrease.

3. Based on the biochemical values obtained from mollusc fauna, during Upper Burdigalian (Ottnangian- Karpatian) the Sr/Ca ratio in Antalya Miocene basin (2.16-2.25) is lower than that (6.8-9.0) of Kasaba Miocene basin. Since the Sr in sea water is proportional to the salinity either increase or decrease (Turekian, 1955), it is concluded that, Antalya Miocene basin in this period has a marine realm with lower salinity with respect to that of Kasaba Miocene basin. The widely distributed brackish water - marine samples in Antalya Miocene basin also confirm this result.

4. The 1000 Sr/Ca ratios increased a little big (2.39-8.99) in Antalya Miocene basin during Langhian (Lower Badenian). However, it is the same in Kasaba Miocene basin (4.5-11.1). Consequently, although the salinity increased a bit, it is lower than Kasaba Miocene basin.

5. During Lower Tortonian, the 1000 Sr/Ca values in Antalya basin ranged between 2.19-9.07. In Kasaba basin, there is no only marine deposit in this period. Hence, any comparison can not be carried out.

6. The Sr trace element concentration of *Crassostrea gryphoides* (Schlotheim) which is widely distributed in Antalya Miocene basin is very low. Its originally crust composition (calcite) has not been also changed. The shells of this species in different localities indicate the same values.

Table captions: E: Early, O: Middle, G: Late, Ol: Oligocene, A: Aquitanian, B: Burdigalian, L: Langhian, S: Serravalian, T: Tortonian, Mes: Messinian, Pl: Pliocene, P: Pleistocene, Gun: Recent, Eg: Egerian, Egb: Eggenburgian, Ott: Ottnangian, K: Karpatian, Bd: Badenian, Sr: Sarmatian, Kr: Karagonian, Sak: Sakarulian, Tr: Tarchanian, Çk: Tschokrakian, Kon: Konkian.

ACKNOWLEDGEMENTS

This study is a part of "PhD Thesis" fullfilled in Geological Engineering of Naturel and Applied Science Institute in Ankara University. The authors acknowledged to the General Directorate of MTA for field and laboratory facilities, to TUBITAK authorities to supporting an abroad scholarship Nato A2 provided for 1th author.

Manuscript received March 12, 2002

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Mineral Res. Expl. Bull., 126. 43-48, 2003

A DEBATE PELAGIC PALEOCENE SEQUENCE IN BIGA PENINSULA: BALLIKAYA (BALIKKAYA) FORMATION

Eşref ATABEY* and Kemal ERDOĞAN*

ABSTRACT.- An olistostromal unit, composed of andesite, basalt, sandstone and conglomerate, and limestone blocks within red-wine colored mudstone matrix is cropped out in surrounding areas of Balıkkaya hill, Havdan and Sansuvat villages 500 to the west of Biga township (Çanakkale). The existence and age of this unit is under discussion as it is accepted in Thanetian-Danian (Paleocene) age based on foraminiferas found in mudstone and named as Ballıkaya formation. In this area, the limestone blocks are in Malm-Early Cretaceous age and the matrix to these blocks, however is rarely exposed and contains red, bordeaux, thin-bedded limestone which is Late Maastrichtian in age based on foraminferas identified as *Globotruncanella havanensis* (Voorwijk), *Globotruncanella citae* (Bolli), *Abathomphalussp.*

INTRODUCTION

The investigation area is restricted to the north by Biga centrum and Akpınar village, to the south by Havdan, Sarısuvat and Ovacık villages and to the east by Biga-Çan highway (Fig. 1). Yıkılmaz et al., (2002) and Okay et al., (2002) in their studies around Biga refer to the presence of Paleocene aged pelagic unit since the Cretaceous aged rock units were not preserved and eroded in this region. At the 500 m west of Ballıkkaya hill (named as Ballıkkaya by Yıkılmaz et al., 2002) the Ballıkaya formation has been defined at this locality where the representative outcrops are present and is composed of pelagic limestone, calciturbidite, debris flow, graywacke, basalt and limestone blocks of various size.

According to these authors, it is pointed out that, the type section locality is at the Bal lıkaya hill, its age is Danian-Thanetian (Paleocene) based on the pelagic foraminiferas identified in pelagic limestones of the unit, the unit, the thickness in more than 100 m and it is cropped out in an area of 2 km^2 Also, during Paleocene in this region there was a tectonically active and deep marine environment which is thought to be related to the intra-Pontide ocean. Based upon this, it is claimed that, the close of the intra-Pontide ocean was took place during Late Paleocene-Early Eocene.

The rock units in this area were previously defined as Late Triassic Karakaya complex, Liassic Bayırköy formation, Middle-Late Jurassic Bilecik limestone and Cretaceous Vezirhan formation by Bingöl et al., (1975), Okay (1988), Altıner et al., (1991) and Okay et al., (1990). Siyako et al., (1989) suggested Jurassic Bayırköy formation for limestone exposures to the west of Biga, Jurassic-Early Cretaceous aged Bilecik formation for the unit around Balıkkaya hill and defined limestone blocky unit to the south of the Havdan village, as Asmalı formation in the (pal Unit belonging to the Triassic Karakaya complex. Okay et al., (1990), however, described the Aptian-Maastrichtian aged unit as Vezirhan formation cropped out at the south of Biga.

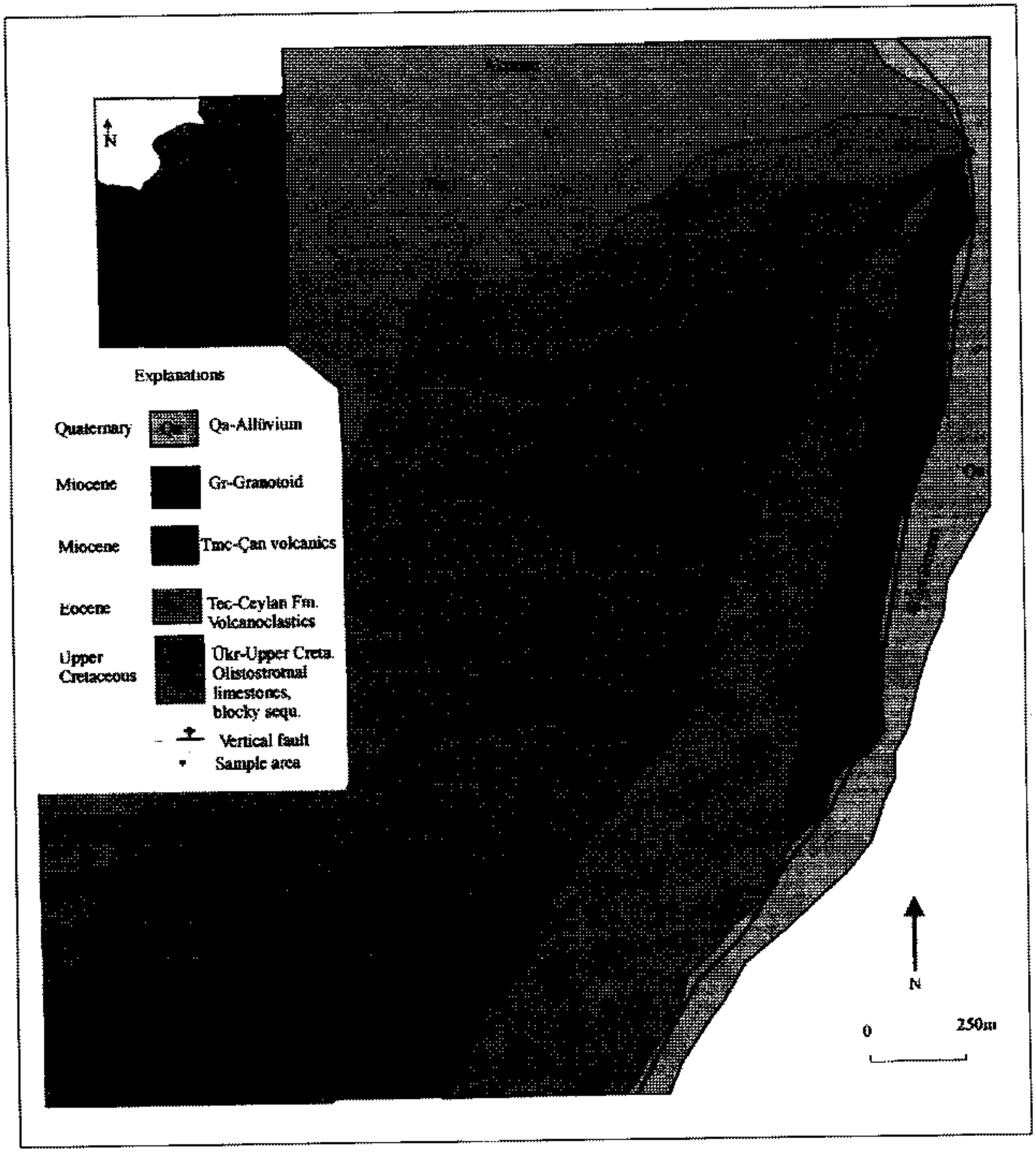

Fig. 1- Geological map of the study area.

The aim of this study is to discuss the existence of a pelagic Paleocene sequence exposed in the west of Biga from the point of view of the type locality and type section, boundary relations, sequential characteristics, age and distribution based on lithostratigraphic rock unit definitions.

GENERAL GEOLOGICAL SETTING OF BALLIKAYA FORMATION

The rock unit consisting of Jurassic-Early Cretaceous limestone blocks overlies the Karakaya Complex in the west corridor of the Sakarya zone at south-soutwest of Biga. At the south of Biga among Sarıkaya, Eybekli and Ovacık villages and to the west of Biga around Akpınar village, this blocky unit (Ballıkaya fm. ?) is unconformably overlain by the Eocene aged volcanoclastic rocks of Ceylan formation including sandstone, calcarenite, shale, tuff and andesite. There are also acidic tuff at surrounding of Sarıkaya village and granitoid mass cutting across Ceylan formation in the vicinty of Ovacık village (Fig. 1)

LITHOSTRATIGRAPHY

Yıkılmaz et al., (2002) named the rock unit as Ballıkaya formation which includes pelagic limestone, calciturbidite, debris flow, graywacke, basalt and neritic limestone blocks of various sizes at Balıkkaya hill 500 m to the west of Biga township, where the representative outcrops are located. The type locality of this unit at Ballıkaya hill is not so clear as suggested (Plate-I, fig. 1). The lower boundary relationship can not also be obseryed. The unit is unconformably overlain by Eocene Ceylan formation. Although Yıkılmaz et al.; (2002) described a 2 km^2 area of exposure and having more than 100 m thickness, no outcrop in this thickness and width could be observed. Along northeast-southwest trending ridge at southern slope of the Balıkkaya hill, there are gray-white colored and fractured recrystallized limestone blocks ranging between 10-25 m in various size (Fig. 1, Plate-I, figs. 2, 3, 4a and 5d). The thin-medium bedded calcarenite is sometimes present at the base of limestone blocks (Plate-I, fig. 4b). The limestone blocks are cropped out at Kokarca hill, north of Sarısuvat village (Plate-I, fig. 3) and in very limited area at 1 km southwest of Havdan village (Plate-I, fig. 4). The red, vine colored, thin bedded pelagic limestone is exposed along a roadcut in length of 25 m and height of 2 m at 350 m northeast of this village (Plate-I, fig. 5a). At the exposure of Havdan village, an olistostromal level containing 20-50 cm diameter blocks of limestone, andesite, basalt and sandstone is in tectonic contact with the pelagic limestone (Plate-I, fig. 5). Furthermore, at Balıkkaya hill (name as in the map), 1 km north of Havdan village and at hill 250 m to the north of Sarısuvat village, the breccia/conglomerate rocks are present which are composed of rounded, subangular, chert and limestone pebbles 15-30 cm in diameter (Plate-I, figs. 6 and 7). The pebbles cemented with red and vine colored carbonate cement. There are spilitic basalt and andesite containing limestones blocks at the hill south of the Havdan village.

AGE EVIDENCES

The limestone blocks cropped out along ridge trending at west-soutwest slope of Balıkkaya hill to the west of Biga, around Sarısuvat village and Kokarca hill and also at 1 km north of Havdan village yield Malm-Early Cretaceous age. The limestone pebbles in olistostromal level and the conglomerate/breccia pebbles exposed at 1 km north of Sarısuvat village and at Balıkkaya hill also give the age of Malm-Early Cretaceous (Plate-I, figs, 1, 2, 3, 4, 5, 6, 7). The conglomerate/breccia pebbles collected from Balıkkaya hill include *Palaeomiliolina strumosum* (Gümbel), *Globuligerina* gr. *oksfordiana* (Grigelis), *Patellina* sp., *Ammobaculites* sp. yielding Callovian-Oxfordian age (Plate-II, figs. 1-4, 5-7, 8, 9). The limestone block at Kokarca hill to the north of Sarısuvat village and south of Havdan village gives Kimmeridgian age based on the identified *Protopeneroplis striata* Weynschenk, *"Conicospirillina" basiliensis* Mohler, and *Pseudocyclammina lituus* Yokoyama (Plate-II, figs. 10-11, 13, 15), *Tubiphytes morronensis* Cressenti, *Koskinobullina socialis* Cherchi and Schroeder, *Cladorcoropsis mirabilis* Felix and *Trocholina* sp. The fossils identified in limestone blocks at northeast of Havdan and Asar hill north of Sarısuvat village are *Neotrocholina valdensis* Reichel, *Protopeneroplis trocchoangulata* Septfontaine and *Trocholina odukpaniensis* Dessauvagie implying Berriasian age (Plate-II, figs. 14, 16, 17 and 20). The Late Tithonian-Berriasian age based on the *Cladocoropsis mirabilis* (Plate-II, fig. 18), *Tubiphytes morronensis* Cressenti, *Neotrocholina valdensis* Reichel, *Calpionella alpina* Lorenz, *Tintinopsella* sp. and *Neotrocholina* sp. which has been obtained from limestone block cropped out at north of Sarısuvat village. Another limestone block at eastern slope of Balıkkaya hill, includes *Globuligerina hoterivica* (Subotina), *Meandrospira favrei* (Charrolis, Bronnimann ve Zaninetti), *Spirillina* sp., which give Hauterivian age and this block bears characteristic of Epistominid foraminifer a biofacies (Plate-II, figs. 19, 21, 22).

The limestone blocks at the northeastern of Havdan contain *Globigerinelloides ferreolensis* (Moullade) (Plate-III, figs. 1-3), *Hedbergella delrionsis* (Carsey), *Hedbergella planispira* (Tappan) and *Hedbergella trocoidea* (Gandolfi) which imply Late Aptian age.

The red-vine colored pelagic limestones as the matrix of the limestone blocks include foraminiferas yielding Maastrichtian, especially Late Maastrichtian. The samples collected from red colored pelagic limestones at the northeast of Havdan, at Kokarca hill to the north of Sarısuvat village and southwest of Havdan give Maastrichtian age based on *Globotruncana gr. Linneiana* (d'Orbigny), *Globotruncanita stuartiformis* (Dalbienz), (Plate-III, figs. 4, 5, 7, 9) and Late Maastrichtian with respect to identified *Globotruncanella citae* (Bolli), *Globotruncanella havanensis* (Voorwijk), *Abathomphalussp. Rugoglobigerina rugosa* (Plummer) and Heterohelicidae foraminiferas in characteristic of pelagic biofacies (Plate-III, figs. 6, 8, 10-12, 13, 14, 15, 16).

DISCUSSION AND CONCLUSION

A regular pelagic sequence is not cropped out in the study area including also surrounding of Ballıkaya hill, Havdan and Sarısuvat villages. For this reason, the type locality is also not clear where the better sequential characteristics can be observed. The limestone blocky unit between Biga township and Havdan village was defined as Liassic aged Bayırköy formation by Okay (1988) and Siyako et al., (1989), while the unit at south of Havdan village was considered to be in Triassic aged Karakaya Complex containing Permian limestone blocks. However, these two units have been interpreted as a pelagic sequence in Danian-Thanetian age (Paleocene) based on the three micritic limestone samples collected from Balıkkaya hill including *Morozovella pseudobulloides* (Plummer), *M. uncinata* (Bolli), *M.* cf. *trinidadensis* (Bolli), *Planorotalites compressa* (Plummer) *Globigerina triloculinoides* Plummer and *Morozovella velascoensis* (Bolli) and named as Ballıkaya formation having more than 100 m thickness by Yıkılmaz et al., (2002) and Okay et al., (2002).

Throughout this study, the rock units in the mentioned area have been differentiated, detailed sampling carried out and the characteristics of the unit have been interpreted. The name of the hill is not Ballıkaya as it is published, however, it is Balıkkaya hill as at the 1/25 000 scale quadrangle. Around this hill, the conglomerate/breccia and limestone blocks are scarcely exposed (Plate-I, figs. 1 and 2). A complex rock assamblage composed of limestone block in olistostromal andesite, basalt, sandstone, lime and mudstone is cropped out between Biga township and Sarısuvat village and it is not mappable at 1/25 000 scale. The limestone blocks in the study area are in Malm-Early Cretaceous age depending on the paleontologic analyses. Consequently, a pelagic rock unit with clear sequential characteristics and type section, a thickness of more than 100 m and having 2 km^2 area is under discussion. But in this area, the red, vine colored and thin-bedded pelagic limestone which is not mappable at 1/25 000 scale is present at the base of limestone blocks. As mentioned before, these pelagic limestones are of Late Maastrichtian based on the containing foraminiferas.

As a result, based upon the paleontologic determinations no Palaeocene fauna has been detected, instead the age of the red pelagic limestones are Late Maastrichtian. In this area, the presence of a pelagic Palaeocene sequence suitable for lithostratigraphic code of nomenclature defined and named as Ballıkaya formation by Yıkılmaz et al., (2002) and Okay et al., (2002) is under debate. For this reason, the existence of a deep marine environment during Palaeocene at south of Biga and the closure of related intra-Pontide ocean during. Late Palaeocene-Early Eocene are under discussion.

Consequently, the usage of Ballıkaya formation (named Balıkkaya in the map) as suggested in Turkish Stratigraphy Commission on Marmara Workshop will cause the problems during stratigraphic nomenclature for Marmara region.

ACKNOWLEDGEMENTS

This article includes part of the work in MTA-İTÜ joint project of Economy and Environmental geology of Biga peninsula and Tertiary project study. The authors are greatly indebted to General Directorate of Mineral Research and Exploration, MTA for supporting the study opportunities and Dean of Mining Faculty of ITU and project coordinators and their assistants for their helps Alper Sakitaş for taking part in field work. Also acknowledgements are expressed to Dr. Ercüment Sirel for his paleontologic critism, E. Nevzat Erkan for nannoplankton determination and Aynur Hakyemez for the identification of planktonic foraminiferas.

Manuscript received January, 3, 2003

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PLATES

PLATE-I

Fig. 1- Jurassic limestone block series
(Balıkkaya H. Coord.: x: 52750, y: 19500).

Fig. 2- Jurassic limestone block (Balıkkaya H. Eastern slope,
Coord.: x: 52550, y: 20000).

Fig. Jurassic limestone blocky (northeast of Sarısuvat village,
Kokarca Hill, Coord.: x: 48375, y: 15750).

Fig 4a- Jurassic limestone blocky, b- Thin-medium bedded calcarenite
(southwest Havdan Coord.: x: 50375, y: 17800).

Fig. 5a- Red-vine colored, thin bedded pelagic limestone,
b- Andesite, c- Olistostromal complex with Jurassic limestone pebble,
d- Jurassic limestona block (I km northeast of Havdan village,
Coord.: x: 50375, y.:17800).

Fig. 6- Breccia/conglomerate (Balıkkaya H. Coord.: x: 52685, y: 19525).

Fig. 7- Breccia/conglomerate (northeast of Sarısuvat, Coord.: x: 48600, y: 15050).

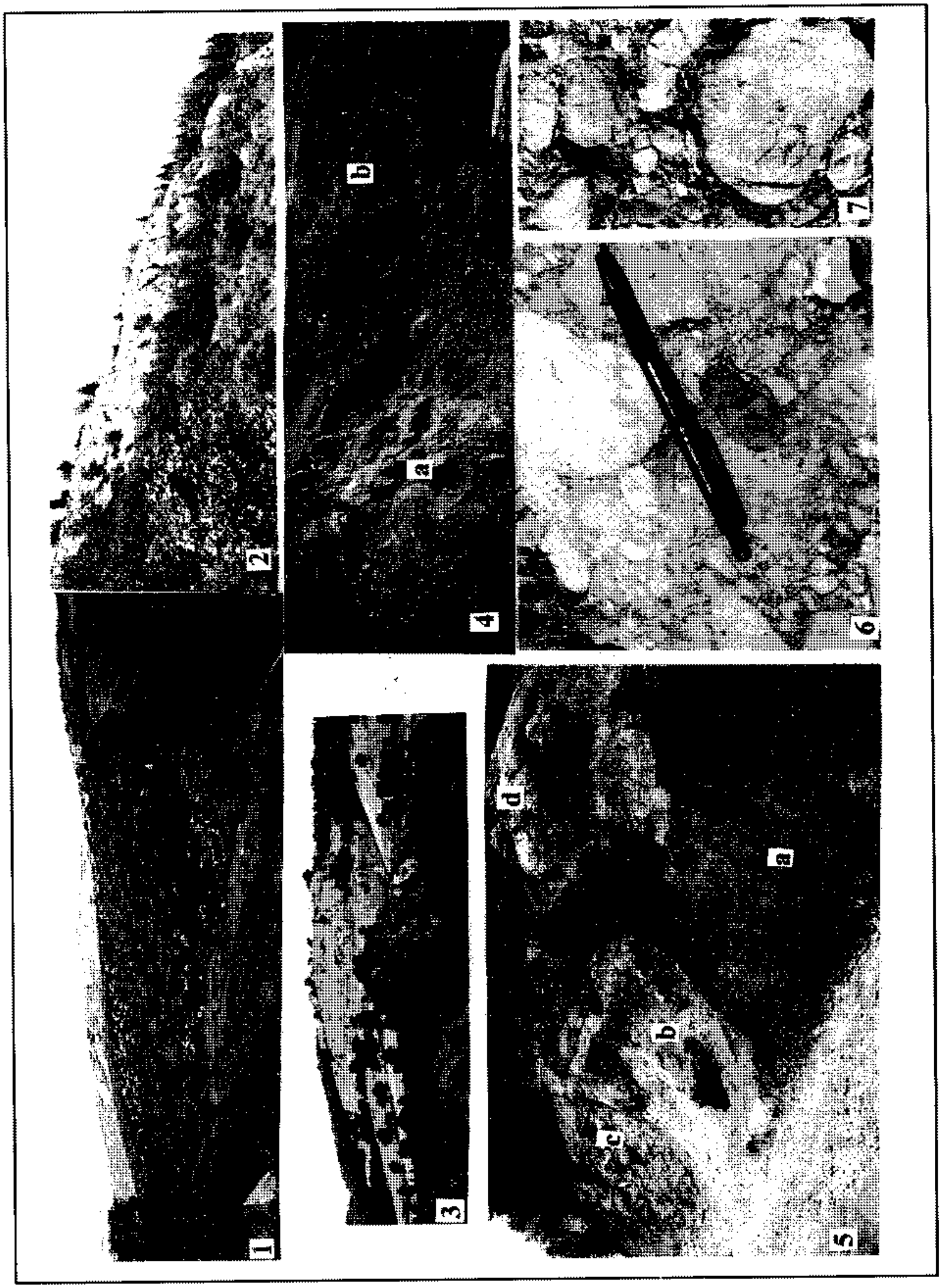

PLATE-II

Fig. 1-4- *Palaeomiliolina strumosum* (Gümbel), Callovian-Oxfordian, subaxial section.
Sample no: 1 and 2: 23, 100X (Coord: x: 52250, y: 19450), 3 and 4 : 174, 100X
(Balıkkaya H., Coord.: x: 52750, y: 19500).

Fig. 5-7- *Globuligerina* gr. *oxfordiana* (Grigelis), Callovian-Oxfordian, horizontal section.
Sample no: 175, 100X (Balıkkaya H., Coord.: x: 52750, y: 19500).

Fig. 8- *Patellina* sp., Sample no: 174, 100X, Callovian-Oxfordian, vertical section.
(Balıkkaya H., Coord.: x: 52750, y: 19500).

Fig. 9- *Ammobaculitessp.,* Sample no: 174, 40X Callovian-Oxfordian, vertical section.
(Balıkkaya H., Coord.: x: 52750, y: 19500).

Fig. 10-11-Proropeneroplis *striata* Weynschenk, Sample no: 25, 40X, Kimmeridgian, subaxial section. (South of Havdan, Coord.: x: 49500, y: 16500).

Fig. 12- *"Conicospirillina" basiliensis* Mohler, Berriasian, subaxial section.
Sample no: 30B, 40X, (North of Sarısuvat, Coord.: x: 48650, y: 15100).

Fig. 13- *"Conicospirillina" basiliensis* Mohler, Berriasian, subaxial section.
Sample no: 31 A, 40X, (North of Sarısuvat Kokarca H., Coord.: x: 48650, y: 15750).

Fig. 14 and 17-*Neotrocholina valdensis* Reichel, Sample no: 34, 40x, Berriasian, vertical section.
(northeast of Sarısuvat, Asar H. Coord, x: 48550, y: 16500).

Fig. 15- *Pseudocyclammina lituus* Yokoyama, Kimmeridgian, tangential section through two chambers. Sample no: 25, 40X, (Northeast of Havdan, Coord.: x: 49500, y: 16500).

Fig. 16- *Protopeneroplis trochoangulata* Septfontaine, Berriasian, subaxial section.
Sample no: 30B, 40X, (North of Sarısuvat, Coord.: x: 48650, y: 15100).

Fig. 18- *Cladocoropsis mirabilis* Felix, Upper Tithonian-Berriasian, Sample no: 30A,
(North of Sarısuvat, Coord.: x: 48650, y: 15100).

Fig. 19- *Globuligerina hoterivica* (Subotina), Hauterivian, Sample no: 45, 100X,
(West of Biga, Coord., x: 52625, y: 20250).

Fig. 20- *Trocholina odukpaniensis* Dessauvagie, Berriasian, horizontal section.
Sample no: 39, 40X, (Northeast of Havdan, Coord., x: 52500, y: 17850).

Fig. 21- *Meandrospira favrei* (Charrolais, Bronnimann ve Zaninetti), Hauterivian.
subequatorial section. Sample no: 45, 40X, (West of Blga, Coord., x: 52625, y: 20250).

Fig. 22- *Spirillina* sp., Epistominid foraminifera biofacies, Hauterivian, axial section.
Sample no: 45, 40X, (West of Blga, Coord. x.52625, y: 20250).

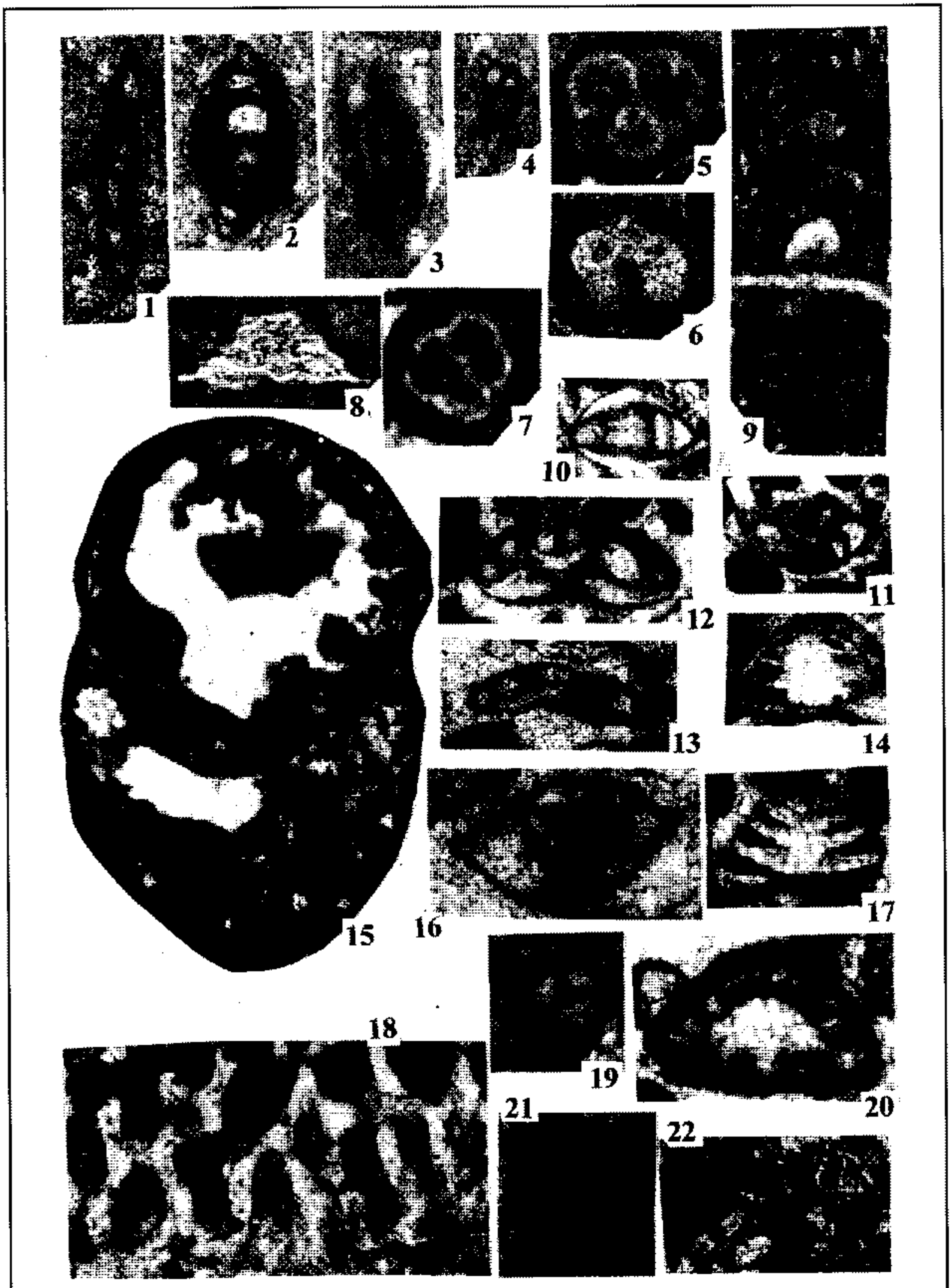
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PLATE-III

Fig. 1-3- Globigerinelloides ferreolensis (Moullade), Late Aptian, 1-2 axial section, 3; equatorial section. Sample no: 179, 100X, (Northeast of Havdan, Coord., x: 50375, y: 17750).

Fig. 4- *Globotruncana* gr. *linneiana* (d'Orbigny), Maastrichtian, vertical section. Sample no: 32A, 100X, (North of Sarısuvat Kokarca H., Coord., x: 48650, y: 15750).

Fig. 5- *Globotruncana area* (Cushman), Maastrichtian, vertical section. Sample no: 32A, 100X, (North of Sarısuvat Kokarca H., Coord., x: 48650, y: 15750).

Fig. 6- *Globotruncanella citae* (Bolli), Late Maastrichtian, vertical section. Sample no: 32D, 100X, (North of Sarısuvat Kokarca H., Coord., x: 48650, y: 15750).

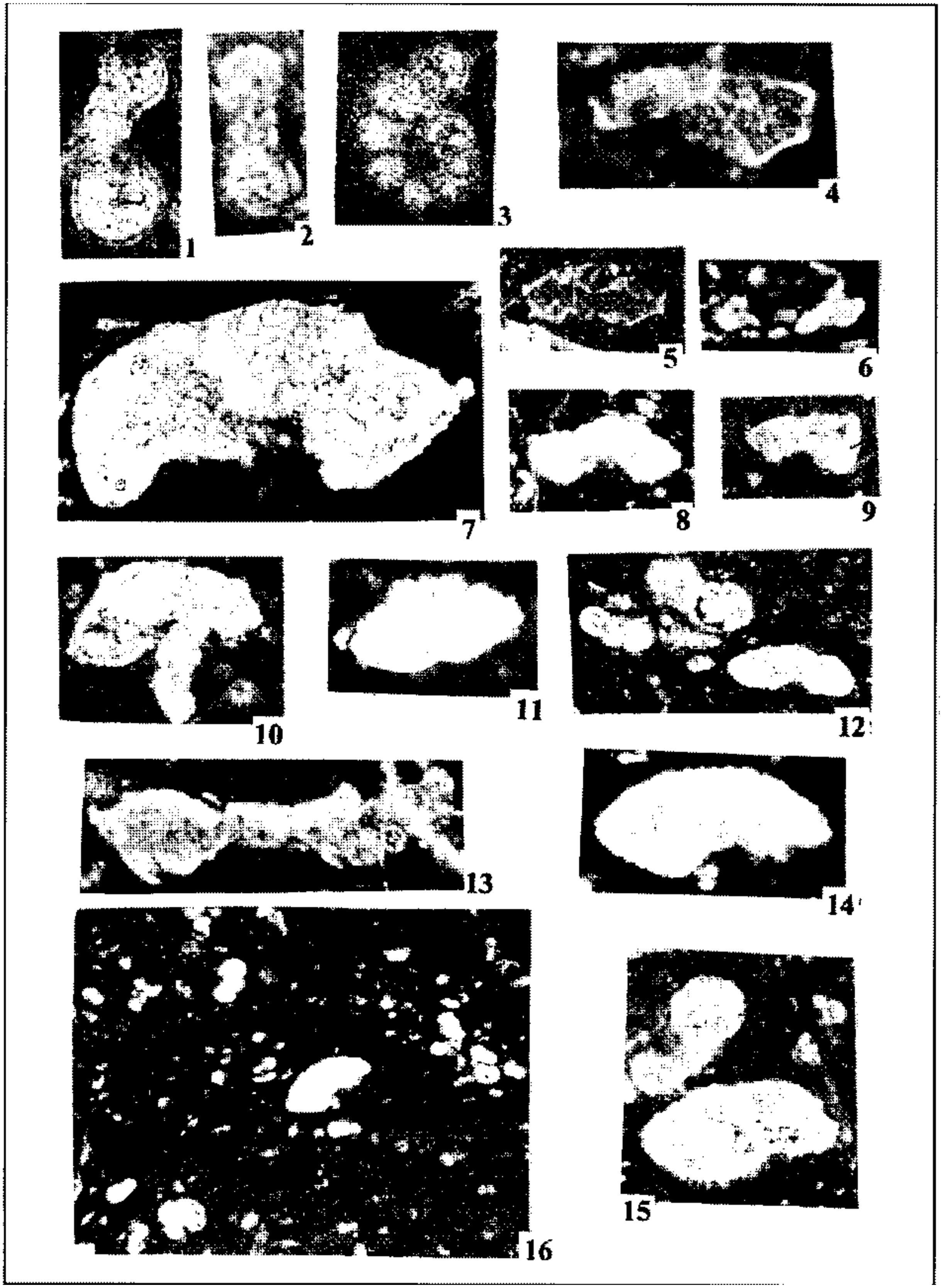
Fig. 7 and 9- *Globotruncanita stuartiformis* (Dalbiez), Maastrichtian, vertical section. Sample no: 7, 32D, 100X, Sample no: 9, 32D, 40X, (North of Sarısuvat Kokarca H., Coord., x: 48650, y: 15750).

Fig. 10-12 *Globotruncanella havanensis* (Voorwijk), Late Maastrichtian, vertical section. Sample no: 10, 11, 28A, 100X, (Southwest of Havdan, Coord., x: 49375, y: 16375). 12: 32C, 40X, (North of Sarısuvat Kokarca H., Coord., x: 48650, y: 15750).

Fig. 13- *Abathomphalus* sp. Late Maastrichtian, deformed vertical section. Sample no: 32C, 100X, (North of Sarısuvat Kokarca H., Coord., x: 48650, y: 15750).

Fig. 14 and 15- *Globotruncanella havanensis* (Voorwijk), Late Maastrichtian, vertical section. Sample no: 14: 32D, 100X, 15: 32C, 100X, (North of Sarısuvat Kokarca H., Coord., x: 48650, y: 15750).

Fig. 16- Pelagic biyofacies Late Maastrichtian, Sample no: 32D, 40X, (North of Sarısuvat Kokarca H., Coord., x: 48650, y: 15750).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TERTIARY GEOLOGY OF GÖKÇEADA AND BOZCAADA (ÇANAKKALE), TURKEY

Yaşar KESGİN* and Baki VAROL**

ABSTRACT.- Karaağaç formation which is made up of mainly sandstone lithology and presented by the regresive features toward up in the Gökçeada and Fıçıtepe formation which consist of red continental conglomerates are Early Eocene in age. Middle Eocene carbonates of the Soğucak formation including numerous Nummulites overlie Early Eocene units unconformably. Soğucak formation is presented as lens with no lateral continuation in the field. Sedimentation continued with the shale deposition of the Ceylan formation and left its place to the shore face facies of the Mezardere and Osmancık formations with the beginning of the regression in the Early Oligocene. Continental Danişmen formation overlies all these units. Volcanic activity (Hisarlıdağ-Ayvacık volcanics) continued intensly during Early-Middle Eocene in the region. Depositional systems which were formed under tectonic control in the Late Miocene continued to be develop until the beginning of the Early Pliocene. This is turn provided Gazhanedere, Kirazli and Alçıtepe formations to be deposited. Approximately 1000 m Thick Pliocene sediments (Ergene formation) were determinal in the offshore sedimentary basins by the seismic and drilling data, however they do not encountered in the field exposures. Facies were seperated according to their depositional difference. There are four main depositional periods in the islands. These are Early Eocene, Middle Eocene-Late Oligocene, Late Miocene-Pliocene and Pliocene-Present depositional periods. The most important tectonic feature in the islands is the Ganos fault which is a western extention of the Late Miocene NAF. This fault borders the northern part of the Gökçeada island. Lateral components of the Ganos fault in the southern parts provided sedimentary basins to be developed in the Late Miocene-Pliocene. There is no tectonic data from the Early Miocene time in the islands. However, tectonic features can be seen in the seismic sections from the offshore areas.

PALEOGRAPHIC EVOLUTION OF THE WEST MARGIN OF THE ÇANKIRI-ÇORUM BASIN IN EARLY-MIDDLE MIOCENE

Levent KARADENİZLİ*** Gürol SEYİTOĞLU****, Gerçek SARAÇ*****, Nizamettin KAZANCI******, Şevket ŞEN*******, Yavuz HAKYEMEZ*** and Didem SAVAŞÇI****

ABSTRACT.- Çankrı-Çorum basin is one of the many basins developed during Tertiary time in central Anatolia and had important sedimentary accumulation from Paleocene to Pliocene. In this study, tectono-sedimentary development of western part of the basin during the Early - Middle Miocene has been examined. In this time interval, under the extensional tectonic regime Kumartaş formation accumulated and its upper part lateraly-vertically passed into Hançili formation. The age of these formations is based on the mammalian fossils (MN 3-4-5) and facies analysis has been made by measuring logs from appropriate sequences. As a result of the facies analysis, following facies have been determined: Non-organized massive conglomerate, graded-matrix supported conglomerate, bedded-grain supported conglomerate, massive sandstone, trough-planar cross-bedded sandstone, ripple laminated sandstone, sorting-bedded sandstone, massive gravelly mudstone, organic matter rich claystone, massive marl, green-yellow colored laminated claystone, bedded fossilliferous limestone, oolitic limestones, lignites and tuffite. The facies interfinger with each other and from certain associations. The facies associations show that three different sedimentary environments were formed in Early-Middle Miocene time. These are; alluvial fan and rivers (braided with sediment - gravity flow deposits, meandering river and flood plain environments, lacustrine shoreline (fan-delta, near shore sand bars, carbonate bank) and lacustrine offshore (deep and shallow lake) environments. Normal faults representing extensional tectonic regime in the region have controlled the basin margins and the vertical movements of paleohighs in the basin and cause the fluctuations of lake level. When the lake level failed, intense erosion in the adjacent uplifted land areas occurred causing to the deposition of the alluvial fan ad fan-delta sediments which supplied abundant elastics to the lake basin. However, when the lake level rised, the sand bars were formed by reworking of the previously transported elastics into the lake basin. During the periods with no clastic influx the carbonate banks developed. In some period it is clear that rising water level completely covers the paleohighs. The basin was fragmented by normal and a tectonic slice of thrust faults at its western and eastern margins respectively and the deposited Miocene sediments were deformed during Late Pliocene.

MTA Dergisi 126. 87-88, 2003

"ATTEPE DEMİR YATAĞINDA JEOTERMOMETRİK ÖLÇÜM ÇALIŞMALARI" MAKALESİ ÜZERİNE ELEŞTİRİ

Taner ÜNLÜ*

Çolakoğlu ve Sezerer-Kuru'nun (2002) "Attepe Demir Yatağında Jeotermometrik Ölçüm Çalışmaları" isimli makalelerinde "Alt Kambriyen yaşlı bitümlü şeyl-fillit ve metakuvarsitler içerisinde pirit ve hematit oluşuklarının (1. tip), sedimanter tipte çökeldikleri ilk kez Küpeli (1986) tarafından tanımlanmıştır. Alt-Orta Kambriyen yaşlı metakarbonatlar içerisinde hidrotermal süreçler sonucunda II. tip cevherleşmeler Ünlü ve Stendal (1986) dışındaki tüm araştırmacılar tarafından kabul edilmiştir. Ünlü ve Stendal (1986) jeokimyasal verilere göre sedimanter oluşum modelini savunmuşlardır. Küpeli, (1999)" denilmektedir.

Oysa Ünlü ve Stendal (1986, 1989) makalelerinde Attepe Demir yatağının tabanında yer alan bitümlü şistler içerisinde gözlenen ve yan kayacıyla uyumlu konumda olan bir siderit merceğinden (75 x 200 cm) alınan cevher örneklerinde yapılan jeokimyasal verileri sunmuşlardır.

Ayrıca Ünlü ve diğerleri (1984) Adana-Feke-Mansurlu çevresinde yaptıkları kısa süreli saha çalışmalarına yönelik raporlarının gözlemler bölümünün 1. maddesinde: "Bölgedeki demir yataklarının tümü hematit, limonit, götit gibi düşük ısı mineral parajenezinden oluşan yataklanmalardır. Bu yatakların büyük çoğunluğunun sideritten dönüştüğü gözlenmiştir. Buna bölgedeki en iyi örnek, Attepe demir yatağındaki piritli-bitümlü şist seviyeleri - içerisinde korunmuş olarak kalan siderit mercek reliktidir" denilmektedir. Aynı raporun gözlemler bölümünün 3. maddesinde: "Yatakların, yataklanma şekilleri incelendiğinde; alttan üstte doğru bir istiflenme yapılarına sahip oldukları gözlenmiştir. Özellikle Attepe yatağında alttan üstte doğru; çamurtaşı-kiltaşı istifi, üzerine yaklaşık 15-20 metre kalınlığında siyah renkli, bitümlü, yaygın özbiçimli dissemine pirit içeren (H_2S zonuna işaret eden) bir seviye gelmektedir. Yukarıda sözü edilen siderit mercek relikti de bu seviye içinde saptanmıştır. Hematit ve limonitten oluşan gevşek dokulu demir yığışımı piritli zonun üzerine uyumlu olarak gelmektedir. Demir yığışımlarının üst bölümlerinde değişim ürünü olan götit seviyeleri yer almaktadır. Bu dizinimin üzeri yaşı belirlenemeyen kireçtaşlarıyla örtülmüştür. Kireçtaşları genel görünümü ile demir yatağını korur konumdadır. Söz konusu kireçtaşlarının yatakların oluşumu ile eş zamanlı olmayıp tektonik olarak yerleştiği düşünülmektedir." denilmektedir. Aynı raporun gözlemler bölümünün 4. maddesinde ise: "Bu gözlemler, yöredeki demir oluşumlarının, hidrotermal-metasomatik bir yataklanmadan çok, sedimanter bir oluşum intihasını vermektedir. Ayrıca cevherin ana ve iz element kimyasındaki aykırılıklar da bu kanıyı doğrulamaktadır. Attepe ve çevresindeki yatakların demir cevherlerinde yapılan kimyasal analizlerde (Henden ve diğerleri, 1978) görülen Si, Ca ve Cr değerleri metasomatik bir yataktan çok, sedimanter bir oluşuma işaret etmektedir." denilmektedir.

Ünlü'nün (1989) makalesinde Saimbeyli-Feke havzası yatakları anlatılırken "Birincil cevher Alt Kambriyen yaştaki bitümlü şistler içerisinde sedimanter özelliktedir. Örneğin, Attepe yatağında cevherin altında bitümlü şistler yer almaktadır. Ancak, bu konudaki veriler henüz çok yerel olup, bu görüşün havza boyutunda yorum yapılabilecek olgunluğa ulaşması için zaman ve yeni çalışmaların yapılmasına gerek vardır. Cevherlerin bugünkü konumu tektonik kontrollüdür. Kısmen sedimanter özellikte, kısmen de tektonik hatlara bağlı olan büyük siderit, ankerit kütleleri şeklinde görülen cevher, daha sonra karstlaşma ve yüzeysel ayrışmalar sonucunda ileri derecede limonitleşmiş ve yatak bugünkü konum ve görünümünü almıştır. Genelde siderit ve ankerit zuhurları bitümlü şist ve kireçtaşları içerisinde yataklanmıştır. Buna karşılık götit cevheri ise bitümlü şistler ve metakumtaşları içerisinde bulunmaktadır. Götit cevheri ile birlikte değişik oranlarda kil mineralleri de izlenmektedir. Götit büyük olasılıkla sideritin değişmesi sonucu oluşmuştur" denilmektedir.

Sonuçta, Ünlü ve diğerleri, (1984), Ünlü (1989), Ünlü ve Stendal'in (1986, 1989), makalelerinde, Attepe demir yatağındaki mobilizasyonlarla ilişkili, yan kayacı veya yapıyı kateden hidrotermal geç evre siderit damar(cık) sistemleri için sedimanter oluşum modeli Çolakoğlu ve Sezerer Kuru'nun (2002) iddia ettiği şekilde hiçbir biçimde savunulmamıştır. Aksine, çalışmalarında yukarıda da değinildiği gibi bitümlü şistler içerisinde gözlenen ve yan kayacı ile uyumlu konumda olan siderit mercek reliktinden de esinlenilerek birincil cevher oluşumlarının sedimanter olabileceği görüşü gündeme taşınmıştır.

Yayına verildiği tarih, 24 Ocak 2003

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MTA Dergisi 126, 89-91, 2003

"ATTEPE DEMİR YATAĞINDA JEOTERMOMETRİK ÖLÇÜM ÇALIŞMALARI" MAKALESİNİN ELEŞTİRİSİNE CEVAP

Ali Rıza ÇOLAKOĞLU*

Attepe Demir Yatağında Jeotermometrik Ölçüm Çalışmaları adlı makalede yer alan "Alt Orta Kambriyen yaşlı metakarbonatlar içerisinde hidrotermal süreçler sonucunda II. tip cevherleşmeler Ünlü ve Stendal (1986) dışında tüm araştırmacılar tartından kabul edilmiştir. Ünlü ve Stendal (1986) jeokimyasal verilere göre sedimanter oluşum modelini savunmuşlardır (Küpeli, 1999)" ifadesine Taner Ünlü tarafından yapılan eleştiriye karşı cevap aşağıdaki şekildedir.

Bu konuyla ilgili olarak ilk bakışta bile hemen görülebilen bir sorun dikkati çekmektedir. Bu da bölgedeki önceki araştırıcıların yapmış oldukları çalışmalarda temel çalışmaların eksikliğinden kaynaklanan genelleştirilmiş istifte yer alan litolojik birim ve formasyonların farklı tanımlanmalarından ve verilen farklı yaş konaklarından ileri gelmektedir. Hala bölgede istif ile ilgili bir takım sorunlar vardır. Ünlü ve Stendal (1986), 9 farklı (adet) demir yatağı ile ilgili yapmış olduğu çalışmasında cevherlerin yataklanma tiplerini saha gözlemlerine göre 2 grup altında toplamıştır. Birinci grup cevherin serpantinlerle, kireçtaşlarıyla ve granitoyitlerle tektonik dokanaklı konumlarıyla karakteristik olduğunu (Divriği A-B kafa, Akdağ, Karahalka, Bizmuşen, Kurudere, Akuşağı, Sultanmurat), ikinci grup için ise "(Konglomeratik) sedimanter yataklanma özelliği taşır (Otlukilise, Akdağ, Attepe)" demektedir. Makalede Attepe yatağı için yataklanma tipi olarak Paleozoyik kayaçlar içinde yerleşmiş (konglomeratik değil) sedimanter yataklanma özelliği taşıdığını belirtmekte ve makalede Divriği A ve B kafa hariç 8 farklı yataktan cevher dışında sadece yankayaç olarak Attepe'den örnekleme yapıldığını ve alınan yankayaç numunesinin "hemen cevherin altında yer alan bitümlü seviyeyi karakterize eder" şeklinde ifade yer almaktadır. Jeokimyasal verilere göre yapılan yorumda da "yüksek Ba içeriği sedimanter ortamlar için çok normaldir" denmektedir. Bu çalışmada Attepe ile ilgili başka veri ve yorum yapılmamıştır. Ayrıca belirtildiği gibi bitümlü şistler içerisinde gözlenen bir siderit merceğinden/reliktinden ve/veya birincil cevher oluşumlarını ifade edecek şekilde hiçbir veri ve ifade yer almamaktadır. Makalede ayrıca (sayfa 7, 2. sütun 1. paragraf) ayrım yapılmaksızın "9 adet demir yatağı için ayrıntılı incelemelere konu olmuş, saha gözlemlerine dayanan yorumlar doğrultusunda tüm bölgeyi temsil edebilecek yatakların seçilmesine çalışılmış, örnek alımı işlemlerinde de yatağı tanımlayabilecek örneklemeye büyük bir titizlik gösterilmiştir" ifadesi yer almaktadır. Attepe' den alınan 5 adet cevher örneğinin XRD yardımı ile tesbit edilen mineral birlikteliklerinde de; 3 örnekte götit, 2 örnekte siderit ve 1 örnekte ise manyetitin varlığı saptanmıştır.

Buna göre Ünlü ve Stendal, (1986) makalesinde: 1- Attepe'den alınan örneğin sedimanter olmadığını ve / veya bu örneğin sadece birincil cevheri karakterize eden ve bundan türeyen damar tipli hidrotermal veya karstik oluşumlardan hiç bahsedilmemekte aksine yatağın sedimanter kökeni vurgulanmaya çalışılmaktadır. 2- Yankayaç sadece bitümlü seviye olarak isimlendirilmiş ve hemen cevherin altında olduğu vurgulanmıştır. 3- Ünlü ve Stendal (1986, 1989); Ayhan ve diğerleri, (1992), Küpeli'nin (1999) referanslarında daha önce sedimanter görüşü vurgulamadığını belirttiği Ünlü ve diğerleri (1984) ve Ünlü (1989) raporlarının referansları bulunmamaktadır. Dolayısıyla bu referanslara ulaşılamamıştır. 4- Ünlü ve diğerleri, (1984) tarafından kısa süreli saha çalışmalarından yayımlanan 3 sayfalık rapora ulaşılmış olsa bile bu makalede bazı çelişkiler görülmekte ve yatağın sedimanter olarak oluştuğu izlenimi açıkça vurgulanmaktadır (Bknz. Eleştiri 3. Paragraf). 3. Madde ve 4. Maddede de bu ifadeler yatağın sedimanter olduğunu anlatmaktadır. Aksi bir görüş ileri sürülmemektedir. Özellikle 4. Maddede bu durum aşağıda olduğu gibi açık olarak belirtilmektedir "yöredeki demir oluşumlarının, hidrotermal-metasomatik bir yataklanmadan çok, sedimanter bir oluşum intihasını vermektedir. Ayrıca cevherin ana ve iz element kimyasındaki ayrılıklarda bu kanıyı doğrulamaktadır. Attepe ve çevresindeki yatakların demir cevherlerinde yapılan kimyasal analizlerde (Henden ve diğerleri, 1978) görülen Si, Ca, ve Cr değerleri metasomatik bir yataktan çok, sedimanter bir oluşuma işaret etmektedir" (Ünlü ve diğerleri, 1984). 5- Bu çalışma ve gözlemler oldukça kısa sürelidir ve bir bilimsel çalışmanın sonuçlarını yansıtmamaktadır.

Ayrıca (Çolakoğlu ve Sezerer, 2002) "Ünlü ve Stendal (1986) jeokimyasal verilere göre II. Tip cevherleşmeler için sedimanter oluşum modelini savunmuşlardır (Küpeli, 1999)" ifadesinde Küpeli (1999) referansı verilmiş olmasına rağmen orjinal makale (Ünlü ve Stendal, 1986) okunmuş ve durum tarafımızdan da aynı şekilde yorumlanmıştır. Söz konusu eleştiride bu makale ile ilgili olmalıdır.

Ünlü ve Stendal'da (1989) yatağın jenezine yönelik birincil cevherin sedimanter özellikte, Alt Kambriyen yaşındaki bitümlü şistler içinde olduğunu ve cevherin bugünkü konumunun tektonik hatlara bağlı büyük siderit ve ankerit kütleleri şeklinde cevherin görüldüğünü ve daha sonradan karstlaşma ve yüzeysel ayrışmlar sonucunda ileri derecede limonitleşmeye uğradığını ve yatağın bugünkü konumunu ve görünümünü aldığını belirtmektedir. Ancak burada da sideritler için hidrotermal bir oluşumdan bahsedilmemekte ve / veya cevherin geometrisi ile ilgili damar tipi veya düzensiz kütleler gibi bir açıklama yer almadığından önceki görüşler de (Ünlü ve diğerleri, 1984; Ünlü ve Stendal, 1986) gözönünde tutularak okuyucuyu yoruma zorlamaktadır.

Sonuç olarak örnekleri alan kişilerin ve yapılan gözlem ve tanımlamaların farklılıklarından kaynaklanan hatalarla bir takım ifade eksiklikleri veya yanlış yorumlamaların yapılmış olması muhtemeldir. Çolakoğlu ve Sezerer, (2002) tarafından yazılan makale, araziden alınan örneklerin Küpeli, (1986, 1991, 1999) tarafından belirtilen ve bu çalışmada da kabul edilen II. Tip cevherleşmelere ait olduğu düşünülen örneklerden, jeneze yönelik bir katkı sağlaması amacıyla yapılmış bir çalışmadır. Ayrıca yayımlamış olduğumuz makalenin yaratmış olduğu bu tartışma sayesinde, bu zamana kadar bitümlü seviyeyi karakterize eden birim içinde sedimanter kökenli siderit merceğinden Ünlü ve diğerleri, (1984), dışında kimsenin bahsetmemiş olmasının farkına varılmıştır. Bu da bölgede özellikle bu ilginç gözlem dikkate alınarak, temel istifle ilgili yeni çalışmaların yapılması gerektiğini ortaya koymaktadır.

Yayına verildiği tarih, 24 Ocak 2003

DEĞİNİLEN BELGELER

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MTA DERGiSiNDE YAYINLANMAK ÜZERE YAZI GÖNDERECEK YAZARLARA NOTLAR

Yazıların, MTA Dergisinde yayımlanabilmesi için nitelik, kapsam ve biçim açısından Maden Tetkik ve Arama Dergisi yayım kurallarına uyması gereklidir. Yayım Kuralları kitapçığı Maden Tetkik ve Arama Genel Müdürlüğünden doğrudan ya da yazışma yoluyla elde edilebilir.

Aşağıda, yazı gönderecek yazarların sık sık baş vurma gereksinimi duyabilecekleri ve daha çok yazıların düzeni ve yazı taslağının hazırlanması ile ilgili kurallardan bazıları öz olarak belirtilmiştir.

YAYIM DİLİ - Derginin her sayısı biri Türkçe, diğeri ingilizce dilinde basılır.

Türkçe baskıda yer alan yazılar için Türkçe ve ingilizce başlık ve öz verilmelidir.

Redaksiyon Kurulu tarafından yabancı dil baskısında yayımlanması uygun görülen yazılar tüm ek ve resimlemeleri ile birlikte Ingilizceye çevrilir. Ana dili Türkçe olup, yalnızca yabancı bir dilde yazı göndermiş olan yazarlardan yazılarını Türkçeye de çevirmeleri kendilerinden istenir.

YAZININ ANA BÖLÜMLERi - Bir yazı sırasıyla Başlık, Yazar Adı ve Adresi, Öz, Giriş, Örü, Sonuçlar, Tartışma (gerektiğinde), Katkılar (gerektiğinde), Değinilen Belgeler ve Ek Açıklamalar (gerektiğinde) bölümlerini kapsamalıdır.

Öz, yazının diğer bölümlerine baş vurmadan anlaşılabilecek ve tek başına bir öz dergisinde yayımlanabilecek düzende olmalıdır. Yazının amacını, bilinenlere katkısını, konu ile ilgili olarak sağlanan yeni verileri ve yorumları yansıtmalıdır. Özde yazının diğer bölüm ve resimlemelerine ya da başka belgelere değinme yapılmamalı, dipnot kullanılmamalıdır. Öz yazısı yaklaşık 200 sözcüğü aşmamalıdır.

Katkılar bölümünde, çalışmanın gerçekleştirilmesinde önemli yeri olan ve yapana az ya da çok sorumluluk yükleyen katkılar belirtilmeli, olağan görev gereği yapılmış olup, yapana sorumluluk yüklemeyen katkılar belirtilmemelidir.

Değinilen belgeler bölümünde, yalnızca yazıda değinilmiş olan belgelere eksiksiz olarak yer verilmelidir. Aşağıdaki örneklerde değinilen belgeler ile ilgili bilgiler değişik belge türlerine göre düzenlenmiştir. Yazarlardan belgelerle ilgili bilgileri, noktalama işaretlerini de gözeterek, bu örneklere göre düzenlemeleri istenir.

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Değinmelerle aşağıdaki örneklerden birine uyulmalıdır. "Altınlı'ya (1972) göre........" "...............(Sirel ve Gündüz, 1976)"; değinme yapılan belge ikiden çok yazarlı ise ilk yazar soyadından sonra "ve diğerleri" sözcüğü kullanılır, örneğin "Ünalan ve diğerleri (1976) Kartal Formasyonunu tanımlamıştır.": bir başka yayın içinde yer alan belgeye değinmek için, önce ilksel belge, sonra da değinmenin yer aldığı belge belirtilir. Örneğin "Lebling'in Çakraz dolayında Liyastan söz ettiği bilinmektedir (Lebling, 1932: Charles. 1933 ten)"; "sözlü ya da yazılı görüşmelere değinmede (O. Eroskay, 1978, sözlü görüşme): N. Toksöz'e göre (1976, yazılı görüşme)........" şekillerinden biri kullanılır.

YAZILARIN OYLUMU - Dergide yayımlanması isteği ile gönderilen yazılar, tüm resimlemeleri ile birlikte 30 yazı makinesi sayfasını geçmemelidir (sayfaların boyutları ve kullanılışı "Yazı Taslağı" bölümünde belirtilen kurallara uygun olmalıdır).

Yazıda kullanılacak resimlemelerin boyutlarının seçiminde ve yazı içine yerleştirilmesinde Dergi sayfasının kullanılabilir alanının boyutları ve Derginin yazı düzeni göz önünde tutularak yer kaybını olabildiğince önleyecek tutum içinde bulunulmalıdır.

Dergide katlamalı sayfalara yer verilmeyeceğinden resimlemeler baskıya girecek sayfa boyutlarını (16x21 cm) aşmamalı ya da küçültülmeye elverişli boyutlarda düzenlenmiş olmalıdır.

YAZI TASLAĞININ (MANUSCRIPT) HAZIRLANMASI - Dergide yayımlanması isteği ile gönderilen yazılar tüm resimlemeleri ile birlikte "Yazı Taslağı (Manuscript)" adıyla anılmaktadır.

Yazılar A 4 (29.7x21 cm) boyutlarından büyük olmayan yazı kâğıtlarının bir yüzüne yazı makinesi ile çift aralıklı satır kullanılarak yazılmalıdır, yazı kâğıdının çevresinde 2.5 cm genişliğinde boşluk bırakılmalıdır.

Yazıda koyu harflerle basımı istenen sözcüklerin altı çift çizgi ile, italik harflerle basımı gereken sözcüklerin altı tek çizgi ile çizilmelidir.

Özel harfler ve simgelerin kullanılmasını gerektiren formüller klişe yapılabilmesi için saydam bir kâğıda çini mürekkebi ile yazılmalıdır.

Resimlemelerin yazı içinde yerleştirilmeleri uygun görülen yerler, yazarı tarafından sayfa kenarı boşluklarından yararlanılarak kurşun kalemle belirtilmelidir.

Dipnot zorunlu görüldüğü durumlarda kullanılmalı, 10 satırı geçmemeli ve yazıda birden çok dipnot kullanılıyorsa sıra güderek numaralanmalıdır.

RESİMLEMELER - Yazıda yer alacak çizim, çizelge, fotoğraf ve levha gibi tüm resimlemelerin seçiminde nitelik, gereklilik ve elverişlilikleri üzerinde titizlikle durulmalıdır. Kullanılan resimleme sayısı metnin hacmiyle orantılı olmalıdır.

Çizimler siyah-beyaz veya renkli basılacak şekilde düzenlenmeli, düzgün, temiz ve ustaca çizilmeli, küçültüldüğünde yitebilecek çok ince ve silik çizgiler kullanmaktan kaçınılmalıdır. Çizimlerde kullanılan simge ya da harf boyları, küçültülme yapıldığında 2 mm den küçük olmayacak büyüklükte olmalıdır. Çizim içinde kullanılan standartlaşmamış harf ve simgeler, çizim içinde ya da açıklama yazısında açıklanmalıdır. Çizimlerde çizgisel ölçek kullanılmalıdır.

Fotoğraflar parlak kâğıda ve kontrastlı basılmış olmalıdır.

Resimlemeler "şekiller", "çizelgeler", ve "levhalar" olarak sınıflandırılmalı; fotoğraflardan tek başına olanlar şekil sınıfına sokulmalıdır.

Şekiller, çizelgeler ve levhalar kendi aralarında ve birbirlerinden bağımsız olarak numaralanmalı, numaralama yazı içinde değinme sırasına göre yapılmalıdır. Şekil ve çizelgeler lâtin rakamları, levhalar romen rakamlarıyla numaralanmalıdır.

Resimlemelerin numaraları ve yazının yazarının adı resimlemelerin arkasına kurşun kalemle yazılmalıdır.

Resimleme açıklamaları resimlemelerin üzerine yazılmamalı; şekil ve çizelgeler için ayrı ayrı açıklama listeleri düzenlenmelidir. Levha açıklamaları ise her levha için ayrı birer kâğıda yapılmalıdır.

Bültenin Türkçe sayısında yayımlanacak yazıların çizimlerinde kullanılan çizim içi yazı ve açıklamalar yalnızca Türkçe olarak verilebilir.

Türkçe ve yabancı dilde yayımlanacak yazıların çizimlerinde kullanılan simge, harf vb. için yapılan çizim içi yazı ve açıklamalar biri Türkçe diğeri ingilizce dilinde düzenlenmiş iki takım olarak verilmelidir.

YAZI GÖNDERME - Yazılar, tüm resimlemeler ve resimlerin açıklamaları biri ilk. diğer ikisi kopya olmak üzere üç takım gönderilmelidir. Fotokopi yöntemiyle çoğaltılmış şekil ve çizelgeler ilk kopya olarak kabul edilmemektedir.

Resimlemelerin kopyaları ozalit, fotokopi ya da benzeri bir yolla elde edilmiş olabilir.

Yayımlanmayan yazıların ikinci takımı yazarlarına geri verilmez.

Levha halinde basımı öngörülen fotoğrafların bir takımı beyaz karton üzerine basımı istenen düzende yerleştirilmeli, ikinci takımı ise yerleştirilmeden gönderilmelidir. Kartonun kullanılan boyutları Dergi sayfasının kullanılabilir boyutlarına eşit, ya da bu boyutlara getirilebilir oranda olmalıdır. Levhaya yerleştirilen her fotoğrafın altına levha içindeki şekil numaraları yazılmalıdır.

Dergi yayım kurallarına biçim ve düzenleme açısından uygun hazırlanmamış "yazı taslağı" eksikliklerin tamamlanması ya da düzeltilmesi isteği i!e yazarına geri gönderilir. Önerilen tamamlama ve düzeltmeler yapılıp, yayım kurallarına uygun hale getirilen yazı, Redaksiyon Kurulu tarafından nitelik bakımından incelenir.

ELEŞTiRi - Derginin yayımlanmış en son sayısında yer alan bir yazının tümünü ya da bir bölümünü eleştiren yazılar, yayımlanması isteği ile derginin dağıtıldığı tarihten sonra en geç iki ay içinde gönderildiğinde, izleyen ilk sayıda yayımlanır. Eleştiri yazıları yayımlanmadan önce eleştirilen yazının yazarına yanıtlanması için gönderilir. (Birden çok yazarlı yazılarla ilgili eleştiriler ilk yazarına gönderilir.) Eleştirinin öngörülen süre içinde yanıtlanması durumunda eleştiri ve yanıt yazıları birlikte yayımlanır. Yanıtlamanın gecikmesi ya da yapılmaması durumunda eleştiri yazısı tek başına yayımlanır; yanıt daha sonra gönderilse bile yayımlanmaz. Yanıtların yeniden eleştirilmesine olanak tanınmaz.

Eleştirme ve yanıtlamada bilimsel tartışma kurallarına uyulmalı, kişisel suçlamalardan kaçınılmalıdır. Eleştiri ve yanıt yazılarının her biri varsa resimlemeleri ile birlikte dört yazı makinesi sayfasını aşmamalıdır (sayfaların boyutları ve kullanılışı "Yazı Taslağı" bölümünde belirtilen kurallara uygun olmalıdır).

KISA NOTLAR BÖLÜMÜ - Maden Tetkik ve Arama Dergisinin "Kısa Notlar" bölümünde yer bilimleri alanında yapılmış ya da sürdürülmekte olan bilimsel araştırma ve uygulamalardan elde edilen veri ve bulguları yansıtan bilimsel haber niteliğinde kısa, somut ve öz yazılara yer verilir. "Kısa Notlar", bölümünde yayımlanabilecek nitelikte düzenlenmiş yazılar iletişimde çabukluk sağlanması amaciyle Genel Müdürlüğe yayımlanması istemi ile gönderildiği tarihten sonra çıkacak olan ilk ya da en geç ikinci sayıda sıra bekletilmeksizin yayımlanır. Bu yolla Türkiye'de yer bilimleri alanında gereksinimi duyulan bilimsel iletişimin daha etkin bir şekilde gerçekleştirilmesi amaçlanmaktadır.

Yazıların "Kısa Notlar" bölümünde yayımlanabilmesi için tüm resimlemeleri ile birlikte dört yazı makinesi sayfasını aşmamaları gereklidir (sayfaların boyutları ve kullanılışı "Yazı Taslağı" bölümünde belirtilen kurallara uygun olmalıdır). Kısa Notlar bölümünde yer alacak yazılar için öz verilmemelidir.

AYRI BASKI - Dergide yayımlanan her yazı için 25 adet ayrı baskı yazarına parasız verilir. Bu sayının üstündeki istekler paralı olarak karşılanır.

- Makalelerin disketleri de Redaksiyon Kuruluna orjinal metinlerle birlikte verilecektir.
- Telif ücretlerinin ödenebilmesi için yazarlar banka numaralarını da dilekçelerinde belirteceklerdir.