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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.

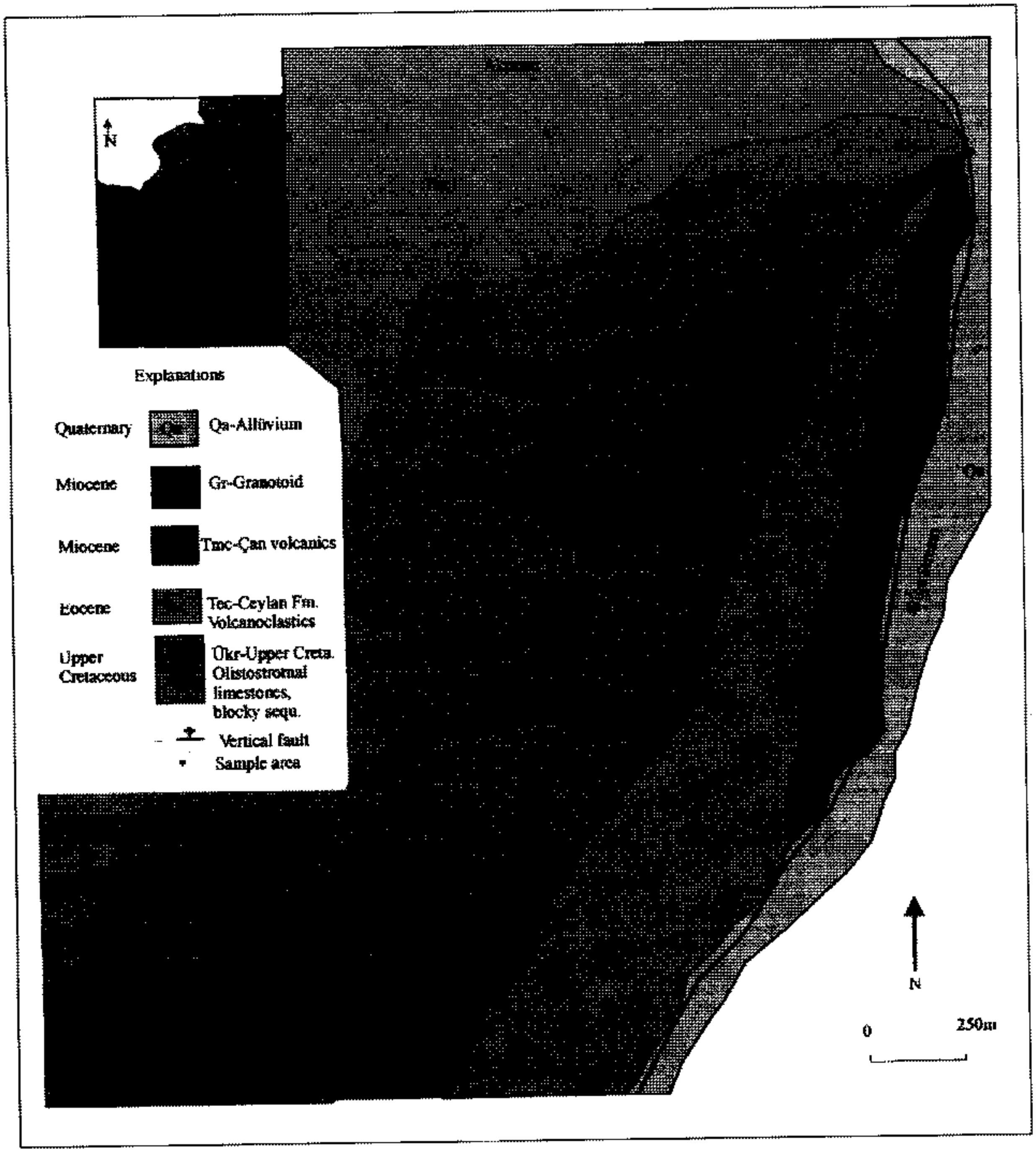

Fig. 1- Geological map of the study area.

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.

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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).

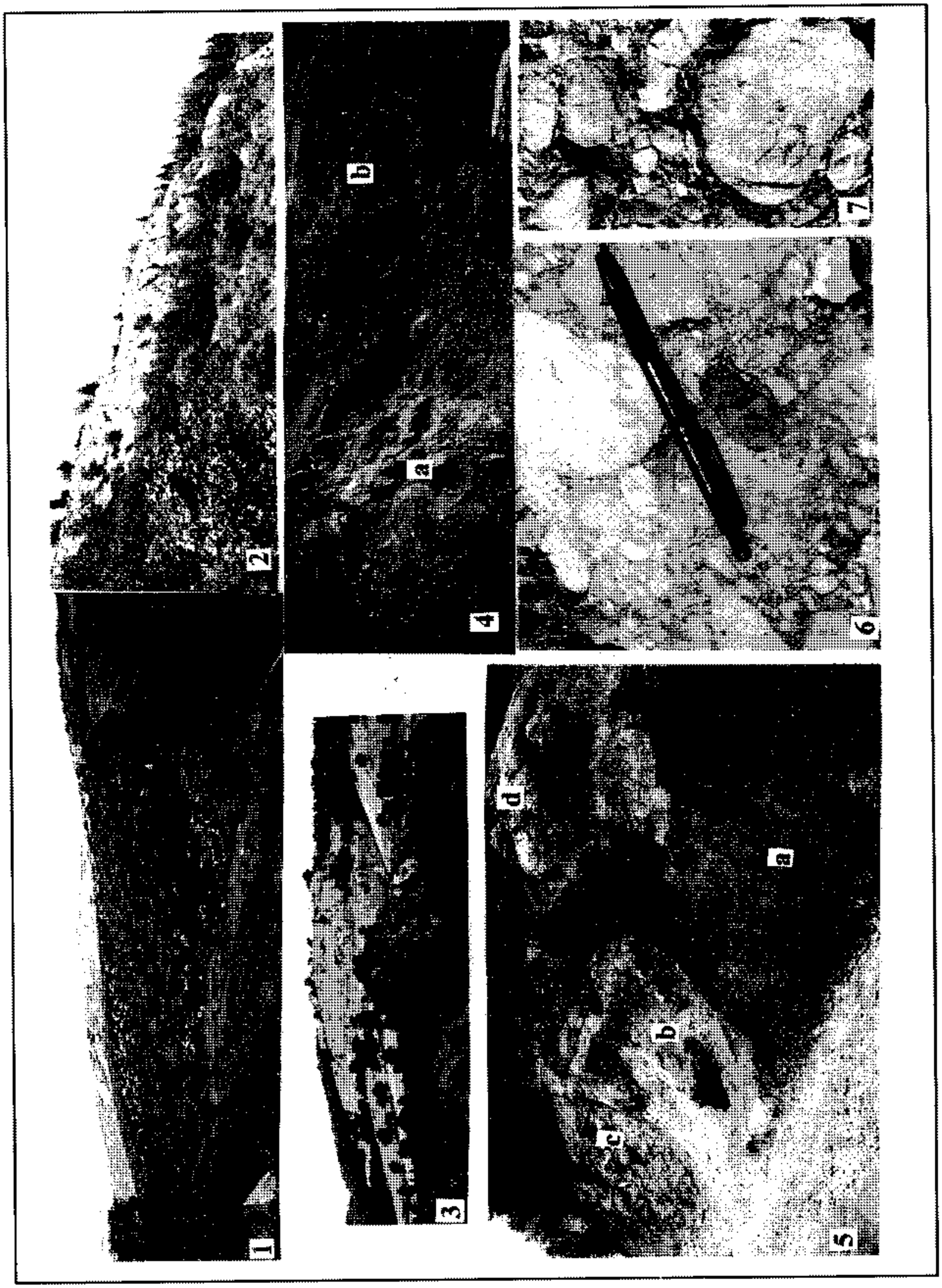
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PLATE-II

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).

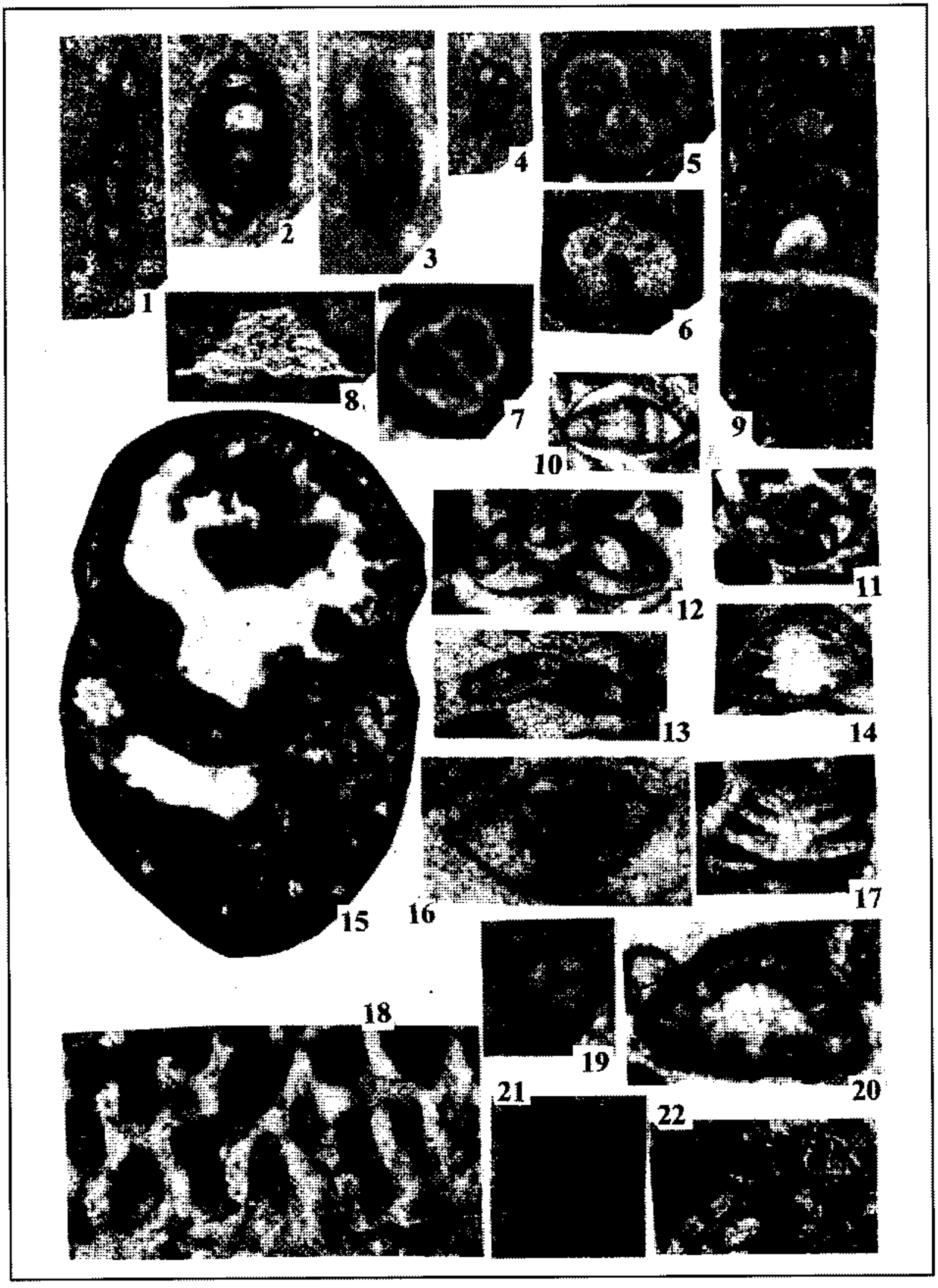
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PLATE-III

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).

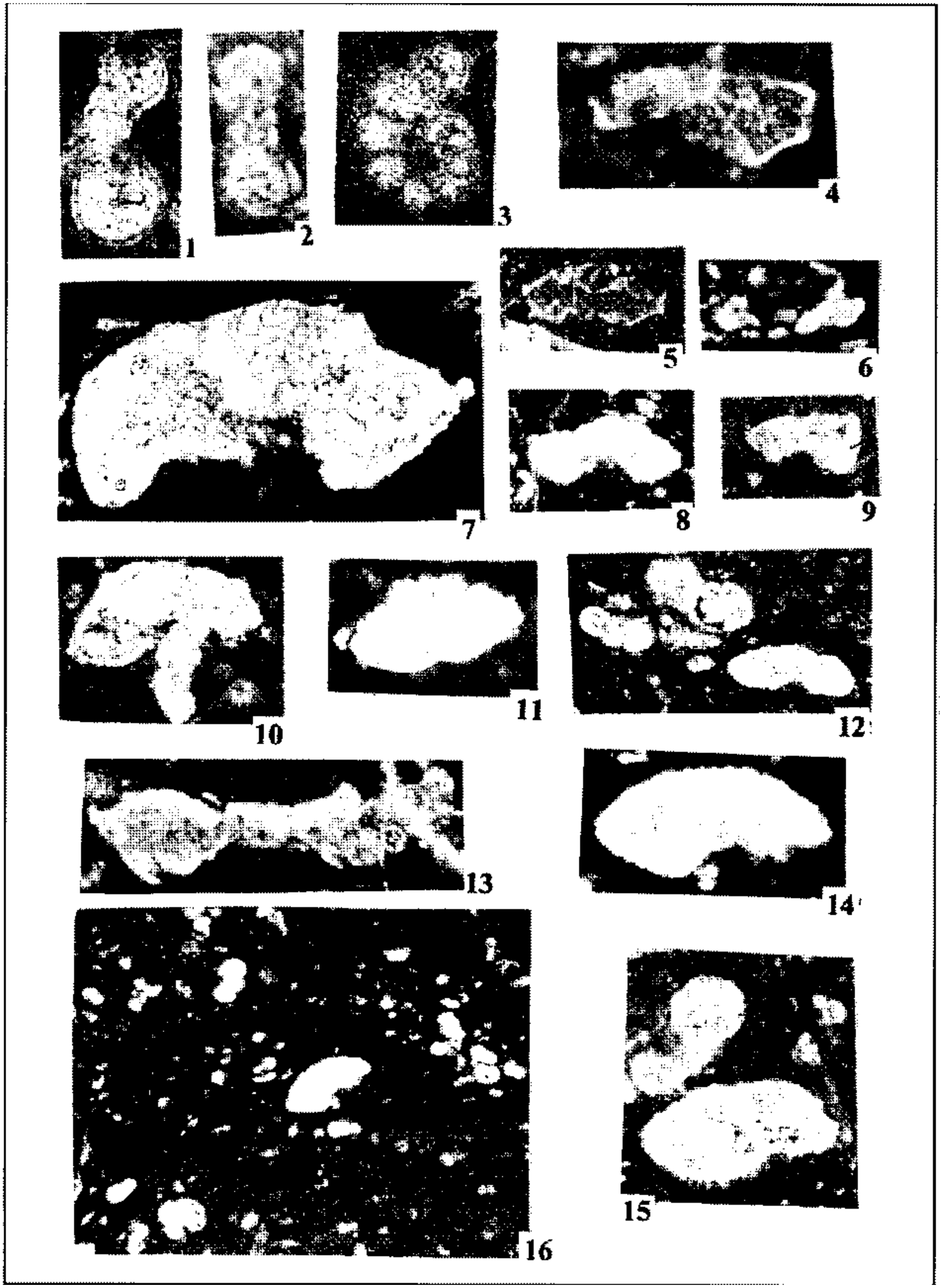
Fig. 7 and 9- *Globotruncanita stuartiformis* (Dalbiez), Maastrichtian, vertical section. Sample no: 7, 32D, 100X, Sample no: 9, 32D, 40X, (North of Sarısuvat Kokarca H., Coord., x: 48650, y: 15750).

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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ABSTRACTS OF THE PAPERS PUBLISHED ONLY IN THE TURKISH EDITION OF THIS BULLETIN

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.

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MAIN PARTS OF THE ARTICLE - An article should contain, a title, the name and address of the author (s), an abstract, introduction, main body of the text, conclusion(s), discussion (if necessary), references, and additional explanations (if necessary).

ABSTRACT - Should be so clear and informative that no consultation to the other parts would be needed and should be issued directly in an abstract periodical, directly. It should include the purpose, the addition to the knowledge, the gathered new data and the interpretation related with the subject, of the article. In the abstract, attributions and footnotes should not be used in the abstract. The abstract should not exceed 200 words.

In the acknowledgement section, persons who bear important inputs as well as responsibilities should be acknowledged, but the contributions of the persons who conduct them as normal functions of their duty should not be acknowledged.

The references to be made should be only with the papers cited in the text. The style of references are as given examples below;

Pamir, H.N., 1953, Türkiye'de kurulacak hidrojeoloji enstitüsü hakkında rapor: Türkiye Jeol. Kur Bull, 4, 63-68.

Baykal, F. and Kaya, O., 1963, İstanbul bölgesinde bulunan Karboniferin genel stratigrafisi: Maden Tetkik ve Arama Enst. Derg., 61 , 1-9.

Ketin, I., 1977, Genel Jeoloji: İst. Tek. Üniv., İstanbul, 308p.

Anderson, D.L., 1967, Latest information from seismic observations Gaskell T.F . ed. in The Earth's Mantle: Academic Press, London, 355-420.

Citings should be made in the following ways; "Altınlı'ya göre........"..............(Sirel ve Gündüz, 1976)". If the authors of the references are more than two "......et al." abbreviation for "and others" should be used after the first author; For instance, "Ünalan et al." described the Kartal Formation". To refer to an article which is published in another publication, firstly the original and secondly the publication in which the article has appeared should be mentioned; for instance "it is known that Lebling mentiones about Lias around Çakraz (Lebling, 1932; from Charles, 1933)". Personal communications or correspondances should be in the same way of "O. Eroskay, 1978. personal communication", or "according to N. Toksöz 1976, written communications".

LENGTH OF THE MANUSCRIPT - The manuscript submitted for publication with all illustrations, should not exceed 30 typed pages. (The size of the pages and the spaces used should be consistent with the rules explained in the "preparation of the draft text").

Selection of the size of the illustrations and their accomodation in the text should be carefully considered not to cause any loss of the space and details.

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Special lettering and formulea must be written with Indian ink on a tracing paper

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