Mineral Res. Exp. Bull., 139, 1-15, 2009

SEDIMENTOLOGICAL- STRATIGRAPHICAL EVALUATION OF TERTIARY CARBONATES (SOĞUCAK FORMATION) OF THRACE BASIN (BOZCAADA - KIYIKÖY)

Baki VAROL*, Meltem BAYKAL** and Turhan AYYILDIZ*

ABSTRACT.- Soğucak formation which crops out in Thrace Basin has characteristics of reefal limestones and is one of the target levels in oil exploration studies in the basin. While this unit directly and unconformably overlies the basement rocks in some areas, it is transitive to siliciclastic-dominated units (Koyunbaba formation) in other areas. The Soğucak formation is comprised of carbonates of reefal-shore complex which was deposited in a shelf environment as a consequence of a transgression which lasted between Early-Middle Eocene and Early Oligocene. The rocks of the lower limit of the age interval of the formation, the Lower Eocene, crops out in Bozcaada only and is transitive to Fıçıtepe formation. In general, the unit was deposited in SE of the basin between Middle-Late Eocene, and between Late Eocene and Early Oligocene in NE of the basin. Sedimentological features and age data indicate that Soğucak formation was deposited under the control of antecedent topography and it is the product of a time-transitive transgression together with coastal morphology and sea level changes.

Key words: Thrace Basin, Soğucak formation, sedimentology, stratigraphy

INTRODUCTION

Because of its rich coal, natural gas and quartz sand resources, the Thrace Basin has been studied in detail by various oil companies, MTA and University researchers for long years. The Tertiary units of Thrace are in general comprised of clastics and include carbonates in shelf areas (Figure 1). TPAO conducts detailed surface and subsurface (seismics, well log and test-development wells) studies because of the natural gas explored in the region. Among the researches conducted in the area, mainly Kopp et al., (1969) and Turgut et al., (1983, 1991) can be cited. The most significant documents for the stratigraphic definiton of the Thrace basin are the 1:100 000 scale geological maps published by the MTA (İmik, 1998; Çağlayan and Yurtseveri 1998; Şentürk and Karaköse, 1998). The Tertiary sequence which begins to cropping out at the southern foothills of the Strandja Mountains and covers almost the whole Thrace basin, reaches up to a thickness of 900 m (Kopp et al., 1969; Turgut et al., 1983, 1991; Görür and Okay, 1996; Turgut and Eseller, 2000; Siyako, 2006). The Eocene-Oligocene units are covered by Miocene and younger units in the Central and Northern Thrace. İslamoğlu et al., (2008) revealed the Oligocene paleogeography of the northern part of the Thrace basin.

Detailed description and various age data of the Soğucak and Ceylan formations of the Thrace Basin was studied by Siyako (2006). Researches conducted until today indicate that Soğucak formation is comprised of carbonates deposited in shelf environment. Besides, it was deposited in patchy reefal facies around Pınarhisar while the subsurface data show that it has characteristic features of pelagic clayey limestone (Siyako, 2006). Although different ages were attributed to the formation in different researches conducted in the basin, the generally accepted age for the Soğucak formation is the Middle Eocene – Early Oligocene (Siyako, 2006).

During this research, facies characteristics and age of the formation, based on fosil content, were studied in detail. According to the data acquired, the age of the carbonates of the Soğucak formation was revised; consequently the position and the place of the formation in the basin chronostratigraphy were reevaluated.

MATERIAL AND METHOD

Carbonates from the Soğucak formation are the materials used in this research. The samples from carbonates were collected along 15 measured stratigraphic sections where the Soğu-

*Ankara Üniversitesi Mühendislik Fakültesi Jeoloji Mühendisliği Bölümü 06100, Ankara

** MTA Genel Müdürlüğü Jeoloji Etüdleri Daire Başkanlığı Balgat, Ankara

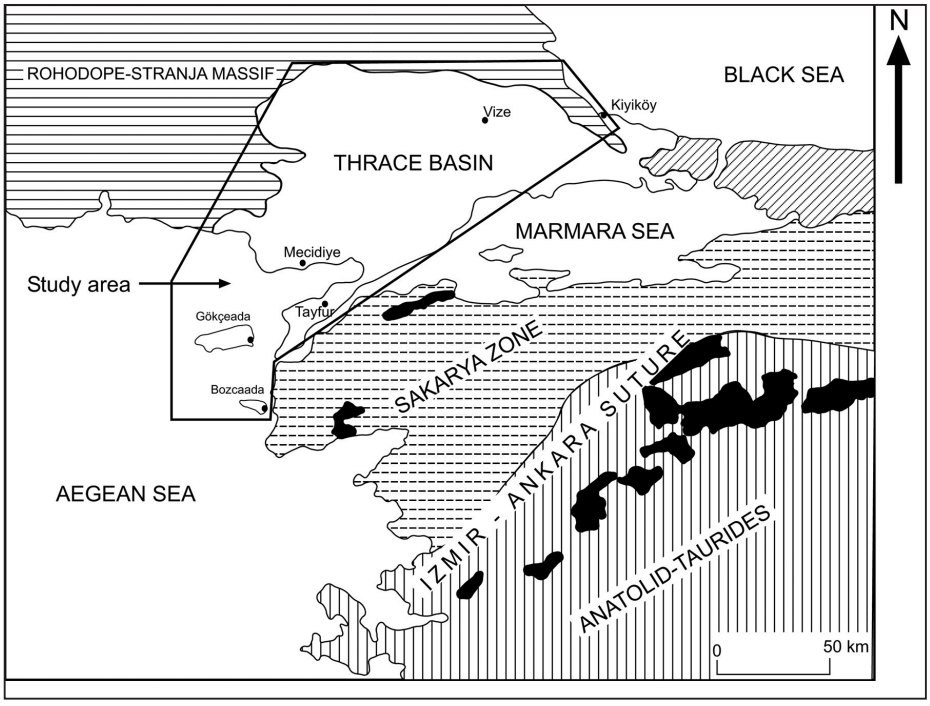

Figure 1- Location map of the study area (modified from Okay and Tansel, 1992).

cak formation is observed typically. These are Gökçeada, Bozcaada, Mecidiye, Süloğlu, Dolhan, Tekedere, Erenler, Soğucak, Poyralı, Okçular, Akören-Pınarhisar, Manastırdere, north of Vize, Kıyıköy1, Kıyıköy 1a, Kıyıköy 2 and Kıyıköy 2a sections. Besides where no good outcrops were observed, point samples were collected. From these limestone samples collected along the sections and the points, 350 thin sections were prepared in TPAO Research Center. Petrographic and paleontological study of the thin sections were conducted both in Petrography Laboratory of the Ankara University Department of Geological Engineering and Department of Geological Research of MTA. Leica DMEP Polarising microscobe and Nikon E5400 Coolpix (5.1 MG pixel) were used to study and to take photographs of the thin sections, respectively.

STRATIGRAPHY

Stratigraphy of the Thrace Basin was studied in detail during many researches until today (Keskin, 1974; Siyako, 2006; Siyako and Huvaz, 2007). Previous studies, in general, indicate that

Middle Eocene-Early Miocene units unconformably overlie the Paleozoic-Mesozoic basement in the northern parts of the basin (Esso Standart, 1960; Holmes, 1961; Keskin, 1974; Kasar et al., 1983). The clastic sequence overlying the basement rocks were defined as the Koyunbaba Member in these studies, and the age attributed to this member is Middle Eocene (Siyako et al., 1989). Later on Keskin (1974) defined this member as Koyunbaba formation. Soğucak formation which overlies the Koyunbaba formation is of Middle-Late Eocene age in southern Thrace, namely in the Gelibolu peninsula, Bozcaada, Gökçeada and Biga peninsula (Kasar et al., 1983; Sümengen et al., 1987; Temel and Çiftçi, 2002; Siyako et al., 1989). The age of the outcrops of the formation, at the foothills of the Strandja Mountains and in the northern Thrace, was in general determined as Late Eocene (Erenler, 1985; Batı et al., 1993). Besides, Önal (1985, 2002) differentiated the Early Eocene carbonates below the Karaağaç formation in the Gelibolu Peninsula as Başoğlu member. On contrary, in Kuleli-Babaeski paleo-rise area located in the northwest of Thrace, the age of this formation was determined as Early Oligocene based on the well data (Kes-

kin, 1974; Siyako, 2006). Ceylan formation which is observed to overlie these units is assumed to be conformable in general on the Soğucak formation. However, in the south, in Bozcaada, the Soğucak and Ceylan formations (Kesgin and Varol, 2003) and in the north, around Karaburun, Soğucak and Karaburun formations (Early Oligocene) were observed to have unconformable relations (Sakınç, 1994). On these rocks, Late Eocene-Early Miocene Mezardere, Osmancık, Danişmen (Taşlısekban, Pınarhisar and Armutburnu members) and Çantaköy formations of Yenimuhacir Group take place. These units also are covered by Pliocene unconformably.

Soğucak formation which is the subject of this research is quite widespread in the northern parts of the Thrace Basin, and in general, the age of the unit is accepted as Middle-Late Eocene as cited above. Besides, the upper section of the Soğucak formation in the north of the basin (around Dolhan village) was dated as Oligocene (Sirel and Gündüz, 1976).

In this study, based on descriptions made along the measured stratigraphic sections which are given below in detail, the age of the Soğucak formation is determined to be as Early (?)-Late Eocene – Early Oligocene.

MEASURED STRATIGRAPHIC SECTIONS

The limestones of the Soğucak formation crop out as blocks (their size varying between a few m and a 100 m) along approximately east-west lying lines in the north of the basin. The measured stratigraphic sections (MSS) are located in the north of the basin, beginning in the west from Süloğlu village to Dolhan, Tekederesi, Kaynarca, Pınarhisar, Erenler, Soğucak, Vize, Okçular and around Kıyıköy in the easternmost. In the south, stratigraphic sections were measured on the outcrops in Bozcaada, Gökçeada; Tayfur and Mecidiyeköy. The rock samples and fossils collected along these sections were used to evaluate the age data of the formation (Figures 2, 3, 4 and 5).

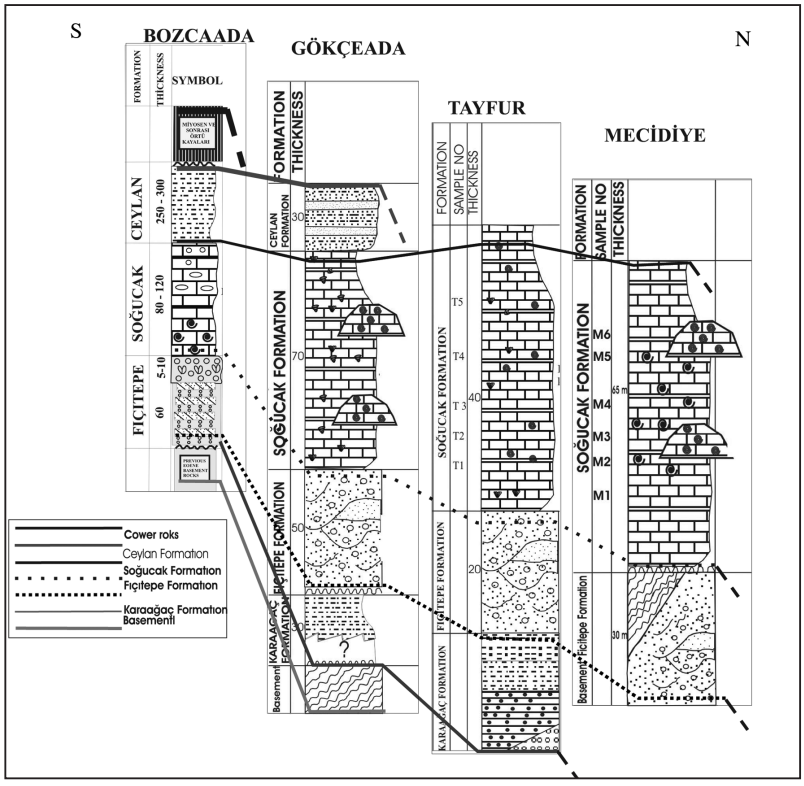

Figure 2- Correlation of the formations of the measured stratigraphic sections in south of the Thrace Basin.

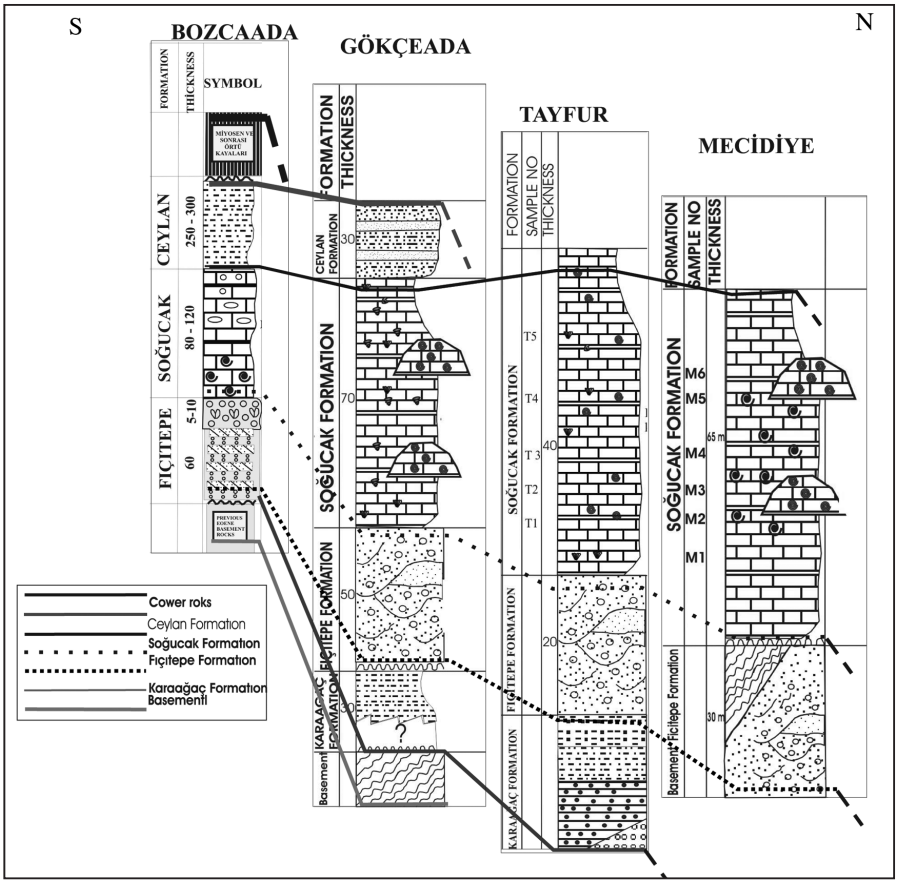

Figure 3- Chroronostratigraphic correlation of the measured stratigraphic sections in south of the Thrace Basin.

Southern Sector of the Thrace Basin(Bozcaada, Gökçeada, Mecidiye, Tayfur)

The previous studies in the Bozcaada point out that Soğucak formation unconformably overlies the terrestrial Fıçıtepe formation and the age of the of the formation is Middle Eocene (Temel and Çiftçi, 2002; Kesgin and Varol, 2003). During this study, in pebblestone units of the Fıçıtepe Formation small scale individual reef developments were observed; this levels were observed to transite to Soğucak formation by sandstones, algae spreads and limestones with ostrea (Figure 6). Paleontological data acquired from this transitive levels indicate Early Eocene (Varol et al., 2007). However, the relation of these two units are reported to be unconformable in Mecidiye and Tayfur regions (Siyako, 2006). Besides, Önal (1985) differentiated the levels as Başoğlu Member which could assumed to be equivalents of the Early Eocene limestones. In this situation, it was found necessary to study the this unit which crops out in the Bozcaada in detail.

In Gökçeada-Kolbaşı hill the Soğucak formation is represented by typical patchy reefs and the surrounding reefs. As seen in paleontological evaluations in table 1, Late Eocene-Early oligocene age is attributed and its upper contact is transitive to the Ceylan formation (Figure 2).

Another section was measured around Mecidiye in the south of the basin. Here, Soğucak formation begins with algae oncoid bearing banks and passes into coral reefs upwards. The

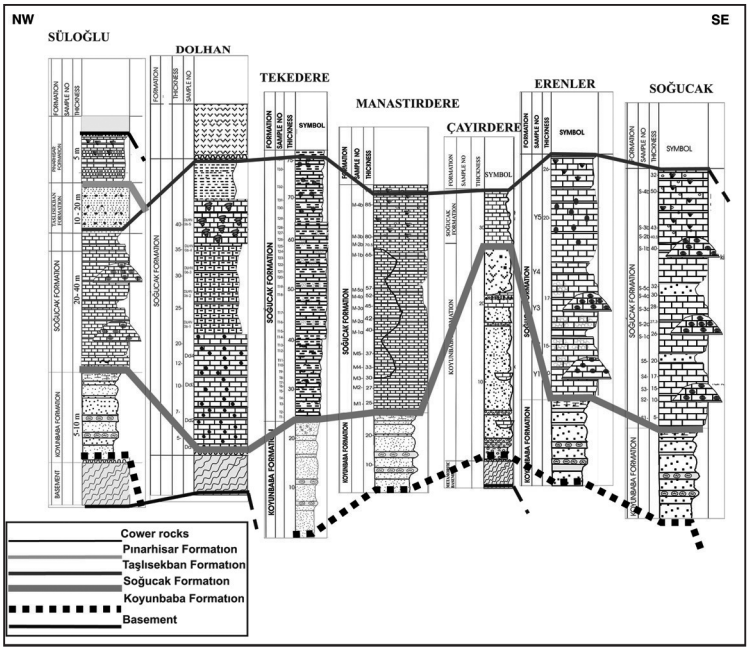

Figure 4a- Formations correlation of the measured stratigraphic sections within the northern part of the Thrace Basin

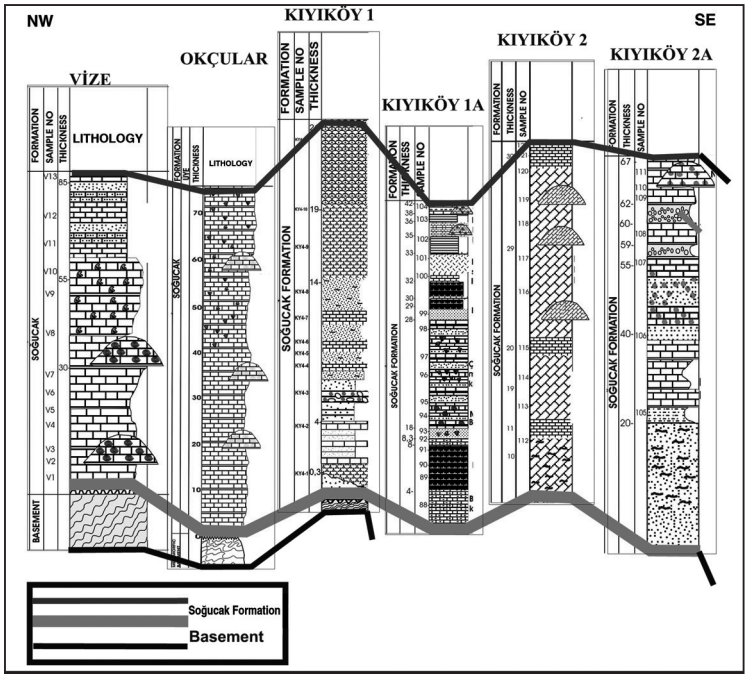

Figure 4b- Correlation graphic of the meassured stratigraphic sections belonging to the Soğucak formation within the northern part of the Thrace Basin

facies surroundings of the reef is represented by bioclastic limestones. Here, Soğucak limestone unconformably overlies the basement rocks in the Fıçıtepe formation in some places (Siyako and Huvaz, 2007).

The last section representing the Gelibolu Peninsula was measured in the north of the Tayfur village. The approximately 10-15 m thick limestones are comprised of lenticular Nummulites banks and the age of the unit is Late Middle-late Eocene (Figure 3). At the basement, it has unconformable relation with the Fıçıtepe formation.

Northern Sectodr of the Thrace Basin
(between Süloğlu – Kıyıköy)

During the study conducted in Thrace Basin, the places where the Soğucak formation is directly time-transgressive onto the basement are Süloğlu, Dolhan, Vize and Okçular sections. On contrary, in Tekedere, Manastırdere, Erenler, Soğucak and Poyralı sections it is transitive to Koyunbaba formation at the basement. The age determined in these sections is Late Eocene-Early Oligocene (Table 1) (Figure 5).

Along the Süloğlu section, Soğucak formation is unconformable on the matamorphic basement, along some other sections it is transitive to a very thin (3-4 m, comprised of quartz sandstones) Koyunbaba formation. The lower levels are transitive to *Nummulites* banks from back-reef environment; at the top this carbonate assemblage passes to coastal sandstones with 10-20 m thin mudstone bands. This unit was defined and mapped as Taşlısekban member in previous studies (Siyako and Kasar, 1985). Later on, the sequence ends up with a few metres thick *Congeria*-bearing limestone levels (Figure 7). These limestones crop out at some distinct regions of the Thrace Basin (Kaynarca – Erenler) and are differentiated as Pınarhisar formation (Keskin, 1966; Umut et al., 1983; Umut et al., 1984). Along Dolhan section carbonates of the Soğucak formation directly and unconformably rest on the basement. The lower levels of the sequence begin with bank type limestones bearing abundant *Nummulites* and continues with mudstone dominated, cross bedded sandstone which deposited in lagoon-beach environment. It ends up with gastropoda bearing limestones which represent brackish water at the top. The samples collected here which include abundant *Nummulites* yield Late Eocene-Early Oligocene age which harmonize with the dating in Sirel and Gündüz (1976) (Figure 4, 5).

The Tekederesi section begins with the clastics which unconformably rest on the basement. The sandy limestones of the Soğucak formation with abundant bioturbation and ostrea are transitive to the clastic levels of the Koyunbaba formation (Figure 8). The levels, in general represent the lagoonal enviroment, are followed by *Nummulites* banks. In this period, based on the fast sea level changes, back-bank and fore-bank facies were developed very well. This bank-type deposition passes upwards into patchy reefs where the coral assemblages are dominant. In this section, the age of the *Nummulites* banks which form the lower-middle parts was given as Middle Eocene in previous studies (Baykal et al., 2007), however, according to latest paleontological data, age of this reefal assemblage is revised as Late Eocene-Early Oligocene (Figure 4). This indicates a relative sea level increase in this area by the end of the Eocene and beginning of Early Oligocene (Figures 4, 5).

Along the Manastırdere section, Soğucak formation rests on the Koyunbaba formation transitively. The first levels of the section is comprised of reef-backreef (lagoon) assemblages. The reef assemblage that developed in later stages around Kaynarca village form the massive reefal core of 50-60 m thick where the corals are dominant. In the SW direction thin bedded fore-reef facies with pelagic intercalations take place. This reefal assemblage ends up with limestones bearing *Congeria* near the junction of Kaynarca-Manastır road (Figure 9).

The section measured in Soğucak village which is reported as the typical section of the Soğucak formation in the Thrace Basin (Holmes, 1961) massive limestone deposition developed

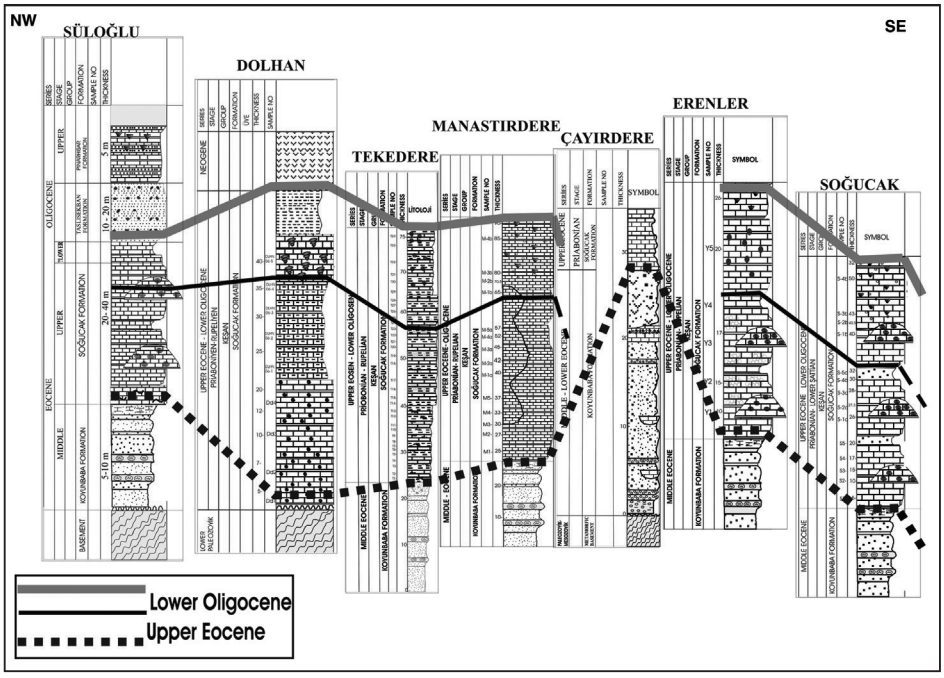

Figure 5a-Chronostratigraphic correlation graphic of the measured stratigraphic sections within the northern part of the Thrace Basin

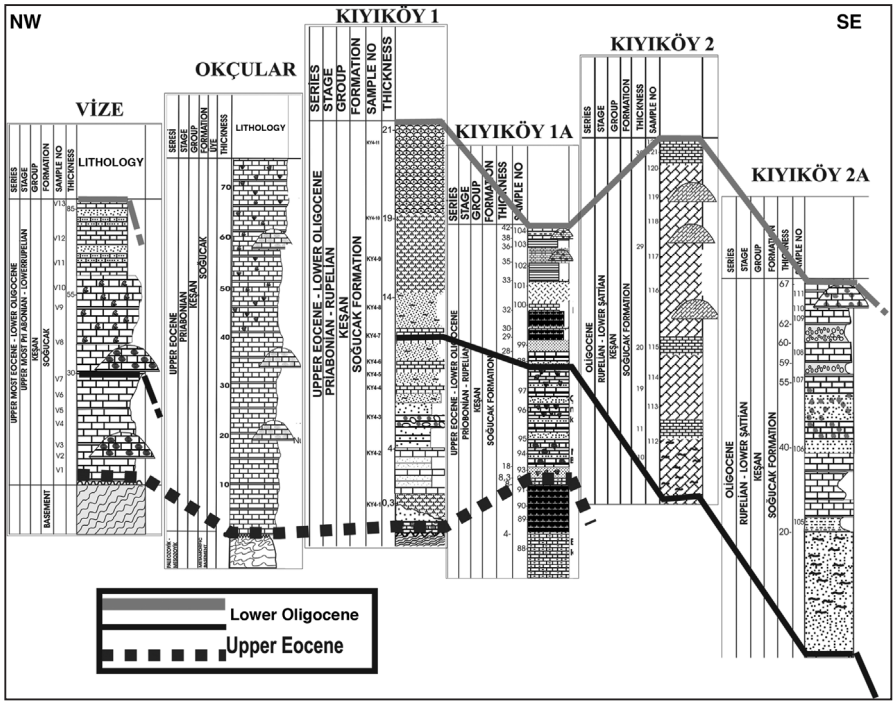

Figure 5b- Chronostratigraphic correlation graphic of the measured stratigraphic sections belonging to the Soğucak formation within the northern part of the Thrace Basin

Table 1- The age intervals of the Soğucak formation determined in measured stratigraphic sections in the investigated region.

MEASURED SECTION LOCATION	FOSSIL CONTENT	AGE INTERVAL IN THIS STUDY
BOZCAADA	*Bryozoa*, *Alveolina* sp. *Nummulites* sp. *Milliolidae, Cuvvilerina* sp., *Discocyclina* sp., *Assilina* sp., *Opertorbitolites douvivillei, Alveolina* aff.*cemali* (n.s.p).	EARLY EOCENE
GÖKÇEADA	*Spharegypsina, Gypsina, Famiania cassis/ Gyroidinella* sp. Rotalidae., *Asterocyclina* sp., *Discocyclina* sp. Globigerapsis sp. *Alveolina* sp., *Asterigerina* sp., *Nummulites perfatus, Nummulites ptukhiani., Nummulites* cf *incrassatus, Assilina* sp.,	MOST EOCENE - OLIGOCENE
MECİDİYE	*Fabiania, Spiroclypeus* sp., *Discocyclina* sp., *Nummulites* sp., *Gyroidinella magna*	LATE EOCENE
TAYFUR	*Gyroidinella maga.,Fabiania cassis,Heterostegina* sp., *Halksyardia minima., Discocyclina* sp., *Nummulites* sp., *Alveolina* sp., *Orbitolites* sp. , *Acervulina* sp.,	LATE MIDDLE - LATA EOCENE
SÜLOĞLU	*Congeria* sp., Gastropoda, Coral, Red alg Bryozoa, *Nummulites* sp.,	LATE EOCENE - EARLY OLIGOCENE
DOLHAN	*Nummulites intermedius, Nummulites ficteli, Nummulites vascus, Asterigerina* sp., *Operculina* sp., *Rotalia* sp., *Nummulites fabianii., Fabiania cassis.,*	LATE EOCENE - EARLY OLIGOCENE
TEKEDERE	*Fabiania cassis, Gyroidinella cf-magna., Acervulina.* sp, Miliolidae., *Spiroclypeus* sp., *Nummulites* cf., *vascus Planispira* sp., *Textularia* sp., Bryozoa, Kırmızı alg	LATE EOCENE - EARLY OLIGOCENE
MANASTIRDERE	*Red algea, Nummulites* sp., Miliolidae, Pelecypoda *Asterigarina* cf *rotula* Textularidae, *Nummulites vascus Rotalia* cf *armata* Ostrokoda, Pelecypoda	LATE EOCENE - EARLY OLIGOCENE
ERENLER	*Nummulites* sp., *Nummulites* cf. *yascus Nummulites* cf., *fichteli,* Red algea, Bryozoa *Nummulites* sp.	LATE EOCENE - EARLY OLIGOCENE
SOĞUCAK	Red algea, Ekinit, *Nummulites* sp., Miliolidae, Pelecypoda, Mercan Amhisteginid, Rotalidae., *Sphaerogypsina* sp., *Nummulites* cf. *vascus, Nummulites* sp.,	LATE EOCENE - EARLY OLIGOCENE
VİZE	*Gyroidinella magna, Acervulina.*, Miliolidae, *Orbitolites* sp, *Asterigerina* sp., *Rotalia* sp., *Nummulites* cf., *vascus Gyroidinella* sp., *Asterigerina rotula, Spiroclypeus Chapmanina gassinensis, Alveolinidae, Fabiania* sp.,	LATE MOST EOCENE - EARLY OLIGOCENE
OKÇULAR	*Nummulites* cf, *fabiani, Asterigerina* sp. *Discocyelina* sp. *Orbitolites* sp., *Heterostegina* sp., Rotalidae, Miiolidae, Ostracoda, *Nummulites* sp.,	LATE EOCENE
BALKAYA	Red algea, *Nummulites* sp., Amphisteginid, Miliolidae,	LATE EOCENE
KIYIKÖY 1	Red algea, *Nummulites* sp., Coral., Bryzoa, Pelecypoda, *Nummulites* cf. *Vascus Cytheridae* cf. *pernota, Costa tricostata Paijenborchella* sp.,	LATE EOCENE - EARLY OLIGOCENE
KIYIKÖY 2	*Nummulites* sp., *vascus Operculina?* sp. *Operculia* cf. *Complanata* Amphisteginid, *Krithe* cf., *bartonensis, Cytheretta tenuistriata Costa tricostata, Ruggieria* sp., Cytheridae	OLIGOCENE
KIYIKÖY 3	*Neorotalia lithothamnica, Nummulites fichteli, Nummulites vascus,Nummulites* sp., Ekinit, Pelecypoda., Red algea	OLIGOCENE
KIYIKÖY 4	*Neorotalia lithothamnica, Nummulites* cf. *vascus Oeprculina?* sp. *Operculia* cf. *complanata,* Amphisteginid *Krithe* cf. *bartonensis, Cytheretta tenuistriata, Cytheridae Cytheretta tenuipunctata, Costa tricostata, Ruggieria* sp.	LATE EOCENE - EARLY OLIGOCENE

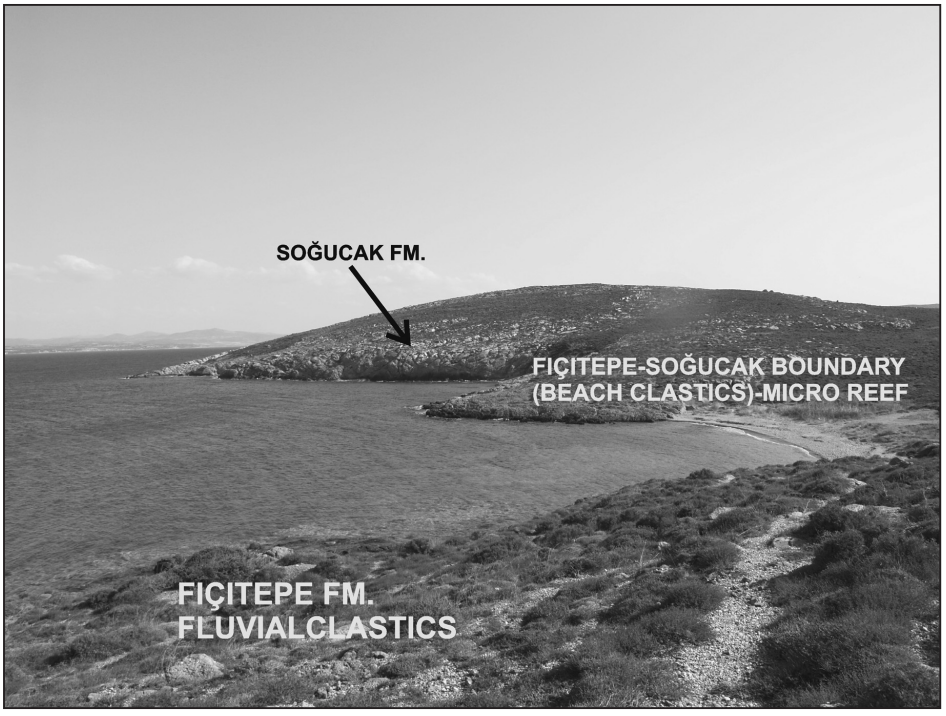

Figure 6- Transition of Fıçıtepe – Soğucak formations in south of Bozcaada – Poyraz port.

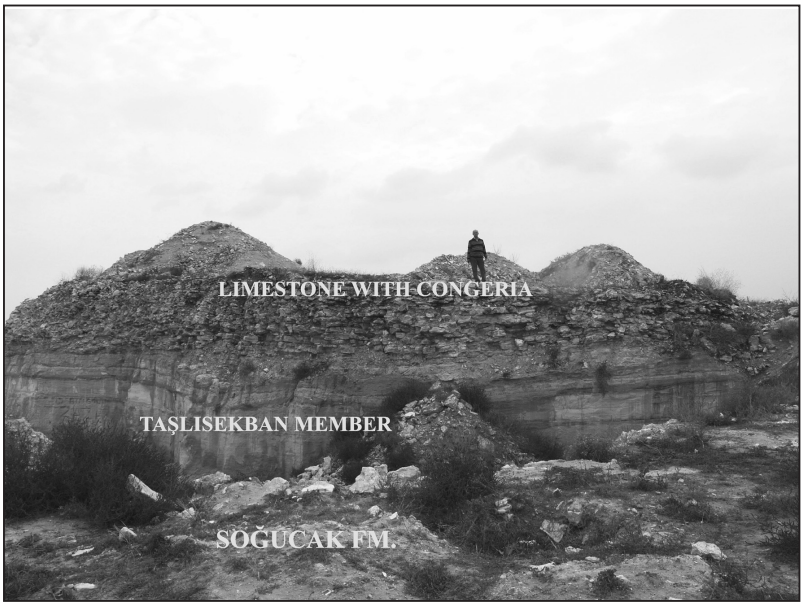

Figure 7- Transition of Soğucak formation – Taşlısekban Member in (north of) Süloğlu.

in form of bank-reef complex is observed. Around this assemblage, back-reef and fore-reef facies spread out in wide areas. In this area, onlaps and offlap sets which indicate fast sea level changes overlie each other angularly. Dating from the samples collected from the entire sequence indicate Late Eocene-Early Oligocene (Table 1). Along the Erenler section which is located at the southeastern extension of this section, this reefal assemblage is covered by 5-7 m thick cross bedded ooliitic limestones. The transgressive layering observed in oolites which represent the carbonate shoal indicate the changes in the coast line based on the sea level changes. The Congeria sp. bearing limestones which form the uppermost level of the section represent a brackish water facies that developed in the platform where the Soğucak formation was deposited; its stratigraphical position is interpreted as the upper section of the formation.

Paleontological determinations indicate that age of the unit is Late Eocene-Early Oligocene (Figure 5, Table 1).

In the north of Vize, the Soğucak formation unconformably overlies the basement rocks. In this section which displays examples of a a typical bank formation, the E-W trending massive bank and the surrounding facies represented by thin to medium limestones are observed (Figure 8). The back-bank facies deposited during the regressional periods are in general thin bedded and include carbonaceous mudstone intercalations and abundant bioturbations (Figure 10). The age interval of the formation, different from the previous studies (Baykal et al., 2007: Middle Eo-

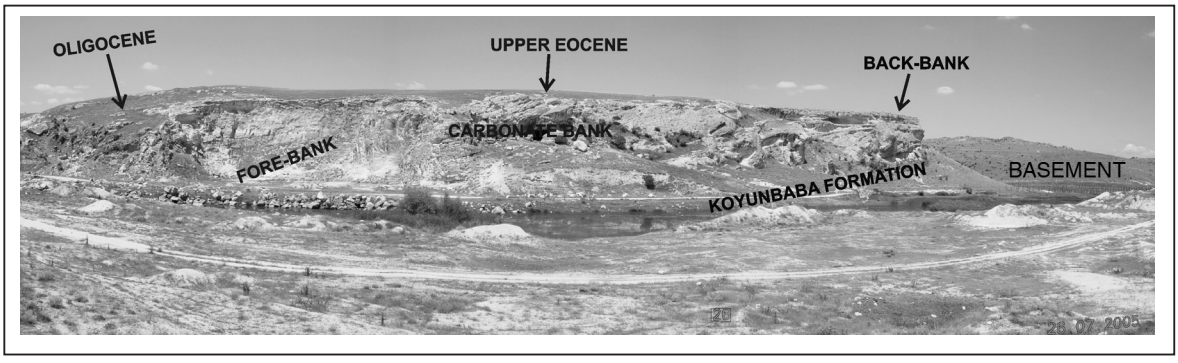

Figure 8- The facies and stratigraphic relation of the Soğucak formation with the other units in the Tekederesi section.

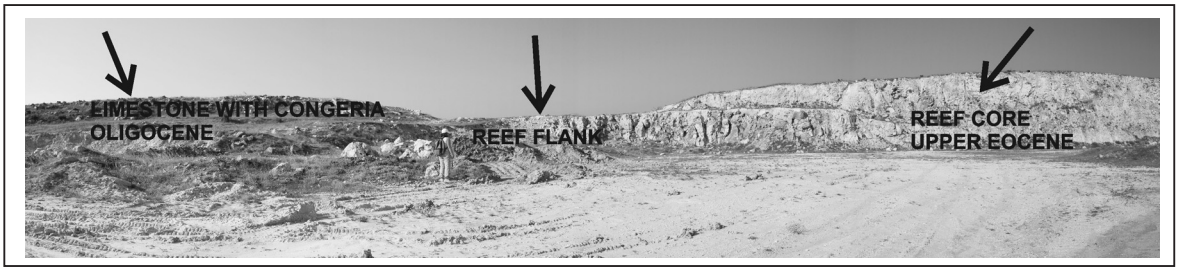

Figure 9- Transition from reefal Soğucak limestone to *Congeria* bearing limestone in the Manastır section (north of the Kaynarca village).

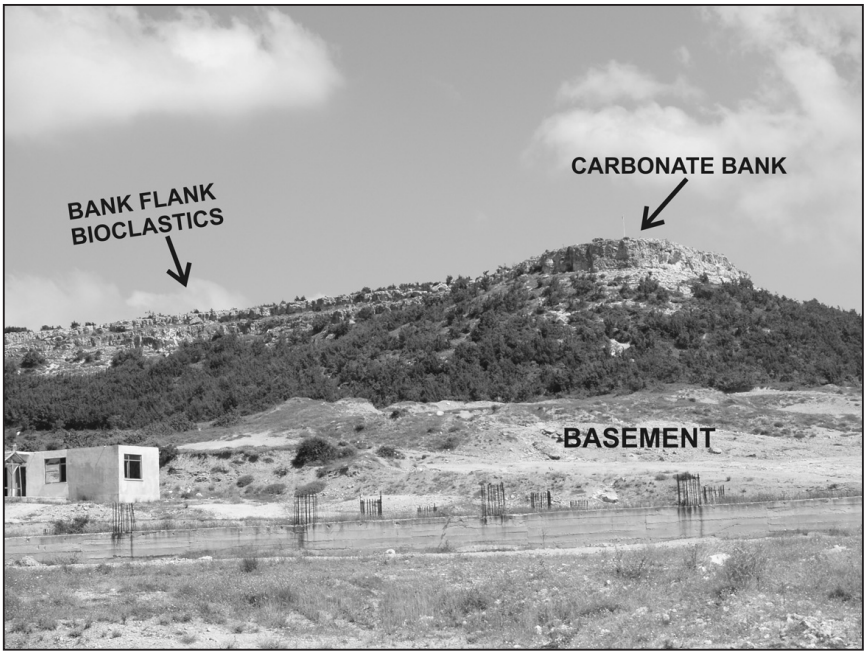

Figure 10- Facies assamblages of the Soğucak formation in the north of the Vize

cene) but conformable with the other sections, was determined as Late Eocene – Early Oligocene (Figures 4, 5) (Table 1).

The Soğucak formation which can be observed in the easternmost part of the study area crops out around the Kıyıköy and was investigated by sections measured on both flanks of an anticline observed on the coast. The sequence unconformably rests on the basement rocks and there is a thin siliciclastic-dominant level at the base of the formation. In the overlying coast sandstones (5-10 m thick) with bioturbation, mudstones including mud intraclasts and flame structures representing tide conditions take place. This level passes upwards into cross bedded clastic limestones (Figure 4). This clastic section is 10-15 m thick and includes a few meter thick individual coral reefs. The sequence ends up with levels bearing *Ostrea* and gastropoda deposited along a retreading coast line. This way, the levels including mudstone intercalations pass into the Ceylan formation through a tuffaceous level (Figure 11).

Section (2, 2a) represents the southern flank of the syncline. Sandy limestone with bioturbation is located at the base similarly (10 - 15 m). This level passes upwards massive bioclastic sand and sandstone with coral fragments. At these levels many soft deformation structures and brecciation and nodules are observed. In this section which is about 50 m thick channels fills with pebbles, cross bedding and local interbands with echinoid lineaments can be observed. The sequence in general is of set sand complex nature. In the back-set abundant pelecypod, *Ostrea* and gastropoda bearing bioturbated sandy limestone and carbonate mudstones were deposited. The most typical examples of bioclastic dominated Soğucak formation is revealed in this section. Along the coast, NW-SE trending limestones with huge cross beds most probably mark the megaripples active along the coast line (Figure 4).

The age interval which is valid fort he whole Kıyıköy section is determined as Late Eocene (Priabonian) –Oligocene (Rupelian – Early Chattian) (Baykal et al., 2009) (Table 1) (Figure 5).

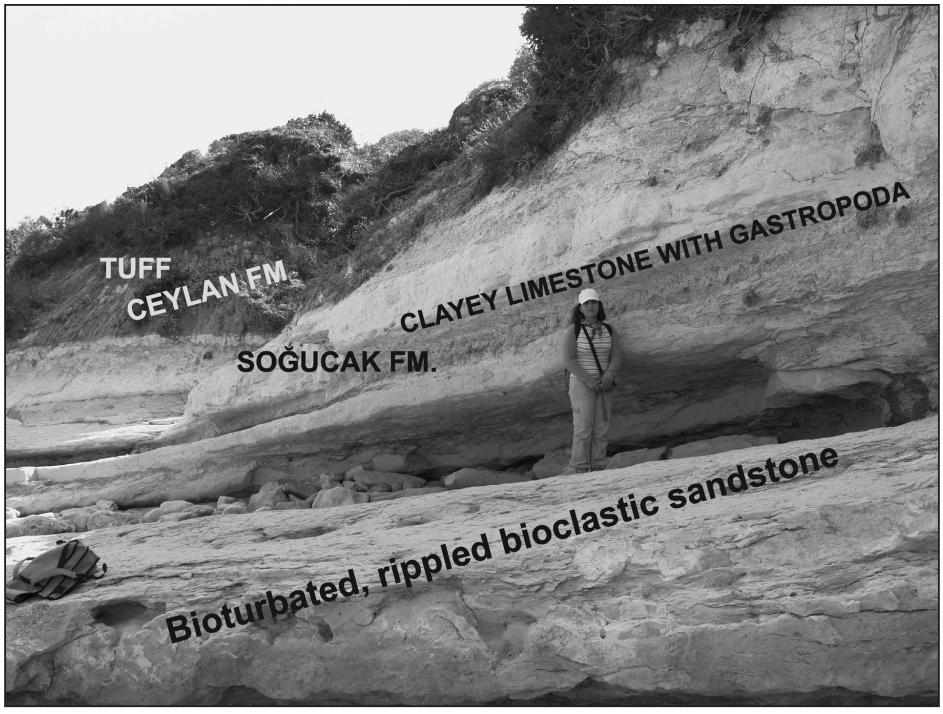

Figure 11- Facies assemblages representing the transition of the Soğucak – Ceylan formations in the Kıyıköy.

COMPARISON OF THE MEASURED STRATIGRAPHIC SECTIONS

Southern Sector: In this sector, the Bozcaada, Gökçeada, Tayfur (in Gelibolu Beninsula) sections and Mecidiye section (Gulf of Saros) were measured. The most different section here is the Bozcaada section; abundant *Alveolina canavari*, *Alveolina pasticillate*, *Alveolina* aff. *pisiformis*, *Alveolina avellena*, *Alveolina cemali*, *Alveolina* sp., and *Nummulites* sp., (Table1) fossils are dominant throughout the bank-type limestones in the unit which was determined to be Middle Eocene Soğucak formation previously. However the above mentioned fossils indicate Early Eocene (Figure 3). Another different point is about the lower boundary of the Soğucak formation. In previous studies, Fıçıtepe formation is defined as aterrestrial formation in the region. In this study, it was observed that the upper boundary of the formation is composed of beach pebblestones-micro reefal assemblage, and it is transitive with the Soğucak formation (Varol et al., 2007). Although in the Gökçeada, Mecidiye and Tayfur sections Fıçıtepe formation is unconformably located at the lower boundary of the Soğucak formation, especially in the Mecidiye section, it can directly overlie the basement rocks as a result of time transgression. Age of the unit defined in these sections is Middle-Late Eocene. In all the sections, Ceylan formation conformably take place at the upper boundaries of these sections (Table 1) (Figures 2-3).

Northern Sector: When a west to east ordering was made here, the first group is represented by the Süloğlu, Dolhan and Tekedere sections. The age interval determined as Late Eocene – Early Oligocene (Figure 5). In these sections the Early Oligocene (?) Soğucak formation (Late Eocene in Dolhan stream) unconformably overlies the basement. However, along the other

sections, clastics of the Koyunbaba formation are transitively located at the base. The upper contact of the formation is variabe in this region. In the Süloğlu, in a limited area, quartz sandstone and mudstone which are the products of a siliciclastic coastal development overlie the platform limestone (Taşlısekban formation) and this is overlain by *Congeria* bearing limestones (Pınarhisar formation). Extensions of these two formations which overlie the Soğucak formation are not observed in this position along the other sections. Only in the Dolhan stream a formation similar to the Pınarhisar is observed to overlie the Soğucak formation (Table 1). In the Tekedere stream this upper section is missing (Figure 4).

Northeastward, along the Manastırdere, Çayırdere, Erenler and Soğucak sections the Koyunbaba formation is observed at the base. Along Okçular section, Soğucak formation is observed to overlap the basement. Age of the Soğucak formation determined here is in general Late Eocene – Early Oligocene, however, along the Okçular section it is Late Eocene. Erenler section has a difference in this group (Figure 4). The oolitic facies and the *Congeria* bearing limestone in the section are not observed along the other sections. In previous studies these facies assemblage is mapped as the Pınarhisar (Keskin, 1966).

Along the Vize and Kıyıköy sections which are located at the easternmost part of the study area Soğucak formation is unconformable on the basement, however, along the section Kıyıköy 1a, a thin (3-5 m) siliciclastic level behind the Soğucak formation can be correlated to the Koyunbaba formation with its stratigraphic position. The age interval obtained from these sections is Late Eocene – Early Oligocene (Table 1, Figure 5). A significant matter that should be mentioned here is that Kıyıköy facies is quite different than the other facies assemblages in the areas of the other section with respect to the facies types and environments (shore, back-shore, beach, lagoon). The upper limit of the Soğucak formation passes by a thin tuffaceous level in lagoon facies to the Ceylan formation in Kıyıköy (Figure 11).

DISCUSSIONS AND RESULTS

Soğucak formation which crops out in the Thrace was deposited as reefal facies in general between Middle Eocene – Early Oligocene. The *Nummulites* banks, from the point of facies development, dominantly characterizes the Middle – Late Eocene. The dominant coral patchy reefs were deposited during Late Eocene – Early Oligocene. The facies around reefs have formed different deposition environments based on the sea level changes. These can be differentiated as back-reef – lagoon, tidal flat, oolite shoals and fore-reefs.

Soğucak formation was deposited in Early Eocene in the Bozcaada section. If this time interval is taken as a beginning point, it can be said that the Eocene transgression in the Thrace basin has advanced on an irregular topography time transgressively from south to north. For this reason, in the Kıyıköy which is the distant point of the transgression, a thick Oligocene sequence was deposited. The depositional features and age limits of the Soğucak formation pointed out in this study emphasize the necessity to deal with the following subjects:

1- The Early Eocene limestones cropping out in the Bozcaada were included in Soğucak formation, however, this unit must be studied in detail and its position in the Eocene must be clarified.

2- Interpretation of oolite and *Congeria* bearing limestones which were assumed to be a distinct facies group in the Soğucak formation in the Kaynarca-Erenler section as a different facies assemblage deposited in the platform where the Soğucak formation was deposited, and consequently its redefinition as a single formation (Soğucak Fm); this redefinition shall facilitate the correlation of Early Oligocene units which crop out widespreadly in the Soğucak formation.

3- The units which rest on the basement in the Kıyıköy are quite different than the facies defined in the Soğucak formation. In the region which is represented by high energy clastic carbonate depocenters (set island – beach complex, megaripples, etc.) detailed sedimentological studies are required.

ACKNOWLEDGEMENT

The authors thank TÜBİTAK for its contribution in realizing this study (Project no. 104Y333) and Dr. Ercüment Sirel (Ankara University) who carried out the paleontological determinations and Mr. Muzaffer Siyako (TPAO) for his remarks on the study.

Manuscript reacived February 2, 2009

REFERENCES

Batı, Z., Erk, S., and Akça, N., 1993. Trakya havzası Tersiyer birimlerinin palinomorf, foraminifer ve nannoplankton biyostratigrafisi. TPAO Araştırma Merkezi Grubu, Rapor no:1947, 92 p. Ankara, (unpublished).

Baykal, M., Varol, B., and Ayyıldız, T., 2007. Kuzey Trakya Soğucak Formasyonu' nun sedimantolojisi. 60. Türkiye Jeoloji Kurultayı Bildiri Özleri, 358, Ankara.

_____, _____, and _____., 2009. Kıyıköy ve yakın civarında (KD Trakya) Soğucak Formasyonu' nun ortamsal değerlendirilmesi. 62. Türkiye Jeoloji Kurultayı Bildiri Özleri Kitabı-I, 324-325, Ankara.

Çağlayan, M.A., and Yurtsever, A., 1998. Burgaz-A3, Edirne-B2 ve B3; Burgaz-A4 ve Kırklareli-B4, Kırklareli-B5 ve B6, Kırklareli-C6 paftaları, 1:100000 ölçekli açınsama nitelikli Türkiye Jeoloji haritaları, No:20,21,22,23 MTA, Ankara.

Erenler,M., 1985. Trakya baseni merkezi kısmında seçilen kuyuların mikropaleontoloji ve biyostratigrafileri. TPAO Araştırma Merkezi Grubu, Rapor no: 809. Ankara (unpublished).

Esso Standard, 1960. I sayılı Marmara petrol bölgesi AR/EST/105,106, 108 ve 109 hak sıra numaralı sahalara ait terk raporu. TPAO Arama Grubu, Rapor no: 1031. Ankara, (unpublished).

Görür, N and Okay, A.I., 1996. Fore – arc origin of the Thrace basin, northwest Turkey. Geologische Rundschau, 85, 662-668

Holmes, A.W.,1961. Stratigraphic review of the Thrace. TPAO Rapor no: 368. Ankara, (unpublished).

İmik, M, 1988. Kırklareli-C2-3 Paftası ve İzahnamesi, 1:100 000 ölçekli Türkiye Jeoloji Haritaları. Maden Tetkik ve Arama Genel Müdürlüğü, Ankara 10 p.

Islamoğlu, Y., Harzhauser, M., Gross, M., Jime´nez-Moreno, G., Coric, S., Kroh, A., Rögl, F., and van der Made, J., 2008. From Tethys to Eastern Paratethys: Oligocene depositional environments, paleoecology and paleobiogeography of the Thrace Basin (NW Turkey).

Kopp, K.O., Pavoni,N and Schindler,C., 1969. Geologie Thrakiens IV: Das Ergene-Becken. Beih zum Geol.Jahrb.,Heft 76,136 p., Hannover.

Kasar, S., Bürkan, K., Siyako, M., and Demir, O., 1983. Tekirdağ - Şarköy - Keşan - Enez bölgesinin jeolojisi ve hidrokarbon olanakları. TPAO Arama Grubu, Rapor no:1771, 71 p. Ankara, (unpublished).

Keskin, C., 1966. Pınarhisar resif karmaşığı mikrofasiyes incelemesi. Rev. Fac. Scien. Univ. İst., Seri B,31/3 -4, 109-146.

_____, 1974. Kuzey Trakya havzasının stratigrafisi. Türkiye İkinci Petrol Kongresi Tebliğleri Kitabı, 137-163.

Kesgin, Y., and Varol, B., 2003. Gökçeada ve Bozcaada'nın Tersiyer Jeolojisi (Çanakkale). Maden Tetkik ve Arama Dergisi, 126, 49-68.

Okay, A.I. and Tansel, İ., 1992. Pontid-İçi Okyanusunun Üst Yaşı Hakkında Şarköy Kuzeyinden (Trakya) Yeni Bir Bulgu. Maden Tetkik ve Arama Dergisi, 114, 21-24.

Önal, M., 1985. Gelibolu (Çanakkale) kuzeybatısının jeolojisi. Doktora Tezi, İstanbul Üniversitesi, Jeoloji Müh. Bölümü, İstanbul, 200 p.

_____, 2002. Başoğlu Üyesi'nin Litostratigrafisi (Gelibolu Yarımadası), Trakya Bölgesi'nin Litostratigrafisi adlamaları; Türkiye stratigrafi komitesi 2. Çalıştayı, MTA, 7, Ankara.

Sakınç, M., 1994. Karaburun (B İstanbul) denizel Oligosen'inin stratigrafisi ve paleontolojisi. Maden Tetkik ve Arama Dergisi, 116, 9-14.

Sirel, E. and Gündüz, H., 1976. Kırklareli (Kuzey Trakya) denizel Oligosen'in stratigrafisi ve Nummulites türleri. TJK Bülteni, 19/2, 155-158.

Siyako, M., 2006. Trakya Bölgesi Stratigrafi Komitesi Litostratigrafi Birimleri Serisi-2, 43-83. MTA Genel Müdürlüğü, Ankara.

_____, Bürkan, K. and Okay, A., 1989. Biga ve Gelibolu yarımadalarının Tersiyer jeolojisi ve hidrokarbon olanakları. Türkiye Petrol Jeolohları Derneği Bülteni, 1, 183-199.

Siyako, M. and Huvaz, O., 2007. Eocene Stratigraphic Evolution of the Thrace Basin, Turkey. Sedimentary Geology, 198, 75–91.

Şentürk, K. and Karaköse, C., 1998. Çanakkale-D2 Paftası, 1:100 000 ölçekli açınsama nitelikli Türkiye jeoloji haritaları, No: 62. MTA Genel Müdürlüğü, Ankara.

Sümengen, M., Terlemez, İ., Şentürk, K., Karaköse, C., Erkan, E.N., Ünay, E., Gürbüz, M., and Atalay, Z., 1987. Gelibolu yarımadası ve güneybatı Trakya Tersiyer Havzasının stratigrafisi, sedimantolojisi ve tektoniği. MTA Genel Müdürlüğü Rapor no:8218 (unpublished).

Temel, V. and Çiftçi, N.B., 2002. Gelibolu yarımadası Gökçeada ve Bozcaada Tersiyer Çökellerinin Stratigrafisi ve Ortamsal Özellikleri. Türkiye Petrol Jeologları Derneği Bülteni,14,17-40, Ankara.

Turgut, S., Siyako, M., and Dilki, A., 1983. Trakya havzasının jeolojisi ve hidrokarbon olanakları. Türkiye Jeoloji Kongresi Bülteni, 4, 35-46.

Turgut, S.,Türkaslan, M., and Perinçek, D., 1991. Evolution of the Thrace sedimentary basin and its hydrocarbon prospectivity. In: Spencer AM (ed) Generation, accumulation, and production of Europes hydrocarbons. Special Publication of European Association of Petroleum Geoscientists,1, 415-437.

_____ and Eseller, G., 2000. Sequence stratigraphy, tectonics and depositional history in Eastern Thrace Basin, NW Turkey. Marine and Petroleum Geology, 17, 61 - 100.

Umut, M., Kurt, Z., İmik, M., Özcan, İ., Sarıkaya, H., and Saraç, G., 1983. Tekirdağ, Silivri (İstanbul), Pınarhisar alanının jeolojisi: MTA Derleme no: 7349. Ankara, (unpublished).

_____, _____, _____, Ateş, M., and Saraç, G., 1984. Edirne-Kırklareli-Lüleburgaz-Uzunköprü civarının jeolojisi: MTA Derleme No: 7604. Ankara, (unpublished).

Varol, B., Sirel, E., Ayyıldız, T., and Baykal, M., 2007. Bozcaada'da (Çanakkale) Soğucak Formasyonun'da saptanan yeni paleontolojik ve sedimantolojik Bulgular. Maden Tetkik ve Arama Dergisi, 135, 83-86.