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**MICROFACIES CHARACTERISTICS OF THE
GUVERCINLIK FORMATION, TAHTAISKELE-
YELLICEBELEN MOUNTAIN
(KARABURUN PENINSULA)**

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Graduate School of Natural and Applied Sciences of
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the Degree of Master of Science in Geology Engineering,
General Geology Program**

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DOKÜMANTASYON MERKEZİ**

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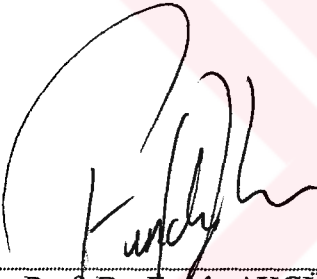
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We certify that we have read this thesis and “**Microfacies Characteristics of the Guvercinlik formation, Tahtaiskele-Yellicebelen Mountain (Karaburun Peninsula).**” completed by **Emel Sedef KAYA** under supervision of **Prof. Dr. Sacit ÖZER** and that in our opinion it is fully adequate, in scope and in quality, as a thesis for the degree of Master of Science.



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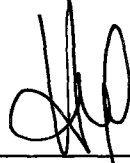


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Emel Sedef KAYA

ABSTRACT

The facies characteristics and depositional environments of the Güvercinlik formation are examined around Çatalkaya Village (Mordoğan). The Güvercinlik limestone (Norian-Rhätian) consists of dolomitic limestones, stromatolitic dolomitic limestones, megalodon-bearing limestones, mudstone intercalations and sandstone lenses.

Three stratigraphic sections were measured in the Tahtaiskele, Yellicebelen Mountain and Zendemir Hill and collected 93 samples. Results of petrographic studies of these samples identify eleven microfacieses; stromatolite / algae-boundstone / mudstone, mudstone-bioclastic mudstone, Intraclastic-algae / bioclastic wackestone, wackestone-packstone, bioclastic wackestone-floatstone, intraclastic packstone, bioclastic / miliolid packstone, pelletoidal / packstone-grainstone, bioclastic packstone-floatstone, packstone-boundstone / algae framestone, and bioclastic grainstone-rudstone-floatstone.

These microfacies associations indicate; intertidal channel, intertidal, subtidal, restricted shallow and biostrome depositional environments.

Different diagenetic effects were developed. Dolomitization is the most observed diagenetic effect. Another diagenetic events are dedolomitization, geopetal structure, stylolization, micrite envelope, fracture and void filling spar, bioturbation structures and recrystallization.

ÖZET

Güvercinlik formasyonunun (Noriyen-Resiyen) fasiyes özellikleri ve çökelme ortamları Çataalkaya Köyü (Mordoğan) çevresinde incelenmiştir. Güvercinlik formasyonu kireçtaşları, dolomitik kireçtaşları, stromatolitik dolomitik kireçtaşları, megalodon içerikli kireçtaşları, çamurtaşı arakatkıları ve kumtaşı merceklerinden oluşur.

Tahtaiskele, Yellicebelen Dağı, Zendemir Tepe'den üç stratigrafik kesit ölçülmüş ve 93 adet örnek derlenmiştir. Bu örneklerden yapılan petrografik çalışmalar sonucunda 11 adet mikrofasiyes tanımlanmıştır; stromatolitik / alg-bağlamtaşı / çamurtaşı, çamurtaşı-biyoklastik çamurtaşı, intraklastik – alg / biyoklastik vaketaşı, vaketaşı-istiftaşı, biyoklastik vaketaşı-yüzertaş, intraklastik istiftaşı, biyoklastik / miliolid istiftaşı, pelletli / istiftaşı-tanetaşı, biyoklastik istiftaşı-yüzertaş, istiftaşı-bağlamtaşı / alg çatıtaşı ve biyoklastik tanetaşı-kabataş-yüzertaş.

Mikrofasiyesler 5 çökelme ortamında gelişmişlerdir; Gelgit içi kanal, gelgit içi, gelgit altı, sığ sınırlı, biostrom.

İncelenen kesitlerde farklı diyajenetik etkenler gözlenmiştir. Dolomitizasyon en çok gözlenen diyajenetik olaydır. Dedolomitizasyon, geopetal yapılar, basınç erimesi, mikritik zarf, çatlak ve boşluk dolgusu spar, biyoturbasyon yapıları ve rekristalizasyon diğer diyajenetik olaylardır.

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CHAPTER ONE

INTRODUCTION

1.1. Location of the Study Area

The study area is located in the eastern part of Karaburun Peninsula, about 80 km west of Izmir, in 1/25000 scale Urla K 17 d3 and L 17 a2 maps. This area is situated between the Çatalkaya Village and Tahtaiskele area (Fig 1.1). Izmir-Cesme highway can be used to reach the study area.

The study area has high topografic relief. Zendemir Hill, Yellicebelen Mountain and İçme Hill are main topografic peaks in the study area. Mainly, scrubs and forests are seen in the study area.

1.2. Purpose and Methods

Purpose of this study is to determine microfacies characteristics and deposition environments with diagenetic properties of the Güvercinlik formation.

Three vertical sections were measured in the Tahtaiskele area, Yellicebelen Mountain, and Zendemir Hill. 93 samples were taken and thin sections prepared. Olympus, B / 201 research microscope is used for taking microfacies photographs.

Carbonate samples were classified using Dunham (1962) and Gregg & Sibley's (1984) classification schemes (Fig 1.2 and Fig 1.3). Dunham (1962) was classified the carbonate rocks based on primary components and Gregg & Sibley (1984) were classified the dolomitic rocks based on the shape of crystals.

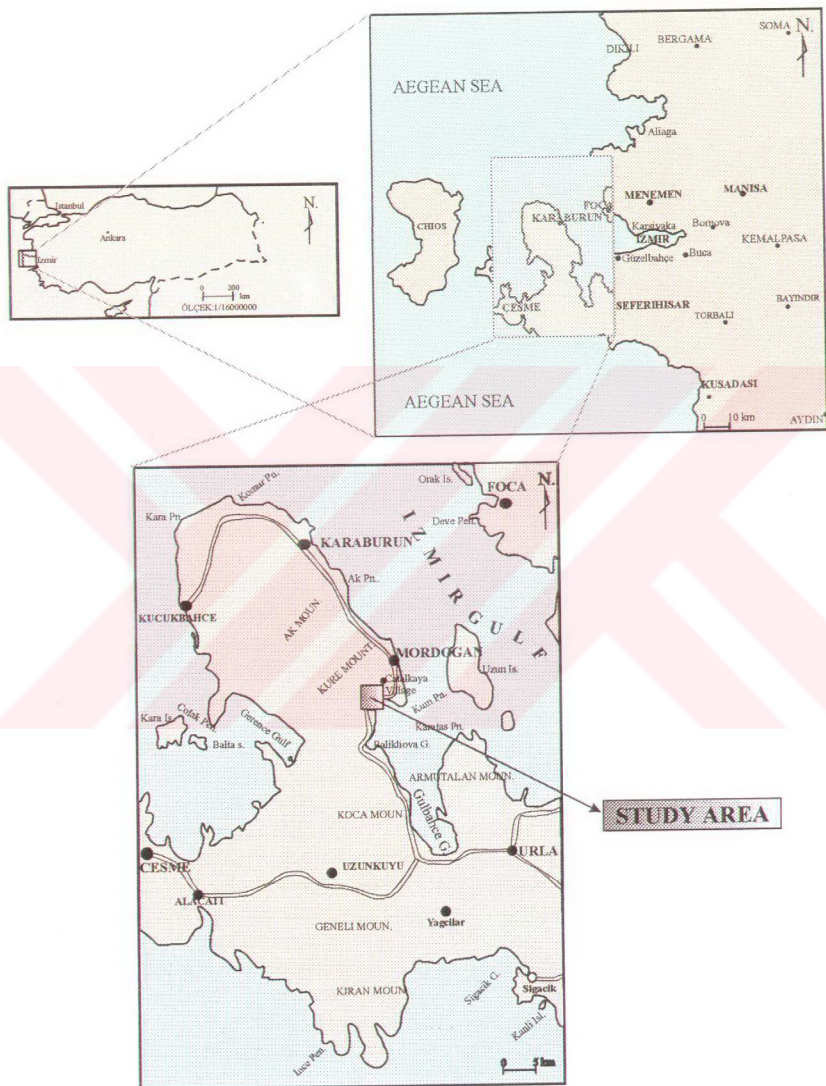


Figure 1.1. Location Map of The Study Area

ALLOCHTHONOUS LIMESTONE				AUTOCHTHONOUS LIMESTONE		
Original components not organically bound during deposition				Original components organically bound during deposition		
Less than 10% > 2 mm components		Greater than 10% > 2 mm components		By organisms that build a rigid framework	By organisms that encrust and bind	By organisms that act as baffles
Contains lime mud (<0.03 mm)		No lime mud		BOUNDSTONE		
Mud supported		Matrix supported				
Less than 10% grains (>0.03 mm <2 mm)	Greater than 10% grains					
MUDSTONE	WACKSTONE	PACKSTONE	GRAINSTONE	RUDSTONE	FRAMESTONE	BINDSTONE
				BAFFLESTONE		

Figure 1.2. Classification of Carbonate Rocks According to Depositional Textures (After Embry and Klován, 1971 and James, 1984)

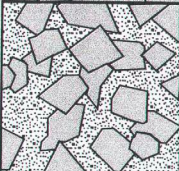
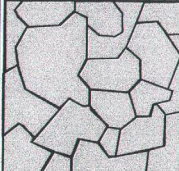
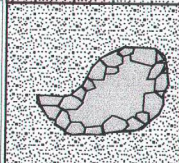
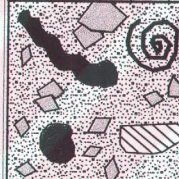
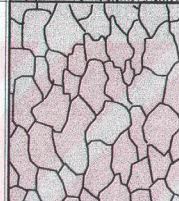
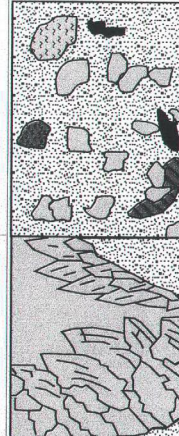
CRYSTAL BOUNDARY SHAPE					
PLANAR (IDIOTOPIC) DOLOMITE rhombic, euhedral to anhedral crystals			NONPLANAR (XENOTOPIC) DOLOMITE nonrhombic, commonly anhedral dolomite		
PLANAR-EUHEDRAL most dolomite crystals are euhedral rhombs; crystal- supported with intercrystalline areas filled with another mineral or unfilled (porous)	PLANAR-SUBHEDRAL subhedral to anhedral dolomite crystals with low porosity and/or low intercrystalline matrix; straight compromise boundaries are common and many of the crystals have preserved crystal-face junctions	PLANAR VOID-FILLING euhedral dolomite crystals lining large pores and vugs or surrounding patches of another mineral such as gypsum or calcite	PLANAR-PORPHYROTOPIC euhedral dolomite crystals floating in a limestone matrix; crystals are matrix-supported	NONPLANAR-ANHEDRAL tightly packed anhedral dolomite crystals with mostly curved, oblate, serrated, indistinct or otherwise irregular intercrystalline boundaries; pre-crystal-face junctions rare; crystals commonly have undulatory extinction	NONPLANAR-VOID-FILLING pore-lining, saddle-shaped, or baroque (irregular) dolomite crystals characterized by scimitar-like termination, as viewed in thin section; sweeping extinction
					

Figure 1.3. Classification of dolomite textures (After Boggs, S. 1995)

1.3. Scope

The goals of this study are as follows:

- 1) To identify the microfacies of the Güvercinlik formation and the bottom of Nohutalan formation based on the petrology, sedimentary structures and fauna.
- 2) To determine the depositional environments of the Güvercinlik formation with respect to identify microfacies.

1.4. Previous Studies

The study area was examined by various researches (Kalafatçıoğlu, 1961; Brinkmann, 1966; Brinkmann et al, 1967; Erdoğan et al, 1990; Erdoğan, 1990; Işintek, 2002).

Brinkmann (1966), studied geological evolution of the western Anatolia and determined paleogeography of the Triassic carbonate succession in Karaburun Peninsula.

Kalafatçıoğlu (1961) studied northwestern part of Karaburun and defined detrital rocks as the Devonian graywackes, Jurassic to Crataceous aged carbonate succession was defined by author laying on Devonian graywackes, overlid by Miocene aged youngest units which are tuff, andesite, basalt and riolite. The author was observed many cracks and faults in the field because of the volcanic activity.

Brinkmann et al (1972) was investigated central region of the Karaburun Peninsula. The authors were studied in detail microflora and, micro and macrofauna of the Triassic to Cretaceous carbonate succession.

Erdoğan (1990) was studied in western Anatolia separated three tectonic belts, which are Menderes Massif, Izmir-Ankara Zone and Karaburun Belt, from east to west. According to the author, the Menderes Massif is composed of metamorphic rocks, the upper most section of which is Early Eocene age. The Izmir-Ankara zone, which is thrust over the Menderes Massif, is represented by a melange of Campanian-Danian age. The author used Bornova melange for this coatic unit, is made up of matrix of sedimentary rocks of flysch facies and mafic volcanic intercalations and blocks of limestones more than 20 km in length in some areas. According to the author the limestones megablocks are similar to the Karaburun carbonate succession. Erdoğan (1990) determined that the Karaburun succession evolved İzmir-Ankara Zone. After that because of the tectonic activity it was transported as nappes during the flysch deposition.

Erdoğan et al (1990) studied the thick Karaburun carbonate assemblage and separated units from older to younger;

- Lower and Middle Carboniferous aged Alandere formation,
- Scythian-Anisian aged Denizgiren Group which is divided into two members; Karareis formation and Gerence formation,
- Ladinian-Carnian aged Camiboğazı formation,
- Norian- Retian aged Güvercinlik formation,
- Lias-Lower Cretaceous aged Nohutalan formation,
- Campanian-Maastrichtian aged Balıklıova formation which is composed of Haneybaşı member and Karahasan limestone member,
- Maastrichtian-Danian aged Bornova Melange,
- Neogene aged andesites and lake sediments.

İşintek (2002), studied stratigraphy and paleontology of Mesozoic carbonate succession of the central region of the Karaburun Peninsula. According to the author Güvercinlik formation is separated in to three unit from base to top; Hanaylı member, Güvercinlik formation and Lower limestone subunit of the Nohutalan formation, which are yield an age ranging from Norian to Rhatian.

CHAPTER TWO

STRATIGRAPHY

2.1. Introduction

Three tectonic belts are separated in the western Anatolia, around Izmir region. These are from east to west the Menderes Massif, the Izmir-Ankara Zone and the Karaburun Belt. The Karaburun Belt is consisting of platform type carbonate succession. According to Erdoğan (1990) the oldest unit of the Karaburun succession is in the Lower-Middle Carboniferous Alandere formation, which is composed of dark brown and dark gray limestones with abundant fossils and crinoid stalks. In the Lower-Middle Triassic the Denizgiren group is unconformably overlies the Alandere formation. It includes the detrital-rich Karareis and the carbonate rich Gerence formations. The Camiboğazi formation resting with a gradational contact on each of these units consists of massive limestones and yields an age of Ladinian-Carnian. The Güvercinlik formation overlies conformably the Camiboğazi formation, and consists of intercalations of dolomitized algal stromatolites, megalodon-bearing limestones and red sandstones. The formation ranges in age from Norian to Rhetian. The Güvercinlik formation conformably grades into the overlying the Nohutalan formation that is neritic limestones and yields an age ranging from Liassic to Albian. Campanian-Maestrichtian age Balıklıova formation overlies all carbonate succession with angular unconformity. Balıklıova formation is divided into Haneybaşı member and Karahasan limestone (Erdoğan et al, 1990), which consist of sandstone and mudstone intercalation and neritic limestone respectively. Neogene volcanics unconformably overlies Balıklıova formation. This volcanics are whitish-light yellow colored that is composed of unconsolidated tuff and andesite blocks. Alluvium and Talus are interfingering each other and unconformably lies on Neogene Volcanics (Fig 2.1-2).

According to Işıntek (2002), the Mesozoic carbonate assemblage consists of pre-Middle Anisian aged and/or Middle Anisian aged Gerence formation, Middle Anisian to Norian aged Camiboğazı formation, Norian aged Güvercinlik formation, Rhatian to Middle Liassic aged Nohutalan formation, Kimmeridgian aged Birgi formation and Albian and/or post-Albian aged Aktepe formation from base to top. The Camiboğazı formation is divided into three members, which are; Middle Anisian to Ladinian, aged Laleköy, Ladinian to Carnian aged Saplazdağ and Carnian to Norian aged Hanaylı Members. The Nohutalan formation is divided informally into two members Thaetian to Early Liassic Lower limestone and Early to Middle Liassic Upper limestone subunits. The Aktepe formation is divided into two members which are; informally into Albian Limestone and Albian and/or post-Albian Limestone-conglomerate subunits.

In this study, the stratigraphic position of the Güvercinlik formation is used based on Erdoğan et al (1990).

2.2. Stratigraphy

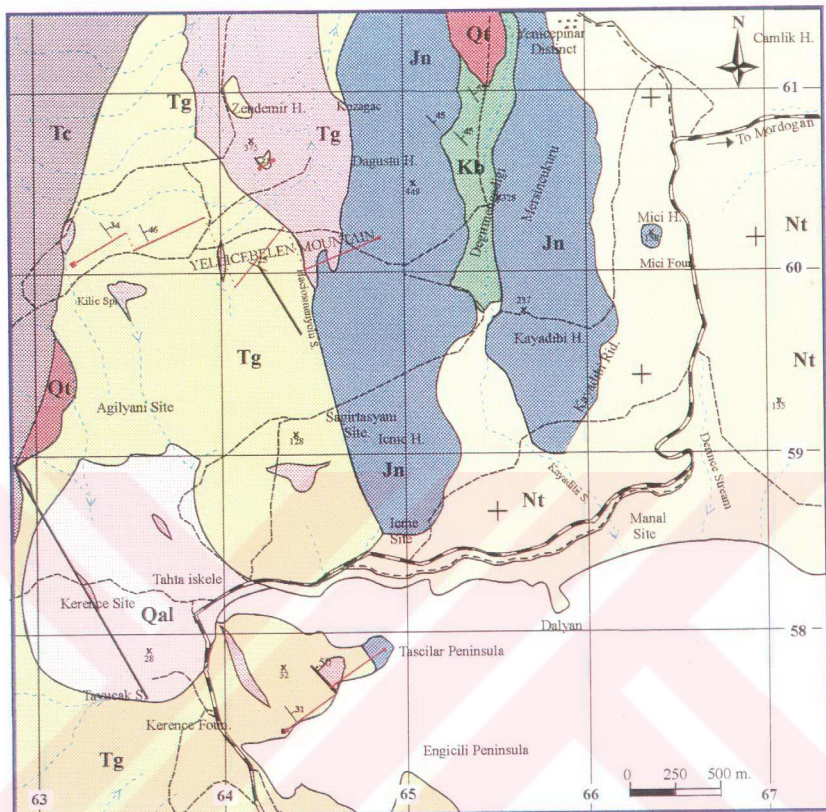
Güvercinlik formation, Nohutalan formation, Balıklıova formation and Neogene volcanics are seen in the study area (Fig 2.3). In this chapter the main field characteristics of the formations will be described.

2.2.1. Güvercinlik formation

2.2.1.1. Description

Güvercinlik formation is observed in Zendemir Hill, Yellicebelen Mountain and Tahtaiskele locality from north to south (Fig. 2.3.).

The Güvercinlik formation characterized by dolomitic limestones, limestones, mudstones and red sandstone lenses. Limestones are seen as inclined slopes and thin ridges, and dolomitic limestones and sandstone lenses are seen in plains.



EXPLANATIONS

Quaternary	Qt	Tallus	Boundary	Road
	Qal	Alluvium	Fault	District
Neogene	Nt	Mici Unit	Strike and dip of fault	Stream
Campanian-Maastrichtian	Kb	Balikliova formation	Strike and dip of bedding	
Lias-Lower Cretaceous	Jn	Nohutalan formation	Section Line	
Norian-Rhaetian	Tg	Guvercinlik formation (Limestones, dolomitic limestones, stromatolitic limestones)	Hill	
Ladinian-Carnian	Tc	Camibogazi formation	Path	

Figure 2.1. Geological Map of the Study Area

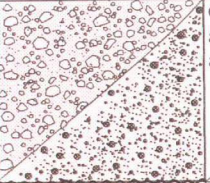
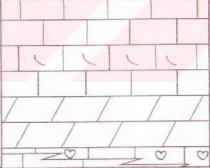
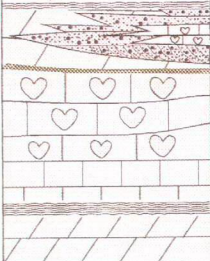
AGE		Thickness	Formation/ Unit	Symbol	LITHOLOGY	EXPLANATION
CENOZOIC	QUATERNARY		TALLUS ALLUVIUM	Qt		Gray limestone blocks in a reddish colored clay and silt matrix
				Qal		Unconsolidated pebbles and clay-sand size soil
	TERTIARY					DISCONFORMITY
	Neogene	~ 110m	NEOGENE VOLCANICS	Nt		Light yellow colored unconsolidated tuff
						DISCONFORMITY
MESOZOIC	Cretaceous	~ 50m	BALIKLIOVA FORMATION	Cb		Intercalations of sandstone and shale, observed deformation
						DISCONFORMITY
	Jurassic	~ 1800m	NOHUTALAN FORMATION	Jn		Beige, bituminous limestone, dolomitic limestone
	Triassic	~ 1200m	GUVERCINLIK FORMATION	Tg		Stromatolite dolomitic limestone, limestone with megalodont, green colored mudstone, and sandstone lense

Figure 2.2. Generalized Stratigraphic Columnar Section



Figure 2.3. Panoramic View of the Study Area.

Nt Neogene Volcanics

Kb Balıklıova formation

Jn Nohutalan formation

Tg Güvercinlik formation

2.2.1.2. Lithology

The formation is consist of light gray to light beige, whitish gray, medium to thickly bed to massive limestones and dolomitic limestones, and quartzite red sandstone lenses that comprises megalodon-bearing limestone lenses. The red sandstones contain sedimentary structures including crossbeds and bioturbation structures (Collinson & Thompson, 1987; Wright & Milroy, 2000). Doloites have interbedded green mudstones which are approximately 30-50 cm thick (Fig. 2.4).



Figure 2.4. Photo Depicts Dolomite of the Güvercinlik Formation with Intercalations of Green Colored Mudstone. Coordinate: 65020 / 56533.

Güvercinlik formation is composed of beige-gray colored dolomitic limestones (medium thick to thin bedded), beige-light gray colored stromatolitic limestones (medium thick to thin bedded), whitish-pink colored megalodon-bearing limestones (massive to thick bedded) and pink limestones with gray limestones with gray limestone breccias (Fig 2.5).



Figure 2.5. The Dolomitic Limestones of the Güvercinlik Formation in the Tahtaiskele Location. Coordinate: 64680/ 57880.

2.2.1.4. Contact

The Güvercinlik formation overlies conformably the Camiboğazı formation (Erdoğan et al, 1990). The contact between the Güvercinlik and Nohutalan formation is conformable (Erdoğan et al, 1990) (Fig 2.1). The contact is exposed in western part of the Yellicebelen Mountain and Zendemir Hill.

2.2.1.5. Age and Fossil Content

According to fossil assemblages of Erdoğan et al (1990) the Güvercinlik formation ranges from Norian to Rhaetian. The fossil association of the formation is *Ataxophragmiidae*, *Auloconus permodiscoides*, *Aulotortus* sp., *Aulotortus sinousus*, *Aulotortus tumidus*, *Earlandia* sp., *Glomospira* sp., *Lituolidae*, *Mayncina*

sp., *Mayncina* cf. *termieri*, "*Meandrospira*"sp., *Mesoendothyra* sp., *Orbitopsella* cf. *primaeva*, *Paleodasycladus mediterraneus*, *Paleodasycladus elongatulus*, "*Siphovalvulina*" sp., *Thaumatoporella parvovesiculifera*, *Triasina hantkeni*.

2.2.2. Nohutalan formation

2.2.2.1. Description

Nohutalan formation is can be observed in different localities such as Dağüstü Hill, Kayadibi Hill, Mersinçukuru locality of Çatakaya Village and Mici Hill. The formation is recognizable by its high relief in topography (Fig. 2.1.).

The Güvercinlik formation is characterized by well-bedded bioclastic limestone and stromatolitic limestone. This formation is equivalent of "cladocoropsis limestones" of Brinkmann et al (1972).

2.2.2.2. Lithology

The Nohutalan formation which is medium thick-thick bedded to massive limestone succession, is beige-light beige and grey coloured. Massive limestones consist of coral, algae, and reefal facieses. Karst structures can be observed in the field.

2.2.2.3. Contact

The Nohutalan formation overlies conformably Güvercinlik formation (Erdoğan et al, 1990). The contact is observed in western part of the Dağüstü Hill.

Bahıklıova formation overlies unconformably the Nohutalan formation (Erdoğan et al, 1990).

2.2.2.4. Age and Fossil Content

Erdoğan et al (1990) determined the Nohutalan formation ranges in age from Liassic-Albian based on following fossil assemblages; *Aulotortus sinousus pragsoides*, *Aulotortus sinousus sinousus*, *Aulotortus communis*, *Aulotortus* sp., *Triasina* sp., *Auloconus permodiscoides*, *Glomospira* sp., *Ataxophragmiidae*, *Tharmatoporella parvovesiculifera*, *Kurbnia* ex. gr. *Palastiniensis*, *Pfenderina* sp., *Parurgonia caelinensis*, *Valvulina lugeoni*, *Tokayella taurica*, *Protopenneropsis striata*, *Cladocoropsis mirabilis*, *Clypenia jurassica*, *Clypenia* sp., *Rectocyclammina* sp., "*Siphovalvulina*" sp., *Pseudoclypenia* sp., *Ophthalmidium* sp., *Nodosaridae*, *Tubiphytes morronensis*, "*Lithocodium*" sp., *Conicospirillina basiliensis*, *Lenticulina* sp., *Miliolidae*, *Spirillina* sp., *Haplophragmoides* sp., *Globochaete alpina*, *Trecholina* sp., *Pseudocyclammina lituus*, *Nautiloculina* sp.

2.2.3. Balıklıova formation

2.2.3.1. Description

Haneybaşı member of Balıklıova formation, which was determined by Erdoğan (1990) and Erdoğan et al. (1990) is observed in the study area. this member can be seen in and around the Dağüstü Hill, Mersinçukuru and Kayadibi Hill (Fig 2.1).

Haneybaşı member is characterized by detrital sedimentary rocks which are mudstone and sandstone. Because of mudstone intercalations Haneybaşı member can be taken into consideration wrongly that is flysch (Erdoğan, 1990; Erdoğan et al. 1990).

2.2.3.2. Lithology

The Haneybaşı member is which is composed of sandstone and mudstone intercalations, is thin bedded to laminated, is dark brown-beige colored. Quartzite vein is widespread in this member. Orientation of the layers of this formation was changed by deformation.

2.2.2.3. Contact

The Haneybaşı member of the Balıklıova formation overlies the Nohutalan formation with an angular unconformity (Erdoğan et al, 1990). The contact is observed clearly between Dağüstü Hill and Mersinçukuru, and Kayadibi Hill localities.

The Neogene volcanics unconformably overlies the Haneybaşı Member (Erdoğan et al, 1990).

2.2.2.4. Age and Fossil Content

Haneybaşı member of the Balıklıova Formation is Campanian-Maastrichtian in age (Erdoğan, 1990; Erdoğan et al, 1990).

2.2.4. Neogene Volcanics

Neogene Volcanics outcrops can be seen in Tekke District, Çatalkaya Village, and Yenicepınar District (Fig. 2.1).

The Neogene Volcanics, which consists of tuff and andesite blocks and pebbles, are light cream and yellow colored are medium bedded. The Neogene Volcanics included silica noduls, andesite blocks and pebbles are observed in Neogene aged Tuff in Derince Stream northeast of Manal site.

The Neogene Volcanics unconformably overlies the Haneybaşı Member of the Balıklıova formation.

The volcanics is Neogene in age (Kalafatçıoğlu, 1961).

2.2.5. Alluvium and Tallus

Alluvium is exposed in the study area where is plain. Especially, alluvium is seen in the Tahtaiskele locality (Fig. 2.1.).

Alluvium consists of different materials Which are the fragments of the surrounding rocks.

Mainly limestones which are well rounded, is seen in the alluvium. Clay size to block size of different type of rock fragments are typical.

Tallus is observed in the southern part of Çatalkaya Village and Northerneast part of Dağüstü Hill.

The Tallus consist of limestones belonging probably the Nohutalan formation. Limestone debris are angled and matrix is reddish brown colored consisting clay to sand material, which is unconsolidated.

The Alluvium and Tallus overlie angular unconformably Neogene Volcanics.

Tallus and Alluvium are Quaternary in age.

2.3. Measured Sections

Three stratigraphic sections are measured in the Tahtaiskele, Yellicebelen Mountain and Zendemir Hill locations as follows. Locations of these measured stratigraphic sections are displayed in Fig 2.1.

2.3.1. Tahtaiskele Measured Stratigraphic Section

Tahtaiskele Section is measured in Tahtaiskele Location which is started from the Güvercinlik formation limestones and is continued with the Nohutalan formation

limestones. Length of the section is approximately 851 meters and 38 samples are collected.

Approximately first 30 m. of the measured section mainly consist of fine crystalline, gray-dark gray colored, generally dolomite and limestone, and stromatolitic limestone (Fig 2.6-7).



Figure 2.6. Typical View of Stromatolite Dolomitic Limestones.

Coordinate: 64307 / 57286.

Low faunal diversity and little numbers of forms observed in these meters that are miliolid, gastropod, "*Siphovalvulina*" sp. and algae. Dolomitization is most appeared diagenetic effect in this 30 meters, which is observed to scattered above matrix and / or completely covered originally texture in some thin sections. All kinds of dolomite crystals were observed according to Gregg & Sibley (1984)'s classification. And also, well-developed palanar (idiotopic) dolomite crystals were zoned in this study by using thin sections.



Figure 2.7. The Stromatolitic Dolomitic Limestones and Cross Lamination. Diameter of the Scale is 6 cm. Coordinate: 64307 / 57286.

Half rounded and unrounded intraclasts are observed in dolomitic limestone. Intraclasts which are composed of limestones and stromatolitic limestones, poorly sorted (Fig 2.8.). Pink colored thin-layered limestones are observed in the Tahtaiskele stratigraphic measured section that are included white colored limestone breccias (Fig 2.9.), which are not orientate and its size are approximately 1.5 cm.

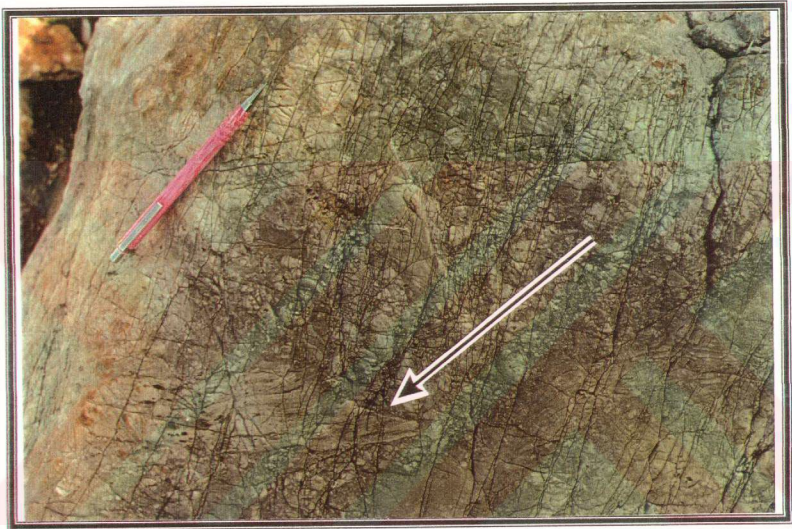


Figure 2.8. Dolomitic Limestone, Which is Include Intraclasts of Limestone and Stromatolitic Limestone (Arrow). Coordinate: 64350 / 57350.

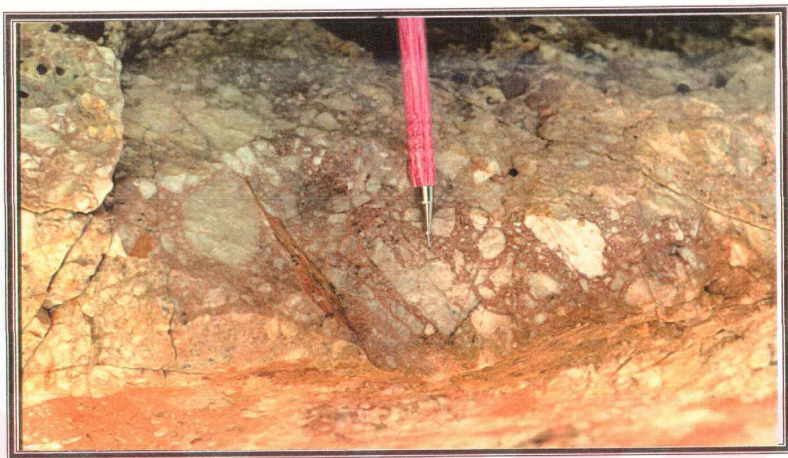


Figure 2.9. Pink Colored Thin-Layered Limestones Included that White Colored Limestone Breccia. Coordinate: 64351 / 57350.

Fenestrae generally appeared in limestones that are generally millimeter-scale features. It can be opened or/and filled by spar calcite and dolomite. Demicco & Lawrence (1994) were described fenestrae and divided them into four categories, which are laminoid, tubular, spherical to subspherical, and irregular (Fig 2.10.). origin of laminoid fenestrae is due to the molds of fleshy cyanobacterial mats buried by sediment. In addition, drying out of surface cyanobacterial mats can wrinkle, lift and separate them from the adjacent sediment. Gases generated by organic decay can also lift subaqueous mats or buried mats to produce Laminoid fenestrae. These fenestrae may also be produced by the compaction of subspherical gas bubbles. Irregular fenestrae are the most problematic because they can be formed in a variety of ways. Also, they can be formed by desiccation and soft-sediment deformation. Originally, some irregular shaped fenestrae, such as gas bubbles, evaporite molds, burrows. Other origins that have been suggested for irregular fenestrae include dewatering of gel-like carbonate muds, replacement of evaporites, and replacement of allochems (Demicco & Lawrence, 1994).

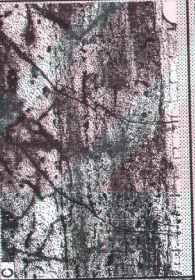
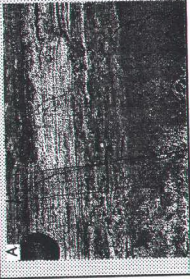
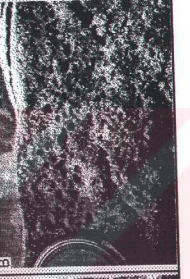
FENESTRAE				
Laminoid Fenestrae They are molds of fleshy cyanobacterial mats buried by sediment, and by the compaction of subspherical gas bubbles.	Tubular Fenestrae Originate as burrows and as root holes, but they can also be formed by the upward escape of gas bubbles biogenically produced within the sediment.	Spherical and Subspherical Fenestrae Produced by air and gas bubbles trapped during deposition of the host sediment or generated by post-depositional decay of organic matter.	Irregular Fenestrae Formed in a variety of ways, such as gas bubbles, evaporite molds, burrows, so on (dewatering of gel-like carbonate muds, replacement of evaporites, replacement of allochems).	
Depositional Environment: under intertidal to supratidal.	Depositional Environment: supratidal.	Depositional Environment: subtidal.	Depositional Environment: subtidal.	
				
				

Figure 2.10. Categories of the Fenestral Fabric (After Demicco and Hardie, 1994)

In the measured columner section, after approximately 30 meters, limestones are thicker and lighter than the previous sequence that are included thick and large megalodon fossils and size of these megalodons 15-60 cm. (Fig 2.11-13.).



Figure 2.11. The Megalodon Fragments in the White Colored Limestones of The Güvercinlik Formations. Coordinate: 64410 / 57380.

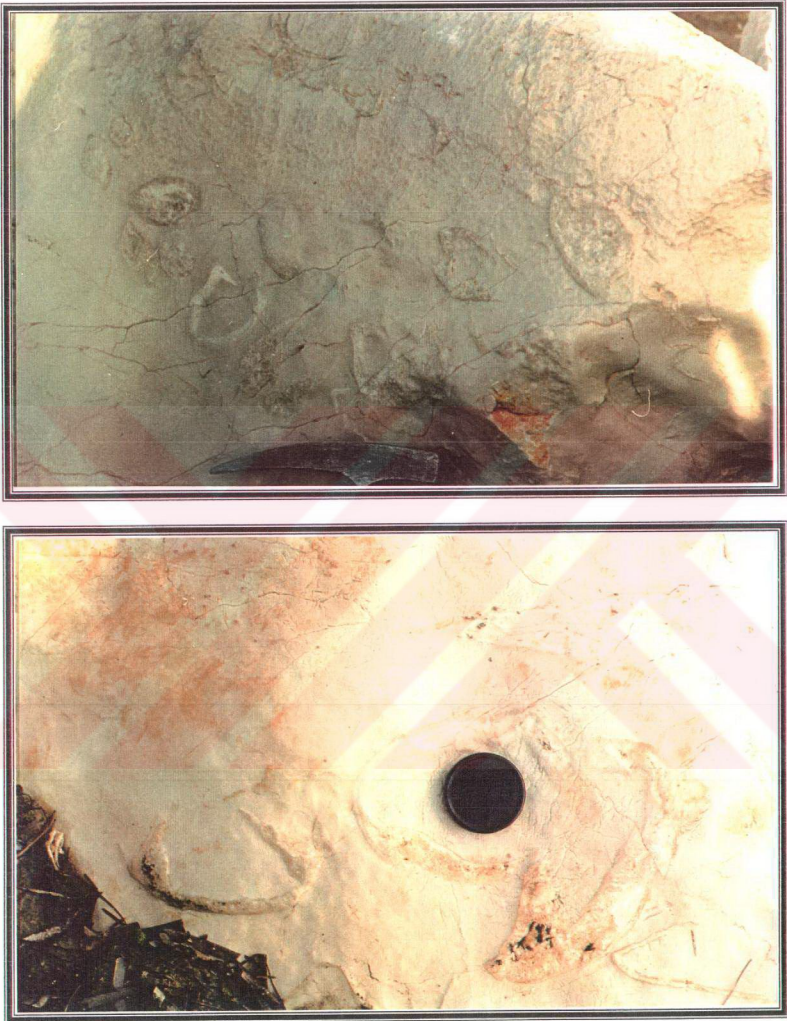


Figure 2.12-13. Photos Show the Megalodons in the White Colored and Masif Limestones of the Güvercinlik Formation. Note the Size of Megalodons. Diameter of the Scale is 6 cm.
Coordinate: 64410 / 57380.

Various energy and facies changing is observed most of the area in the Tahtaiskele section. This energy changing was formed pebbles, breccias and various sedimentary structures (Fig. 2.14-15)

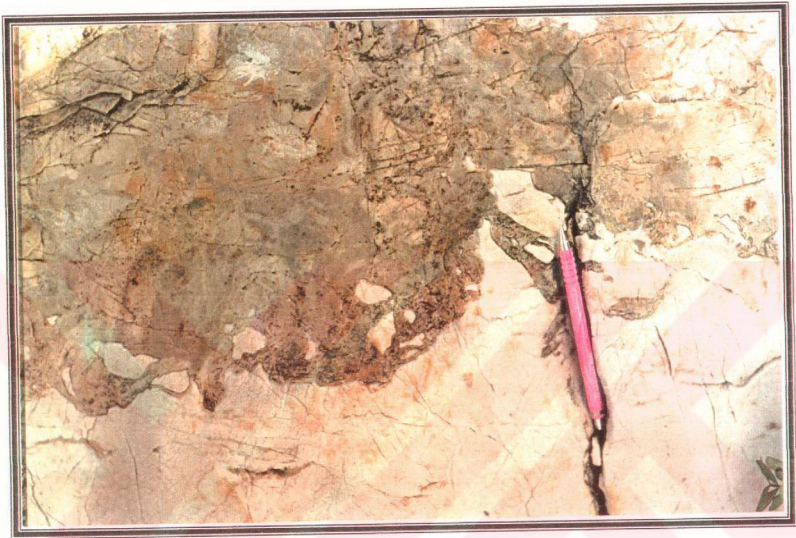


Figure 2.14. Energy Changing in Güvercinlik Limestones. The Construction of Beige Colored Dolomitic Limestone on the Top and White Colored Massif Limestone on the Bottom. Note the Wavy Contact and White Small Breccia. Coordinate: 64510 / 57580.



Figure 2.15. Beige Colored Limestone Breccia in Dolomitic Limestones of the Güvercinlik Limestones. Coordinate: 64512 / 57583.

These breccia is probably *in-situ* or collapsed breccia that was occurred in shallow subtidal / intertidal environments from solution pores or vugs and fenestrae. This structures occurred in progressively increasing duration of exposure (Yılmaz & Altınır, 2001) (Fig 2.16).

Result of energy changing can be observed in facies varying and facies succession (Fig 2.17).

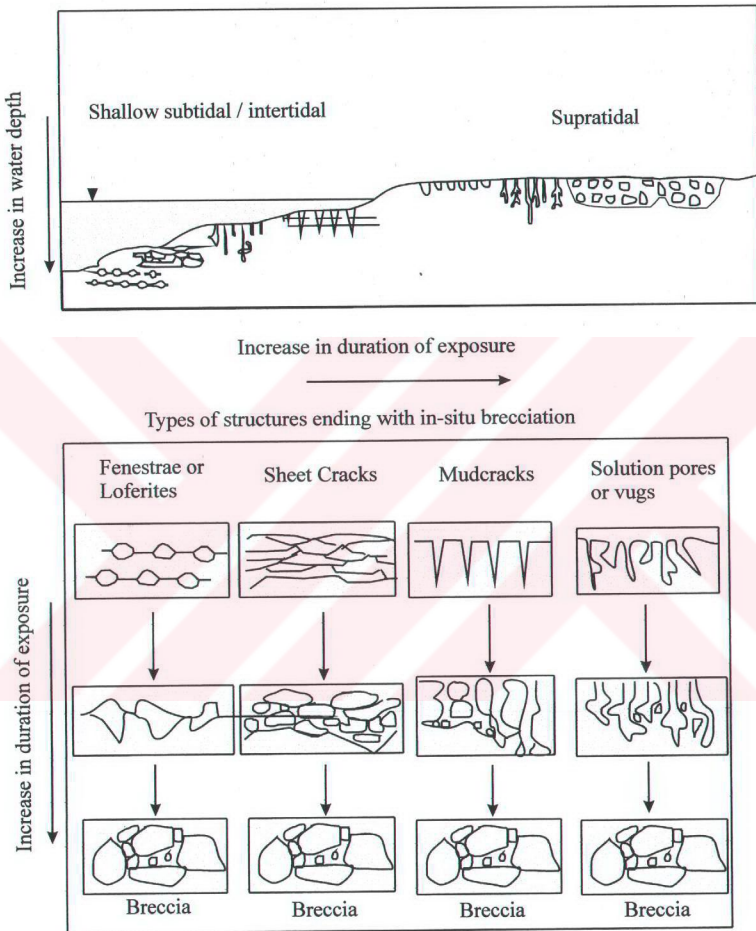


Figure 2.16. Relationship of Sedimentary Structures to the Rate of Exposure and Water Depth (After Yilmaz & Altiner, 2001)



Figure 2.17. Facies Changing and Succession in Güvercinlik Limestones. It Consists of Beige Colored Dolomitic Limestone on the Top and Bottom, and White Colored Small Rounded Pebbles in the Dolomitic Limestone on the Middle. Coordinate: 64550 / 57585.

Carniol structures are observed in the contact between the stromatolitic dolomitic limestone and red colored sandstone lense (Fig 2.18-19).

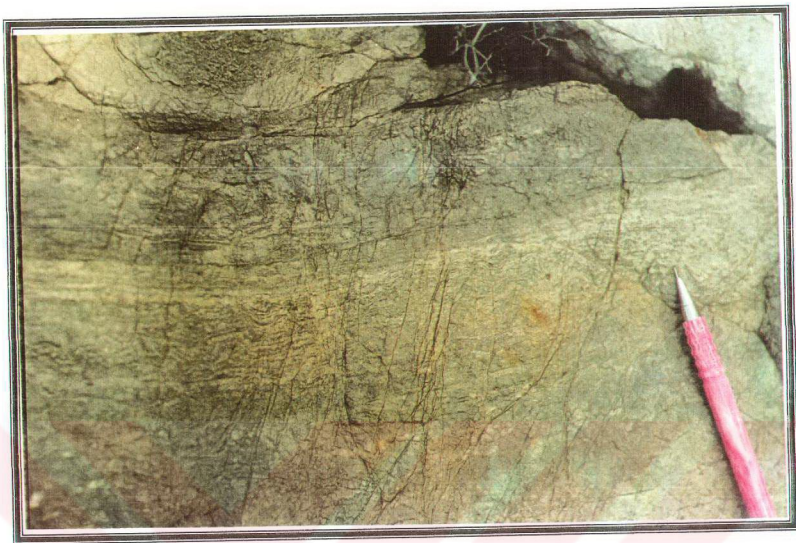


Figure 2.18. The Stromatolitic Limestones of the Tahtaiskele Measured Section on the Güvercinlik Limestones. Note the Wavy Lamination that is Pencil Point this Lamination with Small Scale. Coordinate: 64640 / 57780.



Figure 2.19. Outcrop Photograph Showing Dolomitic Limestones With Carniol Structures. These Dolomitic Limestones Are Highly Weathered and Weak Rock. Coordinate: 64675 / 57810.

There is a fault which is present in the red sandstones about 740 m. up in the measured section. Strike and dip of the fault is N42W/50NE and normal fault (Fig2.20). Sandstones are not primary position because of tectonic. Slickensided surfaces are seen commonly in the field.



Figure 2.20. Normal Fault that is between dolomitic limestones and red colored sandstones. Coordinate: 64680/ 57880.

The sandstones consist of quartzitic pebbles in beige-pinkish silt-clay matrix. Cross lamination is existed in these sandstones (Fig 2.21.).



Figure 2.21. Cross lamination in the red colored sandstones. This structure is not primary position. Coordinate: 64681/ 57882.

Green colored mudstone, which are intercalated with dolomitic limestones are highly weathered and weak. In some areas these mudstones are observed as lenses in the dolomitic limestones (Fig 2.22.).

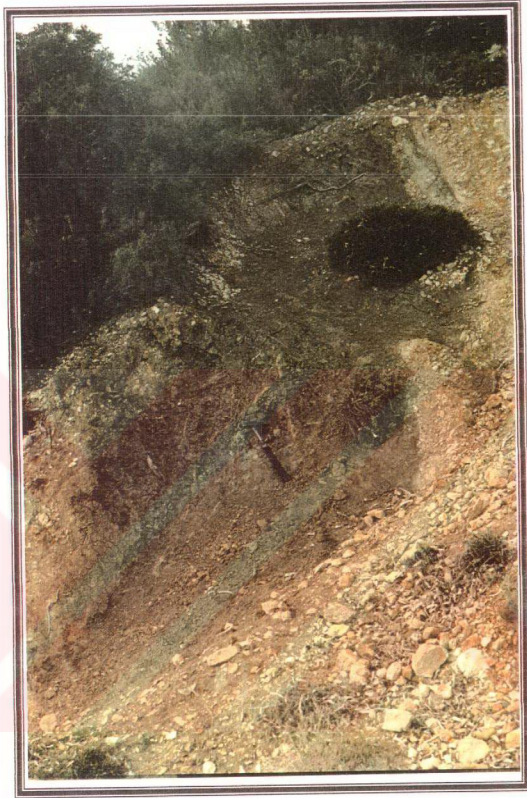


Figure 2.22. Mudstones are green colored, highly weathered and weak rock that is lense in the dolomitic limestones of the Güvercinlik formations. Coordinate: 64685/ 57885.

Algae can be observed in the white colored massive limestones of the Güvercinlik formation (Fig 2.23.).



Figure 2.23. Photo Shows Algae in the White Colored Massif Limestones of the Güvercinlik Formation. Coordinate: 64690/ 57892.

Along the diachronic contact between the Nohutalan and Güvercinlik formations, detritic input is observed in Tahtaiskele. This siliclastic material is pinkish colored and the size of silt-clay, which is a flow structure presented (Fig 2.24.).

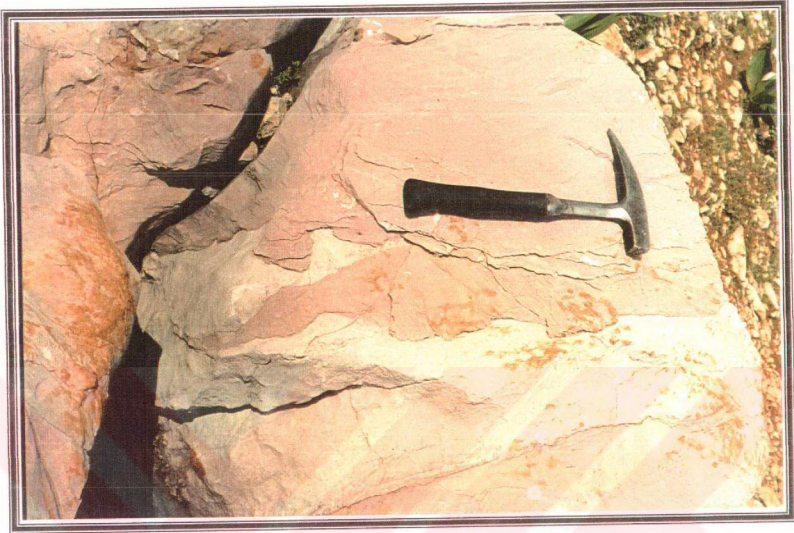


Figure 2.24. Detritic Input in the Gray Colored Limestones of the Güvercinlik Formation. Coordinate: 64700/ 57900.

Nohutalan formation consists of gray-beige colored limestones, which have abundant fossil fauna (Fig 2.25). These fossil fauna is composed of gastropod, megalodon and shell fragment that are sometimes recrystallized (Fig2.26-28.).

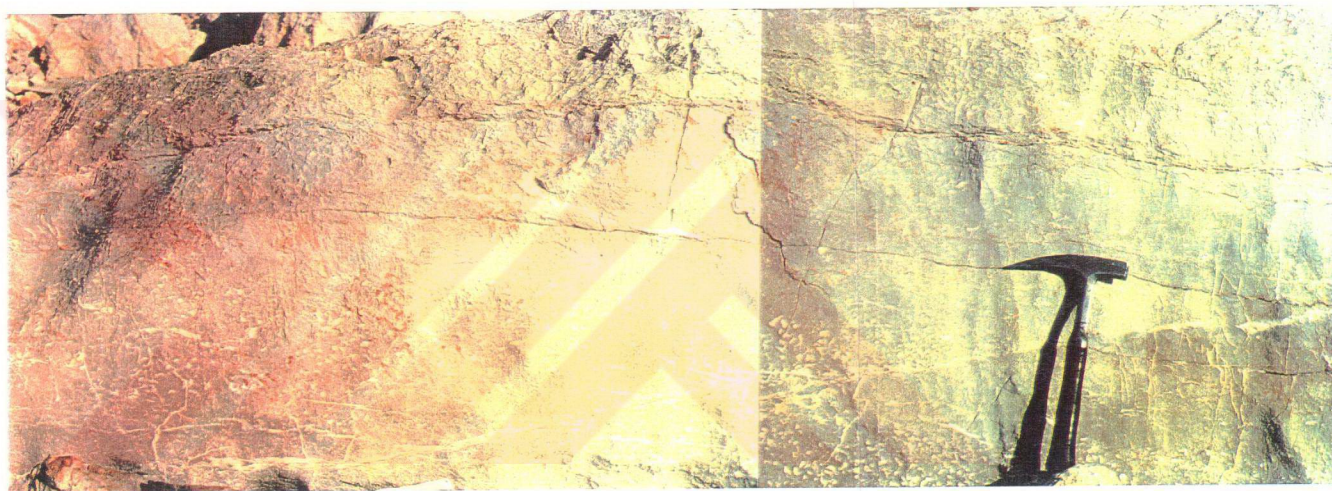


Figure 2.25. Shell Fragments In The Nohutalan Formation.

Coordinate: 64780/ 57900.

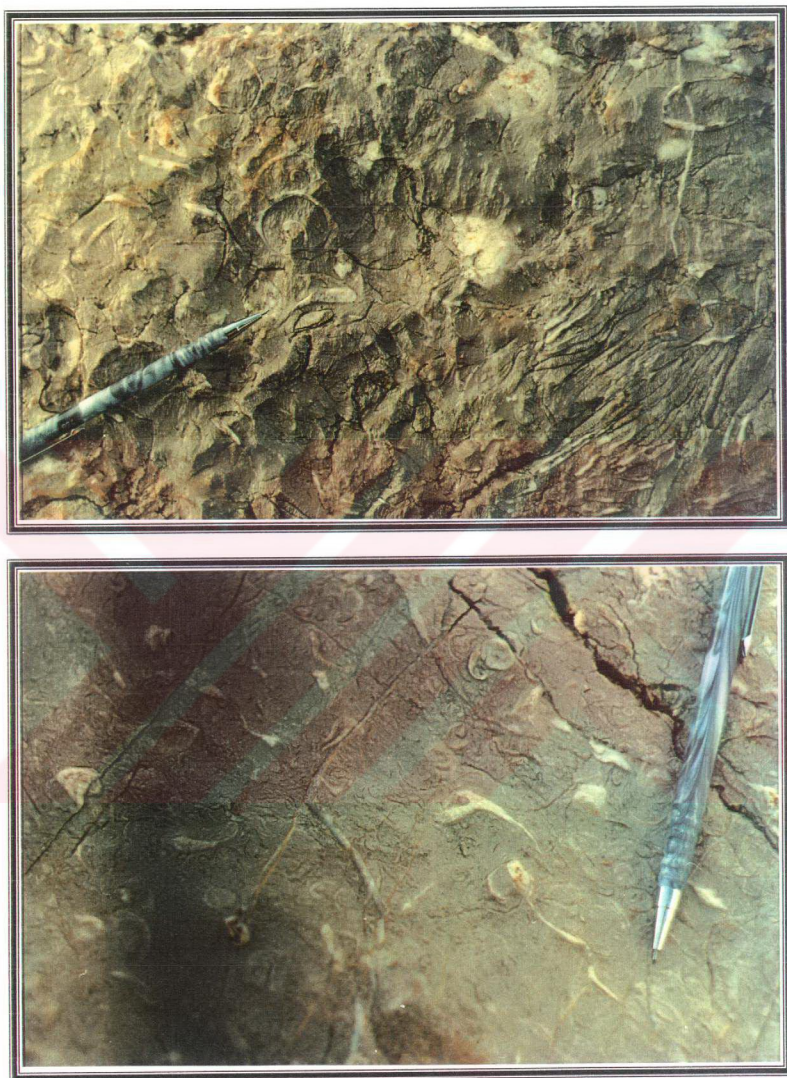


Figure 2.26-27. Shell Fragments and Gastropods, Which are Recrystallized in the Nohutalan Formation. Coordinate: 64856/ 57892.

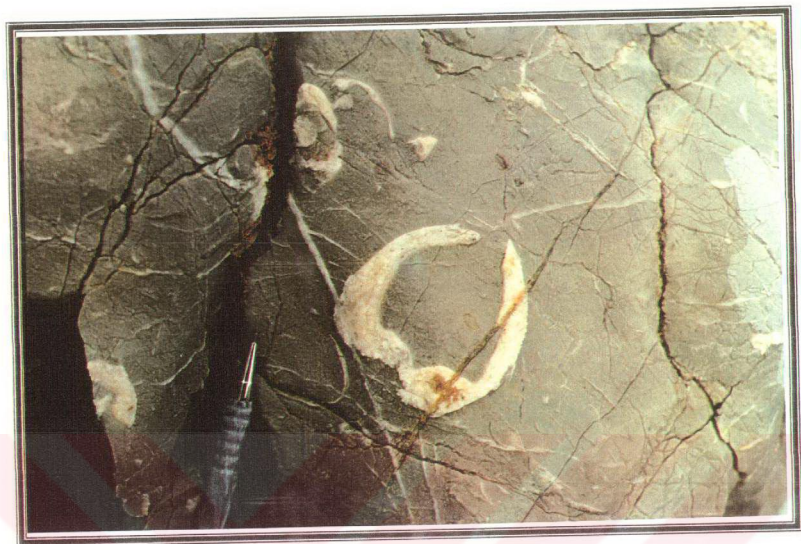


Figure 2.28. Megalodon in the gray colored Nohutalan limestones.

Coordinate: 64890/ 57850.

Some areas in the Nohutalan formation shells of megalodon are flatness shaped because of pressure (Mondéjar-García, 1990) (Fig 2.29).



Figure 2.29. Photo Showing Flat Megalodons in Gray Colored Limestone of the Nohutalan Formation. Coordinate: 64870/ 57910.

Irregular fenestra is also observed but rarely in Nohutalan limestones (Fig 2.30.).



Figure 2.30. Irregular fenestrae in the Nohutalan limestones.

Coordinate: 64770/ 57950.

Explanation of all sections is seen in fig 2.31. Lithologic characteristics of Tahtaiskele measured stratigraphic section is seen in Fig. 2.32.

EXPLANATIONS	
	Erosional surface
	Massive limestone
	Stromatolitic limestone
	Dolomitic limestone
	Limestone
	Cover
13▶	Samples number
	Miliolidae, Glomospiroid form
	Foraminifera, <i>Siphovavulina</i> 'sp.
	Gastropod
	Algae
	Shell fragment
	Pellet
	Intraclast
	Breccia
	Megalodont
	Fenestrae
	Stromatolite algae
	Dolomite crystal
	Zoned dolomite crystal
	Cracked
	Stylolite
	Geopetal fabric

Figure 3.31. Explanations and Symbols for All Sections

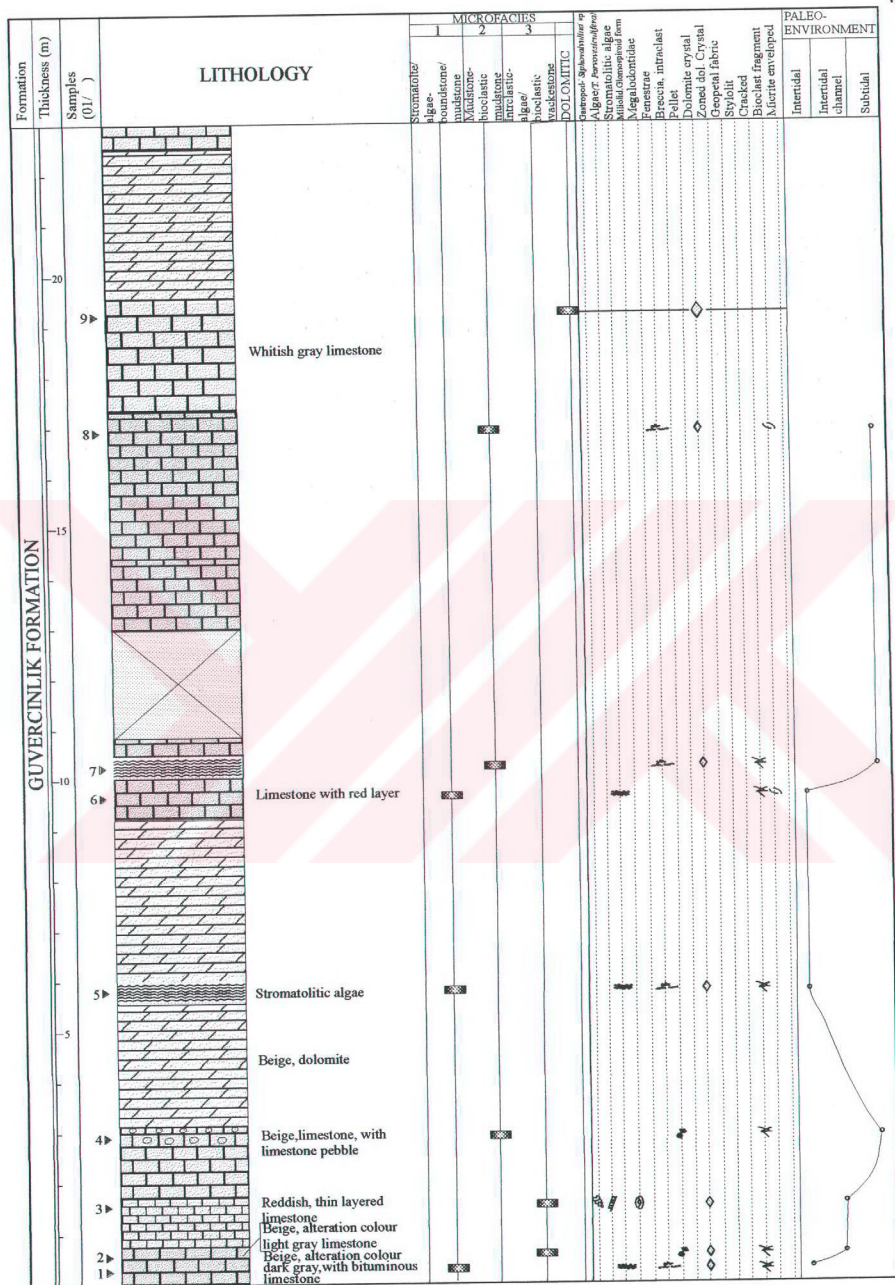
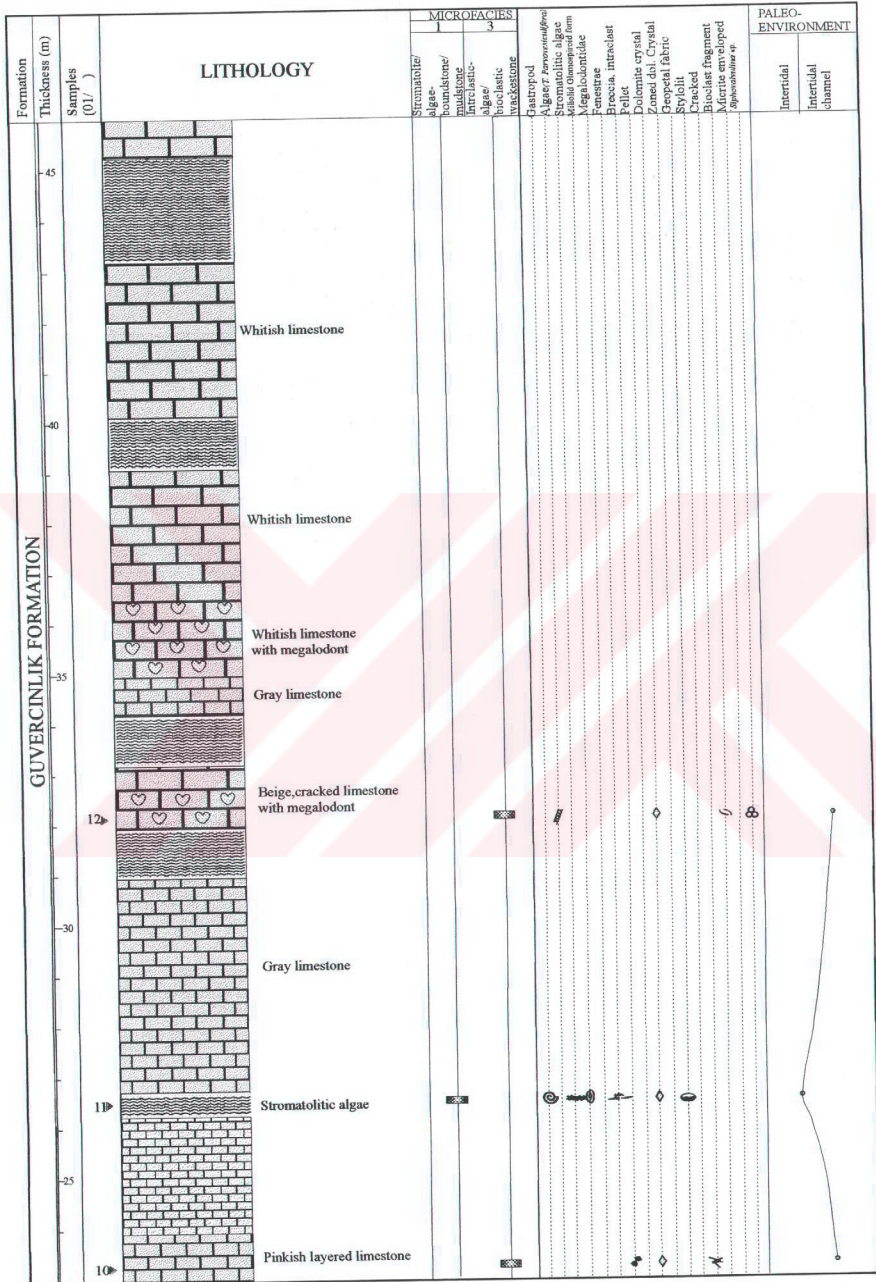
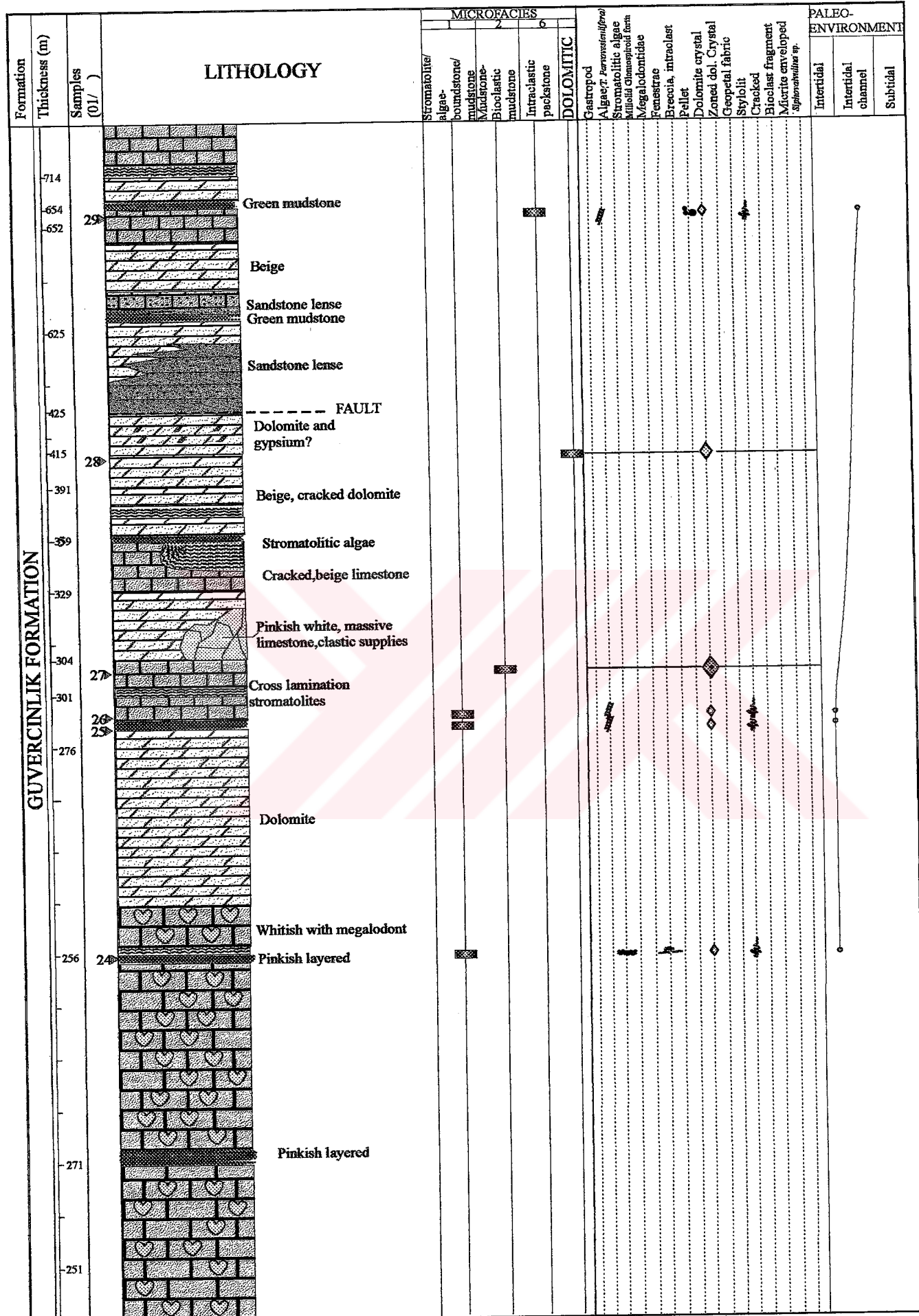


Figure 2.32. Measured Stratigraphic Section of the Tahtaiskele.



Formation	Thickness (m)	Samples (01/)	LITHOLOGY	MICROFACIES		Gastropod Algae: <i>Parasaccinella</i> sp. Stromatolitic algae Mollusk <i>Glaucospira</i> form Megalodontidae Fenestres Bryozoa, intraclast Pellet Dolomite crystal Zoned dol. Crystal Geopetal fabric Styolite Cracked Bioclast fragment Micrite enveloped <i>Sphaerulites</i> sp.	PALEO- ENVIRONMENT
				Mudstone- Bioclastic mudstone	DOLOMITIC		Subtidal
GUVERCINLIK FORMATION	146	17	Whitish limestone				
	121		Whitish limestone				
		16	Cracked whitish limestone				
	106		whitish limestone, massive				
			Cracked whitish limestone				
			Whitish limestone				
	91	15	Bioclastic limestone				
			Whitish limestone				
		14	Cracked limestone				
			Cracked dolomite				
		13	Whitish limestone and reddish layered				
			Cracked dolomite				
	66		Cracked dolomite				
	51		Whitish limestone				

Formation	Thickness (m)	Samples (01/)	LITHOLOGY	MICROFACIES				Gastropod <i>Algaert. Perovosculpta</i> Stromatolitic algae Miliolid Clamshell form Megalodontidae Fenestral Breccia, intraclast Pellet Dolomite crystal Zoned dol. Crystal Geopetal fabric Styrolit Cracked Bioclast fragment Micrite enveloped <i>Sphaerulites</i> sp.	PALEO-ENVIRONMENT	
				1 Mudstone- Bioclastic mudstone	2 Intraclastic- algae/ bioclastic wackestone	3 Intraclastic packstone	4		Tidal channel	Subtidal
GUVERCINLIK FORMATION	241		Pinkish white limestone							
	231		Breccia, pinkish white limestone							
	221		Whitish, massive, cracked limestone							
	211		Whitish, massive, large megalodont							
	230		Pinkish, cracked							
			Pinkish white limestone							
			Massive, whitish limestone							
	220		Massive limestone							
			Large megalodont							
	196		Whitish limestone							
	210		Whitish limestone with chort, massive							
	200		Pinkish white limestone with limestone breccias							
	176		Cracked limestone							
	190		Pinkish white limestone							
	156		Reddish stromatolitic algae, recrystallize							



2.3.2. Yellicebelen Measured Stratigraphic Section

Yellicebelen stratigraphic section is measured in the Yellicebelen Mountain location which from the Güvercinlik formation to bottom of the Nohutalan formation. Length of the section is approximately 945 meters and 40 samples are collected.

This section starts with sandstone lenses of Güvercinlik formation and continued to dolomitic limestones that are gray-dark gray colored, thin to medium bedded, moderately weathered and weak rock. White colored bioclastic limestones of the Güvercinlik formation are appeared approximately 70 metres of measured section. These limestones pass to thick bedded and moderately strong rock of fossiliferous limestones.

Red colored sandstones are formed in lenses in Güvercinlik Formation on Yellicebelen Mountain. The sandstones consist of pebble size and/or sand size quartzitic material and red colored silt-clay matrix (Fig 2.33.), which are included in bioturbation structures (Fig 2.34.).



Figure 2.33. The Red Colored Sandstones Lense in Limestones of the Güvercinlik Formation. Coordinate: 63910/ 60120.



Figure 2.34. A Bioturbation Structure on the Red Sandstone of the Güvercinlik Formation. Coordinate: 63975/ 60010.

In measured section, after approximately 600 metres white colored, most strongly, massif limestone is appeared that thickness is 70 metres, which have not macrofossils.

Along the Haciosmanyolu Stream there is a diachronic contact between the Güvercinlik formation and Nohutalan formation. Nohutalan formation is gray-beige colored, cracked, which have been filled by pinkish colored calcite (Fig.2.35).

2.3.3. Zendemir Hill Measured Stratigraphic Section

The section is measured in the red quartzite sandstone containing limestone lenses of the Güvercinlik formation in the Zendemir Hill. 23 meters are measured and 13 samples are taken from this stratigraphic section.

After 0,5 meters of this section, bituminuous limestone, white colored limestone, massif bitümunuous limestone, cross-lamination beige colored bituminous limestone and massif limestone were observed. White colored limestones and dark beige colored dolomitic limestones were observed in this measured section. This limestones have abundant fossil, which are generally megalodon and gastropoda where is top of all section (Fig 2.36.). This Section is showed in Fig. 2.37.



Figure 2.36. Abundant Fossil Association of the Limestone Lense in the Sandstone of the Güvercinlik Formation. Coordinate: 64190/ 60610.

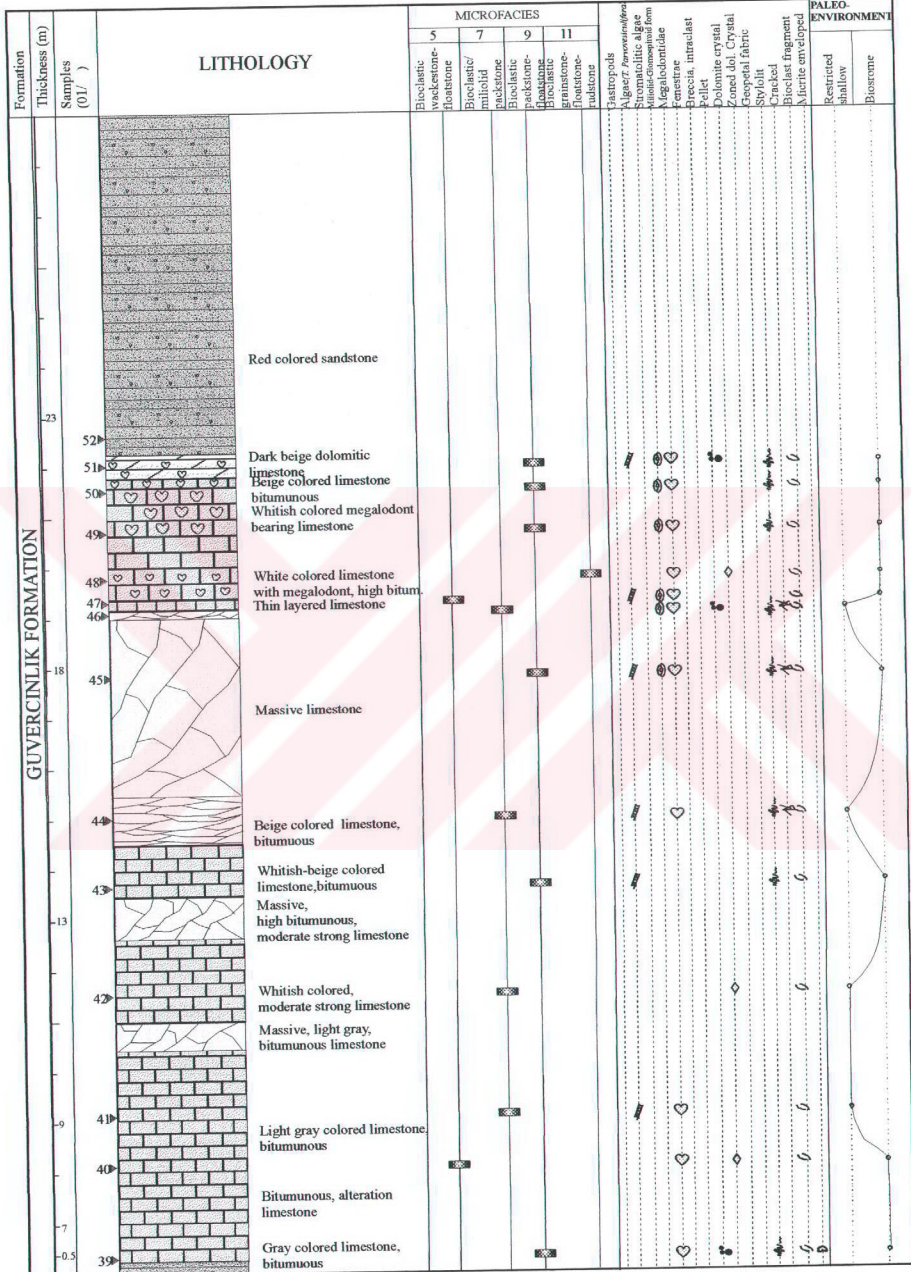


Figure 2.37. Measured Stratigraphic Section of the Zendemir Hill

CHAPTER THREE

MICROFACIES

3.1. Introduction

The purpose of this chapter is to recognize carbonate microfacies of the Güvercinlik formation. These microfacieses are stromatolite / algae-boundstone / mudstone, mudstone-bioclastic mudstone, Intraclastic-algae / bioclastic wackestone, wackestone-packstone, bioclastic wackestone-floatstone, intraclastic packstone, bioclastic / miliolid packstone, pelletoidal / packstone-grainstone, bioclastic packstone-floatstone, packstone-boundstone / algae framestone, and bioclastic grainstone-rudstone-floatstone. The carbonate microfacieses are named according to Embry and Klovan's (1971) modification of Dunham (1962) carbonate rock classification (Chapter I).

3.2. Description

3.2.1. Microfacies 1: Stromatolite / algae-boundstone / mudstone

The microfacies contains algae, stromatolitic algae, rarely gastropod and bioclast, which present less than %10 of the total rock quantity (Fig 3.1-5). The matrix is dominantly microcrystalline calcite ($\geq 90\%$) and peloidal grains. The microfacies is observed Yellicebelen and Tahtaiskele measured section of the Güvercinlik formation.

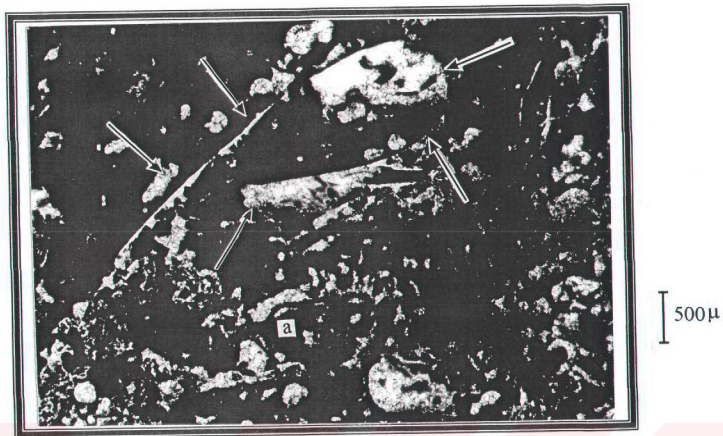


Figure 3.1. Microfacies 1, Stromatolite / Algae-Boundstone / Mudstone
Yellicebelen Measured Section, No: 01/55, Güvercinlik Formation
Microfacies Composed of Algae Mats (a), Bioclastic Fragment (Big
Arrows), and Micritic Matrix with Partially Dolomitized.

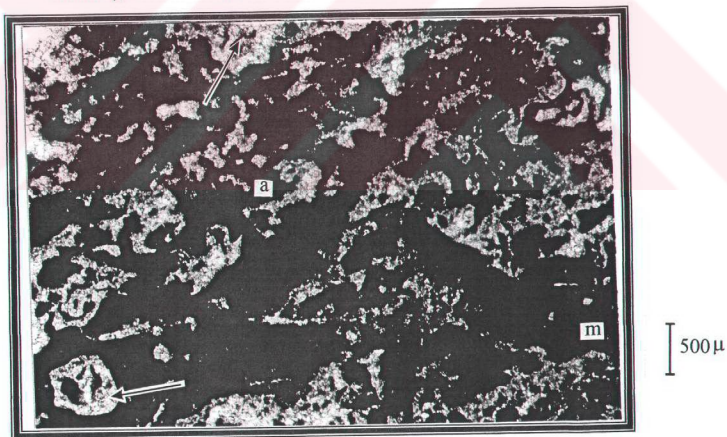


Figure 3.2. Microfacies 1, Stromatolite / algae-boundstone / mudstone
Yellicebelen Measured Section, No: 01/56, Güvercinlik formation.
The Microfacies Composed of Algae (a) and Micrite Matrix (m). Note
the Cavities Have Been Filled by Dolomitic Cement (Arrows).

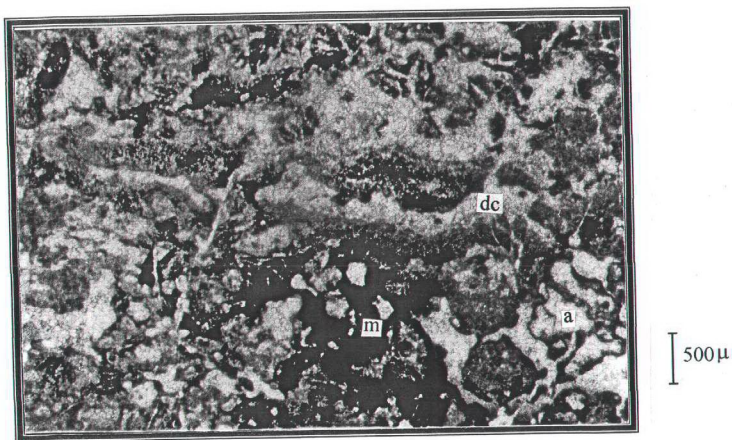


Figure 3.3. Microfacies 1, Stomatolite / algae-boundstone / mudstone
 Yellicebelen Measured Section, No: 01/56, Güvercinlik Formation
 The Photo Shown is that Micritic Matrix (m), algae (a), and Dolomitized Cavities (dc).

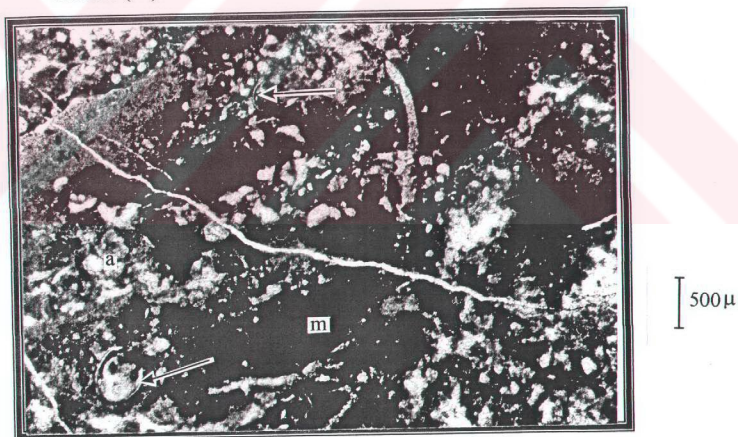


Figure 3.4. Microfacies 1, Stomatolite / Algae-Boundstone / Mudstone
 Yellicebelen Measured Section, No: 01/58, Güvercinlik Formation
 The Microfacies is Consists of Algae (a), Dark Micritic Matrix (m),
 Bioclastic Fragment (Arrows) and Lighter Finely Dolomitic Crystals.

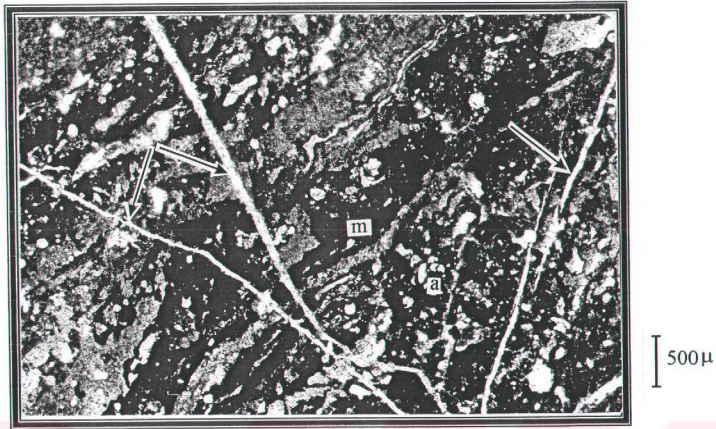


Figure 3.5. Microfacies 1, Stromatolite / Algae-Boundstone / Mudstone
 Tahtaiskele Measured Section, No: 01/06, Güvercinlik Formation.
 The Microfacies Consists of Algae (a), Dark Micritic Matrix (m). Note
 The Cracked With Filling Sparry Calcite (Arrows).

Diagenetic effects in the microfacies are abundant, but restricted to a few types. The diagenetic effects include dolomitization, dedolomitization, void filling spar, geopetal structure, stylolite and fracture filling spar. Dolomitization is the most prominent diagenetic effect. The boundary shape of the dolomite crystal is planar-euhedral, planar-void filling, nonplanar void-filling, and nonplanar-anhedral (Boggs, 1975; Tucker & Wright, 1989). Most of the well-developed planar-euhedral dolomite crystals are having zonal structure, which is modified or destroyed by dolomitization of the original depositional texture. These well-developed crystals are related shallow burial (Reinhold, 1998; Török, 2000) (Fig. 3.6-8).

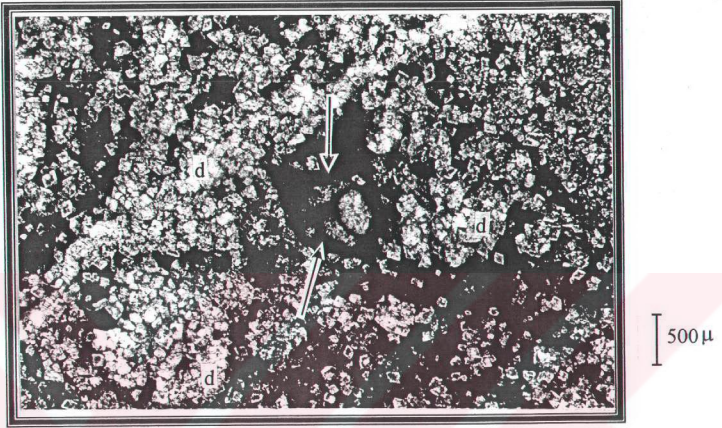


Figure 3.6. Microfacies 1, Stromatolite / Algae-Boundstone / Mudstone
 Tahtaiskele Measured Section, No: 01/25, Güvercinlik Formation.
 The Originally Texture of the Microfacies is Algae Boundstone (Arrows)
 Which is Partly Dolomitized in a Dark Colored Micritic Matrix. Note the
 Zoned Planar- Euhedral Dolomite Crystals (d) that are Composed of Core
 and Thin Rim.

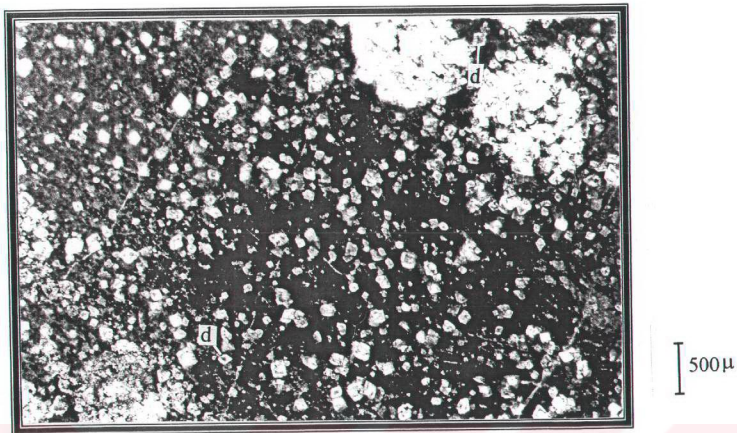


Figure 3.7. Microfacies 1, Stromatolite / Algae-Boundstone / Mudstone
Tahtaiskele Measured Section, No: 01/25, Güvercinlik Formation
Partly Dolomitized Microfacies 1. Note the Zoned Planar-Euhedral
Dolomite Crystals (d), Which have Core and Rim.

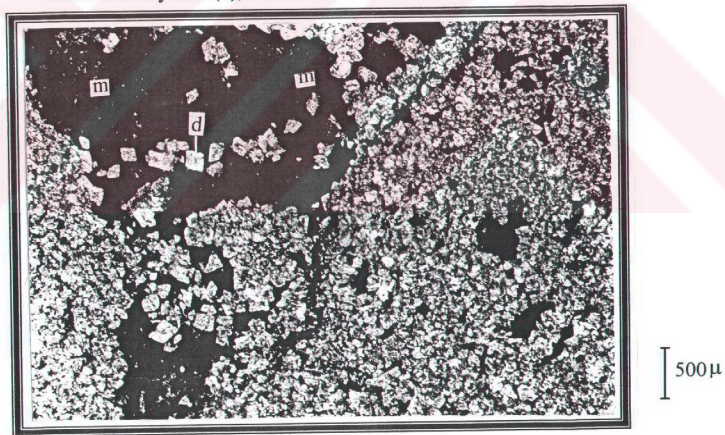


Figure 3.8. Microfacies 1, Stromatolite / Algae-Boundstone / Mudstone
Tahtaiskele Measured Section, No: 01/26, Güvercinlik Formation
Partly Dolomitized Microfacies 1. Origin Texture is Composed of
Micritic Matrix (M). Note the Boundary Shape of Dolomite Crystals is
Planar-Euhedral and Nonplanar-Anhedral.

Dedolomite is a product of replacement of dolomite by calcite, which is brought about by circulation meteoric water at low temperatures (deGroot, 1967; Evamy, 1967; Friedman, 1994b; Guo, 1994; Guo et al, 1996). This event suggests the near-surface conditions. (Fig 3.9)

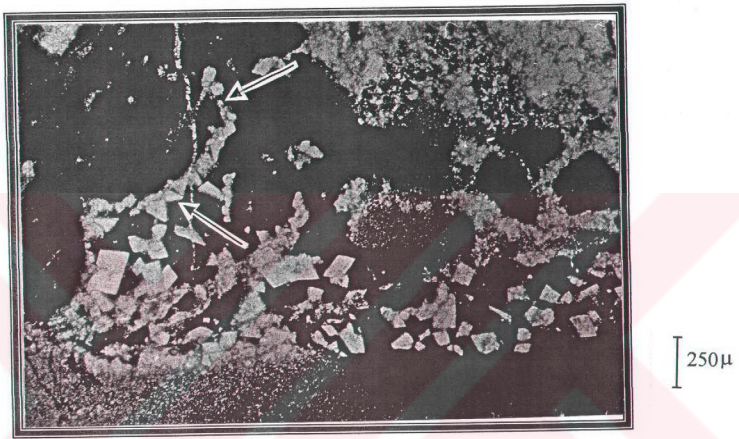


Figure 3.9. Microfacies 1, Stromatolite / Algae-Boundstone / Mudstone
Tahtaiskele Measured Section, No: 01/01, Güvercinlik Formation
Dedolomitization Where Along the Walls of Vug (Arrows). Note the
Boundary Shape of the Dolomite Crystals Planar-Euhedral.

Void filling spar is clearly observed in thin sections that is pseudo-spar with formed by grain growth (Larsen & Chilingar, 1967).

Fenestrae also known “bird’s eye” structures are open and filled vugs containing sparry calcite, saddle dolomite or euhedral quartz (Selleck, 1987). They are found to be abundant in this microfacies and that is laminoid fenestrae (Demicco & Hardie, 1994) and it’s void is open or filled by generally dolomitic cement with sparry cement (Fig 3.10-16). This structure is occurred gas bubbles within cyanobacterial mats (Demicco & Hardie, 1994).

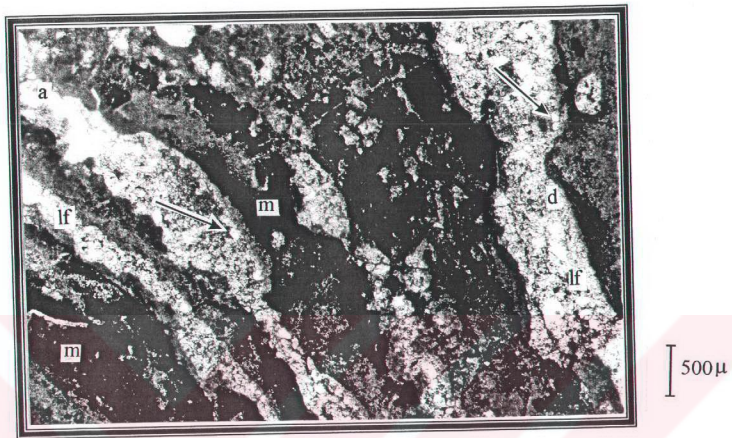


Figure 3.10. Microfacies 1, Stromatolite / Algae-Boundstone / Mudstone
 Tahtaiskele Measured Section, No: 01/01, Güvercinlik Formation
 The Microfacies Consists of Regular Algal Stromatolite (a), Micrite (m)
 Laminoid Fenestrae (lf) Which Voids Filling With Dolomite Crystals
 (d). Note the Boundary Shape (Arrows) of the Dolomite Crystals is
 Planar-Void Filling and Nonplanar-Anhedral.

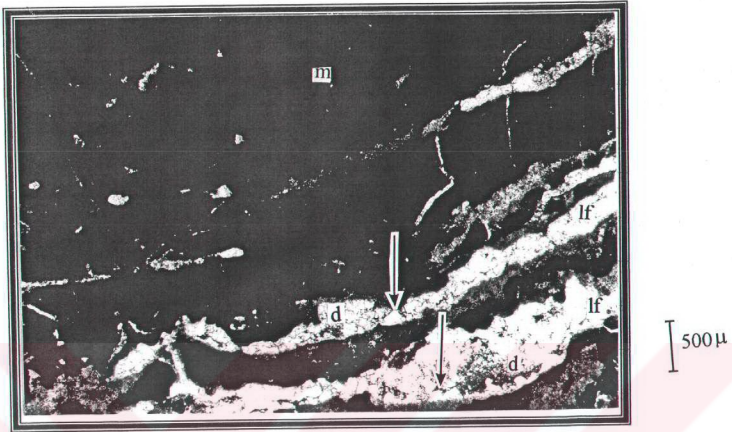


Figure 3.11. Microfacies 1, Stromatolite / Algae-Boundstone / Mudstone
 Tahtaiskele Measured Section, No: 01/01, Güvercinlik Formation
 The Microfacies Consists of Micrite (m) and Laminoid Fenestrae (lf)
 That Voids Filling by Dolomite Crystals (d) in a Micritic Matrix. Note
 the Boundary Shape (Arrows) of the Dolomite Crystals is Planar-Void
 Filling and Nonplanar-Anhedral.

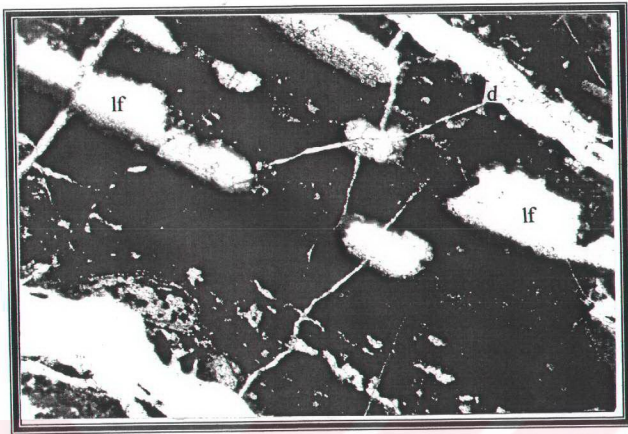


Figure 3.12. Microfacies 1, Stromatolite / Algae-Boundstone / Mudstone
Tahtaiskele Measured Section, No: 01/05, Güvercinlik Formation
Laminoid Fenestrae (lf) in a Micrite Matrix. Void of Fenestrae is Filled
With Planar-Void Filling and Nonplanar-Anhedral Dolomite Crystals.
Note The Irregular Cracked Which is Filled by Dolomitic Cement (d).

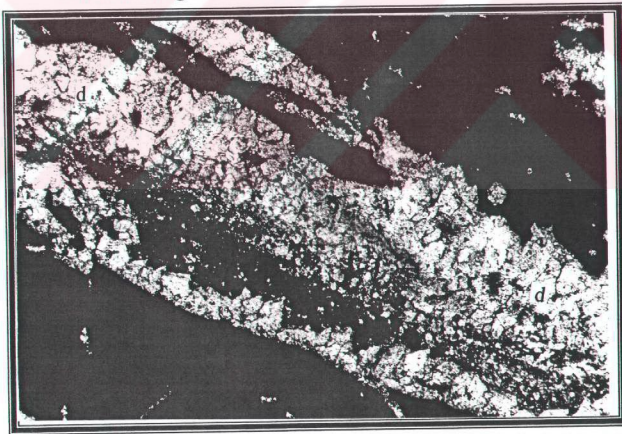


Figure 3.13. Microfacies 1, Stromatolite / Algae-Boundstone / Mudstone
Tahtaiskele Measured Section, No: 01/05, Güvercinlik Formation
The Laminoid Fenestrae Consist of Coarsely Crystalline Dolomite (d)
Which are Predominantly Nonplanar Void-Filling Crystals.



Figure 3.14. Microfacies 1, Stromatolite / Algae-Boundstone / Mudstone
 Tahtaiskele Measured Section, No: 01/24, Güvercinlik Formation
 Irregular Fenestrae (if) that is Filled by Lighter Finely Crystalline
 Dolomite (d) in a Partly Dolomitized Micritic Matrix.

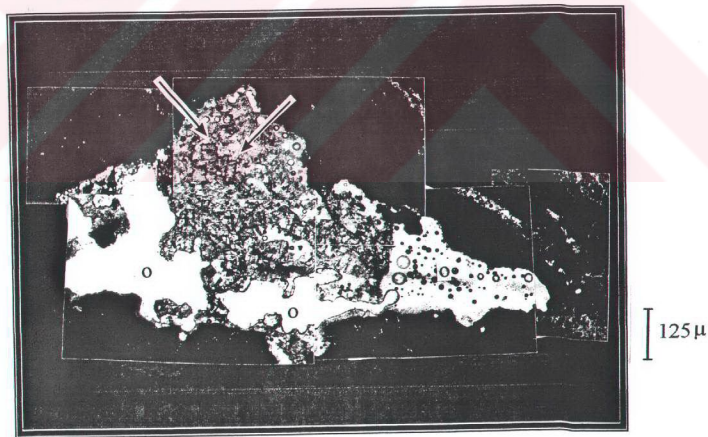


Figure 3.15. Microfacies 1, Stromatolite / Algae-Boundstone / Mudstone
 Tahtaiskele Measured Section, No: 01/30, Güvercinlik Formation
 The Fenestral Cavity is Partly Open (o) and Partly Filled by Dolomitic
 Cement (Arrows).

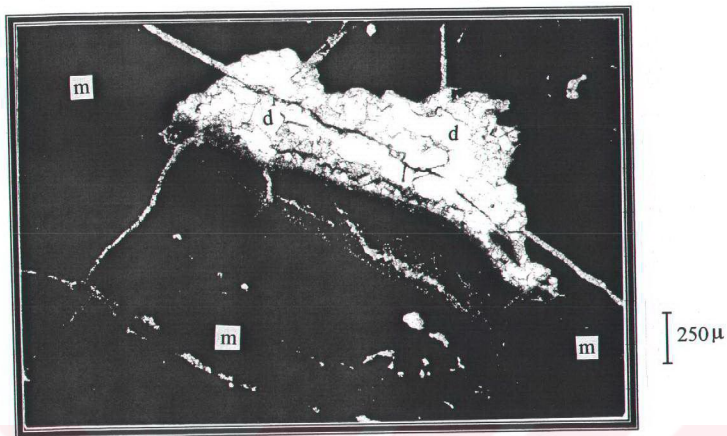


Figure 3.16. Microfacies 1, Stromatolite / Algae-Boundstone / Mudstone
 Yellicebelen Measured Section, No: 01/54, Güvercinlik Formation
 The Fenestral Cavity is Filled by Lighter Coarsely Planar-Subhedral
 Dolomite (d) and Dark Finely Micrite (m). Note the Micritic Matrix is
 Shown Diagonal Structure.

Geopetal structures are found in cavity fills within limestones, where the lower part of the cavity has been filled with sediment and the upper part filled later with cement. Geopetal structures are observed in gastropod shell (Fig 3.17).



Figure 3.17. Microfacies 1, Stromatolite / Algae-Boundstone / Mudstone
Tahtaiskele Measured Section, No: 01/11, Güvercinlik Formation
Gastropod Shell That Filled by Dark Colored Micrite and Lighter
Coarsely Crystalline Calcite, and Display Geopetal Fabric in This
Microfacies. Geopetal Fabric is Shown the Top of the Layer (Arrows).

Stylolite is (Fig 3.1) an irregular, suture-like contact, produced by pressure solution of rock under deep burial conditions that is presented rarely in this microfacies.

Stromatolites are products of a high-energy subtidal or lower intertidal channel environment (Ginsburg, 1975). Fenestare is also developed intertidal or supratidal areas (Demicco & Hardie, 1994; Wilson, 1975; Duran & Şengüdüz, 1993). In respect of these data depositional environments of the microfacies is intertidal area.

3.2.2. Microfacies 2: Mudstone-bioclastic mudstone

The microfacies consists of dark colored microcrystalline calcite, pellet, dolomite crystals and bioclastic fragment, which are small in size, thin and represented less than %10 of the total rock volume. This bioclastic fragments are small and thin, which is not recognizable for genus (Fig. 3. 18). This microfacies is presented in Tahtaiskele and Yellicebelen measured sections on Güvercinlik formation.

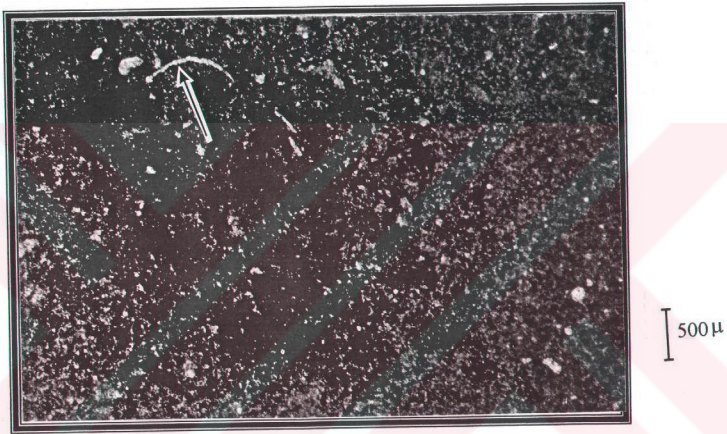


Figure 3.18. Microfacies 2, Mudstone-Bioclastic Mudstone

Yellicebelen Measured Section, No: 01/76, Güvercinlik Formation

The Bulk of Microfacies Consist of Microcrystalline Calcite that Contains Abundant Pellet and Light Colored Finely Dolomite Crystals.

Bioclastic Fragments (Arrow) are Rarely Observed.

Dolomitization is most prominent diagenetic function in microfacies 2. Dolomite crystals are observed scatter in microcrystalline matrix and has occurred leaving vuggy and moldic porosity (Fig 3.19-22).

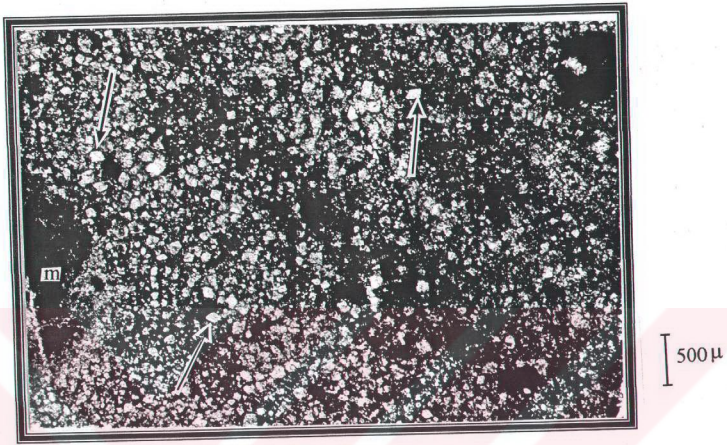


Figure 3.19. Microfacies 2, Mudstone-Bioclastic Mudstone

Tahtaiskele Measured Section, No: 01/15, Güvercinlik Formation

The Bulk of This Microfacies Consists of Scattered Light Finely Crystalline Dolomite (Arrows) in a Dark Colored Microcrystalline Calcite Matrix (m). Note the Boundary Shape of Dolomite Crystals are Planar-Euhedral.

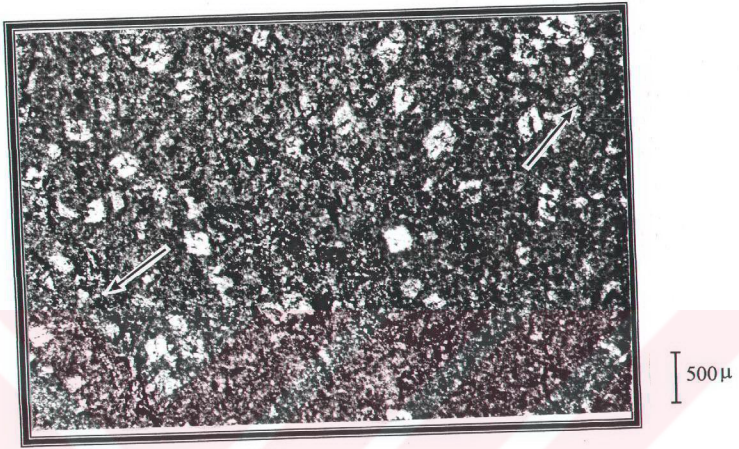


Figure 3.20. Microfacies 2, Mudstone-Bioclasic Mudstone
 Tahtaiskele Measured Section, No: 01/19, Güvercinlik Formation
 Partly Dolomitized Mudstone-Bioclasic Mudstone Microfacies.
 Stylolite is Observed (Arrows). Crystal Boundary Shape is
 Planar-Euhedral and Planar-Porphyrotopic.

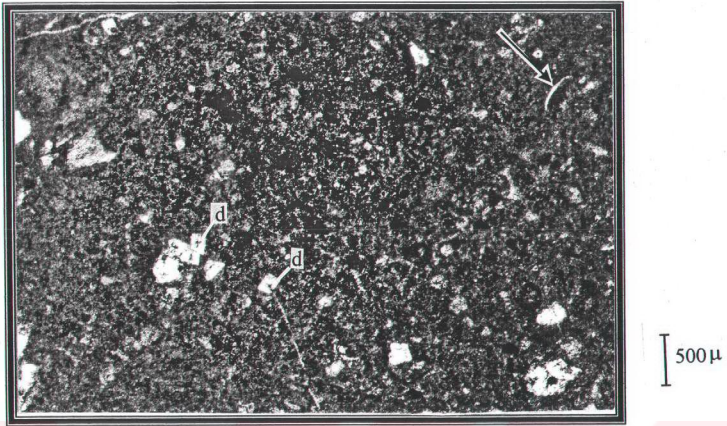


Figure 3.21. Microfacies 2, Mudstone-Bioclastic Mudstone

Tahtaiskele Measured Section, No: 01/22, Güvercinlik Formation

Photo of Partly Dolomitized Mudstone-Bioclastic Mudstone Microfacies. Planar-Porphrotopic Dolomite Crystals (d) are Scattered in Dark Colored Microcrystalline Matrix and Finely Crystalline Dolomite. The Bioclast Fragments (Arrow) are Rare in This Microfacies.

Well-developed planar-euhedral dolomite crystals modified or destroyed the original depositional texture or revealing ghost of former allochems. Certain dolomite crystals are have zonal structure. (Fig3.22-24).

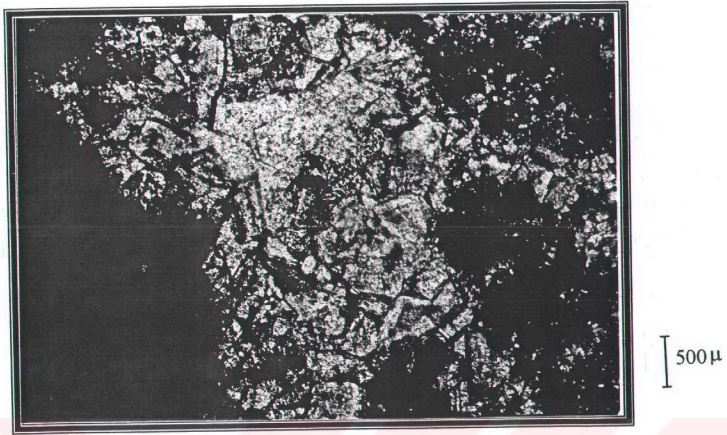


Figure 3.22. Microfacies 2, Mudstone-Bioclastic Mudstone
Tahtaiskele Measured Section, No: 01/15, Güvercinlik Formation
Dolomitic Crystals have been Filled to Union Cracked. Note the
Boundary Shape of the Dolomite Crystals is Definite.

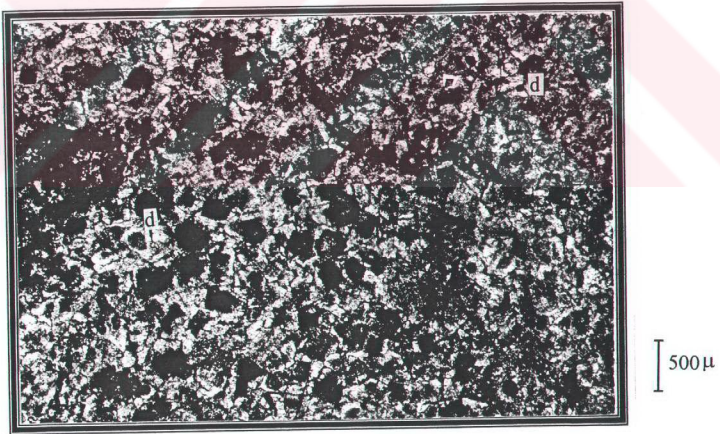


Figure 3.23. Microfacies 2, Mudstone-Bioclastic Mudstone
Tahtaiskele Measured Section, No: 01/16, Güvercinlik Formation.
The Microfacies Consists of Impure Clouded Coarsely
Crystalline Planar-Subhedral Dolomite (d).

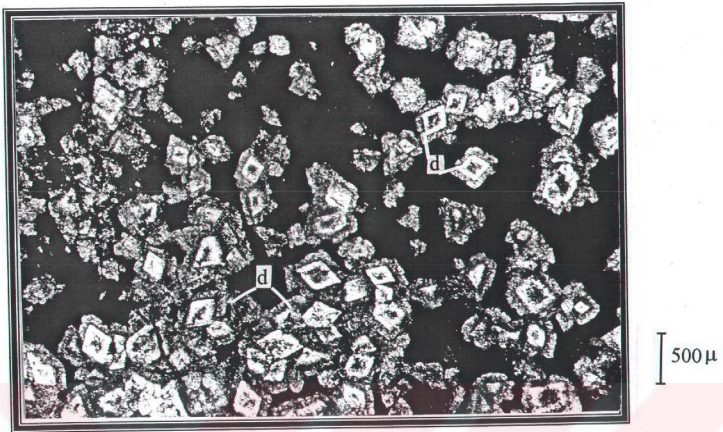


Figure 3.24. Microfacies 2, Mudstone-Bioclastic Mudstone

Tahtaiskele Measured Section, No: 01/21, Güvercinlik Formation

The Mudstone-Bioclastic Mudstone Microfacies is Partially Dolomitized. the Large Dolomite Crystal (d) is Zoned Planar-Euhedral Crystal Boundary Shape.

Fenestral void is also observed in this microfacies that is irregular fenestrae. The void of these fenestrae are filled by generally finely crystalline dolomite (Fig 3.25-26). Irregular fenestrae is suggested subtidal environment of deposition.

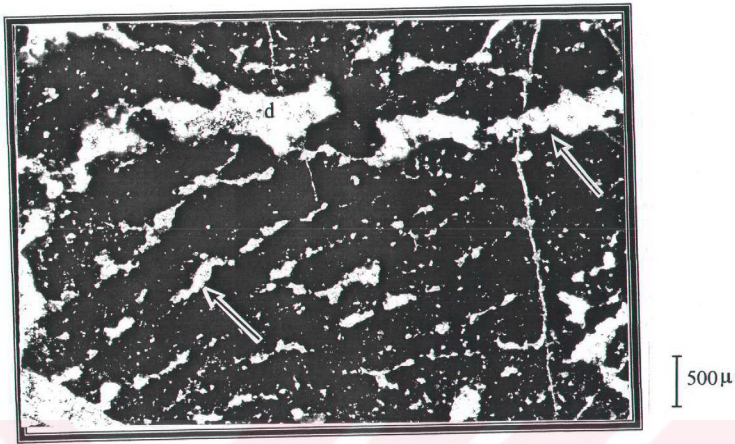


Figure 3.25. Microfacies 2, Mudstone-Bioclastic Mudstone
 Tahtaiskele Measured Section, No: 01/7, Güvercinlik Formation
 The Microfacies Composed of Microcrystalline Matrix and Irregular
 Fenestrae (Arrows). It is Filled by Light Finely Crystalline Dolomite (d).

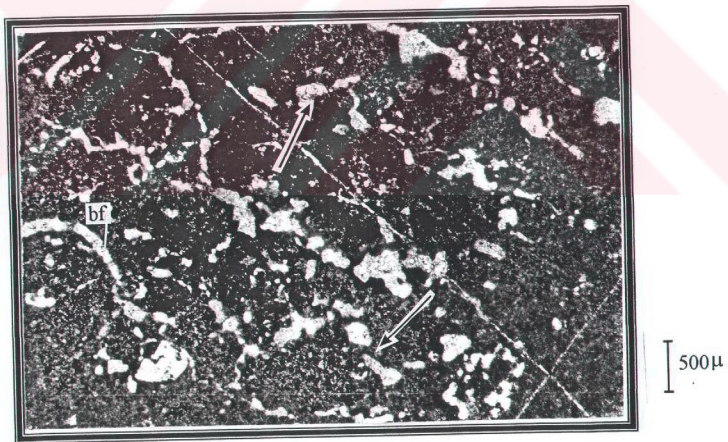


Figure 3.26. Microfacies 2, Mudstone-Bioclastic Mudstone
 Tahtaiskele Measured Section, No: 01/8, Güvercinlik Formation.
 Irregular Fenestrae (Arrows), which is Filled by Lighter Finely
 Crystalline Dolomite. Bioclast Fragments are Also Rarely in This
 Microfacies (bf).

Some thin sections are presented redeposition produces which are mud matrix related vugs and cracks. Void of this structures have been filled sparry calcite cement and/or dolomitic cement and sediment (Fig 3.27). Reason of this constitution may be exchange or remaining energy of depositional environment.

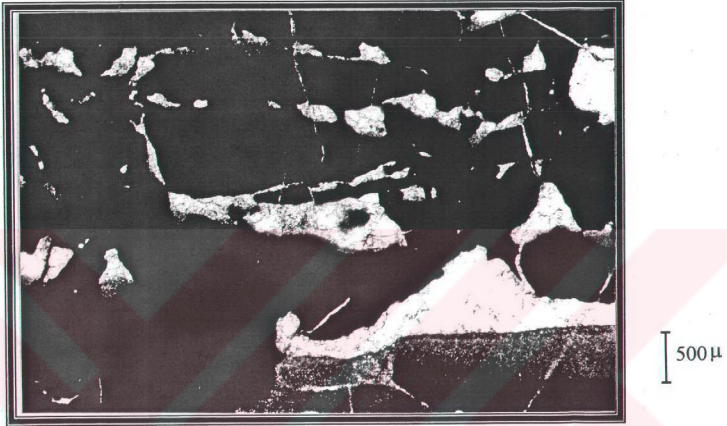


Figure 3.27. Microfacies 2, Mudstone-Bioclastic Mudstone

Yellicebelen Measured Section, No: 01/64, Güvercinlik Formation

Mudstone is Produced to Modified Energy; the Void of Cracks and Vugs Filled by the Top Light Colored Dolomitic Cement and the Bottom Dark Colored Micritic Sediment.

This facies indicates a low energy, relatively deep (i.e. below storm wave base) subtidal environment of deposition.

3.2.3. Microfacies 3: Intraclastic-algae / bioclastic wackestone

The microfacies characterized by intraclast, algae fragment and various bioclastic or/and bioclast fragment.

Matrix of the microfacies is generally partly dolomitized or dolomitized microcrystalline calcite (Fig 3.28).

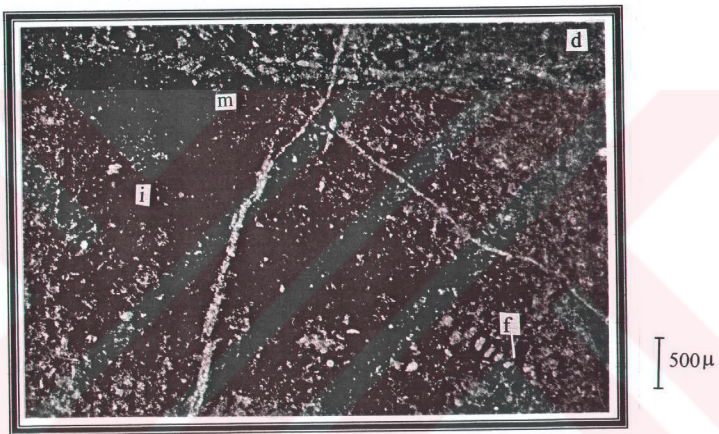


Figure 3.28. Microfacies 3, Intraclastic-Algae / Bioclastic Wackestone
 Yelicebelen Measured Section, No: 01/79, Güvercinlik Formation
 Microfacies Composed of Foraminifera (f), Bioclast Fragment (Arrow)
 and Micritic Intraclast (i). Matrix is Consist of Micrite (m) and Light
 Finely Dolomitic Crystals (d).

Intraclasts are observed in studied thin sections, which is a carbonate fragment of lithified, or partly lithified sediment, derived from the erosion of nearby sediment and redeposited within the same area. It is commonly low to medium rounded and origin is micrite matrix (Fig 3.29-35).

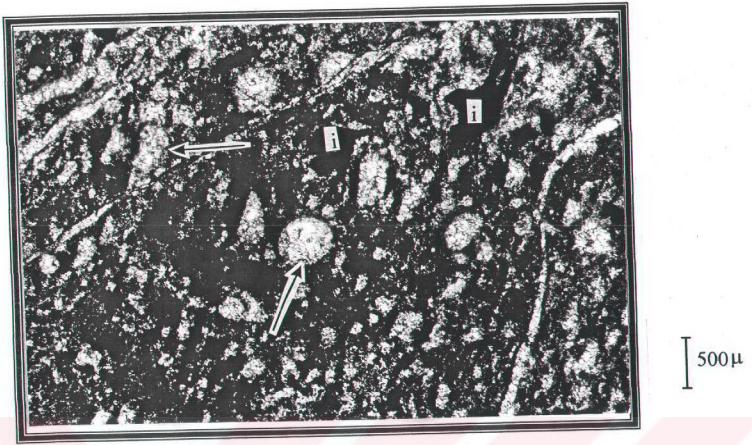


Figure 3.29. Microfacies 3, Intraclastic-Algae / Bioclastic Wackestone
Tahtaiskele Measured Section, No: 01/2, Güvercinlik Formation
The Microfacies Consists of Partly Dolomitized (Arrows)
Microcrystalline Calcite and Micritic Intraclast (i).



Figure 3.30. Microfacies 3, Intraclastic-Algae / Bioclastic Wackestone
Tahtaiskele Measured Section, No: 01/3, Güvercinlik Formation
Partly Dolomitized (Arrow) Microcrystalline Calcite Composed of
Micritic Intraclast (i) And Algae Fragments (a).

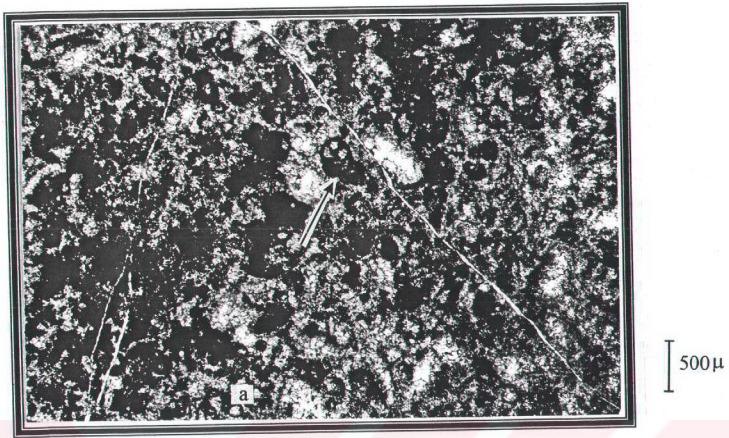


Figure 3.31. Microfacies 3, Intraclastic-Algae / Bioclastic Wackestone
Tahtaiskele Measured Section, No: 01/3, Güvercinlik Formation
The Microfacies Composed of Algae Fragment (a), Foraminifera
(Arrow) and Intraclast in Micritic Matrix and Dolomite Crystals.

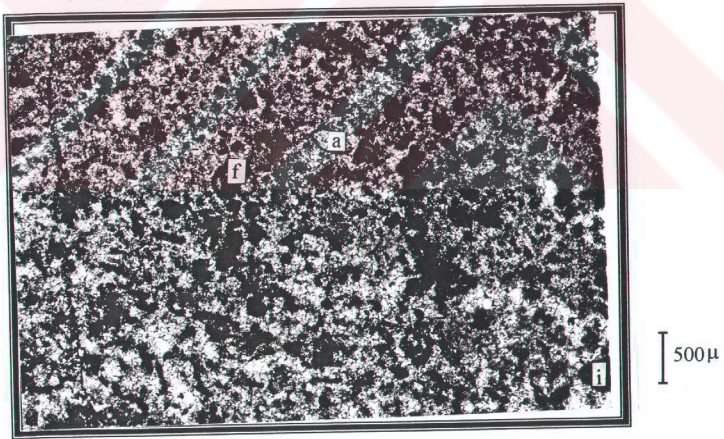


Figure 3.32. Microfacies 3, Intraclastic-Algae / Bioclastic Wackestone
Tahtaiskele Measured Section, No: 01/12, Güvercinlik Formation
The Microfacies Composed of Algae Fragments (a), Foraminifera (f),
and Intraclast (i) in A Partly Dolomitized Micritic Matrix.

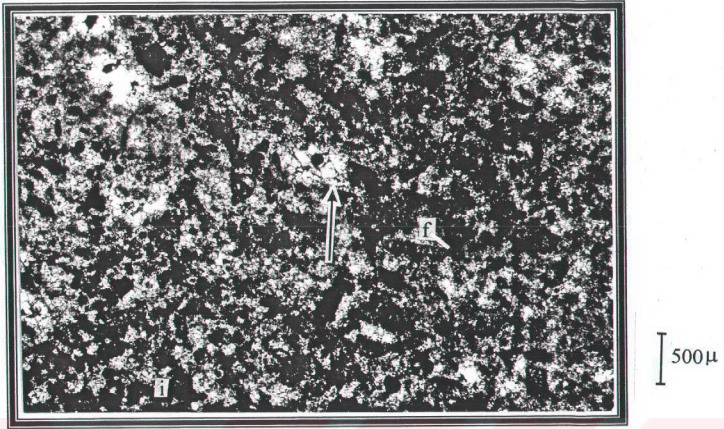


Figure 3.33. Microfacies 3, Intraclastic-Algae / Bioclastic Wackestone
 Tahtaiskele Measured Section, No: 01/12, Güvercinlik Formation
 Partly Dolomitized (Arrow) Micritic Matrix Composed of Intraclast (i)
 and Various Foraminifera (f).

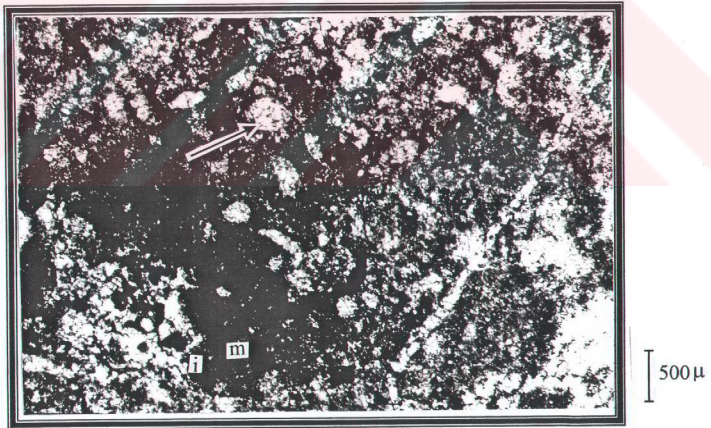


Figure 3.34. Microfacies 3, Intraclastic-Algae / Bioclastic Wackestone
 Tahtaiskele Measured Section, No: 01/23, Güvercinlik Formation
 Texture of this Microfacies Composed of Partly Dolomitized (Arrow)
 Dark Colored Microcrystalline Calcite (m) Matrix with Intraclast (i).

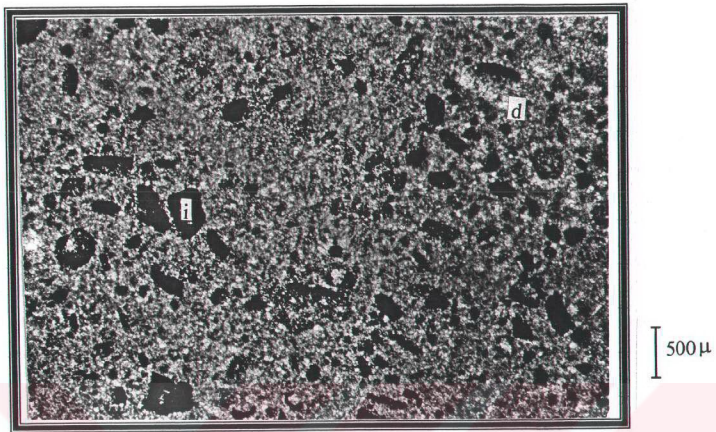


Figure 3.35. Microfacies 3, Intraclastic-Algae / Bioclastic Wackestone
 Yellicebelen Measured Section, No: 01/86, Güvercinlik Formation
 Microfacies Consists of Medium to Well Rounded Micritic Intraclast (i)
 and Finely Light Colored Crystalline Dolomite (d).

Wavy effects are rounded some micritic intraclast which are settling dolomite the rim of this materials (Fig 3.36).

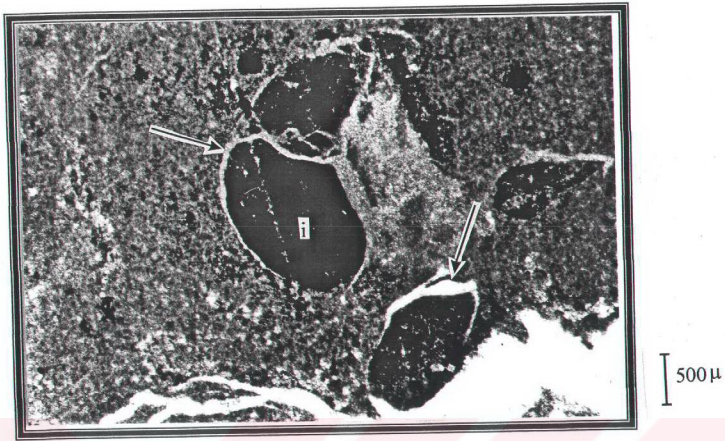


Figure 3.36. Microfacies 3, Intraclastic-Algae / Bioclastic Wackestone
 Tahtaiskele Measured Section, No: 01/10, Güvercinlik Formation
 Dark Colored Micritic Intraclasts (i), which are Set In Light Colored
 Dolomitic Crystals. Note the Dolomitic Rim of the Micritic Intraclasts
 (Arrows).

Bioclasts are generally rare (<10%) that composed of gastropod, brachiopod, algae and various not definite bioclast fragments (Fig 3.37-39).

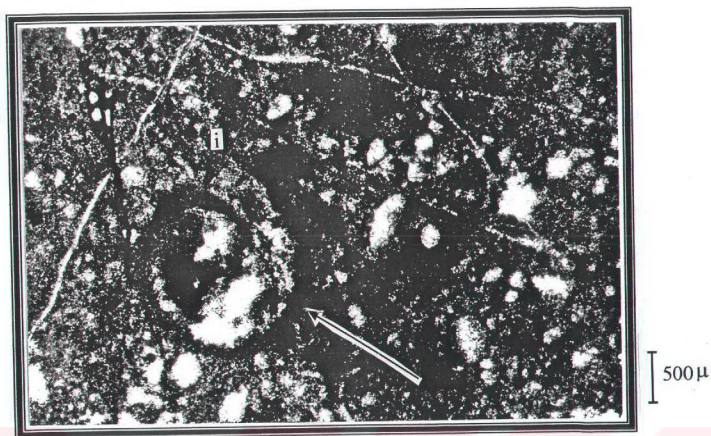


Figure 3.37. Microfacies 3, Intraclastic-Algae / Bioclastic Wackestone
Tahtaiskele Measured Section, No: 01/23, Güvercinlik Formation.
Partly Dolomitized Micritic Matrix, Intraclast (i) with Bioclast
Fragment. Arrow is Shown Equatorial View of Gastropod.



Figure 3.38. Microfacies 3, Intraclastic-Algae / Bioclastic Wackestone
Yellicebelen Measured Section, No: 01/72, Güvercinlik Formation
A Gastropod in a Dark Micritic Matrix (Arrow). Note the Cracked
Which is Filled by Lighter Finely Crystalline Sparry Calcite and Pulse
of Cracked.

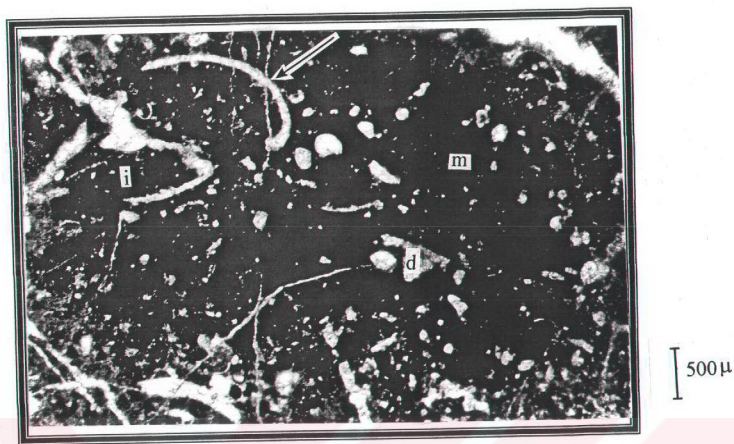


Figure 3.39. Microfacies 3, Intraclastic-algae / bioclastic wackestone
 Tahtaiskele measured section, No: 01/37, Nohutalan formation
 The microfacies composed of bioclast fragments (arrow) and intraclast
 (i) in a partly dolomitized (d) micritic matrix (m).

Dolomitization is also presented in the microfacies (Fig 3.40). Matrix is generally partly dolomitized, sometimes covered the original depositional texture and it is shown ghost allochems (Fig 3.41).



Figure 3.40. Microfacies 3, Intraclastic-Algae / Bioclastic Wackestone
 Yellicebelen Measured Section, No: 01/87, Güvercinlik Formation
 Original Texture of this Microfacies that is Composed of Small and Thin Bioclast Fragment (bf) and Dark Colored Micritic Matrix. In the Some Areas of the Microfacies 3, Well-Developed Planar-Euhedral, Planar-Subhedral and Nonolunar-Anhedral Dolomitic Crystals have Been Covered the Original Texture (Arrow).

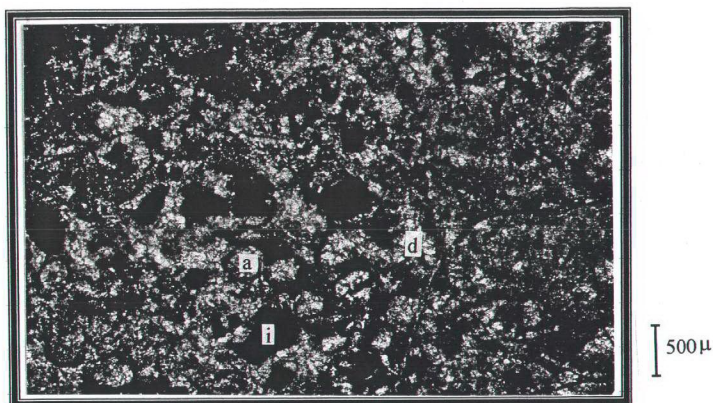


Figure 3.41. Microfacies 3, Intraclastic-Algae / Bioclastic Wackestone
 Yellicebelen Measured Section, No: 01/67, Güvercinlik Formation
 Micritic Intraclast (i) and Ghost Algal Fragments (a) Consisting of
 Light Finely Crystalline Dolomite (d).

Dolomitization is observed within void of the crackeds, which is form, a secondary texture. Generally it covered the primary calcite in the crackeds (Fig 3.42).



Figure 3.42. Microfacies 3, Intraclastic-Algae / Bioclastic Wackestone

Tahtaiskele Measured Section, No: 01/18, Güvercinlik Formation

The Groundmass is a Dark Micritic Matrix (m). The Large Cavity in the Middle is Occupied Primary Sparry Calcite Mosaic (s), After this Developed Dolomite Crystals (d). Note the Boundary Shape of Dolomite Crystals is Non-Planar Void Filling (Arrow).

Unexpected energy changing is presented different constitution in the microfacies. These are redeposition produce that is unrounded micritic intraclasts and some times shown sorting in this intraclasts (Fig 3.43).

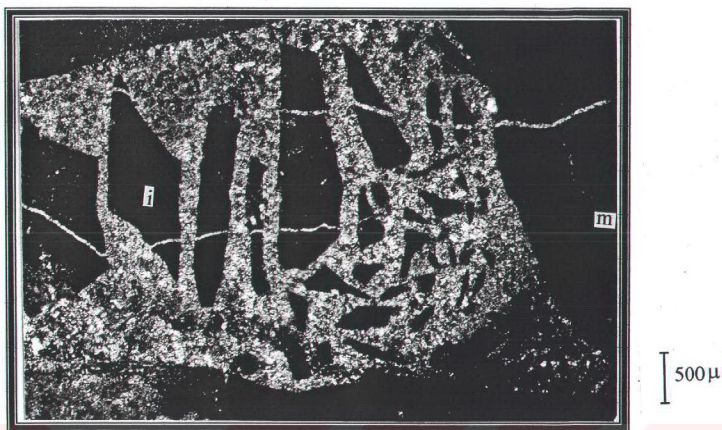


Figure 3.43. Microfacies 3, Intraclastic-Algae / Bioclastic Wackestone

Yellicebelen Measured Section, No: 01/72, Güvercinlik Formation

The Groundmass is a Dark Colored Micritic Matrix (m). The Large Cavity in Filled by Light Finely Dolomite Crystals and Micritic Unrounded Intraclasts (i). Note the Sorting of the Micritic Intraclasts.

The facies indicates a moderate to high energy, relatively shallow, tidal channel of deposition (Duran & Şengüdüz, 1993). Where present the redeposition produce, determined the sudden energy changing or rising.

3.2.4. Microfacies 4: Wackestone-packstone

The microfacies is determined that Tahtaiskele measured section on bottom of the Nohutalan formation.

Matrix of this microfacies consists of microcrystalline calcite and sparry calcite. Components of the microfacies are pelletoid, intraclasts, bioclast (miliolid, *textularia*, foraminifera, megalodont) and it's fragments, and algae (*Thaumatoporella parvovesiculifera*) (Fig 3.44).

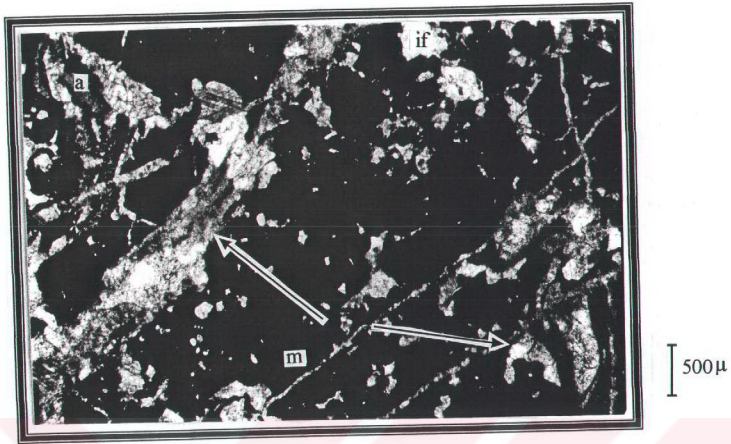


Figure 3.44. Microfacies 4, Wackestone-Packstone

Tahtaiskele Measured Section, No: 01/34, Nohutalan Formation

Microfacies Consists of Algae (*Thamatoporella Parvovesiculifera*) (a), Irregular Fenestrae (f) and Dark Colored Micritic Matrix (m). The Void of Cracked and Vugs Filled by Sparry Calcite Cement (Arrows).

Dolomitization is rare in microfacies 4 and generally determined sparry cement within fenestrae vugs and cracked (Fig 3.44).

Thamatoporella parvovesiculifera is mainly Mesozoic carbonate platform microfossil and the environment that is of shallow-water and mainly marine intertidal to subtidal (de Castro, 1990). Miliolids are characterized by restricted marine environments but not abundant this microfacies. Deposition of this microfacies is probably occurred shallow water, subtidal to probably restricted marine environments (Duran & Şengüdüz, 1993).

3.2.5. Microfacies 5: Bioclastic wackestone-floatstone

Microfacies 5 is presented the Zendemir Hill measured section on the Güvercinlik formations.

Matrix of the microfacies is microcrystalline calcite. Miliolid, megalodon, and algae (*Thaumatoporelle parvovesiculifera*) are component of the microfacies 4. Large and thick megalodon fragments are abundant that is generally recrystallized by coarser, granular, sparry calcite (Fig 3.45).

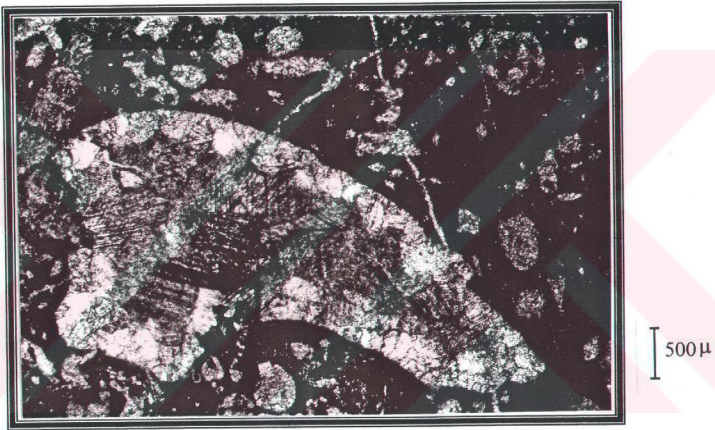


Figure 3.45. Microfacies 5, Bioclastic Wackestone-Floatstone
Zendemir Hill Measured Section, No: 01/47, Güvercinlik Formation
Recrystallized Megalodon Shell Fragment Within the Micritic Matrix.

Recrystallization is thought to be produced by the selective recrystallization of the limestone, with larger crystals growing at the expense of smaller ones. In this microfacies is also observed on the megalodon shell fragment (Fig 3.46).

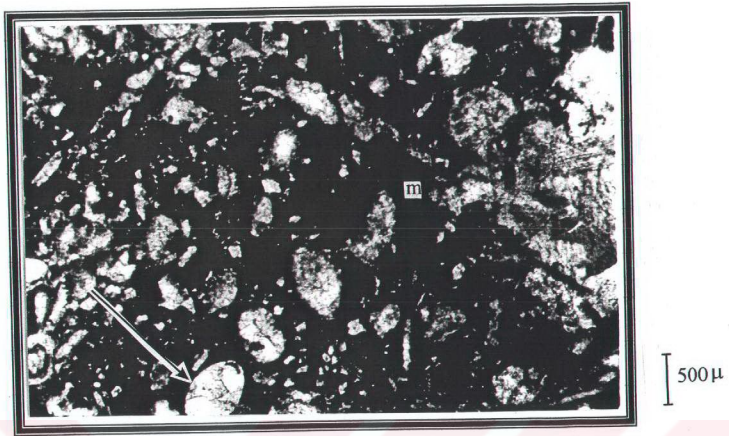


Figure 3.46. Microfacies 5, Bioclastic Wackestone-Floatstone
 Zendemir Hill Measured Section, No: 01/47, Güvercinlik Formation
 Microfacies Consists of Recrystallized Bioclast Fragments (Arrow) and
 Micritic Matrix (m).

Grain growth is another diagenetic effect, which is the changing of crystal fabric or crystal size without an accompanying change in mineral chemistry. Partially granular grain growth and granular open space filling sparry calcite is observed in the microfacies (Fig 3.47).

Depositional environment of the microfacies is probably shallow water, biostrome environment.

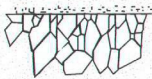
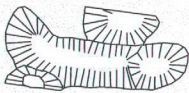
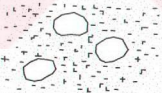
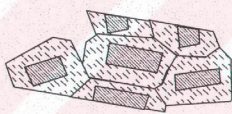
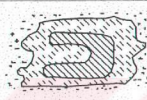
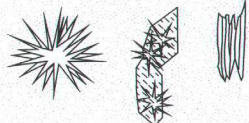
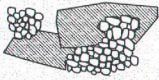
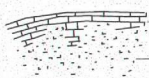
GENESIS	Open space filling CEMENT					Grain growth (= aggradation recrystallization)				Grain diminution (= degradation recrystallization)			
	Granular (Ortho-)	Drusy (Ortho-)	Fibrous (Ortho-)	Micrite cement (Ortho-)	Syntaxial rim (Ortho-)	Granular (Pseudo-)	Syntaxial rim Replacement (Pseudo-)	Fibrous calcite Replacement (Pseudo-)	Granular (Pseudo-)	Micrite (Pseudo-)			
FABRIC													

Figure 3.47. Diagenetic Fabrics (After Larsen & Chilingar ,1967)

3.2.6. Microfacies 6: Intraclastic packstone

The microfacies is observed Tahtaiskele and Yellicebelen Mountain measured sections of the Güvercinlik formation that is composed intraclasts, peletoid, breccia, and rare bioclast fragments within partly dolomitized micritic matrix and sparry calcite.

Intraclasts consist of quartzitic, sparitic and algal material, which are generally unrounded, coarse and medium-weak sorting (Fig 3.48-50).

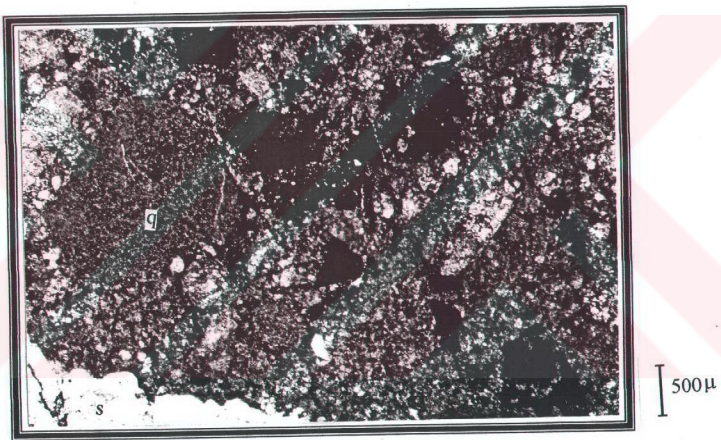


Figure 3.48. Microfacies 6, Intraclastic Packstone

Tahtaiskele Measured Section, No: 01/20, Güvercinlik Formation

The Groundmass is a Mosaic of Finely Crystalline Dolomite and Micrite. Unrounded Intraclasts, Which is Cracked, Composed of Quartzitic (q) and Sparitic (s) Material.



Figure 3.49. Microfacies 6, Intraclastic Packstone

Yellicebelen Measured Section, No: 01/90, Güvercinlik Formation

The Dark Intraclasts is Finely Microcrystalline Calcite (m) and Light Colored Material is Probably Siliciclastic Material.

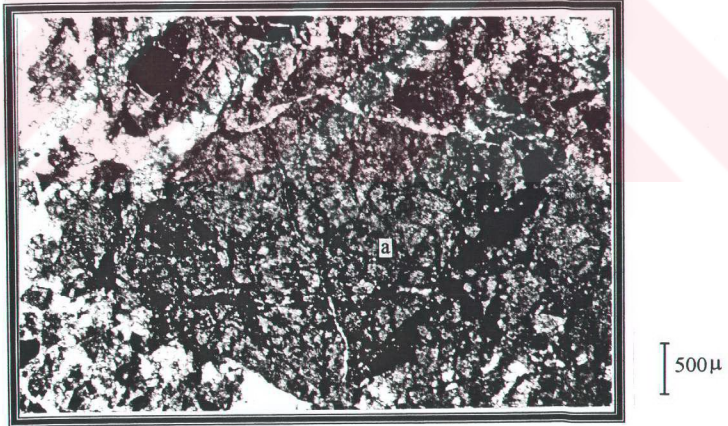


Figure 3.50. Microfacies 6, Intraclastic Packstone

Tahtaiskele Measured Section, No: 01/20, Güvercinlik Formation

The Large Clastic in the Middle is a Part of Algal Framestone (a)
Within Intraclastic Micritic Matrix.

Dolomitization is rare but well developed, which is a single dolomitic crystals observed in this microfacies (Fig 3.51).

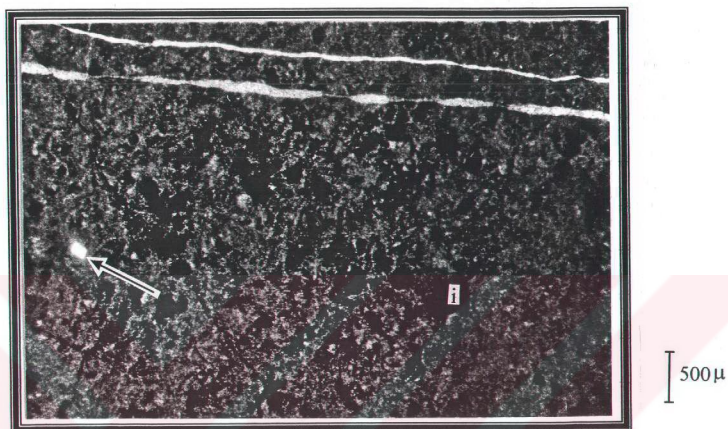


Figure 3.51. Microfacies 6, Intraclastic Packstone

Zendemir Hill Measured Section, No: 01/53, Güvercinlik Formation

Intralasts (i) Set in Dark Colored Micritic Matrix. Parallel Crackaed Filled by Light Finely Crystalline Dolomite. Arrow is Shows Well-Developed Single Dolomite Crystal.

Micritic intralasts are replaced by dolomite crystals in some areas of the microfacies 6 (Fig 3.52).

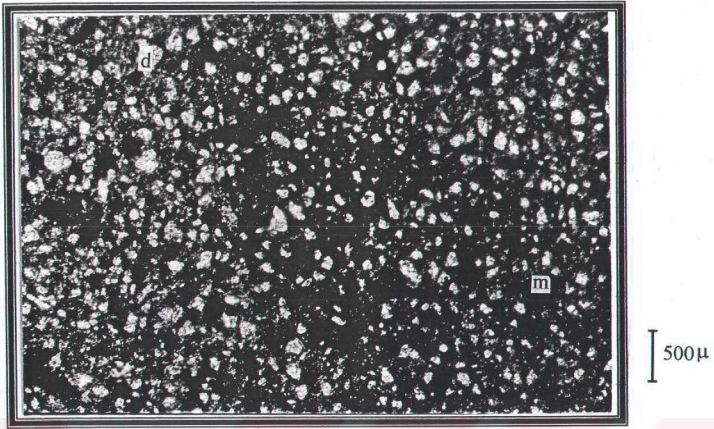


Figure 3.52. Microfacies 6, Intraclastic Packstone

Tahtaiskele Measured Section, No: 01/29, Güvercinlik Formation

Microfacies is Composed of Micritic-Unrounded Intraclasts (m), Which are Replaced by Dolomitic Crystals (d).

Diagenetic effects are mainly composed of dolomitization and rare stylolization that is between unrounded intraclasts.

This microfacies indicates a medium to high energy, relatively deep, shallow marine, tidal channel depositional environment.

3.2.7. Microfacies 7: Bioclastic / Miliolid packstone

The microfacies is observed Zendemir Hill measured section of the Güvercinlik formation that is composed intraclasts, bioclast and it's fragments, miliolid, algae (*Thaumotoporelle parvovesiculifera*) set in micritic matrix and sparry calcite cement.

Bioclasts are contents of miliolid, megalodon and various shell fragments. Miliolids are abundant and clearly observed in this microfacies. Megalodons also abundant, which have thin shell (Fig 3.53-56).

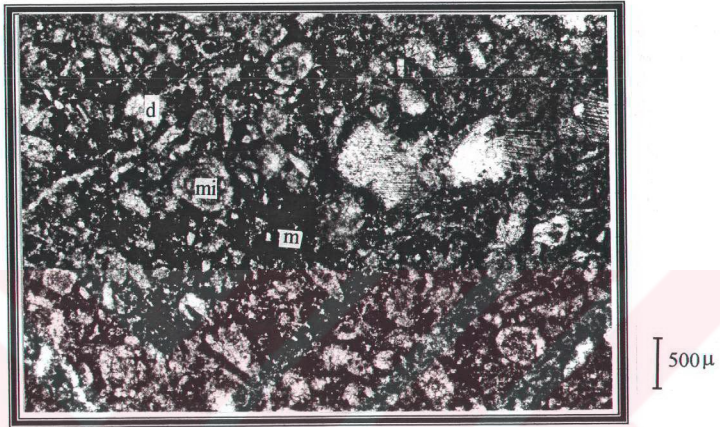


Figure 3.53. Microfacies 7, Bioclastic / Miliolid Packstone
Zendemir Hill Measured Section, No: 01/42, Güvercinlik Formation
Microfacies is Composed of Partly Dolomitized (d), Micritic Matrix (m)
and Miliolids (mi).



Figure 3.54. Microfacies 7, Bioclastic / Miliolid Packstone
 Zendemir Hill Measured Section, No: 01/46, Güvercinlik Formation.
 Miliolid (mi) and Bioclast Fragment (bf) Set in a Partly Dolomitized
 Micritic Matrix.

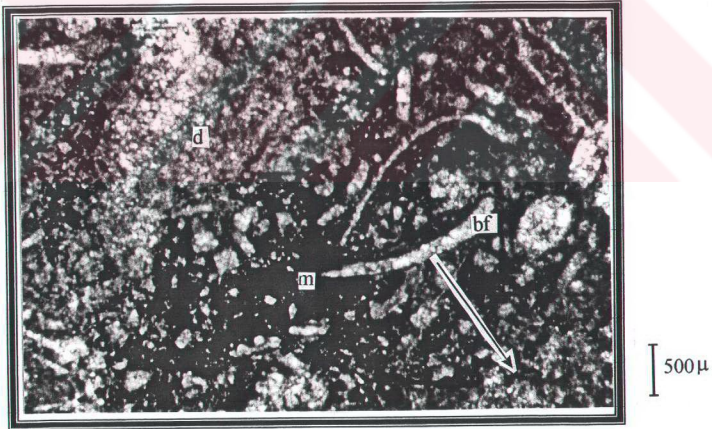


Figure 3.55. Microfacies 7, Bioclastic / Miliolid Packstone
 Zendemir Hill Measured Section, No: 01/41, Güvercinlik Formation
 Partially Dolomitized (d) Micritic Matrix (m) and Bioclast Fragment
 (bf). Arrow is Shown Stylolit.

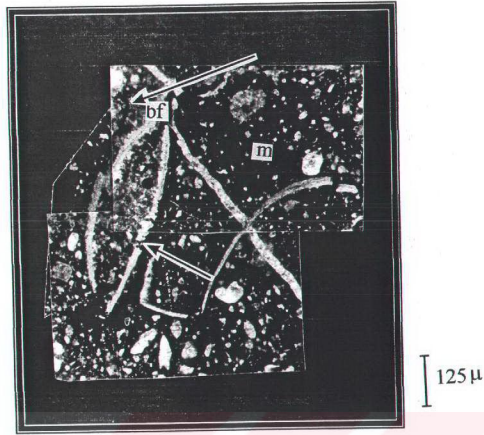


Figure 3.56. Microfacies 7, Bioclastic / Miliolid Packstone

Zendemir Hill Measured Section, No: 01/44, Güvercinlik Formation

Bioclast Fragments (bf) in a Dark Micritic Matrix (m). Stylolite Contacts are Conspicuous Among the Larger Fragments (Big Arrow). Note the Bioturbation Structures of the Large Fragments (Small Arrow).

Diagenetic effects are composed of dolomitization, bioturbation and stylolite.

Stylolite is generally observed between the shell fragments (Fig 3.56).

Bioturbation is the disruption of sediment by organisms and sediment that has destroyed depositional sedimentary structures. Clearly recognizable burrows, trails, and traces on the fragment (Fig 3.56).

This microfacies indicates a medium energy, relatively deep, shallow marine, shallow restricted depositional environment.

3.8. Microfacies 8: Pelletoidal / packstone-grainstone

This microfacies is available Yellicebelen measured section on the Güvercinlik formation. Components of this microfacies are pelletoid, bioclast and algae (*Thaumatoporelle parvovesiculifera*), which are set in micritic and partly dolomitized micritic matrix (Fig 3.57).

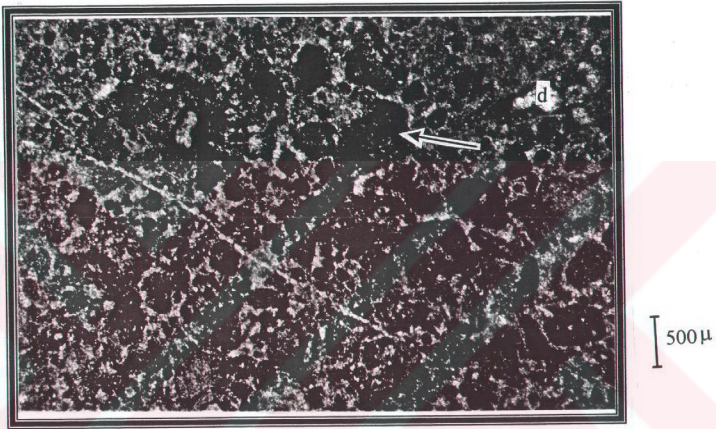


Figure 3.57. Microfacies 8, Pelletoidal / Packstone-Grainstone

Yellicebelen Measured Section, No: 01/78, Güvercinlik Formation.

The Dark Components are Finely Microcrystalline Calcite of Algal Origin (Arrow). The Matrix is Occurred Light Colored Finely Crystalline Dolomite (d).

Dolomitization is dense examined in thin section of the microfacies, which is crystal size is fine that is probably rapid precipitation of dolomite crystals during replacement of fine-crystalline carbonate.

Pellets are abundant in the microfacies that is preserved in low-energy, muddy environments colonized by an rare fauna but abundant diversity, e.g. lagoons and tidal flats. This microfacies indicate that restricted shallow environment.

3.2.9. Microfacies 9: Bioclastic packstone-floatstone

Microfacies 9 is only examined Zendemir Hill measured section that is consists of Bioclast fragments (megalodon), miliolid, pelletoid are set in micritic matrix and sparry cement.

Megalodon fragments are abundant, recrystallized and coarsed (Fig 3.58). Miliolids are rare and generally recrystallized (Fig 3.59).

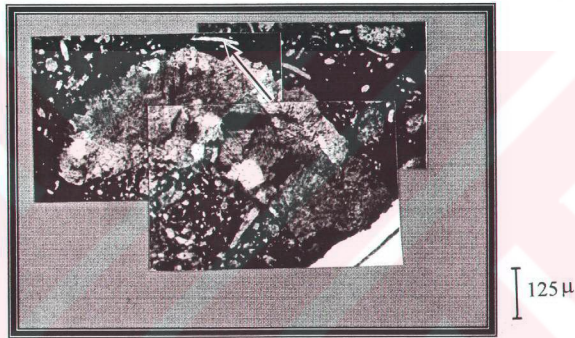


Figure 3.58. Microfacies 9, Bioclastic Packstone-Floatstone

Zendemir Hill Measured Section, No: 01/39, Güvercinlik Formation

Recrystallized Bioclast Fragment in Micritic Matrix. Note the Rounded Small and Thin Fragments in the Matrix (Arrow).

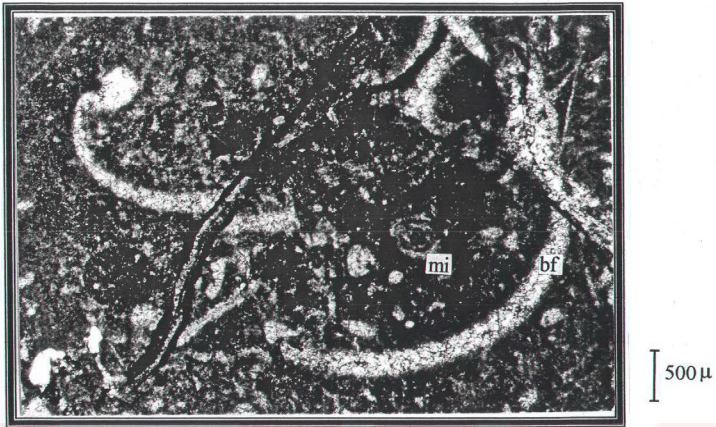


Figure 3.59. Microfacies 9, Bioclastic Packstone-Floatstone

Zendemir Hill Measured Section, No: 01/49, Güvercinlik Formation

Bioclast Fragment (bf) and Miliolid (mi) are Set in a Dark Micritic Matrix, Which is Partly Dolomitized.

Diagenetic events are effective such as dolomitization, recrystallization, stylolite, bioturbation, micritic envelope and iron oxidation.

Dolomitization, stylolitization, bioturbation and iron oxidation are generally presented. Stylolite and iron oxidation are existed between shells. Bioturbation is clearly observed above the bioclast fragments (Fig 3.60-62).

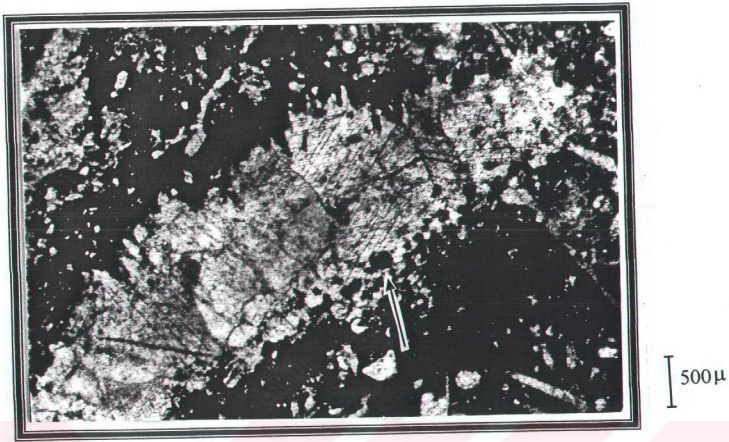


Figure 3.60. Microfacies 9, Bioclastic Packstone-Floatstone
 Zendemir Hill Measured Section, No: 01/39, Güvercinlik Formation
 Megalodon Fragments Present Bioturbation Structures (Arrow). Note
 the Clearly Recognizable Burrows on the Fragment.



Figure 3.61. Microfacies 9, Bioclastic Packstone-Floatstone
 Zendemir Hill Measured Section, No: 01/51, Güvercinlik Formation
 Bioclast Fragment (bf) With Red Iron Oxide are Set in a Partly
 Dolomitized Micritic Matrix.

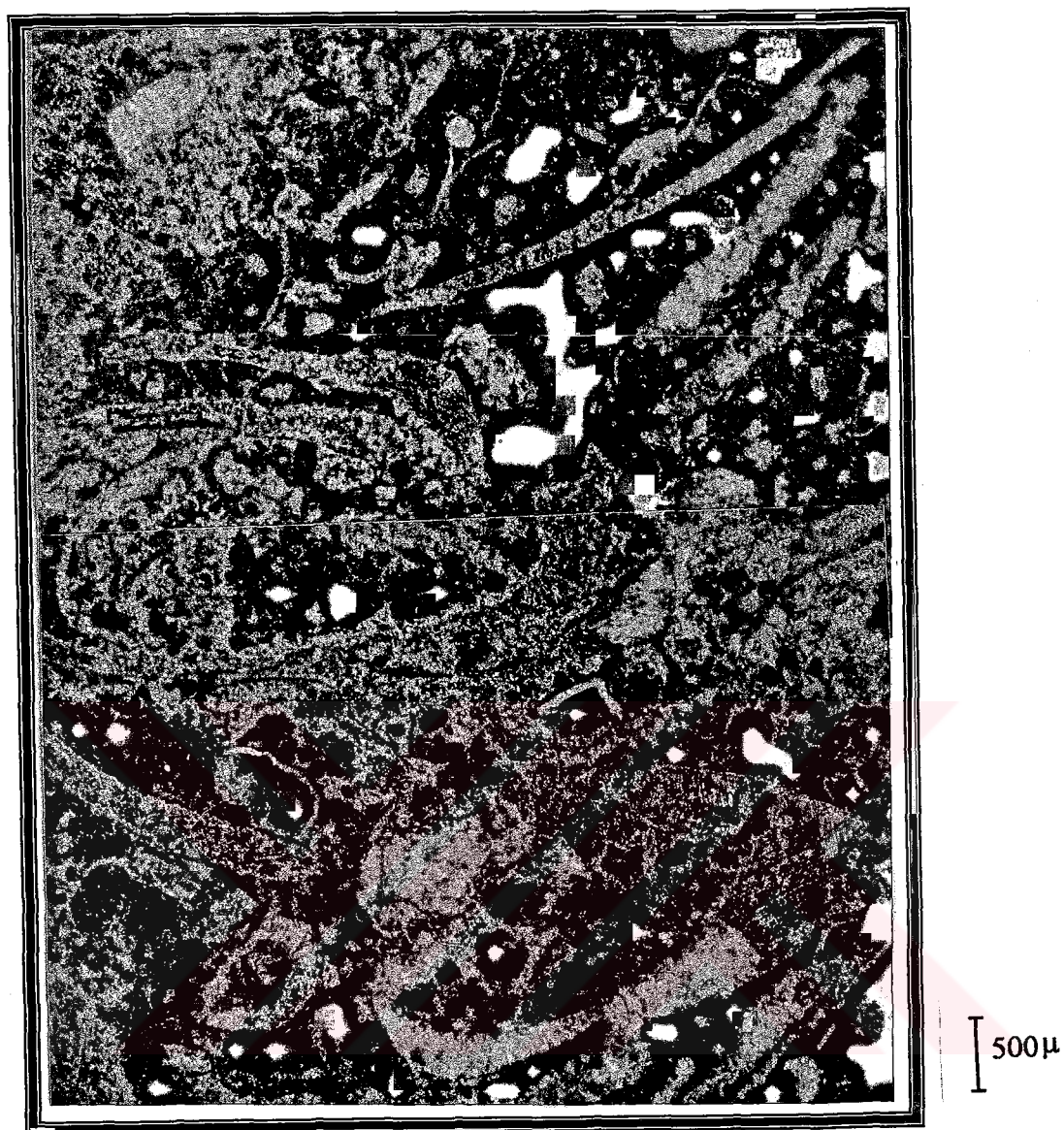


Figure 3.62. Microfacies 9, Bioclastic Packstone-Floatstone

Zendemir Hill Measured Section, No: 01/51, Güvercinlik Formation

Bioclast Fragments with Red Iron Oxide are Set in a Dark Micritic Matrix.

Deposition the microfacies 9 is probably occurred in biostrome environment.

3.2.10. Microfacies 10: Packstone-boundstone / algae framestone

The microfacies is only examined Yellicebelen measured section. The microfacies is consisting of algae, bioclast fragments and micritic matrix (Fig 3.63).

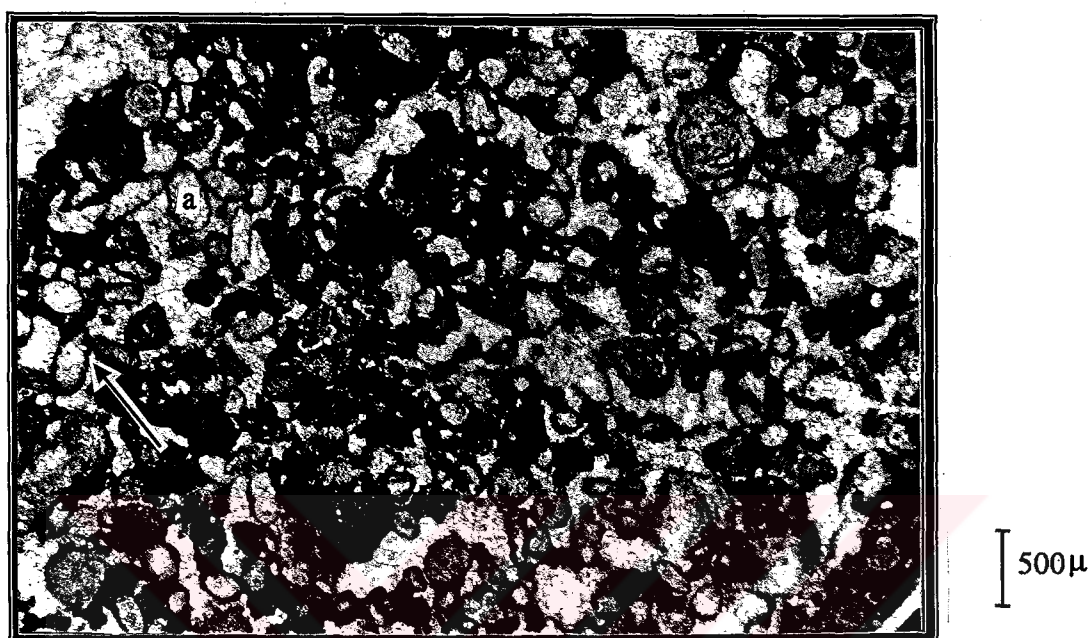


Figure 3.63. Microfacies 10, Packstone-Boundstone

Yellicebelen Measured Section, No: 01/82, Güvercinlik Formation

Algal Fragments (a) Consisting of Light to Dark Finely Crystalline Dolomite are Set in Dark Microcrystalline Calcite and Light Finely Crystalline Dolomite. Note the Dark, Micritic Envelopes (Arrow) Around Algal Fragments.

Diagenetic effects are also observed in the microfacies that are dolomitization and micritic envelope (Fig 3.63). Micrite envelope is a dark-colored, fine-grained, carbonate exterior found around carbonate skeletal fragments. It is produced by the alteration of the original mineralogy of the fragment to micrite, commonly caused by the boring into the skeletal material of certain algae. In some micrite envelopes the tiny, tube-like borings of the algae are preserved. Coatings of filamentous algae form some micrite envelopes over the grain. If the development of the micrite envelope proceeds to an advanced stage, the primary structure of the skeletal fragment will be totally replaced by micrite, leaving an amorphous peloid, or lump.

This microfacies indicates shallow marine, probably subtidal depositional environment.

3.2.11. Microfacies 11: Bioclastic grainstone-rudstone-floatstone

The microfacies is observed all measured section on the Nohutalan formation and the Güvercinlik formation. Bioclastic grainstone-rudstone-floatstone microfacies is composed of bioclast (megalodon, gastropod,), foraminifera ("*Siphovavulina*" sp.), algae (*Thaumatoporelle parvovesiculifera*) and pelletoid. The matrix consists of microcrystalline calcite and sparry calcite cement.

Fauna are abundant but not diverse. Skeletal fragments are generally recrystallized and occurred bioturbation (Fig 3.64-71).

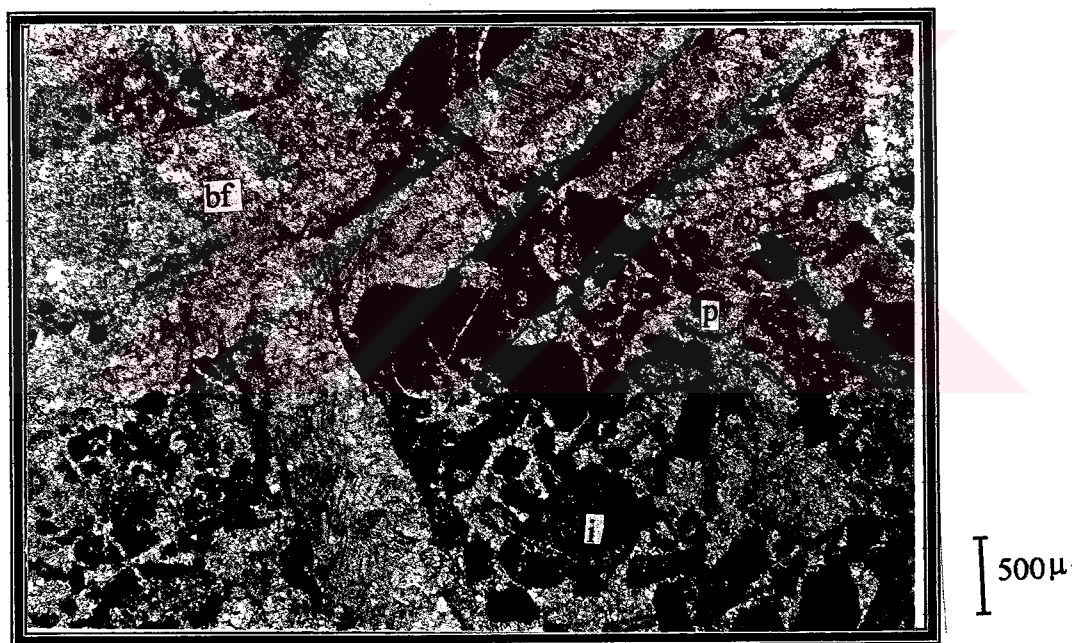


Figure 3.64. Microfacies 11, Bioclastic Grainstone-Rudstone-Floatstone

Yellicebelen Measured Section, No: 01/92, Nohutalan Formation

Microfacies is Composed of Sparry Calcite with Micritic Intraclasts (i), Pelletoids (p) and Coarse Bioclast Fragments (bf). Note the Bioclast Fragments, which Display Recrystallized Shells of Coarsely Crystalline Calcite.

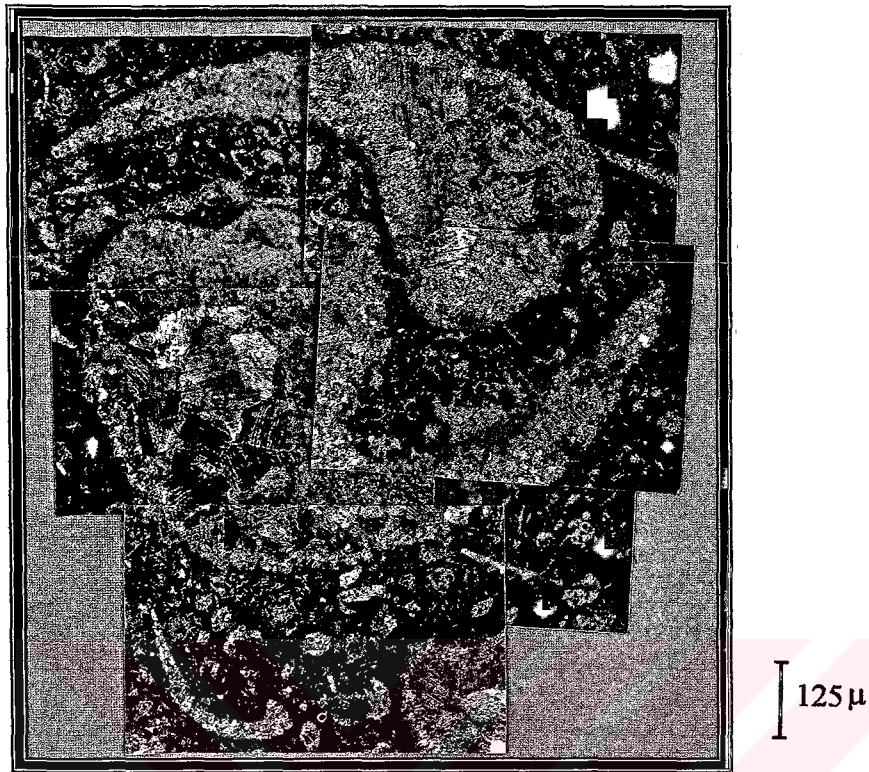


Figure 3.65. Microfacies 11, Bioclastic Grainstone-Rudstone-Floatstone

Zendemir Hill Measured Section, No: 01/48, Güvercinlik Formation

Megalodon Shells Which Display a Recrystallized Shells of Coarsely Crystalline Calcite. The Matrix is Composed of Dark Colored Microcrystalline Calcite with Rounded Small Bioclast Fragment.

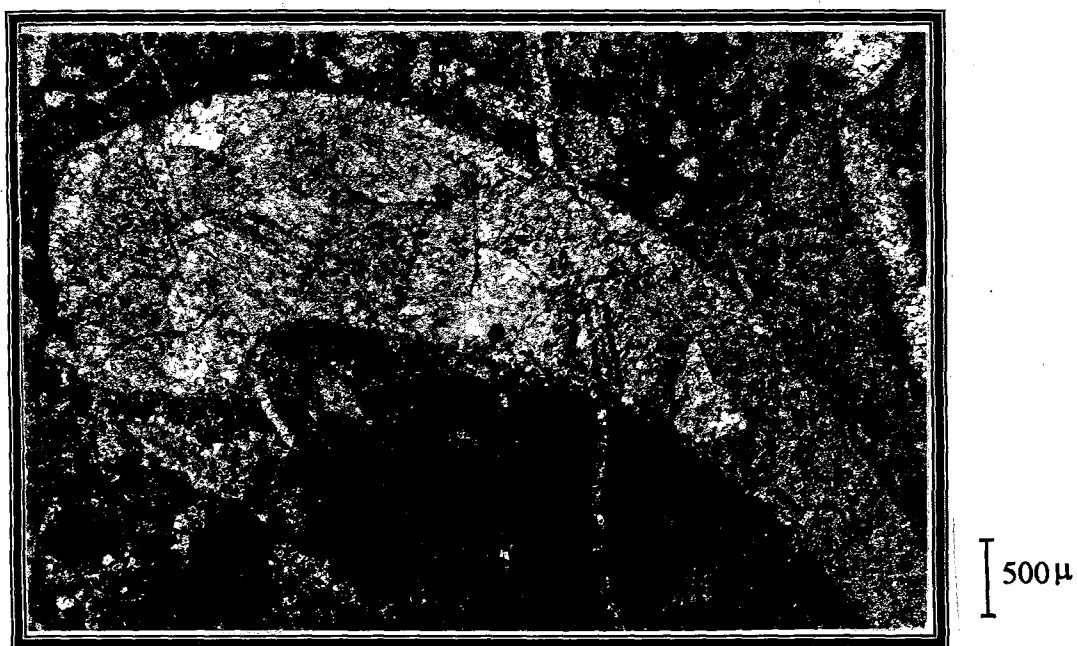


Figure 3.66. Microfacies 11, Bioclastic Grainstone-Rudstone-Floatstone
 Zendemir Hill Measured Section, No: 01/48, Güvercinlik Formation
 Recrystallized Megalodon Shell is Set in a Dark Colored
 Microcrystalline Calcite and Lighter Pseudo-Sparite.

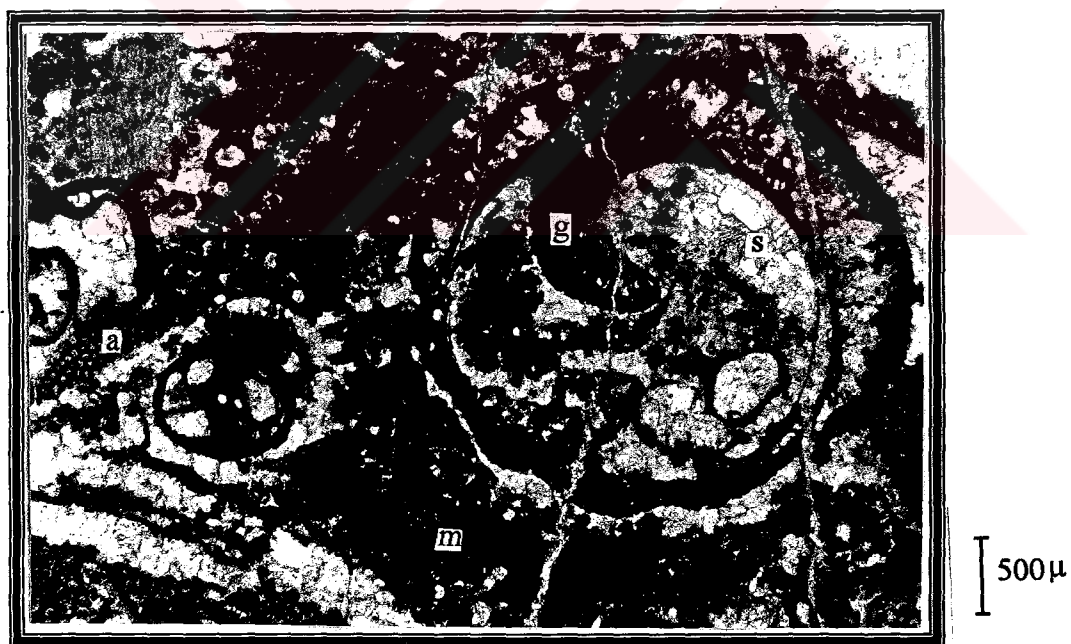


Figure 3.67. Microfacies 11, Bioclastic Grainstone-Rudstone-Floatstone
 Tahtaiskele Measured Section, No: 01/35, Nohutalan Formation
 Gastropod Shell (g) and Algae (a) (*T. parvovesiculifera*), are Set in a
 Dark Colored Micritic Matrix (m) and Sparry Calcite (s) Cement. Note
 the Gastropod Shell is Filled by Sparry Calcite and Micrite or Pelletoid,
 and Display Geopetal Fabric.

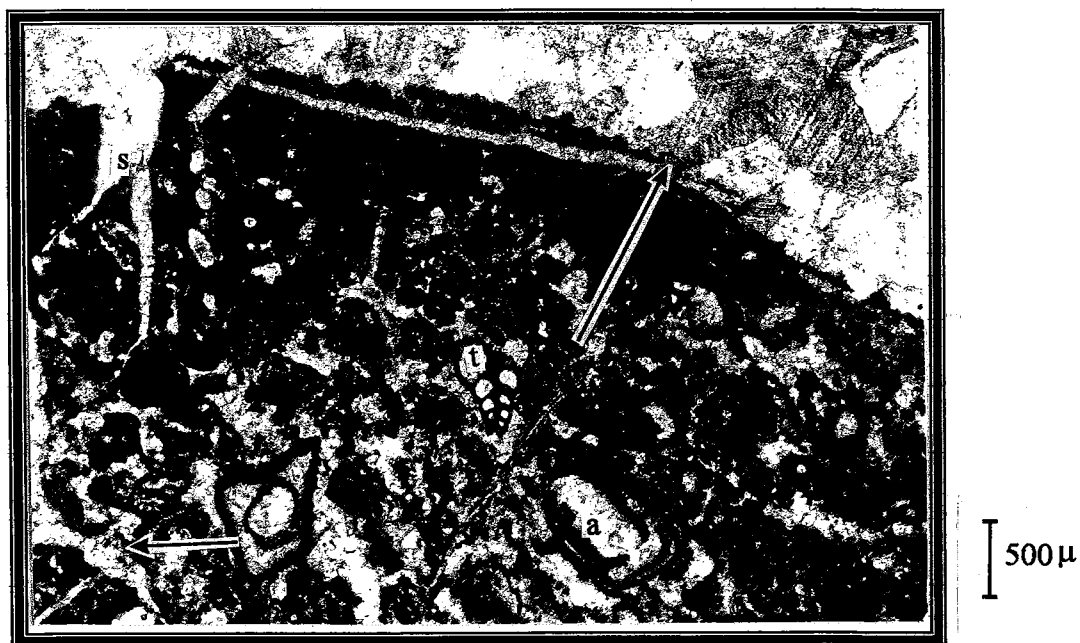


Figure 3.68. Microfacies 11, Bioclastic Grainstone-Rudstone-Floatstone

Tahtaiskele Measured Section, No: 01/35, Nohutalan Formation

This Microfacies Consists of Sparry Calcite (s) with foraminifera "*Siphovavulina*" sp.,(f), Algae (*T. parvovesiculifera*) (a). Small Arrow is Shows Granular Pseudo-Spar in Micritic Matrix. Most Bioclast Fragments Void Filled With Sparry Calcite (Big Arrow).

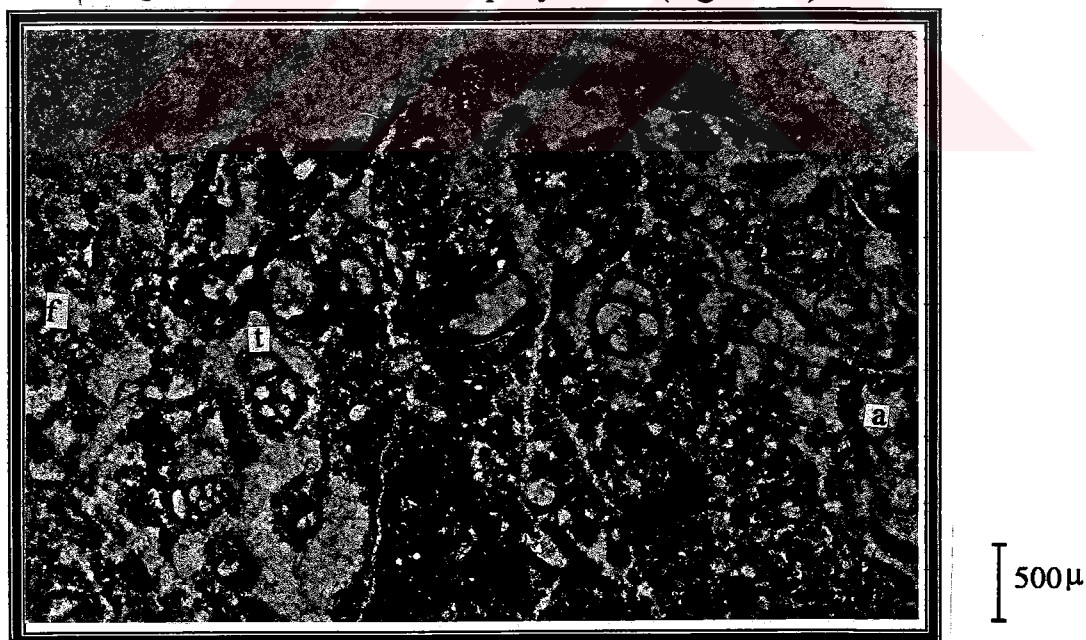


Figure 3.69. Microfacies 11, Bioclastic Grainstone-Rudstone-Floatstone

Tahtaiskele Measured Section, No: 01/35, Nohutalan Formation

Algae (*T. parvovesiculifera*) (a), foraminifera "*Siphovavulina*" sp.(f) and Pellet are Set in Sparry Cement and Prefentially Recrystallized Micrite.

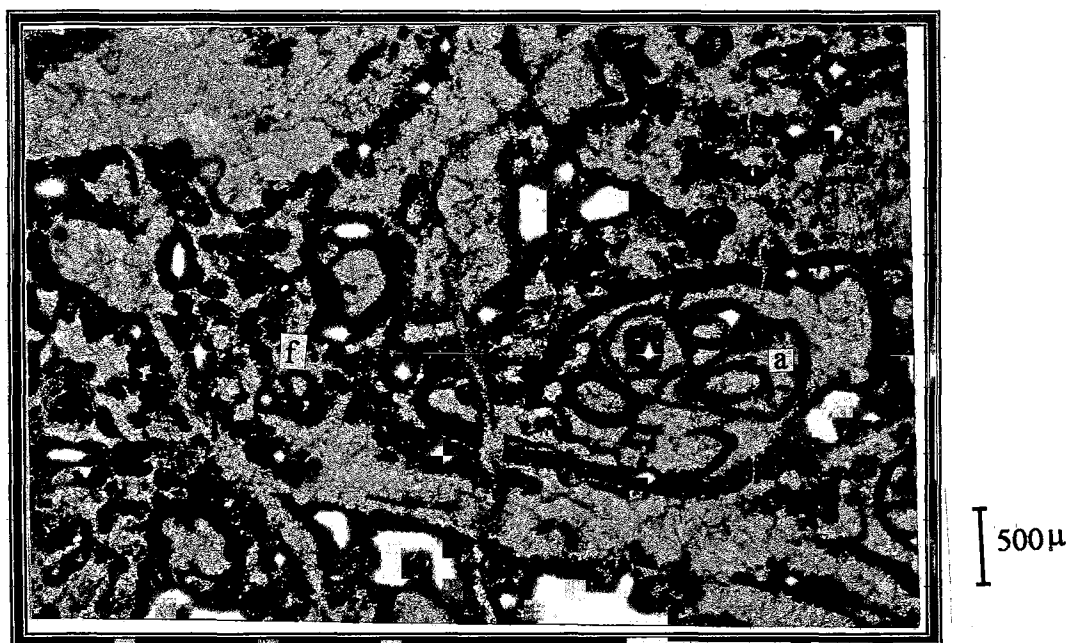


Figure 3.70. Microfacies 11, Bioclastic Grainstone-Rudstone-Floatstone
Tahtaiskele Measured Section, No: 01/35, Nohutalan Formation
Thaumatoporella parvovesiculifera (a), Foraminifera (f) and Pellet in
Sparry Calcite Cement.



Figure 3.71. Microfacies 11, Bioclastic Grainstone-Rudstone-Floatstone
Tahtaiskele Measured Section, No: 01/35, Nohutalan Formation
Megalodon Shell Recrystallized to Coarse Calcite Spar That is Set in
Sparry Calcite (s) With Pelletoids (p) and Micritic Bioclast Fragment
(bf).

Stylolites are determined some thin sections in this microfacies (Fig 3.72). Stylolites are presented various styles according to burrowed diagenesis phase (Duran & Şengündüz, 1993) (Fig. 3.73).



Figure 3.72. Microfacies 11, Bioclastic Grainstone-Rudstone-Floatstone
Tahtaiskele Measured Section, No: 01/36, Nohutalan Formation
Stylolite (Arrows) Among Recrystallized Megalodon Shells.

Depositional environments of this microfacies is probably biostrome.

STYLES OF PRESSURE-SOLUTION	
NON-SUTURED SEAMS	SUTURED SEAMS
BEDDING-PARALLEL SINGLE  SWARMS  NON-PARALLEL RETICULATE GRAIN-CONTACT  MULTI-GRAIN  NODULE-BOUNDING 	*BEDDING-PARALLEL  LARGE AMPL. SINGLE  SMALL AMPL. SWARMS  NON-PARALLEL RETICULATE **GRAIN-CONTACT  **MULTI-GRAIN  ***NODULE-BUILDING  * stylolite ** microstylolite *** may be fitted fabrics

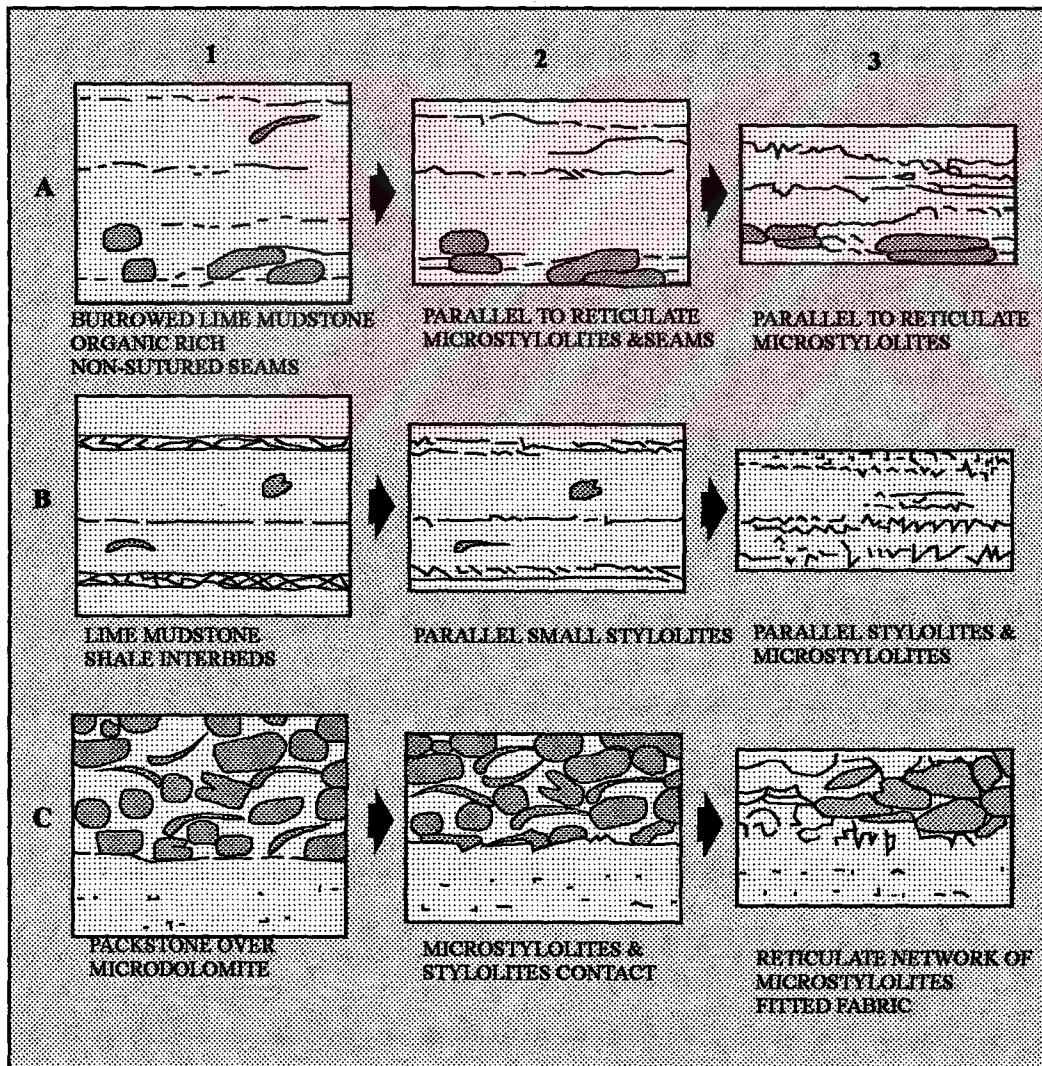


Figure 3.73. Occure of Stylolite (Duran & Sengunduz, 1993)

CHAPTER FOUR

ENVIRONMENTAL ANALYSIS

Five major depositional environments can be distinguished from shore to open sea in the Güvercinlik formation as follows: (1) intertidal channel, (2) intertidal (3) subtidal, (4) restricted shallow, (5) reef tallus and patch reef. Schematic diagram of these depositional environments and it's microfacieses are displayed in Fig 4.1.

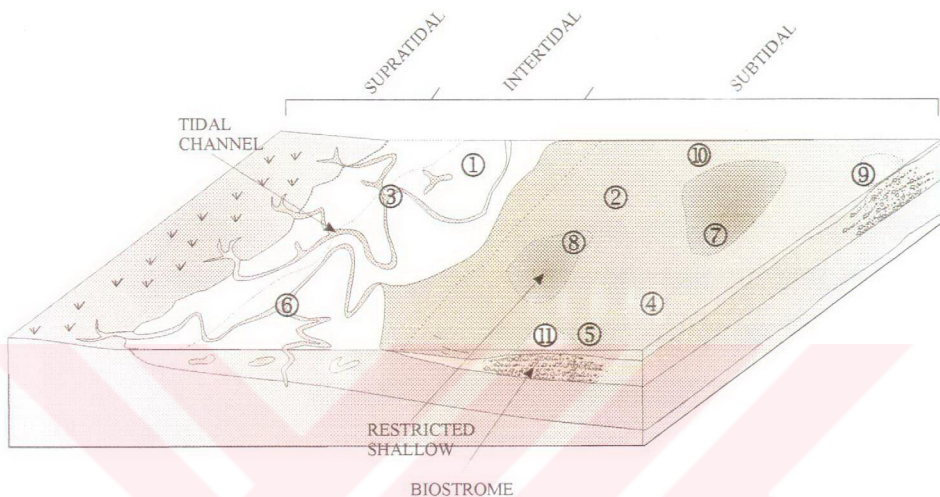
4.1. Intertidal Channel Depositional Environment

Mainly microfacieses of this depositional system chacterized by microfacies 3 and 6.

The main feature of the intertidal channel is the predominance of sand-sized grains over micrite matrix (Colacicchi et al., 1975). The grains are intraclasts, pelletoids and very fine-grained fossil fragments, which are unrounded and weak sorting in examined thin sections.

According to Duran & Şengündüz (1993), intraclasts are occured storm period in intertidal and tidal flat. However, Wilson (1975) is also determined breccia-pebble conglomerates formed shallow tidal channel.

Besides, sedimentary structures of this depositional environment are observed low-angle; cross-lamination that is asymmetrical in the stromatolitic limestones of the Güvercinlik formations in the Tahtaiskele locality (Fig 2.21).



- ① Microfacies 1. Stromatolite / algae-boundstone / mudstone
- ② Microfacies 2. Mudstone-bioclasic mudstone
- ③ Microfacies 3. Intraclastic-algae / bioclasic wackestone
- ④ Microfacies 4. Wackestone-packstone
- ⑤ Microfacies 5. Bioclasic wackestone-floatstone
- ⑥ Microfacies 6. Intraclastic packstone
- ⑦ Microfacies 7. Bioclasic / Miliolid packstone
- ⑧ Microfacies 8. Pelletoidal / packstone-grainstone
- ⑨ Microfacies 9. Bioclasic packstone-floatstone
- ⑩ Microfacies 10. Packstone-boundstone / algae framestone
- ⑪ Microfacies 11. Bioclasic grainstone-rudstone-floatstone

Figure 4.1. Depositional Environments of the Guvercinlik Formation

4.2. Intertidal Depositional Environment

Microfacies 1 is characterized this environment in the study.

Laminoid fenestrae and stromatolitic algae are observed in microfacies 1 and displayed intertidal environment.

Laporte (1975), Halley (1975), Collinson & Thompson, (1987), Egenhoff et al. (1999), Kamoun et al. (2001) and Lehrmann et al. (2001) are determined commonly stated view stromatolites are indicators of intertidal-tidal flat conditions. Fenestrae is also appeared intertidal and lower intertidal depositional environment (Read, 1975; Zamarreno, 1975; Fischer, 1975; Davis, 1975).

4.3. Subtidal Depositional Environment

This environment is determined microfacies 2, 4, and 10. Common characteristics of the environment are dark colored microcrystalline calcite, pellet and thin bioclasts fragments. *Thaumatoporella parvovesiculifera* is more common shallow water and intertidal to subtidal environment in microfacies 4 (de Castro, 1990).

Irregular fenestrae is also observed in microfacies 2 that is appeared subtidal-tidal flat environment (Zamarreno, 1975; Demicco & Hardie, 1990; Martini et al., 1997; Strasser et al., 1999,). Laporte (1975) is described subtidal environment that is pelletal lime wackestone.

Pellets, mud aggregates, and a few bioclasts (fragments of gastropods and foraminifera) in a micritic matrix are the main constituents of this system. Laminations of algal origin observed in the higher parts (Colacicchi et al., 1975).

4.4. Restricted Shallow Depositional Environment

Restricted shallow depositional environment is used as deeper and restricted circulation in the subtidal zone. This environments is similar to lagoon environment that is avoided wavy action. Allochems and bioclasts are presented weak sorting. Fauna is rare of the Microfacies 7 and 8, which is consist of generally miliolid and small and thin bioclasts(Duran & Şengündüz, 1993; Geel, 2000).

4.5. Biostrome Depositional Environment

This environment composed of microfacies 5, 9, and 11, which are generally consist of thick and coarse megalodon, various bioclast fragments (*Textularia*, gastropod , foraminifera) , and algae (*T. parvovesiculifera*) in a partly sparritic micrite matrix and sparry calsit cement. In general recrystallized is observed skeletal fragments.

Biostromes developed in the subtidal environment. In the Upper Triassic, megalodon were common and diverse. They occur as frame builders in the shallow subtidal environment. This megalodons locally enlarge associated with much smaller allochem and shell fragments (*Textularia*, Gastropoda , Foraminifera and rare miliolid) within Packstone / Grainstone / Rudstone.

CHAPTER FIVE

CONCLUSIONS

This study focuses on the microfacies and depositional environments of the Upper Triassic (Carnian-Norian) Güvercinlik formation. The Güvercinlik formation consists of limestones, dolomitic limestones, stromatolitic dolomitic limestones, megalodon-bearing massive limestones, mudstone intercalations and sandstone lenses.

Result of detailed petrographical studies on the Güvercinlik formation is identified eleven microfacies:

Stromatolite/algae-boundstone / mudstone microfacies is characterized by algae, stromatolitic algae, gastropods and bioclasts in a micrite matrix.

Mudstone-bioclastic mudstone microfacies is composed of pellets and bioclast fragments. The matrix is partly dolomitized micrite.

Intraclastic-algae / bioclastic wackestone microfacies is comprised of intraclasts, algae fragments and bioclast fragments. Matrix of the microfacies is partly dolomitized micrite.

Wackestone-packstone microfacies consists of micrite matrix and sparry calcite cement, pellets, intraclasts, various bioclasts and algae (*Thaumatoporella parvovesiculifera*).

Bioclastic wackestone-floatstone microfacies is characterized by micrite matrix, miliolid, megalodon and algae (*Thaumatoporella parvovesiculifera*).

Intraclastic packstone is comprised of intraclasts, pellets, breccias and bioclast fragments are set in partly dolomitized micrite matrix and sparry calcite cement.

Bioclastic / miliolid packstone microfacies is composed of intraclasts, bioclasts, miliolid and algae (*Thaumatoporella parvovesiculifera*) in a micrite matrix and sparry calcite cement.

Pelletoidal / packstone-grainstone microfacies is characterized by pellets, bioclasts and algae (*Thaumatoporella parvovesiculifera*) that are set in partly dolomitized micrite matrix.

Bioclastic packstone-floatstone microfacies consists of bioclast fragments (megalodon), miliolids, pellets are set in micrite matrix and sparry calcite cement.

Packstone-bounstone / algae framestone microfacies is chacterized by algaes, bioclast fragments and micrite matrix.

Bioclastic grainstone-rudstone-floatstone microfacies consists of various bioclasts, algae (*Thaumatoporella parvovesiculifera*) and pellets in a micrite matrix and sparry calcite cement.

A lot of diagenetic effects are observed in these microfacies. The most common diagenetic effect is dolomitization that is presented various crystal boundary shapes and zonation. Other effects are dedolomitization, geopetal structure, stylolization, micrite envelope, fracture and void filling spar, bioturbation structures and recrystallization.

Five depositional environments is described based on microfacies characteristics. These depositional environments are from shore to open sea (1) intertidal channel, (2) intertidal, (3) subtidal, (4) restricted shallow, (5) biostrome.

Intertidal channel depositional environment is characterized by intraclasts, breccia and pelletoids. Micritic and quartzitic intraclasts and/or breccias and pelletoids are observed in Microfacies 3 and 6.

Variety features are occurred intertidal depositional is observed in microfacies 1, which characterized by stromatolite algae and fenestrae fabrics.

Subtidal environment is determined in microfacies 2, 4, 6 and 10, which consists of irregular fenestrae, pellets and rare diversity fossils.

Restricted shallow depositional environment is used to described narrow and restricted subtidal environment. Microfacies 7 and 8 have been occurred this environment.

Biostrome depositional environment chacterized by coarse megalodon fossils and sparry cement that is observed in microfacies 5, 9 and 11.

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