

INTERNATIONAL STUDIES IN

# ENGINEERING

*June 2023*

## EDITORS

PROF. DR. COŞKUN ÖZALP

ASSOC. PROF. DR. SELAHATTİN BARDAK

 SERÜVEN  
YAYINEVİ

**Genel Yayın Yönetmeni / Editor in Chief • C. Cansın Selin Temana**

**Kapak & İç Tasarım / Cover & Interior Design • Serüven Yayınevi**

**Birinci Basım / First Edition • © Haziran 2023**

**ISBN • 978-625-6450-62-2**

**© copyright**

Bu kitabın yayın hakkı Serüven Yayınevi'ne aittir.

Kaynak gösterilmeden alıntı yapılamaz, izin almadan hiçbir yolla çoğaltılamaz.

The right to publish this book belongs to Serüven Publishing. Citation can not be shown without the source, reproduced in any way without permission.

**Serüven Yayınevi / Serüven Publishing**

**Türkiye Adres / Turkey Address:** Kızılay Mah. Fevzi Çakmak 1. Sokak

Ümit Apt No: 22/A Çankaya/ANKARA

**Telefon / Phone:** 05437675765

**web:** www.seruenyayinevi.com

**e-mail:** seruenyayinevi@gmail.com

**Baskı & Cilt / Printing & Volume**

Sertifika / Certificate No: 47083

## Chapter 4

### **SEDIMENTARY FEATURES OF THE ORHANIYE FORMATION (LUTETIAN) AROUND ORHANIYE-GÜVENÇ (ANKARA, TÜRKİYE)**

*Ali Müjdat ÖZKAN<sup>1</sup>*

*Ayla BOZDAĞ<sup>2</sup>*

---

1 Assoc. Prof. Dr. Ali Müjdat ÖZKAN; Konya Technical University Faculty of Engineering & Natural Sciences Department of Geological Engineering. amozkan@ktun.edu.tr \*Corresponding author ORCID ID: 0000-0001-6686-327X  
2 Prof. Dr. Ayla BOZDAĞ; Konya Technical University Faculty of Engineering & Natural Sciences Department of Geological Engineering. aybozdag@ktun.edu.tr ORCID ID: 0000-0002-6114-0678



## Introduction

Offering a narrow spread in the study area; the unit, which consists of cream-colored fossiliferous limestone, sandstone, and mudstone, took its name from Orhaniye Village (Figures 1, 2). Gökten et al. (1988) first defined and named this unit under the name Orhaniye Formation. In this study, the unit was studied under the name of Orhaniye Formation.

The Orhaniye Formation outcrops in the study area, along the line of Orhaniye Village and Güvenç Village, in the south and north of Lezgi Village, and Karyağdı Hill, Akpınar Hill and Dikbayır Hill (Figure 1).

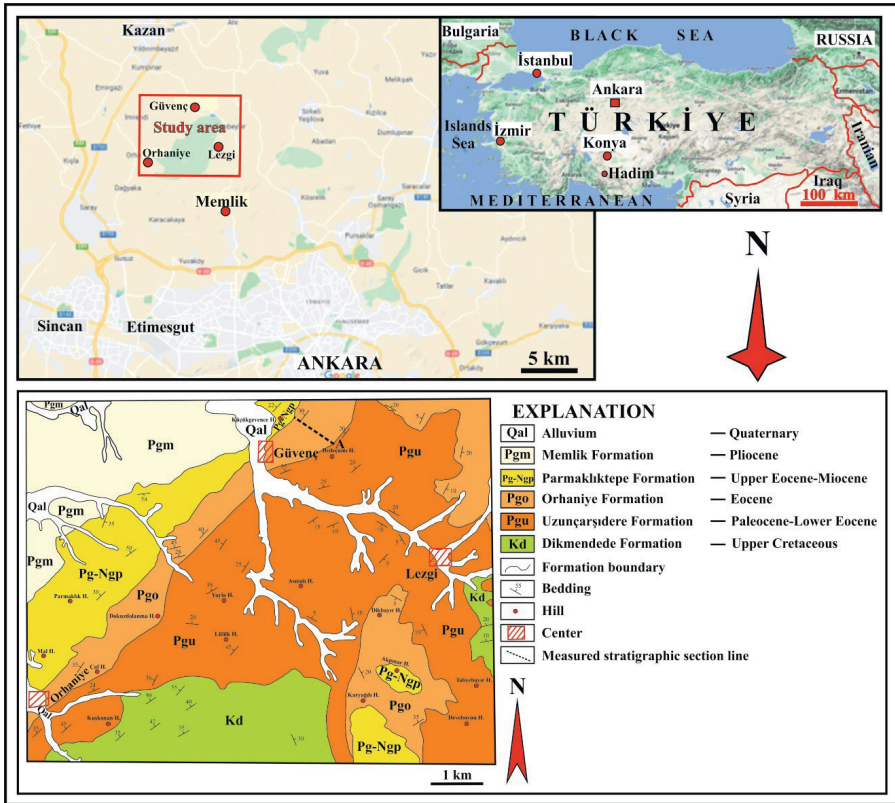


Figure 1. Location (GoogleMaps) and geological map of the study area (modified from Özkan and Ayaz, 2004)

ERATHM	SYSTEM	SERIES	STAGE	FORMATION	THICKNESS	LITHOLOGY	EXPLANATION	
<b>S E N O Z I C</b>	<b>Neogene</b>	Quaternary		Alayunt	Meter 5		Gravel to clay	
		Pliocene		Memlik	100		Conglomerate, sandstone and clayey limestone	
			Upper Eocene-Miocene		Parmaklıktepe	400		Beige chert nodular limestone, green-red sandstone, claystone and beige marl
	<b>Paleogene</b>		Lutetian		Orhaniye	250		Beige fossiliferous limestone, cream sandstone and marl
		Paleocene-Lower Eocene			Uzunçarşidere	500		Yellow-red-gray conglomerate, green-red-gray sandstone, mudstone, yellow-beige limestone, marl and volcanic lava spread
								UNCONFORMITY
<b>MESOZOIC</b>	<b>Cretaceous</b>	Upper Cretaceous	Maastrichtian	Dikmendede	750		Intercalation of gray conglomerate, green-greenish gray sandstone, shale and siltstone	

Figure 2. Stratigraphic column section of the study area (modified from Özkan and Ayaz, 2004)

A measured stratigraphic section was taken towards northwest from Dedeçamı Tepe, which is the best exposed part of the Orhaniye Formation (Figure 3). Orhaniye Formation includes sedimentary facies in which deposition takes place in shallow marine, lacustrine and braided fluvial environments (Figure 3). While the Orhaniye Formation exhibits a sterile condition in terms of sedimentary structure, it is rich in micro and macro fossils.

### Sedimentary Characteristics of Orhaniye Formation

The Orhaniye Formation starts with green and/or cream-colored sandstone and mudstone with no fossils at the base and containing fossils upwards. After this section, which is 8-10 m thick, the unit continues with cream-beige colored limestones with abundant fossils (Figure 3).

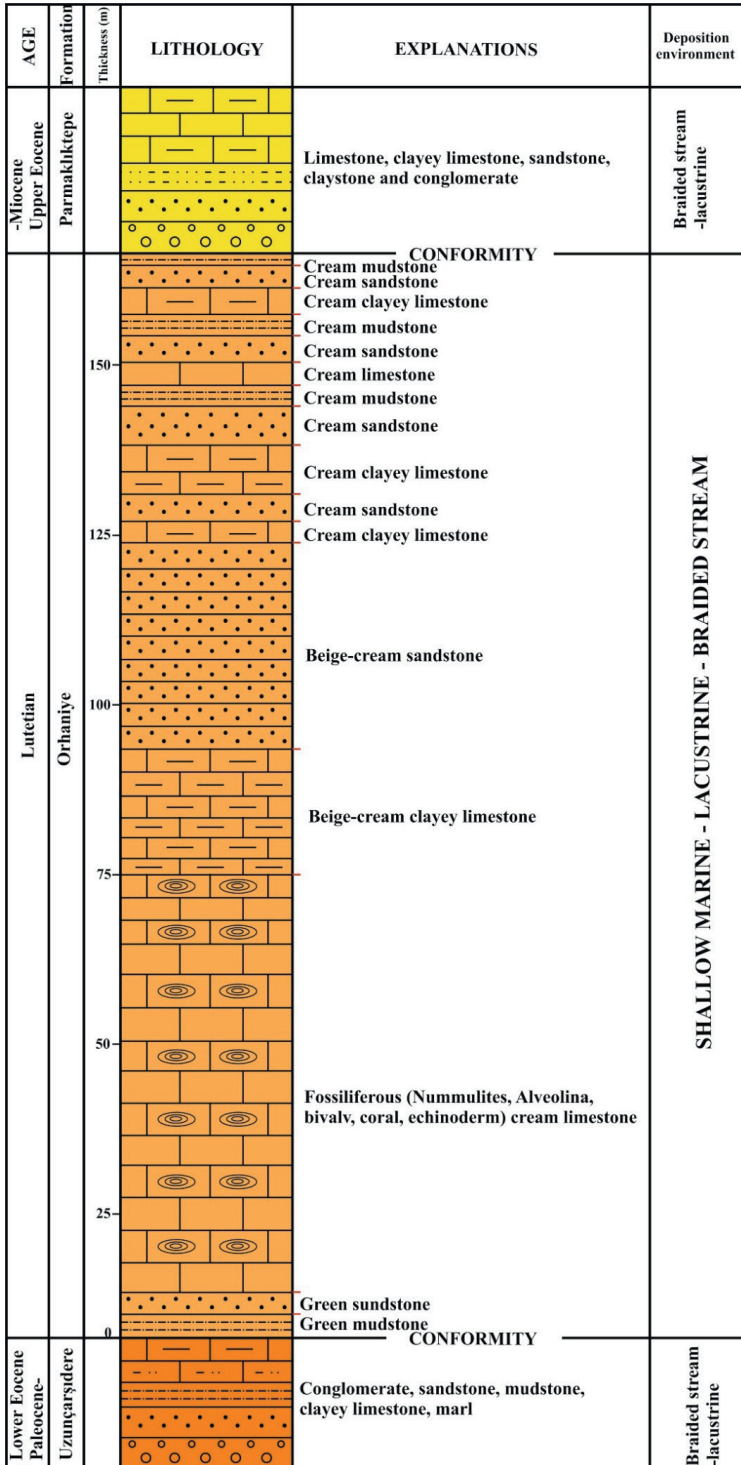


Figure 3. Orhaniye Formation type section (modified from Özkan and Ayaz, 2004)

These limestones contain abundant fossils such as *Nummulites* (Figure 4), coral, echinoderm (Figure 5), miliolid (Figure 6), *Alveolina* (Figure 7), *Textularia* (Figure 8), ostracod (Figure 9), and bivalve. In addition, fenestra structures (Figure 10) are also observed in the micritic matrix at some levels.



Figure 4. *Nummulites* sp. (black arrow) observed in the limestones of the Orhaniye Formation (southwest of Çal Hill) Scale (pencil length: 14 cm)



Figure 5. Echinodermata fossils (black arrows) were observed in the limestones of the Orhaniye Formation (Akkaya Ridge). Scale (pencil length: 14 cm)

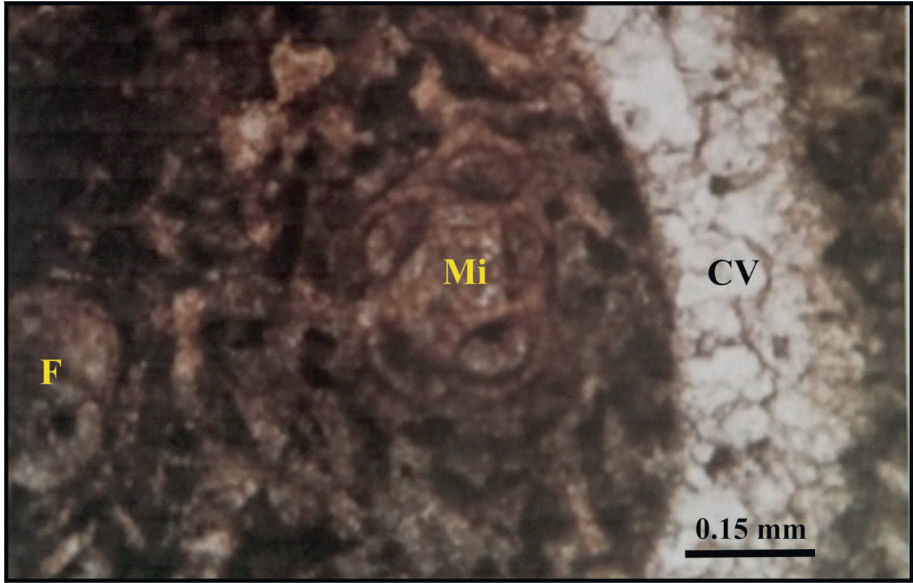


Figure 6. Miliolid (Mi), fossil (F), and calcitic vein (CV) observed in the limestones of the Orhaniye Formation (PPL)

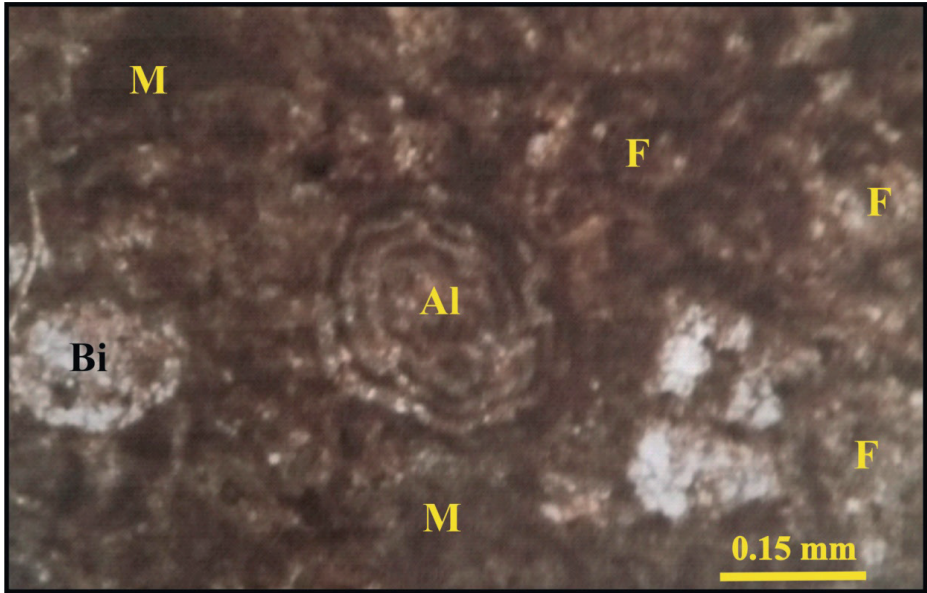


Figure 7. Alveolina sp., biomold (Bi), fossils (F), and micritic matrix (M) observed in (AI) the limestones of the Orhaniye Formation (PPL)



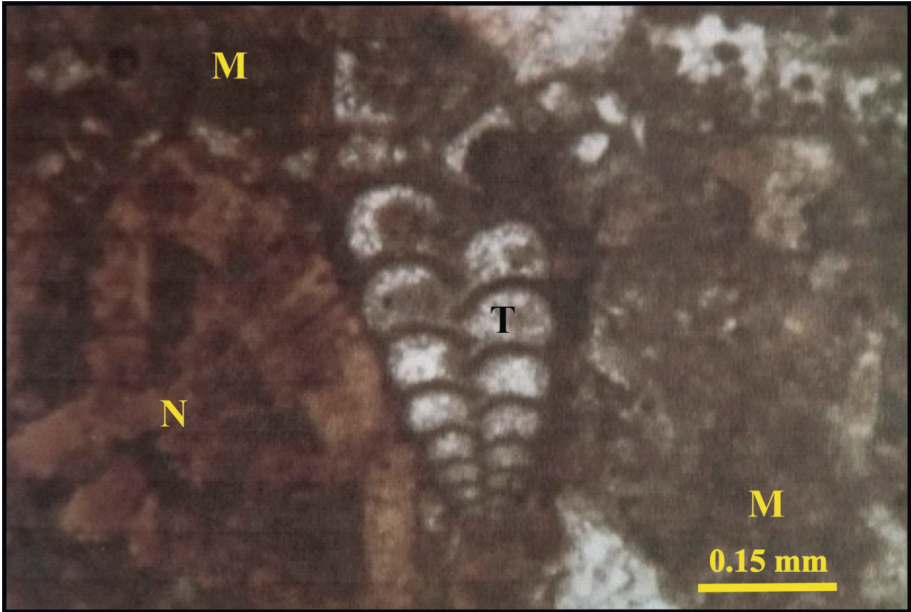


Figure 8. *Nummulites* sp. (N), *Textularia* sp. (T), and micritic matrix (M) were observed in the limestones of the Orhaniye Formation (PPL)

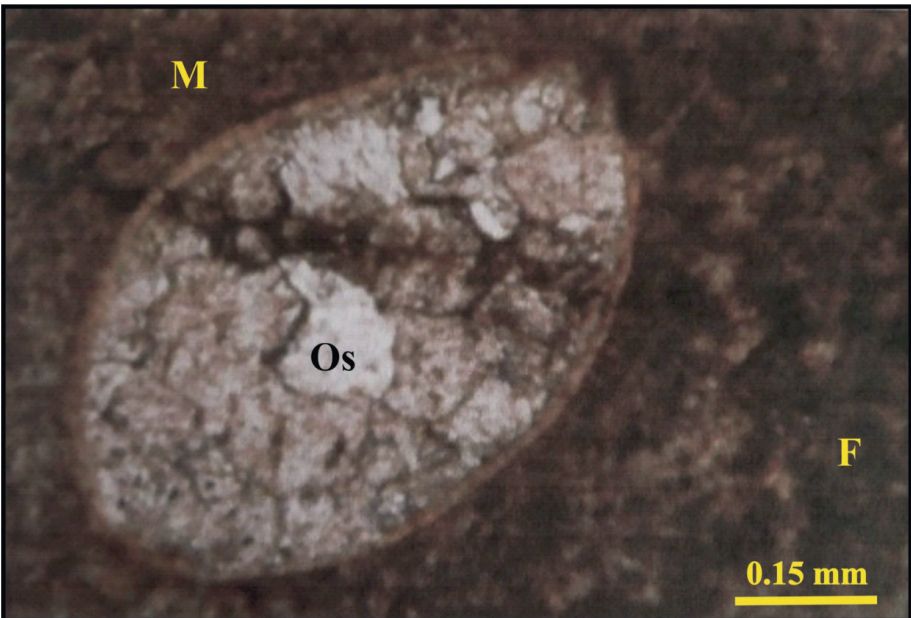


Figure 9. *Ostrocod* (Os), fossil (F) and micritic matrix (M) observed in the limestones of the Orhaniye Formation (PPL)

The Orhaniye Formation passes into beige-cream colored clayey limestones and beige-cream colored sandstones towards the top (Figure 3). The unit presents intercalation of cream colored clayey limestone, sandstone mudstone and ends with mudstone (Figure 3).

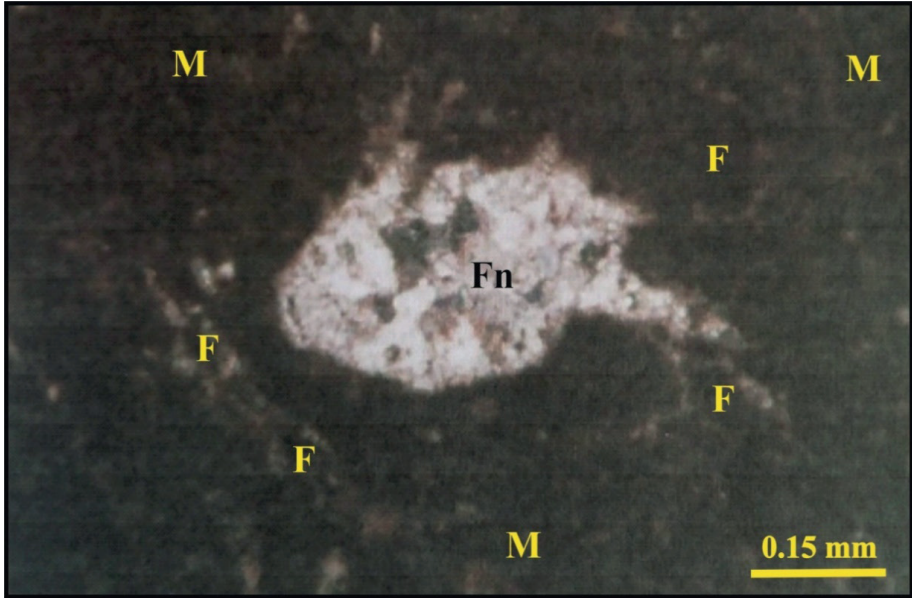


Figure 10. Fossil (F), fenestra (Fn), and micritic matrix (M) were observed in the limestones of the Orhaniye Formation. (XPL)

In the samples taken from the limestones of the Orhaniye Formation, 20-35% fossil, 2-8% pellet, 2-3% intraclast, 25-65% micritic matrix and 5-50% sparry calcite cement were determined (Figure 6-10). The fossils mostly consist of benthic foraminifers (Figure 6-8), and represent a shallow marine and lagoonal environment. The chambers of the fossils may be filled with micritic matrix or filled with sparry calcite cement (Figures 6-10). Substitution of amorphous iron cement is also observed in some fossils (Figures 6-8).

In some samples of the Orhaniye Formation limestones, it was observed that the micritic matrix was transformed into micro-sparite due to the neomorphism developed in the diagenetic process. Again, in some samples, the sparry calcite cement precipitation took place during the diagenetic process.

In the petrographic examination of the limestones of the Orhaniye Formation, the rock nomenclature was determined to be wackestone and packstone according to the Dunham (1962) classification.

Orhaniye Formation is overlain by the Paleocene-Early Eocene aged Uzunçarşidere Formation with a conformable contact (Figure 11) at its lower

boundary, while it passes with a conformable contact with the Late Eocene-Miocene aged Parmaklıtepe Formation at its upper boundary (Figures 2 and 3). The thickness of the Orhaniye Formation is 165 m compared to the measured stratigraphic section (type section) (Figure 3). In addition, Ocakoğlu (1998) stated the thickness of the Orhaniye Formation as 165 m in his study in the study area.

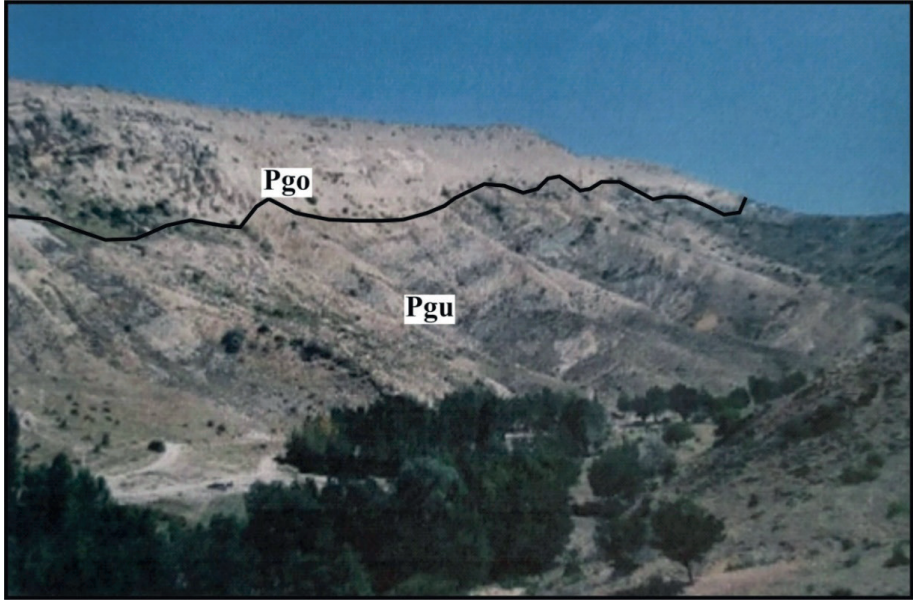


Figure 11. Boundary relationship of Uzunçarşideree (Pgu), and Orhaniye (Pgo) formations (looking northeast from the northeast hillside of Kuşkonan Tepe)

Gökten et al. (1988) gave the Orhaniye Formation a Middle Eocene (Lutetian) age according to the benthic foraminiferous fossils they collected from the unit in their study in and around the study area. Microfauna: *Nummulites laevigatus*, *Nummulites uranensis*, *Nummulites lehneri*, *Nummulites gizehensis*, *Nummulites millicaput*, *Nummulites ataricus*, *Nummulites perforatus*, *Nummulites brangniarti*, *Alveolina frumentiformis*, *Alveolina elliptica nuttalli*, *Alveolina cf. tenuis*, *Sphaerogypsina globulus*, *Eorupertia magna* (from Gökten et al., 1988). Macrofauna: *Echinolampas heberti*, *Schizoster cf. vidali*, *Brissopsis cf. vilplanae*, *Euspatangus subovatur*, *Euspatangus gibretensis*, *Ostrea aff. uncifera*, *Ostrea (Alectryonia) aff. ctotbeyi*, *Campanile giganteum*, *Velatesschimideli chemnita*, *Arca (Barbatia) insignis* (from Gökten et al., 1988).

Fossils such as *Nummulites* sp., *Alveolina* sp., *Textularia* sp., Miliolidae, Ostracoda, Echinodermata, Bivalvia and coral were compiled from the Orhaniye Formation by Özkan and Ayaz (2004) and assigned a Lutetian age to the unit. In this study, the unit was given a Lutetian age.

While the lithological and paleontological features of the Orhaniye Formation show the deposition in a shallow marine environment, they emphasize the deposition in the lacustrine environment and finally in the fluvial environment.

### **Acknowledgment**

This study was supported by the project numbered 2003/024 by the Scientific Research Projects Coordinatorship of Seluk University. The authors would like to thank Seluk University Scientific Research Projects Coordinatorship.

## REFERENCES

- Dunham, R. J. (1962). Classification of carbonate rocks according to depositional texture. *Mem. Am. Assoc. Pet. Geol.* 1, 108-121.
- GoogleMaps: <https://www.google.com/maps/@40.079773,32.794561,12.21z>
- Gökten, E., Kazancı, N. and Acar, Ş. (1988). Ankara kuzeybatısında (Bağlum-Kazan arası) Geç Kretase-Pliyosen serilerinin stratigrafisi ve tektoniği. *MTA Dergisi*, 108, 69-81.
- Ocakoğlu, F. (1998). Orhaniye bölgesi (Ankara kuzeyi) Üst Kretase-Eosen istifinin kil stratigrafisi: eski ortamsal ve iklimsel koşullarla ilişkin ip uçları. *Türkiye Jeoloji Bülteni*, 41 (2), 31-40.
- Özkan, A. M. and Ayaz, A. (2004). Güvenç-Memlik (Kazan-Ankara) yöresinin sedimantolojisi. *Selçuk Üniversitesi Bilimsel Araştırmalar Projesi*, Proje no: 2003/024.