J E M T
Journal of Earth and Marine Technology
homepage URL: ejurnal.itats.ac.id/jemt

# Micropaleontological Analysis of Planktonic and Benthic Foraminifera from the Claystone Member of the Bayah Formation (Tebm) and the Limestone Member of the Cijengkol Formation (Tojl), Jatake Area, Lebak Regency, Banten Province

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**Article info**
Received:
Mar 18, 2026
Revised:
Apr 25, 2026
Accepted:
Apr 27, 2026
Published:
Apr 30. 2026

**Keywords:**
Planktonic foraminifera; Benthic foraminifera; Biostratigraphy; Depositional environment; Bayah Formation.

**Abstract**

Micropaleontological analysis of planktonic and benthic foraminifera from three rock samples—muddy micrite, allochemic sandstone, and wackestone—was carried out to determine the relative age and depositional environment of the Claystone Member of the Bayah Formation (Tebm) and the Limestone Member of the Cijengkol Formation (Tojl) in the Jatake area, Lebak Regency, Banten Province, Indonesia. A total of 43 foraminiferal specimens were identified, including 28 planktonic and 15 benthic individuals. These were used for biostratigraphic and paleoenvironmental interpretation. The results show that the Claystone Member Tebm (RL19) dates to the Middle Eocene, mainly within planktonic foraminiferal biozones P14–P15, which falls under a wider P14–P17 range. In contrast, the Limestone Member Tojl is younger, with sample RL85 assigned to the Late Oligocene (N1–N3) and sample RL23 corresponding to the Late Oligocene to earliest Miocene interval (N3–N4). Benthic foraminiferal groups from all samples suggest deposition in outer neritic to upper bathyal environments. The estimated paleobathymetric ranges are about 390–1100 ft for RL19, 350 - 1630 ft for RL85, and 390 - 1230 ft for RL23. Even though the ages differ, the similarity in depositional environments hints at comparable marine bathymetric conditions in the study area. The differences in age suggest that the Bayah Formation and the Cijengkol Formation represent different depositional phases instead of a continuous stratigraphic sequence. This finding offers important insights into the stratigraphic framework and depositional evolution of the Bayah Dome region.

## 1. Introduction

The stratigraphy of southern Banten records a complex geological history shaped by tectonic activity, magmatism, and shifts in depositional systems. Reconstructing this history requires integrating lithologic observations with biostratigraphic and paleoenvironmental data, particularly microfossils, which provide time- and environment-sensitive information preserved in sedimentary rocks [1]. Among marine microfossils, planktonic foraminifera are widely used for age determination because of their rapid evolutionary rates, wide geographic distribution, and well-established biostratigraphic zonations [2]. Benthic foraminifera, by contrast, are commonly used to interpret depositional environments because their distribution is controlled by environmental factors such as substrate type, oxygenation, salinity, nutrient availability, and water depth [3]. Their assemblages are therefore valuable indicators for reconstructing paleobathymetry and depositional conditions, particularly when combined with lithologic and petrographic observations. Foraminiferal analysis has been widely applied in stratigraphic studies in Indonesia to determine relative age, correlate sedimentary units, and reconstruct marine environments, especially in formations of Paleogene to Neogene age [4]. However, age interpretations and depositional environments of formations in the Bayah region remain insufficiently constrained, particularly regarding the relationship between the Bayah Formation and the Cijengkol Formation [5]. This study focuses on the Claystone Member of the Bayah Formation (Tebm) and the Limestone Member of the Cijengkol Formation (Tojl) in the Jatake area, Lebak Regency, Banten Province. The objectives are to determine the relative age of the studied units based on planktonic foraminifera and to

interpret the depositional environment using benthic foraminiferal assemblages, supported by field observations and petrographic analysis [6]. The results are expected to provide a clearer understanding of the stratigraphic relationship and depositional evolution of these formations in the Bayah Dome region.

## 2. Methodology

This study used a combined field and laboratory approach, which included geological observation, sample collection, petrographic analysis, and micropaleontological examination [7]. Three representative samples were collected from the Claystone Member of the Bayah Formation (Tebm; RL19) and the Limestone Member of the Cijengkol Formation (Tojl; RL85 and RL23). A total of 43 foraminiferal specimens were obtained, consisting of 28 planktonic and 15 benthic individuals derived from muddy micrite, allochemic sandstone, and wackestone lithologies. Sample preparation followed standard micropaleontological procedures [8]. The samples were mechanically disaggregated, washed, and soaked in a hydrogen peroxide solution (2:3 ratio) for 20 - 24 hours to break down the matrix and release microfossils [9]. The residues were then rinsed, dried, and sieved using 30, 50, 100, and 200 mesh sizes to obtain the 63 - 500 µm fraction suitable for foraminiferal analysis [10]. Specimens were hand - picked under a binocular microscope for taxonomic identification [11]. Quantitative analysis was conducted using the abundance classification of the Geological Engineering Study Program, Sriwijaya University: Rare (1 - 5 specimens), Common (6 - 10 specimens), and Abundant (≥11 specimens) [12]. Planktonic foraminifera were identified based on established Cenozoic biostratigraphic zonations, while benthic foraminifera were used for paleoenvironmental interpretation following standard bathymetric references [13]. Relative age determination was based on the narrowest stratigraphic overlap of key marker taxa using first appearance datum (FAD) and last occurrence datum (LAD) [14]. Paleoenvironmental interpretation was derived from the bathymetric distribution of dominant benthic assemblages, particularly those classified as common to abundant, to minimize bias from rare taxa [15]. Petrographic analysis was conducted using the [16] classification to quantify grain composition, matrix, and cement. This integrated approach ensures that interpretations of age and depositional environment are supported by both qualitative assemblage composition and quantitative abundance data [17].

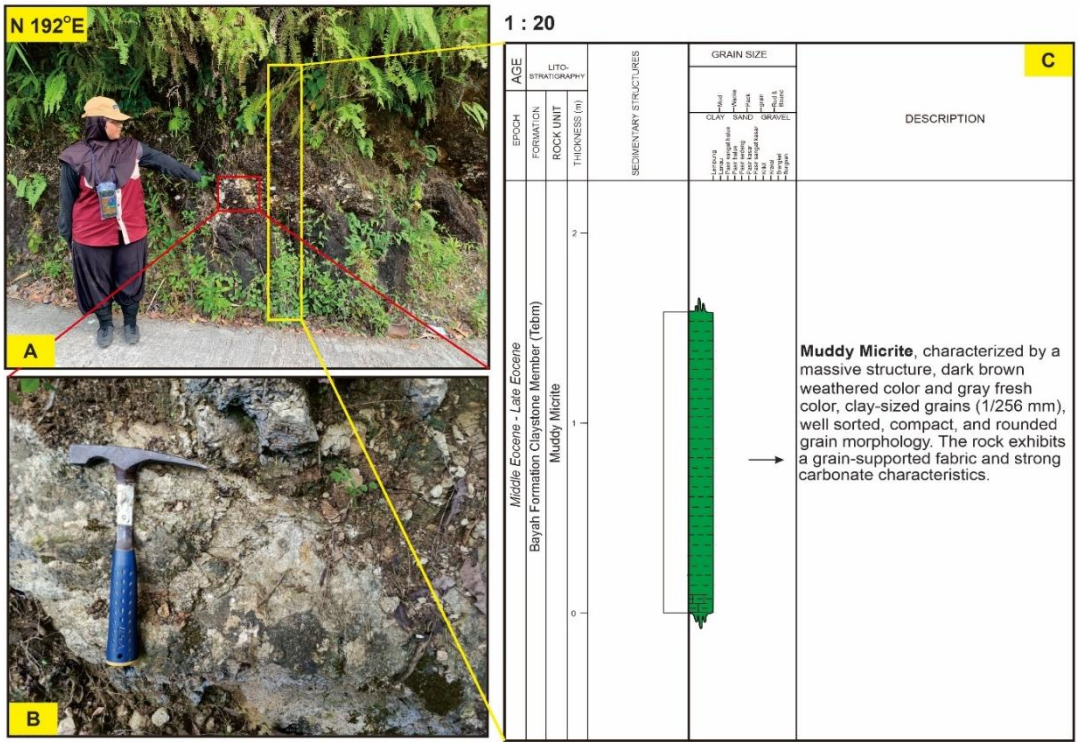



**Figure 1**. Muddy Micrite Outcrop at Station/RL 19, Cimandiri Village; (A) Distant view of the outcrop, (B) Close-up view, and (C) Outcrop profile

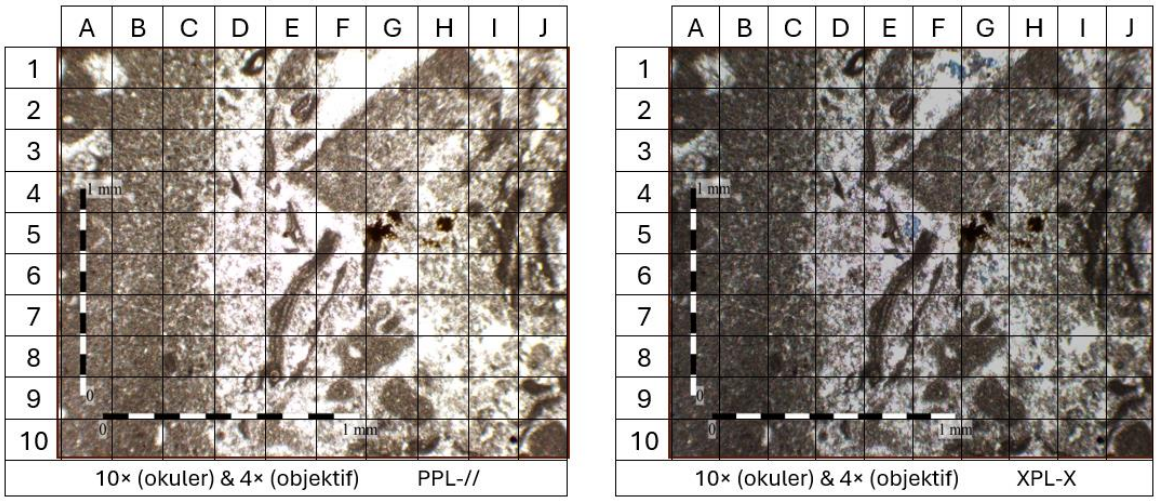



**Figure 2**. Thin Section of Muddy Micrite from Station/RL 19 (UTM 634589; 9243651), Claystone Member of the Bayah Formation (Tebm)

## 3. Results and discussions

Field observations conducted in the study area identified three outcrop locations representing different lithologies, namely muddy micrite of the Bayah Formation Claystone Member (Tebm), allochemic sandstone, and wackestone of the Cijengkol Formation Limestone Member. From these outcrops, three representative rock samples were collected for further paleontological and petrographic analyses. The locations of the sampled outcrops are presented in Figures 1, 5, and 9, which also illustrate the samples that were subsequently analyzed in this study.

### *3.1. Muddy Micrite of the Bayah Formation Claystone Member (Tebm) at RL19*

The lithology encountered in the studied formation within the research area (Figure 1) consists of muddy micrite. Megascopically, the calcareous claystone at RL 19 exhibits a dark brown weathered color and a gray fresh color. The rock is characterized by a clay - sized grain fraction (1/256 mm), very well sorting, a compact texture, and rounded grain morphology. The rock shows a grain - supported fabric and strong carbonate characteristics, with the main mineral composition consisting of quartz and orthoclase, supported by a micrite matrix and sparite cement.

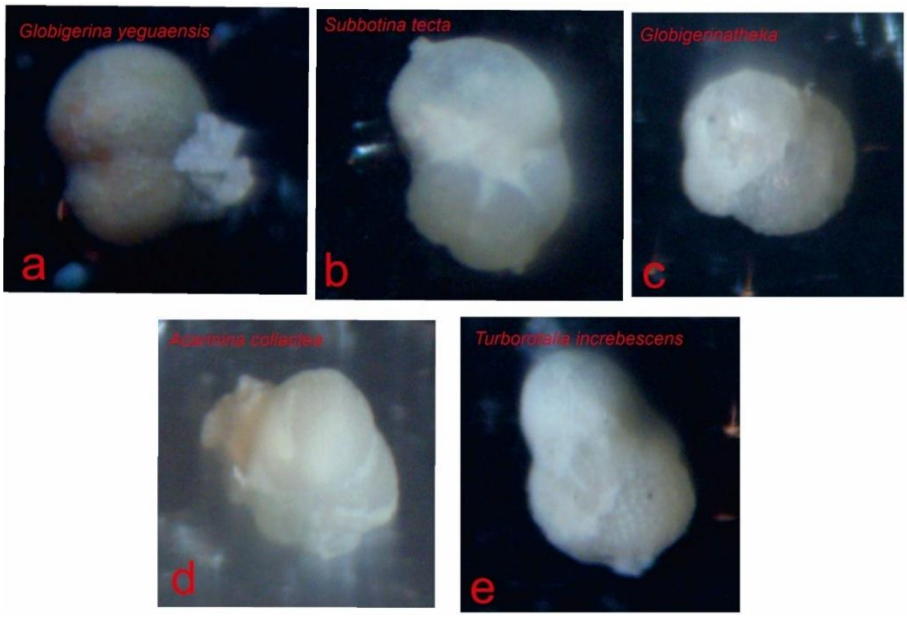



**Figure 3**. Planktonic foraminifera fossils from Station/RL 19 (UTM 634589; 9243651), Muddy Micrite of the Claystone Member, Bayah Formation (Tebm).

**Table 1**. Relative age interpretation of the RL19 Muddy Micrite lithology based on planktonic foraminifera.

| | | | |
|---|---|---|---|
| Sample / Formation | : RL 19 / Tebm | Rock Type | : Sedimentary Rock |
| Location | : Cimandiri Village | Age Range | : Middle – Late Eocene |
| Rock Name | : Muddy Micrite | Analyzed by | : Salsabiila Fadhilah Ahmad |

| Age -> Planktonic Foraminifera (Blow, 1969) | Eocene | | | | | | | Oligocene | | | | | Miocene | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Middle | | Late | | | | | Early | Mid | Late | | | Early | | |
| | a | | b | | | | | c | d | e.1-4 | | | e.5 | | |
| | P13 | P14 | P15 | P16 | P17 | P18 | P19 | N1 P20 | N2 P21 | N3 P22 | N4 | N5 | N6 | | |
| *Globigerina yeguaensis (C)* | | | | | | | | | | | | | | | |
| *Subbotina tecta (C)* | | | | | | | | | | | | | | | |
| *Globireginatheka (A)* | | | | | | | | | | | | | | | |
| *Accarinina collactea (R)* | | | | | | | | | | | | | | | |
| *Turborotalia increbescens (R)* | | | | | | | | | | | | | | | |

Thin section analysis of siliciclastic sedimentary rock observed under 40× magnification shows colorless characteristics under plane - polarized light (PPL) and dark brown to black interference colors of second order under cross - polarized light (XPL), with a birefringence value of approximately 0.037 (Figure 2). The rock exhibits grain sizes ranging from 0.2 to 1 mm, with a matrix size of 0.04 - 0.1 mm and cement measuring approximately 0.01 - 0.03 mm. The grains display angular to subangular roundness and low sphericity. The rock fabric is grain - supported with closed packing and well - sorted grains. Grain contacts are predominantly floating contacts, and the porosity type is mainly intragranular. The rock is composed of skeletal grains, lithic fragments, quartz, orthoclase, a micrite matrix, and sparite cement. The rock classification follows the siliciclastic sedimentary rock classification proposed by [16]. This classification is based on the percentage composition of the rock constituents, consisting of approximately 47% micrite, 29% allochems, and 22% mud. Based on these proportions, the rock is classified as Muddy Micrite.

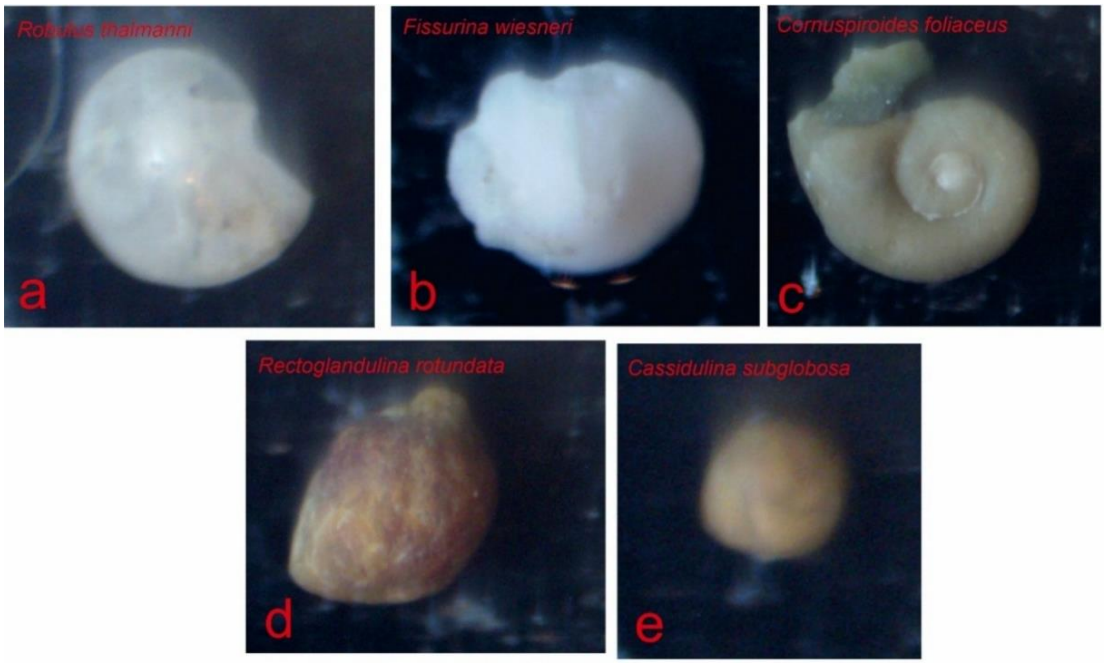



**Figure 4**. Benthic foraminifera fossils from Station/RL 19 (UTM 634589; 9243651), muddy micrite of the Claystone Member, Bayah Formation (Tebm).

**Table 2**. Table of Bathymetric Environment Interpretation for the RL19 Muddy Micrite Lithology

| | | | |
|---|---|---|---|
| Sample / Formation | : RL 19 / Tebm | Rock Type | : Sedimentary Rock |
| Location | : Cimandiri Village | Bathymetric Environment | : Outer Neritic – Upper Bathyal |
| Rock Name | : Muddy Micrite | Analyzed by | : Salsabiila Fadhilah Ahmad |

| Bathymetric Environment, feet depth -> | Transitional | Neritic | | | Bathyal | | Abyssal |
|---|---|---|---|---|---|---|---|
| | | Inner | Middle | Outer | Upper | Lower | |
| Benthic Foraminifera (Barker, 1960) | 0 | 20 | 100 | 200 | 500 | 2000 | 4000 |
| *Robulus thalmani (C) 390 ft* | | | | * | | | |
| *Fissurina wiesnari (R) 1100 ft* | | | | | * | | |
| *Cormuspiroides foliaceus (R) 390 ft* | | | | * | | | |
| *Rectoglandulina rotundata (C) 725 ft* | | | | | * | | |
| *Cassidulina subglobosa (A) 675 ft* | | | | | * | | |

Micropaleontological analysis of sample RL19 identified five planktonic foraminiferal taxa: *Globigerina yeguaensis* (7 specimens), *Subbotina tecta* (6 specimens), *Globigerinatheka* sp. (12 specimens), *Acarinina collactea* (3 specimens), and *Turborotalia increbescens* (3 specimens). Based on abundance classification, *Globigerinatheka* sp. is abundant, *Globigerina yeguaensis* and *Subbotina tecta* are common, while the remaining taxa are rare. The assemblage is therefore dominated by common to abundant taxa, indicating a representative fossil population rather than isolated occurrences, as illustrated in Figure 3. Age determination was carried out by correlating the identified fossil assemblages with the planktonic foraminiferal biostratigraphy zonation [18]. The age determination was carried out by identifying the youngest first appearance and the earliest last occurrence of the fossil assemblage. Based on this approach, the relative age of the rock unit is interpreted to range from biozone P14 to P17 (Middle Eocene - Late Eocene), as presented in Table 1.

In addition to determining the relative age, this study also examines the bathymetric environment of the rock units using benthic foraminifera fossils. The benthic foraminiferal assemblage consists of *Robulus thalmanni* (8 specimens), *Fissurina wiesneri* (2 specimens), *Cornuspiroides foliaceus* (4 specimens), *Rectoglandulina rotundata* (7 specimens), and *Cassidulina subglobosa* (13 specimens). The assemblage is dominated by common to abundant taxa, particularly *Cassidulina subglobosa*, as illustrated in Figure 4. Bathymetric information for each fossil taxon was obtained [19], which is widely used in marine paleoecological studies. Bathymetric interpretation was carried out based on the depth ranges of the identified benthic foraminifera, considering the shallowest to the deepest occurrence of the species. The bathymetric overlap of these benthic taxa indicates an outer neritic to upper bathyal depositional environment (Table 2), corresponding to an estimated depth range of approximately 390 - 1100 ft. The presence of *Fissurina wiesneri* supports extension into upper bathyal conditions [19].

### *3.2. Allochemic Sandstone of the Cijengkol Formation Limestone Member (Tojl) at RL85*

Calcareous sandstone of the Limestone Member of the Cijengkol Formation (Tojl) was formed through the mixing of fine - to medium - grained siliciclastic sediments with carbonate material deposited in a shallow marine environment characterized by low to moderate energy conditions. Subsequently, the sediment underwent compaction and calcite cementation, resulting in the development of calcareous characteristics [20]. The formation of this lithology was controlled by several factors, including fluctuations in wave energy, the supply of terrigenous sediments, variations in water depth, and the activity of carbonate - producing organisms [21]. Megascopically (Figure 5), the calcareous sandstone exhibits a dark brown weathered color and a light brown fresh color. The rock shows a bedding structure with coarse sand grain size (1/2 - 1 mm), well - sorted grains, and rounded grain morphology. The rock fabric is characterized by closed packing and a compact texture, with relatively good permeability and strong carbonate properties.

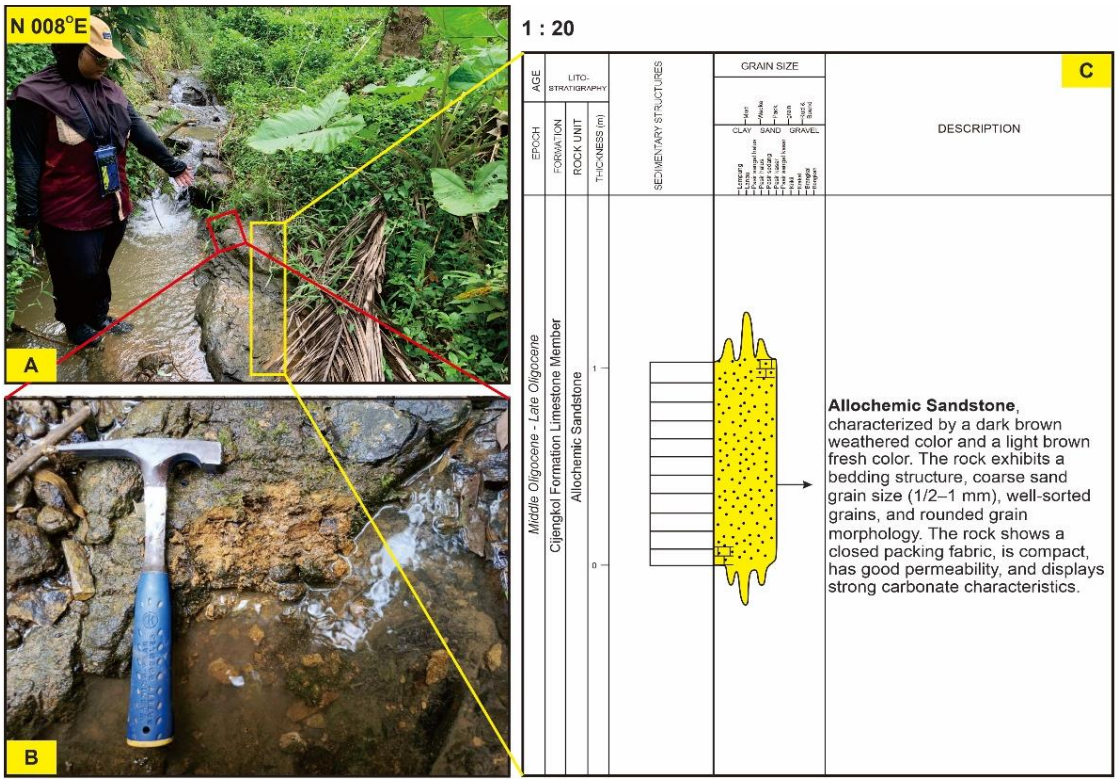



**Figure 5**. Allochemic Sandstone Outcrop at Station/RL 85, Cimandiri Village: (A) Distant view of the outcrop, (B) Close - up view, and (C) Outcrop profile.

Under thin - section observation at 40× magnification, the rock (Figure 6) appears colorless under plane - polarized light and shows a brownish - cream color under cross - polarized light. The rock is characterized by small to medium - sized grains that are generally rounded and display clearly visible intergranular pores. The composition consists of skeletal fragments, quartz, lithic fragments, calcite, glauconite, and orthoclase, with micrite as the fine - grained matrix and microsparite as the cement. The relatively uniform and clean grain arrangement suggests a stable and consistent depositional process. The rock nomenclature follows the siliciclastic sedimentary rock classification [16]. This classification is based on the percentage composition of the rock constituents, consisting of approximately 14% micrite, 32% allochems, and 52% sand. Based on these proportions, the rock is classified as Allochemic Sandstone.

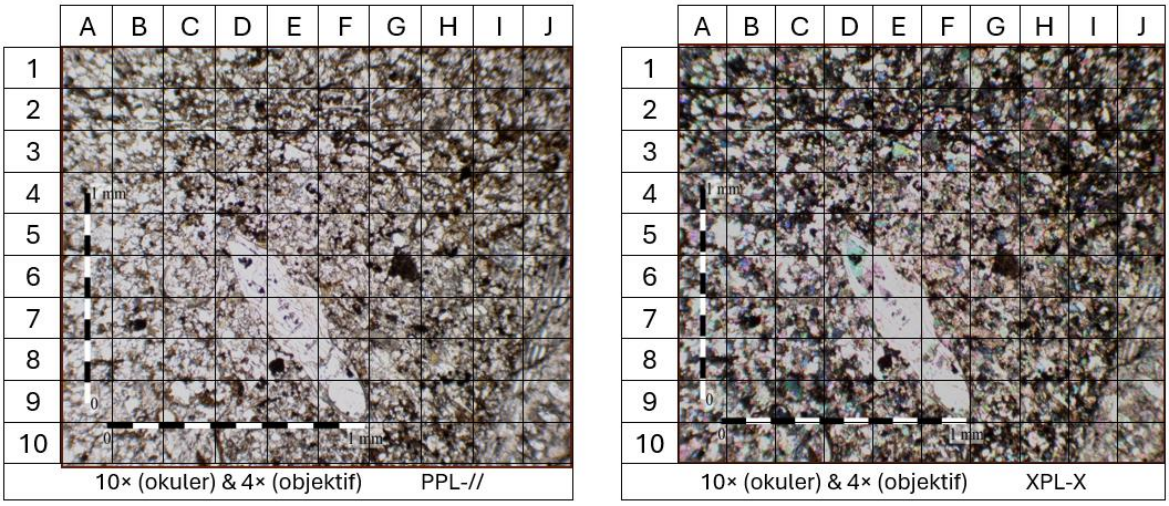



**Figure 6**. Thin section of Allochemic Sandstone from Station/RL 85 (UTM 638218; 9242113), Limestone Member of the Cijengkol Formation (Tojl).

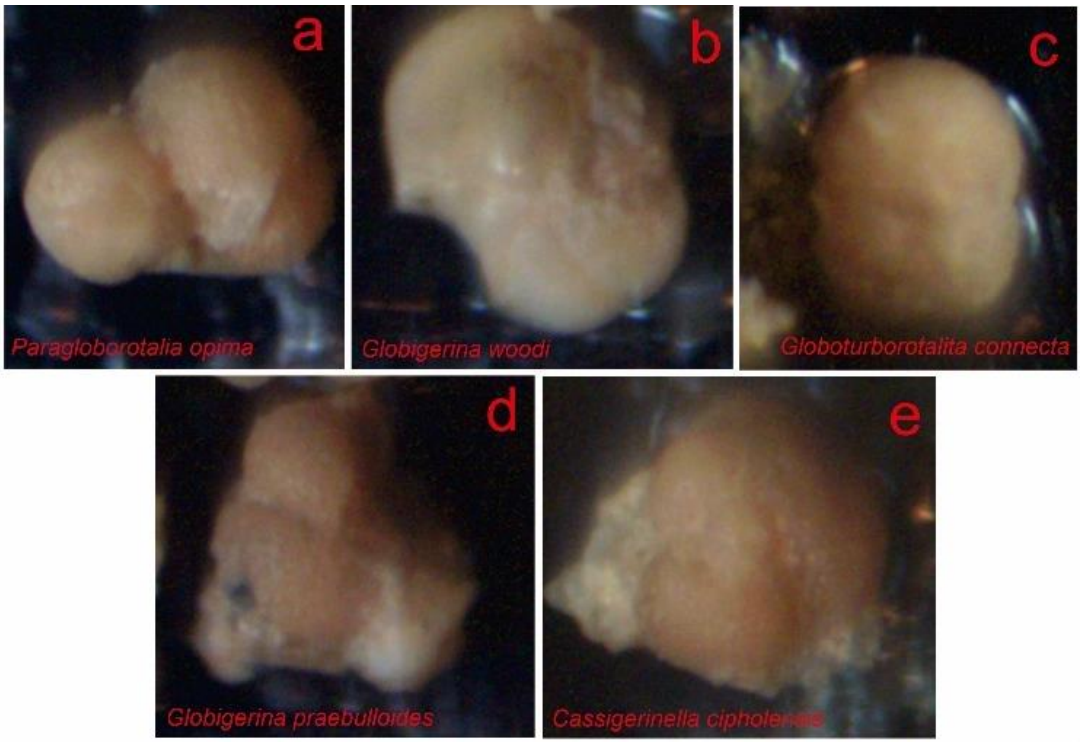



**Figure 7**. Planktonic foraminifera fossils from Station/RL 85 (UTM 638218; 9242113), Allochemic Sandstone of the Limestone Member, Cijengkol Formation (Tojl).

Sample RL85 yielded five planktonic foraminiferal taxa (Figure 7): *Paragloborotalia opima* (14 specimens), *Globigerina woodi* (9 specimens), *Globoturborotalita connecta* (2 specimens), *Globigerina praebulloides* (3 specimens), and *Cassigerinella cipholensis* (8 specimens). Based on abundance classification, *Paragloborotalia opima* is abundant, *Globigerina woodi* and *Cassigerinella cipholensis* are common, while the remaining taxa are rare. Age determination was carried out by correlating the identified taxa with the planktonic foraminiferal biostratigraphic zonation [18]. The assemblage is interpreted as Late Oligocene, corresponding to planktonic foraminiferal biozones N1 - N3, based on the stratigraphic overlap of the identified taxa. This interpretation reflects the occurrence of Late Oligocene taxa and avoids reliance on a single marker species, as shown in Table 3.

**Table 3**. Relative age interpretation of the RL85 Allochemic Sandstone lithology based on planktonic foraminifera.

| | | | |
|---|---|---|---|
| Sample / Formation | : RL 85 / Tojl | Rock Type | : Sedimentary Rock |
| Location | : Sogong Village | Age Range | : Late Oligocene |
| Rock Name | : Allochemic Sandstone | Analyzed by | : Salsabiila Fadhilah Ahmad |

| Age -> | Eocene | | | | | | Oligocene | | | | | Miocene | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Middle | | Late | | | | Early | Mid | Late | | | Early | | |
| | a | | b | | | | c | d | e.1-4 | | | e.5 | | |
| Planktonic Foraminifera (Blow, 1969) | P13 | P14 | P15 | P16 | P17 | P18 | | P19 | N1 P20 | N2 P21 | N3 P22 | N4 | N5 | N6 |
| *Paragloborotalia opima ( A)* | | | | | | | | | | | | | | |
| *Globigerina woodi ( C)* | | | | | | | | | | | | | | |
| *Globoturborotalita connecta ( R)* | | | | | | | | | | | | | | |
| *Globigerina praebulloides ( R)* | | | | | | | | | | | | | | |
| *Cassigerinella cipholensis ( C)* | | | | | | | | | | | | | | |

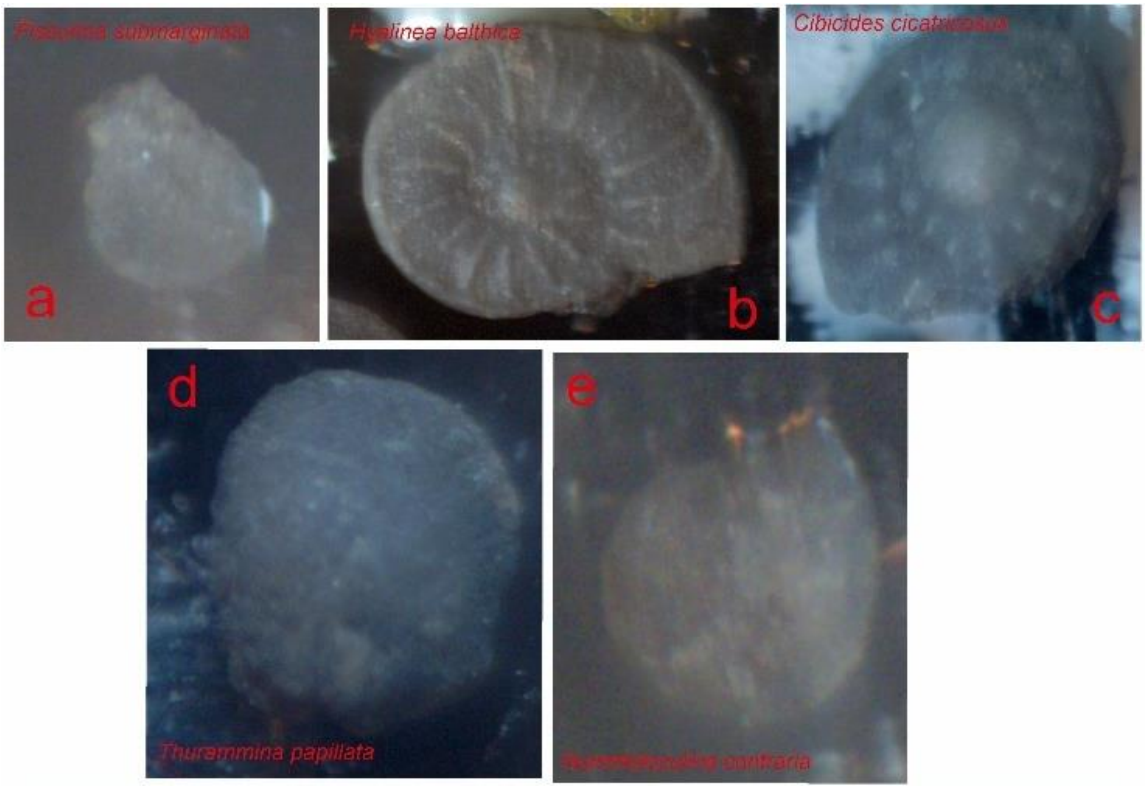



**Figure 8**. Benthic foraminifera fossils from Station/RL 85 (UTM 638218; 9242113), Allochemic Sandstone of the Limestone Member, Cijengkol Formation (Tojl).

Benthic foraminifera (Figure 8) inhabit the seafloor, the benthic assemblage in RL85 comprises *Fissurina submarginata* (12 specimens), *Hyalinea balthica* (12 specimens), *Cibicides cicatricosus* (14 specimens), *Thurammina papillata* (6 specimens), and *Nummoloculina contraria* (7 specimens). These taxa are mostly common to abundant and overlap in bathymetric preference as illustrated in Figure 6. The bathymetric ranges of these species were determined using the classical reference of [19]. To estimate the depositional environment, the depth ranges of the identified benthic foraminifera were compared, from the shallowest to the deepest occurrences. Based on the bathymetric information of the five benthic taxa according to [19], the combined bathymetric ranges of these taxa indicate an outer neritic to upper bathyal environment, with an estimated depth range of approximately 350 - 1630 ft as shown in Table 4.

**Table 4**. Table of Bathymetric Environment Interpretation for the RL85 Allochemic Sandstone Lithology

| | | | |
|---|---|---|---|
| Sample / Formation | : RL 85/Tojl | Rock Type | : Sedimentary Rock |
| Location | : Sogong Village | Bathymetric Environment | : Outer Neritic – Upper Bathyal |
| Rock Name | : Allochemic Sandstone | Analyzed by | : Salsabiila Fadhilah Ahmad |

| Bathymetric Environment, feet depth -> | Transitional | Neritic | | | Bathyal | | Abyssal |
|---|---|---|---|---|---|---|---|
| | | Inner | Middle | Outer | Upper | Lower | |
| Benthic Foraminifera (Barker, 1960) | 0 | 20 | 100 | 200 | 500 | 2000 | 4000 |
| *Fissurina submarginata ( A) 1375ft* | | | | | * | | |
| *Hyalinea balthica ( A) 1630ft* | | | | | * | | |
| *Cibicides cicatricosus ( A) 675ft* | | | | | * | | |
| *Thurammina papillata ( C) 350ft* | | | | * | | | |
| *Nummoloculina contraria ( C) 675ft* | | | | | * | | |

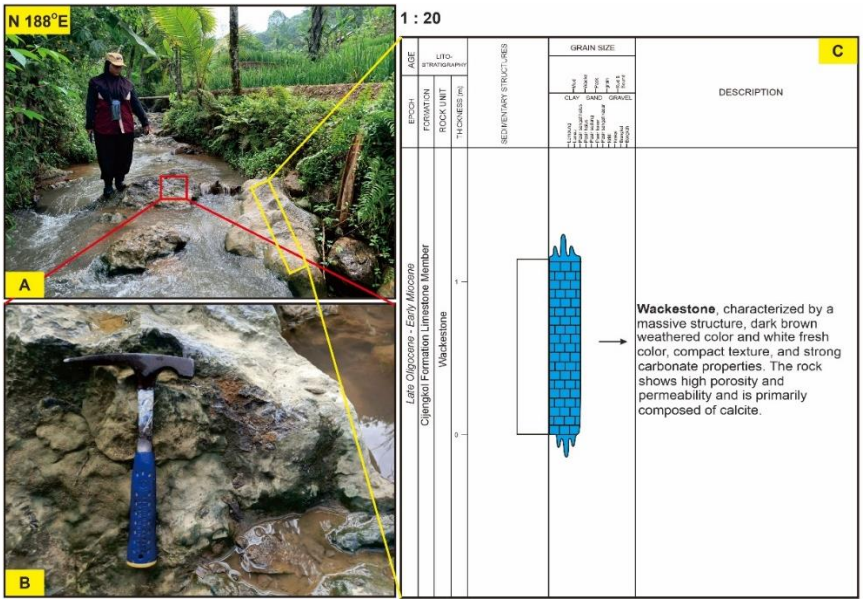



**Figure 9**. Wackestone Outcrop at Station/RL 23 in Sogong Village: (A) distant view of the outcrop, (B) close - up view, and (C) outcrop profile.

### *3.3. Wackestone of the Cijengkol Formation Limestone Member (Tojl) at RL23*

This Wackestone is characterized by a very solid appearance with a massive structure and no clearly defined bedding. When weathered, the rock displays a gray color; however, when freshly broken, the interior appears bright white. The rock texture is hard and compact, typical of carbonate - rich lithologies (Figure 9). Despite its compact nature, the limestone contains a considerable amount of pore spaces, indicating relatively high storage and fluid flow capacity. Mineralogically, the rock is predominantly composed of calcite, which represents the main constituent of carbonate rocks. The combination of color, compactness, and permeability suggests characteristics typical of limestone formed in a shallow marine environment with abundant carbonate accumulation.

Thin - section analysis of the carbonate sedimentary rock (Figure 10) under 40× magnification shows colorless appearance in plane - polarized light (PPL) and dark gray to black first - order interference colors in cross - polarized light (XPL) with a birefringence value of 0.006. The grain size ranges from 0.4 to 1 mm, with matrix sizes between 0.05 and 0.1 mm, and cement sizes ranging from 0.01 to 0.03 mm. The rock exhibits a grain - supported fabric, well - sorted grains, and intragranular porosity. The main components consist of micrite, skeletal grains, and calcite. Based on the carbonate sedimentary rock classification proposed [22] and modified [23], this rock is classified as Wackestone.

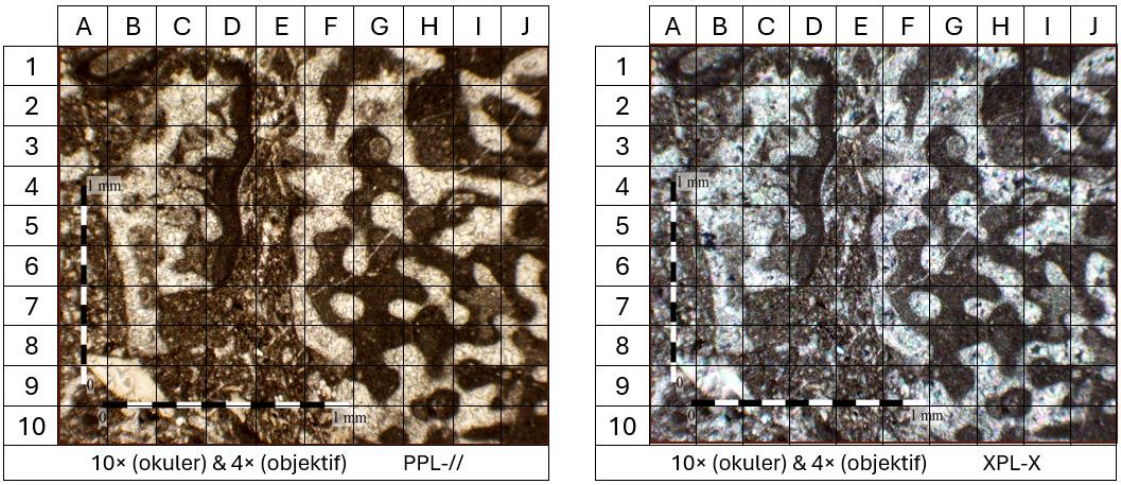



**Figure 10**. Thin Section from Station/RL 23 (UTM 636715, 9243816): Wackestone of the Limestone Member, Cijengkol Formation (Tojl)

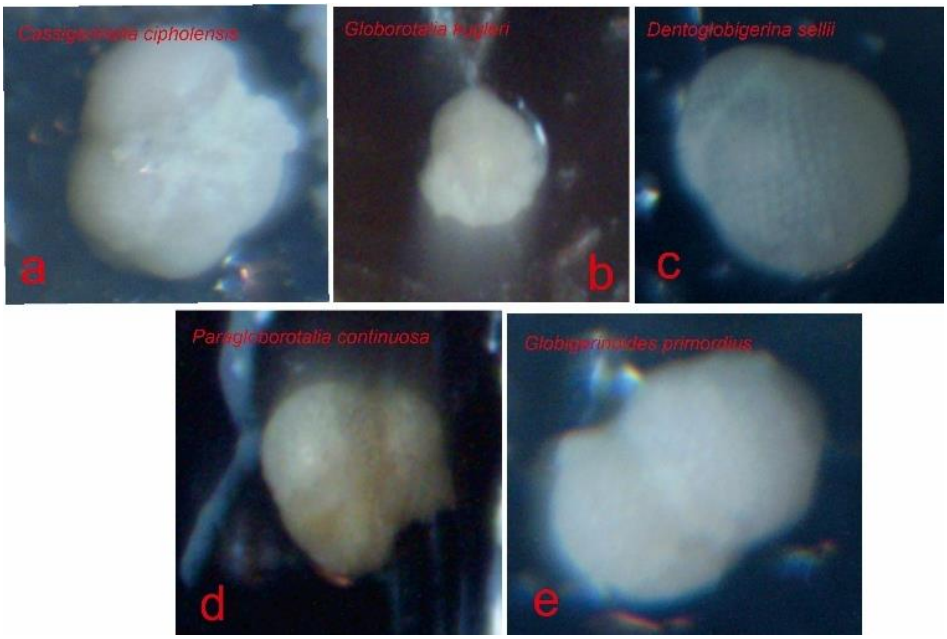



**Figure 11**. Planktonic foraminifera fossils from Station/RL 23 (UTM 636715, 9243816), Wackestone of the Limestone Member, Cijengkol Formation (Tojl).

At research location 23, a foraminiferal analysis was conducted on a limestone sample. The planktonic foraminiferal assemblage in RL23 includes *Cassigerinella cipholensis* (7 specimens), *Globorotalia kugleri* (1 specimen), *Dentoglobigerina sellii* (7 specimens), *Paragloborotalia continuosa* (2 specimens), and *Globigerinoides primordius* (11 specimens). Based on abundance classification, *Globigerinoides primordius* is abundant, *Cassigerinella cipholensis* and *Dentoglobigerina sellii* are common, while the remaining taxa are rare as shown in Figure 11. The analysis of these planktonic foraminifera was carried out to determine the relative age of the rocks belonging to the Limestone Member of the Cijengkol Formation (Tojl). Age determination was performed by correlating the identified fossils with biostratigraphic references proposed by [18].

Age determination was carried out by using the stratigraphic range between the last occurrence of the youngest fossil and the earliest extinction of the oldest fossil. The assemblage indicates an age corresponding to planktonic foraminiferal biozones N3 - N4, representing the Late Oligocene to earliest Miocene interval as presented in Table 5

**Table 5**. Relative age interpretation of the RL23 Wackestone lithology based on planktonic foraminifera.

| | | | |
|---|---|---|---|
| Sample / Formation | : RL 23 / Tojl | Rock Type | : Sedimentary Rock |
| Location | : Sogong Village | Age Range | : Late Oligocene - Early Miocene |
| Rock Name | : Wackestone | Analyzed by | : Salsabiila Fadhilah Ahmad |

| Age -> | Eocene | | | | | | Oligocene | | | | | | Miocene | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Middle | | Late | | | | Early | Mid | Late | | | | Early | | |
| | a | | b | | | | c | d | e.1-4 | | | | e.5 | | |
| Planktonic Foraminifera (Blow, 1969) | P13 | P14 | P15 | P16 | P17 | P18 | | P19 | N1 P20 | N2 P21 | N3 P22 | | N4 | N5 | N6 |
| *Cassigerinella cipholensis ( C)* | | | | | | | | | | | | | | | |
| *Globorotalia kugleri ( R)* | | | | | | | | | | | | | | | |
| *Dentoglobigerina sellii ( C)* | | | | | | | | | | | | | | | |
| *Paragloborotalia continuosa ( R)* | | | | | | | | | | | | | | | |
| *Globigerinoides primordius ( A)* | | | | | | | | | | | | | | | |

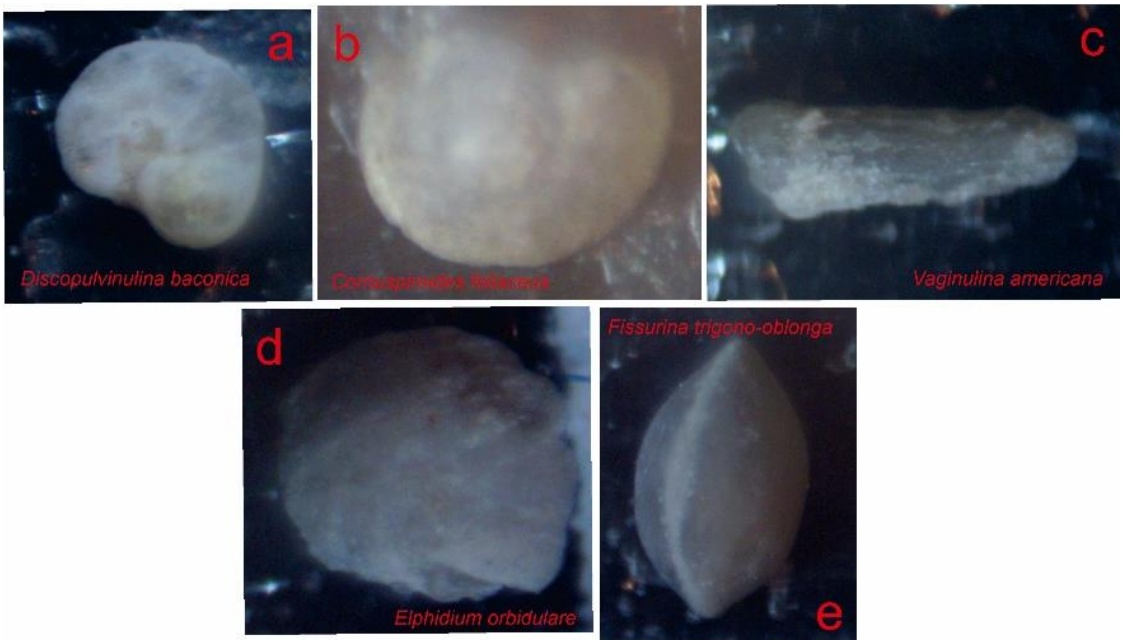



**Figure 12**. Benthic foraminifera fossils from Station/RL 23 (UTM 636715, 9243816), Wackestone of the Limestone Member, Cijengkol Formation (Tojl).

In this study, five species of benthic foraminifera fossils were successfully identified (Figure 12), The benthic foraminiferal assemblage consists of *Discopulvinulina baconica* (6 specimens), *Cornuspiroides foliaceus* (3 specimens), *Vaginulina americana* (7 specimens), *Elphidium orbidulare* (13 specimens), and *Fissurina trigono - oblonga* (2 specimens). The assemblage is dominated by common to abundant taxa, particularly *Elphidium orbidulare* as illustrated in Figure 12. To estimate the depositional environment, the depth ranges of the identified benthic foraminifera were compared, from the shallowest to the deepest occurrences. Based on the bathymetric information of the five benthic taxa according to [19], the bathymetric overlap of these taxa indicates an outer neritic to upper bathyal environment, corresponding to an estimated depth range of approximately 390 - 1230 ft. The presence of *Discopulvinulina baconica* supports a broader bathymetric range extending toward upper bathyal conditions, as shown in Table 6.

**Table 6**. Table of Bathymetric Environment Interpretation for the RL23 Allochemic Sandstone Lithology

| | | | |
|---|---|---|---|
| Sample / Formation | : RL 23/Tojl | Rock Type | : Sedimentary Rock |
| Location | : Sogong Village | Bathymetric Environment | : Outer Neritic – Upper Bathyal |
| Rock Name | : Wackestone | Analyzed by | : Salsabiila Fadhilah Ahmad |

| Bathymetric Environment, feet depth -> | Transitional | Neritic | | | Bathyal | | Abyssal |
|---|---|---|---|---|---|---|---|
| | | Inner | Middle | Outer | Upper | Lower | |
| Benthic Foraminifera (Barker, 1960) | 0 | 20 | 100 | 200 | 500 | 2000 | 4000 |
| *Discopulvinulina baconica ( C) 1230ft* | | | | | * | | |
| *Cornuspiroides foliaceus ( R) 390ft* | | | | * | | | |
| *Vaginulina americana ( C) 390ft* | | | | * | | | |
| *Elphidium orbidulare ( A) 632ft* | | | | | * | | |
| *Fissurina trigono-oblonga ( R) 620ft* | | | | | * | | |

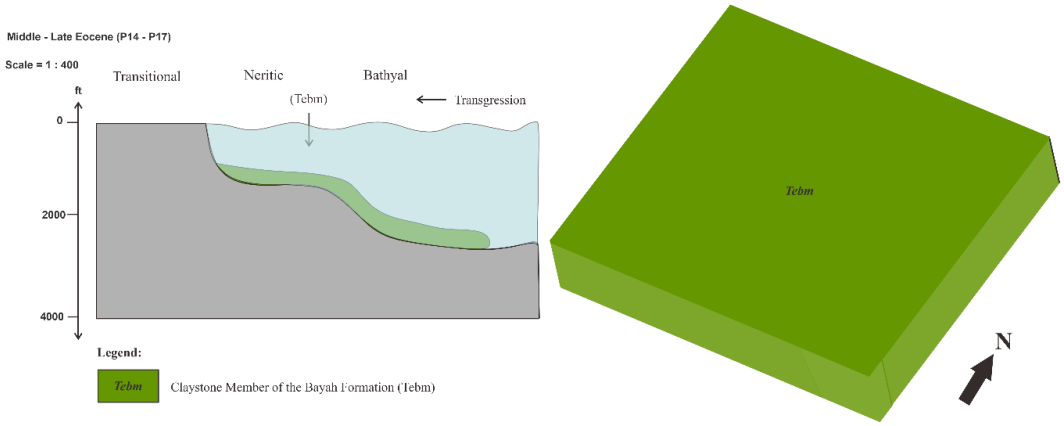



**Figure 13**. Depositional model for the formation of the Claystone Member of the Bayah Formation (Tebm).

*3.4. Reconstruction of the geological history of the study area*

The reconstructed geological history of the study area is based on the integration of micropaleontological age data and interpretations of the depositional environment. The Claystone Member of the Bayah Formation (Tebm), represented by sample RL19, indicates deposition during the Middle Eocene - Late Eocene within an outer neritic to upper bathyal setting (Figure 13). This suggests that the study area was already part of a relatively deep marine environment during this time.

The Limestone Member of the Cijengkol Formation (Tojl), represented by samples RL85 and RL23, records younger depositional phases ranging from the Late Oligocene to the earliest Miocene. These units also indicate outer neritic to upper bathyal environments, suggesting that similar bathymetric conditions persisted during later stages of basin development. Despite the similarity in depositional environment, the significant difference in age between the Bayah Formation and the Cijengkol Formation indicates that sedimentation did not occur continuously. Instead, the two formations likely represent separate depositional phases, which may have been influenced by changes in regional tectonics, sediment supply, or basin subsidence. This interpretation implies the possible presence of unconformity between the two units. The depositional model illustrated in Figure 14 should therefore be interpreted as representing different stages of marine sedimentation rather than a single continuous system. The persistence of outer neritic to upper bathyal conditions suggests a relatively stable marine basin setting, while the temporal gap reflects changes in depositional dynamics over time.

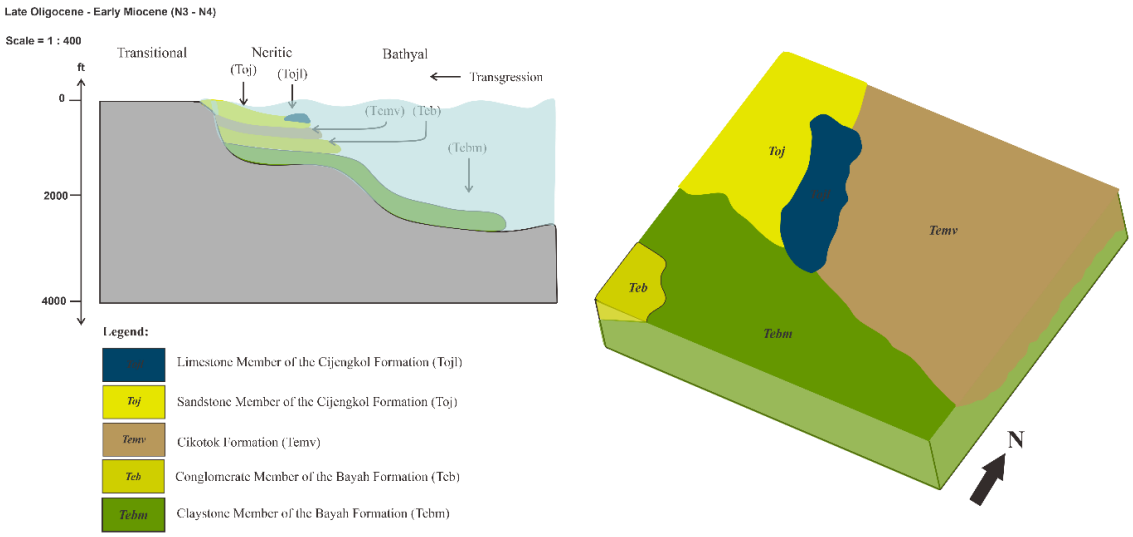



**Figure 14**. Depositional model for the formation of the Limestone Member of the Cijengkol Formation (Tojl).

## 4. Conclusion

Micropaleontological analysis of planktonic and benthic foraminifera from the Jatake area demonstrates that the Claystone Member of the Bayah Formation (Tebm) and the Limestone Member of the Cijengkol Formation (Tojl) represent distinct stratigraphic intervals. The Claystone Member (RL19) is interpreted as Middle Eocene, most consistently corresponding to planktonic foraminiferal biozones P14 - P17, while the Limestone Member (RL85 and RL23) represents younger depositional phases ranging from Late Oligocene (N1 - N3) to Late Oligocene - earliest Miocene (N3 - N4). All samples indicate deposition in outer neritic to upper bathyal environments, with estimated paleobathymetric ranges of approximately 390 - 1100 ft for RL19, 350 - 1630 ft for RL85, and 390 - 1230 ft for RL23. The consistency of depositional environments across different stratigraphic intervals suggests comparable marine bathymetric conditions within the study area. The significant age difference between the Bayah Formation and the Cijengkol Formation indicates that these units do not represent a single continuous depositional sequence. Instead, they reflect separate phases of marine sedimentation, likely influenced by changes in basin evolution, sediment supply, or regional tectonics. This interpretation highlights the importance of integrating planktonic foraminiferal biostratigraphy (FAD - LAD) with benthic assemblage analysis to resolve stratigraphic relationships in complex sedimentary systems. Further regional correlation is required better to constrain the stratigraphic framework of the Bayah Dome area.

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