LIMESTONE DIAGENETIC OF KLAPANUNGGAL FORMATION BOGOR BASIN WEST JAVA PROVINCE

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Abstract

Limestone has a high heterogeneity, it is caused by the diagenetic process that occurs in the limestone. Limestone located in the Cibinong area, Bogor Regency which is included in the Klapanunggal Formation has a distinctive diagenetic process. So this study aims to determine the diagenetic processes formed. The method used is petrographic analysis, 17 petrographic data are taken from data taken from field observations in the form of observation of limestone outcrops vertically in the position of the layer. The results of the analysis show the processes that occur in the limestones of the Klapanunggal Formation include, neomorphism as indicated by the presence of equant and blocky cement, micritization which changes the mud carbonate a lot, dissolution of limestone as indicated by the presence of a vug in the Lp 2C sample, the compaction process is also seen with the presence of fractures and stylolite, fragments that contact. Dolomitization were also recorded in limestone samples Lp 4A. The vuggy porosity visually observed is very much present, and also moldic and fractures porosity are also present in this limestone.

Keywords: Limestone, Diagenesis, Vuggy, Dissolution, Klapanunggal Formation

INTRODUCTION

The Klapanunggal Formation in the Klapanunggal and surrounding areas, Cibinong,
West Java, which is known to be Middle Miocene-Uppper Miocene age (Sudjatmiko, 1972). Limestone consists of reef limestone and clastic limestone. This limestone is exposed quite well in the limestone mining area owned by PT INDOCEMENT. Detailed research on diagenetic studies in limestones in this formation is still rarely done. This study aims to determine the diagenetic processes in the limestones of the Klapanunggal Formation. The research location is administratively located in the Klapanungal area, Cibinong, Bogor Regency, West Java Province (Figure 1.) more precisely in the industrial area and limestone mining area belonging to Indosemen. Limestone is a rock that has heterogeneous properties in terms of composition and properties. In one limestone facies, the composition or formation can vary. This is caused by diagenetic processes that occur in limestone. From one limestone facies the porosity formed can vary. Likewise from diagenetic processes such as dissolving, cementation and others.

**Figure 1.** Research map location Modified From (Sudjatmiko, 1972), (Achdan dkk, 1992), (Turkandi dkk, 1972), (Effendi dkk, 1992).

**METHODOLOGY**
This study uses data from observations of limestone outcrops of the Klapanunggal Formation, Bogor basin, which is then taken from the limestone samples. Limestone sampling in the study area, using a ± 300 meter long traverse in the limestone mining area owned by PT INDOCEMENT using intervals or distances of ± 10-20 meters taken vertically. The sample is then made into a thin section petrographic. Petrographic analysis is the main method used in this study. Limestone samples were taken as many as 17 samples, from one traverse made. Observation of the carbonate rock cements formed is important to determine the type and shape of limestone cement. From the observations made, a graphic is made that shows the content or diagenetic processes in each sample.

**RESULT AND DISCUSSION**
The limestones of the Klapanunggal Formation in the study area generally consist of wackestone-grainstone limestones. Outcrop conditions in this area, in good condition. However, in some places it has undergone weathering and dissolving. And also formed caves in some places. From the results of the analysis carried out, the limestone in the study area have several diagenetic processes recorded in this limestone.

**Figure 2.** The condition of the limestone outcrops in the study area, (a) packstone limestone outcrops at the Lp1A sample location, (b) Dissolution results in limestones that form vug in Lp1B samples, (c) packstone-grainstone limestones, in Lp 3A samples (d) limestone outcrops packstone-grainstone and above it is
mudstone-wackestone, at sample location Lp 5A (e) calcite mineral covering the gully in limestone, at sample location Lp 4A (f) packstone limestone outcrop at sample location 3B

**Cementation**

The cementation process occurs in almost all limestones in the study area, the type of cement formed is cement with equant and blocky types. These two types of carbonate cement are formed in almost all limestones in the study area. Both types of cement are environmental markers of meteoric diagenetic. That is, limestone has been affected by surface processes, triggered by the presence of surface water or meteoric water. This cementation process is a re-cementation process or neomorphism that occurs due to the dissolution and re-precipitation of this limestone. Neomorphism is a characteristic of cement formed in meteoric diagenetic environments, especially meteoric freshwater phreatic. This environment occurs when the limestone is still below the ground water level and the dissolution process has not been so significant.

**Micritization**

Micritization occurs in the wackestone-grainstone limestones in the study area. The carbonate matrix are transformed into micrite. Namely micro-sized calcite crystals. Limestone fragments such as foraminifera, coral fragments and others are turned into micrite, as a result of the diagenetic process that occurs in a meteoric environment. In the limestones in the study area, micritization appears to alter these limestone matrix.

**Dissolution**

In this limestone of Klapanunggal Formation, almost all of the limestone have been exposed to the surface so that the dissolving process occurs. However, in some places there are indications that there is no dissolution process. This is influenced by the facies and structures that develop in these limestones. In the boundstone limestone facies of the Lp 5A sample, it is seen that there is no dissolution process recorded in the limestone. In addition, the structure also plays a role in this dissolution process. If there is no structure that develops in the limestone, the dissolving process is difficult. This dissolution process is characterized by the presence of porosity with a vuggy type or the presence of caves with both macro and micro sizes formed as a result of the dissolution process. In this research area, caves with macro size exist in several places. The vuggy porosity is also seen very much in this limestone.
Figure 4. Graphic showing the percentage of carbonate cements, diagenetic processes and visual porosity formed in the study limestone.

The compaction process that occurs in limestones in this study area, which can be seen is mechanical compaction. What can be seen in these limestone fragments are almost attached to one another. Rupture of foram shells also indicates mechanical compaction. Contact between fragments was also seen in some of the incision samples. Chemical compaction characterized by the presence of stylolite is not visible in the limestones in this study area. This compaction process occurs in a diagenetic burial environment when the limestone is deep below the surface under pressure.

Dolomitization

Dolomite is a carbonate mineral with a high Mg content. The dolomitization process in limestone often occurs in limestones in areas with high evaporation, or areas with high temperatures. In the research area, the dolomitization process occurred significantly. Especially towards the top of the limestone in the study area. The dolomite plays a role in replacing the calcite in the limestone. Dolomite has white sucrose or parallelogram-shaped crystals. Dolomite formed in limestone in the study area is secondary dolomite. Namely, dolomite that occurs after the rock was formed. This dolomitization process is well recorded in the thin section of limestone in the study area.

Visual Porosity

The diagenetic process in limestone is also closely related to the resulting porosity. Porosity in limestone, which is heterogeneous, can indicate diagenetic processes that occur. The porosity formed in limestone in the study area is dominated by porosity with the vuggy type, this is directly proportional to the dissolving process that occurs in limestone in this study area. Other porosity formed is moldic and fracture. However, both porosities are present in small amounts. In Figure 4. above, in the visual porosity section, it can be seen that the porosity of the vuggy type and the porosity of the fracture type are formed simultaneously. It is suspected
that fractures in limestone in the study area are the main triggers in the formation of secondary porosity or porosity formed as a result of the diagenetic process.

**CONCLUSIONS**

The limestones of the Klapanunggal formation in the study area consist of wackestone-grainstone limestones. The diagenetic processes formed are re-cementation or neomorphism, micritization, compaction, dissolution and dolomitization. The visual porosity formed includes vuggy or caves which dominates the limestones in this study area. Meanwhile, other types of porosity such as moldic and fracture are also present in small amounts. Cement with equant and blocky types are the two main cements present in this limestone. Other cement that forms is fibrous in very small amounts.

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