Petrography and XRD mineral dolomites, paciran formation, district of Lamongan, East Java

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Abstract. Limestone area research in Paciran area has attracted many geologists. Limestone Paciran is known to have more dolomite composition than limestone located in Tasikmalaya or other areas. The limestone facies in the area consisting of Grainstone, Packstone, and wackestone. These research methods are petrography, micropaleontology and XRD. Petrographic analysis shows that the diagenetic process has occurred, dissolution, dolomitization, and cementation. XRD analysis on the dolomite limestone are almost 31.02%, Micropaleontological analysis shows the fossils of large fores of the type of lepidocyclina which have been filled with cement and pieces of algae. The purpose of this research is to determine the composition of the dolomite minerals contained in the Paciran formation. At this time the limestones Paciran continues to be explored by miners for mining needs, dolomite as building construction, cement making, neutralizing acid in the chemical industry, magnesium and calcium sources in animal feed, flux in metal processing industry, glass making base material, ceramic, as fertilizer in the paper industry.

1. Introduction
Lamongan regency has long been known as one of the dolomite mineral producers in Indonesia, this dolomite mineral has advantages, among others: pure dolomite minerals. The appearance of dolomite minerals almost resembles calcite, which is white, not colorful. The purpose of this study was to look for the potency of dolomite contained in the Paciran formation. This study mixed the results of analysis of Petrography, Micropaleontology and XRD.

Limestone mining in the Lamongan area of East Java has been prolonged, proving that the study area leaves the valley with the remaining high limestone cliffs in the mining area (Figure 1). In Lamongan mining, limestone mining is generally open mining. East Java is known as the hydrocarbon producing basin in Java Island, from the drilling result known that its reservoir mostly comes from a carbonate [1].

The mining situation in the study area shows barren and dry land with terraces topography, rarely found vegetation, light brown limestone, some still in exploitation some of the remaining abandoned mining in the form of basins and tunnels. Mining limestone miners open/open pit. Changes in morphology and topography, followed by differences in soil and rock characteristics. The cut hills due to mining have left relatively large limestone [2].

Previous researcher: Dolomite can be used as a brick in this study made of cement mixture [3], In megascopic facies of limestone in Montong Sekar area can be divided into 4 faces, namely coral bafflestone, sizeable benthic foram rudstone -Algae bafflestone, floatstone-algae rudstone Mollusca, sizeable benthic foram-Mollusca floatstone [4]. While microspheres consist of 5 microfacies, namely Foraminifera Mudstone, Large Benthic Foram Wackestone-Algae Packstone, Algae Packstone-
Grainstone, Algae. Santika et al. examined the cement raw material from the Paciran Formation limestone and the Bulu Formation using X-RD, AAS, and X-RF. The X-RD method is used to determine the mineral composition of the rock. AAS and X-RF are used to determine the main mineral content of rocks [5]. The ups and downs of sea level temperatures conducted on reefs in the Paciran Formation, East Java, in his research it was concluded that during the formation of Paciran Formation in Tuban there were four heats or interglacial periods. dolomite as building construction, cement making, neutralizing acid in the chemical industry, magnesium and calcium sources in animal feed, flux in metal processing industry, glass making base material, ceramic, as fertilizer in paper industry.

The most exciting part of limestone mining in Lamongan is the presence of dolomite minerals which is about 41-51% percent of the existence of limestones [6]. Dolomite including mineral carbonate, pure dolomite miner, theoretically contains 45.6% MgCO3 or 21.9% MgO and 54.3% CaCO3 or 30.4% CaO.

![Figure 1](image1.jpg)

**Figure 1.** Limestone mining, leaving a high cliff that has not been exploited.

![Figure 2](image2.jpg)

**Figure 2.** Tuban Area Geology Map.

The research area is composed of rock sediments of the Kujung Formation Prupuh Formation Formation Formation (Figure. 2). This formation comprises limestone, compact, cemented, forming large outcrops alongside napal and claystone, containing orbitoid foraminifera and corals. Above precipitated composition, Tuban formation consists of green siltstone and grayish yellowish with limestone interiors. Above is accelerated Paciran Formation, composed of Paciran dolomite and dolomite, white gray, reddish brown, organic with algae fragments, corals, large foraminifera and mollusks. Above it is covered with beach alluvium deposits. The purpose and purpose of this research are to know in detail the dolomite content in Paciran formation, fossil content, and age of Paciran Formation [7].
2. Methods
Field data collection is done before field penetration in the form of library data collection. In the field conducted field observations to several limestone mining locations in the northern part of Lamongan regency, precisely in the outcrop of Paciran Formation. Then the interpretation of facies of limestones, rock sampling for petrographic analysis and XRD.

The research method used in this research is petrography and XRD analysis, this method is chosen because it is the appropriate method for this research. Petrography will reveal detailed analysis of mineral composition in rocks in the study area, and XRD will disclose excellent rock compositions. The classification used in this carbonate dividing carbonate classification based on the content of fossil XRD research was conducted at XRD Lab of Research Center of Geotechnology, the analysis of the study was conducted by collecting [8].

![Figure 3. Outcrop of Paciran formation.](image)

Dolomite selected limestone, up to 10-50 um mesh, then inserted into XRD for analysis. The analysis results are then reprocessed with the software to ensure dolomite results Figure 3 Outcrop of Paciran Formation.

3. Results and Discussion
The research in Lamongan district coordinated is located in the North part of Lamongan district precisely in Paciran Formation. Paciran formation at this time in the exploitation by the miners as building materials and a mixture of fertilizer (dolomite).

The result of petrography analysis of the area Petrographic analysis of the Paciran Formation showed several units based on presence on the deposition texture of limestone. There are three layers of rock units, which are grainstone-wackestone. The observed rock structures consist of lower laminate parallels are units of wackestones, packstone, and top of grainstone the thickness of the layer that is exposed approximately 10 meters, the bottom shows a more delicate texture than the top.

3.1. Facies Grainsitone.
The grainstone unit was unveiled in the research area in the northern part of Lamongan, the outcrop consisting of limestone yellowish white limestone, excavated from grainstone, massive, yellowish white, petrography from Facies Grainstone composed of large fossil Forams (X), algae (XX), the algae cut (XX) in Photograph 4b, while in photo b, shows the dominant algae cuts and large foram fossil pasies that have not been well observed, the cement of the incisions is calcite, white, present among the large foram fossils and algae.
3.2. Facies Packstone.
Packstone facies are exposed in the study area, white, yellowish limestone, medium-hard rock, have fossil components of foraminifera and algae. In the incision photographs, the traces of large foram fossils are unclear what species, intraclass with sedimentary rock fragments on clay sediment basis. the bottom part of the incision consists of clay with brown color and interparticle porosity.

![Figure 4](image)

**Figure 4.** Grainstone rock units Paciran Formation showing fossils of large forams (a) algae that dominate the incision (XX), (b) showing pieces of algae dominated by incisions (XXX).

![Figure 5](image)

**Figure 5.** Photo thin section packstone Paciran Formation, dominated by clays, large foram shells can still be observed (C).

3.3. Wackestone facies.
The wackestone facies of thin section shows no fossil foraminifera or bentos and algae present, the incision comprising particles of great sedimentary rock and a bit of seaweed (Fig. A). Porosity in both photographs is seen scattered with intra particle and cavern [9].

3.4. XRD Analysis
XRD Analyzed Samples of Paciran Formation were analyzed using XRD, intended to know the content of dolomite CaMg (CO3) 2, the analysis results show significant numbers for dolomite content in each rock sample it’s about 31.02;41.23; and 51.09, at this analysis obtained other minerals (Na), Aluminum (Al), Silicon (Si) and Iron (Fe) in the form of oxide compounds with lower levels.

XRD analysis on lamongan limestone to determine the composition of dolomite, the researchers based on XRD can provide unique “fingerprints” of the crystals in the sample. When interpreted correctly, with a comparison with the standard reference pattern and size, this fingerprint allows identification of fingerprint crystals. The result of analyze that dolomite contained in the fancier formation is almost 31.02%.
4. Conclusion
There are three layers of rock units at Paciran Formation in Lamongan East Java, are Grainstone, Packstone, and Wackestone, each facies have a character that can provide an overview of the depositional and diagenetic environment of the Paciran Formation, while XRD analysis shows that dolomite is found in facies of the Wackeston-re-packing facility of 31, 02%.

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