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The analysis of volcanic activity influences at the lower and middle part of Sentolo Formation, Kulon Progo using petrographic method

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Abstract. The research area is a part of South Serayu Mountain zone, specifically Bregada Kulon Progo. The Bregada Kulon Progo is a product of volcanic activity in the past, which can be seen by the volcanic rock called Old Andesite Formation. The end of the volcanic activity is characterized by the deposition of carbonate rocks which were part of Jonggrangan Formation and Sentolo Formation. The lower part of Sentolo Formation is composed by the mix of carbonate and volcanic materials. The research is carried out by two methods. The first is field method, which is implemented by geological mapping and rock sampling. The second is laboratory method, which is implemented by petrographic method. The petrographic method is implemented by making thin section of the rocks, then observing the thin section with polarization microscope to determine the composition of the rocks. The rock samples are mainly from the lower and middle part of Sentolo Formation, which probably still got the influence of volcanic activity. The benefit of the research is knowing the influence of volcanic activity in the carbonate rocks of Sentolo Formation. The presence of volcanic materials in the lower part of Sentolo Formation, can be predicted by two processes. First, the volcanic activity supplied those materials directly, and second, from the rework of the volcanic materials then mixed with carbonat materials of Sentolo Formation.

1 Introduction

1.1 Background

Bregada Kulon Progo, the location of this research, is a part of the physiography of the Southern Mountains [1,5], based on other sources Bregada Kulon Progo belongs to the South Serayu Mountains [6]. Bregada Kulon Progo is the product of the volcanism activity during the Oligocene to Early Miocene. The volcanism activity produced the formation of volcanic deposition called Old Andesite Fomation (OAF).

The end of volcanism activity is marked by the growth of reefs namely Jonggrangan Formation. During the Early Miocene to Middle Miocene the Jonggrangan Formation was

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formed. The growth of reefs at Bregada Kulon Progo was followed by the deposition of clastic carbonate rocks called Sentolo Formation. Sentolo Formations from bottom to top are composed by tuffaceous marl, limestone, and marly sandstone [6]. Sentolo Formation was deposited unconformably above the Old Andesite Formation and then covered by the Young Merapi Deposits and the Alluvial Sediment unconformably [8].

The lower part of the Sentolo Formation is composed by a mixture of carbonate materials and volcanic materials. The presence of volcanic material at the bottom of Sentolo Formation leads to the presumption of volcanic activity which supply the volcanic material into Sentolo Formation or the existence of rework material from the old Andesite Formation which was deposited into the Sentolo Formation, resulting in a mixing on the lower part of Sentolo Formation. Based on the description, a study was conducted to study the lower and middle stratigraphy of Sentolo Formation, based on differences or variations in the composition of the formation.

1.2 Location

The research area is located at Sidomulyo Village, Pengasih District (X = 407000-411000 TM and Y = 9134000-9137000), and Giripulo Village, Girimulyo District (X = 407000-411000 TM dan Y = 9138000-9141000), Kulon Progo Regency, Yogyakarta Province, Indonesia (Fig. 1).

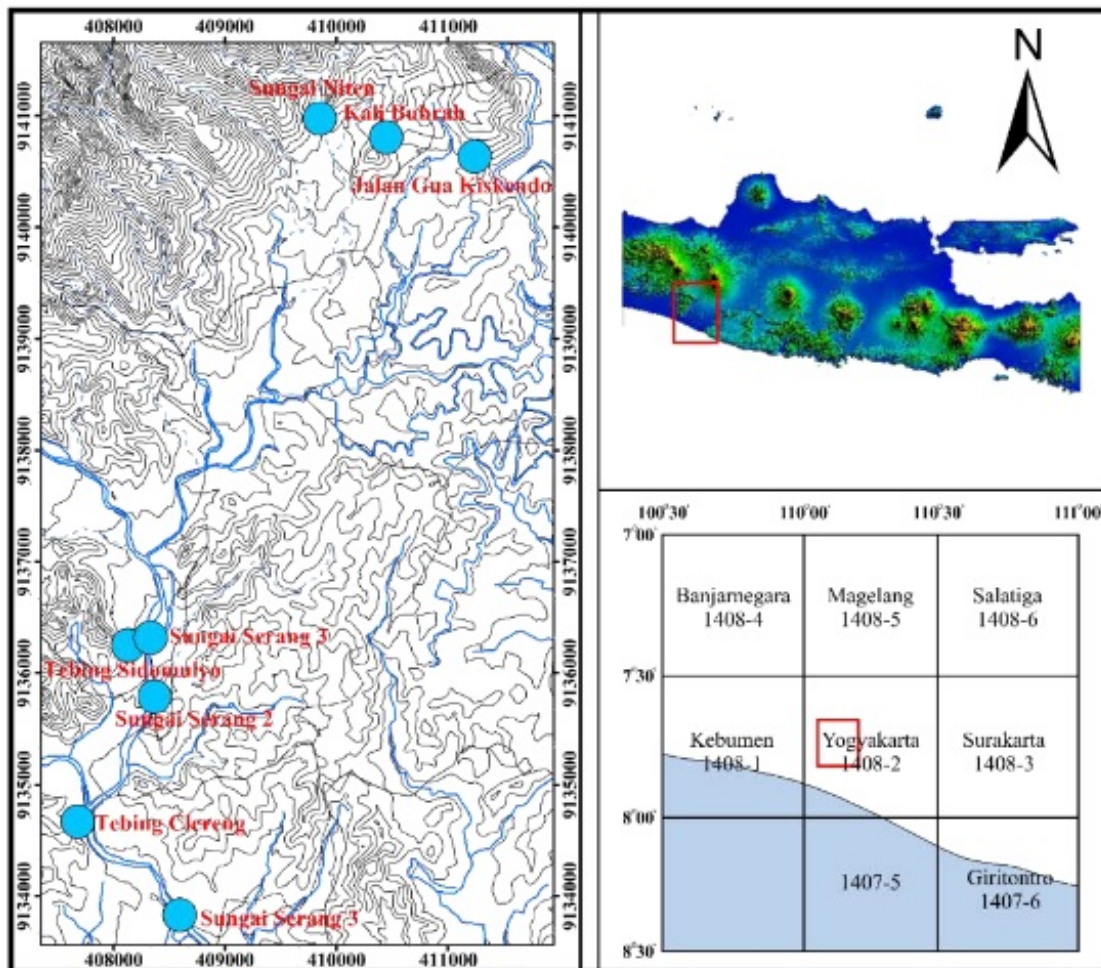


Fig. 1. Research area location

2 Literature Review

The research area is part of regional geology of Kulon Progo, particularly Sentolo Formation. The Sentolo Formation is deposited above The Old Andesite Formation. It is interfingering with Jonggrangan Formation which also deposited above The Old Andesite Formation. The Sentolo Formation consists of limestone and marly sandstone. The bottom of the formation consists of conglomerate piled by tuffaceous marl with tuff insertion. Towards the upper part of the formation, the rocks gradually transform into layered limestone. The thickness of this formation is about 950 m [8].

3 Methods

This research was using petrographic method to analyze the rocks in thin section. The rock samples from the research area were polished to make the thin sections. The thin sections were analyzed using polarization microscope. This analysis aims to determine the character of the rock and the microscopic composition of the rock composition of each sample.

4 Discussion

Observation of changes in the composition of volcanic materials in the study area, particularly in the lower Sentolo Formation to the middle Sentolo Formation is held by sampling the rocks on each of the stratigraphic measurement paths assumed to be the lower or middle part of the Sentolo Formation. Rock samples from each measured stratigraphic path were observed with petrographic analysis.

At the bottom of the Sentolo Formation there is a volcanic material input inside the rock Volcanic material supply derived from erosion on the body of volcano (post-volcanism) is seen on the Niten River and Kali Bubrah tracks. On both tracks were found volcanic rocks debris deposit. The products of the erosion were sandstone deposits composed of volcanic material and the presence of igneous rock fragments floating on the sandstone body (Fig. 2)



Fig. 2. The outcrops of debris sandstones on the Niten River showing the supply of volcanic material after the process of volcanism (post-volcanism).

The volcanic materials were interpreted not directly derived from the volcanic eruption but from the erosion of pre-existing volcanic materials of Old Andesite Formation. It was proved by the presence of foraminifera fossils at the rocks. Organisms such as foraminifera could not live in the environment where there was volcanic activity.

Based on the results of petrographic observations can be seen that there was a huge supply of volcanic material at the bottom of Sentolo Formation with a small organism diversity (Fig. 3).

It can be interpreted that the bottom of Sentolo Formation is not directly deposited by carbonate material, because at the time of the deposition of Sentolo Formation, the sea conditions have not been in a clear and stable environment, so the organisms were unable to live well.

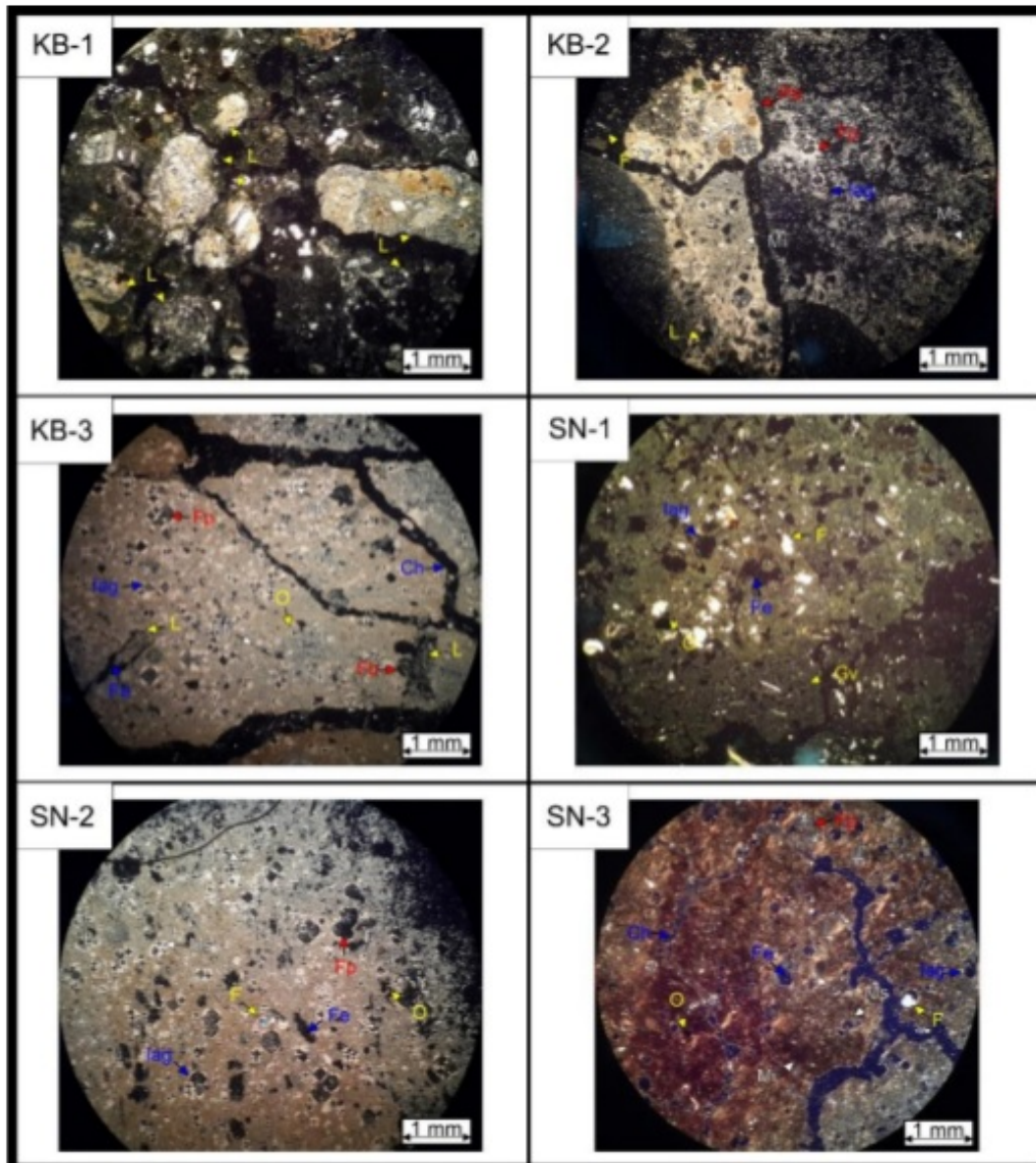


Fig. 3. The thin section of rocks from Lower Sentolo Formation (Fp= Planctonic Foraminifera; Fb= Benthic Foraminifera; O= Opaque Mineral; L=Lithic; F=Feldspar; Gv=Volcanic Glass; Mi=Micrite; Ms=Microspar; Ch=Channel Porosity; Fe=Fenestral Porosity; Iag=Intragranular Porosity).

Towards the middle of the Sentolo Formation the supply of volcanic materials has begun to diminish until nothing remains, although some thin sections show the existence of volcanic glass material with a very wide array of organisms (Fig. 4).

Overall measured stratigraphic measurement path from the bottom of the Sentolo Formation toward the middle of Sentolo Formation show the decrease of volcanic material abundances. This change in composition is due to the occurrence of equilibrium, either sea level rise or reduction of tectonic processes and volcanic activity, so the environment condition was suitable for the development of organisms.

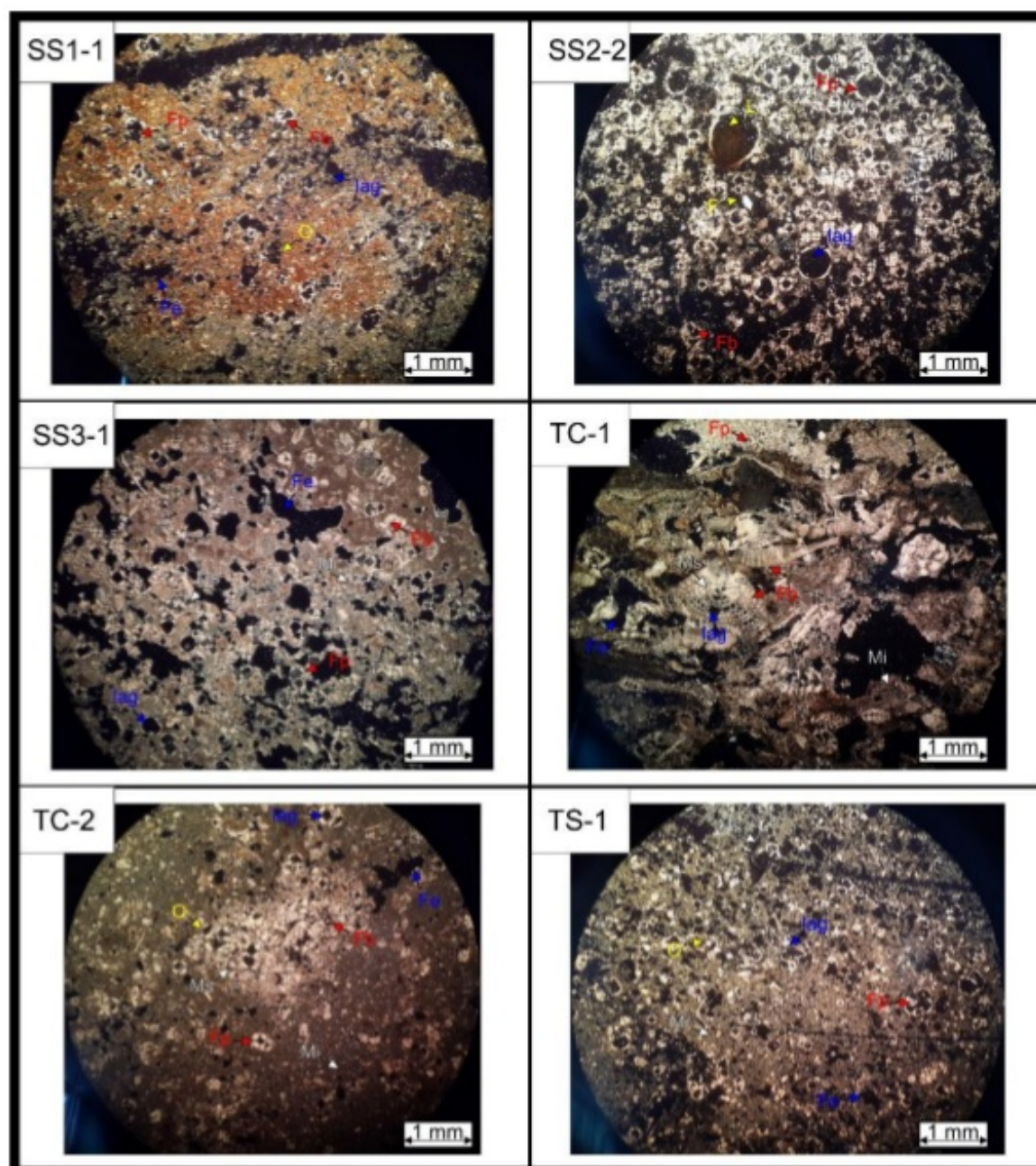


Fig. 4. The thin section of rocks from Middle Sentolo Formation (Fp= Planctonic Foraminifera; Fb= Benthic Foraminifera; O= Opaque Mineral; L=Lithic; F=Feldspar; Gv=Volcanic Glass; Mi=Micrite; Ms=Microspar; Ch=Channel Porosity; Fe=Fenestral Porosity; Iag=Intragranular Porosity).

5 Conclusions

1. The volcanic material in Sentolo Formation is abundant in the bottom part of the formation and decreasing toward the middle part of the formation.
2. The volcanic materials in the Sentolo Formation derived from the erosion of volcanic rocks of Old Andesite Formation and not directly from volcanic activity.

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