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Zonation of Volcanic Hazard Lava Flows and Fissure Flank Possiblity of Slamet Mount in Belik and Surronding Areas, Pemalang Regency, Central Java Province, Indonesia

Dwi Indah Purnamawati[1], Nenden Lestari S[2]
[1,2]Institut Sains dan Teknologi Akprind Yogyakarta, Indonesia

Abstract: Slamet Mount is one of Quarternary volcano which has vulcanian and strombolian type which is classified as A type volcano which can erupt at any time. During the Pleistocene and Holocene, the Slamet Mount experienced several eruption phases including changes from the eruption phase of ash, the lava dome dusk to the lava incandescent from 1772 to 2009. Based on the geological identification and geological structures carried out in Belik and surrounding areas which are ± 18 km from Slamet Mount eruption center can be identified zonation of volcanic hazard lava flow, ballistic burst (bomb, block and lapilli scoria) from the source of eruption as well as the existence of geological structures include: normal faults and oblique faults which may be the path of flank eruption. This is evidenced by the existence of structure data that has the orientation of Northwest-Southeast straightness with the orientation of the emergence of cinder cone. The presence of cinder cones, caused by the fissure flank around the foot of Slamet Mount break through the Tertiary rocks through the weak zone. Based on the geological structure, it is likely that the structural patterns that exist in the research area have potential as the fissure flank line for future disasters. Geological approaches and geological structures are essential to the volcanic hazard potential which is then implied into the volcanic hazard zonation map. This is intended to facilitate local community preparedness for future disasters.
Keywords: cinder cone, issure flank, slamet mount, structural geology, volcanic hazard.

1. Introduction

Administratively the research location is in Belik area, Belik District, Pemalang Regency, Central Java, Indonesia. The research area is the eastern slope of Slamet Volcano. The astronomy lies in the coordinates 07°10'00 "- 07°15'00" LS - 109°17'30 "- 109°22'30" BT. The volcano Slamet is one of the Quaternary volcanoes, where in the Pleistocene period the formation of the Slamet Volcano was due to the subduction of the Plate Indo-Australia Administratively the research location is in Belik area, Belik District, Pemalang Regency, Central Java, Indonesia. The research area is the eastern slope of Slamet Volcano. The astronomy lies in the coordinates 07°10'00 "- 07°15'00" LS - 109 °17'30 "- 109°22'30" BT The volcano Slamet is one of the Quaternary volcanoes, where in the Pleistocene period the formation of the Slamet Volcano was due to the subduction of the Indo-Australia Plate on the Eurasian Plate in the south of Java Island. Slamet volcano is one of the stratovulcano-type volcanoes and its status includes a type A volcano that can reactivate at any time. Administratively located in 5 districts in Central Java province, Indonesia. The five districts are Brebes, Banyumas, Purbalingga, Tegal, and Pemalang. on the Eurasian Plate in the south of Java Island. Slamet volcano is one of the stratovulcano-type volcanoes and its status includes a type A volcano that can reactivate at any time. Administratively located in 5 districts in Central Java province, Indonesia. The five districts are Brebes, Banyumas, Purbalingga, Tegal, and Pemalang.

An academic point of view or with a mainly practical perspective; the latter approach would answer the questions that authorities ask scientists to manage emergencies in the event of a volcanic crisis. This scientific answer [1][2][3] can only be given in terms of probabilities, both for the beginning and the ensuing development of the event and the definition of the area affected. On the other hand, so that volcanologists can give this answer, they must make some assumptions that simplify the scientific problem, and these assumptions must be coherent and justified by the available information. There is a lot of data (volcanological and structural geology) concerning Belik area. However, there is relatively little information which is significant for our objectives, and it is also quite unlikely that existing data can be improved or refined in the future, more sophisticated studies.

In Belik area, there is no instrumental experience concerning the behaviour of possible precursors in previous eruption. Therefore, this information basically comes from analysis of structural geology, cinder cones occurance and lithology paramaters.

2. Geological Setting

The division of Central Java's physiography [4] is divided into 6 sections (Figure 1):

1. Quaternary Volcano.
2. Alluvial Plains of Java North Coast.
3. Anticlinorium Rembang Madura.
4. Antiklinorium Rembang-Serayu Utara-Kendeng.
5. Embankment and Dome of the Depression Center.
6. Southern Mountains.

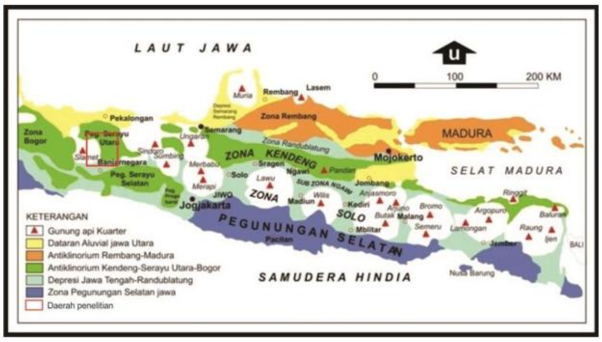

Figure 1 East Java physiography (source: Bemmelen, 1949)

Based on the division of physiography, the research area is included in North Serayu zone. The northern Serayu Mountains bordering the Bogor Mountains to the west [4] have an area of 30-50 km west-east direction with curved geometry opening towards the south and both ends are occupied by Quaternary volcanoes.

Stratigraphy of regional research area is included in Purwokerto-Tegal stratigraphy section which has been prepared by Djuri, et al in 1996 [5] (Figure 3). The research location is on the Indonesian earth map of Sheet Belik (1308-641). Here is the stratigraphic order of research areas starting from the oldest are Rambatan Formation (Tmpr), Halang Formation (Tmph), Kumbang Formasi (Tmpk), Batuan Terobosan Tersier (Tmi(d)), Batuan Terobosan Tersier (Tmi(m)).

Rambatan Formation (Tmpr)

Formation this propagation consists of shale, napal and sandstone gampingan [6]. Napal alternates with gray sandstone gampingan gray. Many found a thin layer of klasit that is perpendicular to the slope of the layer. Many contain small foraminifera [7]. Thick layer about 300 meters, this Rambatan Formation is Middle Miocene [8] and deposited in an environment with a turbidit current system mechanism under the sea fan [9]. Above it is harmonized in harmony Halang Formation, but locally trashed [2].

Halang Formation (Tmph)

This formation consists of a tyranny conglomerate, sandstones and a sandstone inserted napal. Above the plane of sandstone layers, there are traces of worms or burrows. The small foraminifera shows the final Miocene to Pliocene. This formation has a thickness of 800 m. Halang formation is a kind of sediment of turbidite sediment in upper bathyal zone [2]. In some places at the top of this formation, reef bumps are found.

Kumbang Formation (Tmpk)

This formation consists of breccia, andesite lava, and tuff. In some places there are breccia and tuff sandstone. This formation is a typical sediment of the Pliocene volcano product. Van Bemmelen in 1949 says the age of the formation is the Late Miocene[4]. This formation is deposited on an underwater fan system with turbidit current mechanism [6] and has a thickness of about 2000m [10].

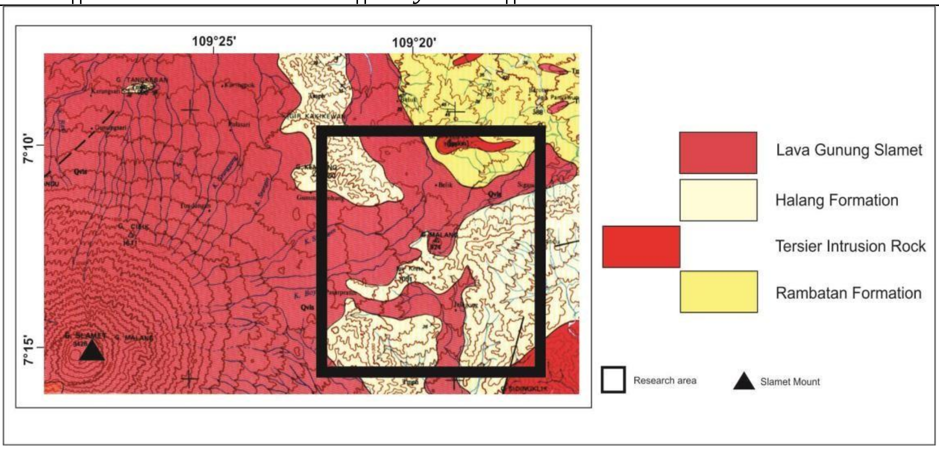

Figure 2 Regional geology of research area

Diorit Intrusion Tersier (Tmi(d))

This formation is composed of igneous rock diorite dark brown and black. Holochemical textured subdiabas porf iron with feldspar feldspar and feminine minerals. These rocks are estimated to be Tertiary aged.

Lava Gunung Slamet (Qvls)

This unit is composed of hollow basalt and andesite lava scattered along the eastern slopes of Mount Slamet.

Aluvium (Qa)

Alluvium deposits are composed of loose materials such as gravel, sand and silt as a sedimentary material of a river having a certain thickness.

3. Methodology

The research method used to determine the effect of geological structure on the appearance of cinder cone in the research area consists of 2 (two) stages, namely primary data collection method and secondary data collection method.

Primary data

Primary data collection is done by geological mapping directly in the field that includes taking lithologic data, geological structure data retrieval and also data from DEM (Digital Elevation Model).

Secondary data

Secondary data collection is done by collecting regional geology data and also journal related to research area. Both data will then be processed using some software such as global mapper, info folder, arcgis, wintensor, dips, and corel draw to generate maps, structural analysis data and stratigraphic data.

4. Result and Discussion

Volcano-prone areas are areas that have been affected or identified as potentially threatened by eruption either directly or indirectly. Map of disaster prone areas of volcano is a map that is designated as the level of disaster vulnerability of a region in case of volcano eruption or volcanic activity [11]. Based on Regulation of Minister of Energy and Mineral Resources No. 15 of 2011 concerning Guidance on Volcano Disaster Mitigation, Resistant Movement, Bimim and Tsunami Earthquake hence the mapping of volcano prone areas is conducted to determine the area based on the level of vulnerability to volcanic eruption hazard and not limited by administrative area[12]. This map is used as the basis of anticipation and decision-making consideration for the Government and local government in the effort of disaster mitigation of disaster prone areas of volcano is divided into 3 (three) areas, namely:

1. Disaster prone areas I is a potentially lava-stricken area, stricken material fall in the form of ash rain, and / or water with high acidity. If the eruption is enlarged, this area has the potential to be exposed to hot clouds and crushed material fall in the form of heavy ash rains, and bursts of incandescent rocks;
2. Disaster-prone areas II is a hotspot-potentially hot zone, lava flows, incandescent rock, lava fall, heavy ash rain, hot
3. Mud rain, lava flows, and / or poisonous gas;

4. Disaster-prone areas III is a very potentially hot clouds, lava flows, lava fumes, incandescent rocks, and / or toxic gases.

Table 1 Classification of Disaster Prone Areas

Hazard Level	Distance (from eruption center)	Disaster vulnerability	Risk Description
Low Hazards	30 Km	I	Low
Medium Hazards	20 Km	II	Medium
High Hazards	10 Km	III	Hight

Based on analysis of geological mapping data and linkage with DEM data to eruption center can be seen in figure 3, that research area is located ± 18 km from eruption center of Gunungapi Slamet. Thus, it is interpreted that the research area is included in the medium hazard zone based on the distance from the eruption center.

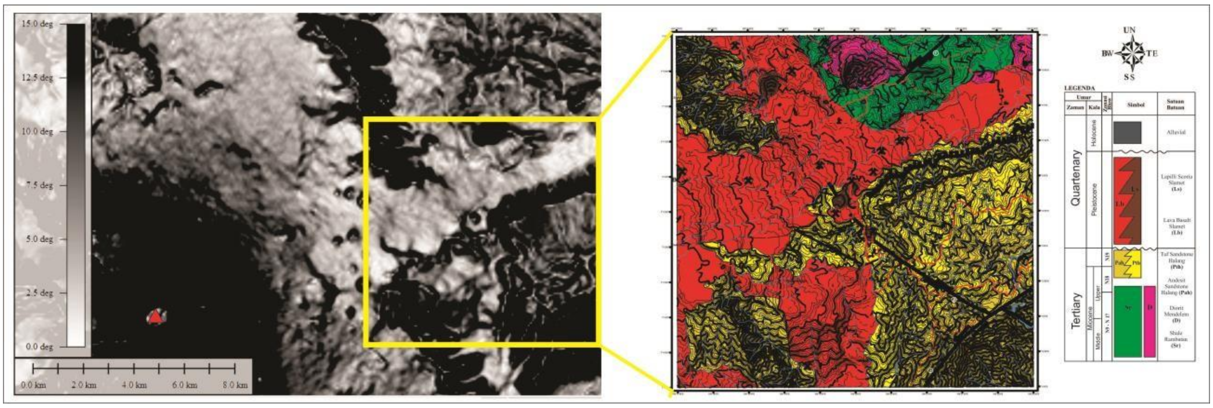

Figure 3 DEM and Geologic Map of Research Are

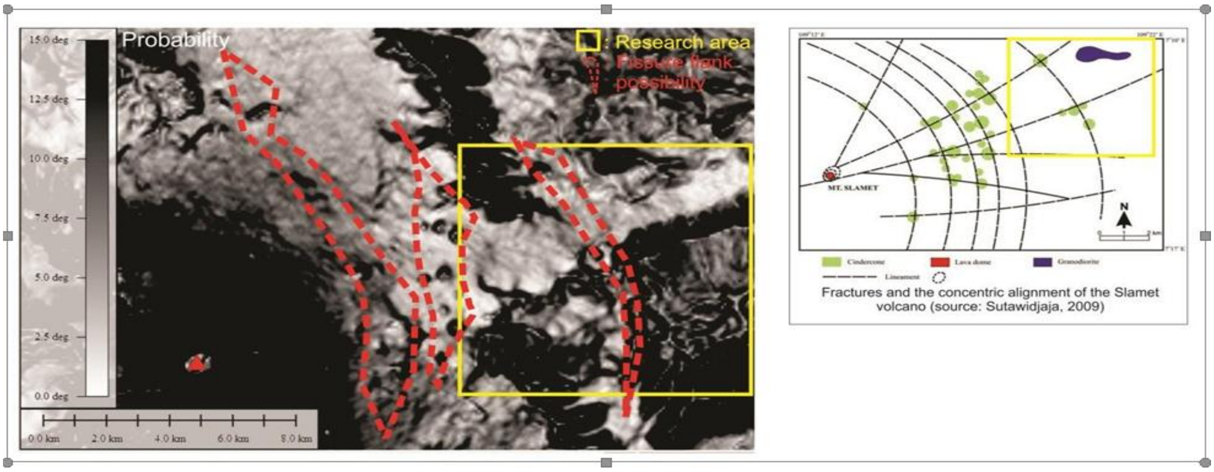

Figure 4 Fissure flank interpretation based on alignment in DEM

5. Conclusions

In the area of Slamet Volcano is surrounded by a radial faults associated with Slamet Volcano and cinder cone. The existence of cinder cone is on the fault that is around it. There are two main directions of fracture that are northeast-southwest and northwest-southeast (Djuri, 1975). On the east side of the Slamet Volcano there is an oblique fault, which has a south-southeast alignment and the alignment makes the presence of the cinder cone to the surface. The relationship between the tectonic and straightness of the cinder cones is very clear, where fracture patterns generated around the summit of Slamet Volcano have a west-east pattern generated by the Java subduction activity. Based on the existence of fault-faults that exist in the study area may be possible fissure flank if the fault is reactivated again.

Based on the zoning map prone to disasters it can be interpreted that the research area includes the hazard zone I which is a potentially lava-stricken area, struck by the fall material in the form of ash rain, and / or water with high acidity. If the eruption is enlarged, this area has the potential to be exposed to hot clouds and crushed material fall of heavy ash rain, as well as bursts of incandescent rock. The possibility of the emergence of fissure flank can be known based on a regional structure that has 5 concentric ranks and potentially as a fracture if one day there is volcanism activity again.

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Author Profile

Dwi Indah Purnamawati received the Ir. and M.Si. degree in Geological Engineering from the National Development University, in 1989 and in 993 from the Graduate Study Program in Environmental Science, Gadjah Mada University. From 1991-present worker as a lecturer in the Geological Engineering Departmen, Faculty of Mineral Technology, Institut Sains dan Teknologi Akprind Yogyakarta and head of Dynamic Geology laboratory.