The Palu Earthquake Formed a New Geological Structure

Anugrahadi, A.*, Sumarto, U., Purwiyono, T. T.

Geological Engineering, Faculty of Earth and Energy Technology, Trisakti University

*afiat@trisakti.ac.id

Abstract. Earthquakes are a natural phenomenon where there is a vibration on the surface due to the sudden release of energy from inside the earth. In October 2018, this event has occurred in Palu, Central Sulawesi and the surrounding areas with a scale of 7.4 Richter Scale. The Palu earthquake has caused quite a lot of damage, not only to facilities and infrastructure as a result of human development, but geologically it has caused various impacts such as the formation of fault activity, ground movements, etc. The purpose of this study is to describe the formation of new geological structures due to the Palu earthquake. There are two methods used in this research, that is analysis based on aerial photographs and field data as supporting data. From these methods, it appears that the fault zone is active during the earthquake and resulting new faults zone with dominant of normal fault and strike-slip fault which have NNW – SSE trend.

1. Introduction

Sulawesi Island is located in triple junction of the Eurasian, Pasific, and Australian plates. So, it is possible having occurrence of earthquakes caused by movement of the earth’s plates in this area. In October 2018, the earthquake that occurred in Palu, Central Sulawesi with 7.4 Richter Scale had a big impact, including geological impacts such as ground movements, landslides, liquefaction and tsunami. This impact can also be affected by the main fault of this area, Palu-Koro Fault. This fault is an active fault in Central Sulawesi with left lateral movement and a NNW-SSE trend [1], [2]. The research team in the previous study conducted an aerial photo survey using drones and obtained information on morphological features that have been formed due to the Palu earthquake and the surrounding area. Therefore, this study aims to describe the formation of new geological structures due to the Palu Earthquake using topographic map analysis integrated with field data analysis.

2. Geology Regional

The Palu area and its surroundings are located on Sulawesi Island at the triple junction tectonic crust. The main fault that controls this area is the Palu-Koro Fault which has a NNW-SSE trend. The Palu-Koro Fault is a system of irrigation faults that form elevations and low such as the Palu Valley, Poso Lake, and Matano lake [1], [2], [3]. Palu Valley was formed due to transtensional tectonic associated with the Palu-Koro Fault [4], [5], [6]. This area was covered by fluvial deposits which causes liquefaction after the earthquake occurred in 2018.

3. Methodology

The survey was carried out in the valley of Palu area and its surroundings, especially to trace the Palu-Koro fault line on the western slope of the Palu Valley. The method is to analyze the topographic map using aerial photography data from the previous study then integrated with field data. Survey trajectory of the drone attend to the Palu-Koro Fault trend, that is NNW-SSE.
4. Results and Discussion

4.1. Field Data Analysis
Field data shows that there is a clearly visible ground movement as shown below. Figure 2 shows the existence of a fault zone where side of a road subsides due to the earthquake activity indicating a normal fault. Whereas Figure 3 shows an offset indicating dextral movement of strike-slip fault.
4.2. Aerial Photo Data Analysis

The results of data processing carried out by previous studies using aerial photograph to make the topographic map shows that Palu area occurred new fault zone formed by the earthquake [7]. Those faults have NNW-SSE trend. This trend has the same orientation with the main fault, Plau-Koro Fault. Thus, these new faults is dominated by synthetic faults because it has the same dip with the main fault [8].
5. Conclusion
Based on the integrated analysis of topographic map data and field data, it shows that the formation of new structures occurred due to the Palu earthquake activity. Fault types identified through field data are normal and strike-slip faults. The topographic map shows the existence of a new fault zone with dominated of synthetic fault because it has the same dip orientation as the main fault, the Palu-Koro Fault.

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