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Application Landsat 8 OLI/TIRS in Identifying Rock Lithology at Sutami Dam, Malang Regency

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Abstract**—** *It has been conducted by research on Rock lithology in Sutami Dam using remote sensing method. The purpose of this study is to identify the lithology of rock in Sutami Dam. The satellite imagery used is Landsat 8 OLI/TIRS satellite imagery. Landsat 8 OLI/TIRS image was then corrected, and further RGB Composite performed. Remote sensing data processing shows that the lithological surface of the research area is dominated by limestone and clay, and there is also volcanic rock consisting of lava, andesite lava, volcano breccias and floating stone tuff originating from Mount Kawi and Mount Butak.*

Keywords**—** *Sutami, remote sensing, Landsat 8.*

I. INTRODUCTION

Sutami Dam (Fig. 1) is a dam located in Karangkates Village, Sumberpucung subdistrict, Malang regency at coordinates 659469-659300,24 BT and 9098111-9097358 LS with a height between 188-387 m, peak length of 800 m, width 13.7 m with an area of 2050 km.

Fig. 1. Map of Sutami Dam (*Source: Google Earth*)

Sutami Dam is one of the hydroelectric power plant in Indonesia. So, the type of rock in Sutami Dam really has the durability of the dam. One method that can be used to know the litology of rock in Sutami Dam is to use remote sensing method.

Remote sensing is one of the earliest methods used in mapping for various purposes, one of which is exploration. This is because remote sensing can provide an early overview of geological conditions, geomorphology, and other conditions that you want to know. One of the remote sensing methods that are often used is using Landsat image, one of which is the image Landsat 8 Operational Land Imager/Thermal Infrared Sensor (OLI/TIRS). Landsat 8 is an image launched by the American state, and has 11 different channels (bands) with spatial resolution of 15 x 15 meters to 100 x 100 meters (United States Geological Survey, 2016).

The analysis of Landsat imagery is generally used to determine the conditions on the Earth's surface by looking at the character of Reflectance and the adsorment of electromagnetic waves of objects on the surface of the Earth. One of the applications used in this research is to know the litology of rocks located in Sutami Dam.

In earlier research, shows that Sutami Dam is located in an area vulnerable to land movements (Fitriah, 2015). Geologically, Sutami Dam is located around the local sliding fault of Pohgajih, local Patahan Selorejo, and the limestone contact field-Andesit Selorejo (Sunaryo, 2015). In addition, the location of Sutami Dam is also in the area prone to earthquakes (Purwana, 2019).

In this study, the remote sensing method can be used as a method of knowing the litology of rocks at Sutami Dam from the surface. This research can be used as a preliminary recommendation to improve awareness and monitoring of Sutami Dam.

II. REGIONAL GEOLOGY OF RESEARCH AREA

a. Regional Geomorphology

Physiographically, the research area is part of the southern mountain strip of East Java, while the northern part is part of the mountainous Solo strip (Bemmelen, 1937). Morphologically, the area can be divided into three units, namely the slopes of volcanic cones, hills, and lowland.

b. Regional Stratigraphy

The oldest rocks are the andesite lava to the basal and the porfir latit Mandalika (TOMM) formation, with members of the Tuf Mandalika Formation (TOMT) in the form of a clap of the dacitic and Rhyolite (Liparit). His second relationship is to close. The second age of the rock unit is estimated to be the final Oligocene (Sartono, 1964) or possibly up to the early

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Miocene. The Mandalika formation was overthrown by the Miocene-aged rock units belonging to the Campurdarat (TMCL) formation, the Wuni (TMW) formation, the Nampol (TMN) formation, and the Wonosari Formation (TMWL).

All of these units were indictory not aligned with the quarter volcanic rocks consisting of lava, andesite lava, Volcano Breksi and Tuf pumice originating from Mount Kelud and Mount Butak with a mixed sediment consisting of volcanic material originating from Mount Kelud, Mount Butak and volcano quarter in Malang area (Mount Tengger, Mount Semeru and Mount Kawi).

III. Material and Methods

In determining Sutami dam rock litology The material used is regional geological map of scale 1:100,000, image Landsat 8 OLI/TIRS, as well as publications related to the research area. In this research, the software used in image processing and map creation is Enviromental for Visualizing Images 4.5 (Envi 4.5).

Satellite imagery of Landsat 8 the OIL/TIRS that was used is a satellite image of 118 row 66 on April 24, 2020 with cloud cover parameters of 10% or less to minimize noise. Then done geometry correction on the image of Landsat 8 OLI/TIRS. Geometry correction is a transformation that corrects the spatial connection between the pixels contained in the corrected image. The corrected satellite imagery was then composited. The purpose of this composite band is to obtain a better visual representation of the view of infrared aerial photographs, so that object observation, sample selection and aesthetic aspect of the imagery is improved.

IV. Result and Discussion

Result of Landsat 8 satellite imagery data that shows rock contacts in Sutami Dam. The Data used is the 118 row 66 path dated April 24, 2020 with cloud cover parameters of 10% or less to minimize noise.

On the composite image 432, Band 4 (0636-0673 μm) is positioned in the red channel, Band 3 (0533 – 0590 μm) positioned in a green channel, Band 2 (0452 – 0512 μm) positioned in the blue channel. The combination of these three bands is able to display geological and geomorphological kondsi regionally from the research area. Physiography, the research area is part of the southern mountains of East Java, while the northern part is part of the Volcano Solo Lane. Morphologically, this area can be divided into two units, namely hills and lowland.

Fig. 2. Composite image RGB 432

In the RGB 567 composite image, Band 5 (0851 – 0879 μm) is positioned in the red channel, band 6 (1,566 – 1,651 μm) positioned in a green channel, and the band 7 (2,107 – 2,294 μm) is positioned in the blue channel. The combination of the three bands is able to provide information on the geological conditions better than the natural color composite 432.

Based on the image of 3 areas with light blue is thought to be limestone and clay. As for the orange part, it is part of the volcanic rock, where it consists of lava, andesite lava, volcano Breksi and floating stone tuf originating from Mount Kawi and Mount Butak.

V. Conclusion

Remote sensing data processing shows that the lithological surface of the research area is dominated by limestone and clay, and there is also volcanic rock consisting of lava, andesite lava, Breccia volcano and floating stone tuf originating from Mount Kawi and Mount Butak.

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