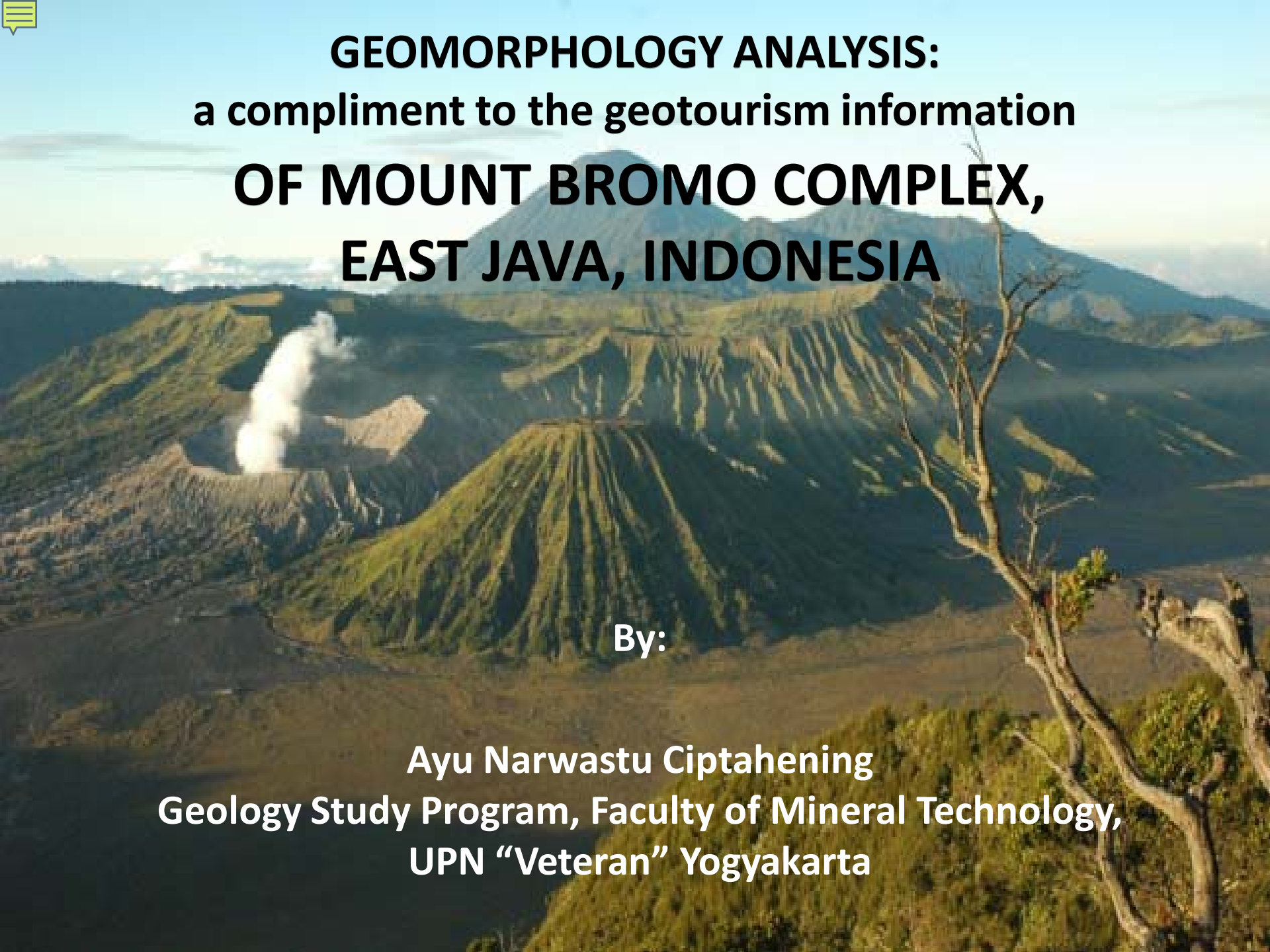
GEOMORPHOLOGY ANALYSIS:
a compliment to the geotourism information
OF MOUNT BROMO COMPLEX, EAST JAVA, INDONESIA



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OUTLINE

1. INTRODUCTION
2. SITUATION AND PHYSIOGRAPHIC REVIEW
3. GEOMORPHOLOGIC ANALYSIS
4. VOLCANIC EVOLUSION BASED ON GEOMORPHOLOGIC ANALYSIS
5. CONCLUSIONS

1. INTRODUCTION

- In spite of Indonesia rich of natural resources and culture, this country is also rich of volcanoes.

- This condition is caused by the tectonic setting of Indonesia that is in the meeting point of three big lithosphere plates, i.e. Indo-Australia plate in the south, Eurasia plate in the north, and Pacific plate in the east.

- The tectonic setting of Indonesia makes this country belongs to seismicity and volcanic active, on the other hand Indonesia is also located in the “ring of fire”

- **Among the 129 active volcanoes of Indonesia, here is a well-known volcano, namely Mount Bromo.**

- **This volcano is active and belongs to the most attractive tourism object in the East Java province, Indonesia.**

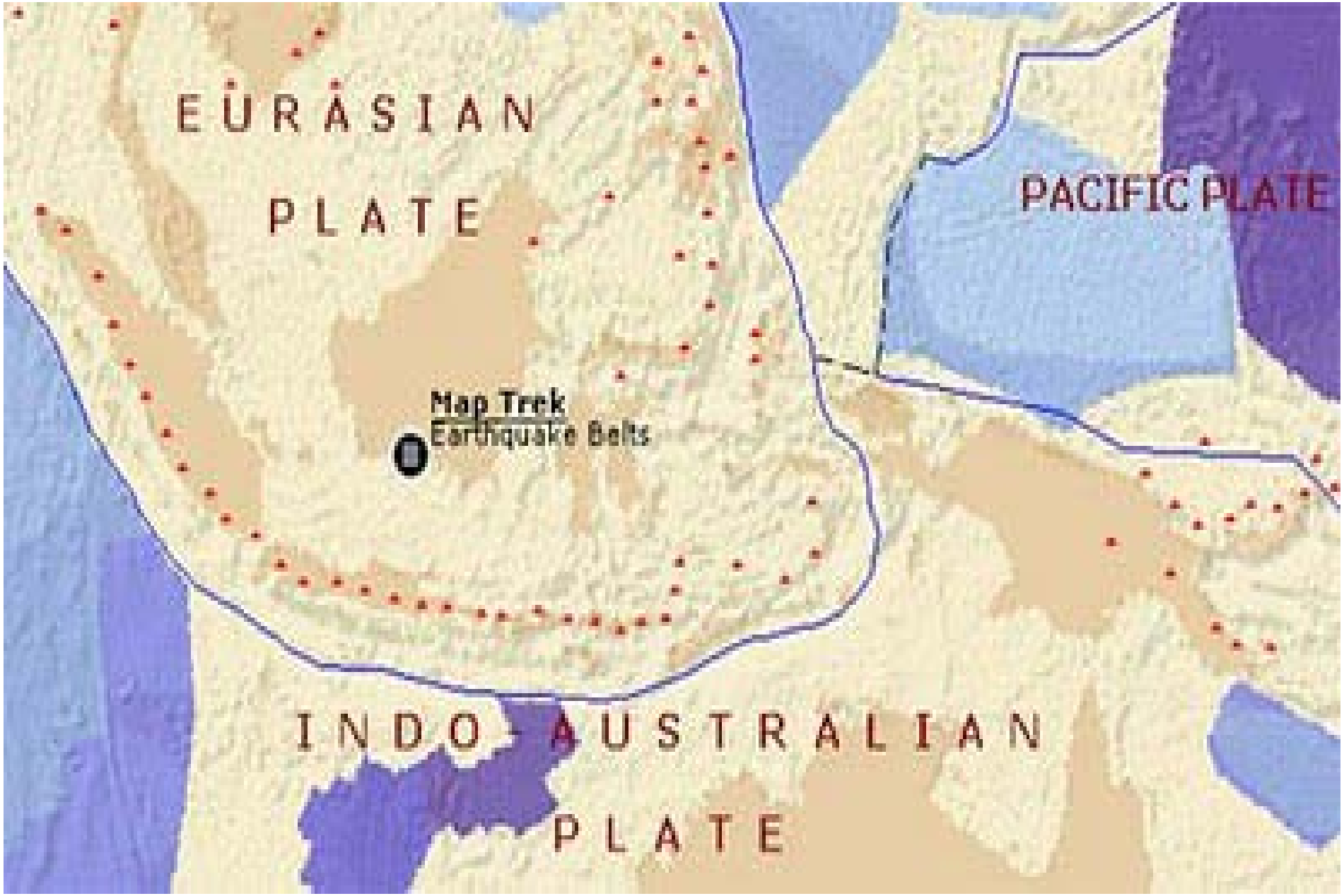

Fig.1. Map of tectonic and the situation of volcanoes of Indonesia

Fig. 2. The Bromo complex with Mount Semeru as the background. Mount Bromo is the only active volcano in this volcanic complex

2. SITUATION and PHYSIOGRAPHIC REVIEW

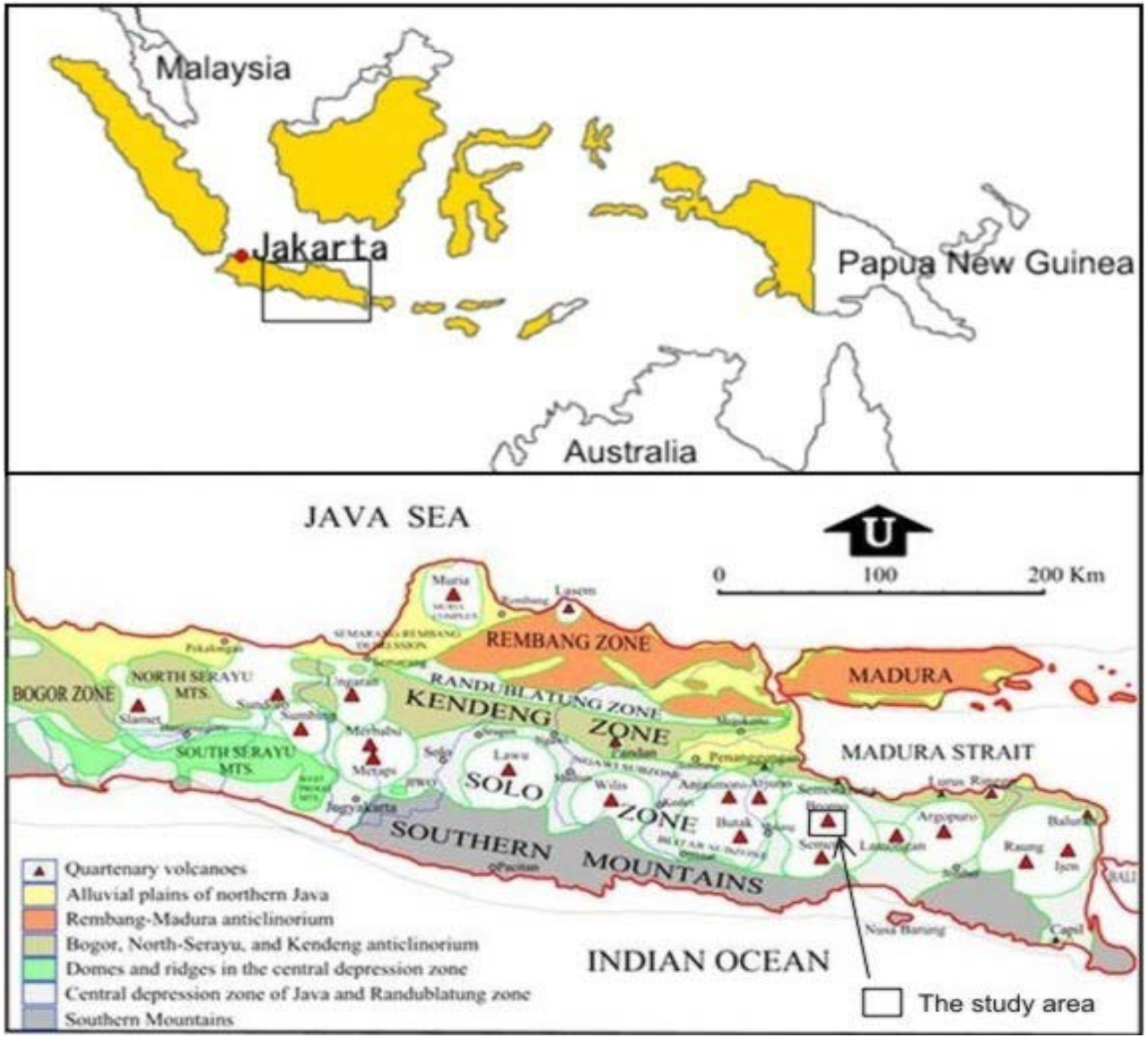

Fig. 3. The location of the study area and Physiographic map of East Java (Van Bemmelem, 1949)

3. GEOMORPHOLOGIC ANALYSIS

There is a large caldera with about 10 km x 8 km square. From the base of the caldera grow some volcanic bodies with several eruption centers, they are Mount (Kursi, Watangan, Widodaren, Bathok, and Mount Bromo).

Mount Watangan and Mount Widodaren are assumed to be previously one volcanic body with more than one crater, Mount Kursi and Mount Bathok are other independent small volcanoes, and Mount Bromo is another center of eruption.

Among all of the volcanoes mentioned above, Mount Bromo is the only center of eruption which is still active up to now.

By interpretation and analysis using topographic map and satellite image, geomorphology of the Bromo complex can be divided into six (6) geomorphologic units. The units are the main volcanic body, caldera, volcanic cone, parasitic cone, eccentric cone, and crater.

Fig. 4. Satellite image of the Bromo volcano complex

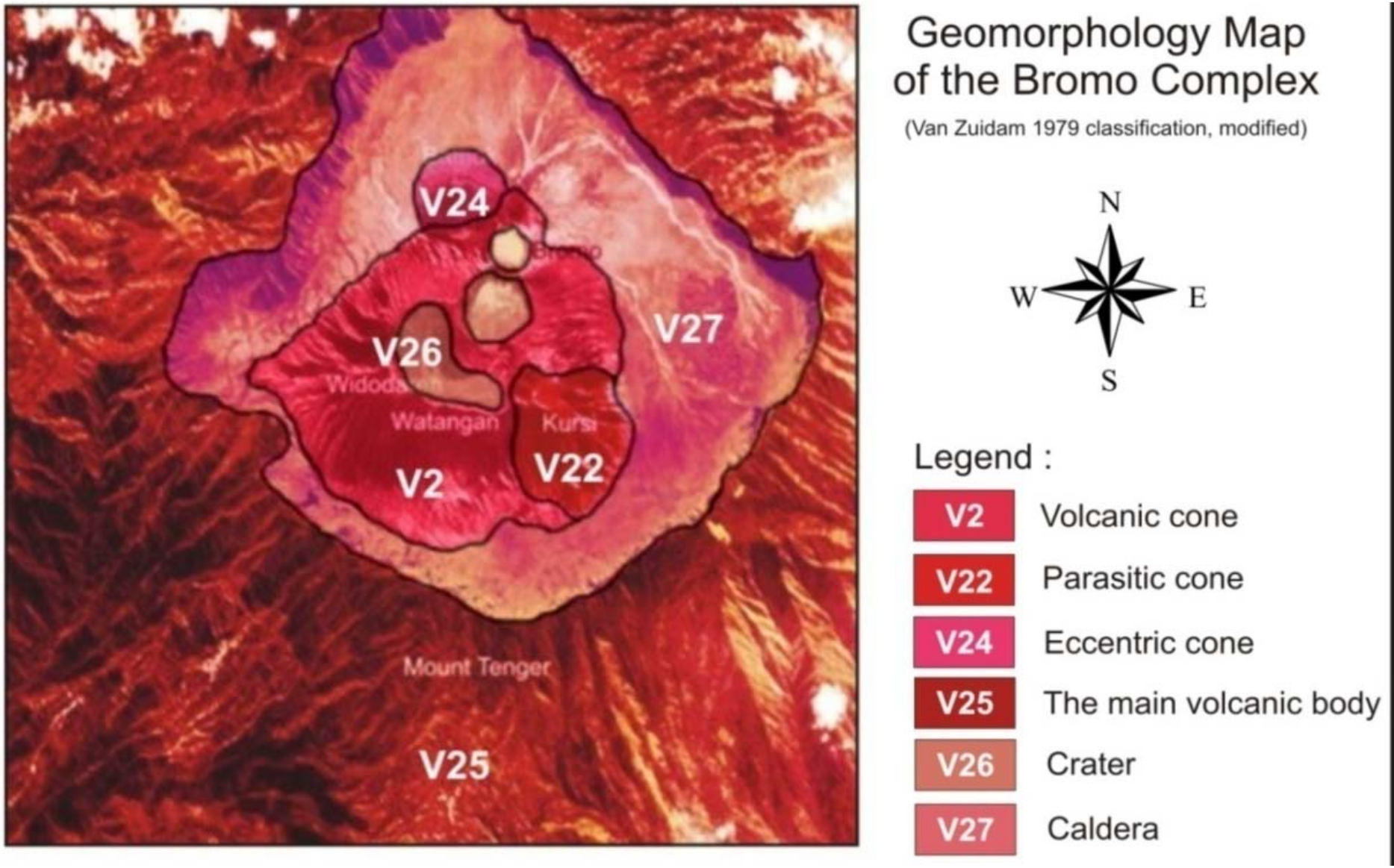

Fig. 5. Geomorphology map of Bromo Complex

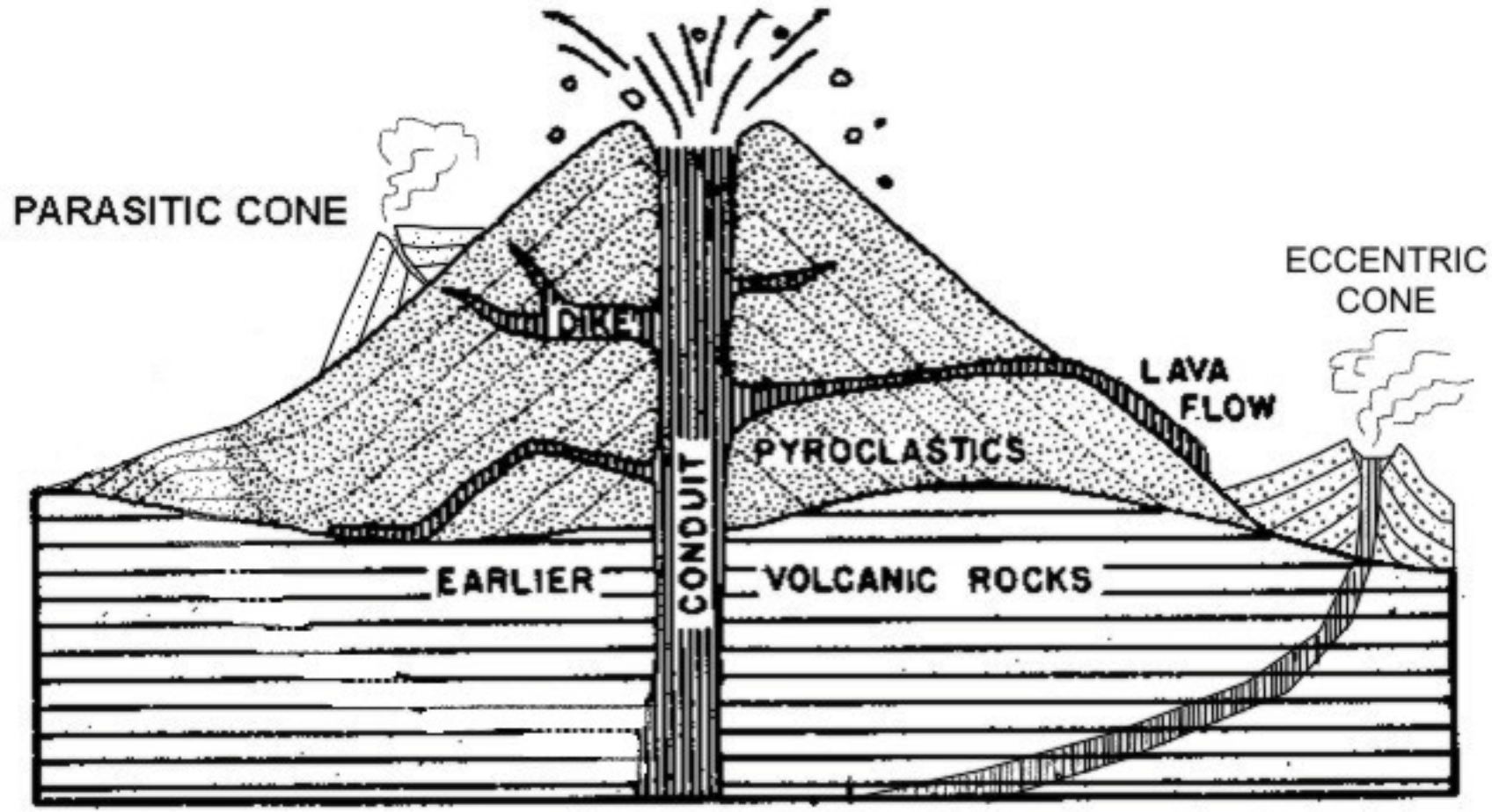

Fig. 6. Parasitic and eccentric cones of a volcano (MacDonald, 1979, modified)

4. Volcanic Evolusion Based on Geomorphologic Analysis

The evolution started from the existence of a big volcano namely Mount Tengger. The volcano is Pliocene to Pleistocene, or more than 2,000,000 years age (Van Bemmelen, 1949).

Mount Tengger was very active, developed its body with pyroclastic deposits of breccias, sand, and tuffs, laharic breccias, and lava flows. In the end of its activity, the volcano erupted paroxysmally, followed by collapse and subsidence of a part of its body, brought about the formation of the Tengger caldera.

The volcanic processes were recycled, after such a silent period. New volcanic activity occurred, began from the born of the son of Mount Tengger, called the ancient Bromo volcano.

The volcano involved Mount Watangan and Mount Widodaren. The ancient Bromo volcano activities were very dynamic, and the center of eruption had moved around for several times, as can be verified from the existence of some craters on Mount Watangan and Mount Widodaren.

Relatively in the same period with ancient Bromo activity, there was a parasite eruption forming Mount Kursi. The volcanic activity of mount Kursi also coincided with the occurrence of an eccentric eruption of Mount Bathok.

The life time of Mount Bathok as the eccentric eruption of ancient Bromo volcano was no longer. Finally the center of eruption has transferred to the crater of Mount Bromo, the only volcano that is still active up to now.

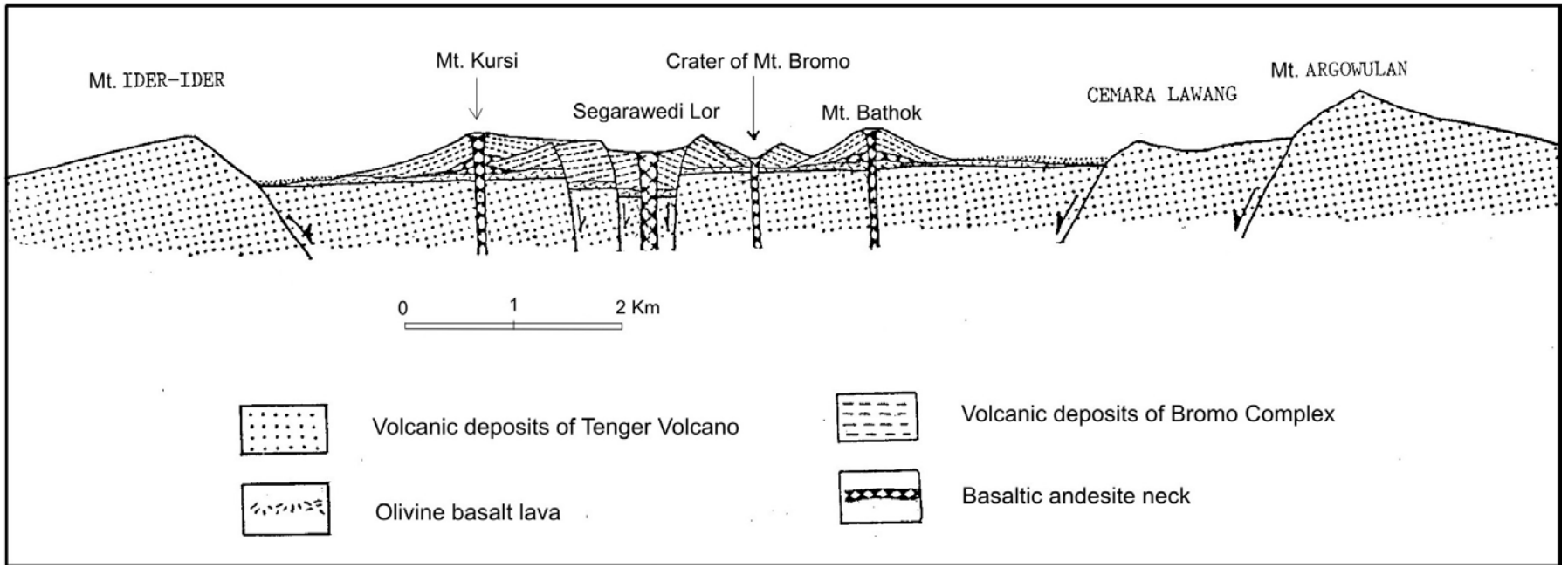

Fig.7: Volcanic development of the Bromo complex (Sari Bahagiarti K, et. al., 1990)

Fig. 8: Bromo eruption on November 2010, Strombolian type, and Mount Bathok

Pyroclastic materials

Mount Batok

The Wall of Caldera Tengger

The Crater of Mount Bromo

Mount Bromo

Mount Bromo Complex

CONCLISIONS

Based on geomorphologic analysis, the geomorphology of the Bromo Complex can be divided into six units, they are the main volcanic body, caldera, volcanic cone, parasitic cone, eccentric cone, and crater.

The evolution of the Bromo complex was started from the existence of a very big volcano called Mount Tengger. Tengger volcano had ever erupted paroxysmally, followed by the collapse and subsidence of the volcano forming the Tengger caldera.

The volcanism was silent for a moment, continued by volcanic activities of ancient Bromo volcano (Mount Watangan-Widodaren), parasitic eruption of Mount Kursi, eccentric eruption of Mount Bathok, and activities of the modern Mount Bromo respectively.

Mount Bromo is the youngest volcano in the Tengger caldera, and still active in the present time.

These conclusions can be used to accomplish information needed to support the geotourism of Mount Bromo complex and surrounding areas.

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