

Tectonic and compositional variation in Flores Island, Indonesia: implication for volcanic structure and geothermal occurrences

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Introduction

Flores Island is part of a volcanic arc in an active continental margin, straddling between Sunda Arc and Banda Arc. In contrast with the surrounding islands, Flores Island has a trenchward magmatism and high volcanism which indicate different controls exist.

The present location of Flores Island is now a transition zone from subduction to collision of Australian Continental Crust. We divide Flores Island into two region based on the structural trend and also volcanism.



Volcanism and Geothermal energy occurences

> Trenchward migration of volcanism occured in western half of Flores Island.

> The West Flores has wider volcanism area which was built by the quaternary volcanism on top of the south part of tertiary volcanism. While the East Flores is only composed by the quaternary - recent volcanism on top of the basement.

> East Flores volcanism dominated by High-K volcanism while in West Flores were dominated by calc-alkaline - low-K volcanism.

> The volcanic structure in the West Flores is more developed (e.g. crater and caldera)



Figure 1: Simplified tectonic setting of the Nusa Tenggara and Eastern Indonesia

Tectonic settings

Flores Island as part of Eastern Indonesia, is located at the triple junction between Eurasian, Australian and the Pacific plate, which has undergone several geodynamic changes within a convergent tectonic regime.

Flores island shows two distinct lineament trend which is the result from different tectonic regime in the past (Figure 2). In the present day, east part of Flores Island undergone in collisional regime with northward-moving Australian Continental Crust, in contrast with the west part which is in subduction regime. This condition also confirmed by the geochemistry data (Vroon, 1992) based on Helium isotope ratio sample on Banda Arc (Figure 3).

compare to the East Flores. Furthermore, West Flores also has more heatsource for geothermal energy based on its high volcano edifice spacing.

> Based on the structural and volcanism point of view, the potential geothermal energy is more favourable in West Flores.





Figure 2: Lineament trend on Tertiary and Quaternary volcanoclastic in different area of Flores Island



Figure 4: Cross section of West Flores (Upper) and East Flores (Lower), with their inset showing the volcano stratigraphy (modified from Tate, et al, 2015, Harris 2009).

Conclusions

- **1.** Three different tectonic regime controls the volcanism and structural trend
 - > N-S Extension (Flores Basin)
 - > E-W Extension (Banda Basin)
 - > NNE SSW Convergent (Australian Continental Crust)

2. Two region were distinguish based on its tectonic and volcanism

> West Flores: E-W structural trend, Tertiary - Quaternary
> East Flores: NNE - SSW structural trend, Quaternary volcanism

Figure 3: Value of Helium Isotope ratio on volcanic rock sample from Banda Arc with a transition boundary marked with a dashline (modified from Vroon, 1992)

3. Flores Island has a good potential of geothermal energy potential due its high volcanic activity. However, the difference between East and West Flores, related to its overall structure, makes West Flores more favourable.

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