

INTISARI

Pulau Sumatra terbentuk akibat dari interaksi atau tumbukan antara lempeng indo-australia dan lempeng eurasia yang menyebabkan terbentuknya suatu sistem sesar yang disebut sesar besar sumatra. Sesar ini mempengaruhi morfologi gunung api di pulau sumatra, seperti gunung api yang ada pada offset sesar akan cenderung berbentuk assimetris sedangkan gunung api yang terbentuk pada jalur sesar akan cenderung berbentuk lonjong searah dengan arah sesar. Penelitian ini menganalisis pengaruh tektonik terhadap morfologi gunung api di Provinsi Jambi dan sekitarnya dengan pendekatan geostatistik menggunakan data morfometri, struktur geologi, serta metode Principal Component Analysis (PCA) dan K-means clustering. Data morfometri diperoleh dari analisis Digital Elevation Model (DEM), sedangkan data struktur meliputi panjang sesar, orientasi, serta parameter slab depth dan slab dip. Gunung api di Provinsi Jambi dan sekitarnya tersebar mengikuti jalur Sumatra Volcanic Arc dengan variasi morfologi yang menunjukkan perbedaan spasial, di mana bagian selatan didominasi gunung api berukuran kecil hingga sedang dengan kawah terbatas atau tidak berkembang, sedangkan bagian utara didominasi gunung api berukuran menengah hingga besar bertipe stratovulkano dan kaldera. Orientasi morfologi gunung api, baik tubuh basal maupun kawah, secara konsisten menunjukkan arah dominan barat laut–tenggara (NW–SE) yang selaras dengan orientasi struktur tektonik regional, terutama Sistem Sesar Sumatra beserta segmen-segmen turunannya. Hasil analisis *machine learning* mengelompokkan gunung api ke dalam tiga klaster berdasarkan kemiripan karakteristik morfologinya. Gunung api yang berkembang dekat jalur sesar utama cenderung berukuran lebih kecil dan terdeformasi akibat banyaknya jalur keluarnya magma, sedangkan gunung api yang berkembang lebih jauh dari sesar utama cenderung berukuran lebih besar dan lebih simetris. Karakteristik morfologi gunung api tidak dipengaruhi faktor tektonik seperti kemiringan lempeng dan kedalaman lempeng (slab dip & slab depth).

Kata kunci : Morfometri, Gunung Api, Struktur Geologi, PCA, K-means

ABSTRACT

Sumatra Island was formed as a result of the interaction and convergence between the Indo-Australian Plate and the Eurasian Plate, which led to the development of a major fault system known as the Great Sumatran Fault. This fault system influences the morphology of volcanoes on Sumatra, where volcanoes located at fault offsets tend to exhibit asymmetric shapes, while those formed along fault traces are generally elongated parallel to the fault orientation. This study analyzes the influence of tectonic factors on volcanic morphology in Jambi Province and its surrounding areas using a geostatistical approach that integrates morphometric data, geological structures, and machine learning methods, namely Principal Component Analysis (PCA) and K-means clustering. Morphometric data were derived from Digital Elevation Model (DEM) analysis, while structural data include fault length, fault orientation, and slab parameters such as slab depth and slab dip. Volcanoes in Jambi Province and adjacent regions are distributed along the Sumatran Volcanic Arc and display spatial variations in morphology, with the southern part dominated by small- to medium-sized volcanoes with limited or poorly developed craters, and the northern part characterized by medium- to large-sized volcanoes, including stratovolcanoes and calderas. The orientation of volcanic morphology, both at the basal edifice and crater levels, consistently shows a dominant northwest–southeast (NW–SE) trend that is aligned with the orientation of regional tectonic structures, particularly the Great Sumatran Fault system and its subsidiary segments. The results of the machine learning analysis group the volcanoes into three clusters based on similarities in their morphometric characteristics. Volcanoes that developed close to major fault zones tend to be smaller and more deformed due to the presence of multiple magma ascent pathways, whereas volcanoes that formed farther away from major faults are generally larger and more symmetrical. The morphological characteristics of the volcanoes are not significantly influenced by tectonic parameters such as slab dip and slab depth.

Keywords : *Morphometry, Volcano, Geological Structure, PCA, K-means*