

Framework Geology of a Zeolite-Bearing Mineral System: Insights from the Volcano-Sedimentary Evolution of the Sukabumi Arc, Indonesia

Wa Ode Jasmine Syifa¹, Keyla Alina¹

¹University of Indonesia, Depok, Indonesia

This research investigates the geological characteristics and depositional history of the Gunungguruh area, Sukabumi, West Java, with a specific focus on the occurrence of zeolite within volcanic-sedimentary sequences. The interpretation was conducted from field mapping, petrographic analysis, and structural evaluations. The depositional history of the area spans from the Early Oligocene to the Holocene. A critical finding is the presence of zeolite minerals as secondary alteration products within the Early Miocene Tuffaceous Sandstone Unit, which is lithologically correlated to the Jampang Formation (Tmjt). These zeolites formed through the diagenetic alteration of volcanic glass within a matrix of tuffaceous sandstone. The depositional environment for these units is interpreted as a medial-distal volcanic setting or a deep-sea fan influenced by submarine volcanism. In this environment, volcanic ash and glass-rich pyroclastics settled together with siliciclastic material, creating a tuffaceous sandstone with high volcanic glass content. Zeolite formation did not occur during deposition but developed subsequently during burial diagenesis. After rapid accumulation, unstable volcanic glass underwent alteration under low-temperature conditions, driven by pore-water interactions. The presence of circulating fluids, likely alkaline and enriched in dissolved ions, facilitated the transformation of amorphous glass into zeolite minerals. Petrographic data showing zeolite dominating the matrix supports this replacement process. The study concludes that zeolite formation in the Sukabumi region is controlled by two key factors: the initial abundance of volcanic glass during Early Miocene deposition and the subsequent diagenetic environment that enabled its transformation, providing insights into the mineralogical evolution of West Java's volcanic arcs.