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Preservational attributes and mineralogy of Youngest Toba Tuff ash, Padang Terap, and Lenggong valley, Peninsular Malaysia

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Abstract: The Youngest Toba Tuff (YTT, ca. 75 ka) eruption, Sumatra, Indonesia had dispersed enormous fine-grained pyroclastic material over entire Southeast Asia including Peninsular Malaysia. These ash remains constituting 1-4 m thick vertical profiles, occasionally mixed with the host sediments, are well preserved in the Quaternary alluvial sediments of Padang Terap and Lenggong valley of Perak river, Malaysia. The same has been investigated to understand their preservational attributes and mineralogy to interpret the transportation history, depositional setup, and mineralogical composition. To achieve the same, detailed field investigation, grain size analysis, XRD and microscopic studies of a total of 23 ash samples belonging to both the river basins have been conducted. Widely distributed tephra in the Padang Terap river basin is light gray to light greenish-gray, fine-grained, semi-consolidated, and structured in nature that ranges from 1.5 m thick in thickness. Based on its bedding geometries, this ash is considered reworked. Whereas, the same in the Lenggong valley is retrieved as primary, secondary, and compact reworked ashes that are deposited in close association with each other. These ashes are attributed together with light gray, light greenish-gray to grayish orange-pink colors, powdery to semi-consolidated appearance, and massive to structure nature attaining 2-4 m thicknesses. The grain size data of ash, obtained by both sieve analysis and laser diffraction technique, revealing higher percentages of fine-grained fractions, indicate calm water conditions during their deposition and suspension as the prime mode of sediment transport. Microscopically, the ash comprises predominantly of vitric glass masses, minor occurrences of minerals, and unidentifiable fine admixture. Glass shards are represented dominantly by bubble walled morphology and pumice that are mostly fine-grained with sharp and angular edges. The XRD analyses of both bulk ash and clay fractions of the same show good representations of quartz followed by kaolinite, biotite, orthopyroxene, and magnetite in the former and, kaolinite, illite, chlorite, corrensite, montmorillonite, quartz, and calcite in the later. The dominant presence of quartz and clay minerals in the samples also indicates the reworking of the tephra. These studies together suggest that the tephra, after their settlement in both the river basins have traveled for a short distance in the serene fluvial environments.

Keywords: Youngest Toba Tuff, volcanic ash, grain size, glass shards, Quaternary