

Zircon Evidence Linking Mesozoic Magmatic Quiescence in Korea to Cretaceous Large Igneous Province in Eastern China: Provenance Insights from Ash-Fall Tuff at the Boundary of Hasandong–Jinju formations, Gyeongsang Basin, Korea

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Zircons formed during the Mesozoic magmatic quiescence (MQ) period in Korean Peninsula have been identified in the Gyeongsang Basin, Korea, leading to multiple interpretations. Some studies suggest that short-lived and low-intensity magmatism in the Yeongnam Massif left no observable traces or was completely eroded. Others propose that zircons were transported from the Sulu Belt in East China via a long drainage system. The other suggests that they were likely delivered from eastern China by large-scale volcanic eruptions and westerly winds.

In the Korean Peninsula, no intrusive or extrusive rock bodies have been reported from the MQ period. Instead, the presence of MQ-period zircons has only been identified through detrital zircons in sandstones. As a result, determining their exact source and transport mechanism remains challenging. In this study, we discovered an approximately 3–5 cm thick ash-fall tuff from the MQ period at the boundary of the Hasandong and Jinju formations in the Gyeongsang Basin. To accurately characterize this ash-fall tuff and determine its depositional age, provenance, and transport mechanism, we conducted fieldwork, thin section observations, XRD analysis, whole-rock geochemistry, zircon SHRIMP U-Pb dating, and oxygen isotope analysis. Thin section observations revealed the presence of volcanic glass shards. The eruption age of this tuff is approximately 117.4 Ma, and the $\delta^{18}\text{O}$ values of zircons within the tuff are around 5.2‰, which is similar to mantle value. The extremely thin nature of the tuff and its composition of very fine-grained particles suggest long-distance transport through the air. Additionally, the zircon oxygen isotope value is significantly lower than those reported from basement rocks (>7‰) of the Korean Peninsula but is comparable to values observed in Cretaceous rock bodies from eastern China. The Hf isotope values of MQ-period zircons reported from the Korean Peninsula show a trend that closely resembles those of the North China Craton (NCC) rather than the Central Asia Orogenic Belt. In summary, this tuff and the MQ-period zircons reported from the Korean Peninsula are interpreted as materials erupted from volcanic activity in the North China Craton (NCC) and transported to the Korean Peninsula by westerly winds.