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Study of sediment provenance and paleogeographic reconstruction through detrital zircon U-Pb dating of unconsolidated sedimentary layers: A case study of the Paleolithic Site at Jeongok, Yeoncheon, South Korea

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Zircon is an accessory mineral found in most igneous rocks, excluding ultramafic and mafic rocks, and is used for U-Pb dating to determine the formation ages of rocks. Zircon is particularly known for its physical and chemical stability, making it resistant to alteration during weathering and erosion, and it is preserved as detrital zircon in sedimentary rocks. This detrital zircon serves as an important indicator for tracing the origin and transport of sediment, and provenance analysis using detrital zircon is particularly useful in reconstructing paleogeography during sediment deposition. In this study, detrital zircon was used for paleogeographic reconstruction from a 55-meter core sample collected from the Jeongok, a well-known Paleolithic site in South Korea. The study area is significant for its Paleolithic artifacts found within the unconsolidated sedimentary layers overlying thick Quaternary basalt layers. U-Pb analysis of detrital zircon was conducted to investigate the sedimentary environment and to reconstruct the paleogeography of the site. The core sample used in this study contained unconsolidated sedimentary layers in the 0–6m and 20–29m intervals, with a thick Quaternary basalt layer between 6–20m. Additionally, the basement rock below 29m was identified as metamorphosed volcanic rock. Detrital zircon was collected from the unconsolidated layers just above (5.6–6.0m) and below (21–22m) the basalt layer, and the variations in the zircon age patterns within these layers were analyzed. The age distribution of the detrital zircons in the 5.6–6.0m and 21–22m intervals showed significant differences, particularly in the 5.6–6.0m interval, where many age groups observed in the underlying basalt layer (21–22m) were absent. This suggests a reduction or change in the sediment supply. These results imply that the sedimentary environment of the study area underwent significant changes due to basalt eruptions, and the sediment supply routes may have shifted. This study demonstrates that the U-Pb dating of detrital zircon in unconsolidated sedimentary layers can trace the provenance of sediments and contribute to reconstructing the paleogeography of the study area.