

Invertebrate trace fossil-bearing wairakite layer from the Cretaceous Haman Formation, Gyeongsang Basin, Korea: Occurrence, origin, and paleoenvironmental implications

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Abstract:

An abundant invertebrate burrow-bearing white bed was found in the Cretaceous Haman Formation of the Hayang Group, Gyeongsang Basin, Korea. The Haman Formation is composed of reddish mudstones and sandstones deposited in a sheetflood-dominated alluvial-plain environment under a seasonal, semi-arid climatic regime. The white bed is 2–3.5 cm thick developed in a reddish mudstone sequence, and burrows are well exposed on the bedding plane. Burrow-fills are composed of reddish sand and show a distinct color contrast with surrounding white matrix materials. The burrows were identified as *Taenidium barretti*, *Planolites beverleyensis*, and *Planolites montanus*. Various analyses including microscopic observation, XRD, X-ray CT, and FE-EPMA were carried out to characterize burrow architecture, mineralogy and origin of the white bed, and its paleoenvironmental and tectonic implications. Based on the XRD analysis, the mineralogy of the white materials consists mostly of wairakite, a zeolite mineral with an analcime structure but containing a calcium ion, and quartz. Although zeolites are commonly found as a secondary mineral in volcanogenic sediments, wairakite is rarely reported due to its high formation temperatures (about 200–400 °C). We investigated the maximum paleotemperatures that the Haman Formation experienced and the Ca source needed for the wairakite formation. The results of this study provide important information on burial diagenesis and/or hydrothermal alteration associated with volcanic activity during the Cretaceous Hayang period in Korea which was located in the active continental margin setting.

Keywords: trace fossil, Haman Formation, wairakite, Cretaceous