

Resolving the Provenance of Marine Sediment in the Ulleung Basin to Reconstruct the East Asian Monsoon

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Identifying the provenance of eolian, volcanic, and/or fluvial material in marine sediment requires the parsing of distinct, yet compositionally similar, aluminosilicate sources. Recent advances in applying multivariate statistics to comprehensive geochemical datasets has demonstrated the ability to resolve even those sources that are very similar compositionally. This approach ensures that the provenance determination reflects the breadth of the sedimentary geochemical composition.

We present eolian sediment provenance from IODP Site U1430 in the Ulleung Basin in which we “un-mix” multiple aluminosilicates over the last 10 Myr in the marine record. We apply multivariate statistical techniques (Q-mode Factor Analysis (QFA), Multiple Linear Regressions) to bulk sediment elemental concentrations of a suite of elements associated with the terrigenous component(s).

Using multivariate statistical analysis, it is possible to significantly differentiate between aluminosilicates. QFA indicates that five factors are required to explain 99% of the variability in the dataset. Constrained Least Squares multiple linear regression indicates that the sediment is comprised of several dust materials (Chinese Loess, Chinese and Mongolian Gobi Desert, Taklimakan Desert) in addition to material from the Korean Peninsula. The identification of different dusts from the Asian interior, rather than a generic “loess”, is a significant step forward both for paleoclimate studies and geochemical determinations.