Asian Monsoon moisture transport 1999-2005 and its implications for palaeomonsoon reconstructions

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The Asian summer monsoons affect the livelihood of the world's most populous regions. Predictions of future monsoonal variability require reliable palaeoclimate reconstructions from proxy data. Speleothem $\delta^{18}O$ records from Chinese cave sites are assumed to provide direct palaeomonsoon intensity records, but recent research suggests $\delta^{18}O$ integrates a more complex climate signal. We detected the sources modern monsoonal precipitation across China using a Lagrangian precipitation source diagnostic and reanalysis data. Our results show that monsoonal precipitation (May-August) in this region is primarily derived from the northern and western Indian Ocean; identification of this signal is consistent with recent GCM results. We also find that recycled moisture over continental Indo-China is an important contributor to west-to-east moisture transport during the monsoon season. These data highlight the importance of proxy site location and improve our ability to isolate the precipitation amount or monsoon intensity signal in palaeomonsoon reconstructions.

Trace element and ^{26}Al–^{26}Mg constraints on silicate differentiation of the HED parent body

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The howardite–eucrite–diogenite meteorites are considered to originate from the asteroid Vesta. Diogenite meteorites appear to be mafic cumulates with a pyroxene-dominated mineralogy, whereas eucrites are basaltic in mineralogy and composition. However, the relationship(s) between these products of silicate differentiation of their parent asteroid(s) remain enigmatic, if indeed they originated from the same parent body as is suggested by their common three-oxygen isotope compositions.

We have conducted a detailed *in situ* major and trace element study of minerals (pyroxene and plagioclase) in a large number of diogenites and non-cumulate eucrites (n = 44) by LA-ICPMS. We have also analysed to ultra-high precision ($\delta^{26}Mg^* \pm 0.002‰$) the Mg isotopic composition of the same bulk meteorites by MC-ICPMS. Significant variations in $\delta^{26}Mg^*$ related to ^{26}Al decay in the first 5 Myr of the Solar System are evident amongst the suite of diogenites ($\delta^{26}Mg^*$ = –0.011‰ to +0.013‰) and eucrites ($\delta^{26}Mg^*$ = +0.004‰ to +0.0040‰). Despite their limited range in mineral major element compositions, mineral trace element concentrations vary widely. For example, moderately incompatible heavy rare earth element concentrations in pyroxene vary by more than two orders of magnitude (e.g., Yb = 0.02 to 3.1 ppm).

Trace elements such as Yb in pyroxene and Sr in plagioclase co-vary with bulk rock $\delta^{26}Mg^*$ values, which potentially implies rapid magmatic differentiation of a magma ocean. However, the large range of trace element abundances is difficult to reconcile with any simple cogenetic model for partial melting or crystallization of diogenites (cumulates) and eucrites (residual liquids) from a common parent body or magma ocean. Stable Mg isotopic compositions ($\delta^{25}Mg$) of eucrites appear to be distinct from those of both diogenites and terrestrial basalts, which might imply that diogenites and eucrites originated from separate parent bodies or that eucrites are the product of a formation process (i.e., residual liquids of extensive fractionation of an ultramafic magma body) that is fundamentally different to the partial melting processes that produces basaltic magmas on Earth.

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