

# **History of Asian dust in the Japan Sea since the Miocene and its coupling evolution with tectonic and climatic changes**

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Define the history and timing of major climatic changes in Asia, especially the evolution of Asian aridity and eolian dust, is an important way of understanding the climate–tectonic interactions and late Cenozoic cooling. As a semi-enclosed marginal sea in the Asian margin, the Japan Sea/East Sea is located between the Asian dust source region and the North Pacific and thus has the potential to provide an excellent record of the history of Asian eolian dust input. Continuous and high-resolution clay minerals and Sr-Nd isotopic records from the Japan Sea indicate the proxy records of past changes in Asian eolian input to the basin since 15 Ma that highlights the four-step drying of Central Asia, which in turn was controlled by the stepwise uplift of Tibetan Plateau and global cooling. The carbon isotopes of black carbon extracted from Japan Sea sediment reveals a significant shift at Miocene-Pliocene boundary, suggesting C<sub>4</sub> plant expansion in broad Central Asian regions. Both tectonic uplift and global cooling driven increased seasonality and aridity were proposed as the primary influencing factors drove the C<sub>4</sub> plant expansion. Eolian dust input the deep-sea potentially exerts influence on oceanic biogeochemical cycles through iron fertilization. Palaeoproductivity proxies indicate remarkable increases in productivity at the late Pliocene. We suggest that higher dust-derived iron supply was likely driven by the growth of the Northern Hemisphere ice sheets and could account for enhanced primary productivity and export production in the Japan Sea.