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Clay mineral contribution from various provenances in the northern South China Sea over the past 400 kyr: implications for the East Asian monsoon evolution

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Clay mineralogy of Core MD12-3432 taken at 2125 m water depth (CIRCEA cruise on board the R.V. Marion Dufresne, IPEV) in the northern South China Sea was investigated in order to understand the time series contribution of terrigenous sediments from various provenances. With calibration of a low-resolution analysis on carbonate concentration and major elements, we converted the XRF core scanned calcium data into a high-resolution carbonate content records. Through referring to the well-dated carbonate record of nearby Core MD05-2904, we established a reliable age model, indicating about 400 kyr ago at the bottom of Core MD12-3432. The clay mineral assemblage is dominated by smectite (23-59%) and illite (22-43%), with minor chlorite (13-27%) and kaolinite (4-13%). The time series variation of clay mineral assemblages indicates strong glacial-interglacial cyclicity. In general, the variation in smectite content is similar to that of carbonate concentration, with higher values during interglacials than during glacials, while illite and chlorite contents showing opposite patterns. The change in kaolinite content shows an independent pattern with high values during glacials, corresponding well with the illite crystallinity variation. The provenance analysis of these clay minerals suggests three end-member sources: all smectites derive from Luzon, all kaolinites originate from the Pearl River, and illite and chlorite are coming from both the Pearl River and Taiwan. Using the linear separation method of illite crystallinity, a time series of the clay mineral contribution from the three major provenances to the northern South China Sea was reconstructed. Combined with spectral analyses, we suggest the clay mineral contribution from Pearl River was mainly influenced by sea level change, while the East Asian summer monsoon controlled the contribution from Luzon. The strong precipitation rate related to intensive East Asian summer monsoon would have enhanced the denudation and intensified the delivery of terrigenous materials from Luzon to the South China Sea. Though Taiwan is also suffering from the monsoon rainfall, the major sediment discharge is caused by strong activities like typhoon rather than average precipitation. Thus, the glacial-interglacial variation in the clay mineral contribution from Luzon indicates the East Asian monsoon evolution.
This work is presently conducted in the framework of the Franco-Chinese LIA-MONOCL.