# Provenance and glacial-interglacial cyclicity of clay minerals since the mid-Pleistocene in the southwestern South China Sea

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Deep-sea sediments retrieved from Hole U1433A, IODP Expedition 349, in the Southwest Subbasin of the South China Sea were analyzed for clay mineralogy combined with Sr and Nd isotopes to determine their provenance and glacial-cyclic variations as relating to oceanographic dynamic process and environment change. Chronology of Hole U1433A sequence is constructed based on the astronomically tuned reflectance a*. The clay mineral assemblage ranges from 25-60% for smectite, 20-40% for illite, 10-25% for chlorite, and 2-16% for kaolinite. Illite and chlorite contents mostly co-vary, while smectite content often shows an opposing trend. Illite crystallinity averages to 0.17°Δ2θ, while 87Sr/86Sr and εNd values fall between 0.722-0.728 and -12.3 to -11.2, respectively. Our clay mineralogical and isotopic data reveal a strong mixing in sediment provenances. Multivariate analytic technique was adapted to statistically model the relative composition of clay-mineral end members in each sample, and three dominant fractions that represent different sources can be recognized: (1) strong mixed sources with differential settling of clay minerals marked by enriched smectite content, (2) Taiwan drainage system, and (3) the Red River. Temporal variations of clay minerals well characterize the glacial-interglacial cyclicity, with decreasing kaolinite coeval by increasing illite and chlorite during interglacial periods. The significant lower kaolinite/(illite+chlorite) ratio in interglacial periods can be attributed to lesser kaolinite reaching the deep basin when shelf areas were submerged to become the center of kaolinite deposition. As smectite exhibits strong effects from differential settling in deep sea environments, it appears to explain why its variations present little glacial-cyclic patterns. Therefore, the deposition process of deep marine sediments, like their shallow water counterparts, is strongly regulated by the glacioeustatic changes, which govern the availability and the amount of fluvial sediment input. Sea level lowstand during glacial periods provides a direct pathway for in-shelf estuaries to deliver fluvial sediments into the deep basin.