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Silicate weathering signals in clay-size fraction lithium-isotope records overprinted by by provenance change and sediment transportation in response to abrupt seawater intrusion

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The Lithium (Li) isotope of river-borne sediments is a promising proxy for tracing chemical-weathering intensity and regime. However, its application is complicated by sediment provenance, as well as potential physical and chemical interactions with seawater during material transportation in coastal areas before deposition. The Changjiang, originating from the Tibet Plateau, debouches huge amounts of sediments and materials into the East China Sea, and even supplies the most sediment deposited in the nearby Qiantang River system. The postglacial Qiantang River incised-valley fill (~ 18 cal. ka BP to present) records a relatively complete land to sea depositional continuum that witnesses environmental changes driven by sea-level, climate and Changjiang sediment distribution. Therefore, the Qiantang River incised-valley fill is a natural laboratory to evaluate the preservation of continental-weathering signals reflected by river-borne-sediment Li isotopes. We extracted clay-size (<2 mm) fraction of core samples, as well as surface sediments from the modern Changjiang, Qiantang River, and ECS shelf for chemical and mineralogical analysis to eliminate the influence of sediment sorting. Results indicate that δ7Li values are sensitive to climatic variation in the lower fluvial and palaeoestuary intervals that accumulated in the landward and more freshwater part of the Qiantang River system with sediments derived primarily from the Qiantang River. Notably, Li isotopes show an abrupt increase of ~ 2.09‰ that is coincident with the marine transgression at ~ 9.0–8.5 ka BP, and maintain elevated values in the upper shallow-marine and modern-estuary intervals that accumulated in a more seaward and saline environment. We argue that this abrupt increase in Li isotopes is mainly caused by a provenance change, due to the arrival of Changjiang clay-size fraction that overwhelmed the Qiantang River contribution. Moreover, Li isotopes of the Changjiang clay-size fraction are overprinted by intensive sediment-seawater interaction during transportation from the river mouth, through the ECS shelf, and finally into the Qiantang River system, preventing the accurate documentation of chemical-weathering regimes. This study sheds new light on tracing palaeo-weathering regimes at a centennial-millennial scale using river-borne sediments in a delta-shelf-estuary system.