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Evidence of Historical Mining Impacts on Saltmarshes from east Cornwall, UK

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In landscapes with extensive mining history, saltmarshes can become sinks for contaminants that are vulnerable to release with sea-level rise and increased storminess. Given the prolonged residence time of heavy metals in the environment, data is urgently required to contextualise the impacts of past and present mining and pollution events and provide a baseline against which to assess Water Framework Directive (WFD) (2000/60/EC) compliance within an integrated catchment management framework.

The geology of east Cornwall, UK (with intrusions of granite into the surrounding sedimentary rocks) was favourable for a prosperous mining industry, although large scale operations did not start until about 1830. Tin, cooper, lead and tungsten were the most important ores in the region. In order to quantify the spatial and temporal extent of contamination from past mining, sediment cores were collected from three saltmarshes, namely: Antony Marsh and Treluggan Marsh on the Lower Basin of River Lynher, and Port Eliot Marsh on the Lower Basin of River Tiddy.

Core sections at 1 cm intervals were analysed by gamma-ray spectrometry for Pb-210, Ra-226, Cs-137 and Am-241, and the well-established Constant Rate of Supply (CRS) model was employed to derive Pb-210 geochronology with bomb-derived Cs-137 and Am-241 as independent chronological markers. The geochronological data provided the sedimentary accumulation and temporal context for the study.

In terms of sediment quality with respect to mining pollution, core sections were analysed using Q-ICP-MS techniques and, additionally, WD-XRF instrumentation at Plymouth University. Measurements were performed for target elements that are normally associated with mining and smelting activities (e.g. Pb, Cu, Sn, Zn, Cr, Cd, etc.), and lithogenic elements (e.g. Fe, Al, Ti) that allow enrichment factors for the anthropogenically-derived elements to be determined. The grain size distribution was determined to identify storminess events and to detect discontinuities in the sediment record. Downcore trends in metal pollutants are discussed in the context of the chronological data, sediment composition and historic meteorological and river flow records.

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