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Assessing recent anthropogenic disturbances and environmental recovery in the Nalón estuary (Asturias, N Spain)

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The estuaries of the northern Atlantic Iberian margin are susceptible to alteration due to human activities and transformation from relative sea-level rise.

The Asturian region, northern Atlantic Iberian margin, is characterized by extensive coal and polymetallic mineral deposits, including mercury ores, which have been intensively exploited since the late 19th century. In particular, the Nalón estuary has been subjected to intense physico-chemical modifications as a result of mining of such deposits in the catchment area and port activities.

This research aims to decipher the environmental transformation of the Nalón estuary and the natural and/or anthropogenic forcing mechanisms during the last 200 years. We employed a multiproxy approach (*i.e.*, benthic foraminifera, trace metals, grain size, magnetic susceptibility, microparticles and natural and artificial radionuclides) to study three 50-cm long sediment cores extracted from the middle and lower estuary. The records show degraded ecological conditions that persisted since ~1880. These were driven by the alteration of hydrological patterns, as a result of coal and mercury mining activities in the river basin and physical modifications (*e.g.*, factory dams, dredging activities) performed in the lower estuary. Additionally, the study of eighteen surface samples, collected from different estuarine subenvironments along the main axis of the estuary, reveals the existence of a great number of living foraminifera associated with a remarkable environmental recovery since ~2010, coinciding with the end of mining and dredging activities.

Future multidisciplinary studies of these regional estuarine areas will be critical to establishing appropriate coastal management practices under a climate change and sea-level rise context.