

Benthic foraminifera (Protista) as indicators of metal pollution in areas of historic mining: examples from southwest England

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Southwest England has been, from Roman times, an important mining area supplying a range of important metals, including copper, tin, tungsten, arsenic, zinc, silver, etc. This mining activity virtually disappeared in the twentieth century, although one tungsten mine near Plymouth has recently re-opened. Large areas of Cornwall and West Devon are now inscribed as the 'Cornish Mining World Heritage Site' on the cultural list of UNESCO. Many of the old mines with their spoil heaps and tailings dams are now protected and, together with the mineral-rich local geology, provide many catchments with on-going metal pollution. In January 1992, after a period of prolonged, heavy rainfall Wheal Jane mine flooded and discharged heavily polluted, acidic, water into Restronguet Creek and the Fal Estuary. This event provided the setting for a detailed investigation of the immediate impact of the pollution and the resulting environmental improvements caused by engineering interventions and natural re-adjustment.

Benthic foraminifera disappeared from Restronguet Creek for a number of years and while there is now an abundant, though low diversity, estuarine assemblage of foraminifera living in the creek there are still high levels (<15% in 2004) of test deformity recorded (Olugbode et al., 2005). In other parts of the Fal Estuary (a Special Area of Conservation under the EU Habitats Directive, 2000), deformed foraminifera are very rare and the measured levels of pollution can be used to compare with the test deformity data. In other estuarine systems in southwest England, such as the River Fowey and the River Tamar, levels of deformity are less, though still significant for areas no longer being actively mined. This demonstrates that polluted sediments in all these estuaries, which can be disturbed during floods or times of stormy weather, and the background levels of metal elements in the catchments that supply these estuaries, are sufficient to maintain these levels of deformity in the long term.

OLUGBODE, O.I., HART, M.B. & STUBBLES, S.J. 2005. Foraminifera from Restronguet Creek: monitoring recovery from the Wheal Jane pollution incident. *Geoscience in south-west England*, 11, 82–92.