



Sediment geochemistry of streams draining abandoned lead/zinc mines in central Wales – the Afon Twymyn

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Catchment disturbances occur at a range of spatial and temporal scales. Polluted discharge from abandoned metal mines and spoil heaps can persist for centuries after the closure of a mine and leave a legacy of heavy metal contamination in sediment systems. Following the decline of metal mining in Wales during the 20th century, there are over 1 300 abandoned metal mines, many of which discharge metal rich waters to river systems. In some cases these discharges have been occurring for over a century resulting in severe impacts on sediment quality. Poor sediment quality is likely to impede the achievement of 'good' chemical and ecological status for surface waters under the European Union Water Framework Directive. This paper examines the legacy of the Dylife lead/zinc mine (central Wales) on the Afon Twymyn and associated sedimentary, water quality and ecological characteristics; and highlights the importance of incorporating sediment quality in the overall assessment of river ecosystem status.

Sediment heavy metal concentrations are elevated throughout the Afon Twymyn with metal concentrations upstream of Dylife mine exceeding values downstream by up to 260 times. Lead concentrations are up to 100 times greater than levels predicted to have deleterious effects on aquatic ecology (draft Environment Agency of England and Wales predicted effect level guidelines). At the mine site, 54% of lead, 53% of zinc, 52% of cadmium and 19% of copper exist in the easily exchangeable and carbonate-bound geochemical phases. These metal species are unstable and can be absorbed by aquatic organisms or released into solution given changes in pH, ionic strength, redox conditions and/or the concentration of complexing agents. Downstream of the mine, sediment metal concentrations decrease sharply however, there is an increase in the proportion found in more mobile geochemical phases. Metal levels remain elevated above background concentrations for at least 20 km from the point of contamination.