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Monitoring of Environmental Heavy Metal Loads Using the Shell of Dreissina polymorpha: A Laser-Ablation Inductively-Coupled-Plasma Mass-Spectrometry Study

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Elevated concentrations of heavy metals pose a threat to the health of many organisms, including humans. Historical records are of value to identify the origin of excessive environmental loadings. Provided that metals are incorporated in proportion to their environmental concentrations, bivalve mollusc shells (found in a wide range of aquatic settings) offer a source of such records, both short term (as registered in successive growth increments) and long term (as registered in stratigraphic sequences of shells). Laser-ablation inductively-coupled-plasma mass-spectrometry provides for microsampling and analysis at sufficient spatial resolution and accuracy to resolve within-shell variation in metal content. Application of the technique to fresh-water (Schettler & Pearce, 1996) and marine (Fuge et al., 1993; Price & Pearce, 1997) species has shown a correlation between shell and environmental concentrations; however, the closeness and extent of the correlation has not been fully investigated.

The influence of genetics, microenvironment and the general level of contamination was studied in *Dreissina polymorpha* collected in late autumn 1999 from Mapperley Reservoir (near Ilkeston, U.K.), a small lake fed during wet periods by water from adjacent, disused, open-cast coal workings. Concentrations of Cu, Pb and Zn in sediment vary by a factor of two between sites in the lake and are fairly closely correlated with concentrations in water. Sediment concentrations of Pb and Zn are paralleled by soft-tissue concentrations in *D. polymorpha* but only for Zn is there a correlation between sediment and shell concentration. Schettler & Pearce (1996) recorded a relationship between sediment and shell concentration for all three elements in a study of *D. polymorpha* from Lake Breitling, Germany. In that environmental loadings there are about twice those at Mapperley and the concentration of Zn in sediment at Mapperley is typically about twice that of Pb and at least three times that of Cu, it would seem that there is a lower limit of environmental concentration below which heavy metal contents are not reflected in shell. This lower limit, which implies an ability to exclude heavy metals at relatively low concentrations, means that *D. polymorpha* will not necessarily give a full picture of environmental fluctuations.

Concentrations of strontium and magnesium, determined concurrently with heavy metals, are typically much higher in the earliest-formed shell of *D. polymorpha*. This probably reflects high temperatures (summer) at the time of settlement and a lifespan of no more than six months by the time of collection.

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