Increasing Zinc Pollution of the Earth Surface Environment? An Example from an Irish Peat Bog

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Most global, atmospherically-fed surficial archives show an upwards increase in Zn concentration reflecting industry's growing demand for Zn during the last centuries.

In this study we present trace element, stable Zn isotope, and radiogenic Pb isotope data from a peat core recording 300 years of history in the Wicklow Mountains, eastern Ireland. Trace element and Pb isotope data demonstrate the immobility of (post-) transition metals, such as Zn, within the peat bog. Combined trace metal and Zn isotope data indentify two key sources of Zn pollution operating at different times. The 18th to 20th century local mining signature is revealed by synchronous Zn and Pb enrichments. These two contaminants become progressively detached towards the top of the core, representing the last 100 years. Whereas Pb pollution becomes progressively insignificant, Zn shows well-defined enrichment episodes, concurrent with peaks in Mo, Ni, and Cd enrichment.

The isotopic composition of Zn shows an evolution from heavy (0.55‰±0.02) to lighter (0.18‰±0.02) $\delta^{66}Zn_{JMCLyon}$ values towards the top, in agreement with findings of other studies of peat cores. Zinc fractionation by living *sphagnum moss*is is minor in the context of the measured isotopic range. Mixing models show a systematic coherence between trace elements and Zn isotope data, pointing to two major polluting sources: a geographically restricted (local mining) and a more diffuse (northern Hemisphere?) source with possible contributions from fossil fuel burning, automobile tire abrasion, metalliferous and chemical industries. There is also the added possibility that local application of forestry fertilisers contributes to the Zn contamination.

Based on these lines of evidence, we interpret the upward increase in Zn contamination in the peat core as a real pollution signal and not as a product of post-depositional redistribution within the peat bog itself. By analogy, the severe Zn contamination observed in top sections of many other surficial archives could point to an important environmental concern, which requires wider assesment. In our case, pollution signals were best identified through the combination of Zn isotopes with other geochemical tools.