

## **Geochemistry as a tool for mineral exploration at Ballinalack, Ireland**

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Geochemical anomalies in soil and sediment samples are often used as a tool in mineral exploration. Zinc soil anomalies have been applied with great success in the Irish Midlands contributing to the discovery of the Lisheen, Galmoy and Navan (Tara Mines) deposits. More recent advancements in the field of trace-element analysis and of stable metal isotopes could provide new insights into fingerprinting mineralization in surficial sediments.

Both major and trace elements can be easily mobilized during fluid-rock interaction; in addition, isotopic composition can be influenced by chemical reactions and transport. These element and isotopic signatures are often passed on to the overlying sediments (tills) and soils and their magnitude depends on Eh and pH conditions, as well as the mineralogy of the host medium. The detailed process of mobilization and any associated isotopic fractionation are currently not fully understood. Research will provide insight into the geochemical processes generating metal anomalies and may help fingerprint cryptic alteration haloes, which would have a significant impact on mineral exploration programs.

In this study, we present the geochemical distribution of major and trace elements associated with mineralization of the Ballinalack carbonate-hosted Pb-Zn deposit, in the Irish Midlands. In addition to base metals (Pb, Zn, and Cu), trace elements exhibit enrichment in the overlying Quaternary sediments as well as in soils at surface. These results confirm that the observed trace-element pattern is an indicator for element mobility (reduced chimney) above the Ballinalack Pb-Zn deposit.

In the future, further investigation will examine processes of mobilization and isotope fractionation in surficial sediments and could help to refine exploration models for the discovery of blind mineralization in the Irish Midlands. Analyses of stable metal isotopes, e.g.  $\delta^{66}\text{Zn}$ ,  $\delta^{56}\text{Fe}$  and  $\delta^{65}\text{Cu}$ , could provide the proximal-distal relationship of a soil surface sample to the orebody itself.