Regional chemostratigraphic correlation of the Irish Zn-Pb orefield

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Most of the ore deposits in the Irish Pb-Zn Orefield are restricted to two stratigraphic units: the deeper water Waulsortian Limestone Formation in southern and central Ireland and the shallow marine Navan Group of north central Ireland. Both formations were deposited during a northward directed marine transgression in the Tournaisian [1]. Circulating hydrothermal solutions subsequently transported and precipitated tens of millions of tons of zinc and lead metal in the form of sulphides in these carbonates. Thus, the ores hosted in the Carboniferous carbonates in the Irish Midlands constitute the highest concentration of Zn per square kilometre on the planet [2]. Research on the origin and geological context of these Irish-type deposits requires accurate stratigraphical correlations within the host rocks. Volcanic ash layers within the Tournaisian and early Viséan provide possibilities of high resolution correlation to supplement the relatively coarse resolution established using biostratigraphy for these rocks.

This study introduces a multi-proxy approach to correlate these volcanic ash horizons using high-precision trace element bulk-rock geochemistry, U-Pb zircon geochemistry, as well as apatite characterisation (trace element and U-Pb analyses) to provide a chemostratigraphic framework.

Three different tuff horizons from the Slieve Dart area have been confidently distinguished and correlated using all of the above mentioned methods. 11 out of 16 tuffs from the host rocks of the Lisheen deposit revealed the same geochemical signature using REE diagrams, biplots and a best match comparison method, modified after Marx et al., 2005 [3]. There is also a specific, more variable trace element pattern for the Navan tuffs, which could not be cross-correlated with other tuffs. U-Pb zircon ages from six different Lisheen samples, taken from six drillcores, yield ages between 344 ± 2 Ma and 349 ± 3 Ma, whereas no zircons were found within the Navan tuffs. Besides the possibility of differences in primary magma chemistry, the tuffs could also reflect the different hydrothermal regimes of the Irish Orefield.

[1] Philcox, 1984, IAEG, Dublin, 89 p.; [2] Singer, 1995, Econ. Geol., 90(1), 88-104; [3] Marx et al. 2005, Earth Surf. Process. Landf. 30, 699-716