Goldschmidt 2022 Abstract
https://doi.org/10.46427/gold2022.11152

Characterisation of Irish volcanic ash layers using combined *in-situ* U-Pb and Lu-Hf analyses of zircon and/or apatite and its implication for the growth rate of the Waulsortian reef

HILDE ANNA KOCH[1], DAVID M CHEW[2], MURRAY W. HITZMAN[1], PAUL SLEZAK[1], EOIN DUNLEVY[1], ESZTER BADENSZKI[1] AND MARK HOLDSTOCK[3]

[1]University College Dublin/iCRAG
[2]Trinity College Dublin
[3]Group Eleven Mining & Exploration Ltd
Presenting Author: hilde.anna@ucd.ie

The Waulsortian Limestone, a Carboniferous deep-water mudbank bioherm-facies, is the main host rock for multiple significant Zn-Pb sulfide deposits in Ireland. However, neither the timing of mineralisation nor the age of host rock is well constrained. This study contributes to our understanding of the growth rate of the bioherm, by dating volcanic ash beds in stratigraphic equivalent formations above and below the Waulsortian Limestone. Samples are from regional drill cores and are restricted to the Limerick Syncline (Stonepark) and Lisheen/Rapla district. The altered volcanic ash beds are between 2 and 10 cm thick and are distinct from the surrounding limestones due to their green-beige colour and high clay content.

Uranium-Pb isotopic and trace element analyses on zircon and apatite grain mounts were conducted by LA-ICP-MS at Trinity College Dublin (TCD). An aliquot of each sample was crushed and analysed for 40 trace elements by solution-Q-ICP-MS. Whole-rock trace-element characterisation of the ashes did not allow for cross-correlation between Stonepark and Lisheen/Rapla. However, apatite trace element analyses of the tuffs underlying the Waulsortian indicate an evolved magmatic source, with the closest known evolved source being the Variscan Belt of Europe, >1000 km from Ireland. As such a distal source seems unlikely, the volcanic source remains uncertain. Further source characterisation using Hf isotopes on zircon will clarify the ash layer sources and potentially contribute to stratigraphic correlations in the Stonepark and the Lisheen/Rapla district.

The mean age of the stratigraphically underlying ash beds is 350.5 ± 3.9 Ma, while the overlying volcanic ash is dated at 348.2 ± 2.4 Ma. The thickness of the Waulsortian Limestone at Stonepark is up to 550 m [1]. Thus, the age of these ash layers implies a growth rate of ~240m / Ma, albeit with a large uncertainty. This agrees with the growth rate of a modern reef equivalent, which is 1 Ma for 130 m [2]. CA-ID-TIMS dating of these ash layers will yield significantly more precise age constraints on the growth rates of the substantial Waulsortian mud mounds.

[1] McCusker, Reed (2013), Mineralium Deposita 48, 687-695
[2] Titschack et al. (2009), Marine Geology 259, 36-46