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Spatial distribution, chemical composition, and genesis of breccias in the Zn-Pb Lisheen mining district

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The Paleozoic Central Ireland Basin is a world-class base metals metallogenic province, hosting more than 150 Mt of massive sulfide ore. Since the 1960s Zn-Pb-(Ag-Cu) has been mined in the Lower Carboniferous carbonate rocks in five economic ore bodies: Tynagh, Silvermines, Navan, Galmoy, and Lisheen. The Lisheen Zn-Pb(-Ag) deposit contains more than 22 Mt of ore with an overall grade of 11.5 % Zn, 1.9 % Pb, 26 g/t Ag, and 16 % Fe hosted in Lower carboniferous Courceyan to Chadian Lisduff oolitic limestone of the Ballysteen Formation, and in the Waulsortian mudbank, the dominant ore bearing strata [1]. The ore is structurally controlled by sets of normal ENE faults segmented by relay zones. The stratabound sphalerite, galena, pyrite and tennantite mineralization is forming complex ore textures from massive sulphide replacement, to collomorph fillings of dissolution vugs, and polygenic breccias. The gangue minerals include dolomite, calcite, barite, and quartz. The Waulsortian mudbank was affected by regional-scale dolomitization, and later by hydrothermal dolomite alteration described as black matrix, and white matrix breccias, both associated with the sulphide mineralization [2].

A set of samples from the Lisheen trend ore pods were selected to provide an illustrative set of black matrix, and white matrix breccias. Respectively from the WSW to the ENE: Main Zone, the Main Zone / Oolite area, the Island, as well as the Rapla prospect.

The aim of this study is to provide a comprehensive analysis of the breccias' texture descriptions (microtectonic observations, composition, geometry of fragments, and matrix ratios), gangue and sulphide mineralogy, and in-situ trace elements chemistry using EMP and LA ICP-MS in order to understand the genetic processes of volume creation and its metallogenic significance. It also aims to assess the possible use of the geochemical signature of the breccias zones as an exploration tool, particularly with sulphide remobilization during the post-mineralization tectonic events. Preliminary results suggest that the breccias' complexity are the result of the succession of several fundamental mechanisms of brecciation as identified in Jébrak et al. 1997 [3], including but not restricted to fluid-assisted brecciation, wear abrasion, collapse, and corrosive wear.

References:

1 Shearley et al. (1995) Geologists Guidebook Series 21:123–138
2 Hitzman et al. (2002) Econ Geol 97:1628-1655
3 Jébrak et al. (1997) Ore Geo Rev. 12:111:134