ST.012

δ18O Isotope Review of the Irish Midlands and Implications for Models of Dolomitization

Christopher Reed[1], Malcolm Wallace[2], John Ashton[3]
1. Teck Resources, West Perth, WA, Australia, 2. The University of Melbourne, Melbourne, VIC, Australia, 3. Consultant, Navan, Ireland

A regional compilation of available dolomite ^{13}C and ^{18}O isotope data for the Irish Midlands has been undertaken to assess potential regional fluid pathways and histories. The database contains over 700 georeferenced points from public sources and includes samples from drillcore, outcrop, and underground samples from Zn-Pb deposits. The rocks included are the Waulsortian and Pale Beds; here, we present results from just the Waulsortian Limestone. The large spatial distribution afforded by this database allows regional trends to be evaluated over a significant area of the Irish Carboniferous.

A consistent paragenesis has been assigned based on the sample descriptions. This is summarized as an early Mn-Fe-poor planar dolomite, followed by a coarser-grained, grey to white, Mn- and Fe-rich saddle dolomite. The Zn-Pb mineralization typically occurs synchronously with the early planar dolomite and may overlap with the saddle dolomite, which typically occludes the remaining porosity. Based on this, the dolomites were categorized as pre-, syn-, and postmineralization (Reed and Wallace, 2001, 2004).

Previous authors have suggested that the dolomitizing event was driven by a south-to-north directed fluid flow event triggered by the Hercynian Orogeny (Hitzman and Beaty, 1998). This conclusion was supported by a progressive shift in ^{18}O values from lighter in the south to heavier in the north. The transition from light to heavy oxygen isotope compositions is attributed to progressive host-rock buffering as the fluids migrated through the carbonate sequence. Conversely, Gregg et al (2001) argued against a single flow event and documented a more complex history involving multiple fluid generations.

As can be seen in this more extensive dataset (figure 1), a south-to-north trend is not evident. Significantly, the data do not display any significant deviations in values in samples close to or associated with Zn-Pb mineralization. The transition to more depleted ^{18}O values in the later diagenetic phase (saddle dolomite) is consistent with increasing burial temperature.

We suggest that dolomitization is a diagenetic event from a pore fluid that was uniformly buffered by the host limestone as burial temperatures increased, and there is no evidence for a north-directed fluid flow event. Instead, it’s possible to envisage more localized fluid sources that are not dependent on a single distal source or hydrothermal fluid. This has implications for models for the Zn-Pb mineralization as it does not require a single fluid flow event.

FIGURE 1

$\delta^{18}O$ values (*n* = 405) for the syn-mineral dolomites within the Waulsortian Limestone (y-axis). X-axis is northing in Irish National Grid (metres). Data has been summarized as box plots with 30-km bin size. Black dots are the outliers. Jitter applied to points for visualization.