

Contrasting origins and diverse record of tectonothermal events in the lower crust of the British and Irish Caledonides

**PROF. J STEPHEN DALY, BA (MOD.), PHD¹, ESZTER
BADENSZKI¹, MICHAEL J. FLOWERDEW² AND MARTIN
J. WHITEHOUSE³**

¹University College Dublin

²CASP

³Swedish Museum of Natural History

This contribution addresses the lower crustal evolution of the British-Irish sector of the early Palaeozoic Caledonian Orogen, using evidence from deep crustal xenoliths transported by mid-Carboniferous-Permian magmatism, and tectonically-exhumed lower crustal exposures. While the xenoliths record events associated with the classic division of the orogen: Grampian (c. 470Ma), Scandian (c. 420Ma) and Acadian (c. 400-395Ma), they also yield evidence of independent thermal activity.

Metadiorite and metatonalite xenoliths from the Scottish Midland Valley yield U-Pb zircon protolith ages of c. 415 Ma and c. 450 – 430 Ma respectively. These have juvenile Hf isotopic signatures, and the metatonalites are interpreted to represent the previously proposed (“Midland Valley”) buried arc. Detrital zircon U-Pb ages indicate deposition of metasedimentary xenoliths in late Ordovician-early Silurian and a Laurentian and mid-Ordovician provenance, the latter derived from the arc. Zircon overgrowths indicate metamorphism at c. 415 Ma (metadiorite intrusion?), c. 397 Ma and c. 389 Ma, the latter two linked to the Acadian. Relatively low pressures from thermobarometry (c. 5-7 kbar, 620-780°C) suggest that the deepest crust is not represented within the xenolith suite.

Along strike, SE of Midland Valley, the predominantly metasedimentary Slishwood Division of northwestern Ireland is an exhumed fragment of deeper (> 14 kbar) lower crust that experienced Grampian (c. 470 Ma) eclogite- and HP-granulite-facies metamorphism. Potentially it represents the “missing” basement on which the Midland Valley metasediments were deposited. Detrital zircons show that the Slishwood Division sediments were deposited after c. 863 Ma and also derived from Laurentia.

Central Ireland lower crustal xenoliths, from the Iapetus Suture footwall, are predominantly metasedimentary. U-Pb dating of detrital zircons and inherited zircons in granitic veins indicate maximum protolith ages of 460 – 476 Ma and Gondwanaland provenance. Following ductile deformation (Scandian?), the xenoliths record several melting/ high grade events c. 414 Ma - 360 Ma. Heating in this protracted interval correlates only partly with Acadian deformation and thus invites speculation as to its cause. It predates the well-known Mississippian magmatism but may correlate with uplift and erosional removal of the Lower Old Red sandstone cover preserved in SW Ireland and SW Wales.