A multi-isotope investigation of granite petrogenesis in the Caledonian Iapetus Suture Zone

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Major parts of the Irish lithosphere are made up of accreted crustal and arc volcanic and plutonic rocks that assembled, together with Laurentian basement and peri-Gondwanan terranes, during the Caledonian Orogeny. After assembly, the crust was extensively modified by late- to post-collisional granitic magmatism astride the Iapetus Suture Zone (ISZ). Petrogenetic investigation of these rocks and the earlier arc systems aims to identify the major source inputs.

SIMS U-Pb zircon geochronology on the oldest arc-related granites yielded Ordovician ages (c. 460 and 455 Ma). Late- to post-collisional granites yield early Silurian to Lower Devonian ages (c. 435, 418, 410 and 394 Ma). Proterozoic inherited zircon grains and cores were derived either by assimilation from wall rock (meta-) sediments or from hitherto unknown basement rocks. Several of the Devonian granites north of the ISZ contain inherited Ordovician zircons (c. 485, 470 and 455 Ma) with εHf_T values down to -18, consistent with derivation from an Ordovician arc founded on older continental crust.

Hf-O isotopic analyses on dated magmatic zircons generally range between +10 and -1 εHf_T and 5.5 to 8.5 $\delta^{18}O$ which indicates a juvenile contribution to several of the granites. This is likely including the Ordovician arc system. A bimodal distribution in $\delta^{18}O$ in several granites suggests involvement of isotopically distinct source rocks.

A distinction between the εHf_T from granites north and south of the ISZ is supported by a similar pattern in LA-ICPMS Pb isotopic analyses of K-feldspar. Less radiogenic lead in the northern granites is consistent with involvement of Laurentian basement in their genesis. This pattern is also seen in coeval volcanic rocks suggesting similar source constraints and the likely reprocessing of Ordovician subduction-related arcs in the genesis of post- and late-collisional plutons.