



## **Zircon geochronology and Hf-O isotope geochemistry from granites in the Iapetus Suture Zone in Ireland and the Isle of Man**

Tobias Fritschle (1), J. Stephen Daly (1), Martin J. Whitehouse (2), Brian McConnell (3), and Stephan Buhre (4)

(1) University College Dublin, School of geological sciences, Ireland (tobi.fritschle@gmx.de), (2) Laboratory for Isotope Geology, Swedish Museum of Natural History, Stockholm, Sweden, (3) Geological Survey Ireland, Beggars Bush, Dublin 4, Ireland, (4) Institut für Geowissenschaften, Johannes Gutenberg-Universität, Mainz, Germany

Late Caledonian syn- to post-orogenic granites located in the Iapetus Suture Zone (ISZ) in Ireland and Britain have been related to A-type subduction and possible slab breakoff<sup>[1]</sup> following the Laurentia-Avalonian collision. Lack of reliable age data (especially in Ireland) has inhibited petrogenetic investigations of these rocks. Hence, ion microprobe U-Pb and oxygen isotope analyses as well as LA-MC-ICPMS Lu-Hf isotopic measurements on zircons from Irish and Isle of Man granites have been undertaken to provide better constraints on this enigmatic episode of the Caledonian Orogeny.

Four stages of Late Caledonian granitic magmatism (c. 435, 417, 410 and 394 Ma) are indicated by U-Pb dating of oscillatory-zoned magmatic zircons. The Crossdoney, Kentstown, Drogheda and Ballynamuddagh granites together with a rhyolite from Glenamaddy have yielded U-Pb concordia ages, interpreted as intrusion-ages, between  $419.9 \pm 4.3$  Ma (Glenamaddy) and  $415.8 \pm 2.0$  Ma (Crossdoney) with a weighted average of  $417.5 \pm 0.9$  Ma (MSWD = 1.3). The Glenamaddy Granite – which intruded the Glenamaddy Rhyolite – yielded an age of  $410 \pm 2.1$  Ma. In addition, the Rockabill Granite yielded a younger age of  $393.9 \pm 1.9$  Ma, whereas the Carnsore Granite yielded an older age of  $434.6 \pm 1.9$  Ma.

Inherited zircons (487 to 453 Ma) occur in several of the granites, and are interpreted to have been derived from Ordovician arc magmatic rocks accreted within the ISZ. A younger group of c. 440 Ma inherited zircons occurs in the c. 417 Ma Crossdoney and Ballynamuddagh granites. These grains could be related to continued or renewed Silurian arc magmatism.

Hf-O isotopic measurements on the dated zircon grains range between  $-2$  and  $+7$   $\epsilon\text{Hf}_i$  units and  $5.5$  to  $8.5$  ‰  $\delta^{18}\text{O}$ . These are interpreted to indicate the contribution of juvenile mantle melts – possibly derived from the Ordovician arc – to some of the granites. Significant heterogeneities in zircon oxygen isotopes in at least four of the granites further suggest the involvement of isotopically distinct protoliths.

The Dhoon and Foxdale granites in the Isle of Man were previously regarded to be of Late Caledonian age. Surprisingly, zircons from these granites yielded concordant U-Pb ages of  $455.6 \pm 2.1$  Ma (Dhoon) and  $455.9 \pm 2.1$  Ma (Foxdale), respectively. Inherited cores are of Meso- and Palaeoproterozoic age. Hafnium isotopic analyses of the dated magmatic zircon rims from both intrusions are slightly more radiogenic than those from the Late Caledonian granites. Their  $\delta^{18}\text{O}$  values range between  $5.5$  to  $7.5$  ‰. The Isle of Man granites are now suggested to be the plutonic equivalents of a Late Ordovician (Caradocian) volcanic arc generated in the Iapetus Ocean.

<sup>[1]</sup> Atherton & Ghani (2002), *Lithos* 62, 65-85.