c.479 Ma Lu-Hf garnet ages from the footwall of the Shetland ophiolite: Rapid crustal-heat propagation during the onset of orogenesis or diffusional artefact?

S. WALKER[1], M. F. THIRLWALL[1], A. F. BIRD[2] AND R. A. STRACHAN[3]

[1]Dept. or Earth Sciences, Royal Holloway, University of London, Egham, Surrey, UK. Stephanie.walker.2009@live.rhul.ac.uk
[2]Dept. of Geography, Environment, and Earth Sciences, University of Hull, Hull, UK. A.Bird@Hull.ac.uk
[3]School of Earth and Environmental Sciences, University of Portsmouth, Portsmouth, UK. Rob.Strachan@Port.ac.uk

The timing of obduction of the Shetland ophiolite is constrained to c.484±4 Ma by U-Pb in metamorphic zircon [1], coeval with the onset of Caledonian orogenesis. The timing of peak metamorphism within the immediate footwall is constrained using Lu-Hf garnet geochronology to 458±7 Ma, indicating that the current contact between the two units is a later tectonic break [2], and that crustal thickening within the footwall is coincident with timing of peak metamorphism in the Caledonides of Scotland and Ireland.

A Lu-Hf isochron age of 478.6±1.4 Ma from diffusionally zoned garnets in the footwall of the Shetland ophiolite on the island of Fetlar appears to relate to the timing of ophiolite obduction. However, the estimated stratigraphic thickness of 7km of the Shetland ophiolite could not create sufficient overburden to produce such high-grade garnets. Further, peak Grampian metamorphism is tightly constrained within Scotland, Ireland, and other parts of Shetland [3] as significantly later, at c.470±4 Ma.

Two explanations for such an old Lu-Hf garnet age are explored: 1) due to the close proximity to the base of the ophiolite, the age may relate to the way in which heat propagates through the crust at the onset of orogenesis, or 2) the preferential retention of radiogenic Hf in diffusionally zoned garnets [4] may lead to an anti-clockwise rotation of the isochron, and hence an apparently old age.

[1] Crowley & Strachan (2015) *JGSL* [2] Cutts *et al*. (2011) *JGSL* **168**, 1265-1284 [3] Walker *et al*. *Submitted*, *JGSL* [4] Bloch *et al*. (2015) *CMP,* 169:12