Geophysical Research Abstracts
Vol. 19, EGU2017-5219-1, 2017
EGU General Assembly 2017

Using apatite fission track and an innovative approach to apatite (U-Th)/He thermochronometry to study the tectonic-geomorphic history of The Grampian Highland area-Scotland.

Awara M.Amin (1), Roderick Brown (1), and David Brown (2)

(1) School of Geographical and Earth Sciences, University of Glasgow, Glasgow, United Kingdom (Roderick.Brown@glasgow.ac.uk), (2) School of Geographical and Earth Sciences, University of Glasgow, Glasgow, United Kingdom (David.Brown@glasgow.ac.uk)

Problems of the relief development of the Scottish Highlands have received much attention in recent years. Over last 30 years low temperature thermochronology methods including fission track and (U-Th)/He analysis have been utilized to quantify the surface uplift and denudation of rocks, as well as history of re-deposition across parts of Scotland (Hurford 1977, Lewis et al. 1992, Thomson et al. 1999, Persano et al. 2007, Holford et al. 2010). The landscape evolution of the Scottish Highlands is traced over the last 400 Ma. The Caledonian Orogeny and its second stage including the Grampian and Scandian orogenic events mark the starting point for the evolution of the present relief. Although there is considerable evidence that the current topography of Scotland has been affected by tectonic uplift that started during Late Mesozoic to Early Cenozoic, it remains unclear to what degree the present topography of Scottish Highlands has retained remnant features of the topography from Caledonian Orogeny c. 400 Ma. Low temperature thermochronology provides meaningful estimates of the thermal history, rate of exhumation and denudation on a time scale of millions of years to better understand landscape evolution, as well as modelling of sedimentary basins. The NW of Scotland has been broadly concentrated on over last three decades to constrain the timing of Early Cenozoic magmatic activity and its effects on the surrounding rocks. However, the history of the unroofing of the late Caledonian new granites and earlier Granites (generally post_Devonian erosion) of the Grampian region still is unclear.
In this study, apatite fission tracks and (U-Th)/He dating systems are applied for the collected samples from a profile of Ben Nevis in the Grampian area to constrain the timing and magnitude of denudation of the older and earlier granitic intrusions emplaced during and late Caledonian Orogeny. Apatite fission track ages of Ben Nevis rock samples yielded ages between 208 $\pm$ 18 Ma to 238 $\pm$ 41 Ma. Preliminary results show that there is clear correlation between apatite fission track ages and topographic elevation of the studied samples. The Preliminary thermal history result has recorded two periods of cooling. The cooling rate before and during the Early Permian (up to about 280 Ma) is higher than the later period starting around 260 Ma (Late Permian), therefore the amount of denudation between c.400 and 280 Ma is higher and is about 143 m/m.y. and it reduces after the late Permian to 92 m/m.y. Although we point out that the rate of cooling is not very rapid initially, and so not consistent with only conduction controlled cooling from higher intrusion temperatures. For the first time we will produce the first systematic combined AFT and AHe data set across The Grampian area for different profiles (e.g. Cairngorms, Lochnagar, Ben Nevis and Ben Starav) which could provide more accurate estimation of the cooling time of the Early Cenozoic magmatic activity and related denudational cooling.