MRes opportunity: Meteorite impact influence recorded within the Bay of Stoer Formation

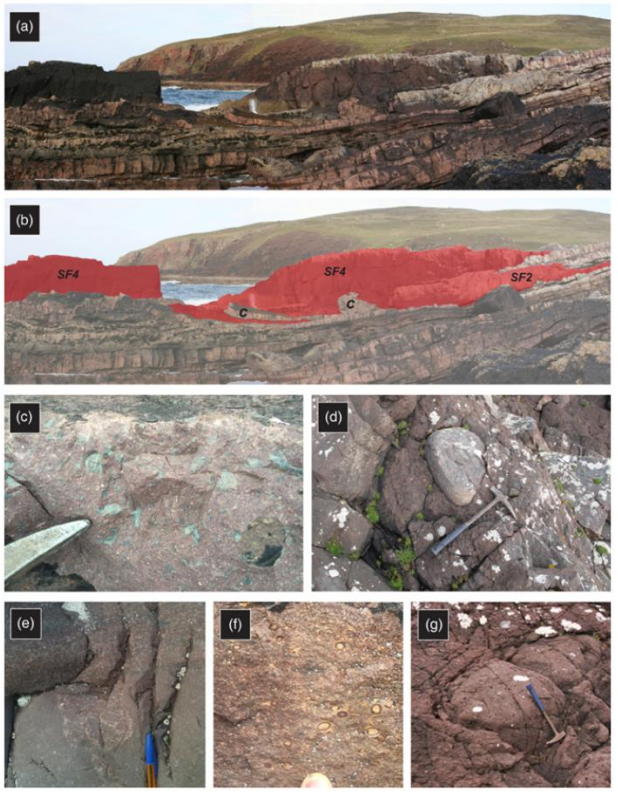
Supervised by: Prof David Selby, Richard Brown, Bob Holdsworth (Earth Sciences)
Contact David Selby via https://www.dur.ac.uk/staff/d65d2f66/

Background: The Stac Fada Member is a layer about 20m thick within the Bay of Stoer Sandstone Formation found in northwest Scotland. The Stac Fada Member shows evidence of a large meteorite impact in Scotland at ~1.2 Ga. Evidence for a meteorite original is interpreted from the classification of the member as a suevite (impact melt-bearing breccia with a particulate matrix), presence of reidite and coesite (high P polymorph of zircon and quartz, respectively), and impact diamonds. Token geochemical analysis highlight elevated iridium, platinum, rhodium, palladium abundances and epsilon ^{53}Cr values in the Stac Fada Member, and the overlying reworked sandstone of the Stoer Formation. Preliminary osmium-isotope analysis of the suveite possess a meteorite affinity (a nonradiogenic $^{187}Os/^{188}Os$ composition with an elevated osmium abundance (~1ppb). The latter is distinct from the rhenium-osmium isotope systematics of a bed of the Bay of Stoer Formation ~2m below the Stac Fada Member – Low Re and Os abundance (~40 and 20 ppt, respectively), and possessing moderately radiogenic initial $^{187}Os/^{188}Os$ (~0.45).

Aims and Method: This project will investigate the Bay of Stoer Formation, the Stac Fada Member, and the basal section of the Poll a'Mhuilt Member of the Stoer Group. Principally through through fieldwork and geochemical analyses (rhenium-osmium-isotope stratigraphy) but including additional sedimentological, structural and geochemical analysis (e.g. impact direction indicators, detailed logging, PGEs) this project with endeavour to characterize the paleoenviroment of the Bay of Stoer Formation (pre-impact deposition), the physical and chemical change through the Stac Fada Member (impact interval), and the overlying paleoenvironment of the Poll a'Mhuilt Member (post-impact deposition). The latter is argued to have a marine influence and therefore means the importance for Mesoproterozoic lakes being habitats for early eukaryotic life remains unsolved.

Scientific benefits: Detailed fieldwork and geochemical analysis of a ~1.2 Ga of the Stoer Group with provide detailed insight into the paleoenvironmental change through the deposition of the group while interrupted by a meteorite impact.

Training: Training in field analysis and state-of-the-art rhenium-osmium isotope (PGE) geochemical analyses at the world leading laboratory in the Department of Earth Sciences, Durham.



Field photographs of the Stac Fada Member. (a) Bay of Stoer locality. (b) Same image as (a) with the Stac Fada Member highlighted in a red overlay; 'c' are two large sandstone clasts. (c) Classic example of the Stac Fada Member with green vitric clasts. Tip of rock hammer for scale; Bay of Stoer locality. (d) Rounded gneiss clast, centre above 35 cm long rock hammer; Bay of Stoer locality. (e) The upper contact of the Stac Fada Member with overlying basal sandstones preserves evidence for erosion and reworking. (f) Accretionary lapilli at the Enard Bay locality. (g) Rock hammer resting on Stac Fada Member. The more rubbly outcrop wrapping around the 'intact' Stac Fada Member are interpreted to be later channel fill deposits. Taken from Osinski et al. (2020). doi.org/10.1144/jgs2020-056