Temporal and Structural constraints of Magmatism and hosted Mo mineralization

Supervised by: Profs David Selby, Ken Mccaffrey, Bob Holdsworth (Durham) and Cyril Chelle-Michou (ETH)
Contact David Selby via https://www.dur.ac.uk/staff/d65d2f66/

Background: **S**trategic and/or critical minerals/elements have changed over time. Several critical minerals (e.g., bismuth, gallium, germanium, indium, rhenium, tellurium, etc.) occur in such small concentrations in ore deposits that they are uneconomical to mine alone and are recovered as bi-products of mining other minerals such as copper, lead, molybdenum, silver, gold, and zinc. Future sources of some of these critical minerals may be associated with these precious and base metal deposits and tied to the processing of these other mineral commodities. For example, molybdenite, both the source of molybdenum and rhenium. Thus, understanding genetic models of ore mineral formation is critical.

Aims and Method: This project will primarily focus on the genesis of the of the Starav intrusions and associated molybdenite mineralization (Fig. 1). Current U-Pb zircon intrusion chronology is limited and yields crystallization timings of 418 ± 3, 415 ± 6 and 408 ± 0.3 Ma. In contrast, pilot Re-Os molybdenite chronology proposes mineralization occurred at 419 ± 0.8 Ma, which overlaps with the oldest U-Pb zircon age. The proposed ca. 419 age for Inner Starav disagrees with the hypothesis that the Inner Starav intrusion is the last intrusive phase of the Etive Complex. The study aims and methods are:

1) To (re)assess the setting and character of the Etive Complex through detailed fieldwork. The latter will evaluate the intrusion/structural relationships between the Starav intrusive phases. Fieldwork will also be critical to evaluate the extent and nature of the molybdenite mineralization and enable the collection of key samples for further analysis (aims 2 & 3).

2) U-Pb zircon geochronology applying state-of-the-art techniques to constrain the timing of emplacement of the Starav intrusions.

3) Re-Os geochronology to constrain the timing of the molybdenite mineralization of the inner Starav intrusion.

Scientific benefits:

1. New detailed field description and charactetrisation of Starav intrusive suites and associated Mo mineralization.
2. New U-Pb zircon and Re-Os molybdenite dating will constrain the timing of magmatism and mineralization, and test hypothesized genetic links with host granites.
3. Demonstrate state-of-the-art methodologies are required to understand intrusion complex and mineralization histories.

Training:

1. Industry-relevant field experience
2. State-of-the-art geochronology (U-Pb, Re-Os)
3. Constraining genetic histories of intrusions and associated mineralization

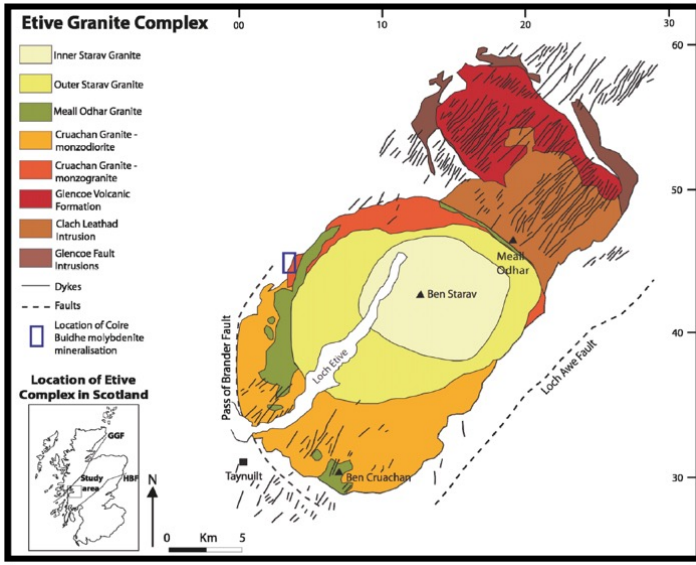

Figure 1: Geological map of the Etive Complex. See Neilson et al., 2009. Timing, relations and cause of plutonic and volcanic activity of the Siluro-Devonian post-collision magmatic episode in the Grampian Terrane, Scotland. J. Geol Soc., v. 166; p. 545-561, doi:10.1144/0016-76492008-069