Characterisation of antimony-gold mineralisation in Ireland and Newfoundland

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Project Highlights:

- A unique opportunity to investigate potential sources of a key critical metal in Ireland and Newfoundland
- Gain a wide skillset through field work, microanalytical, geochemical and geophysical approaches supporting both academic and industry career routes
- Collaborative multinational academia-industry CASE project with access to company data, a 3-month industry placement at Conroy Gold and Natural Resources, and additional research funding

Overview:

Antimony (Sb) is listed as a critical raw material (CRM) by the UK and the EU, due to its key role in the economy and the Green Energy Transition, and the high risk to its supply chain. Antimony is used in a wide variety of technologies, including semi-conductors, circuit boards, photovoltaic cells, and batteries. Over 90% of global antimony is produced in China, Russia and Tajikistan, so there is a need to diversify the global supply of the metal. Particularly in light of the recent export restrictions by China, the world's most significant antimony producer, puts increasing pressure on finding other significant antimony resources.

This exciting, multi-disciplinary project examines antimony mineralisation associated with orogenic vein-gold deposits in Ireland and Newfoundland. Two areas are of particular interest: the Clontibret deposit in Ireland, and the potentially world-class Beaver Brook area in Newfoundland (Fig. 1). The antimony is found in stibnite and can form massive pods within the veins: in drill core at Beaver Brook, for example, Sb grades in some intervals reach >30% whilst gold grades in both areas of up to 28-35 ppm have been recorded in drill core and channel sample intervals.

Both deposits are located within the geological terrane straddling the Iapetus suture (known as the Southern Uplands Terrane in the UK and Ireland and the Gander Zone in Newfoundland). The deposits are, therefore, analogous in terms of their tectonic association and geological framework. These offer an excellent natural laboratory to compare and contrast deposits, in order to illuminate the entire mineral system and the wider geological controls on antimony-gold mineralisation. The project will also feed into wider research interests of the project partners to understand the controls on vein-hosted mineralisation along the Caledonian-Appalachian belt from Scotland to Eastern North America. Finally, research into antimony is an emerging field within economic geology, and the results of this project will be of a significant value to understanding antimony mineralisation globally.

The project includes additional research funding and an opportunity for a 3-month placement with the CASE partner Conroy Gold and Natural Resources.

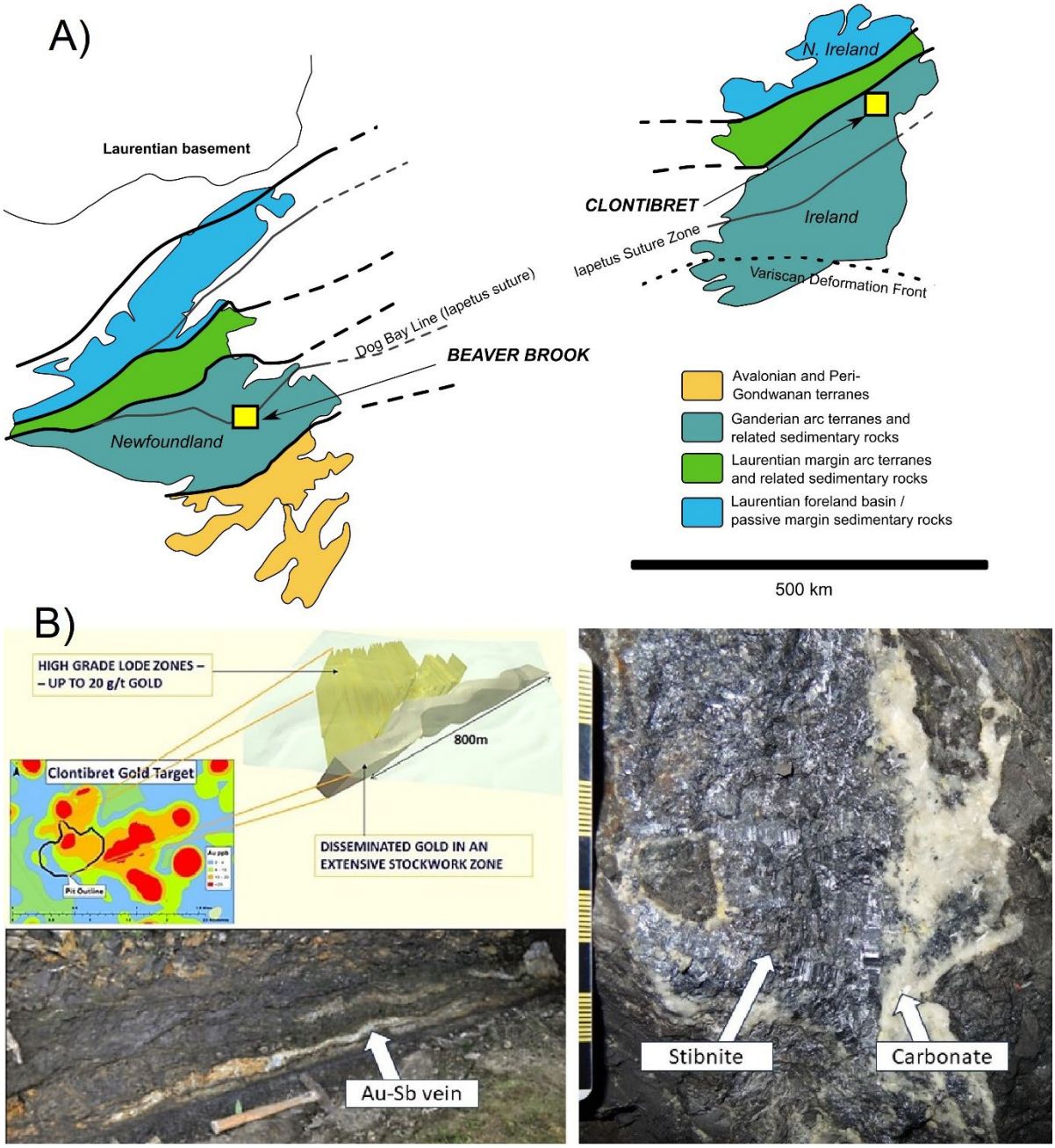

Figure 1. A) Generalised geological map of Ireland and Newfoundland, showing the locations of the study areas in Ireland and Newfoundland. B) Examples of the ore bodies and mineralisation at Clontibret (left) and Beaver Brook (right).

Methodology:

The project is underpinned by field work and sampling in Ireland and Newfoundland. A significant sample suite exists with the project partners (e.g. drill core and analytical data from both study areas). Regional high-resolution airborne geophysics and ground-based geochemistry are also available to tie the results into the wider geological context. Existing datasets and samples will be combined with newly acquired samples and vein structural/textural data, including microanalytical and geochemical/isotope data as appropriate. The main methods are:

- Textural mapping and paragenetic interpretation using Scanning Electron microscope (SEM)
- Detailed geochemical/trace element characterisation of key phases using Electron Microprobe Analysis (EMPA) and Laser-Ablation Inductively Coupled Plasma Mass Spectrometry (LA-ICP-MS)

In addition, depending on the vein mineralogy, the project will include other approaches such as directly date the veins, e.g. through Re-Os dating of molybdenite or pyrite, $^{40}Ar/^{39}Ar$ dating of muscovite, or stable isotope data to investigate fluid sources.

Possible Timeline

Year 1: Data collation and new data acquisition: literature review, field work, sampling, sample preparation, petrography, GIS analysis/data compilation

Year 2: Main analytical phase: SEM/EPMA/LA-ICP-MS work; company placement (3 months); further field work; writing publication #1 (optional)

Year 3: Finish analysis; geochronology; writing publication #2 (optional); final interpretation and synthesis of data

Training and skills:

TARGET researchers will participate in a minimum of 40 days training over the 3.5 years of study composed of:

- an annual one-week workshop dedicated to their year group, and tailored to that cohort's needs in terms of skills development – *for the first three years of their study*;
- an annual all-TARGET workshop with cross-year interactions, advanced training and opportunities to specialise in particular areas – *all years of study*;
- a number of one-day workshops;
- additional online events and in-person workshops attached to relevant conferences.

In addition to the training within TARGET, the project provides specialist training in: (i) state-of-the-art microanalytical and geochemical techniques; (ii) textural-structural and mineralogical analysis and field work; and (iii) industry-standard exploration and software skills. The PhD is equally suited to academia or industry careers: there is excellent potential for publications, whilst exposure to industry-relevant skills in exploration and ore geology through data sourcing and collation, industry placement, and multi-method analyses provides non-academic vocational experience. You will be able present at both national and international, academic or industry facing conferences according to your career trajectory.

Partners and collaboration (including CASE):

The main supervisor is Dr Torvela (Leeds), expert in structural and textural/paragenetic analysis and interpretation of hydrothermal veins. Co-supervisors are Dr Hollis (Edinburgh) with geochemical and stable isotope expertise; Dr Cooper (GSNI) providing local expertise on Irish and Northern Irish ore deposits; and Dr Deady (BGS) who is an expert in antimony deposits.

CASE partner Conroy Gold and Natural Resources will provide additional research funding, sample materials and a 3-month placement in year 2. In addition, this multinational project involves the Geological Survey Ireland (Dr McGrath) who can further advise on local geology and data; and DIETNL (Dr Sandman) and NRC (and Dr Honsberger) who will provide access to existing samples, data and expertise on Beaver Brook.

Further reading:

Earls G, 2016 'Gold exploration in the north of Ireland: new targets from the Tellus projects' in M.E. Young (ed.), Unearthed: impacts of the Tellus surveys of the north of Ireland. Dublin. Royal Irish Academy. DOI:10.3318/ 978-1-908996-88-6.ch6

Lusty PAJ, Scheib C, Gunn AG & Walker ASD, 2012. Reconnaissance-Scale Prospectivity Analysis for Gold Mineralisation in the Southern Uplands-Down-Longford Terrane, Northern Ireland

Sandeman HAI, Peddle C & Newman R, 2018. Beaver Brook antimony mine revisited: an update on operations and new structural and geological observations. Newfoundland and Labrador Department of Natural Resources, Geological Survey Report 18-1, 123-152.

http://www.conroygoldandnaturalresources.com/projects/clontibret

Further details:

Please visit https://target.le.ac.uk/ for additional details on how to apply.

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www.youtube.com/@ourmetallicearth

https://environment.leeds.ac.uk/see/staff/1576/dr-taija-torvela