National Argon Map: an AuScope initiative

Data Acquisition Project Proposal

This form should be completed and returned to Geoff Fraser (Geoff.Fraser@ga.gov.au) for consideration by the National Argon Map Oversight Panel

Project Proponent

Name: Ian Terence Graham
Affiliation and position: UNSW Sydney, Senior Lecturer
Collaborators: Hongyan Quan (UNSW PhD student), Emmanuel Madayag (UNSW Honours student), Rohan Worland (White Rock Minerals) and Angela Lay (ANPM, Timor Leste)
Project Title: Age of mineralisation within the Drake Goldfield
Geographic Region: North-eastern NSW
Geological Province or Tectonic Unit: New England Orogen, Drake Volcanics

Brief Project Description:

Approximately 500 word maximum. Include what geological process/problem will be addressed, and how new $^{40}Ar/^{39}Ar$ data from the specific samples to be dated will contribute. Please include reference to pre-existing geochronological constraints, if any exist. Please include a simple location map which showing the spatial distribution of samples in their geological context (with scale).

A recent U-Pb zircon geochronology study undertaken by Waltenberg et al (2016) included two samples from the Drake Goldfield. These were from the Red Rock and White Rock fields, both of which are also distant from the main Mount Carrington field. The zircons from both samples gave ages of 265.3 ± 1.4 Ma and 265.3 ± 1.5 Ma which are indistinguishable from each other and importantly, over 10 million years older than the Wandsworth Volcanic Group of which they were previously believed to represent the lowest interval. The zircons themselves which were dated are euhedral grains which under cathodoluminescence imaging show well-developed oscillatory zonation typical of magmatic zircons. Therefore, these ages would represent the magmatic crystallisation age of the zircons. Although Waltenberg et al (2016) suggested that these ages also represent the age of mineralisation within the Drake Goldfield, they provide no evidence for this at all. Also, a previous Ar-Ar attempt to date the mineralisation proved unsuccessful due to the too fine-grained nature of the alteration phases. However, previous work by a number of my Honours, Chomiszak (2016) and White (2017) on the White Rock and White Rock North fields, and my PhD students, Lay (2019) on Ag-rich mineralisation within the White Rock, White Rock North, Silver King, and Lady Hampden deposits and Quan (current) on mineralisation and associated alteration throughout the entire Drake Goldfield have not only clearly shown that the mineralisation cross-cuts the volcanics and is hence older, but also that there is a clear genetic relationship (mutual grain boundary relationships) between the main stage of mineralisation and illite/muscovite and/or adularia alteration. Thus, the question to be answered is 'What is the age of mineralisation within the Drake Goldfield and is it different from the magmatic age of crystallisation of the host volcanics?'. The project will form an integral part of the current PhD project of Hongyan Quan and the current Honours project of Emmanual Madayag at UNSW Sydney.

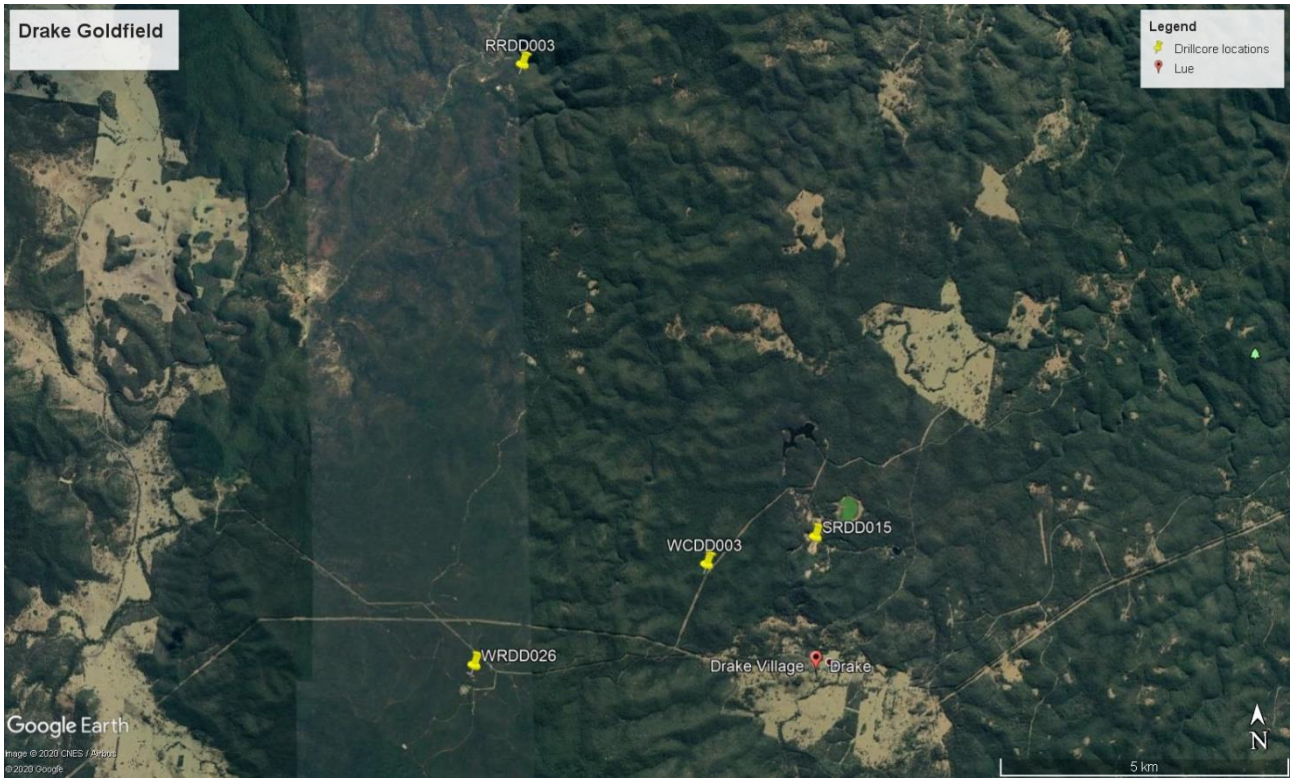
The Drake Volcanics comprise three main fields, Mount Carrington Group (including the historic Mount Carrington, Lady Hampden, Strauss, Kylo, Silver King, Gladstone Hill, Copper Deeps), White Rock and White Rock North and Red Rock (by far the smallest of the fields) which are separated from each other by over 15 km. In order to test the hypothesis that mineralisation post-dates the age of crystallisation of the host volcanics, we propose to attempt to date four samples (all from diamond

drillcores), one from each field using the Ar-Ar technique, with one each from the White Rock (WRDD026 @ 99.7 metres containing 48 wt% adularia and 6.8 wt% muscovite), Red Rock (RRDD003 @ 221.55 metres containing 13.5 wt% illite and 7.6 wt% muscovite), Strauss (SRDD015 @ 192.2 metres containing 9 wt% illite) and Copper Deeps (WCDD003 @ 382.3 m containing 16 wt% muscovite) deposits. We already have quantitative XRD analysis and thin-sections for each of these, along with wholerock geochemistry. Petrographic analysis of the chosen samples shows co-crystallisation textures (i.e. mutual grain boundary relationships with common cuspate-lobate contacts) between illite/muscovite or adularia with sulphides from the main mineralisation event.

Approximate number of samples proposed for $^{40}Ar/^{39}Ar$ analyses: 4

Lithologies and minerals proposed for $^{40}Ar/^{39}Ar$ analyses:
Illite/muscovite and adularia separates from crystal tuffs from four deposits: White Rock (WRDD026), Red Rock (RRDD003), Strauss (SRDD015) and Copper Deeps (WCDD003).

Do you have a preferred ^{40}Ar-^{39}Ar laboratory? (ANU, Curtin, UQ, UMelb):
We would prefer to use the facility at Curtin for this project as I have used in previously for Ar-Ar analysis of alteration phases associated with mineralisation from the Woodlark Island epithermal deposits, Papua New Guinea.



A bigger picture map is needed also.

Guidelines and Criteria

Project Proposals for funding support as part of the AuScope National Argon Map initiative will be assessed on the following criteria.

Australian: Samples must come from Australia (this may include Australian offshore regions)

Non-confidential: $^{40}Ar/^{39}Ar$ data must be made publicly-available (ie non-confidential)

Impact: to what extent new $^{40}Ar/^{39}Ar$ data from the proposed samples will contribute to geographic data coverage, or address key geological questions

Feasibility: whether the nature of the work is tractable via $^{40}Ar/^{39}Ar$ geochronology and the scale of the proposal is realistic within the time frame of the National Argon Map initiative (January 2020 – June 2021)?

Appropriate sample material: whether the proposed samples are (i) appropriate for $^{40}Ar/^{39}Ar$ analyses, and (ii) available within the time-frames of the National Argon Map initiative?

Oversight Panel

Dr Geoff Fraser, Geoscience Australia
Professor Zheng-Xiang Li,
Dr Anthony Reid, Geological Survey of South Australia
Peter Rea, MIM/Glencore
Dr Catherine Spaggiari, Geological Survey of Western Australia
Dr David Giles, MinEx CRC
Dr Marnie Forster (observer role as Project Coordinator)

Expectations

AuScope funding will cover the costs of sample irradiation and isotopic analyses.

Project Proponents will be responsible for:

- Provision of appropriate sample material. This includes mineral separation, which can be arranged at the relevant $^{40}Ar/^{39}Ar$ laboratories (in many cases this is preferred), but costs of mineral separation will be borne by the project proponent. The relevant laboratory reserves the right not to analyse material if it is deemed unsuitable for $^{40}Ar/^{39}Ar$ analysis.
- Provision of appropriate sample information. A sample submission template will be provided. Information in these sample submission sheets will form the basis of data delivery/publication, and the oversight committee or relevant laboratory reserves the right not to proceed with analyses unless and until appropriate sample details are provided. This includes description and geological context for each sample.
- Leading the preparation of reports and/or publications to deliver $^{40}Ar/^{39}Ar$ results into the public domain within the duration of the National Argon Map initiative (January 2020 – June 2021).
- Project Proponents will be expected to communicate directly with the relevant $^{40}Ar/^{39}Ar$ laboratory once a project has been accepted by the Oversight Committee, in order to clarify project expectations, arrange sample delivery, discuss results, collaborate on reporting and data delivery etc.

Participating Ar Laboratories will be responsible for:

- Providing advice to project proponents regarding suitable sample material and feasibility of proposed work
- Irradiation of sample material
- $^{40}Ar/^{39}Ar$ isotopic analyses
- Delivery of data tables, and analytical metadata to project proponents

Queries regarding possible projects as part of the National Argon Map initiative can be directed to Marnie Forster (Marnie.Forster@anu.edu.au) or Geoff Fraser (Geoff.Fraser@ga.gov.au)