

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 Graham
Affiliation and position: Senior Lecturer at UNSW Sydney
Collaborators: Tom Klein (Bowdens Silver), Hongyan Quan (UNSW PhD student), Angela Lay (ANPM, Timor Leste)
Project Title: Ar-Ar geochronology of the Rylstone Volcanics
Geographic Region: central-west NSW
Geological Province or Tectonic Unit: Lachlan Orogen/Rylstone Volcanics

Brief Project Description:

Approximately 500 word maximum. Include what geological process/problem will be addressed, and how new $^{40}\text{Ar}/^{39}\text{Ar}$ 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).

The Rylstone Volcanics are an enigmatic package of dominantly rhyolitic tuffs and tuff-breccias which form a distinctive linear belt in Central NSW extending from Kandos in the south to Botobolar in the north, forming part of the northern Capertee High. They are thought to be of possible Late Carboniferous to Early Permian age. The main aim of this proposal is to obtain a meaningful Ar-Ar biotite crystallisation age on the Rylstone Volcanics and Ar-Ar adularia and illite/muscovite ages on the alteration intimately associated with the main mineralisation event. These ages are of significant importance in terms of the geological/tectonic evolution of the region (i.e. do the Rylstone Volcanics represent an early Permian proto rift stage of the Sydney Basin or are they from terminal Late Carboniferous magmatism) and economic geological importance as they contain the largest unexploited silver resource in Australia, the Bowdens epithermal Ag deposit near the town of Lue. A better understanding of the age of the volcanics will help us develop better constrained geological models for the volcanics and the mineralisation events. It will also inform future exploration for epithermal deposits in the region.

To date, the only age on the Rylstone Volcanics is 292 ± 10 Ma by Shaw et al. (1989) using the Rb-Sr method on biotite. Based on stratigraphic evidence and the nature of contacts, Langworthy (1986) provided convincing evidence that the Rylstone Volcanics were deposited unconformably upon the Carboniferous Bathurst Supersuite granites in the region. In addition, the Rylstone Volcanics are unconformably overlain by the basal Snapper Point Formation of the Sydney Basin sequence. However, as yet there are no age determinations on the mineralisation itself.

Just to the south of Rylstone itself in a road-cutting besides the main road the Rylstone Volcanics are well-exposed. Petrographic analysis of samples from this unit shows that it is a crystal lithic ash fall tuff and contains a significant amount of biotite visible to the naked eye. Thus, we propose to obtain an age of crystallisation of this using Ar-Ar dating of a biotite separate from sample IG 01/18.

Previous work on diamond drillcores of the Rylstone Volcanics from the Bowdens deposit by one of my former honours students, Keothammavong (2018) and one of my former PhD students, Lay

(2019) included detailed petrographic analysis, scanning electron microscopy and EMPA, sulfur isotope analysis, LA-ICP-MS analysis of the sulfides, quantitative XRD and pXRF analysis, along with some laboratory XRF and ICP-MS analysis. Importantly, these two studies showed that the main mineralisation event was associated with illite/muscovite and adularia alteration with well-developed intergrowths between low-Fe sphalerite and illite/muscovite and/or adularia. Based on this work, we have chosen two samples for Ar-Ar dating for this proposal as follows:

BD17017 @ 57.5 metres: quantitative XRD shows 45.6 wt% adularia and no other K-bearing phases

BD17011 @ 178.5 metres: quantitative XRD shows 14.4 wt% illite and no other K-bearing phases

Approximate number of samples proposed for $^{40}\text{Ar}/^{39}\text{Ar}$ analyses: 3

Lithologies and minerals proposed for $^{40}\text{Ar}/^{39}\text{Ar}$ analyses:

1 biotite separate to determine the age of crystallisation from a road-cutting just south of Rylstone

1 adularia separate from diamond drillcore BD17017 at a depth of 57.5 metres from the Bowdens deposit

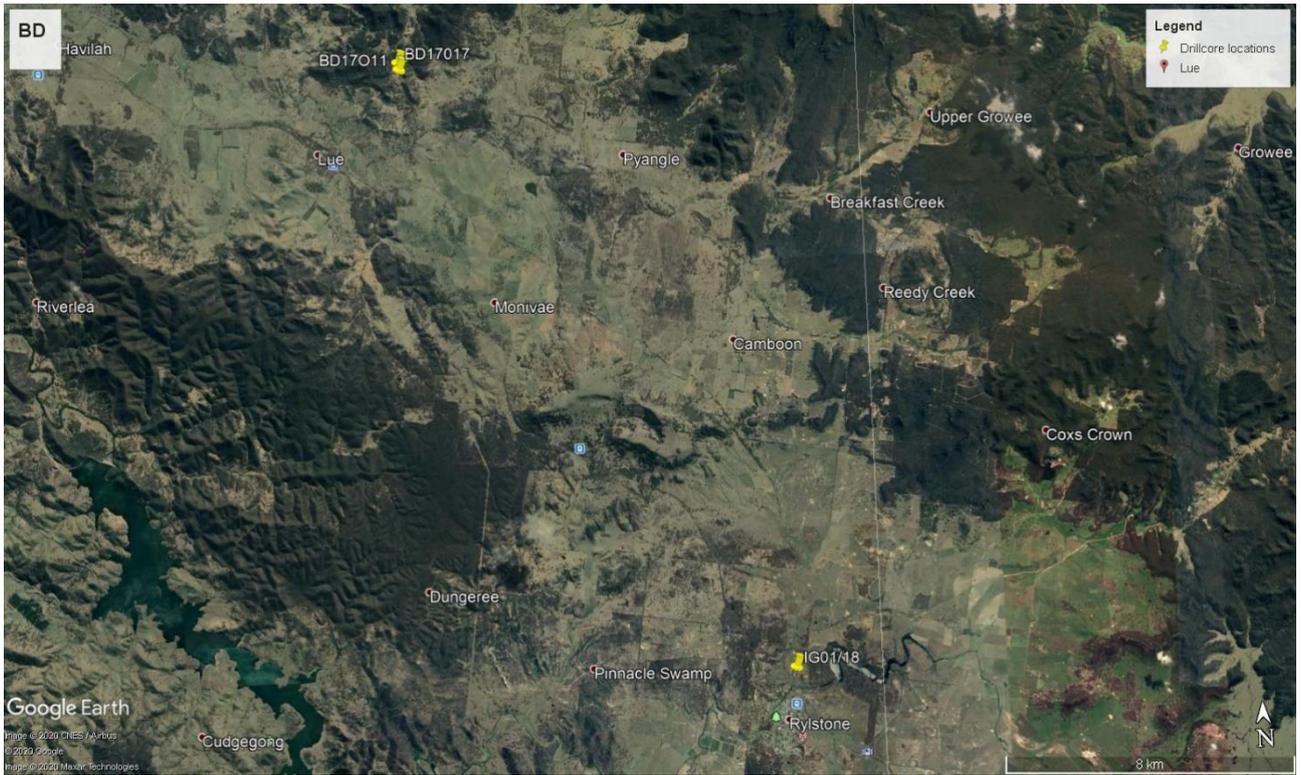
1 illite/muscovite separate from diamond drillcore BD17011 at a depth of 178.5 metres from the Bowdens deposit

Do you have a preferred ^{40}Ar - ^{39}Ar laboratory? (ANU, Curtin, UQ, UMelb):

If so, why you prefer this laboratory (e.g. student affiliation, ongoing relationship, sample type etc):

As I have collaborated with Prof David Phillips from the University of Melbourne in the past on Ar-Ar dating of epithermal systems, this is the preferred laboratory for this project.

Another map with regional perspective would be worthwhile.



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

Impact: to what extent new $^{40}\text{Ar}/^{39}\text{Ar}$ 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 $^{40}\text{Ar}/^{39}\text{Ar}$ 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 $^{40}\text{Ar}/^{39}\text{Ar}$ 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 $^{40}\text{Ar}/^{39}\text{Ar}$ 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 $^{40}\text{Ar}/^{39}\text{Ar}$ 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 $^{40}\text{Ar}/^{39}\text{Ar}$ 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 $^{40}\text{Ar}/^{39}\text{Ar}$ 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
- $^{40}\text{Ar}/^{39}\text{Ar}$ 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)