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: *Roland Maas*
Affiliation and position: *School of Earth Sciences, Univ. of Melbourne, PhD student*
Collaborators: *Dr Roland Maas (UMelb), Prof Ian Nicholls (Monash)*
Project Title: *Devonian granites on and off the Selwyn Block, western Lachlan Fold Belt*
Geographic Region: *central Victoria*
Geological Province or Tectonic Unit: *Bendigo, Melbourne and Tabberabbera Structural Zones*

How will these samples benefit the National Argon Map?

Provide a succinct answer to this question, see the suggestions in the Guidelines and Criteria on the next page.

Biotite (±muscovite) ^{40}Ar-^{39}Ar dating will provide the first, or improved, emplacement ages for eight broadly Late Devonian granitic intrusions in a 200 km West-East transect across the northern Selwyn Block, western Lachlan Fold Belt

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).

Many of the Devonian granites of the Lachlan Fold Belt have been dated using K-Ar and/or Rb-Sr mica (e.g., Bowen 1975; Richards and Singleton, 1981 for Victoria), with relatively large age uncertainties. More recent ^{40}Ar-^{39}Ar or U-Pb zircon dating has improved matters but many intrusions remain undated and were assigned emplacement ages based on geological setting only. As part of a regional granite Sr-Nd-O isotope study (e.g., Maas and Nicholls, 2012, 2017), we wish to acquire ^{40}Ar-^{39}Ar mica ages (mostly biotite, in some cases also muscovite) to either provide the first radiometric dating (Mt.Crosbie, Mt. Black, Commissioners Flat, Glenaroua, Lurg, Almonds, Youarong) or refine existing K-Ar/Rb-Sr dating (Pyramid Hill) for 8 late Devonian granitic intrusions in Central Victoria. These intrusions vary in size (some do not show in Fig.1 due to scale reasons), are mostly S-type (Commissioners Flat is I-type) and were emplaced at shallow crustal level. Sr-Nd-(O) isotope compositions are available for all and will be published, with any new geochronological results in a forthcoming paper which examines lower/mid-crustal architecture in the western Lachlan Fold Belt from the perspective of granite Sr-Nd-O isotope compositions. New ^{40}Ar-^{39}Ar biotite and muscovite ages for the Pyramid Hill Granite, a large S-type granite thought to be sourced in the enigmatic Durham-Ox Magnetic High, will be compared to a LA-ICPMS U-Pb zircon age measured as part of a recent UMelb MSc study (Shrimpton, 2020).

Bowen (1975) Rep. Geol. Surv. Vic 1965/3, Maas & Nicholls (2012) abstract, 34th IGC, Brisbane; Maas & Nicholls (2017) abstract, Granites 2018@Benalla, Aust. Inst. Geosci, Bulletin 65, 86-89; Richards &Singleton (1981) J. Geol. Soc. Aust 28, 395

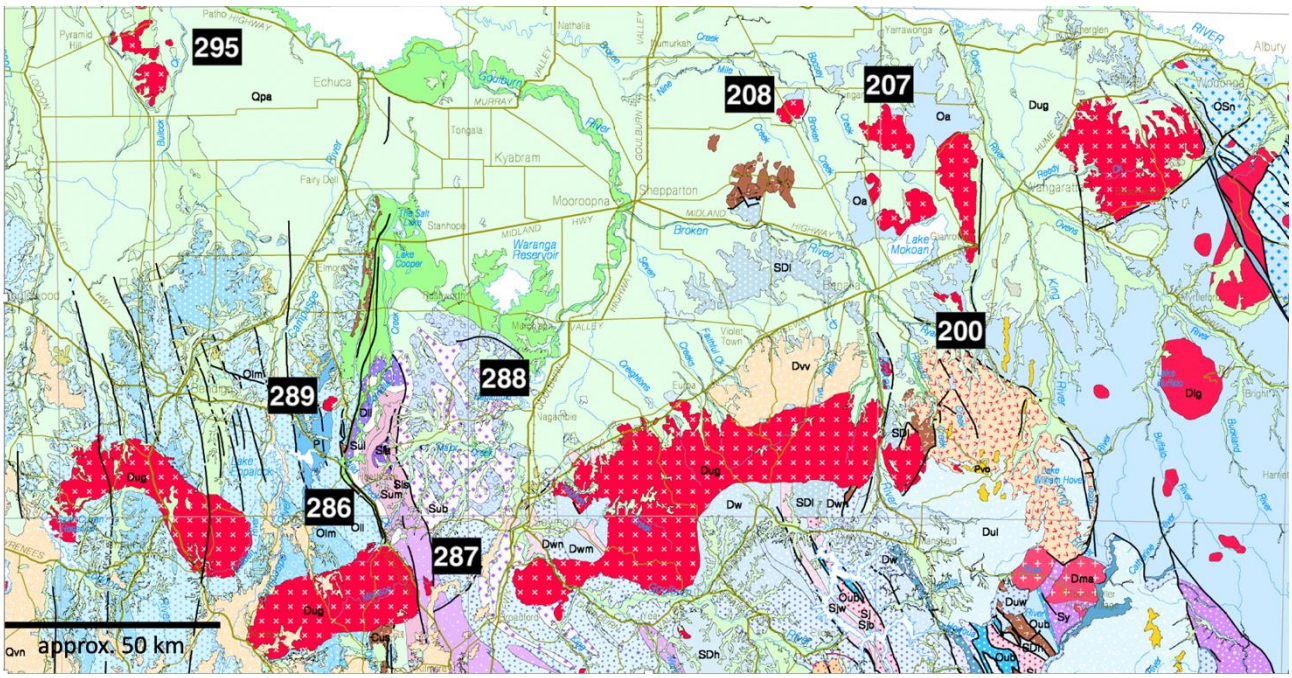

Fig.1 Location map for the Pyramid Hill (295), Mt Crosbie (289), Commissioners Flat (286), Mt Black (288), Glenaroua (287), Youarong (208), Almonds (207) and Lurg (200) granite plutons in northern Central Victoria. Modified from Vandenberg et al. (2000).

Approximate number of samples proposed for $^{40}Ar/^{39}Ar$ analyses:
8 biotite separates, 2 muscovite separates

Lithologies and minerals proposed for $^{40}Ar/^{39}Ar$ analyses:
Biotite ± muscovite from post-tectonic, shallow-level granitic intrusions

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):
UMelb
Roland Maas is at Univ. of Melbourne and has an ongoing relationship with the UMelb noble gas lab. If this application is approved, samples could be included in an irradiation run in early 2021 and measured before the mid-2021 time limit for the NAM.

Roland Maas, UMelb, 28 Dec 2020
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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)