

# 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](mailto:Geoff.Fraser@ga.gov.au)) for consideration by the National Argon Map Oversight Panel*

### Project Proponent

Name: Mark Eastlake
Affiliation and position: Geoscientist (Geoscience, Acquisition & Synthesis unit), Geological Survey of New South Wales
Collaborators: Geoscience Australia, University of Newcastle
Project Title: New $^{40}\text{Ar}/^{39}\text{Ar}$ age constraints on the timing of deformation on major faults in the Lachlan Orogen, NSW.
Geographic Region: Central and southern-central NSW.
Geological Province or Tectonic Unit: Central Lachlan Orogen, NSW

### Brief Project Description:

Faults and fault zones mark major strato-tectonic divisions in the crustal architecture of the Palaeozoic Lachlan Orogen in eastern Australia. The timing and kinematics of movement on these faults provide important constraints on the geodynamic evolution of the Lachlan Orogen with implications for the study of mineral systems.

Building on the Seamless Geology of NSW, the GSNSW is currently working on modelling crustal scale faults in 3D and developing a state-wide attributed fault architecture. The fault attribution includes geometric, kinematic and temporal constraints on fault history. Previous regional-scale  $^{40}\text{Ar}/^{39}\text{Ar}$  geochronology projects in the Lachlan Orogen have focused on major fault zones in Victoria and the eastern Lachlan Orogen in NSW (e.g. Gray & Forster 1998; Foster et al. 1999). Other studies have focused on specific areas (e.g. Fergusson et al. 2005, Doublier in prep. and Bell in prep.).

The four samples proposed for this initial study are part of an ongoing systematic approach to date the deformation history of major faults in the Lachlan Orogen and greater Tasmanides in NSW, with implications extending into Queensland and Victoria. We aim to build on the abovementioned studies, the recent SLACT seismic acquisition across the NSW–Victorian border, the East Riverina Mapping Project, ongoing mineral-systems work in the Cobar Basin and the Lachlan ARC project. In addition, our approach will inform geodynamic reconstructions in MinEx CRC National Drilling Initiative areas in NSW.

Three of the proposed tectonite samples have igneous protoliths that have been successfully dated in collaboration with Geoscience Australia using SHRIMP U–Pb zircon/monazite geochronology, providing maximum ages for deformation and removing a degree of uncertainty in the interpretation of  $^{40}\text{Ar}/^{39}\text{Ar}$  data.

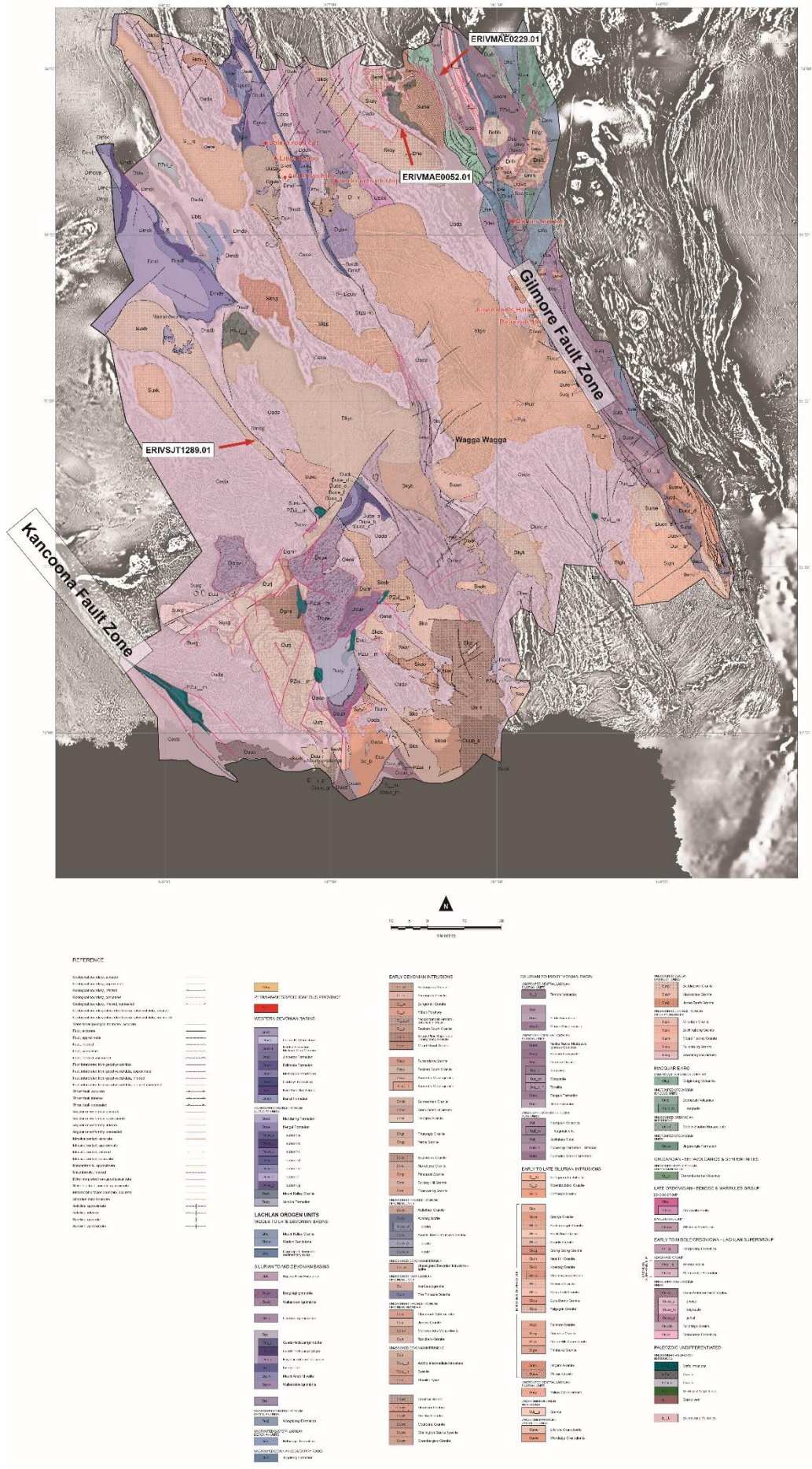


Figure 1 Geology map showing the location of tectonite samples from faults in the southern Central Lachlan Orogen, NSW. Geology is overlain onto a background aeromagnetics image (IVD TMI RTP).

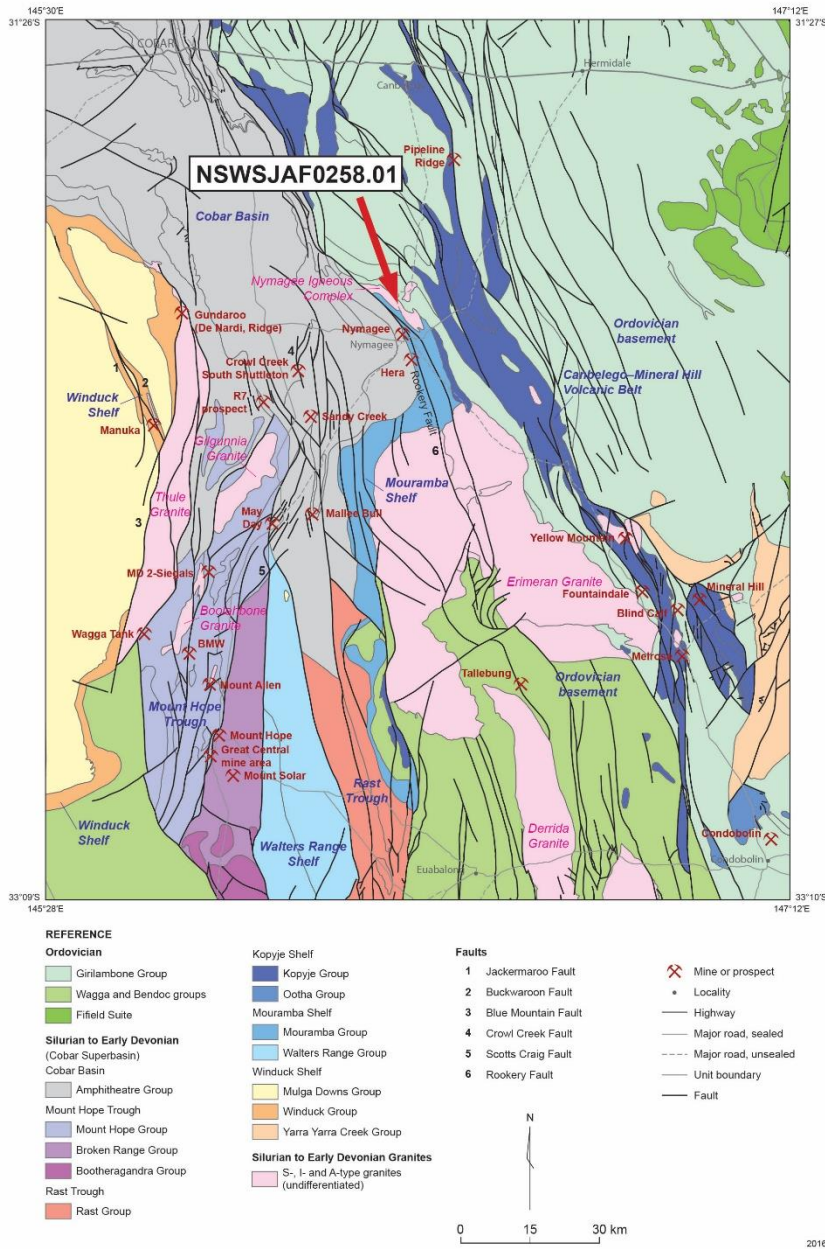


Figure 2 Geology map showing the location of tectonite sample NWSJAF0258.01 from the Nymagee Igneous Complex in the Central Lachlan Orogen (map modified after Downes et al. 2016).

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

4

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

For three samples the target mineral is deformation-related sericite and/or muscovite defining S–C shear fabrics in mylonitised granites. The remaining sample will target muscovite defining foliation in muscovite-schist.

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

ANU due to successful recent collaborations with Dr. Marnie Foster on similar materials with complex deformation histories.

## **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](mailto:Marnie.Forster@anu.edu.au)) or Geoff Fraser ([Geoff.Fraser@ga.gov.au](mailto:Geoff.Fraser@ga.gov.au))