National Argon Map: an AuScope Initiative
$^{40}Ar/^{39}Ar$ Geochronology Laboratory Sample Submission Form

This form must be completed and returned to Marnie Forster (Marnie.Forster@anu.edu.au) before any work can be commenced in the Argon Laboratories.

Person submitting samples: Alexander Prent
Affiliation: John de Laeter Centre, Curtin University
Project Title: Quadruple dating of a shear zone, comparing techniques and analytical efficiencies
Sample Number(s) (including IGSN if one exists): 16BM1 [XXAAVNRADO], 16BM2A [XXAAFUNWPC], 16BM2B [XXAAFUNWPC], 16BM3 [XXAA9AH7X4] and 16BM4 [XXAA7H5EMR]
Mineral separation required? Yes or No: No
Date submitted: September 2020

GEOGRAPHIC AREA/ PROVINCE/ BASIN : Reynolds Range, central Australia	
1:250k SHEET NAME: NAPPERBY	**NUMBER:** SF 53-9
1:100k SHEET NAME: Reynolds Range	**NUMBER:** 5453
LOCATION METHOD: (GPS: WGS84 / AGD66 / AGD84 / GDA94) GPS: WGS84	
ZONE:	
EASTING:	**NORTHING:**
LATITUDE: -22.56606	**LONGITUDE:** 133.28756

STRATIGRAPHIC UNIT FORMAL NAME *: Boothby Orthogneiss
STRATIGRAPHIC UNIT INFORMAL NAME:
LITHOLOGY: Granite

DRILLHOLE ID (if applicable):
PROSPECT (if applicable):
DEPTH FROM (metres):
DEPTH TO (metres):

* Stratigraphic Unit names can be searched and checked within the Australian Stratigraphic Units Database via the following link: https://asud.ga.gov.au/

Dating Objective

What is the geological question $^{40}Ar/^{39}Ar$ analysis will address?

What is the timing and thermal evolution of shearing in the north-south oriented shear zone at Mt Boothby?

What type of age(s) are expected? (e.g. magmatic crystallisation, metamorphism, fluid alteration/mineralisation, cooling, shearing etc):

Metamorphism and timing of fluid-rock interaction during shearing at c. 350 Ma.

Mineral target(s) for dating:

K-feldspar, biotite and muscovite (on aliquot chlorite)

Estimated $^{40}Ar/^{39}Ar$ age (e.g. Cenozoic, Mesozoic, Paleozoic, Proterozoic, Archean – provide estimated numerical age range if possible):

350 Ma (400-300 Ma)

Sample Information

Location description (e.g. a sample of x was collected from y, z km from abc town):

Samples were collected along a transect encompassing the shear zone and wall-rock.

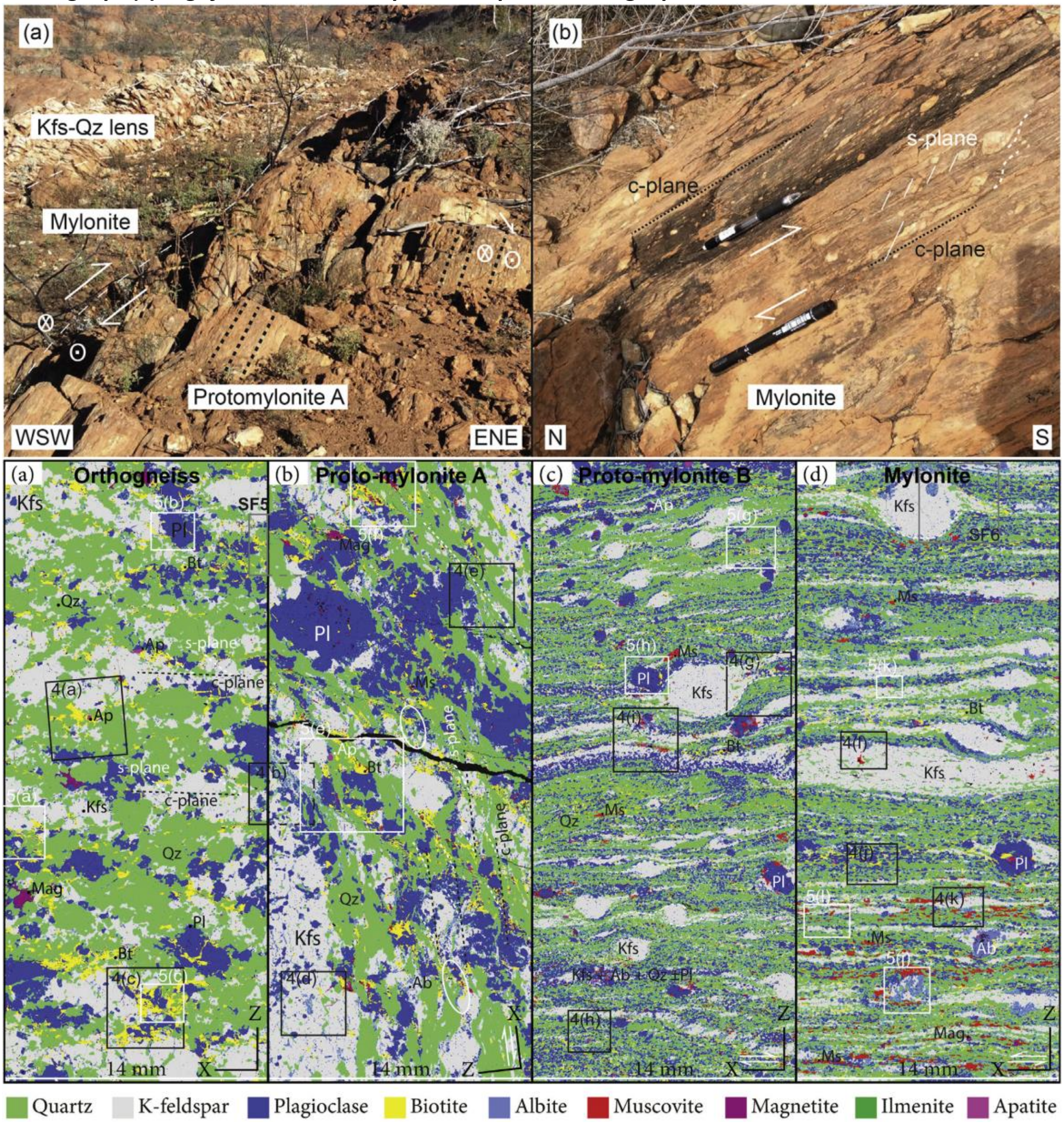
Lithological characteristics (rock description):

Rock samples comprise metamorphosed granites that have been altered during fluid infiltration and deformation (shearing).

Relative age constraints (pertinent geological relationships with surrounding rock units and any previous geochronology):
High temperature pervasive metamorphism at c. 1550 Ma from monazite dating. Apatite wall rock dating at c. 350 Ma along fluid pathways.

Thin section description (if available):
Thin sections show the pronounced change in microtexture from the orthogneiss to the shear zone (Figs. 3, 4 and 5), consistent with macroscopic outcrop observations (Fig. 2). This textural change is accompanied by a change in mineralogy (Fig. 3), foliation, bulk rock and mineral compositions (Tables 1a–1c; Figs. 3–5; Supplementary Fig. 4, “mineral compositions”). The orthogneiss consists of quartz (~35 vol %), megacrystic perthite (~35%), plagioclase (~20%), biotite (< 10%) and accessory magnetite, ilmenite, zircon, monazite and apatite. The mylonite consists of 35–40% quartz, 30–35% K-feldspar, 15% plagioclase, 5–10% albite, < 5% biotite, < 5% muscovite and accessory oxides, zircon and apatite (Supplementary Table 4). Overall, the orthogneiss to mylonite transition is accompanied by increased albite, muscovite and apatite content and a decrease in perthitic K-feldspar, biotite, plagioclase, and monazite.

Photograph(s) e.g. field site, hand-specimen, photomicrograph:



Relevant bibliographic references:
Prent, A.M., Beinlich, A., Raimondo, T., Kirkland, C.L., Evans, N.J., Putnis, A. Apatite and monazite: An effective duo to unravel superimposed fluid-flow and deformation events in reactivated shear zones. Lithos, Vol. 376–377, 2020, https://doi.org/10.1016/j.lithos.2020.105752.