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: Anthony Reid
Affiliation: Senior Principal Geoscientist, Geological Survey of South Australia
Project Title: Ar-Ar thermochronology age constraints on mafic and felsic magmatism, and deformation in the Curnamona Province
Sample Number(s) (including IGSN if one exists): 3704279
Mineral separation required? Yes or No: **Y**
Date submitted: 17/05/2021

GEOGRAPHIC AREA/ PROVINCE/ BASIN Curnamona Province	
1:250k SHEET NAME: SH5414 CURNAMONA	**NUMBER:**
1:100k SHEET NAME: 7035 Lake Charles	**NUMBER:**
LOCATION METHOD: (GPS: WGS84 / AGD66 / AGD84 / GDA94) GDA2020	
ZONE: 54	
EASTING: 458772.71	**NORTHING:** 6548419.54
LATITUDE: -31.1975865	**LONGITUDE:** 140.5672542

STRATIGRAPHIC UNIT FORMAL NAME *: Bimbowrie Suite
STRATIGRAPHIC UNIT INFORMAL NAME: NA
LITHOLOGY: two mica granite

DRILLHOLE ID (if applicable): YAM 52C
PROSPECT (if applicable):
DEPTH FROM (metres): 179.7
DEPTH TO (metres): 182.2

* 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?

The application of Ar-Ar for thermochronology and understanding deformation history in the Mundi National Drilling Initiative (NDI) area in NSW and the Olary Domain in SA will further our geological understanding of the Curnamona Province, the Adelaide Rift Complex and the Delamerian Orogeny – with implications for the geodynamic setting and mineral systems potential in western NSW, eastern South Australia and western Victoria.

The Curnamona Province is host to one of the world's largest mineral deposits at Broken Hill and has prospectivity for IOCG mineral systems as witnessed by deposits such as Kalkaroo and Portia. There is, however, very little argon geochronology from the Curnamona Province. Overview of sample information (Figure 1):

- New South Wales – a maximum of ten samples selected from drillholes and outcrop in rock units present in the MinEx CRC Mundi NDI area of the Curnamona Province
- South Australia – two samples selected from drillholes in the Olary Domain of the Curnamona Province

This sample is an undated granodiorite. Diorites in the Benagerie ridge region are known to intrude metasedimentary rocks and are typically either less altered or weakly altered than the adjacent albitite or albite-rich rocks. This suggests the diorites may be late in the alteration history or are part of a younger magmatic event.

Geochemically the diorites are similar to other mafic rocks of the Ninnerie Supersuite and interpreted to therefore be part of the c. 1580 Ma magmatic event. The sample selected, 3704279, contains both hornblende and biotite that are amenable to argon dating. A previous attempt to date the diorite from a nearby drill hole was unsuccessful as no zircon grains were recovered (Jagodzinski and Fricke 2010).

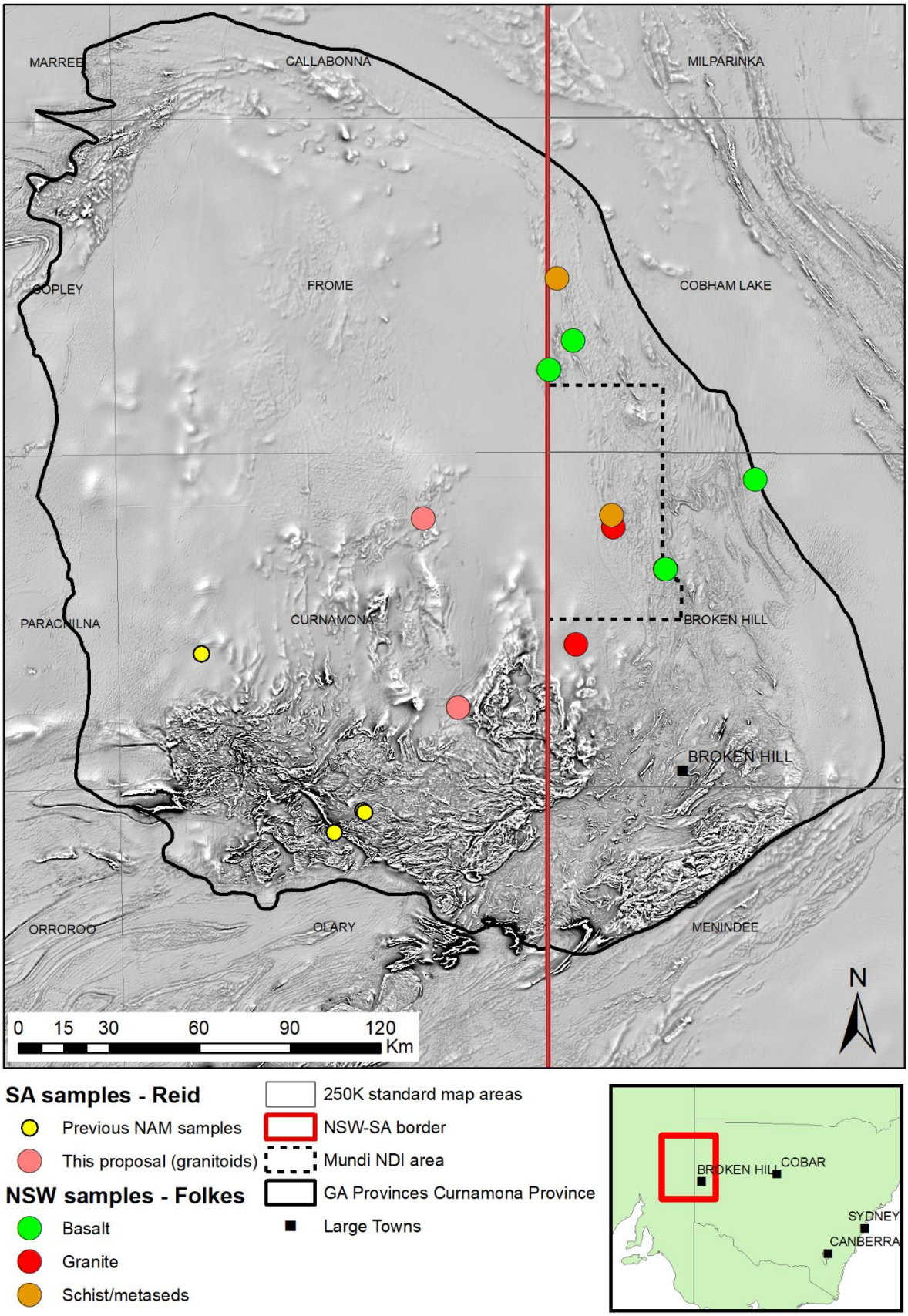


Figure 1. Location of proposed samples from the Curnamona Province. The MinEx CRC Mundi NDI area is shown. The background image shows the 2019 Geoscience Australia greyscale national total magnetic image (TMI) first vertical derivative (1VD). Previous samples submitted for the National Argon Map from the Curnamona Province in South Australia are also shown.

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

Cooling age

Mineral target(s) for dating:

Hornblende, biotite (if possible)

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

Mesoproterozoic - Paleozoic

Sample Information

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

Drill hole

Lithological characteristics (rock description):

Sample 3704279 is a quartz monzonite, with hornblende, biotite and orthoclase.

Relative age constraints (pertinent geological relationships with surrounding rock units and any previous geochronology):

This granite has not been dated however, geochemically appears to belong within the Ninnerie Supersuite.

Thin section description (if available):

Description of nearby thin section:

From petrology report of Envelope 08958 (Hodkinson et al., 2000):

Note thin section in preparation (May 2021)

MRL23653: LR98007 **Massive quartz monzonite to adamellite, with iron-rich biotite and hornblende, accessory ilmenite, trace sulphide (pyrite > chalcopyrite, rare ?molybdenite).**

Field Note : *Grey, medium fine grained biotite hornblende granite similar to that intersected in LD97001 (MRL26239).*

Mineral	Vol %
Quartz	15-20%
Plagioclase	45%
Orthoclase	30%
Biotite	4%
Hornblende	3%
Ilmenite	1%
Sulphide	<1%

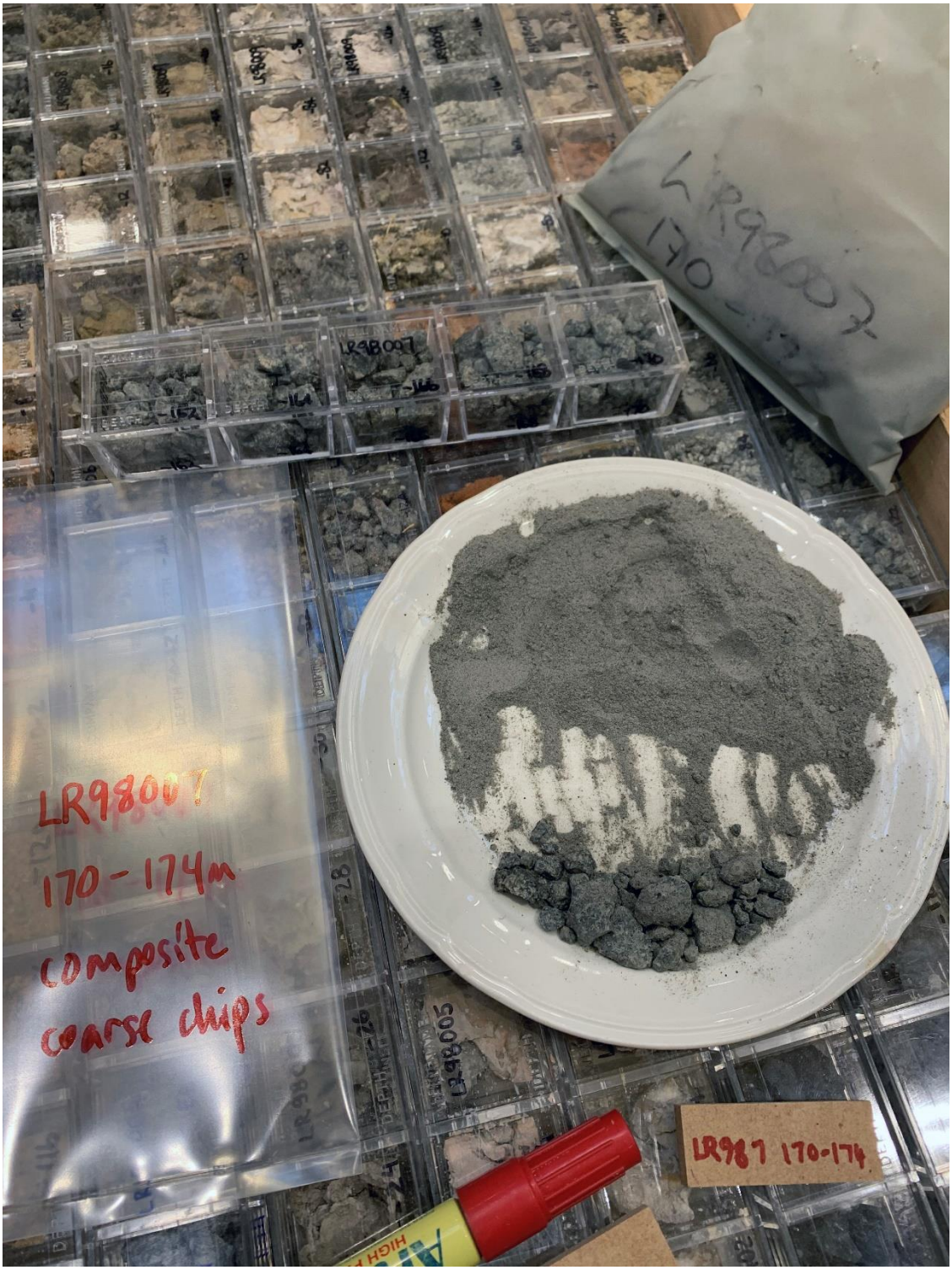
The stained offcut indicates that this sample is a relatively quartz-poor, mafic granitoid with slightly more abundant plagioclase than alkali feldspar.

The thin section shows that the rock is dominated by weakly to strongly sericitised sodic plagioclase with some concentric zoning. The alkali feldspar is perthitic orthoclase to 4 mm in grainsize and is part of a bimineralic interstitial aggregate with quartz. The quartz is commonly poikilitic and may be optically continuous for 5 mm. The mafic minerals seem to be iron and titanium-rich and are dark brown. They are also poikilitic, with biotite to 4 mm in grainsize and hornblende as grains that may be optically continuous over 6 mm or more.

Accessory opaque oxide is ilmenite, to 0.8 mm in grainsize, and there is trace pyrite to 0.3 mm in grainsize as well as rare chalcopyrite. The largest biotite flake enclosed a single very small crystal with optical properties indicating possible molybdenite, or a possible bismuth or antimony-bearing mineral.

This is an unusual granitoid and may be of "A"-type. The visually estimated mineralogy suggests a quartz monzonite to adamellite composition.

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



Photograph of sample rock from drill hole LR98007, sample 3704279.

Relevant bibliographic references:

Hodkinson, I., Teale, G.S., Brewer, A.M., Rennison, M.W., Rutley, A.J., Hedger, D., Whittall, M., Loftus, K., Fielding, D., 2000. Billeroo West and Lake Charles. Data release made in lieu of submitting separate first partial surrender reports for ELs 2013 and 2560 : annual reports for the period

1/9/1994 to 25/10/2000. South Australia. Department of Primary Industries and Resources. Open file Envelope, 08958.