

National Argon Map: an AuScope Initiative

$^{40}\text{Ar}/^{39}\text{Ar}$ 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: Dating of mineralisation-related alteration in the Olympic Cu-Au Province, Gawler Craton
Sample Number(s) (including IGSN if one exists): 2111462
Mineral separation required? Yes or No: Y
Date submitted: 20/03/2020

GEOGRAPHIC AREA/ PROVINCE/ BASIN : Gawler Craton	
1:250k SHEET NAME: ANDAMOOKA	NUMBER: SH5312
1:100k SHEET NAME: Mattaweara	NUMBER: 6237
LOCATION METHOD: (GPS: WGS84 / AGD66 / AGD84 / GDA94) GDA2020	
ZONE: 53	
EASTING: 672516.76	NORTHING: 6627750.51
LATITUDE: -30.4700925	LONGITUDE: 136.797095

STRATIGRAPHIC UNIT FORMAL NAME *: Hiltaba Suite
STRATIGRAPHIC UNIT INFORMAL NAME: NA
LITHOLOGY: granite with hornblende-magnetite alteration

DRILLHOLE ID (if applicable): Blanche 1
PROSPECT (if applicable):
DEPTH FROM (metres): 1005.6
DEPTH TO (metres): 1006

* 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

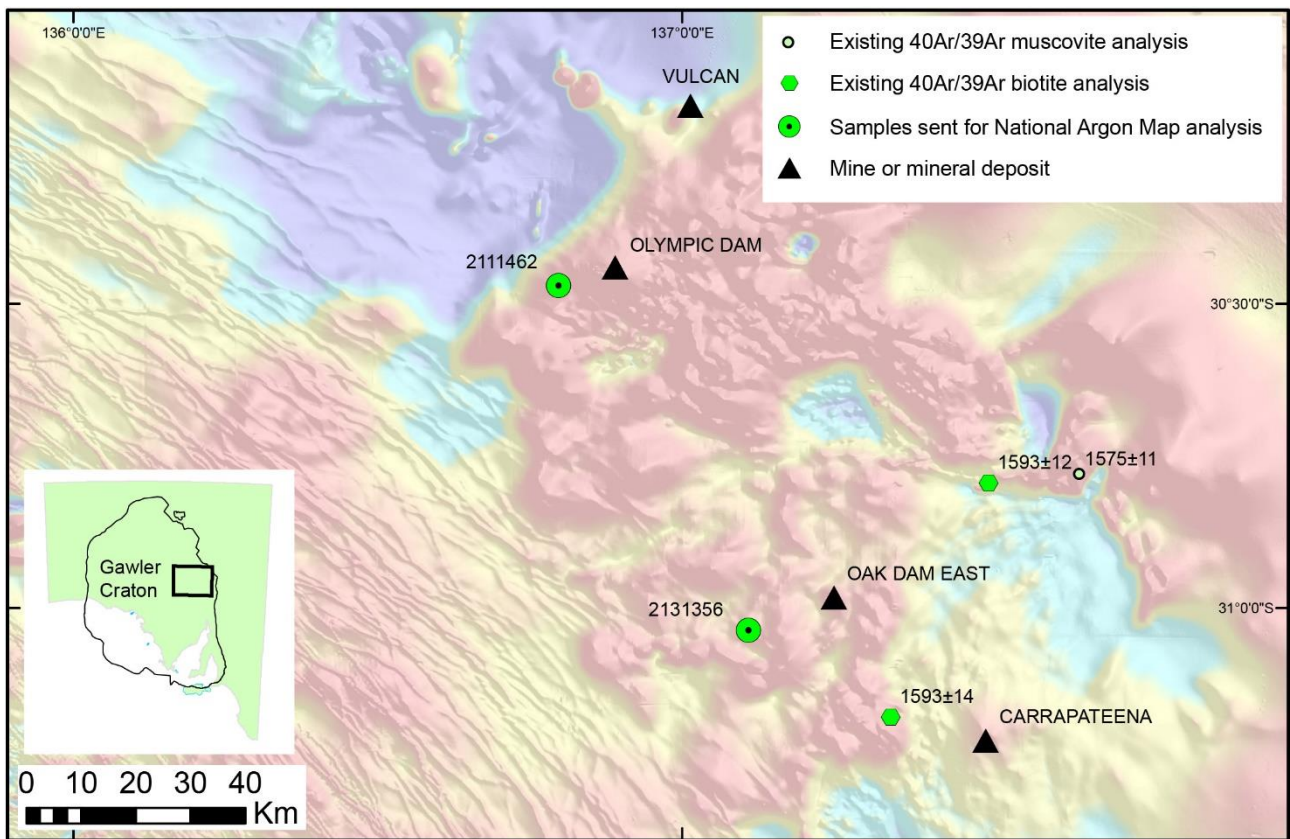
What is the geological question $^{40}\text{Ar}/^{39}\text{Ar}$ analysis will address?

The Olympic Cu-Au Province is a metallogenic province in South Australia that contains one of the world's most significant Cu-Au-U resources in the Olympic Dam deposit. The Olympic Cu-Au Province also hosts a range of other iron oxide-copper-gold (ICOG) deposits including the Prominent Hill and Carrapateena deposits.

Previous thermochronology work within the region of the Olympic Dam deposit has demonstrated that the mineralising event at c. 1590 Ma is also recorded as a thermal event by biotite and muscovite in country rocks of the region (Skirrow et al., 2007).

However, to the north east of Olympic Dam, $^{40}\text{Ar}/^{39}\text{Ar}$ dating of hydrothermal K-feldspar suggests that younger events have also modified the crust in this region, with evidence for c. 1.3 – 1.1 Ga fluid flow (Reid et al., 2017).

The thermal evolution of the Olympic Cu-Au Province is poorly constrained and the influence of younger events poorly known. This proposal seeks to build on the 3 existing $^{40}\text{Ar}/^{39}\text{Ar}$ analyses from the region around Olympic Dam with two more samples. The first is from a hematite altered but unmineralised granite in the vicinity of Olympic Dam. The second is an altered granite in the vicinity of the Oak Dam prospect.



Location map of samples submitted for this National Argon Map application. Note the samples of biotite in the vicinity of Carrapateena and Oak Dam East are from Skirrow et al. (2007).

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

Alteration age.

Mineral target(s) for dating:

K-feldspar

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

Mesoproterozoic

Sample Information

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

Lithological characteristics (rock description):

Sample 2111462 is a coarse grained granite from geothermal drill hole Blanche 1. The granite comprises syenogranite and monzogranite, generally massive but with several zones of low- and high-angle fractures.

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

A CA-TIMS zircon age from this sample yields a crystallisation age of 1591.79 ± 0.42 Mas (Jagodzinski et al., 2021).

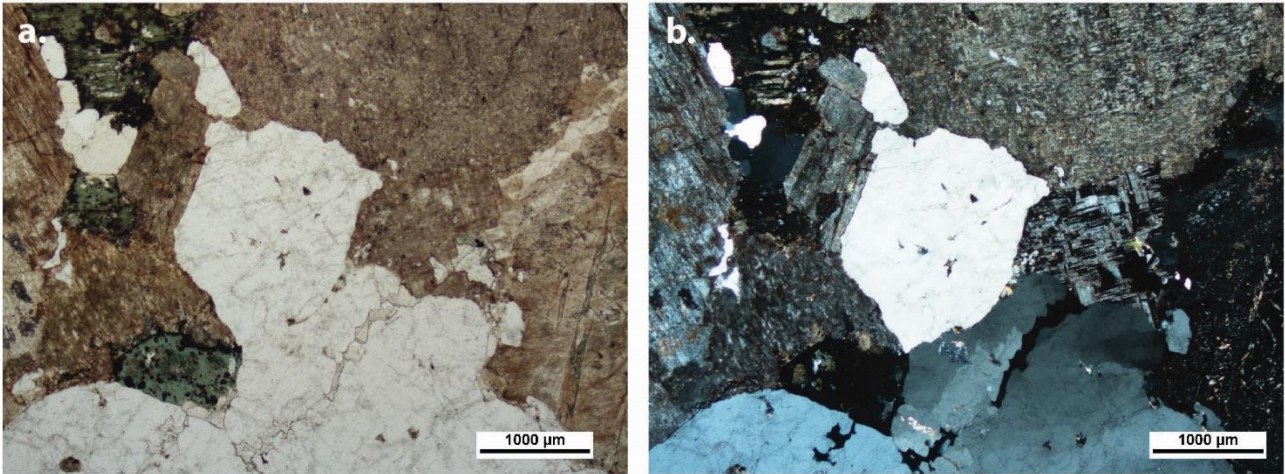
Previous dating from this drill hole was attempted by Hall et al. (2018), who analysed apatite via U-Pb and fission track methods. A weighted mean ^{206}Pb - ^{238}U age of 1559 ± 20 Ma (MSWD=0.53) was calculated from 24 apatite analyses (Hall et al. 2018). Sample 2111462 recorded an AFT central “age” of 207 ± 21 Ma (Hall et al. 2018).

Thin section description (if available):

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



Photograph of sample 2111462.



Photomicrographs of sample 2111462. a. Plain polarised light. b. Cross polars. Photographs show the transition from the hornblende-rich magnetite-bearing alteration on the left of the field of view to the quartz and sericite altered feldspar that represents the granite on the right.

Relevant bibliographic references:

Hall, J.W., Glorie, S., Reid, A.J., Collins, A.S., Jourdan, F., Danišik, M., Evans, N., 2018. Thermal history of the northern Olympic Domain, Gawler Craton; correlations between thermochronometric data and mineralising systems. *Gondwana Research* 56, 90-104.

Jagodzinski EA, Crowley JL, Reid AJ and Bockmann MJ. 2021. High Precision CA-TIMS dating of the Hiltaba Suite, Gawler Craton. Report Book 2021/00001. Department for Energy and Mining, South Australia, Adelaide.

