

National Argon Map: an AuScope Initiative

⁴⁰Ar/³⁹Ar 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): 2131356
Mineral separation required? Yes or No: Y
Date submitted: 20/03/2020

GEOGRAPHIC AREA/ PROVINCE/ BASIN : Gawler Craton	
1:250k SHEET NAME: TORRENS	NUMBER: SH5316
1:100k SHEET NAME: Arcoona	NUMBER: 6335
LOCATION METHOD: (GPS: WGS84 / AGD66 / AGD84 / GDA94) GDA2020	
ZONE: 53	
EASTING: 701269.78	NORTHING: 6564445.28
LATITUDE: -31.0364764	LONGITUDE: 137.1088647

STRATIGRAPHIC UNIT FORMAL NAME *: Donington Suite
STRATIGRAPHIC UNIT INFORMAL NAME: NA
LITHOLOGY: granite

DRILLHOLE ID (if applicable): ASD 1
PROSPECT (if applicable):
DEPTH FROM (metres): 961.45
DEPTH TO (metres): 962.4

* 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 ⁴⁰Ar/³⁹Ar analysis will address?

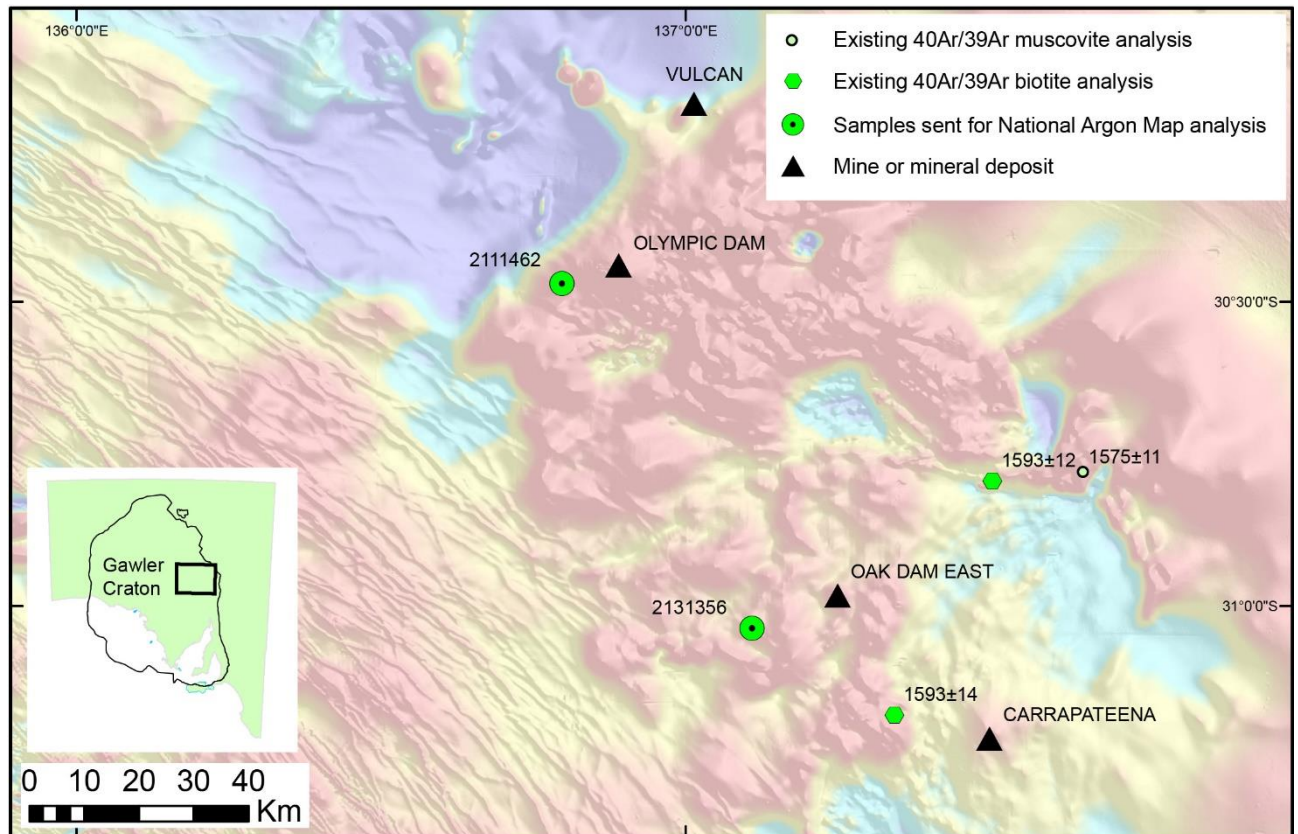
The Olympic Cu-Au Province is a metallogenic province in South Australia that contains one of the world's most significant Cu-Au-U resources in the Olympic Dam deposit. The Olympic Cu-Au Province also hosts a range of other iron oxide-copper-gold (ICOG) deposits including the Prominent Hill and Carrapateena 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, ⁴⁰Ar/³⁹Ar 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 ⁴⁰Ar/³⁹Ar 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):

Fluid alteration and or cooling ages

Mineral target(s) for dating:

Muscovite

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

Mesoproterozoic to Neoproterozoic

Sample Information

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

Drill hole in region of Oak Dam prospect, west of Lake Torrens, SA.

Lithological characteristics (rock description):

Sample 2131356 is an altered granite from drill hole ASD 1. The granite is hematite altered and the muscovite is medium to fine grained. The analysis of muscovite may provide constraints as to the timing of the alteration in the region to the east of Oak Dam. Oak Dam West is a major new discovery by BHP in the region.

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

Host rock is Donington Suite, c. 1850 Ma. Apatite U-Pb date on this sample yielded an age of $206\text{Pb}-238\text{U}$ age of $1811 \pm 26\text{Ma}$ (MSWD=1.2) from 40 apatite grains (Hall et al. 2018).

Thin section description (if available):

Coarse grained, K-feldspar (microcline) rich granite, with quartz, sericite-altered plagioclase and chloritized biotite. Red dusting suggests hematite intergrowths within the plagioclase and K-feldspar.

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



Photograph of sample 2131356, drill hole ASD 1.

Thin section photograph pending.

Relevant bibliographic references:

Hall, J.W., Glorie, S., Reid, A.J., Collins, A.S., Jourdan, F., Danišík, 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.