

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: Nick Roberts
Affiliation: Mineral Resources Tasmania
Project Title: Mid-Cenozoic chronostratigraphy of central and northern Tasmania
Sample Number(s) (including IGSN if one exists): R000538 (MRT Reg No); EV20 (field number)
Mineral separation required? Yes or No: No
Date submitted: 20/07/2021

GEOGRAPHIC AREA/ PROVINCE/ BASIN: Central-NW Tasmania	
1:250k SHEET NAME: Geology of NW Tasmania (2020)	NUMBER: SK55-3 Burnie (old series)
1:25k SHEET NAME: Guildford	NUMBER: 3841
LOCATION METHOD: 1:25000 topographic map, converted to GDA coordinates	
ZONE: 55	
EASTING: 389100	NORTHING: 5414200
LATITUDE: 41°24'58"S	LONGITUDE: 145°40'23"E

STRATIGRAPHIC UNIT FORMAL NAME *:
STRATIGRAPHIC UNIT INFORMAL NAME: Tertiary basalts
LITHOLOGY: Basalt

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 $^{40}\text{Ar}/^{39}\text{Ar}$ analysis will address?

Provide age constraint on the top of a thick, mid-Cenozoic, basalt stack with several thin zones of continental sediments part of the >750-km² basalt plateau near Waratah in northwestern Tasmania. The stratigraphy is penetrated by ten holes drilled in the mid-1980s during MRT's Sub-Basalt Drill Project (SBDP). The age of this sample (from near the top of 250-m basalt sequence) will improve upon existing palynostratigraphy for the SBDP holes and magnetostratigraphy from hole SBDP5 (980 m to the west) specifically. This includes constraining the termination of mid-Cenozoic effusive volcanism in the Waratah area.

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

Cooling/emplacement ages of an individual basalt flow at the base of the ~250-m-thick basalt stack.

Mineral target(s) for dating:

Groundmass

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

Cenozoic. Based on ^{40}K - ^{40}Ar and $^{40}\text{Ar}/^{39}\text{Ar}$ ages of other Tertiary basalt-flow sequences in this part of Tasmania, the age is likely to be between ca. 40 and 20 Ma. Palynostratigraphic constraints from thin sediment zones in SBDP holes, including SBDP5 (the closest hole) and SBDP4 (4.8 km to the southeast) penetrating the basalt sequences narrow the expected age range to latest Eocene to early-Oligocene time (Seymour, 1989).

Magnetostratigraphy from the basalts in SBDP5 (Lucas, 1988) records a (top-down) N-R-N-R polarity sequence. Seymour (1989) interprets these magnetozones as recording Chron 13, which is currently dated to 34.999 Ma

(base of C13.r) 33.157 Ma (top C13.n) based on a spline fit of the geomagnetic polarity timescale (GPTS) (Ogg, 2020); this sample correlates to the upper part of the highest normal magnetozone in SBDP5, suggesting a potential numerical age between 33.705 Ma 33.157 Ma. However, the previously proposed polarity correlation is uncertain as refinement of the GPTS over the last few decades has shifted several polarity reversals such that a different Chron may be recorded by the polarity sequence.

Sample Information

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

This surface sample is from 12 km east-northeast of Waratah, Tasmania. It is along Guildford Road ~3.6 km from the junction with Ridgley Highway. The sample is from an elevation of ~580 m asl, just less than a kilometre east of SBDP5.

Lithological characteristics (rock description):

Porphyritic basalt with olivine phenocrysts (chemically an olivine tholeiite).

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

This sample is from an outcrop that, based on its elevation, corresponds one of the uppermost flows in the ~250-m-thick flow stack penetrated by the nearby (<1 km to the west) SBDP5 drill hole. Assuming that the flows are horizontal, of consistent thickness, and not faulted, this surface sample likely comes from either flow 26 or 27 in the 28-flow sequence in SBDP5 described by Lucas (1988). The basalt sequence in SBDP5 is underlain by 49 m of hyaloclastite that in turn overlies Cambrian basement.

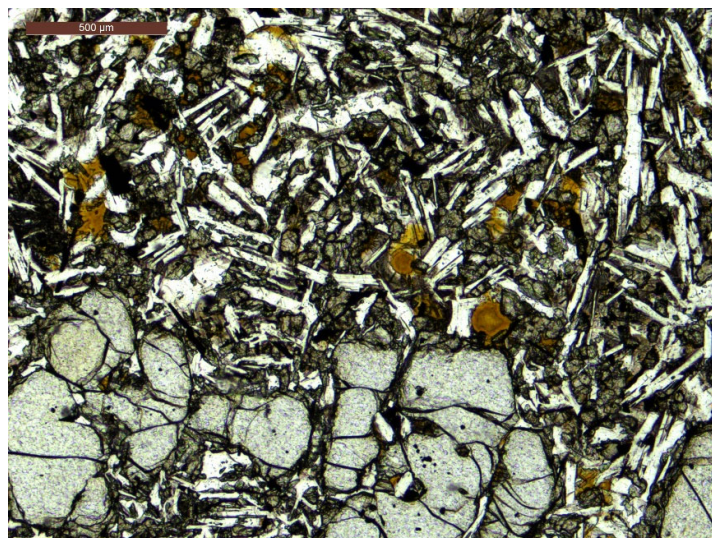
Based on stratigraphic relationships, the present sample should be younger than the two basalt samples from the bottoms of nearby drillholes that are also being submitted for dating in this batch: sample A500731 (221.8 m depth in hole SBDP5) is ~192 m lower; sample A501207 (364.4-365.5 m depth in hole SBDP4) is ~290 m lower.

Thin section description (if available):

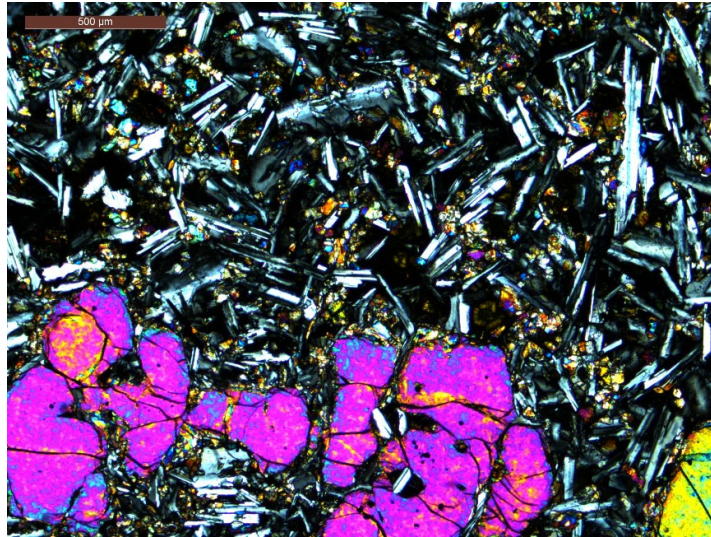
A porphyritic basalt with olivine phenocrysts (mostly 0.5 – 2mm) in an intergranular groundmass. The olivine phenocrysts are commonly deeply embayed and mostly fresh, but some are completely replaced by a fine-grained fibrous pale brown alteration product. The groundmass consists of randomly oriented plagioclase laths (~200 – 400um), interstitial colourless augite granules (~30 – 100um), narrow elongate ($\leq 200\mu\text{m}$) to equant angular opaques, and a fairly abundant orange-brown \pm isotropic smectite-like secondary mineral (hisingerite?) filling interstices.

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

These and additional photomicrographs have been provided to laboratory staff at Curtin University.



R000538_EV38_x5_PPL



R000538_EV38_x5_XN

Relevant bibliographic references:

Lucas, D.S. 1988. *Magnetics of the Tertiary basalts of north-western Tasmania*. B.Sc. thesis, Geology Department, University of Tasmania. 109 pp.

Ogg, J.G. 2020. *Geomagnetic Polarity Time Scale*. In *The Geologic Time Scale 2020* (Gradstein, F.M., Ogg, J.G., Schmitz, M.D, Ogg, G.M. [Eds.]). Elsevier. p. 159-192.

Seymour, D.B. 1989. *Geological atlas 1:50 000 series. Sheet 36 (8015N). St Valentines*. Geological Survey Explanatory Report, Tasmania Department of Mines. ER80155 147 pp.