National Argon Map: an AuScope initiative

Data Acquisition Project Proposal

This form should be completed and returned to Geoff Fraser (Geoff.Fraser@ga.gov.au) for consideration by the National Argon Map Oversight Panel

Project Proponent

Name: Phil Gilmore
Affiliation and position: Manager, Regional Mapping, Geological Survey of New South Wales
Collaborators: Geoscience Australia, University of Wollongong, Lord Howe Island Board, Lord Howe Island Nature Tours
Project Title: New Ar-Ar geochronology age constraints on the Lord Howe Seamount Chain
Geographic Region:
Geological Province or Tectonic Unit: Balls Pyramid volcanics, Lord Howe Seamount Chain

Brief Project Description:

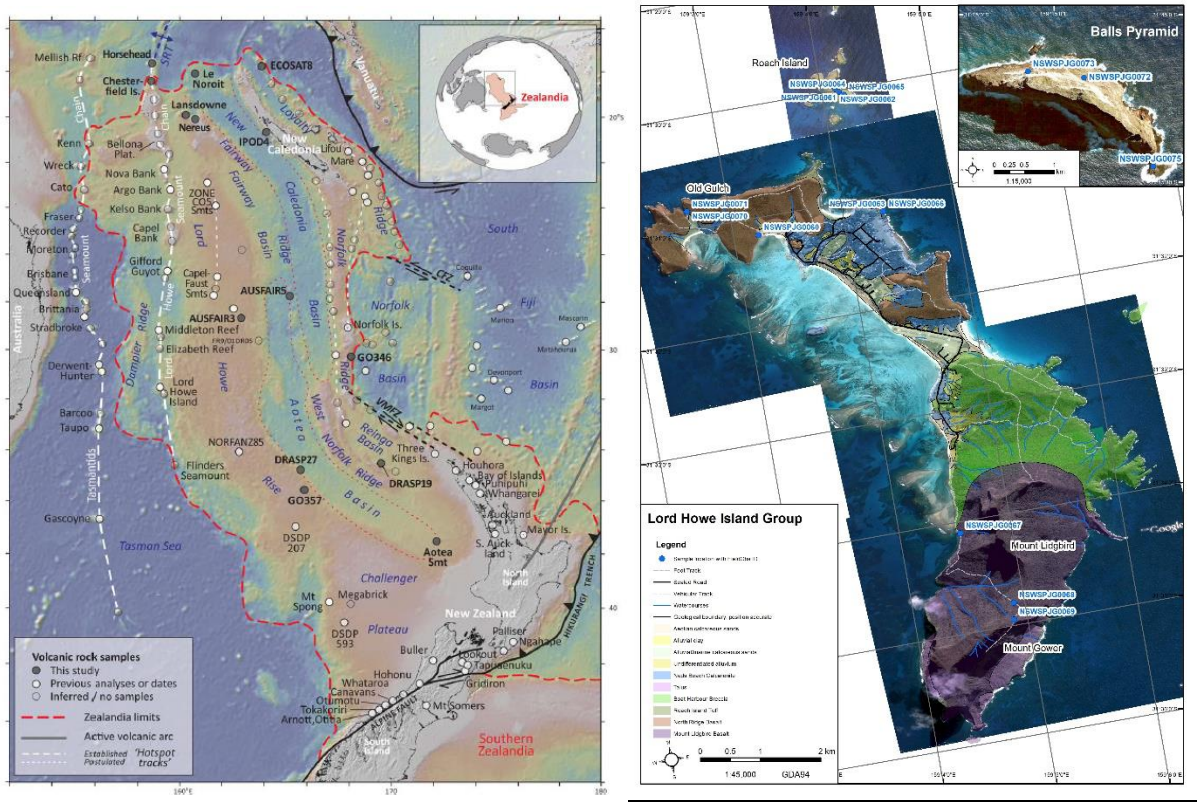
Balls Pyramid is a rock stack approximately 15km southwest of Lord Howe Island, though separated by 4000m water depth. Balls Pyramid is interpreted to be the youngest exposed seamount in the Miocene Lord Howe Island Seamount Chain, related to mantle plume activity as the Australian plate drifts north.

An Ar-Ar date would be the first geochronology of the seamount and compliment recent Ar-Ar on Lord Howe Island by GSNSW (Gilmore et al. in prep.). This work showed the benefit of high resolution Ar-Ar geochronology – with errors an order of magnitude lower (~ ±10 000 years) than from previous K-Ar geochronology in the 1970s (~ ±100 000 years).

The date will help determine the timing of volcanism, mantle plume longevity and timing of plate movement. This will benefit researchers from Geoscience Australia, University of Sydney, University of Wollongong, GNS and JAMSTEC who are all involved in research of the Lord Howe Island Seamount Chain – and the parallel belts of the Tasmantid Seamount Chain and the Australian continental central volcanoes to the west. The date will also benefit geotourism on Lord Howe Island, by developing the understanding of this world heritage area.

Landing on Balls Pyramid is hazardous and sampling is prohibited without a permit under World Heritage guidelines. This sample was collected under a research permit in 2017, but was previously deemed not to be fresh enough for Ar-Ar analysis. Recent conversations with Dr Marnie Foster (ANU) has indicated that Ar-Ar analysis may be success on this sample, supported by identification of fresh plagioclase phenocrysts and plagioclase and clinopyroxene crystals in the groundmass under a microscope by Dr Kate Bull (then GSNSW).

Thin section (T090734) is in the GSNSW petrology collection, and information on the sample is available in MinView under the sample ID NSWSPJG0075.



Left: Location of Lord Howe Island (white circle) and Balls Pyramid (grey circle) near Lord Howe Island label (Source Mortimer et al. 2017). Right: Sample location on Balls Pyramid (top right) (Source: Gilmore et al. in prep.).

Approximate number of samples proposed for $^{40}Ar/^{39}Ar$ analyses:
1

Lithologies and minerals proposed for $^{40}Ar/^{39}Ar$ analyses:
Whole rock, basalt

Do you have a preferred ^{40}Ar-^{39}Ar laboratory? (ANU, Curtin, UQ, UMelb):
ANU.

If so, why you prefer this laboratory (e.g. student affiliation, ongoing relationship, sample type etc):
Recent Ar-Ar analysis was done by UMelb on fresh samples from Lord Howe Island. Due to weak weathering of this sample, and recent successful collaboration with Dr Marnie Foster, ANU is preferred laboratory.

Guidelines and Criteria

Project Proposals for funding support as part of the AuScope National Argon Map initiative will be assessed on the following criteria.

Australian: Samples must come from Australia (this may include Australian offshore regions)

Non-confidential: $^{40}Ar/^{39}Ar$ data must be made publicly-available (ie non-confidential)

Impact: to what extent new $^{40}Ar/^{39}Ar$ data from the proposed samples will contribute to geographic data coverage, or address key geological questions

Feasibility: whether the nature of the work is tractable via $^{40}Ar/^{39}Ar$ geochronology and the scale of the proposal is realistic within the time frame of the National Argon Map initiative (January 2020 – June 2021)?

Appropriate sample material: whether the proposed samples are (i) appropriate for $^{40}Ar/^{39}Ar$ analyses, and (ii) available within the time-frames of the National Argon Map initiative?

Oversight Panel

Dr Geoff Fraser, Geoscience Australia
Professor Zheng-Xiang Li,
Dr Anthony Reid, Geological Survey of South Australia
Peter Rea, MIM/Glencore
Dr Catherine Spaggiari, Geological Survey of Western Australia
Dr David Giles, MinEx CRC
Dr Marnie Forster (observer role as Project Coordinator)

Expectations

AuScope funding will cover the costs of sample irradiation and isotopic analyses.

Project Proponents will be responsible for:

- Provision of appropriate sample material. This includes mineral separation, which can be arranged at the relevant $^{40}Ar/^{39}Ar$ laboratories (in many cases this is preferred), but costs of mineral separation will be borne by the project proponent. The relevant laboratory reserves the right not to analyse material if it is deemed unsuitable for $^{40}Ar/^{39}Ar$ analysis.
- Provision of appropriate sample information. A sample submission template will be provided. Information in these sample submission sheets will form the basis of data delivery/publication, and the oversight committee or relevant laboratory reserves the right not to proceed with analyses unless and until appropriate sample details are provided. This includes description and geological context for each sample.
- Leading the preparation of reports and/or publications to deliver $^{40}Ar/^{39}Ar$ results into the public domain within the duration of the National Argon Map initiative (January 2020 – June 2021).
- Project Proponents will be expected to communicate directly with the relevant $^{40}Ar/^{39}Ar$ laboratory once a project has been accepted by the Oversight Committee, in order to clarify project expectations, arrange sample delivery, discuss results, collaborate on reporting and data delivery etc.

Participating Ar Laboratories will be responsible for:

- Providing advice to project proponents regarding suitable sample material and feasibility of proposed work
- Irradiation of sample material
- $^{40}Ar/^{39}Ar$ isotopic analyses
- Delivery of data tables, and analytical metadata to project proponents

Queries regarding possible projects as part of the National Argon Map initiative can be directed to Marnie Forster (Marnie.Forster@anu.edu.au) or Geoff Fraser (Geoff.Fraser@ga.gov.au)