

**MARINE
NATIONAL FACILITY**

2005 RV *Southern Surveyor* program

voyageplan

SS09/2005

Naturaliste Plateau

Itinerary

Depart Fremantle 1600 hrs 21/10/05

Arrive Fremantle 0800 hrs 16/11/05

Principal Investigator

Prof Anthony J Crawford

School of Earth Sciences, University of Tasmania

Private Bag 79, Hobart, TAS 7001

Phone: 03-62262490 **Email:** Tony.Crawford@utas.edu.au

Scientific Objectives

The key target of this research voyage is to multibeam swath-map and sample by dredging the basement rocks of the Naturaliste Plateau and the Diamantina Zone immediately further south. The latter zone formed during ultra-slow spreading between Australia and Antarctica ~100 Ma, and was almost amagmatic, with exposures of upper mantle peridotites exposed as ridges on the seafloor. The nature of the upper mantle and the small volume basaltic magmatism in this relatively cold extensional setting are of great interest, and can be compared with slow-spread crust sampled on the Gakkel Ridge (Arctic Sea) and the Galician margin of Spain.



Two prior dredges carried out on the margins of the Naturaliste Plateau suggest that at least some of the basement may be composed of Proterozoic metamorphic rocks of the same age as those exposed in the Leeuwin Complex, which are exposed as a narrow coastal strip on the adjacent shoreline around Cape Leeuwin. If the plateau is indeed largely continental, then its basement rocks will provide a rare glimpse of the recently proposed Kuunga Suture, the last suture in the assembly of Gondwana, believed to have formed ~ 500 million years ago. Finally, during Gondwana breakup around 120 million years ago, the Naturaliste Plateau was located near the junction of the three major plates: Australia, Antarctica and Greater India. Claimed proximity at this time to the massive plume head outpourings of basalt that formed the Kerguelen Plateau (and Bunbury basalts onshore south of Perth) suggest that the Naturaliste Plateau may be part of a large igneous province, effectively the easternmost end of the Kerguelen Plateau. Dredging scarps around the northwestern, western and southern margins of the Naturaliste Plateau will provide a far more comprehensive understanding of the geological evolution of this region than is presently available.

Voyage objectives and time estimates

The voyage objectives are very simple, and fall into two parts. The first part will involve approximately 10 days of swath mapping the margins of the plateau (Figure 1), with swath paths about 3-4 km apart to ensure coverage of the relatively steep slopes on large sections of the margin. The actual voyage path (initially south from Fremantle then starting swath mapping along a clockwise path, or alternatively starting directly west from Fremantle and commencing an anti-clockwise swath path) will depend on the weather, predicted currents, and recommendations from the ship's master. We estimate the proposed swath path will take ~10 days, following a 1.5 day transit to where we commence the main swath operation.

The second part of the voyage will involve dredging steep slopes on targets identified by the swath mapping, using a chain-bag dredge. We estimate that with likely dredge targets at depths from 3500-1500m, about 13 days of dredging will yield ~35-40 dredges before the 1.5 day transit back to Fremantle.

Voyage Track

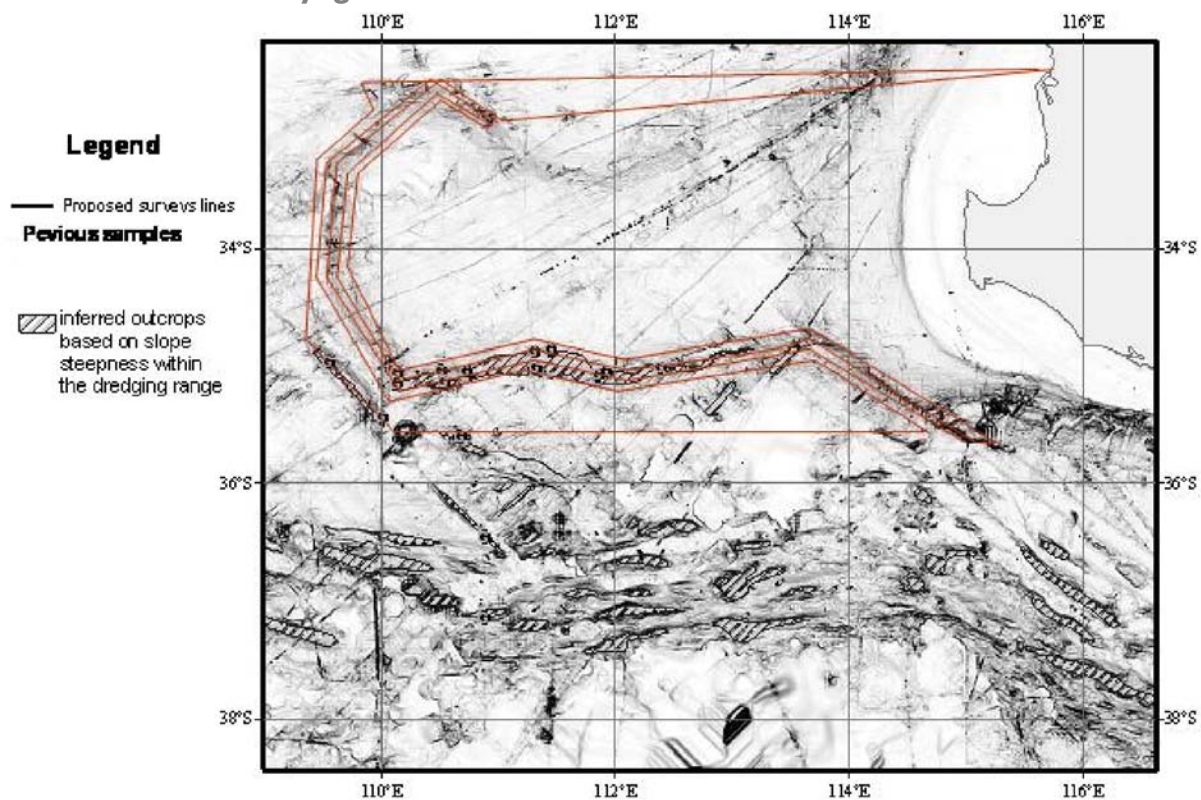


Figure 1: Proposed voyage track to and from Fremantle, including an estimated 4 subparallel tracks for swath mapping the southern and western margin of the Naturaliste Plateau.

Piggyback projects

There are no planned piggyback projects.

RV *Southern Surveyor* equipment

Chain-bag dredges (3 available on the National facility, and we will ask GA to leave 2 of theirs aboard following voyage 08/05 in the same region).

Consumables – paper for multibeam swath mapper
– shear pins for dredges
– steel, chain for dredge maintenance

User equipment

Two chain-bag dredges to be provided by GA. White plastic rock drums will be provided.

Personnel list

Tony Crawford – University of Tas, Chief Scientist
Bob Beattie – CMAR, Voyage Manager/Computing Support
Stephen Thomas – CMAR, Electronics Support
Cameron Buchanan – Geoscience Australia, Swath mapping
Prof Mike Coffin – University of Tokyo
Dr Nick Direen – University of Adelaide
Dr Caroline Forbes – Geological Survey of WA
Lesja Mitrovic – University of Adelaide, PhD student
Ben Cohen – University of Queensland, PhD student
Bence Paul – Melbourne University, PhD student
Galen Pettigrew – University of Tasmania, Student
Cameron Hamilton – University of Tasmania), Student

This voyage plan is in accordance with the directions of the National Facility Steering Committee for the Research Vessel RV *Southern Surveyor*.

Prof AJ Crawford

Chief Scientist