



2006 RV Southern Surveyor program

voyageplan

Hot Subduction – recycling of oceanic crust
in a dynamic W Pacific setting. Part 2.

Itinerary

Depart Suva, Fiji, 1600hrs Friday 18 August, 2006

Arrive Noumea, New Caledonia, 0800hrs Monday 11 September, 2006

Principal Investigator

Assoc. Prof. Leonid Danyushevsky (Chief Scientist)

CODES CoE, University of Tasmania

Phone: 03-62262469 **Fax:** 03-62267662 **Email:** L.Dan@utas.edu.au.

Dr. Trevor Falloon

School of Earth Science and Centre for Marine Studies, University of Tasmania

Phone: 03-62262270 **Fax:** 03-62262547 **Email:** Trevor.Falloon@utas.edu.au



Scientific Objectives

This project aims to study the seafloor between Fiji and Vanuatu in the SW Pacific. This is a continuation of research undertaken during voyage SS10/2004.

This fundamental research in petrology and geochemistry addresses magma generation processes at active transition zones between continents and oceans. In such areas, the Earth's oceanic lithosphere is subducted back into the mantle triggering extensive volcanic activity. These processes form complex chains of volcanic islands separated from continents and from each other by extensional backarc basins. It is widely accepted that this magmatism plays an important role in the formation of the Earth's crust, atmosphere and hydrosphere.

The submarine Hunter Ridge (between Fiji and Vanuatu) contains unusual magmatic rocks not normally associated in time and space, some of which require abnormally hot temperatures during subduction. One of these magma types was discovered for the first time in a modern setting during voyage SS10/2004. Such rocks are a subject of international interest as they have implications for magma genesis on the early Earth, for which theoretical and experimental studies have proposed abnormally hot (cf. modern day) subduction zones.

To fully understand the significance of this new exciting discovery, we need to know the age and spatial distribution of magmatic rocks on the Hunter Ridge and their relationship to young magmatic rocks exposed on Kadavu Island at its northern end. This also has implications for tectonic reconstructions of the SW Pacific and understanding of SE Australia geology.

Voyage Objectives

We intend to conduct a multibeam survey, a magnetics survey and rock sampling in three areas along the Hunter Ridge. The questions which we are seeking to answer are as follows:

Kadavu and northern Hunter Ridge (area 1)

Questions: 1) What is the lateral extent of adakites on the seafloor around Kadavu Is?

2) What is the structural relationships between the northern Hunter Ridge and Kadavu Island? To answer these questions we plan to do detailed swath mapping, sound-bottom profiling and dredge sampling in area 1. The use of the sound-bottom profiler will be vital in determining whether the seafloor has a volcanic, sediment-poor, basement or alternatively the seafloor is formed by sediments. This information will significantly help the interpretation of the swath mapping.

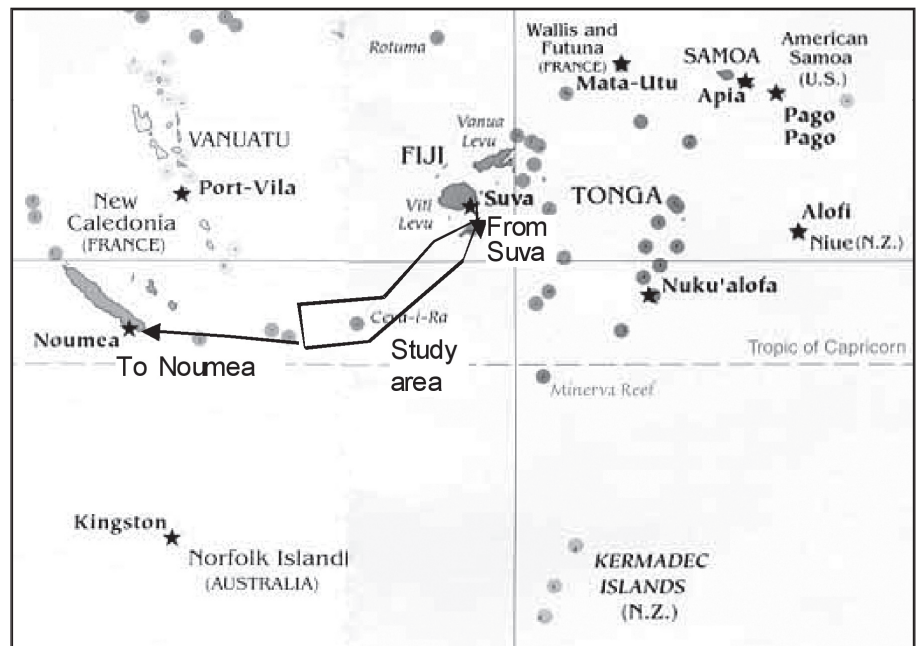
Rift Zone at the southern end of the Hunter Ridge (area 2)

Questions: 1) What is the distribution of different magma types within the rift? To answer this question we wish to perform 10-15 dredges within the main rift zone between 1500-2500m water depth.

North Fiji Basin propagating spreading centre (area 3)

Questions: 1) What is the age and rate of southward propagation of the spreading centre? We plan to conduct a magnetic survey along 3 lines across the spreading ridge to obtain magnetic profiles. Due to the limited time during voyage SS10/2204 to conduct a detailed sampling of the spreading centre, we plan to do further sampling using a specially modified piston corer, designed for sampling glassy pillow rinds of young lavas.

Voyage track



Time Estimates

Transit to Area 1 from Suva will take ~ 5 hours.

Swathe mapping and dredging in Area 1 will take from 10 to 15 days. The exact timing will depend on the tectonic features present on the seafloor and the extent of sedimentary cover. We plan to conduct 10-15 dredges in this area.

Transit to area 3 will take ~ 24 hours.

Magnetic survey in area 3 will take ~ 24 hours (~ 240 nautical miles). Wax piston coring along the spreading axis in Area 3 will take ~ 50 hours. We plan to conduct ~ 20 piston core samples.

Transit from Area 3 to Area 2 will take ~ 5 hours.

We plan to spend 5-10 days in Area 2 depending on the time spent in Area 1. During this time we will perform swathe mapping and dredging. The maximum of 30 dredges will be done in this area.

Transit from Area 2 to Noumea will take ~ 24 hours.

Southern Surveyor Equipment

Dredges (2), including winches and wire for dredging, safety pins, spare weak link, spare chain bag links and shackles for attaching the chain bag to the dredge.

- We plan on conducting a maximum of 60 dredges during the voyage at water depths less than 3,500 meters.

To optimise the number and ratio of successful dredges we are planning to dredge under the following conditions:

- rate of dredge deployment ~ 60-70 meters/minute until the length of wire out equals the depth under the ship;
- speed of the ship during deployment approaching the touch down position ~ 5-6 kn;
- rate of dredge recovery once off the bottom ~ 60-70 meters/minute;
- to ensure representative sampling of the seafloor, we will need to dredge both into the wind and with the wind - the use of bow thrusters is essential when dredging with a tail wind;
- it is important, while sea conditions allow, that the scientific personnel are able to process the sample from the dredge on deck while the ship proceeds to the next station.

CTD winch with the 8 mm conducting cable for piston corer sampling:

- The cable should be equipped with a pressure meter calibrated to depths of at least 4,000 meters.
- We plan to conduct ~ 25 piston corer stations. The ship must remain stationary during coring, which makes the use of bow thrusters essential. The procedure involves :
- deploying the corer to the depths ~ 30-40 m above the sea floor with a rate of > 70 meters/minute;
- when at that depth, an extra 80 meters of wire is deployed with the maximum possible rate to ensure the highest impact on the seafloor. The corer should be recovered at the fastest possible rate.

Access to **differential GPS** is highly desirable within the study area.

Swathe mapper EM 300. Swathe mapping is one of the major activities during the voyage. During mapping surveys the swathe mapper will be running 24 hours/days. To ensure 24 hour operation Andrew Stacey from the scientific party will receive appropriate training at GA prior the start of the voyage.

Sub-bottom profiler

Single-beam echo sounder EA 500. EK 500

The use of the single-beam echosounder is essential when the ship is stationary over a sampling station to monitor water depth.

The **Fish laboratory** will be used for washing, sorting, initial description and packing of dredge and piston corer samples.

User Equipment

Piston wax corer. The corer (~ 2 meters long) will be transported to the ship in a wooden case and needs to be secured on deck close to the winch with the 8 mm conducting cable.

Magnetometer on loan from GA. The magnetometer will be supplied by GA with the winch and cable. GA will also provide plans for securing the winch on deck.

Two spare dredges on loan from CSIRO Exploration and Mining.

Binocular microscope to be positioned in the small room in the front end of the Fish laboratory.

Personnel List

Leonid Danyushevsky	Univ. of Tasmania	Chief Scientist
Trevor Falloon	Univ. of Tasmania	Geochemist
Michael Roach	Univ. of Tasmania	Geophysicist
Patrick Quilty	Univ. of Tasmania	Palaeontologist
Pavel Plechov	Moscow State Univ., Russia	Geochemist
Roman Leslie	Univ. of Tasmania	Geochemist
Andrew Stacey	Univ of Tasmania	Geophysicist; PhD student
Michelle Farran	Univ of Tasmania	Geologist; PhD student
Fijian rep., TBC	MRD, Fiji	Geologist
Vanuatu rep., TBC	Vanuatu geological survey	Geologist
Michele Spinoccia	Geoscience Australia	Swath data processing
Bob Beattie	CSIRO/MNF	Computing Support/ SST
Stephen Thomas	CSIRO/MNF	Electronics Support/Voyage Manager

SST – System Support Technican

MNF – Marine National Facility

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

Leonid Danyushevsky
Chief Scientist