

MARINE
NATIONAL FACILITY

2004

RV Southern Surveyor
program

voyageplan

SS10/2004

Hot subduction – recycling of oceanic crust
in a dynamic W Pacific setting.

Itinerary

Depart Brisbane 1000 hrs, Saturday 2 October, 2004

Arrive Nuku'alofa, Tonga 1000 hrs, Tuesday 26 October, 2004

Principal Investigators

Dr. Leonid Danyushevsky (Chief Scientist) – CODES SRC and School of Earth Sciences,
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CSIRO
MARINE RESEARCH

Scientific Objectives

Production of continental crust mainly occurs in the 'subduction factory' of the W Pacific region, via recycling (subduction) of old oceanic crust back into the mantle. In most instances, this old, altered, wet oceanic crust being returned to the mantle dehydrates at <100km depth. Water released in this process ascends into the mantle 'wedge' above the subducted 'slab' of oceanic crust, triggering partial melting, and the generation of magmas that rise to form the well-known island arc volcanoes of the Pacific 'ring of fire'.

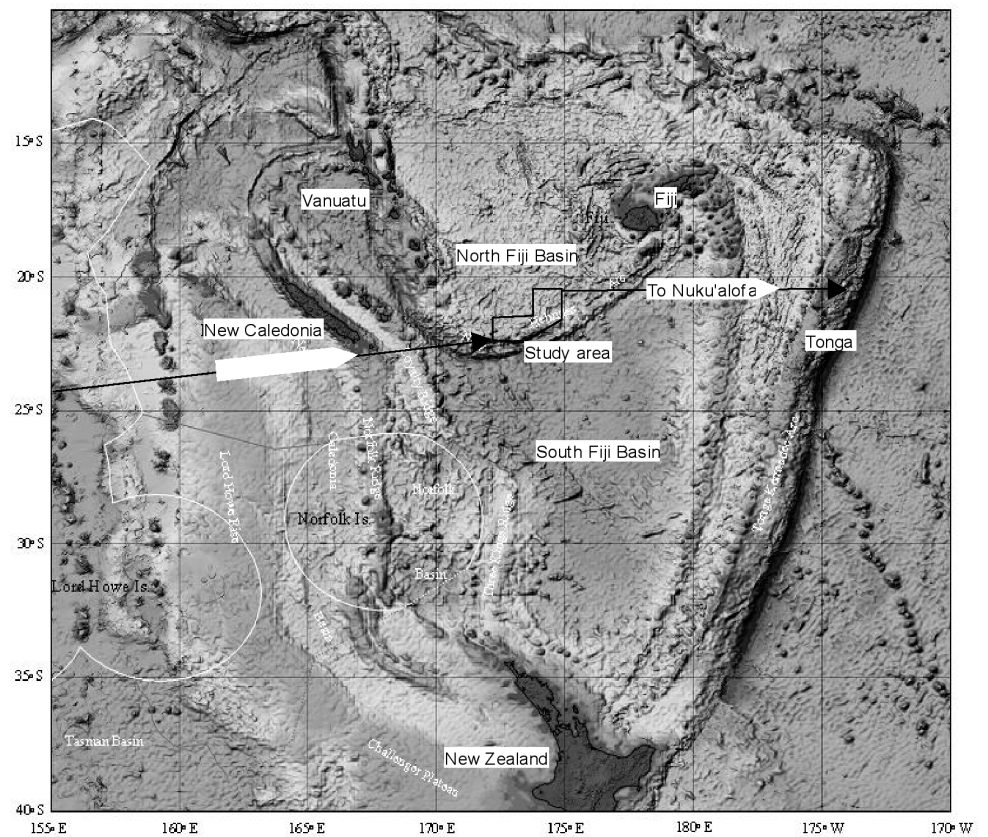
We wish to discover the nature of subduction-related magmas associated with an abnormally young and hot over-riding mantle above the subducting slab. Such settings are rare globally, but one well developed example occurs where the main N-S orientated spreading centre of the actively opening North Fiji Basin (between Fiji and Vanuatu) is propagating into the submarine Hunter Ridge; an extinct island arc formed ~7 and 3 million years ago. We wish to know how this young, very hot mantle wedge affected dehydration/melting of the down-going slab of oceanic crust, what type of magmas were generated, and whether any chemical signal is being transmitted from the slab along the active spreading centre. The study has implications for magma genesis on the early Earth, for which theoretical and experimental studies have proposed abnormally hot (cf. modern day) subduction zones.

Voyage Objectives

Key problems we wish to address during this cruise include:

- 1) the exact location of the propagating tip of the North Fiji spreading centre, where it interacts with the Hunter ridge, is unknown due to the lack of seafloor mapping between 173-174°E, ~ 22°S. We plan to conduct seafloor mapping in this area.
- 2) the nature of magmas associated with subduction into very hot, young over-riding oceanic lithosphere. Does the downgoing slab partially melt, rather than dehydrate, thus imprinting quite distinctive geochemical features on the magmas generated? We plan to conduct systematic dredging in the area to reveal the compositional range of erupted magmas.

Voyage Track



Time Estimates

1000 hrs, 02/10 - 2200 hrs, 06/10

Transit from Brisbane to Study area: ~ 1,200 miles; ~4.5 days;

2200 hrs, 06/10 - 1500 hrs, 23/10

Dredging and mapping in the study area 172.7-174.4oE and 21-22.5oS
(mapping of ~7,500 km² within 8.5 days; 25 dredges within 8.5 days)

1500 hrs, 23/10 - 1000 hrs, 26/10

Transit from Study area to Tonga: ~ 750 miles; ~3 days.

Piggy-back Projects (if any)

N/A

Southern Surveyor Equipment

Swathe mapper

Dredges; winches and cables for dredging

Binocular microscope

User Equipment

Large rock-cutting saw to fit on deck

Small rock-cutting saw

Additional dredges

Additional binocular microscope

Personnel List

Leonid Danyushevsky – Univ. of Tasmania, Chief Scientist

Trevor Falloon – Univ. of Tasmania, Geochemist

Chris Small – Columbia University, Geophysicist

Andrew Stacey – Univ of Tasmania, Geophysicist; PhD student

Sofia Tetroeva – Univ of Tasmania, Geochemist; PhD student

Patricia Sie – Monash University, Geochemist; PhD student

Ilai Waga – MRD, Fiji University, Geologist

Pamela Brodie – CSIRO Marine Research, Computing/Voyage Manager

Drew Mills – CSIRO Marine Research Electronics Support

Hiski Kippo – CSIRO Marine Research, Computing Support (Trainee)

Andrea Cortese – Geoscience Australia, Swath Mapping

Michele Spinoccia – Geoscience Australia, Swath Mapping

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