RV *Investigator* Scientific Highlights

Voyage #:	IN2015_C01
Voyage title:	GAB deep water geological and benthic ecology program
Mobilisation:	Hobart, 0900 Thursday, 22 October 2015–Sunday, 25 October 2015
Depart:	Hobart, 1800 Sunday, 25 October 2015
Return:	Port Lincoln, 0800 Saturday, 28 November 2015
Demobilisation:	Port Lincoln, 0900-2359 Saturday, 28 November 2015

Introduction

The Great Australian Bight (GAB) represents one of Australia's most prospective frontier hydrocarbon exploration regions but the region remains poorly studied and understood. This voyage aims to understand how this large basin evolved since Australia's separation from Antarctica, the geological processes that have shaped this deep water environment and the benthic communities that currently reside there.

The voyage objectives were built around three main survey targets:

- Collection of samples from deep water rock outcrops to help characterise the sediments and paleo-environment of the GAB over the last ~90 million years
- Characterise, assess and sample areas of potential seepage to determine if hydrocarbon seepage can be identified. Seeps, indicative of a subsurface hydrocarbon systems, provide unique habitats for chemosynthetic biological communities and provide information of subsurface processes.
- Identify, characterise and sample deep water seamounts to help understand the nature of the unusual volcanism that occurred in the Great Australian Bight ~40 million years ago.

At all of the sites, collect biological samples to describe the deep water animals that live in, or at, the seafloor in the deep water soft and hard sediments of the Great Australian Bight.

The voyage undertaken over 34 days was a great success with 37 researchers from seven research organisations and the vessel crew undertaking 128 operations in water depths ranging from 700 m to 5,437 m. The voyage deployed a diverse and large collection of instrumentation fully utilising the *Investigator* capabilities. This involved the deployment of some of the equipment types significantly deeper than previous deployments either in Australia or worldwide. The data and samples collected significantly augment the sparse data and sample collections within the deep water GAB to date.

Contribution to the nation

The collection of data and samples in this poorly studied region will permit a more detailed understanding of the geological evolution and biological communities of the Southern margin of Australia.

This is important from a fundamental understanding of the processes and environment that have shaped this region overtime and will also help in the understanding of the prospectivity of the margin. An understanding of the seafloor benthic habitats and biological communities will enable us to understand how deep water biological communities function and inform future management decisions on oil exploration and development, commercial activities and preservation of this deep water marine environment.

As a result of this voyage

Through our collections of samples and data from between 700 m to 5437 m, our understanding of the geological evolution of the GAB, including the distribution and occurrence modern day benthic fauna, will greatly enhance our understanding of the region.

We have collected 25,553 biological specimens including a number of species which may be the first records of their kind in Australia. We have also collected 1.3 tons volcanic and sedimentary rocks, which for the volcanics have never been previously sampled in the GAB.

We have mapped 28,922 km^2 of seafloor by multibeam sonar, 10,225 km^2 of which was at high resolution, finding several previously unmapped deep water canyons and ten previously unmapped volcanic seamounts and revealing a complex deep water sedimentary environment.

We have commenced a program of detailed analysis and interpretation of the geological and biological samples. This will be integrated with the processed voyage data to better inform the processes that have formed the Great Australian Bight and describe the present day environment and fauna.

CSR/ROSCOP Parameter CodeS

	METEOROLOGY
M01	Upper air observations
M02	Incident radiation
M05	Occasional standard measurements
M06	Routine standard measurements
M71	Atmospheric chemistry
M90	Other meteorological measurements

	PHYSICAL OCEANOGRAPHY
H71	Surface measurements underway (T,S)
H13	Bathythermograph
H09	Water bottle stations
H10	CTD stations
H11	Subsurface measurements underway (T,S)
H72	Thermistor chain
H16	Transparency (eg transmissometer)
H17	Optics (eg underwater light levels)
H73	Geochemical tracers (eg freons)
D01	Current meters
D71	Current profiler (eg ADCP)
D03	Currents measured from ship drift
D04	GEK
D05	Surface drifters/drifting buoys
D06	Neutrally buoyant floats

	MARINE BIOLOGY/FISHERIES
B01	Primary productivity
B02	Phytoplankton pigments (eg chlorophyll, fluorescence)
B71	Particulate organic matter (inc POC, PON)
B06	Dissolved organic matter (inc DOC)
B72	Biochemical measurements (eg lipids, amino acids)
B73	Sediment traps
B08	Phytoplankton
B09	Zooplankton
B03	Seston
B10	Neuston
B11	Nekton
B13	Eggs & larvae
B07	Pelagic bacteria/micro-organisms
B16	Benthic bacteria/micro-organisms
B17	Phytobenthos
B18	Zoobenthos
B25	Birds
B26	Mammals & reptiles
B14	Pelagic fish
B19	Demersal fish
B20	Molluscs
B21	Crustaceans
B28	Acoustic reflection on marine organisms

D09	Sea level (incl. Bottom pressure & inverted echosounder)
D72	Instrumented wave measurements
D90	Other physical oceanographic measurements

	CHEMICAL OCEANOGRAPHY
H21	Oxygen
H74	Carbon dioxide
H33	Other dissolved gases
H22	Phosphate
H23	Total - P
H24	Nitrate
H25	Nitrite
H75	Total - N
H76	Ammonia
H26	Silicate
H27	Alkalinity
H28	PH
H30	Trace elements
H31	Radioactivity
H32	Isotopes
H90	Other chemical oceanographic measurements

B37	Taggings
B64	Gear research
B65	Exploratory fishing
B90	Other biological/fisheries measurements

	MARINE GEOLOGY/GEOPHYSICS
G01	Dredge
G02	Grab
G03	Core - rock
G04	Core - soft bottom
G08	Bottom photography
G71	In-situ seafloor measurement/sampling
G72	Geophysical measurements made at depth
G73	Single-beam echosounding
G74	Multi-beam echosounding
G24	Long/short range side scan sonar
G75	Single channel seismic reflection
G76	Multichannel seismic reflection
G26	Seismic refraction
G27	Gravity measurements
G28	Magnetic measurements
G90	Other geological/geophysical measurements

	MARINE CONTAMINANTS/POLLUTION
P01	Suspended matter
P02	Trace metals
P03	Petroleum residues
P04	Chlorinated hydrocarbons
P05	Other dissolved substances
P12	Bottom deposits
P13	Contaminants in organisms
P90	Other contaminant measurements