

## Illuminating the bathymetry around Christmas Island

Geoscience Australia's recent marine reconnaissance survey off the coast of Western Australia (see *AusGeo News* 92) has already yielded some unexpected bonuses. After leaving Singapore the RV *Sonne* with a research team of 25 scientists and technical officers sailed close by Christmas Island en route to the survey area.

Once in Australian territorial waters the research team commenced acquiring multiple data sets, including multi-beam swath data, gravity and magnetic data and water column data. This data allows us to image the seafloor and assists in characterising the seabed, assisting ongoing marine planning and management of the area.

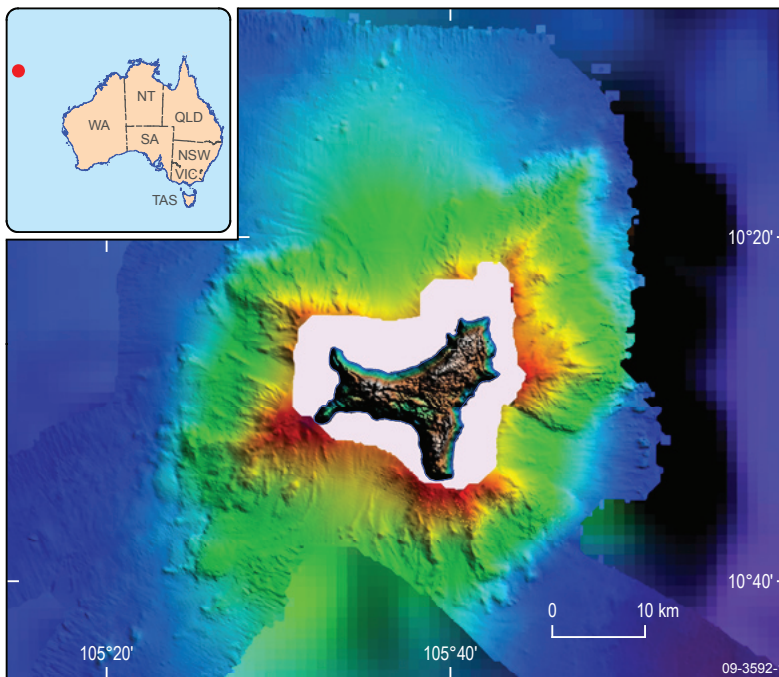
This opportunity yielded a stunning dataset of detailed bathymetry not previously evident from existing nautical charts. The new data reveals the dramatic submarine architecture of the volcanic-based pinnacle reef, which is Christmas Island, emerging from water depths of more than 5000 metres (figure 1).

Generally, the shoreline of Christmas Island is strongly embayed with four main erosional features. These features are found on all sides of the island and were formed when landslides slid into the

sea, leaving prominent remnant headlands. One of the largest marine landslides is on the northern side of the island. Here a large slump scar was found with an extensive debris field fanning northward. This indicates a significant submarine failure (or underwater landslide) of tens of cubic kilometres.

The eastern side of Christmas Island is dominated by a precipitous rugged blocky seafloor while the south-eastern flank is dominated by the scarp of another submarine failure with a debris field several kilometres long. The western side of the island is characterised by two headlands separated by another smaller submarine failure.

The data acquired has increased our knowledge of this important Indian Ocean territory and the surrounding seamounts. This will enhance the agency's knowledge base and will be used for research by several Geoscience Australia programs. They include geohazards (for the study of tsunamis) as well as Law of the Sea and maritime boundaries and environmental management.



**Figure 1.** Bathymetry around Christmas Island based on data gathered on the 2008–09 Geoscience Australia surveys.

### **For more information**

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## Graduate project takes Geoscience Australia to Dalwallinu

Each year Geoscience Australia's new graduate recruits develop and undertake a group project to promote the agency's key priorities as well as further strengthen ties with a local community. The 2008 graduate project followed an invitation to give a presentation about research Geoscience Australia is conducting in the Dalwallinu Shire, and provide resources for the proposed Dalwallinu Environmental

Interpretive Centre. Dalwallinu is a small township located in Western Australia, 254 kilometres northeast of Perth, and is the administrative centre for the Shire.

The project was undertaken because of the relatively high level of seismicity recorded in the area of Dalwallinu and its surrounds are of interest to Geoscience Australia. Australia's most damaging earthquake (M6.8) occurred in Meckering, 198 kilometres south of Dalwallinu, in 1968 and another large earthquake (M6.0) hit the small town of Cadoux (102 kilometres southeast of Dalwallinu) in 1979. These were followed by an earthquake swarm at Manmanning (10 kilometres south of Cadoux) in February and March of 1982. Consequently, Geoscience Australia collects geological and geophysical data in the Dalwallinu region to assess earthquake hazard and to better understand seismic activity in the area.

Geoscience Australia also collects airborne geophysical and digital elevation data, aerial photography, and satellite imagery in the Dalwallinu region. The data are used to better understand the regolith and the subsurface geology, and to assist natural disaster impact assessment, land use planning, mineral and geothermal exploration, and future resource development.

The main activities of the project were:

- Design and production of interpretive public displays for the proposed Centre (figure 1) showing: the geological history of the area, earthquake monitoring and its application to risk assessment, the extent and damage from recent seismic events, acquisition of geophysical data (aeromagnetic, radiometric, gravity and seismic) and its interpretation, and soil distribution and composition.
- Presentations to school groups and the general community in Dalwallinu to highlight the importance of geoscientific data acquisition and how this benefits the community.

The interaction between members of the local community and the graduates during the community presentations and the field trip has strengthened relations between Geoscience Australia and the Shire of Dalwallinu. Members of the Shire Council were particularly impressed by the team's professional and engaging manner in their



**Figure 1.** Some of the display material relating to earthquake monitoring and data acquisition in the Dalwallinu area prepared by the graduate team.

presentations to the school and general community and their ability to respond to audience queries on a range of topics at the appropriate level.

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#### **Related websites/articles**

Shire of Dalwallinu  
[www.dalwallinu.wa.gov.au](http://www.dalwallinu.wa.gov.au)

## **Understanding Australia's arid zone palaeovalley systems**

Geoscience Australia is taking a major role in an innovative research project to better understand the characteristics and behaviour of groundwater resources in Australia's arid areas. Water for Australia's Arid Zone – *Identifying and Assessing Palaeovalley Groundwater Resources* (also known as the Palaeovalley Groundwater Project) is a four-year project which commenced in April 2008. Project funding of \$4.935 million was provided through the Raising National Water Standards program which is administered by the National Water Commission. The program supports the Australian Government's National Water Initiative through funding projects that improve Australia's national capacity to measure, monitor and manage our water resources.

Currently, there is only limited information available on the fundamental characteristics of palaeovalley systems (see information box) and their contained groundwater resources for most parts of arid Australia. The Palaeovalley Groundwater Project is directly addressing this significant knowledge gap by undertaking detailed field studies at several demonstration sites in the arid zone. The knowledge

gained during this investigative work will be used to develop a national strategy for the sustainable utilisation and management of Australia's palaeovalley groundwater resources.

Geoscience Australia is working closely with government agencies from Western Australia, South Australia and the Northern Territory to ensure the success of these hydrogeological investigations. The first workshop meeting of the Technical Advisory Group (TAG) assembled for the Project was held in October 2008 at Glen Helen Station in the western MacDonnell Ranges about 130 kilometres from Alice Springs in central Australia. Thirteen representatives from six of the collaborating agencies (Western Australia Water; Northern Territory Department of Natural Resources, Environment, the Arts and Sport; Primary Industries and Resources, South Australia; Northern Territory Geological Survey; Geological Survey of Western Australia and Geoscience Australia) attended the workshop.

The workshop program included a one-day field trip followed by two days of presentations, discussions and debate around the central theme of arid zone palaeovalley systems. Glen Helen was chosen to host the workshop primarily because of its proximity to several of the Project's field investigation sites which allowed participants an opportunity to view, discuss and debate the many challenges relating to understanding and managing outback groundwater resources. The main objectives of the technical workshop were to:

- Evaluate existing datasets and identify the main knowledge gaps, scientific and technical issues, and groundwater resource needs relevant to the Project.
- Develop working models of different palaeovalley types and aquifers, representing the range of geological and climatic settings across arid and semi-arid Australia.
- Discuss the merits of the nominated field demonstration sites, with a view to selecting sites for future fieldwork investigations.

The lively discussions involving the TAG participants provided a solid basis for the future scientific direction of the Project. In particular, the TAG endorsed an initial focus of collating and analysing existing geoscience data and information relevant to palaeovalleys in South Australia (SA), Western Australia (WA) and the Northern Territory (NT). These include the eastern margin of the Eucla Basin (SA), the Tanami region (WA and NT), Paterson Province (WA), the Murchison–Gascoyne region (WA), Musgrave Province

(SA, WA and NT), the Haast Bluff Aboriginal Land Trust (NT) and the Ti Tree Basin–Willowra area (NT). Based upon these initial studies, the final selection of demonstration sites for further field-based investigations will be made by the TAG during their next meeting in 2009.

### Palaeovalleys

Palaeovalleys are geologically ancient river valleys which no longer function as active surface water systems. Palaeovalleys in outback Australia were originally formed when climatic conditions were different than they are today. An example is the Eocene epoch (about 56 to 34 million years ago) when rainfall levels were significantly higher and much of the present-day outback was covered by rainforests. Although surface water no longer flows in most of the palaeovalleys, the sediment which has filled the river channels commonly forms good quality aquifers which are capable of storing significant quantities of groundwater. In many desert areas of Australia, the groundwater resources contained in palaeovalley aquifers may be the only reliable supply of potable water available to remote water users such as aboriginal communities and pastoral stations.



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