

Promising results from Bight Basin survey

Samples show excellent source rock potential

Jennifer Totterdell

Initial analysis of data from a new geological sampling survey by Geoscience Australia in the Great Australian Bight provides new evidence for the presence of potential petroleum source rocks in the Bight Basin.

Exploratory drilling in the Bight Basin has historically concentrated on the inboard margins of the basin. Apart from Woodside's Gnarlyknots 1A well, which was drilled in the Ceduna Sub-basin in 2003, only the more proximal parts of the Cretaceous depositional systems have been sampled.

Geoscience Australia's previous basin analysis study (1999–2004) identified a series of potential source rock intervals at different stratigraphic levels, including marine or marine-influenced sediments whose source rock character was predicted to improve further basinward.

A study of all available seismic data indicated that these rocks cropped out on the seafloor at the seaward edge of the Eyre Terrace where canyon formation, slumping and faulting have exposed the mid-Cretaceous section. This area was the prime dredging target for the survey conducted earlier this year.

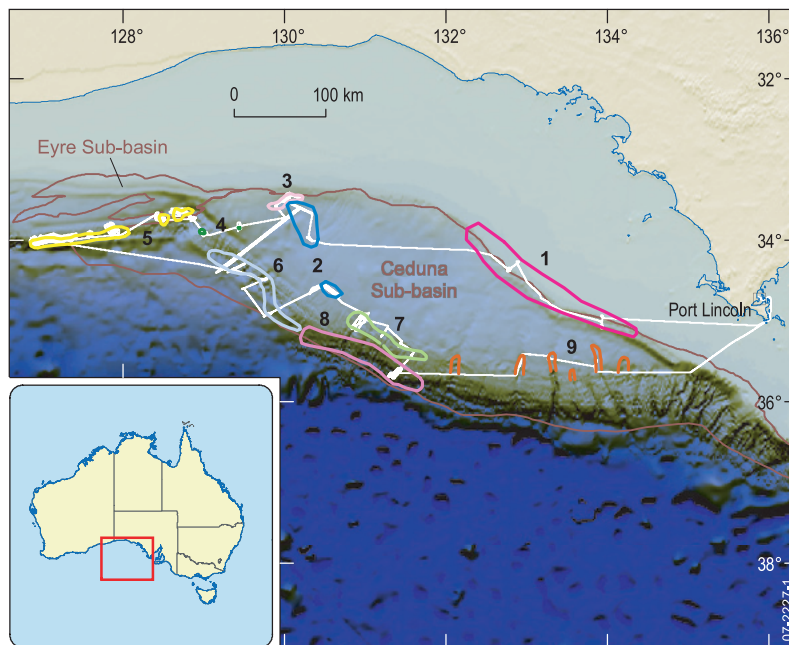


Figure 1. Voyage track across the nine survey areas during SS01/2007.

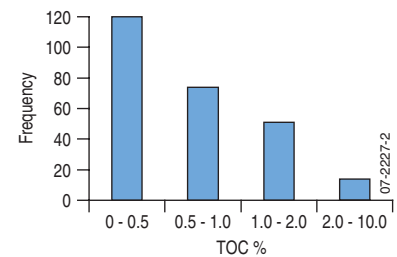
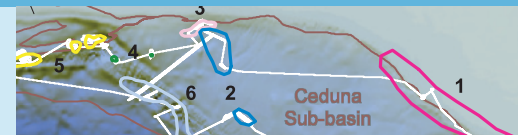


Figure 2. Total organic carbon (TOC) results for Bight Basin survey samples.

The seismic study also identified a range of sites where, if other geological conditions were met, seepage of hydrocarbons was most likely to occur. These included areas where recent reactivation of deep-seated faults was evident at the seafloor, basin margin areas where seal facies thin sufficiently to allow seal failure, and areas high-graded by the presence of slicks detected by synthetic aperture radar.

Conducted by the Marine National Facility vessel RV *Southern Surveyor* (survey SS01/2007), the survey gathered geological samples and geophysical data via deep sea dredging and gravity coring techniques.

Southern Surveyor departed Port Lincoln, South Australia on 22 February 2007 for a three-week survey, with a crew of 12 Geoscience Australia scientists and technicians, a scientist from the Geological Survey of Western

Australia, and two CSIRO technicians. Good sea and weather conditions enabled sampling to be completed in all nine target areas (figure 1). The survey resulted in the collection of thirty seven dredge samples, 69 gravity cores and 15 grab samples, as well as 4600 kilometres of swath data and 2400 kilometres of sub-bottom profile data.

With the physical material now sorted, catalogued and subsampled, a detailed analysis program has been developed to incorporate sedimentological, geochemical and biostratigraphic analyses.

The organic geochemical analysis program is designed to assess the source rock characteristics of the dredge samples, and to investigate whether the gravity core samples reveal any indication of hydrocarbon seepage. While initial results from the gravity cores have proved disappointing, early results from the source rock characterisation study have been highly encouraging.

“Preliminary organic geochemical analysis has shown that some of the samples ... have excellent source rock potential, with high organic carbon contents and the potential to generate liquid hydrocarbons.”

Preliminary organic geochemical analysis has shown that some of the samples from Area 5 on the Eyre Terrace (figure 1) have excellent source rock potential, with high organic carbon contents and the potential to generate liquid hydrocarbons. These are the best source rock results reported from the Bight Basin, and indicate that careful targeting of appropriate depositional systems is vital for understanding hydrocarbon source potential.

The results can be summarised as follows:

- A total of 259 dredge samples were analysed for total organic carbon (TOC) and pyrolysis yields (Rock Eval).

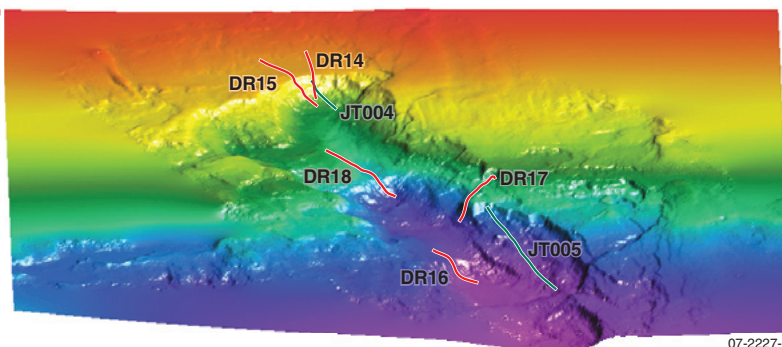


Figure 3. Dredge sample locations in a canyon on the Eyre Terrace (Area 5).

- Good to very good organic richness was found in 13 samples with TOC values between 2.1% and 6.2% (figure 2).
- Of these, seven show liquids potential with hydrogen indices (HIs) ranging between 274 and 479 milligrams hydrocarbons per gram TOC.
- The sample with the highest liquids potential (HI 479) also has the highest TOC. If further biostratigraphic and organic geochemical facies analyses prove that this rock is marine in origin, it can be classed as an oil shale (defined as TOC > 5%).
- No hydrocarbon potential was found in 120, or just under half, of the samples with TOC < 0.5%.
- HIs are below 150 for samples with TOCs between 0.5% and 2.0%, indicating only gas potential. However, our previous experience with the Bremer Sub basin dredge samples suggests that, if the isolated kerogens are re-analysed and the mineral matrix effect is eliminated, HI values can improve significantly.
- All samples with a TOC higher than 0.5% have low Tmax values (<440°C), indicating that the rocks are immature for hydrocarbon generation, as expected in this part of the basin.

More sophisticated geochemical analysis is now being

applied to a high-graded subset of these samples, most of which come from Area 5, the prime dredging target on the edge of the Eyre Terrace (figure 3).

If the seismic interpretation is correct, the best samples are likely to be from the upper White Pointer and/or Tiger supersequences, which

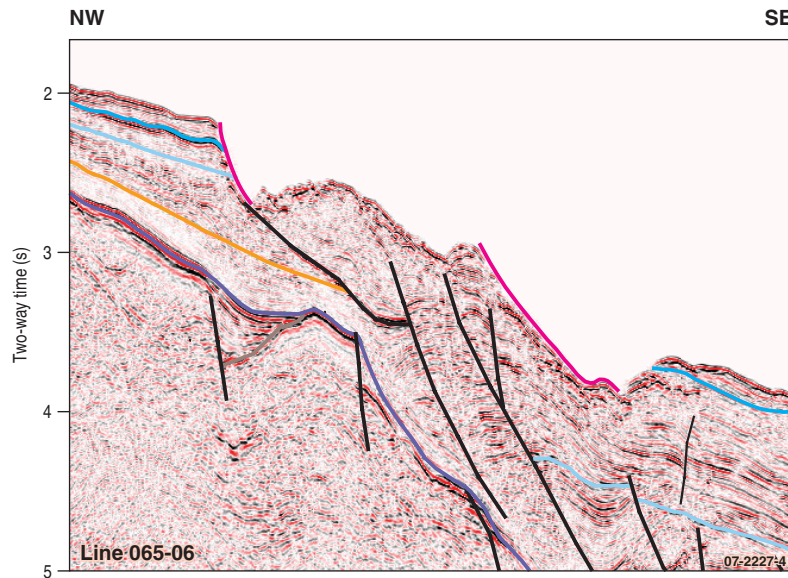


Figure 4. Portion of the seismic line crossing the canyon shown in figure 3. Indicative dredging sites shown by pink line.

have been preliminarily dated to be of Cenomanian–Turonian age (figure 4). Palynological analysis of the samples is now underway, with results from the first batch of samples expected by early November.

The results of the survey are being compiled as a Geoscience Australia record, which is expected to be available in mid 2008.

For more information

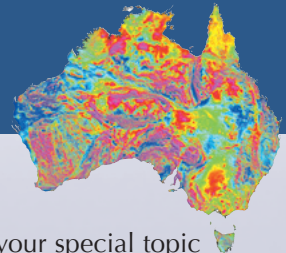
phone Jennifer Totterdell on
+61 2 6249 9407
email jennifer.totterdell
@ga.gov.au

Related websites

Fieldnotes (Geological Survey of Western Australia): The search for petroleum sources and seeps
<http://geodocs.doir.wa.gov.au/>

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