Capel and Faust basins: Preliminary assessment of an offshore deepwater frontier region

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Introduction

The Capel and Faust basins are located in the northern Tasman Sea between eastern Australia and New Caledonia at water depths of 1,300–2,500 m (Fig. 1). Geoscience Australia has recently completed data acquisition surveys that provide new insights into the petroleum prospectivity of the region. The surveys were conducted as part of the Australian government’s New Petroleum (2003–2007) and Energy Security (2007–2011) programmes, to identify new offshore frontier petroleum exploration areas within Australia’s maritime jurisdiction, and to gather pre-competitive geoscience information for distribution to the industry and other stakeholders. This paper presents the initial results of these surveys.

Regional setting

The Capel and Faust basins are rift basins developed within the Lord Howe Rise, a large continental fragment that extends 1,600 km from the eastern Coral Sea near New Caledonia to the Bellona Trough (Fig. 1). The current structural configuration of the region is the result of Early Cretaceous to Eocene oblique extension, which followed a prolonged phase of convergent tectonics in eastern Australia throughout the Palaeozoic and Mesozoic (Gaina et al. 1998; Sdrolias et al. 2001; Veevers, 2000; Crawford et al. 2003; Schellart et al. 2006). It is proposed that rift basins initially formed on the Lord Howe Rise during the mid-Aptian–Albian (c. 120–100 Ma), accompanied by widespread regional magmatism, and volcaniclastic and fluviolacustrine deposition (Symonds et al. 1996; Veevers, 2000; Norvick et al. 2001; Crawford et al. 2003). A second phase of rifting and fluviolacustrine deposition appears to have taken place during the Turonian (c. 90 Ma), preceding the onset of ocean floor spreading in the Tasman Sea and extension in the Middleton and New Caledonia basins during the Santonian–Early Eocene (c. 85–50 Ma; Gaina et al. 1998; Sdrolias et al. 2001; Norvick et al. 2001). The rift basins of the Lord Howe Rise region have experienced a thermal sag phase and marine deposition since approximately the Campanian–Maastrichtian (Norvick et al. 2001, Willcox and Sayers, 2001).

Recent Geoscience Australia surveys

Recent surveys by Geoscience Australia have vastly improved the data coverage in the Capel and Faust basins. This data acquisition program commenced with the joint French-Australian AUSFAIR MD-153 regional reconnaissance survey in February 2006, and was followed up by the Capel–Faust GA-302 seismic survey in late 2006–early 2007 (Fig. 2). The GA-302 survey acquired approximately 6,000 km of 106-fold 2D data along 23 lines with a typical spacing of 15–30 km (Fig. 2). This survey significantly improved the geological understanding of the area. New depocentres were revealed, some of which are up to 150 km long, 40 km wide and contain up to 5 km of sedimentary section.

The Tangaroa TAN0713 survey in late 2007 acquired c. 24,000 km2 of multibeam bathymetry and c. 11,000 line km of shipboard gravity and magnetic data over the central part of the Capel and Faust basins (Fig. 2). The high-resolution gravity and magnetic grids significantly enhanced the interpretations derived from the pre-existing filtered satellite gravity and ship-track gravity/magnetic data. The multibeam bathymetry, supplemented with outcrop/sediment sampling and camera footages, mapped the seafloor in unprecedented detail.

Basin architecture and seismic stratigraphy

The GA-302 seismic data reveal the presence of over 10 major rift depocentres. The depocentres are larger, deeper and more numerous in the Capel Basin than in the Faust Basin (Fig. 3a). At least five major seismic megasequence packages (Fig. 3a) have

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