Geology of the submarine Kenn Plateau off northeast Australia: a rifted continental block

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New seismic reflection data and dredged rock samples confirm that the submarine Kenn Plateau is a thinned continental fragment. It is twice the size of Tasmania and lies 400 km east of central Queensland beyond Cato Trough. East and northeast trending faults separate thinly sedimented basement highs from sedimentary basins with >2 km of Cretaceous and younger strata. In the Late Cretaceous the future plateau fitted against Australia south of Marion Plateau, and consisted of Late Triassic and younger basins unconformably overlying the New England Fold Belt. After Lower Cretaceous rift volcanism, the Kenn Plateau itself formed by Late Cretaceous extension and breakup. Paleocene drifting moved it northeast and rotated it 30° anticlockwise, leaving behind Tasman Basin oceanic basalts. Siliciclastic sediments poured into the basins from the Australian mainland and local highs. After a regional Paleocene-Eocene boundary unconformity, siliciclastic sedimentation resumed nearshore. In deep water, deposition of radiolarian chalks ended at the regional Eocene-Oligocene boundary unconformity, and pure biogenic carbonates accumulated in warming surface waters. From the Middle Eocene, calcarenite formed on the shelves of the subsiding plateau. Some seismic profiles show Middle to Late Eocene compression, probably related to New Caledonian obduction to the east. Hotspots formed parts of two volcanic chains as the plateau moved northward: in the west, Upper Eocene and younger volcanics of the Tasmantid chain; and in the east Upper Oligocene and younger volcanics of the Lord Howe chain. The subsiding volcanoes were fringed by reefs, some of which have persisted until now; others have subsided to form guyots. The plateau has subsided 2000 m or more since its breakup and is now subject solely to pelagic carbonate sedimentation.

Key words: Kenn Plateau, submarine plateau, Cretaceous rift volcanics, Paleocene rift sediments, Cenozoic chalks, Cenozoic hotspots

Organisers please note: *This oral presentation is designed to highlight the results of a lot of pioneering results about a very interesting offshore area, which is based on a paper in press with the Australian Journal of Earth Sciences. Added to this in July will be the results of on-going palaeontological and petrological work. I consider that there is little point in preparing a detailed extended abstract for publication at this stage. Some new results may be added to the abstract in March if the paper is accepted. Hopefully, there is enough information below for you to decide whether you want the paper presented in the convention.*

INTRODUCTION

The Kenn Plateau (Figure 1), a submerged feature twice the size of Tasmania and lying east of Queensland beyond the Cato Trough, has long been regarded as consisting of thinned continental crust on the basis of regional tectonics, bolstered in recent years by satellite gravity information. The literature is extensively reviewed by Exon *et al.* (in press), which paper provides the basis for this abstract. The paper brings together information about regional tectonics and from satellite gravity maps, with the results of two recent marine surveys using R.V. *Southern Surveyor* (seismic profiling and sea bed sampling). The principal result of this work is a confirmation of the continental origin of this complex plateau, and a first geological history of this piece in the tectonic jigsaw of the southwest Pacific. The geological history is well based in part, but remains somewhat speculative in part.

Figure 1. The location of the Kenn Plateau between Australia and New Caledonia

METHODS AND RESULTS

In 2004, the Research Vessel *Southern Surveyor* carried out Survey SS5/2004, a geoscientific study of the Kenn Plateau known also as Geoscience Australia Survey 270. The survey was designed to test whether there were fundamental differences in basement geology and margin development across the plateau, related to proximity to the seafloor-spreading terrains in the south or the ridge propagation terrains in the north, and also to address other fundamental questions about its nature and tectonic evolution. The survey acquired 3090 km of 24-channel reflection seismic profiles, about 25,000 km^2 of multibeam sonar mapping data, and 12 dredge hauls of rocks. Initial results were presented in Exon *et al.* (2005b). In 2005, another 15 dredge hauls were made on the Kenn Plateau during *Southern Surveyor* Survey SS2/2005 (Geoscience Australia Survey 274). Initial results were presented in Exon *et al.* (2005a). All the key results are brought together in Exon *et al.* (in press).

East and northeast trending faults separate thinly sedimented basement highs from sedimentary basins with >2 km of Cretaceous and younger strata. In the Late Cretaceous the plateau fitted against Australia south of Marion Plateau, and consisted of Late Triassic and younger basins unconformably overlying the New England Fold Belt. After Lower Cretaceous rift volcanism, the Kenn Plateau itself formed by Late Cretaceous extension and breakup. Paleocene drifting moved it northeast and rotated it 30° anticlockwise, leaving behind Tasman Basin oceanic basalts. Siliciclastic sediments poured into the basins from the Australian mainland and local highs. After a regional Paleocene-Eocene boundary unconformity, siliciclastic sedimentation resumed near shore. In deep water, deposition of radiolarian chalks ended at the regional Eocene-Oligocene boundary unconformity, and pure biogenic carbonates accumulated in warming surface waters. From the Middle Eocene, calcarenite formed on the shelves of the subsiding plateau. Some seismic profiles show Middle to Late Eocene compression, probably related to New Caledonian obduction to the east. Hotspots formed parts of two volcanic chains as the plateau moved northward: in the west, Upper Eocene and younger volcanics of the Tasmantid chain; and in the east Upper Oligocene and younger volcanics of the Lord Howe chain. The subsiding volcanoes were fringed by reefs, some of which have persisted until now; others have subsided to form guyots. The plateau has subsided 2000 m or more since breakup and is now subject solely to pelagic carbonate sedimentation.

CONCLUSIONS

The geology of Kenn Plateau and its geological history are now reasonably well established, and questions about how it fitted into the southwest Pacific tectonic context have been resolved. As very little was known about this plateau before our study, we can hardly compare it to earlier work in any detail. The study shows that there are deep Late Cretaceous and younger basins on the Kenn Plateau, much of which is within the Australian marine jurisdiction. In practical terms, these basins just might have some long-term petroleum potential, and this study is certainly relevant to the study of the petroleum potential of the gigantic continental Lord Howe Rise to the southeast.

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