Countries surrounding the North Sea have benefited from around 40 years of oil and gas exploration and production. The North West Shelf of Australia is a similar hydrocarbon province. **James Riding**[1] and **Daniel Mantle**[2] describe ways of correlating the Mesozoic rocks of Europe and Australia.

Age really is an issue

The majority of the source and reservoir rocks for the hydrocarbons in North Sea and the North West Shelf are Jurassic (200–146 Ma) in age. In both the exploration and production phases, the study of palynology, especially fossil dinoflagellate cysts, is one of the principal techniques used in subdividing the hydrocarbon-bearing successions. High-resolution zonal schemes have been developed for both these areas, and have been routinely applied for around thirty years. The BGS has been a key player in the formulation and refinement of the standard Jurassic scheme and we have shown that integrated studies using these microfossils can resolve interregional geological problems.

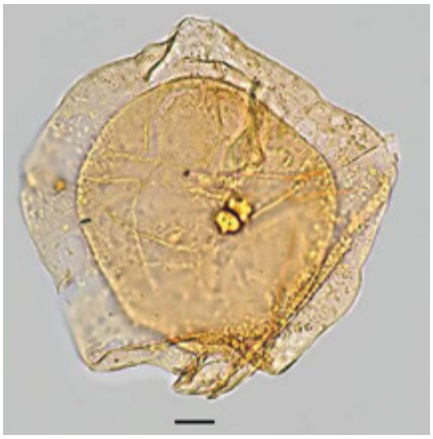
Dinoflagellate cysts are the resting bodies of unicellular phytoplankton. Their planktonic nature means that they have the potential to be very geographically widespread and there are several species which have global distributions. This is unusual, and most other fossil groups are significantly more provincial. These include the ammonites (extinct marine molluscs) which are the standard zonal fossils for the Jurassic. Long-range ammonite correlations are reliant on a somewhat convoluted process that typically involves multiple steps across several continents. The single occurrence of Jurassic ammonites in onshore Australia is a fauna from the Middle Jurassic Newmarracarra Limestone in Western Australia. These localised faunas have been assigned to the Early Bajocian (172–170 Ma). Recent BGS work has demonstrated that this limestone unit is referable to the early part of the Early Bajocian Laeviuscula chronozone based on strontium isotope stratigraphy.

The Jurassic dinoflagellate cyst zonation established in Europe can be applied in the Americas, the Middle East and western Asia. By contrast, there are many more provincial species in Australasia. This endemism means that the correlation of the Australasian zones with their European counterparts is not straightforward.

The North West Shelf represents the passive continental margin of north-western Australia and comprises the Northern Carnarvon, Roebuck, Offshore Canning, Browse and Bonaparte basins. The region is the premier hydrocarbon province in Australia. The North West Shelf formed as an intracratonic rift with the earliest known tectonic activity occurring in the Cambrian, and the first continental slivers detaching during Devonian to Permian fragmentation. The final significant period of terrane dispersal, which led to the break-up of Gondwana, occurred in the Late Triassic to Late Jurassic.

Correlating Australian Jurassic palynozonation schemes to the geological timescale, or making valid correlations to the more tightly constrained European dinoflagellate cyst zonations, has always been problematical. However,there are

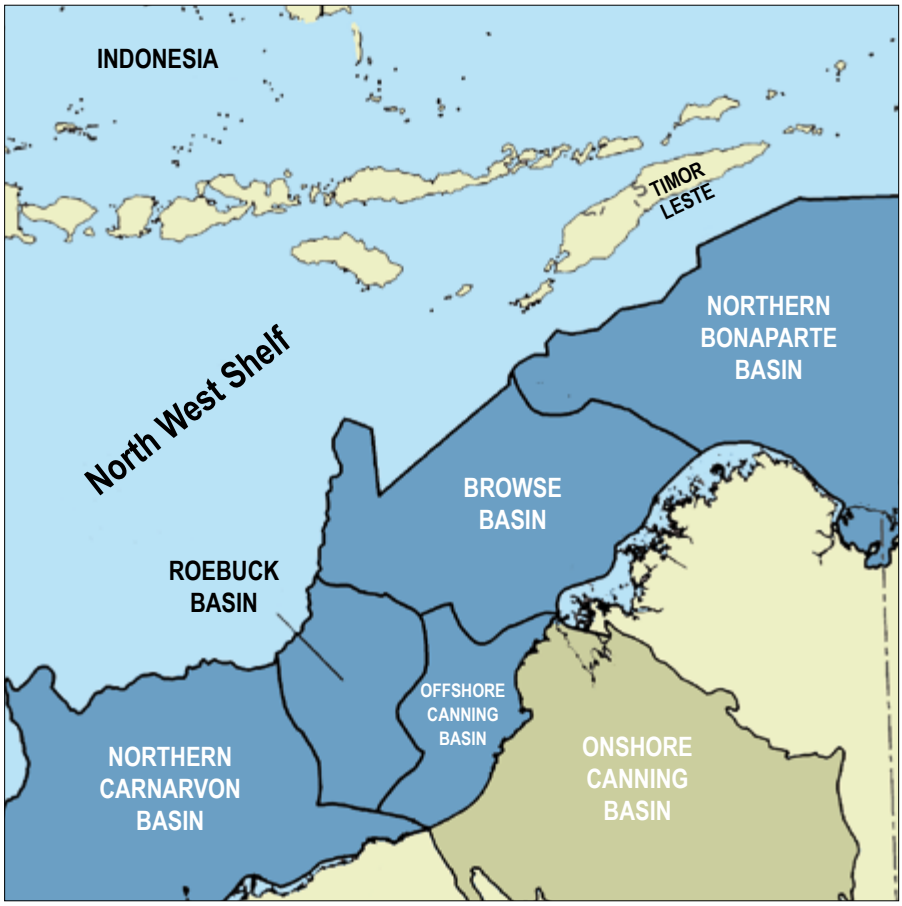
Phallocysta erregulensis *closely resembles* Phallocysta elongata *differing only in being consistently smooth with a differing opening and a less variable outline. Both species are consistent with an Early Bajocian age.*



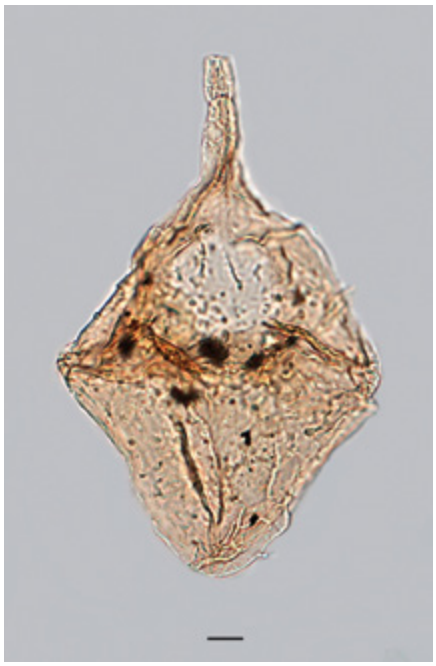
Endoscrinium luridum *is similar in morphology to the European taxon* Endoscrinium asymmetricum. *The range base of the latter is early Late Bajocian and a correlation is eminently possible based on this morphostratigraphical evidence.*

[1] British Geological Survey, Keyworth, UK
[2] Geoscience Australia, Canberra

Gonyaulacysta ceratophora *is significant because this Australian species is similar in gross morphology to* Gonyaulacysta jurassica *subsp.* adecta *var.* longicornis. *The latter is characteristic of the Early–Middle Oxfordian of Europe.*



The North West Shelf of Australia (dark blue shading).



Scriniodinium prolatum *from offshore Western Australia has morphological similarities to* Scriniodinium pharo *from Europe. These two species are large, and have well-developed apical horns; they are both present around the Jurassic–Cretaceous transition.*

striking morphological similarities between the five dinoflagellate cyst taxa illustrated here from the southern hemisphere and virtually coeval marker taxa from the northern hemisphere. In all cases the scale bars represent 10 µm.

Ctenidodinium ancorum *is very similar to* C. sellwoodii. *The Australian specimen comes from the Upper Jurassic, Elang Formation.*

Recently we reassessed the ages of the Australian Triassic (251–200 Ma) and Jurassic dinoflagellate cyst zones. This refinement of the correlation of zonal schemes between the hemispheres improved our understanding of phenomena such as relative sea-level change, ancient climate trends, plankton evolution, ancient ocean circulation patterns and sequence stratigraphy. It will also help us improve the interregional correlation of key successions such as organic-rich shales which form the oil source rocks. Future work will include the application of this research, the documentation of the palynology of key successions from the North West Shelf of Australia, the continued refinement of correlations between Australasia and Europe, and the quantification of biotic endemism.

For further information, contact:

James Riding, BGS Keyworth
Tel: +44(0)115 936 3447
e-mail: jbri@bgs.ac.uk