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Artikel: Late Aptian-Early Albian radiolaria of the Windalia radiolarite (type section), Carnarvon Basin, Western Australia
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3. Lithostratigraphy

The type section of the Windalia Radiolarite consists of a weathered pale coloured (yellow to orange) mesa capped by a thin silcrete layer (part of the lateritic profile). About 34 m of the lower part of the formation is present overlying the Muderong Shale with conformity (Fig. 3). The poorly exposed contact with the Muderong Shale is gradational over 50–100 cm, and is placed at the change from soft, dark grey, friable, bentonitic claystone and siltstone (Muderong Shale) to firmer colour-banded mottled radiolarite. The Windalia Radiolarite has a unique lithology and the term "radiolarite" in the formational name can be somewhat misleading (though correct in terms of radiolarian abundance and the dominantly biogenic nature of deposition) as the sediment is atypical of the Tethyan radiolarites (cherts and siliceous limestones). Characteristically, the Windalia Radiolarite is a radiolarian claystone and siltstone, has low specific gravity, is pale in colour, and has very high porosity and permeability. The formation is opalized in places and breaks with a conchoidal or blocky fracture.

The section is composed of continuous varicoloured banded horizons of variable unrelated induration and thickness (from millimetre "liesegang" to metre scale banding). This gives the section a bedded appearance. Close inspection, however, shows that burrow mottles (often iron stained) are ubiquitous, and obscure nearly all primary sedimentary structures. Indistinct bedding planes are sometimes visible, but most of the banded appearance results from varying degrees of iron oxidation in response to groundwater percolation through the sediment, and does not necessarily reflect original planar bedding. Colouration of the sediment is generally white when fresh, but varies from yellow through to dark red-brown depending on the intensity of iron oxidation. Decalcified casts of ammonites and belemnites and distinct bioturbate textures are common, often crowding along horizontal (bedding) planes. Their occurrence appears to be laterally extensive, but poor exposure prevents confirmation of widespread correlatability. Towards the top of the section, the radiolarite becomes fissile and paler in colour. This is probably the result of extensive downward leaching within the lateritic profile and the removal of organic silica and other mobile elements leaving the rock more permeable and paler than the underlying sediment. Iron oxide and lesser manganese oxide staining is evident throughout. The unit is capped by a thin (2 m) cream opaline chert and silcrete layer, which is the result of reprecipitation of unstable biogenic silica as opal during silcretization. Original sedimentary textures and structures are destroyed in this interval.

Petrologic examination of samples from the type section show radiolaria are the dominant rock (and fossil) constituent. Thin section observation indicates that recognizable radiolaria can occupy more than 80% by volume of the rock, but more commonly constitute 5–60 volume%, the remainder being reprecipitated silica and kaolinitic (?) clay. A few grams of sediment will often yield several thousand radiolaria when processed. The availability of such large amounts of silica from radiolarian tests indicates why the sediment is often opalized. High porosity and permeability also can be attributed to the interstitial voids between and within the radiolarian tests. Glaucony and lesser pyrite are present in varying low abundance, sometimes seen replacing radiolaria and foraminifera. Secondary gypsum is presently forming within fractures along bedding and joint planes.

4. Fossil distribution

Radiolaria

Throughout the studied sequence radiolaria are generally common to abundant, but preservation varies considerably, confining useful assemblages to softer material (Table 1). Most recognizable radiolaria are present throughout the section, although their occurrence may be sporadic and abundance variable. Samples WIND 21, 23 and 24 contain only poorly preserved taxa. These samples are from near the top of the section where the effects of leaching are strongest. The absence of specific taxa in these samples is interpreted to be a result of post-mortem diagenesis (i.e. dissolution) and not necessarily a reflection of biostratigraphic change.

Spumellariina, and particularly forms with spongy cortical shells, dominate all the assemblages. *Arachnosphaera exilis* (HINDE) outnumbers all other taxa (often more than 50% of the assemblage); other common radiolaria characteristic for the assemblages include *Actinomma* (?) *pleiadesensis* n. sp., *Praeconocaryomma excelsa* n. sp., *Patulibracchium* (?) sp., *Spongodiscus renillaeformis* (CAMPBELL & CLARK), a variety of orbiculiformids and a profusion of unidentified actinommids (Actinommid gen. & sp. indet. being the most common). Both *P. excelsa* and *P.* (?) sp. are present only in the lower samples; *Paronaella* (?) *diastimusphere* n. sp., although rare, is large and easily recognized. Nassellarians are subordinate, comprising less than 20% of the total fauna and dominated by several species of *Windalia* n. gen. among them *Windalia pyrgodes* (RENZ). With the exception of the orbiculiformids and *S. renillaeformis*, all the above radiolaria have been documented only in sediments in the southern hemisphere (see Renz 1974; Haig & Barnbaum 1978; Ling & Lazarus 1990; Baumgartner 1992) or are newly described herein. They are considered to be non-Tethyan and appear to represent endemic elements that developed in the epicontinental basins of Australia and/or the restricted juvenile Antarctic and Indian Oceans that characterized the southern fragmenting portions of Gondwanaland in the early-mid Cretaceous. A variety of early Cretaceous Tethyan taxa are present in the Windalia assemblages, including *Acaeniotyle diaphorogona* FOREMAN, *A. longispina* (SQUINABOL), *Amphipyndax stocki* (CAMPBELL & CLARK), *Angulobracchia crassa* OZVOLDOVA, *Crucella messinae* PESSAGNO, *Histastrum aster* LIPMAN, *Holocryptocanium barbui barbui* DUMITRICA, *Tricolocapsa antiqua* (SQUINABOL) and species of *Archaeospongoprunum, Paranoella, Praeconocaryomma* and *Crucella* suggesting some connection with the low-latitude Tethyan seaway. However, all these forms show only moderate or rare abundance and are not dominant features of the Windalia assemblages.

Ammonites

Ammonites are well represented and diverse at the type section. They occur, almost without exception, as fragmentary or crushed moulds making specific identification difficult. However, generic identification is possible. Specimens collected by the author were identified, with the assistance of Dr Ken McNamara of the Western Australian Museum, as *Tropaeum* SOWERBY, *Australiceras* WHITEHOUSE and *Toxoceratoides* SPATH. Brunnschweiler (1959) reported the presence of *Tropaeum, Paracanthoplites* STOYANOW, *Aconoceras whitehousei* BRUNNSCHWEILER, and *Aconoceras astronisoides* BRUNN-