Palynological Analysis of four samples from Casterton Beds Otway Basin

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Summary

One cuttings and three core samples were submitted for analysis by Melinda Mitchell in an attempt to improve the palynological age dating of the Casterton beds in the Otway Basin.

The two core samples from Casterton-1 from what is generally regarded as the type section of the Casterton beds or Formation (Morton *et al.*, 1994) gave no new information but confirmed previous unpublished work that the Casterton beds contain poor palynological assemblages which have an age range of Late Jurassic to basal Cretaceous. The basis for a Late Jurassic age remains the **negative evidence** of the absence of the Early Cretaceous index species *Cicatricosisporites australiensis* and related forms. No palynomorphs considered characteristic of or restricted to the Late Jurassic were recorded.

The other samples, a cuttings from Hawksdale-1, and the core sample from Moyne Falls-1 gave good palynological assemblages which are Early Cretaceous in age and compositionally quite distinct from the assemblages in Casterton-1. Although the data is very limited, neither sample would support a correlation to the type section of the Casterton beds. As both these wells are over 80 kilometres from Casterton-1 and in a different trough separated by the Merino High it is quite possible that different units are being lumped together under the one stratigraphic name.

Although the original problem of the age of the Casterton beds was not resolved by this limited study, good palynological assemblages were obtained suggesting that a more extensive and detailed study would obtain worthwhile results.

Casterton-1

Casterton-1 penetrates a sequence of interbedded carbonaceous shale, with minor feldspathic sandstone, siltstone and basaltic volcanics which is generally considered the oldest unit deposited in the Otway Basin. This has been variously named the Casterton beds, Group or Formation (Morton 1990). The current preference is to consider it a formation and a type section has been recently designated between 7283-8038 ft. (2220-2450m) by Morton *et al.* (1994).

The two core samples examined in Casterton-1 both contained very poorly preserved assemblages without index species restricted to either the Late Jurassic or Early Cretaceous. The shallower sample from core-18 at 7388 ft (2251.9m) gave a high yield of organic residue in which spores were very rare and too poorly preserved for confident species identifications. The deeper sample from core-22 at 7947-57 ft (2422-25m) was slightly better preserved and a moderate diversity assemblage was recorded. Emphasising the very poor preservation, when a count of the assemblage was attempted greater than 37% of the palynomorphs could not be confidently identified even to very broad species groups. Because such a large fraction of the assemblage could not be identified it is very difficult to assign any zone or age to the sample. The most diagnostic species recorded was *Concavissimisporites variverrucatus* which Helby *et al.*(1987, fig.13) shows as occurring most consistently from the Late Jurassic *M. florida* Zone to the basal Cretaceous *C. australiensis* Zone. As this is the general age range previously assigned to the Casterton beds this new analysis has provided no further refinement to the age of these beds.

Species recorded from the two samples are listed below. The dominant forms identified are large and small smooth trilete spores most of which can be referred to *Cyathidites*, although because of the poor preservation the counts in these categories undoubtedly also contains closely related genera such as *Birettsporites* and *Dictyophyllidites*. That *Corallina torosa* s.l. is the next most frequent type is not surprising as this species group can be identified in even extremely poorly preserved material, and thus may be over represented in the count because of its characteristic morphology.

Hawksdale-1

The single cuttings sample at 5630-40 ft (1716-19m) contains a high diversity assemblage which is moderately well preserved. The surprise is that the sample contains a mixed Early Cretaceous and most likely Early Triassic assemblages without any species, or species abundances, which would be considered to have a Jurassic character.

The Triassic palynomorphs comprise at least a quarter of the count but are probably considerably more abundant. The count is undoubtedly biased to the Early Cretaceous assemblage, firstly because of the better preservation of the younger spores and pollen, and secondly because of the difficulty of precise species identification of specimens assigned to the *Alisporites/Falcisporites* complex. Since *Falcisporites australis* may often overwhelmingly dominate Triassic assemblages it is suspected that many of the specimens counted as *Alisporites* spp. could in fact be the former species.

Whether this data can be used to assign a Triassic age to the Casterton beds cannot be determined from this cuttings sample as reworked Permo/Triassic spores and pollen occur throughout the Otway Group and there is currently very little data on their abundance in individual samples. This sample, however, contains the highest recorded abundance of reworked Triassic palynomorphs of all Early Cretaceous samples I have counted.

Because the cuttings sample is near the base of the Casterton beds picked at 1790m in Hawkesdale-1 by Kopsen & Scholefield (1990, fig.7) my preferred interpretation is that the sample is Early Cretaceous in age and the Triassic spores and pollen are reworked.

Moyne Falls-1

The core sample analysed at 2418-33 ft (737-42m) contained a high diversity assemblage (45+ species) which can be confidently assigned to the Early Cretaceous. The assemblage would belong to the *F. wonthaggiensis* Zone on the ranges given Helby *et al.* (1987) but more recent work in the Otway Basin by Roger Morgan has indicated that the first appearance of *Pilosisporites notensis*, which is prominent in the sample, is a more reliable datum for the base of the overlying *C. hughesii* Zone. This latter interpretation is followed here giving an

Aptian age to the sample. (ie even younger)

Scaling off the electric log correlations presented in Kopsen & Scholefield (1990, fig.7) the top of the Casterton beds in Moyne Falls-1 is estimated to lie at about 724m, above the core sample analysed here. However, the *C. hughesii* Zone assignment and Aptian suggests that this formation assignment is likely to be in error and it would be more appropriate to correlate the core with either the Windermere Member or Lower Eumeralla Formation (compare figs 4 & 7 in Kopsen & Scholefield 1990). This correlation is appealing because the supposed Casterton beds in Moyne Falls-1 are clearly on a higher basement block than the Casterton beds in the adjacent Hawkesdale-1 well yet Kopsen & Scholefield (1990, p.266) state..."the undifferentiated Casterton Group (*sic*) is commonly eroded from, or not deposited on, the crest of major basement blocks....." In addition the superposition of the Lower Eumeralla Formation directly above the Casterton Beds in Moyne Falls-1 is clearly anomalous compared to the other cross-sections illustrated by Kopsen & Scholefield (1990).

Previous palynological work available for review from Moyne Falls-1 consisted of a report by Dettmann (1970) on twelve sidewall core samples, of which the deepest productive sample was from 2330 ft (710m) within the Eumeralla Formation. Similar assemblages to the core sample analysed here were obtained over the interval 1802-2330 ft (549-710m).

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Casterton-1

Species List	**Core 18 7388 ft (2251.9m)**	**Core 22 7947-57 ft (2422-25m)**
Indeterminate palynomorphs		37%
Alisporites/Podocarpidites spp.		5%
Alisporites grandis		x
Baculatisporites spp.	Abundant	5%
Baculatisporites comaumensis	x	x
Callialasporites turbatus		cf.
Cibotiumspora juriensis		<1%
Concavissimisporites variverrucatus		x
Corollina simplex		x
Corollina torosa		13%
Cyathidites australis s.l. (large forms)		11%
Cyathidites minor s.l. (small forms)		18%
Exesipollenites sp.		1%
Laevigatosporites ovatus		x
Marattisporites scabratus		<1%
Neoraistrickia spp.	x	x
Neoraistrickia truncata		x
Osmundacidites wellmanii	x	x
Podocarpidites ellipticus		x
Polycingulatisporites crenulatus		x
Retitriletes eminulus		x
Retitriletes spp.	x	<1%
Stereisporites antiquasporites		2%
Trilete spores undiff.		5%
Circulisporites parvus		x
Insect setae		x
Total Palynomorph Count		**168 specimens.**

Hawksdale-1

Species List	**Cuttings 5630-5640 ft (1716-1719m)**
Cretaceous Species	
Alisporites spp.	29%
Alisporites grandis	x
Baculatisporites spp.	4%
Ceratosporites equalis	<1%
Cicatricosisporites australiensis	x
Corollina torosa	<1%
Cyathidites australis	4%
Cyathidites minor	<1%
Cycadopites spp.	<1%
Dictyophyllidites spp.	3%
Dictyotosporites speciosus	x
Laevigatosporites belfordi	x
Marattisporites scabratus	1%
Matonisporites cooksoniae	x
Microcachryidites antarcticus	<1%
Neoraistrickia spp.	2%
Osmundacidites wellmanii	1%
Pilosisporites notensis	x
Pilosisporites parvispinosus	x
Podocarpidites spp.	21%
Retitriletes circolumenus	x
Retitriletes nodosus	x
Retitriletes spp.	<1%
Stereisporites antiquasporites	<1%
Vitreisporites pallidus	<1%
Trilete spores undiff.	5%
Sigmopollis hispidus	<1%
Total Cretaceous palynomorphs	**77%**
Permo/Triassic species	
Aratrisporites spp.	5%
Dictyophyllidites mortonensis	x
Distoverrucatus sp.	7%
Falcisporites australis	5%
Horriditriletes ramosa	2%
Kraeuselisporites spp.	4%
Protohaploxypinus spp.	x
Tuberculosporites abadarense	x
Total Permo/Triassic palynomorphs	**23%**
Total Palynomorph Count	**144 specimens**

Moyne Falls-1

Species List	Core-3 2418-1433 ft (737-741.6m)
Early Cretaceous Palynomorphs	
Allsporites similis	x
Allsporites / Podocarpidites spp.	12%
Aequitriradites spinulosus	x
Aequitriradites tilchaensis	x
Aequitriradites verrucosus	x
Annulisporites microfoveolatus	x
Araucariacites australis	2%
Baculatisporites / Osmundacidites spp.	5%
Ceratosporites equalis	4%
Cibotiumspora jurlensis	x
Cicatricosisporites australiensis	x
Cicatricosisporites ludbrookiae	x
Cicatricosisporites spp.	2%
Clavatipollenites sp. cf. *C. hughesii*	x
Concavissimisporites penolaensis	x
Cooksonites variabilis	x
Corollina torosa	4%
Crybelosporites berberoides	x
Cyathidites / Biretisporites spp.	33%
Cyathidites australis	x
Cyathidites minor	17%
Cyathidites punctatus	x
Cyclosporites hughesii	0.7%
Dictyophyllidites crenatus	x
Dictyotosporites complex	x
Dictyotosporites speciosus	x
Foraminisporis wonthaggiensis	3%
Klukisporites scaberis	x
Laevigatosporites ovatus	x
Leptolepidites verrucatus	x
Microcachryidites antarcticus	3%
Neoraistrickia spp.	0.7%
Pilosisporites notensis	x
Pilosisporites parvispinosus	x
Pilosisporites spp.	3%
Podosporites microsaccatus	1%
Retitriletes austroclavatidites	x
Retitriletes eminulus	x
Retitriletes facetus	x
Retitriletes spp.	1%
Stereisporites antiquasporites	1%
Vitreisporites pallidus	x
Trilete spores undiff.	3%
Schizosporis reticulatus	x
Sigmopollis carbonis	3%
Reworked Palynomorphs	
Falcisporites australis	x
Protohaploxypinus spp.	x
Total Palynomorph Count	**150 specimens**