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The middle Jurassic of New Zealand

A study of the Lithostratigraphy and Biostratigraphy of the Ururoan, Temaikan and Lower Heterian Stages (?Pliensbachian to ?Kimmeridgian)

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The University of Auckland

A thesis submitted as a requirement for the degree of Doctor of Philosophy in Geology

University of Auckland

April 1999
“What’s the use of their having names,” the Gnat said, “if they won’t answer to them?”

“No use to them,” said Alice; “but it’s useful to the people that name them, I suppose. If not, why do things have names at all?”

Through the Looking-Glass - Lewis Carroll
ABSTRACT

The lithologic and biostratigraphic successions of Ururoan, Temaikan and Lower - Middle Heterian (?Sinemurian, Pliensbachian - ?Kimmeridgian) strata from southwest Auckland, south Otago and Southland, New Zealand, are described and discussed. A more logical correlation of the lithologic sequence at Port Waikato with that at Te Akau is proposed. Two new formations are introduced for the sequences on the western limb of the Kawhia Regional Syncline, the Whakapakiki Mudstone for the fine grained lower Kirikiri Group strata in the Awakino Valley and the Gribbon Formation for the Rengarenga Group strata between Marokopa and Mahoenui. In Southland a new formation (Ben Bolt Formation) is proposed for the c.1340m sequence overlying the Flag Hill Sandstone, in turn overlain by a 485m thick, mudstone-dominated formation for which a long disused name is resurrected (Lora Formation). The Lora Formation is in turn overlain by a coarse-grained unit, for which the name West Peak Formation is proposed.

In the absence of suitable alternatives, a subdivision of the Ururoan Stage into a Lower Ururoan, the range-zone of Pseudacella marshalli, and an Upper Ururoan, the interval-zone between the last appearance of Pseudacella marshalli and the first appearance of a Temaikan fauna is proposed. The existing three-fold subdivision of the Temaikan Stage is emended. Belemnopsis mackayi and B. deborahae are retained as the indices of the Temaikan and its lowest subdivision, as they are present in most sections at a consistent stratigraphic position. Retroceramus (Fractoceramus) inconditus is proposed as the basal Middle Temaikan index species. Retroceramus (R.) brownei, which first appears consistently higher than R. inconditus, but below R. marwicki is proposed as the index for the upper Middle Temaikan. Retroceramus (R.) marwicki is proposed as a replacement Upper Temaikan index for "Macrocephalites cf. beta-gamma" which is unsuitable. Meleagrinella n. sp. is inconsistent in its first appearance and therefore unsuitable as a Middle Temaikan index and, although confined to this stage, it ranges from Early to early Upper Temaikan. Basal Temaikan Belemnopsis spp. are absent from sections in the Catlins district whereas the earliest Temaikan taxon appearing above typical Ururoan faunas is Meleagrinella n. sp. In the absence of a better alternative Meleagrinella n. sp. is used to mark the base of the stage in the Catlins sections. However, the base of the Temaikan is here likely to be slightly younger than in other sections.

Within the redefined Upper Temaikan four subdivisions based on the sequence of Retroceramus species are recognised. The lowest of these is characterised by the first appearance of R. (R.) marwicki, the second by the first appearance of R. (R.) n. sp. A., the third characterised by the first appearance of R. (R.) stehni, and the highest marked by the first appearance of either R. (R.) sp. C. (a wide triangular form) or sp. D. (an ovate flat form). The presence of these two morphologic forms indicate finer zonation of the Upper Temaikan may be possible, with further field work.

The Ururoan to Middle Heterian succession of New Zealand is correlated with the international chronostratigraphic scheme based mainly on comparison of New Zealand's Retroceramus succession with that of South America and Indonesia and on relatively rare ammonites. The Ururoan is equivalent to the ?Sinemurian to Late Toarcian, Temaikan to the ?latest Toarcian to Early Callovian and the Early Heterian to the Middle Callovian to latest Middle to Late Oxfordian.

Early Ururoan is correlated with the ?Sinemurian to Pliensbachian based on the presence of the ammonite
Juraphyllites. Presence of the Early Toarcian ammonites Harpoceras cf. falcifer and Dactylioceras spp. in the Late Ururoan indicates a potential international correlation of ?Late Pliensbachian to Late Toarcian.

A ?late Toarcian to Aalenian correlation for the Early Temaikan is suggested by the presence of the European belemnite Brevibelus zieteni. Retroceramus (Fractoceramus) inconditus is similar to the Northern hemisphere Mytiloceramus lucifer and the northern hemisphere Retroceramus gr. popovi and thus suggests a latest Aalenian to Early Bajocian correlation of the Middle Temaikan. The earliest Late Middle Temaikan Retroceramus (Retroceramus) marwicki is also present in the Late Bajocian (Rotundum Zone) of Argentina. ?Teloceras gr. banksi, ?Stephanoceras (S.) gr. humphriesianum, Chondroceras (C.) gr. evolvescens, C. (C.) cf. recticostatum, and C. (Defonticeras) cf. oblatum are present in the Middle Temaikan reinforcing an earliest to late Early Bajocian correlation for this stage. Toxamblyites aff. densicostatus Sturani, Chondroceras (C.) gr. evolvescens (Waagen), C. (Schmidtoceras) orbignyanum (Wright), C. (Defonticeras?) sp. indet. occur with Retroceramus marwicki indicating an Early to Late Bajocian correlation for this zone, slightly broader than in Argentina. However, somewhat anomalously the first of these ammonites suggests a Mid Aalenian to Early Bajocian correlation. The succeeding zone (Retroceramus (R.) n. sp A. zone) has yielded the Latest Bathonian Xenocephalites grantmackiei and Lilloyetta aff. boesei. Retroceramus (R.) stehni is the index for the third Upper Temaikan Retroceramus zone and is also known from the latest Bathonian to Early Callovian of Argentina. In New Zealand R. stehni is associated with Lilloyetta cf. lilloetensis and Xenocephalites cf. stipeaniceti which also indicate a latest Bathonian to Early Callovian correlation. The fourth and highest zone of the Upper Temaikan has yielded the ammonites Araucanites marwicki, Eurycephalites gr. extremus, Iniskinites gr. cepoides and Choffatia (Homoeoplanulites) sp. suggesting an Early to Middle Callovian correlation. The overseas relationships of the associated Retroceramus (R.) spp. C. and D. are unknown.

The Heterian index Retroceramus (Retroceramus) galoi is of Oxfordian age in Indonesia where it is associated with Malayomorica malayomorica. In New Zealand Araucanites marwicki and Sulaites heteriense are present in the Early Heterian, below the incoming of Malayomorica malayomorica, low in the range of Retroceramus galoi. The presence of Sulaites high in the Early Heterian suggests a Middle to Late Oxfordian correlation while Araucanites indicates the lowest part of the range of Retroceramus galoi could be slightly older, perhaps Upper Callovian.

The biostratigraphic scheme presented here is a significant advance on those proposed previously.
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