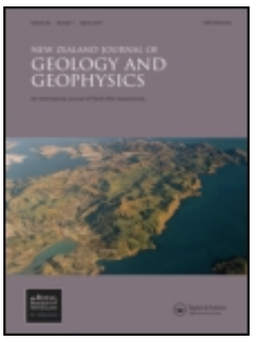

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UPPER JURASSIC BELEMNITES FROM KUAOTUNU (COROMANDEL PENINSULA) AND NORTH-EASTERN GREAT BARRIER ISLAND

G. R. STEVENS

Lower Hutt

Fraser and Adams (1907) recognised three divisions in the Mesozoic sedimentary rocks of the Coromandel Peninsula: Tokatea Hill Series (oldest), Moehau Series, Manaia Hill Series (youngest). Modern usage, however, tends to recognise an undifferentiated, largely unfossiliferous, thick sequence of greywackes and argillites for which the name Manaia Hill Group is used. The Manaia Hill rocks are largely covered by younger rocks (Beesons Island Volcanics, Minden Rhyolites, etc., *see* Schofield, 1967) but is exposed in scattered outcrops, mainly along the coastline.

Relatively large areas of Manaia Hill rocks occur bordering the coast north and south of Coromandel Harbour. Fossils are very rare but at Manaia Hill and nearby localities (Fraser and Adams, 1907; Kear, 1955; Stevens, 1965, pp. 104–5), pebbles from conglomerates in the Manaia Hill Group contain the Upper Triassic (Warepan Stage) fossil *Monotis richmondiana* Zittel, and the Upper Jurassic fossils *Inoceramus galoi* Boehm

(Heterian stage) and ? aff. *Hibolithes marwicki marwicki* Stevens (Puaroan stage). *Malayomaorica ? malayomaorica* (Krumbeck) (Heterian–Ohauan stages) and *Inoceramus* cf. *galoi* have been recorded from greywackes and argillites in Ponui Island and Hunua Ranges, on the opposite side of the Firth of Thames (Milligan, 1959). Similar strata extend southwards at least as far as Ongarue (Kear and Schofield, 1965; Kear 1955, 1960; Kear and Tolley, 1957; Healy *et al.*, 1964; Grindley, 1960) and *I. galoi* and *M. richmondiana*, as well as *Inoceramus haasti* Hochstetter (Upper Jurassic, Ohauan stage) are known from conglomerate pebbles at Morrinsville and *Malayomaorica malayomaorica* from Karapiro (Kear, 1955).

Thus the little fossil evidence available indicates an Ohauan–Puaroan age for the Manaia Hill Group rocks to either side of the Firth of Thames and their continuations in a southerly direction.

Similar rocks on the eastern side of Coromandel Peninsula, in the region of Kuaotunu, have been correlated on the basis of lithology with the Manaia Hill Group, but until now their age has been undetermined.

In January 1964, a beach boulder containing six belemnites, was collected by Mr R. J. Dent from the coast at Kuaotunu, Coromandel Peninsula (N40/529; grid ref. *c.* 224767) (Fig. 1). The boulder is now in the collections of the Auckland Museum, and I wish to thank Mr A. P. Mason for drawing it to my attention.

All of the specimens are preserved as natural moulds. Some calcite was originally present around the alveolus of the largest specimen, but as it obscured the underlying structures it was removed with acid. Rubber impressions were made of all the specimens, and these showed that the guards had been corraded and exfoliated to a varying extent before being incorporated in the sediment. This imperfect preservation has hindered exact identification. The belemnites belong to the *Belemnopsis aucklandica* (Hochstetter) group and appear to have some similarities to *B. aucklandica trechmanni* Stevens, of Ohauan age (Stevens, 1965, p. 88). However, as exact subspecific identification is not possible the determination must remain as *Belemnopsis* ex gr. *aucklandica* and the stratigraphic range as Ohauan to Puaroan.

Dr D. N. B. Skinner, N.Z. Geological Survey (pers. comm.), states that the lithology of the beach boulder can be matched with that of the rocks forming the coastline at Kuaotunu. These rocks, comprising conglomerates and sandstones, have been mapped as Manaia Hill Group by Schofield (1967).

Argillites and greywackes, apparently similar to those of the Manaia Hill Group, are found in the northern part of Great Barrier Island (mapped as Moehau Formation by Thompson, 1960) and Mr J. A. Grant-Mackie, University of Auckland, has kindly drawn my attention to a belemnite fragment recently collected from this area: fossil locality N30/508; grid ref. 906555; boulder on beach, north-east tip of Great Barrier Island; collected by J. K. Ash, University of Auckland. The fragment could only be examined in polished transverse section but identification was made as *Hibolithes* cf. *arkelli*, of probable Puaroan age.

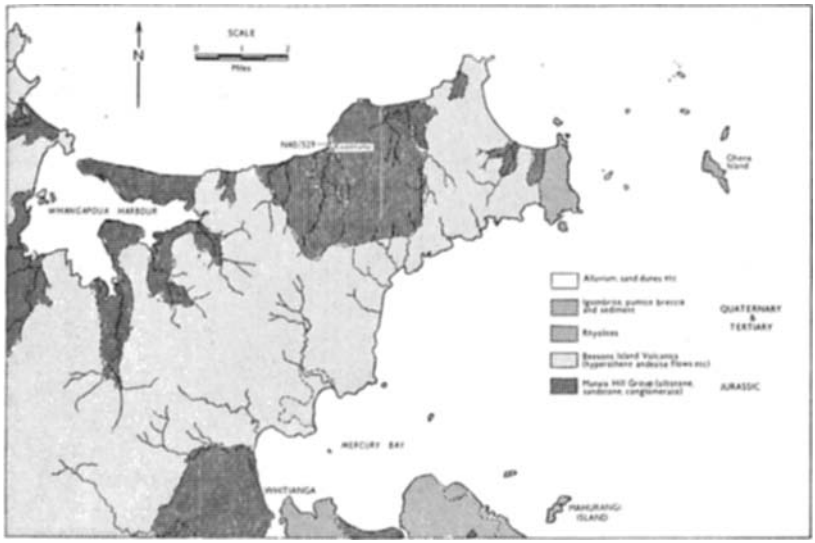

FIG. 1—Geological map of the Kuaotunu area, Coromandel Peninsula. After Schofield (1967).

The matrices of these belemnites have been petrologically examined by Dr J. J. Reed (N40/529) and Mr P. R. L. Browne (N30/508), who have kindly provided the following notes:

"Petrological sample, P32698, obtained from fossil sample N40/529, consists of plentiful dark, generally angular rock fragments measuring from 2–12 mm in length surrounded by smaller lighter coloured rock fragments and interstitial clastic quartz, andesine feldspar, brown hornblende, augite, and epidote. Minor secondary calcite is also present. The dark fragments are entirely argillite (siltstone) and are possibly of intraformational origin. The smaller lighter coloured rock fragments are dominantly volcanic—andesitic, trachytic, or rhyolitic, commonly with either marked flow textures or fine grained, crypto-crystalline or cherty textures. The rock is a fine grained conglomerate similar to that illustrated by Fraser and Adams (1907, plate 10), the poorness of the sorting, with a gradation in size from clastic grains to rock fragments, indicating that the rock belongs to the wacke class. The abundance of rock fragments and volcanic debris further classifies the specimen as a lithic-volcanic fine conglomerate or pebble-wacke, thus contrasting markedly with the quartzofeldspathic wacke rocks which characterise the main axial mountain chains of New Zealand (Reed, 1957)." (J. J. Reed, pers. comm.).

"Petrological sample P38204, obtained from fossil sample N30/508, is a very poorly sorted rock containing abundant dark argillite fragments from 2–15 mm in length and rounded to subangular in shape. Volcanic rock fragments are also common, although generally smaller in size, and include

(in approximate decreasing order of abundance) rhyolite, trachyte, devitrified obsidian, and andesite. The rhyolite is occasionally banded and commonly has a cryptocrystalline texture. Interstitial, and usually angular, crystals of quartz, plagioclase (sometimes with incipient clay alteration), biotite and chlorite are also present and there is some minor secondary calcite and pyrite. According to the classification of Williams *et al.* (1953), this rock is a lithic-volcanic pebble wacke and is similar to P32698" (P. R. L. Browne, pers. comm.).

In terms of the divisions recognised by Reed (1966, pp. 1039, 1040, 1048; *see* Cope and Reed, 1967, pp. 65, 66) in the deposits of the New Zealand Geosyncline ("Terrestrial", "Shelf", "Marginal", "Axial"), both samples have features gradational between the "Marginal" and "Shelf" categories. This agrees with paleogeographic conclusions reached by workers in the Coromandel–Hauraki Gulf area (D. N. B. Skinner, in prep., and J. C. Schofield, pers. comm.), who consider the Manaia Hill Group sediments of the Coromandel Peninsula to be slope deposits on the opposite (i.e., eastern) side of the New Zealand Geosynclinal axis to the sequences in the Kawhia area. Further to this interpretation, these workers consider the Hunua–Waiheke greywackes and argillites to be the axial deposits, and the Karapiro–Ongaruhe greywackes and argillites the slope deposits flanking the Kawhia shelf deposits.

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A NOTE ON AXINITE FROM AVIEMORE, WAITAKI VALLEY

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and

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Lower Hutt

Axinite, a boron rich silicate, is present in a quartz-calcite vein 5 cm wide, exposed during the construction of Aviemore Dam. The mineral has been recorded only once before in New Zealand when Mason (1959) found it in quartz veins cutting quartzo-feldspathic schist of the Chlorite 2 subzone near the Perth River, Westland. The vein at Aviemore was exposed in the excavation for the left abutment of the dam in alternating greywacke and argillite of the Torlesse Supergroup, probably Permian in age at this locality. The greywacke and argillite form part of the prehnite-pumpellyite facies (quartz-prehnite subfacies) of Coombs (1960) (*see also* Landis and Coombs, 1967). Quartz and feldspar, mainly acid plagioclase, are the dominant components of the greywacke, but fine-grained schistose fragments and a few grains of basic volcanic rock are also present. The argillite contains abundant illitic clay, and both the argillite and greywacke in places contain up to 20% calcite in addition to that present in veins.

The axinite-bearing vein dips 55° south-south-west, cutting across the Torlesse Supergroup rocks which dip between 70° and 88° north-east; well-developed joints parallel both the bedding and the vein directions. A second vein of similar size and containing quartz and calcite was seen in the excavation, but in general large veins are rare although in many places thin irregular veinlets generally less than 0·5 mm wide are common. The rock in the abutment has been dislocated by movements along a series of thin crush zones that strike north and north-east and dip steeply to the north. The veins have been displaced where they cross some, but not all of these crush zones. The latter are thought to have formed during the Kaikoura Orogeny at the same time as the Waitangi Fault (Marwick, 1935).

In hand specimen (P37768) the vein has a distinct irregular banding parallel to the vein walls and also a sharp contact between almost white vein material and finer-grained greenish-grey vein material. Thin section