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To cite this article: C. A. Fleming & R. P. Suggate (1964) The 550ft raised beach at Amuri Bluff, New Zealand Journal of Geology and Geophysics, 7:2, 353-358, DOI: [10.1080/00288306.1964.10420181](https://doi.org/10.1080/00288306.1964.10420181)

To link to this article: <https://doi.org/10.1080/00288306.1964.10420181>



Published online: 05 Jan 2012.



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THE 550 FT RAISED BEACH AT AMURI BLUFF

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(Received for publication, 16 September 1963)

ABSTRACT

The stratigraphy and fossil fauna of a Pleistocene raised beach on the north-east coast of the South Island of New Zealand, first reported by McKay in 1877, are redescribed, and its place in Quaternary chronology discussed. The deposit is tentatively attributed to the Terangian Stage (penultimate interglacial), although it has an anomalous cool-climate facies.

Fossils are rare in the marine deposits associated with the raised beaches of the north-east coast of the South Island, but McKay (1886, p. 126) noted that "recent marine shells occur on the top of Amuri Bluff Hill at a height of 500 ft above the sea". His collections GS 158 and GS 767, made in 1876, have the following data in McKay's personal copy of his handwritten list of localities:

"Locality 158. Amuri Bluff Hill, Amuri Bluff, Kaikoura County, Marlborough, McKay, 1876. Recent and Post-Tertiary Raised beaches and Estuarine deposits (I. 2). The collection contains 2117 specimens. The fossils are all recent species and the bed that yields them is four hundred and fifty feet above sea level. It consists of a moderately fine beach gravel now overlain by 8 or 10 or more feet of fine loam."

"Locality 767. [Same locality and date.] Raised beaches and Estuarine deposits (I. 2). The collection contains 69 specimens. The rest of the collection is numbered 158."

These notes by McKay confirm that the collections are the same, as recorded by Suter (1921), and not different in locality or age as suggested by Thomson's citations (1913) based on the Geological Survey register of fossil localities. McKay recorded the altitude as 450 ft in both versions of his notes but in three publications (1877, pp. 173, 177-8; 1886, p. 126; 1890, p. 181) he gave the altitude as 500 ft. Despite this inconsistency, he nowhere referred to more than one locality, nor has any other fossil locality been reported; so that it seems most probable that only one is involved.

The locality was relocated by H. E. Fyfe and J. Marwick, who made a small collection in May 1934 (GS 2835), and more recently by E. T. Annear and R. P. Suggate, who obtained further collections. The outcrop is about 60 ft long—a mere fragment clinging to the edge of the cliff overlooking the north side of Amuri Bluff about 30 chains north-north-east of Trig. T (583 ft). It has a total thickness of 8 ft, comprising sand with pieces of local rock and two sandy shell beds 2 ft apart, and is capped by up to 10 ft of silt, probably of slope-wash origin; it is about 550 ft above

sea level, about 30 ft below the level of the trig., which is set on rock that presumably stood above the sea as an island when the beach deposit was formed. McKay was apparently mistaken in judging the altitude of his collections, and it is quite reasonable to conclude that they came from 550 ft rather than 500 ft or 450 ft; all collections are similar in preservation and have the same dominant species.

Jobberns (1928, p. 534) grouped the deposit with others representative of a shore platform at 500–600 ft; he did not precisely delimit the altitude of the inner margin, which is not well defined. This platform, the "third and highest terrace" of McKay (1877, p. 177), probably originally extended half a mile inland from the fossiliferous locality, and the deposit was presumably formed as the sea retreated from its maximum level. The actual altitude is not significant for correlation with deposits elsewhere, because differential uplift has affected this part of the South Island.

The fauna has not previously been described in full, but four species were recorded by Suter (1921, p. 34) and one by Marwick (1957, p. 29)—*Stiracolpus symmetricus*, a cool-water form. Possibly influenced by the expectation that a raised beach deposit would have been formed during an interglacial period, and hence that the fauna would be warm in aspect (cf. faunas in the Wanganui district; Fleming, 1953), Marwick suggested that this species might be derived from nearby folded early Pleistocene beds.

McKay's collections were combined when the many specimens were sorted and reduced in bulk in 1952. A fossil list for the combined collections of McKay (S56/38, GS 158; S56/39, GS 767), for that of Marwick and Fyfe, 1934 (S56/44, GS 2835), and for the two shell beds recently collected (the lower one S56/510, GS 9014; the upper one S56/511, GS 9015) is given in Table 1. Identifications of GS 158 and 767 are by J. Marwick and C. A. Fleming and of GS 2835, GS 9014, and 9015 by C. A. Fleming.

Taken together the recent collections comprise 27 species of molluscs; McKay's collection, much larger in bulk, comprises 65. The total number of species is 73, of which 18 (25 per cent) are common to both old and new collections. This low percentage may raise doubts whether precisely the same locality has been collected. It may be that the cliff, which is eroding away rapidly, stood further to the north 85 years ago than it does today, so that McKay's collection may have come from significantly further from the actual beach. On the other hand, many of the records in McKay's large collection are based on only a few specimens.

The new collection GS 9015 contains abundant, well preserved *Zeacolpus* (*Stiracolpus*) *symmetricus*, as did previous ones, making a derived origin, as suggested by Marwick, less probable. Moreover the whole aspect of the fauna is cool. *Gaimardia*, *Hochstetteria modiolus*, *Subonoba foveauxiana*, *Zeacolpus symmetricus*, *Cominella* (*Eucominia*) *nassoides* (in shallow habitats), and *Comitas trailli* are all southern forms not certainly recorded living north of Otago. Their presence is not offset by records of two forms of apparently northern relationships: a *Thoristella* resembling *T. crassicosta* Powell from northernmost New Zealand, and *Buccinulum* aff. *wairarapensis*, the ancestor of *B. colensoi* which now inhabits the North Island coast from East Cape to south of Castlepoint.

TABLE 1—Fossil List: Amuri Bluff Raised Beach

GS 158, collected by A. McKay, 1876 (includes also GS 767).

GS 2835, collected by H. E. Fyfe and J. Marwick, 1934.

GS 9014, 9015, collected by R. P. Suggate and E. T. Annear, 1962.

Fossils	Collection
BIVALVIA	
<i>Nucula dunedinensis</i> Finlay	158
<i>Barbatia novaezelandiae</i> (Smith)	158
<i>Hochstetteria modiolus</i> Finlay	158 9015
<i>Cosa costata</i> (Bernard)	158 9015
<i>Mytilus edulis</i> (cf. <i>aoteanus</i> Powell)	158
<i>Aulacomya maoriana</i> Iredale	158
<i>Modiolus</i> cf. <i>aerolatus</i> (Gould)	9015
<i>Chlamys</i> aff. <i>celator</i> Finlay	158
<i>Ostrea angasi</i> Sowerby	158
<i>Venericardia purpurata</i> (Deshayes)	158 2835
<i>Pleuromeris zelandica</i> (Deshayes)	9014
<i>Cardita aoteana</i> Finlay	158
<i>Condylocardia crassicosta</i> Bernard	158
<i>Gaimardia</i> cf. <i>forsteriana</i> Finlay	158 9015
<i>Kidderia</i> cf. <i>anpouria</i> Powell	158
<i>Costokidderia</i> cf. <i>lyallensis</i> Finlay	9015
<i>Lasaea binemoa</i> Finlay	158
<i>Notolepton antipodum</i> (Filhol)	158 9015
<i>Tawera</i> aff. <i>spissa</i> (Deshayes)	158 2835 9014 9015
<i>Cbione</i> (<i>Austrovenus</i>) <i>stutchburyi</i> (Gray)	158
<i>Protohaca</i> (<i>Tuangia</i>) ?n. sp. aff. <i>crassicosta</i> Deshayes	158
<i>Pullastra</i> (<i>Paphirus</i>) <i>largillierii</i> (Philippi)	158
<i>Amphidesma</i> (<i>Taria</i>) cf. <i>pliocenicum</i> Oliver	158
<i>Pholadidea</i> aff. <i>sutevi</i> Lamy	158
<i>Myadora striata</i> (Q. & G.)	158
GASTROPODA	
<i>Sinezona</i> cf. <i>brevis</i> (Hedley)	9015
<i>Cellana ornata</i> (Dillwyn)	158
<i>C. stellifera</i> (Gmelin)	158
<i>C. radians</i> (Gmelin)	158
<i>Coelotrochus tiaratus</i> (Q. & G.)	158
<i>Thorista viridis</i> (Gmelin)	9014
<i>Thoristella</i> n. sp. ?aff. <i>crassicosta</i> Powell	158
<i>T.</i> n. sp. aff. <i>cbathamensis</i> (Hutton)	158
<i>Micrelenchus</i> aff. <i>sanguineus cryptus</i> Powell	158
<i>Cantharidella tessellata</i> (A. Adams)	158 (not seen in revision)
<i>Maurea punctulata stewartiana</i> Oliver	158
<i>M.</i> cf. <i>cunninghamii</i> (G. & P.)	158
<i>Zethalia zelandica</i> (A. Adams)	158
<i>Cirsonella</i> aff. <i>parvula</i> Powell	158
<i>Modelia granosa</i> (Gmelin)	158

TABLE 1—*continued*

Fossils	Collection
GASTROPODA— <i>continued</i>	
<i>Melaraphe cincta</i> (Q. & G.)	158
<i>Subonoba foveauxiana</i> (Suter)	158 9015
<i>S. cf. fumata</i> (Suter)	158 9015
<i>Estea</i> sp.	9015
<i>Merelina</i> aff. <i>maoriana</i> Powell	158 9015
<i>Dardannula</i> cf. <i>olivacea</i> Hutton	158 9015
<i>Notozetia</i> cf. <i>lampra</i> (Suter)	158 9015
<i>Maoricolpus roseus</i> (Q. & G.)	158 9015
<i>Zeacolpus</i> (<i>Stiracolpus</i>) <i>symmetricus</i> (Hutton)	158 2835 9014
<i>Sigapatella novaezealandiae</i> Lesson	158
<i>Proxiuber australis</i> (Hutton)	158
<i>Argobuccinum</i> aff. <i>tumidum</i> (Dunker)*	158
<i>Axymene</i> cf. <i>corticatus</i> (Hutton)	158 2835 9014
<i>Xymene plebejus</i> (Hutton)	158 9014 9015
<i>Zeatrophon ambiguus</i> (Philippi)	158
<i>Comptella curta</i> (Murdoch)	158
<i>Lepsithais lacunosus</i> (Bruguiere)	158 2835 9014 9015
<i>Zemitrella sulcata</i> (Hutton)	158 9014
<i>Paxula</i> sp.	158
<i>Buccinulum</i> (<i>Euthrena</i>) <i>littorinoides</i> (Reeve)	158 9014
<i>B.</i> (<i>Euthrena</i>) aff. <i>wairarapaensis</i> Powell	158 2835 9015
<i>Cominella</i> (<i>Acominia</i>) <i>adspersa</i> (Bruguiere)	158
<i>C.</i> (<i>Eucominia</i>) <i>nassoides</i> cf. <i>otakanica</i> Powell†	158
<i>Baryspira australis</i> (Sowerby)	158
<i>Comitas trailli</i> (Hutton)	158
<i>Aoteadrillia wanganuiensis chordata</i> (Suter)	158
<i>Antimelatoma buchbanani</i> (Hutton)	158
<i>Pervicacea tristis</i> (Deshayes)	9014
<i>Pyrgulina</i> sp.	9015
<i>Benhamina obliquata</i> (Sowerby)	158
<i>Siphonaria</i> ? aff. <i>zelandica</i> (Q. & G.)	158
BRACHIOPODA	
<i>Notosaria nigricans</i> (Sowerby)	158 9015
CIRRIPIEDIA	
<i>Balanus</i> sp.	158

*See Dell (1963).

†Although described as a full species, *otakanica* appears to be a geographic race of *nassoides*.

In New Zealand, the only other Hawera Series fauna from a raised beach that is likely to be of similar age, judged by sequences of raised beaches in the two areas, is the fauna of the Brunswick Formation of Wanganui, the basis of the Terangian Stage (Fleming, 1953). The Terangian fauna is best known at Mt Jowett, Wanganui, at a height of about 350 ft, but coeval deposits are tectonically warped and faulted up to heights of over 600 ft 15 miles to the west. The Mt Jowett fauna differs from the Amuri Bluff fauna in the presence of three extinct molluscs (perhaps all of warm-water affinity), *Pecten benedictus zeehaenae*, *Maoricrypta* aff. *radiata* Hutton, and *Leucotina ambigua* Hutton; and in lacking cool-water elements. It agrees with the Amuri Bluff fauna (and differs from Castlecliffian and older faunas) in the presence of two molluscs that enter the fossil record for the first time in this early Hawera period: *Protothaca* (*Tuangia*), and *Cantharidella*. Several other forms appear for the first time as fossils at Mt Jowett (*Risselopsis varia*, *Taron*, *Lepsiella scobina*) and at Amuri Bluff (*Costokidderia*, *Argobuccinum*, *Benhamina*). These fairly substantial additions to the fossil record in early Hawera time are probably not all immigrants; they are mainly rock-dwelling types for which suitable facies are lacking in older deposits.

In a few genera, the species present at Amuri Bluff show small but significant differences from their living representatives (*Protothaca*, *Pholadidea*, *Thoristella*, *Micrelenchus*, *Argobuccinum*), such as might be expected if the fauna is of early Hawera age. Such differences cannot as yet contribute to the dating and correlation of the fauna, but they suggest that it is older than the Oturian Stage (Last Interglacial), in which such differences are less marked or lacking.

About a quarter of the total of 73 species from Amuri Bluff are also found in the collection from the raised beach at Motunau, 40 miles to the south-west, recorded by Fleming (*in* Wilson, 1963, pp. 75-6). The Motunau raised beach probably belongs to the Oturian Stage.

Thus the character of the Amuri Bluff fauna is consistent with correlation with the Terangian Stage, but its cool-climate facies is anomalous. This may perhaps be accounted for by the suggestion that at the time of deposition the sea had begun to retreat significantly from the maximum transgression of the eustatic cycle.

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