The Oretian Stage of the New Zealand Triassic System

By J. D. CAMPBELL,
Canterbury University College.

[*Read before the Canterbury Branch, May 5, 1954; received by the Editor, May 24, 1954.*]

Abstract

THE Oretian Stage is defined and the faunal succession at the type locality (Western Hokonui Hills, Southland) is outlined. Descriptions of Oretian sequences at Nugget Point, Nelson and Marakopa are included. Species described from Oretian localities are listed.

INTRODUCTION

New Zealand geologists (Ongley, 1939, p. 38; Allan, 1945, p. 5) have long recognised the need for re-study of the type locality of the stratigraphic unit formerly known as the Oreti Series, now the Oretian Stage. The locality seems to have escaped detailed examination until the present work was undertaken for while Cox (1878) omitted it, McKay (1878, pp. 71–2) appears to have given it general treatment only. The most westerly line of traverse described in detail by these workers lies some five miles farther east. The key fossil, *Mytilus problematicus* Zittel, whose incoming marks the base of the overlying Otamitan Stage was not discovered in the early survey (McKay, 1878a, p. 127) and consequently the exact extent of Oretian beds has never been known.

Throughout this paper fossil localities are referred to by the New Zealand standard fossil record form numbers based on the One Mile Sheet series.

HISTORICAL

In the course of the survey of the Hokonui Hills, Cox (1878, p. 28) subdivided the Triassic rocks into 49 beds of which beds 21 to 33 inclusive were grouped together as the Lower Wairoa Series (*op. cit.*, p. 46). From these beds he noted "a shell like *Inoceramus* and *Spirifers.*"

McKay (1878, p. 76) referred to the Lower Wairoa Series as "Ash Beds" and stated (p. 89) that a fossil collection was made near the railway line three miles north of Dipton (then called Oreti) railway station.

Hector (1878, p. x) introduced the term "Oreti Series" to replace the Lower Wairoa Series. In describing the Oreti Series he stated: "... it includes a great formation of green and grey tufaceous sandstones and breccias having at its base a remarkable conglomerate. ... This conglomerate has a thickness varying from 50 to 400 feet, and is never absent from its proper sectional position in any part of the Hokanui District." The series was correlated with the Lower Triassic (p. vii). Hector listed (p. xi) seven characteristic species and included the first description of *Spiriferina* (*Psiondea*) *conjuncta* Hector (see Marwick, 1953, p. 39).

Hutton (1885, pp. 194, 204) classified Triassic rocks overlying the Kaihiku Series into two series, the Oreti and Otapiri Series, which together constituted the Wairoa Series.

Hector (1886, p. 75) referred the Oreti Series to the Permian.

Vol. 82, Part 5, pp. 1033–1047, Plate 39, 4 Text-figs., March, 1955

Trechmann (1918, p. 167) correlated the Oreti Series with the lower Carnic of the Upper Triassic. Within the Wairoa Series two horizons were indicated above the Oreti-Kaihiku boundary and below the *Mytilus problematicus* horizon (Table 6).

Benson (1921, pp. 23–4), in accepting Cox's (1878, p. 45) statement that the Upper Wairoa Series was characterized by *Monotis salinaria* Zittel, referred all post-Kaihikuan and pre-Warepan beds to the Oreti Series.

Ongley (1939, pp. 37-40) subdivided the Wairoa Series into Otamita and Warepa Series, the lower boundaries being the first appearance of *Mytilus problematicus* Zittel and of *Monotis richmondiana* Zittel respectively.

Marwick (1950) introduced stages and series for divisions of the Hokonui System, Oretian Stage being equivalent to the Oreti Series. The Gore Series was introduced to include Etalian, Kaihikuan and Oretian Stages. A single species was listed (p. 9) as occurring in the stage along with three genera, the latter all represented from other stages.

The same author (1952, p. 29) referred the Otamitan and Oretian Stages to the Middle Triassic.

Marwick (1953, pp. 13-4) designated the type locality of the Oretian Stage and listed 14 species described or recorded from Oretian beds. *Oretia coxi* Marwick was described from a locality in the type section.

Definition

The Oretian Stage is defined as the rocks that were laid down at the type locality between the first appearance of the genus *Halobia* and the first appearance of *Mytilus problematicus* Zittel. In stratal terms this consists of 6,800 feet of sandstone, siltstone and tuff lying between localities S160/508 and S160/520.

The following forms appear to be restricted to Oretian beds at the type locality.—

Spiriferina (Psioidea) conjuncta Hector
Retzia morganiana Wilckens
Oretia coxi Marwick.

Several undescribed brachiopods are restricted forms.

At the type locality the following make their first appearance in the Oretian but are not restricted to it:—

Spiriferina (Psioidea) australis Trechmann
Athyris cf. *wreyi* (Suess)
Halobia cf *hochstetteri* Mojsisovics
H cf. *lilliei* Marwick
Hokonuia limaeformis Trechmann
Anodontophora angulata Trechmann
Pleurotomaria cf. *hokonuiensis* Trechmann
Lepidotrochus wilckensi Marwick.

The following are restricted forms in sequences that are Oretian by correlation:—

Spiriferina novoseelandica (Wilckens)
Spiriferina (Psioidea) nelsonensis Trechmann
Retzia reticulata Wilckens

Dicyclocidaris denticulata Fell
Palaeoneilo cf. *hamiltoni* Wilckens
Cucullaea wellmani Marwick
Myophoria nuggetensis Trechmann
Lima georgii-boehmi Wilckens
Poroa arata (Trechmann).

Work is proceeding on a number of undescribed brachiopod species that qualify for inclusion here.

The following forms, also known from Otamitan beds make their first appearance in beds that are Oretian by correlation:—

Hokonuia sp. *(Gonodon mellingi* Hauer of Wilckens)
Raha spectabilis (Trechmann)
Proclydonautilus mandevillei (Marshall)
Rhacophyllites sp.

TYPE LOCALITY

The type section lies between Dipton and Caroline railway stations in the western Hokonui Hills, Southland. It consists of a regular series of beds dipping to the south-west at angles between 70° and 45° and striking consistently SSE (130°-135° T). Near Caroline the rocks are well exposed in road and rail cuttings but farther south natural outcrops must be relied upon. In all, a fairly complete exposure is available

The total thickness for beds of the stage is 6,800 feet.

Halobia first appears in a bed 2 feet thick, of fairly finely bedded medium grained blue sandstone some 300 feet stratigraphically above the highest of the three prolific Kaihikuan fossil bands. The *Halobia*-bearing bed crops out (S160/508) in a road cutting on the southern slope of a spur one mile south of the Caroline railway station, the rail cutting through this spur being well known as G.S 380, the Kaihikuan fossil locality of Trechmann, "Caroline Cutting."

The *Halobia*-bearing bed is immediately underlain by a conspicuous bed of massive coarse grained blue sandstone. Some 300 feet above the *Halobia*-bearing bed, coarse sandstone at least 200 feet thick appears. This is pebbly in parts and near the top grades into a coarse conglomerate

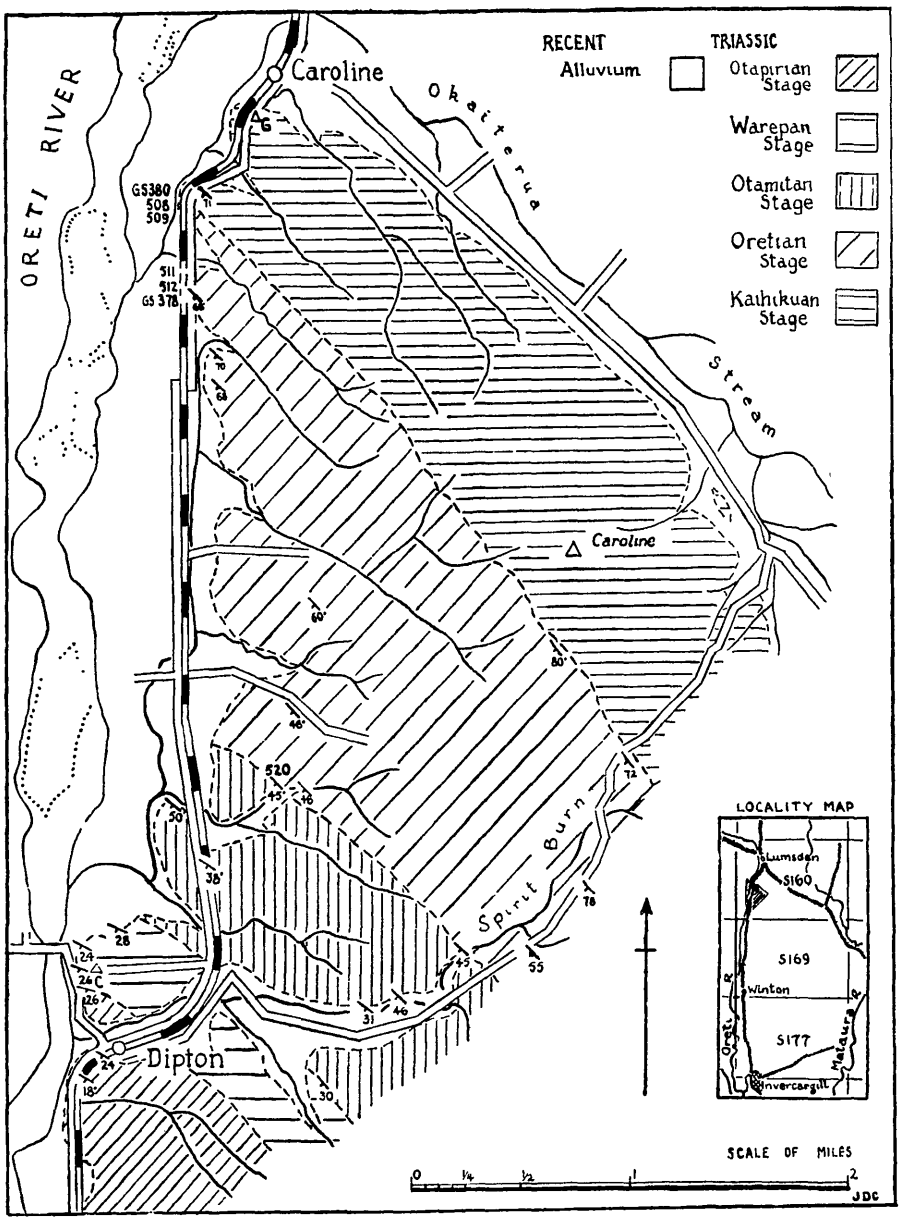
Thirty feet of sandstone with *Halobia* (S160/509) intervene between the conglomerate and a further bed of coarse sandstone. The two beds of coarse sandstone are possibly equivalent to the conglomerate mentioned by Hector (1878, p x) as marking the base of the Oreti Series. McKay (1878, p. 71) considered the conglomerate to be represented by the upper bed of coarse sandstone " . . seen on the sides of a gully a little south of the third cutting from Cowans [now Caroline] railway station" On the southern slopes of Caroline Hill, 1½ miles SE of the railway line the Kaihikuan fossil beds (S160/507) are overlain by a conspicuous band of coarse conglomerate at least 300 feet thick.

The specimens of *Halobia* from the bed in which the genus first appears conform well with the description and figure of *H. lilliei* Marwick. The identification is tentative, however, since type material of the three species described from New Zealand has not been examined.

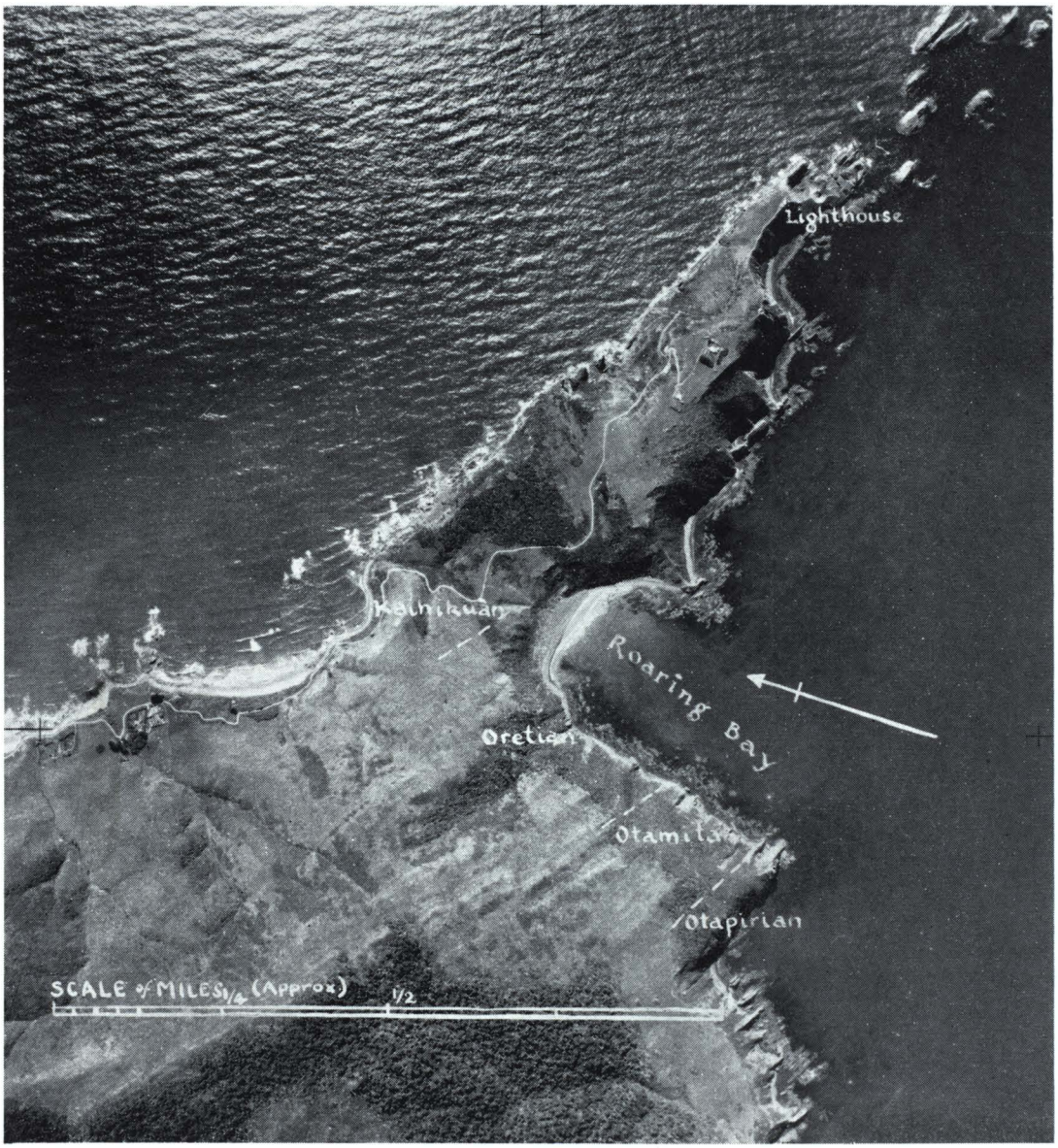
A number of new forms make their first appearance in a group of beds, some 350 feet thick, that are well displayed in a road cutting 3½ miles north

of Dipton railway station The cutting is in the spur mentioned by McKay (1878, p. 71) and the lithology of the beds exposed here was described by Beck (in Marwick, 1953, p. 13).

At the northern end of the cutting in a bed (S160/511), 1,200 feet above the base of the stage the following make their first appearance:—



TEXT-FIG 1.—Geological map of the north-west portion of the Hokonui Hills, Southland. Important localities are indicated by fossil record form numbers (e.g., 509) for sheet S160.



Aerial Photograph of Nugget Point, South Otago. Published by permission of the Department of Lands and Survey.

Lands and Survey Dept., photo.

Facing page 1036]

" Terebratula " n. sp.
Retzia morganiana Wilckens
Athyris cf *wreyi* (Suess)
Anodontophora angulata Trechmann
Hokonuia linaeformis Trechmann
Pleurotomaria cf. *hokonuiensis* Trechmann

The first-named species was discovered by Coombs (1950, p. 436) in Oretian beds on Wether Hill, 3½ miles NW of the present locality, and on White Hill It also occurs at Nugget Point

Athyris cf. *wreyi* (Suess) is a common fossil throughout 400 feet of the sequence It is preserved in large numbers at several horizons exposed in the road cutting. McKay (1878, p. 71) discovered some of these prolific beds at the northern end of the spur.

Two brachiopods, *Spiriferina (Psiondea) australis* Trechmann, and *Athyris* n. sp. make their appearance in an horizon 1,400 feet above the base of the stage. The bed is a prolific one and crops out (S160/512) just north of the middle of the cutting.

The faunule mentioned by McKay as including "a large *Inoceramus*-like shell " and occurring on the southern side of the spur (G.S. 378), appears in an horizon (S160/514) 1,500 feet above the base of the stage. Species making their first appearance here are:—

Spiriferina (Psiondea) conjuncta Hector
Oretia coxi Marwick
Lepidotrochus wilckensi Marwick

Although exposures are less abundant in the overlying 5,300 feet of sediments much fine material was examined but not one incoming species was recognised. The only fossils found in these beds were —

Halobia sp
Hokonuia linaeformis Trechmann
Anodontophora angulata Trechmann

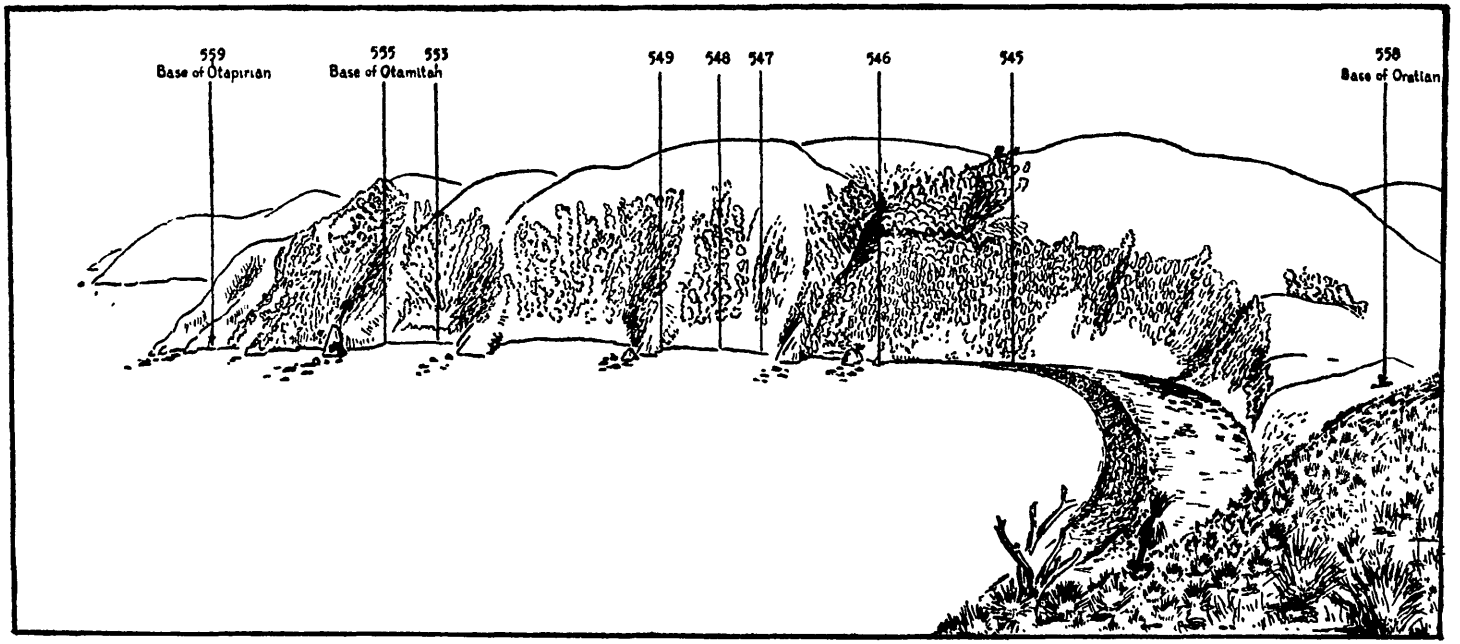
Beck (in Marwick, 1953, p 13) recorded vitric tuffs from the sequence exposed in the road cutting (1,200 to 1,500 feet above the base of the stage). There is a much greater development of tuffs in the uppermost 3,000 feet of the stage. No fossils were found in these rocks.

The upper limit of the stage is marked by the incoming of *Mytilus problematicus* Zittel. This fossil occurs in abundance 6,800 feet above the base of the Oretian Stage. The most westerly outcrop near Dipton (S160/520) is in a stream valley 1½ miles NE of Dipton railway station and 30 chains east of the railway line. The railway line crosses the stream 1¼ miles from Dipton.

NUGGET POINT

Introduction The Triassic sequence displayed in Roaring (Shaw) Bay, Nugget Point, South Otago, has long been recognised as a classic. It is particularly useful for testing the validity of any criterion of subdivision of the Triassic rocks of New Zealand

The writer has recently (1953-4 field season) re-measured the Roaring Bay section from the Kaihikuan fossil bed upwards using a 100 feet steel tape Large scale measurements were checked against a vertical air photograph.



TEXT-FIG. 2.—Field sketch of Roaring Bay, Nugget Point, South Otago. **Important localities are indicated by fossil record form numbers (e.g., 549) for sheet S179.**

Historical: Nugget Point had been visited by Lindsay in 1860–1 (*fide* Park, 1910, pp. 1, 2) and McKay in 1873 (McKay, 1877, p. 60) before the survey of the Hokonui Hills was undertaken in 1877-8. Hector, Cox and McKay appear to have made no attempt to subdivide the Nugget Point sequence in terms of the units proposed for the Hokonui Hills.

Park (1904) measured the Triassic section in Roaring Bay recognising 21 beds with a total thickness of 2,500 feet. Within his " Shaw Bay Series " and between the " *Spiriferina* " beds (Kaihiku Series) and " *Mytilus* and *Monotis* " beds (Wairoa Series) he recognised " *Halobia* " and " *Trigonia* " beds. These included beds 6 to 16 and 17, 18 respectively (p. 383).

Trechmann (1918) visited Nugget Point but did not succeed in finding the Kaihikuan fossil bed. He published a diagrammatic section (fig. 2, p. 180), based partly on Park, in which 19 units were recognised. Of these, 3 to 16 inclusive were indicated as Carnic, 5 to 16 lying below the incoming of *Mytilus problematicus* Zittel.

Trechmann described three species from the Carnic beds of Nugget Point. Of these, *Cardiomorpha? nuggetensis* Trechmann is either Otamitan or Oretian while *Myophoria nuggetensis* Trechmann is definitely Oretian.

Wilckens (1927) described Triassic fossils from Roaring Bay collected by Park nearly 25 years previously. Park's divisions were used with European correlatives following Trechmann:—

Beds AA " *Spiriferina* and *Halobia* " beds
Beds BB " *Trigonia* " beds
Beds CC " *Mytilus* and Oyster " beds
Beds DD " *Clavigera* " beds

AA included Kaihikuan and Oretian beds (*op. cit.*, p. 44), and the three species described from the rocks of this division are all Kaihikuan. No species were described from the overlying " *Trigonia* " beds (BB) which undoubtedly represent the remainder of the Oretian Stage.

Mackie (1935, pp. 280-1) correlated Park's and Trechmann's subdivisions and, following Trechmann, used European stratigraphic units.

Marwick (1953, p. 14) doubtfully referred beds 14 and 15 of Mackie to the Oretian Stage. From beds BB of Park (in Wilckens, 1927) he described *Lepidotrochus wilckensi* Marwick.

Roaring Bay Sequence: The lowest occurrence of *Halobia* is in a bed of fine grained sandstone some 300 feet above the highest Kaihikuan fossils. The bed crops out (S179/559) on the track that leads down into Roaring Bay from the gate into the Lighthouse Reserve. The bed was noted by Park (1904, p. 382) and formed part of his " *Halobia* " beds.

Other fossils making their first appearance at this horizon are:—

" *Rhynchonella* " n. sp.
" *Terebratula* " n. sp.

The last named species is recorded above from the type section of the stage.

The rocks immediately underlying this bed are not exposed and it is fully realised that this horizon may not mark the first appearance of *Halobia* in the section.

Kaihikuan fossils were collected from beds of fine grained sandstone (S179/560) above and below a bed of massive coarse grained feldspathic sandstone

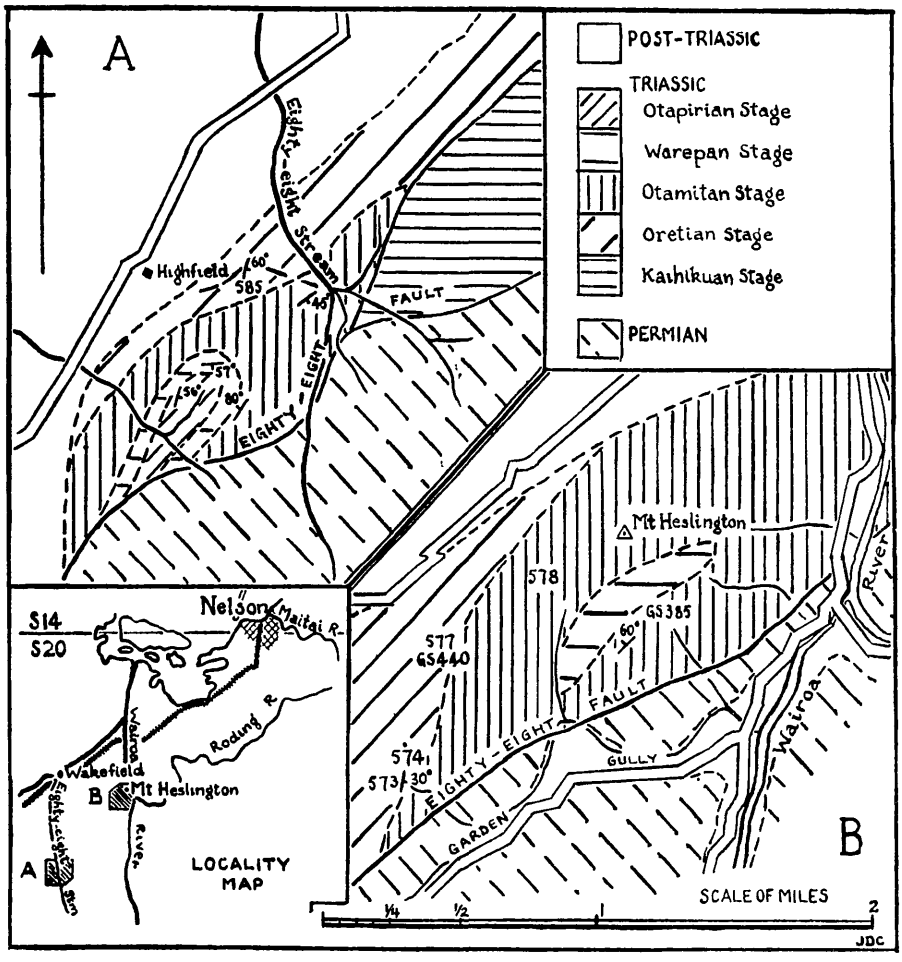
which crops out 100 yards north of the gate into the Lighthouse Reserve. The feldspathic sandstone is correlated with a similar bed which crops out " . . . at the point where the road leading to the lighthouse leaves the beach " (Park, 1904, p. 381). Here, too, sandstones with Kaihikuan fossils (S179/563) lie above and below the coarser bed.

Anodontophora angulata Trechmann makes its appearance 200 feet above the base of the stage in sandstones that are exposed in wooded cliffs at the north-west extremity of Roaring Bay.

In an horizon, 100 feet higher in the sequence, in outcrops on the west wall of the high beach (S179/545) two forms make their first appearance:

Palaeoneilo cf. *hamiltoni* Wilckens.
Lepidotrochus wilckensi Marwick.

All but a few feet of the overlying 1,200 feet of Oretian beds are continuously displayed in the wave-cut platform, stacks and cliffs on the west



TEXT-FIG. 3.—Geological maps of Eighty-eight Valley (A) and the Mt. Heslington Region (B), Nelson (based in part on Wellman MS). Important localities are indicated by fossil record form numbers (e.g., 585) for sheet S20.

of the bay. In this section which can be measured with great accuracy, the first relatively resistant bed met with as one moves south off the high beach, is an horizon 400 feet above the base of the stage. In this bed of massive sandstone (S179/546) the following make their first appearance in the section:—

Athyris cf. *wreyi* (Suess)
Halobia cf. *hochstetteri* Mojsisovics
Hokonuia limaeformis Trechmann
?Panope sp.

The last named species which also occurs at Marakopa, was discovered by Coombs in Oretian beds on Wether Hill, Taringatura (pers comm.).

Less than 50 feet above the fossil bed is the base of a conspicuous bed of conglomerate that forms the major headland at the north end of the west shore section.

Two species of cephalopods, *Proclydonautilus mandevillei* (Marshall) and *Rhacophyllites* sp., make their appearance in a sandstone bed (S179/547) 600 feet above the base of the stage and immediately underlying a bed of conglomerate less than one foot thick (bed 15 of Park, 1904, p. 383; bed 9 of Trechmann, 1918) It was possibly from this locality that McKay (1877, p. 65) noted "chambered shells."

In a bed (S179/548) 700 feet above the incoming of *Halobia*, two molluscs make their apearance —

Myophoria nuggetensis Trechmann
Pleurotomaria cf. *hectori* Trechmann

They are preserved in massive medium grained blue sandstone and the large shells make it a conspicuous horizon. This bed and those overlying it but underlying the *Mytilus problematicus* bed were termed "*Trigonia*" beds by Park (1904)

At an horizon 900 feet above the base of the stage the brachiopod *Spiriferina* cf. *nelsonensis* Trechmann makes its appearance (S179/549)

An horizon at 1,000 feet is marked by the incoming of crinoids.

Poroa arata (Trechmann) was collected from a bed (S179/551) 1,300 feet above the base of the stage and in an horizon 50 feet higher (S179/553) *Spiriferina* cf *novoseelandica* (Wilckens) and *Lima georgii-boehmi* Wilckens make their appearance.

The upper limit of the Oretian Stage is clearly marked by the incoming in profusion of *Mytilus problematicus* Zittel, 1,500 feet above the first appearance of *Halobia* This conspicuous bed crops out (S179/555) just north of the largest stack on the west shore of the bay It was noted by McKay (1877, p 65), Park (1904, p 383) and Trechmann (1918).

NELSON

Introduction. Beds of Triassic age crop out along a narrow strip for some 12 miles south-west from Nelson City Kaihikuan and higher stages are represented.

The writer has not mapped the Nelson Trias in detail but has collected extensively there more especially from localities at Hart Creek, Mt. Heslington, Garden Gully, Pitfure Creek and Eighty-eight Valley. He is grateful to Mr. H. W. Wellman, New Zealand Geological Survey, who generously made available his MS on the Nelson Trias.

Historical: Hochstetter's early visit to the Triassic rocks south of Nelson City led to the description of the following fossils:—

Halobia hochstetteri Mojsisovics
Monotis richmondiana Zittel
Mytilus problematicus Zittel
Athyris wreyi (Suess)

He introduced the term " Richmond Sandstone " to include the rocks from which these fossils were collected.

Hector (1878, p. x) in separating the Oreti Series from the Wairoa Series stated ". . . . it [the Oreti Series] does not occur in the Wairoa District as far as yet known."

McKay (1878, pp. 125-6) described the Triassic sequence in the Mt. Heslington (then called Mt. Wellington) region. He recognised two divisions of beds underlying the *Mytilus problematicus* bed, " Lower conglomerates and breccia beds " and " Fine grained sandstones with *Spirifer,* etc."

In his second report (1879, pp. 101, 119), McKay termed the latter division the " *Psioidea* " beds. He stated that no representative of the Oreti Series had been recognized in the Nelson district.

Park (1904a) described three sections across the Triassic rocks south of Wairoa Gorge recognizing three divisions between the " *Spiriferina* claystones and sandstones " and the " *Mytilus* Sandstone ".

Trechmann (1918) described nine species from the Triassic rocks of Nelson and of these the following were from Oretian beds.

Spiriferina (*Psioidea*) *nelsonensis* Trechmann
S. (*Psioidea*) *australis* Trechmann
Megalodon globularis Trechmann
Poroa arata (Trechmann)
Raha spectabilis (Trechmann)

The two species of *Spiriferina* were described from Oretian beds on the crest of the Mt. Heslington ridge, termed by Trechmann, " *Halobia* " beds.

Wilckens (1927) described the Triassic fossils collected from Nelson localities by Park. Of the seven species described the following were from Oretian beds:—

Spiriferina novoseelandica (Wilckens)
Retzia reticulata Wilckens
R. morganiana Wilckens
Lima georgii-boehmi Wilckens

Fell (1950) described the echinoid *Dicyclocidaris denticulata* Fell from an Oretian locality on Pitfure Creek.

Marwick (1953) described two species from Oretian beds in the Nelson district:—

Cucullaea wellmani Marwick
Pinna octavia Marwick.

Marwick included the first record of Oretian beds in the Nelson area (p. 14) and stated (p 51) that " G.S. 440 ' *Psioidea* ' beds of McKay, probably comprises both Oretian and Otamitan."

Eighty-eight Valley In 1952 the writer discovered a boulder of blue sandstone on the track leading down to Eighty-eight Creek from the homestead

on Thomas Hunt's " Highfield " property (S20/585). This boulder was recognized as lithologically similar to the matrix from which Wilckens described his species of *Retzia* and it contained the following faunule:—

Spiriferina novoseelandica (Wilckens)
Retzia reticulata Wilckens
R. morganiana Wilckens
Athyris cf. *wreyi* (Suess)
Cucullaea wellmani Marwick
Halobia cf. *hochstetteri* Mojsisovics
Lima georgii-boehmi Wilckens.

Some of these fossils in a slightly coarser matrix were found in place nearby, about 150 feet stratigraphically below the lowest *Mytilus problematicus* horizon. It was suspected that this Oretian horizon was in fact Wilckens' " Bed A, Eighty-eight Valley."

Pitfure Creek: In 1953, in company with G. H. Scott, B.A., G.S. 4592 (S20/573) was visited. From an horizon less than 200 feet below the base of the Otamitan Stage, the same faunule as recorded above for S20/585, Eighty-eight Valley was collected along with: —

Spiriferina (Psioidea) nelsonensis Trechmann
S. (Psioidea) australis Trechmann.

Garden Gully: A large collection was made in Garden Gully (S20/574) from an horizon 150 feet below the incoming of *Mytilus problematicus* and the following fossils were among those found:—

Spiriferina novoseelandica (Wilckens)
Spiriferina (Psioidea) nelsonensis Trechmann
S. (Psioidea) australis Trechmann
Retzia reticulata Wilckens
R. morganiana Wilckens
Athyris cf. *wreyi* (Suess)
Dicyclocidaris denticulata Fell
Cucullaea wellmani Marwick
Halobia cf. *hochstetteri* Mojsisovics
Lima georgii-boehmi Wilckens

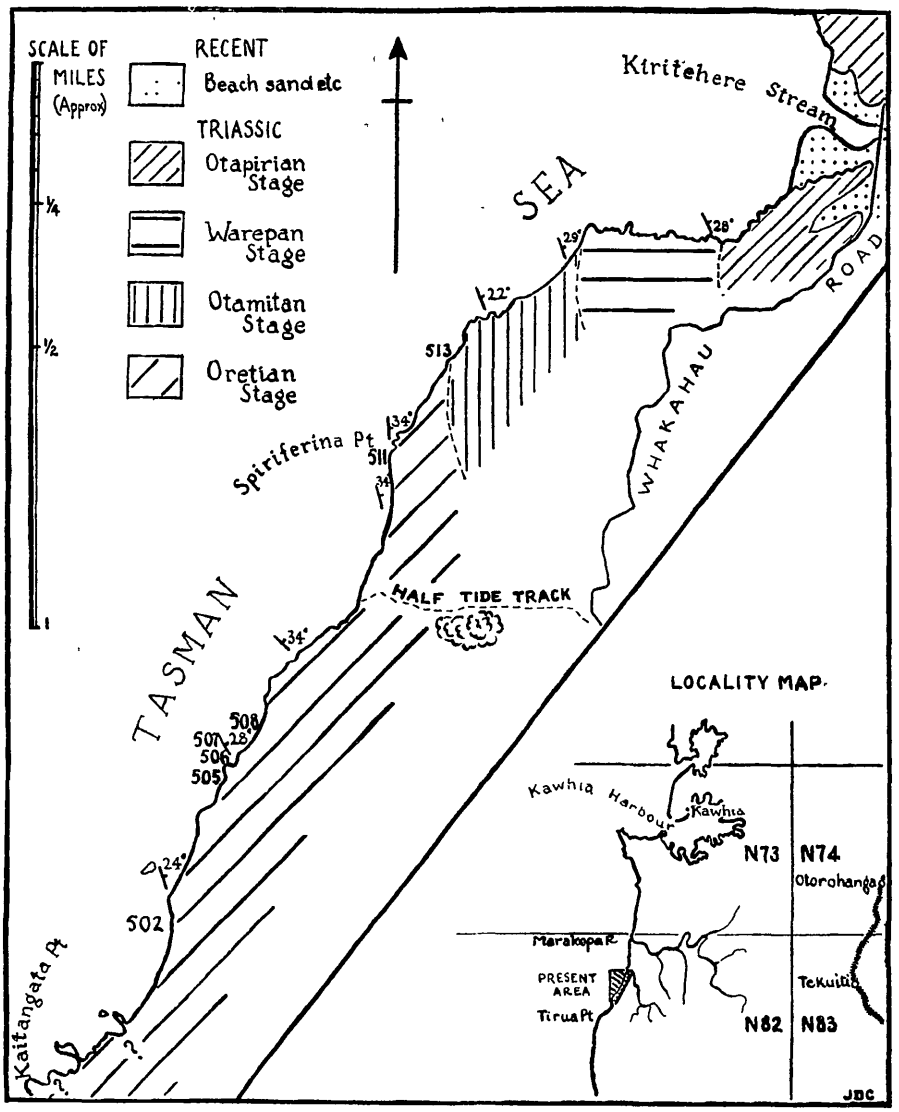
Mt. Heslington: From the head of Garden Gully the prolific Oretian fossil bed was traced over the Mt. Heslington ridge, where on the western slopes its outcrop (S20/577) gives rise to a scree which is clearly the locality G.S. 440, the " *Psioidea* " beds of McKay and " *Halobia* " beds of Trechmann.

MARAKOPA

Introduction: Triassic sediments are exposed without significant break for more than two miles south of Kiritehere Stream on the west coast of the North Island near Marakopa, Marakopa and Whareorino Survey Districts.

During the 1953-4 field season Dr. D. S. Coombs and the writer re-measured the sequence exposed between Kaitangata Point and the mouth of Kiritehere Stream.

Historical: Williamson (1932) first mapped and measured the coastal section south of Marakopa. He divided the Triassic beds into six units based partly on fossils and partly on lithology. No fossils were found below the base of



TEXT-FIG. 4.—Geological map of the coastline between Kiritehere Stream and Kaitangata Point, Marakopa district, South Auckland. Important localities are indicated by fossil record form numbers (e.g. 508) for sheet N82.

the Whakahau Series (incoming of *Mytilus problematicus* Zittel) but on grounds of lithological similarity to the type section in Southland, 2,500 feet of "greywacke and argillite" were referred to the Oreti Series. The underlying Moeatoa Series, consisting of 4,000 feet of "coarse marine igneous conglomerate, minor indurated sandstone and grit" was doubtfully correlated with the Kaihiku Series.

Marwick (1946, pp. 24-7) retained Williamson's classification.

Coastal Sequence.—The Moeatoa Series which includes the lowest beds exposed on the coast south of Marakopa consists of conglomerate with lenses of

sandstone and, near the top, siltstone and tuff Fossils were found in the siltstone, 35 feet stratigraphically below the unconformable contact of the siltstones and tuffs with the top 60 feet of conglomerate The siltstone crops out at beach level 33 chains NNE of Kaitangata Point (N82/502)

The fossils are *Halobia* sp. and conform closely with *H lilliei* Marwick.

The fact that *Halobia* first appears in the lowest occurrence of a type of lithology suited to its preservation suggests that facies is involved here and it is therefore unsafe to correlate on the basis of the first appearance.

Two feet above the base of a bed 15 feet thick of finely bedded mottled sandstone and 360 feet above the incoming of *Halobia* the following fossils make their first appearance (N82/505) :—

" Rhynchonella " n. sp.
" Terebratula n. sp.
Spiriferina (Psioidea) australis Trechmann
Mentzeliopsis n. sp

Sixty feet higher in the sequence (N82/506), *Anodontophora angulata* Trechmann, makes its appearance.

An horizon 460 feet above the incoming of *Halobia* contains the following :—

Spiriferina aff *trechmanni* (Wilckens)
Spiriferina (Psioidea) nelsonensis Trechmann
Athyris cf *wreyi* (Suess)
Halobia cf. *hochstetteri* Mojsisovics
Lima georgii-boehmi Wilckens.

The fossil bed is a coarse grained blue massive sandstone which grades up into fine conglomerate. It crops out at beach level (N82/507) on the north wall of a promontory 55 chains NNE of Kaitangata Point.

A great series of siltstones with pink, white and grey tuffs makes up the remaining 1,670 feet of Oretian beds The siltstones appear to be fossiliferous throughout Near the base of the unit (N82/508) and 480 feet above the appearance of *Halobia* the following make their appearance :—

?Panope sp
Hokonuia cf *limaeformis* Trechmann.

Three hundred feet below the base of the Otamitan Stage the following make their appearance. —

Spiriferina n sp
Hokonuia sp. *(Gonodon mellingi* Hauer of Wilckens)
Proclydonautilus mandevillei (Marshall)
Rhacophyllites sp.

The fossils are abundant and well preserved The outcrop is 25 chains N of the Half Tide Track where it forms a promontory (*" Spiriferina "* Point). The horizon is 1,810 feet above the incoming of *Halobia.*

The highest beds of the Oretian Stage are not exposed at beach level; Oretian siltstones are faulted against Otamitan beds (N82/513) crowded with *Mytilus problematicus* Zittel. From examination of the cliff section farther south it would appear that the throw of the fault does not exceed 50 feet.

Faunal Index

The following species have been described from the type locality of the Oretian Stage:—

Spiriferina (Psioidea) conjuncta J. Hector, 1878
Oretia coxi J. Marwick, 1953

The following species have been described from beds correlated with the Oretian:—

Spiriferina novoseelandica (O. Wilckens, 1927)
Spiriferina (Psioidea) nelsonensis C. T. Trechmann, 1918
S. (Psioidea) australis C. T. Trechmann, 1918
Retzia reticulata O. Wilckens, 1927
R. morganiana O. Wilckens, 1927
Dicyclocidaris denticulata H. B. Fell, 1950
Cucullaea wellmani J. Marwick, 1953
Myophoria nuggetensis C. T. Trechmann, 1918
Halobia lilliei J. Marwick, 1953
Pinna octavia J. Marwick, 1953
Lima georgii-boehmi O. Wilckens, 1927
Megalodon globularis C. T. Trechmann, 1918
Lepidotrochus wilckensi J. Marwick, 1953
Poroa arata (C. T. Trechmann, 1918).
Raha spectabilis (C. T. Trechmann, 1918).

The age of the beds from which the following were described is uncertain; in each case it is either Oretian or Otamitan:—

Athyris wreyi (E. Suess, 1864)
Cardiomorpha? nuggetensis C. T. Trechmann, 1918
Halobia hochstetteri E. Mojsisovics, 1864
Proclydonautilus mandevillei (P. Marshall, 1909).

Literature

Allan, R. S., 1945. Palaeozoic and Mesozoic Brachiopod Faunas in New Zealand: With an Index to the Genera and Species. *Trans. Roy. Soc. N.Z.*, 75, pp. 1–22.

Benson, W. N., 1921. Recent Advances in New Zealand Geology. *Rep. Aust. Ass. Advanc. Sci.*, No. 15, pp. 45–133.

Coombs, D. S., 1950. The Geology of the Northern Taringatura Hills, Southland. *Trans. Roy. Soc. N.Z.*, 78, pp. 426–448, Pl. 54.

Cox, S. H., 1878. Report on the Geology of the Hokanui Ranges, Southland *N.Z. Geol. Surv. Rep. Geol. Explor. 1877–8 (11)*, pp 25–48, map, sections

Fell, H. B., 1950. A Triassic Echinoid from New Zealand. *Trans. Roy. Soc N Z*, 78, pp 83–85, Pl. 12.

Hector, J., 1878. Progress Report. *N.Z. Geol. Surv. Rep. Geol. Explor., 1877-8 (11)*, pp. i-xv.

——— 1886. Outline of New Zealand Geology. *App. to Ind. and Col. Exhib., N.Z. Court. Detailed Cat. and Guide to Geol. Exhib.*, Wellington, 88 pp.

Henderson, J. and Grange, L. I., 1926. The Geology of the Huntly-Kawhia Subdivision. *N.Z. Geol. Surv. Bull.* No. 28. 112 pp. 3 Pls, maps.

Henderson, J. and Ongley, M., 1923. The Geology of the Mokau Subdivision. *N.Z. Geol. Surv. Bull.* No. 24, 83 pp., 4 Pls., maps.

Hochstetter, F. v., 1864. Geologie von Neu-Seeland. *Reise d Oster. Freg. Novara, Geol, Theil.* 1 (1), 575 pp.

HUTTON, F. W., 1885. Sketch of the Geology of New Zealand. *Quart J. Geol Soc. (Lond.)*, 41, pp. 191–220.

McKAY, A., 1877. Reports Relative to Collections of Fossils in S.E. District of the Province of Otago. *N.Z. Geol. Surv. Rep. Geol. Explor. 1873-4* (8), pp. 59-73, sections.

——— 1878. Notes on the Sections and Collections of Fossils Obtained in the Hokanui District. *N.Z. Geol. Surv. Rep. Geol, Explor, 1877-8 (11)*, pp. 49–90.

——— 1878a. Report on the Waitoa and Dun Mountain Districts *N Z Geol Surv Rep Geol. Explor. 1877–8 (11)*, pp 119–159, map, sections

——— 1879. Report on the District Between the Wairau and Motueka Valleys. *N.Z. Geol. Surv. Rep. Geol. Explor, 1878–9 (12)*, pp 97–121, map, sections

——— 1884. On the Geology of Kawhia District. *N.Z. Geol. Surv Rep Geol. Explor., 1883–4 (16)*, pp. 140–148, map.

MACKIE, J. B, 1935. The Geology of the Glenomaru Survey District, Otago. *Trans Roy Soc N.Z.*, 64, pp. 275–302, Pls. 51, 51a.

MARWICK, J., 1946. The Geology of the Te Kuiti Subdivision *N.Z Geol Surv Bull.* No 41, 89 pp., 28 Pls, maps.

——— 1951. Series and Stage Divisions of N.Z Triassic and Jurassic Rocks *N Z. J. Sci Tech. (B)*, 32 (3), pp. 8–10.

——— 1952. The Affinities of the Commoner Brachiopoda and Mollusca of the Permian, Trias and Jura of New Zealand. *Symposium sur les Series de Gondwana* pp 28–33

——— 1953. Divisions and Faunas of the Hokonui System (Triassic and Jurassic) *N Z. Geol. Surv. Pal. Bull.*, No. 21, 141 pp., 17 Pls

ONGLEY, M., 1939. The Geology of Kaitangata-Green Island Subdivision. *N.Z. Geol. Surv. Bull.* No 38, vii and 90 pp., 5 Pls, map.

PARK, J., 1904. On the Subdivision of the Lower Mesozoic Rocks of New Zealand *Trans. N.Z. Inst.*, 36, pp. 373–404, Pls. XXVIII–XXXI.

——— 1904a. On the Jurassic Age of the Matai Series *Trans N.Z Inst* 36, pp. 431–446, Pls. XXXIII–XXXIV.

——— 1910. *The Geology of New Zealand: An Introduction to the Historical, Structural, and Economic Geology.* Christchurch: Whitcombe and Tombs 488 pp, 27 Pls geol map

THOMSON, J. A., 1913. Materials for the Palaeontology of New Zealand. *N.Z. Geol. Surv Pal. Bull.* No. 1, 104 pp., 6 Pls.

TRECHMANN, C. T., 1918. The Trias of New Zealand *Quart. J Geol. Soc (Lond.)*, 73 (3), pp. 165–246, Pls. XVII–XXV.

WATTERS, W. A., 1952. The Geology of the Eastern Hokonui Hills *Trans Roy Soc N Z*, 79 pp. 467–484, Pls. 95–6.

WILCKENS, O., 1927. Contributions to the Palaeontology of the New Zealand Trias *N Z Geol. Surv. Pal. Bull* No. 12, 65 pp., 10 Pls

WILLETT, R. W., 1948. Triassic. *The Outline of the Geology of New Zealand* N Z. Geological Survey, Wellington, 47 pp

WILLETT, R W. and ROUT, M. V., 1949. The Geology of the Wanaki Survey District, Southland. *Trans. Roy Soc N Z*. 77, pp. 291–305, Pl 35

WILLIAMSON, J. H., 1932. Te Kuiti Subdivision *N.Z. Geol. Surv 26th Ann Rep*. pp 5–8, map.

WOOD, B. L, 1953. Paleozoic and Mesozoic Stratigraphy and Structure in Southland *Rep Roy Soc. N.Z. 7th Sci. Congr.*, pp. 106–114.