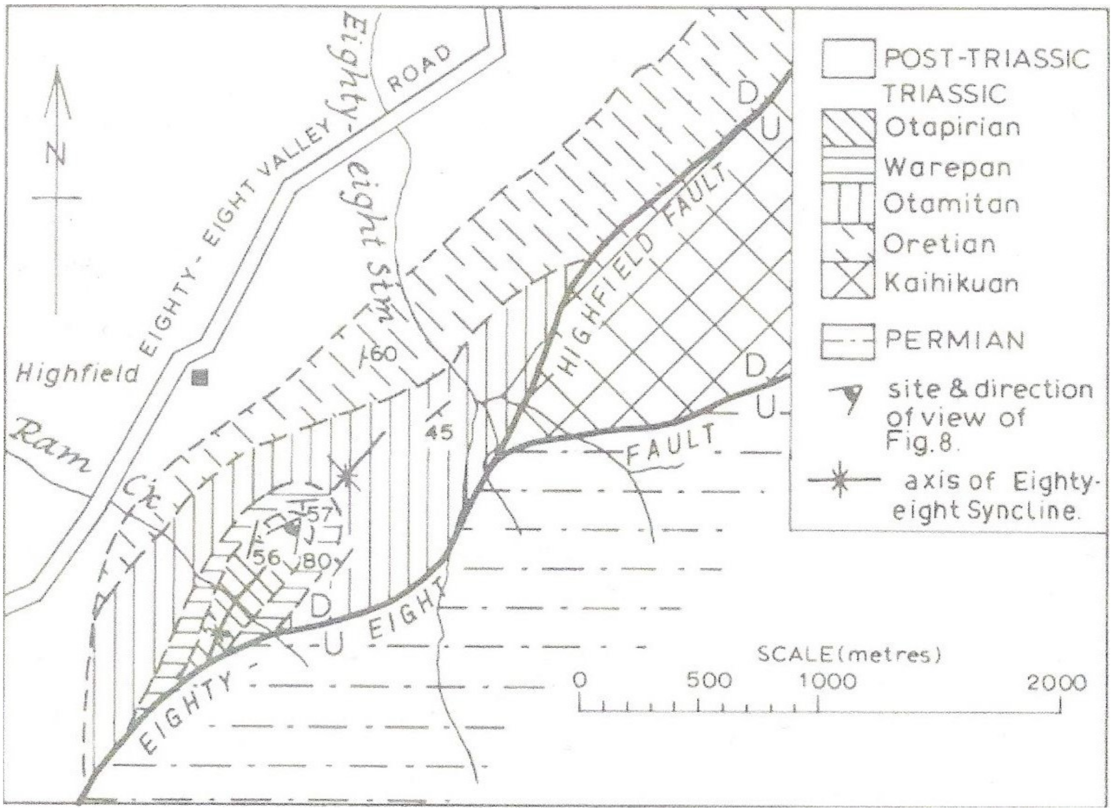
'Highfield' (88 Valley) Project

By Ian Iadds and Dave Briggs 2016

Our project is focusing on the area within Highfield Farm, in the 88 Valley. The land-owner has kindly given the Club access to the farm. (With permission from other land-owners in the area, we have also had brief forays onto nearby farms).

The below map is the base from which we are working. While the project started as collecting trips it soon became apparent that there was a lot of geology to see and understand. What sequences were we looking at? How do we get a syncline on top of the hill? Where are the faults and what is their effect on the stratigraphy and landscape?



Map 1. The geology of the Highfield area as mapped by Grant Mackie (GGNZ, Volume 14, 1984 - after Campbell, 1955)

Other interesting questions have arisen as we've worked. One is the position of the 88 Valley fault. Our preliminary research indicates that it is much straighter than shown on the map. We also have concerns about the boundary between the Oretian and the Kaihikuan, which does not seem to match that shown on the map.

For years I have collected without really understanding the place of each fossil, its environment, why its where it is, and so on. But now we try to place the fossils with GPS readings, which allow us to locate them accurately on a map. Then, by learning their names, we can place an appropriate time span/era to the area in which they occur, and as a consequence divide the farm into its geological time zones. Identifying the fossils, however, isn't always easy, because many of the fossils previously identified aren't available as photographs – just as a name in a list. So knowing what they look like is challenging!

We can also study the rock outcrops, and measure their dip and strike, to help work out the stratigraphy, and match the strata to the fossils.

TABLE 4.5 *Series, stages, correlations, and characteristic fossils of the Lower and Middle Triassic (Gore Series) in New Zealand*

NEW ZEALAND SERIES and STAGES		CHARACTERISTIC FAUNA	INTERNATIONAL STAGES (*fide* Marwick, 1953a; Kummel, 1965)		
GORE SERIES	KAIHIKUAN	*Mentzeliopsis spinosa* (Trechmann) *Spiriferina kaihikuana* (Trechmann) *S. trechmanni* (Wilckens) *Athyris kaihikuana* (Trechmann) *Entrochus undatus* Bather *Monotrypella maorica* Wilckens *Daonella apteryx* Marwick *Agonisca corbiensis* Fleming *A.? thomsoni* (Wilckens) *Praegonia coombsi* Fleming *Patella nelsonensis* Trechmann	LADINIAN	MIDDLE	TRIASSIC
GORE SERIES	ETALIAN	*Ptychites cultrata* (Browne) *Leiophyllites marshalli* Browne *Parapopanoceras fraseri* (Browne) *P. bartrumi* (Browne) *P. routi* (Browne) *P. tepungai* (Browne) *Monophyllites* cf. *sphaerophyllus* (Hauer) *Mellarium mutchi* Waterhouse *M. nodulosum* Waterhouse	ANISIAN	MIDDLE	TRIASSIC
GORE SERIES	MALAKOVIAN	*Prosphingites coombsi* Kummel *Owenites* cf. *koeneni* Hyatt & Smith *Flemingites* cf. *lidacensis* Welter *Subvishnuites welteri* Spath *Wyomingites* cf. *aplanatus* (White) *Worthenia phillipsi* Waterhouse rhynchonellid, athyrid, dielasmatid, palaeophoriid	SCYTHIAN	LOWER	TRIASSIC

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Table 1.The Lower and Middle Triassic sequence in New Zealand

Even now we see things that we had not realised at the start. One issue concerns the extent of the Warepan. Outcrops of the Warepan are marked out by the presence of the bivalve, *Monotis.* According to previous studies, the Warepan is confined to the flanks of the syncline, which occurs in the SW corner of the farm. Our field work suggests that *Monotis* extends more widely around the syncline, suggesting that the Warepan beds are more extensive. With a bit more field work, we hope soon to have these mapped.

Map 2. Results of mapping the

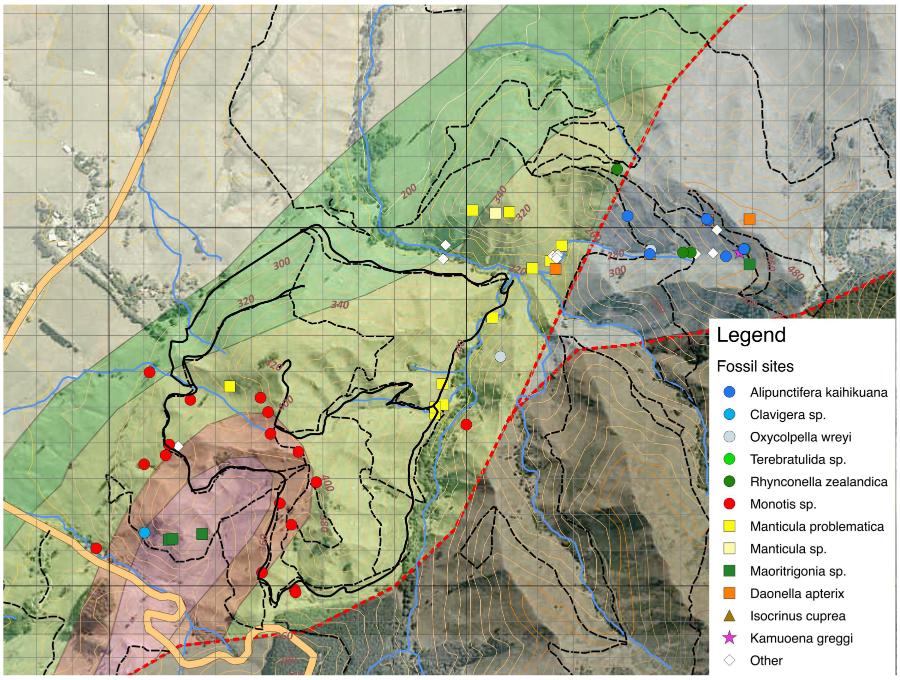


Table 2, below, summarises the Balfour series fauna and helps us check our fossil types with sites. The following sections summarise what we have learned, and what we have been studying, in recent months.

Table 2. Fossils of the Balfour Series (Upper Triassic)

TABLE 4.6 *Series, stages, correlations, and characteristic fossils of the Upper Triassic (Balfour Series) in New Zealand*

NEW ZEALAND SERIES and STAGES		KEY FOSSIL	CHARACTERISTIC FAUNA	INTERNATIONAL STAGES (*fide* Marwick, 1953a; Kummel, 1965)	
BALFOUR SERIES	OTAPIRIAN	*Rastelligera diomedea* Trech.	*Mentzelia kawhiana* Trechmann *Clavigera tumida* Hector *C. cuneiformis* Hect. *Rastelligera gypaeetus* (Trech.) *Otapiria dissimilis* (Cox) *Minetrigonia* n.spp. *Maoritrigonia* n.spp. *Aulacoceras otapiriense* Hect. *Arcestes* cf. *rhaeticus* Clark	RHAETIAN	UPPER TRIASSIC
	WAREPAN	*Monotis richmondiana* Zittel	*Rastelligera*, *Clavigera* *Spiriferina trechmanni* (Wilckens) *Psioidea* cf. *nelsonensis* Trech. *Monotis calvata* Marwick *Falcimytilus* sp. *Maoritrigonia* n.sp.	NORIAN	
	OTAMITAN	*Manticula problematica* (Zitt.)	*Rastelligeria acutissima* Trech. *Psioidiella otamitensis* (Trech.) *Athyris manzavinioides* (Trech.) *Terebratula pachydentata* Trech. *Nuculana semicrenulata* Trech. *Maoritrigonia otamitensis* Trech. *Tutcheria parvula* (Trech.) *Mysidioptera riceae* Waterhouse *Hokonuia limaeformis* Trech. *Halobia hochstetteri* Mojsisovics *Pleurotomaria hokonuiensis* Trech. *Sisenna hectori* Trech. *Lepidotrochus marshalli* Trech. *Cenoceras trechmanni* Kummel *Proclydonautilus mandevillei* Marshall *Rhacophyllites debilis* Hauer *Cladiscites beyrichi* (Welter) *Arcestes hokonui* Marsh. *Pinacoceras*	KARNIAN	
	ORETIAN	*Psioidea conjuncta* Hector *Retzia morganiana* Wilck. *Oretia coxi* Marwick	*Psioidea australis* Trech. *Spiriferina novaeseelandica* (Wilck.) *Retzia reticulata* Wilck. *Halobia lilliei* *Halobia hochstetteri* *Cucullaea wellmanni* Marwick *Lima georgii-boehmi* Wilck. *Maoritrigonia nuggetensis* (Trech.) *Maoritrigonia* n.sp. *P. nelsonensis* Trech. *Dicyclocidaris denticulata* Fell *Epigymnites* sp. *Poroa arata* Trech.		

Oretian

At present the Oretian series is the most difficult to define, although I have found some indications. The best is the small brachiopod *Retzia sp,* along with *Oretia coxi* and *Oxycolpella wreyi* (previously *Athyris wreyi*). Although the area of Oretian outcrop is small, there are difficulties in understanding it, partly because there is a fault shown running through where the Oretian fossils are being found.

Otamitian

At this point, the Otamitian looks like being the most extensive group of beds in the area. *Manticula problematica* is definitive of this stage, and we find abundant specimens from the entance to the gorge to the already mentioned *M.problematica* beds which run up the 88 Valley stream, mostly on the western side of the stream. They are found in scree material right to the southern boundry in the area of the 88 Valley fault . A few have also been found on the northern flank of Grandfather's Gully, on the west side of the area. This is an especially interesting area, for *Monotis* occur in scree and blockfields in the floor of the gully and on its southern flank, so a junction between the *Manticula* and *Monotis* beds must lie in this area – even though elsewhere in the area they seem to be separated by a substantial thickness of rock.

Some papers suggest that a cross fault runs up the valley. We are checking this at present . A survey I did a year or two ago along a track on the north face of Cat Hill,m above the 88 Valley gorge, found *M. problematica*, in situ, throughout the gorge, from the western end to where the 88 Valley turns south at the eastern side of the gorge, a distance of 250 – 300 m . All of this neads confirming with more field work. The front (western) face of the farm is still being worked on, and the fossils found so far have to be confirmed and related to the ground area in which they are found.

Warepan

The area of Warepan rocks is now reasonably well sorted out, and detailed mapping has been done along all the ridges surrounding Ram Gully. We have a good ring of in situ *Monotis* sites here, and the remining work is mainly for confirmation and to tidy up details. Diane has helped a lot with understanding the stratigraphy in this area, and as a consequence the evidence has fitted together neatly. As noted, our finding show that *Monotis* is more extensive than previously thought, sugggesting thatr the Wqarepan beds are thicker. Questions also remain about the presence and location of the faults asscoiated with the syncline, but these will not change the general view .

Otapirian

The Otapirian is elusive. Previous papers show it as a small area in the centre of the syncline, but mapping it in the field is proving difficult. *Clavigera tumida, Maoritrigona sp* and one or two other fossil species indicative of the stage have been found, but further work is needed to map their distribution.

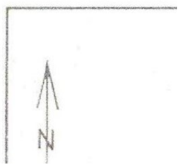
Faults

Finding and mapping the faults has been one of the main parts of the study. They are crucial to understanding the area because they often mark the boundaries of the stages, and can be responsible for bringing rocks of very different age together.

We have so far ingored the Waimea Fault, which runs along the west of the stuy area, and have focused mainly on the 88 Valley fault and its daughters. Work on this is nearing completion, and we have a reasonable idea of where it runs, although further confirmation is needed. Highfield Fault, and the other, smaller cross faults and splinter faults are still being explored. They are not easy for us to detect from the landscape, so again changes in fossil types etc can and do help. At least one apparent fault (Photo 1) that is visible in a track-cutting, is especially interesting, because it might not be a fault at all. Dave thinks it is a ‘gull’ – a feature formed by the opening up of joints or bedding planes as tension, caused by valle-cutting, causes the rocks to slide down the valley side. Again, more work is needed to confirm this theory – but if he’s right it would be one of the first (if not the first) recording of gulls in New Zealand.

Photo 1: Fault or ‘gull’? Map3 shows our current understanding of the faults.

Map 3. Distribution of faults



Come and join the fun!

As for what to do now, we still have lots of question to resolvem so if you enjoy learning about geology this is a good place. We debate, question, disagree and still have fun. We learn and get passionate about what we discover: as we do at present about the gull (cambering) versus fault debate. So feel free to join us and add your thoughts – or just enjoy the debates. Oh, and I should mention the dip and strike debate which at one site lasted a good half hour. The country is so broken that finding consensus is bound to be ******, very difficult.

Acknowledgments – To those who have helped and enjoyed the experience
Dave Briggs , Mary and Keven Davies-Bourne , Diane Toole , Tom Brown ,
Paul Henare , Gretta Trapper plus other my memory is letting me down on .