

Fig. 10. Map showing location of stratigraphic columns within NZMS 260 Sheet V21.

**Stratigraphic Column No:** 201

**Grid Reference:** Top

**Bottom**

NZMS 260 V21

**GPS Waypoint No(s):** 118, 165-167, RC11

**E:** 2815956

2816250

**Region:** Ritchdale Farm, on Ophero Road.

**N:** 6171364

6171043

**Location:** Outcrops along cliffs above tributary of Ngaruroro River, visible from roadside before one-way bridge.

**Altitude:** 180 m

94 m

**201**

**NZMS 260 Sheet:** V21 Napier

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**Author:** S. Dyer

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Stratigraphic Unit	Thick. (m)	Lithology	Structures	Dominant Fossils	Facies Code	WP No.	Description	
Okauauwa Formation	90		≠				Well-sorted, massive, friable, non-calcareous quartz sandstone.	
	80		=		Cg <sub>1</sub>	168	2 poorly consolidated gravel units of subrounded, moderately sorted greywacke pebbles, coarsening upwards from pebbles to cobbles, and separated by weakly crossbedded gravel unit. Lower gravel unit less well sorted and finer grained than the upper unit. Crossbeds coarsen upwards and segregation of light and heavy rock fragments give crossbeds a banded appearance.	
			↗		Cg <sub>3</sub>			
	70		=		Cg <sub>1</sub>			
			mm			RC 11		Blue/grey, calcareous, weakly cemented, horizontally bedded, fine sandstone with discontinuous and intermittent shell lenses dominated by gastropods, which are flattened. Eroded into by overlying gravel. Common lineations (<0.05 m thick) of graywacke granules and small pebbles.
	60							
	50							
	40							
	30							
	20			≠		M <sub>1</sub>	118	Blue/grey, calcareous friable, massive siltstone with discontinuous and intermittent shell lenses. Coarsening upwards and becoming bedded. Bivalves dominating shell lenses at base, giving way to gastropod domination with height. Small sharks teeth collected.
10								
0								
		Mud fine med coarse Silt fine med coarse Sand Gravel						

**Stratigraphic Column No:** 202

**Grid Reference:** Top

**Bottom**

NZMS 260 V21

**GPS Waypoint No(s):** 153 - 154

**E:** 2813506

2813534

**Region:** Ophero Station, end of Mangatahi Road.

**N:** 6170912

6170882

**Location:** Outcrops along banks of Mangatahi Stream, and exposures along farm tracks.

**Altitude:** 170 m

145 m

**202**

**NZMS 260 Sheet:** V21 Napier

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Author: S. Dyer

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Stratigraphic Unit	Thick. (m)	Lithology	Structures	Dominant Fossils	Facies Code	WP No.	Description
Okauawa Formation	30		=		Cg <sub>1</sub>	154	Unconsolidated gravel of subrounded, blocky-shaped, poorly-sorted greywacke and chert pebbles, and cobbles within a matrix of greywacke granules and coarse sand. Laterally discontinuous ribbons of friable, massive, non-calcareous, pumiceous siltstone common near the top of unit.
	28						
	26		mm				
	24						
	22						
	20						
	18						
	16						
	14						
	12						
	10		≠		M <sub>1</sub>	153	Blue/grey, calcareous weakly indurated, fossiliferous, massive siltstone, becoming coarser and less calcareous with height. Siltstone contains "debris" accumulations of jumbled fresh angular shell fragments and fractured bivalves. Gastropods fragile and appear squashed, Dominantly <i>Pellicaria convexa</i> , <i>Sigipetalla novaiszelandiae</i> , <i>Zeaculpus</i> sp. and <i>Amalda</i> sp.
	8						
	6						
	4						
	2						
	0						
		Mud fine med coarse Silt fine med coarse Sand Gravel					

**Stratigraphic Column No: 203**

**Grid Reference: Top**

**Bottom**

NZMS 260 V21

**GPS Waypoint No(s): 221 - 223**

**E: 2812878**

**2812966**

**Region: Totanatahi Station on Salisbury Road.**

**N: 6164285**

**6164344**

**Location: Column starts from the main farm track that leads southwards from farm sheds towards Yarrow Stream.**

**Altitude: 190 m**

**158 m**

**203**

**NZMS 260 Sheet: V21 Napier**

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**Author: S. Dyer**

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Stratigraphic Unit	Thick. (m)	Lithology	Structures	Dominant Fossils	Facies Code	WP No.	Description	
Okauawa Formation	34							
	32				Cg <sub>2</sub>	223	Greywacke gravel, graded, base of well-sorted, flattened, slightly elongated, well rounded imbricated pebbles, rapidly changing to massive, less well-sorted cobbles within a granule matrix of angular quartz and gwacke fragments.	
	30				M <sub>4</sub>		Blue-grey weakly indurated non-calcareous massive silt with fine laminations of coarse moderately-sorted gwacke sand appearing in top metre of silt.	
	28							
	26							
	24							
	22							
	20							
	18					Cg <sub>1</sub>	221	Greywacke gravel of moderately sorted, well rounded pebbles in a sandy matrix similar to sand below
	16					S <sub>2</sub>		Brown/beige friable, well-sorted, very weakly calcareous, laminated fine sand. Laminae are wavy, frequently discontinuous, and often grade laterally into rippled laminae. Also present are discontinuous cm-bedded wavy bands of highly weathered shell material
14					Cg <sub>1</sub>		Greywacke gravel bed of rounded pebbles at base coarsening upwards to rounded cobbles in a coarse poorly sorted gwacke sand matrix. Sharp erosional lower contact with silt	
12								
10					M <sub>1</sub>	222	Grey, massive, weakly indurated, weakly calcareous silt. Thin (<8 cm) shell lenses of non articulated Tawera and juvenile Ostrea valves at base disappearing with height	
8					Cs <sub>1</sub>		Silty shell bed dominated by non articulated and articulated bivalves. Other species identified incl. <i>Amelda</i> , <i>Atrina</i> , <i>Zeacolpus</i> and <i>Stiracolpus</i> , <i>Patro</i> , Bryozoan colonies, Slipper gasts and Cuppuchino gasts. Most orientated right way. Majority of material is non fragmented but very brittle.	
6							Blue-grey, weakly indurated, non calcareous silt, grades upwards from massive to mm laminations with orangey-brown mottles. Sharp upper lower contact with sand layers.	
4							Brown, well sorted, friable, weakly calcareous sand, mm laminations, with occasional weakly cemented vertical burrows, rare Glycemeris valves	
2					M <sub>1</sub>		Blue-grey, massive, calcareous, weakly indurated silt with few coarser mm laminae.	
0								

<b>Stratigraphic Column No:</b> 204	<b>Grid Reference:</b> <b>Top</b>	<b>Bottom</b>	NZMS 260 V22  <span style="font-size: 2em; color: red;">204</span>  1 of 1
<b>GPS Waypoint No(s):</b> 224 - 226	<b>E:</b> 2812878	2812966	
<b>Region:</b> Totanatahi Station on Salisbury Road.	<b>N:</b> 6164285	6164344	
<b>Location:</b> Column continues from previous column, heading eastwards along Yarrow Stream bed, starting past water pump shed	<b>Altitude:</b> 190 m	158 m	
<b>NZMS 260 Sheet:</b> V21 Napier	Page 1 of 1		

Stratigraphic Unit	Thick. (m)	Lithology	Structures	Dominant Fossils	Facies Code	WP No.	Description
Petane Group  Okauawa Formation	30				S <sub>5</sub>	226	Dense shell-bed dominated by <i>Glycemeris sp.</i> , weathered <i>Pellicaria convexa</i> , <i>Sigapetella sp.</i> , <i>Tawera sp.</i> (articulated and nonarticulated), disarticulated <i>Pupurocardia purpurata</i> , <i>Amalda</i> , <i>Alcithoe</i> , robust branching and encrusting Bryozoa, echinoderm spines, barnacles (encrusting bivalves), <i>Mesopeplum sp.</i> rare <i>Zethalia zelandica</i> and juvenile <i>Ostrea chilensis</i> valves. Rare, very well rounded spherical greywacke pebbles (Maximum diameter ~ 1 cm ). In an orangey-brown very weakly cemented, well-sorted, subangular quartz-dominated, sandy matrix. Both shell material and sand is strongly bedded.
	25				S <sub>1</sub>		Orangey-brown, very friable laminated sand, non-fossiliferous, weakly calcareous, well-sorted, sub-angular grains. Dominated by quartz with very fine sand-sized greywacke fragments, augite and titanomagnetite lining base of laminations. Flecks of white weathered shell material present.
	20				M <sub>1</sub>		Massive, blue-grey/beige, calcareous, well-sorted silt. Dominated by adult and juvenile <i>Zeoculpus</i> , <i>Poirieria sp.</i> , and <i>Cirsotrema</i> . Few highly weathered, and fragile <i>Pellicaria fossa</i> . With height becomes non-fossiliferous and more sandy.
	15				Cs <sub>1</sub>	225	Discontinuous, tightly packed shell bed dominated by disarticulated <i>Patro undatus</i> , <i>Ostrea chilensis</i> , disarticulated and articulated <i>Purpurocardia purpurata</i> , and <i>Atrina zelandica</i> all in real life positions. Strongly imbricated, and well bedded. In a blue-grey silty matrix. Lower and upper boundaries sharp but not erosional.
	10				M <sub>1</sub>	224	Massive, blue-grey calcareous, well-sorted sandy silt. <i>Pellicaria fossa</i> and <i>convexa</i> abundant, with lesser juvenile brachiopods, <i>Sigapetella sp.</i> , <i>Aneator</i> , <i>Zeoculpus</i> , and clumps of tube worm mats - tubes up to 0.5 cm diameter and multiple discontinuous lenses of few <i>Ostrea chilensis</i> and <i>Patro undatus</i> valves. Fossils very well preserved - colouring and fine details still retained, but are easily broken due to silt swelling when immersed in water.
	5				M <sub>1</sub>		
	0	<div style="display: flex; justify-content: space-between; font-size: 8px;"> <span>Mud</span> <span>fine med coarse Silt</span> <span>fine med coarse Sand</span> <span>Gravel</span> </div>					

Stratigraphic Column No: 205

Grid Reference: Top

Bottom

NZMS 260 V21

Section:

E: 2816093

-

GPS Waypoint No(s): 128

N: 6165068

-

Region: Central Hawkes Bay

Altitude: 120 m

-

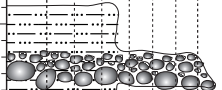
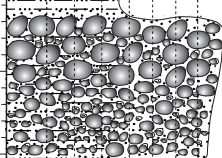

Location: First road cutting - Salisbury Rd, before bridge, approx. 500 m from intersection on SH 50

Author: S. Dyer

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Stratigraphic Unit	Thick. (m)	Lithology	Structures	Dominant Fossils	Facies Code	WP No.	Description																
Makaretu Mudstone	4																						
	3		≠		M <sub>4</sub>		Tan, non-calcareous, massive, friable siltstone with rare angular greywacke granules and 5 cm thick band of poorly sorted greywacke pebbles in tan silty matrix.																
	2		cm		Cg <sub>1</sub>		Gravel bed composed of poorly sorted, well rounded, unconsolidated, subspherical greywacke pebbles within a coarse greywacke granule and quartz-rich friable sand.																
1			≠		M <sub>1</sub>		Blue/grey, calcareous, massive fossiliferous siltstone. Fauna dominated by articulated and disarticulated bivalves; <i>Ostrea chilensis</i> , juvenile brachiopods and <i>Tawera subsulcata</i> . Crushed rare <i>Zeoculpus</i> sp. also present.																
0		<table border="0"> <tr> <td>Mud</td> <td>fine</td> <td>med.</td> <td>coarse</td> <td>fine</td> <td>med.</td> <td>coarse</td> <td>Gravel</td> </tr> <tr> <td></td> <td>Silt</td> <td>Sand</td> <td></td> <td>Sand</td> <td></td> <td></td> <td></td> </tr> </table>	Mud	fine	med.	coarse	fine	med.	coarse	Gravel		Silt	Sand		Sand								
Mud	fine	med.	coarse	fine	med.	coarse	Gravel																
	Silt	Sand		Sand																			

**Stratigraphic Column No: 206**

**Grid Reference: Top**

**Bottom**

NZMS 260 V21

**GPS Waypoint No(s):** SD49, SD37 SD57

**E:** 2818043

2817273

**Region:** Western face of Mason Ridge, overlooking Maraekakaho River.

**N:** 6164465

6164600

**Location:** Composite column of outcrops along Top Rocky Farm track.

**Altitude:** 223 m

193 m

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Stratigraphic Unit	Thick. (m)	Lithology	Structures	Dominant Fossils	Facies Code	WP No.	Description
Torran Limestone Member	19						
	18						
	17						
	16			≠		C <sub>1</sub>	
	15						
	14					SD 37	Yellow/cream-coloured, mouldic, poorly-sorted, well-cemented, horizontally-bedded, fossiliferous grainstone. Dominantly composed of fine-grained, subangular bryozoan and mollusc fragments and subrounded barnacle plates. Becomes well-sorted, and massive with height
	13			=			
	12						
	11					C <sub>3</sub>	Yellow/cream-coloured, moderately-sorted, well-cemented, trough-crossbedded, fossiliferous, grainstone, dominated by subangular bryozoan and mollusc fragments and subrounded barnacle plates, <i>Ostrea chilensis</i> , and <i>Glycymeris shrimptoni</i> .
	10					S <sub>1</sub>	Cream-coloured, fine, well-sorted, friable, calcareous, non-fossiliferous sandstone.
Mahaeakeke Mudstone Member	9						
	8				M <sub>1</sub>	SD 57	Blue/grey, massive, weakly-pumiceous siltstone. Weakly calcareous at base, increasing with height. Non-fossiliferous at base, containing cemented, well-rounded cobbles of limestone. Discontinuous lenses of angular shell debris increasing with height, giving way to gastropods and juvenile brachiopods, <i>Ostrea chilensis</i> and <i>Mesopeplum convexum</i> .
	7						
	6			≠			
	5						
Mahana Limestone Member	4						
	3						
	2			=		C <sub>1</sub>	Densely mouldic, horizontally-bedded, well-cemented, poorly-sorted, coquina-like grainstone,
	1					SD 49	Yellow/tan-coloured, very well sorted, friable, calcareous sandstone, with massive bedding grading upwards to weakly convoluted ripples. Shell fragments increase in density with height. Sharp upper contact with well-cemented, vertical burrows.
	0						

Mud  
fine med  
Silt coarse  
fine med  
Sand coarse  
Gravel



Stratigraphic Column No: 208

Grid Reference: Top

Bottom

NZMS 260 V21

GPS Waypoint No(s): 020

E: 2823987

-

Region: Oban Station, on Valley Road

N: 6163216

-

Location: Farm entrance coming off Valley Rd. Altitude: 46 m  
Outcrop on track alongside pine shelter belt ~200 m from road

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Stratigraphic Unit	Thick. (m)	Lithology	Structures	Dominant Fossils	Facies Code	WP No.	Description
Mahana Limestone Member	3				Cs <sub>1</sub>		Highly bioturbated shellbed of dominantly bivalve moulds and <i>Ostrea chilensis</i> valves within a calcareous, moderately-cemented, silty matrix.
	2				C <sub>3</sub>	020	Low angle trough cross beds grade upwards into higher angle crossbeds.
	1						Broad, low-angle trough cross-beds of same material as the tabular cross beds, but moderately cemented.
	0						Water escape structures - mark boundary between tabular and trough crossbedding
		fine Mud med Silt coarse fine med Sand coarse Gravel					

**Stratigraphic Column No:** 209

**Grid Reference:** Top

**Bottom**

NZMS 260 V21

**GPS Waypoint No(s):** 06-11

**E:** 2826351

2826337

**Region:** Washpool Station - north end of Washpool Ridge.

**N:** 6162160

6163560

Access off Maraekakaho Road, ~1 km E of intersection with SH50

**Altitude:** 179 m

44 m

**Location:** Composite column of station, starting from farm track leading up to Washpool and No. 2 E trig stations.

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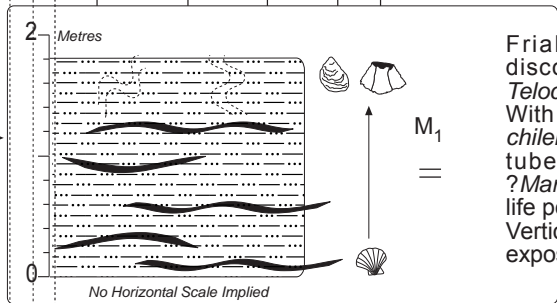
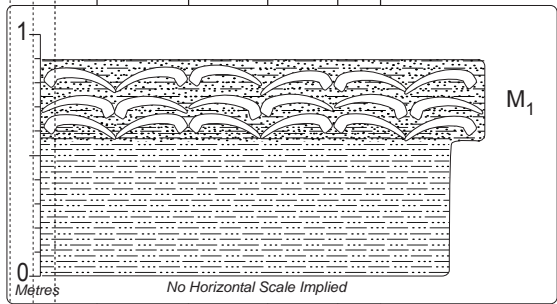
**Author:** S. Dyer

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Stratigraphic Unit	Thick. (m)	Lithology	Structures	Dominant Fossils	Facies Code	WP No.	Description
Makaretu Mudstone	180					09	Well-cemented, massive, tan-coloured sandy silt with abundant moulds of Devil's Toe Gasts, and convex <i>Telochlamys</i> sp., <i>Tawera</i> sp. and <i>Purpurocardia</i> sp. valves at top of exposure.
	140					08	Weakly indurated, very calcareous, massive blue-grey silt with <i>Telochlamys</i> sp. and angular bivalve fragments. Laterally (~1 m) turns into a white, very calcareous, chalky deposit of about 40cm width.
	110					10	
	100		≠	M <sub>3</sub>		11	Very well indurated, fine, calcareous silt
	70					06	Very well indurated, fine calcareous mud/silt with mm flecks of iron staining.
	40					07	
	0						Friable, blue-grey, massive silt with discontinuous and intermittent lenses of <i>Telochlamys</i> sp. and shell hash. With height, non-articulated juvenile <i>Ostrea chilensis</i> valves, barnacle plates and serpulid tubes occur, as well as rare crushed <i>Marioculpus</i> and <i>Atrina zelandica</i> (in life position). Vertical bioturbation weakly visible near top of exposure, infilled with slightly coarser material.



**Stratigraphic Column No:** 210

**Grid Reference:** Top

**Bottom**

NZMS 260 V21

**GPS Waypoint No(s):** 147

**E:** 2821423

-

**Region:** Marae Downs Station, Whakapirau Road.

**N:** 6162716

-

**Location:** Column from outcrops exposed along

**Altitude:** 147 m

-

farm track crossing a wide stream valley ~ 200 m to the east of farm quarry.

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Stratigraphic Unit	Thick. (m)	Lithology	Structures	Dominant Fossils	Facies Code	WP No.	Description																
Torrans Limestone Member	9																						
	8																						
	7		=		Cs <sub>1</sub>		<i>Ostrea chilensis</i> , <i>Patro undatus</i> and brachiopod-dominated, tabular-bedded shell bed in a matrix of pumiceous grey/tan-coloured, weakly-cemented, calcareous siltstone.																
	6		V																				
	5		V		C <sub>2</sub>		Creamy/tan-coloured, pumiceous, well sorted, grainstone with abundant terrigenous granules (<2 mm diameter). Intensely bioturbated and well-cemented about bioturbation features. Sharply overlying lower unit.																
Maharakeke Mudstone Member	4		≠		C <sub>1</sub>		Creamy/tan-coloured, differentially-cemented, tabular-bedded, well sorted, skeletal sandstone, with abundant terrigenous granules (<2 mm diameter). Relatively common thin (~ 2 cm), bioturbated pumiceous layers.																
	3		V																				
	2		≠		S <sub>3</sub>	147	Green/grey-coloured, friable, calcareous, massive, poorly to moderately sorted, glauconitic, shelly sandstone with well-cemented concretions.																
	1		≠				Blue/grey, calcareous, massive siltstone.																
	0	<table border="0"> <tr> <td>Mud</td> <td>fine</td> <td>med</td> <td>coarse</td> <td>fine</td> <td>med</td> <td>coarse</td> <td>Gravel</td> </tr> <tr> <td></td> <td>Silt</td> <td>Sand</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table>	Mud	fine	med	coarse	fine	med	coarse	Gravel		Silt	Sand										
Mud	fine	med	coarse	fine	med	coarse	Gravel																
	Silt	Sand																					

Stratigraphic Column No: 211	Grid Reference: Top	Bottom	<b>NZMS 260 V21</b>  <span style="font-size: 2em; color: red;">211</span>  1 of 1
Section:	E: 2820184	2820184	
GPS Waypoint No(s): SD71	N: 6162248	6162248	
Region: Central Hawkes Bay	Altitude: 198 m	190 m	
Location: Marae Downs Station, Whakapirau Rd., column from freshly exposed face in farm quarry	Author: S. Dyer		
NZMS 260 Sheet: V21			

Stratigraphic Unit	Thick. (m)	Lithology	Structures	Dominant Fossils	Facies Code	WP No.	Description
Torrans Limestone Member	9		=		Cs <sub>1</sub>		<i>Ostrea chilensis</i> , <i>Patro undatus</i> and brachiopod-dominated, tabular-bedded shell bed in a matrix of grey/tan-coloured, weakly-cemented, calcareous siltstone.
	8		=		Cs <sub>1</sub>		
	7		▲		C <sub>3</sub>		Creamy/yellow-coloured, well-cemented, weakly trough-crossbedded, well-sorted grainstone containing juvenile and adult brachiopods and rare <i>Ostrea chilensis</i> . Becomes more pumiceous with height and sharply overlain by shellbed.
	6		(=)		C <sub>2</sub>		Creamy/tan-coloured, differentially-cemented, massive to weakly horizontally-bedded, well-sorted, skeletal sandstone, with abundant terrigenous granules (<2 mm diameter).
	5		(=)		C <sub>2</sub>		
	4		▲		C <sub>3</sub>	SD 71	Grey/yellow-coloured, differentially-cemented, moderately-sorted, weakly trough-crossbedded grainstone dominated by juvenile brachiopods, juvenile <i>Glycemeris shrimptoni</i> , <i>Purpurocardia purpurata</i> and fragmented gastropods. Underlain by massive, creamy/white-coloured, friable, poorly-sorted, pumiceous grainstone/skeletal sandstone.
	3		≠		C <sub>2</sub> Cs <sub>1</sub>		Honey/tan-coloured, poorly sorted, weakly-cemented, pumiceous, horizontally-bedded grainstone, with terrigenous granules (av. diameter 3 - 5 mm). Coarsens upwards and gradually becomes densely fossiliferous packstone.
	2		=		Cs <sub>1</sub>		
	1		▲		C <sub>1</sub>		Grey/white-coloured, weakly-cemented, weakly-pumiceous, massive to horizontally-bedded, grainstone, composed of poorly-moderately sorted barnacle plates, angular mollusc, bryozoan and echinoderm fragments and small terrigenous granules (< 3 mm diameter). Mud stringers (1 cm thick x 20 cm long) common. Upper contact wavy and sharp.
	0		Mud fine med Silt coarse fine med Sand coarse Gravel				

Stratigraphic Column No: 212

Grid Reference: Top

Bottom

NZMS 260 V21

GPS Waypoint No(s): SD60, 61, 69.

E: 2818309

2817797

Region: Western face of Mason Ridge, overlooking Maraekakaho River.

N: 6163580

6163482

212

Location: Property next to Top Rocky Farm, northern Whakapirau Road.

Altitude: 228 m

206 m

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Stratigraphic Unit	Thick. (m)	Lithology	Structures	Dominant Fossils	Facies Code	WP No.	Description
Mahana Limestone Member	0-4	Grey/tan-coloured, well-cemented, moderately-sorted, very calcareous, mouldic packstone. Aragonite moulds of shell fragments, no more than 2 mm.	≠		C <sub>2</sub>		
	4-6	Creamy, friable, horizontally-bedded, moderately-sorted, skeletal sandstone sharply overlain by a differentially-cemented, tabular-bedded, moderately-sorted packstone dominated by angular bryozoan, barnacle, bivalve and gastropod fragments and juvenile brachiopods.	=		S <sub>1</sub>		
	6-8	Creamy/tan, friable, moderately-sorted pumiceous skeletal sandstone/shell hash, with lineations of <i>Glycemeris shrimptoni</i> . With height becomes more cemented and more calcareous, forming a well-cemented, horizontally-bedded grainstone.	=		S <sub>1</sub>		
	8-10	Creamy/tan, friable, moderately-sorted pumiceous skeletal sandstone/shell hash, with lineations of <i>Glycemeris shrimptoni</i> . With height becomes more cemented and more calcareous, forming a well-cemented, horizontally-bedded grainstone.	=		S <sub>1</sub>		
	10-14	Honey-coloured, coarsening upwards, weakly cemented, poorly-sorted, fossiliferous grainstone with occasional well-cemented discontinuous lenses. At top, well-cemented vertical burrows occur, while blue/grey mudstone inclusions (2cm high x 5 cm long) occur near base. Sharp, undulating upper and lower boundaries.	≠		C <sub>1</sub>	SD 69	
Mahaeaakeke Mudstone Member	14-18	Mouldic, well-cemented, poorly-sorted shell bed dominated by <i>Ostrea chilensis</i> and angular bivalve fragments, within a fine, well-cemented, silty sand matrix.	≠		Cs <sub>1</sub>		
	18-20	Pale tan/grey coloured, slightly pumiceous, fossiliferous, moderately-sorted, massive calcareous siltstone.	≠		M <sub>3</sub>		
Torran Limestone Member	20-22	Red/brown-coloured, massive, friable, well-sorted quartz-rich sandstone. Non-calcareous and non-fossiliferous at base, becoming more calcareous and increased fauna with height.	≠		S <sub>2</sub>		
	22-24	Well-sorted, weakly-cemented, massive shell bed of <i>Purpurocardia purpurata</i> , <i>Tawera subsulcata</i> , <i>Plueromeris ?marshalli</i> and <i>Turcetona laicostata</i> in silty matrix of below. Separated from overlying sandstone by an undulating contact.	≠		S <sub>5</sub>	SD 60	
	24-26	Pale tan-coloured, calcareous, massive, friable, well-sorted quartz-rich sandstone. Top of unit has discontinuous shelly lenses of same fauna as below.	≠		S <sub>1</sub>		
Torran Limestone Member	26-28	Pale tan-coloured, calcareous, massive, friable, well-sorted quartz-rich sandstone. Top of unit has discontinuous shelly lenses of same fauna as below.	≠		C <sub>1</sub>	SD 61	
	28-30	Yellow tan-coloured, massive, well-cemented, moderately-sorted grainstone grading into well-cemented, low-angle trough-crossbedded, well-sorted grainstone. Underlain by differentially cemented, moderately-sorted, massive skeletal sandstone.	≠		C <sub>3</sub>	SD 61	

Stratigraphic Column No: 213

Grid Reference:

Top

Bottom

NZMS 260 V21

Section: M4

E: 2816200-2817200 -

GPS Waypoint No(s):

N: 6162800 -

Region: Central Hawkes Bay

Altitude: -

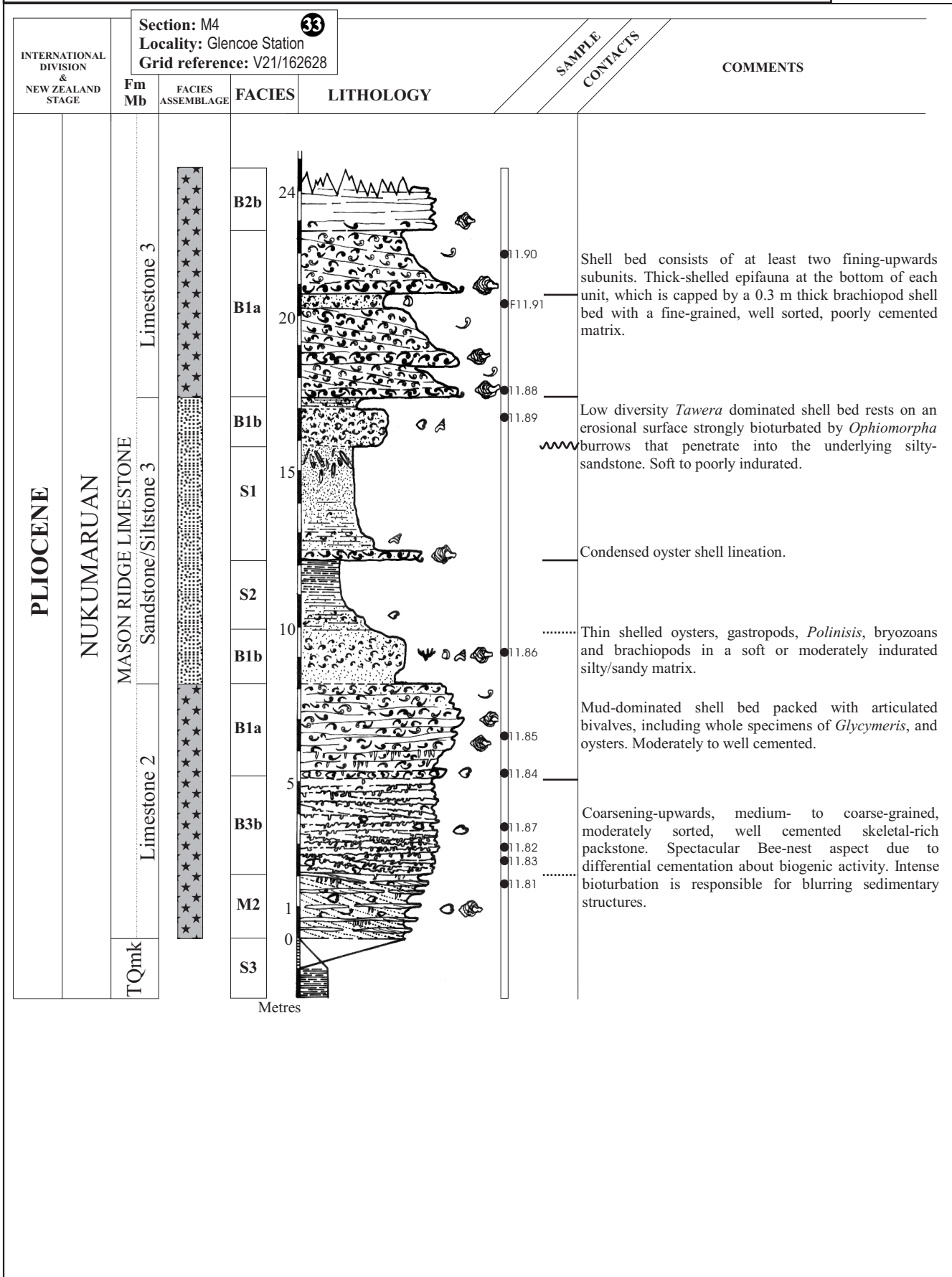
Location: Glencoe Station

NZMS 260 Sheet: V21

Author: V.Caron

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1 of 2



Stratigraphic Column No: 213

Grid Reference: Top

Bottom

NZMS 260 V21

Section: M4

E: 2816200-2817200 -

GPS Waypoint No(s):

N: 6162800 -

Region: Central Hawkes Bay

Altitude: -

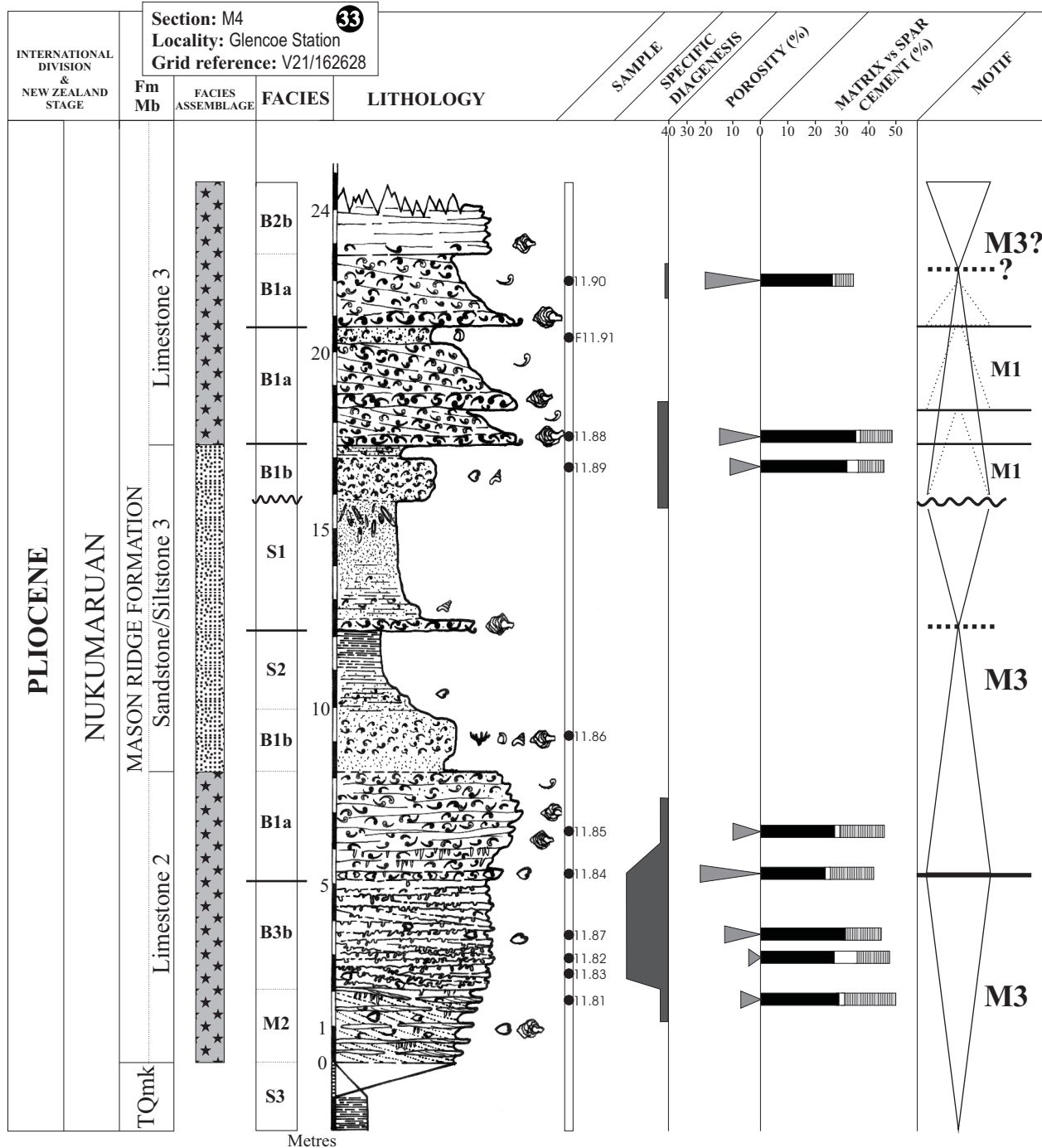
Location: Glencoe Station

NZMS 260 Sheet: V21

Author: V.Caron

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**Stratigraphic Column No:** 214

**Grid Reference:** Top

Bottom

NZMS 260 V21

**GPS Waypoint No(s):** 01 - 03

**E:** 2817131

2817144

**Region:** Glencoe Station, SH 50

**N:** 6162742

6162757

**214**

**Location:** Outcrops above Station vineyard, northwards.

**Altitude:** 219 m








197 m

**NZMS 260 Sheet:** V21 Napier

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Author: S. Dyer

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Stratigraphic Unit	Thick. (m)	Lithology	Structures	Dominant Fossils	Facies Code	WP No.	Description
Whakapirau Mudstone Member	30		≠		M <sub>1</sub>	03	Blue/grey, calcareous massive sandy siltstone with scattered, coarse sand-sized grains of angular shell fragments.
	28		=		Cs <sub>1</sub>		Shell bed capping grainstones dominated by <i>Ostrea chilensis</i> , <i>Patro undatus</i> and few brachiopods within a tan/grey, moderately-cemented siltstone matrix.
Torran Limestone Member	26		(=)		C <sub>1</sub>		2 fining-upward grainstone units of horizontally-bedded to massive, creamy/tan-coloured, moderately-cemented grainstone. Dominated by well-rounded, moderately-sorted, barnacle, bryozoan and mollusc fragments. Base of each unit populated by <i>Glycymeris shrimptoni</i> , brachiopods and disarticulated juvenile <i>Ostrea chilensis</i> .
	24						First 20 cm of lower grainstone unit dominated by <i>Tawera subsulcata</i> and <i>Zethalia zelandica</i> .
Maharakeke Mudstone Member	22		∩		S <sub>5</sub>		Tan/yellow-coloured, weakly cemented, fossiliferous shelly sandstone sharply overlain by grainstone. <i>Ophiomorpha</i> burrows at boundary.
	20				M <sub>3</sub>		
Maharakeke Mudstone Member	18				Cs <sub>1</sub>	02	Shell lineation of articulated adult and juvenile <i>Ostrea chilensis</i> .
	16		≠		M <sub>1</sub>		Tan/grey-coloured, friable, fossiliferous silty sandstone containing <i>Polinisis</i> sp. grading rapidly into a blue/grey fossiliferous, calcareous massive siltstone.
Mahana Limestone Member	14				S <sub>5</sub>		Shell bed capping grainstone dominated by <i>Ostrea chilensis</i> , whole <i>Glycymeris shrimptoni</i> and disarticulated <i>Purpurocardia purpurata</i> within a tan/grey, very weakly cemented siltstone matrix.
	12		=		Cs <sub>1</sub>		
Mahana Limestone Member	10		⊕		C <sub>2</sub>		Strongly bioturbated, creamy/tan-coloured, coarsening upwards grainstone dominated by well-rounded, moderately-sorted, barnacle, bryozoan and mollusc fragments. Bioturbation structures well-cemented within moderately to poorly-cemented grainstone with honeycomb structures formed due to weathering.
	8						
Makaretu Mudstone	6						
	4						
Makaretu Mudstone	2		≠		M <sub>3</sub>	01	Blue/grey fossiliferous, calcareous massive siltstone.
	0						
		Mud fine med coarse Silt Sand Gravel					

**Stratigraphic Column No:** 215

**Grid Reference:** Top

Bottom

NZMS 260 V21

**GPS Waypoint No(s):** 213

**E:** 2815672

2815672

**Region:** SH50, ~ 400 m past Glencoe Station driveway

**N:** 6162455

6162455

**Location:** Where SH 50 starts winding downhill into a gully. On right hand side, small slip has exposed silt and sand beds.

**Altitude:** 258 m

252 m

**NZMS 260 Sheet:** V21 Napier

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Author: S. Dyer

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Stratigraphic Unit	Thick. (m)	Lithology	Structures	Dominant Fossils	Facies Code	WP No.	Description
Mahana Limestone Member	7						
	6				C <sub>1</sub>		Weakly cemented, well sorted creamy-tan skeletal grain stone. Massive to weakly horizontally bedded.
Makaretu Mudstone	5						
	4		mm				Beds of weakly indurated, blue-grey, well sorted, calcareous sandy-silt grading up into beds of friable, grey-brown, moderately sorted, massive to weakly laminated, sparsely fossiliferous calcareous sand, which is weakly cemented with height.
	3		$\neq$		Ms <sub>1</sub>	213	Both sand and silt beds vary in thickness, with silt ranging from 10 cm - 1 m thick, and sand varying from ~ 5 cm - 35 cm thick. Silt is always thicker than the sandy units and has a sharp lower boundary with sand, but gradational upper boundary.
	2						Silt and sand units dominated by clusters of <i>Tawera</i> shells (articulated and nonartic), majority of which are situated right way up. Shells are highly weathered and very fragile.
	1						Concentrations of broken shell fragments found at gradational boundaries between silt and sand, and juvenile Brachiopods and <i>Ostrea</i> found at upper boundaries of topmost silt units.
	0						
			Mud fine med coarse Silt Sand fine med coarse Gravel				

**Stratigraphic Column No:** 216

**Grid Reference:** **Top**

**Bottom**

NZMS 260 V21

**GPS Waypoint No(s):** 163 - 164

**E:** 2815524

2815610

**Region:** State Highway 50, ~ 100 m past Column 24

**N:** 6162203

6162289

**Altitude:** 182 m

172 m

**216**

**Location:** Where SH 50 starts winding uphill from gully, on left hand side, ~ 500 m from Churston Station driveway

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**Author:** S. Dyer

**NZMS 260 Sheet:** V21 Napier

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Stratigraphic Unit	Thick. (m)	Lithology	Structures	Dominant Fossils	Facies Code	WP No.	Description
Kidnappers Group Salisbury Gravel Formation	20						
	18						
	16		≠		M <sub>4</sub>		Mottled (black, pale honey/beige and yellowy-orange streaks), weakly indurated, very well sorted, massive pumiceous silt.
	14						3 groups of interbedded gravel, silt and sand units. Silt and sand are non- calcareous, non-fossiliferous, and pumiceous, with the sand being dominated by quartz and greywacke granules. Gravel size decreases from ~7 cm average diameter at lower bed to ~1 cm diameter.
	12		↙		Cg <sub>1</sub> S <sub>2</sub> M <sub>4</sub> Cg <sub>1</sub> S <sub>2</sub>	163	Very well sorted, rusty-red quartz-rich, trough cross-bedded sand. Few well-rounded, subspherical greywacke pebbles at base of cross beds.
	10		≠		M <sub>4</sub>		Well sorted, pale grey-beige, weakly indurated, very pumiceous sandy silt. In upper 1 m common to find random greywacke pebbles (0.5 cm diameter).
	8				Cg <sub>1</sub> S <sub>2</sub> Cg <sub>1</sub>		
	6		↙		S <sub>2</sub> Cg <sub>1</sub>	164	Poorly sorted greywacke gravel, massive with lineations of rounded, subspherical boulders (20 cm diameter). Pebbles are rounded - subrounded and slightly flattened, and consist of greywacke, quartz and jasper.
	4			(=)			Within gravel are discontinuous lenses of very coarse, poorly-sorted sand dominated by angular quartz and greywacke fragments. Range from being horizontally bedded to very low angle cross beds
	2			↙	S <sub>2</sub> Cg <sub>1</sub>		
0							

**Stratigraphic Column No:** 217

**Grid Reference:** Top

**Bottom**

NZMS 260 V21

**GPS Waypoint No(s):** 227-229

**E:** 2813373

281334

**Region:** Glen Orchy Station, SH50

**N:** 6161953

6162215

**Location:** Composite column exposed in immediate area at end of main farm track, at base of Ben Lomond (prominent hill).

**Altitude:** 278 m

243 m

**217**

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**Author:** S. Dyer

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Stratigraphic Unit	Thick. (m)	Lithology	Structures	Dominant Fossils	Facies Code	WP No.	Description								
Poutaki Pumiceous Formation	30		V				Potaka Tephra								
	28		≠		Cg <sub>1</sub>	227	Massive, poorly sorted gravel of well rounded greywacke pebbles and cobbles.								
	24		≠		Cg <sub>1</sub>	228	Massive, poorly sorted gravel of well rounded pumice and greywacke pebbles and cobbles, within matrix of sandstone below. Occasional pumiceous mudstringers								
	18				S <sub>2</sub>		Red/brown, friable quartz-rich, very well sorted, non-calcareous, non-pumiceous sandstone. Grades up to pebbly pumiceous, sandstone underlying gravel unit.								
	14				M <sub>4</sub>		Horizontally-bedded siltstone of 1 cm thick, laminated, non-pumiceous, non-calcareous, alternating orange and white discontinuous layers.								
	10		V		M <sub>4</sub>		Very well sorted, tan-coloured, pumiceous, non-calcareous siltstone/ash? containing 0.5 cm charcoal fragments								
	4				Cg <sub>3</sub>		Trough-crossbedded, well sorted greywacke gravel of well-rounded, subspherical pebbles.								
	0	<table border="0"> <tr> <td>Mud</td> <td>fine</td> <td>med</td> <td>coarse</td> <td>fine</td> <td>med</td> <td>coarse</td> <td>Gravel</td> </tr> </table>	Mud	fine	med	coarse	fine	med	coarse	Gravel					
Mud	fine	med	coarse	fine	med	coarse	Gravel								

**Stratigraphic Column No: 218**

**Grid Reference: Top**

**Bottom**

NZMS 260 V21

**GPS Waypoint No(s): 234a - 235**

**E: 2814316**

2814270

**Region: Lester Property - Churston Station SH50**

**N: 6160113**

6160154

**Location:**

**Altitude: 210 m**

207 m

**218**

**NZMS 260 Sheet: V21 Napier**

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**Author: S. Dyer**

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Stratigraphic Unit	Thick. (m)	Lithology	Structures	Dominant Fossils	Facies Code	WP No.	Description
Okauawa Formation	18				Cg <sub>1</sub>		
	14				Cs <sub>1</sub>	235	Shell bed dominated by juvenile <i>Ostrea</i> , <i>Marioculpus</i> , <i>Purpurocardia</i> sp., <i>Tawera</i> sp. echinoderm spines as well as branching and encrusting bryozoan sp. Few <i>glycemaris</i> , slipper shells, and juvenile brachiopods. Many shells disarticulated and fragmented into angular pieces, within a silty, blue-grey matrix.
	12				Ms <sub>1</sub>	234a	Massive, friable, non-calc. silt
	10				Cg <sub>1</sub>		Massive, poorly sorted sub-angular reddish-brown gravel
	8		≠ mm		Ms <sub>1</sub>		Interbedded non-calcareous blue-grey, laminated silt and tan coloured, friable massive sand units. No grading between lithologies.
	6				M <sub>4</sub>		Tan, weakly indurated, non-calc. orange blotchy silt.
	2		≠		S <sub>2</sub>	234b	Reddish-brown well-sorted, friable, quartz-rich sand
	0	<div style="display: flex; justify-content: space-between; font-size: small;"> <span>Mud</span> <span>fine Silt</span> <span>med. Silt</span> <span>coarse Silt</span> <span>fine Sand</span> <span>med. Sand</span> <span>coarse Sand</span> <span>Gravel</span> </div>					

Stratigraphic Column No: 219  
 Section: K7  
 GPS Waypoint No(s):  
 Region: Central Hawkes Bay  
 Location: Waimarama  
 NZMS 260 Sheet: V21

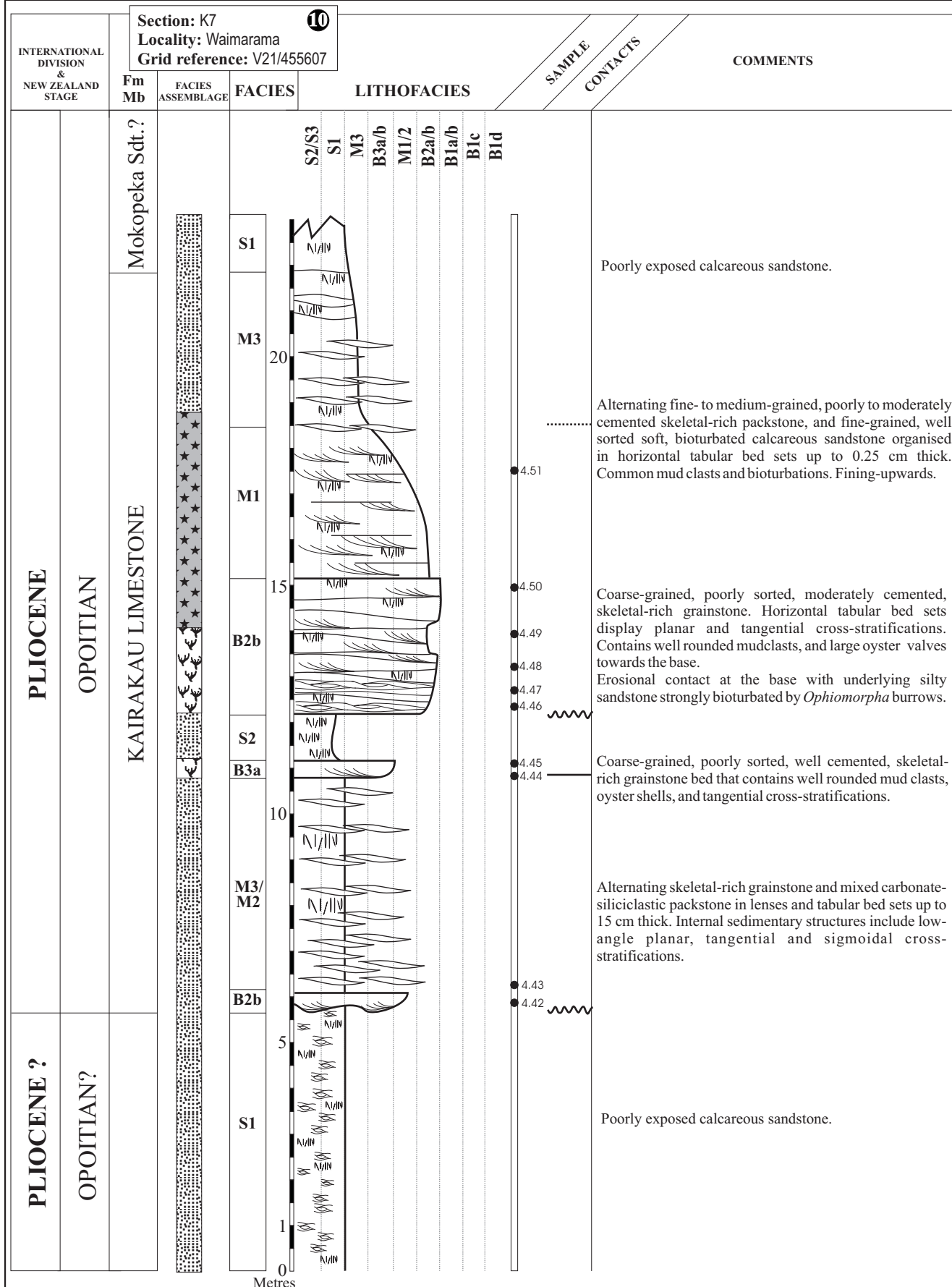
Grid Reference: Top Bottom  
 E: 2845500 -  
 N: 6160700 -  
 Altitude: -

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Author: V.Caron





Stratigraphic Column No: 220  
 Section: A2a  
 GPS Waypoint No(s):  
 Region: Central Hawkes Bay  
 Location: Te Mata Peak  
 NZMS 260 Sheet: V21

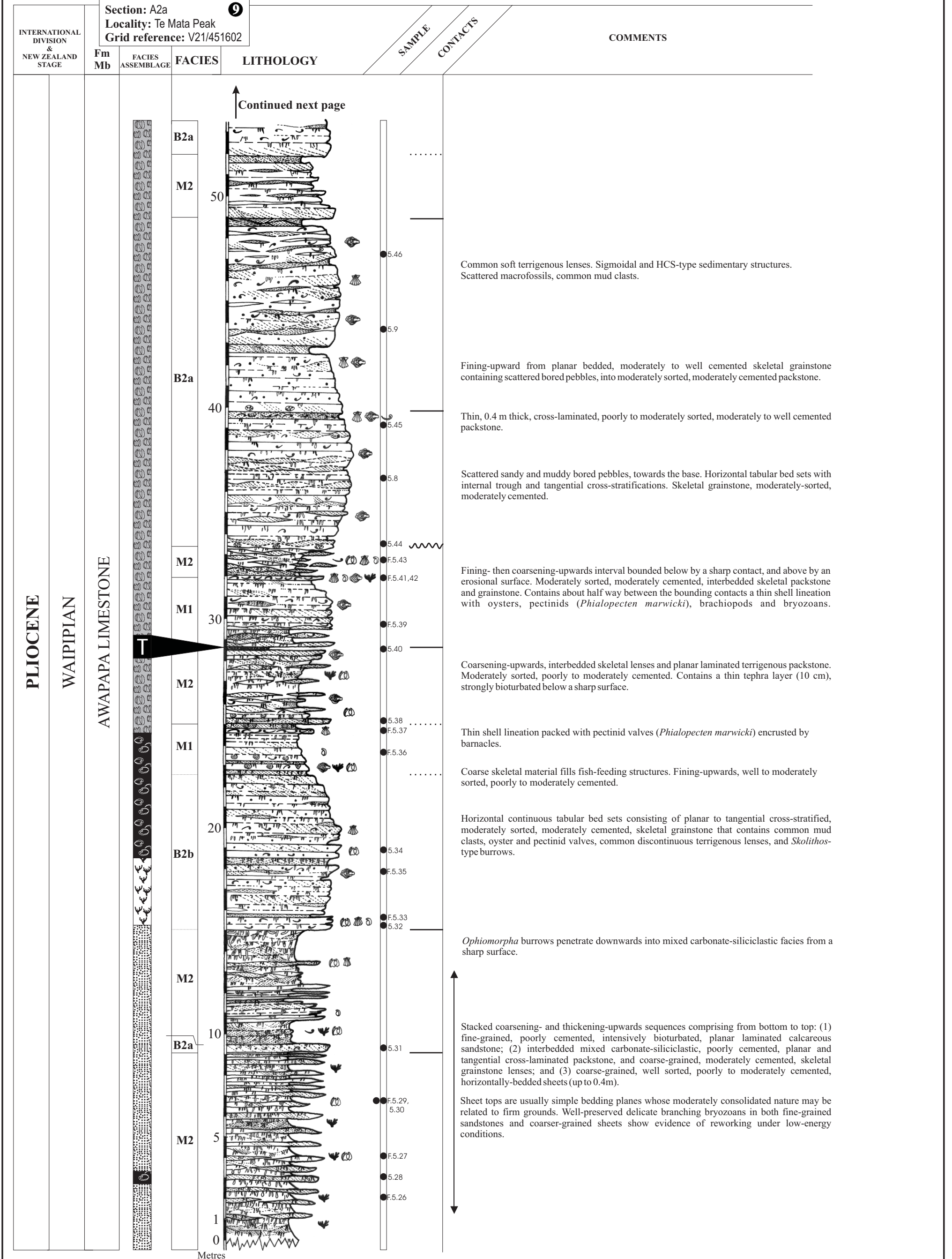
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 N: 6160200 -  
 Altitude: -

Author: V.Caron

NZMS 260 V21

220

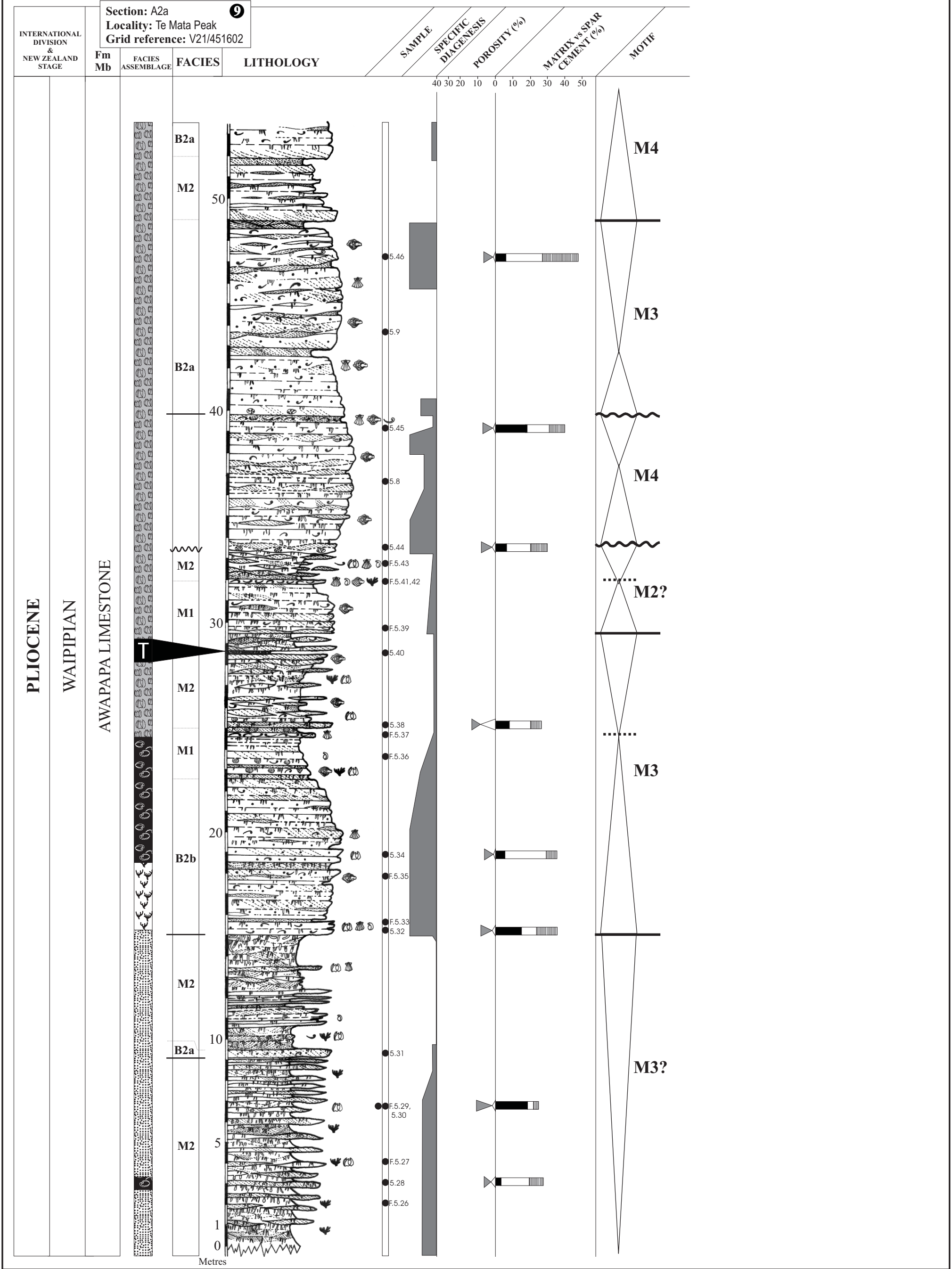
1 of 4 A3



Stratigraphic Column No: 220  
 Section: A2a  
 GPS Waypoint No(s):  
 Region: Central Hawkes Bay  
 Location: Te Mata Peak  
 NZMS 260 Sheet: V21

Grid Reference: Top Bottom  
 E: 2845100 -  
 N: 6160200 -  
 Altitude: -  
 Author: V.Caron

NZMS 260 V21  
**220**  
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Stratigraphic Column No: 220  
 Section: A2b  
 GPS Waypoint No(s):  
 Region: Central Hawkes Bay  
 Location: Te Mata Peak  
 NZMS 260 Sheet: V21

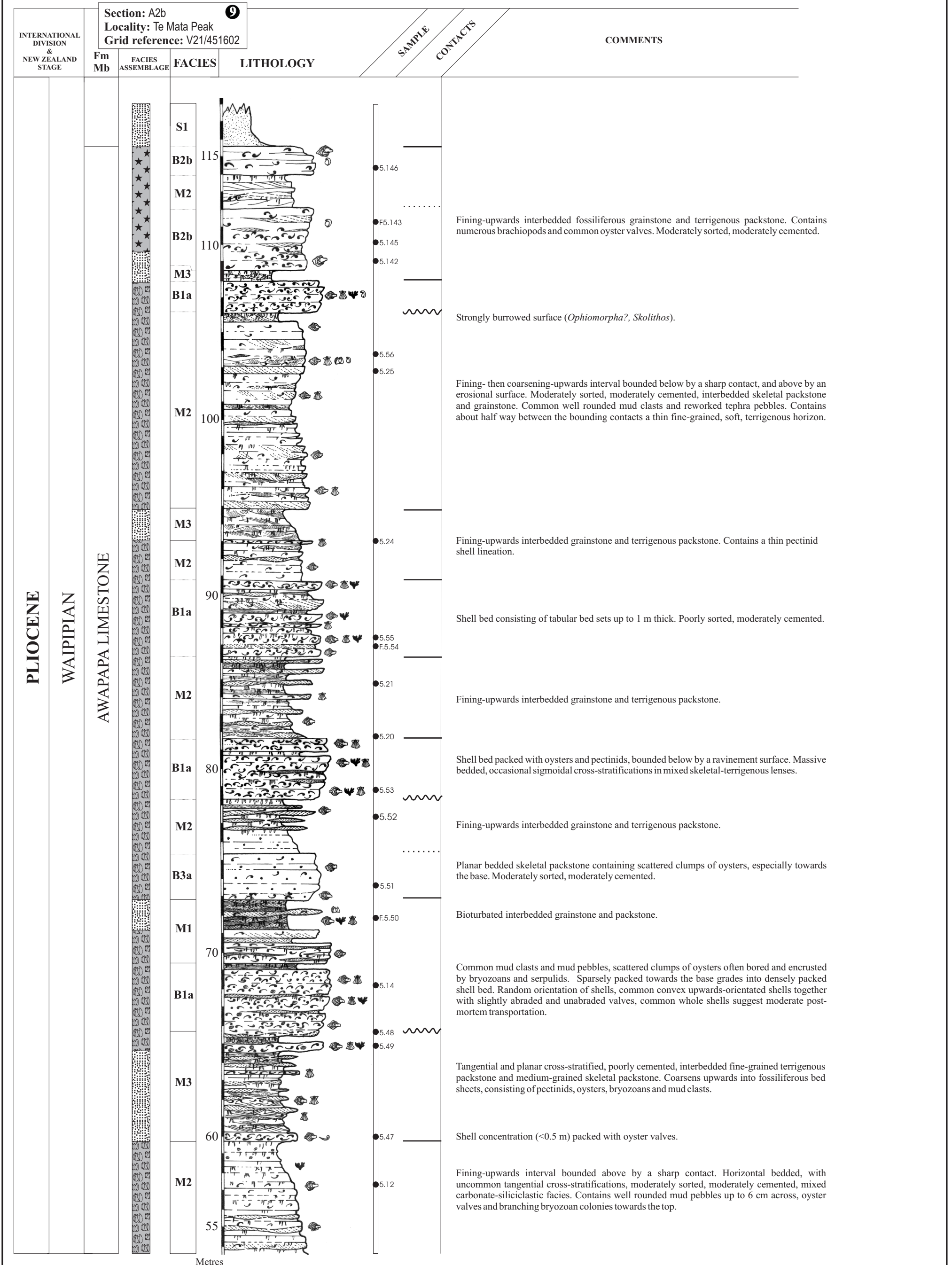
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 E: 2845100 -  
 N: 6160200 -  
 Altitude: -

Author: V.Caron

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220

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Stratigraphic Column No: 220

Grid Reference: Top Bottom

Section: A2b

E: 2845100

-

GPS Waypoint No(s):

N: 6160200

-

Region: Central Hawkes Bay

Altitude:

-

Location: Te Mata Peak

Author: V.Caron

NZMS 260 Sheet: V21

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