

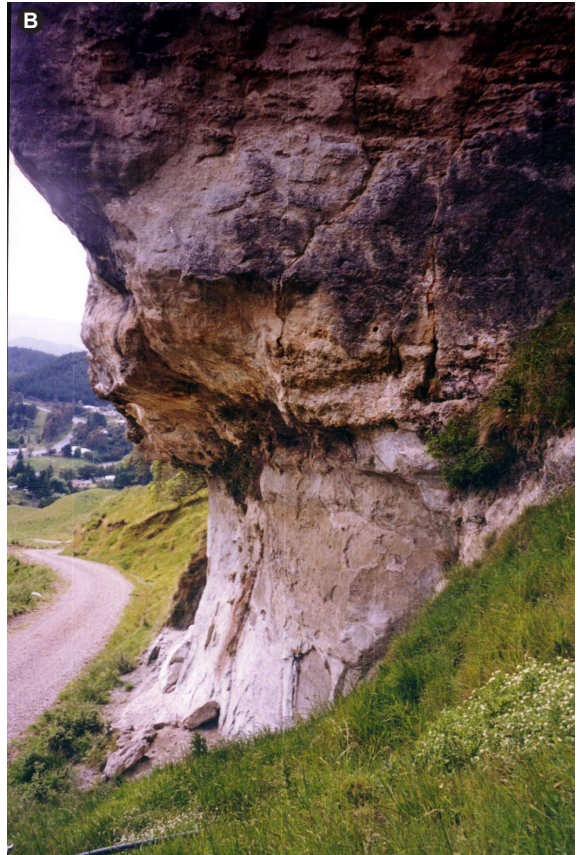
Fig. 7. Map showing location of stratigraphic columns within NZMS 260 Sheet V20.

Stratigraphic Column No: 48 Grid Reference: Top Bottom
 GPS Waypoint No(s): Site 107 E: - 2836100
 Region: Te Pohue N: - 6207300
 Location: Deep Stream upstream of Alexander Road ford Altitude: - -
 NZMS 260 Sheet: V20 Esk Page 1 of 1 Author: K. Bland 1 of 1

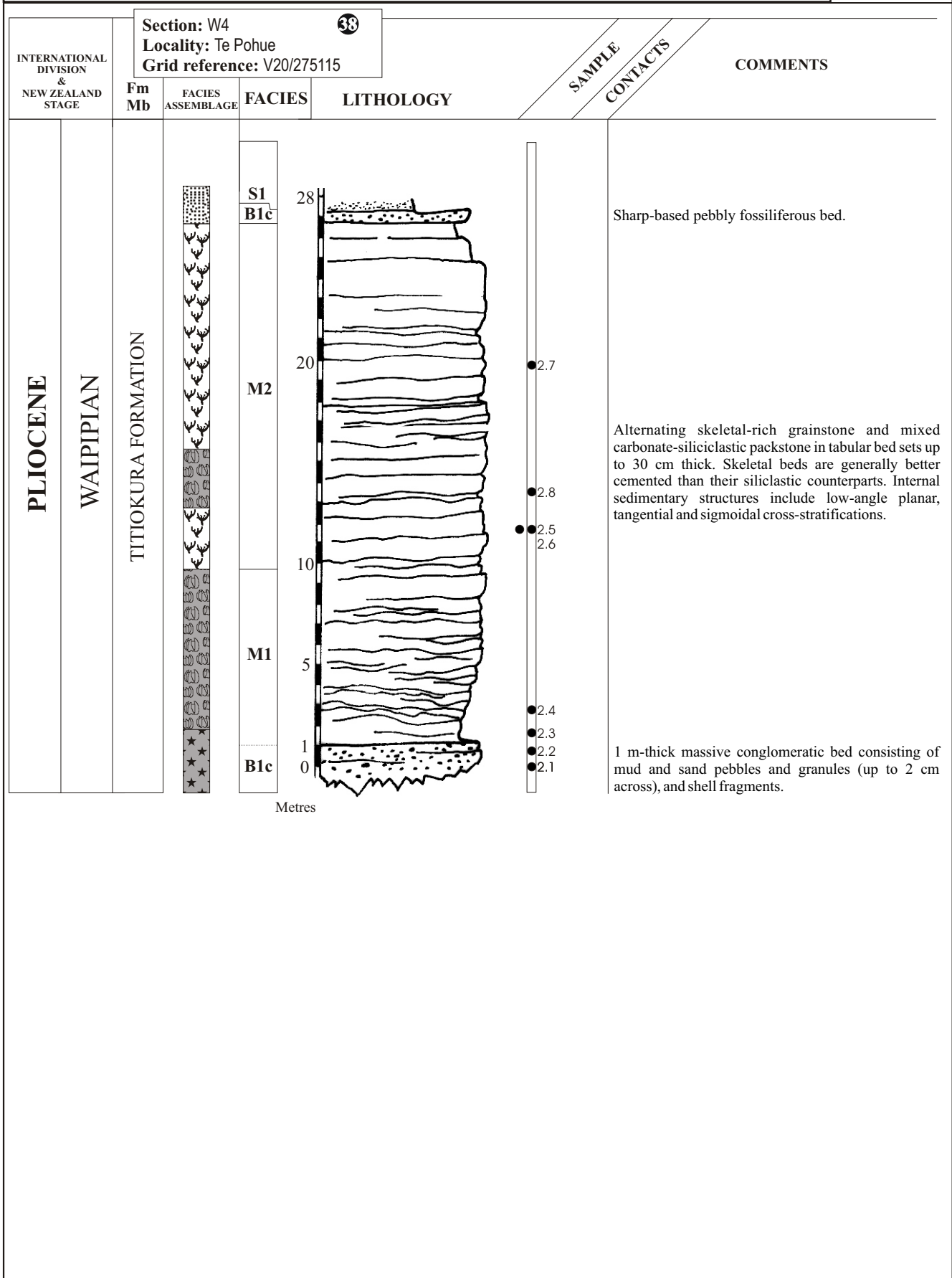
Age	Strat. Unit	Scale (metres)	Lithology	Sampling interval	Facies	WP No.	Samples	Contacts	Description
Late Pliocene	Lower Nukumaruan	10 9 8 7 6 5 4 3 2 1			Z ₃				Siltstone approximately 40 m thick.
					V ₁ Z ₈				Fine ash, airfall tephra bed.
Upper Mangapanian	Matahorua Formation/Papakiri Member				Z ₃				Non cemented siltstone. Contains <i>Maoricolpus roseus</i> , <i>Atrina pectinata zelandica</i> .
	Mangaheia Group				Z ₂				Pebbly siltstone containing fine greywacke pebbles reworked from underlying conglomerate. Gradational contact between the two beds.
					Z ₅				Highly fossiliferous pebbly shellbed containing lowest occurrence of <i>Phialopecten triphooki</i> with <i>Tucetona laticostata</i> , <i>Paphies australis</i> , and <i>Austrovenus stutchburyi</i> .
					Cg ₆		● Site 107		Non cemented greywacke conglomerate with moderately well-sorted clasts averaging 30 mm across. Macrofossils are scattered throughout the unit, with several continuous shell layers ~ 0.15 m thick spaced about 1 m apart. Contains <i>Tucetona laticostata</i> (dominant, some articulated), <i>Austrovenus stutchburyi</i> , <i>Paphies australis</i> , <i>Paphies subtriangulata</i> , ? <i>Lamprodominea</i> and <i>Amalda</i> .
			mud fine med. coarse fine med. coarse granu. pebb. cobb. bould. silt sand gravel						

Stratigraphic Column No: 49	Grid Reference: Top	Bottom	NZMS 260 V20 49 1 of 1
GPS Waypoint No(s): Wp 166	E: 2833682		
Region: Te Pohue	N: 6207160		
Location: Gravel pit on Old Coach Road near Trelinnoe Station	Altitude: 343	-	
NZMS 260 Sheet: V20 Esk	Page 1 of 1	Author: K. Bland	

Age Int.	N.Z.	Strat. Unit	Lithology	Sampling interval	Facies	WP No.	Samples	Contacts	Description					
		Late Pliocene												
		Lower Nukumaruan												
		Mangaheia/Group												
		Matahorua Formation/Papakiri Member												
					S ₄				Dirty-coloured, silty sandstone sharply overlying greywacke conglomerate bed.					
					Cg ₁				Poorly to moderately sorted, crudely laminated, greywacke conglomerate. Clasts are moderately to well rounded and from granule up to 60 mm in diameter, averaging 30 mm across in lower portions of the bed. The upper 0.6 m is moderately well sorted and coarser-grained with clasts up to 100 mm diameter. Sandstone rip-up clasts are common in poorly sorted portions of the conglomerate. This bed sharply overlies the underlying silty sandstone.					
					S ₇	WP 166			Dirty-coloured, laminated silty sandstone with common thin (<0.01 m thick) siltstone stringers. The basal 0.1 m of this unit comprises a pebbly shellbed containing abundant <i>Austrovenus stutchburyi</i> and <i>Patro undatus</i> . Pebbles are up to 30 mm diameter. A second shellbed is present 0.4 m above the basal one containing disarticulated bivalves including <i>Austrovenus</i> .					
					Cg ₂	KJB 34			Very poorly to moderately sorted massive greywacke conglomerate. Sharp erosional boundary with underlying unit, with tens of centimetres of relief on the contact. Clasts are up to 150 mm in diameter and average 30-40 mm across. Many sandstone stringers are present, generally up to 0.15 m thick comprising well sorted, fine to medium sandstone. These stringers are continuous over several metres.					
					Cg ₄				Slightly cemented, moderately to very well sorted, granule to fine pebble sized greywacke conglomerate bed. Clasts are arranged in beds of similar sized grains, and are well rounded and typically oblate in shape, although spheroid shaped grains are present. Occasional sandstone rip-up clasts are present in the upper 1 m of this unit. Internal beds are up to 0.5 m thick, with finer-grained beds generally thicker than coarser-grained ones.					
			<table border="1"> <tr> <td>mud</td> <td>fine coarse silt</td> <td>fine med.</td> <td>med.</td> <td>coarse granu.</td> <td>pebb. cobb.</td> <td>bould.</td> <td>gravel</td> </tr> </table>	mud	fine coarse silt	fine med.	med.	coarse granu.	pebb. cobb.	bould.	gravel			
mud	fine coarse silt	fine med.	med.	coarse granu.	pebb. cobb.	bould.	gravel							



Stratigraphic Column No: 51	Grid Reference: Top	Bottom	NZMS 260 V20 51 1 of 2
Section: W4	E: 2827500	-	
GPS Waypoint No(s):	N: 6211500	-	
Region: Central Hawkes Bay	Altitude:	-	
Location: Te Pohue			
NZMS 260 Sheet: V20	Author: V.Caron		



Stratigraphic Column No: 51
 Section: W4
 GPS Waypoint No(s):
 Region: Central Hawkes Bay
 Location: Te Pohue
 NZMS 260 Sheet: V20

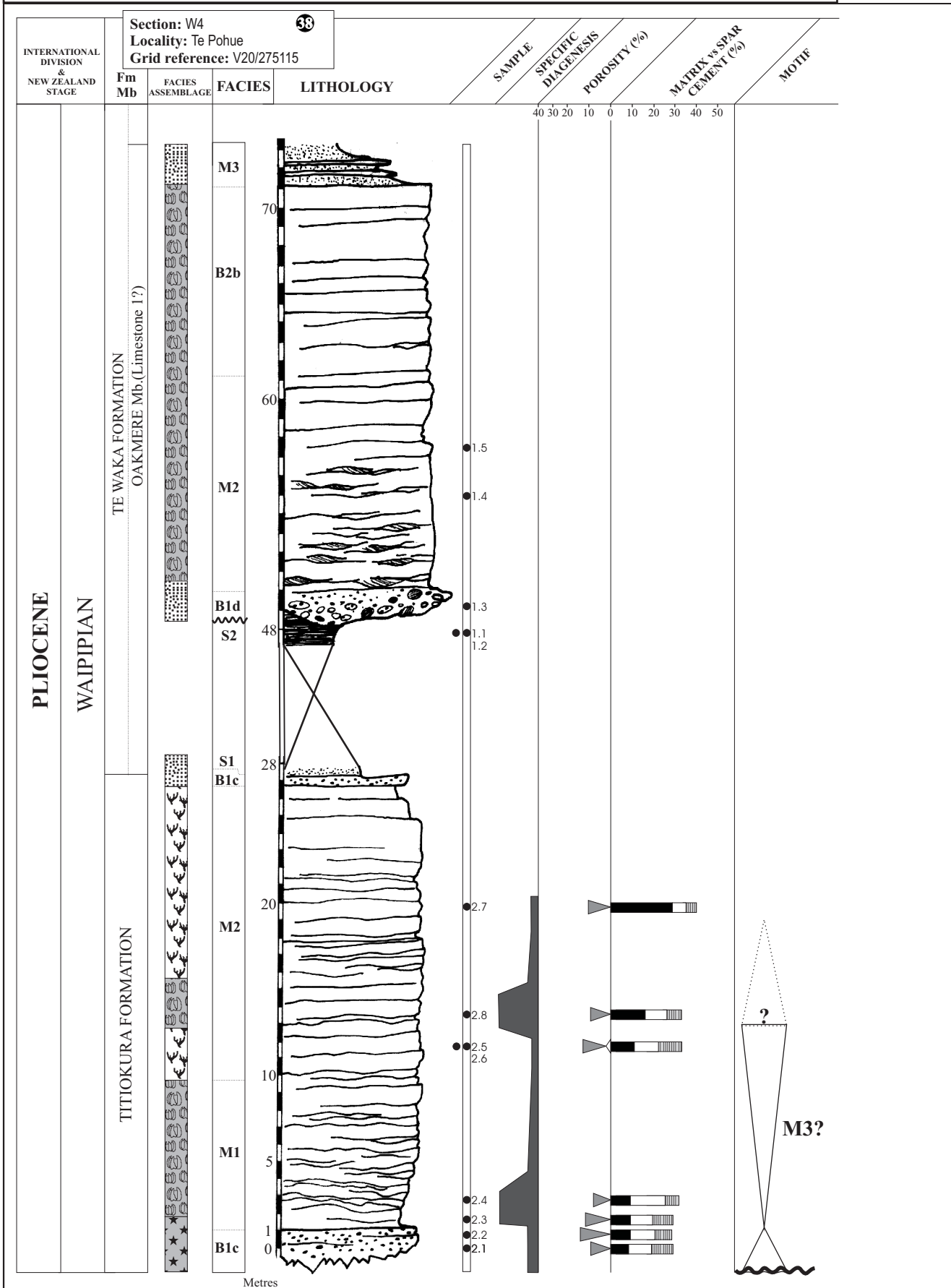
Grid Reference: Top Bottom
 E: 2827500 -
 N: 6211500 -
 Altitude: -

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Author: V.Caron



Stratigraphic Column No: 52 **Grid Reference:** **Top** **Bottom**
GPS Waypoint No(s): Wp 777-779 **E:** 2828954 2828727
Region: Titiokura **N:** 6214200 6214418
Location: SH5 on Napier side of Titiokura Saddle **Altitude:** 654 m 681 m
NZMS 260 Sheet: V20 Esk **Page 1 of 1** **Author:** K. Bland **NZMS 260 V20**
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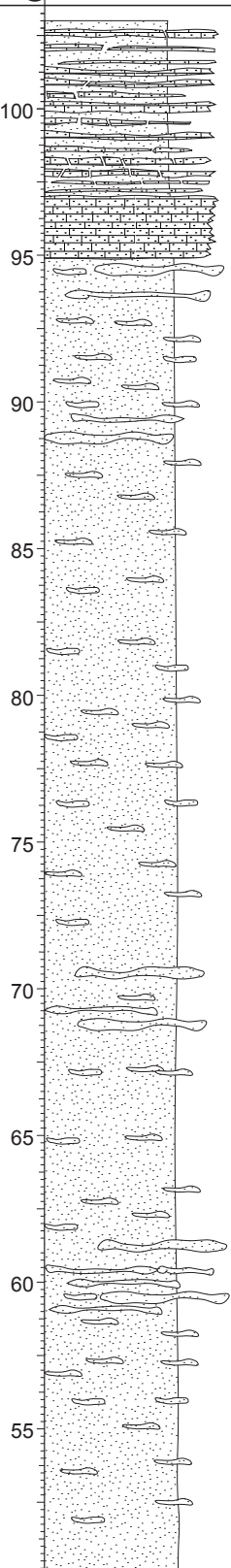
Age	Strat. Unit		Scale (metres)	Lithology	Sampling interval	Facies	WP No.	Samples	Contacts	Description							
	Int.	N.Z.															
Late Pliocene	Waipiian	Mangaheia Group Titiokura Formation	21			BC ₂				<p>Dirty-cream, moderately cemented, medium to coarse sand shellhash limestone comprising stacked bioclastic bodies that become slightly coarser-grained towards the base of the unit. Contains <i>Atrina pectinata zelandica</i>, <i>Talochlamys</i> (dominant), <i>Ostrea</i>, <i>Mesopeplum</i> sp., <i>Purpurocardia</i>, barnacles, brachiopods, and bryozoans. Abundant well sorted, sub-angular to well rounded greywacke granule to fine pebble sized clasts are present. Intact shells more common in lower parts of the limestone. Sharply overlies fine sandstone sandstone.</p>							
			20														
19																	
18																	
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5																	
Late Miocene-Early Pliocene	Upper Kapitean-Lower Opoitian	Tolaga Group Mokonui Sandstone	4										S ₃				<p>Blue-grey, massive to weakly laminated, slightly to moderately fossiliferous bioturbated fine sandstone. Occasional burrows are present, as are scattered intact valves of <i>Tawera</i>, <i>?Mactra</i> and <i>Talochlamys gemmulata</i>. This bed sharply underlies sandy limestone.</p>
3																	
2																	
1																	

mud	fine med coarse	fine med.	coarse granu.	pebb. cobb.	bould.
silt	sand	gravel			

Stratigraphic Column No: 53	Grid Reference: Top	Bottom	NZMS 260 V20 53 1 of 4
GPS Waypoint No(s): Te Waka Trig	E: 2825600	-	
Region: Te Pohue	N: 6213100	-	
Location: Section below repeater towers, north end Te Waka Range, Te Waka Trig	Altitude: 1021 m	-	
NZMS 260 Sheet: V20 Esk	Page 1 of 3		Author: K. Bland

Age	Strat. Unit	Scale (metres)	Lithology	Sampling interval	Facies	WP No.	Samples	Contacts	Description												
										Int.	N.Z.										
Late Pliocene	Waipipian	50 45 40 35 30 25 20 15			S ₁₀				<p>Light-brown to pale-grey, non to slightly fossiliferous, bioturbated, concretionary silty sandstone coarsening up into fine sandstone. Massive to weakly laminated. Some shellhash is present in lower parts of the unit, with concretions concentrated in certain parts of the section. Concretions range in size from small oval bodies to large continuous horizons.</p>												
										Mangahaia Group Te Waka Formation											
		10 5			S ₁₀	MX ₃			<p>Brachiopod-dominated (<i>Neothyris</i> aff. <i>obtusa</i>) conglomeratic limestone. Clasts comprises sandstone and mudstone pebbles with some greywacke components. Some <i>Phialopecten marwicki</i> (Wp form) and <i>Ostrea chilensis</i> are present.</p> <p>Yellow-brown stacked bioclastic-dominated/siliciclastic-dominated bodies rich in barnacle fragments and plates. Outcrop is flaggy with common case-hardened zones. Contains common <i>Neothyris</i> aff. <i>obtusa</i>, <i>Mesopeplum crawfordi</i> (uncommon), <i>Ostrea chilensis</i> and scattered concentrated zones of <i>Phialopecten marwicki</i> (Wp form).</p>												
			<table border="1" style="font-size: small;"> <tr> <td>mud</td> <td>fine med coarse</td> <td>fine med coarse</td> <td>gravel</td> </tr> <tr> <td></td> <td>silt</td> <td>sand</td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> <td>pebb. cobb. bould.</td> </tr> </table>	mud	fine med coarse	fine med coarse	gravel		silt	sand					pebb. cobb. bould.						
mud	fine med coarse	fine med coarse	gravel																		
	silt	sand																			
			pebb. cobb. bould.																		

Stratigraphic Column No: 53 **Grid Reference:** **Top** **Bottom**
GPS Waypoint No(s): Te Waka Trig **E:** 2825600 -
Region: Te Pohue **N:** 6213100 -
Location: Section below repeater towers, north end Te Waka Range, Te Waka Trig **Altitude:** 1021 m -
NZMS 260 Sheet: V20 Esk **Page 2 of 3** **Author:** K. Bland **2 of 4**

Age	Strat. Unit	Scale (metres)	Lithology	Sampling interval	Facies	WP No.	Samples	Contacts	Description								
										Int.	N.Z.						
Late Pliocene	Mangapanian	100			S ₁₀				Yellowish-brown, poorly to slightly cemented, moderately fossiliferous concretionary sandstone. The unit comprises alternating bioclastic/siliciclastic-dominated sand bodies. Calcareous packages become thicker and more dominant down-dip. Contains <i>Antalis pareorensis</i> , <i>Phialopecten marwicki</i> (Wp form) <i>Atrina pectinata zelandica</i> and <i>Mesopeplum convexum</i> .								
	Waipiian	95			MX ₄				Yellowish-brown, sandy barnacle-rich bioclastic sheets alternating with siliciclastic-dominated beds. Prominent burrows and other bioturbation features present through layers.								
	Mangaheia Group	80			S ₁₀												
	Te Waka Formation	70							Light-brown to pale-grey, non to slightly fossiliferous bioturbated concretionary silty sandstone coarsening up into fine sandstone. Massive to weakly laminated. Some shellhash is present in lower parts of the unit, with concretions concentrated in certain parts of the section. Concretions range in size from small oval bodies to large continuous horizons.								
		65															
		60															
		55															
			<table border="1"> <tr> <td>mud</td> <td>fine med. coarse</td> <td>fine med.</td> <td>coarse granu. pebb. cobb. bould.</td> </tr> <tr> <td>silt</td> <td></td> <td>sand</td> <td>gravel</td> </tr> </table>	mud	fine med. coarse	fine med.	coarse granu. pebb. cobb. bould.	silt		sand	gravel						
mud	fine med. coarse	fine med.	coarse granu. pebb. cobb. bould.														
silt		sand	gravel														



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Stratigraphic Column No: 54	Grid Reference: Top	Bottom	NZMS 260 V20 54 1 of 1
GPS Waypoint No(s): Wp 40	E: 2825217		
Region: Te Waka	N: 6212916		
Location: Te Waka Range west of Transmitter	Altitude: 955 m	-	
NZMS 260 Sheet: V20 Esk		Page 1 of 1	Author: K. Bland

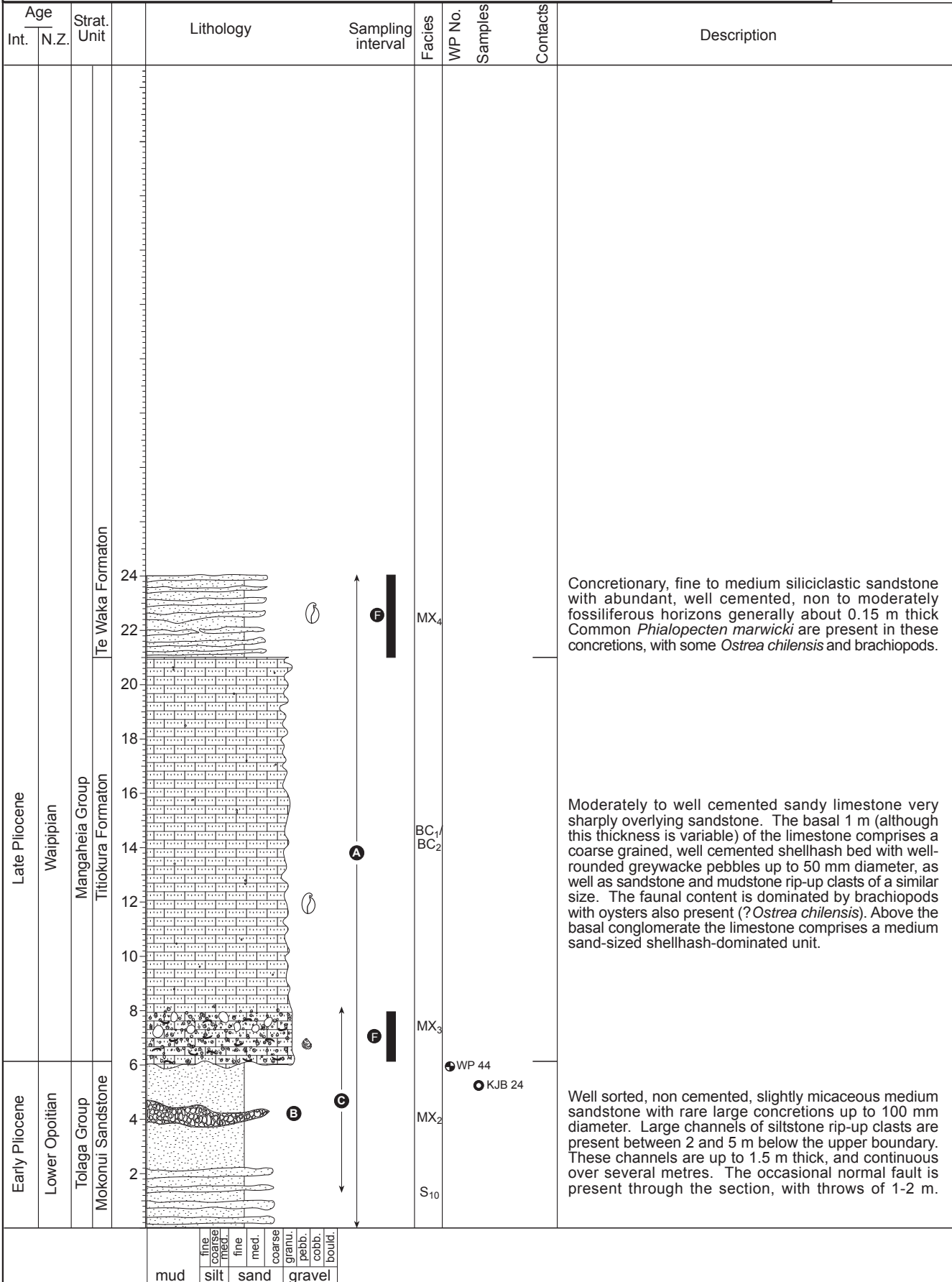
Age Int.	N.Z.	Strat. Unit	Lithology	Sampling interval	Facies	WP No.	Samples	Contacts	Description																																							
		Late Pliocene																																														
		Upper Waipian																																														
		Mangaheia Group																																														
		Te Waka Formation																																														
					BC ₁ BC ₂	WP 40 KJB 15		<p>Yellow-brown, moderately to well cemented, fine to coarse calcareous sandstone grading upward into sandy limestone. The unit is dominated by shellhash and siliciclastic sand. The upper 6 m of section in this unit is flaggy due to preferential weathering. The lower contact with the underlying sandstone is not exposed.</p> <p>Non cemented, non fossiliferous, well sorted, moderately weathered, fine to medium siliciclastic sandstone. The sandstone is non concretionary. Base of unit is not exposed.</p>																																								
			<table border="1"> <tr> <td></td> <td>fine</td> <td></td> <td></td> </tr> <tr> <td></td> <td>coarse</td> <td></td> <td></td> </tr> <tr> <td></td> <td>med.</td> <td></td> <td></td> </tr> <tr> <td></td> <td>fine</td> <td></td> <td></td> </tr> <tr> <td></td> <td>med.</td> <td></td> <td></td> </tr> <tr> <td></td> <td>coarse</td> <td></td> <td></td> </tr> <tr> <td></td> <td>granu.</td> <td></td> <td></td> </tr> <tr> <td></td> <td>pebb.</td> <td></td> <td></td> </tr> <tr> <td></td> <td>cobb.</td> <td></td> <td></td> </tr> <tr> <td></td> <td>bould.</td> <td></td> <td></td> </tr> </table>		fine				coarse				med.				fine				med.				coarse				granu.				pebb.				cobb.				bould.							
	fine																																															
	coarse																																															
	med.																																															
	fine																																															
	med.																																															
	coarse																																															
	granu.																																															
	pebb.																																															
	cobb.																																															
	bould.																																															
			mud	silt	sand	gravel																																										

Stratigraphic Column No: 55	Grid Reference: Top	Bottom	NZMS 260 V20 55 1 of 2
GPS Waypoint No(s): Wp 41	E: 2824874		
Region: Te Waka	N: 6213393		
Location: North face of the Te Waka Range overlooking the Mohaka River.	Altitude: 991m	-	
NZMS 260 Sheet: V20 Esk	Page 1 of 1		Author: K. Bland

Age	Strat. Unit	Lithology	Sampling interval	Facies	WP No.	Samples	Contacts	Description			
									Int.	N.Z.	
Late Pliocene	Te Waka Formation			MX ₄				<p>Yellow-brown, non to moderately cemented, fine to medium sandstone with very common concretionary lenses 0.15-0.2 m thick. Concretionary lenses become further apart (up to 0.7 m apart) up-section. Moderately well cemented horizons are present within the concretionary sandstone section. The sandstone displays small-scale, low angle cross-bedding. The thickness of concretionary horizons and lenses has been exaggerated in this column for clarity. The sandstone is sparsely fossiliferous, with most fauna present in cemented layers. <i>Phialopecten marwicki</i> and <i>Atrina pectinata zelandica</i> dominate the fossil content with assorted gastropods.</p>			
	Waipipian			BC ₁ / BC ₂				<p>Moderately to well cemented, medium to coarse grained sandy limestone, rich in shellhash and barnacle fragments. The unit sharply overlies sandstone, and grades into the overlying sandstone facies through a series of concretionary horizons over 1-2 m.</p>			
	Titokura Formation										
	Lower Opoitian			S ₁₀				<p>Non to slightly cemented, fine to medium siliciclastic sandstone with common concretionary lenses and horizons. The base of the sandstone is not exposed, but the unit is thought to be at least 150 m thick.</p>			
		<table border="1"> <tr> <td>mud</td> <td>fine coarse med.</td> <td>silt</td> <td>fine med.</td> <td>sand</td> <td>coarse granu. pebb.</td> <td>gravel</td> <td>cobb. bould.</td> </tr> </table>	mud	fine coarse med.	silt	fine med.	sand	coarse granu. pebb.	gravel	cobb. bould.	
mud	fine coarse med.	silt	fine med.	sand	coarse granu. pebb.	gravel	cobb. bould.				



Stratigraphic Column No: 56	Grid Reference: Top	Bottom	NZMS 260 V20 56 1 of 2
GPS Waypoint No(s): Wp 44	E: 2823966		
Region: Te Waka	N: 6212811		
Location: Te Waka Range southwest of transmitter.	Altitude: 937	-	
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Stratigraphic Column No: 57	Grid Reference:	Top	Bottom	NZMS 260 V20 57 1 of 2
GPS Waypoint No(s): Wp 74	E:	2820543		
Region: Crohane	N:	6212478		
Location: Church Bush Road in Crohane Forest south of Inganatahi Stream.	Altitude:	517m	-	
NZMS 260 Sheet: V20 Esk		Page 1 of 1	Author: K. Bland	

Age	Strat. Unit	Lithology	Sampling interval	Facies	WP No.	Samples	Contacts	Description												
									Int.	N.Z.										
Miocene	Lower Tongaporutuan																			
	Tolaga Group/Waitere Formation																			
	Tarawera Limestone Member																			
				S ₁ /S ₉				Well sorted greywacke conglomerate lenses in massive fine to medium siliciclastic sandstone. Clasts in the conglomerate beds are up to 30 mm in diameter, averaging ~15 mm in diameter.												
				S ₃				Light-brown to blue-grey, massive, non cemented fine to medium siliciclastic sandstone with rare intact shells.												
				S ₁₀				Non cemented concretionary fine to medium sandstone. Concretions are well cemented and up to 0.3 m thick.												
				MX ₁	WP 74			Highly calcareous sandstone directly overlying Torlesse greywacke. Highly fossiliferous in places, dominated by serpulid worm tubes, with some barnacle fragments (<i>Tasmanocubanus accutus</i> or <i>Fosterella tuberculatus</i>) and bryozoans. The unit infills cracks and fissures in the underlying greywacke. Rare <i>Crassostrea ingens</i> were also observed. Along section this calcareous layer grades into a concretionary sandstone.												
								Very indurated, moderately weathered, shattered greywacke with metre-scale relief on upper surface.												
Mesozoic	Torlesse																			
		<table border="1"> <tr> <td>mud</td> <td>fine med coarse</td> <td>fine med.</td> <td>coarse</td> <td>granu.</td> <td>pebb.</td> <td>cobb.</td> <td>bould.</td> </tr> <tr> <td></td> <td>silt</td> <td>sand</td> <td>gravel</td> <td></td> <td></td> <td></td> <td></td> </tr> </table>	mud	fine med coarse	fine med.	coarse	granu.	pebb.	cobb.	bould.		silt	sand	gravel						
mud	fine med coarse	fine med.	coarse	granu.	pebb.	cobb.	bould.													
	silt	sand	gravel																	



Angular unconformity between strongly fractured greywacke and bioclastic-dominated basal bed of the Te Ipuhape Sandstone Member. Metre-scale relief is present on this contact.



Overview of lower parts of the section logged. Conglomerate beds are well exposed in the middle-top of the photograph (arrowed).

Stratigraphic Column No: 58	Grid Reference: Top	Bottom	NZMS 260 V20 58 1 of 1
GPS Waypoint No(s): Wp 78	E: 2820039		
Region: Crohane	N: 6210545		
Location: Cherry Block Station, up small stream from end of Potter Road.	Altitude: 547m	-	
NZMS 260 Sheet: V20 Esk	Page 1 of 1		Author: K. Bland

Age	Strat. Unit	Lithology	Sampling interval	Facies	WP No.	Samples	Contacts	Description																
									Int.	N.Z.														
Mesozoic																								
	Toniessa																							
	Miocene																							
	Lower Tongaporutuan																							
	Tolaga Group/Waitere Formation																							
	Te Ipohape Sandstone Member																							
								<p>Light-brown, well cemented, non to moderately fossiliferous flaggy sandstone. Only biomoulds remain of assorted bivalves. Middle portions of the unit contain well cemented greywacke conglomerate beds up to 1.5 m in thickness. Clasts in these beds are well rounded, well sorted and spheroid in shape, averaging 20-30 mm in diameter, and up to 40 mm diameter. Some pebble bands are present that are a single clast thick. The base of the unit is not exposed but it is inferred to rest directly onto greywacke basement.</p>																
								<p>Moderately deformed, very well indurated moderately weathered greywacke basement.</p>																
		<table border="1"> <tr> <td>mud</td> <td>fine med</td> <td>fine med</td> <td>coarse</td> <td>granu.</td> <td>pebb.</td> <td>cobb.</td> <td>bould.</td> </tr> <tr> <td></td> <td>silt</td> <td>sand</td> <td>gravel</td> <td></td> <td></td> <td></td> <td></td> </tr> </table>	mud	fine med	fine med	coarse	granu.	pebb.	cobb.	bould.		silt	sand	gravel										
mud	fine med	fine med	coarse	granu.	pebb.	cobb.	bould.																	
	silt	sand	gravel																					

Stratigraphic Column No: 59	Grid Reference: Top	Bottom	NZMS 260 V20 59 1 of 1
GPS Waypoint No(s): Wp 79	E: 2819271		
Region: Crohane	N: 6210191		
Location: Outcrop up small stream on Cherry Block Station at end of Potter Rd.	Altitude: 525m	-	
NZMS 260 Sheet: V20 Esk	<i>Page 1 of 1</i>		Author: K. Bland

Age	Strat. Unit	Lithology	Sampling interval	Facies	WP No.	Samples	Contacts	Description			
									Int.	N.Z.	
Miocene	Lower Tongaporutuan										
Mesozoic	Torlesse composite terrane										
								<p>10</p> <p>9</p> <p>8</p> <p>7</p> <p>6</p> <p>5</p> <p>4</p> <p>3</p> <p>2</p> <p>1</p>			
								<p>S₁ WP 79</p> <p>Cg₁</p> <p>S₁</p>			
								<p>Light-brown non cemented, fine to medium sandstone.</p> <p>Well sorted, slightly to moderately cemented greywacke conglomerate bed. Well rounded clasts that are up to 100 mm in diameter, but averaging 20-30 mm in diameter.</p> <p>Light-brown non cemented, fine to medium sandstone. The base of the unit is not exposed, but is inferred to rest directly onto basement.</p> <p>Moderately deformed, very indurated, moderately weathered greywacke basement.</p>			
		<table border="1"> <tr> <td>mud</td> <td>fine silt</td> <td>med. silt</td> <td>coarse silt</td> <td>fine sand</td> <td>med. sand</td> <td>coarse sand</td> <td>gravel</td> </tr> </table>	mud	fine silt	med. silt	coarse silt	fine sand	med. sand	coarse sand	gravel	
mud	fine silt	med. silt	coarse silt	fine sand	med. sand	coarse sand	gravel				

Stratigraphic Column No: 60	Grid Reference: Top	Bottom	NZMS 260 V20 60 1 of 2
GPS Waypoint No(s): Wp 458, 459	E: 2815949	2815869	
Region: Pakaututu	N: 6212682	6212915	
Location: Hukanui Station at northern boundary fences	Altitude: 845 m	785 m	
NZMS 260 Sheet: V20 Esk	Page 1 of 2		

Age	Strat. Unit		Lithology	Sampling interval	Facies	WP No.	Samples	Contacts	Description																
	Int.	N.Z.																							
Early Pliocene	Upper Opoitian	Mangaheia Group Pakaututu Formation	41	↑ Page 2																					
			35																						
			29																						
			23																						
			17																						
			16		F1	S ₁₁				<p><i>Struthiolaria (Callusaria) ?obesa</i> dominated bed.</p> <p>Weathered, well cemented massive to laminated sandstone. Flaggy and fluted in places.</p>															
			15			S ₅																			
			14																						
			13																						
			12							<p>Non to poorly exposed interval with occasional well cemented beds cropping out.</p>															
11																									
10																									
9																									
8						● WP 458		<p>Well cemented, flaggy, laminated case-hardened sandstone concretions and beds interbedded with well-sorted, orange-brown, medium sandstone which is generally restricted to the lower 1 m of the outcrop.</p>																	
7																									
6								<p>Non to poorly exposed interval.</p>																	
5								<p>Fluted and slightly flaggy well cemented massive to laminated sandstone with scattered pebbles and pebble bands.</p>																	
4								<p>Moderately to well cemented pebbly shellbed with alternating layers of fine and coarse-grained shells. Abundant biomoulds, fauna dominated by <i>Struthiolaria (Callusaria)</i>.</p>																	
3								<p>Well cemented slightly pebbly sandstone.</p>																	
2								<p>Slightly fossiliferous well cemented sandstone with scattered fine greywacke pebbles. Overlain by well cemented pebbly sandstone with scattered shells.</p>																	
1								<p>Very well cemented, densely pebbly limestone. Clasts are of granule to large pebble size, averaging 25 mm across. Common bivalves and gastropods present. Basal 0.1 m comprises very well cemented greenish-grey sandstone with scattered pebbles.</p>																	
								<p>Non cemented greywacke grit with scattered coarser-grained pebbles. Overlies siltstone and Torlesse greywacke.</p>																	
			<table border="1" style="width: 100%; text-align: center;"> <tr> <td>mud</td> <td>fine med.</td> <td>fine med.</td> <td>coarse med.</td> <td>coarse granu.</td> <td>pebb.</td> <td>cobb.</td> <td>bould.</td> </tr> <tr> <td></td> <td>silt</td> <td>sand</td> <td>gravel</td> <td></td> <td></td> <td></td> <td></td> </tr> </table>	mud	fine med.	fine med.	coarse med.	coarse granu.	pebb.	cobb.	bould.		silt	sand	gravel										
mud	fine med.	fine med.	coarse med.	coarse granu.	pebb.	cobb.	bould.																		
	silt	sand	gravel																						

Stratigraphic Column No: 60	Grid Reference: Top	Bottom	NZMS 260 V20 60 2 of 2
GPS Waypoint No(s): Wp 458, 459	E: 2815949	2815869	
Region: Pakaututu	N: 6212682	6212915	
Location: Hukanui Station at northern boundary fences	Altitude: 845 m	785 m	
NZMS 260 Sheet: V20 Esk	Page 2 of 2	Author: K. Bland	

Age	Strat. Unit	Scale (metres)	Lithology	Sampling interval	Facies	WP No.	Samples	Contacts	Description
Late Pliocene	?Waipiian	60 59 58 57 56 55 54 53	Puketitiri Formation						
Early Pliocene	Upper Opoitian	52 51 50 49 48 47 46 45 44 43 42	Mangaheia Group Pakaututu Formation						<p>Creamy-grey, non cemented, slightly weathered, fine sandstone. Intensely bioturbated and burrowed, massive to strongly-laminated with common concretionary beds in the lower two-thirds up to 0.7 m-thick. Concretions are not continuous through the outcrop, are well cemented and almost entirely dominated by recrystallised <i>Struthiolaria (Callusaria) ?obesa</i>.</p>
<div style="display: flex; justify-content: space-around; font-size: small;"> Page 1 </div>									

Stratigraphic Column No: 61	Grid Reference: Top	Bottom	NZMS 260 V20 61 1 of 1
GPS Waypoint No(s): Wp 91	E: 2815665		
Region: Puketitiri	N: 6211514		
Location: Hukanui Station below Hukanui Trig.	Altitude: 965 m	-	
NZMS 260 Sheet: V20 Esk	Page 1 of 1	Author: K. Bland	

Age	Strat. Unit	Scale (metres)	Lithology	Sampling interval	Facies	WP No.	Samples	Contacts	Description									
										Int.	N.Z.							
Late Pliocene	Managapanian																	
	Mangaheia Group																	
	Te Waka Formation	18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1			BC ₅	WP 91			<p>Moderately cemented, coarse-grained barnacle plate-dominated coquina. Grains are coarse sand in size with rare to some well-sorted, well-rounded greywacke pebbles. The unit is flaggy in outcrop, with each flag being 0.15-0.2 m thick, although this is variable. Some mudstone and sandstone rip-up clasts are present, as are valves of <i>Talochlamys gemmulata</i>, some <i>Phialopecten thomsoni</i>, <i>Crassostrea ingens</i>, <i>Ostrea chilensis</i>, <i>Mesopeplum</i> sp. and other bivalves. The unit is characterised by centimetre to metre-scale trough cross bedding that is present throughout the outcrop thickness. Some giant-scale cross-beds are present, many metres in size.</p>									
			<table border="1"> <tr> <td>mud</td> <td>fine silt</td> <td>med. sand</td> <td>coarse sand</td> <td>gravel</td> </tr> <tr> <td></td> <td>fine med. coarse</td> <td>fine med.</td> <td>coarse granu.</td> <td>pebb. cobb. bould.</td> </tr> </table>	mud	fine silt	med. sand	coarse sand	gravel		fine med. coarse	fine med.	coarse granu.	pebb. cobb. bould.					
mud	fine silt	med. sand	coarse sand	gravel														
	fine med. coarse	fine med.	coarse granu.	pebb. cobb. bould.														

Stratigraphic Column No: 62	Grid Reference: Top	Bottom	NZMS 260 V20 62 1 of 1
GPS Waypoint No(s): Wp 88	E: 2815569		
Region: Puketitiri	N: 6211418		
Location: Hukanui Station below Hukanui Trig.	Altitude: 977m	-	
NZMS 260 Sheet: V20 Esk		Page 1 of 1	Author: K. Bland

Age	Strat. Unit	Scale (metres)	Lithology	Sampling interval	Facies	WP No.	Samples	Contacts	Description											
										Int.	N.Z.									
Late Pliocene	Mangapanian	0 to 10			MX ₄				<p>Slightly to moderately cemented shellhash-dominated calcareous sandstone to sandy limestone. The unit is fine sand at the base and coarsens upward through the section into a sandy limestone bed many metres thick. Occasional greywacke granules are present, as are abundant barnacle plates and fragments. Shellhash beds are up to 0.3 m thick, and average 0.15 m in thickness. They are separated by more siliciclastic-dominated beds, although abundant shellhash is still present in these layers. The siliciclastic beds display low-angle, medium-scale cross-bedding. The contact between the underlying sandstone and the calcareous unit is sharp and slightly coarser-grained with more greywacke pebbles and intact <i>Ostrea chilensis</i> valves in the lowermost 0.1 m.</p>											
	Mangaheia Group									Te Waka Formation										
	?Waipian-Mangapanian	1 to 3			MX ₃	WP 88			<p>Blue-grey, non fossiliferous laminated fine sandstone. The base of the unit is not exposed here, but overall thickness is at least 40 m. The upper 1 m is slightly siltier than underlying parts.</p>											
	Puketitiri Formation									S ₄	S ₁									
			<table border="1"> <tr> <td>mud</td> <td>fine silt</td> <td>med. sand</td> <td>coarse sand</td> <td>gravel</td> </tr> <tr> <td></td> <td>fine med. coarse</td> <td>fine med.</td> <td>coarse granu.</td> <td>pebb. cobb. bould.</td> </tr> </table>	mud	fine silt	med. sand	coarse sand	gravel		fine med. coarse	fine med.	coarse granu.	pebb. cobb. bould.							
mud	fine silt	med. sand	coarse sand	gravel																
	fine med. coarse	fine med.	coarse granu.	pebb. cobb. bould.																

Stratigraphic Column No: 63	Grid Reference: Top	Bottom	NZMS 260 V20 63 1 of 3
GPS Waypoint No(s): Wp 472-476	E: 2814120	2813663	
Region: Puketitiri	N: 6211746	6212952	
Location: North face of Hukanui Hill, northeast of Puketitiri	Altitude: 915 m	715 m	
NZMS 260 Sheet: V20 Esk	Page 1 of 3		Author: K. Bland

Age	Strat. Unit		Lithology	Sampling interval	Facies	WP No.	Samples	Contacts	Description																				
	Int.	N.Z.								Scale (metres)																			
Late Pliocene		?Waipipian			Cg ₁	WP 478			Moderately cemented, clast supported greywacke breccia to conglomerate. Clasts are of granule to boulder size, and are moderately to poorly sorted. Massive unit with sandy matrix, underlain by siltstone.																				
										Z ₁																			
Early Pliocene		Upper Opoitian			BC ₃	WP 477			Moderately well cemented <i>Tucetona laticostata</i> -rich whole shell sandy limestone overlying concretionary fine sandstone. The limestone contains occasional <i>Phialopecten marwicki</i> .																				
		?Lower Opoitian			S ₁₁	WP 482			Brown, massive, bioturbated, well sorted, moderately indurated fine sandstone. Contains thin greywacke pebble bands. Overlain by a concretionary bed containing abundant <i>Struthiolaria</i> sp.																				
										S ₁																			
Mesozoic	?Jurassic	Torlesse			Cg ₁				Scattered exposures of poorly cemented greywacke conglomerate.																				
						WP 476			Red-brown to grey, moderately weathered, fractured greywacke.																				
			<table border="1" style="font-size: small;"> <tr> <td>mud</td> <td>fine med. coarse</td> <td>fine med.</td> <td>coarse granu.</td> <td>gravel</td> </tr> <tr> <td></td> <td></td> <td></td> <td>pebb.</td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> <td>cobb.</td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> <td>bould.</td> <td></td> </tr> </table>	mud	fine med. coarse	fine med.	coarse granu.	gravel				pebb.					cobb.					bould.							
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Stratigraphic Column No: 63	Grid Reference: Top	Bottom	NZMS 260 V20 63 2 of 3
GPS Waypoint No(s): Wp 472-476	E: 2814120	2813663	
Region: Puketitiri	N: 6211746	6212952	
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NZMS 260 Sheet: V20 Esk	<i>Page 2 of 3</i>		Author: K. Bland

Age	Strat. Unit		Lithology	Sampling interval	Facies	WP No.	Samples	Contacts	Description									
	Int.	N.Z.																
Late Pliocene		?Waipian																
		Mangaheia Group																
		Puketitiri Formation																
					S ₁													
					S ₁													
					Z ₁	● WP 474			White, fractured and frittered, hard, very fine-grained massive siltstone sharply overlain by tan-brown, non cemented, very well sorted, strongly bioturbated massive to laminated sandstone. The upper 0.05-0.1 m of this sandstone contains very abundant burrows. Sandstone passes up into laminated siltstone.									
					Z ₁													
					Cg ₁	● WP 478												
			<table border="1" style="font-size: 0.8em;"> <tr> <td></td> <td>fine</td> <td>med.</td> <td>coarse</td> <td></td> </tr> <tr> <td>mud</td> <td>silt</td> <td>sand</td> <td>gravel</td> <td></td> </tr> </table>		fine	med.	coarse		mud	silt	sand	gravel						
	fine	med.	coarse															
mud	silt	sand	gravel															

