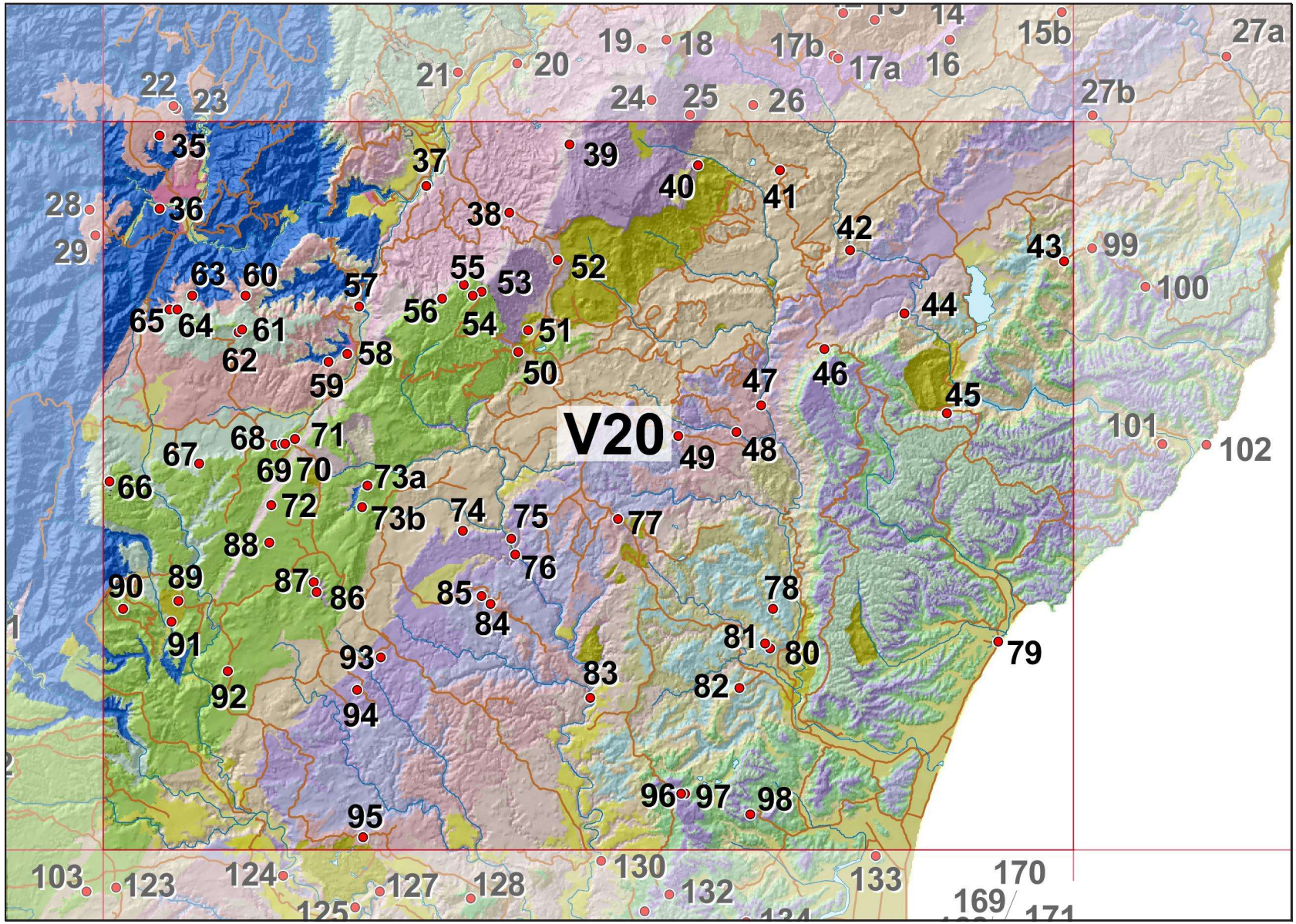


Fig. 7. Map showing location of stratigraphic columns within NZMS 260 Sheet V20.

*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

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| Age Int. | Age N.Z. | Strat. Unit | Scale (metres) | Lithology | Sampling interval | Facies | WP No. Samples | Contacts | Description |
|---|---|---|---|---|---|---|---|---|---|
| Late Pliocene | Lower Nukumaruan | Mangaheia Group / Matahorua Formation/Papakiri Member | 10 | | | $z_3$ | | | Siltstone approximately 40 m thick. |
| | | | 9 | | | | | | |
| | | | | | | $V_1$ | | | Fine ash, airfall tephra bed. |
| | | | 8 | | | $z_8$ | | | |
| | | | 7 | | | | | | |
| | | | | | | $z_3$ | | | Non cemented siltstone. Contains *Maoricolpus roseus, Atrina pectinata zelandica*. |
| | | | 6 | | F | | | | |
| | | | 5 | | | $z_2$ | | | |
| | | | | | | $z_5$ | | | Pebbly siltstone containing fine greywacke pebbles reworked from underlying conglomerate. Gradational contact between the two beds. |
| | | | 4 | | | $Cg_6$ | Site 107 | | Highly fossiliferous pebbly shellbed containing lowest occurence of *Phialopecten triphooki* with *Tucetona laticostata, Paphies australis,* and *Austrovenus stutchburyi*. |
| | Upper Mangapanian | | 3 | | | | | | |
| | | | 2 | | | $Cg_6$ | | | 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 *Tucetona laticostata* (dominant, some articulated), *Austrovenus stutchburyi, Paphies australis, Paphies subtriangulata*, ?*Lamprodominea* and *Amalda*. |
| | | | 1 | | | | | | |

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

**Stratigraphic Column No:** 49 | **Grid Reference:** | **Top** | **Bottom**

**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 | -

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| Age Int. | Age N.Z. | Strat. Unit | Lithology | Sampling interval | Facies | WP No. Samples | Contacts | Description |
|---|---|---|---|---|---|---|---|---|
| Late Pliocene | Lower Nukumaruan | Mangaheia/Group; Matahorua Formation/Papakiri Member | 9 | | | | | |
| | | | 8 | | $S_4$ | | | Dirty-coloured, silty sandstone sharply overlying greywacke conglomerate bed. |
| | | | 7 | | | | | |
| | | | 6 | | $Cg_1$ | | | 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. |
| | | | 5 | | | | | |
| | | | | | $S_7$ | 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 *Austrovenus stutchburyi* and *Patro undatus*. Pebbles are up to 30 mm diameter. A second shellbed is present 0.4 m above the basal one containing disarticulated bivalves including *Austrovenus.* |
| | | | 4 | | | KJB 34 | | |
| | | | 3 | | $Cg_2$ | | | 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. |
| | | | 2 | | | | | |
| | | | 1 | | $Cg_4$ | | | 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. |

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

**Stratigraphic Column No:** 50 **Grid Reference:** **Top** **Bottom**

**GPS Waypoint No(s):** Oakmere Station **E:** 2827100 -

**Region:** Te Pohue **N:** 6210600 -

**Location:** Limestone bluffs beside Translator Road, Oakmere Station **Altitude:** - -

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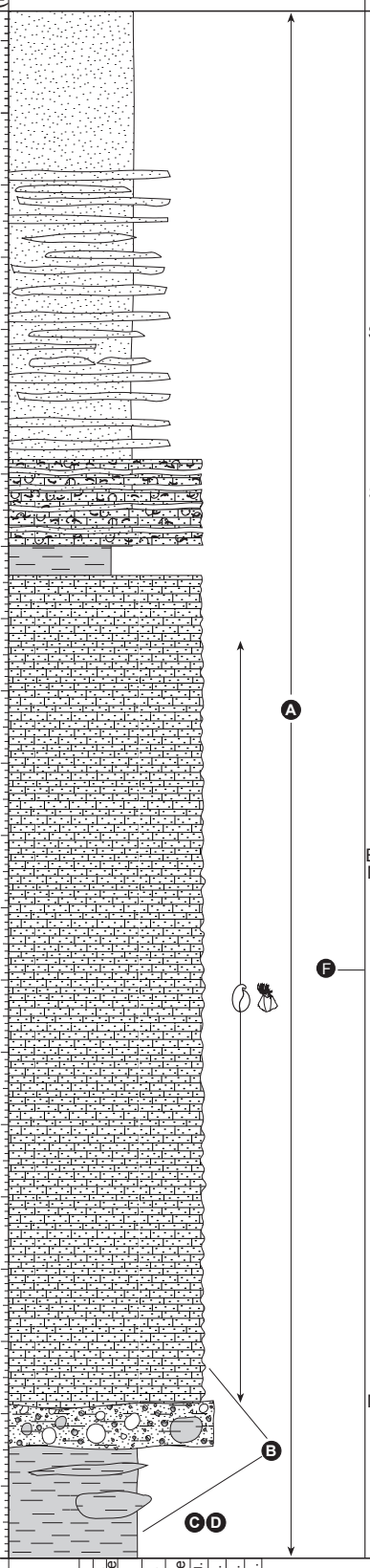
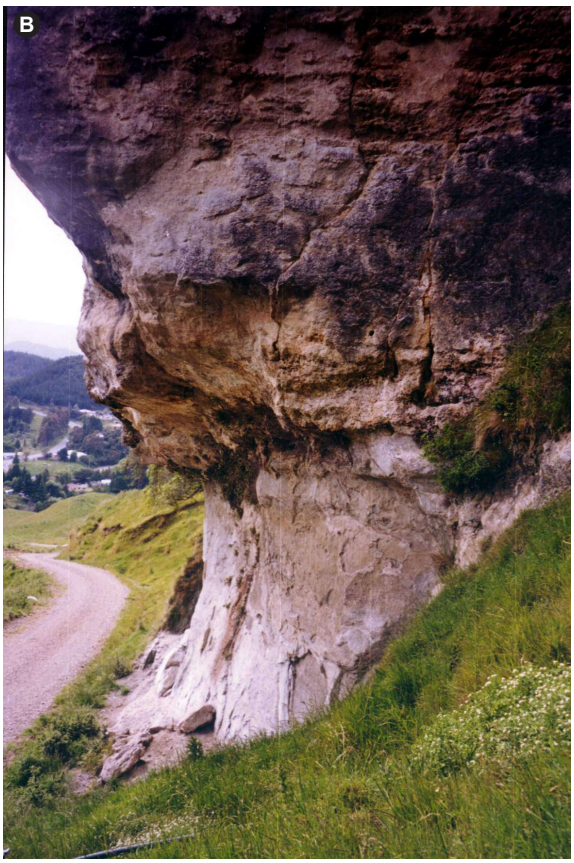



| Age Int. | Age N.Z. | Strat. Unit | Facies | WP No. | Samples | Contacts | Description |
|---|---|---|---|---|---|---|---|
| Late Pliocene | Mangapanian | Mangaheia Group, Pohue Fmn | $S_1$ | | | | Olive-brown, non to moderately cemented, moderately fossiliferous, strongly bioturbated sandstone with moderately fossilifeorus concretionary layers and lenses. Planar cross-bedded to low-angle trough cross-bedded. Siltstone lenses <8 cm thick are present that show well-developed ripple and planar laminations. |
| | | | $S_{10}$ | | | | |
| | | | $S_{11}$ | | | | Moderately fossiliferous, concretionary fine to medium sandstone. |
| | | Te Waka Formation | $Z_2$ | | | | Blueish grey-brown, moderately fossiliferous siltstone with thin layers of coarse sand sized shellhash. Strongly bioturbated. |
| | | | $BC_2$/ $MX_1$ | WP 149 | | | Yellowish-brown, moderately to well cemented stacked alternating barnacle-rich bioclastic-dominated - siliciclastic dominated sand bodies 0.1-0.25 m thick. Common oyster (*Ostrea chilensis*), gastropod and brachiopd (*Neothyris* aff. *discors*) fossils present. Unit coarsens up-section, with more fossils present in upper half. Low-angle trough cross-bedding is visible in places. |
| | | | $MX_2$ | | | | Conglomerate incorporates concretionary clasts from underlying siltstone. |
| | Waipipian | Titiokura Fm | $Z_2$ | | | | Non to poorly cemented, slightly micaceous, sparsely fossilifeorus concretionary siltstone. Siltstone displays “lam-scram” bedding (muddy turbidite flows). |


A


B


C


D

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: | | - |

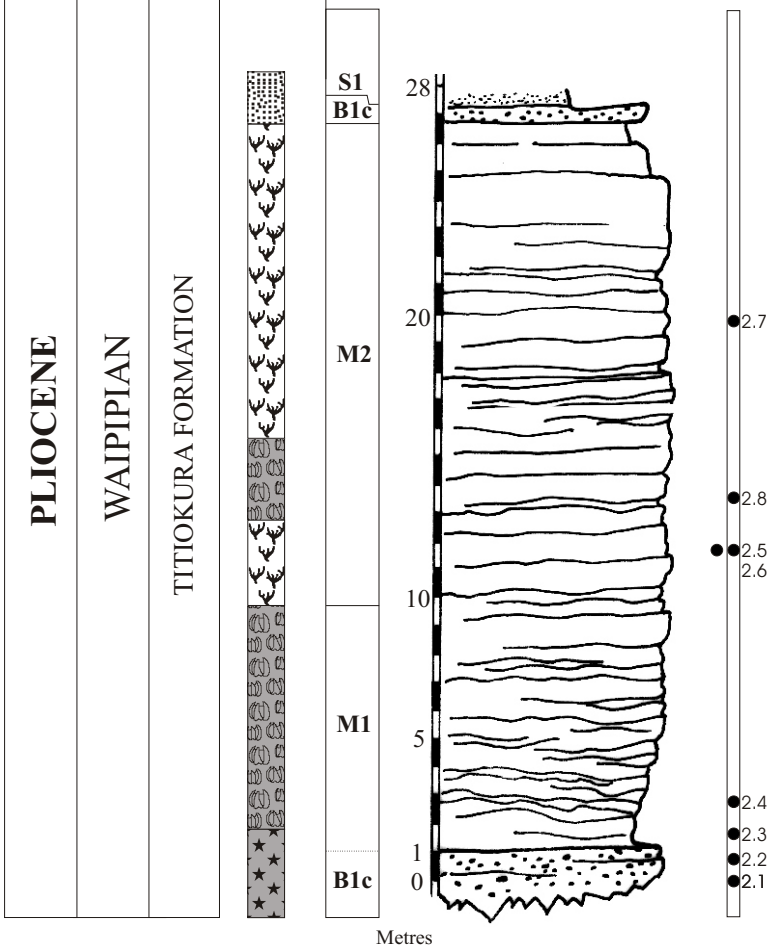
**Author:** V.Caron

NZMS 260 V20

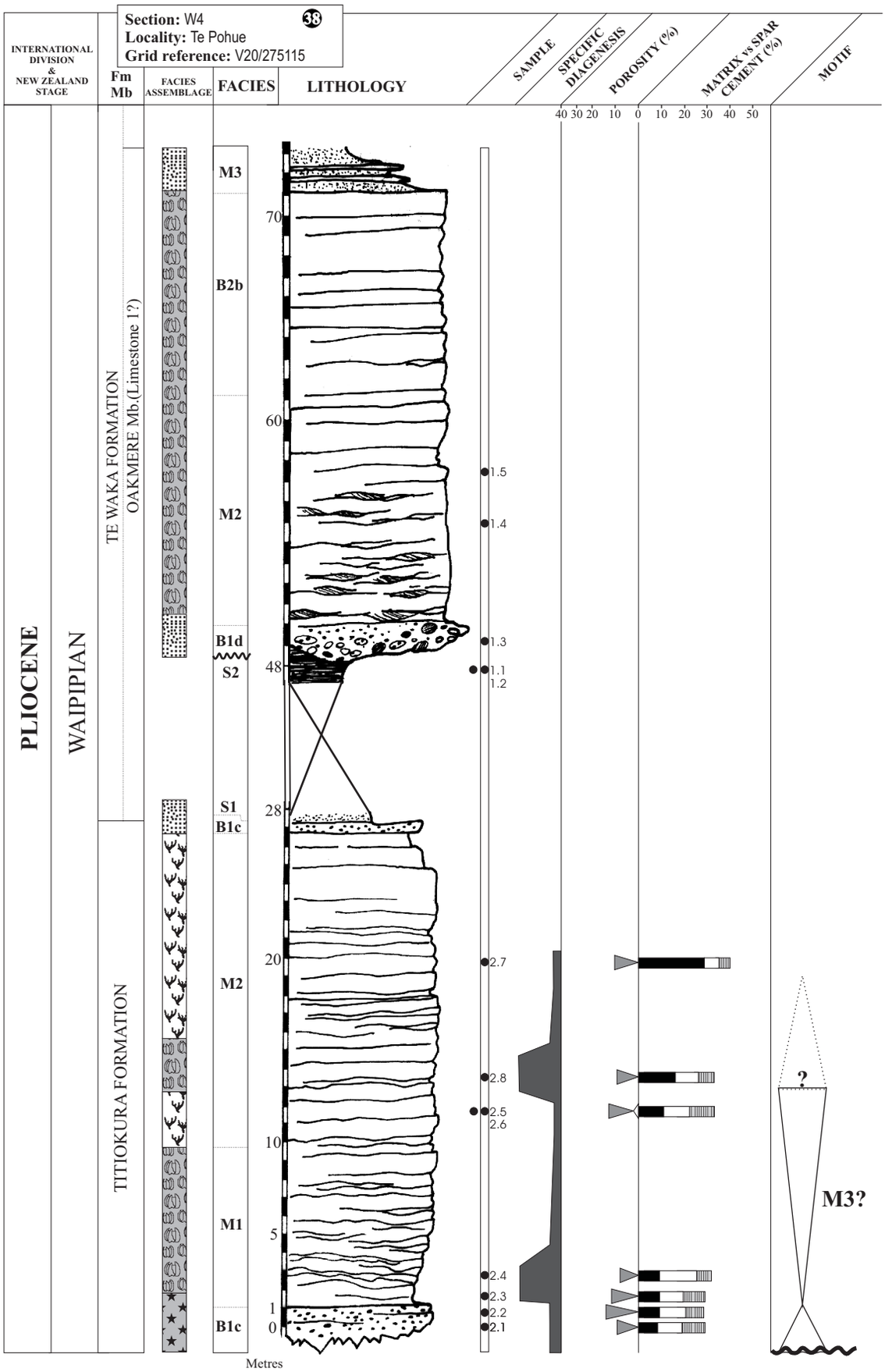
**51**



**Section:** W4 (38)
**Locality:** Te Pohue
**Grid reference:** V20/275115



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

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| Age Int. | Age N.Z. | Strat. Unit | Scale (metres) | Lithology | Sampling interval | Facies | WP No. Samples | Contacts | Description |
|---|---|---|---|---|---|---|---|---|---|
| Late Pliocene | Waipipian | Mangaheia Group / Titiokura Formation | 21–5 | | F | $BC_2$ | WP 149 | | 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 *Atrina pectinata zelandica, Talochlamys* (dominant), *Ostrea, Mesopeplum* sp., *Purpurocardia*, 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. |
| Late Miocene-Early Pliocene | Upper Kapitean-Lower Opoitian | Tolaga Group / Mokonui Sandstone | 5–1 | | | $S_3$ | | | Blue-grey, massive to weakly laminated, slightly to moderately fossiliferous bioturbated fine sandstone. Occasional burrows are present, as are scattered intact valves of *Tawera*, *?Mactra* and *Talochlamys gemmulata*. This bed sharply underlies sandy limestone. |

mud | silt (fine, med., coarse) | sand (fine, med., coarse) | gravel (granu., pebb., cobb., bould.)

**Stratigraphic Column No:** 53 | **Grid Reference:** | **Top** | **Bottom** | NZMS 260 V20

**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

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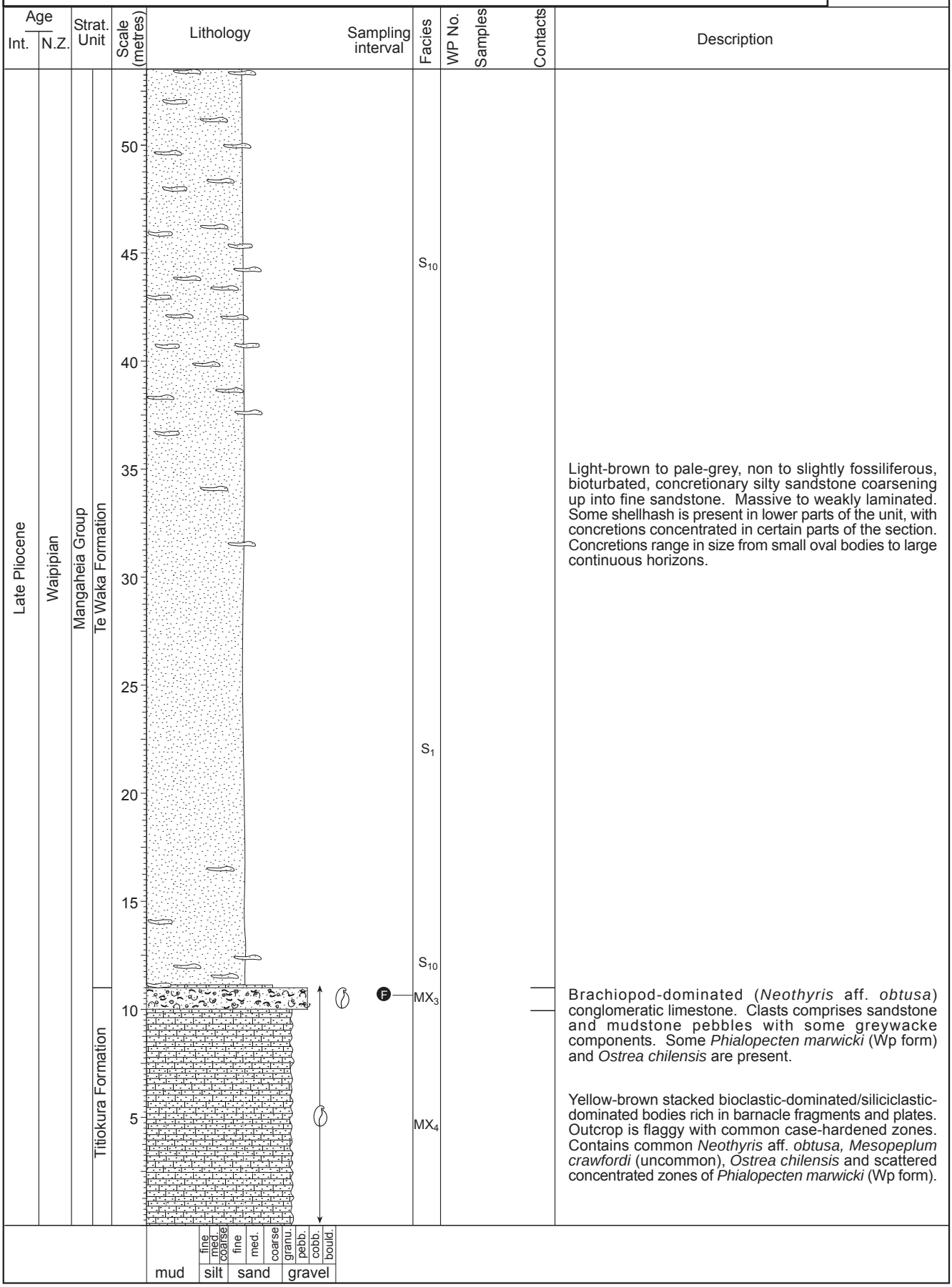
1 of 4



**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

NZMS 260 V20

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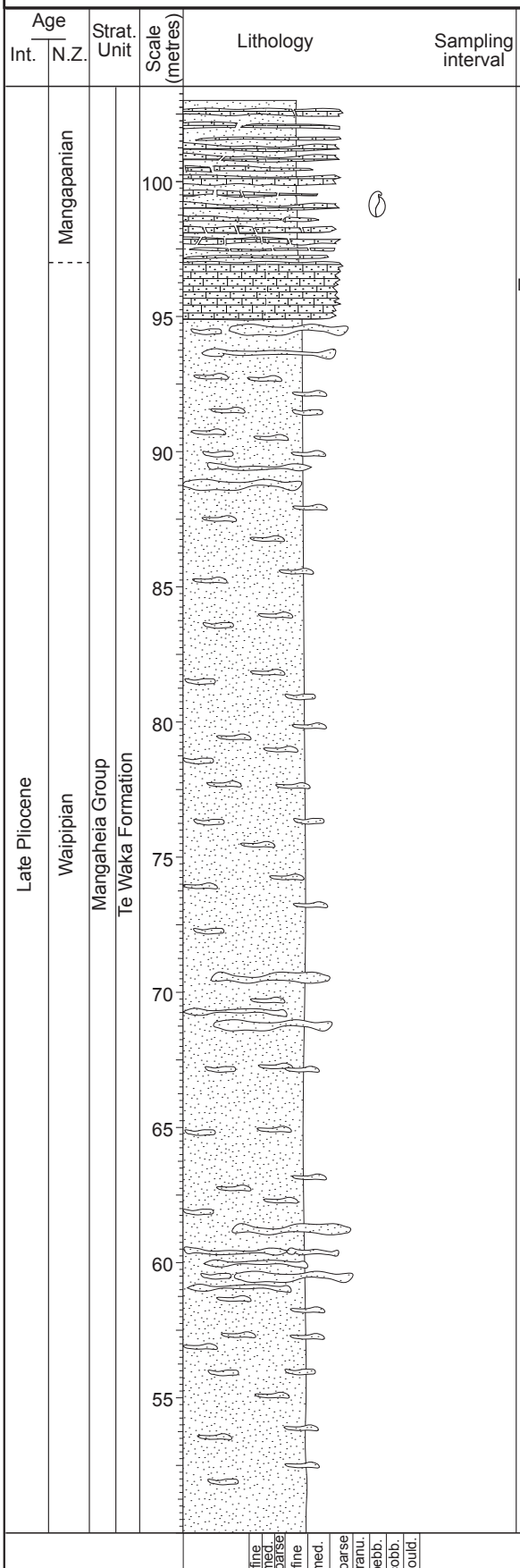
2 of 4




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 *Antalis pareorensis*, *Phialopecten marwicki* (Wp form) *Atrina pectinata zelandica* and *Mesopeplum convexum.*

Yellowish-brown, sandy barnacle-rich bioclastic sheets alternating with siliciclastic-dominated beds. Prominent burrows and other bioturbation features present through layers.

Light-brown to pale-grey, non to slightly fossilifeorus 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.

**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* 3 *of* 3 | **Author:** K. Bland

NZMS 260 V20

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| Age Int. | Age N.Z. | Strat. Unit | Scale (metres) | Lithology | Sampling interval | Facies | WP No. Samples | Contacts | Description |
|---|---|---|---|---|---|---|---|---|---|
| Late Pliocene | Mangapanian | Mangaheia Group / Te Waka Formation | 115 | | | | | | |
| | | | 110 | | | MX$_4$ | | | Yellow-brown barnacle-rich sandy shellhash limestone. Unit comprises stacked bioclastic-siliciclastic dominated bodies 0.1-0.6 m thick. Some small-scale trough cross-bedding is evident. Contains *Maoricardium spatiosum* and *Phialopecten thomsoni.* Case-hardening is common. |
| | | | 105 | | | S$_{10}$ | | | |

mud | silt (fine, med., coarse) | sand (fine, med., coarse) | gravel (granu., pebb., cobb., bould.)


NZMS 260 V20

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***Stratigraphic Column No:*** 54 | ***Grid Reference:*** | ***Top*** | ***Bottom*** | NZMS 260 V20

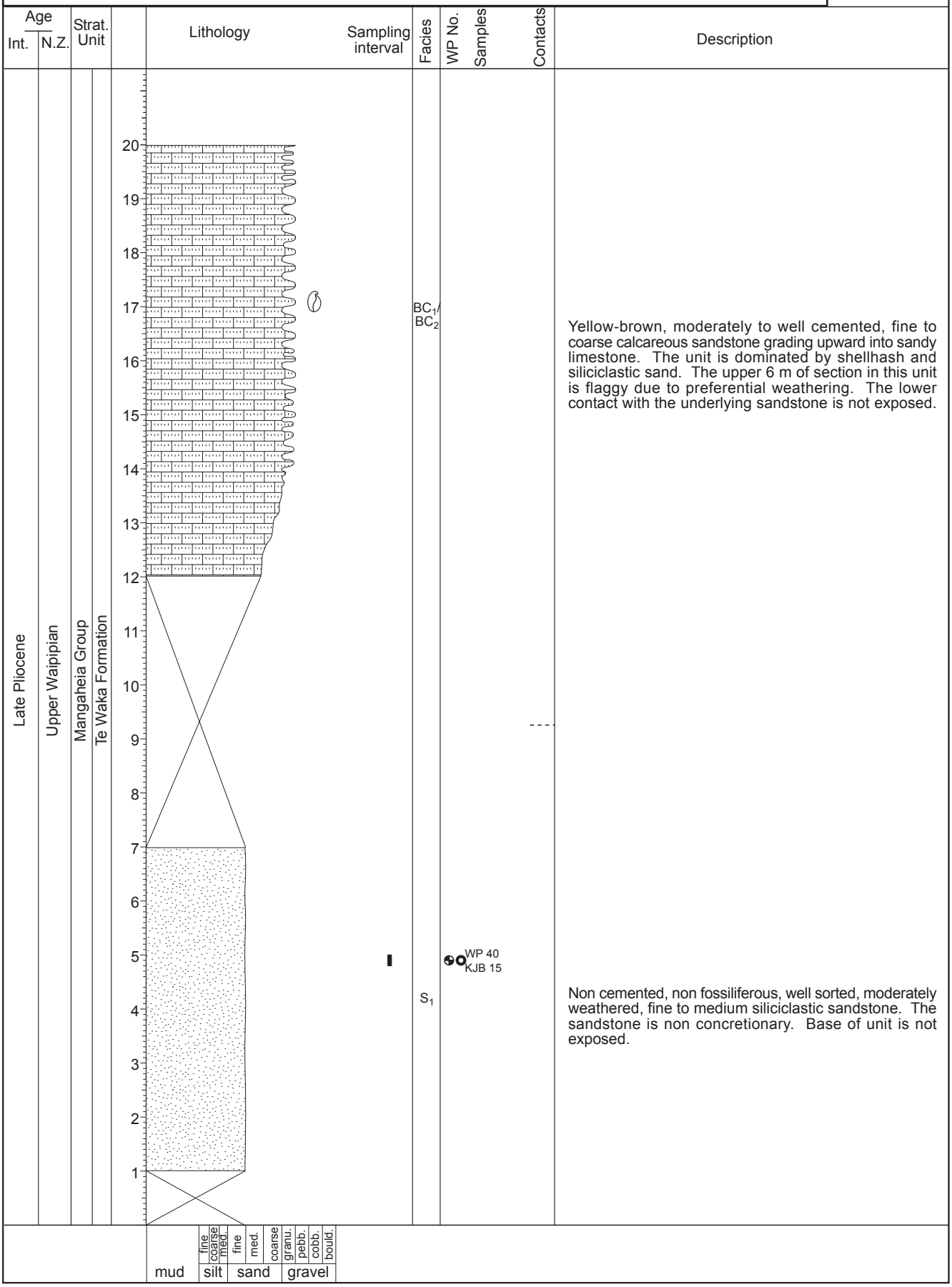
***GPS Waypoint No(s):*** Wp 40 | ***E:*** 2825217

***Region:*** Te Waka | ***N:*** 6212916

***Location:*** Te Waka Range west of Transmitter | ***Altitude:*** 955 m | -

54

***NZMS 260 Sheet:*** V20 Esk | *Page* 1 *of* 1 | **Author:** K. Bland | 1 of 1



**Stratigraphic Column No:** 55 | **Grid Reference:** | **Top** | **Bottom**

**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

NZMS 260 V20

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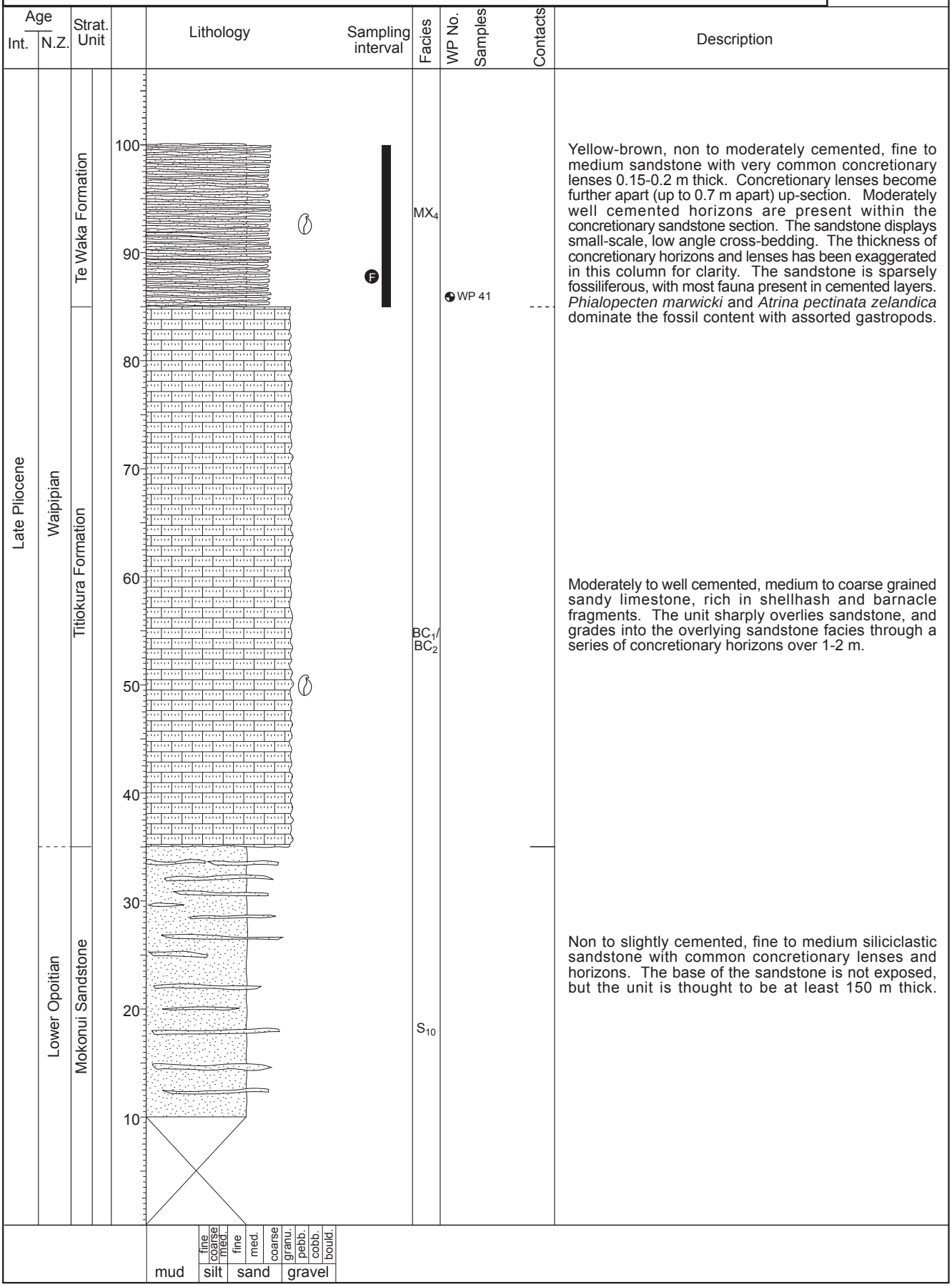
1 of 2




A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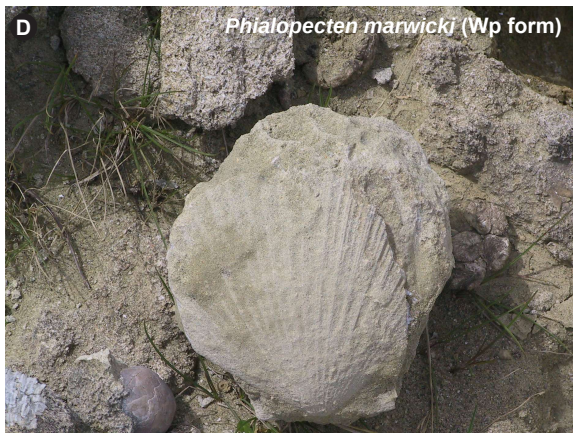
C


D
*Phialopecten marwicki* (Wp form)

**Stratigraphic Column No:** 56 | **Grid Reference:** | **Top** | **Bottom**

**GPS Waypoint No(s):** Wp 44 | **E:** 2823966

**Region:** Te Waka | **N:** 6212811

**Location:** Te Waka Range southwest of transmitter. | **Altitude:** 937 | -

**NZMS 260 Sheet:** V20 Esk | *Page* 1 *of* 1 | **Author:** K. Bland

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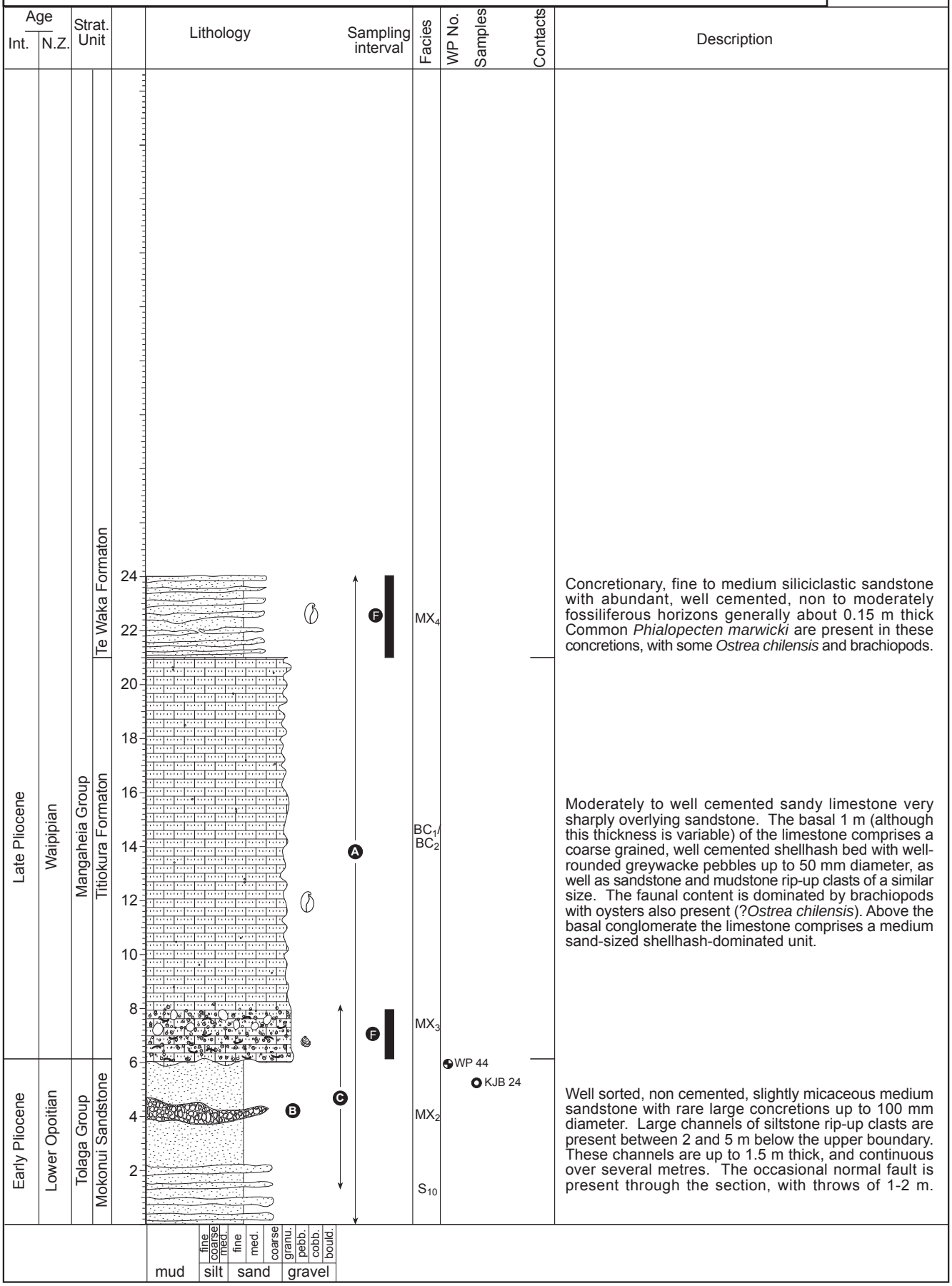


A


B


C

**Stratigraphic Column No:** 57 | **Grid Reference:** | **Top** | **Bottom** | NZMS 260 V20

**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 | -

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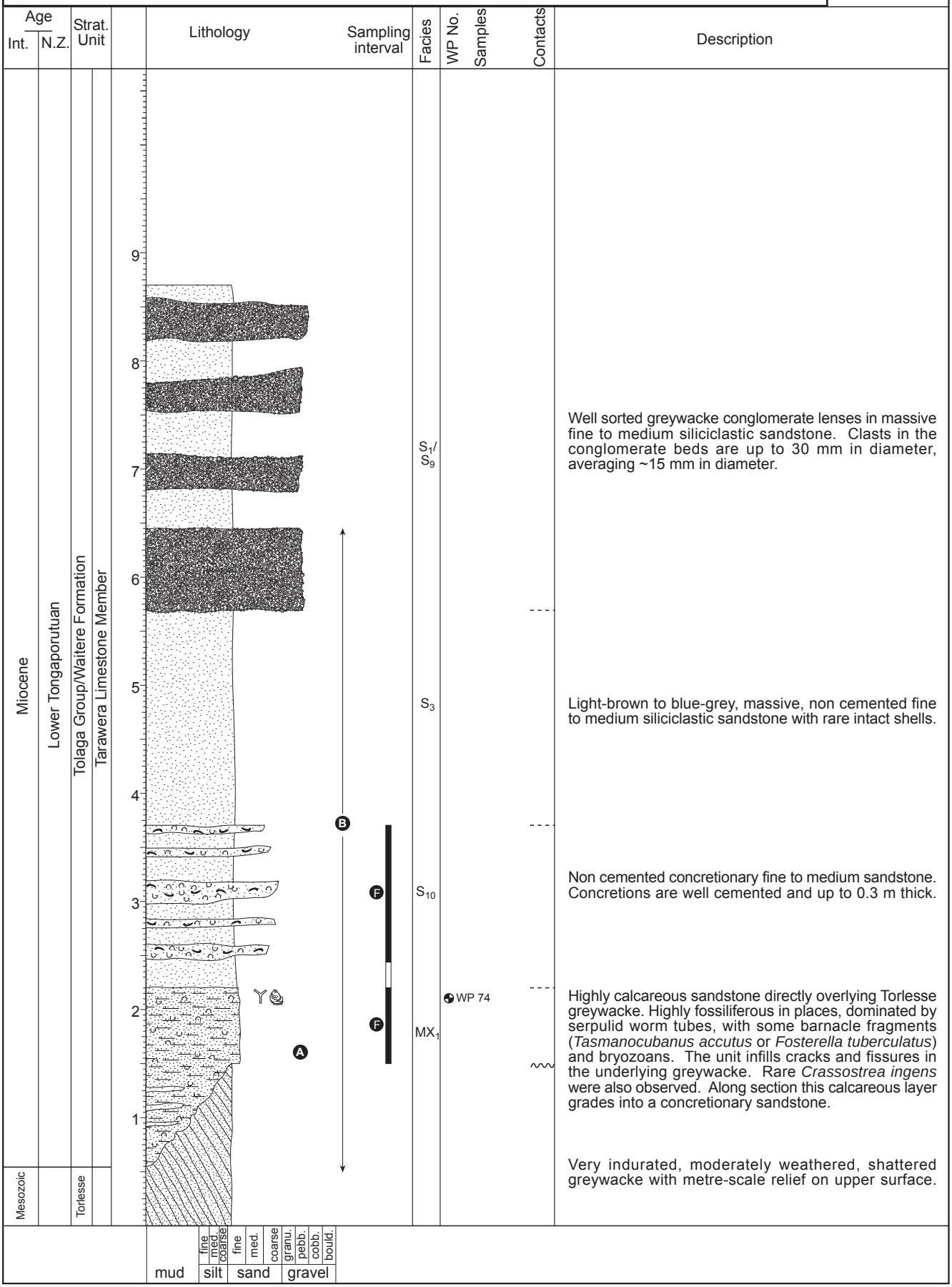


Angular unconformity between strongly fractured greywacke and bioclastic-dominated basal bed of the Te Ipuohape Sandstone Member. Metre-scale relief is present on this contact.


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

**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 | -

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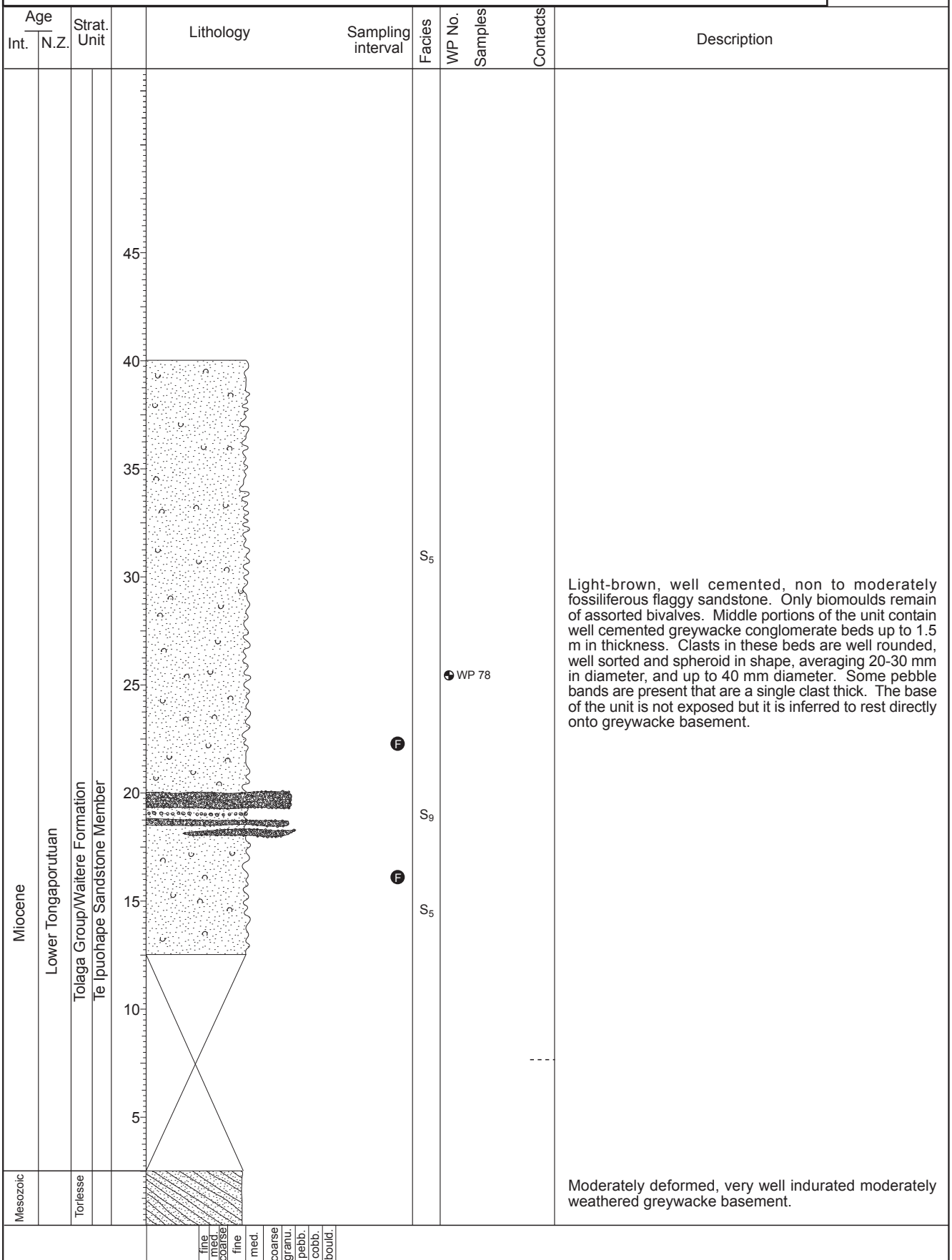

**Stratigraphic Column No:** 59 | **Grid Reference:** | **Top** | **Bottom** | NZMS 260 V20

**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 | *Page* 1 *of* 1 | **Author:** K. Bland

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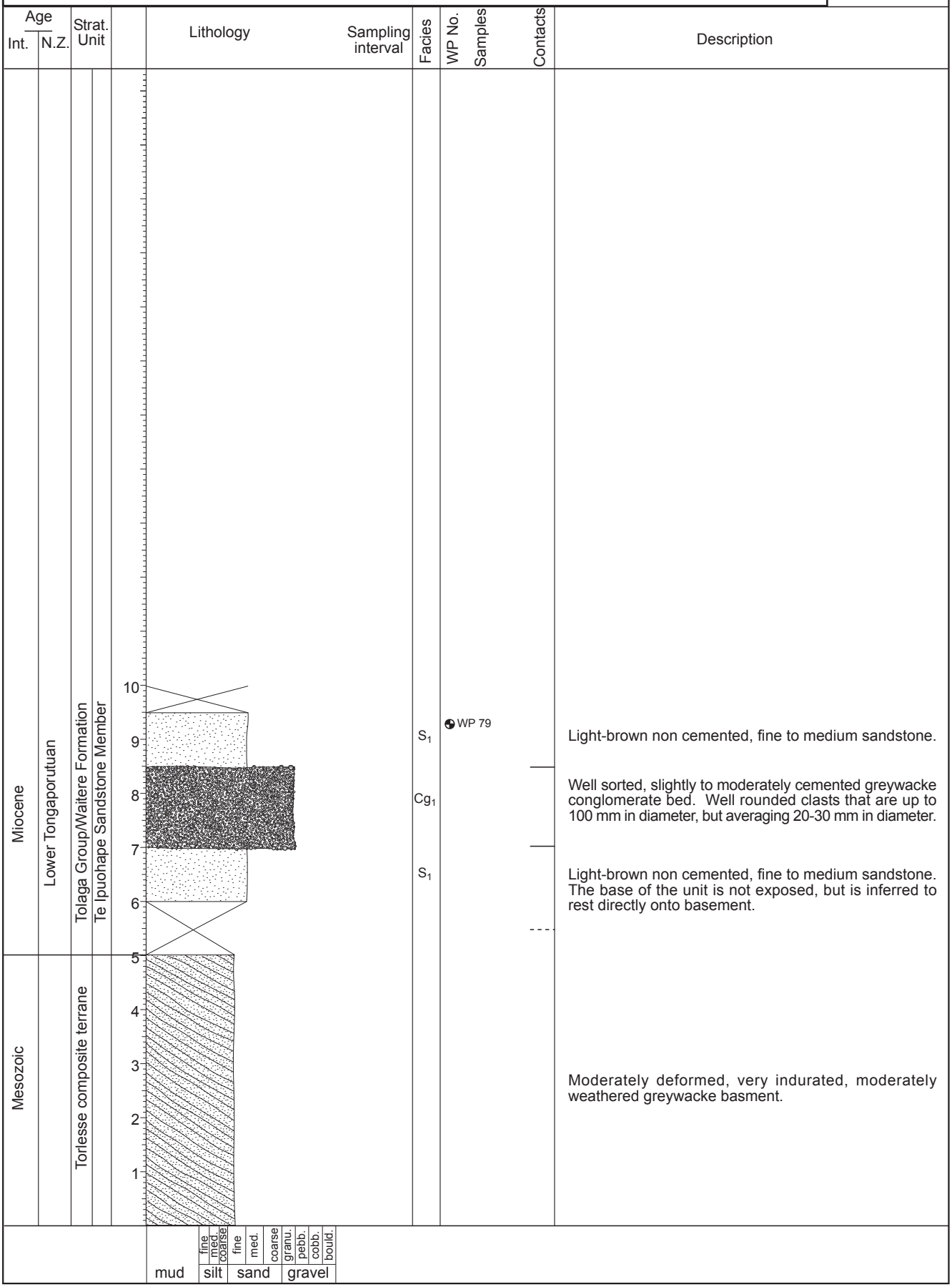

**Stratigraphic Column No:** 60 **Grid Reference:** **Top** **Bottom**

**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 **Author:** K. Bland

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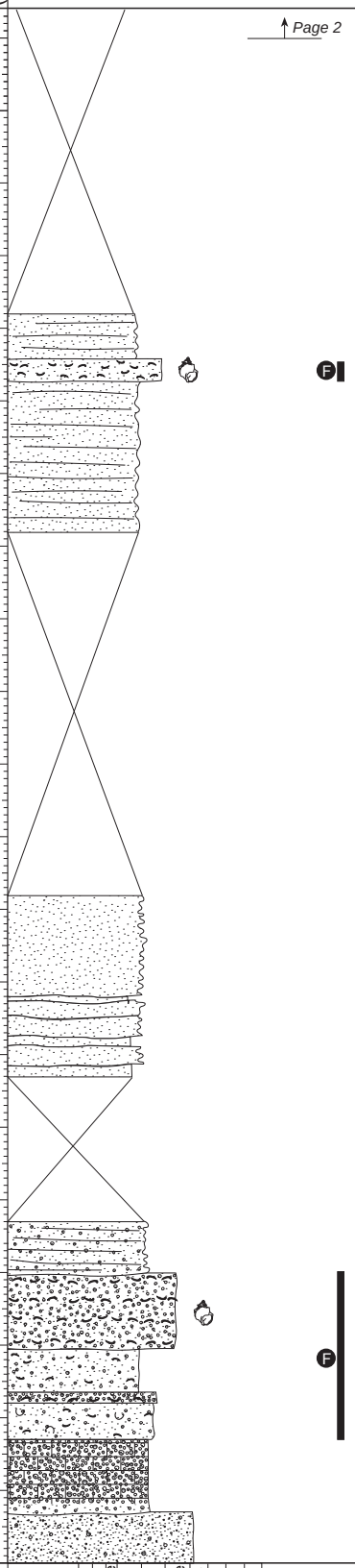
| Age Int. | Age N.Z. | Strat. Unit | Scale (metres) | Lithology | Sampling interval | Facies | WP No. Samples | Contacts | Description |
|---|---|---|---|---|---|---|---|---|---|
| Early Pliocene | Upper Opoitian | Mangaheia Group / Pakaututu Formation | 41–1 |   | | $S_{11}$ | | | *Struthiolaria (Callusaria) ?obesa* dominated bed. |
| | | | | | | | | | Weathered, well cemented massive to laminated sandstone. Flaggy and fluted in places. |
| | | | | | | $S_5$ | | | |
| | | | | | | | | | Non to poorly exposed interval with occasional well cemented beds cropping out. |
| | | | | | | $S_5$ | WP 458 | | 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. |
| | | | | | | | | | Non to poorly exposed interval. |
| | | | | | | | | | Fluted and slightly flaggy well cemented massive to laminated sandstone with scattered pebbles and pebble bands. |
| | | | | | | $S_9$ | | | Moderately to well cemented pebbly shellbed with alternating layers of fine and coarse-grained shells. Abundant biomoulds, fauna dominated by *Struthiolaria (Callusaria)*. |
| | | | | | | | | | Well cemented slightly pebbly sandstone. |
| | | | | | | | | | Slightly fossilifeorus well cemented sandstone with scattered fine greywacke pebbles. Overlain by well cemented pebbly sandstone with scattered shells. |
| | | | | | | | | | 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. |
| | | | | | | | | | Non cemented greywacke grit with scattered coarser-grained pebbles. Overlies siltstone and Torlesse greywacke. |

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

**Stratigraphic Column No:** 60 | **Grid Reference:** | **Top** | **Bottom** | NZMS 260 V20

**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

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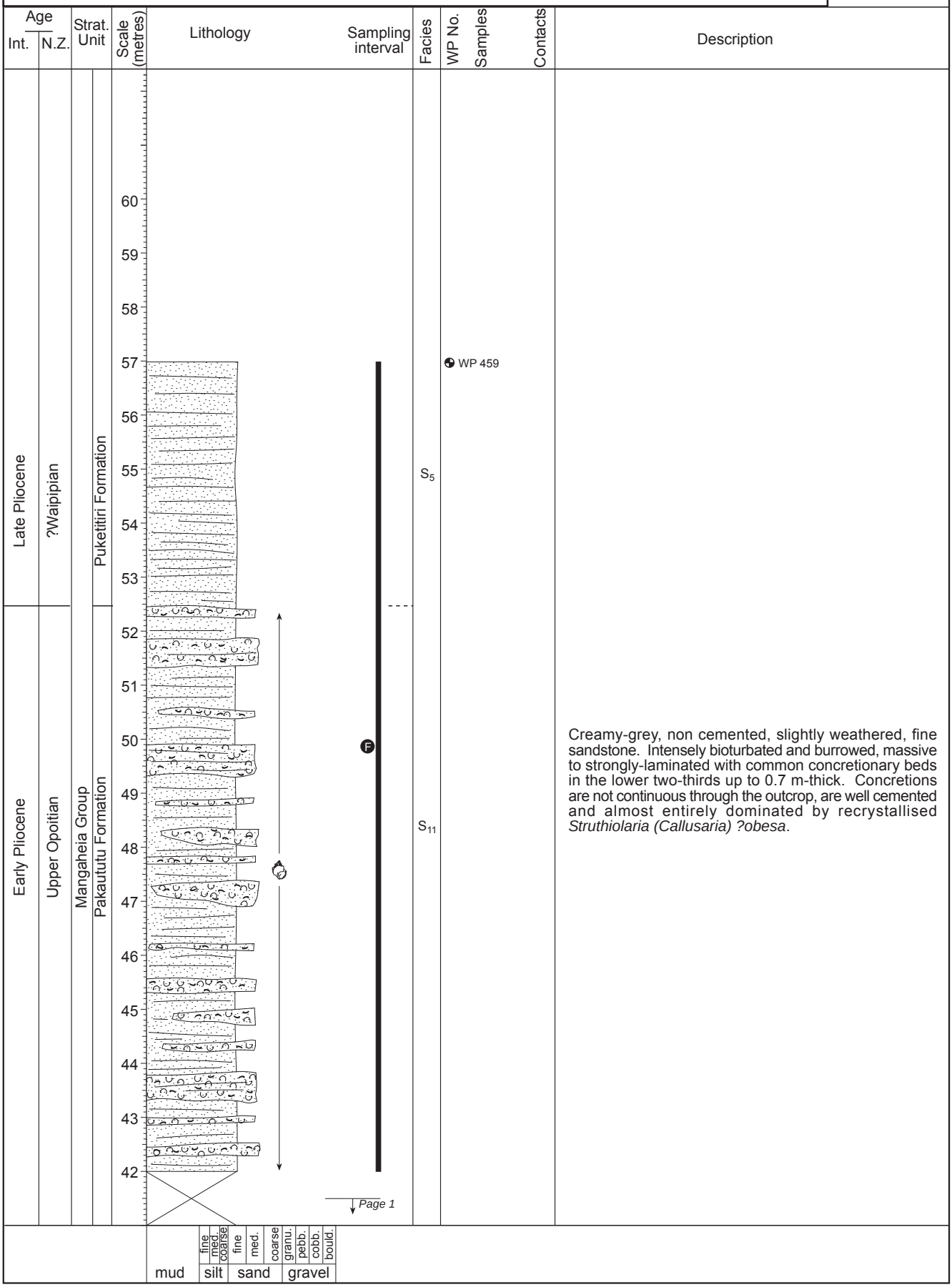

**Stratigraphic Column No:** 61 | **Grid Reference:** | **Top** | **Bottom** | NZMS 260 V20

**GPS Waypoint No(s):** Wp 91 | **E:** 2815665

**Region:** Puketitiri | **N:** 6211514

**Location:** Hukanui Station below Hukanui Trig. | **Altitude:** 965 m | -

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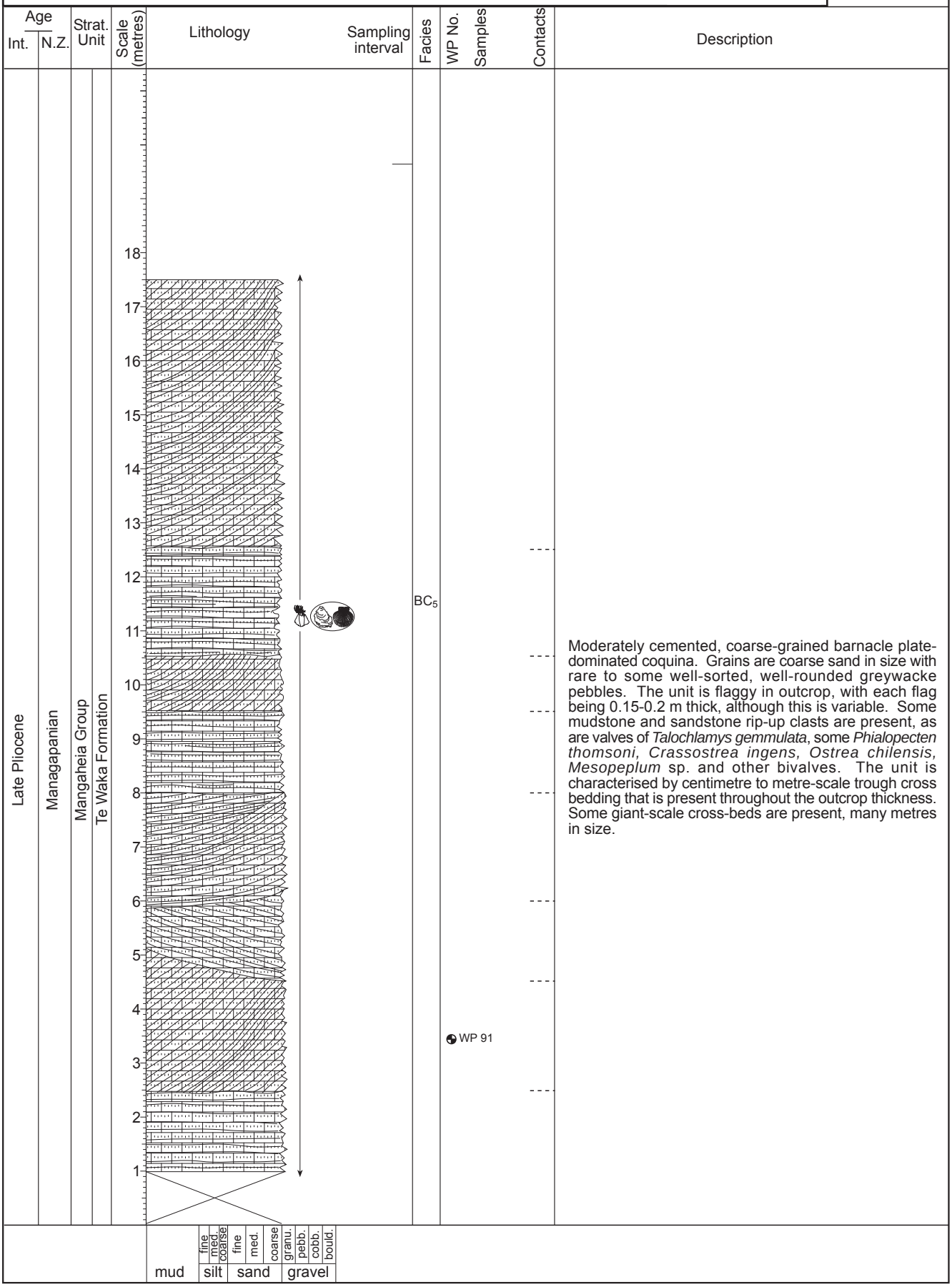
**NZMS 260 Sheet:** V20 Esk | *Page* 1 *of* 1 | **Author:** K. Bland | 1 of 1



**Stratigraphic Column No:** 62 | **Grid Reference:** | **Top** | **Bottom** | NZMS 260 V20

**GPS Waypoint No(s):** Wp 88 | **E:** 2815569

**Region:** Puketitiri | **N:** 6211418

**Location:** Hukanui Station below Hukanui Trig. | **Altitude:** 977m | -

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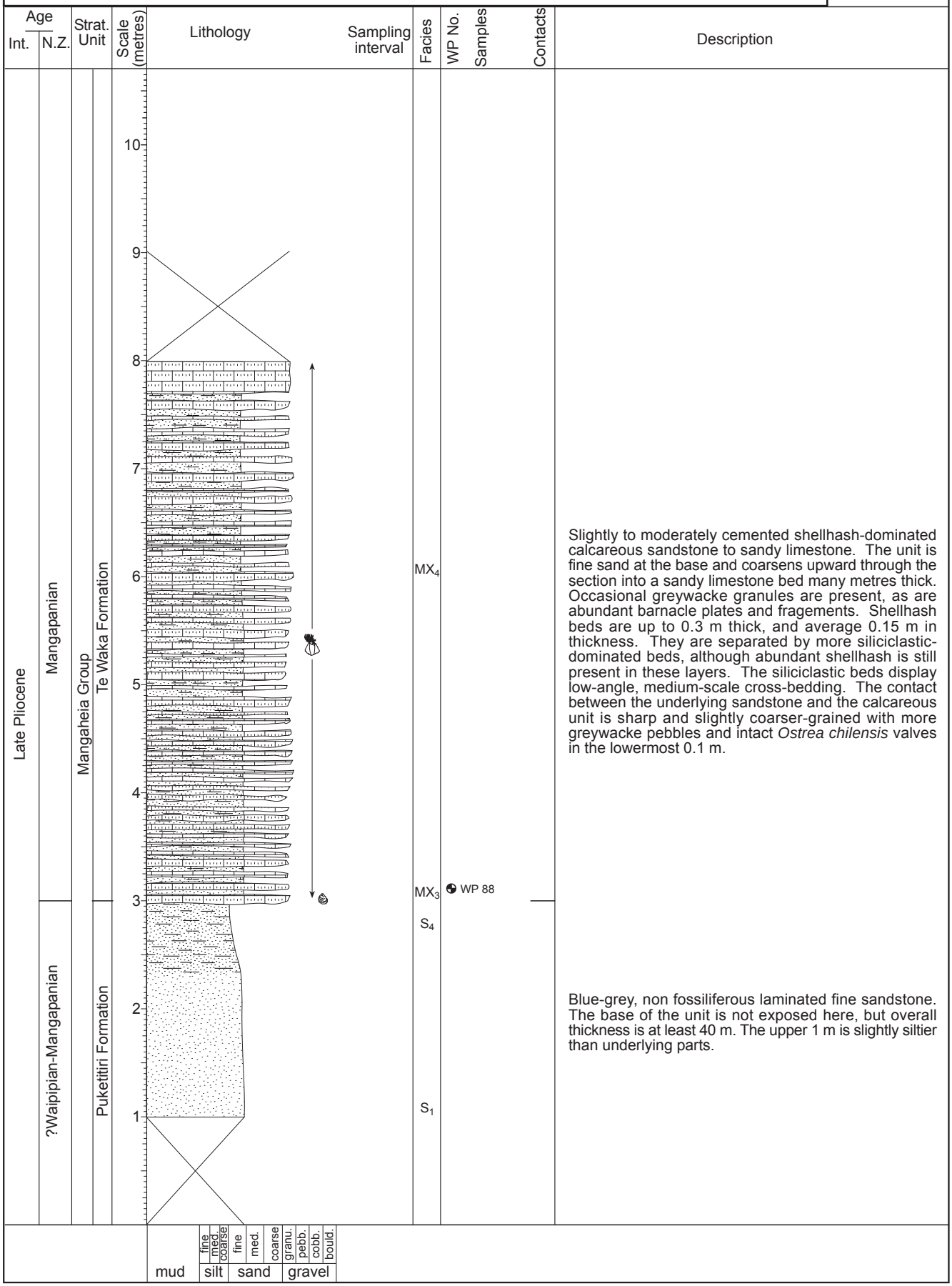

**Stratigraphic Column No:** 63 | **Grid Reference:** | **Top** | **Bottom** | NZMS 260 V20

**GPS Waypoint No(s):** Wp 472-476 | **E:** 2814120 | 2813663 | **63**

**Region:** Puketitiri | **N:** 6211746 | 6212952

**Location:** North face of Hukanui Hill, northeast of Puketitiri | **Altitude:** 915 m | 715 m

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| Age Int. | Age N.Z. | Strat. Unit | Scale (metres) | Lithology | Sampling interval | Facies | WP No. Samples | Contacts | Description |
|---|---|---|---|---|---|---|---|---|---|
| Late Pliocene | ?Waipipian | Puketitiri Formation | 100 | | | $Cg_1$ | 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. |
| | | | | | | $Z_1$ | | | |
| | | | 90 | | | | | | |
| Early Pliocene | Upper Opoitian | Hukanui Lst. Mbr | | | | | WP 477 | | Moderately well cemented *Tucetona laticostata*-rich whole shell sandy limestone overlying concretionary fine sandstone. The limestone contains occasional *Phialopecten marwicki*. |
| | | | 80 | | | $BC_3$ | | | |
| | | Mangaheia Group | 70 | | | | | | |
| | | | 60 | | | | | | |
| | | Pakaututu Formation | | | F | $S_{11}$ $S_1$ | WP 482 | | Brown, massive, bioturbated, well sorted, moderately indurated fine sandstone. Contains thin greywacke pebble bands. Overlain by a concretionary bed containing abundant *Struthiolaria* sp. |
| | | | 50 | | | | | | |
| | | | 40 | | | | | | |
| | | | 30 | | | | | | |
| | ?Lower Opoitian | | 20 | | | $Cg_1$ | | | Scattered exposures of poorly cemented greywacke conglomerate. |
| Mesozoic | ?Jurassic | Torlesse | 10 | | | | WP 476 | | Red-brown to grey, moderately weathered, fractured greywacke. |

mud | silt (fine, med., coarse) | sand (fine, med., coarse) | gravel (granu., pebb., cobb., bould.)

**Stratigraphic Column No:** 63 | **Grid Reference:** | **Top** | **Bottom**

**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

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| Age Int. | Age N.Z. | Strat. Unit | Scale (metres) | Lithology | Sampling interval | Facies | WP No. Samples | Contacts | Description |
|---|---|---|---|---|---|---|---|---|---|
| Late Pliocene | ?Waipipian | Mangaheia Group / Puketitiri Formation | 200 | | | | | | |
| | | | 190 | | | | | | |
| | | | 180 | | | $S_1$ | | | |
| | | | 170 | | | | | | |
| | | | 160 | | | $S_1$ | | | |
| | | | 150 | | | $Z_1$ | 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. |
| | | | 140 | | | | | | |
| | | | 130 | | | | | | |
| | | | 120 | | | $Z_1$ | | | |
| | | | 110 | | | $Cg_1$ | WP 478 | | |

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

**Stratigraphic Column No:** 63 | **Grid Reference:** | **Top** | **Bottom**

**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* 3 *of* 3 | **Author:** K. Bland

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