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SEDIMENTOLOGICAL ANALYSIS AND CORRELATION OF THE
MULLAGHMORE SANDSTONE FORMATION IN THE NORTH AND NORTH-WEST OF IRELAND

A thesis for the degree of Doctor of Philosophy in the Department of Geology,
University of Dublin, Ireland

By
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VOLUME 2

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CHAPTER 1

Figure 1.1 Outcrop distribution of the Mullaghmore Sandstone
North and north-west Ireland

Figure 1.2 Outline map of the geology of the north of Ireland

CHAPTER 2

Figure 2.1 Correlation of the Dinantian stratigraphy across the north and
north-west of Ireland

Figure 2.2 Dinantian classification and zonation applicable to the British Isles
after Riley (1993)

CHAPTER 3

Figure 3.1 Rose diagrams exhibiting palaeocurrent data from Facies 1-6

Plate 3.1 Facies 1 sandstone with erosive base, Pollayarry, Mullaghmore
Head Log MH 1 @ 4.5m

Plate 3.2 Gradational contact between Facies 1 and Facies 2 sandstones,
Mullaghmore Head.

Plate 3.3 Internal erosion surface in Facies 1 sandstone, Mullaghmore Head

Plate 3.4 Trough Cross-Beds, below Classic Bawn Castle, Roskeeragh,
Mullaghmore Head, Log MH 7.5 @ 61.2m

Plate 3.5 Dewatering structures from Inishmurray Island in Facies 1
sandstones.

Plate 3.6 Dewatering structure C at Inishmurray Island Log IMc @ 1m

Plate 3.7 Concentric pattern at circumference of dewatering structure C, Log
IMc @ 1m.
Plate 3.8 Circular concretion in Facies 1 sandstone in Pollayarry, Mullaghmore Head, Log MH 1. @ 5m.

Plate 3.9 Large scale plant debris in Facies 1 sandstone.

Plate 3.10 U-shaped burrow (*Diplocraterion*), Log MH 7.4 @ 75m.

Plate 3.11 Southerly dipping downstream accretion surfaces opposite Mill’s Island, Mullaghmore Head, Log MH 2.3 @ 60m.

Plate 3.12 Extensively bioturbated top (by *Chomatichnus*) of Facies 2 sandstone, Mullaghmore Head, Log MH 1 @ 9-10m.

Plate 3.13 *Chomatichnus* burrow on top surface of Facies 2 sandstone, Mullaghmore Head, Log MH 1 @ 10m.

Plate 3.14 Large amplitude wave ripples at Lackcam, Mullaghmore Head, Log MH 2.3 @ 50.5m.

Plate 3.15 Small scale ripple trough cross-laminae with superimposed HCS, Facies 2 sandstone at Mullaghmore Head, Log MH 2.3 @ 50.7 m.

Plate 3.16 Facies 3 – Interbedded sandstones and shales at Mullaghmore Head, Log MH 1 @ 10-16m.

Plate 3.17 *Rhizocorallium* burrows in Facies 3a, Pollayarry, Mullaghmore Head, Log MH 1 @ 14.7m.

Plate 3.18 Orthoconic nautiloid in Facies 3 sandstone, Pollayarry, Mullaghmore Head, Log MH 1 @ 12m.

Plate 3.19 Interbedded Sandstone and Siltstone Facies (Facies 4a)

Plate 3.20 Ball and pillow style soft sediment deformation in Facies 4a, Pollayarry, Mullaghmore Head.

Plate 3.21 Flame structure in Facies 4c sandstone at Devil’s Bridge cliff section.

Plate 3.22 Facies 5 – Parallel laminated sandstone at Mullaghmore Head.

Plate 3.23 Fossilised tree with roots in Facies 5 at Pigeon’s cove,
CHAPTER 4

Mullaghmore Head.

Plate 3.24  Facies 7 – Hummocky Cross-Stratified Sandstone,
Mullaghmore Head, Log MH 1.3 @ 52m.

Plate 3.25  Facies 7 – Hummocky Cross-Stratified Sandstone,
Mullaghmore Head.

Plate 3.26  Facies 8 – Siltstone, with vague laminae and extensive
bioturbation visible.

Plate 3.27  Facies 12, Mountcharles, McMonagles Quarry A.

Plate 3.28  Facies 13 – Quartz Pebbly Sandstones, Mountcharles.

Locality map for the Mullaghmore Sandstone from
Conor’s Island to Rochfort Lodge, Bundoran and
Tievebaun Mountain stream sections.

Locality map with logged sections for area 1 - Mullaghmore Head
(see Figure 4.1)

Locality map for areas 2-5 (see Figure 4.1) with positions of
logged sections for cliff section to Bundoran.

Locality maps for areas 6 (Rochfort Bridge) and 7 (Conor’s and
Dernish Islands) (see Figure 4.1) with positions of logged sections.

Facies pie-chart for Mullaghmore Head, cliff section to Bundoran
and Conor’s and Dernish Islands.

Facies pie-chart for river sections: Ballaghnatrillick, Duff,
Coolagraggy and Aghamore.

Rose diagrams for Facies 1 and 1b sandstones at Mullaghmore.

Rose diagrams exhibiting palaeocurrent data from Facies 2-5
at Mullaghmore.
Figure 4.6 Rose diagrams exhibiting palaeocurrent data from Facies 6-8 at Mullaghmore.

Figure 4.7 Depositional model for the Mullaghmore Sandstone at Mullaghmore

Logs for Mullaghmore

Log MH1
Log MH 1.2
Log MH 1.3
Log MH 1.4
Log MH 2.1
Log MH 2.2
Log MH 2.3
Log MH 4/5
Log MH 6.1
Log MH 6.2
Log MH 7
Log MH 7.2
Log MH 7.3
Log MH 7.4
Log MH 7.5
Log MH 8.1
Log MH 8.2
Log MH 9
Log MH 9.2
Log MH 10
Log MH 11.1
Log MH 11.2
Log MH 12.1
Log MH 13 contact between the Bundoran Shale and the Mullaghmore Sandstone Formation
Log 13.2 contact
Log MH 13
Log MH 14
Log MH 16, Mermaids Cove
Log CI 1
Log CI 2
Log CI 3 Black Rock, Conor’s Island
Log 1 Dernish Island
Log 2 Dernish Island
Aghamore River Section Log
Coolgraffy River Section Log
Log 15 – Ballaghnatrillick River Log
Log 15.1 – Ballaghnatrillick River Log
Duff River Section Log

Plates

Plate 4.1 The first major sandstone of the Mullaghmore Sandstone Formation at Rochfort Lodge, Co. Donegal.
Plate 4.2 Sandy limestone at Tievebaun Mountain river section, representative top of the Mullaghmore Sandstone.
Plate 4.3 Small scale ripple trough cross-laminae with superimposed HCS, Facies 2 sandstone at Mullaghmore Head, Log MH 2.3 @ 50.7m

CHAPTER 5

Figure 5.1 Locality maps for Carrowmorran and Aughris Head, south Sligo
Figure 5.2  Facies pie-chart for the Carrowmoran Sandstone Formation.

Figure 5.3  Facies pie-chart for the west limb of the Carrowmoran anticline, Carrowmoran Sandstone.

Figure 5.4  Facies pie-chart for the east limb of the Carrowmoran anticline, Carrowmoran Sandstone.

Figure 5.5  Rose diagrams for trough and planar cross-beds of Facies 1 Sandstones, Carrowmoran.

Figure 5.6  Rose diagrams for palaeocurrent data from selected Facies 1 sandstones on the east and west limbs.

Figure 5.7  Rose diagrams exhibiting ripple trends and cross strata data from Facies 2-6.

Figure 5.8a  Hubbard’s (1966) logged sections (1-3) for the east and west limbs at Carrowmoran.

Figure 5.8b  Hubbard’s (1966) logged sections (4-6) for the east and west limbs at Carrowmoran.

Figure 5.9  Depositional model for Carrowmoran.

Logs for Carrowmoran

Log CM 1 east
Log CM 2 east
Log CM 2.1 east
Log CM 2.2 east
Log CM 2.3 east
Log CM 2.4 east
Log CM 1 west
Log CM 1a west
Log CM 3 west
Log CM 4.1 west
Log CM 4.2 west
Log CM 4.3 west
Log CM 4.4 west
Log CM 4.5
Log AH 1
Log AH 2 (Aughris Head)

*Plates*

Plate 5.1  Transitional facies marking the passage of the Bundoran Shale Formation into the Carrowmoran Sandstone Formation at Portmore.

Plate 5.2  Preferential concentration of fossils in the sandstone beds in the transitionary sequence at Portmore, Carrowmoran.

Plate 5.3  Fossils, including orthoconic nautiloids, gastropods, brachiopods and few crinoids, found in sandstone beds in the transitional sequence at Portmore, Carrowmoran.

Plate 5.4  The first major sandstone of the Carrowmoran Sandstone Formation at Portmore.

Plate 5.5  *Stigmaria* fragment in Facies 1 at Carrowmoran.

Plate 5.6  Lycopsid tree stump at Carrowmoran.

Plate 5.7  Carbonate nodule in a shale bed of Facies 3, Carrowmoran.

Plate 5.8  Larger amalgamated carbonate nodules in a shale bed of Facies 3, Carrowmoran.

Plate 5.9  Dewatering structure in Facies 1 sandstone east of Cloghadoo.

Plate 5.10 Dewatering structures west of Pollnadivva Pier.

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**CHAPTER 6**

Figure 6.1  Kildoney locality map, Co. Donegal
Figure 6.2  Facies pie-chart for Kildoney Point.

Figure 6.3a  Rose diagrams for trough and planar cross beds from Facies 1 at Kildoney.

Figure 6.3b  Trough and planar cross bed data from Facies 1 sandstones at Kildoney ctd.

Figure 6.4  Rose diagrams for ripple crests from Facies 2 and 3 at Kildoney.

Figure 6.5  Depositional model for the Mullaghmore Sandstone at Kildoney.

Logs from Kildoney

Log Kd 1.1
Log Kd 1b, Comorant’s Rock
Log Kd 2.1
Log Kd 3
Log Kd 4
Log Kd 4.2
Log Kd 4.3a
Log Kd 4.3b
Log Kd 4a
Log Kd 4b
Log Kd 5
Log Kd 6

Kildoney Point Quarry Log

Plates

Plate 6.1  Facies 1 sandstone at Comorant’s Rock with Inclined Heterolithic Strata and overlying internal erosion surface.

Plate 6.2  Inclined Heterolithic Strata in Facies 1 sandstones at Castle Flag, Log Kd 4 @ 15.5m.

Plate 6.3  Inclined Heterolithic Strata at Corlack.
Inclined Heterolithic Strata at Illanbeg.

Inclined Heterolithic Strata at Illanbeg.

CHAPTER 7

Figure 7.1  Map of Inishmurray Island with logged sections.

Figure 7.2  Facies pie-chart for Inishmurray Island.

Figure 7.3  Rose diagrams exhibiting palaeocurrent data recorded from trough and planar cross strata at Inishmurray Island.

Figure 7.4  Depositional model for Inishmurray Island

Logs for Inishmurray Island

Log IM south 1
Log IM a
Log IM b
Log IM c
Log IM d
Log IM e
Log IM f
Log IM g
Log IM h

Plates

Plate 7.1  Trough cross bed dipping to the south/south-west, line indicates the approximate width of the bedform.

Plate 7.2  Section from Log IM south 1, exhibiting Inclined Heterolithic Strata, internal erosion surface, shallow troughs and parallel laminated sandstone.

Plate 7.3  Undulose strata in Facies 1 sandstone in Log IM south 1.

Plate 7.4  Inclined Heterolithic Strata recorded in Log IM c.
Plate 7.5 Facies 1 sandstones (Log IMe @ 10m) with erosive base and underlying hummocky sandstone.

Plate 7.6 Trough cross-bedded Facies 1 sandstone with erosive base and underlying interbedded siltstones and sandstone lenses in IM g.

Plate 7.7 Haematite streaks in siltstone in Log IMc, Inishmurray Island.

CHAPTER 8

Figure 8.1 Locality map of the Mountcharles sections.

Figure 8.2 Facies pie-chart for the Mountcharles Sandstone.

Figure 8.3 Rose diagrams for palaeocurrent data of Facies 12, Mountcharles

Figure 8.4 Depositional model for Mountcharles.

Logs for Mountcharles

- Log MC 1 – Drumkeelan Roadside Section
- Log MC 1(b) – Drumkeeland Roadside Section
- Log MC 2 – Drumkeelan Quarry A
- Log MC 2A – Open Quarry at Drumkeelan Quarry A
- Log MC 3 – Upper floor of Drumkeelan Quarry A
- Log MC 4 – East end of Drumkeelan Quarry A
- Log MC 5 – Drumkeelan Quarry B
- Log MC 6 – Upper Drumkeelan Quarry C
- Log MC 7 – NW of Upper Drumkeelan Quarry D
- Log MC 8 – Upper Drumkeelan Unused Rubbish Quarry
- Log MC 9 – Upper Drumkeelan Quarry D (McMonagles)
- Log MC 10 – Upper Drumkeelan Quarry D (McMonagles)
- Log MC 11 – Corn Mill
- Log MC 12 – Corn Mill
Log MC 13 – Drumconnor Quarry
Log MC 14 – St. Peter’s Lough
Log MC 15 – Drumbeagh Quarry/Inver Oil
Log MC 16 – Southeast of Drumbeagh Quarry
Log MC 17 – McMonagles Quarry A
Log MC 18 – McMonagles
Log MC 19 – McMonagles Quarry C
Log MC 20 – McMonagles Quarry C2
Dromore Stream Section Log

Plates
Plate 8.1 Shallow channel in the Facies 12 sandstones of Mountcharles, Drumbeagh Quarry.
Plate 8.2 Shallow channel (?) in Facies 12 sandstones of Mountcharles, McMonagles Quarry A.

CHAPTER 9
Figure 9.1 Outcrop distribution of the Mullaghmore Sandstone, North and North-West Ireland.
Figure 9.2 Locality map for boreholes in the Lough Allen Basin.
Figure 9.3 Facies pie-chart for the North of Ireland.
Figure 9.4a Outcrop of the Derrygonnelly Sandstone (2) and Clonelly Sandstone (1).
Figure 9.4b Outcrop of the Aughnacloy Sandstone Formation and Drumman More Sandstone Member.
Figure 9.5 Facies pie-chart for Derrygonnelly.

Logged section for the Roogagh River
Locality 217, Derrygonnelly Sandstone
Locality 218b, Derrygonnelly Sandstone
Figure 9.7  Facies pie-charts for Clonelly.

Figure 9.8  Palaeocurrent data from Facies 1 sandstones in the Clonelly Sandstone.

Figure 9.10  Facies pie-chart for Aughnacloy.

CHAPTER 10

Figure 10.1  Palaeogeography map of the base of the Mullaghmore Sandstone Formation.

Figure 10.2  Palaeogeography map for the top of the Mullaghmore Sandstone Formation.

Figure 10.3  Facies pie-chart for the Mullaghmore Sandstone Formation.

Figure 10.4a  Heavy mineral pie-charts

Figure 10.4b  Heavy mineral pie-charts
Outcrop of the Mullaghmore Sandstone and equivalents.

1. Mountcharles Sandstone
2. Kildoney Sandstone
3. Mullaghmore Sandstone, S. Sligo
4. Inishmurray Island
5. Carrowmorean Sandstone
6. Mullaghmore Sandstone, N. Mayo
7. Derrygonnelly Sandstone
8. Clonelly Sandstone
9. Aughnacloy Sandstone
10. Drumman More Sandstone Mb

Fig 1.1: Outcrop distribution of the Mullaghmore Sandstone, North and North-West Ireland
Fig 1.2: Outline map of the geology of the north of Ireland, showing the positions of the Carboniferous synclines. Adapted from Caldwell (1958).
Fig 2.1: Correlation of the Mississippian stratigraphy across the north and north-west of Ireland. Stratigraphic columns adapted from Oswald (1955), George & Oswald (1957), Bowes (1957), Hubbard (1966), Graham (1996), GSI sheet 7 (1996), GSNI sheets 44, 56, 43, 31, 32, 33, 46, 47. Columns correlated by the base of the Mullaghmore Sandstone Formation.
Fig 3.1: Rose diagrams exhibiting palaeocurrent data from Facies 1 - 6

(a) Facies 1: Trough and Planar cross-beds
(b) Facies 1b, planar cross-beds
(c) Facies 2 - ripple crests.
(d) Facies 3 - ripple crests
(e) Facies 4 - ripple crests.
(f) Facies 5 - ripple crests
(g) Facies 6 - ripple crests
Plate 3.1: Facies 1 sandstone with erosive base, Pollayarry, Mullaghmore Head
Log MH 1@ 4.5 m

Plate 3.2: Gradational contact between Facies 1 and Facies 2 sandstones (arrowed),
Mullaghmore Head proposed base of Facies 2 arrowed.
Plate 3.3: Internal erosion surface in Facies 1 sandstone, Mullaghmore Head.

Plate 3.4: Trough Cross-Beds, below Classic Bawn Castle, Roskeeragh, Mullaghmore Head, (hammer, circled, for scale). Log MH 7.5 @ 61.2m
Plate 3.5: Dewatering structures from Inishmurray Island in Facies 1 sandstones (Chapter 3 (3.2.1)).
Plate 3.6: Dewatering structure C at Inishmurray Island Log IMc @ 1m

Plate 3.7: Concentric pattern (arrowed) at circumference of dewatering structure C Log IMc @ 1m.
Plate 3.8: Circular concretion in Facies 1 sandstone at Pollayarrry, Mullaghmore Head.
Log MH 1 @ 5m

Plate 3.9: Large scale plant debris (along length of hammer) in Facies 1 sandstone.
Plate 3.10: U-shaped burrow (*Diplocraterion*), Log MH 7.4 @ 75 m.
Plate 3.11: Southerly dipping downstream accretion surfaces (along the length of the arrows) opposite Mill’s Island, Mullaghmore Head, Log MH 2.3 @ 60 m.
Plate 3.12: Extensively bioturbated top (by *Chomatichnus*) of Facies 2 sandstone, Mullaghmore Head, Log MH 1 @ 9 - 10 m

Plate 3.13: *Chomatichnus* burrow on top surface of Facies 2 sandstone, Mullaghmore Head, Log MH 1 @ 10 m
Plate 3.14: Large amplitude wave ripples at Lackcam, Mullaghmore Head, Log MH 2.3 @ 50.5

Plate 3.15: Small scale ripple trough cross-laminae with superimposed HCS, Facies 2 sandstone at Mullaghmore Head, Log MH 2.3 @ 50.7 m.
Plate 3.16: Facies 3 - Interbedded sandstones and shales at Mullaghmore Head, Log MH 1 @ 10 - 16 m

Plate 3.17: *Rhizocorallium* burrows in Facies 3a, Pollayarry, Mullaghmore Head, Log MH 1 @ 14.7 m.
Plate 3.18: Orthoconic nautiloid in Facies 3 sandstone, Pollayarry, Mullaghmore Head, Log MH 1 @ 12 m

Plate 3.19: Interbedded Sandstone and Siltstone Facies (Facies 4a) (arrowed)
Plate 3.20: Ball and pillow style soft sediment deformation in Facies 4a, Pollayarry, Mullaghmore Head.

Plate 3.21: Flame structure in Facies 4c sandstone at Devil’s Bridge cliff section.
Plate 3.22: Facies 5 - Parallel laminated sandstone at Mullaghmore Head.

Plate 3.23: Fossilised tree with roots in Facies 5 at Pigeon’s cove, Mullaghmore Head.
Plate 3.24: Facies 7 - Hummocky Cross-Stratified Sandstone, Mullaghmore Head, Log MH 1.3 @ 52 m

Plate 3.25: Facies 7 - Hummocky Cross-Stratified Sandstone, Mullaghmore Head.
Plate 3.26: Facies 8 - Siltstone, with vague laminae and extensive bioturbation visible.

Plate 3.27: Facies 12, Mountcharles, McMonagles Quarry A
Plate 3.28: Facies 13 - Quartz Pebbly Sandstones, Mountcharles
Fig 4.1: Locality map for the Mullaghmore Sandstone from Conor's Island to Rochfort Lodge, Bundoran and Tievebaun Mountain stream sections
Fig 4.1 a: Locality map with logged sections for area 1 - Mullaghmore Head, see Fig 4.1.
Fig 4.1 b: Locality map for areas 2 - 5 (see Fig 4.1) with positions of logged sections for cliff section to Bundoran (see Fig 4.1a for key).
Fig 4.1 c: Locality maps for areas 6 (Rochfort Lodge) and 7 (Conor’s and Dernish Islands) (see Fig 4.1) with positions of logged sections (see Fig 4.1a for key).
Fig 4.2: Facies pie-chart for Mullaghmore Head, cliff section to Bundoran and Conor's and Dernish Islands.
Fig 4.3: Facies pie-chart for river sections: Ballaghnatrillick, Duff, Coolagraffy and Aghamore
Fig 4.4: Rose diagrams for Facies 1 and Facies 1b sandstones at Mullaghmore
Fig 4.5: Rose diagrams exhibiting palaeocurrent data from Facies 2 to 5 at Mullaghmore.
Fig 4.6: Rose diagrams exhibiting palaeocurrent data from Facies 6 to 8 at Mullaghmore

(a) Facies 6 - Ripple crests

(b) Facies 7 - Ripple crests
**Fig 4.7:** Depositional model for Mullaghmore with Logs MH 1, 6 and 7 correlated over space and time, see Enclosure 1
Tabular geometries continue up cliff section, consisting of alternations of sst and shale.

Traceable along cliff near base fine dark grey sst, odd lens of muddy material in sst, but sst is a whole in quite muddy.

Prominent bedding plane

Tabular sst, sharp base with underlying shales and ssts, in places the basal 15cm is ext., which increases to half the trace laterally.

Tabular geometries, ssts are quite traceable, but do tend to pinch out here and there, some ssts are not traceable at all. Predominantly a shaley section.

Possible rhizocoralia, sst is micaceous, poss. interference ripples, clumps of colonial coral, poss. syringopora.

Abundant rhizocoralia trace fossils

Ball & Pillow is random along section, and increases in prominence seawards, lithostrotion noted on the top surface.

Calcereous shales and thin beds of calcereous sst

Slightly shaley in nature seawards, rhizocoralia and zoophycos noted

Calcereous shales and interbedded ssts, ssts increase with competence and extent outwards inland. Sst lens and pinch out laterally. Sst thicknesses vary from 2-12cm thick

Calcereous sst

Biotaurbation possibly by Chomatichnus

Boundary between calc top and fluvial sst sharp in places, though basal 50cm of the calc top is not very calcareous - gradation from fluvial to marine sst.

Sandy/silty shale/micaceous with micaceous sst partings.

Base in places appears to be quite sharp, though undulates slightly landward part over the HCS sst, beds seem to amalgamate laterally.

Silty sst, ball & pillow questionable, poss. just soft sed defmn., traces landwards to a grey quartz sst with poss HCS.

Drapes of sst over ball & pillow, balls consist of fine sst, pillows are predominantly silty.

Though this unit has a sharp base with the underlying horizon landwards, they appear to amalgamate laterally.

Muddy streaks are discontinuous laterally, possible zoophycos.
Fine muddy sst 1-10cm thick, quite laterally traceable, none are quite biot, so in places are difficult to trace, enclosing lithology is a muddy siltst.

Quite large wave ripples on top surface, sharp base to sst.

Enclosing lithology - muddy fine silt/siltst, muddier in places.

Calcareous sst very pebbly and weathered
Thickness varies extensively laterally
Middle and top of the sst are quite pebbly on outer surface, pebbles are quartz, and can be up to 4cm in diameter.

Top surface quite weathered
Concretions show parallel to undulose lamination.

Section traceable on different sides of a gully
Fine grained quartzose sandstone and muddy siltstone.

Balls - light/muted grey fine gr quartzose sst, pillows or enclosing lithology same. Again the extent of the ball and pillow varies laterally.

Pillows consist of muddy siltst, section varies laterally, appears more muddy on cliff face pointing NNE wards, with random balls floating in the mud, balls are generally fine gr. quartzose sst with internal curved laminae. Muddy siltst in quite well parallel laminated.

Traceable around cliff
Calcareous sst, but top 10cm non-calc and muddy
Sst laterally traceable horizon, pillows mainly muddy siltst.

Calcareous top to sst
Mica rich, fine sst balls and silty set pillows, slightly muddier towards the top of this unit, ball and pillow is not very distinctive.

Irregular top surface, also pebbly
Pebbles of quartz, 3-5mm in size, base is in places very irregular, and in others very sharp.

Mud dominant unit forming erosive base to overlying sst
Both sets and muds show HCS. The sets pinch and swell along section.
Laterally traceable horizon
Fine set and silty/silty set. Set bases & tops are extensively burrowed, sets are also calcareous
Muddy set, thin layered, slightly calcareous

Calcareous set, top forms extensive bedding plane
Tracing section landwards increases in thickness to 160-170cm and prob even thicker due to more prominent erosive base seawards (SWwards). Gradually grades up into calc set, but does seem to be slightly separated from it by 2cm mud parting before becoming extensively calc.
Sandy shales
Set disappears landwards beneath erosional surface

Tracing landwards is tabular and traceable, but seawards tends to become muddier and amalgamates with the overlying unit.
Thickness seaward and balls become larger. balls are fine set, pillows slightly muddier gravelly set
Seaward sets form one prominent set unit
Non-calc mud
Set breaks up laterally into separate beds, which pinch & swell, sets are 4.5 - 30cm thick

Silty mud, calcareous
Thickness of the sets varies laterally.
Fine calc sets & dark grey silty mud, set thicknesses vary from 1.5-15cm, sets near the top more difficult to trace laterally.
This and underlying unit, tracing seawards appears to be deformed at the base and also up thru section.

Calcareous set, replaced crinoid ossicles
Siltstone with sandstone lenses, sets are 1.5-20cm thick and are tabular and traceable.
Shaley set with possible set dykes
One ball weathered out c.45cm, ball & pillow horizon consists of fine quartzose set and muddy siltset, sets tend to pinch out laterally, thick ness varies from 6-18cm.
Quartz rich set, tabular & massive

Base seems to show calcareous weathering, parallel lamination continues through the concretionary patches, which are generally circular in shape, entire unit exhibits sharp base.
Weathered muds
Quite weathered in places
All beds are quite weathered in particular the muds.

Log MH 1.3
Parallel to undulose lamination at the base
Qtzose, tabular with sharp top.

Laterally traceable horizon
Fine, calc silt (3-13cm) and micaceous silt, some of the thicker sets display HCS,
nearer the base the sets are thinner and more laterally traceable, thought they do pinch
and swell.

Log MH 1.4
Tabular and traceable horizon, sharp and planar contacts with the surrounding units.

Slightly calcareous, laterally traceable in cliff section.

Muddy fine micaceous silt, quite weathered in places. Silt tends to break up laterally into individual beds.

Silt (1.5-9cm) slightly calcareous and not traceable laterally, silts quite weathered, basal 135cm composed predominantly of siltts, last 50cm becomes sandier.

Slightly calcareous silt, top more calcareous.

Base not very planar again due to the amplitude of wave ripples on calc silt.

Non-calc silt, irregular base due to underlying wave ripples.

Top forms extensive bedding plane, extensively cross-bedded, can see surface expression on the top surface.

Micaceous silty muds with tabular silt.

Tabular & traceable silt, silt massive, top surface irregular due to the overlying and downcutting erosive base, also shows some irregular and wavy laminations towards the top.

Sets undulate slightly along section.

Tabular silt, top forms extensive bedding plane.

Calcareous silt, weathered top surface which forms an extensive bedding plane, bed thickness 10-55cm. Sharp base with underlying unit.

Drapes of silt over ball & pillow horizon, quite large scale ball & pillow and it is quite deformed in places, balls - quartzose silt, pillow - silty micaceous silt.

Sills contain tiny weathered out nodules.

Silt (10-18cm) and muddy silt, alot of the sills are broken up along section and it is difficult to make the distinction between sills and siltts, some sills trace laterally thought they may pinch and swell slightly.
Ssets pinch and swell along section.

Basal contact seems planar and sharp. Sset is quite micaceous, bedding quite tabular in the cliff section breaks up more as you trace it seawards, beds 35-70cm thick.

On the top surface some of the concretions have pebble patches, alot of the concretions have weathered considerably into hollows, giving the surface a potholed appearance.

43 + 63 + 120m horizons seem to amalgamate, difficult to make distinction from underlying 62cm unit, as the contact is slightly irregular, with the overlying sset cutting down into the top muddy layer in places.

Laterally traceable sset

Ssets are 2-6cm thick.

Calcereous sset, quite weathered, laterally traceable, top forms major bedding plane surface

Non-calc sset pinches and swells along section, tracing this sset landwards it seems to grade into the overlying calc sset.

Muds also contain weathered out nodules, sset (15-20cm) thickness increases landwards.

Top surface is quite calcareous and also quite weathered, traceable sset but breaks up laterally, landwards appears to amalgamate with the top set (less form) of the underlying unit, thin seawards post due to weathering.

Ssets (10cm thick) trace quite well laterally, but do pinch out at times, some of the set lenses overlap.
South dipping accretion surfaces

Sandy mud

Vertical surface shows concretionary patches.

Top forms prominent bedding plane, also is very weathered, gastropods partially infilled with sparry calcite. Tracing set N of erosive base, it is a 10cm parallel set, with sharp planar top and basal contacts

Muds quite recessed in places

Laterally traceable set, top forms prominent bedding plane

Calcareous muds and calcareous ssts, some lenses of set have no lateral continuity

Calc sst

Micaceous shales

Fine calc sst

Ssts (calc. 3-15cm thick) pinch and swell along section and some are undulatory in nature. Mud contains fragments of set broken into lensoid shapes which undulate along section.

Grey silty muds, weathered out semi-nodules towards the top c12cm in diameter, mica rich mud.

Top forms extensive bedding plane

Calcareous mud

Set in calcareous and mud is quite micaceous

Log MH 2.3
Top forms major bedding plane surface, very weathered sst, pebbles quartz to 2 cm in size.
Traces around to pebbly calcareous unit forming base of log at Darby's hole.
Contact between two units appears to be quite sharp, though could not be described as planar. Top surface is extensively weathered.

Tabular sst, bottom 10 cm quite muddy and weathered.
Muddy ball & pillow horizon, top of this horizon is more competent sst and quite well parallel laminated.
Top 10 cm shows draping of sst.
Micaceous sst, muddy in places, quite laterally traceable.
Silts are very weathered, some of the sst pitch out laterally.
Sand dominant horizon, quite laterally traceable.
Muddy ball & pillow horizon, balls are fine micaceous sst, pillows are muddy sst/silt.
Tufa noted on shaly and sst surface.
Dark grey calc sst, seem quite laterally traceable.
Top forms prominent bedding plane surface, very weathered with crustacean style burrows. Sst becomes increasingly pebbly towards the top surface, pebbles are quartz, sst is quite weathered.
This horizon doesn't trace well laterally, ball & pillow change in size laterally, horizon offset due to faulting, ball & pillow consist of fine sst and muddy micaceous sst.

Top 80cm has patches of quartz pebbles, pebbles up to 1cm in diameter.

Set becomes muddier up thru' section, and not as tabular, has siltst partings which are quite micaceous and contain plant debris, sets in places are irregular and pinch and swell laterally; some undulating slightly.

Large tree trunks on top surface with roots attached.

Light grey, tabular and traceable sst.

Slightly calcareous sst, more calcareous patches traced along section medium grey sst tabular and traceable along section.

Some concretionary patches are irregular, top 60cm extremely calcareous pebbly and weathered, no definite lithological contact seen.

Difficult to define the contact between the fluvial set and calc set, in places it appears quite abrupt and in others gradational, in that it is difficult to pinpoint exactly where it becomes increasingly calc, where the contact is sharp however it is not planar.

Pebbles on top surface are quartz.

Siltst partings are quite micaceous and contain plant debris.

Laterally traceable horizon.

Muddier and more micaceous towards the top.

Fine set alternating with a muddy set, undulatory contact between the two.

Recessed weathered grey mud

Sst seems to sink into underlying set as small scale ball & pillow

Slightly calcareous sst.
Basal contact is sharp and planar in places and in others quite irregular, but definite, however base is not calc, must be a gradation to a calc top.
Sat gets muddier towards the top.
Quite massive set, irregular base and top becomes more irregular and broken as you trace laterally, poss weathered out tree trunk on top surface with rootlets attached, surfaces micaceous. Belonging to one of the fluvial facies.
Interbedded sandy shales and ssts(2-10cm thick), ssts are difficult to trace laterally due to the weathered nature of the section.

Top shows large and numerous rhizocorallia burrows

Top 30 cm slightly calcareous and very weathered and holed, also shows possible undulose lamination, contact with the calc top, in places is abrupt and in others quite gradational.

Top 30 cm are quite calcareous and weathered, seems to be at an angle to the rest of the horizon

Section disappears into cliff and cliff walls, calc sst with calc mud partings
Partings are a muddy silt, c1-8cm thick.

Top surface is quite irregular and weathered
Barnacle covered tidal rocks.

Top surface forms extensive bedding plane
Muddy silt partings (<5cm thick), can be either shaley or muddy in nature, in places streaks of plant debris are present in these partings, top 32cm that are co-er and calc.

Not very tabular when traced laterally

Pinches and swells along section. Sst surfaces are micaceous, thought thick and tabular at the landward end this set pinches out to the south (seaward).

Log MH 6.2
Tracing seaward this and the overlying 17cm seem to amalgamate. Parallel laminated set laterally traceable silty muds. Muddy-silty partings. Calcareous mud, well laminated, sandy laminae, pinches out seawards and becomes part of the underlying unit. Set is slightly calcareous and very micaceous, thickness varies from 1-6cm and pinch and swell along section. Set has silty partings, top is quite calcareous, tabular geometries. Sets, 18-44cm thick, silts from 18cm tend to vary laterally. Pos. Chlamydosphaera on the top surface.

Large slump fold recorded. Top forms prominent bedding plane. Abrupt change into calcareous set, dark brown in colour and weathered, poss HCS at the base. Quite large fragments of plant debris. Parallel laminations are noted to be continuous through the concretions. Towards the top a number of sets show pinch and swell, foresets not very traceable, horizon shows tabular geometries Sets show quite tabular geometries in the cliff section, some show a distinct lensoid shape. Set thicknesses c 2-20cm. Top is small scale ball & pillow horizon, set is slightly calcareous, difficult to trace log around cliff section. Sets are 7-40cm thick, and trace quite well laterally. Tracing the small scale ball & pillow laterally SW wards it becomes a competent set with soft defm., and poss small scale ball & pillow towards the top. Flint 110cm is extremely broken up and weathered, and difficult to get any detail. Patches are coarse and pebbly, traces of parallel lamination, thins laterally southwards Weathered grey muds Tabular and laterally traceable horizon. Micaceous and very weathered Top surface forms extensive bedding plane, large wave ripple remnants Contact between the fluvial set and the calc top is gradational, calc top surface is quite pebbly, with quartz pebbles (>1.7cm). Again some Chlamydosphaera noted although not as extensive as on equivalent horizon noted near the beginning of Log 1.
Grey calcareous mud, laterally traceable

Very weathered and brown calc sst.
Calc top to sst shows biodebris, also forms extensive bedding plane

Ssts undulate in their layering, some are very lenticular
Even though some of the ssts are lensoid in nature and pinch out laterally, others are quite tabular and seem to be continuous along the section.

Top forms prominent bedding plane
Due to the nature of the outcrop it is difficult to tell whether there is a sharp or gradational contact between the fluvial sst and the calc top, which in most places seems to be 5-10cm thick, poss that the thickness of this changes laterally.

Avicennia’s cuspate structure.

Plant fragments of different shapes and sizes are quite abundant.
Sst surfaces are quite micaceous.

Fine ssts and silty muds.

Ssts (1.5-7cm thick) show traces of parallel lamination, and pinch and swell laterally.
Top forms prominent ledge, sst pinches out laterally, poss Chomatichnus oval surface
Anagamates with the underlying unit in places.
In places ssts seem to pinch and swell, also quite micaceous
May be faint trace of undulose lamination
Well laminated mud doesn’t trace laterally
Pieces of ssts suspended in mud, tracing this seawards becomes more obvious bulb & pillow
Undulose lamination cuts down into the underlying unit in a saucer shape.

Log MH 7.2
Slightly calcareous at the base, possibly due to the presence of concretions. Very thinly bedded, some antipodean tabular

Irregular top surface to sst, sst traces down and around to the next inlet. What is notable is that there is no calcareous top to this sst. Some convolute laminations which may be due to dewatering or soft sediment deflation.

Laterally traceable ssts (0.7-3-6cm thick), muds (muddy silt) are recessed and weathered.

This horizon extends down into the sea.

Ssts are up to 16cm thick, most of which break up along section, show pinch and swell and undulate.

Balls - fine calc sst, pillows - silty mud, sst laminae throu' out undulate around the balls, some of the balls <40cm in diameter, smaller scale towards the top of the horizon, balls also contain laminations which appear convolute, not usual concentric circles.

"Wavy" laminations near the top of the sst poss. reflect the presence of wave ripples.

Sst pinches and swells along section and cuts down into the underlying muds southeastwards, top surface is also irregular.

Top sst well laminated.

Tabular and thick ssts. At times it can be quite difficult to draw a distinct boundary between this and the underlying sst and at other times it is very sharp.

Ssts (3-12cm thick) seem to undulate in places and are also calcareous. Muds are silty and range from 10-15cm thick, though at this size they may contain some sandy laminae.

Micaceous sst, parallel to low angle laminae.

Top forms ledge in cliff and is calcareous.

Log MH 7.3
Unit as a whole traces well laterally. Top forms erosive base to overlying sst.

Interbedded fine-med calc sst (2-30cm thick, gen=10cm) and muddy sstts, apart from the lenses the sstts are quite laterally traceable.

The smaller of the two larger lenses is 77cm thick and c=5 m lateral extent pinches out laterally north and south wards. The more southerly lens seems to lens down into the underlying lithologies in a bulb and pillow style.

Tabular and laterally traceable sst.

The thickness of the calc top varies extensively along section, in places there is no calc top, irregular surface with hollows and ridges, but calc top only noted in the hollows - irregular concretions???

Horizon pinches out westwards, may be a slight erosional contact between a sst bed and a mud which pinches out southwards

Internal erosion surface
Sst seems quite massive
Irregular concretions

Lower half of sst has parallel to low angle lamination which is defined by the alignment of mica flakes
Tabular and massive sst
Top forms extensive bedding plane

Sst seems quite massive
Irregular concretions

Lower half of sst has parallel to low angle lamination which is defined by the alignment of mica flakes
Tabular and massive sst
Top forms extensive bedding plane

Top undulates
Top forms prominent bedding plane

Log MH 7.4
Foresets difficult to pick.

Notable sharp base to fluvial set.

Sets are generally 12-15cm thick, interbedded with siltsets. Posy Stigmaria fragments noted, other fragments of plant debris also noted.

Rhizoconia noted.

Sets quite massive and extensively burrowed, interbedded with siltsets.

Siltsets (muddy) contain nodules of sst. beds are extensively weathered, sst interbeds are c14: - 20cm thick.

Breaks up laterally slightly southwards to amalgamate with the lower unit

Set traced laterally pinches out southward and amalgamates with another set higher in the succession

Set is so fine that it has a glassy appearance, mud is recrusted and weathered.

Set is quite micaceous, undulates due to uneven top surface of the underlying surface set.

Fine bands of mica
Internal erosion surfaces defined by muddy partings

First internal erosive surface is filled with a coarse quartzose sst, extremely hard and pebbly, with mud and plant debris. Mudflly bits seem to be in patches. Difficult to describe the nature of the base, as it is covered in boulders, poss that it might be erosive.

Unable to take readings of foresets due to tide

Very difficult to discern current direction as troughs difficult to trace Grain size may decrease upwards

Top shows 2-3 cm crust

Irregular top surface, bipolar foresets

Calcarenous ssts are quite massive

Log MH 8.1
Sandstone weathered brown in places.

Muddy sandstone
25cm calcareous top with extensive biodebris, and 6cm chert nodules. Top surface is extensively bioturbated and burrowed.

Sat is quite well bedded, beds c.65cm thick and thicker.

Sandstone traces around to Agaphaphraghan.

Massive ball and pillow horizon, sat gets slightly muddier in places, pinches out eventually while tracing around in cliff section, so that the overlying fluvial sat directly overlies the interbedded sits and silts.

Sits 3-7cm thick.

Partings between the sits are quite muddy, with other thin broken up sits. Sit thicknesses 3-20cm, sites pinch and swell along section, tracing ripples laterally trend becomes indiscernible and ripples are interference.

A lot of the sit surfaces are micaceous.

Sat shows extensive brown leaching.

Nodules of fine grained sit/silt, non-calc, c.6-8cm in diameter.

Sat surfaces are micaceous, interbedded with the sat is a muddy sat, and there also seems to be streaks of mud through some of the sits, some seem to undulate along section at one point amalgamating to form one tabular sat, middle of sat leached of calcite.

Tracing westwards this sit pinches out gradually passing into the overlying calcareous sat. Also eastwards.

Co-er pebbly patches confined to the top 45cm, this horizon is traceable but not as tabular laterally and breaks up slightly.

Sat(G-15cm thick) interbedded with silty shale, both extensively micaceous, silty shale gets quite muddy in places, sits pinch and swell laterally.

B-sat not continuous laterally, and size of same varies, westwards pinches into a laterally traceable horizon which undulates slightly along section.

Laterally this horizon seems to amalgamate with the underlying horizon, tracing these westwards they form a b-sat unit which lens downwards for c.3-4m laterally before returning to above.

Micaceous sat, eastwards amalgamates with the underlying unit, westwards becomes quite muddy and weathered, top surface is irregular.

Muddy siltite towards the top the silittle becomes more competent, only muddy in places.

*Rhizopogon*.
Numerous leached out orange/brown patches.

Quite a tabular horizon.

Gastropod debris on top surface, also weathered out gastropods are quite numerous, up to 2-2.5cm in diameter.

Sst is quite broken up but when traced laterally eastwards, is a more tabular sst, pebbly in places and muddy in other places, sst surfaces are micaceous.
What is notable is that there is no calcareous top to this stratum.

Parallel to low angle lamination noted in some of the concretions.

Difficult to pinpoint the exact base, notable in that it is not erosive, but quite planar, but still seems to belong to facies B.

Sets (3-12cm thick, gen=10cm) pinch out laterally, interbedded with silts.

At times the contact between this and the underlying horizon appears quite sharp and planar, but tracing around cliff section it appears to dip down and amalgamate with the underlying horizon.

Sets (7-33cm thick) near the top are extremely weathered and burrowed, difficult to see any internal laminations, they are interbedded with slightly silty mud. Sets pinch and swell along section. Appears to be related to the under and overlying units.

Calcareous patches are very pebbly, laterally traceable along the cliff section.

Top 60cm is quite leached, broken up and weathered.

Sharp planar base to set.

Traces quite well laterally, though at times becomes broken up.

Sets (5-8+15cm thick) pinch and swell along section. Tracing eastwards sets increase in thickness, up to 1m thick and in lensoid form, original thickness maintained westwards.

Laterally traceable horizon

Traced eastwards this mud horizon is overlain by 13 cm of set not seen westwards, fine slightly calcareous, parallel laminated, slightly undulate in places.

Tracing this set laterally it becomes increasingly muddy and at times is difficult to distinguish from the underlying horizon.

Set lenses pinch out, interbedded with silts.
Monstrous rhizocorallia noted on the top surface 80x19 cm.

May be fossiliferous silt. Coarse grained concretions?

weathered out rounded concretions? - non-calcareous

Unduloid nature to the silt, lens out along section, base of the section is alot more tabular

Possible Sigmatonia fragment.

Log MH 11.1
Sample MH 113 has a thickness of 5-6 m and contains some sandy and muddy partings. Large bits of plant debris are noted on the top surface.

Calcareous patches become more extensive from east to west, with some sandstone lenses amalgamated from the channel cut. Breaks up into thinner beds eastwards before reforming into tabular beds again further east. The base is more irregular than erosive, and the section east from "Channel Cut" is extremely irregular defined by muddy partings. Some sandstone lenses are 10 m wide at the base of the section, and these amalgamate to form higher-pitched beds.

Chalky laminae are micaceous and surfaces are micaceous. Sample MH 114 from a channel cut lies between the western channel margins and contains some sandy and muddy partings.

Large bits of plant debris are noted on the top surface.
Contains some larger grains, mainly calcite and recrystallised fossil debris.

Top forms extensive bedding plane

Sat pinch and swell

Sat is fine grained and light grey in colour, 1-10cm thick.

Top forms extensive bedding plane, amalgamates with the underlying sat seawards, tabular and traceable, thickness increases eastwards to 1-5m. Amalgamation can show ball and pillow at times.

Sat is mica rich, tabular, cuts down into underlying mud at landward end, in ball and pillow style, balls up to 110cm in diameter.

Tabular sat and laterally traceable, exhibits muddy base as indicated by flame structures.

Silts with sandy (0.5 - 2cm thick) partings, silts are quite muddy in places. Sats difficult to trace laterally.

Calcareous muddy sat, traced laterally becomes churned up in ball & pillow style

Sat is a dark grey colour and fossiliferous.

Dark grey sat, quite micaceous, with fossil debris scattered throughout, weathered orange/brown colour.

Mud thickens eastwards and thins westwards

Sat pinches out eastwards and amalgamates with the overlying sat.

Bottom 5 cm are slightly muddy

Thinly bedded sat draped over the top.

Sat is calcareous.

Base of the sat covered by boulder beach
Top undulates seawards and dips down into the underlying sandstones.

Sandstones seem to pinch and swell laterally.

One trace fossil identified as *Rhizocorallia*.

Top possibly pinches out seawards.

Shaley siltstone

Thickness of this unit varies laterally.

Sandstone thickness varies laterally.

Silty mud has pebbles, continuous silt lenses, mud quite bioturbated near the top.

Sets are extensively fossiliferous.

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Log MH 13 contact between the Bundoran Shale and the Mullaghmore Sandstone Formations
Weathered orange/brown sandstones, weathered out patches.

Sandstones are quite broken up along section.

Tabular and traceable sandstone

Tabular sandstone, Possible *Chomatichnus* on top surface.

Sandstone pinches out both east and westward.

Log MH 13.2 contact
Lots of muddy partings, uneven bedding. Beds seem to undulate towards the south. Top of the set seems to be less muddy and more tabular and less broken. Possible that the general channel direction is N/S.

Thickens when traced northwards, may show some deformed troughs.

Tidal rocks not able to record foreset data.

Log MH 13
Beds are deformed in places, possible debris flow?

Irregular top to bottom

Sat quite massive, surface rises and falls, change in bedding

Boulders strewn over outcrop

Log MH 14
Tracing around to the fluvial set top of cliff section at Aghaphreachan.

Sometimes set breaks into lenses, section undulates in places.

Sst is medium grey in colour, quite tabular though muddy in places and breaks up slightly westwards. Bottom half of the set is tabular, whilst the top half is more broken up and undulates slightly. Base of the set also shows longitudinal concretionary structures.

Ssts show traces of parallel lamination.

Tracing set eastwards it becomes alot more tabular with less muddy partings apart from one at the top where it passes into the overlying horizon.

This set seems to drape over the underlying set, tracing laterally it seems to form some type of soft sediment deformation with the underlying unit possible ball & pillow. Difficult to distinguish due to tidal nature of the exposure. Set does not trace laterally.

Top surface forms bedding plane.

Log MH 16, Mermaids Cove
Intraformational clasts from the overlying set

Traces of internal laminations

Log CI 2
As you trace this unit southwards it passes into a massive balled structure which cuts down through the muddy unit to previous calcareous sst horizon.

Calcareous ssts and muds

Calcareous mud with calcareous sst lenses, ssts more laterally traceable towards the top.

Black calcareous muds, well laminated.

Log CI 3 Black Rock, Conor's Island
Log 1 Dernish Island

- Fine micaceous silt, contains weathered out brownish nodules
- Passes up into mud with nodules and odd silt lenses
- Nodules of possible silt/flint
- Shaley calcareous mud
- Possible biodebris in silt, slight loss of exposure due to boulders
- Quite tabular silt
Log 2 Dernish Island
Transition into the Benbulben Shale
Extensively fossiliferous, particularly with crinoids

Silty fine micaceous sst

Fine shaley sst
Proposed top or near top of the Mullaghmore Sandstone Formation. Similar to that seen at Conor's Island

Extensively oolitic sandstone

2–3 m of section missing

Aghamore River Section
Benbulben Shale
Some of the grains are quite well rounded. Quite tabular and traceable around the waterfall. Large quartz grains noted.

Mullaghmore Sandstone
Tabular sandstone, top surface very nobby and holey (possible burrows).
Possible lut, very tabular
Tabular, slightly calcareous set
Outcrop in river very patchy and inaccessible

Coolgraffy River Section
Hummocky top surface
Tabular sandstone
Extends underneath waterfall next to Gleniff Mills
Massive sandstone

Log 15 - Ballaghnatrillick River
Log 15.1 - Ballaghnatrillck River

- Sandstones not well bedded and not laterally traceable, section very difficult to trace up stream.
- Very weathered horizon
- Tabular, well bedded
- Rejoin log above unused bridge, possible repetition of units
Plate 4.1: The first major sandstone of the Mullaghmore Sandstone Formation (arrowed) (Log 13 contact), at Rochfort Lodge, Co. Donegal (hammer for scale circled).

Plate 4.2: Sandy limestone at Tievebaun Mountain river section (Log Aghamore River section), representative top of the Mullaghmore Sandstone, (hammer for scale, circled).
Plate 4.3: Small scale ripple trough cross-laminae with superimposed HCS, Facies 2 sandstone at Mullaghmore Head, Log MH 2.3 @ 50.7 m.
Fig 5.1: Locality maps for Carrowmoran and Aughris Head, south Sligo.
Fig 5.2: Facies pie-chart for the Carrowmorran Sandstone Formation
Fig 5.3: Facies pie-chart for the west limb of the Carrowmoran anticline, Carrowmoran Sandstone
Fig 5.4: Facies pie-chart for the east limb of the Carrowmoran anticline, Carrowmoran Sandstone.
Fig 5.5: Rose diagrams for trough and planar cross-beds of Facies 1 Sandstones, Carrowmoran.
Fig 5.6: Rose diagrams for palaeocurrent data from selected Facies 1 sandstones on the east and west limbs.
Fig 5.7: Rose diagrams exhibiting ripple trends and cross strata data from Facies 2 to 6
Fig 5.8a: Hubbard (1966) logged sections for the east and west limbs at Carrowmoran.
Fig 5.8b: Hubbard's (1966) logged sections for the east and west limbs at Carrowmorran
Possible crevasse splay deposits responsible for the thinner Facies 1 sandstones on east limb?

Log from east limb see below

Log from west limb see below

Foreshore deposits

Basic cross-section of channel with proposed central position of west limb and marginal position of the east limb

Example of Log from east limb
Log CM 4.3

Example of Log from west limb
Log CM 2 east

Fig 5.9: Depositional model for Carrowmorran, note that logs are not time equivalent
Set shows calcite overgrowths on its vertical surface, which seem quite burrowed. Channel set increase in thickness eastwards up to 4m. Lateral accretion surfaces are noted dipping to the east. At times difficult to trace the set.
Large Stigmaria stems
Section is quite tabular, calcareous nodules increase in abundance seawards (northwards)

Silty calcareous shale with fossiliferous (gastropod and brachiopod debris) sandstone interbeds.

Nodules of sandy bit/calcereous silt noted in one shaley silt layer, some rounded, others longitudinal, random orientations.

Nodules of slightly calcareous muddy silt (5 - 6 cm in diameter)

Stigmaria stems noted
Trough cross beds approximately 1 m across

Log CM 2 east
Possible tree stump on top surface, with radial external ornamentation

In lower sandstone layer orthocone noted which has been replaced by calcite/sparite and then pyritised

Very thinly bedded and undulates slightly seawards

Section is quite tidal

Calcareous sandstone

Fragments of Stigmaria

Stigmaria on top surface. Also present is what seems to be an emergent tree stump

Non-calcareous micaceous sandstone, thinly bedded and quite tabular

Silty sandstone contains fossils beds, some of which are pyritised. Isolated sandstone dyke which contains abundant fossils is pyritised.

The whole section undulates slightly

Stigmaria stems noted of no particular orientation, tree stumps also noted

Muddy silt/silt, calcareous and fossiliferous, some fossils are pyritised

Tree stumps present, some are pyritised, no external ornamentation noted

Fossil horizons are present, many of the fossils are pyritised

Log CM 2.1east
Approx. 3-4 m of section missing due to boulders and seaweed.

Towards the landward end of the section it seems to be very deformed. Possible Xylogites on surface, difficult to discern as covered in barnacles. Deformed foresets from the N/NW.

Missing approx. 3-4 m of section covered in seaweed and boulders.

Fine sandstone is fossiliferous.

Top surface is extremely irregular and hummocky weathered out into mound like structures. Fine calcareous sandstone is interbedded with muddy sandstone which is also calcareous.

The whole section with the top of the underlying shales seems to undulate slightly. Muddy calcareous shale with some silty sandstone partings which tend to be fossiliferous, some of these fossil beds are pyritised.

Log CM 2.2 east
Fragments of bryozoa on top surface

Benbulben Shale
Seem to be fragments of bryozoa present
Silty shale, possibly with some sandstone partings
Thickness varies slightly due to slight undulation. Section is extremely weathered all over
Shaley mud thins out both northwards and southwards
Top surface is very irregular and quite pebbly. Some of the sandstones seem to form lenses within the section
Sandy shale, slightly calcareous. Thickness varies laterally as top forms erosive base to overlying sandstone.
There are some calcitic overgrowths on the sandstone vertical surface
Whole section undulates
Limestone is full of holes
Possibly large Stigmaria stem on top surface

Approx. 5-6 m of section missing

Missing section, see map

Log CM 2.3 east
Difficult to trace section due to boulder beach.

Overgrowth of calcite on stratum surface, slumping present in this stratum.

Slightly micaceous stratum, irregular hummocky top surface.

Leaves out westwards and begins to undulate slightly.

Muddy partings not continuous across section, hummocky top surface, top surface forms ledge in cliff.

Fine, non-calcareous stratum, quite shaley and fissile, internal lamination is irregular and wavy.

Stratum beds are quite laterally continuous with only the odd one pinching out laterally. The fossils seem to be particularly concentrated in the stratum layers giving them a fleshy appearance.
Above boulder beach in cliff section are glacio-eustatic folds in set, presumably the set belongs to the last horizon of the log.

Carbonate nodules recorded at top of shale horizon, irregularly shaped and range up to 40 - 50 cm in size.

Sets lenticular in nature and pinch out laterally, those at the landward end are more tabular, particularly those near the top.

This set joins up with first major set near core of the anticline. Set is quite micaceous. Dewatering is quite spectacular on the set top surface.

Horizon thins slightly northwards before disappearing between underlying hummocky set and overlying dewatered set.

Tree trunks noted

Thickness varies along strike, fossil tree trunks (possibly Stigmaria) noted

Tree stump noted in this shale

Calcareaous sets pinch out seawards, quite fossiliferous
Sands increase in importance further east over the pier wall.
Thickness of sands in logged section varies very little laterally.

Fine calcareous sand, possibly oolitic, tubular and traceable along the cliff section.
Chondrites trace fossil recorded.

Prominent traceable horizon.
Sparse lenses of sandy lut, that seem pyritised.

Tabular and traceable horizon, quite weathered.
Holey weathered appearance, calcite overgrowths.
As you trace this unit around the cove, it forms a single unit with the overlying sst, with a thin mud parting.
Black weathered non-calcareous sst, quite micaceous, muddier toward the top, laterally traceable.

Both ssts and shale are calcareous, the ssts are also fossiliferous. The ssts are slightly pyritised.

Ssts pinch out or amalgamate laterally.

Tabular and traceable and undulates slightly across section, dyke disrupts section slightly
Silt - very thin layering
Doesn't trace well laterally

Breaks up laterally into sst lenses and muddy partings, calcite overgrowths on sst surface.
Muddy sst breaks up in places into sst lenses and muddy partings.

Quite tabular sst, traceable along section, thickness may vary slightly.
Thickness of the sst varies between 20 - 170 cm, some ssts exhibit a lensed shape.

Sst horizon seems to have a very churned up appearance, may be due to small scale slumping or loading, possibly dewatering?

Over next c. 70 cm possible repetition of units
Calcereous overgrowths on sst ribs
Parallel to undulose lamination towards the top. Amalgamates with overlying horizons laterally.

Sst is quite tabular.
Possible cross beds

5 - 6m of section missing

Lst extensively fossiliferous, section covered in sand and seaweed. Some of the shell hash is pyritised.
Nodules of fine calcareous sst, both sst and mud bioturbated
Nodules of micritic lat. calcarous sst contains oolites
Silt pinches and swells seawards, hummocky top surface.

Flat bedded sst

Stigmaria noted, possible sst dykes - slightly calcareous
Stigmaria noted, possible sst dykes
Shelly marine fauna

Wavy internal stratification, possible muddy partings near base. Change in direction of dips between this and underlying horizons

Calcitic overgrowths on some sst surfaces, also calcite veins. Erotribe base of sst in two parts A & B. Sst top surface shows extensive plant debris. Major dewatered sst. Muddy partings define dewatering structures.

Hints of bipolarity, with north-westerly directed foresets recorded near the base

Log CM 4.2 west
Tabular and traceable section, undulates slightly.

Trace fossil is possibly *Eolithocoralla*

Muddy partings are calcareous, sst in sst dykes is calcareous

Fossil debris has hole borings, horizontal burrows contain fossil debris.

Sst dyke is calcareous

Base 20 - 30cm of the erosive sst is decalcified with some fossil debris

Tabular sst, parallel bedded. Pinches and swells seawards.

Sst is micaceous and very thinly bedded

Top surface of sst are "Flakey"

Thickness of the section increases northwards. Towards the top the sst becomes more tabular and flat bedded and quite micaceous. Sst has a draping effect.

Loss of exposure, strewn with boulders

Calcareous sandstone with predominantly north-easterly directed foresets

Possible micro shell hash, calcareous sst

Section covered in seaweed

*c 2 - 3m of section missing due to boulders and sand*

Log CM 4.3 west
Benbulben Shale

Gap in exposure for 5-6m

This surface may be cut off point for accretion surfaces
Point Bar Surfaces dipping NNE
Possibly oolitic towards the top

Seawards the set becomes slightly churned up possibly due to scour and fill, plant debris noted in these instances

This unit varies in thickness laterally. This and the overlying set in places seem to be draped over the underlying set.
Possibly oolites present

Log CM 4.4 west
Stigmaria stems noted
Not many crinoids noted previously in the Benbulben Shale. Here they are quite rounded, large and flattened.
180 cm of med-co sandstone - not too sure where this fits into log as a whole possibly in the middle of that displayed in log. The top surface is quite fossiliferous particularly with canna corals and brachiopods which have been replaced by calcite/sparite.

Sandstone is more micaceous towards the top with rusty reduction patches. There are calcitic overgrowths on the vertical surface.
The whole section is very irregularly bedded and undulates.

Sandy laminae seem to increase in thickness westwards.

Silty micaceous shale.

Quite a traceable horizon.

Top 40 - 50 cm seems quite broken up and undulates very slightly.

Log AH 2 (Aughris Head)
Plate 5.1: Transitional facies marking the passage of the Bundoran Shale Formation into the Carrowmoran Sandstone Formation at Portmore, Carrowmoran (Log CM 1 west @ approximately 5 m)

Plate 5.2: Preferential concentration of fossils (including orthoconic nautiloids, gastropods, brachiopods and few crinoids) in the sandstone beds in the transitional sequence at Portmore, Carrowmoran (Log CM 1 east @ 4.7 m)
Plate 5.3: Fossils including, orthoconic nautiloids, gastropods, brachiopods and few crinoids, found in sandstone beds in the transitional sequence at Portmore, Carrowmoran (Log CM 1 east @ 4.7 m). Pencil for scale is approximately 15 cm in length.

Plate 5.4: The first major sandstone (arrowed) of the Carrowmoran Sandstone Formation at Portmore, Carrowmoran (Log CM 1 west base approximately at 7.4 m)
Plate 5.5: *Stigmaria* fragment in Facies 1 at Carrowmoran (Log CM 4.2 west @ 29.9 m)

Plate 5.6: Lycopsid tree stump at Carrowmoran (Log CM 1a west @ 2.5 m).
Plate 5.7: Carbonate nodule in a shale bed of Facies 3 (Log CM 1a west @ 2.5 m), Carrowmoran

Plate 5.8: Larger amalgamated carbonate nodules in a shale bed of Facies 3 (Log CM 1a west @ 10.6m), Carrowmoran
Plate 5.9: Dewatering structure (internal cusp) in Facies 1 sandstone, east of Cloghadoo. (Equivalent to Facies 1 sandstone in Log CM 4.2 west from 22 - 26 m)

Plate 5.10: Dewatering structures (chaotic unit), west of Pollnadivva Pier. Droplets (synformal structures) arrowed. (Log CM 4.1 west from 3.8 - 6.2 m)
Fig 6.1: Kildoney locality map, Co. Donegal.
Fig 6.2: Facies pie-chart for Kildoney Point

- Facies 1: 49%
- Facies 2: 11%
- Facies 3: 10%
- Facies 3b: 14%
- Facies 4a: 5%
- Facies 5: 4%
- Facies 7: 4%
- Facies 8: 1%
- Facies 9: 1%
- Facies 10: 1%
Fig 6.3a: Rose diagrams for trough and planar cross beds from Facies 1 at Kildoney
Fig 6.3b: Trough and planar cross bed data from Facies 1 sandstones at Kildoney ctd
Fig 6.4: Rose diagrams for ripple crests from Facies 2 and Facies 3 at Kildoney
Fig 6.5: Depositional model for the Mullaghmore Sandstone Formation at Kildoney

Log $K_d 4.2 + 4.3a$
This sandstone increases in thickness to the west across a fault to approx. 10m. (Cormorant's Rock) The fault trending 002 downthrows the logged section to the east. The logged section to the east appears to have a calcareous top or may possibly contain a number of concretions. The inaccessible section to the west displays accretion surfaces dipping approx. to the northwest and also possibly another higher set dipping to the east-northeast. Check photos.

Tracing this horizon northwards, some of the sandstones amalgamate to form a thicker sandstone which sinks slightly into the shale of the same horizon.

Neither sandstones nor shales appear to be fossiliferous.

Laterally traceable from northeast end around cliff section.

Sandstones are very thin and not laterally traceable, they increase in thickness southwestwards. Some of the crinoids are quite compressed.

Syringopora is the colonial coral which is noted, Zoophycos is the trace fossil. The top of the sandstone forms a prominent bedding plane at the base of cliff section. Cliff section is cut by a number of small scale faults. At Leckpeggy this sandstone has calcitic pebbles on its surface.

In the top 3m some of the crinoidal debris has been flattened.

Sandstones are calcareous and quite micaceous, they do not trace well laterally and tend to pinch and swell along section, some sandstones attain a thickness of 25cm.

Towards Leckpeggy it seems that fossils are concentrated in the sandstone layers even though fossils are also noted in the shale layers.

Numerous brachiopods are noted including a number of profiles with no particular death orientation.

At Altskinni as you trace the gradational unit of alternating sandstone/shale along the cliff section there is an abrupt change laterally from distinct sandstone/shale layers to a dominantly competent sandstone with few muddy bedding. Bedding is difficult to pick out in this unit and this continues for 6m of the 9m gradation.
This section is completely inaccessible at Comorant’s Rock and thicknesses and in cases lithologies are estimated. The erosive base of the fluvial sandstone cuts out the interbedded sandstones and siltones to the south-west. This sandstone also exhibits lateral accretion surfaces in the first 5 m, which appear to dip to the north-north west.
Concretionary patches are also noted, spherical concretions show parallel lamination.
Sandstones more tabular near the base. Further southwestwards along cliff section the erosive base cuts down more into the underlying lithologies. Channel geometry noted.
Accretion surfaces dipping to the northeast/east. Possibly another set higher in the section dipping to the southwest.

Sandstones difficult to trace laterally, some lens out.
Horizon traces quite well laterally along cliff section, sandstones maintain their thickness quite well.
Large amplitude wave ripples on top surface tending towards interference ripples as you trace the outcrop to the northeast. The top of the ripples are extensively bioturbated with horizontal burrows in particular being concentrated on the ripple crests. The large U shaped burrows that are also noted are not concentrated at the crests or troughs. Two possible casts also noted, no external ornamentation visible.
Top of horizon becomes increasingly calcareous, showing weathered out calcareous patches. Base of what appears to be a bed undulates slightly.

Middle part of horizon when traced laterally shows variation in the number of muddy partings (they decrease) and there is also a decrease in the burrowing activity.

Tidal horizon, covered in barnacles, seaweed etc, unable to access and examine in greater detail.
Sandstone contains a number of concretionary patches, sandstone is also very micaceous.

Accretion surfaces dipping to the northeast

Base of sandstone undulates slightly

Interbedded sandstone and mud as opposed to sandstone and shale as seen previously.

Basal sandstones quite laterally traceable, higher sandstones difficult to trace.

Equivalent to the third basal unit of log 2
Mud and sandstone lens in ball and pillow style. Curved laminations in ball in both corners. Sandstone is otherwise well parallel laminated.
Both the sandstone and shale are calcareous.

Sandstone traces quite well laterally, quite undulatory in nature eastwards, at base it is mixed with quaternary mud.

Irregular base passes down into underlying lithologies.

Most of the sandstones are parallel laminated. Tracing southwestwards sandstone passes laterally into overlying sandstone.
Sandstones are quite well parallel laminated in the middle. Amalgamation with the underlying sandstone where it pinches and swells along section.
Well parallel laminated sandstone, pinches out southwestward, pinches and swells basal 284cm are inaccessible.

Completely inaccessible section.
Quartzose sandstone, increases in thickness southwestwards

Calcereous shales and sandstones, horizon becoming increasingly calcereous upwards.

Increase in thickness of sandstone as you trace southwestwards
Base of shale is white in colour and contains numerous layers of nodular limestone. Top black shale is more muddy and friable than the lower shale, some nodular limestone also noted.

Calcite overgrowths on vertical surface, sandstone is laterally traceable
Towards the top of this horizon both the sandstones and the shales become increasingly micaceous, sandstones in particular contain quite large micas. Basal limestones may also be oolitic.

Shale is quite micaceous

A lot of the limestone debris is on mm scale in the first 20cm
Trace fossil possibly rhizocorallia

Shales more distinctly shaley as section is traced towards the southwest.

Trace fossil possibly rhizocorallia

Fine grained limestones or very fine grained calcereous sandstones. Fault downthrows section to the southwest, section approx. 30cm thicker on downthrown side.

As sandstone traces around rocky inlet there is an increase in the number of muddy partings. Lower down in cliff section there are accretion surfaces which dip to the east/northeast. Slight increase in thickness around inlet.
Veiy thinly bedded, quite micaceous sandstone
Flowing sandstone passes eastwards into interbedded sandstone and shale. Only hints of trough cross beds which indicate a NW/SE current. Extensive dewatering structures deform the trough cross bedding.

Sandstones are very calcareous

Sandstone is quite micaceous and contains quartz grains up to 3mm in a finer grained matrix.

Log Kd 4.3b
This part of the section is very tidal and almost completely covered in barnacles and seaweed.

Micaceous sandstone, pinch and swell along section.

Tidal section completely covered in barnacles and seaweed etc., difficult to map any detail.

Anticline noted trending 246.

Troughs are approx. orientated ENE/WSW.

Shales contain carbonate nodules.

Log Kd 4a
Quartz pebbles up to 3-3.5cm in length noted on sandstone surfaces c30cm from the top. Generally found in clusters with the odd one scattered here and there. Some of the pebbles also seem to be made up of sandstone. Two thirds of the way up section there is an abundance of plant debris with a lateral extent of 5m, weathered out and with long stems lying in an approximate E-W orientation. The top of the sandstone is slightly calcareous with no distinct break between this and the non-calcereous sandstone.
Sandstone is quite micaceous, and the top is quite weathered, glacial folding noted in hill section.

Sandstone shows traces of parallel to low angle lamination.

Sandstone is quite micaceous.
Calcareous weathered sandstone

Gap in exposure across beach to Carricknaconra

Gap in exposure across sand beach

A lot of the fossils have been replaced with calcite
Plate 6.1: Facies 1 sandstone at Cormorant's Rock with Inclined Heterolithic Strata (arrowed) and overlying internal erosion surface (Log Kd 1b @ 3 - 12.5 m).

Plate 6.2: Inclined Heterolithic Strata in Facies 1 sandstones at Castle Flag, (rucksack for scale, circled), Log Kd 4 @ 15.5 m.
Plate 6.3: Inclined Heterolithic Strata (arrowed) at Corlack.

Plate 6.4: Inclined Heterolithic Strata (arrowed) at Illanbeg.
Plate 6.5: Channel cut at Illanbeg, rucksack circled for scale.
Fig 7.1: Map of Inishmurray Island with logged sections
Fig 7.2: Facies pie-chart for Inishmurray Island

- Facies 1: 76.5%
- Facies 4a: 6.7%
- Facies 4b: 4.2%
- Facies 4c: 3.0%
- Facies 6: 2.8%
- Facies 8: 2.2%
- Facies 10: 2.0%
Fig 7.3: Rose diagrams exhibiting palaeocurrent data recorded from trough and planar cross strata at Inishmurray Island
Fig 7.4: Depositional model for Inishmurray Island.
Grey medium to coarse-grained quartzose sandstone.

Grey quartzose sandstone.

Section in parts seems to undulate and have irregular contacts.
Top 1 m of the section is broken up.
Half way up the section the sst are in lens form.

Sst beds at times pinch out.
Some of the sst surfaces are quite micaceous

Tracing this sst laterally it amalgamates with the underlying sst
Post *Rhizocorallia* on the top surface.

Trough cross beds indicate flow from the north, sst surfaces are quite micaceous.
Irregular top surface due to dewatering structures.

Trough cross beds are present and are oriented W/WNW - E/ENE, current from the W/WNW.

Contacts between this and the underlying unit are not planar, but undulatory (deposition) on irregular surfaces.

Silt veins are present near the top of one silt horizon, seem micaceous, branching, and double layered, some of the silt veins appear to be weathered out. Top surfaces are irregular and it is difficult to decipher any bedding planes and their orientation.
Pebbles are c.3.5cm in size, and are quartzose.

Pebbles up to 1.5 x 3 cm in size, trough cross beds poss orientated N/S - NW/SE. Though the base of this set is planar, it does undulate and can be irregular in places.

Quite large quartz pebbles, largest 8 x 3 cm, but mainly 3 cm in size.
Contains red/orange/brown streaks (silty mud).

Sst has a shaly appearance, a lot of the section is covered with boulders.

Internal erosion surface may have caused some brecciation.

Tracing section laterally westwards the sst breaks up considerably, some lensoid forms are notable. Sst becomes traceable again further westward. Sst dykes noted on the top surface.

Sst beds vary very slightly laterally in thickness, they also tend to undulate slightly. Thickest sst bed is c. 12cm thick.

Sst dykes weathered on the top surface, of similar lithology to the horizon.

Passes laterally into interbedded silty mud and fine sst. Sst mud shows red/orange streaks and also sand filled burrows. Lat nodules noted in sst c. 10cm.

Point bar surfaces are noted, attain thickness of up to 4.85 - 5m, in the thickest parts of these surfaces the contacts are quite sharp and planar, sets forming the bars are quite well parallel laminated.

Sat pinches out eastward. Boulder beach obscures a lot of the view of this unit.

Tracing the sst laterally westwards it cuts downwards through the section to the first unit recorded in this log, and further westwards again the thickness of the sst increases to 5-6m, further westwards again it cuts down into the first unit in this log.

Undulatory nature along section, decreases in thickness westwards.

Ssts (7-13cm thick) interbedded with muddy siltst with red streaks.

Muddy siltst, grey with red streaks, which generally are parallel to section, sometimes they bifurcate. Tabular and traceable.

Fine sst, silty, light grey in colour with red and white streaks - which exhibit small scale HCS.

Fine micaceous sst, quite weathered, and slightly crumbly with some rusty red partings which are only mm's thick and don't trace well laterally, firz slightly with acid.

Probable that this unit does correlate across the boulder beds to the east of the boulder beach, but at this locality the troughs seem to be deformed by extensive soft sediment deformation and dewatering. Troughs orientated in the same direction as those on the east side of the gully. Flow from NNW - S/SE.

8cm sst is weathered, mica rich, and light grey in colour with a reddish tinge in outcrop.
Top surface is very irregular, possibly due to dewatering structures, and abundant sst dyke features are noted on this surface.

Sst dykes are noted on one sst surface.

Tracing the sst north and westwards, the intervening mud pinches out between this and the underlying sst and the contact is defined by an internal erosion surface. Following this sst southwards it has a very irregular base as it is situated over the soft sediment deformed sst and mud, possibly the base of 230cm sst sinks into this.

Sst lens is quite micaceous, top surface slightly irregular, sst dykes cut through silty layers.
Tracing this section laterally along the cliff section it breaks up a lot, the upper most set loses its "Channel Cut" geometry, and it is difficult to distinguish the underlying horizons from one another.

This unit when traced laterally breaks up into more competent sets which dip at 20-30° angle to the north before passing into the "Channel Cut" set. Northwards they pinch out, pass that they are channel margins??

Thought the set is med grained, it is quite muddy and brittle. 60cm set is not very traceable breaking up into surrounding mud.

The top of the section is extremely weathered and does undulate allot.
Sets with silty mud partings.

Tracing these two units laterally south they amalgamate into a competent set, similar to that of the larger unit, this amalgamation pinches out quite abruptly into sets and muddy silts beneath the erosively based "channel cut".

Med grained set with some larger grains, again set is quartzose.
Large pieces of plant debris are noted near the top surface, this set amalgamates with the underlying set laterally.

Concretions have quartz pebbles standing out on the surface.
Sst increases in thickness seawards in wedge type fashion and pinches out landwards.
Sst increases in thickness E/SE wards to 5-6m.

Tabular and traceable, don't pinch out laterally, slightly undulatory in nature landwards.

Tabular set and prominent, but at times seems to cut down into the underlying unit and amalgamate with it, extremely undulatory.

Set veiolets are red in colour, quite a laterally traceable horizon, though does undulate at times along section.
This unit seems to pinch out eastwards into Clashmore Harbour and the horizons below this unit seem to return to their usual tabular and traceable geometries.

The internal erosion surfaces are quite muddy, one place in particular a lot of mud is present mainly towards the base of the unit. The unit beneath this mud dominant unit is in lens form.

Sst (4-15cm thick) coarsens upwards to quartzose coarse ssts.

Sst is quite micaceous, muddy bits (quite silty) on the erosional surfaces, also contains red/orange streaks parallel to bedding.
Plate 7.1: Trough cross bed dipping to the south/south-west, line indicates the approximate width of the bedform. Hammer for scale.
Plate 7.2: Section from Log IM south 1, exhibiting Inclined Heterolithic Strata (arrowed), internal erosion surface (outlined with red dash), shallow troughs (outlined with black dash) and parallel laminated sandstone.
Plate 7.3: Undulose strata in Facies 1 sandstone in Log IM south 1
Plate 7.4: Inclined Heterolithic Strata (arrowed) recorded in Log IM c
Plate 7.5: Facies 1 sandstones (Log IMe @ 10 m) with erosively base and underlying hummocky sandstone
Plate 7.6: Trough cross-bedded Facies 1 sandstone with erosive base and underlying interbedded siltstones and sandstone lenses in Log IM g
Plate 7.7: Haematite streaks in siltstone in Log IMc, Inishmurray Island
Fig 8.1: Locality map for the Mouncharles sections
Fig 8.2: Facies pie-chart for the Mountcharles Sandstone

- Facies 13: 13%
- Facies 12: 87%
Fig 8.3: Rose diagrams for palaeocurrent data of Facies 12, Mountcharles
Longshore drift

Tidal currents

Pebbles

Low gradient pebbly streams

Marine embayment?

Barrier

Amplification of tidal currents?

Fig 8.4: Depositional model for Mountcharles
On the surface of one of the slabs, abundant comminuted plant debris has been observed.

Tracing the section westwards, the grain size seems to be more uniform and patches of pebbles aren’t as common if not completely absent.

The cross beds seem to be truncated by the overlying pebbly patch, some may even be distorted by it.

As traced coarse bed laterally northwards the coarser grains seem to be confined to the base of the bed with the top of the bed being more medium to coarse grained. Doesn’t seem to grade from coarser to finer grains, more abrupt with the odd coarser quartz grain floating in medium grained matrix, grading seems to be lateral.

Log MC 1 - Drumkeelan Roadside Section
Ssets more thinly bedded, and flaggy in nature, grey in colour and quartzose.

Light beige/grey sst, quite weathered and leached, tabular.

Log MC 1(b) - Drumkeelan Roadside section
Walking eastwards the quartz pebble conglomerate bed seems to trace well, able to trace it into an area of well exposed quarry. No channel geometries have been noted.

Contains a number of coarse grains, the number of which decreases up section, towards the top of the section the set becomes very broken up and difficult to trace, some sets tend to pinch out or amalgamate with others laterally. Some tops of beds undulate or are uneven.

Tracing the section eastwards there is a very abrupt change from 45cm to 105cm pebble conglomerate, continues east till disappearing under pile of rubble.

Possible that top of this pebble conglomerate connects with top 180cm. Tracing the section eastwards there is a very abrupt change from 45cm to 105cm pebble conglomerate, continues east till disappearing under pile of rubble.

Traces of parallel lamination, and cross laminae in quartz pebble conglomerate. Clay from the base, the set becomes extremely co-grained as in "qtz pebble conglomerate". Weathered out vertical burrows and horizontal filled burrows on vertical surface.

Quartz pebble set, becomes increasingly co-grained up through the section. Qtz grains are of a pretty uniform size and quite well sorted. Nearer the base grains 1-2mm in size are few in a finer grained matrix. Throughout though the Qtz grains seem quite angular.

Possible host lithology for fossils found in slabs - straight hinged brachiopods and gastropods.
Tabular beds, thickness c.70cm. Quartz pebbles up to 7.5cm in size. Pebble layer is not laterally continuous.

Can't remember how this section relates to Log MC 2, may be a continuation, or may be a parallel section. Think now that it is a parallel section from the west side of the open quarry.

Remainder of the quarry section is a mod beige/grey sst, inacessible.
Brown very weathered, crumbly co at, no sedimentary structures noted.

Not too sure where this lies with respect to the last bit of the outcrop, no sedimentary structures noted.

Quite tabular and massive.
Possible that sets in the upper part of the quarry are equivalent to those at top of exposed quarry face no. 9. The section between the lower and upper quarry floor seems conformable, there may be a slight gap.

Mod light grey set, coarsening slightly upwards to coarse brown, very weathered and crumbly set. Some cross strata seem slightly preferentially weathered out.

Log MC 4 - East end of Drumkeelan Quarry A
No sedimentary structures
Bedding broken up and difficult to discern

Some of the gtz pebble conglomerate patches continue laterally, but do tend to end abruptly, elsewhere in near section throst maintains med-co grained with the odd pebble.

Tracing the set laterally - quite co, pebbly in place towards the base, pebbles 0.7cm in diameter, largest up to 1.5cm.
Section very broken up in the top 170cm. Possibly some cross strata but difficult to determine directional properties due to the broken nature of the section.

Section forming rest of the quarry is inaccessible, comprises of 5 thick beds, up to 1.5m. Similar to the two previous tabular systems mapped in this section with the "sugar granite" effect.

Broken up sst, shaley in places, extremely micaceous, some beds more competent than others. Unit as a whole difficult to trace around the quarry due to overgrowth of grass and also the effect of weathering. Tabular thickly bedded sst.

Log MC 6 - Upper Drumkeelan Quarry C
Coarser grained beds are tabular and continuous. Tracing section laterally does seem to get quite coarse in places. Some coarse laminae but difficult to trace due to the nature of the outcrop. Traces of cross-strata very faint and not continuous.

The base of the quartz pebble conglomerate is not as sharp as noted previously, the layer is 30cm thick.

Dark shaley silt, quite micaceous

Badly exposed outcrop covered in moss.
Coarse and friable set, orange/brown in colour. No. of weathered out patches - looks like calc weathered, but has no reaction with acid. There are no irregularly shaped calcitic overgrowths on the surface.

"Sugar Granite" not noted in this section.
Walking north through the quarry, loose slabs contain a lot of comminuted plant debris, even in slabs of the quartz pebble conglomerate.

Traces of cross beds from the SW not continuous

Beds of the “Quartz Pebble Conglomerate” are approximately 10cm thick.

Cross beds truncate in to the quartz pebble conglomerate, also possibly some parallel lamination in between the pebble lenses.
Tabular and traceable sst, increases in thickness slightly NE wards.

Med sst partings show // lamination. Muddy partings contain quartz pebbles.

Log MC 10 - Upper Drumkeelan Quarry D (McMonagles)
Nature of the section is very cruddy and weathered, appears to be some differential weathering between the top and the bottom of the section.
Seems more friable than the previous set, plant debris present but no sedimentary noted.

Log MC 12 - Corn Mill
Some coarse pebbles scattered in places
Quartz grains 2-3 cm noted.

On top of quarry floor - possible about 1m maybe slightly more, possible also that there may have been wave ripples on one of the surfaces but it is now completely covered in rubble. Top of this surface is also black.

Again contains black shaly partings. Top of this unit defines contact with the coarse pebble quartz conglomerate. Towards the top of the section there are a no. of large pebbles noted, both of quartz and calcite.

Beds are 8-50cm thick. Surficial surfaces are particularly micaceous. A lot of the bedding plane surfaces that are exposed are a dark grey/black colour, some of the striations seem to be separated by sandy shale type partings which are extensively micaceous - may cause the black colour of the top tips. Calcitic overgrowth on vertical surface.

Log MC 13 - Drumconnor Quarry
Section is set in off the shore, in the bushes, outcrop is crumbly and weathered, hence not able to calculate bed thickness.

Log MC 14 - St. Peter’s Lough
Sats are quite micaceous. Towards the base the sats is platy/flaggy in nature. Difficult to calculate the thickness of the beds, as some show a lensoid form and pinch out along section, generally above the level of the parallel lamination. Like the sats, silty partings are not continuous.

Channel geometry noted. 5m in width, with max depth at 40-45cm. Difficult to discern western channel margins.

Sample MS 32
04
03
02
01

ms ms cs co

Log MC 15 - Drumbeagh Quarry / Inver Oil
Possible trough cross beds present, exposure very scrappy, difficult to tell.

Blue/grey ssts, silt partings, silt filled vertical burrows.

Log MC 16 - Southeast of Drumbeagh Quarry
This part of the section is inaccessible, lithology similar to that below it, is quite broken though and thinly bedded.

Fine-med quartzose sst, sst surfaces are micaceous. Possibly some silty partings

Grey quartzose sst, quite micaceous. Tracing laterally a channel geometry is noted, c.7.5m wide, c.38cm at its deepest point. Approx 26cm above the base of the thalweg point, change in lithology, and bivalve/brachiopod mould.

Grey quartzose sst.

Micaceous sst, silty horizon.

Top silt weathers out laterally.

Tabular sst, laterally traceable.

Contains abundant plant debris, has plant rich silty parting, quite tabular.

Log MC 17 - Mc Monagles Quarry A
Log MC 18 - McMonagles Quarry B

Sample MS 38 - from the rubble of the quarry.

- Sample MS 37
  - Very weathered, contains lots of plant debris, some of it forming discontinuous streaks/partings.
- Section is very weathered.
- Quartzose sst
  - Quartzose sst, poss silty parting weathered out in the middle, beds 40-50cm thick.
- Blue/grey sst, tabular, quite micaceous.
Sat is more thinly bedded and broken up, similar to that seen at the tops of sections at other quarries. Again difficult to tell the thickness of the beds due to the nature of the section.
Sit is quite broken up, seen also in McMonagles Quarry C.
Large quartz grains up to 1.5 cm in diameter

Dark to medium grey sandstone

Outcrop covered in water and moss.
Plate 8.1: Shallow channel in the Facies 12 sandstones of Mountcharles, outlined, Drumbeagh Quarry

Plate 8.2: Shallow channel (?) in the Facies 12 sandstones of Mountcharles, McMonagles Quarry A, outlined, hammer for scale, circled.
Outcrop of the Mullaghmore Sandstone and equivalents.

1. Mountcharles Sandstone
2. Kildoney Sandstone
3. Mullaghmore Sandstone, S. Sligo
4. Inishmurray Island
5. Carrowmorran Sandstone
6. Mullaghmore Sandstone, N. Mayo
7. Derrygonnelly Sandstone
8. Clonelly Sandstone
9. Aughnacloy Sandstone
10. Drumman More Sandstone Mb

Fig 9.1: Outcrop distribution of the Mullaghmore Sandstone, North and North-West Ireland
Fig 9.2: Locality map for boreholes in the Lough Allen Basin
Fig 9.3: Facies pie-chart for the North of Ireland

- Facies 1: 12%
- Facies 2: 24%
- Facies 3a: 6%
- Facies 3b: 6%
- Facies 4a: 6%
- Facies 4b: 6%
- Facies 4c: 6%
- Facies 5: 38%
- Facies 9: 6%
- Facies 10: 6%
- Facies 11: 6%
- Facies 0: 6%
Fig 9.4a: Outcrop of the Derrygonnelly Sandstone (2) and the Clonelly Sandstone (1) (see Fig 9.1)

Fig 9.4b: Outcrop of the Aughnacloy Sandstone Formation and Drumman More Sandstone Member (in box)(see Fig 9.1).

Outcrop of the Mullaghmore equivalent
Fig 9.5: Facies pie-chart for Derrygonnelly

- 9% Facies 1
- 15% Facies 2
- 67% Facies 3a
- 6% Facies 3b
- 2% Facies 4b
- 2% Facies 4c
- 2% Facies 5
- 2% Facies 9
- 2% Facies 10
- 2% Facies 11
- 2% Facies 0
Locality 217, Derrygonnelly Sandstone

Sample LM 218

Bioclastic calc. sst, difficult to define the base, amalgamates slightly with the underlying horizon, sst broken up and muddy at the base, vertical calcite veins noted, no. of small scale cross beds but they are not continuous. Interbedded fine calc. sst and sandy shale, clac. sst seems to be bioclastic

Extensively fossiliferous

very weathered and some surfaces are quite irregular, presence of synclinal structure indicated by change in the direction of dip of the bedding, veins of calcite present.

Slightly further upstream

Further upstream

Further upstream

Slightly further upstream

Slightly further upstream

Further upstream

section may be conformable

Probable that section is conformable

Shaley sst, mica present

Concretions - some are just surface features, others are weathered out and are standing prominently on the surface.

Set is slightly shaley in nature and the surfaces are micaceous

Previously assumed that sst was fluvial in origin, as most of it was out of reach, now seems that it may be calcareous, or else sst is just capped by a calc. sst.

Sets are not laterally continuous, some breaking up into small lenses, others just pinching out laterally Tabular calc. sst, laterally traceable, but pinches out eventually to the east, also in places it is seen to lenses Interbedded fine muddy sst, calc. and of a shaley nature and fine micaceous sst

Set is tabular and continuous, some have planar bedding planes others are quite irregular, some beds undulate along section Can't reach bottom of the section due to turbulent river
Muddy calc shaley sst

Set traces well laterally, however the individual beds seem to pinch and swell, and break up laterally.

Lst, similar to the lst s found in nodular form in the underlying unit.

Tabular and bioclastic sst
Sst is slightly shaley in nature

Across other side of river which is inaccessible is possible lst or sandy lst.

Locality 218b, Derrygonnelly Sandstone
Fig 9.7: Facies pie-chart for Clonelly
Fig 9.8: Palaeocurrent data from Facies 1 sandstones in the Clonelly Sandstone
Fig 9.10: Facies pie-chart for Aughnacloy

- Facies 1: 47%
- Facies 3b: 6%
- Facies 9: 4%
- Facies 10: 19%
- Facies 0: 24%
Outcrop of the Mullaghmore Sandstone and equivalents.

Fig 10.1: Palaeogeography map of the base of the Mullaghmore Sandstone Formation
Outcrop of the Mullaghmore Sandstone and equivalents.

Fig 10.2: Palaeogeography map for the top of the Mullaghmore Sandstone Formation
Fig 10.3: Facies pie-chart for the Mullaghmore Sandstone Formation
Fig 10.4a: Heavy mineral pie-charts.
Fig 10.4b: Heavy mineral pie-charts