Lecture 4:
The sedimentary history of the Western Irish Carboniferous basin – nomenclature, paleontology and zoning.
Sources of sediment and basin paleogeographic reconstructions. Models for basin fill.
Aims

• Stratigraphy
• Formations and geology
• Basin fill
• Models for basin fill
• Pose hypotheses to examine in the field
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<tr>
<th>Age \n(Ma)</th>
<th>KINDERSCOUTHAN</th>
<th>ZONAL GONIATITE</th>
<th>SHANNON ESTUARY</th>
<th>NORTHERN CLARE</th>
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<tbody>
<tr>
<td>311</td>
<td>R1c</td>
<td><em>Reticuloceras reticulation</em></td>
<td>Kilkee Cyclothem</td>
<td>Hags Head Fm.</td>
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<td>R1b3</td>
<td><em>Philippoceras stubblefieldi</em></td>
<td>Tullig Cyclothem</td>
<td>Doonagore Flagstones</td>
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<td><em>P. nodosum</em></td>
<td>Gull Island Formation</td>
<td>Doonagore Shale Formation</td>
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<td>Cronagort Sandstone</td>
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<td>R1a5</td>
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Visean Limestones
Visean Limestones

• Well bedded limestones
• Extensive bedding surfaces
• Occasional clay bands
• Extensive karstic weathering
Visean Limestones: attributes to examine & hypotheses to test

- Nature & ecology of Carboniferous seafloor
- What controls distinct bedding? ...deposition &/or diagenesis
- Evidence for cyclicity?
- Origin of clay bands
- Geomorphological features of karst and influence on ecology
Clare Shales

from USC Sequence Stratigraphy website
Clare Shales

• Up to 180m thick to S (12m in north)
• Fissile grey-black shales
• Pyrite and sulphur weathering common
• Marine bands
Clare Shales

from USC Sequence Stratigraphy website
Clare Shales... *attributes to examine & hypotheses to test*

- Depositional environment & paleoecology
- Oxic/dysoxic/anaerobic conditions
- Why basin deepening and why? (and how?!)
- What terminated carbonate deposition?
- Why N-S thickness change?
- Nature of diagenetic products
Ross Sandstone Formation

from USC Sequence Stratigraphy website
Ross Sandstone Formation

• Interbedded muds, silts and sands
• 400m thick to south (thickest in Shannon area)
• % sands increases up succession
• Often laterally extensive
• Top of succession (upper 100m) – deformation, erosion, thickness changes
Ross Sandstone Formation

from USC Sequence Stratigraphy website
Ross Sandstone … attributes to examine & hypotheses to test

• Paleoenvironments
• Paleocurrents
• Why coarsening upwards?
• Any cyclicity in sediments? (if so, what/how/why?)
• Depositional ‘architecture’
Gull Island Formation

from USC Sequence Stratigraphy website
Gull Island Formation

• Generally fines (mud)-rich
• Often very deformed (maybe 75% in places)
• 550 m thick in S (150m in N)
• Coarser at top of formation
Gull Island Formation
Gull Island Fm... attributes to examine & hypotheses to test

• Paleoenvironment?
• Why a return to finer-grained sediments?
• Why huge % deformation – origin/causes/scales
• Paleocurrents
Tullig Cyclothem

from USC Sequence Stratigraphy website
Tullig Cyclothem

- Repetitive cycles that ‘coarsen-up’
- Lower cycles thicker
- Evidence of subaerial exposure towards top (vegetation/soils)
- Large thick sandbody towards top (30m thick)
Tullig Cyclothem

(from USC Sequence Stratigraphy website)
Tullig Cyclothem... attributes to examine & hypotheses to test

• Paleoenvironments?
• Paleocurrents?
• Nature and cause of cyclicity?
• Why differing scale ‘cycles’?
• How is cyclothem terminated?
Upper Cyclothems

from USC Sequence Stratigraphy website
N-S County Clare section

Graham (in press)
Upper Cyclothems

• Kilkee, Doonlicky and 1 other cycle?
• Coarsening upwards
• Evidence of subaerial exposure towards top (vegetation/soils)
• Large thick sandbody towards top
Upper Cyclothsems... attributes to examine & hypotheses to test

• Paleoenvironments?
• Paleocurrents?
• Nature and cause of cyclicity?
• Why are these thinner?
• Paleocurrents – the same or different?
Thickness of Namurian Sediments

from USC Sequence Stratigraphy website
Depositional Environments

from USC Sequence Stratigraphy website
Model of Basin Fill

A - CLARE SHALE FORMATION
- Distant western shoreline
- SLOPE BREAK
- Restricted fine sedimentation on trough margin
- Fine grained deposits on trough margin
- Water level
- Limestone

B - ROSS FORMATION & LOWEST GULL ISLAND FORMATION
- Stumps generated
- Minor channels
- Fine grained deposits on trough margin
- Turbidity currents
- Sand concentrated in trough
- Weakly defined sandy lobes

C - MIDDLE & UPPER GULL ISLAND FORMATION
- Minor frontal turbidity currents flowing ENE at highstand
- Delta shifts to more northerly position
- Bathymetry partly eliminated

D - TULLIG CYCLOTHEM
- Delta plain conditions prevail towards west
- Shifting delta lobes
- Slope is muddy and less active in areas distant and lateral to active delta lobes

After Collinson et al., 1991
Model of Basin Fill 2

Wignall & Best, 2000
Broader Questions... attributes to examine & hypotheses to test

- Auto and allo cyclic controls on deposition?
- Nature and fingerprint of sea-level changes
- Nature and cause of cyclicity?
- Controls on sediment thickness?
- Paleocurrents & paleogeography
- Tides/basin salinity


http://strata.geol.sc.edu/Deepwater/Clare-Basin-Clastics.html
Next week

- Start refresher sessions on paleoenvironments
- Rivers and deltas