Quaternary Engineering Geology: Education & Training, A Portsmouth Experience

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Outline

- Background & Rationale
- Quaternary Engineering Geology: Content & Contexts
- Quaternary Engineering Geology: Fieldwork Programme
- Feedback & Critique
  - Applied Geoscience Employers
  - Applied Geoscience Graduates

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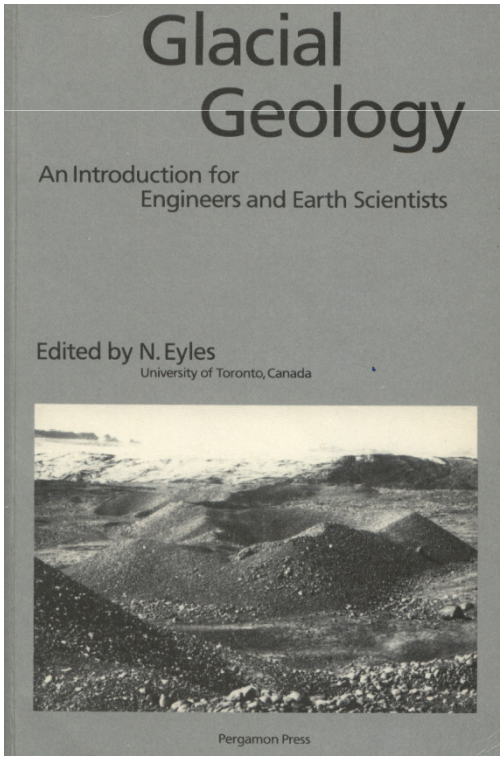
University of Portsmouth Applied Geoscience Undergraduate Programme

- BEng Engineering Geology & Geotechnics
- BSc Geological Hazards

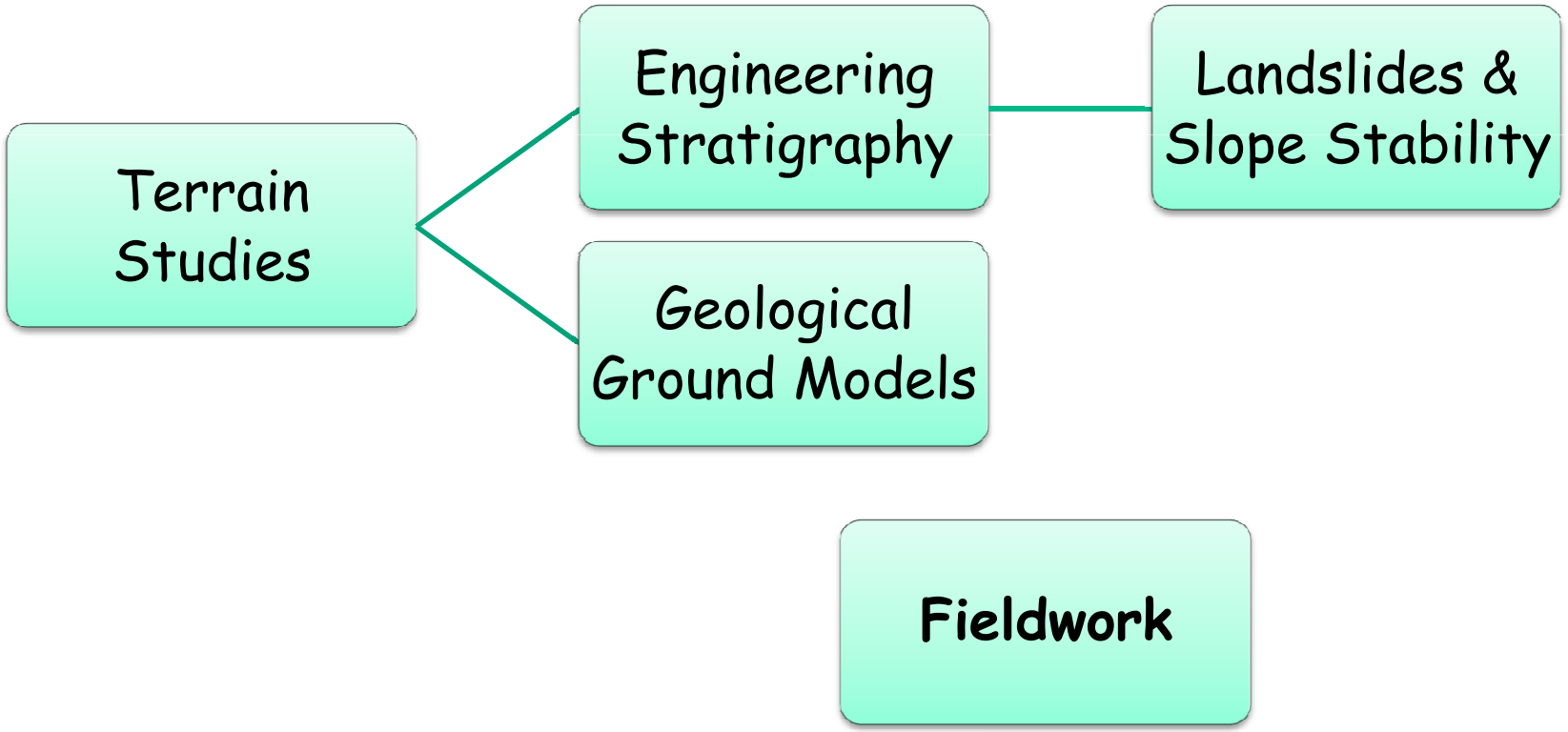
Earth and Environmental Sciences
40 years of Engineering Geology at Portsmouth

Background

- Eyles et al
  - Glacial Geology: An Introduction for Engineers & Earth Scientists

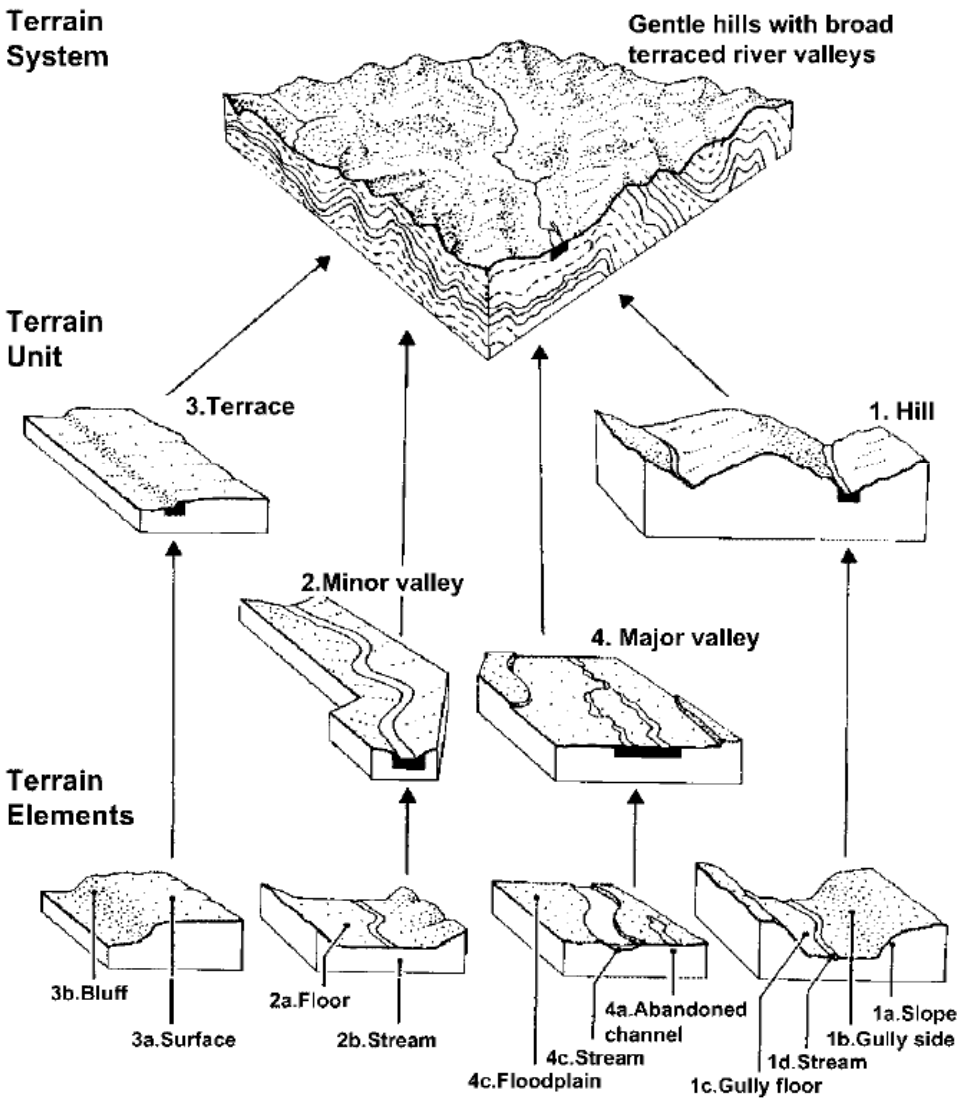


Curriculum


Terrain Studies
Engineering Stratigraphy
Geological Ground Models
Landslides & Slope Stability
Fieldwork

Land System Model

- Key Quaternary Environments



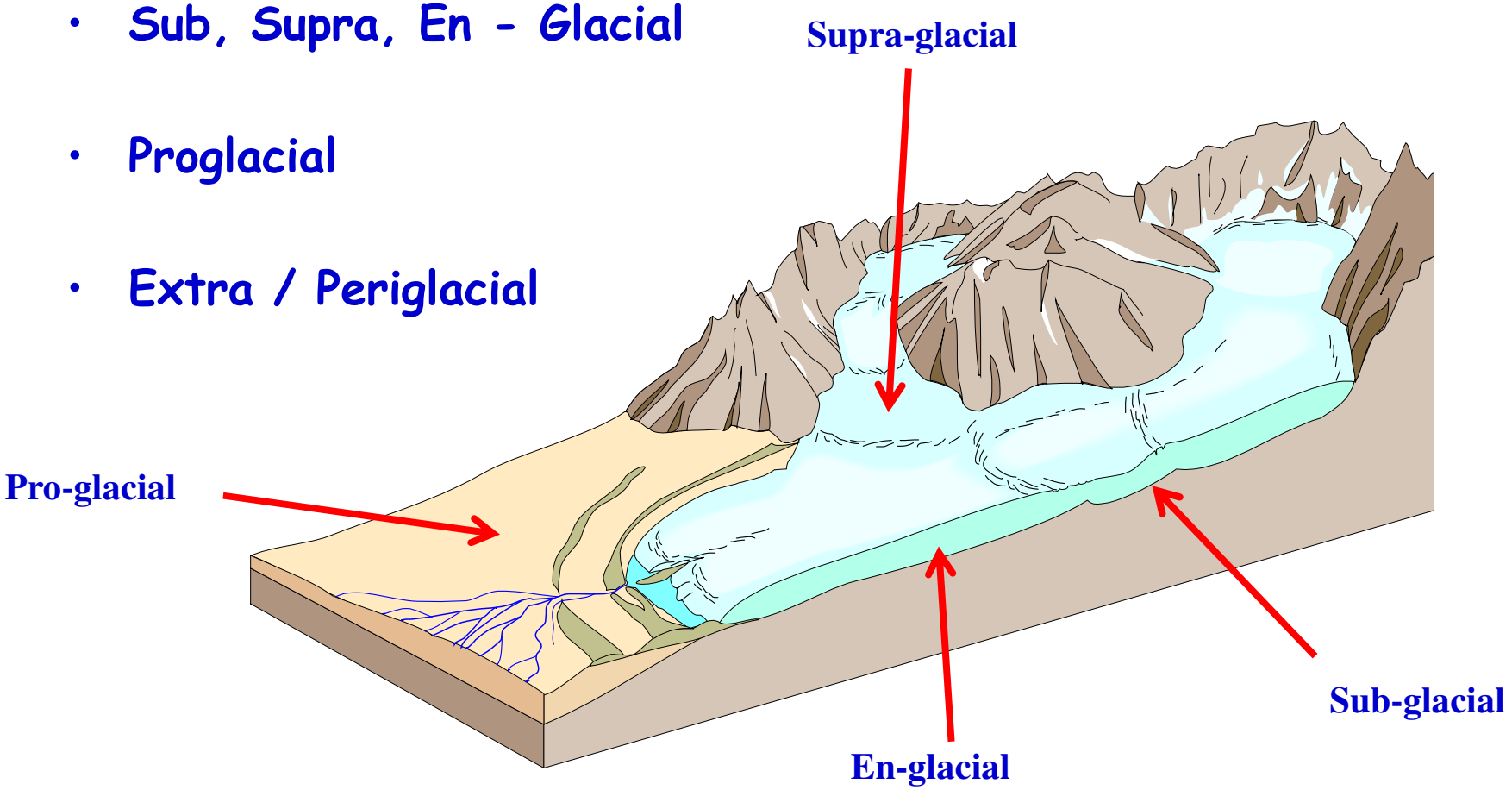
Terrain Systems mapping from Phipps (2002)

Glacial Landsystem

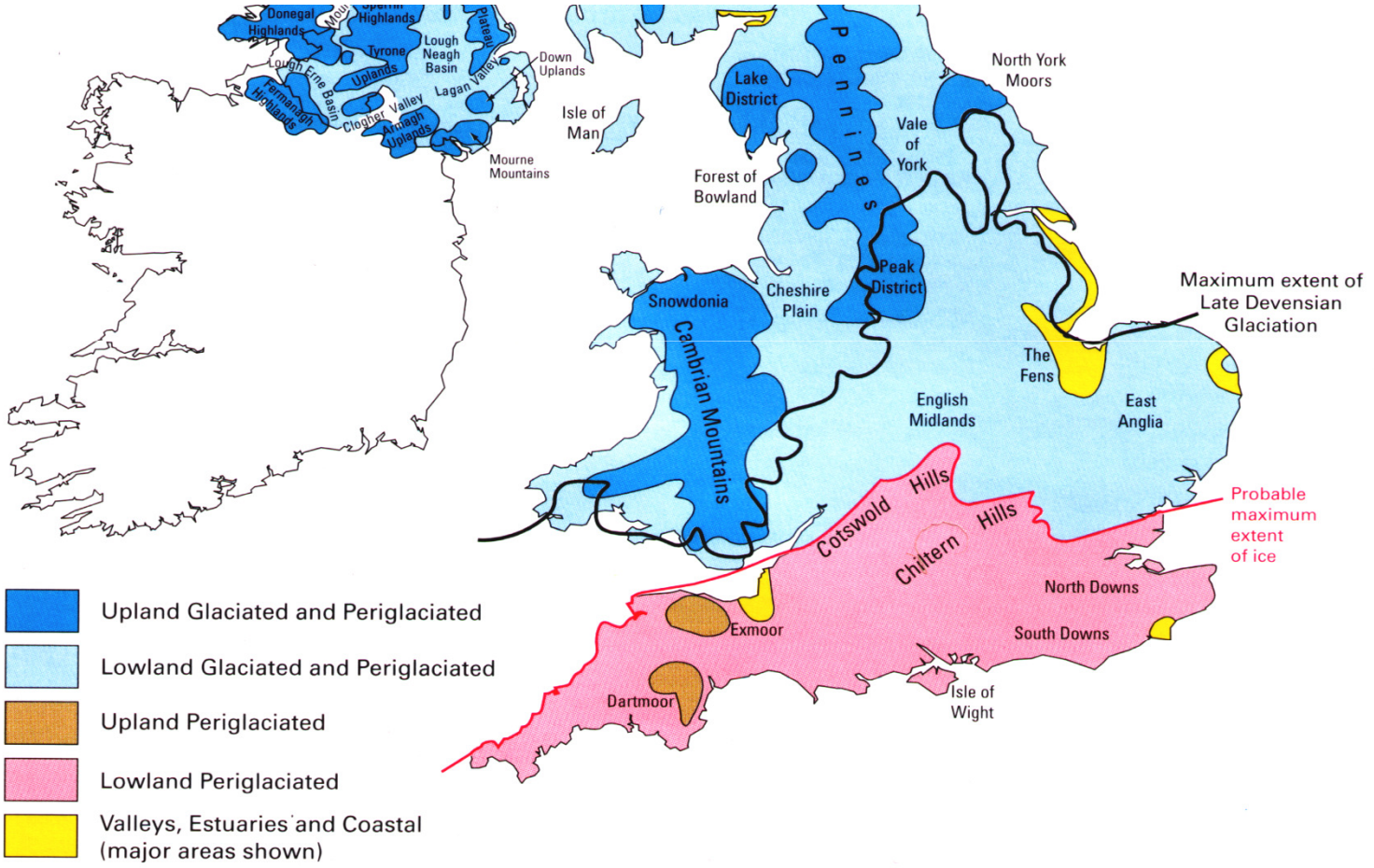
- Subglacial
- Supraglacial
- Glaciated Valley
- Proglacial
- Extra / Periglacial

Key Quaternary Environments

- Sub, Supra, En - Glacial
- Proglacial
- Extra / Periglacial



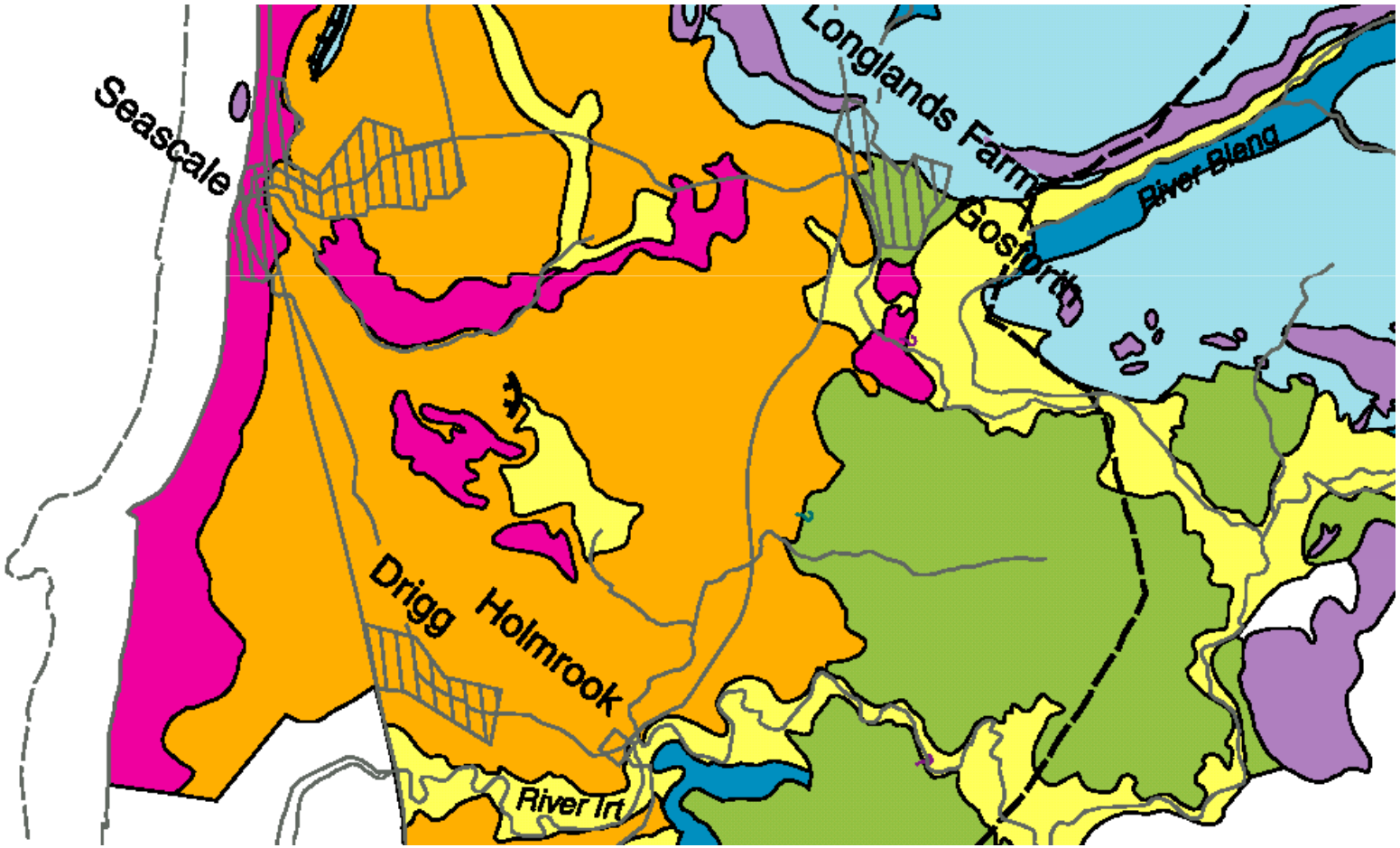
Provinces



UK Quaternary Provinces from Forster et al (1999)

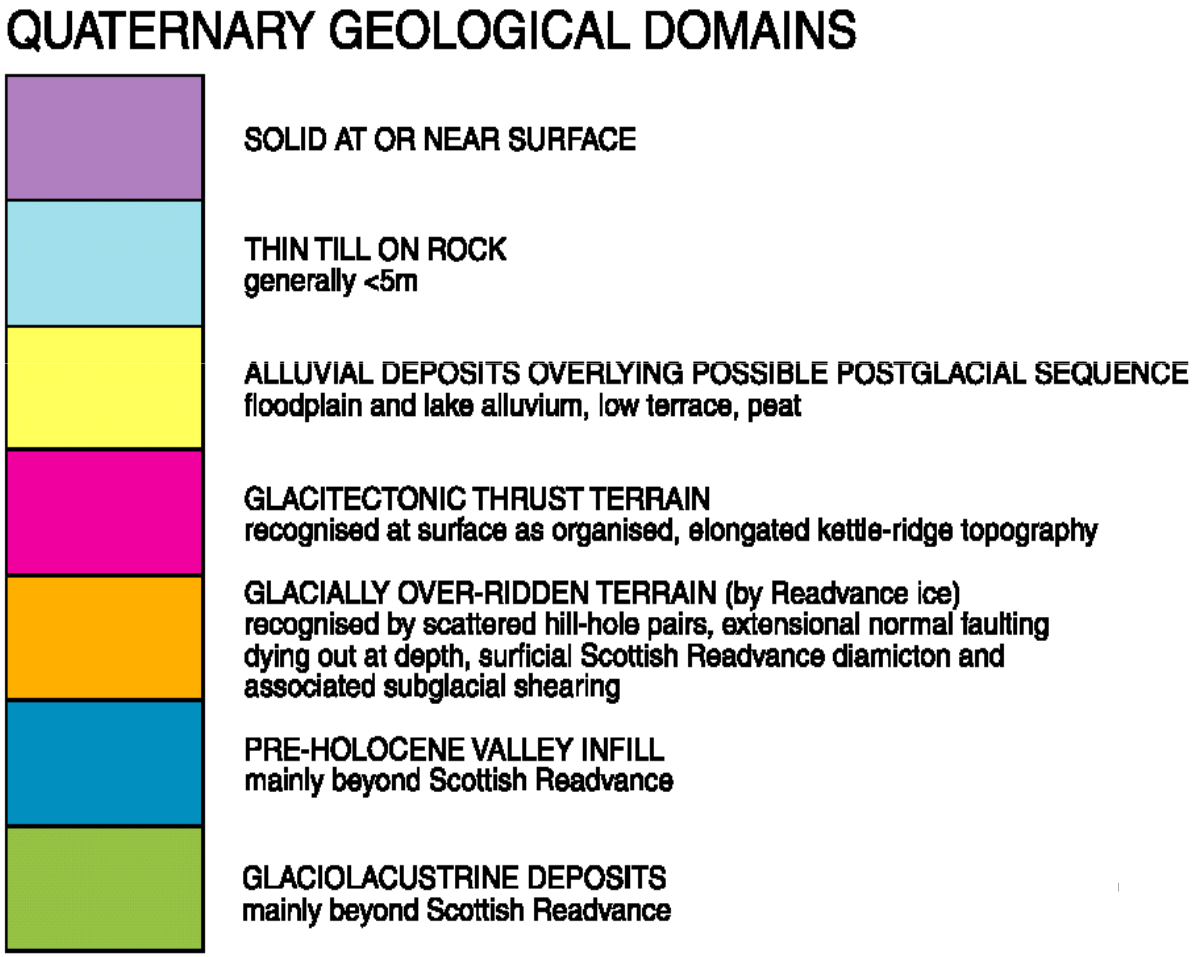
Figure 2 The UK Quaternary provinces.

Domains



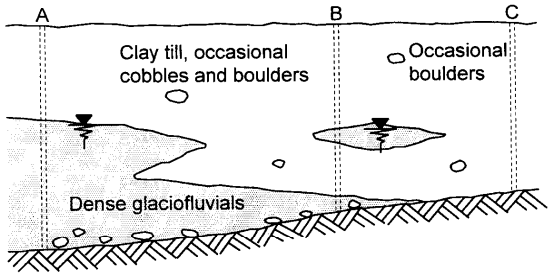
Quaternary Domains from McMillan, A.A. et al (2000)

Domains

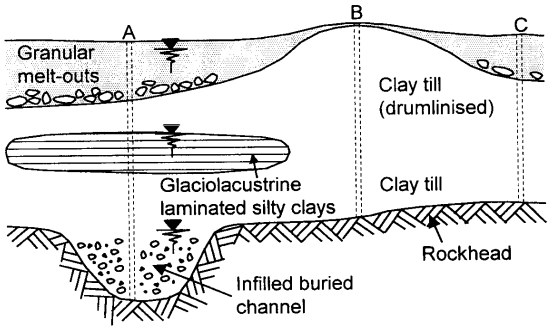


Quaternary Domains from McMillan, A.A. et al (2000)

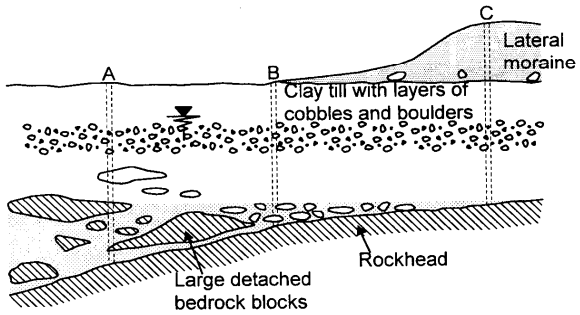
Glacial Environment



(a) Subglacial landsystem



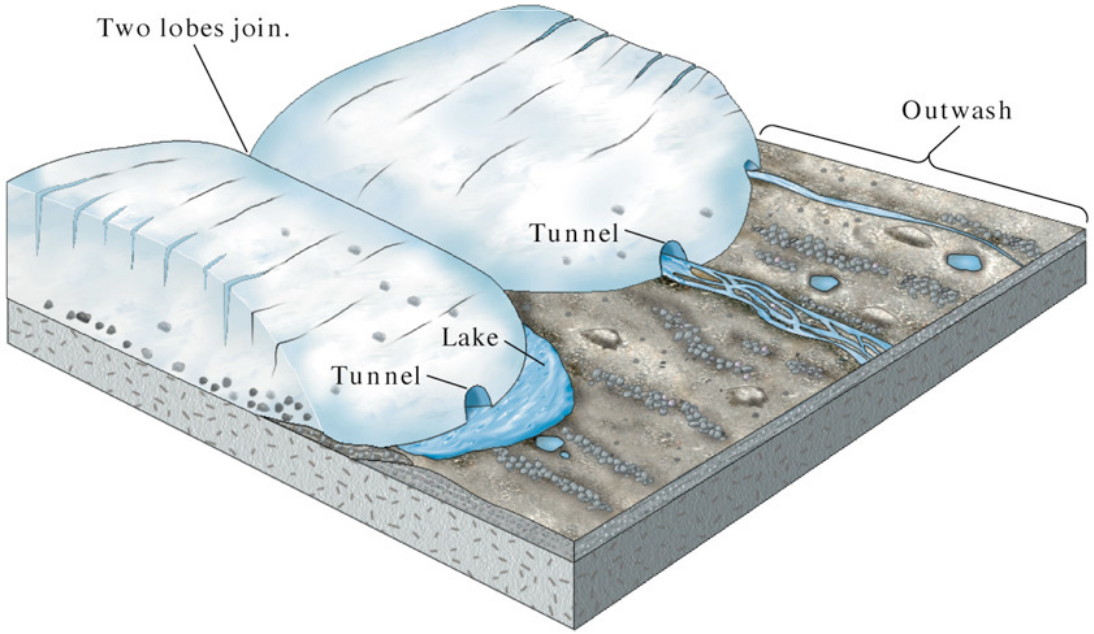
(b) Supraglacial landsystem



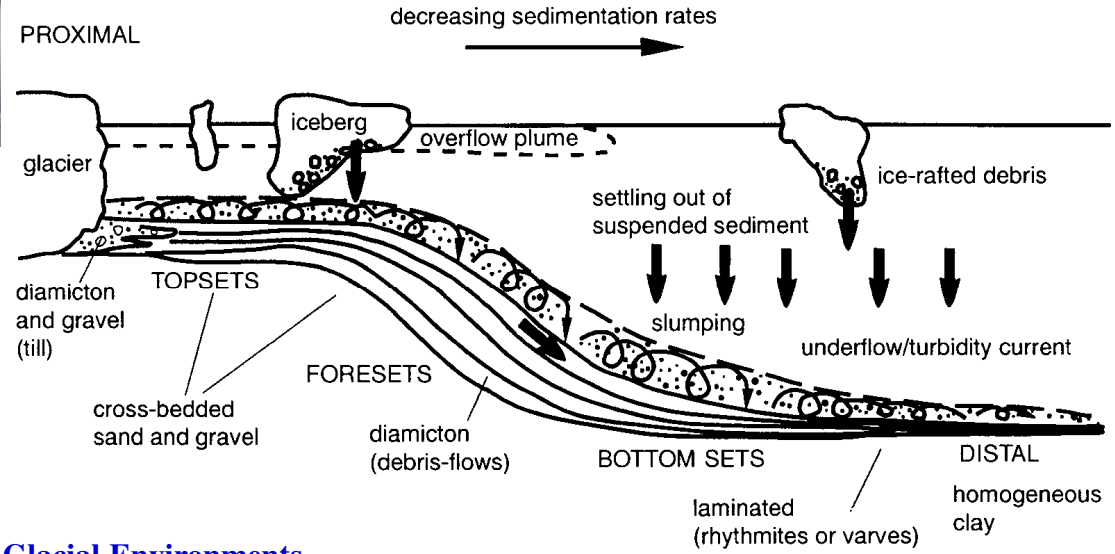
(c) Glaciated valley landsystem

Trenter N.A. (1999) Engineering in Glacial Tills

Fluvioglacial Environment

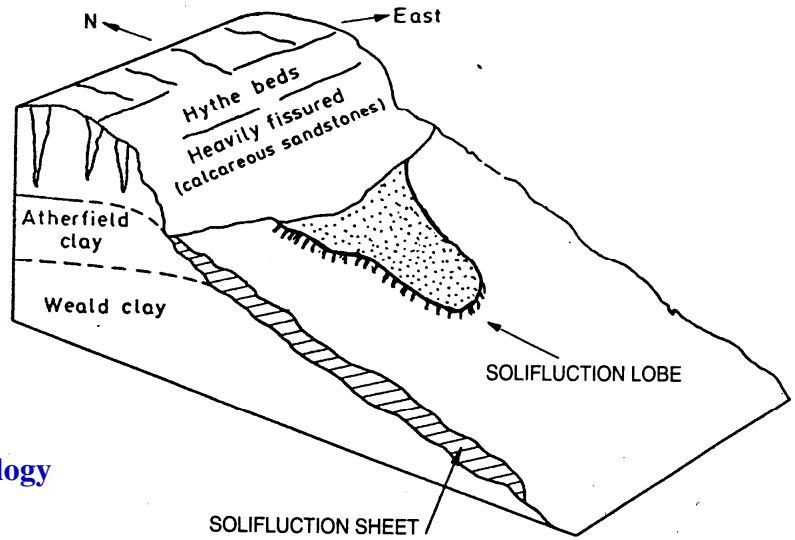


Glaciolacustrine Environment



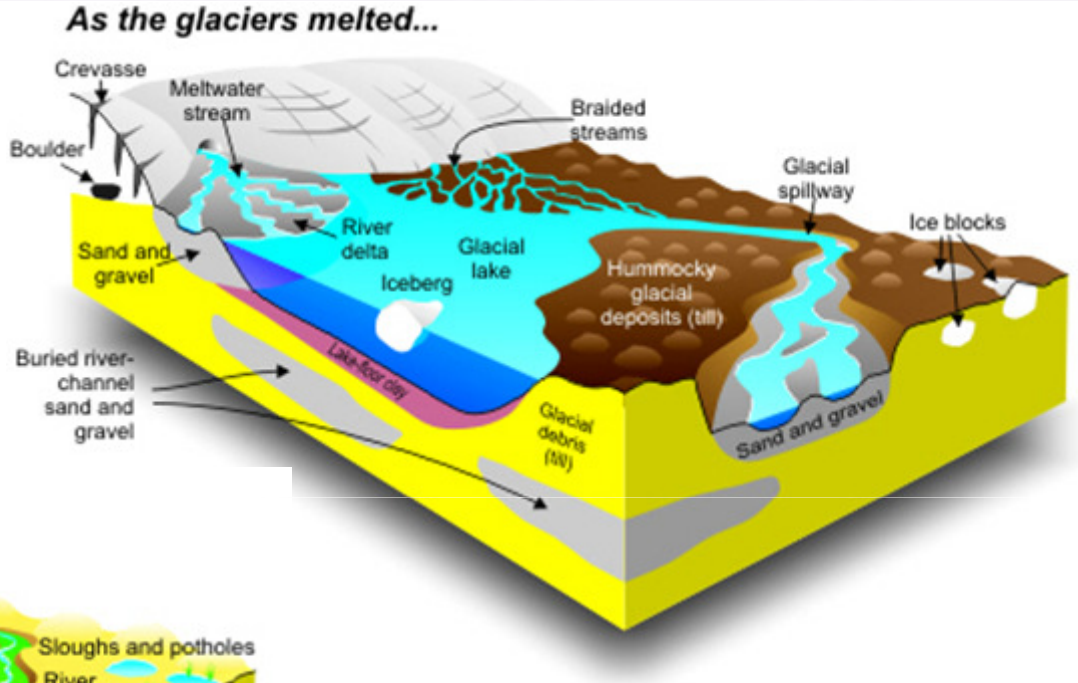
Hambrey, M. (1994) Glacial Environments

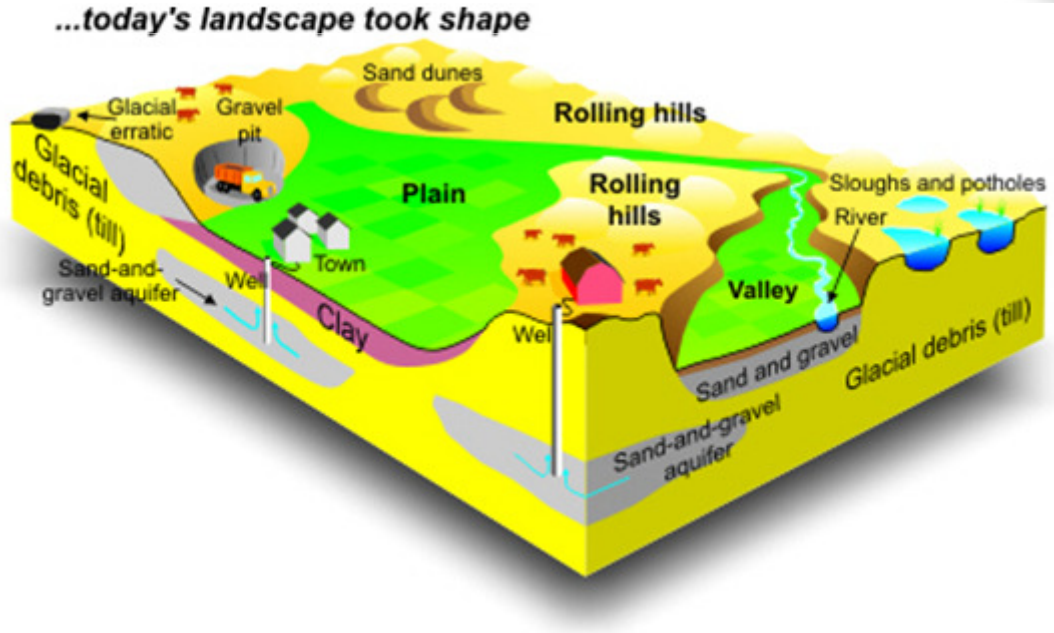
Periglacial Environment



Lower Greensand Escarpment Ground Model (Geology and Morphology) (After Symonds and Booth 1971)

Contemporary v Relict





Skills

- Description
- & Logging

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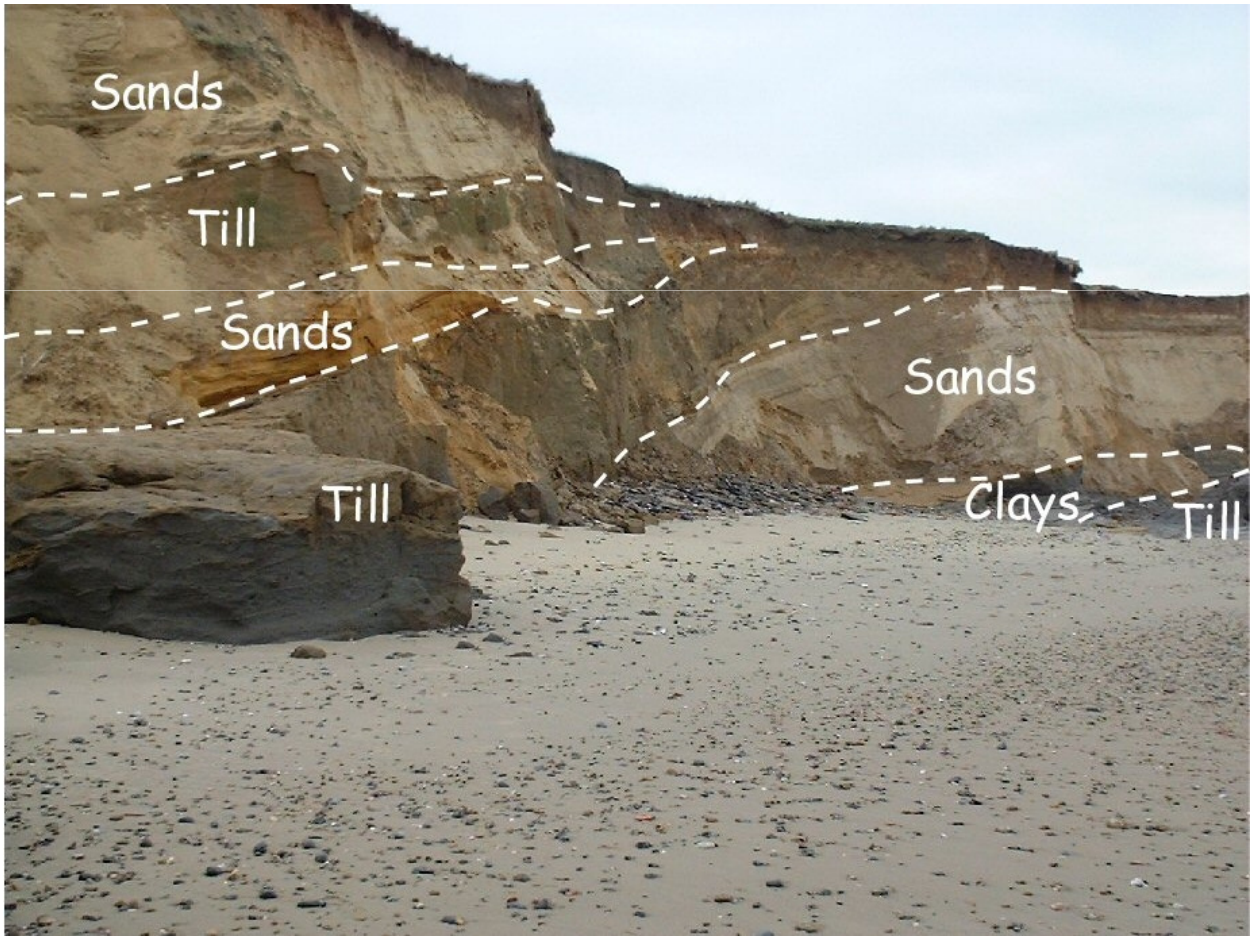
Skills

- Mapping

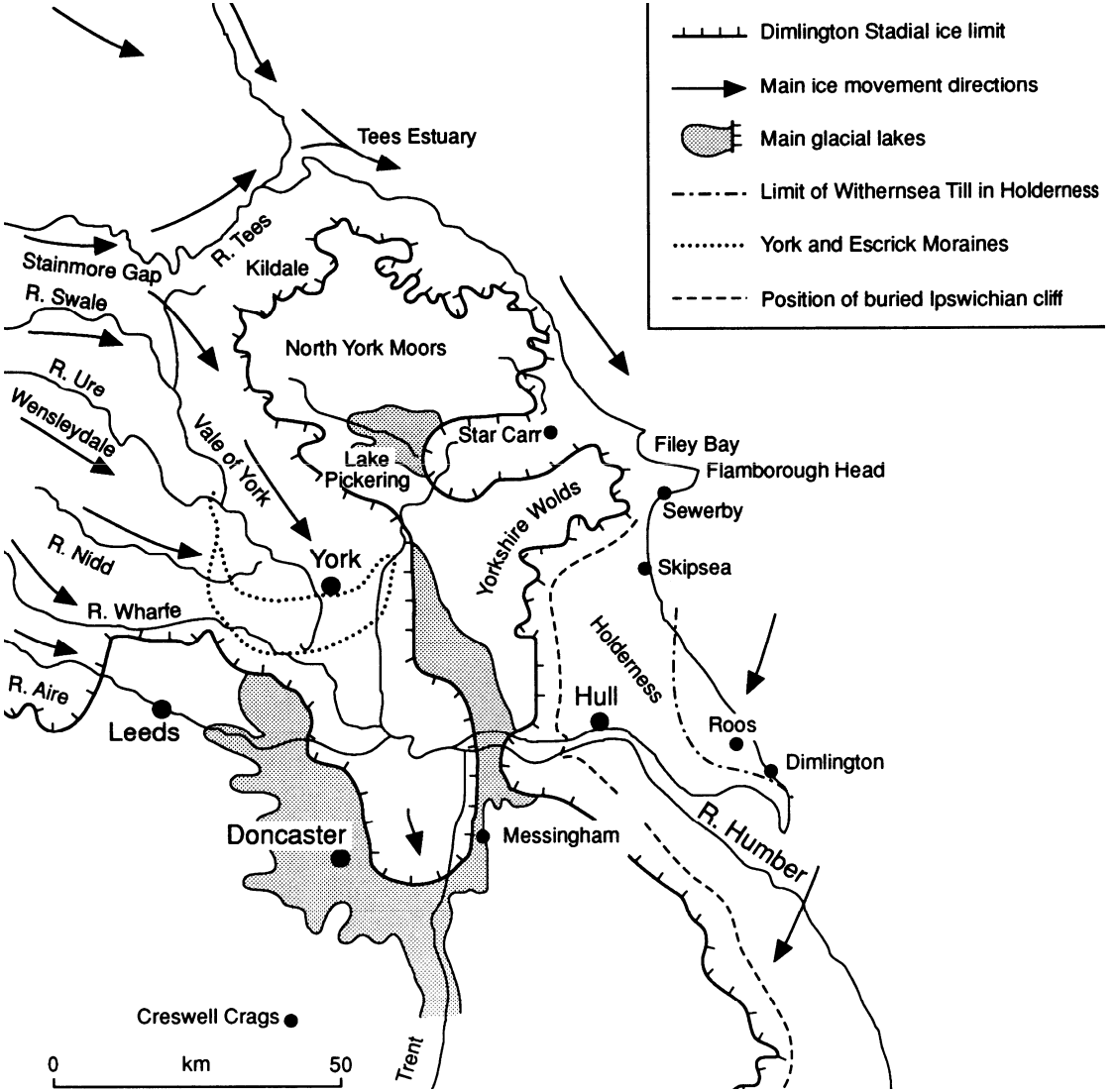
Skills

- **Interpretation**



Skills

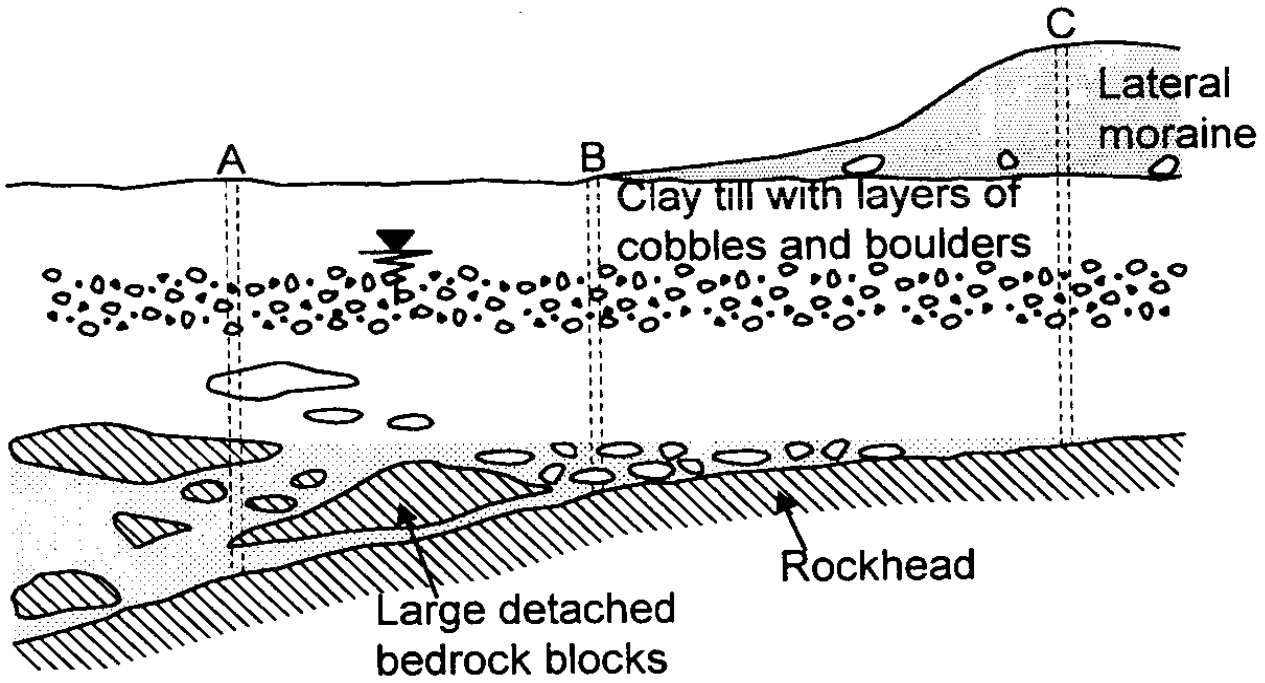
- Palaeoenvironmental reconstruction



Devensian glacial features of east Yorkshire (Catt 1987)

Skills

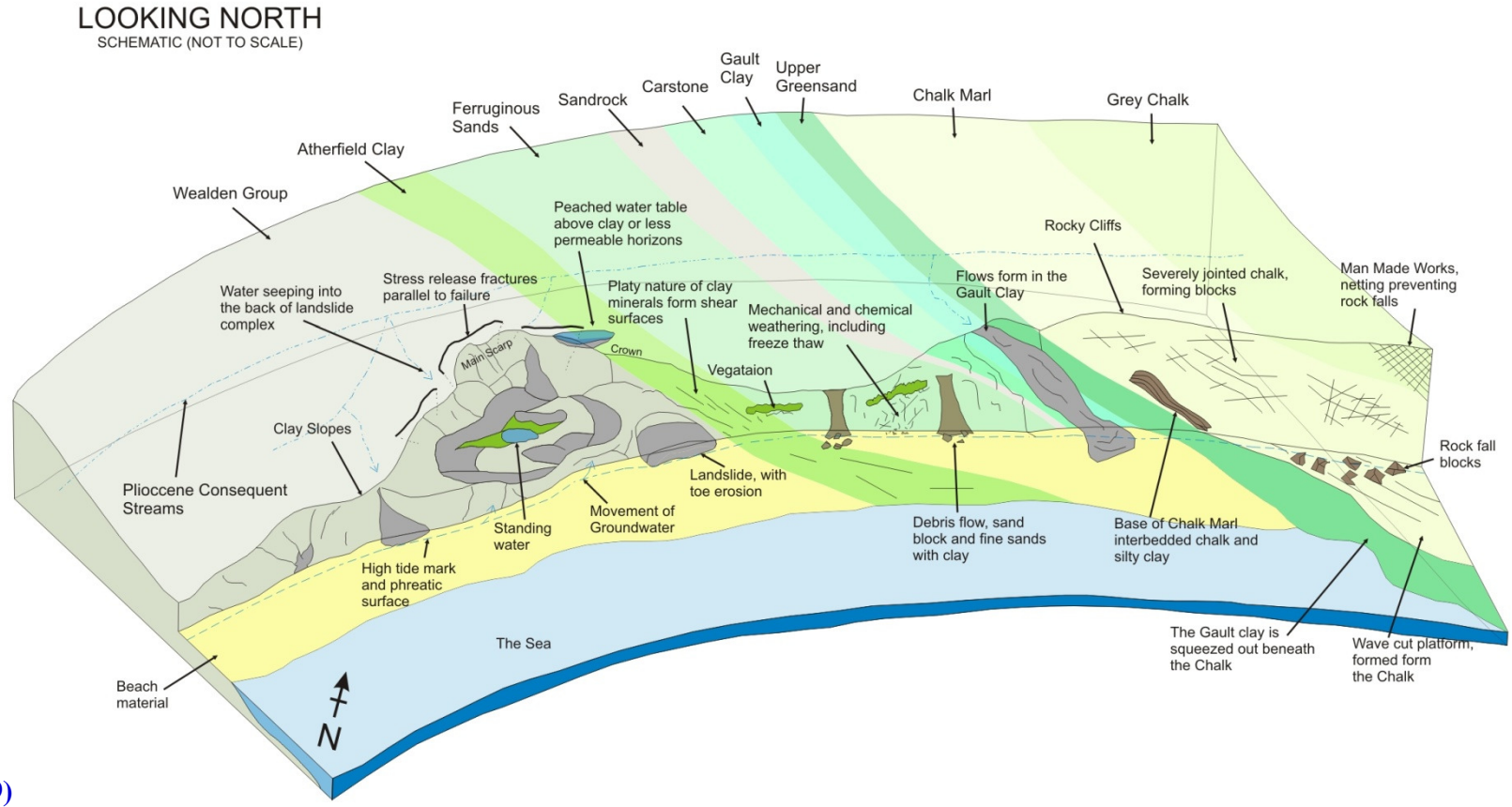
- **Conceptual Ground Models**



(c) Glaciated valley landsystem

Trenter N.A. (1999) Engineering in Glacial Tills.

Conceptual Ground Models

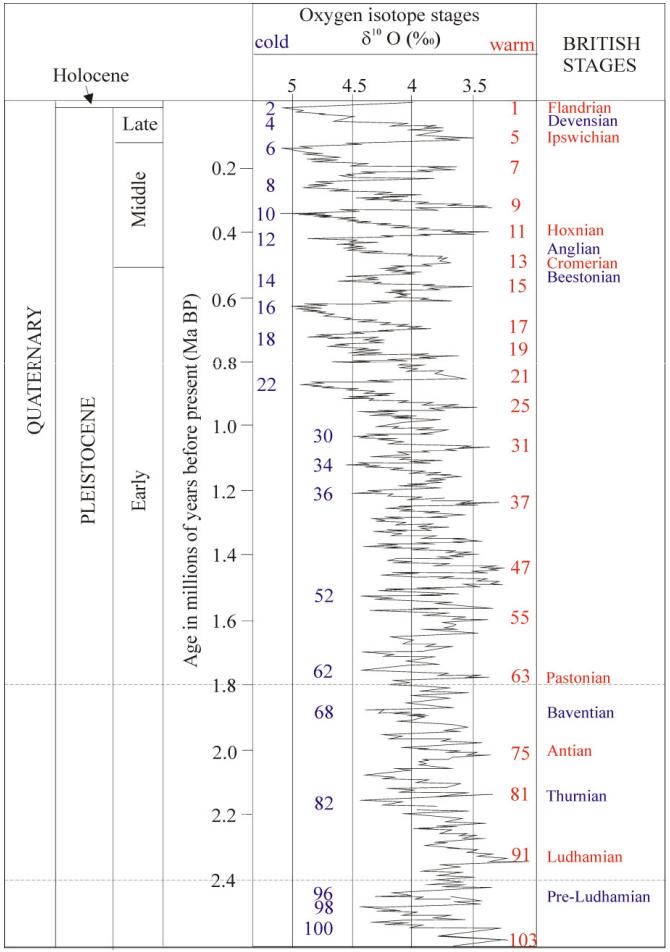


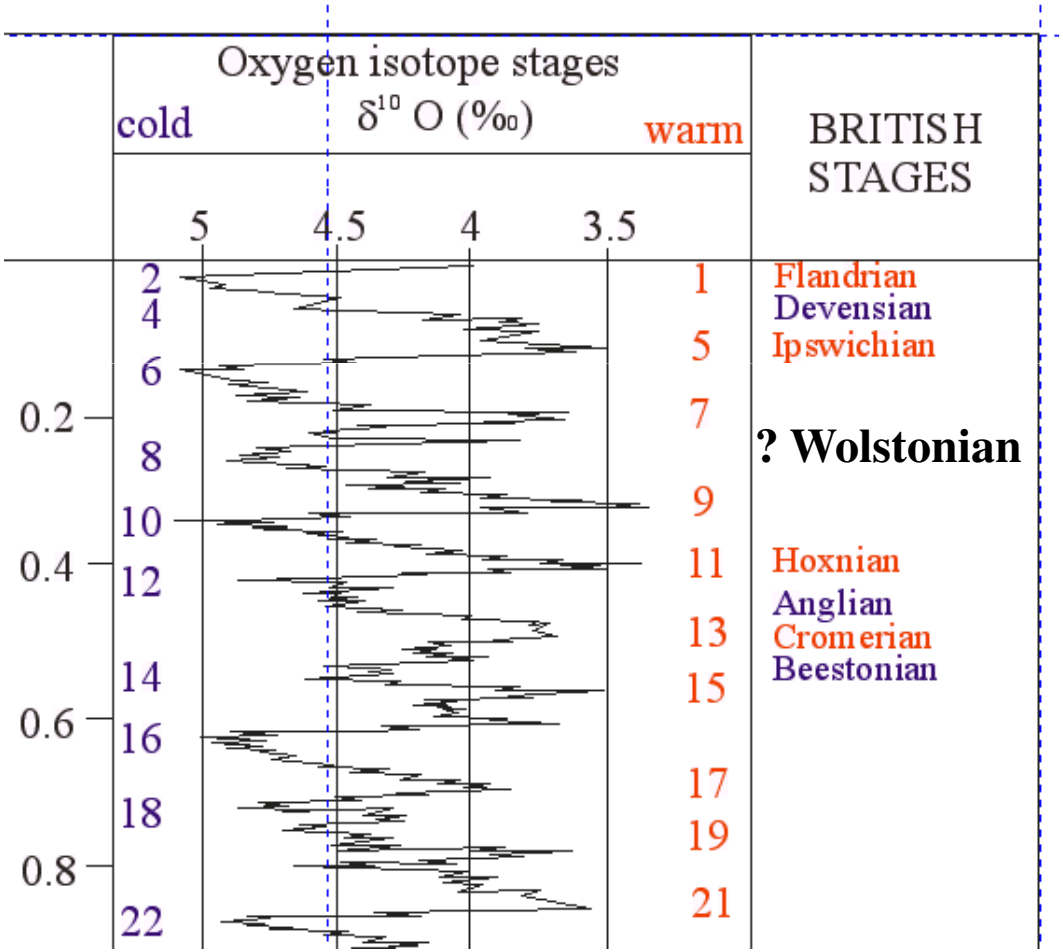
Wilkinson, L. (2009) University of Portsmouth

SANDOWN BAY - ISLE OF WIGHT

GEOLOGICAL & HYDROGEOLOGICAL GROUND MODEL
FIGURE 13

Stratigraphic Context





British Quaternary Stages from Forster et al (1999)

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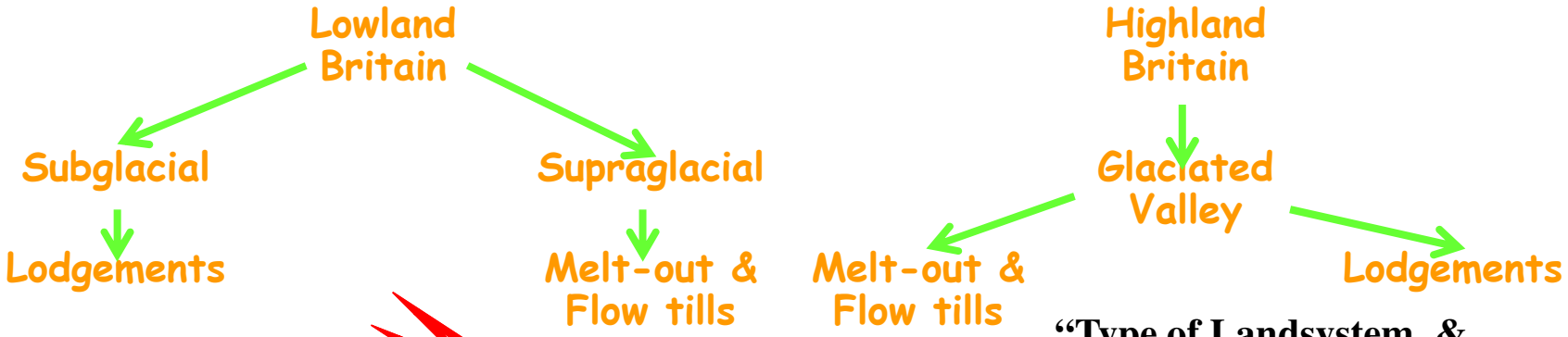
Geotechnics of Quaternary Deposits

Till Differentiation

- Primary Tills
  - Formed mainly by direct release of debris
  - Deposited by primary glacial processes
- Secondary Tills
  - Products of re-sedimentation of glacial debris
  - Little or no sorting by meltwater

Lodgement Till
Sub-glacial Melt-Out Till
Deformation Till
Supra-glacial Melt-Out (Moraine) Till
Flow Till
Sublimation Till



"Type of Landsystem, & hence the nature of the associated tills, is strongly dependent upon whether deposition was within lowland or highland terrains", CIRIA Report C504

Topographic Region

Land System

Till Type

Depositional Fabric

Pots – Depositional fabric

CIRIA Report C504

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Geohazard Posed by Quaternary Deposits

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Fieldwork Programme

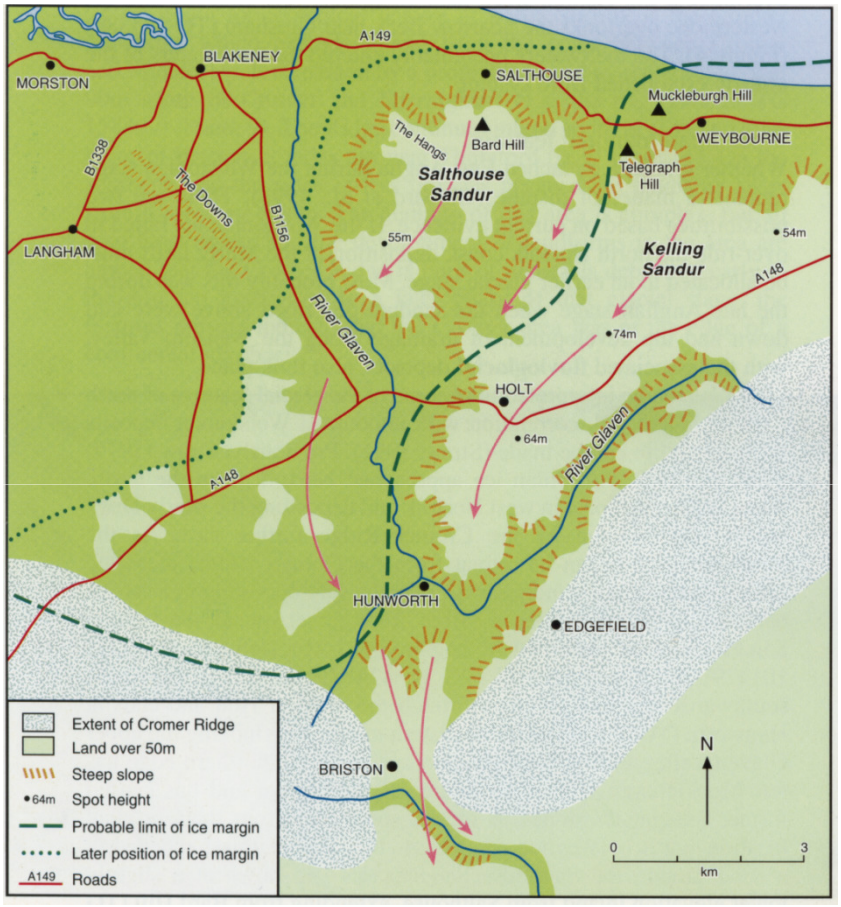
Hertfordshire

- Royston

Aerial view of a typical scene on the Chalk scarp, looking east along the scarp from over Therfield towards Reed (right centre) and Barkway (top right), showing till with chalk rafts emplaced by glacial tectonics (photo by Brian Sawford).

North Norfolk

- Kelling Heath



E M Bridges (1998) Classic Landforms of the North Norfolk Coast

North Norfolk

- Happisburgh

North Norfolk

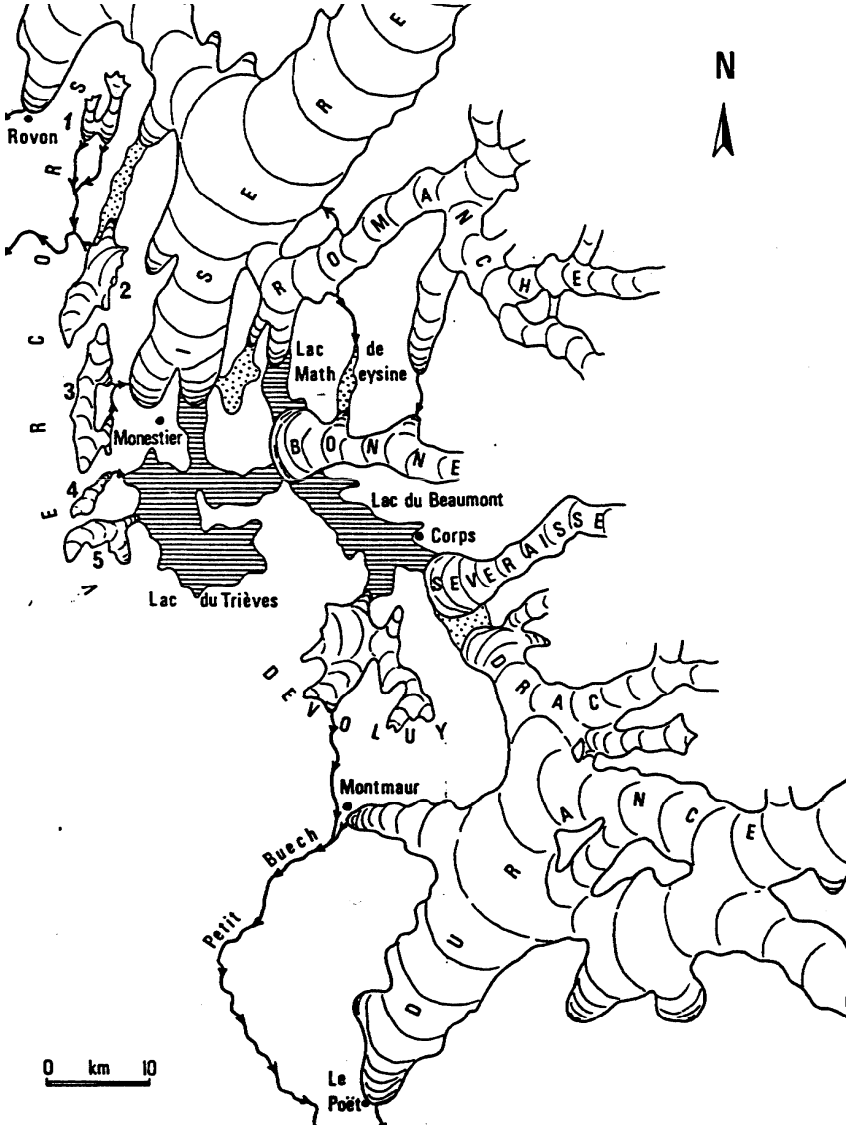
- West Runton

North Norfolk

- Overstrand

French Alps

- Isere



French Alps

- Sinard

French Alps

- Sinard

French Alps

- Ponsonnas

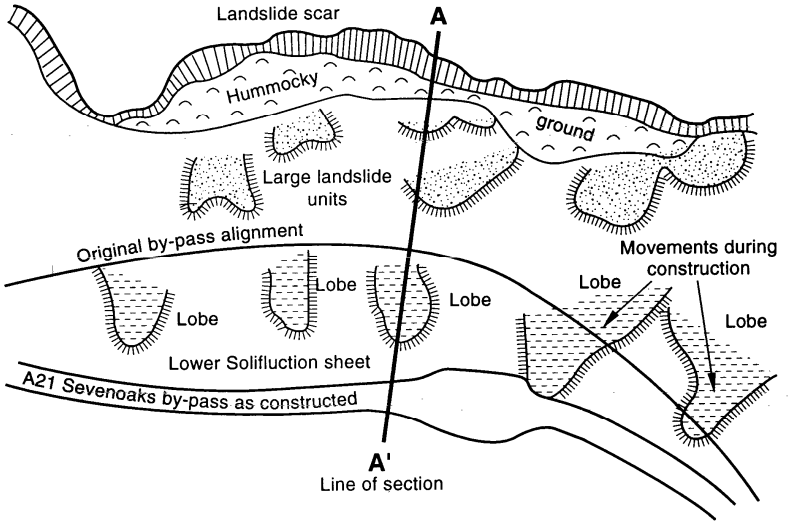
French Alps

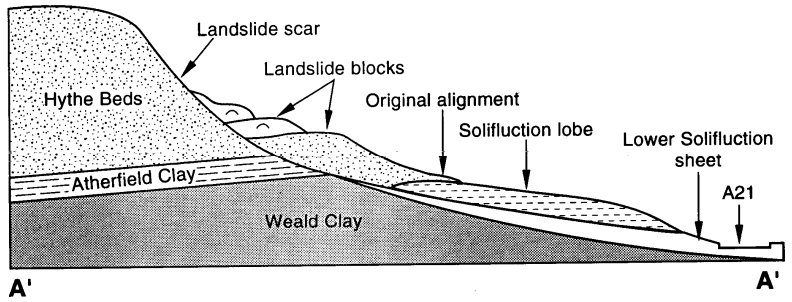
- Salle en Beaumont

Periglacial Environments

- A21 Sevenoaks Bypass

Lower Greensand Escarpment at Sevenoaks, which caused considerable problems during road construction, after Brunsden et all, 1988.





Periglacial Environments

- Pegwell Bay

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Periglacial Environments

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Periglacial Environments

- Pegwell Bay

Summary

- Observe a wide range of relict glacial & periglacial environments
- Observe a wide range of glacial & periglacial deposits

- Describe, log, map & interpret
- Understand Quaternary processes / deposits & Recognise their engineering significance

- Visualise & develop Quaternary Conceptual Ground Models

Feedback

- Is this the type of education, training and Continuing Professional Development required for Quaternary Engineering Geology ?
- What is missing ?
- What is redundant ?
- Comments / Input very welcomed !

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Key References

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- Phipps, P.J. (2002) Engineering geological constraints for highways schemes in Ireland: N6 Kinnegad to Athlone dual carriageway case study. *QJEGH, 35, 233–246.*
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- Hambrey, M. (1994) Glacial Environments. UCL Press.
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Acknowledgments

The Higher Education Academy Geography, Earth and Environmental Sciences (GEES)

- Small-Scale Learning and Teaching Research and Development Projects: 2005
  Theme: Bringing the 'Real World' into the GEES Student Learning Experience

  The Development of Fieldwork Problem-Based Learning in the Applied Geosciences