

Geology of the Yorkshire Coast



Dr Liam Herringshaw - lgh865@hotmail.com

4. Staithes – of Sand and Iron

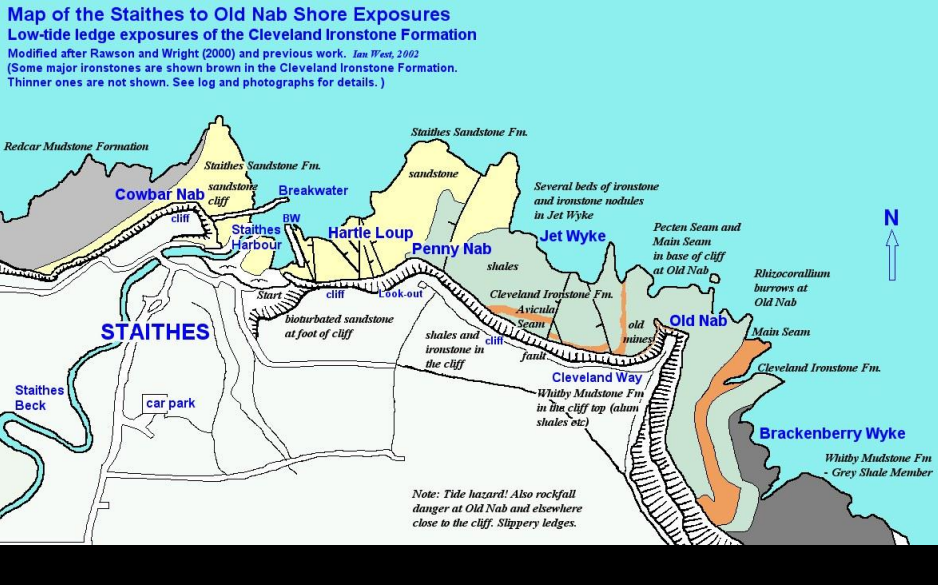


Early Jurassic

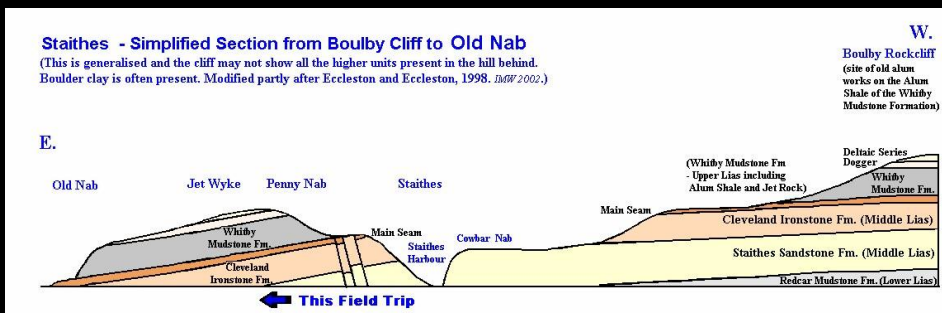
Staithes
Sandstone
Formation

Cleveland
Ironstone
Formation

Staithes to Old Nab



Simplified cliff section



Rocks get younger towards south and east:
RMF-SSF-CIF-WMF

Staithe Sandstone Formation



Upper Pliensbachian	Spinatum	Cleveland Ironstone Formation	Kettleless Member (10 m)	Redcar Ro Robin Hood's				
	Margaritatus		Penny Nab Member (19 m)					
	Davoei	Staithe Sandstone Formation (25 m)						

Early Jurassic: Middle Pliensbachian

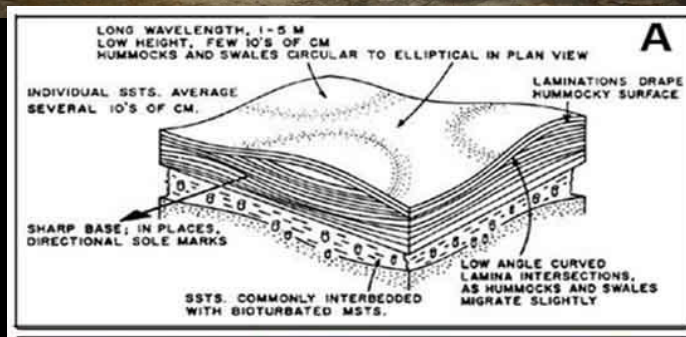
Key features



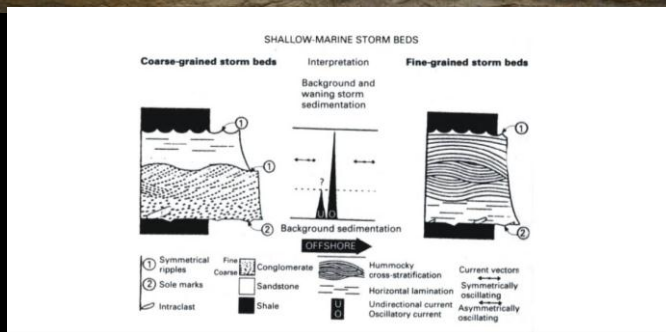
Sandstones with cross-stratification

Burrowed siltstones

Hummocky cross-stratification



Fine-grained storm deposits



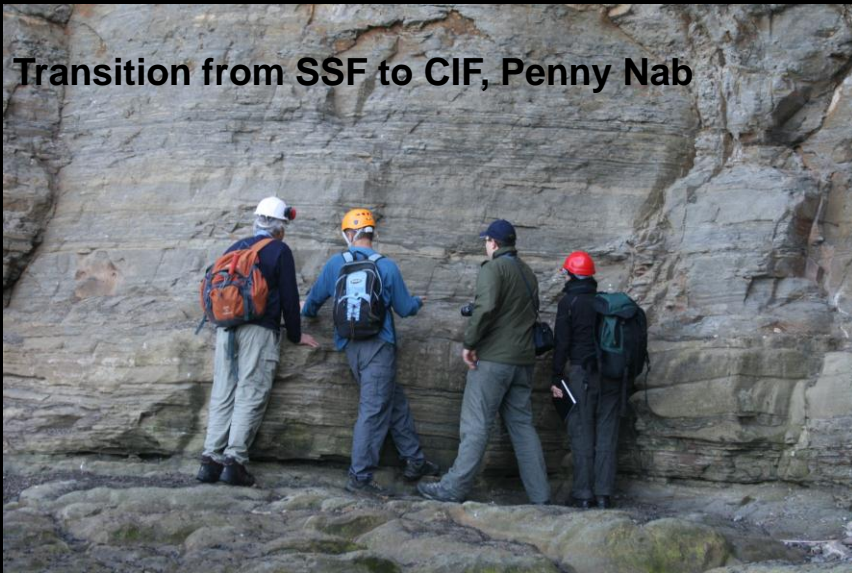
Burrowed siltstones



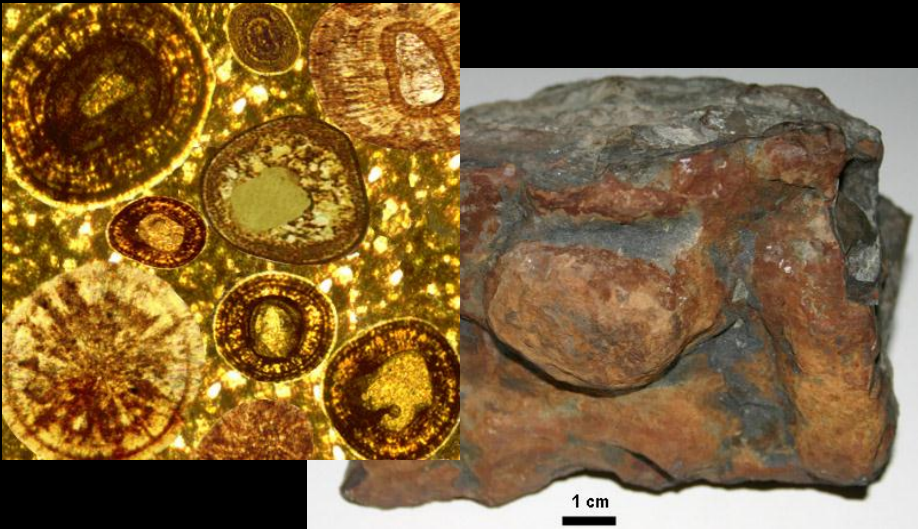
After each storm, organic-rich silts deposited in quieter conditions

Cleveland Ironstone Formation

Transition from SSF to CIF, Penny Nab

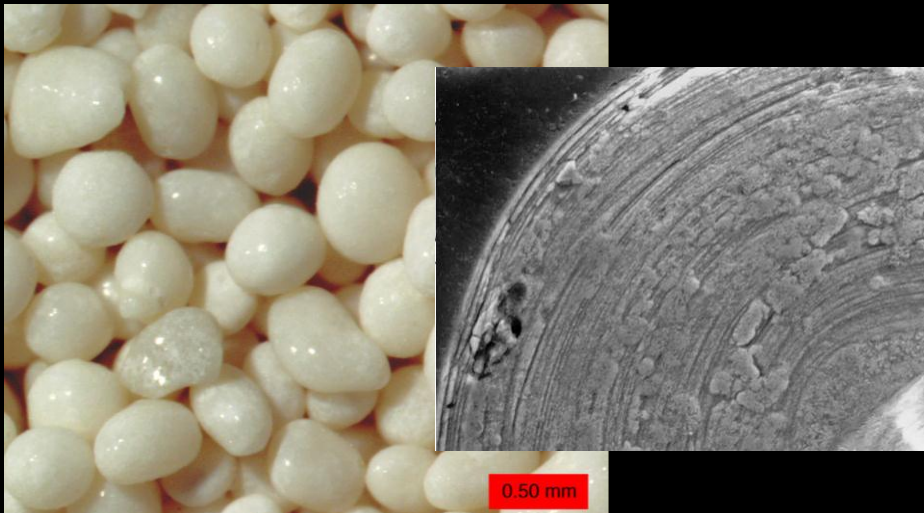


Oolitic ironstones



Cleveland Ironstone Formation

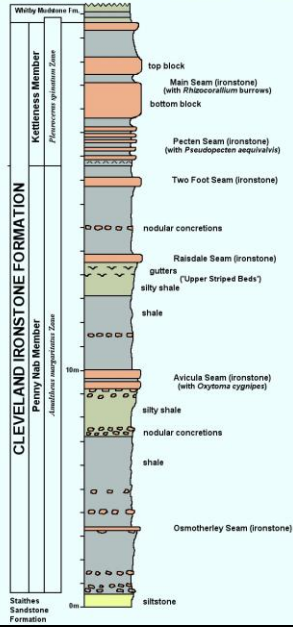
Modern oolites



Warm, wave-agitated waters

Cleveland Ironstone Formation - Succession between Staithes and Old Nab.

(With simplifications and modifications after Rawson and Wright, 2000. See that publication for full details, bed numbers, and references to previous work, 1899, 2002.)



Stratigraphy

Cleveland Ironstone Formation in the cliff at Penny Nab, Staithes
Ian West (c) 2002



Fossils



Old Nab



Ironstone burrows



Siderite – iron carbonate

Grows in sediment



Staithes Yorkshire, Jet Wyke. Concretionary siderite nodules in shale of the Cleveland Ironstone Formation, Middle Lias, Lower Jurassic. (Eroded, intertidal, shore platform with numerous living, black, *Littorina* shells and white barnacles). August 2002. Ian West (c) 2002.

Needs low oxygen,
low-sulphide
conditions with iron
and calcium

Normally grey; turns
red when oxidized

Cleveland ironstone environment

Fossils = marine conditions

Ooids = high energy environment

Primary iron-rich ooids = iron-rich waters

Burrow scratches = firm sediments

Shallow sea, wave-agitated, lots of runoff
from land (with iron-rich soils?)

Jet-powered Whitby



Early Jurassic

Whitby
Mudstone
Formation

Grey Shales
Black Shales
Alum Shales

Whitby Mudstone Formation



Whitby Mudstone Formation

Stage	Ammonite zone	Lithostratigraphy	
Toarcian	Aalensis	Blea Wyke Sandstone Formation	Yellow Sandstone Member (9 m)
	Pseudoradiosa		Grey Sandstone Member (9 m)
	Dispansum		Fox Cliff Siltstone Member (11 m)
	Thouarsense	Whitby Mudstone Formation	Peak Mudstone Member (13 m)
	Variabilis		Alum Shale Member (37 m)
	Bifrons		Mulgrave Shale Member (32 m)
	Serpentinum		Grey Shale Member (14 m)
	Tenuicostatum		

Rocks of the Bay
 Castlechamber to Maw Wyke
 Miller's Nab to Blea Wyke
 Staithes to Port Mulgrave
 Boulby Quarries
 Whitby to Saltwick

Late Early Jurassic – Toarcian
5 subdivisions, mostly muddy

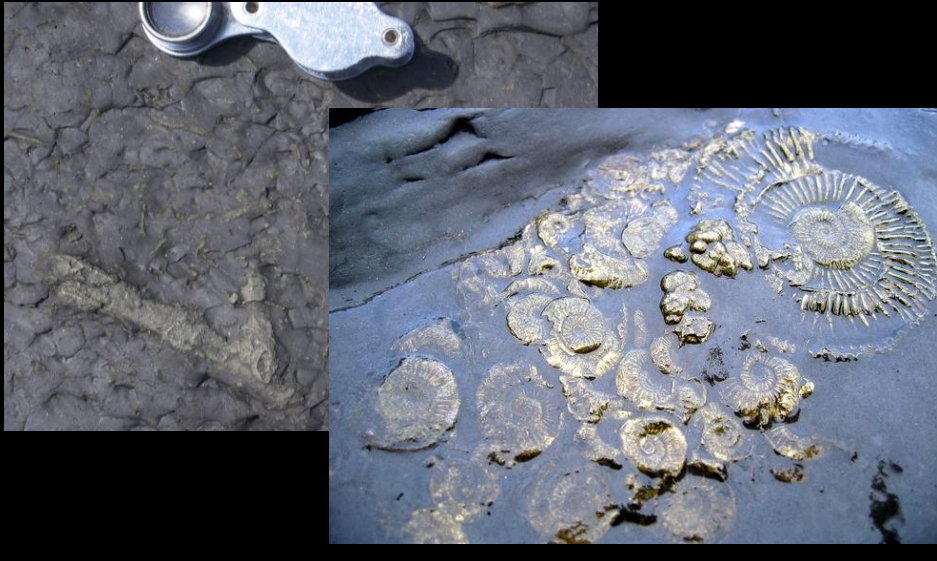
Common features - sediments

Finely laminated, dark grey mudstones



Common features - minerals

Pyrite (iron sulphide)



Ammonites



Harpoceras



Hildoceras



Dactyloceras

Fossils - reptiles



Temnodontosaurus crassimanus

Plant fossils

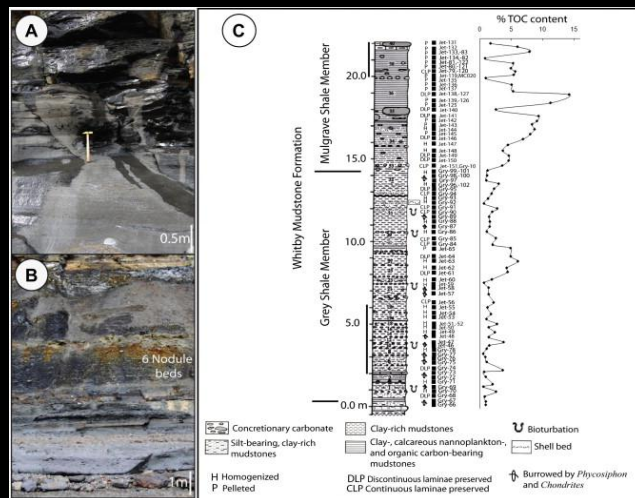


Port Mulgrave



Mulgrave Shale Member (Jet Rock)

The Jet Rock



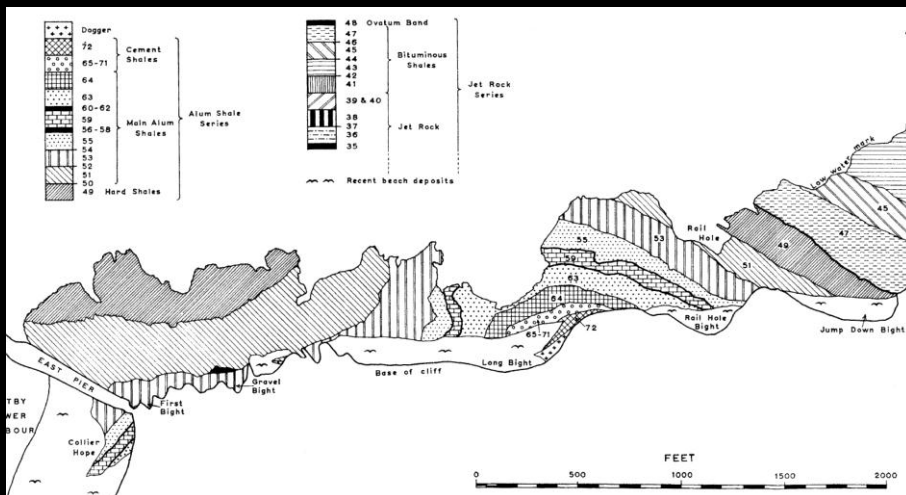
Significant increase in Total Organic Carbon

Mid-upper WMF – Whitby



Bituminous → Alum Shales

Whitby–Saltwick Nab



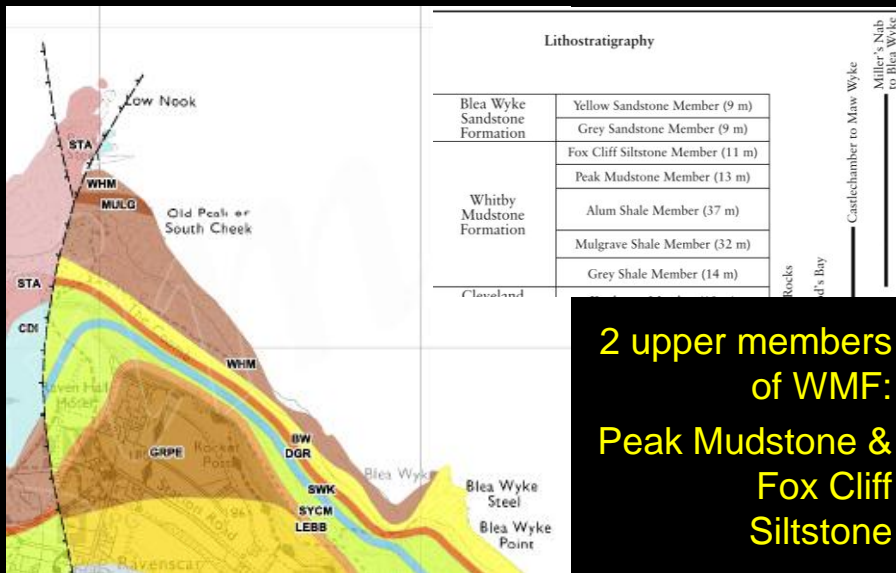
Bituminous → Alum Shales

Saltwick Nab



Bituminous Shales beneath Alum quarries

Ravenscar – Blea Wyke



2 upper members of WMF:
Peak Mudstone & Fox Cliff Siltstone

Upper WMF – Blea Wyke



Mudstone → Siltstone → Sandstone

Links

Oolitic ironstones (US Geological Survey):

http://pubs.usgs.gov/bul/b2004/html/bull2004oolitic_ironstones.htm

Geology of Staithes:

<http://www.southampton.ac.uk/~imw/staithes.htm>

John Vaughan, Cleveland Iron Man:

<http://www.chrisscottwilson.co.uk/#/bolckow-v-2/4546273208>

Links

The Toarcian Ocean Anoxic Event:

<http://www.space.com/5271-gasping-breath-jurassic-era.html>

The Alum Trade of North Yorkshire:

<http://www.tvrigns.org.uk/industrial-geology/alum>

Fossils in Whitby Museum:

<http://www.whitbymuseum.org.uk/collections/foss.htm>