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Some new insights into the Geology of the Black Country UNESCO Global Geopark

'celebrating Earth heritage supporting local communities'

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Talk Structure

- A few facts about the Geopark
- General geological setting
- Current research & recent discoveries events
- The Geopark Research Group & themes
- How you can help
- Questions

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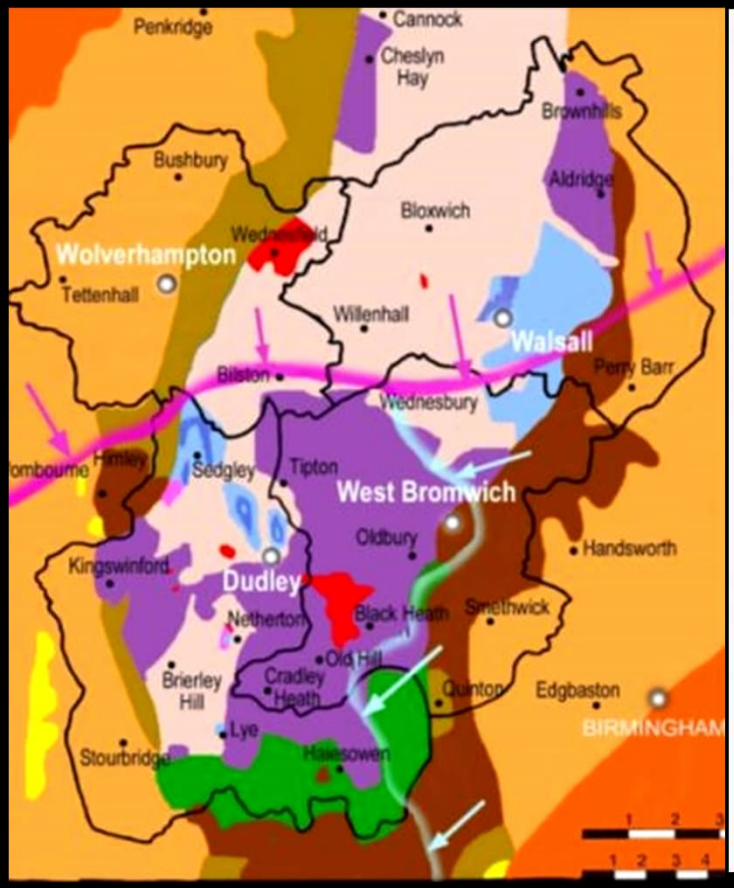
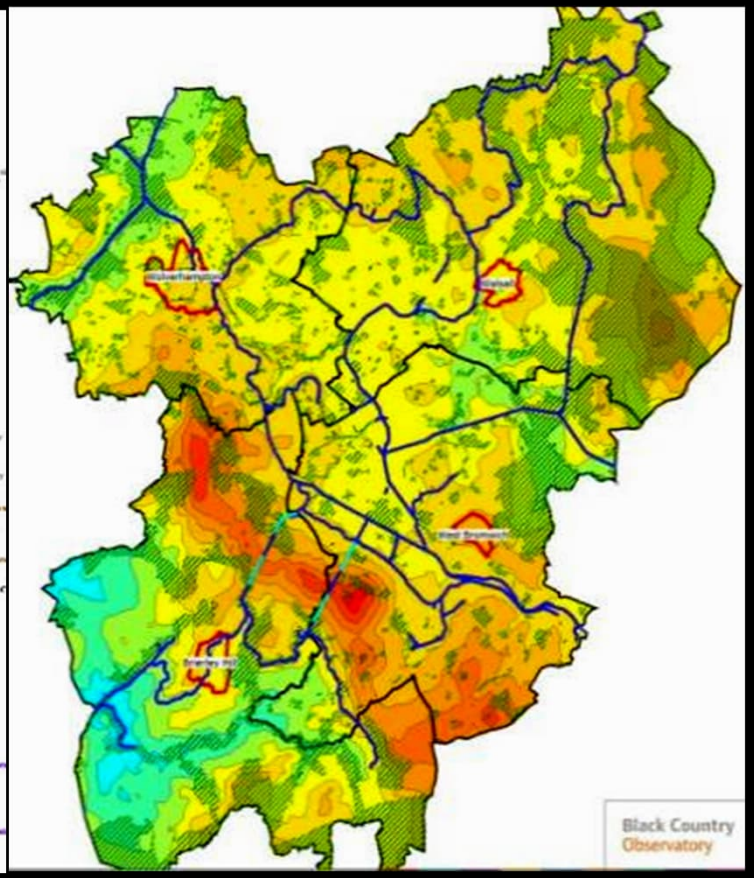
Exceptional Geology, Unique Landscape

The Black Country UNESCO Global Geopark





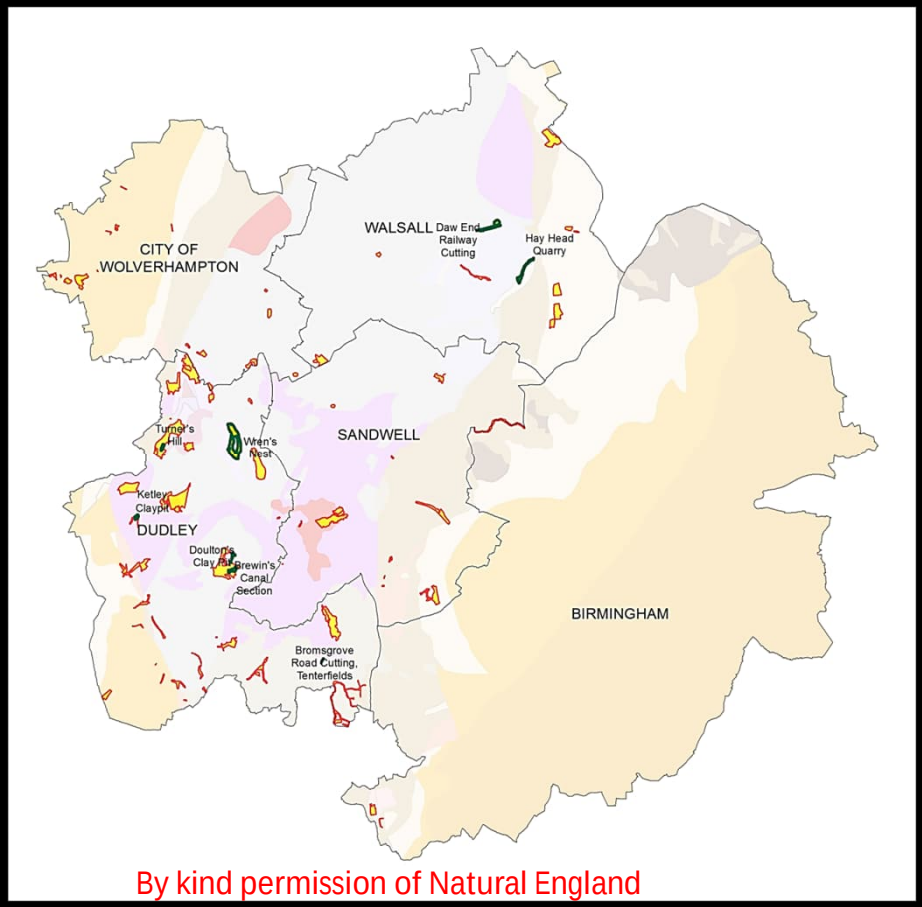
'Nowhere in England are more geological features brought together in a small compass than in the environs of Dudley or in which their characters have been more successfully developed by the labours of practical men'..... *Sir Roderick Murchison 1841*

Source BCGAP

Source BCC EIU

Geological Assets of the Black Country

- UK's first Palaeozoic geological NNR
- 16 SSSIs
- 235 sites of importance for nature conservation
  68 are geological
- 471 sites of local importance for nature
- 3 museum collections



By kind permission of Natural England

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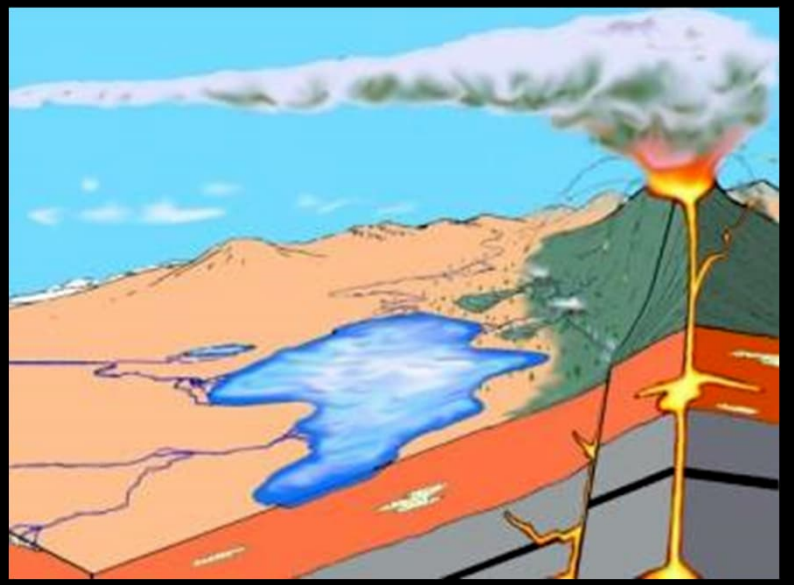
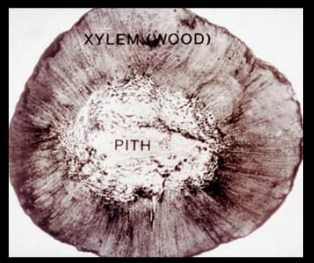
Exceptional Geological Heritage





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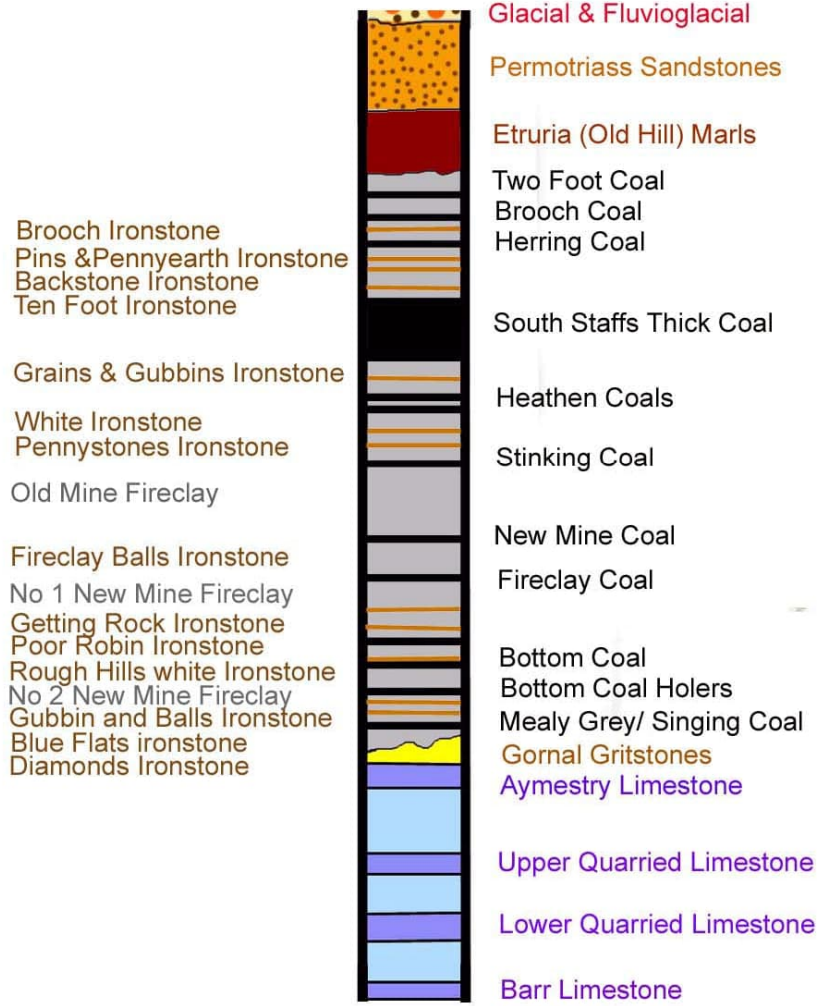
Some of the major mineral horizons worked in the Black Country



Not To Scale

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Digging the Dirt -Black Country minerals & mining summary

- Iron age clay working
- Roman ironstone mining
- Medieval coal mining 1271 onwards
- 10,000 ironworks 1665
- 1500 coal mines from 1874 onwards
- 11 coal seams
- The thickest coal seam in the UK 12m
- 11 Ironstones
- 14 fireclays
- 4 limestones

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Current research & latest events & discoveries

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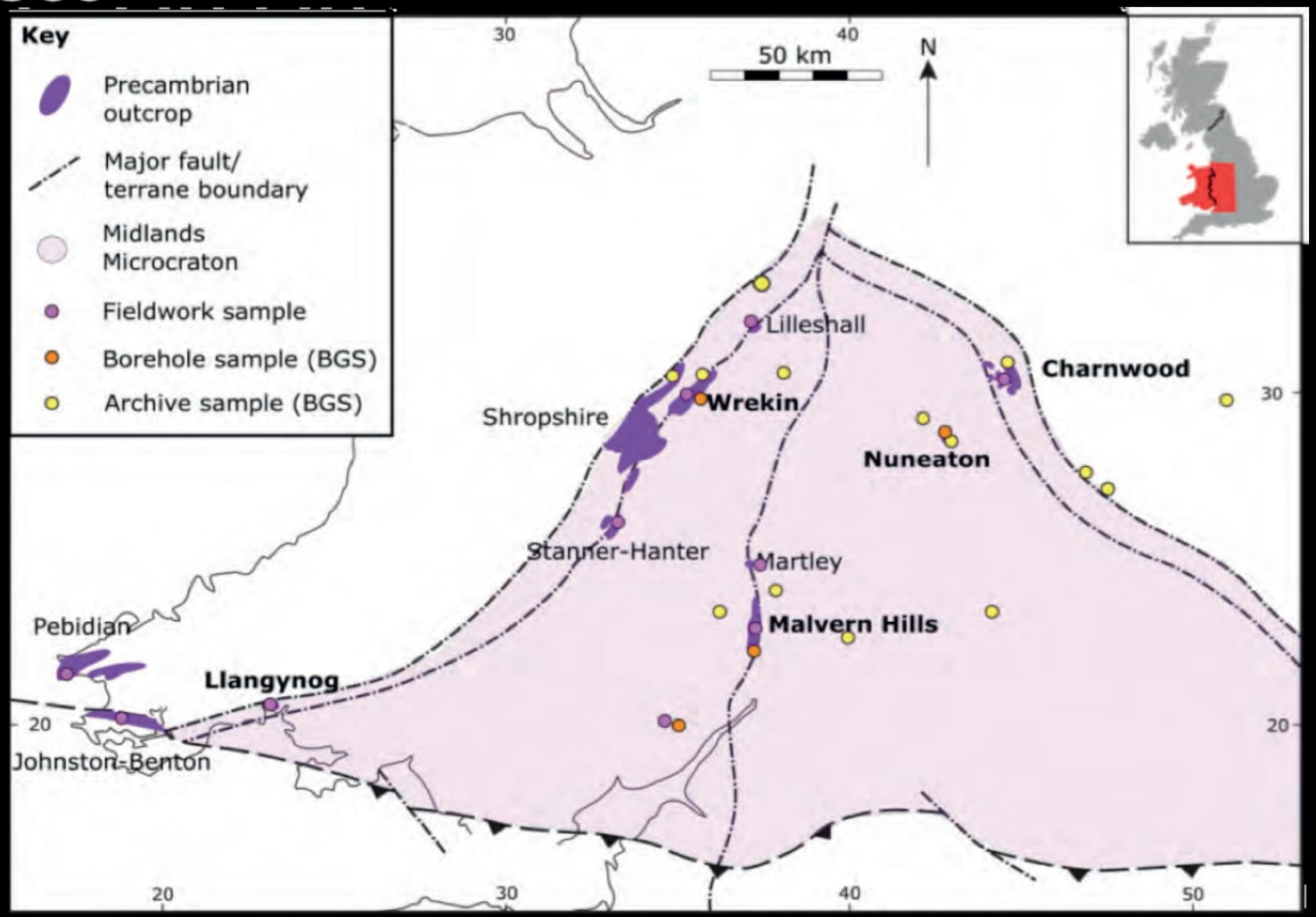
Midlands Microcraton



After Miocevich and based on Pharaoh T and Carney J (2000),

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Midlands Microcraton

- roughly triangular region in central Britain
- most of England's and Wales' Precambrian outcrops
- behaved as a coherent deformation-resistant block
- 5–10 km thicker rigid crust compared to its surroundings
- most cratonic regions are thought to have dry,strong, high-grade metamorphic rocks
- Midlands Microcraton is relatively hydrated arc volcanic and related sedimentary rocks, which show no evidence of high-grade metamorphism

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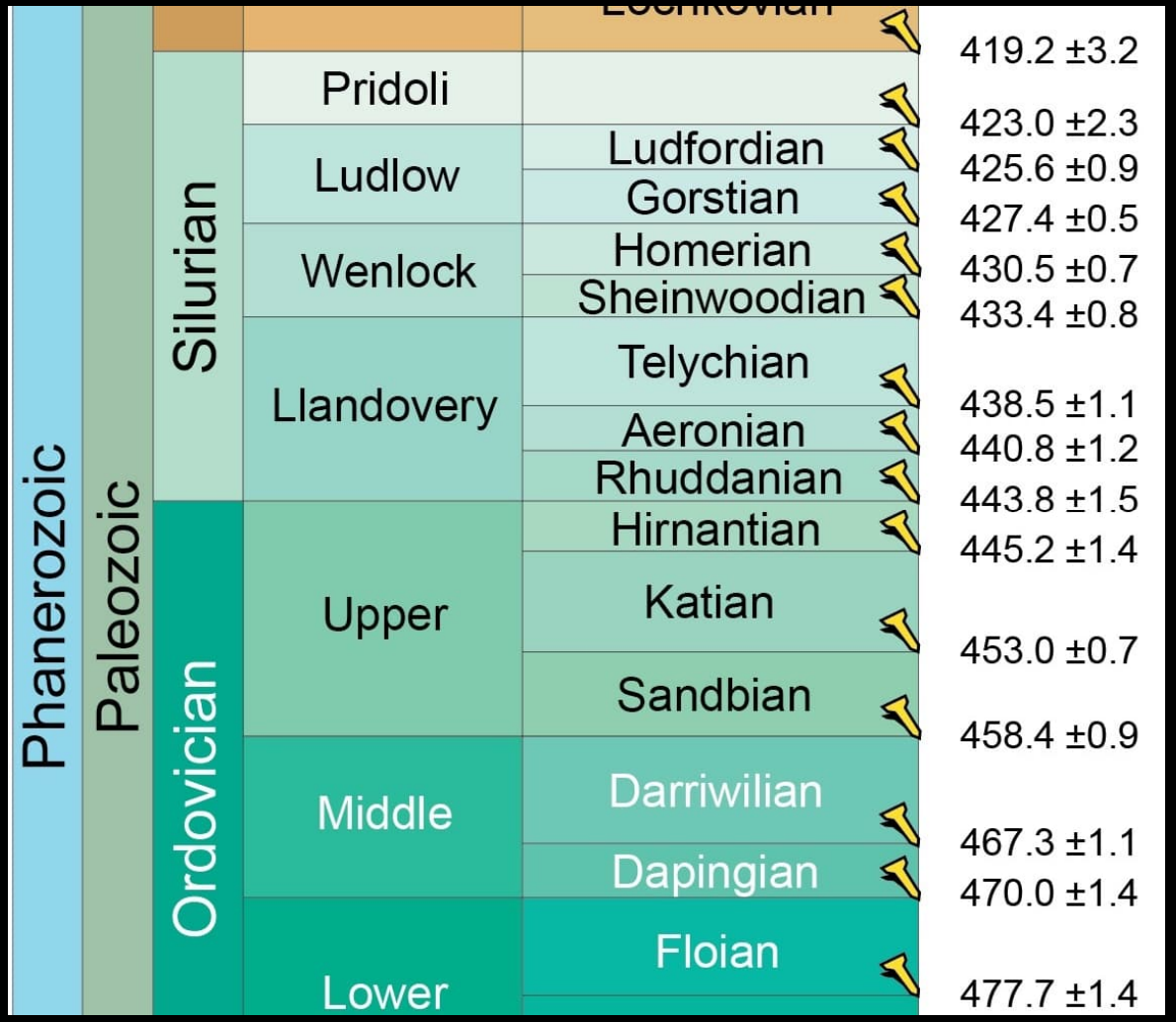
Lower Palaeozoic rocks



Source : ICS
Chronostratigraphic Time
Chart
June 2023

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Rubery & Lickey Hills

- Alan Richardson March 2023 (ehtchampions)
- W Flank of Rednall Hill
- Lickey Quartzite Formation
- Single bedding plane

- First evidence of Ordovician benthic fauna

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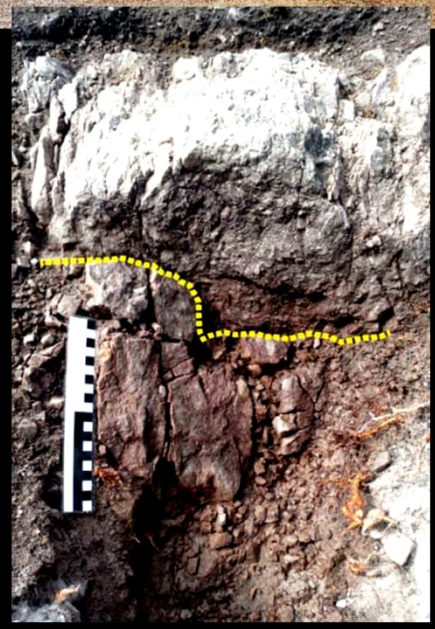
Rubery & Lickey Hills

- Alan Richardson March 2023 (ehtchampions)
- Unconformity
- Quartzite Breccia on
- Lickey Quartzite Formation
- Silcrete horizon
- Rare & Important
- May be contemporaneous with Bilberry Hill



The Odovician & Silurian Strata

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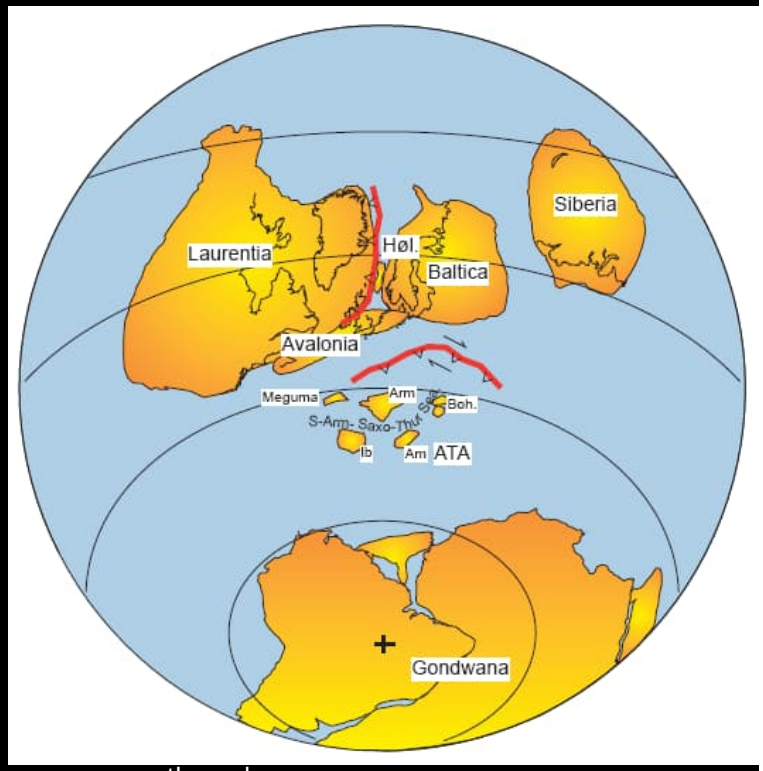
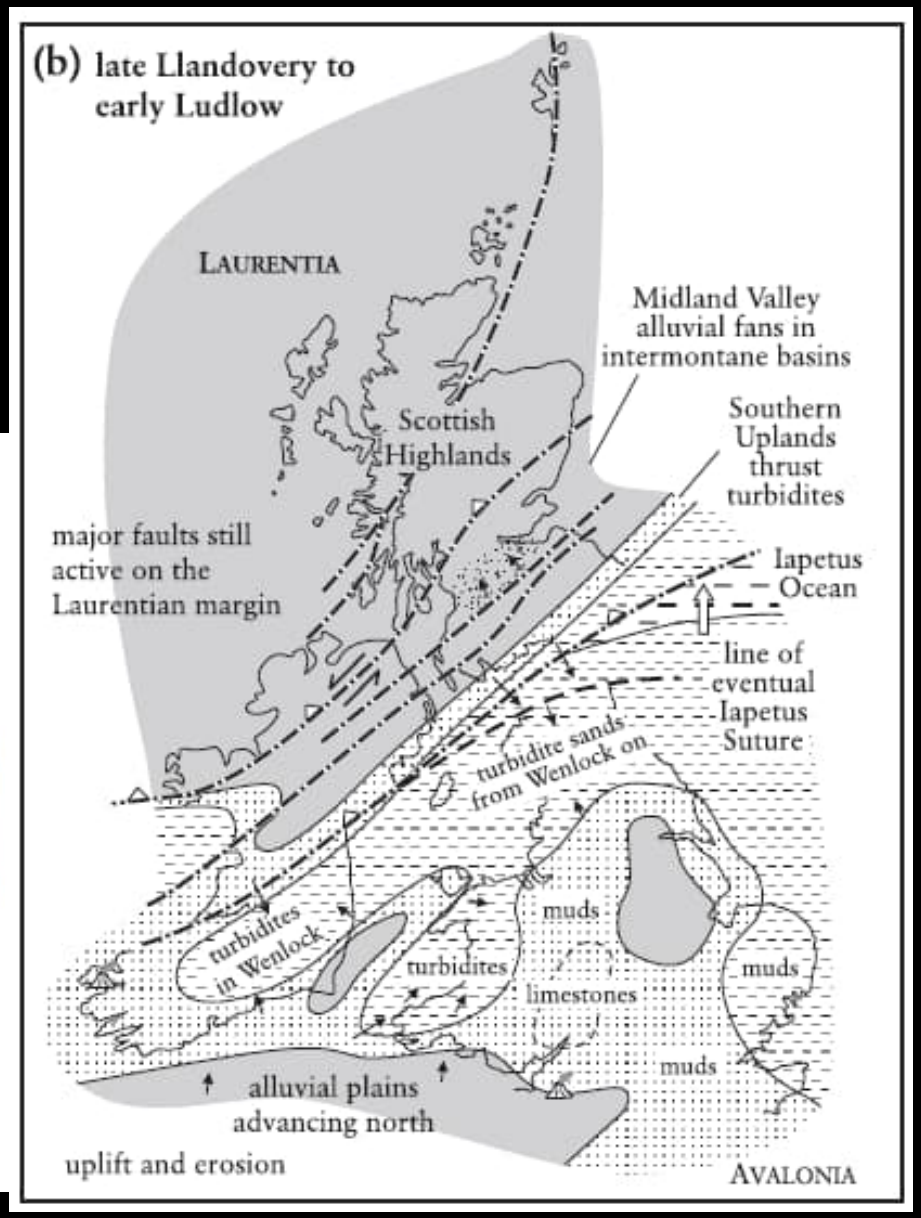
PERIOD	EPOCH	LITHOLOGICAL DIVISIONS		
SILURIAN	PRIDOLI	LEDBURY FORMATION		419.2 ±3.2
	LUDLOW	UPPER LUDLOW SHALES FORMATION	Ludfordian	423.0 ±2.3
		LOWER ELTON FORMATION	Gorstian	425.6 ±0.9
	WENLOCK	MUCH WENLOCK LST FORMATION	Homerian	427.4 ±0.5
		COALBROOKDALE FORMATION	Sheinwoodian	430.5 ±0.7
		BARR LIMESTONE LST FORMATION	Telychian	433.4 ±0.8
	LLANDOVERY	LLANDOVERY SANSTONE FORMATION	Aeronian	438.5 ±1.1
			Rhuddanian	440.8 ±1.2
ORDOVICIAN		LICKEY QUARTZITE FORMATION		443.8 ±1.5

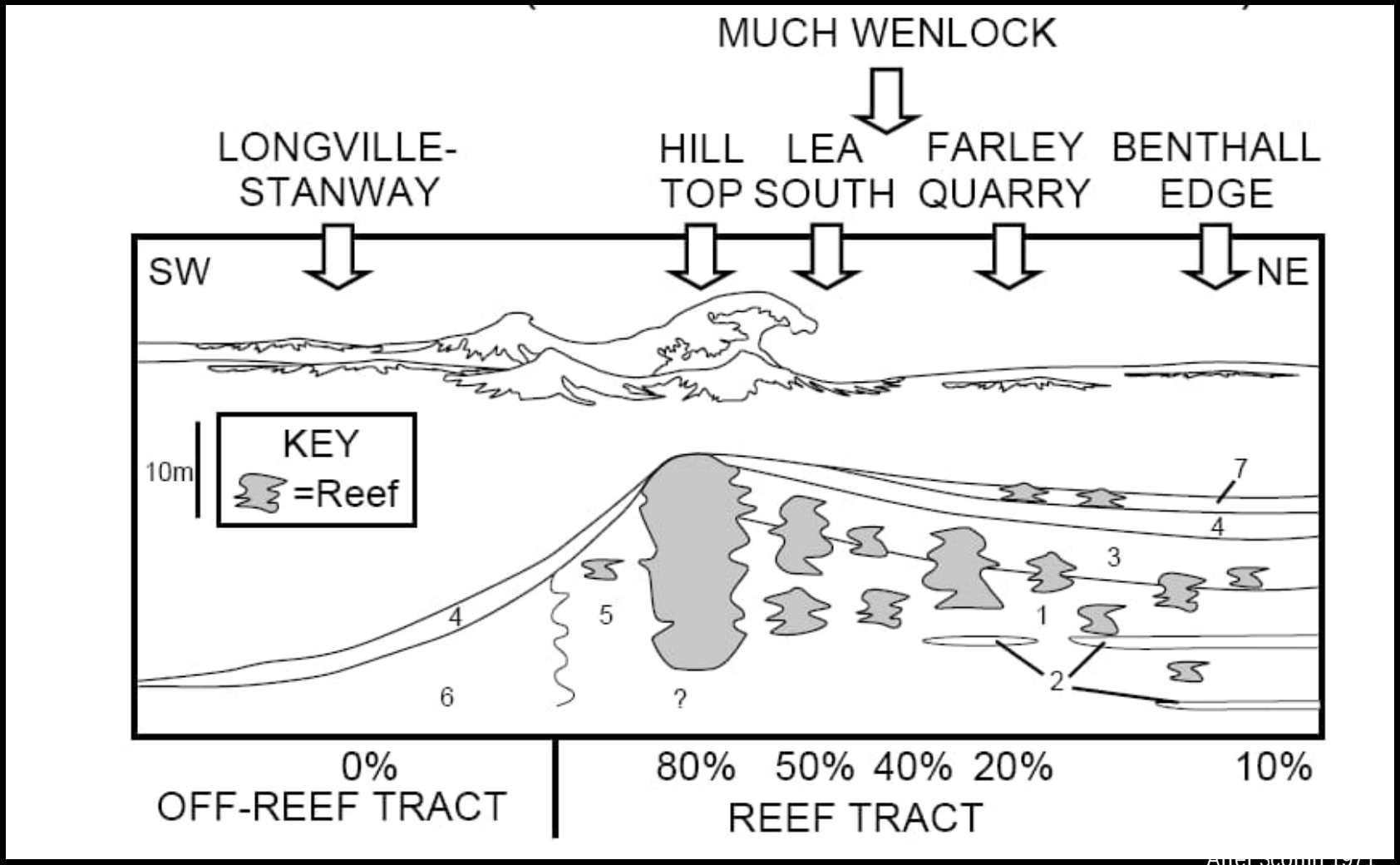
The Wenlock Series

427.8 to 432.5 ma



www.earth.ac.uk





After Scrutton 1971

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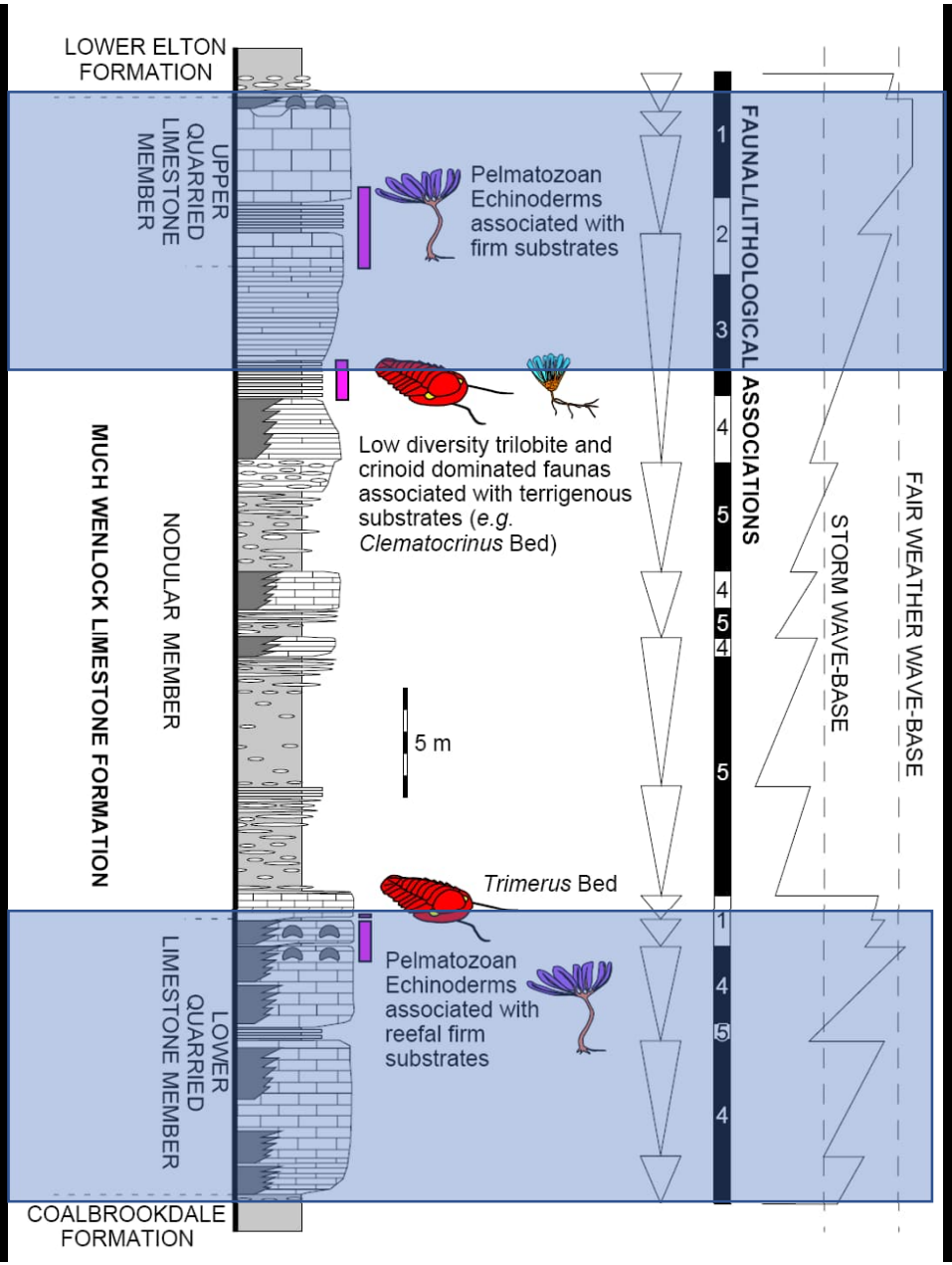
Sea levels in the early Silurian

- During the early Silurian (Telechyian) the sea transgressed the Midlands Platform from the west
- This resulted in the westward progression of marine sediments
- Initially these were well-sorted quartz sands but as the water depth increased these were succeeded by deeper water siltstones and shales
- David's current research is looking at trying to construct a sea level curve over time and to try to establish an approximation of the water depth and causes of that sea-level rise.
- Early estimates are 40 – 70m in West Wales (mean 55m)
- The current work is looking at boreholes and exposures in the West Midlands to work out what the maginitude of sea level rise was here.

2011


LOWER ELTON FORMATION
UPPER QUARRIED LIMESTONE MEMBER
Pelmatozoan Echinoderms associated with firm substrates
Low diversity trilobite and crinoid dominated faunas associated with terrigenous substrates (e.g. Clematocrinus Bed)
MUCH WENLOCK LIMESTONE FORMATION
NODULAR MEMBER
5 m
Trimerus Bed
Pelmatozoan Echinoderms associated with reefal firm substrates
LOWER QUARRIED LIMESTONE MEMBER
COALBROOKDALE FORMATION
FAUNAL/LITHOLOGICAL ASSOCIATIONS
STORM WAVE-BASE
FAIR WEATHER WAVE-BASE

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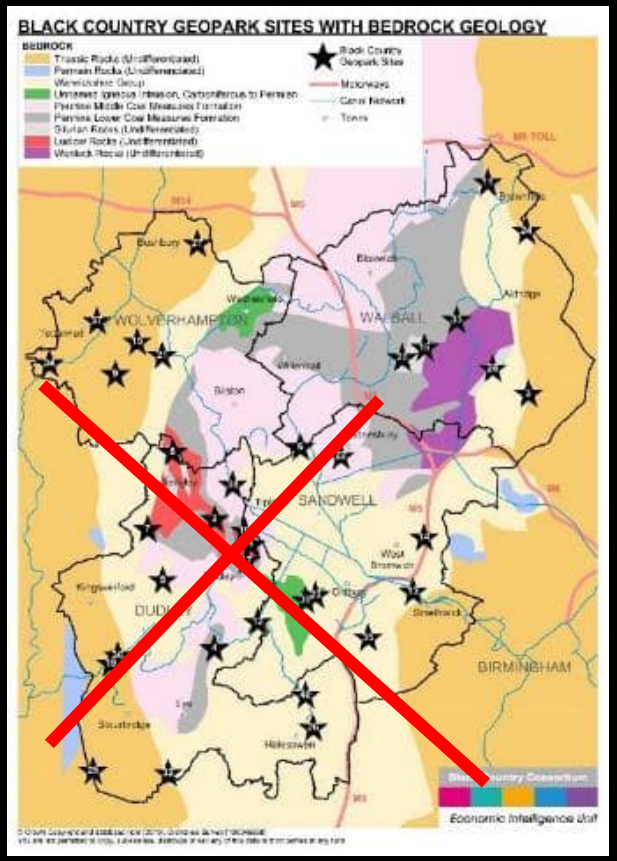
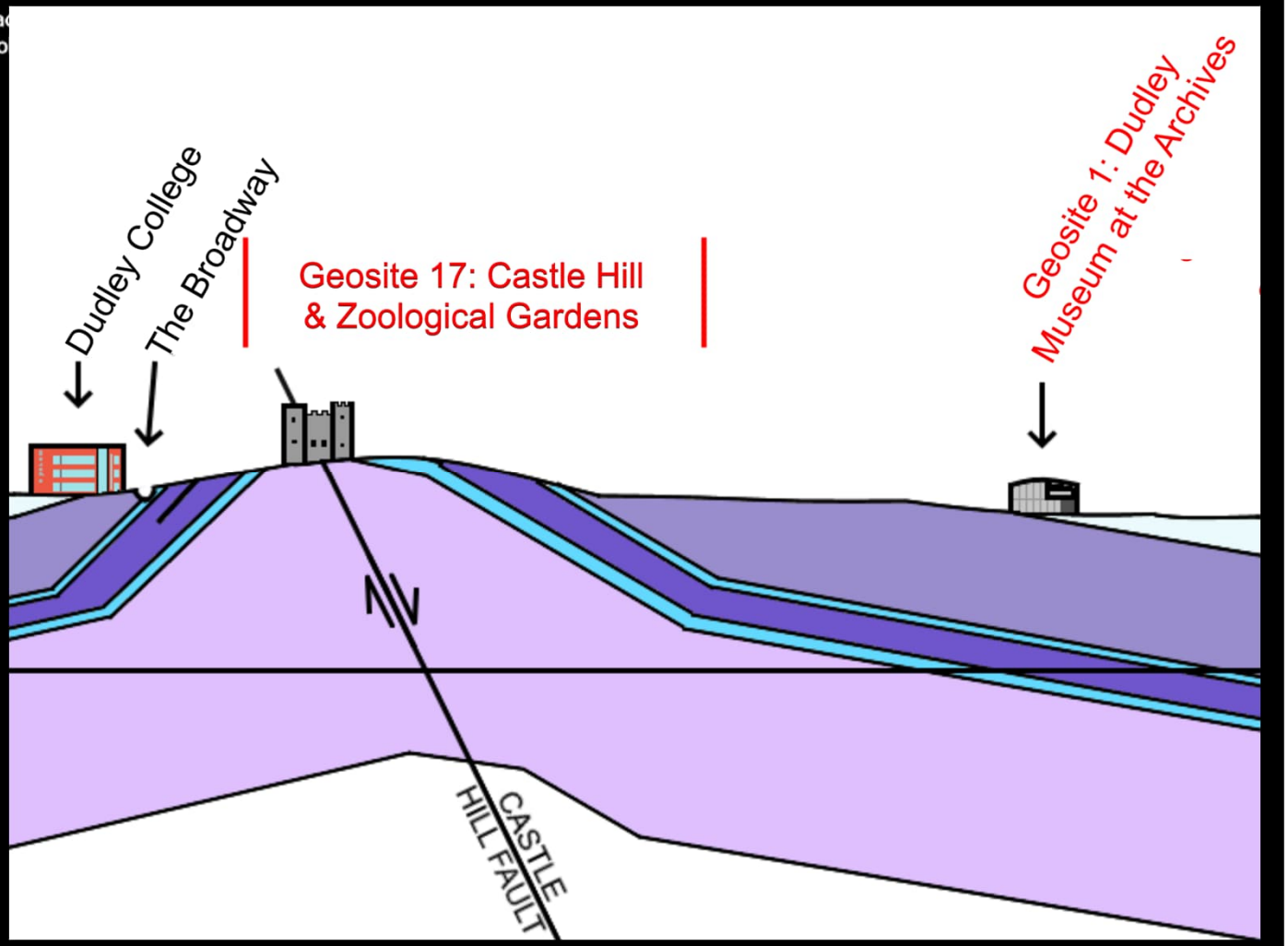
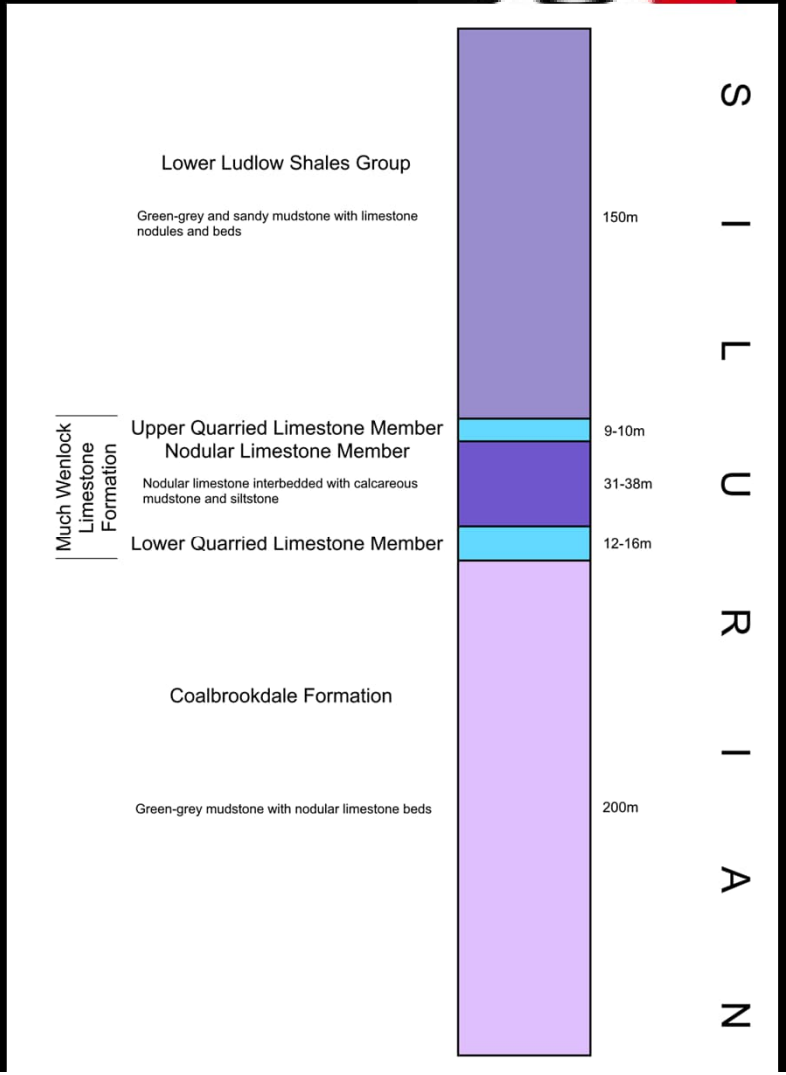
The Midland Metro



Castle Hill Exposures





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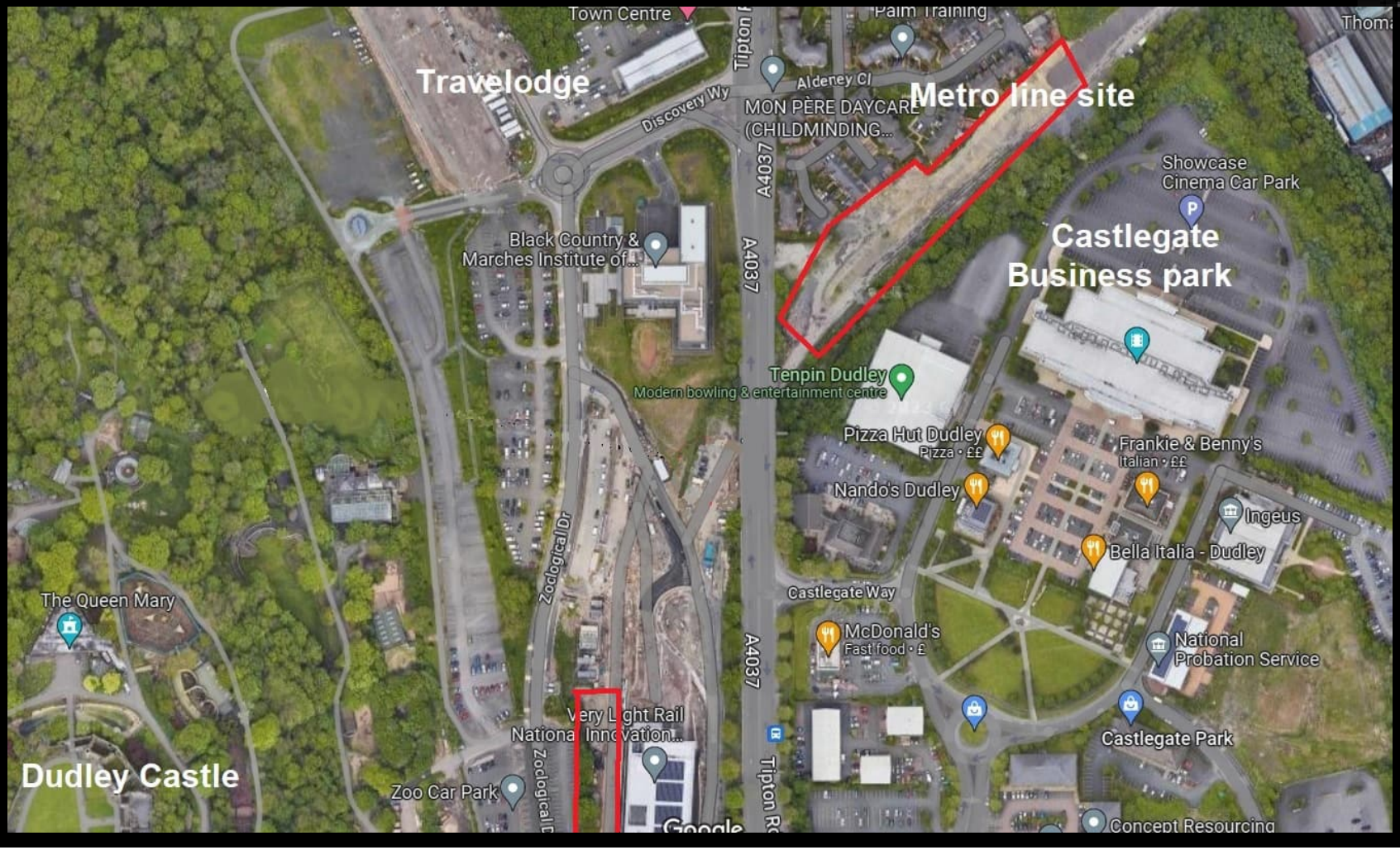
Midlands Metro, Castle Gate



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VLR Retaining Wall exposures

Image Courtesy of New Heritage/Dudley MBC

Image courtesy of Dudley MBC

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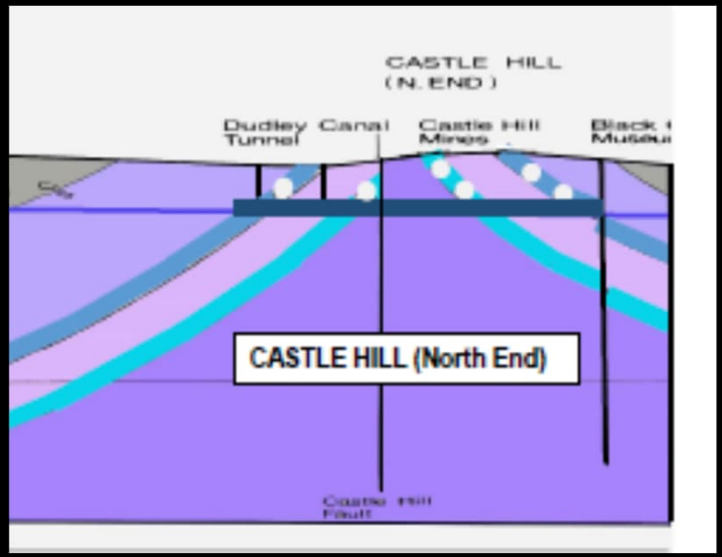
Sustainable Development

Castle Hill Geosite (VLR)



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Sustainable Development

Castle Hill Geosite (VLR)

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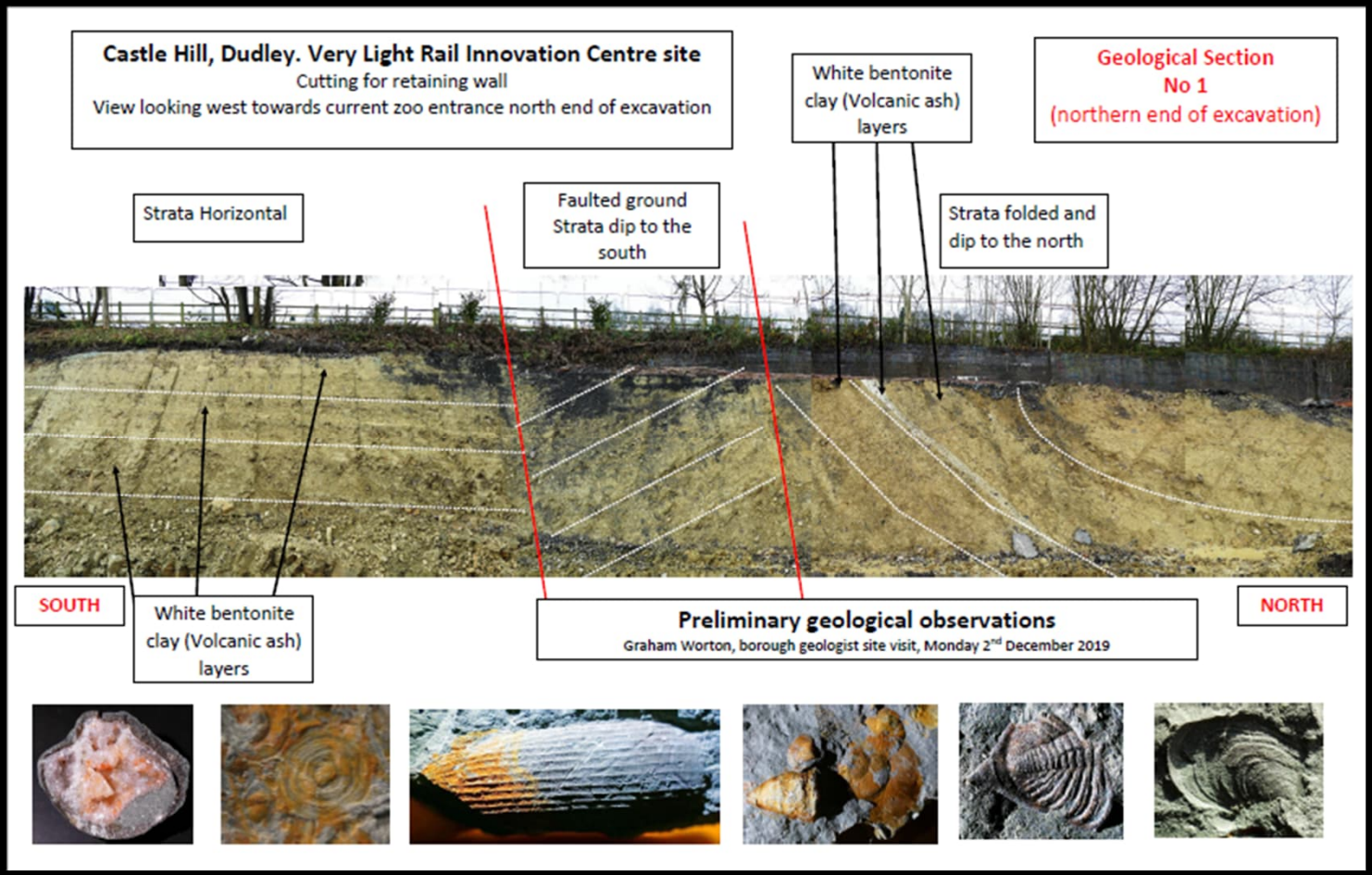
Sustainable Development

Castle Hill Geosite (VLR)



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The Midland Metro Line

Palaeontological bias & Taphonomy

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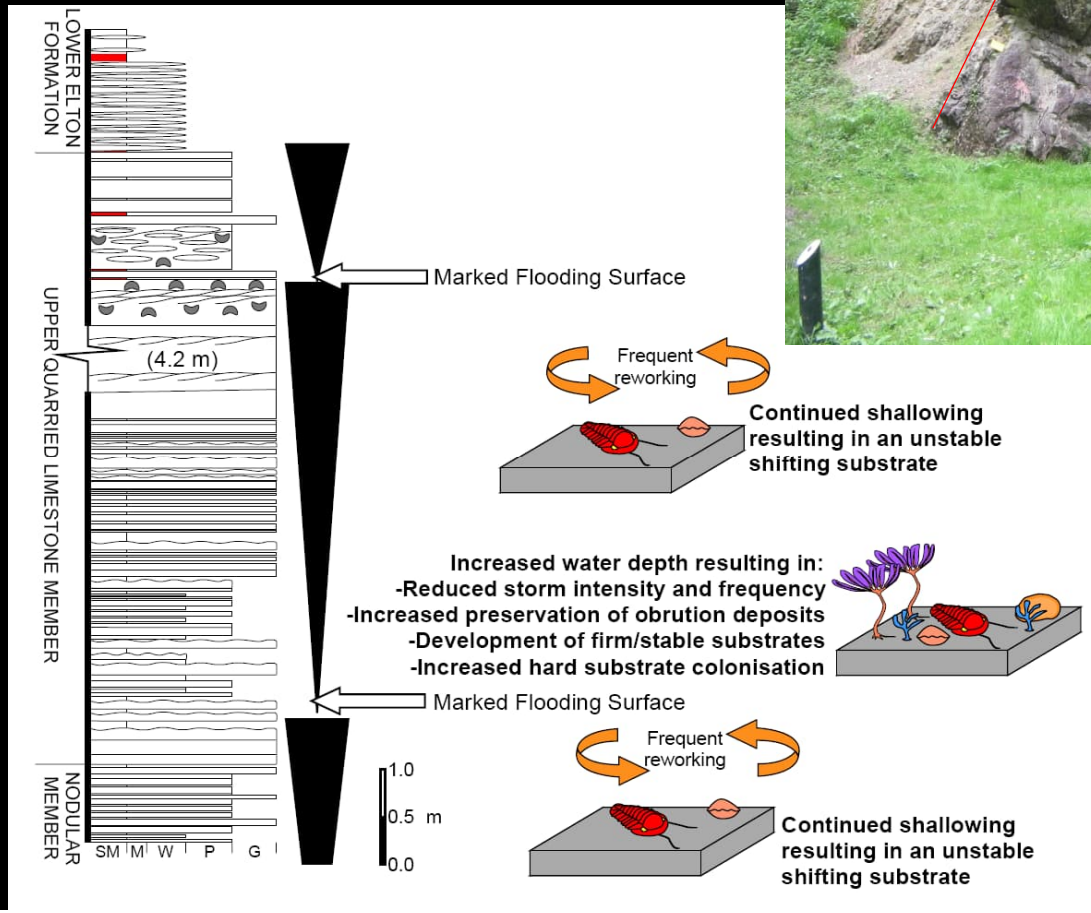
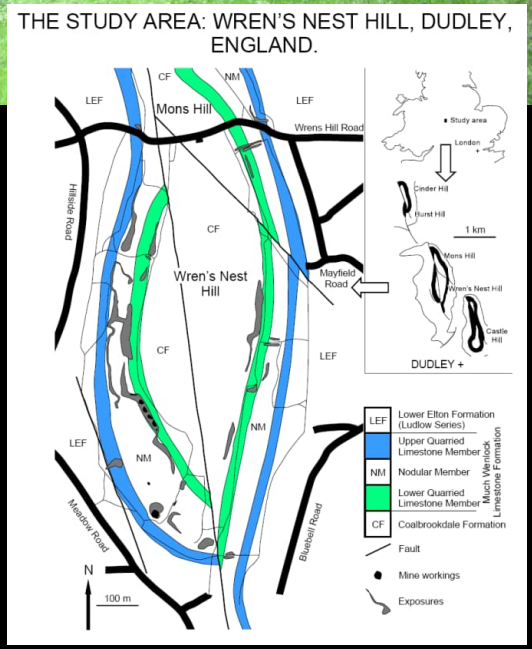
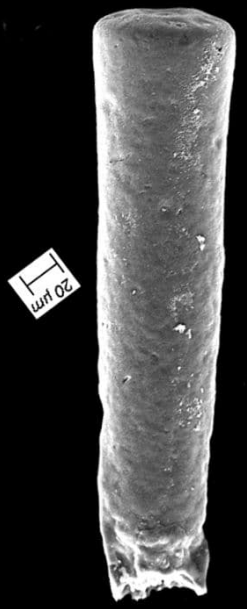
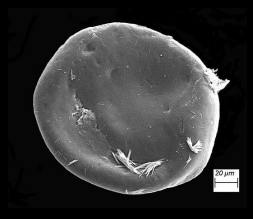
Preservation and distribution of taxa is clearly linked to sea-level change.

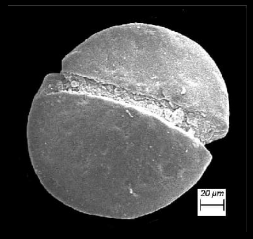


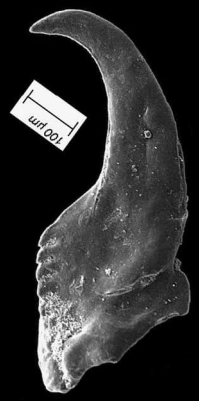


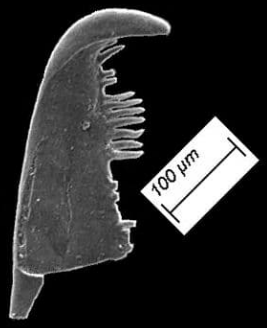
Microfossils

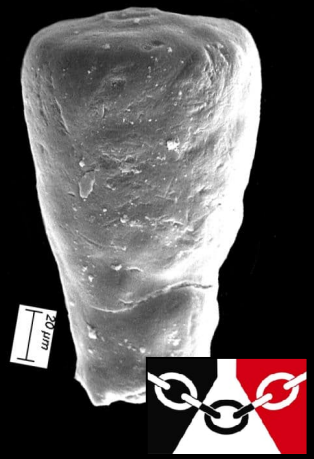












West Midlands Composite, England
Series
Stage
Litho-strat.
Graptolite zones
m
Ludlow
Gorstian
Wenlock
Homerian
Lower Elton Fm.
Much Wenlock Limestone Fm.
Upper Quarried Limestone Mbr.
Nodular Beds Mbr.
Lower Quarried Limestone Mbr.
Coalbrook-dale Fm.
Neodiversograptus nilssoni
Colonograptus tudexsis
Gothograptus nassa
Cyrtograptus lundgreni
427.77 ± 0.25
428.06 ± 0.21
428.47 ± 0.33
290k ± 330k
700k ± 420k
410k ± 400k
WNH14
WNH13
WNH12
WNH11
WNH10
WNH9
WNH8
WNH7 (Djupvik)
WNH6
WNH5
WNH4
WNH3(Grötlingbo?)
WNH2
WNH1
Survival Interval
Extinction Interval
0
+2
+4
δ13Ccarb (‰ VPDB)
Thick bedded limestone
Nodular limestone
Thin bedded limestone
Silty mudstones
Thin bedded limestone and silty mudstone
Limestone nodules and silty mudstone
Interval of reef growth
Stromatoporoid pavement

The Bobbit Worm

Series
Stage
Litho-strat.
Graptolite zones
m
West Midlands Composite, England
Ludlow
Gorstian
Lower Elton Fm.
Neodiversograptus nilssoni
Wenlock
Homerian
Much Wenlock Limestone Fm.
Upper Quarried Limestone Mbr.
Nodular Beds Mbr.
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427.77 ± 0.35
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700k ± 420k
410k ± 400k
290k ± 330k
WNH15
WNH14
WNH13
WNH12
WNH11
WNH10
WNH9
WNH8
WNH7 (Djupvik)
WNH6
WNH5
WNH4
WNH3(Grötlingbo?)
WNH2
WNH1
Survival Interval
Extinction Interval
0
+2
+4
+6
δ13Ccarb (‰ VPDB)
Thick bedded limestone
Nodular limestone
Thin bedded limestone
Silty mudstones
Thin bedded limestone and silty mudstone
Limestone nodules and silty mudstone
Interval of reef growth
Stromatoporoid pavement

Carboniferous of the Black Country

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PERIOD	EPOCH	LITHOLOGICAL DIVISIONS	STAGE	AGE
CARBONIFEROUS	PENNSYLVANIAN	SALOP FORMATION Enville Member Alverley Member	Gzhelian	298.9 ±0.15 303.7 ±0.1
		HALESOWEN FORMATION	Kasimovian	307.0 ±0.1
		ETRURIA FORMATION	Moscovian	315.2 ±0.2
		PENNINE MIDDLE COAL MEASURES	Bashkirian	
		PENNINE LOWER COAL MEASURES		323.2 ±0.4

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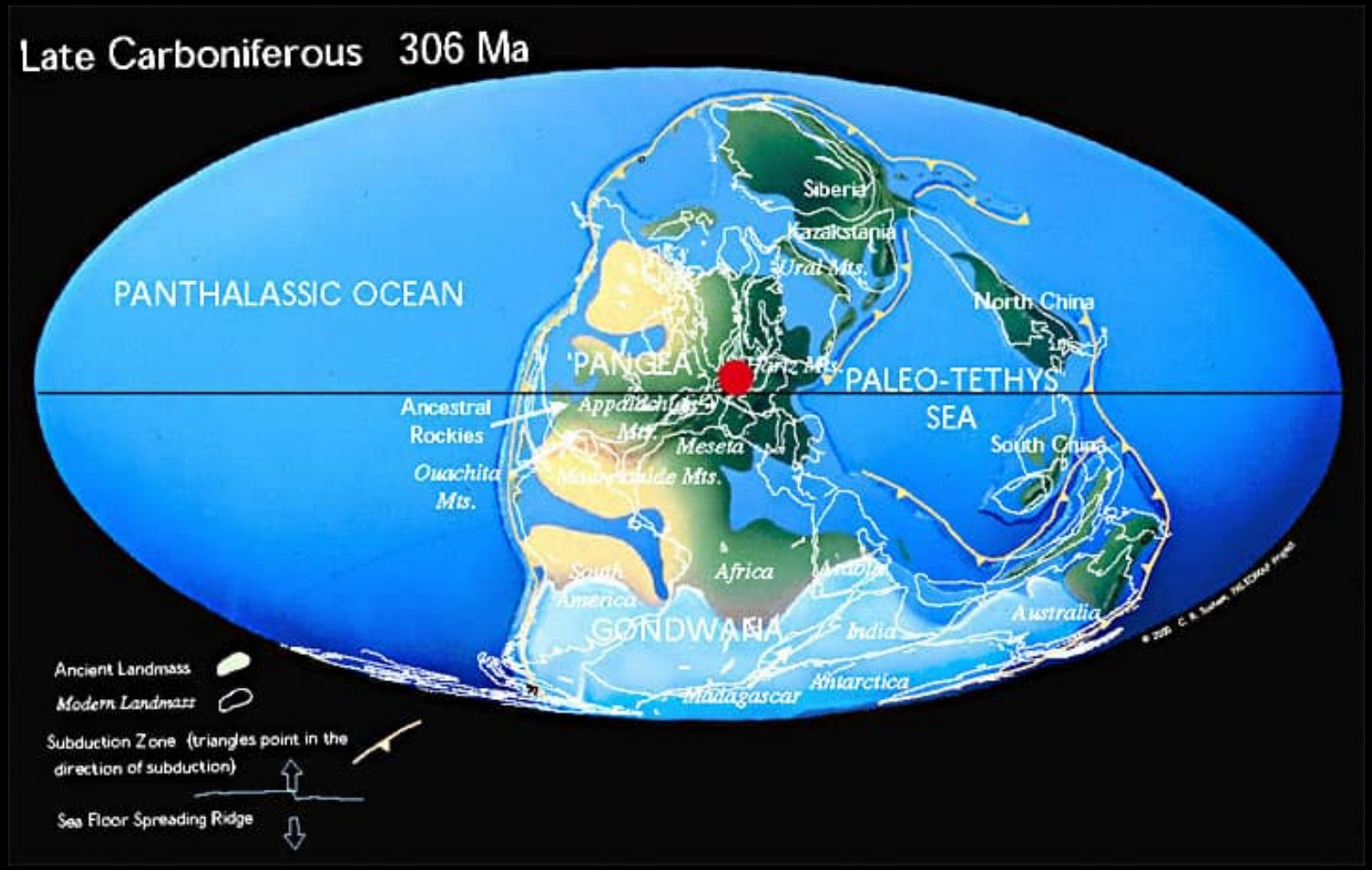
Carboniferous Palaeogeography



Source ‘palaeomap project courtesy of Chris Scortese

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Saltwells National Nature Reserve

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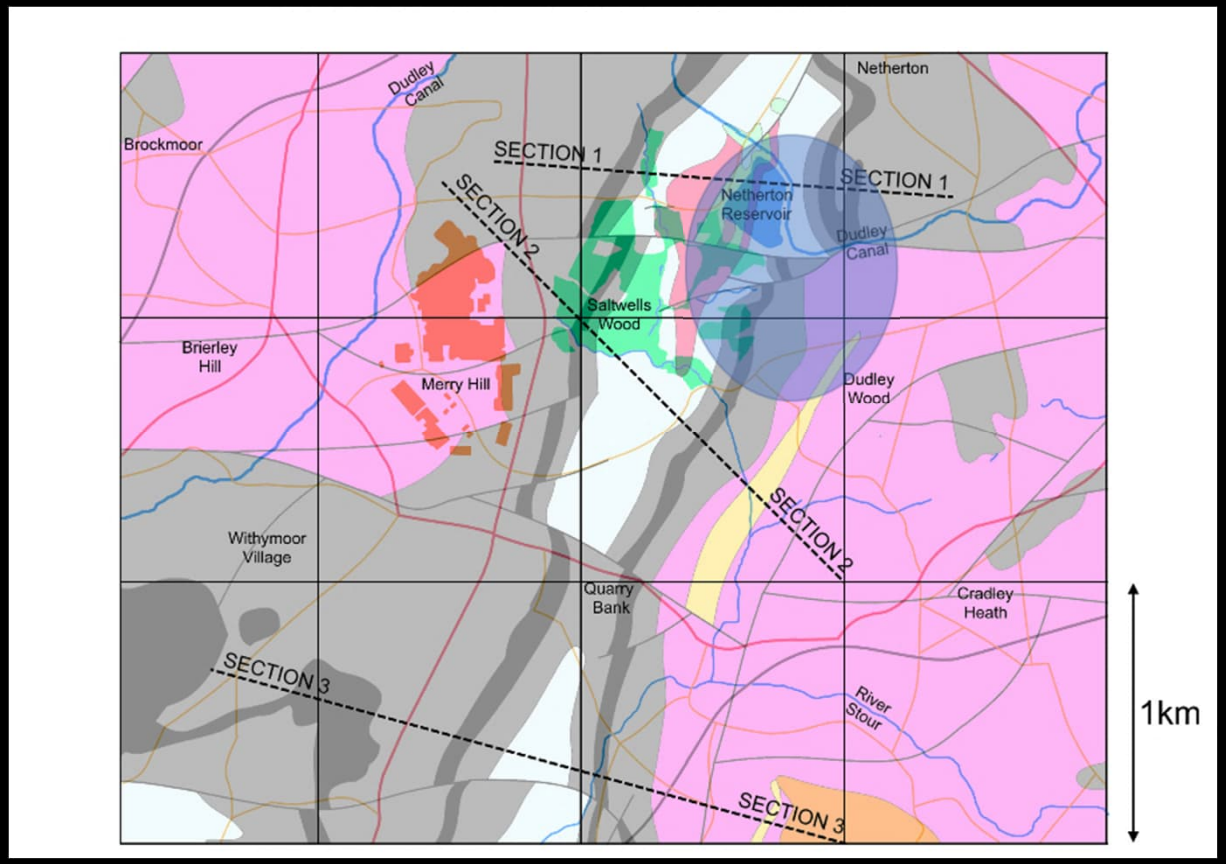
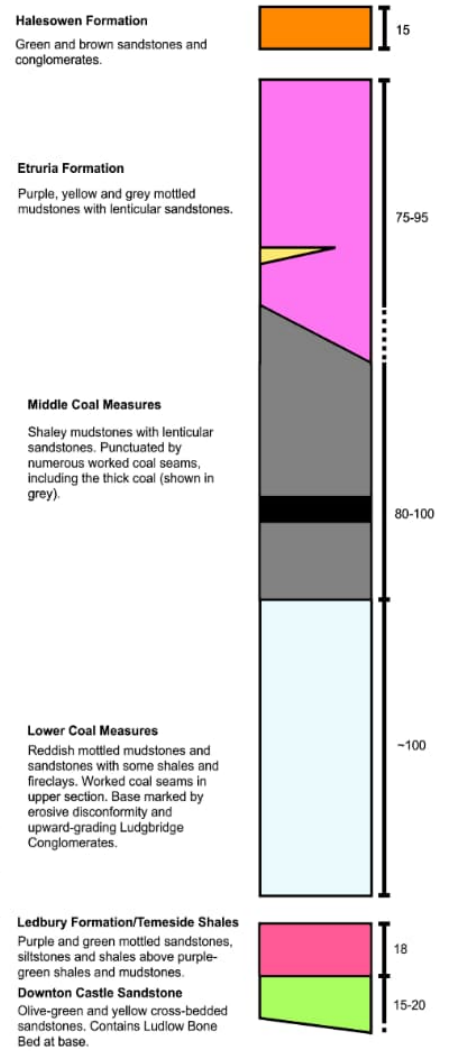
Saltwells NNR



STRATIGRAPHIC COLUMN



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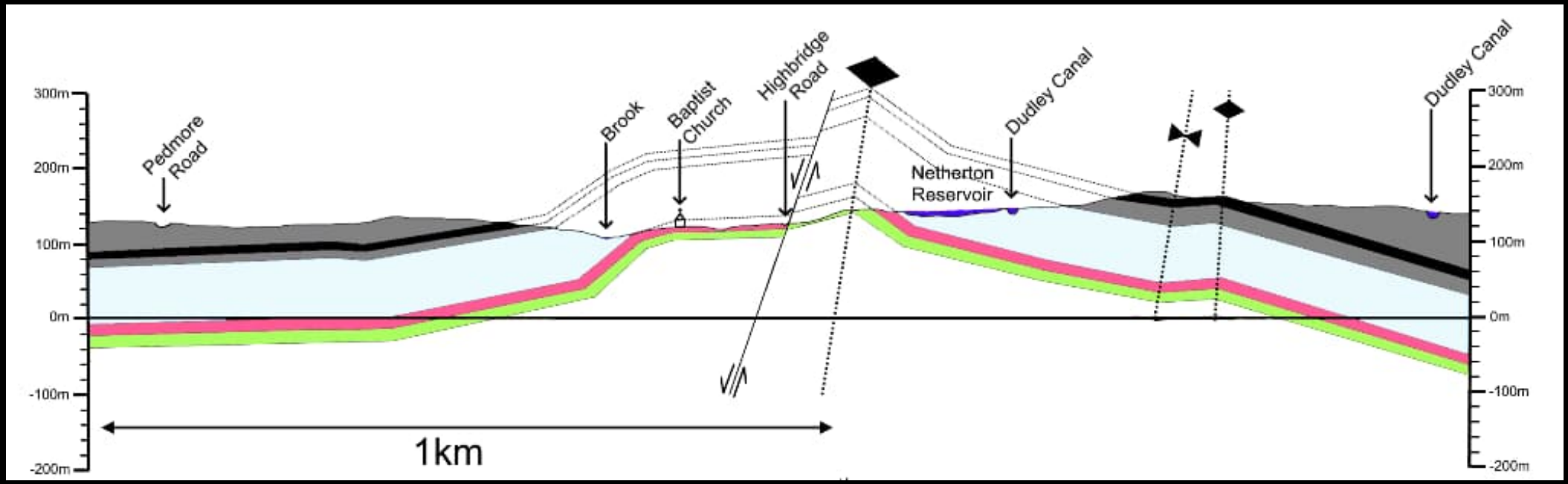

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Updates and New Exposures 2023

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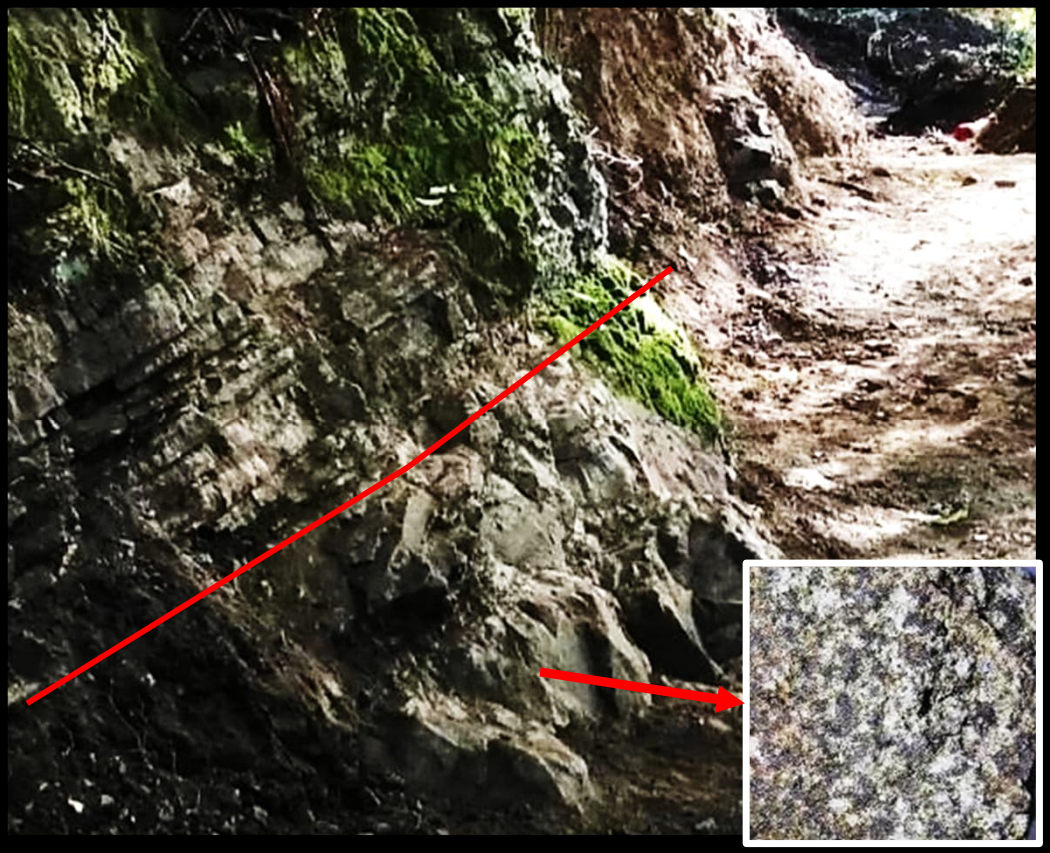
Updates and New Exposures 2023



New discoveries 2023

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Princes Trust Exposures

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- Saltwells NNR

- NNR declared
- New base constructed
- New Video being made
- Interpretation being created

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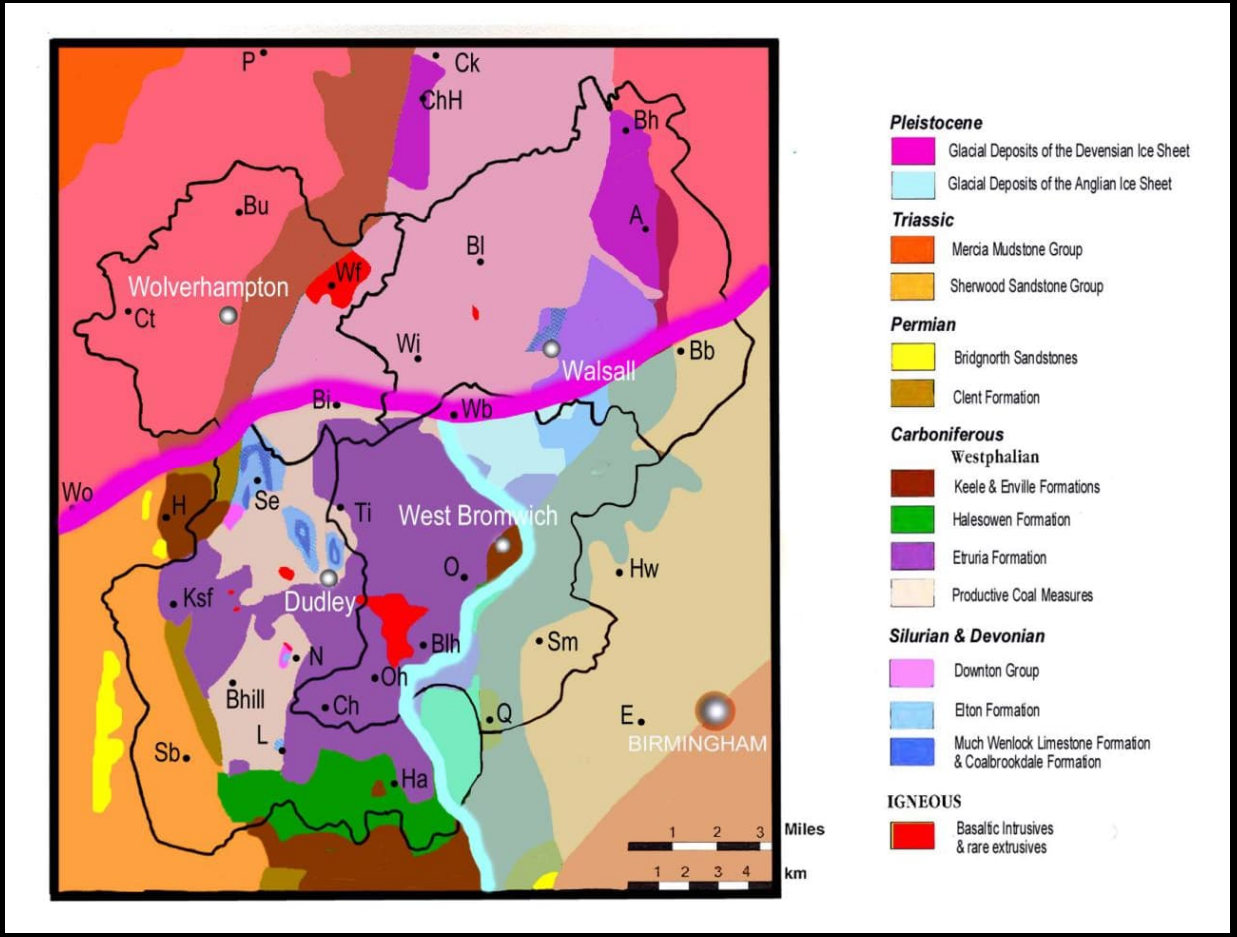
Birmingham's Boulders



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The Glacial Landscapes of Smestow Valley & Wightwick Wedge

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The Glacial Landscapes of Smestow Valley & Wightwick Wedge

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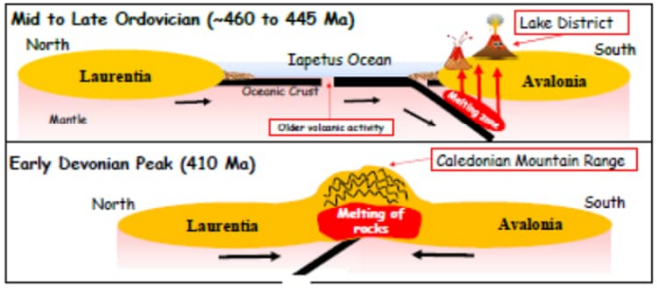
The Glacial Landscapes of Smestow Valley & Wightwick Wedge

How were the rocks making up the boulders created?

In the Lower to Upper Ordovician (470-440 Ma), Laurentia (land mass containing Scotland) was separated from Avalonia (land mass containing England + Wales) by the large Iapetus Ocean. Over time, these 2 land masses came together and the ocean started to close. On the southern side, part of Laurentia's crust was subducted below Avalonia, followed by crustal melting and violent volcanic activity in the Lake District down through Snowdonia into Pembrokeshire.

In the Lake District, the Borrowdale Volcanic Group was formed and comprises tuffs (from volcanic ash) and andesites (from volcanic lava and rock fragments). These volcanic rock layers are up to 6 km in thickness, so major eruptions

Eventually in the Devonian, the 2 land masses came together and collided to form a high mountain range—the Caledonian Orogeny, peaking at 410 Ma. Such collisions create a lot of friction with some crustal melting, but not enough to create volcanoes. Granites and granophyres result at depth from cooling magma. Most of northern England is underlain by granite from the Caledonian Orogeny.



Why are the rocks now at the surface of the Earth?

Over time the Caledonian mountains were broken down by wind, rain and ice, so that they are now long gone. Earth movements also pushed rocks upwards. Thus rocks that were once buried deep in the Earth's crust (possibly up to 6 to 8 km depth) are now exposed at the Earth's surface. And the process continues!

Recent erosion during the ice ages meant that rocks could fall onto ice sheets and glaciers, so that movement away from the source area could begin. But we might never discover the finer details of the boulders' incredible journey.

Useful Information Sources:

Gibbard, P.L. & Clark, C.D. (2011) Ch.7: Pleistocene glaciations in Great Britain, pp. 75-83, In: J. Ehlers, P.L.Gibbard & P.D. Hughes (eds) *Quaternary Glaciations - Extent and Chronology: a closer look.* Developments in Quaternary Science, Elsevier.

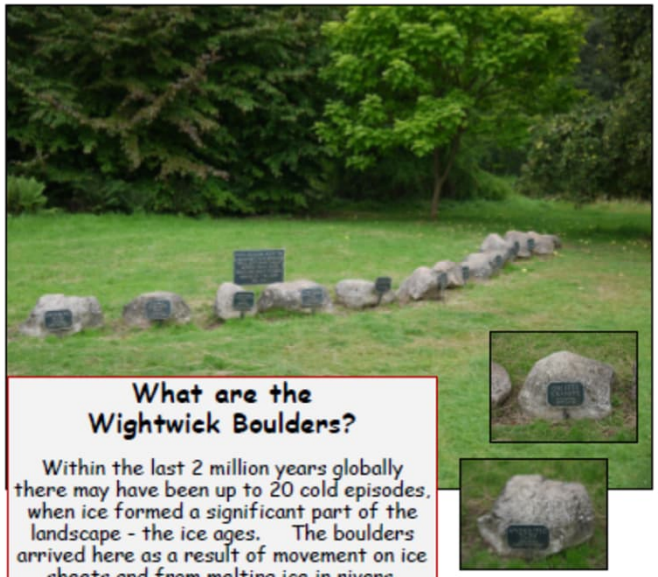
Morgan, A.V. (1973) The Pleistocene geology of the area north and west of Wolverhampton. *Phil. Trans. R. Soc. Lond.*, B. 265, No. 868, 233-297.

Toghill, P. (2006) *Geology of Shropshire, 2nd Ed.* Crowood Press, Marlborough. 253 pp.

National Trust

Wightwick Manor & Gardens

The Wightwick Boulders



What are the Wightwick Boulders?

Within the last 2 million years globally there may have been up to 20 cold episodes, when ice formed a significant part of the landscape - the ice ages. The boulders arrived here as a result of movement on ice sheets and from melting ice in rivers.

Where are they from?

The boulders are from the Lake District and Southern Scotland, up to 350 kilometres north of Wightwick Manor. Their evolution is a fascinating tale to tell, so please read on for more details →

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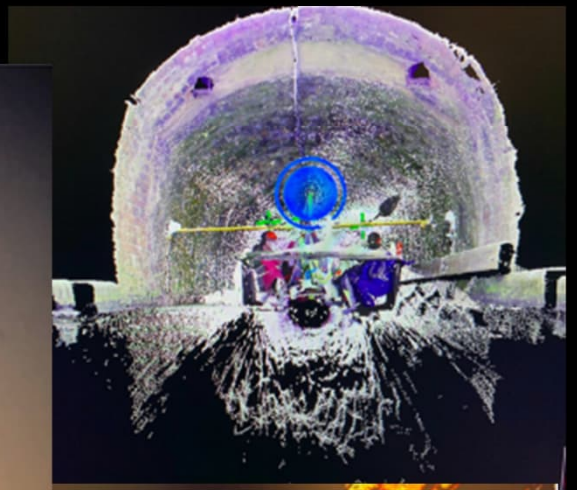
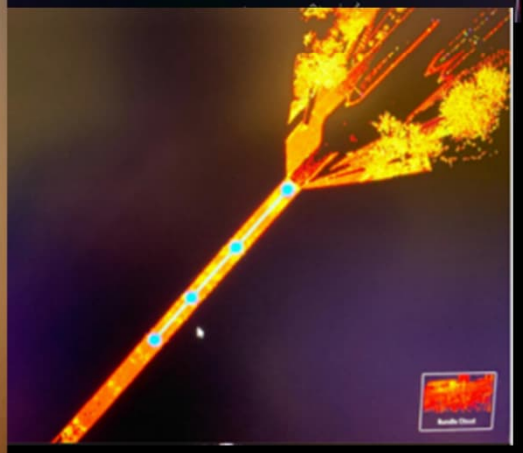
Dudley Canal & Tunnel Trust
New Interpretation
Virtual Reality





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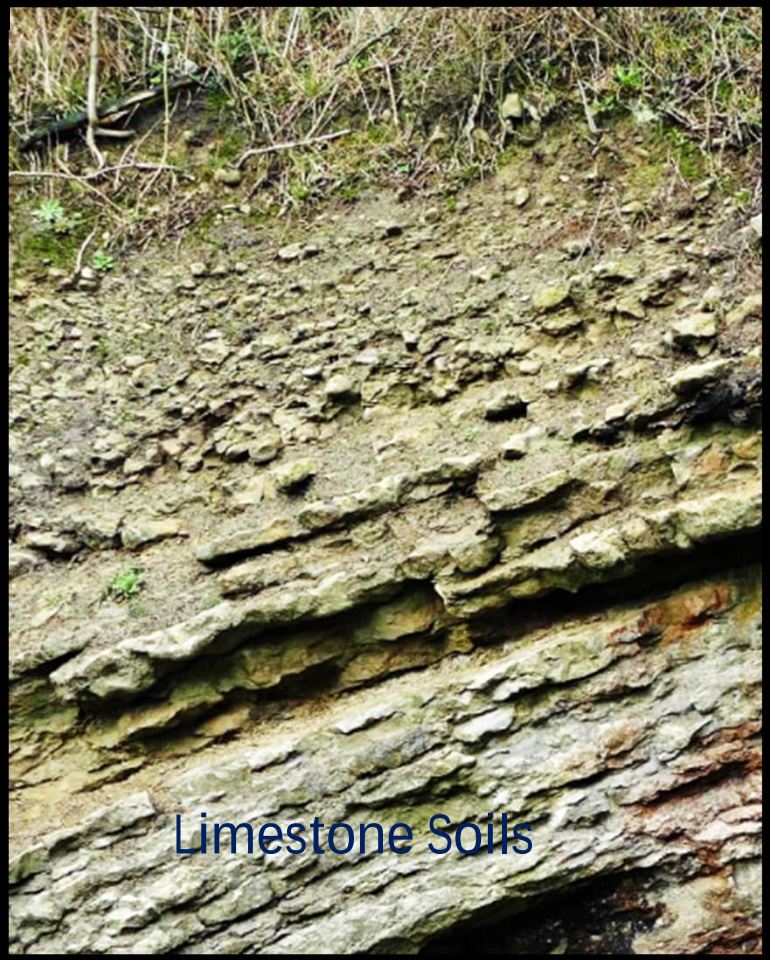
Geology defines soils



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Geology and soils

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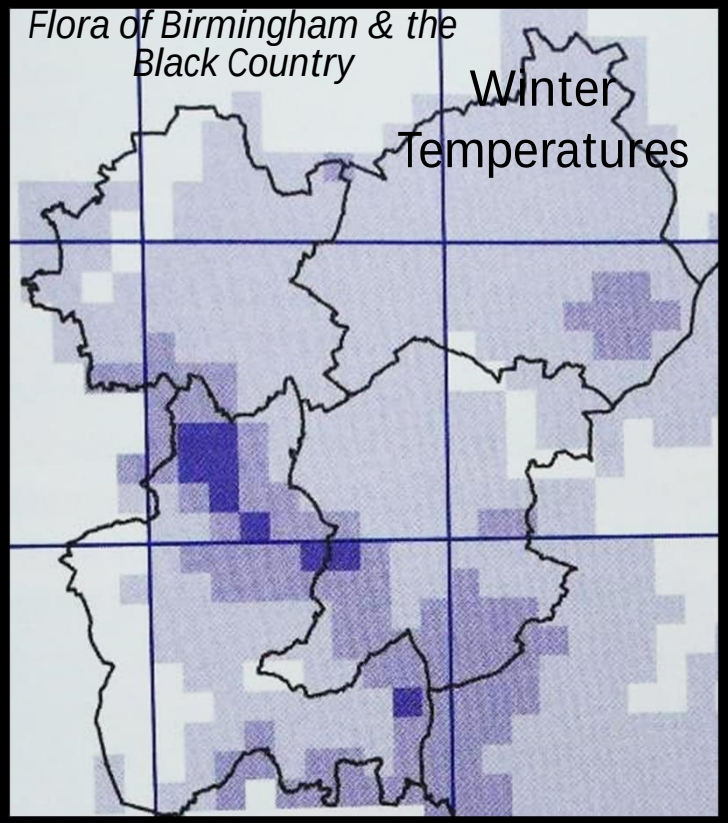
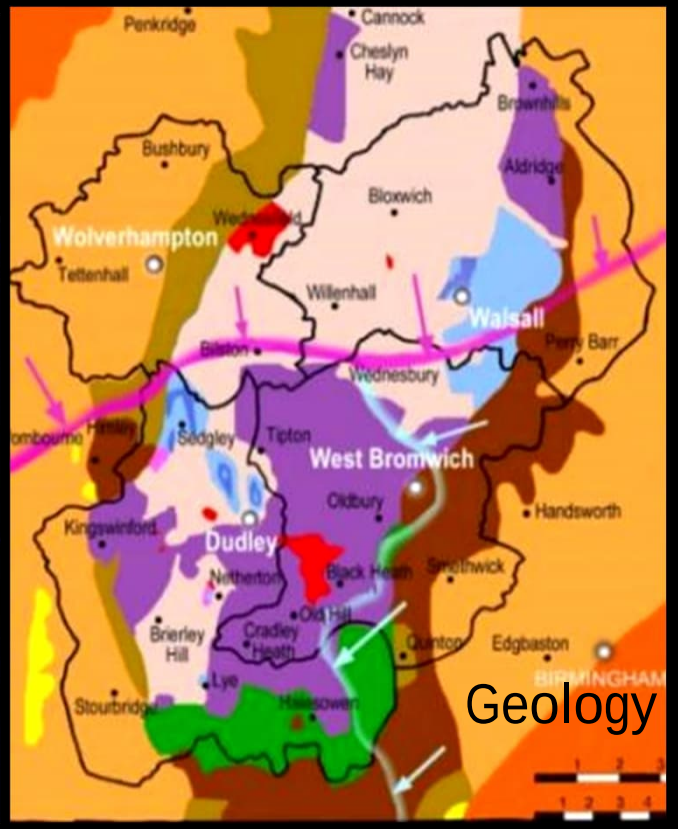
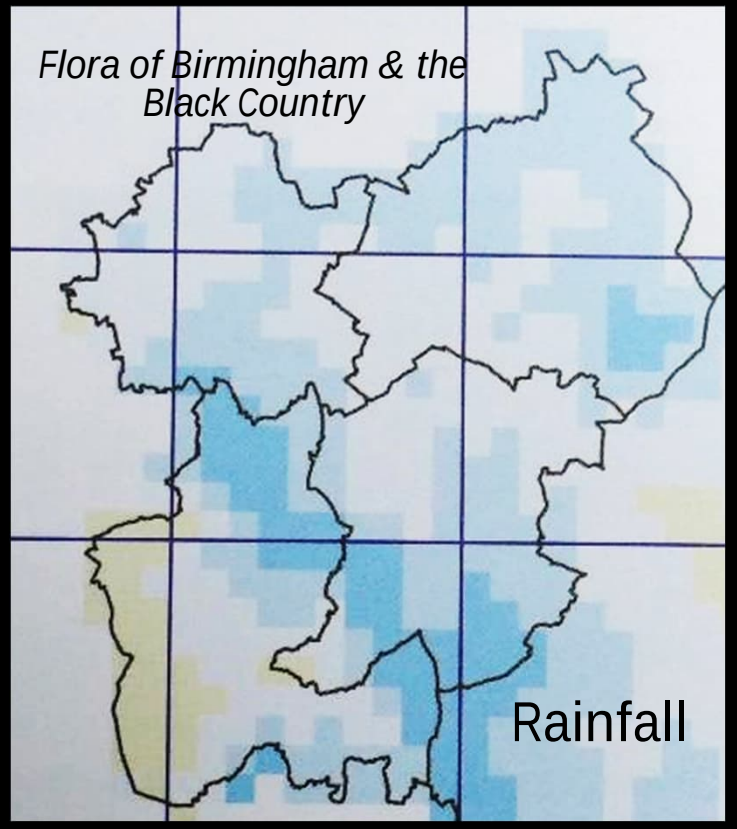
Geology defines local climate



Source 'Flora of Birmingham & the Black Country'





Source 'Flora of Birmingham & the Black Country'

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Geology, Soils & Climate define Ecosystems and Environments






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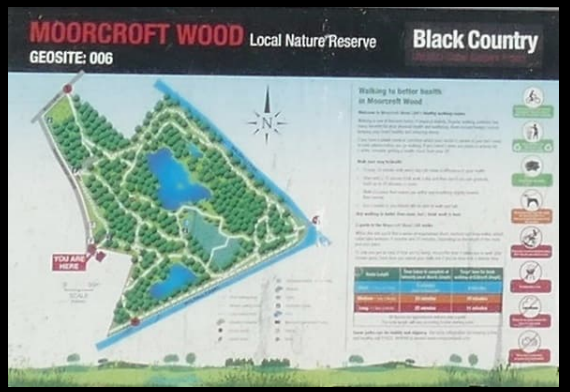
Geosite 6 - Moorcroft Wood LNR



Purple Horizons

project area

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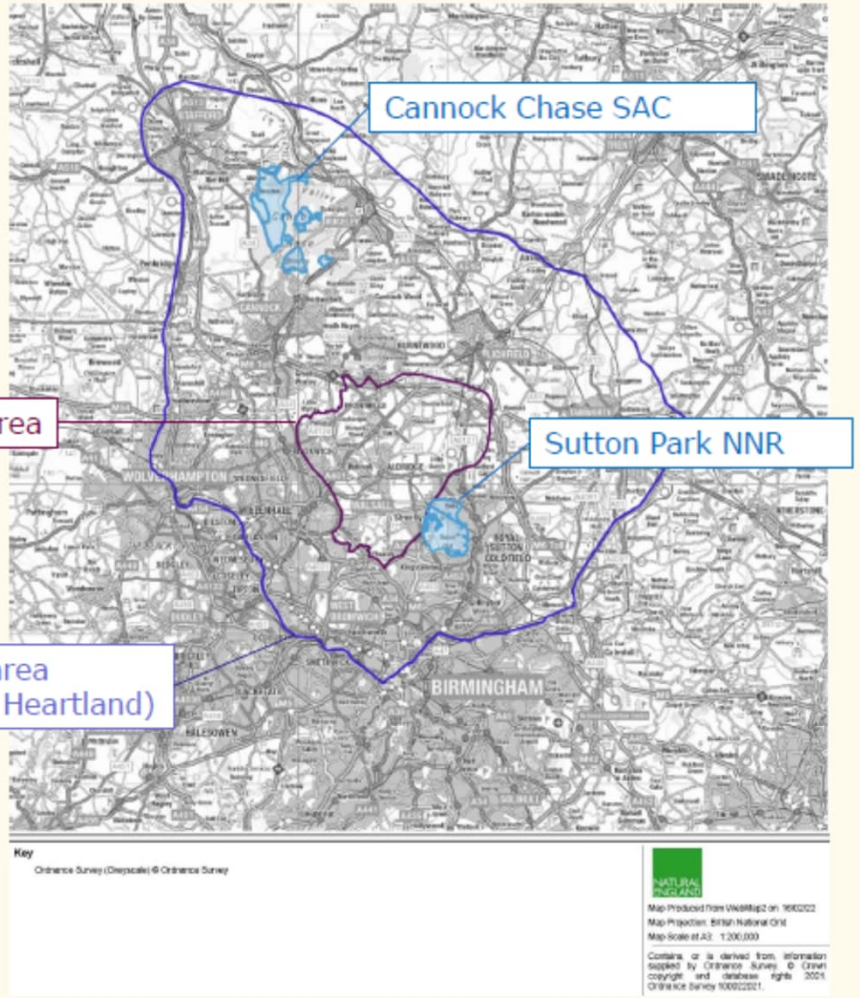

Source ; Natural England

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Purple Horizons Project

Walsall Geosites

- DEFRA/NE partnership project
- 4 years duration
- One of 5 National Projects for NRN
- Holistic Approach to Landscape recovery
- Midlands Heathlands Heartlands Project
- Cannock Chase – Walsall – Sutton Park
- Green Businesses/economy
- Environmental Education
- Film Making (inc Drone footage)
- Particular focus on Heathland & Pollinators
- Geoconservation & interpretation funded

Purple Horizons

Barr Beacon Quarry

Pinfold Lane Quarry
2021

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Purple Horizons

Barr Beacon Quarry

Pinfold Lane Quarry
2022

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Triassic of the Black Country

PERIOD	EPOCH	LITHOLOGICAL DIVISIONS	STAGE	AGE
TRIASSIC	UPPER	ABSENT		
	MIDDLE	SHERWOOD SANDSTONE GROUP)	Ladinian	~ 237
		HELSBY SSTN FORMATION (150m)	Anisian	~ 242
	LOWER	WOLDMOOR SANDSTONE (61-240m) CHESTER FORMATION (50-120m) HOPWASS BRECCIA (> 20m)	Olenekian Induan	247.2 251.2
			Changhsingian	251.902 ±0.0 254.14 ±0.0

Barr Beacon & Pinfold Lane Quarry

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Geosite 24 - Shire Oak Quarry LNR

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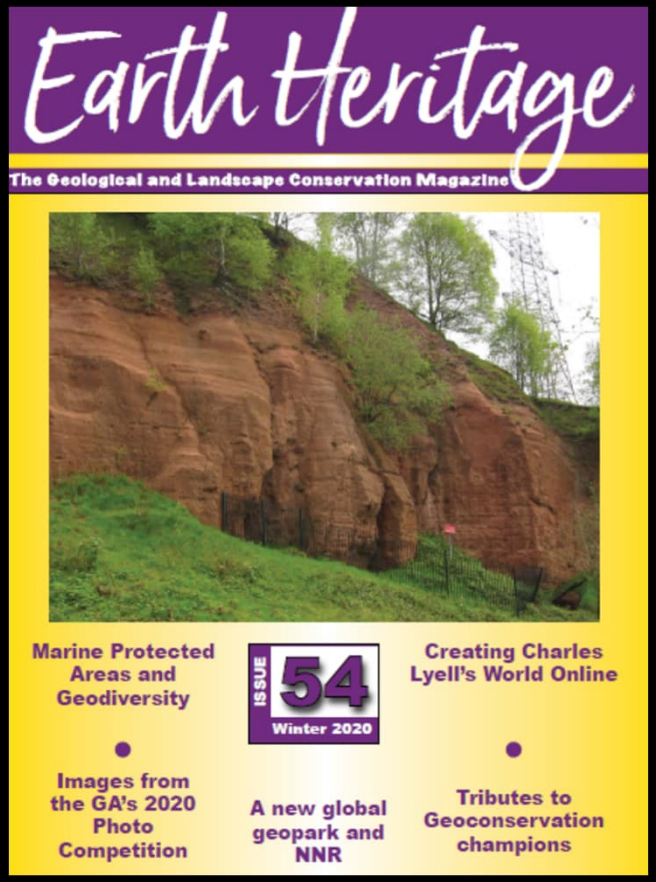
Power to the Pollinators



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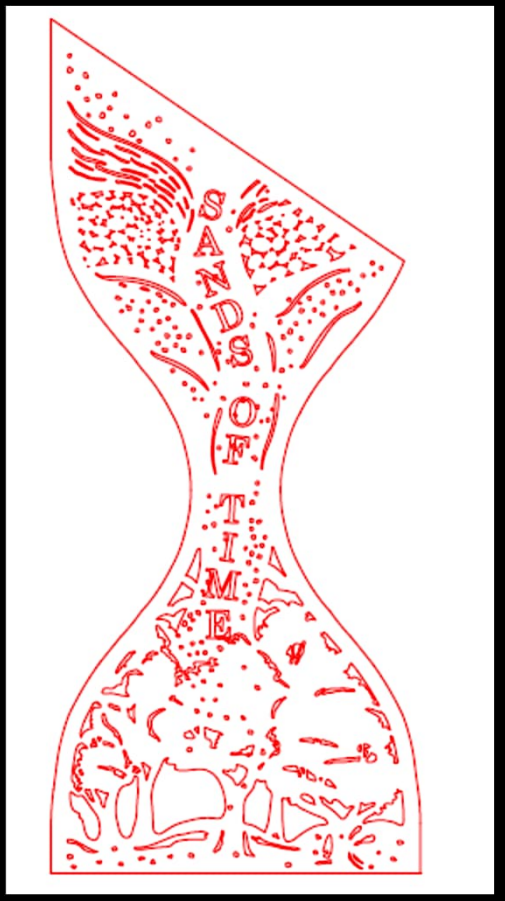
Purple Horizons

Shire Oak Quarry

Purple Horizons

Barr Beacon Quarry



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How Local Geologists can help

- Let us know when projects are likely to create temporary exposures
- Let us know when site investigations might pass through or sample key boundaries
- In both cases put us in contact with those who can provide non-sensitive information or site access to record and sample before things are re-buried or disposed
- Come along and support our events
- Join the research group

Geopark Research Group

- Ist Group - Researchers in fields of
  - Geology/ Geodiversity/ applied geology
  - Archaeology/ Industrial Heritage
  - Biology/Biodiversity/Climate Change

- NE, Universities, LA's, Companies, specialists
- Defining gaps in our Knowledge
- Defining levels of question/resources needed
- Looking at ways to distribute new knowledge
- Looking at funding opportunities

Image courtesy of BCC

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Thanks for listening

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Graham.Worton@dudley.gov.uk