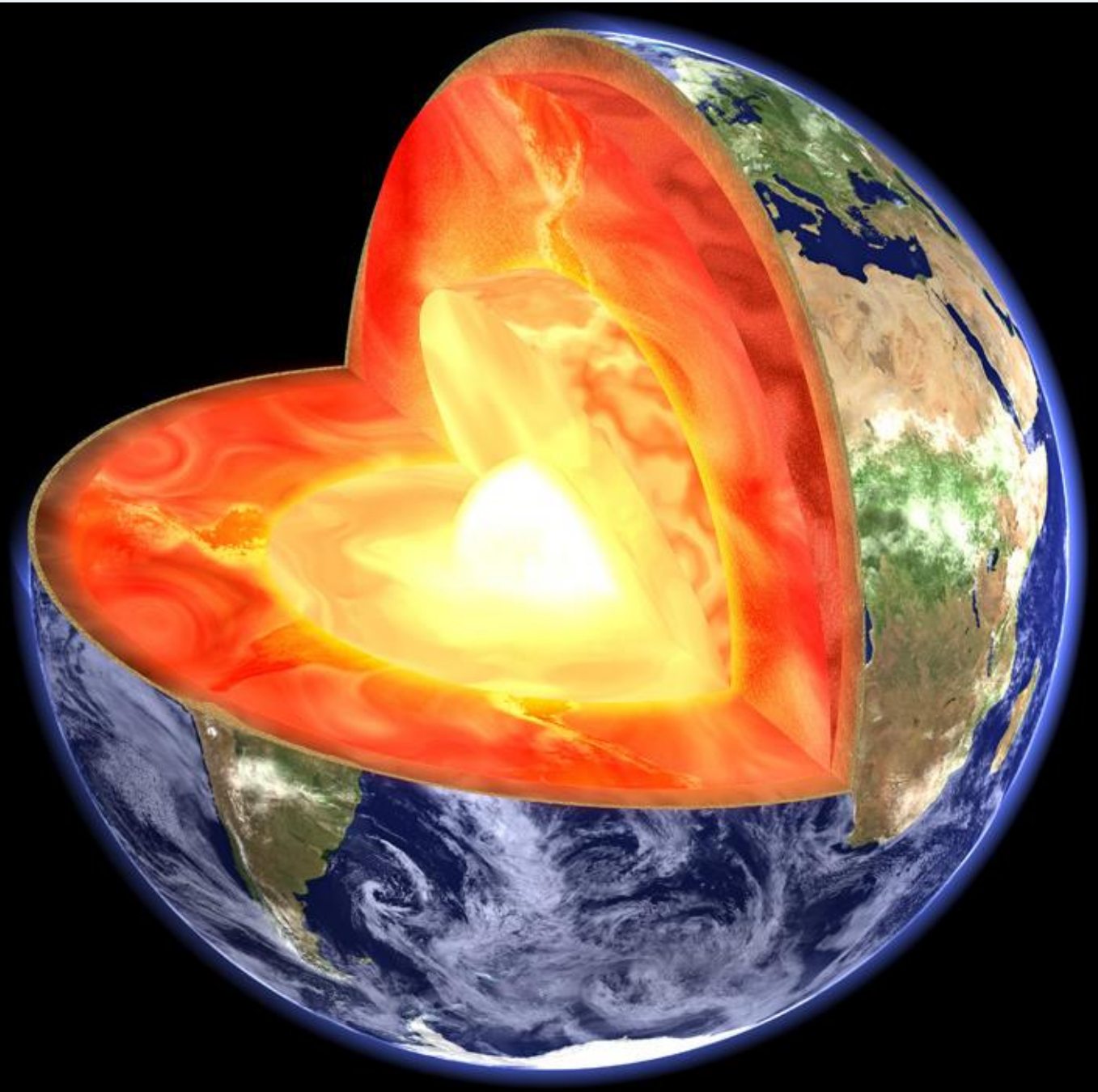
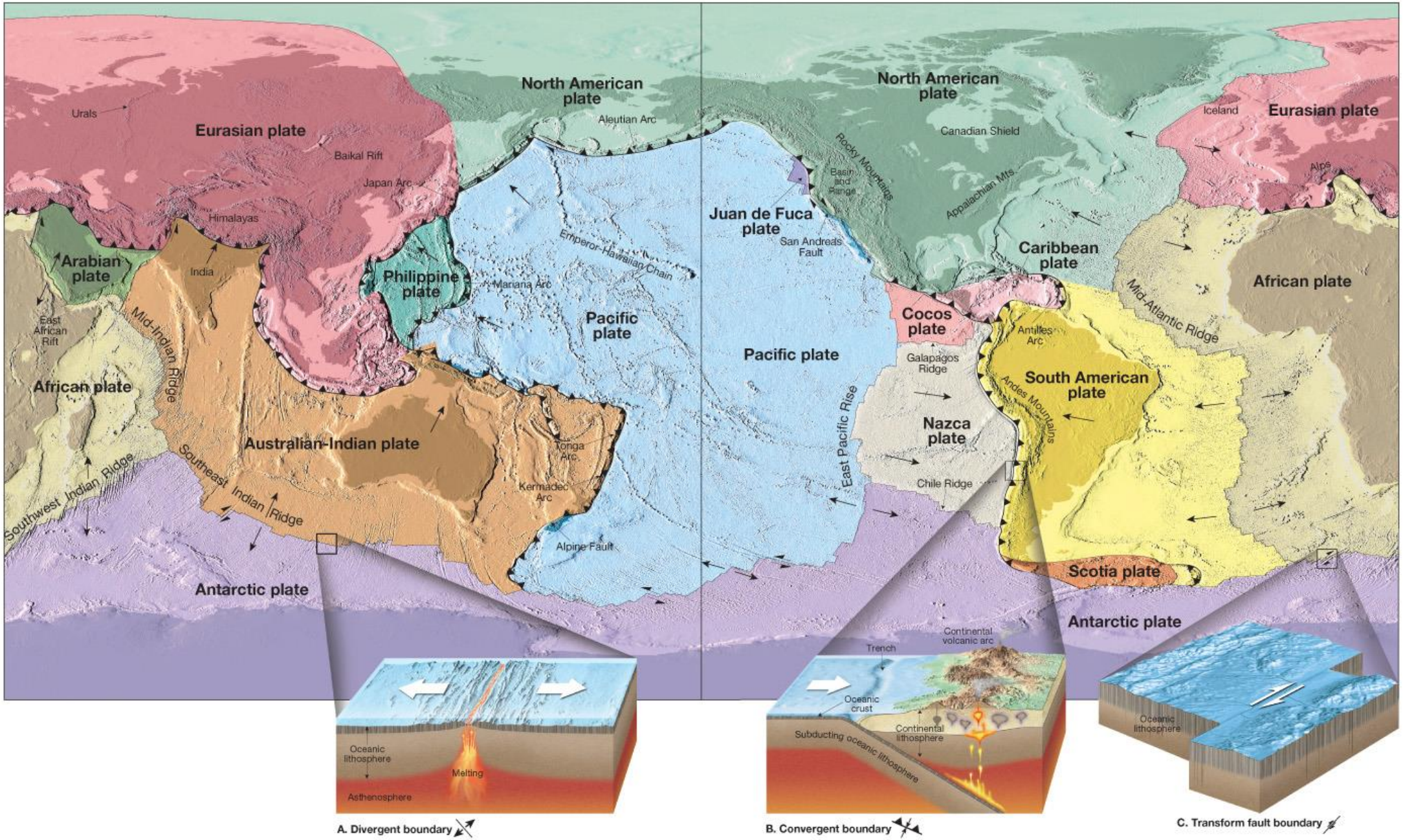
GY4051 Earth Science and Society

Laurentia, Avalonia, and the Iapetus Ocean





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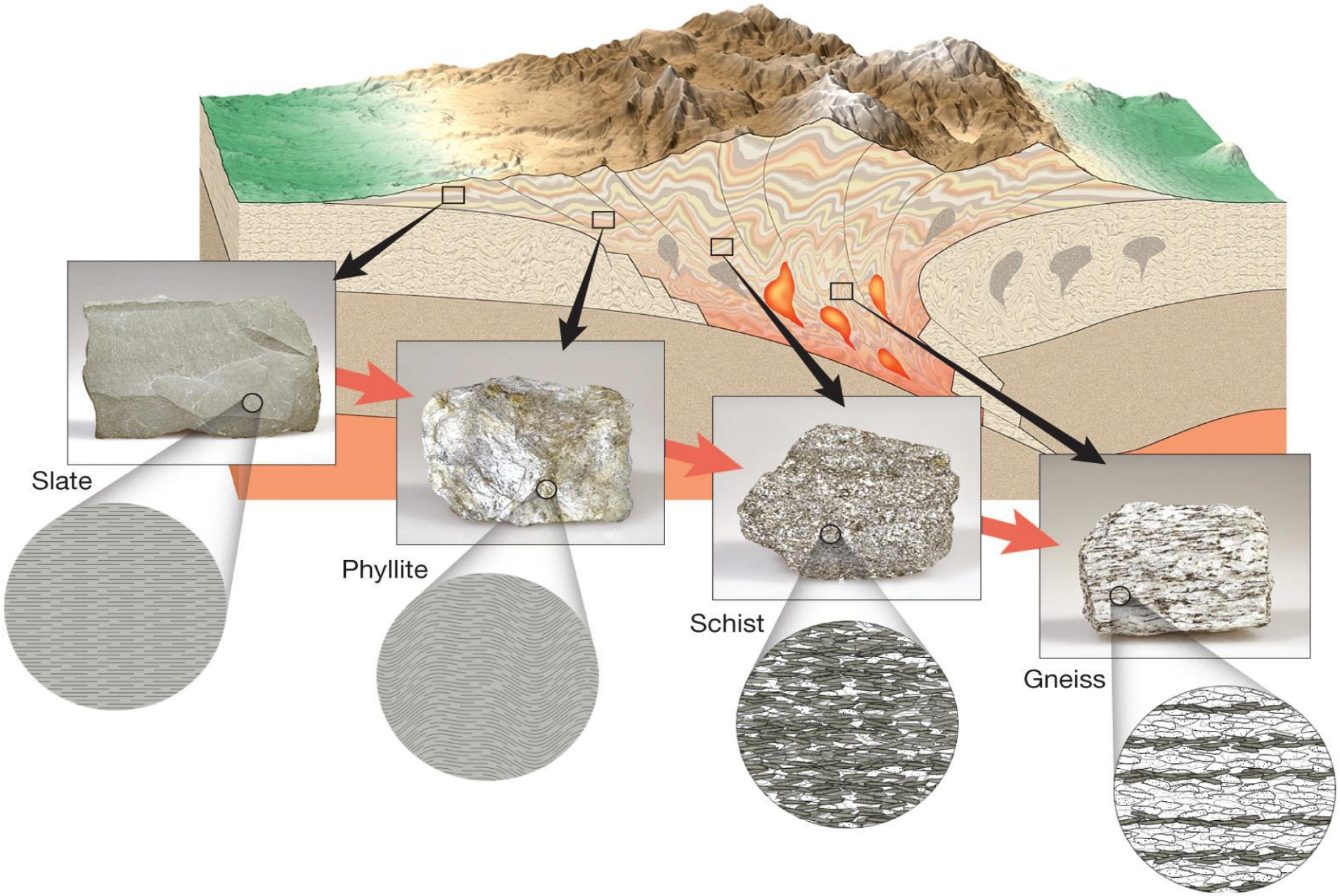

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INTERNATIONAL CHRONOSTRATIGRAPHIC CHART

IUGS

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International Commission on Stratigraphy

v 2023/09

Eonothem / Eon	Erathem / Era	System / Period	Series / Epoch	Stage / Age	GSSP	numerical age (Ma)
Phanerozoic	Cenozoic	Quaternary	Holocene	U/L Meghalayan		present
				M Northgrippian		0.0042
				L/E Greenlandian		0.0082
			Pleistocene	U/L *Upper*		0.0117
				M Chibanian		0.129
				L/E Calabrian		0.774
				Gelasian		1.80
		Neogene	Pliocene	U/L Piacenzian		2.58
				L/E Zanclean		3.600
			Miocene	U/L Messinian		5.333
				Tortonian		7.246
				M Serravallian		11.63
				Langhian		13.82
				L/E Burdigalian		15.98
				Aquitanian		20.44
		Paleogene	Oligocene	Chattian		23.03
				Rupelian		27.82
			Eocene	Priabonian		33.9
				Bartonian		37.71
				Lutetian		41.2
				Ypresian		47.8
			Paleocene	Thanetian		56.0
				Selandian		59.2
				Danian		61.6
Mesozoic		Cretaceous	Upper	Maastrichtian		66.0
				Campanian		72.1 ±0.2
				Santonian		83.6 ±0.2
				Coniacian		86.3 ±0.5
				Turonian		89.8 ±0.3
				Cenomanian		93.9
			Lower	Albian		100.5
				Aptian		~ 113.0
				Barremian		~ 121.4
				Hauterivian		125.77
				Valanginian		~ 132.6
				Berriasian		~ 139.8
						~ 145.0

Eonothem / Eon	Erathem / Era	System / Period	Series / Epoch	Stage / Age	GSSP	numerical age (Ma)
Phanerozoic	Mesozoic	Jurassic	Upper	Tithonian		~ 145.0
				Kimmeridgian		149.2 ±0.7
				Oxfordian		154.8 ±0.8
			Middle	Callovian		161.5 ±1.0
				Bathonian		165.3 ±1.1
				Bajocian		168.2 ±1.2
				Aalenian		170.9 ±0.8
			Lower	Toarcian		174.7 ±0.8
				Pliensbachian		184.2 ±0.3
				Sinemurian		192.9 ±0.3
				Hettangian		199.5 ±0.3
		Triassic	Upper	Rhaetian		201.4 ±0.2
				Norian		~ 208.5
				Carnian		~ 227
			Middle	Ladinian		~ 237
				Anisian		~ 242
			Lower	Olenekian		247.2
				Induan		251.2
Paleozoic		Permian	Lopingian	Changhsingian		251.902 ±0.024
				Wuchiapingian		254.14 ±0.07
			Guadalupian	Capitanian		259.51 ±0.21
				Wordian		264.28 ±0.16
				Roadian		266.9 ±0.4
			Cisuralian	Kungurian		273.01 ±0.14
				Artinskian		283.5 ±0.6
				Sakmarian		290.1 ±0.26
				Asselian		293.52 ±0.17
		Carboniferous	Pennsylvanian	Gzhelian		298.9 ±0.15
				Kasimovian		303.7 ±0.1
				Moscovian		307.0 ±0.1
				Bashkirian		315.2 ±0.2
			Mississippian	Serpukhovian		323.2 ±0.4
				Visean		330.9 ±0.2
				Tournaisian		346.7 ±0.4
						358.9 ±0.4

Eonothem / Eon	Erathem / Era	System / Period	Series / Epoch	Stage / Age	GSSP	numerical age (Ma)
Phanerozoic	Paleozoic	Devonian	Upper	Famennian		358.9 ±0.4
				Frasnian		372.2 ±1.6
			Middle	Givetian		382.7 ±1.6
				Eifelian		387.7 ±0.8
			Lower	Emsian		393.3 ±1.2
				Pragian		407.6 ±2.6
				Lochkovian		410.8 ±2.8
		Silurian	Pridoli			419.2 ±3.2
			Ludlow	Ludfordian		423.0 ±2.3
				Gorstian		425.6 ±0.9
			Wenlock	Homerian		427.4 ±0.5
				Sheinwoodian		430.5 ±0.7
			Llandovery	Telychian		433.4 ±0.8
				Aeronian		438.5 ±1.1
				Rhuddanian		440.8 ±1.2
		Ordovician	Upper	Hirnantian		443.8 ±1.5
				Katian		445.2 ±1.4
				Sandbian		453.0 ±0.7
			Middle	Darriwilian		458.4 ±0.9
				Dapingian		467.3 ±1.1
			Lower	Floian		470.0 ±1.4
				Tremadocian		477.7 ±1.4
		Cambrian	Furongian	*Stage 10*		485.4 ±1.9
				Jiangshanian		~ 489.5
				Paibian		~ 494
			Miaolingian	Guzhangian		~ 497
				Drumian		~ 500.5
				Wuliuan		~ 504.5
			Series 2	*Stage 4*		~ 509
				Stage 3		~ 514
			Terreneuvian	*Stage 2*		~ 521
				Fortunian		~ 529
						538.8 ±0.2

Eonothem / Eon	Erathem / Era	System / Period	GSSP	GSSA	numerical age (Ma)
					538.8 ±0.2
Precambrian	Proterozoic	Neo-proterozoic	Ediacaran		~ 635
			Cryogenian		~ 720
			Tonian		1000
		Meso-proterozoic	Stenian		1200
			Ectasian		1400
			Calymmian		1600
		Paleo-proterozoic	Statherian		1800
			Orosirian		2050
			Rhyacian		2300
			Siderian		2500
	Archean	Neo-archean			2800
		Meso-archean			3200
		Paleo-archean			3600
		Eo-archean			4031 ± 3
	Hadean				4567

Units of all ranks are in the process of being defined by Global Boundary Stratotype Section and Points (GSSP) for their lower boundaries, including those of the Archean and Proterozoic, long defined by Global Standard Stratigraphic Ages (GSSA). Italic fonts indicate informal units and placeholders for unnamed units. Versioned charts and detailed information on ratified GSSPs are available at the website http://www.stratigraphy.org. The URL to this chart is found below.

Numerical ages are subject to revision and do not define units in the Phanerozoic and the Ediacaran; only GSSPs do. For boundaries in the Phanerozoic without ratified GSSPs or without constrained numerical ages, an approximate numerical age (~) is provided.

Ratified Subseries/Subepochs are abbreviated as U/L (Upper/Late), M (Middle) and L/E (Lower/Early). Numerical ages for all systems except Quaternary, upper Paleogene, Cretaceous, Jurassic, Triassic, Permian, Cambrian and Precambrian are taken from 'A Geologic Time Scale 2012' by Gradstein et al. (2012), those for the Quaternary, upper Paleogene, Cretaceous, Jurassic, Triassic, Permian, Cambrian and Precambrian were provided by the relevant ICS subcommissions.

Colouring follows the Commission for the Geological Map of the World (www.cgm.org)

Chart drafted by K.M. Cohen, D.A.T. Harper, P.L. Gibbard, N. Car
(c) International Commission on Stratigraphy, September 2023

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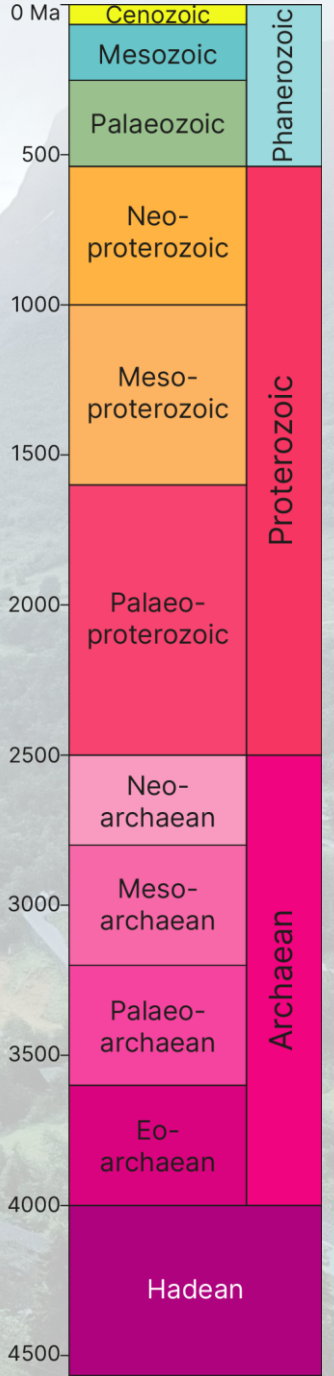
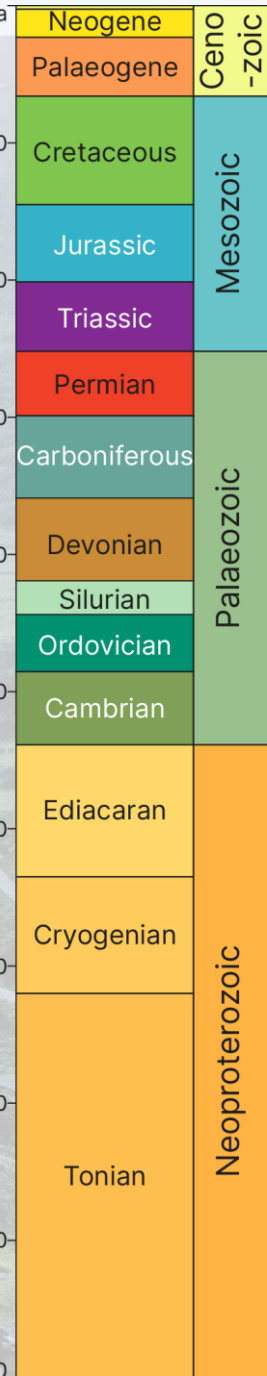
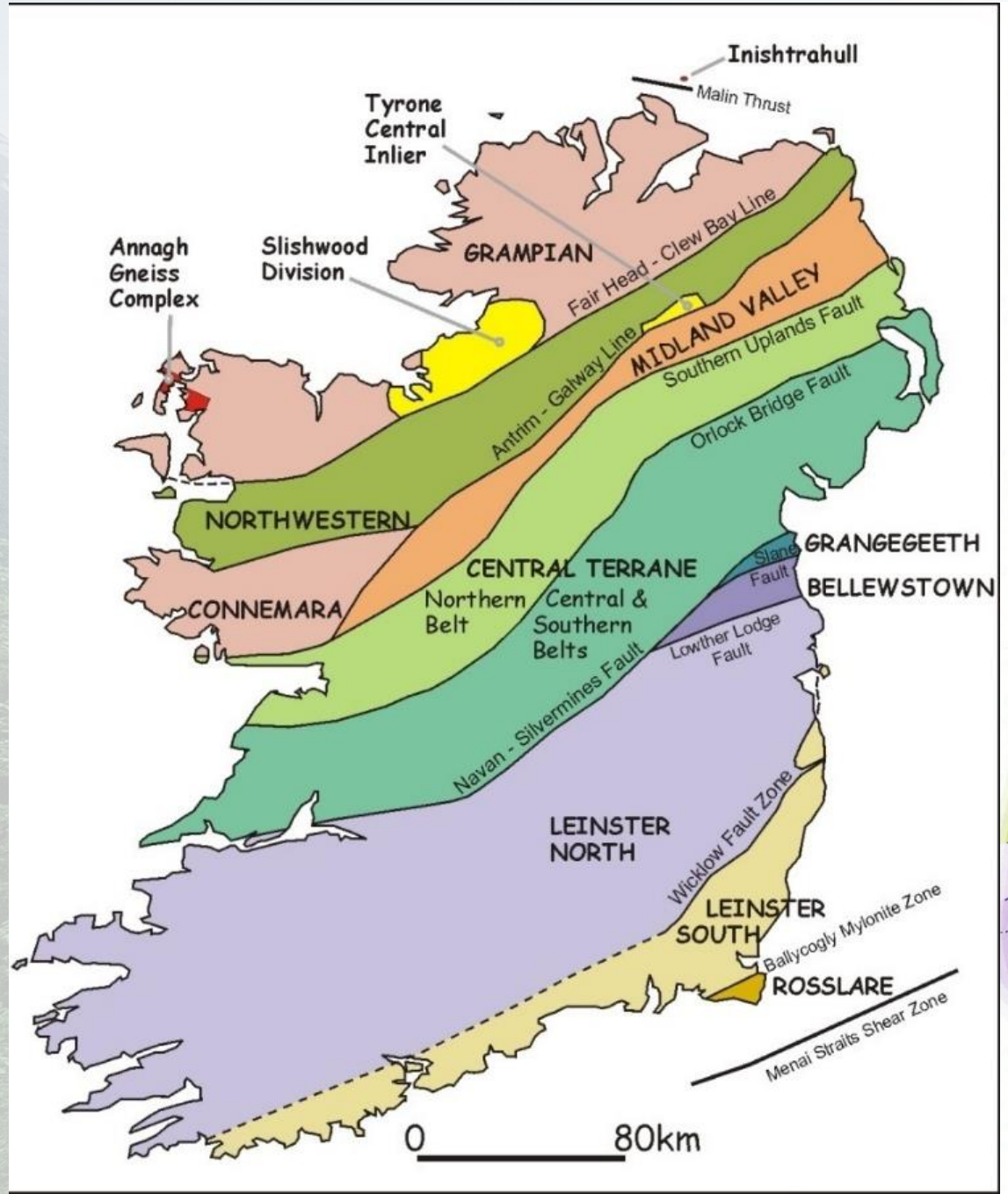
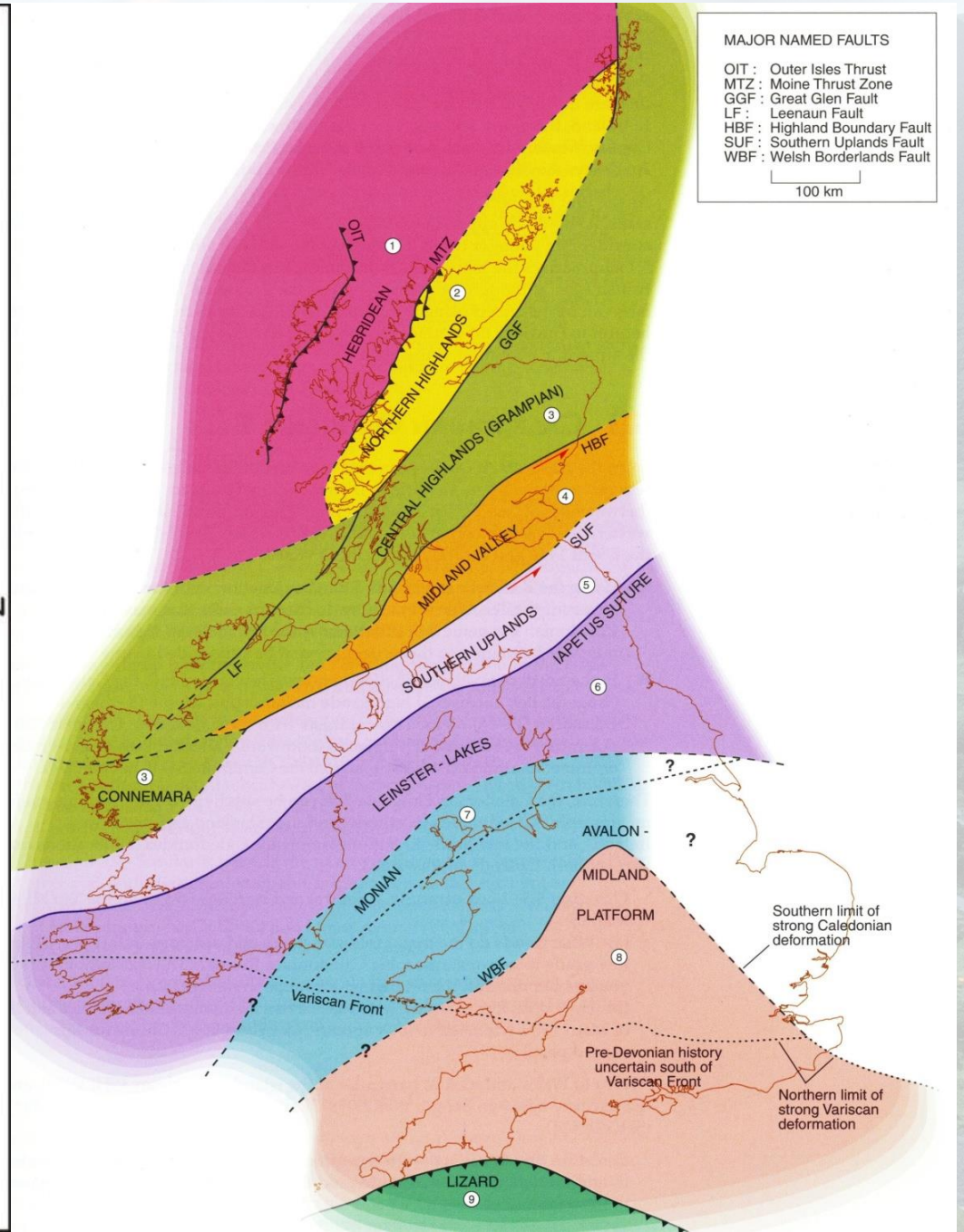
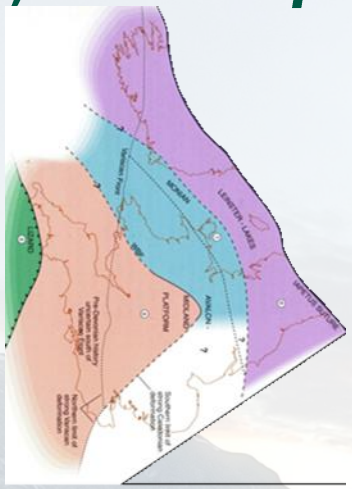
URL: http://www.stratigraphy.org/ICSchart/ChronostratChart2023-09.pdf

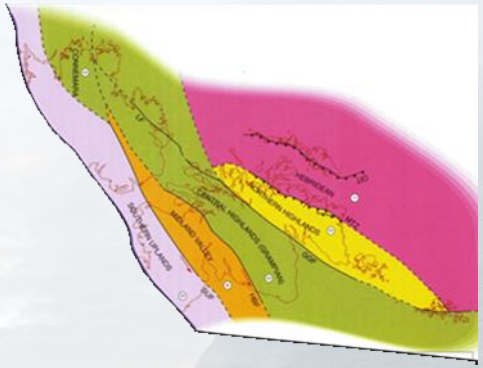


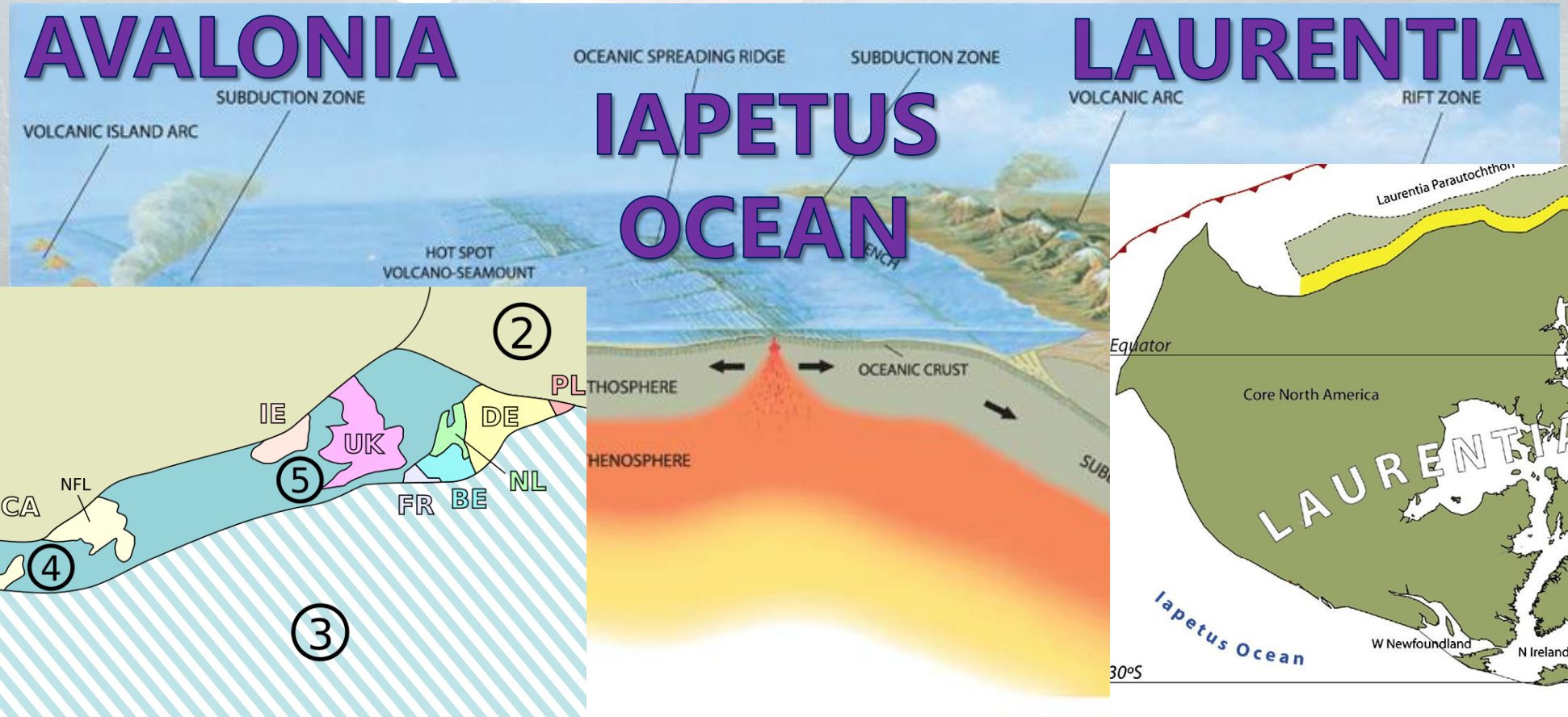


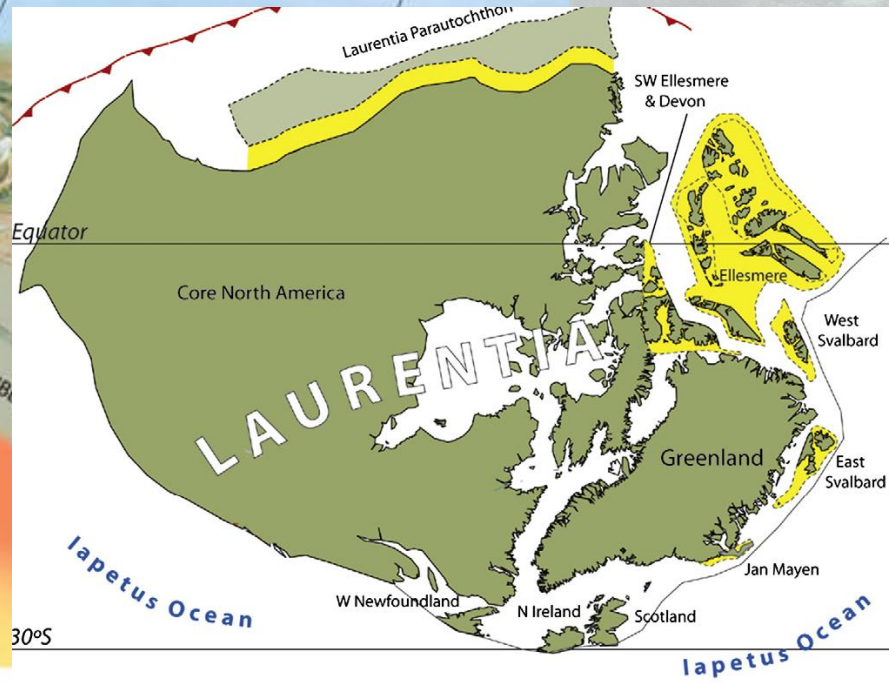

Inishtrahull
Malin Thrust
Tyrone Central Inlier
Annagh Gneiss Complex
Slishwood Division
GRAMPIAN
Fair Head - Clew Bay Line
MIDLAND VALLEY
Antrim - Galway Line
Southern Uplands Fault
Orlock Bridge Fault
NORTHWESTERN
CONNEMARA
CENTRAL TERRANE
Northern Belt
Central & Southern Belts
Slane Fault
GRANGEGEETH
BELLEWSTOWN
Lowther Lodge Fault
Navan - Silvermines Fault
LEINSTER NORTH
Wicklow Fault Zone
LEINSTER SOUTH
Ballycogly Mylonite Zone
ROSSLARE
Menai Straits Shear Zone
0
80km

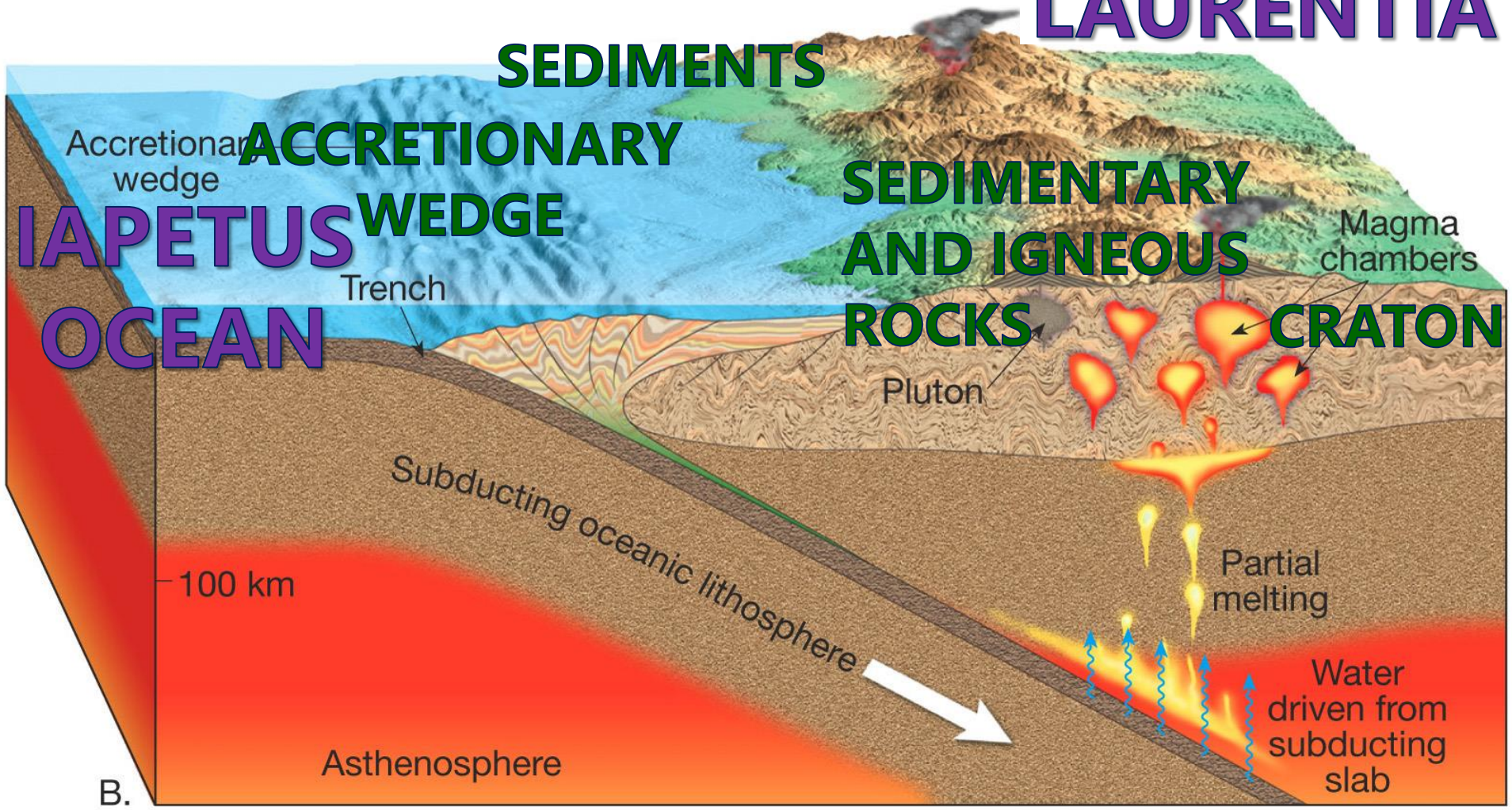

MAJOR NAMED FAULTS
OIT : Outer Isles Thrust
MTZ : Moine Thrust Zone
GGF : Great Glen Fault
LF : Leenaun Fault
HBF : Highland Boundary Fault
SUF : Southern Uplands Fault
WBF : Welsh Borderlands Fault
100 km
OIT
MTZ
HEBRIDEAN
NORTHERN HIGHLANDS
GGF
CENTRAL HIGHLANDS (GRAMPIAN)
HBF
MIDLAND VALLEY
SUF
SOUTHERN UPLANDS
IAPETUS SUTURE
LF
CONNEMARA
LEINSTER - LAKES
AVALON - MIDLAND PLATFORM
MONIAN
WBF
Variscan Front
Southern limit of strong Caledonian deformation
Pre-Devonian history uncertain south of Variscan Front
Northern limit of strong Variscan deformation
LIZARD






AVALONIA
SUBDUCTION ZONE
VOLCANIC ISLAND ARC
OCEANIC SPREADING RIDGE
SUBDUCTION ZONE
IAPETUS OCEAN
LAURENTIA
VOLCANIC ARC
RIFT ZONE
HOT SPOT VOLCANO-SEAMOUNT
OCEANIC CRUST
THOSPHERE
HENOSPHERE
1
2
3
4
5
US
ME
NB
PE
CA
NFL
NH
MA
CT
RI
NS
IE
UK
DE
PL
FR
BE
NL


Laurentia Parautochthon
SW Ellesmere & Devon
Equator
Core North America
Ellesmere
West Svalbard
LAURENTIA
Greenland
East Svalbard
Iapetus Ocean
Jan Mayen
W Newfoundland
N Ireland
Scotland
30°S
Iapetus Ocean



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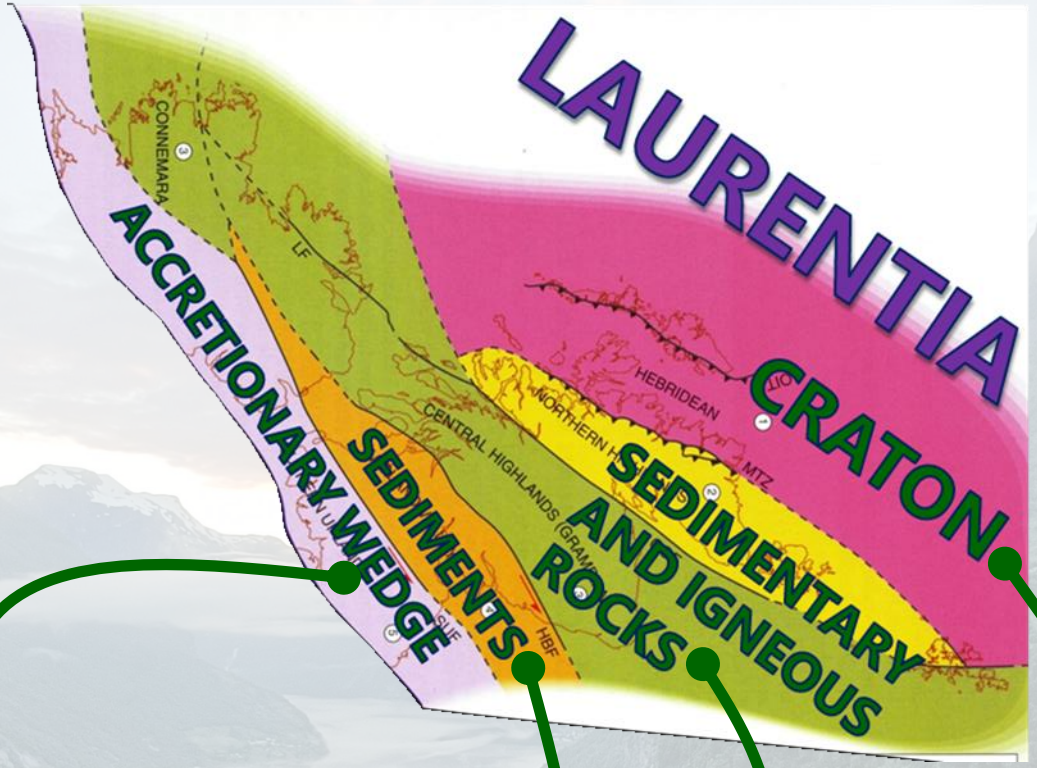
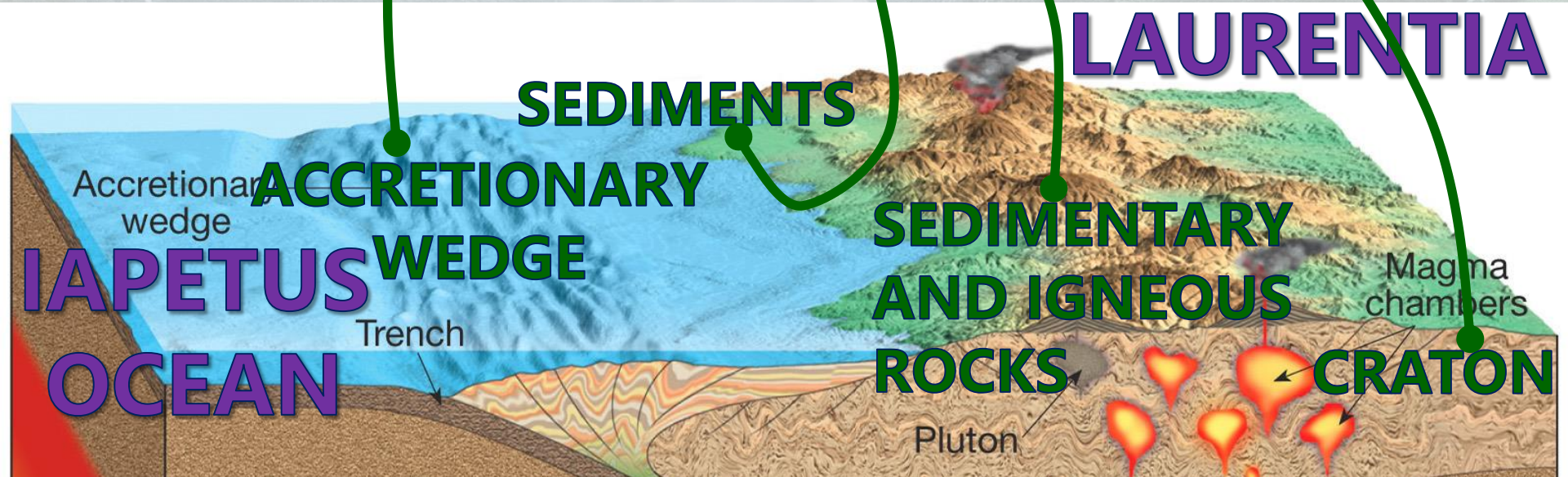
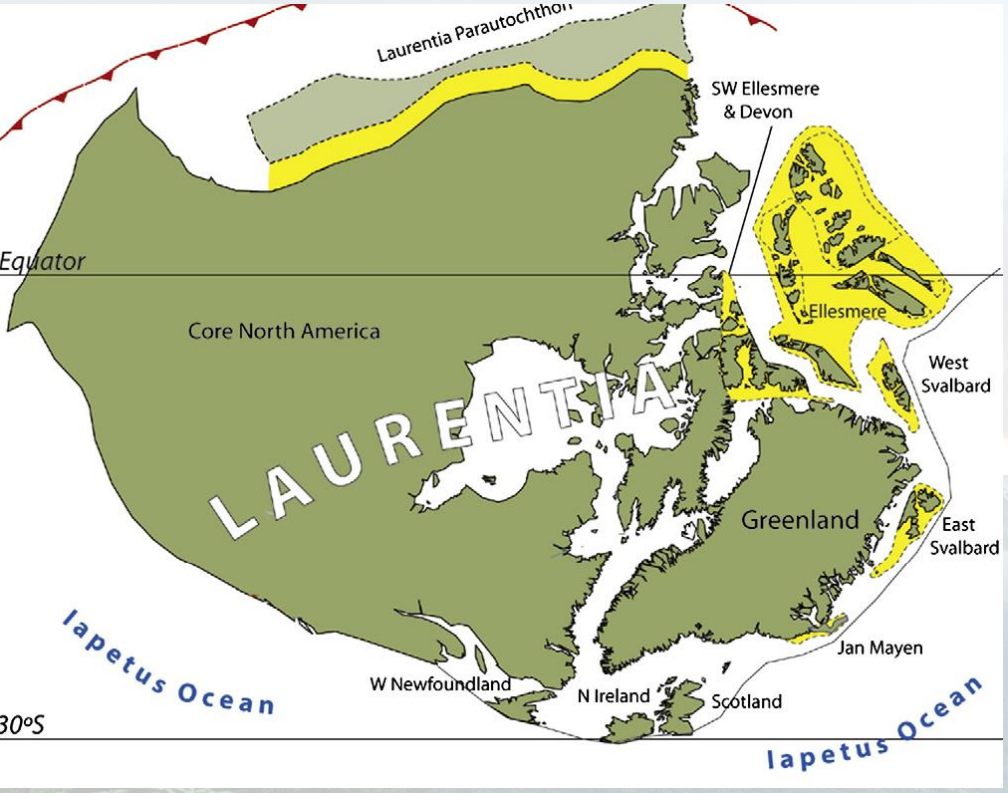
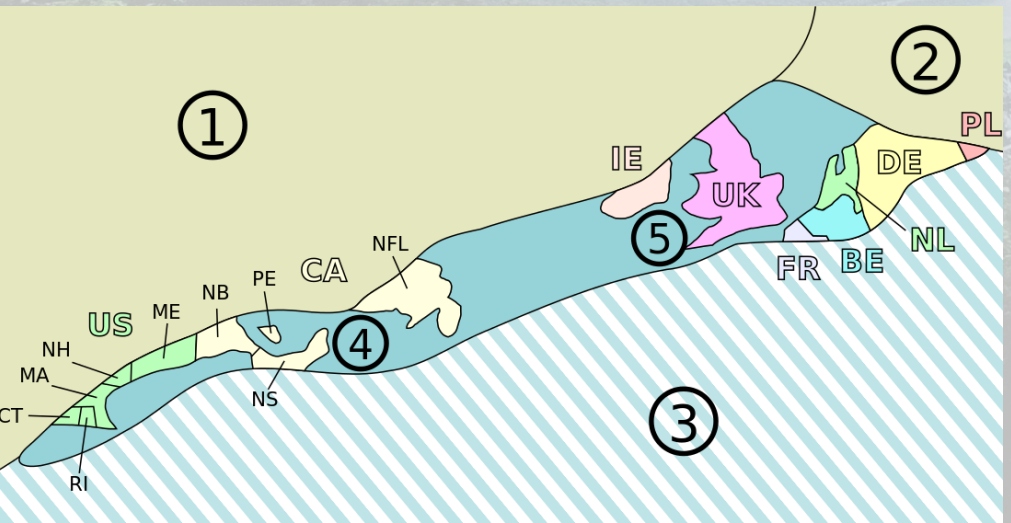
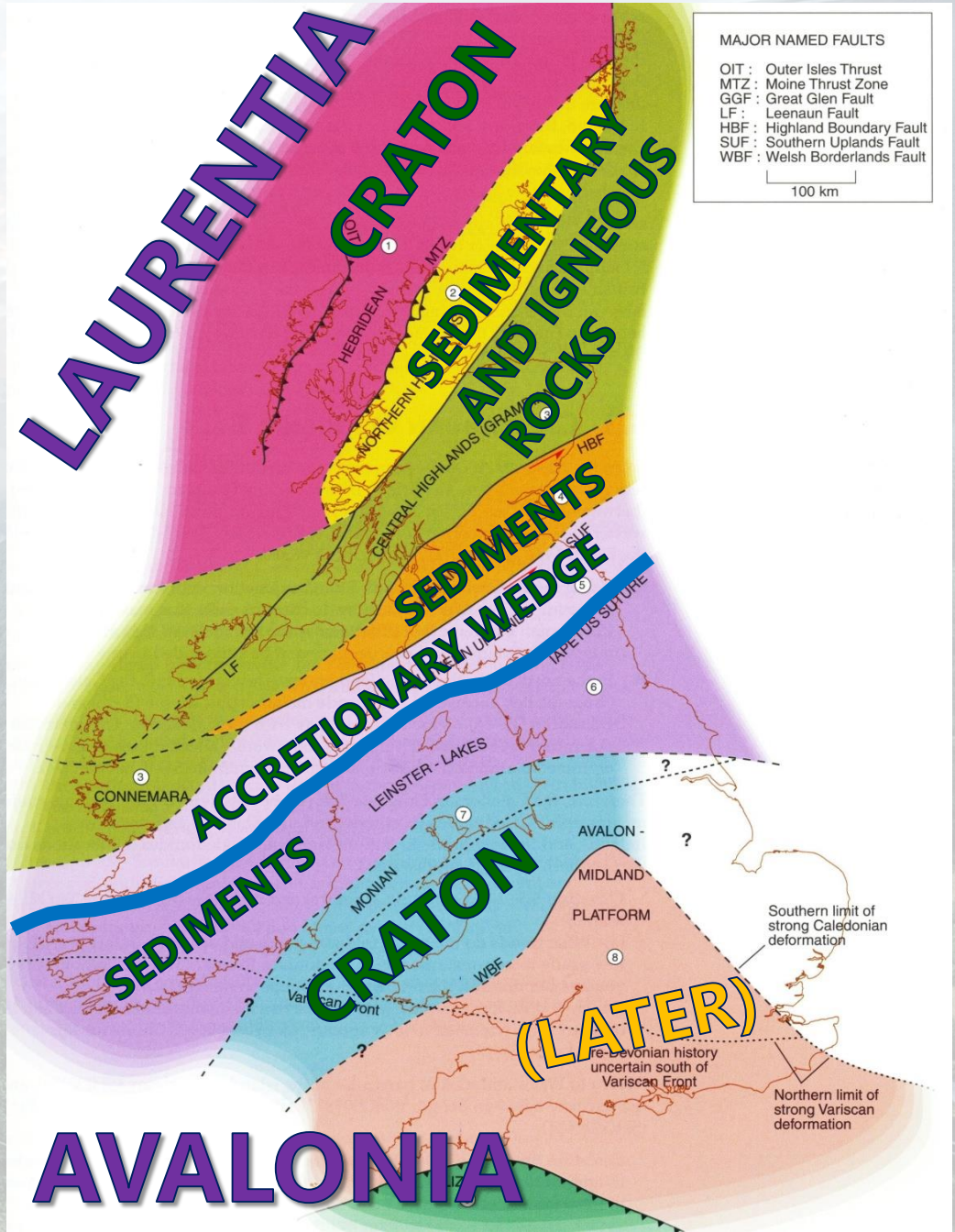

LAURENTIA
CRATON
SEDIMENTARY
AND IGNEOUS
ROCKS
SEDIMENTS
ACCRETIONARY WEDGE
CONNEMARA
HEBRIDEAN
NORTHERN
CENTRAL HIGHLANDS
LIC
MTZ
LF
HBF

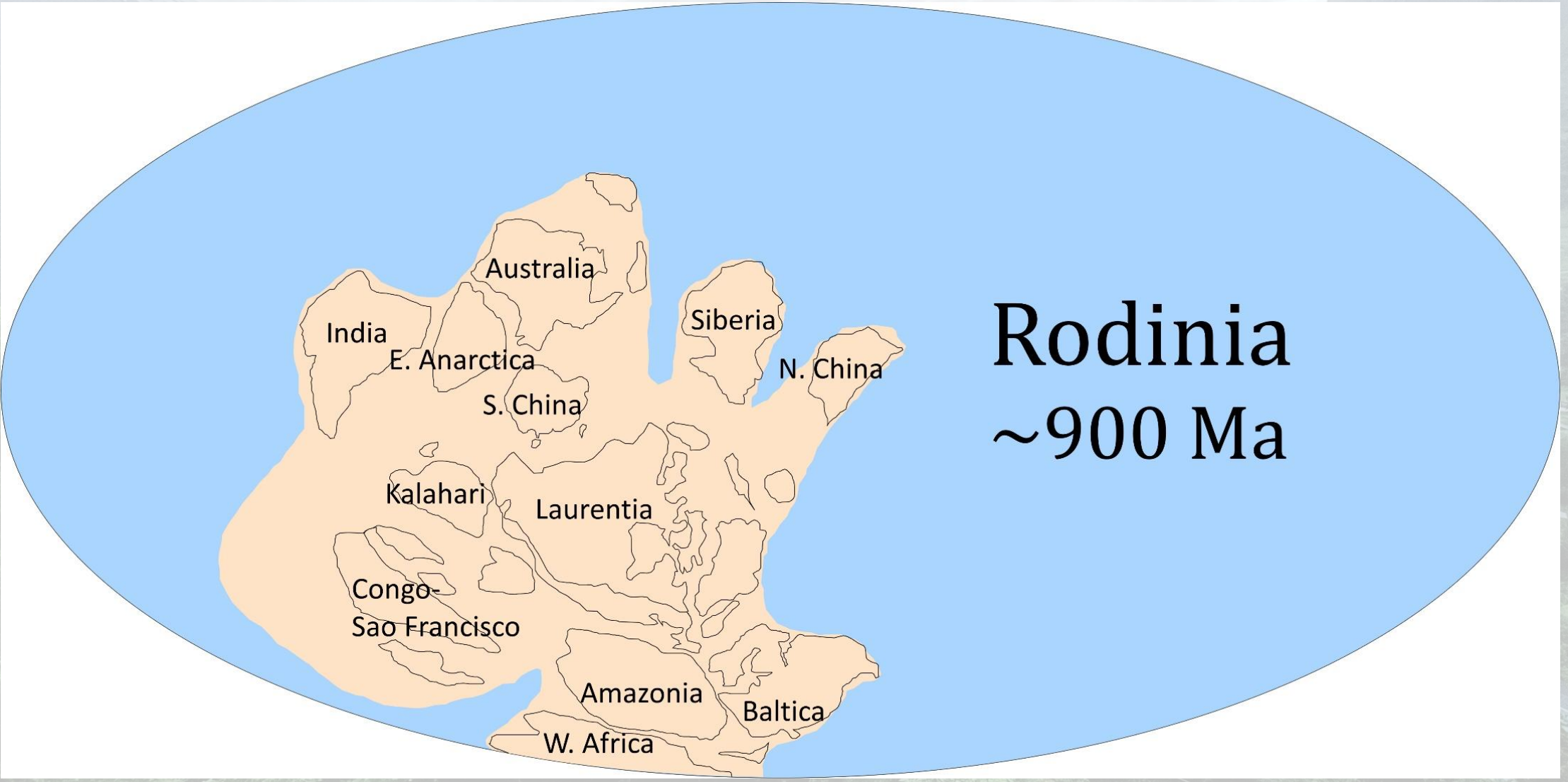

LAURENTIA
SEDIMENTS
ACCRETIONARY
WEDGE
Accretionary
wedge
IAPETUS
OCEAN
Trench
SEDIMENTARY
AND IGNEOUS
ROCKS
Magma
chambers
CRATON
Pluton

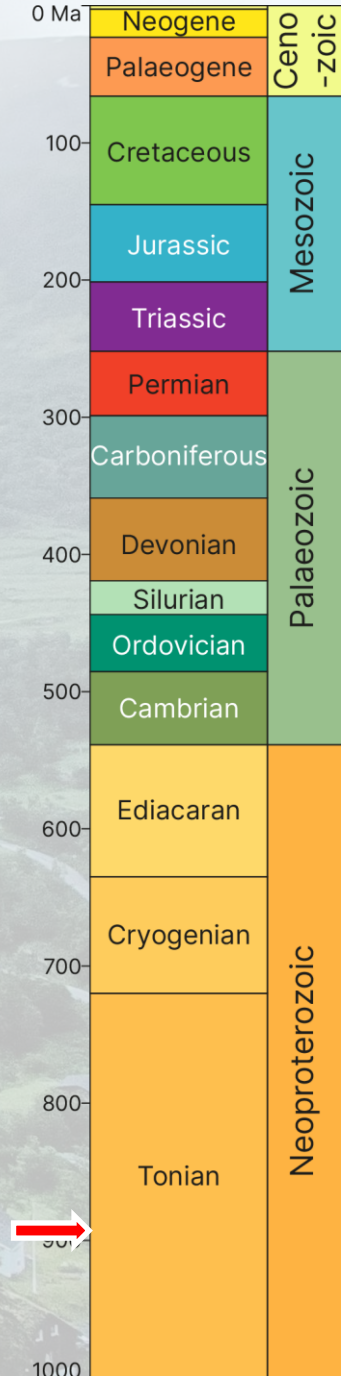


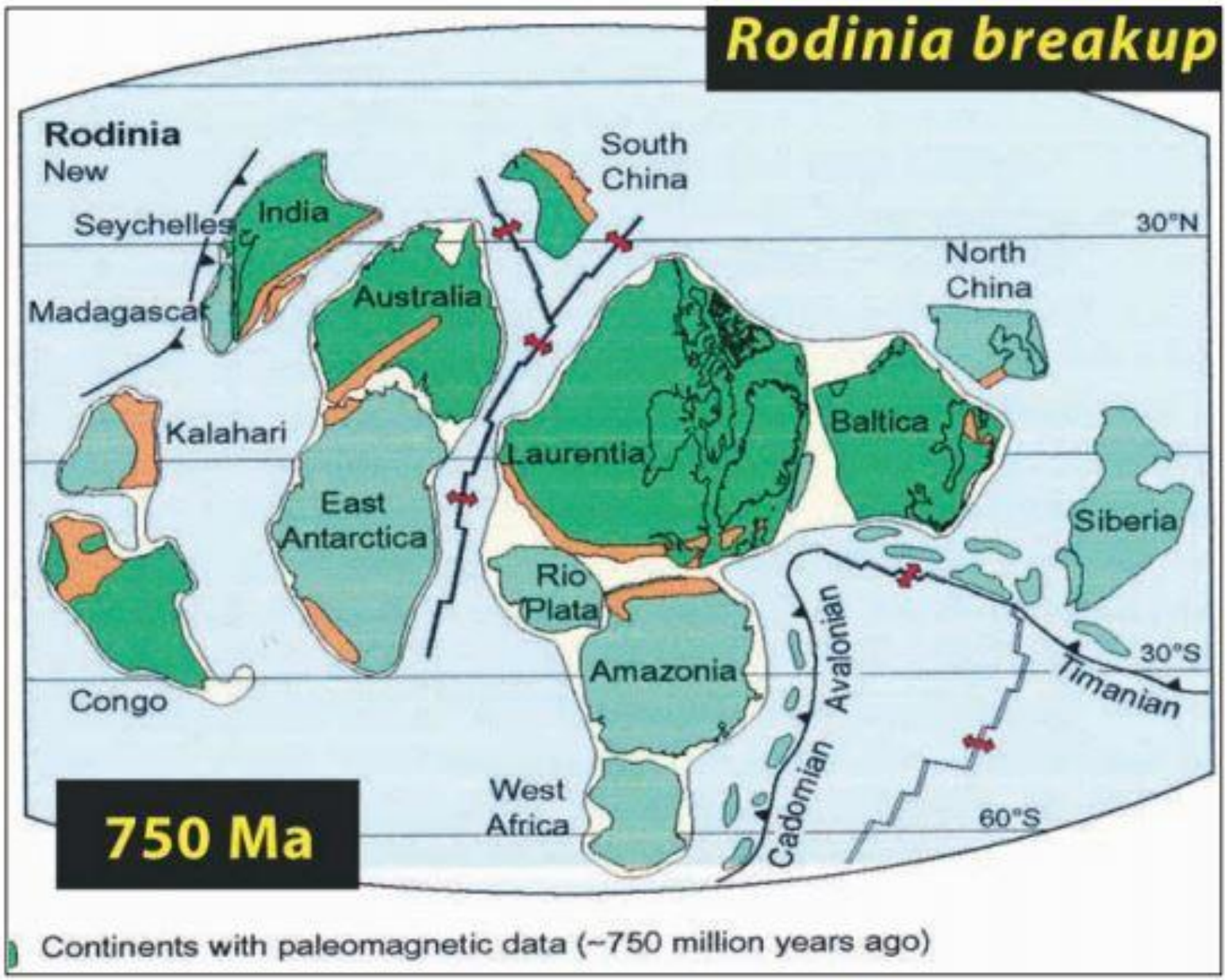


IAPETUS WOZ ERE

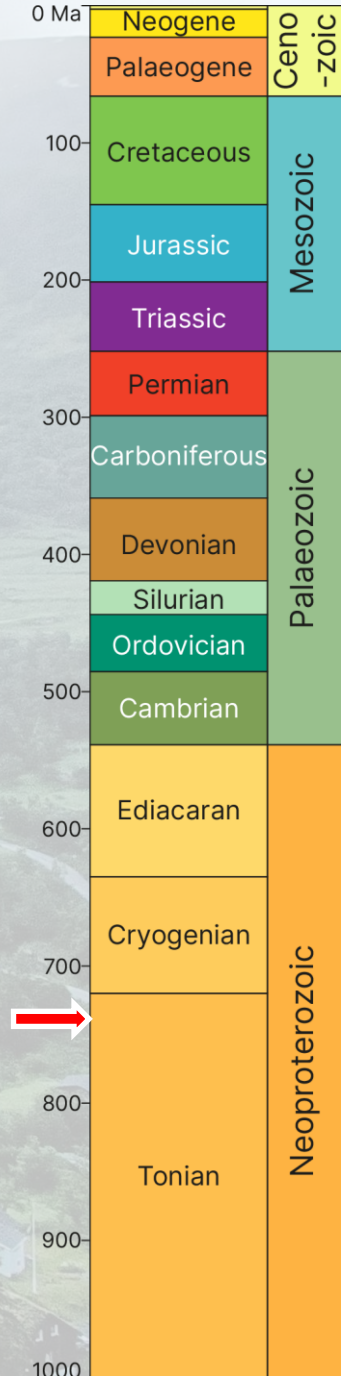



Australia
India
E. Anarctica
Siberia
N. China
S. China
Kalahari
Laurentia
Congo-
Sao Francisco
Amazonia
Baltica
W. Africa
Rodinia
~900 Ma

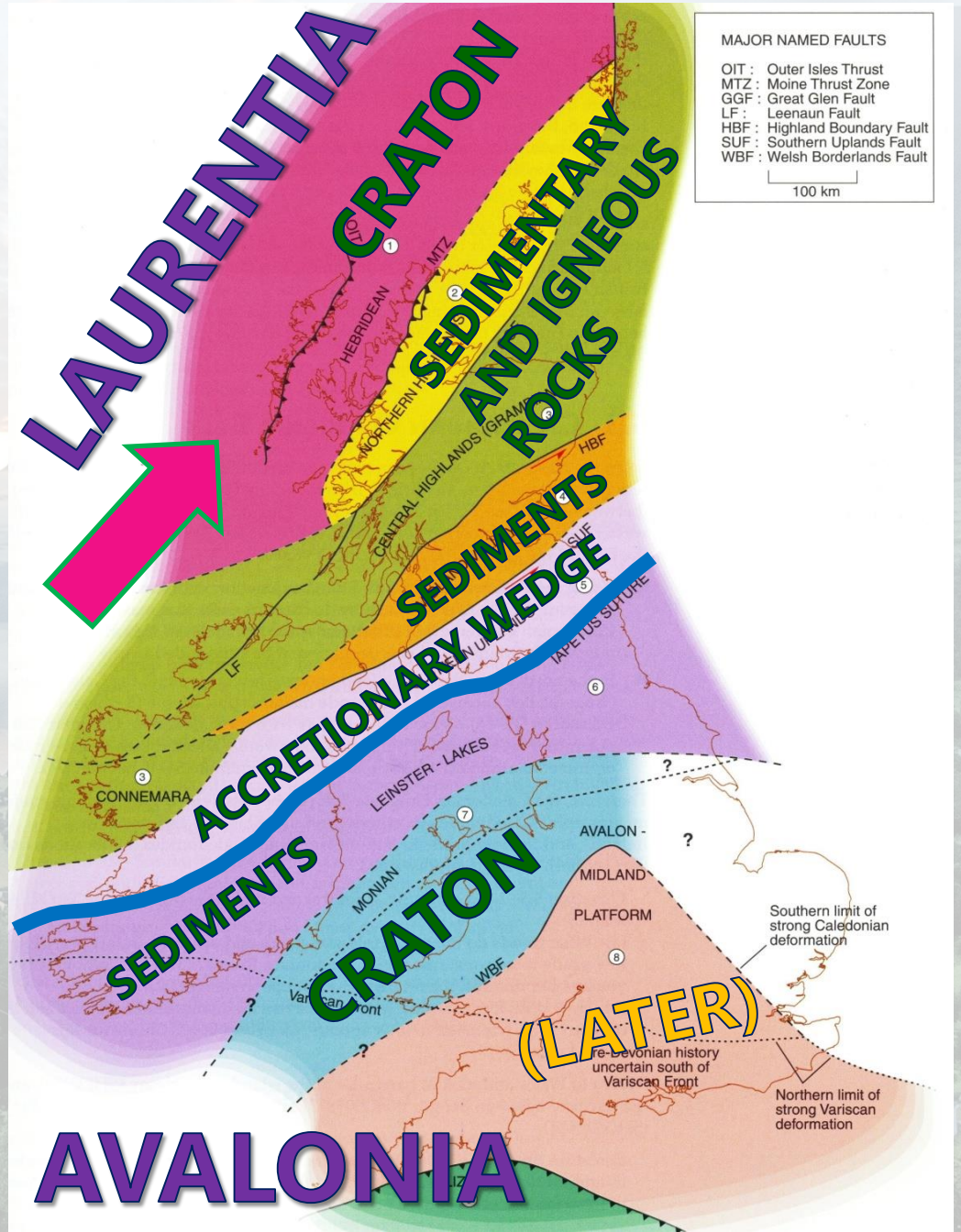

0 Ma
100
200
300
400
500
600
700
800
1000
Neogene
Palaeogene
Cretaceous
Jurassic
Triassic
Permian
Carboniferous
Devonian
Silurian
Ordovician
Cambrian
Ediacaran
Cryogenian
Tonian
Ceno-zoic
Mesozoic
Palaeozoic
Neoproterozoic



Breakup and dispersal of the Rodinia supercontinent (Torsvik, 2004). Source: snowballearth.org

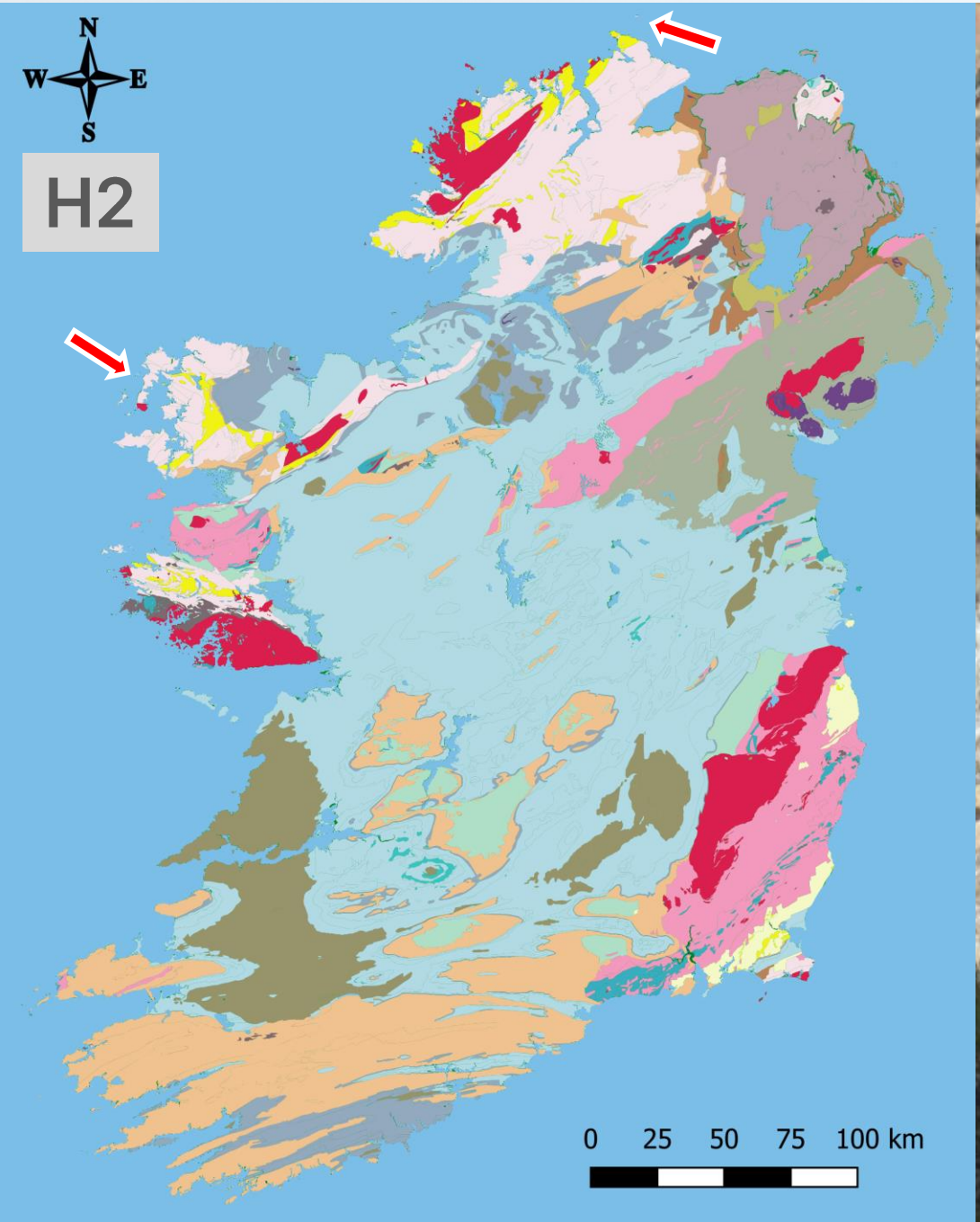


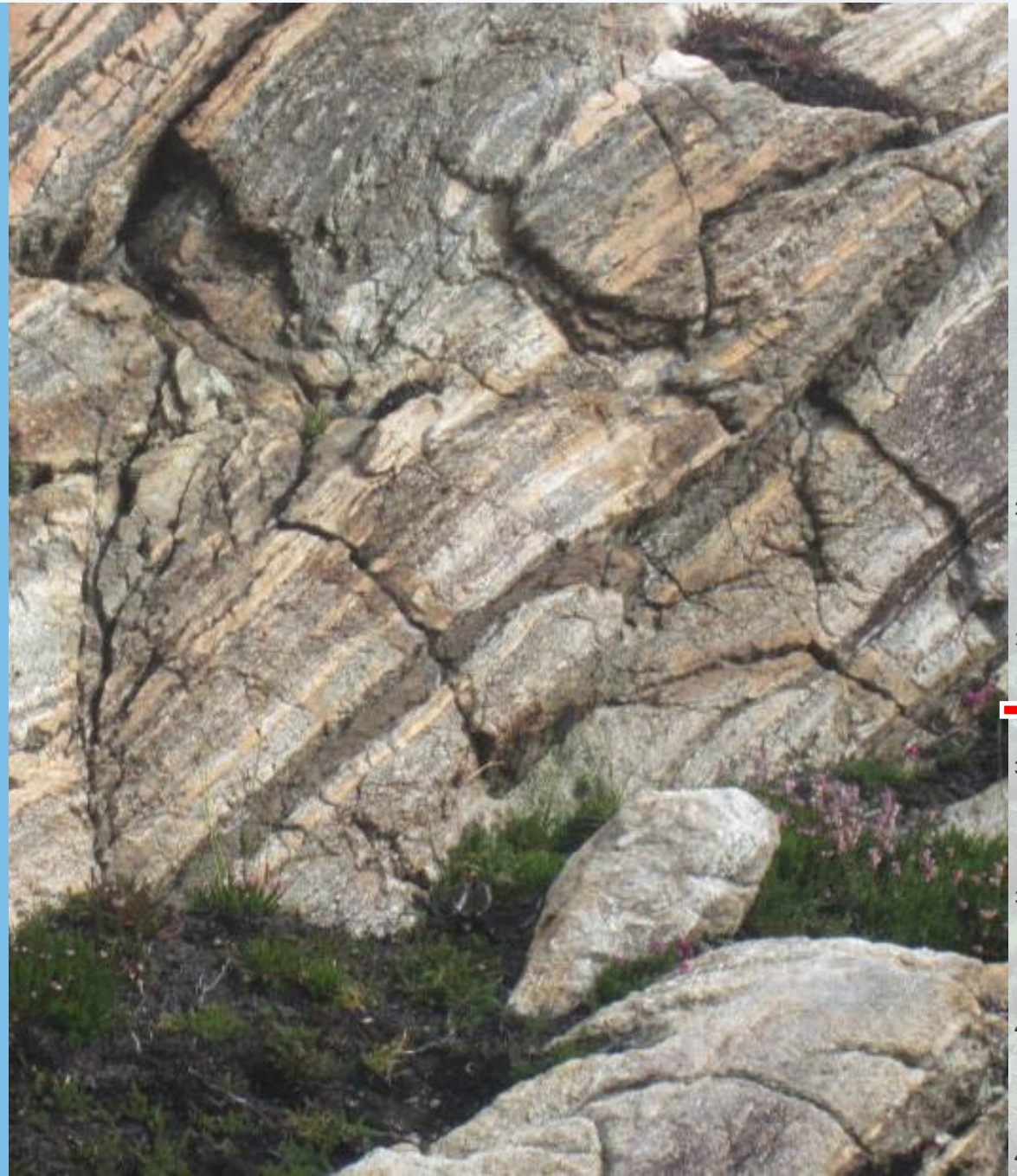
HEBRIDEAN

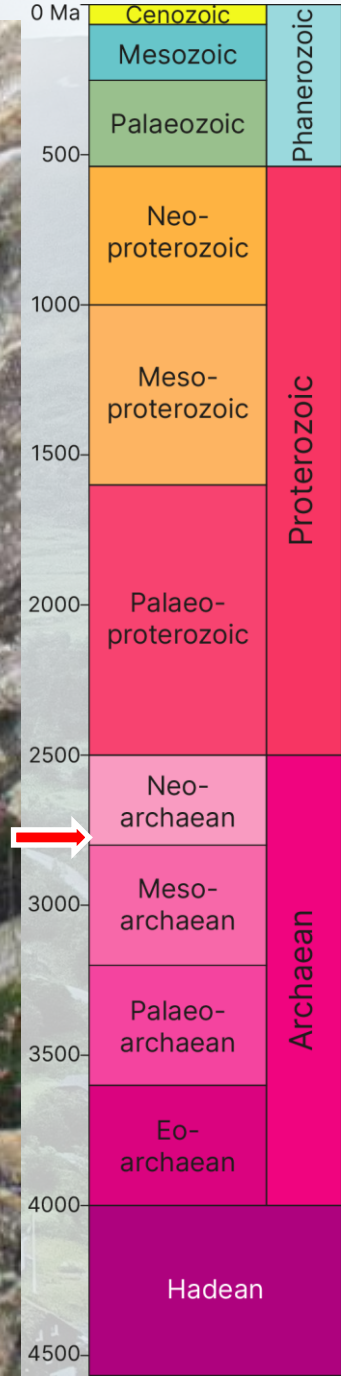


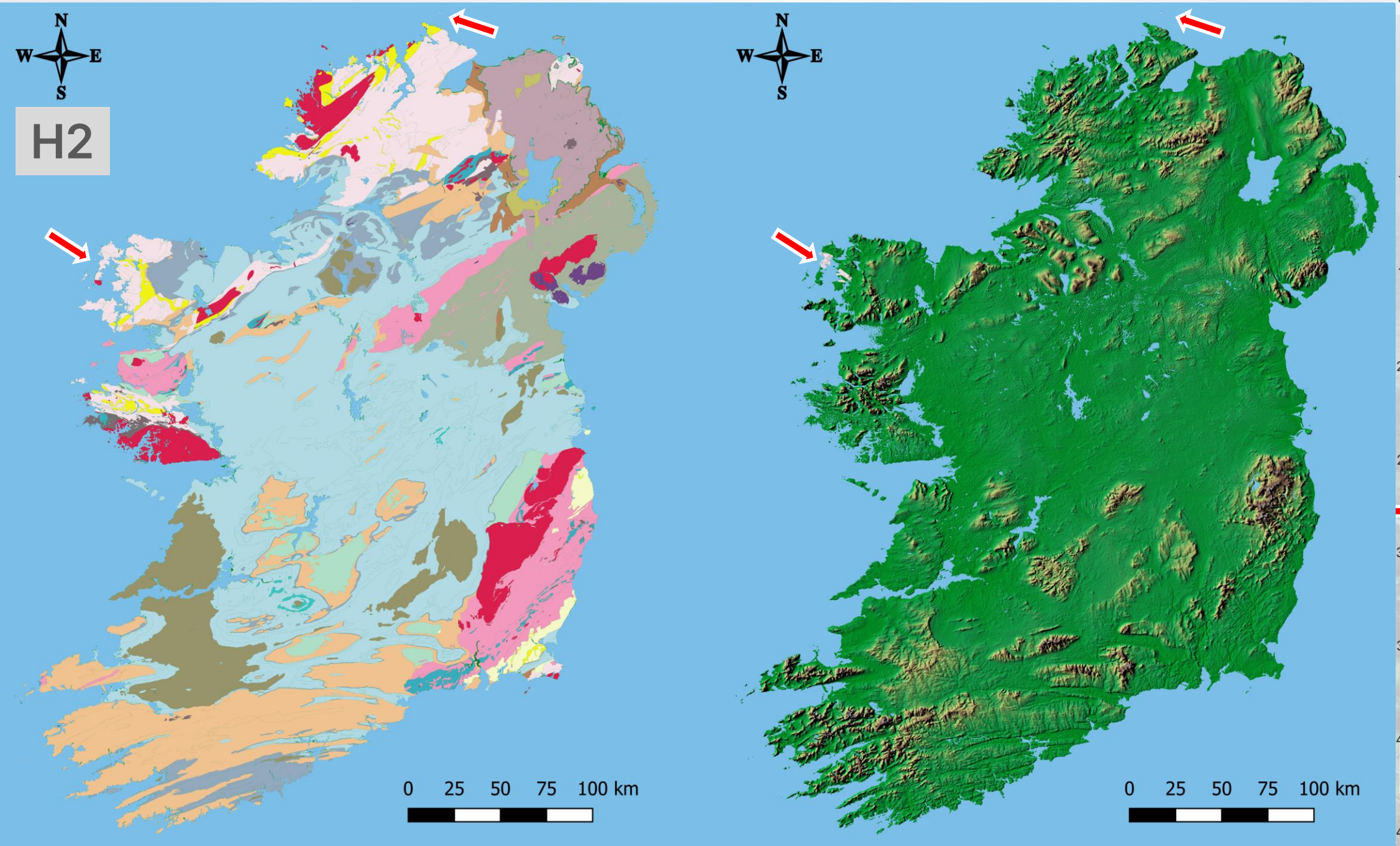
IAPETUS
WOZ
ERE

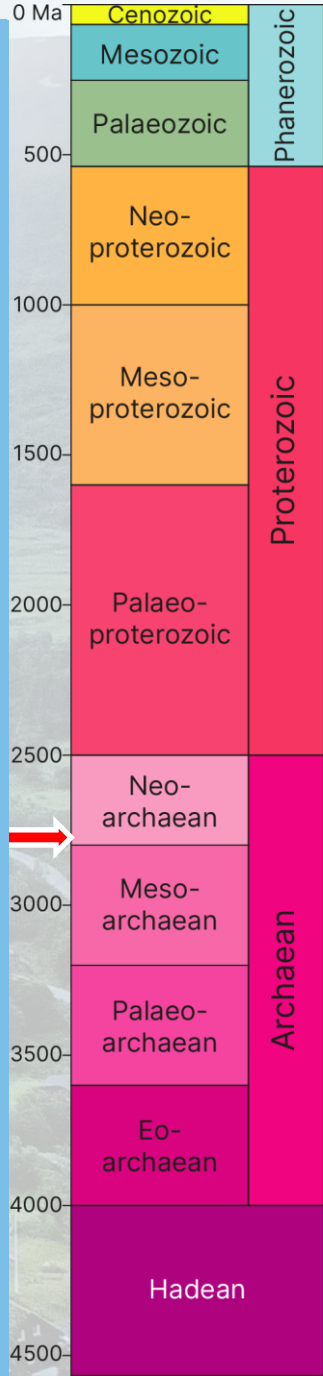
H2
0 Ma
Cenozoic
Mesozoic
Palaeozoic
Phanerozoic
500
Neo-proterozoic
1000
Meso-proterozoic
1500
Palaeo-proterozoic
Proterozoic
2000
2500
Neo-archaean
Meso-archaean
3000
Palaeo-archaean
3500
Eo-archaean
Archaean
4000
Hadean
4500

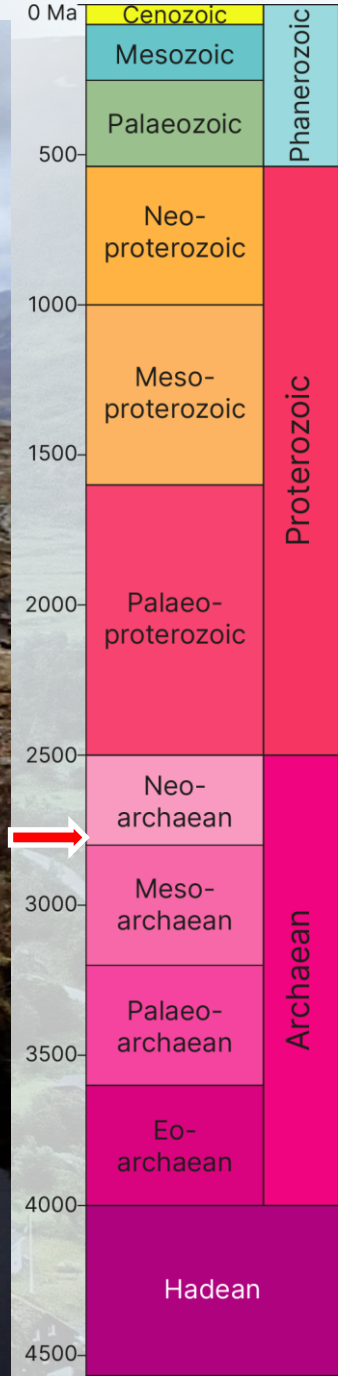

N
W
E
S
H2
0 25 50 75 100 km




0 Ma
Cenozoic
Mesozoic
Palaeozoic
Phanerozoic
500
Neo-proterozoic
1000
Meso-proterozoic
1500
Palaeo-proterozoic
Proterozoic
2000
2500
Neo-archaean
Meso-archaean
3000
Palaeo-archaean
3500
Eo-archaean
Archaean
4000
Hadean
4500


N
W
E
S
H2
0 25 50 75 100 km
N
W
E
S
0 25 50 75 100 km

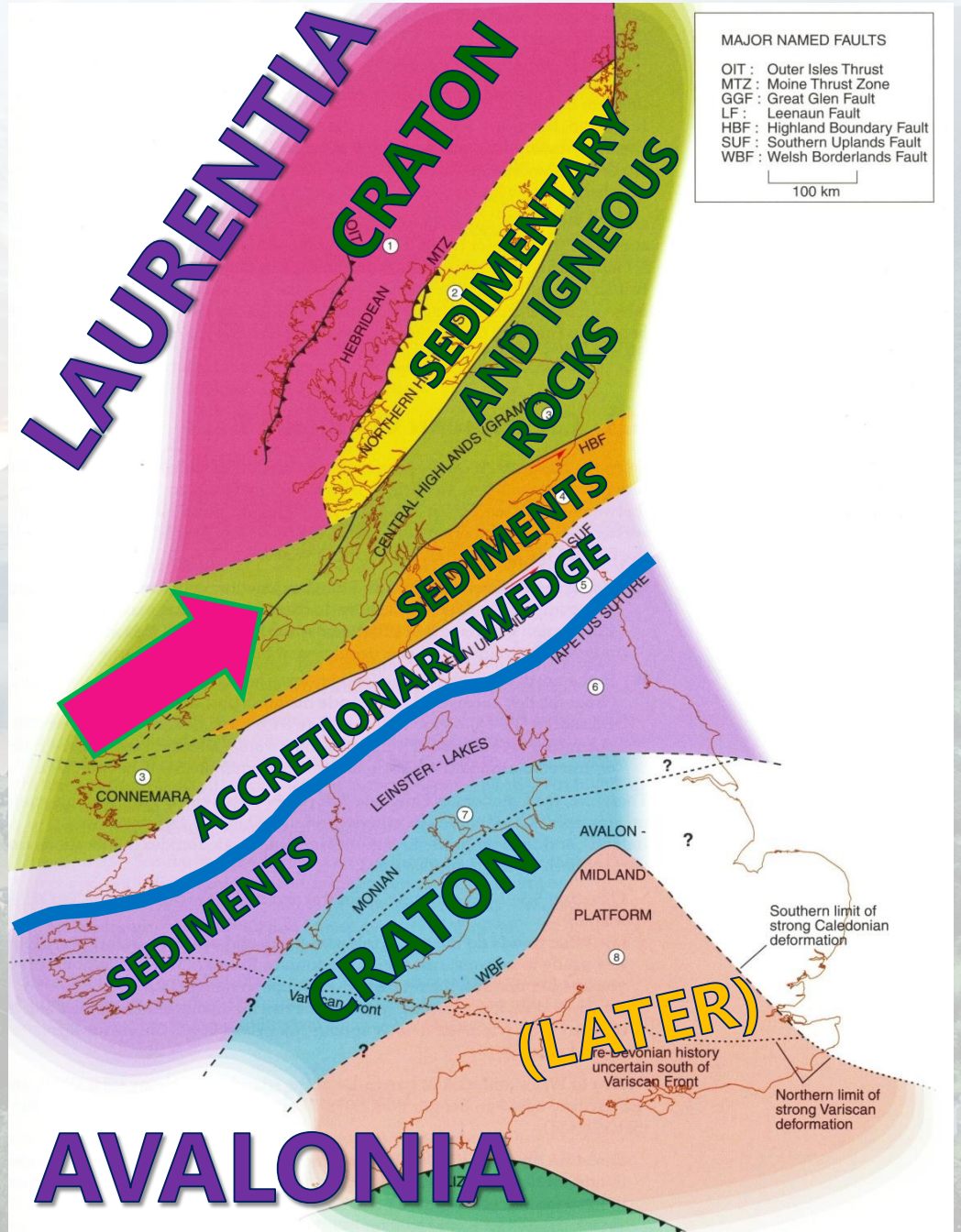

0 Ma
Cenozoic
Mesozoic
Palaeozoic
Phanerozoic
500
Neo-proterozoic
1000
Meso-proterozoic
1500
Palaeo-proterozoic
Proterozoic
2000
2500
Neo-archaean
Meso-archaean
3000
Palaeo-archaean
3500
Eo-archaean
Archaean
4000
Hadean
4500


0 Ma
500
1000
1500
2000
2500
3000
3500
4000
4500
Cenozoic
Mesozoic
Palaeozoic
Phanerozoic
Neo-proterozoic
Meso-proterozoic
Palaeo-proterozoic
Proterozoic
Neo-archaean
Meso-archaean
Palaeo-archaean
Eo-archaean
Archaean
Hadean

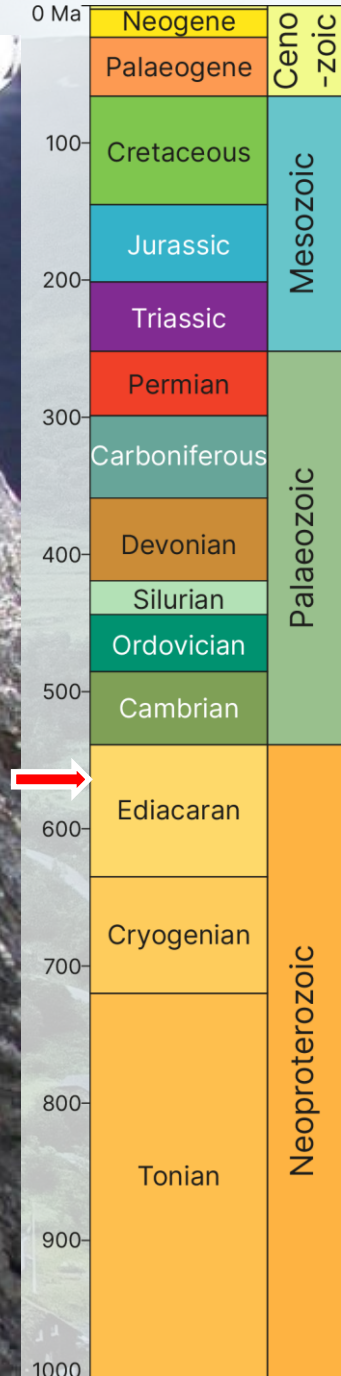
NORTHERN & CENTRAL HIGHLANDS

(Moine and Grampian)

IAPETUS WOZ ERE



G_1
G_2
I


0 Ma
100
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300
400
500
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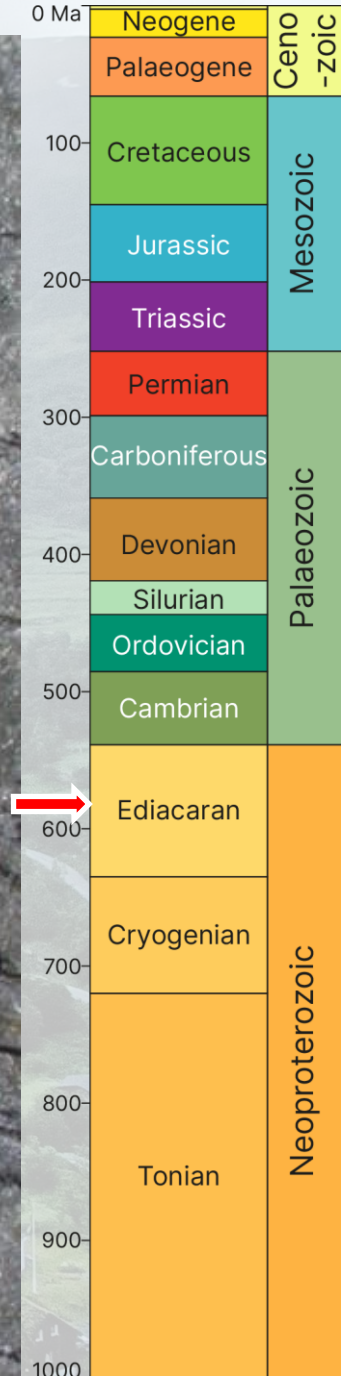
700
800
900
1000
Neogene
Palaeogene
Cretaceous
Jurassic
Triassic
Permian
Carboniferous
Devonian
Silurian
Ordovician
Cambrian
Ediacaran
Cryogenian
Tonian
Ceno-zoic
Mesozoic
Palaeozoic
Neoproterozoic

G1
G2
I


0 Ma
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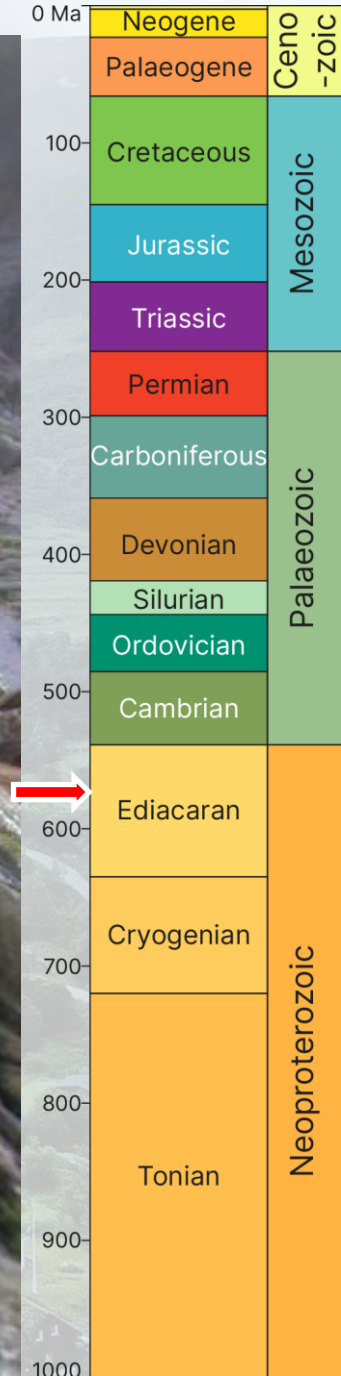
Neogene
Palaeogene
Cretaceous
Jurassic
Triassic
Permian
Carboniferous
Devonian
Silurian
Ordovician
Cambrian
Ediacaran
Cryogenian
Tonian
Ceno-zoic
Mesozoic
Palaeozoic
Neoproterozoic

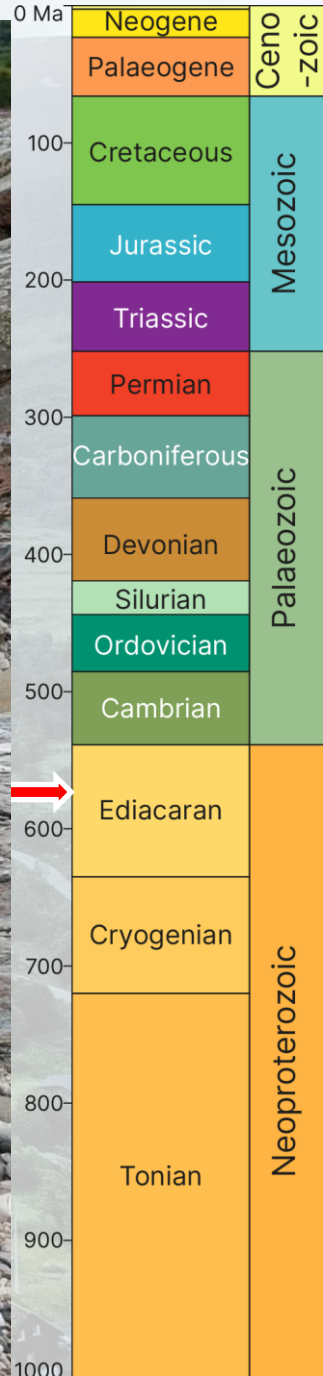
Laurentia, Avalonia, and the Iapetus Ocean | *The Laurentian margin*

GY4051



Laurentia, Avalonia, and the Iapetus Ocean | *The Laurentian margin*

GY4051



G_1
G_2
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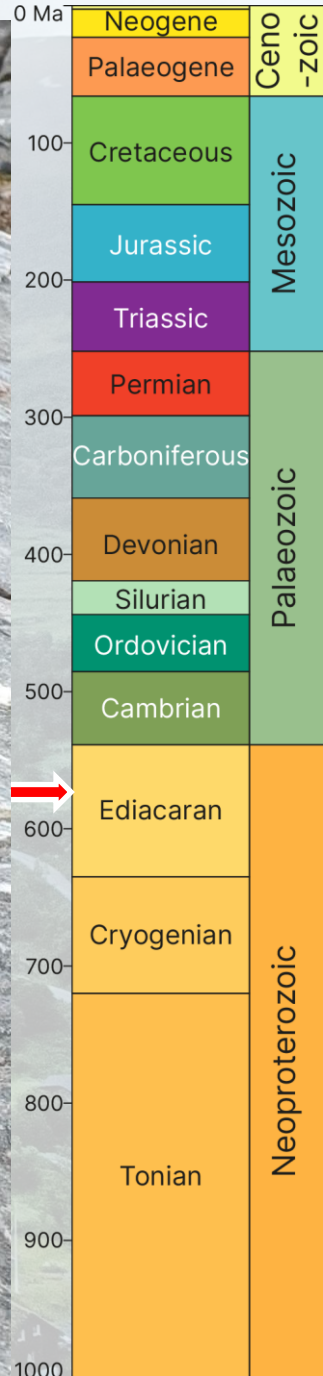
0 Ma
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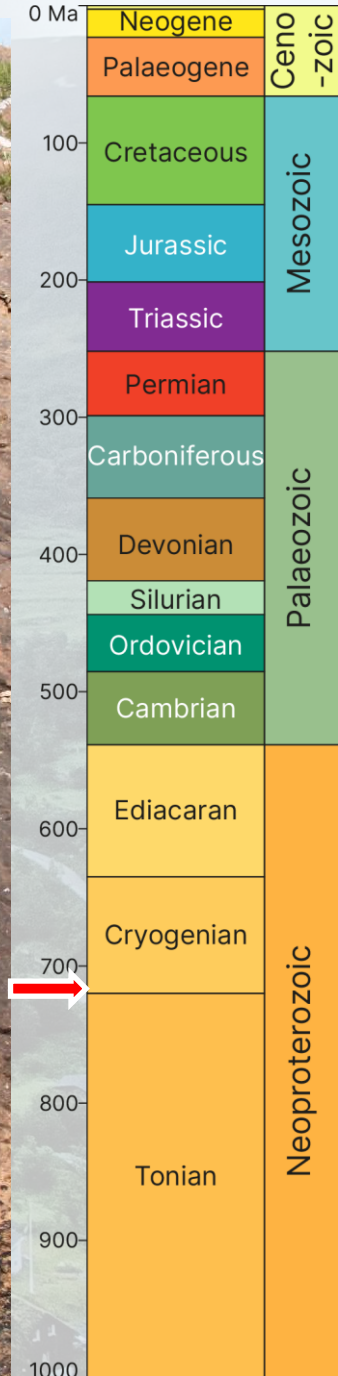
Neogene
Palaeogene
Cretaceous
Jurassic
Triassic
Permian
Carboniferous
Devonian
Silurian
Ordovician
Cambrian
Ediacaran
Cryogenian
Tonian
Ceno-zoic
Mesozoic
Palaeozoic
Neoproterozoic

M1


0 Ma
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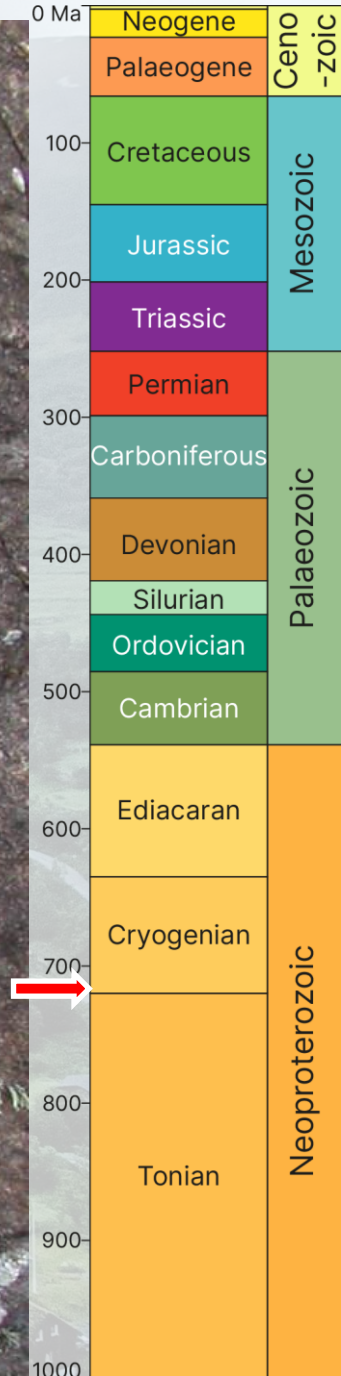
Neogene
Palaeogene
Cretaceous
Jurassic
Triassic
Permian
Carboniferous
Devonian
Silurian
Ordovician
Cambrian
Ediacaran
Cryogenian
Tonian
Ceno-zoic
Mesozoic
Palaeozoic
Neoproterozoic


0 Ma
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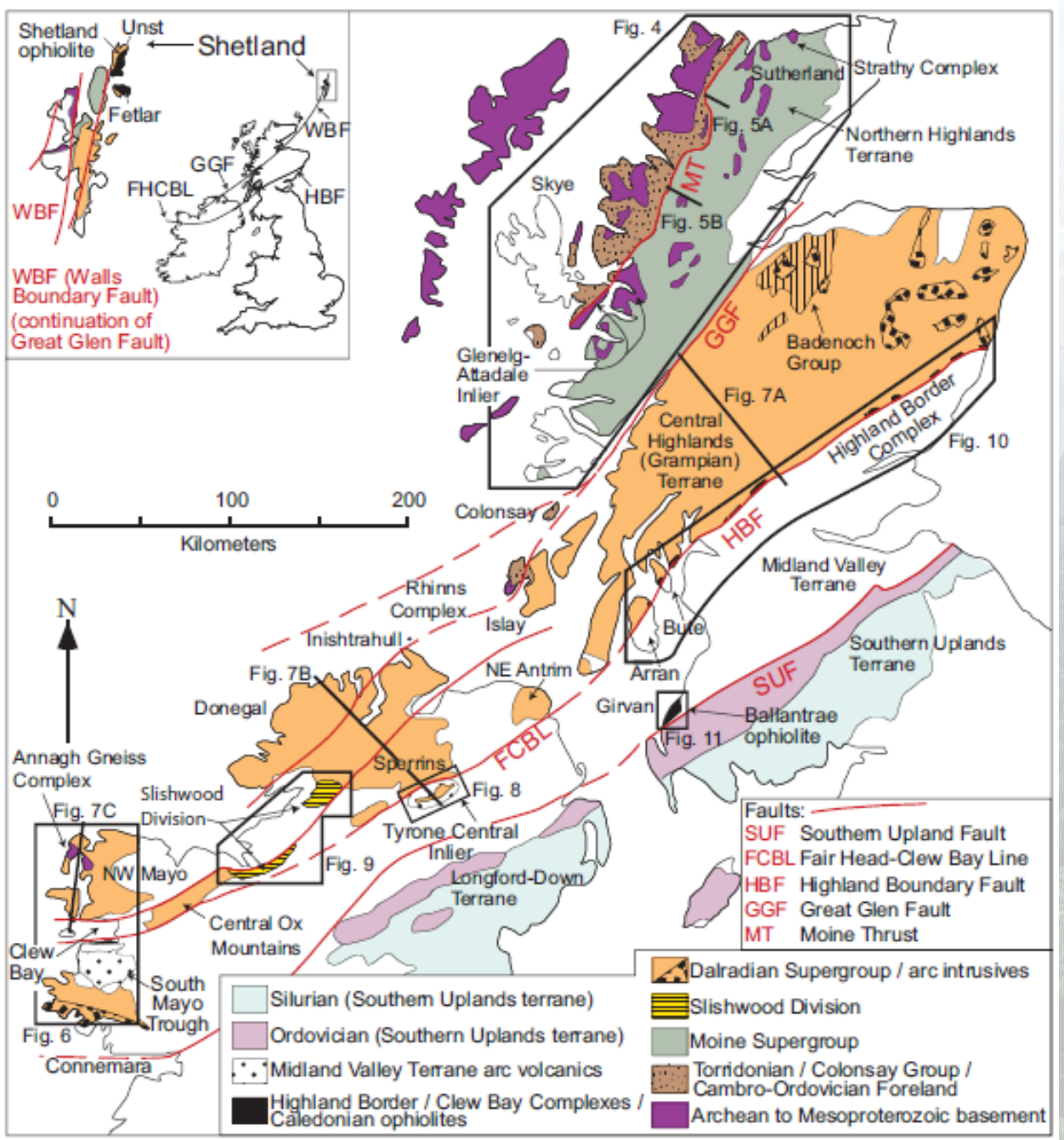
Neogene
Palaeogene
Cretaceous
Jurassic
Triassic
Permian
Carboniferous
Devonian
Silurian
Ordovician
Cambrian
Ediacaran
Cryogenian
Tonian
Ceno-zoic
Mesozoic
Palaeozoic
Neoproterozoic

G_1 M_1

G_2

I


Shetland ophiolite
Unst
Shetland
Fetlar
WBF
GGF
FHCBL
HBF
WBF (Walls Boundary Fault) (continuation of Great Glen Fault)
Fig. 4
Sutherland
Strathy Complex
Fig. 5A
Northern Highlands Terrane
Skye
MT
Fig. 5B
GGF
Badenoch Group
Glenelg-Attadale Inlier
Fig. 7A
Central Highlands (Grampian) Terrane
Highland Border Complex
Fig. 10
0 100 200
Kilometers
Colonsay
HBF
Midland Valley Terrane
Rhinns Complex
Islay
Inishtrahull
Bute
Arran
Southern Uplands Terrane
Fig. 7B
NE Antrim
SUF
Donegal
Girvan
Ballantrae ophiolite
Fig. 11
FCBL
Sperrins
Fig. 8
Annagh Gneiss Complex
Fig. 7C
Slishwood Division
Tyrone Central Inlier
NW Mayo
Fig. 9
Longford-Down Terrane
Central Ox Mountains
Clew Bay
South Mayo Trough
Fig. 6
Connemara
N
Faults:
SUF Southern Upland Fault
FCBL Fair Head-Clew Bay Line
HBF Highland Boundary Fault
GGF Great Glen Fault
MT Moine Thrust
Silurian (Southern Uplands terrane)
Ordovician (Southern Uplands terrane)
Midland Valley Terrane arc volcanics
Highland Border / Clew Bay Complexes / Caledonian ophiolites
Dalradian Supergroup / arc intrusives
Slishwood Division
Moine Supergroup
Torridonian / Colonsay Group / Cambro-Ordovician Foreland
Archean to Mesoproterozoic basement

Dalradian Supergroup
Macduff Slate
Inishowen
595±4 Ma[11]
Port Askaig
Kinlochlaggan
Spean Bridge
Southern Highland Group
Tayvallich
Crinian
Argyll Group
Easdale
Islay
Blair Atholl
Appin Group
Balla-chulish
Lochaber
Glen Spean
Grampian Group
Corrieyairack
0
5
10
15
0 Ma
100
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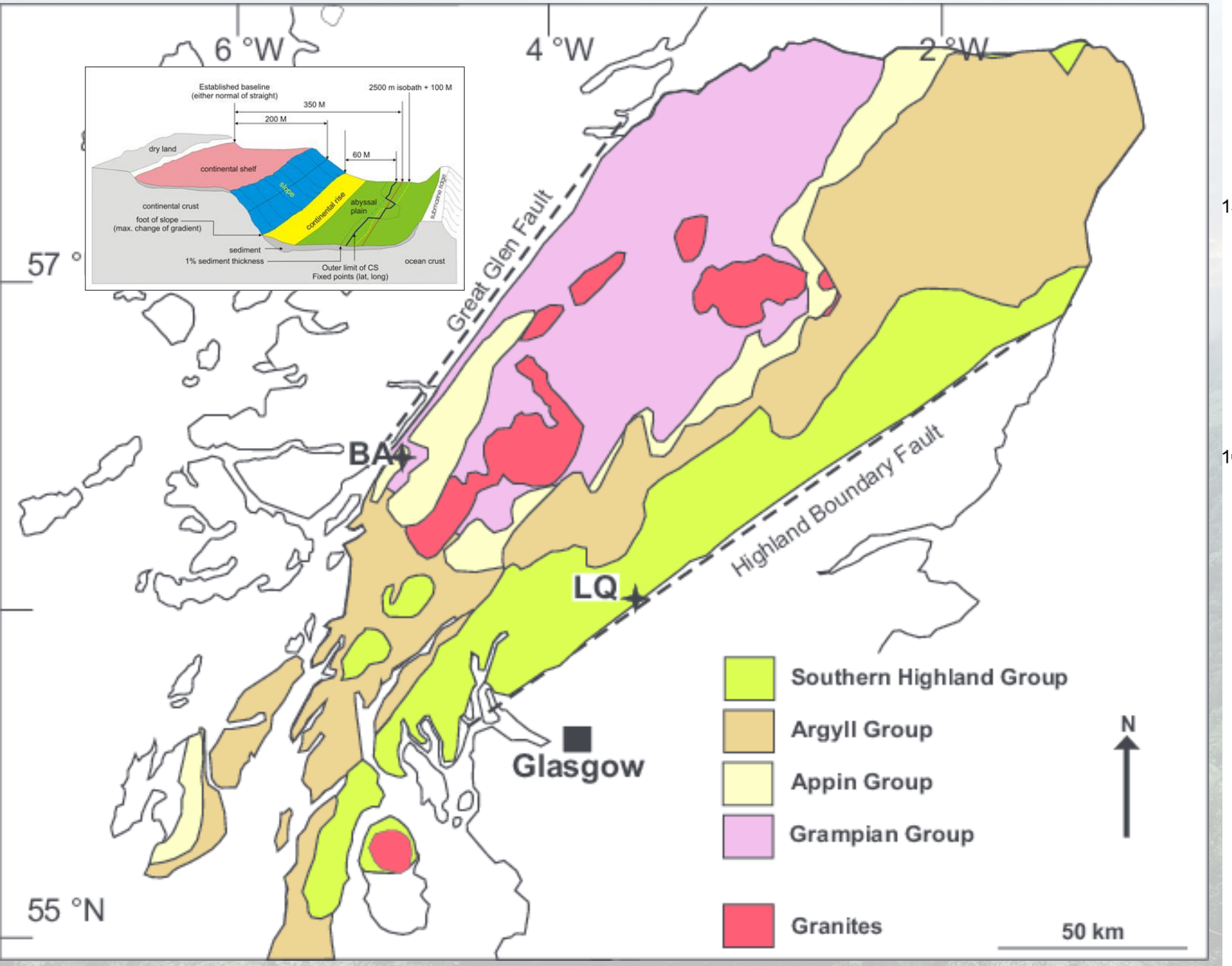
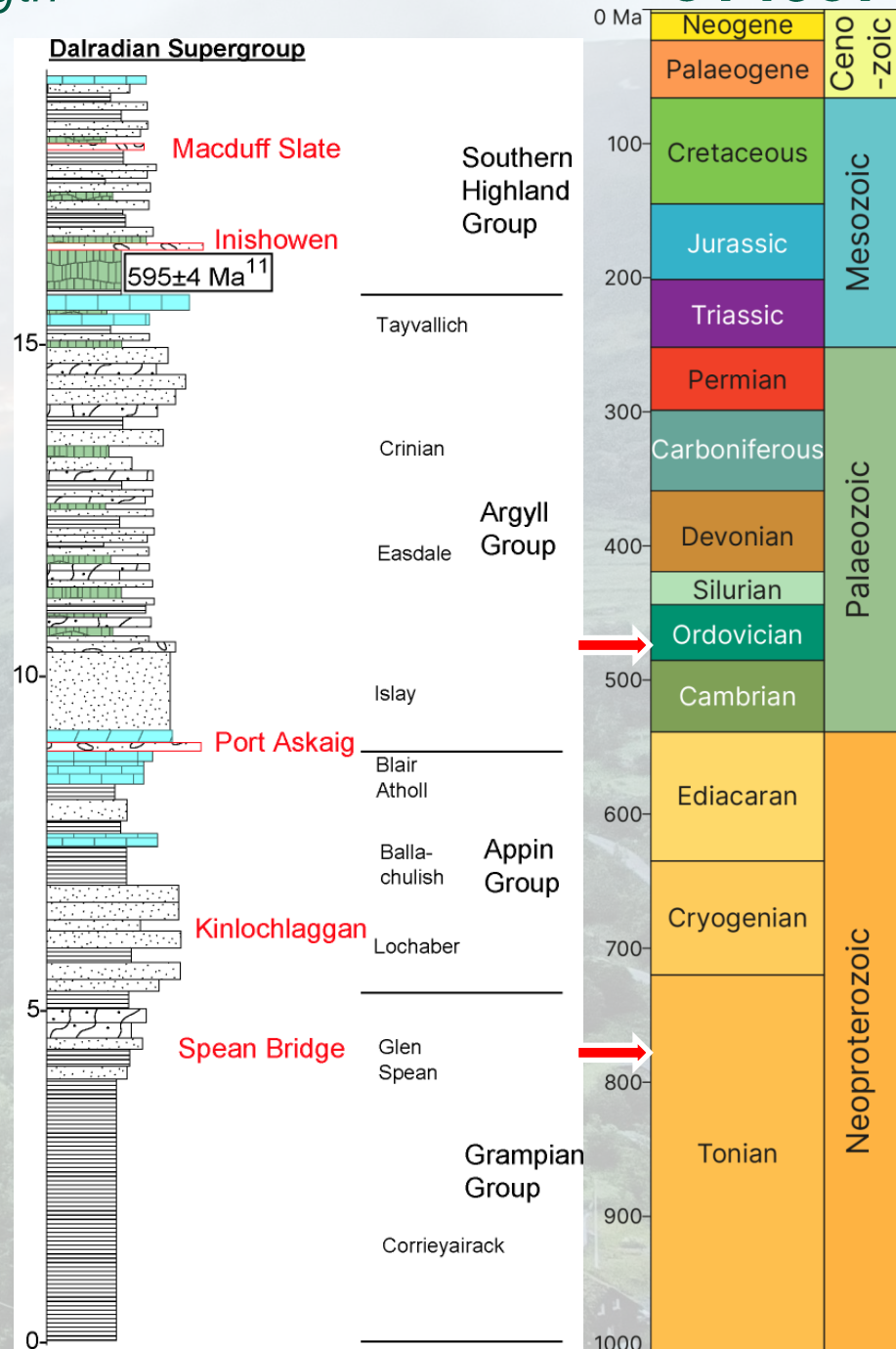
500
600
700
800
900
1000
Neogene
Palaeogene
Cretaceous
Jurassic
Triassic
Permian
Carboniferous
Devonian
Silurian
Ordovician
Cambrian
Ediacaran
Cryogenian
Tonian
Ceno-zoic
Mesozoic
Palaeozoic
Neoproterozoic


6 °W
4 °W
2 °W
57 °
55 °N
Great Glen Fault
Highland Boundary Fault
BA
LQ
Glasgow
Southern Highland Group
Argyll Group
Appin Group
Grampian Group
Granites
N
50 km
Established baseline (either normal of straight)
2500 m isobath + 100 M
350 M
200 M
60 M
dry land
continental shelf
slope
continental rise
abyssal plain
seamount
continental crust
foot of slope (max. change of gradient)
sediment
1% sediment thickness
Outer limit of CS Fixed points (lat, long)
ocean crust


Dalradian Supergroup
Macduff Slate
Inishowen
595±4 Ma[11]
Port Askaig
Kinlochlaggan
Spean Bridge
Southern Highland Group
Tayvallich
Crinian
Argyll Group
Easdale
Islay
Blair Atholl
Balla-chulish
Appin Group
Lochaber
Glen Spean
Grampian Group
Corrieyairack
0
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15
0 Ma
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700
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900
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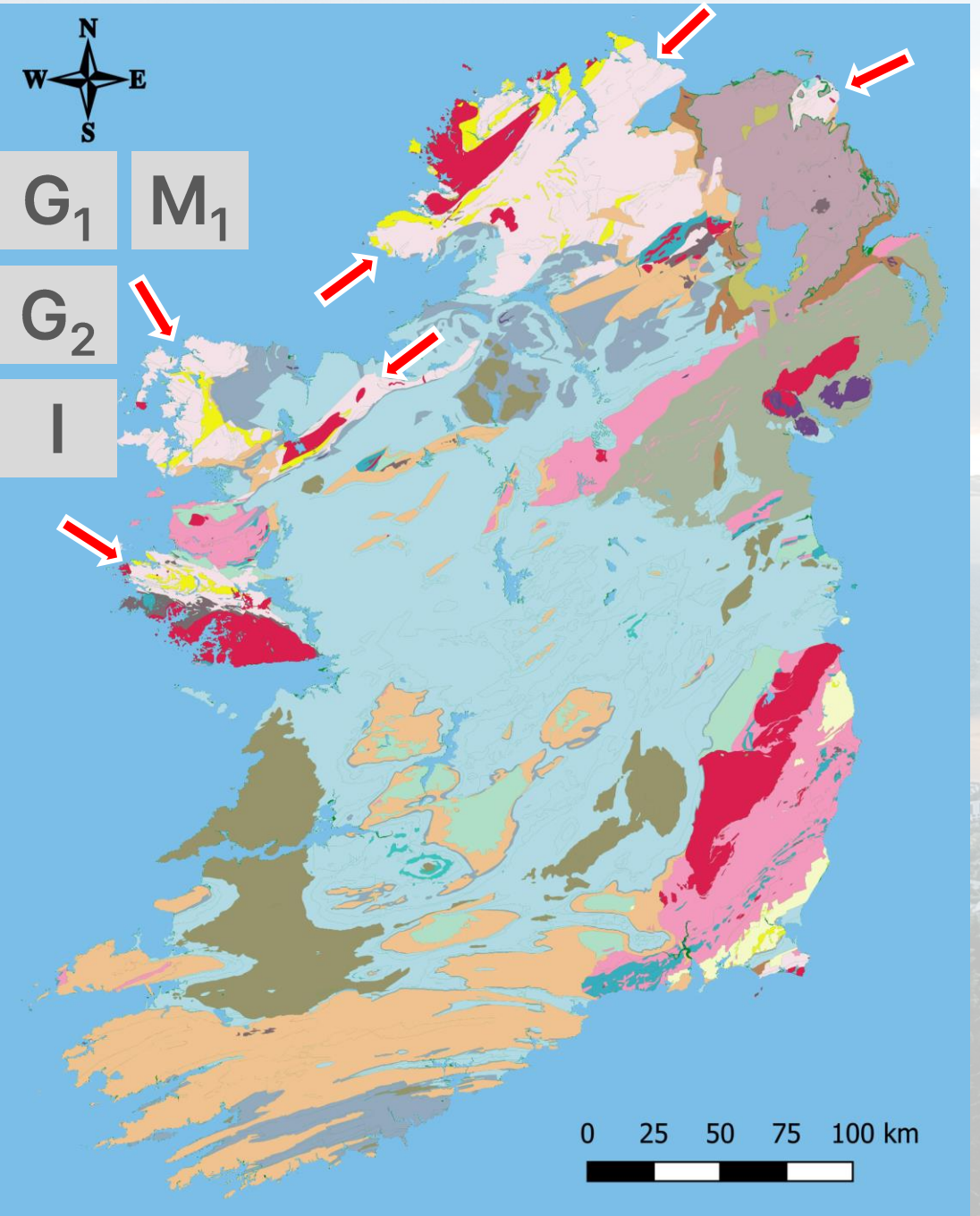
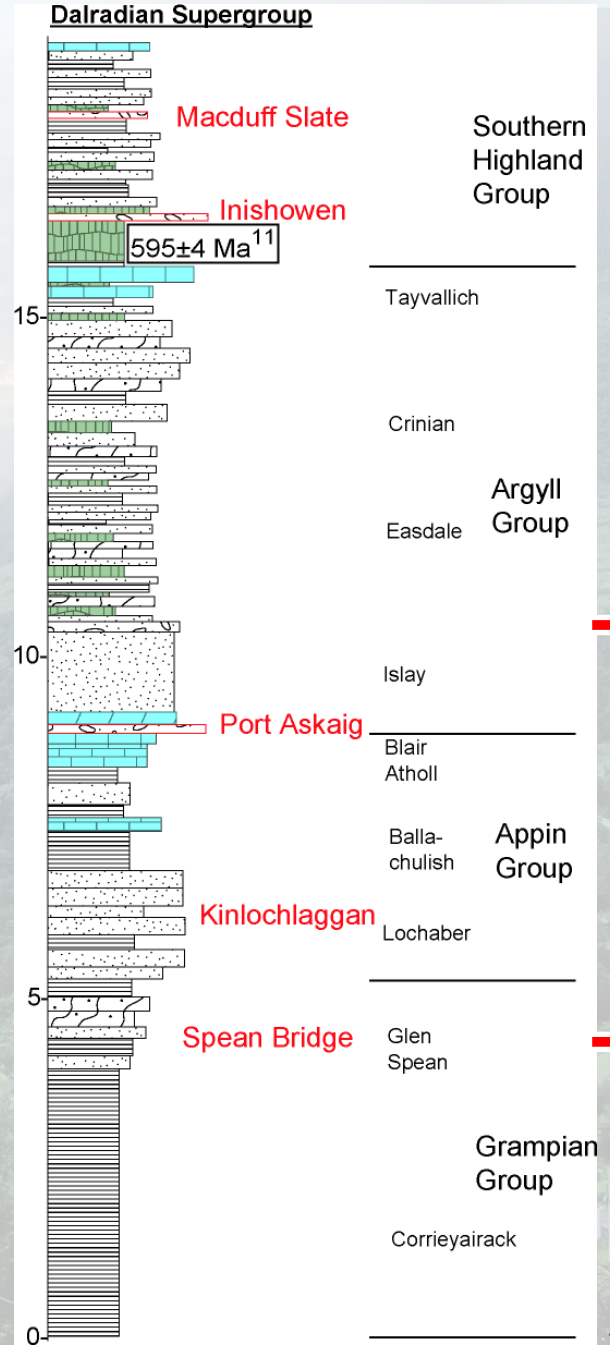
Neogene
Palaeogene
Cretaceous
Jurassic
Triassic
Permian
Carboniferous
Devonian
Silurian
Ordovician
Cambrian
Ediacaran
Cryogenian
Tonian
Ceno-zoic
Mesozoic
Palaeozoic
Neoproterozoic


N
W
E
S
G1
M1
G2
I
0 25 50 75 100 km


Dalradian Supergroup
Macduff Slate
Inishowen
595±4 Ma[11]
Port Askaig
Kinlochlaggan
Spean Bridge
Southern Highland Group
Tayvallich
Crinian
Argyll Group
Easdale
Islay
Blair Atholl
Appin Group
Balla-chulish
Lochaber
Glen Spean
Grampian Group
Corrieyairack
0
5
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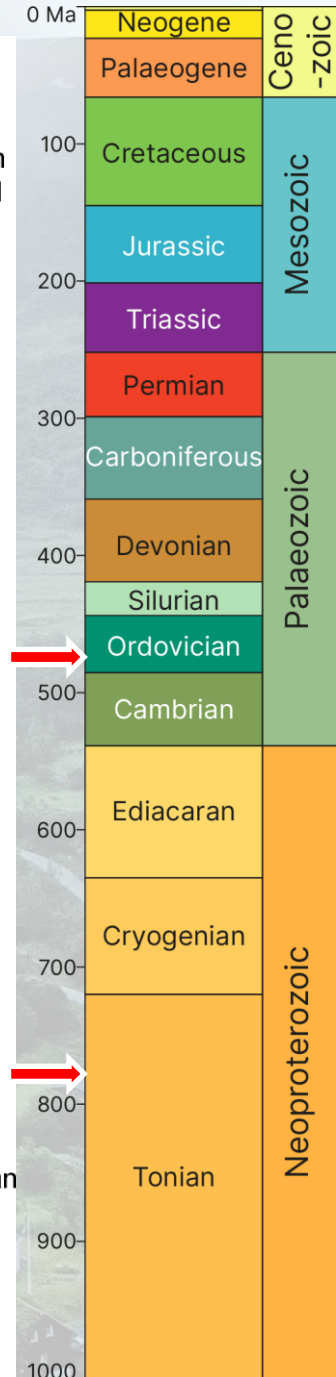
15


0 Ma
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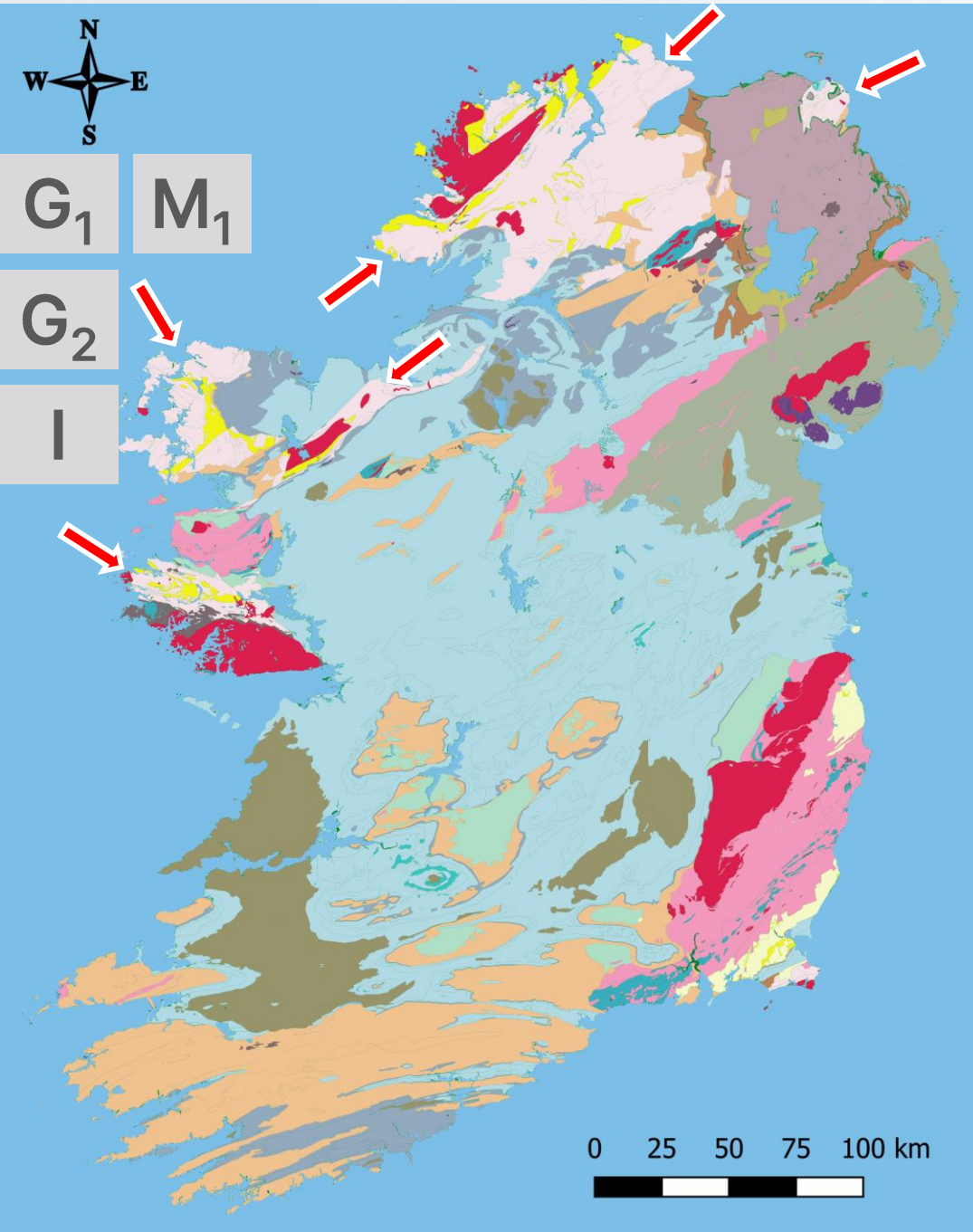
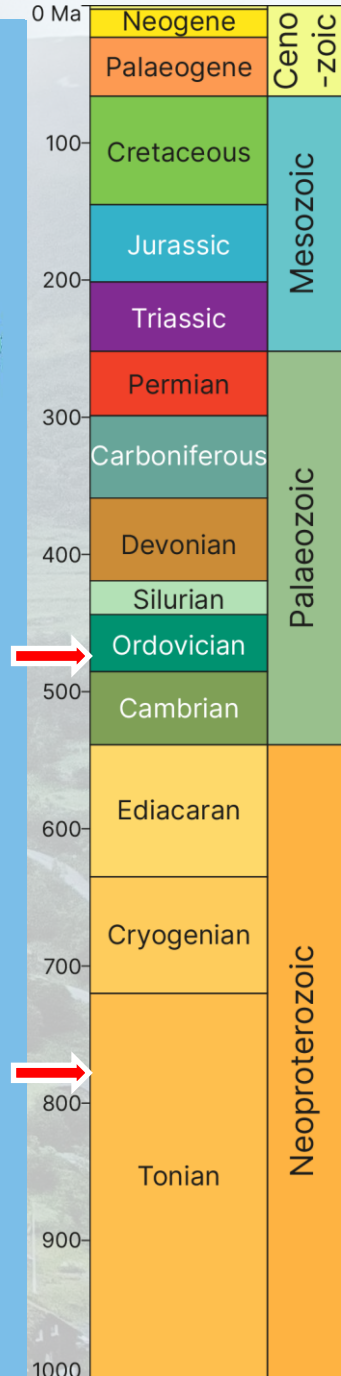
Neogene
Palaeogene
Cretaceous
Jurassic
Triassic
Permian
Carboniferous
Devonian
Silurian
Ordovician
Cambrian
Ediacaran
Cryogenian
Tonian
Ceno-zoic
Mesozoic
Palaeozoic
Neoproterozoic


N
W
E
S
G_1
M_1
G_2
I
0 25 50 75 100 km

N
W
E
S
0 25 50 75 100 km


0 Ma
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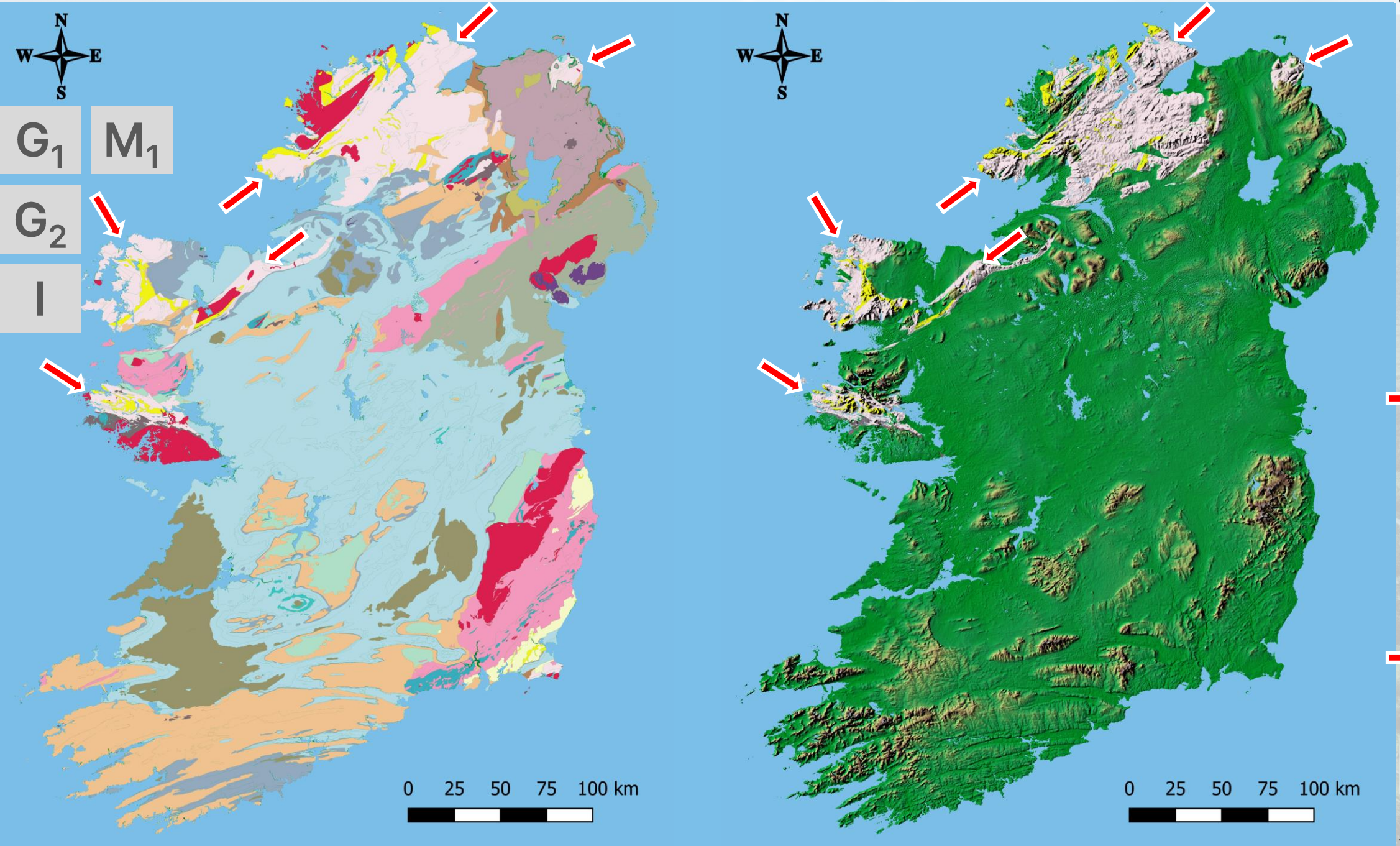
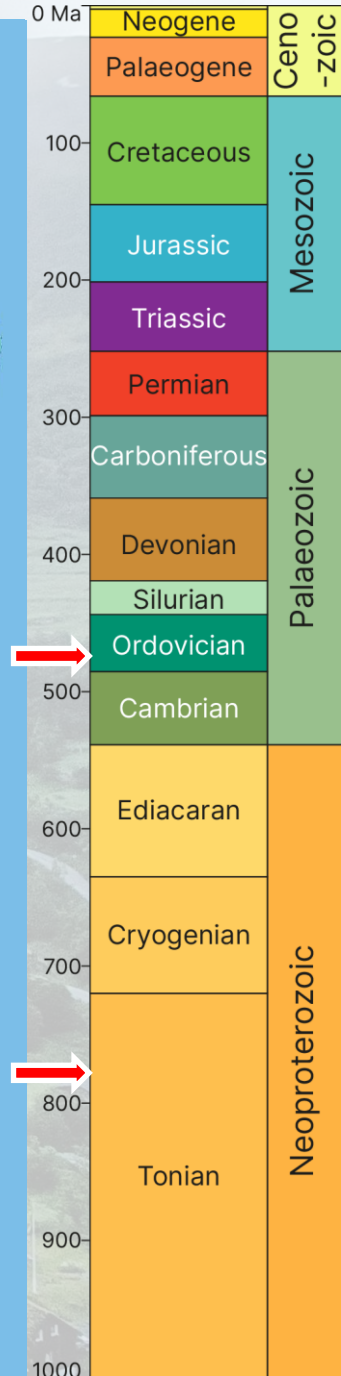
Neogene
Palaeogene
Cretaceous
Jurassic
Triassic
Permian
Carboniferous
Devonian
Silurian
Ordovician
Cambrian
Ediacaran
Cryogenian
Tonian
Ceno-zoic
Mesozoic
Palaeozoic
Neoproterozoic


N
W
E
S
G_1
M_1
G_2
I
0 25 50 75 100 km
N
W
E
S
0 25 50 75 100 km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Neogene
Palaeogene
Cretaceous
Jurassic
Triassic
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Carboniferous
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Ordovician
Cambrian
Ediacaran
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Tonian
Ceno-zoic
Mesozoic
Palaeozoic
Neoproterozoic

Laurentia, Avalonia and the Iapetus Ocean | *The Laurentian margin*

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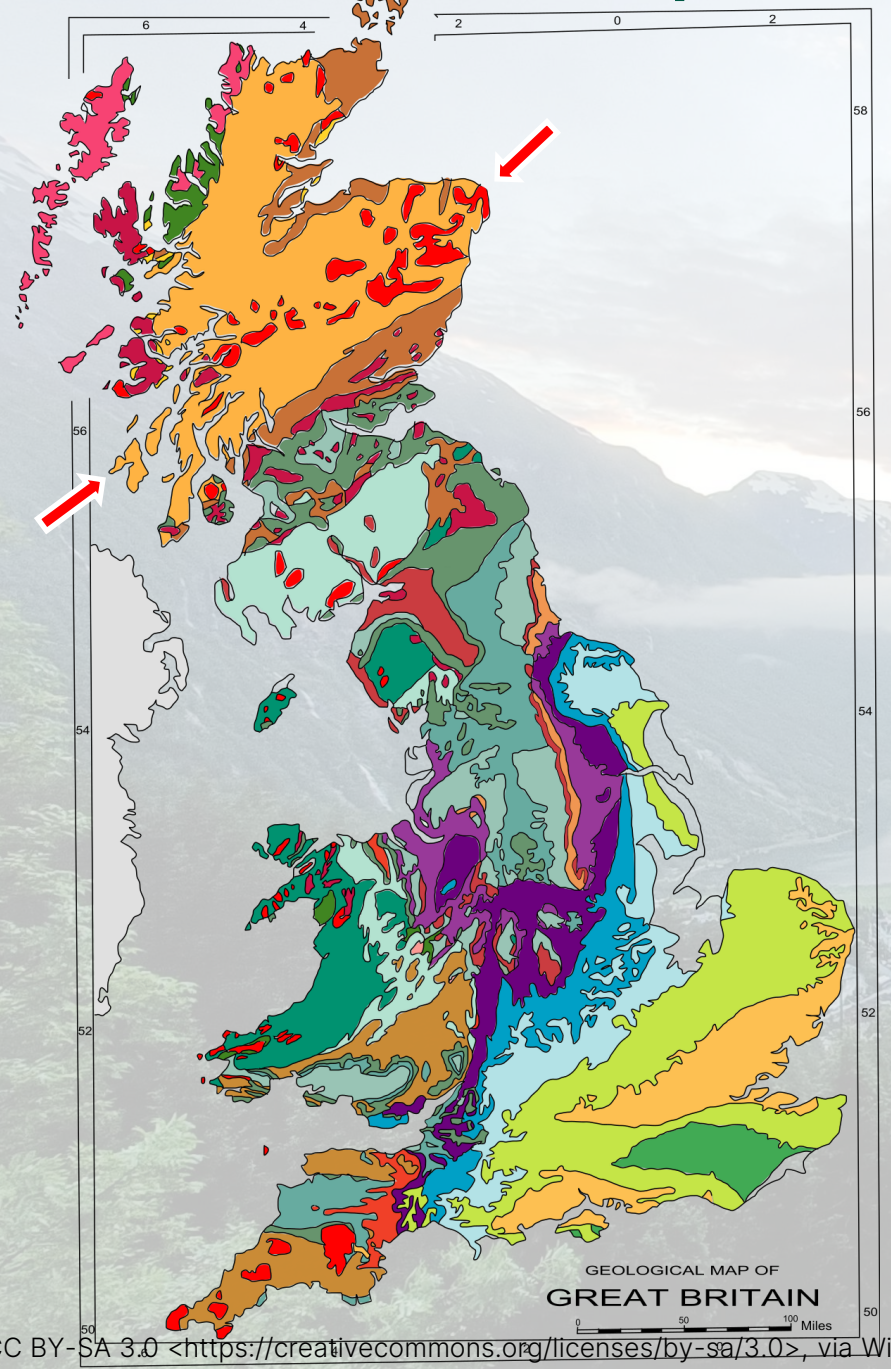

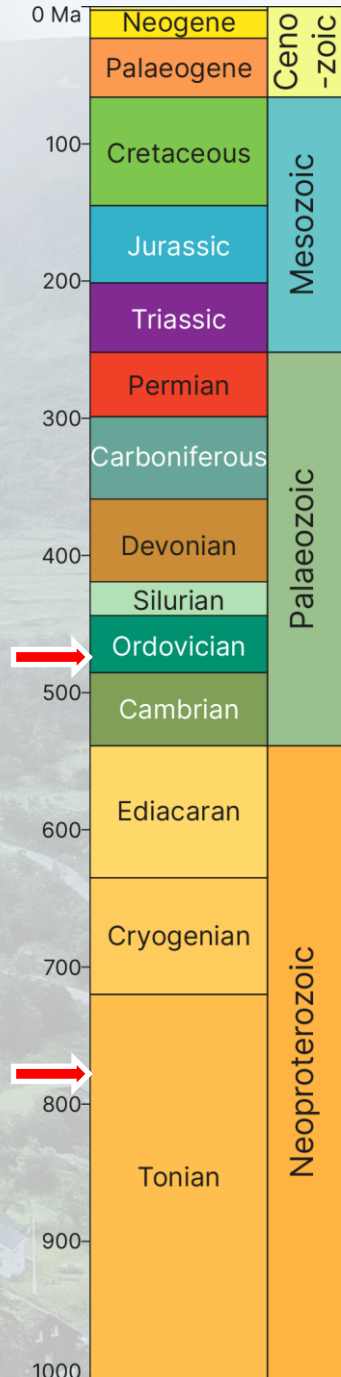

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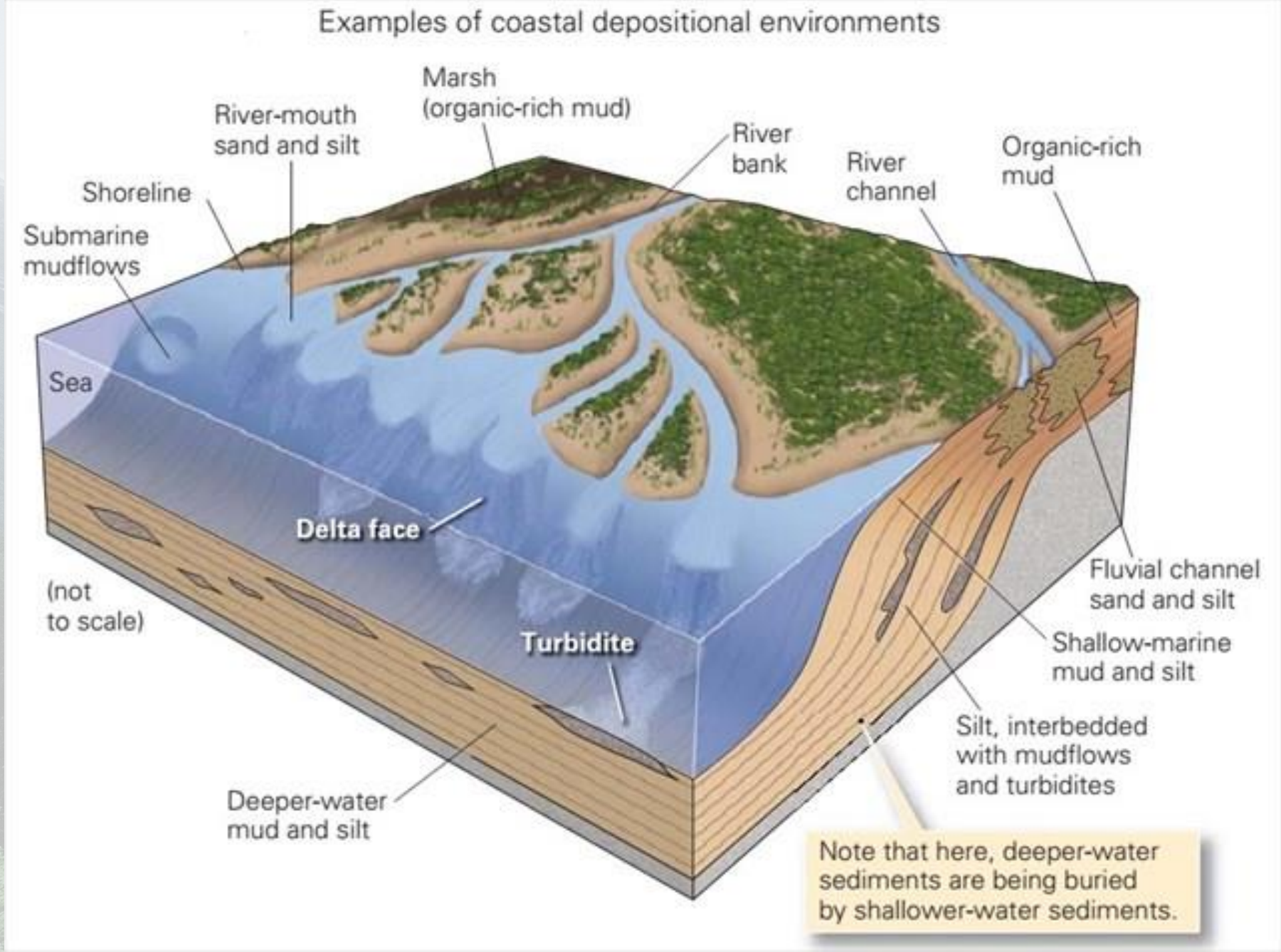
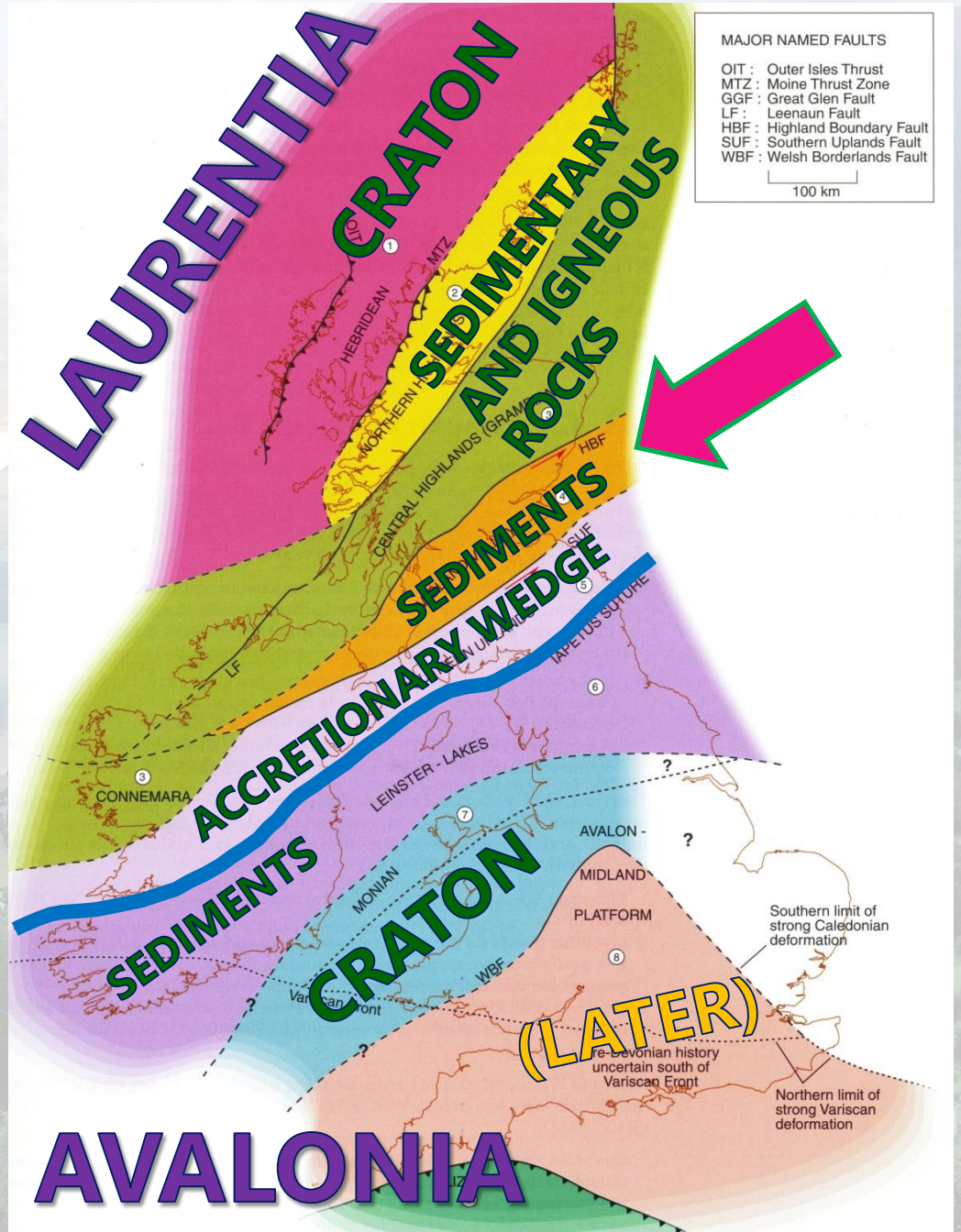
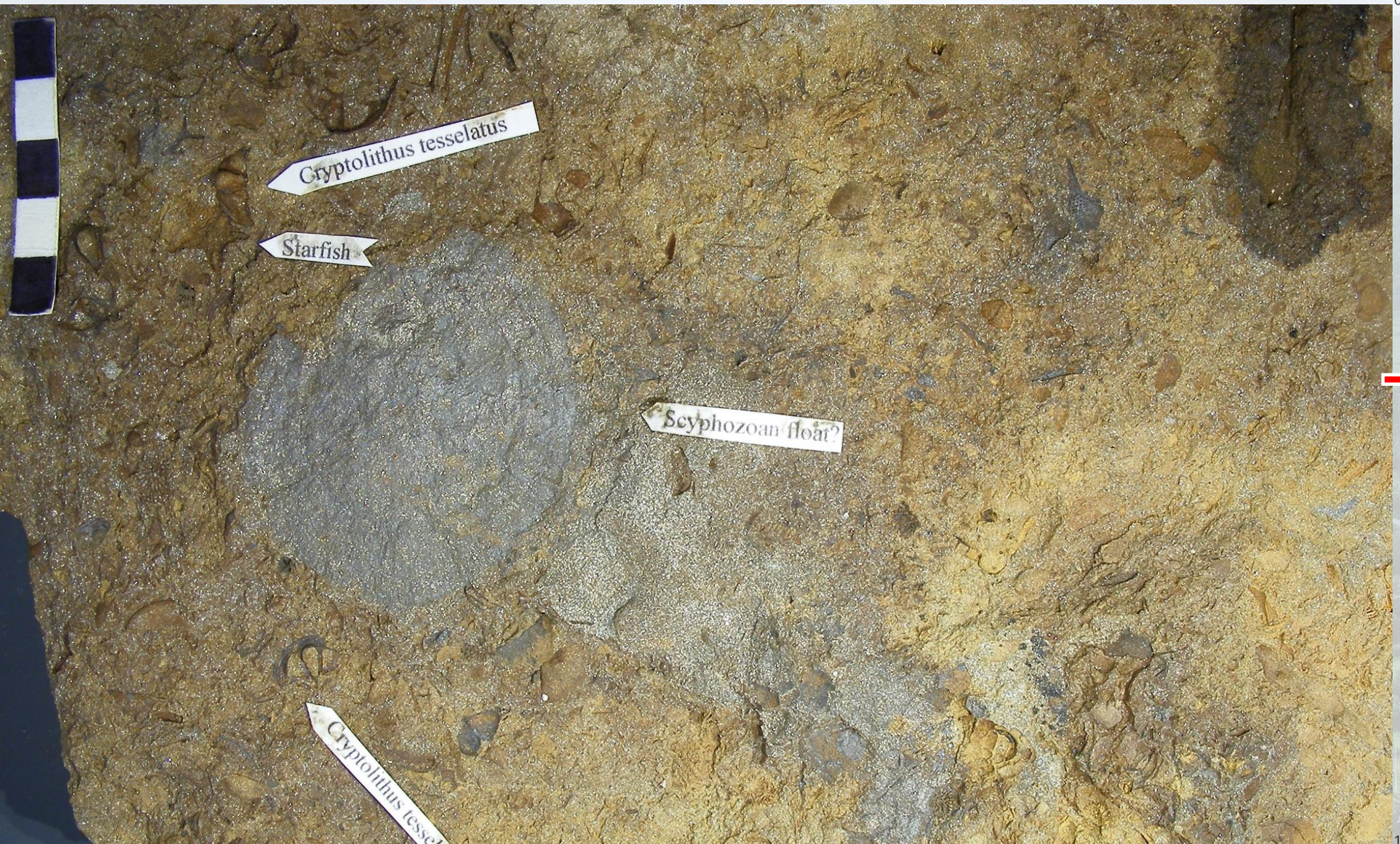
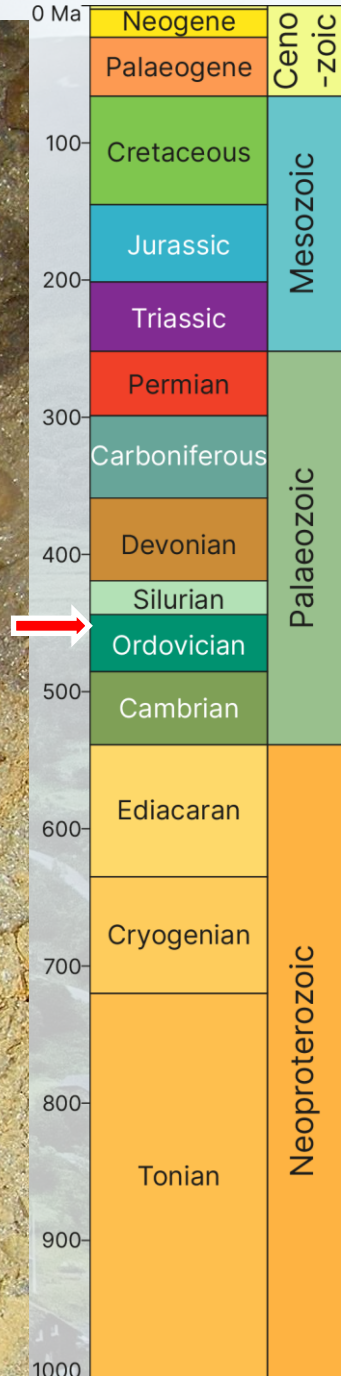

Examples of coastal depositional environments
Marsh (organic-rich mud)
River-mouth sand and silt
River bank
River channel
Organic-rich mud
Shoreline
Submarine mudflows
Sea
Delta face
(not to scale)
Turbidite
Fluvial channel sand and silt
Shallow-marine mud and silt
Silt, interbedded with mudflows and turbidites
Deeper-water mud and silt
Note that here, deeper-water sediments are being buried by shallower-water sediments.

MIDLAND VALLEY




Cryptolithus tesselatus
Starfish
Scyphozoan float?
Cryptolithus tesse


0 Ma
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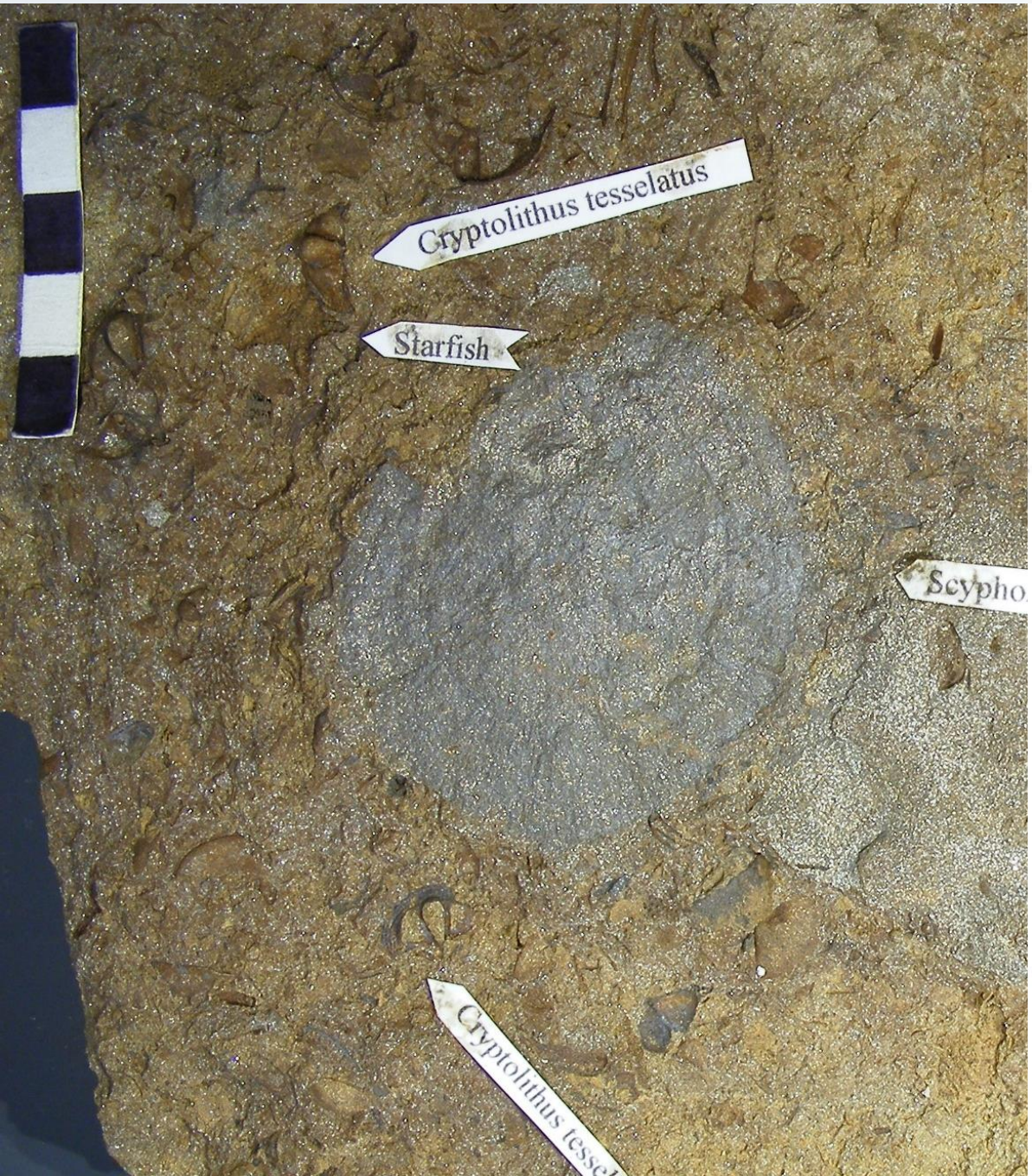
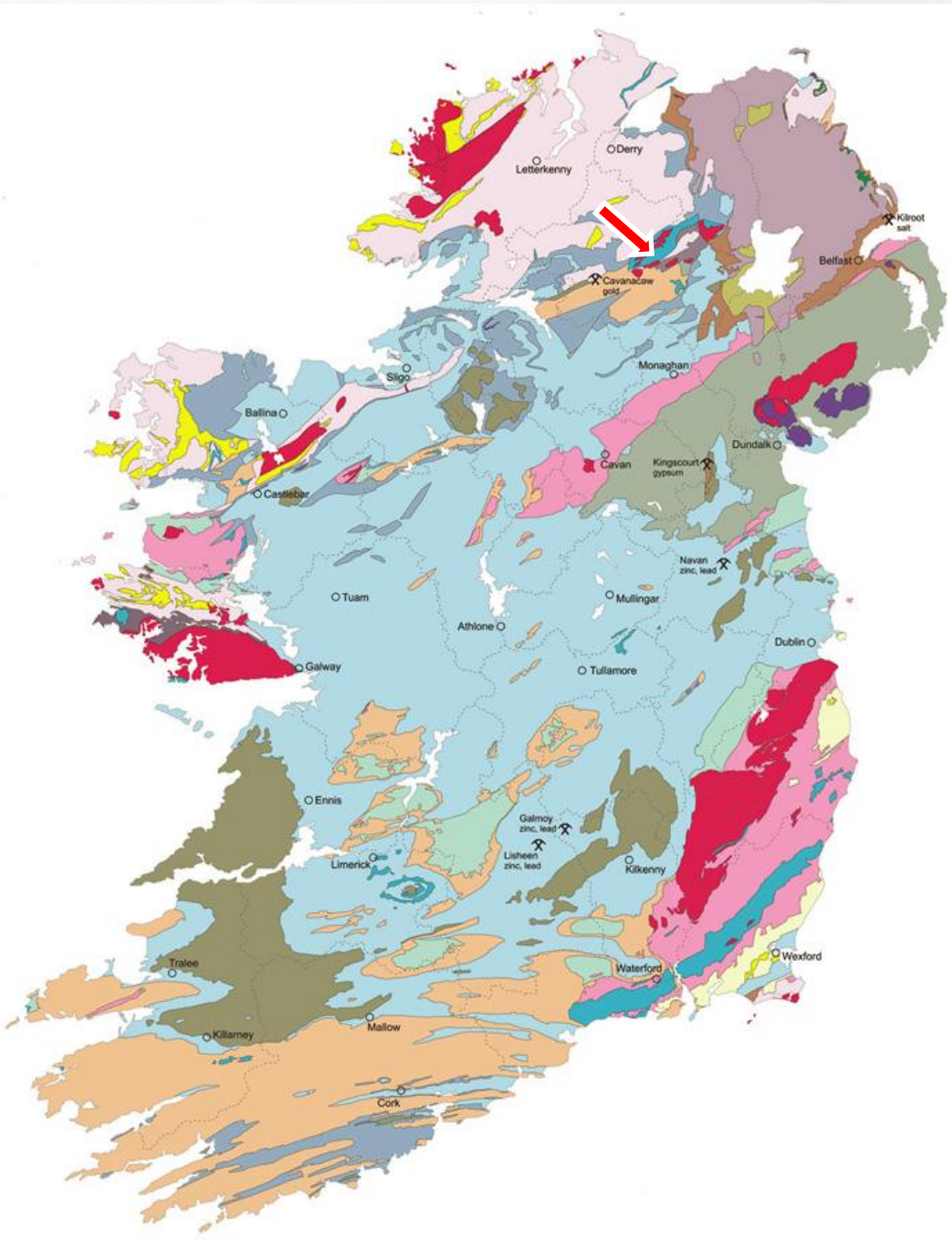
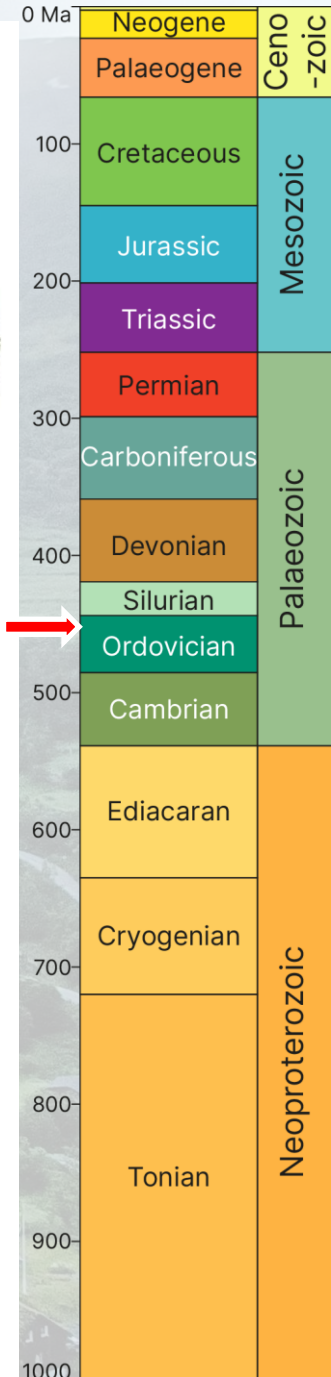
Neogene
Palaeogene
Cretaceous
Jurassic
Triassic
Permian
Carboniferous
Devonian
Silurian
Ordovician
Cambrian
Ediacaran
Cryogenian
Tonian
Ceno-zoic
Mesozoic
Palaeozoic
Neoproterozoic


Cryptolithus tesselatus
Starfish
Scypho
Cryptolithus tesse


Letterkenny
Derry
Kilroot salt
Belfast
Cavanacaw gold
Monaghan
Sligo
Ballina
Dundalk
Cavan
Kingscourt gypsum
Castlebar
Navan zinc, lead
Mullingar
Tuam
Athlone
Dublin
Galway
Tullamore
Ennis
Galmoy zinc, lead
Lisheen zinc, lead
Limerick
Kilkenny
Wexford
Waterford
Tralee
Mallow
Killarney
Cork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Neogene
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Cretaceous
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Tonian
Ceno-zoic
Mesozoic
Palaeozoic
Neoproterozoic

Laurentia, Avalonia, and the Iapetus Ocean | *The Laurentian margin*

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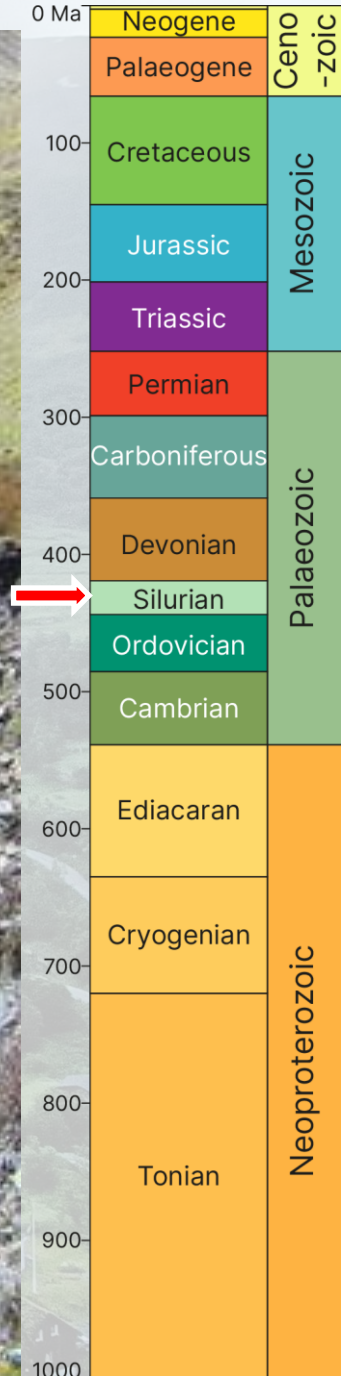
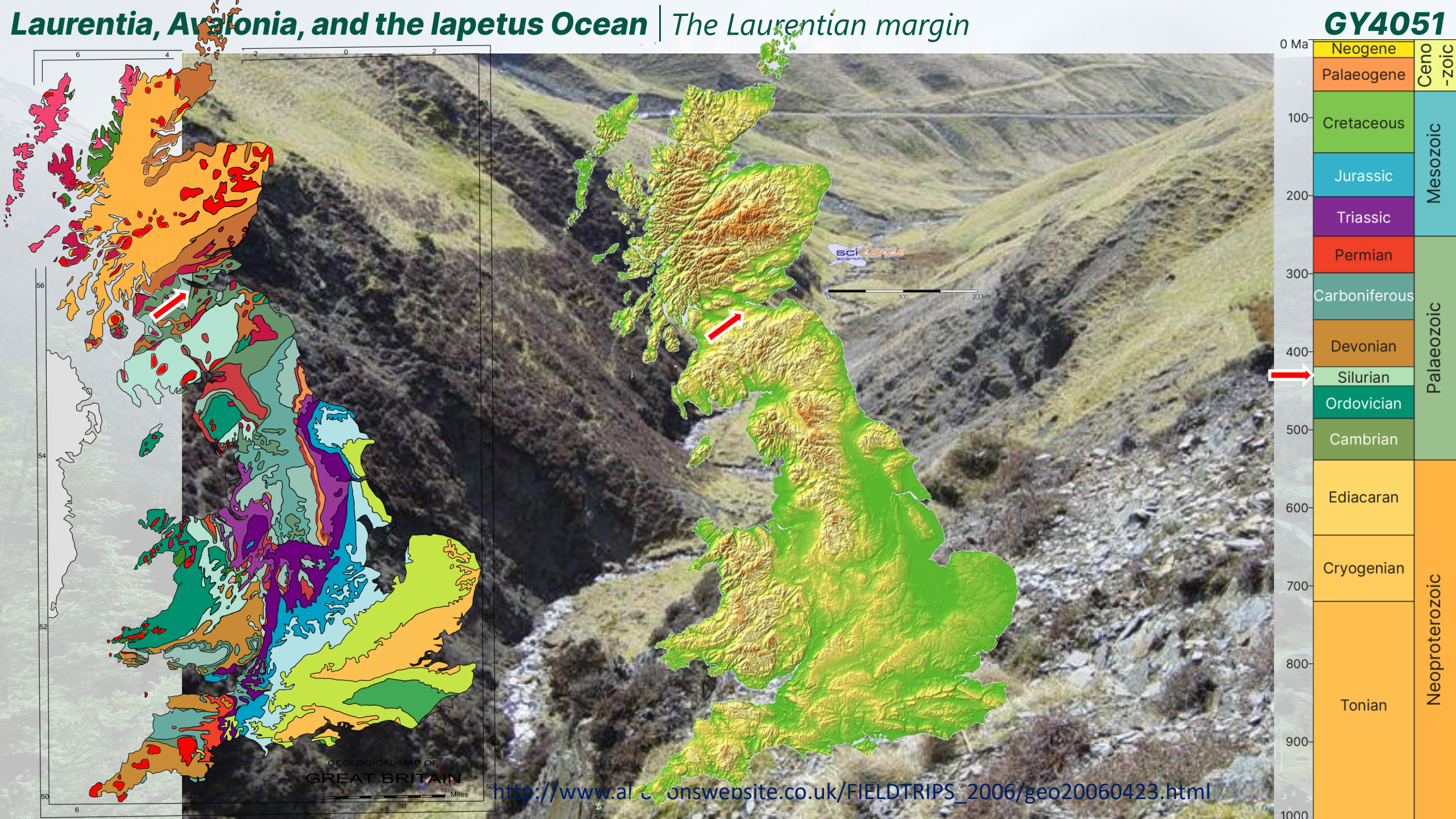


http://www.aboltonswebsite.co.uk/FIELDTRIPS_2006/geo20060423.html

Laurentia, Avalonia, and the Iapetus Ocean | *The Laurentian margin*

GY4051



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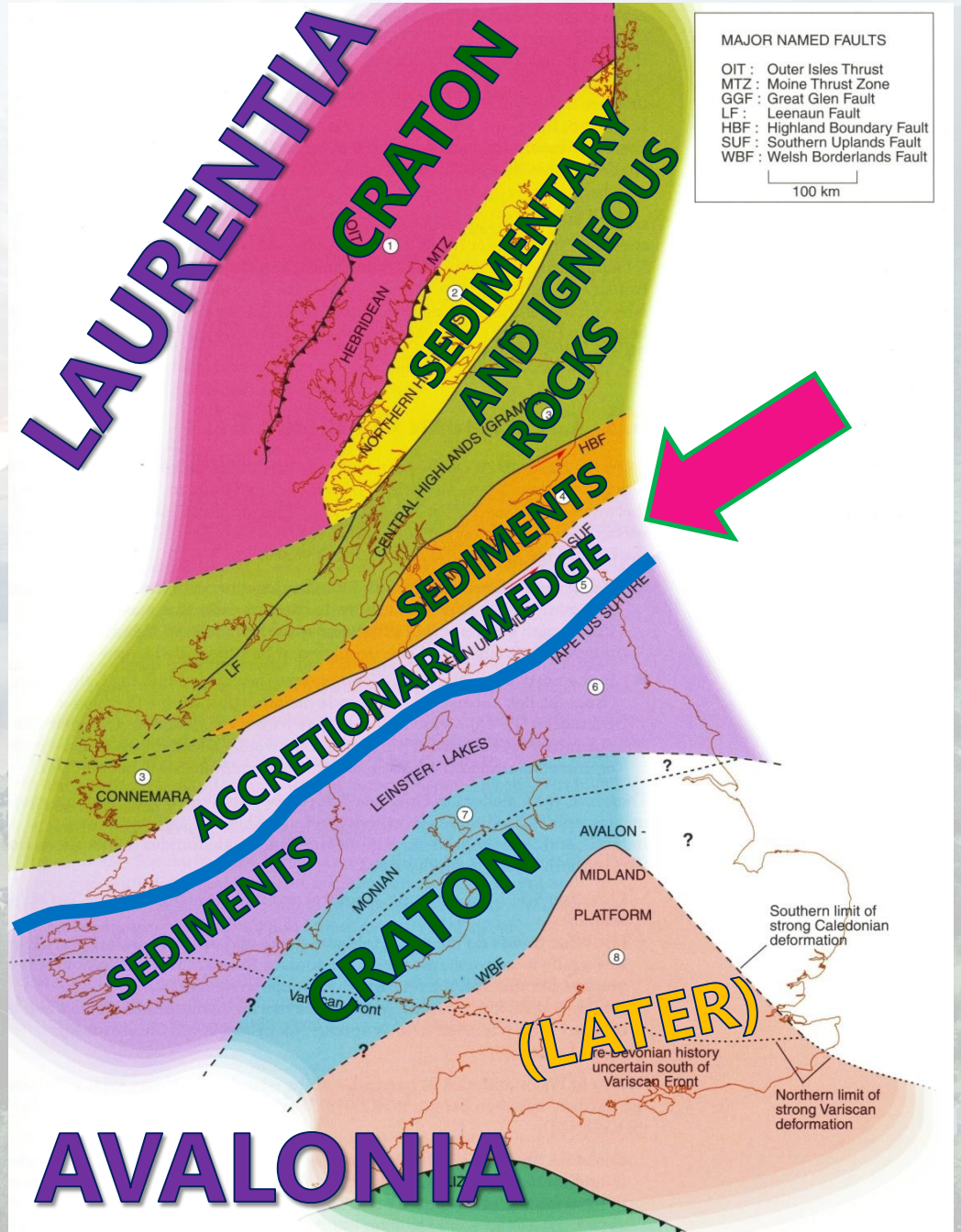
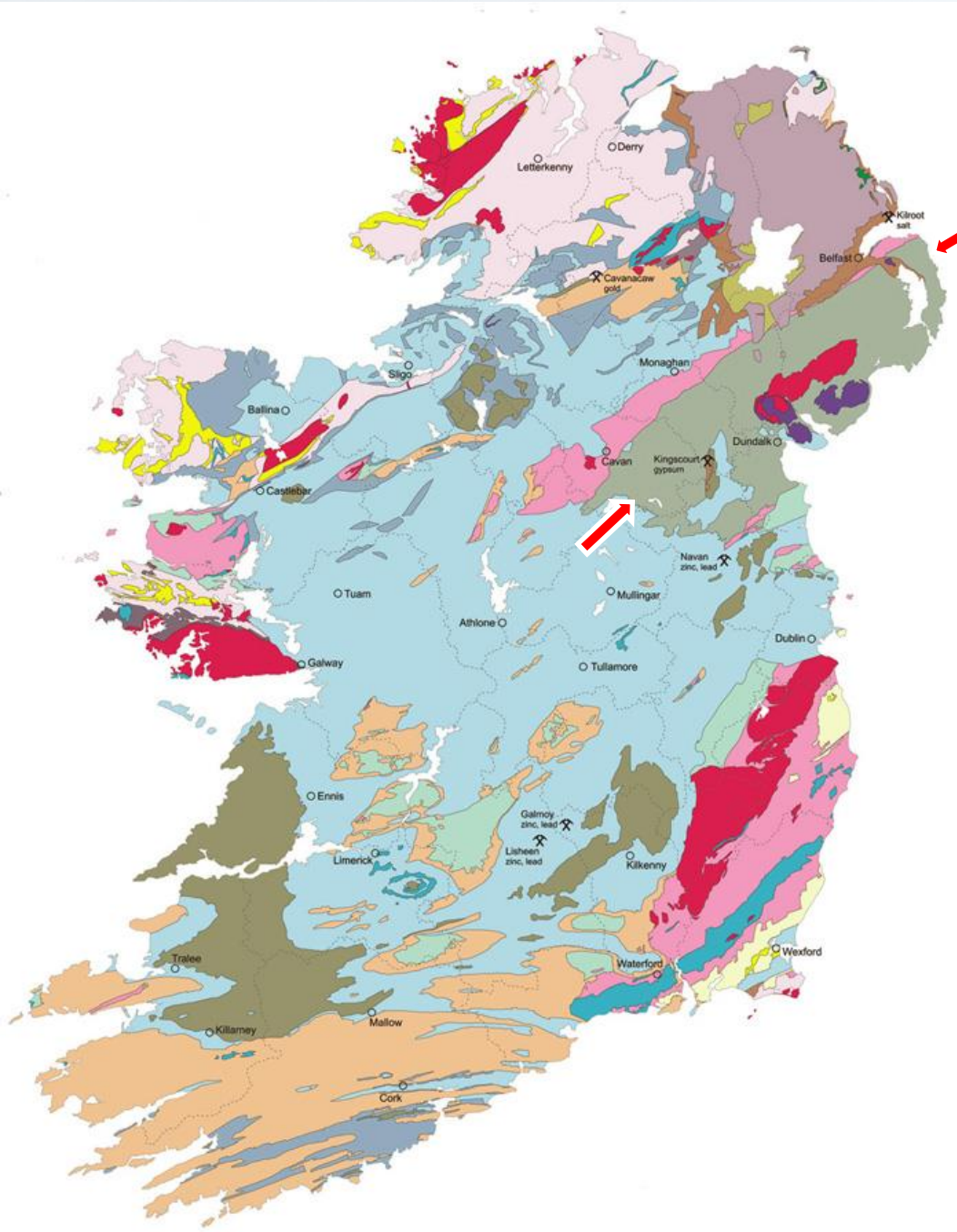
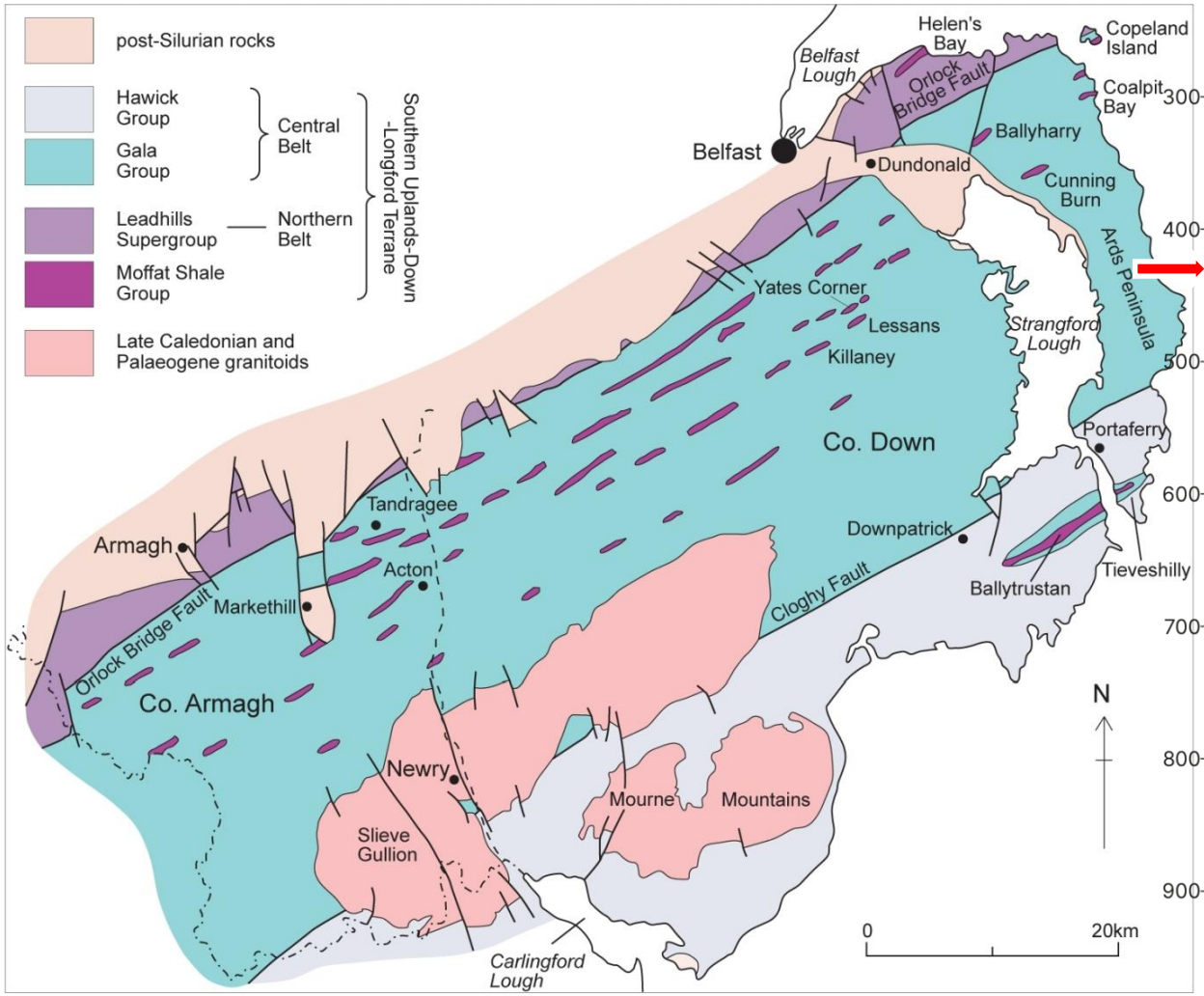
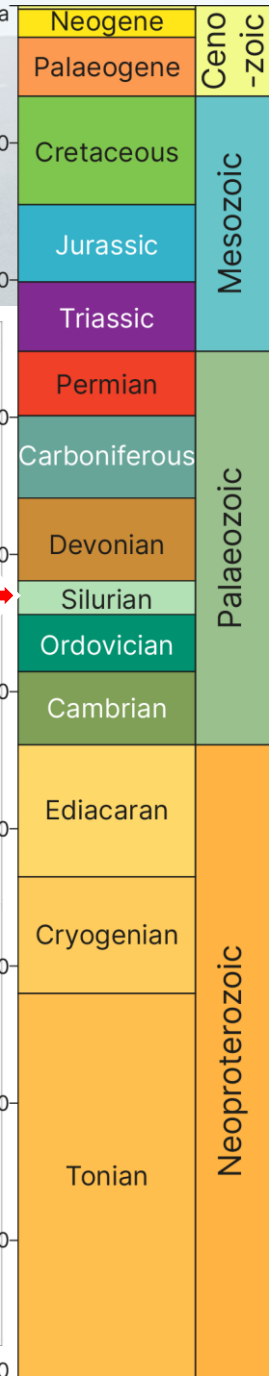
SOUTHERN UPLANDS/ LONGFORD-DOWN



IAPETUS WOZ ERE

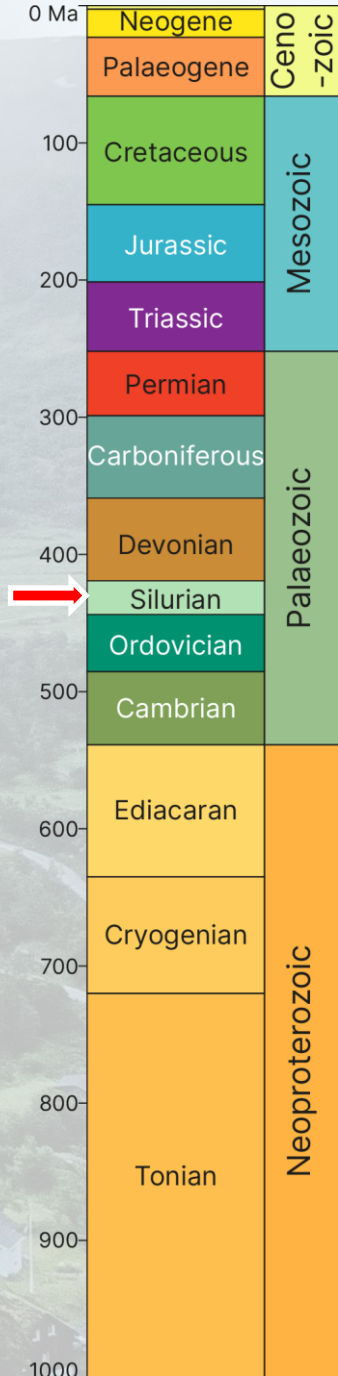

Letterkenny
Derry
Kilroot salt
Belfast
Cavanacaw gold
Sligo
Monaghan
Ballina
Dundalk
Cavan
Kingscourt gypsum
Castlebar
Navan zinc, lead
Mullingar
Tuam
Athlone
Dublin
Galway
Tullamore
Ennis
Galmoy zinc, lead
Lisheen zinc, lead
Limerick
Kilkenny
Tralee
Waterford
Wexford
Killarney
Mallow
Cork


post-Silurian rocks
Hawick Group
Gala Group
Central Belt
Leadhills Supergroup
Northern Belt
Moffat Shale Group
Southern Uplands-Down -Longford Terrane
Late Caledonian and Palaeogene granitoids
Helen's Bay
Copeland Island
Belfast Lough
Orlock Bridge Fault
Coalpit Bay
Belfast
Ballyharry
Dundonald
Cunning Burn
Ards Peninsula
Yates Corner
Lessans
Killaney
Strangford Lough
Co. Down
Portaferry
Tandragee
Armagh
Acton
Downpatrick
Markethill
Orlock Bridge Fault
Cloghy Fault
Ballytrustan
Tieveshilly
Co. Armagh
N
Newry
Mourne
Mountains
Slieve Gullion
0
20km
Carlingford Lough

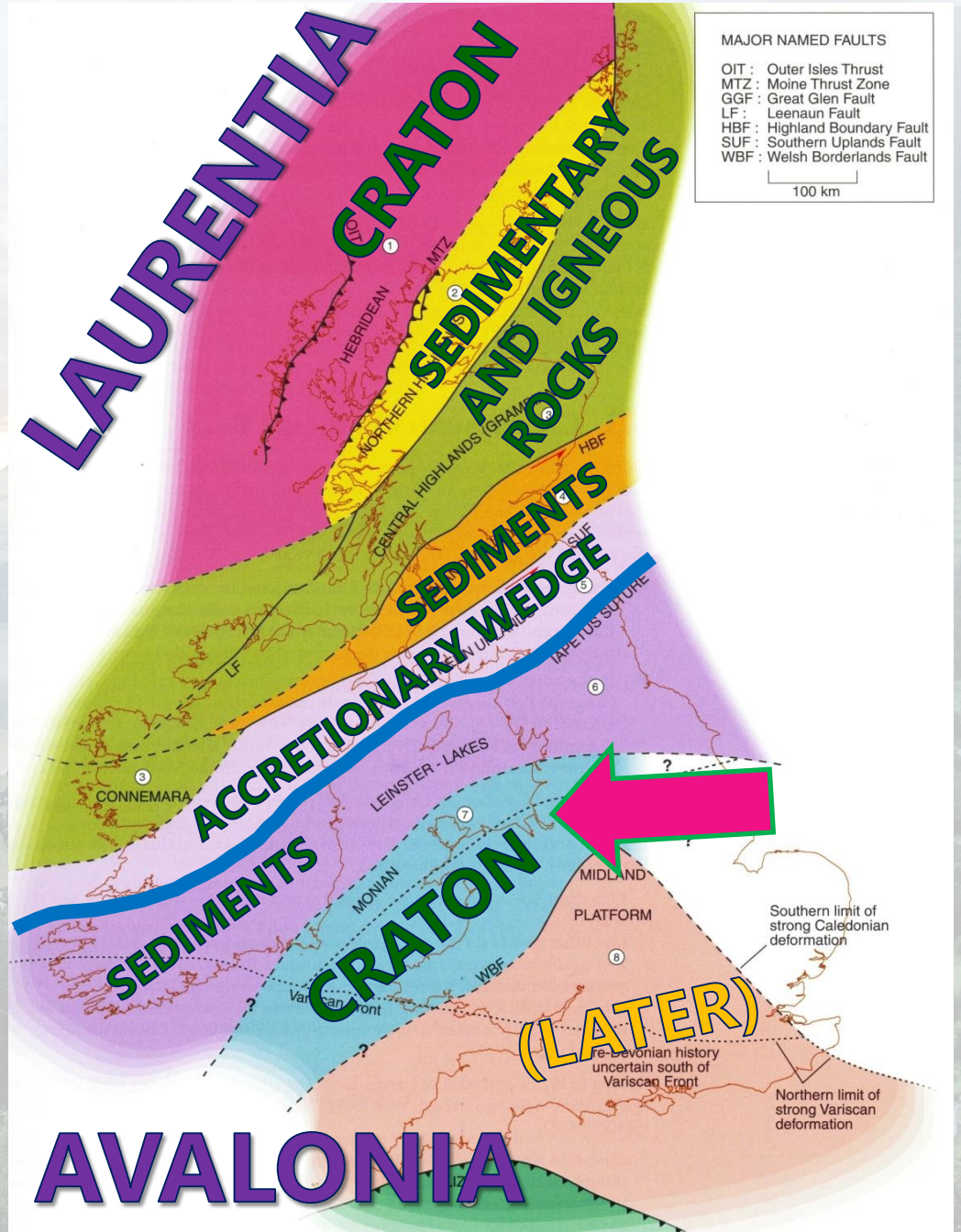

0 Ma
100
200
300
400
500
600
700
800
900
1000
Neogene
Palaeogene
Cretaceous
Jurassic
Triassic
Permian
Carboniferous
Devonian
Silurian
Ordovician
Cambrian
Ediacaran
Cryogenian
Tonian
Ceno -zoic
Mesozoic
Palaeozoic
Neoproterozoic

Laurentia, Avalonia, and the Iapetus Ocean | *The Laurentian Margin*

GY4051



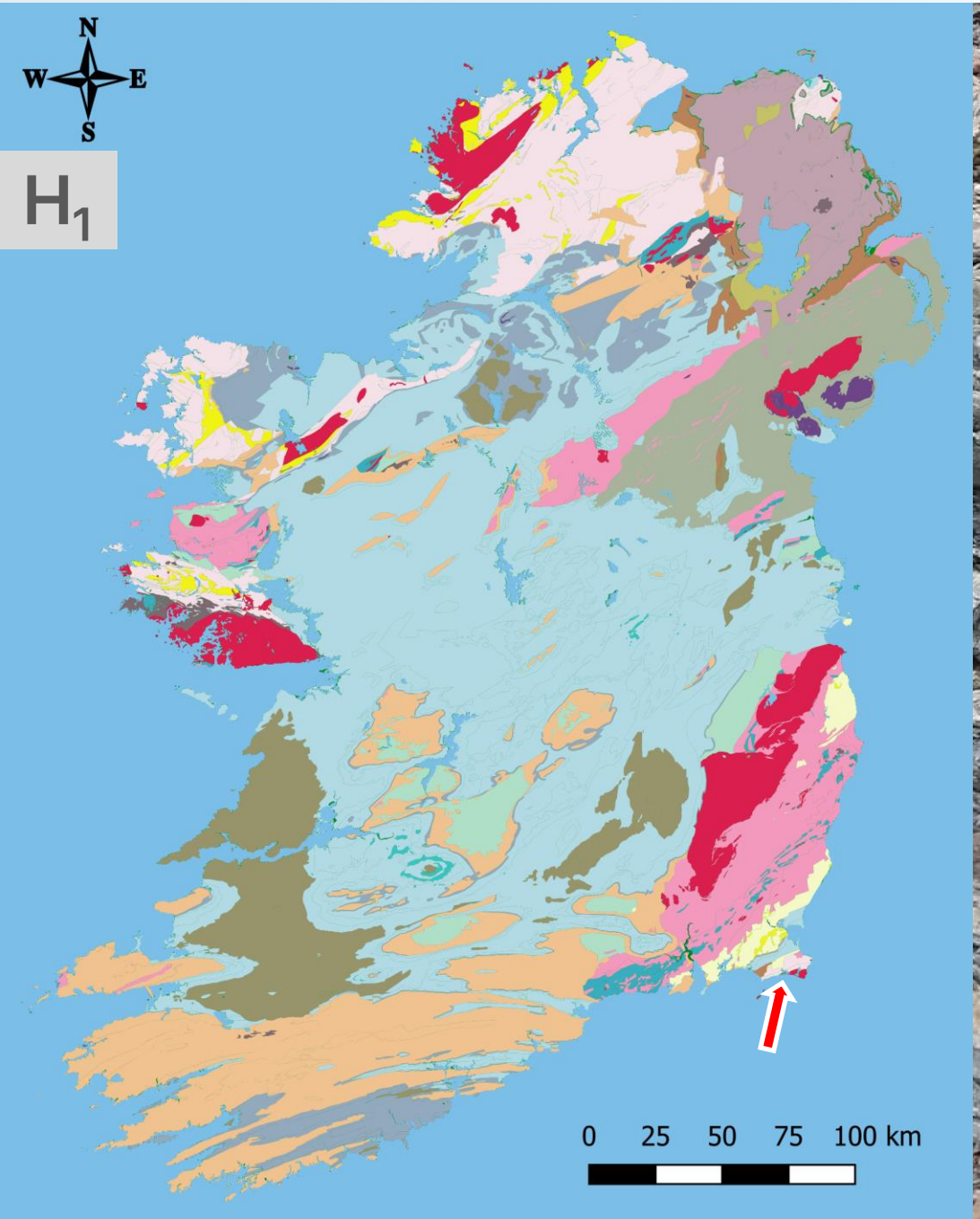
MONIAN

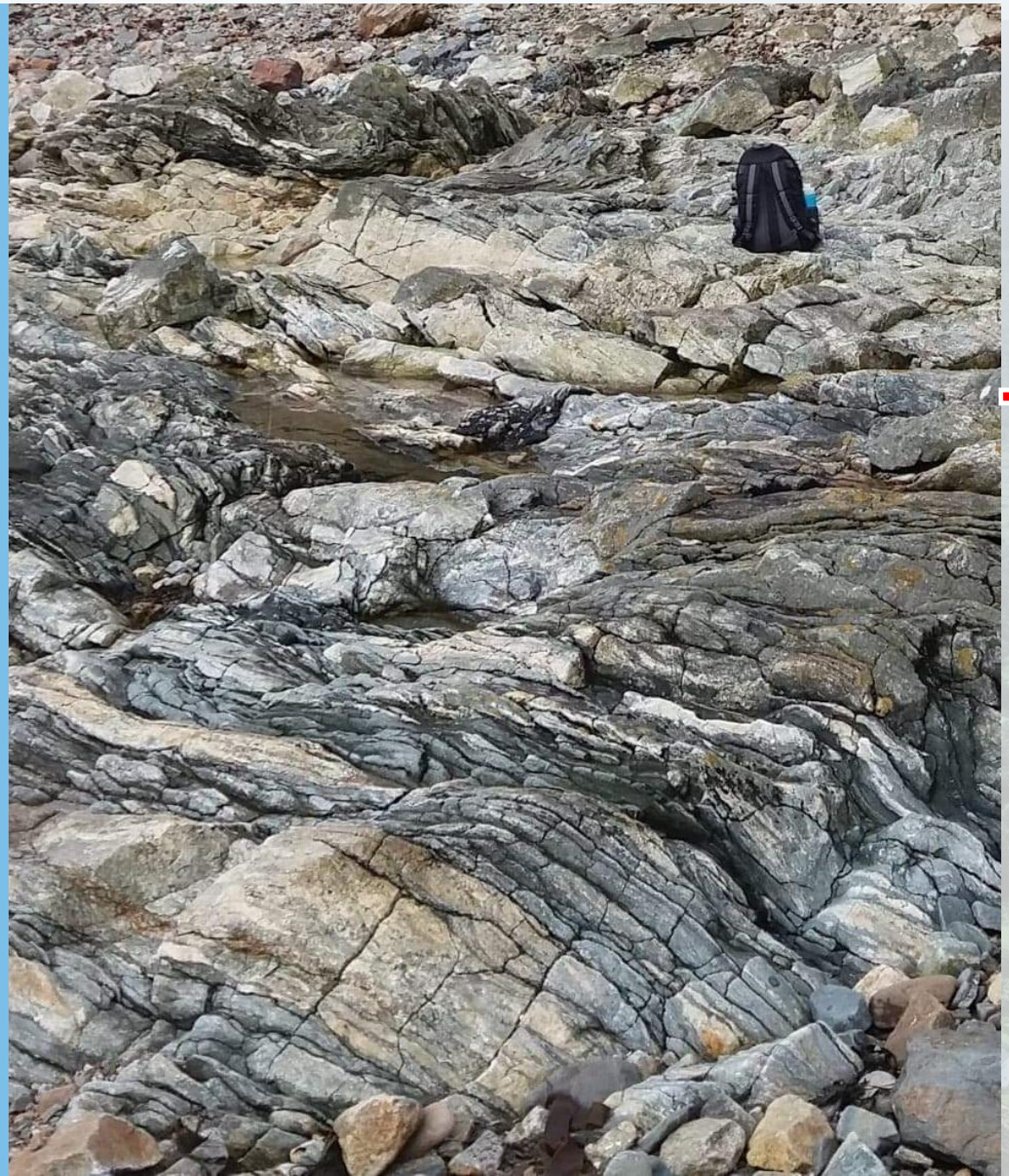


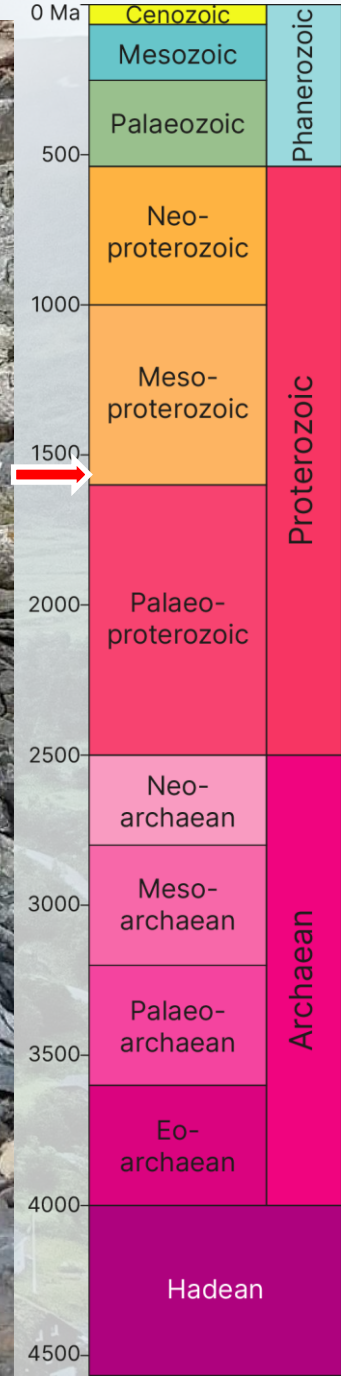
IAPETUS
WOZ
ERE

H_1

0 Ma
Cenozoic
Mesozoic
Palaeozoic
Phanerozoic
500
Neo-proterozoic
1000
Meso-proterozoic
1500
Palaeo-proterozoic
Proterozoic
2000
2500
Neo-archaean
Meso-archaean
3000
Palaeo-archaean
3500
Eo-archaean
Archaean
4000
Hadean
4500


N
W
E
S
H1
0 25 50 75 100 km




0 Ma
Cenozoic
Mesozoic
Palaeozoic
Phanerozoic
500
Neo-proterozoic
1000
Meso-proterozoic
1500
Palaeo-proterozoic
Proterozoic
2000
2500
Neo-archaean
Meso-archaean
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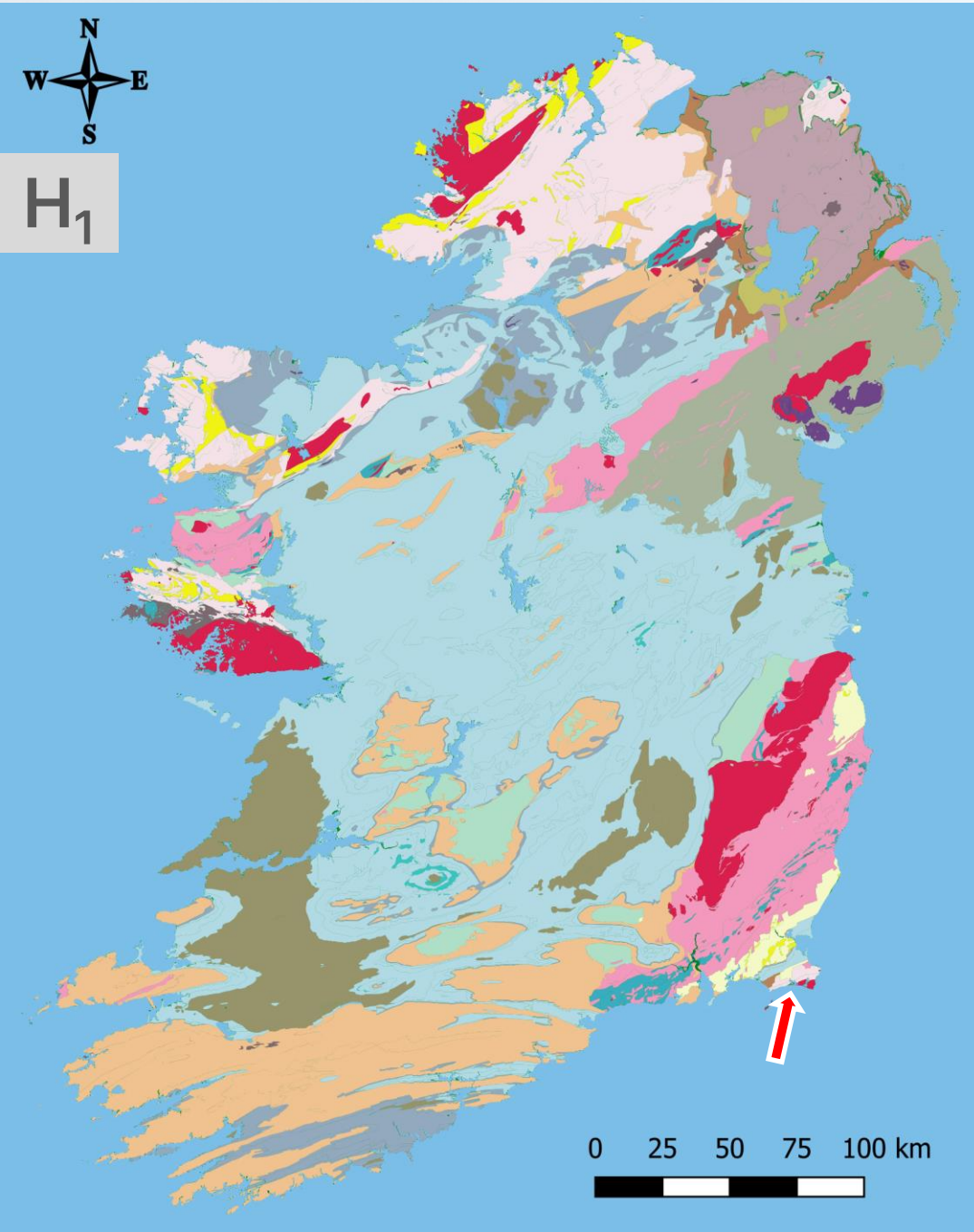
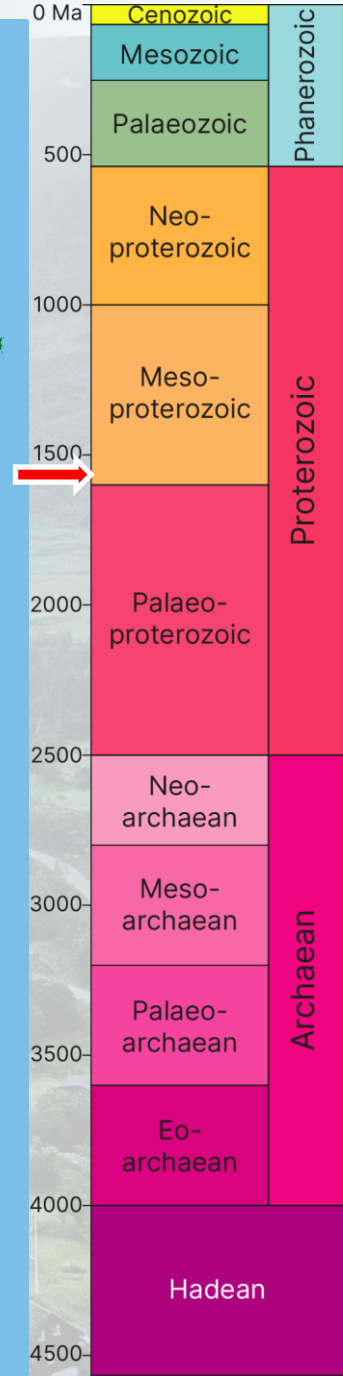
Palaeo-archaean
3500
Eo-archaean
Archaean
4000
Hadean
4500

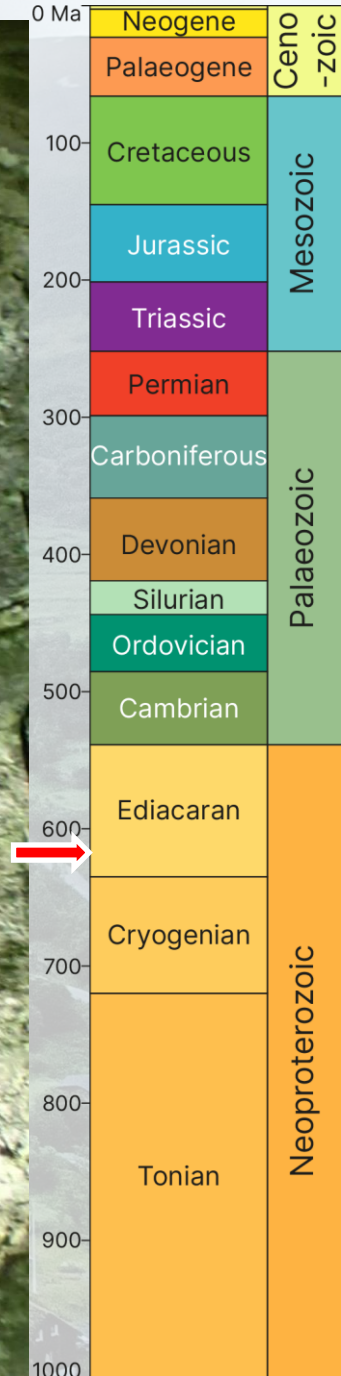

N
W
E
S
H1
0 25 50 75 100 km

N
W
E
S
0 25 50 75 100 km


0 Ma
Cenozoic
Mesozoic
Palaeozoic
Phanerozoic
500
Neo-proterozoic
1000
Meso-proterozoic
1500
Palaeo-proterozoic
Proterozoic
2000
2500
Neo-archaean
Meso-archaean
3000
Palaeo-archaean
3500
Eo-archaean
Archaean
4000
Hadean
4500

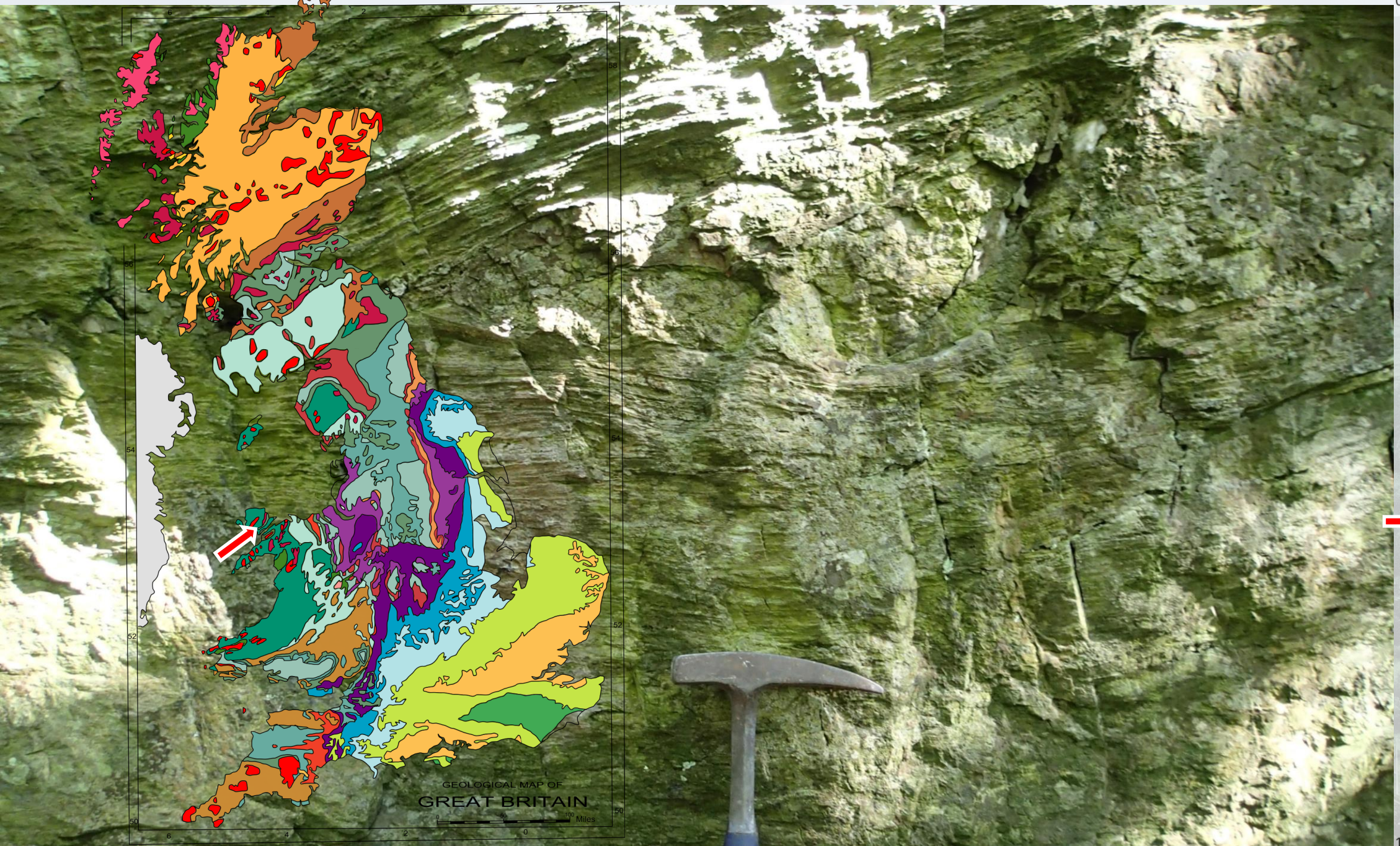
Laurentia, Avalonia, and the Iapetus Ocean | *Subduction Zone in Wales*

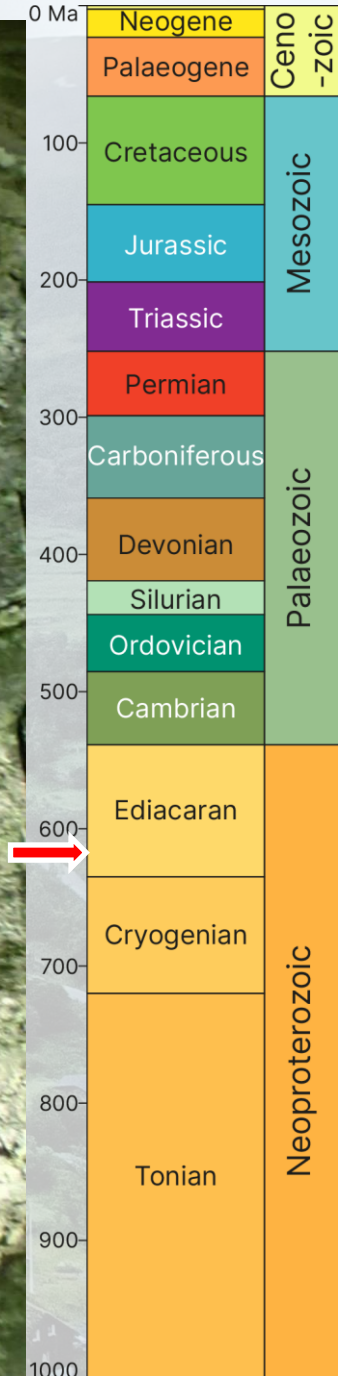
GY4051



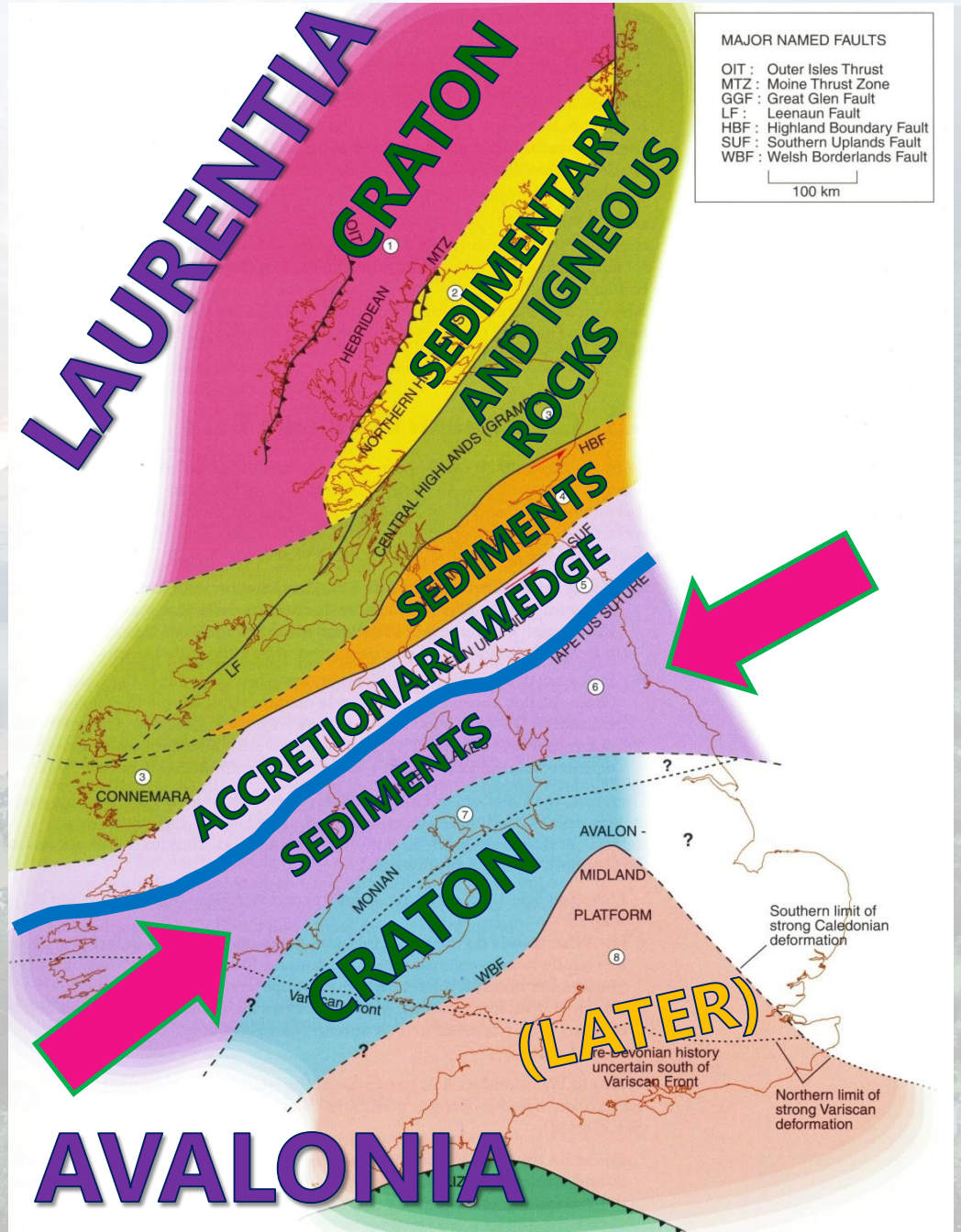
Laurentia, Avalonia and the Iapetus Ocean | *Subduction Zone in Wales*

GY4051





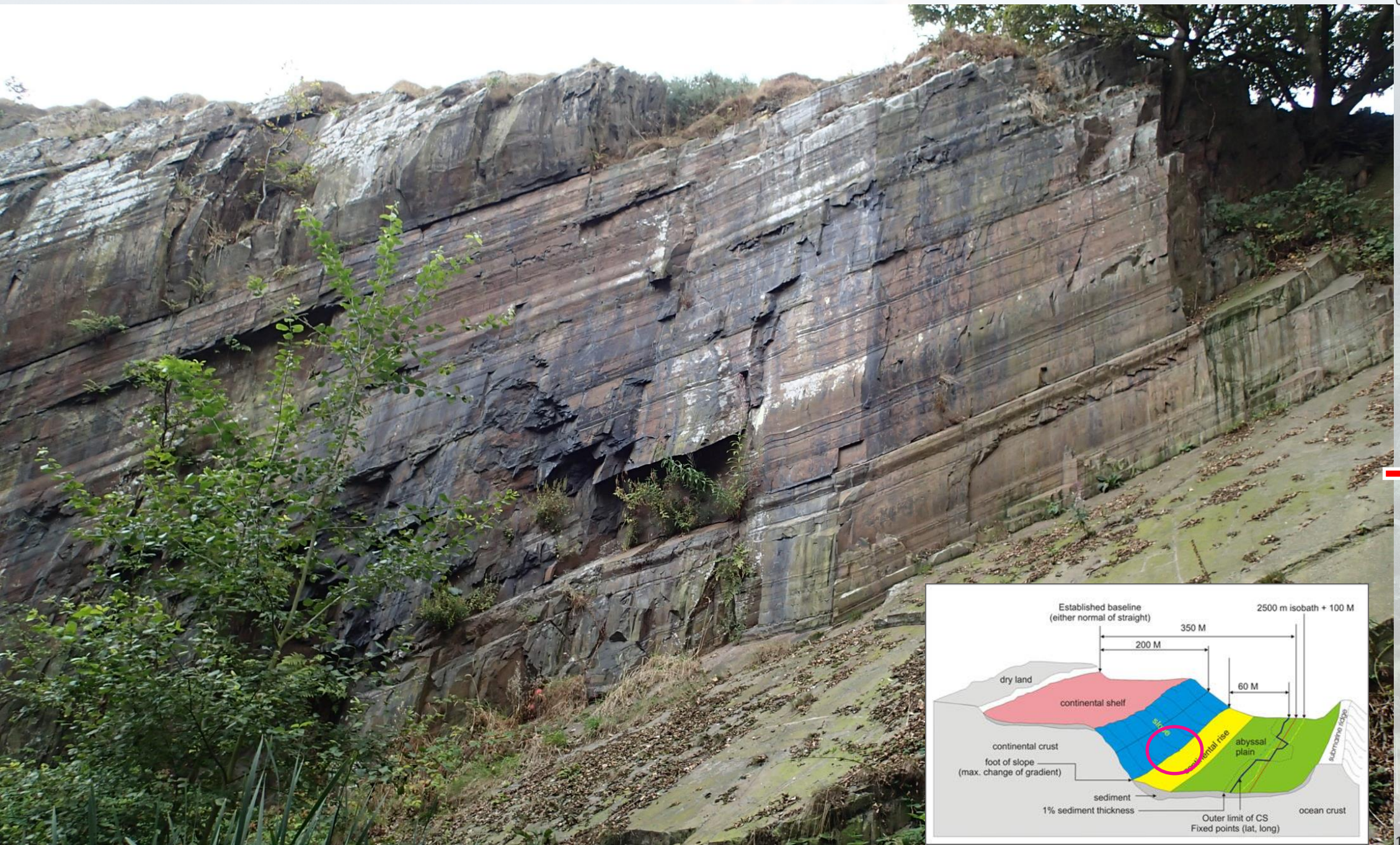
LEINSTER

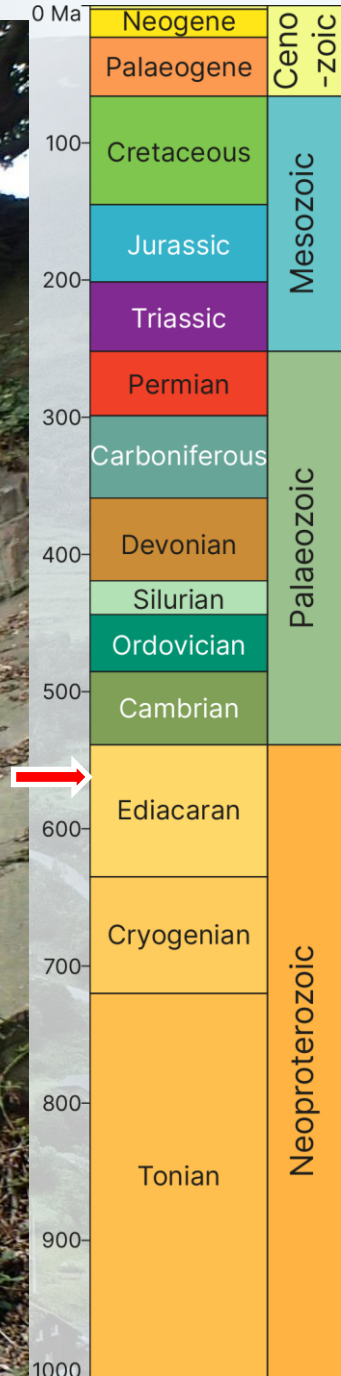


IAPETUS WOZ ERE

Laurentia, Avalonia, and the Iapetus Ocean | *Ediacaran – Deep Marine*

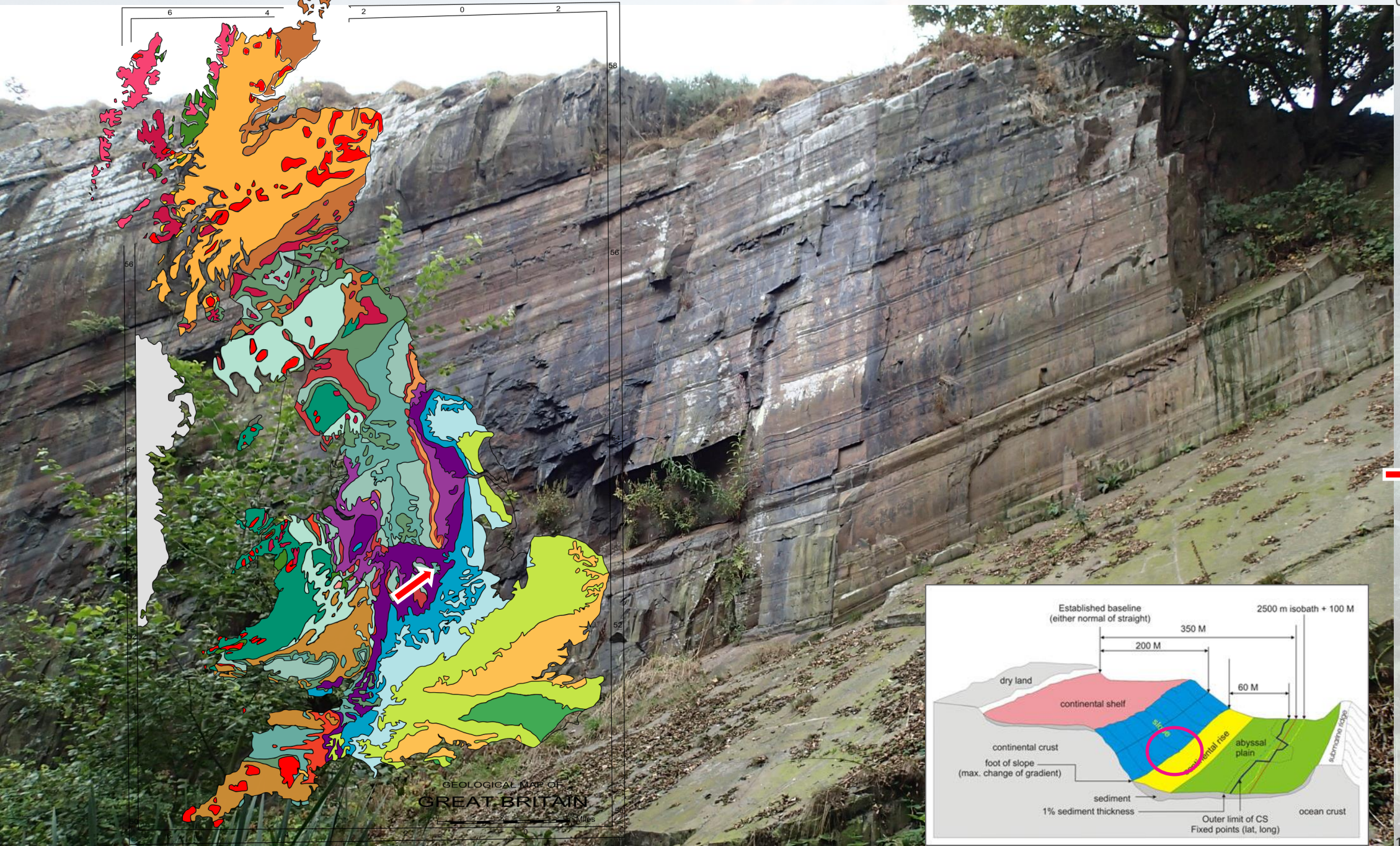
GY4051

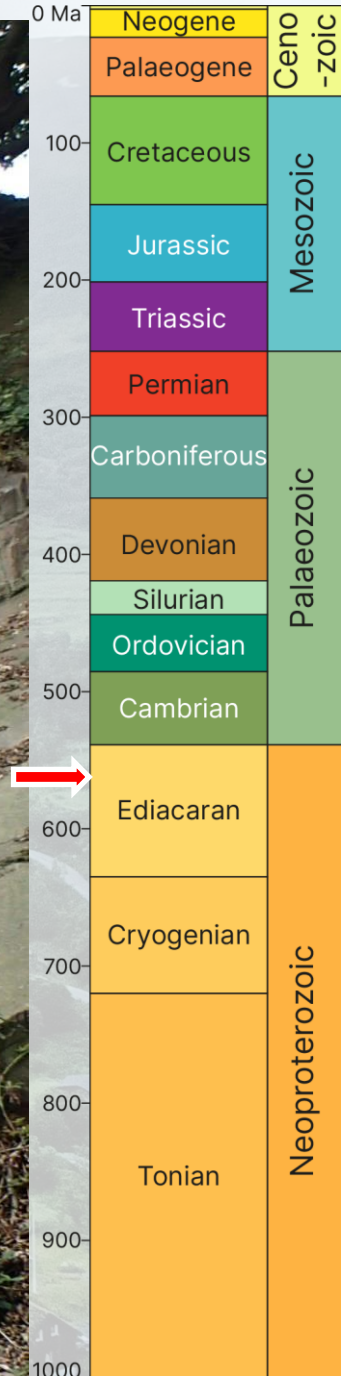




Laurentia, Avalonia and the Iapetus Ocean | *Ediacaran – Deep Marine*

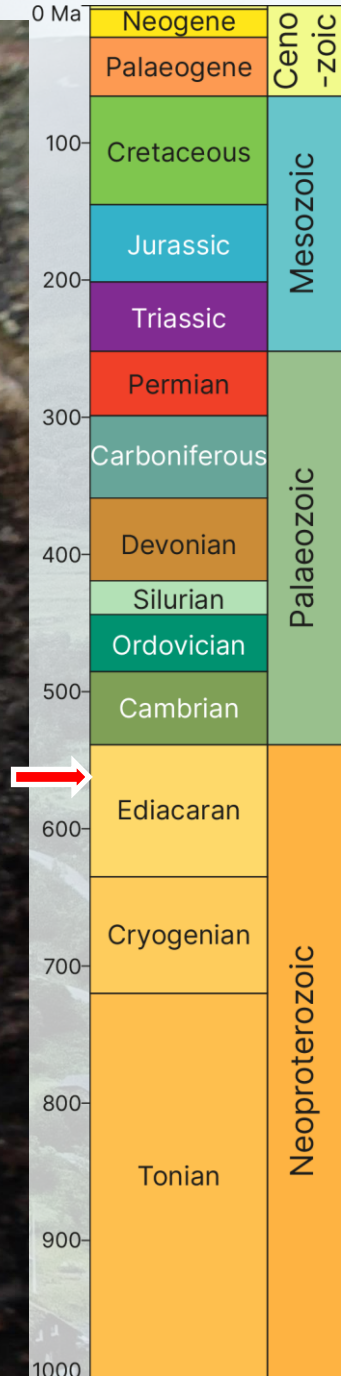
GY4051





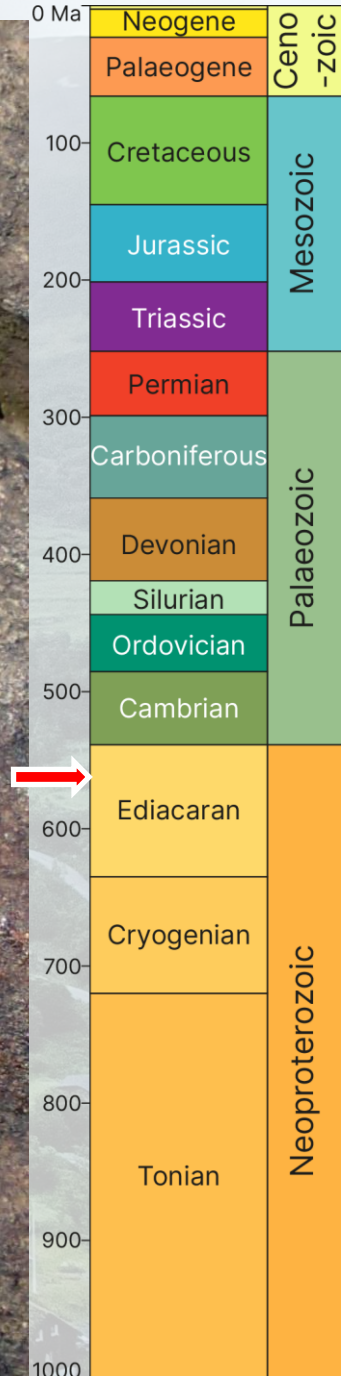
Laurentia, Avalonia, and the Iapetus Ocean | *Ediacaran – Deep Marine*

GY4051



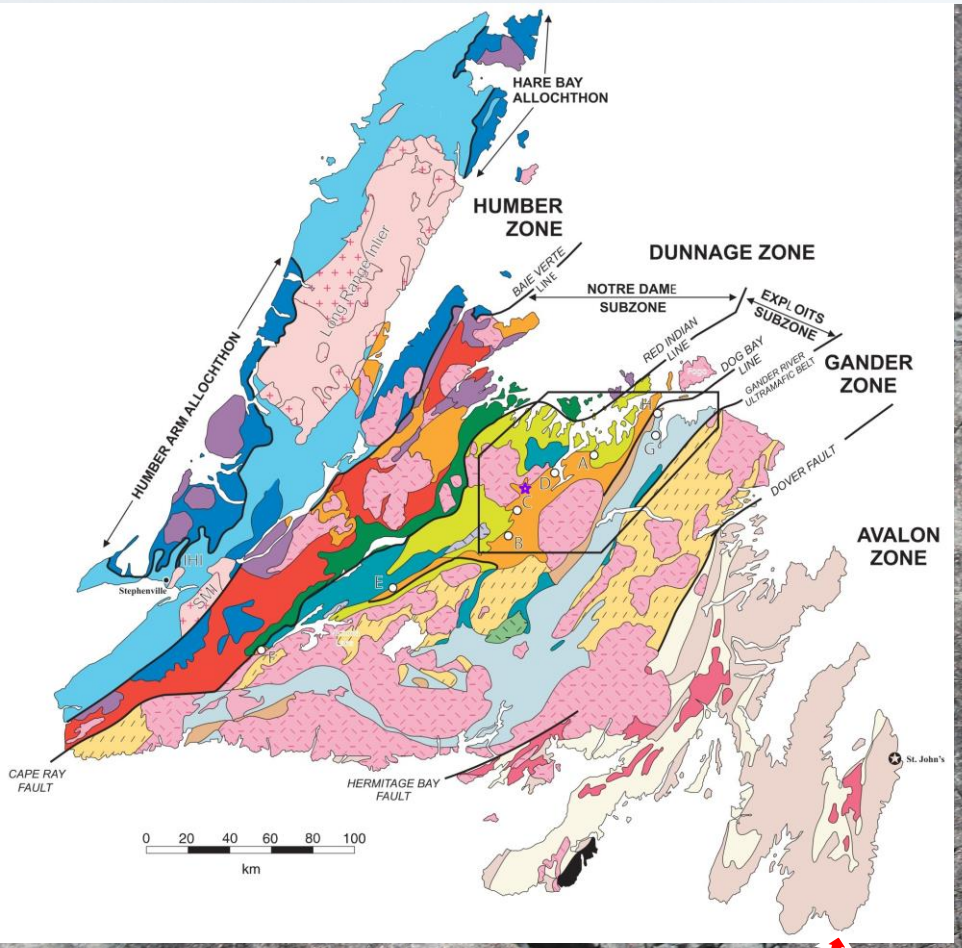
Laurentia, Avalonia, and the Iapetus Ocean | *Ediacaran – Deep Marine*

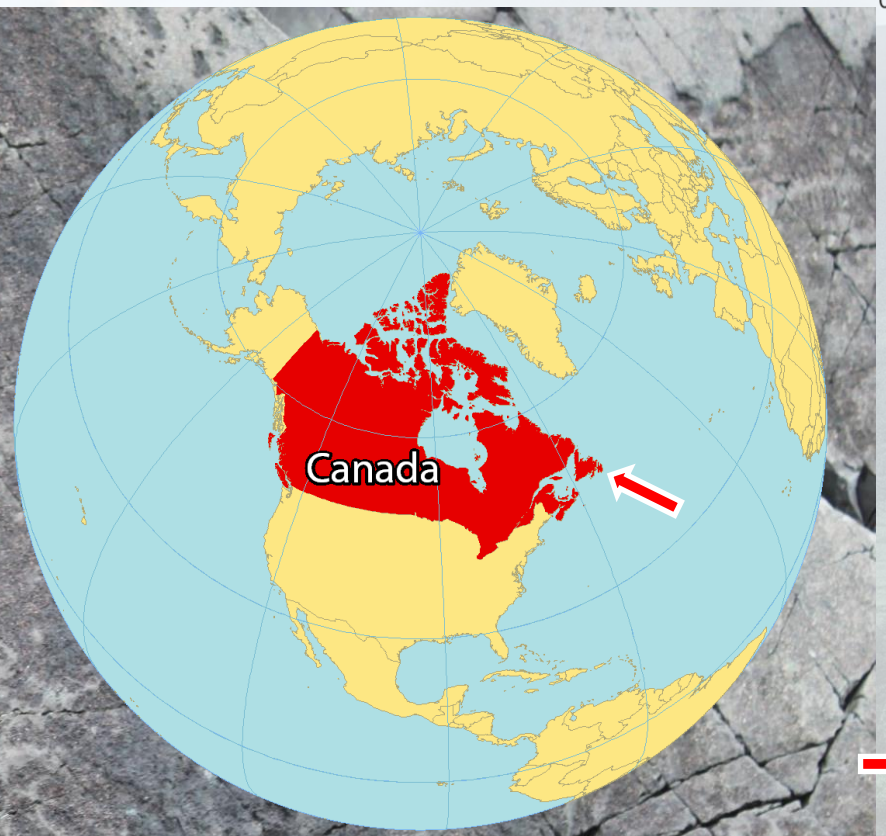
GY4051

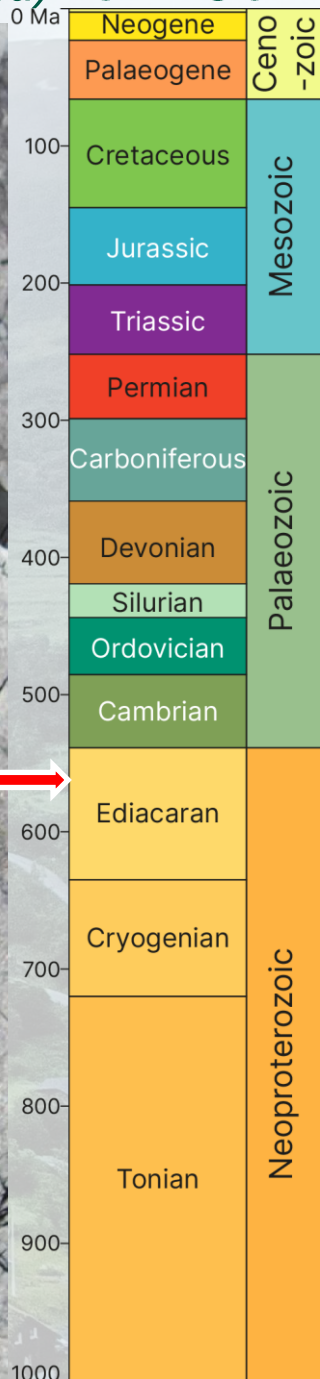


Laurentia, Avalonia, and the Iapetus Ocean | *(Across the ocean – Ediacaran of Newfoundland)* GY4051

Laurentia, Avalonia, and the Iapetus Ocean | (Across the ocean – Ediacaran of Newfoundland) GY4051

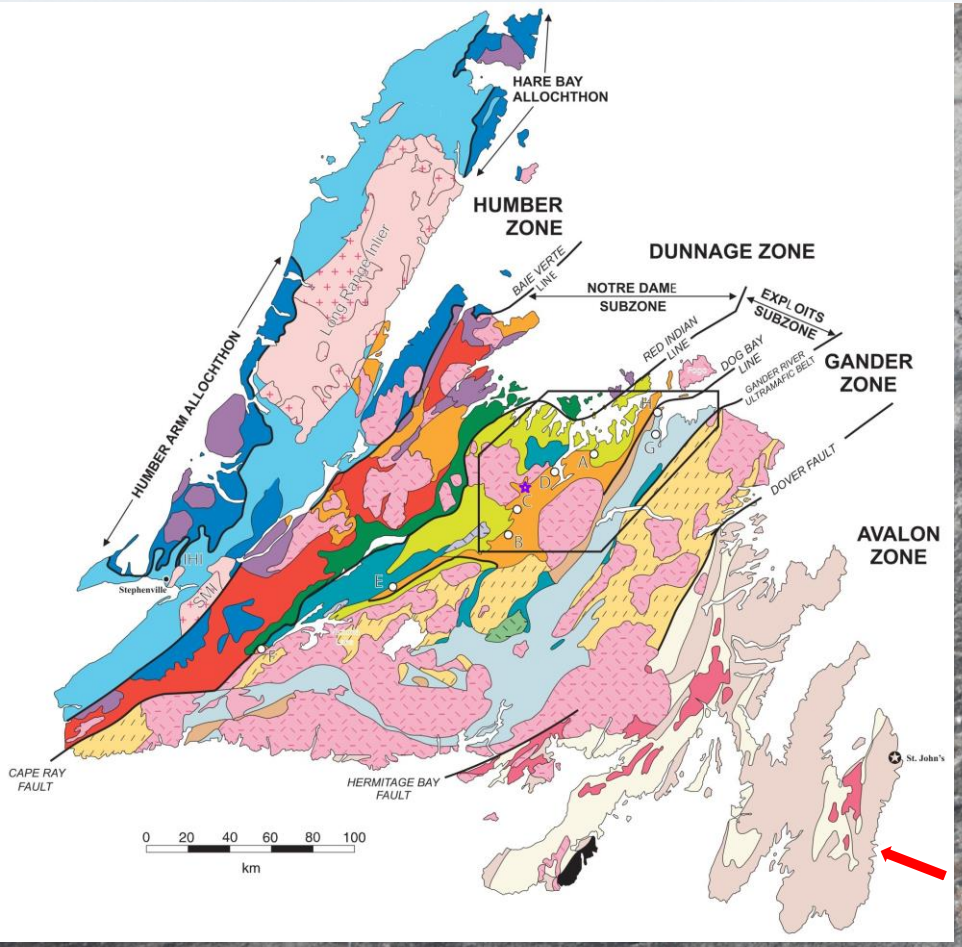


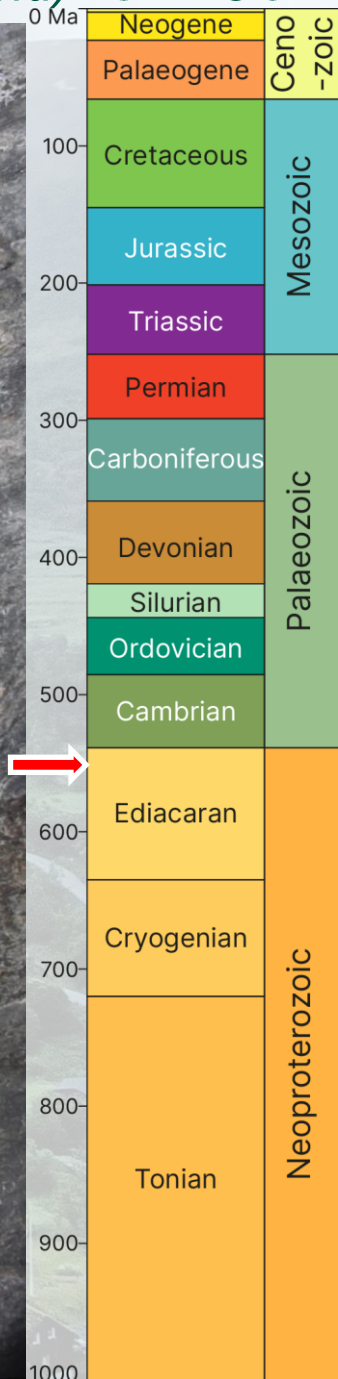




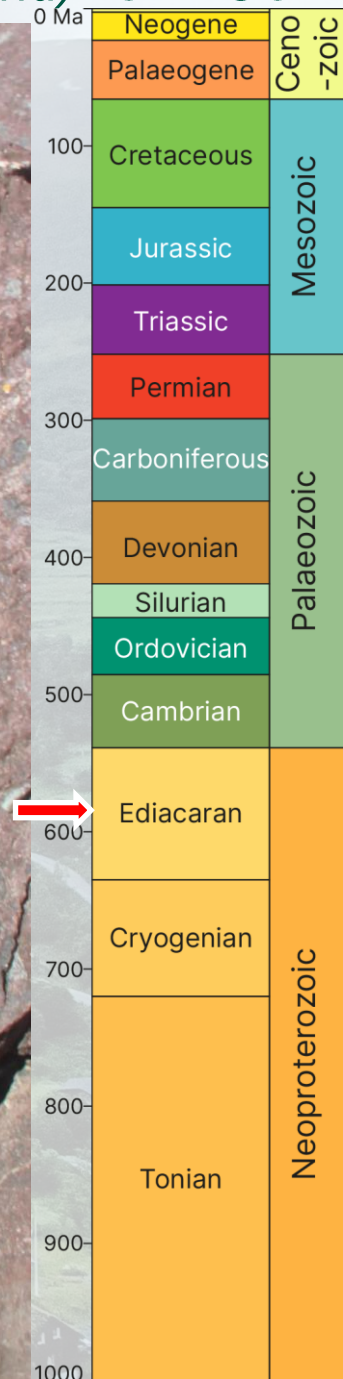
Laurentia, Avalonia, and the Iapetus Ocean | *(Across the ocean – Ediacaran of Newfoundland)* GY4051

Laurentia, Avalonia, and the Iapetus Ocean | *(Across the ocean – Ediacaran of Newfoundland)* GY4051

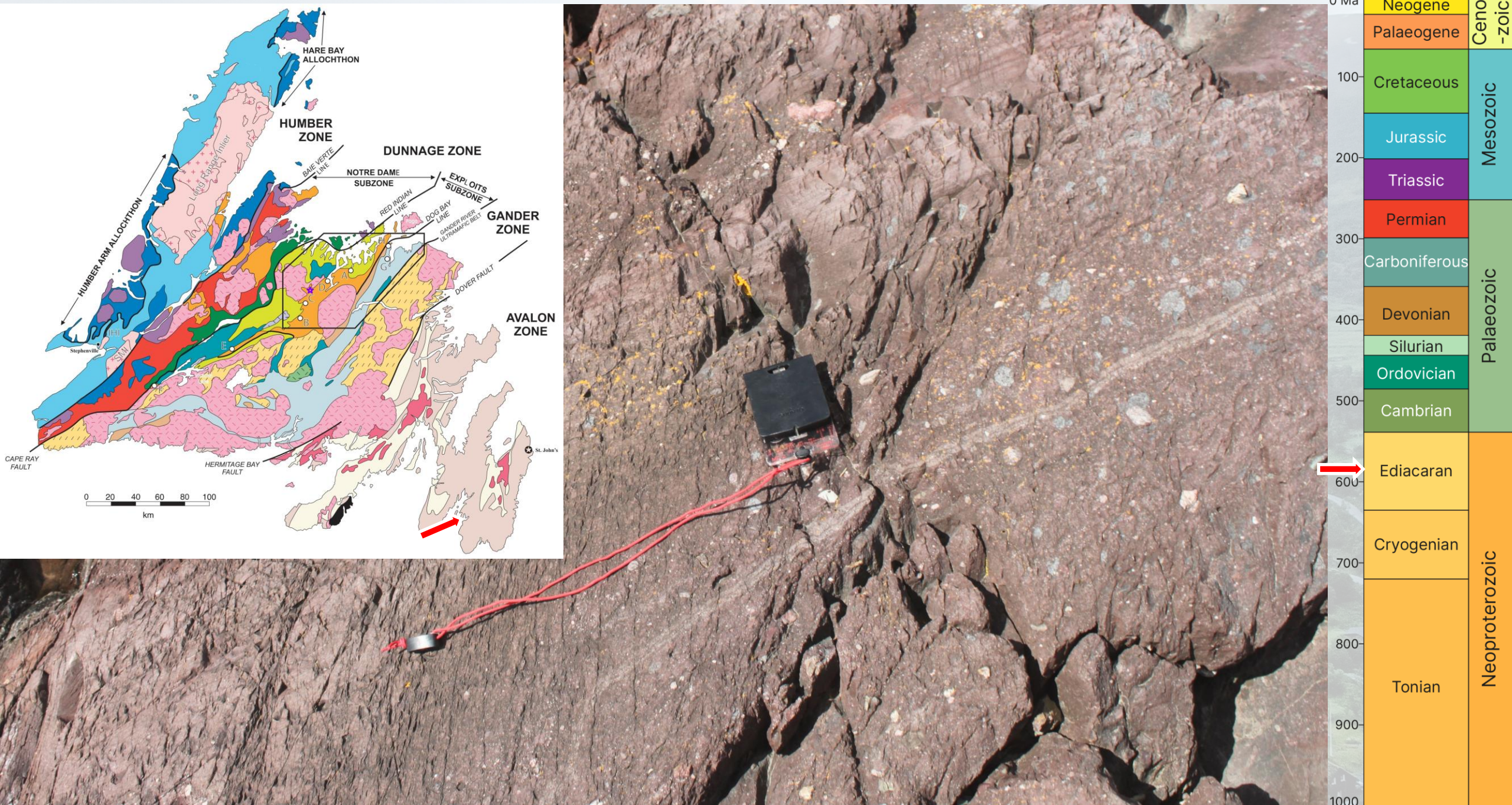




Laurentia, Avalonia, and the Iapetus Ocean | *(Across the ocean – Ediacaran of Newfoundland)* GY4051

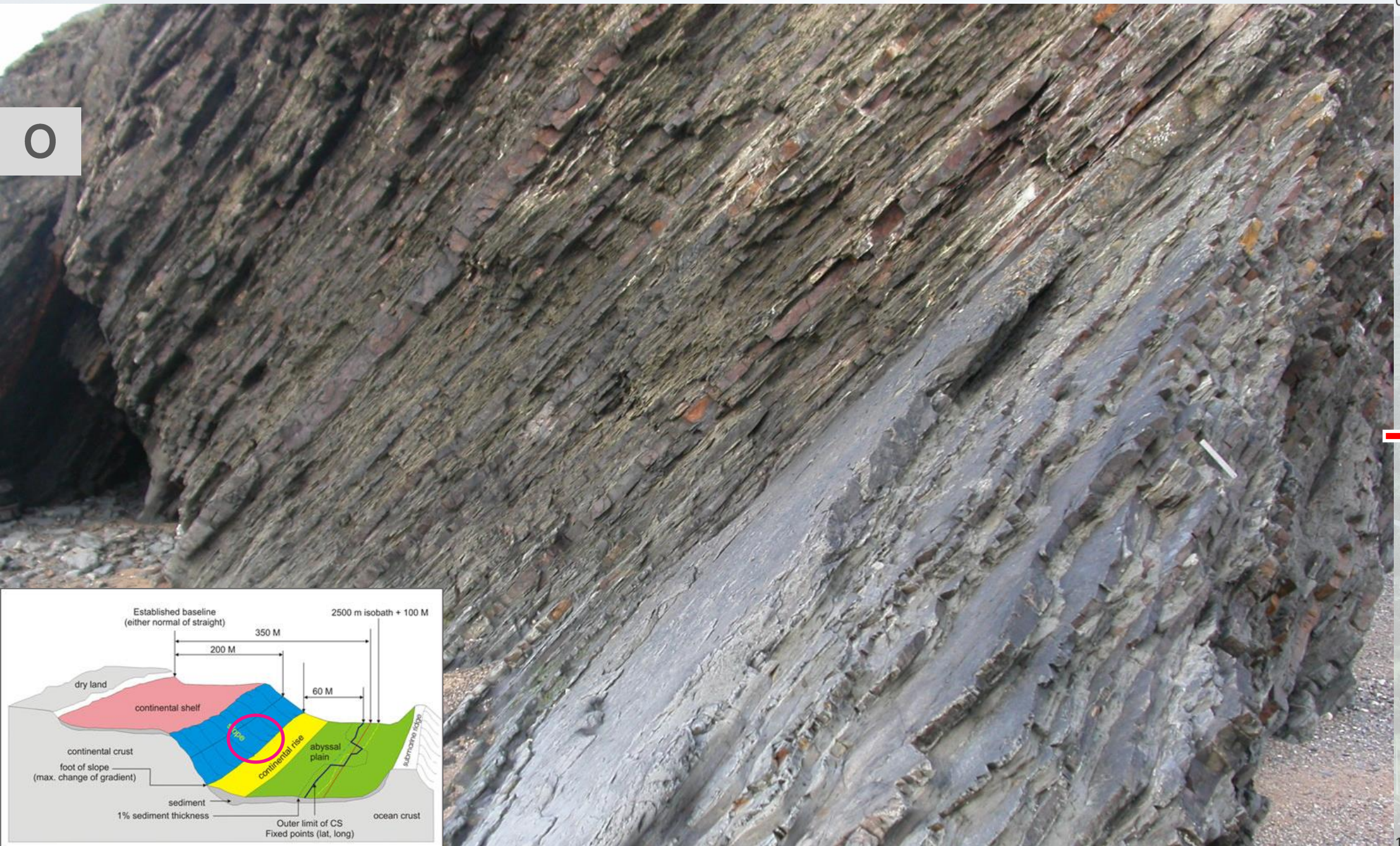


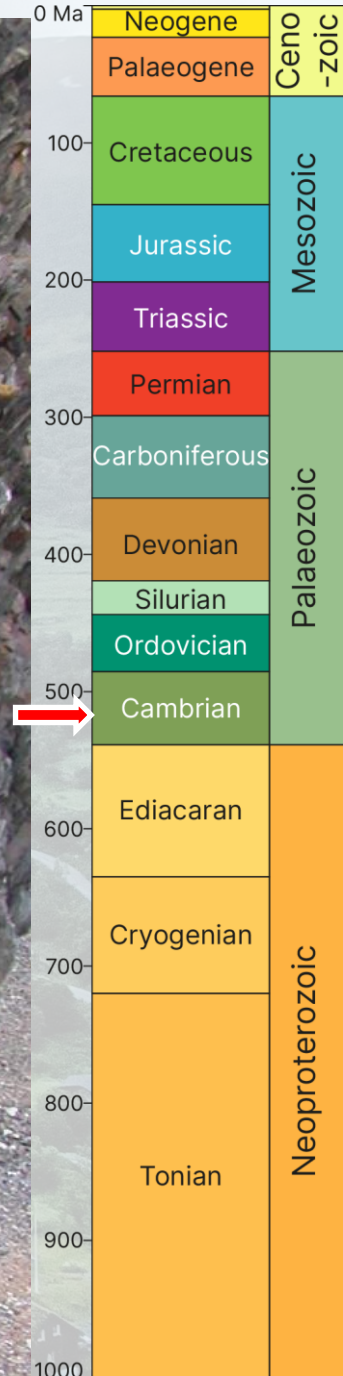
Laurentia, Avalonia, and the Iapetus Ocean | *(Across the ocean – Ediacaran of Newfoundland)* GY4051



Laurentia, Avalonia, and the Iapetus Ocean | *Cambrian – Deep Marine*

GY4051





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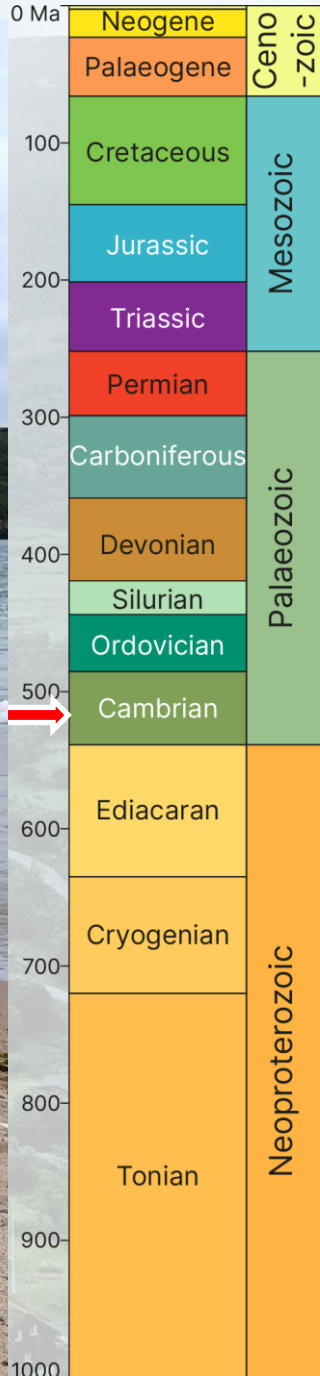
0 Ma
100
200
300
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500
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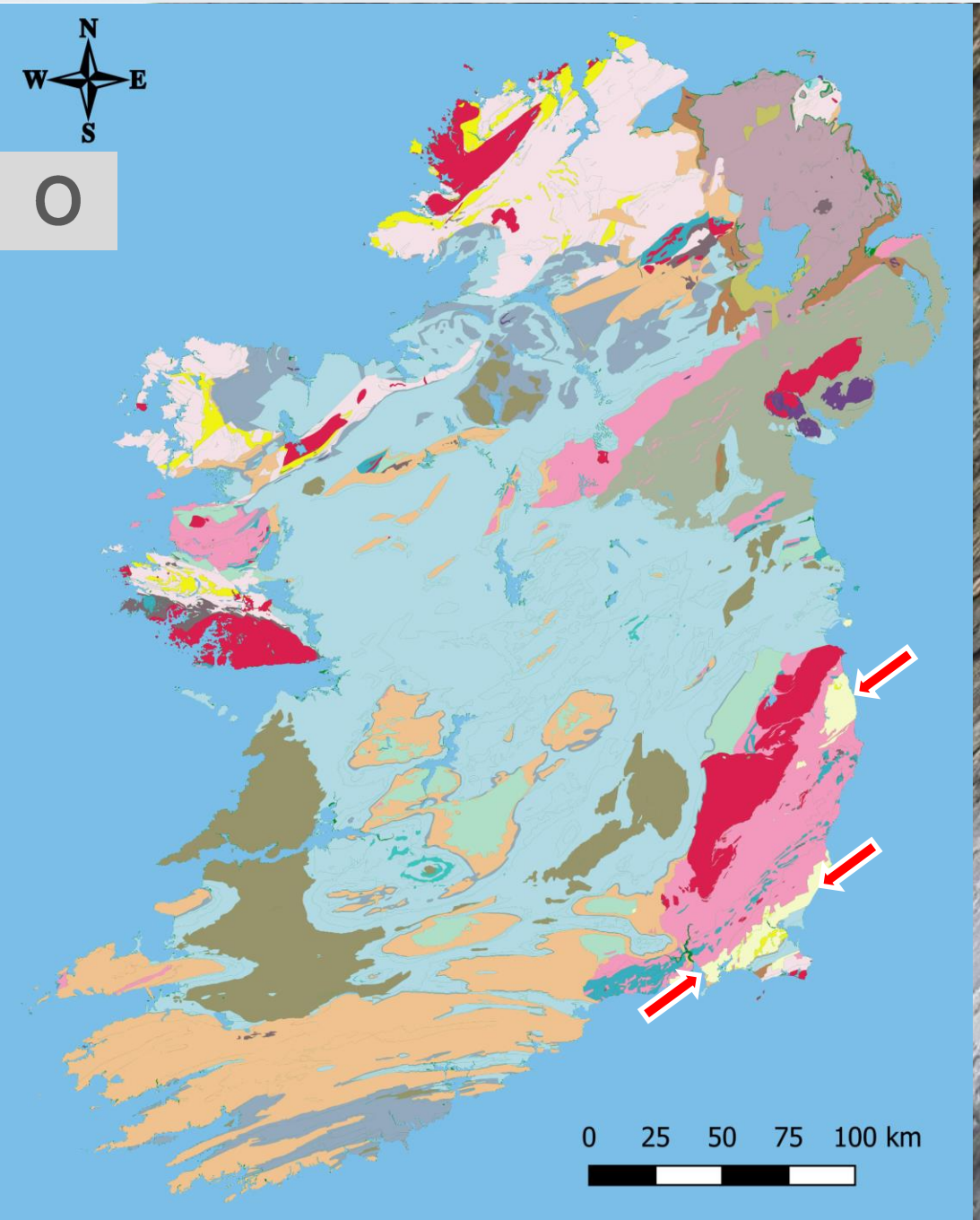
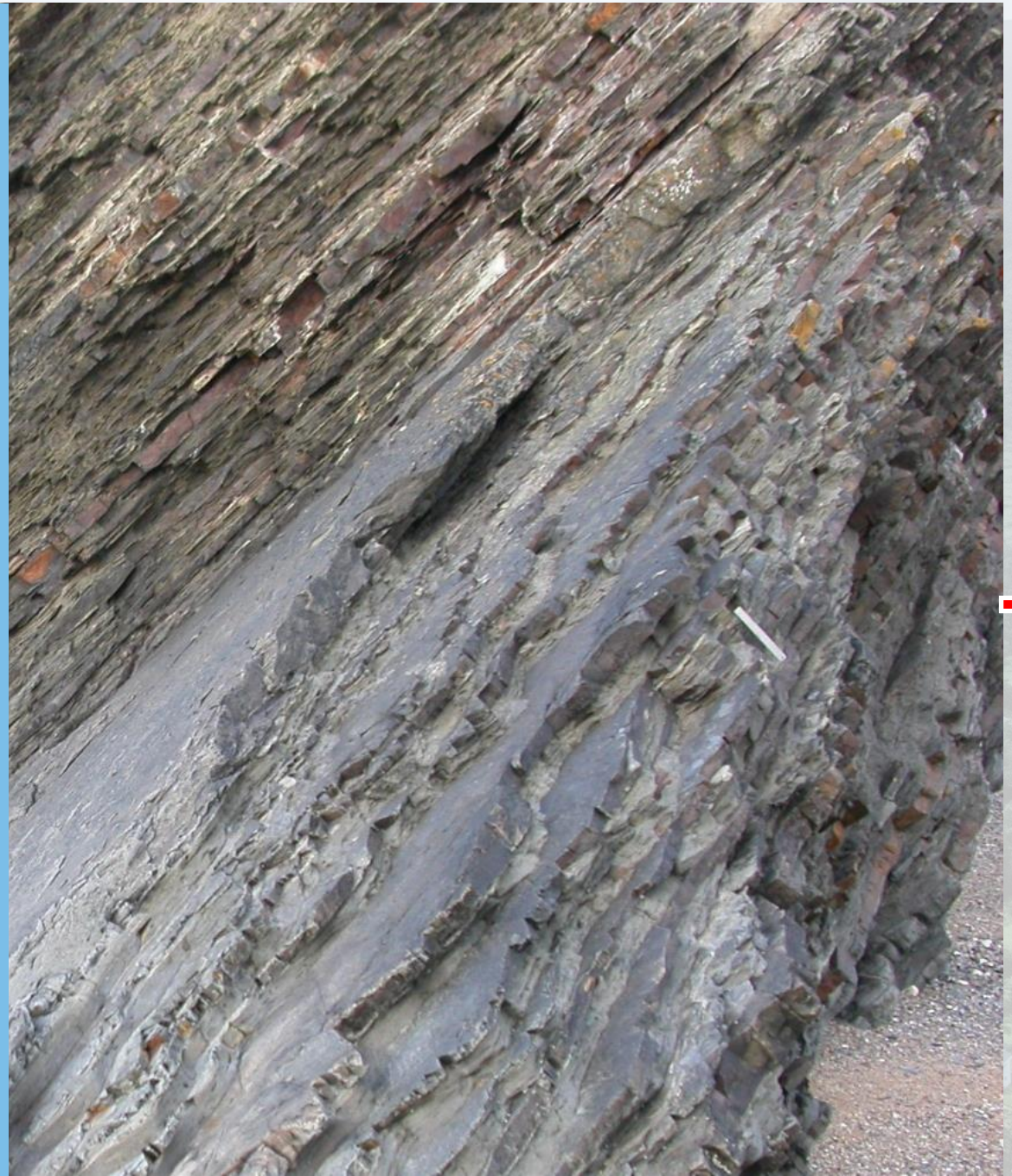
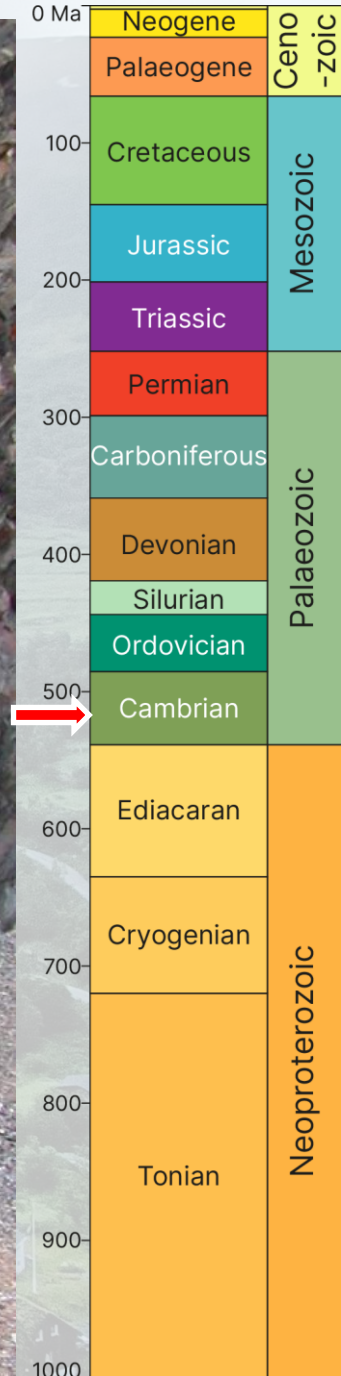
700
800
900
1000
Neogene
Palaeogene
Cretaceous
Jurassic
Triassic
Permian
Carboniferous
Devonian
Silurian
Ordovician
Cambrian
Ediacaran
Cryogenian
Tonian
Ceno-zoic
Mesozoic
Palaeozoic
Neoproterozoic


N
W
E
S
O
0 25 50 75 100 km




0 Ma
100
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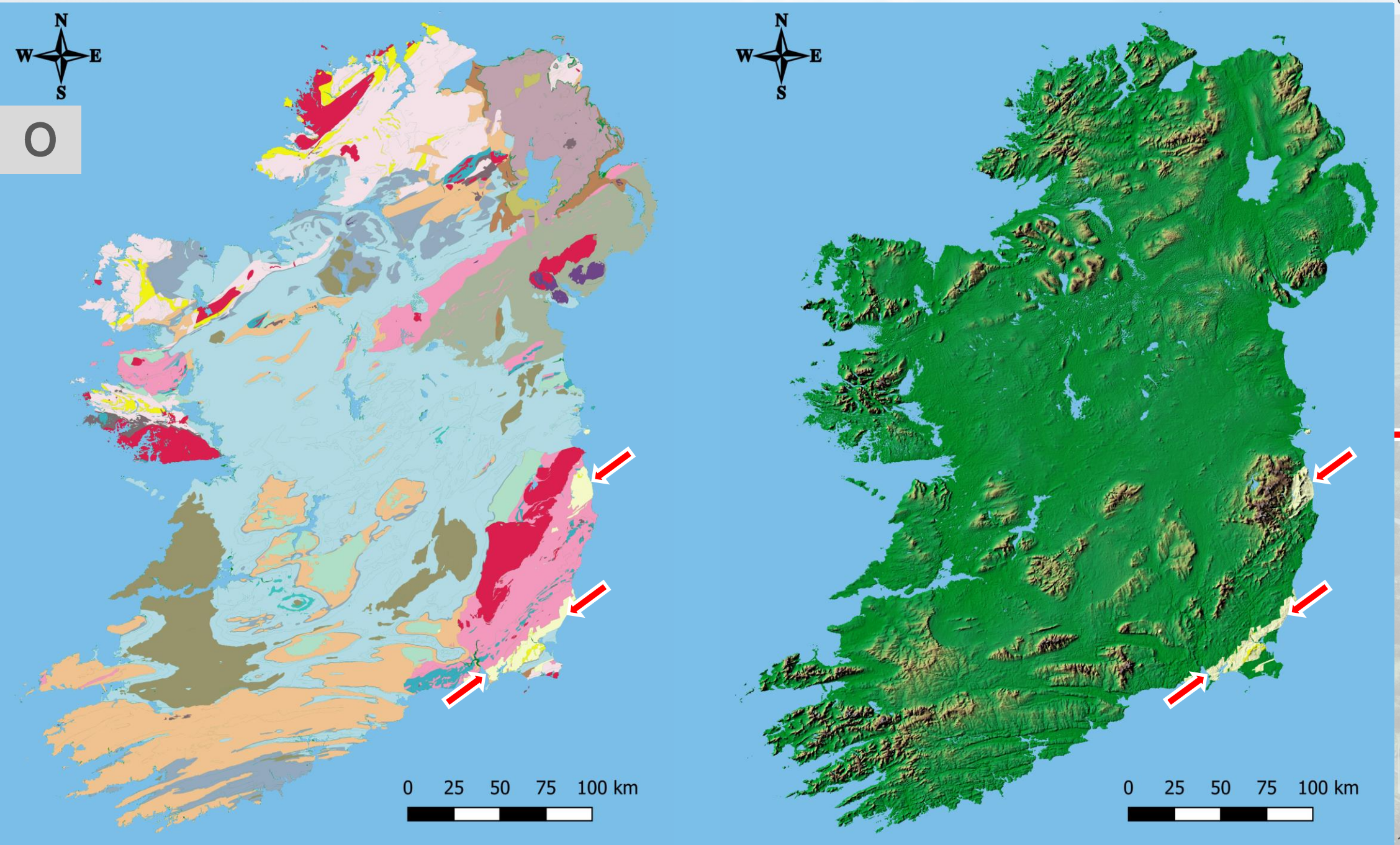
Neogene
Palaeogene
Cretaceous
Jurassic
Triassic
Permian
Carboniferous
Devonian
Silurian
Ordovician
Cambrian
Ediacaran
Cryogenian
Tonian
Ceno-zoic
Mesozoic
Palaeozoic
Neoproterozoic


N
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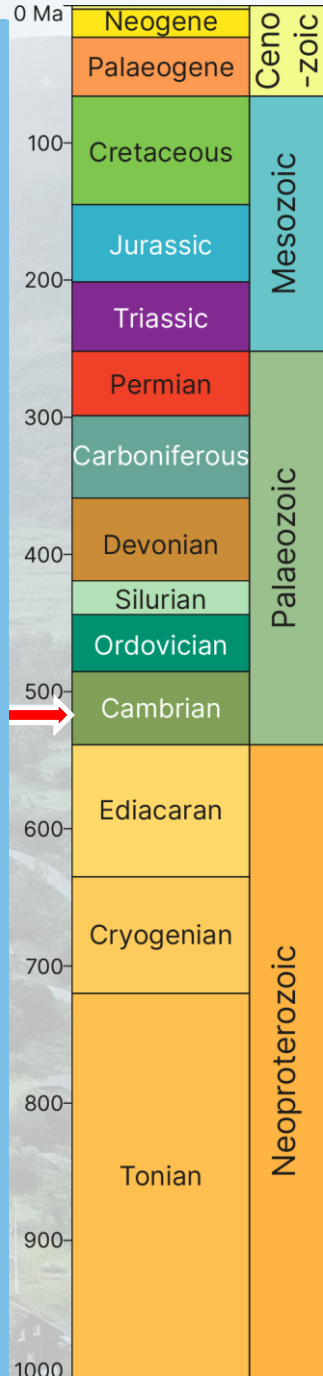
S
O
0 25 50 75 100 km
N
W
E
S
0 25 50 75 100 km


0 Ma
100
200
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400
500
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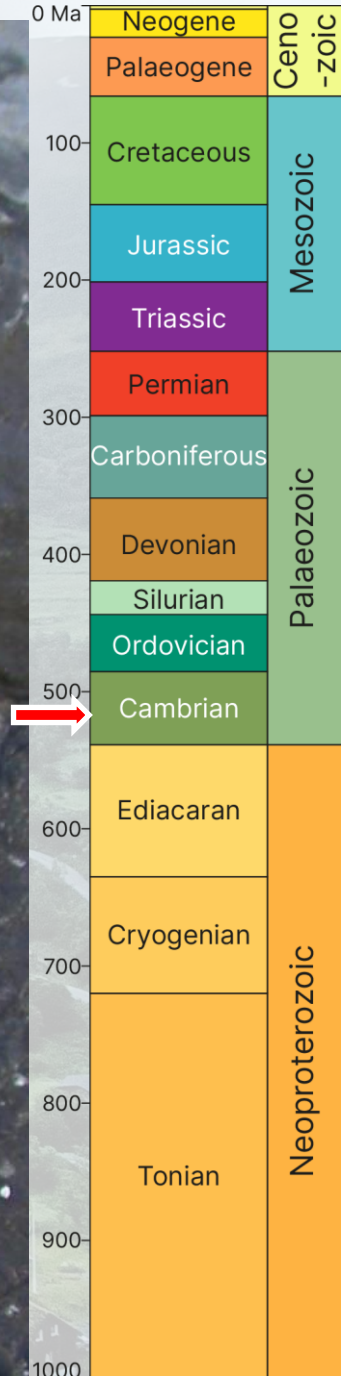
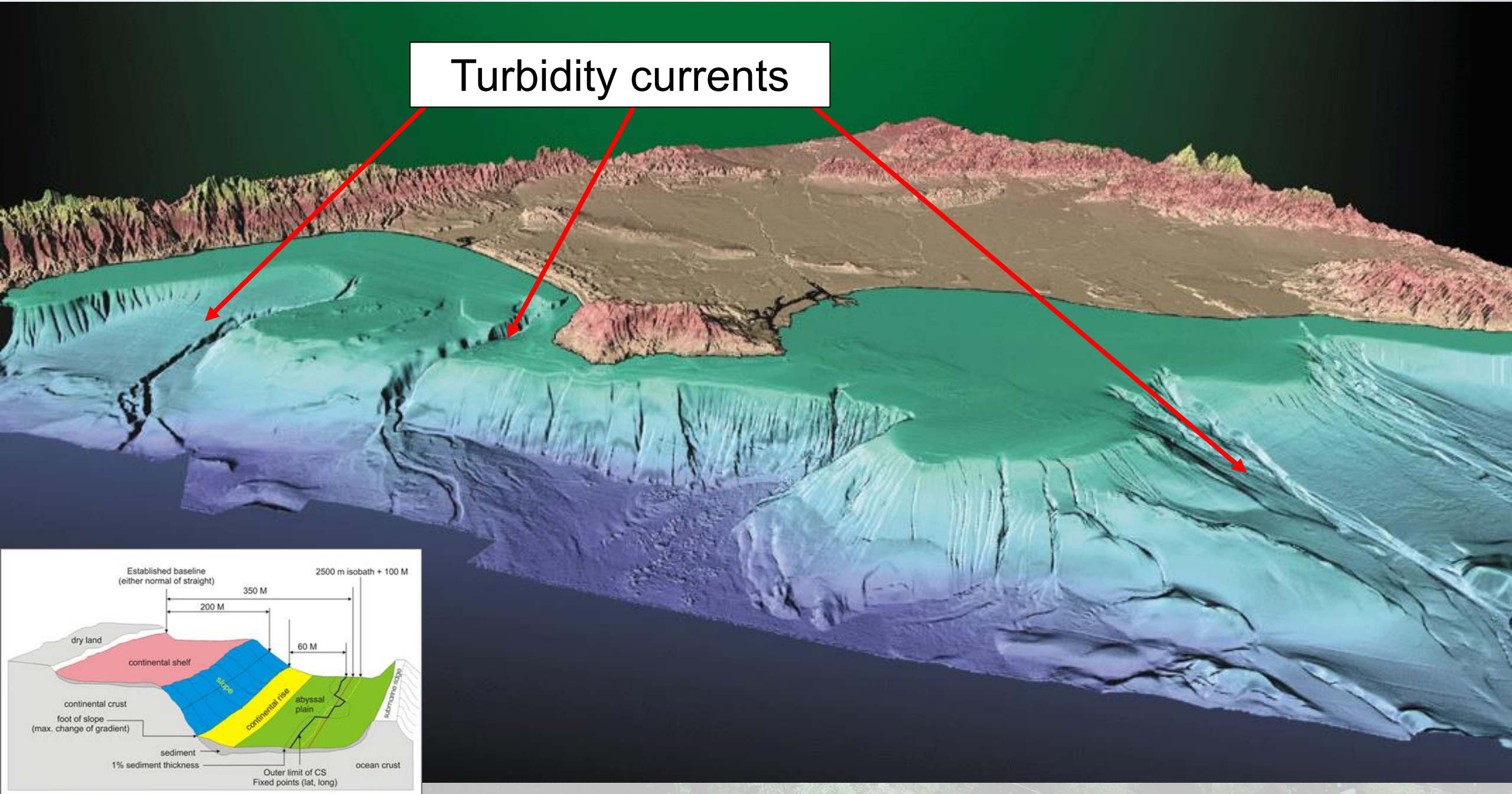
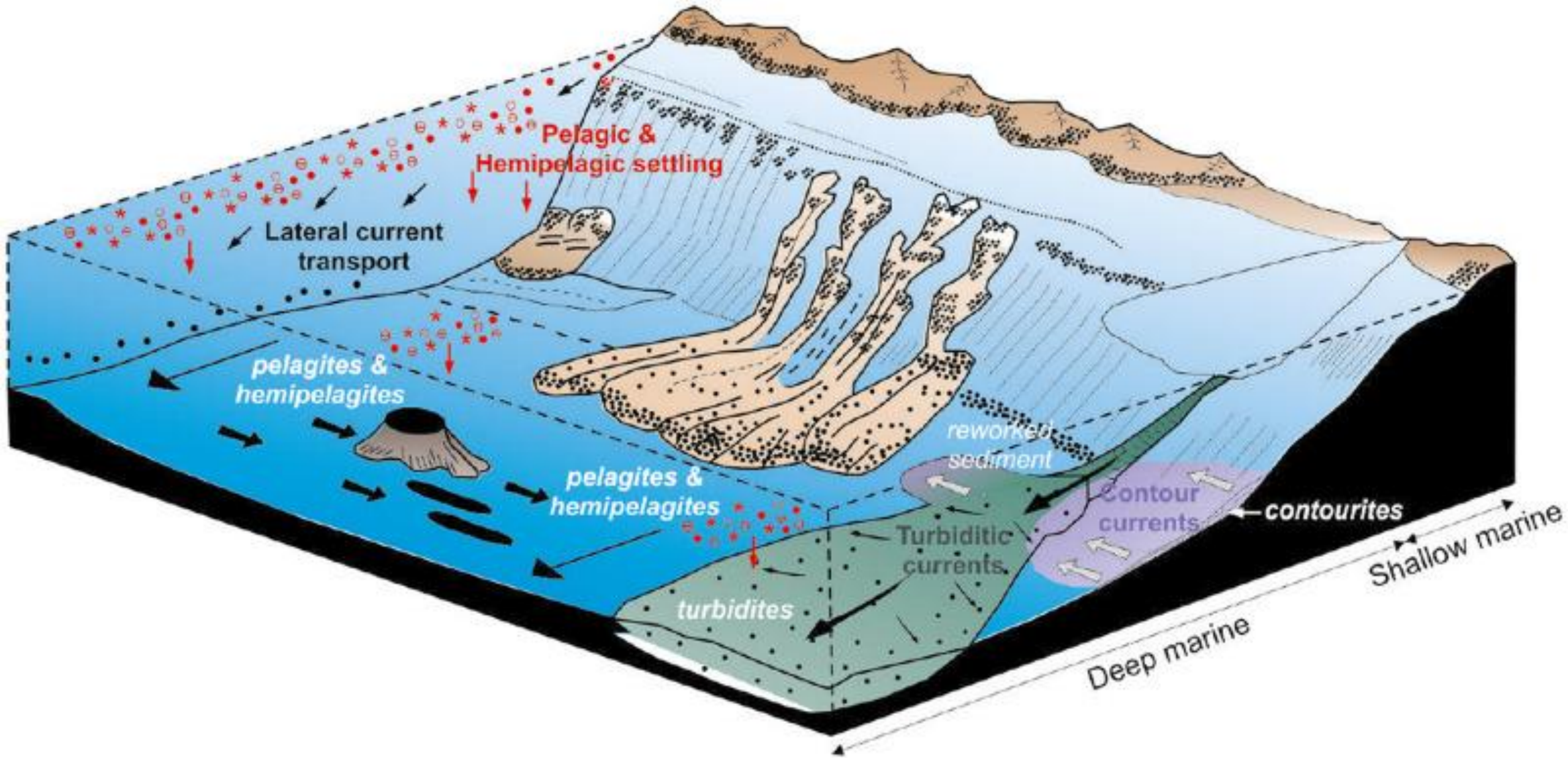
800
900
1000
Neogene
Palaeogene
Cretaceous
Jurassic
Triassic
Permian
Carboniferous
Devonian
Silurian
Ordovician
Cambrian
Ediacaran
Cryogenian
Tonian
Ceno-zoic
Mesozoic
Palaeozoic
Neoproterozoic

Laurentia, Avalonia, and the Iapetus Ocean | *Cambrian – Deep Marine*

GY4051

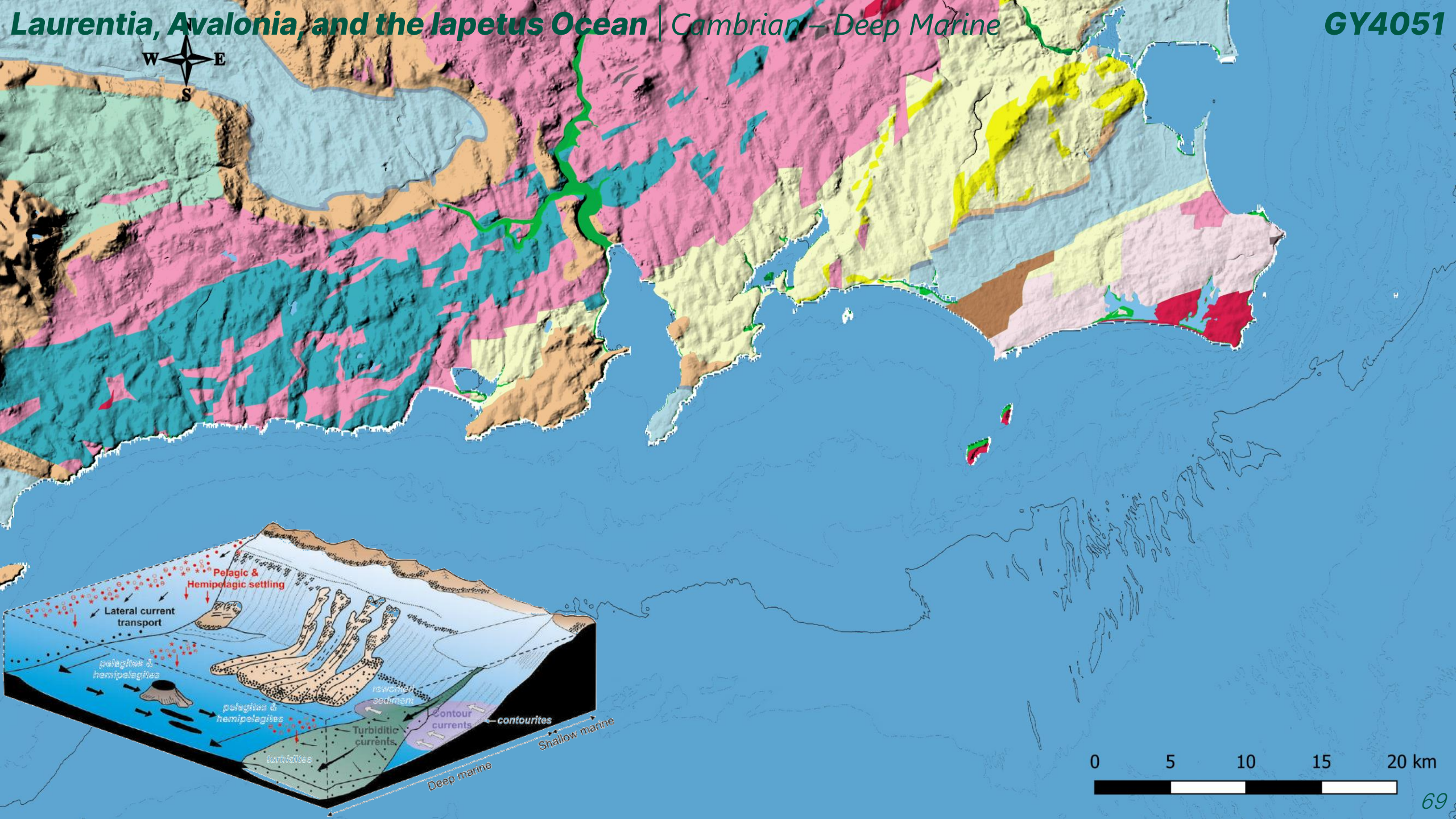



Turbidity currents
Established baseline
(either normal of straight)
2500 m isobath + 100 M
350 M
200 M
60 M
dry land
continental shelf
slope
continental rise
abyssal
plain
submarine ridge
continental crust
foot of slope
(max. change of gradient)
sediment
1% sediment thickness
Outer limit of CS
Fixed points (lat, long)
ocean crust

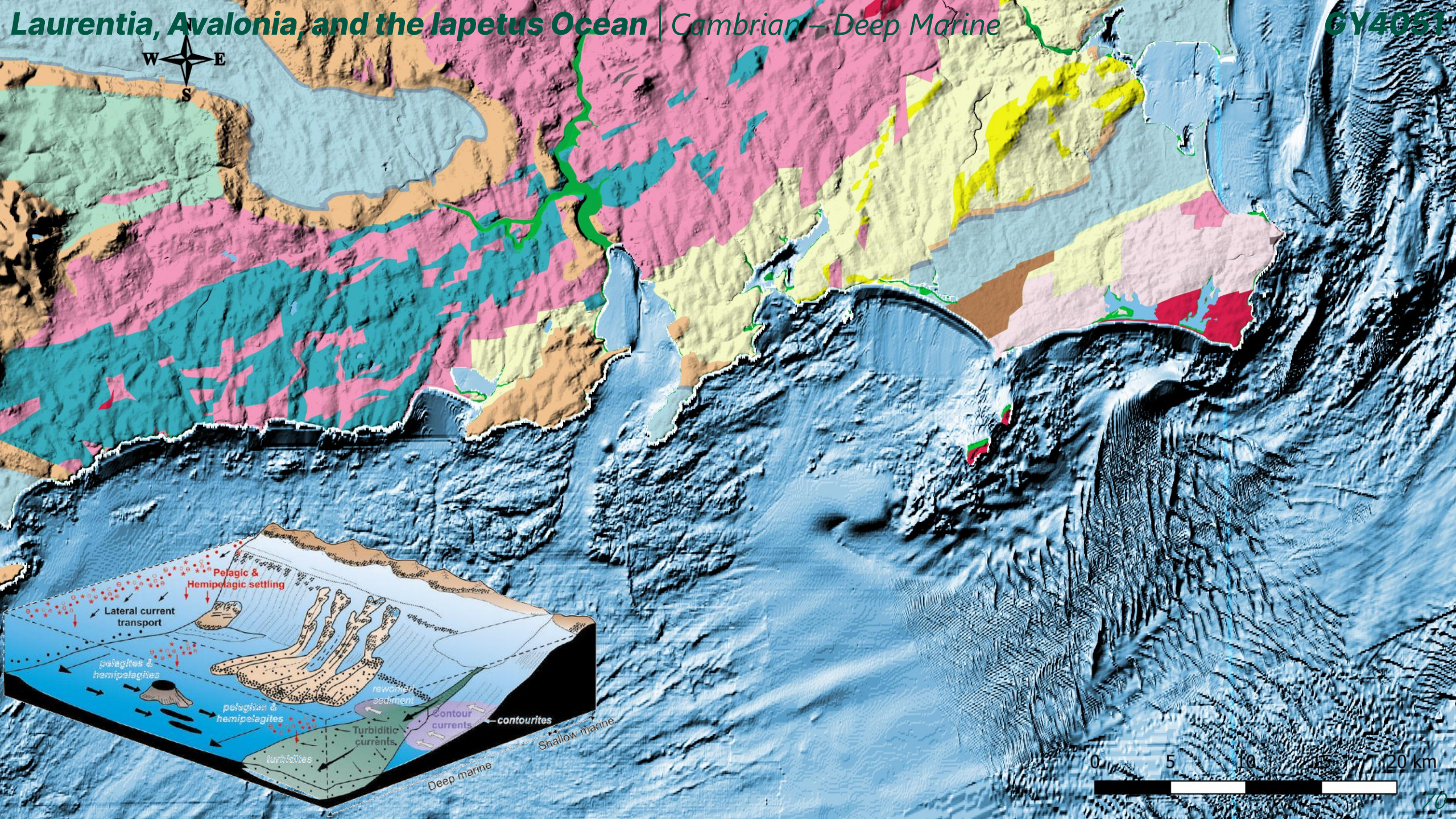

Pelagic &
Hemipelagic settling
Lateral current
transport
pelagites &
hemipelagites
pelagites &
hemipelagites
reworked
sediment
Contour
currents
contourites
Turbiditic
currents
turbidites
Shallow marine
Deep marine

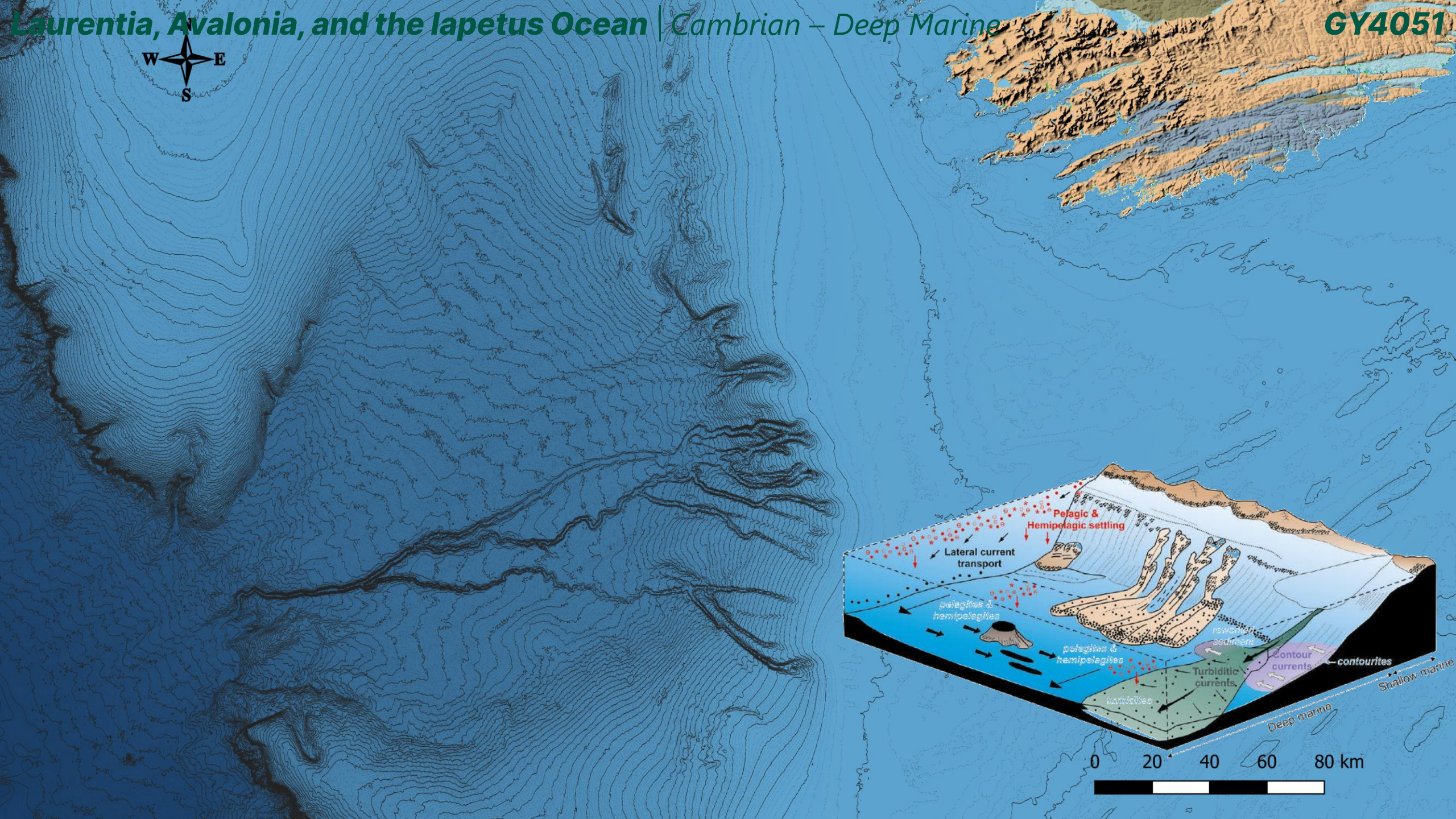
Laurentia, Avalonia, and the Iapetus Ocean | *Cambrian – Deep Marine*

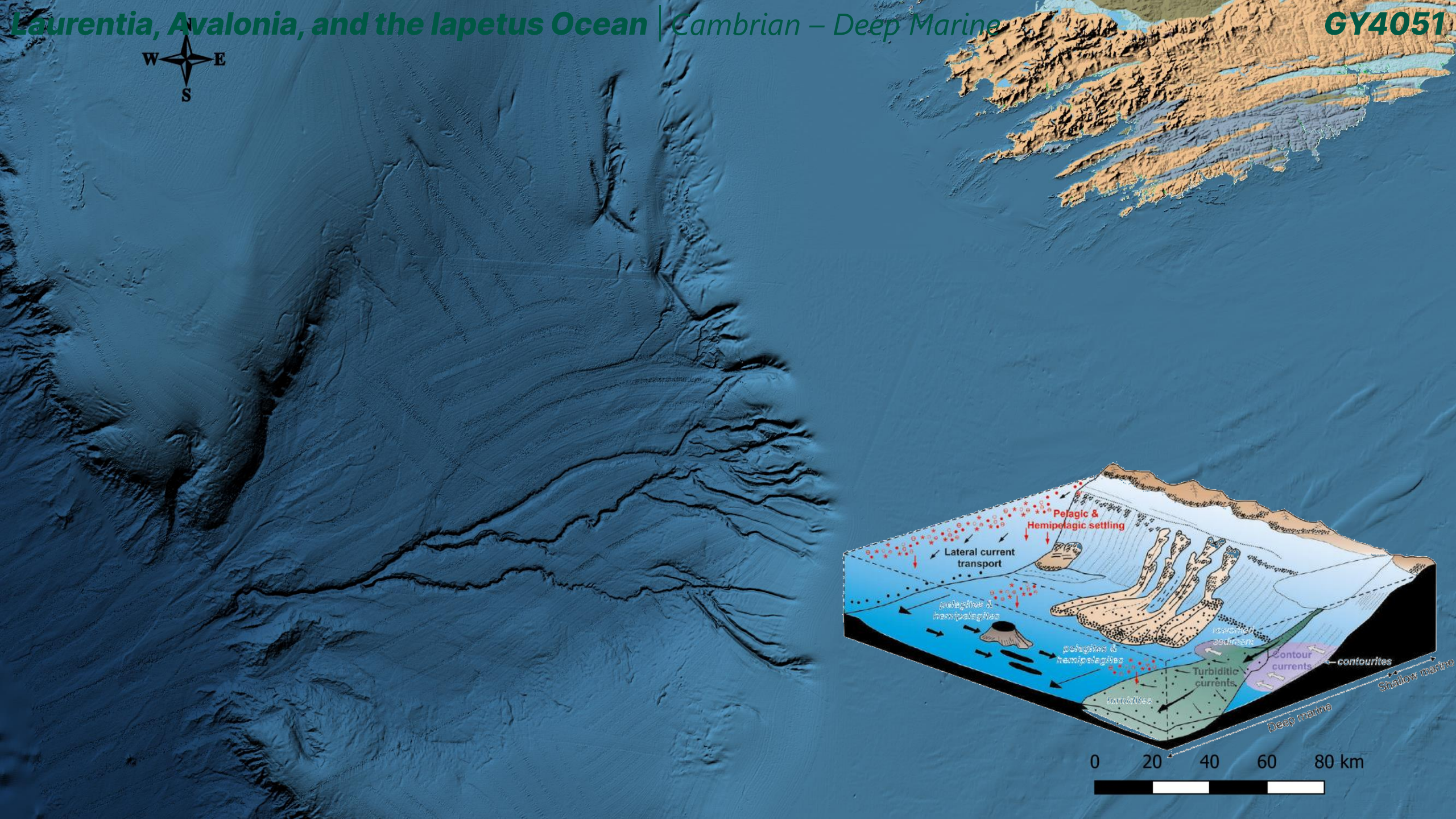
GY4051



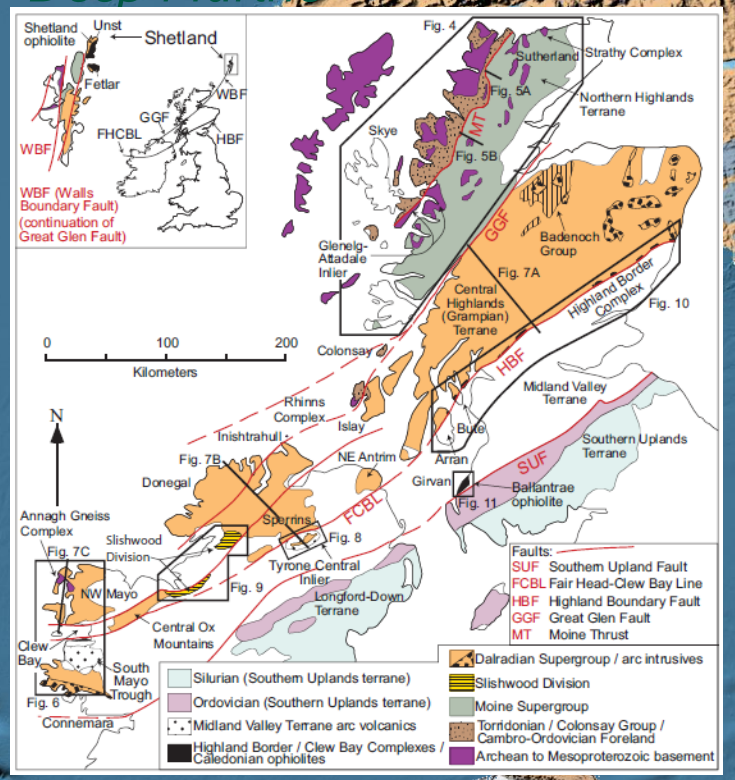
Laurentia, Avalonia, and the Iapetus Ocean | *Cambrian – Deep Marine*

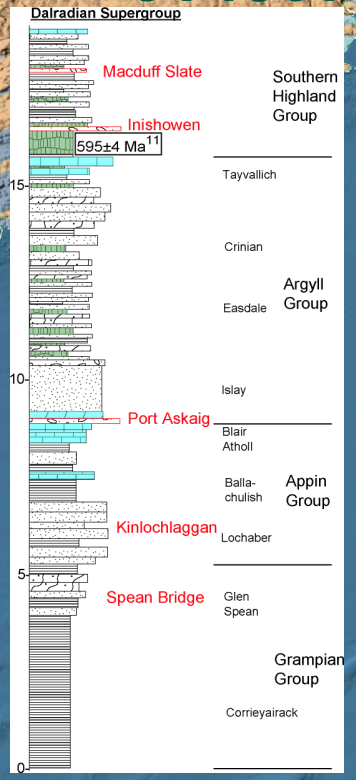


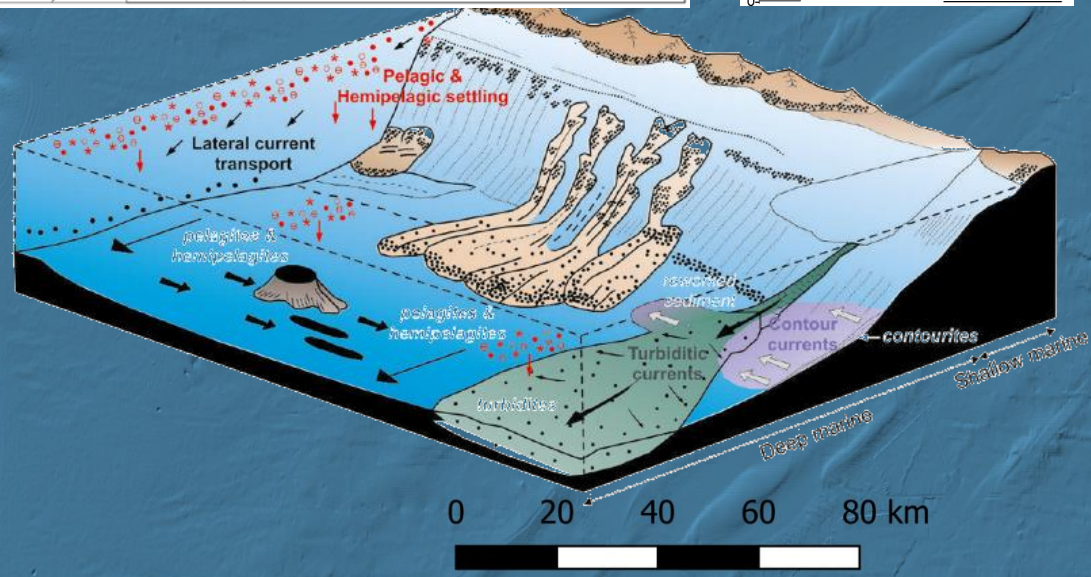

W
E
S
Pelagic &
Hemipelagic settling
Lateral current
transport
pelagites &
hemipelagites
pelagites &
hemipelagites
reworked
sediment
Contour
currents
contourites
Turbiditic
currents
turbidites
Shallow marine
Deep marine
0
20
40
60
80 km


W
E
S
Pelagic &
Hemipelagic settling
Lateral current
transport
pelagites &
hemipelagites
pelagites &
hemipelagites
Turbiditic
currents
Contour
currents
contourites
Shallow marine
Deep marine
0
20
40
60
80 km

Laurentia, Avalonia, and the Iapetus Ocean | Cambrian – Deep Marine

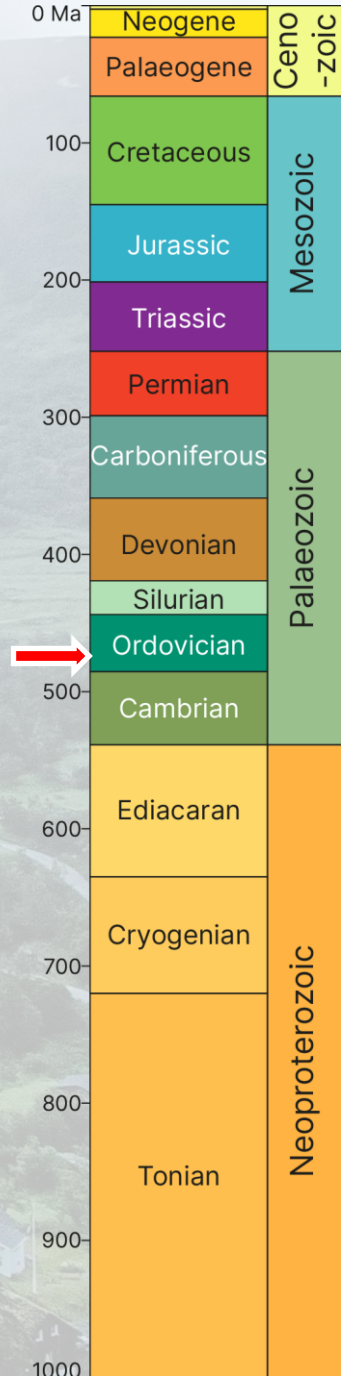






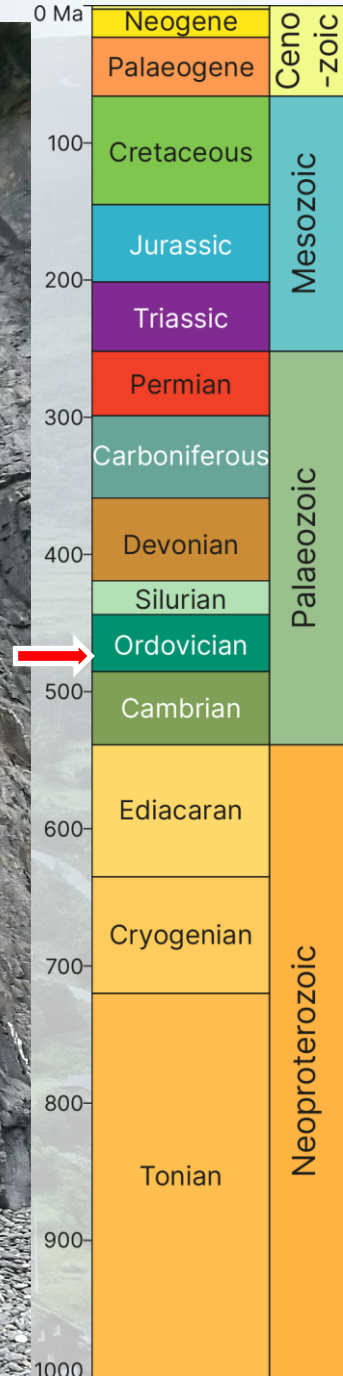
Laurentia, Avalonia, and the Iapetus Ocean | *Ordovician – Subduction volcanism*

GY4051



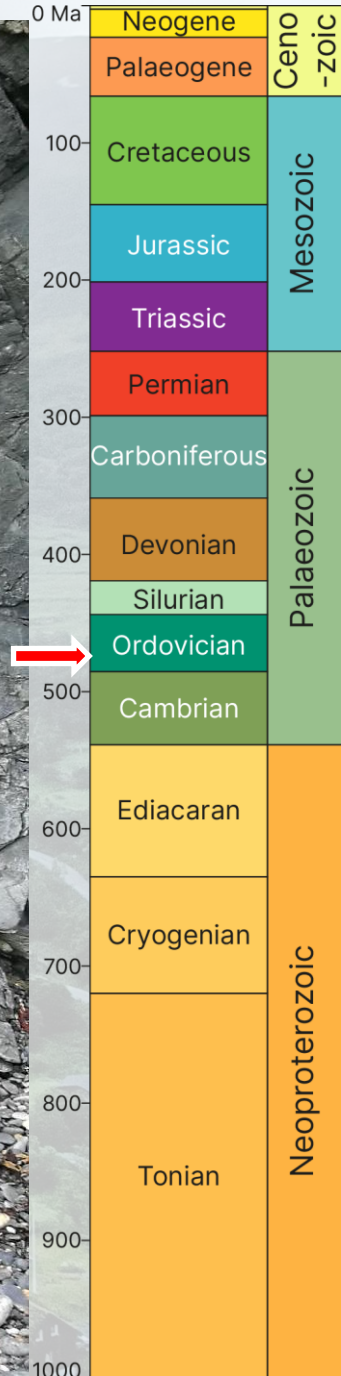
Laurentia, Avalonia, and the Iapetus Ocean | *Ordovician – Subduction volcanism*

GY4051



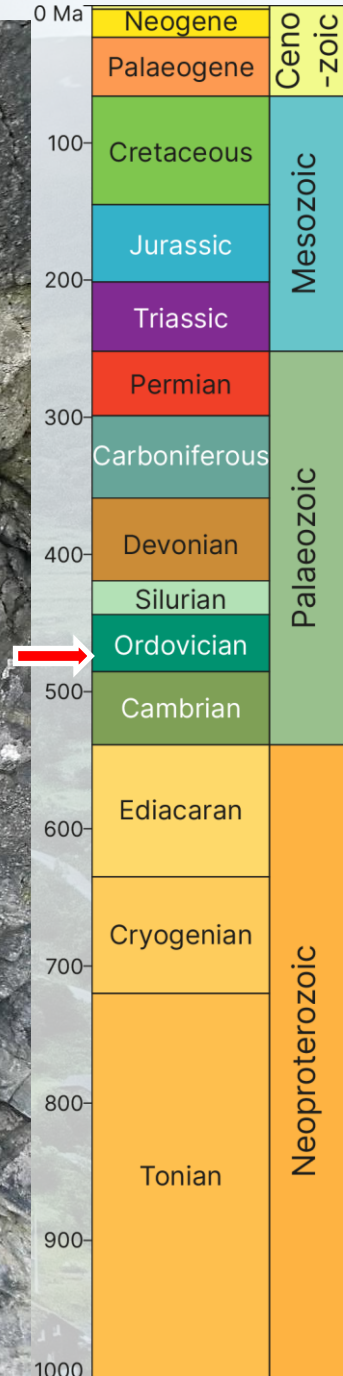
Laurentia, Avalonia, and the Iapetus Ocean | *Ordovician – Subduction volcanism*

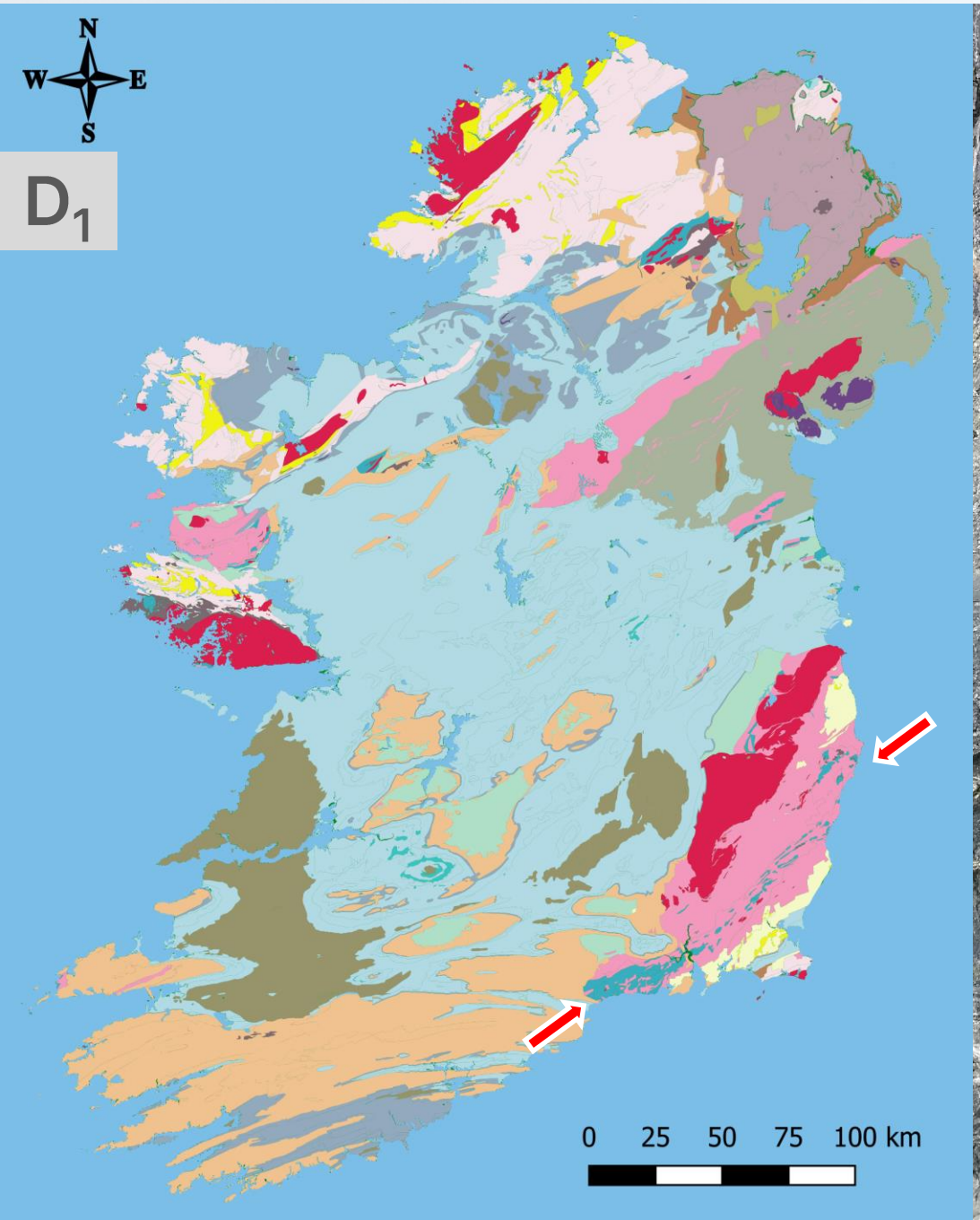
GY4051



Laurentia, Avalonia, and the Iapetus Ocean | *Ordovician – Subduction volcanism*

GY4051

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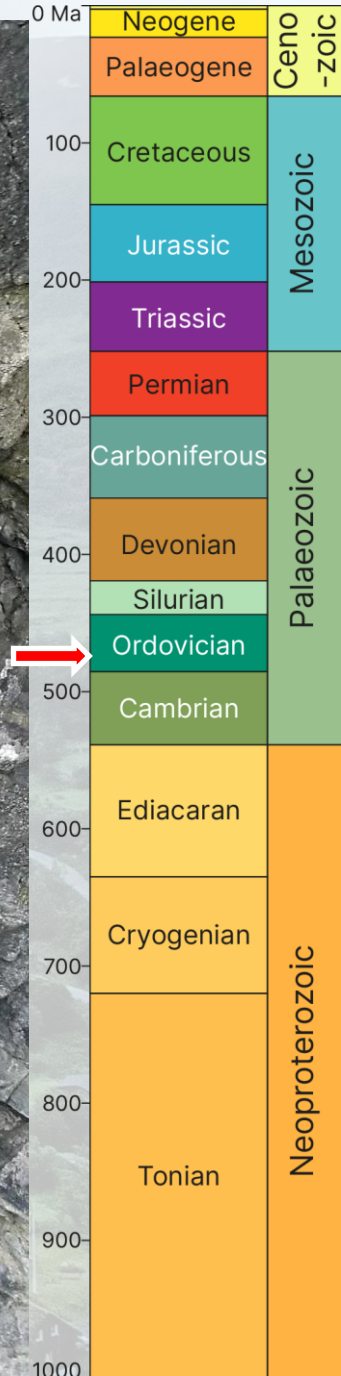
0 Ma
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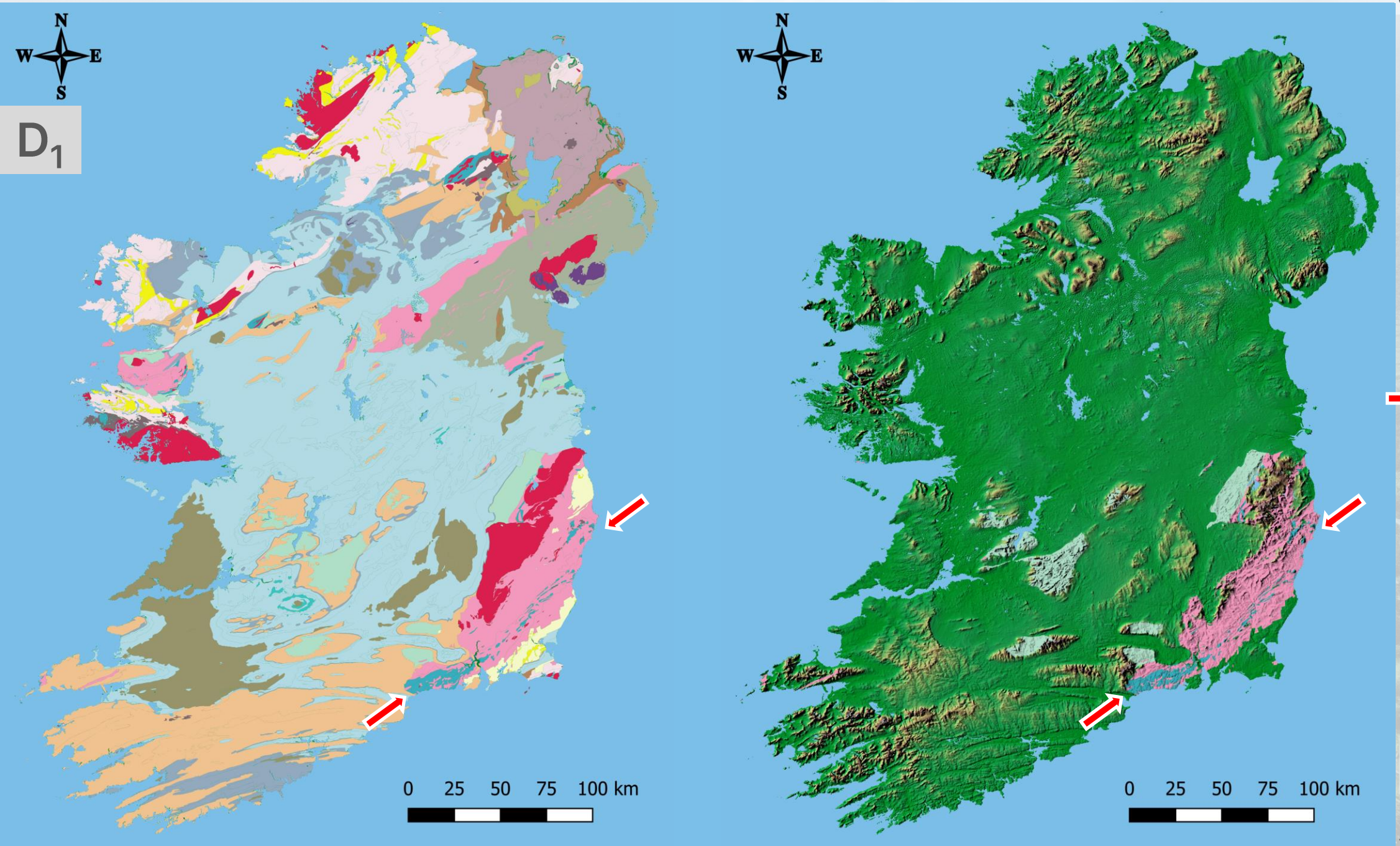
Neogene
Palaeogene
Cretaceous
Jurassic
Triassic
Permian
Carboniferous
Devonian
Silurian
Ordovician
Cambrian
Ediacaran
Cryogenian
Tonian
Ceno-zoic
Mesozoic
Palaeozoic
Neoproterozoic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N
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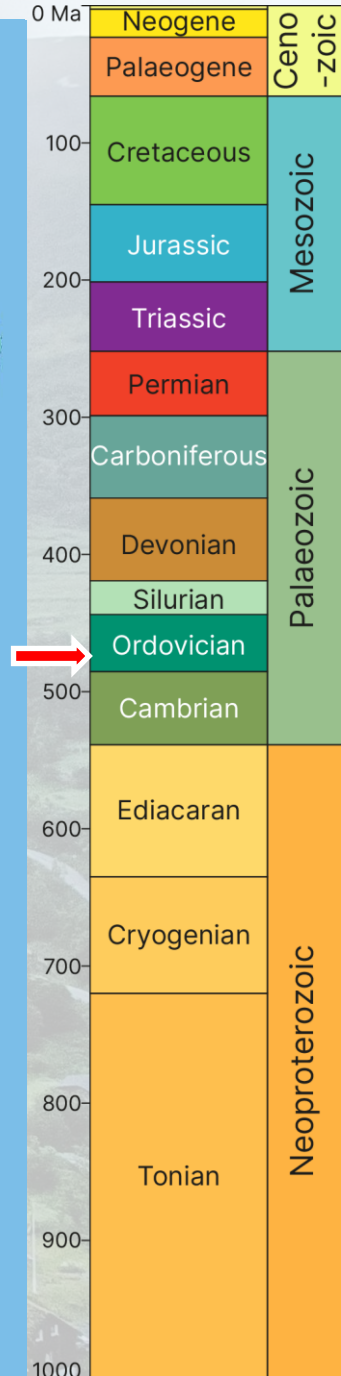
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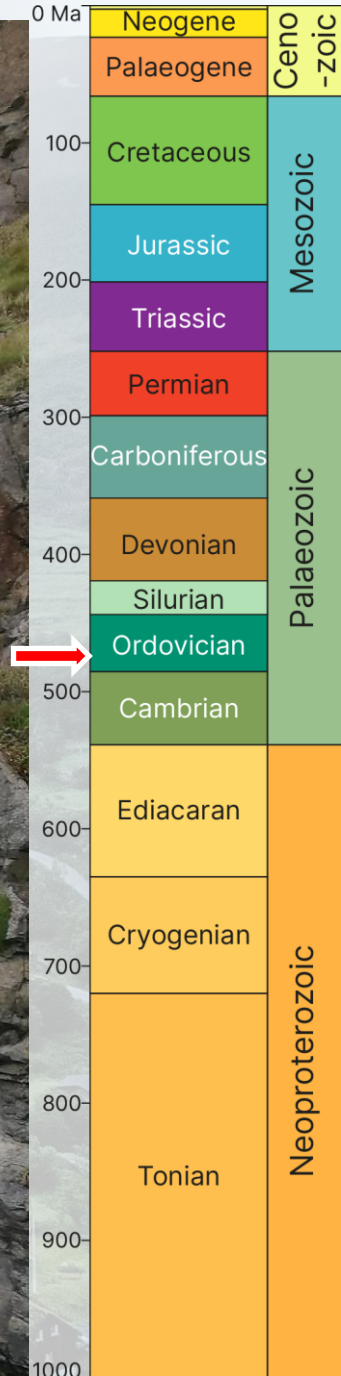
Neogene
Palaeogene
Cretaceous
Jurassic
Triassic
Permian
Carboniferous
Devonian
Silurian
Ordovician
Cambrian
Ediacaran
Cryogenian
Tonian
Ceno-zoic
Mesozoic
Palaeozoic
Neoproterozoic

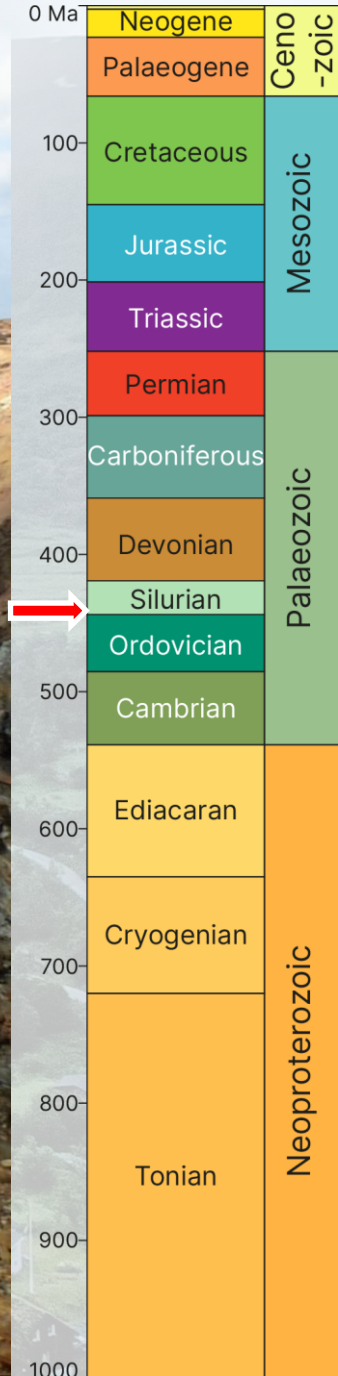
Laurentia, Avalonia, and the Iapetus Ocean | *Ordovician – Subduction volcanism*

GY4051



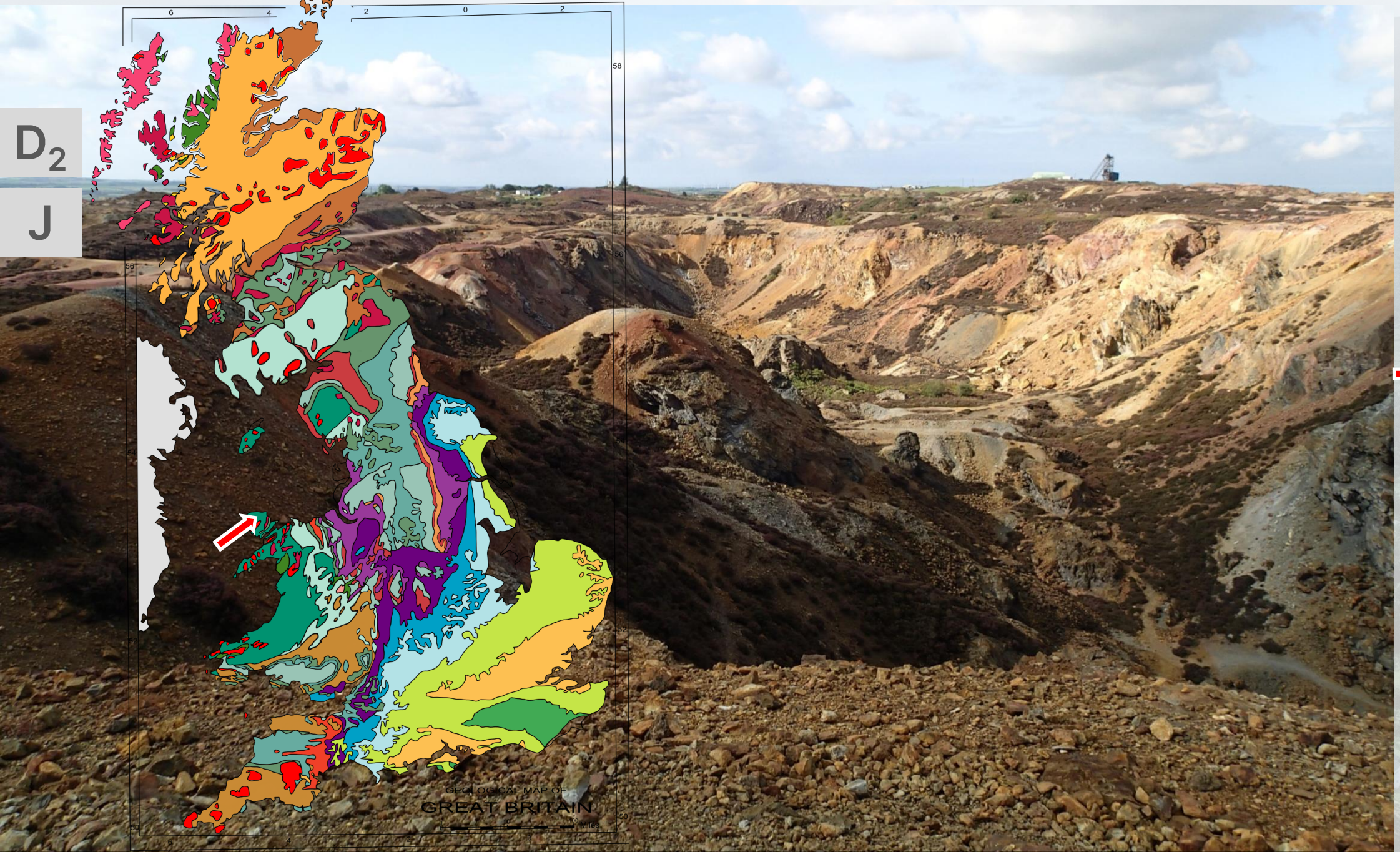
Laurentia, Avalonia, and the Iapetus Ocean | *Ordovician – Subduction volcanism*

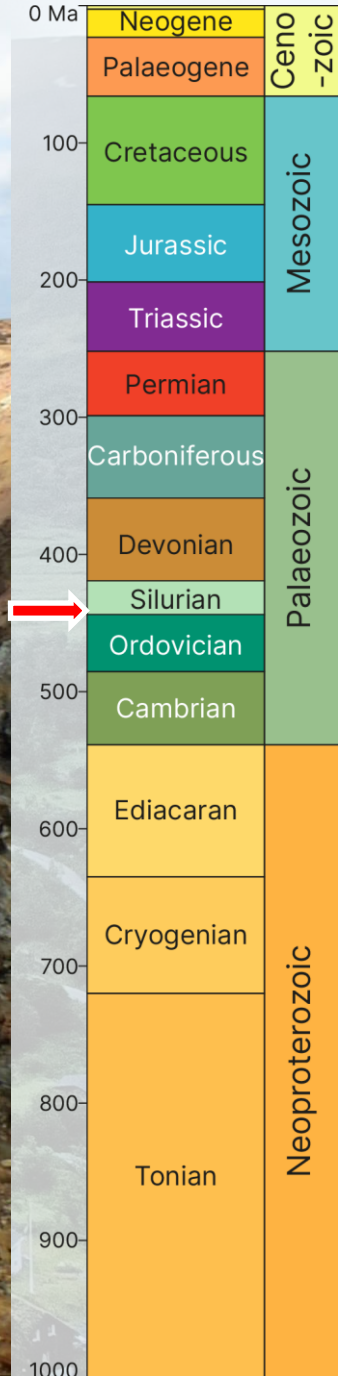
GY4051



Laurentia, Avalonia and the Iapetus Ocean | *Ordovician – Subduction volcanism*

GY4051





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Cretaceous
Jurassic
Triassic
Permian
Carboniferous
Devonian
Silurian
Ordovician
Cambrian
Ediacaran
Cryogenian
Tonian
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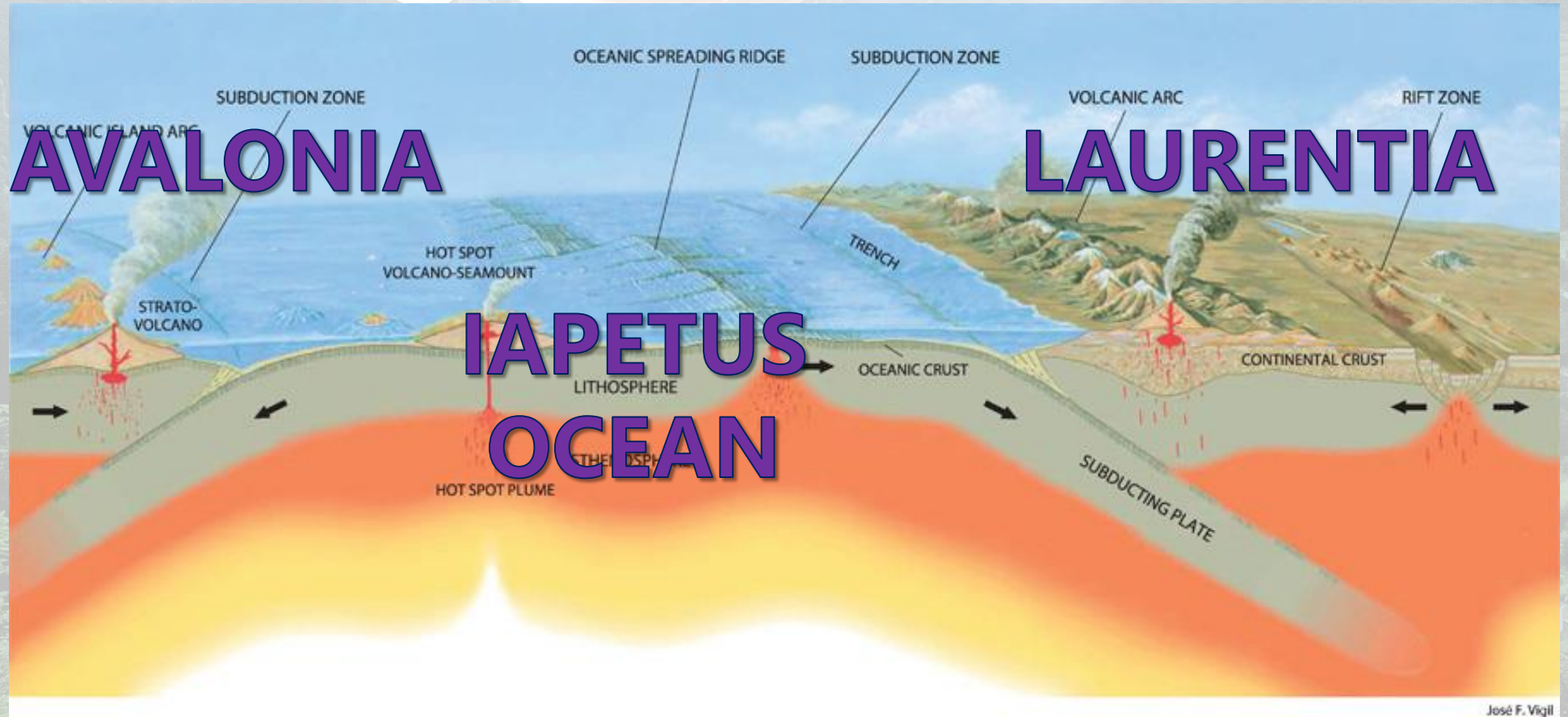
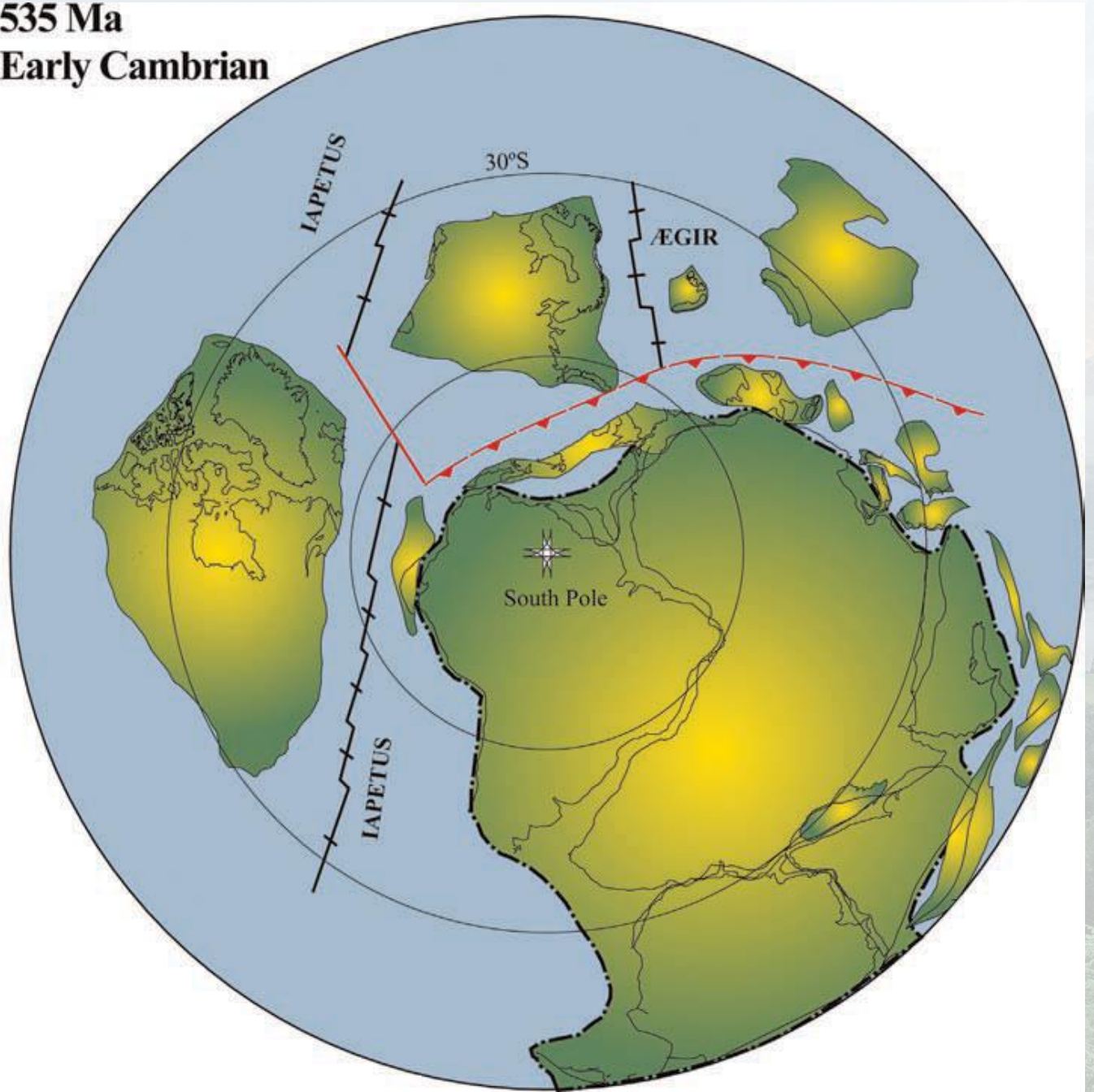
Mesozoic
Palaeozoic
Neoproterozoic

Laurentia, Avalonia and the Iapetus Ocean | *Ordovician in Wales*

GY4051

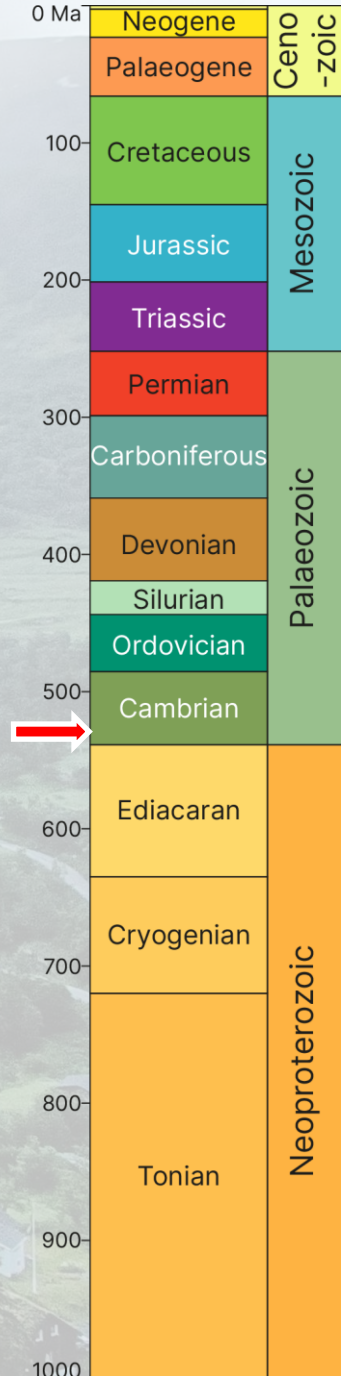

AVALONIA
LAURENTIA
IAPETUS OCEAN
SUBDUCTION ZONE
OCEANIC SPREADING RIDGE
SUBDUCTION ZONE
VOLCANIC ARC
RIFT ZONE
STRATO-VOLCANO
HOT SPOT VOLCANO-SEAMOUNT
TRENCH
LITHOSPHERE
OCEANIC CRUST
CONTINENTAL CRUST
HOT SPOT PLUME
SUBDUCTING PLATE
José F. Vigil

Laurentia, Avalonia, and the Iapetus Ocean | *Early Cambrian*

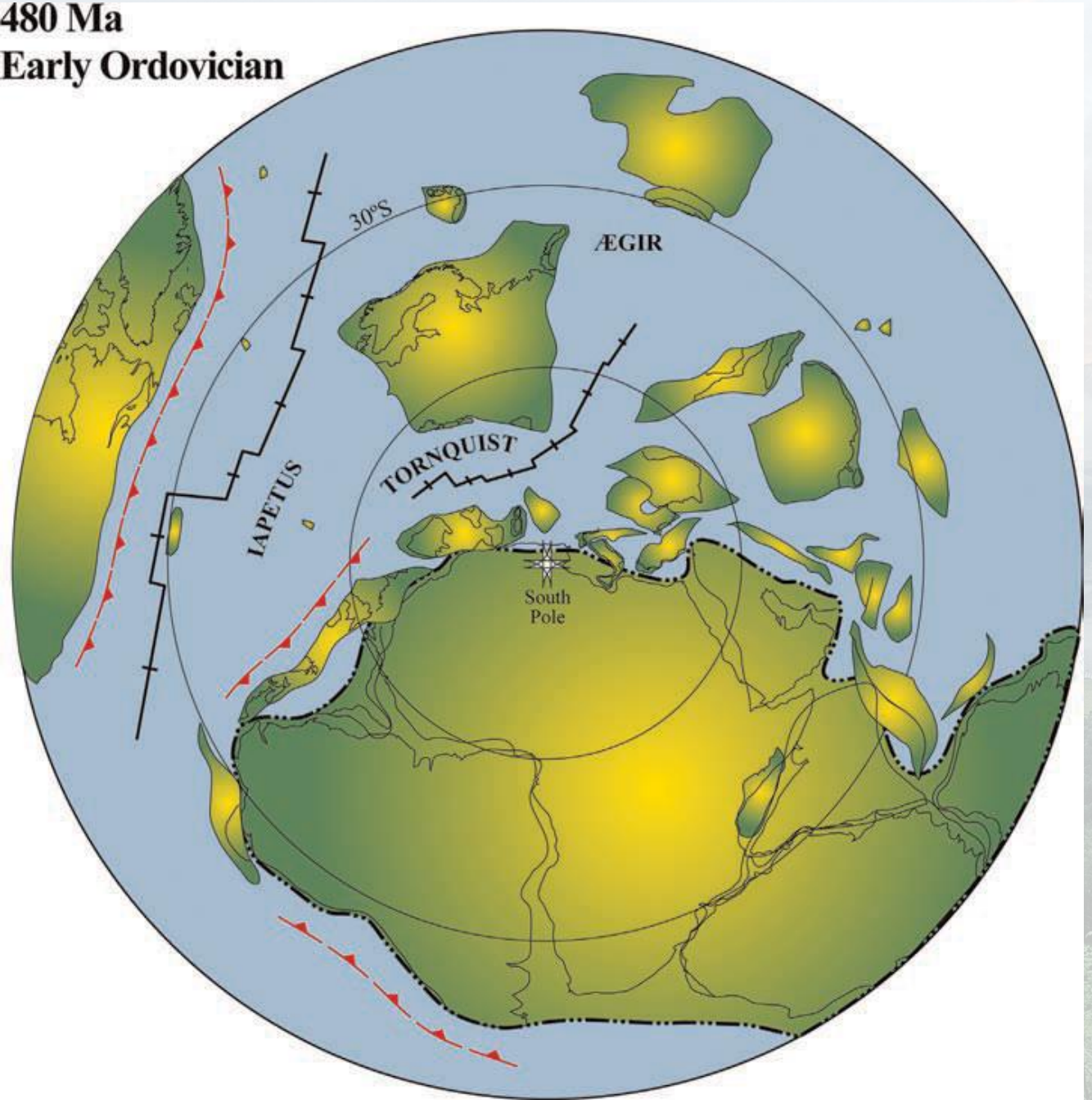


Rifting of Rodinia

- Iapetus Ocean opening
- Northern Britain and Ireland part of Laurentia
- Southern Britain and Ireland still part of Gondwana

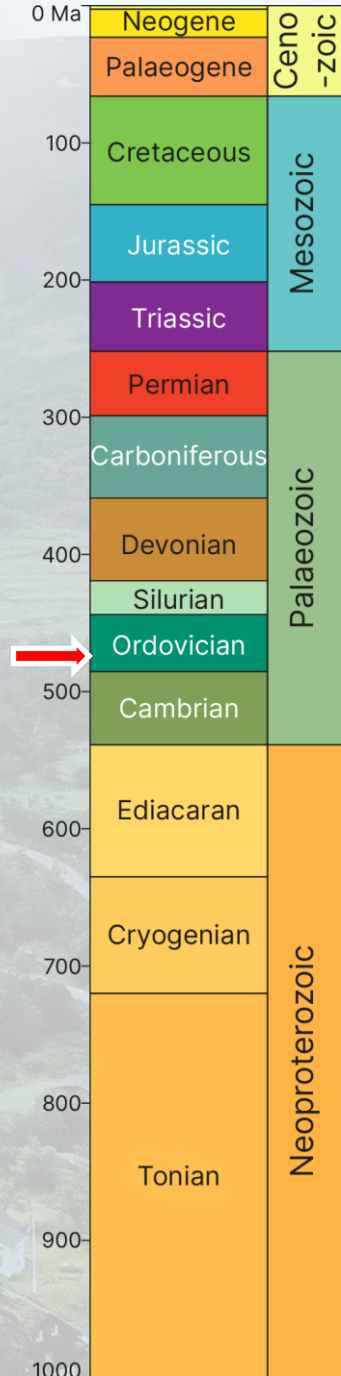


Laurentia, Avalonia, and the Iapetus Ocean | *Early Ordovician*

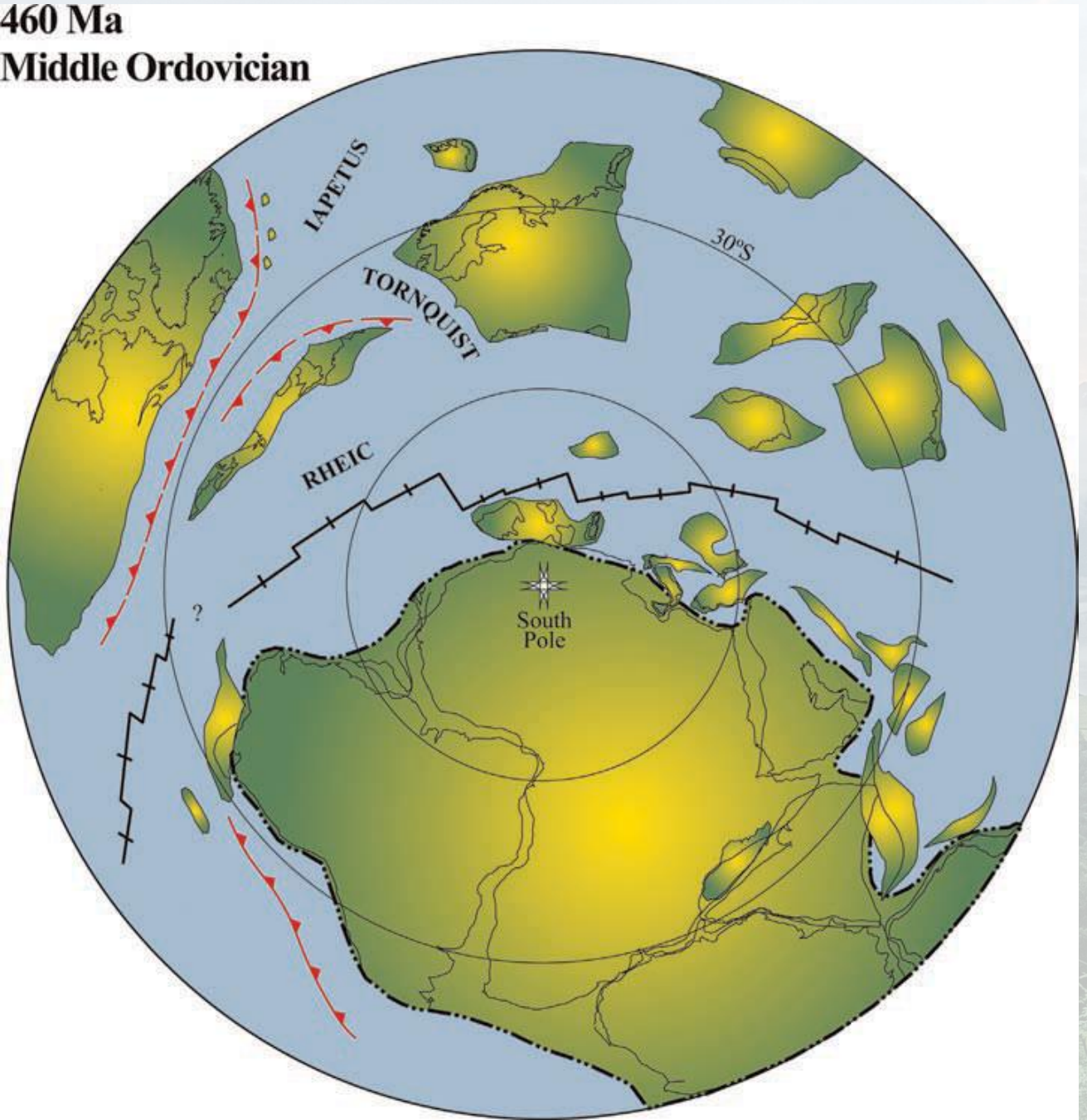


Iapetus Ocean starts to close

- Southern Britain and Ireland starts to rift from Gondwana
- Becomes microcontinent of Avalonia

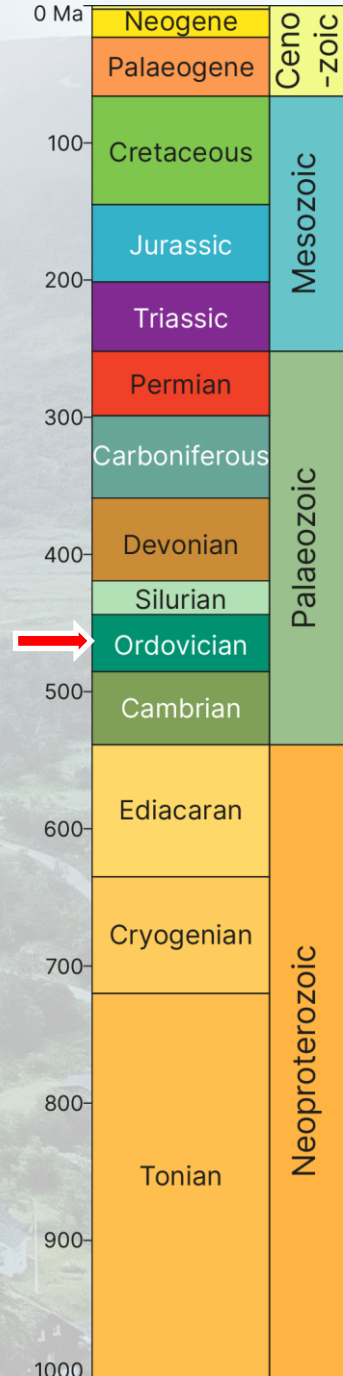


Laurentia, Avalonia, and the Iapetus Ocean | *Middle Ordovician*

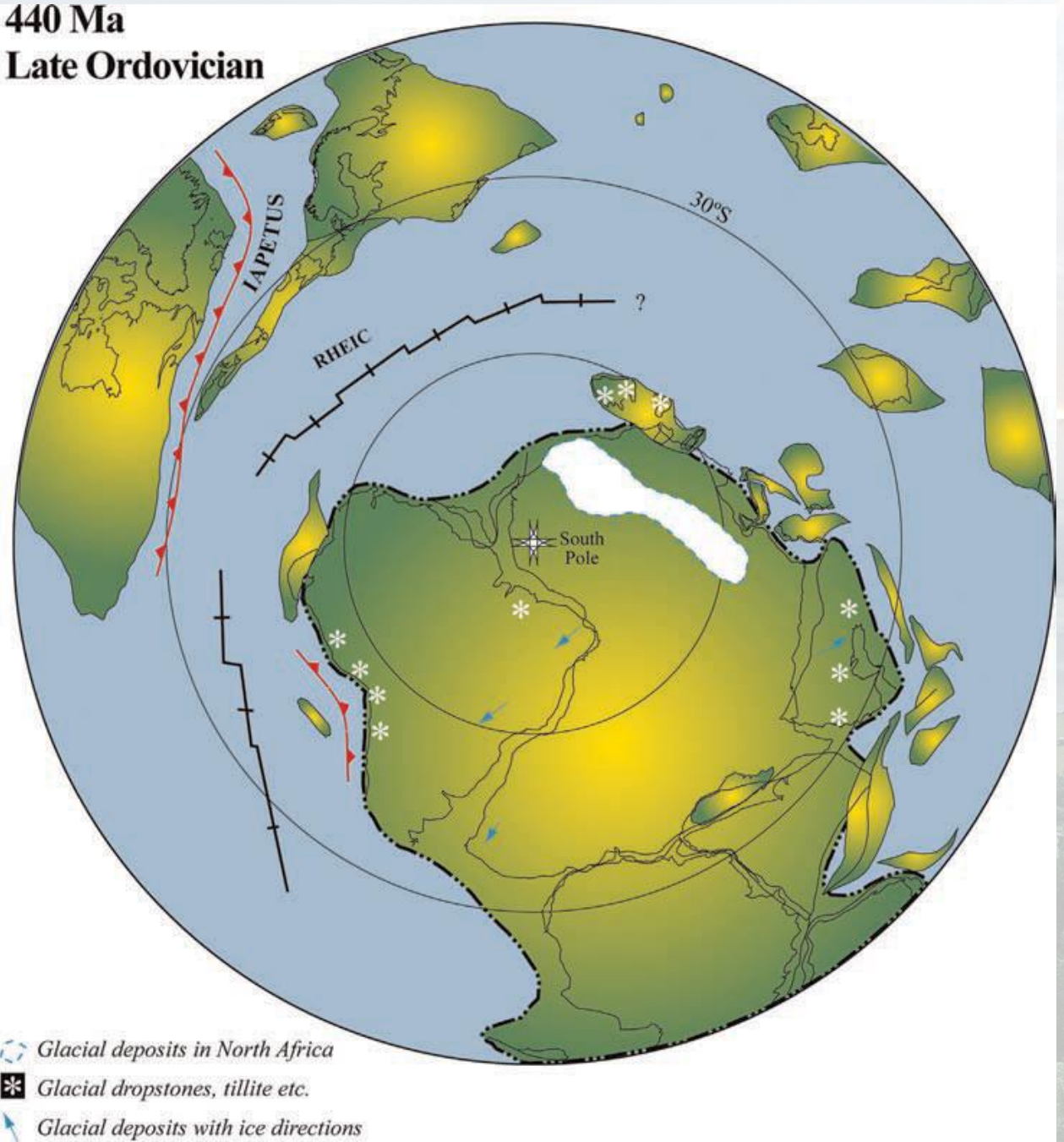


Iapetus Ocean continues to close

- Rheic Ocean opening between Avalonia and Gondwana
- Avalonia moving north towards Laurentia as Iapetus narrows

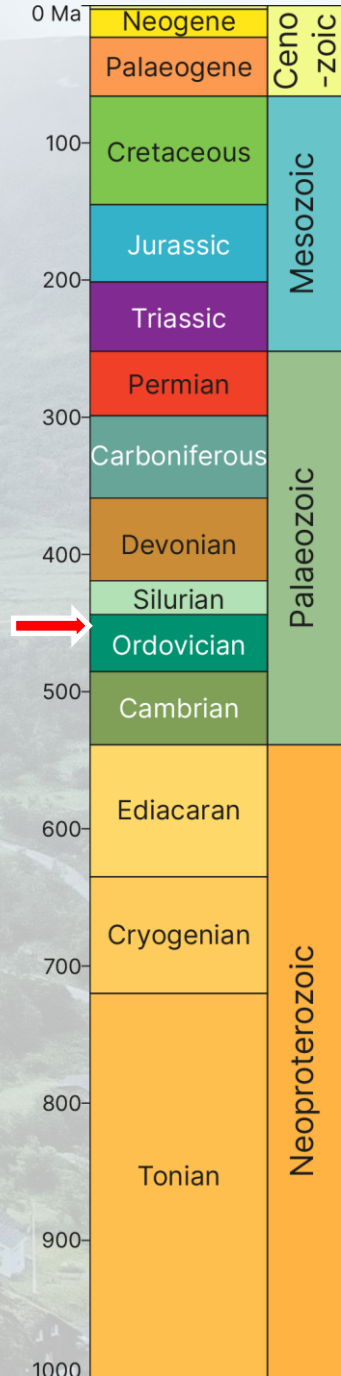


Laurentia, Avalonia, and the Iapetus Ocean | *Late Ordovician*

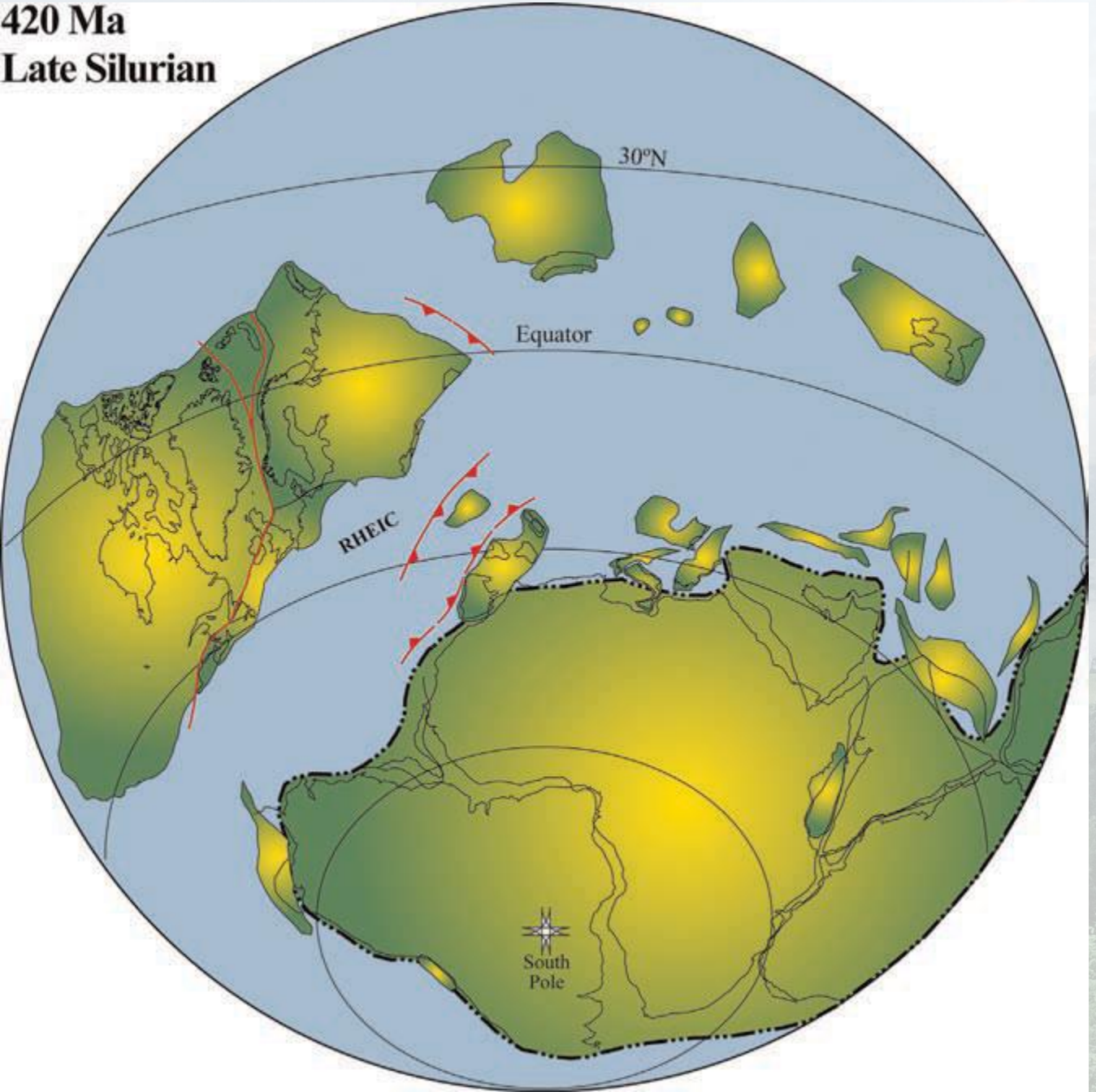


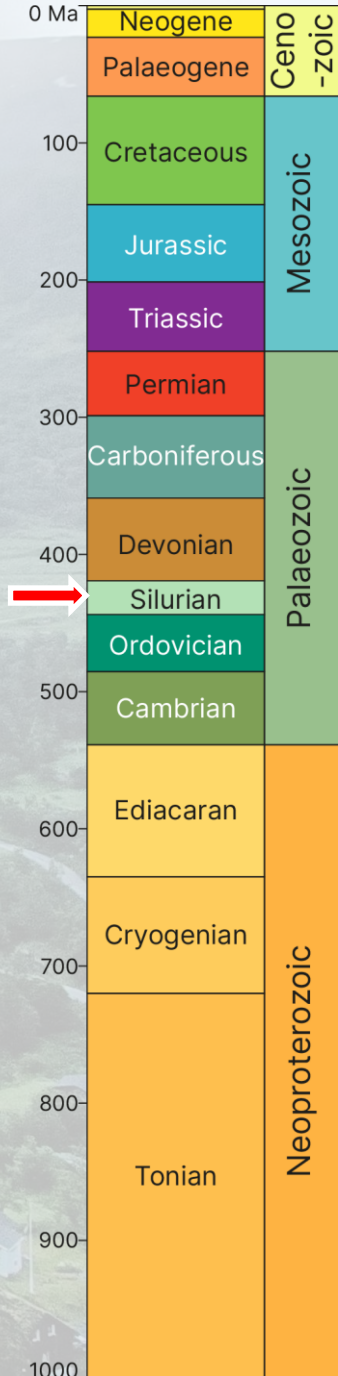
Iapetus Ocean nears the end

- Two halves of Britain and Ireland very close
- Baltica starts to collide with Eastern Avalonia
- Rheic Ocean widening



Laurentia, Avalonia, and the Iapetus Ocean | *Late Silurian*



Iapetus Ocean is gone

- Avalonia has collided with Laurentia and Baltica in the Caledonian Orogeny
- Continent of Laurussia
- Britain and Ireland joined, separated from Gondwana by the Rheic Ocean