Glossary

This glossary provides brief explanations of the technical terms used in the introductions to the chapters and in the 'conclusions' sections of the site reports. These explanations are not rigorous scientific definitions but are intended to help the general reader. Detailed stratigraphical terms are omitted as they are given context within the tables and figures.

Acadian: Used for a major Devonian tectonic episode. Also a stratigraphical term for the Middle Cambrian in eastern North America; broadly, but not exactly, comparable to the 'St David's Series' used in this volume (see (Figure 2.2)).

Accretionary prism: The wedge of sediments accumulating near an ocean trench that has been 'scraped off' the top of a plate being subducted by the overriding plate.

Acritarchs: Microscopic hollow organic-walled fossils, useful for biostratigraphy in marine argillaceous rocks.

Appalachian: Pertaining to the geology of the eastern North American fold-belt along the Appalachian Mountains.

Arc: The chain of volcanoes that forms on the overriding crustal plate parallel to the oceanic trench at a subduction zone, where one plate is subducted beneath another.

Arenig: The second epoch of the Ordovician Period in the British stratigraphical standard. See (Figure 6.2).

Arenaceous: Descriptive of detrital sediments with sand-sized particles.

Argillaceous: Descriptive of detrital sediments with silt to clay-sized particles.

Armorican: A mountain building episode that occurred during the Carboniferous Period. Synonymous with, and largely replaced by, the term Variscan.

Ashgill: The last epoch of the Ordovician Period in the British stratigraphical standard. See (Figure 6.2).

Avalonia: An early Palaeozoic crustal plate consisting of south-east Newfoundland, England, Wales, south-east Ireland and part of western Europe, which collided with Laurentia during the Silurian Period. See (Figure 1.2).

Back-arc basin: A sedimentary basin that is on the *opposite* side of the volcanic arc from the oceanic trench.

Baltica: 'Baltic', an early Palaeozoic crustal plate consisting of much of present day Scandinavia, European Russia and part of central Europe; the plate formed the southeastern continental margin of the Iapetus Ocean and collided with Laurentia to form the Caledonian mountain belt when the oceanic crust was subducted.

Batholith: A large irregular body of igneous rock, commonly granite, emplaced deep in the Earth's crust.

Bathymetry: The measurement of the depth of water.

Benthos (adj. Benthic): Living on or in the sea floor.

Bentonite: A type of clay, derived from the weathering of glassy volcanic ashes.

Biofacies: A fades defined by its characteristic fossil assemblage, and reflecting environmental conditions.

Biostratigraphy: The subdivision and correlation of sedimentary strata based on their fossil content.

Biozone: A thickness of sedimentary rocks characterized by its fossil content, most usefully by species of narrowly defined temporal, but wide spatial, range, and named after one (occasionally two) constituent species.

Bioturbation: Disturbance and 'stirring' of soft sediments by burrowing organisms.

Brachiopod:**(Brachiopoda)**: Marine shellfish that have two unequal but symmetrical shells (valves) held together at a hinge area. Particularly common in the Palaeozoic seas but largely replaced by the molluscs as the dominant shellfish since the beginning of Mesozoic times. See (Figure 10.12).

Branchian: Stratigraphical name for part of the Lower Cambrian of eastern North America. See (Figure 2.2).

Cainozoic: 'Recent life', the division of geological time that succeeds the Mesozoic and is characterized by the radiation of the mammals, flowering plants and insects.

Calcite: (adj. calcitic). The rock-forming mineral, calcium carbonate ($CaCO_3$), the commonest constituent of lime.

Caledonian Orogeny: A major period of mountain building that took place during the early and mid- Palaeozoic Era, associated with the closure of the Iapetus Ocean.

Cambrian: The first geological period of the Palaeozoic Era (and Phanerozoic Eon), named after *Cambria,* the Roman name for Wales where rocks of this age were first categorized. The base is taken below the level of appearance of the first abundant fossils with hard shells and the period ranges from about 540 to 490 million years ago.

Caradoc: The fourth epoch of the Ordovician Period in the British stratigraphical standard. See (Figure 6.2).

Cephalopod (Cephalopoda): A class of marine mollusc, usually with a chambered shell, that includes the extinct ammonites, belemnites, and the living squid, cuttlefish, octopus and *Nautilus.*

Cheirurid: An Ordovician to Devonian group of trilobites, generally with a spinose tailpiece, that characteristically lived in shallow, clear seas.

Chitinozoa: An enigmatic group of extinct marine, organic-walled microfossils consisting of small flask-like vesicles less than 1 mm long.

Chronostratigraphy: The correlation and subdivision of geological intervals of time, intended to provide an international terminology independent of the types of rocks (if any) deposited during those intervals.

Clast: A rock, shell or mineral fragment derived by erosion of pre-existing rocks. Most commonly used for coarser particles (>2mm)

Clastic: Descriptive of fragmental sediment composed mainly of particles derived from pre-existing rocks or minerals, including organic remains (designated as *bioclastic*) .

Cleavage: Incipient parting in a rock, produced by the alignment of platy crystals such as mica in response to confining pressure during deformation.

Coeval: Of the same age or time.

Conglomerate: A coarse-grained sedimentary rock containing well-rounded clasts.

Conodont (Conodonta): 'Cone teeth', an extinct group of small eel-like marine animals, characterized by assemblages of paired tooth-like structures made of bone-like material. These 'teeth' have considerable use in biostratigraphy.

Craton:**(adj. cratonic)**: The central part of a continental plate, usually with a relatively long history of stability because of its distance from active crustal plate boundaries.

Cross-lamination/stratification: Sedimentary laminae or strata that were deposited at an angle to the horizontal, as a result of current flow.

Cystoid: A type of echinoderm with a globose body constructed of plates and with free arms (the latter are commonly not preserved). See (Figure 8.23).

Dalradian: A large tract of (mainly) late Precambrian metamorphosed sedimentary rocks in the Grampian Highlands of Scotland and the north of Ireland.

Dasycladacean algae: A type of green alga, with filaments emanating from a central axis. Often encrusted with calcium carbonate, leading to their preservation as fossils.

Décollement: The dislocation surface, commonly in soft strata, upon which rocks have slid and become folded or faulted, leaving the rocks below the surface relatively unde-formed.

Detritus (adj. detrital): Eroded fragments of pre-existing rock and mineral matter.

Devonian: The first period of the Late Palaeozoic sub-Era, ranging from 395 to 345 million years ago.

Diachronous: 'Through time' — descriptive of a body of rock that forms a continuous outcrop, but which was in fact deposited in different places at different times, e.g. as a result of a marine transgression.

Disconformity (adj. disconformable): A break in continuity of deposition, during which either no sediment was deposited or the sediment that has been deposited was subsequently eroded before the succession of strata continues — but without angular discordance.

Distal: Far from the source.

Downthrown: The side of a fault which, relatively, has been displaced downwards.

Dyke: A sheet-like body of igneous rock that cuts across the bedding of the rock that it intrudes, often steeply inclined.

Echinoderms: Marine invertebrates commonly characterized by a five-fold symmetry and possessing a calcite skeleton. Includes echi-noids (sea urchins), crinoids (sea lilies), cystoids and asteroids (starfish). See (Figure 14.14).

Era: A large unit of geological time composed of several periods. The Phanerozoic Eon is divided into the Palaeozoic, Mesozoic and Cainozoic eras, and their constituent periods are recognized on the basis of their characteristic contents of invertebrate, vertebrate and plant fossils

Euconodonts: The typical or main class of Conodonts.

Eustatic: Concerning world-wide changes in sea level (as distinct from changes when land locally sinks into or rises from the sea). Eustatic changes of sea level may be caused by ice-ages or may reflect periods of major tectonic activity.

Facies: The characteristic features of a rock unit, including rock type, mineralogy, fossils, texture and structure, which together reflect a particular sedimentary, igneous or metamorphic environment and/or process.

Feldspar: A group of very common aluminium silicate rock-forming minerals.

Feldspathic: Containing feldspar.

Foreland basin: A sedimentary basin developed by depression of a continental margin due to the weight of sediment accumulating in front of an orogenic belt.

GCR: Geological Conservation Review, in which nationally important geological and geomor-phological sites were assessed and selected with a view to their long-term conservation as SSSIs.

Geochronology: The measurement of absolute geological time and its division into episodes, in years, or millions of years (Ma), before the present time.

Gondwana (Gondwanaland): A grouping of the major southern continental plates of Africa, Australasia, Antarctica, South America, India, several smaller plates and fragments of what are now parts of Mediterranean Europe, which together formed a massive southern supercontinent in Palaeozoic times.

Graben: A linear block of crust downthrown between two parallel faults to produce a rift or trough.

Graptolite: An extinct group of marine colonial planktonic animals, widely used in biostratigraphy. See (Figure 15.7)

Greywacke: A type of arenaceous rock made up of poorly sorted, commonly angular, material whose constituent grains are set in a matrix of fine, muddy material.

Horse: A displaced mass of rock caught between two faults.

Horst: An upfaulted block of crustal rocks, often on either side of a graben.

Hyolithid: An extinct group of mollusc-like animals with a conoidal shell, a single aperture covered by a lid and, in some at least, a pair of curved appendages. See (Figure 8.4).

Iapetus Ocean: A former ocean, which separated the Early Palaeozoic crustal plates of Laurentia and Baltica plus Avalonia until the ocean floor was subducted in Ordovician–Silurian times during the Caledonian Orogeny. It divided the present British Isles and its trace is situated between what is now Scotland and the northern part of Ireland, and the rest of Britain. See (Figure 1.2).

Illaenid: An Ordovician to Silurian group of trilobites, with a smoothed-out and featureless crust, which characteristically lived in clear, shallow seas.

Imbricate: Overlapping (like roof tiles). In conglomerates, descriptive of the internal structure of the rock where the long axes of pebbles lie roughly parallel to each other but at an angle to the bedding. Also descriptive of rock units tectonically thrust into roughly parallel overlapping slices.

Inlier: An area of rock that is completely surrounded by younger rocks.

Intercalations: Layers of rock of one type alternating with other, thicker, layers of a different type.

Isograptid: A group of early Ordovician graptolites that favoured deeper levels in the ocean and characterize a deep-water biofacies.

Lamprophyre: A type of igneous rock, usually forming minor intrusions.

Laurentia: After 'St Lawrence'; the major North American crustal plate in early Palaeozoic times, prior to the subduction of the Iapetus Ocean; comprised mainly of the ancient Precambrian core of the Canadian Shield and Greenland plus Scotland and north-west Ireland.

Lithology: A term encompassing the constitution of rocks, especially the size, shape and the mineral composition of constituent crystals or clasts in the rock.

Lithofacies: A facies, defined by its constituent rock type (s).

Lithostratigraphy: The description, subdivision and correlation of rocks in terms of their rock-type features, rather than fossil content or precise time-equivalence.

Llandeilo: In earlier classifications of the Ordovician Period in Britain this was the fourth epoch, but in this work it is subsumed within the Llanvirn.

Llandovery: The first epoch of the Silurian Period.

Llanvirn: The third epoch of the Ordovician Period in the British stratigraphical standard. See (Figure 6.2).

Matrix: Mechanically introduced (rather than chemically precipitated) material between grains or clasts in a sedimentary rock.

Megasequence: A major body of sedimentary rocks, bounded above and below by major unconformities. Built up of a number of sequences.

Menevian: A formation in the Middle Cambrian of South Wales, formerly used as a stage of the Cambrian Period. See (Figure 4.1).

Mesozoic: 'Middle life', the middle division of geological time with abundant life, after the Palaeozoic, before the Cainozoic and containing the Triassic, Jurassic and Cretaceous periods.

Metabentonite: Metamorphosed bentonite.

Metamorphism (adj. metamorphic): Alteration of igneous and sedimentary rocks by increases in pressure and/or temperature within the Earth's crust.

Moine: A major lithostratigraphical division of Precambrian metamorphic rocks in northern Scotland.

Molluscs (Mollusca): Invertebrates with a fleshy soft body and, usually, a hard shell. May be marine, freshwater or terrestrial. Includes gastropods (snails, limpets) bivalves (oysters, mussels) and cephalopods. Contrasted with brachiopods.

Monian: Name for rocks of the Mona Complex in Anglesey, which may be partly Cambrian in age, although they were formerly recognized as wholly Precambrian.

Moridunian: The earliest stage of the Arenig Series. See (Figure 6.2).

Nekton (adj. nektonic): 'swimming', those organisms that actively swim rather than float (Plankton) in the water column.

Neritic: Relating to the sub-littoral zone, between the continental shelf and low water mark.

Olenid: A type of Cambrian to Ordovician trilobite that could live in poorly oxygenated water; it characterizes a particular biofacies.

Olistostrome: A sedimentary deposit consisting of a chaotic mass of intimately mixed heterogeneous materials, commonly including very large blocks, and formed by submarine slumping of unconsolidated sediment.

Ophiolite: An ordered sequence of petrogenetically related ultramafic rocks, gabbros, sheeted dykes and basalt lavas that originated through the generation of oceanic crust, but were subsequently thrust (obducted) onto continental crust.

Orogenesis (adj. orogenic): Crustal thickening following the collision of tectonic plates and resulting from magmatism, folding, thrusting and accretion, leading to regional uplift and mountain building.

Ordovician: The second period in the Palaeozoic Era, ranging from about 490 to 440 million years ago, named after a Celtic tribe called the *Ordovices.*

Ostracod (Ostracoda): 'Shell-like', members of a group of small crustaceans having a two-valved shell around the body. Throughout their long geological history (Cambrian? or Ordovician to Recent) they have diversified into a wide range of aquatic ecological niches both on land and at sea.

Outliers: Geographically, where younger rocks are surrounded by older rocks.

Palaeozoic: Ancient life', the first major division of geological time that is characterized by abundant life and which is preceded by the Proterozoic and succeeded by the Mesozoic; divided into six (or seven) periods from the Cambrian to the Permian.

Paraconodonts: A minor group of animals having tooth-like structures similar in form to conodonts, but the teeth are of simple form and different mineralogy

Phanerozoic: Period of 'evident life' — the period of time comprising the Palaeozoic, Mesozoic and Cainozoic Eras, commencing around 540 million years before present.

Placentian: A stratigraphical term for the lower part of the Lower Cambrian of eastern North America. See (Figure 2.2).

Plankton (adj. planktonic): Minute aquatic organisms that drift with the water movements.

Plate (Continental Plate): A large area of continental crust that has had its own history of geological movements and events. Compare the more restricted concept terrane.

Precambrian: A term to encompass the time that preceded the Phanerozoic Eon.

Proterozoic: The second eon of geological time, forming the later parts of the Precambrian.

Pyrite (adj. pyritic): 'Fire stone', an iron sulphide mineral ('fool's gold'), common within sediments, resulting from the biochemical action of bacteria within anaerobic environments.

Pyroclastic: Descriptive of rocks formed from fragmented volcanic material.

Quartzites: A metamorphic rock formed from more or less pure quartz sandstones.

Rheic Ocean: The ocean that separated part of Gondwana (e.g. what is now Brittany and central Germany) from southern Britain, northern France and northern Germany during the later Ordovician and Silurian periods. Its closure caused the Variscan Orogeny. See (Figure 1.3).

Sequence: In stratigraphy is used both in a general way to mean a succession of strata, and in a particular technical way to refer to a body of strata bounded below and above by unconformities (a 'sedimentary sequence').

Serpentinite: Altered ultramafic rocks (such as peridotite), giving masses of soft greenish or red-coloured magnesium silicate minerals ('serpentine').

Sheeted dykes: Closely spaced dykes intruded parallel to each other; a major component of an ophiolite.

Silurian: The third period of the Palaeozoic Era, ranging from about 440 to 395 million years ago.

SSSI: Site of Special Scientific Interest. The designation of an area of land for statutory protection under the provisions of the *Wildlife and Countryside Act 1981.*

Stratigraphy: The study of rock strata and their distribution in space and time.

Stratotype: A sequence of strata at a particular location, which has been designated as the definitive section for a particular lithostratigraphical or chronostratigraphical division.

Subduction (adj. subducted): The process of one crustal plate descending beneath another during plate convergence. The line of sub-duction is usually marked by an oceanic trench and a volcanic arc.

Succession: In stratigraphy, a continuous sequence of sedimentary rock units.

Taxonomic group: A category at any level in the classification of organisms (e.g. phylum, class, order, family, genus, species).

Tectonism (adj. tectonic): Pertaining to the deformation of the Earth's crust and the consequent structural effects (e.g. faulting, folding etc.).

Terrane: A fault-bound body of oceanic or continental crust having a geological history that is distinct from that of contiguous bodies, cf. plate.

Tornquist Sea: A former sea-way that separated Baltica from Gondwana and Avalonia during the Cambrian and earlier Ordovician.

Transgression: Referring to the encroachment of the sea across a landscape as a result of *either* a (eustatic) rise in sea level or subsidence of the land.

Tremadoc: The first epoch of the Ordovician Period in the Btitish stratigraphical standard. See (Figure 6.2).

Trilobites: An extinct class of marine arthropods, of importance in biostratigraphy. See, for example, (Figure 4.8), (Figure 9.21).

Trinucleid: A type of trilobite with a pitted marginal fringe on the head-shield. See (Figure 8.18), (Figure 10.20).

Tuff: A compacted fine-grained pyroclastic rock.

Turbidite: A sedimentary deposit that was formed by the settling out of detrital matter from a mass of sediment in water, which, being denser than normal water, had flowed (as a turbidity current) down a submarine slope.

Type locality: The location where the type section (or stratotype) for a stratigraphical unit is located, or where the original type section was first described, or where a fossil was originally described from.

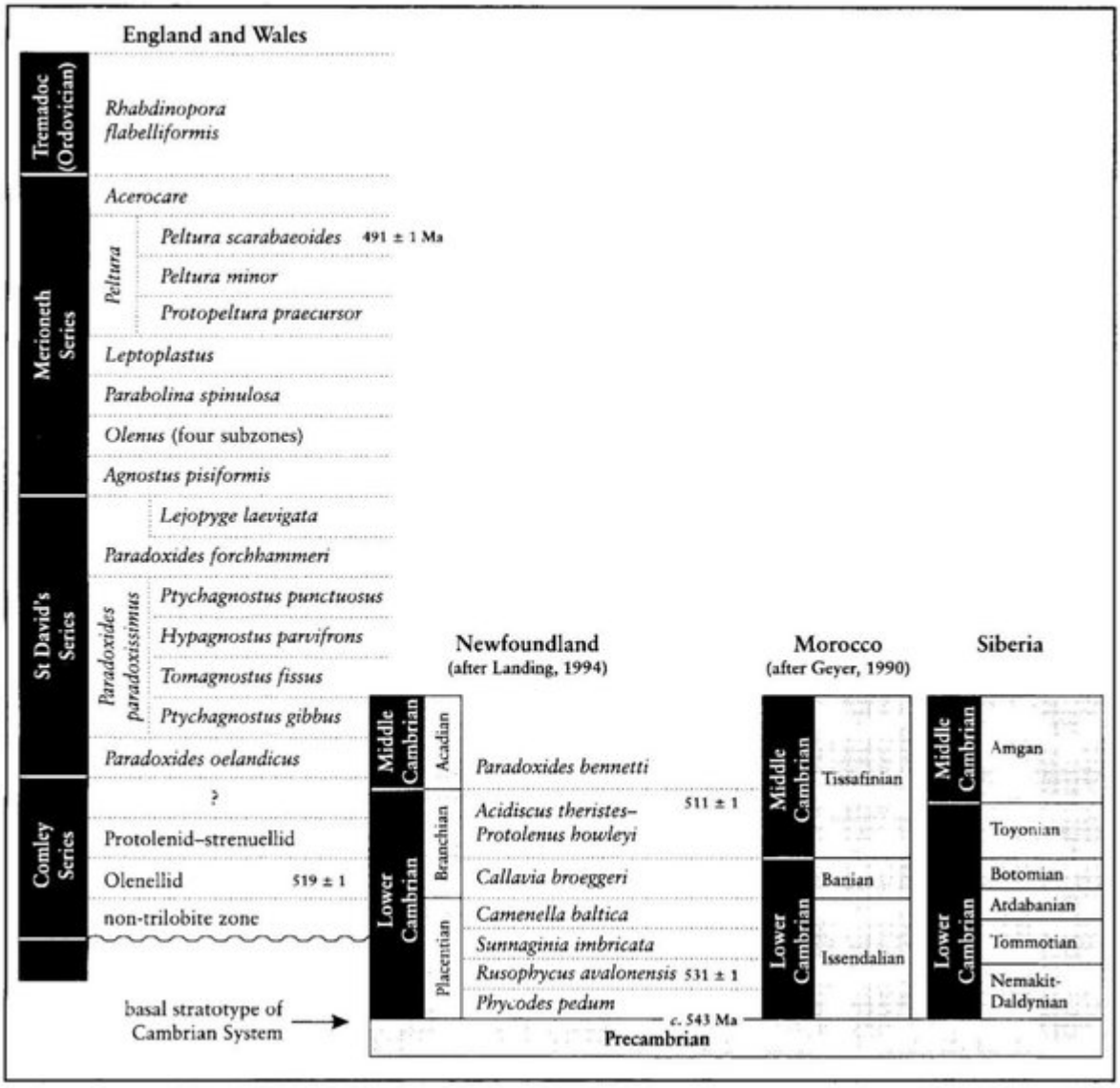
Ultramafic: Describes an igneous rock in which dark-coloured (ferromagnesian) minerals (e.g. pyroxene, olivine) comprise more than 90% of the rock.

Unconformity: A break in the relationship between successive strata in a sequence, resulting from a variety of causes, ranging from lack of deposition to an intervening phase of tectonism and erosion; consequently the time interval not represented by rock may also vary enormously.

Variscan Orogeny: A mountain building episode that occurred during the Carboniferous Period and affected, in the UK, rocks in south-west England, South Wales and southern Ireland.

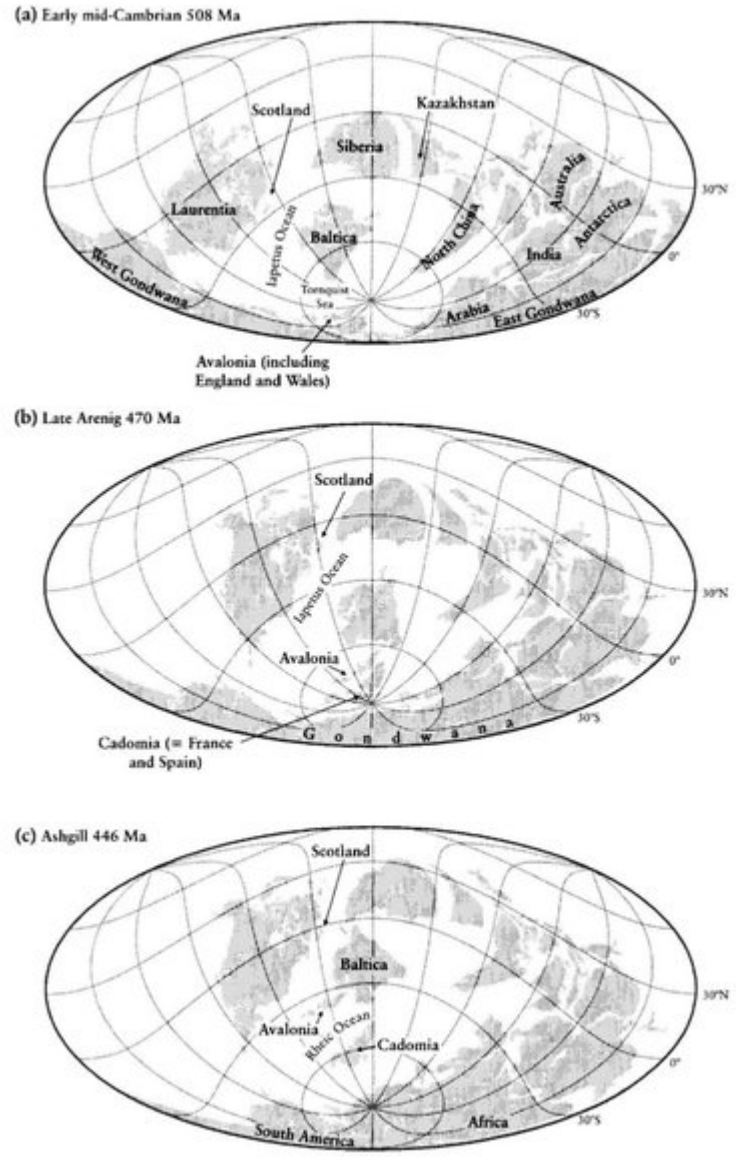
Volcanics: Volcanic rocks, including ashes, pyroclastic flows and lavas.

References

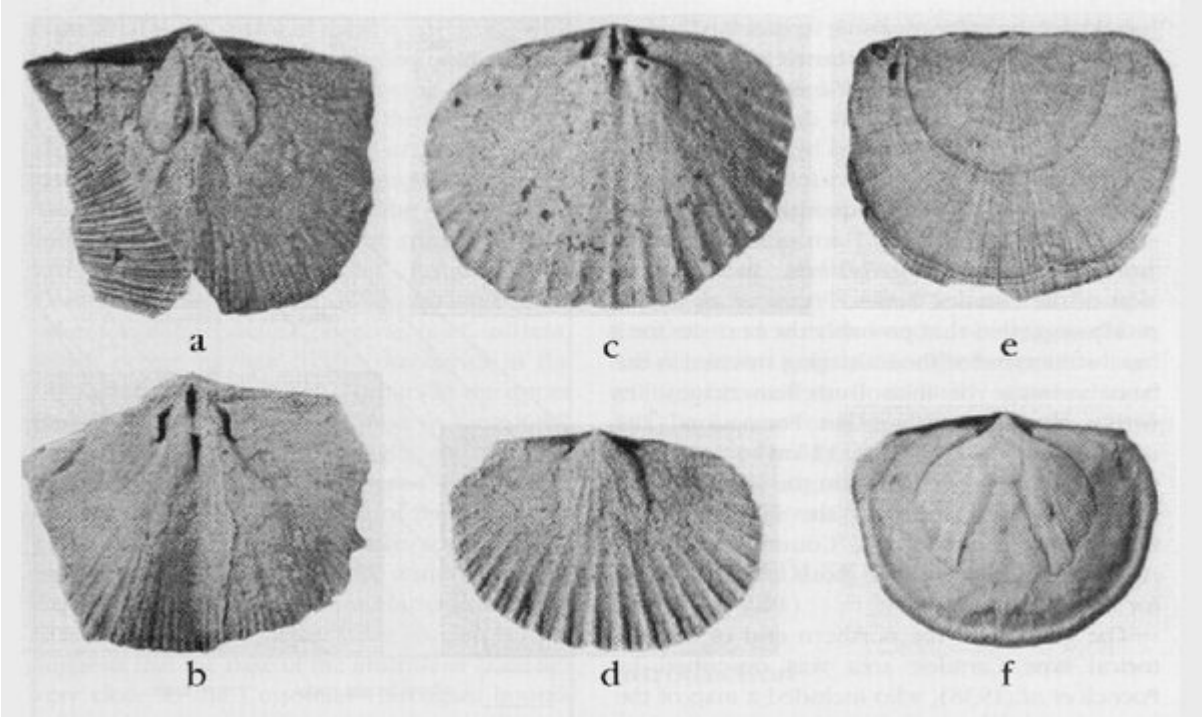


(Figure 2.2) Cambrian chronostratigraphy and trilobite zones in England and Wales, with Lower Cambrian schemes for south-east Newfoundland and Morocco shown for comparison. The base of the Cambrian System is defined at the base of the Phycodes pedum Zone at Fortune Head, south-east Newfoundland. For sources of radiometric dates, see Davidek et al. (1998) and landing et al., 1998.

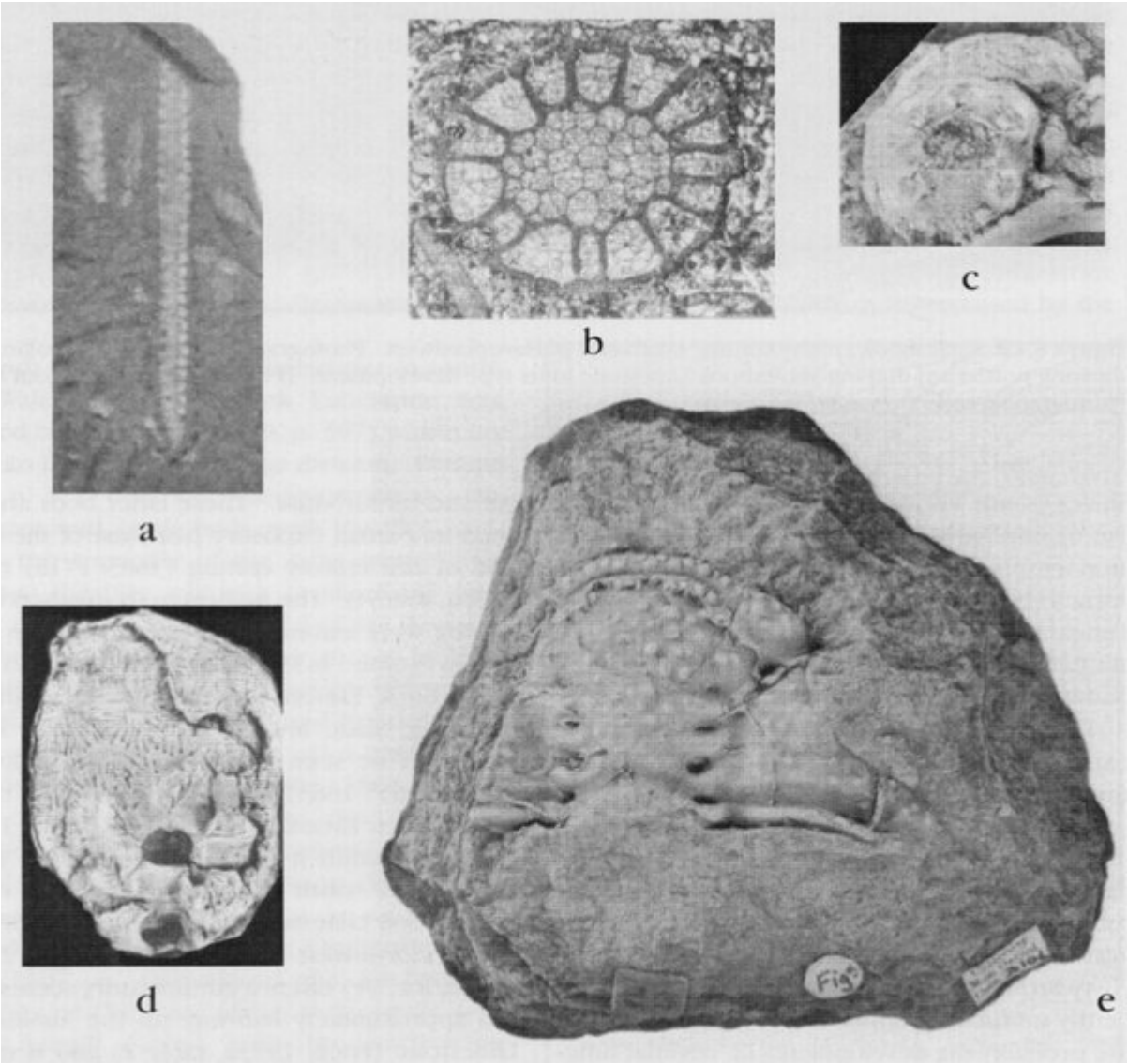
(Figure 6.2) Chronostratigraphy of the Ordovician of England and Wales, correlated with the graptolite zonation. Selected ages (in millions of years) from the study of radioactive isotopes are shown to the right. Sources: 1, Tucker et al. (1990); 2, Compston and Williams (1992); 3, Landing et al. (1997); 4, Davidek et al. (1998); 5, Tucker and McKerrow (1995).



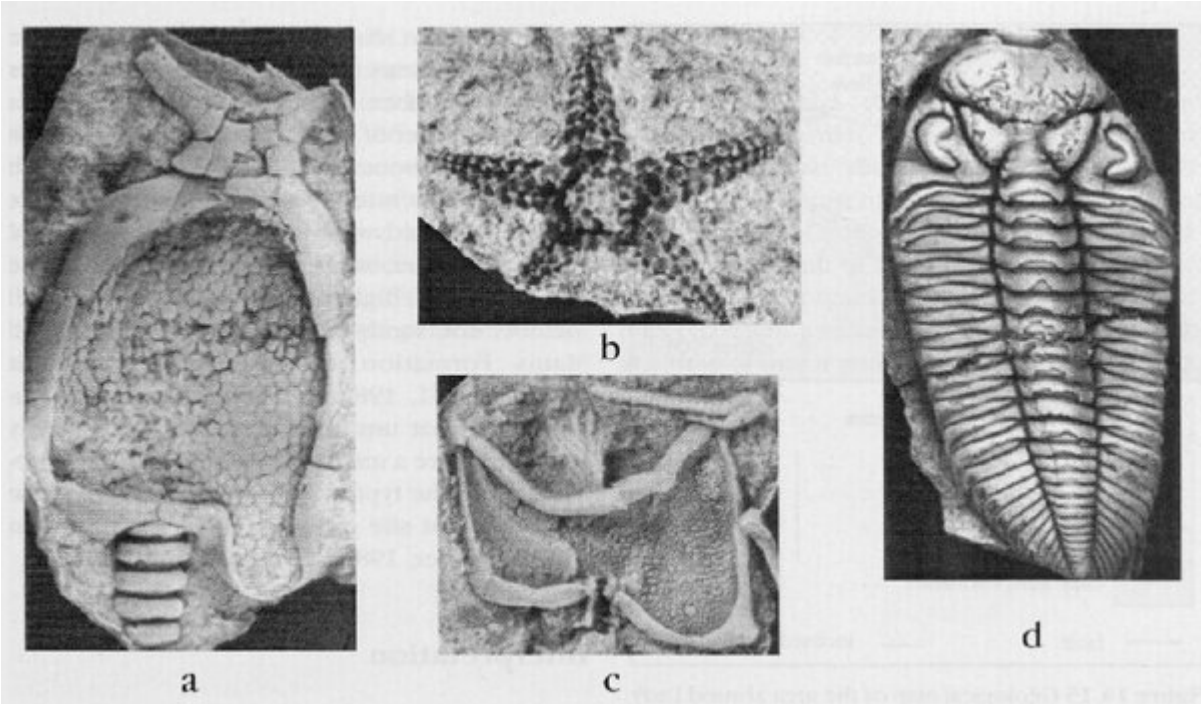
(Figure 1.2) Palaeogeographical sketch-maps of the world, showing the changing relative positions of England, Wales and Scotland through the Cambrian and Ordovician. Adapted from maps generated by Dr David Lees using Atlaswinpro (Cambridge Paleomap Services).



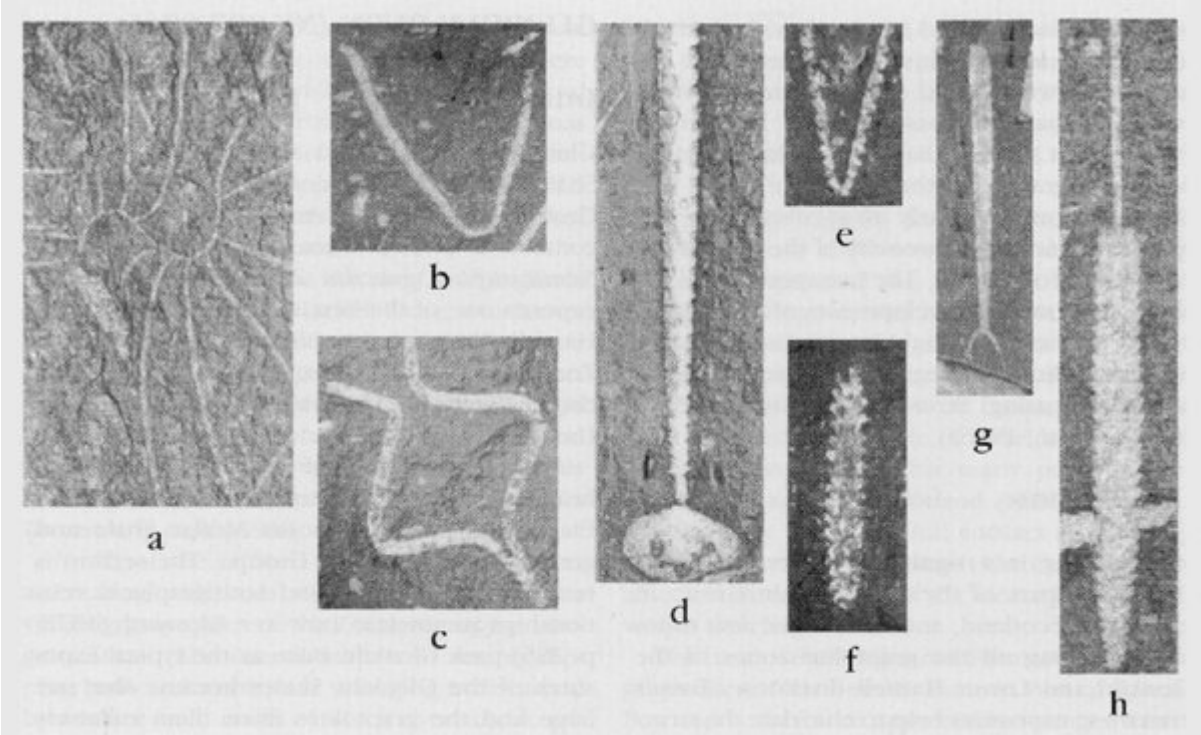
(Figure 10.12) Brachiopods from the type Caradoc area. (a, b) Harknessella vespertilio (J. de C. Sowerby), x2, Coston. (c, d) Dinorthis flabellulum (J. de C. Sowerby), x2, Coston. (e, t) Heterorthis alternata (J. de C. Sowerby), x 1.5, Soudley.



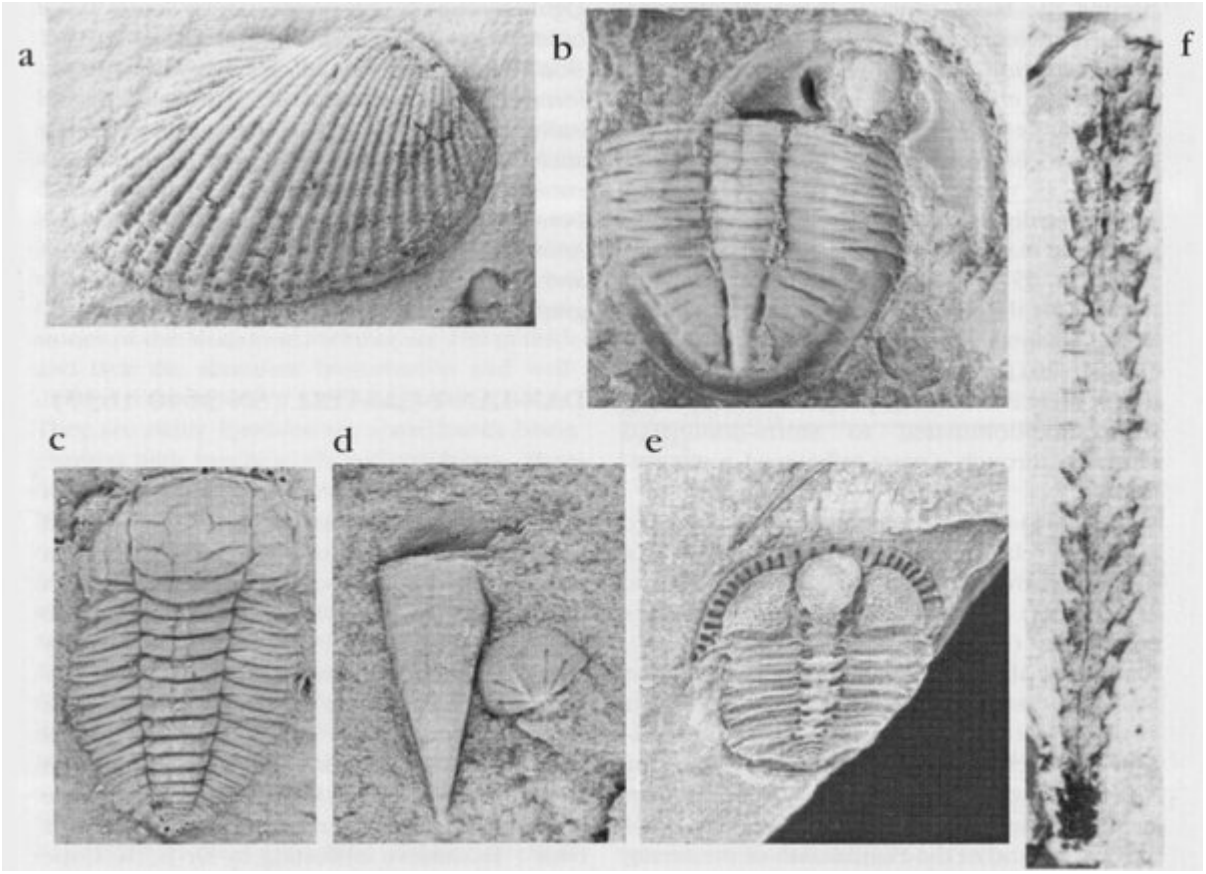
(Figure 8.23) (a) Normalograptus sp., x 3, a typical graptolite that proliferates in the upper beds of the Mydrim Shales at Pengawse Hill. (b) Transverse section of the bryozoan Kuckersella borealis (Bassler), x30, Slade and Redhill Beds, Pengawse Hill. (c) Eucystis pentax Paul, x4, Sholeshook Limestone, Sholeshook. (d) Archegocystis stellulifera (Salter), x2, Sholeshook Limestone, Sholeshook. (e) Atractopyge verrucosa (Coalman), holotype cranidium, x1.5, from the Crûg Limestone, Crûg.



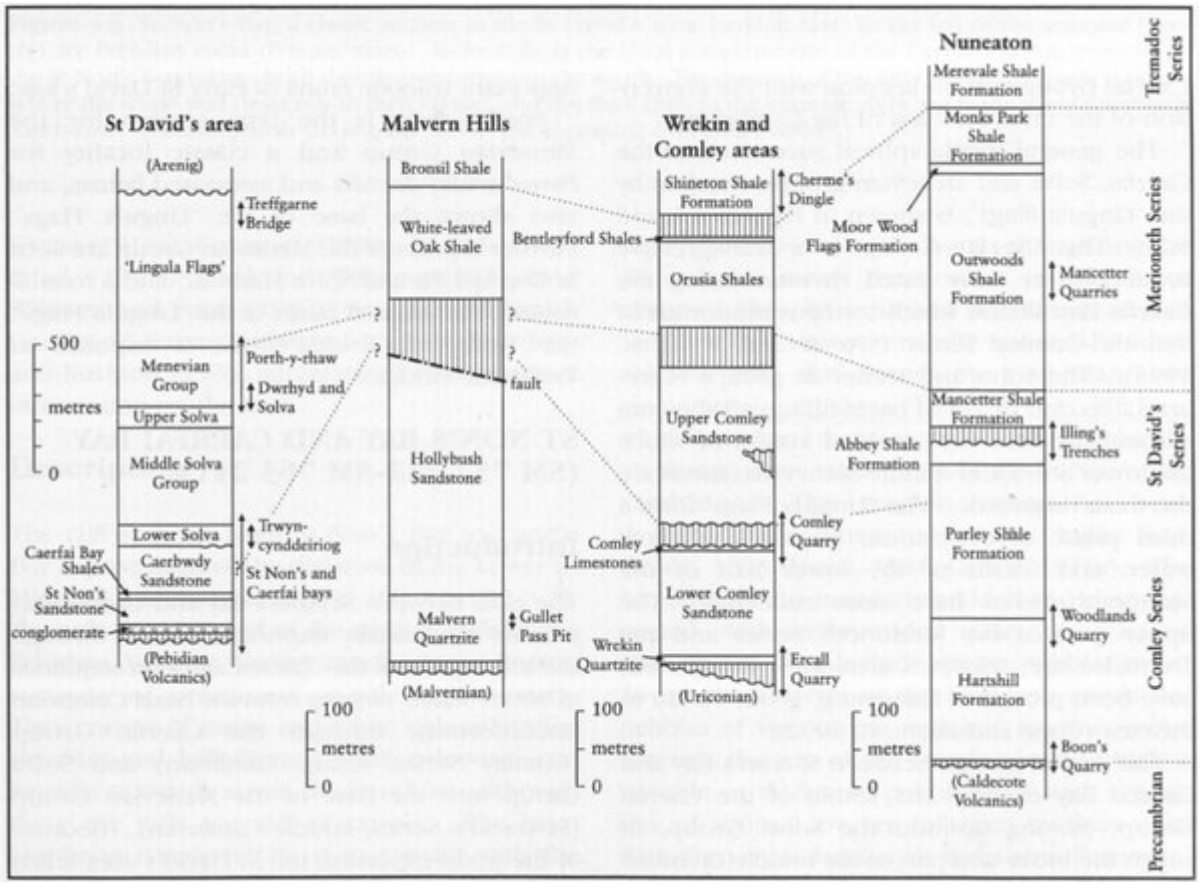
(Figure 14.14) Fossils from the Starfish Beds, South Threave. (a) Rhombiferan cystid Pygecystis quadrata Bather, x 2. (b) Asteroid starfish Mesopalaeaster primus (Spencer), x 4. (c) Cornute calcichordate Scotiaecystis curvata (Bather), x 1.5. (d) Trilobite Toxochasmops bisseti (Reed), x 1.5.



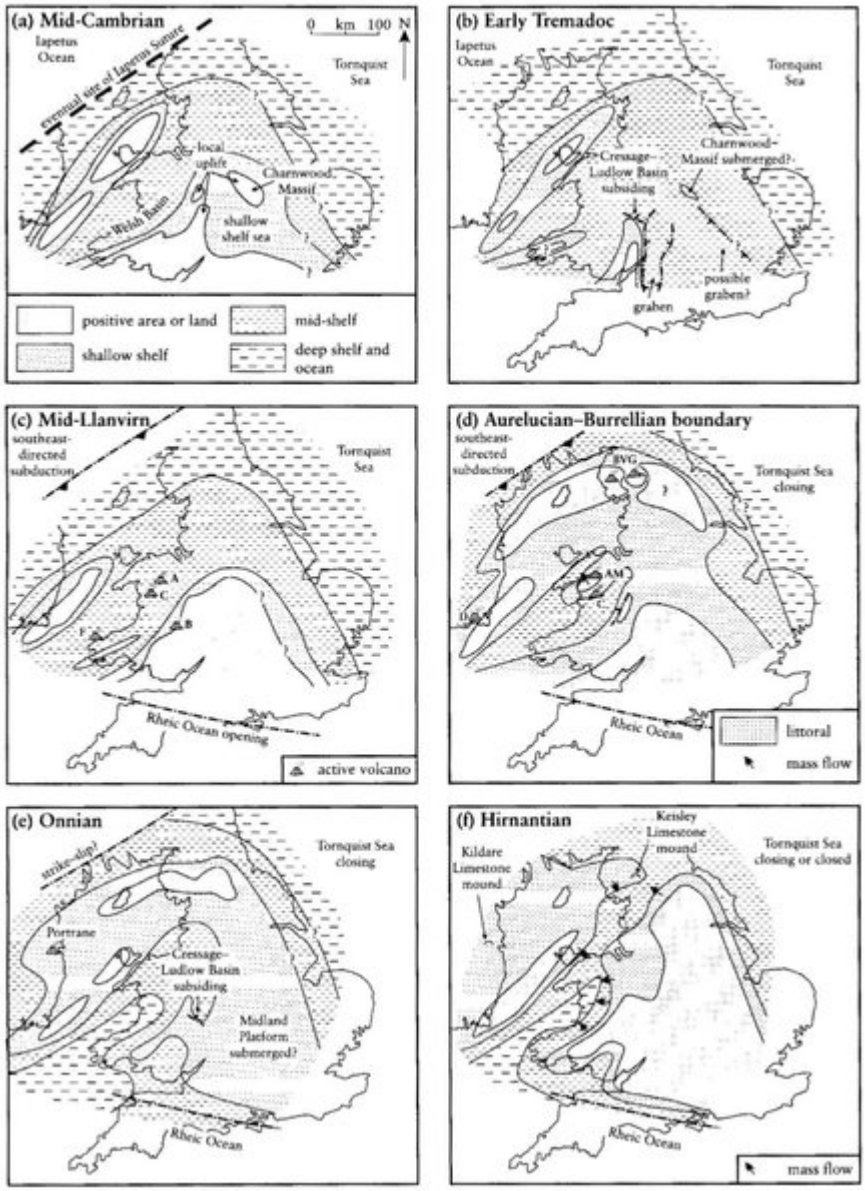
(Figure 15.7) Graptolites from Glenkiln Burn (a) and Dob's Linn (b-h). All figures x2. (a) Nemagraptus gracilis (Hall), gracilis Zone. (b) Dicellograptus morrisi Hopkinson, clingani–linearis zones. (c) Dicranograptus ziczac Lapworth, peltifer Zone. (d) Climacograptus wilsoni Lapworth, wilsoni Zone. (e) Dicellograptus anceps (Nicholson), anceps Zone. (f) Lasiograptus harknessi (Nicholson), wilsoni Zone. (g) Climacograptus supernus Elles and Wood, anceps Zone. (h) Orthograptus calcaratus (Lapworth) sensu lato clingani–linearis zones.



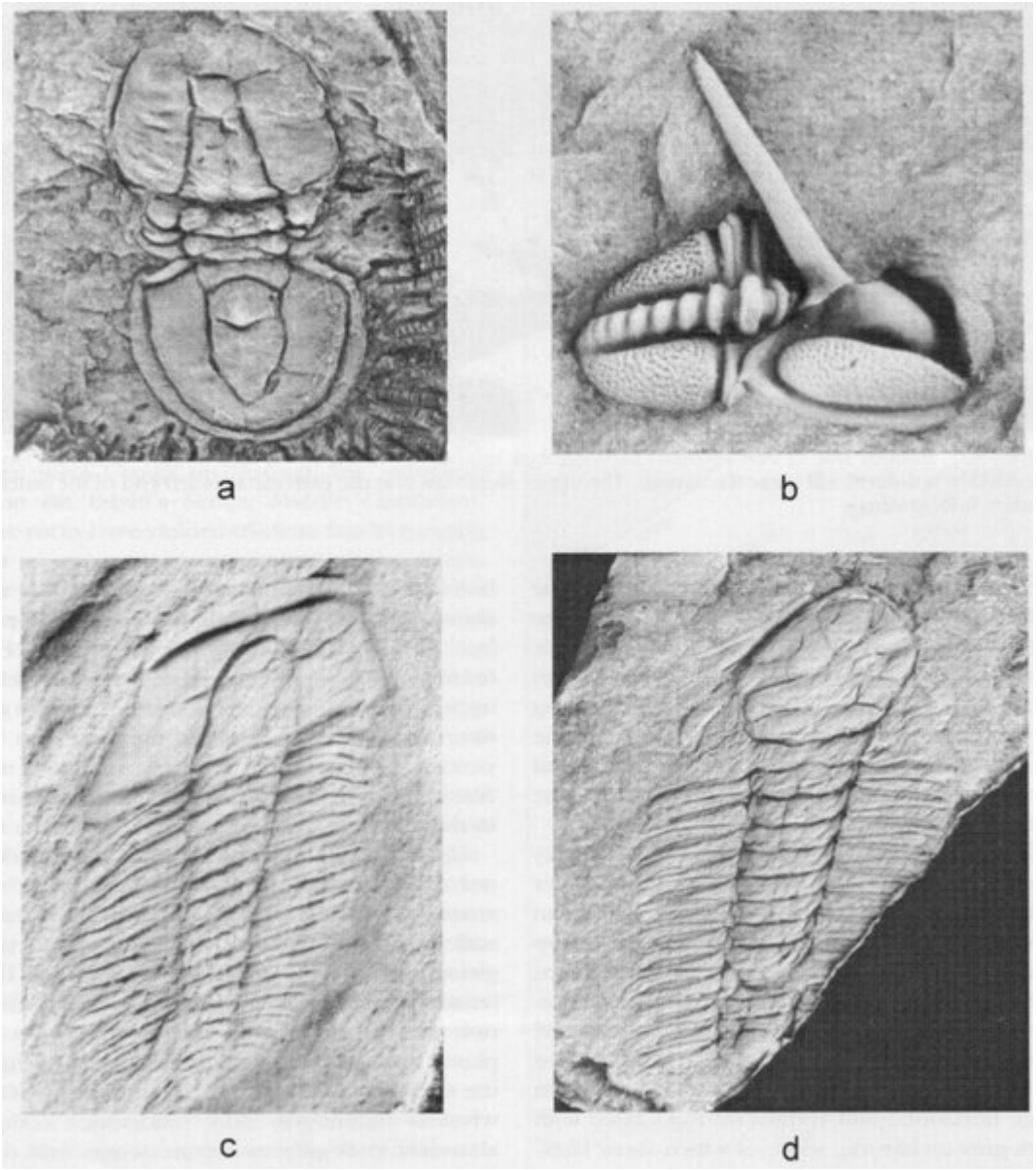
(Figure 8.4) Fossils from Arenig and Llanvirn sites in South Wales. (a) Falcatodonta costata Cope, x4.5, from the Bolahaul Member (Moridunian) at Dan-lan-y-castell. (b) Merlinia selwynii (Salter), x2.5, Pibwr Member (Moridunian), Glan Pibwr. (c) Portedieldia punctata (Crosfield and Skeat), x8, Cwm yr Abbey Member (Moridunian), Cwm yr Abbey. (d) Hyolithid conch and operculum, x 5, and (e) Bergarnia rushtoni Fortey and Owens, x 3.5, both from the Pontyfenni Formation (Fennian), Pontyfenni. (I) Undulograptus austrodentatus (Harris and Keble), x6, Llanfallteg Formation (basal Abereiddian), Llanfallteg.



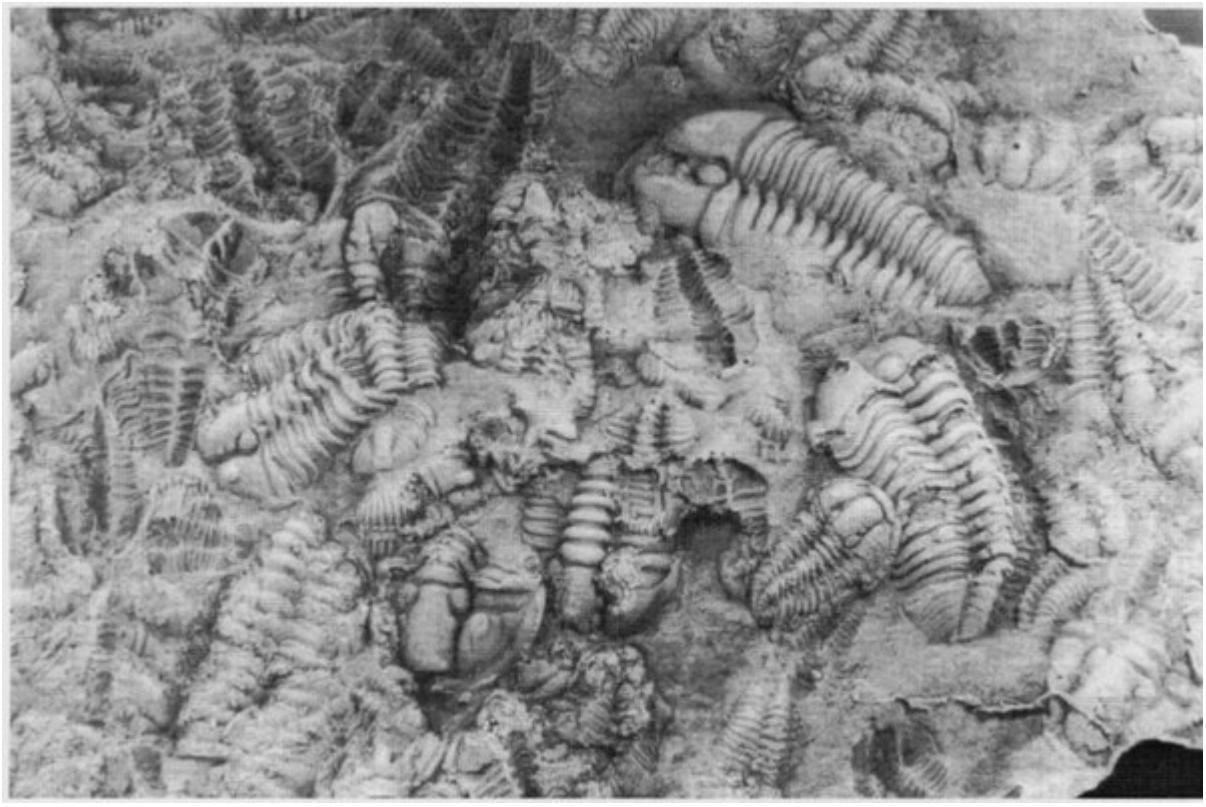
(Figure 4.1) Correlation of the principal Cambrian sequences in South Wales and England, modified from Rushton (1974, figs 2, 3). The stratigraphical ranges of the GCR sites are indicated. For the location of Treffgarne Bridge, see (Figure 8.1).



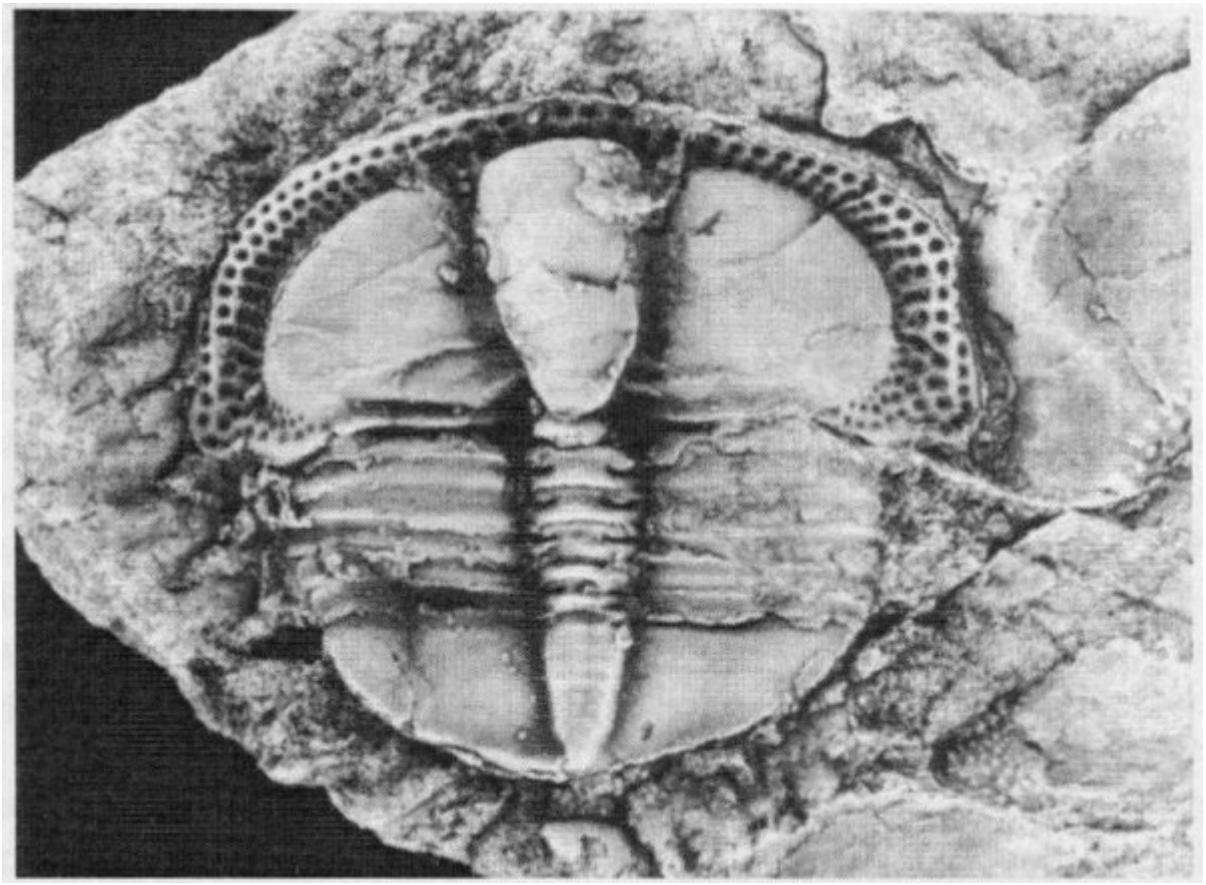
(Figure 1.3) Simplified palaeogeographical maps for the Cambrian and Ordovician of England and Wales, modified from Cope et al. (1992). In (c) the active volcanic areas are A, Arenig; B, Builth; C, Cadair Idris; F, Fishguard. In (d) the volcanic areas are AM, Aran and Moelwyn; BVG, Borrowdale Volcanic Group; C, Cadair Idris; 13, Duncannon.



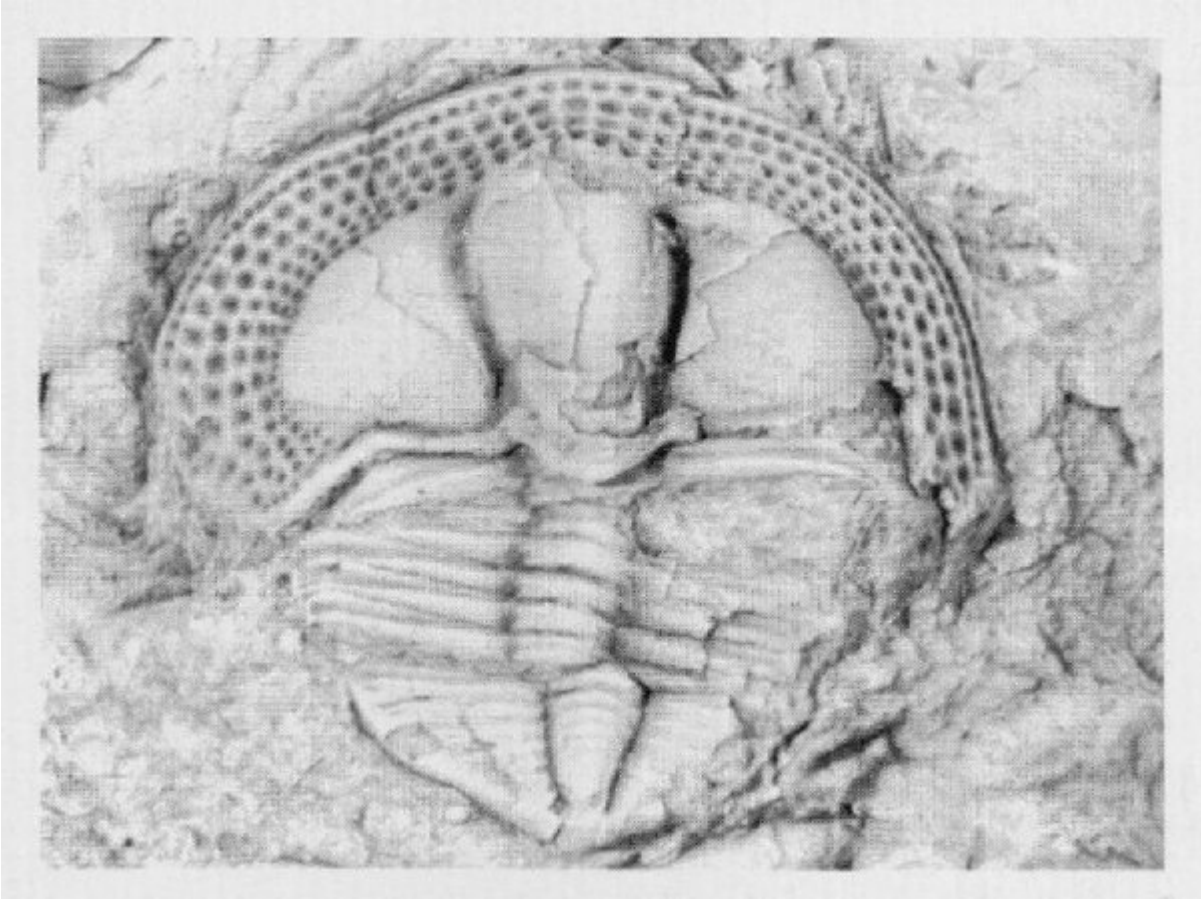
(Figure 4.8) Middle Cambrian Trilobites from South Wales. (a) Onymagnostus davidis (Hicks), x4, from Solva Harbour. (b) Eodiscus punctatus (Salter), x8, from Porth-y-rhaw. (c) Bailiella lyelli (Hicks), x3, from Trwyncynddeiriog. (d) Plutonides hicksii (Hicks), x2.5, from Dwrhyd. (Photos: M. Lewis.)



(Figure 9.21) 'Graveyard' of Gravicalymene arcuata Price, x 5, Cynwyd.



(Figure 8.18) Marrolithoides simplex (Williams), x4, from the Middle Llandeilo Flags, Talar Wen, Bethlehem.



(Figure 10.20) Onnia gracilis (Bancroft), x3, from the Wistanstow Member of the Acton Scott Formation (Streffordian, Onnian Substage).