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## 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. References to geological time are based on Gradstein *et al.* (2004).

**Angiosperm:** a flowering plant belonging to a major division of the plant kingdom with some 260 000 species (Early Cretaceous-present day), defined by the form of their reproductive organs (flowers) and mode of reproduction, with seeds developed within an enclosed ovary. The group includes a wide variety of forms from weedy to shrubby and tree-sized plants.

**Annelids:** a major group of segmented worms that probably originated in late Precambrian times and now has over 17 000 living species.

**Anterior ganglia:** an expansion of nervous tissue at the front of an animal from which nerve fibres diverge.

**Anthophilous insects:** insects that are attracted by flowers or feed on flowers.

**Arthropleurid:** an extinct group (Late Carboniferous–Early Permian) of land-living myriapod arthropods related to centipedes and millipedes, that flourished in Late Carboniferous times when some grew to well over a metre in length.

**Bennettitaleans:** members of a group of extinct (Triassic–Cretaceous) seed plants, also known as the 'cycadeoids' because of a superficial resemblance to the cycads, and characterized by thick trunks and flower-like structures, which were thought to show an evolutionary connection to the flowering plants, but they are now known to be closer to the cycads.

**Charophytes:** members of a freshwater group of 'green algae' (Silurian-present day), which take up calcium carbonate (commonly known as 'stoneworts'), and are closely related to the Plantae. Modern morphological data and molecular studies show that charophytic algae and land plants together make up a monophyletic group, the streptophytes, with the Characeae being the sister group to the land plants.

**Chelicerates:** a large group of arthropods, originating in Silurian times, which is now represented by over 77 000 species, and includes the scorpions, spiders, mites and horseshoe crabs.

**Chitin/cuticle:** a tough mucopolysaccharide present in the annelid cuticle, the arthropod exoskeleton and some plants.

**Curclionid beetles:** the 'snout' beetles or true weevils, which form one of the largest beetle groups, with over 60 000 living species, mostly plant feeders (Triassic-present day).

**Cycad:** member of a major group of seed plants, which evolved in Early Permian times, were particularly abundant in Jurassic times, and is now reduced to some 65 living species. They are characterized by a stout trunk and large crown of compound leaves, whose fossils are frequently mistaken for palm or fern leaves.

**Cycadophytes:** an extant group of gymnosperms (plants with seeds not enclosed in an ovary), which originated in Early Permian times, became abundant in the Mesozoic and are characterized by stems with largely unbranched stems and a crown of large compound leaves.

**Decapods:** aquatic malacostracans, including the crabs and lobsters (Triassic–present day), characterized by five pairs of legs on the thorax, which is completely covered by the carapace.

**Dipterans:** a major group of insects formed by the true flies, characterized by a single pair of wings on the mesothorax, with the second pair of wings on the metathorax reduced to pair of halteres. They evolved in Mid Triassic times and are

now represented by some 120 000 living species.

**Ecdysis:** the act of shedding or moulting a cuticular layer or exoskeleton.

**Ecdysozoans:** a major animal grouping (Early Cambrian-present day) that includes the arthropods, nematodes and some other more minor groups, all of which shed their exoskeleton, and which is confirmed as a natural grouping by molecular studies.

**Echinoderm:** a major grouping (phylum) of marine animals, which evolved in Cambrian times, and contains some 7 000 living species. Their larval development shows that they are closely related to the chordates.

**Elytra or tegmina: the modified forewings** of certain insects, especially the beetles, which has been hardened as a wing sheath to protect the hind wings.

**Entomofauna:** a naturally occurring fauna (association) of insects or the insects of a particular environment or region.

**Eoarthropleurid:** an early fossil representative (Silurian–Early Devonian) of an extinct group of myriapod arthropods related to the centipedes.

**Eumalacostracan:** a group of crustaceans (Cambrian-present day) containing most living malacostracans, some 22 000 species, characterized by five cephalic, eight thoracic and six abdominal segments, 19 in total.

**Euryhaline:** tolerant of a wide range of salinities.

**Eurypterids:** an extinct group of aquatic arthropods (Ordovician–Permian) related to the arachnids, also informally known as 'sea scorpions', later forms having colonized freshwaters.

**Euthycarcinoid:** an extinct group (Cambrian–Mid Triassic) of small amphibious stem euarthropods, whose affinities have been variously assigned to the crustaceans and hexapods. The oldest representative was, until recently, known from the Devonian Rhynie Chert but the range of the group now extends down into the Cambrian Period.

**Fossil:** the remains of a once living organism, usually found within sedimentary strata. The remains may be preserved in a variety of ways, ranging from chemical traces, marks left in the surrounding sediment by the behaviour or movement of the original organism to hard parts, such as shells and other skeletal materials, and, rarely, preserved indications of the original soft tissues. The form of the hard parts may also be moulded and cast or otherwise replicated by other naturally occurring minerals and sediments.

**Fossiliferous:** containing fossil remains, particularly in sediment or sedimentary rock.

**Gastrotricha:** a group (phylum) of short-lived and soft-bodied microscopic (millimetre-sized) aquatic animals, many of which live between sediment particles and have no fossil record.

**Geropterous:** pertaining to the extinct odonatopteran Eugeopteridae-based monobasic order, which include some of the first dragonfly-like winged insects (Carboniferous in age).

**Gnetaleans:** an extant group of gymnosperm plants (Gnetales) with tropical tree, shrub and liana habits (Jurassic–Recent). They are thought to have been the first plants to be insect pollinated.

**Hemipterans:** members of the hemimetabolous Order Hemiptera of sucking insect such as the myriad aphids, scale insects, hoppers and cicadas along with predatory and plant bugs, which altogether form a monophyletic group based on the loss of the maxillary and labial palps and the development of the uniquely structured rostrum or 'sucking beak' (Permian–present day).

**Hexapod;** the largest and most diverse group of arthropods (Devonian–present day), with over 830 000 living species, made up mostly of insects but including other groups such as the proturans and springtails (collembolans). They have

conquered all terrestrial environments and some have secondarily returned to an aquatic existence.

**Hymenopterans:** a major group (order) of diverse hexapods, comprised of more than 125 000 living species, including bees, wasps and ants, whose early phylogeny is still obscure (Triassic–Recent).

**Ichnospecies:** a taxonomic group based purely on trace fossils.

**Isopod:** a large group of eumalacostracan arthropods including the aquatic sea slaters and terrestrial sowbugs (pillbugs and woodlice) with over 11 000 living species and a fossil range extending back to Carboniferous times.

**Kampecarids:** extinct millipede-like myriapod arthropods (Late Silurian–Early Devonian) that may have been aquatic, do not have as many body segments as millipedes, and with each segment bearing a pair of uniramous legs.

**Limuloid xiphosuran:** this group of aquatic chelicerate arthropods are today represented by *Limulus*, commonly known as the 'horseshoe crab' or 'kingcrab', which has a distinctive body form with a fused head shield articulating posteriorly with a plate-like opisthosoma and long tail spine or telson. The limuloids include both extant and fossil forms with this body form and they originated in Carboniferous times.

**Lithological:** relating to the lithology or character of a rock as defined by its composition, grain size and structure.

**Megasecopterans:** an extinct group (Carboniferous–Permian) of palaeodictyopteroid insects with a distinctive pattern of cross-veins on the narrow wings like many damselflies and long tails like mayflies.

**Mecopterans:** commonly known as the scorpionflies, this extant group of panorpoid insects includes some 400 fossil species with a fossil history extending back to Permian times, and they retain a number of primitive features such as mandibulate mouth parts.

**Metazoan:** an organism made of many cells that allow increase in size and structural complexity. Most metazoans are independently motile eukaryotes, whose body plan is determined as they develop, although some undergo a metamorphosis (change in body form) later in life.

**Microphagous detritivore:** an organism that consumes fine-grained detritus and its contained microscopic organisms for food.

**Monophyletic:** any group of organisms that is descended from a single common ancestor.

**Myriapod:** a group of extant terrestrial arthropods with uniramian (single branched) limbs that appears in Silurian times.

**Nematode:** a group of non-segmented worms, commonly called 'round worms', with a thick cuticle covering the body and having both free-living and parasitic representatives. Despite their abundance, with some 20000 living species, they have a very limited fossil record, largely restricted to preservation in amber and as trace fossils (*Cochlichnus*).

**Non-stridulating:** see stridulating

**Oligochaete:** a group of soft-bodied microphagous annelids which includes the terrestrial earthworms and aquatic forms, altogether comprising some 3500 living species. Their fossil record mainly consists of trace fossils of their burrows.

**Orthopterans:** a large extant group (order) of over 22 500 species of polyneopteran winged insects that first appeared in Late Carboniferous times and includes the living crickets, grasshoppers, locusts and wetas.

**Ostracods:** an extant group of aquatic crustaceans that are known from Ordovician times, and are characterized by two hinged valves which enclose the body and are generally mineralized with calcium carbonate.

**Palaeodictyopterans:** an extinct group (order; Late Carboniferous–Permian) of diverse and herbivorous beaked insects with prothoracic winglets, which made up some 50% of known Palaeozoic insects, and some of which grew to a large

size.

**Panarthropod:** a grouping of segmented animals, the Arthropoda with the Tardigrada and Onychophora, which was thought to have evolved from the annelids (Lophotrochozoa) but is now thought to belong to a larger group of animals that moult and are known as the 'Ecdysozoa'.

**Phalangiotarbids:** an extinct group of small terrestrial arachnids (Early Devonian–Early Permian) thought to be related to the harvestmen (Opiliones) or mites (Acari).

**Phosphatocopids:** a group of extinct primitive crustaceans (Cambrian–Early Ordovician) in which the original parts were probably phosphatic.

**Phyllocarid:** an ancient and primitive group of aquatic crustaceans, which have a bivalved carapace covering most of the body, and which was abundant in Early Palaeozoic times.

**Phylogeny:** the evolutionary development and history of a species or group.

**Polyneopteran:** one of three major lineages of neopteran winged insects originating in Late Carboniferous times. Defined by an expansion of the anal region of the hind-wing by the addition of numerous anal veins.

**Polyphyly:** where there is a combination of characters derived from more than one ancestral group or implying descent from more than one ancestral group.

**Pteridosperm:** an extinct group (Devonian–Eocene) of gymnosperms or seed plants, commonly known as the 'seed ferns', that were particularly abundant during the Carboniferous and Permian periods, when some of them grew to the size of small trees with large metre-sized fronds which are superficially fern-like, hence the old name 'seed ferns'.

**Stridulating (organ):** a special 'file-like' apparatus developed on the metathoracic and anterior abdominal segments of certain insects and other arthropods that makes a rasping noise when rubbed by the animal's legs.

**Stylonurid eurypterids:** a group of extinct aquatic arthropods (Ordovician–Permian) belonging to the Suborder Eurypterina, characterized by their small non-toothed chelicerae (pre-oral appendages).

**Stylonurid fauna:** an assemblage of fossils dominated by stylonurid eurypterids

**Stylonuroids:** those eurypterids with close anatomical similarities to the stylonurids and that are considered to be sufficiently closely related to be placed in this large and somewhat looser grouping

**Synziphosurine chelicerate:** an extinct group of xiphosurid arthropods (Ordovician–Devonian), related to the limuloids in which most of the abdominal segments are free.

**Trigonotarbid:** an extinct group of small terrestrial, spider-like and predatory arachnids (Late Silurian–Early Permian), which became abundant in Late Carboniferous times and whose fossils are particularly associated with 'coal measure' deposits.

**Trilobite:** a large and diverse extinct group (Cambrian–Permian) of marine arthropods, with some 5000 genera, that is well represented in the fossil record because of their mineralized dorsal carapace.

**Xiphosuran:** pertaining to a group of merostome chelicerates (Cambrian-present day), which includes the extinct aglaspids, the extinct eurypterids, and the xiphosurids, which are represented by the surviving limulids.

## [References](#)