The **Burgess Shale** of Canada and Chengjiang, in Yunnan Province, China are the best known Lagerstatte of Cambrian time. Both sites have a great diversity of benthic or burrowing creatures. Less well known is that the western state of Utah has similar fauna of the Cambrian Explosion. Interestingly, some scientists believe that a larger number of species are found in the Weeks, Wheeler and Marjum Formations within the **House Range in Utah** than in the Burgess Shale, though the fossils are far less abundant and not as well preserved. Even fewer are collected simply because collectors usual do not recognize them as fossils.
Creatures from the Cambrian explosion. A. Marrella, ranging from 2.5 to 19 mm in length. B. Opabinia, 43 to 70 mm long, showing the frontal nozzle with terminal claw, five eyes on the head, and body sections with gills on top. C. Sidneyia, an arthropod, seen from below and above. D. Two species of Anomalocaris; the biggest specimens are estimated to have been nearly 2 ft long – by far the largest of all known Cambrian animals.
C: Aysheaia was a genus of soft-bodied, caterpillar-shaped organisms average body length of 1–6 cm; D: Leanchoilia is a four-eyed arachnomorph arthropod known from the Cambrian Burgess shale. It was about 5cm long and had long, whip-like feelers mounted on frontal arm-like appendages. Its guts are sometimes preserved in three dimensions; E: Waptia was a small, shrimp-like stem group crustacean.
Haplophrentis was a tiny shelled hyolithid which lived in the Cambrian Period. Its shell was long and conical, with the open end protected by an operculum, from which two fleshy arms called helens protruded at the sides. These arms probably acted as stabilisers, or were used for locomotion, rowing the animal across undersea mudflats.
Hyoliths are an extinct group of animals that had cone shaped shells. They lived from the Cambrian to the Permian, but were most diverse and abundant during the Cambrian. Most paleontologists think that they lived on the sea-floor, did not move around much, and fed on organic material in the sediment (deposit feeders). Many paleontologists agree that hyoliths are related to mollusks.
Opabinia, 43 to 70 mm long, showing the frontal nozzle with terminal claw, five eyes on the head, and body sections with gills on top.
Pikaia is a primitive creature without well defined head and less than 2 inches (5 centimetres) long which swam in the mid-Cambrian seas, and is close to the ancestor of all backboned animals (vertebrates), from fish to birds to mammals. The fossils compressed within the Burgess Shale clearly show chordate features such as traces of an elongate notochord, dorsal nerve cord and blocks of muscles down either side of the body – all features of the vertebrates. The notochord is a flexible rod that runs along the back of the animal, lengthening and stiffening the body so that it can be flexed from side to side by the muscle blocks for swimming. In the fish and all subsequent vertebrates, the notochord forms the backbone.
Fusulinids are an extinct group of Foraminifera with tests composed of secreted microgranular calcite. Fusulinids were single-celled organisms, about the size and shape of a grain of wheat. Unlike multicellular animals, which accomplish basic life functions (such as locomotion, feeding, digestion, and reproduction) through a wide range of specialized cells, fusulinids and other single-celled organisms have to carry on these same functions within the confines of a single cell. As a result, the cell is highly complex.
The earliest fusulinids were minute, smaller than the head of a pin, and somewhat spherical in shape. During their 80 million years on earth, fusulinids evolved rapidly, typically becoming progressively longer and narrower. By the late Permian Period, some forms were over two inches long, an amazing size for a single-celled organism. As fusulinids changed over time, the internal test walls also became increasingly complex, with more ornate subdivisions of their internal chambers. Fusulinids look fairly similar from the outside. In order to identify them, scientists usually examine a cross section of the fossil test under a microscope.
The Archaeocyatha or *archaeocyathids* ("ancient cups") were sessile, reef-building[1] marine organisms of warm tropical and subtropical waters that lived during the early (lower) Cambrian period. They became the planet's very first reef-building animals and are an index fossil for the Lower Cambrian worldwide.
Early Paleozoic sponges. Sponges are animals of the phylum Porifera. Sponges do not have nervous, digestive or circulatory systems. Instead, most rely on maintaining a constant water flow through their bodies to obtain food and oxygen and to remove wastes, and the shapes of their bodies are adapted to maximize the efficiency of the water flow. All are sessile aquatic animals and, although there are freshwater species, the great majority are marine (salt water) species, ranging from tidal zones to depths exceeding 8,800 meters.
Astraeospongia, a Silurian sponge with six-rayed, star shaped spicules.
*Hydnoceras*, a Devonian siliceous sponge. Sponges have an internal skeleton usually composed of needlelike, mineralized spicules and spongin, a fibrous, horny substance. The only sponges likely to be preserved are those whose spicules have been fused into a rigid framework. A few of these forms are fairly common in Paleozoic rocks.
Sponge anatomy

- Excurrent opening (osculum)
- Spicule (skeleton)
- Mesenchyme
- Choanocyte (collar cell)
- Incurrent pores
Groups of the phylum Cnidaria

- Portuguese Man-of-War
- Brain coral
- Precious coral
- Organ-pipe coral
- Sea fan
- Sea anemone
Cninarians belong to a phylum containing over 9,000 species of animals found exclusively in aquatic and mostly marine environments. Their distinguishing feature is cnidocytes, specialized cells that they use mainly for capturing prey. Their bodies consist of mesoglea, a non-living jelly-like substance, sandwiched between two layers of epithelium that are mostly one cell thick. They have two basic body forms: swimming medusae and sessile polyps, both of which are radially symmetrical with mouths surrounded by tentacles that bear cnidocytes.
The *tabulate corals*, forming the order Tabulata, are an extinct form of coral. They are almost always colonial, forming colonies of individual hexagonal cells known as corallites defined by a skeleton of calcite, similar in appearance to a honeycomb. Adjacent cells are joined by small pores. Their distinguishing feature is their well-developed horizontal internal partitions (tabulae) within each cell.
Devonian rugose horn-shaped coral. The Rugosa, also called the Tetracoralla, are an extinct order of coral that were abundant in Middle Ordovician to Late Permian seas. Solitary rugosans are often referred to as horn corals because of a unique horn-shaped chamber with a wrinkled, or rugose, wall. Some solitary rugosans reached nearly a meter in length. However, some species of rugose corals could form large colonies. When radiating septa were present, they were usually in multiples of four, hence Tetracoralla in contrast to modern hexacoralla, colonial polyps generally with six-fold symmetry.
Lithostrotionella, a rugose coral
**Hexangonia**, a rugose coral
Rugose corals diorama
Paleozoic branching bryozoan
The Bryozoa, also known as Ectoprocta or commonly as moss animals, are a phylum of aquatic invertebrate animals. Typically about 0.5 millimetres (0.020 in) long, they are filter feeders that sieve food particles out of the water using a retractable lophophore, a "crown" of tentacles lined with cilia. Most marine species live in tropical waters, but a few occur in oceanic trenches, and others are found in polar waters. One class lives only in a variety of freshwater environments, and a few members of a mostly marine class prefer brackish water. Over 4,000 living species are known. One genus is solitary and the rest colonial. Lower right is *Fenestella*. 
Fossil bryozoan *Archimedes* are from the Mississippian Period. They are about 324 million years old and were found in Crawford County, Indiana. This is a sample of our inventory your fossil bryozoan will be very much like the one pictured here.
Brachiopods are a phylum of marine animals that have hard "valves" (shells) on the upper and lower surfaces. Most species of brachiopod went extinct during the P–T extinction over 250 million years ago, but many survive today.
Brachiopod valves are hinged at the rear end, while the front can be opened for feeding or closed for protection. Articulate brachiopods have toothed hinges and simple opening and closing muscles, while inarticulate brachiopods have untoothed hinges and more complex muscles. In a typical brachiopod a stalk-like pedicle projects from an opening in the hinge or from a hole in the larger valve, attaching the animal to the sea bed but clear of silt that would obstruct the opening.
Brachiopods live only in the sea. Most species avoid locations with strong currents or waves, and typical sites include rocky overhangs, crevices and caves, steep slopes of continental shelves, and in the bottoms of deep oceans. However, some articulate species attach to kelp or in exceptionally sheltered sites in intertidal zones. The smallest living brachiopod, Gwynia, is only about 1 millimeter (0.039 in) long, and lives in gravel.
Over 12,000 fossil species are recognized,[6] grouped into over 5,000 genera. While the largest modern brachiopods are 100 millimeters (3.9 in) long, a few fossils measure up to 200 millimetres (7.9 in) wide. The earliest confirmed brachiopods have been found in the early Cambrian
The inarticulate Lingula is often called a "living fossil", as very similar genera have been all the way back to the Ordovician. Articulate brachiopods representatives have also survived mass extinctions.
At their peak in the Paleozoic the brachiopods were among the most abundant filter-feeders and reef-builders, and occupied other ecological niches, including swimming in the jet-propulsion style of scallops. However, after the Permian–Triassic extinction event, informally known as the "Great Dying", brachiopods recovered only a third of their former diversity.
It was often thought that brachiopods were actually decline in diversity, and that in some way bivalves out-competed them. However, in 1980 Gould and Calloway produced a statistical analysis that concluded that: both brachiopods and bivalves increased all the way from the Paleozoic to modern times, but bivalves increased faster.
Spiriferida is an order of extinct articulate brachiopod fossils which are known for their long hinge-line, which is often the widest part of the shell. In some genera (e.g. Mucrospirifer) it is greatly elongated, giving them a wing-like appearance. They often have a deep fold down the center of the shell.
Spiriferids first appear in the Early Ordovician. They were rare during the Silurian but underwent a dramatic evolutionary radiation during the Devonian period, reaching peak development in variety and numbers. Spiriferida survived the great Permian extinction, finally becoming extinct during the Early Jurassic.
Brachiopods have a lophophore, a crown of tentacles whose cilia (fine hairs) create a water current that enables them to filter food particles out of the water. Some articulate brachiopods also have a brachidium, a calcareous support for the lophophore attached to the inside of the brachial valve.
Permian spinose brachiopod
Phylum Mollusca

- GASTROPODA: Snail
- CEPHALOPODA: Octopus
- AMPHINEURA: Chiton
- BIVALIA: Clam
- SCAPHOPODA: Tooth shell
- MONOPLACOPHORA: Neopilina
Grastopoda
Cephalopoda
NAUTILOID    Cambrian to Recent

GONIATITIC    Devonian to Permian

CERATITIC    Late Permian to Triassic

AMMONITIC    Jurassic and Cretaceous

AMMONOIDS
Straight Nautiloid
Fossil goniatitic ammonoid