

## BRIEF GUIDE TO FOSSILS

### What is a fossil?

- Evidence of ancient life
- Must be 10,000 years old or older
- Fossilization depends upon environment, soil types, availability of hard parts, and size of the organism.
- Very few organisms become fossils.



*Trilobite – Devonian Period*

### How are fossils classified?

There are three different categories of fossils: body fossils, trace fossils, and chemical fossils.

- **Body Fossils:** preserve part or all of the shape, structure and organic makeup of a plant or a terrestrial or marine animal.
- **Trace Fossils:** include coprolites (fossil animal excrement), footprints or trackways, impressions (leaves or tree trunks), trails and burrows (from worms or other burrowing invertebrates), skin impressions, eggshells, and gastroliths (stones swallowed by ancient reptiles and birds).
- **Chemical Fossils:** fossil fuels such as oil (marine plankton), coal (plant material), and gas.

### What type of body fossils occur?

- Unaltered remains. This occurs when decay is halted by extreme conditions. For example: mummies in cold or dry environments, in bogs, or organisms trapped in amber.
- Recrystallization. The fossil organic remains are dissolved in water and then redeposited in the original mold.
- Replacement. Plant or animal remains are dissolved and another mineral seeps into the cavity, replacing the original structure molecule by molecule.
- Petrification (**permineralization**). Usually occurs with bone or wood. Each pore in the material is filled with a mineral (usually agate or jasper).
- Carbonization. The plant or animal is flattened between layers of fine-grained sediment, and most organic molecules are forced out leaving behind only carbon (frequently occurs in fish fossils in shale).
- Molds and casts.



*Fossil Mold – Scallop shell – Cretaceous Period*

### What is the difference between a fossil cast and a fossil mold?

- **Molds** are formed when an animal part or plant is pushed into sediment or mud and the organic matter decays while leaving behind an imprint. Examples are footprints, skin impressions, or molds of shells.
- A **cast** is formed from the imprint (mold) when sediment fills the imprint and becomes solidified into rock.

### What rocks and/or minerals are associated with most fossils?

- Sedimentary rocks.
- The great majority of fossils are of marine invertebrates. Most of these fossils are found in limestone or marine shale.

- Plant fossils, footprints, and fish from rivers or lakes commonly occur in shale produced by river floodplains, lake deposits, or mud flats.
- Vertebrate fossils occasionally occur in terrestrial sandstones, but are more commonly encountered in sandstones or shale produced by river floodplains, lake deposits, or mud flats.
- Petrified (fossilized) wood is created by permineralization or replacement by a mineral. The mineral quartz, usually jasper or agate, commonly replaces the organic wood material to create petrified or fossilized wood. Jasper, opal, chalcedony or even pyrite can sometimes replace shell material of marine invertebrates through the same process.



*Coelophysis skull - Triassic Period*

## Does New Mexico have a state fossil?

- Yes. Coelophysis, the small Triassic Period raptor-type dinosaur, is New Mexico's official state fossil.
- Coelophysis was discovered in 1881, but the first good fossils were found more than 60 years later at Ghost Ranch near Abiquiu, New Mexico, where many complete skeletons have been excavated.

## What are the most common and least common fossils on earth?

- The most common fossils are small single cell marine invertebrates called foraminifera, diatoms, and radiolaria. They are so common that they are the basis for diatomaceous earth used in gardens, and make up the chalk beds of the White Cliffs of Dover.
- Next are multicellular marine invertebrates (shells of clams and brachiopods, coral, crinoids – particularly from the Paleozoic Era). These common marine fossils are frequently used as **index fossils**. Some **trace fossils** (such as worm burrows or tracks) are common.
- However, other trace fossils such as, eggshells or skin impressions, are rare.
- Large vertebrate fossils (reptiles or dinosaurs from the Mesozoic Era and mammals from the Mesozoic and Cenozoic Eras) are very rare compared to invertebrate fossils.

## What is an index fossil?

- A fossil that can be used to identify and date the rock layer in which it is found. Index fossils are used to easily determine the relative stratigraphy of rock layers.
- An index fossil must have distinct characteristics that are easily recognized, have lived within a very short time range, and occur commonly or in great abundance over a broad, even worldwide, geographic range.
- The best index fossils include swimming or floating organisms that evolved rapidly and were distributed widely, such as graptolites and ammonites.



*Ammonite partly replaced by pyrite - Jurassic*

**On the first Monday of each month, when the museum is open, you can bring a fossil for identification.**

**Or...Go to <http://www.nmnaturalhistory.org/exhibits/youth-and-family-programs/mineral-monday-online-edition> for information about sending a photo/description of a fossil to be identified.**

**And when the museum is open, stop by *Fossilworks* to observe our Museum volunteers preparing vertebrate fossils to be added to our collections and used for research or exhibit.**

**For questions about this Brief Guide, contact: Jayne Aubele, Geologist and Educator, New Mexico Museum of Natural History and Science, email: [jayne.aubele@state.nm.us](mailto:jayne.aubele@state.nm.us)**



## FOSSILS IN THE MUSEUM

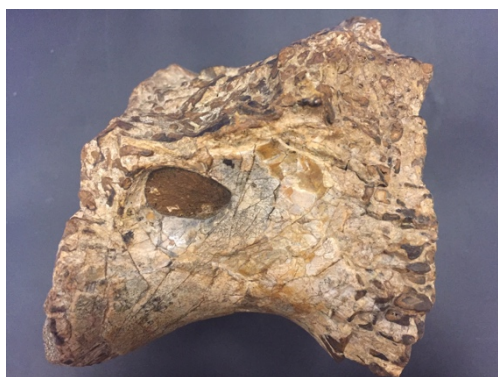
### Are these all real fossils in the Museum?

- Look for the “Certified New Mexico Fossil” symbol on signs in all of the halls. This sign indicates that the specimen is a real fossil found in New Mexico, not a manmade replica.
- There are many real fossils on display; however many large mounted skeletons or very large vertebrate bones in museums are actually man-made casts because the fossilization process, that replaces organic material with rock makes them extremely heavy and difficult to exhibit.



### Where can real fossils be viewed in the Museum?

- Permineralized ammonite (*Placenticerias meeki*) in the *Mineral Gallery*
- Stromatolites (algal mats from the Precambrian) in the *Origins Hall*
- Marine crinoids from the Paleozoic at the end of *Origins Hall*
- Petrified wood in the *Dawn of the Dinosaurs Hall* and in *New Mexico's Seacoast Hall* (both upstairs and downstairs)
- Many vertebrate fossils from dinosaurs, including phytosaur skulls, *Dawn of the Dinosaurs Hall*, seismosaurus vertebrae, *Age of Supergiants Hall*, and pentaceratops skull, *New Mexico's Seacoast Hall*.
- Tracks from the Cretaceous trackway at Clayton Lake State Park in the entry to *New Mexico's Seacoast Hall* and plant (leaf) impressions in shale in *New Mexico's Seacoast Hall*
- Trace fossils from dinosaurs (tracks, skin, eggshells, coprolite) in *New Mexico's Seacoast Hall*
- An assortment of teeth in *New Mexico's Seacoast Hall* (underground) and *New Mexico's Ice Age Hall*
- Sandstone showing a trackway (camel, cat, and antelope) and mammal jaws/skulls – *Evolving Grasslands Hall*
- Camel mounted skeleton in the *New Mexico's Ice Age Hall*
- Orthoceras and ammonites in *NatureWorks* (the rock panels on the side of the cash register counter).
- Fossilworks.
- Short-term and special exhibits.



*Tyrannosaurus vertebra - Cretaceous*

### Fossilworks

- This is both a working laboratory and an exhibit.
- Trained museum volunteers work as “paleo-preparators” to remove and clean fossilized bones from the rock.
- Field teams led by museum paleontology curators, excavate the rock and return it to the museum.
- These specimens will become part of the museum collections and used for future research and exhibit.
- The museum is the official repository for all vertebrate fossils found on federal or state land in N.M.