

SPANISH FLORA AND INVERTEBRATE FOSSIL COLLECTION

INFORMATION SHEET 4 (CASES 29-72)

The Spanish Flora and Invertebrate Fossil Collection contains about 37,200 specimens, of which 7,700 are displayed in 44 cases located in the main hall of the museum. The collection illustrates the palaeontological diversity found in Spain, and is arranged in chronostratigraphic order (i.e. according to successive periods of geological history) from the Cambrian (542 million years ago) to the Pliocene (2.5 million years ago).



CASES 29 AND 30 PALAEOZOIC-CAMBRIAN

The Cambrian witnessed a key event for life on Earth, the "Cambrian explosion". This term refers to the sudden appearance of multicellular organisms, marking an abrupt transition in the fossil record, with the appearance of the more primitive ancestors of many metazoan (multicellular) phyla. The "explosive" appearance of such adaptive variation and diversity is thought to be the result of rapid evolutionary change.

Conocoryphe heberti.
Middle Cambrian (510 million years ago).
Murero (Zaragoza, Spain).
Maximum dimension: 3.2 cm.

A key palaeontological site in Spain for the study of the Cambrian explosion is the locality of Murero (Zaragoza), which is Middle Cambrian in age (510 million years ago). The site has yielded a vast diversity of taxonomic groups, consisting mainly of numerous fossils of trilobite arthropods. However, the remains of brachiopods, echinoderms, molluscs, hyoliths and hydrozoan cnidarians have also been found.

Paradoxides brachyrhachis.
Middle Cambrian (510 million years ago).
Murero (Zaragoza, Spain).
Maximum dimension: 7.5 cm.

The site's importance is further heightened by the exceptional state of preservation presented by soft-bodied organisms that lack skeletons, such as sponges, worms and algae. Case 29 displays organisms other than trilobites that were found at Murero. Sponges are marine animals. This is a small, conical specimen that lived anchored to soft substrates. The fragile Cambrian sponges only fossilised under exceptional conditions. This is the first record of this type of fauna in Europe.

Leptomitus conicus.
Middle Cambrian (510 million years ago).
Murero (Zaragoza, Spain).
Maximum dimension: 2.5 cm.

Case 30 contains a good and varied collection of trilobites from Murero, notable among which are the complete specimens such as *Conocoryphe heberti*. The size of the cranidium of *Paradoxides brachyrhachis* indicates the full size it would have attained, which was larger than that of the other specimens on display.

Acrothele cf. coriacea is a brachiopod, in other words an invertebrate with a shell composed of two valves that lived attached to the substrate.

Acrothele cf. coriacea.
Cámbrico Medio (510 m.a.).
Murero (Zaragoza, Spain).
Dimensión máxima: 0,8 cm.

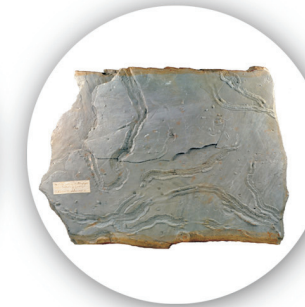
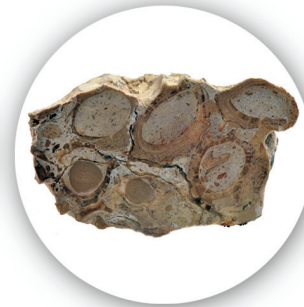
CASE 36 PALAEOZOIC-DEVONIAN

Cases 35, 36 and 37 display several examples from the localities of Arnao (Asturias) and Colle (León). Both are classic sites in the history of palaeontology. They are characterised by the presence of exceptionally well-preserved echinoderms (blastozoans and crinozoans), although trilobites, corals, stromatoporoids, bryozoans, brachiopods and the occasional cephalopod have also been found.

Trybliocrinus flatheanus.
Early Devonian (410 million years ago).
Arnao (Asturias, Spain).
Maximum dimension: 13 cm.

Many of the specimens were collected prior to 1940, and some of them were even studied and deposited by important early 20th century palaeontologists such as Casiano de Prado and Lucas Mallada. Two unique specimens are the calyces of the crinozoans *Trybliocrinus flatheanus* and *Pradocrinus baily*, since these are type specimens used to define both species.

Pradocrinus baily.
Early Devonian (410 million years ago).
Colle (León, Spain).
Maximum dimension: 8.5 cm.



CASES 46 AND 50 MESOZOIC-JURASSIC

Among the cephalopod molluscs, the ammonoids represent a very useful group of fossils since they can be used to define and identify biostratigraphic units throughout the Mesozoic. This is because they present all the necessary characteristics of an index fossil: wide geographical distribution, rapid rate of morphological evolution and abundance. In fact, the definition of Mesozoic biostratigraphic units is based on ammonoids. However, it is the Jurassic system which has been characterised in most detail based on the ammonites, establishing horizons within the different strata that span a period up to about 200,000 years.

Hildoceras bifrons.
Early Jurassic (187 million years ago).
Ricla (Zaragoza, Spain).
Maximum dimension: 4 cm.

Given the geological timescale (the Jurassic lasted for about 70 million years), these horizons are extraordinarily precise. The species *Hildoceras bifrons* and *Perisphinctes (Dichotomoceras) bifurcatus* have been used to establish horizons for the Early and Late Jurassic, respectively, thus dividing this period of time into the *bifrons* and *bifurcatus* zones. Case 46 contains three specimens of *Hildoceras bifrons*, while case 50 displays two specimens of *Perisphinctes bifurcatus*.

Perisphinctes bifurcatus.
Late Jurassic (148 million years ago).
Cazorla (Jaén, Spain).
Maximum dimension: 4 cm.

CASE 61 MESOZOIC-CRETACEOUS

There were numerous reefs in the Cretaceous, but many of them were built not by corals but by rudists. These latter formed a group of bivalve molluscs whose two-part shell was specially adapted to reef environments. The lower shell (valve) was conical and attached to the substrate, while the upper valve was flat, very small, and served as a "lid" covering the valve below. They could measure up to 1 metre high and are always found in large groups forming immense reefs. These dense constructions probably protected them from predators.

Hippurites (Vaccinites) cf. galloprovincialis.
Late Cretaceous (83 million years ago).
Vilanova de Meiá (Lérida, Spain).
Maximum dimension: 24 cm.

There is a good number of this type of bivalve mollusc on display here. The specimen of *Hippurites (Vaccinites) cf. galloprovincialis* indicates the size they could attain. Other specimens are cut crosswise, showing the internal structure. The fossil pictured above shows several specimens joined together, illustrating how they were arranged in a reef.

Bourmonia gardonica.
Late Cretaceous (88 million years ago).
Patones de Arriba (Madrid, Spain).
Maximum dimension: 9 cm.

CASE 62 CENOZOIC-EOCENE

Trace fossils (also known as ichnofossils) from the Eocene flysch at Zumaia-Guetaria (Guipúzcoa). Most of these specimens are of considerable historical and scientific value. The flysch at Zumaia consists of a sequence of alternating layers of limestone, marl and sandstone, whose age spans the Cretaceous to the Eocene. This singular landform represents 50 million years of the history of life on Earth without missing a single chapter. For example, it records the Cretaceous-Tertiary boundary (the K-T boundary) extinction event, during which the dinosaurs and many other species perished due to the impact of a meteorite. It also records the last global warming event, which marks the boundary between the Paleocene and Eocene about 55 million years ago, associated with very high levels of CO₂ in the atmosphere. *Scolicia prisca* is a trace fossil created by echinoids (sea urchins).

Scolicia prisca.
Eocene (46 million years ago).
Zumaia (Guipúzcoa, Spain).
Maximum dimension: 38 cm.

CASE 67 CENOZOIC-MIOCENE

The palaeontological site at Ribesalbes (Castellón) has yielded many fossil remains in an exceptional state of preservation. This locality has been classified as a *Konservat-Lagerstätte* and is characterised by both the type and excellent preservation of the fossils it contains. These kinds of deposit are very scarce throughout the world. This site is composed of a series of marly shales that were deposited in a lacustrine environment, and thus contains the fossilised remains of lake-living organisms such as arthropods (insects and spiders), amphibians and numerous plants. Case 67 contains plant remains. Of particular note is *Celtis* sp., which is the fossil of a branch bearing two fruits.

Celtis sp.
Miocene (20 million years ago).
Ribesalbes (Castellón, Spain).
Maximum dimension: 7 cm.