

409 to 300 million years ago

Devonian and Carboniferous

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1 - Limestone cobble with Devonian fossils

Solland Quarry, near Exbourne

Solland Quarry poses a geological mystery. The fossils in the limestone in the conglomerate are of Middle Devonian age. The only outcrops of Middle Devonian limestone now lie south of the Dartmoor Granite, which formed high ground in Permian times. How did the limestone get into the conglomerate? Possibly there was Middle Devonian limestone north of Dartmoor in the Permian.

2 - Sandstone

Upper Carboniferous
Exeter area

This hard, dark sandstone from the Upper Carboniferous is called greywacke – a corruption of the German grauwacke, meaning grey rock. Layers of greywacke and shale form most of the Carboniferous rocks across central Devon. Greywacke contains a variety of different sand grains in a muddy matrix. It was formed by turbidity currents. These are sea floor currents brought about by the collapse of soft sediments down a slope, like an undersea avalanche. The suspended sediments are eventually redeposited down-slope.

3 - Flute casts on sandstone

Stoke Woods, Exeter

These distinctive structures from the Upper Carboniferous were formed when a fast moving current of water scoured channels in mud on the sea floor.

These were then filled with fine sand as the current slowed.

Flute casts show the direction that water once flowed in.

Hence, geologists are able to tell if the rocks have been folded and whether the sandstone bed is the right way up or turned upside down.

4 - Load casts on sandstone

Stoke Woods, Exeter

Load casts were formed in the Upper Carboniferous when sand fell onto soft mud on the sea floor. As the heavy sand landed on the mud, the mud was squeezed up into the sand, forming bulges and ripples. When the sand became sandstone, these bulges and ripples were preserved in the rock. Load casts always formed on the underside of the sandstone bed.

5 - Limestone

Plymouth

The limestones around Plymouth have been folded, but not fully re-crystallised. Because they can take a high polish they are sometimes referred to as marbles, although they are not strictly marble in the geological sense.

6 - Volcanic tuff

Hurdwick Quarry, Tavistock

Tuff is the name given to hardened volcanic ash. It was formed 290-350 million years ago when volcanic ash fell into water. Greenish Hurdwick stone has been used for centuries as a building stone in the Tavistock area.

7-9 Trilobites

Phacops laevis

Devon

Trilobites are an extinct group of arthropods that were found all over the world. In the Devonian some lived in the shallow waters and reefs of southern Devon. Others occurred in dark grey, deep-water mud that was laid down in the north of the county. Trilobites, like modern woodlice, had a hard exoskeleton with a head, body and tail that easily fossilised. An extensive fossil record was left, which is valuable for correlating rocks worldwide.

10 - Moulds of fossil gastropods and bivalves

North Devon or Somerset

11 - Bivalve cluster

Cucullaea unilateralis

Pilton, Barnstaple

These bivalves probably lived much like modern cockles, burrowing in the silty mud of the sea bed. The actual shells have been dissolved away and their shape is preserved as moulds of the interior and exterior shell surfaces. A transition between the Devonian and Carboniferous occurs in the Pilton Beds.

12 - Fossil lamp shell

Cyrtospirifer verneuili

Delabole Quarry, Cornwall

The old quarrymen named this fossil the Delabole butterfly.

13 - Fossil crinoid

Devonian

Crinoids are marine animals, sometime called 'sea lillies' due to their shape. They are related to sea urchins and starfish.

14-17, 19-20 - Plant roots

From southern Wales and Abbotsham, Devon

Fossil roots such as these were originally described as *Stigmaria ficoides*. They were later shown to belong to a tree-like plant called *Lepidodendron* or the scale tree. Quillworts, the closest modern relatives, look like rushes and have leaves up to 20 cm (8 inches) long.

18 - Impression in sandstone of a fern-like leaf

Archaeopteris hibernica

Kiltorcan Hill, County Kilkenny, Ireland

Archaeopteris, a distant ancestor of modern woody trees, grew around lakes on land now found as rocks in southern Ireland and southern Wales. This land lay to the north of the sea that covered Devon. Land plants became prominent in the later Devonian and plant remains are found in some Cornish Devonian rocks.

21, 24 - Lycophytes or club mosses

Sigillaria species

Radstock coalfield, Somerset

These pieces of giant club moss trunks show the rounded scars from which the leaves grew. Carboniferous club mosses could grow to 30 metres (100 feet) tall.

22, 25-27 - Fossilised fern-like leaves

Wales

Many Carboniferous plants had fern-like leaves.

23 - Fossil plant

Sphenophyllum species

Wales

A slender forest floor-dwelling creeping vine or shrub.

28 - Fossil horsetail

Annularia radiata

Wales

The leaves of this fossil plant form rosette-like shapes. This fossil dates back to the Late Carboniferous, about 299-358 million years ago.

29-59 - Fossil corals

South Devon

Patches of coral reefs grew in the shallow seas of South Devon. The Devonian reefs largely consisted of corals in a variety of shapes and sizes. Stromatoporoids, or sponges, also made up the reef structure. Other reef inhabitants were trilobites, brachiopods and cephalopods.

36 - Fossil coral

Calceola sandalina

South Devon

A coral shaped like a Middle Eastern sandal, giving it its species name sandalina.

60-61 - Fossil fish

Cheiracanthus latus

Grampian, north-east Scotland

The Devonian Period has been called the 'Age of Fishes'. Many species of fish developed at this time. Some of these early fish had no jaws and their skeleton was made of cartilage rather than bone. Cartilage does not fossilise as readily as bone. Some of the earliest fish fossils are known from protective plates, scales and teeth.

62-69 - Goniaticites

Devon

Goniaticites were ancestors of the ammonites and were particularly common in the Devonian and Carboniferous periods. This abundance now makes them important zone fossils, used for defining the relative age of rocks and correlating different rocks of equivalent age.

70-71 - Pearly nautilus

Nautilus pompilius and *Allonautilus scrobiculatus*

South-west Pacific Ocean

These modern genera of nautilus are the most recent of a lineage of nautiloid molluscs extending back nearly 500 million years. They are the closest living relatives of the extinct ammonites, which they resemble with their spiral chambered shell and connecting tube, or siphuncle. The ammonites evolved from them in the Permian, but why they survived the ammonites at the end of the Cretaceous is uncertain.

72 - Report on the Geology of Cornwall, Devon and West Somerset, containing hand-coloured Ordnance Survey map

Henry T. De la Beche

Published 1839

This volume was the first memoir of the Geological Survey of Great Britain (now The British Geological Survey). It was compiled while the Ordnance Survey was revising the topographical maps in the South West. De la Beche (pronounced beech) was employed to 'apply geological lines' to the ordnance maps. Subsequently he became the first director of the Geological Survey.

73 - Siluria

Sir Roderick Impey Murchison

Published 1867

This book describes Murchison's work on the Silurian rocks. Murchison, a former army officer, was a well-to-do amateur geologist who became one of the founders of British geology. One of his major areas of work was in Wales where he studied a group of rocks which he called the Silurian – after the Silures, a pre-Roman Welsh tribe. Murchison later became director of the Geological Survey.

74 - Watercolours used by the Geological Survey

1970s

A lot of fieldwork and surveying goes into the production of geological maps. Part of this work was to make a fair copy of the geological map from field slips. In the past these paper copies were drawn up and hand painted in the winter months. This set of watercolours was used to colour Geological Survey maps. Some of the colours were specially made and named appropriately, for example Granite and Devonian.