# 290 to 208 million years ago

**Permian and Triassic**

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**1 - Fossilised reptile skeleton (rhynchosaur)**

Ladram Bay, near Otterton

Rhynchosaurs were plant-eating reptiles that lived in the semi-arid sandy plains of Triassic Devon, about 220-240 million years ago. They fed on riverside plants, and grew up to one metre in length. These fossils include the back bones, ribs, shoulder blade and the lower left leg of a young rhynchosaur. They had sharp claws for digging for roots and other food.

**2 - Fossilised reptile skull (rhynchosaur)**

Ladram Bay, near Otterton

Dating to about 220-240 million years ago, these reptiles had powerful jaw muscles and rows of small round teeth. A tusk-like bone projected from their upper jaw for digging for roots and other food.

**3-7 - Fossilised amphibians**

Sidmouth

Labyrinthodont and Mastodonsaurus were amphibians with a very flat, triangular skull and a lizard-like body. They lived in lakes and rivers but could survive for short periods on dry land.

3 Labyrinthodont, skull with eye sockets

4 Labyrinthodont, bone and fang

5 Mastodonsaurus, skull fragment

6 Mastodonsaurus, skull fragment

7 Labyrinthodont, skull cast

**8 - Fossilised fish**

*Dipteronotus cyphus*
Sidmouth

This extinct genus of prehistoric freshwater fish lived in lakes and rivers about 235-245 million years ago. The scales and fins are exceptionally well preserved in very fine-grained ancient mud. The skull is missing. Scientists used these particular specimens to more accurately record the species, based on the unique scale ornamentation.

**9-10 - Burrow trace fossils**

Broadclyst

These are the remains of burrows made in soft ground, probably by small reptiles. Later, sand and mud filled them and the shape was preserved as a cast. Trails, footprints and borings, like these, are sometimes the only indicators of past life. They are quite common in the red cliffs of Devon.

**11-15 - Pebbles with fossil shells**

Budleigh Salterton

Some beach pebbles at Budleigh Salterton reveal impressions of fossilised shells and trilobites, about 245 million years old. One shell was named Orthis budleighensis as it was first found at this beach. The fossils originate from Brittany, and the pebbles were brought to Devon by a powerful river millions of years before the English Channel formed.

**16 - Fossil plant fragments**

Sidmouth

This specimen, about 235‑245 million years old, contains impressions of long, narrow leaves. It comes from the cliffs of south-east Devon and is a rare example of a fossil plant from these local rocks. Vegetation here was probably localised and sparse, and the conditions for preservation of organic matter unfavourable.

**17 - Uranium and vanadium nodule**

Budleigh Salterton

The red cliffs on Devon's southern coast hold dark grey, egg‑shaped lumps which contain valuable minerals including vanadium, uranium, native copper and traces of silver.

**18 - Gypsum 'desert rose'**

Modern specimen from Africa

Not all geological processes are slow – sometimes they only take decades. In deserts around the world gypsum quickly forms into bizarre shapes. Underground, the tabular crystals grow in clusters to form 'petals' that led to its name the desert rose.

**19 - Gypsum (calcium sulphate)**

Branscombe

Gypsum was formed in shallow lakes in the desert. Under the hot sun pools of water evaporated, leaving behind a brine rich in minerals like gypsum. The veins of gypsum found in the red mudstone cliffs at Branscombe were extracted in the 19$^{th}$ century for making plaster.

**20-21 - Baryte (barium sulphate)**

Sidmouth

Baryte is a heavy mineral that can be found in the red mudstone cliffs near Sidmouth. It occurs as pale grey crystals inside calcite nodules. It has many modern day uses including as a filler in paint and plastics.

**22-27 - Volcanic lava**

Devon

Stone formed from volcanic lava is common around Exeter. As the hot lava flowed, about 280-290 million years ago, the gas bubbles it contained were squeezed and lengthened. When the lava cooled it formed hard rock around these bubble cavities.

**22 Crediton**

**23 Uton Quarry, near Crediton**

**24 West Sandford, near Crediton**

**25 Columbjohn Wood, Killerton**

**26 Raddon Quarry, Thorverton**

**27 Washfield, Tiverton**

**28-29, 31 - Decorative volcanic lava**

Devon

Some of the red or purple volcanic rocks near Exeter contain decorative clusters, or mazes, of white dots and bands. The white consists of a mineral called calcite. As hot calcium‑bearing fluids soaked the volcanic rocks, crystals of calcite formed in the holes and cracks.

**28 Pocombe Quarry, Exeter**

**29 Killerton, near Broadclyst**

**31 Pocombe Quarry, Exeter**

### 30 - Volcanic minette

Killerton Park Quarry, near Broadclyst
A special type of volcanic rock, called minette, is found at Killerton. Some geologists believe this area is situated on the remnants of an ancient volcano.

### 32 - Breccia

Solland Quarry, Exbourne

About 250-265 million years ago, occasional violent rainstorms washed vast amounts of rock debris from the hills in central Devon onto the flat plains to the north and east. These built up into thick layers full of angular rock fragments. Contained within this rock are clear quartz crystals from Dartmoor granite, pale limestone chips from Torbay, grey pieces of shale, and fragments of red sandstone and purple lava from around Exeter and Crediton.

### 33 - Dressed block of breccia stone

Exeter

Breccia, pronounced ‘brechia’, is prone to weathering, yet was a popular building stone. Quarries opened at Heavitree and Wonford in Exeter around 1350, and operated until the middle of the 19$^{th}$ century. Blocks of breccia can be found in many of Exeter’s parish churches, merchants’ houses, the Guildhall, and Georgian warehouses at the quay.

**34 - A boulder from the Heavitree breccia**

From a water borehole, Exminster

The powerful torrents of storm water which carried the debris to form breccia even carried small boulders like this. It provides an indication of the climate at this time, which was similar to many semi-arid desert regions of the world today.

**35-36 - Dune sandstone**

Dawlish

In the winds of the ancient desert plains tiny grains of sand collided with each other. Gradually their sharp edges were worn away leaving polished, rounded grains. The shape of these rounded grains and the structure of the sandstone beds – resembling modern sand dunes – enable much of the sandstones at Dawlish to be interpreted as fossil sand dunes.

**37 - Cracks in clay**

Sidmouth and Solland Quarry

As mud dries out it shrinks and creates a complicated pattern of cracks, like a puddle drying out in the sunshine. Such ‘suncracks’, dating to about 208-235 million years ago, occur in the cliffs in south-eastern Devon. Geologists know that the rocks were laid down above sea level – a valuable piece of information when indicator fossils are not present.

**38 - Wind-polished stones (ventifacts)**

Devon

Ventifacts are pebbles that are shaped by the force of wind. About 245 million years ago, over a dry plain, strong wind raised millions of sand grains into the air and blew them across the ground. They act like a powerful sandblaster, shaping and polishing the surface of pebbles and boulders.

**39 - Dressed block of Pocombe stone**

Exeter

Volcanic stone from the Exeter area has been quarried for many centuries. It can be seen in structures across the city from the Roman city wall to the exterior of this Victorian museum.

**40 - Dressed block of volcanic stone**

St Nicholas Priory, Exeter

Volcanic stone was used extensively in the medieval walls of St Nicholas Priory.