

The geological heritage of the Copper Coast European Geopark, located on the south east coast of Ireland, reflects the variety of environments, which emplaced over 460 million years.

The rocks illustrate the closure of an ocean, the subsequent volcanism, the collision of two continents leading to the creation of Ireland, the installation of a desert with large rivers' deposits and the effect of the glaciers during the Ice Age.

> Mudstones (sedimentary rock)

Mudstones originated as very fine muds and deposited about 460 million years ago on the floor of a deep ocean, close to the South Pole. Sometimes, pale grey bands, about 2cm wide, are visible within the dark mudstones. These bands reflect the layering of coarser material created as the sediments were deposited.

You can also see another type of layering within the mudstones: a very fine sheeting, along which, rocks similar to these may be split to form slate. This sheeting was created by extreme pressure during the collision of two continents 400 million years ago.

→ Mudstones can be found in Stradbally Cove, Ballyvooney Cove, Knockmahon Strand, Boatstrand Harbour, Benvoy Strand and Kilfarrasy.

> Mudstones



> Andesite (igneous rock)

Andesite is a green coloured, volcanic rock similar in composition to basalt. It forms a very "runny" type of lava, molten at about 800°C. Such lavas are normally extruded in the earliest stages of the formation of a volcano. The rock is rich in iron and magnesium minerals, which give it its green colour. It also contains distinct blobs and veins of a pale yellowish green, calcium and iron rich mineral, epidote, and white to greyish white glassy quartz.

→ Andesite can be found in Stradbally Cove, Ballyvooney Cove (low tide only), east of Ballydwane Bay and at Stage Cove (east end of Bunmahon).



> Andesite (above), Limestone with fossilised shells (below)



> Limestone (sedimentary rock)

Limestone forms in the sea from the accumulation of broken and/or pulverised shells of shellfish. The material slowly accumulates as layer upon layer of lime rich mud, frequently containing complete or broken fragments of shellfish.

The limestone visible along the Copper Coast is an unusual and rare type. It formed under relatively cold water conditions, during a pause between two distinct volcanic eruption events, and it is much older (at about 455 million years old) than the vast areas of limestone ("Carboniferous", 350 to 300 million years old) which underlie much of central Ireland – for example in the Burren region, Counties Clare and Galway, and more locally, along Clonea Strand near Dungarvan.

→ Limestone is best exposed around Dunabrattin Head, and at Lady Elizabeth's Cove, Tramore. It occurs also along Knockmahon Strand and in the western part of Kilfarrasy Strand.

> Rhyolite (igneous rock)

Rhyolite is treacly lava, produced during the "old age" phase of volcanic activity. It solidifies quickly from lava (molten at about 600°C). Much richer in silica than the andesite, it is prone to explosive disruption creating vast clouds of ash and fragments – like Vesuvius or Mt. St Helens.

Rhyolite is usually grey to cream coloured but can also be multicoloured, ranging from raspberry red to orange, yellow and white, reflecting the alteration caused by very hot fluids moving through the rock. The alteration process can change mineral compositions, as well as colours. Here, the various colours reflect oxidation of iron. Alteration is also commonly associated with mineral rich veins and was eagerly sought by old time prospectors and miners as a guide to mineralisation.

→ Rhyolite can be found in Knockmahon Strand, Benvoy Strand, Annewstown, Dunhill and Kilfarrasy Strand.

> Rhyolite



> Red Sandstone and conglomerate (sedimentary rocks)

Sandstone is formed of sand sized particles of rock, quartz and other minerals, deposited on river beds, lake bottoms and sea floors by water currents. Conglomerate is essentially a coarser grained version of sandstone. The rock colours can vary enormously. Here, as in the Comeragh Mountains, and in Counties Cork and Kerry, they are a distinct reddish-brown colour. This reflects a significant amount of iron in the matrix.

Both rock types formed about 380 million years ago when the Copper Coast, along with the Comeraghs and Cork and Kerry, formed part of a desert located near the southern edge of an ancient continent. Large rivers flowed south through the desert with material eroded from an ancient chain of mountains located way to the north of Ireland. The environment was somewhat similar then to that of the modern day River Nile flowing through the Egyptian desert. The material became progressively finer and better rounded as it was ground down during the transport process, and then dumped in vast sheets during flood events.

→ Red sandstone and conglomerate can be found in Ballydwane, Tranamoe (west of Bunmahon) and Stage Cove (east of Bunmahon).

> Red sandstone and conglomerate (left), copper mineralisation (right)



> Copper mineralisation (metal)

The Copper Coast Geopark derives its name from the rich copper deposits discovered and mined extensively during the 19th Century in and around Bunmahon.

The copper mineralisation occurred in the form of extensive, relatively thin, steeply inclined sheets, called "lodes" or "veins". These are composed principally of quartz and variable amounts of the commonest type of copper mineral: chalcopyrite (copper-iron sulphide, CuFeS<sub>2</sub>: copper content 34.5%). Secondary copper minerals - formed by the alteration of chalcopyrite - are common in places: the copper carbonate minerals malachite (bright green) and azurite (bright blue). The age of formation of the veins is uncertain. Different studies suggest ages of pre-410 million years, between 410 to 354 million years or maybe younger: we use an age of 354 million years here.

The bright green and bright blue colours of the secondary copper minerals are well exposed in places in the cliffs along Knockmahon Strand. They are most easily and safely seen in quartz blocks in various buildings around Bunmahon, particularly in the walls of the "Copper Yard" at Stage Cove, and as a conspicuous stain across the lower part of the concrete slipway in Stage Cove.

→ Quartz blocks with copper staining can be found in the walls in Bunmahon (Geological Garden and Stage Cove).