

NATURAL HERITAGE

(2009)

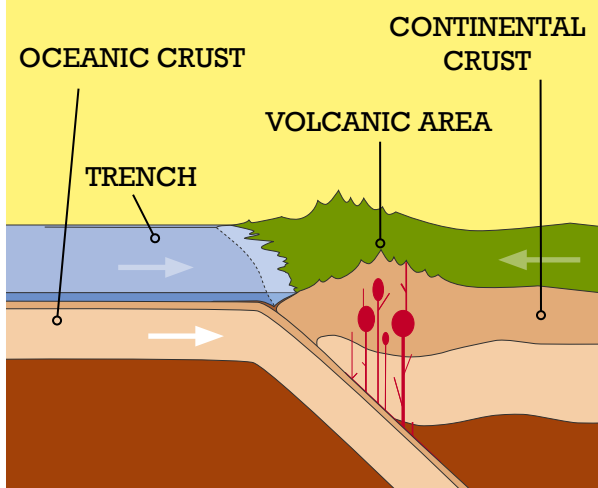
NH 001

The rocks beneath our feet feel so hard and permanent that it is easy to think of Ireland as an island which has existed since the Earth formed in space approximately 4,500 million years ago. But look closer at those very rocks and they tell a tale from the dawn of time; of continents and ocean floors drifting across the globe, of ancient oceans closing over while new seas open and tear land apart, of land rising from the sea only to sink again, of volcanoes covering the land with fire and lava and massive ice sheets scouring mountains into sand. These rocks, formed in many different environments and weathered by a variety of processes, now combine to form the Ireland we see today.

WANDERING CONTINENTS

The structure of the Earth is similar to a plum. The core (the stone) is metallic iron and is surrounded by the mantle (the flesh). This is made of solid rock so hot that it can flow slowly like sticky toffee. The outer rocky surface of the earth is called the crust (the skin). It is broken into a number of plates that float on the mantle below. Convection currents within the mantle slowly circulate the liquid rock below the crust causing the crustal plates to move slowly past each other at 2-4cms per year, about the rate that fingernails grow. This is called plate tectonic movement or drift. New crust is created while older crust is destroyed, or occasionally preserved. The rocks that form the part of the crust that we now call Ireland have travelled across the world in this way. Remember, however, that in the past Ireland has taken many different forms, occasionally disappearing completely below the sea.

CONVERGENT TECTONICS CONTINENTAL/OCEANIC PLATE BOUNDARIES



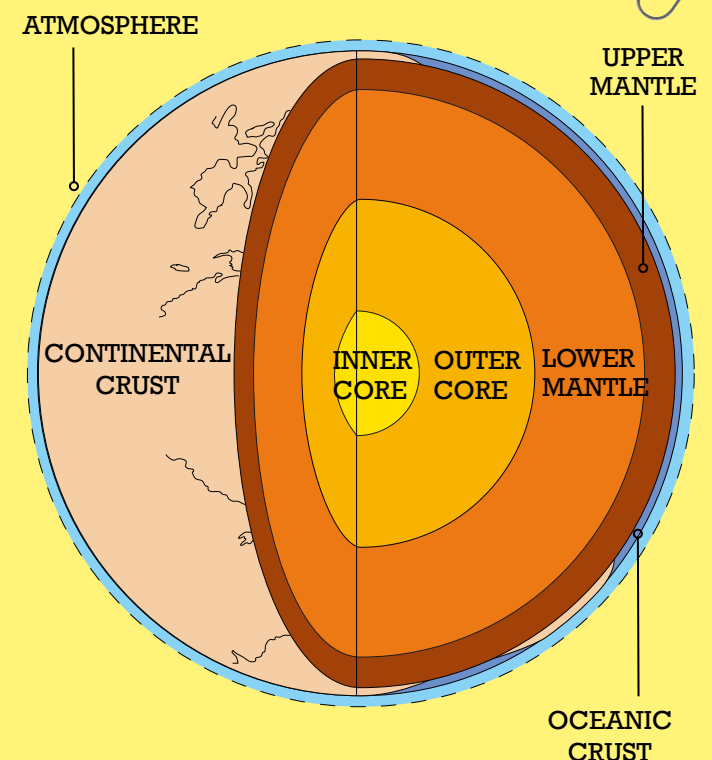
PRE-CAMBRIAN "IRELAND" (pre 570 million years)

During this period of earth's history the rocks that now make up Ireland sat south of the equator where Indonesia is found today. Ireland was split in two: Scotland and the north of Ireland were part of the North American plate, while the south of Ireland and England were part of Europe. In between lay the Iapetus Ocean. Simple organisms and plankton existed only in the sea.

CAMBRIAN "IRELAND" (570-500 million years ago)

The Iapetus Ocean dominates the world at this period. Complex life-forms have developed and are now widespread in the oceans. There are no Cambrian rocks present in Northern Ireland.

THE EARTH'S GEOLOGY



ORDOVICIAN AND SILURIAN "IRELAND" (500-395 million years ago)

The Iapetus Ocean eventually began to shrink as the ancient continents drifted closer. This slow movement generated heat that baked the rocks of the Sperrins and

north-east Antrim into the hard metamorphic rocks we see today. Very gradually the Iapetus Ocean closed completely eventually joining Ireland and Scotland with England. The dark blue/grey sandstone rocks at Grey Point and Crawfordsburn beach contain evidence of the former ocean floor. Such rocks can be found over most of Counties Down and Armagh.

DEVONIAN "IRELAND" (395-345 million years ago)

Ireland was now a small part of a large continent, sitting where Central America sits today. The climate was hot and dry, similar to today's Sahara Desert. The Old Red sandstones found at Cushendun and parts of Tyrone formed during these desert conditions. These rocks contain evidence of ancient rivers and violent desert floods and the occasional volcanic eruption. By now primitive fish had colonised the oceans and lakes. The first plants had appeared on land and were soon followed by insects and spiders.

CARBONIFEROUS "IRELAND" (349-320 million years ago)

By this time Ireland had moved further east and north into tropical latitudes on the equator. A large shallow sea had engulfed most of the original continent. Coral reefs now grew in the shallow waters. The organisms that teemed in these warm tropical seas slowly built up layers of lime mud which together with the corals and other materials eventually formed the limestone uplands of Fermanagh. As sea levels gradually declined, sandstone layers were deposited over the underlying limestone. The lush swampy forests that now developed on the low lying land around the edge of the sea supported giant horsetails, tree ferns and giant club mosses and were home to amphibian-like reptiles and giant dragonflies. The partially decayed remains of these forests formed the coal seams of Coalisland and Ballycastle.



SAND DUNES

PERMIAN AND TRIASSIC "IRELAND" (290-190 million years ago)

Ireland had now moved further north to where the Sahara is today and was enduring desert conditions again. The red sandstone of Strangford Lough and Scrabo Hill are the remains of ancient sand dunes and dried-up lakes. The salt seams beneath Carrickfergus formed when the hot desert sun dried up shallow sea lagoons. Forests of conifers and cycads gradually replaced earlier simple plants and about 200 million years ago reptiles became prolific. Ireland was by now part of a super continent called Pangaea which contained all the continents on Earth. By the end of this period however, Pangaea had started to break up.

JURASSIC AND CRETACEOUS "IRELAND" (190-65 million years ago)

Ireland continued to move north to where Spain sits today. The Atlantic Ocean began to open separating America from Europe. Gradually the new ocean pushed southwards splitting Africa and South America apart. Following a period of mudstone and sandstone formation Ireland was covered by warm shallow seas teeming with life. Microscopic animals thrived and fell to the sea bed to form the white chalks that are now found on the North Antrim coast. Fossils of sea urchins and belemnites, a relative of the squid, are also found in these rocks. Round nodules of flint (a form of quartz) formed in the chalk. This was the age of the dinosaurs. The remains of the first dinosaur to be found in Ireland have been uncovered in east Antrim. About the end of the Cretaceous period many species including the dinosaurs became extinct.

TERTIARY "IRELAND" (65-2 million years ago)

During the Tertiary period mammals flourished and flowering plants replaced earlier more primitive species. The continents were shaped very much as they are today but the Atlantic Ocean was narrower and India had still not joined Asia. Ireland was now further north, roughly on the French Mediterranean coast, and its rocks rose slowly above sea level. Over several million years the surface chalk weathered to a soft rounded landscape covered by a red-brown clay soil with flints. This period was brought to a sudden end by volcanic activity. As Greenland and Europe were wrenched apart by the widening Atlantic, volcanic vents opened across Northern Ireland and smothered the land with lava. The remains of burned soil and vegetation can be seen below the lavas at Belshaw's Quarry Nature Reserve near Lisburn. The basalts of North Antrim are solidified lava flows from this period. In places, notably the Giant's Causeway, the basalts cooled into remarkable columnar forms.

PLATE TECTONICS OVER MILLIONS OF YEARS

EUROPE

NORTH AMERICA

SOUTH AMERICA

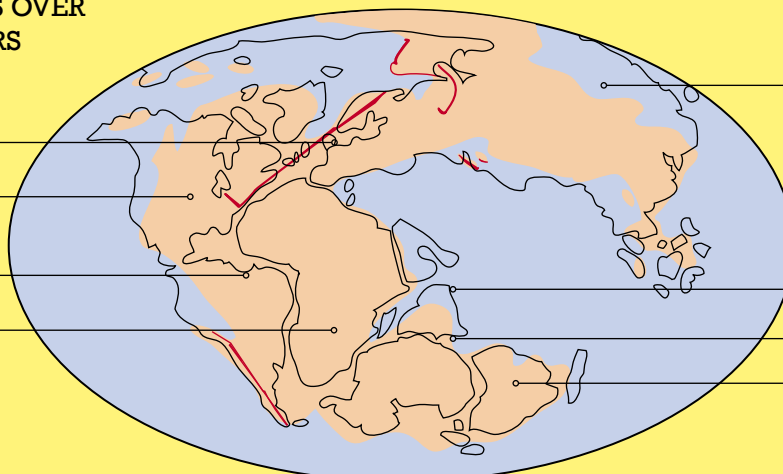
AFRICA

ASIA

INDIA

ANTARTICA

AUSTRALIA



SINUS BOREALIS

SCANDINAVIAN MOUNTAINS

CALEDONIAN MOUNTAINS

APPALACHIAN MOUNTAINS

VEGETATION

ANDES

DESERT

PANGAEA

URAL MOUNTAINS

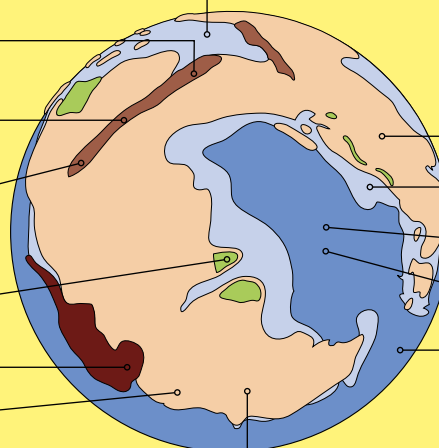
DESERT

CONTINENTAL SHELF

TETHYS SEA

DEEP OCEAN

PACIFIC OCEAN



QUATERNARY "IRELAND" (the last 2 million years)

This is the time of the Ice Ages. As the climate fluctuated Ireland was covered by successive sheets of ice with warm periods in between. Some of the warm periods lasted as long as 90,000 years allowing forests of oak to grow before the next ice sheet swept them away. The slow moving glaciers plucked rocks and gravel from the ground as they passed. Some areas like the Mourne Mountains were sanded by the ice into rounded shapes. Stones, gravels and sands were pushed along in front of the ice to form piles of debris called moraines. Other debris was carried by rivers below the ice to form eskers (long narrow banks of gravel). The glaciers also formed drumlin hills and re-shaped Scrabo Hill in County Down. Huge boulders were carried for miles inside the glaciers only to be dumped when the ice melted. The Butterlump rock on the eastern shore of Strangford Lough came from Scotland.

When the ice left Ireland around 11,000 years ago the land would have looked like the Arctic tundra with grass and sedges, birch and willow trees. As the climate slowly warmed grasses flourished to support herds of Giant Irish Deer whose antlers (up to 3m across) have been found all over Ireland. When the climate cooled for a short time the grasses died and with them went the last of the giant deer. The climate finally warmed 10,000 years ago and has been fairly stable since then. Sea levels after the last ice age were very low as water was still locked up in the ice. For a short time Ireland and England were connected to Europe by land bridges allowing plants and animals to colonise Ireland. As the ice continued to melt sea levels rose and Ireland became an island. Man arrived about 7,000 years ago to find a land covered by oak forests where deer, boar, wolves and bears roamed. The climate now shifted slightly to become wetter and colder. Peatland plants thrived as bogs spilled out from hollows to blanket open land, hillsides and sometimes early farmland and settlements. People began to clear the forests for farmland so beginning the relatively short period of man's influence on the landscape of Ireland.

THE FUTURE OF IRELAND

At present Ireland may be in the early stages of a warm inter-glacial period with the ice sheets poised to return once again, global warming permitting of course. In the longer term Ireland will continue to move over the surface of the earth carried along on the European and Asian tectonic plate. Its future movement will be driven by convection currents inside the mantle until the Earth has cooled and is no longer warm enough to move the continents around. It is impossible to know for sure what the future will hold for the little bit of the earth's crust we call Ireland but the study of the history of our rocks will help us to predict the geological future.

FURTHER INFORMATION

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Geological Maps can be obtained from the Geological Survey of Northern Ireland.

ORGANISATIONS TO CONTACT

1. Geological Survey of Northern Ireland,
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2. Ulster Museum, Botanic Gardens,
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Our aim is to protect, conserve and promote the natural and built environment for the benefit of present and future generations.

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