A QUICK GUIDE TO THE

GEOLOGY OF THE BURREN

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GEOLOGICAL FEATURES OF THE BURREN

The Burren is not just famous for its wildlife, archaeology and rich culture: the so-called 'place of stone' or 'fertile rock' is also renowned for its wonderful geology which features a wide range of glacial and solutional (water worn) features. It is described as one of the best examples of a 'glaciated karst' landscape in the world and it is fascinating at a macro and a micro level.

In 2011 the Burren was awarded the designation of a 'Geopark' in recognition of its rich and varied geology. This new status attests to the importance of the Burren's geology and also the need to protect it. One of the great things about the Burren that over 360 million years of geology is all around us here, making it the perfect outdoor classroom.

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Bedding Plane

The Burren's limestone was laid down during the Carboniferous period, some 340 million years ago. It was formed from the remains of marine organisms which fell to the bottom of this warm, shallow sea. But this limestone was not formed all at once: it was laid down in stages. Between these stages different deposits were laid down – perhaps from ancient rivers washing mud into these tropical seas.

Today, when we look at the slopes of Burren hills we can see the layers of limestone, and we can see much thinner layers between. These horizontal 'bedding planes' are usually between 15 and 50cm thick and are composed of mudstone. This mudstone can be worn away, particularly at coastal sites, causing the bed of limestone above it to collapse.

Drumlin

The Burren is a very diverse landscape geologically. While the limestone rock is dominant, occasional hillocks resembling islands of fertile green land may be seen pasted on hillsides or marooned in a sea of stone. These 'egg shaped' mounds are called drumlins and they were formed by glaciers which, when they melted, dumped the load of material they had gathered when passing over the landscape. Most drumlins have a NE-SW orientation, reflecting the movement of the glaciers.

Drumlins are composed of glacial till - a mixture of soil, sand and stone. A good – but not very deep - layer of clay has formed on these drumlins and this supports a strong growth of vegetation. As a result, these relatively productive and free draining areas have been the focus of agricultural activity for a long time, used to grow crops and fodder as well as rich grazing.

Cave

The Burren contains a very large number of caves. In fact, more caves have been mapped here than in all of the rest of Ireland! Caves are described as either fossil or active. Fossil caves are those which no longer contain water running through them and therefore are no longer actively evolving. Many of the caves of the Burren uplands are fossil; such as those at Kilcorney, Aillwee and Glencurran.

Active caves tend to be concentrated along the shale-limestone interface, particularly in the south-west Burren near Slieve Elva and Poulacapple. Here, rainwater streaming down from the acid surface of the shale hills burns swallow holes into the limestone, then disappearing underground, sculpting and shaping cave systems as they go. Some of these caves run for several miles, many are still unmapped. Caves shapes and sizes are very variable, some are very tall and narrow, others are more rounded.

Chert

In some parts of the Burren, outcrops of a darker, abrasive rock may be seen protruding from the limestone. This rock is called chert (it is called flint when found in chalk areas) and it is composed of a substance called Silica (SiO_2). It is a very hard rock and would have been used in Stone Age times for arrow heads and for cutting.

Chert was formed from the remains of microscopic plankton that lived in the ancient seas. It isn't as soluble as limestone and so it often sticks out above the limestone in small or larger patches. In these cases it can impede drainage and cause hummocks of peat to develop above it. Chert bands may also be seen in bedding planes between the limestone.

Fossil

When walking in the Burren you are walking on an ancient sea bed formed over 300 million years ago when the 'burren' lay just south of the equator and was in fact a warm shallow sea. In fact, when you take a closer look around you can see the remains of the wildlife that lived in these tropical waters. These 'petrified' remains are known as fossils.

Fossils that can be found embedded in the Burren limestone include those of corals, brachiopods (a type of shellfish, an ancestor to the bivalve filter feeders we have today like mussels), gastropods (snails), and crinoids (a relative of starfish). These fossils are a wonderful window to the past. They should not be disturbed or removed.

Glacial Erratic

While much of the Burren is composed of very angular blocks of limestone, in some areas giant round boulders may be seen littering the landscape. These wonderful rocks are age-old migrants to the Burren, brought here by glaciers many Millennia ago. Known as glacial erratics, they are composed of large blocks of limestone – or sometimes granite – which were rounded through abrasion at the base of the glaciers before being dropped as the glaciers melted.

Many of these erratics sit on a small pedestal. This is because the erratic has protected the limestone underneath from dissolution by the acid rainfall, while the limestone all around had been gradually eaten away over time. Many erratics support vegetation in their crevices, small ferns, flowers, even trees! The area around Rockforest in the east Burren is literally a forest of erratics.

Clint

Many people, when asked to describe what they consider a typical Burren landscape will describe sheets of bare limestone separated by long, narrow cracks or fissures. Roughly 18,000ha of 'limestone pavement' are found in the Burren but these pavements are widely variable. The classic pavements are massive or blocky with deep fissures but others are described as 'shattered'.

The classic Burren pavement is composed of blocks of limestone called clints (often referred to as cregs locally) separated by grikes. These blocks vary in size and shape but are usually between one and five square meters. Clints provide a very hostile home to plants – there is little water or soil and temperatures can get very high. In the Burren they were often used for gravestones.

Doline

Dolines are classic features of karst landscapes like the Burren where mildly acidic water has, over millions of years, dissolved the limestone forming different shapes and patterns. Doline is the term used to describe natural depressions or hollows visible on the surface of the land. They vary in size but it is estimated that over 1500 dolines in excess of 100m2 area are found in the Burren!

Dolines are formed either by water dissolving the limestone from above or by a cave collapsing beneath the surface, or indeed by a combination of both. Large dolines such as those found at Clab and on Slieve Carron which are the size of football stadia must have begun to form millions of years ago when acid shales would have covered much of the Burren.

Grike

The classic Burren pavement is composed of blocks of limestone called clints separated by vertical linear fissures known as grikes (known locally as 'scailps'). These grikes are formed by acid rainwater gradually dissolving the limestone along microscopic lines of weakness. These lines of weakness are a result of tectonic forces squeezing and 'cracking' the Burren limestone some 190m years ago.

Grikes vary in length and dimension but some are as deep as 2m and as wide as 8cm. Most grikes run in a (roughly) North-South direction, though this is not always the case. In contrast with clints, grikes provide a cool, shaded habitat for plants and animals and boast an ecology that has more in common with areas of woodland.

Kamenitza

Closer inspection of the Burren limestone reveals a range of micro-solutional features known as Karren, almost like a miniature version of the larger 'karst' features seen in the landscape. Among the most common karren features are kamenitza – small (5-30cm wide) circular hollows in the surface of the rock. These have been formed by water solution.

Kamenitzas are thought to begin forming as a result of the presence of a lichen growing in the rock which absorbs water and which then begins to gradually dissolve the limestone to form the hollow. When rainwater falls on the limestone it gathers in this hollow and sits there until evaporates, all the while eating away at the limestone. Plants – including algae – will often colonise these little 'pockets' assisted by nutrients from goat or hare droppings.

Limestone Pavement

Limestone pavement is one of the most characteristic features of the Burren, composed of blocks or limestone (clints) separated by vertical fissures (grikes). These pavements began to form when glaciers moved over the Burren, stripping back layers of shale and exposing the limestone to the elements. Tectonic forces also played a part, causing microscopic vertical fissures to form.

Over time, rainwater – a natural acid – has painstakingly eaten away at the surface of the limestone to form a wonderful array of karren features, as well as eating vertically through the rock to form the grikes. The Burren is estimated to contain over 18,000ha of limestone pavement, a priority habitat for conservation under the EU Habitats Directive.

Mushroom Stone

Mushroom stones are a curious phenomenon. They are found throughout the country along the edges of water bodies and are formed by the water lapping against the edge of the rock. Over time this process gradually erodes the rock into a 'mushroom-like' form.

What makes these stones so interesting is that many of the water bodies that shaped them have long since disappeared so these stones are almost like 'markers' showing us how the landscape might have looked a long time ago. Some fine examples of mushroom stones can be seen to the east of Loch Gealáin at the base of Mullaghmore mountain and elsewhere in the east Burren.

Polje

A polje is a geological term used to describe a massive natural depression in the landscape formed over many Millennia by water solution. As with dolines, poljes are formed either by water dissolving the limestone from above or by a cave collapsing beneath the surface, or indeed by a combination of both. The fact that poljes are bigger simply reflects the fact that they have taken longer to form.

The Carron polje in the central Burren is a classic example. This massive closed depression is two miles long and over 200 feet deep. It contains a turlough which is thought to be the most elevated in Ireland. The word polje originated in the former Yugoslavia where similar karst features are found.

Runnel

Runnel is the word used to describe channels formed on the surface or along the edges of limestone pavements. They are micro-solutional 'karren' features which are formed as rainwater, which is a mild acid, gradually dissolves the limestone as the rainwater makes its way from the clint surface down into the grike and on out to sea.

Runnels vary in size and often describe a wonderful organic shape as the water wends its way slowly across the pavement, then speeding up as it heads underground, forming more linear runnels as it does so. Older runnels can be very deep and canyon-like and such water worn pavement is, regrettably, coveted by many people for landscaping purposes.

Stalagmite

A stalagmite is a type of speleothem that develops on the floor of a limestone cave due to the dripping of mineralized water which gradually deposits calcium carbonate. The corresponding formation on the ceiling of a cave is known as a stalactite and if these eventually meet they form what's known as a column. Aillwee cave has some good examples of stalagmites.

Stalactite

'Stalactite' comes from a Greek word which means to drip. Limestone is constantly being dissolved by the acid in rainwater. This dissolved limestone makes its way underground and may reach a cave. The air in the cave causes the dissolved calcium carbonate in the limestone to precipitate out and form a stalactite in the ceiling of the cave. Doolin cave has the longest stalactite in the Northern hemisphere: measuring 7.3 metres (23 feet) in length, it was discovered by English pot-holers in 1952 and is now a popular visitor attraction.

Turlough

Turloughs are very special habitats closely associated with limestone regions. These temporary lakes form where a depression in a limestone is intermittently flooded – mainly from groundwater which fills in through underground springs and swallow holes. Across the turlough basin the flooding depth and duration vary widely and there may be some pools of permanent water in the centre.

An estimated 275ha of turloughs are found within the Burren, equating to c.10% of the national total for what is a priority habitat for conservation under the EU Habitats Directive. Many plants and insects found in turloughs are highly specialized to account for their unusual circumstances - being submerged under water for extended periods, then being subject to long dry spells.

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The Burrenbeo Trust is a landscape charity dedicated to connecting all of us to our places and our role in caring for them.

Every place is special, with its own unique natural, built and cultural heritage. All of our places benefit from having an engaged local community to look after them.

To support the work of the Burrenbeo Trust, please become a Burrenbeo Trust member. Your membership will help us to provide programmes focused on education, information provision, active conservation, research and advocacy.

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