Carboniferous Limestone Rock

The following information about Carboniferous Limestone Rock, How it formed and what it is creating as it slowly disappears. It is of interest to everyone, particularly students in primary and secondary schools.

The Carboniferous Limestone rock of the White Peak of Derbyshire is about 350 million years old and made from the limey shells, bones and secretions of marine life. Creatures living in ancient seas obtained calcium from sea water to make their shells, bones, and structures. When these creatures died they sank to the sea floor where they were gradually compressed and cemented together to make limestone rock. Some of these sea creatures retained their shape and we see them as fossils.

The steep sloping front of Treak Cliff was part of a great reef and is very rich in the fossilised remains of sea creatures, some are very rare, others very common, like crinoids, plant-like creatures that lived on the sea bed about 350 million years ago, some crinoids were a few centimetres tall, others much larger, their average size was about a metre high. Crinoids were very easily damaged by wave action so we can see an abundance of broken stems but very rarely complete fossil crinoids.

All this exotic life could only exist in the semi-tropical seas somewhere near the equator. At this time we were a tiny bit of a huge continent. Continental Drift is responsible for us being where we are today. The huge continent including Britain has been drifting northwards for about 350 million years.

Early geologists calculated the Carboniferous Limestone rock in Derbyshire to be about 600 metres thick. In 1971 a borehole was drilled in Stoney Middleton Dale proving the limestone rock to be about 1800 metres thick. There are similar fossils to those already mentioned at that depth. The surface area of the limestone rock in the White Peak is roughly 40 km long x 15 km wide x 1.8km thick, imagine the countless billions of sea creatures that must have lived and died to make this mass of limestone rock.

All the rainwater that falls on Treak Cliff eventually finds its way into little underground streams. This can be observed happening inside some of the caves in Treak Cliff. (Treak Cliff Cavern is an excellent place to experience these things) Inside these caves you can actually see, hear and feel the water dripping from the cavern roof, it disappears somewhere below the floor of the cavern. On its journey from the surface to the cavern this water is continually dissolving the limestone rock and carrying it away.

The limestone rock of the White Peak is very pure, about 98% of it is soluble; the insoluble parts are left behind as clay. Most of the limestone dissolved by the rainwater is near the surface although some solution erosion can continue downwards for several metres.

Where conditions are suitable inside caverns some of the dissolved limestone is deposited and it crystallizes, forming stalactites, stalagmites, flowstone and helictites. The mineral deposited in this way is only a very tiny proportion of the dissolved limestone being carried away by the rainwater.

Where you can, look carefully at the stalactites; one rarely sees water dripping from them, 4 to 7 drops of water an hour is the best rate of dripping to form stalactites. Many of them drip much more slowly hence lots of small stalactites.

In these caverns the average rate of growth of stalactites is about 1 mm every 65 years. Radio Carbon Dating suggests these formations are about 111 thousand years old. Quite “modern” when compared to the limestone rock.

Limestone rock is calcium carbonate, a sedimentary rock soluble in water. Stalactites, stalagmites, cave formations and calcite are minerals, they also are calcium carbonate but not soluble in the same way as limestone. Limestone rock is permeable not porous. Proof of this is easy to see where stalactites are forming. Look at the stalactites and see they are arranged in little rows and not indiscriminately here and there. They are forming where water appears from a tiny crack in the rock and at the correct speed for mineral to be deposited

The very noticeable dripping of water in the caverns varies with rainfall. This water is not stationary long enough to deposit minerals so it does not make any formations. After heavy rain on the surface the rainwater takes from about an hour in a few places and up to several weeks in other places to appear inside some local caverns, this depends on the size of the tiny cracks in the rock the water has to get through.

It has been scientifically calculated that the rainwater falling on about six square miles of the local limestone catchment area continually dissolves away the limestone rock lowering the surface area of the limestone watershed about 30 centimetres every five thousand years. This rainwater eventually finds its way into natural underground drainage systems that come to the surface in Castleton and drains into Peaks Hole Water, Castleton’s River.

Most of the water in this river comes to the surface from the Russet Well and from an opening below Peak Cavern about 300 metres upstream beyond Russet Well. There are several minor streams feeding the river in this area, some of them are only active in very wet weather. Together they are the sources of water forming Peaks Hole Water, the river that runs through

Castleton. Dye tests prove the water from the Treak Cliff area enters Peaks Hole Water about 50 metres above Russet Well on the opposite side of the river.

Peaks Hole Water flows east from Castleton and joins the River Noe at Hope, in turn the Noe joins the River Derwent at Bamford, the Derwent flows south into the River Trent which flows north and joins the River Humber and the Humber flows out into the North Sea. This water takes with it all the dissolved limestone referred to earlier out into the sea where it will be dispersed and can then be recovered by living sea life to make their shells and bones thus completing a huge cycle of nature that started about 350 million years ago.

Think about this, it has taken about 350 million years for the limestone rock to get here from the Equator. If we continue to move north at the same rate, in about 200 million years we will be at the North Pole. But if the limestone rock continues to dissolve away at the current rate it will all be gone long before we get there. The “speed” we are drifting north is about the same rate as the growth of healthy fingernails.

Here is a bit of information that I think is of interest; as already mentioned the White Peak covers an area roughly 40 km long, 15 km wide and 1800 metres thick. Using these measurements and assuming one cubic metre of limestone rock weighs about three tonnes the weight of all this limestone rock is about 3240,000,000,000 tonnes.