Rocks and Stones of Clifford

Phillip Murphy, who was born and raised in Clifford, spoke to members and guests of Clifford Local History Group on 23rd March in the Village Hall Supper Room. Although he used a lot of complicated technical geologist's terms, he explained them all very clearly; better than I can do here, and I suggest you look up anything I haven't explained well on the internet. Fortunately there's lots of relevant information there.

He started by naming the pale stone that most local buildings are built of as Magnesian Limestone, which was deposited in the Permian era, some 248 to 290 million years ago. He showed us a chart of geological history periods which demonstrated how this era fitted in with some of the other incomprehensibly-old periods we have all heard of from time to time. The visual appearance of this magnesian limestone is what causes outsiders to exclaim at the beauty of our village and the others round here (whereas residents are all used to it!). The Houses of Parliament are built from magnesian limestone, but taken from near Doncaster, not from Tadcaster quarries.

Chemically, magnesian limestone is magnesium-calcium carbonate. It dissolves in rainwater but not as quickly as normal limestone (which is calcium carbonate), so the rate of erosion is slower than it might be. It's the same stuff as Dolomite, in the Dolomite mountains of Italy. We were taught at school that limestone is calcium carbonate and we did ask how the magnesium came to be in the limestone but Phillip said that there is still no definite answer as to how the magnesium got in there, only a number of possibilities. One of the difficulties of working out how the magnesium came to be there is that there isn't anywhere in the world where it's currently being made, so we can't watch the process happening.

The local magnesian limestone rock formations also contain Anhydrite (anhydrous calcium sulphate) and Gypsum (calcium sulphate dihydrate), such as was mined at Sherburn in Elmet. These dissolve more easily in water leaving cavities (holes!). This can have serious effects and Phillip showed us some photographs of back gardens of houses in Ripon where huge holes had suddenly appeared. These often occur in farmland and to Phillip's disappointment (as a geologist) they are quickly filled-in by farmers, who quite reasonably want their level field back. Also there are areas of sand, sometimes a special form of sand which is particularly suitable for glass-making, as at Glasshoughton.

The well-known story that 'once upon a time all this area was under a shallow sea' may refer to the Zechstein Basin. Our area was at the very western edge of a sea in this basin, 250 million years ago, which was roughly where the North Sea is now but also extended well into Europe, and east as far as a place called Perm. The local limestone here – and there – is called Permian limestone and that era is called the Permian era. This basin was flooded with seawater on ten separate occasions. As global sea levels rose and fell above/below the lip at the edge of the bowl, so the sea flooded in, or didn't. When the sea wasn't coming into the bowl, the water level dropped through evaporation, and salts from the water were deposited on the floor. These deposits built up over time and resulted in the Permian limestone deposits.

Later tectonic plate movements distorted the underlying rock layers, causing the formation of the Pennine hills, and the layer of limestone which was level on the floor of the Zechstein basin now slopes down to the east. Erosion has reshaped the surface, and we now have the edge of the layer of limestone showing at ground level in a line from Teesside down to Nottinghamshire, passing through Clifford and Tadcaster. The hill as you

go down into Thorner actually is the edge of this layer, and the bowl of Bramham Park lies in a hole in the Permian limestone, revealing the carboniferous layer below. This is why rhododendrons will grow in Bramham Park but not in the natural soil in Clifford. Phillip told us that the Romans were well aware of the properties of limestone as a solid, well-draining base on which they built their main south-north road, which locally followed a line from Castleford through Newton Kyme and north from there..

Phillip described many other geological features including the Middle Permian Marl which is the mud/clay that reaches the surface near Firgreen Beck where the allotments are, and moraines such as that on which York is built.

Limestone is well-known as a porous, well-draining rock. Normally streams on limestone are very short as they tend to disappear into the porous ground, maybe to re-appear somewhere else as a spring, flow along the surface for a while and then fade away again. Under the ground there are a web of fissures in the rock structure that conduct water from point to point, not always in the obvious straight-downhill direction. There exists underground vast quantities of water sitting on top of the impermeable layers beneath the limestone. This is the water that wells and boreholes make available to us. The depth of the surface of this water (called the 'water table') varies depending on climate conditions – and how much various organisations extract for tap-water, brewing, chemical processes, etc. He warned us that the decline in water extraction following the closure of the coal mines and decline in some industries could lead to a rise in the water table and consequent resurgence of springs which have been dry for many years, and which might take some people by surprise.

Phillip explained why dry valleys such as that behind Lairum Rise towards the A1 ('the clinks') exist. These were formed at the end of the last ice age, when the ground was frozen solid and was eroded by glacier meltwater. The ground wasn't porous, being frozen, and the source of the water has now disappeared leaving a dry valley.

Also he described Firgreen Beck as something of an oddity. Given the porous nature of limestone, it would normally be expected that such a stream would disappear into the ground. Phillip's theory for the existence of this stream is that it lies in a valley which is cut so deep into the underlying rock that it is below the water table and all the way along its length it is fed by springs and seepage from the limestone, so that as it travels along it gains water from its surroundings rather than losing water.