than the Chalk). The Greensand's chert content is what makes it hard here, where it forms ridges rising to around 200 metres, given over to woodland because of the steep slopes and acid soils. After burial on the seafloor, the sand became cemented by very finely crystalline silica, called chert, originally from the skeletons of sponges and certain plankton, as well as by calcium carbonate from shells.

The Chalk, being a relatively soft rock, is not found much in buildings where there is an alternative available. However, quarrying was widespread on the downs, as chalk was needed for mortar, agricultural lime and for cob walls. So although by the time you get to **Hindon**, you are back on the Chalk again, the only indication is in the occasional garden wall.

The village street was rebuilt after a fire in the 18th century using Chilmark Stone.

The Wessex Ridgeway, the White Horse Trail, the Monarch's Way, the Macmillan Way….. These are just a few Wiltshire examples of footpaths explored by The Geology Trusts members' landscape & geology guides.

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Explore the Landscape of the Vale of Wardour is available from Shaftesbury Tourist Information Centre, Tisbury Post Office and online from www.thematic-trails.org

Explore the Landscape of the Vale of Wardour

The Building Stones around Wells Cathedral

Elizabeth Devon

Figure 1 Wells Cathedral

As part of 2012 Mendip Rocks, David Rowley who teaches at Wells Cathedral School, gave us a splendid insight into the building materials used around the Cathedral and the Cathedral Green. We met in the lecture room of Wells and Mendip Museum where David introduced 'A story in stone'. He explained that the wide variety of rocks we would see were all derived within 10km or so from Wells and tell a story of environments as different as coral reefs and deserts. All the rocks occurred over a timespan of 250 million years, dating from those of Devonian age (416 million years old) to those of Jurassic age (145 million years old). All the rocks we were about to see are sedimentary, i.e. they are made from sediments weathered and eroded from somewhere else (second-hand rocks) or they formed directly in the sea from the remains of fossils. These sediments become buried, compacted and cemented into hard rock over time. David put some sand grains with a little water into a cut-off plastic syringe and demonstrated how sand grains cannot be cemented together by plain water but when some sort of cement is added (in this case calcium sulfate or plaster of Paris) the result is a hard 'pellet' of rock which can be tested for strength.

Our first stop when we left the Museum was at the wall on the same side as the Museum by Cathedral Green road. We managed to find some pieces of Devonian Old Red Sandstone, easily identified by its deep reddish brown colour caused by iron oxides and manganese. When this rock was deposited 420 million years ago, this part of the Earth's crust was south of the equator in the equivalent latitude of the present-day Kalahari Desert. The sandstones were deposited by seasonal rivers.

As we followed this wall along, westwards, we found evidence for a tropical limestone, the Carboniferous Limestone. This is the dominant rock of the Mendip Hills, seen in Cheddar Gorge and Burrington Combe. The limestone formed in a coral reef when "Wells" (this part of the tectonic plate) was near the Equator about 340 million years ago. We found fossil evidence for these colonial corals, (Lithostrotion).

Before we investigated the rocks of the Cathedral, we looked closely at the paving stones just in front of the west front. These are Pennant Sandstones of Upper Carboniferous age, c 300 million years old, and were deposited in a huge river delta that covered the area at the time. The coal trees were growing on the flood plains of this river system. David passed a piece of muscovite mica around to demonstrate that it splits in one direction but is relatively strong in the other. These sandstones contain flakes of this mica which explain how they split easily into paving stones.

One of the most obvious rocks in the wall, however, is the Dolomitic conglomerate, a rock made of lots of different sized pebbles cemented together. This formed 240 million years ago after the Mendips had recently been uplifted into a mountain range over 2km in height. There were many flash floods in this semi-arid environment and the floods created deep gorges or wadis on the north and south sides of the Mendip mountains. The sediments deposited by the floods contained a great variety of angular fragments of the older rock (Old Red Sandstone and Carboniferous Limestone) eroded from the mountains. The fact that the pebbles are mostly angular indicates that the rivers did not flow very far before their load was deposited. When this rock is cut and polished, it is known locally as 'Draycott Marble'. Marble is metamorphosed limestone so this is not a true marble. It is called 'marble' because it cuts well and takes a good polish.
Yet another rock easy to identify in these walls is the Triassic New Red Sandstone (Mercia Mudstone). When this was deposited, "Wells" was in a latitude equivalent to that of the Sahara desert today. The Mendip mountains had been rapidly eroded by now and thick deposits of muds, silts and sands were deposited, largely burying the existing landscape. The grains are finer than the Devonian Old Red Sandstone and in some of the blocks the rock would be called a mudstone rather than a sandstone. With a piece of sandstone glued to the end of a cut-off syringe, David demonstrated that this rock is porous. He forced water with a bit of washing-up liquid in it through the rock with an excellent bubbly result!


Figure 2: Demonstrating porosity of the rock

Next we searched for the Blue Lias. This rock


Figure 3: Columns on west front of Wells Cathedral

Figure 4: Demonstrating an oolith

formed about 200 million years ago in the seas of the Lower Jurassic. This is a grey/blue coloured, fine-grained limestone, the latter indicating a low energy environment for deposition. We found fossils of bivalves like mussels and oysters preserved in white calcite. Later we identified this limestone again in some of the columns of the west front of the Cathedral, though many have been replaced with the more durable Irish Carboniferous Limestone known as 'Kilkenny Marble'. Like the Draycott Marble, mentioned earlier, this is not a true marble but a hard limestone which takes a good polish.

It was easy to find some examples of Doulting Stone, a variant of the familiar 'Bath Stone'. This is Middle Jurassic and about 165 million years old. It stands out because of its rich, golden yellow colour and, of course, it is the main building stone of Wells Cathedral (figure 1). Doulting is a village 10km SE of Wells. David used the example shown in figure 4 to explain oolith formation.

The ooliths are formed by concentric layers of calcium carbonate which have been precipitated from the sea water by minute algae, around a tiny grain or shell fragment. The grains are constantly rolled back and forth in highly-agitated, strongly-evaporating, shallow sea water, resulting in a structure like an aniseed ball. When the grains are too heavy to be supported by the currents, they are deposited and accumulate on the sea bed to eventually become compacted and cemented to form the limestone. Ooliths are forming off the Bahamas and Indonesia today, so we know what sort of environment existed in "Wells" 165 million years ago. Although there were no crowds or traffic jams, there were flying reptiles, enormous dinosaurs and

Stone (Inferior Oolite). When the Doulting quarries were under the control of Glastonbury Abbey in the 1100s, Chilcote Stone was used as an alternative to Doulting Stone. It is a local Lower Jurassic pebbly sea-shore limestone and is easy to identify in the cathedral by its pock-marked surface.

Figure 5: Doulting and Chilcote Stones

The last rock to be identified was the Purbeck 'Marble'. Again this is not a true marble but a very fossiliferous limestone. It comes from the Upper Jurassic and is about 140 million years old. It is packed with the freshwater snail (gastropod), Viviparus. It was seen in some of the columns in the west front and quire of the Cathedral.

We spent part of the afternoon with Jerry Sampson, Wells Cathedral architect. The Cathedral's West Front forms the most important gallery of 13th-century carving in northern Europe outside France. The earliest Gothic building in Britain, it has an important palce in architectural history. The major conservation programme, carried out 1974-1986, pioneered techniques of conservation for the preservation of the almost 300 medieval sculptures of the west front.

Many thanks to David Rowley for his clear descriptions, entertaining demonstrations and very useful guide, much used in the writing of this article.

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