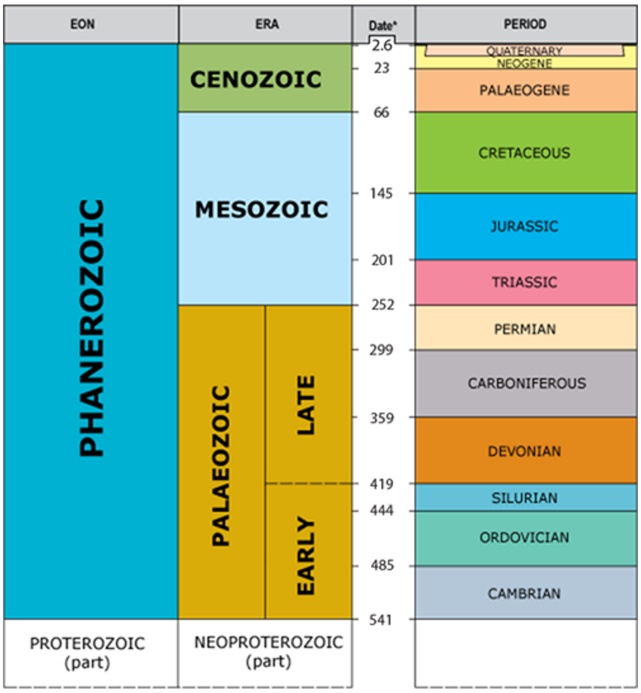
Wells U3A Geology Group Talk
Whirr we'm to, tectonically speaking.

When we are out on our field trips and discussing the various rock formations, Chris and Doug will say (for example): 'When this sediment was laid down, Somerset would have been somewhere like Cairns, Australia or the Atacama Desert, Chile. But sitting here on a chilly February day that seems a little difficult to take in. So how did we get here and, since this is Somerset, Whirr be we'm to? Tectonically, that is.

Like all the best stories this one starts a long time ago: 700 million years ago, give or take a few million years.

When the Earth had formed, early processes began which settled into a geological pattern. This consisted of the creation of rocks which were then eroded away; then the resultant debris was re-formed into new rocks. At this time, Somerset was scattered all over the place, waiting to come together; it just snoozed away in the background.



Of the time we can read the record of, Somerset actually missed the first 300 million years. The Pre-Cambrian, the Cambrian and the Ordovician Periods meant nothing; Somerset slumbered on….

….until in the Silurian Period some 444 to 416 million years ago there was a Big Bang and we woke up to a volcano in our backyard. And thus Stoke St Michael was built. But where was Somerset located? As far as we can work out most of the land masses were collected around the south polar area with some parts edging out towards the equator.
We were a long way south – at least 30degrees south. Somewhere nearby there could have been a clash between our tectonic plate and one or more other plates with the resultant volcanism.

From studies of the andesite around Stoke St Michael and Beacon Hill it would appear our volcano was surrounded by a shallow sea. The deposits which we can still see are a mixture of andesitic lavas and compacted volcanic ash called tuff. The tuffs comprise coarse, brecciated, broken-up rocks and show that the eruptions were very explosive in nature. Pillow lavas have also been found so they must have been erupted into water.

After this episode Somerset went back to sleep, the volcano was subjected to weathering and erosion and our tectonic plate started drifting northward towards the equator. From the data we can derive from the rocks we can only determine the north/south movement. At present we cannot work out any east/west travel. With all the different plates exerting pressure in different directions, there will have been some east/west movement but not that we can prove.

Sleepiness lasted around 30 MY and Somerset drifted steadily towards the equatorial regions and towards another landmass that contained Scotland. We collided and have been stuck with them since.

This collision of plates pushed up a huge mountain range in what is now Wales, Northern England and Scotland. From these mountains flowed large rivers full of erosional material that was deposited all over the now southern England. Somerset was in a massive delta area in an arid desert environment which had a number of seasonal/meandering rivers. Somerset became covered in large deposits of sandstones and mudstones. Huge amounts of material could be deposited in a single event such as a monsoon flood, which could move debris of all shapes and sizes. Evidence of these delta deposits we found at Beacon Hill.

During this phase Somerset would have been about fifteen degrees south of the equator and would therefore have experienced similar conditions to those found in the present Sahara or North Chilean Deserts, but with a Mississippi river running through.

This may sound strange but the Sahara has two permanent rivers, the Nile and the Niger, but satellite imagery has located another three ancient river systems, one more than 500 kilometres long.

These Devonian sandstones now form the core of the Mendips and if you head south-west to the other side of Somerset, the rocks of the Quantocks and the Brendon Hills are also from the Devonian period. If you go even further west, guess where these rocks were first studied and named?

Somerset continued its rush north towards the equator and did not go to sleep for its next adventure. Doug likes to go snorkelling and Somerset's next stop brought us to areas similar to the Bahamas, although first we had to get a bit muddy. Either our plate took a dive underwater or the sea levels rose, but whichever, Somerset got wet and the first deposits brought with this sea was mud. It was a shallow sea and the early mudstones turned to limestones as the sea became more calcite rich. We saw this earliest limestone measure at the top of the side gulley in Burrington Combe, where some of the muddier bands were very laminated. All of these rocks are now called the Avon Group.

Gradually, as the calcification increased, the rocks that were deposited are more pure limestone and formed massive beds mostly of reef limestone. As time passed, the chemical composition changed and the fossils left in the rocks also changed. Slight differences occurred, which give us the blackrock limestone, Burrington oolite, Clifton Down limestone, and Oxwich Head limestone. We walked through all of these beds on our return to Burrington car park and we have found them in practically every field trip in various guises. This is not surprising as they are the predominant rock of the Mendips.

These limestones are massive and it took a long time to deposit them so our northerly drift either slowed down or possibly we moved sideways or even backwards. Towards the end of this period things change and erosion deposits coming into the sea became sandy and beds of quarzitic sandstone appeared. It was not all bathing heaven because on the edges of the sea were river deltas which in these lovely warm conditions were a paradise for plants which grew in abundance.

Periodically, these jungly deltas were flooded by the sea. This made it very swampy and much vegetation fell into to water that was largely anoxic which was ideal for turning the dead plant material into peat beds. With successive floodings, these peat beds became covered with material that formed various rocks but the peat eventually became coal. We have come close to these deposits on our visits but they are not easily seen because most of the workable coal is in the north of the county.

Somerset spent about 60MY basking in this balmy seascape during which time it travelled from roughly 5degrees south to 5degrees north of the equator. Proto-Africa was getting jealous and wanted the easy life so gate crashed the party and sent us flying northward again with a gert thump in our rear (well, France's actually). Somerset received the Variscan orogeny aftershock and our lovely pristine horizontal limestone was bent upwards and produced a line of mountains about 1500 metres high. This (to quote Doug) put us nearer to Bristol but at least the height of the mountains made difficult to get there which cannot be said of the remnants we call the Mendips.

This thump also propelled us into the Permian Period and away from the equator, but still in hottish conditions. Our Mendip mountains are a large craggy upland and for the next 42 MY they were subjected to a great deal of erosion. Most of the debris was washed away and is now being converted into new rocks out on the continental plains off the end of Cornwall and beyond. This erosion continued unabated into the Triassic Period but we do have some remains of the debris to see.

We remained in the sub-tropical region about 20degrees north and Somerset became a desert landscape again. The Mendips continued to be eroded and scree slopes cascaded down the sides of the mountains, flash floods moved boulders and scree further down the slopes and onto the desert floor. Some of these screes were later infilled with mineral deposits and formed what we now call Dolomitic Conglomerate, which we saw in situ at Draycott and in the form of building stone and gateposts in Wells.

Towards the end of the Triassic our northerly drift continued, but once again we went underwater, or rather the slopes of the Mendips were submerged while the tops of the mountains formed a string of islands leading away from Wales. In the sea, the eroded material from the island peaks were deposited as a series of mudstones. We saw evidence of this change at Nibs Hanging.
The colour of the rocks went from red to green to grey, which showed the transgression of the sea over the land until Somerset was completely under water. Eventually, these seas became shallow and deposited organic material which gave us the dark mudstones and limestones of the Penarth Group. Sometimes these seas or lakes dried up altogether, leaving thick layers of salty deposits similar to halites or barytes.

Still awake, Somerset slipped into the Jurassic period. It was still heading towards 30degrees north and began to cool down a little although we were still swimming. In these seas rubbly limestones were deposited nearer the coast and in deeper waters the beds of lias were being laid down. On our trip to Croscombe and Shepton we found these two rock types only a few kilometres apart.

Towards the end of the Jurassic Somerset was about 35degrees north of the equator and even the Mendips went swimming. But the seas had powerful currents which scoured large areas of the remaining Mendips. We saw these erosional surfaces at Vallis Vale and Tedbury camp. When the seas calmed down, these surfaces became a home for oysters and marine organisms which bored into the rocks leaving traces we can still see today.

The seas became shallow again and not so vigorous allowing an oolitic limestone to be deposited on top of the erosion surface. Thus the Inferior Oolite forms an unconformity with the underlying Carboniferous Limestone since they were laid down with a time gap of 170 MY. We saw this clearly at Tedbury and Vallis. Other deposits of this age were accumulated at Doulting and give us the lovely building stone much used in this area. Once again, different conditions could be found only a few miles apart which gave variations of rock formation.

The geological history of the Mendips for the remainder of the Jurassic and the following Cretaceous period is poorly known, as any rocks that formed during this time have since been removed by erosion.
It is assumed that the region was deeply buried beneath marine sediments with a brief return to land in the early Cretaceous. The final exposure of the Mendip hills from beneath the mask of younger rocks has probably only occurred within the last few million years.
Most of the final shaping of the Somerset landscape may have been carried out by melt waters from the ice sheets from the last couple of ice ages. While all of this last phase played out, Somerset's tectonic plate slowly moved further north until it reached its current position at 51° north of the equator.
Additional notes for Geology talk February.
From a point raised on the last field trip. The environmental conditions throughout the various geological periods were not static and would have been completely different from those we see today.
We are seeing changes in our lifetime but we still think of them being static. But every parameter that determines the environment is variable and every minor change can trigger a large scale event somewhere further down the chain. But that is another afternoon’s talk. Ocean currents would be vastly different from ours today but they still have an effect on how the atmosphere and weather behave, which could mean much larger storms than those we currently see, even the tropical storms.
Add to this the earth was spinning faster so shorter days and higher Coriolis Effect. The moon was closer which gave higher, stronger tides and more than two per day. The ocean's chemical balance was different; with more/less oxygen once it became available, variable concentrations of salts washing into tidal/non-tidal sea basins.
The atmosphere also had differing compositions and was not so effective a shield against solar radiation. So, there are a lot of variations and many if’s and but’s. That again is a talk for another time.
With storms of a larger magnitude than we are used to, huge amounts of sediment could be transported and deposited in a short space of time. We have seen some evidence of this on our field trips. To compare an example of today’s largest river, the Amazon, it is estimated that its annual sedimentary load is 1.2 billion tons of sediment, most of which is in the rainy season.

Stephen 1st March 2019
If you are interested in more detail of the underlined sites above, read our field reports.