From Jurassic to Carboniferous

Elizabeth Devon

Since we moved from Wiltshire to Northumberland, we have visited one exciting geological site after another. It was fortunate that I already knew one geologist in the area quite well. We both taught A level geology and she was as involved in her local geology in Yorkshire as I was in the Bath/Wiltshire areas. She moved to Berwick upon Tweed many years ago now and has become very familiar with the geology of this area. She introduced me to other geologists and very kindly included me in the 'Berwick Geology Project'. In November 2015, Helen Page, a physicist and enthusiastic amateur geologist, published a book, `Northumberland Coast Rocks!' This is described as 'interesting geological things to look out for on seashore walks between Holy Island and Alnmouth'. Because of the popularity of
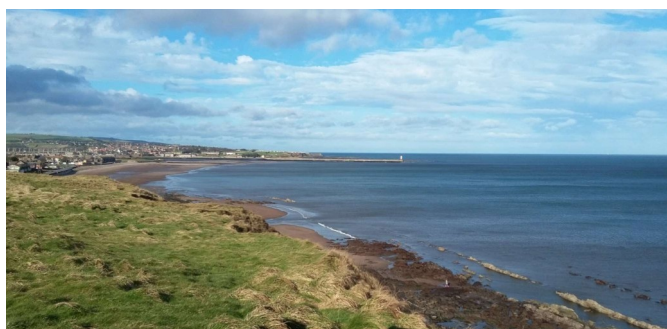

Fig 1: *View from the cliff top at Hud's Head towards Berwick*

this book, Helen was persuaded to write another book of similar walks north of Holy Island, from Cocklawburn to Cove; this is due to be published in time for Christmas. I was involved in the site visits and planning of this book and it could not have been better as the locations are on the stretch of coast that is closest to us, Cocklawburn being only about 20 minutes away.

On one of the first expeditions I went on, I saw rocks from the most wonderfully clear Carboniferous cyclothem at Hud's Head, Spittal, just south of Berwick. The whole series of different rocks indicating the different environments can be seen. The sands, muds and silts represent the large river channels with mobile sand bars and alluvial plains upon which the Carbonifer-

Fig 2: *Corals near Hud's Head*

Fig 3: *Head Stripey sandstones near Hud's Head*

ous forests grew. A coal seam can be seen clearly together with the seat-earth (the soil). The sea then came in over the area and became deep enough for corals to flourish. This must have happened quite quickly as the limestone with corals can be seen directly on top of the coal. When the sea deepened further, mud was deposited but when the sea retreated, the area was once more dominated by rivers depositing a variety of sand, silt and mud again. The cycle then starts again with the alluvial plains upon which the forests grew. These conditions cycled lots of times (cyclothem) as a result of glacials (sea level low) and interglacials (sea level high) and the enormous delta (like the Mississippi) changing shape.

My contribution to the book will be to produce Earthcaches for the different sites. Geocaching is like a treasure hunt where you search for physical containers using GPS, often solving clues along the route. An Earthcache is similar but there is no container, just a series of questions which the cachers must answer before they can log the find. Earthcaches are always at places of geological or geomor-

phological interest and they can be found all over the world. I had set twelve before we moved north and now have set two up here. One of them is Carboniferous Cycles (described above) and the other is round the headland and is called Hud's Head Quarry Quest. Anyone can play; just log in,

Fig 4: *Contact between Whin dolerite and Carboniferous shales*

search for Earthcaches and start.

https://www.geocaching.com/play,

Another site with a high wow factor is on Lindisfarne or Holy Island. First of all you

Fig 5:*Nautiloid Orthoceras and brachiopods, Carboniferous shales*

Fig 6: *Trilobite, Carboniferous Shales*

Fig 7: *Columnar jointing in Borthwick Quarry, Duns*

have to wait for low tide in order to cross the Causeway. The cliff at the back of the beach near St. Cuthbert's Island is part of the Whin Sill igneous complex and is a dolerite dyke.

About 295 million years ago, towards the end of the Carboniferous, east-west compression against the Cheviot block created minor anticlines and synclines. The movement allowed the emplacement of the magma which cooled and crystallised to form the dyke. It is the most northerly of the four late Carboniferous doleritic dykes of northern England which belong to the Whin Sill suite. The dyke forced its way into Carboniferous shales and, of course, baked them as it did so. You can see the most amazing baked margin here in the shale. I was last here with some primary school children and a geologist friend. My friend produced a piece of bread from his bag and then a piece of toast. He asked the children what had happened to change the bread to toast. He then produced a piece of very burnt toast and asked the same question.

They could see that the bread had changed both in colour and consistency. He then showed them the cooked shale and how it changed towards the dolerite. Good analogy! Away from the influence of the igneous rock, you can find beautiful fossils in the shale; lots of brachiopods and crinoid ossicles which are known locally as St. Cuthbert's beads. The children also found a few of the nautiloid, *Orthoceras* and just one tiny trilobite. A third site worthy of special mention is Borthwick Quarry, Duns. It is privately owned but we should like to secure it geconservation site. The columnar jointing in the basalt/dolerite rivals the

Giant's Causeway in Northern Ireland.

The Edinburgh Geological Society is a very active one and produces lots of very good leaflets which you can download free of charge.

http://www.edinburdhgeolsoc.orq/publications/deoconservation-leaflets/

Amongst these free publications is one for the famous Siccar Point, described by James Hutton. The St. Abbs leaflet was produced this summer and was written by my geologist teacher friend.

http://edinburdhqeolsoc.ord/downloads/lbdc-leaflet-st-abbs.pdf

It's excellent and I thoroughly recommend the walk with the leaflet to hand.

As you can tell from the above, we are extremely fortunate to have moved from one beautiful area to another and I hope I shall be able to welcome members of the Bath Geological Society in the future. The geology is fabulous!

Fig 8: *Goswick beach, as empty as the roads!*

Marine and fluvial erosion and deposition can be studied easily here.