North Eastern Geological Society

Newsletter October, 2015

UPCOMING EVENTS

Lecture: 20th November Dr. Rick Smith FWS Consultants: The recent polyhalite discoveries in North Yorkshire

And

OUGS Northumbria field trip: November 7th **Cowshill** : Meet: 10.00 a.m. Car Park off A689 on lane heading north immediately to east of bridge at Burtreeford. (NY 856406).

FIELD TRIP REPORTS

Saltwick Bay to Whitby 19th Sep. 2015

Leader: John Waring

It was a bright, sunny and warm day when seven members met at Whitby Abbey car park at 11.30 am. Since low water was not until 2.15 pm the party walked over to the Abbey headland for a panoramic view of Whitby and the coast stretching as far as Kettleness where the sequence of rocks to be examined were briefly described.

This was followed by a leisurely walk to Saltwick Bay along the cliff top path, in places uncomfortably close to the cliff edge due to coastal erosion. Before descending to the beach (Saltwick Hole, a preglacial river channel) the leader pointed out the main features to be examined. While on the beach one of the members took us to the large boulder which, according to the late Dr. M. Whyte, contained upside down casts of sauropod prints.

The wave cut platform, (Bituminous Shales of the Mulgrave Shale Member) containing pyritised harpoceratid ammonites and the bivalve Pseudomytiloides, was also examined before proceeding to the wave washed reef, formed by the almost circular "Millstones" consisting of a tough limestone overlying the Jet Rock itself.

Casts of Sauropod prints above left and below right.

Discussion ensued as to how the limestones, proved by the acid test, were formed. The leader also mentioned how the high total organic content of the bituminous shales had led to research which demonstrated a major extinction event caused by orbitally forced global warming. This resulted in an anoxic environment caused by the release of methane hydrates. Remains of the alum industry were also pointed out.

The party then proceeded westerly across the Nab to the "Ovatum Band", a double row of concretions, some supposedly containing the ammonite Ovaticeras, which conventionally marks the transition from the top of the Mulgrave Shale to the overlying Alum Shale Member. Most of the concretions were conspicuous by their absence, leaving only circular depressions!

Saltwick Nab: breaking waves mark the "Millstones" overlying Top Jet Dogger.

During the traverse, belemnites were observed and it was here that the leader had just explained how groups of them could sometimes be observed with the points (rostra) facing roughly the same direction when one of the group immediately discovered this phenomenon; i.e. a current directed shell-lag or death assemblage (thanatocoenosis).

Due to time and tide, the party then moved on to where the Dogger Formation, a sideritic sandstone with a basal conglomerate, forms a conspicuous westerly dipping shelf. It unconformably overlies the Alum Shale Member; the whole of the Peak Mudstone, Foxcliff Siltstone Members and the Blea Wyke Sandstone Formation are missing. No one seems to know if erosion was subaerial or submarine. Unfortunately, masses of seaweed prevented a close examination. Instead, a photo was shown of U shaped tubes descending from the unconformable base of the Dogger Formation into the underlying Alum Shale Member. The burrowing creatures, probably Diplocraterion or Thalassinoides, could indicate that the Alum Shale Member was not completely consolidated prior to deposition of the Dogger Formation.

Burrow descending from the Dogger Fn. into the Alum Shale Member

A thin section photograph of the Dogger showing poorly sorted quartz grains set in a fine grained matrix of siderite was also examined and discussed.

The party then moved on to where there were fallen blocks of sandstone with carbonised remains, the sight of the Whitby Plant bed. Unfortunately, time and tide did not permit a search for plant remains.

A little towards the west a large channel sandstone, which almost completely washes out the underlying Dogger Formation, was demonstrated as having easterly dipping cross bedding, i.e. lateral accretion cross sets. They are interpreted as point bar deposits and indicate that the meander was migrating in an easterly direction.

Channel sandstone with easterly dipping cross sets

A little further to the west the so called Cement Shales were observed underlying the Dogger Fn. They are named as such because of their abundant calcareous concretions which in some localities were used for making cement.

With the tide beginning to rapidly come in the party briskly continued towards the East Pier, but finding the time to discover occasional squashed dactylioceratids and the abundant small bivalve Dacryomaya ovum, (Q. Nuculana ovum), the fossil which Lewis Hunton (1814 -1838) the Alum manufacturer used as an indicator for the best type of shale for the Alum making process.

On reaching the East Pier the Whitby Fault which roughly follows the course of the river, was demonstrated by the contrast between the evenly layered Saltwick Formation rocks on the east side of the river and those on the west which consist of multi-storey channel sandstones. It was also observed how the Dogger Formation is 12 metres above sea level east of the pier and approximately at sea level immediately west of the pier.

Footnote:

An unsuccessful attempt was made to find this fossil, discovered on a previous visit, on the wave cut platform (Mulgrave Shale Member) immediately east of Saltwick Nab. It is roughly 20cm in diameter. Probably the ammonite Phylloceras heterphyllum. Cf. British Mesozoic Fossils, pp.106-7.

Thanks to John Waring for this report and pictures.

Knock Fell: Pennine Escarpment. 26th Sep 2015

Leader: Dr. Eric Johnson

The Pennine escarpment defines the western margin of the Alston Block and comprises up to 500 metres of Carboniferous rocks that were deposited over an interval of ~12 million years. The rock succession is split into four major groups that record changes in the depositional environments with time (Table 1).

The main purpose of the excursion is to investigate the different Carboniferous rock groups and changes in their depositional environments. Other features of geological interest such as the Whin Sill, mineralisation, former mining activity and karst features will also be seen on the excursion.

The Carboniferous rocks rest on a foundation of deformed Ordovician and Silurian rocks, parts of the Skiddaw Group, Borrowdale Volcanic Group and Windermere Supergroup named after their main outcrops in the Lake District. The groups also crop out along the foot of the Pennine escarpment in the 20 kilometre long x 2 kilometre wide mostly fault bounded Cross Fell Inlier.

The excursion starts at the sheep pens by the side of the Dun Fell Road [NY697 296]. It follows a footpath alongside the enclosure wall southeast, close to the sub-Carboniferous unconformity, until it meets the Pennine Way and Swindale Beck. The Pennine Way is then followed for 3kilometres to the north east onto Knock Fell with diversions into Swindale Beck to look at the geology. The footpath continues northwards and after 1.5 kilometres joins the Dun Fell road that leads down back to the start, a distance of 3 kilometres.

Age (Ma)	Time interval	Rock Group	Sedimentary Environment
327	Namurian	Stainmore	Deltaic
331	Brigantian	Alston	Cyclical marine/deltaic
336	Asbian	Great Scar Limestone	Marine carbonate platform
~340	Holkerian	Orton Group	Fluvial

Table 1 Summary of Carboniferous rock groups and geological time intervals

Locality 1: Sink Beck [NY 698 292] Glacial deposits and Lower Palaeozoic rocks

The stream has eroded through the glacial till deposit into the underlying Great Scar Limestone Group. The pale coloured limestones form rough beds from 0.5 to 1 metre thick. Although they are made up of calcareous sand-grade material derived from marine organisms they contain very few large fossils apart from crinoid fragments.

The view to the southeast includes several conical hills that lie within the Lower Palaeozoic Cross Fell Inlier. The two most prominent hills, Knock Pike and Dufton Pike, comprise high-grade welded tuff that is part of the Borrowdale Volcanic Group.

The rocks in the inlier lie within the Pennine Fault system and are much faulted due to several compressional and extensional displacements and reactivations from Ordovician times onwards.

Locality 2: Swindale Beck [NY703 286] The Carboniferous marine transgression

In a meander scar on the north bank of Swindale Beck bed rock is exposed beneath glacial deposits. At the base of the section, siltstones that are part of the Orton Group are exposed. The siltstones do not contain any marine fossils and are thought to have deposited in a freshwater alluvial setting. Higher up the section, thin beds of limestone are interbedded in the siltstone succession and reflect the first marine influences in Carboniferous deposition on the Alston Block.

The limestone beds increase in thickness and become more abundant up the succession as more open marine conditions prevailed with

time. The boundary between the Orton and overlying Great Scar Limestone group is not exposed in the stream section. However, higher up on the north bank of the stream scars of thick bedded limestone are present. They are typical of the Great Scar Limestone Group are pale in colour reflecting their high purity (>95% Ca CO^3). They comprise mostly coarse grained carbonate sand (calcarerite grainstone and packstone) that is locally cross bedded and was deposited in a high energy environment on a carbonate platform. In places the limestones have a mottled appearance due to bioturbation by soft bodied animals. A few fossil corals and brachiopods are present in the limestone.

The thick beds of limestones are also pseudobrecciated and have a rubbly appearance. The apparently fragmental texture is a result of the limestone recrystallizing in situ during low-stands in sea-level when the carbonate platforms sediments were exposed to meteoric rainwater. Above the scars the thick-bedded limestones form a broad flat bench; similar features can be seen on the south side of Swindale Beck.

Locality 3: Pennine Way [NY703 287] Great Scar Limestone Group – Alston Group boundary

Following the Pennine Way northeast uphill the footpath crosses several small grass covered bench features. Weathered blocks of limestone are present in the benches. A detailed examination of the limestones reveals that they are dark grey fine-grained calcite siltstone and mudstone (calcisiltite/calcilutite). The change in limestone type marks the Great Scar Limestone – Alston Group boundary marks and the onset of the cyclical succession of limestones and deltaic sedimentary rocks. It also reflects a change in the depositional environment from an open high-energy carbonate shelf to a lower energy one into which finer grained clastic sediments are being introduced.

The change is more evident where the Pennine way climbs steeply across the first substantial sandstone in the local Alston Group Succession, the 15metre thick Smiddy Ganister. The sandstone outcrop is very broken as a result of freeze-thaw action under periglacial conditions that followed the last glaciation. The sandstone blocks show a variety of features such as planar bedding, crossbedding and ripples that indicate deposition in a shallow water deltaic environment.

Locality 4: Pennine Way Cairn [NY705288]. Landscape and mineral exploration features.

The sandstone escarpment next to the cairn provides a good vantage point to view some of local landscape features and evidence of former mining activity.

Looking south, the Great Scar Limestone forms prominent cliffs on the south side of Swindale Beck. A line of small sink or shake holes and a single large one is present in the top of the limestone. Eastwards, the straight line of a hush can be seen on Low Scald Fell. The hush runs diagonally across the contours indicating that it is a man-made feature rather than a natural one. The hush was used to search for mineral veins in the past, Water was diverted to run down the hush to strip away topsoil and expose the bed rock and any mineral veins.

Locality 5: Shake Hole [NY709 291] Limestone karst feature

A large sink/shake hole is present between the Pennine Way and Swindale Beck. It is about 50metres in diameter and 30metres deep. The size is incongruous with the

underlying Alston Group geology. The Tyne Bottom Limestone is seven metres thick, overlain by silty mudstone and underlain by the Whin Sill, i.e. unfavourable conditions for large scale cave formation to accommodate the amount of material removed from the sinkhole. A possible solution to the inconsistency is the ESE trending fault shown on the 1:25 000 scale geological map. The sinkhole is situated above the fault which may have provided pathway for the movement of groundwater and any debris that it carried.

Locality 6: Swindale Beck NY 710 291 Whin Sill

Next to the Shake Hole the Whin Sill is exposed in Swindale Beck. It has been intruded between sandstones at the top of the Jew Limestone cyclothem and the Tynebottom Limestone.

The basal contact is well exposed and can be examined in both banks of the beck. The upper contact is seen further upstream, high up on the south bank. The sill is much weathered along the cooling joints. The concentric style of weathering is often referred to as onion skin weathering and is a common feature of iron-rich igneous rocks when they are oxidised.

Locality 7: Knock Hush [NY712 292] Mineral exploration

The Pennine Way turns northeast and follows the course of Knock Hush that was created in the past search for minerals. A look at the 1:25 000-scale OS map shows that the hush runs diagonally across the contours indicating that it is man-made rather than natural. After 200 metres or so the hush intersects a natural stream course. Here an embankment has been constructed to divert water into the hush and the dry course of the stream is evident on the west side of the hush. Further on The Scar Limestone and overlying sandstone are exposed in the side of the hush. The hush can be traced through peat covered ground built to a disused dam [NY715 297] that was used to control the operation. The dam embankment and stone work around the sluice gate are still visible.

Locality 8: Green Fell Springs [NY718 299] Alston Group - Stainmore Group (Visean – Namurian) boundary

Numerous springs issue from the base of the Great Limestone which defines the base of the Stainmore Group and the start of the Namurian time interval. The limestone represents the last major episode of marine deposition before deltaic conditions became dominant. The boundary is also defined by a marked change in vegetation. Heather and

sedges grow on the poorly drained siltstones and sandstone whilst short grasses flourish on the limestone.

Locality 9: Knock Old Man [NY720 301] Deltaic sedimentation

The first sandstone in the Stainmore Group forms the summit area of Knock Fell. Freeze-thaw conditions that were most intense when periglacial conditions prevailed after the last glaciation have broken the sandstone up into an extensive block field.

The sandstone blocks contain sedimentary structure such as cross lamination, ripple marks and scours that indicate deposition in a shallow water delta-top environment. In places the sandstone contains fragments of tree roots named Stigmaria that indicate the delta top must have been emergent long enough to allow vegetation cover to grow.

Locality 10: The Heights [NY719306]. Former mining.

Two circular spoil tips associated with bell-pit workings are present on the west side of the Pennine Way footpath. The 1:25 000 scale geological map reveals that the southern bell pit has been sunk on an east-west fault that contains a galena baryte vein. A little rusty weathering vein material and baryte are present on joint surfaces in the limestone spoil. There is no evidence of any mineralisation in the spoil tip of the northern spoil tip, only blocks the underlying Great Limestone.

Maps

OS 1:25 000 Explorer Series Sheet OL 31. North Pennines:Teesdale and Weardale.

OS 1:50 000 Landranger Series Sheet 91 Appleby

Geological Maps

BGS 1:25 000 Geological Special Sheet. Cross Fell Inlier

BGS 1:50 000 Geological Sheet 25 Alston

BGS 1:50 000 Geological Sheet 31 Brough under Stainmore

References

Dunham K C 1990 Geology of the Northern Pennine Orefield. Volume 1 Tyne to Stainmore. Second Edition. *Economic Memoir of the British Geological Survey.* London HMSO

Stone et al 2010 *British Regional Geology: Northern England (Fifth Edition).* Keyworth Nottingham: British Geological Survey

Comprehensive reference lists are included in these publications

Thanks to Eric Johnson for this report and for leading a most interesting Field Visit.

LECTURE AND FIELD TRIP PROGRAMMES

Lecture dates for 2015/16

18th December **Members Evening**

1. Les Barnes

The Isle of Purbeck; a geologist's paradise.

2. Members Night Rocks

.....you are invited to bring along a maximum of two specimens (photographs or hand specimens). Each would need a label with a description of the character of the specimen and its value, and most importantly, your name on the reverse.

3. Speaker TBA

15th January 2016

Dr. Edward Dempsey, Durham University

Minding your P's & Qs's: Using **p**yrite, **p**yrrhotite, **q**uartz and **q**uartzine to understand the origin of the North Pennines orefield.

19th February, 2016

Dr. Brian Young, Durham University

Mapping it out: William Smith 200 years on

18th March, 2016 AGM followed by

Prof. Mike Bentley, Durham University

Antarctic ice sheets and climate change

NEWS AND LOCAL EVENTS

Dates for your diary

April 2nd 2016. **NEGS** Geolab

September 10th 2016 **NEGS** at Heritage Open Days

NATIONAL EVENTS

March 5th, 2016 The Oxford Colloquium

[From Oxford geology Group]

Another amazing line-up of speakers will address topical and key issues in the world of geology and the Earth sciences. This year's speakers - including scientist and author, Professor Chris Stringer - will cover a range of subjects from volcanology to human evolution, and from hydrocarbons to the interpretation of buried landscapes.

Tickets for The Oxford Colloquium 2016 are the same price as last year, an extremely reasonable £20 and must be purchased in advance. See the OGG website for full details of the speakers and abstracts of their talks -

http://www.ogg.uk.com/#!the-oxford-colloquium-2016/c8qx

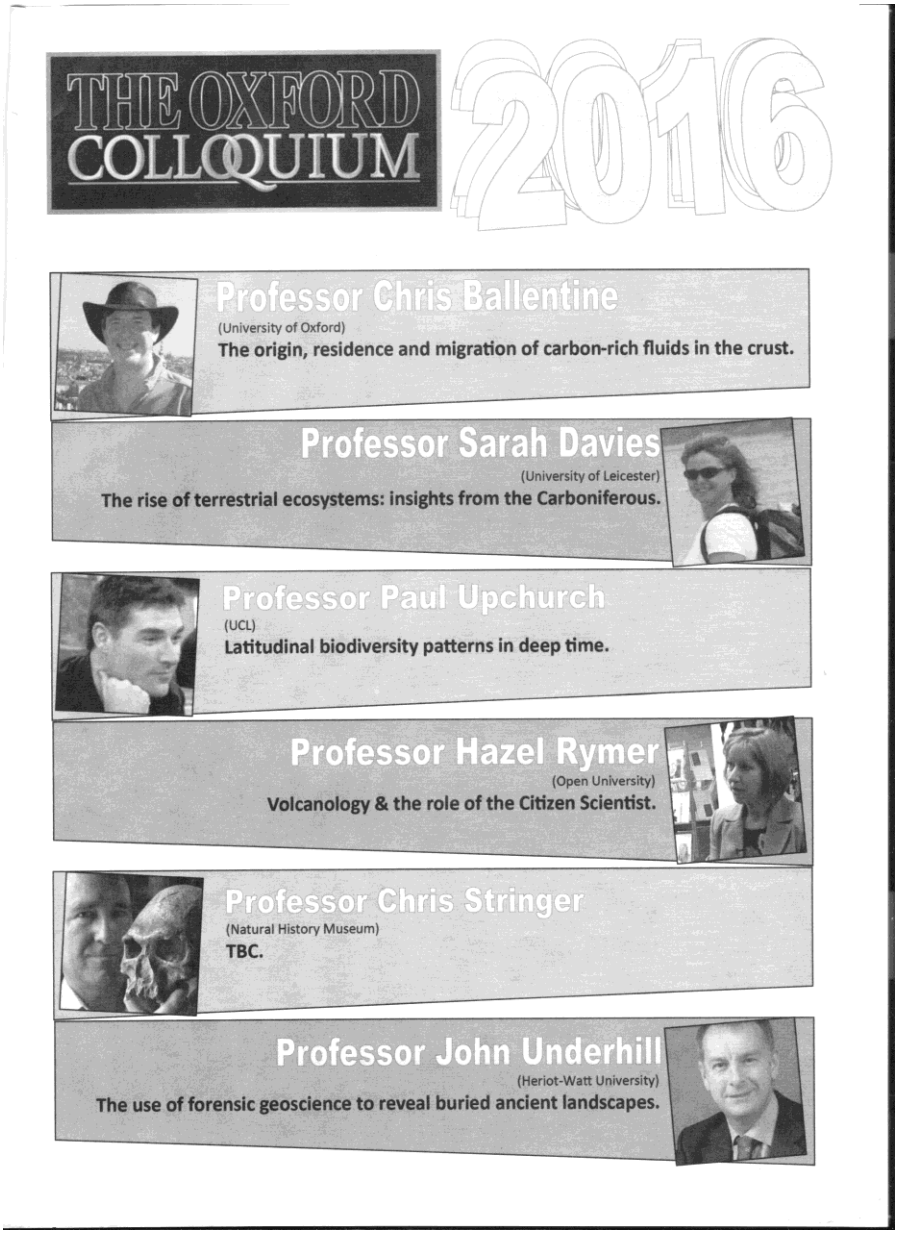
More .....

The website also provides a link to Oxford Geology Group's on-line, secure ticket purchasing facility provided by Eventbrite. This year all tickets must be purchased by this method

Please note that Oxford Geology Group will also be organising a 1-day Geo-ramble on the day (Sunday 6 March 2016) after the Colloquium. Details of this event will be advertised via EventBrite later in the year. There will be a discount of 10% on prices for the Geo-ramble for any group booking more than 10 places.

Secretary: I intend to go to this event (got my ticket at this year'scolloquium) and will be driving down and staying in a motel, taking the excellent 'Park and Ride' in to the natural History Museum (worth a visit in itself). Anyone wishing to car-share is most welcome to contact me.

negsec@gmail.com



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