North Eastern Geological Society

Newsletter October 2019

Upcoming events

The Lecture series for the winter starts on Friday 18th October, at the Arthur Holmes Lecture theatre in Durham University. More information at https://www.negs.org.uk/winter-events

18th October 2019

Dr Matthew Funnell, Durham University

Beneath the waves: how physics is used to develop our understanding of the world at the bottom of the oceans and beyond

22nd November 2019

Dr Christopher Saville, Durham University.
Subject to be confirmed**.**

13th December 2019

Members Evening
Geological 'show-and-tell'

Do you have a geological object that has a humorous or interesting story behind it? Then you are invited to bring it along with you to Members Night to talk about it to the group. We would like members to give a short informal one to two-minute talk about their chosen object and the member with the most interesting object, as voted by those present, will win a prize courtesy of the committee.

The object you bring might be your trusty geological hammer that's been with you all over the globe, or a fascinating rock, gem or fossil specimen that you collected from somewhere exotic; or maybe it's the map you produced or the compass clinometer that you used to produce it.

Whatever it might be, please bring it along to share its story with the group.

There will be one formal talk of 20 minutes **Christine Taylor.**

The Comrie igneous complex

…….and the rest of the evening is up to you. The usual Xmas buffet will be available.

--Everyone welcome—

17th January 2020

Dr Julie Prytulak, Durham University

50 years of discovery by drilling oceanic crust

21st February 2020

Dr John Nudds, University of Manchester.
Archaeopteryx

(Members may remember the excellent talk from Dr Nudds in January 2015 on Chinese Dinosaur Embryos from the Henan Province PRC)

20th March 2020

Dr Helen Adamson, Newcastle University.

The effects of blanket bog restoration techniques on vegetation.

FIELD TRIP / LECTURE REPORTS

Trow Point, Marsden and Byer's Hole. 7th July

Members joined Karl Egeland-Eriksen (NOUGS) who has provided his notes for the visit.

The Magnesian Limestone of the Durham coast formed on the shallow submarine slopes near the western margin of the Zechstein Sea during the last 5-7 Ma of the Permian. Repeated drying out and flooding of the basin resulted in a sequence of five major carbonate formations separated by insoluble residues of former salts (halite and anhydrite). Fracturing and foundering of the overlying carbonate rocks occurred as a result of dissolution of the salts.

The coastline between Trow Point and Byer's Hole exposes the lowest two carbonate cycles, namely the Raisby Formation (EZ1) and the Concretionary Limestone Formation (EZ2). The headland at Trow Point exposes a number of important features associated with the lowest Zechstein cycles. At the base of the cliff are undisturbed beds of the Raisby Formation (EZ1). They are composed of low-dipping, fine-grained, thinly bedded, buff dolostone.

Above the lower beds is an assemblage of large, tilted or contorted masses of fine-grained, thin- to medium-bedded buff dolostone. This is up to 15m thick on the north and west sides of Trow Point but consists of only a single 0.8m bed of vuggy dolostone on the south side. The discordant contact with the undisturbed beds below is quite apparent. The upper portion of the Raisby Formation is interpreted as an olistostrome.

Olistrostome sitting on undisturbed beds

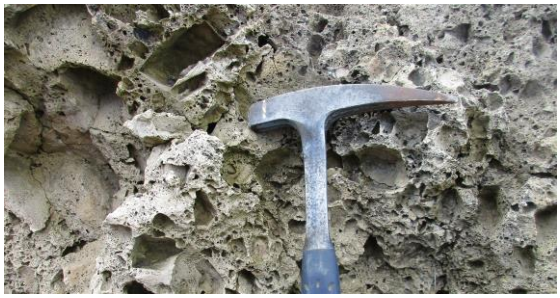
It was produced by a large, downslope submarine slide (known as the 'Downhill Slide') of unstable carbonate sediment near the end of the Raisby Formation time. The slide plane is of regional extent; the slump involved much of the formation from Blyth to Seaham with over 100 million cubic metres of partly lithified mud moved downslope towards the basin.

The surface of the olistostrome is covered by a grey oolitic and oncolitic dolomite with radial arrays of stromatolites. This bed is known as the Trow Point Bed and extends towards Germany and Poland. This deposit would have formed slowly in water of moderate depth with very little sediment input.

The uppermost bed of the Raisby Formation is a thin dolomitic, partly laminated, sandy clay. This is the residue of the evaporites formed at the end of the EZ1 cycle when the Zechstein was drying up. Meteoric water (?Early Tertiary) has dissolved out the anhydrite leaving this thin deposit known as the Hartlepool Anhydrite Residue.

Thin Hartlepool anhydrite residue

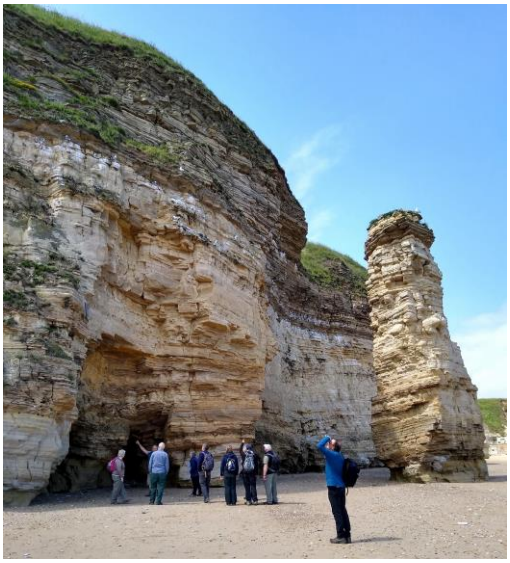
The top of the cliff at Trow Point is composed of rocks of the Concretionary Limestone Formation (EZ2 cycle). It is a breccia of mainly dedolomitised limestone. The rectilinear fragments are often laminated and are cemented in a partial matrix of microcrystalline calcite. Many of the clasts have been dissolved out leaving a 'negative' breccia.



"Negative" Breccia

The formation was deposited in a low-mid basin-margin slope zone and has become foundered and brecciated as a result of the dissolution of the Hartlepool Anhydrite.

Towards the south end of Marsden Bay, opposite the narrow stack known as Lot's Wife, the cliffs are formed of 16-20m of cream and buff fine-grained dolostone of the Concretionary Limestone Formation (EZ2).



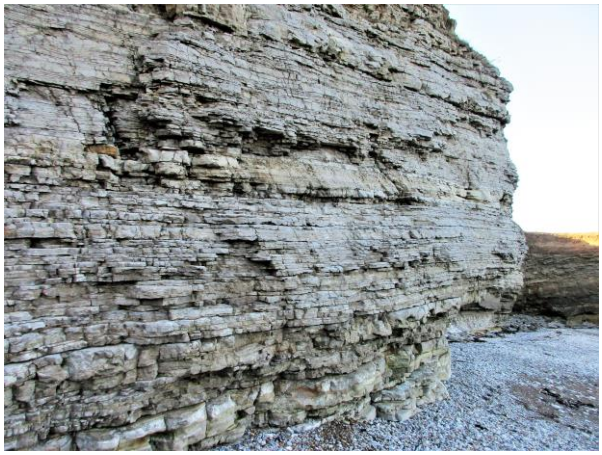
"Lot's Wife"

There is much evidence of foundering caused by the dissolution of the underlying evaporites. Although the thickness of evaporite that has been removed would have been similar throughout the region, the extent of foundering varies greatly. Some beds show little dislocation having been let down gently. Others are intensely fractured into what are known as 'breccia-gashes' and 'pipes'.

"Breccia gash" or "pipe"

Close inspection shows the rock to be a mixture of finely laminated and unlaminated beds of fine-grained buff dolostone. Many of the beds are graded and some have tight folds and shear-planes caused by downslope slumping and sliding. The rocks were probably formed on the low-middle part of the basin-margin slope, in anoxic conditions under 120-200m of stratified sea water. The laminites are built up of couplets (?annual) of pelagic lime mud (winter) and phytoplankton (summer). The graded beds are probably turbidites composed of lime mud and silt originally deposited in oxygenated shallower water on the shelf or higher on the slope.

At Byer's Hole the cliffs exceed 10m in height but decrease in height southwards. Magnesian Limestone strata in the cliffs and shore platforms here belong to the middle and upper parts of the Concretionary Limestone Formation and, despite having foundered by at least 100 m through the dissolution of the Hartlepool Anhydrite, are mainly structurally simple and only locally collapse-brecciated.



Cliffs at Byer's Hole

The cliffs are mainly composed of a laterally variable, interbedded sequence of unlaminated and laminated thin-bedded grey limestone, grey and brown spherulitic limestone and lenticular to relatively persistent thick beds of cream finely crystalline to powdery dolomite.

The lateral variability of these strata is expressed in several ways, including the proportion of calcite spherulites and thin calcite lenses present and in changes of bed thickness.

Changing bed thicknesses

Analyses of grey limestones from nearby Byer's Quarry show that they are amongst the purest limestones in the area, with calcium carbonate contents ranging from 96.94 to 98.04% (three analyses); an interbedded brown friable bed had a calculated composition of 93.2% of dolomite and 5.8% of calcite.

Karl Egeland-Eriksen

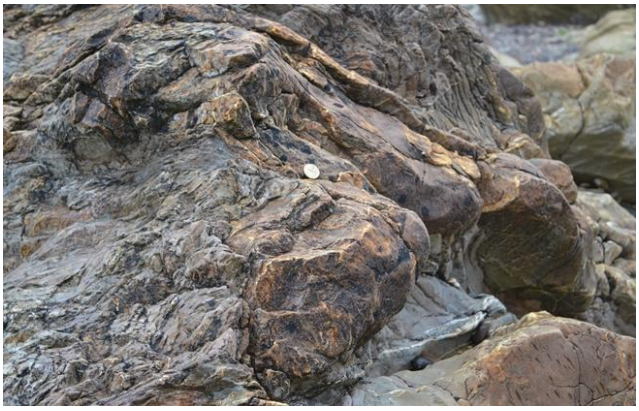
Coldingham and Linkim Beds

3rd August 2019

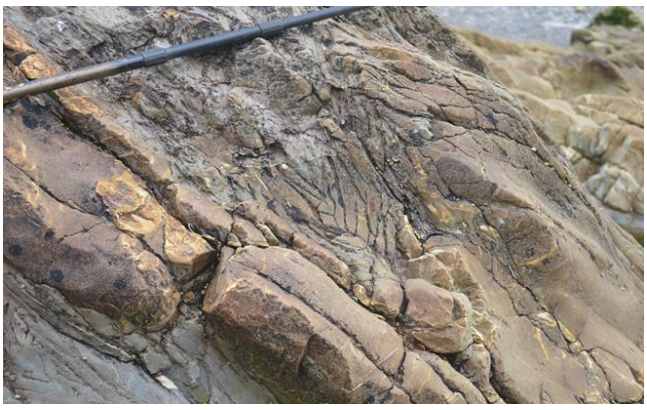
A dozen members joined Louis Golightley at Coldingham Sands on August 3 to explore the Coldingham and Linkim beds exposed on the coast.

The area is a picturesque location with excellent water sports/ beach fun. Our group was introduced to the area by Louis using the BGS solid map, it revealed the fault-bounded inlier structure of Silurian [Wenlock age (c.433-427 Ma)] material surrounded by Devonian rocks. Louis explained how the area lies at the northeast of the Accretionary Prism created as the Avalonian plate subducted beneath Laurentia. The subduction process scraped material, collected in trench type conditions, with subsequent compression, produced much structural deformation of the young Silurian greywackes and shales. Louis provided extensive summary graphics illustrating the probable sequence of events, these supported the excellent notes on the geology of the area that had introduced the area to members. The main features of the excursion are the highly disrupted Coldingham beds to the North and the more regular, but inverted, Linkim beds to the South.

Moving onto the beach the severe distortion of the sediments [soft sediment deformation] was easily recognised together with the characteristic greywacke shale sequences that revealed that the area had collected vast quantities of turbidity materials. Various localities were studied to help the members to appreciate the evidence supporting the interpretation of the processes that had taken place during Silurian times.



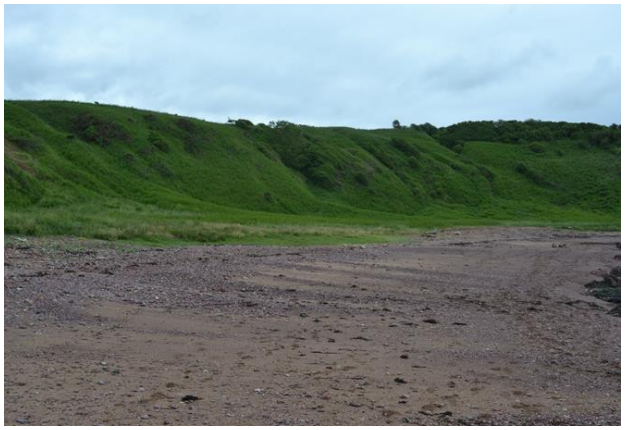
Highly distorted Turbidite unit, south of Milldown point



Chevron folding in Coldingham turbidite at Milldown point

Behind the exposed material the coast rose rapidly to 60 metres creating an impressive backdrop to the story being told. We continued south crossing multiple faults and

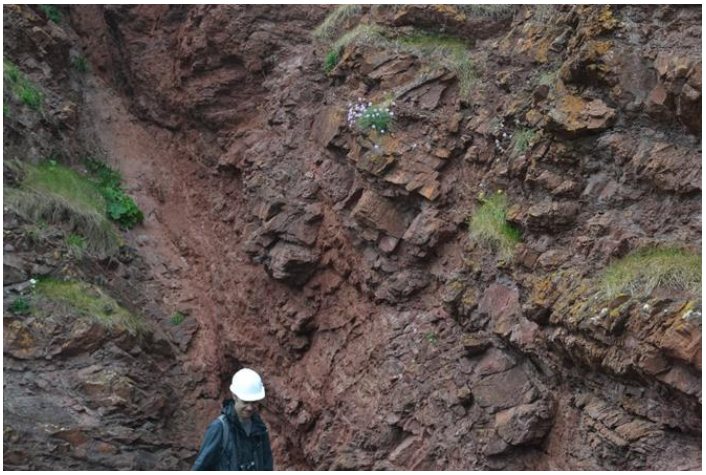
folding structures at various scales. This material was the Coldingham beds, the original thickness having been multiplied by underthrusting, folding and possible refolding. This supported the hypothesis that the area had experienced much compression on a catastrophic scale.



Linkim shore looking North-west: palaeo cliffs and raised beach

Moving south, bright red material, looking similar to Devonian sediments, were examined. Louis outlined fragmentary graptolite fossil evidence for a Silurian Wenlock date. The sediments continued to show much distortion but a sandier texture. These have been interpreted as shallow water deposits possibly accounted for by the shallowing of the area by the underthrusted Accretionary Prism developed by subduction. Some excellent examples of faulting were studied whilst lunch was taken.

The group noted that the precipitous cliffs demonstrated a dramatic change of process as the cliff line became heavily vegetated. Discussion of this suggested a variety of possible causes for the absence of erosion at the back of the bay.



Major fault in Linkim Beds

Progressing south, the Linkim Kip sea stack showed distortion within dipping material. Louis had outlined the academic discussion of the evidence together with the changes in the possible interpretations – Recumbent Anticline [Shiells and Dearman: 1960s] or Gravity sliding in Turbidite channel high on the Accretionary Prism [Casey et al: 1980s] that allowed active discussion in the group. The metamorphic grade of both Coldingham and Linkim beds is low, suggesting they were not subject to deep burial or high temperatures.

The visit ended with an examination of the southern end of the Silurian inlier, which includes the Silurian-Devonian unconformity in this area, the Devonian ORS conglomerate being succeeded, in turn, to the South east by a volcanic vent.

The day was a tremendous success with the members very appreciative of the materials and summarising of the evidence and interpretations by Louis. A warm vote of thanks and much personal appreciation ended the trip that had benefitted from wonderful weather.

Gordon Liddle