Tees Valley RIGS Group NEWSLETTER

Issue No. 4
December 2014

Party performing survey of plant fossils at Marske Quarry in October 2014
(From L-R: Dr. Chris Hill, Andy Cooper, Mike Windle, Dr. David Smith, Stuart Swan, Charles Morris and Alan Simkins)

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Conserving geodiversity in the districts of

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Contents

Greetings dear reader and a warm welcome to the fourth issue of TVRIGS Newsletter dated December 2014. In it we hope to convey something of the various works being done by the group locally, alongside a brief digest of other news items which may be of interest to you.

In this issue we have reports on TVRIGS ongoing collaboration with North East Yorkshire Geology Trust (NEYGT) on the Lewis Hunton Project; a joint walk with Cleveland Naturalists between Whitby and Sandsend; further work on the palaeobotany of the early Middle Jurassic at Marske Quarry; Part 2 of a review of Loftus and Boulby Alum Quarries SSSI; and more developments on the proposed exploitation of offshore coal seams using the Underground Coal Gasification (UGC) process.

News in Brief

TVRIGS Rock & Fossil Collection

Members will be delighted to learn that the group's eclectic collection of rocks, fossils and minerals, accumulated over the past dozen years or so, has at last been fully documented. The collection includes material gathered, or donated, by both members and others and now contains more than 700 specimens. Ranging from Carboniferous limestone, *Lepidodendron* (tree

Carboniferous crinoidal limestone (Dent Marble) from Arten Gil,l Dent Dale

Image: J. Waring

bark) impressions and *stigmaria*, through Permian stromatolites, to remnants of the Saltburn *ichthyosaur* one of the oldest known specimens, sadly robbed from Huntcliff scar by commercial collectors. Perhaps most striking are some of the delicate ferns recovered from Marske Quarry, also a wealth of split and polished Jurassic ammonites donated by Dr. Telfer.

The greatest part of this formidable task has been completed by John Waring to whom, I feel, we all owe a great debt of gratitude. John has performed the onerous tasks of identifying, labelling and storing specimens (with only limited storage space) and produced a comprehensive catalogue of the collection (in XL format) with links to images of many of the specimens. John also does much good work for the North East Geological Society including overseeing their website which is well worth a visit.

Ichthyosaur vertebra recovered from the scar at Saltburn.

Image: J. Waring

Copies of the catalogue can be provided on request. The collection is lodged at Margrove Heritage Centre.

Lepidodendron (fossil tree bark) from the Carboniferous of the North Pennines.

Image: J. Waring

Millholme Beck Plant Beds

During sorties with the Durham students along the beck NE of Millholme Farm Alan Simkins noticed the remains of an *Equisetum* stem embedded in a streamside sandstone block below the footbridge near NZ 6783 1932. The specimen was later recovered and now resides in the group's rock and fossil collection (specimen no. 581).

Equisetum *stem embedded in sandstone alongside Millholme Beck*
(Approx dimensions: 4cm dia. By ca. 15cm long)

Exploring upstream a short distance, a few plant remains were found within slumped clay and humus, but these appear unconnected with the aforementioned sandstone block.

Some 200m-or-so downstream of the footbridge however, about NZ 6777 1954 where floods in 2013 exposed more of the beds on the E side of the beck, an argillaceous black shale was located some 1.5m above stream level, over- and underlain by sandstone. It is fairly soft at outcrop and contains many plant fragments. It resembles a low outcrop occasionally exposed on the foreshore at Whitby, due N of the junction between North Promenade and Mulgrave Road (about NZ 887 118).

Only a mere 10m-or-so downstream of the outcrop on the opposite bank and seemingly underlying the sandstone, is an exposure of grey shale, approx.

1.5m high and 2m long containing bands of iron proto-nodules (i.e. in the process of formation) which may be a representative of the much sought after Dogger Formation in this locale. A search for fossils in this deposit proved inconclusive.

Outings will be arranged for other members to view and collect samples here in the New Year.

Yorkshire Geologists

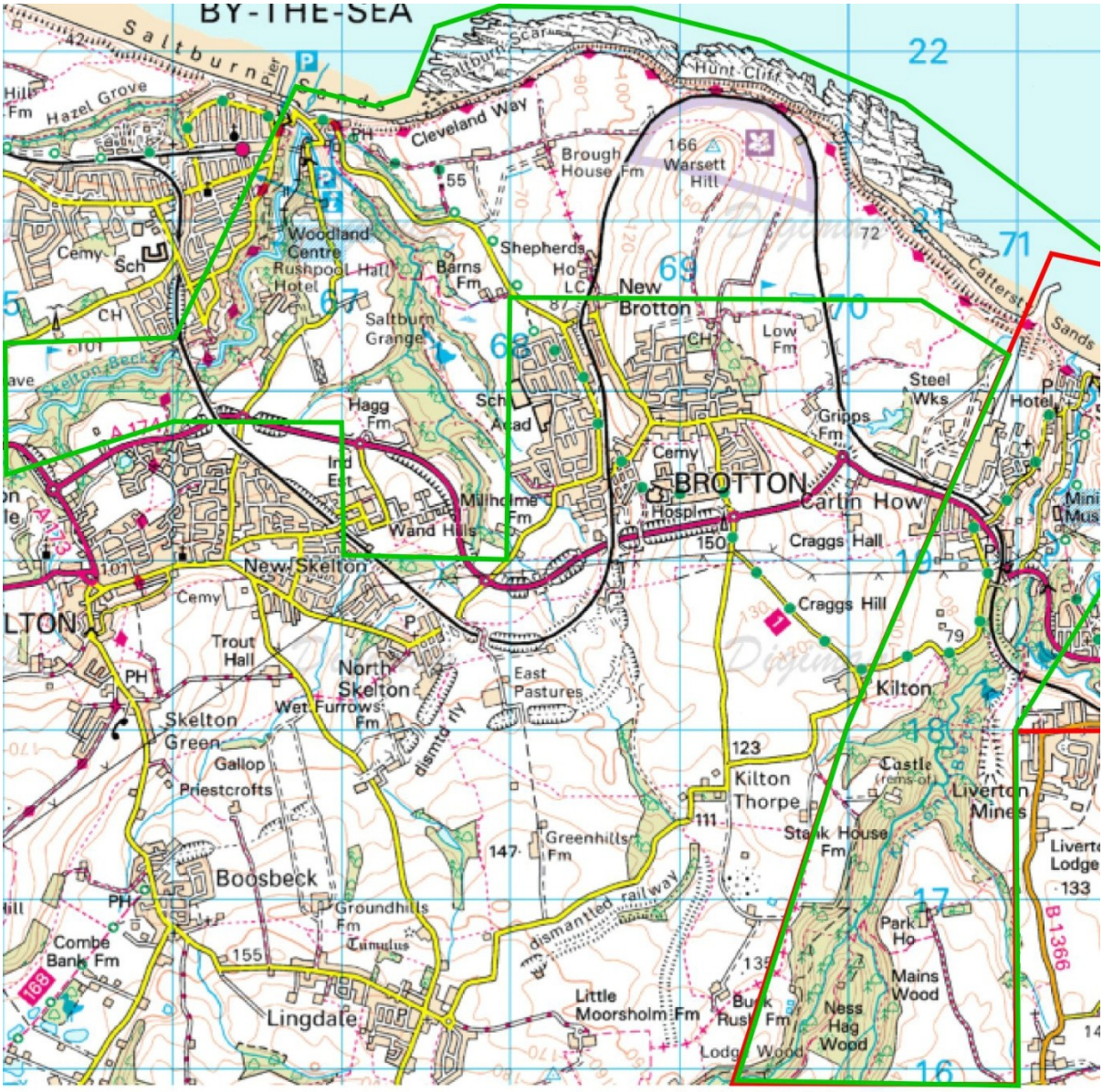
Elsewhere in this issue is an article on Lewis Hunton a pioneering young Yorkshire geologist whose contributions in the 1830s to the nascent discipline of *biostratigraphy* we have been focussing on for some time now.

This is now leading some of us to consider the merits of a regular series of articles in our newsletter on other influential Yorkshire geologists over the past 200 years or so – there will be no shortage of contenders. For Example, and in no particular order of merit:

W. Smith	Hemingway	Simpson
Phillips	Kendall	Wroot
Tate	Elgie	Gregory
Blake	Burton	Fox-Strangways
Bird	Veitch	Rastall
L. Charlton	Leo Walmsley	Barrow
Young	S. White	Williamson

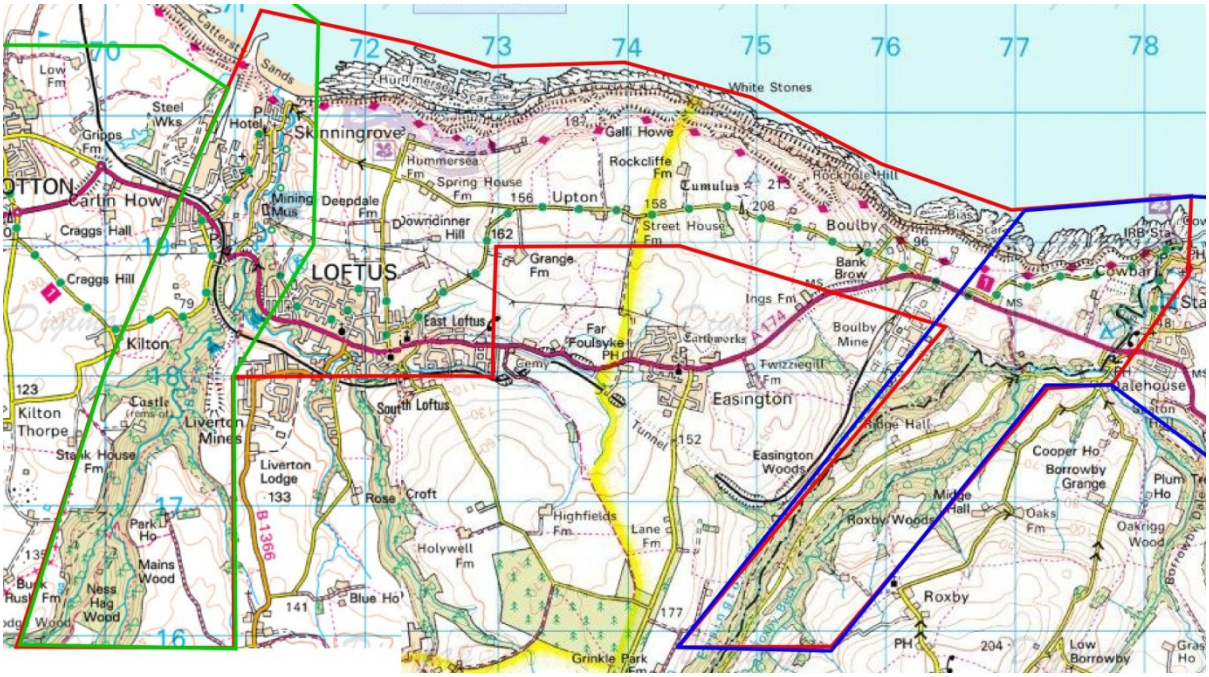
Durham University Student Mapping Projects 2014

TVRIGS group's links with Durham University were strengthened in 2014 when TVRIGS helped host three students, Abdullah, Adrian and Mohammed, to prepare for their mapping projects in our area. Tutored by Dr. Jonathan Imber, the overlapping areas defined for their projects covered the coast and beck valleys between Saltburn and Kettleness (see maps below).



Green line denotes mapping area between Saltburn and Skinningrove

The students, travelling by public transport from Stockton, were helped by Alan Simkins and Andy Cooper with aspects of access and safety during the term of their projects including tide tables and notes on foreshore and beck valley safety.



Red line denotes area mapped between Skinningrove and Staithes

Blue line denotes area mapped between Staihes and Kettleness

As background the students were furnished with a copy of *Along the Scar* and *The Floating Egg* to provide them with excellent local information and a source of good references to get them started with their research

We wish Abdullah, Adrian and Mohammed every success with their projects and future work in the realm of geology. It is hoped that they will be able to give a presentation to the group in 2015 outlining their work and findings.

We also hope that this "pilot" proves successful and will lead to other initiatives with Durham University Earth Sciences Department on student projects. Potential new projects for 2015 onwards are being discussed and include:

- Scarborough Formation studies
- Cleveland Ironstone mine plans and related faulting patterns
- Coastal Alum Quarries, levelling and depositional characteristics

Mohammed, Abdullah, Adrian and Alan Simkins at Kettleness

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100 Greatest UK Geosites Named

Earlier in 2014 the Geological Society ran a competition to find one hundred of the UK's greatest geosites. TVRIGS submitted three local sites for consideration these being Roseberry Topping, Cliff Rigg Quarry and Huntcliff (see minutes of meeting 27th March 2014). Unfortunately, none of the sites submitted by TVRIGS made the final list. Winners were placed into ten categories with ten sites in each. The top ten, one from each category, were:

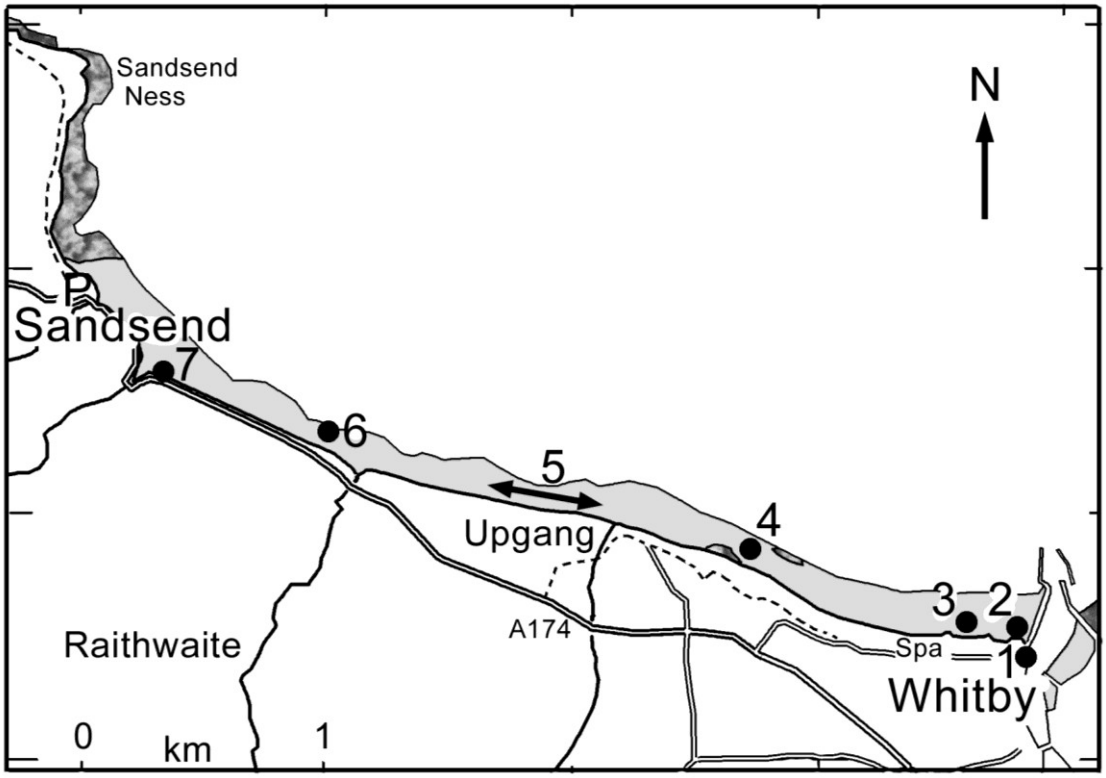
Category	Site
Landscape	Upper Teesdale (inc. High Force)
Industrial & Economic Heritage	Great Orme Bronze Age Mine
Historical & Scientific	Portrush: The site is world renowned for its role 200 years ago in the battle between the 'Neptunists' and the 'Vulcanists' over how igneous rocks were formed
Educational	Granite Pluton, Isle of Arran
Adventurous	Porth Yr Ogoth Caves: Porth yr Ogof is a cave located in the Brecon Beacons National Park. Its name means 'the mouth of the cave' in Welsh owing to the size or the entrance. It is situated in a narrow band of carboniferous limestone.
Human Habitation	Callanish Stones: The Callanish Stones are a circle of standing stones near the village of Callanish on the west coast of Lewis in the Outer Hebrides, they are all of the same rock type, the local Lewisian gneiss.
Coastal	Giant's Causeway
Outcrops	Brimham Rocks
Folding & Faulting	Glencoul: The double fjords of Glencoul and Glendhu provide world-famous transects through the Moine Thrust Belt.
Fire & Ice	Arthur's Seat & Salisbury Crags

Full details can be found online at http://www.geolsoc.org.uk/100geosites.

Whitby to Sandsend walk, made jointly with Cleveland Naturalists, 30th August 2014

Denis Goldring

The party met at 11am at the bandstand (NZ 898 115). The day was sunny and dry but there was a trying westerly wind that made walking difficult on the sands. The idea was to look at some Jurassic sedimentary rock exposures and Quaternary glacial deposits and compare them with the on-going processes of erosion and deposition. Low tide was at 13.37.



Map of the route taken showing numbered locations referred to in text

1. East and West Cliffs, contrasted Jurassic successions and the Whitby Fault

The splendid view of East Cliff shows Lower Jurassic (Whitby Mudstone Formation) marine mudstones overlain by deltaic beds, mostly bedded flood plain deposits (Middle Jurassic, Ravenscar Group). Two critical marker horizons (the Dogger and Eller Beck Formations) mark marine incursions. On the west side, thick, current-bedded, river channel sandstones (also Ravenscar Group) are seen on each side of the Khyber Pass. This striking

contrast in lithology was first noticed long ago (e.g. by Rev. George Young in 1817) and was one reason for placing a major dislocation (fault) along the line of the River Esk.

Whitby East Cliff, November 2014. The sandstone unit of the Eller Beck Formation is near the cliff top below a capping of till. The Dogger is about 12m above high water mark but is now obscured by wire netting. Level bedded flood plain deposits of the Saltwick Formation are in between.

The supposed ups and downs of the fault have varied from over 60m to nil over the years as a result of changing interpretations. Roger Osborne has listed them in his readable book *The Floating Egg*. John Hemingway (1963), local geologist and Professor at Newcastle University, was the first to set the record straight by means of finding the marker horizons on the west side. There is, indeed, very likely some sort of fault, otherwise why would the river channel be there? There may be trans-current (sideways) movement, but any vertical movement is certainly small.

2. Battery Sands

John Hemingway reported in 1949 that there was a lens of black sand near high water mark below the Spa. This location is close to a wreck with a cargo/ballast of Swedish magnetite iron ore and the two might be related. Unfortunately, there was too much ordinary sand cover to see these features.

3. West Cliff (First & Second Nabs)

The river channel-fill sandstone and associated deposits here are ideally exposed in the cliffs. There are two sequential deposits in view consisting mainly of current bedded sandstone. The lower one passes up into thinly bedded deposits including coaly shale. The two units are separated by a distinct break in the sequence, in effect an unconformity, albeit local and minor in terms of the geological history. The cliffs have been described by, for example, Hemingway, Wilson & Wright (1963) and, Knox *et al* (1990)

Whitby West Cliff, September 2014. A lower unit consists of channel sandstones overlain by level bedded, finer grained deposits. There is a distinct break in the succession, followed by an upper unit with similar deposits.

4. Lector Cliff and the reef near the low water mark

Lector Nab, low tide reef, March 2011. Sandy ooidal ironstone beds of the Dogger Formation dip towards the shore.

This reef has a rugged indented top surface as a result of its iron-rich nature. The shifting sands often hide it. Missed by earlier geologists, Hemingway (1949) was the first to recognize its nature as ooidal ironstone (with the characteristic fish-roe texture when looked at with a hand lens) and that it represents the marker Dogger Formation. On the present excursion, the reef was partly exposed and the distinct southerly dip could be made out. Lector Cliff itself and the scar immediately fronting it consist of massive channel sandstone. Between the two outcrops, when sand conditions are favourable, dark grey mudstone with rootlets is present and it's possible there may be a fossil plant horizon here waiting to be found. Other than Lector Cliff itself, the cliffs along this stretch were landscaped and drained in the 1970s and the promenade extended to Upgang.

5. Upgang and the cliffs to the west

The party were able to stop for lunch here gaining some shelter from the wind by the armourstone blocks of Norwegian gneiss (rocks that have undergone intensive pressure and heat as a result of tectonism). East of Upgang the cliffs are formed of the natural Quaternary glacial deposits and are being eroded rapidly to the detriment of the golf course.

George Barrow of the Geological Survey (1885) divided the glacial deposits in to three units, Upper Boulder Clay, Middle Glacial Sands & Gravel and Lower Boulder Clay (boulder clay is now called till). The sands and gravel overlying the boulder clay are clearly seen on several promontories but the main feature along these cliffs is the rapid erosion with landslips, mudflows, etc obscuring the glacial sequence. Near the cliff base a distinct colour difference from dark grey to purplish red marks a change in boulder clay type from material consisting mainly of local (Lower Jurassic) rock to boulder clay with a variety of stones from much further afield.

Boulder clay cliffs east of Upgang, September 2014. Dark grey boulder clay of local (Liassic) origin overlain by purplish red boulder clay and by sands and gravels.

At a time when the beach sand must have temporarily disappeared, Hemingway and his student Riddler (1980) described three large glacial deposits, 'rafts', within the till consisting of intact, bedded Jurassic strata. These rafts are actually within the till sequence; rockhead is at least 15m below high tide level. Roberts *et al*., (2013) have re-examined the section recently but have been under the disadvantage of not being able to look at the rafts, now hidden by sand. They think that the deposits date from the last main ice age, around 21k years ago, with the uppermost boulder clay unit being from the final re-advance, around 15k years ago.

6. Raithwaite Beck mouth

This is the next locality where the Dogger Formation is present at around sea level. The Eskdale Iron Company developed a drift mine near the beck mouth. Output totalled 14,290 tons from 1856 to 1858, the ore being shipped from a jetty about 300m to the west. With so much sand the wooden stumps of this jetty were hardly seen but occasionally, after storms, they are clearly visible. Rastall and Hemingway (1939) described a section of the Dogger ironstone close by on the main road. Both it and the mine adit have long been obscured.

Raithwaite, January 2010. Dogger Formation beds of ironstone and ferruginous sandstone inclined to the northeast.

The beach was stripped of sand and the bedrock exposed in early spring, 2010 and, again, around Christmas, 2013). Along much of the beach east of East Row a thin layer of boulder clay was seen to rest on Jurassic mudstone (probably the Lower Jurassic, Mulgrave Shale,) that is inclined gently seawards. Further east, close to the jetty, the Dogger ironstone was seen forming a sequence of beds, alternating sandy ironstone and mudstone and inclined at about 30° to the east. At the time it was thought most likely that this was another glacial raft but there is the possibility that the beds might be within a fault zone. It is only 1.5 km from here to the former Sandsend railway where the Dogger is high up on the hill about 60m above sea level.

7. Sandsend

As the party approached Sandsend it became even more obvious that the sand cover was unduly thick. It was seen to have been eroded back locally by wave action with an almost cliff-like slope developed.

Sandsend, west of East Beck. January 2010. Exposures of the Whitby Mudstone Formation (probably Bituminous Shale) dip gently seawards.

The walk ended close to the beach café at East Row but some members went on to view the cliffs and scar beyond the Council Car Park (the site of Sandsend Alum House, NZ 861 129). Traces of the alum liquor conduit tunnel from the alum quarries were looked for in the cliff side and the post holes of the wooden jetty on the scar were counted. The jetty was used for loading cementstones. It was also amusing to find pyritised impressions of ammonites, including the zone fossil *Harpoceras,* although they are too fragile to be collected.

The original article was published in Cleveland Naturalists Magazine, all images by D. Goldring.

Literature

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Rastall, R. H. and Hemingway, J. E., 1939, Black oolites in the Dogger of North-East Yorkshire. Geol. Mag., 76, 225-233.

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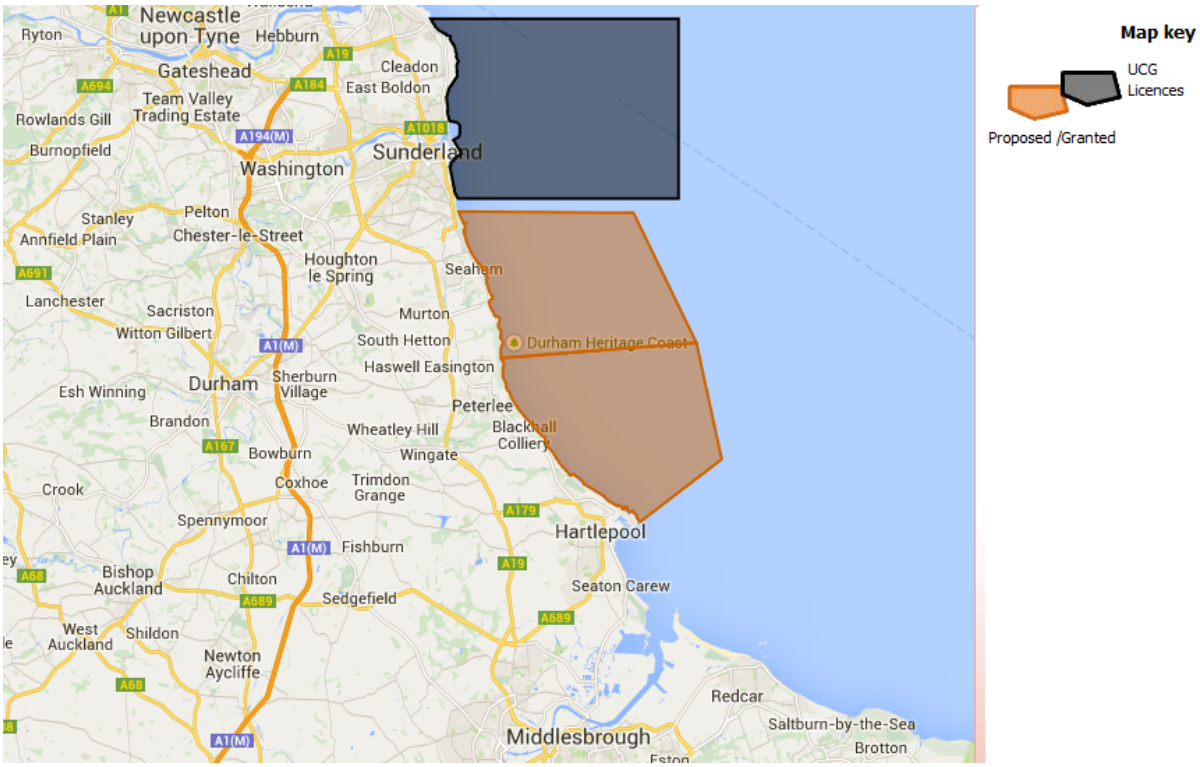
Further Information on Underground Coal Gasification

Further news has emerged concerning the process of Underground Coal Gasification (UCG), a subject touched upon previously in this newsletter (*Coal is new black gold under the North Sea;* Issue 3; p9).

The initial article by TVRIGS covered the possibility of using UCG to exploit usually unreachable or low-grade coal seams of Carboniferous age, extending far out into the North Sea Basin. Proposals were being put forward to begin exploratory boring at a rig off Tynemouth in autumn 2014. An article in *Coastal View & Moor News* (Issue 53; October-November 2014) mentions newly proposed areas for exploration located north of Teesmouth, between the Heugh Battery at Hartlepool and Ryhope, just south of Sunderland (see map). The earliest mention of this process, which involves



Map showing new licence areas for UCG between Hartlepool and Ryhope

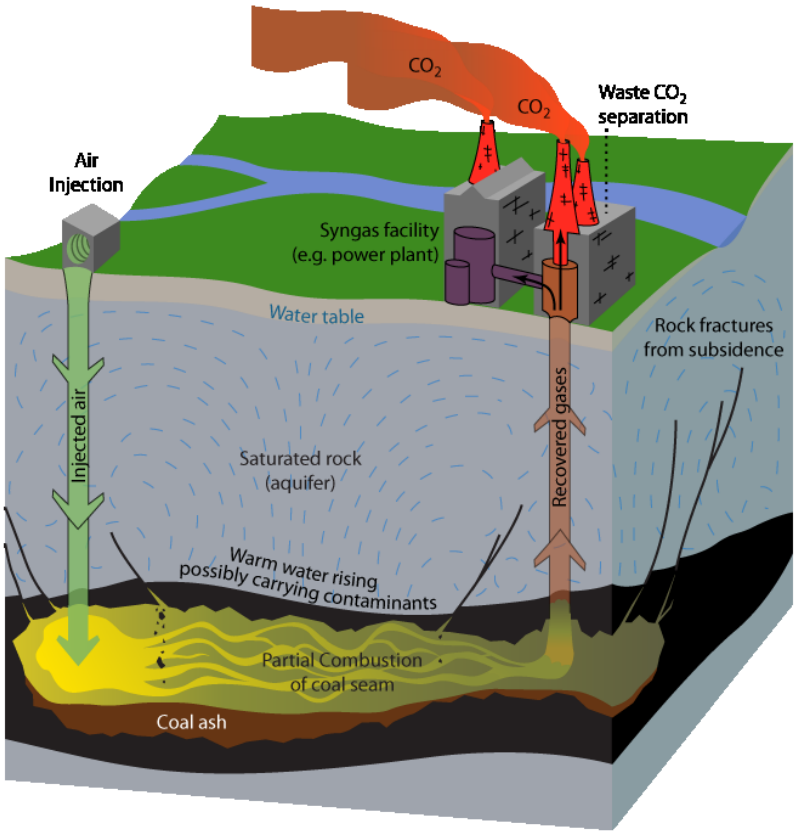
pumping a mixture of steam and oxygen into the seams and extracting the resultant syngas[1], can be traced back to 1868, when Sir William Siemens in

[1] SYNGAS: a fuel gas mixture consisting primarily of hydrogen, carbon monoxide, and very often some carbon dioxide. The name comes from its use as intermediates in creating so-called synthetic natural gas (SNG) and for producing ammonia or methanol. Syngas is usually a product of gasification and the main application is electricity generation.

his address to the Chemical Society of London suggested the underground *in-situ* gasification of waste and slack coal[2].

Russian chemist Dmitri Mendeleyev further developed Siemens' idea from the late-1880s and, by the early-20th century and with increasing air pollution plaguing many British cities, Sir William Ramsay suggested using the process to alleviate the problem.

> *"At the beginning of the 20th century, many industrial cities were covered by a heavy smoke — an unpleasant side effect of the coal-fuelled industrial revolution. At that time, prominent British scientist Sir William Ramsay declared that the smoke menace could be defeated by ceasing the burning of coal, gasifying it underground in the bowels of Earth and using the syngas to supply our energy needs. This process is now called underground coal gasification (UCG). Ramsay made this suggestion well before its time.[3]"*



Process diagram showing UCG in action

[2] Siemens, C.W. (1868). "On the regenerative gas furnace as applied to the manufacture of cast steel". *J. Chem. Soc.* (Chemical Society of London) (21): 279–310.
[3] Klimenko, Alexander Y. (2009). "Early Ideas in Underground Coal Gasification and Their Evolution" (PDF). *Energies* (MDPI Publishing) **2** (2): 456–476.

Plans made by Ramsay to begin exploitation in the Durham Coalfield were scrapped following the start of WWI. Despite numerous proposals no implementation was actually attempted until the 1920s.

By 1913 Ramsay's work had been noticed by Russian exile Vladimir Lenin who promised to protect workers from the hazardous work in the mines by employing UCG. Between 1928 and 1939 underground tests were conducted in Russia. First tests commenced in 1933 in the Moscow coal basin at Krutova mine but this, and several following tests, failed. The first successful test was conducted in 1934 in Lysychansk, Donetsk Basin by the Donetsk Institute of Coal Chemistry.

The latest idea of employing UCG on coal seams underlying the North Sea to yield both energy and industrial gases for the local petrochemical cluster is the brainchild of Dermot Roddy, former Professor of Energy at Newcastle University. The CO_2 inevitably produced would be sequestered by injection back into the spent seams deep beneath the sea floor, a process dubbed Carbon Capture and Storage (CCS).

The processes involved in both aspects of this method, the extraction and CCS, are far from being uncontroversial however, and although proponents cite elimination of mine safety issues, surface damage and solid waste discharge as being advantageous there have already been issues with aquifer contamination. A burn at Hoe Creek, Wyoming, produced operating pressure in the burn cavity greater than the surrounding rock, forcing contaminants (including the carcinogen benzene) into potable groundwater[4]. Furthermore, CCS had never been successfully implemented on a commercial scale due to a number of environmental and health problems caused at test sites.

We wait with interest for news of any further progress on UCG in the north east of England.

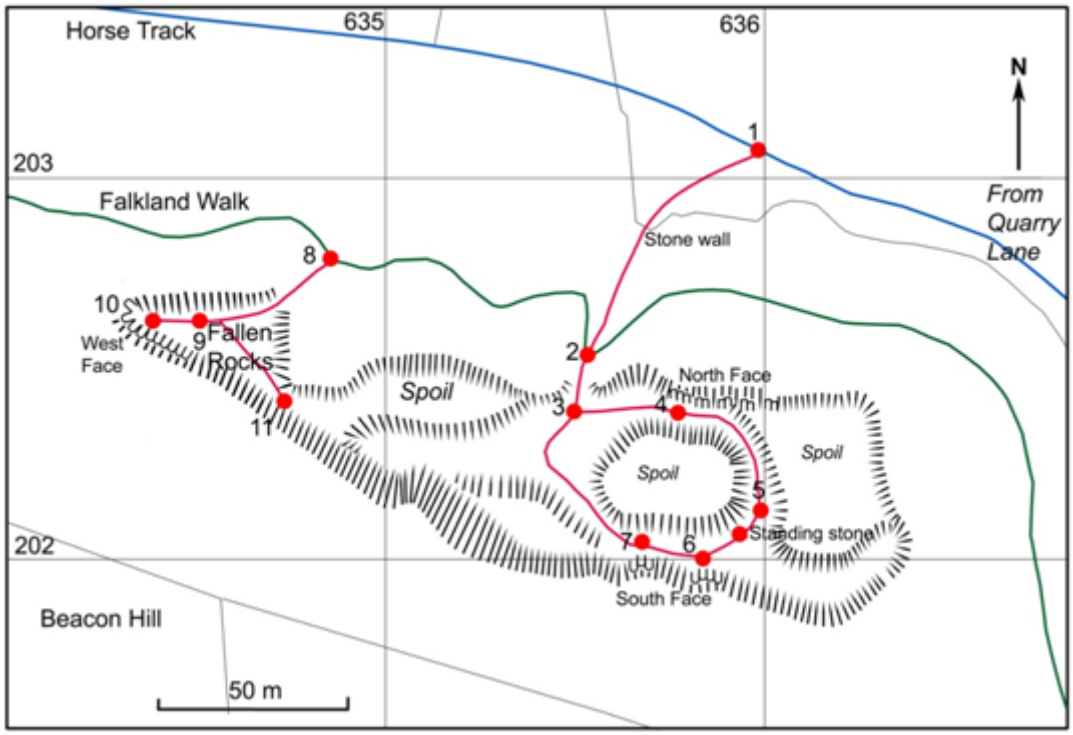
A.C.

[4] Walter, Katie (2007). "Fire in the Hole". Lawrence Livermore National Laboratory.

Marske Quarry Fossils Revisited

In October 2014 members of TVRIGS and NEYGT were joined by retired palaeobotanists Dr Chris Hill and Dr David Smith at Marske Quarry, the site of Cleveland Naturalist John Hawell's fossil finds dating back to the early 1900s.

Work was undertaken before the visit to expose more of the former face at a location near to where Chris Hill recorded a section in the 1970s (labelled 11 on the plan below). A section by G.J. Lane also exists (Lane, 1913).



Plan of Marske Quarry

At an area 10m-or-so west of the point marked 11 the soil was cleared from the face to leave an area of exposure around 2.5m^2 near the top of the quarry back wall. Three platforms were constructed, one at the base around a metre wide and two narrower ones above to give access to the top of the new exposure.

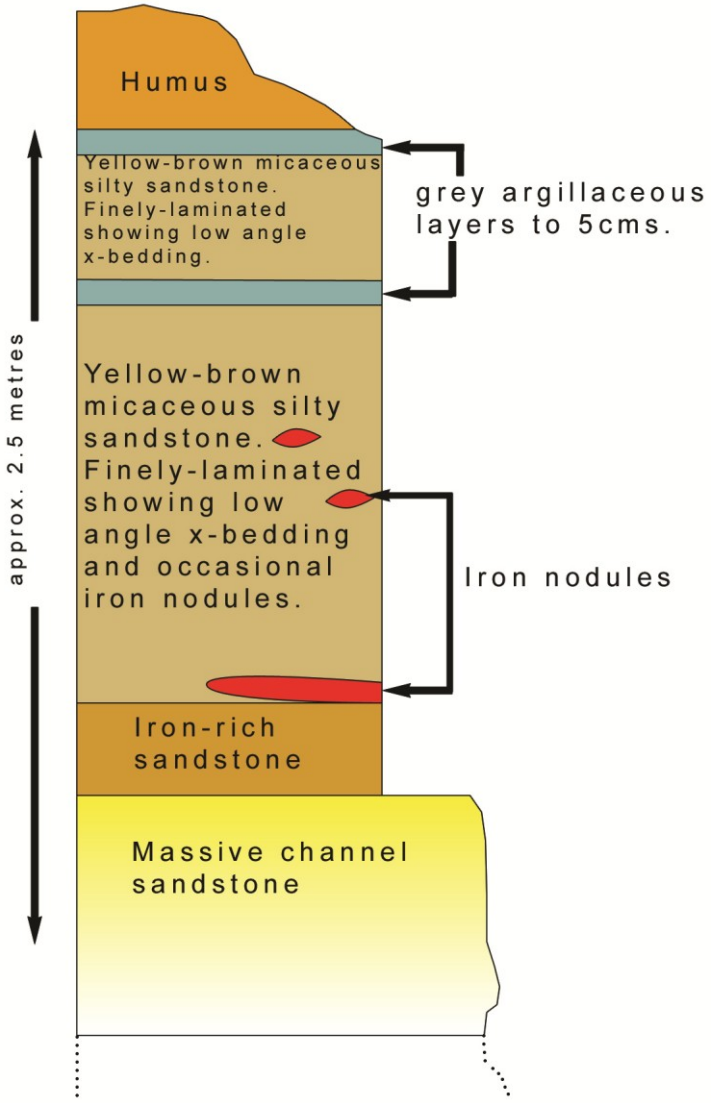
Existing exposure at point 11 showing location of new exposure to the west

Platforms created at the new exposure to allow access to the face

At the base of the exposure, some distance above the former quarry floor, is channel sandstone to *ca.* 75cms (bottom left in the image above). Overlying

this is a bed of iron-rich sandstone to 20cms capped by lenticular iron nodule bands of around 5cms thickness. The deposit fines upwards from here, becoming siltier with increasing mica. Two grey argillaceous bands, possibly overbank deposits, occur near the top of the exposure around 50 cms apart, the uppermost band marking the top of the new exposure. A simplified section is given below and a more detailed lithological log is to be prepared.

Plant remains were apparent from roughly the level of the lowest iron nodule band upwards, though they are dispersed in distinct pockets rather than continuously present. No fossils were recovered from the iron-rich regions. More investigation will be carried out.



Simplified section (not to scale) of the newly exposed beds in Marske Quarry

Chris Hill collected fossil specimens from the area about the lower of the two argillaceous beds. Stuart Swan logged and photographed the section. As this was ongoing others present secured reference samples, at point 11, from a level close to the lower argillaceous bed, which included *Equisetum*, *Ptillophylum* and other specimens preserved as fusain imprints.

Images of reference fossils from Marske.

Upper two images are slab and counter slab with possible Zamites*; Imprint of* Equisetum *(above); two images on the left await identification.*

TVRIGS would like to extend their heartfelt thanks to *Friends of Errington*

Woods for their assistance and experience in creating the platforms giving access to the exposure.

Marske Quarry ca.1908
BGS Picture No. 246669

Further collecting trips are envisaged to this important palaeobotanical site and Chris Hill hopes to return to the quarry in 2015, and is also interested in comparing the situation here with other investigations he is making at Hasty Bank and Botton Head.

A.C.

References

Lane, G.J. 1913; *Notes on the Stratigraphy of Marske Quarry;* Quarterly Journal of the Geological Society, v69; p249-251).

The Lewis Hunton Project

The Lewis Hunton Project, upon which TVRIGS is collaborating with North East Yorkshire Geology Trust (NEYGT), passed another milestone in September 2014.

Two thousand Lewis Hunton leaflets (entitled *Lewis Hunton – A Life Worth Celebrating*), two sets of six exhibition panels giving details of his life and work, and two green plaques were researched, designed and printed/fabricated in time to be deployed at dual events on Sunday 14th September.

A special Service of Thanksgiving was held at St Leonard's Church, Loftus to celebrate the life and work of Lewis Hunton (1814-1838).

The Revd. Adam Gaunt, Rector, arranged the Service that was attended by a congregation of over fifty. Professor Hugh Torrens gave a eulogy to the life and work of Lewis Hunton and the Bishop of Whitby, the Ven. Paul Ferguson gave the sermon.

It was pointed out that, although Lewis Hunton died so young, aged only 23, his ideas continue to form some of the central tenets of geological science and are referred to in modern literature. In his time, of course, there were divergences of opinion between geological science and religious dogma that have now been successfully overcome.

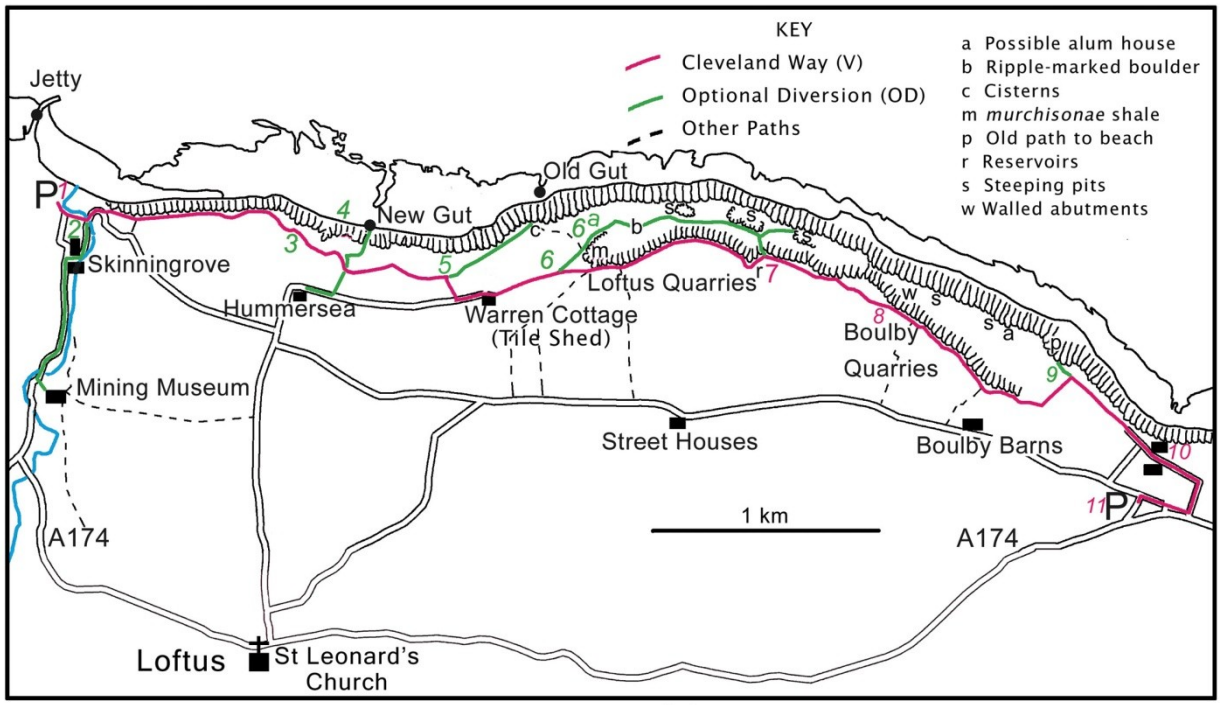
Following the service, attendees were able to view the gravestones of the Hunton Family and the Memorial Stone to Lewis near the entrance to the churchyard. Two green memorial plaques were shown that are to be placed at suitable locations.

The North East Yorkshire Geology Trust provided an excellent display in the Town Hall concerning local geology and the influence that Lewis Hunton had on the development of the science. The importance of geology in the modern world was emphasised and the need for including it in general education. After viewing and discussing the exhibition, attendees were treated to an excellent tea.

The Guisborough Forest Festival, held each year near Pinchinthorpe, also benefitted from a set of the same exhibition panels which were viewed by many of the day's visitors a good number of whom wished to learn more. One hundred-and-twenty-seven leaflets were distributed with many people expressing an interest the included geotrail between Skinningrove and Boulby that takes in both Loftus and Boulby Alum Quarries (see excerpt from leaflet below).

The project continues into 2015 with a variety of events and further work including guided walks around the Loftus Quarries geotrail, an interpretation panel on the Cleveland Way, work in the quarry to re-expose some of the geologically important strata and siting of the green memorial plaques.

The Hunton Trail, his home ground, along the Cleveland Way



1. **CAR PARK.** The ironstone mine, works, jetty and slag cliffs all postdate Lewis Hunton.

2. **(OD** Optional Diversion) 18th C village and Cleveland Ironstone Mining Museum.

3. **(V** View) Views of the old Alum House and Old Gut jetty. The sea-cliffs and scar are formed mainly of Lower and Middle Lias mudstones and sandstones. Mine-workings in the Main Seam ironstone and the Jet Rock are towards the cliff top.

4. **(OD)** (a) Go down the steep path to Hummersea Beach, the New Gut landing and the site of the 'new' Alum House. Beware of the tide. (b) Look at Hummersea House, Lewis's home (private).

5. **(OD)** Follow cliff path to the large cisterns with views back of the New Gut and Hummersea beach.

6. **(V)** This is the main track into Loftus Quarries. Go down about 200 metres to see the high south face formed of Middle Jurassic deltaic sandstones.

6a. **(OD)** Explore the alum quarries, roasting and steeping sites. Take Care!

7. **(V)** Look down on the alum shale (Whitby Mudstone) workings and pass the reservoir sites.

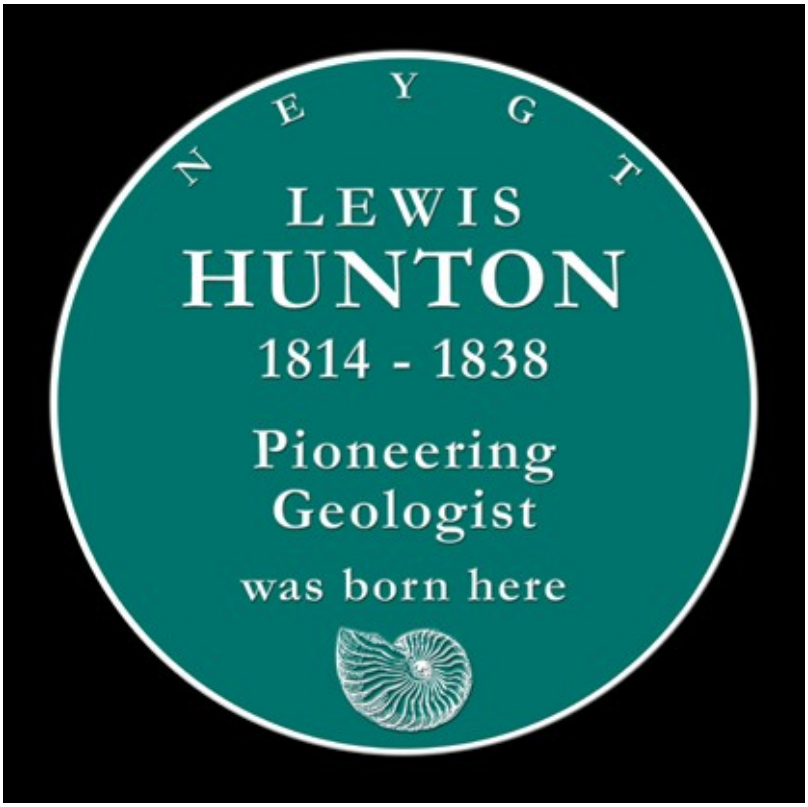
8. **(V)** Look down on Boulby Quarry workings, with the stone revetments and steeping-pit sites.

9. **(OD)** Go a short distance down the thin path (Old pony track) to view one site of Lewis's fossil collecting. Take Care!

10. **(V)** Site of Boulby Alum House with shaft and tunnel to beach **(private).**

11. **CAR PARKING** on lane. Former ironstone mine site. Views of Boulby Potash Mine.

Hunton project exhibition panels being erected at the Guisborough Forest Festival September 2014



Example of green memorial plaque

Events Diary

Listed here are various events publicised on other geological sites...

From the website of the North East Geological Society:

Lecture Programme 2015:

16th January, 2015
Chinese Dinosaur Embryos

Dr John Nudds Manchester University

20th February, 2015

Chromite, tungsten and iron: Mineral deposits and mines in Portugal

Lesley Dunlop Northumbria University

20th March, 2015

Poles Apart? Glaciers and Climate Change in the Arctic and Antarctic

Prof. Chris R. Stokes Durham University

PLEASE CHECK THE APPROPRIATE WEBSITE FOR FULL DETAILS

News from the Web

Given below are links to geologically-themed stories on other websites.

Four-winged dinosaur is 'biggest ever'

A new four-winged dinosaur has been discovered, with exceptionally long feathers on its tail and "hindwings". *Changyuraptor yangi* was a gliding predator which lived in the Cretaceous period in what is now Liaoning, China. Its remarkable tail feathers - measuring up to 30cm - are the longest in any non-avian dinosaur.

http://www.bbc.co.uk/news/science-environment-28295571

Sulphur surplus: Up to our necks in a diabolical element

Sulphur has many uses, from making acid to stiffening rubber, but right now we have more than we need - a lot more. It's worth hanging on to, though, because one day it may help feed the world. "*A sulphur mine in Sicily is about the nearest thing to a hell that is conceivable in my opinion*." So wrote the American author Booker T Washington in 1911, referring to what was at the time the world's main source of this distinctive yellow mineral.

http://www.bbc.co.uk/news/magazine-28369829

Diamond crushed to Saturn's extremes

Diamond, nature's hardest material, has been crushed to record extremes of pressure using the "world's biggest laser", US scientists report. The carbon crystal was condensed to the core pressure of Saturn - 14 times that at the centre of the Earth.

http://www.bbc.co.uk/news/science-environment-28295574

Sandstone shapes 'forged by gravity'

Geologists have discovered the secret that gives dramatic natural sandstone monuments their shape: gravity. By studying cubes of sand in the lab, they showed that areas squeezed by vertical stress are protected from erosion, while others wash away.

http://www.bbc.co.uk/news/science-environment-28365410

Dinosaurs 'shrank' regularly to become birds

Huge meat-eating, land-living dinosaurs evolved into birds by constantly shrinking for over 50 million years, scientists have revealed.

http://www.bbc.co.uk/nature/28563682

Taiwan's 'vanishing canyon' erasing quake record

Geologists say the Daan River, which floods regularly and violently, will wipe the gorge off the map in 50 years. Massive earthquakes shake this region every 300-400 years, but these results explain why so little evidence remains of previous tremors, making predictions and mapping of fault lines difficult.

http://www.bbc.co.uk/news/science-environment-28810357

United States: 'Sailing rocks' mystery finally solved

Scientists have finally solved the mystery of how rocks can move across the flat ground of a dry lake bed in Death Valley, California. Visitors have long been puzzled by the sight of boulder tracks criss-crossing a dusty bowl known as the Racetrack Playa in Death Valley National Park.

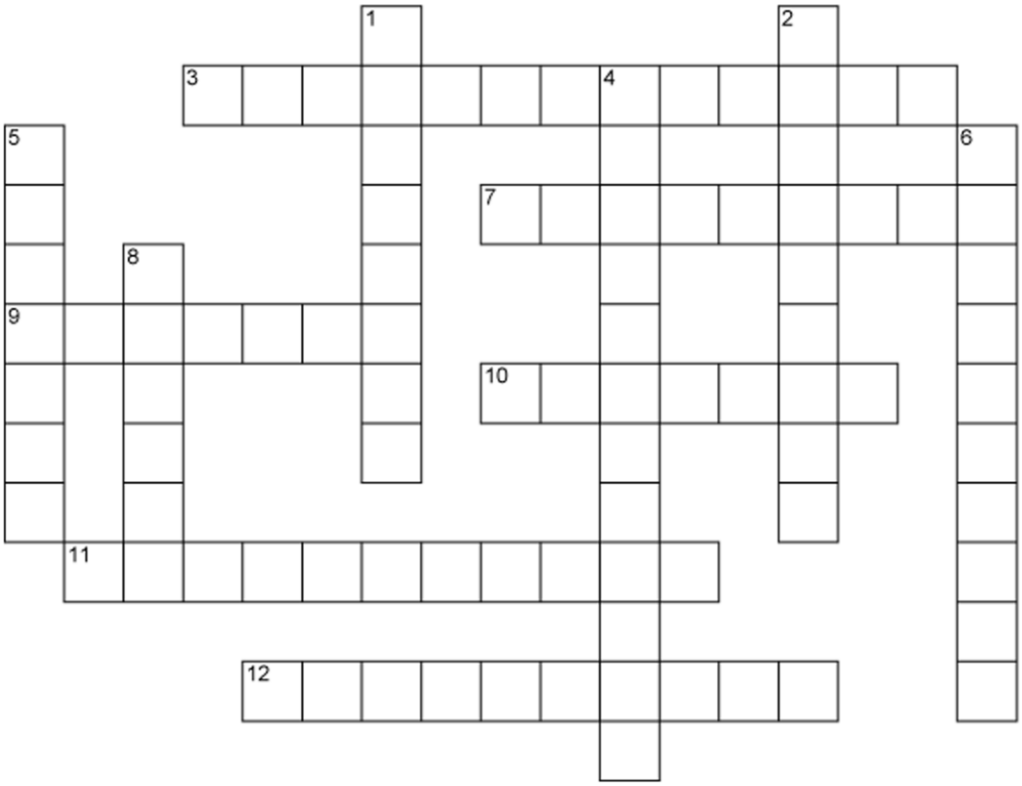
http://www.bbc.co.uk/news/blogs-news-from-elsewhere-28989520

Glaciers in the Grand Canyon of Mars?

For decades, planetary geologists have speculated that glaciers might once have crept through Valles Marineris, the 2000-mile-long chasm that constitutes the Grand Canyon of Mars. Using satellite images, researchers have identified features that might have been carved by past glaciers as they flowed through the canyons; however, these observations have remained highly controversial and contested.

http://www.geosociety.org/news/pr/2014/14-67.htm

Sedimentary Rocks Crossword



ACROSS

3 the changing of sediments into rock
7 sand grains cemented together into solid stone
9 _____sedimentary rocks form from sediments being cemented together
10 the combination of weathering and movement of the resulting sediments
11 rocks formed from the sediments of other rocks
12 the process of settling out and grading of sediments

DOWN

1 _____sedimentary rocks are formed by the precipitation of dissolved minerals
2 silt particles cemented together
4 made up of rounded pebbles cemented together
5 made up of angular pebbles cemented together
6 anything that breaks the rocks into smaller pieces or sediments
8 rock salt made by the evaporation of sea water

Solution will be published in the next issue

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