North Eastern Geological Society

Newsletter June, 2015

UPCOMING EVENTS

Saturday 4th of July

Siccar Point and Barns Ness.

Leader Mike Browne (Edinburgh Geol Soc/retired BGS)

Meet in Cockburnspath village, parking on The Square, opposite Village Store and Post Office, from **10am for a 10.30 start**. There are shops and toilets in the village and car shares can be arranged before moving on towards Siccar Point (roadside parking at NT800 705).

FIELD TRIP REPORT

On **May 9th** a hardy group of 8 or 9 members set off along Boulmer steel on a northerly walk to examine the Namurian facies exposed on the shore.

The presence of shales, gritstone and limestone reflected the changing environments in these times. It is interpreted as deltaic with open sea conditions developing at times.

Seven thin coal seams indicate short terrestrial environments whilst fossiliferous beds support the marine environments with Brachiopods and broken trilobite fragments.

The sequence has been faulted with a rift like section occupied by Sugar Sands Bay and Howick Burn mouth.

A cold damp day improved to a warm afternoon rewarding the members with an enjoyable and interesting trip. The leader, Derek Teasdale was warmly thanked for his excellent work.

LECTURE AND FIELD TRIP PROGRAMMES

Lecture dates for 2015/16

December 18th **Members Night**

We are seeking volunteer speakers for this event.

Can you do a 2o minute session?

Also, your Committee would be pleased to hear of suggestions for lectures/lecturers this coming season.

Let me know soon - negsec@gmail.com

Field Trip Programme 2015 -16

September 19th **Whitby – Saltwick Bay**

Leader: John Waring

Meet at the Abbey Car Park (NZ 904 110) at 11.30 am. Low water is at 2.15 pm.

From the Abbey Car Park we will walk along the cliff top to Saltwick Bay, which will take about half an hour, from where the traverse will begin.

The purpose of the trip to this classic area is to study the paleogeography, depositional environments, palaeontology, petrology (thin section photos) and industrial archaeology of the Lower Jurassic Whitby Mudstone Formation as well as the overlying Middle Jurassic Dogger and Saltwick Formations. The traverse will include an examination of the famous Middle Jurassic Whitby Plant Bed as well as the possibility of finding dinosaur footprints.

Safety helmets should be worn if close to the cliff face. Bring a packed lunch.

Toilets are available at Market Place, the Abbey Headland Car Park and near the entrance to the West Pier. Car Parks (map and list) can be found at http://www.scarborough.gov.uk/home/parking/car-parks/whitby-car-parks

Parking charges apply; e.g. Abbey Headland C.P. and West Cliff C.P. 6 hours - £5.00; 24 hours - £6.00. Total walking distance is approx. 3 miles.

Ref. "The Yorkshire Coast" G.A. Guide No.34, P.F.Rawson, J.K.Wright, pub. 2000, Itin. 2

September 26th **Knock Fell, Pennine Escarpment.**

Leader: Eric Johnson

Meet on the side of the Great Dun fell road where it leaves the enclosed ground by the sheep pens [NY 697 296] for a **10.30 start**. The circular route follows the Pennine Way up the escarpment alongside Swindale Beck onto Knock Fell and returns via the Dun fell road.

October 10th **Coldberry Gutter, Teesdale**

Leader: Brian Young

Meeting time and place at a later date.

NEWS AND LOCAL EVENTS

Our student rep at Durham, Rosie Kincaid stood down in May when she graduated with a 2:1. Rosie goes on to study at Newcastle University, but she intends to stay in touch and has offered assistance with a future project.

Meanwhile Rosie is replaced by **Katharine Groves** who is keen to begin her term of office after the summer break - she has already been co-opted onto a planning group!

Welcome Katharine Groves.

Planning Group

NEGS is hoping to run a one day public event in 2016 (with the support of G.A.). To this end a planning group has been set up with Committee member Gordon Hull as chairperson. If any members have an interest in joining the Planning Group please do let me know.

The new NEGS website is now online, it is a work in progress, but do please visit and use:
http://www.negs.org.uk/

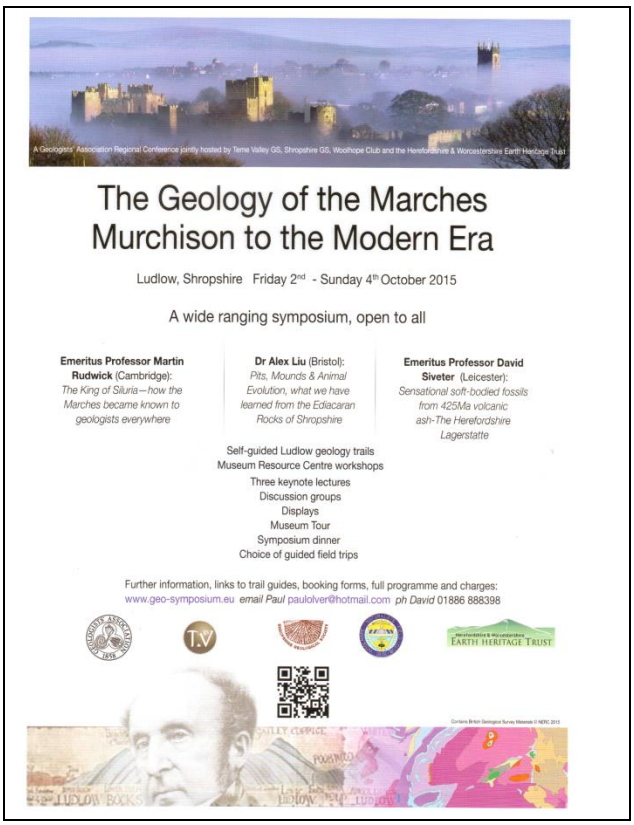
Don't forget that we're also on **Twitter** courtesy of Kirsten Dutton **(Our Student Rep at Newcastle University).** Tweet us - '@NEGS_UK'.
k.e.dutton1@newcastle.ac.uk

Membership secretary Christine Taylor says that we used to have NEGS T shirts once upon a time and wonders if the membership might be interested in this again.

Let me know – negsec@gmail.com

NATIONAL EVENTS

GA Annual Conference at Keyworth



WHERE THE EARTH MOVED – SEDLING MINE COLLAPSE, AUGUST 2014

Brian Young

In August of 2014 Sedling Mine at Cowshill gained national celebrity by featuring in several national papers, television reports and a flurry of comments on a variety of social media sites. The reason: a spectacular surface collapse into long-abandoned underground workings (Figures 1 and 2). Events of this sort make for good newspaper stories but, as in this instance, a remarkable amount of exaggeration and alarmist content almost inevitably creeps in. From some of these, especially some of the remarks on mine exploration web sites, it seemed that a version of Armageddon was about to be visited upon the Northern Pennines. Concerning though these recent events have been, especially for those whose property has been affected or threatened, this might be a suitable opportunity to take a more informed and balanced look at what actually occurred here in both its immediate and wider context, and to take a look at the potential for future events of this sort. The following brief account summarises some of the results of a short study I undertook in the immediate aftermath of this collapse.

> ***"……There is some evidence of past mining for coal, iron or lead in the area"……!!***

Media reports suggested that the large hole appeared suddenly and apparently without warning, late one evening on the west side of Sedling Burn, about 500 metres north of Cowshill bridge. Most of the press reports describe it as a 'sink hole' adding the suggestion, wholly astonishing to anyone who knows anything about the Northern Pennines, that there is "*some evidence of past mining for coal, iron or lead in the area*"!!

From my examination of the site, in the light of detailed maps which incorporate information derived from mining records, the hole clearly lies directly upon the outcrop of Sedling Vein approximately 100m west of Sedling Burn and is plainly a 'crown hole' resulting from the collapse of part of the long-abandoned stopes within this vein formerly worked at Sedling Mine.

GEOLOGY OF SEDLING MINE

Details of the local geology, including that of Sedling Mine, are contained in the late Sir Kingsley Dunham's classic Geological Survey Memoir, *Geology of the Northern Pennine Orefield Volume 1*, (Dunham, 1990) from which the following brief notes have been mainly complied.

Sedling Mine worked lead ore and fluorspar from the prominent WNW-ESE trending Sedling Vein. This, together with the similarly trending Slitt Vein, of which Sedling Vein may be regarded as a westerly *en echelon* extension, is one of the suite of veins collectively known in the Northern Pennines as the 'Quarter Point' group of veins. In common with other veins in the central part of the orefield, the main mineral filling of the Sedling Vein was fluorite, with subordinate quantities of galena and other minerals including quartz, marcasite and siderite. A significant feature of the 'Quarter Point' veins, relevant to understanding the recent collapse at Sedling, is their considerable width, commonly in excess of 3m, compared to the much smaller widths characteristic of most of the orefield's other veins. These 'Quarter Point' veins carried the orefield's largest and most significant economic fluorspar deposits.

Dunham described two major groups of ore bodies within the Sedling Vein here : a western set extending for roughly 500 m on either side of Sedling Burn, and an eastern set, also roughly 500 m long, which began approximately 1 km E of the burn. Much, if not all of the mine's fluorspar production appears to have come from the eastern group of orebodies. Although Dunham does not record the vein width in the western part of the mine, he notes widths of up to 3.7 m in the Great Limestone in the eastern orebodies. Similar widths might reasonably be supposed to have occurred in the western stopes which, from surviving plans and sections appear to have been up to over 60 m in height.

Immediately west of Sedling Mine, the vein terminates against the Butreeford Disturbance, a N-S trending zone of faulting and folding that disrupts the local rocks in a belt that extends from Lunedale to the Tyne Valley near Hexham. The conspicuous and extensive old surface workings, known as the Queensberry Ironstone Workings, extracted iron ores from flat deposits associated with several veins which unite in this area.

MINING AT SEDLING

The mine was worked for lead ore by WB Lead, between 1818-1878, and subsequently mined for fluorspar by the Weardale Lead Company from 1900-1948. During these periods at least 17 455 tons of lead concentrates and at least 166 421 tons of fluorspar were raised. The date and extent of any earlier workings, and the amounts of any ore that may have been obtained from them, are unknown.

Sedling Vein was almost certainly originally worked from opencast excavations and shallow surface shafts on both sides of Sedling Burn, though the great majority of its output was no doubt derived from the deeper underground workings. The original main access to these workings was via the 130 m deep Sedling Drawing Shaft, the partially collapsed collar of which remains conspicuous on the east side of the burn (Figure 2). Although not mentioned by Dunham, Fairbairn (1996) refers to a separate 308 m deep pumping shaft, sited near the Drawing Shaft. This depth is almost certainly incorrect as the known workings here do not remotely approach such a depth and no shaft of anything like this depth is known in Weardale. In its latter years as a fluorspar producer, the principal access to Sedling Mine was via the Midge Pits Level, driven from the east bank of the burn, roughly 250 m SW of Sedling Drawing Shaft.

Sedling Mine's upper levels were partly drained by the Burtree Pasture Water Level, the portal of which is situated downstream from the entrance to Midge Pits Level. This level connected with, and drained, the upper levels of the extensive underground workings of Burtree Pasture and parts of Breckonsike mines, the main entrances to which lie N of the surface outcrop of Sedling Vein.

THE RECENT CROWN HOLE

The recent crown hole lies above the long-abandoned western group of stopes in Sedling Vein that were worked for lead ore by W B Lead. I have been unable to establish whether any more recent re-working or exploration for fluorspar took place in this part of the vein during the Weardale Lead Company's occupancy. These extensive western stopes were worked on both sides of the burn from beds extending from the Great Limestone near the surface to the Slaty Hazle sandstone beneath the Five Yard Limestone at a depth of around 120 m below the burn.

Figure 1.
The crown hole viewed from the east. Old surface workings on Sedling Vein, close to the position of Sedling Shaft, may be seen in the bottom left of the picture. Parts of the extensive surface Queensberry Ironstone Workings associated with Breckonsike and Burtree Pasture veins are seen beyond the crown hole. *Photo: B.Young*

As discussed above, whereas the widths of the old lead stopes beneath the crown hole are not recorded by Dunham (1952 and 1990), it is likely that they may, at least locally, be of comparable dimensions to those in the more recent fluorspar workings. Together with

their likely aggregate height in places of up to 60m, these void spaces at the depths of the mine workings here, are quite capable of creating a substantial surface crown hole in the event of their collapse.

Figure 2.
The crown hole viewed from the west. Note the ominous cracking of the bare soil surface adjacent to the hole.
The surface outcrop of Sedling Vein is clearly traceable through the gully on the hillside opposite, with the dumps from Sedling Drawing Shaft also prominent in the middle distance. *Photo: B.Young*

To describe this particular hole as a 'sink hole' is misleading. Sink holes, sometimes referred to as swallow holes or dolines, are typically natural collapse features that form progressively above cave systems created, or joints widened, by natural dissolution of soluble rocks such as limestone. These are common features, often seen in linear belts that mark the outcrops of many of the limestones of the Northern Pennines. Holes that appear at the surface, often suddenly and without obvious warning, as a result of the collapses of underground mine workings are usually referred to as 'crown holes'. They may be relatively common in areas of underground mining, though in the Northern Pennines they are rather less numerous, or certainly less widely recognised, than natural 'sink holes'.

OTHER CROWN HOLES IN THE NORTHERN PENNINES

Whereas similar substantial crown holes are known to have appeared suddenly at a number of places within the orefield, for example in the 1980s near Barbary Mine, Ireshopeburn (Figure 3); above the Groverake Vein on the hillside east of Groverake Mine (Figure 4); on the course of Slitt Vein west of Cambokeels Mine; and above some of the old stopes in the South Cross Vein of Greyside Mine, near Newbrough in the Tyne alley, they are not numerous.

Figure 3.
The Ireshope Burn pouring into a collapse in the stream bed and into underground workings in Barbary Mine, Photographed in 1983. *Photo:Dick Graham*

Figure 4.
Large crown hole on the outcrop of Groverake Vein on the fellside east of Groverake Mine. The vein itself lies in the collapsed ground on the left of the picture. Photographed 2013. *Photo: B.Young*

Considering the enormous extent of long disused underground workings, many dating back several centuries, this might seem surprising. Their relative infrequency may be explained by the general form of

most of the area's veins. Veins in the Northern Pennines are typically rather narrow, often 1 metre or less wide. Consequently the void spaces left in the stopes of many of the mines are of rather small dimensions. The inevitable processes of collapse, sometimes decades, or even centuries, after the end of mining frequently, though not invariably, results in the bulking of the collapsed rock, effectively absorbing the amount of space as the collapse propagates upwards. In such situations the collapse may never result in any obvious surface expression, even when the workings are at comparatively shallow depth. Spectacular crown holes such as the recent one at Sedling Mine are more of an exception and are likely to develop only above large stopes in some of the area's wider veins, usually those belonging to the 'Quarter Point' group.

..... likely to have added to the fragility of the adjoining workings, making further collapses probable.

POSSIBLE CAUSES OF THE COLLAPSE

The sudden appearance of such spectacular collapses understandably invites questions about their cause. If support is not adequately and actively maintained, any underground excavation will eventually collapse. Depending on a variety of factors, this may be very soon after its creation or decades, or even centuries, later. Without knowing the detailed circumstances of this collapse, and we shall probably never know these, it may simply be that its time had come. One factor that may, however, be relevant and thus worthy of consideration here and elsewhere in parts of the orefield is the present condition of the nearby stream.

Not so long ago the Sedling Burn was a robust stream carrying drainage from the fells to the north. Catastrophic erosion by flood waters within the burn recently destroyed one the tracks that crossed the Sedling Mine site. However, except during periods of exceptionally heavy rainfall and associated flooding conditions, the volume of water carried by the burn where it flows across the Sedling and nearby underground workings has progressively diminished markedly in recent years. At the time of my visit in August, the stream was completely dry at this point, though a modest trickle of water was seen to re-emerge from its bed further downstream, close to the position of the Burtree Pasture Water Level. It is tempting, and I think justifiable, to suggest the possibility of a link between the appearance of this crown hole and the progressive disappearance of the surface flow of Sedling Burn.

It is likely that the natural outcrop of Sedling Vein beneath the burn coincides with an area of comparatively fractured ground. Even modest amounts of settlement within the vein stopes beneath would almost certainly exacerbate this fracturing, allowing parts of the stream flow to disappear underground into the vein and its associated workings. This could lead to a further widening of fractures eventually resulting in the greater part of the stream's flow taking this route. The passage of substantial volumes of water through the long-abandoned stopes could weaken them causing further deterioration and lead to their eventual collapse.

Whereas I am not aware of any recent changes to the drainage regime within the nearby Burtree Pasture Water Level, it is possible that greater flows of water from the Burtree Pasture and/or Breckonsike workings, perhaps related to underground collapses within these workings, or to additional water infiltration into them from the higher reaches of the Sedling Burn, may have increased the flow of water through this level. If so, this could also have acted as a destabilising factor by further weakening the stope walls and underground support within the Sedling workings.

POTENTIAL FOR FURTHER INSTABILITY

Whereas the recent collapse could have restored, at least for the time being, some sort of stability to the old stopes, it is more likely to have added to the fragility of the adjoining workings, making further collapses above adjoining underground workings probable. Hopefully, a watchful eye will be maintained on the ground immediately adjoin the recent collapses and, if necessary, appropriate precautionary measures put in place. We are

fortunate in the Northern Pennines in having a good understanding of the surface outcrops of many veins with, especially in the Quarter Point veins likely to have comparatively recent wide abandoned stopes within them, reliable plans and records of their extent. Vigilance of the ground above such workings is therefore a sound strategy both here at Sedling and in comparable situations across the orefield.

Whilst we should not be complacent about such stability issues, there is no reason to fear the imminent collapse of major parts of the Pennine dales, as hinted at in some of the more alarmist comments that have appeared recently. As with all matters of this sort it is essential to establish as precise an understanding as possible of the nature and extent of the ground likely to be affected, and to concentrate attention on those areas. Above all, the philosophy expressed by both Corporal Jones of Dad's Army fame, and the Hitchhikers' Guide to the Galaxy is appropriate – "Don't panic!".

As a post script, aficionados of truly spectacular crown holes might care to keep an eye on West Cumbria. Here huge abandoned underground workings in some of the hematite orebodies that would dwarf anything the North Pennines can offer have, from time to time, created some real whoppers.

Acknowlegements

The writer thanks Mr Hensby, owner of the Sedling Site for allowing access for this study, and to Dick Graham for allowing the use of his photograph of the Ireshopeburn collapse.

References

DUNHAM, K.C. 1990. Geology of the Northern Pennine Orefield Vol. 1. Tyne to Stainmore. Economic Memoir of the British Geological Survey, H.M.S.O., London.

FAIRBAIRN, R.A. 1996. Weardale Mines. Monograph of the Northern Mine Research Society. No. 56.

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Bringing up the rear

From member Gordon Hull: A perfect U-shaped valley. But where is it?