North Eastern Geological Society

Newsletter February 2024

UPCOMING EVENTS

(New Members! Welcome to Suzanne Hutchinson and Jonathan May**)**

Friday 16th February 2024 - online (Zoom)

Lecturer - Dr. Catriona D. Menzies of Durham University will speak on **"Fluid flow in orogenic belts, gold mineralisation & geothermal activity"**

Friday 15th March, 2024 - face to face, Durham

Lecturer -Dr. Julia Knapp of Durham University will speak on **"Going down the Drain: Water Quality in a Changing Climate"** - an important current political issue!

The AGM will precede the March lecture. Papers seeking nominations for the organisation roles will be sent out soon. Items for Any Other Business may also be sent to the (Acting) Secretary at this time.
Reports from current role holders will be sent out at the end of February with the Agenda for the AGM.

FIELD TRIP / LECTURE REPORTS

NEGS Christmas Lecture - members night.
Three members gave excellent presentations on the evening of the 8th of December in Durham.

1. Hydrogen in the gas mains?

Steve Woodward BSc Fellow of the Institute of Mining and Metallurgy

Steve educated us upon the problems that might arise around the use of existing gas mains for piping hydrogen should the use of it as a fuel ever be realised.

Some things we might not have appreciated - a pure hydrogen flame is invisible (how do you know it has ignited?) and the gas is odourless and adding an agent to give it an odour is not feasible. It is as we all know very inflammable. We learned something about scale at the atomic level when he pointed out that a hydrogen ion (the atom with its electron removed) is only 1/77,500 the size of two hydrogen atoms (the usual molecular form of the gas).

It follows, as he demonstrated, that while a hydrogen molecule (two atoms, H_2) cannot penetrate steel, the hydrogen ion, present in small quantities in gas and liquid forms of hydrogen, readily penetrates the interstices of steel pipes - leading to blistering and embrittlement of the structure, with cracking.

Steve opened the door onto a land of dark materials when he discussed the use of austenitic steels in piping for hydrogen. This variant of stainless steel has a crystalline structure that makes it less susceptible to the intrusion of hydrogen ions.

A question at the end about "Hydrogen ready" gas ovens left us all wondering how much of a contribution the readiness of an oven makes to the readiness of the whole system. This was fascinating stuff.

2. Geological mapping of Durness

Lewis, third year Geology student

Lewis spent six weeks last summer living on this peninsula in northwest Scotland. There's a lot of geology there and some of it, as we know, is very old indeed. We heard about five phases apparent in the mapping. These included the Lewisian Basement, part of the Laurentian continent some 2.7bnya, the Cambrian/Ordovician phase and the opening of the Iapetus Ocean, the period of the Moine Thrust and the Caledonian orogeny(490-390mya), the post Caledonian faulting of the Moine Thrust into the Laurentian foreland and finally Quaternary processes.

While Durness is a long way from anywhere, we learned that sitting as it does on the 'North Coast 500' route there is a lot of traffic through in the summer months.

3. Slipping though the Permian on the downhill slide

Andy Lane

Andy discoursed on the theory that across the northeast coast there has been an episode similar, if not as large, as the Norwegian Storegga event (over 6000 BCE). He reminded us that the northeast coast lay under the edge of the Zechstein Sea which extended 20-30 km inland from the present coastline and that there was a reef associated with it whose remains we see at Claxheugh Rock just to the east of Hylton.

A mystery in need of explanation has been the absence of the Raisby magnesian limestone at some points between the younger Reef and older Yellow sandstones. David Woollcott, a science teacher in Sunderland, was puzzled by this appearance at Claxheugh. He postulated the collapse of caves to explain this but Andy pointed out that this does not explain the thin layer of marl apparent. Denys Smith (1920-2007) worked on the Permian period for the BGS in the area around Sunderland - he suggested that a landslide might explain the absence of the Raisby formation. He gathered his thoughts together in a memoir which is a considerable resource for anyone wishing to get to grips with the geology of Sunderland. Andy explored this theory in his presentation, highlighting observations that remain problematic. (Smith, D B. 1994. Geology of the country around Sunderland. Memoir of the British Geological Survey, sheet 21 accessible online.

Gordon thanked the contributors for their presentations, and we retired for a buffet and drinks including mulled wine and Christmas cake. Thanks to our social secretary and members for this excellent repast, much enjoyed.

Professor Neil Phillips of Stellenbosch University - online lecture 19th Feb

Professor Phillips is a geologist and economist with an extensive knowledge of gold mining both historically and at the present time.

He began with an overview of gold production. South Africa remains the capital of gold production. At the present time 27% of all gold mined has come from South Africa, followed by 10% from Russia, 9% from the USA, 8% from Australia, 6% from Canada, 5% from China and 3% from Brazil, looking at the major producers. He represented some of this data in terms of production related to land area. South Africa remains the major producer but, in this league, it was followed by Ghana, New Zealand, Papua New Guinea, Uzbekistan, the Philippines and Zimbabwe. The average across this group was 1.4 tons of gold per square kilometer.

Neil then outlined the history of production in the last seventy years. In the period 1960 to1970 production in South Africa rose from 600 metric tons per year to about a 1000 but has since then declined and now stands at 100 metric tons per year. In this period, Australian and USA production has risen to around 300-350 metric tons per year and for now has settled at around 300 per year for Australia and 200 per year for the USA.

He pointed out that the deciding factor in his opinion regarding exploration and extraction was not the gold price but the success of exploration. South Africa's reserves may be close to exhausted but in the USA exploration in Nevada and in Australia further exploration in Western Australia has opened up new sources (though there are now restrictions by some states in the USA) - there have been no new finds in South Africa since 1951.

Neil expanded on the Australian perspective. Australia is now the largest producer (he added that figures from Russia and China are difficult to verify). Gold was first discovered in 1851; production rose during the Boer War but has now climbed steeply as noted above. The gold reserves are found chiefly in the Yilgarn Craton inland from Perth (Kalgoorlie sits at its centre). At Kalgoorlie there is now a "Superset", a vast open cast site 5km across and between and 600 and 800 metres deep.

He went on to discuss the linking of research to discovery and the need for inventiveness, highlighting for example the development of the Witwatersrand site which began with George Harrison staking a claim in 1886 (which, remarkably, he quickly sold before leaving the

scene) in the region known as the Langlaagte. A further revolution in 1897 occurred with the advent of cyanide extraction process developed by Macarthur and the Forrest brothers from Glasgow, while in 1930 Dr Rudlof Krahman's magnetometer enabled location of further deposits in the area.

Perceptive questions followed including a query as to the meaning of "X carat gold" which Neil explained was due to the alloying of gold with amounts of silver, copper, mercury platinum or palladium to produce a harder material. There was also discussion of the place of alluvial deposits in guiding exploration.

This was an interesting insight into the economics of a mineral. Many thanks to Professor Phillips. He has recently written a book on this subject "Formation of Gold Deposits" published by Springer.

NEGS / NOUGS trip to Greenleighton & Wards Hill Quarries 20.8.23

A very large group of enthusiastic members met at Greenleighton (close to Fontburn Reservoir). where Karl and Brenda welcomed the Group to the National Trust property - it was a very large, long lived limestone quarry, now closed.

Karl organised a thorough set of documentation that also covered the second stop. This illustrated the geological relationships and likely fossils that may be seen at each stop.

The Great Limestone is very well exposed, Karl developed for the party an understanding of the exposure in terms of the multiple elements of the Great Limestone, massive limestone members with thin shale partings.

Discussion helped the party to appreciate the marine conditions the deposit was created under. This part of the Earth was tropical marine with large deltaic environments encroaching from the NE. Sea level fluctuated- possibly reflecting Milankovitch cycles. The site is a type locality for Goniatites, we saw a considerable variety of fossils and trace fossils.

The original workings appear to have used a wedge and hammer technique to quarry the stone. A crushing plant was installed on site but all elements of that have been removed. Latterly explosives were used fracturing the rock much more. The 'ramp 'structures that can develop in limestone deposits were examined. Some members were very interested in the plants that appear at this location.

Lunch allowed the party to eat and move a few miles NE to Wards Hill.

This was initially a small limestone quarry (in the Great Limestone) but developed into an important road-stone quarry as dolerite was found intruding the great Limestone.

The group were taken by Gordon on a brief location exercise identifying eight sites to examine in detail. The group split into eight teams and selected a site to examine on their own to develop an understanding of their site. Despite initial misgivings the teams demonstrated exceptional skills of observation and interpretation. Each site was explained by one team to the whole group.

The location is complex with the limestone and shale sequence penetrated by dolerite sills, a small dyke, and transgressive boundaries. Discussion was enthusiastic and knowledgeable on elements of the site, notably why metamorphism was so poorly represented. The sedimentary material revealed abundant Branchiopoda specimens. The group warmly thanked Karl and Gordon for the day.

Gordon Liddle

NEWS AND LOCAL EVENTS

"New Developments in the understanding of the geology of Northern England and adjacent regions"

Yorkshire Geology Society are holding a meeting at Northumbria University on the afternoon of Saturday 10th February in the Ellison Building. Nonmembers welcome. Registration advised (it's free!)

https://www.yorksgeolsoc.org.uk/events-list/newcastle-geology-of-north-england