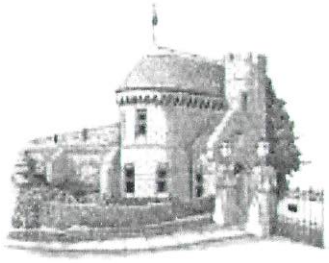
Founded
1822

Yorkshire Philosophical Society



NEWSLETTER

Yorkshire Philosophical Society

Promoting the public understanding of science since 1822

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From the Chair

Dear Members,

Hopefully by the time you read this newsletter the winter snows will have given way to spring flowers. Soon we may be able to make plans to meet up in person and organise at least a few socially distanced activities. In the meantime we are continuing our programme of lectures and other activities on Zoom. The programme of speakers is updated regularly on http://www.ypsyork.org and we hope to record some of the sessions to host on YouTube so anyone with a connected TV will be able to catch up on them.

We were grateful to Paul Hildreth, from the Yorkshire Geological Society, who at short notice presented the December Café Scientifique on the "Geology of North Yorkshire". It was wonderful to sit warmly at home being taken on such a clear and informative journey across the county from Sedburgh in the west to Flamborough Head in the east, with one or two diversions, demonstrating to us the diversity of both geology and landscape across Yorkshire.

LARGE PRINT COPIES OF THIS NEWSLETTER ARE AVAILABLE BY CONTACTING info@ypsyork.org or 01904 656713.

Opinions expressed in the articles that follow are those of the individual writers and do not necessarily reflect the views of the YPS.

Snowdrops by the Foss Photo: Dorothy Nott

Also in December members of the Activities Group turned quiz presenters to test the knowledge of participants during the online Christmas Quiz. Some people appeared on screen in splendid hats and jumpers, surrounded by festive decorations and with at least one inquisitive pet. Group members are offering two *online* tours this spring, one in York and the second around the Caribbean. (see page 3) Thank you to everyone in the Activities Group for providing these creative interludes in the current, challenging "stay at home" era.

As we approach the bicentenary next year we are interested in recruiting volunteers who may have some free time to support the management of the Society. We are particularly keen to recruit some help from members with financial, marketing, publishing or charity governance backgrounds. Do contact myself, the

Clerk or any trustee, to discuss potential involvement; most of the roles are fascinating, rather than onerous, and you will be made welcome on Council or within other YPS groups.

A reminder for your 2021 diaries is **Tuesday 22nd June from 2pm to 4pm** for the postponed AGM, followed by a lecture. This has been booked in the Tempest Anderson Lecture Theatre in the Yorkshire Museum.

Although it has been good that Museum Gardens has remained open throughout autumn and winter, providing a much-appreciated green space for many in York, it has presented challenges for York Museums Trust and the Gardens Team. In the current circumstances we were grateful to receive articles for the forthcoming 2020 YPS Annual Report from YMT CEO Reyahn King and Gardens Manager, Steve Williams. This YPS report is now at the printers and will be published in the spring.

On behalf of the YPS Trustees and myself we send you our good wishes.

Catherine Brophy, Chair
chair@ypsyork.org York 499179

York Museums Trust News

As you may know curators at the Yorkshire Museum have organised regular "Curator battles" on Twitter. This **#CuratorBattle** campaign has won a national marketing award from the world's largest PR professional body. The online "battles" from the Yorkshire Museum's Twitter account invite other museums to share objects under a given theme. They have generated millions of engagements and news coverage around the world. The campaign has now been recognized in the "Just Marketing Awards", winning the category "Best Performance During COVID-19". The awards, run by the PRCA, reflect outstanding work across the marketing industry.

YMT Blog has more details and examples:
https://www.yorkmuseumstrust.org.uk/blog/the-impact-of-curator-battle//

Women's Hour Power List 2020: Our Planet

Congratulations to YMT Trustee Miranda Lowe, a museum scientist as well as Principal Curator of Crustacea & Cnidaria at the Natural History Museum, who is one of 30 women based in the UK included in this list, which reflects the range of roles women hold in environmental work. The list also includes Green Party MP Caroline Lucas, CEO of the RSPB Beccy Speight and broadcaster Kate Humble.

The Trust continues to welcome individual donations to help it through these difficult times. If you would like to support YMT and the Yorkshire Museum in this way, donations can be made using Paypal or credit or debit card via the YMT website:

Donations- York Museum Trust

Tributes

We were very sorry to receive news of the death of David Rowe at the age of 96. David joined the Society in 1996 with his late wife, Lily, and was active in cataloguing the old YPS library and contributing to the collection of Yorkshire Scientists articles on our website. Undeterred by increasing frailty he used a wheelchair to continue attending lectures and social events and rarely missed the annual dinner.

We were also very sad to learn that Karen Baker has died after a long illness. In over 20 years of membership Karen, with husband Tony, was among our most regular supporters of lectures, visits and tours, when many of us were able to enjoy her company.

We send our condolences and best wishes to both families.

Help Needed

Our February 2020 newsletter carried an appeal for a volunteer to replace Jim Spriggs as the Society's nominee on the **City of York Council's Conservation Area Advisory Committee**. Understandably in the light of circumstances over the past year no member has yet come forward, but we hope that signs of an improving situation may now encourage a response. Jim would be happy to have a chat about the role, which is not onerous.

If you are interested in planning matters, or even just architecture generally, please do get in touch on info@ypsyork.org. It would be a shame for the Society to give up its chance to help preserve what is good in York's built heritage.

News from the Activities Group

We are really sorry that the pandemic has prevented us from organising the usual programme. Instead, we are trying to provide a series of virtual events, while looking forward to the time when we can take part in real-life activities.

Our first virtual event took place on 16th December, when we ran an informal Christmas Quiz, which provided some light-hearted entertainment and an opportunity to greet other members.

Sadly, the next, more substantial, event, a virtual tour of Bletchley Park, had to be postponed, because staff in the Bletchley Learning Department are furloughed. We are currently hoping to rearrange this as soon as they get back to work.

We hope many of you were able to enjoy our next event, which will have taken place before you get this. It was arranged by Manuela Sowter, who has gained great pleasure over the lockdowns in exploring York Cemetery, which is close to her house. She put together a delightful presentation of pictures and stories, to share with you via Zoom at 7.30 pm on 24th February.

We have just arranged a Zoom event on the theme of chocolate, which seemed appropriate as we approach Easter. See below for details, and please note that advance booking is required for this one.

Also, as we may still be restricted in what we can do for a while after Easter, the Leonards would like to share memories of their gypsy days sailing round the Caribbean, again via Zoom, at 7.30 pm on 7th April. All these events are intended also to provide informal opportunities to greet other members while relaxing at home. Joining details for free events will be sent out via email in the usual way.

Looking forward to the future, we had planned to run a real event on 20th April, when we had booked a tour of Drax power station. We had hoped to combine this with a visit to the farm of Richard Bramley, the arable farmer who spoke at Café Sci on 7th October. However, Drax visitor department now doubts that they will be open by April, so the visit to their site may take place at a later date. We are making enquires of Richard Bramley about suitable dates for a farm visit, which may take place separately.

Latest information about our 5-day tour of Cambridge and the surrounding area follows, and we feel confident that the Stratford tour will go ahead in November.

Please keep checking the website, as we will try to update the information as soon as we have further news.

Margaret Leonard

Chocolate: from Bean to Manufactory

with Ashley Petch, Events Manager, Cocoa House, York

A Zoom event on March 24th at 7.30pm

Join us for this celebration of Chocolate: demonstrating how this Manufactory and Chocolate Training School has developed.

Members will be able to be seen and speak at this event and there will be a prize draw for chocolate treats at the end of the evening. To cover costs there is a fee of £5. Booking form on the website:

https://www.ypsyork.org/events/chocolate-from-bean-to-manufacture/

Places available on rearranged YPS Tour to Cambridge and Sutton Hoo

Do you fancy a great holiday with YPS friends later in 2021? Our travel agent, JFG, has just re-opened for business. They confirm that the above tour can take place later in the year after the lockdown has been lifted. The new dates will be announced as soon as possible. We have some spare places, so please let me know via info@ypsyork.org if you may be interested. I will then contact you as soon as I have more details. The tour is described on the YPS website at https://www.ypsyork.org/?s=cambridge&x=19&y=12 but some minor details may change - as, of course, will the date. Many thanks,

Rod Leonard, YPS tour leader

Notes from the Geology Group

Further notes on geology in the time of Covid.

February (up-dated for March)

1. a) Virtual Trips:
   The Yorkshire Geological Society has added a **Field Guide to the Geology of Graves Park, Sheffield** to their website
   https://www.yorksgeolsoc.org.uk/virtualfieldtrips/onlinefieldguides
   (The advertised Google Earth tour of Graves Park is not yet available)

   b) Virtual Events and Talks:
   The Yorkshire Geological Society has an online talk, still available on YouTube from 25th February (watch by 11th March)
   Nick Shaw - A new (exciting) opportunity for future geothermal energy in Yorkshire
   https://www.youtube.com/watch?v=ICxbTQnhWRA&ab_channel=YorkshireGeologicalSociety

2. Women and Men in Geology:
Mary Anning. A statue is to be erected at Lyme Regis, Dorset, to Mary Anning, the fossil collector and discoverer of fossil marine reptiles and fish from the cliffs around Lyme. The costs were crowd-funded from an appeal by 13-year-old Evie Swire.
https://www.theguardian.com/uk-news/2021/jan/19/statue-fossil-hunter-mary-anning-erected-campaign-lyme-regis
Several of the Early Jurassic marine fossils at the Natural History Museum and elsewhere were her finds, ichthyosaurs, plesiosaurs, pterosaurs as well as ammonites, belemnites and brachiopods. The Deep Oceans section of the Yorkshire's Jurassic World exhibition at the Yorkshire Museum has on display the Yorkshire examples of this era (when it reopens).
Many of the noted geologists and palaeontologists of the C19th examined her discoveries and discussed anatomy with her. They often presented results to societies and in papers without acknowledging the collector, as often happened at the time. Henry De La Beche sold copies of his painting of Jurassic time, Duria Antiquior, to raise funds to support Mary Anning.
https://www.nhm.ac.uk/discover/mary-anning-unsung-hero.html
https://www.lymeregismuseum.co.uk/collection/mary-anning/

3. Online Study: Yorkshire-based.
York University CLL and Liam Herringshaw. Saturday York University CLL course
The Geology of the Yorkshire Dales
Saturday 20 March 2021, 2.00pm to 5:00 PM
https://www.york.ac.uk/lifelonglearning/dates/2020 21/spring/saturdaycourses/thegeologyoftheyorkshir edales/
Both courses appear to be full, but a waiting list often produces a repeat of the session.

4. Trips outside: Yorkshire-based.
Healaugh Church West Riding, St John the Baptist. York Wetherby back road.
The Church is often open to visitors, even at this difficult time. Mainly 12th century, of beautiful magnesium limestone with a magnificent south doorway and corbels, chancel arch with interlaced carving on the pillars and a remarkable alabaster altar tomb bearing effigies of Lord Wharton in full armour, and his two wives. The sides of the tomb show the children.
https://historicengland.org.uk/listing/the-list/list-entry/1316655
https://ecclesiarum.wordpress.com/yorkshire/healaugh-st-john-the-baptist/
https://www.crsbi.ac.uk/view-item?key=SXsiUCI6eyJ2YWx1ZSI6ImhlYWxhdWdoIiwib3BlcmF0b3IiOjEsImZ1enp5UHJlZml4TGVuZ3RoIjozLCJmdXp6eU1pblNpbWlsYXJpdHkiOjAuNSwibWF4U3VnZ2VzdGlvbnMiOjUsImFsd2F5c1N1Z2dlc3QiOm51bGx9LCJGIjoiZXlKMElqcGJObDE5In0&WINID=1612029246303#y_liP-4sqksAAAF06bKhcg/13125
The church was originally dedicated to St Helen; an early Saxon cross/grave marker discovered in the churchyard in the 19th century suggests a long-term use of the site. The building is on Church Hill on the edge of a steep slope overlooking a former glacial lake.
https://chacklepie.com/ascorpus/catvol8.php?pageNum_urls=96
One story is that the pock marks in the stone on the South wall of the chancel were from musket balls as prisoners were executed after the Battle of Marston Moor (about 4 kilometres away).
Nearby Healaugh Priory was founded towards the end of the 12th century. Wighill and Walton churches are both nearby and 12th century.
https://www.genuki.org.uk/big/eng/YKS/ARY/Healaugh

5. Our Museum of the Month:
Oxford Museum of Natural History
The museum has a collection of dinosaurs found in the county, marine reptiles, minerals and petrology. Try a virtual tour.
https://www.oumnh.ox.ac.uk/
https://my.matterport.com/show/?m=bkx57o7jbCk
The columns surrounding the main hall inside are made of decorative rocks from the British Isles and were planned by John Phillips.
http://www.oum.ox.ac.uk/learning/pdfs/columns.pdf http://www.oum.ox.ac.uk/learning/museum.htm

6. Books and Mags:
Books on the work of Mary Anning:
Mary Anning 1799-1847 A Life on the Rocks. Nigel J Clarke
https://www.nigelclarkepublications.co.uk/index.php?page=books
The Fossil Woman. The Life of Mary Anning. Tom Sharpe
https://www.dovecotepress.com/shop/new-books/the-fossil-woman-a-life-of-mary-anning-by-tom-sharpe/
Other books by Tracy Chevalier, Patricia Pierce and Shelley Emling are available.

New for March:

7. a) Virtual Trips:
Roger Suthren, University of Derby, has a website *virtual-geology.info* with some virtual field trips for students at Derby in 2020. **Staithes, North Yorkshire**

A description of the Middle Lias (Lower Jurassic) of Staithes (NW of Whitby) is at https://wessexcoastgeology.soton.ac.uk/staithes.htm And the field trip at http://www.virtual-geology.info/VFT-GeoEnergy/Staithes.html

b) Virtual Events and Talks:
The Yorkshire Geological Society has an online talk 4pm 25th March.
Prof. Chris Greenwell - Lead in the way: developing low-cost passive remediation methods for legacy metal mine pollution Register at (or watch on YGS YouTube channel)
https://www.yorksgeolsoc.org.uk/registrationgreenwell

8. Women and Men in Geology:
Lewis (also Louis) Hunton 1814-1838. English Pioneer in Ammonite Biostratigraphy.
In any discussion of the historical development of what was later to be named Biostratigraphy it is often assumed that a modern basis for the subject had already been reached by the cumulative work in the subject up to 1815; culminating in that of William Smith (1769-1839) and Alexandre Brongniart (1770-1847). But to this time fossils had only been used to identify (and discriminate between) often repetitive lithological units or to establish a relationship between rock units in different areas. The practical demonstration that particular lithological units could be regularly subdivided with significant consequences, on the basis of their contained fossils was a later achievement over several generations. One of the first to free stratigraphical palaeontology from such a lithological control was the forgotten Englishman Louis Hunton. (Hugh Torrens 1984).
Lewis was from a family of Alum Works managers in Loftus, on the NE Yorkshire Coast. Alum is found in the Upper Lias (Lower Jurassic) along with many fossil reptiles and ammonites. He wrote his - later influential - paper on the limited vertical range of specific fossils and use for geological tests at the age of 21 and died from tuberculosis 2 years later. Read more at
https://www.teeswildlife.org/what-we-do/past-projects/alum-alchemy-and-ammonites/alum/lewis-hunton/
https://www.nyma.org.uk/_webedit/uploaded-files/All%20Files/Voice%20of%20the%20Moors/VOICE-115.pdf (pages 6-7)
https://en.wikipedia.org/wiki/Lewis_Hunton

9. Online Study: Yorkshire-based.
York University CLL and Liam Herringshaw.
Saturday York University CLL course
The Geology of the Yorkshire Dales
Saturday 20 March 2021, 2.00pm to 5:00pm
https://www.york.ac.uk/lifelonglearning/dates/202021/spring/saturdaycourses/thegeologyoftheyorkshiredales/
If the course is full, it is being repeated on 22nd May.
https://store.york.ac.uk/short-courses/centre-for-lifelong-learning/short-courses/the-geology-of-the-yorkshire-dales-second-cohort

10. Trips outside: Yorkshire-based.
To accompany the virtual trip to Staithes, when travel is permitted, try
Lower Jurassic rocks between Staithes and Port Mulgrave - an excursion
From Yorkshire Rocks and Landscape, YGS
http://earthwise.bgs.ac.uk/index.php/Lower_Jurassic_rocks_between_Staithes_and_Port_Mulgrave_-_an_excursion

And to accompany the notes in 2. is the 4-mile Lewis Hunton walking trail from Loftus
https://www.walkingloftusandthenorthyorkshirecoast.com/self-guided-walks

Hidden Horizons are running Hidden Geology Walks with Liam Herringshaw on 31st March and 1st April at Ravenscar and Burniston Bay
https://hiddenhorizons.co.uk/collections/expert-geology-walks

11. Our Museum of the Month:
To accompany the notes on the North East Yorkshire Coast, Lower Jurassic, Hunton and Alum, I shall allow The Whitby Museum and its collection to have a repeat mention (from November)
https://whitbymuseum.org.uk/whats-here/collections/

12. Books and Mags:
Roger Osborne has two books on the NE Yorkshire Coast. From Hightide Publishing. £5 each.
The Dinosaur Coast, Yorkshire Rocks, Fossils and Landscape. Pocket edition 2015, but a larger format version from 2001 can also be found.
https://hightidepublishing.co.uk/product/the-dinosaur-coast-yorkshire-rocks-fossils-and-landscape/
Yorkshire's Jurassic Fossils. Pocket edition 2019
https://hightidepublishing.co.uk/product/yorkshires-jurassic-fossils/

Paul Thornley

Photo: Andrew Wheeler

Andrew Wheeler's ***Letter from Australia*** in our November 2020 newsletter reported on his work at the Mars Society Desert Research Station in Utah. The results of this have now been published and the paper "The Drinkable Rock: Extracting H_2O from minerals for resource depleted emergencies on future Mars missions" can be read at:

https://link.springer.com/article/10.1007/s42797-021-00026-0

Andrew's latest *Letter from Australia,* below, draws on his expertise as an exploration geologist currently working in the coalfields to explain the geology behind the Australian coal industry.

Letter from Australia

G'day Friends,

Ancient peoples appear to have been aware that the light weight black rock (that we call coal) could be burnt but it was only after the Roman invasion and conquest, commencing in 43AD, that a history of the winning and use of coal has been recorded in Great Britain. Most coal has, traditionally, been termed The Coal Measures regardless of locality, but as dating methods improved, the ages of the various occurrences around Great Britain came to be determined.

The most extensive of The Coal Measures deposits were tropical freshwater swamps for millions of years between 313.5 million years ago (Ma) and 306.5Ma during the Westphalian Stage of the Carboniferous Period. In the mid and northern Pennines, though, there are slightly older coals dated to the Namurian Stage (327/326Ma to 313.5Ma) and the Brigantian Stage (330Ma to 327/326Ma). On the North Yorkshire Moors, in the more temperate climate during the Bajocian Stage of the Jurassic Period (171.6/170.3Ma to 168.3/167.7Ma), the freshwater swamps were sufficiently extensive and long lived to develop younger coal occurrences. Even younger lignite (brown coal) occurrences from the Cretaceous Period (145Ma to 65Ma) were extrapolated to exist in the Kent region and under the English Channel as an extension of the geology of northwestern France, whilst even younger still are lignite occurrences in Devon that date from the Miocene Epoch (23Ma to 16Ma) of the Neogene (formerly Tertiary) Period. Finally, since the retreat of the glaciers approximately 10 000 years ago (10ka), peat has been accumulating in wetlands throughout the kingdom.

The Westphalian Coal Measures, in the United Kingdom, extend from west to east divided by the Pennine Anticline. To the west, these Lower and Middle Coal Measures are also referred to as Westphalian A seams. Over time, 19 seams associated with the Westphalian A were worked, with the most exploited being the Lower Mountain/Union, Upper Mountain, Arley, Dandy and King Coal seams. Most seams are between 0.6m and 2.2m thick and have been utilized for many roles ranging from heating homes and cooking (in either solid form or gas following extraction processing), steam production for continuous electric supply generation to coke creation for steel manufacture.

To the east of the Pennine Anticline, these predominantly Middle and Upper Coal Measures are also referred to as the Westphalian B seams. There are 60 described seams though only 21 seams have mainly been the targets for exploitation. Again, most of these 21 seams are between 0.6m and 3.0m thick and have been utilized for home heating and cooking (solid fuel or gas), steam production for continuous electric power generation and coke reduction for steel making with the most exploited being the Silkstone, Parkgate, Swallow Wood, High Hazels and Barnsley seams. The coalfields of Scotland, almost exclusively Upper Coal Measures, fit into the Westphalian C and D seams nomenclature that extends east into western Europe and as far as Slovakia.

On the 26th of January 1788, with the raising of the Union flag, the formation of the modern nation of Australia was set in motion with the official establishment of the New South Wales Penal Colony. In 1791, coal was observed in the cliffs above a river to the north of Sydney Cove and a camp to support the mining and transport of that coal was formed. That camp became Newcastle and, by 1799, it had begun exporting coal to India. It continues exporting to this day and has been described as the world's largest coal export port with an average output of 160 million tonnes per annum. When the colony expanded to include the Moreton Bay Penal Colony in 1824, coal was observed in the river banks of the Bremer River, a tributary of the Brisbane River, at a location now called Kholo within the now limits of the city of Ipswich in 1825. The first coal mine was opened downstream at Redbank in 1843. In 1845 coal was identified in Central Queensland near Clermont. This is located within the western margins of the Bowen Basin and these coals were initially used to support the gold mining industry

and the transport industry when the railways were extended to the area. With the realization that the coal rank was within the coking range, mining for the export market has supported the prosperity of the region ever since.

In Australia, the coal fields are vast. Each state, the Northern Territory and even the Australian Antarctic Territory that we administer (though, by international agreement, there is no mining) has coal. During the Carboniferous Period, Australia was a part of Gondwana and situated at such a high latitude that it was too glaciated for wide area peat swamps to form. Consequently, these deposits, found in places in Western Australia, are of little extent, thin or of high ash and are not utilised. It was during the Permian Period (298.9Ma to 251.9Ma) that continental drift rafted Australia to lower latitudes enabling swamp expansion in depositional basins. These cold-temperate freshwater swamps were extensive and date from the Sakmarian Stage (295Ma to 290.1Ma) of the Cisuralian Epoch to the end Changhsingian Stage of the Lopingian Epoch (259.1Ma to 251.9Ma). Coal formed during this time ranks as bituminous and sub-bituminous and continues to be primarily used as coking coal in steel mills and thermal coal for steam production in continuous supply electricity generation around the world. Most of the east coast of Australia (from the Laura Basin in Far North Queensland, through New South Wales to the Tasmania Basin in Tasmania) has basins with these coal deposits.

The Bowen Basin in Central Queensland underlies an area of approximately 150 000 km^2 (57 900 mi^2). By comparison, Great Britain (excluding the islands and Ulster) has an area of approximately 230 000 km^2 (88 800mi^2). This equates to approximately 66% of the size of Britain. It is just one of eleven coal basins in Queensland and extends through contemporaneous basin development into New South Wales. If one were to travel from the northern margin of the Bowen Basin to the southern margin of the Sydney Basin, it would be the equivalent of travelling from York to Rome.

In this Permian Period, there are four recognized coal groupings. Group I, called the Reids Dome Beds, are the oldest from the Early Permian Period, are of good quality coking and steaming coal and can attain thicknesses in excess of 30m (at considerable depth) but the shallower deposits are thinner. Group II are younger, though still Early Permian Period, and generally occur as semi-isolated depositional centres at the margins of the Bowen Basin ranging from Collinsville in the north (9 seams), Calen in the east and Rugby, Karin, Wolfang and Blair Athol (4 seams - #3 at 29m thick) in the west. Again, the rank is from coking coal to medium volatile, low ash, low rank steaming coal. Next younger in age are Group III coals of the Late Permian Period. These are mostly high grade, volatile rich, hard coking coals of the Moranbah Coal Measures (to the north and east of the Bowen Basin) and the contemporaneous German Creek Formation (to the south and west). The Moranbah Coal Measures contain 5 seams that split into 20 thinner seams progressing east to west. All are exploited with the Goonyella Lower seam (up to 9m thick), Goonyella Middle (up to 19m thick) and the Goonyella Lower the most productive. The German Creek Formation has 11 thinner seams with the most productive being the German Creek, Corvus 1, Corvus 2, Tieri, Aquila and Pleiades seams. Immediately overlying these seams are sedimentary sequences that have been greatly affected by tuff depositions from extensive volcanism. These have been identified as Group IIIA and are not exploited at this time. In the north, these are named the Fort Cooper Coal Measures (containing the up to 30m thick Girrah seam) of numerous, very thin plies and sub-plies. In the south, they have been divided into the Fairhill Formation (the lower unit) and the Burngrove Formation (the upper unit). Finally, Group IV coals are the youngest, occurring at the end of the Permian Period. In the north, these are named the Rangal Coal Measures (Leichhardt and Vermont seams), whilst in the south, they are the Baralaba Coal Measures and the Bandanna Formation (Cancer, Aries, Castor, Pollux and Pisces seams). These are both the most widely distributed (and display the most seam splitting and coalescing) and the most diverse in terms of quality and rank across the basin.

Following the Permo-Triassic extinction event at 259.1Ma, peat swamp formation ceased and only resumed during the Anisian Stage (247.2Ma to approximately 242Ma) of the Middle Triassic and continued through to the Oxfordian Stage (163.5Ma to 157.3Ma) of the Upper Jurassic. Again, most of the coal mining centres of Eastern Australia, as well as South Australia and Western Australia produce these lesser ranked sub-bituminous coals for electricity generation locally and abroad. The Northern Territory has deep seated basins in which coals of these ages have been identified but are currently not economical to extract.

Younger still (of Cainozoic or Cenozoic Era) are the even lower ranked brown coal or lignites that have developed in slowly subsiding basins underlying thickly forested swamps. They occur from Victoria through South Australia into Western Australia. The oldest of these deposits date from the Bartonian Stage (41.2Ma) of the Eocene Epoch (56Ma to 33.9Ma) of the Palaeogene Period and the youngest (the last coal laid down in Australia) began forming during the Burdigalian Stage (20.44Ma to 15.97Ma) and ceased during the Langhian Stage (15.97Ma to 13.82Ma) of the Miocene Epoch (23.03Ma to 5.3Ma) of the Neogene Period. These lignites in places are up to 150m thick and make up 23% of the world's supply. Nearly all is used locally for domestic continuous supply electricity generation.

Form	Rank	Specific Energy (SE)	Carbon Content	Volatiles	Ash
Anthracite	High	35.2 kJ/kg	>95%	2%	10%-20%
Semi-anthracite	High	36 kJ/kg	91%-95%	8%	10%-20%
Bituminous	High	35.6-36.4 kJ/kg	80%-91%	3.1%-14%	3%-12%
Sub-bituminous	Medium	33.5 kJ/kg	71%-80%	40%	<10%
Lignite	Low	23 kJ/kg	60%-71%	52%	10%-50%
Peat	Low	14.7 kJ/kg	<60%	60%	20%-36%
Wood	Low	12 kJ/kg	<50%	65%	4%-10%

Table 1: Ranges of the most commonly measured characteristics of coal that are used to determine rank. SE – kiloJoules per kilogram – is a measure of the amount of heat energy that would be given off if a kilogram of material was combusted to completion.

Finally, is the lowest ranked peat. Peat formation in Australia is very small scale, being confined to the wetlands that mostly occur around the continental margins of the coast and the moderate to high rainfall areas of the higher altitude uplands regions. Peat formation commenced at the termination of the last glacial period 14 700 years ago (14.7ka) and is mostly utilized today by being compressed into bricks for home heating and cooking but there is no large scale exportation of this energy product.

As previously mentioned, various forms of coal have a number of different uses and quality analyses define the form. This definition is known as the rank of coal and there are a number of attributes that contribute to the assigning of rank. Generally, the carbon content, calorific value (or specific energy), volatile material content and non-combustible material (ash) content are the major determinants for rank (Table 1).

From the Table, it can be seen that there are four ranks of coal: anthracite, bituminous (and semi-anthracite), sub-bituminous and lignite. Below these ranks are peat and wood/biomass. Though they are not coal, it is useful to compare them to the alternate forms that temperature and pressure can produce.

Anthracite, as the highest ranked coal, generally has a high specific energy, high carbon content, low volatile matter content, low ash content and low water content. These, also generally, are the oldest coals that have been subjected to the most metamorphism due to prolonged compaction and heating. They tend to burn cleaner with low residue and produce higher temperatures longer. They are useful for running steam engines and for household heating and cooking. As rank decreases, some of the components that determine rank increase. For example, water content, ash content and volatile matter content change the properties, and therefore, the uses of coal.

The next ranked coal - bituminous (and semi-anthracite) have properties that allow the production of coke for use in making steel. The suitability of coal for this purpose is mostly determined by the calculation of a crucible swell number (CSN). In this determination, a small sample is powdered and heated in a ceramic pot causing the volatile matter to expand the sample into domed or spherical shapes. The range of shapes are graded from 0 to 9 where a CSN of 7 to 9 is a fresh coal and suitable for coking, a CSN of 4 to 6 is a partially weathered coal that can be blended into a saleable product as pulverized coal injection (PCI), where coal fines are directly injected into the furnaces for steel making, or thermal for steam production and continuous supply electricity generation or stockpiled as waste, and a CSN of 'undetectable' and 0 to 3 is weathered coal and is stockpiled as waste or blended to create a thermal coal. The third ranked coal – sub-bituminous – is often characterized as those coals that have no swelling capabilities and are suitable only as thermal coal for power generation. It is these ranked coals – bituminous and sub-bituminous – that constitute many of the deposits of the Bowen Basin and the ones in which I am most familiar.

The fourth ranked and youngest coal is lignite or brown coal. These are deposits of carbonaceous material that haven't been subjected to the compaction and high temperatures of deep burial. As such, they have a significant water content (35%) and wood fragments of bark, branches, stems and seed pods are often still discernable. Used as a source for steam production and power generation, lignite is limited in its utilization.

As stated above, peat – compressed biomass remains that is as much as 75% water – isn't coal and doesn't fit into the ranking scale but it has traditionally been used as an energy source in single user situations and can be compared to coal in the same terms so as to chronicle its role throughout history. At the commencement of the latest interglacial from approximately 14 500 to 12 000 years ago, peat swamps have been forming where plants in slowly subsiding flatlands have been continuously growing upwards so as to keep above the water level. In higher latitudes such as the Arctic and the Antarctic, the swamps freeze during the winter months and 'peatification' is a slow process. Where the water

remains permanently frozen (permafrost), the peat making process is non-existent. Mostly, peat as a fuel, is used for household heating and cooking.

Wood and biomass, as the lowest ranked members on the solid energy producing scale, occasionally are capable of producing as much heat as peat and lignite though from larger mass volumes. As a fuel for continuous supply power generation, these furnaces are voracious.

Finally, it might be useful to define SE (Specific Energy) as introduced in Table 1. SE is a measure of the heat that is released when a fuel source is burned. A calorimeter consists of a water bath, of known volume, in which a thermometer measures the change in temperature caused by the complete combustion of a fuel source. An exothermic combustion would cause a temperature increase of the water whilst an endothermic combustion would cause a decrease. The amount of heat transferred is measured in Joule (J) and 1J is defined as the heat energy required to raise the temperature of 1 gram of water from 0.0°C to 0.24°C. By this definition, 4.184J is the same as 1 Calorie (cal) which is the heat energy required to raise the temperature of 1 gram of water from 0.0°C to 1.0°C. Similarly, 1 British Thermal Units (Btu) is equivalent to 1055.06 J (or 1.055kJ) and is defined as the amount of heat required to raise the temperature of 1 pound of water from 58.5°F to 59.5°F at sea level. Understanding this might be helpful when comparisons are made between energy sources such as coal, oil, gas, nuclear, hydroelectric, solar or wind.

All the best for the 2021. Stay well and safe.

Andrew Wheeler
YPS member
Queensland , Australia

Contemporary Scientist No 4

Dr Lucy Woodall, Principal Scientist for Nikton and Senior Research Fellow, Department of Zoology, University of Oxford

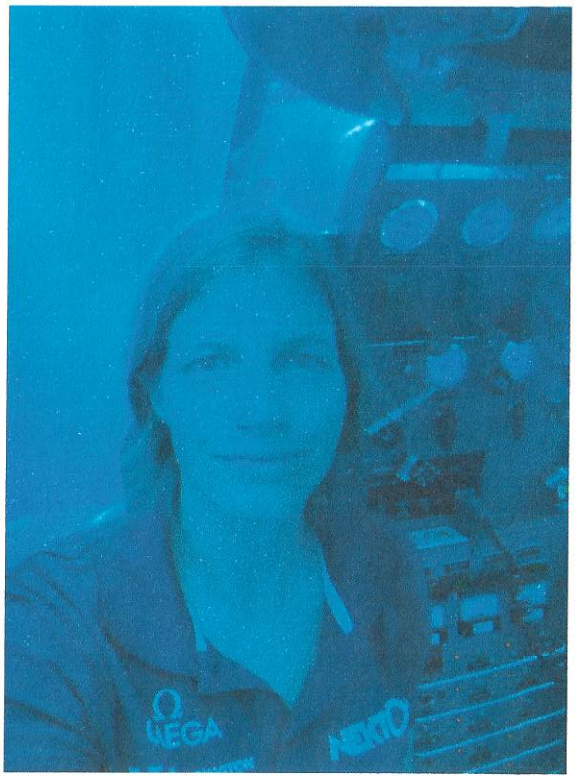
Dr Lucy Woodall is an expert in deep-sea biology, her current work broadly focuses on the processes that drive biodiversity in the marine biome. Lucy seeks to understand the impacts of human activities on the marine environment. She gave a lecture to the Society on "Microplastics and marine litter" in 2017: Lecture abstract and review 2017

In autumn 2018 she shared the following text and image with us for the "Contemporary Scientist Exhibition" in York Explore:

"This is a photograph of me in a submersible at 200m depth in Seychelles while running an expedition there in early 2018. In this image I was waiting to do the first live broadcast from a submersible at depth ever, in partnership with Associated Press. I am interested in documenting and understanding patterns of biodiversity in deeper reef systems, this including recording environmental parameters and human impacts. Expeditions that I run are co-produced with host nations and seek to answer the most pertinent questions for the nation."

See also:

https://www.wiseoceans.com/an-interview-with-wiseoceans-lucy-woodall



Some Simple Ways to Adapt Your Life to Minimise Climate Change

- Reduce Consumption
- Reuse, Recycle, Mend
- Waste Less

Live simply that other may simply live - Gandhi

Average global temperature increase (already over 1 C) needs to stay below 1.5 C warmer if we are to minimise climate change, and extreme weather – floods, droughts, crop failures, migration, sea-level rise resulting from melting ice-caps. The poorest in the world will be the hardest hit.

We have a climate emergency; we must change our behaviour quickly; each of us making small changes, and helping others to do likewise, will make a difference. What we do affects the global population and the developed world has the highest CO_2 emissions.

Limit use of fossil fuels – Transport, especially cars, planes. Have a car free day? Do many things on one car trip. Alternatives to car use? Next car change, consider electric or hybrid; they'll be cheaper very soon. Don't leave car engine running; accelerate slowly. Holidays abroad? How many per year? Always by plane? Planes are the biggest polluters, and air fuel is not fairly taxed.

Heat and light - switch to a renewables provider. 7% of electricity came from renewables in 2010, up to 25% in 2016. Reduce central heating a little, wear a sweater! Turn off radiators in unused rooms; add extra layers to curtains. Thicken insulation in lofts, on doors etc. Switch off lights, don't leave items on stand-by. Bleed radiators to ensure 100% efficiency. Install LED lights - more expensive but use 90% less energy and last up to 25% longer.

Phasing out fossil fuels is essential Europe wants to be fossil fuel free by 2030. UK has greatly reduced coal use, but supports oil exploration and plans a new deep coal mine in Cumbria. The UK boasts about reducing emissions but has 'exported' most of its industrial activity to developing countries.

Food Shopping: aim to avoid plastic packaging (from fossil fuels). Point out to supermarkets that they must try to switch to recyclable materials. (Some changes have been made.) Take your own bags, including paper ones to pack loose fruit and veg. Think about how far fresh goods travel and aim to use mostly UK grown, seasonal produce. Why have strawberries in winter? Enjoy delicious fresh local ones in season. Cook larger quantities and freeze some for later.

Grow your own fruit and veg. - fresher, tastier, no packaging. It is possible in a small space and in pots, even windowsills; try to get an allotment or share one. Freeze the excess. Look out for apples lying on the ground and ask owners politely if you can have a few; some people leave fruit at gates. Don't throw food away, freeze, make soup/sauce. Sell by/best before dates allow more days for use, especially if stored properly; it is obvious when food is inedible. Plant trees and shrubs to absorb CO_2, for memorials, celebrations; fruit trees give you produce.

Water: be sparing in all water use, showers not baths; avoid having a running tap. Collect rain-water for the garden and cleaning the car. Use a bucket not a hose to clean outside. Water gardens very early or very late in dry times; never water lawns, they always recover. Collect cold water coming from a boiler (before it turns hot); use for toilet flushing, rinsing, indoor and pot plants etc. Unless you have a dirty job, outer clothes do not need washing daily and 30 degrees is perfect for almost all washes. In dry and warm weather reduce spin speed; dry clothes outside. Use environmentally safe washing powders, cleaning products. Air coats outside rather than dry clean, sponge collars and cuffs.

Household cleaning - clear/distilled vinegar or lemon juice and bicarbonate of soda will do most jobs. Avoid damaging chemicals in cleaning products and cosmetics, all chemicals end up in the sea. Examine labels – avoid any product with many chemicals. There are books and on-line advice on all the uses of vinegar and bicarb. Bicarb is a deodoriser, use underarms, to clean teeth, in an empty fridge if away. Drop a spoonful of bicarb down a plughole, add some vinegar, a tiny volcanic eruption helps cleanse the pipe

Network - join friends to share transport; consider sharing large items which are only used sometimes eg lawnmowers, other large garden or DIY equipment. There are equipment hire firms.

Clothes - good quality natural fabrics last longer than cheap fashion items. Always take unwanted clothes to charities, or turn them into other items, or swap or give to others. Man-made fibres cause micro-plastics which cannot be filtered out and are then washed into streams, rivers and the sea where they are ingested by wildlife.

Other shopping Avoid upgrading tech. items – phones tablets etc. They need lots of energy to produce and are difficult to recycle. Demand that inbuilt obsolescence must cease in items such as white goods, TVs, cars etc. These items should last for years as they used to. There are some companies which recycle computers and phones; investigate on-line.

Recycling in some areas is limited. General waste goes to incineration and produces energy but better to reduce

general waste. Glass, cans, paper and some plastics can be recycled. Encourage better recycling which should be standardised and comprehensive across the country.

Investments and finance: look for companies with ethical management policies (some of the well-known banks fund destruction of environments through removing natural vegetation, exploration and extraction etc.) **Covid 19** has been hard but we have managed with less and some people have changed their lifestyles and noticed less expenditure

This brief list should prompt more ideas – be creative! And share your ideas!

Barbara Hickman

Another tree detective story …

You may remember the True Service Tree (*Sorbus domestica* pyriformis) in the Museum Gardens, probably the rarest native tree in England: it grows so close to the river that the need to protect it was incorporated into plans for the forthcoming enhancement of York's flood defences. We now know this tree came from a unique specimen in the Wyre Forest, discovered in 1678 and burnt down in 1862. It has a very few relatives, at Thorp Perrow, Oxford Botanic Garden, and Kew; apart from a small wild population recently found near the site of the initial discovery.

Between the Museum and the Multangular Tower stands another very rare tree, a variety of beech known as the Pear-barked beech (*Fagus sylvatica* miltonensis).

The reason for the common name is that the bark is rougher than the relatively smooth bark of the standard beech and more like that of a typical pear tree. If you stand close, you will see that the rough bark starts about shoulder height from the ground, and that there is an apparent discontinuity at this level. This is because the tree is the result of grafting a Pear-barked 'scion' onto normal beech rootstock – not an unusual technique in arboriculture. It is notoriously difficult to age trees, without chopping them down and counting the rings. Making a reasonable guess from its girth, this tree was definitely planted during the Yorkshire Philosophical Society's occupancy of the Gardens, and probably some time in the mid-nineteenth century.

How did the Society acquire such a rarity? The clue is in the name: 'miltonensis'. Every 'miltonensis' in existence stems (literally!) from a single tree, discovered in the early 1830s on the Milton Hall estate, near Peterborough. Milton Hall was then the seat of Viscount Milton, heir to Earl Fitzwilliam. The Fitzwilliam family owned estates in Yorkshire, including Wentworth Woodhouse and around Malton, and Viscount Milton (later Earl Fitzwilliam) had strong associations with the area. The founders of the Yorkshire Philosophical Society – meaning, almost inevitably, the Rev. William Vernon Harcourt – invited Milton to become Patron of the Society. He served as Patron and President of the Society until 1857.

In a letter to John Claudius Loudon – the godfather of English horticulture – dated 2nd June 1837, the Rev. M.J. Berkeley describes how 'in one of the plantations bordering Milton Park … there is a beautiful accidental variety of the beech … Mr Henderson, the very intelligent gardener, has propagated it by grafts'. Loudon published the letter in the third volume of his *Arboretum et Fruticetum Britannicum*, which appeared the following year. Cambridge University Botanic Garden still has one of Mr Henderson's flourishing offspring, acquired in 1846.

So how did such a rarity get from Milton Hall to York?

The Milton/Fitzwilliam connection with the Society is irresistible. Either Lord Milton, knowing of Mr Henderson's activities and of the rarity of the Milton Hall tree, offered a grafted sapling to his friends in the North for their new botanic garden. Or, perhaps more likely, our own very intelligent gardener, Henry Baines, read of the discovery in the YPS Library copy of Loudon's *Arboretum et Fruticetum* and – never one to miss an opportunity – arranged matters, either via the grandees of the Society and Lord Milton, or directly with Mr Henderson. Head Gardeners of the time were pretty good at 'networking'! In either case, the likelihood is that the York miltonensis was actually planted by Henry Baines.

We may never know the answer, but when access to the YPS archives again becomes possible, the search for clues will resume …

Peter Hogarth

Fanny Baines
A life in Museum Gardens

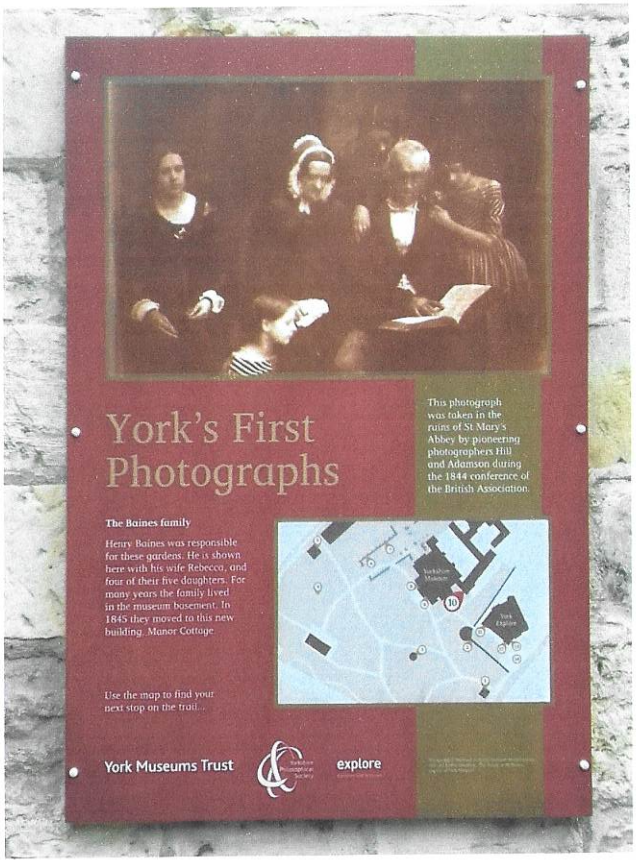
Many YPS members will have explored the YPS Lodge, described by Rita Wood in the August newsletter. It is over ten years since I first climbed the spiral staircase from the office and print room downstairs, and looked round the upstairs of this quirky little building. The two rooms up there, now used as a library, and for meetings and storage, had clearly once been bedrooms, intended for use of the gatekeeper. I wondered who this might have been, and discovered that, as Rita indicated, from 1879 to 1916 it was Fanny Baines

I knew that Fanny was a daughter of Henry Baines, the gardener and sub-curator who had contributed so much to the establishment of the gardens and care of the museum. What sort of life had his daughters led, and how did Fanny come to be the gatekeeper and occupant of the Lodge for so many years? It proved to be an interesting story.

Henry was appointed by the YPS in 1829. When the Yorkshire Museum was completed, in 1830, he was provided with accommodation there – 3 rooms in the basement. Long ago they were made into galleries, though the fireplaces are still visible. Before the addition of Tempest Anderson Hall, in 1913, these rooms opened onto the gardens, but they were hardly ideal accommodation, as Henry already had a wife and three small daughters, Ellen, Mary and Annie. Two further daughters, Fanny and Maria, were born in the basement in 1833 and 1835.

So cramped and unsatisfactory were the conditions in Fanny's basement home, that the family doctor sent a letter of protest to the Society, but it was some years before they rectified the situation. Finally, in 1843, Stephen Beckwith, a local doctor and Vice President of the Society, died, leaving many charitable bequests. One of these was £10,000 to the YPS, on condition they use some of it to build a suitable house for the Baines family. It seems likely that Dr Beckwith had been their doctor. £350 of the bequest was used to construct the house, using stone from the ruined abbey.

In spite of the cramped conditions in the basement, Rebecca, Henry's wife, must have done her best for the growing family. In 1844, before the new house was finished, the British Association for the Advancement of Science came to York to hold their Annual Meeting. This was the first time they had returned to York since the association was founded here in 1831. A series of early photographs, called calotypes, was taken to record this event. Most were of the delegates, but two record Henry's family. By this time, the eldest daughter, Ellen, had moved out to take up a job in service, but the rest of the family are shown gathered round Henry, who is reading a book. This may represent the book he wrote on the flowers of Yorkshire. All are clearly in their Sunday best, with the two youngest girls in identical striped dresses.



The photographers also took Henry on his own. It is very likely that it was Henry who helped them set up their studio in the ruins of St Mary's Abbey, and gave them space to prepare and develop their photographic paper. I suspect Mrs Baines may have provided them with cups of tea, and allowed them to warm their hands by the fire, as all their photographs had to be taken outside. It may have been the Baines' furniture that the photographers used to make it appear the photographs were taken indoors. I wonder what the girls thought about this amazing new process?

At last, Henry and his family were able to move in to their new accommodation. Manor Cottage, as the new house is still called, is the stone building to the right of the museum, set back behind the fern garden. It now bears a blue plaque to celebrate Henry, and is used as offices by the museum staff. Although now rather overcrowded with desks, bookshelves and office equipment, it is easy to see that it would have seemed like a palace to the Baines family. The parents must have felt hugely relieved, and we can only imagine the excitement of the girls, running up and down their own stairs, and peering out of all the windows.

We know few details of the life Fanny and her sisters led in childhood. Henry had clearly valued education, and in later life. Fanny wrote well, so they presumably went to school. I imagine they would have been required to help Rebecca in the house, and would have learned to sew – perhaps they embroidered samplers. I hope Henry allowed them to play in the gardens, when no one else was using them. He was known to be quite fierce with 'boys' whom he caught misbehaving and trespassing.

Time passed and the girls grew up. One by one, Fanny's three elder sisters married. First in 1848 Mary married Matthew Walls, a young man employed as an administrator in the Mechanics Institute, then in 1852 Ellen married Robert Ward, a jeweller. Finally, in 1855 Annie married Thomas Joseph Banks, an artist who later painted a portrait of Henry. Neither Fanny nor Maria married, and they continued to live in Manor Cottage with their parents.

The YPS understood the value of Henry's work, and in 1859 made a generous presentation to recognise his service. Ten years later, at age 75 he had to give up his work in the gardens, and the following year he retired completely. The Society awarded him a generous pension, and he was allowed to continue to live in Manor Cottage, with his wife and two remaining daughters. Fanny was clearly very proud of her father's achievements, and wrote an account of his experiences which provides a valuable insight into Henry's contribution to the gardens and museum.

In 1877, Maria died, followed in 1878 by Henry. Fanny and her mother must have been concerned about their situation, but Fanny wrote to the YPS, suggesting that she and her mother could move into the recently built Lodge, where she could act as gatekeeper. The Society was clearly keen to do the best it could for Henry's widow and daughter, and accepted the suggestion, paying Fanny well for her work.

The Lodge must have seemed quite small after Manor Cottage, but it is a charming little building, if somewhat prone to damp. Two bedrooms upstairs, and two rooms and kitchen downstairs would have been quite adequate for the two ladies. Mrs Baines died in 1882, at the age of 87. Fanny continued to live at the Lodge and work as gatekeeper. By 1911, when she was 78, she was employing a live-in maid. In 1913, she was no longer able to continue as gatekeeper, but the Society allowed her to remain at the Lodge, on full pay, with her maid, until her death in 1916. Her whole life of 83 years was spent in Museum Gardens, from the museum basement, to Manor Cottage, and finally the Lodge.

Margaret Leonard

Manor Cottage Photo: Margaret Leonard

Thoughts on NORTH AND SOUTH by Elizabeth Gaskell

The story first appeared in 1854-55 as a serial in *Household Words*, a weekly magazine edited by Charles Dickens. When published as a book the author added a few short passages and several new chapters.

In March 2019, just before lockdown, I found myself standing in Oxfam in Goodramgate in front of their books. I had heard a lecture on Elizabeth Gaskell a few months before, and had read a biography on the strength of that, so now here was this thick paperback offering itself. It was an obvious duty to buy it, and educate myself. I don't read much fiction; though the Book Programme on the radio sounds wonderful and I wonder how I survive without all those books, they seldom work for me. The last successful dip was with *The Reluctant Fundamentalist,* which I would recommend; they mostly discuss newish books. 'Gaskell' this old one said big on the spine, then 'North and South', less legible, as though it expected me to be a fan of the author already.

I do read Jane Austen, and probably know most of them off by heart as when the weather is not cold I would have one by the bed for last thing at night, and it will be there for months, friendly. It was some days before I braved opening the thick Gaskell book, wondering if I could take the change of pace, or recognise this author's world, and hoping it was not like Dickens. Flicking through, some of her language was strange, though, funnily, language does not hinder me reading Austen who wrote some 50 years earlier. The spelling 'sate' for 'sat' was constantly irritating, and Gaskell's use of 'proud' is clearly not quite what I would expect. Knowing I read fiction too fast, and as the lockdown had now begun, I decided to read this book aloud to

myself, both to make sure I read every word and to keep my voice working.

That was a long time ago, and I have not gone back to Jane Austen. All Gaskell's minor characters are interesting, they are not stock characters or just there to move the story on, but they are individuals, recognisable, strong and well-recorded; they are not really minor at all. I wonder if men also find this novel engaging? Her male characters are well-drawn and I remembered from the biography I had read that William Gaskell often advised on the dialect, and probably other things, while Elizabeth was writing. However, the chief characters, Margaret Hale and John Thornton, were not quite so real to me, the heroine so often weeping, disfigured by a curling lip, taper fingers and a neck like a swan's – and the hero harrowed by a terrible mother (what a mother-in-law was pending, surely, she will have to be run over by a train). Subsequent re-readings of the book at first concentrated on trying to find the points at which John and Margaret began to turn into compatible creatures, but so well-written is it, and so inattentive am I, that I don't think I have spotted them all yet. It needs more work; it is not a bedside book.

The bulk of the story is set in Milton-Northern, the manufacturing town in Darkshire – say, Manchester – with periods in Harley Street in London, at Helstone a hamlet in the New Forest, and with short visits to the sea at Heston – Silverdale? Southport? – and Cromer,

Manchester from Kersal Moor by William Wyld, 1852

and an even briefer visit to Oxford. These were all places familiar to Elizabeth Gaskell, and again each place has a recognisable character briefly sketched. The heroine Margaret, reared in the beauty and ease of the south, yet comes to yearn for the north, with its struggle and danger. This struck me as a rather odd, unromantic, move for a lady novelist, and then I admitted to myself that there were two other themes to the book, and that I had shrugged them off because they were making me uncomfortable. The first is that the heroine comes to love the industrial revolution, the energy and power of it; she believes in progress even though it tarnishes her beloved Helstone (ch. 46). Other characters too (early on her father and, later, Henry Lennox) also admire the energy of the northern industrial scene, so are signalling to readers its general acceptability. This book was written when 'hands' were working ten-hour days six days a week (achieving higher living standards than in the agricultural south, which is not saying a lot), and it was a time when manufacturers could fail and disappear through no fault of their own, taking their dependents to ruin with them. Progress in manufacturing had been lauded by Mr Thornton, our hero, (in ch. 10) likening it to a 'war which compels, and shall compel, all material power to yield to science.' He would probably have said much the same at the end, but with some amelioration begun.

There is a second theme that Gaskell did not consciously write about, but that is detectable now. For example, as spring arrived in Milton, Margaret went for a walk to the outskirts of the town, and 'had gathered some of the hedge and ditch flowers, dog-violets, lesser celandines, and the like, with an unspoken lament for the sweet profusion of the South.' These few (wilting?) flowers were, individually, amazing enough for the invalid Bessy, but for Margaret they were nothing like the fullness of a natural ecology – and how far do we have to go to see that sweet profusion now? Again, on several occasions Margaret sits pensively staring out of her window in the evening, turning over her situation, wondering about her life, and the sky is described. One of these occasions is near the end of the book, when she is back in London (ch. 48), it is summer, and she is watching 'the faint pink reflection of earthly lights on the soft clouds that float tranquilly into the white moonlight, out of the warm gloom which lies motionless around the horizon', Was this 'warm gloom', I wondered, the same effect I had noticed when I lived in London as a child, the low layer of opaque mauveish air round the horizon, different from a blue sky or sharper clouds? What is now known as air pollution. For Mr Thornton and Miss Hale in their separate ways, the 'unparliamentary' smoke whose 'deep lead-coloured cloud' marks out the site of Milton in the landscape is criticised because it wastes coal or means that hands and net curtains have to be often

washed; it is no worse than the fog in London, and both are signs of prosperity and progress.

So, in 1855 when *North and South* was being written, any damage caused by industrialisation was far outweighed by advantages, and few worried about the changes. John Ruskin's lecture at the London Institution in 1884 considered 'a series of cloud phenomena' he had observed, though with speculations and conclusions which could hardly be believed at the time and were put down to his madness – but 'the problem with these dismissals is that Ruskin was right. Ice cores taken at the poles reveal a marked spike in carbon content beginning in the middle of the nineteenth century. By the 1870s, after a century of rapid industrialization coupled with exploding population growth and urbanization, coal smoke rising from the furnaces firing the engines of industrial modernity had so altered the dynamics of the atmosphere as to produce a darkness visible even in the skies of the Lake District, where Ruskin had retreated in hopes that immersion in nature would heal his mental and physical infirmities' (Jesse Oak Taylor, https://19.bbk.ac.uk/article/id/1718/print/). Readers will remember, if they got there in time, the exhibition at York Art Gallery 'Ruskin, Turner and the Storm Cloud'; that began at the end of March 2019, and showed how Turner, Ruskin and the contemporary artist Emma Stibbon have recorded the same landscapes in the Alps – the same, but definitely not the same. The memory of this exhibition cannot but intrude on a modern reading of *North and South*.

Rita Wood

A Small World

Elizabeth Gaskell's husband, William, trained for the Unitarian ministry at Manchester New College, which at that time was located in York, where his tutors included Charles Wellbeloved. An early member of the Yorkshire Philosophical Society, Unitarian minister, social reformer and scholar, Wellbeloved supervised the excavation of St Mary's Abbey when the Society built the Yorkshire Museum and served as its first curator of antiquities.

Citizen Science at the heart of Museums

The recent film "The Dig" *(Netflix 2021)* based on the Sutton Hoo discoveries in 1939 with its emphasis on the role of Basil Brown, reminded me of how useful Citizen Scientists are to scientific investigation. Brown described himself as an "excavator", rather undermining his immense experience and erudition as an "amateur" archaeologist, steeped in the Suffolk landscape. Today the Sutton Hoo collection in the British Museum has been relabelled to include his contribution alongside the landowner and instigator of the archaeological dig, Mrs Edith Pretty.

In the last year when many of us have been paying attention to epidemiologists, virologists, mathematical modellers and other scientific contributors to the understanding of the Covid-19 virus, it may seem that there is little role for the Citizen Scientist. Certainly we are not going to produce a "cure" in our home laboratories but we are part of a scientific conversation, with implications for the health and well being of our communities and which underpins the decisions that we make both individually and collectively.

As a Society, founded by Citizen Scientists 200 years ago, we today invite distinguished professional scientists to explain their research to us and, enjoying the privilege of questioning them, we are part of this scientific conversation. For example, some of you may have taken part in the "Genome Debate" we hosted with a biologist, neuroscientist and a GP who each gave us their different viewpoints, from their specialisms, around the use of Genome data and privacy. At the end of the debate we voted on the motion "This house believes that all children should have their genome sequenced at birth" with the result of 6 for and 12 against.

Our national and local museums are collections built up by donations from both experts and ordinary people. Every year the Portable Antiquities Scheme, for example, adds many archaeological objects to our museum collections. Many of the objects are discovered by metal detectorists, but also by people walking, gardening or through their everyday work. These ever increasing numbers of artefacts provide Curators with challenges in managing such large collections. The Natural History Museum holds 800 million items and is planning a large programme of digitization. Outsourcing some of the work of data capture through Citizen Scientist projects enables anyone to contribute to the scientific work of the Museum's scientists. Currently there is a project to transcribe manuscript descriptions of South Sea Fishes accompanying original drawings by self-taught American naturalist Andrew Garrett (1823-1887). Other Citizen Science projects hosted by the NHM include "The Big Seaweed Search" and reporting "UK Whale and Dolphin Strandings."

Thousands of people are taking part in projects by observing wildlife, collecting samples and transcribing hand written records.

The NHM is also planning to develop the 5 acres around its South Kensington buildings into a biodiverse environment under the "Urban Nature Project" (1) to demonstrate to schools and community groups how they can build their own biodiverse environments as well as conduct their own science projects.

The NHM has an unrivalled team of over 300 scientists working with them; a very different situation from local museums, particularly Natural Science Museums where a science curator has many roles alongside their scientific work, ranging from marketing to clerical. However local museums do provide many open learning opportunities for their communities, including both schools and interested adults alongside providing opportunities for visiting academics.

Among the many treasures in the Yorkshire Museum there is the Tempest Anderson collection (2) of over 3000 photographs of volcanoes, a tremendous resource for contemporary volcanologists, which a YPS volunteer has been helping to organise. A second project involving two YPS volunteers involved cataloguing; photographing and digitising Kirkdale cave specimens i.e. fossils from Buckland's Reliquae Diluvianae. It was hoped that a potential bicentenary project for the Society would be to work with the University of York on sampling, non-invasively, ancient DNA from sample fossils in this collection to answer questions such as confirming species and investigations about evolution and extinction.

In the current existential funding crisis for Museums how can we ensure that they not only survive but also thrive in future? The City of York has declared a "climate emergency"*; is there a leading and creative role for the Yorkshire (i.e. Natural Science) Museum and Garden in the city centre to play in educating and demonstrating the action needed to overcome global warming? It is certain that we need both scientists and citizens to work together to find solutions to the many pressing problems we currently face.

Catherine Brophy

** City of York Council declared a Climate Emergency in March 2019 in response to the Intergovernmental Panel on Climate Change's Special Report, "Global Warming of 1.5°C", Oct 2018. This report said that, unless **emergency** action is taken, global warming will likely reach 3°C with disastrous consequences.*

1. https://www.nhm.ac.uk/take-part/citizen-science.html
2. https://www.yorkshiremuseum.org.uk/collections/collections-highlights/temptest-anderson-explorer-and-surgeon/

I avoided Science

Science was an area I studiously avoided - or, rather, should I say regarded with suspicion and was even a little frightened of. Biology was tolerable until it came to the dissecting of worms, their soggy uneven halves wriggling across the lab bench and stinking of formaldehyde. What was I doing there? It looked so much more inviting outside the classroom and wasn't history the next period? I longed for the fresh air of a nature walk. Chemistry had the ephemeral advantage of some excitement with the odd bang and flash, but I soon came down to earth when the chemistry master enquired, rather scathingly I thought, whether my diagram of an experiment was meant to represent 'New York at Night'! As for physics, my only wish was to get through a lesson without being asked a direct question.

So you will understand that 'science' was not the direction I chose for my future, but instead retreated into the comfortable sphere of literature, drama, history, languages and art - especially art history. But that was in my teens and twenties. A very busy career drove science out of my mind altogether, until, as retirement approached, I gradually came to see that science was just a love of knowledge, of expanding the mind and delving into new and unknown areas, cross-referencing and filling in gaps. The forbidding boundaries of 'maths', 'physics' and 'chemistry' seemed to dissolve and I became fascinated by the quasi-detective story of Fermat's Last Theorem and the mystery of Schrodinger's cat. I began to branch out and read the stories of earlier scientists like Robert Hooke, Robert Boyle, Isaac Newton, written by cultural historians, and could almost feel their frustrations and the ultimate frisson of discovery. On to the 18th and 19th centuries, the time of the self-made, self-educated man - the Lunar

Men, Josiah Wedgwood, Matthew Boulton, James Watt and friends, followed by William Smith, Thomas Cooke and John Snow - all destined in their own fields to change our world. How could I not have seen how exciting it must have been when they made their own important break-through?

Reflecting on my own interests of history and art, I then realised science was fundamental to the formulation of mediaeval glass, the Gothic Arch, the scientific discoveries of the monks, many anonymous, who but for Henry VIII may well have advanced the Industrial Revolution by several centuries. I visited Sutton Hoo to see the beautiful re-imagining of the Anglo-Saxon ship discovered there and admired its engineering - the lines, the precision, the artistic design and remembered earlier visits to Oslo - to the Gokstad and Oseberg Viking ships and to Roskilde and was filled with admiration for the genius, imagination and physical skill on display. Then, how can one ignore archaeology when living in York? It is everywhere. And what about the engineering in our most precious artefact, the Minster, built over 400 years with no plan save the enhancement of the building for the glory of God?

How could I have ignored the fusion of art and science, their dual roles in building and understanding our universe. Artists are scientists in their thirst for representing ideas whether on canvas, in sculpture or in performance art. Imagine Anthony Gormley, Andy Goldsworthy or Barbara Hepworth sculpting without understanding the nature of their materials. Similarly, scientists have proved themselves artists in their elegant equations or in, say, the beautiful double helix of DNA. I am grateful that at last in my 70s I have come to appreciate this staggering interrelationship and to restore 'science' to, if not its proper place, then to a status I would never have thought possible in my 20s.

A YPS member

Read on for ideas of how to expand your own horizons.

Exploration from your armchair

New on the YPS website

We are grateful to Professor Paul Dodds for sharing with members the slides from his lecture on 23rd February, "The Hydrogen Economy":

The Hydrogen Economy | Yorkshire Philosophical Society (ypsyork.org)

Stonehenge

As a follow up to Professor Alice Roberts' BBC2 programme "Stonehenge: the lost circle revealed" there is a more detailed report in the journal "Antiquity" Volume 95 issue 379 published online by Cambridge University Press 12th February 2021: "The Original Stonehenge? A dismantled stone circle in the Presali Hills of west Wales".

https://www.cambridge.org/core/journals/antiquity/article/original-stonehenge-a-dismantled-stone-circle-in-the-preseli-hills-of-west-wales/B7DAA4A7792B4DAB57DDE0E3136FBC33

"Future Forum"

The most recent "Future Forum" involved a survey of 1,000 14-18 year olds on a range of issues including genetics research, medical data usage and COVID-19, gathering their perspectives on the impact such work has, and will have, on their lives. More details and a link to the full report are available on the British Science Association blog.

https://www.britishscienceassociation.org/blog/future-forum-2020-report-launch

A walk around York

If you fancy a virtual walk around York, this web-site is highly recommended:

http://yorkstories.co.uk/

Or further afield

In a series of three short films Professor Malcolm Airs explores aspects of his beautiful home town of Dorchester-on-Thames.

Date inscriptions on buildings:
https://youtu.be/7tzPADmRlls
A history of windows: https://youtu.be/sJHYPoH7kLQ
Building materials:
https://www.youtube.com/watch?v=WcWs1o8yiOc&feature=youtu.be

For armchair archaeologists

CBA Yorkshire's website has some interesting short talks including Eric Houlder describing his work at Sutton Hoo in the less famous but no less fascinating 1960s dig on the site:

http://www.cba-yorkshire.org.uk/fireside-chats-one/

Online art

A virtual contemporary art gallery, including work by, among others, art and design students at Selby College who were unable to stage their usual graduate exhibition in Selby Abbey due to Covid restrictions. This year's exhibition is entitled "The Role of Technology in Art and Design" – type Selby College into the search box on the website.

www.artsteps.com

Covid heroes

The National Science and Media Museum in Bradford hosts an online photographic exhibition showing engineering heroes of the Covid crisis:

www.scienceandmediamuseum.org.uk/whats-on/engineering-response-covid-19

Diary

Please note that there have been several changes to events listed in the printed programme distributed last autumn. The following is correct at time of going to print but details may change and we continue to add new events. For the most up-to-date information, please check the website: www.ypsyork.org

2021

Tues 9 Mar, 7.30 pm – YPS Lecture
The Enemy Between Us: The Impact of Inequality
Professor Kate Pickett & Professor Richard Wilkinson

Tues 17 Mar, 7.30 pm – YPS Lecture, jointly with YANT
Wentworth Castle and Wentworth Woodhouse: Georgian rivals united through 21st-century restoration and public access
Dr Patrick Eyres

Tues 23 Mar, 7.30 pm – YPS Lecture
Following the Paper Trail: The Value of Country House Archives
Dr Christopher Ridgway, Curator, Castle Howard

Wed 24 Mar, 7.30 pm – YPS Zoom Event
Chocolate: from Bean to Manufactory
Ashley Petch, Events Manager, Cocoa House, York
NB Advance booking required – see page 3

Tues 7 Apr, 7.30 pm – YPS Talk
Caribbean Memories – an escape from Covid
Margaret & Rod Leonard

Tues 13 Apr, 7.30 pm – YPS Lecture
Lifeways and deathways of the first farmers in Europe
Dr Penny Bickle

Wed 9 Jun, 7.30 pm – Café Sci
You've changed your tune: intonational variation and change in Middlesbrough (and York)
Dr Sam Hellmuth

Tues 22 Jun, 2.00 pm – **Annual General Meeting**
Tempest Anderson Hall, Yorkshire Museum, York
This will be followed by a lecture.

Dates to be confirmed – see page 3
Cambridge & Sutton Hoo Study Tour

Tues 9 Nov to Thur 11 Nov
A Stratford-upon-Avon Tour with a difference!

Unless otherwise stated, all the talks listed will be on Zoom. Details for each lecture will be sent to members by email. We are aware that our present limit on number of participants has meant that for popular lectures some have been disappointed. We are exploring ways to increase our limit and also looking into recording the lectures and making them available on a YPS YouTube channel for viewing after the event. We are grateful for your patience while we look into the best options.

SAFEGUARDING

The Yorkshire Philosophical Society (YPS) takes seriously its obligations and responsibilities to protect and safeguard the welfare of any child, young person or vulnerable adult who attends our events.

Unless otherwise stated, all our events are open to members and non-members. We welcome children provided that they are accompanied by a responsible adult.

The Safeguarding Policy is displayed at the Lodge. The Safeguarding Officer is the Chair, Ms Catherine Brophy (chair@ypsyork.org) to whom all safeguarding concerns should be addressed.

PRIVACY

The Yorkshire Philosophical Society (YPS) holds members' names and addresses and, where supplied, telephone numbers and email addresses. This personal information is used for sending out details of our activities. The information remains confidential and is retained within the Society. Members may have access to their personal information on request by contacting the Clerk at info@ypsyork.org