THE GEOLOGICAL SOCIETY OF GLASGOW

PROCEEDINGS

Session 161
October 2018 to September 2019

Anglesey Trip - September 2019. The group at the Holyhead Quartzite quarry at Breakwater Park, Holy Island.

Registered Scottish Charity No. SC007013

President: Dr Neil Clark

www.geologyglasgow.org.uk

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SESSION 161 (2018-2019)

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Council Members

The positions that came up for election at the AGM on December 12th 2019 are listed here along with the nominee, proposers and seconders.

All nominees were elected unanimously.

Position	Nominee	Proposed by	Seconded by
Secretary	Walter Semple*	M Cummings	N Clark
Archivist/Asst Librarian	Margaret Anderson*	W Gray	N Clark
Proceedings Editor	Vacant		
Librarian/Publications Officer	Vacant		
Webmaster	Bill Gray*	C Forrest	M Cummings
Website Consultant	Neil Clark*	I Millar	J Morrison
Ordinary Member+	Simon Cuthbert*	M Cummings	W Semple
Ordinary Member+	Mina Cummings	M Anderson	N Clark
Editor of SJG	Brian Bell*	N Clark	W Semple
Editor of SJG	Colin Braithwaite*	N Clark	W Semple
Independent Examiner	Ian Anderson*	N Clark	W Semple

Notes:

* Denotes retiring postholder willing to stand again
+ The Council can have up to six ordinary members.

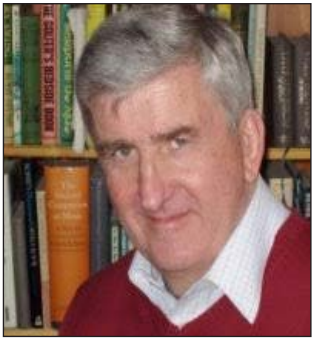
Retirees:

Jim Morrison has stood down as Vice President. **Bob Diamond** has stood down as Librarian/Publications Officer

Continuing Officers:

The following continue in office: **Neil Clark** - President, **Brian Bell** - Vice President, **Campbell Forrest** - Membership Secretary, **David Webster** - Meetings Secretary and Newsletter Coordinator, **Roy Bryce** - Day Excursions Secretary, **Maggie Donnelly** - Residential Excursion Secretary, **Ian Millar** - Ordinary Member, **Ann Ainsworth** - Ordinary Member

Neil Clark - President



Walter Semple - Hon Secretary

Reports

a. President's Report

Exciting things are happening in the world of geology in Scotland with the help of the Geological Society of Glasgow. There is a new Scottish Geology Trust that is about to be launched and is hoped to help promote and fund geological projects in Scotland. The famous 19th century Scottish geologist and author of Principles of Geology, Charles Lyell's notebooks were offered for sale and bought for Edinburgh University. There have been so many projects that the members have been involved in that only a few can be mentioned here. The Society has become more involved with community projects including the Societies' Day at Kelvingrove, activities relating to the visit of Dippy the Dinosaur to Glasgow, and the Westerton Gala Day which had an extra-terrestrial theme including a stall explaining meteorites, with the help of Dr Luke Daly (University of Glasgow), Matthew Staitis and David Webster.

The Membership Survey, organised by David Webster, was a great success and has provided information which will help us to improve the Society over the coming years. This feedback will be a core part of future meetings of the Council, which Members are encouraged to join.

Thanks to Maggie Donnelly and Roy Bryce, we have had a fantastic range of field trips, which have been very well attended, including the joint field trip with the Edinburgh Society to Blairskaith Quarry. The trip to Islay was so popular, that we decided to return there in 2020 where priority will be given to those who were unable to attend the 2019 trip, thanks to David Webster as well as Maggie. You can keep up to date with the activities of the Society on our new updated website, as well as the social media pages on Facebook and Twitter. Thanks to Bill Gray and the Website Committee for the immense amount of work upgrading the website, it is now first-class.

The publications of the Society are undergoing changes too and we are consolidating the Proceedings into the quarterly Newsletter which we hope will make it a more interesting read. Due to limited access in the Geology Department, we are looking to rehouse many of the Society's books. Thanks to Bob Diamond and the rest of the Publications Committee for all the sterling work they have done.

The Society is also heavily involved in the conservation and preservation of Fossil Grove in Victoria Park. This unique internationally important geoconservation site has been at risk for many years. More recently, Walter Semple, Campbell Forrest, David Webster and others have become involved with the Fossil Grove Trust and have done a lot of work liaising with Glasgow City Council in order to develop a plan to improve this vital geological site on our doorstep.

We are always sad when distinguished members of the Society leave us, and we are particularly sad that both Ben Browne and Mervyn Aiken both passed away this year. I would like to thank all Council Members for their commitment, ingenuity and contributions to the Society and I look forward to working with them in the future. We are always looking for new members of the Council and there are positions available

for ordinary Council Members. We welcome opinions, suggestions and any help with the various committees and activities of the Society. Please contact us if you might be interested in finding out more or becoming more involved in discussing our future direction.

Neil Clark

b. Meetings Secretary's Report

First up on the 12th October was Professor Alasdair Skelton of the University of Stockholm who presented a case study of metamorphic fluid flow from the SW Scottish Highlands (including Islay).

On 9th November we welcomed Professor Ian Alsop from the University of Aberdeen who gave an enlightening talk on earthquake induced soft-sediment deformation. He used a case study from the Pleistocene of the Dead Sea area to give pointers as to what to expect and interpret in ancient deposits.

Our speaker for the 14th December lecture was Dr. Roddy Muir from Midland Valley Exploration here in Glasgow who gave a fascinating and very well received talk about the Ben Nevis North Face Survey and described an alternative model of igneous activity to the traditional caldera collapse model.

Into the New Year. On the 10th January our President, Dr Jim Morrison, delivered his Retiring Presidential Address entitled "A broader view of the Moine Thrust".

We welcomed Dr Nick Fraser from the National Museums of Scotland on the 8h February where he told us all about the amazing variety of Triassic beasties. This was a joint lecture with the Glasgow Natural History Society.

On the 8th March we welcomed Dr Bernard Besley, a consultant with Besley Earth Science Ltd, an expert in Carboniferous sedimentology and he delivered a very interesting talk on "Basin evolution in the Variscan foreland in southern Britain" - geology largely hidden beneath the Mesozoic cover and a bit different to the more familiar Scottish Carboniferous.

On the 11th April, in a change to the original programme, we were very grateful to Dr Iain Allison of the Society who stepped up to the plate without a lot of notice and gave a enlightening talk on Greenland. He covered aspects of the Archaean and early Proterozoic gneisses and, on Disko Island, their cover of Palaeogene volcanics and also the impressive glacial scenery and culture in west Greenland.

Finally, we had our usual Members' Night on 9th May. The presentations were from:

- Jim MacDonald: "Coastal Dunes in North West Spain."
- Matthew Staitis: "The 'Blooms of Doom'- The effect of volcanic induced temperature and iron concentration increase on cyanobacterial growth, a possible analogue for the End Permian Mass Extinction."
- Margret Greene: "Strathclyde Geoconservation Activities."
- Bob Bower:: "What has sparked my interest in Geology and what I have learned so far."

- Gary Hoare: Trearne quarry fossils (desk-top presentation).

David Webster

c. Day Excursion Secretary's Report

The day excursions program started on 1st June with a trip to the Paraffin Young museum at the Almond Valley Country Park visitor centre followed by lunch then a guided tour of the National Mining Museum at Newtongrange. I had promised to arrange one excursion this year that could be enjoyed by members who had lost their enthusiasm for clambering over barbed wire fences and this very enjoyable and leisurely excursion was the outcome. There were 18 participants on the trip. Our leader on the day was Dr Iain Allison.

The next excursion was on 22nd June to Blairskaith Quarry. For the first time since I started organising these trips 5 years ago circumstances meant that I was unable to attend on the day. Bob Diamond very kindly offered to perform the admin duties in my place. Since this was our annual joint meeting and meal with the Edinburgh Geological Society, there can be some extra last minute changes to plans, but Bob coped admirably. On this trip there were 8 GSG and 18 EGS participants led by Dr Neil Clark.

Trip number three was a visit to the St. Abbs Head National Nature Reserve. I had worried that this was quite a long bus journey but it turned out to be a popular choice with 19 participants. We started and finished our trip at the excellent visitor centre coffee shop. The excursion then followed a well made walking path with magnificent views both of the geology of the cliffs and out over the sea from the cliff tops. Many thanks to Dr Con Gillen for leading this trip.

The fourth field trip was on 27th July to inspect parts of the Ballantrae Complex. This is not called a Complex without reason, and Con had suggested that we would enjoy visiting a selection of sites along the coast. Unlike the museums visit, the paths we navigated were usually quite steep and slippery, so several of the party (including myself) decided not to attempt the descent to a couple of the exposures. Those that did brought us back some spectacular photos so we did not feel left out. Thanks again to Dr Con Gillen for leading this trip.

I have been struggling somewhat to find accessible places of geologic interest around the Glasgow area that we haven't already visited recently, so decided to offer one trip further afield this year in the hope that this would attract more people. On 17th August, 10 of us left for Threlkeld in the north of the Lake District. We were lucky with the weather and enjoyed excellent views over the landscape. This was followed by an excellent meal in the Horse and Farrier Inn. Many thanks to Dr Simon Cuthbert for his insights and local knowledge from previous trips.

I requested suggestions for places to revisit that we had not been to for a while, and the 2002 trip to Dalry and Saltcoats was mentioned by several people as well worth recreating. I contacted Dr Colin MacFadyen and he was kind enough to agree to dig out his old notes. On 7th September 21 of us set out on a cool but clear skied day to look for fossils in the Lynn Glen. The river was in spate but luckily Colin had some examples

that he had found earlier. Next we drove down to Saltcoats for a walk along the coast culminating in a "find the fossil treestump" competition which attracted some local participation alongside our efforts.

As ever, could I thank everybody who joined us on the excursions, without your participation we would not be able to make these trips happen.

Roy Bryce

d. Residential Excursion Secretary's Report

1. **Islay** – Fri 26th to Mon 29th April 2019
Leader – Mr David Webster 21 participants
2. **Anglesey** – Sun 22nd to Fri 27th Sept 2019.
Leader – Ms Christine Arkwright, Open University. 18 participants

On Islay we stayed in various B & Bs in Bowmore and on field days used a 17-seater minibus plus one private car. The weather was mixed but the geology fascinating.

On Anglesey we stayed together in one hotel in Llanfairpwllgwyngyll (yes that town). We had booked (and paid for) a 17-seater minibus but the company actually provided a 27-seater coach – much more comfortable! The weather was good with some sunshine; again the geology was fascinating and so different from that of Scotland.

As on previous trips, volunteers were 'persuaded' to write a half day report, providing 6 reports for Islay and 9 for Anglesey.

Maggie Donnelly

e. Librarian's Report

There are a number of issues which need to be taken forward by someone (or a group) with the energy to undertake a quite considerable task.

1. What should be the collection and retention policy of the Library?

At present the Society's books and journals are intermingled with the Departments. Neither material is much used, but it does contain substantial amounts of valuable paleontological and Scottish geological material eg complete sets of BGS Scottish memoirs. There is a complementary complete set of Scottish Geological maps. Potentially this is of value to the membership but two issues would need to be resolved. Firstly, how would this material be publicised? and secondly, where would it be stored?

2. Although the immediate threat to the continued storage of our material seems to have abated, it is likely to be only a matter of time until the University asks us to remove our stock. It would be prudent to have a contingency plan in place for such a scenario.

Bob Diamond

f. Publications Officer's Report

Council has set up a Publications sub-Committee consisting of David Webster, Brian Bell, Margaret Greene and Bob Diamond. It has not met recently, but has identified the production of a new Glasgow Guide and a new Skye Guide as a priority. David Webster has done a great deal of work in identifying the possible sites for the new Glasgow

guide. In order to restart momentum, and continue it there is a need for someone with time and energy to take a lead.

Online sales of the Madeira Guide still continue to provide a steady income. The book stock continues to decline, and it is doubtful if we should continue to stock anything other than Scottish field guides. The impact of Amazon and other online book sellers means that the purchase of 'commercial' books is probably uneconomic. Someone with ideas and energy is needed if this venture is to be continued. The present stocktaking and moving of books from store to upstairs is quite a disincentive to continuing with the service.

Bob Diamond

g. Proceedings Editor's Report

The proceedings were, as usual, printed by Panda Print wo have been serving us well for several years. Some were distributed by hand but most were mailed. Thanks go those who wrote extensive reports on the two residential trips and on the day trip to Muirsheil Country Park. Copies of these reports are now available in full colour on the website.

Mina Cummings

h. Scottish Journal of Geology Editors' Report

The final issue for 2019 is in page proofs and should be available in the near future. Papers are already published in 'Online First' on the journal website. This issue will include a number of articles written by budding young authors, with help, where necessary, from the Editorial Board. This departure has been overseen by Heather Stewart and Martin Kirkbride and has been well received as doing something positive to promote new careers. However, we continue to suffer from a dearth of submisssions and remind readers that they do not need to be professional geologists if they have something to say about Scottish geology, the Board will assist them.

On our behalf GSPH also undertakes substantial additional editing. All references and order are checked. Symbols and equations are checked and any supplementary materials given direct links. Language, spelling and grammar are checked together with sentence inconsistency, figures and captions.

In the past year Maarten Krabbendam has found it necessary to give up his place on the Board because of commitments to his real work. His efforts both as an editor and referee have been much appreciated over the years. In his place, covering the same general fields, we have welcomed Romesh Palamakumbura.

Our partnership with the GSPH continues to bear fruit. A new feature is the exposure of the Journal in the Lyell Collection, of which we form a part, on Social Media, with combined subscriptions now of over 20,000. There are continuing concerns regarding Open Access. Our publishers operate the hybrid system that benefits the SJG. However, there is official pressure to move exclusively to Open Access but concerns as to how this can be financed when it currently costs an estimated £1,800 to publish a single

article. There is a suggestion that it will become impossible for Gold standard OA to publish in what are referred to as hybrid journals, while at the same time failing to fund publication in wholly OA titles. The Geological Society (London) and Geoscience World (California) are in discussion, and a solution may be some way off, but these facts underline our dependency on these larger organizations that currently offer 46 Journals >2,000 Books and 4 million reference records. We would be unlikely to survive without this backing as most of our authors do not have independent funding.

Colin Braithwaite

i. Website Report

The website continued to be an important platform for promoting the society during Session 161. The Lectures and Excursions sections publicised the society's current activities to members and non-members alike, while the News section contained items of general geological interest as well as ones of immediate relevance to the society. A new set of extracts from the society's proceedings for significant anniversary years (150 years ago to 25 years ago at 25 year intervals) was added to the Anniversaries page of the Archive section, thanks to the efforts of the society's honorary archivist, Margaret Anderson.

A major upgrade to the website took place during Session 161. The original website was launched in January 2011 and given a minor upgrade in 2014. The main purpose in carrying out the new upgrade was to produce a "responsive" site which adjusts its display to suit the type of device that is being used to view it, and the upgraded site looks a lot better on phones and tablets than the previous site did. The upgrade involved a lot of work in the design and prototype stages, which lasted from September 2018 until July 2019. This process involved extensive discussions between the society's website group and the website developers, Red Paint. The new site was launched on 1 August 2019. Following the launch, many teething problems were discovered, most of which have now been resolved.

The new website has a radically different appearance from the old one and has several new features. The Local Rocks map now has a zoom facility and has an additional interactive feature that allows one or more of the different rock types (sedimentary, igneous, metamorphic) to be highlighted. There is also an events calendar that displays the events taking place during a particular month and allows any of these to be selected to allow the details to be seen.

In previous years, the website report has contained a breakdown of traffic to the site and a comparison of the current year with the previous one. This is not possible this year because the website traffic was disrupted during the preparation and testing of the new website. I hope that it will be possible to reinstate this feature next year.

In addition to the website, the society continues to use its Facebook page and Twitter account to engage with the public. The Facebook page contains features of general geological interest as well as information about the society and its forthcoming events. The number of followers of the page has increased over the last year from 93 to 143.

The most responses to a post occurred in April, when 457 people interacted with the post on the Lochaber Geopark. The 19 events advertised on the page over the last year reached 11,000 people, with 331 responses. The post that reached most people was the one on the "Should we bring dinosaurs back to life?" discussion at Kelvingrove, with over 9,500 reached and 264 responses. The majority of those considered "fans" were in the 25-34 age bracket, with the 55-64 age group coming a close second. There were almost equal numbers of women and men among the fans. The same could be said for our followers too. If you have a Facebook account, or use other social media, please "like" and share any society posts that you find particularly interesting.

The society's Twitter account (@GeolSocGlasgow) continues to gain in popularity and now has 61 followers, almost twice the number that it had a year ago (31). If you have a Twitter account, please follow us and retweet any of our tweets that you like.

In my role as Webmaster I am assisted by three society members who join me in the website working group: Neil Clark, Maggie McCallum and Maggie Donnelly. This group meets regularly to discuss the development of the website and has been especially busy in the past year with the website upgrade. I am grateful to all three for their continuing support.

The website requires a continuing input of news items and event details to keep it fresh and topical. I am grateful to society members who have provided such material in the past and encourage all members to continue to send relevant articles and information to web@gsocg.org.

Bill Gray

j. Membership Secretary's Report

Membership number appears stable, but includes a number of lapsed/defunct members. These are quite difficult to detect due to the fairly high proportion of "late" payers and the high proportion of members (34%) who do not pay by standing order.

Considerable effort will be made during Session 162 to "clean up" this number. Terminations and deaths recorded were 12.

	At end Session 161 (30 Sep 2019)	At end Session 160 (30 Sep 2018)
Honorary Members	5	5
Ordinary Members	253	253
Associate Members	70	70
Junior Members	19	18
Institute Members	3	3
TOTAL Members	350	349
New Members	13	18

Campbell Forrest

k. Strathclyde Geoconservation Group Report

On 16th February SGG had a stall in Kelvingrove Museum as part of 'Dippy' Information Day. A5 fliers were produced for that day, they cover: The Whangie, The Highland Boundary Fault at Balmaha, Campsie volcanoes and lava, Glasgow Necropolis, New Lanark, Glasgow Drumlins and Havoc Hole at Dumbarton. The fliers and other leaflets were available and a number of SGG members discussed the geology of the surrounding area with members of the public.

Our next 'Dippy' day was on 6th April. This was an 'activity' day which was held in the Educational Room of the Museum. A wide range of 12 different activities was on offer; one of the favourites was gold panning for which we have to thank Sarah Arkley from BGS. Another favourite was identifying various dinosaurs; there was also a quiz about Dippy with a prize of an egg containing a small dinosaur for the correct entries.

Over the summer M Greene was forwarded a number of queries which came in to the GSG mail, these included a request to find out what quarry the sandstone of the enquirer's house came from - and another quarry related question from a couple who were involved in an art project called "Erratic Drift" https://www.facebook.com/erraticdrift/.

D Webster put the North Lanarkshire Geodiversity Audit, written by Paul Carter PC and Mike Browne MB and typed by A Drummond and B Balfour, in the February GSG Newsletter. The NLC Geodiversity Action Plan is now on the NL website again due to the efforts of PC and MB. The script for a new leaflet "North Lanarkshire Rocks" has been passed to Laura McCrory, biodiversity officer at NLC, who is hoping to help with layout and printing. This is still pending.

B B has also been typing up their audit reports of sites in South Lanarkshire, namely Calderglen Country Park and Rotten Calder, East Kilbride Expressway to the River Clyde. Once MB has added photos etc, the documents will be submitted to the Biodiversity Officer of South Lanarkshire.

500 copies of the booklet on the geological trail in Glasgow Necropolis were printed. The Friends of Glasgow Necropolis received a number of them and Glasgow Cathedral has received approx 200.

SGG was asked to look into the fact that there is no geology in the Lodge (formerly the David Marshall Lodge) above Aberfoyle, run by Forest and Land Scotland (FLS). This resulted in a number of members of SGG meeting with Mike Keen in the Lodge on 13th August to discuss a variety of proposals. There has been encouraging correspondence with FLS and at present we are in the process of gathering a small display of rocks relating to the geology around Aberfoyle as well as putting together information sheets on a variety of geological subjects e.g. the Highland Boundary Fault and the slate quarries.

In September SGG was involved in the Doors Open event with a walk round the Building stones of Central Glasgow on the 18th and Allison Drummond was present at the Fossil Grove for its Open Day on 22nd September.

Margaret Greene

l. Geodiversity: Argyll and the Islands Report

The GAI AGM was held in March 2019 on Luing at the Atlantic Islands Centre. The meeting was joined by Seonaid Leishman from Strathclyde Geoconservation group. Following the meeting there was a short excursion to Ardinamar to discuss the mineralisation associated with the Tayvallich Volcanics, metamorphosed to epidiorite schist/metabasite. A variety of common minerals were noted, but the exposures were too fractured and faulted for useful conclusions to be drawn. The locality is known for its manganese minerals as well as more common minerals including galena, chalcopyrite and sphalerite. In WW2, the area is reported to have been assessed by Canadian miners for its potential for manganese ore extraction, but the only signs are small trial adits.

In September Historic Environment Scotland in association with the Rockfield Centre in Oban held a public event called Stonefest intended to stimulate interest in natural stone, including the resurgence of skills associated with working stone. GAI and the Luing History Group provided specimens and exhibits for a display of slate working history on Luing. A visit to Luing by HES indicated they were interested in the potential for small scale slate working for conservation work, with associated skills training. This remains to be taken further.

A*lastair Fleming*

m. Treasurer's Report

1. The results for the year show that expenditure exceeded income resulting in a deficit of £3,193. This was anticipated and has come about because of planned expenditure of £4,403 on a major upgrade to the website.
2. After deducting the deficit Members' funds are £17,427. In addition, we have Restricted Funds of £8,356 and an Endowment Fund of £59,171.
3. Membership income is down very slightly at £6,695. There is no gift aid income this year as the claim has not yet been submitted and processed. However, the income of around £1,000 will be included in the following year.
4. Publication income is well up at £437 due to good sales of the Madeira and Moine guides, and there are surpluses on both the Saturday and Residential excursion accounts.
5. Excluding the website upgrade overall expenditure is down £1,077 on last year with savings in a number of areas.
6. The Conoco Phillips fund was set up to award a prize to the top pupil in the Geology Higher. As there is no longer such a Higher, we have agreed with Conoco Phillips that the balance on the fund can be shared between the 3 Scottish Geological Societies to be used for suitable purposes.
7. The Endowment fund which was set up last year has generated income on the year of £3,083 of which £375 has been spent on awards. Together with the surplus from last year there is an income balance of £5,486 to be used as appropriate.
8. The balance on the Endowment Fund is £59,171 down by £295 on last year due to

market movements. This is not a concern as the investments are long term and are achieving the objective of generating endowment income.

Ian Veitch

THE GEOLOGICAL SOCIETY OF GLASGOW

Income and Expenditure Account for year ending 30th September 2019

			Session 161 2018 - 2019		Session 160 2016 - 2017	
Income						
1. Subscriptions						
Received during year			6564		6580	
Deduct paid in advance this year			-50		-181	
Add received in advance last year			181	6695	324	6723
2. Investment Income						
National Savings				167	132	132
3. Gift aid				0		1185
4. Publications	In house	net surplus	250		112	
	Moine Guide	revenue	187	437	75	187
7. Saturday excursions		net surplus		285		97
8. Week end excursions		net surplus		31		48
9. Donations (coffee collections & personal)				438		275
10. Bank Charges net refund				0		25
Total income				**8,053.00**		**8672**
Expenditure						
1. Meetings incl speakers expenses, etc			866		1582	
Room Hire			3687	4,553	3663	5245
2. Publication and postage of Proceedings				502		535
3. Strathclyde Geoconservation				0		0
4. Library and Down to Earth				320		270
5. Affiliation fees				40		40
6. Insurance				213		202
7. Website	Maintenance		338		374	
	Upgrade		4403	4,741	54	428
8. Admin costs - postage, stationery, etc						
Newsletter				584		788
Miscellaneous				9		5
Membership Secretary(including new software)				212		329
Treasurer				72		58
9. Presentation for long service				0		200
Total expenditure				**11,246.00**		**8100**
Deficit fot the year				**-3,193.00**		Surplus 572

THE GEOLOGICAL SOCIETY OF GLASGOW

Balance Sheet as at 30th September 2019

		Session 161 2018 - 2019		Session 160 2017 - 2018	
Members' Funds					
Balance as at 30/09/2018		**20,620**			
Add Surplus for the year		(3,193)		Surplus 572	
Members' Fund as at 30th September 2017			**17,427.00**		
Restricted Funds	TN George fund	340			
	less engraving costs	0	340		
	Brian Bluck fund at 30/9/18	8,000			
	less prize 2019	500	7,500		
	Conoco-Phillips fund	1,350			
	less share to other societies	834	516		
Total non endowment Funds			**25,783**		
Represented by					
Current assets					
Cash at Bank					
Royal Bank of Scotland		6,539		9636	
Less due to endowment fund		882	5,657		
National Savings Income Bond			12,000	12000	
National Savings Investment Account			4,307	21,964	4140	25776
Cash in hand					
Publications Officer			22		
Weekend Excursion sec			165		
Stock of Publications	In house		2,608		2854
	Moine Guide part of stock held by Nat Mus Scot		1,007		
Add Debtors	Room Hire in advance		483		
Less Liability			26,249		
	Subs paid in advance	50			181
	Outstanding payments	416	466		
Net assets			**25,783**		

Endowment Fund			
Investments			Balances
Value at 30.09.18			59,466
Loss in value in the year			(295)
Value at 30.9.19			**59,171**
Income			
Balance at 1 October 2018			1,778
Income for the year		3,083	
Sponsorship			
to Strathclyde RIGS	200		
to Scottish Geodiversity Forum	125		
to Friends of Hugh Miller	50		
Total Sponsorship		375	
Surplus for the year			2,708
Legacy from Nigel Trewin			1,000
Balance at 1 October 2018			**5,486**

The financial statements were approved on …….. by the Trustees and signed on their behalf by

Signed as approved by the Trustees ..... Dr Neil Clark *(President)*

Signed by the Independent Examiner ..... Dr Ian Anderson

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Excursion Reports

Day Trip to Two Mining Museums

Saturday 1st June 2019

Leader Iain Allison **Participants 18**

Report by Mina Cummings

Our party set off at 9am on a pleasant, dry morning. A great relief after three days of heavy rain. Iain provided an historical overview of the Mining industry and we set off first for the Shale Oil Museum in the Almond Valley Centre in Livingston. There we examined the exhibits at our own pace. Indoors were examples of the many things for which oil could be used, for example early rubber baby's dummies.

There were samples of different types of oil-bearing rock, much of the geological exhibits aimed at firing the interests of children but it worked just as well for us.

Rather alarmingly there were also exhibits of Paraffin heaters and advertising posters for Pink Paraffin which some of us could remember using. It was a bit disconcerting to find such familiar objects in a Museum.

Outdoors apart from a very nice tea room there are lots of exhibits and activities for children having nothing to do with geology but very interesting nonetheless. There are pigmy goats and a variety of ducks, two black swans and the biggest white rabbit we'd ever seen complete with its own house and gazebo.

The History of the Shale Oil industry presented by Iain is as follows: The modern mineral oil industry started in Scotland in 1850 when James Young was granted a patent for producing oil from coal and oil was produced from 1851 from coal, boghead coal(torbanite)and oil shale(lamosite). Liquid oil was first produced at Petrolia Ontario Canada in 1857 and at Titusville Pennsylvania USA in 1859. Mining occurred at Tarbrax in the south to Philpstoun in the north between Linlithgow and Kirkliston. When oil production ceased in 1963 there were 27 bings containing over 200 million tonnes of burnt shale which represents a volume of a cube with sides 900 meters – from the Gregory building to Kelvingrove subway station.

Geologically the layers of oil shale occur in the Lower Carboniferous (Dinantian) between the Cementstone at the base of the Carboniferous and the Lower Limestone Group. The stratigraphy was divided into a Lower and an Upper Oil-Shale

Group with the boundary at the Burdiehouse Limestone. The Upper Oil-Shale Group is thickest around West Calder at about 850 metres and thins to the east and south. Production was mainly from the Upper Oil-Shale Group and yields ranged from 70-200 litres of oil per tonne of oil shale. This stratigraphic unit, from the base of the Clyde Plateau Lavas to the top of the Upper Oil-Shale Group, is now called the Strathclyde Group and within it the Upper Oil-Shale Group is now referred to as the Hopetoun Member. The Bings are also of considerable social and historic importance; Five Sisters and Greendykes are scheduled as historic industrial monuments. They are a focus of community identity in a population whose common culture of mining is slowly being eradicated by families of non West Lothian origin taking up residence in the many new housing developments in the county. As a consequence, the bings have potential as an educational resource at all levels because of the historical importance of the industry which created them (from paraffin to detergent), the ecological importance of their extensive flora and fauna (nature reserves and primary succession) and the geological importance of the Carboniferous sedimentary rocks from which they were mined.

Following our very enjoyable visit to Almond Valley we went to look at the Albyn shale Bing at Broxburn, a very impressive sight. The afternoon was spent at the National Mining Museum of Scotland at Newtongrange, south of Dalkeith.

The main story the guide told us was that once the coal came up from the pit, it was laid out on sorting tables for women to pick out the stones. New rules came out meaning that women were no longer allowed to do such work, so they were all sacked. Since they were completely uneducated and often widowed with several children, the law of unintended consequences meant starving women and children.

Once stones were removed, the load was weighed again and if the tallyman thought there were too many stones in the original bogey, pay was docked completely. Didn't take too long for a new worker to try hard not to have many stones in his bogey. Not such 'Good Old Days'

Arrangements had been made by Roy for us to have lunch together in the Museum cafeteria which was very much appreciated. We also had the privilege of witnessing the photo session for a wedding being celebrated in the Museum's function suite. We were all agreed that this was a very enjoyable trip and thanks were expressed in the customary way.

Residential Excursion to Islay

Fri 26th to Mon 29th April 2019

Leader: David Webster **Trip organiser: Maggie Donnolly**

Bruichladdich & Port Charlotte: Fri 26th April, pm

Report by: Bill Gray

After a rainy crossing on the 13:00 ferry from Kennacraig, it was dry by 16:00, when we met our leader, David Webster, opposite the shop at Bruichladdich for our first encounter with the rocks of Islay (NR 267614). We were in the Rinns of Islay, and this was our introduction to the Rinns Complex, a suite of metamorphic rocks dating to around 1.8 Ga, which forms the basement of the island. The main outcrop of the Rinns Complex is on the southern section of the Rinns peninsula, to the south of Port Charlotte, but there is a tongue that stretches north to meet the coast at Bruichladdich. The complex consists of two different types of metamorphic rock – a pinkish syenite gneiss and a dark metagabbro, or amphibolite. Both the igneous rock types have been metamorphosed at amphibolite facies; with the syenite undergoing an earlier gneissose deformation prior to gabbro intrusion. The protoliths were calc-alkaline rocks formed in a volcanic island arc above a subduction zone at the edge of the supercontinent Columbia at around 1.8 Ga and these were metamorphosed shortly after, when the arc collided with the supercontinent.

Fig. 1. Augen gneiss of the Rinns Complex at Bruichladdich (Bill Gray).

On the shore opposite the shop we saw outcrops of the metasyenite and noted the gneissose fabric. The main mineral was pink potassium feldspar (syenite is quartz poor). Within the outcrop there were patches of darker foliation, which consisted mainly of the more mafic mineral amphibole. We then walked 100 m to the north where we saw outcrops of greenish rocks, which were examples of the metagabbro. The main minerals were amphibole, plagioclase feldspar, chlorite and epidote. We continued northwards across the bay to a headland (NR 268615), where we examined an outcrop of the dark green metagabbro with pink inclusions. This was an augen gneiss (Fig. 1). The rocks had a shearing fabric, and the inclusions were composed of potassium feldspar. David explained how the mafic minerals were smeared out as the fabric developed, and the feldspars grew later between the foliated layers. The stretching direction was NE – SW.

We returned to the cars and drove 2 miles further south along the Rinns to Port Charlotte, where we parked and went down to the shore to look at the rocks to the north of the Gleann Mor burn (NR 253585). We were just north of the main outcrop of the Rinns Complex, and the rocks on the shore were dark metasedimentary rocks which were deformed and contained pods of quartz (Fig. 2). These rocks belonged to

Fig. 2. Metasedimentary rock with quartz pods, from the Colonsay Group, at Port Charlotte (Bill Gray)

the Octofad Sandstone Formation of the Colonsay Group. The Colonsay Group is in the lowest part of the Grampian Supergroup and consists of deltaic sandstone and mudstone sediments laid down when the supercontinent Rodinia broke up at around 750 Ma. The rocks were lightly metamorphosed during the Caledonian Orogeny and contain the greenschist facies minerals chlorite and muscovite. We then crossed the burn to examine the rocks on the south side. Here we looked at two groups of rocks; the group to the north, next to the burn, was composed of metasedimentary rocks belonging to the Octofad Formation, similar to the rocks we had seen north of the burn, while the southerly group consisted of meta-igneous rocks of the Rinns Complex. (From this point to the south of the peninsula, virtually all of the rocks belong to the Rinns Complex.) We examined the fabric in the metasediments, which corresponds to the bedding in the original sediments. There is a sheared unconformity between the two groups of rocks, corresponding to a time gap of around a billion years (1 Ga). Although the unconformity wasn't visible, the outcrops on either side of it were close together, and it was possible to straddle the stratigraphic gap that corresponded to the 1 Ga time gap (Fig. 3).

Fig. 3. David straddling the 1 billion year unconformity at Port Charlotte. The Rinns Complex rocks (1.8 Ga) are to the left (south) and the Colonsay Group rocks (0.75 Ga) are to the right (north) (Bill Gray).

We now returned to the road and went to the Islay Nature Centre in Port Charlotte, where we had very welcome tea and biscuits and a talk by David to introduce us to the geology of Islay and outline the plan for the weekend ahead. We then drove to our accommodation, keenly anticipating the rest of the excursion.

Sat 27th April, am

Report by: Maggie Donnelly

On a damp and blustery morning we met up in the 'Square' in Bowmore and, in a seventeen-seater minibus and a car drove south along the A837 on the Rinns peninsula. The sea was wild and dramatic with white capped waves crashing against the rocks below. About 1 km north of Portnahaven we turned right to West Claddich where there was a small grassy parking area (NR 152 534). We stepped out into what was now a

howling gale and made our way down to a small sandy cove – Currie Sands. On the east side the rocks were greenish amphibolites, polished by the sand, and penetrated by intrusions of fine-grained grey metabasalt. The rocks on the west side were very foliated and sheared pink gneisses containing pockets and lenses of the original gneiss. Because of the intensity of the foliation and shearing the rocks can be regarded as a mylonite.

On this west side below the high tide level there is an exposure of breccia with angular clasts of gneiss in a bright red, probably dolomitic, matrix, and thin cross-cutting veins of haematite. The breccia marks the line of a N – S fault along which erosion has created the beach and bay. We climbed up the east side of the cove and walked about 200m NW across rough grass and through a gate to a vehicle track which led us to the site of an old wave generator, no longer in use. This was situated on a rock platform some distance down the cliff below us (Fig. 4). The wind was still a howling gale and we had to stand back from the edge to prevent being blown over!! The platforms on either side of the generator were of sheared and foliated pinkish and pale green mylonite. The deformation seemed to be concentrated in the mafic rocks – the pinkish felsic gneisses were less deformed. Fresh surfaces of the greenish rocks felt soapy indicating the presence of talc, a product of the intense deformation of ultramafic igneous rock, and small pockets of fibrous chrysotile asbestos could be found. There were also veins of 'pistachio-green' epidote, produced by the later metasomatic alteration of the mafic rock.

Fig. 4. Remains of the wave generator (Seonaid Leishman).

Having returned to the vehicles, we continued along the coast to park beside a field gate and much farmyard junk (NR 159 535). The group set out along the edge of the cliff to access the beach at Lossit Bay via a very steep slope. The rocks around the beach were again greenish amphibolites and much foliated sheared pink gneisses (Fig. 5). The Rinns Complex is now regarded as the 1.8 Ga basements of Islay and the Highlands between the Great Glen Fault and the Highland Boundary fault. It is also found beneath Scandinavia and Labrador. The syenite and the gabbro yield dates of around 1.8 Ga - with the gabbro being about 100 Ma younger. A younger radiometric date of 1,780 Ma indicating somewhat later metamorphism has also been obtained from similar gneisses in

Fig. 5. Felsic gneiss on north side of the beach at Lossit Bay. (Rhona Fraser).

Fig. 6. A contact between gneiss and a later metagabbro intrusion (Rhona Fraser).

Northern Ireland, which likely correlates with the late Laxfordian thermal event, possibly caused by the the collision of an island arc with Colombia. Towards the south of the beach a felsic pegmatite penetrated an ultrabasic black rock – this latter contained 70% hornblende and a small amount of serpentine indicating that it had a pyroxenite protolith. A contact between the metagabbro and the (older) foliated syenite was observed (Fig. 6).

Sat 27th April, pm

Report by: Iain Allison

As the rain and blustery wind continued, we drove from Lossit Farm north to Kilchiaran, parking by the chapel. The aim of the afternoon was to examine the meta-sedimentary rocks of the Colonsay Group. We walked back, south-west, along the road to inspect the slates in the road cutting and look down to the north-west to an obvious square-cut gulley of the former slate quarry. The slates belong to the Kilchiaran Phyllite Formation above the basal meta-sandstones. In the road cutting they have an obvious sub-horizontal crenulation lineation (Fig. 7).

Fig. 7. Slate of the Kilchiaran Phyllite Formation at Kilchiaran with nearly horizontal crenulation lineation (Iain Allison)

Fig. 8. Gully marking the shear zone between the Rinns Complex, left, and the Colonsay Group, right (Iain Allison).

From the road, through a gate, we walked down grassy slopes towards the shore and observed a narrow gulley carved out along the shear zone between the Lower Proterozoic (~1800 Ma) gneisses of the Rinns complex, to the south-west, and the meta-sedimentary rocks of the Upper Proterozoic (~750 Ma) Colonsay Group to the north-west (Fig. 8).

Returning to the road we then took some shelter in the 14th Century Kilchiaran (St. Ciaran) chapel. Some took the opportunity to have a quick lunch. The roofless chapel contains a stone font and a grave slab with relief carving of, possibly, a priest. Heading down towards the beach, we first looked at the till exposed on the north-west side of the little valley for flint clasts. Although no Cretaceous chalk is recorded onshore in the Hebrides, it occurs offshore and glacial

action has transported flint clasts in the till. On the valley sides the rocks are smoothed by ice action and have numerous glacial striae.

On the beach, the Kilchiaran Phyllite of the Colonsay Group is well exposed with the bedding picked out by alternating layers of paler siltstone and darker mudstone. The thick layer of slate occurs towards the base of the Kilchiaran Phyllite. Some layers show structures reminiscent of soft-sediment deformation. Finally, we looked at a thin lamprophyre dyke, cutting the bedding, and dated at 412 Ma (earliest Devonian).

We drove to Port Charlotte for a toilet stop at about 3.30 pm at the Islay Natural History Trust's Nature Centre then headed back north-west to the coast at Saligo Bay. We traversed the beach from north to south. The rocks here are meta-greywackes of the Smaull Greywacke Formation of the Colonsay Group which are younger than the Kilchiaran Phyllites we saw previously. The greywackes are turbidites with coarse granular bases and very muddy tops (Fig. 9). There are soft sediment deformation folds

Fig. 9. Fine-grained top of one turbidite unit overlain by the sandy base of the next bed at Saligo Bay (Iain Allison).

Fig. 10. Small-scale upright folds at Saligo Bay (Iain Allison).

in the muddy layers. There are numerous small-scale folds of the turbidites (Fig. 10) on the limb of the anticline-syncline fold pair with a wavelength of about 2000 m. A thick, ~3 m. Palaeogene brown-weathering dolerite dyke cuts the meta-sedimentary rocks and trends NW – SE. After an hour at this locality we headed back to Bowmore at 5.10 pm. (Reference: The afternoon localities are described in Excursion 3, Localities 1,2, 3 and 9 and Excursion 4, Localites 8 and 9 of Webster, D., Anderton, R. & Skelton, A. 2015. A Guide to the Geology of Islay, Ringwood Publishing, Glasgow)

Sun 28th April, am

Report by: Con Gillen

Bowmore to Port Askaig.

The day started calm, with sunny intervals, but a short shower at lunchtime made us dash for shelter. David gave us a summary of the stratigraphy for the day, as follows:

Jura Quartzite Formation (sandstone)

Bonahaven Dolomite Formation (limestone and dolostone)

Port Askaig Tillite Formation (PAT: diamictites, disrupted beds, dolostone Great Breccia near base)

Lossit Limestone Formation (top of Appin Group Dalradian; dolostone and limestone. The latter overlies the Bowmore and Colonsay Groups)

The Colonsay Group is about 800 Ma old, and may have been part of a Grenville foreland basin. Bowmore Sandstone comes above the Colonsay Group, followed bythe Appin Group -dominated by limestones (including Lossit), then the PAT. Limestone is still being worked for roadstone at Ballygrant, with extensive open quarries. The Jura Quartzite is 5 km thick, thinning to 500 m on the Mull of Oa. Several thrusts (Loch Skerrols, Bolsa, Beinn Bhan) push up the strata into an 'anticline': a pop-up structure.

We crossed limestone country to get to a small (newish) roadside quarry at (NR 3492 6481) in the Port Askaig Tillite (PAT), with an overall orange-weathering appearance. Fresh surfaces were purplish, while joint faces were rusty. We found a few angular and sub-rounded granite clasts in the clay-size host rock, which had a strong fabric. Blue slate was found at the foot of the quarry, and brown diamictite higher up. Bedding structure is obvious, in the form of a crude lamination. Carbonate clasts were common, as weathered-out white and grey limestone, and creamy and rusty dolostone. These had been eroded from the underlying limestone formation. Granite clasts were quite rare. One large stone of tillite indicated that the rocks had been reworked. A clast-supported breccia bed was present, and more granitic material higher in the sequence. The strong fabric, more or less parallel to bedding, resulted from being close to the Loch Skerrols Thrust.

We then followed the main road via Ballygrant to Loch Lossit. The car park was at the local waterworks (NR 4085 6552). The Bonahaven Fault runs across the north end of Islay (the road follows this fault). On the SE side of Loch Lossit is the PAT, and Lossit Limestone (with Jura Quartzite at the top of section). We followed a rough path around the west side of the loch. On the way, we noted the trial mining pits (for lead) in the Lossit Limestone (close to Mulreesh, where the old lead mines occur), at [NR 4096 6476]. The hill of Beannan Buidhe lay above some boggy ground, and the ridges opposite had a couple of distinctive Cenozoic dolerite dykes cutting the Lossit Limestone Formation at (NR 4145 6465). Careful examination showed small sand injection structures (earthquake-related?). Moving gently up hill to (NR 41378 64755) we came across yellow and orange dolostone, finely laminated, with a change of thickness, indicating a possible microbial mound (cf stromatolites). David explained the subtleties of carbon isotope studies, likely indicating that the climate was warm at the time (heavy C more life, light C less life.) but got colder upwards.

Fig. 11. An impressive karstic feature near Beannan Buidhe (Con Gillen).

At the top of the ridge we came across an impressive karstic feature (Fig. 11), typical of limestone country, at (NR 4144 6486), in pale dolostone or limestone. Above the limestone came the basal breccia of the Port askaig Tillite Formation with limestone clasts, then sandstone with a distinctive dolomite cement, and small clasts of dolomicrite. We then managed to find some shelter for a brief lunch.

Sun 28th April pm

Report by: Rhona Fraser

After lunch at the top of the 'hill' we started slowly descending a spur containing at first 2 units of the PAT– a unit containing breccias above the Lossit limestone followed by a brown dolomitic sandstone. Lower down the ridge, mudstone/slate and then quartzite layers appeared below the limestone. At one locality (NR 4142 6488) stromatolites were exposed directly below the breccia unit (Fig. 12). The breccia here is thought equivalent to the Great Breccia on the Garvellach Isles.

Fig. 12. Stromatolites overlain by breccia at Beannan Buidhe (Con Gillen).

Further downhill a siltstone bed above the brown sandstone showed a layered texture thought to be due to seasonal fluctuations in the amount of sediment deposited i.e. it was a varvite. Several dropstones were seen to be deforming these layers implying that they had fallen from melting ice into soft sediment at the time of its deposition (Fig. 13). Above the siltstone was a further sandstone bed with prominent cross-bedding (Fig. 14).

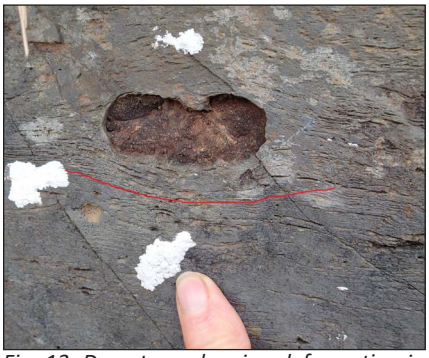


Fig. 13. Dropstone showing deformation in the varve layers (Rhona Fraser)

Fig. 14. The varved siltstone unit with the cross-bedded sandstone above (Rhona Fraser).

If the 'Snowball' Earth hypothesis is to be believed, the breccia layer here indicates the start of the unfreezing and is equivalent to D13 on the Garvellachs. There is no D1-D12 on Islay. D1-D12 on the Garvellachs are thought to indicate the growth of glaciers suggesting a unconformity between the tillites and the Lossit limestone.

Further west we came to the famous 'Disrupted Beds' (Fig. 15) which on Islay are

Fig. 15. The Disrupted Beds (Rhona Fraser)

Fig. 16. First major diamictite, equivalent to D14 on the Garvellachs (Rhona Fraser)

thinner and less blue-grey silstone than on the Garvellachs. They are called this due to their uneven appearance. The red layer contains sandy dolomite, plus or minus clasts, while the blue-grey layer is 30% iron (hence colour) either as haematite or magnetite (NR 4125 6476). It has been suggested that this iron layer is equivalent to a Banded Iron Formation (BIF) when, it is thought, the sea was separated from the air by ice, preventing iron from oxidizing and hence forming the BIF. The cause of the disruption in these beds is now thought likely to be an effect of volume change during early dolomitisation.

Above the Disrupted beds is a typical diamictite (D14) of the PAT (Fig. 16). The diamictite shows rough bedding and has a steep cleavage. The clasts are not dropstones here, indicating instead a source from grounded ice.

Our next locality was accessed via a rough narrow coastal path from the distillery of Bonahaven. Port Askaig Tillite (PAT) seen in the last locality, is now overlain directly by the Bonahaven Dolomite which contains banded dolomite and siltstone, muds with shrinkage cracks and stromatolites. TheFormation has four members containing mostly siltstone with a small amount of dolomite. This combination suggests a shallow marine or subtidal environment. The third member here has the most dolomite of the formation but also contains stromatolites. There are several late Carboniferous dykes. and run NW – SE (compare with the Midland Valley dykes which run E – W) and were likely feeders to a Permian lava field present in the sound of Jura. One dyke contained rare mantle xenoliths at its base with vesicles/amygdales nearer the top possibly implying the dyke has been tilted.

Walking further south across a small rough promontory we came to a beach of fallen blocks which on closer inspection were made mainly of laminated structures i.e. stromatolites. Looking back at the south face of the rough promontory we saw it consisted of a ‘cliff’ of stromatolites. Importantly, the presence of these stromatolites implies that after the end of the glacial period, conditions became warm enough for life to restablish itself. The Bonahaven Dolomite could be a ‘cap carbonates’ to the underlying PAT, formed due to increasing CO2 levels, warming and increased weathering after deglaciation. This would lead to an increase in seawater carbonate with a resultant precipitation of cap

carbonates. Also seen here were a few anhydrite nodules implying evaporation and a possible sabkha environment. The Jura Quartzite overlies the dolomite.

Happy with today's expeditions we 'staggered' back to the cars and hence back to Bowmore where we had a lovely sociable meal in a local restaurant in the evening.

Mon 29th April am

Report by: Jim Martin

The day started with an excursion to Kilnaughton Bay. Our route took us out towards Carraig Fhadda Lighthouse. David met an acquaintance who was delighted to learn that the stone structure in his garden was a sea stack.

Subsequently we passed 3 significant exposures; the Jura Quartzite, Jura Slate and Scarba Conglomerate. The Jura Quartzite is likely to be about 630 Ma. Its depositional environment was a gradually filling, while deepening sand basin mobilised by strong tidal currents. Kyanite blades were present in mudstone interbedded within the quartzite, indicating high grade metamorphism at a level unique within the UK. Regrettably, a previously published reference to the presence of the kyanite had resulted in the removal of a prime specimen by persons unknown.

We then examined a grey laminated mudstone, the Jura Slate, stratigraphically above the quartzite and of similar age to the Easdale slate. Its depositional environment was deeper than that of the quartzite with the sand source switched off. We took the concrete path out to the lighthouse walking over the Scarba Conglomerates – well bedded pebbly metaconglomerates showing a gradual finning upwards. These metaturbidites were formed in a basin during the Caledonian orogeny.

On relocating to Port Ellen, David reviewed the weekend's programme summarising the locations and formations we had visited and their significance. He went on to arrange our group in time sequence (Fig. 17), incorporating the geological events relating to the formation of Islay and its wider environment. This exercise, supplemented with

Fig. 17. Our group 'in time sequence' on the beach at Port Ellen (Seonaid Leishman).

props, was thought provoking and provided an opportunity for our group excursion photograph.

Margaret thanked David, expressing our gratitude for his leadership and dissemination of his extensive knowledge of the complexities of Islay's geology. Seonaid, in turn, thanked Margaret for all her efforts in organising an excellent trip – enjoyed by all.

Reference and further reading

Webster D., Anderton R. & Skelton A. C. 2015. A Guide to the Geology of Islay. Ringwood Publishing

Botanical Backdrop to the Islay Rocks

Report by Anne Gray

While our attention was focused primarily on the wonderful rocks of Islay, we could not help also noticing the wonderful spring flowers around us, on our late April geological weekend. The first impact was the blaze of bright yellow from the gorse as we drove inland from the ferry. Next came the pale lilac-blue carpets of bluebells in numerous woodland stretches and all along the roadsides.

This year has reportedly been a remarkable spring for primroses; Islay was no exception. There were masses of the beautiful pale yellow clusters clinging to damp rocky slopes and all along the hedgerows. On many sites, these were complemented by the blue of dog violets and a few early germander speedwells. In spite of the wild wet weather on the Saturday, we spotted one or two orange tip butterflies and knew to look for the cuckoo flower on which they lay their eggs; we did find a smattering of them in sheltered spots.

The coastal path towards the lighthouse at Port Ellen was particularly rich in wild flowers, with many still in bud, ready to delight the next set of visitors.

Residential Excursion to Anglesey

Sun 26nd to Fri 27th September 2019

Leader: Christine Arkwright, OUGS **Trip organiser: Maggie Donnolly**

Introduction **Maggie Donnelly**

The oldest rocks of Anglesey, the Mona Complex, 650 – 500 Ma, have a different geological history from those of the rest of the British Isles, while the rest provide a detailed record of events leading to the formation of southern Britain. They cover more than half of Anglesey. The oldest is the Coedana Complex – ca. 614 Ma granite intruded into older gneiss plus schist and hornfels. Slightly younger is the Blue Schist – which are ca. 580 Ma metamorphic rocks of blue schist facies and the Monian Supergroup. This is comprised of Gwna Melange (Cambrian 490 – 540 Ma) formed in the later stages of the Cadomian Orogeny and the earlier Precambrian Gwna Group (debris flows, spillitic lava, tuff, with jasper, chert, limestone, schist, quartzite), the Skerries Group (massive volcanic tuff), the New Harbour Group (green mica schists, with intense micro-folding, and the South Stack Group comprising greywacke, schist of the Rhoscolyn Formation, the Holyhead Quartzite with intense micro-folding and greywackes and schists of the South Stack Formation.

Ordovician rocks include altered silica rich volcanic and shales, with Cu mineralisation of the Fydlyn Group. Silurian-age marine conglomerates, sandstones, and shales are succeded by Devonian red conglomerates, and sandstones, siltstone and Carboniferous limestone, chert, shale, sandstone (Dinantian), deltaic sandstones and siltstones (Namurian) and red mudstone, sandstone, coal of the Westphalian. There are also Mesozoic (very small), Palaeogene, Quaternary and Holocene outcrops,

Fig. 1. The name of the town displayed in the hotel reception area. (M Donnelly).

Fig. 2. Chris introduces us to the complexity of the terranes of Anglesey (Bill Gray).

On Sunday our group made their separate ways, by train or car, to the Carreg Bran Hotel in Llanfairpwllgwyngyll (Fig. 1), close to the Menai Straits where we met our leader, Chris Arkwright (Fig. 2) and had an enjoyable evening meal.

Mon 23rd Sept, am **Report: Maggie Donnelly**

On a dry and bright Monday morning we awaited the arrival of our 17-seater minibus when a very comfortable 27-seater coach pulled up to collect us. This was to be our transport for the four days! Driving north to Red Wharf Bay we parked near the sea and

set off along the rocky shore which was bordered by an undulating cliff. The rocks are Carboniferous – the original sediments were deposited on top of the older Devonian rocks in the east and south of Anglesey. There is a major unconformity between the Devonian and the first Carboniferous rocks. Deposition of the Carboniferous sediments took place in narrow gulfs and depressions with NE to SW trends; karst features (limestone solution weathering), solution pipes and sand-rich deposits are common.

A HUGE block of limestone (Castell Mawr) came into view (Fig. 3), standing alone on top of the cliff, easily 200 to 300 m high – the remnant of a thick limestone bed which extended some distance inland. A little distance later we moved in close to the now low cliff to see a number of red sandstone beds underneath a deposit of mostly angular clasts in a muddy matrix. The latter was a glacial till left by the last ice age. Examining the sandstone beds we realised that we were looking at the cross-section of a river channel which had flowed at right angles to the present shoreline. Further on, we were able to inspect several sedimentary features including a solution pipe (Fig. 4). We then arrived at a wide sandstone platform with circular features about 1 m in diameter and 10 to 20 cm deep. After some speculation, the most plausible explanation was that these were the tops of filled-in solution pipes (Fig. 5). We made our way back to the coach and proceeded to Ligwy Bay where we had lunch.

Fig. 3. Our first sighting of the rocks of Anglesey: the Carboniferous limestone strata of Castell Mawr, Red Wharf Bay (Bill Gray).

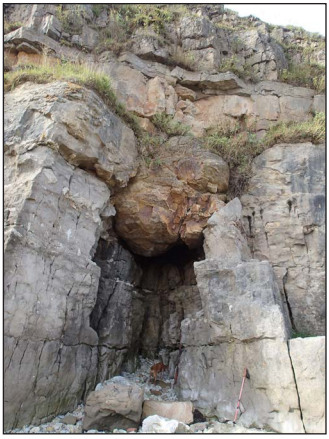


Fig. 4. A sandstone pipe (Rhona Fraser).

Fig. 5. Rocky platform with the tops of sandstone pipes (Rhona Fraser).

Mon 23rd Sept, pm Report: John Guerrier

The afternoon was spent at Traeth Lligwy beach. Turning right/southeast from the car park brings you to a rock face of basal Carboniferous age. The bottom of this succession

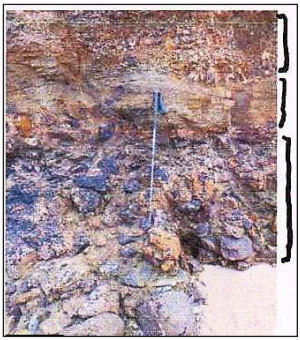


Fig. 6. Series of sandstone and conglomerate layers (John Guerrier).

was a sandstone conglomerate with large 30/40 cm, rounded and poorly-sorted clasts. Above this was another conglomerate with much smaller clasts. At some points there was an in-between narrow, 30cm, band of coarse grained sandstone (Fig. 6). It was suggested that the lower conglomerate layer could be beach sediment and the difference of the layers suggest changes of sea level of the period. The surface of the lower bed was gently undulating so that erosion must have started before the upper layers were laid down. A little further along the beach was a large block of fossiliferous limestone surrounded by sandstone conglomerate. It was suggested that the limestone block may be the remains of a sea stack. There was obvious faulting in these beds further along the beach, although we only saw this from a distance.

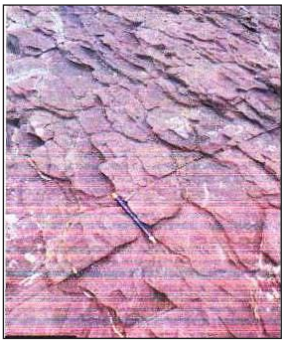


Fig. 7. (left) Purple rocks showing polygonal desiccation patterns (John Guerrier).

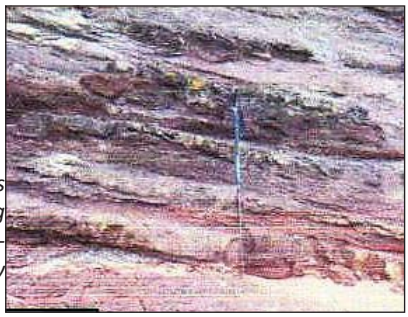


Fig. 8. (right) Rocks showing alternating lamination of fine-grained and crusty layers. (John Guerrier).

Retracing our steps back along the beach and now heading north we reached a series of very fine-grained, purplish sandstones of Devonian age. This is some of the only Devonian rock on Anglesey. The rocks showed very clear polygonal desiccation patterning which interestingly also showed in the present day muds above the rock bands (Fig. 7). These rocks exhibited alternating lamination of fine-grained layers and crusty layers (Fig. 8) The purple rocks were also dotted with many corn stones formed out of limey mud (Fig. 9). This pattern suggested shallow water in desert-like conditions, with cycles of water evaporation and windblown fine dust particles. Faulting could be seen on this Devonian side of the bay as we had observed on the Carboniferous rocks side. Unfortunately heavy rain started and we were obliged to make a quick dash back to the coach.

Fig. 9. Mudcracks and cornstones in the Devonian ORS (Bill Gray).

Tuesday 24th September, am **Report: Bob Diamond**

On Tuesday morning we set off for Llanddwyn Island, on the southernmost tip of Anglesey. We were met there by the ranger (it's a nature reserve with restricted access), and led to the seashore – first, however, removing a small tree from our path. as you do.

The first geology we encountered was the pillow lavas of the Gwna group (540 + Ma). These rocks form the basement of Anglesey and were formed during the Cadomian orogeny. At this time the Iapetus Ocean was still opening, and Anglesey was on its southern margin as part of Avalonia. However Avalonia was tracking towards Laurentia as a result of which oceanic crust was beginning to subduct under the continental crust. Lava was being extruded on the ocean floor (not at the mid ocean ridge) as pillows. However here the pillows were subsequently turned through 100 – 110 degrees during the Grampian orogeny – so not the nice flat sequence we see at Ballantrae. Soon after the pillows formed there was mineralisation (probably from deep sea vents) which introduced cherts, jasper and other silica rich minerals (Fig. 10).

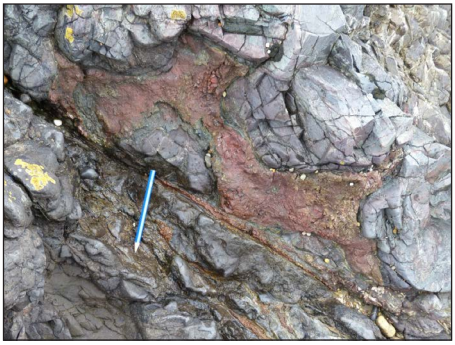


Fig. 10. Silurian-age pillow lavas with chert, on Llanddwyn Island (Bill Gray).

At the second location we saw evidence of sub-sea reworking of ocean sediments, including the pillows. The sediments were quite fine-grained, and had been metamorphosed to blue schist facies (low temperature/low pressure). There had been a considerable amount of jumbling up of the strata to produce a quite chaotic outcrop. Once again there was secondary intrusion of cherty material. As we walked along the island we came across outcrops of fine-grained mudstones with some volcanic tuffs amongst them. Further along there were layers of jaspery chert and chloritized mudstones, but nothing to alert us to the visual and geological feast we were about to experience.

Fig. 11. Two photos of the the beautifully-coloured melange of the Monian Gwna Group, formed during Cadomian Orogeny (Bill Gray).

Our lunch stop and third location (Fig. 11) was the site of the 'melange', first identified by Edward Greenly who mapped Anglesey in the early 1900's. The melange consisted of a chaotic mixture of clasts, with little or no bedding. The clasts consisted of pink jaspers, greenish chlorite minerals, cherts and many other silicic and quartz rich minerals. This had been formed when the sediments which had accumulated in the trench of the subduction zone had been scraped off the descending plate as an accretionary wedge, but what a difference from the greywacke sequence of the Southern Uplands!

Finally we returned via the pilot's cottages where in times past ships pilots waited in order to safely guide ships through the treacherous Menai Straits. We also had a look at the remains of St Dwynwen's church. She is the Welsh patron saint of lovers. There were also two lighthouses on the island. All in all a very special place

Tuesday 24th September, pm **Report: Maggie Donnelly**

After a late lunch we drove northwest towards Rhosneigr, stopping on the way at a plant that crushed freshly quarried granite, clasts of which, up to 10 cm in diameter, had been spread across the area immediately outside the gates and the fence. We spent a considerable time examining these and collecting some. The granite is pale grey, containing plagioclase feldspar, pale pink potassium feldspar. quartz and muscovite. Some of the clasts had mineral veins of haematite, pyrites and chalcopyrite. We then continued to Rhosneigr and onto its shore. These black slates, originally sands and muds, are Ordovician. They are intensely folded (Fig. 12) with bedding almost parallel to cleavage, and are seen to be the 'right way up' because the bedding is at

Fig. 12. Eye-catching folding and cleavage of Ordovician sandstone and mudstone, at Rhosneigr (Bill Gray).

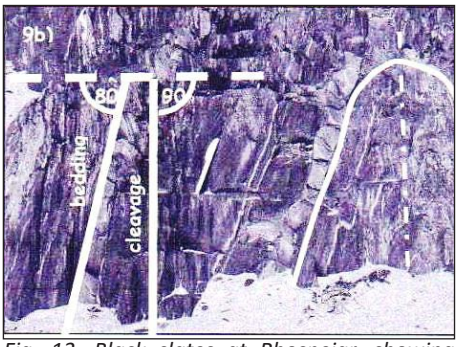


Fig. 13. Black slates at Rhosneigr, showing vertical cleavage (90^0 to horizontal) and shallower bedding (80^0 to horizontal), indicating that this is the left hand limb of an anticline, the core of which is highlighted on the right (Christine Arkwright).

Fig. 14. Cleavage refracting from parallel in mudstone to fan-shaped in sandstone (Christine Arkwright).

a shallower angle than the vertical cleavage (Fig. 13). Also, the cleavage can be seen to refract from the sandstone into the mudstone where it is more closely spaced (Fig. 14). Graded bedding and cross-bedding can also be identified. Again we spent a considerable time examining all the beautiful features and taking photos. The late afternoon sunshine was now truly beautiful as was the view across the sea. We then set off back to the hotel.

Wednesday 25th Sept, am **Report: Anne Gray**

We spent most of the day on Holy Island, the most westerly point of Anglesey. In the morning we visited Breakwater Quarry Park (see cover photo), which lies in the Holyhead Quartzite formation. This is the oldest member of the South Stack Group of the Monian Supergroup, which are among the oldest rocks in Anglesey. The three members of the South Stack Group, the Holyhead Quartzite, the Rhoscolyn Formation and the New Harbour Schists, started off as sandy and muddy sedimentations off the shelf of the ancient continent of Gondwana, in Cambrian times, around 525 Ma. Underwater landslides transported them into a deep basin. As the Iapetus Ocean began to open, they were subducted under the continent. Regional metamorphism rendered the sandstones into quartzite and the mudstones into greywacke and green mica schists. Further alteration occurred as this group of rocks was scraped off the subducting plate and formed part of an accretionary wedge on the continental shelf, resulting in extensive folding of the schists. This was at the time when Avalonia was splitting away from the continent in the late Ordovician, and the terranes that eventually formed Anglesey were yet to slide into their present position next to north Wales.

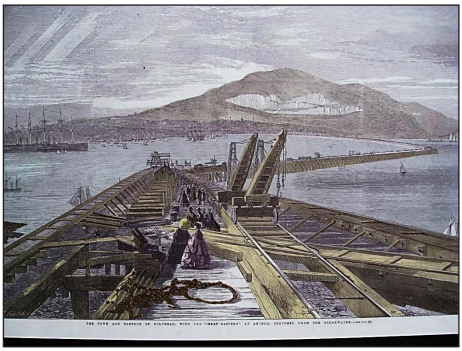


Fig. 15. Victorian scene of construction of the breakwater with the quartzite quarry in the distance.

Fig. 16. Quartzite quarry at Breakwater Park, Anglesey (Bill Gray).

Holyhead Mountain was extensively quarried in the mid-19th century (Fig. 15) to provide material for the huge breakwater protecting Holyhead harbour, and the quarry area is now a country park (Fig. 16). The quartzite cliffs of the quarry face sparkled in the sunshine as we approached the country park. We were given an unscheduled talk by park warden Will before walking to the viewpoint, across a beautiful meadow bordered by ripe brambles. From here we had a close view of the quartzite rocks, and could look

down over an inlet to the Rhoscolyn Formation; there was a stack in the inlet, which was the remnant of a dyke in a fault stretching to the SE, separating the older quartzite from the younger schists. We then looked at some of the quartzite spoil at one of the quarry faces, a chance for those of us who are collectors to choose their specimens. We saw a pair of Peregrines flying over the quarry and settling on the upper rim.

We then went down to a point where we had a view back over a different inlet to the Rhoscolyn Formation. In the coves far below us we spotted several plump seals. We then returned to the car park area to have lunch beside the lake. There was time for a quick look at the open air museum based in the former brick works; after completion of the breakwater, the quartzite continued to be quarried and the site used to make high quality bricks for ovens and kilns.

After lunch we drove down to the breakwater for a closer look, and had our first look at the highly folded mica schist of the New Harbour Formation (this afternoon's topic) in the walls of the buildings of the original quarry operation in Victorian times.

Wed 25th Sept, pm **Report: Walter Semple**

The Group visited 3 sites on the west coast of Anglesey which expose mainly Precambrian and Cambrian rocks. These rocks were formed as a result of the Cadomian Orogeny between 614 and 550 Ma. This comprised subduction of the oceanic plate into the Gondwana continental plate at a latitude of around 60 degrees south. The rocks are part of the Mona complex which is the most extensive exposure of basement rocks in Britain to the south of the Scottish Highlands.

Start of Holyhead Breakwater

The picturesque green schist chlorite bedrocks form the foundation of the start of the 1.7-mile-long Holyhead breakwater opened in 1873. Perhaps for that reason they are known as the New Harbour rocks. They are considered to have originated as marine sediments which were metamorphosed during the last stage of the Cadomian Orogeny in the Ordovician. The rocks demonstrate massive compression of the bedding followed by intense folding. They have been used as building stones giving a quaint light green and rough surface appearance to local buildings (Figs. 17 & 18).

Fig. 17. Highly folded green mica schist of the South Stack Group, used as building blocks at Breakwater Park, Holy Island (Bill Gray)

Fig. 18. Building stones near Holyhead harbour (Walter Semple).

Fig. 19. The folded schists of the New Harbour Group in situ at Treadur Bay (Bill Gray)

Fig. 20. Detail of the intense folding in the New Harbour Group at Trearddur Bay (Walter Semple).

Trearddur Bay, in the West of Holy Island, not far from Holyhead.

The rocks here were also in the New Harbour Group and of similar composition. Here however the folding was considerably more intense, as though the rock material had passed through a vast natural mixer (Figs. 19 and 20).

Porth Nobla to the South of Rhosneigr.

This exposure showed the Coedana Granite appearing on the surface in layers alongside the gneiss and schist (Fig. 21). The Ordovician represents a continuing marine transgression associated with the opening of the Iapetus Ocean. This exposure is further complicated by the later intrusion of basaltic material including dykes (Fig. 22), whose age has not yet been confirmed.

Fig. 21. Layered granite and schist at Port Nobla (Walter Semple).

Fig. 22. Basalt dyke and intrusion at Porth Nobla (Walter Semple)

Thursday 26th Sept, am **Report: Jim Martin**

Visit to Parys Mountain Copper Mine.

We arrived at Parys Mountain Copper Mine on a windy but bright morning and enjoyed dry conditions throughout our visit (Fig. 23). The mine's products originate some 440 million years ago. Sulphides of copper, iron, lead and zinc were created on the margins of a deep-sea basin by submarine smokers, volcanoes, erupting lavas and ashes. These

Fig. 23. Hard hats at the ready for our visit to the Parys Mountain copper mine (Bill Gray)

products, namely chalcopyrite (copper and iron) galena (lead) as well as pyrite (iron) and sphalerite (zinc) occurred in close proximity to form a valuable source of minerals unique within Britain.

There is evidence of ores having been extracted from Parys Mountain since the bronze the age (4,000 years ago) and it is considered a site of archaeological significance. During the 1780s this mine, being the largest producer of copper in the world, determined the market price of copper globally and continued to be significant until the 1880s. Our tour of the mine began at the overlook of the "great open cast" (Fig. 24). and our first impressions were of the enormous size of the pit and the astonishing variety of colours emphasised by bright sunlight (Fig. 25). We ventured down into the base of the pit observing adits, exploratory excavations, roadways and mine structures all created by human labour. An overturned syncline was visible from the quarry floor.

Fig. 24. View across the "great open cast" of the Parys Mountain Copper Mine (Maggie Donnelly).

Fig. 25. Our group exploring the mine (Maggie Donnelly).

The two overwhelming visual aspects of the mine are the sheer volume of material which has been removed from the pit which forms "the great open cast" and the vibrant colours of the various spoil heaps. Additionally, there were extensive underground workings below the quarry base below sea level and up to 300 meters in depth. Working conditions were harsh, unhealthy and dangerous, whole families being involved in the extraction and processing of the ores. This aspect is underlined by there having been an onsite mortuary.

Leaving the mine site we drove on to the nearby costal village of Amlwch, the port through which the mine's products and supplies where shipped and where the mining museum and the Geopark headquarters and information centre are based.

Thurs 26th Sept, pm **Report: Ian Veitch**

Leaving the mine, we travelled to Port Amlwch from where the copper ore was exported by sailing ship. We visited the GeoMon Headquarters in the old watch house which is manned by volunteers and has displays of local rocks as well as guidebooks and maps. Outside was a colourful clock display of the Anglesey rocks through geological time. They work hard to promote their geology. We also examined the folded greenschist which was exposed at the harbour.

After lunch and refreshments at the Sail Loft café the bus driver expertly manoeuvred us down the narrow windy road to Cemaes Bay. A short walk across the sand took us to the cliffs showing clearly the Mona series Melange once again. We were impressed to see so many different rock types in blocks one against the other in a chaotic sequence. Chris again explained that the different facies were formed from large scale submarine debris flows during the Cadomian Orogeny and then metamorphosed to produce multiple folds and faults. The rocks we examined included black schist, conglomerate, sandstone, limestone and laterite. None of us could recall seeing anything like this elsewhere; it was well named a Melange.

From here we travelled a short distance to Cemaes West Side and walked to a clifftop location with informative geological information boards and individual displays of the Anglesey rock types arranged by period. We were able to identify NW/SE trending dykes cutting across the mélange which was again on display. The dykes had been preferentially weathered and were presumed to be Tertiary and originating from Northern Ireland.

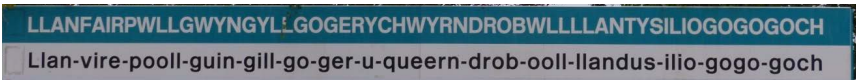
We returned to the car park where Maggie made a presentation to Chris and thanked her for being such a knowledgeable, patient and informative leader. There was then a presentation to Maggie ostensibly to thank her for all the excursions she had organised over the years but actually to put towards a new pair of boots!

Back on the bus and right on cue the rain started. Apart from a shower as we headed back on Monday, we had been lucky with the weather all week.

We celebrate a wonderful trip - with thanks to Maggie and Chris (Roy Bryce).

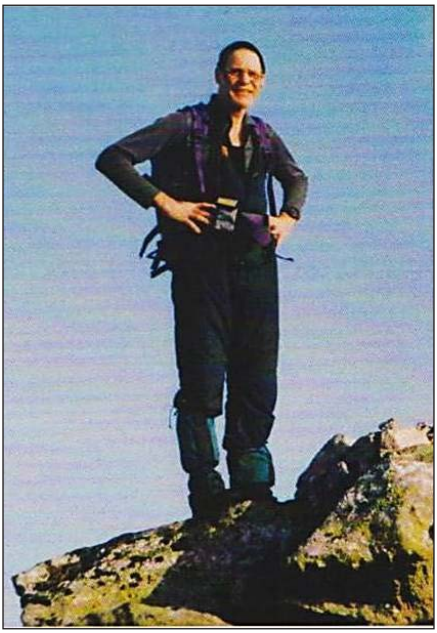
Reference: The Excursion Notes: "GSG Field Trip to Anglesey 22-27 September 2019" by Christine Arkwright

... and farewell to .....



Obituary: Benjamin Harding Browne

1946-2019



Dr Ben Browne joined the Geological Society of Glasgow in Session 129 (1986-1987). Over a period of almost thirty-three years he provided an enormous contribution and became a highly respected and valued member. His knowledge and understanding of geology were immense and he continually enhanced these by attending the University of Glasgow's Open Studies classes on many aspects of geology and by his own personal investigations and extensive reading.

Ben was born in Hereford and grew up in Worcester where he received his first taste of geology. His mother had her own collection of minerals and Ben spent much of his youth walking and climbing among the varied and fascinating rocks of the Malvern Hills. He attended University College London where he gained a degree and doctorate in mathematics, and where he subsequently took up a post teaching maths. He would meet Sudi, later his wife, while teaching maths with the OU. He also started teaching judo, eventually forming a small close group of enthusiasts. Calling themselves the "Universal Artists", UA, they played judo in university clubs in England, competed in the Eindhoven international students' tournaments and attended the annual British open judo championships at Crystal Palace – to watch, not to participate! They labelled their judo UA meetings as "Conventions" and they have continued to the present – almost 50 years later.

After some years Ben decided to study medicine but for this he needed A Level Chemistry

and Biology. He achieved this in one year – a remarkable feat! Ben moved to Sheffield where he gained his medical doctorate and specialised in ophthalmology. As a result his friends thereafter referred to him as "Big Ben the Double Doctor"! Ben had a gold-plated tea pot in which he infused Earl Grey – a novelty at that time in the 1980s. He also had his own local butcher, baker (and probably even candlestick-maker!!). He was active in the Sheffield University Judo Club, and in the 1990s a "UA Convention" was held in Stratford-upon-Avon to celebrate a 50th birthday. He is particularly remembered for "holding himself out horizontally" from a lamp-post outside the group's hotel, thus exhibiting his tremendous physical strength.

After Sheffield, the family lived in Summertown, Oxford while later, in 1986, they moved to Glasgow where Ben had acquired a position at the Royal Infirmary and where, in the course of time, he became a Consultant in Ophthalmology. Ben was renowned for his caring and conscientious manner: his great strength was that he always saw his patients as "people" first and "patients" second, and took a very personal interest in them. Part of his remit was the training of new doctors. In this he was his usual meticulous and patient self, such that his trainees became very well qualified and proficient. Ben was very astute and had a wry and entertaining sense of humour – considering the vagaries of the NHS he would say that "the NHS management is like the weather in Scotland. There is no point in complaining, you can't change it. You just have to be prepared and make the most of the occasional sunny day"!

Ben joined the Oban Mountaineering Club in 1987. His numerous climbing ventures included all 282 Scottish Munros (individual mountains over 3,000 feet) – he was one of only nine members of the club, over a period of about 40 years, to do so. For this he received the "Golden Nut Award". This does not refer to the character of the climber – a nut is a piece of climbing equipment used to secure ropes! At the same time he accumulated a detailed knowledge of Scotland and of its topography, and developed a deep love for the Scottish mountains. Ben had a very enquiring mind, constantly observing and asking questions about all the plants, trees and environment. He regularly climbed with a friend who had a background in ecology and forestry. This led to a number of stops along the way … "Vaughan, this looks like a good one" comes a voice from down in the heather or from behind a boulder. "What's happening with these trees here do you think?" This inquisitive nature attracted him to a wide variety of interests. No matter what was the new subject, Ben was soon deeply involved, always with extra input freely given, and all part of a very generous character. Lately he successfully combined two of these interests, water-colour painting and wild flowers, by attending classes in the latter at Edinburgh Botanic Gardens; his finished paintings are simply exquisite. Ben's hand-writing was also exquisite, beautifully crafted and instantly recognisable.

Ben retained the judo skills of falling down and could convert a tripping stumble into an instant roll and a bounce back up – a neat trick indeed. Typically he would be walking over rough hilly ground chatting away, but also trimming his finger nails with clippers – the multi-tasking mountaineer. He became club treasurer and deservedly one of only two honorary members of Oban MC. He was truly a polymath, and the finest of

companions.

On joining the Geological Society of Glasgow in 1986 Ben, as ever, quickly became totally involved. He regularly attended its monthly lectures given by experts in their field; not only was he able to converse in depth with these experts on a wide range of topics, he also gave his own talks and provided displays. These included the geology of Al Jabal al Akhdar (Green Mountains) of Oman in 2009 and a mid-Atlantic walk in Iceland in 2012. He became a regular contributor to the proceedings of the society, reporting not just on its finances, but also on the many field trips in which he took part. Among these were Ardnamurchan, Argyll, Islay, NW Highlands, Ben Lawers and Ben Lui, Stonehaven, Lochaber, Raasay and the Fife Coastal Walk. Ben also took part in field trips abroad, organised by the tutor of his Open Studies classes, to France, Italy, Spain, the Rocky Mountains of Canada and the Grand Canyon Arizona. His wife Sudi, also a member of GSG, accompanied him on many occasions. Ben led a field trip with another society member to Schiehallion and Strath Fionan. For this he studied the area intensively, visiting it three times on reconnaissance before the "day". This enabled him to deliver a detailed introduction to a very complex geological area, explaining all its intricacies with great erudition … and he was able to maintain this for the whole day. Ben took his geology very seriously and was always well organised with maps, compass, torch and, most usefully, his Swiss army knife, without which it would have been sometimes difficult to finish the day properly … with a glass of wine. He was extremely observant and often noticed the significant features of an exposure long before anyone else. On more than one occasion he would continue his geological musings in strong winds and heavy rain when most of the others had found shelter.

Ben was treasurer of the society for six years in the 1990s, co-auditor from 1999 until 2007, a vice president from 2012 until 2014, and then treasurer again from 2013 until 2018. He was also recently elected an honorary member of the society in recognition of his contribution to its objectives and his distinction in service. Last but not least, he took charge of organising the tea and biscuits at the end of the monthly meetings! Ben was a very thoughtful and considerate person, with always a helping hand for others. He cared very much for the members of the society, having been involved in all its aspects for so many years. Ben passed away peacefully on 25th May 2019 after a short illness. He will be greatly missed by us all. Ben is survived by his wife Sudi, son Tristram, daughter Claire and grandchildren.

Maggie Donnelly

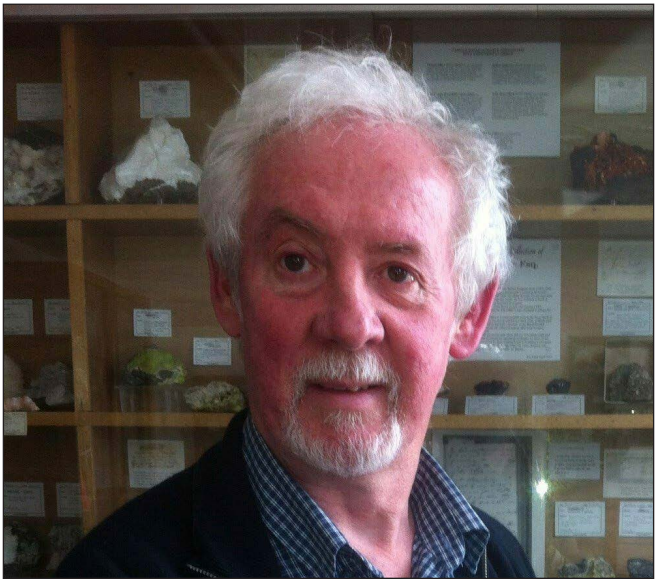
Residential Excursions Secretary

Geological Society of Glasgow

Acknowledgments: Eulogies from David Yorston, Patrick Curzon, Vaughan Hammond and Neil Clark and my own personal memories of Ben.

Obituary: James Gordon Todd

1951-2018



Gordon was born in 1951, in Pune, India, where his parents worked as Church of Scotland missionaries. His father Bill ran the mission hospital, while his mother was a schoolteacher. The family returned to Scotland in 1957, and Gordon's interest in geology and natural history was nurtured on family holidays on the Ayrshire coast, Arran and around Montrose, where collecting became a favourite activity. Most of Gordon's senior school education was at Greenock Academy, although he spent 1966 in Chingola, Zambia, where his father worked as a medical officer with the Anglo-American Mining Corporation. This provided him with fantastic opportunities for collecting minerals and insects. Even after returning to school in Greenock, Gordon revisited Africa during summer holidays to collect minerals, shells and insects.

Following in his father's footsteps, he studied medicine at the University of Glasgow, graduating in 1975. Apart from a short period in New Zealand, his working life was spent in Scotland, where in the 1980s he became a consultant anaesthetist in Glasgow, working in surgery across several hospitals, and teaching students.

Gordon loved the outdoors, and was a passionate hill-walker, rock-climber, potholer and kayaker, and he deployed all these techniques in his mineral and fossil collecting. He collaborated widely on fieldwork and collecting with many other collectors (notably Kemp Meikle, David Anderson, Michael McMullen, Simon Ingram and David Green) and museum geologists from the Hunterian and National Museums Scotland.

In 1994, he opened his museum of Scottish mineralogy in a secure and beautifully

fitted-out building in his garden in Kilbarchan. Gordon loved sharing stories, science and specimens and the museum became something of a shrine for Scottish and visiting mineral collectors, as well as jealous museum curators. He lectured widely on minerals and collecting to a wide range of audiences, his sense of humour and enthusiasm giving his talks a unique and compelling flavour.

As well as collecting specimens, Gordon purchased Scottish minerals and fossils, acquiring some wonderful old-time specimens from classic localities such as the Leadhills-Wanlockhead mining district, as well as newly collected material from collectors such as Stan Wood and Mike Wood. In 2010, he opened an indoor extension to his mineral museum to cover broader natural history themes and display shells, fossils and insect collections, as well as even more minerals.

Gordon was a member of the Geological Society of Glasgow from 1984 until his death. He served on the society's council and gave many presentations and talks on members' nights, covering his mineralogical and palaeontological collecting and research (see below). He was a co-author, with Dr Chris Burton, of the chapter on Trearne Quarry in the society's excursion guide to the Glasgow and Girvan area, published in 1992. He was also active in the Russell Society and the Paisley Natural History Society, among others.

In addition to medical research papers, he published a wide range of papers on Scottish mineralogy based on his collecting work, mostly in the UK Journal of Mines and Minerals. He was also very happy to lend and share specimens with museums, and his specimens were included in exhibitions at Girvan, Paisley Museum, Pollock House, National Museums Scotland, and the Hunterian, among others. In 2003, the Hunterian put on a major exhibit of his material–"The Cabinets of Dr Todd", occupying several cases in the Ewing Room of the museum. Gordon was one of a small number of contemporary collectors featured in the NMS book "Minerals of Scotland: Past and Present", written by Alec Livingstone and published in 2002.

In 2012, a book "The Cabinets of Dr Todd", celebrating his life and collections, was published by his family, but by this time he had begun to suffer from an aggressive form of dementia, which cruelly curtailed his active and sociable life. His wife Pamela, and "Team Todd" helpers, including his children, Chris and Claire, cared for him at home, until his eventual death in December 2018. The quality, extent, scope and documentation of his collection, and the beautiful displays in his museum spaces mark out Gordon's collection as one of the most remarkable ever assembled in Scotland. He discovered new localities, rediscovered old ones, and loved working to enthuse others, and to preserve, document, and share Scotland's mineralogical heritage on a scale that few other individuals have matched.

John Faithfull,

The Hunterian, University of Glasgow

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1989 Feb. 23 The Cinderellas of Trearne (talk, and a display of minerals)

1990 Feb. 8 Muirshiel -Moors and Mines and Minerals (talk and a display of minerals)

1992 Feb. 14 Excellent Scottish Minerals collected in 1991 (display)

1994 April 28 Minerals with Fossils (display)

1996 April 25 New Facets of Scottish Gemstones (talk and display of gemstones)

2003 May 5 Tertiary Flora of the Isle of Skye (talk)

2004 May 13 The Mystery of Quartz Fingers (talk and display)

2005 May 12 Rock Art: A Thing of the Past

Ben Browne examining synsedimentary folds on the Knapdale excursion in April 2016 (D Webster).

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