

**PROCEEDINGS OF  
THE GEOLOGICAL SOCIETY  
OF GLASGOW**



Our group at the uphill entrance to Burn O' Vat.

*Walter Semple*

**Session 160**

**2017-2018**

**SESSION 160(2017-2018)**

**Page**

	Members of Council	3
<b>Reports</b>	President	4
	Membership	4
	Library	4
	Scottish Journal of Geology	5
	Publications	6
	Website	6
	Strathclyde Geoconservation Group	8
	Argyll and the Islands Geodiversity	9
	Proceedings Editor	10
	Treasurer	11
	Meetings Secretary/	16
	Lectures and Members night	
15		
Excursions	Secretaries' Reports	17
	Excursions Reports	19
<b>Intimations</b>		46

## Members of Council

President	Dr. J.M. Morrison
Vice Presidents	Dr. Brian Bell
	Dr. B. Browne
Secretary	Mr. W. Semple
Treasurer	Dr. Ben Browne
Membership Secretary	Dr. Robin Painter
Meetings Secretary	Mr. David Webster
Librarian	Dr. Chris J Burton
Assistant Librarian	Mrs. Margaret Anderson
Excursions Secretary (Day)	Mr. Roy Bryce
Excursions Secretary (Residential)	Ms. Maggie Donnelly
Minutes Secretary	Mrs. Margaret Greene
Junior Members' Representative	Mr. Mathew Staitis
Proceedings Editor	Mrs. Mina Cummings
	Mrs. Mina Cummings /
Publications Officers	Mr. Bob Diamond
Webmaster	Dr. Bill Gray
Web Consultant	Dr. Neil Clark
Website Coordinator	Miss Emma Fairley
Publicity (General)	Dr. Robin A Painter
Newsletter Coordinator	Mr. David Webster
Strathclyde Geoconservation Chair	Mrs. Margaret Greene
Argyll & Islands	<b>Mr. Alistair Fleming</b>
Editors, Scottish Journal of Geology	Dr. Colin Braithwaite
	Dr. Brian Bell
Ordinary Members	Dr. David Brown
	Mr. Campbell Forrest
	Dr. Simon Cuthbert
	Dr. Neil Clark
	Dr. Helen Kennedy
Independent Examiner	Dr. Ian Anderson

## **President's report session 160**

It is now nearly the end of the third and final year of my term as President and I would start by thanking the members for their continuing support. Without the membership, there would be no Geological Society of Glasgow and in the thirty-odd years I have been associated with the Society, I have been struck by the continuing interest and enthusiasm of the members.

A subset of the membership - the Council - are responsible for running the Society as best they can for the benefit of members. This is a two-way process, as due to age and human frailty, the Council needs to be constantly topped up with new blood. I would encourage any of you who feel that they could make a contribution to come forward. For example, we need three members of Council right now.

We have been fortunate in recent years in that some of our newer Council members have made notable contributions in relatively short time. For example, David Webster, who replaced me as Meetings Secretary has also become active in Publications and has participated in efforts to try to improve the unfortunate situation at Fossil Grove. Campbell Forrest, who took over at short notice as Membership Secretary has also become a Trustee for Fossil Grove. I will say a few words about the work of some other Council members at the AGM on 13 December. The day and weekend field excursions are enjoyed by many members and thanks are due to Roy and Maggie for the effort they put into the arrangement and running of these trips.

The Society has long had a concern about the state of Fossil Grove and Margaret Greene in particular has made efforts over a sustained period. Our current Secretary, Walter Semple, became interested in Fossil Grove – a site of international significance – some three years ago and had managed to effect significant changes in the Fossil Grove Trust. He has been ably supported by David Webster and Campbell Forrest, who are now also on the Trust.

Other recent activities of GSG Council are a review of publications, which had been somewhat neglected by the Society for a time and a subcommittee is trying to rectify this, especially in the preparation of a new 'Glasgow Guide' and in the use of new production and printing techniques. With our sister society in Edinburgh, discussions are taking place to develop a "Scottish Geology Trust" which could raise funds for Scottish geological projects.

## **Jim Morrison**

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### **Membership Secretary's Report**

Although the total membership numbers show a small increase over the previous year, a number of lapsed/terminated memberships had not been formalised at the year end, so the total is slightly inflated, and will balance out very close to the previous year.

At end Session 160  
(30 Sep 2018)  
5

At end Session 159  
(30 Sep 2017)  
5

Ordinary Members	256	246
Associate Members	70	68
Junior Members	18	13
TOTAL Members	349	332
New Members	18	23
Memberships Closed	1	25

**Campbell Forrest**

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**Library Report**

**This report is not available at this time. It will be included at a later date**

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**Scottish Journal of Geology: Editors’ Report**

The Journal remains hampered by the low level of submissions. Although these have increased in the last three years from 11 in 2016 to 20 in 2018, the number of papers accepted shows only a slight increase, from 7 to 8. The explanation for this disparity is simple and may reflect the greater exposure and success of the Journal online. Most of the 13 papers rejected have been submissions from overseas readers who have failed to follow the advice offered on our website and sent articles on topics with no relationship to the Geology of Scotland, however broadly we choose to draw the limits. No doubt this will prompt some to argue that broadening the scope of the Journal would solve problems but in doing this we would compete with 4 or 5 other Journals in the UK, some of which are better resourced, and it would be unlikely that we would see any increase at all.

We are currently launching an initiative to encourage Postgraduate students to submit papers, offering to guide them through the learning process of first submissions. We have previously offered the same opportunity to members of the two societies who may not be professional geologists but are, nevertheless, expert on some aspect or area of particular interest to them. The time between submission and publication online is steadily reducing but it is difficult to hurry the peer review process. Reviewers are not paid and have to fit in reviews with their other work.

We continue to attract papers on a wide range of topics. The most read and discussed in the last year, are by Paige de Polo and colleagues on newly discovered sauropod trackways on Skye; Martin Whyte’s paper on the mating tracks of a giant millipede in Fife; work by Maarten Krabbendam and colleagues on the evolution of the Precambrian Proto-Moine Knappe in Glenelg; a study by Liam Bullock and colleagues on pyrite genesis and selenium enrichment in Ayrshire; a paper by Michael Newman on Middle Devonian fish in Shetland; and work by Tang and colleagues on the petrography of Upper Devonian sandstones on Orkney.

## **Colin Braithwaite**

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### **Publication Report session**

Sales were from a simplified stock list after rationalisation by devaluation of inactive stock. In house sales were reduced but The Madiera Guide sold 11 copies by post with payment via PayPal.

Payment has been received from The Edinburgh Geological Society for our share of sales of the Moine guide this year from stock that we had already written off on our Balance Sheet. We have paid £1183.50 for 25% of a reprint of 500 copies of the Moine Guide. This now appears on our stock list as 125 copies valued at £9.50 each totalling £1187.50p. The stock of 500 copies is to be held centrally by The National Museums of Scotland where most sales take place. The stock is owned in the ratio 25:25:50 by ourselves, Edinburgh Geological Society and National Museums of Scotland.

### **Ben Browne for Bob Diamond**

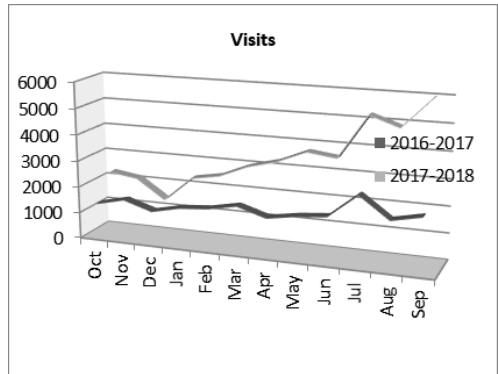
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### **Website Report**

The website continued to be an important platform for promoting the society during Session 160. 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. Work was also carried out to increase the number and quality of the photos on the website's slide show and to enhance the geological information in the captions. 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. (Material from previous anniversary years is retained in a document which can be viewed through a link on the website.) The Anniversaries section is well worth exploring for the insight it gives into the society's history and for the wealth of fascinating historical material it contains. Our thanks are due to the society's honorary archivist Margaret Anderson for the research she carries out to produce this material in this section.

The website had a minor upgrade in 2014 but is now about to undergo a major upgrade, which is aimed at producing a "responsive" site which will adjust its display to suit the type of device that is being used to view it. The upgraded site will therefore look a lot better on phones and tablets than the present site does. The company that hosts the website is currently working on the new design, and the target date for the upgraded site to go live is January 2019

The traffic to the website has increased steadily since the website was launched in January 2011. In Session 160 there were 40245 visits to the site, an increase of 98.5% over the total for the previous session (20274). The number of visitors, as opposed to visits, was 34441, an increase of 108.5% over the previous session's total (16515). The chart shows the number of visits each month for Sessions 160 (2017-2018) and 159 (2016-2017). The increase in visits reflects increased traffic both from the UK and from abroad, but the majority of the increase was in visits from abroad. The number of visits from the UK in Session 160 was 10940, which was 27.2% of the total visits and an increase of 29.7% over the UK visits for Session 159 (8436). Outside the UK, the three most productive countries were the Philippines with 8072 visits (3443 in the previous session), the USA with 5754 (2328) and India with 3957 (1417). Within the UK, Scotland accounted for 6049 visits (5115 in Session 159), England for 4571 (3117), Wales for 167 (123) and Northern Ireland for 143 (72). The map shows the amount of traffic from cities within the UK. Glasgow was the most productive city, with 2470 visits (2251 in the previous session), followed by London with 1478 (962) and Edinburgh with 731 (519).



The most popular part of the website was again the Local Rocks section, with the Rock-forming Minerals page accounting for 16.2% of pageviews, followed by the Metamorphic Rocks page (12.6%), the Rock Cycle page (12.3%), the Igneous Rocks page (5.6%) and the Scottish Fossils page (2.0%). Other popular pages were the website's Home page (8.3%), the Arthur Holmes page (2.3%), the Lectures page (1.6%) and the Excursions page (1.5%). By far the most productive source of traffic to the website was Google, which was responsible for 32600 visits (15390 in the previous session). The next most productive was direct logons to the website, which produced 4888 (3151) visits, while the search engines Bing and Yahoo produced 711 (490) and 145 (136) visits respectively. The majority of the remaining visits resulted from referrals from other websites.

The most productive source of referrals was Facebook (280 this session compared to 148 last session), followed by scottishgeology.com (100 compared to 21), and thecampsies.co.uk website (90 compared to 96).

In addition to the website, the society uses 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 most popular recent posts on the page relate to the discovery of dinosaur footprints near Inverness and the associated crowd-funding project, with 240 people reached; the award of books to Dr Chris Burton for

his 44 years as society librarian, with 168 people reached; and the largest UK gold nugget found in Scotland, with 124 people reached. In addition, several inquiries for the identification of rocks, minerals and fossils have arrived via the page. 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](https://twitter.com/GeolSocGlasgow)) has gradually being gaining in popularity and now has 31 followers. 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 we are currently concentrating on the requirements for the upgrade of the site. 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](mailto:web@gsocg.org)

**Bill Gray**

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## **STRATHCLYDE GEOCONSERVATION GROUP ANNUAL REPORT 2017-2018**

The office bearers have not changed and Margaret Greene MG remains chairperson, David Hamilton as Treasurer and Barbara BalfourBB as Secretary. Maggie McCallum is in charge of website matters and Margaret Anderson in charge of archives. Usually about 8 to 10 members attend the meetings. [Leaflets/Booklets/Geology walks](#)

Preparation for the Necropolis booklet for printing is nearly complete. Costing has yet to be determined. There is a possibility of SGG making a booklet on the geology of Mugdock Country Park but preliminary talks with the park ranger are still to take place.

MG led a successful walk on 12th September 2108, with 16 participants, as part of the program for Glasgow Doors Open. Ian Allison IA also attended.

Also, in connection with Doors Open, David Webster DW gave talks and guided walks to the quarry. Ian Allison, Allison Drummond AD and MG also attended helping with fossil rubbings and offering information.

### Local Authorities:-

*South Lanarkshire:* Two members of SGG attended a meeting on 8th November 2017 to find out about the Clyde & Avon Valley Landscape Partnership Geology Exhibition at New Lanark. MG attended the launch of the exhibition on 22nd February 2018. Unfortunately, the funding for CAVLP has come to an end. MG gave a Powerpoint presentation on the subject on GSG Members’ Night, 10th May and wrote up a report in order that David Webster might include it in Newsletter 160/4. Paul Carter PC and Mike Browne MB are now doing site assessments in South Lanarkshire and have asked for help from SGG with typing.

*North Lanarkshire:* Paul Carter and Mike Browne completed the assessments of geological sites in North Lanarkshire (six years of field work). Several members of SGG typed up the handwritten assessments and Mike Browne handed the final tranche to North Lanarkshire Council for incorporation into their SINC's (Sites of Importance for Nature Conservation). AD and BB typed up Paul Carter's hand written North Lanarkshire Council Geodiversity Audit. Mike Browne added photos etc to the document and then it will be passed to the Biodiversity of NLC. This is a valuable amount of work that PC and MB had put into this document which includes many good descriptions of places of geological interest to visit within North Lanarkshire. They hope to make a booklet from some of the material with the help of NLC. MG typed a paper on glaciation in North Lanarkshire that PC has written. Paul Carter continues to lead walks and run geology activities for schools etc.

*Renfrewshire:* MG along with Dr Simon Cuthbert are assessing geological sites in Renfrewshire. Ultimately these will be incorporated into the Local Biodiversity Action Plan. MG wrote about a recent Geol. Soc. excursion (led by IA) to Mursheil Park with the help of information from Dr Chris Burton CB. MG went to a Local Biodiversity Action Plan (LBAP) all Renfrewshire meeting on 27th June. MG has submitted 4 sites and to look at another 5 with Dr Simon Cuthbert. There were also reports from East Renfrewshire and Inverclyde. There is no money to do a LBAP but Renfrewshire will make sure geology is in the Local Plan.

*Inverclyde:* some sites assessed by Dr Chris Burton CB and got an enquiry from the Planning Officer, Inverclyde.

*East Dunbartonshire:* SL had been asked to comment about the planting of trees on some land at Craigmaddie Muir in connection with Craigmaddie Muir Woodland Creation Group. Her recommendation, based on East Dunbartonshire Geodiversity Audit, is that it is important that planting be limited to North of NS 767 in order to maintain the significant rock features such as glacial features, and exposures of Douglas Muir Quartz Conglomerate and the Craigmaddie Muir Sandstone, exhibiting sedimentary features, within the lower part of the Lawmuir Formation.

*North Ayrshire:* MG attended the North Ayrshire LBAP meeting in Largs. She reported that Garnock Valley Programme had received Lottery Funding for 3 years. However, the Biodiversity Officer had not considered bringing geology into the programme. CB has given MG a number of geological sites of interest in North Ayrshire.

#### Fossil Grove

DW who is a Trustee of Fossil Grove and also a SGG member is keeping the SGG informed of any developments regarding Fossil Grove. He is also actively working to improve the conditions at FG. IA and DW have written an excursion guide to FG quarry which is now available for purchase. A revised version of the SGG leaflet is being printed. One volunteer, AD from SGG has been liaising with the visitors to FG over several Sundays, finding out what they think of the fossils and the condition they are kept in. Positive for the fossils and negative for the conditions. FG was open on 31st March till 21st October 2018. Matthew Staitis, the student representative to Council and also a member of SGG, gave a presentation to undergraduates about FG with some interest from the audience. He thought the profile of FG could be raised to undergraduates and had mentioned it to Prof. Bell. It is hoped that GU geology undergrads may get involved in mapping exercises on newly exposed surfaces at the quarry now that LES have cleared the vegetation. DW wrote a report, summarising the

progress and problems in monitoring the environmental conditions within the Fossil House, the status of the lighting and other issues, which was circulated to SGG members.

#### Dippy the diplodocus's visit to Kelvingrove Museum, Glasgow

Ann Ainsworth AA, Curator, Glasgow Museums Resource Centre, attended the SGG meeting of 22nd March 2018. AA invited SGG to join in the events to celebrate Dippy, the diplodocus fossil, which be displayed at Kelvingrove from 21st January to 5th May 2019. There will be an 'information' day from 11.00am-4.00pm on February 16th 2019 and SGG will have a stall with leaflets and information about SGG. There is also an 'activity' day on 6th April where SGG will have activities especially for children as many are expected. Preparation for these events are well in hand.

#### Scottish Geodiversity Forum:-

Some SGG members attended the Charter Launch at Dynamic Earth, Edinburgh on 16th November 2017 and the AGM held at the Engine Shed (Historic Environment Scotland) Stirling on 21st February 2018. Thus, SGG members are kept informed of geology news, events and activities in Scotland. MG attended the Charter meeting on Wednesday 30 May. MG had an article on the New Lanark exhibition in the autumn Charter newsletter

**Margaret Greene**

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#### **Geodiversity: Argyll and the Islands Report**

GAI is making one administrative change, by putting back its AGM from December to March. The group find it difficult to set a meeting in December that is not liable to postponement because of weather (and thus ferry cancellations), availability near Christmas and other factors. Our constitution allows up to 15 months between AGMs.

This year a start has been made on developing a Lorn Islands Geological Trail. The Lorn Islands Partnership (between the four island community trusts if Easdale, Kerrera, Lismore and Luing) has already developed a general tourist trail leaflet encouraging visitors to Oban and Lorn to take day trips to each island. The plan is to develop associated trail leaflets for different interests, and the first of these hopefully will be the geology trail. A start was made in June when Jim Blair kindly led a field excursion under the auspices of the Oban U3A Geology group to Kerrera, unfortunately in appalling weather conditions. Luing and Easdale geology is already well covered in John Sedgwick's publication, The Geology of Seil and Easdale, copies of which may be purchased at the Atlantic Islands Centre on Luing. The geology of Lismore is of course very different, and that contrast will be part of the trail.

**Alastair Fleming**

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## **Proceedings editor's report**

Session 159 proceedings took a bit longer than usual to prepare due to the great success and popularity of the Lochaber trip which had to be run twice to accommodate the record number of participants. There were, therefore, three residential trips as well as the day trips to be recorded along with all the council officers' reports. Many thanks are due to all who took part in the reporting and the production of excellent photographs. All copies were distributed in good time and the contents have been posted on the website thanks to Bill Gray.

## **Mina Cummings**

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## **Treasurer's report**

The Income/Expenditure Account and the Balance Sheet are shown below. These have been checked and signed off by Ian Anderson, Independent Examiner.

## **Notes to the Financial Statements**

1. Membership subscriptions and Gift Aid are slightly reduced.
2. National Saving still pays a minimal interest on Bond and Investment accounts
3. After a major reassessment of stock last year Publications sales simplified but a little reduced. We have contributed 25% of the cost of a reprint of 500 copies of the Moine Guide.
4. Both Saturday and Weekend Excursions have returned a modest surplus.
5. This was the last of three years at an agreed rate for Room Hire from the University. We now have an agreement to continue at this same rate for one further year.
6. Other costs of meetings are increased above last year's low level.
7. Postage of our Proceedings was reduced by a reduction in their weight.
8. Costs of the Newsletter were reduced by a change of printer.
9. The Library paid only one of two journal subscriptions and no invoice yet for Down to Earth.
10. Public Liability Insurance costs remain essentially unchanged.
11. There were minor costs in updating the website but a major updating is planned for the near future at an estimated cost of £6,000.

12. The restricted TN George and Brian Bluck Funds continue to pay out to their intended purposes.
13. We have been unable to progress on the Conoco-Philips prize. My proposal is to distribute the remaining funds to the three participating Societies. We are attempting to get a note of agreement to this from Conoco-Philips.
14. The apparent significant reduction in our Surplus from £1,500 to £570 reflects the fact that investment dividends are now held within the newly created Endowment Fund.
15. We have undertaken a significant reorganisation of our investments and established an Endowment Fund consisting of investments now held by a broker with the intention of drawing dividends to be used for our charitable purposes whilst hopefully maintaining their real value. What was presented on last year's Balance Sheet as a Common Fund is now presented on this year's Balance Sheet as a separate Member's and an Endowment Fund. The latter has received £2,936 in dividends from reorganised investments compared to £636 last year. However, only £1,050 have been distributed in sponsorship to Lochaber Geopark, the Scottish Geodiversity Forum and the Friends of Hugh Miller.
16. It should be noted that the cash holdings outside the Endowment fund are £25,775 of which £9,690 are assigned to restricted funds leaving £16,085 as Member's Fund. This is just twice the current annual expenditure of £8,100.

THE GEOLOGICAL SOCIETY OF GLASGOW

Income and Expenditure Account for year ending 30th September 2018

		Section 180		Section 189	
		2017 - 2018		2016 - 2017	
<b>Income</b>					
1. Subscriptions					
Received during year		6580.25		7322	
Deduct paid in advance this year		-181.25		-324	
Add received in advance last year		324.32	6,723.32	241	7249
2. Investment Income					
Dividends: see under Endowment Fund				636	
National Savings			131.64	143	779
3. Gift aid			1,184.86		1300
4. Publications		net surplus	112.08	422	
In house		Revenue	75.38	250	
Moine Guide			187.46		
7. Saturday excursions		net surplus	97.33		-38
8. Week end excursions		Rassay	net surplus	17.00	
Stonehaven		net surplus	30.50	47.50	114
9. Donations (coffee collections & personal)			275.57		328
10. Bank Charges net refund			24.83		
<b>Total Income</b>			<b>8,872.61</b>		<b>8682</b>
<b>Expenditure</b>					
1. Meetings incl speakers expenses, etc		1581.68		633	
Room Hire		3663.00	5,244.68	3839	4272
2. Publication and postage of Proceedings			534.66		789
3. Strathclyde Geoconservation			0.00		200
4. Library and Down to Earth			270.00		725
5. Affiliation fees			40.00		90
6. Insurance			202.72		202
7. Website		Maintenance	374.38	360	
Upgrade		54.00	428.38	79	436
8. Admin costs - postage, stationery, etc					
Newsletter			788.84	707	
Stationary			4.69	3	
Membership Secretary(including new software)			328.89	430	
Treasurer			57.98	7	1147
9. Presentation for long service			200.00		
<b>Total expenditure</b>			<b>8,100.84</b>		<b>8348</b>
<b>Surplus</b>			<b>671.87</b>		<b>Surplus 1304</b>

THE GEOLOGICAL SOCIETY OF GLASGOW

Balance Sheet as at 30th September 2018

The Common Fund of the Balance Sheet 159 of £79,088.65 is separated into Members Fund £20,048.18 and Endowment Fund £59,040.50

	Session 160 2017 - 2018	Session 159 2016 - 2017
<b>Members' Funds</b>		
Balance as at 30/09/2017	20,048.18	
Add Surplus for the year	571.67	Surplus 1506
<b>Member's Fund as at 30th September 2017</b>	<b>20,619.85</b>	

<b>Restricted Funds</b>		
TN George fund	380.00	
less engraving costs	40.00	340.00
Brian Bluck fund at 30/9/17	8,500.00	
less prize 2018	500.00	8,000.00
Conoco-Phillips fund		1,350.00
<b>Total non endowment Funds</b>		<b>30,309.85</b>

**Represented by**

**Current assets**

<b>Cash at Bank</b>			
Royal Bank of Scotland	9,892.79		
Less owing to Endowment fund	257.06	9,635.73	10579
National Savings Income Bond		12,000.00	12000
National Savings Investment Account		4,140.13	25,775.86
<b>Cash in hand</b>			
Publications Officer, Bob Diamond		101.04	
WE Excursion sec		192.14	
<b>Stock of Publications</b>			
In house		2,854.97	3008
Moine Guide part of stock held by Nat Mus Scot		1,187.50	
Gift Aid from HMRC		1,184.86	
<b>Add Debtors</b>		31,296.37	
<b>Less Liability</b>			
Subs paid in advance	181.25		324
Outstanding payments	905.27	986.52	
<b>Net assets</b>		<b>30,309.85</b>	

**Endowment Fund**

At 30.9.17 this consisted of Investments valued £59,010.02 and cash £30.48 totalling £59,040.50.

<b>At 30.9.17 Cash at Broker</b>		30.48
Add interest retained at broker	2,678.85	
less fees	138.00	
to Lochaber Geopark	500.00	
to Scottish Geodiversity Forum	500.00	
to Friends of Hugh Miller	50.00	1,188.00
		1,490.85
<b>At 30.9.18 Cash at Broker</b>		1,521.33
Interest retained in RBS account		257.06
<b>Total cash in Endowment Fund</b>		<b>1,778.39</b>

<b>At 30.9.17 Valuation of investment</b>	59,010.02	plus cash value	59,040.50
add appreciation	455.88		
<b>At 30.9.18 Valuation of investment</b>	59,466.00	plus cash value	61,244.39

The financial statements were approved on 20/11/2018 by the Trustees and signed on their behalf by

Signed as approved by the Trustees

Dr J Morrison (President)

Signed by the Independent Examiner

Dr Ian Anderson

## **Income & Expenditure**

Steady increase in membership fees and gift aid.

True return on book sales masked by necessary revaluation of stock.

Deficit on two unpopular Saturday excursions almost recouped by the remainder.

Weekend excursions popular with modest surplus.

Meetings cost rather less than last year.

Proceedings; increase in printing (27%) and postage (102%) costs due to increased weight.

Sponsorship at £500 to Remote Scotland Expedition below target.

Library paid subscription to Paleontology for both last year and this.

Newsletter; a significant increase in costs after losing access to university printer now largely rectified.

We returned a useful surplus of £1,506.39p.

## **Investments**

At the start of the year we held two investments in our own name and other investments with financial advisors who informed us during the year that it was no longer viable to meet current financial regulations for small accounts and they wished to close ours. An Investment Committee was convened and with Council approval reorganised investments in funds of their choice to be managed without advice by a new broker and to be held in an Endowment Fund. The objective is that these should as nearly as possible maintain their real value whilst yielding improved dividends identified as being principally for our charitable purposes.

## **Holding at 30/9/16**

£30,000 invested with Spiers & Jeffrey at June 2014

J P Morgan Higher Income Fund (611.94)

M&G Charifund (660)

Conservative Balance Sheet valuation of above at 30/9/16 £44,000

## **Realised during year**

Sale of Spiers & Jeffrey holding	£39,525.86	
Sale of J P Morgan 611.94 units	£ 3,483.78	
Market value of M&G 660 units at 30/9/17	£10,638.94	£53,648.58
<u>Appreciation against Balance Sheet valuation at 30/9/16</u>		<u>£ 9,648.58</u>

## **Transfer from Members Fund to Endowment Fund**

Invested with Redmayne Bently holding	£44,404.00	
Invested with M&G Charifund (further 310.03 units)	£ 5,000.00	
<u>Transfer of M&amp;G Charifund (660units) valued at 30/9/17</u>	<u>£10,638.94</u>	<u>£60,638.94</u>

## Value of Endowment Fund at 30/9/17

Valuation of Redmayne Bently holding	£43,404.00	
Valuation of M&G (970.03 units)	£15,636.50	£59,040.50
Initial depreciation of Endowment Fund		£ 1598.44
Net appreciation against Balance Sheet valuation at 30/9/16		£ 8,050.14

### Ben Brown

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### Meetings Secretary's Report

First up on the 12th October was Professor Peter Doyle, a geologist who specialises in battlefield geology and he gave us an intriguing insight into the geology of the Western Front.

9th November was 'whodunnit' night when we welcomed Professor Lorna Dawson from the James Hutton Institute, Aberdeen who talked about her speciality - soil forensics.

Lorna has advised many of the 'noir'-type detective series on TV and showed a video clip from the BBC 'One Show' where she successfully identified the exact location of the mud on a welly boot from its clay and mafic mineralogy.

Our speaker for the 14th December lecture was Professor Stephen Daly from UCD who gave us a talk on the Palaeoproterozoic evolution of the Nuna/Columbia margin - i.e the late stages of the Lewisian, the Rhinns Complex and other Palaeoproterozoic rocks in Ireland and Rockall.

On the 11th January we thanked society member and past Hon. Sec. Dr. Simon Cuthbert from the University of the West of Scotland for stepping in at short notice to give us a very interesting talk on 'Venus – behind the veil'

We welcomed our well-known colleague Dr. Roger Anderton on the 8th February where he told us all about the sea-bed geology of the Firth of Lorne.

Our colleagues from the Edinburgh Geological Society hosting the Joint Celebrity Lecture and awarded their C.T. Clough Medal to Professor Bob Holdsworth, of University of Durham, who gave a talk entitled 'Cracked and full of sand: insights into the development of fractured basement reservoirs west of Shetland' on the 21st February in Edinburgh.

On the 8th March we welcome Dr. Nick Tosca from Oxford University who gave us a lecture on Precambrian ocean chemistry and new perspectives on the environmental backdrop to early life concentrating in particular on banded iron formations.

On the 12th April we presented our T. Neville George Medal for services to stratigraphy to Dr. Tony Spencer for his work on Precambrian glaciations - in particular for his detailed study of the Port Askaig Tillite on Islay and the Garvellachs - which was the subject of his fascinating lecture to us.

Finally, we had our usual Members' Night on 10th May. One of the short talks was given by students from Glasgow University's Remote Islands Expedition 2017, where they told us about their various integrated geological and biological projects on Islay. Other talks were

from Allan Jack on the Jabal Sayid Copper Mine and Margaret Greene on the Shaping the Landscape Exhibition at New Lanark and David Degan on moon-rock analogues.

*David Webster*

## **David Webster**

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### **Excursions Secretaries Reports**

#### **Day Excursion Secretary's Report**

The day excursions program started on 2nd June with a trip to Muirsheil Country Park with 15 participants. Fine weather meant that some of the party took the high road through a kilometre of heather to visit a barite outcrop near the top of the hills while the more sensible took the low road (which was actually a road) to meet us at the abandoned barite mine. I hadn't realised there was a wilderness area so close to Glasgow – well worth a visit if only for the walk. Our leader on the day was Dr Iain Allison.

The next excursion was on 9th June. This was a follow on to last year's trip to Comrie when we ran out of time to visit all the planned sites. Glen Lednock is one of these marvellous places in Scotland where you can view rocks from several different geological events within metres of each other. The weather was kind enough to wait until we got back on the bus before torrential rain forced us to head to the Famous Grouse Visitor Centre in Crieff to round off the day. On this trip there were 16 participants led by Simon Cuthbert.

Trip number three was our joint excursion with the Edinburgh Geological Society on 30th June. Clear blue skies all day meant we could fully enjoy all the sights and sites we visited. We started off with a walk through Kinnoull Hill Woodland Park which offered panoramic views over the River Tay from the cliffs. We then moved on to Quarrymill Woodland Park. After lunch we toured the building stones of Perth then had an excellent joint High Tea with our Edinburgh colleagues. Many thanks to Con Gillen for coping with such a large party of 15 GSG members and 16 ESG folk.

The fourth field trip was on 18th August to visit Spireslack Quarry with 15 members. This recently abandoned quarry offers an amazing opportunity to view a complete 1 kilometre exposure which would form a wonderful geological education site. Sadly, its remote location and the expense involved in making it safe for general public visitation means that this is unlikely to happen. The site is truly impressive but on the day we were forced to cut the visit short due to high winds and heavy rain. Many thanks to Graham Leslie from Edinburgh BGS for his informative talk on the history and possible future of the former open cast coal mine. In a slightly different vein, our next excursion on 22nd August was to accept an invitation to visit Derek Fabel's laboratory at the Scottish Universities Environmental Research Centre facility in East Kilbride. Here the 11 participants got a chance to see the 5MV Tandem

Accelerator which enables Derek and his team to establish the age of rock samples with astonishing accuracy.

Con Gillan was kind enough to offer to lead two-day excursions again this year so on 8th September we met him at the Beecraigs Visitor centre outside Bathgate to see a dyke and Carboniferous Limestone. Then we drove up to Cairn apple Hill and the Knock via the Witch Craig geology wall. Then on to Petershill Reserve to see some fossiliferous reef limestone. There were 15 participants on this trip.

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**

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### **Residential Excursion Secretary's Report**

1. Raasay – Fri 27th to Mon 30th May 2018

Leader – Dr Brian Bell, University of Glasgow: 18 participants

2. Aberdeenshire – Fri 14th to Mon 17th Sept 2018.

Leader – Dr Con Gillen. 18 participants

Both trips were very successful.

In Raasay, where we stayed in Raasay House, we had wall-to-wall sunshine and blue skies for the whole weekend. For Aberdeenshire, we were spread between two B & B's in Stonehaven and again the weather was good. Both trips provided excellent geology and scenery, such that everyone learned a great deal, and visited numerous sites that were completely new to us all. On each trip, travel was by shared private cars and volunteers were 'persuaded' to write a half day report, providing 6/7 reports for each trip.

**Maggie Donnelly**

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## **Residential field trip to Raasay**

Friday 27<sup>th</sup> to Monday 30<sup>th</sup> April 2018

**Leader: Dr Brian Bell**

### **Friday 27<sup>th</sup> April**

We drove to Skye in shared cars and boarded the ferry at Sconser for the twenty-five-minute sail to Raasay. By late afternoon the group had all met up at Raasay House where we would be staying.

### **Saturday 28<sup>th</sup> April, am.**

Report by Seonaid Leishman

When Brian Bell was asked by Maggie Donnelly to take a GSG excursion to Raasay it was clear that long notice was required, not only to fit in with Brian's reputation and busy schedule, but because of the popularity of the main accommodation on the Island! We therefore had 18 months to build up high expectations – all of which were all met!

The original Macleod house was burned following Culloden and rebuilt in 1747. Boswell, visiting in 1773 states, "we found nothing but civility, elegance and plenty". Not much has changed. The Raasay House Community Trust has worked hard to set up the Hotel and Outdoor Centre in this elegant building. On the Friday we joined Brian and his colleague Ian Williamson at the House and had the first of many excellent meals followed by an introductory talk in the House library provided for our Group's use. The Island has well exposed rocks ranging in age from Archaean Lewisian Gneiss, through Torridonian sedimentary rocks, Triassic and Jurassic including Raasay Ironstone and topped by Palaeogene lavas and sills. We would see all these exposures – however not necessarily in the right order!

Saturday morning before breakfast photos were urgently being taken of sun on the Red Cuillins – this weather and view wouldn't change all weekend!



The Red Cuillins from Raasay House

Brian then explained that *because* of the sun he wanted to skip sequence and NOT start with the oldest rocks, in order to ensure a great photo that morning on the east

coast at Hallaig. Having parked at Fearn, the end of the tarmac, we walked along the well preserved ancient track towards the deserted village of Hallaig. We noted landslips in the Late Devensian diamictite below the ridge of Jurassic Scalpay sandstone. The village of Hallaig, cleared in 1852, is just beyond Rubha na' Leac where a memorial stands. There Iain Allison recited the first verse of Sorley McLean's Gaelic poem, Hallaig, inscribed on the cairn to Sorley of this air. To the north of us was laid out the whole stratigraphy of Raasay from Lewisian upwards topped by the Palaeogene lava on Dun Caan. A photo opportunity indeed!



Track to Hallaig



View from Hallaig of East Coast stratigraphy

At sea level on Rubha na' Leac there are exposures of the Triassic Stornoway Formation consisting of fine and coarse sedimentary rocks. As the crust stretched, basins formed in arid equatorial conditions not unlike Death Valley today. Alluvial fans deposited red siltstone interspersed with cobble conglomerates when the current was stronger. Some of these varied clasts are recognised as Cambrian and Moine. Brian described this environment as a 'sink' with no exit so that calcretes formed as the shallow lake waters evaporated. The exposure also includes Palaeogene dykes and sills which have baked the country rock.



Rubha na' Leac



Triassic Stornoway Formation

After clambering back up to the road and enjoying the views to South Skye, we took our lunch at Fearn and set off north for the Lewisian Gneiss complex.

*All photos by Seonaid Leishman*

**Saturday 28<sup>th</sup> April, pm.**  
Report by Iain Allison

Lewisian and Torridonian

After a sunny lunch at the road end in SE Raasay with views over the Isle of Scalpay to Kyleakin, Kyle of Lochalsh, the Crowlin Islands and the southern Applecross peninsula, we retraced the route and drove north. En route we stopped to view the landslips on the Isle of Skye below Beinn Tianavaig, south of Portree bay, (Fig. 1) where the Palaeogene basalt lavas have slipped down on Lower Jurassic shales, as at the more famous locality of The Storr, clearly visible in the distance.



Fig.1

We continued north past the sign for Calum's Road to the end of the public road before turning around and parking near some well exposed road cuttings.

These show all the important features of the Lewisian gneiss which forms the metamorphic basement of the Hebridean and Northern Highlands terranes (Fig. 2).



Fig.2

These gneisses, originally of Archaean age ( $2790 \pm 210$  Ma), were reworked during the Laxfordian event and the fabrics now seen reflect this overprinting. In the period 2400-2200 Ma a suite of mafic intrusions was emplaced and subsequently deformed and metamorphosed. These now occur as sheets parallel to the dominant gneissic foliation.

The enclosing 'granitic' gneisses are grey to pink and have an average composition of granodiorite yielding ages of  $1680 \pm 170$  Ma. Laxfordian deformation has caused pinch and swell structure to form in the mafic sheets and, in places, separation to form boudins with the space between filled with granite pegmatite. The minerals and structures represent deformation at mid to lower crustal levels. The attitude of the gneissic foliation is very variable but here it was flat-lying.

We headed south and parked at Brochel Castle, which sits on the Triassic conglomerate, and ascended the slope above the sign "Calum's Road," to see the relationship between the Triassic conglomerate, seen in the morning at Rubha na' Leac, and the underlying rocks.

Here the conglomerates overly the Lewisian gneisses but all the clasts are of the Torridonian (Fig. 3, BRB).

The steep contact implies that the Triassic breccias infilled a hilly landscape.

Fig.3



The clasts were a mixture of tabular angular fragments of shaly rock as well as more rounded clasts of sandstone.

The clasts are cemented with calcite and in places we saw drusy nail-head spar calcite lining small cavities (Fig.4). Walking to the top of the rise and NW across the moorland we could see, to the north,

Fig.4



Loch an Uachdair and the westerly dipping Torridonian overlying the gneisses. It was possible to trace the unconformity south down the east side of the loch and round to the

west beneath our feet. It then turns SE close to our previous exposure showing that there was indeed a local source of Torridonian clasts. To the NW we could just pick out the third small outlier of Triassic rocks which form a line from Brochel Castle.

Continuing south, we parked north of Glam and walked up to low cliff exposures on the west side of Beinn a' Chapuill to see the internal structure of the beds of Applecross formation sandstones which here on Raasay are called the Leac-stearnan member (Fig. 5).



Fig.5

These thickly-bedded fluvial sandstones deposited in braided rivers show dramatic soft-sediment deformation and dewatering structures preserved after overpressuring gave rise to quicksands. The cross-bedding is very distinctive – in places the foresets can be traced laterally and their dip increases until they become overturned. As well as the cross-bedding to indicate way-up, many layers show grading from pebble sandstones through granules to coarse sand.

This ended an excellent day of spectacular scenery and excellent rocks seen under blue skies and we returned to Raasay House.

*All photos by Iain Allison*

**Sunday 29<sup>th</sup> April, am.**

Report by Monica Reilly

#### Outcrop 1- Breakish Formation

The first locality of the day focused on the south of Raasay near East Suisnish. Here, after a short walk from the pier, through numerous derelict buildings associated with the iron ore mining industry, the Breakish Formation is exposed. The exposure consists of calcareous sandstone interbedded with mudstone and limestone and abundant in bivalves, notably gryphea. The depositional environment for this unit has been described as nearshore (as the gryphea are largely intact) with periods of higher energy washing in sand.



*Breakish Formation showing stratification between gryphea rich beds and calcareous sandstone.*

### Outcrop 2- Pabay Shales

The second locality of the day was a short walk, approximately 500 m, north of the pier along the single-track road to a cutting through Pabay Shale Formation. The Pabay Shales, also lower Jurassic, comprise fine grained laminations of mudstones and siltstone with calcareous nodules. This unit shows an obvious transition to a deeper, offshore environment in comparison to the Breakish Formation. Calcareous nodules have been described as a result of burial and dewatering and are not associated with the deposition of the mudstone and siltstone sequences.

*Pabay Shale formation*



### Outcrop 3- Granite Sill in Pabay Shale

The third locality was approximately 400 m north from the previous location and in a roadside cutting. At this location, pale grey Palaeogene granite has intruded into the Pabay Shale Formation. This has caused disturbance within the shale beds. Contact

metamorphism has also been noted between the shale and granite intrusion. Shale at the margins is typically less weathered due to alteration from the granite. It has also been noted that there is a dyke intrusion through the shale formation which terminates at the point of contact with the granite.



*Granite intrusion into Pabay Shale Formation.*

*Photos by Monica Reilly*  
**Sunday 29<sup>th</sup> April, pm.**  
Report by Katerina Braun

### Dun Caan Summit

Just before reaching the summit of Dun Caan, a change in rock type is observed marked by a straight NNE-SSW cliff line and two lochs, Loch na Meilich and Loch na Mna situated below the cliff line. This linear feature marks the position of a fault that separates granitic rocks to the west and the basic igneous rocks that form the summit of Dun Caan to the east. There is no granite present east of this feature; hence the fault must post date the granite intrusion.



View of Dun Caan Summit, Loch na Meilich, fault line and granite cliff line.

Flow banding is evident in the basic igneous rock outcrops on Dun Caan summit and is also visible in thin section. Dr Brian Bell informed the group that he believes these basic igneous rocks are extrusive and formed from lava flows. Dr Brian Bell also reported that red horizons have also been observed in these basic igneous rocks exposed on Dun Caan summit, further supporting his lava flow theory. Dr Brian Bell considers the suite of Dun Caan basic igneous rocks therefore to be a remnant of the Skye lava plateau. Evidence of landslide activity east of and below Dun Caan summit is easily visible from the summit.



*Close up view of Dun Caan basic igneous rock outcrop with flow banding structure*

*Easterly view from Dun Caan summit and evidence of landslide activity below*



### Oskaig Point

The last locality of the day included a visit to an ultrabasic sill at Oskaig Point. This sill is faulted against granite to the northeast and Jurassic strata are present to the southwest. This sill is composed of Picrite, which is more basic than basalt and has a higher olivine content. Dr Bell informed the group that this sill is similar to other sills observed across northern Skye. This sill is chemically related to Little Minch sill complex on northern Skye. There is also a large offshore intrusion in Jurassic rocks between Lewis and Harris of similar chemistry. The sill chemistry is chemically distinct to the Skye lava pile, which has a lower silica content and higher alkali content. Dr Bell noted that all these chemically similar sills have been intruded into Jurassic rocks and that currently, there are no known exposures where these sills have been intruded into the Skye lava flows.

*All photos by Kat Braun*

### **Monday 30<sup>th</sup> April, am.**

Report by Jim Martin

### Visit to the Raasay Iron Mine Workings

On Monday morning we visited the workings of the now derelict iron mine, opened prior to the first war, to exploit the Raasay Ironstone. It is situated at the very southeast of the island near the old pier, and after parking near the adit of No 2 Mine, we climbed up to the remains of the surface workings, close to No 1 Mine. The ironstone formed during the Toarcian, within the Jurassic, in a shallow marine environment and is described as thinly-bedded, chamositic (silicate) ooidal, dark grey to black and micaceous. It is typically 2-3 m thick. The ironstone was extracted using an extensive network of eight kilometres of underground tunnels and surface strip mining. On the Portree Shale formation, the strata below that previously strip mined, we observed fossilised ammonites and belemnites. The surface material was quarried first, having a higher iron content and being more easily won. A system of draglines, hutches, cables, winches and narrow-gauge railways was created to transport the ore from the mines to the processing plant at Suishnish. Here, prior to shipping, the ore was concentrated and then shipped out via Ardrossan in Ayrshire for onward transport to Coatbridge and Glengarnock. Concentration was achieved through calcination, a process which involved a controlled burn of crushed ore mixed with imported coal.

To support the operation William Baird and company, operating on behalf of the British government, created an infrastructure to support the community of workers, managers, a doctor, and up to 200 German prisoners of war along with 60 officers and soldiers as their guards. The employment of the prisoners was justified on the basis that soldiers could not be released to do the work, but was contentious because mining for iron could be in contravention of the 1907 Hague Convention. Fourteen German soldiers died while working on Raasay, two from accidents and the others from influenza. The works produced a total of 200,000 tons of ore with peak production occurring in 1916. The

works were maintained in readiness to resume production until being dismantled for scrap during World War 2.

We returned downhill and walked a short distance to view the adit of No 2 Mine. An iron railing now closes the entrance (danger of rock falls and poisonous gas) but we could look inside. It is thought that because of severe faulting there was virtually no production from this mine. It must have been an expensive white elephant considering the cost of constructing the high viaduct, hauler house and other mine-head buildings. However, it was not entirely unused as Baird's built a sawmill here and all timbers used in the mine for pit props, railway sleepers power poles and other purposes were sawn here and transported by rail.

Back at the cars our leader was given a **very** big "thank you" for providing us with such an interesting and enjoyable weekend, and was presented with the customary gift of appreciation, before we all set off to catch an afternoon ferry.

### **References:**

The Iron Ore Mine on the Hebridean Island of Raasay *Der ANSCHNITT 51 1999*

The Raasay Iron Mine Where Enemies Became Friends *Laurence and Pamela Draper*.

## **GSG residential excursion to Aberdeenshire.**

Fri 14<sup>th</sup> Sept to Mon 17<sup>th</sup> Sept 2018

Leader: Dr Con Gillen

Participants 18

**Fri 14<sup>th</sup> Sept pm**

*Reporters: M Donnelly, Bill Gray*

### **Crawton Shore**

We met up at Crawton south of Stonehaven, around 1 pm, had lunch and then made our way down the cliff path to the shore of Crawton Bay, NO 877 796. To the west, the bay ended in a high promontory of LORS conglomerates with some crude bedding, and the shore itself consisted of a large selection of pebbles and cobbles. Many of them were of conglomerate but there were also basalts and lavas with vesicles. To the east, a long thin spur of dark rock extended seawards. We were in the Crawton Volcanic Formation, a series of interbedded lavas and conglomerates (of alluvial fan origin) at the top of the Crawton Group of the Lower ORS and this was the highest conglomerate in the sequence. High on the cliff to the north of the beach was a cross-bedded sandier facies which formed part of a seaward dipping fan with slightly steeper apparent dip than the underlying conglomerates. The latter had pebbles and boulders over 50 cm in diameter while the finer-grained material was less well rounded. The conglomerate was mostly clast-supported and had a coarse sandy matrix. Volcanic debris was plentiful, with massive, porphyritic, vesicular lavas, but there were also quartzites, granitic rocks, metagreywackes,

felsite, banded chert, jasper and “greenstones”. The jasper and greenstones came from rocks similar to those of the Highland Border Complex while the metagreywackes with spaced cleavage came from Dalradian rocks north of the Highland Boundary Fault. Pebble imbrication and source information indicated a variety of convergent transport directions. A good storm beach, which merged with vegetated talus from the cliff, was developed.

The dark spur of rock (NO 878 796) was the top lava, a massive purplish basalt with vesicles, some over 10 cm in diameter and filled with calcite, quartz, and occasional brick red stilbite. Its surface was intermingled with the conglomerate deposited on top. Continuing along the shore, NO 879 795, there were now fewer lava clasts but prominent boulders up to 1 m in diameter of a fine grained pinkish granite whose size range indicated that they had been derived locally.

The top of the next lava, lying under conglomerate, was exposed a few metres beyond. Its top was vesicular and porphyritic with lath-shaped phenocrysts of feldspars (some 20 mm long and 2 – 3 mm thick), and it had impressive flow directions, mainly in the body of the flow. As it had been eroded before deposition of the conglomerate its surface was now irregular with conglomerate-filled erosion hollows.



Lava /conglomerate junction. *Bill Gray*

The contact between the third and second lavas lay at the base of the cliff and had thin, intermittent red mudstones and blocks of altered lava. The reddening indicated a phase of subaerial weathering producing a 'red bole'.

We then climbed the conglomeratic ridge to the top of the cliff and followed the latter's edge north from where we had an excellent view of the promontories formed by the four lava flows. We walked to the southern edge of the vertically sided inlet Trollochy, NO 880 798, whose cliff was of crudely stratified conglomerates. Within these were some lenticular well sorted sandstones with inclined bedding and trough cross-bedding. They probably represented sandy deposits on the gravel bars of an alluvial fan, laid down during periods of low water level and reduced stream power. Trollochy had been eroded along a series of joints and minor faults which threw down to the south. A prominent joint trending NNW-SSE had been exploited by the sea – a blowhole used to function along its line, but this was now blocked by debris. The stream that formed the waterfall followed a post-glacial course along the line of the blowhole.

We descended a grassy slope onto the lowest lava flow (1) and crossed its top to a small gully eroded along a prominent joint, NO 880 797, within which the subhorizontal surface of the lava flow's central part had cross-sections through columnar jointing. The columns were generally 30 – 60 cm in diameter; their softer centres hollowed out, and the column margins raised as ridges. The columns varied in the number of their sides –

hexagonal or with 5 or 4 sides. In vertical sections on the west wall the columnar jointing formed downward divergent fans. The base of this lava had more vesicles and its feldspar phenocrysts were disoriented. The patches of laminated sandstones and mudstones lying under the lava had been disrupted and baked. The lava's top surface, now a wave-cut platform, had many small cavities and large joints with a different orientation to those seen earlier, indicating that it had been formed by a different pulse of lava.



Top of lava – wave-cut platform.  
*Bill Gray*

We returned to the cars and set off for Stonehaven to book into our accommodation and enjoy a well-earned evening meal.

### **Sat 15th Sept 2018, am**

Leader: Dr Con Gillen

Reporter: *Joyce Stewart*

After breakfast we all met at Stonehaven harbour car park at 9.30 am. Our leader gave us a synopsis of what we were going to see today and we walked from the car park along Shorehead Road, near the end of which were large blocks of migmatite from the locality of Girdle Ness, a promontory of migmatite on the north of Nigg Bay. Unfortunately, this had been destroyed by the building of a new harbour. The migmatite consisted of grey metamorphic rock with pink veins. When the rock is close to melting point (700° C) at around 15 km deep, molten material cuts through the mica inside the rock schist and causes melting. Crystals line up during compression and folding. The rock splits like a slate but the pieces are thicker and more irregular. There is no granite in the Stonehaven area – the main rock types are old red sandstone and conglomerate. As we made our way along the shore we found many examples of the junction between fine sandstone and conglomerate.



The example in Fig. 1 has a ‘pebble supported matrix’ falling into the sand. The day before, we found that the rocks had mainly a ‘boulder supported matrix’.

Fig 1. Junction between fine sand and conglomerate

There were also good examples of cross-bedding in the sandstone created by changing currents. Fig 2.



Photos by *Joyce Stewart*.

We saw an igneous dyke – a dark rock with sharp edges cutting through the sedimentary rock. On either side the sandstone was proud as it had been hardened by the heat and re-crystallised. We then made our way to the cliffs in which there had been two big quarries. Facing the cliffs from the beach on the right was fine sandstone and on the left conglomerate. The conglomerate had made channels in the sandstone with powerful streams bringing in boulders. When the current was reduced it deposited pebbles, cobbles and finally sand.

**Sat 15th Sept 2018, am**

Reporters: *Joyce Stewart, Bob Diamond*

We made our way back to our cars and drove to Cowie Harbour, a small weathered out fault, where we examined the Late Silurian ‘fish beds’ in which fish scales which belonged to jawless fish such as lampreys (lived on dead material and algae) can be found. These occurred in a sequence of alternating grey sandstones, shales and mudstones with brown, grey and red cross-bedded fluvial sandstones below and above, and lie within almost vertical strata. Con informed us that the Cowie fish beds provided ages for its

vertebrates; the oldest of the fossil fresh water fish was found here in 1911. The oldest known air breathing millipede was found here in 2004. We walked along to look at sedimentary structures and came to two irregular quartz-porphyry dykes trending NE-SE which seemed to have been intruded into a fault line – hardly surprising since we were rapidly approaching the Highland Boundary Fault Zone. The sequence then changed to a series of sandstones and mudstones, laid down in a low energy environment – there were a number of depositional cycles, fining upwards. The top often showed signs of erosion indicating some sort of seasonality. We found mud clasts in the sandstone as sometimes rivers would pick up dried mud at the banks and bring them down, spreading them out in a string. Some of the mud flakes are coloured red by oxidised iron, others coloured green by reduced iron. There were also good examples of honeycomb weathering by the sea as the carbonates were worn out. The edges of the network are hardened by silica. Concretions or nodules are elliptical structures which can be formed by a chemical reaction or by organic matter (e.g. when organic matter rots and a gel forms around it). Some nodules have been found to have fish scales inside, as a nucleus is needed to start the process. Sand then gets trapped, builds up over time, and in some of the nodules had formed cross-bedding.

Eventually we reached the irregular unconformity between the Silurian Cowie Formation and the Highland Border Complex (HBC), situated below the ruins of St Mary's Church. ORS sediments dip to the south at 70-80°, whereas the HBC rocks have a penetrative cleavage which dips steeply to the NW. The cross-bedded units are typically coarse sandstones with a few small pebbles, interbedded with plane laminated or rippled sandstones and red mudstones. The nature of the unconformity and overlying sediments indicated that the local relief had been low, without nearby mountains to provide large volumes of detrital material.

**Sat 15th Sept 2018, pm**

Reporters: *Bob Diamond, Maggie Donnelly*

We returned to the cars, drove north, parked beside the golf course and walked down to an excellent viewpoint overlooking Craigeven Bay. On the opposite north coast of the bay the Highland Boundary Fault with its fault rock could clearly be seen – its line crossed the bay towards us, delineated by pairs of sheared rocks rising above the waves and finally exposed on the beach below us – easily the **best** view of the fault which many of us had seen!!



Easily the best view of the fault which many of us had seen!! *M Donnelly*

We set off down a steep grassy slope to the sandy shore and turned south, climbing over an outcrop of extremely rugged rocks below the ruins of St Mary's Church. These were the pillow lavas!



These were the pillow lavas! *M Donnelly*

They are the lowest part of the HBC. We climbed across to the seaward side and looked back to see a number of vertical faces of well-formed but badly sheared elliptical pillows between 50 and 100 cm long. Their 'way up' direction northwards was easily identified, but they did not have typical pillow structures such as concentric interiors nor distinctive rinds. Altered into chlorite schists, they are called 'greenstones'.

We then started to walk around the bay, stopping at three localities where sheared rocks at the base of the grassy cliffs were exposed. They belonged to the Dalradian grits and phyllites of the Southern Highland Group, with open folds plunging gently to the SW, together with a number of small kink bands. They had a spaced cleavage and were fractured and veined by quartz. Grading in pebbly greywackes gave way-up evidence and in the coarse beds the quartz and feldspar grains were flattened. Eventually we reached the end of the bay and the Highland Boundary Fault where we spent time examining the fault rock and the rocks on either side. Crossing the bay there was a very obvious band of yellow rock – the highly altered fault rock of the Highland Boundary Fault. It was a silicified dolomitic limestone and was cut by many thin carbonate veins. These rocks were of Ordovician Age (*ca* 460Ma), now named the Trossachs Group. This was all in all an excellent end to a fascinating day, and we headed back to Stonehaven.

## **Sun 16<sup>th</sup> Sept am**

*Reporter: Seonaid Leishman*

We all met at Dunnottar Castle – an impressive Pictish site on a sea stack with buildings dating back to the 13<sup>th</sup> century it has played an important part in Scotland's history. We followed the path towards the Castle along the edge of a gorge, a meltwater channel formed in the conglomeratic Devonian Dunnottar Formation at the margin of the last major ice sheet as it retreated to the NW. A cleft formed by erosion of a major joint beneath the Castle stack became an escape tunnel seaward during attack! The beach to the north, Castle Haven, is a wave-cut platform where we investigated the conglomerate for clast size, degree of sorting, direction of flow, possible source. Most clasts are Dalradian, Southern Highland Group therefore from the Grampian Block, north of the HBF and can be up to boulder size. The thickness of these beds and distance from source confirm the vast height of the Grampian mountain chain. We also found unusual caliche indicating calcite cement – *and* some quartzite which has still to be fully explained.

We then drove to north of Garron Point, crossing the HBF yet again, to reach Skatie Bay. The path to the beach winds down beneath the railway, following another meltwater channel, formed in original Dalradian rocks, not re-worked as at Castle Haven. This beach is special. It exposes the Dalradian greywackes (deep water sediments) of the Steep belt of the Tay Nappe Downbend which have been sheared, buckled and kinked by movement on the HBF. It should be possible to identify three distinct deformation phases with related ductile folds and penetrative cleavages giving the schistosity, i.e. D1, 2 and 4. To make matters complex, in most places bedding is parallel to cleavage. Con emphasised

to those new to Dalradian structures that cleavage is mineral crystal alteration due to deformation or metamorphism, not fracturing.



Skatie Shore and  
Garron Point

*Seonaid Leishman*

We had  
lunch at this lovely

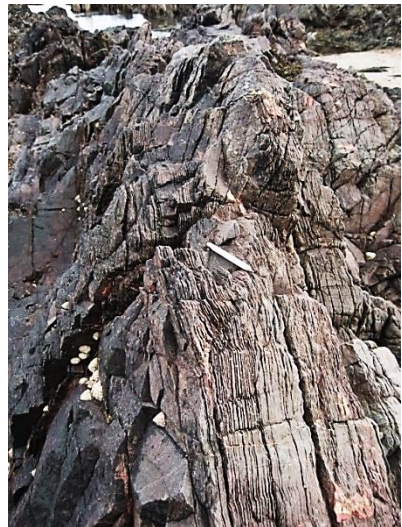
spot, all the while trying to discern bedding v cleavage and get evidence for way up in the form of graded bedding, cross-bedding and crenulation cleavage. There was even a rare sighting of a D1 fold hinge. This is a locality worth further investigation – certainly by me!

### **Sun 16<sup>th</sup> Sept pm**

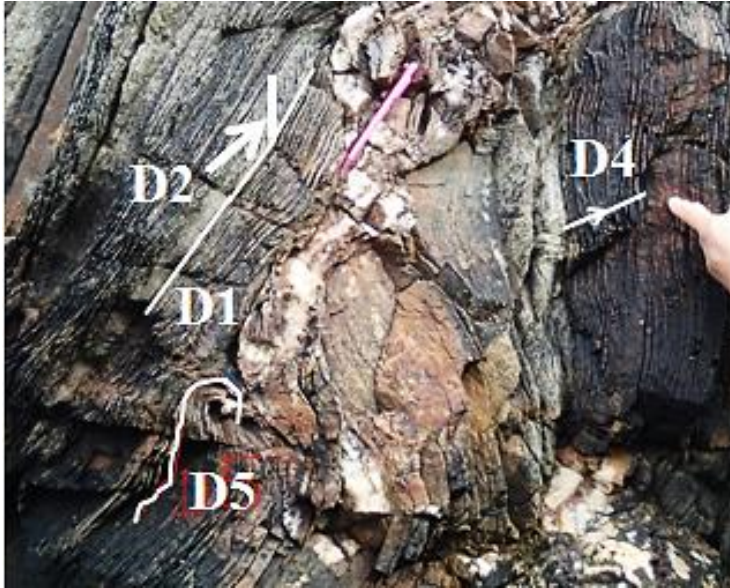
*Reporters: M Donnelly, Rhona Fraser*

We walked north a short distance along the shore and then our leader struck out over the intensely sheared, slippery rocks towards the sea and beckoned that we should follow. (About six of us felt that this was a step too far and started back up the cliff path.) The first exposure had micaceous layers showing crenulation, and cleavage parallel to bedding – this was D1.

Bedding and cleavage  
*Seonaid Leishman*



In coarser material there was evidence of cross-bedding which was younging to the north. Further north, bedding became less steep than cleavage. The group then walked and paddled to a sea stack with a narrow cleft into which only two or three people could fit at one time. However, this single exposure was **most impressive**. It displayed four deformations – D1, D2, D4 and D5!! Most of us had **never** seen an exposure which so clearly showed four deformations. D1 is labelled, D2 is at an acute angle to D1, there is no D3 exposed in this area, D4 is crenulation, D5 is a box fold (conjugate folds with rounded hinges).



This single exposure was **most impressive**. *Rhona Fraser*

We returned to the cars, drove north on the A92 and turned right onto the A956 which took us to the Cave of Red Rocks, NJ 965 029,. Parking under the railway bridge we followed the path to the cliff-top on the south side of a deep coastal inlet eroded along a fault line. This path ran over the upper surface (close to the upper contact) of a slightly porphyritic late Siluro-Devonian felsite sill, about 5 m thick, which contained small quartz and feldspar phenocrysts. Faint flow-banding, mainly parallel to its edges, permeated the sill but this was more pronounced near the upper and lower contacts where it was occasionally folded and contorted. The rock was composed almost entirely of quartz, potassium feldspar and oligoclase with very minor biotite, garnet and muscovite. A number of us followed the path **very carefully** down onto the rock platform by the sea where Dalradian migmatites were well exposed. These were originally pelites and semi-pelites, and now contained a number of large muscovite porphyroblasts. A succession of

pressure-solution cleavages could be identified, the second of which was folded, indicating at least three deformation events.

We then drove south, almost to Cove Bay (NJ 962 018) and, on foot, followed the path to the cliffs, observing that the surrounding rocks had become extremely brecciated. Soon we arrived at approximately the centre of a huge breccia pipe, 500 m in diameter, with steep contacts and the characteristics of an igneous explosive origin. There was a body of pink muscovite-biotite granite in the central part, thought by some to be a later intrusion, but by others, simply a large breccia block. The fragments of breccia comprised gneissic metasediments, amphibolite and a foliated two-mica granite in a cataclastic matrix. There were several bodies of red felsite, particularly near the margins of the granite, and occasional lamprophyre clasts have been found within this felsite-cut breccia. This is similar to other intrusions in the area. Quartz and calcite filled small cavities throughout, and large fissures contained veins of quartz. The matrix included pyrite and minor molybdenite. Extensive faulting and broad crush zones penetrated the whole breccia. The pipe probably belonged to the 'Newer Granites' suite and had occurred at shallow depth. It had similarities to the appinite suite of Argyllshire. A small Carboniferous aphyric quartz dolerite dyke with obvious chilled contacts cut the breccia at NJ 961 017. After a fascinating day we returned to Stonehaven

### **Mon 17<sup>th</sup> Sept**

*Reporter: Walter Semple*

The rolling fields of Aberdeenshire are a delight to lovers of "Sunset Song", but less rewarding for those in search of rock exposures. After spending the first part of the field trip on the dramatic wave carved rock exposures at the sea on either side of the Highland Boundary Fault, we were led up the course of the river Dee to Dinnet near Aboyne. Beside the Dinnet Bridge, the careful cutting of the bank vegetation to avoid fouling the salmon fishers' casts allowed the bankside rock exposures to be readily seen. We were now on the flat section of the fold in the Argyll South Highland Group in the Grampians. The metamorphic rock is mixed but mainly limestone. On the north bank a small dyke had intruded. Our second stop was at Burn O'Vat, a spectacular feature important enough to support a visitor centre and car park. It is a glacial pothole thought to have formed when a rock became lodged in the river bed causing a torrent of melt water to spiral around and carve out the underlying granite bedrock. It measures 13 meters deep and 18 meters wide with a sediment bed estimated at up to 7 meters. The entrance is a narrow stream passage that suddenly opens into the natural amphitheatre.



Our group at the uphill entrance to Burn O' Vat.

*Walter Semple*



Looking downhill across Burn O' Vat. *Rhona Fraser*

We moved on to the Pass of Ballater to view the well-known granite rock climbing crags. Plentiful examples of the rock can be seen in the rock falls without any need to climb. The granite has two types of red feldspar crystals giving it an attractive red appearance. The crystals are large indicating formation at high temperatures deep in the crust. Our last stop, the final stop before the journey home, was beside Gairnshiel Bridge, a picturesque stone structure built around 1750 as part of the Hanoverian work to open up the Highlands after

the Jacobite rebellion. The granite rocks in the slopes above the bridge are a short distance below the Dalradian rocks further up the hill. This indicates that the granite rocks were at the top of the magma intrusion. Our leader Con Gillen explained that the more easily crystallised minerals had crystallised lower down in the magma chamber leaving the last to crystallise at the top. The result was crystallisation of several different minerals, the most abundant being Zinnwaldite, a silicate mineral in the mica group, here predominantly green in colour. Because of the unusual rock, the locality has become well known to geologists and students and abundant examples of the hammered rock are available to be examined.

Finally, our leader was given a very warm and enthusiastic ‘thank you’ for taking us on a such an interesting and fascinating excursion and was presented with the usual gift of appreciation, before we all headed homewards.

### **Reference**

1. Excursion Notes provided by our leader, Dr Con Gillen
2. Kneller, B. C., Gillen, C, 2016, Excursion 1, Aberdeen City and Environs.. Aberdeen Geological Society Excursion Guide.
3. Trewin, N. H., 2016, Excursion 22, Crawton. Lavas and Conglomerates of the Lower ORS. Aberdeen Geological Society Excursion Guide.
3. Gillen, C., Trewin, N. H., Excursion 23, Dunnottar to Stonehaven and the Highland Boundary Fault. Aberdeen Geological Society Excursion Guide.

## **Weekend Field Trips**

### **Muirsheil Country Park**

Saturday<sup>2nd</sup> June 2018

Leader Iain Allison

*Report Margaret Greene*

Participants 15

We gathered at the Visitor centre at Muirsheil Country Park before setting out on this sweltering June day.

The area is of Lower Carboniferous volcanic rocks, close to the base of the Clyde Plateau Volcanic Formation.

The first locality we were led to was a section of the River Calder at Grid Ref NS 310 632.



Here was a prominent band of volcanoclastic conglomerate crossing the river. The clasts were part rounded: some were vesicular, all are igneous. The deposit is clast supported, suggesting a water-lain environment. This section consists of volcanic conglomerate sandwiched between trachyte lava flows.- some of which are vesicular.

Cutting the lavas are a series of WSW-NNE oriented dykes, the majority of which are felsic alkaline or trachyte types. One such dyke was investigated a short distance further upstream, and further on still was an example of water-laid tuff with layering of the ash deposits.

We all then went back to the track and carried on along towards the barytes mine. Part way a number of the party headed off up the moorland to seek out an exposed band of barytes while some of us carried on to the mine,



and one or two who had had enough of the sun headed back to the Visitor Centre.

Barytes, a hard pink rock, has many uses. Converted into barium sulphate, it was employed in hospitals for barium meal x-rays. It was also used as a constituent of paint and in the paper and cosmetic industries. More recently, it has been incorporated in oil-drilling muds pumped down through drill pipes for lubricating purposes.

In its early years the barytes was excavated by open cast working; later on, adits were struck to open up new seams of the mineral.

A number of veins of barytes cut the Trachyte on Queenside Muir; the main vein was up to 6 metres wide and could be traced for 800m in a NNE-SSW direction. At the northern end the main vein is diverted in an E-W direction. The mine was worked from around 1750 and finally closed in 1969. The entrances to the mine are now heavily fenced off although fragments of barytes can be found at the workings and on the track.

The party who had headed up the hill found an exposed vein on the side of the Berryglen Burn, at tributary of the Calder water at NS286643.



Some of the party lunched next to the fenced off section before heading back to the visitor centre where the group who had gone off cross country caught up. The centre thankfully not only provided teas and coffees but also ice lollies !

## Perth & environs: 30 June 2018

### Leader: Con Gillen

Report by: *Anne & Bill Gray*  
GSG, 19 from EGS

Participants: 13 from

This was a joint excursion with the Edinburgh Geological Society. The original aim of the excursion was to study exposures of the Lower Devonian Ochil Volcanic and Scone Sandstone Formations that dominate the geology of the Perth area and then to look at a variety of rock types that have been used for building stones in Perth city. However an event at Scone prevented us from visiting the Scone Sandstone exposures. The geology of

the Perth area and the localities we visited are described in Browne & Gillen (2015) and the locality numbers from that guide are given in the following account.

Our coach went to Kinnoull Country Park to meet the Edinburgh group and our leader, and arrived at 10:30 in glorious sunshine, which lasted all day.

We started with the short walk from the car park to the Corsiehill Quarry (NO 1350 2334; Locality 15.1), operational from 1832 until 1932, where a Carboniferous quartz-dolerite sill was extracted for road metal. Con pointed out the contrast in durability between the porphyritic dolerite and the surrounding lava, which forms Kinnoull Hill. The lavas were softer and more crumbly than the dolerite, with numerous vesicles.

From the quarry, a 30 minute steep walk up through the dappled shade of the forest led us to the top of the hill (NO 1366 2282; Locality 15.2), where we admired glorious views from several viewpoints, sampled tiny wild strawberries, and visited Kinnoull Tower, a folly that occupies a commanding position above the escarpment on the south-east side of the hill. From here we had a majestic view of the River Tay meandering across the valley below, and of the scarp of the Ochil Volcanic Formation which marks the position of the North Tay Fault. The lava flows in this cliff are much less defined than those seen in the Clyde Plateau Volcanic Formation. We then returned to the buses to travel to the city centre.

Photo 1 (P1040941\_2.jpg). View from Kinnoull Hill viewpoint (Locality 15.2) looking east. The scarp of the North Tay Fault with Kinnoull Tower on top can be seen on the left. The outcrop belongs to the Ochil Volcanic Formation. *Bill Gray*



View from Kinnoull Hill viewpoint (Locality 15.2) looking east. The scarp of the North Tay Fault with Kinnoull Tower on top can be seen on the left. The outcrop belongs to the Ochil Volcanic Formation. *Bill Gray*

There used to be many quarries in the Perth area, mostly mining the Scone sandstone, but they are now all defunct. Our original plan had been to visit one of these, the Quarrymill, near Scone Palace. The stone from these quarries is thought to have been worked for the abbey and palace at Scone and to have been used for the Stone of Destiny. However, because this plan had to be cancelled, we turned our attentions to the way the stone was used in the building of St John's Town, the original name for Perth. We were dropped off on the west side of the river and walked across Queen's Bridge to visit Kinnoull Aisle (NO

1231 2332; Locality 16.9), the remains of the 14<sup>th</sup> century church that is the burial site for the Kinnoull family. The Scone Sandstone Formation has a very varied appearance, ranging from pale blond to a rich dark red, is well-bedded, often cross bedded and displaying usually small well-rounded clasts. Con described how it was laid down in great depth over the millennia that followed the end of the Caledonian orogeny. The mountains were by then well eroded and the sand fragments that reached the Perth area had been transported by rivers from far-off low-lying hills in the north, becoming rounded and frosted by their deposition. Warm climatic conditions account for the presence of iron, giving the red hue to the stone.

We then had lunch in Kinnoull Park, amid very pleasant terraces overlooking the river. After our lunch we walked up from the park to the eastern section of Queen's Bridge (NO 1226 2342, Locality 16.8), where we saw a fine example of a sand volcano in the Carboniferous sandstone from which the bridge is constructed, and learned that this was a de-watering structure.

We next visited Kinnoull Parish Church (NO 1230 2354; Locality 16.6), which is constructed of Scone sandstone which displays fine bedding with some elongated mud clasts.

One of the most spectacular constructions from the local stone is the Smeaton Bridge over the Tay (NO 1202 2385; Locality 16.5).

Smeaton Bridge (Locality 16.5). The columns are made of Scone sandstone & the spandrels (the circular inserts) of basalt. *Bill Gray*



The pillars are formed from large blocks of bright red cross-bedded sandstone from Quarrymill, some containing pebbles standing proud of the surface, while the round spandrels (circular inserts) are formed from the local black basalt. Therefore, the bridge neatly encapsulates the geology of the area. The column on the west bank displays marks recording the levels of flooding that the city has endured over the last 100 years. The pillars of the new flood defences are fashioned from smooth-faced Locharbriggs red sandstone. This was a Permian desert formation, without the rich variety seen in the local sandstone.



Column on the west bank of Smeaton Bridge (Locality 16.5), composed of cross-bedded Scone sandstone and with marks recording the levels of flooding over the last 100 years. *Bill Gray*

On our way to look at the building stones we made a detour through North Inch park to look at the granite plinths of the war memorial (the granite probably came from China) and the statue of Prince Albert (NO 1190 2390; Locality 16.5c) The plinth of the statue is made of Scone sandstone and the blocks in the upper part have been laid with the bedding vertical, resulting in fast erosion. The statue itself is made of cross-bedded Carboniferous sandstone from Redhall Quarry Edinburgh (Gullane Formation).

The centre of the old city houses several buildings of Scone sandstone, notably St John's Kirk, the oldest building in the city, and St Matthew's Church. The buildings we looked at were:

St Matthew's Church (NO 1210 2357; Locality 16.10) – Scone sandstone but with an entrance arch of Carboniferous sandstone.

Sheriff Court (NO 1207 2340; Locality 16.11) – Carboniferous sandstone at the front (probably from the Lothians), Scone sandstone at the back. (The columns at the entrance had originally been intended for a building in Charleston in Fife.)

Wall of County Prison (NO 1210 2357; Locality 16.11) – Carboniferous quartz-dolerite blocks with doorways of sandstone & slate.

St John's Kirk (NO 1195 2355; Locality 16.1) – Perth's oldest building (1126) - Scone sandstone.

City Hall (NO 1185 2355; Locality 16.2) – Dundee Flagstone Formation (below Scone Sandstone Formation).

Former Bank of Scotland (NO 1200 2350; Locality 16.2c) – Carboniferous sandstone.

Sandeman Building & Gloag Building (Kinnoull Street ) (NO 1165 2370 & 1170 2372; Locality 16.13) - Locharbriggs sandstone from Dumfriesshire

Con gave us a challenge when we came to the old city wall (NO 1194 2372; Locality 16.3): to find a block of garnet mica schist. He explained that this 12<sup>th</sup> century structure was the only place where one can see building stones that have come from the Highlands. These early defensive walls were erected using the local sandstone and also stones gathered from the island in the middle of the river in the city, composed of quartzite, greenschist and mica schist, which had been brought down by rivers and were well

rounded and worn. We were, of course, successful in our search, helped by the bright sunlight highlighting the mica in the schist.

Our last port of call was the complex of old mill buildings (NO 1145 2373; Locality 16.14) which cluster around the city lade which powered the water wheel. Formed again from the local Scone sandstone, these are very handsome and well-preserved buildings.

Section of city wall  
(Locality 16.3). The  
garnet mica schist is the  
large block near the  
centre of the picture. The  
other blocks are  
composed of sandstone,  
greenschist & quartzite.

*Bill Gray*



By now, the late afternoon sunshine was taking its toll on our energies and we were looking forward to our high tea at the Grampian Hotel nearby. It provided a welcoming cool hall, lots of iced water, pleasant dishes and tasty scones and cakes. Refreshed, we joined our coach shortly after 6 pm and headed back to Glasgow. A good day was had by all.

#### **Reference**

*Browne M.A.E. & Gillen C. (eds) 2015. A Geological Excursion Guide to the Stirling and Perth Area. Edinburgh Geological Society, 3-23, 183-203.*

#### **Intimations**

It is with sadness we report the death on 23<sup>rd</sup>. December 2018 of Gordon Todd who was a very active member of The Geological Society of Glasgow for 34 years until he developed Alzheimer's Disease and could no longer participate.



Looking downhill across Burn O' Vat. *Rhona Fraser*

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