THE GEOLOGICAL SOCIETY OF GLASGOW

PROCEEDINGS

Session 163
October 2020 to September 2021

'On the Beach' at Port Ellen: Human geological time-line from the Big Bang to the Stone Age.
A bit of educational fun on the Excursion to Islay September 2021.

Registered Scottish Charity No. SC007013

President: Dr Neil Clark

www.geologyglasgow.org.uk

Hon. Secretary: Walter Semple email: sec@gsocg.org
Newsletter/Proceedings Editor: David Webster email: meetings@gsocg.org

SESSION 163 (2020-2021)

Contents

Council Members

The positions that are open for election at the AGM on December 9th 2021 are listed here along with the nominees, proposers and seconders.

Position	Nominee	Proposed by	Seconded by
President	Simon Cuthbert	N Clark	D Webster
Vice President	Neil Clark	W Semple	M Donnelly
Vice President	Brian Bell*	M Donnelly	R Bryce
Treasurer	Ian Veitch*	N Clark	R Bryce
Meetings Secretary	Ian Millar	W Semple	I Veitch
Publications Officer	Gary Hoare	W Semple	I Veitch
Ordinary Member+	Vacant		
Ordinary Member+	Vacant		
Ordinary Member+	Vacant		
Ordinary Member+	Vacant		
Ordinary Member+	Vacant		
Junior Representative	Matthew Statis*	N Clark	D Webster
Editor of SJG	David Brown	B Bell	N Clark
Editor of SJG	Colin Braithwaite*	B Bell	M Cummings
Independent Examiner	Brian O'Neill*	I Millar	I Veitch

Notes:

* Denotes retiring postholder willing to stand again

+ The Council can have up to six ordinary members.

Retirees:

Anna Milligan, Elaine Shaw and **Ann Ainsworth** have decided to stand down as Ordinary Members.

Continuing Officers:

The following continue in office: **Roy Bryce** - Day Excursions Secretary, **Maggie Donnelly** - Residential Excursions Secretary, **Neil Clark** - Website Consultant, **Walter Semple** - Hon. Secretary, **David Webster** - Newsletter & Proceedings Editor, **Bill Gray** - Webmaster, **Margaret Anderson** - Honorary Archivist & Asst. Librarian, **Mina Cummings** - Ordinary Member.

Council Officers' Reports

a. President's Report

The last 3-years as president of the Geological Society of Glasgow have been memorable. It has been one of the strangest times due to the pandemic, but we have seen a huge increase in folk being able to be part of the remote and online talks and meetings. We have been proud to have kept the society running in a way that has seen the largest ever attendances via online talks. Due to this success we are now looking to make online access, for those who cannot attend talks in person, a part of the GSG lecture and outreach program. All going well, we will soon be meeting again in person.

I want to say a huge thank you to all members of the Council who have gone above and beyond in fulfilling their duties in the face of the pandemic. In particular I would like to thank David Webster for the online talks and field-visits that he organised as well as Maggie Donnelly for organising a physical trip to Islay led by David. I would also like to thank all those involved in the public engagement events for COP26 and Fossil Grove, especially Margaret Greene and the whole SGG team. Thanks also to Bill Gray and the social media team who are keeping us up-to-date with the events on the website and other media; Campbell Forrest for simplifying our memberships system; Matthew Staitis for representing junior members of the Society; Ian Veitch for keeping an eye on our finances; Ian Millar for assisting the Meetings Secretary for this year; Roy Bryce for continuing as day excursion organiser; Margaret Anderson supplying us with interesting stories from the Archives; our Ordinary Members of Council (Mina Cummings, Anna Milligan and Gary Hoare) for their enthusiastic contributions; and Brian Bell for his many years as editor of the Scottish Journal of Geology, for Colin Braithwaite for continuing as an editor, and David Brown for accepting to become an editor. Special thanks go to Walter Semple who has supported me throughout this period and kept me right on aspects of procedure and offered valuable advice.

Our Society is proud to continue to lead on many outreach activities, influence geological trusts and forums, and support relevant research in Scotland. All members of the Society are invited to take part in the outreach activities of the Society, so please turn up to them if you are available and we ask that you also consider joining the Council of the Society.

b. Meetings Secretary's Report

All our talks this session were held remotely by Zoom. This proved popular with most people and online attendances were higher than our normal in-person talks. There were also a significant number of views of the recordings. Every cloud has a silver lining!

We decided to start our lecture programme early this session given the lack of opportunity to see real rocks over the summer. So on the 10th September we welcomed ***Dr. Simon Cuthbert,*** one of our Vice-Presidents to give us his talk on 'The Geology of Mercury'.

Mercury has been recognised as a "wanderer" of the night sky since Babylonian times, but its proximity to the Sun has made it a difficult body to study. The situation has changed dramatically since the recent MESSENGER mission, which has revealed a fascinating and distinctive member of the family of terrestrial planets.

Dubbed the "iron planet" it has a huge metallic core and a relatively thin rocky mantle. In some ways the geology and landforms of Mercury resemble Earth's Moon with its heavily cratered surface, extensive smooth lava plains and lack of an atmosphere, but it is unusually dark - a possible vestige of a primordial crust made of graphite! Tectonic features suggest that the entire planet has shrunk by several kilometres since it originally solidified.

Simon's presentation explored current knowledge about this rather uncelebrated planet and considered how its curious nature might be inherited from the special environmental conditions close to the Sun during the very earliest history of the Solar System. We look forward to the Bepicolomobo mission that will reach Mercury soon and will hopefully give us fantastic new geological insights into this strange world.

On the 8th October ***Professor Matthew Thirlwall*** from Royal Holloway, University of London, zoomed in to tell us about New isotopic age determinations from the Northern Highlands and their implications. Matthew explained that over the last 15 years we have carried out a large number of new age determinations on metamorphic rocks from the Moine and its basement inliers. Some of these are published and some not. They include Lu-Hf and Sm-Nd ages on garnets and Rb-Sr ages on white mica and biotite. Lu-Hf garnet ages are probably close to crystallization ages, while Sm-Nd garnet ages in most cases represent stages on a cooling trajectory. This can clearly be demonstrated on a few samples where core Sm-Nd ages are younger than rim Lu-Hf ages. White

mica ages are in some cases substantially younger than Sm-Nd garnet, and in other cases agree well.

We see a long record of Proterozoic events, but there are few if any Archean ages on the basement inliers. There are almost no Silurian ages, neither from garnets, nor from white micas, implying that Scandian events did not result in substantial new garnet or mica growth. White mica ages largely cluster in the late Ordovician around 445Ma, and are clearly too old to reflect final collision.

On the 12th November we welcomed ***Professor Bruce Levell,*** of the University of Oxford, who gave us a talk entitled The Argyll Group: Two Beauts. The Neoproterozoic Argyll Group (Dalradian Supergroup), is a well-exposed, 10km thick sequence recording a transition from glacial through shallow marine to slope and deep-water sediments and pillow lavas. It probably represents the rift-to-drift sequence of the Laurentide margin of Iapetus.

Bruce discussed two beautifully exposed rock successions in the Argyll Group: the Port Askaig Formation, probably the Sturtian phase of "Snowball Earth", and the Jura Quartzite, a 5km thick cross-bedded, sandstone. Bruce discussed implications for the "Snowball Earth" hypothesis and also preservation bias in the sedimentary record.

Our speaker for the 10th December lecture was ***Dr. Daniel Field,*** of the University of Cambridge who delivered a fascinating talk on Bird evolution from the Late Cretaceous onwards. Daniel enthusiastically spoke about the evolution of birds across mass extinctions, and the timescale of the modern bird radiation. The end-Cretaceous (K–Pg) mass extinction dramatically affected vertebrate life worldwide. He beautifully described the discovery of *Asteriornis,* a fossil bird skull from just after the extinction event which he dubbed the "wonderchicken". Looking like a cross between a duck and a chicken it was probably one of the few avian dinosaurs to make it through the event and is probably a Last Common Ancestor to modern birds.

Into the New Year. On the 14th January ***Dr Tim Kearsey*** of the British Geological Survey in Edinburgh spoke to us about Palaeosols as evidence of terrestrial climate change at major Palaeozoic vertebrate evolutionary events. Tim

explained that climate change is a major driver of evolution and that palaeosols (fossil soils) are one of the few direct indicators of terrestrial climate and provide a record of climate changes and landscape architecture, and are critical in understanding the terrestrialization of vertebrates in the Carboniferous and the Earth's largest mass extinction at the end of the Permian.

On the 4th February we hosted an extra lecture from ***Doug Robinson*** of Bristol University on The Geology of the Mendip Hills. It was a well-balanced talk, suitable for all levels of geological knowledge with a beautifully illustrated tour of the Mendips. Doug even unearthed a thrust fault in his back garden!

We welcomed ***Professor David Beerling***, from the University of Sheffield on the 11th February. He delivered a very topical talk on Large-scale CO2 removal via enhanced rock weathering. David explained that enhanced silicate rock weathering (ERW), deployable with croplands, has potential use for atmospheric carbon dioxide removal, which is now necessary to mitigate anthropogenic climate change. ERW also has possible co-benefits for improved food and soil security, and reduced ocean acidification. He further discussed the challenges and opportunities of ERW deployment, including the potential for excess industrial silicate materials (basalt mine overburden, concrete, and iron and steel slag) to obviate the need for new mining, as well as uncertainties in soil weathering rates and land–ocean transfer of weathered products

On 11th March ***Dr. David Schofield,*** from the British Geological Survey in Edinburgh described Terrane tectonics in southern Britain. David used summaries of isotopic data to contrast Neoproterozoic rocks with their Cambrian cover successions in southern Britain and those in the Caledonian-Appalachian Orogen as a whole, to try to understand when the component terranes may have been assembled and largely stabilised.

Earlier interpretations of the orogeny compare southern Britain with the Avalon Peninsula in Newfoundland based on the similarity of their Cambrian shelfal sedimentary successions and cold water faunas, known as East and West Avalonia respectfully. However, isotopic

studies of the Precambrian basement to southern Britain show that it more closely resembles that of other terranes that formed around the continental margin of West Gondwana, Meguma of Nova Scotia and Ganderia of Central Newfoundland and New Brunswick of the northern Appalachians.

He also showed that North Wales and the Midland Platform of England most closely resemble Meguma while those of Anglesey (Monian Composite Terrane) and the Leinster-Lakesman Terrane most closely resemble Ganderia. While in the northern Appalachians these terranes largely travelled separately before their accretion in a piecemeal fashion onto the continental margin of Laurentia; in the UK they were juxtaposed during the Early Ordovician Monian Orogeny, after which southern Britain and Ireland probably travelled as a single terrane before arriving on Laurentia during the Silurian.

Our last talk of the session was held on Thursday 8th April where we welcomed ***Dr Queenie Chan***, from Royal Holloway, University of London. Queenie gave us a fascinating talk entitled Catching a Shooting Star. She explained that it is not easy to catch a shooting star, but when we find one, we make the most out of it by studying it in every detail to learn its secrets. Although the building blocks of life in meteorites could be vulnerable to extreme conditions, e.g. toasty temperature during a meteorite's fiery entry into the atmosphere, the interiors of meteorites are buffered from those conditions. She described how she and her colleagues undertake the analysis of the chemical and organic contents of astromaterials including meteorites and asteroidal/cometary samples returned by space missions and she discussed how water and life's simple building blocks were delivered to the early Earth.

Members' Night

This was held on the 13th May and, in a departure from our normal short talks from members, Neil Clark gave us a very enjoyable geological quiz.

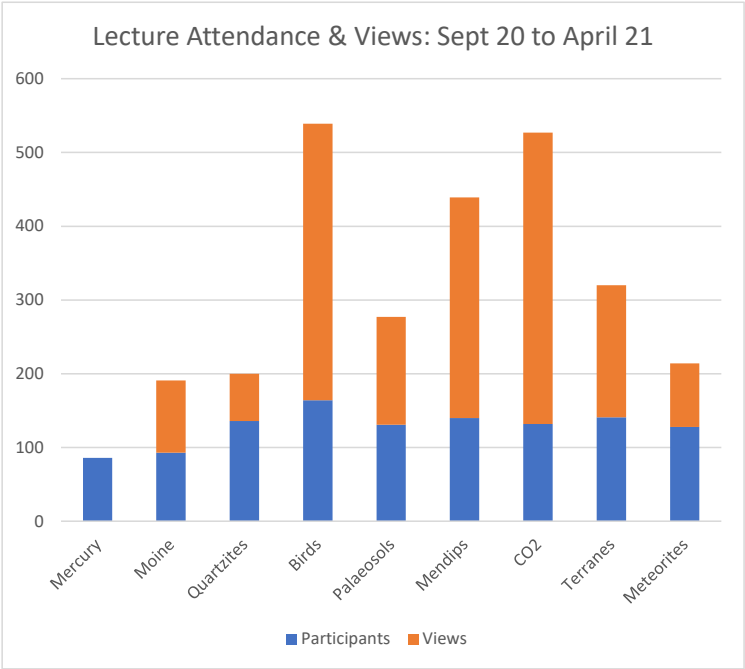
Research Seminar

The Society hosted a 2-day virtual research seminar on 26/27 May on the Neoproterozoic glaciation in the Port Askaig Formation on the Garvellach Islands and Islay as part of the production of a future Geological Society Memoir.

Attendances at online events

This was higher than we originally anticipated - necessitating the purchase of a large meeting add-on to Zoom to allow more that 100 participants. As well as members a large number of non-members attended. The attached chart summarises attendances and subsequent views of the recordings. Most

speakers were happy for us to record their talks but the majority preferred that the talk remain online for a limited period only.



David Webster

c. Day Excursions Secretary's Report

Unfortunately due to the continuing situation with Covid we were unable to run any excursions during the summer of 2021. It is our intention to return to outdoor excursions in 2022.

Roy Bryce

d. Residential Excursions Secretary's Report

We had hoped to run the excursions cancelled from last session:

Islay: Leader David Webster: April 24 to 27

Ardnamurchan: Leader Con Gillen: May or June

Snowdonia: Leader Simon Cuthbert: September.

In the event, with the Covid restrictions and uncertainties still operating, we were once again forced to cancel all three trips early in the session. However, by late March, the Covid situation was easing and the vaccination programme well under way so we then started to tentatively organise the Islay trip - Fri Sept

10th to Mon Sept 13th 2021. This presented considerable difficulty as much of the accommodation and restaurants had not reopened. However, it was well supported (16 members and a waiting list) and went ahead. We used private cars, no minibus, and as parking was tight at most localities, we restricted the number of people to 16. Covid restrictions were followed – no more than 4 people in one car with windows open, face masks at all appropriate times and advice to obtain lateral flow tests before boarding the ferry. Finally, despite all the hurdles, the trip was a great success; many thanks go to Leader David Webster who expertly revealed and explained the fascinating geology of Islay which everyone greatly appreciated and enjoyed. Reports from attendees are included within this edition of the Proceedings.

Maggie Donnelly.

e. Membership Secretary's Report

New members welcomed to the society totalled 25. Subscriptions have still to be received from a very small number of these. And a further 3 have joined in the new session, to date.

A number of member subscriptions have still to be received by the treasurer, and so these numbers will possibly require adjustment during the current session. 14 terminations, including deaths, were recorded.

The society was delighted to bestow Honorary Membership on Professor Donald Bowes during the session. Professor Bowes would be remembered by all who studied under him at Glasgow University. It was with great regret that the news reached us very recently of his death, but not before his Honorary Membership had been appreciated

	Session 163	End Session 162
	Ended 30 Sep 2021	Extended 17 Nov 2020
Honorary Members	4	3
Ordinary Members	235	229
Associate Members	89	84
Junior Members	7	8
Institute Members	3	3
TOTAL MEMBERS	338	327
Incl New Members	25	22

Campbell Forrest

f. Librarian's Report

Due to the pandemic, there was no access to the library during Session 163.

Margaret Anderson

g. Treasurer's Report

The draft Income and Expenditure Account and statement of Balances for Session 163 are shown below. These are still subject to Independent Examination and the final accounts will be made available to all members in advance of the AGM on 9th December. Comments are as follows:

1 In the unrestricted funds the society made a surplus of £5,167 in the year bringing the unrestricted funds to £30,880. The surplus has mainly arisen because meetings were held online with no room hire costs and little in the way of speakers' expenses.

2 Savings were made on printing and postage costs for the newsletter and proceedings as most of these are now distributed online.

3 The investments in the endowment fund made up most of the previous year's losses increasing in value by £11,466 in the year as markets recovered and they were valued at £56,042 at the year end.

4 The Society has assisted the Fossil Grove Trust with their financial administration in the year by taking a donation from the Trust which is being used to meet Fossil Grove expenditure. This is included within the restricted funds

Income & Expenditure:

THE GEOLOGICAL SOCIETY OF GLASGOW						
Income and Expenditure Account for year ending 30th September 2021						
	Note	Un restricted Funds	Restrict - ed Funds	Total		Year Ended 30/9/20
Income						
1. Subscription Income		7,112	0	7,112		6,672
2. Investment Income		3,089	0	3,089		3,324
3. Gift aid - (S162 - 2 years' worth)		1,262	0	1,262		2,158
4. Publication Sales		8	0	8		8
3. Day excursions net surplus		0	0	0		0
4. Residential excursions net surplus		0	0	0		0
5. Donations & Grants Received		0	10,221	10,221		114
6. Miscellaneous Income		0	0	0		5

Total income		**11,471**	**10,221**	**21,692**		**12,281**
Expenditure						
Cost of Charitable Activities:						
Meetings - room hire, zoom and speakers	5	1,044	0	1,044		4,362
Publication and postage of Proceedings		131	0	131		313
Library and Down to Earth		43	0	43		342
Affiliation fees		40	0	40		40
Insurance		254	0	254		170
Website	5	209	0	209		1,919
Newsletter	5	233	0	233		890
Membership Secretary		0	0	0		152
Treasurer		94	0	94		15
Purchase of Camera Equipment	5	224	0	224		0
Miscellaneous		132	0	132		419
Total Charitable Activities		2,404	0	2,404		8,622
Governance Costs		150	0	150		0
Grants and Donations	4	3,750	3,116	6,866		1,375
Total expenditure		6,304	3,156	9,460		9,997
Surplus (Deficit) for the year		**5,167**	**7,065**	**12,232**		**2,284**

THE GEOLOGICAL SOCIETY OF GLASGOW						
Statement of Balances at 30 September 2021						
	Note	Unrestricted Funds	Restricted Funds	Year Ended 30/9/21		Year Ended 30/9/20
Funds Balance as at 1st October 2020		25,713	7,840	33,553		31,269

Surplus (deficit) for the year		5,167	7,065	12,232		2,284
Funds at 30 September 2021		30,880	14,905	45,785		33,553
Represented by:						
Bank and Cash Deposits						
Royal Bank of Scotland				20,695		5,978
National Savings Income Bond				12,000		12,000
National Savings Investment Account				4,542		4,491
On deposit with Redmayne Bentley				5,500		7,745
Cash in Hand (float)				105		165
Total Cash and Savings				42,842		30,379
Stock of Publications				3,517		3,595
Less Liabilities:						
Subscriptions paid in advance				-324		-363
Payments Due	7			-250		-58
Net Assets				45,785		33,553
Investments						
Analysis of Movement in Investments						
Balance at 1/10/20		44,576				59,171
Increase (Decrease) in value		11,466				-14,595
Valuation at 30/9/21	8	56,042				44,576
Total Unrestricted Funds		**86,922**				**70,289**

Notes to the accounts

1 Basis of Accounting

These accounts have been prepared on the Receipts and Payments basis in accordance with the Charities & Trustees Investment (Scotland) Act 2005 and the Charities Accounts (Scotland) Regulations 2006 (as amended)

2 Nature and purpose of funds

Unrestricted funds are those that may be used at the discretion of the trustees in furtherance of the objects of the charity.

Restricted funds may only be used for specific purposes. Restrictions arise when specified by the donor or when fund are raised for a specific purpose. The restricted funds are:

The T N George Fund: to be used to engrave a medal for the annual T N George lecture

The Brian Bluck Fund: to be used to award a prize to the top student in the final year of Geology at Glasgow University

Fossil Grove Trust Fund: to be used for expenditure on the Fossil Grove on request from the Fossil Grove Trustees

3 Related party transactions

The Society's insurance policy includes Trustee Indemnity Insurance for all council members. No remuneration was paid to the trustees during the year (2020: nil)

4 Grants and Donations

	£
Unrestricted Funds:	
Scottish Geology Trust	1,500
James Croll Fund	1,000
Mary Anning Statue Fund	500
Friends of Hugh Miller	50
Static Flow Filming	100
Erratic Drift Filming	600
Total Unrestricted Funds	3,750
Restricted Funds:	
Fossil Grove Trust	3,156
Total Grant and Donations	6,866

5 Expenditure

•Meetings Costs: because of Covid 19 all meetings were held on Zoom so with no room hire and very few speaker expenses there were reduced meeting costs compared with last year

•Newsletters have been emailed this year resulting in considerably reduced printing and postage costs

•Website costs consist of hosting and domain renewal

•The society purchased high resolution camera equipment for photographic records of geological and palaeontological sites

6 Restricted Funds

Movement on the funds:	T N George Fund	Brian Bluck Fund	Fossil Grove Trust Fund	Total
	£	£	£	£
Balance at 1 October 2020	340	7,500	0	7,840
Income	0	0	10,221	10,221
Less: Grants & Donations	0	0	(3,156)	(3,156)
Balance at 30 Sept 2021	340	7,500	7,065	14,905

Notes

The T N George Medal was not awarded this year due to the Covid restrictions.

The Brian Bluck Prize has not yet been awarded for 2021

Fossil Grove Fund expenditure is authorised by the Fossil Grove Trustees

7 Payments Due at the year end	£
Independent Examiner Fee	150
Newsletter Printing & Postage	100
Total	250

8 Investments

The investments in the Endowment Fund increased in value by £11,466 in the year substantially offsetting the reduction in value following market falls last year.

The fund is invested in 4 Unit Trusts which generate income to be used for the purposes of the society. In the year the investment income was £3,038 and,

with a balance brought forward from S162 a balance of £5,500 is available in the endowment fund to be used for future grants and donations.

Ian Veitch

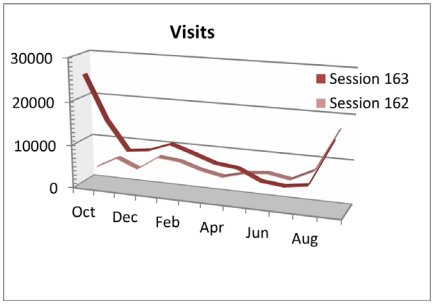
h. Website Report

Session 163 saw further consolidation of the website following the upgrade in August 2019, with a considerable amount of new content being added. Covid-19 continued to make its presence felt, with the website reflecting the changes in the society's plans caused by the pandemic.

One notable addition was an updated version of the Aberfoyle excursion itinerary, prepared by Mike Keen. This is an extensively revised version of the itinerary prepared by B. J. Bluck and James D. Lawson for Geological Excursions around Glasgow & Girvan, published by the society in 1992. A comprehensive article describing James Croll's connections with the society was added to the Archive section, along with 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). Our thanks are due to the society's honorary archivist Margaret Anderson for preparing this material.

The Society Presidents page was also extended during the session. This page lists all the past presidents of the society, with links to biographical details. For earlier presidents, these details are taken from a variety of sources, while for more recent presidents they have been provided by the presidents themselves. The list of biographies is now almost complete. This page and the Archives section are well worth exploring for the fascinating insight they give into the society's history.

The traffic to the website has increased steadily since the website was launched in January 2011. In Session 163 there were 133,391 visits to the site, an increase of 73.1% over the total for Session 162 (77,073). The number of visitors, as opposed to visits, was 115,485, an increase of 75.1% over the total for Session 162 (65,964). The chart shows the number of visits each month for Sessions 163 (2020-2021) and 162 (2019-2020).



The increase in visits was mainly the result of increased traffic from abroad, as the traffic from the UK was only slightly larger than in the previous session. The number of visits from the UK in Session 163 was 12,605, 9.5% of the total visits

and an increase of 3.5% over the UK visits for Session 162 (12,184). Outside the UK, the three most productive countries were the Philippines with 56,139 visits (19,708 in Session 162), India with 19,815 (11,805) and the USA with 15,528 (12,529). Within the UK, England accounted for 6,166 visits (6,058 in Session 162), Scotland for 5,889 (5,706), Wales for 289 (259) and Northern Ireland for 223 (132).

The map shows the amount of traffic from cities within the UK. Glasgow was the most productive city, with 2,173 visits (2,278 in Session 162), followed by London with 1,379 (1,442) and Edinburgh with 731 (1,516).

The most popular part of the website was again the Local Rocks section, with the Rock Cycle page accounting for 44.6% of pageviews, followed by the Rock-forming Minerals page (26.0%) and the Metamorphic Rocks page (5.3%). Other popular pages were the website's Home page (4.3%), the Arthur Holmes page (2.0%), the Lectures page (0.5%) and the James Croll page (0.5%). By far the most productive source of traffic to the website was the Google search engine, which was responsible for 115,452 visits (63,184 in Session 162). The next most productive was direct logons to the website, which produced 11,864 (10,654) visits, while the search engines Bing and Yahoo produced 1,194 (808) and 167 (131) visits respectively. The majority of the remaining visits resulted from referrals from other websites. The most productive source of referrals was Facebook (324 this session compared to 345 in Session 162), followed by Google Classroom (166 compared to 139) and scottishgeology.com (114 compared to 173).

In addition to the website, the society uses its Facebook page and Twitter account (@GeolSocGlasgow for both) to engage with the public. Both of these have been steadily gaining in popularity. The Facebook page, which Neil Clark looks after, now has 184 followers, 15 more than a year ago, and the Twitter account, looked after by David Webster, now has 149 followers, 46 more than a year ago. If you have a Facebook account, please "like" and share any society posts that you find particularly interesting and, 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. 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 again encourage all members to continue to send relevant articles and information to web@gsocg.org.

Bill Gray

i. Strathclyde Geoconservation Group

SGG had been informed that the information boards at Campsie Glen car park were in a poor state due to vandalism. After reviewing the state of the boards a small group of members of SGG cleaned the boards and replaced the Perspex on one which was badly cracked. At time of writing the boards are still clear.

Colin McFadyen from NatureScot asked for an article on SGG be written which could appear in the Earth Heritage magazine, this duly appeared in edition 55 which came out in summer 2021. The magazine can be accessed on www.earthheritage.org.uk.

Inventory of Glasgow area sites. It was proposed that a number of sites in and around Glasgow could be written up and presented on the society's website. D Webster produced a spreadsheet with a number of sites, most of which appeared on Local Authority Geodiversity Audits. It was decided to ask members of the group to review these sites to see if they were suitable for visiting by the general public, with a view to writing up a short A5 or A4 sheet on the local geology. A number of sites have been reviewed; quite a number are not suitable, but none so far have been written up. Simon Cuthbert is investigating a Geographic Information System (GIS) which he suggested as the appropriate means to make this information readily accessible on the GSG website.

Fossil Grove. M Greene took along the SGG information board and a number of leaflets to the Fossil Grove open day in August. A number of members of SGG were involved with information and children's activities on 18th September in relation to the Scottish Geology Festival and on the 19th September with the Doors Open Festival.

Local Authorities. M Greene responded to Inverclyde's Local Development Plan consultation in June. MG received North Ayrshire approved Biodiversity Duty report and forwarded to Arran Geopark. MG attended and online meeting of LBAP steering group of East Renfrewshire, Inverclyde and Renfrewshire.

SGG is now a member of the newly formed Friends of Muirshiel Park.

In response to an appeal from Friends of Havoc Meadows, West Dunbartonshire, in relation to a planning application to build houses on the land above the meadows and specifically to site a SUDS pond above Havoc Hole itself, SGG has sent a note indicating concerns in regards to this application.

No new leaflets have been produced this year although the SGG postcards have

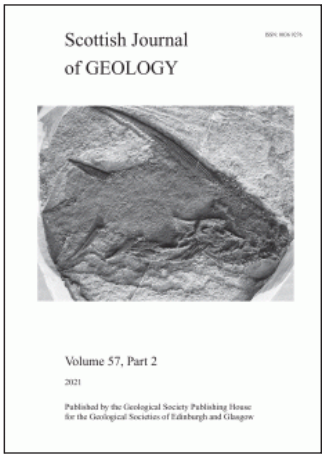
been reprinted and widely distributed at Fossil Grove events.

Site assessments in Falkirk Council Area. Paul Carter and Mike Browne have surveyed 12 geological sites in Falkirk Council area. The handwritten reports have been typed by B. Balfour and after additions of photos by MB, the reports will be submitted to the Biodiversity Officer of Falkirk District Council.

Scottish Geology Trust. Three members of SGG attended three, two hour sessions of an online training course on 'Geoconservation in Scotland' run by the Trust.

Margaret Greene

j. Scottish Journal of Geology Report



The Board has not met physically for some time but has continued to meet via Zoom. Where we might have expected an increase in submissions as a result of the confinement of authors during Covid lockdowns the real outcome has been a reduction that is reflected in a very thin final part for this year. However, projections based on new submissions in hand suggest that this is likely to be rectified next year. Similar variations have occurred in the past but become less obvious as the way in which the Journal is produced changes. There are two ways in which this appears. First, we are moving to a 'continuous publication' model in which papers accepted are immediately posted online and only later assembled to form Parts and Volumes. From an author's perspective this means that they do not have to wait for some other submission for a Part to be complete and their work to be published. This pattern will allow us to produce themed sets over longer periods and plans are already in hand for two of these. The second change, that would affect members more, and this is a shift by publishers (internationally) from paper copies to online only provision. In the group of Journals (7) published by GSL the SJG is, with one possible exception, is the only one still producing a paper copy. The costs in printing this are substantial and although editing and typesetting are no longer physical processes (there is no longer any type) their costs remain and we do not pay for them. The outcome of this is in the hands of the two societies and GSL and will depend on an assessment of Journal usage by members.

Colin Braithwaite

Residential Trip to Islay

Fri 10th to Mon 13th Sept 2021

Leader: David Webster

Friday 10th September pm - Report by: Ian Veitch

Bruichladdich

After a very misty crossing on the 13:00 ferry from Kennacraig to Port Askaig we gathered at 4.00 beside the shore at Bruichladdich to meet our leader, David Webster. David told us we were now in the Rhinns Complex. These are the oldest rocks in Islay and are thought to underlie most of the island.

The Rhinns Complex was formed about 1,800 Ma and is made up of a variety of metamorphic rocks. On the shore we were able to identify the two main and contrasting rock types: a pinkish gneiss which was originally a syenite and a greenish metagabbro. These were originally igneous rocks and are thought to have formed in a volcanic arc above a subduction zone. We examined various structures along the shore and debated whether an obvious dyke had been inserted into a sinuous weakness or had been subjected to subsequent movements.

The rain then came on and everyone headed back to their accommodation on the island to prepare for the following day having had the opportunity to meet each other and to get our bearings.

David introduces us to the geology of Islay

Augen gneiss in the Rhinns Complex

An obvious dyke cutting though the metamorphic rocks

Saturday 11th September am - Report by Campbell Forrest

Portnahaven & Kilchiaran

The excursion began with a familiarisation of “Islay Time”, in which shorter visits of around 10 minutes last 30 minutes of Standard Time, and longer sections of 3

or 4 hours expand by 50%. Not that the group was complaining

A very “quick” stop was made at the dramatic inlet of Portnahaven, an eroded fault which extends offshore between two islands. The fault cuts the pink gneiss of the 1800 Ma Rhinns Complex, a rock we would come to know well.

Onwards to Currie Sands, where the other dominant rock type of the Rhinns - a greenish metagabbro - was seen in beautiful water-washed exposures. The other, west, side of the beach was a small cliff of the pink syenitic gneiss, here sheared by the small Triassic (?) fault, the erosion of which has created the bay.

A short walk then led to the rough wave cut platform adjacent to the decommissioned wave generator. Here the rock was greenish white, and contained talc as well as lenses of pistachio green epidote. The source rock for this was probably an ultrabasic intrusion into the syenite, but Simon postulated an alternative - the syenite undergoing low temperature metamorphism with extremely high shearing. Could this be close to the basal shearing of the Dalradian? The coast here was very exposed to the south west, making it an ideal location for the wave generator experiment.

Then a drive about halfway up the west coast to Kilchiaran Bay, with views of white-tailed eagles en route. Here we were about to leave the Rhinns Complex and join the 800 Ma lower Colonsay Group bedded quartzites. And the transition is the extremely dramatic Billion Year Gap, where the Kilchiaran Shear Zone has been eroded to form a dramatic 10 foot wide gully and cave system. Colin and Austen made a serious attempt to find out whether the cave might emerge on the other side of the peninsula near Bunnahabhain, before the call of lunch brought them out.

Saturday 11th September, pm - Report by: John Guerrier

Kilchiaran & Saligo Bays

Having spent rather a lot of time exploring the Billion Year Gap with some of the group disappearing inside it seemingly never to return, we finally collected together and were ready for our lunch. However, on the way down the road from where some of the cars were parked, or up the hill from the Kilchiaran Chapel, the road cutting showed an excellent example of shattered quartzite or welded fault breccia (fig 1). Simon describing it as a “fossilised earthquake”. (NR 2026 5998). With the weather now glorious we gathered around the ruins of the 14th century chapel for lunch (fig 2).

Figure 1


Figure 2


Figure 3

On the right side of the track down to the beach is a well exposed area of glacial deposition (fig 3). The gravel here and at the beach contains pebbles of flint and chalk which must have been transported from some considerable distance as there are no flint deposits on Islay. Probably because of these flints, there was considerable activity here by hunter-gatherers in the Mesolithic period (1,050 BP), utilising a Germanic style of flint knapping. The smooth rocks on


Figure 4


Figure 5

the opposite side of the path show good examples of smoothing and scratching caused by glacial movement (fig 4).

On the left further down, just before the beach, there is the remains of an old slate quarry. The slates here are metamudstones of the Colonsay Group, deposited originally at around 800 Ma and then compressed during the Caledonian Orogeny (470 Ma). The slates, while of quite poor quality, were used as roofing material (fig 5). On the opposite side of the quarry the rocks are interleaved with metasiltstones showing soft sediment deformation (fig 6). These would have been deposited in an area somewhat like the Mississippi basin today.

On the beach is a dyke of unusually light colour, it is an ultra-potassic rock type called lamprophyre (fig 7). The date for this intrusion is about 420 Ma.


Figure 6


Figure 7

Before heading on to Saligo Bay, we had made a short but important stop to the source for the water used for cutting (watering down from cask strength) the whisky Bruichladdich. In the small cabin that protects the source, David told us the story of the connection that the distillery has forged with Peru, on the basis of having not only similar rock types, but also having their very own town called Islay. Needless-to-say a special commemorative whisky has been distilled with the appropriate geological – not altogether accurate - map on the label (fig 8). David had a bottle of this whisky to hand which he curiously failed to share with all of us!


Figure 8

Our final stop of the day was to Saligo Bay and we couldn't have had more perfect weather. With the sun blazing down we passed by the ruins of the WWII Radio Station across the dunes and on to the beach. As at Kilchiaran there were lamprophyre dykes that had been intruded into the metasandstone and metamudstone layers. These latter layers, particularly the mudstones, were spectacularly folded and deformed within larger synclines and anticlines (fig 9). The metasandstones are deep water turbidites that were probably formed when an earthquake triggered a dramatic collapse of sediments from shallow to deep water.

This flow could have travelled at up to 40 miles an hour and would have deposited the beds graded from coarse to fine. These rocks are part of the Smaull Greywacke Formation and higher up in the Colonsay Group than the rocks at Kilchiaran (fig 10). It was wonderful to spend time in this magical place.


Figure 9

Figure 10

Sunday 12th September 2021- Report by: Nick Pierpoint

Ballygrant, Islay - Beannan Buidhe - 'Snowball Earth'

This part of our trip involved examining an unusual series of sediments which have been interpreted as glacial deposits from the Port Askaig Formation (Argyll Group) of the Dalradian (c 670 ma). The Dalradian sediments were deposited from 800 to 600 ma, at a time when Islay was within the Rodinia supercontinent. Incidentally Rodinia is a Russian word for 'homeland'. In the late Neoproterozoic (around 750 ma) rifting commenced on Rodinia and saw the formation of Laurentia, Amazonia (Islay Peru) and Baltica. This was the opening of the Iapetus Ocean. The sediments of the Argyll Group are typically of a marine gulf or continental margin environment.

Our excursion started from the waterworks on the northern shores of the Loch Lossit. We made our way on a good track which soon became an ATV track across some rough country to the south of the loch. At the first location we examined some old lead mine works (North Glasco Beage), some rough trenches which followed mineralised veins through the Lossit Limestone. This would have been a tough place to work with limited reward. There were a few spoil heaps from some tree planting – these were briefly examined we did not spot any galena! From this location it was easy to see the vegetation contrast reflecting the different bedrock. The heather on the poor soil dominated the sands and silts of the Port Askaig Formation whereas the grass and 'lush' green vegetation on the carbonates of the Lossit and Ballygrant limestones. We made our way to the south face of Beannan Buidhe where David led us on a zig-zag trail to examine a series of exposures working up through the sequence from the Lossit Limestone to the Port Askaig Formation (straddling the Appin and the Argyll Groups). This sequence has been interpreted as the start of the Sturtian glaciation c. 700 ma: a major global event with ice at sea level on the equator.

The oldest sediments were a series of carbonates (warm water) which were

subsequently exposed to periglacial karstic weathering. Fluvial sands, silts and mudstones followed. Further up the section we examined dolostones and iron rich siltstones which represented sedimentation in glacial marine environment. It is amazing that soft sediment deformation structures, such as injectites (photo 1) and dropstones features (photo 2) in laminated sediments are so well preserved, given their age and having 'survived' subsequent 'greenschist grade' metamorphism during the Caledonian Orogeny.

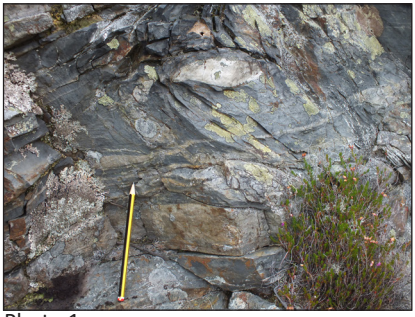


Photo 1

Photo 2

Perhaps the most striking deposits are the brown diamictites with banding of blue-grey iron rich siltstones and orange-brown dolostones (photo 3) . This is a complex deposit requiring some unusual chemical and environmental conditions. The siltstone is mainly haematite and magnetite (not sufficient to move a compass needle). It is thought to have formed in meltwater underflows near ice margins which created local oxidation conditions in an otherwise anoxic body of water. The dolostones were thought to be detrital in origin given their shape and form. However, the current interpretation is that they were formed by the diagenetic process of dolomitisation and the volume changes have led to the disruption in bedding. This type of lithology – concretions or doggers can be seen in the Kimmeridge Clay Formation within the Jurassic in Dorset.

Photo 3

The rocks reveal quite a story, and to be joined by sea and golden eagles made it a memorable morning geologising. It was time to retrace our tracks and make our way back to the vehicles at Loch Lossit and continue our trip at Bunnahabhain.

Sun 12th September pm- Report by: Bill Gray

Bunnahabhain and Port Askaig:

Note. The locality numbers in this report are those in Excursion 8 of A Guide to the Geology of Islay (Webster et al. 2021).

After our strenuous morning activities, we had a gentler afternoon session exploring the coastline at Bunnahabhain, for which the weather was overcast and mild. The rocks in this area belong to the Bonahaven Formation, formed at around 690 Ma and part of the Argyll Group, lying between the older Port Askaig Formation and the younger Jura Quartzite. The rocks of this formation were formed from sediments that were deposited in a shallow tropical sea. The rocks we saw belong to the youngest member of the formation (Member 3: dolostones and siltstones), but there were also some later igneous intrusions.

The group from the morning excursion rendezvoused at the Bunnahabhain distillery with those who hadn't been on that trip. We started by looking at the rocks behind the distillery, which belong to the Jura Quartzite, and then went through a gate and set off south along a path above the shoreline, which was overgrown with tall bracken and bramble and tricky to negotiate. In the process, we crossed the Bonahaven Fault, a major fault which runs SW towards Bridgend, and entered the Bonahaven Formation, which is on the upthrown SE side of the fault. We went down to the shore to examine the rocks there (Locality 8.4a; NR 4227 7320). These were fine-grained dolomitic sandstones, which dip gently to the NE. We also examined a Palaeocene (60 Ma) dolerite dyke which contained amygdales and displayed spheroidal weathering. Shortly later we saw some exposures of stromatolites, which are rare examples of Precambrian life. (Stromatolites are formed when sedimentary grains are trapped by films of microbial material, especially cyanobacteria.)

Palaeocene dyke showing spheroidal weathering, with dolomitic sandstone at back right (Locality 8.4a; NR 4227 7320).

Stromatolites at Locality 8.4a (NR 4227 7320).

The original plan had been to rejoin the path now, but it was now even more overgrown than earlier and we had to proceed along the shore instead. This was very rocky and difficult to negotiate, so some of the group stopped here while the rest carried on to the Rubha a'Mhill headland (Locality 8.4b; NR 4232 7322), where we saw exposures of bedded dolomitic sandstones and siltstones and some NNW trending early Permian dolerite dykes. We carried on for about 100 m to Locality 8.4c (NR 4239 7318), where we saw a Permian dolerite dyke containing zeolite-filled amygdales and rusty brown inclusions, which Simon told us were weathered xenoliths of mantle material. The zeolite had been precipitated at a shallow depth from late-stage hydrous liquids into hollow vesicles in the dyke; these vesicles had been created earlier by the evaporation of volatiles from the magma. The xenoliths had originally been composed of dunite, a type of peridotite containing more than 90% olivine, but the iron in the olivine had weathered to iron oxide.

Permian dolerite dyke with zeolite-filled amygdales and weathered peridotite xenoliths (Locality 8.4c; NR 4239 7318).

We carried on along the shoreline for another 60 m to a NE-SW trending ridge (Locality 8.4d; NR 4243 7213) and made our way through a cleft in the ridge to examine the exposure on the south side of the ridge. The main feature here was a 2 m thick stromatolitic bed. This was thought to have formed in shallow waters when warmer conditions followed the end of the Port Askaig glaciation. The Bonahaven Formation has been interpreted as a cap carbonate to the Port Askaig Formation.

Granite boulder in Port Askaig diamictite near the ferry terminal (Locality 8.1a; NR 4301 6921).

We now returned to the car park and drove into Port Askaig for an unscheduled visit to the Port Askaig Formation near the ferry terminal (Locality 8.1a; NR 4301 6921 to NR 4307 6934). We first looked at the rock face on the western side of the road near the sign for the Jura ferry. The rock was a sandy clay mudstone containing widely spaced pebbles and boulders of pink granite. This was the famous Port Askaig Tillite, a diamictite deposited at around 700 Ma during the "Snowball Earth" glaciation. The sediments are believed to have been deposited by melting grounded ice. The boulders are around 1,800 Ma old but their origin is unclear; they may have come from Greenland, Labrador or Scandinavia. We then walked about 100 m up the road past a fault and more diamictites to look at a 7-8 m thick bed of laminated cross-bedded quartzite (metamorphosed sandstone). The sandstone is thought to have been deposited in shallow water in an interglacial period.

We returned to our cars after a very full day and drove back to Bowmore for a rest before our group dinner in the Lochside Hotel (Picture - back cover)

Mon 13th September - Report by: Anne Gray

Kilnaughton and Port Ellen

For our last morning, we travelled down to the south of the island, but up the stratigraphic table – to the top of the Dalradian. This covered from around 630 to 600Ma, from the Jura Quartzite to the swarm of sills that marked the opening of the Iapetus Ocean. We had a lot to pack in before setting off for our ferry home.

Jura quartzite

1. David started with a demonstration of the sequence of rocks already seen, represented in differently coloured felt squares, folding and "eroding" them – an effective way to understand the complexity of Islay's rocks.

2. We then set off along the shore road to look at the Jura Quartzite, a beautiful bright rock which occurs in exceptional thickness in Jura (forming the Paps). It thins to 1,500 metres in Islay. Our first sighting of the quartzite was as a sea stack in a garden on the raised beach. There were several good exposures of the extent of the quartzite, showing cross-bedding in places. (Photo 1)

3. The rock sequence younged as we walked towards the lighthouse, with the quartzite giving way to the Jura Slate, which we looked at in a disused quarry. More of a light-coloured meta-mudstone, it was quarried for roofing slate.

4. En route, David pointed out a small anomaly feature: an exposure of white kyanite crystals in the quartzite. Kyanite usually needs much higher grade of metamorphism than is seen in Islay's rocks.

5. The Carraig Fhada Lighthouse stands on the Scarba Conglomerate, originally turbidites that were metamorphosed in the Caledonian Orogeny. The clasts were small, flat, stretched pebbles, fining upwards.

Multiple reworking of Port Ellen Phyllite.

Phenocrysts of plagioclase feldspar in metadoloerite spilitised by sea water.

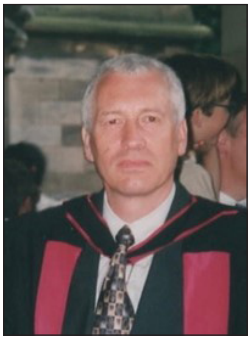
6. After the lighthouse, we retraced our steps, and drove round to Port Ellen shore, where we found the next member up the sequence, the Port Ellen phyllite. Simon talked us through the multiple folding and cleaving episodes that the phyllites had been exposed to, and explained that this was very characteristic of the Dalradian (Photo 2).

7. Our last site of the day was the shore of The Ard, just to the south of the town. Here soft phyllites were inter-bedded with multiple meta-igneous sills, probably related to the opening of the Iapetus. The main interest of these sills was the attractive metasomatism, with sea-water altering the feldspars, to form large pale-coloured phenocrysts.

8. Finally, we all returned to the beach at Port Ellen for a little drama, acting out the history of the Earth, each member of our party taking charge of a major event in geological history. This created much amusement, captured on camera (see cover photo).

We then formally thanked David for his superb and "indefatigable" geological tour of the island, and presented him with – a bottle of Islay whisky, of course.

Obituary: Allan J. Hall
1946-2021



Allan James Hall was born in Dunfermline on 23rd December 1946 to James and Christina and was the younger brother of Ken. Allan met his wife, Irene, at Dunfermline High School and they married in 1967 while he was still an undergraduate in the Grant Institute of Geology, The University of Edinburgh. As a couple they moved around for the next 10 years, first to Durham for Allan's PhD then to Paris as a post-doc and a brief spell at Newcastle before settling in Bothwell when Allan joined the Department of Applied Geology at the University of Strathclyde. The Bothwell house was to be the family home until his death on 1st January 2021 at the age of 75. Michael was born in 1978 and Malcolm followed in 1980. Irene was a primary school teacher and after the boys were older she returned to teaching in a role of support for learning and inclusion. Sadly, she passed away in 2008, only three years before Allan retired. Theirs was a happy home with lots of laughter, family outings on bicycles and family holidays in the UK and further afield, often on the back of Allan's attendance at conferences. Allan had an easy-going nature and was a patient father encouraging his sons to be inquisitive. In the 1980s they visited California and in 1991-92 Allan had a sabbatical when they went to Australia and New Zealand.

Allan was always keen to embrace new technologies and was quick to adopt home computing. Both sons graduated with degrees in computing science from the University of Glasgow. A few years after retiring in 2011, Allan was diagnosed with PSP – progressive supranuclear palsy, a rare condition which increasingly led to problems with balance, mobility and, later, speech. These physical problems didn't diminish his desire to be involved with his archaeological research or attending lectures of the Geological Society of Glasgow which he did up until the first Covid-19-induced lockdown in March 2020.

Michael married Maria in 2018 and Allan became close to Maria's family, especially her mother Bridget. Malcolm was working in the USA but returned to the family home as Allan's carer when his illness progressed. Both sons were instrumental in providing the care and engaging support services that allowed Allan his wish to remain in his own home to the end. Special mention must be made of his personal assistant, Grzegorz (Greg), who provided daily care, healthy nutritional meals and outings to local parks for Allan.

As an undergraduate, Allan would commute from the family home to the university on his scooter over the Forth Bridge. For a time he was involved

with the student newspaper. Following his graduation with a first class honours degree in geology in 1968, Allan and Irene moved to Durham where he spent 3 years studying synthetic sulphosalts, especially tetrahedrite, under the supervision of Roy Phillips. His thesis of 1971 was on The mineralogy of some synthetic sulphosalts. There followed a post-doctoral position at the Université de Paris and a brief post in Newcastle University before Allan was appointed a lecturer in the young Department of Applied Geology at the University of Strathclyde in 1976. He was instrumental in changing the culture within the department by bringing together the academic and technical staff socially to appreciate that success could only be achieved by working collaboratively. In 1989, Allan moved, with the rest of the staff and students, to the University of Glasgow to form the new Department of Geology and Applied Geology. Following increasing collaboration with Drs Richard Jones and Effie Photos-Jones, in 1998 he transferred into the Department of Archaeology where he remained until he retired. In Archaeology, he investigated industrial minerals in Greece and early metal exploitation in Scotland, conducted geomorphological surveys around the River Earn and had his share of undergraduate teaching and supervision of research by BSc, MSc and PhD students.

Most of Allan's research was funded by small to moderate grants from mining companies, charities or government departments, but he was co-Principal Investigator on a large grant studying the origin of life on Earth in collaboration with Mike Russell resulting in papers in the late 1990s and research which continued till the end of his active academic life. His research has focused on understanding the chemical behaviours of ore and industrial minerals using standard and novel techniques. Mentioning some of the topics he investigated shows his breadth of interests: gold mineralisation, laser isotope analysis, redox behaviour of iron sulphides, carbonation of concrete, methanogenesis, sulphur isotopes, emergence of life – on Earth and on Mars, the socio-economic significance of industrial minerals in antiquity, historic mortars, lead isotopes in musket balls, Bronze Age copper mining in Greece, CO_2 in Scottish rivers, Mediterranean sugar, Al geochemistry in early medicines and the post-glacial geomorphology of Strathearn.

Allan was unassuming, kind, generous with his knowledge and an accomplished academic; he is proud of the success of his research students whom he encouraged to publish while still working on their PhDs. He supervised 14 research students and was a mentor to many more, such was his approachability and unselfish willingness to share his knowledge.

Allan was the author of almost 100 scientific papers with almost as many co-authors covering a wide diversity of research areas. In addition, he authored a similar number of reviews, conference abstracts and unpublished reports. Collaborating with Colin Gribble, Allan wrote the first student textbook to

combine transmitted and reflected light microscopy. He was a member of the Mineralogical Society of Great Britain and Ireland for which he was on the committee of the Applied Mineralogy group and the organising committee for its 1994 conference.

In addition to his teaching duties, he took a major role in admin tasks including the departmental lead for the first research excellence survey. Allan served on a variety of committees for the departments, faculty and the university as well as on national bodies. He oversaw the running of the XRD laboratory with Murdoch Macleod and Dugald Turner and the polished section laboratory with John Gilleece. In Archaeology, he was convenor of the Technical Liaison Committee for many years and established lunchtime "science" talks. He was an adviser of studies for all of his time in the University of Glasgow, first for geology students then for those studying archaeology.

Allan joined the Geological Society of Glasgow in session 125 (1982-1983) and was elected on to Council in December 1988. He was President from 1st December 1991 to 8th December 1994 (sessions 134-136). This was also the final three years of Janey MacDougall's long service as secretary. During his tenure, he led an excursion to the northern Lake District and another to East Kirkton and the Bathgate Hills. He also presented the 9th and 10th Professor George Memorial Medals to W. J. Kennedy and Diane Edwards.

Allan is survived by his sons, Michael and Malcolm, and by his brother, Ken.

Iain Allison

Obituary: Mike Arrowsmith

Mike was a member of the society for 25 years and died on 6 March 2021 after a short illness. Mike was one of a fortunate group of retired people who benefited from a golden age of studying geology in later life with the University of Glasgow. Mike was very interested in modern technology and was an early adopter of digital cameras. He took many pictures with his first digital camera on the tour of the Colorado Plateau in 2002. Because of the limited storage space in these early cameras, each evening he had to sort out his photos to make room for the next day's bounty. He was meticulous in his recording of his shots, using a digital voice recorder and an altimeter for extra measure. He participated in several other foreign trips, including those to Tuscany (2007), the French Alps (2008), Asturias (2011),

the Western Pyrenees (2012), Provence (2014) and Gran Canaria (2016). On each of the trips, Mike seemed to have some new recording technology that he was able to educate the other participants about.

Mike was a gentle and friendly person, with a very enquiring mind. He was always ready to chat – and to take photographs to make all these experiences memorable. He will be missed.

Bill and Anne Gray

Obituary: Donald R. Bowes
1926-2021

Donald Ralph Bowes was born on 9 September 1926 in Brighton, South Australia (just outside Adelaide). Don was a very keen sportsman partly driven by being one of four brothers who were all good at sport and also determined and successful in their own ways. He did play for Sturt Football Club his local Adelaide Australian Rules football club while at high school and while he was at Adelaide University. He was a good cricketer also and played while doing his PhD at Imperial College.

He made the right choice with geology as all of its aspects did provide a very fulfilling life. One event that was significant was his attendance at the International Geological Congress in Prague in 1968 when the Russians invaded. Don was the first UK citizen to return to the UK, organising a convoy with Shirley Temple to get out of Czechoslovakia, as it was then. He subsequently worked with a range of Czech geologists and fostered publishing by them. He worked with those who had been political prisoners due to their insistence for academic freedom. He had two Czech nurses stay with the family for some months in Glasgow after the 1968 invasion who were refugees as they were persecuted for their Christian faith. There is a plaque at Charles University, Prague recognising Don's academic contribution. The family much appreciated this acknowledgment as it was tangible evidence that the work he invested most of his waking hours in was valued.

Simon Cuthbert notes that there is much to celebrate in Don's long life and sustained, energetic service to his science. Simon knew him first during his postdoc work in the late '80s when he asked him to contribute to the encyclopaedia mentioned in the festschrift, and subsequently gave him opportunities to teach petrology to Glasgow honours students – the first such opportunity that set him up well for a lifetime of university teaching thereafter.

Simon will always be grateful for his generosity and encouragement in those days. Geology transcends frontiers and Don set a fine example with a truly international community of collaborators. His exploits in Czechoslovakia in 1968 were legendary!

Simon adds "As one who has been based in Scotland but researched mainly overseas I've often felt that Don's full scope of achievement internationally has not had the full recognition it deserves in his home territory, so it's good that the GSG will publish an obituary. I was present when Don gave a very moving eulogy for his long-standing colleague and friend Brian Bluck a few years ago and I'm sure many will similarly wish to show their respect and appreciation for Don. I also hope that the Society can find some way to continue to honour Don's long and distinguished career."

His last paper published when he was 90 in 2017 included co-authors Vojtech Janousek from the Czech Geological Survey and Colin Braithwaite - a fitting finale. He was a member of the Geological Society of Glasgow from 1956 (Session 99) and served on its Council during Sessions 100-103.

In retirement he lived in a rural area part North Devon which he moved to from Glasgow in late 2017. With no family in Scotland to help them in the waning years Mary and Don moved to where Mary was from and Alan, their youngest son, lived nearby where he owns and runs a manufacturing business. It was a wrench for them leaving Glasgow where Don enjoyed the academic camaraderie, the congregation at Woodlands Church not far from the University and attending the RSNO concert season. They fortunately did settle into a happy quiet life where Mary was pleased to return home and Alan kept a watching eye over them.

Don died on 3rd November 2021 - aged 95.

Compiled by D Webster from notes supplied by Ian Bowes, Simon Cuthbert and Neil Clark

The following article written by Bernard Leake in 2006 about Donald's immense contribution to geology is included below. It was published in the Proceedings of the Geologists Association (2006), **118,** pp. 5-10.

Donald Ralph Bowes

Don Bowes attained his eightieth birthday on 9 September 2006 and has been a member of the Geologists' Association (GA) for nearly 60 years, having joined in 1948. His past and present colleagues and students wished to mark this milestone and recognize his quite remarkable energy, research enthusiasm, the astonishing variety and quantity of his publications over fifty years, and his continuing publication output even today, with a *festschrift* that - like Don's

interests - would range widely over the geological sciences.

Don was one of four brothers born in Brighton, South Australia. He entered the University of Adelaide taking mathematics, physics and chemistry and, to make up the required fourth First Year subject, geology. The Head of the Geology Department in Adelaide was the resolute and astonishingly tough Professor Sir Douglas Mawson FRS (1882-1958), knighted for his Antarctic work and known, in particular, for his lone survival and long trudge back after the death of both his companions and the loss of almost all the food at a location remote from any help. This yielded perhaps the most gripping account of tenacious and ingenious solitary survival and early Antarctic exploration ever published - *This Accursed Land* (Bickel, 1977), with the more scientific story in *The Home of the Blizzard* by Mawson (1915). In Don's own words "an inspiring individual to train under, who was not an exciting lecturer but one from whom you learnt rather than being taught". Mawson would ask "Did you know ...? Have you read ....T", He made you think for yourself. After being on a few field excursions to the Flinders Ranges with Mawson, Don was hooked on the challenges of geological discovery in a relatively unexplored country. He obtained a BSc in Geology and Chemistry in 1945, graduating with a First Class Honours in Mineralogy and Petrology in 1946 and an MSc in 1948, becoming Tate Medallist for 1948 in the University of Adelaide.

In the 1940s it was not possible to obtain a PhD in Australia, so, in 1947, Don was successful in becoming an 1851 Exhibition Scholar for Australia, one of only two awards, the first made after the Second World War. This enabled him to spend 1948 and 1949 at Imperial College (IC), London, from where he obtained his DIC and PhD in 1950, and his Adelaide MSc, which gained him the Tate Medal, much of it being written up on the long boat trip from Australia.

A major surprise for Don on arrival in the UK was the general 'fixist' view of the Earth's crust that then prevailed, of course with some exceptions, such as the IC-educated and one-time Demonstrator in Geology, Arthur Holmes, then Regius Professor in Edinburgh. Whereas Mawson in Adelaide and Warren S. Carey in Tasmania and others in the Southern Hemisphere accepted movements of the continents, most European and American geologists did not at that time.

At IC, under Professor Herbert H. Read FRS, for his PhD , he did the laboratory work on a field project he had already mapped in 1947 at Mount Fitton, NE Flinders Range, South Australia, involving a granite in a tillite and the process of form ation of this granite which eventually became the subject of his first two papers (Bowes, 1952, 1953). This was when the Read dogma of granitization was irresistibly flowing at IC and no magmatist was even allowed over the threshold. Probably the interpretation would have been different if Don had followed in the footsteps of the distinguished Adelaide graduate, Professor Cecil E. Tilley FRS and had gone to Cambridge for his PhD, as Mawson had wanted.

Don used to tell of how, when he first arrived at IC, he complained to Read that he was having trouble interpreting British maps as Australians were used to having the south, not the north, at the top of the map! Presumably such

Fig. 1. Donald Ralph Bowes, June 1970, aged 43 years.

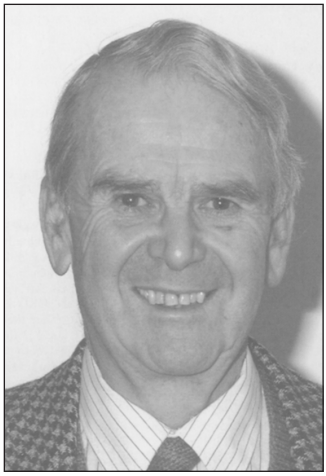


Fig. 2. Donald Ralph Bowes in 2005

leg-pulling was ascribed by the more stately venerable senior staff to a brash Australian upbringing, but there is no doubt that then, and since, Don brought a breath of unaccustomed fresh air to academia. It was during his time at IC that Don became both a Fellow of the Geological Society and a member of the GA . It was George Sweeting, Departmental Librarian and GA stalwart, who persuaded Don to become a Life Member of the GA and join field trips around the London area. At IC Don became friends with Janet Watson and John Sutton, fellow postgraduates and they long remained in contact, even though in later years differences of geological interpretations might have suggested other wise to those who didn't know. The first rock exposures Don looked at in Britain were at Laxford Bridge in the Lewisian with Sutton and Watson ; a portent of much that was to follow! Don was responsible for reviving the use of the rock analysis laboratory at IC, which had not been used during the Second World War. He played cricket for IC and rugby for the Royal School of Mines and, when he returned after being absent for two days watching an Australia vs. England Test Match, Read came running down the corridor, grabbed Don by the shoulders and said "Don, get back to Lords, your country needs you" .

Don revelled in the stream of visitors and lecturers that brought intellectual life to both IC and London . The 1948 International Geological Congress in London, which he attended, brought even more visitors than usual and, when in 1950

he returned to Adelaide to a Lectureship in Geology, he missed this activity at a time when, before cheap air travel, most Australian cities were much more isolated than now. He remained in Adelaide until he was appointed by Duncan Leitch to a Lecture ship in Geology in the University College of Swansea in 1953, where he began research in the Scottish Highlands. He moved to a Senior Lectureship in Geology, under Professor Thomas N. George FRS , in the University of Glasgow in 1956, obtaining a DSc in 1968, becoming a Reader in 1972, a Titular (Personal Chair) Professor in 1975, and an Emeritus Professor and Honorary Senior Research Fellow in 1991. In 2006 he completed a nominal fifty years in Glasgow University; nominal because a considerable amount of time has been spent away from Glasgow in the field in many different places.

His teaching in Glasgow was in metamorphic and igneous petrology, Precambrian geology and the mapping of metamorphic rocks and he was characterized by his enthusiasm, drive and his belief that students learnt best if not stuffed with lectures but left to read and do laboratory work for defined short presentations that they themselves gave to the class. His annual Easter mapping classes to Ballachulish and his energetic summer excursion to the NW Highlands, regularly fired up students with a vision of what field geology is about and visiting overseas scholars often went with him and came back full of praises about what they had learnt. He was a firm taskmaster with the students; one remembers a tirade about “half-time students on full-time scholarships”.

From his first paper in 1952 until now, i.e. nearly 55 years, Don has energetically produced a continuous stream of publications, amounting to close to 300 single- and jointly-authored articles, plus the editing of several books and the writing of scores of articles for encyclopedias. The list of these would , in itself, exceed the normal size of PGA articles, so only a few are cited here. His publications range over five continents and concern four main topics in which the first three involve metamorphic and igneous petrology integrated with isotopic , geochemical and structural geology, usually with strong field involvement:

(I) Precambrian crystalline complexes, e.g. the Lewisian Complex of Scotland, the Proterozoic basement of Inishtrahull, north of Ireland, the Balt ic Shield of Finland, the Beartooth Mountains of Montana and Wyoming, Peninsula India, southern Australia, Siberia and China and papers on the principles of succession and correlation in such rocks ;

(2) deep levels of Phanerozoic orogens, e. g. the Caledonian- Appalachian in Scotland and New York State; the Hercynian in the Bohemian Massif (Czech Republic and in Poland), and a number of studies in southern Australia;

(3) igneous petrogenesis, especially the appinite suite and related explosion breccias and related rock s in the type locality in Scotland and similar rocks in Norway, the Czech Republic and Utah; also the petrogenesis of certain

mafic and ultramafic complexes, especially the Bushveld in South Africa, the Stillwater in Montana and the Demir Kapija Gevgelija amphibolites in Macedonia; and

(4) environmental problems of dust mineralogy particularly related to asbestos and talc.

His contributions in the last field led to him being a Contributing Editor of the American Journal of Industrial Medicine for 23 years from 1980 to 2003.

In Britain, Don became best known for his work on the Lewisian Complex in the 1960s and 1970s with his students and colleagues, such as Bisa Dash, J. Duncan Keppie , Samir Khoury. R. Graham Park, Alan. E. Wright, and T. David B. Lyon . This was often conducted with his long-time (over forty years) structural collaborator, Alaric M. Hopgood of St Andrews University and, frequently, for isotopic dating work , with Robert T. Pidgeon of the Scottish Universities Research and Reactor Centre at East Kilbride. The work involved systematic basic mapping including structural sequence deduction so that collected samples came from a field-studied and dated environment. Over forty of Don's papers are concerned with the Lewisian Complex in the NW Highlands (e.g. Bowes et al., 1964) and later in the Outer Hebrides (Hopgood & Bowes, 1972). Early on, he pointed out (Bowes & Khoury, 1965) that the dogma of the Lewisian history being punctuated by one set of intrusive dykes - 'the Scourie dykes' - that followed one major igneous and metamorphic event and preceded another, could not be correct because there was clear evidence that during this interval several sets of dykes of quite differing structural relation ships had been intruded, which later isotopic dating showed had quite different ages - ages which spread over at least 400 million years (i.e. equivalent to time from the Devonian to today), a view now generally accepted . He also pointed out (Bowes et al., 1964) the existence of deformed igneous complexes among the gneisses which, like his views on the dykes, were bitterly contested initially , but are now accepted. Controversy still surrounds some of his structural correlations, based on sequence and orientation of structures. Overall, Don and his co-workers were pioneers in applying detailed mapping , relative chronology and isotopic dating to the Lewisian Complex, as distinct from dating samples without mapping the whole of the surrounding geology (Lyon et al., 1973). Don summarized the then state of knowledge about the Lewisian Complex in Bowes (1978).

The other British topic that attracted much attention in the UK was a series of papers, in the 1960s and 1970s, man y with A. E. Wright (Bowes & Wright, 1967) and later with Syed Hamidullah (Hamidullah & Bowes, 1988), but continuing until 1991, dealing with the distribution and petrogenesis of the appinite suite and related explosion breccias in the Dalradian rocks of the type locality, Appin, and at Kentallen and elsewhere. His work on the Dalradian rocks has

continued with two major papers (Mathavan & Bowes, 2004; 2005) published only recently. These papers on the Barrovian-type metamorphism, show that the usually accepted late age of growth of the albite porphyroblasts in the southern Dalradian of the SW Scottish Highlands is wrong. It was early in the D2 deformation, immediately before the main almandine garnet growth of the peak metamorphism. For the first time a consistent tectonothermal history of this part of the Dalradian rocks is available and it is apparent that the peak metamorphism during D2, with retrogression during D3, is different from the D3 metamorphic peak identified in the classic Barrovian metamorphic zones in the SE Highlands, perhaps because the latter is influenced by the major addition of heat from the syn-metamorphic basic and ultrabasic intrusions. The full unravelling of this awaits further work.

His work with Hopgood mapping the gneisses on the island of Inishtrahull, Co Donegal (Bowes & Hopgood, 1975), preceded the recognition of the early Proterozoic age of these rocks. After the Proterozoic 1900-1800 million year Rhinns Complex had been recognized on Islay, largely by Roderick Muir, a former Glasgow student, Alan P. Dickin and Don published (Dickin & Bowes, 1991) isotopic evidence for the extent of the early Proterozoic basement in Scotland and Ireland.

Don, as a Fulbright Scholar, and his family spent a sabbatical year in Columbia University, New York in 1966 which gave him a chance to work on the polyphase deformation and petrochemistry of the Manhattan Formation (e.g. Bowes & Langer, 1974).

He made valuable contacts with scientists such as Rhodes Fairbridge, who later persuaded Don to edit (and write a good chunk of) *The Encyclopedia ol Igneous and Metamorphic Petrology* (Bowes, 1989). He also made links with Art M. Langer of the Environmental Mineralogy Unit at Mount Sinai Hospital in New York. Together they produced a steady flow of published work on mineral dusts and their environmental and human medical implications (e.g. Bowes et al., 1977); that subsequently led to involvement with the American Journal of Industrial Medicine.

During the 1970s and 1980s Don, with a group including Alaric Hopgood, Adrian F. Park, Norman M. Halden, Tapio J. Koistinen and Kenneth C. Lawrie, put much effort into over twenty papers unravelling the metamorphic and structural history of parts of the Baltic Shield, including ore deposits, especially in the Proterozoic Svecokarelides of Finland (Hopgood et al., 1983; Park et al., 1984) with isotopic ages being contributed by Alexander N. Halliday and Otto van Breemen of East Kilbride and Olavi Kouvo in Helsinki. During this time Don, in collaboration with Paul A. Mueller, Joseph L. Wooden and others, was also heavily involved in elucidating the Precambrian history of the Beartooth

Mountains of Montana and Wyoming in a series of a dozen papers (e.g. Mueller et al., 1983). In the 1980s Don and Hopgood undertook field studies of the Lake Baikal region in Siberia (e.g. Hopgood & Bowes, 1990) linked with isotopic work at East Kilbride by Margaret Aftalion, another long-time co-worker.

As Don Bowes' reputation grew internationally, he was invited as a guest scientist and lecturer to many countries, including Australia, Austria, Brazil, Canada, China, Czech Republic, Finland, India, Poland, Russia, South Africa and USA. Research students from diverse countries, especially those with crystalline complexes, came to study under him and he supervised 28 successful PhD students. Some of these students wanted to study basement complexes in their own countries and Don was generous with effort and time in supervising them in the field overseas, emphasizing the importance of very careful field studies, especially unravelling structural sequences, before undertaking geochemical or age-dating laboratory studies. From such beginnings, stemmed a wide range of studies, including those on the charnockites, granulites and the khondalites of the Eastern Ghats, Orissa, India, particularly with Bisa Dash, a former postgraduate, and with Margaret Aftalion and Timothy J. Dempster supplying the isotopic ages (e.g. Aftalion *et al*., 1988). This prompted an examination, with Hopgood, of the Cape Leeuwin-Cape Naturaliste complex in SW Australia in order to help reconstruct the structural and metamorphic history of the part of Gondwana that India and SW Australia once constituted before being split apart (e.g. Hopgood & Bowes, 1995). The Indian studies were part of a British Council-sponsored exchange link between Glasgow and Utkal (Bhubaneswar) Universities. Don was invited back in 1997 to Utkal University to be guest lecturer and to give the oration at the opening of their new Geology Building.

Although work on the various Precambrian complexes, especially the Lewisian, has been the major part of Don's output and would have more than filled most researchers' time, his next big project - with nearly forty papers - has been ongoing for over twenty years (i.e. about two papers a year) in studying the Bohemian Massif, in collaboration with geologists from Charles University, Prague. This started as an academic exchange link, funded by the British Council, between Glasgow University and Charles University in the dark days of the Cold War as part of the UK's implementation of the Helsinki agreement. For reasons that have never been fully understood, the Communist authorities allowed this life-line to be kept open, year after year, when most such exchanges were either forbidden or allowed only for a short time. Don and his wife, Mary (without whose support little of what is detailed here could have been achieved), put much effort into maintaining these links. Part of the reason for their success was that the Czechs and Glasgow colleagues, including Brian J. Bluck and Peter J. Treloar, worked together on projects such as the Ballantrae Complex in Scotland (Jelinek et al., 1980) while Don and Hopgood worked on the Bohemian Massif,

in collaboration with Czechs including Jan Kosier and Vojtech Janousek, both of whom obtained PhD degrees in Glasgow, and Jaroslav Tonika, while M. Aftalion and O. van Breemen provided many isotopic ages at East Kilbride. The work elucidated the structural, metamorphic and igneous histories of the different tectonic domains - late Precambrian Cadomian, late Devonian Hercynian and early Carboniferous Variscan (Hopgood et al., 1995). By separating out areas where the effects of one orogenic episode was dominant, or the only one represented, it was possible to select material for isotopic study that enabled each episode to be dated and the evolution of the area integrated. (e.g. Kosier et al., 2004). The petrogenesis of the rocks has been at the front of the research, such as Janousek et al. (2000) and the recently published account (Janousek et al., 2004) of a calc-alkaline magma mixing zone at two levels, separated by a I km vertical difference.

Don's immense service in this region over many years was recognized in 1998 by the award of the Gold Medal of the Faculty of Science on the 650th Anniversary of the founding of Charles University, and also by the award of the Emanuel Borickuy Medal in 2003, also by Charles University, "For fundamental contributions to the development of mineralogy and petrology". In contrast, until now, his adopted country seems to have overlooked and not formally recognized his immense contributions and his wide experience in so many different regions.

While Don undertook his share of Learned Society service and the usual University committee work that falls upon most academics (general University, Senate, Faculty, Departmental etc.), the Scottish Universities Research and Reactor Centre Scientific Advisory Committee and the Glasgow University Exploration Society (staff member on six expeditions) are mentioned as they were especially close to his heart; nevertheless a critical feature of his research success was that he spurned advancement in academic administration, the last being the perennial excuse of academics seeking to reduce their research effort. Don concentrated on research and teaching; being a fine example of dedication to top priorities. But he managed to quietly do the Departmental garden for several years which kept it attractive. Don served as Acting Head of the Geology Department in Glasgow University for two spells of a year each, both with emphasis on the 'acting'. The first in 1964-1965 was during the sabbatical absence of Professor T. N. George, the second during that of the author in 1985-1986. Don acted with direction and firmness. During the first period, the Department acquired its first optical spectrograph to determine trace elements in rocks; during the second, its first Apple-Mac computers in the Department. Due to the absence of George, it fell to Don to open the first Geological Society (of London) meeting ever held outside London when *The Phanerozoic Time-Scale* symposium took place in the University of Glasgow on 14 and 15 February

1964. From this meeting, with W. Brian Harland's drive, the Geological Society's first Special Publication (Harland *et al.*, 1964) emerged. The series is now one of the jewels in that Society's reputation.

Don was made a Fellow of the Royal Society of Edinburgh in 1976 and was Vice President in 1980-1983, including being Senior Vice-President during the bicentenary of the Society. His outstanding service to both that body and geology was to take the nearly moribund *Transactions* and re-launch it as *Transactions of the Royal Society of Edinburgh: Earth Sciences,* being the Executive Editor from 1978-1985. He put great energy and dedication into making this a success. This revitalized the serial which, because of its previous lack of subject focus, was in danger of disappearing after nearly 200 years of publication. Don laid the ground for the first Hutton Symposium on *The Origin of Granite* and publishing the granite papers that emanated from these Hutton Meetings, which have made the *Transactions* world famous, although, of course, a wide variety of Earth Science is contained within its pages, not least much systematic palaeontology which benefits from the large page size.

So the Geologists' Association salutes one of its distinguished long-time members, not for 'just' reaching eighty years of age, but because of a lifetime flow of scientific papers which still continues fifteen years after formal retirement at 65, demonstrating continued enthusiasm and drive. We also recognize his immense contribution to fostering international co-operation and goodwill between geologists over much of the globe. Well-done! May your grandparenting, your opera-going, your Methodist hymn singing and your research output continue undiminished.

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Islay Field Excursion - September 2021
Team dinner at the Lochside Hotel on Sunday evening

Edited by D J Webster.
Published by the Geological Society of Glasgow

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