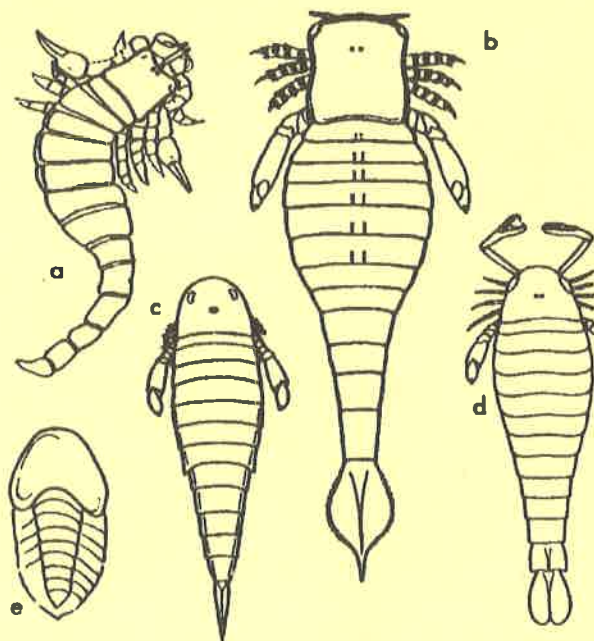


PROCEEDINGS OF THE GEOLOGICAL SOCIETY OF GLASGOW



Front Cover Illustration: —

The front cover is a copy of one of the figures illustrating the excursion to Lesmahagow, in the new field guide to "Geological Excursions around Glasgow and Girvan" published by the Geological Society of Glasgow. Copies of the guide are available from the Publications Sales Officer of the Society, care of the Department of Geology and Applied Geology, University of Glasgow, G12 8QQ.

Thanks are due to Dr. W. D. I. Rolfe for his permission to reproduce the figure.

The fossils illustrated are:—

A — ?aquatic scorpion *Allopalaeophonus caledonicus* x 2.5 (after Petrunkevitch)

B — eurypterid *Slimonia acuninata* x 0.17 (after Størmer)

C — eurypterid *Hughmilleria lanceolata* x 0.5 (after Størmer)

D — eurypterid *Erettopterus* [*Pterygotus*] *bilobus* x 0.17 (after Størmer)

E — early king crab *Cyamocephalus loganensis* x 0.67 (after Størmer)

PROCEEDINGS OF THE GEOLOGICAL SOCIETY OF GLASGOW

SESSIONS 133, 134 and 135

1990-91, 1991-92 and 1992-93

Contents

LECTURES 1990-91 (Session 133)	2
1991-92 (Session 134)	4
1992-93 (Session 135)	8
SECRETARY'S REPORT (Session 133)	11
(Session 134)	12
EXCURSION SECRETARY'S REPORT (Session 133)	12
(Session 134)	13
(Session 135)	14
PUBLICATION SALES REPORT (Session 133)	14
(Session 134)	15
(Session 135)	16
MEMBERSHIP REPORT	16
LIBRARY REPORT (Session 133)	16
(Session 134)	17
(Session 135)	18
SCOTTISH JOURNAL OF GEOLOGY EDITORS' REPORT (Session 133) ..	19
(Session 134) ..	20
(Session 135) ..	21
THOMAS NEVILLE GEORGE MEDAL	23
STEVEN JAY GOULD	23
JOHN MURRAY	25
WILLIAM JAMES KENNEDY	29
EXCURSIONS — SESSION 133 (1991)	32
SESSION 134 (1992)	36
SESSION 135 (1993)	38
APPRECIATIONS	40
Miss. Margaret M. Fotheringham	41
Elizabeth R. Brock	41

LECTURES 1990-91 (Session 133)

The year got off to a good start on 4 October 1990 with a private view of an exhibition entitled '**Giants, Gems and Jewels**' in the Hunterian Museum of Glasgow University. This exhibition was mounted as the Museum's contribution to Glasgow's European Year of Culture celebrations. The meeting was well attended, and gave members an excellent opportunity to view the many spectacular mineral specimens on display, whilst they enjoyed some refreshments.

The first lecture was held on 7 October, when **Professor B. P. J. Williams** (University of Aberdeen) spoke on "Rocks Down Under: Sediments and hydrocarbons in Australia".

On 25 October the Society experimented with a "Geologists Question Time", during which a number of the Society's members answered questions from the floor on a wide variety of geological topics. The experiment was universally regarded as a great success, and everyone who attended went home well entertained as well as well informed.

The first of two meetings in November was held on the 15th. It was addressed by **David Mason** (Johnson, Poole and Bloomer) on "Glasgow's Mineral Wealth and the Legacies of Industrial Success." Amongst other topics, he outlined some of the present day problems for engineering geologists which arise as a result of the former exploitation of coal and iron ore in the city.

The second November meeting was held on the 29th, and was addressed by **Professor D. G. Murchison** (University of Newcastle) on "Organic Maturation in the Midland Valley of Scotland and its Relationships to Possible Hydrocarbon Generation."

The **Annual General Meeting** was held on 13 December. It was followed by the showing of a number of video-tapes of geological interest. The evening was rounded off with the now traditional Cheese and Wine.

The first meeting of 1991 was held on 10 January, when **Dr. James Dickson** (University of Glasgow) spoke to the Society on "Plants and

Animals of the Last Glaciation and their Climatic Implications.” He discussed the types of plant and animal fossils which occur in deposits from the last glaciation. Emphasis was placed on the value of plant fossils as palaeoenvironmental indicators, particularly remains of flowering plants and of mosses. The lecture also included an interesting comparison of environmental reconstructions based upon plant fossils, with those based upon fossil beetles from the same deposits.

On 24 January **Professor J. B. Dawson** (University of Edinburgh) addressed the Society on “Thirty Years with the same Volcano.” He spoke about the composite volcano Oldoinyo Lengae, which is currently the only active volcano in the eastern branch of the Gregory Rift Valley. It is also unique in that it is the only volcano that has extruded carbonate lavas, a fact first observed and recognised in 1960. Violently explosive eruptions in 1966 were of mixed carbonate/silicate ash, but further quiet flows between 1983 and 1991 were again of carbonate composition. Temperature and viscosity measurements made in November 1988 prove them to be the coolest ($585 \pm 10^\circ\text{C}.$) and the most mobile of terrestrial magmas.

The annual **Members’ Night** was held on 14 February 1991. The following illustrated talks were presented: —

Mr. A. Heriot — Refractometry for Beginners;

Dr. J. G. Todd — The Costa Del Clyde, 9000 B. C.;

Miss. R. McGill — North Island, New Zealand, a Geothermal Tour;

Miss. L. Ferguson — A Geologist in China;

Mr. A. McKelvie — The Hidden Depths of Kloof Gold Mine, R.S.A.;

Dr. T. Fallick — The Scottish Universities Isotope Geology Unit: what is it, and what does it do?, and

Dr. C. Burton — Jellyfish and other Monsters from Trearne Quarry.

Both before and after the talks, members had the opportunity to view the following exhibits in the laboratory beside the lecture theatre: —

A. Heriot — Refractometry – try for yourself;

C. Burton & N. Clark — Jellyfish and other Monsters from Trearne;

J. G. Todd — Fossils and Microfossils from the Clyde Beds at Linwood;
D. Hollis — Carboniferous Fossils from the Johnstone By-Pass;
J. Jocelyn — Selected Mineral Specimens and Thunder Eggs;
A. Roberts — L. A. Necker's 'Geological Map of Scotland, 1808';
M. Kennedy — Rocks and Minerals of Aberdeenshire, Part II, and
R. McGill — East Kirkton.

In addition, there were photographs and a video display relating to the Society's field trip of the previous summer to Durham and the north of England.

On 28 February 1991 **Professor D. P. McKenzie** (University of Cambridge) addressed the Society on "Magellan Looks at Venus." He presented the very latest information from N.A.S.A's space probe, illustrated by many beautiful slides of Venus and other planets.

The Joint Celebrity Lecture was given on 25 April by **Professor W. S. Fyfe** (University of Western Ontario, Canada). His topic was "A Planet Under Stress". He gave various examples of environmental alteration as a result of man's activities. As well as dealing with the concept of the Earth as a single system, the so called 'Gaia Hypothesis', he speculated upon what interpretations future geologists would have for the relicts of some of the present environmental crises. Prior to Professor Fyfe's talk, there was a short Extraordinary General Meeting of the Society which approved Council's recommendation of an increase in subscriptions.

LECTURES 1991-92 (Session 134)

The Session got off to a flying start on 10 October 1991 with the presentation of the T. Neville George Medal to **Professor J. W. Murray** (University of Southampton). Following the presentation professor Murray lectured on "The Cenozoic History of the North Atlantic" from his perspective as a leading ostracodologist and a participant in the Deep Sea Drilling Programme.

On 24 October **Dr. John Addison** (University of Edinburgh) gave a talk on environmental geology entitled "Mineral Hazards: Health Risks and Diseases associated with the Natural Geological Environment."

The first of two November meetings was held on the 14th, when **Dr. Michael C. Keen** (University of Glasgow) gave his Presidential Address to the Society. He spoke on "Global Events and Sea Level Changes".

The recent geological past has seen dramatic changes in eustatic (global) sea levels caused by the expansion and contraction of the polar ice caps. Whole continental shelves which were recently above sea level have been submerged during the past 10,000 years, giving rise to some of the earth's most spectacular features such as the Great Barrier Reef of Australia. These eustatic changes are clearly related to climatic change, and study of oceanic cores have shown climatic cycles of varying duration known as Milankovitch Cycles (20k, 40k, and 100k years). These are increasingly recognised in the geological record as small scale cycles (1-2ma). While they are readily explained in the context of a glacial world, such cycles are more difficult to explain in a non-glacial world such as existed during the Jurassic and Cretaceous. Larger scale cycles, which form the basis of sequence stratigraphy, have a duration of 2-3 million years and are difficult to tie in with climate. Repeated transgressive-regressive events are seen as large scale coarsening-upwards cycles believed to be eustatically controlled. The succession of biofacies can help in their recognition. Not all sea-level changes are of eustatic origin, however. The Messinian salinity crisis of the late Miocene affected the whole of the Mediterranean Basin, but was brought about by geographical changes related to plate movement; the closure of the Straits of Gibraltar brought about the desiccation of the basin, with sea level changes of several thousand metres. Major regressions have had considerable affects on the biosphere, and are considered to be one of the prime influences on faunal turnover. The mass extinctions the Permian/Triassic and Cretaceous/Tertiary boundaries were examined in this light.

On the 25th, **Professor Michael J. Russell** (University of Glasgow) spoke on "The Origin of Life."

Professor Russell's thesis is that all life can be traced back to an aggregate of rather helpless cells in which microenvironments are protected from dissipation into the Archean Ocean by membranes composed

of colloidal iron oxyhydroxide and sulphide in a matrix of abiogenic hydrocarbons generated in free hydrothermal convection systems developed in the komatiitic lavas and sills comprising the early Earth's crust. In this convection system carbon dioxide is reduced to "organic" molecules, the somewhat acidic seawater is rendered alkaline by dissolution of alkaline earths, and sulphides are precipitated in chemical gardens away from oceanic ridges and plumes in the oceanic depths where hydrothermal sulphide meets with reduced iron in the seawater as well as the iron oxyhydroxides produced by photolysis. Simple amino acids and amino acid polymers are produced in this mound and these, along with the other organic compounds, are broken down to increase molar concentrations which increase the osmotic pressure within the membranes. These expand, fracture and heal by producing new hemispherical cells or botryoids. It is the oxidised iron produced by photolysis at the sea surface which acts as the terminal electron acceptor. In the speaker's view the first metabolism consists of an anabolic stage produced in the hydrothermal system and in the base of the iron sulphide mound followed by a catabolic stage within the microcosm of the first botryoidal cells; Gaia nourishes these helpless cells, her issue.

The work about which we were told in this talk is a cooperative venture with Allan Hall, Graham Cairns-Smith, Cordon Curry, John Cole, and Gordon Macleod.

The year was completed with the **Annual General Meeting** on 12 December. This was followed by a light hearted quiz and the customary social events.

1992 commenced with a lecture from **Dr. I. Parsons** (University of Edinburgh) entitled "Life and Death of a Magma Chamber."

The annual Members' Night was held on 14 February. The following short illustrated talks were given: —

Dr. J. G. MacDonald — A brief account of the volcanic geology of Madeira;

Dr. C. Burton — Snails and Lava in Eastern Madeira;

Mr. J. Allan — A visit to the Harker Collection of thin sections at the Sedgwick Museum, Cambridge;

Dr. M. C. Keen — The Great Barrier Reef;

Dr. D. Hollis — The geology of the Isle of Man, and

Dr. R. Ellam — Sicilian Volcanoes.

Before and after the talks, the following exhibits were on display: —

Dr. C. Burton & Dr. B. Doody — Precambrian to Pleistocene in the Malvern Hills and the Severn Valley;

Dr. G. Todd — Excellent Scottish Minerals collected in 1991;

Dr. I. Allison — Agalmatolites in Scotland and Canada, and Ledmore Marble;

Dr. M. Cussack — Molecular palaeontology;

Mr. J. Crummy — Gold Ores of Scotland and North West Europe;

Dr. T. Dempster — Xenoliths in the Lamprophyre dykes of Loch Lomondside;

Professor D. Ramsay — Superb non-cylindrical folds from Soroy, Norway;

Mr. I. Jones — Minerals from Wanlockhead;

Miss. A. Roberts — Minerals from the Isle of Man;

Dr. N. Clark — A dinosaur footprint from Scarborough, now in the Hunterian Museum, and

The Hunterian Museum — Recent acquisitions to the collection.

On 27 February, **Dr. R. C. R. Willan** (British Antarctic Survey) lectured on “The West Antarctic Magmatic Arc – Mineralisation in an Unexplored Terrain.”

For more than 70 years, the presence or absence of mineralized rocks in Antarctica has been a matter for speculation, particularly in the well exposed Andean magmatic arc rocks of the Antarctic Peninsula. Some geologists claim the existence of specific deposit types, others suggest that there are no proven areas of significant mineralization. By compari-

son with inhabited and intensively mapped areas such as Scotland (where major deposits have remained undiscovered until very recently), most of Antarctica remains *terra incognita*. This talk illustrated the vagaries of geological fieldwork in the mountains of Graham Land and Palmer Land, in search of these elusive and unusual rocks.

The March lecture was held on the 12th, when the Society was addressed by **Dr. J. P. Platt**, who spoke on "Extensional Collapse of Mountain Belts and the Origin of the Gibraltar Arc."

The final talk of the year was given on 14 May by **Professor R. Kidd** (University of Cardiff) who spoke on "Submarine mass sediment slides on the Eastern Atlantic continental margins."

LECTURES 1992-93 (Session 135)

The new session again started with a social evening, on 8 October 1992. This time it was to mark the publication of the new guide, 'Geological Excursions around Glasgow and Girvan.' A small presentation was made to the two editors — Doctor J. D. Lawson and Doctor D. S. Weedon — and to the person who won the competition to supply the photograph chosen for its cover, Professor B. J. Bluck.

The first lecture was held one week later, when **Dr. W. J. Kennedy** (University of Oxford) was presented with the T. Neville George Medal. Following the presentation, Dr. Kennedy gave a most interesting lecture on "Evolution and Extinction Patterns in Cretaceous Ammonites."

On 29 October the speaker called off at the last minute. The president of the Society hastily arranged a tour of the Department of Geology and Applied Geology for those who could not be contacted in time and who turned up for the lecture. The tour was a success, and may be worth repeating at a future time.

On 12 November, **Mr. T. P. Davies** (Mott-MacDonald Limited, Glasgow) addressed the Society on the topic of "Rock Engineering on the Dundee Inner Ring Road."

Stage XII of Dundee Inner Ring Road runs through a built up part of the city of Dundee and includes a 145m long cut and cover tunnel and a 355m length of road in vertical open cut with retaining walls. Excava-

tions extended some 14m below the level of adjacent ground. During construction, disturbance to nearby buildings and services had to be minimised; close attention was paid to the stability of the excavations and the selection of excavation techniques. This talk presented an outline of the site geology, described the approach to geotechnical investigations, and highlighted certain aspects of design and construction, particularly the stabilisation of the sidewalls and the role of detailed geotechnical mapping.

The route runs within a Devonian age sandstone/mudstone/shale/basic lava sequence dipping at 20 to 30 degrees. Historically, stability problems have occurred in these formations in the Dundee area. Site investigations included inclined coring to clarify the disposition of faults, exploratory trenching, cross-hole seismic work, and rock anchor trials. Particular attention was paid to elucidating the discontinuity characteristics with reference to the presence of low shear strength planes. Rock classification techniques were used to assist in excavability studies and to provide guidelines for rock reinforcement selection.

Excavations were mapped in detail during construction, and supplementary rock testing was carried out. Updated interpretations were prepared, enabling the design for the temporary and permanent works to be kept under review and adjusted as work progressed.

Two weeks later, **Dr. A. G. Leslie** (Queen's University, Belfast) spoke on "Maps and Magnetometers – a glimpse beneath the sod!"

Field relations are, quite rightly, the key to understanding most of our geological problems. All too often, in the Scottish Highlands, a lack of good exposure in critical areas is a major contributor to most of our geological problems. The range of Lithologies present in the Dalradian of the Grampian Highlands, Moray – Buchan and the Monadhliath are such that detailed ground magnetic surveys can be routinely applied to construct stratigraphic sequences and structural chronologies in areas where lack of exposure had previously resulted in maps less useful to the geological community. The technique can be widely applied and should not be seen simply as a method for detecting intrusive bodies, or similar

'obvious' targets, hosted in the Dalradian. New maps from the Highlands, integrating new geological and new geophysical data, were displayed.

As usual, the year was rounded off with the **Annual General Meeting**, held on 10 December. This was followed by a "Geological Call My Bluff" and the Annual Social.

The original speaker intended for the 14 January meeting called off. **Dr. Con Gillen** (Centre for Continuing Education, University of Edinburgh) kindly agreed to step into the breach at very short notice and to give a talk on "The Kola Superdeep Borehole, Arctic Russia."

The Superdeep Borehole being drilled at Zapotyarny in northern Russia is the world's deepest scientific well. It is located close to the town of Nickel on the border with Norway and Finland and is situated within the Pechenga copper-nickel ore field. Drilling has been continuing for 20 years, and the present depth of 12,266 metres has been reached on several occasions, due to technical problems causing collapse and the need for parallel wells to be drilled. The upper 7km of the section consists of Proterozoic volcanics and metasediments with several ore rich horizons, Archaean gneisses form the lower part, the lowermost unit so far encountered being a strongly sheared biotite-feldspar gneiss. No granulite facies rocks have been drilled to date. It is intended that drilling will continue to the planned depth of 15km.

The lecture considered the geology, geophysics and drilling technology of the well and the geological structure of the surrounding region in the Kola Peninsula, and discussed the progress of the large-scale joint international seismic experiment conducted in the spring of 1992, in which the speaker was among a team who carried out a 45km long surface reflection profile, linked to a 6km deep vertical seismic profile within the borehole.

On 28 January, **Professor C. D. Curtis** (University of Manchester) gave a talk entitled "It's time to look again at mudrocks."

On 11 February **Dr. Peter Seldon** (Open University) spoke on "Tri-

lobites, evolution and the origin of species.”

In a most entertaining talk, Dr. Seldon posed the question ‘Does evolution tend to occur gradually and continuously, or in jumps with long periods of stasis in between?’ Only the fossil record can provide an answer to this question, and beautifully preserved Ordovician trilobites from central Wales are yielding important evidence in this debate. The study reveals major descriptive biases that obscure evidence of gradual evolution, which is probably much more common than usually perceived. Stasis is, however, undoubtedly a major feature of the fossil record, and a recent general model suggests a surprising and somewhat counter-intuitive relationship between patterns of evolution of different environments.

On 11 March the Joint Celebrity Lecture was held in Glasgow. It was addressed by **Professor P. Robinson** (University of Massachusetts at Amherst, United States of America), who spoke on “Comparative Tectonics of the Hinterlands of the Acadian and Scandian Orogens.”

The remarkably different Acadian and Scandian orogens formed at nearly the same time during the same collision between North American and amalgamated Avalon-Baltica plates. Early Acadian involved widespread S- and I-type plutonism, fold and thrust nappes in Silurian-Lower Devonian cover, and early low-P high-T metamorphism. Late Acadian involved refolding at higher pressure. Early Scandian produced a thick stack of thrust sheets of strongly to weakly metamorphosed Baltic and North American basement and cover rocks, and very few plutons. The Baltic shield and part of its tectonic cover was deeply subducted, locally imbricated, and subjected to eclogite facies metamorphism. These differences may reflect differences in character of lithospheric mantle delamination near the subduction zone. In both hinterlands latest stages involved orogen-parallel shearing, extension, local rapid uplift, and overprinting of older tectonic fabrics, and in both, close study of stratigraphy and structural fabrics in high grade rocks is the key to tectonic interpretations.

SECRETARY’S REPORT (Session 133)

The editing work on the new version of the “Guide to the Geology of

the Glasgow District" continued. The manuscripts are now in the hands of the printers.

A book token was awarded to Iain Duncan (George Heriot's School) for excellence in Geology in the S.C.E. Higher Examinations.

Jane MacDougall

SECRETARY'S REPORT (Session 134)

Session 134 was another busy one. Council met on 7 occasions. A £20 book Token Prize was awarded to Graham Hutchison (Alloa Academy) for Excellence in Geology in the SCE Higher Exams. £500 was donated to students from the Department of Geology for their extended trip to Ireland, and Dr. Neil Clark was given a donation of £500 towards Geology Week at the Dome of Discovery.

Protests to the Press about the proposed removal of B.G.S. fossil collections to Keyworth, Notts. seem to have added weight to other people's reactions and the outcome has been satisfactory. The collection will remain - almost totally - in Scotland and curatorial staff have been appointed.

Jane MacDougall

EXCURSION SECRETARY'S REPORT (Session 133)

During the 1991 session one weekend and 6 day excursions were arranged as listed below.

11 May	Glens of Dumbarton II	14 attended	Dr. J. Morrison
18 May	North Ayrshire	15 Attended	Dr. C. Burton and Dr. N. Clark
1 June	Glasgow and District	14 attended	Mr. A. McMillan and Mr. A. E. Browne
9 June	Roseneath and Loch Long	20 attended	Dr. G. Tanner
17 August	Pease Bay to Cove	14 attended	Mr. A. Fyfe
29 August-	Isle of Man	11 attended	Dr. D. Hollis
2 September			
21 September	Permian Dumfries Basin	25 attended	Dr. S. Monro

The excursions in 1991 were again enjoyable, varied and extremely

interesting. This was due to the expertise of our excellent leaders who so generously gave so much of their time.

Only one weekend field excursion was arranged this year but we hope to continue our usual practice next year, of having a weekend trip in the Spring as well as the Autumn.

Rosemary McCusker

EXCURSION SECRETARY'S REPORT (Session 134)

During the 1992 session one weekend and six day excursions were arranged as listed below.

9th May	Glen Orchy	12 attended	Dr. P W G Tanner and Dr. P R Thomas
23rd May	Grieston, Meggett and Dob's Linn	15 attended	Dr. B C Lintern
6th June	Aberfeldy	12 attended	Dr. A J Hall and Miss. R McGill
27th June	The Ballantrae Complex	29 attended	Dr. P Stone
8th August	Clyde Plateau Lavas	25 attended	Mrs. J MacDougall and Dr. J G Todd
4th-7th September	The Malvern Hills	23 attended	Dr. C. J. Burton and Dr. J. J. Doody
19th September	East Kirkton and Bathgate Hills	25 attended	Dr. A J Hall and Miss R McGill.

The 1992 Excursion Season was again informative and very enjoyable thanks to our excellent leaders who so kindly gave up their time to lead us to so many very interesting places.

Numbers had to be limited to 12 on both the Glen Orchy and Aberfeldy excursions - commiserations to those of you who did not secure places.

Due to circumstances beyond my control it was not possible to run a weekend excursion in the Spring of this year. Hopefully 1993 will see the return of the Spring weekend.

The deposit system for the buses has worked well resulting in most bus trips almost covering themselves.

Rosemary C McCusker

EXCURSION SECRETARY'S REPORT (Session 135)

During 1993 1 weekend and 4 day excursions were arranged as listed below:

8th May	Gargunnock Burn	10 attended	Dr. W. A. Read
28-31 May	The Lake District	14 attended	Dr. A. J. Hall and Miss R. McGill
12th June	The Solway	19 attended	Dr. M. C. Keen and Mrs. J. MacDougall
24th July	The Turnberry Coast	24 attended	Dr. G. Durant
7th August	Schiehallion	12 attended	Dr. J. G. MacDonald and Dr. G. King

The proposed weekend to Mull, originally planned for September, had to be postponed and the day trip to New Lanark was cancelled due to lack of support. Hopefully both these excursions will be re-arranged in the next session.

Even with the deposit system some members are still cancelling their bus bookings at the very last minute or simply not turning up on the day resulting in a loss to the Society. Also on excursions where numbers have to be limited, such as the Schiehallion trip, this can lead to some members not gaining a seat on the bus but on the day the bus sets off with empty seats. The numbers shown for attendance on each trip are not necessarily the same as those who travelled by bus as some members prefer to meet at the first locality if that is near to their home.

I would once again like to thank all the leaders who made the 1993 Excursion Programme so varied and interesting.

Rosemary C. McCusker

PUBLICATION SALES REPORT (Session 133)

Book sales are down again this year.

The British Museum of Natural History was undergoing reorganisation and many of its publications were not available, a situation which it appears will be rectified in future.

Our books were on sale at the Dome of Discovery during Geology Week, "Agates" and "The Scenery of Scotland" being the most popular.

Sales to retailers were only slightly down on last year, but it is our own members who seem to be reluctant to purchase. I hope that all members are aware that the Geological Society of Glasgow has an excellent stock of excursion guides and geological publications which are for sale to our members at discount prices. Price lists and publications are always available from me, either at meetings, or by leaving a message at the department.

We are all eagerly awaiting the publication of the new Glasgow Guide, hopefully in the not too distant future.

Once again I have to thank all those who have helped me sell books throughout the year.

Alison Roberts

PUBLICATION SALES REPORT (Session 134)

Except for continuing steady sales of the Arran Guide (at the very attractive price of £3.90 per copy) the first eleven months of this year were uneventful.

Then, on 20 August 1992, our eagerly anticipated publication "Geological Excursions Around Glasgow and Girvan" appeared. This was the culmination of three and one half years work by the editors. The guide starts with a detailed geological history of our area and a stratigraphic table which includes palaeolatitudes and an indication of the relevant excursions. There are thirty-three excursions and each chapter starts by describing the theme of the excursion, the features to be seen, relevant maps, type of terrain, distances, possible shorter routes and details of access. A wealth of information makes the book 'a good read' both at home and in the field. The cost of the guide is only £6 to members. By 30 September over 100 copies had been sold or distributed.

We have a new Natural History Museum publication, "Volcanoes", at £5.95. "Story of the Earth" and "Britain Before Man" are both still available priced £1.95 each.

I have to thank Evelyn Lennie, Moira Salter and others for their help in selling the new guide at the launch and for helping me to cope with the rush of mail orders which followed.

Alison Roberts

PUBLICATION SALES REPORT (Session 135)

Three publications have continued to be popular: – the Glasgow and Girvan Guide (98 sold); the Arran Guide (139 sold) and the Skye Guide (86 sold). The year was also marked by the introduction of the Borders Geology Guide from the Edinburgh Geological Society. Stocks of the Arran Guide will last another four to five years at the present rate of sale.

Neil. D. L. Clark

MEMBERSHIP REPORT

Session	132	133	134	135
Honorary Life Members	4	3	3	2
Life Members	1	1	1	1
Ordinary Members	474	410	419	407
Associate Members	53	51	50	58
Junior Members	31	17	16	13
Total Members	563	482	489	481
New Members	62	32	35	23
Deletions	20	85	28	39

Jean Willing

LIBRARY REPORT (Session 133)

Library reorganization continues, with “weeding” of stock being a priority - this process generating a number of journal parts, books and

reprints which were the subject of the first of the book sales in this session, raising £30.76.

In the wake of the reorganisation of the Scottish Journal of Geology our list of exchanges with foreign institutions was revised and updated. We now exchange with 35 institutions worldwide and receive journals, geological survey reports and books in return, these being housed in the University Library.

During the session the production of catalogues listing our collection of geological guides was completed, with the "Europe" and "Rest of the World" lists now joining "Britain".

Among the new books received are a collection of guides to the Quaternary of Canada and the second edition of the guide to Silurian localities in the Mortimer Forest of the Welsh Borderland, an Illustrated guide to the fossils of Brazil (presented by Sir Alwyn Willams) and Fortey's "Fossils - key to the past" join them. Energy resources and the metallogeny of gold cover economic aspects and we now have "Volcanoes" (2nd edn) from the Natural History Museum.

Regular borrowers this session numbered 29 (43 last session), who borrowed 145 items (198 last session).

C. J. Burton.

LIBRARY REPORT (Session 134)

A relatively uneventful year has passed, but with the pace of library reorganization now becoming much faster. The Departmental Management Committee has asked that the library annexe, hitherto choked with departmental holdings, be cleared by the end of November. This will release large quantities of reprints, journal parts, books, etc. many of which will be sold off at forthcoming society meetings. The space made available will be filled with book stacks and the rest of the stock - both the Department's and the Society's - redistributed and reorganized.

New books purchased this session cover a wide spectrum of the subject and include (as a free review copy) the new Natural History Museum title "Rock Solid" - soon available for sale to members - as well as titles

on "Beaches", UK oil and gas fields, "Environmental Science", "Vertebrate Evolution", fractals and chaos(!) in geology and "Heavy minerals in colour". Among the excursion guides newly arrived are those to the Permo-Trias of Cumbria, Western Greece and a number of guides to the Quaternary of areas in the UK and elsewhere. A major addition is, of course, the Society's own guide to Glasgow and Girvan.

Regular borrowers this session numbered 28 (29 last session), who borrowed 107 items (145 last session). These figures show a small decline over last session and, for such an active Society, are somewhat disappointing, especially in view of the large stock of books, excursion guides, etc. purchased with amateur members in mind.

C. J. Burton.

LIBRARY REPORT (Session 135)

The Society's library, together with that of the Department, was completely reorganized this session. Thanks to a donation to the Department, by B.P., of a large amount of library shelving, the library annexe is now fully equipped. This has allowed the annexe to be filled with the Journal collection, some runs coming from storage. The space created in the library itself has been further reorganized and the full reorganization is now complete. A new library location plan will be issued shortly.

The reorganization generated a considerable amount of surplus material which the Council has authorized the librarian to dispose of. This material consists of duplicates, old stock, out of date (19th century) serials, etc. and will be removed section by section, with members having first refusal (or opportunity to purchase).

A new library leaflet for members is in preparation and will be issued to all members next session.

New books purchased this session cover as wide a spectrum as ever. The guides this year include those to the English Lakeland, Epping Forest, and the Quaternary of British regions and of China and Slovakia. Basic texts include the new edition of Holmes' 'Principles of Physical Geology' (ed. Duff), and Butler and Bells' 'Interpretation of Geological

Maps' Derek Ager's last, and still controversial book 'The Nature of the Stratigraphical Record' is on the shelves. Two rather unusual books, 'A Faculty for Science' and 'From Anatomy to Zoology' represent part of the celebrations of the centenary of the University's Faculty of Science.

Regular borrowers this session numbered 22 (28 last session), borrowing between them 85 items (107 last session). One item of stock was destroyed while on loan - by the explosion of a melon in Death Valley - a story so tall that the librarian had no recourse but to believe it! The book was replaced by the borrower.

C. J. Burton

SCOTTISH JOURNAL OF GEOLOGY EDITORS' REPORT (Session 133)

The past year has seen a number of important changes in the Scottish Journal. The new format, introduced with volume 26, is now firmly established. This has been well received and initial problems, including matters such as inappropriate diagrams and complaints of too few pages, have been overcome. We have a steady flow of papers of appropriate quality and are able to take these from submission to print in about 9 months. We continue to attract submissions on a variety of aspects of Scottish geology.

Following difficulties experienced by our publishers, Scottish Academic Press, the two parts of volume 27 were produced by direct negotiation with the printers. Notwithstanding serious delays in the production of part 2 of volume 26 we were able to publish part I of volume 27 before the half year and expect to have part 2 issued by the end of December of 1991. This achievement has been due to the efforts of Byron Lintern and David Stephenson of B.G.S., who are members of the Editorial Board, and to whom we owe a substantial debt.

In the early part of the year, in the light of the problems referred to, and in the expectation that the Scottish Academic Press would not continue, attempts were made to seek a new publisher. The Editorial Board examined various quotations, which finally included an offer from the successor to the Scottish Academic Press, but in the event recommended

to the two Councils that the Journal should be placed in the hands of The Geological Society Publishing House. This recommendation was endorsed and the new publication will commence with volume 28. The general policy for publication remains the same, the printers are unchanged, but we are introducing new editorial procedures which should lead to greater improvements. We expect to improve distribution and to increase exposure of the journal in the geological community, both here and abroad.

Colin J. R. Braithwaite

SCOTTISH JOURNAL OF GEOLOGY EDITORS' REPORT (Session 134)

The journal has seen a number of changes since the new publishers were appointed and minor modifications are continuing. The two issues of volume 28 have appeared slightly ahead of schedule and preparations for volume 29 suggest that it will appear early in the New Year, again ahead of time. The new format has continued to be well received. With the new publisher we have been able to standardize more of our procedures and a new "guide to authors" is in preparation. In common with other Journals we are moving to full citation of references.

The "normal" size for issues is likely to be 96 pages but at least one future issue will be larger than this in order to accommodate the number of papers currently being submitted (and accepted). We are investigating changes to type layout which will allow us to publish more papers within our target size without loss of the generally pleasing appearance of our format.

We feel it important to clear the present backlog of papers. The reasons for this accumulation can be traced to a period when submissions were low but it is important now to maintain the topicality of the Journal. For this reason the Board has (in consultation with David Gould, Treasurer of the Edinburgh Society, and acting Treasurer) approved a small increase in costs (which will fall to the Societies) in order to produce a larger part.

The page charges for 1993 have been fixed at £97.65, with the subscription rate rising to £64.50. These reflect increased printing costs

broadly in line with inflation.

The number of Trade subscriptions shows a slight increase over the same period last year but it is too soon to judge whether this will be sustained. The Journal is certainly being widely publicised by the Publishers and, in a period of contraction of Academic Libraries, maintaining a position is an achievement.

Since we have not yet run a full financial cycle under the new regime we are uncertain of the detailed balance of costs, but these seem to be within acceptable limits.

Discussions on the constitution of the Board have taken place in sub-committees of both Societies and proposed amendments to the Agreement have been circulated. We hope to have these in an agreed form for approval by the Societies in the near future.

Colin J. R. Braithwaite

SCOTTISH JOURNAL OF GEOLOGY EDITORS' REPORT (Session 135)

The Board was saddened by the death in January of its Secretary, Byron Lintern. A note of appreciation was published in volume 29, part 1 of the Journal.

Dr. T. J. Dempster and Dr. P. Stone were co-opted to the Board, whose composition is now:

Dr. C. J. R. Braithwaite (Univ. of Glasgow), Acting Convenor.

Dr. C. J. Burton (Univ. of Glasgow).

Dr. T. J. Dempster (Univ. of Glasgow).

Dr. R. W. Duck (Univ. of St. Andrews).

Dr. D. Gould (British Geological Survey), Acting Treasurer.

Dr. D. Stephenson (British Geological Survey).

Dr. P. Stone (British Geological Survey).

Dr. R. Thompson (Univ. of Edinburgh).

Ms. A. Hills / Mr. M. Collins (Geol. Soc. Publishing House).

Dr. R. F. Cheeney (Univ. of Edinburgh), Acting Secretary.

Volume 28, part 2 (80pp) was published on 1st November 1992; volume 29, part 1 (112pp) on 24th May 1993.

The Board has met on 4 occasions: 1992 October 28; 1993 January 27; 1993 April 28; 1993 July 21, with G.S.P.H. represented at the October and April meetings.

Manuscripts received since 1st October 1992, with their current status, are as follows (figures relating to MSS submitted in the previous year are given in parentheses):

Submitted	23	(33)
Published	3	(16)
Accepted	5	(7)
Min. revision	2	(2)
Maj. revision	3	(2)
Rejected	0	(4)
In hand	10	(2)

Sufficient manuscripts are in hand to complete 30(1) and to lay the foundations for 30(2). It is planned to publish these parts in May and November respectively.

The Agreement with the Geological Society Publishing House is judged to be working well and Board members are grateful to G.S.P.H. representatives and staff for assistance in the efficient conduct of the Journal's affairs.

The Publication Manager's Report has given the Board the following salient points: (i) the level of trade subscriptions has been retained relative to other journals, though reduced in real terms consequent on recessionary trends; (ii) the revised page charges and rates of trade subscriptions imply subventions of c.£1100 per Society in the coming year; (iii) the Journal is featured prominently in the G.S.P.H. catalogue for 1994, 60,000 copies of which are to be distributed worldwide.

The Board wishes to record grateful thanks for continued use of facilities in Murchison House for its meetings and to the diligent assistance

of many referees, called upon to review papers.

Colin J. R. Braithwaite

THOMAS NEVILLE GEORGE MEDAL

During the period covered by this volume the following citations were delivered at the presentation of awards: —

STEVEN JAY GOULD

Madame Acting and Past President, Professor Gould, Ladies and Gentlemen: —

It gives me great pleasure to present the citation to accompany the award of the seventh Thomas Neville George Medal to Professor Steven Jay Gould for his distinguished contributions to the study of evolution and palaeontology.

Professor Gould: as appropriate for a man of giant intellectual stature and accomplishment you were born in a large vibrating city, New York, and in 1963 graduated from Antioch College followed by a Ph.D. from Columbia University in 1967. A migration with a punctuated jump followed to Harvard University where the stable resident population were to be disturbed by your incursion as assistant professor of Geology and assistant curator of invertebrate Palaeontology. From this, a not too gradualist progression brought you to your present position as Alexander Agassiz Professor of Zoology.

You have written over 100 articles and five books and you have had a profound effect on the evolution of evolutionary thought and debate over the last two decades. Your work has been responsible for directing attention once again to the relevance of the stratigraphical record to the study of evolution. Even before finishing your Ph.D. you brought into focus the relationship between the growth of individual organisms and their mode of evolution. More recently you have investigated other aspects of neodarwinism, such as the predominance of adaptive, as opposed to constructional and historical explanations of organic form. Perhaps your most important contributions have been to stimulate debate, make scientists think again in fresh ways and to question the long and widely held view of gradualism — that a new species evolves by a whole

population changing slowly and evenly over its whole geographic range. From your detailed study of Pleistocene land snails of Bermuda you suggested that breaks in the evolutionary sequence represented successive immigration of new species that had arisen in geographical isolation and lead to the concept of 'punctuated equilibria' with populations being relatively stable over time, separated from the next stable population by an abrupt break.

This stimulation of debate is extremely important in science; curiosity is aroused by heated arguments not by bland consensus. Indeed sir, you will recall that Rudwick's book 'The Great Devonian Controversy', which you yourself have acclaimed as possibly 'one of our century's key documents in understanding science and its history', is prefaced by Henry De La Beche's words of 1830, written before the controversy erupted; "That much good ensues, and that the science is greatly advanced by the collision of various theories, cannot be doubted. Each party is anxious to support opinions by facts. Thus new countries are explored and old districts re-examined; facts come to light that do not suit either party; new theories spring up; and in the end greater insight into the real structure of the earth.....is obtained".

Your studies of snails obviously impressed upon you the undesirability of crawling around in a desultory fashion or cogitating statically in an academic *Turritella* and you have vigorously bounced about in your own research on many different topics, some of which have had historical links with this University such as the Giant Irish Elk antler function and the incurving of *Gryphaea*, while more recently the subject of tonight's lecture, the fauna of the Burgess Shale has occupied you. You have written textbooks such as Ontogeny and Phylogeny, you have written a whole series of immensely popular science books, you have appeared on numerous television and radio programmes, you have crusaded against the Creationists and you are a leading authority on the evaluation of the history of science. In 1988 you were named for the Geological Society of America History of Geology Award and this year for the newly-established Sue Tyler Friedman Medal of the Geological Society of London in

recognition of your major contributions to the history of geology over the last 20 years and for your extensive research into rates and modes of evolution.

Professor Maynard Smith F.R.S. described you as 'the best writer of popular science now alive'. The Panda's Thumb won the 1981 American Book Award for Science; The Mismeasure of Man, in which you exposed the fallacies and biases of much racial discrimination, gained the 1982 National Book Critics Circle Award and the 1983 Outstanding Book Award of the American Educational Research Association; the Hen's Teeth and Horse's Toes was awarded the 1983 Phi Beta Kappa Book Award in Science and since then you have gained other literary awards; a truly remarkable series of successes in writing stimulating, attractive and important literature that people actually want to read; even their titles excite curiosity.

You have received over two dozen medals and awards and have been honoured by so many Honorary degrees — nearly another two dozen, mostly Doctorates of Science and Humane Letters — that you must be a connoisseur in savouring the variety, contrast and similarity of citations, the stable frameworks of words which maintain the essential structure and the rare innovatory excursions that public orators occasionally venture into.

Professor Gould, you have been stimulating, immensely productive of innovatory thought, critical evaluation and scientific publication, a scientific philosopher, a highly successful author and historian, a biologist, palaeontologist and geologist, a generalist with peripheral specialisms and above all the ability to provoke curiosity about, and re-evaluation of, accepted concepts. This medal was subscribed to by those who wished to honour and remember Professor Neville George who researched in palaeontology and geology for nearly 60 years and who loved and savoured debate; in accepting it you give lustre and bestow prestige to the award.

JOHN MURRAY

Mr. President, Professor Murray, Fellows and guests: It gives me unusual pleasure to present the citation for the award of the Thomas Neville

George Medal to Professor John Murray for 1991.

Professor Murray: you have established an international reputation for your taxonomic, stratigraphic, ecological and palaeoecological work on foraminifera and it is for these applications of palaeontology that we honour you tonight.

John Murray is a graduate of London University, Imperial College from which he obtained a first class Honours B.Sc., the Watts Medal and A.R.C.S. in 1959 followed by a Ph.D. in only two years at Imperial in micropalaeontology. This study, which firmly set the direction of your future research, involved the ecology and systematics of the benthonic foraminifera of Christchurch Harbour, Hampshire and was the first detailed ecological study of this kind of a lagoon outside of North America. The emphasis was on studying the seasonal changes in the living foraminiferal assemblages and relating them to changes in environmental factors, especially temperature and salinity, and then observing the formation of the dead assemblages. During this study you found framboidal pyrite in recently dead foraminifera. Your 1963 published description of this with Leonard Love was one of the earliest after Love's description of framboidal pyrite in the Jurassic rocks and may well have contributed to the well-known Glasgow examination howler, about "Ordovician black shales can be seen forming in Christchurch Harbour".

This study was followed by the award of a Senior Scholarship for the Exhibition of 1851 which you held at the Marine Biological Association's Laboratory in Plymouth in 1961. Here you investigated the ecology of the Tamar estuary and the shelf along a transect out to the Eddystone Rock and also carried out ecological experiments on living foraminifera. All this early work set a firm seal on the main emphasis of your future research:— the use of foraminifera to identify and quantify environmental influences.

In 1962 you were appointed to an assistant lectureship in the University of Bristol under Professor W. F. Whittard and you rapidly established a record of combining reliability, meticulous teaching and assiduous devotion to research and to publishing the results. In conjunction

with Denis Curry and Fred Whittard you studied the *Globigerina* silts of the English Channel but your main efforts in your early days in Bristol were on a major study of the modern foraminiferal ecology of the hypersaline lagoons and adjacent shelf of the Arabian Gulf which contrasted markedly with the British environmental conditions you had previously, and still continued to study. A whole series of papers reported the Arabian Gulf results from 1965 to 1973 but during this period you also published in 1967 a landmark paper which set out the theoretical basis of the annual production of foraminiferal tests and their contribution to the sediment. This important paper not only enabled you to predict and test models – which you did with a subsequent long-term study of the Exe estuary – but also gave a basis for palaeo-ecological interpretations from fossil assemblages.

It led onto two seminal papers in 1968 dealing with the living foraminifera of Christchurch Harbour, and of lagoons and estuaries in general, which laid the foundation for synthesising data using a statistical measure of faunal diversity together with the relative proportions of foraminifera in each of three extant suborders from which brackish, marine and hypersaline lagoons were readily distinguished. This has made it possible to recognise these three types of lagoons in the fossil record in the Tertiary and Quaternary in particular. Using these and other techniques led onto the means of differentiating most types of modern environments as summarised in your 1973 book 'Distribution and ecology of living benthic foraminiferids'. This widely applauded book rapidly became the standard work on the subject and has only this year, 1991, been superseded by your 400 page 'Ecology and Palaeoecology of the Benthic Foraminifera'. The whole thrust of your work has revolutionised our ability to decipher quantitatively and with confidence, the past environmental conditions and has important implications for current studies of, for example, the greenhouse effect.

This 1973 book confirmed your international reputation and the 1974 award of the Huxley Medal and Prize by Imperial College and your subsequent elevation to the Chair and Headship of Geology in the Univer-

sity of Exeter in 1975 were recognitions of this. Your present position as Professor in the University of Southampton is the result of the Earth Science Review and the closure of the Exeter Department of Geology.

At Exeter you continued your studies of the near-shore and shelf region of Britain but also extended these studies into the deep ocean especially the Rockall region of the North Atlantic and developed in a series of papers the use of foraminifera in palaeo-oceanography through the Deep Sea Drilling Programme. It finally disproved the story that your lagoonal work was prompted by your height as you could, if the boat tipped, always stand on the bottom. You also developed your studies of the transport of foraminiferal tests including studies in the Severn and the English Channel and of recognition of tidal effects in estuarine sediments. More recently you have been studying the foraminifera of the Southern North Sea.

You have now published six books, including two editions (with D. G. Jenkins) of the 'Stratigraphical Atlas of Fossil Foraminifera', and have edited three more and published nearly 80 papers. The award of the Wollaston Fund in 1981 by the Geological Society and of the degree of DSc in 1990 by the University of London recognise your distinguished contributions to understanding past and present environments through means of micropalaeontology.

You have given of your time in support of professional activities such as the British Micropalaeontological Society (Chairman 1976-78), the Palaeontological Association (Council, Editor, Vice-President and currently President), the Geological Society (Marine Studies Group, Publications, Council and currently Honorary Secretary) and external examining for Ph.D. and B.Sc. degrees including this University from 1976-1980.

It is therefore wholly appropriate that this medal, which commemorates Professor T. Neville George's life and work as a stratigrapher and palaeontologist, should, in 1991, be jointly awarded to you by the Society and the Department and I have great pleasure in asking the President of the Society to make the presentation.

Professor J. W. Murray replied:

Mr. President, Professor Leake.

Thank you for your kind remarks. I feel most honoured to be the recipient of the 1991 Thomas Neville George Medal and I accept it with deep gratitude. I remember T. N. George well from attending meetings at the Geological Society in London. Also he was the External Examiner for my bachelor degree.

I consider myself to have been fortunate in my education and career. My parents were very supportive throughout my education. I was encouraged to do scientific experiments and dissections at home for initially I had intended to become a biologist.

I have always enjoyed doing research and I have found it possible to combine my biological and geological interests. Indeed, I have recently started a new study in the Arabian Gulf in conjunction with a biologist from the University of Bahrain.

Research is fostered best where there is the stimulus of working with others. I have been fortunate to work with amiable colleagues in three universities and with some very able research students. In the next few years further new opportunities for collaboration will arise through the forthcoming merger of the Institute of Oceanographic Sciences and Southampton University.

Your comments about standing in a lagoon remind me of a family joke. When my elder son was small he asked his granny what happened to people when they died. She replied that a man dug a hole 6 feet deep and buried the body in it. His response was: 'that wouldn't be any good for daddy – his head would stick out of the ground'!

Mr. President, let me conclude by thanking my wife for her continued support and by reiterating my gratitude for the honour you have bestowed upon me.

WILLIAM JAMES KENNEDY

Mr. President, Dr. Kennedy, Fellows of Glasgow Geological Society and guests. It gives me great pleasure to present the citation for the award

of the Thomas Neville George Medal to Dr. William James Kennedy for 1992.

Dr. Kennedy: you have established an international reputation as one of the leading workers in Cretaceous geology and palaeontology of your generation.

You originally graduated from King's College in 1964 with a first class honours degree in Geology, and continued post graduate studies into: Diagenetic and stratigraphic features of the Lower Chalk of S.E. England under the supervision of Dr. J. Hancock, eventually obtaining a Ph.D. from Kings College in 1968. While still engaged in your post-graduate studies you were appointed to a Demonstratorship at Oxford University and gained a full Lectureship in 1968. You were elected to a Fellowship of Wolfson College at Oxford in 1970 and have remained at Oxford since then.

There is no doubt that you were influenced in your studies by your supervisor - Jake Hancock, and your interest in shell structure and mineralogy and Cretaceous stratigraphy sprang from that period of your career. A large number of important papers on Cretaceous ammonites were published from the beginning of the 1970s to the present time. Of particular note among these articles were three monographs published by the Palaeontographical Society on: The Ammonoidea of the Plenus Marls and Middle Chalk, and The Ammonoidea of the Lower Chalk (parts I & II), with C. W. Wright as your co-author in each monograph.

During your ongoing work on British and European Cretaceous faunas you managed to spend considerable time in South Africa, again researching into the Cretaceous faunas there, with a view to producing a complete revision of these. 30 papers have so far been published on your South African work and hopefully many more will follow. During this period you even became involved in research into the Upper Cretaceous faunas of the U.S. western interior, Gulf coast and Atlantic seaboard; and one of your papers (a Palaeontology Special Paper) is used as a standard reference work on the palaeobiology of this faunal group.

As well as your faunal work you, Dr. Kennedy, have been concerned

with the influence of correlation techniques on Cretaceous stratigraphy, and the Jurassic and Cretaceous time scale. You and your co-workers have revised the faunas of the Upper Cretaceous stages in a number of published papers, and your work on the Turonian, Cenomanian, Coniacian, Campanian, Santonian and Maastrichtian (this latter work hopefully remaining unaffected by the treaty) has been of immense importance to the Cretaceous stratigraphy of Europe. An eventual goal of your stratigraphic correlation has been to test evolutionary, sedimentary and eustatic events in the world's oceans.

I was amazed to learn that you also managed to become involved with the economic field of oil development through your knowledge of the Cretaceous. 60% of Norway's oil and all of Denmark's are trapped in the Chalk and your subsequent work in this field of research has revolutionized our knowledge of this type of oil reservoir. Several key papers have been published on this topic such as, for example: Sedimentology of Late Cretaceous-Paleocene Chalk reservoirs, North Sea, Central Graben.

Your work on the diagenesis and sedimentology of pelagic sediments also stemmed from this phase of your career. Your reputation in the oil industry is high, and I believe that you act as an excellent ambassador for the work that U.K. universities carry out to the hydrocarbon industry. In all you have written nearly 200 papers that have led to your being acknowledged as the foremost researcher in this field, and the many honours and awards that you have received are entirely appropriate to the huge contribution you have made to Upper Mesozoic research. Since 1976 you have even managed to combine your research work with the position of Curator of the University Museum at Oxford, and we in Glasgow undoubtedly owe you a vote of thanks for your influence with the U.F.C. at the time of rationalization of Earth Science Departments in 1989, which led to the Hunterian Museum Geological Section getting substantial funding to provide increased storage facilities.

I am therefore delighted to recommend on behalf of the Society and the Department that this medal, commemorating the life and work of T.

Neville George, be awarded to you. I would ask the President of the Society, Dr. Allan Hall, to make the presentation.

EXCURSIONS

During the period covered by this volume the Society held the following excursions:—

SESSION 133 (1991)

Glens of Dumbarton II:- 11th May 1991 (Leader Dr. J. Morrison) *by Ben Browne*

Following last May's evening trip to the Overton Burn, this longer excursion explored the Upper Old Red Sandstone and Lower Carboniferous succession above Dumbarton. Sandstones, shales and cementstones are spectacularly exposed in the gorges of the Murroch and Auchenreoch Burns and are cut by a variety of dykes.

On this sunny day in May twelve members joined Jim Morrison on a walk up the Murroch Burn and down the succession of the lower Carboniferous Ballagan Beds of shales, mudstones and cement stones into the Devonian-Carboniferous sandstones of the Kinnesswood Formation and its cornstones.

Starting our walk behind the Beechwood Housing Estate above Bonhill we looked across at the Clyde Plateau Lavas displayed in the Lang Craigs at the east end of the Kilpatrick Hills overlying the Clyde Sandstones and the Ballagan Beds which in turn pass into the Kinnesswood Formation raised up as a Horst between NE-SW faults to occupy the foreground between Garshake Burn and the Overton Burn. Turning to the north west we looked down the succession to the Upper Old Red Sandstone underlying Bonhill and the Lower Old Red Sandstone displayed as the Highland Boundary Fault is approached at the southern end of Loch Lomond.

Descending next the steep wooded side of the V-shaped valley of the Murroch Burn to the sound of a cuckoo we found beautiful exposures of dolomitic limestones of the Ballagan Beds and also the first of many old limekilns where this stone had been burnt for use on the surrounding fields. These undulating and nodular beds alternating with fine shales

and mudstones suggested a quiet lagoonal environment in equatorial Carboniferous Scotland. On the surface of some of the more continuous beds dramatic dessication cracks were found indicating the depositional nature of the bed, yet other bands were formed of quite distinct nodules which it was difficult to imagine being formed by anything other than a secondary concretionary process.

As we ascended the burn and descended the sequence we came into more sandy beds with ripple marks indicating a more energetic environment. The shale beds began to show red bands suggesting a drier more oxidising environment. Just beyond a small waterfall and lying on top of these red beds we next came on bands of Cornstones with a distinct upper surface and strange contorted processes running down into the shales. These are thought to represent the chemical deposition of carbonates in a sun dried soil.

These cornstones of the Kinneswood Formation had been taken to indicate the top of the Old Red Sandstone but are found alternating with the "Carboniferous" cementstones. The problem thus raised of defining the transition from Devonian to Carboniferous is not helped by a lack of stratigraphically significant fossils in all these beds. This area is thus now described as Devono-Carboniferous.

Retracing our steps to the site of one of the larger limekilns we turned to the east and scrambled up the narrow Glen Donachy a few yards to find it cut by a N-S dyke of well rotted Markle basalt with Ballagan Beds baked onto its sides and associated with minor mineralisation. Climbing steeply out of this glen we crossed the moor southward with the view of the highlands behind us and suddenly came on the spectacular drop into Auchenreoch Glen. This is a pure V-shaped glen cut 100 meters down through the Ballagan Beds and walled off by a dyke of Markle basalt through which the burn cuts a deep and narrow cleft. In the walls of the glen are displayed the alternating beds of cementstone and shales interrupted by a minor bifurcating dyke and a major fault line.

Having scrambled out of this spectacular glen through the narrow gap in this wall of basalt, a vote of thanks to our leader Jim Morrison by

Judith Lawson was warmly supported by all who had enjoyed this stimulating day.

Minerals, Fossils and Environments in North Ayrshire:- 18th August 1991 (Leader Dr. C. Burton)

The Lower Carboniferous rocks of North Ayrshire provide a rich variety of geology, including extensive subaerially erupted lavas and tuffs, overlain by lateritic soils, together with coals, limestones and slates, all cut by large dykes.

Within this succession can be seen many and varied environments, from forested tropical land surfaces to shallow, tropical seas. The excursion explored these environments together with the extraordinarily diverse assemblages of minerals and fossils to be found in the area.

Glasgow and District:- 1st June 1991 (Leaders Mr. A. A. McMillan, Mr. A. E. Browne)

Emphasis was placed on the Quaternary. Visits were made to Cadder near Bishopbriggs, and the Geilston Burn at Cardross where a variety of glacial, glaciofluvial and glaciomarine sediments were seen. In addition the excursion visited the Ardmore peninsula which boasts one of the finest wave-cut rock cliffs and platforms in the Firth of Clyde.

Roseneath Peninsula and Loch Long:- 8th June 1991 (Leader Dr. Geoff Tanner)

The day was spent looking at Dalradian rocks along a traverse across the Tay Nappe from the Highland Boundary Fault near Kilcreggan, northwards across the D4 Downbend structure and into the Flat Belt. The aim of the excursion was to demonstrate in a simple manner how the complex interference structures seen in the northern part of the traverse developed. This was achieved by studying a few carefully chosen and well-documented exposures in a sequence which passes from simple D1 structures close to the Highland Boundary Fault, to progressively more complex structures (D2-D4) farther north. The latter developed in rocks which were once at a deeper structural level within the nappe pile. These exposures also provide an excellent opportunity to examine and discuss a

variety of small-scale structures such as way-up indicators, minor folds, cleavages, lineations, and veins, as well as glacial features and minor intrusions. For those interested in structural petrology, photomicrographs of the main fabric types were made available for study on the outcrop.

Pease Bay to Cove:- 17th August 1991 (Leader Mr. Alan Fyfe)

The Old Red Sandstone was laid down on a semi-arid alluvial plain, after which marine conditions took over. On this expedition those present looked at the sediments of the Old Red Sandstone and Lower Carboniferous with the aim of identifying the environment of deposition and discovering just what went on in the change from one to another.

Isle of Man:- 29th August to 2nd September 1991 (Leader Dr. D. Hollis)

A full account of this excursion appears in the previous volume of these Proceedings.

Permian Dumfries Basin:- 21st September 1991 (Leader Dr. S. Munro)

The main aim of this excursion was to examine some Permian and Triassic rocks and try to reconstruct as much possible about the environment in which these rocks were deposited.

The party assembled at Locharbriggs Quarry to study the sediments and the structures associated with a Permian aeolian environment. They tried to identify what the climate was like in Permian times and which way the wind was blowing.

The party then drove to Castledykes Park, Dumfries, and had their packed lunches in the rose garden, and then examined the relationships between the aeolian sandstones and the breccias exposed in the faces around the rose garden. This locality is a disused quarry!

They then drove east to Kelhead Quarry, Annan, stopping briefly to look at breccias which are presently being worked for 'limestone'.

They then went further east to Corsehill Quarry, Annan, and examined the sediments and structures in the Triassic, St. Bee's Sandstone and compared these with the Locharbriggs Sandstone.

SESSION 134 (1992)

Glen Orchy:- 9th May 1992 (Leaders Dr. P. W. G. Tanner and Dr. P. R. Thomas)

The aim of this joint excursion with the Edinburgh Society was to demonstrate the presence of a major recumbent fold in the Highlands, a feature often inferred but seldom demonstrated.

The rocks consist of semi-pelites and psammities of the Grampian Group, formerly correlated with the Moine, which show transition upwards into the lowest quartzite and pelite members of the Dalradian Supergroup. A spectacular feature of the river section which was examined during the first half of the excursion is the presence of numerous recumbent minor folds. Together with way-up evidence, the change in vergence of these folds can be used to show the existence of the Beinn Udlaidh Syncline. The age of this fold was discussed with reference to other minor structural features and to microfabrics in the garnetiferous pelite, which was displayed by means of enlarged microphotographs.

In the afternoon the party traversed to one of the corries on the hillside above Glen Orchy to examine minor structures in the Grampian Group and see the evidence for the continuation of the Beinn Udlaidh fold across the high ground between Glen Orchy and Glen Lochy.

Grieston, Meggett and Dob's Linn:- 23rd May 1992 (Leader Dr. B. C. Lintern)

The excursion studied the lithologies, structures and biostratigraphy of a transect of the Lower Palaeozoic turbidite sequence of the Southern Uplands. There was an opportunity to collect graptolites.

The excursion started at Pim Quarry just to the east of Innerleithan. Other localities visited were Thornylee, Grieston Quarry, Cowpeel Bridge, Meggett Water and Dob's Linn. The party returned to Glasgow via Moffat.

Stratiform Baryte mineralisation in the Middle Dalradian Ben Eagach Schist, Aberfeldy:- 6th June 1992 (Leaders Dr. A. J. Hall and Mr. A. Burns)

The excursion visited the central sector of the Aberfeldy mineralisa-

tion where open-cast mining is taking place. The baryte bed is associated with quartz-celsian rock and barian-muscovite schists all enclosed within the host graphitic Ben Eagach schist which is of late Précambrian, Middle Dalradian age. Pyrite, pyrrhotite, galena and sphalerite are found at this locality. Field evidence for the pre-metamorphic origin of the deposit was demonstrated. The site of the proposed underground mine in the eastern sector was also viewed and there was an opportunity to consider problems related to mining baryte in this area.

The Ballantrae Complex:- 27th June 1992 (Leader Dr. P. Stone)

The Ballantrae Complex is an early to middle Ordovician ophiolitic assemblage dominated by serpentinised ultramafic rocks and extrusive volcanic/volcaniclastic sequences. The latter were erupted and deposited in two contrasting settings, an oceanic island arc related to active subduction and a Hawaiian-type within plate volcanic zone. The excursion allowed a comparison of the two sequence types and the opportunity to examine the associated ultramafic rocks. Unconformably above the ophiolitic complex an Ordovician-Silurian sedimentary cover sequence is transgressive northwestwards. Various aspects of the sedimentology and stratigraphy were examined including conglomerates, turbidites, and reef limestones.

Mineralogy of the Clyde Plateau Lavas:- 8th August 1992 (Leaders Mrs. J. MacDougall and Dr. J. G. Todd)

The morning was spent at Loanhead Quarry near Beith where highly altered basaltic lavas of Carboniferous age are cut by a Tertiary dyke. The basic lavas contain a suite of secondary minerals developed in fractures and vesicles. Thirty four species have been recognised of which calcite, prehnite, and thomsonite are the most abundant.

In the afternoon the party visited Muirshiel Mine which can be reached by walking along a good track in a north-westerly direction for 2.5 miles beyond the Muirshiel country park. The lavas in the vicinity of the mine are rhyolites and trachytes of Calciferos Sandstone age. The mine, which was worked for about 200 years, was closed in 1969. Specimens of baryte

can be found in exposed veins and on spoil tips. Strontianite and celestite are rare minerals.

The Malvern Hills and The Severn Valley:- 4th-7th September 1992
(Leaders Dr. C. J. Burton and Dr. J. J. Doody)

The excursion was based (appropriately) at the Rock House Hotel, Malvern, in the centre of an area of remarkable geology and scenery. Geologically the rocks range from the Precambrian to the Pleistocene, with Precambrian igneous rocks and Cambrian, Silurian and Devonian sediments in the Malvern Hills themselves, with Permian, Triassic and Lower Jurassic sediments in the Severn Valley and later Jurassic sediments on the Cotswold Scarp above Cheltenham. Pleistocene sediments cover small areas west of Malvern.

East Kirkton Quarry and the Bathgate Hills:- 19th September 1992
(Leaders Dr. A. J. Hall and Miss. R. McGill)

This excursion was planned in relation to the East Kirkton Symposium held in Edinburgh.

The Lower Carboniferous sequence exposed in the quarry and excavated by the Royal Scottish Museum is interpreted as that of a lacustrine deposit with a hot-spring influence within a volcanic terrain. Its fame stems from its unique early terrestrial biota. The Petershill Limestone, rich in marine fossils, was also visited as well as the nearby site of Hilderston silver mine.

SESSION 135 (1993)

Gargunnock Burn, Stirling:- 8th May 1993 (Leader Dr. W. A. Read, University of Leicester).

This was the annual joint excursion with members of the Edinburgh Geological Society.

The principal aim of the excursion was to use the exposures in the Gargunnock Burn to demonstrate the changing climatic and sedimentary environments during the late Devonian end early Carboniferous, at a time of renewed extensional rifting in the Midland Valley. As rainfall increased, arid desert environments with aeolian dunes and intermittent braided

streams (Stratheden Formation; ?late Devonian), gave place to seasonal, low rainfall climates, meandering rivers and calcic soil horizons (Kineswood Formation; ?Devono-Carboniferous). As rifting continued, low energy, hypersaline lakes (Ballagan Formation; early Dinantian) appeared, followed by more meandering rivers (Downie's Loup Sandstones, Clyde Sandstone Formation). Sediments were finally overwhelmed by extensive alkali-basaltic lavas (Clyde Plateau Volcanic Formation), fed by the WSW-ENE North Campsie Linear Vent System. A major E-W fault, the Abbey Craig Fault, cuts out the topmost part of the sedimentary succession.

In Dinning Quarry a petrographically unusual sill shows abrupt changes in thickness and stratigraphical level of intrusion.

The Lake District:- 28-31 May 1993 (Leader Dr. A. J. Hall)

This excursion, based in Keswick, served as an introduction to the geology of the Lake District. Those who attended saw the volcanic and sedimentary rocks which originated during the Ordovician when much of Scotland was separated from England by about 1,000km of ocean. Although affected by regional deformation and metamorphism, many details of the original lithologies are excellently preserved. The Devonian Skiddaw granite and its thermal aureole with well developed spotted slate and hornfels were visited. Diverse styles of mineralisation were seen and there was an opportunity to look for minerals as well as fossils.

The Solway Firth:- 12th June 1993 (Leaders Dr. M. C. Keen and J. MacDougall)

The party visited localities along the shore of the Solway Firth south of Dalbeattie. The morning was spent at Rockcliffe where the group examined the relationship between the intrusive early Devonian Criffel granodiorite and Silurian greywackes forming the country rock. These are separated from the Carboniferous sediments of the Solway Basin by the North Solway fault; this fault, associated mineralisation, and Carboniferous arkosic alluvial fan deposits were studied at Castle Point just south of Rockcliffe. The second main locality visited was Powillimount, eastwards along the coast towards Dumfries and situated further into the

Solway Basin. There the party saw shallow marine sediments and fluvial sediments of Carboniferous (Dinantian) age. The leaders discussed the development of the Solway Basin, and the distribution of the various facies within it, and considered the basin in its context as part of the Northumbrian Trough.

The Turnberry Coast:- 24th July 1993 (Leader Dr. G. Durant)

Devonian (L. O. R. S.) andesites and basalts crop out along the Ayrshire coast at Dunure, Culzean and Turnberry where they occupy a total area of approximately 15 square miles. They are often highly vesicular and the vesicles are filled by a variety of secondary minerals including the agates which have made this section of coast a haven for collectors.

The volcanic rocks rest upon and are intercalated with sandstones, conglomerates and conglomerates. Fine grained micaceous sandstones occur within the volcanic sequence and the relationship of these to the volcanic rocks is of particular interest. There is debate as to which came first; was the sediment washed or blown into irregular fissures within consolidated lava flows or did the volcanic rocks intrude wet sediment at a high level? The fine grained sediments have yielded a significant number of trace fossils and a specimen of the millipede-like *Kampecaris*. Did these creatures live in the dark recesses within old lava flows or did they inhabit a lake into which magma was erupted?

The excursion consisted of a walk around the outcrops at Turnberry, Culzean and Dunure examining the evidence and debating the pros and cons of the two models suggested.

Schiehallion:- 7th August 1993 (Leader Dr. J. G. MacDonald)

Twelve members enjoyed a day of stimulating geology in the company of Dr. MacDonald who communicated his usual enthusiasm for his subject to all who took part. Our thanks are due for a thoroughly enjoyable day out.

APPRECIATIONS

During the period covered by this volume, two long-standing members of the Society died. They were Miss. Fotheringham and Miss. Brock.

Miss. Margaret M. Fotheringham

Miss. Fotheringham was appointed as an honorary member of the Society in 1990, only months before her death. She joined the Society in 1944, and served on its Council in a number of secretarial capacities for many years. Limited mobility had kept her away from the Society's meetings for a number of years before her death. Well known, and well liked, she will be missed by her many friends.

Elizabeth R. Brock

Miss. Brock, known as "Sally" to her close friends, was the oldest member of the Society at her death in September 1992, aged 97. She was also our longest serving member.

Born in Dumbarton, she moved at age two to the house that was to remain her home until her death. Appropriately enough, this house was known as "Spittal Cottage", apparently named after the source of the flags which formed the front path. Many years later, she was to search for fossil fish in the quarry in the village of Spittal which had given the house its name.

After completing her schooling in Dumbarton, Miss. Brock progressed to the University of Glasgow, where she studied mathematics. As a female student, her degree required to be that of Master of Arts, subject notwithstanding. It was whilst at University that her interest in geology was kindled.

After leaving University, Miss. Brock entered teaching. She first spent a short period teaching in the Hebrides. Thereafter she returned home to teach mathematics to countless pupils in Dumbarton Academy for the rest of her working life. Shortly after this return home, she joined the Geological Society of Glasgow, in 1927. She was a member of the Society for 64 years, eventually becoming one of the rare band of honorary members.

In geology Miss. Brock's interests were wide. She collected mineral specimens in the Lang Craigs near Dumbarton in the heyday of that locality. She collected fossils throughout Scotland and further afield. Though

always stating that she lacked the necessary patience to collect fossils successfully, her collection showed that she was perfectly able with hammer in hand.

Miss. Brock served on the Society's Council as an ordinary member and then for 14 years until 1970 was the Excursion Secretary. This was a period of rapid expansion in the membership of the Society. This was due in no small part to her efforts in attracting additional members, particularly at the exhibition staged by the Society to mark its centenary in 1958.

Outside of geology, Miss. Brock had wide interests in natural history, especially in birds and wild flowers. She was for many years a member of the Andersonian Society (later to become the Glasgow Naturalists). She was the last founder member of the West Dunbartonshire Natural History Society still to attend its meetings. A few years before her death she was active in the establishment of the Dumbarton Natural History Society.

For many years Miss. Brock shared house with another spinster sister. Miss. Brock worked to earn their keep; her sister kept home. Not until the death of her sister, in Miss. Brock's late sixties, did she start to learn to cook. Like anything else which she threw her energies into, she became accomplished at this too. One of my abiding memories of Miss. Brock will always be her efforts to learn to speak German. She was in her 75th year when she started. Her classes involved a twice weekly train trip from Dumbarton to Glasgow. The reason for all this effort? She wished to be able to speak more easily with the locals when she went on her annual walking and mountain flower hunting trip to the Alps!

Always willing to give of her time to encourage newcomers to the geology, especially youngsters, Miss. Brock will be fondly remembered by all those who knew her. With her passing ends a link to the past of our Society. She could remember lectures by all of the great names of Scottish geology before the last war. To many of us who knew her well the Society will never be quite the same place without her.

P.M.M.



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