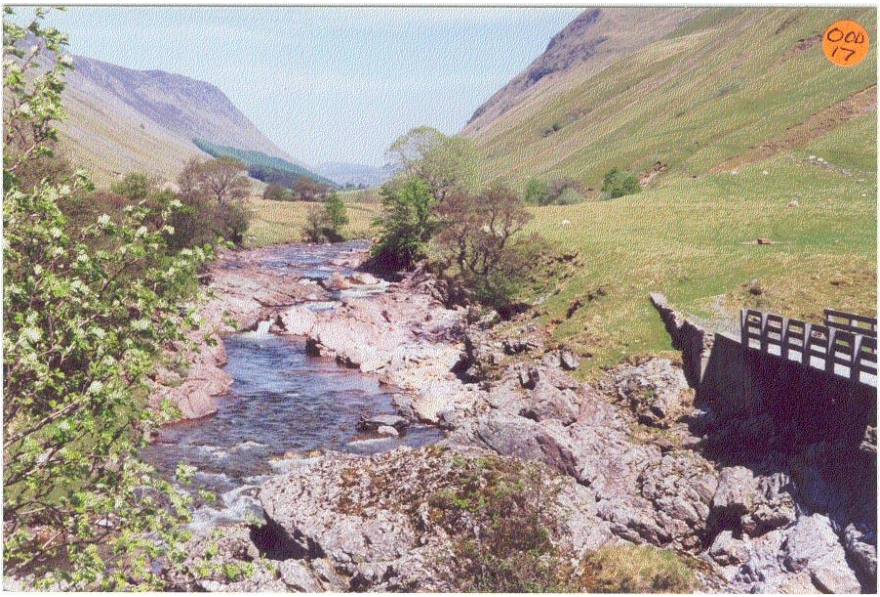
# PROCEEDINGS OF

# THE GEOLOGICAL SOCIETY

# OF GLASGOW



**Sessions 142, 143** **1999 – 2001**

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### SESSION 142 (1999 – 2000)



### SESSION 143 (2000 – 2001)

## SESSION 142 (1999/2000)

### Members of Council

| | |
|---|---|
| President | Mrs Janey MacDougall |
| Vice President | Dr Ben Doody |
| Honorary Secretary | Dr Iain Allison |
| Treasurer | Mr M. H. Aitken |
| Membership Secretary | Mr Charles M. Leslie |
| Minutes Secretary | Mrs Margaret L. Greene |
| Meetings Secretary | Dr J.M. Morrison |
| Publications | Mr Roy Smart |
| Librarian | Dr Chris J. Burton |
| Asst Librarian & Hon. Archivist | Mr W. Bodie |
| Proceedings Editor | Mr David Wilkinson |
| Publicity | Mr Alan Docherty |
| Excursion Secretary | Mrs Rosemary McCusker |
| Rockwatch Rep. | Miss Susan Clark |
| Student Member | Miss G. Bagley |
| Journal Editors | Dr Colin J.R. Braithwaite |
| | Dr Tim Dempster |
| Ordinary members | Mr. John Convery: |
| | Dr. Simon Cuthbert |
| | Mrs. Lindsay Hamilton |
| | Mr. Alistair McKenzie |
| | Mr. Robert McNicol |
| | Mr. Jim Porteous |
| Auditors | Dr Ben Browne, |
| | Mrs Dorothea Blake |

### WEB SITE

The society's web site is at http://www.hamiltonite.mcmail.com/Geology/GSG.html. The site is maintained by David Wilkinson and provides details of our lectures and excursions, as well as links to other sites of geological interest.

## MEMBERSHIP

| | At end Session 142 (30 September 2000) | At end Session 141 (30 September 1999) |
|---|---|---|
| Honorary members | 2 | 2 |
| Life Members | 1 | 1 |
| Ordinary Members | 338 | 346 |
| Associate Members | 73 | 59 |
| Junior Members | 2 | 3 |
| Total | 416 | 411 |
| New Members | 35 | 28 |
| Deletions | (30) | (19) |

The worrying reduction in Junior Membership from two years ago will be addressed by a recruiting campaign in October 2000. Some of the changes in balance of senior members were caused by Ordinary Members transferring to Associate Membership.

**Charles Leslie**

## LIBRARY

This session saw the reorganisation of the Society's library completed, the final operation being the shelving of the monograph collection in the Conference Room (Room 320A/Floor 4 Gregory Building). Thanks are due to those committee members who helped to complete this operation. The library has thus been available for the full consultation and loan service as from January 2000. Prior to the long period of disruption, loans were running at relatively high levels, with a coherent group of users having been built up. However, the lacuna has had the result that disappointingly low numbers of users have been visiting the library. It is clear that the user-base must be rebuilt, and the long-promised leaflet on the Society's Library is now urgently required, in order to promote this necessary growth. The Librarian will be attending to this leaflet as a matter of priority. It should be noted, in this context, that undergraduate use of the library has returned to its normal high rate, and the library is seen by them as a vital resource.

The final remaining library matter to be tackled is that of the Society's rare book collection. This, together with the Division's own collection, forms a unique resource, covering the whole history of Geology and geological writing. Currently, the collection is housed in a number of temporary locations, including the Hunterian Museum, and the task for the coming session is to assemble the collection at an accessible location in the Gregory Building. This will be no easy task, since space is at a premium.

**C. J. Burton**

## SCOTTISH JOURNAL OF GEOLOGY

The Journal has completed another successful year of publication. Along with our usual high standard of technical reports, papers have included a series of invited Millennium Essays that have taken a more personal view of the state and status of geology and the reasons why many of us are drawn to the science.

Although our general membership remains healthy the slow but inexorable decline in our trade subscriptions has continued and is about 8% this year. We will have to increase the cost of our trade subscriptions again to cover increased costs of production and this may prompt a further decline. At least part of our problem seems to lie in the high value of the pound against the dollar. This is, however, an international trend and the only comfort we can take is that we have not fared quite a badly as some others in this respect. What this means is that the two Societies are called upon to support the journal to a greater extent and to increase their subventions. Costs are agreed on a yearly basis with the Publishing House and will increase this year by 3% but it is important to remind members that this is a non-profit making organization.

In an effort to stem this haemorrhage many of the journals within the Publishing House and elsewhere are moving to electronic publishing, whereby copies of the Journal are available on-line to subscribers (in addition to the usual paper versions). The evidence we have is that Journals taking this action fare less badly than those that ignore it. We intend that the Scottish Journal should take this route but such action will also lead to a small increase in costs.

Through the efforts of the Publishing House we have continued to receive wide exposure at six International Conferences, including the Geological Congress in Brazil. In September we were due to appear on a web-based subscription catalogue circulated to around 10,000 libraries and subscription agents, with links to the Society home page.

Our final concern is the rate at which papers are submitted for publication in the Journal. There has been a slowing of receipts in the past year. The good side of this is that we can now offer an even faster publication, with less delay between acceptance and printing, but there are fears that there may not be enough accessions completed to produce particular issues at their usual size. The reasons for this are elusive but are thought to include the forthcoming Research Assessment in Universities that is placing considerable pressure on many would-be authors.

**CJR Braithwaite.**

## PUBLICATIONS SALES

Gross Sales of our Publications together with bought in books, maps, etc. amounted to £2184. About 6% of this amount was taken by the expenses of operating our "Book Department". The profit for the year was £978,

As in previous years sales to members and classes accounted for a substantial part of our sales - about 43% this year. The remainder went to booksellers, BGS, Universities and individuals. It is worth noting that all of these outlets always pay (some a little

later than others) so we have no bad debts or sums written off.
There are no new, Society generated, publications planned except possibly a leaflet style booklet on selected areas around Glasgow.

**Roy Smart**

## TREASURER

**Income and Expenditure Account for Year Ended 30th September 2000**

(Scottish Charity Number SCOO7013)

| **Income** | | | **1998 - 99** |
|---|---|---|---|
| Subscriptions received | £ 4880.00 | | |
| Deduct paid in advance | 48.00 | £4832.00 | £4803.50 |
| Investment Income: | | | |
| Dividends | 369.10 | | 433.60 |
| National Savings | 2083.88 | 2452.98 | 2437.82 |
| Net surplus from publication sales | | 978.19 | 2008.86 |
| Tax refunds (Covenants & Investments) | | 555.93 | 529.07 |
| | | **£8819.10** | |
| **Expenditure** | | | |
| Excursions subsidy | | 107.28 | 25.26 |
| Billets, programmes, postage, telephone, stationery etc | | 1534.62 | 1226.03 |
| Meetings | | 1282.58 | 1816.64 |
| T N George Celebrity Lecture | | 149.95 | 209.10 |
| Library | | 743.29 | 228.00 |
| Insurance | | 399.70 | 316.27 |
| Bank charges | | 20.00 | 10.00 |
| Sponsorship | | 230.00 | 300.00 |
| Scottish Journal of Geology | | 2000.00 | 2000.00 |
| Proceedings of GSG | | 400.00 | 400.00 |
| GSG brochures (5000) | | 364.00 | |
| Affiliation fee | | 20.00 | |
| AGM. - function expenses | 243.00 | | |
| - less ticket income | 219.90 | 23.10 | 15.08 |
| Donations | | 100.00 | |
| Establishing web site | | 32.88 | |
| Mobile phone purchase | | 49.99 | |
| Depreciation on computer @ 20% of cost | | 313.48 | |
| Surplus of income over expenditure | | 1048.23 | |
| | | **£ 8819.10** | |

**Publication Sales Account For Year Ended 30th September 2000**

| | | |
|---|---|---|
| Gross Sales | £ 2184.57 | |
| Deduct Expenses | 138.44 | £ 2046.13 |
| Stock at 1/10/99 | £ 12927.06 | |
| Add Purchases | 602.34 | |
| Publications available for sale | 13529.40 | |
| Deduct stock at 30/9100 | 12461.46 | |
| Cost of publications sold | | £ 1067.94 |
| Net surplus on sale of publications | | £ 978.19 |

**Balance Sheet as at 30th September 2000**

| **Assets** | | | **1998-99** |
|---|---|---|---|
| Debtors for publications at 30/9/00 | | £ 300.45 | £ 563.59 |
| Cash in hand: | | | |
| President | | £ 18.04 | |
| Publications Sales Officer | | 115.50 | |
| Meetings Secretary | | 145.17 | |
| Treasurer | | 13.60 | |
| Cash at Bank: | | | |
| Royal Bank of Scotland Account | £ 2721. 78 | | |
| National Savings Investment Account | 30238.14 | 32959.92 | 30787.28 |
| National Savings Income Bond | | 12000.00 | |
| Investments at Cost | | 1025.70 | |
| Stock of Publication | | 12461.46 | 12927.06 |
| Computer ( at 20% depreciation) | | 940.43 | |
| | | **£ 59980.27** | |
| **Liabilities** | | | |
| Subscriptions in advance | | 48.00 | |
| Uncashed cheques | | 126.74 | 25.00 |
| T.N.George Fund | | 991.97 | 906.97 |
| Due to Secretary | | 31.18 | |
| Due to Membership secretary | | 40.83 | |
| Accumulated fund at 30/9199 | 57693.32 | | |
| Add surplus for year | 1048.23 | 58741.55 | |
| | | **£ 59980.27** | |

We have compared these statements with the books and records presented to us and find them to agree.
We have verified the investment certificates and bank balances held by the Society at the 30th .September 2000

Honorary Auditor **Ben H Browne**
Honorary Auditor **Dorothea M Blake**
Honorary Treasurer **Mervyn H Aitken**

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## MEETINGS

The 142nd Session of the Society included lectures by six invited speakers between October 1999 and May 2000. The session got off to a fine start with the latest TNG Medallist - Professor John Hudson of Leicester University who gave a fascinating talk on the Jurassic of the Inner Hebrides. He was followed by Simon Lamb, author of the book "Earth Story" that accompanied the recent BBC TV series who talked on faults and their effect on landscape.
For the Society, the Millennium started with a Big Bang in the shape of Keith Ingham who delivered a marathon peroration on “The Geology of the Terrestrial Planets”. The earth moved again in February when Alice Walker came through from BGS Edinburgh to give a highly entertaining presentation entitled "Earthquakes Talk". Crises ensued when the March and April talks were both cancelled at very short notice; the first because Mike Benton was fog-bound at Bristol Airport, the next when David MacDonald was detained by family matters. In each case, local stalwarts stepped into the breech - in March, Alan Owen (at a few hours' notice) talked on "Ten Interesting Things about Trilobites", while in April, members were entertained by the exotic double act of Janey MacDougall on the Azores and Iain Allison on Yemen. Members' Night on 11th May brought the session's meetings to a satisfying conclusion.

**Jim Morrison**

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Thursday 14th October
On this occasion the Professor Thomas Neville George Memorial Medal was presented to:

**Professor John Hudson**
University of Leicester

Professor Hudson is a palaeontologist and stratigrapher who has done crucial work on the Jurassic and Cretaceous of the Inner Hebrides, correlating the successions on the various islands with those on the mainland, and conducting extensive palaeontological investigations of these rocks. He is considered to be a Jurassic specialist and his work has included studies on black shales and their geochemistry, and on the wider Jurassic of Britain.

Professor Hudson then addressed the Society on

**THE GREAT ESTUARINE GROUP (JURASSIC OF THE INNER HEBRIDES) AND ITS BEARING ON EVERYTHING ELSE.**

Professor Hudson considered a number of points which arise when confronted with 250m of fossiliferous sedimentary rock with "estuarine" in its traditional name : where the sediment came from, the environments in which it was deposited, the temperature, salinity and fertility of the water, the occurrence of seasonality. He also considered what happened to the rocks subsequently – how deeply they were buried, whether heated by Tertiary intrusions, which minerals were formed during burial, and which lost, and how long these reactions took. One may hope that some of the answers will bear on issues of more than local interest. Together with students, our speaker has been investigating some of these questions in respect of the Great Estuarine Group for over 40 years. He presented a view of the present state of knowledge or ignorance, and indicated some ways forward.

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Thursday 11th November 1999

At the start of this meeting a short Extraordinary General Meeting was held, at which it was agreed to alter words in the Constitution, enabling future new subscription rates to be set without altering the Constitution. Additionally, in order to encourage them to continue membership after graduating, Junior Members were redefined as persons under 25 years of age (previously 21), in full-time undergraduate education or (newly introduced) not more than 4 years after graduating.

**Dr Simon Lamb**, University of Oxford

**"A LANDSCAPE WITH FAULTS"**

The recent natural disasters in Turkey and Greece demonstrate the enormous amount of energy released during earthquakes. Much of this energy results in profound changes to the landscape. During a single earthquake, there may be relative shifts along faults up to several metres. These displacements build up after many earthquakes, displacing both the surface of the Earth and the underlying bedrock. Examples were given of the consequences of earthquakes on major active faults throughout the world, including South America, New Zealand, Greece and Alaska.

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Thursday 9th December 1999

**ANNUAL GENERAL MEETING**

Thanks were expressed to retiring Council Member Dr J.O. Buckman for his contributions to Council and to the Society, and also to retiring Membership Secretary

Mrs J. Willing for maintaining our record of members for nine years, performing this onerous task with diligence and good humour, and ensuring that members received billets and Journals without problems.
The subscription rate was raised to £16 (last raised from £9 to £12 in 1991); Associate Members will be £8, Junior Members £4.
We then held our annual Christmas Social, starting with a quiz game, of geological relevance, and followed by wine, soft drinks, cheeses and nibbles.

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Thursday 13th January 2000
**Dr Keith Ingham**, University of Glasgow

**GEOLOGY OF THE TERRESTRIAL PLANETS**

Nearly forty years of space exploration has provided a major new investigative tool in the study of the planets in our Solar System. Today, at any one time, at least three major projects are underway. We have discovered almost infinitely more about the nature and geology of our nearest neighbours, the terrestrial planets Mercury, Venus, and Mars, during this period than during the whole of recorded history. The high quality of images returned by orbiting satellites, as well as by the Mars lander, have given a wealth of new information about materials and processes on these planets. Tonight's lecture used some of these images, digitally enhanced by the speaker, to illustrate how detailed geological knowledge is elicited from their study and showed that Mars, at least, has been as dynamic a planet as the Earth is at present.

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Thursday 10th February 2000
**Dr Alice Walker**, British Geological Survey, Edinburgh

**EARTHQUAKES**

On average between 200 and 300 earthquakes occur in the UK each year, with around 40 of them felt by the local population. The largest onshore earthquake this century occurred in North Wales in 1994 with a magnitude of 5.4 on the Richter Scale. More recently, in March 1999, a magnitude 4.0 earthquake was felt throughout southern Scotland and into Ireland and caused slight damage in the epicentral area. Offshore, the seismicity can be related to broad geological structures but, onshore, such correlations are unclear. UK seismicity and the hazard it represents were described tonight in the context of UK and worldwide activity.

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Thursday 9th March 2000

**DINOSAURS EVOLVE INTO TRILOBITES ?**

Our March lecture on the "The Elgin Reptiles and the Origin of the Dinosaurs" was due to be presented by Dr Mike Benton of Bristol University. Unfortunately Mike's plane was fog bound at Bristol and regrettably he was unable to attend.
However, the day was saved when Dr Alan Owen from Glasgow University stepped in at the last moment to present a superb lecture entitled "10 Really Useful Things To Do With Trilobites". Alan began with some of the more esoteric uses of trilobites, from North American Indian necklaces to Bohemian Gingerbread moulds, and moved on to discuss the enormous biodiversification in the Ordovician period and the very varied forms it produced. The many species, living through greatly differing time spans, made the trilobites ideal for correlating time zones and terranes, as demonstrated by the great similarity between those found at Girvan in Ayrshire and those of the Appalachians in North America. The ultimate downfall of the trilobites appears to have been what we all suffer from in Scotland – the cold, with the start of a major glaciation period at the end of the Ordovician reducing the number of species from 55 - 60 to only 4 -5. If you are intrigued to know what all 10 things were, then here is the list: Aesthetics, Biodiversification, Biology, Evolution, Correlation, Palaeobiogeography, Palaeoecology, Bathymetry, Extinction and – not least – Entertainment. Many thanks to Alan for coming to the rescue in such an interesting, enjoyable and informative way.

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Thursday 13th April 2000

Our Speaker Professor David Macdonald, Department of Geology & Petroleum Geology University of Aberdeen, was at the last minute unable to attend and so we were rescued by Mrs Janey MacDougall speaking on 'The Azores' and Dr Iain Allison speaking on 'Yemen' at short notice.
The original lecture 'Re-fitting the South Atlantic: is it a simple ocean?' was re-scheduled for November 2000.

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Thursday 11th May 2000
**MEMBERS' NIGHT**

We acknowledge with thanks the contribution of our members noted below to the success of Members' Night :

**Short talks**

| | |
|---|---|
| Alastair McKenzie | "Tales from an exploration geologist : N. Saudi Arabia". |
| Michael Pell | Building Stones of Bath |
| Julian Jocelyn | What is a cairngorm? |

| | |
|---|---|
| Roy Smart | Past Presidents |
| Eric Drew | Three American 'Gems'. |

**Displays**

| | |
|---|---|
| Iain Allison | Sub-Cambrian Soil Profile in NW Scotland |
| Alison Bowdler-Hicks | Ordovician palaeogeography |
| Tim Dempster | Selected Metamorphic Specimens |
| Alan Docherty | Shetland Excursion, September 1999. |
| Margaret Donnelly And Muriel Alexander | Memories of Thera |
| Lindsay Hamilton | Western Australian Thrombolites and Stromatolites. |
| Julian Jocelyn | A Book of Jewels & Citrine Specimens |
| Charles Leslie | Various Society Excursions |
| Janey MacDougall | 'Paper Dragons' – Fold your own dinosaur |
| Alastair McKenzie | 'Roctest' computer-based rock testing |
| Robert McNicol | Belchalow Lignite Mine and glaciotectonics in Poland |
| Jim Morrison | M74 road-cutting |
| Michael Pell | Bath Stone – oolitic limestone. |
| Jim Porteous | Stone-built bridges |
| Roy Smart | Book stall |
| Joan Walsh | Roofing Slates From Around the World |
| David Wilkinson | NE Grampian Excursion, May 1998 |

## EXCURSIONS

During the 142nd Session we had a weekend on Skye, 6 day excursions and the Presidential ten day trip to Germany.

| | | | |
|---|---|---|---|
| 13th May | Glen Tilt | Dr D Stephenson | 28 attended |
| 26th-29th May | Isle of Skye | Dr S Cribb | 28 attended |
| 10th June | St Andrews | Dr C Braithwaite | 29 attended |
| 24th June | Fife Coast | Dr A Hartley | 22 attended |
| 8th July | Mapping | Dr S Kape | 15 attended |
| 19th August | Eastern Borders | Mr W J Baird<br>Mr B Jackson | 25 attended |
| 26th August | Aberfoyle | Dr I Allison | 37 attended |
| 4th-13th Sept. | Germany | Mrs J MacDougall | 34 attended |

The excursion programme was again exceedingly enjoyable, and informative and once again a big vote of thanks is due to all the leaders who gave us so much of their valuable time.
The Presidential Trip to Germany was a new departure and was extremely enjoyable with visits to very interesting places in the field and in museums. The joint trip to Aberfoyle with the Edinburgh Geological Society finished with a meal at Creag Ard House where we had the opportunity to speak with our friends from Edinburgh. The Mapping excursion was another innovation and we hope to repeat this next year with better weather! The weather on the whole was a little better than last year but still not up to our usual standard.
The numbers booking this year were again increased and we had waiting lists for most trips. However several people cancelled at the last minute when it was too late to get someone from the waiting list and some people did not notify me that they were not able to come. This resulted in a higher subsidy to run the excursions. It may be necessary next year to charge the full fare on booking and to make a small charge for those who travel by car to help with expenses.

**Rosemary McCusker**

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**ISLE of SKYE** : 26 - 29 May 2000
Leader : Dr. S.J.Cribb
Report by : *Charles Leslie* Participants : 28

This weekend excursion was "restricted" to the South of Skye within the "Zone of Complication" described by Peach and Horne and by Murchison with thrusting of Cambro-Ordovician rocks over Precambrian Lewisian basement and Torridonian. Large parts of Skye were covered by the Jurassic Sea, while the Tertiary igneous activity which produced the jagged gabbros of the Black Cuillins and the rounded granitic Red Cuillins adds to the "complication"

Friday 26 May, 2000

The main party travelled by minibus from Glasgow and after a short pause to check into the hotel, set out along the Elgol road from Broadford to Cill Chriosd Churchyard at NG 617207. The predominantly sparse and heathery vegetation on the hillside to the South indicated acidic soils but pockets of lush green vegatation suggested limestone pockets. Just beyond the ruined manse, at NG 616201, close to a built wall, the vegetation changed abruptly to heathers indicating the contact between the dolomitised limestone of the ENE plunging Kilchrist anticline and the Beinn Dubhaich granite. At the contact, silicon, aluminium, iron and magnesium were metasomatically introduced into the pure limestones to produce Skarns which provided a host for economic deposits of magnetite and sulphides.

About 50m above the contact, a small marble quarry showed signs of violent metamorphism as a block of the country rock, limestone, was carried up to the roof of a magma chamber and subjected to intense localised heating from all sides to produce roof pendants of marble, near the top of the granite. Like most of the Skye marble,

this was unsuitable for ornamental use, although was economically attractive enough, up to 1914, for it to be transported on a railway ( the only ever on Skye) to Broadford for shipping as an agricultural improver. The working marble quarry at Torrin, which was driven past, produces powder for paint making and small aggregate for road and pavement surface treatments.

Saturday 27 May 2000

Parking the mini-buses at Ord (NG 617131) we set out to see what elements of the Cambro-Ordovician succession were present on this part of the Sleat Peninsula. About 25m to the West of the quartzite summit ( 66m !) of Cnoc na Fuarchad over a small valley, brown rocks of Salterella Grit could be seen. The Pipe rock and Fucoid Beds which lie to thicknesses of 70m and 17m typically between the basal quartzite and Salterella Grit elsewhere in the Cambro-Ordovician succession have been squeezed into a 25m band by some tectonic mechanism. Above the Grits lay grey Ghrudaidh and then creamy Eilean Dubh limestones of the Durness Group. Apart from the "lost" Pipe Rock and Fucoid Beds, the succession seemed complete.

Inspecting mylonite and the Tarskavaig Moine.

A bedding plane covered in white nodules was found on the West side of Rubha Dubh Ard near NG 622141. These are the tops of burrows made by annelid worms which were filled with fine sands before lithification to form Pipe Rock. White "sands" found on the shore are made up of the skeletal remains of the present day algae, Lithothamnion calcareum whose colonies live on the shallow water

covered land reaching out to the island of Eilean Gaineamhach an Arda. To the southwest of the house on the shore, a limestone breccia was found below the hillside while beyond that (at about NG 619139) a coarse red arkose sandstone (Torridonian) was found on top of Pipe Rock i.e. an upside down succession.

After lunch (in light rain) at Ord, we then proceeded to Tarskavaig, to reach the shore via a steep gully at about NG 578083 after a short walk over moorland. A cliff section exposed a planar feature of Mylonite, invaded later by a Tertiary sheet, over a Torridonian sandstone, with, above the Mylonite, what could be metamorphosed "Torridonian", the so called "Tarskavaig Moine". The interpretation of these features was to come later but on the way home, at about NG 680128 on Allt Duisdale "true" Moinian schists were seen, through the hordes of midges, on the line of the main Moine Thrust.

As promised, in the evening after dinner, our leader proposed the following interpretation of what we had seen today for our consideration.

Skye Dyke on Camasunary Burn

Moine rocks were thrust over the Lewisian basement along a "line" from Durness to the Sound of Sleat and beyond, with, perhaps, a suite of Torridonian type rocks thrust over a subordinate Tarskavaig Thrust - the "Tarskavaig Moine". The underlying Kishorn Thrust mainly affected the foreland Lewisian/ Torridonian/ Cambro-Ordovician rocks with the nose of a fold exposing a truncated Cambro-Ordovician succession seen on the summit of Cnoc na Fuarchad this morning. The downward limb of the fold to the West locally overturned the succession as seen just before lunch, with the local Ord Thrust causing lateral displacement.

We were left to ponder the implication of this interpretation.!

Sunday 28 May 2000

Our excursion, today, was to the Strathaird peninsula which yesterday, from Ord, we had seen bathed in sunshine. But not today! Rain had settled in from the West and persisted all day. However, suitably attired, we set off up the path to Camasunary from Kirkibost (NG 544172). This was over Jurassic shales, sandstones and limestones with a capping of Tertiary lavas nearer the summit of the path. Beside the footbridge over the Abhainn nan Leac, at about NG 518185, Torridonian sandstones, indurated by their long ( 900 Million years !) burial were exposed.

Through the drifting rain, the line of the major Camasunary Fault separating us from the Cuillins to the West could be seen disappearing to the North towards Sligachan. Behind the Camasunary "cottage" we turned North across boggy alluvium moving on to bare Torridonian fine grained sandstone which further on was disturbed by dykes of various compositions. This was replaced, quite suddenly, by a coarse gabbro with substantially better grip for climbing - the Eucrite of the OLES ( Outer Layer Eucrite Series).

Stepping Stones on Camasunary Burn

Lunch was taken on ice moulded slabs overlooking Loch na Creitheach at about NG 511194 during a lull in the rain and while gabbro might be good to climb on, it is very uncomfortable to sit on ! As we came off the slabs towards the SW, a patch of bright green vegetation attracted us to an isolated outcrop of limestone at about NG 512 192, on the "wrong" side of the Camasunary Fault. This could be a remnant of the Jurassic cover of the Torridonian or a fault moved block from across

the Camasunary Fault. At about NG 499195 on the East side of Abhainn Camas Fhionnairigh, (hereafter called the "burn") the extrusive sequence of Gabbro followed by cone sheets followed by a dyke was clearly established.

Returning downstream, the burn was crossed safely on partially submerged "stepping stones" at about NG 510192 and, on the wave cut platform, light grey Coire Uaigneich Granite (CUG) was exposed in contact with the darker, greenish plateau lavas. There is evidence that xenoliths of gabbro or Torridonian were partially "digested" by the granite although they probably came from the roof of the magma chamber suggesting the granite was formed near the surface. The granite could have formed from what remained in the magma chamber after the basic extrusive gabbros had gone, to which was added more siliceous material from the incorporation of Torridonian sandstones. However the granite was formed, the sequence of formation appears to have been :- Gabbro (Eucrite), then Granite with xenoliths, then shallow angle cone sheets and finally multiphase doleritic dyke intrusions.

The stepping stones were again safely negotiated, and the party made their individual pace up the path and back to the transport - still in the rain.

Monday 29 May 2000

We reluctantly left our Hotel, (again well chosen by our Excursion Secretary) and headed for home but the geology was not finished yet. In bright sunshine, from the viewpoint on the Sheil Bridge to Glenelg road, the Lewisian Glenelg inlier within the Moine could be seen on the shores of Loch Duich. On closer examination on the shore, near Letterfearn, pods of rarely seen Eclogite were found amongst the gneiss. In the 1960s, a folding episode which affected this area was given a 1100 Ma date by the then developing dating methods while BGS refer to it as "Early Caledonian". Contemporary research may tie the amphibolisation of the Lewisian in the Moine Nappe to the Grenvillian Orogeny dated in Scandinavia and Greenland to about 1100Ma.

All of the areas we saw during our week-end have been extensively studied and our leader tried hard to instil in us some of his enthusiasm in trying to unravel the sequence of thrusts which have produced the varied scenery of Southern Skye.

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**GLEN TILT** : 13 May 2000

Leader : Dr D Stephenson, British Geological Survey Participants : 28

The Society had a fine sunny day for its excursion to Glen Tilt on 13 May. Our first stop in Glen Tilt was at Gilbert's Bridge (NN 881701) to observe the Boundary Slide. This used to be regarded as a major tectonic feature, separating the Moine from the Dalradian. The strain seen in the rocks was attributed to the action of the lower limb of a nappe in the Dalradian moving over the Moine. Immediately below the bridge are strained flaggy psammites, now reassigned to the Grampian Group of the Dalradian. A few yards downstream the psammites are interbedded with meta-limestones. These are assigned to the Appin group. As we could see, there is no stratigraphic break in the sequence, and the Boundary Slide — the region of

strained rocks — is not now regarded necessarily as a major tectonic dislocation. We then went on to Marble Lodge, noting in the river bed pale yellowish rocks which are meta-limestones of the Glen Banvie series of the lowest Appin group. At 904718 we observed in the river bank a thick band of meta-limestone which for a few years about 1800 was extracted for 'marble'.

Next we went to Clachglas Bridge (918727) which is just upstream from where two branches of the Loch Tay Fault unite; the fault then continues NE-wards in a straight line, controlling the direction of the river valley. To the NW of the fault, rocks of the Grampian group are intruded by the Glen Tilt Plutonic Complex. To the SE are Appin Group rocks, with the upper slopes of Beinn a' Ghlo being of quartzite (Ballachullish Subgroup), topographically above the stratigraphically higher Blair Atholl Subgroup rocks and Schiehallion Quartzites and boulder beds of the Islay Subgroup. Outcrops of boulder beds at both top and bottom of the Schiehallion Quartzite show that it occupies the core of an isoclinal recumbent syncline. The bridge at Clachglas rests on a mass of quartzite, right on the Loch Tay Fault line. (Here we encountered a lad who parked his bike on the bridge and proceeded up the hill practically at a run!)

Near Forest Lodge we observed the rocks of the Glen Tilt Igneous Complex — granites and diorites — and found in the river bed a boulder of diorite containing a large angular xenolith of granite which had evidently been melted by the diorite and formed veins in the latter; this was good evidence for the diorite being formed later than the granite. The granite can also show mosaic crystals of quartz, the result of reheating by the diorite. Hereabouts we also noted that the boundary between the granite and the diorite could be gradational. An island in the waterfall at 939747 is formed of an intrusion breccia. This was the site of Hutton's observations in the 1780s on the contacts between granite and country rock, from which he concluded, being the first to do so, that the granite was formed from a magma which invaded the country rock. It was noted that the Igneous Complex lies entirely on the NW side of the Fault, and is cut by the fault. It has been suggested that the position of the western edge of the Complex may be related to an infold of lower Appin Group rocks within the Grampian Group.

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**ST ANDREWS** : Saturday 10th June 2000
Leader : Dr Colin Braithwaite, University of Glasgow Participants : 29

Our excursion started on the beach immediately in front of the St. Andrews Leisure Centre. Within a few minutes of our arrival on the beach, the sun came out and we had a clear view across St. Andrews bay. Colin pointed out the Highland Boundary Fault in the far distance, the cliffs around Arbroath and the Sidlaw Hills (formed from volcanic activity during the Lower Devonian period.) This contrasted with the Carboniferous, basically depositional environment, that we would be examining on this side of the bay. The rocks here were some of the oldest of the Carboniferous with some small volcanic intrusions of Quartz Dolerite by the end of the Carboniferous.

The purpose of the trip, Colin indicated, would be to unravel the depositional environment that had created the geology that we were about to see. The current depositional environment was the first thing of note. The beach sand here was composed of mollusc shells, not cliff sediment which indicated that the beach depositional material was washed in from the North Sea.

The cliffs themselves at this point were made up of thick beds of pale sandstone. Colin pointed out that the dip of these beds was into the cliff face and the large blocks on the beach were due to a land slip that had occurred 5-8 years ago. The pure fine-grained quartz of these sandstones indicated a low lying long distance transport environment where all other rock fragments bar the hardest quartz had been weathered away. The sandstone displayed some particularly striking swirling patterns of red and yellow. These were Leisegang Rings formed by oxides of iron, Limonite – hydrated iron oxide, yellow in colour and Haematite – Iron Oxide, red in colour. Only about 1% of iron in the rocks was needed to create these fantastic patterns.

Further along the cliffs there was an exceptionally good example of cross bedding, indicating a fluvial environment. Colin indicated that to produce such a set of cross beds, some 40cm deep need only take a matter of a few hours. He also pointed out that in addition there was evidence of bioturbation on the surface of some of the sandstone blocks. This type of animal activity would normally only take place in quieter shallow water conditions.

The fact that there were such large depths of sandstone sediment, all laid down in relatively shallow water conditions near to sea level, could be explained by the whole landscape gradually subsiding under the weight of the sediment, allowing further deposition at near sea level. Further along the beach there were some excellent examples of ripple marks. Parallel ripple marks with individual ripples having a symmetrical cross section, explained Colin, were indicative of formation in a shallow pool rather than in a current. A few hundred yards on there were some good examples of small normal faults and evidence of de-watering. This suggested the area had been subject to minor earthquakes.

As the tide receded Colin led us further out onto the rock shore and then dramatically asked us to turn around to reveal a superb anticline structure in the cliffs behind us. We could then make sense of the various bed structures radiating out into the sea. Within the beds on the beach there were black bands of shale and, iron rich carbonate and mussel bands, indicating a brackish water environment, showing we were close to a marine environment. Colin indicated that the best analogy for what we had seen so far was a delta similar to the Mississippi with lots of fingers of sand and with occasional floods breaking the river banks to form brackish inter-channel basins.

All the evidence indicated, Colin concluded, that the whole structure was part of a major river system leading into a deltaic environment that was subject to subsidence and minor earthquakes. This was typical of a rift bounded basin, of which there were many at this time in the Carboniferous.

Our last bit of excitement came when we returned to the bus, to find that despite Rosemary's best efforts, one of our party had escaped and we were one short. After two search parties and a long wait we decided to report our loss to the local police station. Thankfully the person missing was found alive and well at home,

having returned there under their own steam, so all was well in the end.

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**THE FIFE COAST** : 24 June 2000
Leader : Dr Adrian Hartley, University of Aberdeen
Report by : *Monica Thorp* Participants : 22

The purpose of our excursion to the Fife shore of the Firth of Forth, was to look at sediments of the Lower Carboniferous Lower Limestone Formation from the point of view of the petroleum industry. On the Fife Coast are convenient subaerial exposures of the kinds of stratigraphy and structure that petroleum geologists look for beneath the surface.

The coach left Glasgow in fine weather but the further East we travelled the gloomier grew the sky. Our first stop was near the ruins of Ardross Castle, between Elie and St Monans. Here a sea cliff exposes a series of sandstones, siltstones and coal. These sediments were laid down in an Equatorial delta comparable to the Amazon delta of today. The sandstones were deposited as mouthbars, the shales were offshore deposits, while the thin layer of coal represents a time when the area was just above sea-level and formed a swamp.

Dr Hartley explained that several factors are necessary for the formation of an oilfield : a source - algae in marine shale; subsequent burial subjecting the organic remains to pressure and heat; a reservoir of permeable rock into which the hydrocarbons migrate; a seal over this - an impermeable layer such as shale or evaporite; and a structural trap (the result of folding or faulting) that prevents the oil leaking out sideways.

He pointed out that oil companies are interested in how the geology of a potential oilfield will affect production-scale economics. As fluid flow is determined by the combination of structure and rock-type, petroleum geologists look for heterogeneous formations, i.e. a combination of permeable and impermeable rock, structured by faulting or folding in such a way that oil is trapped within the permeable sediment. At the Ardross Castle locality, moreover, the rocks are folded in consequence of the Ardross Fault, a strike-slip fault that runs along the northern shore of the firth. These folds, easily accessible for viewing on dry land, are analogous to the hydrocarbon traps sought by the oil industry, and so provide helpful teaching aids.

All this was explained with the aid of masterly and very extensive sand-drawings and diagrams, executed upside-down from the point of view of the leader. For the impressed members of the Society standing in front of him they were therefore, of course, the right way up. In any geological sand-drawing competition, Adrian Hartley would be a clear winner.

After a chilly lunch at the cliff-top car park at Pittenweem, we went down again to sea level to observe a more porous reservoir rock. Here, larger-grained sandstone was deposited as bars in a higher-energy environment as a lowering of sea-level rejuvenated the river and increased its carrying capacity. Here we saw too that the limestone forms good marker beds that can be traced through many parts of Scotland allowing correlation between different areas. Further along the shore, we

were shown a soft-sediment deformation structure, thought to be caused by the sudden shaking and resultant de-watering of river sand by earthquake activity in the Midland Valley.

We then took to the low cliff-path and were perched on this at an outcrop of limestone - rather impeding the passing dog-walkers - when we spied a spectacular rainstorm rushing up the firth towards us. We scarcely had time to get our waterproofs on before it hit us. The significance of the limestone, and of deep-water and shallow-water corals, and of smashed shells, as evidence of fluctuations in sea level and therefore as indications of cyclothems, suddenly seemed less important than trying to keep dry. Meanwhile, some of the cannier members of the party took the decision to remain on the path - and even return to the bus - while the rest scrambled along the rather steeply dipping and sharply jagged strata on the shore. Eventually, a point was reached at which it was deemed advisable to leap landwards - or slide or be handed down the slippery rockface - to the welcoming sand below.

We then trudged wetly back up to the carpark, thanked Dr Hartley for a most informative excursion, and were glad to take refuge in the shelter of the bus. Those unfortunates who hadn't brought their waterproof trousers with them spent the return journey achieving a state between drenched and merely damp as the windows steamed up. We got back to Glasgow to find it had been a dry, bright day in the West. . . .

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**FIELD MAPPING TRIP - HEADS OF AYR VENT** : 8th July 2000
Leader: Dr. Stephanie Kape assisted by Ruth and Louise.
Report by : *Mervyn Aiken* Participants: 15

The aim of the trip was to make a geological map of the 1 km section of coast around the Heads of Ayr. The weather progressed from a heavily overcast morning to a very wet afternoon. Lunch was a damp and hurried affair.

From the notes:- The volcanics of the Heads of Ayr Vent are Lower Carboniferous in age and comprise bedded tuffs and agglomerate. At the southern end of Bracken Bay are Devonian age lavas in faulted contact with fluviatile Upper ORS sediments. The volcanics intrude the Upper Devonian/Lower Carboniferous cementstone sediments. The vent itself comprises breccias and bedded tuffs (which are folded having collapsed into the vent after deposition).

Thoughtfully Stephanie had provided, in addition to the excursion notes, two blank maps per person - one for immediate on site use; the other to be retained in pristine condition for home completion in full colour. After some initial instruction on how to locate oneself on the map and the correct way to use the compass (appropriately adjusted for declination) and clinometer we were reminded that the dip is always at right angles to the strike direction and to beware apparent dips.

A short walk along a reasonable track from the car park brought us to the starting point at the Upper ORS cliff at the southern end of Bracken Bay. We looked at the pebbles therein and for palaeocurrent markers but did not come to any firm conclusion. Some time was spent measuring the dip and strike of these beds and later from our vantage point we identified the fault on the beach between the ORS

sediments and the Cementstone strata; we tried to trace this and plotted it on our maps. About 100 metres along the shoreline to the north east of this was a Tertiary dyke - monchiquitic basalt - with a trend orientation of 274° and a further 220 metres to the NE was another Tertiary dyke - olivine & dolorite - with a trend orientation of 320° and approx. 5 metres thick. Both were duly notated on the working map.

Moving along the shore to the NE, the outcropping of the Vent was evident. To be seen on the shore were the bedded tuffs, though the Cementstone strata was covered by the tide. There were some good examples of bombs and the associated sags in the tuffs: again dip and strike measurements were taken and duly recorded prior to seeking some shelter near to the Vent for a lunch stop.

At the Heads of Ayr Vent the orientation of the fault cutting through it was measured as were the dip and strike of the bedded tuffs on either side of the fault. Clearly there was a large fold structure in the tuffs. With some difficulty this was also transferred to the map. The eastern part of the fold was found to be truncated by a fault, which had been in part intruded by analcime basalt. More measuring and plotting on map. East of this fault, cementstones are intruded by breccia and monchiquitic basalt; the latter weathering out in black blocky outcrops. Some seemed quite fresh in this location. Approx. 50 meters further to the east another Tertiary dyke intruded 'en echelon' and dipping quite sharply to the NE - a composite dyke with central zoning of olivine-dolerite and an outer of very decomposed tholeiite.

At this point, mid-afternoon, it was suggested that we were "now wet enough to go home"; so we called it a day and made our way back to the car park where a hearty vote of thanks was given to Stephanie, Ruth and Louise for an interesting, informative and very enjoyable day.

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**FIELD EXCURSION TO THE EASTERN BORDERS** : 19 August 2000
Leaders : W..J..Baird and B..Jackson, The Royal Museum of Scotland
Report by : *David Wilkinson* Participants : 25

This excursion took us from Gifford over the Lammermuir Hills looking at Silurian sediments and the Priestlaw granite on the Faseny Water. Further to the South East at Ellemford bridge we examined a trial bore made in 1791 where the local minister claimed to have found and smelted copper ore. At Elba, near Abbey St. Bathans, we looked at three copper mines first worked in 1760.

After crossing the Lammermuir fault on the B6355 we stopped at a roadside quarry in Silurian shales where a hunt for fossils was unsuccessful. The shales, of about 408Ma, are shattered greywacke that does not delaminate easily and although the graptolite “Rhaphidograptus Toenguish” has been found there, it is extremely rare. At Faseny Water (in heavy rain) we looked at exposures of the Priestlaw granite. This was from the late Caledonian orogeny and has been dated at about 410Ma. Copper ores have been found here and there are reports of trial adits upstream from the exposure we looked at, but Bill Baird told us that there were now no traces of these adits. At another roadside quarry (grid ref NT 688 628) we examined what was described as a “type section” of Silurian flute casts.

At Ellemford Bridge, road building in the 18th century exposed mineral ore and a trial bore was made in the 1780s, some evidence of which can still be seen. The 1791 Statistical Account of Scotland says "There are favourable appearances of copper ore. Attempts were made to work it a few years ago; but patience and perseverance were wanting. Some cart loads of ore were dug up in making a road; The present minister smelted some of it, and found it very rich." There is no evidence of copper ore now, however, although there are stringers of baryte. The mineral deposits in this area, which occur in the shear zone, are thought to be probably due to the heating of the granites on the sediments.

At Elba (grid ref. NT 789 608) we saw three disused mines on the bank of the Otter Burn. They were worked in 1760 and again in 1825 but without success. The 1845 Statistical account says "Veins of copper ore having been discovered on the estate of St Bathans, an English mining company obtained right by lease in the year 1825 to work this mineral; but after driving in a single mine, they abandoned the undertaking." Some of the workings are flooded, but one level is accessible and we were able to enter and examine it. This quite extensive working follows a crush zone and we could see green malachite staining on the roof where the mine widened to a substantial cavern. In spite of the damp weather, this excursion was an interesting introduction to an area relatively unexplored by the Society. Bill Baird and Brian Jackson were excellent guides and their enthusiasm gave many of the party a desire to return to the area (in perhaps more clement conditions.

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**QUEEN ELIZABETH FOREST PARK, ABERFOYLE**: Saturday 26th Aug. 2000
Leader: Dr Iain Allison, University of Glasgow
Report by *Stephanie Kape* Participants : 37

The aim of this excursion was to study the rocks along the Highland Boundary Fault in the Aberfoyle area and to consider the geological evolution during the Late Precambrian and Lower Palaeozoic.

Both societies met on a wet, misty day at the David Marshall Lodge. After some hasty additions to the layers of waterproof clothing we were off, our route taking us along the 'geology walk' through the Park.

The Highland Boundary Fault cuts right through the Q.E. Forest Park, trending NE/SW and can be seen as a prominent ridge. We started off on the northwest side of the fault, among outcrops of the Southern Highland Group of the Daradian Supergroup. The first outcrop on the path was of slates with a penetrative cleavage (Aberfoyle Slates). A little further on just off the path in a waterfall we encountered meta-sandstones (Leny Grits). In this area these lithologies are deposited in layers of alternating slates and grits – the numerous waterfalls in general forming over layers of more erosion resistant grit. The grits are interpreted as a turbidite sequence with the thick mud units indicative of a slow sedimentation rate. Upper Dalradian volcanics of the Tayvallich Gp (pillow lavas etc) are often found interbedded and mixed with the sediments (often when the sediments were still soft), suggesting active volcanism during sedimentation. The Dalradian in this area trends

E -W, but is cut by faults oriented NNE/SSW which offset it. These faults are likely to have been transfers to the main Highland Boundary Fault. A little further on along the track, slate with quartz veining was seen. The quartz veining is formed as a result of volume reduction in the slates and mobilisation of the silica. Over a large area, plane strain conditions occur (main compression/extension in two directions only (E3, E1– no change in E2). However, on a more localised scale, non-plane strain conditions are found. These are accommodated by a change in volume of the rock, which leads to the quartz veining seen in this outcrop.

The track had been steadily climbing throughout the forest and at this point we rounded a bend to find ourselves both at the highest point of the walk and facing a quarry with a back wall of Old Red Sandstone conglomerates. We were on/in the Highland Boundary Fault. In this area the Fault is split into two strands, one of which separates the Dalradian rocks from a sequence known as the Highland Border Complex, and a second which separates this from the Old Red Sandstone. The whole fault zone is in the region of 100 metres wide in this area.

An outcrop on the track prior to the quarry was of the Achray Sandstone. This outcrop comprised fine grained sandstones showing a cleavage, interbedded with less cleaved coarser units. Brachiopods and chitinozoa found at this outcrop have dated it as Upper Ordovician. This was the first unit seen of the Highland Border Complex. Lithologies seen in the highland border complex include shales, serpentinite, limestone, a limestone conglomerate and sandstones. A dolerite dyke is also seen within the quarry. These sediments and intrusions represent an ocean floor sequence, that has been caught up in the fault zone during the closure of the Iapetus Ocean. The Achray sandstone shows two types of chitins, one from the Lower Ordovician and one from the Upper Ordovician. This suggests that the Achray Sandstone is comprised of some material reworked from the Lower Ordovician – indicating a very dynamic environment. It is thought that the Highland Border Complex was grafted onto the Dalradian during the Silurian, prior to the final Iapetus closure. The ocean from which the Highland Border Complex derived need not have been particularly large (possibly around the size of the Midland Valley) but had just enough stretching to have generated basalt. A major tilting event occurred in the Midland Valley between the Lower and the Upper Old Red Sandstone. The Dalradian has had at least 10km of overburden removed allowing the succession to appear at the surface. The Highland Boundary Fault was a major lineament, responsible for hundreds of kilometres of dextral displacement, much of it during the Devonian. For this reason the source of the pebbles seen in the Lower ORS in the quarry adjacent to the fault cannot be identified. The composition of the pebbles in the back wall of the quarry are mainly quartzites, of which there is no obvious source in the Present Day – suggesting a landmass adjacent to the fault that has been moved away as the fault slipped. Many of the pebbles seen in the Lower Old Red Sandstone are fractured as a result of the stress caused by the fault movement. For the pebbles to fracture, they would need to have been well cemented, cold, hard and brittle.

The Highland Boundary Fault as seen today is a major reverse fault, with the older Dalradian rocks overlying the younger Old Red Sandstone. The reverse movement on the fault is the latest movement, as the fault finally became a

transpressional structure. The downturn of the Aberfoyle anticline was thought to have occurred at this late stage.

This was the end of the geological part of the day – a slither down a steep grade, used to extract lime for the kilns below, took us back onto the track and we finished off the day with some damp sightseeing at Dukes Pass. It was followed by a magnificent meal on the banks of Loch Ard and a few celebratory drinks! Very welcome after a day with so much good information, unusual rocks and such grotty weather! (with all the facts courtesy of the Leader, Iain Allison).

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**PRESIDENTIAL FIELD TRIP TO GERMANY, SEPT 2000**

Leader : Mrs Janey MacDougall
Report by : *Michael Pell* Participants : 34

To celebrate the end of her reign as President of the Society, Janey MacDougall generously offered to lead a field trip to two geologically fascinating but very different areas of Southern Germany. Consequently on 4th Sept a busload of geologists of varying expertise, accompanied in many cases by their partners, left Glasgow for Hull and thence via P&O to Rotterdam and the first stop at Nordlingen about 100km NW of Munich.

To suit the make up of the party and the particular geological phenomena that were to be seen, the visits were more museum orientated than the normal slog up muddy hills to hidden exposures. A total of six superb museums were visited with displays of major geological significance probably unparalleled in this country and such was the fame and importance of the Glasgow Geological Society that at each one we were greeted by the Director, received an introduction to the museum and its particular exhibits and then taken on a lengthy guided tour, the talks in each case were aimed at making it interesting for our more expert group whilst at the same time holding the interest of the non members who accompanied us. In this, the presenters succeeded totally and what is more disproved the false rumour that Germans are dour people without a sense of humour.

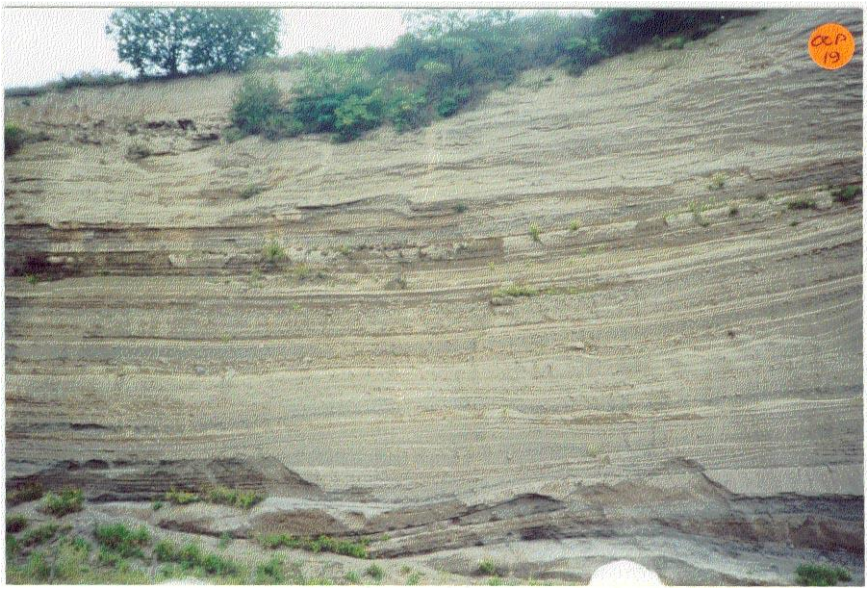
What we saw can be broadly broken down into three main groups : meteorites and palaeontology, Eifel volcanics and precious stones.

In the first part of the trip we were staying in the beautiful small medieval walled town of Nordlingen which is in the middle of a Miocene meteorite impact crater of some 25 km diameter. The result of the impact on the surrounding rocks was studied both in the museums and in building materials used throughout the district. Amongst these was Suevite, formed during the impact which produced a mixture of molten country rock and shattered crystalline basement rocks. The Nordlingen church tower was a fine example of the suitability of this material for durable construction. The other tourists who climbed the tower to enjoy the fine views of the surrounding country, which could be identified clearly as the crater, must have been mystified by this odd group of Brits who were busy with hand lenses (but fortunately no hammers)

peering intently at the stonework of the tower itself.

Also close at hand was another smaller crater but the real interest here was the huge Solnhofen limestone quarry which is still producing a fabulous collection of fossils as well as a very special fine grained, thin bedded limestone used for the lithographic printing process. The converted Archbishop's palace at Eichstatt now houses the Jura museum which has a display of fossils which even held the hard rock group spellbound. The most famous specimen in the museum is a complete specimen of Archaeopteryx which is considered as the connecting stage in evolution between the birds and reptiles. Only six other Archaeopteryx fossils have been found and all of these are from this area which is exciting enough in itself but the preservation is also outstanding with feather imprints also clearly evident.

The return northwards included a visit to Heidelberg en route to our next base in Koblenz. From here we were able to explore the Eifel , one of the youngest volcanic areas in Europe with the last eruption only 11,000 years ago and still active.



Wingertsberg Quarry

The Eifel has been very active since Tertiary times with over 500 volcanoes evident intruding through Devonian oceanic crust. Both basic and acid lavas are found throughout producing in Chris Burton's terminology "Heaps and Holes" topography with the holes left by explosive activity (sometimes water filled "Maars") and the heaps formed by more fluid lavas and scoria cones. We were fortunate to be able to descend via a staircase into a mine cut into a 60 foot thick columnar jointed lava flow which had been worked since the Stone Age. Initially a 39 foot diameter

shaft had been sunk through the 150 foot pumice layer above the lava and then the mine had been worked outwards from the shaft in all directions until by the mid 19th century, the area excavated amounted to 380 football fields, all done by hand all the materials being extracted were brought to the surface through the entry shafts and then reworked locally into building and road materials but most interestingly into large and beautifully made millstones. Today with modern earth moving machinery, the quarry has been converted to open cast operations with the excavation of the pumice from above the lava, and the old workings have until recently provided a home for a brewery whose process benefits from the constant low temperatures at that depth.

Nearby was the Laacher See volcano which was the site of a major explosive eruption some 13,000 years ago which ejected pyroclastic material across much of Europe. In the adjacent Wingertsberg quarry a cross section has been cut through the deposits which are 120 metres thick, all laid down over a ten day period but exhibiting maybe a hundred distinct layers with classic bomb inclusions and variation in colour as the nature of the ejecta changed during the eruption.

It was not all geological studies. We found time to see the Lorelei rock with its romantic legends during a Rhine boat trip which started in cloud but finished in glorious sunshine. We almost got involved in a wine festival but the lure of a look at the Nurburgring motor racing circuit was too tempting to miss. The flying ants that we met there were not part of the fun but that is another story - refer to Charles Leslie for details! The gem museum in Ida Oberstein was a delight to the entire party as we were entertained by yet another enthusiastic Museum Director and shown an incredible collection of precious and semi precious stones which although no longer mined in the locality are still imported and form the basis of one of Europe's biggest cutting and polishing business enterprises. The agate display was breathtaking but the special Tourmaline exhibition really took the prize.

This was a highly successful expedition which everyone in party thoroughly enjoyed and we were all very grateful to Janey for providing the idea and doing so much of the preparation both logistical and geological for it. We know that it is not intended to be a precedent for future retiring Presidents to follow but it would be rather nice…….!

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## INTIMATIONS

With regret we record the deaths of

Mr G.S. Picken, member since Session 119 (1976-77), who died on 10th Nov 1999. Mr Picken had moved to Penicuik some years ago, and usually attended the Edinburgh Geological Society.

Mr G. J. McNellis, member since Session 130 (1987-88), who died in March 2000.

## SESSION 143 2000/2001

### Members of Council

| | |
|---|---|
| President | Dr Colin J.R. Braithwaite, |
| Vice Presidents | Mrs Janey MacDougall |
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| | Dr Jim MacDonald |
| | Mr Alastair McKenzie. |
| | Mr Michael Pell |
| | Dr Joan Welsh |
| Auditors | Ben Browne, |
| | Dorothea Blake |

### WEB SITE

The new address of the Society's web site is http://www.geologyglasgow.org.uk/. The site is maintained by David Wilkinson and provides details of our lectures and excursions, as well as links to other sites of geological interest.

## MEMBERSHIP

| | At end Session 143 (30 September 2001) | At end Session 142 (30 September 2000) |
|---|---|---|
| Honorary members | 4 | 2 |
| Life Members | 1 | 1 |
| Ordinary Members | 338 | 338 |
| Associate Members | 74 | 73 |
| Junior Members | 7 | 2 |
| Total | 424 | 416 |
| New Members | 46* | 35 |
| Deletions | (38) | (30) |

| | |
|---|---|
| * Joining for Session 143 | 33 |
| Joining for Session 144 | 13 |

In this Session, subscriptions were raised, for the first time since 1992.
16 members paid no subscriptions in Session 143, in spite of receiving 3 reminders and thereby ceased to be members on 30 September, 2001 and are included in the above "deletions".
68 (30%) members did not submit new Bankers Orders and subsequently paid at the old rate. After reminders, 47 of those paid "top-up" amounts but the 10 Ordinary Members who had not done so, again after 3 reminders, will no longer receive the Scottish Journal of Geology until their new, £16 subscription is received.
9 payments at a pre-1992 rate and totalling £ 82.50 were considered as donations since all attempts at communicating with the ex-members, through the banks paying the sums, had failed.

**Charles Leslie**

## LIBRARY

The Librarian produced a leaflet with the following information. This was distributed to all members of the Society. Ed.

### THE SOCIETY'S LIBRARY

The Geological Society of Glasgow has a long tradition of furthering the study of Geology, and the Society's library, as an independent unit, has been an essential part of this support for over a century. Since 1976 the libraries of the Society and of the Department of Geology - and its successor the Division of Earth Sciences - have been

combined on one site, today the Gregory Building. Members have full use of this combined library and of the resources of the Library of Glasgow' University, which collectively offer a huge range of titles and subjects.

The joint library of Society and Division is housed within the Gregory Building and, while physically combined, the libraries are still separate entities and the Society retains full control over its holdings. The joint library contains well over 2000 books and 56 current periodicals, as well as a reference section and non~current periodicals.

The stock caters for all tastes and abilities from the beginner to the expert, and from the general reader to the specialist, all of whom are welcome. We provide basic, readable, well-illustrated introductions to our science, guides for field trips both locally, elsewhere in Britain and also further afield, books on fossils and where to find them, on rocks, on minerals, on volcanoes and on every other aspect of the subject. We have geological dictionaries and encyclopedias as well as a wide range of scientific periodicals, including Nature, Science and New Scientist. The library is open to members Monday to Friday, except Public Holidays, 9.00am – 5.00pm, and also 7.00 – 10.00pm on those evening when the Society meets in the Gregory Building. Please note that, as the library is also a teaching room, it may be occupied from time to time during the day. Intending users should consult the notice board outside the room.

The Society's library can be found in the Gregory Building, and is located in two sites. The book collection is in the Conference Room (Room 320NFloor 3) and the journal collection is in the Don Bowes Room (Room 51 0/F1oor 5). A member may have on loan a total of 10 volumes (books plus periodicals) at any one time, loaned material being subject to recall after one month, with a further month's loan if it is not required by another borrower. All material **must** be returned at the end of two months.

To borrow a book simply choose the book that you require and then enter the details (author, title, catalogue number, and your name and address) in the Members' Loan Book which you will find on the bench on your right as you enter the main part of the library. You will also find a stock control card in front of most of the volumes: please put your name on this card, the date, and the initials "GSG" and leave the card next to the loan book. Members are most welcome to browse in the library and the librarian is happy to provide information and help as necessary. The Librarian (Dr. C. J. Burton) or the Deputy Librarian (Mr. W. Bodie) are usually availab1e in the library on meeting evenings, or Dr. Burton can be contacted in Room 521 of the Gregory Building (tel:0141 3305477) and by e-mail (cjb@earthsci.gla,ac.uk) .

A popular service provided by the library is the provision of geological guides or geological details of holiday areas - given some notice the librarian can usually track down a map or an itinerary for the geological traveller. The librarian also welcomes suggestions for additions to the stock, so if you cannot find the book that you want ask him to add it to the purchase list.

Wide-ranging as our library is, it cannot begin to approach the size and range of the University Library, which has over a million volumes covering all subjects and all available to members. Members of the Society are entitled to use the University Library as "Institutional Members" on production of a receipt for their current subscription which can be obtained from the Secretary (sae please with request).

There is no fee for the use of the University Library, and members can borrow up to 12 volumes on any subject (not just Geology) at any one time. In some cases the Issue Desk staff may be unaware of this arrangement, and if this is the case the staff should be asked to refer to Mr. J. N. Moore of the University Library.
This brief introduction merely serves to identify and locate the library and the librarians – the next step is up to you, come and see for yourself what we have on offer and remember, it is your library and exists for your benefit!

**Chris Burton, Society Librarian.**

**Division of Earth Sciences**
**DIVISIONAL LIBRARY**

**Information and regulations for members of the Division.**
**The Geological Society of Glasgow and other University departments.**

**ACCESS:**
***Members of the Division :*** The library is situated in the Conference Room (Room 320A). The library is open for undergraduates from Levels 2, 3 and 4, and postgraduates and staff. The technician in charge of the library is Mrs. S. Tierney. The library is open at all times, except when being used for teaching or meetings. and is permanently booked for undergraduate use between these times. The notice board by the door provides information on bookings. Please ensure that you look at the booking form before entering the room.

***Members of the Geological Society of Glasgow :*** The library is open between 9.00am and 5.00pm Monday - Friday, except public and University holidays. On the evenings of Society meetings the library is open between 7.00 pm and 10.00 pm; at other times by arrangement with the Hon. Librarian of the Society.

***Members of other Departments:*** The library is open for consultation to staff members and research students of any other University department between 9.00am and 5.00pm, Monday – Friday.

**LOANS:**
For those entitled to borrow, all books and periodicals may be borrowed. Periodicals are housed in Room 510.

**LOAN LIMITS:**
***Division of Earth Sciences:***
**Academic staff and postgraduate students:** May have up to a total of **TEN VOLUMES** (books + periodicals) from the library at one time.

**Undergraduates in Levels 2, 3 and 4.** May borrow **FIVE** such volumes from the library at one time.

Material borrowed **MUST** be entered by the borrower in the *Divisional Loan Book.* Cards in the books must also be signed and left next to the Loan Book.

**Members of the Geological Society of Glasgow:** Members may borrow up to **TEN VOLUMES** (books + periodicals) from the library at one time. All loans should be signed out in the *Members' Loan Book.*

**REGULATIONS:**
Loaned material may be recalled **after one month**, but **must** be returned before, or at the completion of **two months** loan. Requests for recalls should be handed to Mrs. Tierney.

**C.J.Burton.**

## SCOTTISH JOURNAL OF GEOLOGY

In the past year the Journal has survived rather than prospered. The significant fall in the number of papers submitted for publication followed a general downward trend but accelerated towards the end of 1999. The only explanation for this that has been advanced so far is concerned with the research assessment exercise (RAE) in Universities. The interpretation placed on the decline is that people who might normally have submitted to us were directing their efforts to higher profile International Journals in the hope of increasing their RAE rating. This may or may not be the only explanation as it appears that a similar trend is affecting other Journals including some in N. America.

The first issue of this year (37/1) was, at 42 pages, a little under half our normal size. However, we seem to be making a good recovery and 37/2 is expected to be around 80 pages. We have a reasonable number of manuscripts in hand and are making strenuous efforts to increase submissions by targeting appropriate conferences and seeking thematic sets. We are optimistic that 38/1 will return to normal size. The plus side of this is that for the moment we have no backlog and, for authors offering few editorial problems, can offer a very rapid passage to publication. A fault-free submission could be in print in as little as 9 months.

The number of Trade subscriptions has again fallen. At the end of October it stands at 182 as against 190 in 2000. However, once more this 4% fall is at the lower end of the attrition rate of other Journals.

In 2002 the SJG will go online and members will have direct electronic access through a personal password. Authors will also be able to download copies of their text onto their own websites. The Journal will "piggyback" on the Geological Society's Journals and will therefore save the set-up cost of £7,500. Ingenta, the organization responsible will supply data that will track those accessing the site.

**CJR Braithwaite, T Dempster**

## PUBLICATIONS SALES

Once more, I wish to acknowledge the support of members who buy our publications, usually at the meetings. Maps have been popular; also two of the Historic Scotland titles, Slate Quarries and Quarries of Scotland. I should mention too, good sales to Extra-Mural Classes, many of whom become members of the Society. On the Commercial side, sales to bookshops and Universities have continued well. The Arran Guide has been on sale in no fewer than eight separate outlets on the island. On the other hand there is only one sales point in Skye, yet that Guide has sold well there. Stock of the Skye Guide is virtually exhausted; we are in discussion with the authors as to reprinting or revising. The Publications produced a profit of £694 this year.

**Roy Smart**

## TREASURER

**Income and Expenditure Account for Year Ended September 30th 2001**

Scottish Charity Number SC007013

| **Income** | | | **1999 - 00** |
|---|---|---|---|
| Subscriptions received | £ 6563.01 | | |
| Deduct paid in advance | 652.00 | £5911.01 | £4832.00 |
| Investment Income: | | | |
| Dividends | 446.02 | | 369.10 |
| National Savings | 2179.53 | 2625.55 | 2452.98 |
| Net surplus from publication sales | | 694.77 | 978.19 |
| Tax refunds (Covenants & Investments) | | 718.94 | 555.93 |
| Excursions - day trips | | nil | (107.28) |
| AGM. - Ticket income | 212.00 | | |
| - Function expenses | 178.19 | 33.81 | (23.10) |
| | | **£ 9984. 08** | |
| **Expenditure** | | | |
| Billets, programmes, postage, telephone, stationery etc | | 1266.26 | 1534.62 |
| Meetings | | 1677.32 | 1282.58 |
| T N George Celebrity Lecture | | nil | 149.95 |
| Durness - Hotel & hires | | 1694.50 | |
| Library | | 460.00 | 743.29 |
| Sponsorship | | 350.00 | 230.00 |
| Scottish Journal of Geology | | 2500.00 | 2000.00 |
| Insurance | | 386.62 | 399.70 |
| Donations | | 200.00 | 100.00 |

| | | |
|---|---|---|
| Geology Week | 59.40 | |
| Bank charges | 15.00 | 20.00 |
| Affiliation fee | 22.00 | 20.00 |
| Depreciation on computer @ 20% of cost | 313.48 | 1048.23 |
| Surplus of income over expenditure | 1039.50 | |
| | **£ 9984.08** | |

**Publication Sales for Year Ended September 30th 2001**

| | | |
|---|---|---|
| Gross Sales | £ 3133.49 | |
| Deduct Expenses | 223.31 | £ 2910.18 |
| | | |
| Stock at 1/10/00 | £ 12461.46 | |
| Add Purchases | 1796.29 | |
| Publications available for sale | 14257.75 | |
| Deduct stock at 30/9/00 | 12042.34 | £ 2215.41 |
| Cost of publications sold | | |
| Net surplus on sale of publications | | £ 694.77 |

**Balance Sheet as at September 30th 2001**

| **Assets** | | | **1999-00** |
|---|---|---|---|
| Debtors for publications at 30/9101 | | £ 290.90 | £ 300.45 |
| Cash in hand: | | | |
| J.E.MacDougall | | £ 132.97 | |
| Secretary | | 30.03 | |
| Publications Sales Officer | | 9.99 | |
| Cash at Bank: | | | |
| Royal Bank of Scotland Account | £ 3981.69 | | |
| National Savings Investment Account | 32417.67 | 36399.36 | 32959.92 |
| National Savings Income Bond | | 12000.00 | |
| Investments at Cost | | 1025.70 | |
| Stock of Publication | | 12042.34 | 12461.46 |
| Computer (at 20% depreciation) | | 626.95 | |
| Money due to Society | | 23.03 | |
| | | **£ 62581. 27** | |
| **Liabilities** | | | |
| Subscriptions in advance | | 652.00 | 48.00 |
| Uncashed cheques | | 789.19 | 126.74 |
| Monies due by Society | | 114.20 | |

| | | | |
|---|---|---|---|
| T.N.George Fund | | 1015.00 | 991. 97 |
| Due to Meetings Secretary | | 229.83 | |
| Accumulated fund at 30/9/00 | 58741.55 | | |
| Add surplus for year | 1039.50 | 59781.05 | |
| | | **£ 62581.27** | |

We have compared these statements with the books and records presented to us and find them to agree.
We have verified the investment certificates and bank balances held by the Society at the 30th. September 2001

Honorary Auditor **Ben Browne**
Honorary Auditor **Dorothea Blake**
Honorary Treasurer **Mervyn H Aitken**

## MEETINGS

The 143rd Session of the Society included lectures by six invited speakers between October 2000 and May 2001. The session started with Dick Kroon of Edinburgh University telling us how margin collapse related to the K/T extinctions in the North Atlantic. He was followed by David MacDonald from Aberdeen University shifting the focus to the South Atlantic and its plate tectonic origins.
In the New Year, Brian Bluck , our 'local worthy' for the session, stayed in the Southern Hemisphere with a visit to the Orange River of South Africa. In February, Mike Benton from Bristol took us nearer home with a talk about the Elgin reptiles and the origin of dinosaurs. The Joint Celebrity Lecture was delivered by Richard Fortey of the Natural History Museum on the subject of bringing trilobites back to life. Members' Night on 19th April maintained its recent high standards and Jane Francis from Leeds University brought the session's meetings to a satisfying conclusion by telling us about the fossil forests of Antarctica and earlier greenhouse effects.

**Jim Morrison**

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Thursday 12th October 2000.
**Dr Dick Kroon**, University of Edinburgh

### MARGIN COLLAPSE AND INSTANT MASS EXTINCTION AT THE CRETACEOUS/TERTIARY BOUNDARY IN THE NORTHEAST ATLANTIC

The Cretaceous/Tertiary (K-T) boundary was drilled several times along Blake Nose in the western North Atlantic during Leg 171B of the Ocean Drilling Program. The boreholes document a complete K-T sequence with evidence of impact-related

sediment and mass extinctions of several groups of plankton. Dr Kroon showed that the mass extinction of plankton is directly associated with the impact, although some reworking needs to be taken into account. Reworking and 'mass wasting' in the form of turbidites and slumps appear to be tightly related to the impact. Seismic reflection data combined with drilling results document regional-scale slumping. Maastrichtian chalk is folded and fractured below the K-T boundary at all Blake Nose sites. Correlation of core to seismic reflection data indicates that the K-T boundary immediately overlies seismic facies characteristic of mass wasting on a huge scale. Mass wasting occurred on the Blake Nose > 1600km from the Chicxulub crater in response to the cataclysmic seismicity generated by the impact. Dr Kroon further showed evidence that mass wasting deposits were possibly very wide spread, which suggests that the Chicxulub impact destabilized the entire eastern seaboard of North America, creating one of the most extensive mass wasting deposits on Earth.

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Thursday 12th November

**Professor David Macdonald**, Department of Geology & Petroleum Geology University of Aberdeen and on behalf of the South Atlantic Geological Research Group

**RE-FITTING THE SOUTH ATLANTIC : IS IT A SIMPLE OCEAN?**

This talk explored the consequences of the Falkland rotation hypothesis for the evolution of the South Atlantic. In Gondwana reconstructions, there are good fits of major continents and poor fits of microcontinents. The Falklands Plateau was assumed to be a rigid fragment of South American crust, in the former group. However, there is evidence for rotation of the Falkland Islands by ~$180^0$ after 190 Ma, making it unlikely that the plateau behaved as a rigid structure during breakup. It now appears that in the Late Palaeozoic, the Falkland Islands lay east of Africa, the plateau was ~33% shorter and Patagonia was displaced east with respect to the rest of South America. The Falkland block moved by clockwise rotation before the Late Jurassic. Rotation was accommodated by a strike-slip fault system; other terranes may have been split elsewhere. To study this, Professor Macdonald and his colleagues have revised the position of the ocean-continent boundary for the South Atlantic to produce a new close fit of Africa and South America. In order to produce the best fit, it is necessary to split South America into four plates. The consequences of this are far-reaching.

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Thursday 14th December 2000
**ANNUAL GENERAL MEETING**

Thanks were expressed to retiring Council members J.S. Convery, S.J. Cuthbert, R. McNicol and J. Porteous, for their willingness to participate in events and for their contributions to the work of Council and the Society.
After the business of the AGM,

The President**, Mrs Janey MacDougall**

addressed members on the subject of

**"BUILDING BY NUMBERS"**

"The waves of the sea, the little ripples on the shore, the sweeping curve of the sandy bay between the headlands, the outline of the hills, the shape of the clouds, all these are so many riddles of form, so many problems of morphology, and all of them the physicist can more or less easily read and adequately solve …". So wrote D'Arcy Wentworth Thompson in his classic work "On Growth and Form" published as long ago as 1917. Are al1 the effects of nature only the mathematical consequences of a small number of immutable laws`? This question was explored in the President's address to the Society.

This was followed by our annual festive event with wine, soft drinks, cheese and nibbles.

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Thursday 11th January 2001
**Professor Brian T. Bluck**, University of Glasgow

**THE ORANGE RIVER AND THE TERTIARY HISTORY OF SOUTHERN AFRICA**

The Orange River drainage, a major conduit for diamond dispersal, is the largest in southern Africa. It has been responsible for building part of the African Atlantic margin since the Cretaceous, when a major deltaic complex formed near its present mouth. The present channel, for extensive reaches, is meandering and incised into basement rocks with a loop scale inherited from the late Cretaceous river. The history of incision is recorded in the changing sediments which have accreted since Eocene times along the coast and on the continental shelf. The incision is a consequence of the rise of southern Africa by 500-800 m, and along with this uplift there developed the most vigorous and long-lasting, longshore drift system in the world.

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Thursday 8th February 2001
**Professor Mike Benton**, University of Bristol

**THE ELGIN REPTILES AND THE ORIGIN OF THE DINOSAURS**

Dinosaurs arose in the Late Triassic, some 230 million years ago. The first dinosaurs were small rare animals and yet, ten million years later they were large, abundant and diverse. What happened? A new study on Scleromochlus, a little creature the size of a blackbird, from the Lossiemouth Sandstone Formation of Elgin, NE Scotland, has shed light on the evolution and ecology of the origin and early radiation of the dinosaurs. Fossil reptiles are found at the base of these Early Triassic rocks, but are readily damaged on removal, as the rocks are much harder. Professor Benton overcame this problem by filling the mould thus created with PVC which could then be easily removed and manipulated. Numerous fossils have been isolated from here, similar to finds in South Africa and South America, at a time when the North Atlantic was beginning to open and a seaway existed between Scotland and western South America, in contrast to English sites which are of Mid -Triassic age. In the 1980's, cladistics showed that the origin of the dinosaurs was mono- and not polyphyletic and that all dinosaurs evolved from the same small reptilian ancestor. They underwent an evolutionary radiation at the Mid/Late Triassic Boundary, following the Permian extinction and environmental change, to fill every ecological niche, just as did the mammals later, after the K/T extinction.

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Thursday 8th March 2001
Joint Celebrity Lecture with the Edinburgh Geological Society

**Professor Richard Fortey,** Natural History Museum, London

**BRINGING TRILOBITES BACK TO LIFE**

Trilobites were first described in the first Royal Society Journal of 1679 by a Mr Lloyd, discussing the large numbers in rocks at Llandeilo, so they were in at the beginning with Galileo and Copernicus! In the 1770's there was speculation about their anatomy and life-styles - grazers and predators were recognised, it was thought they had three pairs of legs, but no real evidence existed. From 1876, Doolittle Walcott did much research, grinding them down to see the underside for the first time. They have three lobes from left to right : head, thorax with individual segments each with a pair of legs and a branch gill, and a tail with fused segments . They utilised fully the properties of calcite – each lens of their prominent compound eyes was on a plane of crystallisation. Some eyes were huge and on each side of the head providing lateral vision, while some could see through $360^0$ and almost met at the front.
Huge numbers (truck fulls!) of trilobite fossils have been found, from the mid Cambrian explosion to the Late Ordovician, when they gradually declined to the Permian extinction. They must have had a soft bodied ancestor and a long unknown

evolution, and may be analogous to shrimps, horse-shoe crabs and sharks.
They occupied many habitats : shallow marine carbonate reefs, continental shelves or slopes (mud, slate, chert) - in Spitsbergen and N America/Scotland (on the equator in the Ordovician), and in England/Europe (high southern cold water latitudes). Benthic dwellers were broad and flat with sledges on the head, while predators were long, slim, streamlined and muscular. The mouth was high in the head with a plate or hypostoma with weird adaptations such as horns in predators, or was lightly fixed with a membrane – a scoop for sediment feeders. Some were free hanging, filter/suspension feeders, as in the non-bioturbated shale/sulphur beds of Utah – did they live, as at black smokers, by cultivating sulphur bacteria on their gills, in anoxic conditions? In these the hypostoma is degenerate and almost gone. Some of these have 'balloons' at the front of the head. Is this a brood pouch like the yokey eggs of horse-shoe crabs? They may have been dimorphic. The many species of trilobites were very prolific and the seas must have been teeming with them!

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Thursday 19th April 2001

**MEMBERS' NIGHT**

We acknowledge with thanks the contribution of our members noted below to the success of Members' Night :

**Short talks**

| | |
|---|---|
| David Wilkinson | Excursion to Germany, Summer 2000. |
| Jim MacDonald | Hawaii – real estate and retirement |
| Brendan Hamill | Origin of the Loch Leven basin |
| Janey MacDougall | Tales from the land where the rainbow shines at midnight |
| Simon Passey | Geology of the Faeroe Islands |

**Displays**

| | |
|---|---|
| David Wilkinson | Excursion to Germany, Summer 2000 |
| Brendan Hamill | Origin of the Loch Leven basin, specimens and thin sections |
| Janey MacDougall | Display on Alaskan geology and the Trans-Alaska pipeline |
| Simon Passey | Geology of the Faeroe Islands |
| Charles Leslie | Excursions Summer 2000 – Germany, Glen Tilt, St Andrews and Skye |
| David J. Brown | Why breccias are so good ! |
| Bill Lamb | Display of brochures from National Parks in the USA re Excursion proposal |
| Roy Smart | Book stall |

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Thursday 10th May 2001
**Dr Jane Francis**, School of Earth Sciences, University of Leeds

**THE GREENING OF ANTARTICA : FOSSIL FORESTS OF ANTARTICA AND EVIDENCE FOR FORMER GREENHOUSE CLIMATES BEFORE GLACIATION.**

Dr Francis has recently returned from Antarctica where her research focused on its ancient climates, particularly during the Permian, Cretaceous and Tertiary. Her lecture painted a vivid picture of an Antarctic world very different from that of today, when the Equator-to-pole temperature gradient was much shallower, due largely to much warmer poles. Antarctica was mainly devoid of permanent ice, but the light regime was similar to that of the present with prolonged periods of winter darkness. Studies of the morphology of fossil leaves and vegetation reveal that Antarctica supported luxuriant forests dominated by deciduous plants which would have required a sufficient supply of rainfall.
Dr Francis has also studied Tertiary forests and climates of the Arctic, examining the fossil forests in order to reconstruct their tree types, forest dynamics, sedimentary environments and climates.

## EXCURSIONS

Foot and Mouth Disease. As a result of the outbreak in the UK of FMD early in 2001, restrictions were placed on people's access to the countryside. Excursions were curtailed to those along beaches or with limited access provided we followed the disinfection rules. Ed.

Originally, seven day excursions were planned for this Session, but because of the foot and mouth outbreaks, the first one had to be cancelled and the some of the others modified. The six that were run were a great success due to the initial organisation by the Excursion Secretary and the enthusiasm of the leaders. Sadly, however, the Excursion Secretary was unable to attend any of the excursions because of injuries sustained in the May crash. ( See Intimations, p. 50, Ed)
In the aftermath of that crash, contact numbers were requested from all members attending excursions with a duplicate list of attendees residing with a "contact" in Glasgow.
In spite of all the difficulties, an average of 18 attended the excursions but with coaches unfilled, costs to individual members were higher than normal and we managed to break even only because of their contributions and the forfeited deposits of those who could not attend. Rain forecast on the excursion days seldom reached us and indeed we enjoyed several "shirt sleeve" days. Well done, Rosemary, on your choice of venues and dates.
Our joint excursion to St Andrews, organised by the Edinburgh Society and at which we had 23 participants, included an interesting walk around the city to see the

building stones and where great men of science had lived as well as an examination of shore line geological features. A fitting ending to the excursion series was the high tea in St.Andrews with the Edinburgh Society who are to be congratulated for their organisation of the event.

**Charles Leslie** (for Excursion Secretary)

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**THE RIGS OF THE LOTHIANS** : 16 June 2001
Leader: Mike Browne, British Geological Survey
Report by : *Seonaid Leishman* Participants : 15

R I G S stands for Regionally Important Geological Sites where the geology is conserved (sometimes with great difficulty) and promoted. The Lothian and Borders RIGS Group (part of Edinburgh Geological Society) have, to their credit, managed the designation of some sites and on 16 June, Mike Browne, Chair of the Group, took us to see three of them.

This was an excursion for those of us who do not want to be too far from a coffee, a loo, or even the weekend shopping!!

At the Dreghorn Link cutting, the bus was parked beside a Little Chef and we distinguished the localities by counting lamp posts, using for interest the Civil Engineering students' guide. It certainly made us appreciate engineers' problems - the best exposure of laminated mudstone was bricked up and the sandstone dipping into the road was pinned. We saw good examples of Upper Old Red Sandstone rock types and formations such as faults and folds.

Then to Sainsburys supermarket inside Craigleith Quarry. The sandstone from here (early Carboniferous, Strathclyde Group) was used for building much of the City of Edinburgh, particularly the New Town. Once the quarry was no longer in use there was an opportunity, with the development of the site by Sainsburys, to preserve an interesting rock succession. The fossilised Carboniferous trees (Pitys Withami) had already been taken to the Edinburgh Botanic Gardens but you can see carvings of Carboniferous leaves and stems on the supermarket wall! The sandstone was deposited by rivers flowing from what are now the Pentland Hills and Southern Uplands and the mudstone, including oil shale, built up on the lake bottom. On the section we saw good examples of soft sediment deformation (shaken by earthquakes?) forming pillow-like structures.

Our last stop was at the sea-side - Joppa beach - for which the RIGS Group have produced not only a leaflet and poster, but a board on site displaying the geology of the Midlothian Syncline. Because of the dip of the Upper Carboniferous rocks, it is possible to walk across exposures of Upper Limestone, Passage Formation and Lower Coal Measure in a few hundred metres. There too we saw interesting soft sediment deformation and the remains of the coal.

We were very impressed with all the work that the Edinburgh Geological Society has put into these RIGS. Mike Browne was an excellent promoter and suggested we take some of this enthusiasm back to Glasgow. We could start by identifying sites in the West that would interest the public, are easy to interpret and

access, and where landowners are supportive. It would be good to emulate Edinburgh on this, wouldn't it!

Craigleith Quarry, Sainsburys

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**KINGSBARNS-RANDERSTON** : 14th July 2001
Leader: Dr C. Braithwaite, University of Glasgow.
Report by : *Margaret Donnelly*. Participants: 15

We left Glasgow in steady rain on a dreich morning, but as we neared the east coast, it dried off, the sun began to appear and our spirits lifted.

Kingsbarns is situated 6 miles south of St. Andrews and we met our leader in the shore car park beside the Kingsbarns Fault which separates the Cambo Sands (Upper Old Red Sandstone) from the Lower Carboniferous (Calciferous Sandstone Measures) to the north. We walked along the coastal path beside the golf course and went on to the beach just south of the Cambo Fault where the Lower Carboniferous is again thrown down to the south. Standing on a bed of pale and smooth calciferous sandstone, between two small inlets where the sea had removed the soft shale beds, a succession of shales, limestones and sandstones could be seen dipping away to the southeast. Our plan for the day was to examine the repeating successions of these beds and to work out the conditions of deposition.

At our feet was a fossil root (stigmaria) of lepidodendron with the small

rootlets still in life position. We moved south past the eroded shale to a bed packed with shells interlaced with mud. These were all of the same bivalve (Schizodus), suggesting restricted, calm, shallow water conditions - possibly a tropical lagoon. It may have alternated between hypo/hyper saline, with sea water evaporation or freshwater input. Immediately above were laminated shales, topped with a thick sandstone whose cross-bedding indicated the direction of current (from the north). The sandstone was poorly cemented and consolidated, with a line of green photosynthetic bacteria just below the surface, a truncated top, and small rounded, equidimensional quartz grains - it had been laid down quickly, perhaps in only a few hours, and its source was far away. We were looking at merely a snapshot of the entire deposition process.

Several limestone beds were heavily stained red (haematite, siderite), and contained a selection of fossil shells including Sanguinolites and Naiadites, showing improved living conditions. Elsewhere there were mudcracks, fossil roots, trace fossils, and one lucky member found a sizeable piece of stigmaria. A little further on was the bed of stromatolites, better exposed than previously by the shifting sands, and with several loose samples lying about (to our delight!). The dip of the beds had changed as we crossed the Randerston syncline. We climbed the cliff to see this syncline to the north, an anticline to the south and a dome structure between. One theory suggests that the dome reflects the presence of a subterranean volcanic vent, and there are several doleritic erratics from the local Fife area lying along the shore.

During the Lower Carboniferous, this area was one of meandering rivers, deltas and swamps, with changing sea-levels as basins subsided along faults, filled in with sediment (also causing subsidence) and then the land became emergent. It was a tropical environment of changing wet/dry conditions, with high mountains to the north and sea to the south and east. In some beds, rounded formations show where wet sediment has been destabilised, and sheets of iron precipitates are upsurged and folded. These sediments were laid down quickly, and there possibly were earthquakes. The sandstone grains suggest a distant source, there are no clasts of schist (and so not from the local Scottish Highland mountains) : these huge river systems may have originated in what is now Scandinavia.

We retraced our steps along the shore and the golf course, having had an excellent day thanks to our inspiring leader, Dr Colin Braithwaite - interesting, informative, challenging and enjoyable - and dry and warm!

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**ARTHUR'S SEAT** : 21 July, 2001
Leader: Dr. Colin MacFadyen - Scottish Natural Heritage
Report by : *Bob Diamond* Participants: 20 *

* The party included Dr. David Muir, a Member since 1946 - 47, who becomes an Honorary member of the Society on 1 October, 2001.

The aim of this excursion was to examine the various volcanic vents and flows associated with the Arthur's Seat Volcano. This volcano was active in the

Dinantian period of the Early Carboniferous some 350 million years ago. Much of the volcano has been lost due to erosion. However this means that the Holyrood area allows a detailed examination of the lavas, vent agglomerates and ashes associated with volcanic activity. In addition to this period of vulcanicity the sedimentary sequences of the Carboniferous were interrupted by a subsequent lava intrusions best exposed in Salisbury Crags about 285 million years ago. The sequence of ashes and lava flows associated with the volcanic activity is very complex and difficult to summarise. In the course of a very instructive day a number of key sites at this SSSI were visited.

St Anthony's Chapel

This exposure of Lava flow 3 is columnar basalt, which sits between layers of volcanic ashes. This site also gave a good view of the St Anthony's fault. The downthrow is about 23m to the north and is very visible in the landscape.

At nearby St Anthony's Well there are some poorly exposed ashy and shaley beds overlain by impure cherty limestone. This indicates that the initial volcanic activity occurred in a shallow marine environment.

Lion's Haunch and Lion's Head Vents

Of the five vents of the Arthur's Seat volcano the Lion's Haunch is by far the most complex. The Lion's Head Vent was fairly circular and infilled with a fine ash and conglomerate mix. The later Lion's Haunch vent is also made up of a red ashy agglomerate. However there are some quite large basaltic and sedimentary clasts within. There are also seven lava flows within the crater rim, which intersperse the 'sedimentary' layers.

Samson's Ribs.

The Samson's ribs crater lavas dip towards the centre of the Lion's Haunch vent. There is an exposure of columnar basalt in this area, but mainly the sequence is one of ashy layers overlain by agglomerates.

Salisbury Crags and Hutton's Rock.

The Salisbury Crags intrusion was much later (*ca*. 285 Ma) than the main volcanic vents. It is a dolerite, which has intruded as a sill into the Cementstone sequence. The major importance however is that this site was where James Hutton demonstrated that the sill cut across the bedding of the cementstones and was therefore later. The classic section is where a wedge of teschenite has lifted a block of sediment rotating it upwards and partly engulfing it.

Nearby is Hutton's Rock, which is an isolated rock at the now disused quarry at Salisbury Crags. This piece of teschenite has a marked haematite band running through it, typical of quite a lot of the quartz veining found in the area. Its main importance is however the 'Hutton' connection.

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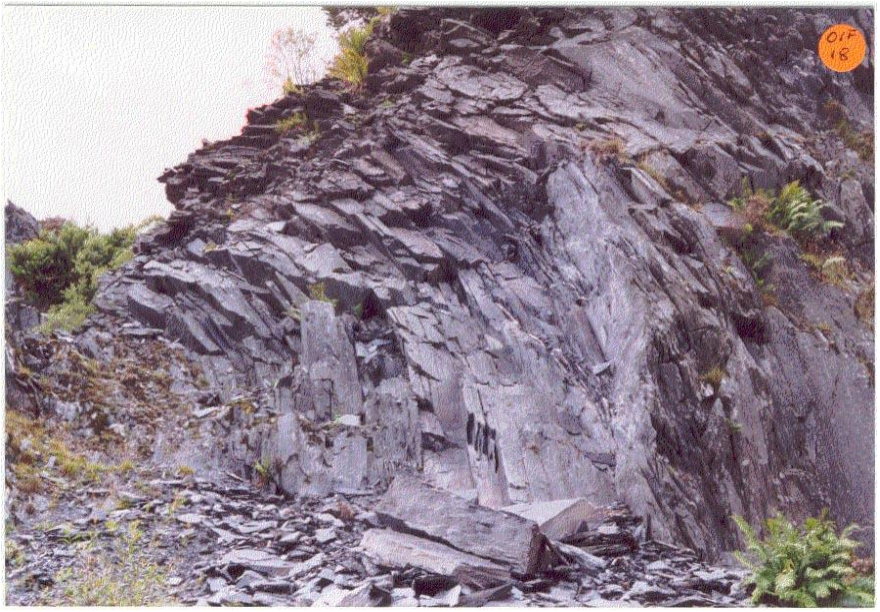
**ABERFOYLE** : 18 August 2001
Leader: Dr Iain Allison, University of Glasgow.
Report by : *Michael Pell* Participants: 16

A group of sixteen members of the Society led by Dr Iain Allison ventured into the late Pre-Cambrian, upper Dalradian rocks on the Duke's Pass, North of Aberfoyle. The main purpose of the trip was to have a look at the large 19th century slate quarries and to link what was seen there to the Tay nappe, Aberfoyle anticline and the Caledonian mountain deformation which created it.




Aberfoyle Slates

The initial introduction to the area was at the viewpoint looking up to Loch Katrine and across the valley to the east, followed by a short inspection of a nearby pair of small ridges. Iain Allison in his enigmatic way posed a series of apparently straightforward questions about vergence and facing folding, S and Z folds, bedding and cleavage and how all these factors made it easy to identify the way in which the current rock structure had been formed. The answers given by the enthusiastic members soon revealed that the formation of metamorphic rocks in general and the Dalradian in particular was more complex than even the most knowledgeable could aspire to. Fortunately Iain had brought his portable "white board" with him and we were treated to a detailed explanation of the processes as we enjoyed one of the few warm sunny mornings of the summer.

The party then proceeded to the huge but deserted Aberfoyle slate quarry where ample evidence was found of the original formation of the slates and subsequent deformations which had rather spoilt the quality of the beds by creating more folding and jointing which limited the size of the slates capable of being taken for building purposes. It was considered that this problem with quality, which resulted in a wastage rate of over 90% was the factor that eventually brought about the closure of the quarry when better sources became available.

The outing finished with a muddy walk back along the old tramway that had been built to transport the slates out of the quarry to the preparation area with the party then returning to the bus down a steep path through head-high bracken.

Iain Allison was given a heartfelt vote of thanks for his clear presentation of the subject and the party all returned home believing that they were a bit further forward in the quest to understand this complex part of Scottish geological history.

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**DUNBAR** : 1 September 2001
Leader: David McAdam, Edinburgh Geological Society
Report by : *Charles Leslie* Participants : 21

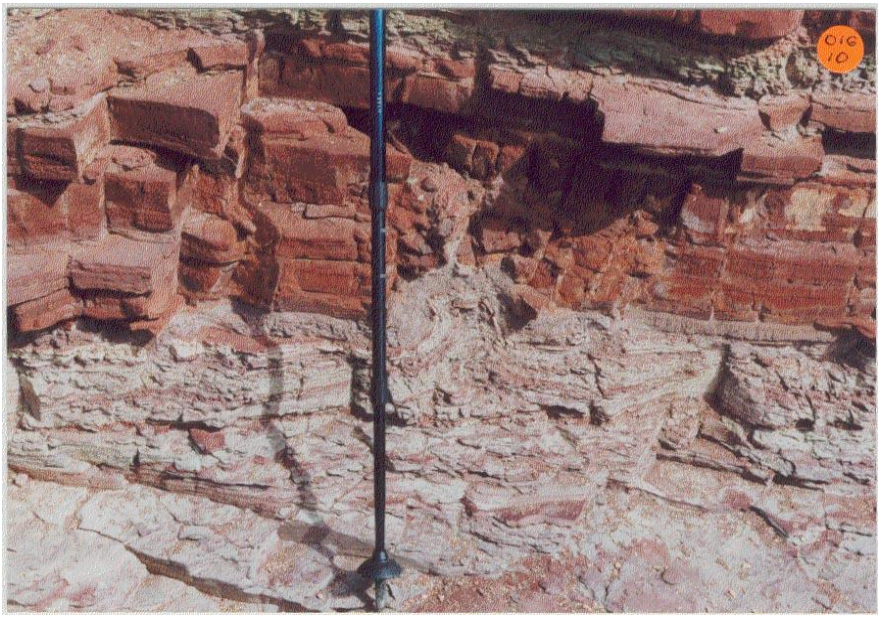
Having picked up our leader in Edinburgh, the Glasgow bus party proceeded to the car park at the John Muir Country Park outside Dunbar for an overview of what we were to see. The Old Red Sandstone of the late Devonian were deposited by rivers in generally arid conditions. As sea level rose, in the Early Carboniferous, quieter rivers deposited the fine sediments of the Kinnesswood Formation grading upwards into more marine lagoonal limey deposits of the Ballagan Formation of cementstones. In the West these were covered by the Clyde Plateau Lavas while in the East, volcanoes erupted through wet sediments to form cinder cones with ash deposited in layers in shallow water and as air borne deposits on the cone flanks. We hoped to see evidence of all this today. Before setting out, however, we turned seawards to see the continuing process with sand accumulation moving the coastline some 300m further out than that shown on 150 year old maps.

At the first location, near the Bellhaven Car Park, beds of bright red fine grained rocks were followed by layered red and green rocks and we were convinced they were all limey cementstones by the karst weathering features of clints and grykes, albeit on a small scale. This was a revelation to many of us more accustomed to the uniform grey Ballagan Beds of the West. The colouration was due to infiltration of the cementation minerals Haematite (red) and magnetite (green) in less oxygen rich conditions. On the horizontal surface of one rock, the limit of infiltration was indicated by a curved abrupt division between red and grey cementstone.

Moving NE along the shore, towards Dunbar, the first WSW - NNE quartz dolerite dyke was met while others could be seen out towards the sea including the Long Craigs rocks. This particular dyke had trapped a pod of sediments where the sands had been metamorphosed to quartzite while the dyke's chilled margins were also seen.

At lunch on the beach near the golf clubhouse, it was apparent that the cliff

feature on the NE side of the bay represented a change from beds of sandstones and cementstones. Up close, it was seen that the cliff was composed of small, angular clasts within a fine ash matrix and represented the ash fall from a nearby vent. Some of the clasts were of the sedimentary layers through which the volcano had erupted. This was repeated further NE along the path towards Dunbar with some of the ash being layered as it was deposited in water, probably shallow.




Dunbar : dewatering structure

Near the site of the old swimming pool, mega ripples in fine sandstones indicated a river depth of some 5 metres and that we had moved down succession into the very early Carboniferous or late Old Red Sandstone facies. The final geological location was near the Old Harbour where the battery built to protect against a possible French invasion at the end of the 18th Century sits on columnar basalts.

David McAdam was thanked for his enthusiastic descriptions on our travels back from the calm lagoonal deposits of the early Carboniferous to the mighty rivers of the Old Red Sandstone period with outbursts of volcanic activity.

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**SCOTTISH GEOLOGY WEEK** : 14th – 23rd September, 2001

The full programme was made available in libraries, Country Parks etc.
The Society organised the following events :
Saturday 15th September - University Building Stones, 2pm meet at the Visitor Centre
Saturday 15th September - Chatelherault Country Park, 2pm meet in front of the house
Saturday 15th September – Fossil Grove, 2-5pm
Sunday 16th September – Finnich Glen, 2pm meet at Queen's View – Michael Pell
Sunday 16th September – Fossil Grove, 2-5pm
Monday 17th September – Rock/Mineral/Fossil Clinic, Gregory Building, 2-4pm
Monday 17th September – Volcanoes, talk in Gregory Building Lecture Theatre at 7pm by Dr Jim MacDonald, MBE
Wednesday 19th September – Rock/Mineral/Fossil Clinic, Gregory Building, 2-4pm
Friday 21st September – Rock/Mineral/Fossil Clinic, Gregory Building, 2-4pm
Saturday 22nd September - Fossil Grove, 2-5pm
Sunday 23rd September - Fossil Grove, 2-5pm

Saturday 15th and Sunday 16th September - Chatelherault, Hamilton. Both ourselves and South Lanarkshire Council Ranger Service had similar walks planned for this weekend so they were combined and led by Graeme MacDonald of the Ranger Service and Charles Leslie both Society Members. In total 13 members of the public attended. The view from the House encompasse the Dalradians of Ben Lomond and beyond, the Carboniferous Clyde Plateau Lavas of the Campsies and Kilpatricks and Quaternary Post-glacial features. The reason for the park's existence, the Productive Coal Measures are exposed in the gorge formed as the ice retreated while the Barren Red Measures provided the building stones of the House. After examination of structures in the building stones, the party then proceeded through the small quarry from which the stones came to the bed of the River Avon to examine and identify the variety of pebbles brought down. Finally, the workmanship and effort required to build the 50m high sandstone bridge was admired.

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**ST ANDREWS GEOLOGY HERITAGE PROJECT**: 6th October 2001
Leaders: Richard A. Batchelor, St. Andrews University and Rosalind E. Garton
Joint excursion organised by the Edinburgh Geological Society
Report by : *Mary Lawrie* Participants: 23 from Geological Society of Glasgow

In 1903, St Andrews University opened its Department of Geology in response to Geikie questioning why geology was not taught there as there is an abundance of field evidence in the area. To celebrate this centenary, in 2003, several projects are being undertaken to bring geology to the attention of the public and help them relate the present to the past.

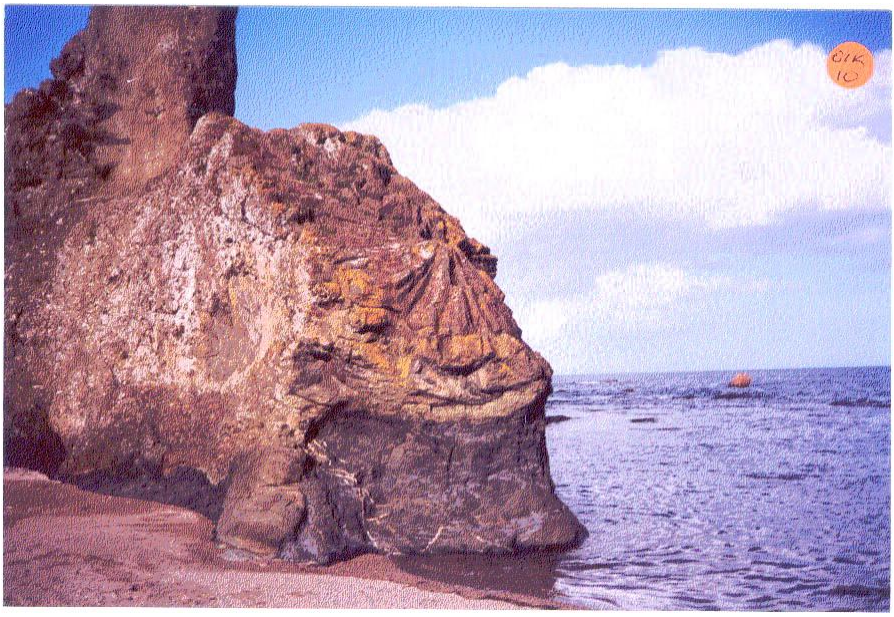
The aim of the excursion was to view these projects and we met up with our friends from Edinburgh near the Jurassic garden which is being planted out with

genetically primitive plants which have scarcely evolved over the last 200 million years. Specimens of Montere Cyprus, Ginkgo Biloba and Monkey Puzzle are already in place to be followed soon by Royal Fern and Equisetum (containerised for obvious reasons). Richard explained that the site was not boggy enough for mosses so unfortunately modern grass would squatter underfoot.

On our way to the Geological wall, we stopped to look at the rippled sandstone surface on the local sandstones which is a good example of the present being the key to the past as the ripples can be compared with those newly formed on the beach below. Then we swarmed around the Wall built from stones collected from sites all over Fife each showing evidence of its origins and depositional environment: coral reef, tropical swamp, volcanic eruption, desert sands, etc. Richard has written an informative leaflet for the Heritage project numbering the stones and describing their histories so that the general public can look and learn about geology. Rosalind pointed out where some of these local stones have been incorporated into St. Andrews buildings together with some "foreign" desert red sandstone from Dumfriesshire which contrasts starkly with the majority of the buildings built from the local beige sandstone. Continuing our town walk, we examined the metal plaques attached to the walls of some of the former houses of famous physicists/authors most of whom were also "proto-geologists": Dr. George Martine, surgeon and physicist, who first measured internal heat in mines concluding that the Earth had its own internal heat source; James David Forbes, physicist famous for theory of light waves who also proved that glaciers were rivers of ice; and Robert Chambers of school-book fame who anonymously published his Natural History of Creation in 1844 – years before Darwin. Walking through the Cathedral grounds we stopped at the remains of the old choir to admire the perfect ashlar stonework but also to visit Chambers gravestone decorated with three beautiful granite slabs.

After a packed lunch in the Abbey grounds, we followed the East Sands coastal path which has had to be diverted in recent years due to coastal erosion and viewed the results of the continuing landslip. From our vantage point along the path we looked down on the Saddleback anti-cline and the Maiden Rock sea stack with its vertical bedding (fluids perhaps cemented the sedimentary sandstones which were later tilted). Further along we descended to the beach to the well known "Rock and Spindle" site where we discussed what could be inferred from these remains of volcanic activity 300 millions years ago. In one stack of solidified ash we looked at the lumps of local rocks – shale, lava, and one with fossils – which appeared to have been ripped off in an explosion of ash and gas. The mainly volcanic rocks on the coastline contained large rafts of sandstone with baked edges suggesting they had been caught up in erupting lavas and nearby there were tuffs with visible layering typical of deposition in water. Vertical layering in the next stack suggests it formed in the central pipe of volcano and the spectacular radial columnar basalt of the "spindle" represents the final spurt of lava which slowly cooled within the vent itself.

Before returning to the Edinburgh and Glasgow bound coaches, an excellent old fashioned high tea was served at the Scores Hotel where it was obvious from the friendly, animated discussions that everyone had enjoyed the outing. Our thanks are due to Richard and Rosalind for making the trip both entertaining and informative.



"Rock and Spindle"

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**Knockan Crag**. The Honorary Secretary had the pleasure of representing the Society at the official opening of the new visitor centre and trails at Knockan Crag, Sutherland, on 16th August. He was very impressed with the new exposure of the Moine Thrust and the engraved stone slabs along the trails and some attractive rock sculptures. The displays are intended to appeal to a very wide audience and to get children interested in the solid earth around them.

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**Dr J.G. MacDonald MBE,** University of Glasgow.
We wish to take the opportunity to congratulate Jim MacDonald on the honour of his being appointed MBE in the Queen's Birthday Honours List in recognition of his services to adult education. We should like to think that it should be an $MBE^2$ for his long-standing service to this Society as well.

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## INTIMATIONS

It is with deep regret that the Council records a serious road accident on Friday 18th May, 2001. This occurred on the A9 north of Blair Atholl as members were travelling north by minibus to Durness for the first excursion of the Society's summer programme and were involved in a collision with a jeep travelling south. Four members died as a result of their injuries : Charles Elliott, Carole McLay, Ronald Rotchford and David Wilkinson. On behalf of the membership, the Council extends to their families our heartfelt sympathy for their loss.
Rosemary McCusker, the Excursion Secretary, sustained multiple fractures, John Hornibrook a fractured skull and concussion. Muriel Alexander and Gill Hornibrook sustained broken bones and severe bruising.
Nine members in a second minibus following had to cope with the trauma of being at the scene of the accident.

Mr David Wilkinson (68) joined the Society in Session 132 (1989-90), and had been a member of Council since Session 138 (1995-6), Publicity Officer (139-141) and Proceedings Editor (142-3). He was a very active member of the Society, participating in most of its excursions, attending the winter meetings and contributing to Members' Nights and other events. He was born in Yorkshire, served as a radio operator during National Service with the RAF and moved to Hamilton in 1965 to work, until his retiral, as an engineer with the National Engineering Laboratory, East Kilbride. Here he was involved in pioneering work on the development of computers and robotics, including the creation of tactile sensing technology for robots. He devoted much time to community work, serving both as a panel member and as vice-chairman on Strathclyde Children's Panel, and helping to found COVEY, the Blantyre-based befriending service which recruits adult volunteers to work with vulnerable young people. He was chairman of COVEY for many years and, at the time of his death, vice-chairman. David also taught computer studies to the inmates of Shotts Prison and Corntonvale, used his technological background to assist blind people who were having trouble with their computers, and had recently stepped down as treasurer of the community printing organisation VOICE. He had been president of Hamilton and District Arts Guild, and had a life-long passion for jazz. A keen rambler, he had 'bagged' 168 of Scotland's Munros and was an enthusiastic member of Blantyre Hill Walking Club. He also completed an Open University degree during his spare time. David was an active, enthusiastic and energetic member of the community. He was much liked and admired by all who knew him and will be greatly missed. Our condolences are extended to his wife, Pat, and his two daughters, Elizabeth and Joanne.

Mrs Carole McLay joined the Society in Session 140 (1997-8) and had a keen interest in geology. She was enthusiastic and energetic, becoming completely involved in all the activities of the Society, and attending many classes of the Department of Adult and Continuing Education. She was planning to begin a degree course in Earth Sciences at Glasgow University in the autumn. She was also a member of the

Glasgow Natural History Society, of which she was a Council Member since 1999. Carole had worked as a research assistant at the School of Veterinary Medicine, Bearsden for many years, and had taken early retirement only three weeks before her tragic accident. She was lively, entertaining and popular, with a quiet liking for cats! She will be much missed by the Society, by the many other societies and organisations of which she was a part, and especially by her many friends. Our condolences are extended to her husband, Rob, to her father and to her two brothers.

Dr Charles Elliott joined the Society in Session 141 (1998-9). He had grown up in Hobart, and graduated as B Sc from the University of Tasmania in 1946, followed by a Masters degree in 1949. He then went as Demonstrator to the Department of Botany in the University of Melbourne, before being awarded, in 1950, a research studentship at Trinity College, Cambridge, where he worked in the Genetics Department of the Botany School of the University and was awarded his Ph.D. in 1953. He subsequently became a post-doctoral Research Fellow in the Genetics Department of the University of Glasgow, was appointed Lecturer in Agricultural Botany in 1958, and later became a Senior Lecturer and then Reader. His book, "Reproduction in Fungi" was published after his retirement, followed by "A Temporary Building", dealing with the history of his local church. He was a keen hill-walker in Tasmania, around Melbourne and in Scotland, where he had climbed all 277 Munros, and this had led to his absorbing interest in Geology. Charles made many friends while following his various interests and pursuits and will be much missed by all who knew him. Our condolences are extended to his wife, Barbara, his son, Christopher and his daughter Alison.

Mr Ronald (Ronnie) Rotchford (59) had only recently joined the Society, in Session 143 (2000-1), having attended one of the DACE Earth Sciences courses the previous year. He had been employed as a wireless operator with Marconi, and later joined what was then known as GPO Telecommunications, planning and maintaining the telephone network, until his retirement. As part of his work he needed to survey the lines, and he combined this with his interest in running, getting his colleagues to drop him off at strategic points along their route. While doing this in the Kilmartin area, his interest in archaeology was stimulated and he started the DACE Certificate of Field Archaeology in 1993. He subsequently became a very active member of the Association of Field Archaeologists, attending many of their events and surveys, including Cyprus, Raasay and their AGM's. Ronnie was energetic, enthusiastic and well liked by all who knew him. Our condolences are extended to his wife, Maureen, his two daughters and all his family.

With regret we also record the deaths of

Mr Norman Niblock, member since Session 137 (1994 -5), who died 10th November, 2000. Norman, who had been ill since May, was an active member of the Society and was known to many of us. His energy and enthusiasm for geology and the Society were a source of great encouragement. Our sympathy and support go out to his widow, Margaret, at this sad time.

Mrs E.R.C. Rollo, member since Session 129 (1986-7), who died January 2001.

Dr M. Laidlaw, member since Session 130 (1987-8), who died March 2001.

Mr C. Edwards, member since Session 128 (1985-6), who died 21st July 2001.

Front cover photograph – Glen Tilt

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