PROCEEDINGS OF

THE GEOLOGICAL SOCIETY

OF GLASGOW

Sessions 144, 145 **2001 – 03**

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Members of Council

President	Dr Colin J.R. Braithwaite
Vice Presidents	Mrs Janey MacDougall
	Mr Michael Pell
	vacant
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Journal Editors	Dr Colin J.R. Braithwaite
	Dr Tim Dempster
Ordinary Members	Miss Muriel Alexander
	Miss Margaret Donnelly
	Dr John Hughes
	Dr Mike Keen
	Dr Jim MacDonald
	Mr Robin Painter
	Dr Joan Walsh

The new address of the Society's web site is http://www.geologyglasgow.org.uk/. The site was temporarily maintained by Dr Gordon Curry, Division of Earth Sciences, Glasgow University, and then by Dr Neil Clark (Publicity Officer).

MEMBERSHIP

	At end 144 30 Sep.,2002	At end 143 30 Sep.,2001
Honorary Members	4	4
Life Members	0	1
Ordinary Members	338	338
Associate Members	65	74
Junior Members	7	7
TOTAL	414	424
New Members	27	33
Deletions	(37)	(38)

"Deletions" include 16 Members who had not paid their subscription by 30 September although three reminders were sent out.

Charles Leslie

LIBRARY

The Society's library has been operating normally during the session, and has been used by 10 members, borrowing a total of 20 items. As always, among these items have been guidebooks from the Society's extensive collection, which covers many geologically significant areas in the UK and Europe, together with other areas worldwide. However, usage of the Library has diminished from the previous session and has been disappointingly small, notwithstanding the distribution of a leaflet notifying members of the facilities available, and the fact that the Library is open on meeting evenings and during weekdays. To raise the profile of the Library the Librarian intends to exhibit some of the stock, including rare books at the next Members' night.

Copies of the updated leaflet "The Society's Library" were distributed to the membership at the last AGM, and a stock of the leaflets has been made available to the Secretary for distribution to new members. The leaflet describes the full facilities available for members, including books, journals and maps from the combined libraries of the Society and the Division of Earth Sciences.

The Society's rare books have still to find a home, the existing shortage of space in the Gregory Building continuing. A University review of space within the building is to take place shortly and it is hoped that this will yield some space for books.

C. J. Burton

SCOTTISH JOURNAL OF GEOLOGY

The precise cause of the fall off in submissions of papers to the Journal in 2001 has not been identified, although there is a strong suspicion that it was related to the Research Review exercise in British Universities. Whatever the reason, as a consequence, publication of issue 38/1 was delayed and, when it appeared, it was limited to only 64 pages. There has since been a slow increase in submissions and at the time of writing it seems likely that 38/2, due out soon, will be of normal size (96 pages) and we already have a number of papers in hand for 39/l. We hope that submissions will now return to their normal levels. One advantage that has followed from this period is that there is essentially no backlog and good quality papers that require little editing can be processed to publication within a matter of months.

The Geological Society Publishing House has continued to serve us well. Their annual submission notes a continuing but slow reduction in Trade subscriptions. Increased costs related to inflation, particularly in the costs of paper, indicate the need for small increases in charges. They have proposed that we increase the Trade rate from £109/$182 to £117/$195, a 7.2% increase in line with the predicted industry average. At the same time the publication page charge paid by the Societies will rise from £131 to £135.5, an increase of 3.5%.

For the information of members, Tim Dempster has retired from the editorial board after several years of service on behalf of the society. The Board will be asking the Society to elect a new editor to represent it.

C.J.R. Braithwaite

The 2002 Journal will be available on-line, accessed through the University Library, or using a password on home computers. Ed.

PUBLICATIONS

Gross sales this year dropped by one third resulting in a surplus of £216, a reduction from last year due mainly to the absence of our Skye Guide. We hope to have this volume back on the market before too long. A guide to Mull is in course of preparation in conjunction with Edinburgh Geological Society and should be available next year. As before, members have supported our Bookshop very well. I would like again to acknowledge the help and enthusiasm given by lecturers in the Extra Mural Classes. They promote our publications, allow an extended interval when I visit the classes and collect money from class members and students who are unable to pay on the night! The expenses of running our Publications amounted to 5% of turnover and we have no 'bad debts'.

Roy Smart

TREASURER

Income and Expenditure Account for Year Ended 30th September 2002

(Scottish Charity Number SCOO7013)

Income			**2000 – 01**
Subscriptions received	£ 6041.91		
Deduct paid in advance	100.00	£5941.91	£5911.01
Investment Income:			
Dividends	362.01		446.02
National Savings	1559.85	1921.86	2625.55
Net surplus from publication sales		216.90	694.77
Tax refunds (Covenants & Investments)		720.92	718.94
Donations		1061.27	
Excursions		22.00	nil
AGM – Ticket income	140.00		
– Function expenses	135.00	5.00	33.81
		£ 9889. 86	

Expenditure		
Billets, programmes, postage, telephone, stationery etc	919.11	1226.26
Meetings	1537.48	1677.32
T N George Celebrity Lecture	122.75	nil
Library	518.50	460.00
Sponsorship	1850.00	350.00
Scottish Journal of Geology	nil	2500.00
Insurance	438.39	386.62
Donations	100.00	200.00
Geology Week	28.60	59.40
Memorial Service	276.99	
Legal Fees	296.10	
Affiliation fee	22.00	22.00
Depreciation on computer @ 20% of cost	313.48	
Bank charges	nil	15.00
Surplus of income over expenditure	3466.46	
	£ 9889. 86	

Publication Sales Account For Year Ended 30th September 2002

Gross Sales	£ 2181.69	
Deduct Expenses	119.40	£ 2062.29
Stock at 1/10/01	£ 12042.34	
Add Purchases	1139.10	
Publications available for sale	13181.44	
Deduct stock at 30/09/02	11336.05	
Cost of publications sold		£ 1845.39
Net surplus on sale of publications		£ 216.90

Balance Sheet as at 30th September 2002

Assets			**2000 – 01**
Debtors for publications at 30/09/02		£ 308.00	£ 290.90
Cash in hand:			
Membership Secretary		147.78	
J.E. MacDougall		132.97	
Secretary		31.25	
Publications Sales Officer		22.38	
Cash at Bank:			
Royal Bank of Scotland Account	£ 7985. 18		
National Savings Investment Account	33977.52	41962.70	36399.36
National Savings Income Bond		12000.00	
Investments at Cost		1025.70	
Stock of Publication		11336.05	12042.34
Computer (at 20% depreciation)		313.47	
		£ 67382.30	

Liabilities

Subscriptions in advance		100.00	652.00
Uncashed cheques		1500.00	789.19
Monies due by Society		1519.79	
T.N.George Fund		1015.00	1015.00
Accumulated fund at 30/09/01	59781.05		
Add surplus for year	3466.46	63247.51	
		£ 67382.30	

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 2002

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

MEETINGS

The 144th Session of the Society included lectures by six invited speakers between October 2001 and May 2002. The session started with the T. Neville George Medal Lecture when Russell Coope gave us a beetle's eye view of the Ice Age. In November, Randy Parrish of BGS Keyworth continued the theme of glaciation by telling us how North American plate tectonics intensified northern hemisphere glaciation by affecting ocean currents.
In the New Year, Alan Hodgkinson from Glasgow gave a gem-orientated talk explaining how visual optics provided an alternative method of gemstone identification. February saw Ray MacDonald from the University of Lancaster talking about supervolcanoes. BGS Keyworth provided us with a second speaker in the form of Phil Wilby who discussed the fauna of the Oxford Clay while "local lad" Tim Dempster gave us a fascinating insight into the complexities of the Dalradian showing that, in spite of all the years of research there are still many fundamental contradictions. Members' Night rounded the Session off nicely with the usual high standard of talks and presentations.

Jim Morrison

Thursday 11th October 2001
After the following citation delivered by Dr Chris Burton, the **Professor Thomas Neville George Memorial Medal** was presented by the President to:

Professor G. Russell Coope, D. Sc, Ph D, FGS
University of Birmingham

Professor Coope started his formal geological career at the University of Manchester in the early 1950s, and was among a group of students, many of whom, including himself, who were to exert a formative influence on the development of Geology. In 1954 Professor Coope moved on to the University of Birmingham as a research fellow – joining the late Professor Shotton's group investigating all aspects of the Quaternary in the English Midlands.
This was a time when various luminaries, including Alwyn Williams, were in transit through Birmingham, and it was perhaps no coincidence that the British Antarctic Survey staff was also there – although it has to be said that they were housed in huts outside the department!
Professor Coope began his published work at Birmingham, and early papers included

a history of Quaternary deposits in Trafalgar Square, London (in the Illustrated London News) and, significantly, in 1959 a review of a Late Pleistocene insect fauna from Cheshire. However, what seems to have been the defining event in his career took place in 1961, with the investigation of a late Pleistocene flora and fauna from Upton Warren in Worcestershire – done jointly with Professor Shotton and Dr. Isles Strachan.

The story attached to this investigation is that Professor Coope discovered what he was convinced was the fossil of a beetle, which he submitted to the "experts" at the British Museum of Natural History. The answer came back that:

a). It was doubted that this was truly a fossil.

b). That even if it was, it was unidentifiable!

This is enough to put anybody on their mettle – and Professor Coope rose magnificently to the occasion by proving the Museum completely wrong and nailing their error in a positive avalanche of papers describing coleopterans (beetles) from a host of localities across the Midlands, East Anglia and Wales, and from places as far apart as Jersey and Ohio. Indeed, in tracing Professor Coope's published material, it becomes clear that the tempo and volume of the work has not abated since that first paper. Many years in the 1970s and onward show multiple papers on all aspects of the Coleoptera and, more importantly, what they have to say about climate and climate change in the late Cenozoic. The year 1977 seems to have been something of an Annus Mirabilis with at least six papers and the award of the Lyell Fund of the Geological Society.

The impact upon Quaternary studies of Professor Coope's work has been immense and profound, causing much rethinking, and generating many spin-off studies on climatology. We would not be in the state of knowledge that we are today without his input.

Professor Coope is that rare scientist – one who combines a strict and disciplined study with a much wider view. He is a naturalist and ornithologist with an interest in anything that lives – a trait that has led to the keeping of hawks in his living room and a tame polecat in the garden. Today is no different, with a retirement dwelling surrounded by Soay sheep, Highland cattle and a resident osprey.

His expertise, and especially the core subject of Coleoptera, has led Professor Coope to being in great demand as a speaker worldwide, and to appearances on television explaining Quaternary climates. I first heard him when I was a student, and was impressed and enthused as we all were.

So, Professor Coope fits well the terms of the T. N. George Medal, in his combination of palaeontology, stratigraphy, climatology and an intense interest in natural history – all of which were espoused by Thomas Neville George himself.

Professor Coope then addressed the Society on

ICE AGE HISTORY : A BEETLES' EYE VIEW

Climatic oscillations of the Quaternary Ice Ages were much more frequent, sudden and intense than we used to believe. The flora and fauna of these times was to a large extent made up of species that are still living today (extinctions were relatively few

but spectacular all the same). But how did these familiar species deal with this rather unfamiliar environment? How did they avoid extinction in the face of dramatic climatic changes? Biologists have for long speculated on the effects on species of large-scale climatic changes but palaeontology shows that the real world was very different from what they expected. This talk endeavoured to reconcile the differences between expectation and reality by examining the presence of cold- and warm-tolerant species of beetles in the fossil record, as well as the suddenness and rapidity with which they sometimes appeared.

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Thursday 8th November 2001
Dr R. Parrish, British Geological Survey, Keyworth.

NORTH AMERICAN TECTONICS IN THE PLIOCENE AND THE INTENSIFICATION OF NORTHERN HEMISPHERE GLACIATION

In spite of a sufficiently cool climate and favourable continental configuration for the last 15 million years, northern hemisphere glaciation only became significant around 3 million years ago. This talk provided a new explanation for this event, relating it causally to the rise of the Coast, St. Elias, and Alaska Range Mountains after about 5 million years ago. Changes in global atmospheric circulation induced by these 2-4 km high ranges allowed the stabilisation of the North American weather patterns we observe today with cold stable air masses in winter. Dr Parrish proposed that this climatic pattern is likely to be one of the most important prerequisites for the build-up of permanent snow and ice.

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Thursday 13th December 2001

ANNUAL GENERAL MEETING

Thanks were expressed to retiring members of Council Roy Smart (Publication Sales Officer), Susan Clark (Rockwatch Representative), Alistair McKenzie and Michael Pell (Ordinary Members) for all their work and contribution to the Society over the past years. Two other Members, Mr D Wilkinson and Mrs L Hamilton, have sadly died over the past six months.
Mr David Muir, a Member since 1946 – 47, addressed the members present and thanked the Society for bestowing on him an **Honorary Life Membership**.
Other business of the AGM was followed by a game of geological "Call My Bluff" and then by wine, soft drinks, cheese and nibbles.

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Thursday 10th January 2002
Mr Alan Hodgkinson, Glasgow

VISUAL OPTICS – AN ALTERNATIVE METHOD OF GEM IDENTIFICATION

Some unorthodox solutions to certain gem identification problems.

The identification of a gemstone is generally solved by one of two routes:-

a. A laboratory kitted out with the latest state of the arts in "heavy" sophisticated equipment.

b. Traditional gem testing equipment.

There are however individual situations to which neither option is available. At such times, alternative methods can save the day. Examples include:-

The identification of synthetic emerald through a shop window.
The distinction of diamond from cubic zirconia, zircon, synthetic moissanite and others in the dark, without seeing the stones, without touching them, and without instruments.
Picking out intruders salted in a parcel of diamonds.
Identification of gemstones which have a refractive index above 1.81
The identification of gemstone doublets in rubover settings.
Pleochroism and interference figures in the sky.
Seeing an absorption spectrum without a spectroscope.

Mr Hodgkinson delivered an informative and entertaining lecture – and even provided some sample gems for the members to examine!

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Thursday 14th February 2002
Professor Ray Macdonald, University of Lancaster

SUPERVOLCANOES

Research over the past two decades has increasingly clarified the environmental effects of large volcanic eruptions, including modification of climate patterns and partial destruction of the ozone layer. It is inevitable that the largest of such systems, the so-called "supervolcanoes", will erupt in the future, although we have at the moment no way of predicting exactly when. More devastating are the effects of prolonged basaltic flood volcanism, which can cause major climatic perturbations and which has been linked to many of the great mass extinctions of biota during geological time. Is the next such event already in train?

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Thursday 14[t'" March 2002
Dr Phil Wilby, British Geological Survey, Keyworth

CALAMARI CATASTROPHE: BELEMNITES WITH SOFT TISSUES FROM THE OXFORD CLAY OF WILTSHIRE

Exceptionally well preserved fossil faunas (so-called fossil lagerstatten) are important but generally poorly understood finds. This talk outlined recent progress made in unravelling the palaeoenvironmental setting of a new exposure of a bed in the Oxford Clay Formation in which vast numbers of belemnites and other coleoids are preserved with all of their soft-tissues intact. It was argued that the coleoids formed large, polyspecific schools that were killed en masse in one or more catastrophic mass mortality events that affected a significant area of the Oxford Clay sea. During the event(s), many coleoids predated upon moribund fish and other coleoids, sometimes of the same species, before becoming overcome themselves.

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Thursday 11th April 2002
Dr Tim Dempster, Division of Earth Sciences, University of Glasgow

COOKING THE HIGHLANDS : FROM FREEZER TO OVEN AND BACK

The problems of unravelling polyphase deformed and metamorphosed rock sequences were considered with respect to the Scottish Highlands and particularly the "well known" Dalradian rock units. Geochronological constraints on this Late Proterozoic? succession suggests that deposition coincided with two major glacial events associated with periods of global ice cover (Snowball Earth). This is most evident in the well-preserved tillite sequences of Islay. However, such evidence highlights problems with the established Dalradian stratigraphy and suggests that one or more significant, but well hidden breaks in the succession may be present. This coupled with metamorphic evidence from the Dalradian and Moine rocks was used to argue for the presence of orogenic breaks within the Highlands involving significant heating and crustal thickening separating the periods of glacial activity. The once simple interpretation of the history of the Caledonian orogeny within the Scottish Highlands was critically re-examined in the light of this evidence and the difficulties in reading the thermal and structural record of polymetamorphic rocks were highlighted. A recipe for much confusion emerged and the unpalatable problems of cooking on a frozen planet without adequate time for defrosting were considered.

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Thursday 9th May 2002

MEMBERS' NIGHT

We acknowledge with thanks the contribution of our members noted below to the success of this evening.

Short talks

Norman Butcher
Neil Clark
Brendan Hamill
Julian Jocelyn
Michael Pell

Displays

Michael Arrowsmith
Hammy Corrance & Neil Clark
Julian Jocelyn
Charles Leslie
Margaret Donnelly
Roy Smart : Book stall
Various : Scarborough excursion

EXCURSIONS

Despite the poor summer weather members enjoyed seven very interesting excursions covering different geographical locations, geological periods and rock types. Sadly Rosemary McCusker was still not well enough to participate in the excursions but lent a very welcome guiding hand to those who tried to emulate her standards of organisation, and provided a base contact in Glasgow during the days out. We saw most of the regulars again this year but were also very pleased to see several new faces joining the ranks and this is a welcome sign for the Society, leaders and organisers alike. Please keep coming, there is no better way to enjoy and understand geology than seeing it in the field with someone who can answer your questions !

Weekend Excursions:
Our spring trip was to Scarborough to look at the sands, shales, chalks and muds of the Jurassic and late Cretaceous. Our leaders were Janey McDougall and Mike Keen and the party of twenty five benefited from their detailed knowledge of the area and discovered that fossil hunting amongst the beach shales was easy and rewarding.
In August, led by Neil Clark, we spent the weekend on Arran looking at various sedimentary structures with the occasional intruding dyke or sill and found yet another unconformity first identified by James Hutton. One of the main objectives was to see the footprints of Chirotherium, a Triassic marine reptile which had been identified in the cliffs and on the beach at Machrie Bay. Fortunately we stayed at an hotel who fed us well because on the Sunday we needed considerable stamina as we searched out the track ways of the giant centipede Arthropleura (we only saw 32 pairs of feet!) and had a lengthy trek back to the bus over a 1000' high ridge.
Next year will we see the igneous petrologists strike back? However our grateful thanks go out to the leaders who put so much time and effort into the preparation of these excursions and provide such enjoyment for all the participants.

Saturday Excursions :
Five one day excursions were arranged for the summer season 2002 all of which went successfully. They were held in the central and west Scotland areas encompassing the Ochils, Leadhills and Wanlockhead, Girvan, Saltcoats and Dalry and Lesmahagow. Grateful thanks go to our leaders, Dr J MacDonald, Dr J Floyd, Dr K Ingham, Dr C MacFadyen and Dr N Clark who respectively gave of their time to research and lead very interesting and informative outings which were enjoyed by all who attended.
The excursions were varied and as always well supported and we were delighted to welcome many newcomers as well as those who attend regularly. The joint excursion with the Edinburgh society to Lesmahagow was rounded off with an excellent high tea at the Popinjay Hotel in Rosemount.
Our thanks are also due to those who assisted on the trips with help and advice, by driving the minibus, offering car transport and the general organisation.

Muriel Alexander and Michael Pell

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SCARBOROUGH 3 – 6 May 2002
Leaders : Dr Michael Keen, Mrs Janey MacDougall, University of Glasgow
Report by : *Sally Orr, Monica Thorp*

On Friday 3 May, a busload of geology enthusiasts, led by Mike Keen and Janey MacDougall, set off southwards to study the Jurassic and Cretaceous rocks along the East Yorkshire coast.

The journey was enlivened by Janey's pointing out sites of geological interest along the way: the Southern Upland Fault, the Iapetus Suture, the Pennine Fault and so on, to the glacial lake that formed the present-day Vale of Pickering. By the time we reached Filey Brigg on the coast, the sun had come out and was to stay out for much of the excursion. Here we had our first sight of the Upper Jurassic Corallian limestone, which had been deformed by permafrost. The ice sheet in this part of Britain had advanced from the North Sea.

Next morning we visited Cloughton Wake, and were shown crevasse splay deposits, formed when large rivers broke through their levees and flooded the plain below. When the floods receded the resultant sands were colonised by plants whose rootlets are still visible, along with a thin layer of coal. From Cloughton Wake, we were whisked up to Whitby where we were promised ammonites. Unfortunately the town council had just arranged for many thousands of tonnes of huge boulders to be dumped as cliff-protection at the entrance to the ammonite bay, completely blocking access from that end. Undaunted, we set off up the 199 steps to the Abbey and along the cliff-top, a number of us eventually scrambling down to the shore at the other end of the bay – but here too access was denied by the tide. We did find small ammonites in the friable Upper Lias (Lower Jurassic) shale, but they crumbled as soon as they were disturbed. However, two teenage fossil-hunters generously gave us some fine specimens that they had found earlier in the forbidden bay. We, alas, were not able to

wait for the tide to let us get round the point, but had to dash back to Scarborough for the hotel's three-line whip: dinner was at 6 o'clock sharp.

We made a very early start on Sunday morning to go further south, beyond the Humber Bridge, to younger rocks. At South Ferriby Quarry, just over the other side, we found a succession consisting of the Late Jurassic Ampthill Clay, the very fossiliferous Kimmeridge Clay, the Cretaceous carstone – a coarse brown sandstone – and above that red and then white chalk. The Kimmeridge Clay abounded with ammonites, while there were plenty of belemnites and terebratulids in the red chalk. The conspicuous black band is an anoxic clay layer marking a major Cretaceous oceanic event.

Filey Brigg

Weighed down with Late Jurassic ammonites, we turned north again and went to Riflebutts Quarry, an SSSI where the Market Weighton Axis is exposed: here the Cretaceous rests unconformably upon the Lower Jurassic. From here, leaving the cowslips and the warm sunshine, we set off for cold and windy Flamborough Head, where the cliffs form the northernmost outcrop of the chalk that extends from Devon to Yorkshire. In Yorkshire it is unusually hard and is used as a local building stone. The Howardian Fault runs through Flamborough Head and in the bay we saw listric faults, counter-fan faults and conjugate faults, fault breccias, calcite veining and stylolites.

By Monday, there was fog for our journey back to Glasgow, so we made only one stop, at another SSSI, this time at East Ayton, west of Scarborough. Here oolitic limestone is overlain by coral rag (patch reefs) containing Isastria, a massive

colonial coral (into which bivalves had bored), indicating that conditions had been similar to those in the present-day Bahamas.

On the return journey we did at last see the Whin Sill, which Janey had been threatening us with all the way down on the Friday. She and Mike kept us entertained and interested throughout the long trip back – as indeed they had done during the whole weekend – and we thank them for a thoroughly enjoyable and instructive excursion.

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THE OCHILS 18 May 2002
Leader : Dr Jim MacDonald, University of Glasgow
Report by : *Seonaid Leishman*

The route to this excursion took us past Stirling Castle with its splendid Great Hall, and the Wallace Monument (both on a Carboniferous Quartz Dolerite sill), to Blair Logie Church. Here we left the bus and took cars to about the 150m contour. We then had an enjoyable 'ramble', exploring the western Ochils, particularly Dumyat and Loss Hill

The geology consisted of Lower Old Red Sandstone volcanics and related mineralisation, with some sandstones.

The Ochil fault has a throw of thousands of metres which brings the bottom of the Old Red Sandstone in contact with the top of the Carboniferous covering the Midland Valley – a geological time gap of around 100 million years. The fault marks the base of the Ochils, and once we reached Dumyat (418m) the Forth Valley was spread out before us. Not an especially good day for clarity, but by Scottish geology trip standards, "not bad". Because the downthrow to the south is so great, the origins of the rocks on the north side had to be surmised. This was not a problem to our leader, Dr. Jim MacDonald, who introduced us to the unusual igneous rocks of the Ochils, and to some of their mysteries, with typical enthusiasm. A great subject for a thesis he thought, as nothing has been published since the Memoir of 1970. However we all became very busy, so no one in the party took him up on the idea just yet.

The lava is fine grained, dark, and contains vesicles. It is alkali (an andesite) which extruded explosively. Interbedded with the lava is a coarse agglomerate containing tuffs. This is believed to be pyroclastic material thrown out from volcanic vents, perhaps in a caldera situation about 1 km distant. However where are the remnants of these volcanoes, and where was the source of some of the clasts in the agglomerate? The probability is that they are faulted out, underneath the Carboniferous coal in the Midland Valley.

One of the interesting characteristics of the lava is its red colouring on some of the right-angled joint faces. This is due to a constituent mineral of the rock (hypersthene – a magnesium-iron-silicate) which forms orthorhombic crystals which appear as tabular masses, with prominent cleavage. As the lava solidifies, water concentrates in the joints and dissolves the soluble iron. Near the top of Dumyat we saw columnar jointing in a sill of porphyrite, an over saturated basalt. The top contact contained xenoliths of volcanic ashy material. We also saw trachyte, which had erupted along with lapilli tuff, consisting of larger consolidated lumps of volcanic

material. The vulcanicity must have halted to allow erosion and redeposition, because we found cross bedded sandstone filling what where originally stream beds formed in fissures within the lava. This was followed by another lava flow, and in some places blocks of hot lava fell into the sediment, baking it to form psammite.

Evidence of glacial action was seen near the top of Dumyat – an erratic of schistose grit from Pitlochry, said our leader. This provided evidence that the ice sheet moved south east, and was at least as thick as the height of the Ochils (*ca* 350-400m).

The best was yet to come! In usual Jim MacDonald style, he pointed out our final exposure on the top of Loss Hill – from our lunch stop at the top of Dumyat – with the valley in between. Some of the party preferred a leisurely walk back to the cars, but for those who climbed up to the 150 year old adit, it was well worth while. Tear faults trending northwest across the Ochils have produced mineralisation which includes copper, silver, and barite. The spoil heap alone, at this small mine gave up many excellent samples of malachite and barite. Some members followed our leader inside the adit, and even he seemed very happy with the resultant spoils.

It was a very interesting excursion, and yet another place added to my lengthening list headed "must go there again sometime". The trouble is, we are always being introduced to yet more new experiences. There's no pleasing some folk!!!

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LEADHILLS AND WANLOCKHEAD 8 June 2002
Leader : Dr Jim Floyd, British Geological Survey.
Report by : *Margaret Donnelly*

We left the Boyd Orr car park on a rather dull morning and travelled south on the M74. Our first stop was the Craighead Quarry, Craighead Farm near Crawfordjohn, where siltstones and sandstones (turbidites) are cut by a NW – SE essexite dyke. Although its trend is similar to Tertiary dykes, its composition is different, and it has been identified as Permo-Carboniferous. It is alkaline, and similar to the essexite of Lennoxtown, but this dyke is composed of nepheline gabbro, and contains large phenocrysts of purplish titanaugite. The country rock is only slightly baked, but the chilled margin of the dyke is very fine-grained. The turbidites have bedding structures – laminations and cross-bedding, and young to the north, as do other tracts of the Southern Uplands, while the latter as a whole young to the south. There are bands of chert, outcrops of barite and evidence for fluids passing through. Looking out across the valley, glacial formations are apparent – the valley is flat-bottomed, its floor is a thick boulder clay which has been partly eroded by the river to form terraces.

We travelled to the north of Crawford, to the Crawford Group of chert and Moffat Shale. Of Arenig age (Ordovician), these are the oldest rocks in the Southern Uplands. After a fairly arduous climb, the surrounding countryside lay before us and we searched for conodonts in the adjacent outcrops. Conodonts are tiny fossils, only recently identified as the teeth of chordate animals similar to eels, and up to 2 feet long. One (of Carboniferous age) was discovered in the Edinburgh collection by Dr Neil Clark, and confirmed by Professor Euan Clarkson. Conodonts have been found

arranged in order with a left hand and a right hand side. Many have been found in the British Isles and in South Africa. We also searched for radiolaria in the chert bands where they originally accumulated in a siliceous ooze. They have been extracted using ~5% hydrofluoric acid – the chert dissolved but not the radiolaria.

Each tract within the Southern Uplands has its own stratigraphy, and they are correlated using the graptolites of the Moffat Shale which occurs at the base of each. Some Raven Gill chert (Arenig) appears within Llanvirn rocks and suggests a large time gap when large blocks of older rocks fell in among younger ones in the turbidites. Conodonts are found in the Castlehill, Raven Gill and Glencaple Burn members. There is a cyclicity of siltstones and chert in these rocks, reminiscent of the Milankovitch Cycles, and they formed in a deep marine environment, similar to the mid-Atlantic.

We then headed for Wanlockhead and lunch. Here we had a guided visit to one of the mines, toured the museum and treated ourselves in the shop. The weather which so far had been kind to us broke down and we got soaked!

The final stop of the day (after the rain stopped) was to the Gripps Shaft Level – a series of mines on the other side of the hill, in the Leadhills, where the drainage pattern is different from Wanlockhead. Here the water has backed up in the mines to appear as a spring higher up. The Leadhills Fault runs through this valley, although it is scarcely apparent, and there is a brown felsite dyke. Again we looked for conodonts and radiolaria in the shale and chert, with some success, before finally returning to Glasgow. Altogether a very enjoyable and informative day!

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GIRVAN : 3 August 2002
Leader: Dr. Keith Ingham, University of Glasgow
Report by: *Charles Leslie* Participants : 20

Before starting up Byne Hill, our leader gave a summary of a possible Lower Palaeozoic geological history of the area we were to examine before lunch. Rocks formed under completely different conditions are found in this area. The underlying Ballantrae Complex formed in the deep ocean from mantle rocks in Lower Ordovician (Arenig) times before being obducted on to the margin of the Laurentian continent. Subsequent rifting created a terrane that drifted eastwards along the new continental margin to be caught up in the closure of Iapetus with its northern flank locked to the Highlands and its southern being uplifted as the Southern Uplands terrane was subducted under it. The Complex has then been buried beneath the Upper Ordovician Cover Sequence of mainly conglomeratic rocks, formed by tropical erosion, as it rapidly rose. Final folding of the assemblage occurred as the Southern Uplands terrane finally docked.

To the right of the path, starting near the Cemetery at NX187 955, through Dultippan Farm and Brochneil Farm above the West bank of the Byne Hill Burn, a poor exposure of harzburgite was found. This was formed deep in the mantle and brought to the sub oceanic surface possibly in Precambrian times at a mid ocean spreading ridge. On leaving the path to the right where the trees ended, a short climb brought us to a face at NX 181 944 on which the contact between serpentinite and the

gabbro that intruded it was seen. This intrusion has formed in layers with upward increasing silica content as a magma chamber slowly cooled. On the remainder of the climb, this was observed in the exposed rocks, with trondhjemite near the summit.

We descended by the safer route to the northeast passing an exposure of the Cover Sequence, a poorly sorted, randomly orientated clastic conglomerate dumped from a rapidly rising land surface under tropical weathering. At the time of formation, in early Devonian times this area would have been about 10^0 S of the Equator, and being thrust upwards and crumpled by the Southern Uplands terrane during the closure of Iapetus. From the start of the path it could be seen that on the NW face of Byne Hill the Cover Sequence Benan Conglomerate has been deformed into a monocline dipping some 60^0 towards the sea.

After lunch taken in the car park on the south side of Girvan, the party moved to the foreshore where sediments coming from fault scarps were carried through river cut canyons and deposited clear of the scarp. Near the Nursing Home at NX 181 962 the underlying, rapidly deposited thick Ordovician sequence has had its Middle and Upper Ashgill succession scoured out by Silurian conglomerates to form a submarine unconformity with the remaining Lower Ashgill Shalloch Formation. Fine grained sandstones of the Lower Llandovery Woodland Formation have been intruded, distorted and scoured out by a submarine fan deposit of quartz conglomerate off a nearby scarp to the NE leaving a sharp contact with no grading, indicative of rapid dumping.

On the Whitehouse foreshore near the 3 Mile post (NX 165 946) on the A77 south of Girvan the beds are essentially vertical on the limb of the Byne Monocline, all younging seawards and southwards. The Three Mile Formation of the Upper Whitehouse Group (Lower Ashgill) occurs as narrow beds with sharp edges exposed. These were formed as distal turbidite or contourite deposits. The Myoch Formation of green and red mudstones follow as channel deposits with the red colouration indicating their formation as levees of deep water rivers that carried oxygen down into these deep water muds. These red mudstones also contain a fossil assemblage of deep water fauna, more typical of the southern supercontinent, Gondwana, brought north on the deep water cold currents from the S. Polar regions. (At this time, Gondwana was far to the south of Girvan which lay at about 10^0S.) The top of this succession, the Mill Formation lies immediately below the Silurian Shalloch Formation but the contact is confused as the Formations mixed as they both slid down unstable slopes during deposition. Our leader illustrated the repeated history of fine muds, river channels and beds sliding down submarine canyons and steep slopes before consolidation, by reference to a large scale map based on an aerial photograph to which he had added the geology from personal observation. The entire party were appreciative of his enthusiasm and clear and patient explanations of events and their effect on the fauna.

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ARRAN : 16 – 19 August 2002.
Leader : Dr Neil Clark, Hunterian Museum
Report by : *Margaret Donnelly, David McCulloch*

Friday 16th August

A group of us gathered at Glasgow Central for the 11.15 am train which connected with the ferry (where there were more of us!) for Ardrossan – a beautiful sunny day and a lovely crossing.

At the hotel in Brodick there were more of us and we set off along the beach in the early afternoon. Here the Permian sediments of Brodick Bay consist of muddy siltstones interbedded with the sandstones and conglomerates of the water lain Brodick Breccia and contain dewatering structures. The muddy beds have desiccation cracks, are limited in extent and probably represent small temporary puddles between channels of the braided rivers that deposited the coarser beds. The conglomerates contain a large variety of pre-Permian and early Permian clasts – vein quartz, red sandstones and schists, which are not well rounded, and, with the sandstones, were deposited in a high energy environment. These beds dip approximately 15^0 to the south, but further along, there is a circular area where the beds have been broken into blocks showing random orientations. Some of these beds show signs of plastic deformation: they appear to have been disrupted before they were completely dewatered and rigid, and have been interpreted as part of the valley walls falling into a fault-bounded wadi.

We examined one of a number of Tertiary feeder dykes which cut through the island – it was eroded along the chilled margin where it is less competent, and also in some central portions because its chemistry (olivine, hornblende etc) is less resistant than the quartz of the surrounding sandstones. The dyke had split into two branches, taking advantage of joints in the sandstone. A second dyke was a multiple intrusion. All round the island, the rocks were pushed up by and dip away from the intruding granite, emplaced when Scotland was moving across a hot spot (now underneath Iceland). In places the breccia had cut down as a channel into the underlying undulating surface whose cross-beds were the right way up. The grains exhibited a mixture of wind and water borne transport. There were also a number of Neptunian dykes.

Saturday 17th August

The day started off not so sunny as we headed by bus to Blackwaterfoot and Drumadoon sill – intruded into Triassic red marls and siltstones (Auchenhew Beds). The sill is a thick, columnar-jointed quartz-feldspar porphyry with large phenocrysts of quartz, plagioclase and alkali feldspar, but has tholeiite at the base and perhaps also at the top, and so is a composite sill. An olivine dolerite dyke, now visible on the shore at low tides, has excellent spheroidal weathering. The feeder dyke for the sill, also quartz-feldspar porphyry, runs sub-parallel to the coast where it has pushed the sediments up to almost vertical.

We made our way further north and had a challenging diversion into the undergrowth at the base of the cliffs to view three excellent footprints of Chirotherium, a marine reptile of the Triassic. Nearby, on the shore, are several more

(hundreds of?) footprints in trackways – all recently discovered and the first of these fossils found in Scotland. Our leader, Dr Neil Clark, gave an amazing impersonation of one of these reptiles walking across the sand, and got a round of applause! The sandstones contain fossil burrows and the siltstones have halite pseudomorphs; there are white splodges of gypsum, mud cracks, and some surfaces have ripples from all directions – this was a large delta front with lakes/lagoons and high evaporation rates. Load structures – the best in the world! – are also common.

A little north is King's Cave, carved by the sea in massive Permian sandstones about 6,500 years ago, where we stopped for lunch, and kept an eye out for the spider, before heading for An Cumhan, a thick composite dyke of quartz-feldspar porphyry, and probably an extension of the feeder dyke to Drumadoon sill. Beyond this on the shore is a pitchstone intrusion in which flow banding of the viscous fluid has been convoluted into tight folds. The tide, however, was too high and we were unable to see the intrusion at close quarters. On the way back, the fault between the Triassic and Permian rocks was seen clearly in the cliffs, with the fault-dragged Triassic rocks folded upwards. We crossed a second pitchstone intrusion on the path and descended to the beach to see more load structures. Here we found lots of pitchstone pebbles for souvenirs! Then the heavens opened and we beat a hasty retreat, soaked, to the tearoom at Blackwaterfoot for tea, cream buns and the bus.

Arran footprint

Sunday 19th August

Heading north from Brodick towards Lochranza, we stopped briefly in North Glen Sannox. The light rain was certainly a disappointment but the real menace soon became apparent as we stepped off the bus into a swarm of midges. The damp, calm, conditions were clearly to their liking. Neil Clark pointed out the Dalradian Schists in the river bed west of the bridge before leading us downstream to find the Ordovician shales. He told us that nearby we could look for highly altered pillow lavas. However by this point most of us were frantically waving branches of bracken around our heads to ward off the midges and a decision was made to retreat back to the safety of the bus.

Hutton's 'other' Unconformity

After being dropped off at Lochranza we walked along the north shore of the loch passing an outcrop of Dalradian schist. Examination of the graded bedding indicated inversion as part of the Tay Nappe fold structure. We then proceeded to Hutton's Unconformity to pay homage to one of geology's founding fathers. A light breeze offered a faint respite from the midges and here we could examine steeply dipping Dalradian grits overlain by much more gently dipping upper Palaeozoic sandstones. The metamorphosed rocks must have been deposited from even older pre-existing rocks, buried, heated, folded, uplifted and eroded before the sandstone was laid on top. If this realisation of the immense time periods involved in the formation of our planet is difficult enough for us to grasp today, how must it have been for Hutton, brought up in an era when strict belief in the biblical teachings of

Genesis was rarely seriously questioned? We also pondered whether the midges of the day had made themselves known to The Great Man.

A little switchback path led through an area of fallen blocks. Further on the cliffs inland revealed some very good exposures of cross bedded aeolian Permian sandstones. The exposures on the foreshore had been eroded into undulating hummocks of smooth rock, uncannily like the dunes which must have existed at the time of their formation. We continued along the coast further back in time to the Upper Carboniferous. Near the old saltpans we came upon a dipping bed of sandstone upon which we could clearly see two parallel tracks of disturbed sediment about 35cm apart. This curious pattern was explained as the trace fossil formed by the passage of a large two metre long millipede-like creature called Arthropleura. Its 23 pairs of legs had left this rare imprint in its wake. It was strange to think that a random, insignificant, event millions of years ago, an everyday occurrence at that time, could entice a sodden, midge-bitten huddle of Homo sapiens to walk over four miles to witness the evidence of the creatures little sojourn across the sands. This reminder of distance prompted us to begin our return journey via Laggan Cottage and a very attractive grassy path climbing obliquely up the steep hillside to a high pass. The views out to sea should have been magnificent but only the faint outlines of Bute, Cowal and Kintyre were visible in the grey murk. On the descent there was no shortage of water flowing with us down the well made path but by now our boots were so full of water anyway it made little difference.

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SALTCOATS AND DALRY : 31 August 2002
Leader : Dr Colin McFadyen, Scottish Natural Heritage.
Report by : *Moira Salter*

After the previous day's rain, and a slightly chilly start, it turned into a beautiful day, and the extra layers of clothing were quickly discarded. We had come to look at the Upper Carboniferous sequence in Ayrshire, along with Carboniferous/Permian sills, and Tertiary dykes.

Our day started at the small bay south of the pier. Here we saw the Upper Carboniferous coal measures dipping approximately southeast. The same dip continued right across to Ardrossan. As we made our way in that direction we were therefore going down sequence, and consequently were able to recognise cyclothems of sandstones and shales. Some shales were fossiliferous (mainly bivalves), but we were not able to find coal seams here, just dark shales verging on coal. The bay below the road had a light coloured teschenite sill, which was underlying a cross-bedded sandstone. This indicated a deltaic environment. We also found a thin band of precipitated limestone which had formed in a freshwater lacustrine environment.

Near the pier there was a sinistral fault where the sill had clearly moved about 30m seaward. The surface was ragged, caused by the magma penetrating different sedimentary strata. The sill had clear vertical jointing. We could only see the top of the sill, but an exposure in another locality has shown it to be a composite sill, where the initial teschenite has been penetrated by picrite. North of the pier were

a series of sandstones, some with ripple marks indicating an inter-tidal environment. One of the strata had infilled burrows suggesting a beach, or river with shallow water.

Colin announced that it was 3 minutes to low water (such was his meticulous planning!), and so we set out seaward to look for the fossil trees. First we came upon Stigmaria roots with indentations where the rootlets had grown. Further towards the sea, beyond a small sill, we found several tree stumps. Most were upright, but one was at a slight angle and another could be seen beautifully below the clear water. It is possible that the sill had separated the trees from their roots.

Fossil trees

A long Tertiary dyke cut across the sediments, and had clearly come up at an angle. The adjacent sediments had been baked to hornfels. We sat on the dyke for our lunch, and as we munched our sandwiches, someone who shall remain nameless (alright it was Charles Leslie!) threatened to take a photograph of the "feeder" dyke!

After lunch we looked closely at the 19m Saltcoats Main Sill. This was a composite sill comprising three successive magmas. The first layer was 2.7m of viscous layered teschenite, containing a lot of nepheline. This was intruded on top of the Kilwinning Coal Seam. The second surge of magma was 4+ m of a biotite-analcite-dolerite, which was intruded between the coal and the teschenite. Finally picrite was intruded when the dolerite was still mushy. Segregation veins formed during this process. We found a good junction between the picrite and the biotite-analcite-dolerite. Picrite is a very basic rock containing both olivine and augite. Here however it was unstable, brittle and partially serpentinised by contact with seawater.

On the other side of the point, by the old swimming pool, we saw the Kilwinning coal immediately below the sill. The sill here had been altered to white trap (containing a lot of kaolin) by the volatiles released from the coal. The Passage Group, comprising Ayrshire bauxite and Troon volcanics, underlies the coal measures, and can be seen looking towards Ardrossan. Unfortunately the advancing tide prevented us from examining it.

We then set off for the beautiful Linn Glen at the edge of Dalry, crossing over the Passage Group on the way to look at the Upper Limestone Group which underlies it. Called the Upper Linn Limestone here, it consists of sandstones, shales and limestones. The limestones contain brachiopods, bivalves, crinoids and trilobites, i.e. a marine fauna. The harder limestone strata form the steps of many waterfalls up the valley. At the footbridge along the Linn footpath the river alters course due to a fault. A cliff on the right bank shows good layers of the Ayrshire bauxite (both red and grey) of the Passage Group. On the opposite side of the river are massive sandstone layers. We went down to the river in search of trilobites – and found one! A truly exciting end to the day.

Many thanks to Colin, who explained everything so clearly. His step by step approach and use of large charts rather than handouts was an excellent idea. It made us listen more carefully and then look for things ourselves.

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LESMAHAGOW : 21 September 2002.
Joint Field Excursion with Edinburgh Geological Society.
Leaders : Dr Neil Clark, Hunterian Museum & Professor Euan Clarkson, University of Edinburgh.
Report by: *Barbara Ottaway* Glasgow Participants : 17

It was a perfect late summer's day as the Glasgow contingent, in a mini bus ably driven by Carolyn Mills, followed the bus containing our Edinburgh colleagues along a dusty track leading to Logan Farm outside Lesmahagow. After meeting up with other members who had brought their cars, the party of nearly fifty (from seven to seventyish!) were introduced to our guides and mentors for the day, Dr Neil Clark and Prof. Euan Clarkson. They explained how the Lesmahagow inlier is a block of Silurian sediments, comprising shales and sandstones, surrounded by sediments of Carboniferous age. Many important collections of Silurian arthropods and vertebrates were made near Lesmahagow in the 1800's. The story starts with a Dr Slimon of Lesmahagow attending a birth in a farmhouse in the area. One of the boys on the farm had some 'unusual' stones which he showed to the doctor. As Dr Slimon was a keen amateur geologist, he recognised that these were a significant find and the rest is history! When the Geological Society of Glasgow set up a camp in the 1890's, named Camp Siluria, rare and complete specimens of fossil fish and eurypterids were collected. However, more commercially driven collectors, resorting even to gunpowder to extract the fossils, have made fossil finding rare but still possible. Neil explained that the Birk Knowes SSSI has extremely limited access and is now surrounded by a deer fence. He did add that there was some debris outside the fence perimeter in which fossils may still be found.

Filled with enthusiasm, the party made its way to the SSSI, also known as the Jamoytius Horizon and named after the rare soft-bodied fish found from this locality. The silts and shales here are all from the Patrick Burn formation and probably represent a shallow brackish-water lagoon with occasional marine water incursions and high sediment output. Lots of grovelling and hammering in the debris reaped rewards for some. Some of the fossil parts found were from Loganellia scotica (found by Jane, Edinburgh's eleven year old amateur!) and several examples of Ceratiocaris papilio, commonly known as the pod shrimp.

The group then walked uphill to a knoll on the moorland terrain and lunch was taken whilst basking in the sunshine. Neil's whistle indicated the next stage of the excursion was imminent and a dyke was next on the itinerary.

Exposed on the hillside about 200m south of the Birk Knowes locality on the Logan Water is a tholeiitic dyke, which is about 6m across and may be traced between the Logan Water and the Kip Burn. It is part of a Tertiary swarm emanating from Mull which extends well into the Midland Valley. The exposed rock has a characteristic sharp edge with spheroidal weathering surface. The crystalline texture may be seen on a fresh sample with aligned feldspar laths. At first glance, however, it could be taken for sedimentary rock, resembling a stone staircase with the steps vertically, not horizontally, placed. Whilst following the line of the dyke, a wonderful view of the Southern Uplands to the east and the Campsies and Ben Lomond to the north was clearly visible.

The party moved downhill to the Kip Burn, to an exposure of where the dyke had intruded into the sedimentary rock causing the rocks to fold upwards close to the dyke. These exposed sediments are of siltstones and shales of the Blaeberry Formation, consisting of pale olive sandstones interbedded with pale olive mudstones, extensively bioturbated and possibly containing small gastropods, ostracods and bivalves. The clear example of buckling and folding of the sedimentary rock at this exposure, suggested a violent intrusion as the dyke was forming.

The group moved on to the next locality, following the Kip Burn down stream to a small pool and waterfall. The shales, in this area, exhibited a blue colour with dark carbonaceous laminations in places. Neil and Euan again encouraged the members to look for fossils in the rocks in the stream bed and again the search met with success. Parts of the pod shrimp (Ceratiocaris papilio), Slimonia acuminata (named after Dr Slimon), and Pterygotus bilobus, including a good example of a pincer, were some of the finds. One piece of shale revealed some gastropods, scaphopods and a couple of bivalves close to one another suggesting they were deposited in quiet conditions.

At the fifth and last locality further down stream of the Kip Burn, the Castle Formation, which is a sequence of thick sandstones and greywackes, was examined. Largely unfossiliferous and mostly devoid of sedimentary structures, these sediments may reflect a more rapid period of deposition at the top of the Patrick Burn Formation, forming a boundary between the more marine nature of the Patrick Burn Formation and the non marine nature of the succeeding deposits. Mr David Redwood of the Edinburgh Geological Society took the opportunity to give the vote of thanks to Neil and Euan for their unfaltering enthusiasm and encouragement throughout the day. Once back at Logan Farm and Charles having done the head count, it was back

to the Popinjay Hotel for high tea. Edinburgh and Glasgow members mixed well with lots of chat. Not many cakes were left either! The weather, company, location and expert guidance all went to make the day very memorable and a most successful joint, and last excursion of the season.

GENERAL INFORMATION

Promoting the study of the Earth

1. The Scottish Societies (Aberdeen, Edinburgh and Glasgow) have united in awarding a prize to the candidate who gains the top mark in the Higher Grade Geology examination. This has been presented by the Glasgow Society for many years, on occasion in person by the President. In addition, Conoco suggested that the Societies contribute a grant for prizes at three levels of examination administered by the SQA. It was agreed that our Society would administer the scheme initially and we received a cheque from Conoco for £1000.

Following the announcement of results in August, three students, from schools in Dumfries, Portree and Cumnock, were awarded the first prizes – £100 book token and a certificate.

2. Council now has two representatives on the working group of the Scottish Earth Science Educational Forum (SESEF) – Dr Chris Burton, also representing the Division of Earth Sciences, and Dr Neil Clark, also representing the Hunterian Museum, both of the University of Glasgow. SESEF hopes to appoint an officer to organise professional development courses for teachers, to encourage more young people to consider a career in Earth Sciences. The distribution of schools which teach geology to Standard grade or Higher is very uneven in Scotland.

Hugh Miller

This year marked the 200th anniversary of Hugh Miller's birth and a number of events took place in Cromarty and Edinburgh. There was also a study week on the Isle of Eigg whose geology was described in Hugh Miller's book 'The Cruise of the Betsy'.

Scottish Geology Week

This year the event consisted of a competition for schools and the winners were presented with their prizes at the BGS Open Day on 28th September, 2002.

Memorial Service

The Society held a Memorial Service to remember those who lost their lives in the accident on 18th May 2001 at the start of the Durness weekend excursion. All members were invited to attend the service which was held in the Chapel of the University of Glasgow at 10.30 am on Saturday 9th March 2002. A short reception was held afterwards in the College Club.

INTIMATIONS

With regret, we record the deaths of the following members :

Mrs Lindsay Hamilton, member since Session 137 (1994 - 95), who died on 12th October, 2001, after a long and brave fight with cancer. Lindsay was an enthusiastic participant in the many activities of the Society and was a Member of Council during Sessions 142 -144. She had started studying Earth Sciences with the Open University in 1993, completing her degree in 1999, almost two years after finding that she had cancer. She joined the Open University Geological Society in 1994 and, as Events Officer of the West of Scotland Branch, became one of the most energetic members of the committee, spending a great deal of time, thought and energy in arranging interesting and enjoyable trips. She also played a vital role in the establishment of the Branch Library of maps and books. Lindsay had a great love and a wide knowledge of Geology, and took part in numerous field trips with energy and enthusiasm – her speciality was 'hard rocks'. She will be greatly missed by all who knew her. Our deepest condolences are extended to her husband, David, her sons, Euan and Neil, and to her many friends.

Mr R.P. Tripp, member since Session 81 (1938-39), who died in January, 2002. Mr Tripp was a Life Member, and had moved to live in the Lake District some years ago.

Mr J.K. Oakley, member since Session 130 (1987-88), who died in May, 2002.

SESSION 145 (2002– 2003)

Members of Council

President	Dr Colin J.R. Braithwaite
Vice Presidents	Mrs Janey MacDougall
	Mr Michael Pell
	vacant
Honorary Secretary	Dr Iain Allison
Treasurer	Mr Mervyn H. Aiken
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	Mr W. Bodie
Proceedings Editor	Mr Bob Diamond
Publicity	Dr Neil D.L.Clark (web)
	Dr R.A. Painter (meetings etc.)
Excursion Secretary	vacant
Overseas Excursion Secretary	vacant
Rockwatch Representative	vacant
Junior Member	vacant
Journal Editors	Dr Colin J.R. Braithwaite
	Dr R.M. Ellam
Ordinary Members	Miss Muriel Alexander
	Mr Philip Close
	Miss Margaret Donnelly
	Dr J. Hughes
	Dr Mike Keen
	Dr Jim MacDonald
	Dr Joan Walsh
	vacant

The web site is at http://www.geologyglasgow.org.uk/. The site is now maintained by Dr Neil Clark (Publicity Officer), who has redesigned the site and introduced a number of new pages.

MEMBERSHP

	At end 145 30 Sep.,2003	At end 144 30 Sep.,2002
Honorary Members	5	4
Ordinary Members	331	338
Associate Members	65	65
Junior Members	13	7
TOTAL Members	414	414
New Members	30	27
Deletions	30	(37)

"Deletions" include 20 Members who had not paid their subscription by 30 September although three reminders were sent out.

C. M. Leslie

LIBRARY

Negotiations have commenced with the University Library regarding a permanent home for the Society's rare books, and Glasgow University Library has committed itself to the retention of all the rare book stock to be lodged therein. Members will have access to the rare books in the normal way.

C. J. Burton

SCOTTISH JOURNAL OF GEOLOGY

Following the difficulties encountered in the production of volume 37/1, attributed largely to the demands of the Research Assessment Exercise of the academic community, it is good to report that the Journal seems to have regained equilibrium. Members will have received both parts of volume 39 on time and both this and volume 38 have been completed with their full complement of 96 pages per part. This has been in part due to the interpolation of the thematic set of papers on Advances on Scottish Graptolite Biostratigraphy but also to a return to what seem to be more typical rates of submission. However, the editors are seeking material for further thematic issues and encourage all readers, whether or not they are members of either society, to consider publishing their work on Scottish geology in the Scottish Journal.

A by-product of this lean period has been a saving in publication costs and it has not been necessary for the Board to seek subventions from the two societies. However, the reserves accumulated have now gone and the Board is seeking finance for the production for the coming year. Our page charges will increase by 3.7%, slightly above inflation but taking into account increased costs of publishers'

staff, paper and distribution. An audited copy of the accounts prepared by the Board Treasurer is available on request. Trade charges will rise by 6%, in line with the industry average. However, Trade subscriptions continue to fall, in line with comparable journals. We have yet to see any impact of the on-line publication but the costs of this are included in the overall charges levied.

C.J.R. Braithwaite

In order to increase the number of student members, from January 2002, Junior Members were able to receive copies of the Journal for an additional fee of £5 per annum. Ed.

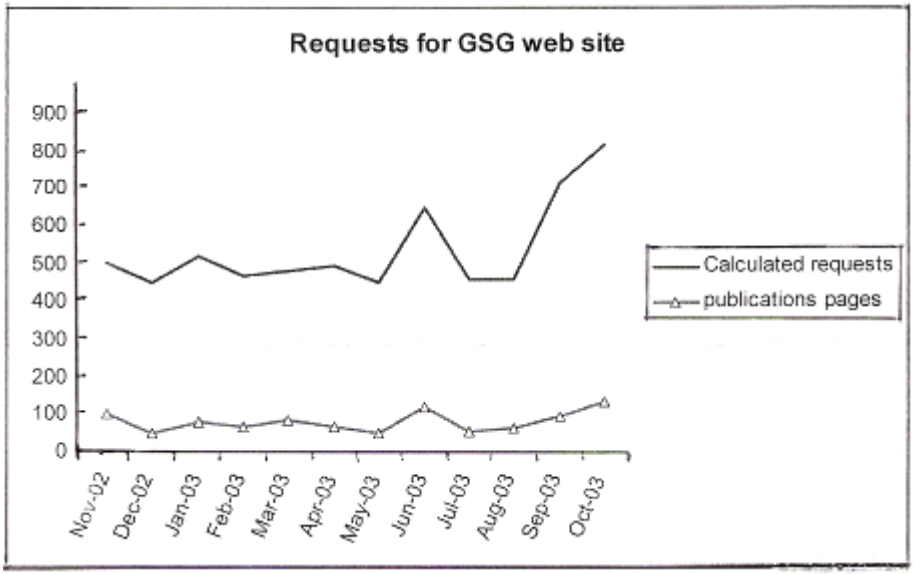
PUBLICATIONS

Best sellers this year have been the Arran Guide, SNH Books, Teach Yourself Geology, Ardnamurchan and Landscapes of Scotland. This latter title by Con Gillen has proved very popular. The Arran Guide, which will shortly go out of print, is being revised by Dr Jim MacDonald. In co-operation with the Edinburgh Geological Society, a Mull Guide is being prepared. Several of the new titles this year have been relatively expensive but members (and classes) have risen to the challenge and supported our sales of these very worthwhile books. With our gross income some 60% up on last session, we finished with a surplus of £838.55.

R. Smart

WEBSITE

http://www.geologyglasgow.org.uk/



The web site is becoming more popular with at least 670 requests (and possibly as many as 818) in October 2003 and up to 6,400 over the last 12 months. The most frequented page is the publications page with 857 requests in ten months. The excursions, lectures and the links pages fall well behind, averaging less than 660 requests over the same period. The home page is becoming more popular with over 438 requests in the last two months, presumably as a link page to other activities. Comments and suggestions for the web pages are always welcome, but the content is reliant on information being provided by members.

Neil D. L. Clark

TREASURER

Income and Expenditure Account for Year Ended 30th September 2003

(Scottish Charity Number SCOO7013)

Income			**2001 – 02**
Subscriptions received	£ 5941.57		
Deduct paid in advance	187.00	£5754.57	£5941.91
Investment Income:			
Dividends	457.65		362.01
National Savings	1414.01	1871.66	1921.86
Net surplus from publication sales		838.55	216.90
Tax refunds (Gift Aid)		722.05	720.92
Donations		150.00	1061.27
Excursions		14.50	22.00
From TNG Fund		615.20	
		£ 9966.53	
Expenditure			
Billets, programmes, postage, telephone, stationery etc		899.57	919.11
Meetings		1271.36	1537.48
T N George Celebrity Lecture		223.10	122.75
Library		350.03	518.50
Scottish Journal of Geology		nil	nil
Insurance		549.67	438.39
Donations		650.00	100.00
Scottish Geology Festival – 'Rock On'		90.00	28.60
Affiliation fee		25.00	22.00
TNG Medals		615.20	
Conoco Philips Scottish Geol. Societies prizes		300.00	
Protective hard hats		207.65	
Hunterian 2007 fund		250.00	
AGM - Income	34.00		
- Expenditure	70.00	36.00	

Depreciation on computer @ 20% of cost	313.47	
Surplus of income over expenditure	4185.48	3466.46
	£ 9966.53	

Publication Sales Account For Year Ended 30th September 2003

Gross Sales	£ 3261.35	
Deduct Expenses	119.57	£ 3141.78
Stock at 1/10/02	£ 11336.05	
Add Purchases	2342.30	
Publications available for sale	13678.35	
Deduct stock at 30/09/03	11375.12	
Cost of publications sold		£ 2303.23
Net surplus on sale of publications		£ 838.55

Balance Sheet as at 30th September 2003

Assets			**2001 – 02**
Debtors for publications at 30/9/03		£ 130.95	£ 308.00
Cash in hand:			
J.E.MacDougall		£ 132.97	
Membership Secretary		135.74	
Publications Sales Officer		6.40	
Cash at Bank:			
Royal Bank of Scotland Account	£ 9272.78		
National Savings Investment Account	35391.53	44664.31	41962.70
National Savings Income Bond		12000.00	
Investments at Cost		1025.70	
Stock of Publication		11375.12	11336.05
Computer (at 20% depreciation)		nil	313.48
		£ 69471.19	
Liabilities			
Subscriptions in advance		187.00	100.00
Uncashed cheques		579.28	1500.00
Moneys due by Society		622.12	1519.79
T.N.George Fund		399.80	1015.00
Hunterian 2007 fund		250.00	

Accumulated fund at 30/09/02	63247.51	
Add surplus for year	4185.48	67432.99
		£ 69471.19

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 2003

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

MEETINGS

The session's meetings opened with the Professor George Memorial Lecture by Richard Jefferies of the Natural History Museum. This erudite presentation illustrated the need for care in the selection of speakers as it was accessible only to the experts even among the professionals. A more user-friendly talk followed from Ben Harte of the University of Edinburgh who entertained us with tales of Japan and its geology. The year closed with the AGM and entertainment in the shape of a GSG version of "Who wants to be a millionaire". Nobody won any hard cash but the proverbial 'good time' was had by all!
2003 saw the return of an old friend in the shape of Peter Haughton, now at University College Dublin, who regaled us with tales of the "Wild West" (of Ireland, that is!) and exotic locations such as the Porcupine Bank. He also kindly offered to take a weekend excursion to his old stamping ground of the Kincardine Coast which we duly enjoyed in September. Bob Spicer from the Open University gave a talk on "Fossil leaves and palaeoclimates" which was as entertaining as it was topical - having been mentioned in the press not long before.
Our Joint Celebrity Lecturer came in the charismatic form of Peter Fookes who has an extensive background both in Geology and Civil Engineering, having worked in 80 countries during a long and active career! He enthusiastically expounded his belief in "Total geology and the geological model for engineers". Local lad Brian Bell brought the session's lectures to a close with a clear and fascinating presentation on "The 1783 Laki eruption in Iceland". Members' Night lived up to its usual high standard and also ventured into the realms of hi-tech as several speakers made PowerPoint presentations.
On an organisational note, it is becoming more difficult to get the programme arranged in time for the start of session, especially in finding speakers for October. I suggest that we bring things forward a little and plan the talks by calendar, rather than academic, year. This way we would always have the October and November talks 'in hand' when the following session's lectures were being organised.

J. M. Morrison

Thursday 10th October 2002

After the following citation delivered by Dr Chris Burton, the **Professor Thomas Neville George Memorial Medal** was presented by the President to:

Dr Richard Jefferies
The Natural History Museum

Dr. Jefferies is a palaeontologist of outstanding ability and a pioneer in a number of key fields in that subject. He commenced his long research career over forty years ago as a student of the formidable A. G. Brighton in the Sedgwick Museum, Cambridge. This initial thesis work concerned Upper Cretaceous Foraminifera from the Anglo-Paris basin, work subsequently published from the British Museum (Natural History) – the 'BM' to most of us from that era – and the permanent base from which Dr. Jefferies' research career developed.

Some of his other studies from this period in the early 1960s included investigations of bivalves and brachiopods from the Triassic and Jurassic – these and the forams demonstrating a range of expertise and some intriguing new approaches and fields consistent with a time of expansion and diversification in palaeontology as a whole.

One such new field had emerged in the late 1950s, when workers such as Strimple in the United States and Ubaghs in Europe had begun to investigate a group of rather strange early Palaeozoic echinoderms – those formerly called 'Carpoids' – something I had myself encountered as curious 'tennis racket' shaped fossils in the Cambrian of the Montagne Noir. Dr. Jefferies was one of those who took up the challenge of these fossils, and a stream of innovative papers followed, indeed there scarcely seems to have been a year since that time when a new paper has not appeared, describing work done in a variety of places, including Girvan.

From the outset this, and all Dr. Jefferies' work has been marked by some key features – meticulous observation, deep scholarship and research of the highest quality – all backed up by the most cogent of arguments. What emerged from this work, and early on at that, was a controversial thesis on the links between these echinoderms and the vertebrates. Indeed Dr. Jefferies is no mean controversialist, as was demonstrated by his espousal of what was then called Phylogenetic Systematics – now Cladistic Taxonomy.

This was a time of extreme controversy as palaeontologists struggled to come to terms with startling new ideas, and a lot of heat and no little light were engendered from the clearly expressed views and explanations of our medalist. I well remember some of the muttered references to 'that lot at the BM' from the more hidebound within the palaeontological community, and at one point it seemed that a complete taxonomy of the cladistic practitioners themselves was about to emerge, as 'traditional' and 'transformed' cladists began to proliferate and diversify.

Yet, and I suppose this is one of the rewards of pioneering a controversial new issue, many were persuaded of the merits of cladistic taxonomy – to the point that today it is accepted as a matter of course.

Through all his studies, Dr. Jefferies has enriched his subject and enlarged the horizons of a generation of palaeontologists – sometimes against their stubborn opposition! In doing this he has been a key influence in the way we all view the

organization of life, and how we understand the structure of that organization. Palaeontologist, taxonomist, pioneer and gadfly to all of us, Dr. Jefferies is a most worthy recipient of the T. N. George medal.

Dr Jefferies then addressed the Society on

FOSSIL EVIDENCE ON THE ANCESTRY OF THE VERTEBRATES

A century ago zoologists already suspected that the chordates, hemichordates and echinoderms belonged together in the group Deuterostoma. This intuition has recently been confirmed by DNA sequence studies. The marine Palaeozoic fossils known as carpoids give the same answer. They have calcite skeletons with each plate a single crystal as in echinoderms. Unlike extant echinoderms, however, they do not have radial symmetry, being bilateral or bizarrely asymmetrical, with gill slits, locomotory tails, fish-like brains etc. Within the deuterostomes, the various carpoids can be assigned to the stem groups of the hemichordates, chordates, acraniates, tunicates and vertebrates. Scottish collectors have played an honourable part in gathering the fossil evidence. With the aid of detailed slides of fossils, and with diagrams using cladistics, Dr Jefferies outlined the most recent theories on the evolution of the vertebrates.

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Thursday 14th November 2002
Professor Ben Harte, University of Edinburgh

VISITING JAPAN

Ben Harte was a visitor at Ehime University on Shikoku Island for 6 months recently, and during his visit travelled through parts of the islands of Honshu (the 'mainland') and Kyushu. His lecture described his personal impressions across a wide range of topics, covering not only the geology and scenery but also the education and social characteristics and was illustrated with stunning photographs of the mountains, volcanoes, thermal pools (where the local monkeys, snow on their fur, copy their erstwhile primate cousins by bathing in the hot water!), coastlines, landscapes, cities and towns which he visited. Altogether a most revealing, entertaining, informative and enjoyable evening!

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Thursday 12th December 2002

ANNUAL GENERAL MEETING

During Session 144 Council co-opted Rosemary Coleman as Rockwatch representative. The following Council members came to the end of their terms at the end of this Session – Mervyn Aiken, Treasurer, Bill Bodie, Assistant Librarian, Charles Leslie, Membership Secretary, Rosemary McCusker, Excursion Secretary,

and Jim Morrison, Meetings Secretary. All but Mrs McCusker were willing to stand for a further three-year term. Mrs McCusker wished to stand down temporarily from the post she has so ably performed over recent years. Rosemary Coleman had recently resigned as Rockwatch representative. We thanked them all for their contributions to the work of the Society over the past three years.
An **Honorary Membership** was bestowed on Mr E Kellock, a member of the Society for 50 years.
The business of the AGM was followed by a geological version of the quiz 'Who wants to be a Millionaire?' with audience participation, and then by wine, soft drinks, and nibbles.

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Thursday 9th January 2003
Dr Peter Haughton, University College, Dublin

WILD WEST – THE GEOLOGY OF IRELAND'S ATLANTIC FRONTIER

Vast areas of the Irish seabed and the underlying geology beneath the NE Atlantic remain poorly characterised. However, during the last five years, new insight has been gained through an integrated programme of imaging, coring and sea bed sampling that has focussed on the Rockall Basin, a large, undersupplied sedimentary basin 300 km to the west of Ireland. This talk highlighted some of the findings of these studies, working from the late Mesozoic through to the Quaternary, and illustrated some of the evidence for volcanic activity, basin development, great slope failures, deep water coral mounds, bottom current activity and ice rafting.

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Thursday 13th February 2003
Professor Bob Spicer, Open University

PLANTS, CLIMATE AND EARTH SYSTEM SCIENCE

The interactions between plants and the environment have resulted in a range of leaf architectural characters that reflect the climate to which the leaves are exposed. The climate signal encoded in leaf architecture is carried through time in the form of fossils, so potentially if we can crack that code we can reconstruct past climate in some detail. Research in the high Arctic (Alaska and northeast Russia) and in Antarctica, has shown that, in the Cretaceous Period, these areas were dominated by luxuriant forests of deciduous conifers with some broadleaved trees and plants, and so must have been warmer than at present, and with an adequate rainfall. Low latitudes were initially hot and arid but became increasingly moist, gradually supporting some tropical plants. This reflected the incursion of a seaway between South America and Africa with the opening of the South Atlantic as the Cretaceous progressed. This lecture was the story of how we can now use fossil leaves to investigate not only past climate, but also learn about the deep interior of the Earth

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Thursday 13th March 2003
Joint Celebrity Lecture with the Edinburgh Geological Society.
Professor Peter Fookes

TOTAL GEOLOGY AND THE GEOLOGICAL MODEL FOR ENGINEERS

The lecture explored the borderland between geology and engineering, largely through consideration of site investigation practice and the use of the geological model in characterisation of sites for engineering purposes. The lecture was illustrated by colour slides from around the world. The premise for the Total Geology and Model approach is that the geology at any one site is a product of its history: the engineering geological environment of the site includes its geological history and the past and current geomorphological processes and climatic conditions. The development of the geological model for any site therefore requires specific consideration of the regional and local geomorphological history and the current ground surface conditions.

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Thursday 10th April 2003
Dr Brian Bell, University of Glasgow

THE LAKI (SKAFTÁR FIRES) & GRÍMSVÖTN EUPTIONS (1783 – 1785), SOUTHERN ICELAND : MODERN ANALOGUES TO LARGE AA FLOWS IN THE PALAEOCENE HEBRIDEAN PROVINCE ?

This talk gave an illustrated account of the Laki fissure eruption (1783 – 1785) in southern Iceland and drew comparisons with large lava flows within the Palaeocene Hebridean Province of NW Scotland (Preshal More, Skye and Fingal's Cave, Mull).
The pulsed Laki (Skaftár Fires) fissure eruption in southern Iceland had a duration of approximately 8 months during 1783 -1784 and produced one of the largest basaltic lava flows of historic times, with as estimated volume of *ca*. 15 km^3. Nearby Grímsvötn volcano was also active from 1783 through to 1785. The Laki lava flowed southwards over 35km from the 27 km-long fissure-aligned vent system. Associated phreatomagmatic eruptions occurred due to the high water table in the area and the resultant tephra was dispersed as far as mainland Europe. Sulphur emissions during the eruption produced an acid haze (aerosol) that had a widespread climatic and environmental impact, both in Iceland and throughout the Northern Hemisphere.
In an attempt to unravel the volcanology of the Palaeocene lava fields of NW Scotland, two large lava flows have been examined in detail: Preshal More (Skye) and Fingal's Cave (Mull). The field relationships of these two spectacular flows were discussed and comparisons made with the Lake fissure eruption.

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Thursday 8th May 2003

MEMBERS' NIGHT

We acknowledge with thanks the contributions of our members noted below to the success of this evening.

Short talks

Bob Downie	Drilling Uganda's 'First' Oil Well
Brendan Hamill	Bannockburn, Gargunnock and the Holy Grail
Robin Painter	Carbon Dioxide Sequestration
Gordon Todd	Tertiary Flora of the Isle of Skye

In addition there were a number of interesting displays in the laboratory.

EXCURSIONS

A very full and successful series of excursions was enjoyed this year by the usual group of regulars but several new members were welcomed as well. We would like this trend to continue. We were indebted to members of the University staff who willingly gave up their time again to lead the majority of the excursions as well as the two visiting leaders.

The Saturday excursions concentrated on the West of Scotland and included the Glasgow Basin, Dunkeld and Newtyle, Lomondside, Loch Leven, Tyndrum and Glen Taggart. All of these were "sold out" and in general benefited from good weather.

The weekend trips visited two geologically significant areas, Ardnamurchan and the HBF in Kincardineshire. The complex in Ardnamurchan was an eye opener for those who had not been fortunate in visiting it before (this did not apply to Brian Bell who admitted that it was his 80th field trip), and in Stonehaven, Peter Haughton from UCD proved to us that conglomerates can be fascinating and excellent forensic evidence to set against other theories.

The organisers would like to thank all the leaders, those who came on the excursions and particularly those who assisted by driving the minibuses which had to be used on occasion.

Carolyn Mills & Michael Pell

GLASGOW BASIN : 26 April 2003.
Leader : Dr. C.J. Burton, University of Glasgow.
Report by : *Margaret Donnelly*

Today we were to investigate the rocks and landscape of the Glasgow Basin and its underlying geology, from the Lower Old Red Sandstone through Upper Old Red Sandstone to the Lower Limestones of the Carboniferous. We first stopped on the road between Killearn and Fintry for an overview – the Campsies to the south, the Highlands to the north, Conic Hill on the Highland Boundary Fault. Green cultivated land lay on UORS, while moorland was underlain by the coarse quartz sandstones of

the Lower Carboniferous. The lava flows of the Carboniferous (extremely fluid olivine basalts) create a 'trapped topography' of steps. The Glasgow Basin is very long-term – it was a rift valley from the Late Silurian to Permian.

At the start of the Devonian, the Caledonian mountains were very high, and a huge river system has been traced from Norway, across Scotland to Somerset, with a delta stretching from London to Cork. Highland debris is found in the UORS but not in the LORS. Fragments of LORS have been brought up in dykes from beneath the Highlands – there is no Middle Devonian in Central Scotland because it was a time of thrust, which buried the LORS and brought the Highlands some 30km closer.

Our first locality was Boquhan Glen, the Stockiemuir Sandstone Formation of the UORS. Here were large and small sandstone beds, weakly cemented by haematite, in a series of coarse and fine units, with lots of feldspar, little quartz, and sub rounded grains. An immature sandstone, its source not far away, it formed in a semi-arid, not tropical, climate and its series of medium-sized channels suggested the seasonal, fast rivers of a braid plain. The iron for the haematite cement could have come from the minerals of the ORS andestic rocks fairly nearby. We moved on to Gartness, where the river cuts down through the UORS, and the UORS/LORS contact is exposed in a fault about 200m downstream, and then drove to Finnoch Glen. From the car park, we viewed the glacial landscape, and where the huge Lake Endrick had flowed out after the ice melted. The land rebounded and the drainage pattern changed, leading to a 'nick point' in the river which can be clearly seen from the bridge. The sandstones (UORS – Stockiemuir Sandstone Formation) revealed in the glen are massive cross-bedded, well-sorted and with well-rounded frosted grains – typical of aeolian dunes. Our next locality was Catythirsty Vent, near Queen's View. This had punched through the Ballagan Formation of the Lower Carboniferous, and is one of a number of vents. Catythirsty is a composite vent, with olivine basalt at the base and agglomerate on top. A raft of Ballagan Beds had fallen into the vent. Both vents and fissures erupted large quantities of lava in this area, with the Earth opening along lines of faults, and over a long period of time. Two linear vent systems can be traced out from the northeast to the southwest and at least one lava flow on the Campsies has been related to Dumgoyne. We drove on to Arlehaven, for a different panorama of the Clyde Plateau Volcanic Formation, and found macroporphorytic basalts with huge feldspar phenocrysts, before arriving at Loch Ardinning where we examined the Douglas Muir Quartz Conglomerate, deposited in a river coming from the northwest. The pebbles are monomineralic and well-rounded, the products of a long series of erosion and deposition cycles in the basins of the Caledonian Mountains to the north. Small saucer-shaped channels separated by sandy units are seen in the face of the quarry – the cross-section of braided systems. This was a tropical river from the local hills, flowing over the lava deposits, whose pebbles broke down to clay which was washed away.

Our next stop was the Linn of Baldernock, where a limestone quarry had been excavated in the river beneath a dolerite sill, and finally to Blairskaith Quarry, both of the Lower Limestone Formation. Here we searched in the black shale (with some success) for various fossils – crinoids, brachiopods, bivalves, and wood, before heading home after a fascinating and action-packed day.

BIRNAM SLATE QUARRIES : 31 May 2003
Leader : Dr Joan Walsh
Report by : *Ben Browne* Participants : 16

Sixteen members of the society were fortunate to be taken on a fine day by Dr Joan Walsh to see an example of a nineteenth century slate quarry. Dr Walsh had been commissioned by Historic Scotland to undertake a survey of Scottish slate quarries since they had been concerned by the threat to the integrity of the Scottish roofscape by the fact that there had been no production of native slates since the 1960's. Sensitive repair of traditional roofs had since then relied on a diminishing stock of second hand slates.

The metamorphic rocks of the Scottish Highlands have yielded suitable roofing slates from many sites. The Birnam and Newtyle quarries are the most north-easterly of the Highland Border group of slate outcrops stretching from Lochranza in Arran before being cut out by the Highland Boundary Fault here at Dunkeld.

Turning off the A9 onto the B867 just short of Dunkeld we parked by a sign for "Dunkeld and Birnam Walks" at NO041404 (Landranger Sheet 52) and walked under the Perth to Inverness railway along a road to the right then up to the left to the first of the quarry faces. Here we learned that we were amongst turbidites metamorphosed and folded into the Tay Nappe. The fine grained beds had formed slates and were bounded on the SE by Birnam Grits and on the NW by Dunkeld Grits. The chemistry of these rocks contrasted with those of the Ballachulish slates which had been formed from stagnant reducing muds and contained pyrites and graphite. The durability of the slates depends on their chemistry and the oxidised forms are less subject to weathering. Within these quarries the chemistry varied between green chlorite rich and the more durable purple haematite rich varieties.

Next finding our way along an overgrown path steeply up to the left of this first face, we discovered the remains of a workman's shelter formerly used by a band of 4 or 5 men. Here we learned how the frequent jointing and gritty bands of the Scottish slates had determined that, unlike the Welsh slates, they had not been produced in a few standard sizes but had been produced in a wide range of small sizes thus increasing the yield of useful slate, and determining the typical and attractive Scottish roofing style with small slates at the ridge grading to large ones lower down. Looking down the steep path we had come up we also realised the difficulty of transporting the finished product and the importance of the river Tay at first in transporting the product of the adjacent Newtyle quarry and later of the railway in transporting that of this quarry, then paradoxically bringing in the competition of cheap imported slate and tiles.

It was clear that Dr Walsh had taken on a geological brief but had soon found herself investigating the related history, economics and sociology just at a time when there were still a few men to be found who had worked in many of the quarries she had investigated. It had clearly been a fascinating study.

Just above this shelter we picked up a track slanting up to the left where we enjoyed lunch on a tipping run with a tutorial from Roger Anderton on the finer details of graded bedding and loaded ripple structures in these rocks. A few yards further on we found ourselves on a more open space bounded to left and right by

outcrops of the Birnam and Dunkeld grits looking across the railway and the Tay to the quarries on Newtyle Hill. Following the Birnam grits on the left we found a tor with very fine cup markings of prehistoric age about which there was a long conversation led by our archaeological member. Just below us was the delightful little castle of Rohallion whilst the ground all about was studded with the perfect white flowers of Chickweed Wintergreen and in the air above buzzards mewed.

Crossing the flatter ground occupied by the slates we made a stiff climb up the Dunkeld grits for a fine view from the summit of King's Seat above Birnam Wood, and I found my map left me to guess where was Dunsinane? On the way down again, structures were found that demonstrated that the rocks were right way up.

The day had been full of interest not only in geology but also history, economics, sociology, architecture, prehistory, botany and ornithology even literature, not to mention the good company. Thanks were offered to Joan whose own study, it appeared, had been likewise more full of interest than might have been guessed at first.

Reference : Scottish Slate Quarries, Technical Advice Note No 21, by Joan A Walsh, Historic Scotland, Edinburgh 2000.

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ARDNAMURCHAN : 6-8 June 2003
Leaders : Dr Brian Bell and Dr Iain Allison, University of Glasgow
Report by : *Chris Henderson and Muriel Alexander*

The Ardnamurchan Peninsula comprises the remnants of an early Tertiary volcanic centre intruded into the Moine metasedimentary rocks and overlain by a sequence of thin sedimentary rocks. The igneous activity here was contemporaneous with the eruptions taking place on Mull, Rhum and Skye. Our aim was to traverse the sequence, examine the rocks and (hopefully) understand the sequence of events!

We arrived at the Sonachan Hotel at various times of the day and most groups had a very pleasant trip with sunny weather and lovely views. Brian and Iain assembled us in the hotel bar to outline the itinerary for the next two days. A beautiful sunset gave us hope that the weather would be fine for our first day in the field.

Saturday 7 June

A bright sunny morning as promised and after breakfast we left by car for Ben Hiant to examine the Tertiary and pre-Tertiary rocks of Centre 1. After a safety briefing we set off up the stream to the first location. The rock exposed in the stream was steeply dipping to the SW, pale and crystalline with a banded appearance typical of Moine rocks. These were the original basement rocks and different heights of the exposure on either side of the valley indicated a fault or tilting. In this case it was a fault which runs from the sea up the valley. Further upstream a paler rock was seen. It scratched easily and an acid test proved Limestone. This was an outcrop of Jurassic Limestone. There was no fossil evidence and it was not a "true" limestone as the sediments had been altered by heat from an igneous intrusion. Further upstream

another pale rock was seen but this time the acid test proved negative. The rock was in fact igneous and the pale colour was due to carbonation when a dyke was intruded into the limestone. Walking upstream a short distance, a large vesicular basalt exposure showing signs of weathering was seen and just a little further on was an exposure of very mixed conglomerate. This was described in the Guide as agglomerate but Brian said that later evidence showed that it was most probably a flood deposit sitting on the lavas. The gradient became much steeper and as we walked on we found more intrusions cutting the conglomerate. We now left the stream and walked SW. There were several exposures of dolerite outcropping on the hillside and looking along the line of the outcrops it was clear that this was an inclined cone sheet. Or rather it became clear once Iain had pointed it out!

Further to the SW there was an outcrop of fine grained crystalline rock with a glassy appearance. This was an exposure of pitchstone lava which develops when there is a sudden drop in temperature as the lava is cooling. It is possible that the deposition of a thick sequence of unconsolidated conglomerate on the lava before it had cooled quenched the lava giving it a glassy structure. This location was close to the summit of Ben Hiant and the outcropping lavas were well displayed. There was a good view of Mull from this location and it was deemed a suitable spot for lunch.

Having stirred ourselves from lunch it was time to continue the examination of the lavas. Where the lavas met a cooling surface the jointing became horizontal and one exposure we examined had a very interesting pattern when the vertical jointing became fan shaped at one end of the contact. This was interpreted as being produced by a finger of lava intruding partially lithified conglomerate. The lava was cooled all around producing the pattern. On the way down we could see the abandoned village of Bourblaige and the remnants of lazy beds. It was hard to imagine growing very much in this isolated spot; however the view was very fine on a sunny day. The final location for the day was the exposure known as Maclean's Nose. This is a spectacular 100m high cliff of conglomerate. Recent interpretation suggests a mass flow deposit which infilled depressions in the eroded lava. Some of the clasts are huge and the whole deposit is very poorly sorted. Ignimbrite blocks have been found but the main clasts are of basalt.

It was a fitting end to an excellent day; however we still had a fairly long walk back to the cars. We were all ready for our dinner when we returned to the hotel and an early night beckoned for most as a busy day was in prospect tomorrow.

Sunday 8 June.

The day started off dull but dry as we set off for our first stop at Kilchoan Pier. To the west of the pier, we saw an intrusive igneous rock cutting the bedding and forming a cone sheet which dipped to a central point at depth. This was part of a series of cone sheets formed by doming and crustal fracturing associated with the centre of igneous activity.

After a drive north-west, we reached our next stop at Sanna Bay, a flat, sandy, machair type, raised beach area. Here, northwards along the coastline we saw a Centre 2 intrusion of hypersthene gabbro – unusual as it showed layering (compositional variation) which was dipping to the south. The explanation of the layering was that it may have been due to differences in the mineralogy of the slow

Kilchoan Sheet

cooling magma as it crystallized the early forming minerals (settlers) which sank forming layers, and also there may have been in-situ growth. However, convection and pulses of new magma could cause circulation, again altering the chemical composition of the liquid magma and crystals which, along with slumping, dyke intrusion and faulting gave a confused impression. After this thought-provoking explanation we relaxed and enjoyed lunch in the sunshine on the sand-dunes.

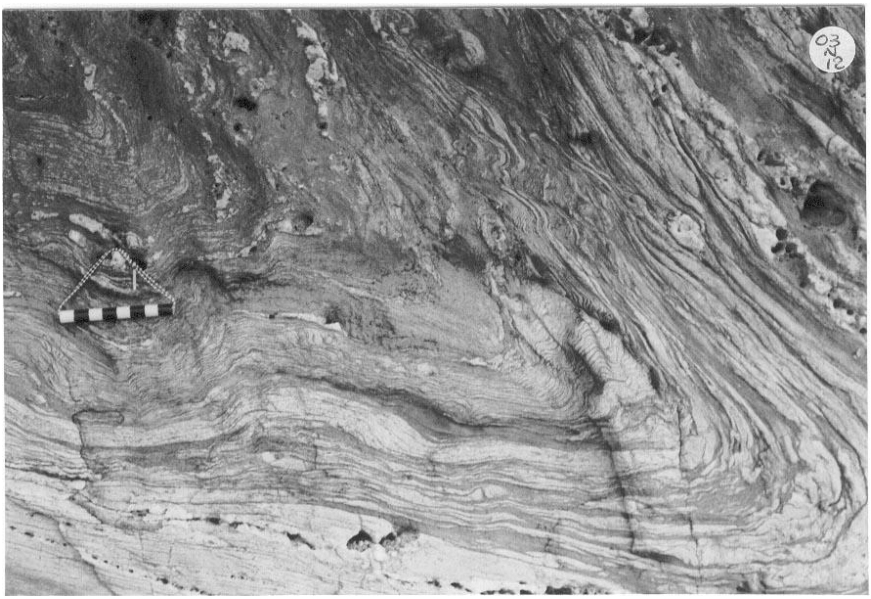
Up and off again we had a short stop at the roadside where we looked at an outcrop of the Great Eucrite, a large gabbro intrusion showing rusty spots of weathered olivine. This crystallized as one single pulse with no layering and showed much evidence of ice action. Then on to our next stop, the very centre of the Centre 3 ring intrusion where the final plutonic intrusions of the complex were seen. They were more evolved, granitic, intermediate rocks with a high silica content, which are thought to have formed by magma partially melting the crustal rock. This formed light-coloured, quartz- and biotite-bearing tonalites towards the outside, surrounding more alkali feldspar rich quartz-monzonite at the very centre. Our last official stop was at Eilean Carrack where a pair of nesting oystercatchers was not at all happy to greet us. However we persevered and found a Centre 2 intrusion of dark quartz-dolerite cut by a network of paler granitic veins (granophyre) which appear to have formed by two magmas, the hotter granitic one invading fractures in the cooling dolerite but without mixing. Further along the beach we found a very coarse grained rock with large crystals of pyroxene and plagioclase which we identified as a gabbro pegmatite. We finally made our way to the lighthouse where a welcome cup of coffee and a wonderful view ended a fabulous weekend.

Ardnamurchan lighthouse

LOCH LOMOND : 21 June, 2003
Leader: Dr. John R. Mendum, British Geological Survey.
Report by : *Charles Leslie* Participants : 13

Before starting the excursion, our leader distributed copies of a comprehensive hand-out with maps, diagrams and definitions of structural geology terms. At a viewpoint on the road between Loch Lomond and Loch Long (MOD road) he set the geographical and geological context of the rocks we were about to examine. At this point, near the Rosneath Fault, Dalradian rocks of the Bullrock Greywacke are in contact with Late Devonian / Early Carboniferous Roseneath Conglomerates, downfaulted by Carboniferous or later faulting to outcrop to the North of the Highland Boundary Fault. To the South, the Highland Boundary Fault skirts Ben Bowie having crossed Loch Lomond from Balmaha via Inchmurrin.

The Dalradian rocks we were to examine belong to the Southern Highland Group having been formed from mainly marine deposits on the shore of Laurentia as Iapetus opened about 570 Ma. They were later regionally metamorphosed, in four recognisable phases of deformation, as Iapetus was closing, absorbing island arcs during the Silurian/ Early Devonian. Within 200m of the viewpoint, Roseneath Conglomerates were examined by the roadside. The clasts were angular and variable in size, with some as large as 60 cm. across, indicating they were of local origin. They were also mainly derived from Dalradian rocks although there were a few quartz pebbles from a Lower Devonian primary conglomerate.



Folded rocks at Arrochar

Our introduction to recognising bedding and cleavage was in an exposure of Luss Slate, down facing in the core of the overturned Aberfoyle Anticline and therefore the oldest structures to be seen on the excursion. This exposure was on the Glen Luss road at its junction with the main A82 road near the wooden bridge by Luss. Prominent cleavage, partly formed by rotation of minerals and partly by recrystallisation, at an angle to the bedding planes provided an oblique view of these beds emphasising grain size variations. Moving northwards, along the A82 from the Wooden Bridge, beds young from the slates to the Bheula Schists with phyllites with silvery sheen produced on cleavage layers of sericite (white mica) and the darker, sandier units showing spaced cleavage. Some 2 miles further north on the A82, an exposure of a quartz rich arenite showed clearer second, spaced, cleavage.

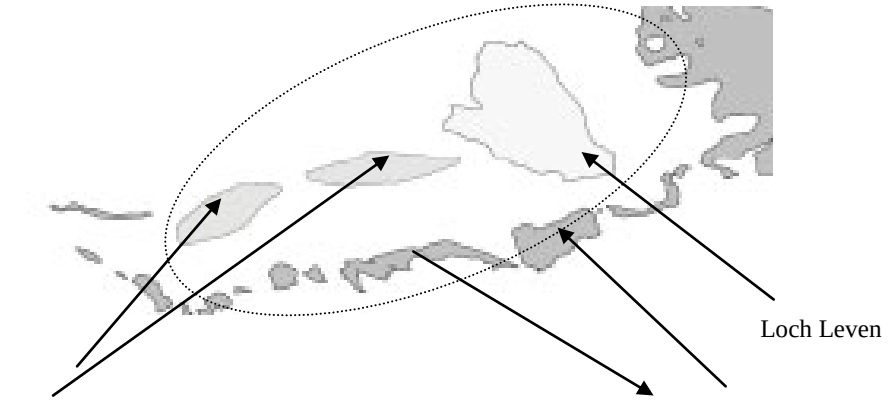
After lunch, taken in the bus to avoid the Loch Lomond midges who had found us by then, we continued along the old road at Rubha Mor to find flat lying F3 folds and also F4 folds, including unusual spaced cleavage associated with the third folds in quartz rich sediments. Although we were by now in the Flat Belt on the underside of the Tap Nappe in overturned stratigraphy, bedding was not evident. We practised identification of fold sequences at Inveruglas and finally near the Old Torpedo Testing Station on Loch Long at Arrochar. At both of these locations, ice had smoothed the surfaces making observation of the folds easier but unfortunately, not their identification.

John Mendum was thanked for his clear explanations and patience as we sought to identify the various folds and perhaps after studying his hand-out again, and examining many more rocks, we will improve. Loch Lomondside certainly provides

easily accessible exposures to study. The excursion covered a time span from the Late Precambrian to a report of an Earthquake near Aberfoyle yesterday (20 June, 2003)! – a truly Dynamic Earth.

LOCH LEVEN – KINROSS-SHIRE : 19 July, 2003
Leader : Brendan Hamill
Report by : *Bob Diamond*

This interesting, even controversial, excursion was led by Brendan Hamill. His hypothesis is that contrary to conventional interpretations the Loch Leven basin was formed as a result of a low angle oblique meteorite impact *ca* 300 Ma.



The excursion was a combination of viewing the overall topography of the area to see the remains of the features, and examining particular sites where Brendan believes the rocks show evidence of high impact. He is convinced that the central ridge represents the rebound 'core' of the impact, and that the Southern boundary of the crater is delimited by the later quartz-dolerite sill.

As well as giving us the overview, Brendan took us to a number of sites where he believes he has found evidence of impact related rocks.

At Powmill we stopped to examine a couple of roadside boulders which Brendan thinks consist of Suevite (an impact melt breccia). He has also found fragments of sandstones which display Planar Deformation Features (indicative of high impact stress) in places like Cult Hill.

Hallcroft Farm and Scaur Hill gave us a chance to look at basaltic impact melts which are found amongst the Carboniferous sandstone and limestone beds.

All in all it was a stimulating and thought-provoking day. Not all of us were convinced by Brendan's ideas, but we had been challenged to think in a different way about a relatively well known area. Never a bad thing!

TYNDRUM : 16 August 2003
Leaders : Dr Iain Allison, Dr Allan Hall, University of Glasgow
Report by : *Julian Overnell* Participants : 23

This was an excursion to the workings of the old lead mine on the hillside about 1km west of Tyndrum, just south of the railway line to Oban. The lead vein was discovered in 1741 and production continued until 1919. It is now worked out. The excursion started at Tyndrum Lower railway station at 11am. The weather was fine and sunny. The party walked to the mine site, partially along a disused mine track. Where this crossed a boulder-strewn riverbed, excursion members were asked to search for evidence of mineralization. The following were found: brecciated country rock supported with vein quartz, vein quartz with lustrous yellow/ brown sphalerite, vein quartz with cubes of galena, vein quartz with more massive fine-grained galena, and vein quartz with small specs of chalcopyrite. Small quantities of pitchblende had been found in the past in the dumps, but the only likely-looking sample found in the river bed failed to make a Geiger counter tick.

The excursion then proceeded up the hillside to the mine workings. The lead and zinc sulphides were embedded in vein quartz in a vein (called the hard vein) which trended NE-SW and dipped steeply to the south east. It was cut off at depth by the nearby strike-slip late Caledonian Tyndrum fault, which had the same strike but was vertical. At one locality examined by the party, the worked out vein was marked by a cut, *ca* 1.5m wide, with galena still present embedded in quartz in the footwall. Above the cut, massive stemple timbers could be seen across the cut, now supporting debris, which had fallen in from the surface. The emplacement of the vein was discussed. Although the Tyndrum fault was late Caledonian, the mineralization of the hard vein was later, probably Lower Carboniferous (~360Ma). The weakness in the country rock (Dalradian Grampian Group psammites) arose close to the old Tyndrum fault and allowed hydrothermal solutions rich in silica, and lead and zinc sulphides to force their way upwards causing the brecciation now seen. Fluid inclusions in the quartz indicate temperatures of up to 300°C, high salinity (~18% NaCl) and evidence for boiling, which indicated that the vein was at a "shallow" depth. During early Carboniferous times this land is not believed to have been below sea level, so seawater was probably not source of the high salt. The source of the heat is problematical. There is no evidence for emplacement of igneous bodies in the area during Lower Carboniferous times; all the granite and diorite exposures now seen in the vicinity are Caledonian in age. The lead and zinc and the sulphide possibly came from strata-bound sulphides thought to be present at depth in the underlying Ben Eagach Schists. After emplacement of the vein, further movement of the old fault isolated the lead.

After examining the mining cut the excursion descended the hillside via a mining incline. This was curious in that at the top of the incline there was a set of massive timbers. They might have been for the foundation of an engine, but they looked as if they marked the entrance to an adit. If this latter was the case, a possible interpretation is that the ore truck descending the incline was counter-balanced by a hoist in a shaft. The bottom of the incline ended in a series of ruined structures, which were probably where the ore was beneficiated (concentrated). It would have

been crushed and the heavier ore separated from the quartz, possibly by a vanning process. At any rate, the excursion saw the remains of the settling tanks, now breached, and partially filled with sand which represented the crushed residue from the vein silica. It is not known where the lead went. Did it find its way to the plumbing of Edinburgh New Town? Was it used at Waterloo? A research project here surely. The excursion ended at ~ 4pm back at Tyndrum Lower station (with the sun still shining).

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STONEHAVEN AREA, KINCARDINESHIRE, NORTHEAST MIDLAND VALLEY : 12 – 14 Sep 2003.
Leader : Dr Peter Haughton, University College, Dublin
Report by : *Julian Overnel*l Participants : 15

The party was based in Stonehaven and was enthusiastically led by Dr. Peter Haughton, University College, Dublin, who was returning to his happy hunting grounds of former times. Excursions were mounted on the Friday afternoon, all day Saturday and Sunday morning. Weather was overcast but dry, and there was a strong wind from the south on Saturday.

The locations visited were all coastal, from Gourdon in the south to the Highland Border Fault in the north, just north of Stonehaven. The strata seen could be divided into two sets. 1) Flat-lying strata to the South of Stonehaven with a dip of only a few degrees to the north; 2) Nearly vertical strata in the Stonehaven area in the vicinity of the HBF. The strata were of Old Red Sandstone age. They younged to the south, with the oldest against the HBF.

1) Flat-lying strata. These were impressive conglomerates with well-rounded clasts ranging in size up to ~ 1m, and with occasional interbedded sand horizons. Flow direction could be clearly seen from the direction of imbrication of flattened clasts, and less clearly seen (to the excursion members) from the cross stratification. Strata showing flow from a northerly direction contained clasts of quartzite, psammites and semipelites with a Dalradian "feel", granite, and soft volcanic rock. The granite was known to be similar in age (470Ma) and petrographic properties to Aberdeen granite. This conglomerate was therefore mainly from north of the HBF, with the volcanic clasts probably locally derived. There was a problem to explain how the large soft round volcanic clasts could be generated and intimately mixed with the hard quartzite and granite clasts, because rounding the hard clasts should have ground away the soft clasts. A plausible explanation was that the volcanic clasts were first generation and the hard clasts were from reworking of sediment, now no longer exposed. Strata showing flow from a southerly direction contained clasts of granite, hornfelsed greywacke, greywacke and softer volcanic rock. The granite was of four types, including a highly foliated granite, and a rotten, red, biotite granite. The provenance of these rocks was unknown and it was presumed that (apart from the volcanic rock, which was probably locally derived) these rocks represented erosion from an exhumed mountain range somewhere in the Midland Valley, now completely covered by younger sediments and no longer exposed. North

Highland Boundary Fault, north of Stonehaven Bay

of Bervie Bay an impressive red, bedded, sub-aqueous, ash deposit was seen, and at Crawton contemporaneous, fresh-looking andesite/basalt lava with clear, semi-aligned flattened phenocrysts of what appeared to be feldspars. The flow showed incipient columnar jointing into columns ~ 1m across.

2) Nearly vertical strata. At Dunottar castle the boulder beds were vertical, and the vertical dip extended north across Stonehaven Bay to the HBF. From the south side of Stonehaven bay to the HBF the facies changed to sandstone, which showed diagenetic concretions and evidence for sub-aqueous dune bedding. The strike was parallel to the HBF. Near the HBF the sandstone merged into red volcanic breccia and sheared rock of the Highland Border Complex (HBC). The HBC was inspected and was seen to be pillow lavas dipping at *ca*. 45° to the north, with a strike approximately parallel to the fault. In the fault line itself, there was a dolomite stratum a metre or two wide, again with an approximately vertical dip. This was believed to represent a dolomitized serpentinite altered from an ultrabasic rock, which had been intruded in the fault plane. North of the HBF the Dalradian psammite strata showed a nearly vertical dip with a strike again parallel to the HBF. The Midland Valley in older literature is called a graben, and the evidence at the fault did appear to indicate a sustained down-throw on the Midland Valley side. The Midland Valley is known to be a separate terrane from the Dalradian, and there was much discussion of the possible relative movements of the former plates, and of the timings of the movements, to account for the observed features (including the 45° dip of the HBC).

The total thickness of all the conformable sandstone and conglomerate beds south of the HBF is approximately 8km. Rare plant spores in the base of the Stonehaven sandstone indicate a late Silurian age, but the colour of the spores

indicated that they had never been buried to 8km. The conclusion was that the sedimentation of the coarse deposits was probably transgressive, with the basin(s) sinking progressively southwards.

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GLENTAGGART OPENCAST COAL MINE : 20 September 2003
Leader: Dr Alison Monaghan, British Geological Survey
Report by : *Seonaid Leishman*

The 2003 joint excursion of the Edinburgh and Glasgow Societies was to Scottish Coal Company's Glen Taggart opencast mine, in the productive coal measures of the Douglas basin, less than 10km from the Southern Uplands Fault. It was a very enjoyable and interesting day. We were visiting the mine as part of Scottish Coal's Open day, which limited the group size, so we only met up with our Edinburgh colleagues after lunch, for a photo opportunity underneath the 20m high giant excavator.

We shared the expertise of Alison Monaghan of the BGS, plus Steve, Sandy John, Neill and Pete from Scottish Coal.

The technology is amazing. Mining has taken place here for centuries, but two years ago the old mine shafts and bell pits, along with their pit props, were sliced into by these huge diggers. Within 8 years, 7 million tonnes of coal, from 16 seams, will have been scraped off and moved by a 6km conveyor, to the A74. From there they go by lorry to Carstairs, where they are transported by rail to the power stations. There is quite an operation to mix the different quality of coal extracted to provide the required 'mix'. To minimise the environmental impact of the release of old mine waters, a 105m de-watering bore hole draws down the water from 4 sets of old mine workings, and pumps clean water out into the Douglas Water at the rate of 900 gals/min. This keeps the water table 200m below the mining operations. By the end of the mine 84 million cu m. of rock and soil will be backfilled into the pit, and the site restored to moorland.

In the centre of the site is a large scale anticline. The excavation is being worked along its axis. The main seam which we saw exposed was the Kennox Upper Drumgray seam, about 50cm thick on average. The exposed faces in the pit showed a number of small faults, along with a larger high angle extension fault. There were associated synclines and anticlines formed by fault propagation folding. What was really interesting was to see the whole three dimensional structures exposed. It was also possible to see sections of all the coal measure cycle, including seat earth, coal, siltstone/sandstone, and mudstone. There were many associated fossils including rootlets, burrows, Lingula in the mudstones, and just above the coal an extremely dense bed of fresh water mussels. Typical sandstone features such as cross bedding and ripple marks could also be seen. We were introduced to the petrological composition of coals i.e. its macerals (the equivalent of minerals). There were excellent examples of vitrain (from woody tissue), fusain (from oxidised woody material), and cannel coal or durain from floating algae. The latter gets its name because the high content of volatiles makes it burn with a bright smokey flame, like a candle. We had gathered as much information as we possibly could from our very

Members of both Societies beside the giant excavator

knowledgeable hosts from Scottish Coal, and our leader Alison, so we celebrated on the way home with a reviving cup of tea. Oh, and the sun shone!

GENERAL INFORMATION

Scottish Geology Festival 13th – 28th September, 2003
This national event was launched in Dynamic Earth, Edinburgh, with the theme of 'Ice'. The Society's contribution was a programme of three lectures, held in the Gregory Building, loosely related to the theme of 'Landscapes Fashioned by Ice' :

Dr CJ Braithwaite	'Climate Change' and its causes
Dr TJ Dempster	'Snowball Earth' – an ancient glaciation some 600 Ma when it is thought that the ice sheets extended into the tropics.
Dr DJA Evans	'Recent Glaciation' – modern glacial processes and how they allow us to interpret landforms better.

Alex Herriot Collection. The late Alex Herriot produced nearly 6000 thin sections, now stored in the Hunterian Museum. It is planned to transfer Alex's index of slides on to a computer database, to improve public access.

Scottish Geology School Prizes. This year the winners were pupils attending George Watson's, Edinburgh, Dollar Academy and Dingwall Academy.

RIGS – Regionally Important Geological and Geomorphological Sites.
RIGS groups already exist for Edinburgh, the Lothians and the Stirling area. Members of the Society and of the West of Scotland Branch of the Open University Geological Society set up the Strathclyde RIGS Group, to be recognised as a sub-group of the Society as per clause 21b of the Constitution. It is hoped that sites of Educational, Scientific or Aesthetic value, or which could be lost by land development, will be incorporated into the Structure Plans of Local Authorities.

INTIMATIONS

With regret, we record the deaths of the following members :

Mr David Hastie, member since Session 135 (1992-93), who was tragically killed in an aircraft accident in Turkey in January, 2003. David graduated as B Sc Honours from Glasgow University in July, 1990, and had been a member of the Society as a student. He worked in the oil service industry since completing his degree and was travelling to the Middle East as part of his work when the accident occurred. David was an enthusiastic supporter of Partick Thistle football team. He had recently become engaged, at Christmas 2002, to Dr Rona McGill, also a graduate of Glasgow University, whom he had known for many years and with whom he planned to set up home in Baillieston. Our deepest condolences are extended to Rona, to his family and to his many friends.

Mrs Muriel Sword, member since Session 113 (1970-71), who died 24th June, 2003. Muriel attended extra-mural geology classes at the University of Glasgow for many years. She was probably the most regular and consistent member of Dr J.D. MacDonald's Thursday afternoon classes, and was one of a small group of adult students from North Ayrshire. She was married to William Sword, son of John Sword who pioneered bus services and aviation in Scotland in the 1930s and was also related to Sword's Bakery of Airdrie. For many years Muriel lived at Balgray Farm near Torranyard, north of Irvine. The barns housed the famous Sword collection of vintage cars. The farmhouse housed her mineral collection which she had gathered over many years. One of her prize specimens was a large piece of pitchblende which she had been given by a miner when visiting a uranium mine in Norway. Apparently the miner took it from his pocket and handed it to her. The specimen was kept in a lead casket in the farmhouse drawing room. Muriel took particular pride in showing visitors her collection of fluorescent minerals which she displayed with the help of an ultra-violet lamp.
Regrettably Muriel's health deteriorated in the 1990s and with failing eyesight she had to give up her geological activities. This must have been a great loss to her as she had taken a keen interest in extra-mural geology and the Geological Society of Glasgow. Muriel will be greatly missed for her cheerfulness, energy and enthusiasm. Our sympathies are extended to her family and many friends

Front cover photograph – Dunottar Castle, near Stonehaven (*taken by Charles Leslie*).

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