PROCEEDINGS OF

THE GEOLOGICAL SOCIETY

OF GLASGOW

Session 147 **2004 – 05**

SESSION 147 (2004 – 2005)

SESSION 147 (2004– 2005)

Members of Council

President	Dr Chris J. Burton
Vice Presidents	Dr Colin J. R. Braithwaite
	Dr Mike C. Keen
	vacancy
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 & Hon Archivist	Mr W. Bodie
Proceedings Editor	Miss Margaret Donnelly
Publicity	Dr Neil D.L.Clark (web)
	Dr R. A. Painter (meetings etc)
Excursion Secretaries	Mrs Carolyn Mills
	Mr David McCulloch
Rockwatch Representative	Miss Ruth Murray
Junior Member	R. Farthing
Journal Editors	Dr Colin J.R. Braithwaite
	Dr R.M. Ellam
Ordinary Members	Mr Philip Close
	Dr Brendan J. Hamill,
	Mrs N.G. Hornibrook
	Mr David McCulloch
	Mrs Rosemary McCusker,
	Dr A.W. Owen.
	vacancy
	vacancy

MEMBERSHIP

	At end 147 30 Sep., 2005	At end 146 30 Sep., 2004
Honorary Members	5	4
Ordinary Members	302	325
Associate Members	58	56
Junior Members	18	20
TOTAL Members	**383**	**405**
New Members	27	
Terminated Members	49	

Transfers amongst the 'Senior' categories of membership distort the apparent loss of Ordinary members, but there was a 5.5 % reduction in overall membership. There were slightly more 'resignations' than usual, some of which might be attributed to re-appraisal of membership when subscriptions were raised. 20 members had their Membership terminated because of non-payment of subscription, a similar number to previous Sessions.

C.M. Leslie

LIBRARY

For the Society's library the session has been a normal one, with borrowing heaviest in the field guide section and lighter elsewhere, with the usual small number of members availing themselves of the facility. This low usage is somewhat worrying, given that our library contains a very wide selection of volumes in every field of geology, with a large number of introductory works as well as professional level material, all available on meeting nights and during weekdays. Members are both welcomed and encouraged to explore the library and to use its facilities, including the journal section available in Room 510 of the Gregory Building. Current copies of many geological journals, including Nature, Science, New Scientist, etc. as well as the publications of other geological societies are to be found on the table.

It was with regret that the resignation of Bill Bodie as Assistant librarian was accepted during the session. Bill has been an active worker in the running, and during the reorganizations that the library has passed through, and many members will have met him and profited from his guidance while he was on duty prior to meetings. He demits office with the grateful thanks of the society.

Chris J. Burton

SCOTTISH JOURNAL OF GEOLOGY

The Journal seems to have entered another difficult period with regard to submissions. There is no obvious reason for this and there have been some signs of revival in the last few weeks but it will remain an important issue in the coming year. One way of

overcoming this problem is to publish appropriate thematic issues, and possibilities for these are being actively pursued. The Geological Society Publishing House continues to offer excellent service in terms of production and promotion.

Since 2002 we have consistently produced 192 page volumes because, as members will recall, the next size down, 160 pages, looks very slim indeed and provides a negative impression to subscribers. Action has been taken to reduce costs by reducing the print run. The reduction in demand has meant that more copies were being held in store with little prospect of sales, and storage had become a problem. However, printing costs have risen in the last five years and the number of Trade subscriptions has fallen. This loss is only partly compensated by the 28% increase in charges. This pattern is repeated across the industry and is not unique to the Scottish Journal. Projections for 2006 suggest that over the five-year period total income for the Journal will have risen by 55% and is expected to be in the order of £30K, divided between Trade subscriptions and the Societies subventions (the latter accounting for just under 30% of the total). Our expenditure is expected to be close to this, representing an increase (over 5 years) of 38%. Members will be aware of the increase in subscriptions in the two Societies. Over this period page charges (the amount we pay for each page published) will have risen by only 13%.

C.J.R. Braithwaite and R. Ellam

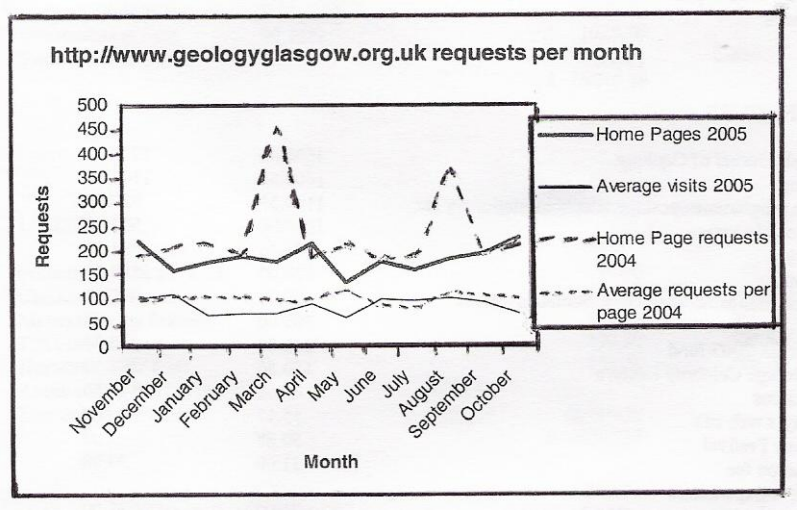
PUBLICATIONS

The year ended with a surplus of £554.94. This figure does fluctuate. The bulk of our sales are now from bought-in items. We usually get a discount on these items from the wholesalers and the general policy is for members and the Society to share this discount. Some items, e.g. The Geology of Scotland, are sold at cost, giving members the best price. We still have considerable stocks of the Glasgow-Girvan Guides which will outlast most of us! It is an excellent value book but has a limited market

Roy Smart

WEBSITE

Over the last year the website home page has been requested an average of over 188 times per month, becoming the most requested single page used as a gateway to the rest of the website. This is slightly less than last year which averaged 233 per month. The next most popular pages are the excursions (not including the Lesmahagow trip of 2002 which had 3,110 requests over the year (an average of about 260 per month), lectures and publications pages with, on average, just over 70 requests per month (a decrease of about 30 requests per month on last year). The two most outstanding months for requests in 2004 (3,048 requests recorded) were not repeated this year, which accounts for the drop in average monthly requests for pages in 2005. If the two peaks are ignored, the monthly requests are virtually identical between 2004 and 2005. Some improvements to the pages have been undertaken throughout the year, and news items have been added occasionally. 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 2005

(Scottish Charity Number SCOO7013)

Income			**2003 - 04**
Subscriptions received	£ 5802.16		
Deduct paid in advance	74.00		
		£5728.16	£5854.38
Investment Income:			
Dividends	485.51		472.75
National Savings	846.23	1331.74	1958.52
Tax refunds (Gift Aid)		813.15	862.23
Net surplus from publication sales		554.94	172.01
Donations		100.00	
		£8527.99	
Expenditure			
Scottish Journal of Geology		4500.00	2750.00
Meetings		1603.50	1146.66
Billets, programmes, postage, telephone, stationery etc		1169.59	927.69
Sponsorship grants		1000.00	500.00
Library		574.46	584.11

Insurance		520.00	588.55
Conoco Philips Scottish Geol. Societies' prizes		400.00	300.00
RIGS		305.00	nil
Hunterian 2007 fund		250.00	250.00
T N George Celebrity Lecture		150.50	281.50
Excursions		62.62	112.50
Society's web site		55.17	nil
Geology Festival		50.88	nil
Affiliation fee		31.00	30.00
AGM – Expenditure	74.00		
– Income	53.00	21.00	33.00
		10693.72	
Less deficit for year		2165.73	
		£8527.99	

Publication Sales Account For Year Ended 30th September 2005

Gross Sales	£ 2208.85	
Deduct Expenses	74.32	£ 2134.53
Stock at 30/09/04	£ 10820.35	
Add Purchases	1520.39	
Publications available for sale	12340.74	
Deduct stock at 30/09/05	10761.15	
Cost of publications sold	1579.59	£ 1579.59
Net surplus on sale of publications		£ 554.94

Balance Sheet as at 30th September 2005

Assets			**2003 – 04**
Debtors for publications at 30/9/05		£ 55.00	£ 77.96
Monies due to Society		00.00	800.00
Cash in hand:			
Membership Secretary		105.05	
Publications Sales Officer		104.87	
Cash at Bank:			
Royal Bank of Scotland Account	£ 7439.88		
National Savings Investment Account	37723.53	45163.41	47184.84
National Savings Income Bond		12000.00	
Investments at Cost		1025.70	
Stock of Publication		10761.15	10820.35
		£ 72072.52	

Liabilities

Subscriptions in advance		74.00	46.00
Uncashed cheques		11107.20	1449.70
Monies due by Society		273.79	900.00
T.N.George Fund		399.80	399.80
Hunterian 2007 fund		750.00	500.00
Accumulated fund at 30/09/04	68776.12		
Add surplus for year	2165.73	66610.39	
		£ 69215.18	

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 2005

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

STRATHCLYDE RIGS GROUP

The group was formed in 2003 as a sub-committee of the Geological Society of Glasgow. It identifies and evaluates sites of geological and geomorphological interest which are of value for educational or recreational purposes. These are notified to the local planning authority. In addition, RIGS groups prepare interpretative material for sites, usually 10, in the form of leaflets.
The Strathclyde RIGS group has identified more than twenty candidate sites in Strathclyde which are in the process of further evaluation. The group produced its first leaflet, on Ardmore Point, in September 2005 with the help of funding from the Society and a grant from Scottish Natural Heritage.

Brendan Hamill

MEETINGS

The Session's meetings opened with Keith Ingham delivering the TNG Medal Lecture on "Girvan: a history of research in a classic area". In November, Ian Stewart, now at Plymouth University and fresh from his TV triumph, gave a very well-received talk on "Seismic Faults, Sacred Sanctuaries" focussing on the Mediterranean. The 2005 year began with another 'local' speaker with archaeological associations, Rupert Housley talking on "Late Holocene sedimentary dynamics of the lagoon of Venice".
Yani Najman had to call off because of sudden teaching commitments, but we hope that she will be able to come again. She kindly arranged for a colleague, Tom Argles to come and give an excellent exposition of Himalayan geology. Rob Strachan of Portsmouth University gave us an update of the perennial problems of Moine geology and the session closed with Trond Torsvik of the Geological Survey of Norway giving

the Joint Celebrity Lecture on "Earth History with emphasis on the Neoproterozoic and Phanerozoic evolution of Europe".

Jim M. Morrison

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Thursday 14th October 2004

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

Dr J. Keith Ingham

Hunterian Museum, University of Glasgow.

The T.N. George Medal is awarded "for excellence in palaeontology and/or stratigraphy". This year's recipient, Dr Keith Ingham, is amply qualified on both counts for this award.

Keith Ingham will be familiar to many members of the Society. He obtained his BSc at the University of Hull in 1959 and his PhD at the same institution in 1962, following which he came to Glasgow to a joint appointment between the Hunterian Museum and the Geology Department, then led by T.N. George. Keith 'retired' in 1998 but is still active in teaching and research and has honorary status in both Earth Sciences and the museum.

Keith is one of those rare people with the ability (and the patience) to find fossils in places where others wouldn't even bother taking their hammers out of their rucksacks. This has stood him in great stead throughout his career.

Keith's PhD work was on the stratigraphy and trilobites of the upper Ordovician succession in the Howgill Fells in northern England. His painstaking work here set the tone for much of the rest of his subsequent research, and his being honoured by the Society tonight. It had three facets:

1. The production of a series of superbly illustrated monographs describing the many trilobite species he discovered and which he used to great effect to subdivide the succession.
2. The establishment of far more detailed stratigraphy than had ever been believed possible in that area before and which remains valid today.
3. The publication of superb geological maps in what on the face of it is very unpromising ground.

In all of these areas, Keith went on to achieve international recognition.

1. As a palaeontologist, he has described Ordovician trilobite faunas from the Welsh Borderland, from Girvan and from the Highland Border Complex at Aberfoyle in papers that will stand the test of time. Perhaps his most famous work has been on the trinucleid trilobites – that quintessentially Ordovician group that is characterised by a pitted fringe around the head. In a classic paper, together with Chris Hughes from Cambridge and a research student of Alwyn Williams', Bob Addison, he revised the taxonomy of the group, assessed the validity or otherwise of some 230 described species from around the world and looked at their changing distributions in space and time.

2. Keith Ingham's stratigraphical work has been on a variety of scales:
    - Local - such as in the north of England or at Girvan – making sense of successions that appear either dreadfully monotonous or far too complicated.
    - Regional – he was a member of the team under Alwyn Williams that produced the first Geological Society of London Correlation Charts of the Ordovician of the British Isles in 1972 and the only member of that team to be involved in the subsequent revision, lead by Richard Fortey some 30 years later.
    - Global – as a member of the International Ordovician Subcommission he was part of the working group that eventually placed the international standard section for the base of the Silurian just down the road at Dob's Linn, near Moffat.
3. His detailed geological maps, especially those of parts of Girvan are legendary. Some of these are published in this Society's Glasgow & Girvan field guide and members of the society may have seen the originals out in the field and been able to recognise virtually every bed that is exposed on the foreshore. The importance of maps in Keith's work is seen in a much larger context in the Geological Society of London's Palaeogeographcial Atlas of the British Isles published in 1992 for which he was a co-editor and a contributor to several of the chapters.

Keith's palaeontological interests don't stop at trilobites. He can talk with authority on topics as diverse as graptolites, Jurassic reptiles or hominid evolution – and many of the museum displays still reflect his wide interests. He is also something of an expert on producing top quality images of the surface of Mars – although tonight we must consider that a bonus as there is no mention of planetary geology even in the fine print of the T.N. George medal.
Throughout his career, Keith Ingham's work in palaeontology and stratigraphy has been typified by:

- Absolute scientific rigour and attention to detail
- The highest standards of illustration – from photographs to drawings that would put many a graphic artist to shame.
- An enthusiasm to communicate his findings whether it be on a one-to-one basis, or to an audience of hundreds be they academics, students or interested amateurs.

For all of these reasons, Dr Keith Ingham is a most worthy recipient of the T. N. George Medal and I call upon the President of the Society, Dr Chris Burton, to make the presentation.

Dr Ingham then addressed the Society on

GIRVAN : A HISTORY OF RESEARCH IN A CLASSIC AREA

At Girvan, the sedimentary rocks at the southern margin of the Midland Valley rest unconformably on the eroded ophiolite complex of Ballantrae. The first systematic survey of stratigraphic relationships was accomplished by Charles Lapworth just over

120 years ago. Research in the area has continued to the present and the rocks around Girvan have been the subject of rigorous refinement and re-interpretation since the time of Lapworth. Dr Ingham delivered a detailed and fascinating account of this history.

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Thursday 18th November 2004
Dr Iain Stewart, University of Plymouth

SEISMIC FAULTS, SACRED SANCTUARIES

The Aegean region is the most earthquake-prone part of Europe, and lands of Greece and western Turkey are criss-crossed by a giant web of seismic fault lines. Little wonder then that many of the major cities of the ancient world lie on or close to earthquake faults – it's hard to avoid them. But geological investigations at some of Classical Greece's most renowned sites – Delphi, Hierapolis, Cnidus – suggest that the ancient Greeks deliberately chose to build their most sacred sanctuaries directly on seismically active faults. This lecture explored their reasons for doing this.

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Thursday 9th December 2004

ANNUAL GENERAL MEETING

Thanks were expressed to retiring members of Council Michael Pell, Vice President, R Diamond, Proceedings Editor, Roy Smart, Publications Officer, Neil Clark, Publicity (web), and Margaret Donnelly and J Hughes, ordinary members for their contribution to the work of the Society over the past three years.
The subscription rate was raised from £16 to £20; Associate Membership will be £10 and Junior Membership £5, from 1st October 2005. The income from subscriptions covers meetings, excursions, the Scottish Journal and administration – costs have recently risen markedly
The business of the AGM was followed by short talks from Dr Brian Bell on the Faeroe Islands and Dr Jim MacDonald on Madeira, before our annual Christmas social including wine, soft drinks and nibbles.

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Thursday 13th January 2005
Dr Rupert Housley, University of Glasgow

LATE HOLOCENE SEDIMENTARY DYNAMICS OF THE LAGOON OF VENICE

The lagoon of Venice is no more than 6000 years old, being formed when the main postglacial sea-level rise reached the head of the Adriatic. Three distinct sedimentary types predominate; salt marshes, mudflats and tidal channels. However, the

environment was, and remains, highly dynamic and has been affected by substantial human interventions that began when the first people settled the islands of the lagoon. This lecture considered the sedimentary framework of the lagoon and described the changes that occurred once the city of Venice was founded.

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Thursday 10th February 2005
Dr Tom Argles, Open University

HIMALAYA

This was a visual tour with a geological flavour from the southern Tibetan plateau down through the High Himalaya to the Lesser Himalayan foothills, returning via north Pakistan to Tibet again. The itinerary visited a variety of rock-types in some magnificent settings, leading into discussion of some current research and theories on how mountains are made and unmade. A sprinkling of fieldwork anecdotes provided some light relief! During the talk, Dr Argles drew partly on his own work, and also on that of colleagues and graduate students, to give an overview of our current state of knowledge of this major mountain range.

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Thursday 10th March 2005
Dr Rob Strachan, University of Portsmouth

NEW EVIDENCE FOR NEOPROTEROZOIC OROGENY WITHIN THE MOINE SUPERGROUP, SCOTTISH HIGHLANDS

The age, affinities and orogenic history of the Moine Supergroup of NW Scotland have long been contentious subjects since the late 19th century. Do these enigmatic rocks, for example, constitute an allochthonous terrane within the Caledonides? Recent isotopic work has led to a much clearer picture of the evolution of the Moine. We now know that the Moine was deposited after 1000Ma but before intrusion of the West Highland granite gneiss and metagabbros at 870 Ma. Detrital zircons can be matched to a variety of sources along the margin of eastern Laurentia. The existence or otherwise of a Neoproterozoic orogenic event (the Knoydartian) has proved highly controversial. However, isotopic data obtained from early regional metamorphic assemblages demonstrate Neoproterozoic orogenic events at 800Ma and 730Ma. Palaeogeographic reconstructions suggest that the Moine sediments accumulated in an intracratonic setting within the supercontinent Rodinia. Closure of this sedimentary basin resulting in polyphase deformation and metamorphism may be analogous to the intracratonic orogenies of central Australia during the Neoproterozoic and Palaeozoic. Although the Knoydartian has no correlative event on the Caledonian foreland, there is still no compelling reason to view the Moine as representing an allochthonous terrane.

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Thursday 14th April 2005
Professor Trond Torsvik, Norwegian Geological Survey

Joint Celebrity Lecture
EARTH HISTORY WITH EMPHASIS ON THE NEOPROTEROZOIC AND PHANEROZOIC EVOLUTION OF EUROPE.

Plate Tectonics is a paradigm that depicts the complex and dynamic evolution of the Earth and addresses the fascinating history of continents that move, split apart, collide and deform through the processes of sea-floor spreading and subduction. At times, continents have coalesced into very large bodies, and even supercontinents, generating vast mountain belts in the process. The formation and break-up of supercontinents is probably the most spectacular demonstration of the extremely dynamic nature of our planet and some evidence points to a periodicity (~500 Ma) in supercontinent formation during Earth's history. Supercontinent amalgamation-dispersal cyclicity has affected both deep and surficial Earth processes and has probably driven biological evolution and climatic changes.
Scotland is today part of the Eurasian plate, but prior to the Silurian (c. 420 Ma), Scotland was located along the eastern edge of Laurentia, a continent that also comprised North America and Greenland. During the Neoproterozoic (c. 750 Ma) Laurentia probably formed the core of a supercontinent named Rodinia. At this time Laurentia was probably attached to Baltica and Southern America (Amasonia), the latter becoming embedded in the vast continent Gondwana by the end of Precambrian (c. 550 Ma). Laurentia rifted off Baltica and South America at around 550 Ma, opening the Iapetus Ocean between them, and Laurentia was situated near the equator during most of the Palaeozoic (545-250 Ma). The Iapetus Ocean was probably at its widest 480 Ma, and at this time most of Europe (including England and parts of Ireland) was part of Gondwana. Southern England formed part of the continent of Avalonia and rifted off Gondwana at about this time. It and later collided with Baltica (Scandinavia and northern Europe eastward to the Urals) in the late Ordovician (c. 443 Ma).
By c. 420 Ma, Baltica, Avalonia, intervening terranes and Laurentia (including Scotland) had all coalesced to form the new superterrane of Laurussia. The ensuing Caledonian orogenic event resulted from the collision of Baltica-Avalonia with Laurentia and was marked by deep subduction of Baltican crust beneath Laurentia.

In the Late Palaeozoic (~330 Ma and onwards) Gondwana merged with Laurussia and intervening terranes (including many European terranes) to form the supercontinent of Pangea. The late Carboniferous and early Permian were marked by a significant glacial episode, but also witnessed the most extensive coal forests of the Phanerozoic. These became the source for one of the highest reserves of natural gas. The climate in the late Permian was extraordinarily arid and no low-latitude coal deposits are known within Pangea. The existence of essentially a single large landmass and intense magmatism created climatic and atmospheric conditions that culminated in the Earth's largest known extinction event near the Permo-Triassic boundary (c. 251 Ma). As a consequence good hydrocarbon source rocks are not known until the Mid Jurassic and

onwards when animal evolution once again was at pace and break-up of the Pangea supercontintent developed new shelf and habitat areas.

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Thursday 12th May 2005

MEMBERS' NIGHT

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

Short talks

Brendan Hamill	Fossil Grove, Saltcoats and Biggar – the missing link?
Jim Morrison	Extreme Islands (Mull and Shetland)
Julian Jocelyn	Orbicular Jasper
Karen Baillie	Air Pollution on Stone Buildings
Julian Overnell	Iceland in thin section
Gordon Todd	Rock Art : a thing of the past?

Displays

Chris Burton	Madeira: the sediments between the volcanics
Margaret Donnelly	Excursion photographs from the Spanish Almeria trip
Brendan Hamill	Fossil trees from Saltcoats; Microfossils from Meadow Hill
Julian Jocelyn	Orbicular jasper, Ocean jasper
Bill Lamb	In Alaska and the Yukon
Charles Leslie	Excursions
Gordon Todd	Rock Art

EXCURSIONS

Saturday Excursions Report

Date	Location	Leader	Participants
14 May	Two Dumbarton Glens	Dr Jim Morrison	22
4 June	Basic Mapping Techniques (Loch Ardinning)	Dr Ruth Watkins	14
16 July	Isle of Bute	Dr Geoff Tanner	24
6 August	Loch Lomond Re-advance (Drymen to Callander)	Dr Clive Auton Dr Emrys Phillips	26
20 August	Ballachulish	Dr Simon Cuthbert	26

This has been a very successful year for our Saturday trips; all the leaders giving their time and knowledge so generously, and the weather on the whole was fine. (Imagine a whole day in Glencoe in shirt sleeves!). Very many thanks to all the leaders for making our days out so enjoyable.

The waiting-list situation was not a problem this session as members not able to go on an excursion gave me fair warning. The Joint excursion with the Edinburgh Geological Society on 6th August finished with an excellent high tea in Callander with much conversation between our friends. We also had a high tea in the King's House Hotel at the end of the Ballachulish excursion which everyone seemed to enjoy after such an early start.

On all of our excursions this year we were driven safely and expertly by Raymond Milliken in a 24-seat Essbee coach. I want to thank him officially for his helpfulness and friendly assistance in a1l manner of situations.

Carolyn Mills

Residential field excursions

Date	Location	Leader	Participants
1-4 July 2005	Galloway	Dr Chris Burton	12
16-19 Sept 2005	Lorn & Mid Argyl1	Dr Roger Anderton & Dr Judith Lawson	20

This was my first year as organiser of the residential field excursions and therefore I asked a1l the participants to complete a questionnaire at the end of the trip so that I could gauge their views about what they want from such excursions in future. Three quarters of participants completed the survey form and the main conclusions were as fol1ows:

- A large majority prefers travelling in a coach with professional driver compared to sharing cars.
- A nightly rate of £45 - £50 for dinner, bed and breakfast was the preferred maximum cost.
- Some members would appreciate more information in advance about the likely terrain and walking distances, possibly including a detailed itinerary.
- Those who walk more slowly would appreciate it if those in front slowed down a bit and kept an eye out for anyone at the back experiencing difficulties.
- Most members stated that one of the things they enjoyed most was the enjoyable company of like-minded people.
- The leaders all came in for praise for their patience and clear explanations.
- The main places which members mentioned as being preferred locations for a GSG residential excursion are (in approximate order of popularity) north and northwest Scotland (Assynt and Torridon in particular), north and west of Ireland, Wales (espccia1ly Pembrokeshire), Western Isles, Cornwall, Rum, Orkney, Shropshire, Mull, Islay, and Isle of Man. (If there are any professionals out there who would he willing to lead a trip to any of these places please get in touch!)
- May and September are the preferred months for excursions.
- Trips lasting four days were felt to be about the right duration although longer trips would be acceptable for more distant places.

I am very grateful to everyone who took the trouble to fill in the form. Members can be reassured that all their comments will be borne in mind next year. I would also like to thank Chris Burton, Roger Anderton and Judith Lawson for all the time and effort they put into planning and leading the trips.

David McCul1och

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GLENS OF DUMBARTON : 14 May 2005
Leader : Dr Jim Morrison
Report by : *Chris Henderson* Participants : 22

It was a fine sunny day when we assembled at Overtoun House, above Dumbarton. Jim Morrison outlined his plans for the day and then we paid a brief visit to Overtoun House and the bridge over the steep v-shaped glen. The house was built using locally quarried sandstone and the first location was the disused quarry further up the glen.

We walked up the gentle gradient and as we ascended the views became quite spectacular. To the right, the Clyde Plateau Lavas were displayed in the Lang Craigs. Ahead was the volcanic vent called Doughnot Hill and behind us the view down the firth of Clyde opened up. The small quarry, now somewhat overgrown, had good examples of cross bedded sandstone. The grains were well sorted and had been deposited in a fluvial environment. These rocks belong to the Clyde Sandstone Formation. As we walked up the glen the outcropping Ballagan Beds could be seen to the left at a much lower level. The next location required a steep descent to the Overtoun burn, which was crossed near an old sluice. In the burn near an almost dried up waterfall was an outcrop of reddish brown sandstone, quite different from sandstone in the quarry. Below the waterfall, calcrete deposits were seen and in the sandstone outcrops in the river bed there were cornstones. These rocks belong to the Kinnesswood Formation which was deposited in a dry, oxidising environment where meandering rivers were a dominant feature. The Formation is thought to be Devono-Carboniferous in age.

Another climb upwards brought us to an outcrop of more red-brown sandstones with thin bands of shales, also part of the Kinnesswood Formation. From this location, where we took a break for lunch, signs of faulting and dyke intrusion could be seen below us.

The final location was the outcrop of Ballagan Beds which we had seen earlier. There were bands of a Dolomitic Limestone some 30 cm thick which could be traced along the outcrop, interspersed with much thicker layers of shale. In places the dolomite layers were faulted. These rocks, which outcrop extensively in the surrounding area, were deposited in a quiet lagoonal environment during the Carboniferous. The Ballagan Beds at this location are quite clearly at a much lower level than the Kinnesswood Formation showing that there is extensive faulting here since the Ballagan should be above the Kinnesswood according to the Stratigraphy.

At this point the group split up and some energetic members headed up the glen towards the Lang Craigs while others followed the burn downstream back to Overtoun House.

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BACK TO BASICS – AN INTRODUCTION TO GEOLODICAL MAPPING

Leader : Dr. Ruth Watkins. Saturday 4 June, 2005.

Report by : *Margaret Donnelly* Participants : 14

About eight of us met at the Gregory Building on a damp morning and headed for Mugdock Country Park where a few others including our leader, with four 'helpers', joined us. We made our way to the junction with the A81 beside Loch Ardinning, crossed a fence and climbed a small rise in the field to survey the whole area which we hoped to map. After an introduction from our leader, using geological maps and compass clinometers, we moved down and round under some trees to an outcrop of low crags – a lava flow of fine-grained olivine basalt. We followed this along, making careful notes about the outcrop and surrounding area on our blank topographical maps. This was the top lava flow – across the valley the Campsies towered above us, illustrating the downthrow of about 1000m on the Campsie Fault. A light rain started, the midges came out – a typical Scottish Saturday in June!

We moved onto open ground (the rain went off), with highland cattle in the near distance, and noted the vegetation and molehills containing basalt clasts. We were now at the south end of the loch where a high (~20m) rock face was exposed. Fortuitously, there had been a recent rockfall so that a number of fresh, large and small blocks lay all around – geologists' paradise! – giving us ample opportunity for examination. This was the Craigmaddie Conglomerate – coarse and cross-bedded with some sandstone beds. Almost all the pebbles are of well-rounded quartz with no obvious volcanic clasts, although the lavas lie underneath. It was lunchtime and we settled down to enjoy the view and review the morning's work.

Our next task was to establish the contact between the conglomerate and the basalt and, spurred on by a 'Highland cow' who invaded our picnic spot, we went down to the shore and up over the field looking at outcrops, vegetation and molehills until agreement was reached, and a fault marked on the maps. We then split into two groups – one with our leader and assistant, and one with two 'helpers' – a Glasgow Graduate and an undergraduate. One group set off across the field, passing conglomerate and Highland cattle until we came to a farm track running the length of a dyke, identified as quartz dolerite with feldspar crystals of up to 3mm. Again we were interrupted by a 'Highland cow' who wished to scratch her back on the branch of an old tree right beside us, so we retreated onto the top of the dyke, noted its length, direction and jointing and scrutinised its glacially polished surface and roche moutonnee shape. We continued to a small quarry in the conglomerate where we measured dip and strike before setting off to change places with the other group. On the way we established the extent of the two rock types, and their possible contact.

At a suitable outcrop of conglomerate, we measured dip and strike direction on a number of beds to give us practice and to verify our readings. The other group joined us rather quickly – they too had had encounters with the Highland cattle! Our leader summarised the findings of the day, helped us to put the final touches to our maps, and demonstrated how they could be 'tidied up at home' into works of art and a geological cross section drawn. We all had a marvellous day; Dr Watkins made her instructions and explanations very clear and we all learnt a great deal on an extremely enjoyable outing.

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GALLOWAY : 1 – 4 July 2005
Leader : Dr Chris Burton
Report by : *Dr David B. Hollis* Participants : 12

Introduction

This visit was designed to show the evolution and architecture of geological basins from their beginnings by local subsidence to their final end by infill by sediments. Extra items included the Doon granite where the process of intrusion of the granite into the country rock was evident, and a visit to an Ordovician sea mount near Sanquhar.

The expedition was ably led by Dr. Chris Burton, who produced an excellent set of handouts, and gave a short talk each evening on the highlights of the following day. At the end of this report is given a list of references, including the main publications upon which this expedition was based. These are referred in the text by (1), etc. A bibliography for further reading is included. Items in this are referred to in the text as Bibl. (--).

We stayed at the Galloway Arms in Newton Stewart, where we had excellent food in a historic part of the hotel believed to be several hundred years old. Our thanks go to David McCulloch for the choice of venue. When we arrived at our hotel and had settled in, Dr. Burton gave an introduction to the modes of formation of basins, and an outline of the sites which we would visit in the next few days. One group of basins form a line from Sanquhar through Thornhill to Dumfries. These were formed by north-south faulting during an east-west shear episode. The Loch Ryan basin, which occupies an infilled half graben, was formed in a similar way. The sediments which were deposited in these basins date from the Carboniferous to the Triassic Periods. The Solway Firth was formed by extensional dip-slip faulting. The Southern Uplands were formed by closure of the Iapetus Ocean, and the subsequent thrusting upwards of slices of the ancient sea floor. The Rhinns of Galloway give excellent exposures of the entire geological sequence of fault bounded tracts from that ancient ocean.

Friday 1 July : Thornhill Basin. (1-3)

We left Glasgow in the morning, and went to Sanquhar, where several more of our party joined us.

Our first visit was to the north end of the Thornhill Basin, where we looked down into the Enterkin Burn (NS874046). The Carboniferous red bed sediments (3-8) are here devoid of any coal, and probably represent a humid, exposed upland area of Westphalian B age. The clasts of greywacke indicate a local provenance from the surrounding Silurian hills. Overlaying these beds are Permian desert sands. A basal Permian lava within the sandstones (Carron Basalt) completed the features which we studied there.

At Jenny Hair's Bridge (NS886024) we were able to study the Basal Permian lavas (Carron Basalt) which were interbedded with the Permian sandstones and breccias, just above the Carboniferous strata. The exact age and mechanism of formation of the Red Beds is still the subject of debate (3-8, and Bibl. 3d, 3f). For

example, has an oxidation process destroyed what were once coal seams? Are these beds of Upper Carboniferous (Westphalian) age, or of lowest Permian age?

Further south, at Crichope Linn (NS907955), Permian desert sandstone which showed dune structures, was seen in a small quarry. A scramble down to the river revealed the strata which underlie the Permian sands – the Upper Carboniferous Duckmantian coarse sandstones, which contain maroon and green patches, and plant remains, suggestive of a low lying wet, possibly lacustrine area. These strata are of Westphalian B age, at which time the climate was becoming more arid, and subject to flash flooding. Erosion or nondeposition seems to have happened later, because the Permian desert sands lie almost directly above the Duckmantian strata. Upstream, in a gorge of the river, spectacular dune bedding in the overlying Permian desert sand is exposed. These are similar to those which were exposed at Mauchline sandstone quarries before they were filled in.

Further south, at Park Quarry (NS907913), the south end of this basin shows clear evidence of marine transgression early in the evolution of the basin. We found remains of marine organisms in the sandy limestone beds. The truly marine limestone beds are below the present water level in the quarry. Although we did not study the Dumfries Basin on this visit, the approach to Dumfries from the north gives a good impression of the flat ground surrounded by low hills which is typical of a basin in the final stages of infill (11, 12). The Sanquhar Basin, when viewed from the surrounding hills gives a good impression of the narrow N – S tear fault structure. That basin has Carboniferous strata which have been mined for coal (9, 10). With care, it is possible to locate gaps in the hills, which represent the east – west shear faults at the north and south ends of this basin.

After arriving at the hotel we had an evening dinner. Later, Dr. Burton produced the first handout and introduced us to basin development.

Saturday 2 July : Loch Ryan and the Rhinns of Galloway (1, 2).

The morning was spent on the western side of Loch Ryan, north of Stranraer. The purpose of this visit was to study the second type of basin – the half graben, in which only one side of the basin subsides. The origin of this basin is the same as that of the Sanquhar – Dumfries series. The subsidence of the Loch Ryan basin is only on the east side, which we did not visit. However, it is known that locally derived clast and mud flows of Permian age form the infill above Carboniferous strata there (13). At our first stop, on the west side, at St. Mary's Croft (NX034659), greywacke clasts in the Permian sandstones on the foreshore indicate the local provenance of these sediments. These are typical desert flash flood alluvial fan deposits. As we looked across Loch Ryan to the east, much discussion took place about the hydrocarbon potential, rock porosity, sealing capability of cap rocks, and "play fairway" along the "subtle trap" formed by the north-south fault along the east side of Loch Ryan. To our knowledge, no economic finds of hydrocarbons have been made there.

Further north, still on the west shore of Loch Ryan, we stopped briefly at Lady Bay (NX027718) to observe the Glen App Fault, which is one of several SW-NE striking faults separating the tracts of the Iapetus sea bed which now form the

Southern Uplands. We could also observe it across the loch where, on the east shore, it forms a narrow valley in the hills.

In the afternoon, we studied the Ordovician and Silurian sequence of the Rhinns of Galloway, which is similar to that of the Whithorn area (Bibl. 3a). The Rhinns of Galloway give an excellent overview of the lower Palaeozoic basin of the Southern Uplands. When the Iapetus Ocean closed, compression forced sections of the sea floor to break up, and turned the strata upside down. This now results in land exposure of pieces of the Ordovician and Silurian ocean floor which young southwards overall, but young northwards in individual tracts (16).

Although we did not go as far north as Portencross on the Ayrshire coast on this visit, it is interesting to note that at Portencross, the highest Silurian grey marine sediments give way to the basal Old Red (desert) sandstones in a continuous manner. This shows near shore to onshore facies at the north edge of the Iapetus basin (14, 15).

Figure 1. Looking north, across the Glen App Fault at Corsewall Point

Our first stop of the afternoon was at Corsewall Point Lighthouse, on the northwest coast (NW978726 to 982727), where we had lunch in bright sunshine, on the south side of the Glen App Fault, which is visible on the coast here as a deep gulley (Figure 1). The Ballantrae ophiolite complex was visible far to our north. Nearer at hand was the Corsewall Formation, just north of the Glen App Fault. A search of this formation for clasts of Ballantrae material raised the question of whether a long-vanished volcanic arc, rather than Ballantrae provided the many clasts of basalt and other volcanic rocks. Their rounded appearance and evidence of flow orientation indicated a provenance from the north or northeast, at a distance closer than Ballantrae, and also well south of the Portencross area. Later that evening, much

controversy centred around the existence or otherwise of that volcanic arc! (Reference 1, part 4, also 16).

At our next stop, Morroch Bay (NX017525), a steep walk down led to the northern part of the bay, in the Moffat Shales, part of the Port Patrick Formation. We studied the black Ordovician shales, from which zone fossils have been recovered in past times. The fauna are pelagic marine. The black cherts here indicate a deep marine environment, well away from the edge of the basin. The shales contain graptolites which we found. The cherts have radiolarians, but none of these were found on our visit. Yellow bentonite veins (rotted volcanic ash) are present, indicating volcanic activity less than 10 km away. Was this the missing volcanic arc? Discussion led to the conclusion that an island arc as close as 10 km would have produced much more material in its locality than these few laminae. Has this material come from island arcs on the south (Avalonian) side of the Iapetus? Discussion in the literature (16) raises this possibility. Driving south from Morroch Bay, we crossed the Orlock Bridge Fault at a deep narrow valley oriented roughly SW – NE. This fault separates one of the Ordovician rock tracts to the north from a Silurian tract to the south.

At Ardwell Bay (NX071449) another steep path led to a raised beach and ancient cliff line which showed a recent high stand of the sea level. The present wave cut platform revealed the Gala Formation. Flute marks in these rocks show a west to east palaeoflow, and that the beds are now upside down. A fawn coloured stratum shows the typical fining upwards of the sediment in a miniature Bouma sequence. At the south end of the bay, slump features indicate that those beds are marine turbidites. Some of our group continued about 500 m south of Ardwell Bay to the "Hooies" (NX069446), a small cove in which more important Ordovician zone fossils (graptolites) have been discovered in the black shales. These too come from a deep water environment. Zone fossils from these rocks have been used to correlate the rock sequences of the Rhinns of Galloway. (Bibl. items 3e, 3g).

The rain and mist came down, so we retired to our hotel for another excellent evening dinner and social time.

Sunday 3 July : The Solway Basin (1 part 2; 2, excursions 3 and 10; 17.).

Today was devoted to the Solway Basin. This area extends up the Solway Firth as far as the Stainmore Trough, and includes the Canonbie area, which was visited, also in July 2005, by the Yorkshire Geological Society (3-8). We did not go as far east as Canonbie, but it is interesting to note that the red beds in the north end of the Canonbie area are similar to those in the north end of the Thornhill Basin (3-8). In general, the further north and east one travels in this basin, the further one progresses from a deep marine environment to an arid sub aerial environment.

At our first stop, Rockcliffe (NX848538), a series of porphyritic andesite dykes penetrates into the Silurian Ross Formation. Metamorphic textures were evident here, as far as West Barcloy (NX852530). The greywackes are strongly hornfelsed. Interestingly, some specimens examined in Rockcliffe bay showed an unusually high content of plagioclase feldspar which is characteristic of adamellite. Several stages of intrusion into the Dalbeattie – Criffel granite are indicated by a clear progression from red adamellite to granite in the locality of Rockcliffe and Port

Figure 2. Rockcliffe. The progression from reddish adamellite to granite.

Donnell. These are described in more detail by Hatch, Wells, and Wells (18), and Bibl. 3b, 3c. (Figure 2). We ascended Castle Hill Point (NX857527) to a fine vantage point which gave a commanding view of the west – east running north Solway Fault. At this place, the fault is defined by a cliff several hundred feet high. The party descended by a steep path to the base of the cliff and examined north – south striking quartz veins which showed blue secondary copper minerals. (Heston Island, which could be seen by looking west from Barcloy Hill, once had a small copper mine on it. Time and tide precluded a visit to it by us.)

At Port O'Warren, (NX880533), we observed the first stages of opening and filling of the Solway Basin. Our leader drew a simple and informative diagram in the sand on the shore. It showed the Southern Scottish Uplands to the north, the dip-slip extensional faults which form the basin, and the English Lake District and the Alston Block to the south (Figure 3). An almost twenty metre thick exposure of sediment, derived from the local granite, slopes down towards the sea, showing some fining seawards of the material. These sediments are arkoses of the lowest Carboniferous (Arundian) stage. Enough angular clasts of granite and feldspar are present to indicate the nearby provenance of these rocks. At low tide, it is possible to see that the Arundian sediments become marine mudstones, which indicates an ancient shoreline not much different from that of the present day. A cliff which faces approximately west has two sets of dip-slip faults. The first set is steeply inclined seawards, representing the tensional subsidence of the basin. Deegan (19) has noted syn-sedimentary subsidence in the Solway Basin further east. The second set is steeply inclined landwards, and in some places cuts across the first set. These faults show later compression and subsequent closure of the basin during the Hercynian orogeny.

In that cliff, at about three metres above the present high tide level, there is a large cave which had once been reached by the sea. We saw several such caves around the south coast of Scotland. Also apparent were raised beaches, and large areas of flat land over which meandering rivers have prograded seawards. These are all indicators of a former high stand of mean relative sea level and subsequent fall of sea and/or rise in land to the present day level. (e.g. 21, 22).

Figure 3. At Port O'Warren, receiving instructions on the nature of the Solway Fault

We drove to a remarkable example of the above mentioned caves, a rock passage called the "Needle's eye" (NX888546). By walking through it, and scrambling through the undergrowth, we came to one of the many places in that vicinity, an old quarry, where radioactive veins exist (20). Here, the action of the hydrothermal fluids at a temperature of about 500 degrees centigrade and pressure of up to 5 Kbar has permeated and altered the Silurian country rock and the granite. This set of veins is part of a copper-uranium-bismuth suite which goes northwards through the granite to Beeswing (NX895692) on the west side of Loch Arthur. Dr. Burton duly produced a Geiger counter, and tested some of the specimens which we found. The level of activity was between five and ten times that of the natural ambient radiation. This was one place where we did NOT collect specimens!

We drove on past Preston Mill (NX577965) where, below the bridge over the stream, Carboniferous lavas exist. Their position in the strata there corroborates conclusions drawn at the east cliff of Port O'Warren earlier in the day, that some of the subsidence of the Solway Basin was syn-sedimentary. At our final stop of the day, Powillimount, (NX563990), we observed the final filling and closure of the Solway Basin. Here, we first observed the marine transgression already noted in connection with the Thornhill Basin. Unfortunately, time and tide did not allow us to walk to Southerness Lighthouse (NX978542) where, at low tide, deep marine Carboniferous limestones are exposed. We restricted our studies to the shallow marine, tidal, and sub aerial features of the basin infill. At Powillimount, the Thurlstane Formation to the east, and the Gillfoot Formation to the west are deformed and folded, as is evident in the present day wave cut platform. This syncline has an

easterly plunge, and an almost east-west axis. The folding on the foreshore is parasitic on larger folds which strike east-west, and can be observed by looking northwards and inland toward the granite. This post Carboniferous compression relates to the Hercynian orogeny, and also relates to the compression and part closure of the Solway Basin which we observed at Port O'Warren earlier in the day.

The upper (Thurlstane) beds are of conglomerate, whereas the lower (Gillfoot) beds are of much finer material which show ripple marks. Some of these marks have a distinct pattern which is associated with the shallow sub tidal zone of the basin. In these beds, fossils of *Lithostrotion* were observed. The soft layers of the Gillfoot Formation are of a shale or mudstone which indicates an estuarine or shallow marine environment. At Thurlstane point (NX991566) a present day sea cave cuts north – south along a fault line through a spectacular estuarine/ river channel structure. The lowest strata are shallow marine. The beds show the folding along an east-west axis noted earlier, such that going from the present land towards the sea, the basin fill sequence runs from coral beds to muds burrowed by *Chondrites*, to sands, to the river channel feature – a distance of about 30 metres from the edge of the present day land surface. In the strata directly below the river channel, desiccation cracks filled with a white material (calcite or evaporites?) show evidence of a shallow tidal or partly sub aerial exposure which is indicative of the filling of the basin. The river channel deposits northeast of the car park provided us with many interesting features. In the higher layers, slumping indicates motion on the listric strike-slip faults of the basin. Some breccia came down the river channel at the time of the slumping, which indicates a steepening of the river profile associated with subsidence. At another place, the river deposits are cut across by other strata, possibly where a new channel has cut through a sand bar. The final phase of filling appears at Arbigland (NX992570) where the river channel beds stop abruptly at a cliff whose face bears at 120 degrees – approximately at right angles to the coast at that locality. Beyond the cliff, to the north and east, flood plain deposits have been downthrown by an unknown extent by the fault which formed the cliff.

Once again, we returned to the hotel along the A27 coast road, which passes through beautiful scenery, and crosses many delightful river estuaries.

All good things must come to an end. However, Dr. Burton had kept one or two gems for the end.

<u>Monday 4 July :</u> Granites and sea mounts (1, part 6; 2 excursions 7 and 6; 18).

On Monday, we returned north by way of the west shore of Loch Doon. At the north end, glacial erosion on a rocky promontory during the recent Ice Age has left an excellent example of roche moutonnee, in which the side facing the advancing ice flow has been scratched and smoothed, and the other side is rough and fractured, where the ice has frozen on to, and pulled away pieces of the rock.

We made our way down to the beach of the loch through the undergrowth and walked south. The full sequence of intrusion by the Doon granite was visible. Fracturing of the rock by quartz veins (Figure 4), up to complete digestion of the country rock by the granite could be seen. In a quarry near the rebuilt Doon Castle, (NX496951) large xenoliths of hornfelsed Ordovician greywackes ingested into the granite lay around where the quarrymen had left them. As the country rock is

digested, the granite becomes more felsic, and cools (Figure 5). At the southeast side of the loch, a change in the topography and vegetation shows the edge of the outcrop of the main granite. On our way north via the Dalmellington coalfield, we passed several open cast sites which are working Lower Carboniferous seams above the Top Hosie Limestone. Deep mining ceased in basins east of Dalmellington around 1970, in a number of places including Sanquhar, New Cumnock, Mennock, and KirkConnell. However, in and around these places, and as far west as Patna in Ayrshire, open casts continue to this day.

Figure 4. The first stages of digestion of country rock by granite – the appearance of quartz grains.

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Figure 5. A xenolith of country rock in the Loch Doon granite, showing that other "rock hounds" had arrived before us!

We finished our visit to the south of Scotland at a volcanic seamount. This is located near Sanquhar, at Bail Hill (NS758143). Here, an accretionary prism of Ordovician age has been separated from its original location, obducted, and pushed up over Carboniferous strata during closure of an ancient ocean. This volcano contains the Hawaiite lavas and tuffs which are associated with island arcs, but the real interest for us was the striking evidence that this was a vent formed under the sea. Dr. Burton took us some way down the slope towards the Sanquhar Basin, and showed us a mass which contained hundreds of well formed green pyroxene crystals. These had formed under the sea. Some of the crystals were over one centimetre long! (Figure 6).

Several members of the party successfully extracted some of these, while the more energetic members went even further down slope in search of the remains of the Ordovician base of the seamount. In fact they encountered the Lower Carboniferous strata which lie down slope, to the southwest of the base of the seamount.

Figure 6. A pyroxene crystal from Bail Hill near Sanquhar.

Dr. Cuthbert has made some interesting observations about the interpretation of the geology of the seamount:
Obduction is a process which takes place at subduction zones, and during the Carboniferous Period this area was in the middle of a large continent. Are the rocks which lie beneath the volcanics of the seamount in fact Lower Palaeozoic? Alternatively, the volcanoes could have been Carboniferous in age. Dr. Cuthbert also noted that Hawaiites are typical of magmatism at oceanic hot spots such as Hawaii, rather than at subduction zones. Where is the island arc from which the volcano originated?

The seamount must have been removed from its source if the rocks below it are more recent than the volcano itself and the remains of the island arc no longer exist. It could have been carried up over a subduction zone by plate motion. The arrival of such a large mass as this could trigger obduction by choking up the subduction channel, and breaking the volcano off the descending plate. However, the subduction would have taken place in the Silurian or the Ordovician, not in the Carboniferous. Therefore one would expect a fault separating the area of the volcano from the Carboniferous strata which are exposed further down the slope. Such a fault exists at the right location. Another interpretation is that the volcano was a topographic feature which stood out above the landscape over which the

Carboniferous sediments were deposited. In that case, one would expect to find an unconformity in the vicinity of the volcano. This latter idea is consistent with the received wisdom for this area.

Before we finally went our separate ways home, a vote of thanks was given to Dr. Burton from all of us for his lucid and patient explanations of the geology of Southern Scotland.

The author gratefully acknowledges the comments and corrections which were made by Dr. Chris Burton, Dr. Simon Cuthbert and Dr. Julian Overnell.

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	Jenny Hair's Bridge	Excursion 2, Locale 3
	Enterkin Burn	Excursion 2, Locale 4
Loch Ryan :	St. Mary's Croft	Excursion 15, locale 2
The Rhinns of Galloway :		
	Glen App fault, Lady Bay	Excursion 15, locale 2
	Corsewall point	Excursion 15, locale 3
	Ardwell Bay	Excursion 15, locale 6
	The Hooies	Excursion 15, locale 6
	Morroch Bay	Excursion 18, locale 3
Rockcliffe and Gutcher's Isle		Excursion 3, pp. 37-41
Southerness to Borron point		Excursion 10, pp. 88-94
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BUTE : 16 July 2005
Leader : Dr Geoff Tanner
Report by : *Jim Morrison* Participants : 24

After a pleasant crossing from Wemyss Bay in the recently-commissioned and Polish-built MV Bute, 22 members assembled at the Dun Scalpsie car park. Geoff led us down to the shore, pointing out the tilted Carboniferous lavas and volcanic sediments of South Bute, and the nearby raised beaches. He explained that we were on the top limb of the Tay Nappe: the Dalradian rocks are 'right-way-up' here, and dip to the SE. The Highland Boundary Fault (HBF) has brought these rocks into contact with the Upper Old Red Sandstone (UORS) Kinnesswood Formation. Geoff pointed out that we were fortunate the winter's storms had exposed more of the Bute ophiolite on the shore section than normal, as he would show us later.

On our way along the shore, we passed the Haystack (to be examined on our return) and watched the seals sunbathing with Arran as a magnificent backdrop. Our first major stop was at an old limekiln, where Geoff explained that the source of the lime had been the caliche of the UORS, much less of which now remains due to the activities of the lime burners!

At the west end of the beach near Ardscalpsie Point we examined the Dalradian/UORS contact, cut by a Tertiary dyke, and the shattered nature of the Dalradian adjacent to the UORS. Geoff spent some time explaining the long-running controversy about the nature of the HBF at this locality. His view is that it is not a major fault separating the Highland Border Complex from the Dalradian rocks, but primarily a faulted unconformity between the latter and the UORS. Other workers do not agree with this viewpoint and Geoff suggested an excursion at which the conflicts could be argued out (and perhaps resolved?).

After lunch, Geoff described the Southern Highland Group of the Dalradian and how he had been mapping it in this area. The mile of shore beyond where we lunched exposes a cross-strike section of these rocks. We examined the relationships between bedding and the spaced D1 cleavage at two localities: one in which a hinge zone could be seen (with the cleavage at right angles to the bedding), and another in which a Z-fold was examined which had inverted beds in the middle limb.

On our way back we saw Dalradian stained red by the UORS which had formerly been adjacent to it, perhaps represented by the enigmatic Haystack which was pondered over for a while, without arriving at any very clear conclusion. Our final morsel was the ophiolite, freshly-exposed between the Dalradian outcrop and UORS and, back towards the bus, the sole thrust of the sheared ophiolite and the partially melted Dalradian rocks beneath it.

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LOCH LOMOND READVANCE BETWEEN DRYMEN AND CALLANDER : 6 August 2005

Leaders : Dr Clive Auton and Dr Emrys Phillips (BGS)

Report by : *Barry Hepworth* Participants : 26

Following the pattern that had been set throughout the summer, a fine, albeit slightly breezy day had been pre-booked by the Excursion Secretary for the joint trip with the Edinburgh Geological Society. Meeting at Drymen, there was ample time for morning refreshments, as we joined up with the leaders from the BGS and our colleagues from Edinburgh and organized ourselves for the day. It also allowed the fashion-conscious ladies' section of the Glasgow Society to compare notes as to where identical items of clothing had been bought. Obviously, much telephoning had taken place the previous evening to arrange this year's colour co-ordinated look.

Notably missing were hammers; in their place, a collection of trowels and spades. What sort of geology was this going to be?

Our first locality was Drumbeg Quarry, not far from Drymen itself. 'Quarry' was a misnomer, as it was more of a sand pit. The journey to the quarry was an interesting experience as our driver skillfully navigated the narrow quarry tracks. Sitting at the back of the bus over its not-too-efficient suspension, I was glad I hadn't

had a wee glass or two the previous evening (OK, not too many, anyway). However, if our driver was required to demonstrate his skills, it was as nothing compared to the Edinburgh party, who arrived in a full-sized, luxury coach. Not an easy job.

The purpose of visiting this locality was to look at the sediments that were deposited in this area, as part of the ice margin of the Lomond Glacier during the early stages of its retreat. So, trowels in hand, we got to work on the banks of the small burn, scraping away bits of loose vegetation and other superficial material, to reveal ever-increasing detail of the well preserved sedimentary structures. The leaders took their role very seriously indeed, employing the aforementioned spades with great dexterity to expose sections of the sediments for us to examine. One trick, not usually allowed to sedimentologists working on older and usually much harder rocks, was the possibility of excavating bedding features in 3-D. This opened up the possibility of getting accurate palaeo-current measurements with ease. I was particularly impressed with this, if not extremely envious.

Dr Auton and Dr Phillips set us challenges to work out what had happened at this site, particularly with respect to the direction(s) of ice movement. We were shown sections where the fluvio-glacial deltaic deposits were over-ridden by the till of the re-advancing glacier, producing deformation structures in the underlying sands, such as folds, faults and even thrusts. All this in sediments deposited only yesterday!

Having unravelled the complexity of events to us, the leaders invited us to imagine the scene some 12,000 years ago. The 'U'-shaped hollow of Loch Lomond in front of us containing a valley glacier, whose snout was only few hundreds or few thousand metres away from us in the distance, with the cold, blue-grey waters of the pro-glacial lake occupying the site just where we were standing. Perhaps we would have heard the cracking of glacier ice as it shelved into the lake, with icebergs of various sizes floating past us.

However, to remind us that conditions, at least on the trip today, were not akin to the last Ice Age, we had the summery scene of a colony of sand martins making their nests in the glacial sand cliffs. Taking much care not to disturb them when we cleaned up the quarry face, we left them with a renovated frontage to their homes for the rest of the summer which Carol Smiley and TV's Changing Rooms programme would have much admired.

We had lunch on the shores of Lake of Menteith and were treated to more ornithological sights. This time, one of the breeding ospreys was busy fishing in competition with the other (human) anglers in their boats.

We spent the afternoon visiting two sites near Callander.

The first one was just off the A84 main road, by the Keltie Bridge Mushroom Farm. We climbed the wooded hill slopes, through head-high bracken, up to a vantage point overlooking the river. What we had in fact climbed was the 'terminal' moraine of the glacier. On one side we could see the steep front of the moraine which was in contact with the ice itself; in the other direction was the gentler slope which drained the moraine and formed the outwash plain. Very impressive. Again, and despite all of the vegetation, one had the strong impression that the glaciation took place only yesterday.

Now, back to our bus driver, again. While we had been looking at the moraine, who should turn up at the mushroom farm but a person who worked there,

complete with a key to the shop and access to the till. Of course, our enterprising driver grasped the opportunity immediately. Absolutely fresh mushrooms were now on sale at the give-away price of £2.50 for a whole kilo, a real steal at the price. By the time we returned to the bus, he was proudly displaying his bargain buy to whoever was interested (most people, of course), and was describing to us the lip-smackingly delicious dishes that would soon be coming his way.

The second site of the afternoon was to the Auchenlaich Pit, where we were to examine outwash sediments in their coarse-grained facies.

Unfortunately for the excursion, the local council had only recently decided to landscape the old quarry by levelling off the faces. So, we could only get a rough impression of the coarse-grained, poorly sorted outwash facies, which had been deposited in front of the 'terminal' moraine.

Dr Auton pointed out to us that as tills extend southwards from the moraine, this wasn't really the terminal moraine in the strict sense. He mentioned that the southern limit of the ice sheet in England also didn't have a widely recognisable terminal moraine. His explanation was that once the ice sheet started to melt and retreat, it simply collapsed like a pile of soggy pudding or jelly on a plate, leaving no evidence of the moraine. However, the height of the moraine does provide direct evidence of a substantial pause in the advance (or retreat) of the Lomond ice sheet.

We took high tea in the Old Bank in Callander, where Dr Auton and Dr Phillip were sincerely thanked on behalf of both Societies, for showing us the exposures and greatly increasing our knowledge and understanding of an extremely interesting period of our recent geological past.

Returning to the bus, I experienced for the first time on a Society field trip this summer, the slightly damp feeling of a few drops of rain. Much credit and thanks must go to the excursion organisers for arranging such excellent weather for us.

Needless to say, on our return to Glasgow, the peace was disturbed only by the quiet snores of contented participants and by the gentle rattling sound of numerous boxes of mushrooms in the overhead shelves, awaiting the evening's culinary fate.

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GLENCOE-BALLACHULISH AREA : 20 August 2005
Leader : Dr Simon Cuthbert
Report by : *Ben Browne* Participants : 26

After an early start for a long day, a nearly full bus met up in bright sun with the last few member of the group at the helipad car park (NN170568) in Glencoe. Simon first reminded us of the structures crossed by the bus: the Midland Valley, The Highland Boundary fault just south of Luss and then the youngest of the Dalradian metamorphics, the Southern Highland Group, followed by the Argyll Group. Crossing over the Tyndrum Fault, which cuts out the Appin Group we had entered the older Grampian Group then climbed up onto the Rannoch granite which intrudes it. Just beyond Kings House we had crossed the ring fault of the Glencoe Caldera. From this first stop we were able to view this deep dissection of the upper part of a Devonian caldera emplaced into both the granite and, to the west, the Appin Group of the Dalradian. Looking south across the glen we saw the Three Sisters. The base of

these mountains is of andesite giving way at a break of slope to rhyolite. Above this, we were told, were to be found tuffs and sediments bearing a record of the surface structures of the active caldera.

The second stop was at the far end of Loch Achtriochtan (NN138567). Crossing to the south bank of the River Coe we climbed a style and walked 200 meters south to the lower slopes of An t-Sron. Looking south at An t-Sron, descending down to our right, we saw a deep gully. To its left, the hill showed the same profile of andesites and rhyolites observed in the three sisters. To its right was a different profile composed of quartzites. The gully is the ring fault intruded by granite. Under our feet however was a low grade metamorphic mica schist which had been downfaulted into the caldera. Exploring outcrops further to the west towards the line of the gully we found increasing evidence of contact metamorphism and then pink granitic rock infilling the ring fault responsible for the high temperatures. Turning about and looking north we could trace the ring fault diagonally up Sgorr nam Fiannaidh, cutting the summit ridge at a point picked out by reddish screes, to the right of which the vertically jointed Aonach Eagach ridge was of andesite.

Here Simon discussed more recent theories of the evolution of the caldera published by Peter Kokelaar and Ian Moore (1). In the upper part of the caldera is evidence of river deposits, lake deposits and sub aqueous eruption of andesites producing the beautiful peperites we were later able to find as a large loose block, and polished in the burn. There is, we were told, also evidence of intersecting extensional faults with subsidence of blocks before the development of the ring fault. The theory is that the ring fault developed only later at the intersection of faults in a NW trending graben occupied by a major river system. It is the 1000 meter deep dissection of the preserved upper regions of this caldera that has allowed this analysis, which may in turn alter our interpretation of the development of other such structures which are less well dissected.

Lunch was taken at the visitors centre (NN112576). Here is to be found an excellent relief model of Glencoe with the ring fault clearly incised helping to make sense of what had been discussed so far.

After lunch we were taken to a small car park (NN050610) just beyond the Shell petrol station over the Ballachulish Bridge. From here we looked across Loch Leven into the Ballachulish Igneous Complex. This is another ring complex of an earlier date than Glencoe and eroded to a greater depth. The view is well described in Pattison and Harte's guide (2) pgs 38-43. Here a sequence of progressively more differentiated granites is intruded into the Dalradian Appin Group. Looking up Glen a' Chaolais into the heart of this horseshoe of mountains, the more pointed peak to the left, Sgorr Dhearg and the ridge running down from this to Meall a' Chaolais just to the left of the bridge is formed of the caldera cap of Appin Quartzite, giving way just below the summit of the ridge to the outermost intrusion, a quartz diorite, which also forms the lower slopes of Craig Ghorm, the steep hillside coming down to the water on the right of the horseshoe. To the right of Sgorr Dhearg the more rounded summit of Sgorr Dhonuill and the Devil's Tooth in front and to the left of it are composed of the more recent central intrusion of true granite. Hidden in the glen to the right of this is the site of the small exposure in the very centre of the complex of the most recent intrusion, of leucogranite, the last dregs of the differentiated magma. Whilst studying

this view Simon reminded us of the tectonic setting that gave rise to these intrusions. Laurentia was approaching Avalonia as the Iapatus closed with associated subdution. It was this subduction of water rich sediments and basic ocean floor under Laurentia that generated the magma and differentiated it to a progressively acidic residue. This process is currently active in the Andes as the Pacific closes.

Our next stop was at the old jetty next to the Holly Tree Restaurant at Kentallen (NN013584) (see (2), pg 57). This site is in the Appin Phyllite only 100 meters west of the outer quartz diorite intrusion. Veins of granite run under the jetty but show no chilled margins indicating a hot host rock at the time of intrusion. Cordierite produced by contact metamorphism at this temperature has decomposed resulting in the pits of a spotted hornfels. The jetty itself offered us a wide selection of various blocks most attractive of which was the coarsely crystalline kentallenite, a diorite rich in augite, which could have been seen in outcrop a few hundred meters south west. This material is thought to represent the original magma from which differentiated the increasingly acidic fractions to be found as one approaches the leucogranite at the centre of the complex.

The last visit of this varied day was to Cuil Bay (NM974554), (See (3), pg168-9). Here we studied the detailed structure of the Cuil Bay Slate. This bay sits within a horseshoe shape of Ardsheal Hill which faces SW. Accepting that the horseshoe was an outcrop of something harder than slate, and observing that the plunge was to the SW Simon, pointed out that we must be in a synform, in fact the Appin Syncline. After this large scale observation we were soon on our knees looking at the fine detail of graded bedding as an indicator of 'way-upness', and the crenulation cleavage as an indicator of at least a second phase of compression in these wonderfully complex and beautiful rocks.

We were fortunate this day in the good weather, the wealth of our geology and the enthusiasm and hard work of our leader.

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LORN AND MID-ARGYLL : 16 – 19 September 2005
Leaders : Dr Judith Lawson and Dr Roger Anderton
Report by : Seonaid Leishman Participants : 20

Friday 16 Sept

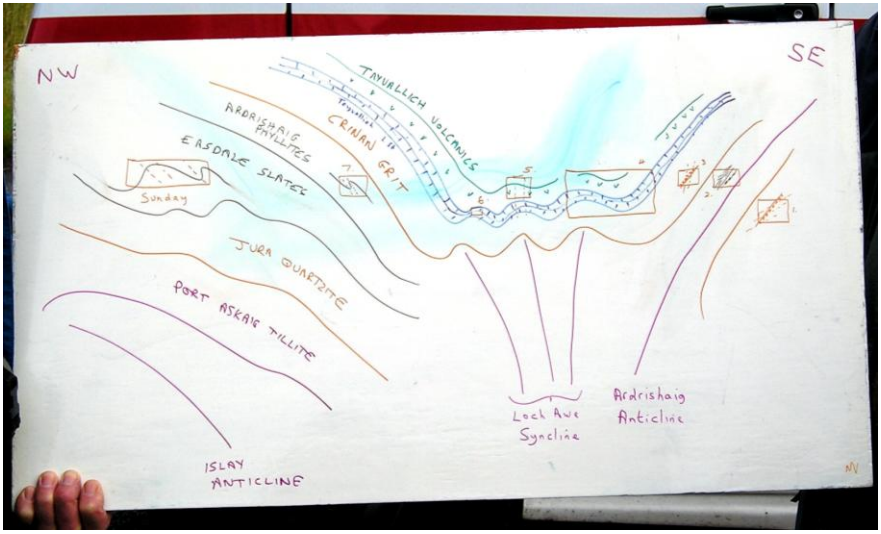
It was a perfect sunny day for the start of the excursion to Lorn and Mid-Argyll led by Roger Anderton and Judith Lawson. We met up at Port Ann on the north shore of Loch Fyne to begin a traverse across the Adrishaig Anticline and Loch Awe Syncline, major structures in the Dalradian. We were to see Easdale Slates, Craignish Phyllites, Crinan Grits and Tavallich Limestones and Volcanics, all part of

the Argyll Group and indicating depositional environments ranging from deep basin, low energy shelf and submarine fans on the edge of a rifting continental shelf. The present 10 Km depth of the Grit (the metamorphic derivative of an arenite) represents about 1000 km of accumulated sediment and is an inscrutable rock according to Roger!

However he recommended that by 'getting up close and personal' with these rocks we would begin to see the Big Picture. So we put our noses onto the grit to decide on cleavage v bedding by working out way up, facing and younging direction. This is essential in order to understand the complex Caledonide structures involving flat folding like the Tay Nappe, the core of which is exposed in the Ardrishaig Anticline.

We had lunch on the other side of the core at Ardrishaig beach amongst the phyllites. These originated as muds on a shallow shelf as the supercontinent Rodinia was fragmenting, when tholeiitic basalts intruded as sills because of the extension. The phyllites being more easily eroded than the Grits influence the pattern of sea lochs such as Loch Fyne and Loch Gilp.

At Kilmichael we were lucky to see the view north to the volcanics, phyllites and grit related by Roger to the west limb of the Loch Awe Syncline and a series of folds several miles wide.



Our Leader's Clear and Explicit Diagram of the Rock Structures Around Us
(by kind permission of Dr Roger Anderton)

After travelling north along strike and admiring the glacial terraces and raised beaches such as Dunadd Fort, the capital of Dalriada, we reached our hotel in Oban just in time for the meal, having made the most of the journey. The hotel was warm and comfortable – just as well given the later developments in the weather!

Saturday 17 Sept

Yes, it rained all day! But what an interesting island is Kerrera! Judith Lawson is an excellent guide and she and Roger grasped our attention all day, though a few had to return early to the hotel to dry out! The island was invested in 1249 by Alexander II who died beside Horse Shoe Bay (now called the Field of the King) when he was trying to enforce his suzerainty on Ewen of Lorn who paid homage to Norway. Kerrera has excellent quaternary beaches, Tertiary dykes, Devonian lavas and conglomerates, rare Upper Silurian fossils (*Mesacanthuhus Mitchelli*), Caledonide faults and Dalradian slate – and unsolved geological puzzles. In fact the South West of the Island is an SSSI.

On our walk south towards Gylen Castle (built 1587, the second stronghold of the MacDougalls) we discussed the lack of evidence of a volcanic centre for the huge outpouring of Devonian lavas thickening to the East. The source could be fissures fed by the dykes and sills. Contemporaneous faulting (NE/SW) has resulted in grabens with the softer slate in the middle making pronounced valleys.

Lower ORS Conglomerate

Then…what a welcome surprise! We found ourselves at the Kerrera Tea Garden which also has a wonderful barn with blazing wood stove, comfortable seating, and serves good coffee, home-made soup, scones etc.

We heard later that while we were lunching, the RNLI were rescuing the crew of a yacht that had sunk off the South West of the Island.

At Gylen Castle we saw wonderful examples of Lower ORS conglomerate which is poorly sorted, mainly rounded quartz because grit, slate, epidiorite etc has been pulverised in recycling of previous conglomerates. The fracturing of some clasts can be either pre- deposition or including the sandy matrix which has then re-welded. Imbrication of boulders shows the current direction (from N/NE) but the lack of structure indicates fast deposition like a flash flood.

On the beach at Port a' Chaisteil we saw folded beds of ferrodolomite which are more competent than the unfolded interbedded slates showing cleavage, i.e. the dolomite is more resistant to crushing so deforms. As we made our way over to the amazing unconformity of ORS conglomerate on the Dalradian slate, those ahead were lucky enough to see an otter scamper off to its holt. The conglomerate immediately

Folded beds of ferrodolomite.

on top of the slate is angular and very un-sorted implying deposition as a fast scree slope.

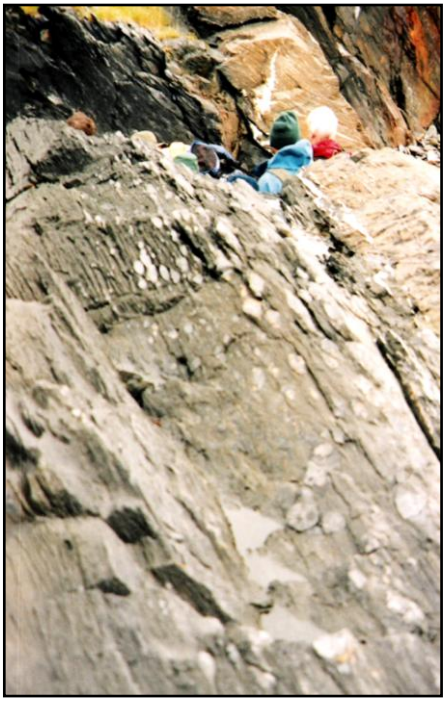
Even in the rain we could see the rock platforms and stacks formed after the rise in sea level with the melting of ice and subsequent isostatic rebound of the land (mantle flows more slowly than water) so that sea level is lowered. This could have happened up to 12 times in the West of Scotland resulting in many metres of hard slate being eroded in a few hundred years, giving a cliff and erosional shoreline with no sediment apron. We heard of possible theories such as the effects of ice shattering from constant freeze/thaw during the Loch Lomond re-advance. We admired views of "submarine" islands such as Dubh Sgeir formed during this erosion.

The Amazing Unconformity of ORS on Dalradian Slate

Sunday 18 Sept

At the Easdale Island Museum

Easdale from Dun Mor with the Garvellachs in the Distance



Carbonated Silt Balls

A better day and off to Seil over the Bridge over the Atlantic. At Balvicar we saw S3 crenulation cleavage (S0 is bedding, S1 cleavage from 1st compression and S3 result of collapse). This is simple we were told – the Lewisian can have up to S36!!

We took the small ferry over to Easdale Island (the Council want a bridge – many islanders don't!) and visited the Museum (sadly to be closed) where Judith gave us the interesting history of the Slate Islands and this man-made landscape. The industry began in the 15th century and gradually the huge amount of waste material dumped at the coast by longshore drift filled the inlet between Ellenabeich and Seil where the village now stands. A major storm in 1881 flooded many of the quarries below sea level and ended the export of slates – all transport being by sea.

We ate our lunch wedged against huge tertiary dykes on the West of Easdale Island, admiring the chilled margins against the slate and the carbonated silt balls which, with metamorphism, become elliptical and make great strain markers. The balls could either be formed as the silt rolls up going down slope, or as load balls of silt in mud. The Degnish Limestone on top of the slate has a source to the north – opposite to the clastic sediments.

On the beach we saw beautiful "necklaces" of pyrite in the slate – a late feature formed as the overburden was stripped and dilatational cracks, cross-cutting the cleavage, filled with pyrite and quartz growing over as needles.

Some of the group climbed up Dun Mor, (Lower ORS Andesite) for a view of the Easdale quarries in a line along strike (i.e. outcrops of the best slate) and of the depositional basin giving rise to the Jura quartzite, north to Loch Creran.

Monday 19 Sept

The rain was torrential as we set off to see extremely interesting quaternary features at Ford on the Southern end of Loch Awe. The combination of the rain and a large bull in the field had us retreating to the coach where Roger talked to us about the work done on linking river and beach terraces south from Loch Awe to Crinan which gives an age of Devensian (about 50,000 BP). However… the terraces at Ford look very fresh so could be included in the Loch Lomond Re-advance (about 10,000 BP).

Handouts were fortunately available – my notebook had by now disintegrated because of the wet!

After admiring the view of terraces from Kilmartin Churchyard it was agreed we would release our leaders Roger and Judith whose enthusiasm was never quenched, and to give them our thanks for such a varied and exciting excursion. We then had the opportunity to visit the Kilmartin Museum (or have lunch!) before going home to dry out.

GENERAL INFORMATION

Scottish Geological Societies-ConocoPhillips Awards.
These were awarded to pupils from secondary schools in Ullapool and Ellon, and from a college in Dundee. In Ullapool, the teacher involved, a member of GSG, arranged the presentation. At Ellon Academy, it was arranged by a member of the Aberdeen Society, accompanied by a representative from ConocoPhillips, who was keen to find out more about the award, while Dr Braithwaite himself made the presentation at Dundee on Feb 10th.

Scotland's First Geopark
In October 2004, the NW Highlands, from Achiltibuie to Cape Wrath and inland to Assynt and Whiten Head, received the accolade of becoming Scotland's first European Geopark. The aims of such a park are to protect the geological heritage, promote geology to the public and promote sustainable economic development, normally through tourism. For further information see www.europeangeopark.org.

Scottish Festival of Geology 1st to 30th September 2005
Over 150 events were held throughout Scotland. Our Society held an Open Day with the following programme of events:
Sat 10th Sept
Guided Walks of the Building Stones of the University – 11.00 am & 2.00pm
Short talks on topics of current geological interest – 11.30 am, 12.30 pm, 2.30 pm, 3.30 pm
Making Casts of Fossils – throughout the day.
Displays of minerals, rocks and fossils – throughout the day.
Tours of Polished Stone Slabs – throughout the day.
Opportunity to run Geological Software– throughout the day.
Ask the Rock Doctors to Identify your Mystery Rock Samples – throughout the day.
Making Thin Rock Sections at Home
Sun 11th Sept., 2.00pm
The Strathclyde RIGS Group arranged a guided visit to the Site at Ardmore Point

Fossil Code
Dr Neil Clark had alerted the Society and others to the proposed amendments to the Nature Conservation (Scotland) Bill which would severely restrict/prohibit all fossil collecting. Two of these were subsequently withdrawn and the third changed to allow a code of practice for fossil collecting to be drawn up by SNH. Dr Mike Keen then

represented the Society on the Group set up within SNH by Dr Colin McFadyen to develop such a code. Later, Dr Chris Burton and other professionals formed a committee to advise the Scottish Executive on how fossil collecting can be progressed in Scotland. The committee hope to produce consultative document, which would be circulated via the web.

Northern Geological Societies Meeting

Following a communication from Edinburgh, Highlands and Leeds Geological Societies, our President attended a meeting, in September, of representatives from Geological Societies in Scotland and the north of England, at Tebay Services on the M6. Items discussed included exchange of information about winter programmes and summer excursions, possible mutual website links, recruitment, publicity, insurance and charitable status. An annual meeting at the same venue was agreed.

Palaeontological Association Conference 2007

This conference originally coincided with the 200th anniversary of the Hunterian Museum, and the Society agreed to host a commemorative evening reception during this conference. A sum of £1000 would be allocated (£250 ring-fenced each year for four years). The conference was later postponed to 2008.

10th Euroseminar – 'Microscopy Applied to Building Materials'

University of Paisley, June 2005. Papers/lectures on the Wednesday, Thursday, Friday with an optional excursion on the Saturday. The Society agreed to affiliate to this conference in name and awarded £500 towards the cost of the excursion.

Expedition Funding

The Society agreed to award a sum of £500 to each of two expeditions, with the usual provision that each send a representative to speak to the Society on Members' Night :

An Approved University of Edinburgh Expedition Aimed at Investigating the Geological History of South Western Greenland.

BSES (formerly British Schools Exploring Society) Expeditions Svalbard 2005, on which Dr Iain Allison would be leading a structural geology project, and a research student from Durham University, jointly supervised by Dr Alan Owen, would be leading a palaeobiology project.

Rock Kits

The Scottish Earth Science Education Forum disseminates educational advice concerning geology to a large number of schools. The Society donated money for the purchase of a computer at the formation of this Forum, and has subsequently agreed to purchase 50 'Rock Kits' (@£32 each) for distribution to schools.

INTIMATIONS

With regret, we record the death of

Miss P. Davison, (member since Session 108 (1965-66), who died 22 January, 2005.

Front cover photograph – Aonach Dubh, Glencoe (*taken by Charles Leslie*).

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