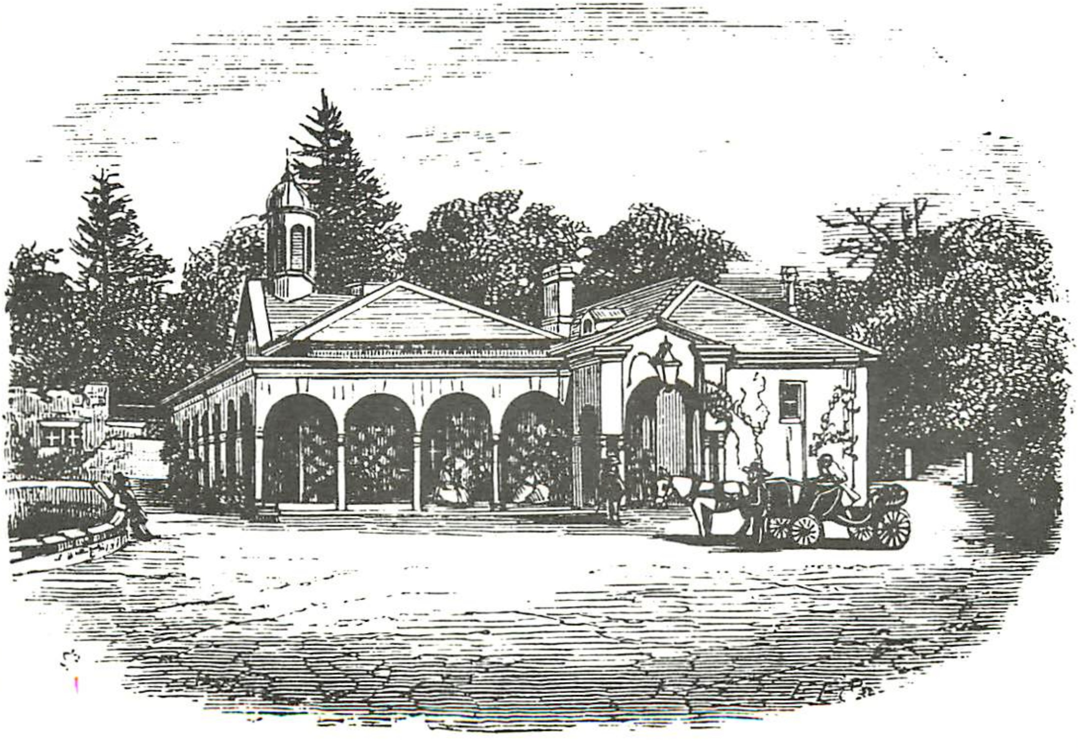
The Edinburgh Geologist

No .22 Spring 1989

Incorporating the Proceedings of the Edinburgh Geological Society

154th Session 1987-1988



The Strathpeffer Spa

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Acknowledgements

The cover illustration is the pump house at Strathpeffer, from Black's Picturesque Guide to Scotland, 1875.

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Editorial

Issue 22 of the Edinburgh Geologist is the first to incorporate the Proceedings of the Society (for the 1987-1988 session). Council has decided that there should be two issues of the Edinburgh Geologist each year. The spring issue will normally include the Proceedings for the session that ended the previous September and the Autumn issue will follow the well-established format seen in editions 1 to 21.

The current edition includes an account of the mineral springs of Strathpeffer by Ben Peach and John Horn, which first saw the light of day in 1900, and has recently been rediscovered by Nick Robins and Andrew McMillan. The Proceedings section includes an obituary to a much respected former President of the Society, Dr Walter (Wally) Mykura; as well as a record of meetings for the 154th session of the society.

In combining the Proceedings within the Edinburgh Geologist, I am very grateful to my predecessors, David Land and David Stephenson, who have been largely responsible for the production of the present issue. I shall be fully 'in harness' for number 23 and I look forward to receiving a wide variety of contributions on all aspects of geology from members of the society.

Clive Auton
March 1989

The Strathpeffer Spa Waters : an appraisal at the end of the 19th century by Ben N Peach and John Horne

edited by N S Robins and A A McMillan
British Geological Survey, Edinburgh

Preface

At various times between 1888 and 1900 Hugh Miller (junior), Ben Peach and John Horne of the Geological Survey were involved in a geological and hydrogeological appraisal of the sulphurous and chalybeate (iron-rich) springs in the Strathpeffer area. At that time the Spa was thriving, and demand for the waters was increasing. This report was prepared in 1900 in response to an enquiry from The Duke of Sutherland who was keen to maximise the groundwater potential from the fetid Spa Beds.

The report lay "incognito" for many years in the Geological Survey archives in Edinburgh. When an incomplete copy was discovered in 1987 it was decided to make an amended text available on open file and as such it can be consulted in the BGS Library at Murchison House. The editors also considered that the report should be made available to a wider readership through the *Edinburgh Geologist*. It is reproduced here, slightly shortened, and with a few editorial comments [in square brackets].

Peach and Horne's original typescript referred to an Estate Plan, which cannot be traced. A general location map of the Strathpeffer area has been substituted (Figure 1) and a small scale plan of Strathpeffer constructed to show the known location of some of the spring and well sources and the outcrop zone of the Spa Beds (Figure 2). Although other locations are not known precisely they have been retained in the text in the expectation that a contemporary location map of Strathpeffer may come to light. The editors are grateful to Allan M Lowrie and Associates Limited of Dingwall, for assistance in preparing Figure 2, and thank the Director of the Geological Survey for permission to publish here.

The Report

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To His Grace The Duke of Sutherland.

Since the Report on the Strathpeffer Spa by Mr Miller and Mr Horne was submitted to your Grace in 1887, further evidence has been obtained regarding the boundaries of the Spa beds, the daily yield of mineral waters from various springs, the chemical composition of the latter, and their behaviour under different atmospheric conditions. In the following report we propose to avail ourselves of these various lines of evidence.

Geological Survey Office	*Ben N Peach*
Edinburgh 1st February 1900	*John Horne*

Geological structure

Recent observations confirm that the succession of the rocks in the Strathpeffer region belong partly to the crystalline schists and partly to the Old Red Sandstone. The sulphur springs are confined wholly to the area occupied by the Old Red Sandstone, whereas the main chalybeate springs issue from the crystalline schists.

The Crystalline Schists

These rocks lie to the west of the area of the Old Red Sandstone; the boundary line between the two formations extends from the village of Contin north-eastwards to a point about half-a-mile west of Auchterneed Station (see Figure 1 and Geological Survey Sheet 83, solid, one-inch to a mile). They are divisible into three sub-groups:-

Flaggy quartzose gneiss
Bands of hornblende-schist
Garnetiferous muscovite-biotite gneiss

The Old Red Sandstone

The following sub-divisions of this formation have been established in the Strathpeffer district, and are listed in descending order in Table 1.

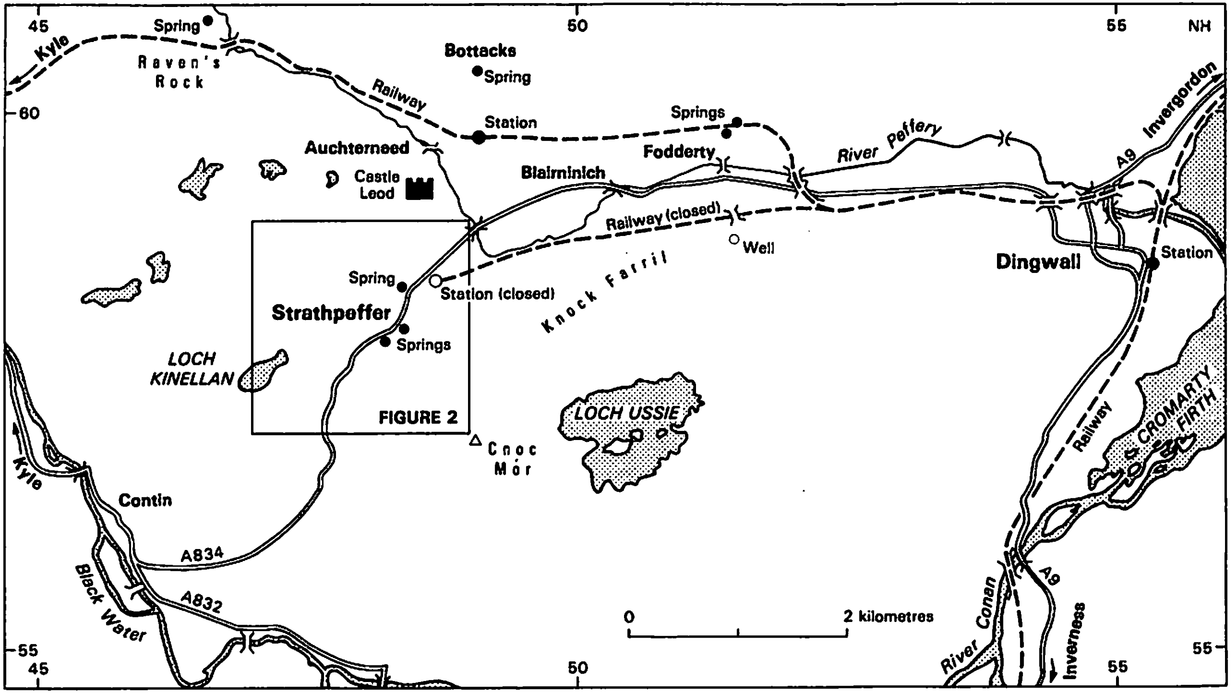

Figure 1 Location of Strathpeffer

Table 1 Sub-divisions of the Old Red Sandstone

9 Red sandstones and shales (Loch Ussie)
8 Coarse conglomerate (Knock Farril)
7 Red shales passing upwards into sandstones, thickness about 600 feet.
6 Olive shales, thickness 125 feet.
5 Shaly fetid limestone, thickness 35 feet.
4 Olive shales, thickness 120 feet.
3 Fetid bituminous calcareous shales and thin limestones, more or less charged with iron pyrites, thickness about 100 feet. The Spa Beds.
2 Olive shales and fetid calcareous bands, thickness 800 to 1000 feet. The Ord Beds.
1 Red and yellow sandstone and conglomerates. Basement Group.

The distribution of the various sub-divisions of the Old Red Sandstone are indicated in [geological] Sheet 83, 1-inch to a mile, [and Ross & Cromarty, sheets] 87 and 88, 6-inches to a mile.

Between the Village of Contin and the hill to the west of Castle Leod, the boundary between the Old Red Sandstone and the Crystalline Schists is a fault or dislocation. Though the rocks are much crushed along this line, the fault may be of no great amount, as the basal sandstones and conglomerates rest unconformably on the gneiss on the hills to the north-east of Auchterneed Station.

A glance at Sheet 83, one-inch to a mile, will show that the various sub-divisions are arranged in parallel strips or belts, extending in a north-easterly and south-westerly direction between the valley of the Conan and the alluvial flat of the Peffery. The strata have a general dip or inclination to the east-south-east so that the lowest beds occur along the western margin of the Old Red Sandstone between Loch Kinellan and Bottacks, and the highest beds found to the east of Knock Farril and Loch Ussie. The Ord Beds are well developed on the Ord Hill to the west of Strathpeffer; the Spa Beds form a very narrow strip extending from the estate boundary at Park Well to the railway station at Strathpeffer; the olive and red shales form the slope to the east and south-east of Strathpeffer; while the escarpment between Knock Farril and Cnoc Mor, west of Loch Ussie, is formed by the coarse conglomerate.

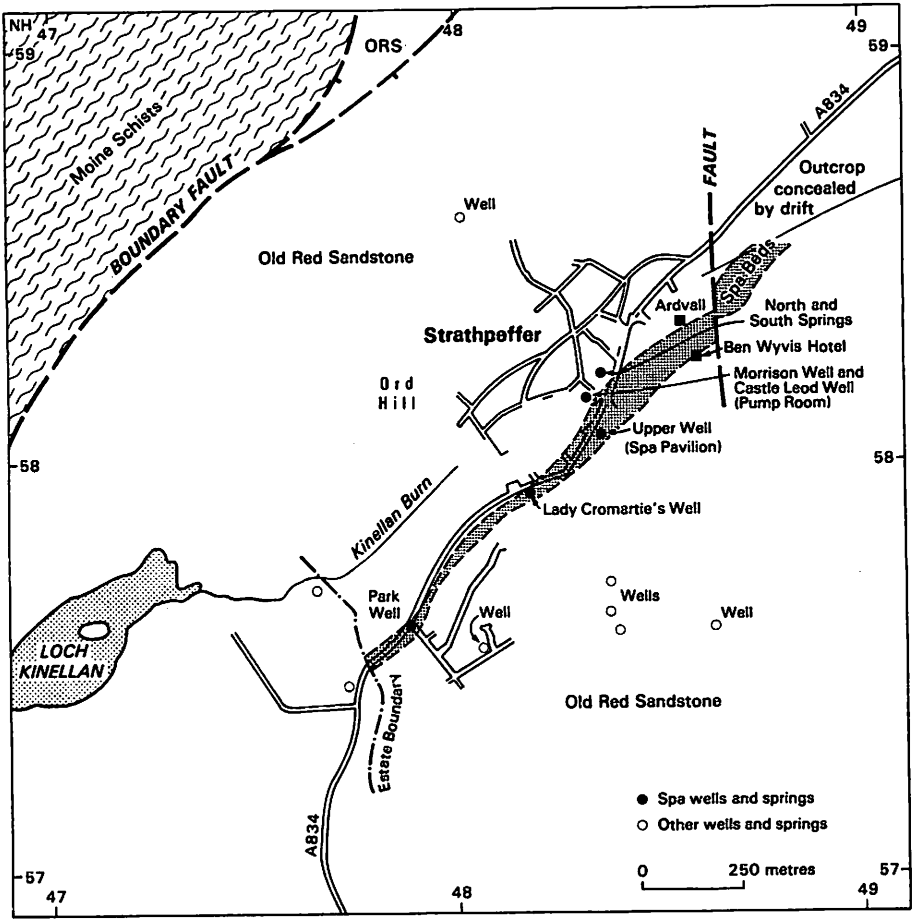

Figure 2 Sources of the Strathpeffer Spa

Although the general dip of the strata is towards the south-east, an important change in the direction of the dip occurs between Castle Leod and Blairninich. For there, the strata belonging to these latter groups dip to the east and pass under the alluvium of the Peffery and the [Late Glacial beach] deposits of the 100 Feet Beach. This change in the dip causes the representatives of the Spa Beds to re-appear on the north side of Peffery near Auchterneed and Fodderty.

The Spa Beds, their characteristics and line of outcrop

Since the sulphur springs at Strathpeffer (with two exceptions to be referred to presently) are confined to the Spa Beds, their line of outcrop is of special importance. The shallow bores put down between Strathpeffer and the estate boundary before our recent visit, together with the trial pits opened under our direction, enable us to define their limits with greater precision than in the previous report in 1877. Though strongly opposed to sinking bores of any depth which might affect the underground circulation of water in the Spa Beds, we beg to state that the shallow bores and trial-pits furnished definite information regarding their outcrop.

The Spa Beds, which consist of fetid bituminous calcareous shales and thin limestones, more or less charged with iron pyrites and rich in lime-salts and organic matter, are traceable as a narrow strip from the estate boundary at Park Well to Strathpeffer.

Beginning at the Park Well, 150 yards from the estate boundary, the Spa Beds were recently exposed in the excavation at this well, and likewise in the trial bore holes. A trial-pit revealed the overlying olive shales; while a drain in the field on the north-west side of the road at the Park Well exposed the underlying olive shales. The actual breadth of the outcrop of the Spa Beds at Park Well, as proved by these shallow bores and trial pits is 200 feet.

About 200 yards to the north-east of the Park Well, a shallow bore put down in the quarry by the side of the road pierced the Spa Beds and similar evidence was obtained from a borehole in the field to the east. The bores put down on the north-west side of the road showed the olive shales, while another trial-pit revealed the olive shales which are about 300 feet wide.

Following the line of outcrop to the north-east the Spa Beds are exposed in the Wood Tank, in the banks of the Kinellan Burn, at the Upper Well, in the Pavilion Tank, in the Post Office Tank, in the Brookside Tank, and in the clothes green behind MacGregor's Hotel. [We cannot be certain of the precise location of these tanks].

In order to fix the limit of the outcrop between the Pavilion and the Ben Wyvis Hotel and Ardvall, trial pits were opened in the field to the south-west of the Ben Wyvis Hotel. These are lettered *a,b,c,d,e,f*. [The precise positions of the trial pits are unknown, but the crop of the Spa Beds as mapped by Peach and Horne is presented on Fig. 2]. The results are as follows:-

Trial-pit *a* exposed grey shales
b exposed thin calcareous seams
c exposed olive shales
d exposed flaggy micaceous sandstone with small pebbles
e exposed olive shales
f exposed dark fetid limestone decomposing

The foregoing evidence shows that the gentle slope to the south-east of the road leading from the Pavilion to the Ben Wyvis Hotel is not occupied by the Spa Beds. Along this slope the rocks are concealed by a thin covering of boulder-clay and from the presence of a spring under the Ben Wyvis Hotel which sometimes shows indications of sulphur. It was inferred that the Spa Beds might extend from the Pavilion to the Ben Wyvis Hotel.

The trial-pits, *a-f* show that the south-eastern limit of the Spa Beds must lie to the north-west of the road between the Pavilion and the Ben Wyvis Hotel. They are visible in a shattered condition in Ardvall Wood and at the mouth of a streamlet, a little to the east of Ardvall.

A fault or dislocation, the course of which is north and south, is probably of no great amount and the down throw, if any, is to the west. The olive shales visible at the side of the road leading to Upper Ardvall are probably the continuation of the olive shales exposed in the trial pits *a* to *e* and the band of fetid limestone in the trial-pit *f* is probably the prolongation of the shaly fetid limestone seen at the road side leading to Upper Ardvall.

Summarising the foregoing observations regarding the outcrop of the Spa Beds in the Strathpeffer district, we may state that they extend from the estate boundary at Park Well north-eastwards by the Wood Tank, Kinellan Burn, Pavilion Tank, Brookside Tank, to Ardvall; a distance of three-quarters of a mile, with a breadth varying from 200 to 300 feet, and the thickness about 100 feet.

There are two sulphur springs which issue outwith the limit of the Spa Beds. The first is the weak sulphur spring below the Ben Wyvis Hotel, which occasionally shows indications of sulphur; [it] is now believed by us to find its source in the band of fetid limestone embedded in the olive shales overlying the Spa Beds, exposed by the road-side leading to Upper Ardvall and in the trial-pit *f*. The outcrop of this band between these two localities probably passes underneath the Ben Wyvis Hotel.

The second record is a small sulphur spring which occurs near Loch Kinellan in the line of fault that passes under the loch and trends in a north-east and south-west direction. It probably arises from the decomposition of iron pyrites with organic matter in the fault breccia. With the exception of this sulphur spring, rising along a fault line between the basal sandstones and the Ord Beds all the springs on the west side of the Kinellan Valley, in the area occupied by the Ord Beds are of fresh water.

Distribution of sulphur springs in the Spa Beds

The striking fact connected with the mineral-water supply of Strathpeffer is the occurrence of all the sulphur springs now in use along the proved outcrop of the Spa Beds (Table 2, Figure 2).

Table 2 Spring locations

	Name of Spring	Situation
1.	Park Well	At roadside, 150 yards from Estate boundary.
2.	Lady Cromartie's Well	At roadside where the Kinellan Burn enters the Strathpeffer Wood.
3.	Springs in Wood Tank	About 33 yards from Lady Cromartie's Well.
4.	New Spring	Close to Wood Tank
5.	Upper (Sutherland) Well	
6.	Pavilion Springs	In Pavilion Tank.
7.	Old Well (Castle Leod Well)	In Pump Room.
8.	Strong Well (Morrison Well)	In Pump Room.
9.	Un-named Spring behind Old Well in Pump Room.	

10. North Spring	In Post Office Tank.
11. South Spring	In Post Office Tank.
12. Spring	In Brookside Tank.

The springs ooze out along planes of bedding of the strata and in some instances along lines of faults in the Spa Beds as in the Wood Tank and in the Park Well. Many of the sulphur springs occur near the course of the Kinellan Burn. Indeed their situation confirms our belief that the Kinellan Loch and Burn have a great influence on the subterranean circulation in the Kinellan Valley. There are indications that the underground circulation is not very deep-seated. For example, all the observations made at Strathpeffer prove that the temperature of the sulphur springs varies with the temperature of the seasons. The mean annual temperature at Strathpeffer is 45.5°F. In winter months the temperature of the sulphur springs falls below this level, from which it may be inferred that the sources of the sulphur springs cannot reach the depth of the zone of constant temperature.

But though the area of the catchment basin of the Kinellan Burn is not large and though the sources of the sulphur springs are not very deep-seated the discharge of mineral water from the springs is remarkable.

Yield of the Sulphur Springs

With the view of obtaining reliable data regarding the yield of the chief sulphur springs at Strathpeffer two sets of independent observations were made (Table 3) albeit at the end of November and beginning of December when the yield, according to experience, is low. To ensure accuracy, the tanks were emptied and the yield was estimated where the springs issue from the rock.

Auchterneed district sulphur springs

To the north of the valley of the Peffery where the strata are concealed under a thick covering of superficial deposits, the olive shales with occasional fetid limestone bands occupy the slopes above and below the railway. Owing to the lateral modification of the various subdivisions of the Old Red Sandstone north of the Peffery the outcrop of the Spa Beds cannot be as definitely fixed as at

Table 3

	Name of Spring	Grains of sulphur per gall. Analyses by Mr Maxwell** 9 Dec 1899	Estimated daily flow in gallons end Nov. 1899	Estimated daily flow in gallons beginning Dec. 1899
1.	Park Well	0.68	72	70
2.	Lady Cromartie's Well	4.42	41	41
3.	Wood Tank Springs	0.97	300*	72*
4.	Upper Well or Sutherland Well	3.73	105	111.5
5.	Old Well or Castle Leod Well	2.00	64	64
6.	Strong Well or Morrison Well	4.47	110	109.5
7.	Unnamed Spring behind Old Well	0.26		31.5
8.	North Spring in Post Office Tank	3.25	369	77.4
9.	South Spring in Post Office Tank	1.25		333.3
10.	Brookside Tank	0.98	430	420

* Mr Gunn informs us that 72 gallons is the daily flow of the chief spring in the Wood Tank; and that the united springs in this tank give 300 gallons per day

**T.W. Maxwell, pharmaceutical chemist of Strathpeffer. Samples estimated for sulphides by titration with iodine solution and results expressed in grains of sulphur (S) per gallon. This represents total sulphides, both hydrogen sulphide and any alkaline sulphides such as sodium sulphide. [To convert grains per gallon to milligrams per litre (parts per million), multiply by 14.29].

Strathpeffer. There can be little doubt, however, that the fetid limestone zone, with bituminous shales, resembling the Spa Beds in character is the source of the sulphur springs occurring there. Three sulphur springs are met with, the first is in the railway cutting 400 yards east-north-east of the Village of Fodderty. The spring issues from the calcareous flags on the north side of the cutting. The spring is fairly good and has a marked taste of sulphuretted hydrogen. An estimate of the flow made during our visit by Mr Mackenzie, Dingwall, amounted to 96 gallons per day. A second spring occurs 250 yards N.N.E. of Fodderty Manse and

50 yards from the railway. This is a copious spring though not strong in sulphur, but is reputed to have valuable medicinal qualities. It is evidently worthy of special attention. A third spring occurs at the side of Auchterneed Burn, 600 yards north of Auchterneed Station. It issues along a line of fault or fissure in the calcareous flags, has a weak flow and is not strong in sulphur.

Chalybeate springs

As already indicated, the chalybeate springs rise within the area occupied by the crystalline schists. The source of these springs is quite different from that of the sulphur springs. The spring near the Raven's Rock, about 1.5 miles west of Auchterneed Station, the water of which is now supplied in the Pump Room, has its source in glacial deposits. There is a large over-flow from this spring, variously estimated from 360 gallons to 540 gallons per day.

This great over-flow is sufficient to meet a large increase in the existing requirements of the Spa for chalybeate water.

Another chalybeate spring, the Saint's Well, about a mile west of Auchterneed Station, issues from a band of muscovite biotite gneiss. This spring yields 480 gallons of chalybeate water per day; this large volume of water might be available for use if required.

Conclusion

During our visit to the Spa, proposals were submitted to us for the improvement of the service of sulphur waters both for drinking purposes and for baths. But our instructions do not entitle us to discuss the merits of the various proposals.

We consider, however, that the evidence embodied in this report proves beyond doubt that the present yield both of the sulphur and chalybeate springs, not only far exceeds existing requirments, but would permit a great future development of the Spa.

There are two points, arising from the foregoing evidence, to which we wish to call special attention:

First, the distinctive quality of the sulphur waters of Strathpeffer which places that Spa on a high level, is due to the presence of sulphur mainly in the form of sulphuretted hydrogen (H_2S). Owing to this fact, Strathpeffer sulphur water is specially sensitive to exposure to the air, to changes of temperature, and to mechanical agitation. For exposure to the air, a rise in temperature, and mechanical agitation, all cause deterioration by loss of sulphur.

Of the various methods which might be employed for raising the water to a higher level, we believe that elevation by ramming would produce the least amount of deterioration.

Second. In view of the future success of the Spa, we beg to urge in the strongest manner that feuing along the outcrop of the Spa Beds, between Corrievanie Villa and the estate boundary at Park Well, be discontinued.

We desire to express our cordial acknowledgements for the valuable aid which we have received in these investigations from Mr Gunn and the various estate officials, Dr Fortescue Fox, Dr Tregelles Fox, Dr Duncan, and Mr Maxwell.

Strange Earth, No. 6

Bill Baird
Royal Museum of Scotland

The stone runs of the Falkland Islands have been an object of wonderment to every traveller who has seen them since the time of Pernety. Darwin, 1839 describes these ribbons of great angular blocks lying in the bottoms of many valleys as "streams of stones". These sharp unweathered blocks of quartz rock range in size from blocks a foot or so across to boulders the size of a house. In some places the streams occupy that position in a valley normally occupied by a river while in others they lie on the hillsides even running to the tops and crests of the hills. Explanations for the occurrence of these stone streams have been many, including earthquakes and glaciers, but present theories suggest a periglacial origin allied to the nature and bedding of the quartzose parent rocks.

References

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Strange Earth, No. 7

To a geologist brought up on a diet of igneous dykes intruded into sedimentary rocks the idea of clastic dykes comes as a surprise. However such sedimentary dykes derived from clastic materials in underlying or overlying beds are not uncommon (see Newsom, 1903; Waterston, 1950; Williams, 1927). When however these dykes are intruded into granite their origin and method of emplacement becomes rather more difficult to explain.

A series of such dykes occurs in the Pikes Peak region of Colorado in a belt about ten miles long and one mile wide. These fine-grained, tough sandstone dykes vary in width from a few inches to several yards and in the latter case are so hard as to stand out in the landscape as ridges. Several theories have been put forward to explain the origin of these dykes including the suggestion that they were intruded from unconsolidated water-bearing sand layers, into cracks caused by an earthquake. Cross (1894) suggests orographic movements as a possible cause.

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Proceedings of the

EDINBURGH

GEOLOGICAL SOCIETY

154th Session

1987-1988

No. 18 December 1988

INTRODUCTION

This the eighteenth issue of the *Proceedings* covers the 154th Session, 1987-1988 and for the first time is being incorporated in an issue of the *Edinburgh Geologist.* Abstracts of the lectures delivered to the Society are included.

MEMBERSHIP

Total membership of the Society at 30th September 1988 was 570, consisting of:

Honorary Fellows	11	Senior Fellows	15
Corresponding Fellows	8	Family Fellows	31
Life Fellows	27	Glasgow Associates	10
Ordinary Fellows	457	Junior Associates	11

Numbers of Fellows and Associates elected, deceased, resigned, removed and transferred during the 154rd Session, 1987-1988:

Honorary Fellow deceased	1	Senior Fellow resigned	1
Corresponding Fellow deceased	1	Family Fellows elected	2
Life Fellow deceased	1	Ordinary Fellow transferred to Family Fellowship	1
Ordinary Fellows elected	20	Family Fellows resigned	2
Ordinary Fellows reinstated	9	Glasgow Associate elected	1
Ordinary Fellows deceased	2	Junior Associates elected	3
Ordinary Fellows resigned	5	Junior Associates removed	2
Ordinary Fellows removed	20		
Ordinary Fellow transferred to Senior Fellowship	3		

PUBLICATIONS

Three parts of the *Scottish Journal of Geology* were published during this session:

1987, Volume 23, Part 3
1988, Volume 24, Parts 1 and 2

The *Proceedings of the Edinburgh Geological Society* No. 17, covering the activities of the Society during the 153rd Session, 1986-1987 and the 20th issue of the Societies informal magazine, the *Edinburgh Geologist*, were published during the year and distributed to members.

In November 1987, the Society published the *Building Stones of Edinburgh* by I.T. Bunyan, J.A. Fairhurst, A. Mackie and A.A. McMillan and in August 1988 *An Excursion Guide to the Moine geology of the Scottish Highlands*, edited by I. Allison, F. May and R.A. Strachan was published by Scottish Academic Press, in association with the Edinburgh Geological Society and the Geological Society of Glasgow.

Explanatory leaflets to the geology of Arthur's Seat and Blackford Hill were reprinted.

CLOUGH MEMORIAL MEDAL AND AWARD

The Clough Memorial Medal for 1987-1988 was awarded to Dr W.S. McKerrow for his distinguished research, particularly in the Southern Uplands.

OBITUARY

WALTER MYKURA, BSc, DSc, FRSE (1926-1988)

Dr Walter Mykura, who died suddenly on 13th May 1988 aged 62 as the result of a road accident in Edinburgh, was an outstanding field geologist, known for his work throughout Scotland. Wally Mykura was a much-loved Life Fellow of the Edinburgh Geological Society, to which he was elected an Ordinary Fellow in 1951 and which he served as President from 1975 to 1977.

Originally from a small town in the north of Czechoslovakia, he came as a refugee to Britain in 1938 and, after war service in the RAF, graduated in geology at the University of Birmingham in 1950. In that year he joined the staff of the Geological Survey in its Edinburgh office, where he remained until a stroke forced his retirement in 1985. Such was his tenacity and purpose that, supported by his wife Alison, he made an almost complete recovery and at the time of his death was eagerly looking forward to leading the Society's week-long May excursion to his beloved Shetland.

Even whilst a student in Birmingham, his ability to observe and discern key field evidence showed in his first publication in 1951, which was based on work in the nearby Abberley Hills. In Scotland, his published contributions are immense and his name will be ranked forever amongst the greatest in Scottish geology. He is the only field geologist in the Geological Survey ever to have gained Special Merit Promotion to Senior Principal Scientific Office, which he achieved in 1979. He was awarded the Wollaston Fund of the Geological Society of London in 1972, the Clough Medal of the Edinburgh Geological Society in 1982 and the T.N. George Medal of the Geological Society of Glasgow in 1987. He was elected a Fellow of The Royal Society of Edinburgh in 1970 and the University of Birmingham awarded him a DSc in 1976.

Many were those that he stimulated to take up geology through his infectious enthusiasm, conveyed in well-illustrated lectures but above all in the field, where he also demonstrated his considerable mountaineering skill. He was an inspiring leader of many of the Society's excursions, especially the week-long excursions in May every year. Perhaps the most memorable of these was that to the Isle of Rhum in 1977. He also led two notable long excursions for The Geologists' Association, to Orkney in 1978 and to Shetland in 1983.

His official duties in Scotland, principally concerned with the production of geological maps and accompanying memoirs, began in the Pentland Hills near his home, covering the Silurian inliers, Lower Old Red Sandstone volcanic rocks and the Pleistocene geology. Later, he co-authored the 3rd Edition of the Edinburgh Memoir with G.H. Mitchell. This was followed by work in the Ayrshire Coalfield, notably demonstrating the replacement of coal by limestone. There then came nine summer seasons of field work in the geologically-remarkable Shetland Islands, concerned with the evolution of the Old Red Sandstone basins, volcanic rocks, metamorphic rocks and plutonic complexes, particularly in Western Shetland. He co-authored the Western Shetland Memoir with J. Phemister in 1976. He provided new evidence on the movements on the Great Glen Fault system as it passes northwards through Shetland. Later work on the Old Red Sandstone of Orkney enabled him to produce a completely new Regional Handbook on the

Geology of Orkney and Shetland, published in 1976. This is perhaps his best-known single work and contains a guide to geological excursions in the two groups of islands. He also worked extensively in the mainland of northern Scotland.

Wally Mykura, as he was universally known and loved, became recognised internationally as the authority on the Old Red Sandstone of northern Britain, in the Orcadian Province. At the time of his retirement from the post of District Geologist in charge of the Highlands and Islands of Scotland, he had already embarked on a major review of the Jurassic sediments which are only briefly glimpsed on land on the west and east coasts of Scotland, but which form such important hydrocarbon-bearing reservoirs offshore.

He is survived by his wife Alison, three sons and a daughter to whom we extend our sympathy.

N.E. Butcher

RECORD OF MEETINGS

7th October 1987
The applications of space and airborne remote sensing to geological mapping for engineering and prospecting.
Dr J.McM. Moore, Imperial College of Science and Technology

Remote Sensing is the term used to describe systems of space and aircraft imaging and terrain measurement, image enhancement methods (image processing) and, more recently, digital map making.

Aerial photographs have been used by geologists for more than 50 years. During the last twenty years photographs and other forms of imagery from many space missions have given us a new and more comprehensive picture of the texture and colour of the earth's surface. This information is a valuable complement to conventional geological and geophysical mapping techniques for mineral, oil and water prospecting.

In addition to photographic pictures recording the visible and very near infra-red wavelengths of radiation, we can now view the earth and other planetary bodies in line-scanned images which show the appearance of terrain in terms of thermal radiation and in the so-called micro-wave wavelength range, based on radar imaging systems.

Pictures from space and aircraft are available both as photographic products and also as digital magnetic tapes. Digital imagery can be manipulated and enhanced to help interpretation by using a computer processing system. This improves the quality of images in ways far more dramatic than are possible in the photographic laboratory.

There has been a dramatic increase in the quality of imagery, both in spatial resolution and also in the sub-division of spectra into fine "filtered" wavelength range bands. As a result, we are approaching the time when it will be possible to obtain "terrain spectra" characteristic of mineral, rock and vegetation types, from space. In other words, the era of automated mineral identification and digital geological mapping is almost upon us!

For the exploration geologist, remotely sensed imagery provides not only much better topographical base maps than ever before, but also the means to enhance geological structure as it is expressed in geomorphology or vegetation patterns (image texture) and soil and rock colours (spectral features). The lecture was illustrated with examples of structural geology, mineral, oil and water prospecting in Europe, Arabia, Africa and America as well as geological mapping of other solar system bodies from our own moon to those of the outer planets.

28th October 1987
Copper and gold in the Andes: a response to tectonic, magmatic and climatic evolution
Dr H. Clemmey, University of Leeds

Some 85 per cent of all gold mined comes from South Africa, most of the rest being from circum-Pacific deposits associated with subduction. All the gold ever mined amounts to 18 cubic metres. The price of gold has remained relatively static at around 400$ per oz as new gold deposits are discovered and brought into production and metal values of 4 to 5 grams per tonne are now economic.

For copper, 60-70 per cent comes from circum-Pacific deposits, mostly in or derived from porphyry copper ore bodies. The percentage grade of copper is highest north and south of the tropics in the arid zones. This demonstrates that the climate is important as well as the geology.

The area inland of the Mejillones peninsula in northern Chile and adjacent parts of Peru and Bolivia is one of the richest metallogenic provinces in the world for copper, gold and lithium. It is also very active tectonically. Subduction takes the Pacific plate under the Andes and gives rise to subvolcanic porphyry copper deposits. As these are exposed by erosion, a hydrothermal circulation system leaches the copper, which is precipitated either in the oxidation zone (which is here very deep because of the dry climate) or in outwash gravels. The porphyry coppers are surrounded by a wide halo of iron sulphides giving acidic ground-water which actively mobilises both copper and gold. Reworking of the gravels mechanically increases the gold grade.

18th November 1987
Geology - the Scottish science?
Professor G.Y. Craig, University of Edinburgh, Clough Memorial Medallist, 1986-87

Should the query apply to the word 'Scottish' or 'science'? Perhaps it is as much an art as a science. Some years ago the committee on Cogeodata arranged for some thirty specimens to be sent worldwide for naming, identical samples from each specimen being sent to each laboratory. The naming was diverse: e.g. one specimen was variously described as limestone, shale, siltstone and slate; another was conglomerate, sandstone or tuff; another was granite or gneiss.

Scottish geologists have made great contributions to the science - one thinks of Hutton, Playfair, Lyell and Murchison (who became Director of the Geological Survey when he was 63 years old). The last two named several Periods, although none of these were named from Scotland. McCoy, who made critical fossil identifications for Murchison and Sedgwick, was sent to Victoria.

Art may reflect science, sometimes with unwitting accuracy, e.g. Leonardo's Virgin and St Ann has the figures on an interrupted Bouma-sequence turbidite. John Houston paints pictures which include the Bass Rock but was not impressed when informed that it was a phonolite plug.

Ideas may be disseminated by spoken or written word or in art and the importance of good clear language must be emphasised. About 50 per cent of Scottish theses are on Scottish topics which indicates that there is still plenty of work to be done in Scotland and that geology could make a good claim to be a Scottish science.

25th November 1987
The ups and downs of New Zealand's active volcanoes
Dr P. Kokelaar, University of Ulster, Jordanstown

The boundary between the Indian plate to the north-west and the Pacific plate to the south-east runs through New Zealand. In the North Island the Pacific plate is being subducted with a component of dextral slip. An accretionary prism at the plate boundary is succeeded westwards by a fore-arc basin, then a shear-zone, then an andesitic-dacitic active volcanic arc and a marginal basin with rhyolitic and basaltic volcanism.

The volcanic arc through Ruapehu and White Island is characterised by explosive activity. Metre-sized blocks have been thrown 3 km and devastating mud, ash and debris flows are a hazard. In the marginal basin 'inverse' volcanoes are formed where huge explosions have blown ash out to be deposited well away from the site of the explosion. This volcanism is less than one million years old. One eruption blew a column of ash 50 km high for 17 hours wreaking total destruction over an area 160 km in diameter.

Hot springs derive from both shallow and deep groundwater. The shallow ones are derived from rainfall which replenishes an artesian system. This is exploited for geothermal energy. There are problems with subsidence - as much as 10 m locally - due to removal of the groundwater. Deep groundwater is acidic, being derived magmatically.

9th December 1987
Last of the foreign devils: western oil and the South China Sea
Dr I. Price, BP Research Centre, Sunbury on Thames

Seismic exploration in the South China Sea started in 1979 and the first well was drilled in 1983. The area did not prove the bonanza which was originally expected, only two small discoveries and one commercial field being found. Exploration was based in Canton, which is situated in a region where hills of late-Cretaceous to early-Tertiary granites are surrounded by alluvial deposits of the Pearl River basin.

Beneath the South China Sea there are small ocean basins which are now dormant. These are rift-related half-grabens in Palaeozoic strata (mostly limestone) with late-Tertiary infills. It was thought that organic-rich lake sediments could provide an oil source with reservoirs in peripheral or central highs in the half grabens. These are characterised by listric faults and two sags with central doming. As the lake sediments are generally overlain by cyclic sandstones and mudstones transgressing over the continental shelf, it was thought that prospects for oil were good. However, in general the lake sediments are too coarse-grained to be potential oil sources.

13th January 1988
Early life on land
Dr W.D.I. Rolfe, Royal Museum of Scotland

The emergence of life on to land was a momentous event which has to be interpreted from a scattered record. Plant life began to emerge from the sea possibly in the late-Precambrian in the form of algae, but true land plants, needing the support of a wax cuticle and gas-exchange arrangements to prevent dessication, probably originated in the Ordovician though maybe not successfully. However, by Silurian times there were simple land plants a few centimetres high. *Rhynia* in the mid-Devonian Rhynie cherts, was less than 1 m high and formed dense thickets near water, giving a damp microclimate in which early land animals (arthropods) could live. Trees are known from the late Devonian, and seeds by the end of the Devonian.

Land animals such as arthropods emerged from the sea in association with the plants. Silurian millipedes from Stonehaven are the earliest known land animals and are important as early soil formers. In the Coal Measures, spiny millipedes up to 2 m long lived on rotting vegetation. Insects are known from the Upper Carboniferous: they formed the prey of tetrapods and some had warning colours. Scorpions which were aquatic in the Silurian were land animals in the Carboniferous. Lower Devonian scorpions up to

1 m long were probably amphibious. Early land amphibians, about 338 million years old, in the uppermost Oil-Shale Group (high Visean), are being investigated at East Kirkton near Bathgate. They lived in an upland area (not a low-lying swamp) and the fauna was preserved under volcanic fall-out.

In addition to their evolutionary significance, arthropods may supplement conodonts as thermal indicators in the search for oil. Comparison of faunas from different palaeocontinents could provide a means of timing continental collisions or splits. Scotland could well provide new evidence, perhaps from supposedly unfossiliferous Old Red Sandstone, of early life on land.

10th February 1988
The global search for the Cambrian base
Dr T.P. Fletcher, British Geological Survey, Edinburgh

Until recently the base of the Cambrian was drawn at the unconformity below the lowest shelly fossils. In the last 30 years more and more Precambrian sequences have yielded fossils such as stromatolites, which are known from rocks older than 3500 million years. Work has also been done on Precambrian-Cambrian sections in areas previously unknown and more and more useful sections are becoming available, especially in Siberia (Lena basin), Kazahkstan, western China, Morocco, Australia and Newfoundland. Workers studying these sequences formed the Precambrian-Cambrian working group in 1972 under the auspices of the International Union of Geological Sciences. The group is a model of international co-operation, involving primary research in stratigraphy, sedimentology, palaeontology, magnetostratigraphy, and geochronology.

Prime candidates for the basal Cambrian stratotype are now east Siberia, west China, and Newfoundland. The relatively inaccessible eastern Siberian sections are generally carbonate sequences, but they contain unconformities. Three fossil zones have been recognised below the earliest trilobites and above tillites. In China, in the Yangtse gorges, sections consist of clastic rocks followed by carbonates. Sections here are presently the front runners for selection as the international stratotype, but much more work needs to be done especially palaeontological work. A third major candidate for selection is the Burrin Peninsular of Newfoundland. This has the advantage of accessibility, splendidly clear coastal sections, and absence of unconformities in hundreds of metres of interdigitating clastic and carbonate facies below the earliest trilobites. Much detailed work has recently been done in this area.

Research continues, since the problems are neither simple nor solved. There are few useful volcanic rocks available for dating and it is necessary to find and use faunas which can be correlated.

24th February 1988
Fellows Night

The Carboniferous of Beijing municipality

by Mr M.A.E. Browne

Mr Browne visited Beijing last year for a Carboniferous conference. He showed pictures of various monuments in and around the city - mostly heavily restored Ming structures - including the Great Wall and a building on Coal Hill where coal was stored.

Trilobites from southern Sweden

by Mrs C.M. Taylor

In southern Sweden the Lower Palaeozoic strata include fossiliferous Upper Cambrian alum shales with concretions and beds of limestone which are packed with articulated trilobites and other fossils. The trilobites exhibit all stages of development and include carapace casts, so that the ontogeny of individual species may be studied. Excellent preservation and persistent uniform sedimentation enable detailed statistical studies to be made both of the population and of individual characteristics down to electron microscope scale.

Ophiolites in Cyprus

by Dr P. Stone

The Troodos ophiolite complex runs through the middle of Cyprus and is part of the Alpine orogenic belt. Mt Olympus in the centre of the complex includes the lowest rocks which are ultrabasic, mostly harzburgites. Asbestos and chromite are mined here. Stratigraphically higher rocks are layered pyroxene-olivine rocks which, with increasing plagioclase, pass into gabbros. Above these is a sheeted dyke complex overlain in turn by pillow lavas. All this forms a classic ophiolite complex of oceanic crust, but the geochemistry of Troodos suggests an island-arc environment rather than mid-oceanic ridge. It is therefore suggested that Troodos formed in an incipient oceanic island arc. Pyrite and chalcopyrite occur in the pillow lavas and the overlying ferruginous shales. These sulphides are comparable with black smokers.

The fifth meeting of European Geological Societies.

by Mr A.A. McMillan

MEGS 5 was held in Dubrovnik, Yugoslavia last September and included several excursions, one of which was illustrated. The coastal area consists of Cretaceous and Eocene limestones which give karst scenery. Inland are flysch sequences and ophiolitic serpentinites. Tertiary basins are filled with lacustrine sediments including lignites.

The Kelifos-Koufos expedition

by Dr J.E. Dixon

This expedition to northern Greece was mounted by four students of the Grant Institute of Geology and was partly supported by the Society. The expedition area in the Sithonia peninsula includes Upper Jurassic limestones and pillow lavas. Mid-Jurassic ophiolites in the region are associated with sea floor spreading 25 million years older than the Kelifos pillow lavas. Did the spreading persist? Studies on Kelifos island show that the limestones and pillow lavas were contemporaneous and that they include limestone flysch and limestone breccias, some very coarse. It is concluded that the strata probably represent a sea-mount, possibly associated with some renewed sea-floor spreading.

Recent developments in Scottish quarries

by Dr C.G. Smith

Granite was formerly quarried as a building or dimension stone, but as this was very labour intensive it became uneconomic in the 1950s. Costs were around £300 per cubic metre; 62 cubic metre blocks were the largest obtainable. Some quarries (e.g. Ross of Mull) are still capable of producing dimension stone. Coastal quarries like this and Bonawe or Furnace are well placed to ship stone cheaply to distant markets. However they have limited harbour facilities and/or variable stone. A new concept is the coastal super quarry. Foster Yeoman, who have led the way with dedicated company trains from quarries in the Mendips to south-east England, have started the Glensanda quarry in the southern part of the Strontian Granite. This quarry is designed to produce up to 7.5 million tonnes per year. It is being developed on the "glory hole" principle with an access tunnel 6x5x1800 m from the primary crusher in the quarry to the secondary crushing and sorting facility by the jetty at Glensanda on Loch Linnhe where 6000 tonne bulk carriers can load.

2nd March 1988
The geological evolution of California
Dr A.H.F. Robertson, University of Edinburgh

California may be divided physiographically into (a) the Coast Ranges, (b) the Great Valley, (c) the Sierra Nevada, and (in the north) the Klamath Mountains, (d) the semi-desert Basin and Range, and (e) the Columbia Plateau.

The Pacific Ocean crust is of Jurassic, Cretaceous and Tertiary age, on either side of the spreading ridge along the East Pacific Rise. This is near to America and indicates that about 5000 km has been subducted eastwards under America. There are also 'suspect' or transported terraines, some of which have moved great distances along strike-slip faults.

The Grand Canyon has Precambrian rocks in the bottom overlain by undisturbed Palaeozoic to Mesozoic strata.

In the Klamath Mountains, terraines from Lower Palaeozoic in the east to Jurassic in the west have been accreted sequentially. They include seamounts, melange and the Ordovician Trinity ophiolite complex, all indicating an active continental margin with subduction and a volcanic arc. Mesozoic rocks in the Klamath Mountains include large scale melange as well as pillow lavas and limestones (sea mounts and atolls). In the Sierra Nevada, strata from Ordovician to Jurassic age are strongly deformed with strike-slip faulting and shearing. The Jurassic rocks of the western foothills of the Sierra Nevada show subduction, a volcanic arc, granites and arc-trench gap sediments, all metamorphosed from low to high grade. Lithologies are mainly quartz-rich turbidites but include pillow lavas and cherts. In the western Klamath the Jurassic rocks show subduction and a marginal basin (continental rifting); in the Coast Ranges there are slivers of ophiolites in various places. There is a regional end-Jurassic deformation event, the Nevada Orogeny. Eastwards subduction dominates the Cretaceous and strike-slip movements become more important in the Tertiary.

Cretaceous Sierra Nevada plutons (which now form the glaciated high Sierras) rose from a subducted Pacific plate, whilst the Great Valley developed as a fore-arc basin containing continental-derived conglomerates and greywackes. In the Cascade Mountains of north California, subduction is still going on, e.g. Mount St Helens and Crater Lake.

The still controversial, coastal Franciscan melange has igneous and metamorphic lumps in a shaly matrix. Sandstones with blue schist minerals, indicating formation at depths of 10 to 15 km, are now at surface. Some geologists look for a mechanism to take rocks to these depths and then return them to surface. The Franciscan also includes pillow lavas, cherts and limestones from the Pacific, all relatively undeformed.

In the Tertiary, subduction continued in the north, with strike-slip movements in the south, especially along the San Andreas Fault along which are small pull-apart basins. Extensional pull-apart is important in the Basin and Range Province where basins (including Death Valley) are being infilled by alluvial and volcanic strata.

23rd March 1988
The Silurian rocks of western Ireland - 'the dullest in Europe'?
Dr D.A.T. Harper, University College, Galway, recipient of the Clough Memorial Award, 1986-87

(It was Murchison who labelled these rocks the 'dullest in Europe', but subsequent research has shown them to be anything but dull.)

The Silurian rocks of western Ireland crop out in three geographically and tectonically discrete successions. Although now juxtaposed, the Clew Bay, Croagh Patrick and Galway-Mayo Border successions display contrasting facies and faunal developments, further accentuated by dissimilarities in the metamorphic grade and tectonic style across the region. The extravagant late-Llandovery transgression and Wenlock regression, manifest in the Galway-Mayo Border succession, are illustrated by a wide variety of siliciclastic facies and rich shelly and graptolite faunas. Nevertheless the patterns of palaeocommunity development are not typical. This succession has many features in common with coeval successions in the Midland Valley of Scotland. Analysis of sea-level curves, magnafacies and clast provenance, together with the development of volcanism suggest containment within a single basin, largely unmodified by subsequent strike-slip movements.

Although the Silurian rocks of western Ireland did not impress Murchison, these successions are proving to be of critical importance in understanding the evolution of the northern margin of the Iapetus Ocean.

30th March 1988
James Wright Memorial Lecture
The tectonics of Asia
Professor A.M.C. Sengor, Technical University of Istanbul

Asia is the earth's largest, youngest and structurally most complicated continent. Although its evolution began almost 4,000 million years ago, more than half of it is currently seismically active. Asia's first-order palaeotectonic (i.e. inactive) units consist of orogenic zones (including complex orogenic collages) formed around common continental host nuclei. The following host nuclei are distinguished: the Angaran, Indian, and Arabian shields; the Kontum Massif; and the north China, Yangtze (Sichuan), Tarim (Serindia), Ust Yurt and Alxa (Ala Shan) blocks. Orogenic zones are the Altaids; the Tethysides including the Cimmerides and Alpides; and the Circum-Pacific Superorogenic System (the last two partly neotectonic).

Asia's first-order neotectonic (i.e. active) units are: stable Asia, the Arabian platform, the Indian subcontinent, the Alpide plate boundary zone, island arcs and marginal basins (or active subduction systems).

The palaeotectonic evolution of Asia ended with the India-Eurasia collision some 50 million years ago; and its neotectonic deformation began disrupting the continent's pre-existing fabric. Every palaeotectonic subdivision affected those older than itself and caused the generation and/or reactivation of cratonic structures. Structure reactivation gives important clues in understanding the behaviour of the continental lithosphere. Examples of such reactivation events are given in the history of hydrocarbon-bearing basins.

Asia is the best museum and laboratory for the study of continental evolution, which can be illustrated with field examples from Turkey, China, Tibet and Soviet Central Asia.

SOCIAL EVENING

4th December 1987	A social evening was held in the Common Room of Murchison House (BGS), West Mains Road and was attended by 95 members and friends.

RECORD OF EXCURSIONS 1987

		Attendance
30 April	Aberfoyle Leader: Dr G.B. Curry	35
14 May	Keirsbeath opencast site Leader: Mr C.W. Mackenzie	22
21-28 May	Shetland Isles: W. Mykura Memorial Excursion Leader: Mr A.A. MacMillan following an itinery prepared by Dr W. Mykura	21
8 June (evening)	The building stones of Edinburgh Leaders: Mr J. Fairhurst, Mr I.T. Bunyan and Mr A.A. MacMillan	42
11 June	Carlops: A. Lamont Memorial Excursion Leaders: Dr E.N.K. Clarkson and Mrs C.M. Taylor	39
22 June (evening)	The Penicuik Peat Company Leaders: Mr W.J. Baird and Mr P. McLintock	36
25 June	Siccar Point and Eyemouth: A. Mackie Memorial Excursion Leader Mr D.C. Greig	50

3 September	The Quaternary geology of the Stirling area Leaders: Mr J.W. Merritt and Mr J.L. Laxton	33
17-19 September	North Solway basin Leaders: Dr S.K. Monro and Mr E. Skipsey	20
24 September	Wandel Burn Leaders: Dr E.N.K. Clarkson and Mrs C.M. Taylor	17

COUNCIL NOTES

With the greatest regret we record the deaths of Dr Walter Mykura and Sir Andrew Bryan. Dr Mykura was a past president and a Clough Medallist, highly respected for his integrity and courage, and known and liked by everyone for his cheerful company and always-helpful advice. Sir Andrew Bryan was an honorary member of the Society who, in the course of a long career in mining, was (among other posts) Professor of Mining at Glasgow and HM Chief Inspector of Mines. He will be remembered best for his promotion of health and safety in mining. We extend our deepest sympathy to the families of these members. In honour and in memory of Wally Mykura a memorial fund has been established to support and encourage geological field work in Scotland.

Grants from the Clough Fund were made to G. Walker and P. Hague of the Grant Institute in aid of field work near Trakhia in Greece; to Mr Wark and colleagues for work at Breidamerkurjokull in Iceland; and to R. Batchelor for work on granites near Ballachulish and Rannoch.

In August the third international exhibition of geological maps of the World was mounted in the Department of Geography, Drummond Street, by kind permission of Professor David Sugden. Some 300 maps from about 35 countries were newly acquired for this year's exhibition; 90 were displayed. The exhibition had about 375 visitors. The Society would like to thank Professor Sugden, John Bartholomew and Son Ltd and the numerous donors of maps for their support of this successful event.

Some 20 books have been added to the Society's library. Through the good offices of Dr Grant, these have been bought at an appreciable discount, and we thank him for this valuable contribution.

On the Society's behalf, Dr C.D. Waterston gave advice on several geological sites in the newly designated Pentlands Park.

We offer grateful thanks for facilities provided for us at the Grant Institute by Professor G.S. Boulton and at Murchison House by Dr R.W. Gallois. It is a pleasure also for me to acknowledge the friendly help of Council and members of the Society. We have enjoyed a fruitful and interesting year and may look forward to an equally excellent 155th session.

STANDING COMMITTEES 1987-88

Finance	Dr I.R. Basham (Convenor) Prof. E.K. Walton, Mr D.H. Land, Dr D. Grant, Mrs M. McLeod, Prof. G.Y. Craig, Mr D.C. Greig, Dr C.D. Waterston.
Publications	Dr D. Grant (Convenor), Prof. E.K. Walton, Mr D.H. Land, Dr I.R. Basham, Dr G.M. Biggar, Dr J.D. Peacock, Dr N.H. Trewin.
Clough Memorial	Mr D.H. Land (Convenor) Prof. E.K. Walton, Dr I.R. Basham, Dr D.J. Fettes, Dr W. Mykura, Prof. B.G.J. Upton.
Excursions	Mr S.I. Hogarth (Convenor) Prof. E.K. Walton, Mr D.H. Land, Dr I.R. Basham, Mr N.E. Butcher, Mr A.D. McAdam, Mr A.A. McMillan, Dr W. Mykura.
Planning *(Map Exhibition)*	Mr D.H. Land (Convenor) Prof. E.K. Walton, Dr I.R. Basham, Mr N.E. Butcher, Dr E.N.K. Clarkson, Dr N.G.T. Fannin, Mr A.A. McMillan, Dr S.K. Monro, Dr W.D.I. Rolfe.

SUMMARY OF ACCOUNTS

Statement of Balances at 30th September 1988

	1988		*1987*	
	£	£	£	£
Fixed Assets				
Investments at market value		45,028		46,699
Current Assets				
Stock of publications	6,660		4,276	
Other stocks	285		293	
Debtors	257		36	
Taxation recoverable	992		585	
Monthly Income Account	3,000		4,500	
Current Account	-		650	
	11,194		10,340	
Less:				
Creditors due within one year				
Sundry	570		751	
Loan (Necker Map)	700		700	
Bank overdraft	348		-	
	1,618		1,451	
Net Current Assets		9,576		8,889
Net Assets		54,604		55,588
Representing:				
Funds				
at 1st October 1987		55,588		47,599
Increase (decrease) in value of investments		(3,152)		6,462
Scottish Journal of Geology allocation		1,400		74
Surplus for year		1,380		2,547
		55,216		56,682
Less:				
Specific Expenditure (Scottish Journal of Geology vol. 23)		(612)		(1,094)
		54,604		55,588

Report of the Auditor to members of the Edinburgh Geological Society

I have audited the accounts in accordance with approved auditing standards. Information supplied by individual Council members has been accepted as being correct where independent confirmation could not be obtained. The valuation of the investments by the Bank of Scotland Investment Services has been accepted.

In my opinion the accounts, which have been prepared under the historical cost convention, give a true and fair view of the state of the Society's affairs at 30th September 1988 and of the net Revenue for the year ended on that date.

74 Colinton Road
Edinburgh EH14 1AT

M. McLEOD C.A.
13th November 1988

Revenue Account for the year ended 30th September 1988

Income	*General*	*Publ's*	*Clough*	*Wright*	*Sime*	*Total*	*1987*
	£	£	£	£	£	£	£
Income from quoted investments	1,351	1,716	344	98	123	3,632	3,538
Bank interest	366	-	-	-	-	366	406
Subscriptions	4,517	-	-	-	-	4,517	4,523
Tax recovered on Deeds of Covenant	48	-	-	-	-	48	57
Profit on sale of Publications	-	793	-	-	-	793	348
Other	-	-	-	-	-	-	3
	6,282	2,509	344	98	123	9,356	8,875
Expenditure							
Lectures	1,008	-	-	280	-	1,288	783
Excursions	428	-	-	-	-	428	466
Audit '88	380	-	-	-	-	380	723
Print. Post. Stat.	1,587	671	-	-	123	2,381	2,052
Miscellaneous	9	102	225	-	-	336	378
Insurance	75	-	-	-	-	75	50
Reception	46	-	-	-	-	46	63
Library additions	180	-	-	-	-	180	219
Bank charges	297	-	-	-	-	297	20
Non-recurrent expenditure	1,165	-	-	-	-	1,165	1,500
	5,175	773	225	280	123	6,576	6,254
	1,107	1,736	119	(182)	-	2,780	2,621
Specific allocations	-	(1,400)	-	-	-	(1,400)	(74)
Surplus (Deficit) for year	1,107	336	119	(182)	-	1,380	2,547

NOTE: Non-recurrent expenditure 1988

Festival map exhibition 1,165

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