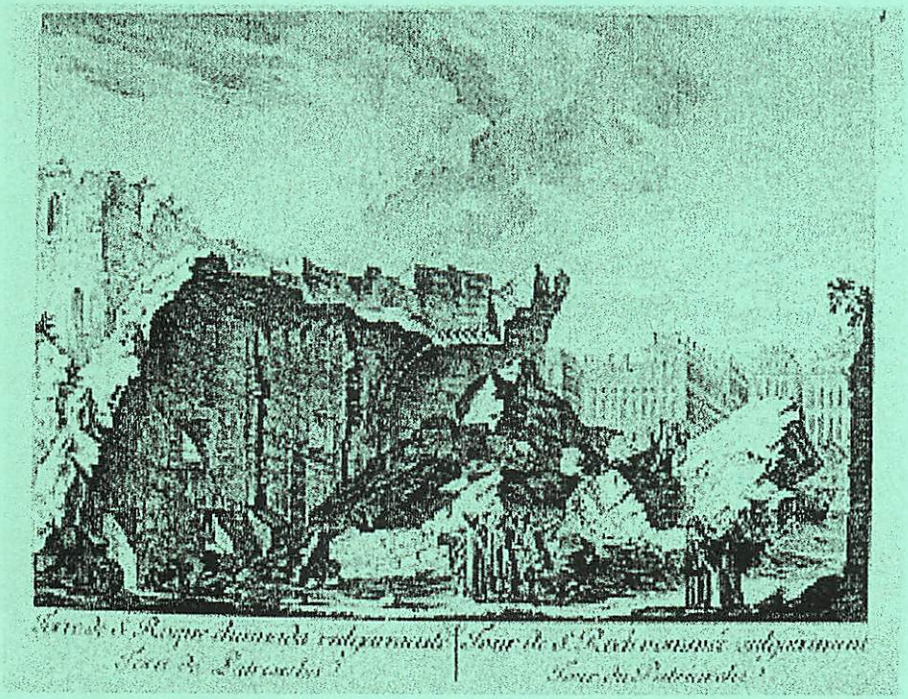
The Edinburgh Geologist

Magazine of the Edinburgh Geological Society

Issue No. 36 Spring 2001



Incorporating the Proceedings of the Edinburgh Geological Society
for the 166th Session 1999-2000

THE EDINBURGH GEOLOGIST

Issue No. 36 Spring 2001

Cover Illustration

The cover shows an engraving by Le Bas of the damage caused by the Lisbon Earthquake of November 1st, 1755. This was based on drawings made by Paris and Pedegache, who were in Lisbon at the time of the earthquake. This engraving shows the ruins of St. Roch Tower.

The illustration is published on the National Information Service for Earthquake Engineering (NISEE) web site, *www.eerc.berkeley.edu/lisbon/index.html*, and taken from the NISEE Kozak Collection of Images of Historical Earthquakes.

see article on 'a new hypothesis of earthquakes' on page 22.

Acknowledgements

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Editorial

by Alan Fyfe

Welcome to the Spring 2001 edition of THE EDINBURGH GEOLOGIST. As Editor of this magazine, it has been a good Millennium for me so far, largely because a number of people have sent me unsolicited mail. Now for the rest of you, this may be a scourge, but to an Editor, let me say, receiving articles out of the blue just makes my day... every time! That is not to say that I have not had to do some customary chivvying as well, but that is part of the job. I have also contributed to a couple of articles myself, which I trust that readers will forgive, but, to be honest, I was just glad not to have to write the whole magazine myself! So what have we?

Well, the first article is something that was inspired in Autumn 1998 by Corresponding Fellow, Dennis R. Dean, who suggested a piece to celebrate the 150th anniversary of the 1850 meeting of the British Association for the Advancement of Science. Well, we missed that anniversary last year (blame it on time passing ever more quickly), but here is the article now, and fascinating it is.

There then follows a splendid article by Dr. Isles Strachan on maps and legends. Dr. Strachan laments the passing of the old and familiar scheme for labelling geological maps. The story of map symbols must be an interesting subject. Does anyone know, for example, why the 'brick' symbol was chosen to denote limestone and when this was first used? It would also be interesting to compare the old legend scheme with the new one adopted in the last few years by the British Geological Survey.

Kenneth Aitken, who has been living in Germany for several years now but who has remained a member of the Society, has sent in an article for the series WHAT'S IN A NAME? Since moving there, his German must have been gradually improving and now that he has picked up a lot of geological words, he finds that he is able to baffle even the native speakers! He shares some of those geological words with us in his *What's in a German Name?*

An active RIGS Volunteer Group meets once a month on Wednesdays in Murchison House. A report on what they have been doing has been contributed by three of their members... three very familiar names too. Dates of forthcoming meetings are published from time to time in the Society's billet or can be found on the Society's web site.

Bob Reekie of the Wanlockhead mining museum has contributed a follow-up article to the review of the museum in the Autumn 2000 issue. Through dint of

Editorial

badgering the authorities, Bob has managed to secure further funding for the administration of the museum. Very proudly, he told me that someone in the Scottish Executive had described him as 'a pest'. The Society also has an excursion to Wanlockhead and Leadhills this summer.

This is followed by a short piece by me. I had been doing some research in the Edinburgh Room of the Central Library, when I came across an extraordinary article on 'a new hypothesis of earthquakes'. It appeared in *The Scots Magazine* almost 250 years ago and just goes to show what progress has been made in our understanding in the last quarter of a millennium. It also goes to show how *The Scots Magazine* has changed over that time.

I am also pleased to be able to publish another in the series of GEO-VINEYARDS (though this is the last that Cecilia has found, so please keep your eyes open when you are *en vacances* this year). In this issue's POET'S CORNER, there is a structural geological parody of the song 'Bonnie Dundee'.

Lastly, there are a couple of reviews, one of the book *Exploring geology on the Isle of Arran*, contributed by Mike Tuke, and one of *The Oxford Companion to the Earth*, contributed by Norman Butcher. And, of course, we have our now regular ROCKSWORD PUZZLE by Angela Anderson.

The Proceedings of the 166th session of the Society are published with this issue.

The copy date for the next issue of THE EDINBURGH GEOLOGIST is Friday 31st August 2001. I await your unsolicited contributions, so come on... make my day!

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Of glacial theory and wholemeal bread

180 years of the British Association

by Norman Butcher & Alan Fyfe

Fifty years ago this year, the British Association for the Advancement of Science met in Edinburgh. It was the sixth time that the annual meeting had been held here, a record which the city then shared with Birmingham. The prospectus made play of the fact that, as well as taking part in the arranged tours to Oban, the Western Highlands, Glencoe, Pitlochry, the Trossachs and the Border Country, delegates could stay on for the International Festival of Music and Drama which began a few days after the meeting. Maybe these were some of the reasons for what turned out to be a record attendance at a UK provincial meeting.

The British Association for the... okay, let us just call it the B.A., for that is what it has become known as, though for a while the name 'British Ass.' was in vogue! The B.A. was founded in 1831 and the previous meetings in Edinburgh were held in 1834, 1850, 1871, 1892 and 1921. It was founded:

> to give a stronger impulse and more systematic direction to the objects of science, and a removal of those disadvantages which impede its progress, and to promote the intercourse of the cultivators of science with one another, and with foreign philosophers.

The driving force for the foundation of the B.A. was provided by the great Scottish physicist and natural philosopher, Sir David Brewster, whose statue still stands today outside the Chemistry Department at King's Buildings in Edinburgh, next to the Grant Institute. On 23rd February 1831, Brewster wrote to the geologist John Phillips, then Secretary of the Yorkshire Philosophical Society, enquiring whether the Society and York itself could accommodate the setting up of such a body as the British Association. Events moved fast and Phillips gave the first informal lecture on Monday 26th September that year on the *Geology of Yorkshire*, illustrated with specimens.

John Phillips, orphaned nephew of William Smith, the Father of English Geology, was to play a crucial rôle as a Secretary of the Association for thirty years. Regularly corresponding with several of the leading scientists and engineers of the Nineteenth Century, John Phillips's own scientific interests covered much more than geology and he was especially active in astronomy. Phillips eventually became the first Professor of Geology at Oxford University and remained in that post until his death in April 1874 as a result of falling down stairs in All Souls College. By

the way, Brewster had earlier, in 1821, founded the Society for the Encouragement of Useful Arts in Scotland, now known as the Royal Scottish Society of Arts.

From the start, the British Association was divided into a number of *Sections*, which, in 1832, were:

Mathematical and physical science
Chemistry
Geology and physical geography
Zoology, botany, physiology and anatomy

As the years passed, these were divided and subdivided, until now there are fifteen sections. *Geology and physical geography* did not last very long and the inevitable rift came one hundred and fifty years ago, in 1851. The decision must have been made at the meeting in Edinburgh in the previous year. What was it, then, that drove the geographers out?

It had been an interesting meeting and a review of the lectures gives a very good indication of the issues of the day. At that time, the President of the Section was Roderick Impey Murchison, who gave a *review of the labours of M. Barrande* in his work in the Silurian of Bohemia and also on the discovery of *Palæozoic Fossils in the Crystalline Chain of the Forez in France*. Anther renowned speaker were the Reverend Professor Sedgwick who spoke *on the Geological Structure and Relations of the Frontier Chain of Scotland* [For more on Murchison and Sedgwick, see article on page 8 of this issue –Ed.]. And there was a lecture *on a Fossiliferous Deposit underlying Basalt in the Island of Mull* given by no less than the Duke of Argyll.

But the main issue of the day was one referred to by Hugh Miller, who gave a talk *on peculiar scratched Pebbles and Fossil Specimens from the Boulder Clay, and on the Chalk Flints and Oolitic Fossils from the Boulder Clay in Caithness*, where he described the boulder clays and the underlying pavements as being scratched and polished. In the rather flowery language of the day, he concluded that:

> the agent which produced such effects could not have been simply water, whether impelled by currents or by waves. No force of water could have scarred such distinct, well-marked lines on such small stones. The blacksmith, let him use what strength of arm he may, cannot bring his file to bear upon a minute pin or nail, until he has first locked it fast in his vice... the smaller stones must have been fastened ere they could have been scratched.

He then went on to imagine a submerged Scotland and discussed the currents in the Atlantic Ocean and the interplay of the warm Gulf Stream and the iceberg-bearing Arctic Current:

> the northern current would be deflected by the more powerful Gulf Stream into an easterly course, and would go sweeping over the submerged land in the direction indicated by the grooves and scratches, bearing with it every spring its many thousand gigantic icebergs, and its fields of sheet ice many hundreds of square miles in extent.

It may seem a rather fanciful explanation now, but at the time, the natural philosophers of the day were striving to explain what they saw. It had been only ten years since Agassiz had made his famous declaration in Blackford Glen: "This is the work of ice." At the same meeting, Charles MacLaren, co-founder and Editor of *The Scotsman* for twenty years, spoke *on Traces of Ancient Glaciers in Glenmessan* and described:

> certain deposits of clay and gravel... resembling moraines of glaciers... [whose] position and appearance suggest the idea that they are remains of terminal moraines formed during the gradual and final retreat of glaciers from the valleys of the Grampians... It seems scarcely possible to account for the abraded and striated surfaces of the rocks and ridges and mounds of gravel, except upon the hypothesis that they have been produced by glaciers at an ancient epoch.

Robert Chambers also spoke *on the Glacial Phœnomena of the Neighbourhood of Edinburgh*, and James Bryce *on Striated and Polished Rocks and Roches Moutonées in the Lake District of Westmoreland.*

We have stayed with the 1850 meeting largely because it was 150 years ago and, for some reason, round numbers always provoke attention. Dennis R. Dean, who wrote an article on Gideon Mantell for the Autumn 1998 issue of *The Edinburgh Geologist*, pointed this out and suggested that it would make an interesting article. But in fact, the 1951 meeting was no less interesting. A whole day was set aside for the subject of *Controversial problems in Highland geology*, with such speakers as H.H. Read, Sir Edward Bailey, Prof. W.Q. Kennedy, Dr. A.G. MacGregor, Dr. J.E. Richey and Prof. R.M. Shackleton.

But much of the controversy must have been on the theory of Continental Drift. It had been a quarter of century since Wegener published his ideas on *the Origin of Continents and Oceans.* At the previous year's gathering in Birmingham, there

had been a joint meeting between four sections, Geology, Zoology, Geography and Biology to discuss this topic. The theory was still being hotly debated and the arguments were still raging. Prof. Harold Jeffreys had said:

> This is the fourth time that I have taken part in a public discussion of this theory. In each previous one a distinguished biologist or geologist has presented the case for drift, and has been followed by equally distinguished ones who have pointed out facts that it would render more difficult to explain... The present impasse suggests that some important factor has been overlooked.

How prophetic! Prof. S.W. Wooldridge was of the latter persuasion and refers to the subject having been discussed at the B.A. in 1931:

> The position as then set forth has undergone no very radical change in the years between. Then, as now, no demonstrably adequate mechanism for movement was in sight.

He did not have long to wait until the 'adequate mechanism' hove into view and all the pieces started fitting together (sorry).

The meetings that brought together three or four Sections of the Association were forever its strength. They were, after all, the meat of the 'intercourse of the cultivators of science with one another'. There had been a similar discussion in 1921 in Edinburgh linking mathematical and physical science, geology, zoology and botany, and this time the subject had been *the Age of the Earth*. The Right Honourable Lord Rayleigh had opened the meeting by showing the relevance of the discovery of radioactive minerals giving out heat and thus keeping the Earth's interior hot. His calculations had given a figure of 1000 million years as the time when the crust became suitable for the habitation of living beings. And it is nice to know that at that time, the more flowery speeches were not yet dead. To quote Prof. J.W. Gregory:

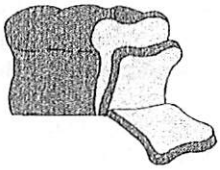
> The claim that geological time must be restricted within a score or a few score million years was regarded by most geologists with incredulity, since a score million years was of little more use to geology than the seven days of the Pentateuch.

But of all the talks ever given at the B.A. in Edinburgh, the most relevant to the intercourse of the cultivators of science must have been at the meeting in 1871, when a Dr. Moffat spoke *on Geological Systems and Endemic Disease*. Dr. Moffat

lived in northern England in an area underlain by Carboniferous Coal Measures and Permian New Red Sandstone. His researches showed that:

> Anæmia, with goitre, was very prevalent among those on the Carboniferous system, while it was almost unknown among those of the Cheshire Sandstone, and phthisis was also more prevalent among the former than the latter... Analysis showed that the wheat grown upon the Carboniferous system was deficient in phosphates and nutritive salts... [and that] the practical deductions [were that]... all young persons living on a Carboniferous formation having symptoms of incipient goitre and anæmia, ought to be moved to a soil upon Red Sandstone, and persons of strumous habit ought to reside upon sandstone at an elevation of at least 800 ft or 1000 ft above the sea... Medical men could not too much impress upon the minds of the public the importance of flour made from the whole of the wheat, or "whole grain."

It has taken a long time for that latter message to get through, but modern nutritionists should be aware that the recommendation was first given in a geological lecture!



Norman is well-known to members of the Society and has been attending meetings of the British Association for the Advancement of Science since the meeting in Edinburgh in 1951, when he was among the delegates that stayed on for the Arts Festival! He has recently been researching the life and work of John Phillips, who played a pivotal rôle in the management of the B.A. in its early years.

Alan's interest is much more recent, having started when he first used his newly-acquired Edinburgh University Library Reader's pass. The Annual Reports of the B.A. are all held in the Library and they kept your Editor entertained for hours in thumbing through the accounts of lectures and other engaging miscellany.

Maps and legends

by Isles Strachan

During the Second World War, the large hall of Chambers Street museum was used for a variety of purposes, including the distribution of ration books and other public materials. In the mid 1940s, there was an exhibition to display ideas for the 'future' which included details of local government and the introduction of a new 'Ten Mile Map' with a national grid covering Britain in two sheets on which all sorts of information could be plotted for planners for display to the public. The exhibition also included a draft of the new geological map of Scotland.

I noticed that the index on this 'new' map consisted entirely of numbers. Until then, geological age and lithology on Survey maps had always been represented by a sequence of letters with superscript numbers. In my view, this was an easy system to recognise and had some meaning. Numbers by themselves conveyed no such relationships. When I asked about the change, I was merely informed that it was the new policy which was being followed. When the map finally appeared in print in 1948, just in time for the International Geological Congress in London, I was surprised to see that while all the Scottish geology was indexed by numbers, the whole of the southern sheet had the usual Survey letters. This showed a clear divergence of opinion between London and Edinburgh. The English sheet even extended the old system to give igneous rocks lower case letters where the age was known. To make matters worse, the English part of the northern sheet also had letters so that, for example, the Carboniferous near Berwick was labelled '56 (d2)'.

The lettering system used on the larger-scale maps seems to have been the result of gradual evolution founded on the simple basis of each geological system having its own letter with the subdivisions numbered as appropriate. An attempt was made to provide continuity between adjoining sheets, though, as with many map series, new developments and discoveries meant that this was not always possible. The letters started from 'a' for the Cambrian and proceeded up to 'k' for the Pliocene. 'Drift' or 'Quaternary' was shown either as an overlay on 'Solid' sheets or on separate maps. Now that a different approach to labelling on the 50 000 sheets is appearing, the following notes on the old scheme may be of interest to readers.

The Cambrian System was normally divided into Lower, Middle and Upper sub-systems so 'a1', 'a2' and 'a3' were regularly used for these divisions. The Tremadoc was, until fairly recently, included in the Upper Cambrian in Britain but is now internationally regarded as part of the Ordovician. This move points up one of the real weaknesses of the scheme. In the 1830s, Lower Palaeozoic stratigraphy

was being unravelled far away from Scotland, with Adam Sedgwick working on the Cambrian of North Wales and Roderick Murchison on the Silurian of the Welsh Borderlands. Between them lay a tract of country that led to a difference of opinion as wide as the Iapetus Ocean itself. Sedgwick considered these rocks to be Upper Cambrian, while Murchison referred to them as Lower Silurian. It was Lapworth, in 1879, who worked out a compromise by creating the Ordovician System, which included much of the disputed strata. But as Dorothy Rayner (1967) states:

Sedgwick	Murchison	Lapworth
Silurian	Upper Silurian	Silurian
Cambrian	Lower Silurian	Ordovician
	Cambrian	Cambrian

A comparison of the three stratigraphic schemes

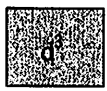
> It was much more than a compromise, however, and brought together rocks and faunas of reasonable unity and convenient definition. Moreover, it is somewhat ironic that this system—the interloper—proves to represent a much longer period than the Silurian, and is comparable with the Cambrian.

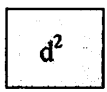
And it played havoc with the lettering scheme, which was complicated even more by the move of the Tremadoc into the Ordovician. Which brings us back to the development of the scheme, where all the rocks between the Cambrian and the Devonian came under the letter 'b'. This was variously divided: 'b1', 'b2' and 'b3' were commonly used to indicate Arenig, Llandeilo and Caradoc (all Ordovician) respectively with 'b4' as Lower Llandovery marking the base of the restricted Silurian. However, the Ten Mile Map (1948 version) omits 'b4' altogether and has the Silurian as 'b5' to 'b7' for Llandovery, Wenlock and Ludlow respectively. On the index map with The Silurian Rocks of Scotland (Peach & Horne, 1899), 'b4' is given as Llandovery and Tarannon, 'b5' as Ludlow-Wenlock and 'b6' as Downtonian.

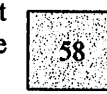
In the Midland Valley inliers of Lesmahagow, Hagshaw Hills and the Pentlands, strata have been mapped as 'Downtonian'. The conjecture that the Scottish 'Downtonian' was younger than the Ludlow arose from the occurrence of fossil fish and attempts to match them with the succession in the Welsh Borders, where fish were generally post-Ludlow. More recent work has led to correlation of the Scottish beds with much earlier Silurian of the English succession and the designation of the rocks of the Pentlands Inlier on the Ten Mile Map as '51 Ludlow & Wenlock' and '52 Downtonian (?Devonian)' is now outdated.

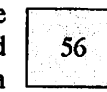
Maps and legends

The letters 'c' and 'd' are used for the Devonian and Carboniferous respectively. Any apparent confusion may or may not have been rectified with the modern scheme, where the same letters are used, but now irrespectively. The Old Red Sandstone poses some problems since there is nothing really like it south of the Border. The division into Lower, Middle and Upper for the Scottish developments allows the letter 'c' to be used as 'c1', 'c2' and 'c3' but there is little direct correlation with Lower, Middle and Upper Devonian of southwestern England, which are also 'c1', 'c2' and 'c3'. As there are plenty of red beds in the lowest Carboniferous of Scotland, the boundary between beds labelled 'c' and those called 'd' can be rather arbitrary and is the subject of continuing research. The division of the Carboniferous in England into Carboniferous Limestone in the lower part and Coal Measures above separated by the Millstone Grit was imported into Scotland with some difficulty and has led to some odd effects at times. I remember seeing a map of resources which marked a great deal of the Midland Valley as rich in limestone because the rocks were called 'Carboniferous Limestone'.









There is no 'd1' on the Ten Mile Map although it appears on Scottish one-inch maps for the Calciferous Sandstone. This would seem to be '56' on the Ten Mile Map for most of the country, but near Berwick, '56' was equated with 'd2, lower'. The old equivalence of the Roslyn Sandstone with the Millstone Grit of English successions has now been abandoned with the recognition of facies change as an important factor in stratigraphy, so 'd4' has lost a lot of its meaning, though the labelling of 'd5' for the Productive Coal Measures and 'd6' for the Barren Measures still makes some sense.

The letter 'e' was used for various beds assigned to the Permian. Subdividing these is still very difficult in the general absence of fossils and the succeeding Triassic, 'f', was similarly hard to correlate from one area to another. Indeed, in some of the Scottish succession, rocks of these ages were often referred to simply as Permo-Trias ('ef') or New Red Sandstone, a general rag-bag, which includes rocks not only of more than one System, but of more than one Era.

In a similar way, on some maps, 'fg' was used to indicate the Rhaetic, now known as Rhaetian to affirm it as a Series rather than a System. This was sometimes included in the Triassic and, generally in older works, sometimes in the Jurassic. As a side note, I remember finding a specimen in the museum. The label indicated that it came from Crowle and I tried to track down its source. The gazetteer

produced two Crowles, one in Worcestershire and one in Lincolnshire. As it was obviously Rhaetic, the geological map should have resolved the dilemma but it turned out that both Crowles were just about on the Rhaetian outcrop which runs across England from Devon to the Yorkshire coast. This is an incredible coincidence as the outcrop is usually less than 100 feet thick and the source of the specimen thus remains unidentified.

The varying succession of clays and limestones that make up the Jurassic allows ample scope for subdivisions of the letter 'g'. The basic subdivision goes back to William Smith and the succession around Bath of Lias, Oolites and Cornbrash ('g1' to 'g9') followed by Oxford Clay, Corallian, Kimmeridge Clay, Portland Beds and Purbeck Beds taking the numbering to 'g14'. These were traced all the way from Dorset to Yorkshire, sometimes with difficulty, but formed the basic outline of English geology in the southern half of the kingdom. The local changes in lithology between clays and limestones provided the main succession but it was not easy to correlate with Scottish developments of Jurassic rocks, since the northern rocks were often of a sandy nature which did not fit the stratigraphic classification. Indeed, it is bizarre that a stratigraphic term such as 'Inferior Oolite' was used to refer to a sandstone on Skye. Similarly, the 'Great Estuarine Series' was quite patently not so.

A similar story goes for the Cretaceous under the letter 'h'. Wealden, Lower and Upper Greensand, Gault and Chalk ('h1' to 'h5') worked for the south of England but the stratigraphy in Scotland, very scattered as it is, does not easily fit and correlation was by fossils. The later Lower and Upper 'Tertiary' (Palaeogene and Neogene), as 'i' and 'k', completed the sequence of solid rocks.

Modern maps have a variety of designations for the different rock types displayed and while the new subdivisions with their logical contractions provide perhaps a more refined system, they seem to lack the memorability of the older system. I, for one, regret their passing.

Dr Isles Strachan (which he took pains to let me know is pronounced 'Strawn') was educated in Edinburgh at the High School and University. He lectured in Birmingham for thirty-five years, identifying graptolites for the Survey in the fifties and sixties when the Southern Uplands work was starting up. He retired to St. Andrews in 1984 and has lived there ever since.

What's in a Name?

Kenneth Aitken e-mailed me with the following article on geological and associated terminology. He is clearly taken with things Germanic though his tongue-in-cheek humour remains distinctly Scottish.

What's in a German Name?

Having already spent four years here in Germany, I have noticed that I get a totally different feeling when reading things to do with geology here. To begin with, forget the word *rock* (which means skirt), though if you are Scottish, you are not allowed to forget the word, because Germans will ask you if you wear a *Schottenrock* (kilt) and play a *Dudelsack* (bagpipes). Here the word *Gestein* is used instead, pronounced 'geshtyne'. Sandstone becomes *Sandstein* ('sandshtyne').

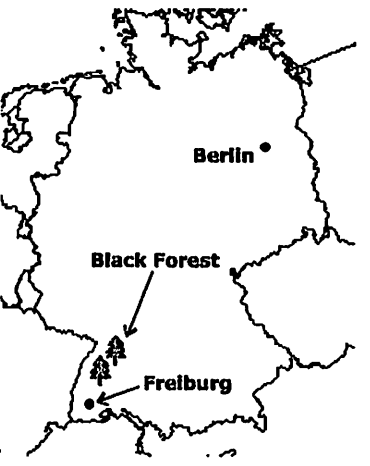
Many geological terms reflect the German no-nonsense, straight-to-the-point, blunt, nothing-airy-fairy temperament: *Mergel* (marl), *Gips* (gypsum), *Kalk* (limestone), Ton (clay), *Schotter* (gravel), *Bruch* (fault). A swathe of names also lose their English endings, although they sound familiar: *Diorit*, *Granit*, *Trachyt*, *Quarzit*, *Quarzporphyr*, *Agglomerat*, *Trilobit*, *Ammonit*.

Geological periods do not escape this process. The Permian becomes *Perm*, the Devonian, *Devon*, the Silurian, *Silur*, the Carboniferous, *Karbon*, the Jurassic, *Jura*, and the Cretaceous, *Kreide* (meaning, unsurprisingly, chalk). But we British have imported several German terms for epochs: *Rotliegende*, *Zechstein*, *Buntsandstein* (meaning coloured sandstone, which has become Bunter), *Muschelkalk* (meaning shellfish-limestone) and *Keuper*.

British geology has not escaped the Germanic influence. My geological dictionary is riddled with words such as: *Graben*, *Tuff*, *Horst*, *Karst*, *Loess*, *Inselberg*, *Grauwacke* (Greywacke), *Kieselguhr*, *Klippe*. So, without any knowledge of German, one can recognise terms in a German geology book. Moreover, just say these words in a string and you will even sound like a German! And one can appear knowledgeable, without knowing much of the language. In my first few months in Freiburg, I dumfounded my flat-mates by using the German word for silicate, *Kieselsäure*!

Chemical elements do a disappearing act here they often turn into some kind of *Stoff* (chemical substance). Hydrogen becomes *Wasserstoff* (water-substance),

oxygen is transformed into *Sauerstoff* (acid-substance) and Nitrogen mutates into *Stickstoff* (stuffy substance). When I go into a chemist, I have to know that hydrogen peroxide is *Wasserstoffperoxid.*



Other than what I have mentioned, German geologists have their own unrecognisable vocabulary: for example, *Gletscher* for glacier, *Gang* for dyke or sill, *Glimmer* for mica, *Schiefer* for slate, shale or schist, *Ausbruch* for eruption, *Senke* for syncline, *Schwelle* for anticline, *Schicht* for stratum, *Marmor* for marble, *Becken* for basin, *Bank* for bed and so on. They also can create long words, by stringing words together, for example, *Schmelzwasserabflussrinnen* (melt-water channels). But there are nonetheless a smattering of words from the bad weather island (as Germans sometimes call Great Britain). In a Scottish vein, there are the *Assyntische* (Assyntian) era and the *Kaledonische* (Caledonian) era, and *Pentlandit* rock. English names include *Essexit*, *Oxford-Kalke* and *Oxford-Mergel.*

The names of stratigraphic units and localities in my book, *Geologie von Baden-Württemberg* (which is the German state where Freiburg resides), naturally sound strange to our ears: *Geiersberg-Formation*, *Heidelberger Granit*, *Freiburger Bucht*, *Grauwackenschiefer-Serie*, *Kreuznach-Gruppe*, *Haardt-Odenwald-Senke*, *Unterer Gipshorizont*, *Uttenweiler Becken*, *Volpriehausen-Folge*, to name but a few. But there are also names which convey meaning, such as *Vitriolschiefer*, *Stinkdolomit*, *Bonebed*, *Mann im Salz* (man in salt a pillar-like anhydrite-clay deposit within a rock-salt stratum), *Coffinit* (perhaps for the *Mann im Salz*!).

But my favourite name comes from a town about an hour's drive from Freiburg, deep in the Black Forest: *Rottweiler Bank*!

Kenneth Aitken has been a member of the Society since 1994. When he lived in Edinburgh, he enjoyed the activities of the Society as a keen amateur. He moved to Germany in 1996 and in Spring 2000 moved to a new job in Freiburg. Last May, he married a local lady called Raufa, who says she is proud to be now a Scot! They live near the edge of the Black Forest, on the bank of the Dreisam, at: Kartaeuserstrasse 86, D-79102 Freiburg, Germany.

Lothian and Borders RIGS Group

by Mike Browne, David McAdam & David Land

Sites of Special Scientific Interest (SSSIs) were set up as sites chiefly of botanical, zoological or geological interest that should be preserved under Government statute. In the 1990s, these were augmented by sites of specifically geological interest: *Regionally Important Geological Sites* (RIGSs). These do not have direct protection from the Scottish Executive or Westminster Government but are registered with local authorities. A site so registered may not be developed without reference to the local RIGS management committee.

In December 1993, a meeting at the British Geological Survey in Edinburgh was organised by Scottish Natural Heritage to kick-start local RIGS Groups in Scotland. The Lothian and Borders Group (LaBrigs) had already been founded in the previous year under the chairmanship of Norman Butcher with the late Mike Smith as Secretary. It was constituted as a sub-committee of the Edinburgh Geological Society and operates under its constitution. Council awards funds for the administration of this sub-committee and to help towards its publications.

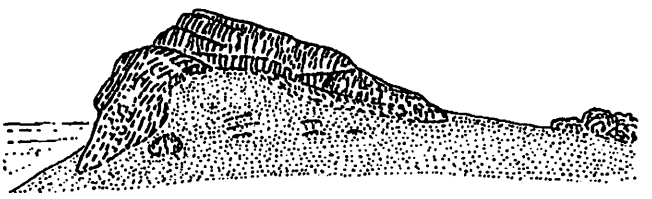
The Group works in the areas of the councils of the City of Edinburgh, East Lothian, Midlothian, West Lothian and the Scottish Borders, and has a vague eye on Falkirk as well because of the Millennium Link Union Canal restoration project. They have links with the Local Biodiversity Action Plan groups in all these authorities. Through the Confederation of Scottish Local Authorities, they helped to draft a sector planning guidance note on the links between geodiversity and biodiversity for the Scottish Executive's Biodiversity Group.

The Group also has links with non-governmental bodies such as the National Trust for Scotland, the New Museum of Scotland, Scottish Natural Heritage, local universities, the Scottish Wildlife Trust, the Scottish Landowners Federation, and the British Geological Survey. Since its inception, the Group has held about fifty management meetings as well as carrying out a number of field visits. There is a keen and active Volunteers Group with a strong presence in West Lothian as well as that in Edinburgh.

A total of fourteen sites within the area have been designated and listed as RIGSs. In Edinburgh, these are at Corstorphine Hill, Craigleith Quarry, Craigmillar Castle, the Dreghorn Link Road, the Hermitage of Braid and Blackford Hill, Joppa Shore and Torphin Quarry. In Midlothian, we have Bilston Glen and Hewan Wood, both part of the Roslin Glen area on the River North Esk. In West Lothian,

the sites are at Petershill Reservoir Quarry Wildlife Reserve, Almondell Country Park, Calder Wood and Binny Craig (in process of registration). In the Scottish Borders only one site has been listed so far, at Inchbonny, Jedburgh.

Field excursions to RIGSs and SSSIs led by members of the Group are an accepted part of the Edinburgh International Science Festival held each year in April. A number of guided walks are also included among events for the biennial Scottish Geology Week, the next being held in September of this year.



Binny Craig: dolerite sill and crag and tail

We are involved in devising a **'Welcome to Lothian RIGS' through posters and leaflets**. This is a funded programme which the Group is using as a focus for its interpretation work. The aim is to produce coloured posters and leaflets, which will be available free-of-charge at local outlets and tourist offices and other outlets near the sites. **Phase One** of this programme includes posters for Joppa shore, Blackford Hill, Roslin Glen and West Lothian, and a leaflet for Corstorphine Hill. Phase one has been mainly funded by an award of £2000, through the Royal Society for Nature Conservation, from the Hanson Environment Fund, together with £500 from the Curry Fund of the Geologists' Association. The help of the British Geological Survey in helping to kick-start this project is readily acknowledged. The Group is hoping to see the posters and leaflets in schools, libraries, doctors' surgeries and other local trusts and public places.

Corstorphine Hill is a dolerite sill intruded into Carboniferous strata, both the sill and the sedimentary rocks being well-exposed in quarries on the hill. Unroofed and scoured by the Midland Valley ice-sheet, the upper surface of the sill is now a spectacular glaciated pavement. A good deal of effort into the description of this geological history has been put in by David McAdam, who lives on the flanks of the hill. The Phase One leaflet, now in the final stages of publication, has had additional funding from the Edinburgh Geological Society, the National Museums of Scotland, the Friends of Corstorphine Hill, and other local bodies. The leaflet is intended to go with the attractive posters on Corstorphine Hill, one of which already hangs in the Royal High School's geology department and on notice boards on the hill park.

Craigleith Quarry has received a good deal of publicity following the publication of The Building Stones of Edinburgh. Now the site of one of Edinburgh's superstores, it was once one of the largest quarries in the area and supplied much of the best building sandstone for Edinburgh's New Town and was shipped as far afield as London. No significant work has so far been carried out at this or the **Craigmillar Castle** site.

The Hermitage of Braid and Blackford Hill together form a popular recreational area on the south side of Edinburgh. The hill comprises Devonian lava flows including an unusually thick (about 60 m) andesite, which forms Blackford Hill itself. Like many of Edinburgh's hills, it was shaped by the Midland Valley ice sheet into a crag and tail feature. In 1840, *The Scotsman* carried headline news of the first recognition of the work of glacial ice on the Scottish landscape. The evidence had been seen in Braid Glen by the Swiss geologist, Louis Agassiz. A leaflet for Blackford Hill by David McAdam was produced by the Edinburgh Geological Society 1985; a colour-printed edition by David Land was published in 1999. A poster to go with the EGS leaflet for Blackford Hill is being prepared under Phase One with assistance from the City Council's Ranger Service

Blackford Glen from the old quarry

The rocks of **Joppa Shore** were deposited during the late Carboniferous, about 310-330 million years ago when Scotland was very close on the equator. The climate was tropical and humid and the landscape comprised a maze of swamps, lagoons and rivers close to the sea, which periodically inundated the entire area. Coal and sandstone have been worked from the beach and the thin fireclays were once used in the Portobello potteries. The geology is depicted on a weatherproof plaque unveiled a couple of years ago by Robert Gatliff of the British Geological Survey and a member of the Joppa Amenity Society. A new poster, based on the existing plaque, is being prepared under Phase One with assistance from the Joppa Amenity Society and Joppa Community Council.

Torphin Quarry is now disused and lies just within the Pentland Hills Regional Park. Lavas, tuffs, faults and barite veins are exposed in the quarry, which worked

olivine basalts belonging to the Warklaw Hill lavas, the lowest lavas of the 410 Ma early Devonian Pentland Hills igneous rocks. Edinburgh City Council have done a great deal to tidy the place but there is still rubbish to be cleared and parts of the quarry need fencing for safety. In 1995 LaBrigs drew up a plan for but this is currently in abeyance while the Pentland Hills Regional Park Board worries about health and safety and birds of prey.

When the local RIGS Group was instituted, management plans by Scottish Natural Heritage and the Scottish Wildlife Trust already existed for the **Petershill Quarry** but neither were fully aware of the enormous wealth of Carboniferous palaeowildlife that was being ravaged by thoughtless fossil hunters. On behalf of the Scottish Wildlife Trust, the Group now manages what has become the Petershill Reservoir Quarry Wildlife Reserve. Our efforts to clear birch and hawthorn scrub (and rubbish) from its wetland appear to have been noticed by West Lothian Council who have approached us about managing another disused quarry for them. An unpublished leaflet has been resurrected by the West Lothian volunteers, for printing with assistance from the SWT and the local council.

At the Borders site of **Inchbonny**, the location of Hutton's famous Jedburgh Unconformity, clearance of vegetation and loose materials has been carried out.

Our work is just beginning but we are very grateful for the efforts provided by our 25 or so 'volunteer members'. If any other members of the Society are interested in the work of the RIGS Group, we meet every month at 7.00 p.m. for 7.30 p.m. in the Common Room, Murchison House. Contact the Group's Secretary, David McAdam, 0131 539 1060, mcadam.39@virgin.net or Chairman, Mike Brown, 0131 650 0289 and maeb@bgs.ac.uk.

Mike Browne is a geologist in the British Geological Survey, who has worked extensively in the Midland Valley, particularly Fife and Central Scotland.

David McAdam is well-known to members of the Society as our Excursions Secretary. In 1999, he retired from BGS, where he had worked extensively in southern Scotland, particularly the Lothians and the Borders. Two of David's drawings illustrate this article.

David Land is also well-known to members of the Society as our Sales Secretary and was President of the Society from 1995 to 1997. He retired from the staff of the British Geological Survey in 1987.

A Special Place

by Bob Reekie

The Museum of Lead Mining is a special place. It is the only lead mining museum in Scotland. It gives a unique insight into the lives of miners and their families, in both their working and their social environments. Situated at over 1500 feet above sea level in the picturesque Lowther Hills, Wanlockhead is the highest village in Scotland.

The village owes its existence to the geological process which formed the landscape and deposited a variety of metallic ores and minerals within the area, which is known as the Lowther Ore Field. The rocks of the area are dominated by shales and greywackes which were deposited as turbidites and pelagic sediment into an ancient Ordovician sea. Later tectonic movements resulted in extensive faulting and folding of the rocks. Mineralisation took place when hot gases and fluids were introduced from great depth through the overlying rocks and deposited ores and crystals into cracks and joints. The vicinity is one of the foremost mineralogical sites in Britain and is internationally known to geologists and mineralogists for its rare minerals such as Caledonite, Leadhillite, Susanite and Lanarkite.

In the nineteenth century the Reverend Porteous coined the phrase 'God's Treasure House' to describe the area. At different periods the minerals galena and sphalerite were extracted to provide lead and zinc. Silver was smelted from the galena and gold recovered from local streams. However, it is primarily the mining and processing of lead ores that has shaped the valley of the Wanlock and the village of Wanlockhead over a period of 500 years.

Caledonite: occurs as small prismatic crystals of a verdigris green to bluish green colour, found on oxides of chalcopyrite and galena ores and associated with most secondary lead minerals.

Leadhillite: occurs as hexagonal platy crystals with a characteristic pearly lustre on cleavage planes. It sometimes occurs on its own but more commonly in association with cerussite or other rare secondary lead minerals.

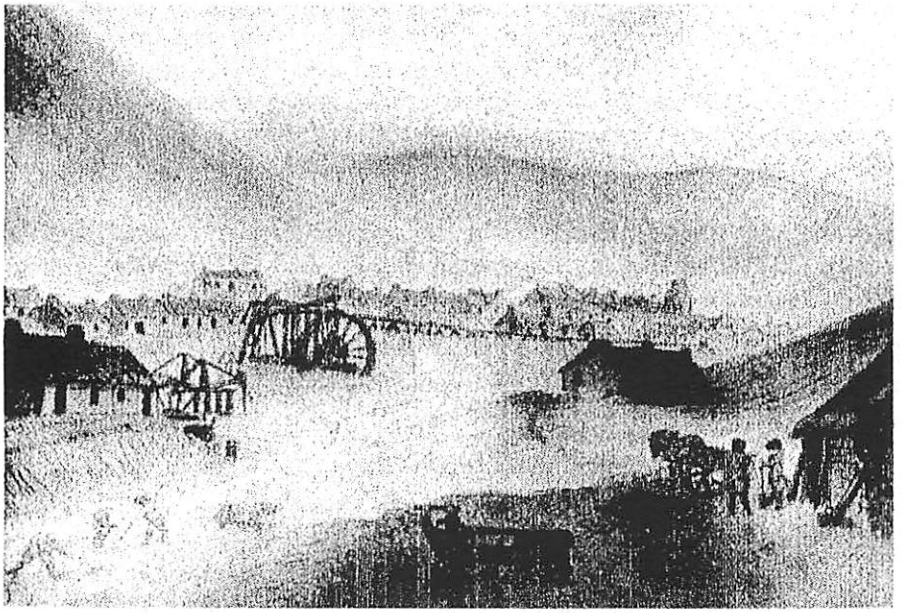
Susanite: a polymorph of leadhillite, can occur as white, green, yellow or brownish crystals with a resinous adamantine lustre, named after the Susanna vein of Lady Manners' Scar mine.

Lanarkite: occurs as small monoclinic prisms diverging into long slender crystals like fingers up to 5 cm in length. Yellowish white, greenish white or grey, with a resinous, adamantine lustre, pearly on cleavage faces.

Although there is no documentary evidence, it is likely that the Romans mined lead ore in the area, since lead was an important material in Roman plumbing. Lead again became an important material in the middle ages when it was used for roofing and plumbing in castles, monasteries and churches. The monks of Newbattle Abbey mined lead ore in the vicinity.

The development of lead mining on a commercial basis first took place at the beginning of the eighteenth century when the London-based Quaker Company opened mines at Wanlockhead. Until this time, there had been no permanent habitation in the hills. It can be said that the villages of Wanlockhead and Leadhills both owe their existence to the lead industry.

In the early eighteenth century lead was in demand, not only as a building material but also for munitions and the crafting of ornamental works of art, such as Pegasus, located in the centre of the nearby village of Thornhill. At this time, the majority of the lead was shipped to the Low Countries (principally to what is now Holland) for the production of silverware, pewter, glass, lead paint and for pottery glazes.



Drawing of Wanlockhead by John Clerk, 1755

A Special Place

In the eighteenth century the development of the mines was hampered by the need to find more efficient methods of removing water from the mine workings. The mine owners enthusiastically embraced the emerging steam technology as a means of draining the mine workings. Two of the pioneers of steam, namely John Smeaton and James Watt, together with engineers George and William Symington, both natives of Leadhills, and William Murdock were involved in the installation of engines to power the pumps at Wanlockhead.

A number of industrial artefacts can be seen around Wanlockhead, including the famous beam engine, driven by water and used to drain the Straitsteps Mine during the nineteenth century. It is a splendid piece of machinery and has been lovingly restored. There is also the engine house of a Watt steam engine that was used to drain the Beltongrain vein at a depth of over 200 metres. The Light Railway from Elvanfoot has also been restored and visitors can take a run up and down the line from Leadhills.

Because of its remote location in the hills, the early miners of Wanlockhead and their families were largely dependent on the mining companies to provide the necessities for life - food, clothing and housing. As with most mining communities, there developed a strong sense of self-reliance and community spirit in response to the harsh conditions under which they lived and worked. This was reflected in their religious and social lives. God-fearing, they regularly attended church. They established their own subscription library in 1756 and this now forms part of the museum. The landowner, the Duke of Buccleuch, provided a village school and paid for the teacher. In 1803, when Dorothy Wordsworth visited Wanlockhead, she was surprised to find that the children went to school and couldn't believe that they were taught Greek and Latin. Various sports clubs and societies were formed, notably the curling club and the silver band.

A visit to the museum will enable you to take away a lasting impression of the lead industry and the dynamic community dependent on the industry.

Bob Reekie was for forty years a curator in the Department of Geology of the Royal Museum of Scotland, from which he retired in 1996. He is now Chairman of the Board of Trustees of the Wanlockhead Mining Museum Trust, on which he spends a good deal of his time and energy. He has recently been elected to the Society's Council.

As Bob mentions, Dorothy Wordsworth visited Wanlockhead and Leadhills in 1803. Travelling with her poet brother, William, and their poet friend, Samuel Taylor Coleridge, she kept a diary and wrote up her recollections. These are held in manuscript at Dove Cottage in Grasmere, where the Wordsworths lived. In the extracts below, she describes the group's arrival at Wanlockhead, her impression of the village and a description of James Watt's great steam pumping engine.

When, after a steep ascent, we had reached the top of the hill, we saw a village about half a mile before us on the side of another hill, which rose up above the spot where we were, after a descent, a sort of valley or hollow. Nothing grew upon this ground, or the hills above or below, but heather, yet all around the village, which consisted of a great number of huts, all alike and all thatched... Every cottage seemed to have its little plot of ground, fenced by a ridge of earth; this plot contained two or three different divisions, kail, potatoes, oats, hay; the houses all standing in lines, or never far apart; the cultivated ground was all together also, and made a very strange appearance with its many greens among the dark brown hills, neither tree nor shrub growing... it was indeed a wild and singular spot— to use a woman's illustration, like a collection of patchwork, made of pieces as they might have been chanced to have been cut by the mantua-maker, only just smoothed to fit each other, the different sorts of produce being in such a multitude of plots, and those so small and of irregular shapes.

...Our road turned to the right, and we saw, at the distance of less than a mile, a tall upright building of grey stone, with several men standing on the roof, as if they were looking out over battlements. It stood beyond the village, upon higher ground, as if presiding over it,— a kind of enchanter's castle, which it might have been, a place where Don Quixote would have gloried in. When we drew nearer we saw, coming out of the side of the building, a large machine or lever, in appearance like a great forge- hammer, as we supposed for raising water out of the mines. It heaved upwards once in half a minute with a slow motion, and seemed to rest to take breath at the bottom, its motion being accompanied with a sound between a groan and a 'jike'. There would have been something in this object very striking in any place, as it was impossible not to invest the machine with some faculty of intellect; it seemed to have made the first step from brute matter to life and purpose, showing its progress by great power. William made a mark to this effect. Coleridge observed that it was like a giant with one idea. At all events the object produced a striking effect in that place, where everything was in unison with it— particularly the building itself, which was turret-shaped, and with the figures upon it resembled much one of the fortresses in the wooden cuts of Bunyan's 'Holy War'.

A new hypothesis of earthquakes

by the Editor

The Scots Magazine of January 1756 reported a series of major earthquakes that continued for a total of 61 days during the period from 1st November to 31st December 1755. These quakes were 'felt with more or less violence from the eastern shores of the Atlantic ocean to the heart of Germany and from the frozen clime of Iceland almost to the Tropic of Cancer.' Reports were published from Milan, Switzerland, Montpelier, Germany, Erfurd, Lisbon, Gibraltar, Amsterdam, Barbadoes [sic], Boston and London. In Scotland, reports came from Edinburgh, Glasgow, Greenock, Dumbarton and Kilmacolm.

In the following issue, March 1756, there was published 'a new hypothesis for earthquakes', which I thought readers might find interesting. It was contributed by someone who merely signed himself A.B. I suggest that you pay close attention, however, because it is all pretty complicated...

> On looking over some of Rev. Dr. Hale's experiments[1], to discover what effects burning and flaming bodies, and the respiration of animals have on air, and considering them attentively, especially experiment 106 of the burning candle under an inverted receiver, I am inclined to think that they afford a better rationale of the causes of the several extraordinary phaenomena accompanying the tremendous earthquake (so far as the same are assignable to natural causes), than any that has hitherto been offered to the public, at least, than I have ever seen.
>
> For if it be true that there are in the bowels of the earth, large beds of water, and that these subterraneous waters do in many parts of the globe communicate with the waters of the seas, rivers, lakes, &c as many people think they do; and that fires are frequently generated in the earth, as is generally believed: then whenever subterraneous fires are kindled over such reservoirs of water, on their communicating canals the first effects of them will be the rarefaction of the air which expanding itself everyway, will press upon the adjacent waters and force them out of their subterraneous beds, into the communicating rivers, seas, &c the water of which will then rise higher in proportion to their proximity to the subterraneous water with which they communicate, and other concurring causes.

Note: 1. Published in *Vegetable Statics*, volume 1, p. 229-239

But this effect of the fire will continue but a very little while; for its absorbing power will soon take place, by which a very great portion of the elasticity of the air will be destroyed and then the extraordinary pressure being taken off and the common pressure lessened, the waters will not only return into their former beds or caverns but the same causes still continuing, they will rise in those caverns and in the communicating canals in the same manner, and for the same reason, that any fluid ascends in the exhausted leg of a syphon.

And then the waters of the communicating seas, rivers, &c will fall again to below their usual limits in proportion to their proximity to the subterraneous waters, and other concurring causes.

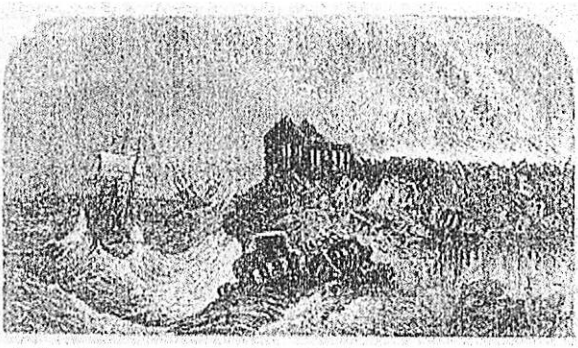
But there will probably remain some elastic air, that hath not, or perhaps could not, be absorbed by the fire; and several kinds of burning materials will also be still generating some fresh air; which being urged by the fire to a further expansion, will endeavour to force a passage where it finds least resistance; and this effort will produce those tremulous motions, and the more violent agitations of the earth, that constitute an earthquake; till at length, by the violence of those convulsions, apertures or chasms are made in the earth through which the confined air makes its escape, sometimes with, and sometimes without an explosion; and through these apertures frequently fire and flame, or water, or suffocating mineral fumes are emitted.

The hypothesis continues in like vein for another page or so, but I feel that readers have probably got the gist of it by now!

Thanks to Paul Henni and Alice Walker for pointing me to details of the 1755 earthquake described in the above article. The epicentre was some 200 km off Cape St. Vincent in the Atlantic Ocean, but it caused such a stir in Europe that it became known as 'The Great Lisbon Earthquake'. The tremors began at 9:30 on November 1st, 1755, and lasted some ten minutes. The effects were widespread and while the worst damage occurred in southwestern Portugal, severe shaking was felt in North Africa, with moderate damage in Algiers and southwestern Spain. Tremors were also felt in France, Switzerland, and Northern Italy.

Far away from the epicentre, suspended objects were observed to oscillate, indicating an enormous area of perceptibility. A large number of seiches were observed, including, reportedly, one on Loch Ness. Other phenomena were recorded, including falling water level in wells in Spain, and decrease in water flow in springs and fountains.

A new hypothesis



A fanciful depiction of the Lisbon earth-quake published in the Illustrated London News in 1850.

Many inhabitants of Lisbon sought safety from the destruction by boarding ships moored on the Tagus river. But shortly after the quake, a huge Tsunami completely swamped the area. The Customs House was the badly damaged by the wave, which devastated much of the western part of the city. Three waves struck the shore and dragged people and debris out to sea. In front of the *Terreiro do Paco*, the maximum height of the waves was estimated at 6 m. Boats overcrowded with refugees capsized and sank.

After the earthquake, fires broke out all over Lisbon, mostly as a result of overturned candles and cooking fires. Some of the inhabitants fled from their homes, leaving fires burning and narrow streets full of quake debris prevented help from getting to the fires. Folk filled the public squares with their rescued belongings, but these squares were soon abandoned, as the fire reached catastrophic proportions. The flames raged for five days.

Illustration taken from a book by Hartwig (1887). View from the right bank of the Tagus looking west.

The reports of seiches, the tsunami that capsized the boats and the fire that destroyed a large part of Lisbon all have their part to play in the formulation of the 'new hypothesis' outlined above.

Web reference (information and images): www.eerc.berkeley.edu/lisbon/index.html

Geo-vineyards

Tasting Notes

Though younger than the bulk of the Jurassique, this vintage does not suffer from the flinty inclusions of the later Cretaceous wines. It has an amazing clarity, considering the stagnant, argillaceous conditions in which the Kimmeridge Clay was laid down. The springlike nose is reminiscent of freshly-mown *Ginkgo huttoni* and the palate has overtones of oil shale. The growing region benefits from great drainage, for which fossil molluscs such as *Lucina concinna* and *Camptonectes lamellosus* are largely responsible. A fine, well-balanced wine that will go well with poultry or shellfish (though perhaps not *L. concinna* or *C. lamellosus*).

This is the second of two labels that Cecilia Taylor sent to me for publication. The first was published in the Autumn 2000 issue of THE EDINBURGH GEOLOGIST. Cecilia should not be held responsible for the Tasting Notes. Does anybody else have any similar trivia brought back from their holidays?

Poet's Corner

A Theme Song for Structural Geologists

written by Gilbert Wilson and sung by him at the 1926 University of Wisconsin Geology Club Banquet.

The tune is 'Bonnie Dundee' — "a popular Scottish song, a great favourite of the young Edinburgh ladies at the early part of the [twentieth] century".

The musical score was provided by Donald W McIntyre for a revival of the song at the 1999 Wisconsin Geology Alumni Reunion.

To the structural class it was C.K. who spoke:*
"There are some rocks that flow, while others get broke,
This problem of jointing's complex as can be
So pay close attention and listen to me.

Chorus: So here's to the strain that is caused by the stress,
And the little we know and the much that we guess;
And here's to the whisky, the gin and the tea
When we've finished our day's work of geology.

"Faults, fissures and fractures are part of the strain
A fact you must firmly fix fast in your brain
The stress is a force that we never quite see,
While the strain shows in such things as schistosity.

Chorus

---

* *Professor Charles K Leith*

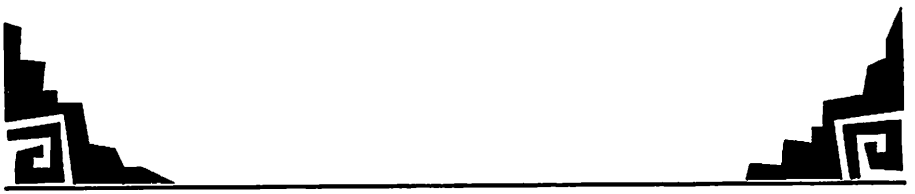
Poet's Corner

"Now when you have two joints and both caused by shear
The problem is easy, solution is clear,
Consider both angles, choose one that is less
And the line that bisects is the maximum stress.

Chorus

"The ellipsoid of strain is the key to the door
Of solutions of structures and problems galore;
So carry it with you, where e'er you may be,
And if you get in trouble just call round on me."

Chorus



The Editor apologises profusely to whomever sent this in for publication. He has found the song, but completely mislaid the covering letter. Please write in so that the contribution may be suitably acknowledged in the next issue!

BOOK REVIEWS

The two most famous university towns in England play a large rôle in the two reviews in this issue. The first, a book on learning geological field skills using the outcrops on the island of Arran, is published by Cambridge University Press and is reviewed by Mike Tuke of Cambridge Regional College. The second book (as the reviewer makes clear) is a more weighty tome, the Oxford Companion to the Earth. It is published by Oxford University Press and is reviewed by Norman Butcher, who attended the launch of the book at the end of last year.

EXPLORING GEOLOGY ON THE ISLE OF ARRAN

Mike Tuke

This is a book about geological field skills, not about the geology of Arran. The book provides some examples of how field skills may be taught using interesting localities in Arran. The book has ten graded exercises all based on easily accessible outcrops in the northern half of the island. The first five are excellent, in that in each, new skills are developed. The second five exercises are also useful and interesting, but are more about interpretation. I thought that bringing in Cuvrier and an errant professor and trying to refute their ideas was a little forced.

The last half of the book describes and explains briefly each of the skills used such as using a compass clinometer, drawing field sketches, taking notes, and plotting rose diagrams and stereo-nets. These pages would be very good as reminders but are probably too brief for those learning from scratch. There are also useful sections on rock description and classification and a good concise chart on recognising the minerals that will be encountered while doing the exercises.

A short list of field equipment is provided. I would have included a grain-size chart, such as those provided by Geosupplies, which also contain mineral percentage charts. I also think a tape measure is not an optional extra but a necessary piece of equipment for measuring bed and dyke thicknesses, etc.

I have a few quibbles with the book. I found all the empty pages with columns for notes and data both wasteful and irritating. Even assuming the reader wanted to write in the book, he might not want to use that format or size, and for field sketches something much larger than the 5 cm allotted is needed. Compass clinometers are not £50 each as quoted but £24. Home-made clinometers as described in the book do not work in the wind [and there is often a good deal of

wind on Arran –Ed.]. The further reading section should have included the excellent little books on field description produced by the Geological Society of London.

Overall the book provides some interesting ways and sites for teaching basic field skills.

EXPLORING GEOLOGY ON THE ISLE OF ARRAN
C. J. Nicholas
Cambridge University Press, £9.95 (US$17.95)
ISBN 0 521 63555 1 (paperback)

Mike Tuke lectures in geology at Cambridge Regional College. He is familiar with the Isle of Arran, having taken parties of students there over the past twenty years.

THE OXFORD COMPANION TO THE EARTH **Norman Butcher**

Weighing in at 2.5 kg, this massive 1174-page addition to the well-established series of Oxford Companion volumes was officially launched by Oxford University Press, appropriately, in the Upper Library of The Geological Society in Burlington House, London on 30th November 2000.

With 268 contributors writing more than 800 entries, and with over 600 illustrations, 200 of them half-tones, this has been a truly epic project started by Paul Hancock of Bristol University, who sadly died before its completion. Brian Skinner at Yale, one of North America's leading geologists, continued as principal editor, and David Dinely, in his retirement at Bristol, has committed sterling work as associate editor.

At the launch, Bruce Wilcock, one-time Secretary of The Geological Society and later Editor with Oxford University Press, sketched the history of the Oxford Companions, beginning with that to English Literature, started in 1928. For the present volume, two contrasting covers have been produced. For the UK market, the cover suggests, perhaps, climate change, whereas the North American cover is more fiery and volcanological. I prefer the UK cover [which means that Oxford University Press has clearly got its marketing right –Ed.].

This is clearly not a volume to read from cover to cover but the browser will find fascinating entries on, for example, *Art and the Earth Sciences*, *Museums and*

Geology and *Music and the Earth Sciences*, to mention but three. Palaeogeographical world maps adorn the inside of front and back covers.

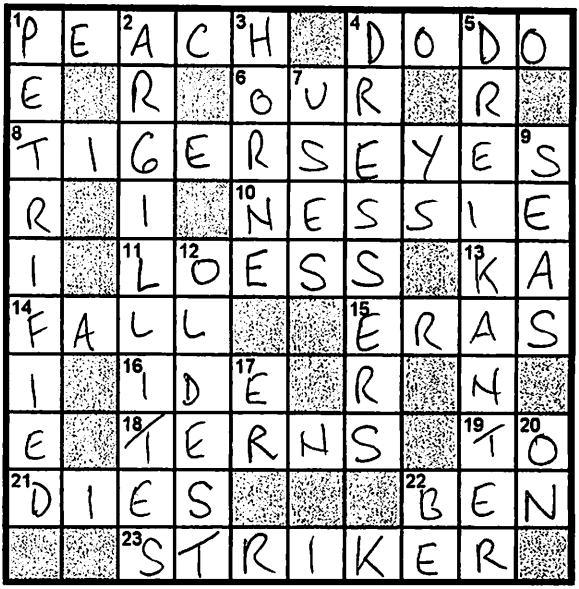
There appears to be very few mistakes in this beautiful production. I spotted two. Under *Geological Societies* on p. 410, the date of the foundation of The Royal Institution in London is given as 1791. It was 1799. And on p. 625, the entry on Charles Lyell has several lines of text missing at the end.

Just before Christmas, I noticed that James Thin's bookshop in George Street, Edinburgh was offering this impressive volume for only £33.50. Apart from anything else, it makes an excellent door-stop.

THE OXFORD COMPANION TO THE EARTH
Paul Hancock and Brian Skinner
Oxford University Press, £35
ISBN 0 19 854039 6 (hardback)

Norman Butcher is well known to members of the Society. This review is a personal tribute by Norman, who bought his copy at the launch, but has enthused about it to anyone he meets. This included the Editor.

Rocksword Puzzle No. 5



compiled by Angela Anderson

Clues across

1, 3 down. The dynamic duo of the N.W.Highlands of Scotland (5,5 letters)

4. O, oddly extinct bird (4)
6. In the four of us (3)
8. Chatoyant gemstones, burning bright (6,4)
10. The Lady of Loch Ness (6)
11. Insoles for wind-blown dust (5)
13. Ancient Egyptian soul or spirit (2)
14. A descent of water or rock (4)
15. In times over as before (4)
16. Beware one 15th of March (3)
18. Commonly sandwich, arctic, roseate, little sea birds (5)
19. Top tailed (2)
21. Ends side up (4)
22. A Scottish mountain and first name of 1 across (3)
23. Perpendicular to a dipper? (7)

Clues down

1. Terrified of being turned to stone (9)
2. Grail tiles are very fine sediments indeed (10)
3. see 1 across
4. Sideboards for preparing ores? (8)
5. Drinker eat triple faceted pebbles (10)
7. Sues for purposes (4)
9. In waters east of here (4)
12. Bold estimate of age (6)
17. Initially Elizabeth Regina hesitates (2)
20. Headless don (2)
22. To -- or not to -- (2)

This is Angela's fifth puzzle, and I can promise readers that there is a sixth in the pipeline. The answers (for those who are absolutely stumped) are on the next page.

Rocksword Puzzle No. 5

Solution to puzzle on page 31

Clues across

1. PEACH
4. DODO
6. OUR
8. TIGERS EYES
10. NESSIE
11. LOESS
13. KA
14. FALL
15. ERAS
16. IDE
18. TERNS
19. TO
21. DIES
22. BEN
23. STRIKER

Clues down

1. PETRIFIED
2. ARGILLITES
3. HORNE
4. DRESSERS
5. DREIKANTER
7. USES
9. SEAS
12. OLDEST
17. ER
20. ON
22. BE

Proceedings of the Edinburgh Geological Society for the 166th Session 1999-2000 No. 30

Compiled by David Land

Proceedings of the Edinburgh Geological Society for the 166th Session 1999-2000 No. 30

Membership:
The total membership on 30th September 2000 was (with last year's figures shown in brackets) 570 (586), consisting of:

Honorary Fellows	7 (7)	Senior Fellows	24 (26)
Corresponding Fellows	12 (12)	Family Fellows	35 (34)
Life Fellows	18 (18)	Glasgow Associates	13 (12)
Ordinary Fellows	452 (467)	Junior Associates	9 (10)

With great regret, we record the tragic deaths of **Alice Wain** and **Steve Robertson** in a road accident while in the field with BGS.

Corresponding Fellow: Dr. Radvan J Horny of the National Museum of Prague was elected a Corresponding Fellow for his research on Palaeozoic invertebrates.

Clough Medal: The Clough Medal was awarded to Prof. Brian J Bluck for his extensive researches in Scottish geology.

Council, elected on 24th November 1999, was as follows:

President	John H Hull
Vice-presidents	David Stephenson Peter M Dryburgh
Secretary	J Michael Dean
Treasurer	David Gould
Membership secretary	Mary M Leitch
Excursions secretary	A David McAdam
Lectures secretary	Donald I J Mallick
Assistant secretary	D Ian Jackson
Assistant secretary (billet)	A Caroline Paterson
Proceedings and Edinburgh Geologist editor	Alan Fyfe
Librarian	Robert P McIntosh
Sales secretary	David H Land
Scientific editors	Philip Stone, Peter G Hill
Ordinary members of Council	William J Coppock, Averil H Hope Smith, Tom S Kerr, Tom McMillan, Suzanne Miller, Diane H Mitchell,
Trustees (not on Council)	W D Ian Rolfe, William G W Harper, S Ian Hogarth
Independent Examiner	Dalgliesh & Tullo, Chartered Accountants

Proceedings

Lecture meetings were held as follows:

13th October 1999	**Mr. G Earls** The history of Irish gold - from the Precambrian to the present
27th October	**Dr. I Selby** Offshore sand and gravels - liquid gold?
10th November	**Prof. J F Dewey** The Grampian problem (**James Wright Memorial Lecture**)
24th November	**Dr. M A Taylor** Reconstructing the provincial fossil collector: Mary Anning, Thomas Hawkins and Hugh Miller (followed by A.G.M.).
8th December	**Mr. J W Merritt** The last major glaciation in the Grampian Highlands and Northeast Scotland
12th January 2000	**Prof. A Manning** A biologist's view of life and the Earth
26th January	**Mr. W J Baird** Is there any future for the past in the 21st Century? Some thoughts on the prospects for geological curation (**Presidential address**)
9th February	**Prof. B J Bluck** The Orange River and the uplift of southern Africa (Prof. Bluck was presented with the Clough Medal at this meeting)
23rd February	Fellows' night.
8th March	**Dr. R P Barnes** A glance at the Proterozoic to early Palaeozoic geology of the Anti Atlas mountain belt of the 'PNCG du Maroc'
22nd March	**Dr. A C Kerr** The geochemical evolution of the Mull Tertiary volcano (Dr. Kerr was presented with the Clough Award at this meeting)

Proceedings

Field meetings were held as follows:

29th April 2000	**W A Cadell & M A E Browne** Grange, Bo'ness & Birkhill Mine
20th - 27th May	**D J Fettes & J R Mendum** The Outer Isles
27th May	**M A E Browne** Arbroath
31st May	**E Spence** Mossmorran
14h June	**R F Cheeney** Dreghorn
17th June	**A D McAdam** North Berwick Shore & Law
23rd - 25th June	**P Stone & A A McMillan** Kirkcudbright
28th June	**A D McAdam** S Queensferry to Hound Point
8th July	**S K Monro** Scremerston
12th July	**N E Butcher** Cammo & River Almond
26th July	**A D McAdam** Corstorphine Hill
5th August	**R E Garton** St. Monans to Elie
23rd August	**S K Monro** Dynamic Earth
26th August	**I Allison** Aberfoyle (jointly with the Glasgow Geological Society
23rd September	**J D Floyd** Tweeddale & Moffatdale

Proceedings

Scottish Journal of Geology: Volume 35 part 2 and Volume 36 part 1 were published during this session.

Edinburgh Geologist: Numbers 33 and 34 were published.

Other publications: No new issues came out in the session, though the Assynt Guide was reprinted. Other guides and pamphlets are at advanced stage of editing.

Publication sales: Numbers of principal books sold during the year were as follows:

Ardnamurchan Guide	57
Assynt Guide	220
Assynt, a Geologist's Mecca	146
Borders Guide	55
Braid — Blackford pamphlet	455
Building Stones of Edinburgh (2nd edition)	200
Discovering Edinburgh's Volcano	776
Fife and Angus Guide	29
Lothians Guide	80
Moine Guide	14
Southwest Scotland Guide	9

Lothian and Borders RIGS: The local RIGS group designated five new RIGSs: Hermitage of Braid & Blackford Hill, Joppa shore, Corstorphine Hill, Bilston Glen and Hutton's unconformity at Jedburgh.

Spanish Translation of Hutton's Theory: Dr. C M G Cruz has published in the *Revista de la Sociedad Española de las Técnicas* a translation of Hutton's 1785 Abstract of his *Theory of the Earth*, together with an introduction and bibliography.

Accounts: a summary of the accounts for the year ending 30th September 2000 follows.

EDINBURGH GEOLOGICAL SOCIETY

REVENUE ACCOUNTS FOR THE YEAR ENDED 30th SEPTEMBER 2000

	General	Public-ations	Clough	Mykura	Total	
					2000	1999
INCOME	£	£	£	£	£	£
Gross income from investments	1,554	913	601	161	3,229	3,893
Net gain on disposal of investments	(259)	(152)	(100)	(27)	(538)	125
Bank interest	162	95	63	17	337	577
Subscriptions	6,297	-	-	-	6,297	5,395
Tax recoverable on Deeds of Covenant	518	-	-	-	518	520
Legacies and donations	145	-	-	-	145	217
Grants for publications	-	-	-	-	-	2,398
Social Evening	100	-	-	-	100	(4)
Sale of publications	-	4,957	-	-	4,957	4,815
TOTAL INCOME	8,517	5,813	564	151	15,045	17,936
EXPENDITURE						
Administrative Costs						
Printing, stationery, postage	213	80	-	-	293	276
Insurance	243	-	-	-	243	229
Bank charges	519	-	-	-	519	595
Miscellaneous	30	-	-	-	30	30
Print Laws, Role, publicity sheet	-	-	-	-	-	1,256
Independent examiner's fee	618	-	-	-	618	550
Depreciation	60	-	-	-	60	303
	1,683	80	-	-	1,763	3,243
Direct Charitable Activities						
Lecture costs	1,344	-	-	-	1,344	1,693
Celebrity lecture	-	-	-	-	-	207
Billets	2,749	-	-	-	2,749	2,572
Award and medal expenses	-	-	512	-	512	206
Excursions	1,440	-	-	-	1,440	1,057
RIGS Group	76	-	-	-	76	-
Scottish Journal of Geology	-	2,500	-	-	2,500	2,000
Edinburgh Geologist	-	1,100	-	-	1,100	1,374
Special publications	-	1,919	-	-	1,919	586
Books for library	-	-	-	-	-	-
Grants made	-	-	675	375	1,050	-
	5,609	5,519	1,187	375	12,690	9,695
Cost of Publications Sold	-	3,624	-	-	3,624	3,878
TOTAL EXPENDITURE	7,292	9,223	1,187	375	18,077	16,812
SURPLUS (DEFICIT) for year	1,225	(3,410)	(623)	(224)	(3,032)	1,124

EDINBURGH GEOLOGICAL SOCIETY

BALANCE SHEET AT 30th SEPTEMBER 2000

	2000		1999	
	£	£	£	£
FIXED ASSETS				
Investments at market value		76,447		79,324
Tangible		60		120
		76,507		79,444
CURRENT ASSETS				
Stock of publications	28,014		27,762	
Other stocks	775		830	
Debtors and prepayments	276		17	
Taxation recoverable	182		342	
Bank accounts	7,915		10,548	
	37,162		39,499	
Less:				
CREDITORS REPAYABLE WITHIN ONE YEAR				
Sundry	810		817	
Scottish Journal of Geology Vol. 35	2,500		2,000	
	3,310		2,817	
NET CURRENT ASSETS		33,852		36,682
NET ASSETS		110,359		116,126
REPRESENTING				
FUNDS				
Permanent endowment		54,561		60,237
Unrestricted		55,798		55,889
		110,359		116,126

Prepared by David Gould, Treasurer,
approved by Dalgliesh and Tullo, Chartered Accountants,
adopted by Council on 24th November 2000.

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