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Cover Illustration:

A Description of the Western Isles of Scotland by John Macculloch
M.D. Volume 3 1819.

“View of the Storr in Sky”

EDITORIAL

GEOLOGY SERVES THE NATION

There is more than a touch of irony that in a year when the British Geological Survey is celebrating its 150th Anniversary it should also be under critical review by its surrogate mother, the N.E.R.C. The Survey from its beginnings has strived for the benefit of the nation to define the composition of the surface of the planet on which we live and the structure of its interior. Charles Lyell, reporting to the Geological Society in 1836, on a submission made by himself, Buckland and Sedgwick to the Board of Ordnance stated: *"...we drew up a joint report, in which we endeavoured to state fully our opinion as to the great advantages which must accrue from such an undertaking, not only as calculated to promote geological science, which alone would be a sufficient object, but also as a work of great practical utility, bearing on agriculture, mining, road-making, the formation of canals and railroads, and other branches of national industry."*

In these varied ways the Survey has served the nation both in peacetime and wartime. It has sent its officers to almost every corner of Britain and many corners of the world to map the rocks and define the vital resources contained therein. Its role in recent years has extended into branches of engineering geology to consider land stability and physical properties of rocks and unconsolidated sediments; hydrogeology, to define resources and advise on landfill sites; geophysics to study geomagnetic variation and to monitor seismicity; and offshore geology to map the sea floor and assess hydrocarbon potential.

Today, the Survey through its accumulated experience and its database of maps and records is in a unique position to continue the service it already provides to the nation. Its task of acquiring data is, however, not finished. It's maps are constantly being updated as new information is gathered and new interpretation is offered. Anyone who, for an instant, believes that a map, once surveyed, offers the 'final' interpretation is indeed myopic. The quest for geological knowledge does not stand still, and the customers and clients of the Survey including government departments, local authorities, planners,

engineers and contractors who over the years have learnt why geology is so important, will not give thanks (or pay) for old information.

With this background, what of the future? No matter what attitude is adopted by the N.E.R.C. there will always be a need for a Geological Survey in this country. The Survey cannot be compared with a university geology department and, although there is scope for good collaborative research, the Survey has its own role to play and should not have to compete with the academic world for funding.

If the N.E.R.C. is compelled to change its emphasis with respect to funding of geological sciences and, furthermore, seek to centralise its geological management then the Survey should look for a new home. The heritage must not be lost.

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CHANGE OF EDITORS

After eight and six years respectively at the helm, Helena Butler and Andrew McMillan are bowing out. They would like to thank most warmly everyone who has contributed to or assisted with the production of the magazine over this period and wish the publication every success in the future. Council is pleased to announce that the new editors will be Lizzie Davenport and Frances Lindsay, ably assisted by two B.G.S. 'advisors'. Contributions for the Autumn Edition should be forwarded by mid-September to Mrs Frances Lindsay, 43 Gilmour Road, Edinburgh EH16.

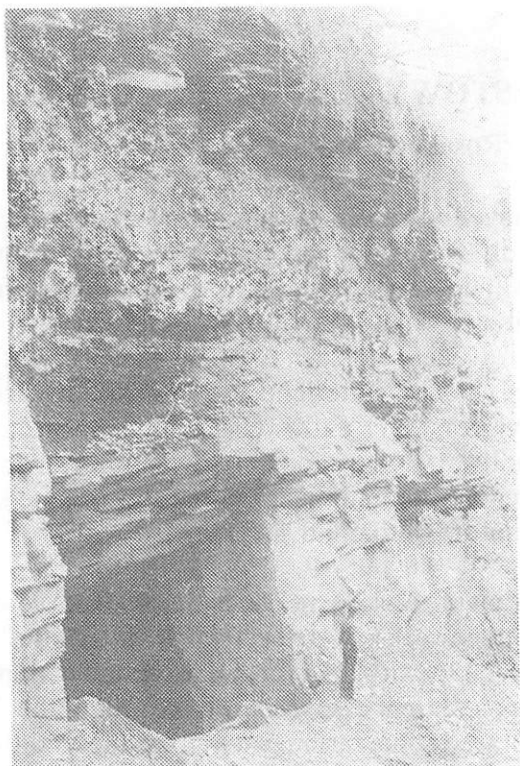
THE CHARLESTOWN LIMEWORKS, FIFE

Rosalind Garton

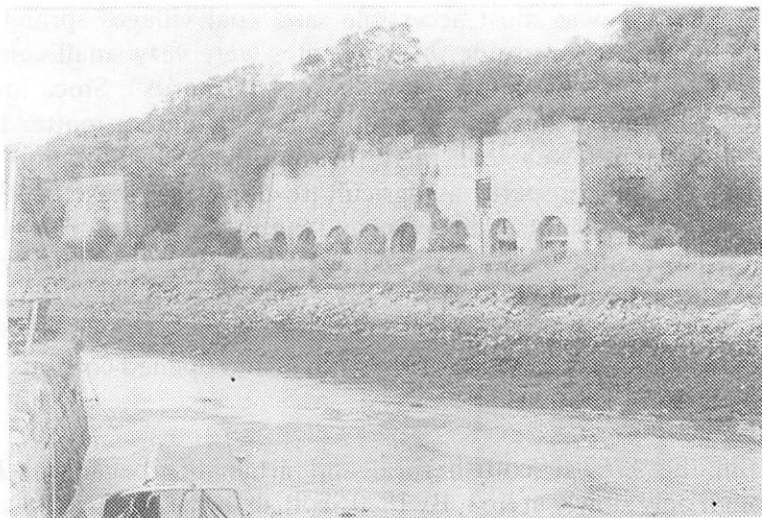
It is hard today to envisage the village of Charlestown as the hive of industry that it undoubtedly was in the late 18th and 19th centuries. Situated near the busy naval dockyards at Rosyth, and not far from the Forth bridges, its present day role is largely a residential one, the majority of its inhabitants travelling outside the village to work. With its picturesque coastal setting, wooded hinterland and large harbour it also attracts a lot of summer visitors. Yet until well into the 20th century there was sufficient local industry to provide employment for over two hundred people. The large harbour and the imposing row of lime kilns beside it give clues to the nature of that industry.

It is as well to consider what life was like in Fife in the late 18th century when the Charlestown limeworks were established. There was considerable overlap between the urban and rural areas in Scotland at that time, as indeed there continued to be until well into the 19th century. Most burghs embraced some farming activities, the traditional craft of handloom weaving being largely confined to villages. Coal was mined where it was most accessible, and coal villages sprang up in largely unspoilt countryside. Many estates were very small compared with the rest of Scotland, some with "bonnet lairds". Since minerals belonged to the estates, mining and quarrying were a matter for the proprietors. They were considered as natural an exploitation of the resources of the property as agriculture and were therefore largely dependent on individual enterprise and the availability of transport. By 1815 coal working was more commonly carried out by a company which leased the mining rights and was connected with one of the new ironworks. The Elgin family which developed the limeworks at Charlestown owns the estate at Broomhall and opened coal pits as well in the parish of Dunfermline.

From the 1760's Scottish rural and urban life began to change, although only slowly at first. By 1820 Scottish farms produced over 50% more food than they had in 1770. This was achieved by such measures as



Charlestown limestone quarry today, showing how it was 'ruined' towards the end of its life.



Charlestown limekilns today, from the harbour. The railway ran alongside the harbour in front of the kilns.

the enclosure of fields by hedges and dykes and changes in the crops grown and rotations used. The drainage of stagnant mosses and the lavish use of lime as a fertiliser provided new impetus to the limestone industry. Farms were amalgamated when tenants died, a practice of which many parish ministers were critical in their entries in the *Old Statistical Account for Scotland*, published in the 1790's. The minister of Auchtertool comments that "This taste for enlarging farms forces the people from the active, healthy employment of a country life to take refuge in manufacturing towns and populous cities which may literally be said to be the graves of the human species." Such dispossessed farm workers, however, were to provide a large proportion of the labour force at the new Charlestown limeworks.

In 1759 the Carron Ironworks, Scotland's first smelting works to use coal as a fuel rather than charcoal, was established near Falkirk. It marked the beginning of another new demand for lime – as a flux in the smelting of iron. Prior to this time the main use for limestone was for making mortar, but with the new demand for it for agricultural and industrial purposes production soared, and as Scotland's industrial revolution progressed, even more lime was needed for new urban building. Scotland's population began to increase, as it was better fed, the processes of industrial and agricultural improvement thus going hand in hand, progress in one stimulating developments in another. J.B. Neilson's discovery of the hot-blast smelting process, patented in 1828, made possible the rise in heavy industries, iron, steel and shipbuilding and a new expansion in coal mining. These developments both stimulated and provided the technology for much needed improvements in transport – new canals, roads and the building of the first railways, which were colliery wagonways, using horse-drawn wagons on wooden rails.

The village of Charlestown lies on rocks of the Lower Limestone Group of the Scottish Carboniferous Limestone Series. The limestone which was worked there so extensively was the Charlestown Main Limestone. The Lower Limestone Group represents the acme of the marine influence in the Carboniferous Limestone, with its thick

developments of limestones and shales containing rich marine faunas, particularly in the lower part of the Group. The Charlestown Main Limestone is a thoroughly marine deposit formed in clear seas and is very pure, containing as much as 96% calcium carbonate in some localities. Its fauna include corals, brachiopods, bivalves, gastropods, crinoids, cephalopods and trilobite fragments, some of these organisms continuing into the overlying shales, indicating that they could tolerate an input of muddy sediment.

The Charlestown Main Limestone was the principal seam worked in the Lower Limestone Group of Fife. Normally about 6-10 feet thick it thickens locally. In some localities it swells out to as much as 60 feet on "reef-knolls" – shell and coral reefs which now form domed lenses in the calcareous strata. The greater part of the workings at Charlestown was in one large reef-knoll, and in the extensive quarry at Roscobie north of Dunfermline, where the limestone was also the Charlestown Main, Wright counted the remains of seven reef-knolls in the old quarry face. At Charlestown the limestone thinned rapidly to the west, and eventually the overburden became too thick for opencast working so recourse was made to mining. The same limestone has also been worked at Lathalmond, Chapel, Bogie Mains (north of Kirkcaldy), Glenniston near Auchtertool, the Lomond Hills and Forthar near Freuchie.

The cycle of sandstones, shales, limestones, seat-earths and coals found in the Lower Limestone Group point to their deposition in gently subsiding deltaic swamps, with occasional marine incursions giving rise to marine shales and limestones. This is an important fact, since the coals worked by the Elgin family were used to burn their lime. The lime was usually sold in the burnt state, this being necessary for its use in mortar. It was burned in funnel-shaped draw kilns, into which were put alternate layers of coal and limestone. A fire was lit and the burnt lime taken out at the opening at the bottom of the kiln, more layers of fuel and limestone being added at the top. The Quick lime (CaO) thus produced was usually slaked by the addition of water, which both made it less caustic and caused it to crumble, making it easier to apply to the soil.

During the years 1756-58 Charles, 5th Earl of Elgin, founded the village of Charlestown. Prior to 1756 the local demand for lime had been met by the small works using turf and stone "clamp" kilns at the neighbouring village of Limekilns. But with a thick limestone bed underlying his land, ample supplies of coal from his own pits to the north of Dunfermline and the growing demand for lime, Lord Elgin saw the potential for a larger limeworks. The entry for Dunfermline parish in the *Old Statistical Account* tells of the Charlestown Limeworks as being "the most extensive lime works in the parish, or even in Britain ... The late Earl ... conceived the idea of extending his lime works on a larger scale than ever attempted by his ancestors. Accordingly, ... his Lordship began to build 9 large draw-kilns, a harbour, wagonways, for drawing the stone from the quarry to the kilnheads, and a village for accommodating his work people. As the works were great, the expense was proportionable; before they were finished ... it is said they cost above £14,000 Sterling. But great as this expense was, it has been repaid ... From 80,000 to 90,000 tons of limestone are quarried annually. It is partly manufactured into lime at the works, and partly sold in the unburnt state ... The principal market is along the coasts of the frith [sic] of Forth and Tay, and the North of Scotland. From 30-50 vessels are usually lying in Charlestown, waiting their turns of loading limeshells during the summer months ... Above 200 men are employed in quarrying and other necessary operations. ... Neither the money sunk in erecting or conducting them has been lost. While they have amply rewarded their noble proprietor, they have occasioned an extensive circulation of money; retained in their native land and supported many thousand people; greatly promoted improvements in agriculture, and may be considered among the most laudable, important and beneficial works for the good of the country, that have ever been undertaken in this part of the kingdom."

It is evident that, apart from the commercial advantages he sought to achieve by the creation of the limeworks, the 5th Earl in common with many enlightened landowners of his time, had another object in mind. He saw a village community, properly conducted, as offering the best

moral environment in which to keep the working population virtuous and respectable. The estate provided a doctor for its workers from 1800, pensions were paid to those suffering severe disablement and a school was provided for the limeworkers' children, where religious instruction was given prominence.

A vital element in the design of Charlestown was the wagon way, or early railway. The appalling state of the roads of the time severely limited industrial development in Fife, confining mining in particular to the coasts, any works inland being to satisfy local demand only. In about 1765 several local pit owners using the harbour facilities at Limekilns build a joint wagon way into the village. The line was bought out by Lord Elgin in 1790 and the 6th Earl altered it so that it swung round into Charlestown. It was sold to the North British Railway Company in 1864 and integrated into the railway system, who also enlarged the harbour.

Charlestown is one of over a hundred planned villages built in Scotland during the late 18th and 19th centuries. Its existence was the direct result of its lying on such economically important rocks, the exploitation of the different rocks being interlinked and leading in turn to further employment. Thus the local coal was used to burn locally quarried limestone and to smelt ironstone also mined in the vicinity. Charlestown had a foundry where iron goods were cast, such as wagon wheels and other articles needed in the local quarries and mines. In common with many villages around the Firth of Forth there was also a salt pan which relied on coal dross, or panwood, to evaporate off the sea water. In the 18th century salt was the third most important export in Scotland after wool and fish, much of it coming from the Forth towns where most of Scotland's population lived before the growth of the Clyde area in the 19th century. Furthermore, since most of the output of the mines, quarries and salt pans was exported, Charlestown harbour became very busy, dispatching coal and salt all over Scotland and possibly to Europe, limestone around Scotland and iron to Carron. The picture drawn, therefore, is of a village economy depending almost entirely on raw materials obtained locally and largely geological in origin.

From their comments about the geology in their respective parishes, it is clear that the ministers who made contributions to the Statistical Accounts for Scotland were well aware of the importance of the local strata to the economies of their parishes. I think that the last word should be left to one Rev. William Ferrie of Kilconquhar, who perhaps appreciated more than most the benefits which could accrue to those fortunate enough to live on Carboniferous sediments! He tells how the coal seams in his parish are:

“more or less injured in the vicinity of the dykes; and by the shifting and upheaval of the beds, much trouble and expense are occasioned to their respective owners. Is their gratitude to the bountiful Giver and Architect of the whole rendered the less? Let them reflect that by these very means, through the agency of these very faults and troubles, the useful mineral has been lifted from the bowels of the Earth, and brought within their reach ... while, by means of the dykes of injected matter which throw down the strata, valuable beds are preserved within the field, which would otherwise have cropped out, and been lost altogether. ‘Oh Lord, how manifold are thy works! in wisdom has thou made them all: the Earth is full of thy riches.’”

Bibliography.

Geikie, Sir A., 1900. The Geology of Central and Western Fife and Kinross. *Mem. Geol. Surv.*

The Statistical Account for Scotland. 1792, Vol. X, Fife.

The New Statistical Account for Scotland. 1845. Vol. IX, Fife.

Charlestown, Limekilns and Pattiesmuir Community Council, *A Short History of the Villages. Charlestown, Limekilns and Pattiesmuir.*

Review

‘GEOLOGICAL MAPS OF THE WORLD’ AT THE EDINBURGH FESTIVAL, 1984

An imaginative project to encourage both scientific and aesthetic interest in geological maps was initiated last year by the Edinburgh Geological Society as part of its 150th Anniversary celebrations. It took the form of an exhibition of some of the best examples of geological cartography from around the world, held in the Open University apartments in Melville Street, Edinburgh, from 13-24 August, 1984. Whilst not losing sight of the value of geological maps as scientific documents, the aim was to encourage innovation and excellence in geological cartography.

The scope of the exhibition was wide and included geophysical and geochemical maps as well as traditional geological ones – in fact any map with an earth sciences basis, preferably published within the past four years. Entries were invited from Surveys, Societies, Universities and other organisations around the world and the response in the short time available was very encouraging. A panel selected 42 maps for exhibition and all of the maps submitted were later retained for storage in a world map archive.

Viewing the exhibits, one realised how many valuable and beautiful maps are available but are generally unknown or not readily accessible. For example, there is no way of knowing from the map catalogue description that the *Geologische Kaart van Nederland 1:50,000 Tiel West 39W* (1982), comprises an excellent drift map, two subsidiary maps and two vertically exaggerated cross-sections which together provide a model example for the display of 3-D geological relationships. Remarks overheard from college and school teachers like ‘I could have used this for teaching last term’ or from map curators ‘we must get a copy of this map for the collection’ were echoed by the writer. The exhibition catalogue prepared by Mr. N.E. Butcher was a great help in this respect. The maps were well lit and each had a thumbnail sized

world map for location but more space around the exhibits would have been an advantage. Maps do require a lot of display space and this is not always easy to arrange.

One aspect of geological maps is particularly difficult to assess: whether or not colour has been used in the most effective and pleasing manner. Geological maps generally present a distillation of many man-years of field mapping and attempt to show not only the two-dimensional outcrop pattern and the present shape of the ground surface, but also sufficient information in the form of symbols for the three-dimensional forms of the rock masses to be appreciated. In attempting to achieve these aims a conflict often develops between the requirements of the geology and the aesthetic appearance of the map. For example, there are certain colour conventions to consider: to most geologists, granite on a map appears red; quartzite, yellow; and limestone, blue. Survey cartographers can be at a particular disadvantage where colours are stratigraphically coded for a complete series of maps, as sooner or later some unpleasant colour combinations are bound to result. If thin bands and very small areas of a particular rock type occur on the map these have to be shown in a deep colour if they are to be identified correctly; larger areas of such rock types sometimes occur and can give a 'heavy' unbalanced appearance to the map. This can be avoided by the combined use of symbols and colour, as is standard practice on most survey maps, but this technique leaves less space for other numerical data and can lead to a 'cluttered' appearance. Also, for smaller projects such as self-financed University map publications, the number of colours and colour combinations available is restricted by cost, and selection of what would be the most pleasing or suitable colour in a particular circumstance is not possible.

Bearing these restrictions in mind my personal selection is as follows. The new edition of the *Carte Géologique de la France*, 1:500,000. BRGM (1980) is a splendid example of how fine detail can be preserved yet the map viewed as a whole has a structural 'grain' and a pleasant appearance. The *Atlas Géologique du Monde*, Sheets 18-22 inclusive, 1:36 m to 1:16 m. UNESCO (1979-83) is well known and now complete

and these sheets in particular synthesise a vast amount of information with clarity and style. The *Carte des Sédiments Superficiels de la Manche*, 1:500,000. BRGM (undated) provides a fine example of the use of colour shading and stipple but the best example of the sensitive use of colour was, for me, the *Simplified Geological Map of Northern Sumatra*, 1:1.5 m. DOS (1982). Use of symbols and colour is demonstrated to advantage in the *Mapa Metallogénico de América del Sur*, 2 sheets 1:5 m. UNESCO (1983). Interesting use of a new technique is seen in the *Geological Photomap, Israel*, 1:10,000. Geological Survey of Israel (1977) in which outcrop information is superimposed on a printed aerial photographic base. Unfortunately the geology in this case is not sufficiently complex for the technique to be seen at its best. The *Tiel W* set of maps referred to earlier provide a fine combination of map data and detailed cross-sections, and a good example of Survey cartography is seen on the *Sunderland* 1:50,000 S and D map. BGS (1978) in which drift and solid maps with a cross-section and explanatory notes are present on a single sheet in an attractive format. The *Carte Géomorphologique du Grand-Duché de Luxembourg*, 1:100,000. Ministère des Travaux Publics de Luxembourg Service Géologique (1984) is simply a beautiful coloured map.

In conclusion, I feel that the exhibition was an extremely worthwhile venture and the organisers should be persuaded to make this a well-publicised annual event.

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LYDIA MILLER (1811? – 1876)

Lizzie Davenport

Some years ago I found a copy of Lydia Miller's *The Dog and his Cousins, the Wolf, the Jackal, and the Hyena* in a second-hand

bookshop in Edinburgh. I was intrigued that the widow of Hugh Miller the geologist had become a writer of natural history for children. Last year's Presidential Address to the Edinburgh Geological Society, with its picture of Hugh and Lydia Miller's grave in Grange cemetery, jogged my memory: I decided to investigate Lydia Miller from such published sources as were available.

The *Dictionary of National Biography* described her education in Edinburgh, and revealed that she had writt^{er} several "works of a moral and religious tendency, principally for the young"; in the entry under Hugh Miller, she is decribed as "a lady of great mental refinement", and her obituary in *The Times* (March, 1876), taken from the Pall Mall Gazette, describes a novel entitled *Passage in the Life of an English Heiress*, which "she wrote at the time of the Disruption of the Scottish Establishment ... in which the views of the non-intrusionist part were advocated". ... "She also wrote a book for young people with the title *Cats and Dogs*, took an active part in editing her husband's works after his death, and gave much assistance to Mr. Peter Bayne in the preparation of his biography of her husband". *Cats and Dog* was in press when Hugh Miller shot himself, in 1856.

But in George Rosie's recent biography and selection from Hugh Miller's writings (Edinburgh, 1981) Mrs Miller's reputation is undermined. Rosie cites an unpublished manuscript of Hugh Miller's nephew, Hugh Miller Williamson, which "provides a sour counterpoint to the pious and often cloying Bayne/Lydia account". The nephew dismisses "the genteel idyll sketched by Bayne and Lydia in the *Life and Letters*" and accuses her of being "a selfish hypochondriac, bound up almost entirely in herself". He claims that she insisted on releasing Miller's suicide note to the press so that she could play the tragic heroine. Rosie claims that Lydia set up a Hugh Miller "industry" after his death:

"...under Lydia's shrewd and watchful eye, a steady stream of Miller's work began to run off the presses of London and Edinburgh ..."

Peter Bayne's *The Life and Letters of Hugh Miller* appeared in two volumes in 1871. Bayne succeeded Miller as editor of *The Witness* and his knowledge of Miller's contributions to the paper was prodigious. The book contains a surprising amount of domestic detail on the Miller menage, presented with humour and affection, and many of the letters quoted are from husband to wife, always loving, sometimes gently bantering, and confirming Bayne's summary of the Miller marriage:

"The impression forms in my mind that Mr. and Mrs Miller were on exactly those terms on which it was desirable and beautiful that a man eminent in the intellectual world and his wife should be".

The intellectual rapport was based on literary and political interests, rather than geological, and Miller frequently apologises for bringing geology into his letters. But the children were encouraged to collect specimens, ancient and modern:

"The bairns will, I trust, have good collections of Portobello shells ere my return, and will be able to stand an examination on their names". Good training for his younger son, Hugh, who became a member of the Geological Survey.

Lydia's role of intellectual co-worker is stressed throughout the *Life*. We read of her help in the early married days in Cromarty:

"Mrs Miller has read to me in very reasonable English Agassiz's paper on the moraines of Jura and the Alps, I have been much interested in it".

She also helped with *The Witness* after Miller's move to Edinburgh as editor in 1839:

"After a little time, she began to assist in the editorial department, first with paste and scissors, then with pen, as contributor of reviews of books, earning thereby some £20 per annum" ... Miller's distinctive journalistic style, it is claimed, was due to his wife's

interest:

“It was his habit to fix upon his subject a few days or even longer before the article was to appear, and nothing pleased him better than to have Mrs Miller as volunteer and antagonist, to maintain against him, at the supper table, the thesis that he proposed to controvert ... there can be no doubt that the extraordinary success of many of his articles – the repeated case of their being the town-talk of their day – was due, in a considerable degree, to his having beaten over the ground with Mrs Miller”. Or put through his paces by his trainer spouse.

She also helped recruit members for a Ladies’ Geology Group which her husband formed in 1848-9 (described by “a Lady”):

“In the end of 1848, I happened when calling on Mrs Miller in Stuart Street to hear that her husband was giving some little lectures on geology to a few lady friends, and I was most kindly invited to join the party. We met on Saturday forenoons, and sat round a table on which he had arranged some specimens to illustrate what he was going to tell us about ... His manner to women I always thought particularly good – wholly wanting in flattery but full of gentle deference. Our meetings frequently ended by our enjoying Mrs Miller’s hospitality and society at luncheon, when we witnessed the same gentle manner in his own family and various little incidents which showed his strong parental love. As Spring came on, our lectures took place in the open air instead of in Mrs Miller’s drawing room and we had some charming walks to shores and quarries in the neighbourhood of Portobello, and to Salisbury Crags and Arthur’s Seat where the Queen’s Drive had been lately opened and afforded us many illustrations of what we had learned from him during the winter”.

Mrs Miller was not just an intellectual partner: she bore five children and managed the practical domestic circumstances of Hugh Miller’s life, extricating him from the comically unsuitable lodgings he found for

himself in St. Patrick's Square when he started his *Witness* work; furnishing their next house in Sylvan Place from her literary earnings; supervising moves to increasingly respectable addresses in Stuart Street, and Shrub Mount, Portobello:

Capable of existing with perfect convenience in a cave, one stone serving for a table, another for a seat, and a plate, knife and fork the whole plenishing, Hugh suffered nothing from the anxiety to put things on a respectable footing which oppressed Mrs Miller". ... "At times, in the friendliest tone she would hint that some part of his dress might be improved, and pleasant little banterings would occur upon the subject ... once ... by way of providing himself with an ally against Mrs Miller on the point, he trained his son Hugh, just beginning to toddle and lisp, to say:

'Papa has got a very bad hat
And many a word he hears about that'.".

I suppose these domestic details do combine into "a genteel idyll". Bayne must be faulted for his depiction of Lydia as a kind of Muse, who compensated for Hugh Miller's lack of formal education with refinements acquired in the South. This is evident in his description of their wedding on 7 January 1837:

"He had dared while in his mason's apron, to aspire to the hand of one who was by birth and breeding a lady... He had waited five years and at times he had been anxious and despondent, for he never wavered in his determination either to marry Miss Fraser into the position of a lady, or not to marry her at all ... He has passed into the ranks of the brain-workers of the community, depending no longer for his livelihood on the toil of his hands, Any bride might be proud of him"...

But the experiences, observations and reflections of Hugh Miller the journeyman mason were not sloughed off on his marriage; they were an essential part (his wife would have written 'tragic part' I think) of the

public figure he later became, in spite of Mrs Miller's veneering.

THE FIFESHIRE GOLD DIGGINGS OF 1852. By W. Lauder Lindsay, M.D., F.R.S.E. Communicated by Mr. Panton, Honorary Secretary. An extract from the *Transactions* of the Society, Volume 1, 1869.

The Lomond gold digging mania occurred in May 1852, and lasted about a month. There was a daily average of 300 diggers – at least 5000 to 6000 in all. Many of them were coal and iron miners, who were earning 15s per week or upwards, and who had thrown up their employment to embark in the alluring lottery of gold seeking. The excitement extended over an area of twenty miles, including the opposite shores of the Forth and Tay. The origin of the mania was the statement of a convict, a native of Kinnesswood, who wrote from Australia to the friends he had in the Kinross-shire village, that he had often seen gold at home at the lime quarries above Kinnesswood, in the Bishop's Hill, similar to what was being dug in Australia. At this particular time the public mind was in a condition of great excitement produced by the brilliant auriferous discoveries in California in 1847, intensified and revived by the no less splendid results of gold digging in Australia in September 1851; added to which, there were certain floating local popular traditions or proverbs which gave a spurious weight or significance to the convict's rash and inconsiderate assertion. The centre of attraction to the Fifeshire diggers – the chief scene of their labours – appears to have been a quarry of carboniferous limestone, known in the district as the "Clattering," or "Clattering Well." This quarry is situated "right above the village," and north-west of Kinnesswood in Kinross-shire, "about a gunshot back from the brow of the Bishop Hill" near its summit. Its locality is on the south base of the West Lomond Hill, overlooking Loch Leven. Superjacent to the limestone, which is richly fossiliferous, is a bed of ochre, abounding in globular masses of iron pyrites, known to the quarrymen as "fairy balls," from the size of a fist to that of a man's head. Incredible as it may appear, these iron pyrites were dug out and carried away in large quantities in the mistaken belief that they were lumps of gold.

STRANGE EARTH No. 2

Bill Baird

Most volcanic eruptions can be classified, depending on the type of the eruption and the nature of the erupted material, into several well defined categories. The recent eruptions of Ol Doinyo (Masai for Mountain) Lengai, S. of Lake Natron, Tanzania, East Africa do not fall into any of these categories. The sodium carbonate lavas of Lengai are uniquely different containing almost no silica but large amounts of alkalis and volatile components. In fact the main constituent of erupted material from Lengai is hydrated sodium carbonate (washing soda).

Some explanations of this strange phenomenon can be found in Dawson, J.B., 1962, *Nature*, Vol. 195, pp. 1075-1076.

A FUTURE FOR THE PAST

A note of the geological conservation meeting held jointly by the Edinburgh Geological Society and the Scottish Wildlife Trust on 6th October 1984 at Battleby, Perth.

This meeting, attended by over 80 people representing the Society, the Trust, schools, museums and other organisations, was designed to stimulate public interest in conservation in geology. The morning session comprised a series of short talks given in the fine auditorium of the Countryside Commission for Scotland at Battleby, north of Perth, courtesy of Mr. Tom Huxley (Deputy Director). The speakers included Dr. Keith Duff (Nature Conservancy Council), Mr. Christopher Dingwall (Dundee Art Galleries and Museums), Mr. Stan Wood (Mr Wood's Fossils, Livingston) and Dr Ian Rolfe (Hunterian Museum, University of Glasgow). Skilfully and entertainingly chaired by Dr. Charles Waterston, the lecture session covered many aspects of geological conservation, although, perhaps inevitably, this first meeting in Scotland tended to concentrate on problems related to fossil sites. The afternoon was spent on Kinnoull Hill, Perth, where Christopher

Dingwall, Margaret King and colleagues described the interesting features in the rocks and landscape. A brief visit by many of the participants to the newly opened Geology Exhibit in Perth Museum, where Michael Taylor was on hand to answer questions, ended a most successful day.

Readers interested to learn more of geological conservation and its relevance for the future should turn to the papers by:

Duff, K.L., 1979. The conservation of geological localities *Proc. Geol. Ass.*, 91, 119-124.

and

Rolfe, W.D.I., 1984. One User's view – the Lesmahagow affair *Geological Society Miscellaneous Paper* No. 16.

Geological Conservation in Britain, editor R.G. Clements, 42-47.

At the meeting Keith Duff presented a paper on “Conserving Scotland’s rich fossil heritage” and Ian Rolfe spoke on “Pillaging the past: lessons from Lesmahagow.”

The following contributions by Christopher Dingwall and Stan Wood offer a flavour of the morning session.

ROCK ON RECORD: A ROLE FOR THE SCOTTISH WILDLIFE TRUST IN GEOLOGICAL CONSERVATION?

Summary of Talk by Christopher Dingwall (Extension Services Officer, Dundee Art Galleries and Museums).

1. Talk was intended as a local/regional perspective of geological conservation. Speaker wears three “hats”:
 - a) *MUSEUMS*: The three district museum services in Tayside Region each responsible for collections and associated
 - b) *EDUCATION*: Use of sites of geological interest with all ages – primary schools to adults for education

c) *SCOTTISH WILDLIFE TRUST*: Works with others on Tayside to promote interests of site conservation. Often asked for advice/information on localities.

Museums and SWT often find themselves in the front line when sites are under threat.

2. Sites of different grades in Tayside as elsewhere

a) *NATIONAL NATURE RESERVES* (NNR)

b) *SITES OF SPECIAL SCIENTIFIC INTEREST* (SSSI)

These sites usually of national importance are generally well recorded and documented, and afforded some degree of legal protection.

c) *LISTED WILDLIFE SITES* (LWS)

These sites are often only of local/regional significance, poorly recorded and with very little protection. For example, site with no very rare features may still have high educational potential because of proximity to schools.

3. Progressive disappearance of sites is evident in Tayside as many inland sites filled. New sites are created very rarely. Problems occurring locally include:

a) *INFILLING/REFUSE DISPOSAL SITES*

1) *Clashbennie* (Perth): former ORS fossil site, now infilled with rubbish.

2) *Knockie, Blairgowrie* (Perth): former Permo-Carboniferous dolerite dyke, now infilled with rubbish.

3) *Whitehouse Den* (Angus): former ORS fossil site, now partly infilled, builders' rubble, etc.

4) *Boddin Point* (Angus): contact/fault line between ORS sandstones and lavas now obscured by agricultural rubbish and waste.

b) **COLLECTING SITES**

Not a major problem as there are few fossiliferous sites in Tayside. Those that exist are already afforded some protection eg.

- 1) *Turin Hill* (Angus) ORS Fossil Plants etc. Most serious recent problem occurring at
- 2) *Ferryden, Montrose* (Angus) where road is being undermined as a result of collecting agates from lavas.

c) **RECREATION**

Erosion of fragile sites occurs, often unintentionally as a result of recreation, eg.

- 1) *Glas Maol* (Angus/Perth) Periglacial patterned ground and other features threatened by skiing development.
- 2) *Whitehouse Den* (Angus) Area not threatened by dumping but used as motor-bike rally course, threatening surviving fossil exposures.

d) **DEVELOPMENT/BUILDING**

Extension of building activity, rebuilding of roads may be accompanied by landscaping which may threaten/destroy sites eg

- 1) *Birnam Exposure* (Perth) Rebuilding of A9 accompanied by landscaping of roadside and bulldozing of outcrops. Part survives only.

4. Among issues highlighted:

- a) **LACK OF KNOWLEDGE** especially of overall patterns of sites within the Region. Difficult to measure one site against totality of sites.
- b) **LEAST INTERESTING SITES** should also be recorded so that they can act as alternatives in cases where more interesting sites are threatened.

- c) “*HISTORICAL*” *SITES* present a problem. Many sites were of interest at time when specimens were collected, or where they were visited by notable people. Often of little interest now. Related to d) below.
- d) *WORKING QUARRIES* main source of new material. Now, many quarries are no longer worked so no new material is available. At many sites interest centres on *spoil-heaps* rather than faces.

Particular problem in recent times arose at *Leysmill Quarry* (Angus) an important fossil site no longer worked. A recent application resulted in withdrawal of SSSI status and granting of permission for partial infill.

Reversal of decisions about site interest may threaten credibility of the existing listings.

- 5. *UNCONSOLIDATED SEDIMENTS* are another area of special concern. In Tayside, Strathmore represents major assemblage of late-glacial/fluvio-glacial features, threatened by extensive sand and gravel extraction. Features destroyed include:

- a) *Topography* and *Geomorphological* features
- b) *Internal Structural* and *Sedimentary* features
- c) *Sub-fossil remains* of plants and animals.

Currently no concerted attempt is made at *recording/photographing/mapping* before extraction takes place, so much information is lost.

At the same time it must be realised that features are only revealed as a *result of the working*, so the need is for recording, *not* preservation.

A major opportunity was lost when *pipelines* were being installed. A major section across Strathmore could have been recorded.

Beware, too, of *repairs*. One example recently of “cosmetic” repairs to fluvio-glacial esker site following adjacent road widening. Such

'repairs' may obscure real features.

6. **NEW SITES** are being created at present, mostly as a result of new road workings: eg.
 - a) *Calvine* (Perth) Fine section through Dalradian metamorphics and associated dykes.
 - b) *Craigend* (Perth) New section through ORS lavas and sandstone.
 - c) *Crossgates* (Perth) fine new section in ORS sandstone/shale, and dyke.

Should recording of sites be undertaken while exposures are still fresh? Should any be considered for notification/protection?

7. Examples of *Logiebrae Quarry*, *Clunie* (Perth) as one where some of above issues were aired at the *Public Enquiry* in 1981. The need is emphasised for concerted efforts to record all sites and devise means of having rapid access to information. SWT and Museums Services on Tayside have agreed on index cards giving basic information on sites (examples were distributed at conference).
8. We are not necessarily arguing for "preservation" of all sites, but for efficient recording. If sites are lost information is lost. It is up to those "in the front line" at the local level to make sure that work is done.

GEOLOGICAL CONSERVATION – NO THANKS!

Stan Wood

The following account, presented at the meeting, is reprinted by kind permission of the Scientific Editor, *Geology Today*

My interest in this debate is the relationship between fossils and people. My goal is to create a framework from which to launch a

renaissance of palaeontological exploration in this country. Such framework will require the opening up of old sites for public participation and the creation of dozens of new sites for the same purpose. Certain popular sites to be manned over the holiday season with a fossil advisor and information caravan, where guide books on suggested family trips, histories of sites and how to record finds should be on sale. Hammers and tools should be available for hire and a selection of site fossils for sale. Car park and admission charges together with portable teas and pees facilities also spring to mind in this regard.

Sounds impossible? At the moment yes, especially so because I feel I'm surrounded by people who wish to conserve the paltry number of worthwhile sites currently collectable. To my mind it's partially a lack of creativity that invites us to conserve this sprinkling of sites handed down to us by our Victorian forefathers. What a condemnation of our pioneering spirits, I've certainly no desire to join this journey to nowhere, for I believe my ideas on field management pave overwhelmingly more inviting paths. Not only do they open up the field but the future as well. Further, we owe it to our children to exploit these deposits and mould them into a package acceptable and available to the next generation.

Geological conservation in its present form of administration is to my mind a pain in the fissure. To those who advocate that the shading in of no go areas on geological maps is the best policy for securing the future of the palaeontology, I have a question, do you think it possible that you may be mistaken? Indeed I have another question to pose, why should we be asked to worship what is known when today's challenge lies in that yet to be discovered? It is my considered opinion that the number of undiscovered sites of palaeontological interest is vast and it follows that the scientific information contained therein is equally so. Please stop mothballing sites that are already known and address yourself to the task of bringing to light the unknown, switching your talents, time and energy to making motorways rather than cul-de-sacs.

The threat of decline of palaeontological activity in this country is

what concerns me and directly motivates my attitudes. The present shortage of research funding, the freezing of academic posts is bad enough, but now university students and public alike, thanks to the present conservation policy are faced with yet more restrictions. This is not the way to encourage healthy growth in our branch of science, but it is one of the most efficient ways of throttling public eagerness to participate, to throng geological exhibition halls, or even to support us in our further studies.

For instance, here is an example of what is happening in geology today ... Long before the NCC Geological Review Unit was set up, two men, in the company of their wives, used to tour the Highlands each summer collecting fossils and minerals. They used to hand in to a leading Scottish museum any fossils they thought may be welcomed by that institution. I quote a letter of 1979 from Dr. X from this institution, 'Many thanks for your generosity to the museum and also for your hospitality and kindness to myself.' This happy state of affairs came to an abrupt halt two years later when they were taken to court by the NCC for illegally collecting from Achanarras quarry, a quarry which they had been collecting from for years. They were admonished I'm glad to say but the fossils they collected were forfeited, so on this occasion the museum missed out on the presentation. I approached the NCC this year and received permission to send two representatives to collect at Achanarras, on the understanding that any scientifically important specimens collected would go straight into the National collections. I then told Dr. 'Bloggs' of the NCC, who issued the official passes for the quarry that my two representatives would be the two chaps who had been admonished and they would come with their wives on their summer vacation. He replied that the court case in his opinion had been an unfortunate mistake and to please let him know when they intended to arrive. Imagine my astonishment when weeks later he phoned to say that he had just received instructions (from England) that the party were not to be admitted – I could literally feel the man's embarrassment on the other end of the phone. Plans had already been laid and so I had the unenviable task of passing on this disgraceful decision to my two men. Both are getting on a bit, indeed one is approaching seventy and

was in hospital when I broke the news, which did nothing to speed his recovery! Now this decision, presumably from men capable of thought, is blatantly non-scientific and is purely a face saving act. This pettiness does nothing at all for the good of palaeontology, but lays before us the priorities of the decision makers.

I am *bound* to oppose any further spread of the Achanarras model elsewhere. At present this model allows the lay person who may be fortunate enough to prize from the NCC Geological Review Unit one of their official passes to collect but two fossils on any one visit to the quarry, which incidently is 100 miles from anywhere. Two fossils, I ask you? Let me name two genera, *Dipterus* and *Palaeonspondylus* from a wide variety of fossil fishes obtainable at this quarry. Of the former, Foster-Cooper in Transactions of the Royal Society of Edinburgh in 1937 wrote, 'of the larger fishes in the quarry's six foot thick band, *Dipterus* can be measured literally in thousands.' As for the smaller *Palaeonspondylus* it is common knowledge that these enigmatic little fishes are present there in tens of thousands. Still controversy rages over this species from Tracquir (1890) to Forey (1982) via many authors in the interim. Moy-Thomas's lengthy 1937 description contains a pertinent quote from a previous paper by Deans in 1904 about this animal which is still true today, 'what is especially needed in our future dealings with *Palaeonspondylus* is less memoir, and more material.' We can easily imagine Dean's consternation with regard to today's rationing at this site. In a poem around 1850 to Sir Robert Murchison, Robert Dick tells us what he thinks of Geological handcuffs, here I quote two verses ...

Hammers an' chisels an' a'
Chisels an' fossils an' a';
the deeper we go, the more we shall know
Of the past an' the recent an' a'.

Here's freedom to dig and to learn –
Here's freedom to think an' to speak;
There's nane ever grumbled to look at a stone

Save creatures baith stupid an' weak.

If an attempt to stem commercialism is the reason for the unacceptable restrictions of the Achanarras model, I can report that a quarry has been opened up elsewhere by commercial collectors to produce the same fauna as Achanarras. I've seen the slabs with many fishes upon each, which only emphasises once again that our rocks have so much to offer everyone in this field. Unfortunately it seems the majority of the profession are unwilling to make this admission. I put it to them that they are unaware of the potential beneath their very feet. Hopefully, before too long my predictions of a big swing in public interest towards fossil collecting will materialise. Helped by a little leverage from myself, I'd very much like to see new sites identified for the NCC to buy or lease, such sites providing a future basis for management along the lines in my opening remarks. I can see the Scottish and English Tourist Boards welcoming this additional attraction in their attempts to lure people to Britain, to spend their money here and to reap a healthy opportunity for learning.

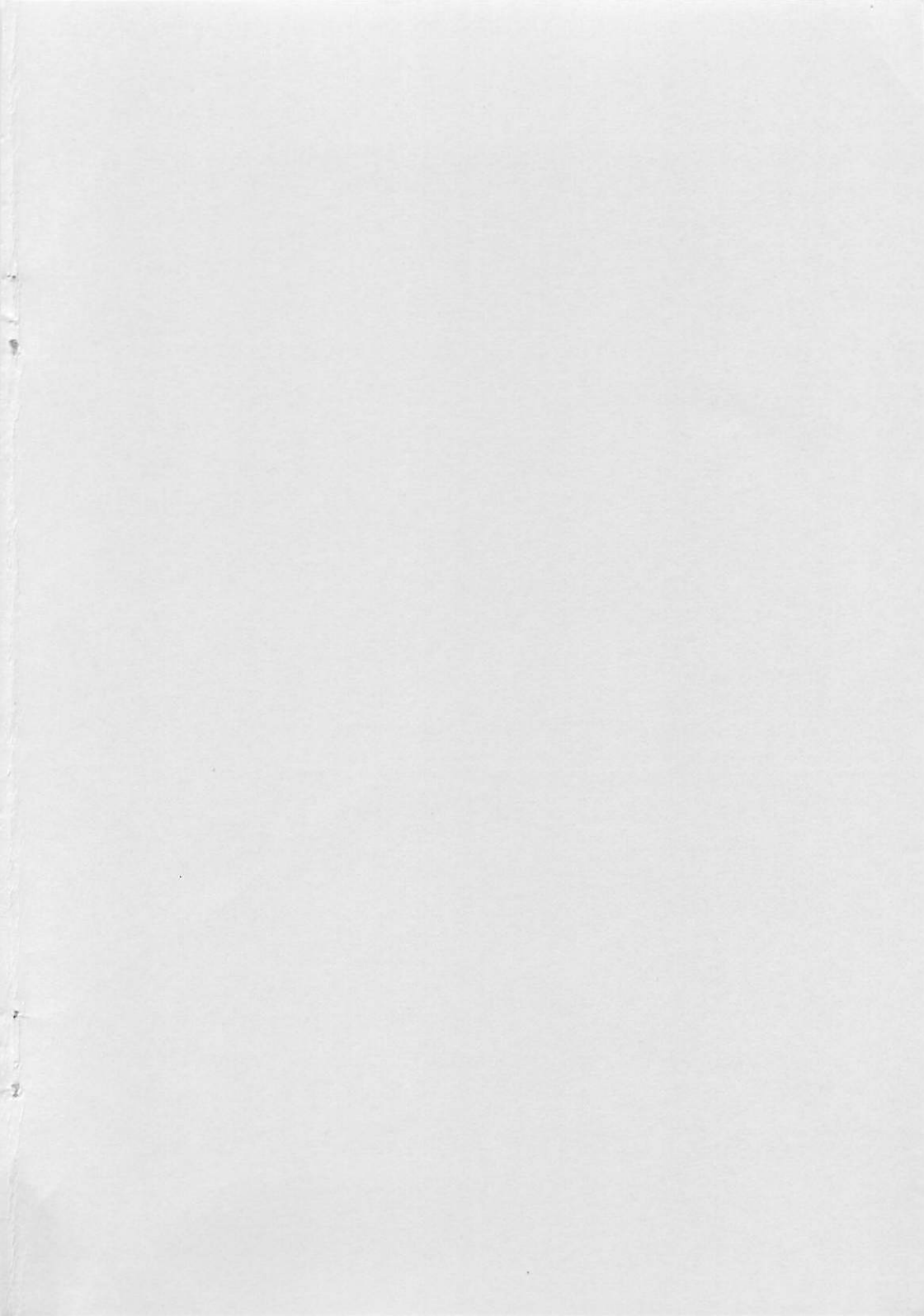
Benton and Wimbledon in 'The Conservation and Use of Fossil Vertebrate Sites ...' (1985) are to be congratulated for their foresight in encouraging the proper excavation of sites new and old, stating also 'Both motivated amateurs and some commercial collectors have made invaluable contributions to our national and local collections.' In a paper entitled 'Geology and the Museum,' Waterston fourteen years ago wrote, 'Although I believe we have moved into a period when really constructive collecting must be done by museum staff, we must remember that the prime geological collections at present contained in our museums are those of enlightened amateurs.' In retrospect we find that museum staff actually entered into a period of non-collecting let alone constructive collecting. The reason being they are neither trained nor funded in order to implement these functions properly. In fairness the excavations conducted at Bearsden by Hunterian Museum Staff (1982) were exceptional, where for once museum management and the NCC got their act together to achieve academic objectives while simultaneously satisfying the public's thirst for participation. It must be

remembered by museums and universities alike that the commercial collector is available to gather field information as well as specimens if contracted to do so, failing this for palae-ecological purposes, a section of all proposed public sites could remain covered awaiting the arrival of museum or university staff.

In conclusion I repeat, lets be positive and encourage rather than discourage the potential collector. I implore your to realise the wealth of exciting opportunities the field has to offer. If I can convince the right people to exploit our palaeontological heritage and unashamedly reap the knowledge and pleasure that undoubtedly awaits us, then we can lift palaeontology into the 21st century on a new wave of discovery, contribution and intellectual challenge.

Reference

Benton, M.J. and W.A. Wimbledon, 1985. The conservation and use of fossil vertebrate sites: British fossil reptile sites *Proc. Geol. Ass.*, 96, 1-6.



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