GEOLOGICAL CURATOR

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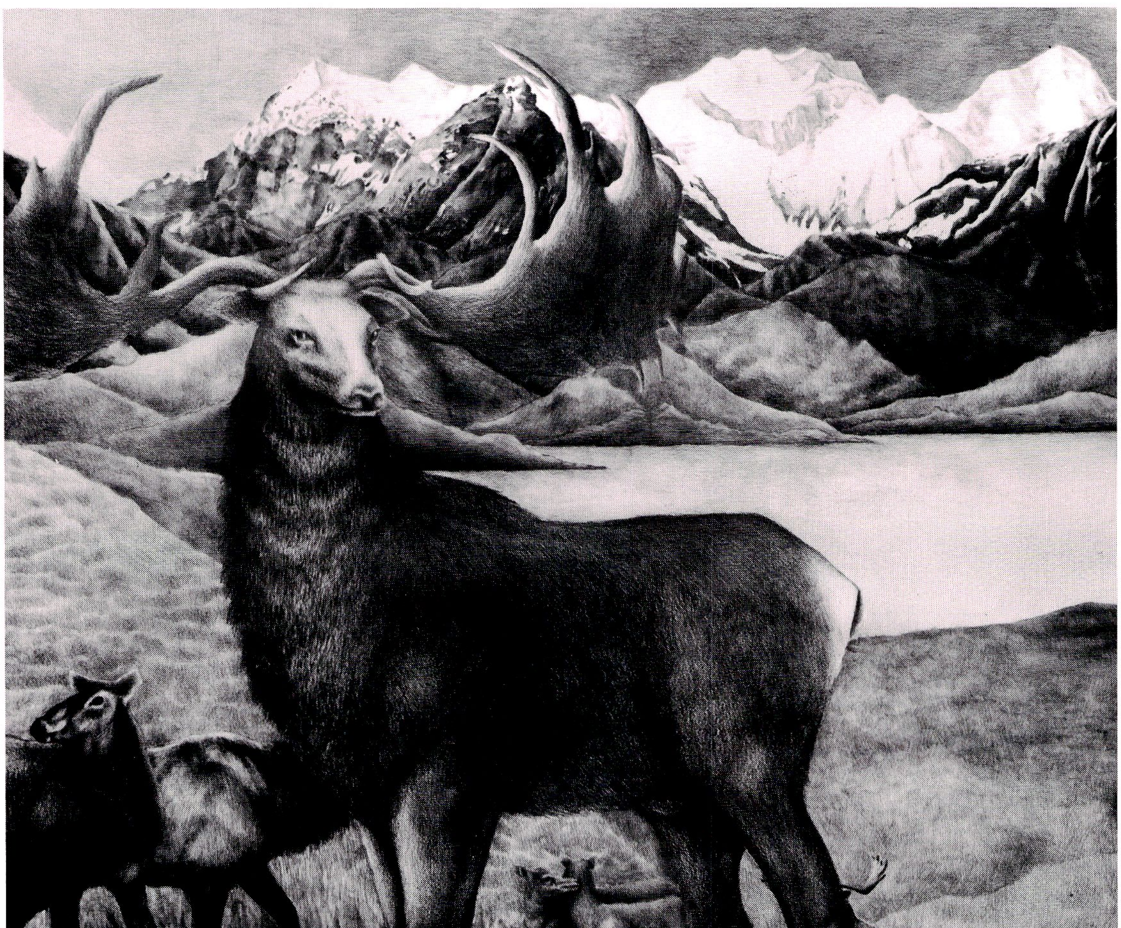

GEOLOGICAL CURATORS' GROUP

Registered Charity No. 296050

The Group is affiliated to the Geological Society of London. It was founded in 1974 to improve the status of geology in museums and similar institutions, and to improve the standard of geological curation in general by:

- holding meetings to promote the exchange of information
- providing information and advice on all matters relating to geology in museums
- the surveillance of collections of geological specimens and information with a view to ensuring their well being
- the maintenance of a code of practice for the curation and deployment of collections
- the advancement of the documentation and conservation of geological sites
- initiating and conducting surveys relating to the aims of the Group.

1995 COMMITTEE

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Cover: Reconstruction of Irish giant deer by Aislinn Adams (©National Museum of Ireland). See article by Nigel Monaghan, p. 171-173.

THE GEOLOGICAL CURATOR

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GEOLOGICAL CURATORS' GROUP - September 1995

A HISTORY OF MUSEUMS IN PETERHEAD, GRAMPIAN REGION, SCOTLAND.

by David M. Bertie

Bertie, D.M. 1995. A history of museums in Peterhead, Grampian Region, Scotland. *The Geological Curator* 6(4): 149-155.

The geological collections of the Arbuthnot Museum, Peterhead, Grampian Region, have their origins in the private museum of Adam Arbuthnot (1775-1850) and the museum of the Peterhead Institute. The former was bequeathed to the town in 1850 and absorbed the latter in 1863. The present museum building was opened in 1893. The Arbuthnot Museum became part of North East of Scotland Museums Service in 1975; rationalisation across the Service saw geology displays concentrated instead at Banff Museum.

David M. Bertie, 9 Port Henry Road, Peterhead AB42 6LA, Scotland. *Received 18th April 1990; revised version received 14th March 1995.*

Introduction

The early part of the 19th century saw considerable geological activity in the Moray Firth area, particularly with the discovery of fossil fishes in the Old Red Sandstone (Andrews, 1982), and scientific societies were established at Inverness (1825), Banff (1828) and Elgin (1836); these societies all quickly established museums with geological collections. By contrast, Peterhead lay in an area of unfossiliferous granite and metamorphic rocks, so that there was little spur there to geological activity. In addition, Peterhead was not a county town and its heyday as a fashionable spa was virtually over by 1820 as the whaling and fishing industries grew (Findlay, 1932). The consequent lack of a substantial middle-class or professional element in Peterhead meant that there was little enthusiasm locally either to sustain a scientific society or to build up strong museum collections.

19th century development

The early history of museums in Peterhead is essentially one of two parallel developments. On the one hand there was the private museum begun by Adam Arbuthnot about 1820 which he bequeathed to the town in 1850. On the other hand there were two attempts, in 1835 and 1857, to establish a scientific society in Peterhead; neither society existed for long but both had museum collections. Accounts of these two developments have already been published (Bertie, 1989, 1990) and the following paragraphs summarise the principal events.

When Adam Arbuthnot (1773-1850) (Figure 1) retired from business about 1820 he began to assemble a private museum which soon became locally celebrated. In 1835 he was one of the founders of the Peterhead Association for Science, Literature and the Arts (Anon., 1835; Figure 2) which had assembled a museum collection by 1840 (Donald, 1845). The Association fell into abeyance in the 1840s and may have been a casualty of the 1843 Disruption of the Church of Scotland. The extent to which Adam Arbuthnot was involved in the Association's museum is unknown, as is the fate of the Association's museum.

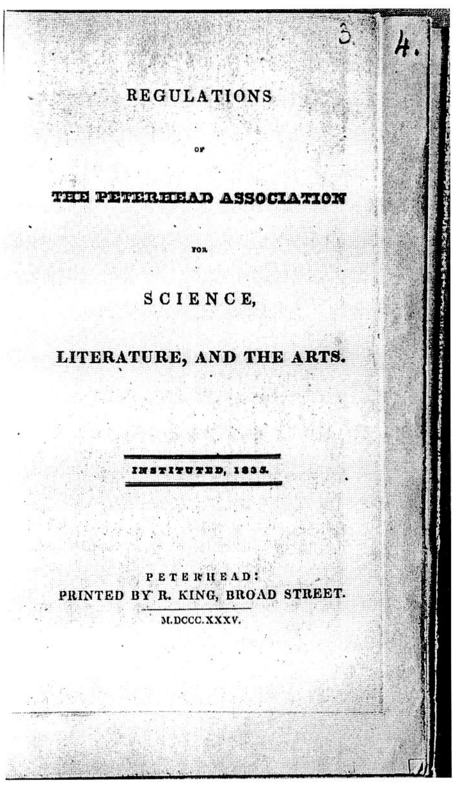
Adam Arbuthnot died in 1850 and bequeathed his private museum to the town of Peterhead. His will expressed the hope that an Institution, based on his collections, would be formed. After moving the collections from Arbuthnot's house in Jamaica Street to a room in Union Street, however, the Town Council took little further positive care of the collections. By 1857 the Arbuthnot Museum was virtually moribund.

That year the Rev. James Yuill, minister of Peterhead Free Church (Figure 3), was the prime mover in the establishment of the Peterhead Institute. It was the intention that the Institute, in addition to holding lectures on scientific and literary subjects, should take over the running of the Arbuthnot Museum. There was resistance to the latter, however, from several town councillors and the Institute instead established its own museum in premises in Maiden Street in 1859.

As a pressure group, though, the Institute successfully galvanised the Town Council into taking action on the Arbuthnot Museum. One of the councillors was appointed Curator in 1858; three years later he secured new premises in Broad Street for the Arbuthnot Museum

Figure 1. Adam Arbuthnot (1773-1850), founder of the Arbuthnot Museum (from Arbuthnot, 1920).

(Figure 4). The Institute, meanwhile, after an initial successful start, found itself in financial difficulties following an over-ambitious winter lecture programme during session 1860-61 and membership dropped. The Arbuthnot Museum absorbed the Institute's museum in



REGULATIONS

OF

THE PETERHEAD ASSOCIATION

FOR

SCIENCE,

LITERATURE, AND THE ARTS.

INSTITUTED, 1835.

PETERHEAD:
PRINTED BY R. KING, BROAD STREET.
M.DCCC.XXXV.

Figure 2. Title page of *Regulations of the Peterhead Association for Science, Literature, and the Arts* (1835).

Figure 3. Rev. James Yuill (1806-1905), founder member of the Peterhead Institute (reproduced by permission of Trinity Church, Peterhead).

1863 and the Institute thereafter held its meetings in the Arbuthnot Museum. The Institute fell into abeyance after 1867.

The Arbuthnot Museum moved to Chapel Street in 1874. Attempts during the 1880s to secure a permanent home for the Museum led to the adoption of the Public Libraries Act in 1890. Construction of a new museum and library building began in 1891 and the building was opened in 1893, housing the Arbuthnot Museum and the Peterhead Public Library (Figure 5).

Early geologists in the Peterhead area

As stated in the opening paragraph, the Peterhead area saw little geological activity in the 19th century. The result was that no major geological figure was ever associated with the Arbuthnot Museum.

Thomas Francis Jamieson, LL.D. (1829-1913): Jamieson was probably the major local northeast geologist of this period. From 1858 to 1910 he published a series of papers on the Quaternary geology of northeast Scotland (reviewed by Gemmell, 1975), but despite living at nearby Ellon, seems never to have had any contact with the Arbuthnot Museum (Godsman, 1958).

William Ferguson, LL.D. (1823-1904): Ferguson of Kinmundy (Figure 6) became interested in geology at an early age, probably as a result of the chalk flint occurrences on his father's estate, and published his first paper on the subject in 1849. He became a Fellow

Figure 4. Broad Street, Peterhead (*c.* 1900). The Arbuthnot Museum occupied the upper floor of Catto's Hall (arrowed) from 1861 until 1874.

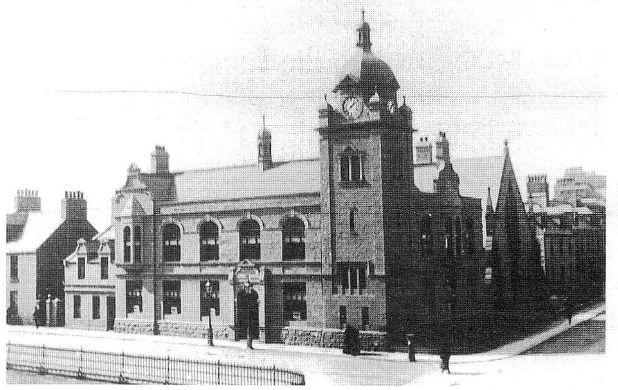


Figure 5. Arbuthnot Museum and Peterhead Public Library (*c.* 1900). The Museum occupies the upper floor.

of the Geological Society in 1854 and published a joint paper with J.W. Salter in 1857 on the Cretaceous fossils of Aberdeenshire.

He was not resident in Aberdeenshire during the period of existence of the Peterhead Institute and seems not to have been a member of that body. He took up residence again at Kinmundy from 1872, and was Chairman of the Great North of Scotland Railway from 1879 until his death in 1904. He became a member of the Buchan Field Club in 1888 and was its President in 1893. That same year, when the Arbuthnot Museum opened its new premises, he presented samples of Greensand from Moreseat and Oxford Clay from Plaidy. His scientific papers are listed in a brief biography in the *Transactions of the Buchan Field Club* (Anon., 1908).

David Fraser (1827-1911): Fraser was born in Peterhead in 1827 (his father, David Fraser, was a Kirkcaldy seaman who subsequently became a

Figure 6. William Ferguson of Kinmundy, LL.D. (1823-1904); portrait by Norman Macbeth in collections of North East of Scotland Museums Service.

Figure 7. John Milne (1836-1920), photographed at Maud, Aberdeenshire (*c.* 1915).

shipmaster). He was apprenticed as a house carpenter and by the mid-1850s had his own building and timber merchant business. He was the architect for Peterhead's United Presbyterian Church built in 1858, and contributed to other Peterhead buildings in the second half of the 19th century.

Fraser was one of the founder members of the Peterhead Institute, of which he was President 1862-63. He gave various lectures to the Institute, on subjects such as plants, light, photography, meteorology and the composition of the Sun. His major lecture was on the geology of Buchan, given in January 1860 and subsequently published in four parts in the *Peterhead Sentinel*. This was an excellent exposition of field geology, demonstrating conclusions derived from direct observations. Fraser was obviously familiar with the recently-published papers of Jamieson and Ferguson, and his geological philosophy appears to have been based on Lyell. He was later a founder member of the Buchan Field Club in 1887.

Fraser entered Peterhead Town Council in 1871 and was Curator of the Arbuthnot Museum in 1871-74 and 1886-87. He retired from the Town Council in 1893 and became one of the ratepayer members of the new Library Committee on which he served until 1908. He also served on the Magistrates' Bench and was appointed a Justice of the Peace (J.P.). Fraser died in 1911. (Bertie, 1989, 1990; Findlay, 1932)

John Milne, M.A., LL.D. (1832-1915): In 1900 the Arbuthnot Museum received a donation of over thirty Greensand fossils from Moreseat. This was a duplicate set of specimens from Aberdeen University, the transfer being arranged by Dr John Milne. Milne was born in New Deer parish, west of Peterhead, in 1832 and graduated from Marischal College, Aberdeen in 1848. He was appointed schoolmaster at King Edward, Aberdeenshire in 1854, and became one of the archetypal rural Scottish dominies of that period. Milne was one of the earliest school teachers to introduce teaching of the natural sciences in the northeast, and received the degree of LL.D. from Marischal College, Aberdeen in 1886. He spent his vacations at the Royal School of Mines in London, and published papers on geology in Scotland, England, Ireland and Switzerland; two of his papers were published in the *Transactions of the Buchan Field Club*:'Geology of Buchan' in 1891, and 'On Rattray' in 1900. He retired to Aberdeen in 1900. The transfer of the Moreseat fossils (probably obtained during the 1896 British Association excavations) may have been the result of a desire on his part to see his 'local museum' benefit from some of the geological research in the area. Milne died in 1915 (Godsman, 1952).

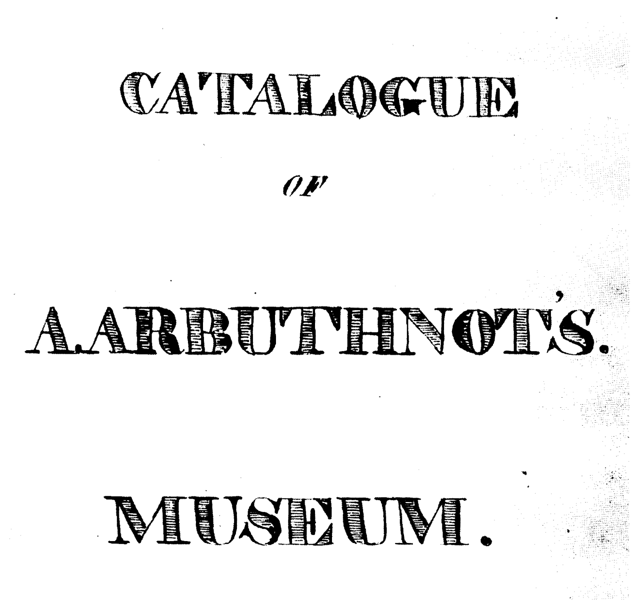
John Milne (1836-1920): This John Milne (Figure 7) was born in New Deer parish in 1836; his father was later a farmer at Atherb in that parish (Milne, 1889). He became a member of the Buchan Field Club in 1888 and published a number of minor papers, two of which were geological, in the Club's *Transactions*. The Arbuthnot Museum has a photocopy of a manuscript 'Geology of New Deer' which he wrote sometime after the publication of the Geological Survey 1" map of Peterhead in June 1885. This gives details of then existing exposures, some now completely overgrown, in the parish. There is a comment on the geological surveyors: 'But the geological surveyours evidently found this part of our parish to intricate to be easily maped out, so they let it alone'. John Milne died at Maud, Aberdeenshire in 1920. He published two geological papers in the *Transactions of the Buchan Field Club*: on drift rocks in Buchan (1892) and on the geology of Mormond (1904).

Catalogues of the Arbuthnot Museum

The museum possesses Adam Arbuthnot's handwritten catalogue of his private museum (Figure 8). From internal evidence this can be dated to about 1843-44.

After Arbuthnot's museum passed to the Town Council a printed catalogue was produced in 1852 which summarised Arbuthnot's handwritten catalogue (Anon., 1852). This catalogue included the "Regulations of the Arbuthnot Museum 1851".

When the museum moved into its present premises in 1893 a printed handbook was drawn up by James Aiken, the Convener of the Library and Museum Committee (Anon., 1893). This listed the museum holdings in general terms only (Figure 9).


CATALOGUE

OF

A. ARBUTHNOT'S.

MUSEUM.

Figure 8. Title page of Adam Arbuthnot's handwritten catalogue.

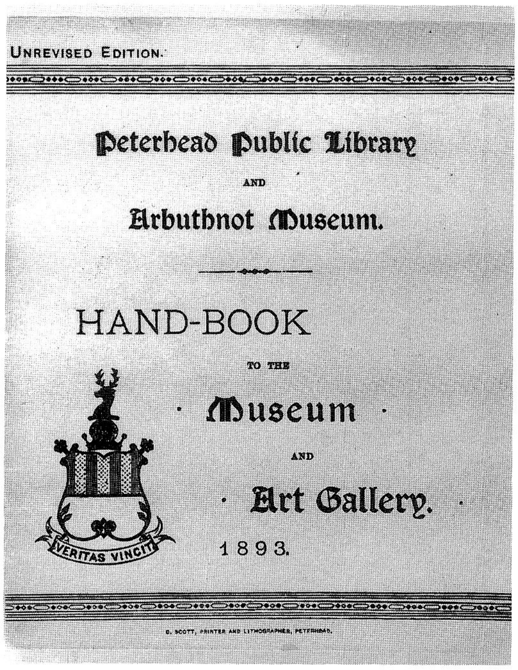


Figure 9. Cover of the *Handbook to the Museum and Art Gallery* (1893).

Figure 10. Productid brachiopod from the Carboniferous of near Glasgow [PEHMS:P4480]; one of the few surviving geological specimens from the Peterhead Institute collection.

There is a further handwritten catalogue in two volumes which appears to have been compiled by James F. Tocher, the Secretary of the Buchan Field Club. This catalogue was drawn up in late 1911 or early 1912; none of the donations to the museum indicated in the Library Committee Minutes from 1912 are included.

Geology collections of the Arbuthnot and Peterhead Institute Museums

About a third of the geological collection listed in Adam Arbuthnot's handwritten catalogue still survives, and is identifiable through labels. Some other items may be Arbuthnot material but without labels are no longer identifiable as such. Items of interest no longer in the collection include three meteorites (one from Disco, Greenland, two from the Mediterranean region) and a 'fish and frog in masses of limestone from Gardenstown'.

Most of the geological specimens from the Peterhead Institute Museum are now missing or, at best, unidentifiable in the present collection. A list of objects presented to the Peterhead Institute as reported in the

Figure 11. Geology display at Banff Museum.

Peterhead Sentinel newspaper is given in Bertie (1990). This list is certainly incomplete; eleven geological specimens survive with 'PHD. INSTITUTE' labels (Figure 10), only seven of which appear in the above list. A number of fossil fishes were given to the Institute, only one of which survives and is unlocalised.

Over 365 geological items are listed in the 1912 catalogue; this included what then survived of the original Arbuthnot and Institute collections. Apart from a selection of various granite types, there was no particular strength - much of the collection was a fairly haphazard mixture of rocks, fossils and minerals. The number of items from the Arctic bore witness to Peterhead's days as Britain's premier whaling port. One item no longer in the collection is "parts of brain cells & tusks of Mastodon exhumed near Sheridan, Chantanqua Co., New York".

Some 60 specimens listed in the 1912 catalogue, including the Moreseat Greensand material, were removed to Aberdeen University in 1971, together with a number of other uncatalogued specimens. Some specimens are also known to have been thrown out at this time. Of the items listed in the 1912 catalogue, only 116 have so far been identified as remaining in the collection.

20th century development

From 1893 to 1975 the Arbuthnot Museum formed part of Peterhead Public Library. Up until the 1st World War the museum was fairly active and the art gallery was the scene of a series of art exhibitions. Following the 1st World War the museum entered a period of relative stagnation, in common with many other small local authority museums, which lasted until after the 2nd World War.

From 1949 to 1975 two successive librarians attempted to revitalise the museum. More emphasis was placed on local history, particularly on Peterhead's whaling, shipping and fishing links. Material felt to be "surplus to requirements" was sold, given away or thrown out. In 1971 Nigel Trewin, of Aberdeen University's Geology Department, rescued a quantity of geological specimens. He made suggestions and donated specimens for a rationalised geology display but a new display never materialised. Some natural history material went to Aberdeen University Zoology Dept., while a number of stuffed animals and birds went to Peterhead Academy.

In 1975, following local government reorganisation, the Arbuthnot Museum came under the control of Banff & Buchan District Council. Three of the Grampian Region districts, Banff & Buchan, Gordon and Kincardine & Deeside, combined to form the North East of Scotland Library Service (NESLS). The responsibilities of NESLS included the museums at Peterhead, Banff, Inverurie, Huntly and Stonehaven (with Banchory from 1978); the museum service headquarters was based at Peterhead. An autonomous North East of Scotland Museums Service (NESMS) was established in 1984.

Figure 12. Geology store at Huntly

Rationalisation of displays across NESMS has resulted in Banff Museum becoming the focus for geology and natural history (Figure 11). There are now no permanent geology or natural history displays at the Arbuthnot Museum, apart from a small display of Arctic wildlife as part of the whaling exhibit.

From 1978 to 1987 cataloguing of the NESMS collections onto MDA cards was carried out as part of a MSC programme. This unfortunately led to the loss of some data for the geological collections. The Arbuthnot Museum geological material was completely recatalogued 1988-89 and concordances with old catalogues prepared. There are currently over 300 specimens fully catalogued on MDA cards. Granites are the only strength in the collection.

A separate store for the geological collections was secured at Huntly late in 1987. This is a single room, with no environmental control, 4.3m x 3.8m (Figure 12). There are three bays of Dexion racking; two bays 18" wide along two walls, with a central bay 36" wide. The catalogued material is stored on specimen trays inside Ryder storage boxes. Uncatalogued material from the other parts of the NESMS collections has been left undisturbed in original storage boxes and trays to avoid loss of data; this material is gradually being worked through.

Staff

A list of curators of the Arbuthnot Museum 1858-93 and of the Peterhead Institute's museum 1857-68 is given in Bertie (1989), along with some biographical notes on the first four librarians 1893-1949. A list of staff after 1893 is given below.

Peterhead Public Library and Arbuthnot Museum (1893-1975)

Robert Stevens
Librarian 1893-1898
David Scott
Librarian 1898-1911
Marion Scott
Librarian 1911-1917
Dora B. Scott
Librarian 1917-1949
Richard D. Milne
Librarian and Curator 1949-1960
George H. Brebner
Librarian and Curator 1961-1975

North East of Scotland Library Service (Museums Service) (1975-84)

Jocelyn E. Chamberlain-Mole
Museums Organiser 1975-1984

North East of Scotland Museums Service (1984-)

Jocelyn E. Chamberlain-Mole
Museums Curator 1984-
David M. Bertie
Depute Curator 1986-

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ANON. [J. AIKEN] 1893. *Peterhead Public Library and Arbuthnot Museum. Hand-book to the Museum and Art Gallery*. D. Scott, Peterhead.

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DONALD, W. 1845. Parish of Peterhead. *In* Anon., *The New Statistical Account of Scotland* **12**, 344-396. William Blackwood, Edinburgh.

FINDLAY, J.T. 1932. *A History of Peterhead*. P. Scrogie, Peterhead.

GEMMELL, A.M.D. 1975. Quaternary studies in north east Scotland:- an introduction. *In* Gemmell, A.M.D. (ed.) *Quaternary Studies in North East Scotland*. Pp. 1-13. Department of Geography, University of Aberdeen.

GODSMAN, J. 1952. *King Edward, Aberdeenshire: The Story of a Parish*. Banffshire Journal, Banff.

GODSMAN, J. 1958. *A History of the Burgh and Parish of Ellon, Aberdeenshire*. W. & W. Lindsay, Aberdeen.

MILNE, J. 1889. The making of a Buchan farm. *Transactions of the Buchan Field Club* **1**, 159-171.

PITFALLS, PROBLEMS AND PROCEDURES IN MICROPALAEONTOLOGICAL PREPARATION AND CONSERVATION

by Owen R. Green

GEOLOGICAL CURATORS GROUP GCG

Green, O.R. 1995. Pitfalls, problems and procedures in micropalaeontological preparation and conservation. *The Geological Curator* 6(4): 157-166.

Some micropalaeontological (palynology and calcareous, phosphatic, siliceous micropalaeontology) problems encountered by preparators, conservators and curators are illustrated using examples of recent preparations, historical collections, and observations from the literature. Better understanding of the mechanics and chemistry of stages employed in processing and preservation methods will reduce or eliminate many of these problems. The dissemination of knowledge gained during all preparation and processing stages is essential for specimen longevity, and avoidance of erroneous results during analytical work.

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Introduction

The purpose of this paper is to examine "preparator induced" problems encountered by micropalaeontologists during preparation, conservation and preservation of geological material. Complex interactions between specimen re-working and organism preservation potential, which if not recognised can result in considerable interpretative error, require detailing separately. However, these factors, which should be assessed and recognised by the micropalaeontologist (the "expert") (Figure 1A), provide a suitable division between "natural" modifications and the pitfalls induced during preparation. Sample collection problems (Figure 1B) will not be discussed in great detail, as these too can be at the discretion of the "expert", determined by field "etiquette" employed, and project objectives. As a preparator we assume the specialist knows why he is collecting samples, and which scientific objectives form the goal of research.

Processing techniques used by preparators are discussed (Figure 1C), as are procedures which conservators/ curators may be required to assess and correct (Figure 1D). Where pitfalls occur, particularly during initial sample processing, and how they can be averted, will be detailed. Corrective measures employed by the conservator/curator will be performed either on previously prepared specimens, possibly of historical interest, or relatively new material such as recently donated collections. The majority of problems encountered manifest over time resulting from slow chemical interactions, not reckless preparation. When one person is responsible for collecting, preparing, conserving, curating, and also interpreting results, then some recognisable errors can be more easily eliminated or reduced in final analysis, and documented for later workers.

Potential areas of specimen damage induced during preparation

Once back in the laboratory, samples are unpacked and further techniques required (Figure 2) in specimen preparation are assessed. Many of the approaches, processing and cleaning procedures described in this paper, are equally applicable to macrofossil groups, *e.g.* graptolites, micro-molluscs, micro-crinoids.

Potentially the most vulnerable time for specimen modification is during processing, particularly sample disaggregation. This involves a number of stages (Figure 2). Not all may necessarily be required for each sample. The main aim of micropalaeontological processing (palynological or calcareous, Figure 3) is to generate a clean "faunal rich" residue. This is then picked or strewn onto slides or stubs and examined under the microscope (light or SEM). Preparation of partially consolidated sediments may involve nothing more than washing and cleaning to reveal the fauna. However, for complete disaggregation of indurated rocks, mechanical and chemical procedures may be required to dissociate all the faunal elements and matrix.

The following aspects will be considered in some detail with respect to conservation and preservation of micropalaeontological specimens:

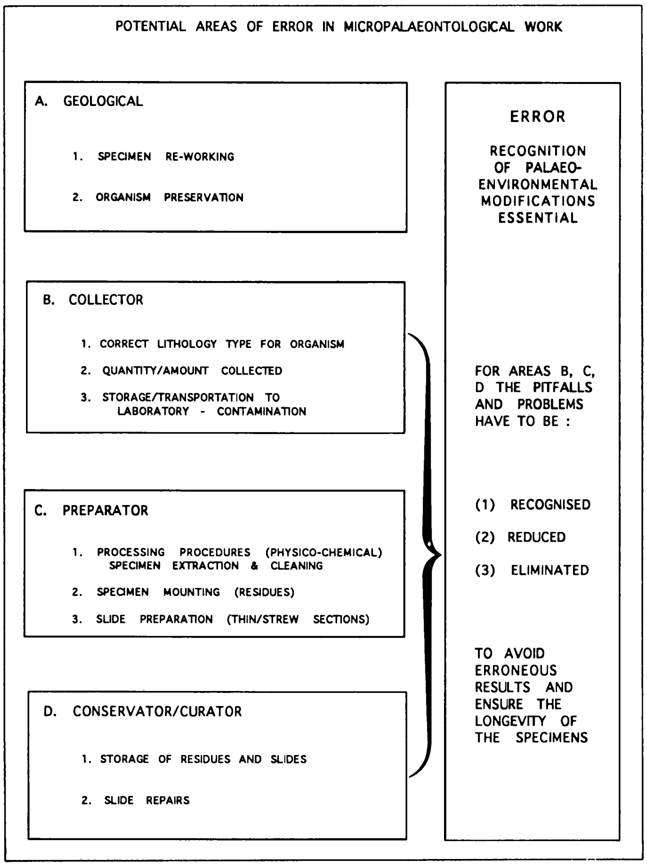

Figure 1. Diagrammatic illustration of the four main areas in micropalaeontology where "pitfalls" and problems can occur, and the specialists (collector, preparator, conservator/curator) capable of recognising them; see text for details. Natural geological errors should be evident to all specialists. The pitfalls and problems in areas (A) and (B) are not discussed in detail in this paper.

1. Processing procedures - the act of releasing specimens from enclosing matrix.
2. Specialised cleaning procedures - utilising additional mechanical cleaning (ultrasonic tank or ultrasonic probe). Processes involved in deflocculation (breakdown of agglomerates to form a stable colloidal suspension - peptization) by the addition of peptizers, subsequent washing and removal of electrolytes (sodium or potassium, bicarbonate) which have formed during dispersion processes.
3. Slide preparation and storage - thin sections (Canada balsam or glycerol mounts); micropalaeontological faunal cell slide residue mounts.
4. Residue and specimen storage - "live" (alcohol/ glycerol storage), and dead (dry residue) material.

Examples of problems encountered in all four areas above will be illustrated from either case studies featuring material worked on by the author, or examples cited in the literature.

Processing procedures

Four main stages of treatment can be applied to partially consolidated sediments to break them down to their component parts. Procedures employed will vary, being dependent upon lithology, mineral composition of the fossilised material, and its state of preservation. The stages are:

1. Mechanical treatment
2. Chemical treatment: acids to remove carbonates; sulphates and sulphides.
3. Chemical treatment: oxidising agents.
4. Deflocculation, washing and concentrating the residue.

Recent work (Hodgkinson 1991, Kontrovitz *et al.* 1991) has shown that many processes used during these stages can have a lasting, often damaging, effect on faunal components of a residue. Moreover, damage is usually related to mode and degree of preservation, together with the time and intensity a sample is subjected to a particular process. In order to minimise effects it is desirable to use as few processing stages as possible, and to constantly monitor the state of specimen preservation, a feature adopted by Hinchey and Green (1994, Figure 4) in processing sediments for diatoms.

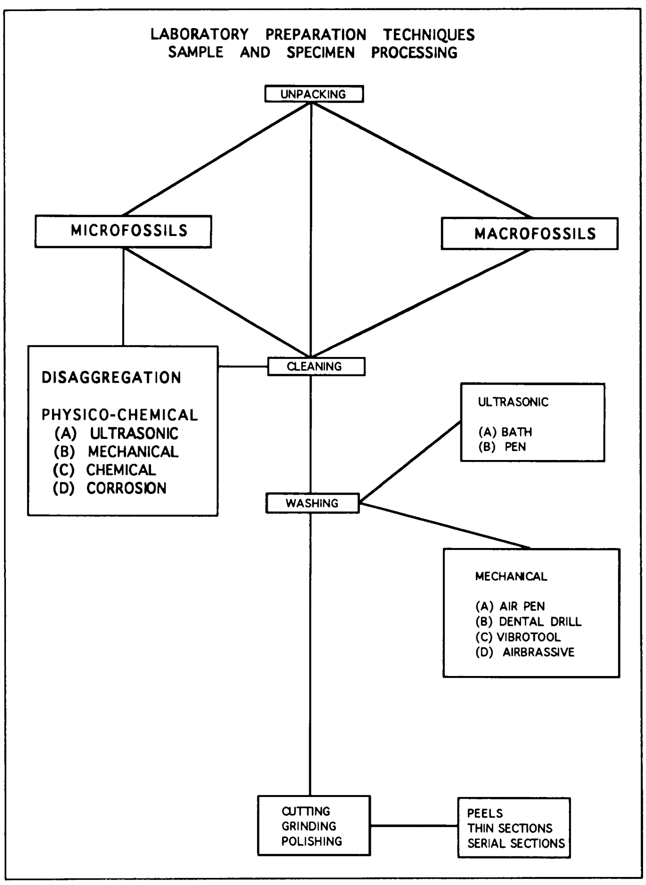

Figure 2. Flow chart illustrating laboratory processing procedures used in the preparation of palaeontological specimens.

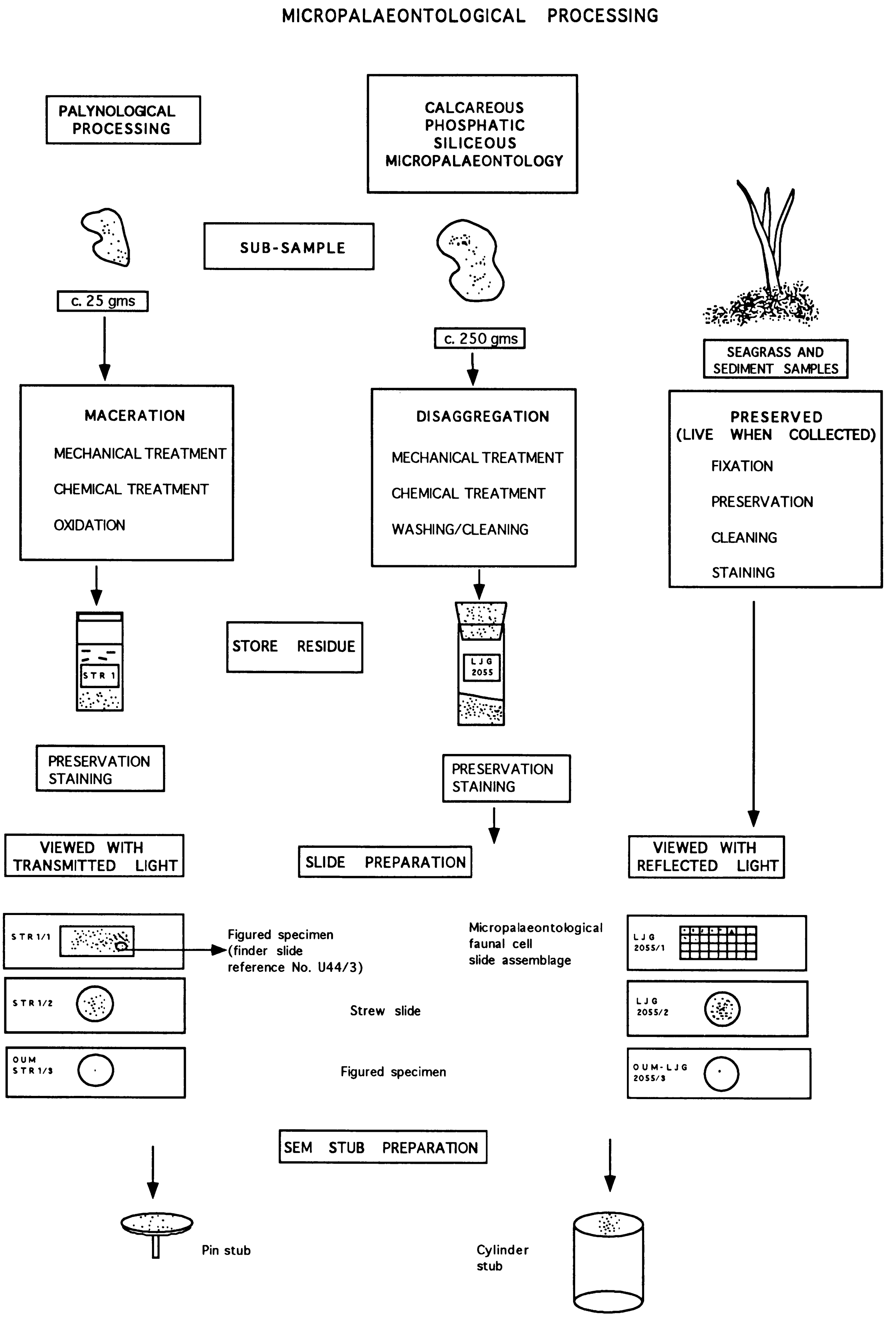

Figure 3. Diagrammatic illustration of micropalaeontological processing (palynological and calcareous/siliceous/phosphatic) showing stages from lithified sample, specimen dissociation, cleaned residue and microscopical examination (modified from Rushton, 1979).

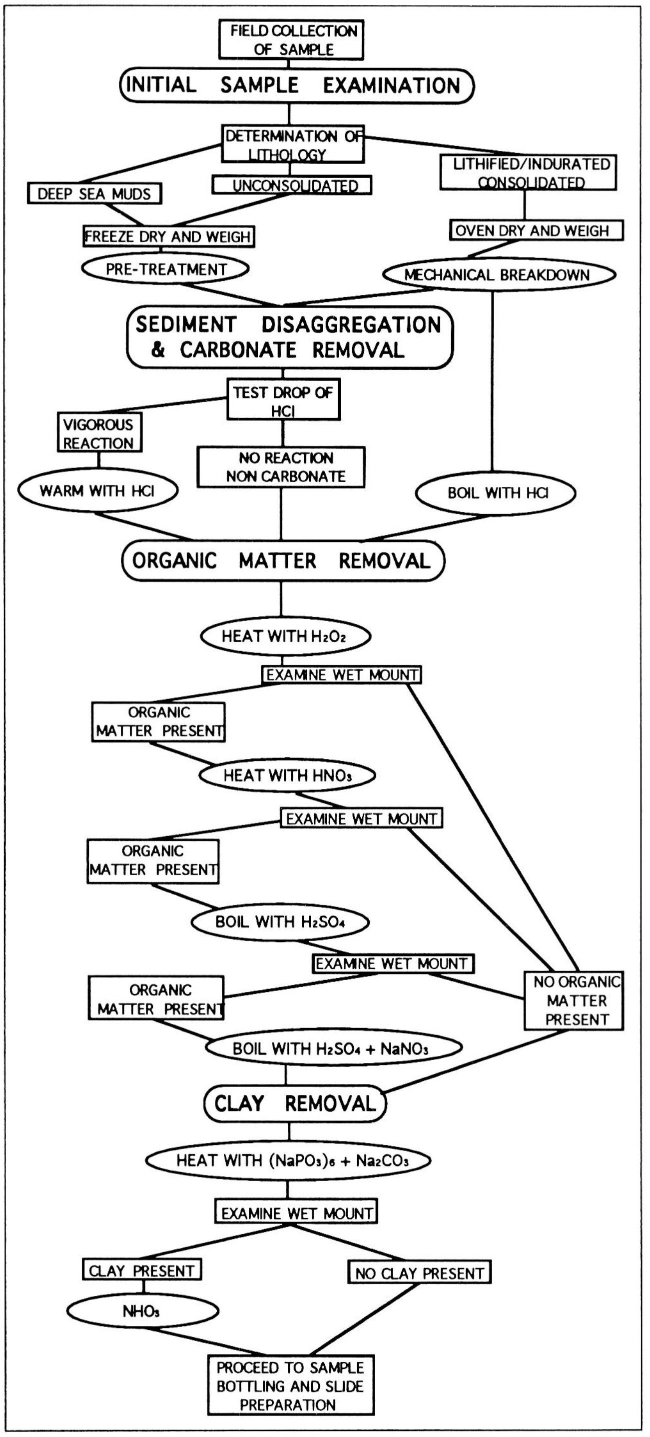

Figure 4. Flow chart of diatom processing. Note temporary slide preparation stages used to monitor processing effects during organic matter and clay removal (modified from Hinchey and Green 1994).

Mechanical and chemical (acid) processing techniques are essential for specimen dissociation and matrix removal. Consequently, it is difficult to avoid damage, particularly from mechanical processes involving the use of percussion or reciprocal tools. However, damage from such instruments is usually clearly identified, and by a skilled operator kept to a minimum. Recently, semi-quantitative taphonomic work has required monitoring both abrasion and dissolution of shell material (*e.g.* Cottey and Hallock 1988, Kotler *et al.* 1992). Generally speaking, the acid treatment employed by the preparator should have a minimal effect on the specimens being extracted. In some processes, buffered solutions are necessary to avoid damage to the organism (Hodgkinson 1991). However, some desirable chemical transformations are induced during extraction and matrix removal. A procedure, first described by Sohn (1956), of immersing ostracod carapaces in a 20% solution of hydrofluoric acid (HF) for 2-24 hours aided siliceous matrix removal, while transforming the opaque calcareous carapace to a translucent calcium fluoride. This enhanced the shell appearance when viewed under a light microscope. The current author has had reasonable success in using this technique on larger thick walled Holocene foraminiferans of the suborder Miliolina from South Florida, when examining internal chamber arrangement of pillars and partitions without having to damage the specimen (Figure 5). A great advantage in this procedure is that the same specimen can then be examined under both light and electron microscope.

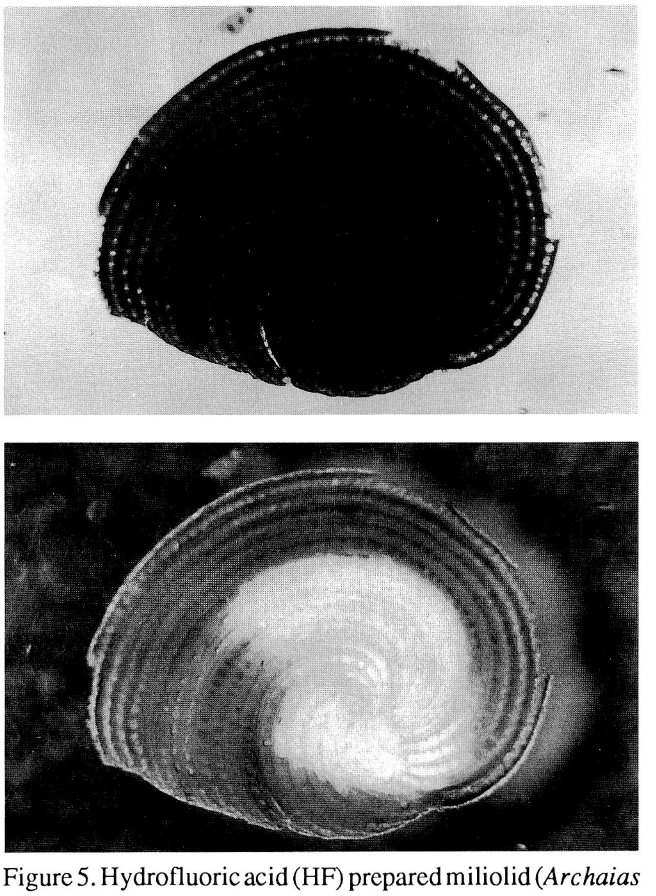

Figure 5. Hydrofluoric acid (HF) prepared miliolid (*Archaias angulatus* 2mm in diameter) from South Florida. This foraminifera has a thick opaque porcelaneous wall structure, (a) transmitted light, (b) reflected light. [FB 93/1]

Particular care must be taken when employing oxidising techniques on calcareous material. These procedures may result in partial shell dissolution, and consequently must be used with great care when this type of material is studied (Hodgkinson 1991).

Specimen cleaning procedures

Cleaning procedures can be particularly destructive to microfauna, particularly if an ultrasonic tank is employed. Although sediment dispersion to component parts may be achieved, some destruction of microfauna is inevitable during this largely uncontrollable process (Hodgkinson 1991). Determining the preservational state of an organism is essential in assessing the time required for immersion in an ultrasonic bath, with success often dependent upon experience. It does, however, remain an invaluable tool to preparators in cleaning individual specimens (for a few seconds at any one time) especially when material is viewed in an SEM and in some cases a light microscope, the principle tools of the micropalaeontologist. Chemical dispersers or deflocculants are often employed to get finer mud/ clay grade particles into suspension, *i.e.* separated from the fauna, prior to their removal by wet sieving. The aggregation, or flocculation of fine particles may result if too little or too much disperser is used. Thus the best dispersers are those that are effective over a wide range of concentrations. Preparators may find it necessary to try several different dispersers before deciding on a suitable one, as not all act with all matrices. A number have been used on clays (usually in 5-20% concentrations):

Sodium hydroxide (NaOH)

Potassium hydroxide (KOH)

Ammonium hydroxide (NH_4OH)

Sodium carbonate (Na_2CO_3)

Hydrogen peroxide (H_2O_2)

tetra-Sodium pyrophosphate ($Na_4P_2O_7$) - the anhydrous form, frequently quoted in the literature, is unobtainable (in UK) from the chemical suppliers *Fisons* or *Merck*. The decahydrated form ($Na_4P_2O_7.10H_2O$) is available, but its effects on residues need to be clarified. Hodgkinson (1991) omits to specify which form was tested.

Reference has also been found to the use of dilute solutions of sodium oxalate ($Na_2C_2O_4$), lithium chloride (LiCl), lithium hydroxide (LiOH), sodium tripolyphosphate ($Na_5PO_3O_{10}$) and sodium hexametaphosphate ($Na(PO_3)_6$) (Gray 1965). This last solution has been shown (Kontrovitz *et al.* 1991) to cause partial dissolution of ostracod valves, even at relatively low concentrations (2.5%), and when prolonged contact is maintained (6 hours+). Using a combined treatment of naphtha and sodium hexametaphosphate, damage to Recent planktonic foraminifera (Oda *et al.* 1975), and fossil and Recent benthonic foraminifera (Hodgkinson 1991) has been reported during processing. To the "expert" this may give rise to misleading taphonomic conclusions, particularly if not informed of the potential effects of this stage in micro-residue processing.

It will be apparent from the discussion above that sediment disaggregation, dispersal and cleaning of microfauna involve chemicals which serve more than one purpose. Care must therefore be taken to ensure that a chemical chosen for one purpose does not, inadvertently, perform a secondary unwanted task, and result in the loss of valuable information, or modify data to such a point that only erroneous conclusions are drawn.

Slide preparation

Once a cleaned residue has been produced, numerous procedures can be employed to observe the material. This can take the form of the basic light microscope (binocular stereozoom with reflected or transmitted light, transmitted polarising petrological or light biological microscope, either of which might have additional facilities for viewing in reflected, phase contrast or fluorescence). Stub mounted material is viewed in the Electron Microscope under a beam of electrons. Slides produced from picked and strew residues, together with thin sections - standard methods of mounting prepared material - will be concentrated on in the case studies described below.

Historical collections

This example involves work from a two part study separated by a 100 year gap. The genus *Discospirina*, a rare pelagic deep sea miliolid, with a large discoidal (≤30mm), thin walled (@40µm) test was originally studied in some detail over a forty year period by the Rev. William (W.B.) Carpenter. His conclusions culminated in a series of papers in the 1880s (Carpenter 1883a, b, 1885, placing *Discospirina* in the genus *Orbitolites*). A century later Martin Brasier (1984) followed up Carpenter's work on the adaptive significance of evolutionary trends, illustrating how it recapitulates its evolution through ontogeny (with the following ontogenetic stages recognised: *Cornuspira* (Carb.-Rec.), *Ophthalmidium* (Jur.-Rec.), *Renulina* (Eoc.-Rec.) *Discospirina* (U. Mio.-Rec.) the key to unlocking foraminiferal evolution). Curiously, *Discospirina* co-exists with all its ancestral forms in bathyl oozes today. This later work involved examination of slides produced by Carpenter, and new slides from fresh material. Original material (Figure 6) is seen as "dry residue" mounts in wooden cavity slides either with or without a glued cover slip and distinctive hand-written labels. Alternatively, because of the thin test, "glycerol" and Canada balsam mounts on glass slides with a sealed raised cover glass, had been prepared

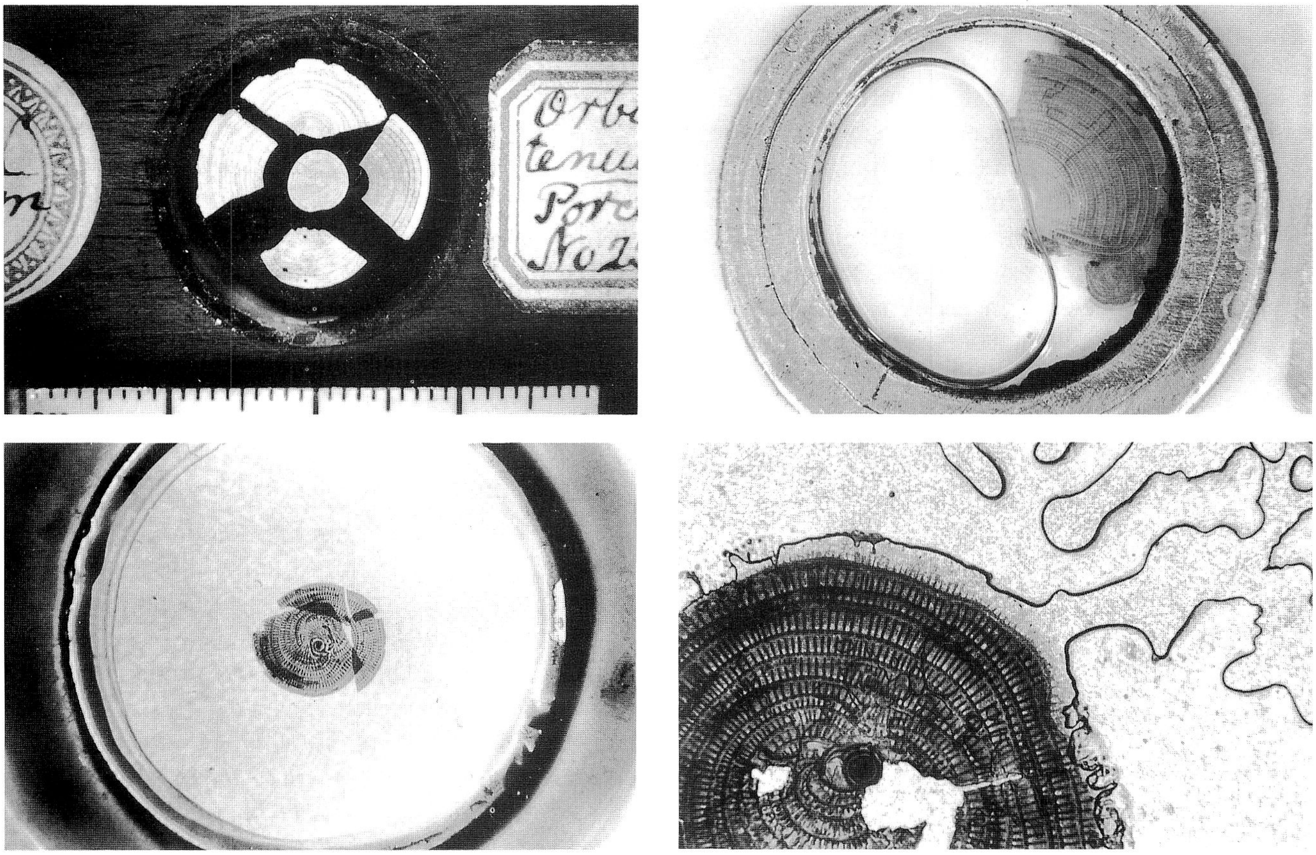

Figure 6. Photographs of W. B. Carpenter's prepared slides of *Discospirina italica* (*Orbitolites tenuissimus*). (a) individual specimen mounted in a 3x1" mahogany wood slide (cavity diameter $^1/_2$"), [BM(NH) 263/1903- 1970]; (b) part of specimen (maximum diameter 9.5mm) preserved in oil, [BM(NH) 263/1903- 1988]; (c) broken specimen (3.5mm diameter) preserved in Canada balsam,[BM(NH) 263/1903- 1979]; (d) Canada balsam decaying around a 6mm diameter specimen. The decaying balsam, yellow in colour, has formed a reticulate pattern, seen in this example as a contrast difference upper right of the specimen, appearing like a water mark, [BM(NH) 263/1903- 1970].

(Figure 6b, c). The delicate nature of uncovered mounted material in wooden slides is obvious. It must be ensured that they are stored in glass fronted slide cabinets, which reduces the amount of dust which can settle on them. The deterioration of glues and mounting media used in the initial preparation of micropalaeontological (and petrological) slides is an all too familiar problem to the geological conservator and curator. Extensive research is required to determine the original materials employed, and substitutes which can now be used in the conservation of materials (see Horie 1987 for discussion).

Despite being sealed, the Canada balsam slides show characteristic signs of age - yellowing and "crazing" of the mounting media (Figure 6d). Likewise decay is also evident in some "glycerol" mounts, with some slides losing all preservative / mountant. However, by modifying the recovery procedure of Wilson (1971), many specimens can be re-mounted. Be sure to record all information on the slide label before starting, and treat slides individually. Remove cover glass sealant with a mounted blade. Place the slide in a beaker of distilled water with, if possible, the label uppermost. Gently heat on a hot plate. The cover slip and specimen will dislodge and fall to the bottom. If the slide is not broken, it may be cleaned with Methanol and re-used for re-mounting the specimen using fresh mounting media. However, this practice introduces ethical problems, many familiar to the curator / conservator, *i.e.* saving and stabilising specimens with the potential loss of historically valuable hand-written labels on slides. If it is not possible to remove labels prior to work on saving the section, or they are to be lost during the process, then a photographic record of the information on them should be taken.

An alternative procedure, that of enzymatic hydrolysis, in which it is claimed labels remained undamaged, was favoured by Watson and Sincock (1992). This method is also preferable in cases where glycerol jelly remains or has solidified around the specimen. Again slides are individually treated, immersed in beakers or petri dishes containing a 10% Trypsin solution at 20°C for 24 hours. Both the cover slip and sealant will float free, while hydrolysis removes all glycerol jelly from around the specimen which can then be re-mounted on the original cleaned slide. In older mounts, solidified jelly may require additional warming and some cutting with a surgical scalpel from around the specimen. However, it is not necessary to remove all the glycerol. Some small fragments may be incorporated in the fresh glycerol jelly mount.

Modern collections

What of the new material, prepared in the early 1980s? Sealed Canada balsam mounts were prepared by Brasier, following similar procedures to that of Carpenter. Only time will tell if these slides will deteriorate in a similar manner. Selection of a suitable slide mounting media reveals conflicting interests and objectives of the curator / conservator / micropalaeontologist. Non-permanent, reversible processes are favoured by curators. Palynologists may opt for high quality glycerol mounts, enabling later removal of material for SEM observation (Collinson 1987), cleaning and re-mounting (Maybury *et al.* 1991). However, diatom worker's main criteria is for a suitable high resolution mountant to aid light microscopy. A suitable permanent mountant, successfully used, is the toluene-based "Naphrax" (Hinchey and Green 1994).

Long term preservation of Canada balsam mounts can be greatly enhanced by careful preparation in the first instance. In preparing these slides try and use "fresh" Canada balsam, *i.e.* filtered, low viscosity. When transferring from the pot to slide, avoid contact of the glass rod with the warmed slide, *i.e.* transferring latent heat back to un-cooked balsam, thus reducing its shelf life. Do not overcook the slide, ensure a hot-plate temperature of 115-120°C (remembering hot plate edges will be cooler than the centre). Cooked balsam becomes brittle when drawn out in a thread using a mounted needle. Overcooked Canada balsam exhibits a yellow colour.

Micropalaeontological faunal cell slide specimen dissolution

Further problems with micropalaeontological residues can be illustrated with foraminiferal material from tropical and sub-tropical faunas of Henderson Island (Pacific Ocean), and South Florida (Figure 7, Spencer 1989). White patches surrounding tests on slides can be seen in both examples. Closer specimen examination reveals test decay by dissolution. Possible explanations for this include insufficient washing of the residue after cleaning with deflocculant or oxidant, and picking material with a damp "OO" paint brush using tap water instead of filtered distilled/deionised water (too acidic / alkali over long periods of time). A further source of dissolution can be initiated by the storing of residues in a preservative such as formaldehyde in which the pH becomes unstable (Bé and Anderson 1976). Residues stored in this manner should be periodically monitored, and thoroughly washed prior to picking.

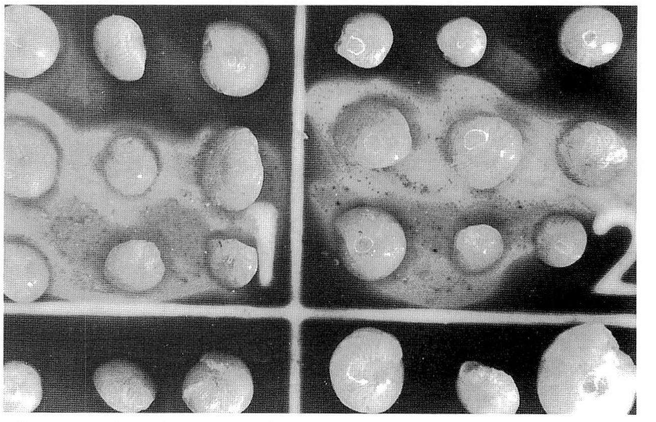

Figure 7. *Amphistegina lessonii* (foraminifera) assemblage from Henderson Island illustrating partial specimen dissolution. [HI 89/3].

If distilled water is stored for long periods of time it is advisable to check its pH to ensure quality is maintained. This may provide one possible explanation why the long term storage of calcareous nannofossil residues in permanent fluid filled phials has proved so difficult (Taylor and Hamilton 1982). Indeed, debate surrounds the entire question of pH values, and how critical they are in the preparation of chemicals / solutions required for storage, transportation and processing of material (Maybury and Ap Gwynn 1993). The effects of pH changes are dependent upon primary biomineralization and shell chemistry of the microfossil group studied, and hence values within the range 8.2 to 9.4 have been suggested (*e.g.* Hay 1977, Lewin 1961, Maybury and Ap Gwynn 1993, Pfannkuche and Thiel 1988, Taylor and Hamilton 1982). What becomes evident, is that constant monitoring of the preservative, and its immediate replacement when a change in pH is recorded, must be routinely undertaken. The damage to material illustrated in this study cannot be reversed, although washing in clean deionised distilled water has arrested further decay.

Fungal growth and salt deposits

Most commercially available micropalaeontological cavity slides are pre-coated with a layer of water soluble glue, ensuring that when a microfossil is transferred to the slide it remains orientated when dry. In reality, additional glue is required. When applied it should be diluted with distilled water to which is added a few drops of formalin. This ensures that fungal growth is reduced, a feature evident in some slides prepared many years ago, where hyphae form a fine matted fibrous covering over specimens (Figure 8). Care must however, be taken with the amount added, as formaldehyde will dissolve calcareous tests, and with Recent material may induce the liberation of fatty acids to further reduce pH (Bé and Anderson 1976). Preservative added to the mounting media must be

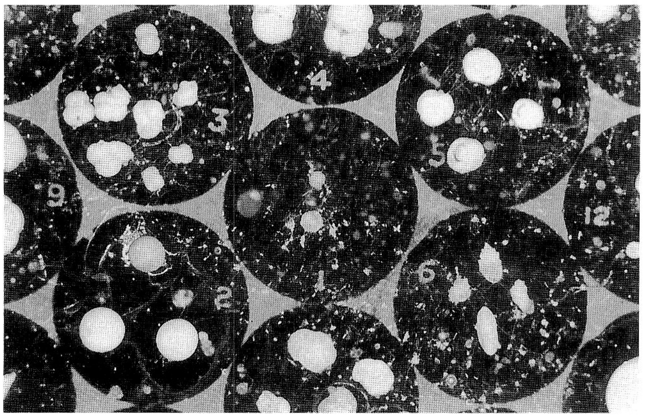

Figure 8. Fungal contamination on a slide prepared by Charles Elcock. Low power (x180) view of the cobweb-like hyphae forming a tangled mass of fungal growth between the foraminiferal tests. The pale, circular out-of-focus areas are colonies situated on the under surface of the cover slip. [MPT IB6].

sufficient to prevent fungal growth, but dilute enough not to effect the calcareous tests. Constantly monitor the mixture prior to use ensuring a stable pH 8.

In addition to partial specimen dissolution described above, the use of non-deionised water may result in fine transparent "salt" crystals growing on the specimen (Maybury and Ap Gwynn 1993). These crystals can be removed by washing specimens with distilled water using a "OO" sable hair paint brush. However, if crystals form within the chambers of the foraminiferal test, they can result in permanent specimen damage.

Slide and Residue storage

Thin sections and palynological slides should preferably be stored flat, coverslips upper-most in slide cabinets with doors to restrict dust settling on slide surfaces. Permanent epoxy mounted slides can be stored vertically in cabinets or individually in card envelopes. The storage of all type and figured palynological material should be adequately recorded (using finder slides if necessary), so it can be located when required for further work. Remember that not all microscope stages are adapted to use finder slide co-ordinates, and that all x-y stages may not zero to the same point with the finder slide.

Dried processed residues are best stored in labelled glass or plastic phials. Some workers store material in poly-grip plastic bags, but these are liable to split along seams, particularly at corners, or go brittle with time. Small glass phials are adequate, but they must be stored correctly to avoid crushing. Palynological material can also be stored in this type of container, although some workers prefer polythene bottles or tubes.

Similarly "live" or stained material should be stored in bottles or phials in alcohol, glycerol or occasionally formalin, (although care must be employed in storing processed residues in flammable liquids in quantity). Material stored in distilled water should have a few drops of thymol or phenol added to reduce algal and fungal growth (Batten and Morrison 1983). Bottles must be sealed tight, often with additional tape to avoid evaporation or loss of solution. In the unfortunate likelihood of this happening, a strong bond between the lid and the phial may result in unavoidably breaking it. Material which has become dehydrated will be difficult to recover, although the reintroduction of a preservative may, in some cases, revive material (see Lincoln and Sheals 1979 for details of solutions recommended). Monitor material, transferring if the container becomes damaged, and replace lost fluid. In the latter case, record details of any changes in preservative used - it may be critical if material is required for further analytical work.

SEM and TEM stubs and grids

Shelf life of SEM stubs and TEM grids is generally unknown, although the problems have been touched on by authors (*e.g.* Collinson 1987). Ideally the life of stubs can be prolonged by careful storage within desiccator cabinets containing trays of silica gel. By ensuring the silica gel is kept fresh, gold coated material may be kept for many years. The mounting media, usually double sided tape is likely to degenerate before the specimen (Chapman 1985). Foraminiferans can be removed from stubs and returned to their original cavity slides for long term storage. TEM grid storage is less well documented, although extreme care should be employed in handling them during preparation (Hayat 1989).

Photographs

Images of type material may best be stored as photographic negatives, or standard illustrations (Chapman 1985, Collinson 1987), a procedure advocated by Lord (1982) for recording calcareous nannofossil specimen type equivalents. However, care must be taken to ensure films are correctly processed and that resin coated paper prints are correctly "fixed" and washed. Incorrect storage of prints and negatives, in areas of bright light, excessive temperatures and humidity and dusty environments will result in a marked deterioration, and a shelf life of less than 50 years (Chapman 1985). Many of these problems may be overcome by the advent of electronic optical storage and retrieval systems, although for many, equipment costs prohibit this approach, while the continued technological advances within this field question the hasty investment in a system which may have a shorter life expectancy than a badly stored photographic print.

Conclusions

1. Employ "good laboratory practice" - know the limitations of your material and the procedures you employ. Avoid multiple techniques / procedures in the laboratory simultaneously - reduce risks of cross-sample contamination by knowing which samples have recently been processed.

2. Obtain the maximum amount of data with specimens from the collector or person who will subsequently analyse the material. Note how they were packed, and which preservatives (if any) have been used to stabilise recent material. Cross-reference all sub-samples and slides to original sources (sample, core, note-book), but store appropriately (slides, residues, hand-specimens).

3. Record all processes used during extraction/cleaning of material, percentages and concentrations of chemicals used. Check for possible interactions between chemical / chemical and chemical / specimen. Always use clean, fresh, distilled water and the best quality Analytical Grade chemicals. General Purpose Reagents may contain impurities which result in organism deterioration.

4. Photographic procedures do not yet provide a "maintenance free" storage system, and like prepared slides, must be correctly stored and conditions periodically monitored.

5. Be the "expert". Professional preparators may become more intimate with samples and specimens than the collector, and appreciate preservational problems and modifications to a greater degree. The knowledge gained by the preparator/conservator/curator during this stage should not be lost when material is returned to collector or sent on for further analytical work.

Acknowledgements

I thank Dr M. D. Brasier for discussion and comment on the content of this paper, and for use of the *Discospirina* material. Thanks also to Eric Milsom for the invitation to speak at the 2nd Symposium for Palaeontological Preparators and Conservators at Cambridge, where this paper was initially presented. Additional improvements to an earlier draft of the text were welcome from a reviewer and Dr Patrick Wyse Jackson.

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ON THE TRAIL OF THE J.H. VIVIAN COLLECTION

by Wendy L. Kirk

Kirk, W.L. 1995. On the trail of the J.H. Vivian Collection. *The Geological Curator* 6(4): 167-170.

John Henry Vivian (1785-1855) after whom the mineral vivianite $(Fe_3PO_4)_2.8H_2O$ was named donated geological material to the University of London (later University College, London) in 1829. It was not unpacked or curated until 1841, consequent upon the appointment of the first Professor of Geology. Although there were over 800 specimens, with two German catalogues, neither specimens nor catalogues have been located in the current University College holdings.

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The mineral vivianite $(Fe_3PO_4)_2.8H_2O$ was named after the English mineralogist John Henry Vivian (1785-1855) (Embrey, 1994) rather than J.G. Vivian, as is quoted elsewhere. The name was first published by the German geologist Abraham Werner in 1817, and referred to a specimen collected in Cornwall. Peter Embrey has been recently attempting to trace a cabinet of minerals allegedly given by Vivian to University College, London (UCL) (Griffiths, 1988).

Correspondence in the College archives confirms that the material was received at UCL, but unfortunately even if it is still at University College it is no longer distinguishable. It is of additional interest because it turns out to be the earliest donation of geological material to the University, at least of any size.

We know this because the following letters show that the College had received upwards of 800 specimens from J.H. Vivian in 1829, a year after it had opened. It is curious that there is no record of the donation either in the annual reports or the Council Minutes for that date.

The letter from Vivian offering the material appears to be addressed to J. Horner. This is almost certainly L. (Leonard) Horner (1785-1864), who was then Warden of the University. In fact, Vivian and Horner had been acquainted through the Geological Society of London for over twenty years, Vivian being an honorary member in the year that it formed (1807) and Horner an ordinary member the following year.[1]

Cullompton 18 Sept 1829

Dear Sir,

I had the satisfaction before I left Home of packing up the two Collections of Minerals which I had the honor of offering for the acceptance of the London University. The one is a Collection of Rocks, consisting of between 4 & 500 specimens formed at Freyburg, the other consists of about the same number of specimens [classified after] "Werner's" System or I should perhaps rather say Methodical [Arrangement] of the External Characters of Minerals. Many of these specimens were collected by myself and the whole was completed at Freyburg under the direction of the good Old Bergrath [Werner].

Should these Collections be of any use in forwarding the Objects you [have in view], it will afford me the highest satisfaction

I remain

Dear Sir

Faithfully yours

J.H.Vivian

I write in haste being on the point of embarking for France where I purpose remaining about six weeks & shall —— return thru London to Wales.

A second letter indicates that the material was sent soon afterwards to the College.

Fresh Wharf

8th October 1829

Sir

Mr. Vivian of Swansea has directed me to send you 2 boxes of Minerals etc. for the London University.

I am Sir

Your ....

Peter Touray

[note on letter:] acknowld 8 Oct.

Leonard Horner was away from London during the autumn of 1829, possibly at the time the material was dispatched. He was involved in quarrels with his contemporaries during this period, and resigned in March 1831. If it was indeed him to whom the material were sent, it is not clear what happened to it at this point, although he donated a series of geological and mineralogical specimens (probably his own) to the College in August 1831.

At the time the material was sent, the chair of Mineralogy and Geology was vacant. Indeed, it was vacant from the time the University of London (later University College London) opened in 1828 until Thomas Webster[2] was appointed Professor of Geology (only) in 1841. Although space was initially allocated for a Museum of Botany, Geology and Mineralogy, it was rapidly used for other purposes. For part of this period, a few lectures on mineralogy and geology were given annually by Edward Turner (Professor of Chemistry). Other lectures on palaeontology were given by Robert Grant (Professor of Zoology), and on palaeobotany by John Lindley (Professor of Botany). John Phillips delivered a systematic geology course of twelve lectures in 1830 - 1831, but subsequently declined the chair. Turner and

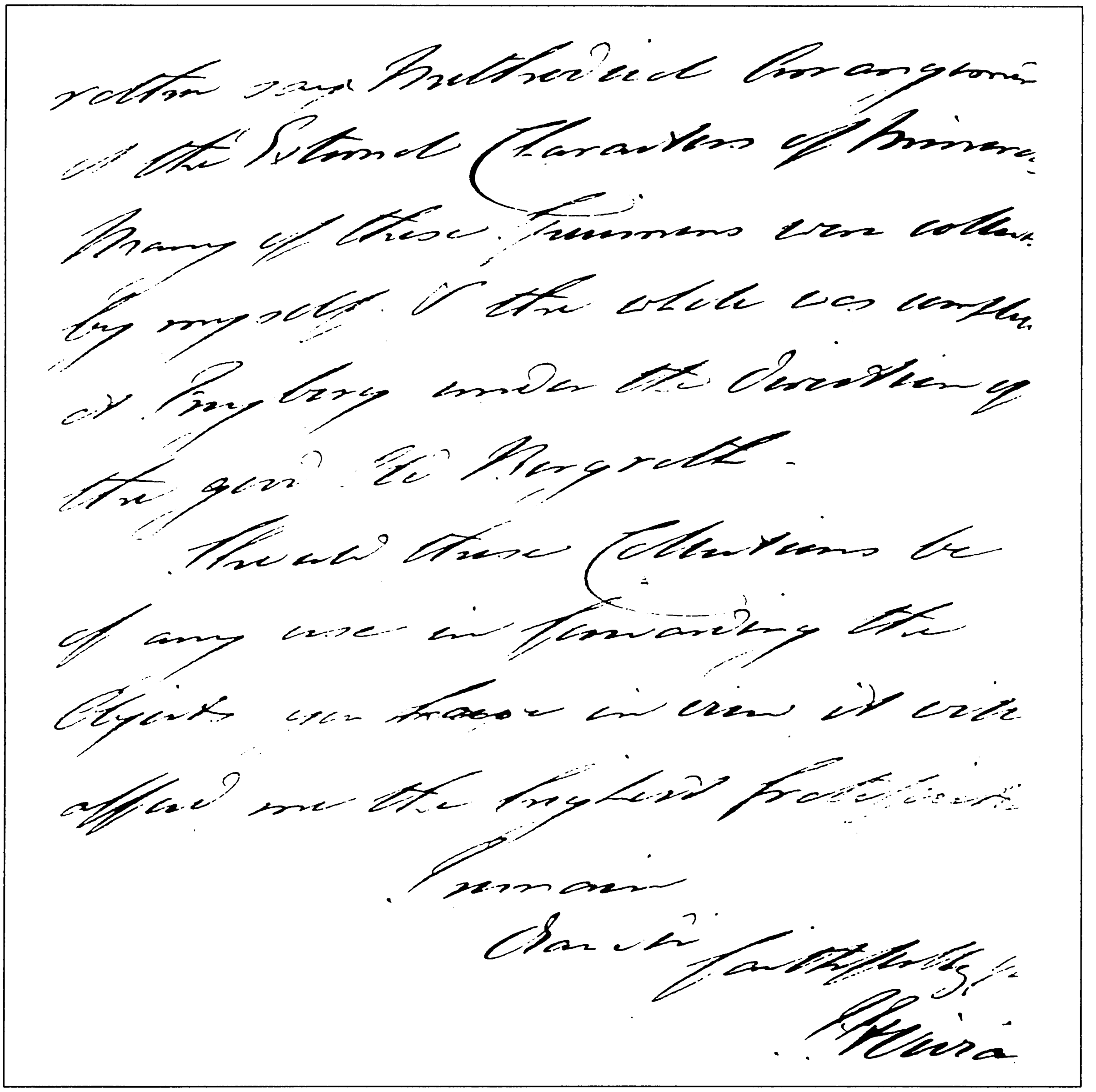
[illegible] Mineral Arrangement
of the External Characters of Minerals
Many of these specimens were collected
by myself & the whole was [illegible]
at [illegible] under the direction of
the [illegible]
Should these Collections be
of any use in forwarding the
Objects we have in view it will
afford me the highest gratification
I remain
Dear Sir faithfully [illegible]
[illegible]

Figure 1. Extract of a letter from Vivian to Horner, dated 18th September 1829, including Vivian's signature

Grant had their own collections which they used for practical demonstrations.

There is no mention of the Vivian specimens until Webster had accepted the chair, and was looking for material with which to illustrate his lectures. Considering the problems that Webster was to have identifying the source of the material, it is ironic to realize, that he, too, must have known Vivian quite well. Webster had been another early member of the Geological Society, having been closely associated with it from 1809 when he joined until 1828. In 1812, he was appointed their first Keeper of the Museum and draughtsman to the society, on Horner's recommendation, a post which he held until 1826. He was also a member of Council from 1817 - 1828, and Secretary from 1819 - 1827. It seems, however, that his time at the Geological Society was not a happy one, with too much work to do, and an unhappy atmosphere (Moore *et al.*, 1991).

The following extract of a letter (dated 3rd November 1841) to Atkinson, the Secretary of the College Council, refers to specimens that must have been Vivian's, and suggests that they had lain unopened for the previous twelve years.

"*...I find that there are two German collections in the possession of the College, which will supply a good deal of what I want: and there are, besides, a number of specimens of various kinds totally unarranged, many of which require to be broken and trimmed before they can be of any use, but some of them are very good as materials. The two German collections, each consisting of upwards of 400 specimens, rocks and simple minerals, seem to be complete, and ought to be kept separate, for the present at least, because they are numbered, & have German catalogues. I have begun to unpack them, but find it useless to proceed until proper cabinets are provided to put them in...The first step to be taken, as it appears to me, is to procure proper Cabinets, the drawers in which the specimens are at present being totally unfit for geological purposes: and there are none for the German collections...*"

The College noted the inadequacy of the available storage, and duly authorized £30 to be spent on the provision of new drawers. Webster was obliged to postpone his lectures for some months due to ill-health. He corresponded with the Council again a year later. A letter of the 4th January 1843 suggests that his efforts to assemble the various specimens in College were frustrated; nor was he able to determine from the Council the donor of the German Collections.[3]

Sadly, this is the last reference to the Vivian Collection which has come to light. The two catalogues have not surfaced, and in spite of Vivian's quite distinctive handwriting, which can be seen in an extract from his letter (Figure 1), no specimens in the UCL collections have been positively identified as his.[4]

Notes

1. They must have remained in contact over many years. Horner was on the Council of the Geological Society from 1809-1814; 1828-1832; and 1837-1864. Vivian was on the Council between 1834 and 1836 (Woodward, 1807). Some years later, Horner wrote very animatedly to his wife about his stay with the Vivians at Singleton whilst on a British Association meeting at Swansea. He gave vivid descriptions of the house and beautiful conservatory, with extensive flower gardens. "Mrs. Vivian is a very pleasing person, and he is a hearty, sensible, well-informed man. They have a large family." (Lyell, 1890).

2. An article on Thomas Webster and his attempts to found a geology collection at UCL has been submitted to *Archives of Natural History* (Kirk, in press).

3. In fact, Webster had probably catalogued Vivian material earlier in his career as Keeper of the Museum at the Geological Society. I am indebted to Peter Embrey for drawing my attention to a specimen of vivianite from [Wheal Kind], St. Agnes Mine, Cornwall, B.M. 1911, 612, in the Natural History Museum, which was donated to the Geological Society by John Henry Vivian on April 2nd 1816. This was then transferred to the Natural History Museum in 1911. (See also Moore *et al.* 1991). The Geological Society number 9611 appears to be in Webster's handwriting.

4. Clues to the provenance of the material might come from an outline of his travels prior to 1829. The following information is derived mainly from Embrey (1994). At the age of sixteen, J.H. Vivian left Truro in Cornwall for Germany, to study languages and business methods. In 1803 he enrolled at the Freiburg Mining Academy in Saxony, studying under Werner, and he subsequently toured mining regions in Austria, Hungary and Germany before returning to Cornwall. He soon became involved in his father's copper smelting business, and became a managing partner for a smelter set up in Hafod, north of Swansea, in 1810. In 1815 he visited Elba, and then went again to Freiburg where he probably donated the specimens of vivianite to Werner. These may have come from Wheal Kind, St. Agnes, or even (but less probably) from Wheal Jane near Truro. The Royal Geographical Society of Cornwall minutes of an 1817 meeting record that Vivian had promised to donate his "mineralogical collection formed at Freiburg immediately under the eyes of Werner" if certain conditions were fulfilled. This apparently did not happen, and it may be this material that was eventually sent to UCL.

Acknowledgements

I am grateful to Peter Embrey for drawing my attention to the existence of this collection, of which I was previously unaware. Information not otherwise acknowledged has been derived from correspondence in the Rare Books and Manuscripts Room of UCL Library, and from Council

Minutes, held in the Records Office of UCL. I thank Susan Stead and Gill Furlong, and Elizabeth Gibson and Carol Bowen respectively, for their help in tracking down the information. I am grateful to Cally Hall for showing me vivianite specimens at the Natural History Museum.

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FACT FILE

THE IRISH GIANT DEER OR "IRISH ELK"

by Nigel T. Monaghan

National Museum of Ireland, Kildare Street, Dublin 2, Ireland.

The Geological Curator 1995; 6(4): 171-173.

Introduction

The antlers of the late Pleistocene giant deer *Megaloceros giganteus* (Blumenbach 1799) adorn the walls of many a stately home throughout Ireland and Britain. They are also widespread in museum collections, having attracted attention for centuries as the largest antlers of any animal, living or extinct. One example is documented back to about 1588 when Adam Loftus of Rathfarnham Castle in south County Dublin made a drawing (now preserved in the National Museum of Ireland NMING : GLM26) of a specimen sent by him to Sir Henry Cecil, Chancellor to Queen Elizabeth I. The antlers have survived and are on exhibition in the Provincial Museum of Edmonton, Alberta, Canada (P. Doughty pers. comm. 1990).

Elk or deer - what's in a name?

Vernacular names can vary for many animals familiar to the general public and the giant deer is no exception. The term 'elk' however has a distinct history dating to the late seventeenth century. The first scientific description of fossil deer with large palmated antlers from Ireland was by Thomas Molyneux (1697) who argued that the "extinct" giant deer was in fact the same as the American moose. His limited knowledge of the moose allowed him to satisfy his religious conviction that none of God's creatures could become extinct. The moose is the same species as the European elk *Alces alces* of Linnaeus, which as deer go, is only the most distant of relatives. The scientific name of the Irish giant deer has also been somewhat variable leading to a specific ruling (Opinion 1566) by the International Commission on Zoological Nomenclature to enshrine the binomen as *Megaloceros giganteus* (Blumenbach 1799). Related species of *Megaloceros* and *Megaceroides* are found in the Forest Bed of Norfolk (Azzaroli 1994) and the nearest living relative is generally agreed to be the fallow deer *Dama dama*.

Where are they found?

Giant deer of the species *Megaloceros giganteus* are common fossils in Ireland and many have been found in various parts of Europe and Western Asia. Distribution records for Ireland have been published in the past (Mitchell and Parkes 1949) and these together with more recent examples contribute over 400 localities to the National Museum of Ireland database REQUIEM (REcords of QUaternary Irish Mammals). A few are from caves but most are recorded as coming from "bogs". These fossils are in fact from lacustrine deposits beneath the peat levels which consist of grey marls. The marls are treacherous when fully water-saturated, making fieldwork exciting to say the least. The suggestion that many giant deer males met their deaths through miring in lake muds is convincing for some examples seen by the author. Barnosky has studied one particular deposit where this model does not appear to be as convincing. The deposit in question, at Ballybetagh, County Dublin (Figure 2), has yielded an accumulation of about one hundred deer, all males

Figure 1. Skeleton of male Irish Giant Deer (TCD.17378) with Professor Frank Mitchell standing beneath (from Mitchell 1977)

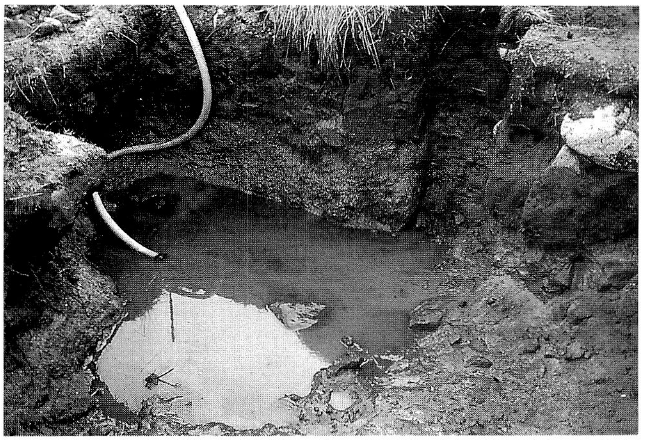

Figure 2. Excavation at Ballybetagh, Co. Dublin, Ireland. The grey marl from which the giant deer remains are recovered is at the base of the pit and overlain by 5 feet of peat. (Photograph: Patrick Wyse Jackson)

(Barnosky 1985). This he attributes to annual deaths during overwintering of undernourished males living in bachelor herds physically drained by the autumn rut. The giant deer from lake deposits date mostly in the range 11,700-10,900 BP but those from Irish caves go back to some 32,000 BP (Woodman and Monaghan 1993) and sites in Norfolk take the record of this species back to 450,000 BP (see Lister 1994). The overwhelming majority of museum examples are males. This is not only an acquisition bias by collectors but a reflection of the rarity of females in Irish deposits.

What were the antlers for?

Antlers, in all living deer apart from reindeer, are found only on the males. In Irish giant deer the antlers can measure almost four metres along the curvature representing a significant investment in bone tissue. Up to 35kg of bone material could be grown and shed in a single year by a mature male but it is worth bearing in mind that females also invest similar resources in the developing foetus and in milk production. Antlers are highly variable as illustrated in the classic anatomical monograph by Reynolds (1929) but all have areas of "palm" which are flat in addition to pointed "tines" which project from the upper edge of the palm area. Some authors (Gould 1987) have suggested that the antlers were display structures, and certainly most antlers in living deer include this function. A convincing argument has been presented by Kitchener (1987) for a fighting function, based on the architecture of the tines, with some protecting the eyes, while others are oriented for gouging the opponent. This he supported with a study of the antler mechanical structure suggesting an engineering strength oriented to withstand combat stresses.

How did they become extinct?

The variety of explanations for the extinction of the Irish giant deer rivals that for the dinosaurs. Pre-dating the recognition of dinosaurs by a considerable period,

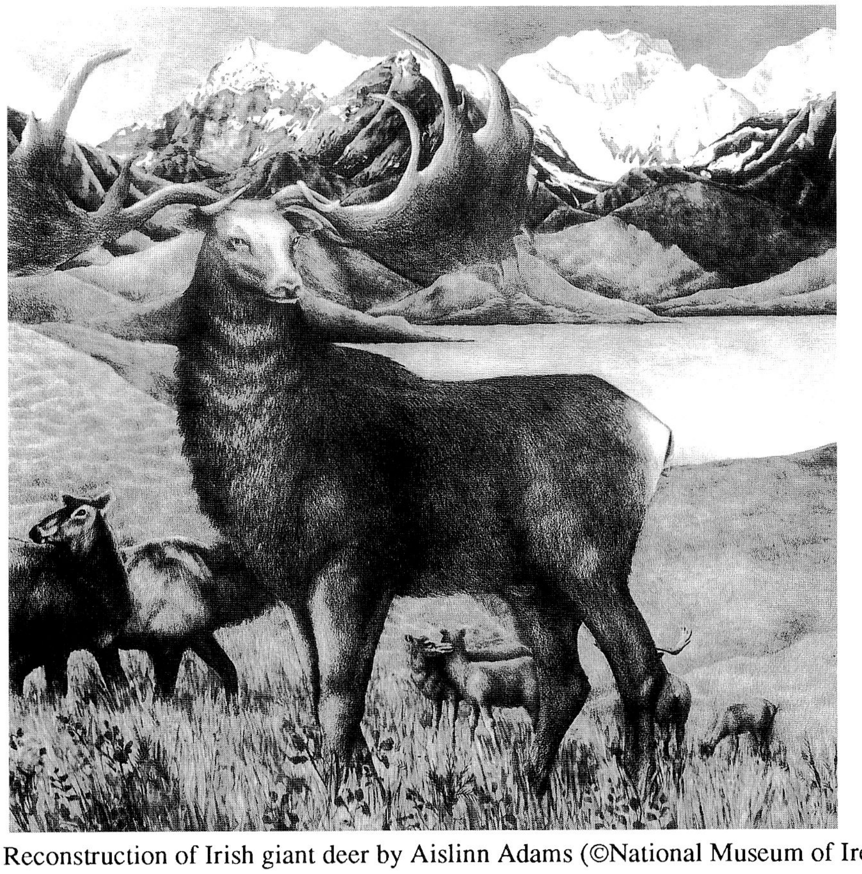

Figure 3. Reconstruction of Irish giant deer by Aislinn Adams (©National Museum of Ireland).

Pleistocene mammals have long attracted the interest of the scientific and not so scientific mind. The dozen or so explanations put forward range from Noah's flood, extermination by Celtic tribes (the deer extinction came 2,000 years before humans settled Ireland) or the Romans (who never invaded Ireland at all), disease, tangling antlers in woodland (they inhabited grassland) or a rush of blood to the head when the velvet was shed causing apoplexy! Another more plausible theory came from anti-Darwinists who used the Irish giant deer as an example of fatal over-specialisation. Their theory of orthogenesis suggests that evolutionary trends cannot be stopped, even if they are harmful to the species concerned. A giant deer's large antlers evolved to attract females, bigger antlers meant more male offspring with big antlers, leading to a vicious circle ending with an animal that evolved to become overburdened by the evolutionary millstone around its neck. Gould (1974) measured dozens of antlers to test the Darwinists' opposing theory of allometry which stated that antlers increased faster than body size as a natural course of development to be seen in any deer during the life cycle of an individual. He concluded that antlers were related to body size in this way, with those of the giant deer appearing so large only because its body size was also the greatest for comparable deer. Barnosky studied the late Pleistocene vegetational history of Ireland and developed the currently accepted theory that giant deer became extinct due to deterioration of climate 10,500 years ago. This led to the collapse of the long spring season of growth of grasses and other plants which had allowed them to build up their body reserves for the rest of the year (Barnosky 1986).

Museum collections

Notable collections of giant deer are held in the Natural History Museum, London and in the Ulster Museum, Belfast but the National Museum of Ireland has the largest collection of all. This is a legacy of 150 years of earlier collecting by institutions such as the Royal Dublin Society and the Royal Irish Academy (where Oscar Wilde's father was the curator). The collection now totals ten skeletons of which three are mounted on display and remains of 250 animals of which only six are females. Many of the world's older museums acquired at least one skull and antler set for display in the last century, others have complete skeletons, although the likelihood of these being at least partly composite is high (see Reynolds 1929 for a list of museums). Rarity of genuine material today is a reflection of the automation of peat extraction which in the last century was largely by hand. Auction prices reflect this with the records standing at £20,000 for a skull and antler set (auction at Sotheby's, London in 1989) and £27,000 for a complete skeleton (auction in Somerset, England, 1992). The National Museum of Ireland now has replica skull and antler sets available on a commercial basis or for exchange with other museums.

Publications

Much of the following is but a small selection from an extensive literature summarised in Lister (1994).

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Acknowledgements

I am indebted to the following whose visits to the National Museum of Ireland's collections, and discussions have each brought insights into this remarkable species. Dr Tony Barnosky (Carnegie Museum, Pittsburgh), Dr Andrew Kitchener (National Museums of Scotland) and Dr Adrian Lister (University College London).

LOST & FOUND

Compiled by Patrick N. Wyse Jackson

Enquiries and information, please to Patrick Wyse Jackson (Department of Geology, Trinity College, Dublin 2, Ireland). Include full personal and institutional names and addresses, full biographical details of publications mentioned, and credits for any illustrations submitted.

The index to 'Lost and Found' Volumes 1-4 was published in *The Geological Curator* 5(2), 79-85. The index for Volume 5 is published in this issue, p. 175-177.

Abbreviations:

CLEEVELY - Cleevely, R.J. 1983. *World palaeontological collections.* British Museum (Natural History) and Mansell Publishing Company, London.

GCG - *Newsletter of the Geological Curators' Group*, continued as *The Geological Curator.*

LF - 'Lost and Found' reference number in GCG.

235 James Frederick Jackson - British Association Photographs

See also GCG, 5(4), 158; 5(6), 230.

Graham McKenna (Chief Librarian and Archivist, British Geological Survey, Kingsley Dunham Centre, Keyworth, Nottingham NG12 5GG, U.K.) writes:

In *The Geological Curator* 5(9), the article by Stephen Howe on James Frederick Jackson refers (p. 349) to photographs of Hampshire and the Isle of Wight taken by Jackson in 1924-25. The article gives the impression that the photos donated to the British Association for the Advancement of Science were lost in the air raid on Bristol in 1940.

Without a list of the photos cited by Stephen Howe, it is not possible to identify which, if any, may have been lost, but readers of *The Geological Curator* may wish to know that the collection of geological photos of the British Association for the Advancement of Science now housed at the British Geological Survey Library at Keyworth does include some 130 prints of Hampshire and the Isle of Wight. These are listed as being donated by Miss C. Morey. A quick check of the Dorset and Devon sets turned up 57 and 6 prints respectively.

Stephen Howe is correct in stating that the plates and negatives for the collection were lost in Bristol but recent experience has shown that in most instances acceptable copies can be made from the prints. Some of these have been displayed at recent British Association for the Advancement of Science Annual Conferences.

Any one interested in following up the Jackson material should contact Graham McKenna at the address above.

236 "*Michelinia*" *balladoolensis* from the Lower Carboniferous of the British Isles.

Patrick N. Wyse Jackson (address above) writes:

"Michelinia" balladoolensis, originally described as a tabulate coral by John Smith (1911, *Trans. Geol. Soc. Glasgow* **14**, 148) from the Lower Carboniferous of the Isle of Man, is an unusual fossil with a distinctive morphology. Restudy of the type specimens, together with material from the Hotwells Limestone, the Asbian of Armagh, and newly collected specimens from the Bee Low Limestones of Derbyshire, demonstrates that *M. balladoolensis* is a cystoporate bryozoan provisionally referable to *Meekoporella.*

Colonies of *Meekoporella balladoolensis* are small inverted pyramids 3 x 3 cm, open-ended and typically five-sided. 4-7 pyramids may be clustered around crinoid stems. Autozooecia are confined to strips 3mm wide and divided by narrow barren areas (Figure 1).

I would be interested to know of any specimens in museum collections, perhaps catalogued under *Michelinia* or *Prismopora* (a cystoporate bryozoan).

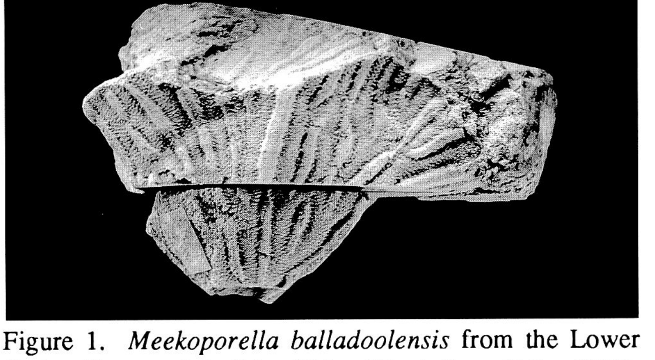

Figure 1. *Meekoporella balladoolensis* from the Lower Carboniferous of the Isle of Man [Geol. Surv. Edin. 5055].

LOST & FOUND - INDEX TO VOLUME 5

Compiled by Patrick N. Wyse Jackson

An index to the entries in 'Lost and Found' contained in Volumes 1 to 4 of *The Geological Curator* and its predecessor *Newsletter of the Geological Curators' Group* can be found in *The Geological Curator* 5(2), 79-85. This present index contains those entries in Volume 5 which are both new (196-232) and which relate to items that first appeared in previous volumes. Readers are referred to the earlier index for additional references to the latter.

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BOOK REVIEWS

Liston, D. (ed.). 1993. *Museum Security and Protection: A handbook for cultural heritage institutions.* Routledge, xiii + 319 pp. ISBN 0 415 07509 2. Paperback. Price: £20-00.

This book prepared by the International Committee of Museum Security follows on from 'A manual for Basic Museum Security' (Burke, R. and Adeloye, S. 1985. ICOM). In an ever-changing field this book attempts an all encompassing approach to museum security and protection presenting a state of the art approach to the field and technology as well as trying to present more practical actions which can be undertaken to improve museum security and protection.

As always start with a criticism. Not being one of the world's greatest book readers my first problem was actually getting into the book. It describes itself as a practical guide with action plans. The small type face and badly thought out layout of the book means that it is not as 'usable' as it should be. Reading 'natural sciences', in the first chapter, I thought augured well, but of course I was soon to be disappointed as, thereafter they only refer to cultural objects. Are geological objects cultural objects? As one would expect I turned to look at all things relating to conservation. Here I found several inaccurate statements such as: "gemstones have excellent resistance to light". In fact most comments on specimen stability relate to Cultural Objects on Paper and Organics not inorganic geological materials and are thus to be ignored by your average geological curator.

Throughout the book initial and on-going training of museum staff is recommended, a statement which I can only endorse. One group singled out for training in all areas of collection protection and security is the often neglected group, the museum attendants.

Generally the book contains useful information. This is however badly presented as the text reads as the jottings of random thoughts as they came into the particular contributor's head. More useful are the practical action lists, which give step by step guides to developing policies and actions. On reading the text however I did wonder about the contributors (lack of) practical awareness of the field they are trying to cover. The book is not particularly readable, but as a book to dip into for information on establishing policy documents for museums it is useful.

Three useful themes the book repeats are: 1. Security is everyones business. 2. Consistent level of adequate care. 3. A reasonable ability to survive an emergency or disaster.

The book introduces us to such people as protection managers, institutional managers, and cultural protection managers who develop the security and protection policies that the book is writing about and it is these people that the book is written for. This reflects the books ICOM and Smithsonian roots. The book throughout, makes the point that these managers should be designated to underlake the development of procedures and policies in institutions and that these people should be given the appropriate levels of responsibility and back up, something which most museums forget.

Everything is discussed in terms of managers and is as such fairly impersonal. In particular the book down grades the role of the museum conservator (I am of course biased), from somebody who has overall interest in the conservation (both remedial and preventive) of museum objects playing a role in a museum team, to someone who has a specific remedial conservation role and is there solely for this purpose. This attitude towards management I cannot agree with.

Overall my impressions were that the book was mainly written with large National Institutions in mind. Most sections were interesting though not directly aimed at the natural sciences. There was some factually incorrect information in the book and I found its layout poor. For those higher up the management scale developing security and protection policy, the book does provide useful action lists for guidance. As one of those people delegated to do this work, I did not think the information was well structured or thought through. Information in the book should have been more thoroughly researched.

The information in the book (for geology) is available in more usable forms elsewhere in UK specific applications, 'Guidelines for the curation of Geological Materials", (Brunton *et al.*, 1985. Geological Society Miscellaneous Paper No. 17.), 'Geology for the Local Museum' (Knell, S. and Taylor, M. 1990. HMSO), 'The Museum Environment', (Thomson, G. 1986. Butterworths), and 'Standards for the care of geological collections, (MGC, 1992), all easier to read.

Let me just leave you with a few pearls of wisdom from the book

'The protection manger is an educated, responsible, rational person who plans common understanding measures to protect an Institution, its staff and visitors'.

'Protection managers make all members of staff aware that they are working in a high risk institution.'

'Institution managers require a daily cleaning and dusting of exposed collections to remove any accumulation'.

'Every Institution with a cultural collection hires a conservator on staff or has direct and immediate access to one'. SEMS take note!

All museum workers are from now on to be known as managers. But does this mean I have to wear a (grey) suit to work.

An interesting book with some interesting points and action lists mainly for non-geological objects, but some mistakes too. I prefer the simplicity of the books mentioned above plus, and in particular the Canadian Conservation Institute's 'A systematic approach to conservation (care) of museum collections' (Michalski, S. 1992. CCI).

Chris Collins, Geological Conservation Unit, Dept. of Earth Sciences, University of Cambridge, Cambridge, U.K. 9th August 1994.

van Rose, S. and Bonson, R. 1994. *The Earth Atlas.* Dorling Kindersley, London, 64 pp. ISBN 0 7513 5211. Hardback. Price: £12-00.

Yet another children's geology book rolls out from Dorling Kindersley, this time in the large format of the publisher's Atlas series (which already includes *The Great Dinosaur Atlas* by William Lindsay). The same high standards of illustration are maintained, but this time the majority of the pictures are maps and cutaway block diagrams by Richard Bonson.

The book contains 30 chapters, each a double page. The first is entitled "Putting the Earth in a book", which explains how the main chapters are laid out and how the block diagrams were constructed. This is particularly useful as in some cases the diagrams can be a bit hard to follow. The next eleven chapters deal with the early Earth, continental drift, plate tectonics, volcanoes, earthquakes and mountain building. These are followed by chapters covering erosion, the variety of landscape, rivers, coastlines, underground drainage, polar regions, ice, deserts and soils, but amongst these topics are chapters dealing with the formation of the Pyrenees and the ocean floor which seemed a wee bit out of place.

The book concludes with a chapter on "Earth's ingredients", covering the formation of the solar system and the chemistry of the Earth, chapters on igneous, sedimentary, and metamorphic rocks, and a final chapter on the age of the Earth.

Most double-page spreads contain a big, dramatic block diagram. I especially liked one showing the 1980 eruption of Mount St Helens, with cutaways showing the interior of the volcano at the moment of eruption, and a diagram of a valley glacier extending from an ice sheets. Block diagrams of glaciers are ten-a-penny, but this is by far the best I have seen. One thing I did find disappointing, though, was that because the diagrams span both pages, the fold into the hinge spoilt some superb illustrations. That aside, they are the sort of graphics which you would dearly love to have in your exhibition, but don't have the money for.

The text, too, is structured in the usual way, each section beginning with a paragraph of large print as an introduction, and smaller, more detailed captions for the illustrations, both drawings and photographs, which surround the main block diagram.

This book, like all of Dorling Kindersley's, is visually extremely attractive. There is no better introduction to geology than through these spectacular illustrations. Congratulations once again to Dorling Kindersley and especially to Susanna van Rose and Richard Bonson for another fine addition to the young person's geology library.

Tom Sharpe, Department of Geology, National Museum of Wales, Cathays Park, Cardiff Cf1 3NP, Wales, U.K. 12th March 1995.

Keillar, I. and Smith, J.S. (eds.) 1995. *George Gordon: man of science.* Centre for Scottish Studies, University of Aberdeen, Aberdeen, ix + 183 pp. ISBN 0 90265 14 2. Paperback. Price: £12-50 (incl. postage and packing from The Centre for Scottish Studies, Old Brewery, The University of Aberdeen, King's College, Old Aberdeen AB9 2UB, U.K.).

George Gordon 1801-1893), minister (i.e. the Kirk of Scotland's equivalent of a Church of England vicar) of Birnie, near Elgin, Morayshire, was one of those almost unsung heroes of nineteenth century natural science, working diligently away in their own territory feeding specimens and other data to the metropolitan scientists. Indeed, while one could hardly have more eminent metropolitan 'collaborators' than Gordon's, in the form of R.I. Murchison and T.H. Huxley, that's not to say that they didn't get it wrong and had to be corrected by Gordon, the man on the spot!

This book comprises the edited and expanded papers from the 1993 centenary conference 'to celebrate the life and work of George Gordon' held by the Moray Society which still runs the museum at Elgin established by Gordon and his friends. The level of expansion from the spoken paper varies, but the book remains - as was presumably intended -accessible to the lay person interested in local history or natural science, with good potted accounts of local geology by Sinclair Ross and current understanding of the local Permo-Triassic reptiles, including their evolutionary importance, by Mike Benton, to put their nineteenth century predecessors' work into context.

Most of this book is devoted to Gordon himself. Mike Benton analyses the scientific collaboration between Gordon and Huxley that led to the description of fossil beasties such as the eponymous rhynchosaur *Hyperodapedon ordoni*, Ian Keillar looks at Gordon's family life and genealogy, and Michael Collie considers George Gordon's role as a scientist, especially in botany and geology, and his activities within the largely amateur milieu of Victorian Scotland, for example in contributing specimens to Louis Agassiz' *Poissons du Vieux Grès Rouge*. Some overlap is perhaps inevitable when Benton and Collie pay especial attention, from slightly different perspectives, to Gordon's role in the long-running and crucial problem of the dating of the different fossiliferous sandstones. The apparent coexistence of 'primitive' Devonian armoured fishes and (comparatively) 'advanced' Triassic (as we now know) reptiles bore directly upon the question of the nature and direction of progress in life, and one which at different times involved Gideon Mantell and Richard Owen as well as Murchison and Huxley.

Kris Sangster places Elgin Museum firmly in its local and national context in the briefest chapter, obviously least expanded from the spoken paper. As well as giving a welcome account of Elgin Museum's foundation, her account reminds us how little we know generally of the history of Scotland's Victorian museums.

An unexpected but welcome inclusion is John A. Diemer's chapter on the geological work on the north side of the Moray Firth of one of Gordon's Kirk and geology colleagues, the Rev. James Joass. Joass was minister first of Edderton and then Golspie, where he was also librarian and curator of the natural history museum at Dunrobin Castle, the seat of the Duke of Sutherland. Amongst other things, he investigated the Sutherland oilfields and his conclusion, that large reserves were improbable, led the Duke to eschew placer-mining in favour of preserving the salmon!

To sum up, although fully referenced, *George Gordon: man of science* is not on the whole a primary research report - such work is in fact mostly published elsewhere, e.g. Collie (1991 and in prep.). But it's none the worse for that, given its (apparent) aim to help Moray people and visitors discover some of their local heritage on the museums and science side. A very useful introduction, well worth taking with Trewin *et al.* (1987, 1993) to find some of the sites mentioned) on your next trip to this delightful corner of the country.

References

Collie, M., 1991. *Huxley at work: with the scientific correspondence of T.H. Huxley and the Rev. Dr. George Gordon of Birnie. near Elgin.* Macmillan.

Trewin, N.H., Kneller, B.C. and Gillen, C., 1987. *Excursion guide to the geology of the Aberdeen area.* Scottish Academic Press.

Trewin, N.H. and Hurst, A. 1993. *Excursion guide to the geology of East Sutherland and Caithness.* Scottish Academic Press.

Michael Taylor. Departent of Geology, National Museum of Scotland. Chambers Street. Edinburgh EH1 IJF' Scotland. 3rd April 1995

Kemp, D., Kemp, L. and Ward, D.J. 1990. *An illustrated Guide to the British Middle Eocene Vertebrates.* Private publication (David Ward, Orpington), iv + 59 pp., 21 pls. Paperback. Price: £5-00.

The aim of this short book is to make the identification of Middle Eocene vertebrate fossils (Bracklesham and Elmore Members of the Barton Group in the Hampshire Basin) more accessible to collectors. Its usefulness is by no means confined to interested amateurs; it serves as a handy pictorial guide for the rapid initial identification of relevant fossils without the need for time-consuming recourse to primary literature for those unfamiliar with fossil vertebrates. It is a potentially valuable tool for both professional geologists and Museum staff.

The small format (21cm x 14cm) means that it is easily carried in the larger pockets of fieldwork clothing. The stiff card cover offers some protection, although "universal" binding might mean that its spine strength is limited if used in the field.

The text is authoritatively written and easily followed. A short introduction to the stratigraphy of the Hampshire Basin is followed by brief suggestions on collecting and recording fossils in the field.

The vertebrate fossils themselves are illustrated in well executed, clear line drawings spread through 21 plates. Major skeletal elements (teeth, tooth plates, rostral spines, vertebrae, jaws, otoliths, limb bones, fin rays and spines as appropriate) of sharks, rays, chimaeroids, bony fishes, reptiles birds and mammals are accurately identified and, where individual species are named, authors and dates given. Each illustration is identified by view, a magnification factor given and the stratigraphical range indicated. Summary tables of the ranges of all illustrated species are also given. A well chosen, but not exhaustive bibliography and glossary of terms is included.

A point of minor irritation is the plate by plate arrangement of the sharks teeth, which does not follow strict taxonomic groupings. For example, lamniforms are represented in plates 1 to 4, occasionally combined with heterodontiforms (plate 1) and hexanchiforms (plate 2) and then appearing again later in plate 9. The arrangement of the figures in each is nonethelss nicely balanced. Particularly useful is the fact that several variants of tooth morphology are often given for single species, reflecting the presence of heterodonty along the same jaw, in opposite jaws, and in different sexes as appropriate.

In conclusion, I can heartily recommend the volume to all those with an interest in, or the need to identify Middle Eocene vertebrate fossils. Copies can be obtained either from The Natural History Museum Bookshop, The Natural History Museum, Cromwell Road, London SW7 5BD, or directly from the publisher, David Ward, 209 Crofton Lane, Orpington, Kent BR6 OBL.

Chris Duffin, 146 Church Hill Road, Sutton, Surrey SM3 8NF, England. 6th April 1995.

Pearce, S.M. (ed.) 1994. *Interpreting Objects and Collections.* Routledge, London and New York, xii+343 pp. ISBN 0 415 11289 3. Paperback. Price: £19-99.

This book is one of six volumes making up the Leicester Readers in Museum Studies. Each volume is a collection of published papers covering different aspects of museum studies. As its title suggests the book is divided into two parts. Part 1 Interpreting Objects with 21 papers and Part 2 Interpreting Collections with 17 papers. The book is 343 pages long. There is an index at the back and references at the end of each paper.

It is the social and cultural meaning of objects and not their geological or scientific interpretation that concerns this book. It covers the field of material culture which is "the study of human social and environmental relationships through the evidence of peoples construction of their material world." Although this book is essentially a sociology text it does use several examples from geology and natural science. In her introduction Susan Pearce admits that, although most of the papers are written about man-made artefacts not natural material, she hopes there will soon be more writing to help us understand natural objects as culture.

Examples of natural history as culture include the description of the moon rock brought back by NASA which has been turned into material culture because, through its selection and display, it has become a part of the world of human values. This theme of the selection of natural history specimens, reflecting the culture they are collected in, runs through many of the papers in this book.

A collection of previously published papers in a series of affordable volumes is a good one. This book costs about half of the subsidised charge to receive these papers by interlibrary loan and one volume containing a range of papers is an easy introduction to a new subject.

Interpreting objects and collections is an academic treatment of an academic subject and as such will probably only be of interest to museum studies student and not a book I would expect to see on every geological curators shelf!

Mandy Edwards, Department of Geology, University of Manchester, Manchester M13 9PL, U.K. 9th May 1995.

Rose, C.L and de Torres A.R. (eds) 1992. *Storage of Natural History Collections: ideas and practical solutions.* Society for the Preservation of Natural History Collections, xvi + 346. pp ISBN 0 9635476 0 7. Wire-bound. Price: $30-00 (+ $6 surface postage). [Available from SPNHC, c/o Suzanne B. McLaren, 5800 Baum Boulevard, Pittsburgh, PA 15206-3706, U.S.A.]

Problems associated with storage of large collections, and the space which they take up, can be one of the main headaches faced by curators of geological museums. Many would readily admit that the facilities in their institution is not as good, as large, or as effective as they would wish. The solution for many would be to install a purpose-built system thus securing the collections into the next century.

On a smaller scale problems associated with particular types of collections can be equally difficult. What are the best means of storing skulls, SEM stubs, large flat objects, or birds nests? Rose and de Torres' excellent volume will tell you how. It illustrates how cheap storage containers can be made through the utilisation of inexpensive materials.

The book is not just concerned with containerisation of collection but also matters of documentation, and environmental control. It contains 113 articles, each two to four pages in length and clearly illustrated, an extensive glossary, and a listing of suppliers of materials mentioned in the text (the majority of these are American).

The book was produced by the Society for the Preservation of Natural History Collections, who together with the editors deserve many congratulations. It is a worthy and reasonably priced volume, which should be on the bookshelf of every curator.

Patrick N. Wyse Jackson, Department of Geology, Trinity College, Dublin 2, Ireland. 30th July 1995.

Ross, C. and Williams, M. 1994. *Clues from the Rocks.* Shell Education Service, 52 pp + 7 activity sheets. Paperback. Price: first pack is free to secondary school teachers giving their school address; subsequent copies £4-50. [Available from Shell Education Service (YM), PO Box 46, Newbury, Berkshire RG13 2YX, U.K.]

The package, which comes in the form of an A4 folder, is designed as a resource to support the teaching of an introduction to Earth Science, as required by the UK National Science Curriculum. Included is a teacher's information booklet of 52 pages, a summary of the National Curriculum requirements and individual sheets of data and exercises, designed for photo-copying.

Clear and well illustrated teacher's notes on mineral identification and use are backed up with a data table of 14 common minerals and an exercise in using a simple key. There is a similar approach to rock identification, but in this case the textural drawings in the teacher's notes are slightly unclear. The keying-out exercises need a good variety of hand specimens, and the necessary simplification introduces a slight degree of ambiguity in places.

The notes on weathering and fossils are tersely written, and accompanying diagrams are useful (e.g. formation of moulds and casts), although the diagram on uplift appears to presuppose such knowledge of tectonic processes as to make the explanation unnecessary, and the sketches of pollen grains and conodont elements are rather too sketchy. A clearly laid out, simple, interesting experiment on shell break-up provides good opportunities to look at scientific methods, data-handling and presentation of results as well as investigating preservation potential.

An introduction to folding and faulting, which includes an explanation of angular unconformities, is well-supported by diagrams, and linked to some simple exercises in deforming plasticene. The other structural geology exercise involves drawing out folds and faults from field photographs. This is a nice idea, but in practice requires a high-definition photocopier for some of the structures to be visible. Also the answer sheet for part C (folds) is inaccurate as an anticline on the left side of the photograph has been ignored. Plate tectonics is reviewed clearly and concisely, although once again I would gripe slightly about the sketchy style of the illustrations and clarity of labelling.

Two further activity sheets comprise a board game which is an oil orientated version of snakes and ladders, and an idea for a group role-playing exercise based on a planning meeting for a proposed quarry. Other topics covered in the teacher's booklet are fossil fuels and geothermal energy, and the environmental impact of mining, waste disposal and nuclear processing. Once again the information is clearly presented and backed up with examples and suggestions for further reading. There is a useful glossary in the teacher's handbook and a list of suitable books, leaflets and suppliers of wallcharts, videos, slides and hand specimens.

Clues From The Rocks doesn't set out to be anything other than a support package, and a fair amount of further reading and resource material would be necessary before entering the classroom. Given the terms of reference however, my only criticisms would centre around the quality of some of the diagrams. Taken as a whole this is a useful resource, with lucid and concise summary notes supported by some interesting ideas for activities.

Jeremy Stone, St Columba's College, Whitechurch, Dublin 16, Ireland. 11th July 1995.

Kavanagh, G. (ed.) 1994. *Museum provision and professionalism*. Leicester Readers in Museum Studies, Routledge, London and New York, 362 pp. ISBN 0 415 11280 X. Hardback. Price: £50-00; ISBN 0 415 11281 8. Paperback. Price: £19-99.

The volume, a substantial tome of 362 pages, is the sixth in the series of Leicester Readers. The *Series Preface* states '[they] bear a generic relationship to the modular arrangement of the Leicester Department of Museum Studies postgraduate course in Museum Studies, but, more fundamentally, they reflect current thinking about museums and their study.'

The volume is divided into seen sections which consider aspects of our profession and professionalism. The sections contain a total of forty-five papers some of which consist of several contributions from different authors. Following the house style established for this series, the Editor has selected them from a variety of sources including journals, and the publications of organisations such as UNESCO, the MGC, ICOM and the MA. The great and the good are well represented not least from the profession in the UK. In the words of the Editor, material was selected which was 'insightful and thought-provoking, or which in some ways summarises either a situation or a school of thought. Despite a publication date in 1994, there are several papers of mid-1993 vintage; the net was being cast up to the last moment.

Apart from a 12 page *Introduction* and brief 'programme notes' by the Editor preceding each paper, the book belongs to the individual contributors, be they visionaries (and their disciples), confronters, researchers and setters of standards.

Perhaps my only regret is that the balance is so heavily weighted toward UK publications; access to the *Museums Journal* and other MA publications would provide a substantial number of the papers. This is clearly a benefit to the North American market where this volume was simultaneously published. The Editor is aware of this and suggests that future volumes could redress the balance. I am sure that this would be worthwhile.

The first section sensibly, and perhaps provocatively depending on your point of view, offers wisdom on the definition of a museum. Sections that follow are titled, *Thinking about museums, Museums UK, the museums profession, Professionalism, Codes of ethical conduct* and *Institutional standards*.

Despite his imbalance, the volume's undoubted success for me lies in the concentration of informative and thought provoking articles in a single book. Amongst much else the reader cum browser will find: Barbara Woroncow's survival kit for the 1990s in which she recommends a 'chameleon strategy' for maintaining museums as 'public palaces for pleasure' rather than 'private places of profit'; a refreshing view of management style from Stephen Locke, and the Ray Pisney/Missouri Historical Society story (*Museum director as manager* by Charles Phillips) giving a challenging read (for that Society the right man was in 'the right place at the right time'); Public, university and independent museums are all touched upon in some way, along with equal opportunities, codes of ethical conduct from as early as 1925 and the present day, and how research and scholarship are not only compatible with, but essential to the health of museums. You can even compare levels of pay with our European counterparts.

Some papers are followed by references or notes but most are not. The Editor does provide a short list of references for further reading.

Over eight pages of an index rounds off this book and is very definitely an asset.

A good buy? Certainly the paperback at £19-99 is not unreasonable in this day and age, though the subscriber to recent issues of the *Museums Journal* who has read each one may feel rather cheated at so much duplication. However, for many this collection of papers will provide stimulating and important insights into our profession, whether seen from the inside or out. Congratulations to Gaynor Kavanagh on her selection.

P.C. Ensom, Yorkshire Museum, Museum Gardens, York YO1 2DR, U.K. 3rd August 1995.

O'Halloran, D., Green, C., Harley, M., Stanley, M. and Knill, J. (eds). 1994. *Geological and Landscape conservation*. Geological Society Publishing House, 544 pp. ISBN 1 897799 09 8. Hardback. Price £70-00.

Curators have always been at the forefront of geological conservation. Their role has perhaps been restricted in one sense by the museum ethos. However the scope and scale of geological conservation as a notion has grown up in recent years. If curators are to continue having a meaningful role as guardians of geological heritage, then they too must expand their horizons and seek to embrace new visions of what geological conservation means. This book is one which goes a long way in assisting the process of development.

The contributions to the Malvern International Conference, on Geological and Landscape Conservation, held in 1993, reflect the diversity and depth of ideas in the field with some 98 contributions by a total of 122 authors. They are separated into five themes of sustainability, landscape conservation, local conservation and community initiatives, site conservation and public awareness and a smaller fifth theme of international convention. Each of the other four are broken into smaller collections of papers, mostly commencing with a keynote address. Most contributions are quite short (less than 6 pages). This is generally sufficient to get across the gist of the topic without getting too technical or tedious. Adequate references to more detailed sources are generally given for those who wish to pursue a particular subject further. The papers are frequently illustrated with clear figures and tables, and crisp photographs are found in many cases where they seem highly appropriate.

The first thematic set of papers on sustainability deals mostly with principles and definition, but with many practical examples and realistic assumptions. There is much here to provoke further thought. The inclusion of two opening addresses verbatim, plus the inclusion of workshop minutes, and the Conference closing resolution, really give one the feeling of having been there, despite not having done so. This is reinforced by Chris Stevens' keynote address on defining geological conservation, as a transcript due to his death shortly after the conference. The dedication of this volume to him is a fitting tribute.

Although the diversity of topics is truly too great to detail, there is unsurprisingly an essentially European flavour to the papers with a strong Australian element, but unfortunately too few Asian or African or even American contributions. There is a spectrum in the second, third and fourth thematic sets, from specific case studies of small local interest, to summaries of national and international policies with regard to geological and landscape protection.

In this book, an apparent attempt to be all things to all people, is really a strength not a failing. It emphasises the links and inter-relationships between apparently unconnected things. It promotes a need to take a holistic approach to many of the issues. It should not be read through entirely, but delved into for different things at different times as needs arise; it may provide inspiration or be a source reference for more information. I expect it will become a yardstick of what geological and landscape conservation is about, for many years to come.

Matthew Parkes, Geological Survey of Ireland, Beggars Bush, Haddington Road, Dublin 4, Ireland. 5th August 1995.

Wilson, C. 1994. *Earth Heritage Conservation.* The Geological Society in association with the Open University, 272 pp. ISBN 1 897799 03 9. Paperback. Price £15-00.

In *Earth Heritage Conservation* readers are provided with the option of starting at different points, selecting their entry level in accordance with their geological expertise, and as a result most museum-based geologists can skip several sections of this book. Classifying myself as "having experience of biological conservation, but no geological knowledge" I was instructed to first read and understand Parts 1 and 2, then proceed to Part 3 to compare biological and earth heritage conservation and see how they might be integrated.

Part 1 gives an introduction to geological time and to geological phenomena through a detailed description of ten key geological sites, explaining the rationale for their protection and how this has been achieved. Especially interesting are how the conservation needs of the sites have been reconciled with those of owners, operators and developers.

Part 2 is essentially a beginner's guide to geology, peppered with a good selection of illustrations and photographs. The introduction to geological fieldwork (with emphasis on the practicalities, including note-taking) is particularly useful in a section which is both comprehensive and enjoyable to read.

Part 3 - Conservation in Action - is where the book begins to address its main theme - on page 155! It is here that Earth Heritage Conservation is defined as "*Being concerned with the part of the physical resource of the Earth that represents our cultural heritage, including our geological and geomorphological understanding, and the inspirational and aesthetic response to the resource*". So geological conservation is about preserving landscapes, study sites, geological knowledge and specimens. Any utilitarian reasons for geological conservation are ignored by the authors, who have even avoided the buzzwords "sustainability" or even "wise-use"; geological resources as a source of energy or materials being set aside as "society's exploitative value set", seemingly not part of the conservation debate. This approach crystallised for me the essential difference in the approaches to conservation between biologist and geologist, between conserving the biotic and the abiotic.

There is a great deal to admire in this section. It deals with site selection, potential threats to sites and practical conservation techniques. Involvement with planning authorities and conservation organisations is discussed, and there are salutory tales of successes and failures. There is passing reference to the National Scheme for Site Documentation (1977), but a significant section on RIGS. Other than this there are few references to the role of museums in earth heritage conservation, and only national museums feature in the list of "useful addresses". Sadly, there is no mention of the scientific and historical significance of geological specimens and the need for proper curation, nor of the role of the Geological Curator's Group in promoting collections care and site conservation.

The comparison between biological and geological conservation is fascinating, and undoubtedly there is a need to try and achieve the two conservation goals together when possible. I enjoyed reading the book, learnt from it, which is no bad thing, and even became interested in geological site conservation and I am sure that it will do much to encourage others too. It is well-written, and the photographs and illustrations are excellent. I have two minor complaints, firstly that the colour plate booklet (a surrogate O.U. kit collection of minerals and rocks) is an accompaniment rather than integral to the work. I must have mislaid it a dozen times. Second, the book is packaged in a stiff plastic wallet. I can understand that this may be useful protection in the field, (will it be used there?), but it is a frustrating experience having to extract it every time an elusive geological fact needs to be researched.

Peter Davis, Museum Studies, University of Newcastle upon Tyne, Newcastle upon Tyne, NE1 7RU, U.K. 9th August 1995.

Knell, S. (ed.) 1994. *Care of Collections.* Leicester Readers in Museum Studies, Routledge, London and New York, 282 pp. ISBN 0 415 11285 0. Paperback. Price: £19-99.

This publication is one of six volumes each of which covers a significant aspect of Museums Studies. The *Leicester Reader Series* aims to bring together and re-publish papers which have made a particular contribution in significant areas, with a view to facilitating research and study for the student of museum studies of all ages and career stage. This volume covers aspects of collection management and collection care. Dealing in conservation issues, light, relative humidity, pollutants, pests, storage, disaster planning, packing and transport. A companion volume, entitled *Collection Management,* edited by Ann Fahy, deals with policy, standards, documentation security and insurance.

The introductory paper written by Knell provides an excellent overview of the issues surrounding collection care in the mid

1990s. It is good to note that Knell emphasises the need for museums to work within the existing economic and political framework in order to further their cause. The most important battles are political and the skills required are thin on the ground in the museum world. He also laments the loss of subject specialists and sees them as having an essential role to play in collection care. The jury is still out on the long term effect of the introduction of collection managers and the subsequent downgrading of subject specialists. I must admit to harbouring the heretical view that it may improve the ability of a museum, in the current economic climate, to secure its collections in the long term rather than reduce it. However, this is an interesting and well-argued paper.

It is stated in the introduction that the papers are the choice of the editor and so reflect his particular interests and approach. He also states that inevitably some areas are covered more comprehensively in other publications and uses Thompson's *The Museum Environment* as an example. It may have helped to list important works in the various areas when they could not be included. There is, for example, no reference to the excellent manual published by the East Midlands Museum Service on disaster planning.

There are, without doubt, some very interesting papers reproduced in this publication. I found the papers by Bradley entitled "Do objects have a finite lifetime" and one by Linnie on health problems associated with the use of chemicals for pest control in museums, well worth a read. The idea that DDT is still so widely used in museums world wide is worrying to say the least as is the range of medical complaints associated with pesticide usage. How many of us have ever taken these dangers at all seriously?

This publication makes a considerable contribution to study of museums by making available literature that otherwise would be difficult to obtain. I fully endorse the principles behind the *Leicester Readers in Museum Studies* and have enjoyed reading the others in the series. The Department of Museum Studies at Leicester University has maintained the high standards that we have grown to expect. The purchase of this volume is essential for all those interested in, or responsible for, the care of museum collections.

Andrew Newman, Museum Studies, Department of Archaeology, University of Newcastle upon Tyne, Newcastle upon Tyne, NE1 7RU, UK. 10th August 1995.

McGowan, C. 1994. *Diatoms to dinosaurs: the size and scale of living things.* Island Press/Shearwater Books, Washington DC, 288 pp. ISBN 1 55963 304 2. Hardback. Price: $24-95.

Not another book on dinosaurs, I thought. In fact they play a small but useful part in this splendid work. The book is good to handle, well bound and printed, written with attractive style and exemplary clarity. It is illustrated by many beautifully executed drawings and diagrams by Julian Mulock. The subtitle indicates what the book is about. The author is curator of vertebrate palaeontology at the Royal Ontario Museum and professor of zoology at the University of Toronto. He writes that he is 'remarkably fortunate to work at a museum that still values the importance of research and scholarship'. It is good to know that some such remain.

The book is very much about living things of many kinds; but he uses the considerable amount of information on scale in these to lead our thoughts towards the fossil reptiles who walked the land, flew, and swam. He takes the story over the three media, but the chapters deal with such diverse matters as temperature control, physiology, life expectancy, the attainment of gigantic size, drag and flow, flying swimming and floating. He comments sensibly on the erroneous idea of hot blooded dinosaurs. 'Gone too ', he says, after discussion, 'is the notion that sauropods could trot and gambol along as depicted in so many illustrations'. The book will be of great benefit to anyone interested in the natural world of living things and palaeobiologists must find it informative as well as salutary reading. The array of detailed information about scale and performance is most useful, and indeed thought provoking, to those trying to interpret the meaning of fossils.

All sorts of information appear here and many of the data are derived from the author's own experience. At one end of the scale of size we read about the blue whale; weighing over 200 tons, it is the largest animal that ever lived. It is no coincidence, the author reminds us, that it is aquatic. Watching the behaviour of elephants, he remarks that 'although their metabolic furnace does not burn as brightly as that of a smaller animal, their immense size requires that it be kept well stoked'. Elephants spend at least eighteen hours every day feeding, taking a few hours fitful sleep while standing up. They have to move carefully and deliberately to avoid undue stress. If they lie down for more than about an hour they risk damage to a side of the body. Within the birds, we learn that the feeding forays of several albatross in the Indian Ocean lasted two to five weeks and, at maximum, covered a remarkable 15,200 km. There is detail of the hovering of humming birds, of which the Cuban bee hummer, the smallest of all birds, is no bigger than a bumble bee and weighs less than 2 grams.

But all this fascinating information, so pleasantly put, is mixed with an erudite, but still clear, discussion of such matters as Reynolds number and aspect ratio. The combination of low wing loading and high aspect ratio of the pterosaur makes the frigate bird a living analogue of these. Humming birds, too, are considered in matters of physiology. Shortly before dawn they begin a vigorous shivering, using some fat reserves to fuel their metabolism and raise their body temperature after the night spent in a 'trance-like state'. At the extremely small end of the scale of size, swimming bacteria cannot move in a straight line because of the Brownian movement of the water molecules.

So much knowledge is put over in such an attractive way. On the life of plankton: Copepods have voracious appetites and can devour all the phtyoplankters in their immediate vicinity - like graduate students at a buffet.

Charles Hepworth Holland, Department of Geology, Trinity College, Dublin 2, Ireland. 10th August 1995.

Stansfield, G., Mathias, J. and Reid, G. (eds). 1994. *Manual of Natural History Curatorship.* Museums and Galleries Commission, HMSO, London, xviii + 306 pp. ISBN 0 11 290513 7. Hardback. Price: £45-00.

For the most part geological curators are blessed with relatively stable specimens compared to the lot of many natural history curators. For that reason some sections of this book will be of little interest to most solely geological curators, including biochemistry in preparation and preservation, pest management in housing and maintenance of collections, and perhaps the chapter on live animals and plants in museums, although even that would be invaluable if you were trying to say organise an exhibition of fossils and their living relatives.

Despite this, there is copious information of relevance to any geological curator that makes this book a recommended purchase for any museum library reference section, and probably for many individuals too.

The editors have stitched together the work of 11 authors in 14 chapters to produce a seamless work with a uniform level of conciseness. The layout and organisation is clear and easily accessed, so that a specific topic is readily found. The book claims to be a manual, and where the details and expansion of a topic can not be fitted in, there are extensive references. Although some chapters (Documentation, Housing and Maintenance of Collections for example) have illustrations, I feel that a few more carefully selected diagrams throughout the manual would have slightly improved it.

However, the text is concise, yet comprehensive in coverage, and the manual makes an ideal first source of information to consult, if following up ideas for developing your displays for example. Most of the text seems like self evident truths having read it, but contains ideas and information which might easily get forgotten.

The approach is more covering the principles and philosophy of what natural history museum curators do and why. It has an international perspective, with examples of practice and process from museums worldwide. The specifics of U.K. national legislation or regulations are not given, but the crucial points are, and where to go for more information, but other national policies are noted for comparative purposes. Since this manual is essentially from the Biological Curators Group, it might seem as if geology only gets mentioned in the text as a sideline, but the underlying philosophy and rationale for doing things one way or another espoused in the manual applies to fossils and other geological specimens as much as stuffed birds or pinned insects. This is most true for the early and later chapters covering function and organisation, acquisition of collections, documentation, education and interpretation, exhibition, schools, information services and working with other bodies.

Although in some ways the specifics of geological curation are well covered elsewhere, this manual achieves its stated aim of being a concise and comprehensive guide to the management of all aspects of natural history museums and museums with natural history collections, and for that wider perspective should be readily applicable to most geological curators.

Matthew Parkes, Geological Survey of Ireland, Beggars Bush, Haddington Road, Dublin 4, Ireland. 14th August 1995.

THE GEOLOGICAL CURATOR

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