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GEOLOGICAL CURATORS' GROUP

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- 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
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Cover: Richard Ford (1913-1996) with Wilkinson's van which was used as a travelling laboratory for insect collecting. [Photograph taken in Bexley, Kent in 1938]. See article by William Blows, p. 323-331.

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RE-EXAMINATION OF THE A.W.G. KINGSBURY COLLECTION OF BRITISH MINERALS AT THE NATURAL HISTORY MUSEUM, LONDON.

by G. Ryback, A.M. Clark and C.J. Stanley

Ryback, G., Clark, A.M. & Stanley, C.J. 1998. Re-examination of the A.W.G. Kingsbury Collection of British Minerals at the Natural History Museum, London. *The Geological Curator* 6(9): 317-322.

Detailed study of eight specimens supposedly collected by A.W.G. Kingsbury from localities in Great Britain has shown beyond reasonable doubt that they came from classic foreign localities. Many species reported by Kingsbury from Britain must now be regarded as of dubious provenance unless validated by further studies.

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Introduction

Arthur William Gerald Kingsbury was born at East Meon, Hampshire, in 1906. After receiving a classical education he practised for ten years from 1929 as a solicitor, first at Sherborne and later at Crewkerne, Somerset. He had developed an interest in mineralogy as a hobby in 1927 and, being based in the West Country, was able to study and collect minerals in the Mendip Hills and in Cornwall and Devon. Kingsbury spent the years of the Second World War running a precision engineering works at Slough and in 1947, on the recommendation of Sir Arthur Russell, was appointed research assistant to the Reader in Mineralogy at Oxford University; the post entailed responsibility for the mineral collections at the University Museum, where he remained until his death in 1968. An obituary was published by Embrey (1973).

At Oxford Arthur Kingsbury continued collecting and studying the rarer British minerals, especially the supergene minerals of metalliferous veins, and particularly those of SW England and the Lake District. From 1949 onwards, through a collaboration with Heinrich Neumann and Jack Hartley at the University of Leeds, and later with the X-ray laboratory at The Natural History Museum in London, he subjected his specimens to examination by X-ray diffraction; thus he was able to add over 60 species to the list of British minerals, as well as numerous new occurrences of many already listed. He published many papers and became internationally recognised as a foremost expert in his field, with a reputation for turning up better specimens and rarer species than anyone else wherever he went.

In more recent years, however, some of these claimed discoveries began to be questioned, both by staff at The Natural History Museum, which had been provided with samples of the described material and acquired the rest of his collection after his death, and by knowledgeable visitors who came to view specific Kingsbury specimens. In some cases these queries have entered into publications (e.g. inferred in Cooper and Stanley 1990, and voiced in Cooper and Stanley 1997). It was the claimed provenance of the specimens that was doubted, and it was frequently pointed out that a Kingsbury specimen was very similar in appearance and association to classic material from a well-known foreign locality. The provenance of a specimen is the one attribute that cannot be rigorously proved by subsequent examination - you have to rely on the word of the collector - and deliberate mislabelling of specimens to enhance their scientific or monetary value is not unknown in mineralogy. A further factor which caused concern about Kingsbury's finds was that in many cases no other collectors were able to discover similar material at the stated localities.

To those who knew Kingsbury, it seemed inconceivable that he could falsify his data in this way, but the discrepancies could no longer be ignored and a reappraisal of all Kingsbury material at The Natural History Museum became necessary.

The Kingsbury collection

Arthur Kingsbury provided over 1200 specimens to The Natural History Museum in his lifetime (mostly by donation but some by purchase) and these are now

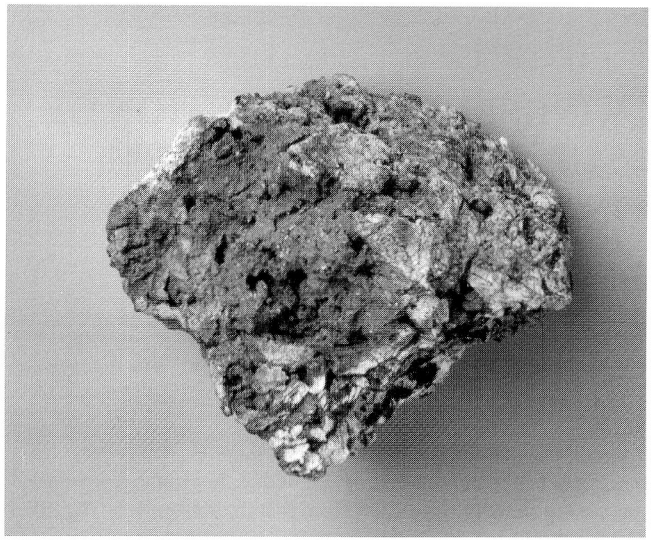

Figure 1. Gold on manganiferous conglomerate, "Porthcurnick Beach" (BM 1965, 83). Width of specimen 75 mm.

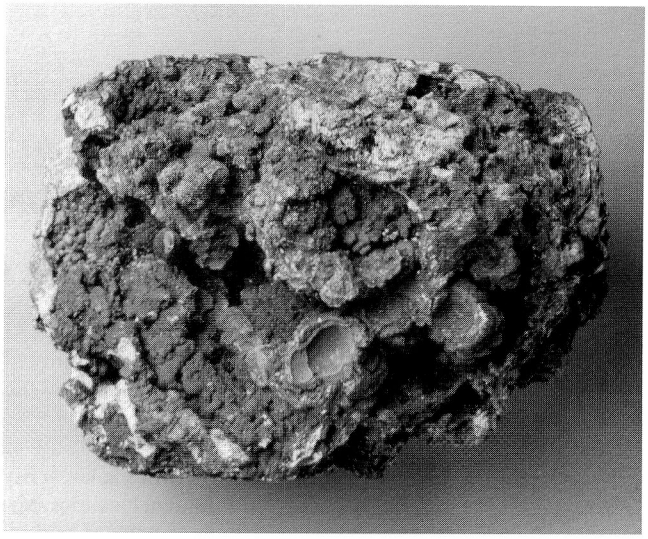

Figure 2. Gold on asbolane, Kanowna, Western Australia (BM 85942). Width of specimen 100 mm.

incorporated in the main systematic mineral collection. The first transactions were recorded in 1938 but the vast majority took place from 1956 to the end of his life. Some of these were fine specimens from old collections he had acquired [The Thomas Kingsbury (his great-grandfather), Gawthorpe, and Murray collections], and there are no reasons to doubt their labelling. However, there are over 800 registered specimens supposedly collected by Kingsbury and these need to be vetted as a priority; this paper is a report of our initial conclusions.

In addition to the specimens directly provided by Kingsbury, his material is incorporated into other collections. In particular, samples of many of his rarer finds were given by Arthur Kingsbury to Sir Arthur Russell, and these now feature in the Russell Collection, also housed at The Natural History Museum as a result of the bequest following Russell's death in 1964.

After Kingsbury's death, his entire private collection, with notebooks and maps, was purchased by the Museum and is now housed in nearly 400 large drawers containing between 10,000 and 15,000 specimens. They constitute a heterogeneous mixture of:

(a) Specimens from the Kingsbury collection proper, numbered and catalogued personally. Unfortunately, the catalogue ends in 1950, at specimen no. 1858. It may be significant that so far no obviously suspect localities have been found among these entries.

(b) Individual labelled specimens from the three old collections referred to above.

(c) A considerable number of fine but completely unlabelled specimens, some probably from the old collections, some probably self-collected.

(d) Individual, labelled, self-collected specimens, some cognate with the material donated to the NHM collections in Kingsbury's lifetime.

(e) Large amounts of unprocessed and partly processed collected material, with varying quality of labelling; much of this was emptied out of old wooden ammunition boxes that Kingsbury used to transport and store material collected on field trips.

Here we report the outline results of investigations of eight questioned specimens from the Kingsbury collection. These investigations are part of a wider project to identify and curate the reputable component of the Kingsbury collection.

Initial case studies

Eight specimens have been studied in detail to establish whether or not acts of forgery have taken place; they are three plancheites, each claimed to be from a different locality, similarly two descloizites, a malachite, a heterogenite and a native gold. The observations are summarised in Table 1. All eight are very unlikely to have originated from the claimed localities; six can be clearly correlated with material in The Natural History Museum collections from well-known overseas localities and for two a tentative foreign locality can be assigned though no matching specimen has been found in the collections. Despite extensive searches by other collectors, no further specimens comparable with Kingsbury's material have been found at any of the localities, except for a small fragment of plancheite found loose on the surface at Alderley Edge and recorded by Braithwaite (1994). The evidence in Table 1 strongly supports the conclusion that the localities given by Kingsbury for these specimens are a deception. One of the eight cases, the "Porthcurnick" gold, is outlined in more detail below as an example.

The gold referred to above is specimen number BM 1965,83 (Figure 1), described by Kingsbury as "from

a manganiferous band in raised beach deposit, north end of Porthcurnick beach, Portscatho, Cornwall" and was supposedly collected by him in 1950. We noted that it is extremely similar in appearance to a specimen of gold from Kanowna, Kalgoorlie, Western Australia, BM 85942 (Figure 2), and the similarity was confirmed by microscopic examination supported by electron microprobe, X-ray diffraction and infrared spectroscopic studies of the two specimens. The matrix is a very characteristic cavernous conglomerate of pale clayey pieces cemented by black manganese oxide crusts showing microcrystallised surfaces in cavities. The gold is in well-formed but tiny (0.5 mm) octahedra and cubo-octahedra scattered on the Mn oxide crusts (*cf.* Maclaren 1908). Furthermore, on both specimens a very thin layer of an as yet unidentified rare-earth mineral (with major La, Nd, Pr) underlies the Mn oxide crusts; the Mn oxide crusts yield almost identical energy-dispersive microprobe spectra (major Mn, minor Fe and Co, trace Ni), and were shown by X-ray diffraction to contain birnessite; the clay of the matrix is halloysite-10Å. There can be little doubt that both specimens are from the same locality.

As there are numerous other occurrences of gold in the British Isles, this claimed occurrence has not been documented as a mineral new to Britain. However, it has been mentioned in at least two publications.

BM number	Description	Claimed locality	Probable true locality
1965,83	GOLD, 0.5-mm crystals on manganese oxides.	Porthcurnick beach, Portscatho, Cornwall.(1)	Kanowna, Kalgoorlie, Western Australia. (*cf.* BM 85942)
1968, 162	HETEROGENITE, matrix-free 4-cm stalactitic mass.	Engine vein, Alderley Edge, Cheshire.(2)	Shaba (Katanga), Zaire. (*cf.* BM 1979,21).
1957, 785	MALACHITE, fibrous with cerussite on galena.	Driggith mine, Caldbeck Fells, Cumbria.(3)	Zellerfeld, Harz Mountains, Germany. (*cf.* BM 59292)
1957,480 1957,481 1964,R8409	DESCLOIZITE, aggregates of small brown crystals with minor vanadinite & quartz.	Brandy Gill, Caldbeck Fells, Cumbria.(4)	Pinal Co., Arizona, USA. (?)
1968, 163	DESCLOIZITE, crusts on sand-stone plus detached pieces.(a)	Engine vein, Alderley Edge, Cheshire.(3)	1) Niederschlettenbach, Lautertal, Rheinland-Pfalz, Germany. (*cf.* BM 26521) 2) Hofsgrund, nr Freiburg, Baden-Württemberg, Germany. (*cf.* BM 40488)
1958,221	PLANCHEITE, sky-blue fibrous radiating, 12-mm spherules in matrix.	Driggith mine, Caldbeck Fells, Cumbria.(5)	Shaba (Katanga), Zaire. (*cf.* BM 1930,797)
1964,412	PLANCHEITE, sky-blue fibrous radiating, matrix-free 13-mm spherule plus fragments.	Engine vein, Alderley Edge, Cheshire.(6)	Shaba (Katanga), Zaire. (*cf.* BM 1957,592)
1968,159	PLANCHEITE, small dark-blue grains in massive "turquoise".(b)	Gunheath china clay pit, St Austell, Cornwall.(7)	Mammoth district, Tiger, Arizona, USA. (?)

(a) Two distinct materials donated as one specimen, matching topotype "dechenite" [=arsenatian descloizite] from Niederschlettenbach and topotype "eusynchite" [=descloizite] from Hofsgrund, respectively.
(b) The matrix (turquoise according to Kingsbury's label) is actually chrysocolla with calcite; it resembles in appearance the massive turquoise with kaolinite which was abundant in Gunheath pit. Chrysocolla and calcite are not known to occur in Gunheath pit.
(1) Criddle and Stanley (1986); Camm (1995).
(2) Ryback and Tandy (1992); Braithwaite (1994); incorrectly stated to be on sandstone in these publications.
(3) Hitherto unpublished.
(4) Kingsbury and Hartley (1956); Young (1987); Cooper and Stanley (1990).
(5) Young (1987); Cooper and Stanley (1990); Ryback and Tandy (1992); Anthony *et al.*(1995).
(6) Ryback and Tandy (1992); Braithwaite (1994); Anthony *et al.* (1995).
(7) Ryback and Tandy (1992); Anthony *et al.* (1995); Golley and Williams (1995).

Table 1. The eight A.W.G. Kingsbury specimens studied in detail.

Species	Claimed locality
Adamite	Several localities in Lake District and Cornwall
*Aerugite	South Terras mine, St Stephen-in-Brannel, Cornwall.
Aikinite	Carrock mine, Caldbeck Fells, Cumbria.
Alunite	Embleton quarry, nr Cockermouth, Cumbria; Grainsgill, Caldbeck Fells, Cumbria.
Amblygonite	Meldon aplite quarry, Okehampton, Devon.
Antlerite	Potts Gill mine, Caldbeck Fells, Cumbria; Old Gunnislake mine, Calstock, Cornwall
*Argentojarosite	West Turf Pits mine, Grassington, Yorkshire; Treore mine, St Endellion, Cornwall
(*Argentopyrite)	Tynebottom mine, Alston, Cumbria.
*Arseniosiderite	Several localities in Cornwall, Devon, and Lake District.
Arthurite	Hingston Down Consols, Calstock, Cornwall. (New species co-discovered with A. Russell)
Beaverite	Several localities in Lake District and Cornwall.
*Beryllonite	Meldon aplite quarry, Okehampton, Devon.
Beudantite	Several localities in Lake District and Cornwall.
Bismutoferrite	South Terras mine, St Stephen-in-Brannel, Cornwall.
Boulangerite	Carrock mine, Caldbeck Fells, Cumbria; St Endellion, Cornwall.
*Brandtite	Meldon aplite quarry, Okehampton, Devon.
Breithauptite	Potts Gill mine, Caldbeck Fells, Cumbria.
Calomel	Chatsworth mine, Grassington, Yorkshire.
*Carpholite	Several localities in Cornwall and Lake District.
(*Cernyite)	Treore mine, St Endellion, Cornwall.
Chrysoberyl	Meldon aplite quarry, Okehampton, Devon.
Conichalcite	Bedford United mine, Tavistock, Devon; and a locality in Cornwall.
*Cornetite	Wheal Phoenix, Linkinhorne, Cornwall.
Cosalite	Carrock mine, Caldbeck Fells, Cumbria.
Cuprotungstite	Wheal Gorland, Gwennap, Cornwall.
*Danburite	Cheesewring quarry, Linkinhorne, Cornwall; Meldon aplite quarry, Okehampton, Devon
Descloizite	Brandy Gill, Caldbeck Fells, Cumbria; and other localities.
*Dioptase	Potts Gill mine, Caldbeck Fells, Cumbria.
*Durangite	Cheesewring quarry, Linkinhorne, Cornwall.
*Euclase	Cligga Head, Perranzabuloe, Cornwall; Meldon aplite quarry, Okehampton, Devon.
*Eudidymite	Meldon aplite quarry, Okehampton, Devon.
(*Fairfieldite)	Meldon railway quarry, Okehampton, Devon.
Genthelvite	Treburland mine, Altarnun, Cornwall.
(*Haidingerite)	Wanthwaite mine, St John's in the Vale, Cumbria.
*Helvine	Red-a-Ven mine, Meldon, Okehampton, Devon; and 3 localities in Cornwall.
Herderite	Wheal Cock, St Just, Cornwall; Colcerrow quarry, Luxulyan, Cornwall.
*Heterogenite	Engine vein, Alderley Edge, Cheshire.
Hübnerite	Carrock mine, Caldbeck Fells, Cumbria; Wheal Gorland, Gwennap, Cornwall.
*Ilvaite	Wh. Messer, Lanivet, Cornwall; Ramsley mine, Okehampton & Smallacombe mine, Ilsington, Devon.
(*Izoklakeite)	Wheal Cock, St Just, Cornwall.
Jarosite	Several localities in Lake District.
(*Jaskolskiite)	Wheal Cock, St Just, Cornwall.
(Kentrolite)	Higher Pitts mine, nr Priddy, Somerset.
(*Leucophanite)	Meldon aplite quarry, Okehampton, Devon.
*Lindgrenite	Brandy Gill, Caldbeck Fells, Cumbria.
Meneghinite	Pengenna mine, St Kew, Cornwall; Shallowford Bridge, South Molton, Devon.
Mercury	Chatsworth mine, Grassington, Yorkshire.
Metacinnabar	Turf Pits mine, Grassington & Cockhill mine, Bewerley, Yorkshire.
*Milarite	Meldon aplite quarry, Okehampton, Devon; Cheesewring quarry, Linkinhorne, Cornwall.
Montebrasite	Meldon aplite quarry, Okehampton, Devon.
Natrojarosite	Wanthwaite mine, St John's in the Vale, Cumbria.
(*Paracostibite)	Wheal Cock, St Just, Cornwall.
*Parahopeite	Turf Pits mine, Grassington & Cockhill mine, Bewerley, Yorkshire; Roughtongill, Caldbeck Fells, Cumbria.
Pharmacolite	Wanthwaite mine, St John's in the Vale, Cumbria.
Picropharmacolite	Wanthwaite mine, St John's in the Vale, Cumbria.
Plancheite	Driggith mine, Caldbeck Fells, Cumbria; Alderley Edge, Cheshire; Gunheath pit, St Austell, Cornwall.
*Plumbojarosite	Several localities in Cornwall, Lake District and Yorkshire.
Pollucite	Meldon aplite quarry, Okehampton, Devon.
*Priceite	Meldon aplite quarry, Okehampton, Devon.
(*Pyrostilpnite)	St Teath, Cornwall.
*Rhodizite	Meldon aplite quarry, Okehampton, Devon.
Rockbridgeite	Wheal Phoenix, Linkinhorne, Cornwall; East Wheal Russell, Tavistock, Devon.
Rosasite	Several localities in Cornwall and Cumbria.
*Spencerite	Turf Pits mine, Grassington, Yorkshire.
(*Sternbergite)	Tynebottom mine, Alston, Cumbria.
Strengite	Wheal Phoenix, Linkinhorne, Cornwall; Burdell Gill, Caldbeck Fells, Cumbria.
Stromeyerite	Pengenna mine, St Kew, Cornwall.
*Svanbergite	Wheal Coates, St Agnes, Cornwall.
Tellurobismuthite	Clogau and Vigra mines, nr Dolgellau, Gwynedd.
Thaumasite	Embleton quarry, Cockermouth, Cumbria.
Variscite	High Down quarry, Filleigh & Pitts Cleave quarry, Tavistock, Devon; Treore mine, St Endellion, Cornwall.
*Weilite	Wanthwaite mine, St John's in the Vale, Cumbria.
Whewellite	Mealbank quarry, Ingleton, Yorkshire.
*Xanthiosite	South Terras mine, St Stephen-in-Brannel, Cornwall.
Zinkenite	Carrock mine, Caldbeck Fells, Cumbria.
*Zunyite	Embleton quarry, Cockermouth, Cumbria.

TABLE 2. A.W.G. Kingsbury's contributions to the British Isles mineral list: first British records of the species listed. Asterisks indicate first and *only* British records. Species in brackets were identified later on specimens from the Kingsbury Collection.

Reflectance data and an analysis of "Porthcurnick" gold were published in Criddle and Stanley (1986), and Camm (1995) mentions a specimen of gold from Porthcurnick beach in the Barstow collection in Plymouth City Museum; enquiries show that this is a piece of the Kingsbury NHM specimen acquired by Richard Barstow by exchange in 1980.

Other species claimed by Kingsbury to be from Britain are under investigation and preliminary results suggest that many more instances of mislabelling will be established. The impact of this on the records of mineral occurrences in the British Isles can be gauged from Table 2, which lists the first British occurrences 'found' by Kingsbury, all now requiring re-evaluation.

Conclusions

There is now overwhelming evidence that Kingsbury mislabelled foreign specimens - often characteristic material from classic old localities - as having been collected by him from British localities. Just how many specimens are suspect will need a considerable amount of work to establish. This mislabelling must have been deliberate - we cannot think of any other plausible or even implausible explanation. For example, while extraneous specimens are occasionally discarded onto mine dumps and are picked up subsequently by an unsuspecting collector, it is incredible that this could have happened to Kingsbury many times at many different collecting sites; nor would the explanation apply to finds claimed to have been *in situ*. Kingsbury, in fact, had a remarkable memory for and knowledge of 'classic' minerals, both foreign and British, and would not have been fooled by anyone else showing him such specimens as British ones.

Kingsbury would have had no difficulty in obtaining the foreign specimens, although there are now no labelled foreign specimens in the Kingsbury collection. According to his obituary (Embrey, 1973) "he did not retain foreign specimens" from the old collections already mentioned, but it is not known exactly how they were disposed of. It will also be necessary to establish whether there are any links between his suspect specimens and the material available to him at Oxford.

Jack Hartley, co-author with Kingsbury of papers relating to Lake District minerals, was in no way involved in the deception, and the same applies to the joint authors of other papers.

We have concentrated here entirely on the suspect specimens, but much of Kingsbury's material is undoubtedly correctly labelled, and is still a remarkable collection - the problem is to decide which material to trust. Unfortunately, the value of the collection as a resource for further studies is now enormously diminished, since genuine and suspect material are so intermixed. For instance, the Kingsbury specimens with Ag-Ni-Co minerals from "Tynebottom mine, Cumbria", studied in detail by Ixer and Stanley (1987), provide a cautionary example; the stated locality is now much in doubt, thus invalidating many of the conclusions reached regarding conditions of formation at this locality. It is in the field of topographical mineralogy that the consequences are so serious; the validity or otherwise of Kingsbury's finds affects the actual status (i.e. they are the first and only records) of some 4% of mineral species currently recorded from the British Isles (Table 2), and a much higher proportion of his other specimens may need to be re-evaluated.

We do not propose at this stage to speculate about Kingsbury's motives; history shows that in scientific fraud the motives can be complex and incomprehensible (Broad and Wade 1985). Perhaps some of his surviving colleagues and friends can shed some light, and perhaps a revealing pattern will emerge from further study of the specimens and documents - or perhaps we will never know. In the meantime we would welcome comments and observations on our investigations from other people who have studied the minerals and localities documented by A.W.G. Kingsbury.

Acknowledgements

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References

ANTHONY, J.W., BIDEAUX, R.A., BLADH, K.W. and NICOLS, M.C. 1995. *Manual of Mineralogy. Vol. II, Silicates and Silica.* Mineral Data Publishing, Tucson, 904 pp. (in two parts).

BRAITHWAITE, R.S.W. 1994. Mineralogy of the Alderley Edge - Mottram St Andrew area, Cheshire, England. *Journal of the Russell Society* **5**, 91-102.

BROAD, W. and WADE, N. 1985. *Betrayers of the Truth.* Oxford University Press, Oxford, 258 pp.

CAMM, G.S. 1995. *Gold in the Counties of Cornwall and Devon,* p. 42, 95. Cornish Hillside Publications, St Austell, xiv + 116 pp.

COOPER, M.P. and STANLEY, C.J. 1990. *Minerals of the English Lake District: Caldbeck Fells.* Natural History Museum Publications, London, 160 pp.

COOPER, M.P. and STANLEY, C.J. 1997 Die Mineralien der Caldbeck Fells, Cumbria, England. *Lapis* **22**(3), 13-34.

CRIDDLE, C.J. and STANLEY, C.J. (eds) 1986. *Quantitative Data File for Ore Minerals.* 2nd edition. British Museum (Natural History), London, lxiv + 635 pp.

EMBREY, P.G. 1973. Arthur William Gerald Kingsbury, 1906-1968. *Mineralogical Magazine* **39**, 1-3.

GOLLEY, P. and WILLIAMS, R. 1995. *Cornish Mineral Reference Manual.* Endsleigh Publications, Truro, 71 pp.

IXER, R.A. and STANLEY, C.J. 1987. A silver-nickel-cobalt mineral association at Tynebottom Mine, Garrigill, near Alston, Cumbria. *Proceedings of the Yorkshire Geological Society* **46**, 133-139.

KINGSBURY, A.W.G. and HARTLEY, J. 1956. New occurrences of vanadium minerals (mottramite, descloizite, and vanadinite) in the Caldbeck area of Cumberland. *Mineralogical Magazine* **31**, 289-295.

MACLAREN, J.M. 1908. *Gold*, p. 105. The Mining Journal, p. 405. London, xxiii + 687 pp.

RYBACK, G. and TANDY, P.C. 1992. Eighth supplementary list of British Isles minerals (English). *Mineralogical Magazine* **56**, 261-275.

YOUNG, B. 1987. *Glossary of minerals of the Lake District and adjoining areas.* British Geological Survey, Keyworth, Nottinghamshire, 104 pp.

CONVERSATIONS WITH A NATURALIST: THE LIFE AND GEOLOGICAL WORK OF RICHARD FORD 1913-1996

by William T. Blows

Blows, W.T. 1998. Conversations with a naturalist: the life and geological work of Richard Ford 1913-1996. *The Geological Curator* 6(9): 323-331.

Richard Ford (1913-1996) was a noted entomologist and zoologist who ran the firm of Watkins and Doncaster, naturalist suppliers for many years. He made important palaeontological collections from many parts of Britain, but particularly from the Isle of Wight. He was involved in a number of dinosaur excavations, and discovered many notable fossils from the Tertiary of the island. These included Eocene snakes and a new species of frog, an Oligocene ungulate, various rodents, and rhinoceros teeth, and Pleistocene elephant teeth and tusks, This paper lists his principal donations to the Natural History Museum, London which number over 27,000 entomological and palaeontological specimens.

William T. Blows, 39 Bow Arrow Lane, Dartford, Kent DA2 6PG, U.K. Received 14th February 1997.

Introduction

The Cretaceous and Tertiary geology of the Isle of Wight in southern England, has over two centuries attracted a fascinating assemblage of geologists, each of whom has had a story to tell. These researchers included Gideon Mantell, William Fox (Blows 1983), John Hulke, James Bowerbank, Reginald Hooley and many others. More recently, important Isle of Wight collections have been made by Stephen Hutt, Richard Ford and the author (Blows 1978).

This biography is the result of numerous conversations and a recorded interview made by the author with Richard Ford over many years from the 1960s to the early 1990s.

Richard Lawrence Edward Ford (1913-1996) (Figure 1) was the eldest son of the celebrated entomologist Leonard Talman Ford M.A. (1881-1961) who held an honours degree in chemistry, then studied law and was called to the bar in 1906 (Anon. 1961). Leonard Ford bred and studied microlepidoptera, and wrote various papers and a book on his research. He became President of the South London Entomology and Natural History Society. Lepidoptera was a major interest of his son Richard Ford, whose combined talents in entomology, ornithology and palaeontology made him a worthy successor to his father as a researcher and author of natural science.

Richard was born on 10th March 1913 in Bexley, which was at that time part of Kent. He was educated at Hurstpierpoint College, near Brighton, Sussex. He took no public examinations and left school without formal qualifications. This proved to be no handicap as he was to make a successful life as a naturalist and businessman. After school in 1931 he worked at Newman's Butterfly Farm before becoming assistant to Douglas Shipton Wilkinson at the Commonwealth Institute of Entomology (then called the Imperial Institute of Entomology) and was based at the British Museum (Natural History) [now Natural History Museum] at South Kensington in London. As full-time collector of insects, Richard Ford gained valuable experience and knowledge in the techniques of his science. His association with the British Museum (Natural History) was to become life-long, and in time he donated many important specimens to both the Departments of Entomology and Palaeontology (Appendices 1 and 2).

When Wilkinson was lost at sea during enemy action in 1941, his work was continued by Dr Gilbert Nixon. Both these men acknowledge in their publications Richard Ford's particular skill in reproducing the conditions for breeding long series of *Apanteles*, a braconis ant. These specimens are now in the collections

Abbreviations: BMNH: The Natural History Museum, London (formerly British Museum (Natural History)); CGB: Museum of Paris, France; MCZ: Harvard Museum of Comparative Zoology, USA.

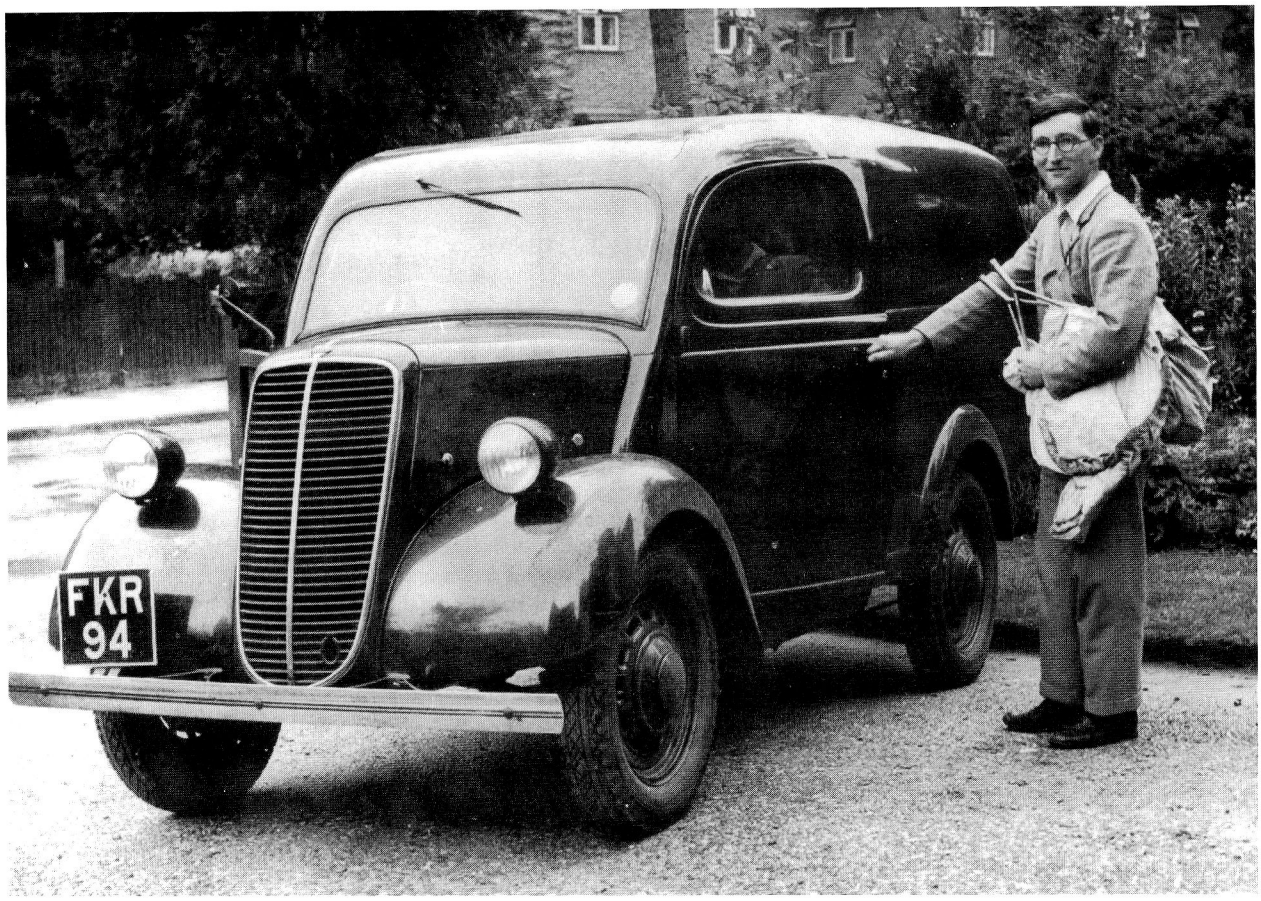

Figure 1. Richard Ford with Wilkinson's van which was used as a travelling laboratory for insect collecting. [Photograph taken in Bexley, Kent in 1938]

at South Kensington. There are some fifty type specimens of insects which carry Richard's name on their data slips.

Watkins and Doncaster - naturalist suppliers

The naturalist company of Watkins and Doncaster was established by Mr William Watkins in 1874 in Eastbourne, East Sussex, and was based in a building called 'The Villa Sphinx', named after the Hawkmoth. It was usually referred to as 'The Villa Stinks'. Five years later in 1879 Watkins transferred the company to 36 The Strand, London, where the company signboard of a Swallowtail butterfly hanging outside became a famous landmark (It was mentioned in several guide books). Here Watkins specialised in entomology before being joined by Arthur Doncaster that same year. However, Watkins retired in 1880 leaving Doncaster as sole director. Doncaster was both deaf and dumb, and conducted his business by writing everything on a slate hung from his neck. Despite this handicap he was a world authority on tropical butterflies and was a consultant to many major museums. Later, Frederick Mette, an authority on birds eggs, joined as a partner and eventually bought the business. However, he proved unable to run the business on his own successfully, and so when he died at the beginning of the second world war, the business which had gradually declined ran with no director for about a year.

In 1941, encouraged by Sir Guy Marshall, Director of the Imperial Institute of Entomology, Richard Ford purchased Watkins and Doncaster and became its Managing Director. During these early years in the Strand the policy of William Watkins, Arthur Doncaster and of Frederick Mette was to purchase large numbers of natural history collections made by Victorian collectors as they became available for sale. These were then broken up and sold as individual items or small sets. Commonly the material comprised butterflies, birds eggs, insects, stuffed birds and mammals amongst other things, and these provided a good stock of items at Watkins and Doncaster. Richard Ford purchased large entomological collections (mostly butterflies) in this way, which he first offered for inspection to the British Museum (Natural History). This resulted, over the years, in the donation of nearly 27,000 specimens of butterflies and moths to that institution (Appendix 2).

In the early 1950s, due to increasing rents and the threat of demolition for road widening, Richard moved the company from The Strand to a new site at 110 Park View Road, Welling, Kent. He remained as Managing Director, and built a business that today provides

educational and scientific equipment for amateur and professional biologists as well as a world-wide international consultancy on all matters of natural history. In 1963 Richard's son Robin joined the company and became a partner.

In 1969, at the age of 56, Richard retired and moved to the Isle of Wight, and left the company in the hands of his son Robin. In 1973 the business moved to its current site just outside Hawkhurst in Kent. Here, in a spacious and purpose built premises, Robin celebrated the centenary of Watkins and Doncaster in 1974. In addition, the company also took over the small shop called Worldwide Butterflies in Brighton, Sussex in 1979. This move almost closes the circle, from Sussex coast to London and back again.

A Family Life and Honours

Richard married Nina Kimpton J.P. on 20th July 1940 and they had three sons: Edward, Robin and William. The choice of the Isle of Wight as a retirement home was obvious: the rich source of microfossils and local wild life were well known to Richard from his early days of research. His work led to a number of awards: he was a Fellow of the Royal Entomological Society, the Geological Society and the Zoological Society for many years. He was awarded the H.H. Bloomer Award for 1983 by the Linnean Society of London for his important contributions to biological knowledge. He served the Isle of Wight Natural History and Archaeological Society as both Vice President and Geological Section Leader at various times, and he was a life member. As such, he made valuable contributions to the meetings, publications and exhibitions of the Society.

In retirement he lived at Yarmouth where he continued his work, sifting clay for micro-analysis, and adding further to the known species from the Tertiary beds on the island. Richard's home overlooked the Solent and the cliffs at Bouldnor from which many of his valuable specimens were obtained.

He lectured on insects, fossils and local wild life to schools, colleges and societies. His talk to the Vertebrate Anatomy and Palaeontology Symposium was inspired. He was the first to introduce the concept of removing the side wall of a fossil jaw to reveal perfect, unerupted teeth, to the astonishment of the audience.

Visitors who stayed at the Ford household at Yarmouth included some eminent geologists and palaeontologists. Over 500 names fill Richard's visitors book from 1969 to 1995, and include members of the Tertiary Research Group in 1974, Dr Jeremy Hooker and Dr Angela Milner of the Natural History Museum, London from 1974 onwards, Professor Kermack and students of University College, London from 1977, and Dr Beverley Halstead who brought with him Reading University students a number of times over the period 1978 to 1984. Overseas visitors to Richard's home included Charles Meszoely (U.S.A.) in 1977, Eric Buffetaut (France) in 1978, Peter Galton (U.S.A.) in 1983, and many others. Richard often maintained that visiting geologists and palaeontologists would do far better to contact him in advance and he would show them around the island, as his unique knowledge of its geology increased their chances of finding fossils.

Geological discoveries

Richard Ford collected fossils from an early age at many sites in the British Isles, but never collected abroad. Charmouth, on the Dorset coast, is a classic Lower Jurassic site which has yielded marine invertebrates and some vertebrate remains from horizontal seacliff exposures. As a youth, Richard studied the stratigraphy here and noticed a correlation between the belemnite fauna and the various horizons within this Liassic formation. He collected many specimens and numbered them sequentially with the strata of the cliff from which they came. He presented the whole collection together with notes and a sketch of the cliffs to the Department of Palaeontology of the Natural History Museum in London.

Richard often said that once one looked down a microscope at the tiny fauna within a rock sample, you discover an unlimited world of animals and plants that the average collector passes by. This fascination for the unseen resulted in a lifetime dedicated to microfossils, particularly those of the lesser known Tertiary beds of the Isle of Wight. He made many new discoveries, some of which bear his name (see Appendix 3).

The Cretaceous (dinosaur and other excavations)

Dinosaurs are well known from Wealden (Lower Cretaceous) rocks exposed along the south coast and near Sandown on the Isle of Wight. The Wealden Group (*c.* 115 million years old) is divided into the older Wessex Formation and the younger Vectis Formation (Daley and Insole 1984). Richard Ford assisted with several dinosaur excavations here, notably with the recovery of a skeleton of the 1 to 1.5 metre long ornithischian, *Hypsilophodon foxi* from Cowleaze Chine. This skeleton was passed onto Peter Galton, then a Ph.D. student at King's College, London. Richard tells the story of its discovery:

> "I was with the Vertebrate Palaeontology Society who came down to the Island and we were shown the cliff by Professor Kermack. He said that this was where *Hypsilophodon* was found. One man looked at the cliff and found a tooth, then he found another one. I had a tin

in my pocket so I passed it over and he put the teeth in the tin. He began poking about with a penknife. Then someone said 'don't dig too much you might do some damage; it could be a skeleton there', because by that time a tiny bone had turned up. Somebody asked him what he was going to do with the fossils and he answered 'I shall give it to the British Museum'. The curator of the British Museum Palaeontology Department was staying with me at the time and was standing at the back of the crowd. He said 'I accept on behalf of the Museum'. That seemed to establish ownership."

Peter Galton was sent for because he was researching the Hypsilophodontidae, and a major dig commenced. On removal of overlying sediment numerous bones became visible which were photographed and covered with tissue paper before a plaster jacket was applied. The whole block was about a metre square and fifty centimetres deep into the cliff. When removed it was placed on a child's toboggan and dragged to the bottom of Cowleaze Chine where a temporary bridge made from drift wood was constructed to get it across a stream. Here it stayed overnight, and the next day it was roped up the cliff, inch by inch, to a ledge halfway up. It was hauled along the ledge until a point was reached where the final climb to the top was possible. The specimen was then placed in a van and driven by Richard to King's College, London. From this block Galton prepared out a partial skull and skeleton which included some previously unknown elements (Galton 1974).

In 1972, Richard Ford assisted the author with an *Iguanodon atherfieldensis* excavation on the beach at Hanover Point, near Brook, Isle of Wight. The larger part of the vertebral column, from early cervical to the first caudal vertebra, together with most of the pelvis was found (Blows 1978). During the two day dig, strangers would arrive and ask the inevitable question: 'What are you digging for?', to which Richard would reply: 'Pineapples', the rationale being that if the stranger thought us to be mad he would leave. In 1979, the author found part of the skeleton of an armoured dinosaur which became the second known *Polacanthus foxi* ever found (Blows 1982, 1987).

As the bones were at a point exposed only at low tide off Compton Beach on the Isle of Wight, the site required damming and bailing of sea water each time we went to do any digging because the previous high tide flooded the site and beach drainage water kept the site wet. The technique of damming was worked out by Richard and proved highly effective. On the first occasion the water level dropped, the points of two large dermal spines gradually emerged from the muddy gloom. Richard helped on the site regularly during the four years it took to remove the fossils. The concept of low tide digging

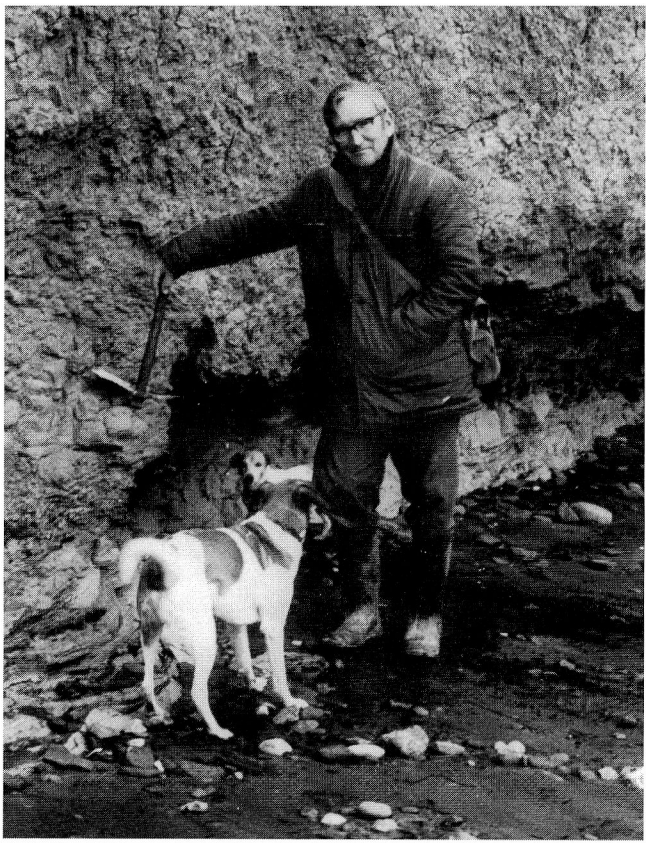

Figure 2. Richard Ford with his dogs Boss and Jig, at the Lower Cretaceous Wealden site near Brook, from where he collected the Isle of Wight's first Cretaceous mammal teeth. [Photograph taken in 1974]

in superwet conditions was well learnt by Richard during his Selsey Bill and *Bothriodon* digs.

He assisted with other dinosaur digs: notably when a *Megalosaurus* pelvis was extracted from the cliffs by a London University team, and when an important *Iguanodon* skeleton, which included a large part of the skull, was found by Nick Chase, and is now in the Natural History Museum, London. Richard never made dinosaurs his major enquiry, he always maintained that there were enough people looking for large fossils, so he concentrated on micro and small fossils. However, it was obvious to him that mammals should be found in the Lower Cretaceous of the Island, in the same beds as the dinosaurs. With this object in view, he re-examined the Wealden in detail and came to the conclusion that the most likely source of mammals would be the lignite (plant debris) beds which crop out at various localities along the south coast. He continued:

"While I was studying the cliff face, I saw what must have been a tree of diameter of 3 or 4 feet. It was a huge thing, but of course it was flattened by the weight of material above it over the years to about 6 to 8 inches. Just a flat slab, but it was sticking out of the cliff towards me. As I looked at it I could see the strata ran along in lines which curved down and ducked under the piece of wood that was sticking out and emerged upwards on the

other side. I realised immediately that it must have been lying in a river bed or moving water because the water had cut under the tree trunk forming a hollow, and pushed its way to the other side. It was obstructing a stream of some kind. I realised also that any small objects in the water were likely to collect in the hollow. So I very carefully dug out about a hundred weight and a half, as much as I could carry that day in a couple of great sacks. I processed it and had three or four thousand teeth altogether. In it were two and a half mammal teeth; three or four species of dinosaur including an *Iguanodon* vertebra; a *Megalosaurus* tooth; some teeth similar to but smaller than *Megalosaurus*; three unknown teeth, one of which may be named after me; three species of crocodile; some crocodile-like teeth with serrated edges which are not megalosaur (possibly *Baryonyx*?); all the fresh-water sharks teeth that Colin Patterson named in his monograph (Patterson 1966); and a mass of fish teeth, mostly *Lepidotus*. They were there by the bucket full."

The two multituberculate mammalian teeth, a left incisor and a left molar are the first mammalian remains from the Weald of the Isle of Wight, from midway between Compton Grange Chine and Hanover Point. They are related to *Loxaulax* sp. (Butler and Ford 1975). The unknown teeth may include the first discovery of a fabrosaurid dinosaur from the Weald. They were studied by Mike Howgate and may eventually be named after the finder. Crocodilian teeth (*Bernissartia*) were also found in this collection (Buffetaut and Ford 1979).

The Eocene

The Eocene deposits (average 50 million years old) on the island include, in sequence from oldest to youngest, the London Clay, the Bagshot Sands, the Bracklesham Beds, the Barton Beds and Lower Headon Beds (Osborne White 1921) with a similar terminology and correlation by Daley and Insole (1984). The strata have yielded fossil scutes and a trunk vertebra of *Ophisaurus* (Meszoely and Ford 1976), a lacertilian lizard from the Lower Headon Beds (Upper Eocene) of Headon Hill and Fishbourne, Isle of Wight. Richard found and described a new species of frog, *Albionbatrachus wightensis* (Meszoely, Spinar and Ford 1984) from the Lower Headon Beds of Alum Bay, Isle of Wight and named after the island. The holotype is a frontoparietal bone (MCZ 8784) and was found by Richard. Other specimens in his collection from the Eocene included the snakes *Calamagras* from Fishbourne, *Dunnophis* from Headon Hill, Totland Bay and Fishbourne and *Vectophis wardi* (Rage and Ford 1980) a new species (Holotype CGB 27), from the Lower Headon Beds, Totland Bay. His collection also consisted of unidentified anura (Palaeobatrachidae and Disgolossidae), lizards (Glyptosaurinae) and salamanders (*Megalotriton*) from Headon Hill (Rage and Ford 1980). He collected many thousands of minute teeth that appear as black specks on white card, until when viewed under a microscope, their structure and beauty was revealed. They are predominantly rodents like dormice and hamsters, but also lizards among others. Some he discovered were new genera, new species or new to the Formation. They represent a faunal array never previously known from these horizons. From the smallest to the largest animals, Richard Ford played a valuable role in the excavation, conservation and publication of these remains.

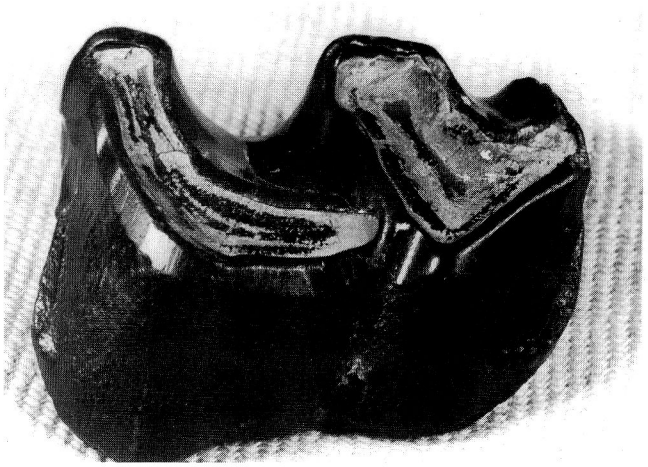

Figure 3. *Ronzotherium* tooth, from a primitive rhinoceros from the Hamstead Beds (Oligocene) of the Isle of Wight, collected by Richard Ford. About 5 times natural size.

The Oligocene

The Oligocene deposits (average 40 million years old) on the Isle of Wight are, in order of sequence from oldest to youngest, the Upper Headon Beds, Osborne Beds, Bembridge Limestone, Bembridge Marls and Hamstead Beds (Osborne White 1921). The Upper Headon Beds and the Osborne Beds are collectively called the Headon Hill Formation, and the Bembridge Marls Member and the Hamstead Member are collectively called the Bouldnor Formation by Daley and Insole (1984). The fauna of these formations include a rich variety of mammals, reptiles, fish and invertebrates. *Gliravus priscus, Gliravus devoogdi* and *Gliravus fordi* are Oligocene rodents, the family gliridae (doormice) from the Isle of Wight (Bosma and de Bruijn 1979). The latter was a new species named in honour of Richard and comes from the Lower Hamstead beds of Bouldnor Cliff, near Yarmouth. The type specimen, a cheek tooth (M^2) was found by Richard during microscopic analysis of clay, and is in the Geological Institute, State University, Utrecht (BC64). Also from the Hamstead Beds he found teeth and bones of *Ronzotherium*, a primitive rhinocerous (Ford 1971) (Figure 3); bones of the pig-like *Elotherium*; an astragulus of *Oxacron courtoisi*, a rabbit-sized ancestor of the deer (Caenotheriidae); and teeth of *Peratherium*,

a member of the opossum family (Ford 1972). He was the only person to find a skeleton of the largest Tapir-like ungulate *Bothriodon* from the Hamstead Beds. The skeleton was three feet tall with jaws up to eighteen inches long. About five inches of this jaw length was a toothless section between the canine and first premolar, and Richard speculated that this elongation is to allow the animal to reach up into the trees for food. *Elomyx* was a close relative of *Bothriodon* and of smaller size, whilst the pig-like *Entelodon* was only slightly larger. *Isoptychus aquatilis* and *Isoptychus fordi* are two species of rodent found by Richard from the Osborn beds of the Isle of Wight, the second named in honour of Richard (Bosma and Insole 1972). The holotype of *Isoptychus fordi* is an isolated tooth (BMNH M29431) sifted by Richard from sediments at Lacey's Farm Quarry, Isle of Wight. Other paratypes are in the Geological Museum at Bristol University. Richard found remains of a total of forty-nine mammals, and large crocodilians of the same age (Ford 1967). He unearthed hundreds of pieces of the turtle *Emys* including mutations within the carapace (Ford 1974) and many fossil insects and fish remains. He also discovered new species of plant remains like the fir cones *Sequoiadendon fordi* and *Pinus fordi* that are named after him (Chandler 1978).

The Pleistocene

On the Isle of Wight, drift and ancient river deposits, predominantly flint conglomerates, including the "Plateau Gravels" are of Pleistocene age (about 10,000 years old) (Daley and Insole 1984). Large Pleistocene mammals and prehistoric stone tools also featured among Richard's discoveries including the tusks and teeth of straight-tusked elephants. These were recovered from Newtown river muds at low tide with the assistance of his colleague Cyril Lucas, who was in charge of the oyster fishing in the area and could provide a boat. The specimens now form part of the extensive collections housed in the Museum of Isle of Wight Geology at Sandown.

Richard was also asked to help with the Selsey Bill elephant dig, along with about forty other people. The four days work resulted in the removal of a skeleton which was missing only part of one leg and the lower jaw. The discovery of flint knives and other implements on the site suggested to Richard that ancient man may have cut off the leg and jaw (with the tongue, a delicacy, still attached) and carried them away. On the island, Richard also found stone age implements such as scrapers from the Plateau Gravel at Cranmore, now in Carisbrook Castle Museum (Ford 1975).

Entomology and Zoology

Richard Ford was an entomologist and a zoologist of international renown. His publications included books on eggs and nests of British birds (Ford 1950); pond life (Ford 1951); British wild animals (Ford 1953); British reptiles and amphibians (Ford 1954); practical entomology (Ford 1963, 1969) and studying insects (Ford 1973). He was the co-founder with E. W. Classey of the *Entomologist's Gazette* in 1949, and in the same year he was awarded the Honorary Associate of the Department of Entomology by the Trustees of the British Museum (Natural History). His papers on insects covered the British Rhopalocera (Ford 1976*a*); spiral rotation in the larva of *Pieris brassicae* (Ford 1976*b*); parasites of ladybirds (Ford 1976*c*) and insect migration (Ford 1979). Richard narrates a story of one collecting field trip:

> "The physician to King Edward collected butterflies, and I met him with my father once in Chiddingfold, Surrey. He would catch a butterfly in his net, turn round to his chauffeur and say 'The box, Jones.' and Jones would fumble in the satchel and produce a pill box. He then put the butterfly safely in it and say 'The lid, Jones'. My father said to him 'Do you want this moth?' showing him a specimen in a box, but he said 'Oh no, I only take specimens I have caught myself'. My father prepared to let the moth go, but the Kings physician said 'Wait a minute, I haven't got my net ready'. When my father let the moth go, the physician caught it, turned to Jones and said 'The box, Jones', going through the routine again."

The Second World War

It would seem unlikely that a naturalist could provide an important contribution towards the war effort, but Richard Ford had memories of two such instances:

> "A young man came into the office at Watkins and Doncaster, then at 36 The Strand, and talked in Flemish. He kept repeating one word which I managed to discover was 'birdlime'. The sale of birdlime is, and was then, illegal, so I simply said 'verboten'. This was clearly understood and so he took from his pocket a letter which instructed me to afford the bearer 'all possible facilities' and to telephone Whitehall if in doubt. I did this and got the all clear. Struggling with my French, I said 'quantite'. By signs we arrived at a 2lb jam pot, so I optimistically said 'demain', and he left. I then tried in vain to phone round and get some birdlime. Not a hope, it was all made in Germany where it was used inside the works of slow moving clockwork toys. After an hour I got the information on how to make it by either distilling mistletoe berries or the inner bark of holly. I went home and got together some fellow members of the home guard and swore them to secrecy. We collected the holly, but it was a dreadful job getting out the inner bark. However, many hands prevailed and we had the most awful brew-up, fortunately outdoors before blackout. Getting it into the jar was a problem in itself. Next morning the young man was presented with the jar, compliments of the firm. We went to the top floor, where I pointed out that we were quite secure, and I produced

a pencil and paper. I had only to point to the jar and then draw a question mark. He drew a man dangling from a parachute and pointed to himself. Then he drew a tall building with a German sentry outside, as distinguished by the shape of their helmets. On the side of this building was a dove cot. Opposite was another building with a parapet around it. He showed how carrier pigeons alighted on the building before hopping over to the dove cot on the German H.Q. He then went though the 'chook, chook' routine with imaginary corn. I managed to explain that you could not put birdlime on a flat surface but he must rig up some kind of perch below the height of the parapet. I then got an old stuffed bird from a glass case and put birdlime on its feet. I washed this off with warm water at our sink and he understood that if he was going to intercept German messages, he would have to put them back and clean up the bird or he would have been discovered. He departed and I never heard another word about it. But it does leave much to the imagination."

Richard was a member of the Home Guard for the duration of the war. He continued his work as director of Watkins and Doncaster, which included the purchase of many book collections. In one such purchase Richard found a photograph album and in it were two excellent aerial shots of Berchtesgaden, Hitler's mountain retreat. A close friend of Richard's was Sir Robert Saundby, second in command of Bomber Command, Royal Air Force, and the photographs were quickly passed on to him with a message from Richard: "Do your stuff!" A short time later they met again with a reply of "What a turn up for the book!" No doubt they proved useful when the barracks at Berchtesgaden was bombed later in the war. Possibly the most important contribution made by Richard Ford concerned the planning operations for the invasion of Europe in 1945:

> "I was visited by a major who wanted to speak to me privately, so we could discuss secrets, and we went up to the roof of the building where we were unlikely to be disturbed. He explained that in Oxford there was a special map room where a complete model of the French coast was built to scale. They knew all the details from the air and maps etc., but what they didn't know was the detail of the vegetation. You can't land men on an unknown beach and suddenly find the vegetation is sea buckthorn, which is totally impenetrable to troops. They wanted to fill in the gaps of all the vegetation, and someone had said that the best source of imformation may be from naturalists or fishermen. So he called on me: did I know any people who had spent the summer holidays there, any collectors? 'Oh yes' said I, 'we have got a card index of them. They spend a week or two abroad, come back to us and ask us to print data labels giving details of place, date, time of collection to accompany the specimens. When we do this we print a copy on a card with the name and address and hold this in a card index because people go abroad and they want some more labels so they write and say "repeat my last order" to save telegram space'. I loaned the entire index to the major which he returned in two weeks, and I learnt that they found several of these collectors quite useful. He took them to Oxford individually, blind-folded them two miles from the city, and took them downstairs into the basement where this model was constructed, well hidden away. He showed them the model and said "We understand that on August the first 1935 you were there" pointing to the map. They all said the same thing: "How the hell did you know?"

Richard Ford died on 13th September 1996 in Newport, Isle of Wight.

Acknowledgements

I thank Richard and Nina Ford and their son Robin for their full cooperation and support in writing this biography.

References

ANON. 1961. Obituary of Leonard Talman Ford (1881-1961). *Entomologist Record* **73**, 67-68.

BLOWS, W.T. 1978. *Reptiles on the Rocks*. Museum of Isle of Wight Geology, Publication no.2.

BLOWS, W.T. 1982. A preliminary account of a new specimen *Polacanthus foxi* (Ankylosauria, Reptilia) from the Wealden of the Isle of Wight. *Proceedings of the Isle of Wight Natural History and Archaeological Society* for 1980, **7**(5), 303-306.

BLOWS, W.T. 1983. William Fox (1813-1881), a neglected dinosaur collector of the Isle of Wight. *Archives of Natural History* **11**(2), 299-313.

BLOWS, W.T. 1987. The armoured dinosaur *Polacanthus foxi* from the Lower Cretaceous of the Isle of Wight. *Palaeontology* **30**(3), 557-580.

BOSMA, A.A. 1974. Rodent Biostratigraphy of the Eocene-Oligocene transitional strata of the Isle of Wight. *Utrecht Micropaleontological Bulletins, Special Publication* I, 1-128.

BOSMA, A.A. and de BRUIJN, H. 1979. Eocene and Oligocene Gliridae (Rodentia; Mammalia) from the Isle of Wight, England. Part I: The *Giravus priscus-Gliravus fordi* lineage. *Proceedings of the Koninklijke Nederlandse Akademie van Wetenschappen, Series B: Palaeontology, Geology, Physics and Chemistry* **82**(4), 367-384.

BOSMA, A.A. and INSOLE, A.N. 1972. Theridomyinae (Rodentia; Mammalia) from the Osborne Beds (Late Eocene), Isle of Wight, England. *Proceedings of the Koninklijke Nederlandse Akademie van Wetenschappen, Series B: Palaeontology, Geology, Physics and Chemistry* **75**(2), 133-144.

BUFFETAUT, E. and FORD, R.L.E. 1979. The crocodilian *Bernissartia* in the Wealden of the Isle of Wight. *Palaeontology* **22**(4), 905-912.

BUTLER, P.M. and FORD, R.L.E. 1975. Discovery of Cretaceous Mammals on the Isle of Wight. *Proceedings of the Isle of Wight Natural History and Archaeological Society* **6**(10), 662-663.

CHANDLER, M.E.J. 1978. Supplement to the Lower Tertiary Floras of Southern England, Part 5, *in Tertiary Research, Special Publication* **4**. Tertiary Research Group, London.

DALEY, B. and INSOLE A. 1986 (1996 reprint). *The Isle of Wight.* The Geologists' Association, Guide 25.

FORD, R.L.E. 1950. *Eggs and Nests of British Birds.* Adam and Charles Black, London.

FORD, R.L.E. 1951. *Pond Life.* Adam and Charles Black, London.

FORD, R.L.E. 1953. *British Wild Animals.* Adam and Charles Black, London.

FORD, R.L.E. 1954. *British Reptiles and Amphibians.* Adam and Charles Black, London.

FORD, R.L.E. 1963. *Practical Entomology.* Butler and Tanner, London.

FORD, R.L.E. 1967. Hampshire's Age of Crocodiles. *The Illustrated London News* **250**, (6660 March).

FORD, R.L.E. 1969. *Practical Entomology* (revised edition). Butler and Tanner, London.

FORD, R.L.E. 1971. A new fossil mammal from the Hamstead Beds (Oligocene). *Proceedings of the Isle of Wight Natural History and Archaeological Society* **6**(6), 400-401.

FORD, R.L.E. 1972. Two more fossil mammals new to the Hamstead Beds (Oligocene). *Proceedings of the Isle of Wight Natural History and Archaeological Society* **6**(7), 493.

FORD, R.L.E. 1973. *Studying Insects - A Practical Guide.* Frederick Warne, London.

FORD, R.L.E. 1974. Mutation in the carapace of the fossil turtle *Emys* from the Hamstead Beds (Oligocene). *Proceedings of the Isle of Wight Natural History and Archaeological Society* **6**(9), 610-611.

FORD, R.L.E. 1975. Flint scraper from Plateau Gravel at Cranmore. *Proceedings of the Isle of Wight Natural History and Archaeological Society* **6**(10), 668.

FORD, R.L.E. 1976*a*. The influence of the Microgasterini on the populations of British Rhopalocera (Hymenoptera, Braconidae). *Entomologist's Gazette* **27**, 205-210.

FORD, R.L.E. 1976*b*. Spiral rotation in the larva of *Pieris brassicae*. *Proceedings of the Isle of Wight Natural History and Archaeological Society* **7**(1), 43-44.

FORD, R.L.E. 1976*c*. Dipterous Parasites of Ladybirds. *Proceedings of the Isle ofWight Natural History and Archaeological Society* (1979), 7 (1), 47.

FORD, R.L.E. 1979. Migration of insects in 1977. *Proceedings of the Isle of Wight Natural History and Archaeological Society* **7**(2), 100.

GALTON, P.M. 1974. The Ornithischian dinosaur *Hypsilophodon* from the Wealden of the Isle of Wight. *Bulletin of the British Museum (Natural History), Geology* **25**(1), 1-152c.

MESZOELY C.A.M. and FORD, R.L.E. 1976. Eocene glass-lizard *Ophisaurus* (Anguidae) from the British Isles. *Copeia* **2**, 407-408.

MESZOELY C.A.M., SPINAR Z.V. and FORD, R.L.E. 1984. A new Palaeobatrachid frog from the Eocene of the British Isles. *Journal of Vertebrate Paleontology* **3**(3), 143-147.

OSBORNE WHITE, H.J. 1921. *A short account of the geology of the Isle of Wight.* Geological Survey of Great Britain.

PATTERSON, C. 1966. British Wealden Sharks. *Bulletin of the British Museum (Natural History), Geology* **11**, 283-350.

RAGE, J.C. and FORD, R.L.E. 1980. Amphibians and Squamates from the Upper Eocene of the Isle of Wight. *Tertiary Research* **3**(2), 47-60.

APPENDIX 1: Specimens donated by Richard Ford to the Department of Palaeontology of the Natural History Museum, London.

1925 Fragment of Chalk Sponge in Flint from Kent.
1937 26 Belemnites from the Lias of Charmouth, Dorset.
1939 10 gastropods from the Oligocene of the Isle of Wight.
1939 11 Bryozoa from the Chalk of Southern England.
1939 Teredo bored wood from Surrey.
1953 1 echinoid with a worm burrow, from Surrey.
1954 1 sponge from the Chalk of Kent.
1958 Bryozoan from the Upper Greensand.
1962 Vivianite crystals on an ammonite.
1962 Fish from the Hamstead Beds, Isle of Wight.
1963 25 mollusca, 4 blocks containing *Erodona plana*, 1 bird bone and crocodile fragments from the Isle of Wight.
1965 11 fossil plants from the Isle of Wight including new species.
1967 1 head of *Rhinocephalus planiceps* from the London Clay of Sheppy.
1983 22 sharks teeth *Scapanorhynchus* and *Squatina* from the Weald of the Isle of Wight.
1986 39 rodent teeth (*Eomys*), Lower Oligocene, Bouldnor Cliff, Isle of Wight.

Total conservative estimate of palaeontological specimens donated, including those not recorded is 156.

Appendix 2: Specimens donated by Richard Ford to the Department of Entomology of the Natural History Museum, London.

1939 100 Chalcids new to the British Isles.
1946 40 Rhopalocera from the British Isles.
1948 2 butterflies (*Papilio*) new to the Natural History Museum.
1949 3 specimens of *Danaus* from Australia.
1949 A collection of about 20,000 Lepidoptera including type specimens.
*c.*1949 1,496 Heterocera from Ceylon.
1950 6 rare butterflies.
1950 65 butterflies from Malaysia and Europe.
1951 1 butterfly, the type of *Polyommatus icarus* Wright. (Common Blue).
1951 2 butterflies from Malaysia.
1951 155 Hesperiidae butterflies from various localities.
1951 1 female *Papilio* and 3 butterflies from Formosa.
1952 205 butterflies from various localities.
1953 8 Ichneumonidae from cacoons.
1953 505 Hymenoptera from Nigeria.
1954 16 butterflies new to the Natural History Museum.
1954 19 British Heterocera.
1954 1 unusual butterfly (*Aglais*).
1955 1 holotype butterfly of *Abisara huntei* from British New Guinea.
1956 1 unusually coloured wood pigeon.
1957 26 butterflies from various localities.
1957 67 butterflies.
1958 76 butterflies.
1958 101 butterflies.
1959 7 butterflies and 69 moths from Burma and France.
1962 5 *Aphoda limacodes*, 2 Rhopalocera and 6 British Heterocera.
1962 Various moths.
1962 3,500 Microlepidoptera.
1962 4 British Heterocera.
1962 1 *Hagenowia infulasteroides*.
1963 76 butterflies from Tanganyika.
1963 1 Indian butterfly and 1 British butterfly.
1963 3 butterflies from various localities.
1963 9 British Heterocera.
1963 22 butterflies.
1964 10 butterflies from various localities.
1964 29 British Heterocera.
1964 1 butterfly *Euphloea core wheeleri*.
1966 9 British Lepidoptera, 6 British Rhopalocera.
1968 264 Rhopalocera from Africa and 3 butterflies from Britain.
1968 1 Pierid butterfly from Nigeria.
1968 14 aberrations.
1969 5 British Heterocera.

Total conservative estimate of entomological specimens donated, including those not recorded is 26,938.

Appendix 3: List of fossil taxa described based on Richard Ford's collections.

New mammal species named after Richard Ford:

Isoptychus fordi, Osborn beds, Oligocene; Isle of Wight (Bosma and Insole 1972).

Gliravus fordi, Lower Hamstead Beds, Oligocene; Bouldnor Cliff, Yarmouth, Isle of Wight (Bosma and de Bruijn 1979).

New mammal species found by Richard Ford:

Gliravus devoogdi, Headon Beds, Oligocene; Isle of Wight (Bosma and de Bruijn 1979).

Mammal species new to the Isle of Wight found by Richard Ford:

Related to *Loxaulax* sp., Wealden Beds, Lower Cretaceous; Compton Bay, Isle of Wight (Butler and Ford 1975).

Oxacron courtoisi and *Peratherium* (Ford 1972) and *Ronzotherium* (Ford 1971), Hamstead Beds, Oligocene.

Other mammals

Elotherium and *Bothriodon*, Hamstead Beds, Oligocene.

Elomyx and *Entelodon* (Oligocene).

New amphibian species

Albionbatrachus wightensis, Lower Headon Beds, Upper Eocene; Alum Bay, Isle of Wight (Meszoely, Spinar and Ford 1984).

New reptile species

Vectophis wardi, Lower Headon Beds, Upper Eocene; Totland Bay (Rage and Ford 1980). [Holotype CGB 27]

Lizards and snakes

Ophisaurus, Lower Headon Beds, Upper Eocene; Headon Hill and Fishbourne (Meszoely and Ford 1976).

Calamagras, Eocene; Fishbourne (Rage and Ford 1980).

Dunnophis, Eocene; Headon Hill, Totland Bay and Fishbourne (Rage and Ford 1980).

Plants species named after Richard Ford

Sequoiadendon fordi , Hamstead Beds, Oligocene; Isle of Wight (Chandler1978).

Pinus fordi, Hamstead Beds, Oligocene; Isle of Wight (Chandler1978).

CRYSTALLOGRAPHY AND THE GEOMETRIC MODELLING OF MINERALS: A REFLECTION ON THE MODELS IN THE NATURAL HISTORY MUSEUM, LONDON

by Peter Tandy

Tandy, P. 1998. Crystallography and the geometric modelling of minerals: a reflection on the models in the Natural History Museum, London. *The Geological Curator* 6(9): 333-338.

The fascination to mankind of natural crystals must have started at the dawn of civilisation, but collectors only started to look at them in a scientific way during the 16th century. Even so it was not until the 18th century, when crystallographic knowledge had advanced sufficiently, that crystallographers began to make models of individual crystals, primarily for teaching. After a brief historical survey, extant examples in the National Collection and the materials used in their construction, are discussed, as well as some aspects of the backgrounds of those who made them and their reasons for doing so.

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Introduction

From the very earliest times, mankind must have been fascinated with mineral substances. In particular, sparkling crystals would surely have caught the eye and thence the imagination, and may well in some instances have been interpreted as an offering from the Gods. We shall probably never know just when crystals first became important symbols, nor when their geometrical properties were first realised, but it is reasonable to conjecture that we can trace an interest and some geometrical knowledge at least as far back as the ancient Greeks. After all, the very word "crystal" is derived, through a Latinised version, from the Greek "Krystallos" meaning ice, as they assumed clear quartz crystals were composed of ice somehow frozen in time. In addition, Plato, though a philosopher and not a mathematician, spoke of the five regular geometrical solids, the cube, octahedron, tetrahedron, icosahedron and dodecahedron, four of which occur in nature in reasonably common compounds. If the Greeks did draw any similarity between the purely mathematical octahedron and natural pyrite or magnetite crystals, or the cube and salt crystals for instance, then the information appears to have been lost, as was much of their learning. Some 1500 years had to elapse before Biringuccio in 1540, made note of the apparently perfect shape of pyrite cubes and Agricola, in 1546, gave a detailed description of the forms of quartz. Despite the efforts of worthies such as Cardanus who in 1550 tried to explain the form of crystals by close packing of spheres, or of Gesnerus in about 1565 who classified 'fossils' (at that time anything dug from the ground) on the basis of shape, or even that of Palissy in 1580 who stressed the importance of geometrical forms, no great leap forwards was made until the 17th century.

In 1610, Kepler studied snow crystals and asked why they are never five- or seven-sided, but always six-sided, and started to consider how they could be constructed from packed spheres. About 60 years later Nicolas Steno proposed his law of the constancy of interfacial angles. Approximately a century was to pass before Rome de l'Isle, in 1772, laid the foundations of morphological crystallography with his *Essai de Cristallographie*, followed 11 years later by an expanded edition, which re-stated and confirmed the law of constancy of interfacial angles. In 1801, René Just Haüy published his *Traite de Mineralogie*, a fundamental work which, with its rigorous geometrical section and numerous crystal drawings took morphological crystallography into a new era and made Haüy the 'father of crystallography'.

By now it was becoming clear that, although many mineral crystals were complex in appearance, there were certain similarities. The idea of scientifically grouping natural substances had been attempted since the days of collectors like Hans Sloane, but this was based more on occurrence, crude chemistry, and perhaps simple physical appearance than anything else, and differed little from the even cruder system from the time of Pliny. Bernhardi advocated in 1808 that it should be possible to group substances into a number of systems based on their morphology. Weiss, in 1815 classified crystals into four main systems with subdivisions, based solely on mutually perpendicular axes, while Mohs in 1822 in his *Grundriss der Mineralogie* included oblique axes and proposed six systems.

Bergmann later increased this to the seven systems we are familiar with today. In 1830 Hessel described the 32 symmetry classes, and in 1850 Bravais enumerated the 14 space lattices which are named after him, although much credit should also go to Moritz Ludwig Frankenheim who published, 8 years earlier, results showing there are 15, only for Bravais to reap the rewards by proving that two of them were identical (see Burke 1962 and Lima de Faria 1990 for excellent general introductions to historical aspects of crystallography).

But the problem of visualisation of crystals, or of their symmetry elements, especially if the genuine articles were small, rare or poorly formed, remained. For teaching in particular it was rarely, if ever possible, to get hold of sufficient examples all exactly the same. Clearly the answer was to produce models of the crystals involved. Initially these concentrated on morphology, but later, structural models became at least equally important. There is no account known to the author stating categorically when the first models of naturally occurring mineral substances were constructed. It is possible that Nicolas Steno, when looking at sections of quartz crystals and deducing that, irrespective of their degrees of perfection, they had the same interfacial angles, may well have made himself some paper or card images; but these would have been only planar non-regular hexagons, and their survival would be extremely unlikely. Whatever models remain from the earliest days of study, few will be older than the late 18th century as the science to describe and understand them was only advanced at that time.

Crystal models

Probably one of the earliest sets of models purely for teaching is that constructed by Lermina and Carangeot to accompany the publication in 1783 of the later treatise by Rome de l'Isle. The set in the Natural History Museum, London (NHM) is made of baked red to pale-brown clay. It consists of some 400 models representing numerous modifications of a series of fundamental shapes called by de l'Isle the regular tetrahedron, cube, rectangular octahedron, rhomboid, rhomboid octahedron, and triangular dodecahedron. A few of the models are made in two halves, bound with fine twine, and intended to show the operation and result of twinning (Figure 1). Each model bears a printed ticket with a number corresponding to the plate in de l'Isle's book. Similar models were made to accompany the work of Haüy. Some of these are known in fine porcelain and are very rare.

From the same period comes another fine set, made in polished mahogany, by the Comte de Bournon for the Hon. C.F. Greville, whose pursuit of mineralogy was only one of his many interests. De Bournon, despite once being a soldier fighting for France, became a political refugee during the period of the Revolution, and arrived in England where he gained some work cataloguing collections and teaching mineralogy. His models in the Natural History Museum, London, apart from being a wide ranging and nearly complete set of 667 (there were originally 714, including no fewer than 363 examples of calcite), are more unusual in each being accompanied by a little booklet, often tied with a red ribbon and written by de Bournon in old French, to explain the crystallography (Figure 2). These models were made by de Bournon with his own hands; the work was laborious and apparently injured his health. Alas there was some damage in particular to the labels, by water in 1940.

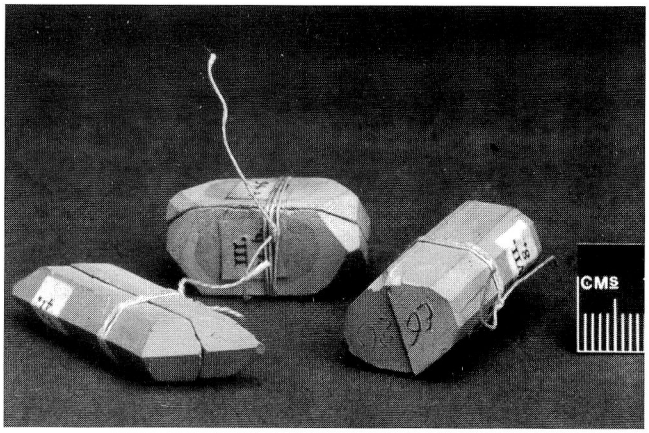

Figure 1. Rome de l'Isle models, 1784, showing twinning.

Amongst the most comprehensive sets ever produced are those made by the German firm of Krantz, one of the earliest geological suppliers, and still in existence today. Made in a fine-grained wood (pearwood?), they number 743 in the 'basic' set with a further 213 in a supplementary set, and it is thought that the NHM has the only complete and original set. Apart from basic forms, the set also has examples made in two halves but on a central pivot (unlike the Lermina and Carangeot examples), so that one half can be rotated around the other to demonstrate twinning (in effect they generally

Figure 2. Comte de Bournon model with accompanying booklet.

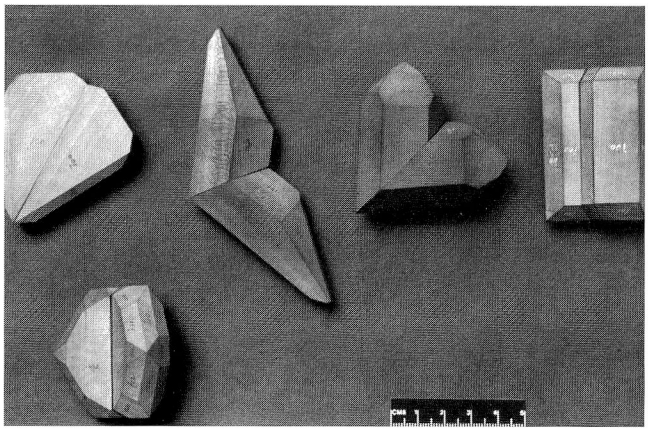

Figure 3. Rotatable models by Krantz in pearwood, showing twinning.

rotate around an axis normal to the twin plane) (Figure 3). Some of these are particularly striking, and once one has operated them a few times, the relationship between two individuals in a twin crystal becomes clear.

Wood

Wood with its versatility and near-universal occurrence, is perhaps the most obvious material from which to construct models, but many other media have been used. An early set of just five models, which originated in that part of the Philip Rashleigh collection which was housed at Stoketon, Saltash and was acquired by Sir Arthur Russell, is made in bronze. These exquisite examples, produced some time before 1811, also each show twinning and are split in two parts, rotatable around a central pivot in the same way that the Krantz examples are (Figure 4).

Lead

Lead should be an obvious medium to use because of its low melting point and easy availability, but surprisingly seems to have been little used. The Natural History Museum has just a few crude 'models' (rather more mathematical than crystallographic); they are from the estate of James Sowerby and date from about 1805.

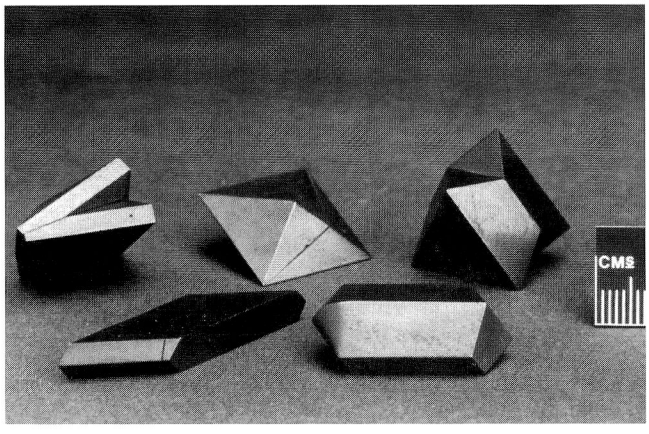

Figure 4. Rotatable models in bronze, pre 1811.

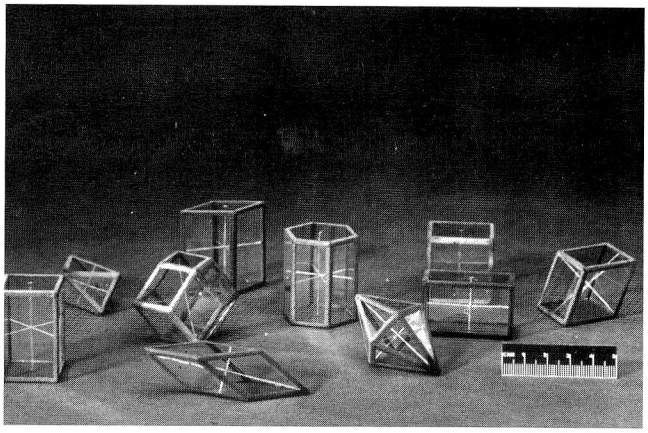

Figure 5. Planar glass models by Krantz, with thread crystal axes.

Glass

Glass is another obvious medium to use. The NHM has a set of 24 tiny models up to about 15mm long, each made in coloured glass to represent the species it is imitating; these were presented by Monsieur de Struve in 1825. By contrast, those made by the firm Krantz in 1901, to a design by (Sir) Lazarus Fletcher of the then British Museum (Natural History) (now the NHM) consist of a simple plane glass envelope edged with passe-partout tape and sometimes including coloured threads to show crystallographic axes (Figure 5). Fletcher wanted those with threads to be in solid glass but the cost of boring the slender holes through the centre was too prohibitive. Some larger examples of the same sort in the NHM are known to date from the late 1930s, so Krantz has been making them to this pattern for some considerable time. Rather similar, but somewhat more extravagant in being much larger (averaging about 15 cm) is a set consisting of clear planar glass with internal coloured wires, which outline a few forms possible within the crystal system as well as indicating the crystal axes. These are thought to have been made by a mineral dealer called N.J. Larkin who wrote a book on crystallography in 1820 (Figure 6).

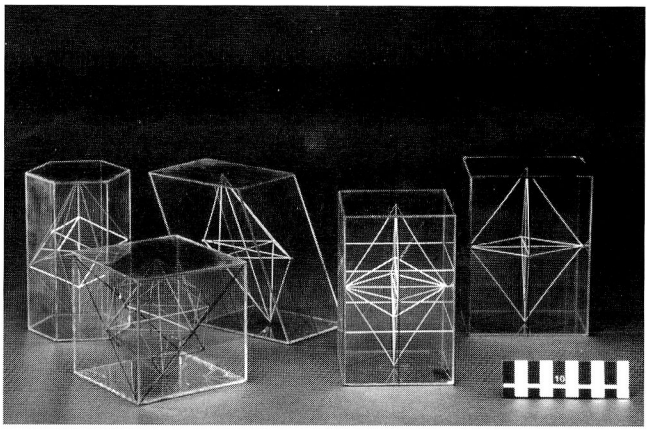

Figure 6. Planar glass models by N.J. Larkin with wire inserts.

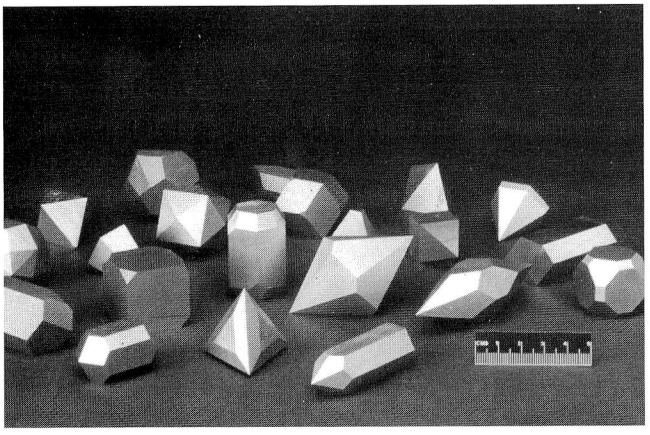

Figure 7. Aluminium models by Cutrock Engineering, *c.*1960.

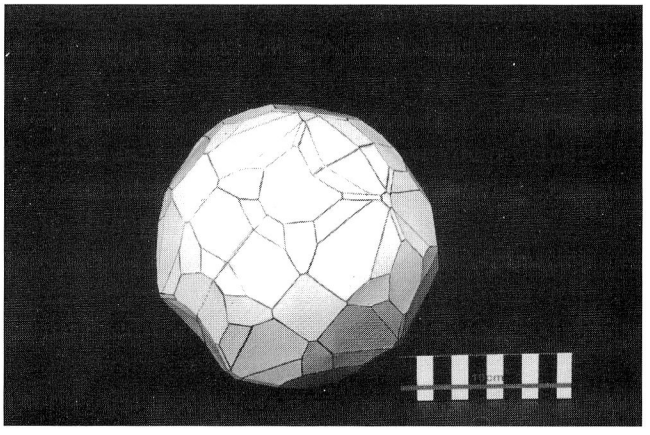

Figure 8. Painted card model of fluorite spinel-twin showing all 7 forms of the holosymetric class, by R. Begley, 1980.

Aluminium

In the 1960s Cutrock Engineering made and sold models of machined aluminium. These were based on forms shown in F.C. Phillips' *Introduction to Crystallography* (Phillips 1956), which accounts for the inclusion, among the usual mineral compounds of such non-mineral compounds as iodosuccinimide, triethylammonium chloride and lead antimonyl tartrate (Figure 7).

Paper or Card

Paper or card is a convenient material to use for modelling crystals, because besides being relatively cheap and versatile, it has the extra advantage over more resilient media of being produced in 2-dimensions easily to be turned into 3-dimensions. No paper models are known, to the best of this author's knowledge, from the very earliest days of crystallography. If there were any, then physical factors or collection mismanagement have probably destroyed them. But once crystallography became more established, by the mid 19th century, a number of treatises included nets for the reader to make their own models.

In 1849, Hermann Kopp of Braunschweig, produced a work on crystallography with a separate atlas of crystal forms and 7 plates of nets (Kopp 1849). Using them it is possible to construct 56 different crystals. They are printed on thin paper, although the idea was probably to cut them out directly rather than trace them. Friedrich A. Kolenati in 1855 had a similar number, but unless he intended the modeller to scale them up, he relied on nimble fingers as they are quite tiny (Kolenati 1855). Adolph Kenngott published in Prague in 1878, a book of 120 nets (Kenngott 1878). As a variation on the theme, John Gorham (1888) used a system of plaiting to produce models; this work includes a cleverly designed plaited model of a bismuth crystal with hopper faces! Thomas Murby, the publishers, produced in 1928, their *Patterns for the Construction of Crystal Models Representing Actual Minerals* in black glossy paper (to be pasted on to card); these were designed by Frank Smithson of London University who was following earlier work by J.B. Jordan. Most recently the British Museum (Natural History), as the Natural History Museum was then, produced a similar limited number for sale in the 1970s.

Finally, among card models it is worth mentioning the two examples based on some remarkable but small fluorite crystals discovered in the U.S.A. The natural crystals show all 7 forms of the holosymmetric class of the cubic system, that is, the special forms of cube, rhombic dodecahedron, tetrahexahedron, octahedron, icositetrahedron and trisoctahedron, as well as the general form hexakisoctahedron. The crystals are complex and the models, a single and a spinel-twin crystal made by an amateur mineral collector in Norfolk, amply demonstrate this (Figure 8).

Builders of models and collections of note

W.H. Wollaston

It is likely that most crystallographers, mineralogists, and a goodly number of chemists, particularly in the 18th and 19th centuries, had a set or sets of models at some time. One who did was the remarkable William Hyde Wollaston, who was born in 1766 at East Dereham, Norfolk, and started as a medical practitioner before relinquishing this in 1801 to study chemistry. He went on to make original discoveries in pathology, crystallography, physics, astronomy and botany. He invented the camera lucida, discovered palladium and rhodium, and in crystallography, invented in 1809, the reflecting goniometer, enabling him to study the morphology of minute crystals. He possessed a comprehensive set of 570 morphological models, constructed in a light fine-grained polished wood similar to the Krantz series, but of a smaller size, and each bearing the species name stamped in minute lettering. These were housed in an inlaid wooden cabinet, of which 10 neat partitioned wooden drawers (but alas no carcase) survive.

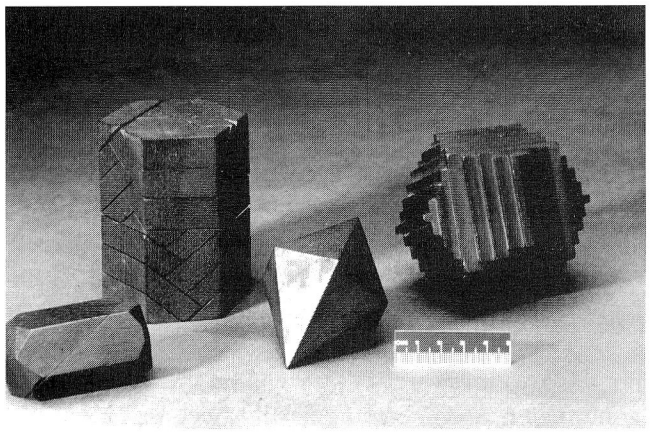

Figure 9. Wood models made by F.Accum, *c.*1813.

Frederick Accum

Another who not only possessed various models, but also made them was Frederick Accum. Although a chemist by profession, he published a small work in 1813 entitled *Elements of Crystallography* (Accum 1813). The models, in a dark polished wood, were made to be used in conjunction with the book, although he made it clear that the book could be used alone. A basic set comprised 50 models, but there was also a second set of 87 models divided into 6 classes. They could be purchased as sets or individually to suit the need (Figure 9).

Alexander S. Herschel

Professor Alexander S. Herschel, FRS, of Slough, the brother of the rather more famous William Herschel who discovered Uranus, made a crude set of his own models in about 1895. He was studying the packing of spaces, and so these are not morphological crystal models in the sense of the previous examples. They are of rough white timber, probably pine or deal, crudely (although effectively) cut, and are mounted on a wire spike on turned or planar wooden plinths (Figure 10).

William Barlow (1845-1934)

Some of the most intriguing and strangest of crystal models are those made by William Barlow, who was

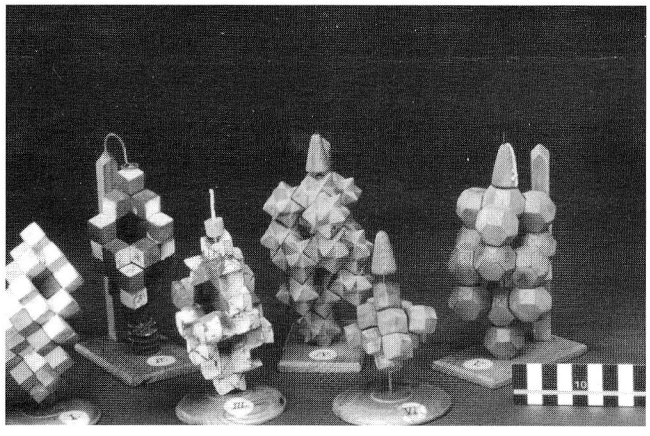

Figure10. Space-filling models by Professor A.Herschel, *c.*1895.

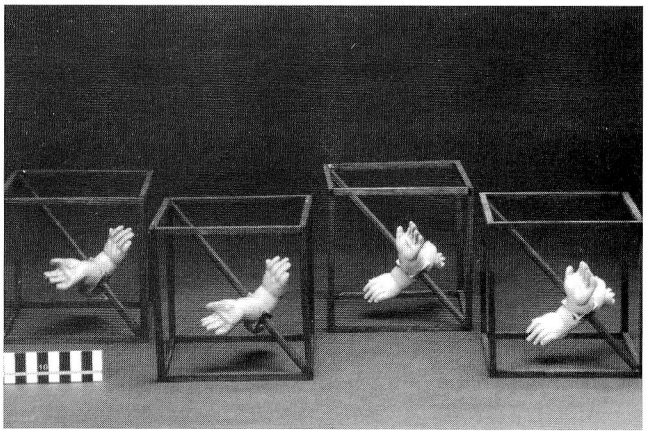

Figure 11. Space-group models made by William Barlow.

born in 1845 and who died in 1934. After a private education, Barlow joined his father's business as a speculative builder just as the north London suburbs were being developed. When his father died William sold the business for a small fortune and was able then to spend his days studying crystallography. Barlow had an extraordinary ability to visualise geometrical structures and it is said that he developed this from working out how to accommodate the greatest number of people and get the densest packing of houses on a acre of land, as well as the placement of doors and windows, and the patterns on wallpapers. He was an expert cabinet maker and his workshop is said to have resembled a toy factory with thousands of balls of various sizes and colours, and myriads of dolls hands used in the making of his models and to show the enantiomorphous nature of crystals. Each of the models (Figure 11) consists of thin mahogany laths forming an open lattice-work cubic 'shell', with 3 plaster dolls hands in a planar group on a wooden diagonal. Each model is one of eight "cubelets", which together form a larger cube. In these models it is the hands that are of paramount importance; the woodwork is merely a framework and is arbitrarily divided into cubelets, and would be better removed entirely. He chose hands as a symbol partly because they are understood by everybody, and especially because they have no

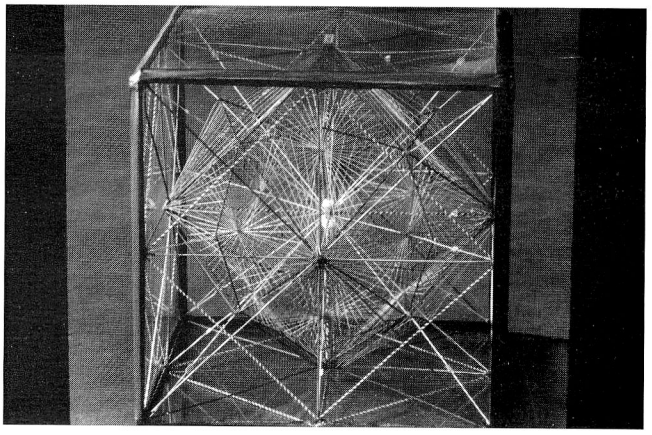

Figure 12. Planar glass cubic model with coloured silk threads showing crystal forms. Made by Nina Hosali, *c.*1920.

suggestion of atomicity as spheres would have. It is important to grasp the point that Barlow was dealing with the elements of symmetry of the arrangement of symbols used (hands), and NOT the symbols themselves. This is the study of space groups, which Barlow independently discovered to number 230. Only 4 models remain from an original set of some 200-300.

Nina Hosali

If Barlow's models are the strangest, then those made by Miss Nina Hosali in about 1920 are perhaps the most beautiful (Figure 12). Using exterior envelopes of plane glass whose shape is of a simple crystal form, Miss Hosali carefully fixed fine silk threads of various colours over wire frames to show two or three other forms. Because this construction method allows faces of one form to intersect faces of another, it was possible to make all forms approximately the same size. Different colours of thread were then used to show the crystallography

a) black threads for crystallographic axes.
b) white threads for symmetry axes (twisted together with the black threads where these axes coincide); the degree of symmetry is attached as a small printed number to the thread ends.
c) twisted red and white threads for traces of the plane on the glass envelope for the simultaneous operation of rotation about an axis and reflection across a perpendicular plane, with a further numbered white thread to show the axis and its degree of symmetry.
d) and a pair of white beads where the symmetry elements are centro-symmetrical. She was able to combine right and left handed forms, as in the tetragonal scalenohedral class, by asking the user to invert the model through 90 degrees, when the alternative form would be then visible. Similarly, enantiomorphic forms could be obtained from one model by reflection in a plane mirror. The complete set of 24 models shows over 70 forms, but with reflections and rotations this is increased to about 140.

Conclusion

Crystal models such as those referred to above represent the classical era when crystallography was taught to all students of mineralogy. Given the huge advances in technology in recent years, it is reasonable to ask whether there is any future for crystal models or whether they now represent nothing more than an interesting piece of history.

Quite apart from the current interest in such items from the antiquarian point of view, especially on the Continent, where examples in auction can command high prices, this author believes that for teaching they have as much use today as they did when originally made. Although there are a number of computer programmes which will show any shape desired, which can then be rotated through any angle, and notwithstanding that computer graphics have progressed hugely in recent years, this, at present at least, is still a 2-dimensional representation of a 3-dimensional object. This author is yet to be persuaded that this is necessarily better than having a 3-dimensional object in the hands which can rapidly be placed in whatever position is required, and viewed from any angle. Furthermore the tactile sense of 'feeling' the shape conveys more than seeing a planar image however good that image might be. Also, as an exercise, they can be measured with a goniometer, and the student who becomes a curator may be required to do this later with a real crystal - and all students can be assured that no real crystal will be flat on a computer screen! Finally, if more reasoning is required, a simple (but hopefully accurate) wooden model, unlike a computer simulation, requires no additional training to operate its rotation in space, is resilient to knocks and bangs, is not affected at all by viruses, will not suddenly 'crash', and is immensely cheap to run! Surely, what more proof is required?

Note

The author has been conducting an initial survey of crystal models held in museums. If anyone would like to add information, a short questionnaire can be obtained from the author at the above address.

References

ACCUM, F. 1813. *Elements of Crystallography, after the method of Hauy, with, or without, series of geometrical models, both solid & dissected...etc.* Longman, Hurst, Rees & Brown, London.

BURKE, J. 1962. *The establishment and early development of the science of crystallography.* Unpublished D.Phil. dissertation, Stanford University.

GORHAM, J. 1888. *A system for the construction of Crystal Models on the type of an ordinary plait.* E. and F.N. Spon, London.

KENNGOTT, A. 1878. *120 Krystallformennetze zum Anfertigen von Krystallmodellen.* Prag.

KOLENATI, F.A. 1855. *Elemente der Krystallographie.* Brunn.

KOPP, H. 1849. *XXI Kupfertafeln zu der Einleitung in die Krystallographie und in die krystallographische kenntniss der wichtigeren Substanzen.* Friedrich Nieweg & Sohn, Braunschweig.

LIMA de FARIA, J. (ed.) 1990. *Historical Atlas of Crystallography.* Kluwer Academic Publishers.

PHILLIPS, F.C. 1956. *An introduction to crystallography.* 2nd edition. Longmans, London.

VERONICA BURNS 1914-1998

Curator Geological Museum, Trinity College, Dublin 1964-1980

Veronica Conroy Burns (1914-1998)
in the Geological Museum, Trinity College, Dublin *c.* 1980.

Veronica Conroy Burns, formerly Curator of the Geological Museum, Trinity College, Dublin, was born at Calvinstown, Co. Kildare, Ireland on 13th November 1914 and died in the Molyneaux Home, Leeson Park, Dublin, Ireland, on 5th January 1998 aged 83 years. Shortly after her birth she was fostered with neighbours on account of her mother's ill-health, and after some time she moved with her foster parents to Dublin where she was raised as their only child. It was only when she was twenty-one years old that she became aware of her natural family, when she was traced by her brother, who was a member of the Metropolitan Police - she had three sisters and seven brothers. She then took her family name, Conroy, as her second name, but remained living with her foster parents. She lived at 39 Pembroke Road, Ballsbridge, in a garden flat, for most of her life, apart from short periods when she worked in Armagh and temporarily in England, and during the final two years of her life. After the death of her foster parents she shared her home with a succession of cats including Amaryllis and later Charlemagne ('Charlie').

Veronica was largely self-educated, and she developed a strong interest and deep understanding of astronomy, classical archaeology, natural history, and geology; subjects in which she built up good reference libraries. In the 1940s she worked for a period as an assistant at the Armagh Observatory under its Director Dr Eric Lindsay, where she compiled meteorological records. She was a founder member of the Irish Astronomical Society in 1937 and served on its first committee in 1938, as Secretary for a period, and as its Vice-President

in 1987 and 1988. During the latter years of the Second World War and immediately afterwards she spent a period training as a laboratory assistant with Goodman's Industries of Wembley and with the General Electric Company. Subsequently she worked in a photographic studio in Dublin.

She joined the Dublin Naturalists' Field Club, a local group of amateur and professional naturalists, in 1953, and quickly became involved with its Geology Group. She was the Club's Honorary Secretary in 1958, and served on its committee for many years, and was later elected a life member. She will be remembered for her long-term organisation of the Club's annual 'Exhibition Meeting', and for her skilled and dedicated leadership during many field excursions to the rocks of County Dublin and further afield. Veronica was also a member of the Irish Geological Association, a sometime Vice-President, and Honorary Member.

In early 1964 Professor R.G.S. Hudson appointed her as a photographic technician in the Department of Geology in Trinity College, Dublin. Soon after her arrival in Trinity she assumed responsibility for the Geological Museum and its large collection. The museum which contained many specimens of scientific and historic value had been downsized about ten years earlier, and although the Professor of Geology was its curator, in reality the collections had been somewhat neglected. Immediately Veronica redesigned and updated the displays. She curated and catalogued some 20,000 specimens, and reorganised the mineral collection of which she was especially fond. She was ideally suited to museum work being neat, meticulous, and interested in visitors. She was never happier than when showing children, either individually or whilst on school trips, around the museum. On her retirement in 1980, when she was succeeded by John Nudds, she retained office space in the Museum and continued to host parties of school children. Years later visitors continue to ask for her, and for many who graduated to employment as professional geologists Veronica and her museum was their first experience of geology.

Veronica's other main geological attribute was as a fossil collector, and in this she excelled. On Saturday mornings she would take a bus to the collecting localities and would spend all day splitting rocks in her search for good specimens, stopping only briefly to eat a sandwich. In the early 1960s she began to collect Silurian graptolites from the coastal area north of Dublin between the villages of Balbriggan and Skerries and from small quarries and exposures inland. These rocks are in the main rather poorly-fossiliferous, but through her tenacity and patience she was able to assemble a large collection which numbered some 2000 specimens. Through the influence of Hudson she additionally focussed on Feltrim Hill, a Carboniferous mudmound north of Dublin, from where she collected a large number of fossils from the Waulsortian limestones and intercalated shales. These were used by Hudson, Michael Clarke and George Sevastopulo in their 1966 paper published in the *Scientific Proceedings of the Royal Dublin Society*. She kept an album of photographs that she had taken of the quarry at the time, and it contains two fascinating images: one is of the windmill that once stood on top of Feltrim Hill, perched precariously on a isolated tower of limestone around which quarrying had taken place [The windmill was removed shortly afterwards], and the second is of Veronica herself brandishing her hammer at a mechanical digger, and captioned "The Rivals". The album and the hammer are now in the Geological Museum in Trinity.

She was rather modest about her achievements and it was only when Barrie Rickards was appointed as a lecturer in geology in Trinity in 1967, was the importance of her graptolite collection recognised. With Rickards and Jean Archer in 1973 and more recently in 1993 with Rickards, she published two papers in which her collections were utilised to determine precisely the age of the succession in the Balbriggan Inlier. In the latter publication the new graptolite subspecies *Monograptus flemingii* (Salter) *warreni* Burns and Rickards, 1993, was described and illustrated. Her sizeable collections are now in the Geological Museum in Trinity.

Although increasingly incapacitated in the last ten years of her life, she remained cheerful and interested in the activities of her family, friends, and in the organisations she had been involved with. She had a wide circle of friends and colleagues and her enthusiasm, energy and kind nature will be sadly missed.

Bibliography

RICKARDS, R.B., BURNS, V. and ARCHER J.B. 1973. The Silurian sequence at Balbriggan, Co. Dublin. *Proceedings of the Royal Irish Academy* **73B**, 303-316.

BURNS, V. and RICKARDS, R.B. 1993. Silurian graptolite faunas of the Balbriggan Inlier, counties Dublin and Meath, and their evolutionary, stratigraphical and structural significance. *Proceedings of the Yorkshire Geological Society* **49**, 283-291.

Patrick N. Wyse Jackson

LOST & FOUND

Enquiries and information, please to Patrick Wyse Jackson (Department of Geology, Trinity College, Dublin 2, Ireland; e-mail: wysjcknp@tcd.ie). 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 was published in *The Geological Curator* 6(4), 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.

247. Flint Jack

Parry Thornton, 3 Church Street, Whitby, North Yorkshire YO22 4AE, U.K. has been studying Flint Jack since moving to Whitby. Having examined an unpublished memoir by a local historian, and then sought out his sources, Parry has compiled a bibliography of almost 90 items.

Parry writes: "In comparing these [sources] I found that the account of Flint Jack's origin and early life in Whitby, given in all accounts after 1867 - including the two articles in *The Geological Curator* [Credland, A.G., 1983, 3(7): 435-443 and Boyd, M.J. & Watson, R., 1983, 3(7): 444-446] - derived from a single source, which was based on the notoriously unreliable testimony of Flint Jack himself; testimony which was contradicted in other accounts which he gave on other occasions - and contradicted locally, immediately after publication, by both implicated and disinterested individuals."

Please contact Parry if you have a similar interest in Flint Jack or information on his life and work.

248. Epibionts on trilobites.

Patrick Wyse Jackson (address above) [e-mail: wysjcknp@tcd.ie]) and Marcus Key, Jr. (Department of Geology, Dickinson College, P.O. Box 1773, Carlisle, Pennsylvania 17013-2896, U.S.A. [e-mail: key@dickinson.edu]) write:

In recent years a number of papers have examined the distribution of epibionts (serpulid worms, bivalves, corals, bryozoans etc) on various host organisms such as nautiloids, trigoniid bivalves, King Crabs, crinoid stems, and trilobites. Brandt, D.S. [1996, *Journal of Paleontology* 70(3): 442-449] examined the distribution of bryozoans on the Ordovician trilobite *Flexicalymene*, and was able to deduce from this some aspects of the palaeoecology of the trilobite. We are embarking on a review of epibionts found on trilobites of any age, and would be grateful for any information on the whereabouts and size of collections of epibiont-bearing trilobites.

BOOK REVIEWS

Parkes, M.A. and Sleeman, A.G. 1997. *Catalogue of the type, figured and cited fossils in the Geological Survey of Ireland.* Geological Survey of Ireland, Dublin, 124 pp. ISBN 1-899702-15-6. Paperback. Price: IR£10-00 (IR£5.00 + IR£1.00 postage to GCG members from Geological Survey of Ireland, Beggar's Bush, Haddington Road, Dublin 4, Ireland).

This catalogue is based on a database developed during the thorough curation of the Survey's long neglected collections (Parkes *et al.* 1994. *The Geological Curator* **6**(2), 62) which was carried out by the authors assisted by M. Davern and R. Maher. Research on the specimens during the project has already led to a string of publications and a reassessment of a number of stratigraphic questions. Experts in a number of taxonomic groups were involved in the project and eight papers based on the collections appeared in the *Irish Journal of Earth Sciences* (Volume 15, 1997). These add to the list of publications incorporating material from the collections which includes over 150 references.

The catalogue includes an introduction to the project, the collections and the people involved with them over the last 150 years. Particularly useful is the analysis and illustration of labels and a clarification of the definitions of type or other status which are not formally defined in ICZN rules. Figured, cited and inferred specimens are included in the catalogue providing a helpful guide to material which underlies faunal and floral lists and supports the stratigraphic conclusions which are making their way onto the new 1:100,000 map series.

Each entry is arranged into one of nineteen taxonomic categories and under an up to date assignment if available. It includes all old names, old numbers, current stratigraphy and locality information as well as publication details. Grid references are given for a proportion of the localities and there are numerous valuable notes. Almost all macrofossil holotypes, lectotypes and best syntypes have been figured, some for the first time. All of the Survey publications, including the nineteenth century Memoirs, are listed with correlation of old illustrations with surviving specimens where this has been possible.

The essence of any catalogue of this kind is the ease with which you can find the fossil you are looking for regardless of how you approach the subject and the quality of information for each fossil once you locate its entry. On these criteria the catalogue is a resounding success and will form a benchmark for other curators to emulate. This is far more than a mere list of specimens and is a valuable stratigraphic and taxonomic tool for further research.

Nigel T. Monaghan, National Museum of Ireland, Kildare Street, Dublin 2, Ireland.

Newman, A., McLean, S.G. and Hudson, D. 1996. *A catalogue of the type, figured and cited fossil vertebrates in the Hancock Museum, Newcastle upon Tyne.* The Hancock Museum, Newcastle upon Tyne, 161 pp. ISBN 0-9509680-8-0. Paperback. Price: £10-00 (from the Hancock Museum, Barras Bridge, Newcastle upon Tyne NE2 4PT, U.K.; Tel: 0191 222 7418; fax: 0191 222 6753; e-mail: hancock.museum@newcastle.ac.uk).

This, the second type catalogue of material in the Hancock Museum published by the museum, contains a listing of all status vertebrate fossils. Divided into several sections it gives valuable background information about the vertebrate collection, which numbers over 9,500 specimens, and briefly discusses the main collectors and those who worked on the material. Most notably, in the latter category, were D.M.S. Watson (1886-1973) who worked on tetrapods, A.L. Panchen on amphibians, and S.M. Andrews, T. Atthey, and T.S. Westoll on fish.

The bulk of the catalogue comprises details of the individual specimens which are listed according to 1998 taxonomic scheme of R.L. Carroll. A symposis of this scheme is given in a tabular form spread over two pages, which also serves as a contents list of the genera found in the catalogue. Each entry contains the modern taxonomic name and where appropriate all the old names under which that specimen was previously published. Full stratigraphical and geographical information, where known, is also listed, as are details of the collector, and the modern Hancock Museum accession number. Papers listed in the entries are arranged in a bibliography at the back of the catalogue. A geographical index of localities notes the vertebrate genera found at each.

Published in an A4 format, with an illustration of the skull of *Megalocephalus pachycephalus* (Barkas) on the cover, the authors have produced a volume that is informative and easy to use. My only negative comment is that perhaps they could have reduced the length of the catalogue by employing a smaller font size and getting more information per page: in this format only two or three specimens are listed on each page.

Although somewhat specialised, type catalogues such as the Hancock example, are the bread and butter of palaeontologists who need to know the whereabouts of important collections. Additionally there is much here of use to those museum curators who have collections of vertebrate material. The catalogue is reasonably priced and like all type catalogues should be purchased by **all** museums with geological material. Doing so will encourage other institutions to publish similar catalogues.

Patrick N. Wyse Jackson, Department of Geology, Trinity College, Dublin 2, Ireland.

Holbrook, Mary with additions and revisions by Anderson, Robert and Bryden, David. 1992. *Science Preserved: a directory of scientific instruments in collections in the United Kingdom and Eire.* HMSO, London, 271pp. ISBN 0-11-290060-7. Hardback. Price: £35-00.

It is an ideal reduced by pragmatism. It truncates the six major collections in the British Isles to brief overviews, when they contain very many more than the 3,700 other instruments listed. The glossary of instrument types includes only 55 entries. The process started with a grant in 1967, but the result was not published until 1992. As a result, some of the entries were outdated on publication. Now, in 1998, significant parts of it have been superseded by more comprehensive works.

Was it better to publish something less than ideal than wait for perfection? In this reviewer's view, the answer is "Yes". Perfection would never have been achieved. Yet we now have this useful resource. For all its limitations, this is a publishing initiative which deserves considerable praise.

The concept of a world inventory of historic scientific instruments was formulated in 1946, and the British challenge was taken up in 1967 when the British National Committee for the History of Science obtained sponsorship from the Leverhume Trust, allowing Mary Holbrook to get to work. While earlier national inventories listed only a few major instruments of outstanding importance, this work includes a much greater range of instruments, many of which could in no sense be considered of seminal importance to the progress of science. In this it made the correct decision, even if it rendered a complete job impossible. It is now realised that the progress of science did not happen because of the occasional great genius - even though their insight and foresight represented giant steps. A great deal of less impressive work prepared the stage for their incisive creativity.

So it is with instruments. Science cannot progress without them. You can't measure unless you have something to measure with. While we are making great strides in science almost on a daily basis, this is not because we are more intelligent than our colleagues of the last centuries. It is because we have a better base of knowledge on which to build, much of this, in turn, based on the improved range and sophistication of instruments available to us.

Science Preserved starts with a very useful glossary of about 55 instrument types, but with nearly three times this number of photographs. While many instruments in the Directory are thus not illustrated and described, this nevertheless represents a good introduction to the beauty and variety of old instruments. The term is used to "cover both artefacts normally constructed by a scientific instrument maker and the relatively few surviving instruments actually designed by, used by, or constructed for distinguished scientists in their research". The great majority of the instruments date to the mid nineteenth century or earlier. The entries are very brief: name, signature, and date, mostly with no, or only a few, words of description.

A listing of instruments is likely to be less than compelling reading to any but the most dedicated specialist, so the highly pictorial glossary adds needed life to the publication, which is also enlivened by useful brief introductions to the institutions whose collections are listed. While the 52 page glossary has recently been largely superseded by the 709 page *Instruments of Science: An Historical Encyclopedia* [sic] edited by Robert Bud and Jean Warner (Garland Publishing, 1998), the latter did not unfortunately follow the example of *Science Preserved* in using many more pictures than entries. The entry under "Dial" in *Science Preserved* with its 14 pictures is very much more illuminating than that for "Sun-dial" in "Instruments of Science" with only one, and that an engraving of a sun-dial maker in action rather than an actual sun-dial.

It is a great indictment of most of the major collections of instruments in the British Isles that, in spite of their considerable resources, they have generally placed so little emphasis recently on publishing catalogues of their collections. It was a sensible pragmatic decision for *Science Preserved* to omit detailed listings of the collections of the Science Museum, the Wellcome Museum and the National Maritime Museum in London, the Whipple Museum in Cambridge, the Museum of the History of Science in Oxford, and the Royal Museum in Scotland. But, of these, it is really only the Whipple Museum (then under the Curatorship of Dr Jim Bennett) which has done what it should, by compiling recent comprehensive catalogues of its collections. Such catalogues should be readily available for all the major Museums. The listings for "Eire" have been superseded by the much more detailed and comprehensive *Irish National Inventory of Historic Scientific Instruments* (Samton Limited 1995). But there appears to be no sign of the needed English, Scottish or Welsh inventories. In the case of England, of course, this would be a formidable initiative in the light of its great riches of instruments. But there is no reason why it could not be compiled on a regional basis, with proper catalogues of the individual major collections.

The great strength of *Science Preserved* is that it draws attention to instruments in a considerable number (over 200) small collections, including many in which those interested wouldn,t think to look. Most of the collections were visited by the authors, so that exercise will have had an important spin off in bringing instruments to the attention of curators, many of whom would perhaps not have known what they were. With luck, they will now treasure them more, and perhaps add to their collections. Two indexes allow instruments to be found based on names of people associated with them (usually maker or supplier) or type of instrument. Thus, you can discover that the British Museum in London has a surprising number of goniometers - although, unfortunately the goniometer is not included in the picture glossary. There is no listing for polarising or petrological microscopes either in the index or the glossary - so geologists might not be satisfied.

There are thus positive and negative aspects of *Science Preserved*. It needs to be further superseded by better listings and catalogues with fuller details. In the interim it is a useful start.

Charles Mollan, 17 Pine Lawn, Blackrock, Dublin. 4th May 1998.

Stone, P. and Denniss, A. 1997. *Holiday Geology Map - Lake District.* Earthwise, British Geological Survey, Nottingham, A3 folded card. ISBN 0-85272-296-6. Price: £1-95.

This folded A3 card continues the BGS series, under the Earthwise brand, of geotourism products aimed at the general public. The format has been criticised previously as too large for a coat pocket, but that criticism is not particularly relevant in this case because it is difficult to imagine anyone finding a use for this card while out and about (except that, since it's glossy, it could keep the soft Lake District rain off). There are no itineraries, suggested walks or key localities in this card, despite the subject area being a major destination for walking holidays. It is an armchair guide.

The "map" of the title consists of a satellite image with colour tints representing the major rock units. While it is entertaining for those who know the topography of the Lake District to attempt to name the peaks from their aerial relief, those not familiar with the area have only the shapes of the lakes and a few place names scattered about to guide them. It certainly would not be possible to guide oneself around the Lake District. However, it actually doesn't matter because, as there are no itineraries, there is no need for the user to find their way to anywhere.

We gather from the card that the Lake District has been the site of volcanic eruptions, of ocean floors and tropical seas, of deserts and ice ages. But when the initial "Gee whiz" has passed the questions remain: why? How come? What history links these environments and events? Where is it happening today? Most people bothering to read this guide will form these questions and will have to go elsewhere to have them answered. Better use of space, for example by reducing the size of the map to what it merits or eliminating the considerable repetition between map legend and other text, could have allowed room for simple introduction to geological concepts to link the various paragraphs on the different rock units and their environments of formation.

The card does illustrate how the landscapes of the Lake District vary according to the underlying rocks, and the landscape photographs are top notch, as we have come to expect from BGS. However, while we might deduce that a smooth, rounded hill is probably underlain by Skiddaw slate, we aren't shown what slate looks like. We learn that Scafell is composed of lavas and volcanic ashes but, when we are on Scafell, how do we tell those apart?

The fact that someone is on holiday and so probably disposed to new ideas is not sufficient justification for selling them some geology. A *Holiday Geology Map* should be useful on holiday, not just a pretty souvenir on the coffee table back home. A guide seriously attempting to introduce geology to holidaymakers would incorporate geology into their holiday activities. For example, it would have directed them to Kirkstone Galleries at Skelwith Bridge, where stone products from paving slabs to polished tableware, made from local volcanic sandstones with beautifully featured sedimentary structures and explanatory information available, can be viewed and purchased over an excellent cappuccino.

Brian McConnell, Geological Survey of Ireland, Beggar's Bush, Dublin 4, Ireland [mcconneb@tec.irlgov.ie]. 4th May 1998.

Waterston, C.D. 1997. *Collections in Context: The Museum of the Royal Society of Edinburgh and the Inception of a National Museum of Scotland.* National Museums of Scotland/The Royal Society of Edinburgh, Edinburgh, x + 212 pp. Paperback. ISBN 0 948636 87 4. Price: £25-00.

Charles Waterston, former Keeper of Geology at the Royal Scottish Museum, is a well-known and respected figure in scientific circles in Edinburgh, both geological and museological, and for his work for the Royal Society of Edinburgh. He is also known to historians of science for a number of papers on the history of geology, dealing with geologists who made their mark in the Edinburgh region. He is thus admirably qualified to write a book on the background to the establishment of the collections of the National Museum of Scotland; and, as the book's cover tells us, he has had the time to pursue this topic since his retirement.

As the book reveals, the collections of the present Museum had their origins in the those of the old Museum of the Royal Society of Edinburgh, which received its Charter in 1783. There were earlier important collections in Edinburgh by Robert Sibbald and Andrew Balfour, but many of the materials were lost before the Royal Society was founded and began its own collection. Initially, the principal figure was John Walker, who served as Museum Curator both to the Society and to the University, where he was Professor of Natural History. By Waterston's account, Walker's achievements were considerable with respect to both the hats that he had to wear, and large collections were assembled for the edification of the Fellows of the Society and for natural history teaching at the University. One will never know precisely what was in the old collections, but chiefly by examining the donations to the Society from 1783 to 1859, published in its *Transactions*, Waterston has reconstructed (in a substantial appendix to his book) probably the best understanding of it that is likely to be achieved.

The collection was, of course, a very mixed bag, and although many of the items—for example those from the Cook voyages—were of high importance, it exemplified a kind of ('Baconian') ant-gathering science that inevitably declined in the 19th century. What might have happened to the collection in ideal circumstances one can hardly say. But what did happen was both unseemly and unfortunate. Walker's successor at the University, Robert Jameson, did not continue the congenial relationship betwixt University and Society so far as the collections were concerned, and items were 'annexed' by the University to the detriment of the Society, which led in 1811 to the writing of a new Charter that allowed the Society to hold *its* collections in its repository.

But by then a tragedy had already occurred: James Hutton's collections had passed, via Joseph Black and the Society, into Jameson's hands at the University, where they were kept from the students, and from the Society's Fellows. Worse (as it seems in retrospect) Hutton's collection was broken up, and gradually whittled away, until it eventually virtually disappeared. No doubt it seemed less important as the years went by, for Hutton's *theory* largely prevailed and the collections on which it was partly based declined in technical significance. It is only in relatively recent years, perhaps, with the growth of interest in the history of geology *per se*, that they again assume such importance.

The loss or dispersal of the Hutton collection seems, perhaps, to be part of a natural process of attrition. But much of it had to do with unedifying inter-personal and institutional politics—as are explained in Waterston's account. He emphasizes, incidentally, that although Jameson was surely culpable in his treatment of the Hutton collection, 'nothing can detract from Jameson's personal achievement in re-creating the Natural History Museum of the University as one of the finest of its type in Europe' (p. 81).

As the 19th century progressed, there were inevitable changes in science and science education, and their institutional frameworks, which are recounted by Waterston in intricate detail so far as Edinburgh was concerned. There were other bodies that had an interest in acquiring the Society's collections: the Royal Botanic Gardens, the University's Natural History Museum, the newly established Industrial Museum of Scotland, the later Edinburgh Museum of Science and Art, the Royal College of Surgeons, the Society of Antiquaries of Scotland, and the Scottish Branch of the Geological Survey. As science broke into different specializations, so too did the Society's collections, the different components coming to occupy different buildings belonging to different institutions. So by 1859 it was determined to relinquish all the collections other than the geological materials. These were generously catalogued by Archibald Geikie, but as the decades passed the residual geological collection became ever more anachronistic, and the collections were eventually dispersed to 'good homes' in 1910.

Three important collections (of David Ure, Lord Webb Seymour, and George MacKenzie) went to Glasgow University, where items from Ure's early palaeontological material are on display in the Hunterian Museum. The specimens from the expedition of Webb Seymour and John Playfair to Glen Tilt languish in drawers in a storehouse in a run-down suburb, but may be seen on request. (I don't know the location of the MacKenzie collection, but it is probably there too.) Other material went to the Royal Scottish Museum, or to Edinburgh University for teaching purposes, and some other educational institutions received specimens too.

Much of Waterston's book details the politics associated with these comings and goings of specimens—which are in fact a major aspect of the 'semi-externalist' history of science. It is a complex story, admirably told. The geologist H.W. Menard argued that specialization in science is an inexorable and inevitable process; and I agree with him, for all that authors such as Nicholas Maxwell have wrung their hands in despairing disapproval. Thus, as science divides into new disciplines and sub-disciplines, it is, I suppose, inescapable that those that depend on collections will subdivide too—but with considerable time-lags, as buildings to house materials always seem to increase arithmetically, while specimens increase geometrically (to parody Malthus). And political considerations will inevitably intrude, since money, land, buildings and egos are always likely to be involved.

Some museums will, or have, become places of entertainment as much as research. As science has developed, it has, of course, become ever more experimentally oriented, and the role of collection-based museums of natural history has declined in relative terms, though they remain as essential places of instruction and research, and places where important specimens and documents may (must) be conserved. On the whole, they perform this task well, though by no means perfectly, as Doughty's important report on *The State and Status of Geology in U.K. Museums* (1981) revealed. Waterston gives some attention to these general issues, reiterating ideas that he propounded in his Presidential Address to the Edinburgh Geological Society back in 1971 ('Geology and Museums', *Scottish Journal of Geology* 8 (1972), 129–44). I find myself in agreement with the general principles that he enunciated there, and am now enlightened by his detailed account of how we have got where we are today—so much of the nature of the journey being admirably illustrated by the history of the Edinburgh scene.

David Oldroyd, School of Science and Technology Studies, The University of New South Wales, Australia. 13th May 1998.

Mulvihill, M. and Deevy, P. (eds). 1997. *Stars, Shells and Bluebells - women scientists and pioneers.* WITS (Women in Science and Technology), Dublin, 179 pp. ISBN 0-9531953-0-9. Paperback. Price: IR£4-95 (IR£6-50 including postage and packaging from WITS, P.O. Box 3783, Dublin 4, Ireland).

This attractive book chronicles the lives, work, and scientific achievements of eighteen women who worked in Ireland since the late 18th century. While historians of science may be familiar with the work of the microscopist Mary Ward, or the astronomer Agnes Mary Clerke, many may have no knowledge of, or only a fleeting familiarity with, the work of others such as the marine zoologist Maud Delap, the lichenologist Matilda Knowles, or the aviator and campaigner for women's participation in the Olympics Sophie Peirce.

Although containing little of direct interest to geologists this volume should be of interest to all historians of science whatever their particular speciality. I enjoyed reading it over a number of evenings, and learnt a great deal about Ireland's hitherto unsung pioneering women scientists. The authors, editors and particularly the publishers have done a great service in producing this book.

Patrick N. Wyse Jackson, Department of Geology, Trinity College, Dublin 2, Ireland. 20th May 1998.

GEOLOGICAL CURATORS' GROUP

23rd Annual General Meeting

27th November 1996 at the Conference Room, Manchester Museum, Manchester.

1. Apologies for absence

Received from Chris Collins, Steve Howe and Roy Clements.

2. Minutes of the 22nd Annual General Meeting 1995

The minutes were approved as a true record of the meeting. They were approved on the "general aye" and signed by the Chairman.

3. Matters arising

There were no matters arising.

4. Chairman's Report from John Nudds

It certainly does not seem a year ago since our Ludlow meeting when I took up the reins of the GCG and I am beginning to think that retiring Chairman, Paul Ensom, was right when he said that the three years fly past too quickly! I can echo Paul's opening remarks of his Chairman's report for 1995 in that support for museums and collections has once again occupied much of Committee's time during 1996. We have given strong support to Bristol Museum which once again faces severe staff cuts and serious threats to its unique collections (we are still awaiting the final outcome, and fear bad news); to the Ludlow Museum for their proposed regional geology centre in Ludlow; and to the Isle of Wlght Museum for its proposed dinosaur museum to be funded by the Millennium Commission. We have been consulted by the Essex Field Club over site recording in the county following the demise of the Passmore Edwards Museum; by the Russell Coates Museum in Bournemouth over the resiting of its famous Geological Terrace; and by Dorset County Council over its World Heritage Site Proposal. We have been asked to comment by the Northern Ireland Department of Education on their draft document *A review of major museums in northern Ireland*; by the BGS on their Pror Options Review; and by English Nature on their draft Position Statement on Fossil Collecting.

Committee has also been concerned with developments in NSGSD and is pleased to record the future liaison with the BGS over site recording. We are grateful to Tony Morgan, who has agreed to take over from John Cooper as GCG representative on The Geological Society Conservation Committee and thank John for his many years service to this cause. Mick Stanley will continue to liaise with NSGSD on behalf of the GCG.

The minor constitutional changes, reported by Paul Ensom in his Chairman's Report last year were implemented at an EGM held in Liverpool on June 26th; these have been accepted by The Geological Society and The Charity Commission and in brief include the creation of the post of Editor of the Newsletter and the replacement of the Publicity Offlcer by a Programme Secretary. The new Constitution has been published in *The Geological Curator* 6(6).

Seminar meetings have been held at Newcastle-upon-Tyne (30th April) on Training; at Liverpool (June 26th) on New Technologies; and at Harrogate, during the MA Conference (September 30th), on Fossil Collecting in Yorkshire. The Newcastle meeting, held jointly with the BCG, looked at the need for professionalism in the training of museum personnel, and heard talks from Leicester University, Cambridge University, The Natural History Museum, the M.A., M.T.I. and S.E.M.S. and was attended by approximately 40 members. The Liverpool meeting was the official launch of the GCG's Home Pages on the Internet, and heard presentations on new technologies by John Faithful, Phil Phillips, The Natural History Museum, Alpha Collections Management Ltd., and UK Consortium for CAL. The meeting was attended by approximately 25 members who enjoyed the fascinating demonstrations by the commercial companies present. The half day meeting at Harrogate, during the M.A.'s 102nd Conference, was another success, attended by 21 members, who learned about the development of collecting in Yorkshire, from such experts as Simon Knell, Rosemary Roden, Kate Andrews and Paul Ensom. Profound thanks are due to Andy Newman, Wendy Simkiss, Paul Ensom and their helpers, for arranging these three very successful meetings.

The Group also had input into the 2nd World Congress on the Preservation and Conservation of Natural History Collections, held in Cambridge from August 20th-24th and organised by Chris Collins. This major international success was attended by over 300 delegates and we are grateful to Chris for his mammoth efforts in this regard and to Wendy Simkiss who acted as GCG representative on the Organising Committee.

Wendy is also acting as GCG representative to the Technical Committee for GeoScience '98, the new biennial event being organised by The Geological Society in Keele from 14th-18th April 1998. The GCG will be inputting to one of the five major symposia at this meeting on Geology and Society; getting the message across. I attended the first meeting of the Technical Committee on November- 11th.

As Chairman, I am also a member of The Geological Society Specialist Groups Committee, and attended the annual meeting at Burlington House on 17th March, which discussed, among other issues, the future tenancy of Burlington House, financial arrangements of specialist groups, and the role of women in geology (groups were encouraged to invite women speakers and, GCG take note, to encourage woman Chairmen). We were also asked to encourage more of our members to become Fellows of the Geological Society,

something which members might like to consider.

My first year in office has been eased by the hard working committee which met three times during the year; on 25th January at Burlington House, and on 9th May and 5th September at Manchester University Museum. Tnanks are due in many quarers, first to Tom Sharpe for his commitment to producing our new display boards to replace the well-travelled originals. I am sure Tom's efforts will be appreciated by generations of GCG members for many years to come. Secondly, to our Recorder, John Faithful, for his faithful dedication to setting up and editing the GCG's Internet pages, now one of the prime sites for web surfers. Third to Monica Price and Tom Sharpe again for their continued editorship of our popular newsletter, *Coprolite*, and to Clinton Burhouse Ltd. for their continued sponsorship. Also to Steve Thompson for his dedication for both GCG and BCG in producing the Orphan Collections Report which will eventually be published in *The Geological Curator*. Also to our Treasurer, Andy Newman, for his zealous keeping of the accounts and for exploring the hidden mysteries of the Charity Commissioners and Geological Society regulations for any possible benefit to the Group's finances. Patrick Wyse Jackson is to be congratulated again for the conception and safe delivery of *The Geological Curator* 6(5) and 6(6). Last, but of course not least, I must thank the secretaries, John Crossling and Mandy Edwards, for their efficiency and willingness throughout to ease my indoctrination this year.

During the year committee lost Nick Goff, who had been co-opted as MDA representative, but whose term of secondment to MDA ceased in May. And today, committee says farewell to Bob Symes, who completes his two years in office. Bob has been a constant source of information and provider of contacts, and will be sorely missed. I sincerely hope we will see him back soon in some capacity. Finally, may I take this opportunity to extend to Bob the belated congratulations of the membership on the award of an OBE in the 1996 New Year's Honours List.

The Chairman added that the Isle of Wight Museum's bid to the Millennium Commission had been successful.

Proposed: Steve Tunnicliff; Seconded: Tom Sharpe.
Carried unanimously.

5. Secretary's Report from Mandy Edwards

The Committee met three times in 1996. In London in January and in Manchester'in May and September. Changes to the structure of the Committee were passed at the EGM at Liverpool in June. These changes will come into effect from this meeting. I will pass over the organising of the seminars to the Meetings Secretary, who will no doubt be looking for ideas for meetings for 1998. The Geological Society will be holding its second conference at Keele University from 19-23rd April 1998. The Geological Society have asked all specialist groups to provide ideas for meeting themes. They have also asked that women speakers and chairs of sessions be encouraged. I am sure that GCG is in a very good position to do this. Wendy Simkiss is our representative on the Geological Society Committee. Please see either myself or Wendy if you have any ideas you wish us to take to the Geological Society. John Cooper (Brighton Museum) resigned from his position on the Geological Society Conservation Committee after many years. We thank him for his work for. the group. Tony Morgan (Liverpool Museum) will be the new representative. Nick Goff stood down from Committee in September as his secondment to MDA finished. He very usefully kept the Committee informed of MDA developments. Bob Symes also finishes his term on Committee. We have enjoyed having the benefit of his experience and it has been nice to have another mineralogical voice to add some balance to our meetings.

The new *Thumbs Up* leaflets were distributed to all UK museums with geological curators. There are extra copies of the leaflets left. Any museums that need extra copies should apply to he Secretary who wi!l send them out to you.

Four seminars were held in 1996. The first meeting of the year was in April at the Headquarters of the North of England Museum Service, Newcastle Upon Tyne. This meeting was held jointly with the Biological Curators Group and looked at Training. In June we held a meeting at Liverpool Museum to look at New Technologies and to Iaunch the groups own web page. In October the Group held a session at the Museums Association Conference in Harrogate. And finally the AGM at Manchester looked at geological models. I should like to thank all of the people involved in the meetings this year as well as those people who have suggested places we should visit and ideas for future meetings.

The meetings organised for 1997 are a meeting on 16th and 17th April at Torquay Museum with a fieldtrip to Kents Cavem. Mike Bishop is the local contact. On the 26th June there will be a meeting at Hull Museum to look at their new gallery and discuss the issues of disability and access. The local contact is Heather Rayfield. The Museums Association Conference is to be held in Cardiff from the 15th to the 21st of September. We are looking to holding a session at the conference, hopefully with BCG. In October we hope to hold a meeting based in Maidstone, Kent with our first trip across the Channel to Brussels. Discussions are proceeding well on this meeting and I am hopeful that it will take place. The theme of the meeting will be "Lost worlds, iguanodons and the European perspective". The local contact is Ed Jarzembowski. The final meeting for 1997 and next years AGM will be held at The Natural History Museum in London where we will be looking at the new developments that are taking place there. Local contact is Cally Hall or Andrew Clarke. If anyone wishes to present a paper at any of these meetings would they please get in touch with the Meetings Secretary or the local contact.

Proposed: Steve Thompson; Seconded: Monica Price.
Carried unanimously.

6. Treasurer's Report from Andrew Newman

Financial report

The Accounts for the period 29/11/95 to 27/11/96 are attached.

The Geological Curators' Group has total assets of £12647.84. The major change during the last accounting period has been the closure of the Current and Premier interest accounts and the opening of a Lloyds Bank Treasurers account, which took place in September. The benefits of such a move include the simplification of accounting procedures and that all of the financial assets of the Group will be earning interest at a competitive rate. Subscription income has been reasonable during the year; if any members still have to pay for 1996 please do so as soon as possible. It is also important to thank our sponsors, The Geological Society, RSNC, and CJC Burhouse. The main expenses of the year has been the production of the leaflet, *Coprolite* and *The Geological Curator*. Subscriptions will remain the same for 1997 but will probably have to be increased in 1998.

Membership

The totals are now

UK personal	290
UK institutions	94
Overseas Personal	62
Overseas Institutions	58
Complimentary	9
TOTAL	513

This represents an increase of 17 since the last AGM.

The Treasurer thanked Peter Davis and Ken Sedman for their work as auditor's of the Group's accounts.

Monica Price asked about the low figures this year for *Coprolite* and *The Geological Curator* when compared to the previous year. The Treasurer explained that there were still some outstanding expenses associated with *Coprolite* which have not been included and that the costs of the latest issue of *The Geological Curator* (which has only just been dispatched) had not been accounted for. The total cost of *Coprolite* is likely to be slightly up on last year.

Proposed: John Faithfull; Seconded: Steve McLean.
Carried unanimously.

7. Editor's Report from Patrick Wyse Jackson

Two issues of *The Geological Curator* were published this year: Volume 6, Part 5, pp 185-217 (issued 30th May 1996) and Volume 6, Part 6, pp 219-244 (issued 3rd November 1996).

Between them they contained five papers, several Lost and Found items, the report of the 21st AGM, the report of the EGM of 26th July 1996, the Constitution, and reviews of eleven books.

I received nine papers this year for consideration for publication this year. Four of these have been published, four have been returned to authors for revision while one was rejected. In addition I am awaiting the return of a paper first submitted in 1995. For the next issue are three items: a paper by Crispin Paine on MGC Standards in the care of museum collections and hopefully the final report of the GCG/BCG orphan collections working party, and the report of the 1995 AGM. If none of the accepted papers returned for revision arrive in time for publication in March 1997 then we are looking at a very thin first issue of *The Geological Curator* for that year. Nevertheless it will appear and I shall stick to the publishing schedule of two issues a year which appear in and around Spring and Autumn.

It concerns me that the number of papers submitted has not increased in the last two years. Now that the publishing schedule is now stable and regular, authors can be guaranteed that their papers will be published reasonably quickly. Why are papers not forthcoming? Can it be that having an editor resident in Ireland is not helpful? Is nobody doing any research on collections or on curatorial methods? Do members actually want a journal?

The bottom line is that if you want *The Geological Curator* to continue you have to submit papers to keep it going.

I continue to enjoy being your editor. I now have an efficient relationship with the printers ColourBooks of Dublin. They collect the CRC from my office, send me out the final dyeline proofs and deliver the finished product to my doorstep. The only draw back to the whole operation is that it is tedious packing 550 copies for postage.

I am grateful to contributing authors, to my colleagues in the Department of Geology, to the mailing service of Trinity College, and to ColourBooks for their continued assistance and cooperation.

Steve Thompson asked if there were any papers forthcoming from the Cambridge Conference. The Editor stated that there were not.

Proposed: Tom Sharpe; Seconded: Andy Newman.
Carried unanimously.

8. Recorder's Report from John Faithfull

This year a Web site has been set up for the GCG. Little has changed on it since the initial impetus of its creation. Contributions and ideas for insertions are needed. The Committee has suggested that theminutes of meetings and extracts from *Coprolite* should be included.

The GCG Terminology Sub-Group has not made much progress recently but it is hoped that next year with Monica Price overseeing the project a piublications produced jointly with MDA will be made available.

Tom Sharpe queried whether *The Geological Curator* would be a more suitable publication for this information.

Monica Price replied that there is no reason why the data should not be published through both organisations but that the links with MDA and SPECTRUM are important and should be maintained.

Proposed: Steve Thompson; Seconded: Monica Price.

Carried unanimously.

9. Publicity Officer's Report

The GCG no longer has a Publicity Officer.

10. National Scheme for Geological Site Documentation Coordinator's Report.

No report was submitted.

11. Election of Officers and committee

At the EGM held at Liverpool Museum on 26th June 1996 several changes to the structure of the Committee were agreed. The posts of Programme Secretary and Editor of Coprolite were created. The post of Publicity Officer ceases to exist.

One post on the Committee becomes vacant for 1997-98 with Bob Symes standing down. No nominations for the Committee have been received by the Secretary. The Committee has nominated the following people for the posts indicated: Steve McLean (Programme Secretary); Tom Sharpe (Editor of *Coprolite*); Alistair Bowden (Member of Committee).

As there were no nominations the above were elected. All other officers remain unchanged.

12. Election of Auditors

Ken Sedman and Peter Davies agreed to continue as the Auditors.

Proposed: John Faithfull; Seconded: Patrick Wyse Jackson. Carried unanimously.

13. Any other business

There was no other business.

14. Date and venue of next AGM

Thursday 27th November 1997 at the Natural History Museum, London.

The Chairman wished all present a Happy Christmas.

Annual Accounts 1996 (29th November 1995 - 27th November 1996)

	1996	1995
Treasurers Account Income		
Subscriptions	4283.00	5018.53
Sale of backnumbers	13.00	-
Advertisements/Sponsorship	2000.00	2570.00
Meetings fees	272.00	115.00
Transfer	2550.00	700.00
Balance on 27/11/95	1291.60	822.32
	10409.80	9225.85
Closure of Premier Interest account		
Transfer on 3/9/96	9298.86	
Interest 3/9/96-27/11/96	55.39	
	9354.25	
	19764.05	

	1996	1995
Treasurers Account Expenditure		
Geological Curator		
Printing	1232.07	3909.09
Meetings		
Committee	379.46	199.54
General	540.68	536.30
Univ Manc	-	250.00
Coprolite		
Print and distribute	1954.00	2470.62
Brighton Medal		
Engrave	-	10.72
Leaflet	3000.00	299.63
Other expenditure		
Returned cheque	-	6.00
Archive	-	48.18
General	-	26.67
Bank Charge	10.00	-
Biology Curator	-	427.50
Balance on 27/11/96	12647.84	1291.60
	19764.05	9225.85

A.G. Brighton Funds held in Treasurers Account

Balance on 29/11/95	1529.93
Income	28.50
Balance on 27/11/96	1558.43

1995/96 Total Surplus/Deficit

Total Income	6853.85	8211.31
Total Expenditure	7116.21	7934.25
	(262.36)	277.06

[signed] A. Newman *GCG Treasurer*

[signed] P.S. Davis and K. Sedman *Auditors*

THE GEOLOGICAL CURATOR

Publication scheme

Two issues of *The Geological Curator* are published for each year (in the Spring and the Autumn); a complete volume consists of ten issues (covering five years) and an index.

Notes to authors

Articles should be submitted as hard copy in the journal style typed on good quality paper (A4 size) double spaced, with wide margins, and if possible on disk (preferably formatted for a Macintosh in Microsoft Word 5 or 6 or MacWriteII, although other disk types will be accepted - please quote system type and wordprocessing package used). Three copies should be sent to the Editor, Patrick N. Wyse Jackson, Department of Geology, Trinity College, Dublin 2, Ireland (tel 01 6081477; fax 01 6711199; e-mail: wysjcknp@tcd.ie). Line drawings should be prepared in black ink at the desired publication size. Photographs for halftone reproduction should be printed on glossy paper. Both drawings and photographs should be proportioned to utilise either the full width of one column (85mm) or two (175mm). References in the text follow the Harvard system, i.e. name and date '(Jones 1980)' or 'Jones (1980)'. All references are listed alphabetically at the end of the article and journal titles should be citedin full. Authors will normally receive proofs of text for correction. Fifty reprints are supplied at cost. Major articles are refereed. Copyright is retained by authors.

If submitting articles on disk please note the following:

1. Do not 'upper case' headings. **Keep <u>all</u> headings in upper and lower case.**
2. **Use italics** rather than underline for latin names and expressions, journal names and book titles. **Use bold** for volume numbers in references.
3. Line spacing. Your hard copy should be double spaced. If possible, **single space** your copy on disk. Use a **single (hard) carriage return** at the end of each paragraph.
4. Single space-bar between words, **double space-bar between sentences.**
5. **Do not attempt** to format your article into columns. Use a minimum of tabs and indents.

Regular features

LOST AND FOUND enables requests for information concerning collections and collectors to reach a wide audience. It also contains any responses to such requests from the readership, and thereby provides an invaluable medium for information exchanges. All items relating to this column should be sent to the Editor (address above).

FACT FILE contains basic information for the use of curators. All items relating to this column should be sent to the Editor (address above)

NOTES comprising short pieces of less than two pages are particularly welcome. Please send contributions to the Editor (address above).

CONSERVATION FORUM helps keep you up to date with developments in specimen conservation. Information on techniques, publications, courses, conferences etc. to Christopher Collins, Sedgwick Museum, Department of Earth Sciences, University of Cambridge, Downing Street, Cambridge CB2 3EQ (tel. 0223 62522)

BOOK REVIEWS contains informed opinion about recently published books of particular relevance to geology in museums. The Editor welcomes suggestions of suitable titles for review, and unsolicited reviews (of 500 words maximum) can be accepted at his discretion. Publishers should submit books for review to the Editor.

INFORMATION SERIES ON GEOLOGICAL COLLECTION LABELS consists of loose A4 size sheets, issued irregularly, which carry reproductions of specimen labels usually written by a collector of historic importance. The aim of the series is to aid recognition of specimens originating from historically important collections. Contact Ron Cleevely, Department of Palaeontology, The Natural History Museum, Cromwell Road, London SW7 5BD.

Advertisement charges

Full A4 page	£80 per issue
Half A4 page	£60 per issue
Quarter A4 page	£40 per issue

25% discount for space bought in three or more issues. Further details from the Editor.

Inserts such as publishers' 'flyers' can be mailed with issues of *The Geological Curator* for a fee of £80 per issue. 550 copies of any insert should be sent to the Editor.

Subscription charges

UK Personal Membership	£10 per year
Overseas Personal Membership	£12 per year
UK Institutional Membership	£13 per year
Overseas Institutional Membership	£15 per year

All enquiries to the Treasurer/Membership Secretary, Andrew Newman, Department of Archaeology, University of Newcastle, Newcastle-upon-Tyne NE2 4PT (tel. 0191 2227419; fax. 0191 2611182; e-mail: andrew.newman@ncl.ac.uk).

Backnumbers

Backnumbers of *The Geological Curator* (and its predecessor, the *Newsletter of the Geological Curators' Group*) are available at £2.50 each (£5.25 for the double issues of Vol. 2, Nos. 9/10 and Vol. 3, Nos. 2/3; £7.50 for Vol. 4, No.7 Conference Proceedings) including postage. Orders should include payment and be sent to the Treasurer (address above).