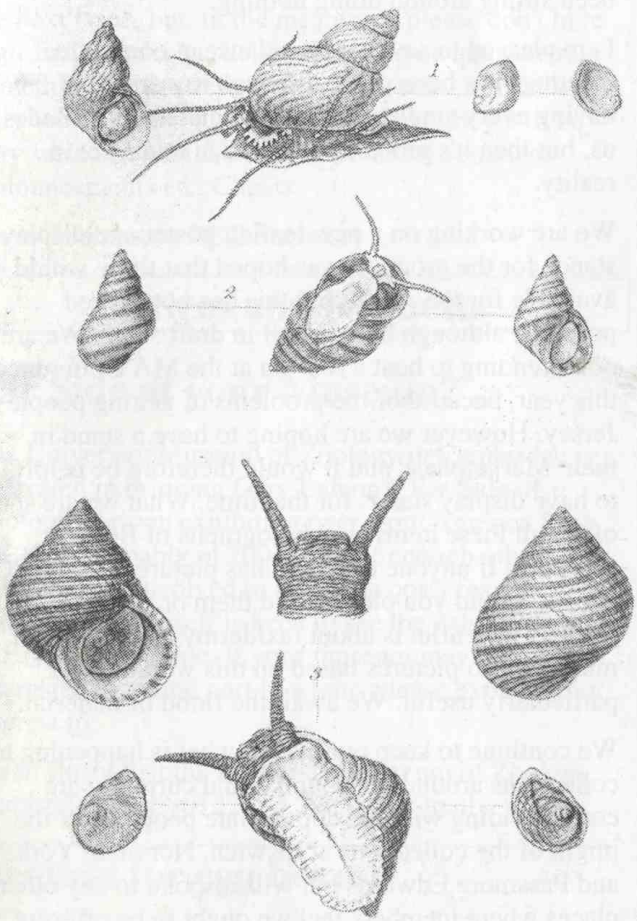
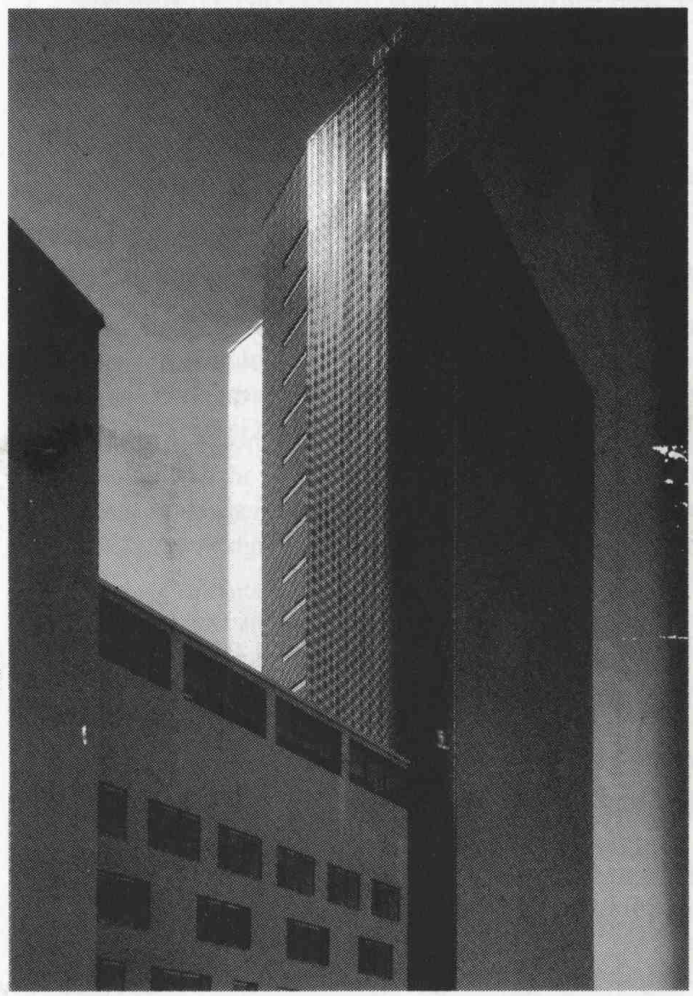
The Biology Curator

The Publication of the Biology Curator's Group

ISSUE 18 AUGUST 2000





'An Introduction To Molluscs' Seminar Papers

Leiden Study Trip 1999 Report

Access to Collections Conference Report

Diary Dates

BCG Study Trip 2000 - Budapest

Study visit to the Hungarian Natural History Museum, Budapest. Leaving London Thursday 9th November, returning on Sunday 12th November. Cost, including flight and hotel with B&B, 250 pounds. If you definitely wish to go, please contact David Carter at: Department of Entomology, The Natural History Museum, Cromwell Road, London SW7 5BD, e-mail: djc@nhm.ac.uk

The cost of this visit can only be kept this low with a minimum of thirty in the party, so please respond as quickly as possible to ensure that the trip goes ahead.

Mr David Carter, Collections Manager, Lepidoptera, Odonata, Hymenoptera, Arachnida & Myriapoda, Department of Entomology, Natural History Museum, Cromwell Road, LONDON, SW7 5BD, UK

TELEPHONE: 020 7942 5716 International: +44 20 7942 5716, FAX: 020 7942 5229 International: +44 20 7942 5229

NSCG: Best Value

28th September 2000

One day seminar organised by NSCG on Best Value and how it affects museums, with particular emphasis on conservation and collections management. To be held at The Potteries Museum and Art Gallery, Stoke on Trent.

Contact: Bob Entwistle, Senior Conservation Officer, NSCG Chairman, Ipswich Museum, High Street, Ipswich, IP1 3QH

BCG: Biology Collections and Information Technology

January/February 2001, Leicester

This one day meeting will look at the increasing uses of information technology in museums. It will consider areas such as documentation, environmental monitoring, public access, the internet, biological recording and exhibitions and display.

Editors Note:

It has been decided by the Committee to re-organise the production of The Biology Curator. Over the last five years TBC has been ably produced by Patricia Francis and Kathryn Berry at Bolton Museum who have been responsible for the overall production of the publication. Pat and Kath have agreed to step down as of last issue owing to the amount of work involved. As of next issue The Biology Curator's new editor will be Steve Moran.

The committee would like to extend their sincere thanks for their excellent work over the years as I'm sure would all readers of the Biology Curator . Many thanks to Pat and Kath for their sterling work over the last five years and for the amount of time and effort they have put into producing many fine issues.

BCG Committee Secretary's Report

Hi folks. My apologies for the fact that there was no report in the last issue of the newsletter. There is no doubt that your committee members, like everyone else, get busier by the day. This means that we haven't managed to complete all of the BCG tasks that we had set ourselves, but this does not mean that we have been sitting around doing nothing.

I am pleased to say that attendance at committee meetings has been good, although my dream of having every single member to a meeting yet eludes us, but then it's probably a bit much to expect in reality.

We are working on a new leaflet, poster and display stands for the group. It was hoped that these would be available for the AGM, but this has not proved possible, although they are all in draft stage. We are not intending to host a session at the MA conference this year, because of the problems of getting people to Jersey. However we are hoping to have a stand in their 'Marketplace' and it would therefore be helpful to have display stands for that time. What we are short of for all these items are photographs of BCG activities. If anyone out there has pictures from BCG events, would you please send them or copies of them to me. The leaflet is about taxidermy and its role in museums, so pictures based on this would be particularly useful. We await the flood of material.

We continue to keep our eye on what is happening to collections around the country, and currently are corresponding with the appropriate people over the plight of the collections at Ipswich, Norwich, York, and Passmore Edwards but will respond to any other places where members feel we ought to be offering support.

Recent meetings have been well attended and well received, with a very successful trip to Leiden at the end of last year, and around forty people attending the Mollusca meeting in Oxford earlier this year. We are organising a meeting based around a trip to Kew Gardens, and a Museum visit trip to Budapest, but places for both of these events are likely to be limited, so don't hang around when details come out. We are

also planning a meeting looking at documentation and performance measurement, which will be affecting everyone, as a result of the introduction of Best Value - some of you will already be feeling the effects of that.

Looking ahead to 2001, we are hoping the foreign trip will be to Boston and New York. As many of you will know, we reluctantly decided to shelve the St. Petersburg trip as it looked like it was going to cost in the region of £600 per person, so we hope that we can make our American venture as reasonable as possible - start saving now! We also intend to have a session at the MA conference, although details of the venue for 2001 have yet to be decided.

We are developing a new policy with regard to obtaining papers for publication in the journal, linking each issue to a particular meeting or theme. However, it takes time for these things to become a reality and consequently the current edition of the newsletter is rather thin as a result. Hopefully this will change for the next issue, but, in the meantime, please don't hide your lights under bushels, but see if you can generate something for the newsletter yourselves - we are not only looking for long articles (although they will be very welcome) but also for short notes. comments, announcements etc. Cheers.

Steve Thompson, BCG Secretary

Notices and Requests

Far Side at your Museum?

The University Museum of Zoology in Cambridge is interested in bringing Gary Larson's 'Far Side of Zoology' cartoon exhibition over from America for a UK tour, probably in 2001-2003 if enough other museums are involved to make the costs feasible. Gary Larson himself is keen to see the exhibition tour in Britain or Europe. If your museum may be interested in taking part in a tour, please express your interest to:

Sarah Bushell at the University Museum of Zoology, Cambridge. Tel. (01223) 336650 or e-mail

Request for egg boxes

Liverpool Museum has become one of the main depositories for confiscated egg collections over the last few years, and we have just had a new secure store built specifically for egg cabinets. Unfortunately, we now have a serious lack-of-boxes problem. We have recently been (very kindly) given a number of glass-topped boxes to suit medium sized to large eggs, but are desperate for boxes suitable for housing small clutches such as passerines and have no budget to buy more than our present small stocks. Can anyone help? We will come and get them!

Clemency Fisher, Curator of Birds & Mammals, Liverpool Museum, William Brown Street, Liverpool L3 8EN. Tel. 0151 922 7945. email: clemf@nmgmzoo2.demon.co.uk

Chillingham Cattle – A request for Information

A research project aimed at investigating the morphometric and genetic variation of the Chillingham cattle is being planned in collaboration with several different researchers and institutions in the U.K.

For this purpose, we are trying to determine in which collections specimens of the Chillingham cattle are currently held in the U.K. and to catalogue these remains.

If your museum should have any skeletal or skin specimens of the Chillingham cattle, we would be grateful for any information in this regard, particularly what skeletal elements are present, year of acquisition and year of death of the animal, sex and age data.

If the museum agrees, we would be interested in visiting the museum later this year to photograph and measure the specimen/s and take a small sample of either skin, bone or tooth for DNA studies.

All information resulting from our study will be made available to the museum, and full acknowledgements given in any publications or catalogues resulting from our research.

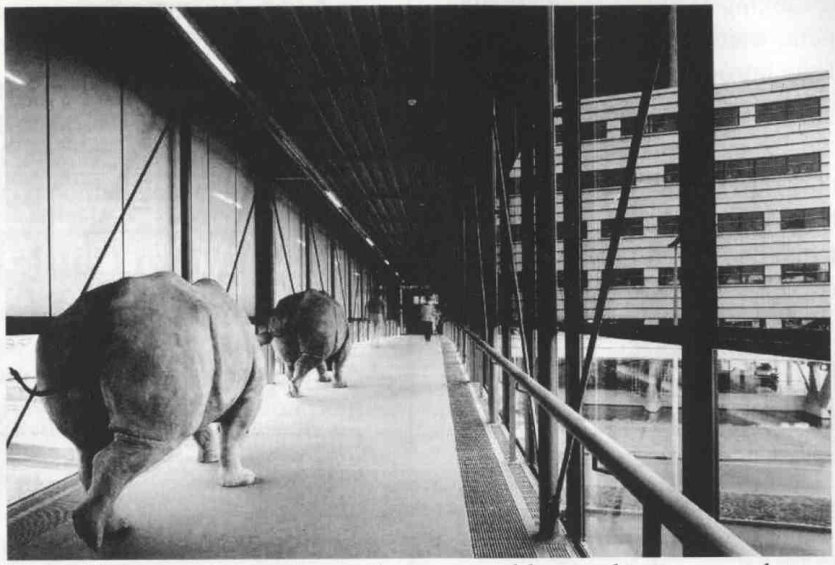
Please Contact: Liora Kolska Horwitz, Dept. of Evolution, Systematics and Ecology, The Hebrew University, Jerusalem 91904, Israel.
Mail: lix100@excite.com
FAX: 972-2-6584741

Conference and Meetings Reports

B.C.G. Study Trip 1999 National Museum of Natural History and Naturalis, Leiden

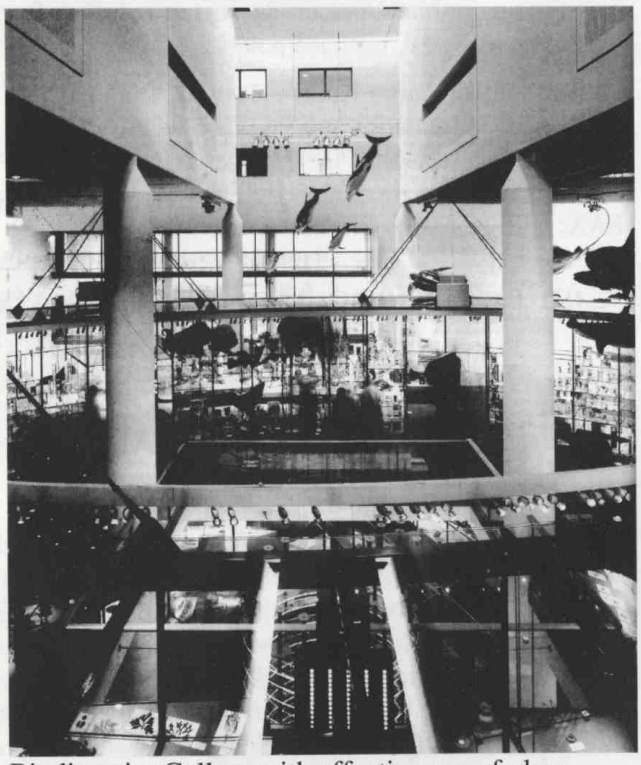
The entrance area to the National Museum of Natural History and Naturalis, complete with lecture theatre, conference room, restaurant, shop and display area, is located in part of the 17th century plague hospital, a large square building with a central courtyard, surrounded by a little moat. This then connects to the other two buildings via a raised walkway which crosses over the main road and a couple of small canals. This second area contains the main public galleries (Naturalis) and the huge collection storage

tower. On our arrival we were warmly welcomed by Dr Jan Krikken, the assistant director, and some of his curatorial staff (there are 60 permanent staff including 24 research curators, 30 collection technicians and 4 clerical staff).



Naturalis had an interesting and some would say robust approach to live animal displays. (Model Rhinos in entrance tunnel)

After coffee Dr Krikken gave us a short talk detailing the moving of the collections to the new tower and outlined some of the problems they had encountered. One point he emphasised several times was that *nothing* should be taken for granted at any time during an operation of this magnitude, and that work should be constantly monitored. For example, he explained that after the building had been signed off, the floors in some storage areas had been found not to be level, this only became evident when the collections furniture was being fitted. In one case a difference of 10cm from the back to the front of a store had been noted, a problem that eventually had to be dealt with by laying a liquid screed. It transpired that the main drawbacks of the new facility were a lack of visitor space and a rather unfriendly working environment; other problems would become apparent during our tours.



Biodiversity Gallery with effective use of glass display cases

The new storage facility was opened in April 1998 and the entire move, of 15 million specimens in 6 million lots, took over a year. Material was brought from seven buildings around Leiden and an outside removals firm who had done large-scale office moves were employed; staff from the removal firm were trained to handle collections before the move and then treated as Museum staff during it. The old storage building has been renovated and is still used for the storage of large specimens and as a sorting area for new collections; it will also be used by other museums around Leiden. It was stated that the move had provided a useful opportunity for systematic reorganisation of the collections to be undertaken.

After the post-talk discussion we were able to explore the public areas. In the plague hospital building we saw the Nature Information Centre, where the public could source information about the natural history of the Netherlands (in fact all of northern Europe); as well as relevant field guides there were many nice mounted specimens as well as drawers of study skins, invertebrate material and specimens in spirit. After rounding up stragglers from the excellent bookshop we crossed the walkway, where two fine mounted rhinos pace eternally above the road, to the main displays and the storage tower.

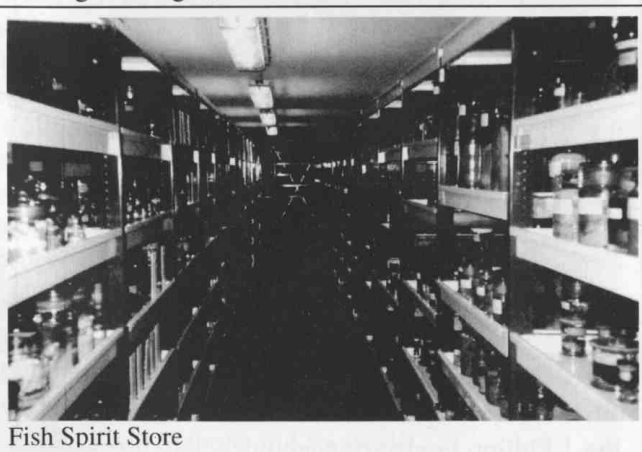
The public galleries (which attracted 350,000 visitors last year) have many levels, with mounts and models everywhere; suspended from the ceiling, leaping over barriers, in glass cases, or even (in the case of a large *Architeuthis* squid) lying beneath one's feet. Visually perhaps the most impressive was the Biodiversity gallery, employing a truly ingenious method of displaying botanical material with specimens displayed between huge sheets of glass, although some problems with micro-climates had apparently been experienced. Labelling throughout was quite minimal, with little more than name labels present in most instances. One fascinating idea was the "Treasury" room which at certain advertised times during the day would provide a snapshot view of a

number of the museum's most precious items, serially lit (very dimly) in a clockwise progression followed round by the (<20) viewers. It was noted that a number of BCG delegates appeared to find the interactive feeding display in the Children's Centre particularly absorbing!

Open racking in the bird store. Air conditioning keeps any dust to a minimum..

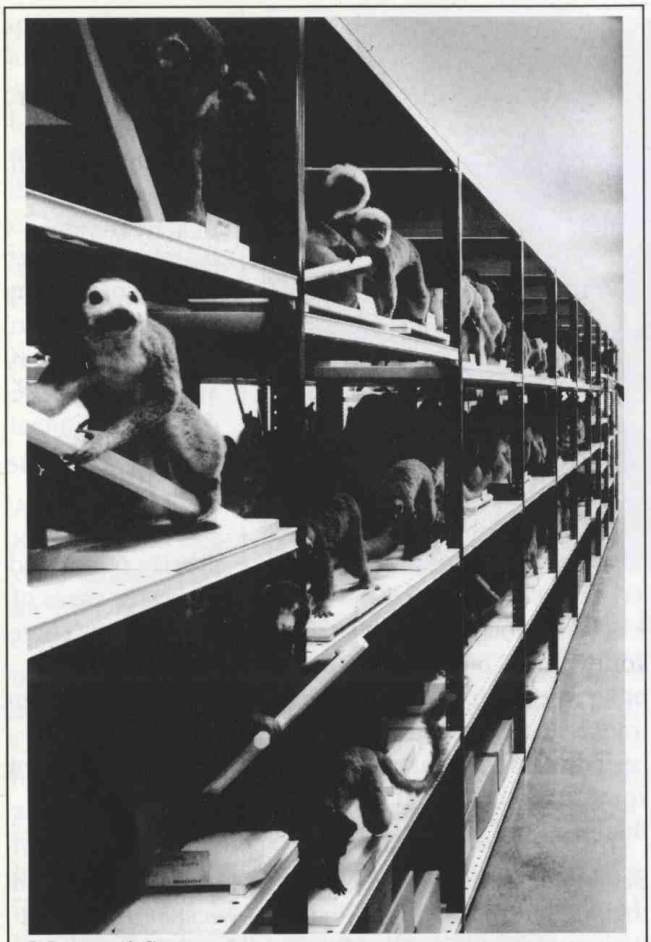
One item of particular interest to NHM staff was a window into one of the storage areas for the general public. This appeared almost pointless as very little could be seen through this rectangle of darkness, but after straining for a few moments the shape of some mammalian specimens could just be made out. We later heard how the curator of mammals had placed a curtain over this window but had been forced to remove it. Only *bona fide* groups and students were given "behind-the scenes" tours here and the news that The Natural History Museum's new spirit storage would feature an entire huge storeroom being glass-walled and permanently brightly lit for the benefit of the public was met by our Dutch colleagues with polite disbelief.

After lunch the delegates were divided into five groups, one group opting to visit the *Rijksherbarium* (report below). The remainder were taken into the storage tower by members of the curatorial staff. The tower is a separate building within the overall gallery space and linked by a loading bay. It stands over 60m tall (22 storeys) and the architect responsible succeeded in his mission to construct the tallest building in Leiden (it was remarked that this had sometimes appeared to be his main priority). The building is airtight, with 10% fresh air intake at each circulation, and is kept at a constant 17° C and 50-55 RH. All the plant is located at the base of the tower. Fire protection consists of Argon gas for spirit material, water sprinklers for dry. Each floor has two storerooms measuring 10x20x3m and there are no internal stairs, use of the external fire stairs is strictly prohibited except in cases of emergency. There are two lifts, one is dedicated to passenger use, the other, measuring approximately 2x1.5m, for specimen transport. As quite a large number of curators could be in the building at any one time, it was revealed that sometimes they spent more time waiting for the lift than they did in the storerooms.



Fish Spirit Store

Security is extremely tight, curators have a smart card that allowed them access to their own specimens, but they cannot use it to get into any of the other stores; staff are not permitted to spend more than two hours at a time in the storerooms. Anything that could possibly cause a spark was banned from areas containing specimens in spirit, this included personal stereos, radios, flash cameras, computers and mobile phones; light switches are explosion-proof. There are wall-mounted telephones outside the storerooms but staff complained that they were often unable to hear them We were told during our introductory talk that the tower occasionally moved in the wind causing the jars to tremble slightly on the shelves; this was observed to happen during our visit but the fish curator said that it was down to poor shock proofing in the elevator shaft which is lined with galvanised steel and concrete. As the tower was mainly constructed of steel and glass, vibrations could travel well throughout the building. There is no water supply to the storerooms, there is a preparation area on the ground floor equipped with formalin benches, fume cupboards and spirit "on tap"; walk-in freezer facilities and a gas chamber were also available in this area.



Mammal Store

The storerooms are windowless and fitted with rows of open (doorless) racking with sliding shelves a metre wide. The wet and dry fish collection for example comprise around half a million specimens with the spirit collections occupying 290 sets of shelves. The main fish collection was started in the 1820s although their oldest specimen dates back to 1734; of special interest was the material collected by Bleeker, an important 19th century ichthyólogist, of which the Lieden museum has the most important collection in the world, including many types and figured specimens. It was interesting to see that many of the spirit specimens were stored in glass jars sealed with wax, excellent for preventing evaporation but not conducive to easy specimen accessibility; Kilner™ jars, where used, were fitted with silicon rubber gaskets. Registration numbers were painted on the outside of the jars and a system of coloured dots used to indicate type or otherwise important specimens. Large specimens were in metal tanks with rubber seals, some of which were observed to be leaking.

In the mammal and bird storage areas mounted material was housed on open Dexion-style racking; covers were not considered necessary since the air-conditioning meant that there was little or no dust. An estimated 600 type specimens were housed separately in a lockable cage. Study skins were stored in drawers. During the introductory talk Dr Krikken had mentioned that the move from the old storage had revealed problems with *Aspergillum* growth on the outside of some of the glass jars. All were cleaned thoroughly before the move by gassing with formalin vapour and then 10 people were employed to wash all the jars with alcohol. Some mould had been spotted on mounted mammal specimens and these were removed from storage areas for immediate treatment. Additionally, a pest control company (Harbour Quarantine Service of Rotterdam) is brought in twice a year to spray the entire building with contact pesticide.

At the end of the afternoon, delegates reassembled in the public galleries where the Chairman of BCG, David Carter, gave a short speech thanking Dr Krikken and his colleagues and presenting them with a copy of *Voyages of Discovery.*

The Rijksherbarium

The Rijksherbarium was founded in Brussels in 1829 by King William I. William lived in exile most of his life and saw the impact that French and British collections were making on scientific progress. The collection was first housed in a converted convent under the directorship of Dr C.L. Blume, the outstanding Malesian botanist. In 1830 the Belgians started an uprising against the Dutch whilst Dr Blume was away on his second honeymoon, but as luck would have it, Philipp Franz von Siebold [Fig.1] was passing through Brussels and realising the significance of the revolt, arranged with J.B.Fischer, the director's assistant, for the transfer of the collection by cart to Leiden.

Fig.1 Philipp Franz von Siebold

For ten years, 1988-98, the Rijksherbarium/Hortus Botanicus (RHHB) was a combination of two complimentary institutes; a museum herbarium and a garden, both with long chequered histories. The Hortus Botanicus or Leiden Botanic Garden [Fig.2] was founded in 1590 as part of the university and had a strong focus on Southeast Asia, influencing the introduction of many ornamental plants into Europe. 1998, however, was a time of significant change for the Rijksherbarium due to government policy and it has now merged with the Herbaria of the Universities of Utrecht and Wageningen to become the National Herbarium of the Netherlands. The Hortus Botanicus is now an institute in its own right.

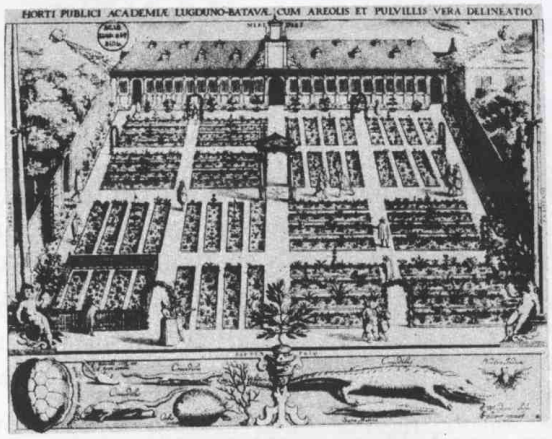


Fig.2 The Hortus Botanicus

The Rijksherbarium is now situated in the middle of the BioScience Park in Leiden in a converted computer building, which is shared with the university; the institute has been at this location since 1995. Here we were met by our hosts, Professor P. Baas, the director, & Mr C.W.J. Lut, the librarian. Prof. Baas first explained the nature of the institute's work to us. The herbarium mainly focuses its research endeavours towards Malesia and Europe (especially the Netherlands) using multi-disciplinary approaches including historical biogeography, geology, scanning electron microscopy and DNA sequencing. Many of the staff teach university courses and supervise PhD projects and are also responsible for the plant displays in *Naturalis*. The institute has in-house publishing, which results in low cost specialist publications, especially for those in developing countries. The Rijksherbarium advise on local, regional and national declines and improvements of flora in the Netherlands e.g. *Cochlearia danica* L., a salt tolerant plant, which was declining, is now making a comeback along motorway ridges due to the national de-icing programme.

After the general introduction, Prof. Baas led us through to a locked room which holds all their pre-1800 collections [Fig.3]. Here, he showed us many old historically valuable Herbaria, which included the Herbaria von Siebold and Rauwolff.

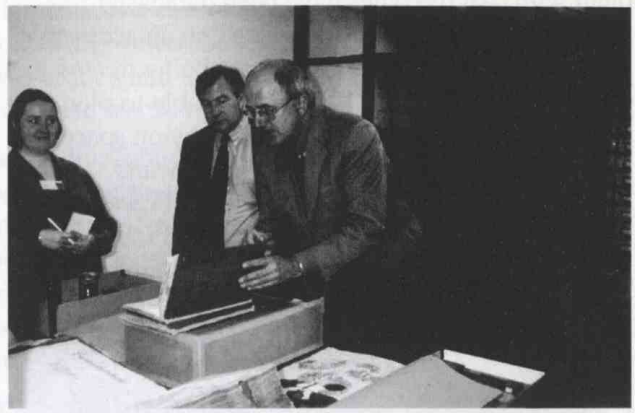


Fig.3 The pre-1800 herbarium collections

Rauwolff was a physician from Augsburg, who collected in 1665 in the Middle East and Palestine. During the 30 years war this volume was in the possession of Queen Christina of Sweden but later it turned up for auction in London where it was bought for the herbarium. Philipp Franz von Siebold was another physician who cured cataracts for the Japanese nobility, in return for which he was presented with extensive collections [Fig.4].

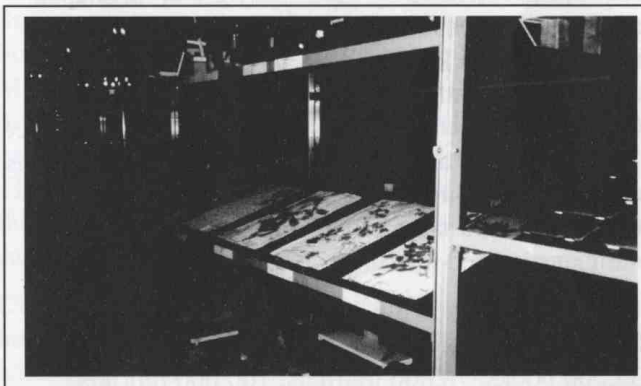


Fig.4 The von Siebold collections on display in *Naturalis*

The general collection is taxonomically arranged and housed within specially made cardboard boxes on open metal shelves [Fig.5].

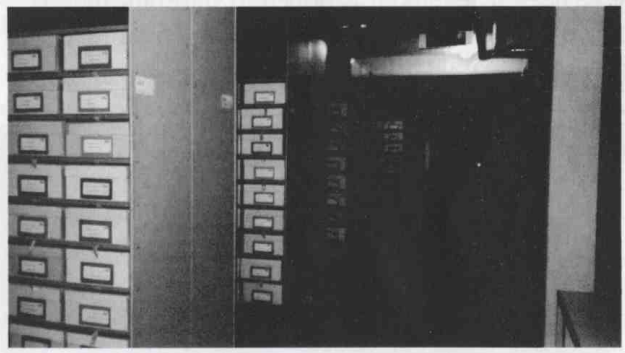


Fig.5 The general herbarium

The collection is stored in this static manner so that researchers do not have to move large numbers of individual specimens at any one time. Each sheet is registered using a bar code system, with approximately 80,000 specimens still waiting to be

dealt with. All the types have been databased, photographed, digitised and placed on an accessible web site and all new specimens are being treated in a similar fashion. The staff have been able to plan for the future and there is plenty of expansion space. Incoming new material, once frozen, awaits incorporation on open shelves [Fig.6]. Precautions against pests include the periodic use of CS gas to fumigate the collection and regular placements of insect light traps.

Fig.6 Material awaiting incorporation

Prof. Baas then took great delight in showing us the wood collection on which he works. He explained that specimens collected by botanists were of all shapes and sizes but those collected by foresters were neat rectangular blocks. The Rijksherbarium has a large collection of samples from what was Dutch New Guinea (Indonesia) and this has been augmented since 1968 by further duplicate material from Kew Gardens and the Commonwealth Forestry Commission in Oxford. All the samples have their registration number punched into the block.

We were then shown the Rijksherbarium Library by Mr C. Lut. He explained that the collection contains 35,000 books, 70,000 journals, 100,000 reprints, 90,000 microfiches and 50,000 illustrations. The library is managed by four and half members of staff, with a bookbinder employed part time. The collection is now housed on metal shelves with no book beyond reach and plenty of expansion space. Computerisation of this literature started in 1970, over 150,000 titles have been listed and it is hoped to start putting this data onto the Internet next year. Rare volumes are kept in a separate locked room [Fig.7].

Fig.7 The rare books room

These included the first catalogue of Hortus Botanicus from 1660 with a plan of the garden; a 1564 cookery herbal; a Dutch 1771 version of Christ. Jacob Trew's "*Uitgezochte Planten*" of which only 57 copies are known; and three very rare volumes of *Natural Printing* by W. Alpherts (1859-1862) [Fig.8].

Fig.8 The Alphert volumes of Natural Printing

At the end of our tour, Mr Lut showed us the storage for some 4,500 original watercolours held in specially designed boxes and recently digitised, conserved and catalogued by an outside conservator. These included wonderful original drawings from the van Royen collection used by Seba in his descriptions. A marvellous finale to our Rijksherbarium visit.

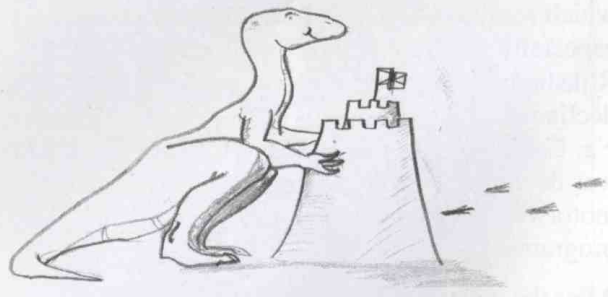
Report compiled from contributions by:-

Amelia Campbell, Oliver Crimmen, Sean Davidson, Eiry Jagger, Mary Spencer Jones, James Macleane, Vicky Purewal, Clare Valentine and Kathie Way

Access to Collections

BCG, GCG, NSCG Joint Conference, Scarborough April 3-4th 2000

Two days in sunny Scarborough!



As the rain closed in, I wondered if I would ever reach my destination. Scarborough and the Spa Complex seemed so far away as yet another tractor pulled out in front of me. After a somewhat slow drive I finally arrived at my very first Biology

Curators Group event. The 'Access to Collections' Conference attracted over 80 delegates and was the first meeting held joint with both the Geology Curators and Natural Sciences Conservation Groups; the perfect place to indulge in the age-old conference tradition of catching up with friends and colleagues and networking with new ones.

The diverse representation from across the natural sciences made this an ideal platform from which to begin to tackle issues of access to collections by swapping ideas, initiating dialogues, highlighting good practise and identifying areas for future development.

The most fundamental yet essential of questions was first on the agenda; 'Why and for whom do we wish to increase access to our collections?'

Our founding museums were developed in an era of intense social exclusion. Many of which sprang up from cliché clubs and societies that addressed only middle-class values. In the 1840's the Natural History Society of Newcastle made the decision to open it's doors to the public and was deluged with interest. Today the question is not **whether** to allow access to museum collections but **how** it can be achieved.

More than ever, museum collections are considered to be within the public domain and not the coveted possessions of the privileged few. A greater emphasis is being placed upon the museum's role in public education and funding bodies are increasingly demanding quantifiable results tested by performance monitoring, for example, the government's Best Value strategy. This era of overwhelming change brings with it exciting opportunities for museums and their stakeholders to revolutionise the way in which we approach access to collections.

This conference highlighted the very diverse nature of access issues that will, in the future, penetrate to the very foundations of all of our institutions.

Basic physical access to collections

Access to original material is sometimes difficult or impossible for many reasons. Firstly and fundamentally, if an object is actively deteriorating future access to it of any kind is uncertain. If this goes un-addressed, documentation and casts or replicas may become the only evidence of the object's existence and a vital link to it. Caroline Butler (National Museums and Galleries of Wales) told the conference of one such situation. The Bendrix formation in southern Wales contains many bipedal dinosaur trackways, some have been lifted from the site to avoid damage caused by erosion and fossil collectors. In 1996, the exciting find of a quadrapedal trackway was made but it could not be removed from the site and was subject to heavy marine erosion. Fast action had to be taken to avoid losing it to the elements so a cast of it was made. During the following winter the lower portion of the trackway was eroded and the cast now stands as the only complete record of this important discovery.

Secondly, John Martin (Leicester City Museums) pointed out that there are legal barriers to the removal of an object from its find site or its movement across borders. Uncertainty over property rights to objects may also occur and stifle access. Good record keeping and adherence to collection management guidelines can often avoid this situation.

Museum professionals and collections

As the waves lapped at the sides of the conference (I'm not being romantic here, I mean literally!) discussion progressed onto staff access to the collections. Physical deterioration of objects that are already in the stores can create barriers for intellectual access, as can poor specimen preparation. Conservators obviously have a keystone role in maintaining a specimen's integrity, as do Curators in spotting problems in collections early or even before they happen.

Staff access may seem like a very basic requirement but it isn't that simple. As Vicky Purewal (National Museums and Galleries of Wales) illustrated with historic botanical specimens, some collections may carry a health hazard for those in contact with them. This kind of situation can restrict even staff access to the collections and ultimately requires extremely careful and strict management.

Disorganised and under-documented stores are not hard to find. However, this is unsurprising when the additional pressures placed on curators and collections managers are considered and added to the number of natural science collections currently cared for by non-specialists.

So how can we expect to offer quality access for others if we do not have it ourselves?

'Collections must be sorted to be accessible' Geoff Hancock, Hunterian Museum, Glasgow

Collections must be organised, documented and protected in order to be accessible.

All of this ratifies the importance of a sound collections management policy and accompanying appropriate conservation program.

After a full day of coffee drinking, gossip and general conferencing I retired to my hotel. To add insult to injury on the way the weather threw its final wildcard at us; snow. Slightly soggy around the edges, I checked-in and it suddenly dawned on me that I was actually staying in 'Fawlty Towers', complete with Spanish waiter/porter/doorman who I'm sure was called Manuel. Thankfully there was no complementary brown rat called 'Basil' thrown in,

along with the towel and dinky toiletries. I made my way to the conference dinner in search of other like-minded museum professionals to quaff wine with and was not disappointed. After a sumptuous meal we retreated to the 'Hole in the Wall', stage to the unofficial B.C.G. annual darts contest that I must admit was a dangerous spectator sport! I decided to try the pubs very own birch wine, which I can assure you was a novel and quite unique experience, which I'm not sure if I'll be repeating!

Opening up collections to the public

After a period of sleep, not necessarily good, I was ready for action and to tackle the problems of providing public access to our collections.

The museum acts as an interpreter between the object and the world. Andy Newman (Museums Studies Department, University of Newcastle) pointed out that the natural sciences in particular have a special role to play in society because they can help define mans relationship with his environment. This can help individuals and communities to develop an enriched sense of identity and belonging and can become a powerful tool. We can also facilitate visitor learning by providing a valuable access route to the scientific thought process.

With 'education, education and education' as Labour's war cry as they came into office, it is obviously now high on the agenda for museums. This links neatly into other current issues affecting access such as life-long learning, the new National Curriculum and social inclusion. Natural Science collections have the opportunity to positively respond to these government initiatives, therefore opening new gateways for funding, advocacy and support. Partnerships with organisations with special expertise in the skills needed to initialise programmes for increased access and social inclusion should be exploited to the full, for mutual benefit. Programmes can be planned to allow development in these areas in a strategic manner but should be fluid enough to incorporate short-term opportunities.

Within these programmes, interpretation needs to be as varied as possible if the majority of the learning styles and abilities in museums actual and potential audiences are to be reached. Museums also need to provide a 'hook' to gain the initial interest of audiences. This could be in a variety of forms from workshops to a special project. One example of this is a project run by the National Museums and Galleries of Wales, which specifically targeted school groups and helped teachers address some of the objectives of Maths year 2000. It mainly involved a numeracy trail at eight differentiated levels around the natural history galleries. A small amount of additional equipment was provided by the museum such as trundle wheels and stopwatches. Learning areas covered include estimating and measuring, map grids, keys, data collection and symmetry and practical activities included calculating the speed of ants in a live exhibit.

'Objects of Desire' provides an interesting example of how diverse audiences can become integrally involved in natural sciences collections. The Hancock Museum in Newcastle invited 1,000 local people from diverse backgrounds to select an object from the geology stores. These then formed the central focus of a major people's display at the museum. Gillian Mason highlighted the problems of sustaining ongoing relations with the groups. Relationships with audiences new and old require time and resources to build and this should not be underestimated.

The concept of open storage is being debated throughout the world and is already widely used in North America. It can be a tool to increase awareness of the roles of museums and the value of 'reserve' collections. It stresses that exhibition just the tip of the iceberg, especially in natural sciences. It can also significantly increase the use of collections. Questions such, as 'does it actually increase access and is this quality access, what is its place' are all being raised. As yet, there is not sufficient research available to satisfactorily answer these.

Staff attitudes are often a barrier to access and once these are broached, half the battle is won.

Once measures to increase the accessibility of our natural science collections are in place, the role of marketing becomes increasingly important to help inform potential audiences of the changes. Improved access is a means to an end and not an end in itself. Simon Knell (Department of Museum Studies, Leicester) highlighted that increasing access may not result in a tangible rise in overall visitor numbers but almost certainly an increase in visitor diversity.

The world outside the walls of the conference hall

Armed only with my stick of Scarborough rock and souvenir postcard I saddled up ready for one of the Conference trips. We headed north to a small well-hidden bay in search of evidence for some of the areas pre-historic inhabitants. As I descended the steep winding steps and the tide washed inwards fast I wondered whether we would be able to find anything here. However, I was not to be disappointed. The wet and windy weather that graced the conference had ladened the cliff faces with additional water, causing fresh rock falls. Something lay awaiting discovery. As the loose rock fragments were brushed off the surface of a newly exposed bedding plane, a small run of dinosaur footprints saw daylight for the first time in over 65 million years. A truly magical moment that for me, solidified many of the surrounding access that

we had been discussing: access to the real artefacts, access to the processes of science.

After lugging an interesting specimen of fossil coral up the hill for the museum, we departed for Whitby Museum. This gave us a chance to see Kate Andrew's Conservation Award winning work on the wall mounted saurian collection. The restoration formed part of a project partly funded by the National Lottery. We heard of the complex and often painstaking processes involved in removing the extensive pyrite decay and historically applied lacquer coating on them. And admired the impressive results. The rest of this small museum is an interesting mix of many objects ranging from a large collection of Whitby jet to curiosities that form part of the local history.

Overall, the conference highlighted and illustrated the multi-faceted nature of access and its necessarily intimate relationship with social inclusion. The subject presents so many considerations for every museum, most of which too important to be neglected if the future of our museums and their collections is to be safeguarded. Answers to these problems are not available 'off the shelf' and a huge amount of work still needs to be carried out to facilitate maximised access to natural science collections. We need to act fast and with purpose if the future is to be grasped and used to our advantage. In response to this, anyone who is making an attempt to find solutions to access problems within museums should make it a priority to share this information with the rest of the profession.

This report was compiled by Kate Geddes from the papers given by the fourteen speakers at the conference, all of whom I would like to thank very much for helping to make it an enjoyable and thought provoking conference. I would like to extend a special thanks to all those involved in organising the conference.

Useful references:

Department for Culture, Media and Sport (DCMS), (2000). 'Centres for social change – museums and archives'.

Department for Culture, Media and Sport (DCMS), (2000). 'Museums for the many'. Government white paper available on the DCMS website.

GEM, Group for Education in Museums, (1996). 'Developing Museum Exhibitions for Lifelong Learning'. Gail Durbin, ed. The Stationary Office, London.

West Midlands Area Museums Council, (1991). 'Could do Better . . . .: marketing museums in a multi-ethnic community'. Project report.

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An Introduction To Molluscs

Curation, Conservation and Uses

Oxford University Museum of Natural History

Monday 31st January 2000

Following on from successful one day meetings on bones, botany and entomology, the lesser tackled subject of molluscs was decided as this years first meeting. This was a very well attended meeting, perhaps highlighting the need for information and training on some of the less high profile collections.

PRESERVATION AND CURATION OF MARINE MOLLUSCAN SPECIMENS

Once specimens have been collected in the field, careful procedures must be followed to preserve and store them as permanent biological collections with lasting scientific value. The care and maintenance of a biological collection is referred to as **'curation'**, and those who do this skilled task are **'curators'**. Clearly, the techniques required for preserving whole living animals are different from those necessary for dead shells, and are described separately below. There are, however, some similarities in the curation of both wet and dry material, which are discussed together.

It is often asked how many specimens should be collected to make a representative collection of a species? This depends upon many considerations, e.g. rarity, conservation considerations, specimen size, storage facilities, and the purpose of the collection. Clearly, for a thorough study of geographical distribution and morphological variation within a single species, large numbers of specimens and samples are desirable. At the opposite extreme, even a broken fragment of a very rare species may be a useful specimen. For a teaching collection, just a few shells may suffice. In general, museums should aim to house samples large and numerous enough to display the range of morphological and ontogenetic variation, to represent the geographical distribution and morphological variation across it, and to have material to spare for destructive dissection as required. For a common species of moderate size, a reasonable sample is 10 to 30 specimens from a locality.

1. Wet and dry collections

When making a collection of molluscs, there is always a dilemma about whether to keep live-collected specimens 'wet' (i.e. preserving both shell and soft parts in a fluid such as alcohol or formalin) or 'dry' (i.e. preserving shell alone, although as a compromise this may still contain the dried animal).

The decision must be made on the basis of the scientific importance of the specimen, the scientific purpose of the collection, and considerations of the practicality and economics of storage.

There are advantages and disadvantages of both wet and dry collections:

WET COLLECTION	Advantages	Disadvantages
	i. Preserves complete, intact specimens of maximum scientific value ii. Possible to dissect soft anatomy iii. DNA can be sampled from alcohol-fixed material	i. Bulky storage ii. Expensive containers iii. Laborious care (topping up of fluid required) iv. Acidity of preserving fluid may damage shells
DRY COLLECTION	Advantages	Disadvantages
	i. Convenience of storage (less bulky; cheaper containers; little long-term care necessary) ii. Easier to pick up and examine shells iii. If purpose of collection is for identification, record or teaching, then for most shelled molluscs only the shell is necessary for species-level identification	i. Scientific value is much reduced, since soft anatomy cannot be examined (but dried animals can be rehydrated, and their radulae can still be examined)

Therefore, most museums maintain both wet and dry collections, which serve different purposes. If the sample of a species is large, part may be dried and part kept wet.

2. Preservation of live-collected specimens

Preservation is often a three-stage process, involving narcotisation, fixation and long-term preservation and storage.

2.1 Narcotization

Most molluscs contract violently when placed in a chemical fixative. In order to preserve the body in a relaxed, lifelike manner it is therefore desirable (and humane) to first narcotise (i.e. relax and anaesthetise) the animal. Many recipes are available for narcotisation, and specialists on particular groups usually have their own favourites, developed through experience.

For marine molluscs, the best general narcotic is a solution of magnesium ions that is isotonic with seawater. A 7.5% (weight/volume) solution of **magnesium chloride** is ideal. The exact concentration is not critical; a satisfactory solution is easily prepared by dissolving one volume of hydrated $MgCl2$ crystals in 13 volumes of fresh water (**not** seawater). The time taken to achieve narcotisation varies from 1 to 12 hours according to the species. When the animal is fully extended, and shows no response if touched, narcotisation is complete. Most molluscs can safely be left in the narcotising solution overnight. However, some delicate forms may die and begin to decompose, so should be kept cool and fixed as soon as possible. Curiously, some molluscs appear to show partial recovery from narcotisation if left too long, and contract before finally dying. There are so many possible responses to narcotics that some trial and error are often inevitable. For bivalves and those gastropods that close the operculum very tightly, narcotisation is much more rapid if the valves or the operculum are first kept open by inserting a pin or small piece of wood while the animal is agape or crawling. For molluscs from brackish water, a more dilute solution must be used.

One alternative is to place the animals in a bowl of sea water and add several small crystals of menthol, but this is generally less satisfactory. If no chemical narcotic is available, animals can be kept overnight in a tightly stoppered container completely full of seawater, and some will relax as the oxygen is exhausted. Opisthobranchs can be cooled (**not** frozen) in a freezer before fixation.

2.2 Fixation

This is the initial phase of preservation, in which the fresh tissues are stabilised by coagulation of proteins or chemical reaction with them. For best results, the fixative should penetrate the tissue rapidly. Two fixatives are commonly used for molluscs: formalin and ethanol (often simply referred to as alcohol or spirit). There are advantages and disadvantages of both:

ETHANOL	Advantages	Disadvantages
	i. Not toxic to humans ii. Will preserve DNA (at concentrations above 90%) iii. Does not normally damage shells (must be buffered for long-term storage)	i. A slow fixative, therefore less suitable for large specimens ii. Poor preservation of tissues at the cellular level (for histology) iii. Large volume must be carried
FORMALIN	Advantages	Disadvantages
	i. A rapid fixative ii. Good preservation of tissues at cellular level iii. Can be carried in concentrated form and diluted with sea water as required	i. Dangerously toxic to humans ii. Destroys DNA iii. Is acidic unless buffered, so will corrode calcareous shells

Ethanol (sometimes known as ethyl alcohol; often sold cheaply as 'industrial methylated spirit', but see remarks on DNA samples below) can be used at concentrations of 70 to 100%. For general-purpose fixation, 80% is recommended. Concentrations above 90% make the tissues unacceptably firm for dissection, but are necessary for preservation of samples for DNA analysis. Dilution of 100% ethanol must be carried out with fresh water, not sea water. It is important that there is sufficient ethanol in the container to fix the tissue. Ideally the volume of ethanol should be ten times the volume of the tissue (remember that for many shelled molluscs the impermeable shell makes up most of the volume of the animal, so that containers can be filled one third full of animals and filled up with ethanol). The time taken for fixation to be completed depends on the size of the animals, but will not take longer than 10 days. For very large animals, some fixative can be injected into the tissues.

Formalin is the recommended fixative if the animals are required for dissection and/or histology. It is very important to remember that formalin is a highly toxic solution, and **must be handled with great care**. Ideally, it should only be handled when wearing latex gloves and eye protection. It is very damaging to eyes even when dilute, and must not be inhaled. There is sometimes confusion about the terminology and concentration of formalin solutions. The chemical molecule responsible for the fixation reaction is formaldehyde. This is a gas at ambient temperatures, and is sold commercially as a solution in water; this solution is called formalin. The strongest concentration available is a 40% solution of formaldehyde gas, and this is called 'concentrated formalin' or '100% formalin'. To use as a fixative, this concentrated solution must be diluted to one tenth of its strength, by mixing one volume with nine volumes of sea water (for freshwater or terrestrial molluscs, fresh water should of course be used instead). This 1:9 dilution produces 10% seawater formalin (which is a 4% solution of formaldehyde). Since formalin is acidic, this solution must be buffered. A common buffering agent is borax (di-sodium tetraborate); one large spoonful should be added to each litre of formalin. If this is not done, calcareous shells will quickly be damaged, their shiny surfaces becoming whitish and etched. Formalin is a more rapid fixative than ethanol, and fixation is complete after 5 days; only the very largest molluscs may require injection of formalin into the tissues to hasten the penetration of the fixative. Ideally, the volume of formalin should be 3 to 5 times that of the tissue to be fixed; containers can therefore be filled one half or two-thirds full of shelled molluscs, and filled up with formalin.

For specialist purposes, other fixatives can be used. Bouin's solution is the best fixative for histological samples (although formalin is adequate for most histological purposes). For electron microscopy, tissues should be fixed in 2.5% glutaraldehyde in a suitable buffer (e.g. phosphate, cacodylate, or filtered seawater). Glutaraldehyde is rather unstable, and should be kept refrigerated; it is also very poisonous.

The coloration of the living animal is usually lost during fixation and preservation. If possible, make notes on the appearance of the living animal, or take a photograph. This is especially important for opisthobranchs, in which colour patterns are often necessary for identification.

2.3 Long-term preservation

Although it is a superior fixative for most purposes, formalin is not suitable for long-term storage, because of its acidity and oxidising properties. Molluscan tissues left in formalin for periods of several years become translucent and gelatinous. Furthermore, as has been stressed, formalin is an unpleasant and dangerous solution. Therefore, formalin-fixed material is usually transferred to 70 to 80% ethanol for storage. Not only is ethanol less dangerous, but it

hardens tissues slightly, making them easier to dissect. The formalin-fixed material must first be thoroughly rinsed under running fresh water, before transfer to ethanol. (Some curators soak the material in fresh water for longer periods, but while removing the formalin this may damage the tissues; instead, for complete removal of formalin, the ethanol solution can be changed after several weeks). Even ethanol can become slightly acidic over time, and should be buffered with a small quantity of borax (0.5cm3 per litre), to prevent damage to shells. One significant disadvantage of ethanol for storage is that it evaporates quickly, so that containers must be of high quality in order to maintain a tight seal. All wet collections must be routinely monitored to check that fluid levels are maintained.

If ethanol is not available for long-term preservation, a 5% buffered formalin solution in sea water can be used, but is less satisfactory as explained above.

If material has been fixed in ethanol, the fluid should ideally be replaced before long-term storage.

2.4 DNA samples

A specialised (but increasingly common) use of biological collections is as a source of DNA samples. Any contact of the material with formalin will make extraction of DNA much more difficult or impossible. If molecular work is a requirement (or even if it is a distant possibility), fixation and storage must be carried out in ethanol. For the best preservation of DNA, fixation and storage must be carried out in ethanol of at least 90% concentration, and 100% is preferred. Rapid fixation is extremely important, and therefore shells must be gently cracked and thick tissues (e.g. foot muscle) sliced with a scalpel, to hasten penetration of the ethanol. Of course, these processes damage the specimen, so it may be preferable to fix material required for DNA studies separately from that required for anatomical work. Another source of damage to DNA molecules is methanol, which is often added to 'industrial alcohol' (or 'methylated spirit') to make it unsuitable for consumption. Although methylated sprit is suitable for fixation and storage of general-purpose collections, only pure ethanol should be used for material for DNA extraction. It is not necessary to preserve the whole animal for a DNA sample; if the animal is unique, or rather large, then a small piece (say 1 cm3) of foot can be removed for the DNA sample, and the rest preserved or dried separately, as a voucher specimen to confirm the identification of the sample.

3. Preservation of dry material and shells

There is an unfortunate tendency among some malacologists to dismiss collection of dead shells for scientific purposes, and to stress the overriding importance of making wet collections of living animals. It is of course true that intact, live-collected, wet-preserved specimens have the maximum scientific value. Nevertheless, it must be appreciated that collections can serve a variety of purposes, and that even dead shells can be scientifically useful. For rare species, or those from inaccessible habitats, only dead shells washed up on the shore may be available. As mentioned earlier, the shell on its own is usually adequate for species identification, and so may be useful for teaching and reference collections. Where live specimens are available, and can be gathered without undue environmental damage, this does make the best material for collections.

3.1 Treatment of dead shells

Empty shells should be washed in fresh water before drying, to avoid chemical deterioration during long-term storage (see 4.2).

3.2 Treatment of living specimens

If only the empty shell, or a dry specimen, is required, the soft tissues can be removed or dried. For removal, the specimens should be placed in cold fresh water and heated for 30 minutes (but not quite boiled). The tissues can then be extracted with a needle and forceps, and the shells left to dry. Alternatively, the shells may be frozen, and the soft parts removed with a powerful jet of water. Insects may assist in complete cleaning of shells. A preferable method is to fix the animals as described earlier (see 2.2), without previous narcotisation, and then dry them without removing the tissues. In this way a compromise is reached; the dry specimens are easily stored, but if the tissues are required for dissection or radula extraction, this can be achieved by rehydrating in detergent solution for 1 or 2 days (the results are, of course, less satisfactory than in the case of wet-preserved specimens). However, under tropical conditions dried animals may decompose unless stored in air-conditioned surroundings, so that complete removal of the soft parts may be necessary.

4. Curation of the collection

Curation includes all aspects of the storage, labelling, cataloguing and long-term care of the collection. The standard of curation again depends upon the function of the collection. The bare minimum is required for a simple reference or teaching collection. However, a large national museum is a repository of valuable scientific material that will be a resource for future generations of scientists; in this case curatorial care must be of the highest possible quality, to ensure the preservation of the specimens in good condition for many years to come.

4.1 Wet material

The most important requirement for wet material is that the containers used must be watertight, to reduce the need for topping up of fluid after loss by

evaporation. Slow evaporation is almost inevitable, but can be minimised. The cheapest containers of plastic, or glass jars with plastic lids, are convenient for short-term storage, but on a timescale of 10 to 20 years the plastic perishes and the fluid is lost. The best quality containers are of glass, with ground glass lids, sealed with petroleum grease, which require little or no attention for centuries, but such containers are very expensive. A compromise can be found in glass jars with metal or glass lids that are sealed with rubber washers (the rubber perishes eventually, and more long-lasting washers are made of neoprene). If the seal is poor, the opening can be covered with plastic film before screwing on the lid. Small containers are relatively more expensive; if only large jars are available, many small samples can be packed in individual glass tubes, plugged with cotton (or mineral) wool, and placed together in the jars. Most containers require regular (e.g. annual) checking to monitor possible evaporation. Since ethanol evaporates more quickly than water, topping up should be done with 95 to100% ethanol if this is available. Otherwise, after many years of slow evaporation and topping up with 80% ethanol, the ethanol solution will become too diluted, and must be entirely replaced. An alcohol meter is available to monitor the strength of ethanol. If wet specimens do dry out completely, they can nevertheless often be quite satisfactorily rehydrated by soaking for 24 hours in a solution of detergent in fresh water, before being returned to ethanol. Wet material should be stored in the dark if possible. A closed, cool cupboard also reduces evaporation. It is important that labels are not stuck only on the outside of containers, but are also included within them (see below).

4.2 Dry material

Dry material presents far fewer difficulties for long-term storage. Specimens can be stored in a range of plastic bags (those with a clip seal are best), plastic boxes, glass or plastic tubes. If tubes are used, these are best closed with a plug of mineral wool rather than a plastic stopper (the former permits ventilation, cushions the shells, and is more long-lasting). Cork stoppers should never be used (they are a source of acid, see below). Very small shells can be contained in gelatin capsules within tubes (such capsules are available for pharmaceutical use, but must be kept completely dry since they dissolve in water). In the long term, ordinary glass tubes (made of soda glass) may damage small shells, and inert plastic may therefore be the best material for small tubes. Shells should be kept in the dark to avoid fading of colours.

Dry shells are relatively robust, but one potentially serious problem can arise during long-term storage. Since shells are largely composed of calcium carbonate, they react with acid in the presence of moisture. There are several possible sources of acidic vapours in dry storage areas. Acidic residues may be present in wood (especially hardwoods; metal cabinets are best), hardboard (this should never be used in cabinet construction, since formic acid is used in its manufacture), cotton wool (this is bleached with acid; mineral wool is much better), cork stoppers, and even in some glass used for tubes (acid-free glass can be obtained). The process of attack is gradual, and affected shells appear dull, with a superficial whitish powdery deposit; when rubbed this deposit has a smell of vinegar (acetic and formic acid salts are constituents). Such shells are said to suffer from 'Byne's disease' (after its describer; no micro-organism is actually involved in this condition). In order to minimise the risk, all sources of acid vapours should be avoided. If this is not entirely possible (e.g. if the only available cabinets are of wood), then the cabinets should be well ventilated, the storage area should be of low humidity, and care should be taken to soak shells in fresh water before they are added to the collection (thus avoiding hygroscopic uptake of water from the atmosphere). To treat a shell affected by 'Byne's disease', wash thoroughly with soap and water, rinse well and dry, then rub with a little silicone oil.

Another problem that can cause deterioration in dry collections is attack by insects and fungi. The calcareous shells of molluscs are usually too robust for significant damage by these agents, but dried soft tissues, periostraca and ligaments of shells, labels and certain storage boxes are all highly susceptible. To avoid fungal damage the collection should be kept in conditions of low humidity. Where possible, air-conditioned storage is desirable in the tropics. Insects can be excluded by keeping all material in closed bags and tubes, but occasional checks for infestation are recommended, and in extreme cases fumigation with insecticide may be necessary. When introducing new material into the dry collection, it should first be thoroughly cleaned and checked for insect pests.

4.3 Labelling

Whatever the purpose of the collection, and whether material is wet or dry, it is essential to label each sample with adequate locality information. The degree of detail required will vary, but the very minimum is the name of the institution, the precise locality, and the date. The correct name of the species is the least important piece of information, since this can always be added or changed later. A record should be kept of any curatorial actions affecting the sample (e.g. examination on loan, publication of figure, re-spiriting, rehydration of dried material etc.). It is very important that if new labels are added to the collection, 'old' labels are retained with the sample and **never** thrown away, even if the identification is believed to be incorrect or the label is hand-written (in the future, these 'old' labels may be a useful source of

historical information, e.g. handwriting can be identified to show which scientists may have examined them). Here is an example of the most complete information on a museum label:

British Museum (Natural History)

Registration number 19993762

Littorinidae: *Littoraria scabra* (Linnaeus, 1758)

Locality: Kampong Uglam Hujung, Kudat, Sabah, Malaysia. 116°33'E, 7°12'N

Date: 3 September, 1998.

Habitat: On branches and trunks of *Rhizophora* mangrove trees, 1-2 m above ground, on edge of forest fringing small, sheltered, muddy bay. Uncommon. Live collected.

Collector: D.G. Reid

Notes: Specimen figured in D.G. Reid (1999) J. Moll. Stud. 65: 127, fig. 6. Sample fixed in formalin. Additional samples in 100% ethanol and in dry collection. Material borrowed on loan by R. Kilburn (Natal Museum) 9/1999.

The best quality of paper that can be afforded should be used (e.g. 100% rag paper, acid-free vegetable parchment, or a synthetic equivalent). Labels should be written in indelible ink, or printed. Labels should always be placed inside the containers with the specimens, never stuck on the outside (where they may eventually become detached and lost).

For the wet collection, labels should be written in indelible ink on waterproof paper, and left to dry thoroughly before immersion in ethanol inside the container. Photocopied labels are unsuitable for wet material, since the printing becomes detached from the paper. If waterproof labels are not available, Dymotape labels are useful for registration numbers inside the containers.

4.4 Registration system

When establishing a scientific collection, it is strongly recommended that a registration system is initiated at the outset. Each sample (otherwise known as a 'lot') should be given a unique registration number, and all the information on the label should be duplicated in a separate registration book, or in a computer database. For both wet and dry samples, this number should be written both on the label and on a separate small slip of paper enclosed within the container (if the original label becomes lost or damaged, this allows the information to be retrieved). In addition, it may be possible to inscribe larger dry shells individually with their registration numbers, using black ink. Do not rely only on an electronic database; a printed or hand-written copy should also be kept for additional security. Museums employ a variety of different numbering systems, for example starting each year with the date followed by a 4-figure field, e.g. registration numbers for 1999 run from 19990001 to 19999999 (this has the advantage of adding the information of the year in which the material reached the museum); it is also possible to simply start at number 1 and number sequentially (which will show the total number of lots in the collection). Complex numbering systems according to species identification or geographical locality are not recommended.

There are many advantages of a registration system: lost data can be retrieved; individual specimens or lots can be referred to (or figured) in publications and then easily retrieved by future workers; in large museums that operate a system of specimen loans, the registration number allows curators to monitor the destination and condition of each sample; in a computer database it is of course essential that each sample has a unique identifier (the species name may be changed according to revisions of taxonomy).

4.5 Arrangement of collection

This will depend largely upon considerations of space and economics. However, within these constraints some recommendations can be made. In almost all cases the collection should be arranged in standard systematic order of families (this order changes somewhat from time to time according to ideas about evolutionary relationships of the major groups, but if an up to date listing of molluscan families is followed (e.g. Vaught, 1989; Rosenberg, 1992) this arrangement can be adopted for convenience. Within families, an alphabetical arrangement of genera and species is usually suitable, with space at the end for unidentified members of each genus and family. Remember to leave sufficient space for future expansion of the collection. A single systematic sequence for all the material in the collection is not usually practicable. For example, wet material has special storage requirements, and is therefore stored separately from the dry collection. Type specimens are of particular scientific value, and for security reasons are sometimes stored separately in locked cabinets. Very large specimens may be too big to fit in the available cabinet drawers. In these cases, it is

strongly suggested that the general dry collection should act as a quick visual catalogue of the entire collection, by including in it empty boxes in their correct systematic position with labels indicating that large, wet or type specimens are stored elsewhere.

5. References

Carter, D. & Walker, A. K. (1999) Care and Conservation of Natural History Collections. 226 pp. Butterworth Heinemann, Oxford.

Lincoln, R. J. & Sheals, J. G. (1979) Invertebrate Animals: Collection and Preservation. British Museum (Natural History), London.

Rosenberg, G. (1992) The Encyclopaedia of Seashells. 224 pp. Dorset Press, New York.

Stansfield, G., Mathias, J. & Reid, G. (eds) (1994) Manual of Natural History Curatorship. 306 pp. London: HMSO.

Vaught, K. C. (1989) A Classification of the Living Mollusca. American Malacologists Inc., Melbourne, Florida.

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The Conservation of Molluscan Collections

All Collections are open to the 'Nine Agents of Decay' (cited in MGC 1998). These have been defined by the Canadian Conservation Institute (CCI) as:

1: Direct Physical Forces e.g. dropping; wearing away.

2: Security e.g. risk of theft; vandalism; displacement through poor collection management.

3: Fire

4: Water e.g. flood; leaking building; fire suppression.

5: Pests e.g. insects; vermin; moulds; microbes; children!

6: Contaminants e.g. atmospheric pollutants; liquids; solids.

7: Light especially visible and UV.

8: Temperature

9: Relative Humidity

Ideally the Collection Environment will protect the specimens from these agents of decay. The environment can be usefully divided into two main compartments;

- The Storage area; the macro-environment.
- The Storage Units housing the collection; the micro-environment.

Mollusc Collections tend to fall into two broad categories. Either dry shell collections or fluid preserved 'wet' collections. Parts of the same specimen can be in both collection types. This is where the shell has been separated from the soft animal parts. It is also possible to dry the whole animal, rehydrating the soft body parts with Decon 90 if required, a practise used at the Natural History Museum.

Dry Collections

Dry Mollusc Collections can have a number of characteristic conservation problems such as Bynes Disease (a white crystalline growth on the surface of the shell), Cracking and Exfoliation. These problems can have a variety of causes, such as;

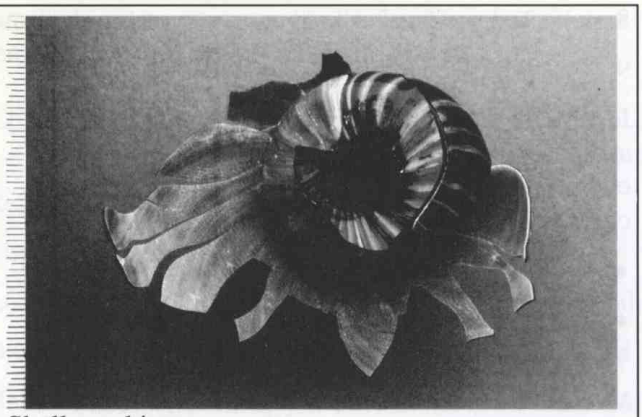
- Original preparation of the specimen.
- Subsequent remedial work.
- Neglect, poor custodial care.
- Environmental conditions; such as incorrect and/or fluctuating humidity and temperature; light – both visible and UV; Pollutants.
- Incorrect storage problems e.g. off-gassing from woods, MDF; decay of storage plastics; plasticisers in plastic clip bags migrating out and degrading.

Looking at some of the more specific problems associated with dry shell collections;

Bynes Disease (Tennant and Baird 1985; Von Endt et al 1996). Not a disease but a chemical reaction causing degradation of the shell;

- Characterised by a white or grey, water soluble crystalline efflorescence on the surface of the shell, which is usually a mix of calcium formate and calcium acetate.
- Affects mainly marine shells, but can be a problem in land shells (where its occurrence probably relates to the method of preparation).
- Caused by formic acid and acetic acid, off-gassing from storage furniture. The presence of hygroscopic salt residues in the shell is also considered to be contributory factor.

Shell cracking (Child and Buttler 1996)



Shell cracking

- Shells of some mollusca, mainly terrestrial and freshwater, have a tendency to crack and fragment in storage.

- Related to the physical and chemical shell structure. At its simplest level this consists of two main layers, the Periostracum (outer protein layer of conchiolin) and the inner mineral layer which is calcium carbonate based minerals such as calcite and aragonite. These two materials respond differently to changing temperatures and humidity

- Caused by a rapid drops in relative humidity which the elasticity of the shell cannot accommodate.

- Remember also that mechanical damage can occur from poor storage or handling.

Exfoliation; this is where the outer protein layer peels away from the mineral layer. Caused by low humidity levels from poor preparation or storage conditions (Child and Buttler 1996).

How do you reduce collection conservation problems?

Specimen Preparation; Ensure that the method of preparation is appropriate, and record any the processes and chemicals used with the specimen. Examples would be;

♦ Wash marine material in clean water to remove hygroscopic salts, and dry carefully.

♦ Avoid acids or alkalis, these will damage the protein layer of the shell.

♦ The use of ovens in drying is probably not a very good idea.....

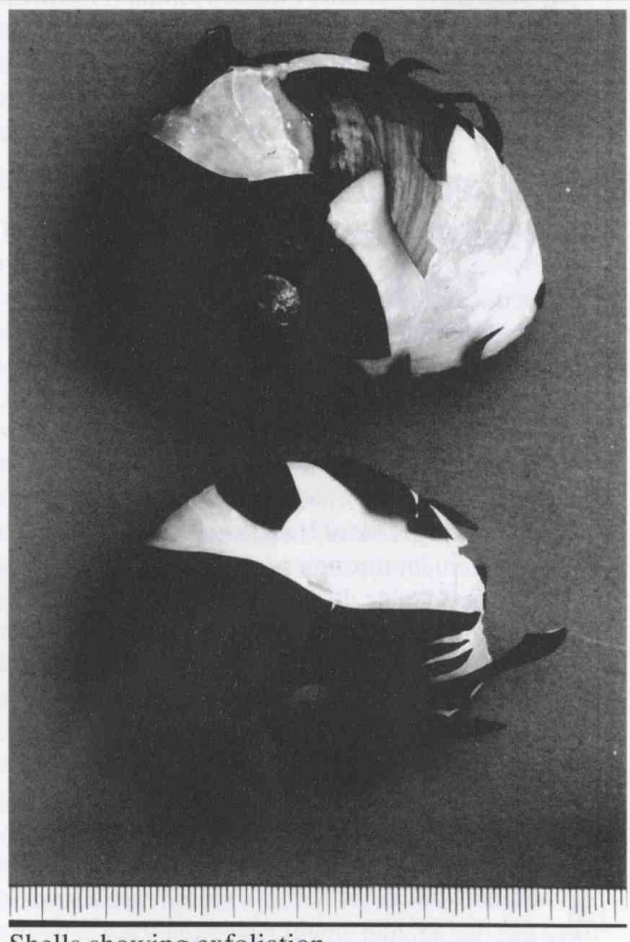
Control the Collection Environment; The macro-environment is usually the most difficult to control, requiring air conditioning systems, building work and lots of money! However on a smaller scale much practical work can be done e.g. draft sealing doors and windows; UV filters on lights and windows; pest monitoring controls. The micro-environment is more easy to control. Good storage will buffer humidity and temperature fluctuations; keep light and insects out; and secure valuable specimens.

Micro Climates and Anoxic Atmospheres. Specimens can be further protected at the storage level by the use of microclimates where the humidity is controlled through the use of conditioned silica gel (Buttler 1994). This can be further developed on by the use of anoxic atmospheres in which most of the oxygen is removed, preventing most chemical degradation reactions, as well providing a useful method of pest control (Burke, 1996).

Good collection environment should eradicate most of the potential conservation problems e.g. good storage furniture that does not off gas will prevent the occurrence of Byne's disease, and the prevention of sudden humidity drops should prevent cracking and exfoliation. Remember to take care when selecting new storage furniture and specimen housing materials. It is possible to assess the suitability of materials for display and storage. (e.g. see Lee and Thicket 1996).

However what if a specimen is decaying and needs conservation work?

♦ Bynes disease – brush off the surface salts. These are also water soluble and can be washed off, and some workers recommend washing the shell to remove hygroscopic salts. Subsequent care must be exhibited when drying the shell. Protective coatings should be only be considered as a last measure.



Shells showing exfoliation

♦ Cracking and exfoliation – broken pieces can be re-adhered if required. It is better to recommend using a weaker reversible consolidate such as Paraloid B72, rather than stronger glues such as epoxy resins. Badly exfoliating specimens can be protected with consolidates such as Paraloid B72 or Primal WS, although be aware these will alter the biochemistry of the specimen. It is not wise use materials such as Varnishes; Petroleum jellies; Linseed oil; Savlon.

Whilst these have been used with some success, these are variable compounds and alter the biochemistry of the material being treated. Think about a treatment before applying, and RECORD all treatments.

Fluid Preserved Collections

Important for the preservation of soft bodied molluscs, e.g. cephalopods, or the bodies of shelled specimens. The main methods used can be summarised as follows;

- Ethanol based preservation — flammability; high evaporation rate; tissue shrinkage. Addition of glycerol or propylene glycol can improve specimen flexibility and protect from evaporation.

- Formaldehyde preservation — needs to be buffered as acidity will dissolve shells if present; possible carcinogen; unpleasant to work with; aqueous based so less tissue shrinkage.

- Glycerol — used to protect shells prone to cracking etc. Messy to work with and difficult to remove.

For more information on fluid preservation the following references are of use – Horie 1989; Simmons 1995; Carter 1998; Moore 1999.

The container used to store a specimen, and the fluid preservative surrounding the specimen, constitute a micro-environment. Upon this will be the wider effects of the macro-environment – light; temperature; pollutants; handling. Key collection problems are a result of these external environmental interactions (e.g. see Horie 1994; van Dam 1997). These can cause problems such as fluid loss, loosening lids, warping of plastic storage jars and accelerated chemical degradation. Some key affects are:

- Temperature. Fluctuations in temperature can cause internal pressure changes in sealed jars. This can ultimately loosen the lid weakening the seal and allowing evaporation of the fluid.

- Relative humidity. Alcohol tends to evaporate from solutions faster than water causing a dilution of the fluid, although the lower the humidity the less this effect.

- Light and UV. Light damage is cumulative, and net exposure will determine the level of photochemical damage.

- Pollutants. Usually dust and grime although leaky jars will add to air pollution problems for workers in collection areas.

- Mechanical Stress. Brought about from environmental fluctuations, vibrations and poor handling.

- Oxygen. A well sealed container will act as an oxygen barrier. However if the seal is compromised oxidative degradation can occur.

The result is that fluid collections tend to require constant maintenance and monitoring to ensure the integrity of specimens. Some of the key requirements in maintaining and conserving fluid collections are;

- Identifying the preservative used, and monitoring the concentration levels. This is best done through monitoring density levels (see Moore 1994; Carter 1994; Simmons 1995).

- Topping up fluid levels and / or changing the preservative used. Care must be taken when deciding to change the preservative as the specimen and the fluid will have reached a chemical equilibrium . Changing the fluid will alter this equilibrium. The decision to change the fluid will be down to unsuitable preservative type or strength, or degradation of the specimen (usually indicated by condition of the specimen and unsuitable pH).

- Removal of deteriorated / dried out specimens for subsequent conservation work. Ensure that any work is correctly documented and that any labelling is stable in the fluid environment. (Pitkin 1995; Carter 1996).

- RECORD all treatments carried out on a specimen – you may know what you have done, but others in the future will not!

References

Burke, J. 1996. Anoxic environments: a simple guide. SPNHC leaflets 1: 1.

Buttler, C. 1994. Packaging. In Conservation of Geological Collections, ed. R.E. Child. Archetype Publications, London, p60-65.

Carter, J.D. 1994. Use of the DMA35 digital density meter. Conservation News 54: 39.

Carter, J.D. 1996. A comparison of two papers and two inks for use as computer generated labels in fluid preserved collections. The Biology Curator 7; 5-7.

Carter, J.D. 1998. Conserving invertebrate animal collections. SSCR Journal. 9(3): 9-13.

Child. R.E. and Buttler. C. 1996. Cracking Molluscan Shells. ICOM Natural History Conservation 10: 8-10.

van Dam, A.J. 1997. Conservation of fluid preserved specimens: the physical interaction between the

preservative fluid, the jar, and the sealant. ICOM Natural History Conservation 11: 12-14.

Horie, C.V. 1989. Conservation of Natural History Specimens: Spirit Collections. University of Manchester Department of Environmental Biology and The Manchester Museum.

Horie, C.V. 1994. Environmental control for spirit specimens. Biology Curators Group Newsletter 6(4): 43-44.

Lee, L.R. and Thickett, D. 1996. Selection of materials for the storage and display of museum objects. British Museum Occasional Paper 111.

MGC. 1998. Ours for keeps – A guide to conservation and collection care.

Moore, S.J. 1989. Conservation of spirit collections. In C.V. Horie (ed) Conservation of Natural History Specimens: Spirit Collections. University of Manchester Department of Environmental Biology, and The Manchester Museum, p 65-90.

Moore, S.J. 1994. What fluid is in the bottle ? Biology Curators Group Newsletter 6(4): 44-45.

Moore, S.J. 1999. Fluid Preservation. In D. Carter and K.W. Annette (eds) Care and Conservation of Natural History Collections. Butterworth Heinemann, p92-132.

Pitkin, B. 1995. Labelling specimens in the life science departments at the natural history museum, London using computers. The Biology Curator, 4: 24-26.

Simmons, J. E. 1995. Storage in fluid preservatives. In C. Rose, C.A. Hawks and H.H. Genoways (eds) Storage of Natural History Collections: A Preventative Conservation Approach, p 161-186.

Tennant, N.H. and Baird, T. 1985. The deterioration of mollusca collections: identification of shell efflorescence. Studies in Conservation 30: 73-85.

Von Endt, D.W., Harasewych, M.G. and Post. J. 1996. Byne's disease revisited. Society for the Preservation of Natural History Collections Annual 11th Meeting Abstracts, p19.

Julian Carter

Conservation Officer, Department of Biodiversity and Systematic Biology, National Museum and Gallery of Wales, Cathays Park, Cardiff, CF1 3NP

"MOLLUSCA FOR THE MILLENNIUM"

LEEDS MUSEUM RESOURCE CENTRE MOLLUSCAN STORAGE AND DOCUMENTATION PROJECT.

The Leeds Museums and Galleries "Mollusca for the Millennium" project is funded by the Designation Challenge Fund, formally administered by the Museums and Galleries Commission M.G.C. now the Museum Libraries and Archives Council. This three-year project is designed to enable the service to develop the city's extensive world-wide shell collections.

The funding will enable us to:

- Install new roller racking to hold the shell collections
- Store the collection in scientific order
- Install a new networked computer system
- Upgrade the documentation of the collections from the present manual system
- Research and publish a series of papers on the collections, including

A catalogue of the type and figured material held in the collection

A register of the collection, range and content, by family, (or maybe even species).

- Help pay for extra staffing within the natural history department
- Help with travel and subsistence expenses
- Help research, develop and produce one or more exhibitions on mollusca

All of the above will help us to develop new, innovative methods, as well as alternative ways of using and displaying the shell collections in any future new museum development within the city.

MOLLUSCAN COLLECTIONS - LEEDS MUSEUM RESOURCE CENTRE

The Leeds Museums and Galleries hold a large number of shell collections, some of which are very well known and others not so well known. It is difficult to separate the more important collections as even the less well known collections have important material within them. Two major collections however, contain large numbers of type, figured and cited material. These are the collections of Sylvanus Charles Thorp Hanley (1819-1899) and Terence Eldon Crowley (1915-1999).

The collection of Sylvanus Charles Thorp Hanley, was originally housed in some 13 cabinets and over

Original painting by A.G.Stubbs of Viviparus viviparus (Linnaeus, 1758) from the River Lea, Rye House, Hertfordshire collected by A.G.Stubbs in 1908

206 drawers, and was transferred to Leeds, from the Tolson Memorial Museum, Huddersfield in 1957. After Hanley's death in 1899 the collection went to his nephew Crew Hanley who sold the collection to H Harvey a dealer. The collection was later sold at auction to Mr.J.C.North who gave the collection to the Tolson Museum. The Hanley collection contains several hundred type, figured and cited specimens, and as such is considered to be of international importance.

The collection of Terence Eldon Crowley came to the museum in two parts. The tropical marine in 1993, followed by the tropical land and freshwater elements, after his death in 1999. He listed 94 paratypes as occurring in his collection, but did not list all the other type specimens or the cited material. The author of a number of monographs, his collection contains a good quantity of other important material.

Over the years an inter-disciplinary approach to collecting, within the natural sciences department at Leeds, has resulted in material being held within the department, which in other museums may be split through several differing departments. For example, within the molluscan collections we have original paintings, photographs, manuscript documents, books, medals and social history material. This has left us with a rich and varied resource with which we can illustrate the work of the department.

The main shell collections housed at Leeds

Alien, Charles, Acc.No.LEEEDM.C.1968.4 Contents - mainly Yorkshire land and Freshwater material.

Appleyard, S.G., Acc.No.LEEDM.C.1969.7

This collection includes several boxes of shells from the old Leeds Co-operative Naturalists' Society collection. This includes material collected by Hans Schiess. Contents - British & Continental L.& F.W.

Armitage, John, (1900-1996) Obit. J.Conch. 36:86-87. Acc.No. LEEDC.C.1993.1 (1997)

This large collection was purchased with the aid of a Science Museum grant. The collection contains material by most of the main collectors of the 20'h century, mainly British and continental L.& F.W.

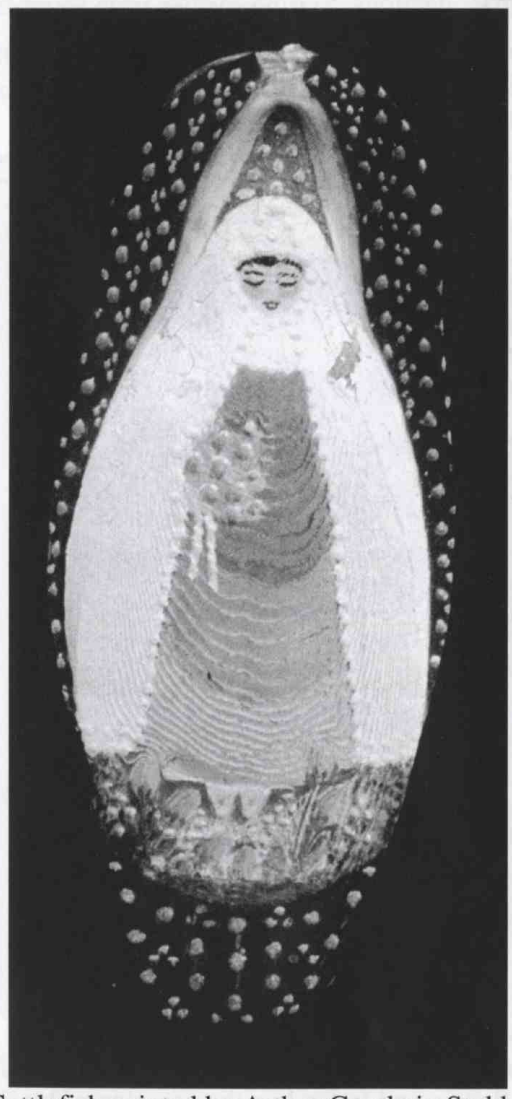
Ashford, Charles, (1829-1894) Obit. J.Conch. 7:405. Acc.No. LEEDM.C.1975.9

An early British collection, mainly L.& F.W. Within the main collection is an early collection of darts. His collection of Pisidia was re-identified by S.Peter Dance.

Atkinson Memorial Collection, Acc.No.LEEDM.C.1975.10

The Atkinson Memorial Collection is in memory of Francis E., Edward and Victor Rupert Atkinson. Tropical L. & F.W.

Aubrook, Edward Wrigley, (1915-1990) Obit. The Naturalist 116:36-37



Cuttlefish painted by Arthur Goodwin Stubbs

A collection of land, freshwater and marine species from New Zealand collected as a result of several trips to that country. This collection has a series of accession numbers.

Baynes, Una M., Acc.No.LEEDM.C.1991.4 Mainly South African marine.

Brooksbank, Hugh, Acc.No.LEEDM.C.1954.61 Presented by D.Osborne via Bradford Museums, British L. & F.W.

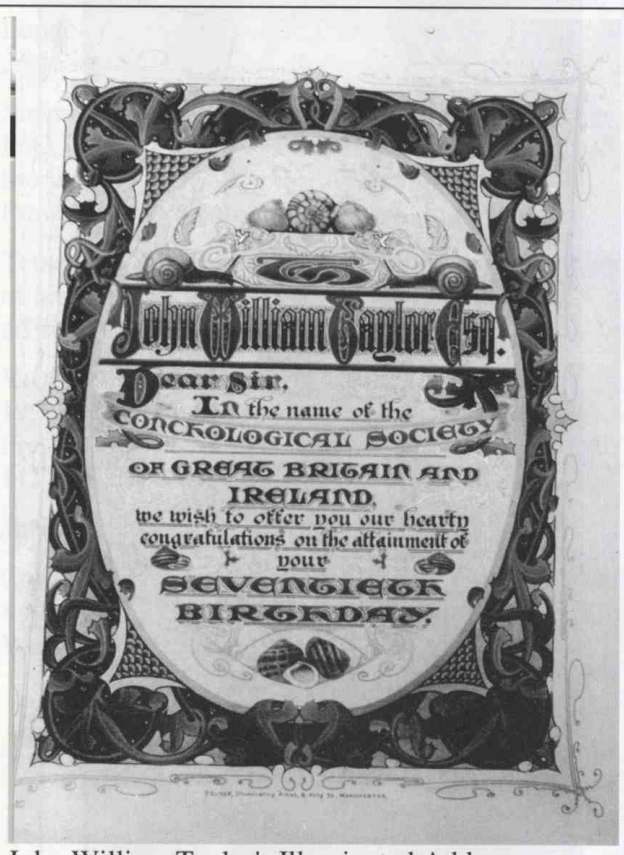
Castell, C.P., (1907-1972) Obit. J.Conch. 27.520. Acc.No.LEEDM.C.1975.4 Mixed British & Tropical.

Crowley, Terence Eldon, (1915-1999) Acc. No. LEEDM. C. 1993.5 World-wide collection of land, freshwater and marine mollusca. Contains numbers of type, figured and cited specimens. This collection includes large numbers of specimens origination from other major collections, such as A.E.Salisbury, C.J.Maynard and Da C(:)sta.

Davis, J.W., (1846-1893) Acc.No.LEEDM.C.1990.1 L. & F.W. & Marine World- Wide, (ex Halifax Museum).

Frazer, C., Acc.No.LEEDM.C.1990.1 Ex Halifax Museum Collections. Marine species from Fiji

Hanley, Sylvanus Charles Thorp, (1819-1899)Obit. J.Conch. 9:269 Acc.No.LEEDM.C.1957.173 Mainly tropical marine bivalves and North American Freshwater Unionid's. This collection contains type material forwarded to Hanley by most of the leading 19th century conchologists.



John William Taylor's Illuminated Address presented to him by the Conchological Society of Great Britain and Ireland on the occasion of his 70" birthday in 1915.

Silver Grenfell Medal inscribed "to A.G.Stubbs for Drawings of Flowers R.H.S. 12 Jan. 1932".

Maddrell, Mariefta, Acc.No.LEEDM.C.1972.5 and 1973.1 British Marine.

Moore, C.H., Obit. J. Conch. 23.85. (1869-1949), Acc. No. LEEDM. C. 1 949.2 Tropical L & F.W. & Marine. Originally estimated at circa 20,000 specimens.

Nelson, William, (1835-1906) Obit. Naturalist 1906XX:1 159, J.Conch. 11:357. Acc.No.LEEDM.C.1960.99 Transferred to the museum from Leeds University. British L. & F.W.

Norris, Adrian, (1942-) World-wide but mainly European L. & F.W. some marine, Numerous accession numbers. Includes type material.

Purdy, J., Acc.No.LEEDM.C.1972.3 British Pisidia, 126 sets.

Seville, Jack & Vi, Acc.No.LEEDM.C.1990.1 ex Halifax Museum. Mainly American Marine species.

Stratton, L.W., (1900-1971) Obit.J.Conch.27.427. Acc.No.LEEDM.C.1971.2 Purchased jointly with Manchester University, Leeds took mainly the British marine and some L.& F:.W. and the tropical collection, including American Unionid's (The New Zealand and most of the British L. & F.W. went to Manchester).

Stubbs, Arther Goodwin, (1871-1950) Obit. J. Conch.23:120 Acc.No.LEEDM.C.1925.2 British and some continental L. & F.W.

Taylor, Fred, (1871-1949), Obit. J.Conch.23.86. Acc.No.LEEDM.C.1975.16 and 1984.1 8 British L. & F.VJ.

Taylor, George H., Acc.No.LEEDM.C.1988.1 British L. & F.W. 544 sets.

Temple, William, (1989-1960), Acc.No.LEEDM.C.1977.1 British L. & F.W. 24 boxes;

Thurgood, William, Acc.No.LEEDM.C.1993.1, British and continental L. & F.W., Donor Mr.S.G.Appleyard.

Anon Acc.No.LEEDM.C.1981.6, ex Huddersfield Naturalists'Club. Tropical L & F.W. c. 1,500 sets.

Anon Ac.No.LEEDM.C.1982.366, Marine Red Sea & North American via Prof Alexander, Leeds University.

Further reading on the Leeds City Museum Natural History Collections

Nunney, J.H., & Norris, A., 1978, A Note on the Natural History Collections, Leeds City Museum Biological Curators Group Newsletter 1 : 6-1 0

Norris, A., 1989, Natural History, pp.47-52. chapter within Brears, P., 1989, Of Curiosities & Rare Things, The Story of Leeds City Museums, published by The Friends of Leeds City Museum.

Norris, A., 1993, Leeds City Museum - its Natural History Collections. (Part 1). Joumal of Biological Curation 1:(314) 1991-92 : 29-39.

Norris, A., 1993, Shell Collections in Yorkshire Museums - No. 1. The Leeds City Museum Collections - Section 1. British and European Land and Freshwater Molluscan Collections. Bulletin, Y.N.U. 20:27-29

Norris, A., 1995, Shell Collections in Yorkshire Museums - Part 2. The Leeds City Museum and its Shell Collections. 2. Section 2. The British Marine and Tropical Collections. Bulletin Y.N.U. 23:17-19.

Norris, A., 1995, Leeds City Museum - its Natural History Collections Part 2. The Biology Curator 4:1 9-24.

Adrian Norris
Senior Curator, Natural Sciences and Ethnography
Leeds Museums Service

A Method of Rehydrating Specimens

1. Prepare a solution of Decon 90 detergent and water in approximate concentration 1:20; exact proportions are not necessary to obtain good results. (The phosphates in the detergent penetrate the cells allowing water to osmose into them)

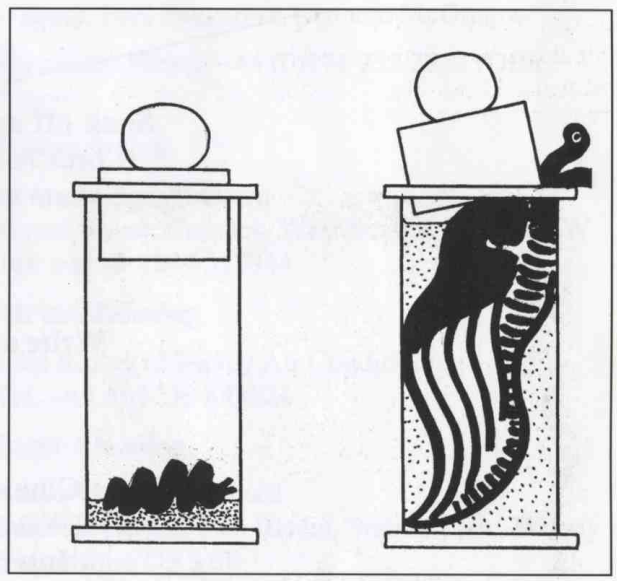
2. Add the solution to the dried out material. Make sure no labels are affected. (The solution causes serious damage to paper and script)

3. Leave for an average of 3 days but check daily to ascertain if the solution needs to be changed or renewed. (Rinse material thoroughly in running, cold water before re-immersing.)

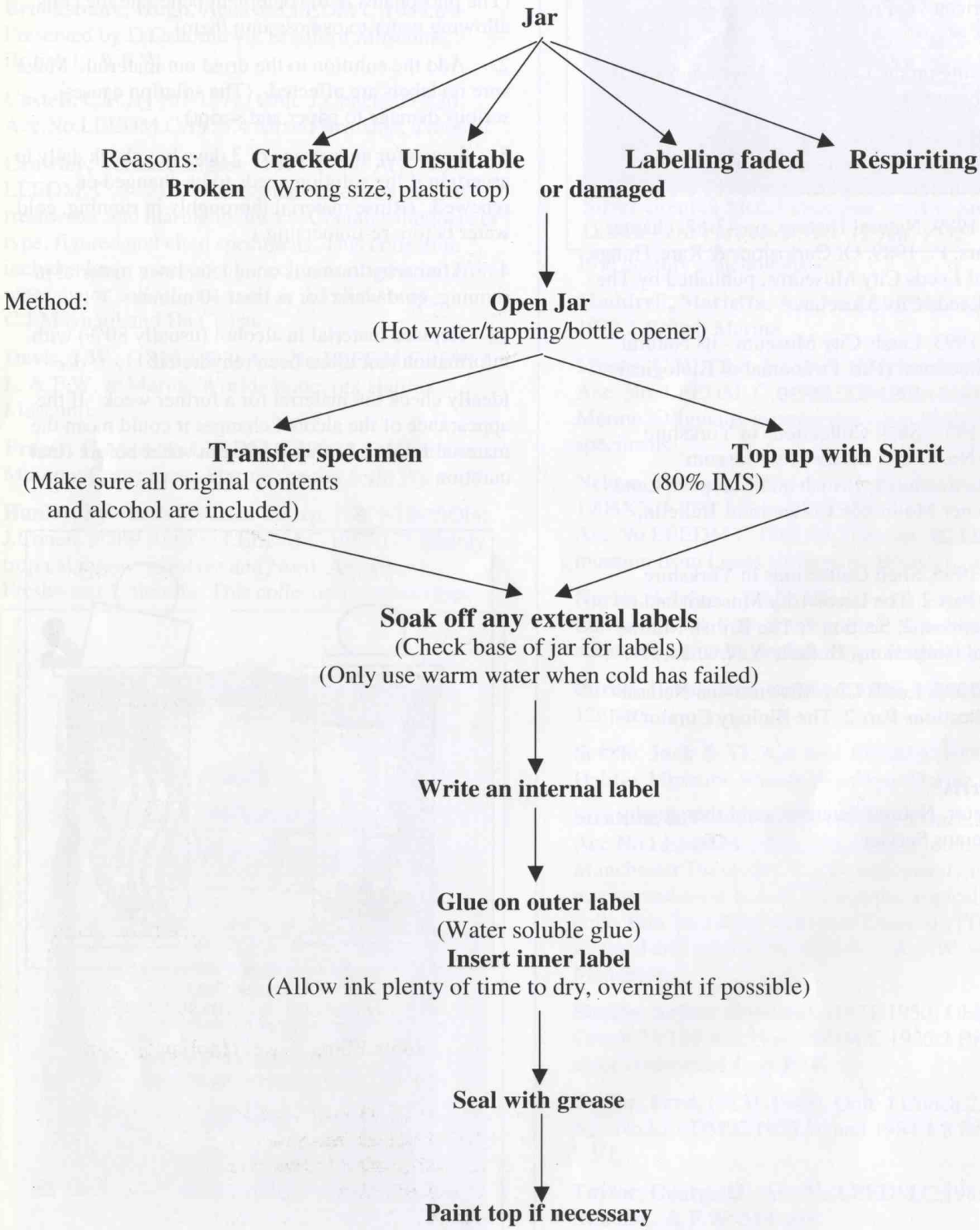
4. After rehydration is complete, rinse material in running, cold water for at least 10 minutes.

5. Replace material in alcohol (usually 80%) with information that it has been rehydrated.

Ideally check the material for a further week. If the appearance of the alcohol changes it could mean the material needs a further rinsing in water before final curation



Wet Curation Procedures



LIST OF SUPPLIERS USED BY THE INVERTEBRATES I DIVISION DEPARTMENT OF ZOOLOGY THE NATURAL HISTORY MUSEUM

Compiled by
Mary Spencer Jones & Clare Valentine
Invertebrates 1
Department of Zoology
The Natural History Museum, London
(Last updated January 2000).

DISASTER PLANNING & CONSERVATION

Freezer facilities & transport

Christian Salvesen Tel: +44 (0)1604 737 100 (24 hours)

FrigoscandiaTel: +44 (0)181 534 5577

Ryder Truck Rental Tel: +44 (0)181 692 2360 (Greenwich)
+44 (0)800 100200

Exclusive Removals Limited.
Contact: George Orchard (Manager), Industrial Moving Division, Docklands House, Leamouth Wharf, 58 Orchard Place, London E14 0JW.
Tel: +44 (0)171 538 0641 Fax: +44 (0)171 538 8225

Cold Stores

Exel Logistics, part of National Freight Corp.
Tel: +44 (0)1234 272222 (Head Office, Morton)+44 (0)1634 373641 (Gillingham, Kent store)
+44 (0)1733 232 854 (Peterborough store)

Drying

Drying Restoration Service
Building 404, Harwell Laboratory
Tel: 01235 434373

Tents

Instant Pop-Up Shelters
103, Hillingdon Hill, Hillingdon Village, Middlesex UB10 0JQ
Tel: +44 (0)1895 813383 Fax: +44 (0)1895 238888

Drying Service

Thermo Lignum UK Ltd.
Tel: +44 (0)181 964 3964 Fax: +44 (0)181 964 2969
19 The Grand Union Centre, West Row, Ladbroke Grove, London W10 5AS

De-humidification

Munters Moisture Control services
Tel: +44 (0)181 759 3161 (London Office) +44 (0)1480 432243 (Head Office)
+44 (0)1223 413787 (24 hour emergency answering service.)

Disaster control and recovery

Imbach RAG Ltd
Tel: +44 (0)181 665 1459 (Croydon Office); +44 (0)1827 310 100 (24 hours)

Data and Archival Damage Control Centre(DADCC)
Tel: +44 (0)171 837 8215Fax: +44 (0)171 278 0221
4 Bridge Wharf, 156 Caledonian Road, London N1 9UU

Crates

Greenwood U.K.
Contact: Alan May
Tel: +44 (0)181 656 6440 (Office hours) Mobile: +44 (0)1860 590212
Greenwood Business Centre, 28 Amberley Grove, Croydon, Surrey, CR0 6ND

Teacrate
54 Wood Lane, London, W12 7RJ
Tel: 0181 740 0400Mobile: 0589 043 736Fax: +44 (0)181 740 4586
Contact: Peel Taggart or Kenneth McGregor

Rentacrate Phone: +44 (0)171 232 2232 (Office hours)

Freeze drying

Edwards High Vacuum
Manor Royal, Crawley, West Sussex, RH1O 2LW
Tel: +44 (0)1293 528844

Air conditioning

John Ripley of Ripley Air Conditioning
Tel: +44 (0)1732 883824

Laser Cleaning

Abbey Heritage Limited
Dartford House, Two Rivers, Station Lane, Witney Oxfordshire OX8 6B
Contact: Stephen Perriss (Managing Director)
Tel: 01993 709699 Fax: +44 (0)1993 7090995

Photographic Filing System (polypropylene wallets)

Nicholas Hunter Ltd., Unit 8, Oxford Business Centre, Osney Lane, Oxford OX1 1TB
Tel: +44 (0)865 727292
Fax: +44 (0)865 200051

Tyvek

Preservation Equipment Ltd.

Conservation & Curation Advice

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Tel: +44 (0)1584 873857 Fax: +44 (0)1584 872019

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The Conservation Centre
Merseyside Museums, Whitechapel, Liverpool, L1 6HZ
Tel: +44 (0)151 478 Fax: +44 (0)151 478 4990

The Conservation Unit Museums & Galleries Commission
16 Queen Anne's Gate, London, SW1H 9AA
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Tel: +44 (0)1223 333456 Fax: +44 (0)1233 333450

Guild of Taxidermists, Duncan Ferguson (Membership Secretary)
Art Gallery and Museum, Kelvingrove, Glasgow G3 8AG
Tel: +44 (0)141 287 2671 Fax: +44 (0)141 287 2690

William Lindsay
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Simon Moore
Hampshire County Museums, Chilcomb House, Chilcomb Lane, Winchester SO23 8RD
Tel: +44 (0)1962 846337 Fax: +44 (0)1962 869836

Natural Sciences Conservation Group
Bob Entwhistle (Chair)
Ipswich Borough Council Museum, High Street, Suffolk IP1 3QH
Tel: +44 (0)1473 213761/2

S.E. Area Museums Service
Ferroners House, Barbican, London, EC2Y 8AA
Tel: +44 (0)171 600 0219Fax: +44 (0)171 600 2581

ENVIRONMENTAL MONITORING & PEST CONTROL

Humidity Indicator Cards

Preservation Equipment Ltd. (UK branch of University Products Inc.)
Shelfanger, Diss, Norfolk IP22 2DG
Tel: +44 (0)379 651527 Fax: +44 (0)379 650582

"Empire 20 "

DowElanco Europe
Buropolis, 1240 Route des Dolines, B.P. 199, Sophia-Antipolis, 06561 Valbonne Cédex, France
Tel: +33 93 95 6000
(Contact for nearest local supplier)

Sticky traps for insect monitoring

Agrisense - BCS Ltd. [Contact for nearest local supplier]
Treforest Industrial Estate, Pontypridd, Mid Glamorgan CF37 5SU
Tel: +44 (0)443 841155 Fax: +44 (0)443 841152

"Constrain"

Historyonics
17 Talbot Street, Pontcanna, Cardiff CF1 9BW

Thermohygrometers (portable) [Meaco HK100 with max./min. memory] [pre-delivery calibration £28.00]

Meaco, Unit 8, Smithbrook Kilns, Cranleigh, Surrey, GU6 8JJ
Tel: +44 (0)1483 267433 Fax: +44 (0)1483 267422

Dataloggers

Meaco, Unit 8, Smithbrook Kilns, Cranleigh, Surrey, GU6 8JJ
Tel: +44 (0)1483 267433 Fax: +44 (0)1483 267422

MATERIALS FOR SPIRIT COLLECTIONS

CHEMICALS

Alcohol

Hayman Ltd [good for orders of various sizes of drum]
Eastways Park, Witham, Essex CM8 3YE
Tel: +44 (0)1376 517 517Fax: +44 (0)1376 510 709

Alcohols Ltd [good for bulk deliveries]
Charringtons House, The Causeway, Bishops Stortford, Herts CM23 2EW
Tel: +44 (0)1279 658 464 Fax: +44 (0)1279 757 613

Formalin

Merck Ltd.
Customer Service Centre, Magna Park, Lutterworth, Leicestershire LE17 4XN
Tel:+44 (0)800 223344Fax: +44 (0)1455 558586

Propylene phenoxetol

Nipa Laboratories Ltd
Nipa Industrial Estate, Llantwit Fardre, Nr. Pontypridd, Mid Glamorgan, CF38 2SN
Tel: +44 (0)1443 205 311

Glycerin

Merck Ltd.
Customer Service Centre, Magna Park, Lutterworth, Leicestershire LE17 4XN
Tel:+44 (0)800 223344Fax: +44 (0)1455 558586

General Chemicals

Merck Ltd
Hunter Boulevard, Magna Park, Lutterworth, Leics LE17 4XN
Tel: 0800 22 33 44Fax: 01455 55 85 86

Sigma-Aldritch
Fancy Road, Poole, Dorset BH12 4QH
Tel: +44 (0)800 717 181Fax: +44 (0)800 37 85 38

Waste disposal

Safety-Kleen UK,
390 London Road, Isleworth, Middlesex TW7 5AN
Tel: +44 (0)181 897 0963 Fax: +44 (0)181 564 7510

Glass jars

Stolzle-Oberglas AG,
Keisslergasse 26,A-1140 Wien, Austria
Tel: +43 1 41565-0 Fax: +43 1 41565-780

3 X 1 Universals [box contains 144 bottles]

Solmedia Ltd.,
6 The Parade, Colchester Road, Romford, Essex, RM3 0AQ
Tel: +44 (0)1708 343334

Acrylic jars

John Dunlop Osteological Supplies
12 Tideway, Littlehampton, West Sussex BN17 6QT
Tel: +44 (0)903 724983 Fax: +44 (0)903 713223

Paper for labels in alcohol

Preservation Equipment Ltd (UK branch of University Products Inc.)[Resistall]
Shelfanger, Diss, Norfolk IP22 2DG
Tel: +44 (0)379 651527 Fax: +44 (0)379 650582

Silicon adhesive"Silastic" 732 RTV

Merck Ltd.
Customer Service Centre, Magna Park, Lutterworth, Leicestershire LE17 4XN
Tel:+44 (0)800 223344Fax: +44 (0)1455 558586

Paraffin Soft White [grease for jars]

Merck Ltd.
Customer Service Centre, Magna Park, Lutterworth, Leicestershire LE17 4XN
Tel:+44 (0)800 223344Fax: +44 (0)1455 558586

Formalin labels [when ordering quote product code SBE]

Signs & Labels Ltd.
Douglas Bruce House, Corry Way, Bredbruy Industrial Park, Stockport, SK6 2RR

"Borax"(di-Sodium tetraborate 10-hydrate $Na_2B_4O_7.10H_2O$) Product number 30175 W (1kg.)
BDH Lab. Supplies, Poole BH15 1TD
Tel: +44 (0)1202 669700.

MATERIALS FOR DRY COLLECTIONS

Plastic boxes

The Stewart Company
Stewart House, Waddon Marsh Way, Purley Way, Croydon CR9 4HS
Tel: +44 (0)181 686 2231 Fax: +44 (0)181 686 3857

Henleys Medical Supplies Ltd
Brownfields, Welwyn Garden City, Herts. AL7 1AN
Tel: +44 (0)1707 333164 Fax: +44 (0)1707 334795

Daco Marketing Ltd
7 Christchurch Road, Folkestone, Kent CT20 2SJ
Tel: +44 (0)1303 226137 Fax: +44 (0)1303 226092

Acid-free Card boxes

The London Fancy Box Company Ltd.
Castle Division, Beaconsfield Road, Dover CT16 2LR
Tel: +44 (0)1304 201598 Fax: +44 (0)1304 213570

Terry Andrews t/a
"The Bag 'n' Box Man"
Unit 1, West Street, Shutford, Banbury, Oxon OX15 6PH

Acid-free Tissue paper

Preservation Equipment Ltd (UK branch of University Products Inc.)
Shelfanger, Diss, Norfolk IP22 2DG
Tel: +44 (0)379 651527 Fax: +44 (0)379 650582

Gelatin Capsules

Agar Scientific Ltd
66a Cambridge Road, Stansted, Essex CM24 8DA
Tel: +44 (0)1279 813519 Fax: +44 (0)1279 815106

Paper & Board pH Testing Pens

Preservation Equipment Ltd.

"Pigma" Pens (permanent pens used for dry specimens labels)

Preservation Equipment Ltd.

Rotring Pens

Rotring GmbH(main Headquarters)
P.O. Box 541060, D-22510 Hamburg, Germany
[Should be available from most good stationary shops]

Polymer Wool

Any Aquatic suppliers
Fish shops

Self seal poly bags [also lay flat tubing for packing]

Polybags Ltd
Lyon Way
Greenford, Middx. UB6 OAQ
Tel: +44 (0)181 575 8200
Fax: +44 (0)181 578 2247

Archival pockets

Secol Ltd
Howlett way, Thetford, Norfolk IP24 1HZ
Tel: +44 (0)1842 752341
Fax: +44 (0)1842 762159

Slide cabinets

Watkins & Doncaster
PO Box 5, Cranbrook, Kent TN18 5EZ
Tel: +44 (0)1580 753133 Fax: +44 (0)1580 754054

Books

Second-hand Book Shops

Aquila Natural History Books
Rechtstraat 72, NL-6221 Maastricht, The Netherlands
Tel: +31 43 325 1044

Dr W Backhuys
PO Box 321, 2300 AH Leiden, The Netherlands
Tel: +31 71 517 0208 Fax: +00 31 517 1856
E-mail: backhuys@euronet.nl

Little Holcombe Books
10 Lumb Carr Avenue, Ramsbottom, Bury,
Lancashire BL0 9QG
Tel: +44 (0)1706 825322
E-mail: littlehalcombebooks@btinternet.com

Pemberley Books
I..A. Johnson BSc. FRES
34 Melrose Close, Hayes, Middlesex UB4 0AZ
Tel: +44 181 561 5494

Savona Books
9 Wilton Road, Hornsea, East Yorkshire HU18 1QU
Tel: + 44 (0)1964 535195
Fax: +44 (0)1964 537346
E-mail: savonabooks@savonabooks.free-online.co.uk
Website: http//:www.savonabooks.free-online.co.uk

Current books

Natural History Book Service Book Net Searches
http://www.nhbs.co.uk
E-mail: nhbs@nhbs.co.uk
Tel: +44 (0)1803 865913
Fax: +44 (0)1803 865280

USEFUL CATALOGUES

Archetype Books (for Museum studies books)
31-34 Gordon Square, London WC1H 0PY
Tel: +44 (0)171 387 9651 Fax: +44 (0)171 388 0283

Atlantis European Ltd. (Archival Suppliers)
146 Brick Lane, London E1 6RU
Tel: +44 (0)171 377 8855Fax: +44 (0)171 377 8859

Conservation Resources (UK) Ltd.
Units 1, 2 & 4 Pony Road, Horspath Industrial Estate,
Cowley, Oxfordshire OX4 2RD
Tel: +44 (0)1865 747755 Fax: +44 (0)1865 747035
Email: 100436.3447@compuserve.com

Preservation Equipment Ltd. (UK branch of University Products Inc.)
Shelfanger, Diss, Norfolk IP22 2DG
Tel: +44 (0)1379 651527 Fax: +44 (0)1379 650582

Meaco
Unit 8, Smithbrook Kilns, Cranleigh, Surrey, GU6 8JJ
Tel: +44 (0)1483 267433 Fax: +44 (0)1483 267422

Collections Research

ARE LOW TEMPERATURE PEST DISINFESTATION PROCEDURES 'SAFE'?

At the September, 1999, meeting of the UK Systematics Forum Insect Collection Managers Group, George McGavin of the University Museum, Oxford, expressed misgivings regarding entomological drawers subjected to freeze-thaw cycles. This related particularly to deterioration of adhesives and changes in the fit of drawer lids. The Group also noted growing interest in the use of carbon dioxide fumigation as an alternative to freezing. As we in The Natural History Museum have come down firmly in favour of freezing as our preferred routine option for eradication of pests in our collections, such

reported problems caused us particular concern. In addition, while carbon dioxide fumigation is certainly a valuable tool in our armoury it does have clear disadvantages over low temperature eradication – the need for specialist equipment and operators, the three-week fumigation period, and health & safety implications come immediately to mind.

In an attempt to demonstrate justification for these misgivings, we subjected four different models of our standard insect accession drawers to seven successive freeze-thaw cycles. In accordance with established procedures the drawers were bagged in a standard 'black bin-liner' and then tightly sealed. The duration of each freeze phase varied between three and five days, with a minimum of one day at room temperature between each 'freeze'. This would mirror seven repeats of the usual freezing cycle – 3 days at minus 30C, then 24 hours at room temperature before the integrity of the seal is broken. At the end of the exercise we could not detect any structural deterioration in our test drawers – the joints were still firm, the lids close-fitting and any linings were still securely attached.

The drawers that we tested were of various vintages and styles – the oldest was a cardboard 'French Style' moth carton; the others were all wooden – a hard wood drawer from the 1960s and its 1980s intake equivalent, and one of our current accession drawers as manufactured by Stephenson Blake & Co. , who kindly provided us with the specifications of the adhesive used in construction, Evo-Stik 9517™.This is a water-resistant polyvinyl acetate emulsion that includes amongst its features "freeze/thaw cycling does not break the emulsion". However, our discussions with the adhesive manufacturers suggested that this practice could not be repeated without the risk of damaging the bond.

While the potential for such problems might relate to special properties of adhesives, there are perhaps two other possible contributory factors. The Group's minutes also note that "poor control of freezing procedures could also result in mould growth if drawers are opened while still cold". Obviously, drawers should not be opened while still cold – there should not even be the opportunity to open them since they should be in containing plastic bags that ought to remain firmly sealed until the drawers have returned to room temperature!

During freezing, as air temperature drops, then the water-carrying capacity of air decreases and the relative humidity of the air increases. At, or below freezing point, air can no longer carry free water which is frozen out. When the temperature starts to rise back to ambient, the opposite changes occur. With a large volume of free air this could cause water loss and consequent physical changes in an object (which for an entomological collection would include the insect drawer). Damage can be further compounded by water in the air condensing on the outside of a cold object when it is removed from a freezer.

The objective of bagging then is to enclose an object in a minimal air space so that air soon reaches an equilibrium and any movement of water to or from an object is extremely small. Bagging also provides a physical barrier between any condensation and the object (in our case the insect drawer). Freezing of objects with a large buffering capacity such as animal skins or textiles is extremely safe as they will produce a very rapid equilibrium in a small bagged air space. Treatment of large, hollow non-absorbent objects needs more careful management, if possible by the use of extra buffering material such as acid-free paper or cotton wadding that would ensure that objects experience little change. Conventional insect drawers, either with a solid base or slatted, contain sufficient buffering capacity to allow for rapid equilibrium. However, specialised Lepidoptera drawers, glazed both top and bottom, might potentially present more difficulties. But whatever the material, following freezing, objects should never be removed from their bags until they have reached ambient room temperature.

The second point relates to characteristics of adhesives at low temperatures, particularly with respect to high vibration levels that could be experienced by an object held in a poorly maintained freezer. It seems quite likely that at the low temperatures routinely reached during disinfestation (minus 30C) significant vibration could have a detrimental effect upon adhesion, perhaps causing actual breakage of the bonding and significant damage to specimens themselves. Using a Tinytag Plus™ shock logger, we tested all three freezers currently used in Entomology for both vertical and horizontal components of vibration. In all cases movement was minimal – in some instances we could detect the cutting-in and out of the motor and also some shock when the freezer door was opened and closed. However, these readings, obtained by attaching the loggers to the outside 'skin' of the freezer with Velcro, might not represent the true vibration of the shelves inside (the loggers would not withstand freezing). If shelf vibration was indeed a concern it could be reduced by using low-temperature tolerant cushioning (say Plastozote) between the shelf and object.

Our re-assessment of freezing for disinfestation has not led to any changes in our own adopted standard protocols. But any institutions that have set in place a rolling programme of preventative freezing on say an annual basis should carefully monitor for deterioration in adhesives whether used as mountants or in the construction of either objects themselves or

collection containers. But even if low-temperature treatment is only employed 'reactively', it should be supported by accurate documentation so that future conservators can associate any deterioration of adhesives with previous actions.

In conclusion, it is perhaps useful to re-state the basic protocol that we use with respect to insect drawers. Upon finding an infestation it should be a matter of routine that all adjacent drawers are searched. For a cabinet-wide infestation, all drawers would need to be removed and the cabinet itself vacuum-cleaned and perhaps lightly sprayed with insecticide (Constrain, a permethrin-based microemulsion is ideal, particularly developed for the museum environment). Then:-

- Infested drawers should be isolated in tightly-fitting plastic bags that are securely sealed.
- Bagged drawers placed in freezer for 72 hours at minus 30 degrees centigrade.
- Bagged drawers removed from freezer and stored at room temperature for 24 hours before seal is broken.
- Only after thawing are drawers opened and necessary remedial work undertaken.
- Keep permanent record of all actions.
- Continue to monitor the area of infestation, both visually and by means of monitoring traps.

Suppliers: Tinytag Plus™ - Meaco, Unit 8, Smithbrook Gdns, Cranleigh, Surrey, UK.

Evo-Stick™ - Evode Ltd, Common Road, Stafford, UK.

Phil Ackery

Adrian Doyle

The Natural History Museum

David Pinniger

Independent Pest Control Consultant.

Books

BOOK REVIEW

"Identifying British Insects and Arachnids - An annotated bibliography of key works", edited by Peter C. Barnard, Cambridge University Press with the Natural History Museum, 1999, ISBN 0-521-63241-2, Hardback, price £50

This is a welcome addition to the field which has been dominated previously by the various editions of Kerrich, Hawksworth and Sims 'Key Works to the Fauna and Flora of the British Isles and North-western Europe. Operating over a narrower taxonomic range than its predecessors and with double the paper, the scope for discussion and annotation is dramatically increased.

The book has a pleasing appearance, is well bound and appears to be well proofed against the ravages of a wet workbench. The introduction sets out its purpose; to case the laborious process of getting to grips with the scattered works which are needed for the identification of any one group of British insects or arachnids. It is 'largely intended for the reader who is moving on from basic texts to more specialised ones'. Entomological journals, societies and general references are listed in this introduction.

There follows a useful chapter on 'Sources of Information' by Julie MV Harvey, enumerating the various ways in which references can be sought out and covering the full range from ink on parchment to web site. A section on understanding bibliographic references contains useful notes on sources of confusion and a guide to journal abbreviations. The pages dealing with entomological libraries are useful, although the shortest section deals with local museums thus - "Some local museums with natural history collections have developed small reference libraries, which may be available to the public" (Quoted in full). My own local museum library is used extensively by members of the public and I am sure that similar arrangements are offered by many of my BCG colleagues. Such a brief statement seems almost to dismiss the pivotal role played by local museums, with collections and expertise, in weaning and giving direction to budding entomologists as they begin to specialise. The remainder of the chapters is taken up with creating personal entomological library.

The meat of the book then appears; 323 pages with chapters on each insect order (23,500+ species) and the major arachnid orders (2420 species). Each chapter introduces an order and ends with a well annotated bibliography highlighting the most pertinent works. The orders are dealt with by individual specialists and, in addition to his own groups, the chief editor seems to have acted as 'sweeper' to deal with any 'orphaned' groups.

The treatment of each order seems to be weighted differently. For instance, the Dipper (6643 species) are allotted just over 20 pages whilst the (admittedly complex) Hymenoptera (7000+ species) have more than 120 pages dedicated to them. It is pleasing to see in the Coleoptera section, mention of clubs, societies, newsletters and recording schemes. For anyone 'moving on from the basic texts', these schemes are as essential as the literature in informing 'part time'

entomologists of developments. The section on my own first love, the Heteroptera, contains no mention of the many useful provisional keys turned out in the Heteropterists Newsletter, a part of the National Recording Scheme, without which 1 should have floundered at times. Distribution Atlases are also mentioned in the Coleoptera section and this too is exceptional within the volume. 1 should imagine that work towards such atlases gives many amateur entomologists added purpose and incentive to become proficient in particular groups. There are some odd omissions in some of the sections. For example, when 1 showed the book to an Arachnologist friend he was puzzled by the lack of mention of 'Big Roberts'(Harley Books -3 volumes, 1985-87) whereas 'Little Roberts', the condensed version published by Collins in 1995 is listed.

The introduction admits that in a book of this scope with over 2,000 references, there are bound to be errors and omissions, and comments and additions are invited. This is a very useful book as it stands although, given its target audience, rather beyond the means of many individuals who would be better spending their money on the works listed in the bibliography. Perhaps each local museum ought to have a copy in its

library, to be made available to emerging or diverging entomologists. Even with references up to 1997 (and a few from 1998), the book may stale fairly rapidly. It would be wonderful to give this invaluable source of information a web site where it can be upgraded on a regular basis. 1 would happily pay a small annual subscription for this service.

Steve Moran
Inverness Museum and Art Gallery

Advert

CATALOGUE OF THE OSTEOLOGICAL SPECIMENS IN THE COLLECTIONS OF THE ZOOLOGY DEPARTMENT OF LIVERPOOL MUSEUM

This is the first published catalogue of the approximately 3,600 vertebrate specimens in the Liverpool Museum. It includes not only specimens stored in the osteology collection, but mounted skeletons (such as Ambush II, who won the Grand National in 1900). The catalogue also lists the skulls which are stored with their cabinet skins in the main collection.

Many of the specimens are very old, and there are some important rarities, such as skulls of Tasmanian Tiger and Falkland Island Wolf. Several of the mammal skulls belong to type specimens, and there are sterna from bird types. Most of these early specimens are from the collection of the XIIIth Earl of Derby, an important naturalist whose collections founded the Liverpool Museum in 1851, and there is an immaculate series of skulls and skeletons from Loder's Menagerie in Sussex. The collections also include an important series of mostly cave and subfossil material.

vii + 194 pages, 6 black and white illustrations; indexes to scientific names; localities, collectors and donors.

Published at £19.99. Postage & packing is: UK £2.50 per copy, non U-K £4.00 per copy.

Order from: NMGM Enterprises, P.O. Box 33,127 Dale Street, Liverpool L69 3LA, UK. Tel: 0151 478 4685 Fax: 0151 478 4024

For information only- email eplent@nmgme2.demomeo.uk

Call For Papers

BCG – Biology Collections and Information Technology

The first BCG meeting of the year will be held in late January/early February in Leicester in conjunction with Leicester University Museum Studies Department. The subject of the meeting is Biology Collections and Information Technology. The meeting will cover topics such as documentation, environmental monitoring, public access, the internet, biological recording and exhibitions and display.

Anyone wishing to present a paper, demonstration or poster should contact:

Nick Gordon, New Walk Museum, Leicester, LE1 7EA
Tel: 0116 25541000
Email: gordn001@leicester.gov.uk

NSCG: Best Value

28th September 2000

One day seminar organised by NSCG on Best Value and how it affects museums, with particular emphasis on conservation and collections management. To be held at The Potteries Museum and Art Gallery, Stoke on Trent.

Anyone wishing to present a paper should contact:

Bob Entwistle, Senior Conservation Officer, NSCG Chairman, Ipswich Museum, High Street, Ipswich, IP1 3QH

The Biology Curator

All future contributions should be sent to:

Steve Moran, Inverness Museum and Art Gallery, Castle Wynd, Inverness, IV2 3ED

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