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First teeth

A funny thing being a natural history curator, where you can identify a worn sperm whale tooth, but not spot your sons new tooth coming through. I was looking at canines in his upper jaw, where his little gums were swollen, so I didn't spot the third tiny incisor on the lower jaw coming through! Teeth are incredibly robust little things, and most collections will have teeth especially with sub-fossil bone collections. A lot of information can be found from just a single tooth as you can find out what species was there by the distinctive pattern in its tooth.

All articles, apart from seminar reviews and book reviews, in *NatSCA News* are now peer reviewed. The Assistant Editor, David Notton, has been invaluable for getting this issue together. Thank you to all the anonymous reviewers who checked and made comments on the articles in this issue. There are lots of interesting articles from the talks at the conference and others. All the remaining conference talk write ups will appear in the next issue.

The next conference is going to be an interesting one held jointly with the Grant Museum of Zoology, at UCL and the Horniman Museum on 29th - 30th March 2012. More details about the conference can be seen on page 11.

The NatSCA committee welcomes four new members. Each has written a little bit of information, which you can see on page 15.

The upcoming seminars are no longer spread throughout the issue, and can be found at the end on pages 97-98. NatSCA are providing some interesting and useful seminars over the coming months, the first looking at storing insect collections followed by conservation of herbarium specimens.

Enjoy this issue the first fully peer-reviewed issue of *NatSCA News*, and thankfully there were no teething problems whilst getting it together! Please continue to send me articles about projects on your collections, collectors, education, conservation and new ideas!

Jan Freedman
10th Aug 2011

Contributions for Issue 22

All articles, letters, news, adverts and other items for inclusion for the next issue of the *NatSCA News* should be sent to the address below by September 25th 2011:

Jan Freedman [Editor, NatSCA]
Acting Keeper of Natural History,
Plymouth City Museum and Art Gallery, Drake Circus, Plymouth, PL4 8AJ

Email: jan.freedman@plymouth.gov.uk

View From The Chair

Having been on the NatSCA committee for a fair few years now, I was delighted to be elected as Chair at this year's AGM in Newcastle. I take over from the ever-dedicated Paul Brown who has served NatSCA since its inception (and before!) – missing only one committee meeting that I remember. A huge thank you to him for his time in the chair: not the easiest of periods with funding for natural science posts and collections being cut across the country.

The 2011/12 committee is a large and interesting one with new faces in the form of Beulah Garner, Roberto Portela Miguez, Angela Smith, David Gelsthorpe and Vicki Purewal adding a range of interests to the committee from across the country. We say thank you and goodbye to Leslie Noe, who goes to pursue his geological career in Columbia, and Pip Strang who is setting up a natural science touring exhibition business, and welcome back dedicated NatSCA committee members: Paul Brown as secretary, Jack Ashby, Paolo Viscardi and Miranda Lowe.

This is an interesting time to take on the chair of NatSCA. In the past few months I have heard that natural science jobs are being lost – or are under threat - at Rotherham, Doncaster and Maidstone museums: with no intention of replacing them. Doncaster Museum are considering disposing of their natural science despite their director Carolyn Dalton claiming that "natural history has potential" and that Doncaster "are not picking on natural history." The 'cuts' are proving deep and museums are making hard decisions. It is up to us as people who care about these collections to do as much as we can to be their voices and advocates.

Fortunately, it isn't all bad news. NatSCA, in partnership with Herefordshire County Council and various museums around the country, has managed to secure £200,000 from the HLF's 'Skills for the Future' pot to fund five trainee biology curators in 2011 and 2012. This was mainly down to the hard work and enthusiasm of Kate Andrew. This project means that skills that might be leaching out of the profession with the departure of so many curators are being passed on to fresh blood with biology traineeships at Hereford, Manchester and Leeds. Two more biology curator trainees will be employed next year.

I am hoping that in the coming year NatSCA will continue to support its membership by offering a range of practical workshops (currently in the pipeline are an insect collection training day on 18th November in London and a botany workshop on 2nd February in Cardiff), advice, advocacy, partnership working and another successful conference. We are hoping to be able to offer a small grant scheme – 'The Bill Pettit Memorial Award' – too, more details to follow soon. The committee always welcomes comments and suggestions on how we could improve NatSCA for its membership and for natural science collections in the UK.

Clare Brown
22nd July 2011

NatSCA AGM
1.30 – 2.15pm, Thursday 3rd March 2011
Great North Museum: Hancock, Barras Bridge, Newcastle upon Tyne, Tyne and Wear, NE2 4PT

Minutes

Committee members present: Paul Brown (chair), Tony Irwin, Miranda Lowe, Nicola Newton, Clare Brown, Jan Freedman, Paolo Viscardi, Maggie Reilly, Kate Andrew, David Notton, Claire Mellish, Jack Ashby, Simon Moore

Apologies for absence
Rosina Down and Richard Sutcliffe

Minutes of AGM Plymouth City Museum and Art Gallery, 6th May 2010 have been published in NatSCA News issue 19 in July 2010.

There were no matters arising from these minutes and a copy was signed by the chair as a correct record of that AGM.

Update on HLF 'Skills for the Future' project: Kate Andrew
A partnership of Natsca, Herefordshire Council, host museums and Renaissance with funding from the Heritage Lottery Fund under the Skills for the Future scheme has allowed us to create eight twelve-month curatorial trainee opportunities. The first four – three biologists and one ceramicist - start this month. Trainees will follow a programme that will see them starting on the Museums Association AMA. They will be supported by their supervisor and an external mentor. They will gain skills and experience in all areas of curation, but specialising in either biology or ceramics. The aim is that trainees will at the end of 12 months have the skills and practical work experience needed for an entry-level post in museums. They will be given a bursary of £13,000 and will spend their time at the host museums, on special projects, national training events and two weeks at a national museum in London.

Chairman's Report: Paul Brown

"Who say the Nations purse is lean,
Who fears for claim or bond or debt,
When all the glories that have been
Are scheduled as a cash asset?
If times are bleak and trade is slack,
If coal and cotton fail at last,
We've something else to barter yet
Our glorious past!"

Sir Arthur Conan Doyle (*This was written about the planned sale of Nelson's flagship HMS Foudroyant (1798) to German ship-breakers in 1891 but was saved by public demand to become a boy's training ship. Wrecked off Blackpool in 1897).*

This is my last AGM as NatSCA Chair. Recently, a comment was made to me that NatSCA would not be the same without myself! I wish to state to AGM that an Association such as NatSCA should not be the preserve of a few egos and that NatSCA **is** the membership. During my tenure, I have written letters of concern and we have even had some replies back but I am always worried that we run the risk of making matters worse for those at risk. One theme mentioned in all replies is the use of volunteers at the expense of permanent professional posts which also worries me much. I give my blessing to Clare Brown who has the enthusiasm, experience and energy to take on the role and I will revert to the role of Secretary and will support her and the Association as best I can. Please do consider yourselves to serve the best interests of NatSCA by serving on committee (although it is a little late now to put your names down for this year's election!) or by helping with any of our seminars, visits and conferences.

We hope to arrange a series of seminars soon and please look for adverts in NatSCA news, our jiscmail, related facebooks and blog sites and on our website at http://natsca.info and support them by attending and contributing to them. Do not confuse us with nasca.com which is a website for the swinger life style which I presume that most of our membership do not allude to !!!

We will continue to represent the best interests of our collections and our membership over the coming months as cuts in the Museum services continue to be applied. We must lobby Government about our concerns for our sector, so do any of the membership have a tame MP or celebrity who could champion our cause? Please let us know if you hear of any impending cuts.

We continue to culture closer links with the to discuss closer ties with the Geology Curators Group, the National Federation of Biological Recording and the National Biodiversity Network. The next Society for the protection of natural history collections SPNHC conference will be held at the California Academy of Sciences in San Francisco from 23rd to the 28th May 2011 on the subject of Sustainable Museums – Sustaining Collections. We are supporting the Conference 'A Pest Odyssey 2011'. 10 years have passed since the memorable Pest Odyssey conference at the British Library that inspired many of us to engage in the challenge of Insect Pest Management within the Heritage sector. This will cover Preventive strategies and case studies, Control strategies and treatments (pest, climate change and research), Innovative solutions and re-evaluation of existing treatments and Training and awareness. The conference will be held at the Natural History Museum on 1st September 2011

We aim to formalise roles such as collections at risk for committee members and will discuss this at our next committee meeting.

The much sort after book *Care and Conservation of Natural History Collections* – edited by Annette Walker and David Carter has been out of print for some time. Simon Moore approached the publishers Elsevier who said that there are no plans to republish or update the work, so we have approached them and all the authors for their permission to take the copyright which they have all agreed to. We will soon be able to scan the work and place it on our website.

Secretary's Report: Clare Brown

	Hereford 12/7/2010	NHM 24/9/2010	Cardiff 13/12/2010	Newcastle Arms 2/3/2011
Kate Andrew	✔	✔	✔	✔
Jack Ashby	X	✔	✔	✔
Clare Brown	✔	✔	✔	✔
Paul Brown	✔	✔	X	✔
Jan Freedman	X	X	✔	✔
Tony Irwin	X	X	✔	✔
Miranda Lowe	✔	✔	✔	✔
Claire Mellish	X	✔	X	✔
Simon Moore	✔	✔	✔	✔
Nicola Newton	X	✔	X	✔
Leslie Noe	X	X	X	X
David Notton	X	✔	X	✔
Maggie Reilly	X	✔	X	✔
Pip Strang	X	X	X	X
Paolo Viscardi	✔	✔	✔	✔

Treasurer's Report: Tony Irwin
NATSCA ACCOUNTS (1 Feb 2010 - 31 January 2011)

	2010-11			2009-10	
INCOME					
Subscriptions (*note 1)					
138 Personal @ £15.00	2070.00			2385.00	
2 Incorrect rate	29.27			15.35	
8 Student @ £10	80.00			50.00	
2 pers.sub for 2009 @ £15	30.00			15.00	
47 Institutional @ £30	1410.00			1500.00	
11 pers.sub for 2011 @ £15	165.00			15.00	
6 inst.sub for 2011 @ £30	180.00			90.00	
Total of 244 subscriptions		**3964.27**			**4070.35**
Other income					
Interest (deposit account) (* note 2)	11.28			13.10	
Incorrect payment (refunded)	180.00			50.00	
Sale of back issues & advertising	0			227.50	
Total other income		**191.28**			**290.60**
Meeting income (*note 3)					
2010 AGM (meeting fees & conf meals)	1585.00			3718.80	(2009agm)
2009 Taxidermy and Law	555.00			240.00	(tax.law)
2010 Osseous materials workshop	480.00				
GCG Street Seminar (*note 4)	273.71				
2011 AGM (meeting fees & conf meals)	300.00				
Total meeting income		**3193.71**			**3958.80**
TOTAL INCOME			**7349.26**		**8319.75**

EXPENDITURE					
Subscriptions, etc.					
Information Commission (data protection)	35.00			35.00	
National Biodiversity Network				27.00	
Total Subscriptions Expenditure		**35.00**			**62.00**
Meetings					
2010 Conference (*note 5)					
Speakers expenses	582.60			620.94	(2009agm)
Room hire and catering	1202.61			4349.20	(2009agm)
Bursaries	300.00			200.00	(2009agm)
Miscellaneous	103.50			229.43	(2009agm)
Taxidermy and the Law Meeting					
Speakers expenses	350.00				
Room hire and catering	560.00				
Bursaries	54.70				
Osseous Materials Workshop					
Speakers expenses	0				
Room hire and catering	332.73				
Bursaries	0				
GCG Street Seminar					
Contribution (*note 4)	500.00				
Misc bursaries	100.00			100.00	
Total meeting expenditure		**4086.14**			**5499.57**
Committee expenses (* notes 6,7,8)					
Insurance	842.83			910.04	
Travel to meetings	2265.19			1019.80	
Postage	4.92			31.46	
Printing & distribution of newsletter	1290.76			3722.91	
Miscellaneous	981.44			726.58	
Total operational costs		**5385.14**			**6410.79**
TOTAL EXPENDITURE			**9506.28**		**11972.36**

ifference between Income and Expenditure (2009/10 loss)	**-2157.02**				**-3652.61**
ASSETS					
HSBC Deposit account 41653636					
Opening balance, 1st Feb 2010	22452.81			23439.71	
Bank interest	11.28			13.10	
transfer to c/a	-3118			-1000.00	
Total and actual balance, 31 Jan 2011	19346.09			22452.81	
HSBC Current account 91645722					
Opening balance, 1st Feb 2010	1819.18			4484.89	
Balance on 1 Feb 2011	2768.88			1819.18	
Total Assets (Cash Funds) at year end	**22114.97**			**24271.99**	
Assets at start of year 2010/11 loss **Assets at start of year minus loss**	24271.99 2157.02 **22114.97**				

* Points to note:

1. A drop in individual and institutional members has reduced our subscription income, offset in a small way by increased numbers paying in advance for 2011 subscriptions.
2. Deposit account interest continues to be disappointing.
3. We are still owed some fees for meetings from 2010. Poor attendance at meetings has meant that all meetings operated at a loss. While we endeavour to break even at meetings, it is entirely appropriate to use our surplus funds to support those that are not well attended.
4. The GCG Street seminar on marine reptiles (held in the town of Street, Somerset, not in a road!) was supported by NatSCA with a net contribution of £226.
5. The cost of the 2010 Conference was much reduced from that in 2009, and we are very grateful for the organisers and Plymouth Museums for making that possible.
6. Committee travel expenses have doubled this year. This is partly a reflection of good attendance at meetings, but mainly the fact that almost all employers are no longer subsidising travel for committee members. Committee is considering ways to reduce this amount which is not sustainable.
7. This year we have only had one bill for Newsletter production compared to three last year.
8. Among the miscellaneous costs are the refund of an incorrect payment for £180, and work on the website which we are trying to keep as up-to-date as possible. Committee hope to share some of the work with our webmaster, so that costs in this area can be kept down.

Overall, the loss of £2157 this year is an improvement on last year's loss of £3652. We will continue using our surplus funds to further the Association's aims, but hope to reduce the deficit through increased attendance at meetings. We do not feel there is a need to increase subscriptions yet, and hope that membership agrees that NatSCA is still excellent value for money.

The accounts are based on the bank transactions that took place in 2010-11. Issued cheques that were presented, or income banked, after 31 January are not included.

Tony Irwin 6 February 2011

The accounts for 2010/2011 have been examined by Velson Horie, our Honorary Auditor, who has approved and signed them on 26th February 2011..

The chair moved that the AGM accept the Treasurers report which was proposed by Kate Andrew and seconded by Lindsay Loughtman. This was carried with no abstentions.

Membership Secretary's Report: Maggie Reilly
1st Feb 2010 – 31st Jan 2011

This year there were 50 Institutional and 152 personal subs making a total of 202 paying members. We continue to send out 12 free of charge mailings to useful contacts. The numbers represent a fall of 6 institutional subs on last year but 5 late institutional subs are actively being pursued. Pleased to welcome 12 new or returning personal members but we are concerned at fall in membership form last year where we had 170 personal members. People have of course retired or left the profession and there are a few late subs still to be reckoned but we have found in the past that new members balance out the non –renewals. Perhaps the fall reflects current financial stringencies.

As is customary, Issue 19 of the Newsletter was sent out in June to all members paid up the year before. Issue 20 sent out in January has only been sent to those members who were paid up for this year.

Members are respectfully reminded to pay their annual subscriptions on a reasonable timescale and we encourage the membership to set up standing orders to facilitate this. Memberships are due in February and sub forms and reminders are sent out. This year in particular there were many late payments which places an additional administrative burden on both the membership secretary and the treasurer.

Editorial & Website Report: Jan Freedman and Paolo Viscardi
Issue 20 was sent out last month, full of interesting articles. There was a typo on the front cover with the date which said 'January 2010' instead of 'January 2011'. Apologies for the error.

Issue 21 is due out in May, and we have a few articles already, and this issue will include all write ups from the conference talks.

Please continue to send Jan Freedman articles for NatSCA News. If anyone is interested in writing a review for a book they have seen, then please send Jan Freedman the details and he will contact the publishers for a free copy. We are intending to update the NatSCA website. Please send any comments and suggestions to Paolo Viscardi who will be facilitating this.

Natural Science Conservation (& Institute of Conservation) Report: Simon Moore
Leaflets for Natural Science Conservation are being discussed with ICON and will be agreed to soon and will probably be jointly produced by NatSCA and ICON**.**

Election of Ordinary members to NatSCA committee :
Today we are electing Chairperson, Secretary and eight ordinary committee members.

Nominees must be willing to devote time to serving the business interests of NatSCA.

The membership secretary has checked to see that those proposed, those proposing and those seconding are all present members of NatSCA. The nominees are as follows:-

1. Chair 11-14 **Clare Brown** Leeds Museums
Proposed: Jack Ashby Seconded: Paolo Viscardi

2. Secretary 11-14 **Paul Brown** NHM Proposed: Theresa Howard Seconded: Geoff Martin

3. OM 11-13 **Jack Ashby** Grant Museum, UCL
Proposed: Erica McAlister Seconded: Alessandro Giusti

4. OM 11-13 **Paolo Viscardi** Horniman Museum
Proposed: Jack Ashby Seconded: Jan Freedman

5. OM 11-13 **Miranda Lowe** NHM
Proposed: Claire Mellish Seconded: Paul Brown

6. OM 11-13 **Angela Smith** Gloucester Museums
Proposed: Kate Andrew Seconded: Clare Brown

7. OM 11-13 **Roberto Portela Miguez** NHM
Proposed: Miranda Lowe Seconded: Paul Brown

8. OM 11-13 **Vicki Purewal** NMGW, Cardiff
Proposed: Paul Brown Seconded: Kate Andrew

9. OM 11-13 **David Gelsthorpe** Manchester Museum
Proposed: Clare Brown Seconded: Henry McGhie

10. OM 11-13 **Beulah Garner** NHM
Proposed: David Notton Seconded: Erica McAlister

As there are vacant posts and candidates to fill them, no election is required. If there are no objections to the candidates, can we accept and elect the listed people en block onto committee to serve for three years for the chair and secretary and two years for other committee members.

This was proposed by Simon Moore and seconded by Nigel Monaghan and was carried with no abstentions.

Still In Post are :

11.	Editor 10-12	**Jan Freedman**	Plymouth Museums
12	Membership Sec 10-12	**Maggie Reilly**	Glasgow University
13	Treasurer 10-13	**Tony Irwin**	Norwich Museums
14	Conservation 10-12	**Simon Moore**	Freelance
15	OM 10-12	**Nicola Newton**	Freelance
16	OM 10-12	**David Notton**	NHM
17	OM 10-12	**Claire Mellish**	NHM
18	OM 10-12	**Kate Andrew**	Hereford Museums

Ex officio:

19.	SPNHC rep	**Clare Valentine**	NHM, London

Pip Strang and Leslie Noe are retiring from the committee this year. We extend our thanks to them and wish them all the best for the future.

Please would newly voted committee members send Paul Brown your contact details for the Charities Commission records and can you chosen people send a CV and suitable photo for our NatSCA committee webpage and for NatSCA News.

12 Any Other Business
No other business.

Next AGM
29th and 30th March 2012 at the Grant Museum of Zoology and the Horniman Museum in London

Next Committee Meeting
Scheduled for 24th June 2011 but changed to 1st July 2011
10.30 for 11.30

Vote of thanks: Paul Brown
I wish to formally thank the committee for the hard work they have done over the last year and again those who are standing down from committee, Pip Strang & Leslie Noe; the organisers of the Conference, Nicola Newton & Simon Moore and the management and staff of the great Northern Museum, Sarah Glynn, Steve McLean & the admin staff and Laura Steel for the catering.and for all those who have contributed with talks and demonstrations for the conference.

Close

NatSCA 2012 Conference
Use It or Lose It: Unlocking Potential
CALL FOR PAPERS

Where: Horniman Museum and Gardens & the Grant Museum of Zoology, London

When: 29th-30th March 2012 (with additional tours on 28th & 31st)

Contact: Jack Ashby [j.ashby@ucl.ac.uk] 020 3108 2052
Paolo Viscardi [p.viscardi@gmail.com] 07507 595 578

Call for papers
We are seeking proposals for papers at the conference covering the following topics:

- Unlocking potential – recognising what we have, what we do and who wants to use it
- Collections as a resource – research, Higher Education, health & wellbeing, arts, schools, community, service provision
- Resources for collections – collections review, partnerships, access, creative approaches, expertise as a commodity, funding sources, successful grant-writing

We are looking for practical sessions as well as traditional presentations. The aim of the conference is to provide guidance. Please bear this in mind when proposing papers.

Please send an abstract of no more than 250 words by **30th September 2011** to Jack Ashby at j.ashby@ucl.ac.uk

If you would like to discuss an idea please contact Jack or Paolo

Conference Evaluation: Newcastle 2011

Paolo Viscardi

Horniman Museum & Gardens, 100 London Rd, Forest Hill, London, SE23 3PQ

Email: pviscardi@horniman.ac.uk

The 2011 NatSCA conference 'Coping with cuts and Coping with collections deterioration' was well attended, with **twice as many delegates as the previous meeting in Plymouth**. A total of 52 evaluation forms were received from a **total attendance of 73** (71%), thereby providing a good reflection of the views of those present. Of the 52 responses, 88% were from members of NatSCA.

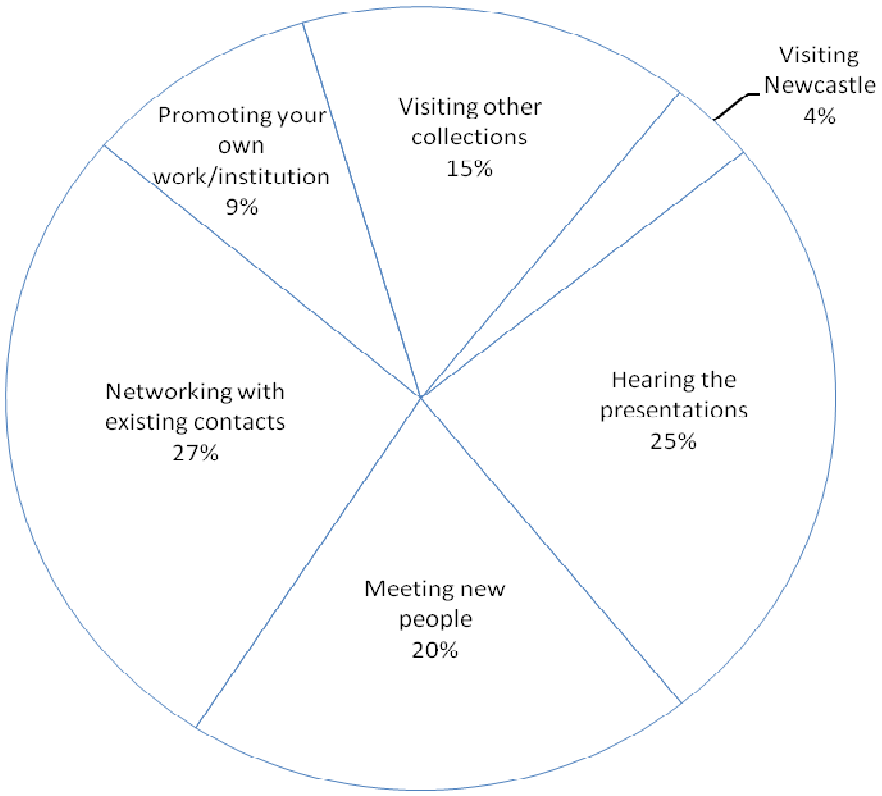
Communication

Most people heard about the conference via email (29%), word of mouth informed 26% of respondents and 24% knew about it through Jiscmail. The remainder found out from the website (11%), because they are on committee (8%) or because they attend every year (2%). The Newsletter was not cited as source of information about the conference.

Clearly **email, Jiscmail and word of mouth play an important role in communication** about the NatSCA conference, but the website is relatively under-used. This suggests that **currently the website is not a very effective mode of communication** and improvements are required. Likewise, there needs to be more information about the conference in the NatSCA News.

Reasons for attending

The main reasons for attending the conference are shown in the chart below:



The main reasons for attending followed a similar pattern to those seen in 2010 - **networking, hearing presentations and meeting new people are the most important factors for attendees**.

The subject coverage in the presentations only completely fulfilled the aims of attending for 20% of respondents, but most (66.6%) still felt that the majority of their aims were met. The remaining 13.3% of respondents felt that the conference partly fulfilled their aims for attending, but nobody felt that conference failed to meet any of their aims.
The aims that were not met were largely related to coping with cuts (46% of respondents). In particular a **need was identified for information relating to sources of funding and guidance on effective grant applications**. It was felt that the conference raised many questions, but provided few answers.

There was a feeling that some additional aspects of Collections Care coverage would have been valuable, in particular labels for wet preservation, skeletal collections and more geology. However, it was acknowledged that the conference already dealt with a wide range of themes and **there were limits to how much could be covered in the time available**.

Conference Format
The 2011 conference followed a slightly different format to previous years, with different themes on day one (Coping with cuts) and day two (Coping with collections deterioration). This change in format was in response to a suggestion reported in the evaluation for the 2010 conference.

The tours were conducted on the afternoon of the first day, followed by the conference meal. The afternoon of the second day saw practical sessions being run for the first time at the conference.

Talks

The number of talks was considered about right by most respondents (92.4%), although several comments suggested that the **talks could have been better distributed between the two days**.

Almost all respondents (98%) thought that 20 minutes was about right for the duration for talks, in contrast to the 89.3% supporting 25 minute talks last year. **It is suggested that a 20 minute talk duration is retained for the next conference**. As with last year, most respondents considered that questions should come at the end of talks (88%) and it was noted that there was insufficient time for questions on the second day.

The talks were all well received and every speaker was placed in at least one attendee's top three, indicating that **all of the presentations were relevant and useful to someone**. The talks on the second day were generally identified as more useful – perhaps unsurprisingly given their practical nature.

Practical sessions

45 attendees made further comments relating to the practical sessions on the afternoon of the second day. Most of these comments indicated that the practical sessions were disorganised, relied too much on one speaker and **could be improved by having smaller groups or by using a camera to project the activity on a big screen**. Despite these issues with organisation, the practical sessions were very well received and **there is a good case for running practical sessions at future meetings**.

Tours

Tours are seen as a valuable component of the NatSCA conference as they provide a focus for knowledge and experience sharing. Most respondents (71.7%) indicated that there were about the right number of tours at the 2011 conference, although a large minority (28.3%) considered that there were not enough, suggesting that **more tours should be made available at the next conference**.

Overall the feedback from the tours was positive, although several people said that **tours were rushed or that groups were too large** and there were **issues with transport to and especially from the stores**. The logistics of organising tours to offsite locations need to be carefully addressed for future conferences in light of this feedback.

Venue & Conference Organisation
With regards to space, refreshments and location, the venues used were satisfactory; completely meeting the

needs of 58.8% of respondents and mostly meeting the needs of 25.5%. The remaining 15.7% found the venues to be adequate.

Critical comments mainly focussed on the catering, in particular the **lack of labelling on sandwiches, lack of hot drinks at lunch, or the lack of vegetarian options at the conference meal**. These complaints should be kept in mind when organising the next conference.

Several attendees suggested that a **delegate list and map with venues clearly marked** would have been a useful addition to the conference pack. Otherwise comments were very favourable about the venue and the organisation of the conference.
The price of the conference was considered reasonable by all but one respondent, who considered it over-priced and there were a couple of comments saying that the catering was too expensive for what was provided. However, the overwhelming majority of attendees were satisfied that the conference was reasonably priced and one comment described it as being **"great value all round"**.

Future Conferences & Workshops
There were a large number of suggestions for workshop topics, the majority of which related to **practical conservation and collections care**, particularly for herbarium, entomology and fluid preserved material. Preparation of mammal skins was also suggested as a practical topic.

Workshops focussing on law and legislation were a popular suggestion, in particular with regard to egg collections. Easy loans, tissue banks, networking in regions, staff development, competencies and training were also flagged as areas to be considered in future.

Suggestions for future conference themes included: teaching & research use of collections, collaborations, collecting for the future, working with volunteers, audience engagement, conservation research, orphaned collections, and the future of taxidermy in museums. There was also the suggestion that **there should be a vote for the theme(s) of the next conference**.

New Committee Members

We are please to welcome five new members who have joined the NatSCA committee. Below is a little information about themselves and why they wanted to join the committee.

Please remember if you are interested in joining the NatSCA committee, or if you would like to find out some more information, please feel free to get in touch!

Angela Smith

Documentation Officer, Gloucester City Museums & Art Gallery

I am the Documentation Officer at Gloucester City Museums & Art Gallery, where I have worked for four years. I have a varied background in zoology including parasitology, genetics, mammals , taxonomy and systematics. I have worked aboard as a field researcher in Thailand, as well as working from England as a taxonomic advisor to field researchers in Thailand, Laos, and Cambodia. I joined the NatSCA committee to enable me to become more involved with the current issues affecting museums today.

Beulah Garner

Curator, Coleoptera, Natural History Museum, London

I am the curator of Coleoptera (Carabidae) at the Natural History Museum, London. I have worked in a variety of museums since 2006, including Sedgwick Museum of Earth Sciences, Cambridge; Norwich Castle Museum; Horniman Museum and Gardens. Working in a diverse range of museums has shown me how different museums work with limited staff and limited budgets. I became a member of the NatSCA committee to make a positive contribution to the furtherance of natural history collections and share my expertise in certain areas of museum curation.

David Gelsthorpe

Earth Sciences Curator, The Manchester Museum

I am the curator of the Earth Science collections at the Manchester Museum, where I have worked since 2006. I started my career volunteering at Weston Park Museum, Sheffield. I was then fortunate enough to obtain an access post at Scarborough and Whitby Museums curating the fossils there. I then worked at Yorkshire Museum on their extensive natural history collections. My current role involves the curation of the geology collections, exhibitions, enquiries, research, outreach and more! I am particularly interested in education and I have developed A-Level programmes to provide hand-on workshops for students. I joined NatSCA because…...

Vicky Purwal

Botanical Conservation and Research Officer, National Museum of Wales

I am the botanical conservation and research officer for the department of Biodiversity and Systematic Biology at the National Museum Wales. This position involves the conservation of all areas of botanical collections such as the vascular and lower plant herbarium, the wax models, timber, archives, prints and drawings. My specialism is in the conservation of wax models and the identification and mitigation of historic pesticide residues on herbarium sheets; I am currently completing my Phd on this subject. I was a long term committee member of NSCG and a member of NatSCA for many years and felt that I am currently in a position to offer my time and experience and hopefully help where possible.

Roberto Portela Miguez

Curator, Mammals, Natural History Museum, London

I have been working at the Natural History Museum for over nine years in different roles and in different departments. For the past 5 years I have been one of the curators of the Zoology Department, but relatively recent became full time curator of the mammal collections. I have always been curious and fascinated with the work that is done back of house in museums and therefore I am extremely fortunate to work where I do. However my curiosity knows no limits and therefore when I became aware of NatSCA I did not hesitate and joined the Society to find out more about collection management techniques and practices elsewhere. I feel that now it is my time to give something back to the society that I benefit from so much for the past few years. I became committee member to enthusiastically help with the Society's mission, share good and efficient collection practice with other colleagues and assist our membership in whatever we can.

Herbaria and Entomology Preservation Course. 18th – 21st October 2010 Institut National du Patrimoine, Paris

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Introduction

I was lucky enough to be offered the opportunity to attend this excellent course held at the Institut national du patrimoine (INP) in Paris, as part of my AMA training. The INP, or the National Heritage Institute, is a higher education institute specialising in courses for curators and conservators, ranging from a few days, to post graduate courses of up to five years. This course was one in Simon Moore's excellent series on the preservation of natural history collections, and focused on problems encountered with herbaria (both paper mounted and fluid preserved) and entomology.

There were 14 participants on the course, and were a mixture of curators and conservators. The amount of previous knowledge of the subject varied from very little to a high degree of expertise, but there was something for all levels of experience. As the course progressed the conservators were able to offer their own ideas and we had the opportunity to experiment with different ways of doing things. Throughout the practical work Simon came to each of us offering advice and encouragement.

The duration of the course was three days, one and a half days each dedicated to herbaria and entomology specimens.

Insects

The problems of entomology collections are well known to natural history curators; *Anthrenus* has a habit of creeping into boxes of specimens and producing larvae that happily munch their way through the collection. If you are lucky you may discover a few woolly bear casts and lose only a few wings, but an all too familiar sight is a box containing little more than dust and fragments of appendages.

It may be possible to reassemble some insects, restoring them to their former glory, while with others it may be a case of simply reuniting parts that were from the same specimen or scooping up recognisable parts into a polyester envelope along with their label.

Herbaria

With herbaria, what may appear to be a pile of stalks and seeds, gathering in the fold of an ageing, insect damaged page, can be reassembled and reattached in their original form. The paper too can be repaired and strengthened. As with all preservation techniques the object of the exercise is not to fool the observer into believing that the specimen has not undergone any damage, but to preserve the information by uniting the specimen with its original mount. Securing the specimen prevents any damage that may be caused by movement within the folder. Once the specimen has been repaired steps can be taken to prevent further deterioration, and attacks by insects and mould.

Day one

The day started with a presentation introducing the main points of concern with herbaria, some basic steps of collection care and simple remedial measures that can be taken by curators. The talk was well illustrated and accompanied by handouts of the slides.

The environment in which herbaria are kept is of utmost importance for preserving specimens. Ideally sheets should be wrapped in acid-free paper and stored in metal cabinets with doors that have gaskets to provide a seal when closed. A well-sealed cabinet and a controlled environment will protect against pollutants and prevent insects from gaining access.

Metal is a better material for cabinets than wood. Wood can give off volatile organic compounds (VOCs)

that can damage specimens. Oak is particularly potent although it does degas with age. Mahogany is slightly better and pine is considered to be fine after one year. Composites such as MDF also give off VOCs. Glues too can cause problems; PVA is acidic unless it is bought specifically as pH neutral (such as Evacon-R™ Adhesive).

Storing herbaria in cabinet drawers requires a good system of identifying specimens. If sheets are continually removed from drawers, plants are likely to get damaged. A combined system of numbering and colour coding was recommended, as used by Hampshire Museum Conservation Service.

Relative humidity should be kept low, ideally not higher than 40%, to prevent mould and discourage insects. Mould weakens paper considerably and insects can eat both paper and plant specimens. The main culprit is the biscuit beetle, *Stegobium* spp., which looks like a smaller version of *Anobium*, the furniture beetle. *Stegobium* can squeeze through very small cracks. Silver fish can cause extensive damage to paper, as can Psocids, or booklice. Regular checking of storerooms and store cupboards for insects, is vital to safeguard the collections, particularly in cracks and places such as inside old fireplaces. Remember that insects can feed on even the smallest invertebrate corpses, so be thorough with housekeeping and remove anything dead that you find. It's also worth noting that Psocids can jump, making them more mobile than some other insect pests.

Be wary of introducing insects into your store. Quarantine new specimens before they are added to your collection and make all staff aware of signs of insects to look out for. Any signs of insects should be reported and recorded with the curator and/or conservator so the relevant preventative treatment can be undertaken.

One method for killing insects without damaging specimens is to use anoxia treatment, whereby oxygen is reduced to a level of 0.5% and nitrogen increased to 50%. This does not suffocate the insect, but causes the spiracles to open up and the body to dry out. It is effective within three days, but the treatment should be continued for one week. Alternatively, insects can be killed by freezing specimens at -18°C for two weeks. If freezing, the drawers or specimens must be doubled bagged and sealed to prevent moisture loss.

The main problems associated with herbaria are:

- Insect damage
- Stains from mould
- Dust that may accumulate on paper and spread to specimens
- Tears in folds of paper caused when it is badly folded
- Glue drying out, causing specimens to become unstuck
- Specimens breaking or disintegrating

When presented with a herbaria sheet in need of preservation the first step is to photograph it, then remove all loose pieces and put in a Mylar envelope.

Paper can be gently cleaned using first a dry paintbrush to remove loose particles (Fig. 1). A soft eraser can then be used to remove surface dirt. Groomstick will remove mould and more stubborn marks. It has the texture of soft putty and can even be used to remove surface ink from newsprint without smudging, so it is ideal for removing mould spores. Live mould should be treated using cotton buds dipped in alcohol, cleaning pads (which are washable and hence reusable), or a glassine sponge, although this may contain diatoms, which may scratch the surface of the paper. Unfortunately stains caused by humidity are irreversible.

If the surface is sticky it can be cleaned with Draft Clean, a powder similar to Fullers Earth. The granules are gently rubbed into the paper, and then brushed off using a soft brush.

The question was asked whether it would be possible to remove the specimens and remount on new paper. Although the specimen would look much better, most museums would agree that it would be unethical to do this, as you would lose the history associated with the paper. The paper is as much a part of the collection as the specimen.

Once the paper has been cleaned, any tears or insect holes can be repaired using Japanese tissue. There are two main types of tissue: traditional hand laid paper, which has fibres running in the same alignment, and

factory produced paper where the fibres are more randomly aligned. As you would imagine, the hand laid paper is much more expensive, however it is far superior. A small amount will go along way and if you can afford it, it is a much better buy.

Fig. 1. Simon Moore cleaning a pressed plant specimen.

There are three types of hand laid tissue each named after the place where it was made. All tissue is available in different weights that can be used in different ways. The tissues that we used were 9 gsm (grams per square metre) Tusa Tengujo which is quite fibrous and 10 gsm Gampi, which seems less fibrous, tears better, is stronger and easier to work with, but is more expensive.

Tissue should be torn to shape rather than cut. Torn tissue gives a more invisible repair once secured in place. The adhesive to use is either a 50% solution of neutral pH PVA (diluted in deionised water) or methyl cellulose. Do not use glue from animal products, as this will attract insects. Put a drop of adhesive onto a glass slide and pull the tissue through it using forceps. Continue to drag the tissue along the glass to remove any surplus glue. Place on the tear and apply light pressure using a soft brush.

An alternative method was suggested by a participant on the course, who was a paper and book conservator. Dye a large sheet of Japanese tissue with watercolour dye to faintly colour it. By using different dyes for different weights of tissue you will be able to identify the weight of tissue when you come to use it. After it is dry, add a small amount of methyl cellulose and allow to dry on Plexiglass or a similar acrylic plastic. This will give you a glued tissue that you can reactivate. When needed, tear a piece to size, or score and tear for a more precise shape, and rehydrate using a sponge, such as artificial chamois which is very soft. Do this by placing the sponge in a saucer of water and allowing it to become saturated. Press a strip of tissue onto the surface of the sponge to wet it then remove surplus water with your finger. Take care not to wet it too much or this will take off the glue. Place tissue in position on the paper (Fig. 2). Put two small pieces of conservation grade blotting paper on top and apply light pressure. A piece of synthetic tissue between the blotting paper and the glued tissue will prevent the glue from sticking to the blotting paper.

Fig. 2. Paper repair of a herbaria specimen using Japanese tissue.

This also works well for larger repairs or to strengthen where weakened by mould. Put a piece of tissue on a piece of glass and wet with sponge (but not too much). Lay the tissue onto the paper in position. Add blotting paper, wool felt and gentle pressure, for example by placing a ream of paper on top. Again, the tissue will dry quite quickly.

Once the tissue is dry, the fibres around the edge can be blended in using glue and a soft paintbrush.

Sometimes mould and damp can cause paper to become stuck to the sheet beneath. If this does not affect the specimen, it is probably best to leave it, as to try and unstick it can cause further damage. If, however, this is causing the page to tear, or there is plant material stuck between the pages, it may be possible to separate the sheets by soaking the stuck area in alcohol, leaving for a short while, then teasing the paper apart very gently with a spatula.

When the paper repairs are complete, if you are sure of where loose plant material has come unstuck from, you can restick it using either archival grade linen hinging tape, with only part of the backing removed so that it does not stick to the specimen, or a 50% dilution of neutral pH PVA. Broken stems can be repaired using a small piece of wood shaved from a cocktail stick, which is then inserted into the stem and used as a splint. Again, neutral PVA can be used to secure this. Alternatively, Japanese tissue paper can be used to join together pieces of broken stem.

Simon briefly mentioned fluid preserved moulds and lichens, although we did not attempt to do any repairs on these kinds of specimens. Conservation fluid fixatives include Kew mixture (ethanol, glycerol, formaldehyde and distilled water) or Copenhagen mixture (70 ml ethanol, 29 ml distilled water, 1 ml glycerol, 2 drops methanol). Other fixatives should not be used because of their affect on chlorophyll.

Day two
Day two began by finishing off the work begun the previous day and perhaps attempting something a little more difficult. It was important to have a go at using the different materials and methods. Now was the time to make mistakes and ask questions while Simon was on hand to give advice.

After lunch it was time for the second part of the course, beginning with the customary lecture. Again, the presentation was well illustrated and was accompanied by handouts of the slides.

Insect problems are well known and it's a rare museum that has not at some time had insect pests. As an adult *Anthrenus* can crawl through a gap of 0.5mm, it is wise to check whether those close-fitting lids really are as close fitting as one might imagine. Even in a seemingly unaffected box, by blowing softly on the wings you might discover woolly bear casts, larvae or even adults that have been hidden underneath. Under the right conditions *Anthrenus* can produce two batches of eggs a year.

The principle of repairing insects is the same as repairing herbaria. Japanese tissue, such as 9gcm Gampi, methyl cellulose or neutral PVA, and cocktail stick splints can all be used to good effect. The main difference when attempting repairs is that insects are more three dimensional. In order to work with gravity, insects can be mounted on stands so that the side to be repaired is uppermost. A very good way to do this is by using a polystyrene cup as a stand. This has the advantage of being unlikely to over-balance while you are working.

In most cases it is necessary to work on the underside of the insect. Remove the pin and re-pin from the other side. If the pin will not easily slide out, heat the pinhead using the tip of a soldering iron. After a minute or so, the pin will slide out easily. Remember to hold the pin with forceps when removing it!

Pin the insect in position on the polystyrene cup. Cut a triangle of paper or transparent plastic and pin this in such a way as to support the part that you will be repairing. Insects are fragile and light; adding tissue and glue causes the appendage to be weighed down, so it needs to be supported in position until the glue has dried (Fig. 3). Alternatively use gravity (Fig. 4) or a piece of polystyrene foam, or a similar material, pinned into position (Fig. 5).

Fig. 3. Image to illustrate the supporting triangle cut out when repairing parts of specimen.

When repairing holes in Lepidoptera wings, microscopic scales can cause a problem because they are not water absorbent, so PVA has a tendency to form blobs. This may not be a problem, but if it is, it might be better to use methyl cellulose. Another potential problem is that small pieces of tissue can roll up when

glued on one side, so to overcome this, after pulling tissue through glue on a glass slide, pull it back the other way, so that both sides of the tissue are coated. Apply the tissue to the tear or hole and tease into position with forceps or a soft paintbrush. Tissue will strengthen the wing and so can extend the life of a fragile specimen. If the specimen is needed for display, it is possible to paint the tissue with watercolour paint, to camouflage the repair. When the glue (and paint, if used) is dry, paint on 10% paraloid diluted in acetone. This will camouflage the tissue. If the result is too shiny, paint on a fine layer of acetone over the top to give a more matt appearance. Any tissue that is visible overlapping the edge of the wing can be trimmed with small sprung scissors using a dissecting microscope.

Fig. 4. Re-attaching the abdomen with the aid of gravity.

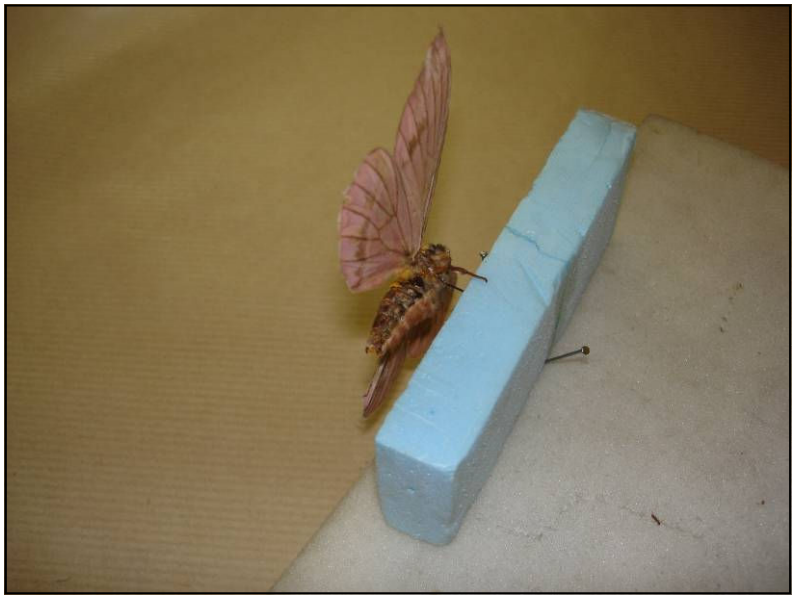

Fig. 5. Re-attaching a leg using a polystyrene block as a support.

If antennae are soiled or dusty, they can be cleaned with a small paintbrush and alcohol. If the specimen is to go on display the antennae can be strengthened with paraloid, but this will clog them up, so it should not be used on a specimen that may be needed for scientific study.

If the body has totally disintegrated, it is possible to fashion a 'papier-mâché' body out of tissue and glue, and attach wings and other appendages from the same insect. Alternatively you can make card wings and attach the real wings to them. In this way you can keep dissociated body parts together along with the label. If neither of these options is possible, place the body parts into a Mylar or polyester envelope.

Unless you need to repair the insect for a specific reason, such as for display, there is no need to attempt any restoration. Removing pest insects, treating by anoxia or freezing, putting the specimen into a sealed box or cabinet and providing the right environmental conditions, will stabilise the specimen and prevent further deterioration. In any case, repaired specimens will also need to be treated thus, or they could well and up as a pile of wings and tissue!

Day three

The last day consisted of more practical work on the Lepidoptera, and, as our confidence grew, we attempted more complicated repairs. As with the herbaria, this last session gave us the opportunity to experiment a little with different ways of doing things and get a feel for how well different techniques work.

I found this course extremely interesting and would fully recommend it. Knowing simple techniques, such as how to remove pins from bodies or reattach plant specimens to paper, is invaluable. Just as important is learning when to attempt repairs and when to call in a conservator, and what kind of repairs are possible in the right hands.

Acknowledgements

I am very grateful to the Trevor Walden Trust for providing me with a grant, NatSCA for awarding me a bursary and Gloucester City Council for their contribution; without their generous help it would not have been possible for me to attend this course. Thank you also to Kate Andrew, my AMA mentor, and Andrew Fox, Gloucester Museums Manager, for supporting my grant application. Finally thank you to the reviewer for checking through the article and providing useful feedback.

Recommended Reading

Brideson, D., & Forman, L., (Eds). 1999. *The Herbarium Handbook.* 3rd Edition. Royal Botanic Gardens, Kew.

Carter, D., & Walker, A., K. (Eds). 1999. *Care and Conservation of Natural History Collections.* The Natural History Museum.

Report on the NatSCA workshop: "How to identify osseous and keratinous material" Leeds Museum Discovery Centre 2nd November 2010

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Dr. Sonia O'Connor of Bradford University is one of the leading lights in the identification of archaeological material made from osseous or keratinous material. NatSCA has long wanted her to run a workshop on this subject for us and so we were delighted when she agreed to do so in November last year. Dr. O'Connor has an archaeological background and so comes at this subject through cultural artefacts. This means that the workshop covered worked and unworked objects giving us a good overview of the problems and solutions that might be encountered when looking at this type of material.

The day was split into two parts: talks in the morning and a practical session in the afternoon. I think all participants would agree that the theory reinforced with the practice made for a comprehensive and rewarding course. We are also grateful to Sonia O'Connor for squeezing the usual two days of the course into one for us.

Perhaps the first things we came to grips with is that there is a good chance that you may never be able to work out what something is made from. Whilst the day equipped us with plenty of knowledge, skills and tips on what to look for, we will only be able to get so far with just a microscope for company. However, it turns out that there is a fair amount to do before despairing.

The following is the briefest of summaries of the points of the day and I could not possibly begin to cover everything. For an informative and practical introduction to the subject, it is well worth attending one of Sonia's workshops.

Identification of bone and antler:

- Size can be a good indication of bone – a large, flat surface can in many cases only be attributed to a bovine scapula or whale jaw for example.
- Periosteum, endosteum and trabeculae are all pretty distinctive in bone: as long as you are lucky enough to have the diagnostic features present.
- Bone is vascular and so a key diagnostic feature of bone is the presence of small holes on the surface (Fig. 1). However, these features can sometimes become filled with frass and so can be difficult to spot.

Fig. 1. A cetacean bone busk (from a corset). The vascularised surface is clearly visible. (Image © Leeds Museum)

- Jaw bone is full of secondary osteons. These are easily identifiable as small circles with a dot in the centre.
- Antler is laid down very quickly and is therefore 'chaotic' in its appearance. It also has a spongy centre when looked at in cross-section (not to be confused with baculum - which also has a spongy core – this compact tissue has an ordered, lamella structure more like that seen in longbone shafts).

Identification of ivories and other teeth:

- There are many types of ivory out there – whale, elephant, mammoth, dugong, hippo etc.
- The tooth enamel is usually worn off and it is the dentine that we think of as ivory. Hippo canines do retain enamel down one side but most of these large teeth only have a covering of cementine.
- Schreger lines, forming the regular Schreger pattern in transverse section, are only found in elephant/mammoth ivory. This pattern is an optical effect and so it is worth turning your object under a light source to find them.
- In ivory longitudinal cracking is relatively regular.
- Walrus ivory (Fig. 2) has an irregular, oval cross-section with a longitudinal groove down one side. Its core fills with secondary dentine ('whorled' ivory).
- Sperm (and other) Whale teeth also often exhibit whorls embedded in the ivory: sometimes singly and sometimes in clusters (Fig. 3).
- Hippo incisor ivory is often deeply ridged on the exterior– something not seen in elephant ivory.

Fig. 2. Walrus Tusk (labelled 'Pair Young Elephant tusks') (Image © Leeds Museum)

Fig. 3. Section through Sperm Whale tooth showing 'whorled' ivory. (Image © Leeds Museum)

Identification of keratinous materials:

- Many types of keratinous materials have been used to create objects – rhino horn, cattle horn, whale baleen, anteater claw (Fig. 4), turtle shells etc.
- Cow horn exhibits a finely layered 'cone within cone' structure. Each cone is minutely corrugated longitudinally.
- Many keratinous objects will show delamination where the layers of keratin are splitting (Fig. 5). However, you can get objects made of compressed horn powder which, obviously, will not show this.
- Baleen often looks corrugated like horn but is also ridged across the grain (Fig. 6 and Fig. 7). Baleen is often referred to as whalebone but it is not whale bone.
- Tortoishell is constructed of uncorrugated keratin formed on bone plates.
- Horn is often died to look like tortoishell.
- Rhino horn is made of tubules of keratin and has no lamella or radial element.

Fig. 4. Giant Anteater (?) claws. (Image © Leeds Museum)

Fig. 5. Detail of a baleen busk showing beginning of delamination. (Image © Leeds Museum)

Fig. 6. Baleen busk showing ridged structure. (Image © Leeds Museum)

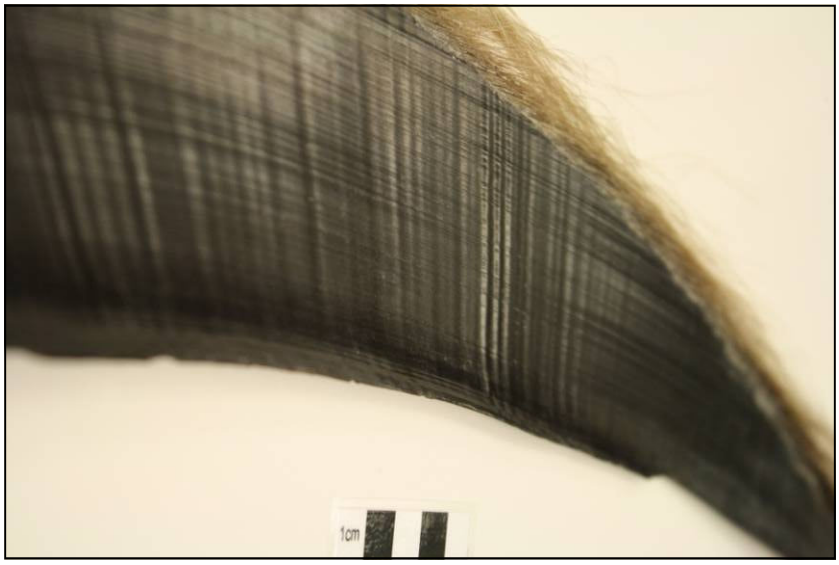

Fig. 7. Unworked baleen showing ridged structure. (Image © Leeds Museum)

Everyone agreed that the day had gone well and I have had several requests to re-run the workshop. Dr. O'Connor will be working on the collections at Leeds Museums and Galleries and at other museums over the coming months as part of her postdoctoral project "Cultural Objects worked in Skeletal Hard Tissues". One of the main objectives of this work is to "develop protocols for the confident identification of raw materials, worked and decayed, whilst minimising or negating the need for curatorially-unacceptable destructive sampling" – an ambition I think we would all be interested in seeing coming to fruition.

Acknowledgements
I would like to thank Sonia O'Connor for delivering the training and looking over this article and Tony Irwin for managing all the bookings and finances for NatSCA. If anyone has any ideas for further NatSCA workshops please let the committee know. All the objects featured in the photographs are from Leeds Museums and Galleries' collection.

Dodos and Partnership: A Celebration of Publication and Exhibition at Kendal Museum

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Abstract

This article tells the story of Kendall Museum working in partnership with Kendal College. The project, initiated to illustrate the taxidermy collections during a time of adversity, has now resulted in publication, educational programmes and a new permanent display illustrating the unique natural history heritage held with the Museums' collections.

Founded in 1796, Kendal Museum's fascinating collections include archaeology, history, geology and natural history from around the globe. Following a programme of conservation and cataloguing in 2008, grant funded by Renaissance North West, the Taxidermy collection was once again revealed as being a magnificent irreplaceable collection of Victorian taxidermy, of world wide importance (Fig. 1) and worthy of publication. As Curator of Natural History I felt that in uncertain times it was essential to record and illustrate the collection, to prove at a glance that here, in the Town Museum, was something truly worth saving and looking after.

In 2008 I was delighted to host the U.K. Guild of Taxidermists conference at Kendal Museum. This served to bring together some of the leading taxidermists working today and to enable members to examine unparalleled examples of the work of known Victorian taxidermists, held in the Museum collection. It was at this

Fig. 1. Kendal's world class collection in the news.

conference that I first came across the work of the British Historical Taxidermy Society (BHTS), founded in 2004 by Martin Dunne and now firmly established as the leading organisation concerned with British historical taxidermy. The BHTS works closely with collectors, museums, local authorities, authors, schools, researchers and the media not only to advise, preserve and record historical taxidermy but to promote this often under-appreciated subject. The BHTS made a repeat visit in May 2008 and a working partnership was formed with the aim of publishing an accessible book to illustrate the Taxidermy to the general public. Guided by their expertise in historical taxidermy, each case was checked, cleaned and photographed.

After 2 years work Kendal Museum was delighted to host the book launch of the first publication of the BHTS in conjunction with the Museum as a pictorial record of the taxidermy collection. (Fig. 2). This book features photographs of many exquisite and exceptional pieces of taxidermy, including a number of rare and extinct specimens, most of which have not been on display. The book includes examples of the work of H. Murray & Son, Rowland Ward, Peter Spicer, Charles Kirk and Edward Gerrard among others. The launch of this book coincided with the new partnership of Kendal Museum with Kendal College, which began in April 2009, one of a number of partnerships between the College and South Lakeland District Council aimed at rejuvenating the Museum. David Bellamy was our special guest; he first discovered Kendal Museum when he made his first visits to the Lake District, and it has remained a firm favorite with him ever since (Fig. 3).

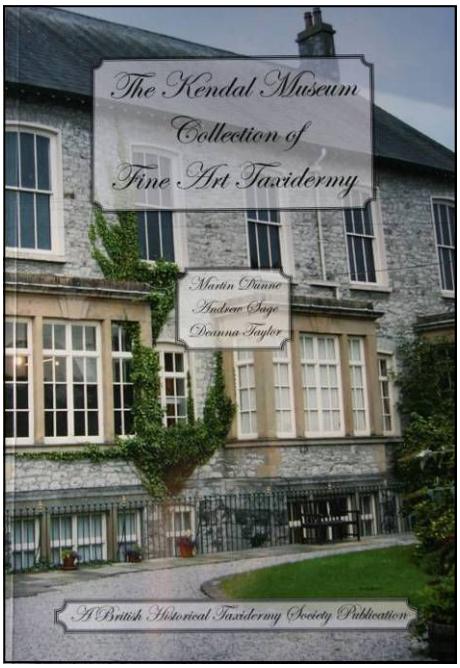

Fig. 2. The cover of the first book: The Kendal Museum Collection of Fine Art Taxidermy.

Fig. 3. Launching the first book with David Bellamy.

During this research into the collection it became apparent that Kendal Museum houses a unique collection of the taxidermy of Henry Murray & Son who lived and worked in Carnforth, near Kendal, arguably the finest in the U.K. and a real jewel in the history of Kendal Town. We decided to publish a second, more detailed book on this collection. Another period of intense photography followed (Figs. 4-5) and six months later, a second volume was published, illustrating the superb quality of the work by H. Murray & Son (Fig. 6). The book also included a fascinating historical introduction to Kendal Museum, which puts into context the collection as it exists today.

Fig. 4. Choosing Murray Cases in the Natural History Store during July 2009.

Fig. 5. Photography of the Murray cases in the Natural History Store during July 2009.

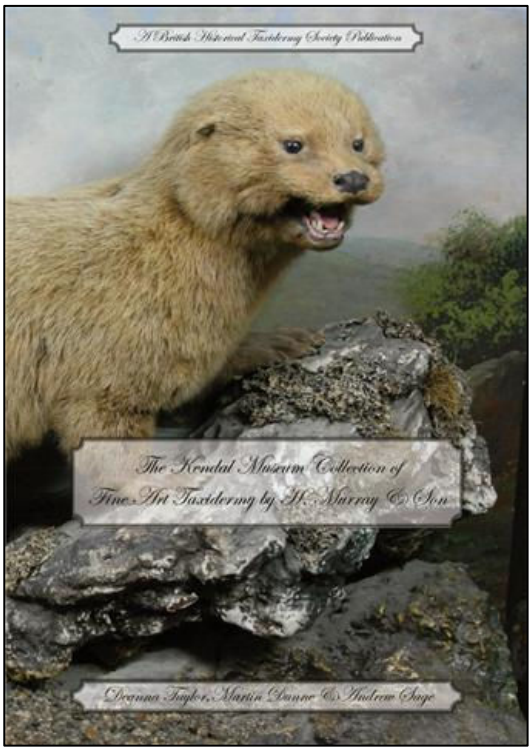

Fig. 6. The cover of the second book: The Kendal Museum Collection of Fine Art Taxidermy by H. Murray & Son.

Fig. 7. Press release photo for the second book. From left to right: Deanna Taylor, BHTS; Graham Wilkinson, Principal of Kendal College; Carol Davies, Curator of Natural History, Kendal Museum; Andrew Sage, BHTS; Martin Dunne, Chairman BHTS; Carl Church, creator of the Dodo model.

The second book was launched at Kendal museum on Oct 23rd 2009 – The event was attended by taxidermists and local natural history and wildlife enthusiasts, as well as local dignitaries and residents. Kendal Museum was delighted to welcome the researchers from the BHTS who had compiled the book over a period of 3 years (Fig. 7). Pat Morris gave a highly entertaining illustration of the changing attitudes to taxidermy and Carl Church, leading bird taxidermist, brought a Dodo model! To capitalise on the publicity of the project, BHTS prepared a series of post cards for sale at the Museum (Fig. 8).

Fig. 8. An example from a series of post cards produced by the BHTS for sale at the Museum.

The Dodo rather stole the show and Kendal College with foresight bought it for the Museum thus generating the next project, WHO'S NEXT, a new education program at Kendal Museum generously supported by Renaissance North west. The recently acquired Dodo will form the iconic centerpiece of a new gallery display featuring extinct and endangered species represented in the magnificent collections (Fig. 9) (see Fig. 11 overleaf for image of panel of extinct and endangered birds and animals in Kendal Museum). To support this display there are a number of educational projects, ranging from Key Stage 1 through to college students in training and education. The Dodo was also featured on a promotional T-shirt available for sale in the Museum's shop (Fig. 10).

Fig. 9. Display during preparation, February 2011

Fig. 10. The museum shop merchandise, including the Dodo T-shirt!

EXTINCT AND ENDANGERED ANIMALS AND BIRDS REPRESENTED IN KENDAL MUSEUM COLLECTIONS

COMMON NAME	SCIENTIFIC NAME	REGIONS OF ORIGIN	RED DATA LIST STATUS	POPULATION STATUS
		Birds		
Huia	*Heteralocha acutirostris*	New Zealand	EXTINCT	Last seen 1907
Eskimo Curlew	*Numenius borealis*	Canada and Alaska	POSSIBLY EXTINCT	Last seen 1980
Black Stilt	*Himantopus novaezelandiae*	New Zealand	CRITICALLY ENDANGERED	c25 adults
Kakapo	*Strigops habroptilus*	New Zealand	CRITICALLY ENDANGERED	124 in 2009
Ivory-billed Woodpecker	*Campephilus principalis*	Cuba	CRITICALLY ENDANGERED	No recent sightings
Red-breasted Goose	*Branta ruficollis*	Siberia	ENDANGERED	37,000
Nahan's Francolin	*Francolinus nahani*	Congo and Uganda	ENDANGERED	Under 100,000
North Island Kokako	*Calaeas wilsonii*	New Zealand	ENDANGERED	Fewer than 1,000
Gouldian Finch	*Erythrura gouldiae*	Australia	ENDANGERED	2,000-10,000
Southern Cassowary	*Casuarius casuarius*	Indonesia	VULNERABLE	Decreasing
Fjordland Penguin	*Eudyptes pachyrhynchus*	New Zealand	VULNERABLE	A few hundred, declining
Spanish Imperial Eagle	*Aquila adalberti*	Spain	VULNERABLE	c120 pairs, increasing
Black Sicklebill	*Epimachus fastuosus*	New Guinea	VULNERABLE	Unknown, declining
Rufous-necked Hornbill	*Aceros nipalensis*	Bhutan and indo-China	VULNERABLE	Rapidly declining
		Mammals		
Tasmanian Wolf	*Thylacinus cynocephalus*	Tasmania	EXTINCT	Last seen 1936
Black & white Ruffed Lemur	*Varecia variegata*	Madagascar	CRITICALLY ENDANGERED	Decreasing
Lowland Gorilla	*Gorilla gorilla*	West Africa	CRITICALLY ENDANGERED	Decreasing
Black Rhinoceros	*Diceros bicornis*	Southern Africa	CRITICALLY ENDANGERED	Under 2,000
Tiger	*Panthera tigris*	Asia	ENDANGERED	Decreasing
Bornean Orangutan	*Pongo pygmaeus*	Indonesia and Malaysia	ENDANGERED	Decreasing
Tasmanian Devil	*Sarcophilus harrisii*	Tasmania	ENDANGERED	Decreasing
African Wild Dog	*Lycaon pictus*	Africa	ENDANGERED	3,000 – 5,500
Walia Ibex	*Capra walie*	Ethiopia	ENDANGERED	c500, increasing
Markhor	*Capra falconeri*	Pakistan, Afganistan	ENDANGERED	Decreasing
Nile Lechwe	*Kobus megaceros*	Sudan	ENDANGERED	c4,000 decreasing
Eld's Deer	*Rucervus eldii*	Indo-china	ENDANGERED	Decreasing
Indian Buffalo	*Bubalus arnee*	Far East	ENDANGERED	Decreasing
Common Chimpanzee	*Pan troglodytes*	Africa	ENDANGERED	Decreasing
Proboscis Monkey	*Nasalis larvatus*	Indonesia and Malaysia	ENDANGERED	Decreasing
Chinese Pangolin	*Manis pentadactyla*	South East Asia	ENDANGERED	Decreasing
Polar Bear	*Ursus maritimu*	The Arctic	VULNERABLE	20,000 – 25,000
Mandrill Baboon	*Mandrillus sphinx*	West Africa	VULNERABLE	Unknown
Hairy Babirusa	*Babyrousa babyrussa*	Indonesia	VULNERABLE	Decreasing
Red Panda	*Ailurus fulgens*	Asia	VULNERABLE	Decreasing
Himalayan Black Bear	*Ursus thibetanus*	Asia	VULNERABLE	Decreasing
Nubian Ibex	*Capra nubiana*	Middle East	VULNERABLE	Decreasing
Indian Rhinoceros	*Rhinoceros unicornis*	India and Nepal	VULNERABLE	Increasing
Swamp Deer	*Rucervus duvaucelii*	India and Nepal	VULNERABLE	Decreasing
Indian Bison	*Bos gaurus*	Asia	VULNERABLE	Decreasing
Clarke's Gazelle	*Ammodorcas clarkei*	East Africa	VULNERABLE	A few thousand
Dorcas Gazelle	*Gazella dorcas*	North Africa	VULNERABLE	Decreasing
Red-fronted Gazelle	*Eudorcas rufifrons*	Central Africa	VULNERABLE	2,5000 decreasing
Soemmerring's Gazelle	*Nanger soemmerringii*	East Africa	VULNERABLE	c6,000 decreasing
Common Hippopotamus	*Hippopotamus amphibius*	Africa	VULNERABLE	Decreasing
Sambar	*Rusa unicolor*	South East Asia	VULNERABLE	Decreasing
African Elephant	*Loxodonta africana*	Africa	VULNERABLE	Increasing
Banded Civit	*Hemigalus derbyanus*	Indonesia and Malaysia	VULNERABLE	Decreasing
Southern Pig-tailed Macaque	*Macaca nemestrina*	Indonesia and Malaysia	VULNERABLE	Decreasing
Sooty Mangabey	*Cercocebus atys*	West Africa	VULNERABLE	Decreasing

INFORMATION FROM IUCN RED DATA LIST 2010

Fig. 11. Display panel of extinct and endangered birds and animals in Kendal Museum.

This is a story of working in partnership; this project, initiated to illustrate the taxidermy collections during a time of adversity, has now resulted in publication, educational programmes and a new permanent display illustrating the unique and priceless natural history heritage held with the Museum collection. It is not finished – a third volume is to be published by the BHTS in conjunction with Kendal Museum and will illustrate the trophy head collection. It is to be launched this year, 2011, and I have a few more ideas yet!

Acknowledgements
The BHTS who, through the generosity of their time, expertise and resources have enabled a lasting record of the taxidermy collections at Kendal museum; Renaissance North West for grant-funding conservation work and the Dodo WHO'S NEXT project at Kendal museum; the dedicated team of volunteers at Kendal museum who have worked on these projects for several years; Kendal College who from 1 April 2009 have managed Kendal Museum as part of a ten-year partnership agreement with South Lakeland District Council; and all our other supporters.

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Pyrite Decay: cause and effect, prevention and cure.

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Abstract

Pyrite (FeS_2) is a common mineral found in igneous, sedimentary and metamorphic rocks; it may be present in petrology, mineral and palaeontological collections. Pyrite decay, or pyrite oxidation, has been recorded since the 19th century and various methods have been devised over the years to prevent or 'cure' it with varying degrees of success. Methods of identifying pyrite decay in collections are discussed along with potential problems this can cause to the specimens and associated labels. Up to date prevention methods are discussed, including microclimates, controlled environments, collections surveys and resin coatings. Modern techniques of 'curing' pyrite are discussed in detail, including ammonium gas treatment and Ethanolamine Thioglycollate treatment.

Introduction

Exactly ten years ago the Natural Sciences Conservation Group provided a day-long seminar about pyrite decay at the Natural History Museum in London, consisting of talks and demonstrations. It might be useful to repeat this event or something similar every five or ten years as there will always be some people new to the profession to whom the issue is a mystery, and some who would like a refresher - particularly as the subject has a long history of confusion over the exact nature of the processes involved. An example of a late 19th century response to pyrite decay describes how "the preparators mistakenly believed that the Pyrite disease was caused by an unknown germ and developed a method to counteract its effects... The bones were soaked in a mixture of alcohol, arsenic and shellac.... The alcohol was able to penetrate the bones, carrying the arsenic (supposed to kill the mysterious "germ" causing the problem), and the shellac successfully hardened the weaker parts" (Spalding, 1993).

Shinya and Bergwall (2007) recently provided a concise summary of what pyrite is, how it decays and (briefly) how specimens may be treated, but their PDF poster included only some of the practical ways of preventing - or at least reducing the likelihood of - pyrite decay. Some other important preventive measures are described below, along with relevant notes about the nature of pyrite and how it decays.

What is pyrite?

Pyrite (FeS_2), also known as 'fools gold', is a common mineral found in sedimentary, metamorphic, and igneous rocks. It grows in crystalline forms, typically cubic or octahedral. The crystal can be several centimetres in diameter for well-grown cubes, or microcrystalline (Howie, 1992). It can occur either compact, well crystallized and stable or porous, microcrystalline, often impure and very unstable. Marcasite (FeS_2) is a dimorph of pyrite that primarily occurs in sedimentary rocks. It is not as commonly found as pyrite but it too can be unstable and susceptible to oxidation (Rixon, 1976; Cornish, 1987; Shinya & Bergwall, 2007).

Mineral and palaeontological specimens that consist almost wholly of pyrite are easily identified as such, as they look and feel 'metallic'. It is much less easy to identify those specimens that contain a relatively small amount of pyrite (where it is finely disseminated through the specimen), or in which the pyrite has developed only within the inner pore spaces of what was once bone, for example.

How does pyrite 'decay'?

Pyrite oxidation (also known as pyrite 'disease', pyrite 'rot' and pyrite 'decay') is caused and accelerated by the presence of oxygen and water, even in relative humidities (RH) as low as 60%. Only a few days exposure to an inappropriate humidity may be enough for the decay process to be triggered in some specimens (for more information on the factors controlling the rate of pyrite decay, see Newman (1998)).

When oxidation of pyrite is triggered, the following chemical process happens over time:

$$(4FeS_2 + 13O_2 + 2H_2O) >> (4FeSO_4 + 2H_2SO_4 + 2SO_2)$$

(pyrite, oxygen, water) >> (ferrous sulphate, sulphuric acid, sulphur dioxide)

It appears that some pyrite oxidation may be caused by or be related to the bacteria *Thiobacillus ferrooxidans* (Temple & Colmer, 1951) and *Thiobacillus sp* (Beijerinck, 1904) - reclassified recently as *Acidithiobacillus ferrooxidans* and *Acidithiobacillus* respectively (Kelly and Wood, 2000). However, this interaction typically occurs above 95% humidity (Howie, 1992; Buttler, 1994) and therefore should not be an issue in most museum collections. The bacteria may be merely opportunistic, or possibly just catalytic, arriving after the reaction has started (Leiggi & May, 1994).

A specimen suffering from pyrite oxidation is often easily identified. Usually it will have lost some surface shine, the surface will develop a crust of white and/or yellow crystals (Figs. 1 & 2), it will begin to smell sulphurous and it may show signs of cracking. Associated labels may exhibit 'scorch marks' (Fig 3). The exact nature of the by-products of the oxidation process will depend on the mineral composition of the fossil and matrix associated with the oxidizing pyrite or marcasite, but are generally sulphuric acid and various hydrated sulphates (e.g., ferrous sulphate, copiapite, fibroferrite or melanterite) (Wang et. al., 1992; Shinya & Bergwall, 2007). Although the symptoms of advanced pyrite oxidation can look terrible at first and specimens can be completely destroyed, it is often the case that careful cleaning and appropriate remedial treatment may save a specimen. The ammonite in Figure 2 looks like it has to be thrown away, but after careful cleaning with a brush followed by some consolidation and gluing it is still a useable specimen (Fig. 3).

Fig. 1. A card tray (approximately 140 mm long) of small fossilised Jurassic ammonites, preserved partly in pyrite. Many have suffered from pyrite oxidation, as evidenced by the mass of grey and yellow powder covering most of the specimens.

Fig. 2. A small fossilised Jurassic ammonite (approximately 40 mm diameter), preserved partly in pyrite. It has suffered from pyrite oxidation, as evidenced by the mass of grey powder covering it. This dry sulphuric acid or hydrated sulphate has damaged both the specimen and the label, leaving both much weaker and friable. The label states that the specimen has been treated before for pyrite decay, but no details were noted on the label and the specimen has continued to deteriorate – possibly because the storage conditions did not change if the specimen was returned to the same place after treatment. This shows the importance of improving the storage conditions for a specimen after cleaning and/or treatment (i.e. by lowering the RH).

Quite apart from being unsightly and potentially a health hazard the dry, powdery, sulphuric acid and/or hydrated sulphates can be quite deleterious for a specimen. If not seen and dealt with in a timely fashion not only can the whole fossil be destroyed but also the accompanying labels or cards identifying the specimen that has been lost. The storage media – card trays, wooden boxes *etc* – can also be destroyed in the process, including the base of a wooden drawer and even the specimens in a drawer beneath. This is one of the reasons people used to think it was a 'disease' that could spread. In all these instances the sulphuric acid is attacking the cellulose present in the paper, card or wood.

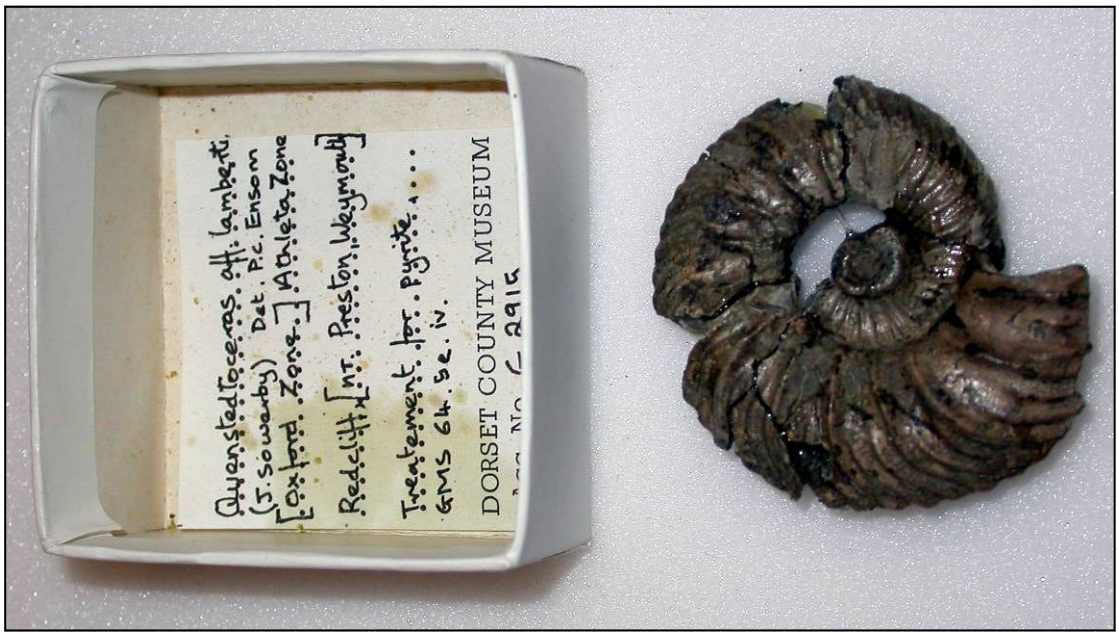

Fig. 3. The same ammonite as in Figure 2 after cleaning and repair.

Importantly, as well as being corrosive the oxidation product is several times the volume of the original mineral. Because pyrite is often present deep inside a specimen the resulting crystal growth and expansion can cause the specimen to fracture (Fig. 4), crumble, and slowly shatter - sometimes catastrophically. Framed and glazed specimens on display that have succumbed to pyrite decay have been known to expand so much that the specimen has pressed against the (non-safety) glazing and forced it to bow outwards. If not detected in time, this could lead to a violent shattering of the glass in a public exhibition space (Cornish *et al*., 1995; Rajan, 1995).

Fig. 4. A fragment (approximately 60 mm across) of a nodule of radiating pyrite after significant pyrite decay. There are two symptoms of pyrite decay in evidence: the white crystalline powder on the internal face to the right of the image, and the deep cracks in the external surface of the specimen, on the left of the image, where sections of the external surface have pulled away from one another as the specimen has expanded.

Another reason that the oxidation process was thought to be a disease was because in collections arranged stratigraphically or geographically, many fossils from the same site or area would be stored together. These would naturally often contain roughly the same amount and type of pyrite so that when the environmental conditions were right, the oxidation of the pyrite in several specimens would begin more or less around the same time. The cabinets would be opened many months or years later to reveal dozens of specimens decaying beneath corrosive yellow and gray powder.

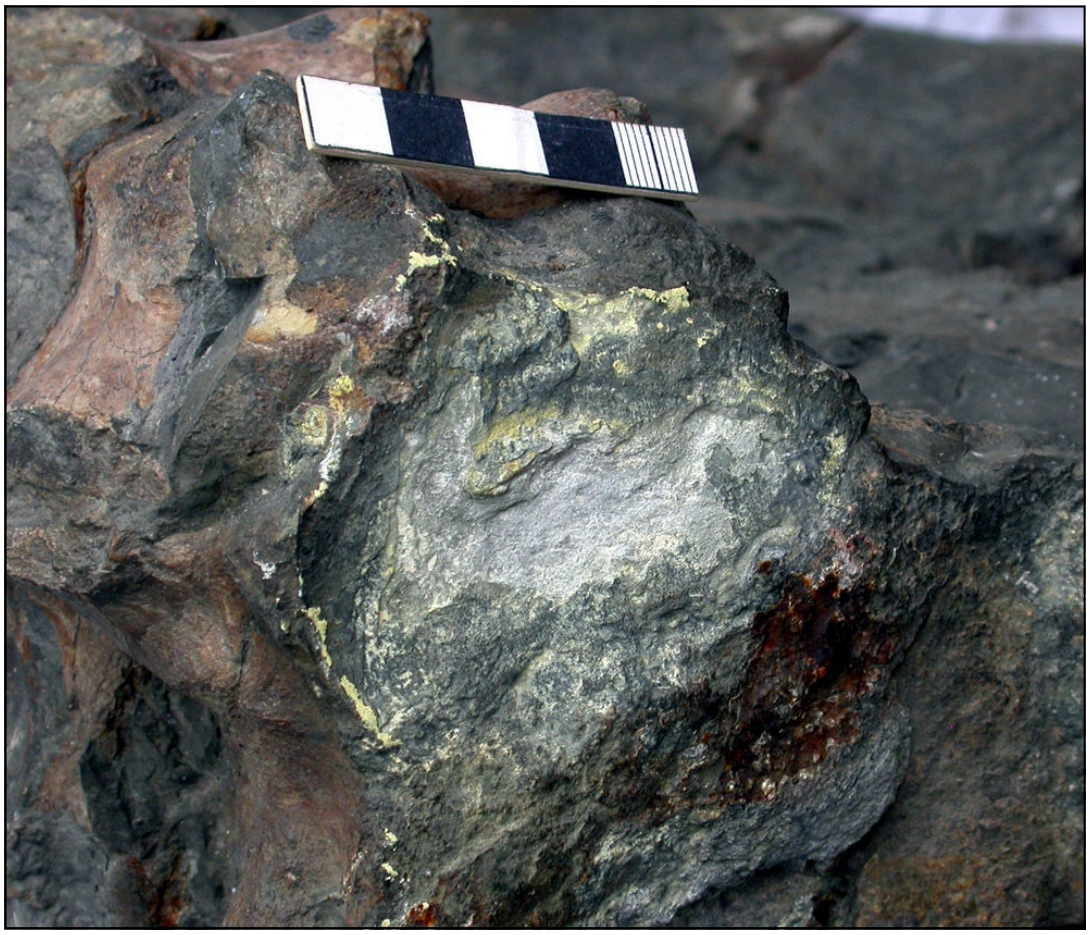

Fig. 5. Pyrite oxidation on the surface of a break in a large pliosaur vertebra. The by-products can be seen in the centre of the picture as a greyish mass in the middle and a yellow crust in the centre and around the edges of the affected area. The scale bar is 50 mm long.

Testing for pyrite oxidation

Pyrite oxidation, especially in the early stages, is not always obvious (Fig 5), so any yellowish or grey powdery crust should be investigated. If a specimen is suspected to be suffering from pyrite oxidation but the outwards signs are minimal, two simple tests can be applied. One is to press Universal Indicator paper moistened with distilled water against the area of a specimen thought to be affected. This will confirm whether the pH is less than, more than or equal to 3, and therefore if it is acidic (indicating by-products of pyrite decay are present) or not (Cornish & Doyle, 1984; Andrew, 1999). The other test is to moisten a small area of a specimen with little ammonium hydroxide. On drying, this will turn brick red if the by-products of pyrite oxidation are present (Rixon, 1976).

Pyrite affecting Labels

The paper specimen label in Figure 3 has been 'burnt' by the by-products of decay. It is not just discolouration, the paper affected can become extremely fragile and friable and corrodes away eventually if the powder is not removed. Such a label is still acidic and should be replaced. To remove the acidic products from pyrite decay, labels should be treated (see below) or washed in water (Stooshnov & Buttler, 2001) and kept stored in a polyester sleeve.

Prevention: climates and microclimates

The damage that pyrite oxidation inflicts on a specimen is irreversible. Therefore although the by-products can be dealt with and the oxidation process arrested and neutralized (see below), it is better by far to prevent the oxidation of pyrite in the first place. Moisture and oxygen are the two factors leading to pyrite decay.

Completely eliminating both can be achieved, but at great cost and inconvenience so a compromise inevitably has to be reached. Maintaining a low enough humidity in a storage area will either prevent the oxidation of the pyrite being triggered, or it will slow down the reaction if it is already underway. RH should preferably be about 30%, but more realistically 45% should be aimed for and certainly always less than 60% (Howie, 1992*)*. Unfortunately, although the environment of some stores may be perfectly controllable, many stores are not so easily controlled and other types of material may be present that require higher levels of RH to maintain their own integrity and stability.

If the RH of a storage environment is not easily controlled and if specific specimens in that area are known to be susceptible to pyrite oxidation, many specimens can easily be housed permanently within the collection in individual suitable storage media to provide appropriate microclimates. They can be sealed within laminate films that exclude moisture and oxygen (even whole cupboards can be sealed this way), or in desiccation chambers made of Perspex or similar material. Oxygen scavengers can be placed within these media for further protection. A cheaper and easier alternative for many specimens is to use a suitable lidded polyethylene or polypropylene container (they are usually impervious to moisture and oxygen), with a desiccant placed inside along with the specimen(s). Desiccants work either by absorption or adsorption of atmospheric humidity. The most common types of desiccants are silica gel, a molecular sieve or preconditioned Artsorb (a moisture-sensitive silica material providing over five times the moisture buffering capacity of regular density silica gel). The ensuing RH of the sealed microclimate can be monitored with a colour-changing card also placed within the container. Usefully large lidded polypropylene containers are available (for instance 'Stewart Boxes' up to 320 mm x 320 mm wide by 160 mm deep), but the quality of the container is of paramount importance as it's seal must close effectively (Larkin *et al*, 1998). Also, it is important to take their lids off immediately if they are bought with the lids attached, so that the volatile organic compounds from the manufacturing process can off-gas rather than be trapped (Larkin *et al*, 2000).

Prevention: maintaining buildings

Much effort can be expended attempting to control RH within a storage area with dehumidifiers *etc* but this is for nothing if the building housing the geology collection is not maintained properly: gutters, downpipes and storm drains should be checked regularly, especially during and after building work. It may take only one incident to trigger the process of oxidation. Two specific examples follow.

Kate Andrew (1999) reported that the severe pyrite decay affecting the large marine reptiles on display at Whitby Museum was due to several problems caused by poor building maintenance. These related to guttering and down pipes, and also leaking skylights. The symptoms of this inadequate maintenance included saturated walls, algal growth on exterior walls and salt efflorescence on interior walls. In one display case a completely dissolved and re-crystallized specimen of sylvite provided independent evidence that relative humidity in that case had reached over 85%. Thermohygrograph charts from the previous winter had recorded relative humidity rising to 76% in the gallery. The roof rainwater collecting system was found to be blocked by, amongst other items, dead birds, a football and a training shoe. Monitoring of the moisture content of the wall suggested that rising damp may also have been a problem.

At the Natural History Museum in London a collection of over a hundred Jurassic marine reptile skeletons are on permanent display on the wall of a long gallery leading to the Palaeontology Department. Many of these specimens are important historically and/or scientifically, including several specimens collected by Mary Anning. Unfortunately, during building work in the early 1990s the rainwater drainage system behind the wall was damaged and to make matters worse this was not realized for some time. A three-year conservation project ensued to remedially conserve, neutralize and clean dozens of specimens (some very large) that had suffered from pyrite oxidation as a result (Cornish *et al* 1995; Rajan, 1995).

Prevention: collection surveys

Time and money spent trying to reduce the RH levels in a collections area to lower the chances of pyritic specimens oxidizing is wasted if there is no material susceptible or if there is only a small amount of pyritic material that could easily be stored in appropriate media with a more controlled microclimate. The trick is to know which specimens, if any, in a collection should be isolated and stored in a controlled low RH microclimate. There are two approaches, and both should be applied. Firstly, there is some information in published literature as to what specimens have deteriorated badly in the past, and from which stratigraphic horizons and/or geographical localities. For instance, fossils from the Lias, Gault and London Clay are prone to the problem (Rixon, 1976), including ammonites and marine reptiles from the Liassic strata of Dorset. Specimens in mineral collections are of course at risk as well, including pyrite, chalcopyrite and marcasite.

Secondly, undertaking a manual (rather than desktop) survey of a collection to identify high risk areas is worthwhile. An experienced person would know which sub-collections to prioritise, but ideally every single drawer, box or cabinet in a geology collection would be given a visual inspection to locate pyrite-rich specimens and check if there are any pyrite issues currently requiring remedial measures. A list of specimens 'at risk' could then be created and ideally these specimens would be checked every year or so. For larger collections, a rolling programme of checking one section of the collection each year in turn may be more practical.

Prevention: resin coatings

Applied directly to a specimen, consolidants and varnishes *etc* were once used to prevent air from coming in contact with the specimen's surface. Unfortunately, such coatings varied greatly and are mostly not impermeable to air and humidity (Cornish & Doyle, 1984). Some resins can provide some limited buffering by decreasing a specimen's natural porosity (Costagliola *et al*, 1997) and in that way slightly reduce their ability to be affected by moisture. However, treatment in this manner adulterates a specimen and ultimately will be detrimental to further analytical or conservation processes and is not recommended considering the possible beneficial effects are only slight (Buttler, 1994).

Moulding and casting

If important specimens (e.g. type and/or figured) are considered to be susceptible to pyrite decay, it is worth making good quality moulds of them to produce replicas in case the originals are damaged by pyrite oxidation in the future. Good quality rubber or latex should be used, and the cast should be made soon after moulding as the rubber or latex mould will degrade over time. Ideally, both the mould and cast should be accessioned and labelled. Interestingly, natural latex rubber contains ammonia as a preservative so its use as a moulding material can have the added benefit of neutralizing to some extent any sulphuric acid and ferrous sulphate present. Although not tested in a controlled scientific experiment, it has been reported that this method was successful in halting the oxidation process in some specimens (Shinya & Bergwall, 2007).

Cure

Once it has started the oxidation process cannot be reversed but there are two reliable ways to treat specimens to neutralise the sulphuric acid and remove the by-products. Both are a little technical and require some equipment and chemicals. The following descriptions of these processes are only summaries (after Shinya & Bergwall, 2007) and the relevant references should be consulted for detailed instructions and health and safety guidelines.

Cure: Ammonium gas treatment

Ammonium gas has been successfully used to neutralize sulphuric acid in specimens affected by pyrite decay (Bannister, 1933; Bannister and Sweet, 1943; Rixon, 1976; Birker and Kaylor, 1986; Howie, 1992; Waller, 1987; Andrew, 1999). Specimens are suspended above a solution of ammonium hydroxide and enclosed by polyethylene or glass to contain the gas created by evaporation. The RH above the solution can reach 70% unless mixed with polyethylene glycol (PEG) in a 10% (volume to weight) solution. This will provide a RH of about 30%. Because porous pyrite will absorb water vapour (resulting in further oxidation) it is important that the ammonium solution be made with a non-aqueous solvent.

Method:

1. Make 10% volume to weight solution of ammonium hydroxide in polyethylene glycol (PEG).
2. Place a plastic coated metal rack over the solution and place specimen on top.
3. Cover the apparatus with polyethylene or glass to treat the specimen with ammonium vapour.
4. Treatment is complete when white or yellowish patches on specimen change to rust coloured stains.
5. Clean the specimen with alcohol and thoroughly dry.

This technique is particularly useful for neutralising small specimens, very friable specimens and specimen labels that have been affected by pyrite decay. Unfortunately, it is a very difficult procedure to apply to large specimens or those still on display that are attached to a wall, especially if in a public area. However, it is not impossible. Andrew (1999) describes using this technique on large specimens in a geology gallery with the rest of the museum still open to the public, utilising a temporary conservation lab with walls made of heavy duty polyethylene sheeting fixed with wooden batons. Local extraction was achieved using a Nederman fan and trunking to vent outside via a window or under-floor vent. However, in such cases health and safety regulations may now pose significant problems as ammonia is both toxic and flammable.

Cure: Ethanolamine Thioglycollate treatment

Ethanolamine thioglycollate both neutralizes sulphuric acid and removes oxidation by-products, perhaps more effectively than ammonium gas treatment. Ethanolamine thioglycollate is an alkaline liquid that is soluble in both ethanol and isopropanol, hence the specimen being treated will not be exposed to water. Before treatment as much of the by-products of oxidation should be removed as possible with soft brushes or an airabrasive unit, to expose the specimen surface (Cornish and Doyle, 1984; Cornish, 1987).

Method 1: Immersion in solution

1. Make a 2% to 5% ethanolamine thioglycollate solution in ethanol or isopropanol.
2. Immerse the specimen in solution for between one and four hours. Change the solution when it becomes a dark violet colour, otherwise brown insoluble precipitation will stain the specimen.
3. Wash specimen with alcohol.
4. Repeat the process until the solution no longer changes its colour when specimen is immersed.

There are some problems with this method. Old consolidants and glues *etc* will probably be dissolved by the solution which would risk a consolidated or glued specimen falling apart. It is not a very useful method for large specimens or those remaining on display, especially large marine reptiles attached to a gallery wall**.** Also, specimens can remain stained, labels will be stained and some old iron-based inks may dissolve, both those applied to labels and those applied directly to the specimen. It is therefore wise to photograph all specimens and labels before treatment.

Method 2: **Paste application**

1. Make a 3% to 5% ethanolamine thioglycollate solution in ethanol or isopropanol.
2. Mix equal amounts (1:1 ratio) of the solution and sepiolite (magnesium silicate).
3. Apply the paste to the affected area and cover it with polythene or aluminium foil to prevent rapid evaporation.
4. Leave specimen covered for between 1- and 3 hours.
5. Clean and wash the specimen or treated area with alcohol.

Although not as fully effective as the immersion technique above, the paste is useful for friable specimens that would disintegrate with immersion (though for very friable specimens the ammonia gas treatment would be better). The paste application is also useful for specimens that have been heavily consolidated previously. It is also useful for specimens too large to immerse and for specimens on display, particularly for those mounted vertically on a wall (Andrew, 1999).

It is important to remember that although all these treatments will arrest the pyrite decay and neutralise its deleterious effects, the treated specimen will remain susceptible to further oxidation. Indeed, further decay is likely if the specimen is returned to the same storage environment in which the oxidation process was triggered rather than stored permanently in a manner that will provide an appropriate regime of relative humidity.

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A New Practical Method for Profiling and Topping Up Alcohol Preserved Entomology Collections

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Abstract

Key aspects of recent research into topping up entomology spirit collections are summarised. A new method of profiling alcohol preserved collections is presented and its use as a diagnostic tool is discussed. A novel tool is also presented as a reference table for calculating the concentration of topping up alcohol, which allows the regulation of preservative alcohol concentration within close limits. The method can be used for remedial and routine topping up and can be adapted to the needs of different collections.

Introduction

The first line of defence against evaporation of fluid preservatives must always be the best storage jar affordable; however, all storage jars allow at least some evaporation and will need a regular schedule of inspection, maintenance and topping up.

In order to facilitate these processes a new method of profiling alcohol preserved collections is has been developed which takes into account the volume of preservative present, and its use as a diagnostic tool is discussed. A new approach is taken to topping up which allows the desired concentration to be achieved while taking into account any variation in starting concentrations and volumes. The new topping up method has a number of key features. By analogy with the control of temperature and humidity for purposes of conservation, potentially damaging fluctuations, both in alcohol concentration and in volume, are managed much more closely. Greater weight is given to the volume of preservative present than previous methods for a number of reasons: to prevent the specimen becoming exposed; because it provides an indicator of low alcohol concentration; because low volumes may be an indication of a faulty seal; and because it is important in calculating the correct concentration for topping up. A novel tool is presented, a reference table for calculation of the concentration of topping up alcohol to be added, which makes the method applicable to large collections. The table gives speed and convenience priority over accuracy; however, because of the use of precise monitoring, the results are still accurate within close limits.

A general approach is developed which can be applied to many alcohol preserved collections. The methods proposed are designed for use with collections in modern storage jars, or where replacement and standardisation of jars is possible. The term Alcohol is used here to include ethanol and also mixed alcohols such as industrial methylated spirit (IMS). Alcohol concentration was measured using the Anton Paar DMA 35N digital alcohol meter. This meter was used on the '%ALC/V' setting, which gives a measurement of the equivalent concentration of an ethanol/water mixture in % by volume at 20˚C derived from density at the measuring temperature (Anton Paar, 2000). For best results the environmental conditions within a store should be managed closely, although the method can be adapted to some extent for the different conditions in stores. It is not the purpose of this paper to consider the initial preservation of specimens, and it is assumed that specimens are preserved and equilibrated with their preserving fluid.

The paper is written from experience of working with the large and varied collection of entomological and other terrestrial arthropods preserved in IMS at the Natural History Museum, London. It follows the approach of not discarding alcohol where possible to reduce leaching, and may not be suitable for collections containing fatty material, especially large vertebrates, where replacement of alcohol may be desirable to counter acidification from the decomposition of fats. Only key results of practical value are given here; a full account, including more detailed references and acknowledgments is published in *Collection Forum* (Notton, 2010).

The aims of topping up

The aims of topping up are:

- Firstly to keep the specimen covered with preservative, so: a) it does not dry out, b) it is physically supported, and c) evaporation does not lead to the deposition of salts and other solutes on the exposed portion of the specimen.
- Secondly to maintain the correct concentration of alcohol for preservation. For insects this is generally considered to be 70-80% for general preservation. Lower concentrations can cause distortion of the specimen by absorption of water and autolysis. 50-80% is recommended by Waller and Strang (1996) as the range with the best antiseptic properties, below 50% growth of bacteria and mould become increasingly likely. Higher concentrations can cause tissue distortion and embrittlement.
- Thirdly to keep fluctuations in concentration limited within acceptable boundaries, by analogy with other methods of environmental control. Osmotic pressure increases particularly rapidly for concentrations above 80%, but also rises steadily between concentrations of 0-75%, suggesting that large changes in concentration during topping up should be avoided as a precaution against osmotic stress which may distort the specimen (Waller & Strang, 1996).

Collection profiles – taking account of volume as well as concentration helps to diagnose problems with topping up procedures

Before starting to top up a large collection it is advisable to make a profile of the collection, to find if the aims of topping up are being met. Previous collection profiles have presented concentration as a frequency histogram (Cato, 1990; Pickering, 1997); while this is useful, it records no information about the volume of preservative present. A new method was used instead, plotting concentration of alcohol against the volume of preservative (as a proportion of the jar filled). This also allowed the profile of volumes and any interaction between concentration and volume to be assessed, e.g., if the preservative is more dilute than expected from its volume. A 'target area' of acceptable concentration and volume can be superimposed on the graph and the proportion of the collection in the target area counted and used as an indicator of 'collection health'. An example graph (Fig. 1) made in 2007 shows that: a) topping up has not been applied consistently; b) many jars were not adequately filled; c) many jars were at the wrong concentration. Clearly there was a problem with topping up, as an alcohol meter has been available to all staff since 2002. Many jars were less concentrated than might be expected for their volume. In all probability they were topped up with understrength alcohol (probably 80%) which is known to reduce concentration over time.

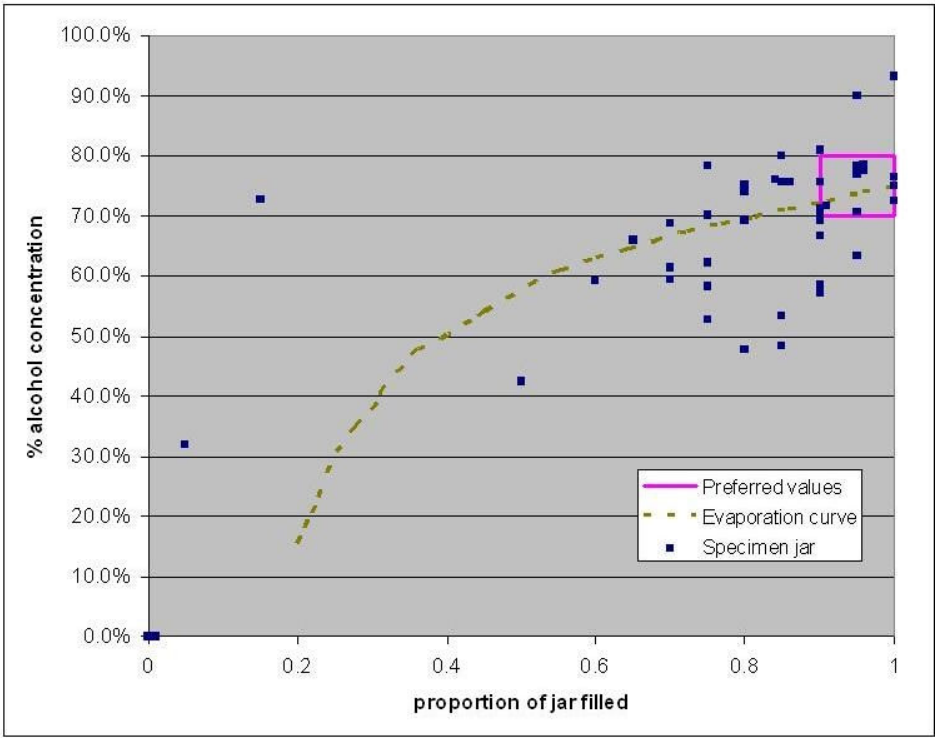


Fig. 1. Profile of Entomology Department alcohol preserved collection, August 2007. Each square represents data for a jar in the collection.

A new & convenient topping up table

Because of the different treatments and conditions that specimen jars may have undergone, different concentrations of topping up alcohol may need to be added to restore them to the desired concentration and volume. A new table was developed to allow this (Fig. 2, overleaf).

The method of using the table is shown simplified in Fig. 3. Read the concentration of the alcohol in the jar using the meter and estimate the proportion of the jar filled with alcohol. On the table read across from the nearest concentration and down from the nearest proportion; where these intersect, the value in the box gives the concentration of alcohol to top up with. Occasionally the alcohol will be too dilute to return it to the desired concentration, and the point of intersection on the table has no value. In this case read left from the point of intersection until there is a box with a value in (arrows). Read up from this box to find the proportion of alcohol, and discard alcohol until this proportion is reached, then top up with 96%.

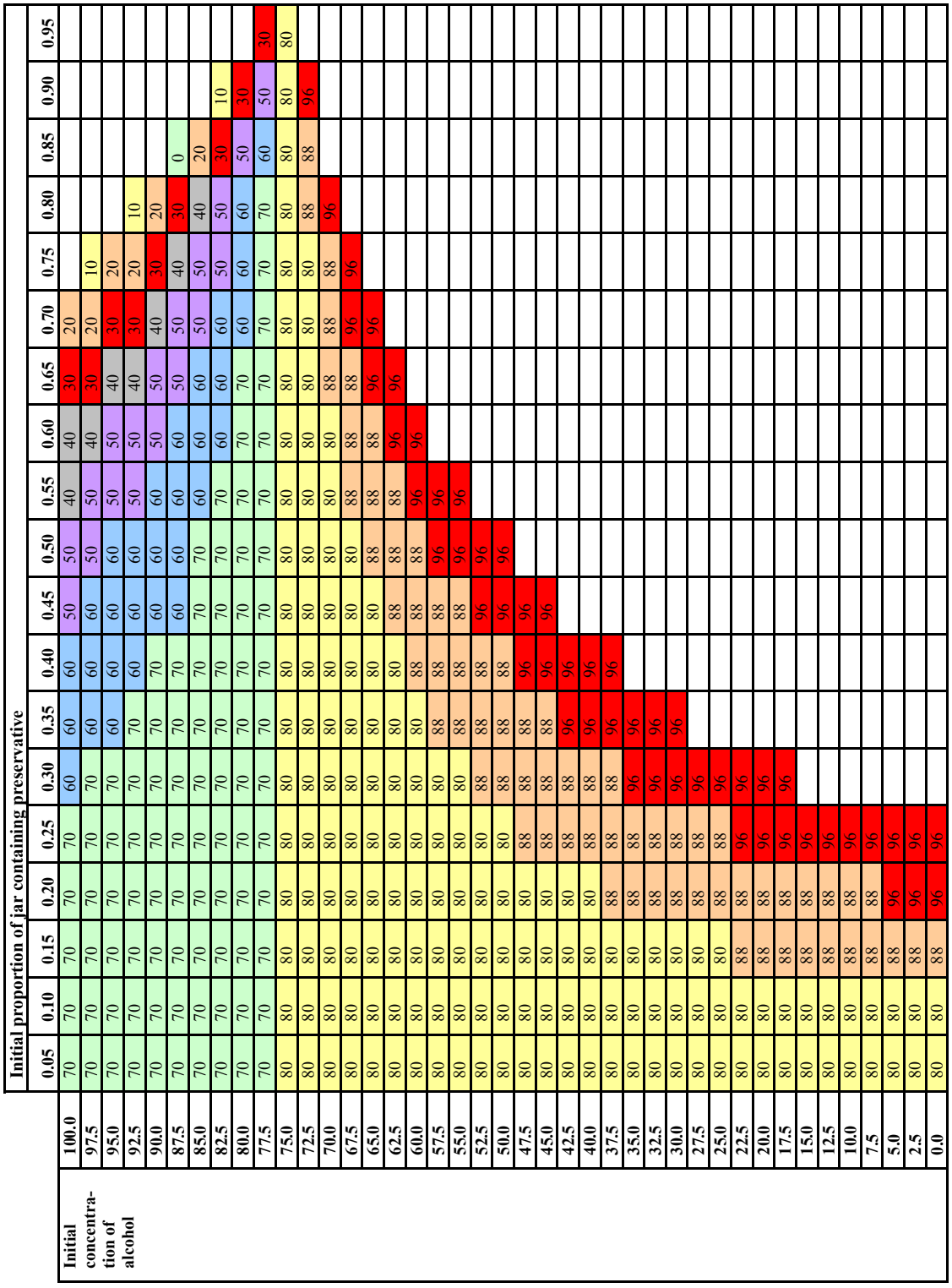
Some general protocols are provided below (Fig. 4) for: a) preparing for topping up; b) remedial topping up for neglected collections; and c) routine topping up for collections which have been regularly topped up.

		Proportion of jar filled				
		0.65	**0.70**	**0.75**	**0.80**	**0.85**
Initial concentration of alcohol	**72.5**	80	80	80	88	88
	70.0	88	88	88	96	
	67.5	88	96	96		
	65.0	96	96			
	62.5	96				

Fig. 3. Illustration of how to find the concentration of alcohol to top up with to get the desired concentration using table 2.

		Proportion of jar filled							
		0.50	**0.55**	**0.60**	**0.65**	**0.70**	**0.75**	**0.80**	**0.85**
Initial concentration of alcohol	**65.0**	88	88	88	96	96			
	62.5	88	88	96	96				
	60.0	88	96	96	←	←	←		
	57.5	96	96						

Fig. 4. Illustration of how to find the concentration of alcohol to top up with in situations where the alcohol is so weak that it cannot be brought to the desired concentration by the addition of 96% alcohol.



Initial concentration of alcohol	Initial proportion of jar containing preservative																			
	0.05	0.10	0.15	0.20	0.25	0.30	0.35	0.40	0.45	0.50	0.55	0.60	0.65	0.70	0.75	0.80	0.85	0.90	0.95
100.0	70	70	70	70	70	60	60	60	50	50	40	40	30	20					
97.5	70	70	70	70	70	70	60	60	60	50	50	40	30	20	10				
95.0	70	70	70	70	70	70	60	60	60	60	50	50	40	30	20				
92.5	70	70	70	70	70	70	70	60	60	60	50	50	40	30	20	10			
90.0	70	70	70	70	70	70	70	70	60	60	60	50	50	40	30	20	0		
87.5	70	70	70	70	70	70	70	70	70	70	60	60	60	50	50	40	20		
85.0	70	70	70	70	70	70	70	70	70	70	70	60	60	60	50	50	30	10	
82.5	70	70	70	70	70	70	70	70	70	70	70	70	70	60	60	60	50	30	
80.0	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	60	50	30
77.5	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	80	80	80	80
75.0	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	96	
72.5	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	88	88		
70.0	80	80	80	80	80	80	80	80	80	80	80	80	88	88	88	96			
67.5	80	80	80	80	80	80	80	80	80	80	88	88	88	96	96				
65.0	80	80	80	80	80	80	80	80	80	88	88	88	96	96					
62.5	80	80	80	80	80	80	80	80	88	88	88	96	96						
60.0	80	80	80	80	80	80	80	88	88	88	96	96							
57.5	80	80	80	80	80	80	88	88	88	96	96								
55.0	80	80	80	80	80	80	88	88	88	96	96								
52.5	80	80	80	80	80	88	88	88	96	96									
50.0	80	80	80	80	80	88	88	88	96	96									
47.5	80	80	80	80	88	88	88	96	96										
45.0	80	80	80	80	88	88	88	96	96										
42.5	80	80	80	80	88	88	96	96											
40.0	80	80	80	80	88	88	96	96											
37.5	80	80	80	88	88	88	96	96											
35.0	80	80	80	88	88	96	96												
32.5	80	80	80	88	88	96	96												
30.0	80	80	80	88	88	96	96												
27.5	80	80	80	88	88	96													
25.0	80	80	80	88	88	96													
22.5	80	80	88	88	96	96													
20.0	80	80	88	88	96	96													
17.5	80	80	88	88	96	96													
15.0	80	80	88	88	96														
12.5	80	80	88	88	96														
10.0	80	80	88	88	96														
7.5	80	80	88	88	96														
5.0	80	80	88	96	96														
2.5	80	80	88	96	96														
0.0	80	80	88	96	96														

Fig. 2. Table for calculating the concentration of topping up alcohol needed to return preservative concentration to 75% alcohol.

Preliminary considerations

Before undertaking any topping up:

a) Undertake the health and safety risk assessments for using alcohol based preservatives and obtain appropriate personal protective equipment
b) Decide the concentration of alcohol to store your particular specimens in and the allowed range of fluctuation around this value. For the Darwin Centre store in the NHM this was set at 75 +/- 5 volume % standardised to 20ºC. Decide the volume at which to top up your specimens. This should be based on the normal rate of evaporation for the store (e.g. see the evaporation curve in fig. 1) giving a margin for error before the concentration drops below the acceptable lower limit (b above), and giving a margin for error before any specimens are exposed. For the Darwin Centre store, this was set at 0.9 of the volume.
c) Decide how often to inspect and top up if needed, work out evaporation rates from different kinds of storage jars, both effective and defective. This should be based on how long it takes the worst kind of jar to reduce the volume of preservative to the volume at which to top up (c above). For the Darwin Centre store, past experience suggests annual losses in the region of c.1% volume in jars with an effective seal and 5-10% in those with a defective seal, with some variation depending on jar and seal type – i.e. inspections must be annual at least.
d) Obtain a digital density meter which automatically converts readings to volume % standardised to 20ºC, such as the Anton Paar DMA 35N or equivalent (Anton Paar, 2000).
e) Calculate a topping up table similar to table 2 based on the formula and method described above, and the desired concentration (b above), print it out, preferably in colour, and seal it in a plastic pouch so it will be alcohol resistant.
f) If it is difficult to estimate proportions of the volume (e.g. some designs of jar which taper slightly) make a graduated dipstick for this kind of jar marked off in tenths.
g) Obtain, or make up, verify and clearly label the concentrations of the stock solutions of alcohol.
h) The protocols below may need to be modified, to allow a larger head space in cases where there is a risk of seal breakage from high vapour pressure, for susceptible jar types in stores with sudden temperature fluctuations.
i) Ideally protocols should include the monitoring of pH, however measuring the pH of alcohol solutions is difficult and is best dealt with elsewhere.

Remedial topping up

This is recommended if starting with a neglected collection, or one at the wrong concentration:

a) Make a profile of a proportion of the collection as described above, selecting systematically across the collection, to represent all parts of the collection; this should help estimate the amount of time and materials required and any special problems.
b) Check every jar in turn.
c) Check the jar is not defective and if so, replace it.
d) Check each jar is tall enough so that evaporation between inspections will not leave any specimen exposed; if this is likely, transfer the specimen to a larger jar.
e) Check the concentration of alcohol and the proportion of the jar filled with preservative - do not assume full jars will be at the correct concentration.
f) Calculate the concentration of the alcohol to add using the topping up table.
g) Fill up the jar with alcohol; jars should consistently be filled to the top (leaving c. 10 mm head space to avoid contact between alcohol and the seal), this allows subsequent visual detection of evaporation easier; if a large change of concentration (more than 5%) is needed top up in stages to reduce osmotic stress
h) Make a final check of the concentration, and adjust if needed.
i) Make a record.
j) If specimens are completely dried out, do not try to rehydrate them without good reason. They are usually stable when dry and rehydration will probably cause more damage – leave a note in the jar saying ‘found dehydrated on such and such a date’, and store at humidity and temperature levels appropriate for dried tissue samples (i.e. not necessarily in a spirit store).
k) Jars with very high concentrations may have been preserved for DNA work, if so, clarify the purpose of preservation, and if they need to be kept at high concentration, label them clearly, and preferably transfer them to low temperature storage.

Routine topping up

This is recommended for collections which have recently undergone remedial topping up to the right concentration and volume. Every fourth or fifth time, a complete check is recommended as for remedial topping up:

- Set your timetable for inspection (preliminary d) and stick to it.
- Top up all jars where volume is less than the volume decided above (preliminary c).
- For each jar topped up check to see if seal is defective and jar or seal needs replacing.
- For specimens known or suspected to be at risk of acidification, replace the preservative completely.
- Check the concentration of the alcohol and the proportion of the jar filled with preservative.
- Calculate the concentration of the alcohol to add using the topping up table (once the collection has been stabilised by remedial topping up this should be straightforward as there should be relatively little variation in concentrations and volumes, and the table can be used to provide rules for common situations, e.g. for the Darwin Centre store, if volume reduced by about 10%: top up with 96% if concentration < 73.75%; top up with 88% if concentration > 73.75%).
- Fill up the jar with preservative; jars should consistently be filled to the top (leaving c. 10 mm head space to avoid contact between alcohol and the seal), this allows subsequent visual detection of evaporation easier.
- Check the topped up jars, so the correct concentration is reached.

Final thoughts

Do not underestimate the human factor – topping up can be tedious and stores are often cold, dull and away from regular places of work. Persist to get topping up seen as a priority, and check that it has been done correctly. The use of clear reasoned protocols should help staff appreciate the problems and implement improved collection care, because the benefits will be clearly seen.

Acknowledgements

Gavin Broad, Claire Valentine and Paul Brown; Andries van Dam and Simon Moore for a helpful reviews and discussion; NatSCA for a bursary and the opportunity to present this at the Newcastle Conference.

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Conservation of Insect Specimens Affected by Verdigris

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Abstract

The problem of verdigris growth in entomological collections is well known. This paper suggests various methods for treatment, including the use of a controlled electric current machine designed and constructed at the Natural History Museum, London.

Introduction

This paper is the product of a demonstration at the Annual NatSCA conference held at the Great North Museum: Hancock, Newcastle upon Tyne, on 2-3 March 2011. A literature search showed that there is little published information on the conservation of insect specimens affected by verdigris. Various expertise held within the Natural History Museum (NHM) was brought together to produce an assessment of the options and curatorial practices available for treating verdigris affected specimens. This paper focuses on the treatment of Lepidoptera (butterflies and moths) and Coleoptera (beetles) however, these treatments could be applied to other insect orders at the conservator's discretion.

What is verdigris?

According to the English Oxford Dictionary 1989, the name verdigris originates from the Old French word *vert-de-Grèce* (c. 1170), literally 'green of Greece', since it was used by Greek artists as a pigment for painting and other artistic crafting. Entomological verdigris however is a waxy green substance which forms at the contact between an insect specimen and its pin, probably as a reaction between the breakdown products of lipids from the insect body with copper and other reactive metals in the pin. Other corrosion products form with ferrous pins and at the point where brass or ferrous pins are inserted into cork drawer linings. The compositions of these substances are unknown to the authors but given the different chemical environment of entomological collections are not necessarily the same as the traditional fine art verdigris pigments.

Verdigris and dry insect specimens

When mounting insect specimens (either pinning or gluing the specimen to a pinned card) good quality stainless steel pins are essential as they are generally resistant to the known degenerative factors in entomological collections (recommended suppliers can be found at the end of the paper). Non-stainless steel pins corrode with time. Moreover if the pin is made of brass or any other alloy containing copper, verdigris can appear following complex chemical reactions between the chemical elements of the pins and the organic compounds in the insect body or in the cork or wood of the drawer. Older pins (pre-1920s) are sometimes made from carbon steel which means they may produce rust (for removing specimens from rusted pins follow the same process as described below).

Verdigris and other kinds of pin corrosion are still a serious problem in entomology collections in many Museums which hold old specimens. The use of stainless steel pins for insect mounting is a relatively recent practice, and in the past many insect specimens were mounted with pins made of nickel-plated brass, or non -stainless steel pins. This has caused and continues to cause verdigris where brass pins are in contact with insects, rusting of non-stainless steel pins and the formation of various minerals where the pin is in contact with the cork drawer lining (Figs 1-3). Pins corroded or 'trapped' by cork in old cork-based entomology drawers are a common problem encountered by entomology curators and should be treated with care. These problems are long term; however in modern collections where relative humidity and temperature are controlled and stable, the deterioration of pins is considerably retarded. The Natural History Museum's dry invertebrate collections are ideally kept in environmental conditions between 45-55 RH & 16-20°C.

Fig. 1. Unidentified mineral formation on a non-stainless steel pin (for the purpose of the photo, the specimen was removed from the original cork-based drawer).

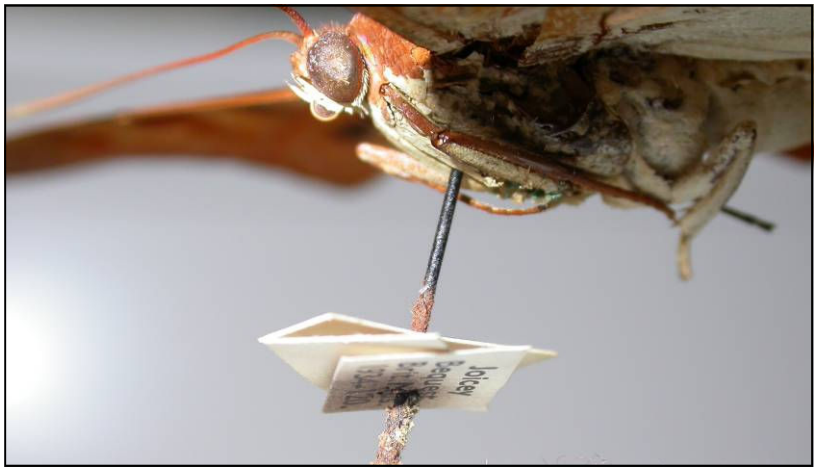

Fig. 2. Unidentified mineral formation on a non-stainless steel pin.

Fig. 3. Rust formation on non-stainless steel pins.

Lepidoptera and verdigris

In Lepidoptera, the species whose larvae are plant stem-borers, and those which don't feed as adults, appear particularly at risk of developing verdigris (Fig. 4). The degree of damage varies depending on the environmental conditions where the specimens are kept. If left to develop, verdigris can seriously damage a specimen; in severe cases the verdigris can develop to the point of being the only thing holding the specimen together (Fig. 5); when the pin eventually breaks, the specimen can fall apart, and in many cases is rendered irreparable (Fig. 6).

Fig. 4. Verdigris formation on a non-stainless steel pin and cross-pins around a castniid moth.

Fig. 5. A carpenter moth (Cossidae) severely affected by verdigris.

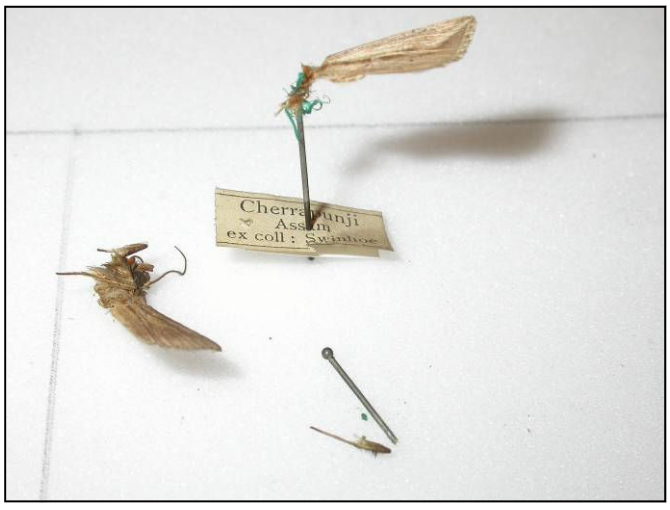

Fig. 6. Severely corroded pins can break, causing the specimen to fall apart.

For collections known to be in need of care

and maintenance, periodic inspections are advisable to evaluate the condition of the specimens. Pay particular attention to specimens housed in drawers with cork linings (Fig. 7-8). Specimens affected by verdigris can then be removed for an immediate or a future treatment; this depends on various factors, including the significance of the specimen (e.g. type specimens) the time available and the level of deterioration.

Fig. 7. Insect specimens housed in drawers with cork bases.

Fig. 8. Old entomology drawer with cork base.

When conservation of verdigris affected specimens is needed, the first conservation step is carefully to brush away the visible verdigris (using a fine soft brush) taking care not to detach any of the specimen's appendages. This is then followed by 'de-pinning' using a reliable and relatively simple method for removing the pin. By passing a low electric current through the pin, it will heat up just enough to soften the specimen's tissues where these have interacted with the brass core of the pin (see below). It is not advisable to 'relax' set Lepidoptera in order to de-pin them, as relaxation can damage a dry specimen further and cause DNA deterioration; besides this is a time consuming procedure given that one has to relax, re-pin and re-set each specimen.

SPECIMEN ASSESSMENT

Collections care

1. Is the specimen at immediate risk? If so, consider taking action as soon as practicable. For smaller entomological collections it may be possible to develop a spreadsheet of specimens at risk, assessed according to a scale of low to high priorities. (Fig. 9).
2. To comply with *SPECTRUM* documentation standards (Conservation & Collections Care http://

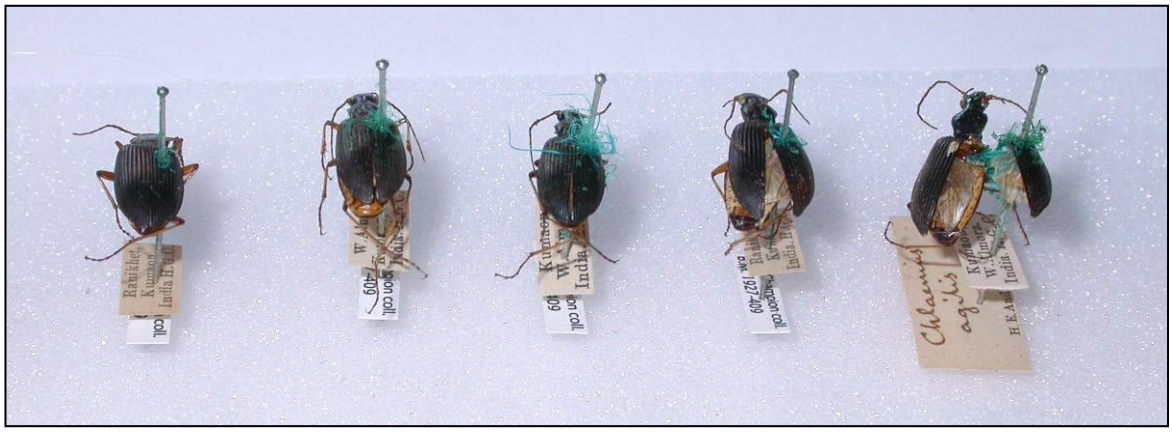

Fig. 9. Degrees of verdigris severity from left 1 – requires monitoring, to right 5 – requires immediate conservation.

www.collectionslink.org.uk/) it is recommended that conservation treatments are recorded on a database as a measure of collections enhancement as well as retaining relevant specimen level information. A specific time each year might be set aside to assess collections for verdigris.

3. For separate collections of historic or scientific value, consider carrying out a project to conserve the whole collection.

Assessment

Initial assessment of specimen:

1. How at risk of damage are the specimens or collection? Do they show the first signs of verdigris or is there the risk of complete disintegration of the specimen? Prioritise the work based on a risk factor: 1=low priority to 5=high priority (Fig. 9).
2. Pay particular attention to the non-stainless pins of carded specimens which need not be touching the specimen for verdigris to develop, because fats can seep from the body of the insect through the card, coming into contact with the pin (Fig. 10).
3. If a specimen is particularly fragile and positioned in a crowded or poorly curated drawer then it may be useful to remove some of the sound specimens around it to clear a 'way out' for your specimen (especially if it is likely to fall apart when moved).
4. Have a unit tray lined with high density expanded polyethylene foam (*Plastazote*) into which specimens may be pinned.
5. If specimens are moved from the original storage (drawer) indicate the location change with a data label and record specimen movement on a database (unless specimens are repaired immediately or one is working through an entire drawer). If there isn't time to take immediate action record the necessity for conservation on a database for future reference or mark the drawer or cabinet with a temporary label.
6. If the specimen is beyond repair and to attempt conservation would further damage it, then retain the pieces in a gelatine capsule, pinned through with the original data labels; or more preferably, glue component parts to a card in the general appearance of the original specimen (see dry method).
7. Add conservation data labels to repaired specimens for historical reference, particularly if the original pins are retained (and kept separately from the newly repaired specimen). This is particularly important for historical specimens where a new pin, while necessary, may appear incongruous.

N.B. Copper compounds can be poisonous and washing hands after dealing with verdigris is advisable.

Fig. 10. Verdigris creep resulting from lipids leached onto card mount, reaching the non-stainless steel pin base.

M E T H - ODS

The de-pinning machine

The de-pinning machine used at the NHM was designed and constructed many years ago, by Mr Deryck Jones, previously the Museum's electrical engineer. To our knowledge de-pinning machines of this kind are not available for purchase; however, with some electrical knowledge it would be possible to copy this design. The components of this specific de-pinning machine are: the electric element (rheostat) which is enclosed in a wooden box; a pair of forceps connected to the electric element and a small cylindrical metal post which completes the electric circuit via the pin; a switch found in the centre of the box regulates the amount of electrical current with two settings: high and low; the electrical current is turned on and off at the plug and indicated by a red light (Fig. 11). The de-pinning machine has successfully passed the recent (February 2011) portable appliance testing (PAT) and is consequently considered safe for use; however only trained curatorial staff is permitted to use the machine. The highest measure of electrical voltage and current that passes through the forceps connected to the electrical element is 7 V and 0.2 A respectively.

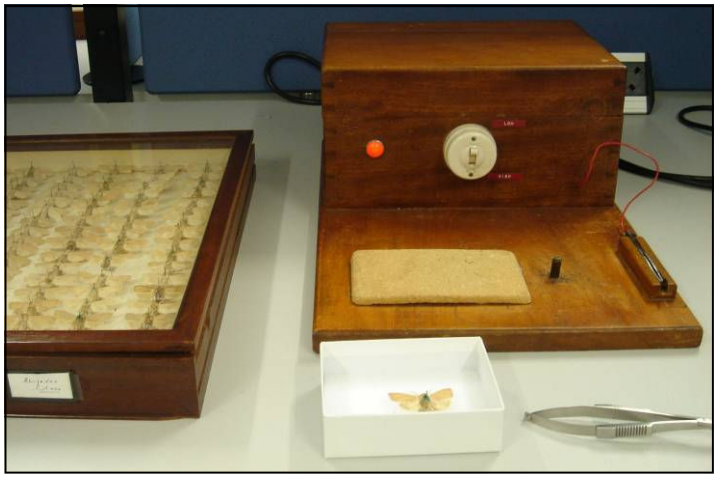

Fig. 11. The Natural History Museum de-pinning machine.

De-pinning a dry specimen is a relatively simple method but is dependant on the degree of deterioration of the specimen. The following procedure refers to lepidopteran specimens which have begun to show signs of verdigris development (Fig. 12).

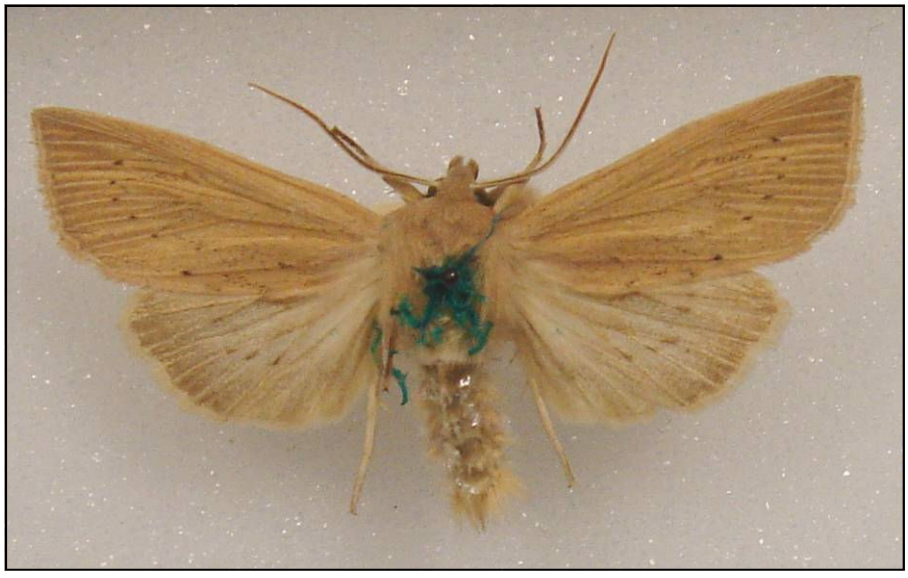

Fig. 12. Noctuid moth affected by verdigris. This specimen is about to be de-pinned.

1. Remove the labels from the specimen. With a fine brush carefully clean the verdigris from the specimen, taking care not to remove any scales or hairs (Fig. 13).

Fig. 13. Using a fine brush to carefully remove the verdigris from the specimen.

2. Using the forceps wired to the rheostat pick up the specimen and touch the point of the pin on the metal post (Fig. 14). The rheostat can regulate the amount of current passing through the pin; larger specimens may require a higher current whereas the lower setting is sufficient for smaller or more fragile specimens.

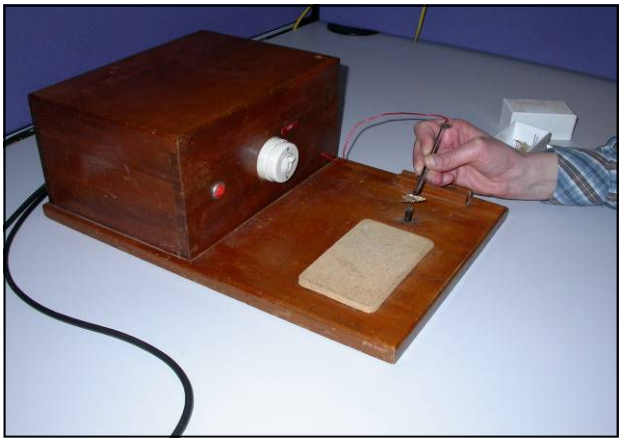

Fig. 14. Using the forceps to pick up the specimen and place the base of the pin onto the metal post.

3. Be aware that when the pin is in contact with the metal post some sparks may be seen at the contact between the pin and the post and smoke may come from the specimen where it touches the pin (due to heating of this part of the insect's body). This is a delicate process and the amount of heating should be regulated by closing and opening the electric circuit by alternately placing and withdrawing the pin from the metal post. There are reported cases of the specimen exploding at this stage, either because the electrical current may have been set too high or the pin was left too long in contact with the metal post. Gentle pressure should be applied to the specimen using fine forceps to test whether it is detaching from the pin. The specimen should slide down the pin after approximately 2-5 minutes depending on the specimen and degree of verdigris (Fig. 15).

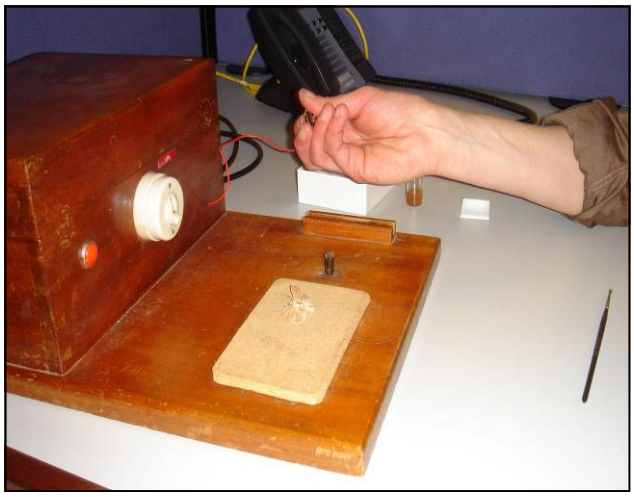

Fig. 15. Specimen successfully removed from the pin.

4. Place the de-pinned specimen into a unit tray lined with *Plastazote* and insert a new stainless steel pin into the existing hole. The pin should be a size or so bigger than the original to gain a secure grip between the specimen and the pin (Fig. 16). Avoid cleaning of the hole as this could further damage the specimen; moreover it is likely the hole is already rather large given that parts of the body are often corroded or displaced by the chemical reaction which formed the verdigris. Often it is necessary to place a drop of glue on the pin, underneath the specimen, to prevent it from slipping down. Once the specimen is re-pinned, replace its labels using a pinning stage and return to the drawer. Record the specimen conservation on a database.

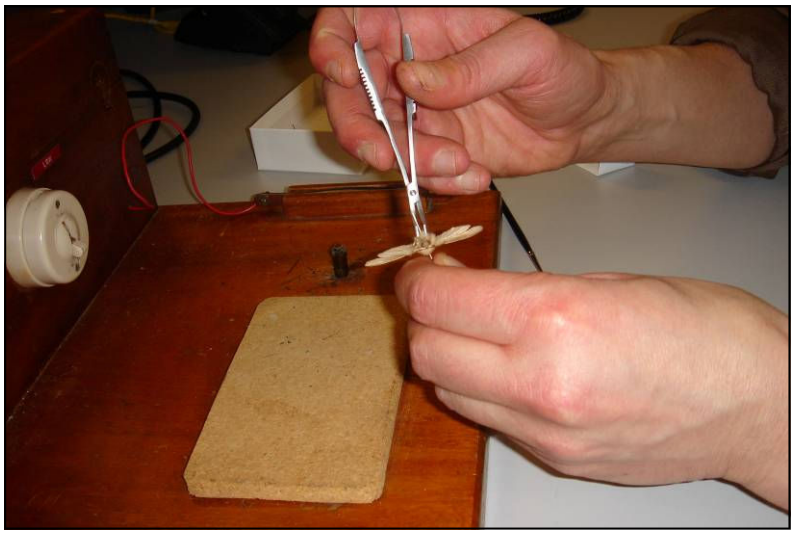

Fig. 16. Re-pinning the specimen with a stainless steel pin.

Wet method for pinned specimens (Not suitable for Lepidopteran specimens) (Fig. 17)

1. Following initial assessment remove the specimen from the drawer and place into a suitable receptacle. We recommend *Plastazote* lined unit trays.
2. Prepare a beaker of warm (c. 60-70°C) distilled water preferably using a hot-plate and *Pyrex* beaker.
3. Remove all data labels and retain in the original order for re-pinning later.
4. Pin the specimen to a cube of *Plastazote* and immerse it upside down in the beaker. The *Plastazote* acts as a float.
5. Check the specimen after a few minutes for any softening (the time will vary from specimen to specimen and from species to species). The softer bodied insects should be quicker (check after two minutes for progress using the technique described in the dry method).
6. Check the purchase of the specimen against the pin; if there is some looseness then the specimen should be carefully moved down the pin and placed onto absorbent tissue to mop up any excess moisture.
7. Assess whether re-pinning or carding is suitable once the specimen has been removed from its original pin. Some more delicate and softer bodied specimens such as Cantharidae (the Soldier beetles) are better carded even though they were originally pinned.
8. For re-pinning use a slightly thicker pin than the original pin to provide a better grip between the pin and the insect. If needed put a small drop of organic glue underneath between the pin and the insect for extra security.
9. For sticking the specimen to a card mount (if the specimen was originally pinned unsuitably) choose a card slightly bigger than the specimen and glue the specimen directly onto the card. Pin the card once the specimen is secure. If the specimen is not in a suitable position for gluing it must be relaxed. To do this, put the specimen in hot distilled water (up to 70°C) or a humidifying chamber with suitable antifungal chemical. The time taken depends on the age and size of the insect. Once the specimen is relaxed its appendages can be moved into a suitable position using a mounted needle and fine forceps.
10. When the specimen is dry and secure, re-pin the labels.

Fig. 17. Wet method of immersing a beetle in hot distilled water.

Dry method for pinned specimens

If the specimen is robust enough (e.g. scarab beetles such as chafers) it is possible to remove the pin and clean the specimen without immersing it in water.

1. Use a seeker or mounted needle along with a fine sable brush to carefully remove any verdigris.
2. Grasp the top of the pin with entomological forceps, carefully place fine forceps at the top of the specimen and push gently to see if the specimen will move down the pin. Carefully slide the specimen from its pin and gently remove the remaining verdigris from the specimen before re-pinning (this method is usually only suitable for the earliest stages of verdigris and for robust specimens). If the specimen cannot be removed this way, use the wet method above.
3. If the specimen has remained intact, re-pin it using a pin a size larger than the original (recommended insect pins come in many sizes, though 1-6 is preferred depending on the size of the specimen; source information can be found at the end of the paper). Replace data labels in the original order, using a pinning stage. It is best to keep the amount of pin holes in the labels to a minimum. If a label is too loose on the pin, then the hole can be closed up by turning the label over and rubbing the area immediately around the hole with a smooth polished metal object, such as the end of a pair of forceps.
4. If the specimen has broken into two or more pieces, where their orientation is certain, these can be glued together before re-pinning. If the specimen is in too many pieces to be consolidated, it can be glued to a card mount (maintaining the general habitus of the original specimen) or put in a gelatine capsule, retaining any data labels with the specimen.

Occasionally the pin will break inside the specimen. It is advisable to remove the remaining pin by pushing at it gently with another pin or mounted needle. At this stage it may be necessary to wet the specimen; this is particularly applicable to larger more chitinous specimens with very hard wing-cases.

For carded specimens

1. The brass pins of carded specimens can be subject to verdigris; the pin need not be touching the specimen for verdigris to develop, because fats can seep from the body of the insect through the card, coming into contact with the pin (Fig. 10). The resulting verdigris can damage the insect in the same manner as if it were pinned.

2. Remove the card from the pin with forceps and place the card on a *Plastazote* surface or pinning block (if suitable).
3. Clean away any remaining verdigris using a seeker needle and / or fine sable brush and re-pin the card using a suitable stainless steel pin, remembering to replace the data labels in the original order.

The pins of historic specimens and types should be retained as these can often tell us more about a collection.

Tools

- *Plastazote* for pinning specimens and as a float
- Watchmaker's forceps
- Spring-form forceps
- Fine blunt forceps
- Archival quality card for making data labels
- Water soluble glue such as *Seccotine* or PVA
- Stainless steel pins size 1-6 *Austerlitz* insect pins with nylon heads
- Unit trays lined with *Plastazote*
- *Excel* spreadsheet or database for recording conservation results
- Fine sable hair paintbrush
- *Pyrex* beaker, approx 250 ml capacity
- Distilled water
- Mounted needle
- Seeker needle
- Pinning block
- Bristol board or archival grade paper
- Pre-cut card mounts

Suppliers

- Entomoravia, http://entomoravia.eu/: *Austerlitz* insect pins size 1-6
- Entosphinx, http://www.entosphinx.cz/: General entomological supplies
- Druchema – Czech Republic, http://www.druchema.cz/cz/katalog/hobby/disperzni-lepidla/herkules-130g.html: *Erkules* Glue (water soluble)
- Watkins & Doncaster, http://www.watdon.co.uk: General entomological supplies
- Agar Scientific, http://www.agarscientific.com/catalogue/action_catalogue.asp?sat=2&saa=3: Gelatine capsules size 1-00
- Shepherds Falkiners archival supplies, http://store.falkiners.com/store/product/3563/Seccotine---150g/: *Seccotine* fish glue

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The Use of Collections for Biological Recording

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Abstract

Biological collections in regional museums have formed the bedrock of historic understanding of the environment, and were the basis for the development of biological recording as a discipline. Over the last 20 or more years, this relationship has tended to break down, with disastrous consequences for collections, and serious implications for the quality of biodiversity data. It is time everyone recognised the supportive roles of collections for biological recording and biodiversity data, and that collections managers and senior staff and policy makers responsible for museums worked towards gaining resources from outside to support these vital functions.

Background

Biological recording has become a major industry over the last 20 or more years, since the National Federation for Biological Recording (NFBR) was founded to promote it, in 1986. The reasons why the NFBR needed to come into existence stem from the perceptions by the then largely museum-based biological records operations, staffed often as a part-time Cinderella exercise alongside other more 'normal' museum curatorial work. Unfortunately without more formal recognition and support essential information about the natural environment was failing to be properly used.

The result has unfortunately been the almost-complete divorce of museum biology departments (if they still exist) from mainstream biological recording, firstly through the formation of stand-alone local records centres, and more recently through the development of complex biodiversity data systems, such as the National Biodiversity Network. While the infrastructure of recording has blossomed, relatively speaking, its roots in the scientifically-based world of collections have withered.

Some of the consequences of this can be seen in the often-repeated mantras of some of the less well-informed official users of biodiversity data:

- "Only records collected in the last 5 years are of any use"
- "We can only conserve what we know is still there"
- "We know all we need to know with a current NVC survey"

For those who understand the business of biological recording, and the need to support information with properly-researched data, collected with care, these kinds of statement are ludicrously unrealistic, and fail to fully comprehend the complexities of the natural world.

An example from the coal face

As an example, I will take my own experience of producing a '*Flora*' of my home county, Hertfordshire, published in 2009. What began as a 'project' under the auspices of the local museum service in 1987, this progressed for its first 3 years as a side-activity of the Museum Natural History Department, then staffed by two people. With cut-backs in 1990, my job moved from the Museum Service to the newly-established Local Records Centre, operated by the County Council (with a 'partnership'). The data being collected became mainstream information for the LRC to use, but the demands of supplying other data and information, managing existing and incoming data etc. meant that running a largely 'amateur' volunteer-based Flora Project was very much low priority, so that, gradually, support was withdrawn. At the same time the LRC, initially operated alongside the Museum (but not part of it managerially) later moved to administrative offices of the County Council. All direct links with the 30,000 herbarium specimens, library and laboratory facilities, microscopes etc. were severed. It became a totally volunteer-based exercise, luckily still resourced enough from private means to enable specimens to be verified and good quality literature to be accessible.

The '*Flora*' has enabled changes in the County's plant communities to be objectively assessed against an earlier survey. It has provided the LRC (and its users) with a baseline against which they can validate new data and make judgements about planning and land use decisions. But, while these are valued outputs (by some at least), who has any idea of the real needs for supporting the quality of the data it presents?

Just to re-cap what these 'resources' (to use the jargon) might include:

- Historic photographs (especially well-localised and documented ones depicting habitat detail).
- The baseline understanding of our vegetation gained from historic literature (earlier *floras*, reports of field meetings etc.), often not available outside good quality libraries maintained over long periods of time.
- Early (especially large-scale) maps, again only generally available from local studies offices or museums.
- Archives of field naturalists' notes and site lists, some of which may be very detailed indeed, and almost certainly not published anywhere. Hertfordshire is fortunate to have a good store of these.
- Not to mention herbaria, of course!

Using these astutely has led to 'discoveries' of supposedly 'lost' species, as anyone will recognise who has done their homework in this way. The mass of detail that can be sifted from these historical records also leads to an in-depth understanding of the nature of the ecology of a local area, because its species communities can be tracked over time.

The outputs from all this background work are then presented to users in what may appear to be pretty bald 'factoids': tables of 'lost' or 'declining' species for example, which aim to focus the mind of users on where the problems really lie, and which 'habitats' may be most threatened. These historic data, therefore, contrary to the 'received wisdom' of those who only believe in the here and now of data collection, have been vital for:

- identifying potential surviving localities (Fig. 1)
- providing a baseline against which changing populations can be measured
- understanding changes in the nature of natural communities
- understanding the impacts of our use of land
- documenting environmental shifts, e.g. climate change

Where do Museum collections fit in this?

Museum biologists know all this already, but the world out there doesn't. So, let us just go through the roles that museum natural science collections play in relation to biodiversity data and information at least. Quite apart from aesthetic, educative or intrinsic scientific importance (e.g. species types), most good natural science collections could carry out most if not all of the following functions:

- They contain original specimens, and can therefore confirm identifications.
- If taxonomy has changed since they were collected, we can confirm what they now are considered to be, thereby validating data.
- They can substantiate recorders' reputations for other records, which also acts as a source of data validation.
- They provide insights into taxonomic and scientific thinking at the time they were collected, which is a window on our understanding of the natural world and how this changes over time.
- If well-documented, they can provide greater detail on habitats and localities than published records, which are almost always, inevitably, a much-condensed piece of much larger quantities of information (Fig. 2).
- They can provide associated information that illuminates the nature of habitat, e.g. as a result of collection commentary
- They can provide chemical data on their source environment, either directly from the plant specimen, or from attached soil etc.
- Their DNA can be examined against modern samples, thereby giving a perspective on the stability or otherwise of populations over time.
- They are a cultural record of the natural science of their time, which has value for other disciplines beyond biodiversity, and which may be attractive for potential users we may not have thought about.

However, despite all this, natural history collections are under threat!

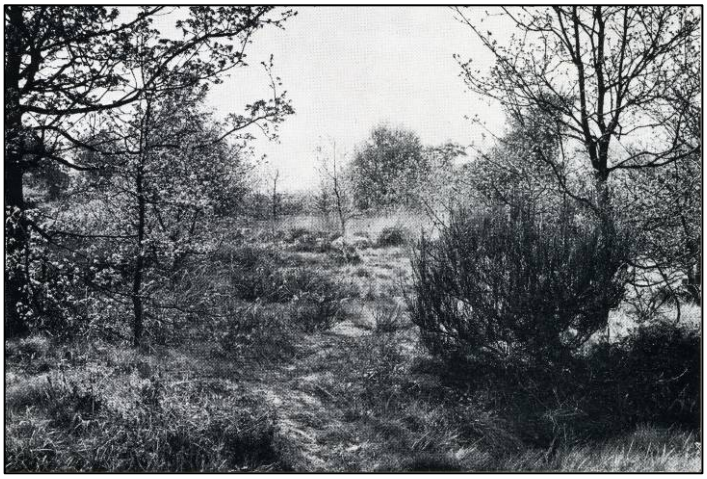
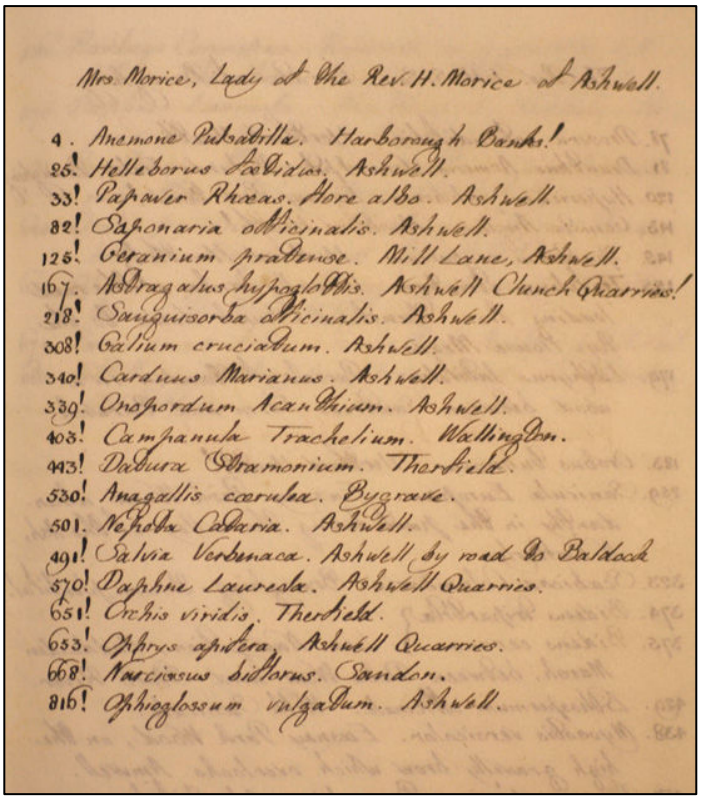


Fig. 1. Old photographs in collections can be a vital resource to highlight changing habitats.



Mrs. Morice, Lady of the Rev. H. Morice of Ashwell.

4. Anemone Pulsatilla. Harborough Banks!
25! Helleborus foetidus. Ashwell.
33! Papaver Rhoeas. flore albo. Ashwell.
82! Saponaria officinalis. Ashwell.
125! Geranium pratense. Mill Lane, Ashwell.
167. Astragalus hypoglottis. Ashwell Church Quarries!
218! Sanguisorba officinalis. Ashwell.
308! Galium cruciatum. Ashwell.
340! Carduus Marianus. Ashwell.
339! Onopordum Acanthium. Ashwell.
403! Campanula Trachelium. Wallington.
443! Datura Stramonium. Therfield.
530! Anagallis coerulea. Bygrave.
501. Nepeta Cataria. Ashwell.
491! Salvia Verbenaca. Ashwell by road to Baldock
570! Daphne Laureola. Ashwell Quarries.
651! Orchis viridis. Therfield.
653! Ophrys apifera. Ashwell Quarries.
668! Narcissus biflorus. Sandon.
816! Ophioglossum vulgatum. Ashwell.

Fig. 2. Archives of naturalists field records are a vital source of historic data for underpinning studies of current species occurrences.

The funding conundrum

So, how do we enhance the standing of biological collections in museums and ensure that potential funding sources are properly tapped to support them?

From thinking about the list of uses above, a number of things strike us as important for us to take notice of and act upon:

1. ***Documenting and publicising collections***
   If people don't know what collections contain, they cannot make use of them adequately without a lot of hard work. More importantly, from the point of view of those supposed to be funding the maintenance of these collections, they are unaware of their value (Fig. 3). Publicising them, drawing attention to potential uses of collections etc., is therefore highly important.

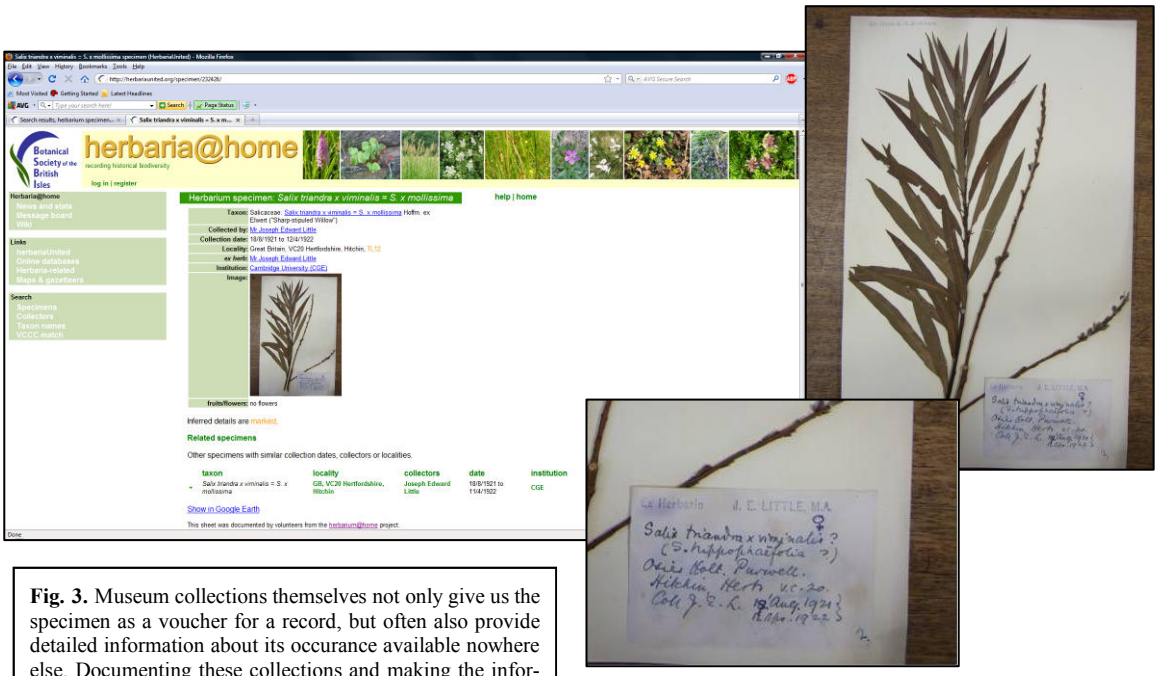


Fig. 3. Museum collections themselves not only give us the specimen as a voucher for a record, but often also provide detailed information about its occurance available nowhere else. Documenting these collections and making the information available (as above) can be vital for biodiversity data interpretation.

2. ***Integrating specimen data with third party records***
   The detail of specimen identification and validation in collections is potentially some of their most important potential contribution to third party users of biodiversity data, because specimen information acts as a validation of species records. Ensuring the existence of voucher information of this kind is integrated into biodiversity data holdings helps to raise the profile of collections and ensure their maintenance.

3. ***Making data from collections available on-line (e.g. the NBN)***
   Making ancillary details associated with specimens available in a way that enables the information to be integrated with other data from elsewhere is also often vital. For example, specimen data can be supplied directly to users through the National Biodiversity Network (and onwards to the Global Biodiversity Information Facility). By doing this, the information held by these collections becomes part of the global pool of biodiversity data, enhancing (and safeguarding) the collections themselves as a result through being a kind of 'shop-window' for what the museum holds.

4. ***Establishing links with biodiversity organisations***
   The example I gave at the beginning of a biodiversity recording project losing touch with collections and related resources demonstrates the weakness this introduces into the process of supporting the collections (not to mention the threat this poses for the biological recording process itself). Many Museums have experienced a decline after biological recording has been taken away, simply because this link was not seen as what it should have been – a vital mutually-enhancing role for the collections as a foundation for the recording activity, not just in terms of the collections themselves, but also the educative function they perform for new recruits, and the outreach opportunities they offer. Making sure these links are recognised and enhanced gives an opportunity for seeking funding to support the collections themselves. Getting involved formally with outside bodies may open up opportunities to gain supporting funding as a result.

5. ***Setting up protocols with others for record validation***
   Not only might we gain recognition of the value of collections through links with biodiversity organisations and their activities, but in some cases there may be opportunities for more formal support. To benefit from these, collections would have to be both well-documented and fully accessible to start with. However, as an active resource, their role could be formally recognised by key biodiversity data users, through reciprocal protocols, for example with a local records centre, or even with larger local authority or other public departments. While museums tend to be seen as a branch of 'entertainment' so often, their real value in these areas will be neglected, because they do not attract funding from outside. Steps need to be taken to go beyond this.

6. ***Exploring management agreements for survey vouchers***
   Essentially this is similar to 5, but could bring in funding from different potential sources, such as professional organisations involved in survey and assessment, especially if the role of collections becomes more formally recognised in these processes.

Summary

Essentially, the message is, therefore, that collections managers in museums need to think what their collections are really potentially usable for, beyond traditional display and demonstration. The opportunities are there, but will need to be worked at in order to be tapped. With the concern being expressed currently about the quality of much biodiversity data, because of lack of the right resources, or the inadequate abilities of many involved to carry out identifications, museum collections are potentially in a good position to rise to this challenge and offer their services – at a reasonable price!

Completely Rethinking the Organisation of Natural History Museums: A taxonomically Arranged National Collection

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Abstract

This paper looks at an alternative way of organising all of the natural history collections in the United Kingdom. Currently, almost every museum manages very diverse collections of biological and geological material. Unlike other types of museums, natural history museums often hold the same or similar selections of specimens across many institutions which could be reorganised nationally by taxonomic group. The advantages and disadvantages as well as the practical consideration of implementing such a new system are examined as a way of efficiently caring for natural history material across museums.

Introduction

The inspiration to write this paper came from seeing some of the most amazing natural history specimens on countless tours of stored collections in museums around the UK. In the last year alone I have seen fantastically preserved palaeontological specimens, specimens collected by Charles Darwin and Captain Robert Scott, various extinct birds including a beautiful moa skeleton, rooms and rooms filled with meticulously prepared herbarium specimens and entire whale skeletons. That natural history museums hold such inspiring material is unsurprising but what is surprising and slightly saddening is that this material is only accessible to people privileged enough to be allowed personal tours of stores, normally by the curators themselves. Tours are not normally made available to the wider public or in some cases not even to the wider professional scientific community. A well-worn cliché is that curator led tours of tucked away stores are more inspiring and engaging than the carefully arranged, labelled public galleries. Obviously, for reasons of security, staff time and logistics, tours of storerooms are rarely regular museum events but the sad fact remains that often some of the most amazing natural history material languishes in store rooms and is only ever viewed by a handful of researchers and the occasional gaggle of curators on a conference tour. This can be for a variety of reasons some of which may be; curators are often over stretched and may not have the time to pay attention to specimens that fall outside of areas of their professional specialism, specimens might not necessarily fit into the display remit for the particular museum, there may not even be a natural history curator on staff or specimens may be held in storage because they are the only example of a taxon within the museum and the risk of displaying the specimen is considered too high. This last reason certainly seems to be the main foundation of the extinct bird cupboard that virtually every natural history museum seems to have.

It was at dinner at the last NatSCA AGM following a tour of the stores of the Great North Museum: Hancock that this facet of stored collections struck me. Entomology curators had missed seeing an apparently important insect collection in the store because they had been on one of the other tours run at the same time. Furthermore, none of them were aware that such a collection existed at Newcastle. Therefore, there is a collection of important specimens in store at the Great North Museum Hancock that is not publicly available, is not listed on the web and has not been publicised to the specialist audience who may be able to make the best of the collection. This is through no fault of the curators; every museum has overlooked areas of collections which are low priority for that specific museum to fully document and curate but which may be internationally or nationally important. This led to thought about how natural history museums can better organise themselves nationally so that the most can be made of all the collections, short of employing armies of documentation assistants and scanners to fully catalogue collections and disseminate the important information about specimens to relevant researchers and curators.

Part of the problem stems from the fact that unlike most other kinds of museums, every single natural history museum has a near identical remit, to inform the public about biodiversity and natural history and as a consequence every natural history museum has much the same material albeit the extent and diversity of varying with size. This is certainly the case for displayed material as can be demonstrated with Natural His-

tory Museum Bingo! (Fig. 1). These overlapping remits and a history of 'stamp collecting' means that there is a great deal of duplication of collections that occurs in natural history museums resulting in already stretched staff having to deal with hundreds of thousands of different objects types in as many different taxa. A small survey sent to the NatSCA JISCmail list of the ratio of full time equivalent collections care and management staff to objects showed that for the nineteen museums that responded there is on average one collections care and management post for every quarter of a million objects. Of the six University collections that replied, the ratio was one member of staff to 260000 objects and for local authority museums the ratio was one to just under 250000 objects. A number of respondents were keen to point out that other responsibilities took time away from hands-on object work including managing staff, other administration, front of house work, public engagement and curating other collections. Given that every individual object can demand tens of hours of research, cataloguing, digitising, displaying and conservation and it is easy to see that 'over stretched' may be sorely understating the situation.

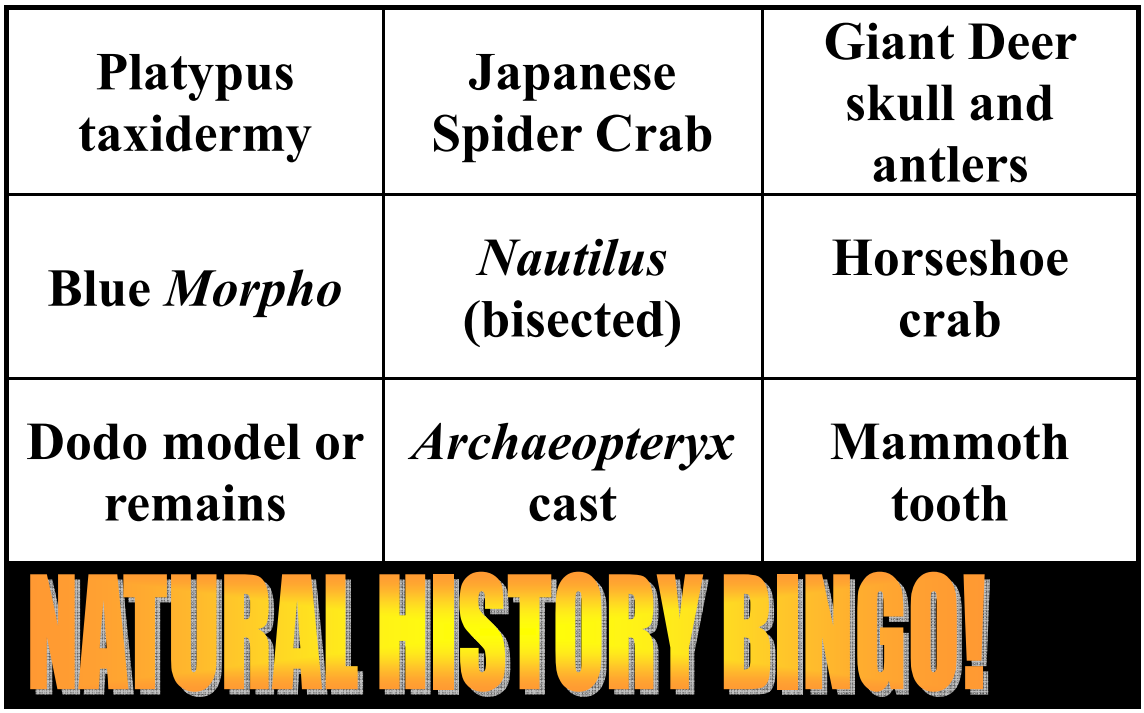

Fig. 1. Natural History Museum Bingo! A fun game to play in natural history museums highlighting how many museums display the same kinds of material. Expanded versions should include a *Megatherium* mounted in the classic tree holding position and the trilobite *Calymene* which seem to be ubiquitous.

This paper will explore a thought experiment about how natural history museums might reorganise themselves nationally to work more efficiently and strategically to preserve material and provide better access to objects in their collective care. This could be achievable if natural history museums reduced the amount of overlap in their work by putting the nation's stored collections together and then dividing the material up taxonomically across museums. Each museum would keep their displays but redistribute the stored collections taxonomically so instead of the Grant Museum storing specimens from virtually every taxonomic group of animals, the finite storage space would instead be used to house one or two taxonomic groups so perhaps, all the nation's Badgers (*Meles meles)* or Hog deer (*Axis porcinus*) or hoolock gibbons (*Hoolock* spp.) would end up in the Grant Museum and so on with museums across the country. A further level of complexity would be to taxonomically rearrange the collections in museums and also to arrange the collections geographically so that neighbouring museums would hold taxonomically related material, tracing a transect up the United Kingdom would follow a taxonomic order. This would bring a series of advantages over the current historically *ad hoc* system as well as a number of potential disadvantages as outlined below.

ADVANTAGES TO TAXONOMICALLY REARRANGING STORAGE

Efficiency/ specialisation

Although the occasional headline of a chance discovery of hitherto unknown important material being discovered in a museum cupboard or drawer makes for a nice story, these incidents can be seen as testament to how museums still struggle with identifying and organising the material they are charged with caring for. Perhaps the foremost advantage of a taxonomic arrangement of natural history museums is that there would be a great deal more efficiency in the curatorship and use of natural history material. Curators of small museums would no longer have to have an unfeasible working knowledge of millions of different groups of organisms but could specialise within smaller taxonomic groups. Access to expertise has been improved by the internet but has not been as revolutionary as it could be. Access to up to date references is still restricted behind pay walls and practical information is still hard to find if present at all. There is a much reduced need for specialisation in the professional sense because there are many networks of professionals available to help but this is redundant if curators never "get around" to working through swathes of the collection. Curators of large museums with separate taxonomic departments could focus on subfamily and species level groups rather than order and family level groups. Furthermore, museums arranged taxonomically would be much better placed to deal with the research community and make much better use of existing collections. For example, a researcher looking for hyena (Hyaenidae) specimens in the UK would, if they were performing an exhaustive search have to independently contact over 200 different museums and collections (or once through networks like NatSCA however, these kinds of enquiries are rare and not every institution is represented). If upon receiving the enquiry, each of the relevant museum staff then took approximately an hour to search for material and answer the enquiry that is roughly 25 working days of the sector's time absorbed in one enquiry. Assuming a quarter of those enquiries necessitated a visit the researcher then has to spend weeks and months travelling the country to access material and further museum staff time and resources is used up with each museum providing access to the material, printing out the relevant forms, going over handling guidelines etc. In reality, from discussions with visiting researchers, this tends to result in researchers reducing the scope of their research visits to one or two of the biggest collections thus limiting the potential quality of the data set and leading to 40 or so missed research opportunities. Under a taxonomic system, the researcher would only have to visit one or two museum stores (admittedly missing those specimens on display across the country) and be assured of a near 100% sampling of the relevant material held nationally. Furthermore, the curators of the hyena material would have more time to focus on curating the material leading to a better quality of information surrounding the specimens.

Online access

Online access to collections would also be greatly facilitated by a taxonomic approach. Currently not many natural history museums and collections in the UK have online databases and to the author's knowledge none provide 100% coverage of the material they hold. Despite initial hopes for digitisation of collections, online access has not quite delivered democratic access to collections for everyone. Online databases that do exist are necessarily full of errors, each uses virtually unique taxonomies (Carnall 2010), they tend to be academically exclusive and often are only useful internally or at best to the research communities that the museums already serve. With a taxonomic arrangement, online databases would no longer have to be so detailed, a list of the high-level taxa that the museums holds would suffice to initiate an email to a curator and museums could instead produce online resources that outstrip Wikipedia in terms of comprehensive information for the wider interested audience. As anyone who has tried to use the web to identify material will testify, finding hard evidence and information of any depth is difficult on the web, particularly with natural history. With resources freed from endeavouring to represent all taxonomic groups, museums could produce web sites and photographic archives detailing very specific information about the types of animals they hold. It does not make sense for each museum to try to compete with online behemoths like Wikipedia to detail the natural history of every organism. With a much smaller focus the museum of salamanders (Caudata) could produce unmatched illustrated and authoritative resources on the habitats, anatomy, pathology, physiology and diversity of the group.

There are a plethora of web portals that offer assistance in the identification and listing of material often incorporating social media elements but the problem with these is that there are thousands of them and typically their success flourishes and dies with the cycles of research funding. A glimpse at this list of Scratchpads part of an EU and NERC funded project to bring researchers together to publish taxonomic lists is both confusing, erratically arranged and as can be seen from the numbers of views on some of the portals not particularly effective (http://scratchpads.eu/scratchpads). 13 alternative informatics portals are listed on the Scratchpad website and many have overlapping or identical remits. When curators at natural history

museums struggle to catalogue and manage the collections they are responsible for, expecting them to then upload data to dozens of separate transient websites is unrealistic. By comparison a new project from colleagues at the Helmholtz centre at the Humboldt University of Berlin has brought together the entire nation's university scientific museums and collections under one portal (http://www.universitaetssammlungen.de/). Every university scientific collection that has or ever existed is listed with comprehensive histories of the collections and the people associated with the collections and the collections are indexed by discipline. Work continues on the project to add object by object information, the database for scientific models is live but the feat is impressive considering that the database is the work of a handful of people not associated with museums and that Germany does not have any administrative organisations analogous to the Department for Culture, Media and Sport, the Museums Libraries and Archives Council, Collections Trust or subject specialist networks.

Flexibility

Rearranging natural history museums would allow a much greater degree of flexibility in terms of the material that is loaned to other museums and scientific institutions as well as the quality of displays and practical sessions in museums across the country. Various recent initiatives from a range of museum organisations have begun to look at making object loans easier including the Smarter Loans Group at the Museums Association (Kendall 2011) and the Bizot Group stating a declaration on museum loans which was subsequently adopted by the University Museums Group (University Museums Group 2010). Nevertheless museum loans are still unavoidably risk-averse but at the moment, the level of risk being assessed is with respect to individual museum collections. For example, if a museum only has one taxidermy orangutan (Pongo sp.) that happens to be on display, a loan of that specimen will not only leave a gap in the displays for the duration of the loan but would also be of relatively higher risk than to a museum that has twenty or thirty such specimens. This is especially the case for specimens which are difficult to replace should they be damaged or destroyed. A museum that stored all of the orangutans in the nation would be much better placed to loan material that would otherwise sit in a store room as well as assess the national importance of such a specimen when considering a loan. Additionally, international loans can be more easily facilitated as the intricacies of CITES permits and other legislation is much easier to administrate if curators have smaller groups to familiarise themselves with. Museum displays up and down the country would also benefit because curators would no longer have to draw on material within their specific collections to construct displays and teaching sessions but have significantly more choice of material with a much-improved culture of loaning material with a better picture of the extent of the national quality and representation of taxonomic groups. Another slight financial benefit would be that natural history museums would be better placed to service film companies and documentary makers looking to source illustrative material without researchers having to speculatively phone twenty museums first.

Storage

Currently, many museums compromise on the provision of preventative conservation within storerooms because, to varying extents, different materials are often stored within the same space requiring that environmental conditions are maintained at sub-optimal levels for specific material types. Although taxonomically rearranging stored collections will still present similar problems, there is capacity to improve conditions for large parts of collections. In particular, the museums that store vertebrates and plants will no longer have to accommodate the specific standards for dry entomology specimens that take up many storerooms. Conversely, the issues with storing gigantic whale specimens will be restricted to one or two museums rather than every museum having to have space for one or two large and awkward shaped specimens. County by county statistics for antler impalement would drop; curators will no longer have to deal with taxidermy hair, scales and feathers within the same storeroom and whichever museum ends up looking after bats would need only one or two drawers at the most for fossil material. In a stroke (well, see logistic considerations under disadvantages) by merely organising material by taxonomy and adjusting storeroom air conditioning and humidity accordingly the average suitability of conditions for the preservation of museum specimens would improve.

Significance

Unlike other kinds of museums, natural history museums are harder to 'sell' in terms of their global significance and importance. Archaeological museums have the hook that the material is 'unique' and evidence of human history. Art collections demonstrate changes in cultural taste over time; give us an insight into modern human history and the progress of artistic techniques from scratches on cave walls through to purposefully stacked piles of bricks. Social history museums tell the stories of the struggles of the past and the shaping of communities. All too frequently, natural history museums can be seen as throwbacks and collec-

tions of rocks, plants and animals that can readily be replenished or reproduced. Even though, especially now, natural history museums hold material that is increasingly a record of a natural world that no longer exists. Every natural historian knows that every single specimen represents billions of years' worth of history and cannot, unlike archaeological artefacts and works on paper, be physically reconstructed or artificed yet natural history museums still have relatively poor standing when compared to the rest of the sector. Museologically, natural history museums remain relatively unchanged since the 19th Century and perspectives from the natural history sector aren't forthcoming or marginalised in the museum press. Politically, they do not have the level of support that other museums have locally or nationally as evidenced by the closure of many natural history collections, and the uncontrolled commercial market in illicit natural history material. This is partly because natural history is a hard sell to those in government despite being the most popular with museum visitors. Of the hundred or so MLA designated collections in England, less than 10% are natural history collections (Museums Libraries and Archives, 2011). Of those collections designated most are deemed significant due to associations with renowned naturalists rather than the biological significance of collections although these two facets aren't mutually exclusive. The issues that natural history collections raise are complex, academic and especially with respect to climate change and widespread extinction very poorly explored and depressing to boot. Rearranging stored collections taxonomically would make it easier to demonstrate the significance of natural history collections and the importance of subject specialist curators in terms that are easier to understand to non-specialists. By default, the museum that houses all of the seahorse (*Hippocampus* spp.) specimens will hold the biggest, smallest, rarest, oldest and youngest specimens and include specimens collected by eminent scientists in the past as well as the central repository for new collected material. Such a collection would be of vital importance to biodiversity records globally as well as *the* national collection of those particular taxa. Because museum staff will be better equipped to curate a set collection of a small group, further important discoveries about specimens will be made further justifying the significance of collections. Within taxonomic groups the history of natural history artisanship could be better explored and demonstrated. With a chronological series of stuffed dog specimens or slide mounted sponge spicules it is easier to reconstruct the history of techniques used to prepare specimens, histories which until recently were almost completely unexplored. Very little, for example, is published on how different preservation techniques and materials change the morphology of specimens and organic structures yet morphometric work continues apace without reference to possible post-mortem deformities. It is true that this significance exists today across national collections; however, this innate significance of collections is much harder to express clearly when justifying the existence and staffing of museums is often assessed on much smaller scales. Furthermore, it will be much harder to cut positions in an already stretched sector when that position holds responsibility for national access to a discrete group of organisms.

Comparative anatomy

There is no doubt that currently there are thousands of foxes and badgers misidentified as dogs in natural history collections as well as gorillas filed as chimps and orang-utans, males mistaken for females and mimetic flies misplaced with wasps. To a specialist, the above differences between organisms may seem like obvious differences; however, to a botanist or geologist looking after zoological collections these differences may not be obvious. Similarly, a vertebrate zoologist might be hard pressed to tell a *Dalmanitina* from a *Kloucekia* or pure allochemical sediment from an orthochemical one. This is where the forgotten science of comparative anatomy could help to improve information about specimens and even facilitate the discovery of new intrataxon anatomical differences. Trying to identify material from a narrow selection of comparative material is limiting but with collections organised taxonomically it will be much easier to make reliable comparative identifications as well as having a much smaller group of organisms to work with. The geological and zoological record would also be improved with the potential for discovering specimens that fall outside of published morphologies and described geographical and chronological ranges This information is much harder to discern looking at one specimen in isolation or by having to keep abreast of the latest thought on a variety of biological groups.

Bridging the ancient and the modern

Lastly, a taxonomic redistribution of stored collections enables a better understanding of the relationships between palaeobiological and modern species. Presently there still exist many divisions between work undertaken on fossil specimens, work on archaeological remains and work on modern specimens. There are some workers who work across geological time but there is a tendency for biologists to pay lip service to fossil taxa and for palaeobiologists to work without reference to recent work on modern material. Each discipline has their own professional organisations, separate museums and, as anyone who has worked on fossil and recent groups of birds, horses or humans will know, completely separate frameworks for classifying and categorising material. There are standards available for taxonomic and other information that could be

mined and delivered across the web but as highlighted above there's little consistency across disciplines and the cautious and slow nature of systematic work doesn't meet the day to day demands of systematic collections organisation. Where classifications frameworks have been bought in by museums, they are often a snapshot of a working system that quickly become outdated because they aren't dynamically updated. Furthermore, perhaps an artefact of where funding can be found is that many available systems are comprehensive for extant vertebrates and families of insects but inconsistent for all other groups. By simply grouping modern and ancient taxonomically related groups together, research on relationships between organisms would be a lot easier. As mentioned above, busy researchers may not even think to contact geological museums as well as zoological and botanical museums but if all the material is in the same place it makes it much easier to extend research on ancient material with reference to modern material and research on modern material to consider extinct relatives. Furthermore, taxonomically arranged reference collections would make identification of fragmented and deformed palaeobiological and archaeobiological material much easier rather than just classifying every miscellaneous bone as fish in palaeobiology or horse in archaeology.

DISADVANTAGES TO TAXONOMICALLY REARRANGING STORAGE

There are a number of disadvantages to a taxonomic system of museum-stored collections but for brevity, some of the more obvious ones are briefly considered here. Chiefly, it would be illegal to break up material in many collections. In England, it is law that material does not permanently leave national collections and there will be countless smaller collections which cannot be broken up because of conditions on bequests, donations and founding statutes. A comprehensive survey on the use of stored collection in a variety of museums and collections will no doubt show that the majority of stored collections just aren't used with anywhere near the intensity that requires museums to hold regional collections with possible exceptions of butterfly and bird collections. Aside from the legality, the logistics of rearranging the nation's museums would require decades of work, to define the scope and extent of each taxonomic group, to calculate how much will fit in each museum storage area and orchestrating the physical logistics of transporting millions of specimens. The same process would then have to be undertaken with all of the associated archive material, with virtually every museum requiring copies of every accession register, catalogues and other archival material. Composite fossil specimens, seascapes in spirits and dioramas which have a number of different taxa present within 'one' specimen raise a number of problems, should the specimen be broken up if possible? Alternatively, should the largest or most significant specimen dictate where the specimen should go? Another consideration would be that disasters would be worse than they currently are as a fire or flood could destroy the entire collection of a taxonomic group, excluding material that is on display in museums elsewhere. A counter point to this argument is that a disaster at a large museum would destroy many type specimens across taxa in one go. Moreover valuable material like rhino horn, precious minerals and ivory could be stored in appropriately high security areas rather than every museum having to have expensive strong rooms and other super high secure facilities. Although it happens with decreasing frequency, major taxonomic revisions would require one museum losing material and another museum having to accommodate a new taxonomic group. It may not make sense to break up geological collections, personal collections and local collections as they may be of more use as a unit than separated into their components. Palaeobiologists looking at specific horizons would have to travel to every individual museum with material within the strata they are interested in. Organising rock collections according to their rock type is less useful than the existing situation partly because they are of superior use with associated fossil material and partly because there is a large degree of subjectivity in deciding whether a sandstone is a very lithic greywacke or a slightly matrixy subgreywacke. A survey of the range of enquiries and use of natural history collections would establish to what extent subcollections are used as a whole unit (i.e. geographically or by collector) against research on individual elements (taxonomically). There is also a risk that museums could lose links with the local community, and donors may baulk at discovering that material they collected locally is to travel to a far-flung museum. Similarly, donors may be less than pleased to discover that donated material is destined to linger in stores and barely get used rather than contribute data to a national collection. Lastly, one unfortunate museum would end up with all the material that we currently store in all of **those** boxes, drawers and cupboards labelled 'misc.', 'mixed' and 'to be identified', which as documentation improves would slowly become empty at best or filled with useless by definition material at worst.

Conclusion

This paper began as a relatively simple thought experiment into rethinking the way that natural history museums operate with some consideration for whether museums could or should work towards this arrangement. The benefits to the above arrangement are that collections would be more effectively and efficiently

stored, organised, used and advocated. If natural history museums were to move in this direction then a museum wide survey would need to be undertaken to assess the long term benefits and whether these will every outweigh the initial cost of reorganisation. If it was found that a taxonomic system was beneficial then a multilateral agreement between hundreds of museums and thousands of different stakeholders would be required. The new system would only be most effective if all parties agreed to the arrangement described. This would require changing the law for national museums and such an arrangement may be fundamentally opposed by the founding doctrines of many smaller museums which may make such musings unattainable in the first instance. In the meantime it appears that the fractured nature of natural history collections has not been greatly improved by virtual access and subject specialist expertise as was anticipated leaving objects, museum professionals, and as has been seen with the recession, entire museums at risk.

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Hidden Treasures: Natural History exhibits at the Royal College of Surgeons

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Abstract

The Huntarian Museum at the Royal College of Surgeons of England opened in 1813. The collection of the anatomist John Hunter formed the basis of this museum, and this remains the case to date. Approximately two thirds of the museum collections were destroyed during the Second World War, but acquisitions have been made since this devastation , which have broadened the collections. This article briefly discusses the variety of the natural history material within the College collections, and describes three recent temporary exhibitions which have enabled the general public to view material usually kept in store.

For two centuries the Royal College of Surgeons (RCS) has held a large and varied collection of natural history specimens, the majority of which has been on display in the College's Hunterian Museum. Upon its opening in 1813, the museum became one of the most extensive of its kind, filling five large gallery spaces. The basis of the museum was the collection of the eighteenth-century anatomist and surgeon John Hunter, which had been previously donated to the College. A significant proportion of this core collection was animal preparations, as the roots of science and surgery and John Hunter's interest were in comparative anatomy. The zoological aspect of the collection was then expanded during the following century. Past curators such as Richard Owen and William Flower studied, repaired and documented these specimens, with the intention of maintaining and exhibiting them for their current and future generations (Blandy and Lumley 2000). Eventually, the triple height space of gallery five became dedicated to comparative anatomy, where the full skeleton of a male sperm whale was suspended from the ceiling (Fig.1).

Fig. 1. Photograph of room 5 of the College Museum, taken around 1910.

Bombing of the RCS in World War Two resulted in devastation not only of the majority of these collections, but also the College building itself, which then prompted the transfer of many specimens that had been left unscathed. Prior to this destruction, the collections were immense, and the one third that remains is still of sufficient size to fill the museum. Fortunately, donations made since the bombing have diversified the collections further. In the 1940s the odontological collection was permanently transferred as a goodwill gesture towards reconstitution of the museum (Miles 1964). This was followed by the acquisition of animal material collected by the anatomist and primatologist William Charles Osman Hill (1901-1975) in the 1970s. The aim of this short article is to indicate the range of natural history material held within the RCS collections and record some recent temporary displays that have incorporated these specimens.

Recent developments

The Hunterian Museum underwent a large refurbishment project in 2003-2005 and since then a larger proportion of the zoological specimens has been kept in store, although still available for research. Given its location, the main themes of the Hunterian Museum are the history of surgery and its more recent practice. Animal and, on occasion, plant specimens were once dissected, prepared and analysed by surgeons to gain insight into the intricacies of biological forms and the comparisons between the species. Pathological specimens were also collected to help understand the processes of development and the malformations that can ensue. It is this collection of prepared specimens which forms the central gallery of the Hunterian Museum today and bridges the gap between surgery, zoology and botany.

The newly opened Grant Museum of Zoology is a near neighbour of the Hunterian Museum. This stunning new venue has diverse, eye-catching displays, where every cabinet is peppered with specimens creating a visual feast. The Grant Museum is proof that where conservation or space is not an issue, it is better to display rather than store. Having attended the recent NatSCA conference based at the new Great North Museum: Hancock in Newcastle, I found the most engaging displays to be those that presented a 'menagerie' of specimens, where there was a wealth of information for the eye to process. Drawing inspiration from such establishments, the three temporary displays here at RCS have a high concentration of specimens which enables a wider range of items to be removed from storage and put on display.

Temporary Exhibitions

Promoting the museum to a wider audience is an ongoing endeavour that everyone in the sector can relate to. The most immediate solution at our disposal is a varied exhibitions programme that unearths stored treasures and places them directly in public view. Recent displays at the Royal College of Surgeons have therefore focused on the natural history specimens with the intention of diversifying the permanent displays. In an attempt to promote the wider collections of the RCS three temporary exhibitions have since gone on display. All three cover themes within natural history and perhaps more importantly, each exhibition has presented the opportunity to display specimens that have previously been kept in store for at least five years, if not longer.

Fig. 2. Examples of odontological ivories.

Ivory; treasures from the Odontological Collection

Ivory went on display last year and occupies two cases within the college entrance hall. This small exhibition shows a selection of items taken from the odontological collection's 250 ivories (Fig. 2). Rather than focus on the immediate connection ivory has with the tusks of elephants, this small exhibition shows the range of ivories grown by both terrestrial and marine species. To connect *Ivory* to the College, a few specimens detail the pathology and repair of these essentially oversized teeth. As the home of both the Faculty of Dental Surgeons and the Faculty of General Dental Practitioners, it was hoped that by tying in the two themes the displays are made relevant to the function of the College and yet of interest to a wider audience.

Extinct

Extinct was installed in cases on the lower floor of the Hunterian Museum in January of 2011, and included some of the Museum's rarest specimens (Fig. 3). The popular theme of the exhibition has encouraged a fair amount of press interest. Having *Extinct* within the museum itself has slightly diversified our audience, and encouraged those with a natural history interest to discover that a medical museum can and does include a wider range of items other than those related to surgery and human anatomy. Furthermore, this small temporary exhibition has enabled the display of a range of fossils, skeletal material and wet preparations that have lain in store for several years now.

Fig. 3. Thylacine (*Thylacinus cynocephalus*) spleen.

BIG

The opportunity to install our most recent natural history exhibition *BIG,* came about when a long term loan was returned to the institution from which it was borrowed, leaving a lofty yet narrow entrance case empty. Our solution was to select the largest and most complete skulls currently held in store, which could then be carefully cleaned and erected onto public display. Since February of this year, five huge crania have been exhibited, some of which had remained in store for decades. After some initial scrubbing these two common hippos (*Hippopotamus amphibius*), black rhinoceros (*Diceros bicornis*), southern elephant seal (*Mirounga leonina*) and killer whale (*Orcinus orca*) were erected onto tiered shelving and will now remain on display in the entrance hall of the RCS throughout 2011.

All three exhibitions have generated positive feedback. But perhaps more significantly, each display has presented an opportunity to revive the stored material which has both unearthed hidden treasures for the public to view and encouraged some specimen cleaning. The odontological collection in particular forms a research source and being able to exhibit some of this material between dissertation seasons has enabled us to generate further interest in this usually unseen collection. These exhibitions have also presented an opportunity to demonstrate the diversity of the RCS collections and disprove the myth that a medical collection is one dimensional.

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Re-organising the Coleoptera Collection at Leicestershire County Council Museums

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Abstract

In 2010, Leicestershire County Council Museums acquired funding to undertake collections management work on their entomological collections. The remit of the resulting project was to incorporate store-box material into the main Coleoptera series. A total of 22,300 specimens were transferred and the collection was re-organised to allow for this expansion. Identification was carried out on the majority of material that was processed. Documentation and accession-labelling were also undertaken. As a result of the project, the collection is more accessible and less vulnerable to pests and to damage.

Keywords: Leicestershire County Council Museums, Coleoptera, Storage, Collection, Identification, Re-organisation, Documentation.

Introduction

The Natural Life collections held by Leicestershire County Council Museums are currently housed at the Collections Resources Centre (CRC) at Barrow-upon Soar, Leicestershire. Here, they are maintained by full -time staff, with assistance from volunteers. The collection contains modest assemblages of British molluscs, mammals and birds, but its strengths are in botany and entomology. The entomology collection is known for its Nationally significant holdings of Lepidoptera (butterflies and moths) and Coleoptera (beetles).

For a considerable time, around half of the entomological collection had been stored in store-boxes rather than cabinets. This situation had resulted from the acquisition of a large number of donations in a relatively short time, when resources were insufficient to process the vast quantity of material involved. Store-boxes are inappropriate for long-term storage of specimens because, as lightweight units, they are vulnerable to vibration which can damage and dislodge specimens. This risk increases when collections are moved.

A much greater threat comes from pest species such as carpet beetle (*Anthrenus verbasci)* which, in its larval form, can penetrate the small gaps in store-boxes to gain access to the interior and reduce the contents to frass and data labels. In order to protect the collection in the long-term, funding was secured in 2009/2010 to transfer the Lepidoptera into secure cabinet units. Work was completed on this group by early 2010.

Funding was acquired for a similar project for Coleoptera and Hymenoptera in the latter half of 2010. This work was undertaken between early September 2010 and early March 2011, by EcoLine staff, Camille Newton and the author. A small amount of work was also carried out on the Hemiptera collection.

This report details the work carried out on the Coleoptera collection.

The Coleoptera Collection

The Coleoptera collection at Leicestershire County Council Museums is one of the largest public collections in the UK. The total number of specimens was estimated in February 2011 to be around 97,200. There is a wealth of associated anecdotal information relating to the collectors and the history of collecting in the region. This has been extensively researched and published by Lott (2009). The information gives Leicestershire's Coleoptera collections a context that is too often lacking in UK Museums.

The collection can be broken down into a number of components, the details of which are as follows:

Main Series (comprising Barrow, Tailby, Taylor, Hunter, Bates et. al.)
Before the project began, the main series was estimated at around 43,300 specimens. This estimate was based on the assumption that each British species was represented on average by 12 specimens. In reality, some of the rarest British species were not present at all whilst the most widely distributed and frequently encountered beetles may have been represented by 40 or more specimens.

The collection is housed in lockable 10-drawer wooden Hills-type cabinets and prior to the project, it occupied 24 of these units. For the most part, specimens were set out in traditional style on cork in paper-lined drawers, the specimens standing over their respective name labels (Fig. 1). The checklist labelling was out-of-date, and appeared to follow the earliest version of Kloet & Hincks checklist of British Insects, published in 1945.

The exception to this layout was for the Carabidae – the Ground Beetles (364 British species), the Gyrinidae through to the Hydrophilidae – the Water Beetles – (some 200 species), the Sphaeritidae and Histeridae (some 53 species) and the Cantharoidea – the Soldier Beetles and allies (50 British species). These groups had all been transferred into plastazote-lined unit trays with up-to-date name labels. There are around 4,000 beetle species in the British Isles; thus around one sixth of the main series collection had already been transferred into unit trays before the project began.

Much of the material was unreliable in terms of its identification accuracy, with a rate of around 3-5% inaccuracy in species determinations. Thus it was estimated that around 2,000 specimens were likely to be wrongly identified and therefore misplaced in the collection. In addition, there were many gaps in the layout within species. This may have resulted from specimens being removed and not returned to their correct places. This has led to the collection appearing untidy and it also wastes space in the drawers.

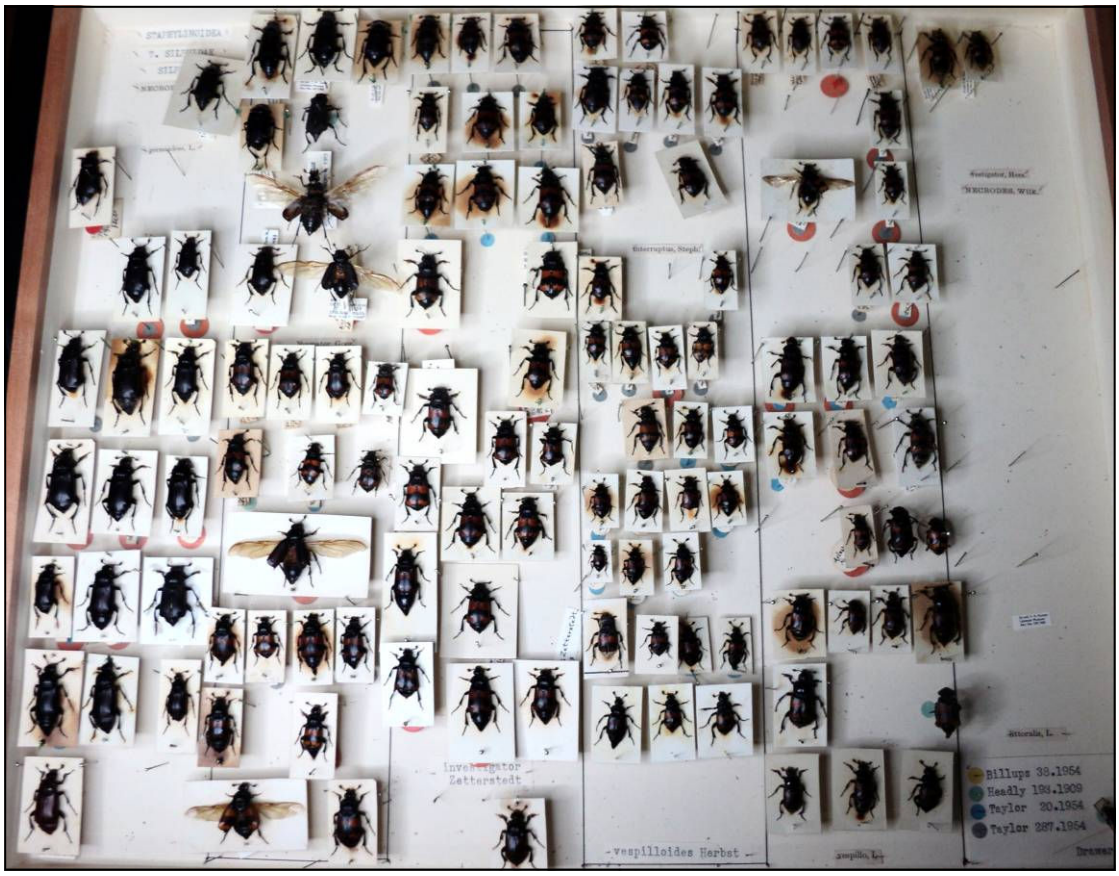

Fig. 1. A drawer of main series Silphidae before re-organisation. (Image © Leicestershire County Council Museums)

The main series contains a small number of old specimens of Nationally extinct species. It is regrettable that in most cases, these are without collecting data, but it is thought that they are likely to have originated from the UK. Examples are specimens of the click beetle *Ampedus sanguineus* (Linnaeus, 1758) (Fig. 2), the ground beetle *Lebia scapularis* (Geoffroy in Fourcroy, 1785) and the dung beetle *Brindalus porcicollis* (Iliger, 1803). In most British Museums, these species are represented by spaces in drawers.

Fig. 2. *Ampedus sanguineus* (Linnaeus, 1758) specimens. (Image © Leicestershire County Council Museums)

The collection also contains significant data that has yet to come to the attention of the National Recording schemes. One example is the heathland leaf beetle *Cryptocephalus biguttatus* (Scopoli, 1763), represented by a solitary specimen, probably originating from Parley in Dorset in July 1936, but labelled *Purley, Hampshire* (sic.) (Fig. 3). This record escaped the attention of Mann & Barclay (2009), who detailed the 122 known specimens in UK collections .

Fig. 3. *Cryptocephalus biguttatus* (Scopoli, 1763). (Image © Leicestershire County Council Museums)

Another example is the metallic green Tansy Leaf Beetle *Chrysolina graminis* (Linnaeus, 1758), a UK BAP species which is fast declining in the UK and now known from only a handful of sites. A specimen from Aylestone, Leicester in July 1951 is very significant indeed (Fig. 4). The Museum has around 120 specimens of this leaf beetle, most with full data.

The store-box collections are as follows:

The Hunt Collection (Accession Z.195.1985) (fig. 5)
This large collection, numbering some 19,300 specimens was housed in 43 store-boxes at the start of the project. Around half of the collection had been catalogued by Trevor Forsythe (TGF) and the majority of these specimens bore accession labels.

Fig. 4. *Chrysolina graminis* (Linnaeus, 1758). (Image © Leicestershire County Council

Fig. 5. A store-box of Hunt Elateridae. (Image © Leicestershire County Council Museums)

However, TGF had not seen or catalogued the Carabidae (1,100 specimens), the Staphylinidae (around 2,800 specimens) or a further 9 store-boxes that were densely packed with a miscellany of unidentified specimens (Fig. 6). Many of these specimens were dirty and mouldy and were mounted on brown-stained card. Some had become dislodged and were lying on top of others with potential to cause damage. None of the specimens had accession numbers.

Fig. 6. A store-box of unidentified miscellaneous Hunt material. (Image © Leicestershire County Council Museums)

It is understood that these 9 boxes were possibly a 'surplus' collection that was at one time intended for distribution to keen amateurs visiting the Museum who wanted voucher specimens for their own reference.

The mould present on Hunt specimens was not active and was thought to have occurred when the store-boxes were stored in a basement that subsequently flooded. The grime and mould present on many specimens creates a potential barrier to identification because it obscures features of the beetles that are critical. The accuracy of identification in this collection was good in some areas and poor to moderate in others. The collection contains a significant number of Red Data Book and Nationally scarce species and is therefore an important data resource.

The Tozer Collection (Accession Z.97.1993) (Fig.7)
This neatly presented collection comprises around 14,000 specimens. Prior to the , which were stored in 31 large store-boxes and glass-topped drawers. With very few exceptions, all specimens had been accession-labelled and catalogued (by TGF). Around 2,500 specimens (the Cantharoidea, the Water Beetles, most Carabidae and some of the Staphylinidae) had already been transferred into the main series before the project began. The condition of Tozer's collection is generally very good and the accuracy of determinations high. It contains a large number of Red Data Book specimens and much local material with full data.

Fig. 7. A store-box of Tozer specimens. (Image © Leicestershire County Council Museums)

The Garner Collection (Accession X.Z5.2010 & X.32.1992)
This collection, housed at the start of the project in three very large store-boxes, and three medium-sized boxes, comprises 1,772 specimens. Most of these were collected in Leicestershire and France. The French material (around 600 specimens) and a small amount of the British material is mounted on composite card mounts with several different species together. The collection was not catalogued or accession-labelled and very few specimens had been identified. It does not hold a great deal of Nationally scarce material, but does have a wealth of locally-collected material with full collecting data.

The collection was found to be in generally good condition, although the pins that Garner used are small and have corroded in most cases. This makes pinning them into any medium rather difficult and somewhat ineffective. It also increases the opportunity for crawling pest species to access the specimens since the cards when pinned into plastazote, lie flat on the bed of the drawer or tray. The small pins, along with the relatively large card mounts, make Garner's specimens instantly recognizable.

The De Montfort University Collection (Accession X Z2. 2004) (Fig. 8)
This collection of 5,707 specimens was housed in 10 glass-topped drawers at the start of the project. The arrangement of specimens was rather disorganised with, for example, specimens of one beetle family occupying sections of several different drawers.

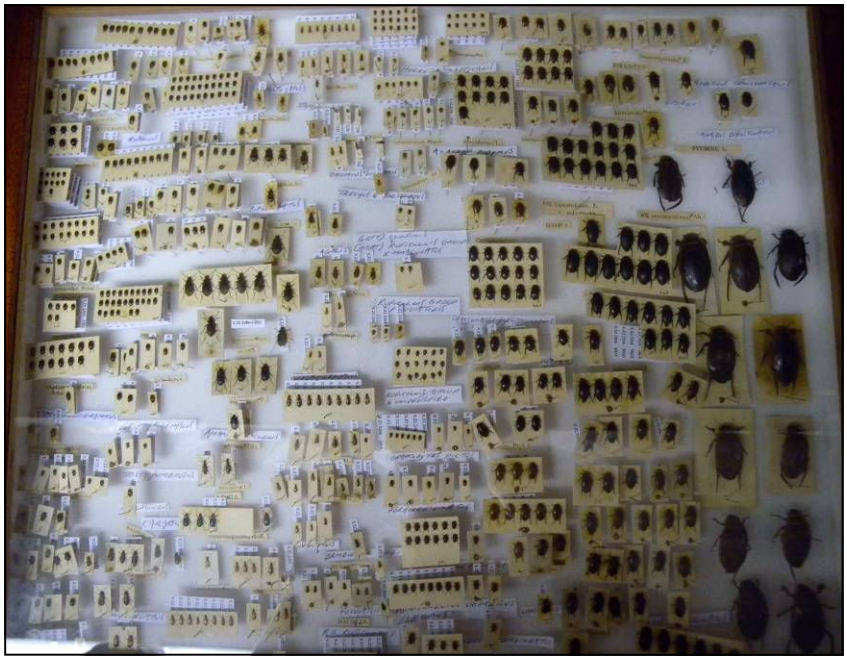

Fig. 8. A DeMontfort drawer containing Carabidae, Dytiscidae and Haliplidae. (Image © Leicestershire County Council Museums)

TGF had accession-labelled, identified and catalogued the entire collection. The overall condition was found to be very good and identification accuracy was found to be moderately high. There is very little if any local material present. Unusually for a collection of this size, there are no weevils. This is normally a popular group, so its absence is surprising and begs the question whether that part of the collection was separated off at some point. Although Nationally Scarce species are present, there is little Red Data Book material relative to the Tozer and Hunt collections.

The Clark Collection (Accession X Z2. 2008) (Fig. 9)
This collection numbers 3,470 neatly presented specimens, representing most of the popular beetle groups and with strength in weevils (Curculionidae). It was stored in 6 large store-boxes prior to the project. Unfortunately, the collection had been attacked by *Anthrenus*, leaving a number of specimens partly or wholly destroyed. Also, in common with the Garner collection, there are a large number of specimens (approximately 900) that are presented as multi-species card mount composites (Fig. 10). TGF had catalogued the entire collection and checked identifications. Identification accuracy was found to be high.

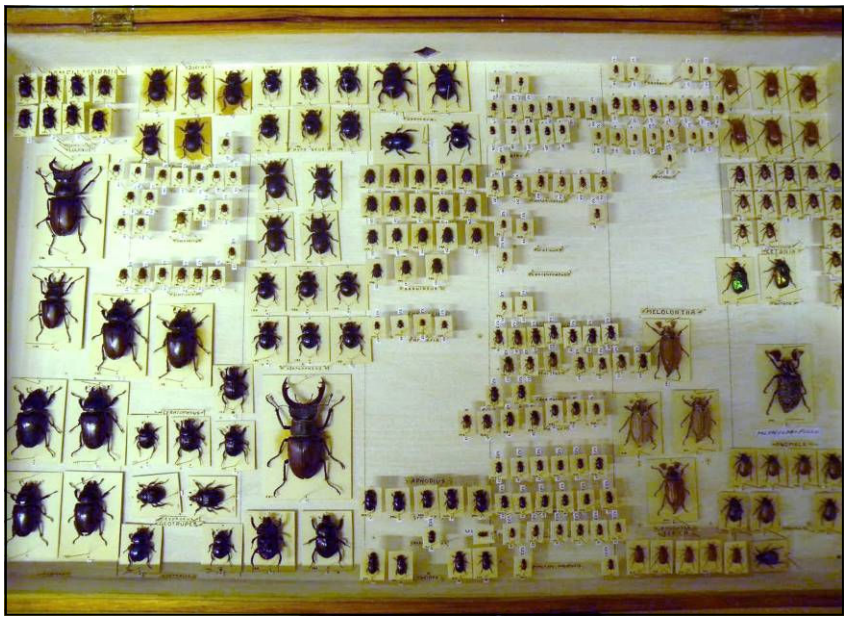

Fig. 9. Clark Scarabaeoidea. (Image © Leicestershire County Council Museums)

Fig. 10. An example of Clark composite species mounts. (Image © Leicestershire County Council Museums)

The Henderson Collection (Accession Z.90.1983) (Fig. 11)
This moderately large collection contains around 8,000 beetles. It occupies 17 drawers in two metal cabinets and has not been amalgamated into the main series. The reasoning behind this segregation is to preserve the unique presentation of the collection. The specimens are all meticulously set and arranged in regular rows above stylised handwritten name labels (e.g. Fig. 11). Some of the rove beetles and all of Henderson's ground beetles (Carabidae) and leaf beetles (Chrysomelidae) had been moved into the main series, but it is not clear why this had occurred.

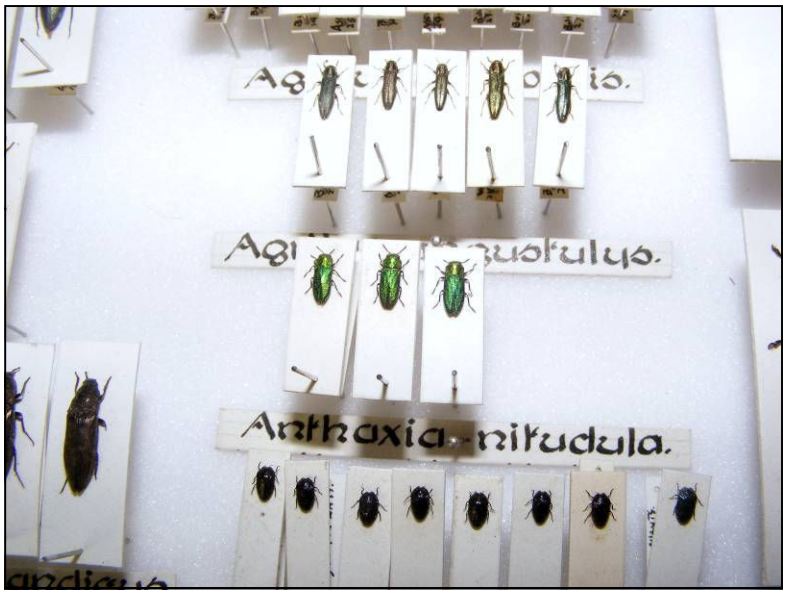

Fig. 11. Detail of a Henderson drawer. (Image © Leicestershire County Coun-

Unfortunately, the collection has suffered significant pest damage from moths as evidenced by the remnants of silk and frass on specimens (Fig.12). The collection contains a relatively high proportion of Red Data Book and extinct British species and is a valuable data resource. The author knows of no catalogue for this collection. It is also apparent that a number of specimens are misidentified or misplaced.

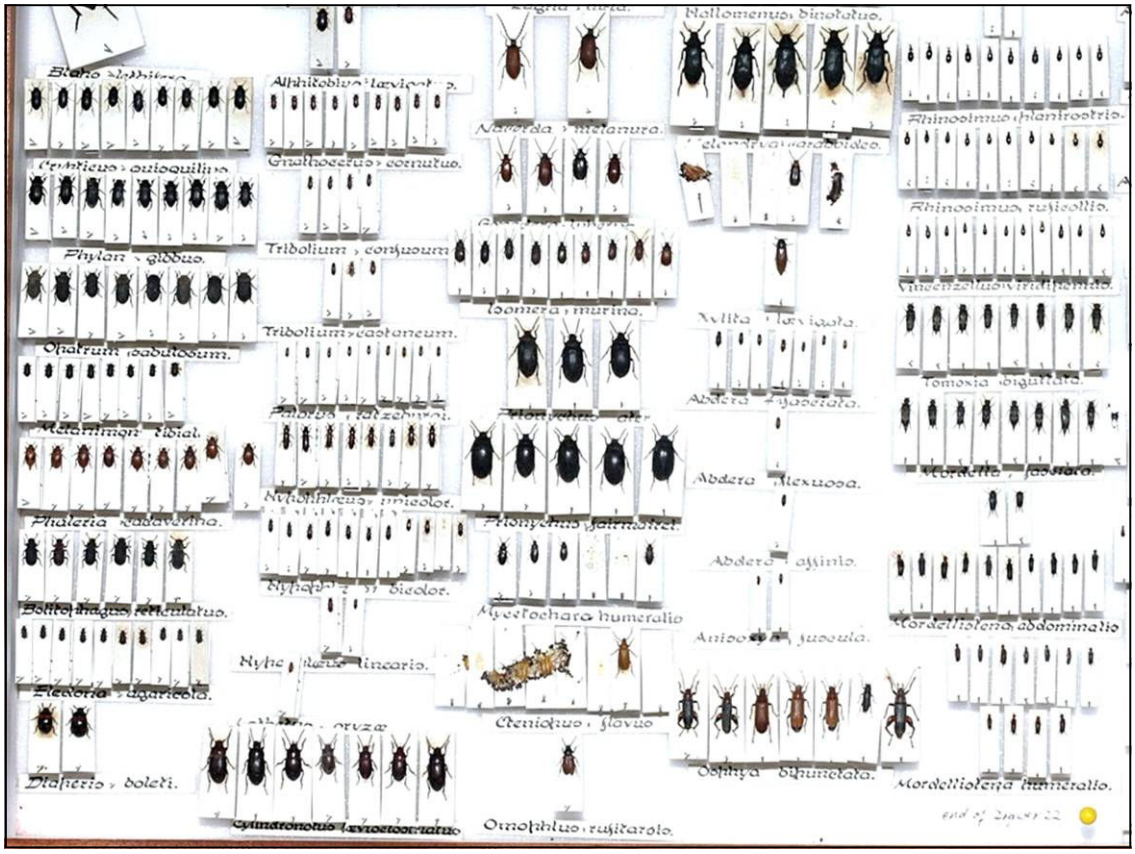

Fig. 12. Henderson Tenebrionoidea showing moth damage (bottom left of centre). (Image © Leicestershire County Council Museums)

Smaller Store-box Collections

The Bullock Collection (Accession X.21.2004) containing 521 specimens, was originally housed in four small store-boxes. It was catalogued but not identification-checked, by TGF and neither was it accession-labelled. Identification accuracy was found to be moderate to poor. The condition of the collection was found to be fair to good, with the exception of a number of badly set, pin-staged specimens that have been destroyed. There is little noteworthy material in the collection.

The Evans Collection (Accession X.Z1.2001) contains only 315 specimens, the vast majority of which are Carabidae with full collecting data. It was housed in one large store-box. Approximately a third of the collection had been identified and was labelled with species labels. The entire collection was without accession labels and had not been catalogued. Unfortunately, it had been badly attacked by *Anthrenus* which has resulted in significant damage to many specimens. Like the Garner and Clark collections, there are several examples of multi-species composite card mounts that cannot be directly transferred into the main series.

Additional smaller store-box accumulations were also present, but these are not detailed here.

Methodology

The primary objective of the project was to transfer store-box material into the main series cabinets. In total, just over 100 store-boxes and drawers contained material for transfer amounting to around 40,500 specimens. The apparently simple task of transfer was complicated by a number of factors, some of which came to light after the project had started. They include the following:

- The main series (apart from those groups specifically mentioned earlier) was laid out in traditional style on cork, in paper-lined drawers without adequate space allocated for expansion of each species. This meant that the main series itself had first to be processed by transferring it out of traditional layout into newly-labelled unit trays before the addition of store-box material could commence

- Large species such as longhorn beetles (Cerambycidae), chafers and stag beetles (Scarabaeoidea) and burying beetles (Silphidae) are not appropriate for housing in unit trays because each tray can only accommodate a maximum of perhaps three or four specimens, thus wasting valuable drawer space. These required to be set out in traditional style in plastazote-lined drawers, making sure to leave adequate space for future collection expansion

- Store-box material was not identified to species level in the Hunt miscellany and in the Evans and Garner collections and therefore had first to be identified before it could be positioned in the main series

- Some Garner and Hunt store-box material was so mixed up that it could not be processed without first sorting into taxonomic groups.

- Some of the collections for transfer were not accession-labelled (some Hunt material, Bullock, Evans, Lott and Garner collections), so these required first to be labelled before transfer

- Expansion of the collection meant that the species content of each main series drawer was liable to change and thus the drawer labelling and indeed the cabinet labelling would have to be renewed to reflect this

- In the Garner, Evans and Clark collections, some of the material existed as species-composite card mounts. To put individual species from these card mounts into their respective places in the main series, they would first have to be soaked off the card and then remounted and re-labelled. The project did not make provision for this process

In reality, the project developed a greater number of tasks as follows:

- To sort miscellaneous store-box material into identifiable family groupings

- To identify unidentified store-box material and to label this with det labels

- To add accession labels to all specimens that were without them

- To transfer main series material into unit trays that had first to be labelled up with up-to-date checklist nomenclature

- To re-arrange groups containing larger species into plastazote-lined drawers with traditionally-labelled layout

- To transfer store-box material into the main series

- To re-label drawers and cabinets to reflect the altered content within

Additional non-essential work carried out to enhance access to the collection was:

- To check species identification where the skill of the contractor allowed this to be done quickly. Any identification that would have been too time-consuming was avoided, with instead, notes being written and placed in the main series next to that species group to the effect that critical identification was required at a later date

- To re-label any re-determined store-box specimens with det labels

- To catalogue collections that were first identified and accessioned during the project (Garner, Evans and Hunt surplus material)

- To note down and document any Red Data Book field collection data for very scarce species from the main series and store-boxes

- To put non-RDB and non-Nationally Scarce specimens without data or provenance into a Learning Collection

- To photograph every drawer in the collection both as a record for the contractor and the local authority and for use by the local authority in any future documentation or publicity relating to the collections

Follow up work would include:

- The documentation of all re-determined specimens from the catalogued collections of Clarke, Bullock, Tozer, Hunt and DeMontfort with the intention that the catalogues will be amended with this information at some later date

- The production of a report detailing the work done and recommendations for future collections care

- The publication of papers in journals detailing the work done and raising the profile of Leicestershire County Council Museums's collection

A decision was made to divide the tasks between CRC Barrow and the EcoLine office in Warwickshire. Thus, resources at Barrow would facilitate the transfer of material from store-boxes into the main series and the organisation and identification checking of the main series. The EcoLine office would be the base for undertaking documentation and sorting, identifying and labelling Hunt, Garner, Bullock and Evans material.

Store-boxes were signed out of CRC and back in by exit form procedures. At EcoLine, boxes were stored in a secure, lockable steel cabinet. Once store-boxes were returned to CRC, they were bagged up and placed into deep freeze at – 40C for a minimum of 24 hours as a precaution against pest infestation. They were then allowed to thaw out before being opened to process material.

Collections were tackled on a family-by-family basis, the order of which was determined by the familiarity of the contractor with identification of those species groups. This work method was thought to be more efficient than using only one collection at a time in a store-box by store-box approach which would have meant revisiting the same parts of the main series at least six times to add material from all of the collections separately. So, specimens of each family group were transferred from all of the store-box collections simultaneously.

The following work sequence of families and super-families was adopted for the project, commencing with the Chrysomeloidea and ending with the aquatic Hydrophiloidea. The number in brackets is the approximate number of British species in each family:

> Chrysomeloidea (269), Cerambycidae (63), Silphidae (20), Tenebrionoidea (139), Elateroidea (80), Scarabaeoidea (92), Buprestidae (14), Cantharoidea (49), Gyrinidae (12), Haliplidae (19), Dytiscidae(111), Carabidae (364), Hydrophiloidea (aquatics) (68)

The unit trays were composed of acid-free card of standardised external dimensions 12cm x 7cm x 2 cm. Each was fitted with a glued insert plastazote base 5mm thick. 18 trays fitted into each Hills cabinet drawer. In the unit tray drawers, trays were created for species which are not currently represented in the collection but which may feasibly at some later date be acquired by the Museum. Trays were not prepared for long-extinct species for which there is no Leicestershire County Council Museums material. One or two empty trays were placed at the end of each drawer to allow for future expansion of the collection.

For beetle families that had already been laid out in unit trays prior to the project, a system had been adopted whereby Leicestershire material had been split off from other UK material and the tray labelled with a red card disc and a label reading 'Leicestershire'.

In order to fit the store-box material into the main series without far exceeding the cabinet capacity in the stores, a decision was made to remove the majority of these labels and to reincorporate Leicestershire material back into the main series for each species. Exceptions were made where species vouchers from Leicestershire were Nationally significant or where trays marked with Leicestershire labels were already full. These were simply left 'as is'.

Unfortunately, re-amalgamating the Leicestershire material with other main series material makes the collection less accessible to people who want to extract Leicestershire data only. However, given the limited capacity for expansion of the collection, no other option was available. The checklist sourced for labelling up unit trays and drawers was Duff (2008).

Generally, the old species-name labels present in previously organised unit trays, were left in situ unless a species name change in the nomenclature warranted an up-to-date label. Any newly laid out trays were usually pinned with a new label. Composite mounts were placed in drawers positioned at the very end of the Coleoptera series. The Henderson collection was not included in the project, although it was consulted to extract Red Data Book specimen data. Given the time restrictions and complications, a large quantity of outstanding store-box material was expected at the end of the project. This quantity was estimated at approximately one third of the store-box collection.

Results

Over the course of around 90 days, 41,400 specimens were identification-checked and re-organised or transferred into the main series (Fig. 13). Within this total, 22,300 were moved from store-boxes. 4,846 previously unidentified specimens were identified and 1,633 previously identified specimens were re-determined (Fig. 14). All 6,479 of these were labelled with det. labels. Identification keys used were mainly Royal Entomological Society Handbooks, with the addition of a number of papers from a variety of entomological journals.

Fig. 13. Checking identification of Carabidae. (Image © Leicestershire County Council Museums)

Fig. 14. Re-organising specimens in unit trays. (Image © Leicestershire County Council Museums)

Of the previously unidentified material, the Hunt collection produced a handful of species which were not otherwise represented in the collections. Examples are a specimen of *Ischnomera caerulea* (Oedemeridae) from the New Forest, Hampshire and two specimens of *Bradycellus distinctus* (Carabidae) from Deal, East Kent. This highlights the importance of processing unidentified material rather than leaving it to languish in obscurity.

Accession labels were attached to 5,766 specimens and 4,719 specimens were catalogued. At least 60 store-boxes were emptied and stockpiled for future sale by the Museum. At the end of the project, the Coleoptera occupied 27 cabinets and a total of 261 drawers within these cabinets. This saw the main series expand by around 3 cabinets.

The work being carried out generated a number of enquiries from National Recording Scheme organisers and experts in particular beetle groups. This prompted us to post all of the Red Data Book species data for groups that had been worked on, onto the internet newsgroup beetles-britishisles@yahoogroups.com. Further enquiries were generated once the data had been released.

Richard Wright, a local entomologist, visited the Museum on a number of occasions to take photographs of species for a new CD-Rom British beetle identification guide. He also assisted the contractor at the end of the project, in photographing every drawer of Coleoptera in sequence (e.g. Fig.15). These photographs were then processed to produce an interactive visual catalogue of the entire main series. Magnification of the photographs allows for species labels to be read and for species numbers to be counted, but it is not generally powerful enough for critical species identification.

A number of close-up photographs were taken of certain 'photogenic' beetles such as the *Ampedus* genus (Elateridae) (Fig. 16), to show greater detail of layout. The rove beetle (Staphylinidae) collection was in constant use by Derek Lott who was writing sections of his Royal Entomological Society Handbooks for the Identification of British Insects keys. A collection-led workshop on Ground Beetles (Carabidae) held at CRC during the term of the project, benefited from the re-organisation of the collection.

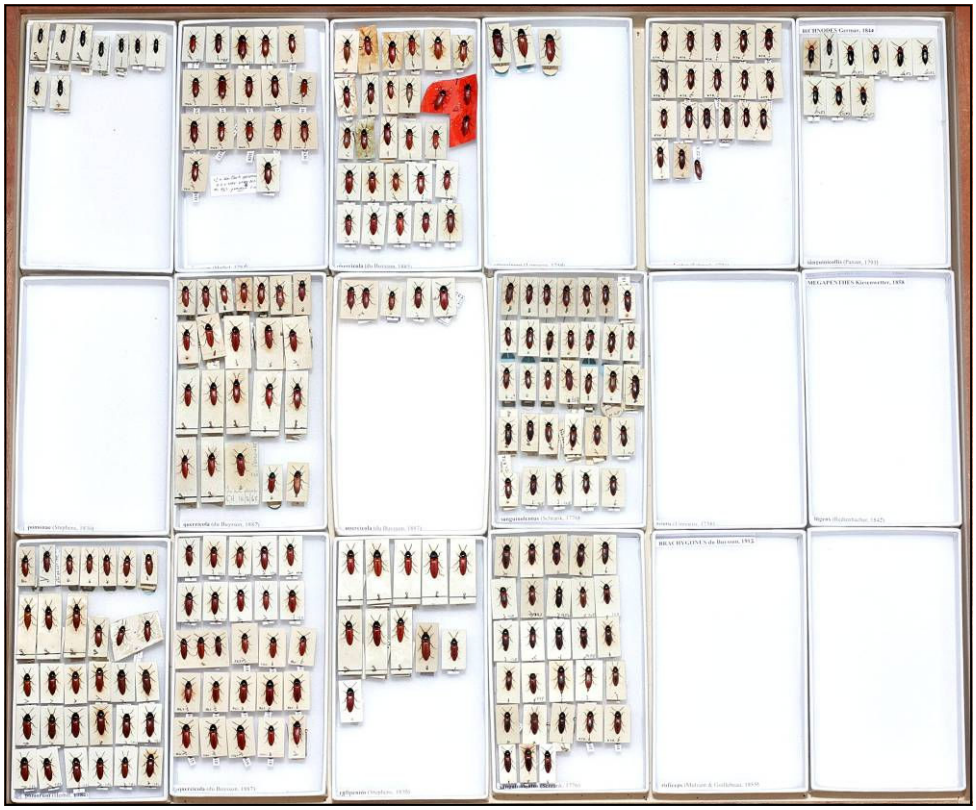

Fig. 15. An Elateridae drawer after reorganisation. (Image © Leicestershire County Council Museums)

Fig. 16. Detail of the same drawer as Fig. 15. (Image © Leicestershire County Council Museums)

Recommendations for Future Work

Further work to transfer and re-organise the remaining 31,617 specimens is essential if the work already carried out on this significant collection is to be completed. This work will produce further useful data for scarce species, enhance the overall accuracy of the collection identification and remove the need for store-box storage. The expansion space required for this additional work is already provided for by nearly three empty cabinets (26 drawers).

The value of any collection lies in the range of species represented, the presence of good data and the reliability of identification. Inaccuracy in identification effectively renders a collection inaccessible. Although identification was carried out extensively during the project, a number of 'difficult' species complexes were not checked because of time limitations. There are also a number of species that require dissection to confirm their identity. Future work might include specialist attention for these species groups.

Access to collections is a major consideration for their continued presence in Museums. Access can take many forms, from academic research through to community-based learning and exhibitions. The design of the best collection-led learning material requires a blend of academic or specialist knowledge of the collections, coupled with a creative approach in interpretation of that material. It is also important to identify the requirements and expectations of any user group before the material is developed. There is great potential for collections use at CRC and despite space and staff resource limitations, there are exciting future initiatives to develop the entomological collections for exhibitions and events.

One of the most important functions of a collection is to provide reliable data that can contribute to our understanding of species distribution and inform future species conservation projects. A database catalogue of Red Data Book, BAP species and Nationally Scarce species, would be useful for this purpose and key to improving collections access for researchers.

The Hunt collection material has suffered from extensive mould growth as a result of inappropriate storage. Perhaps up to 25% of this collection is affected. Some specimens are so densely covered in mould that the beetles are obscured. Otherwise, the majority are affected by grime. It would be advantageous to selectively clean specimens from the Hunt collection, prioritising Nationally scarce and Red Data Book species for this process.

Pest infestation is a constant threat in Museum stores, particularly since the use of pesticides has been phased out. The author was once advised that the best form of prevention for pest infestation is to regularly use the collection. This is good advice, but it is rare for all parts of the collection to receive the same level of regular attention. As a preventative measure, it would be prudent to freeze drawers on a rotational basis, commencing with the first drawer of the first cabinet and working through the collection. In addition, random sample checks for pests should be carried out as part of a pest-monitoring programme. At Barrow, such pest checks are already carried out as part of a wider housekeeping routine.

Acknowledgements:
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Order from chaos: The new Grant Museum of Zoology, University College London

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Abstract

The Grant Museum of Zoology at University College London relocated at short notice over an eight month period, reopening in a new larger venue in March 2011. Whilst describing the relocation process, here I discuss the benefits of installing a gallery without planning displays in advance, a process which occurred in this instance due to time pressures. The new Grant Museum employs cutting edge technology on iPads to engage visitors in conversations about science in society and how museums should operate. We are also providing services to support academic staff to meet their funders' public engagement agendas through co-curated installations based on their current research.

Keywords: museum relocation; redisplay; public engagement; computer interactives; iPads; higher education

With its reliance on a human construction forcing an unnatural structure on a natural process, taxonomy may not be an exact science. What it does do, of course, is create some order from the chaotic processes of speciation and extinction. Looking down from the balcony in the Grant Museum's new home at a couple of hundred crates of specimens randomly piled in the centre of the room, I realised that the small team of staff (a Curator, a Learning and Access Manager, a Conservator and a Manger) and five volunteers had a similar task in hand. The move of the Museum had been nothing short of chaotic, its unpacking would follow a similar theme, but the end result needed to be ordered, comprehensible, and largely taxonomic (Fig. 1).

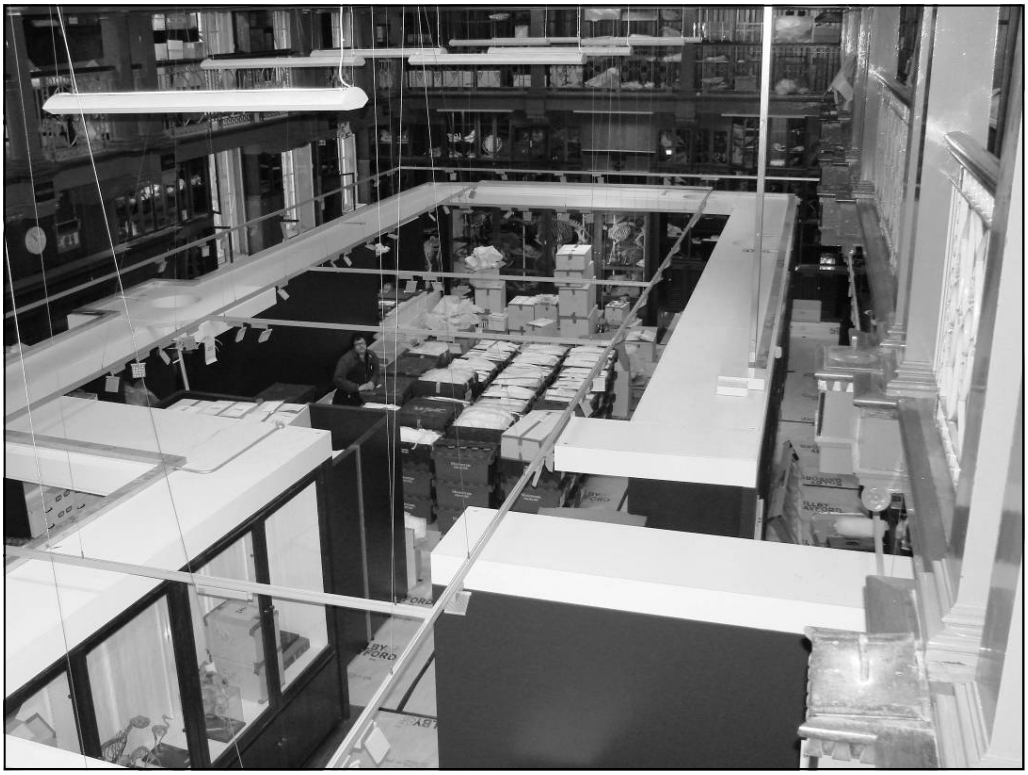


Fig. 1. Packed crates in the new Grant Museum space.

First, a bit of history: the Grant Museum of Zoology was founded in 1828 as the collection of specimens that supported the teaching of zoology and comparative anatomy at University College London (UCL). Over the years it has been added to by its managing curators and professors to fit their own research interests and fill any taxonomic gaps they perceived. Over the past thirty years many other London universities disbanded their zoology collections, and they came under the care of the Grant Museum. We are now the last university zoology museum in London (Chatterjee, *pers comm.*). In 1996 the collection was moved from its laboratory space under the rafters of the Medawar Building at UCL to the ground floor of the Darwin Building on Gower Street. The aim was to turn the historic teaching collection into a public museum. Since then the Grant has substantially grown in its profile and it is now one of the leading providers of informal natural history engagement in London.

In recent years an agenda has arisen to embed public engagement activities into the everyday life of universities. UCL is one of the six Beacons for Public Engagement in the UK (www.publicengagement.ac.uk), and the Grant Museum is one of the University's major platforms for public engagement. In recognition of our growing profile, and the opportunities that having a successful venue with an established audience can provide a university seeking to work with local people, a bigger and better venue was sought for the Museum. Alongside this, the departments we shared the Darwin Building with urgently needed to grow. In the end, our home wasn't suitable as we needed somewhere bigger with better street access, and our neighbours needed our space. Museums that operate within other institutions or services will be well aware of the disadvantages of not having control of their estate. Challenges arise when other branches of your governing institution do not have an accurate grasp of how museums operate. I imagine that being asked to empty an entire storeroom at a day's notice is a horror that hasn't only happened to us.

On this occasion, the request to move the whole Museum wasn't as bad as that; we were given a few months notice to vacate our premises to allow the Departmental expansion in the Darwin Building. Anyone who has undertaken a museum relocation 'properly' will appreciate that this isn't a lot of time. The space that we were moving to, the Edwardian former medical science library across the road in the UCL Rockefeller Building, was occupied until after we had to leave our old space. This meant that we would have to move the collection twice – once to store and once to the new home – and also that we wouldn't have access to the new venue in order to design displays in advance.

The inability to plan fully resulted in a great deal of surprising advantages. We were freed from the lengthy and tedious process of measuring every specimen's footprint and matching that to the available space in the new Museum. Being a former library, the walls of the room are lined with over 100 wooden cabinets that we could fill. Every one of them has a different height, width and depth, so planning the displays for 137 cases would have been quite an undertaking. Not only that, but without a full list of specimens, we couldn't even plan the theme for each of the cases. We knew that the collection was to be largely taxonomically arranged, with some sub-collections being displayed together, but how many cases each taxon would fill couldn't be decided until we were unpacking in the venue.

We closed on 1 July 2010. Over the course of three months the excellent specialist museum movers – Constantine – packed 727 crates and boxes of material. At this point we hit a set-back. The day after the last crate left the Darwin Building a massive flood hit our two store-rooms where the vast majority of our collections was housed. This was particularly bad timing as it was the same day that the Curator left the country to get married, and when I returned from five months fieldwork in Australia.

It had taken over two months to fill diligently the brand new stores in early 2010. It took a little over two hours to evacuate the soaked store where our 'dry material' was kept. Fortunately we had the old Darwin space empty to use as a laying down space. For the period of the Museum's move, it had been planned that we would have access to the stores throughout; we now had to pack all of the evacuated material to place in off-site storage (where it still is now as our flooded stores are still being repaired) until after the move was finished.

While we were closed we still had to fulfil all of our university teaching with the collection. The first job was to rescue the necessary specimens from the pile of flooded material, before they were sent off-site. Then we could pack everything else. This meant that over the course of summer 2010 all 68,000 specimens in our care were packed and moved, most of them for the second time in a year. With the stores drying out and the collection safely housed elsewhere, we could return to refurbishing the new Museum. A large struc-

ture was built to house the cases we brought from the Darwin Building, including those from the 1851 Great Exhibition at Crystal Palace.

Unpacking the Museum in the Rockefeller Building took about three months. Although the six main vertebrate cases remained largely the same as in the previous Museum, all 131 other cases were to be designed from scratch. Normally museums would plan for this quite carefully, but due to the reasons mentioned above, we had to make it up as we went along. Filling the cases went like this: choose a crate and unpack it, cross the crate off the list, measure the specimen, find a case it would fit in, document where you put it, repeat (Fig.2). Towards the end I went round and shuffled specimens to make sense thematically, at least on the bottom row where people can get up close. We are treating the two rows of cases above head height as 'wall-paper' (Fig. 3). People can see what's in them, but only at a distance. With this in mind, we decided that coherent organisation was not necessary, as interpretation was not possible at this height. The alternative to a thematic display (be it taxonomic, historical, ecological etc) is an aesthetic one. We have used this massive area of display space around the Museum to create an atmosphere of discovery and intrigue. Columns of skeletons, skulls and spirit specimens have achieved this end. There has been a great deal of positive feedback, without people asking what the objects actually are.

Fig. 2. Gibbon skeleton in the primate display. © UCL, Grant Museum of Zoology / Matt Clayton.

Having now completed the museum displays without spending the time to plan carefully and map the location of each specimen in advance, I question the need for other redisplay projects to do so. Obviously there are occasions when it is crucial, for example when telling a story about a specific set of specimens, or when the need for a high degree of access to collections in store would require a more structured arrangement. However, I would recommend that anyone managing such a project in the future carefully examines the extent to which they can install a gallery with as little planning as possible. Positive and time-saving results can be achieved ad hoc. At a time when resources are short, opportunities to save at any point in the process should be grabbed with both hands. A major disadvantage to note is that each step cannot be started until the one before it is complete, particularly when the same people are responsible for display and interpretation. The timing crunch we experienced was that the interpretation could not be written until installation was complete. Since we didn't know what was exactly going to be in each case (or in some instances what the theme of a whole case would be) until we installed it, no labels could be drafted, proofed or printed in advance. Although we scheduled time for this from the outset, it was a rush to the finish line.

Fig. 3. View of the Museum, showing top two rows of 'wallpaper' cases. © UCL, Grant Museum of Zoology / Matt Clayton.

The final part of the Grant relaunch was to bring in the technology. We have always been an 'old fashioned museum'. By that I mean that on a daily basis people come in and say 'this is what a museum should look like'. We have a very large number of specimens on dense display and people like that. However, we are also one of the biggest contributors to adult science engagement in London and are not old fashioned in our practice. Working with the UCL Centre for Advanced Spatial Analysis (CASA) and UCL Centre for Digital Humanities, we now have in place some wonderful interactives that don't detract from specimen-engagement in the way that computers and animatronics have in some museums. The 'QRator' project uses CASA's Tales of Things technology on a specially developed application on ten iPads attached to displays across the Museum. We are using these iPads to ask our visitors to comment on the role of science in society and museum practice today (Fig. 4). For the latter at least we will use what they say to inform how we do things. Each iPad will have a question, and visitors can respond on the iPad itself, or via twitter or the 'Tales of Things' app on their smart phones. The first set of these constantly changing questions include: 'What makes an animal British?'; 'Should human and animal remains be treated differently in a museum like this?'; and 'Should science shy away from studying biological differences between races?'. In this way, we are using a fantastic and accessible historic collection alongside cutting-edge technology in a way that museums have never done before.

In our new space we are able to address the University's and wider higher education sector's public engagement agendas by offering to share our display space, audience and expertise with UCL's staff and students. UCL researchers – both scientists and artists – are now able to co-curate installations and exhibitions about their current work in three areas of the Museum (Fig. 5). In this way we are able to increase our worth to our major funder, UCL, as well as provide thoroughly current content for our visitors to engage with. Many academics have a strong desire to engage with the public, and now the funding councils require them to demonstrate pathways to impact for their research grants. What have often been lacking in the process are platforms for academics to reach an audience, and the specific skills required to engage through exhibitions. Museums can offer both, and such partnerships have the potential to serve the varied agendas of the institutions and people involved.

Fig. 4. IPads enable unique specimen engagement. © UCL, Grant Museum of Zoology / Matt Clayton.

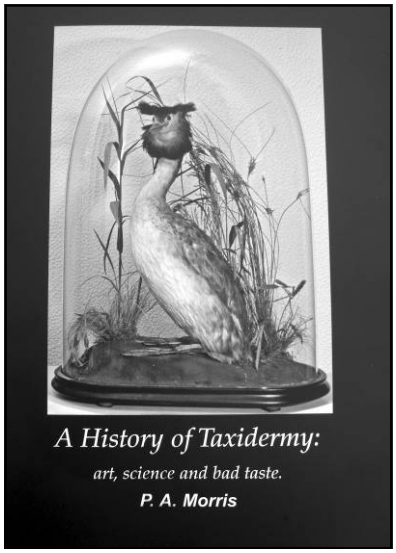
Fig. 5. The new Grant Museum of Zoology. © UCL, Grant Museum of Zoology / Matt Clayton.

The whole move, from closing through packing, storing, delivering, unpacking, remounting, installing, interpreting, marketing and reopening, took just over eight months. It was certainly a chaotic rush, and not standard for a relocation or redisplay project, but the end result has been overwhelmingly positively received.

Acknowledgements
The Grant Museum staff are indebted to the dedicated volunteers who give up their time to assist in the running of the Museum. The move would certainly have not gone smoothly without them. We would also like to thank our colleagues in UCL Museums & Collections and elsewhere who dropped everything to assist in the evacuation of the material after the flood. The QRator iPad project was funded by the UCL Public Engagement Unit. I am very grateful to NatSCA for providing the bursary to the 2011 conference.

Book Reviews

Review for Morris, P A.
A History of Taxidermy: art, science and bad taste.
Privately printed by MPM publishing, West Mains,
London Road, Ascot SL5 7DG.
Hardback £48 (ISBN 978-0-9564873-0-8)
Softback £35 (ISBN 978-0-9564873-1-5)



The author's flyer says it all "**400 pages, colour throughout, over 130,000 words and more than 1,100 pictures – it's all here!"**
For this reviewer, it certainly was true and this book will be an invaluable tool for my peripatetic work, visiting and condition-assessing taxidermy collections. The book's subtitle itself suggests a wry sense of humour, handy when relating the many humorous anecdotes and helping to make the book an easy read. The illustrations are clear showing the art of taxidermy from the supreme to the dreadful and, of course, the utterly bizarre!
One can see, at once, that this has been a life-long project and that the author's vast knowledge and expertise, as well as a lifetime of observation, are represented throughout this volume. The author stresses the cultural importance of taxidermy, its particular relevance during the 100 years when it became considered as fashionable and how this waned more recently but leaving a legacy of art, science, the occasional example of bad taste and the weird! He tells us that taxidermy has 'moved on' and although some terminology has changed, modelling and taxidermy have always gone hand in hand.

Thumbnail sketches of the better-known taxidermists are included in clear and concise detail, showing examples of their work, their trade labels and contemporary publicity also to the 'back-streeters' who worked part-time in several other jobs, to make ends meet, and whose names are almost lost in obscurity. He includes the trend for anthropomorphising the subjects – duelling squirrels and Walter Potter's tableaux which were always and irresistible draw to my younger self.

Museums outside of Britain, with their collections and displays are linked to well-known taxidermists and taxidermy firms, especially those in France and in North America – including the vast dioramas and Carl Akeley's famous elephants at the Field Museum in Chicago.

The author courageously and objectively reviews society's foibles and changing attitudes towards taxidermy, especially with the current changing sensibilities. He touches on techniques, mentions much of the older bibliography and history of taxidermy are all well-covered. Many of today's taxidermists are mentioned including those who have recently retired or died and especially those who have pioneered technical advances.

The finish of the book is really good with details such as the tiny fox mask vignette in the central footer of each page that gives the page number.

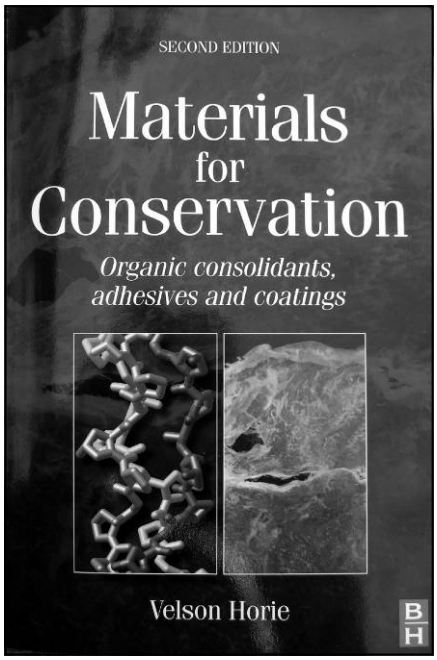
The author's other books have included biographical reviews of the works of Rowland Ward (2003), Edward Gerrard & Sons (2004) and Van Ingen (2006).

This book is going to become somewhat 'dog-eared' as it provides answers to so many of the questions that face me when visiting or assessing taxidermy collections. I highly recommend it.

Simon Moore, MIScT, FLS, ACR
Freelance Conservator of Natural Sciences
January, 2011.

Review for Horie, V.
Materials for Conservation: Organic consolidants, adhesives and coatings.
2nd edition

Butterworth-Heinemann (an imprint of Elsevier), 1986 and 2010 this edition.
[489 pp.] ISBN-13: 978-0-75-066905-4
Cost: £ 53.95



Despite its fairly hefty price tag for a paperback, this book has it all!

No longer will I have to trawl through organic chemistry books or the internet searching for conservation-related adhesives, polymers, monomers and resins (both man-made and naturally occurring), and their appropriate solvents or reversing agents. Velson Horie's book has them listed in tabular form with all their physical, chemical and molecular properties, with such details as fractional and Hansen solubility parameters and also molecular reaction diagrams of how resins cure.

For adhesives there are pages devoted to types, tack properties, suitabilities and how (and why) adhesion can fail in certain situations. Resonance hybrids of molecules are given where relevant.

The main text includes reactions of polymers and their chemical mechanisms, e.g. how cyanoacrylates and some other commercial adhesives create tight bonds through adsorption of hydroxyl anions.

The four appendices and sub-appendices contain information on resin and co-polymer properties, tabulated for quick reference and include polymer solubility charts, solvent properties and synonyms and, of course, a detailed glossary.

The author index itself is impressive, comprising about 1200 names. The references for cited articles and other works are given at the end of each chapter.

The work updates the 1986 (first) edition and is a book that shows the author's dedication to and expertise in the subject.

This is a conservator's bible containing information about every-known consolidant, adhesive and coating that is known at the time of writing and should find its way onto every conservation laboratory bookshelf.

I will certainly find it a most useful reference in my work.

Simon Moore, MIScT, FLS, ACR
Freelance Conservator of Natural Sciences
January, 2011.

Upcoming Seminars

59th meeting of the Symposium of Vertebrate Palaeontology and Comparative Anatomy and 20th meeting of the Symposium of Palaeontological Preparation and Conservation, jointly hosted by the Geological Curators' Group
12th – 17th September 2011
Lyme Regis

Preliminary Programme:
12th Monday - SPPC/GCG talks and posters
13th Tuesday - SPPC/GCG talks and posters; Workshops visits Icebreaker for SVPCA
14th Wednesday - SVPCA talks and posters; Public lecture (eve)
15th Thursday - SVPCA talks and posters; Public lecture (eve)
16th Friday - SVPCA talks and posters; Public lecture (eve); Conference dinner
17th Saturday - Fieldtrip (Details to follow)

For further information visit www.geocurator.org, or email: lyme2011@svpca.org

CARING FOR ENTOMOLOGY COLLECTIONS
A seminar to explore basic Entomology Collections Management, Curation and conservation techniques.

The Dorothea Bate Room, Natural History Museum, South Kensington, London.

Friday 18th November 2011; 9.30 for 10

This course will cover all basic aspects of collections management for Entomological collections, including storage and handling of specimens, loans and legislation, and specimen preparation.

Morning sessions:-
- Entomology Storage tour
- Integrated Pest Management
- Documentation
- Data-basing

Afternoon sessions:-
- Specimen Pinning
- basic slide preparation
- Verdigris conservation
- Spirit Curation

A maximum of thirty participants is planned for and first come first served!
The course will be both theory and practical supported by a booklet covering both aspects.

For further details, contact Paul Brown [p.brown@nhm.ac.uk]

To **book** a place on this course please contact Tony Irwin: tony.irwin@btinternet.com

Upcoming Seminars

CARING FOR BOTANICAL COLLECTIONS
A seminar to explore basic botany collection management, curation and conservation.

National Museum Wales, Department of Industry, Nantgarw, Wales

2nd February 2012

This seminar will cover basic aspects of managing and caring for botanical collections - including storage, handling and specimen preparation.

Morning sessions -
- Herbarium arrangement
- Storage
- Integrated Pest Management
- Documentation

Lunch

Afternoon work shop sessions -
- Herbarium mounting
- Conservation
- Identifying contaminated collections

Herbarium tour back at National Museum Wales, in Cardiff

A maximum of 15 participants is planned for.

The course will be both theory and practical.

For further details, contact:-
Vicky Purewal (vicky.purewal@museumswales.ac.uk)
Donna Young (donna.young@liverpoolmuseums.org.uk)

To book a place on this course please contact Tony Irwin: tony.irwin@btinternet.com

Course numbers are limited so please book early to avoid disappointment.