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Editorial

I hope everyone enjoyed the conference in Leeds this year. It was an interesting theme, about taking a new look at some of our collections, especially with all the hidden gems we have.

This issue is dedicated to the speakers, and they take the stage again, with wonderful write ups of their talks at the conference. Unfortunately two of the speakers were unable to make this issue, but they will be appearing in the next issue of NatSCA News, in October 2009.

JISC mail is working very well for quick queries around the membership. If anyone hasn't already signed up, there is a link on the NatSCA website;

(http://www.nhm.ac.uk/hosted_sites/natSCA/).

Keep an eye on the website; we are working to get it updated with more training session and helpful guides.

There are two other interesting articles in this issue; on the cost effectiveness of resin moulds, and colour guides used with herbaria specimens.

Please continue to send me articles, write ups and news and hope you enjoy this issue!

- Jan Freedman
Editor, NatSCA

Contributions for Issue 18, October 2009

All articles, letters, news, adverts and other items for inclusion for the next issue of the NatSCA Newsletter should be sent to the address below by September 1st:

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View From The Chair

I am writing this at the National Museum of Natural History - Naturalis, Leiden, the Netherlands where I am attending the annual conference of SPNHC (The Society for the Preservation of Natural History Collections) which is primarily based in the USA & Canada but which is increasingly attracting members from other parts of the world. The theme for the conference is Bridging Continents: New Initiatives and Perspectives in Natural History Collections. There is much exchange of latest knowledge and developments in our field and the networking is of great value to all here present and the quality of their journal 'Collections Forum' is formidable.

One item in discussion is the idea to set up local nodes for SPNHC across the world. So there might be a European node and I have said to their committee that we NatSCA must be very much part of this node as an associate or affiliate as we officially represent the natural history collections and professional staff of our natural history museums and our status is officially recognised by UK and Irelands Museum community as the SSN (Subject Specialist Network). NatSCA and SPNHC are complementary and should both strive to communicate and collaborate and to also include as closely as possible GCG (Geological Curators' Group), ICON CCG (Institute of Conservation [UK] Care of Collections Group) and ICOM-CC (International Council for Museums Working Group on Natural History Collections).

I have been studying the list of attendees and note that, out of the British Contingent of 49, there are 40 from the Natural History Museum, London; 3 from National Museum of Wales, Cardiff; 2 from the Horniman Museum, London; 2 associated with Thermo-Lignum Ltd, 1 from the Hampshire Museums Service; 1 from National Museums Scotland, Edinburgh and an additional 1 from National Museum of Ireland, Dublin. The NHM outnumbers the 8 Canadians and comes close to the 46 Dutch and 48 USA members attending! This reflects the present economic strength of the NHM as compared to most other natural history museums in the British Isles, who's budgets and staff's private income do not stretch to cover the cost of a SPHNC conference. As the local organisation, NatSCA can provide a cheaper service and we are working to improve our website and 'NatSCA News' so that all our membership can benefit.

I also recently attended a meeting of the ICON CCG (Institute of Conservation [UK] Care of Collections Group) to discuss how we can collaborate more closely. NatSCA must represent and defend Natural Science collection conservation and the best interest of natural science Conservators and as SSN and through closer ties with ICON we can do this!

Just reading through the above I have been quite acronymed out over the past few days and perceive that there are many and proliferating groups which may be in danger of 'reinventing the wheel' but with careful communication and representation we can avoid this and gain a stronger and harmonious voice both within across other relevant disciplines.

- Paul Brown
Chair, NatSCA

NatSCA AGM
2.00 - 2.30pm, Thursday 7th May, 2009
Thoresby Room, Leeds City Museum, Millennium Square, Leeds, LS2 8BH.

Minutes

Committee members present: Paul Brown (chair), Tony Irwin, Simon Moore, Pippa Strang, Maggie Reilly, Leslie Noe, Kate Andrew, Jeanne Robinson, Jan Freedman, Jack Ashby, Hannah Paddon, Gerry McGowan, Clare Stringer

Apologies for absence
Nicola Newton

Minutes of AGM University Of Glasgow, May 15th 2008
No matters arising.

Chairman's Report: Paul Brown
The year has been busy for all of us as we all have increasingly heavy workloads. In spite of such committee met 4 times during the year.

There seems to be a continuing attrition of posts throughout the Natural History Museums sector. In particular, we have been involved with the changing situation at Bristol and have talked with ex Bristol Museum staff, local collections' user groups and with GCG. In close conjunction with Helen Fothergill chair of GCG we have written letters of concern to Bristol City council members about the perceived loss of posts in Natural History. At present the only curator has left on maternity leave and marks the only time in 180 years that there has not been a natural science curator in post! To lose curatorial posts if temporarily is unfortunate, particularly with MLA placing a greater emphasis on the role of larger regional museums as centres of excellence, as examples of good practice and as advocates for smaller museums within their region. To lose these posts permanently would be a catastrophe. These curatorial posts are not only important to your museum service, but to the natural heritage of the Nation. As a holder of a 'Designated' Collection including Type material, Bristol Museum service has the responsibility for nationally and internationally important scientific collections. Without dedicated and knowledgeable specialist curators to care for these collections, their value would diminish as the material becomes more inaccessible to researchers and the general public and potentially deteriorates in condition.

The latest proposal, as we understand it, is to have a single Natural Science Collections Manager and an assistant: one to be a Geologist and the other to be a life sciences person. Both posts will have to cover Curation, Conservation and Managerial roles and we will continue to hold a watching brief on developments. Recently University collections have been disposed of such as at Greenwich and we must ensure that any material of national or local value is saved for future generations.

If you the membership perceive a problem or foresee any cuts in collections care anywhere in your local areas, you must alert NatSCA committee so that we can represent the requirement for governing bodies to properly fund and look after the collections under their care. We have not officially heard of the fate of collections in Canterbury. Pippa Strang is presently collating records on the change in natural history collections and staffing nationwide.

We are developing closer ties with Care of Collections Forum, GCG and SPNHC, and we hope that as many NatSCA members will benefit from the SPNHC meeting to be held in Leiden, The Netherlands from the 7th to the 11th of July 2009 and the title is "New Initiatives and Perspectives in Natural History Collections". Information can be found at www.spnhc2009.org. Bursaries for attending this conference are available in £100 lots to sponsor members who are not actually giving a talk first come first served.

Jack Ashby wrote a brief for commissioning natural science display consultation. The agreed target is schools, family groups, individuals and museum visitors.

There has not been much development on the Subject Specialist network front and there seems to be no money in the offing.

We have been improving our website and hope to have more links to other related organisations. We hope to develop fact sheets on pertinent subjects.
1. What to do with old birds egg collections
2. How to send spirit-preserved specimens in the post
3. Freezing for pest control
4. Finding current species names
5. Testing for arsenic
6. Testing for mercury
7. How to identify preservative fluids
8. Regulations for the disposal of animal remains
9. Disease risks in the NH lab.

Let us have your suggestions please: -

Secretary's Report: Clare Stringer

	NHM 19/6/08	Bristol 30/09/2008	York 15/12/2008	UCL 23/3/09
Clare Stringer	✔	✔	✔	✔
Gerry McGowan	✔	✔	✔	✔
Hannah Paddon	✔	✔	X	X
Jack Ashby	✔	✔	✔	✔
Jan Freedman	X	X	X	✔
Jane Mee	X	X	X	X
Jeanne Robinson	X	✔	X	X
Kate Andrew	✔	✔	X	X
Leslie Noe	X	✔	✔	✔
Maggie Reilly	X	✔	✔	✔
Miranda Lowe	X	X	X	X
Nicola Newton	X	✔	✔	X
Paul Brown	✔	✔	X	X
Peter Stafford	X	X	X	X
Pippa Strang	✔	✔	✔	✔
Simon Moore	✔	✔	X	✔
Tony Irwin	✔	X	✔	✔

Treasurer's Report: Tony Irwin

Annual Accounts Summary (2008-2009):
The accounts were audited by Velson Horie, and approved as an accurate representation of the Associations finances.

Current Accounts (Feb – Apr 2009)
These are much as expected at this time (see below).

Annual Returns for the Charity Commissioners
As soon as we return from Conference, I will prepare the financial element of the Annual Return and send it

to Paul for completion.

Website development
My proposal for using some of our funds for website development were sent out last month. If everyone is agreed, I will write up something more complete for circulation to the membership.

NATSCA ACCOUNTS 2009-2010

Natsca accounts 1 Feb 2009 - 30 Apr 2009					
INCOME					
Subscriptions	unit value	no of units	totals		
Personal @£15.00	15.00	106	1590.00		
Incorrect rates	15.35	1	15.35		
Student/unwaged	10.00	2	20.00		
2008 sub	15.00	1	15.00		
Institutional @ £30	30.00	22	660.00		
Total subscriptions		46		2300.35	
Other income					
Interest (deposit account)			3.25		
Duplicate payment to be refunded			50.00		
Total other income				53.25	
Meeting income					
2009 AGM (meeting fees & conf meals)			896.00		
Total meeting income				896.00	
TOTAL INCOME					3249.60
EXPENDITURE					
Travel to meetings			295.62		
Website			68.33		
Total operational costs				363.95	
TOTAL EXPENDITURE					363.95

Profit (loss) for 09/10 financial year					2885.65
ASSETS					
HSBC Deposit account 41653636					
Opening balance, 1st Feb 2009	23439.71				
Bank interest	3.25				
Total and actual balance, 30 Apr 2009		23442.96			
HSBC Current account 91645722					
Opening Balance, 1 Feb 2009	4484.89				
Balance on 30 Apr 2009		7367.29			
Total Assets		30810.25			
Assets at start of year	27924.6				
2009/10 profit/loss	2885.65				
Assets at start of year + profit/ - loss		30810.25			

Acceptance of accounts proposed by Kate Andrew, seconded by Clare Stringer. Carried.

Membership secretary's Report: Maggie Reilly
Reporting on year 1st February 2008 – 31st January 2009

There are 181 personal members, the majority of which are UK based, only 11 overseas members either EU or North American. There are 54 institutional members, again the majority being UK based with 13 overseas members. This gives a total paid up membership of 235 which agrees fully with the Treasurer's report. 42 members did not renew, 34 new or returning members joined or re-joined. The baseline membership has been stable for a number of years with non-renewals more or balanced by new recruits. The seminars held during the year bring in a number of new members each time.

The membership are reminded that institutional memberships entitle the holder to two member rate places at meetings and seminars but no voting rights at the AGM. We also remind the membership that the subscription year runs from 1st February to 31st January. Members who join/pay very late in the year ie after the middle of November are normally held over to the following year unless they explicitly state the membership is for the current year.

Communication with members: we have an email distribution list that we try and keep up to date and have been sending out emails on that as requests have come in. Please notify the membership secretary of any changes to contact details, especially email addresses. With the setting up of the JISC-Mail list, there should

be less emails from the membership secretary re queries. In an effort not to clutter up in-boxes, such emails will be restricted to job ads or info that the committee feel all members should be made aware of. Several members are not on email and a more consistent effort to supply key information to them must be made.

Finally, also due to the advent of the JISC Mail list as a more convenient way to communicate, the Forum on the website has been taken down. There was in fact little traffic through the Forum and though worth trying out, it turned out not be a particularly useful feature.

Editorial & Website Report: Jan Freedman

Issue 16 was printed and send out at the end of March/April. Issue 17 will be the conference issue, but please continue to send me articles. The deadline for articles is June 30th, and Issue 17 will go to the printers at the beginning of July.

Issue 13 and 14 will be put up on the website soon.

We have set up a JISC Mail, which is a quick way to look for advice and information or advice for other members.

Natural Science Conservation (& Institute of Conservation) Report: Simon Moore

There have been no conservation issues this year but there have been numerous publications in NatSCA News and there have been 2 successful seminars, one on taxidermy and the other about adhesives, and which attracted a larger-then-average audience from many disciplines and which finished successfully with very many positive comments.

We still maintain a link with ICON, the Institute of Conservation and are still (=chasing up) completing information leaflets about the maintenance of biological and geological specimens and collections.
We wish Nic Newton all the best with her forthcoming baby.

Election of Ordinary members to NatSCA committee :

1	OM 09-11	Jack Ashby	Grant Museum, London
Proposed: Leslie Noe		Seconded: Clare Stringer	
2.	OM 09-11	Miranda Lowe	NHM, London
Proposed: Paul Brown		Seconded: Suzanne Ryder	
3.	OM 09-11	Pippa Strang	Yorkshire Museum
Proposed: Maggie Reilly		Seconded: Simon Moore	
4.	OM 09-11	Paulo Viscardi	Horniman Museum
Proposed: Jack Ashby		Seconded: David Waterhouse	
5.	OM 09-11	Leslie Noe	Thinktank, Birmingham
Proposed: Clare Stringer		Seconded: Maggie Reilly	

As there are vacant posts and candidates to fill them, no election is required. As there were no objections to the candidates, it was proposed by Jeanne Robinson, seconded by Jack Ashby and carried that we accepted and elected the listed people en block onto committee to serve for two years as ordinary committee members.

Any Other Business
The forum on the website has been taken down having had little use during its lifetime. It has been replaced with a JISC Mail service (see 'Editor's Report').

Please would members send any survey work they have on the popularity of various galleries in mixed-display museums to Jack Ashby for collation.

NatSCA would like to advertise their presence on the Society of Vertebrate Palaeontology website. Paulo Viscardi to liaise with them.

David Craven asked NatSCA to look into ongoing legal implications regarding the ownership/custodianship

of natural science collections. Recent DEFRA and HM Revenue and Customs requests to museums have caused concern within the community. NatSCA committee to discuss this at next meeting.

Leslie Noe will be running a fossil workshop in Street, Somerset in September. Please look out for details.

Vote of thanks
To Peter Stafford and Jane Mee who are stepping down this year from the committee.

To Gerry McGowan, John Roles, Joseph Botting, Clare Stringer and all speakers for arranging and being part of this year's conference and AGM.

Close

The attendees of the NatSCA conference in Leeds, Thursday 7th May 2009, on the steps of Leeds Museum.

The Alfred Leeds Collection of Fossil Vertebrates: Past, Present and Future

Leslie F. Noè,

Curator of Natural Science, Thinktank, Birmingham Science Museum, Mullenium Point, Curzon Street, Birmingham, B4 7XG
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Abstract
Alfred Leeds was a gentleman farmer who lived close to the City of Peterborough. He was a born collector, and for the majority of his life amassed fossils, both vertebrates and invertebrates, from the Jurassic Oxford Clay which crops out around the City. Alfred Leeds collected at a fortuitous time, starting at the beginning of the mass excavation of clay for the production of bricks, and ending just as mechanisation began to lead to the destruction of much of the fossil heritage contained within the clays. The Leeds Collection of fossil vertebrates includes fish, ichthyosaurs, plesiosaurs, pliosaurs and marine crocodiles which opened up, for the first time, an entire fossil ecosystem. The Leeds Collection is thus of major international significance, and archive material related to the Collection is beginning to throw new light on the man and his outstanding fossil collection.

Introduction
Alfred Nicholson Leeds (1847-1917) was born, raised and lived at Eyebury, a farm just a few miles to the northeast of the city of Peterborough. He was an avid collector from an early age; he was educated, like his brother, at Warwick Grammar School, and took over running of the family farm when he reached the age of majority (his father had died when he was just four years old). He was married in Glasgow in 1875 to Mary Ferrier Fergusson (Liston 2006), with whom he had five sons, all of which, at various times, assisted with the processing of the bones in his collection. However, the Leeds Collection did not begin with Alfred Leeds, but was initiated around 1865 by Charles Edward Leeds, Alfred Leeds elder brother, when he went up to University at Oxford where he attended the lectures of John Phillips, Professor of Geology. Charles Leeds probably co-opted Alfred and began collecting fossils from the local Oxford Clay (Leeds 1956). Charles Leeds retained an interest in the collection as it grew, but work away from Eyebury, and later emigration to New Zealand, meant his input was probably limited after about 1870. Hence it was Alfred Leeds, later with the help of his family, who developed the collection into an internationally renowned resource. By the end of his life, the Great War had reduced labour supply, severely limited brick production, and mechanical clay extraction predominated in the pits thereby considerably reducing the possibility of finding fresh fossils.

Sources, Clay Extraction and Fossil Collecting Techniques
The fossils in the Leeds Collection were derived from excavation of brick clays in the Peterborough area. Peterborough has a long history of brick making, probably extending back to Roman times. However, with the growth of the cities, particularly London, following the Industrial Revolution demand for bricks outstripped the old hand-making techniques. However, machinery sped up brick production and the introduction of the Hoffmann kiln from Austria permitted rapid and continuous firing. In addition, agricultural depression following the Free Trade laws led to the sale of a number of farms, often through auction, perhaps most notably the Fletton Lodge Estate (Hillier 1981). This estate lay on thick brick-clay deposits to the south of Peterborough and the land was rapidly snapped up by entrepreneurs wishing to invest in new brickworks. Developing rail links with London provided a ready market for the bricks from many of the Peterborough brick manufacturers.

The Oxford Clay Formation from which the Leeds Collection is principally derived is an organic rich, silty mudstone of Callovian (middle Jurassic) age (Hudson and Martill 1994), now known to have been deposited some 150 million years ago (Hudson and Martill 1994; Gradstein, Ogg et al. 2004). Early brick pits exploited the callow or weathered surface clays close to where bricks were needed. These shallow 'borrow pits' were dug, the clay allowed to puddle (break down in the frost of winter) before being 'wire cut' prior to firing in small, specially constructed kilns. However, the industrial expansion of brick making required a constant supply and greater volumes of clay, leading to the opening up of the deeper Oxford Clay deposits. Although brick production had been mechanised, the arduous task of obtaining the clay was still undertaken by hand.

The clay was hewn by 'clay getters', men working with a six-foot long, 36 pounds weight crowbar. Once the pit was opened up, the clay was cut into a concavely curved, stepped 'amphitheatre' with a chute down the middle (Anonymous 1924). Each terrace was cut back in turn, and the clay directed down the chute into a wagon, usually on rails, below. The full wagons would then be transported, in the early days by hand, to the grinding mills and presses to produce green (unfired) bricks. However, these deeper layers of clay were generally more fossil rich than the surface clays, however the fossils accorded a problem for the brick maker. If incorporated into the green bricks, the fossils would explode upon firing, causing damage not just to the brick containing the fossil, but also those surrounding it, considerably reducing production and increasing costs. Hence the fossils were a waste product to the brick-making industry.

An experienced clay getter grew to recognise the sound of the thump of the crowbar on the clay. They could not only distinguish clay from fossil, but from the 'ring' of the crowbar could also distinguish between belemnites, by far the most common fossil, other invertebrates, and bone, thereby giving warning of a fossil lying beneath their feet. The clay getters were provided with 'bolt buckets' (named after the belemnites or 'Devil's thunderbolts' which were so common) and paid a bonus for filling them. However, this method of discovery meant that the fossils were excavated as they were found, sometimes with a long intervening period before the rest of a skeleton was revealed (Leeds 1956), depending how the work of excavating the clay in the pit progressed. In addition the bones were usually broken into many fragments or had to be reconstructed from bolt buckets rather than collected intact in the ground. Indeed a specimen of the fish *Lepidotes* in the Hunterian Museum, University of Glasgow, was reconstructed from the contents of a bolt bucket (Leeds 1956) – a challenging task considering the many thousands of scales that made up the entire fish.

Alfred Leeds got to know the pit owners and would constantly visit the pits. He would pay the workmen to notify him by telegram when significant vertebrate fossils were found and would pay a premium to excavate the bones himself. When collected by Leeds, the clay was removed using household table knives, and quickly and carefully wrapped for later cleaning and reconstruction. During this work Leeds was always keenly aware that he could not interrupt brick manufacture. Once back at Eyebury, Leeds and his family would work for many hours cleaning the fossils of the adherent clay, sorting and ordering the remains, and carefully gluing together and reconstructing the bones. It was the patience and skill required to reunite the thousands of bone fragments that was Alfred Leeds remarkable skill (Leeds 1956).

Leeds Collection

During his lifetime, Alfred Leeds collected, cleaned, and reassembled elements from literally hundreds of skeletons. Charles Leeds, due to his university education, had made a number of scientific connections, most notably Harry Govier Seeley who described some of the collection in 1874 (Seeley 1874). However, as Charles Leeds has less time for the collection, Alfred Leeds continued to collect for his own interest and more than 10 years elapsed before he made contact with the men of science, and even this seems to have been at the behest of his brother prior to leaving for New Zealand. When Henry Woodward, Keeper of Geology at the British Museum (Natural History) in South Kensington, London (the BM(NH) - now the Natural History Museum, London), visited the collection in around 1885 he was utterly amazed at the quality and quantity of the material it contained. This initial visit subsequently led to visits by numerous scientific men of the day, including: J.W. Hulke, Charles Marsh, C.W. Andrews, and A. Smith Woodward, and a lifelong friendship with Woodward himself.

An article in the Peterborough & Huntingdonshire Standard for 7th April 1888 described the Alfred Leeds and his Collection: "It is probable that he has the finest collection of Oxford Clay fossils in the kingdom" and "He has received several requests for it from the authorities of the South Kensington Museum, but refuses to part with it, as it supplies him with some entertainment in the winter evenings" (Anonymous 1888). Indeed the Leeds Collection was so much in excess of material in the national museum that the BM(NH) eventually agreed to purchase the entire 'First Leeds Collection', comprising all material collected up to May 1889, for £1,500 – a huge sum of money at the time. The consignment of fossils that was sent from Eyebury to the museum weighed more than five tons.

Following the sale of his First Collection, Alfred Leeds continued to amass fossils and develop a 'Second Leeds Collection'. Leeds was always keen for others to see his collection, particularly the workmen in the brick pits to encourage them to contact him when bones were first discovered. In March 1896 Alfred Leeds presented a lecture in the local village hall at which he was astonished at the interest shown in his 'old

bones, dry subject'. Significant specimens from the developing collection continued to be offered to the BM (NH), but by now Alfred Leeds and his collection had become widely known across Europe and those specimens not accepted by the BM(NH) were donated, exchanged or sold to institutions across Britain and the World, including Kendal, Liverpool, Cardiff, Edinburgh and Dublin; Bonn, Frankfurt, Tübingen, Paris and Uppsala; and Yale and Washington. Following Alfred Leeds death in 1917 the majority of his remaining collection, consisting of well over 600 specimens, was passed to the University of Glasgow's Hunterian Museum, although some low grade material was disposed of at Eyebury. A small number of choice specimens, retained by his widow were sold to the BM(NH) in 1921.

Present

Today, Alfred Leeds is best remembered for his finds of substantially complete and wonderfully three-dimensionally preserved marine reptiles that once swam in the warm Oxford Clay seas,: the ichthyosaurs, plesiosaurs, pliosaurs and crocodiles (e.g. Andrews 1910; Andrews 1913; Tarlo 1960; Brown 1981; Noè 2001). One of the most impressive Leeds Collection specimens is the tail and other remains of the giant filter-feeding bony fish *Leedsichthys problematicus* (see Martill 1986; Liston and Noè 2004). Leeds also recovered the remains of land living dinosaurs, parts of a rare flying pterosaur and the earliest putative dinosaur egg, all of which went to the BM(NH) (Chapman and Liston 2008; Liston and Noè 2008), with perhaps the single most impressive dinosaur the partial skeleton of the sauropod *Cetiosauriscus leedsi*. Alfred Leeds name lives on, attached to the fossils he found and in the genus and species named in his honour, an enduring testament and a fitting tribute to a man who dedicated his life to revealing the ancient, and until then largely unknown, world of the British middle Jurassic.

Future

In addition to the fossils themselves, there is a huge volume of untapped archive material held at various institutions and by the Leeds family, which adds significant value to the Leeds collection. Data from this archive is beginning to fill in details of, for instance, dates and places of discovery (the brick pits from which the specimens were collected), the materials used to unite the bones, and the prices for which the specimens were sold. These details are being, or will be, published elsewhere. Hence, The Leeds Collection archive, taken together with the fossils contained in the Leeds Collection are, and will continue to, allow us to delve deeper into this unique palaeontological resource, and take study of the Leeds Collection on from its late nineteenth and early twentieth century roots forward into the twenty-first century.

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Is there a viable future for herbaria in British Museums?

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In one word the answer is yes.

I arrived at this conclusion after studying six herbaria in Britain, ranging in size from two thousand specimens that could be accommodated on two shelves of a cupboard to collections approaching three quarters of a million specimens and requiring considerably more shelving. A variety of museums containing herbarium collections were visited for the purposes of this study: local authority: Bolton Museum and Archive and Southend Museums Service; university: Manchester Museum; national provincial: World Museum Liverpool; independent: Haslemere Educational Museum, and of course my own place of work, the Royal Horticultural Society's herbarium at Wisley.

What prompted me to investigate herbaria in British museums? One reason was that, although I work in a herbarium, the RHS is not strictly a museum and I was curious to see how herbaria were accommodated and used in the context of a museum. Were they visible? Were they active? Were they acknowledged within the museum itself? Were they in jeopardy and from what sources?

Nymphaea 'Director G.T. Moore'. (Image Copyright RHS Herbarium)

Another factor which spurred my curiosity was a seeming lack of coverage in the museums' press regarding herbaria in British museums. It is almost a subject without a literature. As long ago as 1954 Harry Stansfield, the then Keeper of Botany at Liverpool Public Museums, referred to herbaria as the 'Cinderella of the natural sciences collections' (Stansfield, 1954), and it has been stated that botany 'occupies in general a very subordinate position in British museums' (Hyde, 1945). My aim is to show that Cinderella deserves to go to the ball. As Linnaeus said, 'A herbarium is better than any illustration; every botanist should make one' (Staflen, 1971).

The fact that herbaria are not intended for display sets them apart from other museum objects in the most obvious of ways. Leander Wolstenholme (2006) more recently commented in *NatSCA News* on the difficulties of displaying the 'undisplayable.' His conclusions were supported in a subsequent article by Julia Tanner (2006). This lack of visibility was one of the concerns raised by the 1987 *Biological Collections UK* report, which also highlighted historical neglect, a lack of curatorial expertise and public unawareness as threats facing the herbarium (Williams 1987). The second part of this paper will look at the various ways in which the selected museums have tackled these challenges.

But before looking at the current state of herbaria in British museums, I would like to start by attempting a definition of the term 'herbarium'; this will be followed by a brief history of herbaria. According to the Oxford English Dictionary, a herbarium is 'a collection of dried plants systematically arranged. Also a book or case contrived for keeping such a collection; the room or building in which it is kept' (Simposon and Weiner, 1989). The original and highly appropriate name for a herbarium was *hortus siccus*, a dried garden. A herbarium, therefore, is a collection of dried, pressed plants, mounted on paper, on loose sheets or in a bound volume and which may be systematically arranged.

What function does the herbarium perform? Traditionally herbaria performed a reference function, as they still do today. They provided the catalogue and identity of the flora of an area and were and still are used to write field guides or manuals to aide in the identification of plants. For example, the Holmesdale Natural History Society has collections made by J.A. Brewer, including many plants cited in his *Flora of Reigate* (1856) and *Flora of Surrey* (1863). Thus the herbarium is an archive that supports the science of plant taxonomy, that is the science that finds, describes, classifies, identifies, and names plants.

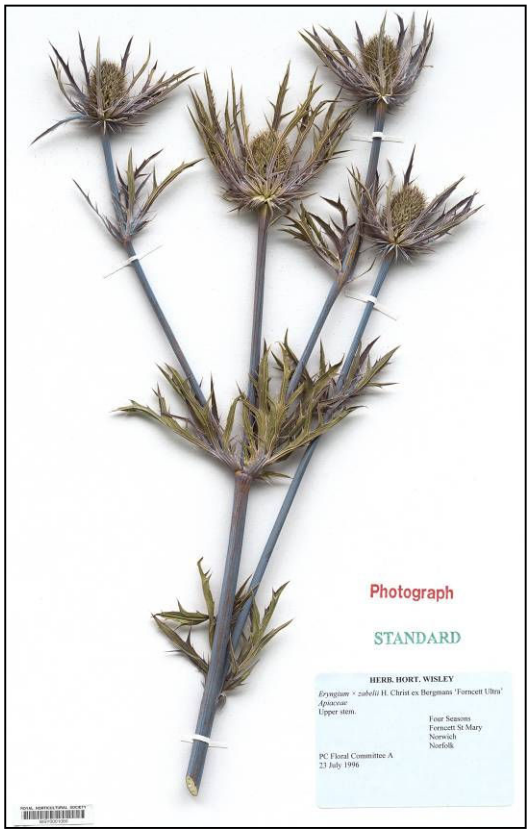
Callistemon rigidus. (Image Copyright RHS Herbarium)

In addition to its traditional role as a reference tool for botanists, the herbarium is increasingly being used by historians, artists, and garden designers. For example, garden designer Lizzie Tulip has been researching the herbarium of Florence Nightingale, the Stovin herbarium, at Middlesbrough Museums & Galleries to coincide with the centenary of Florence Nightingale's death in 2010[1].

Past

Herbaria have been in existence for hundreds of years. The first herbarium is reputedly to be that of the Italian naturalist, Professor Luca Ghini (1490-1556), who was the first director of the botanical garden at Pisa. He is reported to have collected three hundred specimens and preserved them on paper for the purpose of identification. Ghini introduced 'probably for the first time the technique of pressing and drying plants which could then be attached to cards and filed as a source of reference more reliable than an illustration' (Keller, 1972). Thus botanical study could now be conducted all the year round by consulting a collection of dried plants. Ghini also established the practice of field trips as a standard part of the students' training.

In 1530s Italy, at places like Pisa and Padua, it is medicine that is the driving force behind the establishment of herbarium collections; students were taught about the healing properties of plants, animals, and minerals. Unsurprisingly then, the greatest sixteenth century herbalists were physicians. Thus we find the business of self-preservation, and the preservation of the natural world, intimately bound up.



Nomenclatural Standard for *Eryngium x zabelii* 'Forncett Ultra' (Image copyright RHS Herbarium).

In England the Apothecaries Act of 1815 required all medical students to take an examination in herbal knowledge if they wished to practice as licensed practitioners. Not only were botanists and medical practitioners collecting and amassing their own private herbaria, but people from all walks of life, from local worthies to factory workers, were keen to get out and collect plant specimens for their own herbaria. For example, the wealthy businessmen Charles Bailey and Cosmo Melvill, as well as Leopold Hartly Grindon, who was a working class man, all ultimately came to donate their collections to the Manchester Museum.

The mid nineteenth century also saw an explosion in the formation of local botanical societies, which were the origins of many herbaria found in museums today. All the museums in this study were founded in the nineteenth century. Many local floras were also published in the nineteenth century, and Webb and Colman's *Flora Hertfordiensis* of 1848 was described by Dony as being 'as much verse as botany'[2]. This comment evokes the 1870's herbarium collection of a Miss Lightfoot, which is housed at Haslemere Educational Museum, and in which every pressed plant is accompanied by a poem (Fig. 1.).

Fig. 1. A page from the herbarium of Miss Lightfoot (1870's) (Image reproduced courtesy of Haslemere Museum).

It must be admitted that not everybody has been enthusiastic about herbaria: in the twentieth century the esteemed C.D. Darlington, Professor of Botany at Oxford, believed that herbarium specimens should be burned!

Present

After this rather brief and selective tour of the past I would like to return to the present. I found museums and their curators who cared for their collections and indeed were devoted to them. I have chosen three broad themes to illustrate the various ways in which herbaria are playing an active role in the life of the contemporary museum. The themes chosen are: scientific function; display; new developments.

Scientific Function

There was plenty of evidence that the herbaria in this study retained a scientific function.
This was certainly the case at the Royal Horticultural Society's Garden at Wisley which houses a collection of approximately eighty thousand specimens. In 1964 the Council of the RHS decided to formalise the remit of the RHS Herbarium by declaring it to be a dedicated horticultural herbarium. As one of the world's few specialist horticultural herbaria, Wisley is a vital horticultural reference tool for both RHS botanists (who use it daily) and visiting researchers (Fig 2).

Fig. 2. RHS Herbarium, at Wisley (Image copyright RHS Herbarium).

Despite being small, compared with Kew's six to seven million specimens, Wisley does have an international reputation, especially when it comes to the practice of maintaining nomenclatural standards[3]. These are the equivalent of type specimens, but for named cultivars (cultivated varieties). A nomenclatural standard is the herbarium specimen or illustration of a cultivar which forms a permanent record of the distinguishing characteristics of that cultivar (Fig. 3). Whilst the concept of standard specimens was first proposed in 1959 it was only in 1998 that the practice of designating standards really took off as far as the RHS was concerned with the appointment of one full-time member of staff dedicated to this research project. The RHS Herbarium is the world's foremost institution in this respect. The herbarium has nearly 5,000 nomenclatural standards (Fig. 4).

Another traditional function of the herbarium is that of supporting the publication of a local flora. Botany staff have been working on an updated Wisley Flora to be published in 2010 to mark the centenary of the first Wisley Flora. Voucher specimens have been collected.

Fig. 3. Nomenclatural standard for *Delphinium* (David Mannion). Image Copyright RHS Herbarium.

Fig. 4. Standard portfolio for *Lavandula angustifolia*, 'Hidcote'. The herbarium specimen is the nomenclatural standard. Information on the label give the name, description, location and date of collection.
Supporting information on the portfolio includes; a photographic transparency showing form and colour, features lost when the plant is pressed; first place of publication, in this instance a nursery catalogue and other supporting literature. All standard specimens are put in green-edged folders. (Image copyright RHS Herbarium)

The herbarium at Southend Museums Service is small, comprising some two thousand specimens. There is no dedicated botanist as such but the Museums & Galleries Manager, John Skinner, is a trained botanist, and as he proudly told me David Bellamy was his lecturer at Durham University. The focus of this collection is local (Essex) flora. It is this curator's interest that keeps the Southend herbarium alive and vibrant. He is also a keen lichenologist and mycologist and as such the museum has a good collection of these. The Museums and Galleries Manager has good relationships with the vice county recorder and local botanists who contribute to the herbarium (Figs. 5, 6). The earliest herbarium specimens date to the 1820s and are formed from the collection of Christopher Parsons (1807-1882), a gentleman farmer, who recorded all the common plants of his time. Many of these three hundred and sixty-nine specimens are now agricultural rarities and are of significance for their historical interest such as *Agrostemma githago* corn cockle. The museum has a recreation of a Victorian naturalist's study loosely based on Christopher Parsons (Figs. 7, 8)

Fig. 5. *Colutea* arborescens collected by John Skinner, Southend Museums Service (Image reproduced with permission by John Skinner, Southend Museums Service).

Fig. 6. Recently collected lichens from Southend Museums Service (Image reproduced with permission by John Skinner, Southend Museums Service).

Fig. 7. *Agrostemma githago* - corn cockle, collected by Christopher Parsons, 1825. (Image reproduced with permission by John Skinner, Southend Museums Service)

Fig. 8. A Victorian Naturalist study, Central Museum, Southend. (Image reproduced with permission by John Skinner, Southend Museums Service).

Display

When visited all of the museums studied had herbarium specimens on display in the public galleries. For example, at Manchester herbarium specimens collected in the nineteenth century from Lindow Common were used in 'Lindow Man: A Bog Body Exhibition'. These included sphagnum moss, *Sphagnum cuspidatum* and bog rosemary, *Andromeda polifolia.*

At Bolton Museum the natural history galleries were peppered with invitations to the public to visit the herbarium. Incidentally Bolton Museum's first curator was William Midgeley, who made his first pressing at the precocious age of four.

An interesting and unusual feature at Haslemere Educational Museum is the presence of a flower table, which features numerous examples of living plants. This occupies a prominent position opposite the reception desk, and has been a feature of the museum since 1893 (Figs. 9, 10).

New Developments

All of the museums visited found that artists were being inspired by the herbarium collections. As the editor of *Museum Practice*, Javier Pes (2007) comments, 'Artists' interventions are all the rage, especially in non-art museums.'

A novel and imaginative way in which the work of the herbarium has been brought to a wider audience has been through the appointment of an artist in residence in the Liverpool Botanical Collection. Jyll Bradley's appointment has been made possible by Liverpool's status as European Capital of Culture in 2008.

Bradley's work is, as she states, 'often concerned with 'worlds' that are going through difficult periods of self-reflection. These are places and institutions which superficially seem outmoded, but which in fact are very much alive, albeit desirous of re-invention' (Bradley, 2008). The Fragrant Project, as the artist entitles her on-going work with plants, is interdisciplinary, mixed media and site specific (*Ibid*). Bradley sees Liverpool's botanical history as one of dispersal, given that the collections (herbarium, library and garden) have been dispersed and are now in three separate locations. The artist felt that the herbarium was the dried memory of the original garden. She perceived that through herbarium specimens a direct link to the past may be established via connections made with human handwriting and the plant. Each sheet is a story waiting to be told[4].

Fig. 9. The early twentieth century flower table, Haslemere Museum,, A Victorian Naturalist study, Central Museum, Southend. (Image reproduced with permission by Haslemere Museums Service).

Fig. 9. The flower table at Haslemere Museum. (Image reproduced with permission by Haslemere Museums Service).

There is no doubt that Bradley's work has raised the profile of the collections at Liverpool[5]. People are now forming links between the dried and living gardens: for the very first time gardeners from the Liverpool Corporation have been to the herbarium. A major product of the residency was the show garden, 'Mr Roscoe's Garden', which won a silver medal at the Royal Horticultural Society's Chelsea Flower Show in 2008 (Fig. 11). The garden celebrated the life and work of William Roscoe, founder of Liverpool's botanic garden, and the plants came from the Liverpool Botanic Gardens collection. Several herbarium specimens were also included in the display. After leaving Chelsea, the garden gained yet a wider audience by touring to the Bluecoat (an art gallery in Liverpool), and then the Tatton and Southport flower shows.

Fig. 11. Mr Roscoe's Garden, RHS Chelsea Flower Show, 2008.. (Image copyright, RHS shows).

The culmination of Bradley's work was the publication of a book on her research, and also an installation entitled, 'The Botanic Garden' held at the Walker Art Gallery, Liverpool (Fig. 12). This installation consisted of five large panoramic images, the recreation of a virtual garden. One of the images shows herbarium staff preparing herbarium specimens. The artist likens the images to gardens of the mind (*Ibid*).

The culmination of Bradley's work was the publication of a book on her research, and also an installation entitled, 'The Botanic Garden' held at the Walker Art Gallery, Liverpool. This installation consisted of five large panoramic images, the recreation of a virtual garden. One of the images shows herbarium staff preparing herbarium specimens. The artist likens the images to gardens of the mind (*Ibid*).

Manchester Museum has had a research programme with Arts Council funding for artists, the Alchemy Project, which has given artists access to the museum's and university's collections, 'placing particular emphasis on the articulation of research and the creation of new work' (Bond, 2008). As Leander Wolstenholme (2008) says, 'We have more artists coming in than we do botanical researchers.' This was demonstrated by the fact that on the day I visited two artists were working with the collections, but no scientists.

One of these artists was Gaenor Deacon (Fig. 13). In addition to pencil drawings of herbarium specimens selected by the curator, she also wrote a blog about her activities in the herbarium. She tells how she stood outside the herbarium on the Oxford Road, taking photographs and handed out hand made invitations to the

munity one step further by physically presenting the public with an invitation to the herbarium. Perhaps I am fulfilling the collecting process by collecting people to visit the herbarium.' Sadly, she found that the term herbarium was not understood, and that people simply did not know what it was or what it did. Although nobody took up the offer of visiting the herbarium at such short notice the herbarium is certainly accessible and welcomes visitors (Fig. 14.).

Fig. 12. *The Botanic* Garden, The Herbarium, World Liverpool Museum. Assistant Curator, Wendy Atkinson, and Colelctions Manager Donna Young, make a pressing of *Cymbidium.* (Image reproduced with permission).

Fig. 13. *Helleborus* foetidus drawn by Gaenor Deacon, August 2008. . (Image courtesy of Rebecca Chesney).

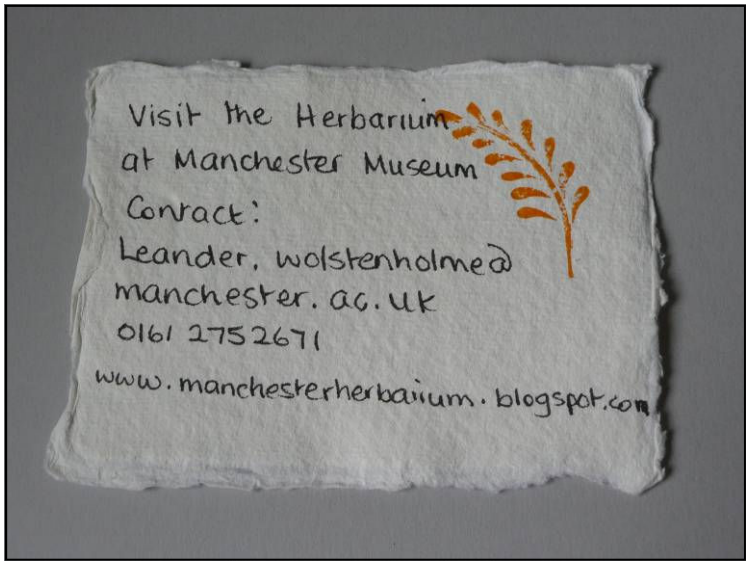


Fig. 14. Handmade invitation by Gaenor Deacon, to the herbarium, Manchester Museum.. (Image reproduced with permission by Gaenor Deacon).

Patricia Francis at Bolton Museum finds informal learning sessions involving groups with no botanical knowledge or notion of what a herbarium is to be an effective way of promoting the herbarium. She finds that in these sessions it is helpful to approach the subject of collections from a social history perspective i.e. the people behind the collections and the times in which they lived, rather than from a purely plant perspective (Fig. 15). For example, a herbarium specimen is rendered far more interesting if we learn that it was collected by a local shoemaker; where and how did he live, and what happened to him?

Fig. 15. Using the herbarium at Bolton Museums & Archives (Image reproduced with permission by Bolton Museums & Archives).

A further development is the significance herbaria can play in the study and observation of climate change. As the Keeper of the Herbarium at the British Museum (Natural History) has recently said:

> 'We used to think of British botany as something that was pretty much done and dusted, but now with climate change these [herbarium specimens] are becoming incredibly important. Among other things they offer an invaluable time series. You can mine them for flowering cycles, carbon content, density of stomata on leaves which changes according to the amount of CO2 in the air - all of that.' (Adams, 2008)

As Miller-Rushing *et al* (2006) concluded, 'Analysis of such collections [herbaria] should dramatically increase our understanding of how climate change affects biological systems at many previously unexamined localities and for a wide range of species.' A plant flowering significantly earlier or later than in the past might well point to climate change but this change can only be observed if there is a record of the past. For example Karen Robbirt, comments that the estimated 2.5 billion herbaria specimens worldwide is 'a largely untapped resource at present, but one which may prove invaluable to conservation science' (Robbirt, Roberts and Davy, 2008). Robbirt's PhD study 'aims to evaluate the long-term changes in flowering time over a period of more than 200 hundred years for a range of species of British orchid, based on more than 2000 herbarium records'[6]. So far analysis of such herbarium data is suggesting that some orchids are flowering significantly earlier[7]. With ever-increasing concerns about the effects of climate change the role of the herbarium has never been more relevant (Fig. 16).

Of course effective acquisitions policies are crucial if herbaria are to continue recording environmental change. Several of the museums visited had labyrinthine acquisition policies, making additions to the collections extremely difficult. This is obviously a concern.

Attitudes towards specimen collection are still ambivalent, being seen both as quaintly old-fashioned and destructive. However, as Clive Stace (2001) reassures, 'only a small part of the plant is needed for diagnostic purposes, and rarely are underground parts essential.' Herbarium specimens provide a vital record of plant identity and distribution over a period of time, and act a bit like an electronic tag in the modern criminal justice system: what is the plant, where has it been, and where is it now.

The military orchid (*Orchis militaris*) is a good example of the importance of curating herbarium specimens (Fig. 17). It was recorded in old floras as occurring in Kent but the majority of modern floras dismissed these records as misidentified lady orchids. However, the Bolton herbarium has a specimen of this rare plant from Kent, what turns out to be the first Kent record, spotted by Patricia and verified by Francis Rose. It dates from 1836 and is a Joseph Woods specimen. 'Checking identifications and distribution data against museum collections', Pettitt (1994) argues, 'is essential for groups that present difficulty in identification.'

Fig. 16. Herbarium specimen of *Orchis mascula*, held at the Royal Botanic Gardens, Kew. Collector R. Graham, 1839. (Image Copyright, the Board of Trustees of the Royal Botanic Gardens, Kew. Image reproduced with permission).

Fig. 17. *Orchis militaris*, the military orchid at Bolton Museums & Archives (Reproduced with permission by Bolton Museums & Archives)

The use of information technology and the digitisation of samples to provide online information is a development which can surely only become more prominent in the future.
The Botanical Collection Managers Group which represents herbaria for UK and Ireland uses virtual volunteers to record entire herbarium collections of herbaria in museums and universities by entering data from labels on digital images of specimens posted onto a website. A pilot scheme was run by the herbarium at Manchester Museum. To date, over thirty-seven thousand herbarium sheets have been transcribed online. Suzanne Keene puts it succinctly in her presentation 'Collections; Treasure or Trash':

> 'the most important development is making available online a complete inventory of what a museum holds. This is fundamental to letting the public know what the museum holds, on their behalf, and to many or most of the other uses of collections.' (Keene, 2008, in Treasure or Trash?)

All six institutions recognised the increasing importance of the internet as a tool for promoting and enhancing collections. Suzanne Keene again: 'The most common request from users (including museum professionals themselves, organising exhibition, loans, etc.) was for collections information, preferably an object-by-object catalogue, to be available online. By far the most users would prefer to find out what was in collections via online listing or catalogues' (Keene, 2008. Collections for the people.).

Visitors to Bolton Museum's website have been encouraged to submit records of their own observations of local flora and fauna which will help in the conservation of a species or site. The internet can also play a vital role in bringing to the public all collections which are not normally on display, in this instance the herbarium.

Future

So is there a viable future for herbaria in British museums? On the evidence presented the answer is a resounding yes.

All the museums investigated are using innovative and imaginative ways to promote their respective herbaria and bring their botanical collections to a wider audience. Looking at the social history behind a herbarium specimen has proved a good way of getting people interested, and perhaps rendered the subject of the *hortus siccus* (dried garden) a little less dry. Stimulating the natural curiosity of children is a challenge which the museums in this study have also met; this is obviously a prerequisite for the viable future of anything, including herbaria in British museums. Both Bolton and Haslemere museums use imaginative ways to involve children. At Bolton primary school children conducted an ecological project in which they examined the Thomas Greenlees collection (Fig. 18). This project won the National 2007 Rolls-Royce Science Prize. At Haslemere a more hands-on approach was adopted involving garden backpacks containing a flower identification sheet and magnifying glass. he internet is also proving an increasingly valuable tool, enabling the public not only to access the herbarium collections, but also to interact with them in ways such as cataloguing. The internet may well be the solution to the problem of 'displaying the undisplayable'; it is certainly bringing the contents of the herbarium to a wider audience.

Fig. 18. Patricia Francis, Curator of Natural Sciences showing how botany can work with children, in this example, using the Thomas Greenless Collection. (Reproduced with permission by Bolton Museums & Archives)

What has become clear is that, in the future, herbaria must provide more than they did in the past. As the *Collections for the Future* report insists, 'Museums must take steps to ensure that more of their collections are used'[8]. Their traditional role as a reference tool, vital though that still is, is no longer enough by itself. Museums have recognised this and are in a superbly strong position to bring the role of the herbarium to a wider public and by doing so ensure a viable future.

Acknowledgements
This paper would not have been possible without the help of: Wendy Atkinson, Assistant Curator - Botany, World Museum Liverpool; Jyll Bradley; Gaenor Deacon; Patricia Francis, Curator of Natural Sciences - Botany, Bolton Museum & Archive; Julia Howard, Assistant Curator, Haslemere Educational Museum; Robert Neller, Collections Assistant, Haslemere Education Museum; Karen Robbirt; John Skinner, Museums & Galleries Manager, Southend Museums Service; Julia Tanner, Curator, Haslemere Educational Museum; Leander Wolstenholme, Curator of Botany, Manchester Museum.

Footnotes

[1] 'This early herbarium should be of major interest to those who study the history of garden plant introductions as many of her [Florence Nightingale's] specimens come direct from the nurseries that were at the forefront of developing suitable strains from wild plants brought into the country by the great plant collectors of the day.' K. Sedman, Senior Curator - Middlesbrough Museums & Galleries, e-mail to RHS Herbarium, 10 June 2008.

[2] J.G. Dony, 'The place of the local flora in the study for the British flora' in *Progress in the Study of British Flora. Being the Report of the Conference held in 1956 by The Botanical Society of the British Isles*, ed. J.E. Lousley (London: The Botanical Society of the British Isles, 1957), 30-39, (p.30). See also D.E. Allen, *The Naturalist in Britain. A Social History*, p. 75 where he lists several books of the 'many thousands that gushed forth from presses … and were selling in their thousands.' Examples given include: Will Cock's *Flora Poetica*, Mrs Mey's *Moral of Flowers* and Miss Twamley's *The Romance of Nature.*

[3] For more information on nomenclatural standards see, D.M. Miller & S.R. Grayer, 'Setting the standard for cultivated plants', *The New Plantsman*, 8:2 (June 2001), 112-126.

[4] J. Bradley, artist, conversation with author, 5 September 2008. She write in her book, *Lilium arboricola*, 'the worlds first known tree-dwelling lily', discovered by Frank Kingdom Ward in Burma on a Liverpool sponsored plant hunting expedition in 1953. It 'caused a sensation and flowered in only two places in England – in Liverpool and at RHS Wisley, being lost to cultivation…It has never been seen since and the only image I have found of it is of the Liverpool flower.' J. Bradley, *Mr Roscoe's Garden*, no page number. The pressing, held in the Natural History Museum, London, was made by the plant hunter's wife, Jean, whom the artist went and visited and showed her the image.

[5] This is an unintended byproduct on the artist's part. The artist's aim was 'to make really good art'. J. Bradley, conversation with author, 5 September 2008.

[6] *Ibid*. Specimens from the herbarium at the Royal Botanic Gardens, Kew, are being consulted for this study.

[7] *Ibid*. See also A. J. Miller-Rushing, *et al.* 'Photographs and herbarium specimens as tools to document phonological changes in response to global warming', p1667. ' In England, plants are flowering as much as a month earlier than they did 50 [years] ago.'

[8] Museums Association, *Making Collections Effective* (London, Museums Association, 2007. p.18. This is a far cry from Professor Weiss addressing to the Museum's Association in 1892, who emphatically stated that 'the herbarium…is not instructed to the uninitiated – that is to the general public.' F. E. Weiss 'The organisation of a botanical museum,' in *Museums Association Report of the Proceedings with the papers read at the Third Annual General Meeting hel in Manchester, July 5, 6, &7, 1892.* ed E. Howarth & H. M. Platnauer. Museums Association. p.29.

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The Natural History Museum, London's Entomology Collections: The Origin or What has been.

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Picture a snowy London town on Christmas Eve and we are at the NHM at South Kensington. We, the audience have just had a visitation from a spectre of a long dead Entomology curator (maybe the ghost of W. N. P. Barbellion, the disappointed diarist who worked on Lice at the NHM 1912 - 1917) who tells us that we are to be visited by three apparitions who will represent the past, present and future of the National Entomological Collections. I am the first, the ghost of Museum past and the morale of my tale, for your improvement and edification, is what has been and what not to do!

The National Collection started as part of a cabinet of curiosities by Sir Hans Sloane who lived from 1660 to 1753, who was a physician with a great curiosity for natural science. He started collecting specimens when working for the Governor of Jamaica and John Ray reported in 1704 that Sloane had a particular knowledge of flies. He housed his collections at Bloomsbury, then in Chelsea where it became the largest and most famous collection made by a private individual and was described as a 'Knick Knackery' by Thomas Hearn, including circa 5400 insects.

The earliest constituent and intact collection from the early years is that made by Leonard Plukenet who was the Queen's gardener at Hampton Court and who lived from 1642 to 1706. He collected insects from the London area and pressed them within the pages of a book in the same manner as his botany specimens. This was kept in the Library for many years by librarians with little knowledge of insects but is now held within the Entomology Historic collection. Our colleague Les Jessop embarked on conservation work on these specimens, reaffixing the somewhat fragmented specimens with reversible glue (Fig 1).

Fig. 1. Conserving the Plukenet specimens.

Sloane purchased the James Petiver collection after his death in 1700, which consisted of more pressed insects in bound volumes. This is the frontispiece of the second of two Volumes. Note the name Cromwell Mortimer who was Sloane's curator. Within these volumes are specimens pressed between sheets of mica and sealed with paper strips. The Insect Room set up at the Montagu House in 1753 where the collections were described as "mouldering and blackening in the tombe or charnel house of unknown treasures". Between 1813 & 1835, the

contents of much of Sloane's collections were periodically 'cleansed' of pests by annual cremations of infested specimens by William Elford Leach, so this book and mica pressed specimens may only have survived because of this method of preservation. These lunar moths survived because they were pest proof within these mica sheets and held in the Museum Library during the period of burnings. 770 Sloane specimens are known to have survived.

Seventeen 18th century drawers of Petiver specimens survive and the insects are housed in small glass boxes (Fig.2). Some of the specimens have pin holes so they were once mounted in cork bottomed boxes or drawers. These specimens have catalogue numbers written by Cromwell Mortimer, which can be traced to an incomplete catalogue held in our library. Carolus Linnaeus inspected some of this collection in 1736 and mentioned such in his 10th edition of Systema Naturae of 1758, Systema Entomologica 1775 & Species Insectorum of 1781.

Fig. 2. Petiver collection drawer.

Petiver was a London Apothecary who did business with passing ship's captains government officials and he handed out this sheet of his 'brief directions for the ease of making and preserving collections of all natural Curiosities' (including insects) of 1700, hoping that these volunteers on their world travels would collect and bring back specimens to his shop, which many of them did. He asked for insects to be preserved in spirit or if mealy to be pressed in books but he does not mention pinning specimens.

One such government official was John Lawson who was a land surveyor in the North American colonies who collected this dragonfly (Fig.3) for Petiver and who was killed whilst on duty by natives in Carolina in 1711. Lawson is now considered the founding father of Entomology in North Carolina.

The British Museum (BM) in Bloomsbury opened in January 1759 in Montague House from the bequest of Hans Sloane. The insect room in the North west corner of the ground floor of the British Museum was initially described by Alfred Russell Wallace & Henry Walter Bates when they visited in 1848 as in utmost confusion, scarcely a genus in proper order and duly named and of little aid to any one wishing to work out any scientific problem in which insects supply the facts! But by 1858, Bates concluded that the collection had become excellent with specimens ticketed with determination and provenance.

Another discrete collection we hold is that made by Sir Joseph Banks who was not only a great botanist. He started his collection when as a boy in Lincolnshire and it holds many specimens collected on Captain

James Cook's World voyage on the Endeavour. This is the first collection which developed beyond the cabinet of curiosities to a fully taxonomic state. He used pins and shallow glass topped drawers which became the norm for insect collections by the end of the 18th Century. This collection is very primary type rich, designated by Linnaeus's student Johann Christian Fabricius and also contains specimens from the Matthew Flinders and William Bligh expeditions (Fig 4). On Banks' death the collection came to Banks' archivist Brown who presented it to the Linnaean Society who not wanting a non-Linnaeus collection passed it to the British Museum in 1860. These specimens were transferred from the original drawers & cabinets into new cork lined Hill drawers after donation in which they still reside. Most of our historic collections have been subsumed into the modern taxonomically arranged collections so are mostly no longer associated such as with Darwin specimens. Such drawers fitted into the figured cabinet (Fig 5) which is an original from Bloomsbury and the drawer became the standard dimension for our present Hill drawers.

Fig. 3. Lawson's dragonfly

Fig. 4. Banks' specimens with later Type designations.

Fig. 5. An original Bloomsbury insect cabinet.

The origin of The Natural History Museum (South Kensington) was brought about by, amongst other things, the congestion of specimens at the BM. Several people, including the notable Richard Owen, argued that the natural history collections needed their own building.

One has to ask the question as to whether we leave the specimens in their historic cabinets on brass pins in cork as a historic document in its own right or do we scrape the cork out and replace with plastazote and re-house them into new pest proof cabinets as we have done here. The old brass pins which have in the past had their heads snipped off to fit the new shallow drawers have also caused verdigris deterioration in the specimens which have been replaced where necessary.

Exhibitions of our specimens have not been a priority in our museum. Wax Models of small insects have been made at different times as this is the best way of exhibiting such to the public. We still have a few models which we hope to display in DC2.

The National repository attracted bequeathed legacies, donations and purchases with the collecting activities of gentlemen collectors in the UK and throughout the growing British Empire. Further specimens collected by Sir Alfred Russell Wallace and Charles Darwin's Beagle voyage were added and in 1939, we acquired the immense collection of Lepidoptera from Baron Lionel Walter Rothschild and his Museum at Tring and which are now part of our holdings at Wandsworth and shortly to be returned to our new Darwin Centre.

Fig. 6. The Type cabinet used to evacuate Types during WW2.

The early collection consisted of a great variety of cabinet sizes, shapes and condition and often separate collections as opposed to the single main collection series of today.

A slow improvement in the accessibility of the specimens and data has occurred over the decades with the development of acquisition registers and species level and typed species & type specimen card indexes as here. Staff levels rose to over 100 with the addition of the symbiotic Imperial later to become the Commonwealth Institute of Entomology staff and such a staffing level continued until recently.

The entomology collections were moved larger accommodation to our new Museum in South Kensington in 1882-83 into the south west corridor now occupied by Molluscs the responsibility of the Zoology Department until 1913 when The Entomology Department came into being with it's own Keeper. With the growth of our collections by up to half a million specimens per year with the collections generated by professional research scientists and from the donations from increasing numbers of able amateurs we soon outgrew this space and the purpose designed Entom block was built in two halves between 1936 and 1952. Variable cabinet and drawer quality and inaccessible dust pockets meant that endemic pest problems continued in the Entomology Building but which were lessened with the use of insecticides until the recent demolition of the Entomology Building. (Fig 7).

Fig. 7. The Old Entomology Block (centre) behind the Zoology Spirit building, r.i.p!

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The organisation and distribution of electronic data at the Natural History Museum

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Introduction
Museums have traditionally focused on preserving collections/treasures etc as well as allowing taxonomists, amateur as well as professionals, to gather and utilise information from the collections.
Nowadays there is a greater need to access this information, and to access it quickly due to increased awareness of global biodiversity issues. The challenge is to enable today's researchers a rapid and accurate database with as much relevant material about the specimens as possible, in an easily accessible format. . We also need to locate, manage and audit the collection effectively, both at lot level (i.e. species) and at specimen level.

History of database at NHM
Historically, at The Natural History Museum, each department, sub department, individual etc has had their own database of the specimens/species that they curate. This resulted in many databases which were incompatible with each other and more often than not did not offer online access. The only online databases in entomology were more involved in relating the research outcomes of the NHM staff or publishing a complete list of all species found within specific groups, whether or not there were specimens at the museum.

What the museum didn't have was any standard online catalogue of the species and specimens that were found in our collection. As well as many of the smaller databases, the Entomology Department held much of its data in a main collections management database – Paradox for Dos. This, along with many of the other databases were flat i.e. the information was stored in one long text file (a tab delimitated file) requiring a standardised input of data. The data was entered onto one page and contained information on the taxonomy, correct status, as well as the locality within the department and what the storage method was (pinned, slide etc). As a retrieval system, it was quick and simple; you were able to ascertain whether we had any specimens, if there were any types and where they were. But this was it. We now want to garner a lot more information from the data that is attached to the specimen i.e. the specific localities for species distribution maps. There was no place on the old system to have this data.

The database was riddled with spelling errors and there was no clear way of enabling the data to be accessed online. In addition, the data had not been entered consistently so there were many different uses for the same field, and the plurality of databases limited the ease with which staff could utilise (or even access) databases from different Sections. The loan system, which is an important part of the way that the collection is managed, was stand-alone. If you traced a specimen in the main collection you had no way of knowing if this was out on loan without either coming out of the system or physically checking the collection.

The New database
A new system was clearly needed; the implementation of a universal database that could bring in line all data handling within the museum and enable it to be accessed by the wider scientific community as well as the general public.

After much deliberation the museum chose the KE-EMu software which is an object-relational database that supports text as well as multimedia objects. A relational database differs from the original flat databases in that they group the data using common attributes found within the dataset e.g. author, collecting locality and taxonomy, whilst In the Object-relational system the data are grouped around objects which are then attached to one another as appropriate rather than grouped according to common attributes i.e. specific author to the species that they have described.

One of the many advantages of this system was that KE provides a broad range of on-going services including provision of expert advice to promote best practice in museum data management.

There were many Implementation and post-implementation activities and tasks, including specification development and Software configuration and customisation – we were able to customize many of the modules to suite our specific needs as a museum. They were able to assist in the developing of reports and give training to enable these to be developed internally. And there is assistance in Web site development and web publication of collection material.

Once the initial process of deciding which system to use, specifying and developing the modules, it took over two years (and some are still going) for all of the different departments' data to be migrated into the new system, but the benefits are beginning to be felt. Each department has initially a similar list of modules including taxonomy, catalogue, parties, bibliography etc but are able to modify the modules to their own specifications.

KE-EMu Database

Entomology relies heavily on the collection index module as it does not have information on every specimen that there is in the department. We have only the specific information on certain individuals within a species, such as the type material or if there was a notable collection (Stag beetles).

The collection Index record brings together the information about the lot localities (there may be several due to slide material, spirit and pinned) and the taxonomy (including a current name if it is a junior synonym). Other modules include the catalogue module which records information about each object or species within the collection; bibliography records details about bibliographic references e.g. journals, books, citations; and parties records the details about people and organisations that can either be contemporary borrowers or authors, recorders etc.

Now that most of the migration is complete, there is a considerable amount of work to do with the data and the operation of the system;

1. Data clean-up – now all of the data is in the same depository a whole raft of new issues has arisen e.g. duplication of records sitting in separate datasets – this is the legacy of non-relational model previously.

2. Training – we have a large body of staff. Core Collection management staff of ca. 30. Up to 30 others to train.

KE-EMu is definitely a more complex system compared to the old Paradox system and the key to success of Emu is ensuring there is an excellent skill base across the department. There is a very good support network from KE-EMu as well as within the department

The department has been using the system for a couple of years now, and the loan system has been successfully integrated. No we are able to create a record for a specific borrower and record the actual specimens that they are borrowing (on the old system it was only the species level that was recorded), giving us a greater ability to track the movement of individual specimens. Considering that we hold one of the largest collections of Type material that is an exceptionally useful tool. We are also able to track anything that comes into the museum (recorded at object level entry) such as external loans and there is the potential for attaching documentation including permits and visas.

EMu provides fully integrated support for a wide range of multimedia resources, including images, video, audio, word processing documents, spreadsheets, presentations, in fact, any online or off-line resource. We are able to add examples of handwriting which is very useful when it comes to identifying scribbles on labels. Any images of the specimen can be added to its specimen level record which can be sent on request to other researches, thus reducing the need to send the specimen itself.

Now that there is one database the ability to serve the data online is manageable, with the data from Mineralogy and Zoology already being accessible on the web. As previously said historically, most of the information online was individual research databases generally associated with specific research staff. Now, there will be 5 specific online catalogues (for each science department), which have been designed in-house to provide specific functionality that is related to the individual departments needs.

The intention of the museum is to get all, where appropriate, records on the web which will include many dirty and redundant records. As a result of the implementation of KE-Emu and the modification and insertion by June/July all specimen records will be served to GBIF.

Just the beginning

There are many challenges that I have not mentioned including deciding what data to collect – given the vast number of fields the time possible to spend populating the database is infinite – how do we decide what to database? There is also the question, for online data, of data sensitivity and to what extent we need to be active in this. There is much still to think about but at least now there is a system that will let us achieve this.

The National Insect Collection: Its Origin and evolution to global accessibility: Evolution.

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This is arguably the most significant time for the Entomology collection since it moved from Bloomsbury in 1881, with the design, construction and occupation of a new building; Darwin centre 2.

The Darwin Centre is a multi-phased project which is currently seeing the completion of its second phase. The Darwin Centre so far is physically made up of 2 new buildings, which provide high quality collections storage and impressive new research and curation facilities. The concept behind the project is to provide the best possible space to house the vast collections at the Natural History Museum as well as making museum science more accessible to the public by showing what science we do behind the scenes.

The two phases of the Darwin centre programme create a new life sciences complex at the Natural History Museum with three equally important aims:

- To safeguard the world's finest collection of animal and plant specimens by replacing antiquated and insecure storage with modern purpose built facilities using the latest designs in environmental control, pest management and security
- To create modern, high quality research facilities for our ever-advancing scientific research
- To reveal what is currently hidden by actively encouraging visitors to explore our collections and interact with curators and researchers.

The overall vision is to improve the care and active curation of our collections, deliver high quality relevant research whilst showcasing our collections research and impact through new and compelling ways of engagement. To ensure innovative and leading edge opportunities for visitors to participate, interact, question, comment and continue their exploration and relationship; onsite and pre- and post-visit as well as supporting scientists in sharing their expertise and passion with audiences and to get feedback, both scientific and social.

Darwin Centre phase 1 was opened 2001 and houses the Museum's spirit collections the majority of which is part of the Zoology collection. It provides behind the scenes tours and daily talks to the public by the resident scientists.

Darwin Centre 2 is now in standing in the footprint of the old Entomology block. Building work for this started in 1936 but wasn't completed until after the war in 1952, it was then demolished in 2005. The Entomology collections since then have been temporarily rehoused across the Natural History Museums sites.

The new building is glass structure surrounding a cocoon designed by C.F.Moller Architects. The building provides 16,000 metre square of space, the cocoon is 8 storeys high and 65 metres long, it is made of reinforced concrete finished with venation plaster. The cocoon is a metaphor for keeping the collections safe and a place where knowledge of the natural world will be developing and growing.

Darwin Centre 2 will house collections and staff from two life science departments, Entomology and Botany. The Entomology collections are currently being moved into the building and will comprise of approximately 17 million specimens in 127,000 drawers and includes approximately 180,000 type specimens. Associated with these collections there will be 60 core funded staff and more than 70 scientific associates, students and postdoctoral researchers. 3 million specimens, including 70000 type specimens, of flowering plants and gymnosperms c. 50% of the total Botany collection are also being relocated in to the new building. This comprehensive collection with worldwide coverage will be rehoused into 62,000 shelf spaces. With the botany collection, 25 core funded staff and approximately 40 Scientific associates, postdoctoral researchers and students will also occupy this building.

The Public offer will increase public engagement with our science thereby enhancing public understanding

of science. This will be achieved through the 'Explore tour' the David Attenborough studio and the Angela Marmont Centre for U.K. biodiversity. The explore tour will be a self guided tour passing through much of the building with windows into the collection areas and views into the molecular laboratories. There will be interactive games and other features presented on this tour. The David Attenborough studio will be a multi-purpose space. It will offer interactive shows, Nature Live programmes and between programmes a 'chill out' mode where visitors can see and hear images of nature around them. Nature live programmes will continue to give visitors the opportunity to meet the scientists, debate topical issues and discover how our collections help us to understand natural biodiversity. The Angela Marmont Centre for UK biodiversity will be for visitors with special interest in British biodiversity. It will house UK collections (although not all UK material), accessible synoptic collections of UK species, enquiries service (e.g. Insect Identification Service) and provide a space for scientific societies where members have a UK interest (meetings, workshops).

The Botany and Entomology collections are some of the most vulnerable collections housed at the museum as they are particularly at risk to pest damage so this building has been designed with close consultation to curation and conservation staff to build in many features to protect the collection from damage. The collections will benefit greatly by being rehoused into a new high quality, environmentally controlled storage facility which provides good security, housing and pest control. The new building will also have 10 –15% expansion space for future development of the collection.

The move, for the Entomology department at least, has obviously been disruptive to everyone, both staff and visitors alike but we have been able to make the most of this unique opportunity by standardising the collections. We have gone from dozens of different cabinet and drawer types to just three for the whole collection. This allows complete flexibility with collection reorganisation and it makes sure we don't have separate main and accessions collections or supplementary collections.

This is a very exciting time for us at The Natural History Museum although it has at times been a difficult journey but from a personal point of view, as someone that has just move into the building, the facility is great for the staff and more importantly for the collections. It officially opens in September so please do come and see it for yourself.

The giant cocoon; the new Darwin 2 centre at the Natural History Museum.

Fossil invertebrates: new perspectives, meanings and values in a smaller museum

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Introduction and background

Great Britain's rich legacy of palaeontological collections in museums stems largely from the early nineteenth century 'Heroic Age' of British geology. At that time, systematic collection of well-preserved fossils was a core activity of the new science, enabling museums and other learned institutions to recreate in their cabinets what was perceived as the natural biological and stratigraphical order, and to provide the material evidence for the new scientific rationale. Systematically arranged collections and displays of the country's fossil wealth proliferated, reflecting the emerging taxonomies that underpin biological and palaeontological classification, and the stratigraphic succession revealed by William Smith's geological maps (Morrell, 1994; Knell, 1996). Today, palaeontological collecting in many museums is strongly influenced by the systematic tradition – the acquisition of well-preserved or hitherto unrepresented fossil species as vouchers for ancient biodiversity and evolutionary change.

The palaeontological sciences have changed immeasurably since the 'Heroic Age'. Subdisciplines have proliferated; treating fossils as the remains of once-living organisms and/or integral components of broader physical and biological systems (Briggs & Crowther, 2001). Amongst the subdisciplines, palaeoecological studies view fossils as components of former ecosystems. To take another example, biostratinomic studies utilise fossils as vouchers for physical and chemical processes such as sedimentation and weathering. Consequently, palaeontological collections are revealing new meanings, significances and values, as their wider scientific potential is realised.

Numerically, the macrofossil record is dominated by remains of marine invertebrates which are the principal components of many palaeontological collections. Historically, as vouchers for fossil species and for display purposes, well-preserved, representative specimens of fossil invertebrates have often been favoured. Such specimens can provide important information on a range of palaeoenvironmental parameters including sedimentation rates, benthic oxygenation, palaeoclimates and/or oceanographic circulation patterns. 'Imperfections', such as bioerosion traces, abrasion and shell breakage patterns, are also potentially of considerable palaeobiological and palaeoecological value, as well as broader palaeoenvironmental (essentially non-palaeontological) interest. Furthermore, ancient skeletal concentrations (e.g. shell beds) can reveal important information bearing upon hydrodynamic activity, bathymetry, depositional rates, chronostratigraphy and sequence stratigraphy (Kidwell, 1991; Kidwell & Bosence, 1991).

This paper explores the theme of information gain from palaeontological collections with special reference to fossil marine invertebrates which feature significantly in the collections of the Warwickshire Museum (Warwick, England). The museum's collections were initiated in 1836 by the Warwickshire Natural History and Archaeological Society. One of the society's main aims was to house and display a geological and palaeontological collection at their museum in the county town of Warwick. The collections soon grew, incorporating stratigraphical and palaeontological voucher specimens from local sites and further afield. In 1932 the collections were transferred to the Warwickshire County Council. A museum was re-opened at the Warwick Market Hall in 1951, where the Warwickshire Museum has been located to the present day. The palaeontological collections continue to grow in accordance with the current acquisitions and disposal policy, and are stored within a traditional taxonomic and stratigraphical framework.

Biostratinomy

Biostratinomic studies treat modern and fossil skeletal elements (such as shells and bones) as sedimentary particles, and document their pathways between death of the parent animal and final burial. As such, preservation style of discrete skeletal particles can provide important information on a range of environmental parameters including pre-burial weathering or corrosion processes, sedimentation rates and water depth

(bathymetry). In addition, the overall sedimentary fabric ('biofabric') of a modern or ancient skeletal concentration will often indicate the final concentrating mechanism (e.g. storm deposition, fair-weather winnowing, or mud-flow deposition).

Warwickshire Museum's palaeontological collection is rich in Jurassic echinoderm material (principally echinoids and crinoids) collected from local sites and 'classic' localities (many of which are no longer extant) further afield. Amongst the crinoids there are intact groups of the Lower Jurassic pseudoplanktonic taxon *Pentacrinites fossilis* Blumenbach from the West Dorset coast (Fig. 1), and typically complete calices of Middle Jurassic *Apiocrinus parkinsoni* (Schlotheim); collected long ago from Bradford-on-Avon, Wiltshire. Representing multi-element structures, calcite crinoid skeletons commonly disarticulate rapidly after death of the parent animal. It is thought that the articulated skeletons of *Pentacrinites fossilis* were preserved through burial in anoxic mud (Simms, 1986). Complete calices of *Apiocrinus parkinsoni* represent shallow-water, hard-substrate crinoid 'meadows' that were preserved by subsequent mud deposition (Palmer & Fürsich, 1974). Thus, specimens of this type, representing vouchers for Jurassic invertebrate species, can also function as vouchers for geochemical and sedimentary processes. In the stratigraphic record, crinoidal limestones confirm the breakdown of countless crinoid skeletons through time, under conditions of slow to moderate net sedimentation (Ausich, 1997). Within the Warwickshire Museum collection, such scenarios are represented for example by crinoidal limestone slabs collected from the Lower Jurassic Blue Lias Formation of eastern Warwickshire, as well as specimens of Lower Carboniferous limestone.

Fig. 1. *Pentacrinites fossilis* Blumenbach. Lower Jurassic Charmouth Mudstone Formation, West Dorset coast, England. Warwickshire Museum specimen WARMS G10385.

Skeletal growth studies

Invertebrate growth lines, commonly preserved on and within fossil shells and coral skeletons, can provide a high-resolution record of environmental change and events during life of the parent organism. Many specimens of the Lower Jurassic oyster *Gryphaea arcuata* are present within the Warwickshire Museum collection. Recent studies (Jones & Gould, 1999) have identified annual growth bands on and within *Gryphaea* shells. A brief inspection of *Gryphaea* specimens within the collection has clearly revealed such growth bands (Fig. 2), underlining their additional value as repositories of geochronological and palaeoclimatic data.

Fig. 2. *Gryphaea arcuata* Lamarck, showing regular (probably seasonal) growth banding on right (upper) valve. Lower Jurassic Lias Group, locality unknown. Warwickshire Museum specimen WARMS G7730/2; length of specimen is 70 mm.

Bioerosion

Microscopic inspection of *Gryphaea* shell surfaces has additionally revealed previously undocumented grazing traces attributable to the feeding activity of regular echinoids and gastropods. Such traces indicate a former cover of algoids and/or bacteria on the Jurassic shell substrates, suggesting that the *Gryphaea* lived and died in shallow-water (photic) settings (Bromley, 1994). Accordingly these fossils are revealing a further significance as indicators of invertebrate activity, and as bathymetric (water depth) indicators.

Unsuccessful predation

Modern and fossil marine shells occasionally reveal repaired skeletal injuries. These are tolerably common in shells of gastropods which can retract the mantle margin deep inside the whorl, but are also sometimes revealed in bivalves (Vermeij, 1983). In modern and ancient shells collected from high-energy (typically littoral) settings, such sub-lethal breaks can indicate impact of shells against rocks or other hard substrates. In low energy, typically offshore settings, unsuccessful predation attempts are generally invoked and have an important bearing on predation rates and evolutionary escalation through time (Vermeij, 1987). Amongst bivalves, repaired breaks are now being recognised from Mesozoic and Cenozoic oysters (Dietl *et al*., 2000). Brief inspection of Warwickshire Museum's collection of Upper Cretaceous invertebrate fossils has revealed repaired breaks in examples of the oyster shell *Pycnodonte vesiculare* (Lamarck), collected long ago from the Chalk of Norfolk, eastern England (Fig. 3). The breaks closely resemble those figured from North American Cretaceous-Palaeocene shells and attributed to failed predation attempts by large durophages (Dietl *et al*., 2000). Importantly, once again, this demonstrates an instance of previously unrecognised palaeobiological information, revealed by historically collected specimens.

Conclusions

These new categories of information underline the need for curators and collectors to be aware of the ranges of data that fossils might encapsulate, above and beyond their value as taxonomic voucher specimens. This bears upon the value of collections as data repositories, and the nature of contemporary and future collecting. Fossil invertebrates act as vouchers for physical, chemical and palaeobiological processes, not just as 'fixed' biological species. As such, it is important to consider imperfect and/or otherwise abnormal specimens, during acquisition.

Fig. 3. Chalk oyster (*Pycnodonte vesiculare* (Lamarck)). Arrows indicate positions of repaired breaks, representing unsuccessful predation attempts. Warwickshire Museum specimen WARMS G3464/1; width of specimen is 48 mm.

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Bringing a herbarium to life at Plymouth City Museum and Art Gallery

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Abstract
Sir John St. Aubyn (1758-1839) was a collector and facilitator to science and the arts. His particular interest was for mineralogy, but he also had interests in botany, which lead him to create a sizeable herbarium containing many interesting plants. Most of these have been collected in the field, but there are also specimens from early plant nurseries and important gardens in Europe. The notes on the herbarium sheets are also exceptionally detailed. Adjacent to many species, the medicinal properties and domestic uses have been described.

Before his death, Sir John donated a folio containing his herbarium to the Civil Military Library at Devonport, which later moved to Plymouth City Museum in 1924, where it was hidden away. In 2007, Plymouth City Museum and Art Gallery secured a grant from the Esmée Fairbairn Foundation, enabling the museum's natural history department to conduct a variety of work on this historic collection. In the following article, I will recount my journey through time as I removed centuries of dust to reveal a collection of scientific and cultural importance.

Introduction

Sir John St Aubyn, 5th Baronet (Fig 1.), was born at Golden Square, London on 17 May 1758. Sir John was captivated by science and the arts and was a keen collector. Sir John's father (the 4th Baronet) was brought up by a Dr. William Borlase (1695 to 1772), a passionate mineral collector and Natural scientist (Hartley, 1977). The influence of his father's learned interest is likely to have also assisted in creating Sir John's fascination with minerals and the natural world. St Aubyn succeeded to the baronetcy at the age of fourteen and was a clever and distinguished man. He served as High Sheriff of Cornwall (at the age of 23), and went on to become a Fellow of the Royal Society, Fellow of the Linnean Society, member of Parliament, Fellow of the Society of Antiquarians, Fellow of the Geological Society of London, Fellow of the Society of Arts and Provincial Grandmaster of the Freemasons. The St. Aubyn's were also well-known gardeners in their time, and on the 5th baronet's Royal Society election certificate, his interest in botany is mentioned.

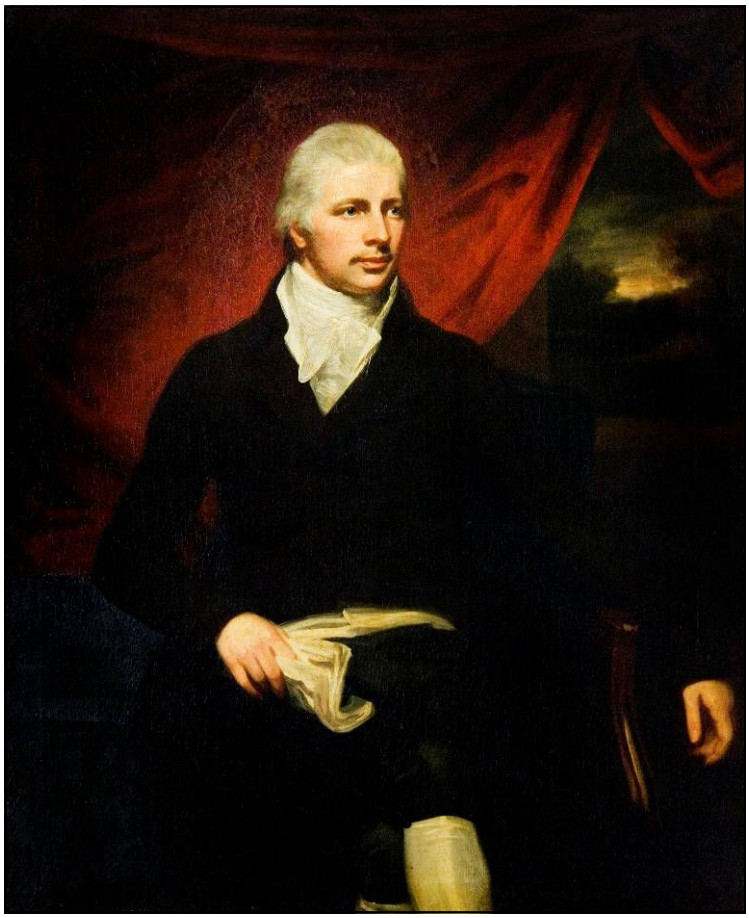

Fig. 1. Sir John St. Aubyn (1758—1839), by John Opie. (Copyright St Michael's Mount.

Sir John was also interested in the arts and collected a huge number of engravings and etchings which were sold at Phillips's Auction Rooms in April 1840. The collection was so vast that the sale is said to have lasted for seventeen days. Sir John was also an early and constant patron and friend of the painter John Opie, and was a pallbearer at the artist's funeral in April 1807 (Hartley, 1977). The remaining few pieces of Sir John St. Aubyn's art collection can now been seen at St. Michael's Mount, Marazion and at Pencarrow House, Bodmin. Pencarrow is the home of the Molesworth-St. Aubyn family, which took it's name when Sir John's sister, Catherine, married John Molesworth in 1790.

The St. Aubyn family had two estates in Cornwall – Clowance and St. Michael's Mount (Fig. 2), which Sir John inherited from his father in 1772. However, it appears that Sir John St. Aubyn found life in this part of the country rather uninspiring for his tastes in fine art and literature, and so he spent more of his time in London, or on estates closer to the city. Towards the end of his life, his family spent a brief time at Shortgrove Hall near Saffron Walden. The family did not seem to stay there for long, with Sir John auctioning his furniture and livestock in 1835 (Paul & Nash, 1835). Sadly, Shortgrove Hall is no longer standing, but the estate is still intact, along with its avenue of lime trees which line the driveway. There is also a small collection of minerals that Sir John donated to Saffron Walden Museum in August 1834.

Fig. 2. Clowance House near Camborne, Cornwall. Sir John St. Aubyn's family seat.

Sir John St. Aubyn is said to have spent a lot of time with a number of young ladies in his early years, but the first lady to live with Sir John at Clowance was Martha Nicholls (Hartley, 1977; Courtney, 2004). Her father, John Nicholls, came from an old Cornish family and was a well known landscape gardener. He was responsible for the grounds at Clowance, which are still very beautiful today. Astonishingly, Sir John St. Aubyn never married Martha, even though she had five of his children. Instead, he married the other lady in his life - Juliana Vinicombe (Fig. 3). Sir John met her when she was very young and sent her to be educated at Cheltenham. He eventually married Juliana, a blacksmith's daughter, in 1822 when he was 64 (Hartley, 1977).

On the 10 August 1839 Sir John St Aubyn died at Lime Grove, Putney in Surrey at the age of 81. His body was conveyed through Devonport on 23 August, on its way to Cornwall where it lay in state at St. Austell, Truro and Clowance. On 29 August he was buried, with a great ceremony, in the family vault in Crowan parish church (Hartley, 1977).

History of the collection

When St. Aubyn died, his own estate was deeply in debt, and much of his property had been sold. The mineral dealer Isaiah Deck (1792 to 1853) had been commissioned to help dispose of his extensive mineral collection in 1834. A small collection was formed for Lady St. Aubyn (Fig. 4) and another for Mrs Parnell (his daughter). Sir John then donated a large proportion of minerals to the Civil Military Library at Devonport (Cooper, 2006). The Devonport collection was later presented to the Mechanics Institute of Devonport in 1876 and subsequently transferred to the Devonport Museum in 1881 (Collins, 1880; Hunt, 1902). Then in 1924, the St. Aubyn mineral collection was relocated to Plymouth City Museum and Art Gallery (Plymouth City Council minutes, 1924a, 1924b, 1924c).

The movements of the mineral collection in Devonport and Plymouth are well documented; however the herbarium is never referred to. With the confusion of the mineral collection coming to the museum as a loan, and then the occurrence of World War II, the documentation starts to become rather woolly after its transfer in 1924. One can only assume therefore, that the herbarium came to us with the minerals, and neither collection was accessioned because it was considered to be a loan. It wasn't until the 1990s when one of our then documentation officers, Simon Hayhow, discovered the true importance of this herbarium (Hayhow pers. comm., 2008). Apparently he was looking at the specimens and made the connection to Sir John St. Aubyn when reading all of the place names. Later, in 1991, the specimens were accessioned.

Herbarium notes

I find herbaria to be great places for inspiration – rather like a three-dimensional library. There is always something very exciting about unwrapping and then seeing a 'mummified' plant, but when I first saw the St. Aubyn herbarium in December 2007, I couldn't believe how pristine it was. Every plant had been pressed so well that they had kept their vivid colours. All the geraniums were bright pink (Fig. 5), and most of

Fig. 3. Juliana Vinicombe (1769-1856) by John Opie (Copyright St Michael's Mount)

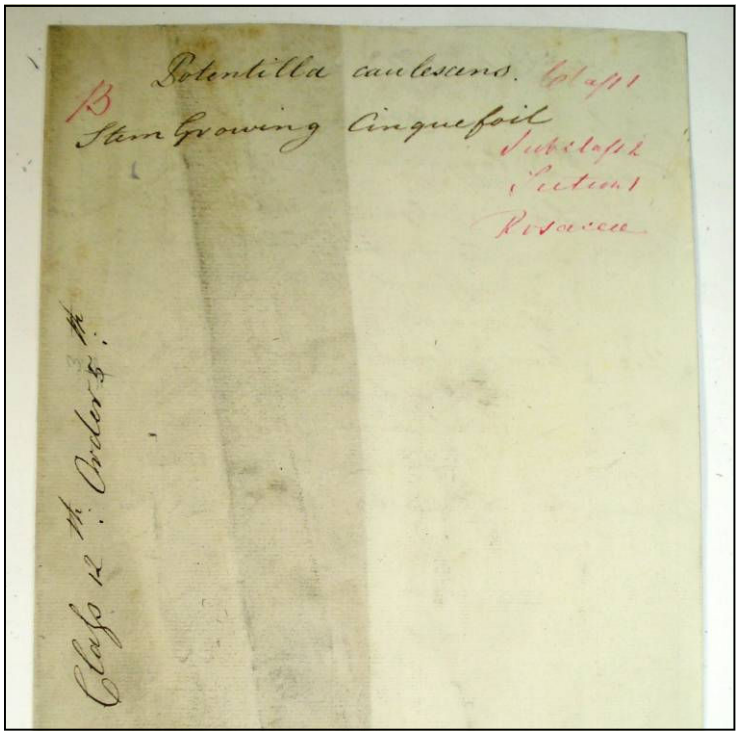

Fig. 4. *Urtica dioica* specimen from the St Aubyn Herbarium. (Copyright Plymouth City Museum and Art Gallery)

the specimens still were coloured green. The leaves and petals were intact; there was no trace of mould or insect. My first thought was that Sir John must have treated the specimens with some type of poison in order for them to survive in this immaculate condition, but the tests were negative. There was only a trace of arsenic, about the same found in bottled water.

There are 1163 herbarium sheets in total, and they have seaweeds, ferns, bryophtes, lichens, wild flowering plants and early cultivars mounted on them. The cultivars are particularly interesting as they indicate the growing enthusiasm for obtaining new plants and their availability during that time. There are very few duplicates, maybe three species in all. The plants are mostly mounted on gatefold sheets of paper (see Fig. 4), which have the names and taxonomic positioning labelled on the front. Once opened, the specimen is always found on the right side, and on the left either Sir John St. Aubyn or his wife has written notes (some of the specimens have the initials J. V. written in the bottom left corner). This layout is a pretty standard format used for all the specimens. However, a few sheets are in fact single, and on these there are relatively few notes. The specimens on these sheets are usually strapped in the middle, with paper strapping that usually has typeset writing on it. These straps or labels look like they may have been cut out of a book, and usually list the name of the plant, and its habitat (Fig. 6). As of yet, I have not been able to find out where these typed labels have come from, and am still searching. If anyone recognises them, then I would be grateful for any information.

The watermarks on the paper used by Sir John are varied. Several sheets of paper have been cut up so that the watermarks are not visible, other times the specimens block the view. Most of the seaweeds which have been collected by John MacCulloch have been mounted onto a separate piece of paper before they were given to Sir John. These specimens have been attached to the gatefold sheets with the original piece of MacCulloch's paper so the watermarks are not visible. However, on each of MacCulloch's sheets it is possible to see through the paper.

Fig. 5. *Geranium sp.* From the St. Aubyn herbarium. (Copyright Plymouth City Museum and Art Gallery)

Fig. 6. *Cherleria sedoides* - one of the many printed straps used on the St. Aubyn herbaria (Copryrght, Plymouth City Museum and Art Gallery).

Visible on the reverse are some of MacCulloch's sketches which are fascinating. However, apart from these specimens, the watermarks can be clearly deciphered:

ProPatria
E & P 1797
W Elgar
Wwilmott 1794
GR 97 (Fig. 7)
BM
GB 97
Floyd & Co 1796
BG
F Fincher 1796
Band
W. Elgar GR
WM GR 97

Lastly, I feel it is important to talk about the detailed notes that have been written on his herbarium. There are two sets of writing, one in red ink and the other in brown. So far, I have managed to find out that the red writing belongs to John Hutton Balfour (1808-1884). He must have seen the herbarium during 1838, and updated all the taxonomy on the front page with a red pen. He has signed and initialled all the sheets, and has left one of his own herbarium specimens of *Pyrola minor* L. within the main batch. After chatting to the librarians at the Royal Botanic Garden Edinburgh, we think he was visiting one of his sons, who was in the Royal Navy at Devonport.

The brown writing however has become more of a challenge to narrow down, and I cannot say with confidence that the writing is exclusively Sir John's, as his hand was almost identical to his wife's – Juliana, whose initials appear on the occasional sheet. However, whoever wrote down these extensive notes did so with a great amount of detail. The most interesting descriptions explain how the plant would have been administered for different ailments, and how it would have been utilized for other purposes (Table 1). There are also detailed notes on flowering/fruiting times and descriptions of where the species was collected from and by whom (Tables 1 & 2). The notes in the herbarium are thought to represent a mixture of John's and Juliana's own observations with quotes from already published works.

Fig. 7. A sketch showing one of the watermark's 'G.B' on the paper in the herbarium.

Observations and medicinal uses of *Salix alba* L. (White Willow): 'Horses, Cows, Sheep and Goats eat it. The Bark is of great efficacy in curing intermitting fevers. It must be gathered in summer when full of Sap and dried by a gentle heat. A Dram of it powdered every 4 hours between the fits is the dose.'

Culinary uses of *Polygonum aviculare* L. (Knot Grass): 'The Seeds furnish a nutritious meal; it is made into thin cakes called Crumpits.'

Flowering times of *Solanum lycopersicum* L. (Tomato): 'Flowers in June and August. Imported from South America in 1596.'

Common names of *Vaccinium oxycoccus* L. (Cranberry): 'Cranberry Whortle, Cranberries, Moss berries, Moor berries, Fen berries, Marsh Whorls, Marsh Whortle berries, Corn berries.' General characteristics of *Narcissus pseudonarcissus* L. (Wild Daffodil): 'Petals 6, equal. Nectary funnel formed, 1 leaved, Stamens within the Nectary.'

Table 1. (above) depicting the range of information which can found associated with specimens.

Table 2. Other collectors, gardens and nurseries represented in the St. Aubyn collection

Collectors	*Gardens*	*Nurseries*
Dr. John Macculoch (1773-1835)	The Botanical Garden of John Simmons Esq., Paddington	Mr. Cree's Nursery Gardens near Chertsey, Surrey
John Stackhouse (1742-1819)	Woburn Farm, near Chertsey, Surrey	Kennedy and Lee's Vineyard Nursery in Hammersmith
Sir James Edward Smith (1759-1828)	Ludovisi Gardens near Rome	
Mr. James Dickson (1738-1822)	Hampton Garden	
Mr. James Hutton (1726-1797)	Saltram Gardens, Devon	
Sir Abraham Hume (1748/49-1838)	Tamerton Castle, Cornwall	
Dr. Bellardi (1741-1826)	Gardens at Pendarves	
Mr. J. Rogers	Penrose Gardens near Helston, Cornwall	
Mr. Coryton	Hot house at Clowance, Cornwall	
Mr. J. Symmons		
Revd. Dr. Wynne		
Mrs. Grylls		

They frequently use this piece of equipment to scan large maps, and with our herbarium sheets being larger than A3, this scanner was ideal for the job.

After all the images were taken, conservation work could commence, and this consisted of dusting with a soft goat hair brush and then rubbing out the ingrained dirt with a Staedtler Mars Plastic rubber no. 52650, and a white akapad where there was writing in pencil. Not all of the sheets needed the second stage. Helen and I were given a choice of treatments to use by our paper conservator Coral Langham, but we decided to use the Mars Plastic Rubber No. 52650, because more research had been carried out on its residues, and the pH of a smoke sponge changes across its surface, and can in fact be very high (pH 7.0-9.5).

In contrast to the conservation work, a lot of time was spent on updating the database. During my first months on the project I decided to transcribe all of Sir John's notes onto an excel spreadsheet and update all of the scientific names. This was a relatively easy task, but unfortunately my knowledge of bryophyte taxonomy was not up to scratch, so I asked Dr. David Long at Royal Botanical Garden Edinburgh to help. David was really impressed by the herbarium, as so few people were collecting moss at this time. After updating all the records, the documentation team got to work on putting all of the notes into the database, using my spreadsheets. After several months of hard graft, the herbarium is now clean and available online: www.plymouth.gov.uk/staubynherbarium, and if anyone is interested in seeing some specimens and reading more about the collection, we will be touring an exhibition across Great Britain, from January 2010.

Driving into the Past

As part of the research on the herbarium, I tried to visit as many of the places mentioned within St. Aubyn's annotations, as well as those that played a role in his life. The most enjoyable and comical of these trips was with Helen in Essex. Initially, it was a trip to Saffron Walden Museum, where we were collecting their St. Aubyn minerals on a loan. However, we thought it would be a great idea to visit some of Sir John's houses while we were in the area. So there we were, following the St. Aubyn trail.

After packing the minerals ready for transporting them back to Plymouth, we decided to find Shortgrove Hall near Saffron Walden and Woolmers House in Hertfordshire. When we arrived at Shortgrove, neither of us was sure if we should enter the estate. The road was sign posted with big black writing: 'PRIVATE PROPERTY', but keen to research every nook and cranny, we continued. As soon as our car past the big entrance, I noticed an avenue of oaks. It was truly beautiful and very well kept. Towards the end of the road before the bend out of the estate we began to find small houses, and this helped us to relax. The estate no longer felt so 'private'. I knew before setting off that the house here was no longer standing, so I was not expecting much. I was indeed correct in this thinking – Sir John's house has been replaced by a replica Georgian style building which must have been built recently. Apart from the avenue of trees, the only other original parts were the two columns marking the entrance to the drive of the house, which were quite small with spheres on the top.

After seeing Shortgrove, Helen drove on to Woolmers. I have to admit, I was much more apprehensive about this house, as I was not sure if it was still standing or not. After a much map-reading on my part we found the Woolmers estate which had become a polo ground, and in the distance we could see a large white house. It was too far away to photograph properly so Helen and I turned into their driveway. Unfortunately, it was a fortress of gates and pointed railings, and everything was locked. There was an intercom, but neither of us had the nerve to use it. So I only managed to capture a small image taken from a huge distance away from the building (Fig.7).

The language used within the notes is also fascinating. Helen Fothergill noticed that Sir John never uses the word 'pink', and always described pink flowers as being 'a whitish reddish hue' or 'whitish with a tinge of purple'. The word pink is, however, used as a common name. Pink appears to be first used to describe a pale rose colour in the early 1700s, but perhaps it had not yet caught-on?! Even on the mineral collection there is a delightful description made by the Comte Jacques Louis de Bournon (1751-1825) about a piece of pisolite. He describes the spheres of stone being the same size as large peas (de Bournon, 1815), but as pointed out by Sarah Chambers and Margaret Morgan from the Royal Cornwall Museum in Truro – they are the size of small peas today. One can only conclude that the size of pea has changed a lot in the past 200 years, and maybe they were big to de Bournon's eyes all those years ago.

Fig. 8. Woolmers Polo Ground, Herefordshire; one of Sir John St. Aubyn's many houses.

The St. Aubyn Project

Helen Fothergill, Kelly Chevin and Jan Freedman at Plymouth City Museum and Art Gallery started writing their applications to fund this project in 2005, and secured a grant from the Esmée Fairbairn Foundation two years later. The natural history department chose the Esmée Fairbairn Foundation as they prefer to support projects that are difficult to fund. They also have interests in culture, education and the natural environment.

Conservation and Documentation

Work on the herbarium began in January 2008. This involved researching Sir John's contemporaries represented in this herbarium, and finding out more about the history of some of the collection sites. I also had to check that this was not a dispersed collection, like Sir John's minerals, by promoting the project in botanical journals and asking for any information.

In contrast to Sir John St. Aubyn's mineral collection, the herbarium did not need to have a great deal of time spent on its conservation. The first thing we did as a department was to make sure the entire herbarium was imaged, and this was done on a fabulous AO inverted scanner at Bristol Record Office.

Lastly, we decided to go home via Chertsey in Surrey to try and find Sir John's house at Woburn Farm. When we set off on the M25 we were in high spirits, but when we exited on junction 12 for Chertsey our spirits were dampened. Not only had we gone off on the wrong exit, we were racing towards London's congestion charge zone (I'm sure Sir John St. Aubyn never had this much trouble). After a flurry of panic, we did finally find Woburn Farm, but it was all fenced off with grandiose gates and pillars. Out of all the houses, this had to be the most private and non-accessible. So, we both quickly decided to give up. We turned our car around in the car park at St. Georges College, and went home.

I suppose many of you are wondering why I have written about one of our journeys on the St. Aubyn trail… It's mainly because I wanted to highlight how important (and fun) it is to try and re-trace your collectors footsteps, especially if you are trying to learn more about a collection, or bring it to life. Helen and I have been on many expeditions, and every time we have come across something of interest. On our last quest, we came across the old St. Aubyn manor house in Devonport, and met the owner, who was able to give us lots of information and new lines of research.

Conclusions

In conclusion I feel that this project has demonstrated how important it is to undertake research on your natural history collections. Without this research, such collections are ineffective to the general pubic and research-based societies. By advertising and promoting the project, I have been able to highlight the presence of the collection, which in turn has attracted a lot of attention from other institutions. I think it is really important for museums to endeavor to bring collections to life. But sometimes of course, it is a funding-related issue that stops departments from spending more time getting to know their collections.

Sadly, it has become increasingly difficult to find funding for projects that may not reap results and therefore more and more places are applying for money for building projects, or for purchasing new acquisitions instead of spending money on finding out the true story behind the collections that they already own. I think Plymouth City Museum and Art Gallery were really lucky to get the grant from the Esmée Fairbairn Foundation, as they uniquely give money to projects that may not reap all the results originally hoped for. I think such optimism in a funding body is rare, but it does show that a little bit of faith can go a long way.

Acknowledgements
Plymouth City Museum would firstly like to thank the Esmée Fairbairn Foundation and Renaissance South West for funding the St. Aubyn Project for two years. We would also like to thank everyone who has contacted us with information about the collection, and all our volunteers, especially Emily Woods, Holly Palmer and Bea Wilson who have helped us with our documentation and conservation. Naturally we are indebted to the St. Aubyn family and staff at St. Michael's Mount who have allowed us to take photographs of the family portraits, the Royal Botanic Garden Edinburgh for their help on the Balfour archives and bryophyte taxonomy, Bristol Record Office for allowing us to use their massive scanner and John Edmondson at National Museums Liverpool for all of his advice. Lastly, I would like to thank Plymouth City Museum and Art Gallery for giving me this incredible opportunity to work with the St. Aubyn collection, it's been great!

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The Moore Collection: World class palaeontology in a small museum

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Introduction
This talk examined the collection of 19th century geologist Charles Moore with particular emphasis upon a collection from a Lower Jurassic marine costal fauna of Ilminster, Somerset.

Bath (Royal) Literary and Scientific Institution (BRLSI) was founded in 1824 with the aim of furthering *the advancement of literature, science and art*. It received its Royal Charter in 1837 and rapidly acquired a prestigious reputation, particularly in scientific circles. The modern BRLSI provides its members and visitors with several hundred lectures and discussion groups every year, covering a whole host of subjects including science, philosophy, literature, history and the arts. The BRLSI also cares for, exhibits and facilitates research upon a museum collection which contains archaeological, ethnological, botanical, zoological, mineralogical and palaeontological collections as well as archives and an historic library with a particular strength in natural history. Regular temporary exhibitions, an expanding virtual museum on their website (www.brlsi.org) and, currently, the touring exhibition Nature Collected make the collections publicly accessible.

Bath played an early role in the development of geology as a science so it is no surprise that the BRLSI houses one of the best palaeontological collection in the South West of England. In 1779 John Walcott published *Descriptions and Figures of Petrifactions found in the Quarries, Gravel Pits etc. near Bath* in which he described (but did not name) a number of fossils and encouraged the reader collect fossils themselves. Walcott met and was an influence upon the young William Smith, whose surveying work in the area would lead to his *Order of the Strata round Bath*, followed by a geological map of the countryside within a five-mile radius of Bath and eventually resulting in his famous *A delineation of the Strata of England and Wales, with part of Scotland* in 1815.

The BRLSI's first curator was himself a geologist, William Lonsdale, later secretary to the Geological Society of London. Between 1825 and 1828 he encouraged the donation and deposition of specimens and artifacts in order to establish a museum. He personally donated about 800 mineral and rock specimens plus 230 fossils. The bulk of the palaeontological collection, however, was the life work of Charles Moore.

Moore's fossils
Moore was born in Ilminster, Somerset in 1815 (the same year Smith published his famous map). He was the second son of a book seller and was educated in Ilminster Commercial School until 1827 and then the Free Grammar School for a further year. On leaving school he joined the family business, moving to Bath in 1837 to work for Meyler's, a book seller and publisher of the Bath Herald.

Moore had had an interest in geology from early age, later reminiscing: *my half-holidays were often spent collecting the Ammonites with which the beds in the Upper Lias in the neighborhood of Ilminster abound, for the purpose of rubbing down to shew their sparry chambers*. His passion for geology was no doubt diminished for a time by the world of work but it was rekindled during his first residence in Bath. Moore returned to Ilminster in 1844 following his fathers death and ran the family business for his older sister the next nine years, he began collecting in earnest during this second residence in Ilminster.

Returning to Bath in 1853 Moore married Eliza Deare, only daughter of the wealthy John Deare of Widcome. This marriage into money allowed him to dedicate more time to his passion for palaeontology. He joined the Institution the same year and offered to deposit his already large and important palaeontological collection with the condition that he might exhibit them as a free public museum. The next year, 1854, Moore was elected a Fellow of the Geological Society of London.

The use of the BRLSI for his personal museum was a huge advantage to Moore, collectors; without such an opportunity had to use their own homes to house their collections often with disastrous effects on their personal lives (consider Gideon Mantel). Moore's collection grew rapidly, within three years he already had twenty three large wall-mounted Ichthyosaurs and it eventually became necessary to expand the space for display by the construction of a raised iron gantry, completed in 1876.

Moore was a community spirited, religious man and led the choir, played the flute and taught in the Sunday school of the Unitarian Chapel. He was elected as a town councilor in 1858 and represented the wards of Widcombe and Lyncombe until 1874 when he was elected an Alderman. Moore died 7th December 1881 and is buried in the Unitarian Chapel, Lyncombe, Bath.

Moore left his estate and collections to his wife. She sold his collection in its entirety to the BRLSI for £1,100, as valued by the British Museum at the time. The collection was purchased by subscription, this was arranged by Jerom Murch who was BRLSI chairman from 1859 onwards (Murch was also seven times mayor and a prominent Liberal politician who regularly preached at the Trim Street Chapel that Moore was involved in).

The future of Moore's Collection

One of the finest parts of Moore's collection are specimens from what Moore called his *saurian, fish & insect bed*. This locality, referred to here as Strawberry Bank, is site of extraordinary preservation of a Lower Jurassic (Upper Lias, Toarcian, 185 Ma) costal fauna in Ilminster, Somerset. It occurs as a laterally discontinuous band of nodules, no more than 50cm thick, which preserve fossils with very little compression. The site was once a quarry, which Moore fastidiously located by an extensive search after two boys found a fish fossil in an old rubble wall. The locality is no longer accessible and new collections seem unlikely as housing now covers the old quarry site.

Among the specimens there are 121 fishes representing at least four genera, 38 reptiles including two genera of ichthyosaur and one species of crocodylomorph, 25 cephalopods from at least three genera, 8 marine arthropods and 10 un-opened nodules. Most of these specimens have been poorly studied despite their exceptional preservation and the numerous fascinating possibilities they present, such as the chance to study an ontogenetic series within the early teleost fish genus *Pachycormus*. In addition to this there is an extensive collection of smaller un-curated fossils, wrapped to late 19th century papers, from the same locality that were deposited with the Somerset County Museum, Taunton, in 1905. These specimens are part of Moore's collection and almost certainly represent what Moore referred to as over one thousand insect specimens.

Professor Mike Benton and the author are developing a project to, in his words, *promote the Strawberry Bank collection as the jewel in the BRLSI geological collections, and to bring it to as wide an audience as possible. To do this, we must carry out conservation and preparation work on the fossils, and we intend to link this with a continuing research programme at the University of Bristol*. The Department of Earth Sciences at the University of Bristol hosts the largest palaeontology research group in the country, and trains some twenty or more Masters and PhD students each year. As head of this group Professor Benton is in an excellent position to facilitate and supervise work on the collection.

The Jurassic ecosystem of Strawberry Bank, Ilminster project (JESBI) is currently seeking funding to support an expansion of a collaboration that has already involved extensive study of the reptilian remains by both PhD and MSc students (Pearce and Benton, 2006; Caine and Benton, 2009). The project will include the following:

Further detailed **curation** of all the Strawberry bank Fossils in both Bath and Taunton.

Cleaning and **preparation** of key specimens to expose further anatomical details.

Re-storing of the whole collection in BRLSI (humidity is elevated at the bases of the cases due to minor rising damp).

Research by MSc and PhD students and post doctoral workers at the University of Bristol resulting in high profile papers.

Designation of the Moore collection in recognition of its international importance.

An **exhibition** featuring the prepared fossils and interpretation based on the research from the University of Bristol, possibly accompanied by reconstructions by John Sibbick

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Revealing a relict collection: Geology at Bolton Museum and Archive Service

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Abstract
Bolton Museum and Archive Service holds a geological collection that has a strong historical connection to the town. The collection has been out of use for the past two decades, rendering it 'relict'. From September 2003 the author has been working to make the collection accessible. This paper reviews that work.

Historical Context

Bolton has had a geology collection longer than it has had a museum. When the borough adopted the Libraries and Museums Act in 1852, the first donation was a collection of fossils.

Through the late 1800s the collection grew, and when the first museum (The Chadwick Museum) opened in 1884 there was already a strong natural history collection, with the basement filled with geology specimens. Continued acquisitions, including some large private collections, saw the collections outgrow their home. In the 1930s work began on a new civic building, Le Mans Crescent, which would house an expanded museum. This is the current home of Bolton Museum and Archive Service, and opened in 1947.

Fig. 1: The current museum on Le Mans Crescent

The geology collections began to be sidelined in the latter part of the 1900s with a focus on art and local history. The collections were stored in a basement room, and then moved on a short-term basis within the building. In the early 1990s, with a new outside store being prepared at an abandoned mill, the geology collections were moved again. By this point the last geologist on staff had left. With no active curation, the collection was effectively archived.

Around 1996 a documentation assistant was hired, but was employed less than a year. In 2003 the museum, as part of the accreditation process, advertised for a Documentation Assistant to catalogue the geology collections. The author was hired and started work in September 2003, initially on a 2 year contract.

Project Planning

The collection had been moved wholesale into what had been the canteen of the previous occupants of the mill building (Littlewoods). The collection was broadly divided into Palaeontology, Petrology and Mineralogy. Each was stored in different types of unit, many of which had been damaged during the moves in the late 1900s. Although the room is large (approximately 120m^2), the organisation of the collection at that time meant the space was cramped and it was hard to work.

Fig. 2: A view of the store in 2003 showing mineral cabinets on the left and palaeontology on the right

The palaeontology was split between late 19th century wooden cabinets, and modern steel drawer units acquired in the mid 1990s. The steel units were made by the Italian company Fami (www.famispa.com) and supplied by Polstore (www.polstore.co.uk). Unfortunately the eight units had not been completed and only half had drawers due to financial limitations. The mineralogy was in MDF units that were badly warped from several moves. Many drawers stuck and it was clear this storage would need replacing. The petrology collection was in hard wood drawers. The drawers had plywood lids that completely hid the contents, and it was necessary to remove the entire drawer to remove the lid. This caused safety issues as many of the drawers were overloaded in weight terms.

In addition to this there were in the region of 150 cardboard boxes of varying sizes and shapes, some in poor condition. Most were unmarked. Many of the boxes contained material which had no data at all. Opening boxes meant regular unexpected exposure to open sources of radiation, asbestiform minerals, toxic compounds, and piles of dust that were once specimens with minor pyrite decay. It is highly recommended that you wear a dust mask and gloves until you know where everything is.

The first three months were spent trying to establish an overview of the collection. Although some work along this line had been done previously, it was hard to match this to the collection since the move. The conclusion was that it would take four years to get the collection organised and fully documented on the computer. Unfortunately at this time the new cataloguing system (The Museum System [TMS], by Gallery Systems www.gallerysystems.com) was not operational. It would take a year for all necessary work to be done on this, which pushed the geology estimate out to five years.

To make a workable space, all old units would gradually be disposed of and new steel cupboards purchased to match the existing new storage. New drawers were also sourced for those existing units. The Fami contract had passed to System Store Solutions (www.system-store.com) and they were asked to act as suppliers. Finishing these cupboards cost approximately £6000. The money for this work came primarily from council capital funds, a bid having been made for long-term redevelopment of the museum stores. This system allows high-density storage, but the drawers are fixed in. This makes collections access awkward as

specimens must be removed individually. However, the 150kg load at full extension makes them excellent for a geology collection.

Fig. 3: A drawer of calcite specimens, in one of the new Fami units

Because there is no other geologist on staff, the author was often asked to work on other projects which would normally be the responsibility of a curator. This caused several delays.

Palaeontology

Given some work had started on the transfer of the palaeontology collections to the new units, it was felt this was the best place to start. It would also allow disposal of the old palaeontology units, which occupied more than half the room. This would create working space.

The collection was already arranged stratigraphically and systematically, and this organisation was maintained. Unfortunately, over the years, much of the collection had been displaced and it was necessary to reorganise the collection as it was transferred from the old units to the new. Collections were initially documented on Microsoft Excel, then transferred to TMS when the system was up and running. Documentation was carried out as the collections were transferred.

Bolton lies in the heart of the Manchester coalfields and, as would be expected, the palaeontology collection is strong on Coal Measures fossils, particularly plants. But as with most collections founded in the 19th Century, the principle was to show a wide range of representative material and there are specimens from most classic British localities, plus small collections from sites such as the Paris Basin.

The documentation and transfer of the palaeontology was completed by mid-2006. The final tally of objects was over 6400.

Mineralogy and Petrology

The Mineralogy and Petrology collections were catalogued in their old units, prior to transfer. This took most of 2007.

The mineralogy collection is primarily a broad, worldwide collection. It was acquired gradually over 150 years, with many purchases from 1950-1990. The intention was to establish a complete reference collection, but it is some way short of this. The collection contains around 3000 specimens.

The mineralogy collection contains a small number (~30) of radioactive specimens. The storage of these specimens was already an active problem in 2003. The museum had been advised a lead-lined safe was needed, but reading regulations this seemed an excessive and unnecessary solution. Further research and consultation with other institutions confirmed this. In 2008 a controlled, lockable area was set aside as a radiation controlled area, a solution that meets all legal requirements.

The petrology collection was acquired on similar principles, mainly in the late 1800s and early 1900s. Again, it is some way short of a full reference collection and at 1800 specimens is a relatively minor part of the overall geology collections.

In documenting the mineralogy collection, the author used the Geological Curators Group mailing and discussion list to gather opinions on what system to use. The mineralogy had been stored according to Hey. Many correspondents suggested Hey was not the most useful system as it relies on detailed aspects of the chemistry that may not be practical for a local authority museum. While some suggested storing on the basis of locality or collector, this would not be suitable for a collection as general as that held by Bolton. Two systems were recommended, Strunz and Dana. Since Strunz is freely available on the internet (webmineral.com) and regularly updated, this was seen as the most economically viable option. This has worked well.

With the palaeontology cabinets emptied, they were disposed of to a local timber recycling company. This allowed the mineralogy cabinets to be moved to the far side of the room, and for new units from System Store Solutions to be installed. The total cost was just over £13,600. The mineralogy and petrology were then transferred into these new units.

Fig 4: The geology store after the palaeontology units had been removed. Note

At this time a mistake in the planning became apparent. When planning the arrangement of the units in the space, two supporting columns were missed off the floor-plan. They had previously been hidden behind older cabinets. This meant the room had to be re-arranged at short notice.

By October 2007 the majority of the geology collection was documented, organised, and in a total of 16 steel cabinets.

Loose ends

With the bulk of the collections transferred and workspace now created, the final task was to deal with oversized specimens, some loose material that had come off display, and the geological slide collection.

Two bays of Dexion pallet racking were acquired from Brysdales Ltd at a cost of £1200. Each bay is 2700mm long and 900mm deep, with a load limit of 2000kgs. The bays have three shelves. This stores the geology material that would not fit within the cupboards, which have a maximum drawer depth of 150mm.

It also houses the collection of display models, including historically significant models of prehistoric animals made by Vernon Edwards in the 1930s and 1940s. The palaeobotanical slides are possibly the most important part of the geology collections. They were mainly made by James Lomax, a local preparator, in the early 1900s. Lomax sent material all over the world, but gave his local museum many of his unsold material. There are nearly 2000 slides across two cabinets, of which around half are from Lomax's company. They are also fully catalogued.

Fig. 5: View of the completed store, showing new Fami cabinets with pallet racking to the right.

By March 2008 the entire project was finished, four years and six months from the start.

Conclusions

When confronted with any open-ended project, especially where your time is limited, it can be very difficult to identify a starting point. The best approach is to identify what aspect is causing you the most immediate issues and start there. Transferring the palaeontology made logistical sense as it created the greatest amount of space in the store, allowing the rest of the redevelopment to take place more easily.

Even with three months spent planning, mistakes were made. It's important to take the time to map your space accurately before beginning the reorganisation. Probably the most useful resource open to us is the wealth of knowledge accumulated by our peers. There's very little chance your project is unique, and asking others for their experiences will allow you to learn from mistakes. It's important we talk about what we've done wrong, as well as what we've done right.

Since completing the project, the collections have been accessed by volunteers and researchers for the first time in at least twenty years. One paper has been written on a specimen from the collection (Craven & Dunlop 2008), with other projects underway.

Acknowledgments

Considering there was originally only two years funding, credit most go to the management of Bolton Museum and Archive Service for continued support. The project has also only been possible due to hard-won support within the local authority. I have drawn on the advice of a great many colleagues, peers and volunteers of the past six years, and credit is due to all of them too.

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Making Collections Count – The lessons learnt for museums and the developing Leicestershire County Council Collections Team from the Community Heritage Initiative.

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Background

The Community Heritage Initiative (CHI) was a five-year programme to help Leicestershire and Rutland residents, of all ages, learn about, appreciate, explore and conserve the area's natural and wider heritage.

The programme was awarded a Heritage Lottery Fund (HLF) grant in October 2003, with a programme team commencing at the start of February 2004 and ending at the end of November 2008. The Historic and Natural Environment (HNE) team was also formed in October 2003, and the CHI team worked within the wider HNE function. At the same time the work of the Biological Records Centre – a previously museum run function – split from the natural history collections and became part of the HNE team.

The HLF grant award was for £516,000 towards the predicted programme costs of £598,000. CHI also received financial support from Leicestershire County Council (LCC) and Rutland County Council.

Within the Community Heritage Initiative project application forms and supporting documentation, it was stated that the project would:

"Develop an innovative approach to collections, with training into collection preparation and use of natural history specimens. By generating greater use of the collections, it is hoped to break down barriers and misconceptions. Training will include why collections are necessary and highlight their value. It is also proposed to develop opportunities for collection of more commonly found natural history specimens (often used at handling sessions and training days) thus developing interaction with collections that should be truly accessible to everyone."

The CHI programme saw many new approaches to work with the collections for our authority, and it was this that has helped inform the developing work of a new Museums Collections Team, brought together in August 2008, as part of a wider structure review of Environment and Heritage services within the County Council. 2009 saw further significant changes with the retirement of Dr Anthony Fletcher, the Keeper of Natural Life, after a long and dedicated career with the collections.

Background to Leicestershire and its museum service

- Rural area 77%
- 32% of Leics population is rural
- fast growing population of pensionable age

The programme worked across the county, which has a diverse landscape and is often, often over-looked as having a rural nature with the associated issues of transport and access to services. CHI, activities were run across county, at LCC sites, village halls, and tourism venues, but the programme did not extend to the urban area of Leicester city.

Leicestershire County Council's museums service includes a Snibston Discovery Museum and Park, three community museums in large towns, Bosworth battlefield and an historic house, plus the Records with its collections housed at the Collections Resources Centre. It worked in partnership with the Record Office for Leicestershire, Leicester and Rutland and with the Biological Records Centre, part of the HNE team.

There are no dedicated galleries for the Natural Life collections, but the collections underpin and introduce many of the displays in the service's community museums. This will be made more significant with the

current development of a new gallery exploring rural life in the 21st century at the Melton Carnegie museum.

The Community Heritage Initiative

HLF now use the project as a best practice benchmark for other programmes, particularly with regard to evaluation, performance tracking, and community engagement (for which LCC won a national Sustainable Communities Award commendation). The programme worked with many partners, such as, the Rural Community Council and the local wildlife trust, as well as community voluntary sector and local experts.

Work was focused on encouraging volunteer activity at the local level, linking to the developing place shaping agenda and stronger communities strand of the Local Area Agreement. The project aimed to make local heritage and natural studies relevant and to empower communities; special interest groups and individuals through:

- provision of comprehensive information
- support and training, as well as advice and signposting (all of which helps add value to their records)
- fast-tracking information into formal conservation and heritage processes

Core strands included:

- working with younger people
- access to information
- skills development at community level
- engaging with older people
- volunteering

Fig. 1. A volunteer working with the entomology collections

Making connections and links was vital. The team provided support and new networking opportunities for many of the specialist interest or community groups.

CHI developed platforms for involvement with regular Heritage and County Recorders' conferences, and re-invigorating panels, such as, the Nature Conservation Forum, which were open to the wider public and attracted between 60-100 people. Collections were always promoted both through presentations and being physically present at such events.

Over the five years, CHI promoted and supported the development of museum collections for use by members of the public, young people, and natural history groups. The Natural Life collections had been assessed as being under-used by community and recorder groups. CHI worked to use them for inspiration, identification training and practical training in collecting. Over £24,000 was invested in enhancing and developing the Natural Life collections over the five years of the programme.

Working with local naturalist groups
The CHI team worked with eight natural history groups to recruit new recorders, develop skills and generate data of relevance to both the local Biodiversity Action Plan and the Biological Records Centre's data users.

This was done through supporting training in identification or habitat recording, publications, assisting with the creation of websites and developing new surveys such as Butterfly Bounty and Ladybirds – linked to the national harlequin project.

CHI funded work to re-order the VC55 local Lepidoptera collection into the current checklist, and following on from this worked with the Leicestershire Entomological Society to develop a Lottery bid based around the national specimens we hold and a lot of recently donated but un-accessioned material. HLF were aware of, and at the time would have welcomed, this project from a community group. In the end it was not submitted as the group were concerned about the financial management aspect of such a large project.

Sometimes help for these groups was as simple as setting up recruitment events, or publishing a community wildlife survey to gather information from a wider audience. One of the most successful projects was working with the local bat group. CHI helped them bring in funds for a new programme of village bat training, recording bat roosts (with new ones being found during the sessions). Osteological specimens were used at these training events, plus a travelling case sent to libraries with related material and ephemera from the entire museum collections was used within this project.

In the review period we ran the new ladybird survey looking of the harlequin ladybird and associated training with the collections. This provided national recording schemes with crucial information about the spread of this new species. Just over 3,300 for the ladybird fact sheets and nearly 2,500 ladybird identification keys were downloaded from the CHI website. Over 3000 Leicestershire and Rutland records of ladybirds were returned. The team's work was nationally recognised by the national recorder in providing crucial information.

Finally, CHI celebrated this work with societies and key county volunteers through the production of a display on the work of local naturalists and in developing a new archive of oral histories of over 30 county naturalists about their work and inspiration from the natural world. This new archive is held within the personalia files of the Natural Life Collections and includes notes about collecting in the 21st century.

Spreading the word about collections
Providing new opportunities for recording and collection of data was essential, but the key to the success of the Community Heritage Initiative was new ways of marketing and training, particularly raising the profile of the natural history collections.

Promotion was essential with over 350 media releases issued in the five years. Monthly talks were given to community groups and all included the collections, even just as a reference.

Projects that worked!
Parish based network of Heritage Wardens:
Heritage Wardens are parish-based community volunteers, who help gather information about the natural

and landscape heritage of their local area. Their role is supported by the local parish council. Heritage Wardens help monitor and conserve the heritage of Leicestershire and Rutland's countryside and biodiversity.

A Heritage Warden's most essential qualification is that they genuinely care for their local environment and its heritage and cultural distinctiveness. No two wardens are the same!

The network is recruited via local press; community newsletters; word of mouth and via parish council's doing their own local recruitment. They are not the same people as key county naturalists 'though many have become important local naturalists.

CHI worked with Heritage Wardens in 67% parishes, leaving an active network in 53% of Leicestershire and Rutland parishes with 200 volunteers.

Wardens work with local heritage groups in many cases. These groups see themselves as "Victorian collectors in the 21st century". This was a key new development for the work of the museum service and collections. Parish Wardens used collections, for example at village exhibitions, talks and direct work with their own community. This is an area we are continuing and developing our offer. This could include developing new curiosity cabinet type projects, small table-top displays, "nature tables" at events and diaries of what has been seen locally.

A number of Wardens are now coming forward to volunteer with the museum collections, and increasingly we are being requested to go into heritage groups to talk about our plans – and for them to come to us and visit the Collections Resources Centre and the Natural Life collections.

Training

Over the five years CHI ran 162 courses/lectures on heritage and natural history topics, with nearly 2,200 attendees. This free training was promoted through a CHI tailored publication/programme, departmental events guide and the local media and was held across the two counties, at various times of the day and week to allow maximum opportunities for uptake.

Topics were often developed following feedback, which always asked people to identify new skills they would like to develop, or ideas of topics that could be cascaded throughout communities. Sixteen of these sessions specifically used collections. CHI also specifically paid for work on the collections; to prepare specimens for training purposes (for example soldier beetles and butterflies) along with new id guides for the county.

One unexpected outcome from the training has been the role of community trainers.
CHI did not just pay our trainers and leave them to it. It offered a support package, which included loan of equipment, preparation of materials and their own training. The first of a 'Training for Trainers' course was run for five of our trainers, which gave them the opportunity to both learn new things and refresh their skills, thereby adding to the quality of the training experience that the programme offered.

Many of these trainers, or those they cascaded this training to, now support our new Natural Life Collections Team "Discover Like Darwin" programme. This is 19 specific collections-related courses with topics, such as, Plant Bug ID (a request from past CHI participants).

Interestingly the Creative Nature programme of arts-based workshops, taking inspiration from the natural world and natural history collections, was the CHI opportunity that we received most feedback on. Many people who attended these went on to further learning in the arts, creative writing and digital photography – as well as Microsoft courses. Most of the project participants indicated that the project had provided them with a valuable opportunity to develop a hobby or interest/passion in wildlife and to improve their skills.

CHI aimed to attract new people by highlighting the importance and relevance of natural heritage to our daily lives, not just through the science of natural history, but also by creative and informal recording.

From May 2007 through to July 2008, 60 sessions were run, with just under 400 attendees. Events included partnerships with the Adult Learning Service and Library Services for training sessions, which encourage people to record and celebrate nature in different creative ways. Topics included digital photography, writing poetry, themed heritage trails – poetry and handling items, botanical drawing, sketching, creating in-

spired artworks from the natural environment (abstract and printing), map making, paper and book making, as well as use of ICT. Sessions were run by Heritage Wardens, first-time tutors, lecturers and creative practitioners. Collections were vital in this delivery.

Now we are making links with local Universities that offer creative design courses and with tutors as a new link to open up the collections to a wider audience.

It was hoped that the creative projects would inspire a reconnection to natural history and the collections, archives, libraries, nature diaries and other aspects of the museums that are potential points of inspiration. As an outcome of this the CHI programme developed publications "Recording Naturally" (a family based project around nature diaries) and "Natural Inspiration". These and all other CHI publications are available online at www.leics.gov.uk/celebratingwildlife.

CHI also purchased Herbarium equipment for loan to groups and developed the 'Petals for Posterity' project. Training was organised and a pack developed. This will address gaps in the Service's herbarium and allow for collecting of some flowering plants. The Twycross Tree Warden subsequently supplied over 100 specimens collected from a local meadow. The project was launched in November 2007, following a pilot training session and production of an information pack. Throughout 2008 CHI offered training to local naturalists and societies in preparing plant specimens. It is hoped, in future years, to enhance and update the Museums' Herbarium handling collections through the lodging of donations created as part of this project.

Store Tours
CHI didn't just do tours of the stores with the collections, but also held "Behind the Scenes" with creative writers; this work is still continuing. CHI also purchased a greater resource of table lights and microscopes for use by groups. As a Collections Team we have listened to feedback that the store was grey and a bit uninspiring, so now we are working on more information posters, reorganising it for use by groups, developing branding, and developing key resources that illustrates the breadth of our collections.

Community Resources for Events
CHI worked with county recorders and members of key local naturalist societies to develop teaching trays with notes and handouts. Societies and local naturalists also got involved, for example with the moth trays, by breeding through or collecting specimens.

CHI developed trays of mosses, lichens, butterflies, pond and garden insects, bees and moths. These have been used by libraries, allotment societies, artists and a parish warden who wanted to illustrate to his parish council what could be found in their local pond.

We are now using this template to develop resources for our school loan service and volunteer teachers and students are helping develop fact sheets.

This greater loan demand has meant we are having now to develop guidance on use of the collections by groups. It also leads to more opportunities; requests have come in for training in setting specimens, and there is a possibility that written-off cabinet drawers could be given to groups to develop their own local displays or curiosity cabinets.

Work with young people
The CHI programme engaged 1,600 young people, through 13 free projects, literature and events. Some of these have been smaller scale and short term whilst others, like the Wild About pack (a family based themed activity publication) has a lasting legacy. The latter is available on the County Council website and has attracted 99,000 downloads of the 13 sections.

Six of the youth projects worked directly with collections. For example the Wildly wicked photography had over 100 photographs submitted (Fig. 2). As one outcome a group requested use of museum collections as a training exercise in microscopy photography and photographing museum objects (a first for curators working with young people of this age). This was then developed as an exhibition for the local Town Hall and as an online gallery by the Charnwood Arts organisation. All images and canvases have been accessioned, including those taken of the collections.

Collecting and Connecting was about working with young people and their "shoe box collections" (most of

which were geological rather than biology based). Participants got to work with curators, were helped with identifications and given guidance on labelling, display and conservation and storage. This project is easily replicable and will be repeated into the future.

Fig. 2. Working with young people; imaging and the collections. Wildly wicked photography involved using the museum collections as a training exercise in microscopy photography and photographing museum objects.

Travelling cases

These were developed to tour libraries and tourism venues (for example Oakham Castle). These brought together ephemera and everyday items with the collections. Topics included ladybirds, butterflies, bats, birds, plants, with the cases generally touring between 4-7 sites (Fig. 3).

The cases had serious messages mixed with popular approaches, for example butterflies on one side focussed on recording, collecting, mentioned checklists and naturalists at work, whilst the other side included stories, folklore and cultural links from flower fairies to butterfly gardening.

The uses of collections received comments like “Yuk dead birds” to “lovely to see birds up close” The case on bats was viewed by over 1,000 visitors at an open weekend, and led to the bat group getting new volunteer and membership enquiries

Future exhibitions for the future could include lichens, collectors and their topics, and molluscs.

In summary the top achievements

- £24,000 invested in collections
- New education trays and handling items
- New oral histories and information about key naturalists
- New creative programmes using the collections
- New trainers working with collections
- Links to youth projects

Informing the future

All of this work was fed in to a staff consultation at a restructure in 2008. This led to a new Collections Team formed at the Environment and Heritage restructuring in August 2008.

Fig. 3. One of the travel cases produced from the project.

The new structure offers:

- Improved relationship between frontline services in museums and the community and place agendas
- Site keepers with expertise based on communities in the districts (there is a museum in all but one district), responsiveness to audiences and local knowledge of their district including both local history and an understanding of contemporary issues such as identity and community cohesion.
- Collections and collections care specialists in a central collections team (a suggestion from the staff) – these maintain subject knowledge and collections care specialisms essential for accreditation standards. The team delivered their first exhibition on an area-based theme (A Celebration of Charnwood, displayed at Charnwood museum) in March 2009.

The new Senior Curator Natural Life, having managed outreach for 14 years with regard to natural life and recording, also brings the lessons learnt from CHI and a strategic support for the Collection Team to help develop community access, volunteering and marketing.

A significant percentage of staff within the team are externally funded through Renaissance, PAS, MLA traineeships or are project staff . Natural Life has the largest proportion of the 11 staff (2.5 permanent posts (one full-time vacant at present with a botany specialism will be advertised late summer**).**

As a Collection Team we are:

- Responding to a new departmental structure
- Developing new working partnerships
- Developing the collections themselves
- Meeting museum standards (legal and social) including accreditation
- Ensuring sustainability

The Collections Team's aspiration as outlined in October 2009 were

- Collections development
- More objects available through exhibitions and displays
- Develop the offer! More publications, access, and outreach.
- Increasing Collection use
- Improve documentation
- Enthuse, inspire and increase understanding
- Maintain/improve standards

Natural Life Collection: Collections of historical and contemporary objects and records, which reflect the landscape, geology, flora and fauna of the county and the plants and animals found in Leicestershire today, plus a large coverage of British and some foreign material maintained for study purposes. Leicestershire County Council Museums Service has over half a million biological specimens. There are a further 300,000 – 400,000 specimens in the City Museum Service and the two services work closely together, referring to and borrowing from each other's collections. Collections include significant number of voucher specimens, some type specimens. The resource includes nationally important lichen and entomology collections due to their scope.

The overwhelming majority of museum natural history collections were made by amateurs and a significant priority is to develop this relationship with county groups and naturalists in terms of contemporary collecting for the handling collections and work to unlock the data that the specimens can provide. This will assist colleagues at the BRC. Natural Life will have a prominent position in the Melton Carnegie developing rural gallery of 21st century life, so we are looking to develop more handling and display items for this!

- Our aspirations are similar to the wider teams
- Sharing interests and information (linking to the HNE supported surveys, inter discipline projects and lessons learnt from the travelling cases)
- Working with more volunteers
- New projects and new partners (bringing in more funds for the collections)
- Develop collections management and documentation
- Better collections access
- Working with new audiences to developing greater respect for collections (greater links to the universities, illustrators, costume links, and links to Creative writers such as the Write Muse project)

Natural Life Collection team is leading on developments with volunteering and to get the specimens out to communities. This will include Revisiting Collections– style projects. The idea of curiosity cabinets and nature table collecting is attracting great interest and will be an area we develop in the coming 12 months.

We have a vast amount of work to ensure we get greater information online with developing catalogues and one volunteer project identified will be to get photographs of the collections. We are revisiting our documentation procedures and making it easier and more responsive. Volunteers are also helping with getting electronic catalogues of slides and being trained in Mymsy to help with new approaches being developed on documentation.

Volunteers are being trained in collections care, cataloguing, are researching the value of the library and developing fact sheets and information. All of this will ensure the collections are more accessible. Volunteers helped identify tasks that others could help with. Many are transferable skills and a team has quickly come together.

In the future, based on the legacy of the CHI contract, the Collection Team will not be delivering in the field survey or ID training directly. We will be using the collections for ID training. This is the basis of the Discover Like Darwin programme. Events will be key to our work – due to the lack of gallery presence and we plan to run more in the coming years and link to photography and creative family and adult sessions at sites.

It is a great time of change, a new team, new curators and new approaches, but ultimately we hope to leave a legacy from our time looking after the collections with the wealth of opportunities we have identified, that the natural life collections are truly at the heart of our work in conserving Leicestershire Life.

Guide to Resin Embedding of Natural History Handling Specimens

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Introduction

The following is an account of the embedment of small natural history specimens in clear resin and is also intended as a step by step guide for the process. 'Water Clear' polyester embedding resin cures with a colourless finish allowing high visibility to any encapsulated specimens. This provides a means to preserve the structure of delicate specimens whilst at the same time allowing people (and children) to get as close as possible, with no risk of immediate physical damage (for pros and cons of resin embedment see Moore, 2006). The resin is supplied as uncured monomer in styrene and needs the addition of 1-3% catalyst (Methyl Ethyl Ketone Peroxide) to undergo the exothermic reaction to a solid cure. A mould is used to create the external shape of the resin which can then be polished to give a hard, smooth and transparent finish.

RAMM's Victorian Microscope Slide exhibition consists mainly of printed images and text so I wanted to create a 3D experience to complement this in the form of handling specimens set into a table-top, to be investigated by children using giant magnifying glasses. This was to be a travelling exhibition with minimal or no supervision so it was decided that resin encapsulation would be the best method of displaying the specimens. A hemisphere was chosen as the mould shape because it offered a flat surface for securing to the table and can be viewed from all angles.

The shape of each cast needed to be identical to fit with the design of the table and interpretation. Specimens were chosen to reflect themes of the exhibition and included granite, a wasp, snail shells, tarantula skins, section of a cactus, seed pods, a leaf skeleton, a beetle and an iridescent feather (all designated as unaccessioned handling specimens and were replaceable).

Fig 1: 'Take a closer look' interactive with resin embedded specimens

The three steps to the casting process are:

1. **Mould making**: The creation (or sourcing) of a negative shape into which to pour the resin.
2. **Casting**: Mixing the resin with a catalyst and pouring in layers over the prepared specimen into the mould and leaving to cure.
3. **Finishing**: The steps needed to get a smooth, durable and clear finish to the final piece, and also shaping to fit any support or mount.

Safety – Continuous exposure to styrene monomer released from the uncured resin could present a health risk if used in an unventilated place. Also the catalyst may cause spontaneous combustion on contact with organic matter (Alec Tiranti Ltd, 1989). Some thought is needed as to the disposal of waste resin – if large amounts build up, these will release fumes into the work place with sever annoyance of nearby conservators (personal experience, the author). Beware, Uncured resin will eat its way out of plastic containers.

MOULD MAKING: To buy or to make?

The choice of mould is of critical importance to shape and finish quality of final piece. The mould needs to be of a stable structure that has the exact negative shape of your desired cast. It needs to be as smooth as possible, heat resistant, flexible, unreactive with polyester and supported in some way so will not distort when full. If you require a specially shaped resin block it might be best to make your own mould. This can be done by pouring room temperature vulcanised (RTV) silicon rubber into a container over a 3d object, (see Resources for further info). Many plastic food containers e.g. yoghurt pots are suitable for casting but bear in mind that any seams or logos in the plastic will imprint on the resin, though these can be sanded down. Casting moulds are available from suppliers (fig 2) usually as a single mould, but bear in mind this limits production to a maximum of one cast per 24hours. Table 2 shows results of testing different mould materials.

Fig 2: A clear polypropylene casting mould.

The final mould (fig 3) was sourced from a catering supplier and consisted of six moulds in one which saved a great deal of time in waiting for layers to cure. A plaster support was built to support the flexible mould by taping the mould upside-down into a plastic storage container and covering with plaster and then inverting once set.

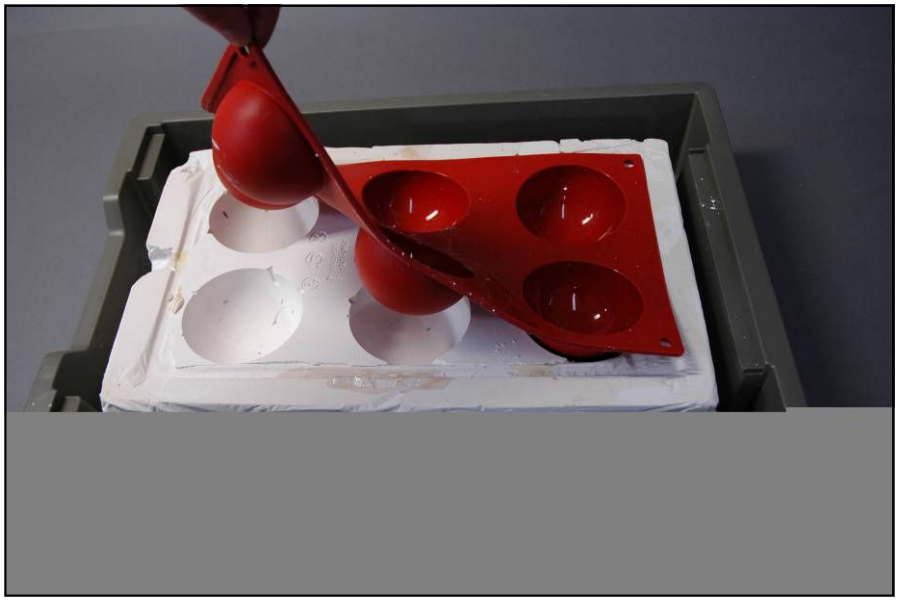

Fig 3: silicon baking mould.

PREPARATION

Layers
Unless you are casting a very small volume of resin the cast must be poured into the mould in layers (fig 4). This prevents the resin from overheating and either breaking the mould or cooking the specimen. It also allows you to position the specimen so that it appears floating inside the finished cast, rather than pressed up against one side. To work out the volumes of each layer, pour water into the mould to the desired depth of your first layer. Suck out with calibrated syringe and measure. Most sources say to add between 1-3% catalyst: resin, or about 1 drop in 10 grams on a warm day (Moore, 2006). If the object being embedded is large and too much catalyst is added the resin may shrink on curing and could crack as it cools (Alec tiranti LTS 1989). If pouring multiple casts mix up enough resin to pour each layer in a batch. Mixing in larger volumes will allow a better accuracy of volumes, which will improve finish quality and desired cure time. The resin goes off quickly in the pot once mixed so it is important to have all equipment to hand and to work out procedures of lowering in delicate specimens before you mix the resin. For a faster (and hotter) cure add nearer 3 % catalyst, this is fine for the first layer. As is generally the case with resin casting, each casting situation has unique factors that will affect the cure so doing a test cast is highly advisable: there are no precise volumes for guaranteed success.

Specimen Preparation
Due to the varied composition of natural history specimens each material needs some consideration as to how it will fare in the casting process. Most sources suggest only casting dry specimens, or freeze drying specimens before hand (Moore, 2006). If the material is naturally slow to decompose, then this may be suitable for casting without drying, although any moisture can react with the resin and reduce visibility.

Cactus section The cactus section was painted with clear nail varnish to seal any living tissue away from the curing resin.

Beetle Left in un-catalysed resin overnight in closed plastic container to prevent specimen floating (resin ate its way out of the plastic container overnight but beetle could be rescued!).

Wasp The wasp was left in un-catalysed resin for two hours in order to let any air bubbles escape through the spiracles. As the specimen floated in the un-catalysed resin, special apparatus was made to keep specimen submerged and also to allow transportation into mould without damage. A tea strainer may be useful for this dipping technique. The wasp had been relaxed and set into a lifelike pose before this and as such was delicate and brittle. Specimens need to be placed into the mould so they will have correct orientation in the finished piece, i.e. upside down. Any arrangement to the specimen once placed in the mould may affect

the cure. Bear in mind that the consistency of the resin may pose a risk to fragile insect limbs and so transportation between beaker and mould must be as quick and precise as possible.

Dried plant material and shells No treatment, Placed directly into resin

Granite Coated with clear nail varnish to encourage a seamless cure of resin and reduce 'silvering' due to shrinkage of resin around the rock.

Iridescent Feather No treatment used, placed directly into resin.

Tarantula skins The first batch were soaked in un-catalysed resin to relax specimen and remove air bubbles.

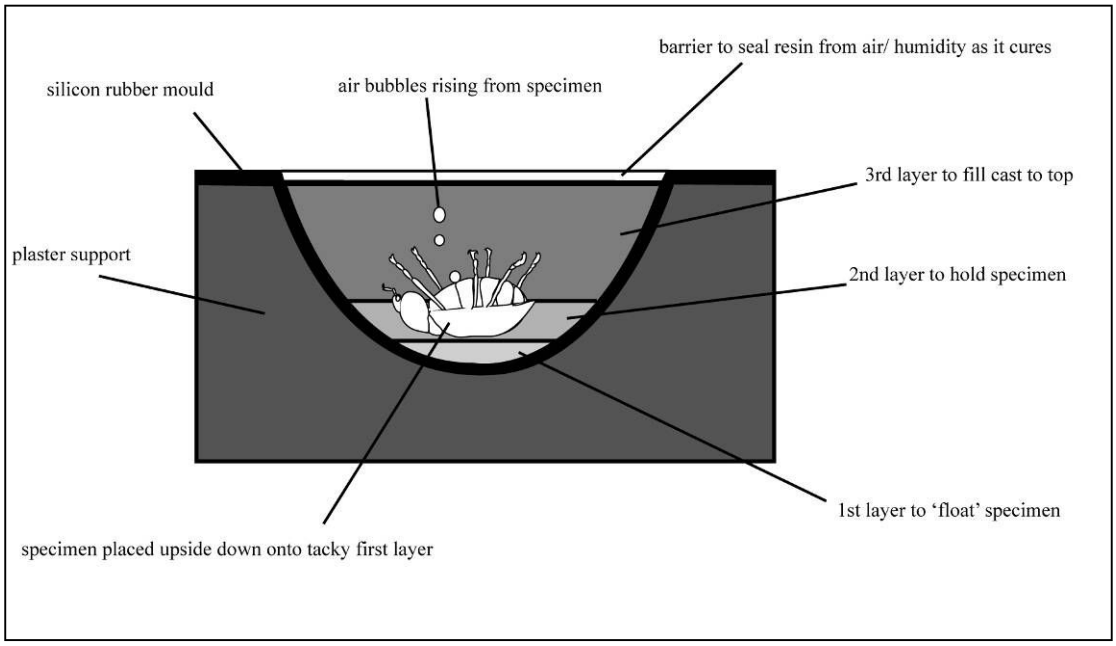

Fig. 4. Simple illustration to demonstrate the best method casting specimens in layers.

CASTING

Layer 1
Add catalyst to resin in a plastic beaker and stir well with wooden spatula until well mixed, trying not to get too many bubbles into the mix. Pour the first layer gently into each mould. Some bubbles at this stage are OK as they will rise to the top before the resin sets. Tapping the mould lightly may help displace stubborn bubbles. Cover the mould to exclude dust and leave until the layer is tacky – this takes about 40minutes and can be tested by lightly poking the surface. Enough surface tension is needed so the specimen will not sink down into the first layer when placed into the mould.

Layer 2
Lower the prepared specimen upside down into the mould (so that it will be correctly orientated in the finished piece), having worked out orientation beforehand and checked it is steady on a flat surface. If specimen is not steady it may be best to construct apparatus to hang it in position inside the mould. Pour the mixed resin over the specimen, or down one side of the mould. To avoid introducing air bubbles the resin can be poured into the mould down a spatula. Pour in enough resin to surround the specimen but not to completely submerge it. If the mould is not level the specimen may slowly shift out of place. Try to minimise manipulation of specimen once it is in position. The second layer should be left for at least 1.5 hours

to cure. If the second layer is still runny the specimen may dislodge and float to the top of the mould on pouring the third layer and so will appear at the bottom of cured piece. If the specimen is not securely resting on the first layer, or the mould is on an uneven surface the specimen may drift and the resulting cast will be off-centre.

Layer 3
If the total volume of the cast is small (>200ml) then fill to the top of the mould, otherwise use more layers. Only pour the third layer once the specimen is well set into the second layer. If possible, seal the resin off from the atmosphere using Clingfilm as air contact will inhibit the cure. This is because air causes evaporation of styrene which is involved in cross linking (Alec Tiranti Ltd 1989). I used circles of polythene cut from ziplock bags and placed onto the top of the mould but these wrinkled as the resin cured leaving a messy finish to the bottom which had to be sanded down later. Leave the resin to cure for 24-48 hours before removing from the mould.

Polishing
The time taken in polishing is dependent on the cure quality of the finished piece, and so relies on many factors including temperature, humidity, volume, specimen etc. Even though the mould I used was perfectly smooth the casts came out in a wrinkled, sticky, stringy mess. At least a few hours manual polishing is needed for each specimen in this scenario.

Remove the cast from the mould after at least 24hours curing time. Check for tackiness by touching the base and seeing if it makes a fingerprint impression. Ideally the resin will have set hard overnight but if the surface imprints leave for at least 48 hours prior to removal. Even if the mould comes out crystal clear it may become cloudy as it becomes imprinted with fingerprints. If the casts are rock hard already then proceed to sanding and buffing.

Remove sticky layer: If present, the sticky layer will remain uncured indefinitely. This layer can be removed by rubbing the surface with acetone and scraping off with an abrasive pad. The sticky layer will 'ball up' with the consistency of chewing gum and can be peeled/ scraped off. The tacky surface can be a result of excess/low temperature, not enough catalyst, solvents in the fume cupboard, too high humidity. Washing up liquid followed by warm water may also help remove the sticky layer. The tackiness of my specimens was blamed on the overnight positioning of a large humidifier next to the opening of the fume cupboard.

Coarse sanding
The resin may cure with branching and rippling patterns as it shrinks in the mould (see fig 5). Once the sticky layer has been removed any largely uneven or lumpy surfaces can be sanded down with course sandpaper. A sanding machine will make quick work of any flat surfaces to be smoothed down. Now is the time for large scale reshaping/sawing if the cast is to fit into a support. Take care not to make any deep scratches at this point – it is easier to sand down ridges from a flat surface than remove deep scratches.

Fine sanding
I used increasingly fine grades of sand paper to remove all scratches and ripples from the resin. 'wet and dry' sand paper has a very fine grain which can be washed and used wet. As the debris clogs the paper it is beneficial to use wet paper, washing away the resulting powdery residue. Eventually the surface will be extremely smooth and clean with no scratches, although visibility will be low still. Keep going until all scratches are gone as any scratches will show up once the cast has been buffed up.

Buffing
Once all scratches are gone the cast can be buffed up either with a mechanical acrylic polisher or a cloth and polishing compound such as T-cut (used for cars). This process should turn any scratch-less translucency into spotless transparent surfaces. This will also highlight any scratches missed during fine sanding - if scratches appear the whole surface needs sanding again.

Any scratches or unevenness to the bottom surface will also show up inside the cast by internal reflection, especially if the block has any curved surfaces. The bottom can be painted with acrylic paint to give an effective backdrop to the specimen. If the bottom surface is to remain unpainted but has scratches that need to be removed, a quick fix is to paint with clear nail varnish; this will restore visibility by filling in scratches.

Results

Fig. 5. Resin casts after one month of being on display (A-G). 5H shows wasp cast immediately after curing and buffing. Despite grubby finger prints the resin casts are clear and scratch free.

Seed pods and leaf skeleton (fig 5 A and F): The leaf skeleton protruded through the final layer (bottom of the cast) and was sanded down at the base – this gave it an effective viewing angle and the boundaries between layers could not be seen. All dried plant material preserved very well.

Tarantula skin (fig 5 B)**:** One skin was completely destroyed while soaking in un-catalysed resin to remove bubbles. New skins were placed straight into the mould and they relaxed once submerged, although some air bubbles were trapped under the chitinous sternum. All iridescence in leg hairs was lost.

Beetle (fig 5 C): The beetle showed a few silvery areas where the resin had not adhered to the elytra. This could possibly have been avoided by brushing with clear nail polish before hand to better seal the specimen with the resin. The dark brown colour of the beetle seems to have been enhanced by the resin to a deep red. The main problem with this specimen was that it drifted whilst layer two was setting and so is off-centre in the finished cast.

Snail shells (fig 5 D): A clear finish with no air bubbles.

Granite (fig 5 E): A good clear finish with high visibility of rock crystals though few tiny air bubbles had been trapped during casting.

Cactus section (fig 5 G): The cactus remained fresh looking whilst embedded, although one side was so close to the edge that this became exposed when the cast was sanded down, increasing the chances of decomposition by exposure to air. Although the cactus was cast when fresh, this did not affect curing or visibility. This may be due to painting the cactus with clear nail varnish before embedding and thus preventing moisture from reacting with resin and affecting the cure.

Wasp (fig 5 H) The bristles on the wasp were particularly well preserved, with no trapped air bubbles, this being due to soaking the wasp in un-catalysed resin before casting, and great care in transporting the wasp between the resin and mould. This cast was very effective, with the wasp appearing clear and lifelike, having been relaxed and pinned into position prior to soaking in resin.

Feather (abandoned)**:** The iridescent duck feather lost all shine and appeared dull brown once embedded. For troubleshooting when preserving iridescence in resin cast specimens (see Moore, 2006).

Centipede (abandoned): This specimen had been preserved in alcohol and was transferred from 70% IMS to Acetone and then air dried prior to embedding. The specimen became dislodged whilst pouring the second layer and had to be manoeuvred in the setting resin. The finished cast showed decreased visibility due to a silvering effect around the centipede and discontinuity between layers.

Evaluation

The whole process took longer than expected due to excess tackiness of the cure, and also experimenting with different moulds. The excess tackiness was attributed to the humidity of the room, and could possibly have been prevented by better sealing off of the setting resin from atmosphere. There are many factors that influence the quality of the finished casts and it is costly in terms of time and space, although the materials are inexpensive. Overall we were impressed by the quality of the finished casts, and the specimens fulfilled their purpose of maximum visibility and accessibility. The unpredictable nature of resin casting makes it difficult to know how many attempts it will take to get a satisfactory cast, and there is a steep learning curve for those trying it for the first time – if conditions are unfavourable then each cast will take hours of sanding and buffing. Conflicts may arise if a fume cupboard must be shared as resin takes up a lot of time, space, disposable containers and not to mention it smells awful. However once favourable conditions are achieved it is possible to fit the process around a working week and with a bit of multi-tasking a good series of casts can be performed, especially with a multi-mould. If casting a one-off specimen or lacking space, time, or a fume cupboard then it would probably be more cost effective to have the cast done professionally by a resin specialist (see resources).

Resources:

Professional resin casting
http://www.sjcrafts.co.uk

Suppliers
Wards Catering (silicon moulds) www.wardscatering.co.uk
Tomps (moulding and casting supplies) www.tomps.com
Tiranti (moulding and casting supplies) www.tiranti.co.uk

Information on mould making
http://www.tomps.com/
Click on Mould Making link in help section

Safety sheets can be downloaded at http://www.tomps.com/
Click on Specialist Resins> Polyester Water Clear > Safety Data Sheet

References:

Alec Tiranti ltd 1995. *The Polyester Resin Booklet* Published by Tiranti Ltd,

Moore, S. J. 2006. Overcoming Problems with Polyester resin blocks, *NatSCA News* Issue 10

NEWS

Notices, Adverts & Meetings

Book Review

British Seashells : A Guide for Conchologists & Beachcombers by Paul Chambers with illustrations by George Sowerby. Published by Remember When (Pen & Sword Books Ltd) Barnsley, England. 233pp 204 species illustrated in B.& W. and colour. Hardback £25.

A book on British seashells, covering both gastropods and bivalves within the same volume, has been long-awaited. Unfortunately, this volume does not live up to the challenge and, like most other books on the subject, does not even attempt to include all known species, in this case most notably the coat-of-mail shells. It is understandable that the author left out some of the other British marine molluscan groupings such as the sea-slugs and the Cephalopods, as well as the smaller, more difficult pelagic species but it is difficult to understand why the coat-of mail shells were omitted. Easily recognisable as coat-of-mail shells on our rocky shores, these are a relatively small group of species, many of which are very common and easily identifiable, although to be fair some are also very difficult.

The reproducing of George Sowerby's illustrations in this work makes these fine, but historic, figures available to a wider readership, but some are of little use or help in the identification of individual specimens. Indeed, the author states "This book is not designed to be an expert guide" and suggests referring to more specific identification guides for accurate identifications. In many cases, only a good reference collection with a wide range of sizes and forms correctly identified for comparison purposes is of any real value for the identification of some species groups. Even then, dissections of the animal itself may be required. It should also be noted that not all of the species are illustrated, even if the index does imply the presence of a figure, and some of the illustrations in the volume are not those of George Sowerby, due mainly to the fact that some species original descriptions post-date Sowerby's illustrations.

The author has written in the style of a Victorian amateur naturalist of the time, which makes the book easy to read and brings out the enthusiasm the author has for the subject. The author has not avoided controversy and has left himself open to some criticism. However, I liked the book. In particular I liked the inclusion of the etymology of the Latin names. I only wish that he had included the dates of publication after the authors' names as this makes it so much easier to trace the original published description of any given species. He states that information on the taxonomic authors themselves can be found by using the index: however, I was unable to find any index which included this information. The major works in which some species descriptions occur for the first time can be found in the references and within the introductory text to specific species. However, I feel that the omission of dates of publication after authors' names was an error of judgement, if only a minor one.

Adrian Norris, May 2009