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Editorial

At the very top of the Natural History Museum, London, conveniently situated a few feet away from the giant Sequoia tree, is the museums botany department. Inside an inconspicuous door houses the curatorial staff and thousands of herbarium specimens. Looking down the long narrow room there are cabinets on either side and cabinets in the middle, running practically the full length of the room. This impressive, almost gothic room is home to thousands of pressed herbaria and countless seeds from all corners of the world.

Hidden away from the eyes of the grand room are small alcoves where the curators work. This is where I met Vicki for our Editor handover. I have to thank Vicki for all her work on the previous issues of *NatSCA News* and for her easy handover. I hope I can continue the high standard that has been set.

It is important for curators to let others know the work they are doing with collections, conservation, training and education. Sharing our ideas means we are not constantly reinventing the wheel. Writing about our ideas and projects can offer inspiration and support our colleagues. *NatSCA News* is that forum for our ideas to be shared.

Thank you to all the authors who have submitted articles for this issue; it is a large varied issue with numerous interesting articles. There are several training courses spread throughout this issue, so keep your eyes open!

Please keep sending me articles on projects you are doing, conservation ideas and fun educational ways of using Natural History specimens.

Enjoy Issue 14!

- Jan Freedman

Contributions for Issue 15, July 2008

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 June 1st:

Jan Freedman [Editor, NatSCA]
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Plymouth City Museums and Art Gallery
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Farewell From The Chair

I am leaving the Botany Department after nearly 10 years here, as a volunteer, temporary and permanent member of staff. As I am moving (perhaps only temporarily) out of science and out of the museum sector I didn't think it would be appropriate for me to carry on as Chair of NatSCA. I have been approached by the private sector and will be joining *the Development Trust Association*, managing a team of 45 consultants who help communities to manage their business assets, as well as lobbying local and central Government.

I'm afraid I won't be able to make the conference this year, which I really regret as it has a set of interesting papers which will be of use to all of us. We have a really good committee at present, some new faces as well as some long-serving friends, and they will be contacting you soon to let you know who will be taking over.

I would like to say a big thank you to you all - I've really enjoyed working with many of you over the years as well as being part of the team that helped move the BCG and NSGC into the new group that is NatSCA. I think we've really breathed some new life into our programme of events as well as doing some hard thinking about what we want to do and where we want to be, and I've found it inspiring to be a part of that.

Very best wishes,

Vicki Papworth

NatSCA 2008 Conference & AGM Programme
15th – 16th May 2008

"Working It Out - Collections and Partnerships"

University of Glasgow, Hunterian Museum

Thursday 15th May

Graham Kerr Building, Lecture Theatre 1

9.00 - 9.45	registration and introduction
9.45 - 10.10	Dr Jo Mould, Natural Talent BTCV Apprenticeships
10.10 - 10-35	Naila Akram, RSPB
10.35 - 11.00	Dr Patricia Lee, Swansea Uni and NHM
11.00 - 11.30	**Coffee**
11.30 - 12.15	Panel Discussion
12.15 - 13.15	**Lunch**
13.15 - 14.00	AGM
14.00 - 4pm	Tours
4.30 – 6.00	reception at Zoology Museum in Graham Kerr Building Wine and nibbles

7.30 conference meal at Drawing Room pub adjacent to Kelvingrove Museum

Friday 16th May

Glasgow City Museums, Kelvingrove

9.15 - 9.30	Introduction
9.30 - 9.55	Alec Coles Director, Tyne and Wear Museums
9.55 - 10.20	Sally Smart, Wildlife Liaison Officer (West Yorks)
10.20 - 10.50	**Coffee**
10.50 - 11.15	Andy Lee, NHM, Real World Science Project
11.15 - 11.40	speaker from 'Amateurs as Experts' Lancaster University
11.40 - 12.30	Panel discussion
12.30 - 13.45	**Lunch**
14.00 - 16.00	Tours

Saturday 17th - Optional Field Trip

As an optional extra, for those interested, who will need to sign up and pay extra in advance, we can offer a half day trip to Rowardennan on the East side of Loch Lomond and part of the National Park area there. Leaving Glasgow University around 9 am or so, return 2.30 pm. Geoff Hancock will lead a 'walk in the woods' general natural history ramble in this beautiful locale. Basing ourselves at the University Field Station, we can arrange a soup and sandwich lunch there. Cost of trip to cover lunch and transport will be no more than £20 depending on level of uptake.

Note that the University of Glasgow Main campus and Kelvingrove Museum are located right beside each other. Also the Glasgow Botanic Gardens are 10 minutes walk from the University.

Glasgow University Tour Options

Thursday pm		2 .00 - 2.30	2.30 – 3.00	3.00 – 3.30	3.30 4.00
	University Library Special Collections Max. 15 people per session (duration 0.5 hour)				
	Zoology stores Max 10 people per tour (duration 1 hour)				
	Campus tour Main Hunterian Museum/ Art Gallery/ Anatomy Museum (duration – ca 2 hours)				
	Thurso St (Geology, Ethnography) Stores Max 15 people per session (duration 1 hour)				

Kelvingrove and related tour options

Friday pm		2pm – 3pm	3pm – 4pm
	Kelvingrove Gallery Tour		
	Glasgow Botanic Gardens visit		
	Fossil Grove visit		

Please photocopy and tick which tour you would like on the Saturday 17th and send to Maggie Reilly at Hunterian Museum, University of Glasgow or email: mreilly@museum.gla.ac.uk

Conference and AGM Booking. May 15th—16th 2008.

(Deadline for booking May 1st 2008)

The full booking form is on the NatSCA website (www.NatSCA.co.uk)

Conference Costs:

	2 day rate	Day rate
Member	£75	£45
Non-Member	£95	£55

Conference dinner £15 (**optional**)

Loch Lomond trip on Saturday 17th May - £20 (includes travel and lunch) **optional**

Cheques should be made payable to '**Natural Sciences Collections Association**'

Contact: Maggie Reilly, Curator of Zoology, Hunterian Museum, University of Glasgow.
Email: mreilly@museum.gla.ac.uk

Further info.

http://www.glasgowwestend.co.uk/
This site is a useful, if a bit gossipy, guide to Glasgow's West End.

Multimap of the West End at
http://www.multimap.com/maps/?&hloc=GB|G12#t=l&map=55.87154,-4.292|16|4&loc=GB:55.88039:-4.30037:16|G12|G12
though unhelpfully, at the back of the Western Infirmary (which is marked on the map) where the University and Kelvingrove Museum are sited, it has a big green and grey space!!!

University maps at
http://www.gla.ac.uk/about/locationmapsandtravel/

Glasgow Museums map at
http://www.glasgowmuseums.com/maps/pdf/venues.pdf

Below is an accommodation list. Please also note that all prices below are approximate and all include breakfast.

1. Best Western Glasgow Pond Hotel (Jury's)
Great Western Road Glasgow, G12 0XP
http://www.gtahotels.com/hotels/ponds_hotel_glasgow.htm

This is one of the Jurys hotels. It is a 20 min walk from the University and there are buses that run down Great Western Road to near the University.

Rates: £80 for a twin room, singles £70

2. Premier Travel Lodge: T: 0870 990 6312. F: 0870 990 6313

10 Elmbank Gardens, Glasgow, G2 4PP
http://www.premierinn.com/pti/hotelInformation.do?hotelId=24162

Rates: £59 for a twin room, singles also £59
This is the nearest of these travel lodGe type hotels to the University. It is about half way between the city centre and the west end. Again, about a 15 minute walk but there is also a bus from Charing X to the Uni.

3. The Town House: T: 0141-357-0862. F: 0141-339-9605

4 Hughenden Terrace, Glasgow, G12 9XR
Email: hospitality@thetownhouseglasgow.com
http://www.thetownhouseglasgow.com

Rates: £36 per person for twin room, £60 for a single
20 mins walk to University. Bus available nearby.

5. The Ambassador Hotel: T: 0141 946 1018. F: 0141 945 5377

7 Kelvin Drive, Glasgow G20 8QG
ambassador@glasgowhotelsandapartments.co.uk

Rates : £80 for a twin room, £60 for a single
15 mins walk to University

6. Sandyford Hotel Glasgow: T: (+44) 0141 334 0000. F: (+44) 0141 337 1812

904 Sauchiehall St, Glasgow, G3 7TF
Email: info@sandyfordhotelglasgow.com
Web: www.sandyfordhotelglasgow.com

Rates: Single En-Suite only £35.00 Per Night
Double/Twin En-Suite only £55.00 Per Night

Again about 15 mins walk to the University but this is nearer the Kelvingrove Museum end.

7. Devoncove Hotel: T: +44 (0) 141 334 4000. F: +44 (0) 141 339 9000

931 Sauchiehall Street, Glasgow, G3 7TQ
E-mail: info@devoncovehotel.com
WWW: www.devoncovehotel.com

Rates singles from £35-£60, doubles or twins £40-£85, Triple £58.50-£105. All rates are per room per night.

Anoxia Seminar

8th November 2007, Natural History Museum, London

David Waterhouse, Assistant Curator of Natural History
Norfolk Museums and Archaeology Service

Simon Moore (Hampshire County Council Museum Service)
Hampshire Museums Service's anoxic treatment regime on a tight budget

The total cost for Hampshire Museums Service anoxia project was about £1,200, but it is easy to use and required very little time to set up. It is basically a fibreglass tank, 3 feet deep, with nitrogen canisters and an oxygen meter. The most expensive part of the set-up was the oxygen meter at about £1,000. Clip seals on a Neoprene gasket make sure it is all airtight. Objects are loaded in to the anoxia chamber by putting them in collapsible crates and lowering them in using cord handles. A second, smaller chamber has since been constructed (which saves on nitrogen gas if only small objects need to be treated).

The nitrogen from canisters passes through de-ionised water chambers (to add humidity to the 'dry' gas). Nitrogen poses little, to no health and safety risk, as it is a very high percentage of the atmosphere anyway.

Pests are killed by a mixture of asphyxiation and being dried out as the gas opens their spiracles. As the nitrogen passes through a water tray it bubbles and this is lets the operator know when the gas has run out.

At Hampshire Museums Service this method has been 100% effective (all pests have been killed when treated). The penetration of the gas has been tested through quite thick feathers to a depth of 13cm. The nitrogen gas is also relatively cheep. Specimens are put into the chamber for a week at a time (if treating woodworm it needs to be for a month). The chamber has to be at temperatures above 20°C for the process to work. Relative humidity needs to be about the same as the object was in originally, so as not to damage the specimen by drying it out or moistening it too much (a general guide is 45% humidity for taxidermy specimens). However, the lower the humidity the more effective the treatment is (as it dries out the insects). It is the fluctuation in humidity that is really harmful for specimens rather than sustained periods of high or low relative humidity.

Advantages of anoxia over freezing are that some materials can de-nature during the freezing process – such as very old glass eyes splitting, *etc*. This does not happen in an anoxic environment.

Dr. Agnoko Michèle Gunn (Musée Quai Branly, Paris)
Advances in anoxic treatment at the Quai Branly Ethnographic Museum, Paris

The Quai Branly Museum collections consist of a library, archives, photos' and ethnographic objects. All the collection was treated before moving them to the new museum in 2006. The process took three years and 300,000 objects were treated.

Nitrogen was produced *in situ* from the air (an oxygen separation unit was used, then the nitrogen was pumped into chambers in with the objects). As the nitrogen is 'dry' when is comes out of the separator, a reservoir of water is used to re-humidify the gas.

Objects were loaded into the chambers wrapped loosely in card or plastic boxes and put into metal trolleys.

The whole process is computer controlled, with onscreen read-outs of humidity, percentage oxygen, temperature, *etc*. Although the temperature was just recorded, and not controlled by the computer; so the room had to be heated separately.

All new objects and loans to the museum are treated in this way (except now they have moved into the museum they have a similar, smaller system). The new system is smaller than the old one, but it has a bubble chamber that can be added to increase its size for larger objects, bigger loads, *etc*. The major difference

with the new system (apart from size) is that temperature is controlled directly using a computer instead of relying on the room being heated separately.

The system was tested using both insect eggs and larvae (of a species of long-horn beetle):

- After 7 days of treatment there was 100% mortality of both larvae and eggs;
- After 5 days there was 100% mortality of larvae, but 64% of eggs were still able to hatch.

During actual treatment the objects are left in for (on average) 14 days (3 weeks in the bubble chamber).

The initial, large unit cost €200,000 (about £140,000) and the small unit still in use cost €50,000 (*c.* £35,000). The system was chosen over freezing because there is much less packing involved and problems arising from condensation are avoided.

Adrian Doyle (Natural History Museum, London)
Recent research into barrier films with practical considerations encountered with the film Escal®

Film bags (Fig. 1) can be used as barriers against high levels of relative humidity, stopping things like pyrite rot (which can happen in as little as 45% humidity). Bags can also be used to stop sub-fossils from drying out (they need a high relative humidity). In theory, two objects needing completely different atmospheric conditions can be stored next to each other using barrier film bags.

Heat welders are good for sealing bags for humidity control, but are not so good for oxygen level control. *Stewarts*® Boxes are the same (no good for controlling oxygen). *Escal* is very useful as it is transparent and is designed specifically to be an oxygen barrier. It is always the heat seal that is the weakest point in the bag. As an alternative method of sealing, *Escal* clips can be purchased, but as they rely on a mechanical process, they don't work so well after a few times (the same with *Weloc* clips). There is no real recommended temperature for heat-sealing these bags. The inside layer has a lower melting point than the outside and it is this layer that welds the bag shut. This layer melts at around 120°C.

Fig. 1. Roll of *Escal* Film (image from www.conservation-by-design.co.uk)

In tests, hairs, creases and dirt were all sealed along the heat weld, then dye was put inside and a weight put on top. Tensile strengths were also tested. The jaws of the heat sealers have a slightly different temperature along them (despite the manufacturers saying that they are even). When the *Teflon* tape along the jaws begin to fail, the temperature settings need to be different – so the tape needs to be replaced when this happens.

The wider the seal the better. Some heat sealers will give up to 10mm seals (which will hold longer if handled a lot). *Crosswelds* have a 2mm weld (which does the job well enough if not being handled too much). Double welds can be used to make sure of a good seal.

Gusseted bags can be bought to put more 3D objects in (however the outside layers are then being welded together at the top of the bag, so this seal may not be as good).

Super Escal is now available (which has a layer of Nylon in it as well). However, more work needs to be done on this as the Nylon may affect the melting temperature of the material.

Sharp objects needing to be packaged can be put into boxes to stop the object from compromising the *Escal*. *Escal* can be bought in the UK from a company called *Conservation by Design Ltd*.

More information about *Escal* from the *Conservation by Design* website (see Fig. 1).

***Escal™ RP System*, Ceramic Deposited Gas Barrier Film**

ESCAL™ is a ceramic deposited super barrier film developed especially for the protection of cultural properties, which is supplied in rolls. The material had been developed for use with the *RP System*. The user can unroll and cut the *ESCAL*™ film to a desired length and seal with a heat sealer or *ESCAL*™ *CLIP*. Each *Escal* ™ film roll includes a continuous data entry space with a white writable background.

ESCAL™ has a particularly outstanding ability to keep out moist air. It is therefore, very useful not only for the preservation of damp wooden artefacts but also for all other conservation or storage purposes. On the other hand, the RP agent works to keep the inside atmosphere of a container very dry, therefore it is not appropriate for conservation or storage of small quantities of paper/textile materials or wooden artefacts, which require a more normal pH.

Chris Collins (Natural History Museum, London)
Packaging and environmental control relating to anoxia

The Natural History Museum conservation unit is driven by research – not display or education. Anoxic environments are not a new thing and have been used for hundreds of years in the form of spirit collections.

Many specimens in the Natural History Museum collections are oxygen sensitive, so anoxic environments reduce the risk of loss and intervention needed, whilst maximising the resource. However, space can be a big issue in large collections.

An anti-oxidant (that doesn't effect humidity) is put in with the specimens to reduce the oxygen levels – the Natural History Museum use *RP System Agent*™.

Mechanical systems of reducing oxygen levels (pumps and the like) aren't as cost effective and are prone to breaking down eventually – so aren't recommended. The ideal system needs to be both low-cost and effective.

The aim of the Natural History Museum is to keep specimens in their anoxic environments for 20 years without needing to intervene. However they must also be accessible. Small, five-sided *Plastizote* enclosures are constructed to put specimens in.

The major problems with this system (especially for smaller museums) are the initial set-up costs and the costs of the *Plastizote* enclosure materials. The Natural History Museum has in the past helped out small museums that cannot afford the set-up costs. They may be able to help out again (if you ask – they can only say no!). Another problem with the system is the monitoring that needs to be done. The monitors that can be bought are expensive and sometimes inaccurate.

An atmosphere of 0.3% oxygen is needed for pest control, but the food industry, for instance used 2% oxygen (as the food is only stored for a matter of months, not years).

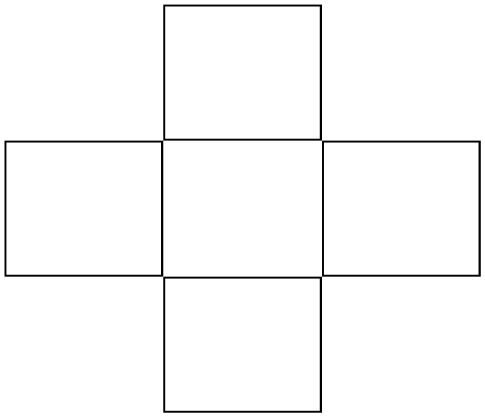
Types of oxygen monitor:
- *Ageless Eye* – effective up to two years
- Fluorescence (*O_2xyDot*®) – effective up to five years

A monitor does need to be put in with every specimen, as the monitor failure rate isn't known. However, this can prove expensive.

Types of oxygen scavenger:
- *RPK* – works at 30% relative humidity
- *RPA* – works at 0% relative humidity
- *Ageless*, *Dustbuster* and *ATCO* all work at 60% relative humidity

You can also purge the oxygen out of a bag by using argon, carbon dioxide or nitrogen (only the latter is legal in the UK). Then one of the above oxygen scavengers is used just to mop up any excess oxygen.

For the purposes of pest control, cheaper, simpler barrier films can be used (as this is generally for much shorter periods of time). Other methods of sealing (apart from heat welding) are using adhesives such as: silicon, butyl rubber *etc*.
Plan of 'sweet packet' barrier design of *Escal* bag:



This method has the potential to be used as a field-collection device as the Natural History Museum has had a completely unprepared shrew in an *Escal* bag containing oxygen scavengers, for well over 10 years! However, this would probably only work for relatively small specimens. Due to the difficulty in heat-sealing in the field (lack of electricity, cumber-some nature of the sealers), the previously mentioned *Escal* Clips may be useful for temporarily sealing these bags.

Emma Sherlock and Lu Allington-Jones (Natural History Museum, London)
Anoxia as an experimental tool

There are many problems with the different substances used to seal microscope slides. Major problems include drying out and cracking. A standard microscope sealant must be able to cope with temperatures of between 18°C and 27°C and a relative humidity of between 37% and 67% (in other words, it needs to be pretty flexible).

As oxygen sensors are not small enough to be put into slides, an experiment for testing a number of micro-scope slide sealants was devised using sealed test tubes.

They found that Canada Balsam (used for over 120 years on slides) was by far the best medium to use (it survived a regime of freezing and oven heating without compromising and was chemically the most stable substance tested).

More information about Canada Balsam from Wikipedia (http://en.wikipedia.org/):
Canada Balsam

Canada Balsam, also called Canada Turpentine or Balsam of Fir, is a turpentine which is made from the resin of the Balsam Fir (*Abies balsamea*).

The resin is dissolved in essential oils, and is a viscous, sticky, colourless (sometimes yellowish) liquid, that turns to a transparent yellowish mass when the essential oils have been allowed to evaporate.

Due to its high optical quality, its refractive index (n = 1.55, very close to that of glass), and its purity, it is mainly used in optics as an invisible-when-dry glue for glass. It is soluble in xylene, amorphous when dried, and it does not crystallize with age, so its optical properties do not deteriorate.

Personal Conclusions
As always, it was a pleasure for me to attend a NatSCA event, and visiting London - the Natural History Museum in particular (Fig. 4) - is always an opportunity not to be missed! I must admit that, as well as the anoxia seminar I also came to see if I could pick up any new and exciting ideas from the NHM for gallery re-developments at Norwich Castle Museum – it is always interesting to see how someone else has ap-proached a similar subject.

I came to the seminar not really knowing what to expect (partly because I was a last minute replacement), but thinking that the seminar would be all about anoxia as a means of pest control (being of that mind-set at the moment having just installed a room-sized freezer at Norwich Castle as part of our integrated pest man-

agement strategy). The thought that anoxia could be used as a preservative environment barely crossed my mind. However, I found the talks about the NHM's programme of packaging oxygen sensitive specimens in an anoxic environment interesting. Especially as we have a similar system of packaging our study skins in Norwich – albeit in plain bags to protect them from pests and dust rather than to preserve them in an anoxic environment. I was also interested when I heard about the potential of using *Escal* bags in the field when collecting small birds and mammals (Chris Collin's 'rat in a bag'!) – this possibility should certainly be explored further.

A couple of minor points - I thought for my needs (and perhaps the needs of most purely Natural History curators), the packaging talks in the afternoon (although very interesting) could have been a bit shorter. Personally I would have preferred to see more time spent on the subjects of the morning sessions - how to set up anoxia chambers for pest control, *etc*. but that's just my opinion! Oh, and the sandwiches were a bit weird (we simple country folk aren't used to the ciabatta rolls filled with cured meats and peppers that Londoners have every day!).

Anyway, that's enough criticism - overall, the seminar was very good and worthwhile. I certainly have a lot to report back about in Norwich and (hopefully) some ideas that may prove useful in the curation of our collections (even if we don't have €200,000 to spend on an anoxia chamber!).

September 2008.
GCG Workshop: Microclimates for your collections
Leeds City Museums Discovery Centre

A practical guide to dealing with your sensitive pyrites, delicate bones and fragile fossils in an individual tailor-made way.

With help from Caroline Butler, geological conservator from the National Museum of Wales and the in-house conservation staff at Leeds City Museums, you can learn how to create and maintain microclimates and the reasons why microclimates might be the best way to safeguard some of your geological specimens.

For further details, please contact Helen Fothergill at Plymouth City Museums & Art Gallery on 01752 30 4765. email: Helen.fothergill@plymouth.gov.uk

Taxidermy Workshop - 13th February 2007

In association with the Guild of Taxidermists, The Lancashire Conservation Studio, Lancashire Museums, Preston.

Patrick Campbell, Natural History Museum, London

Lancashire Conservation Studios is the conservation section of Lancashire County Museum Service. It is a shiny, new, purpose built studio within a beautiful historic grade 2 listed Church. The studios are considered a landmark development to promote conservation to the public and to enhance facilities for collection care training across the North West of England.

Most of the delegates made the trip up to Preston the night before and were booked into the Travel Lodge conveniently situated yards from the Studios.

'Art, Science and Bad Taste'
Dr. Pat Morris

History of Taxidermy
After Registration and morning tea, we were given a presentation by Pat Morris entitled 'Art, Science and Bad Taste'. His talk charted the History of Taxidermy centering on his definition of Taxidermy; 'The Preservation of an animal in a lifelike pose, attempting to recreate life'. Based on this definition one can leave out mummies as they clearly do not represent the animal as it appeared in life. This enables us to arrive at a definite start date for Taxidermy of about the middle of the 17 century (post mummification). Birds, mammals and fish were first attempted (poorly) and kept by noblemen as curios. Pat traced some of the earliest specimens with difficulty as although museums had a lot of the material (Calceolarian museum 1622, Wormian museum 1655); sometimes these were not labeled correctly or not labeled at all. Horses were important status symbols a long time ago so the oldest extant mammal found was a stuffed horse. This horse had been cherished like a prized car when it was alive by its owner Archduke Albert and adored in death as it took a bullet for him in the neck when the Archduke was ambushed one day.

The oldest bird found by Pat was the Duchess of Richmond's parrot 1702 in Westminster Abbey. It died 6 weeks after the Duchess and instructions were given that it should be stuffed and put with the Duchess's effigy. However, the Abbey has no proof that this was the actual parrot and not a replacement. This particular specimen was radiographed by Pat revealing an intact skeleton in its entirety (including the skull and brain) suggesting a technique not typical of 19th century preparation, hence it was likely that this was the original and not a substitute. By the 19th century, taxidermists knew that most of the problems connected with decay of their preparations were because of insect attack, so to combat this they removed all the soft parts, including muscle tissue and the brain. This parrot was kept in a crypt, which being fairly cold, offered refrigerated preservation. Insect life cycles can not be completed in these conditions. The first books were published by the French 1740-50's then they were translated into English after which they were circulated more widely.

Insect attack was the chief problem back then. Nowadays, with central heating and drier atmospheres, this problem just does not exist - at least on pre-1950 specimens, which were covered with chemicals. Preservation of the skin from insect attack was combated using arseneous oxide. This turns into a gas in damp conditions leading to self fumigation, very effective in keeping bugs away in a sealed up case, which when opened, smells of garlic. However, taxidermists soon turned their backs on this form of preservation due to its poisonous nature. Other forms of preservation were then used, they included the use of such chemicals as mercurous chloride, Phenol and Benzene all of which are now classed as hazardous. We were then shown images of the type of damage caused by moths, in the absence of arsenic, which were quite alarming. Pat was of the opinion that there is no proof that taxidermists were more at risk of early death due to their exposure to arsenic. The average age of Taxidermists dying was 73 years old, better than average at the time.

Despite having solved the problem of how to preserve the animal preparations by the 19th century, some of the older examples were poorly prepared. Common faults included the following abnormalities; legs too far

back, neck too stretched, wings drooped in birds. Interestingly these faults were duplicated by artists in their pictorial representations of animals back then and also more recently by photographers today!

By the time of the Great Exhibition in Crystal Palace in 1851, John Hancock did for Taxidermy what J.J. Audubon did for bird illustration; showing 'action' poses. Taxidermy then became much more widespread and people had preparations in their homes leading to a development of commercial taxidermy. (This is why the UK has so many decorative cases). The late 19th century was the great age of taxidermy (around 1895 the peak) tapering off some years later. Shaw's shop in Shrewsbury was quite an 'eye catcher'; many towns had shops with windows decorated with an assortment of stuffed animals. In Glasgow alone there were 18 businesses in 1880, and Edinburgh had similar numbers. Birmingham had 16 and London had about 200-300 about that time. Many small towns did not have enough work for taxidermists hence many people had two or more trades advertised on their business cards:

- W. Alderton; Hairdresser and Picture Framer
- James Ocock; taxidermy, cook, cake manufacturer, ornamental pastry, carving, guilding etc.

Hairdressing was quite often a second trade for taxidermists suggesting that hair taken from customers may well have been used as material for stuffing.

Some of the work carried out by these taxidermists, however, was not of the highest quality; animals were often squeezed in small boxes and a lot of the early work was unlabeled. Some, the larger London taxidermy firms, created work which was colourful and elegant. This was intended for home ornamentation only and not for scientific use and was usually consisted of displays of birds from different parts of the world.

Scientific preparators tried to look at variation for comparative purposes reflecting the scientific questions of the day (Darwin's evolution etc). Later, early 20th century preparations tried to answer questions about ecology and behaviour. Specimens were often demonstrated showing something of their daily behaviour. Other taxidermists put their birds in empty cases so as to turn the focus towards to animal itself without the peripherals. Anglers also had an interest in taxidermy, wanting to preserve their catch as a souvenir not a scientific preparation, often in bow-fronted cases and labeled typically with the weight of the specimen, when it was obtained and where it was obtained. If one was to look a little closer though, it could be seen that these often were not scientifically correct (for example reeds, which were often added to Fish trophy cases, do not flower in water).

Taxidermist customers also included collectors who often wanted rarities and oddities (albinos etc). E.T. Booth was a wealthy gentleman collector who collected birds and started his own museum in Brighton. However, this kind of collector often attracted fakes. Large mammal collectors then moved towards producing dioramas which reproduced whole scenes showing the natural habitat of the stuffed animal, Denver Museum, American Museum of Natural History (probably the biggest and best) and the Natural History Museum in London (dismantled about two years ago) have some excellent examples.

Mammalian Taxidermy

In mammalian taxidermy some of the more initial methods used could be likened to 'stuffing a pillow' which produced lifelike results. Sack-like representations are still on display in some museums. Modern methods use 'bound up bodies' (a mummified 'pillow' mimicking the actual shape of the animal being prepared, this was inserted inside the skin, or the skin was pulled over it) for smaller mammals. Sometimes clay was used under the skin in order to reproduce skin folds to make it easier to show facial features in expressive animals such as dogs and primates. However, the downside is that clay would make the preparation quite heavy. Hunting trophies were a big physical problem; the skins were usually very heavy in large mammals such as walruses. Fox hunting was particularly popular and the taxidermist could almost guarantee being offered a selection of fox heads over the winter (the hunting season) to work on. Snarling foxes, although inaccurate, were often demanded by the customer. Whole foxes could be produced but were rather expensive as they needed larger cases. Hutchings devised a neat way of fitting a large fox in a small case and his work could easily be recognized by the specific way in which he did this. Taxidermists had trademark methods of preparation and display which makes identification of a particular preparation easy because their work was so distinctive.

Moulds and Mannequins
Modern methods use mannequins. This involves skinning the animal, making a clay model out of it and then creating a mould. With this mould you can then produce mannequins out of paper mache or foam. This can be used as a base over which the skin can be pulled. Every one of these is a one-off. The finished product depends entirely on the skill of the person who made it originally. With this method mass production is possible; the skill is invested in making the mould from which many mannequins can be made. Once this has been done, a relatively unskilled person can then be employed to put the skin on top of these mannequins later, the time consuming part of the process. In America it was claimed that this method started as far back as 1901. In the UK Peter Smicers of Lymington started making mannequins out of plaster of Paris in cast iron moulds in the first world war (deer heads, otters and so on). Van Ingen and van Ingen used the method during the time of the Raj.

Practical demonstration - Preparing a small mammal study skin
James Dickinson, Conservation Officer, Lancashire Museums and Chair of the Guild

Making a traditional museum rounded cabinet skin and preparation of a small bird
A lot of the skins used to produce the backup for species lists and inventories are prepared in the field. Before the work is carried out standard measurements are taken; head and body length, tail length, size of the ear (this varies according to latitude particularly within a species, you get smaller and smaller ears with higher latitude) the hind foot length and body weight. This field data will stay with the specimen when it is put in the collection finally.

Methodology:
- Acetone was used to de-fat the animal, water injected into the tail (sometimes a mixture of water and acetone). If the specimen (small shrews for example) is more than a few hours old they start digesting themselves with their own digestive juices and fur comes out in chunks which makes it difficult to get a good skin preparation. Borax used whilst carrying out the preparation, also helps to keep the hands dry. It is also a good preservative on small skins but not so good at combating insect attack. After about 1920 it became readily available but unless it was mixed with an insecticide was ineffective in fighting decay.
- The skin is pulled backwards from the tail. Tail bones need to be removed and replaced with wire or a piece of wood when removing the skin, to keep the shape. Mice (especially dormice) are particularly bad as the tails tend to fall off.
- The skin is taken off ‘like a sock' once it is separated fully from the rest of the body with a scalpel. When you get to the shoulders the process can get a bit tricky. You need to break or cut through connective tissue here and around the ear close to the skull, leaving a big hole then you can cut around the eyelids to release the skin from that part of the anatomy. Cut as near to the eye as possible. In the tropics when this type of work is carried it is quite common to run into difficulties because many of the small mammals there have incredibly thin skins (having the consistency of wet tissue paper) and their connective tissue is often much stronger than the skin leading to inevitable tearing. Injecting the skin with formalin strengthens the skin enabling it to come off in 10-15 minutes, in the UK though most small mammals have quite thick skins, so this is not such a problem.
- The lips and the nose are the last attachments - once these are cut through the skin comes away from the body fully. Inside out the skin reveals dark patches which are moult patterns - the pigment for the fur is actually still resident in the skin where the new skin is growing, this should be recorded (the stage of the moult) as this is not always visible from the outside. Also sexing the animal (looking for eggs) when opened up like this and recording the data is useful. Turn the legs inside out, leave as little flesh in the skin as possible.

Tips:
- Tearing tends to occur when you pull at the skin excessively. This will cause stretching which is difficult to get rid of later, especially when you want it to look lifelike.
- There is not much need for skinning fish in this way. It is much more useful from a scientific point of view to keep the whole specimen pickled in alcohol, while for display purposes models can be made.
- It’s difficult to keep specimens dry in the tropics (very humid); skins can be hung on lines to dry or on the front of cars/trucks near the radiator. Drying skins over fires is not such a good thing because you tend to get them going hard – however all is not lost, they can be relaxed

using water.

- Filling out the space taken up by the bone in the tail can be done using cardboard (as a long thin strip, straws could be several mm wide)
- The skin can be filled using cotton wool, try to avoid using hay or some other natural material which may harbour pests.
- There is no approved insecticide institutionally for helping to preserve the skin, but for home use borax can be mixed with an approved non volatile insecticide like pyrethrum which will help to some degree to make it insect and bacteria proof.

Flat Skins - for teaching purposes recognition and to learn about furs
Pat Morris

Pat showed us some of the very impressive flat skin preparations of mammals, tigers and bats that he stuck on cards for the Natural History Museum. The tails of these preparations were kept rigid by use of the flat card. Information about each specimen was written directly onto the card ensuring that the data always remained with it. The method began with small mammals, but was soon applied to much larger ones. Pat soon found himself presenting the NHM with a Baboon! He has since continued making all sizes of animal preparations in this fashion. Bats were created where one side of the wing was spread to show the detail and the other folded. Although not lifelike in presentation, the method is advantageous in many ways - the main method of preservation is drying and the data is never separated from the specimen. These specimens were quite student- proof and have been passed around students since 1965 without breaking down. They can also be bleached using hydrogen peroxide (Fig. 1).

Fig.1. Pat Morris holding a flat skin.

A word about cases:
Putting a mount in a case helps to preserve it, prevents it from being touched to destruction and makes it look good.

A word about salt:
Salt is a good preservative in field, stuffing an animal with it to prevent decay works well.

A word about freezing:
Wrap the specimen in tissue paper to avoid 'sweating' in plastic bags if and when freezers fail. Acid free tissue and heavy gauge plastic bags should not be used for wrapping preparations; the heavy plastic bags will eventually crush your mount.

Practical demonstration - Preparing a bird study skin
Peter Summers, Taxidermist, National Museums of Scotland
The bird used was a Dunnock, *Prunella modularis*
This was quickly and nimbly done (see Figs. 2-4)

Main steps:
1. Open bill
2. Insert cotton wool down throat
3. Take measurements
4. Incision made in abdomen, magnesium chloride inserted to absorb fluid leaching out.
5. Push knee and the remaining leg bone of the bird up and make a 'wooden splint for leg skin'
6. Cut through backbone to remove 'tail' bone
7. Gently pull skin off without tearing' it (use a lot of magnesium chloride)
8. Cut around the ears and eye
9. Clean the skull out with tweezers making notes all the time about the ossification of skulls - if fully ossified then it's an adult

16. Feed cotton wool up into the cheeks
17. Fill shoulders with cotton wool, 'scapula stitch'
18. Use 'body' removed earlier as a reference for filling the rest of the skin.
19. Sew up the animal

Fig. 2. Peter Summers prepares a small bird.

Fig. 3. Using magnesium chloride to soak up the fluid.

Fig. 4. Cleaning the skull with tweezers.

Modern Taxidermy methods and techniques

James Dickinson

Nowadays 'bodies' upon which skin can be stretched over can either be carved bodies out of foam, balsa wood or polyurethane foam. The polyurethane foam is problematic though in that it is not known whether or not it will eventually degrade. These 'bodies' can also be bought (e.g. mink etc), which provide a rigid filling. They need to anatomically correct (Fig. 5, Fig. 6.).

Hyde pastes

McKenzie's Hyde Paste are used, based on paper mache to which is added PVA glues and tile adhesives for larger skins. There appears to be no real standard here, a try and see policy is followed. However, epoxy glues are hard to work with as they 'go off' quickly hence do not give enough time to complete the preparation. In order to reproduce fatty tissue and to add 'bulk', trade fillers are used, they are mixed in with the glues.

Commercially, fish and reptiles are still in demand. Fibreglass fish are used as a base and dental algenate is poured over the specimen to make a mould from which many models can be fashioned. Fibreglass fish models can be painted using oil colours (again, no standard here regarding the type of paint) but drying time can be a problem, nowadays there is a tendency to use acrylic paints more, these are water based.

A word about fading:

It's very difficult to re-paint hairy mammals, quite often when you examine close enough, naturally, each strand of hair has a slightly different colour so to restore it, each strand of hair needs to be painted individually, which is a tall order. It is perhaps best to leave faded specimens alone as there are some really bad ex-

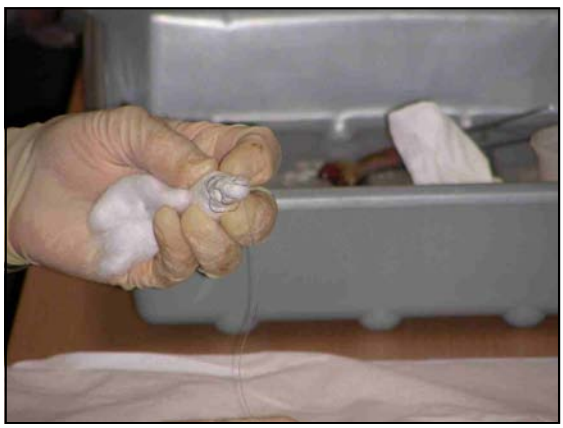


Fig. 5. Making a 'body' for the inside of the skin.

Fig. 6. Sewing up the skin around the newly made 'body'.

Taxidermists are blamed for animals becoming extinct in the wild, as though every owl in a glass case is one less in the wild, akin to blaming undertakers for the fact that people die or that there are less people in the world! Squirrel hunting clubs went out and shot the grey squirrels not the taxidermists. People were paid to go out and shoot animals such as foxes and corvids in the 1800's as they were seen as vermin. It's illogical to think that taxidermy is responsible for the scarcity of some animals.

'Taxidermy is boring' is often heard, or that it is 'too gruesome to display', but if you look at the Dresden Art gallery you see rooms and rooms of two dimensional paintings with some depicting very gruesome scenes. But this is seen as entirely acceptable.

Taxidermy itself has changed; there are a lot of new materials, new opportunities, new skills…and new taxidermists. Skin replacement techniques are used - replace the skin with resin and you end up with an animal whose fur is embedded in the resin. This gives very lifelike results particular with large animals like dogs and pigs. So it is wrong to judge Taxidermy by the very crude results of say 100 years ago when there has been so much progress made recently.

Summary of the event

It was a day when a lot of information was given regarding Taxidermy past and present mingled with the expert handling of practical demonstrations. Leaving those who attended, wanting to go away and 'try for themselves' some of the things witnessed or to improve on methods they themselves were using.

Natural History Collection Conservation Assessment Seminar

Leeds Discovery Centre: 4th April 2008

10.00 – 10.30	Welcome, logistics
10.30 – 11.15	Emma Bowron (Leeds) 3D object conservation
11.15 – 12.00	James Dickinson (Leeds) Taxidermy and conservation
12.00 – 12.45	Clare Valentine (NHM) Collections standards
12.45 – 13.00	Questions
13.00 - 14.00	LUNCH
14.00 – 14.45	Rob Huxley (NHM) "SYNTHESYS" project at NHM
14.45 – 15.00	TEA
15.00 – 15.45	TBC
15.45 – 16.30	Early departures and questions, where from here?

For further information, please contact Clare Stringer (clare.stringer@leeds.gov.uk)

For booking information, please contact Tony Irwin (tony.irwin@norfolk.gov.uk)

The Stockholm beetle [*Trogoderma angustum*] – a new record

David Pinniger, 83 Westwood Green, Cookham, Berks SL6 9DE
[pinniger @globalnet.co.uk]

In 2007, I published a note in the NatSCA News 12 about a new insect pest threat to herbarium collections called *Trogoderma angustum.* In December, I found three dead *T angustum* adults on a windowsill in The Scott Polar Institute in Cambridge. It is not clear where they had come from or what they had been living on, but I would strongly advise anyone in Cambridge with any natural history specimens to check their collections.

Coincidently, when I was in Queens College Library in Cambridge in June 2007, I found some live and dead adults of *Attagenus smirnovi* (commonly called the Vodka beetle). Although this pest is now common in museums in London, the only other previous record outside the Home Counties is from the Fitzwilliam Museum, also in Cambridge. As this pest is also damaging to collections, it would be a good idea to keep an eye open for it.

If anybody needs specimens of *T angustum* or *A smirnovi* checked, please send them to me at the above address.

Fig. 1. *Attagenus smirnovi* adult male. Length 4-5mm.
(Photo by Garry Fry, copyright CSL and MDA)

Fig. 2. *Attagenus smirnovi* head of adult female
(Photo by Garry Fry, copyright CSL and MDA)

Reference

Pinniger, D. B., 2001. New pests for old: the changing status of museum pests in the UK. In: Kingsley, H. *et al* (Ed) Integrated Pest Management for collections. Proceedings of 2001 - a pest odyssey, James and James, London, 2001. 9-13.

Conservation of the 'Great Bass Rock' diorama - an ICON internship at Ipswich Museum

Suzanne Hill, Postgraduate studying World Art Studies and Museology at the University of East Anglia, Norwich

Introduction

In 2006, financed by the Heritage Lottery Fund, ICON launched a new training scheme for conservation. Sixteen internships were offered in different disciplines such as stone, textiles, stained glass and of course natural history. The idea was to bridge the gap between graduating and finding work and also to create training opportunities in areas where it was lacking. The interns were a mixed group of both postgraduate conservators and people, like me, completely new to conservation. When I spotted there was a Natural History placement I was delighted, as I have been interested in this field for a long time. This is how I came to the world of natural history conservation.

The main objective of my internship was to conserve "The Great Bass Rock" diorama.

'The Great Bass Rock'

'The Great Bass Rock' diorama has been on display in Ipswich museum since 1903. Museum curators brought back specimens, sketches and photographs from the Bass Rock, to help create the representation (Fig. 1). The large plaster rock face, constructed on wooden scaffolding, was built and painted by Robert Hall of the British Museum, and originally contained 52 birds as well as eggs and sea weed. The birds were, prepared coloured and set by the Ipswich museum curator (1983 – 1920) Frank Woolnough (Fig. 2).

However, after more than 100 years on display, the whole diorama was in need of attention. My task was to consolidate and clean 30 bird specimens, eggs and rocks, seaweed and a very large plaster rock face. The conservation of such a large and impressive diorama was very daunting. The floor was covered in rocks and with a number of birds suspended from the ceiling it left little room to work in.

Methodology

I carried out a risk assessment, with special reference to any insecticides used, the enclosed working area, and the solidity of the plaster construction (Marte, *et al*, 2006, Thompson, 1986). Appropriate PPE was sourced and obtained.

To assess the condition of the specimens, a simple quick and easy to use tick sheet was devised (Fig. 3). This took into account bird species, mounting, body setting (flying or sitting), evidence of insect attack, feather loss, possible damage, condition of armature, etc (Metcalf, 1981). All loose stones and rocks lining the base of the case were removed to provide access. All the birds were individually numbered and an outline plan of the case was drawn to indicate the exact position, location and number of each bird. Once the

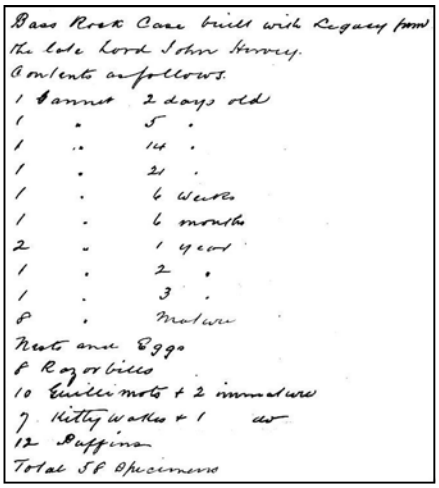
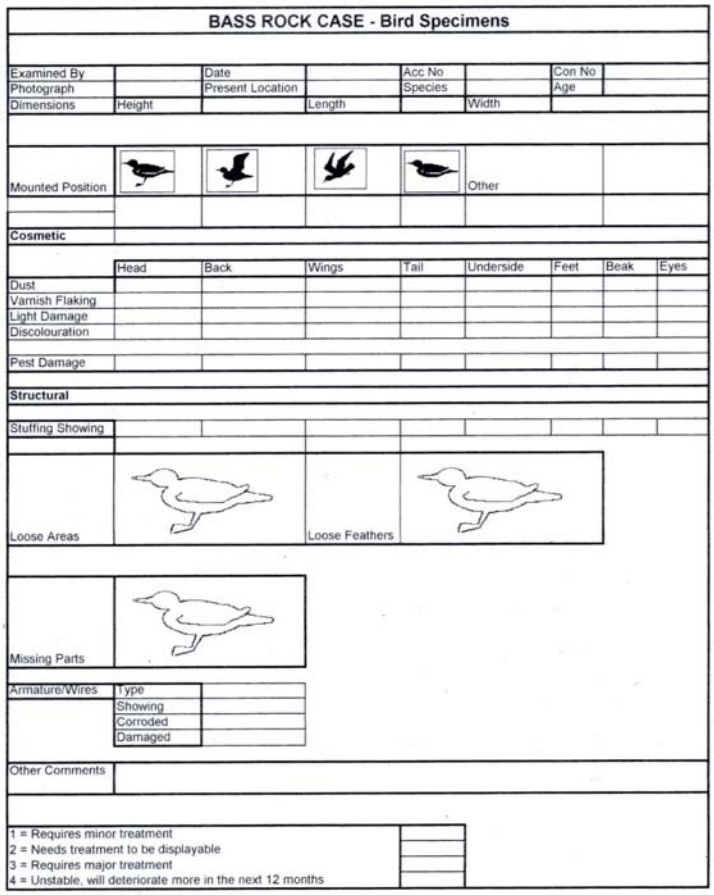

Bass Rock Case built with Legacy from
the late Lord John Hervey.
Contents as follows.
1 Gannet 2 days old
1 " 5 "
1 " 14 "
1 " 21 "
1 " 6 weeks
1 " 6 months
2 " 1 year
1 " 2 "
1 " 3 "
8 " Mature
Nests and Eggs
8 Razorbills
10 Guillemots + 2 immature
7 Kittywakes + 1 do
12 Puffins
Total 58 Specimens

Fig. 1. Museum records from 1903 listing the

Fig. 2. The great Bass Rock diorama, Ipswich Museum.

condition reports were completed the birds could be removed and stored safely to await conservation.



BASS ROCK CASE - Bird Specimens

Examined By		Date		Acc No		Con No	
Photograph		Present Location		Species		Age	
Dimensions	Height		Length		Width		
Mounted Position					Other		
Cosmetic							
	Head	Back	Wings	Tail	Underside	Feet	Beak	Eyes
Dust								
Varnish Flaking								
Light Damage								
Discolouration								
Pest Damage								
Structural								
Stuffing Showing								
Loose Areas			Loose Feathers					
Missing Parts								
Armature/Wires	Type							
	Showing							
	Corroded							
	Damaged							
Other Comments								

1 = Requires minor treatment
2 = Needs treatment to be displayable
3 = Requires major treatment
4 = Unstable, will deteriorate more in the next 12 months

Fig. 3. The tick sheet used for creating a condition report.

Dismounting the display
Most birds were secured by armatures that had been inserted into corks, which were recessed into the plaster rock face. These could be carefully pulled out and their corks were retained when possible. Others were hung from the ceiling with strong thin wire. The wire had to be cut whilst they were supported from beneath. Enough wire had to be kept to reattach the birds after treatment. Some specimens were very awkward to access and it is likely that they were originally put into the display before it was glazed.

Conservation of the rocks
Next, all the other movable objects were taken out and the whole case was thoroughly cleaned. A small force of regular volunteers assisted with the cleaning using back pack vacuum cleaners, brushes and damp cloths.

Some areas off plasterwork had been damaged over the years and these had to be repaired. We replaced like with like and used plaster. Again some willing work experience students assisted with this operation. Due to the size and shape of the rocks and the narrowness of the door, these had to be worked on inside the case, and carefully replaced later. After cleaning, the rock face was retouched where necessary. A protective layer of Paraloid B72 was applied to the plaster prior to painting with acrylics (Fig. 4).

Conservation of the birds
The birds had been mounted in various positions of flight or rest, their feet, legs and beaks had been painted and in some cases this had started to fade or peel away. All the birds had a thick layer of dust and grime and many had suffered from pest damage. Some had yellow staining on feathers or splashes of paint and others had detached wings or tail feathers. They were frozen for a period of 7 days at a temperature below –30ºC to destroy any pest infestations (R. Entwistle, Colchester and Ipswich Museum Service, *pers comm*., 2006).

Cleaning
Taxidermists and natural history conservators were consulted for advice on the cleaning of the birds and their feathers. Tests were carried out using Pastosol AZ degreasing agent on some bird feathers (Dickinson, J. Conservation Officer, Lancashire Conservation Studio, Lancashire Museums. *pers comms*, 2006). This cleaned the feathers much better but left them rather dry due to its degreasing power. Removing and rinsing out the agent was also time consuming so it was decided to use Synperonic A7 instead. On one bird a small area was tested with a poultice of magnesium carbonate and sodium hydroxide 2%. This did not appear to harm the feathers in any way and worked very well. Therefore, it was decided to continue its use on a larger area of the bird. The feathers that were stained from ingrained dust and dirt were returned to their former colour.

For the most part the birds were brushed and vacuumed (S. Moore, Natural Sciences Conservator, HCCMS. *pers comms*., 2006), cleaned with distilled water and a small amount of Synperonic A7 detergent on cotton swabs, this was then rinsed off with distilled water (R. Entwistle, Colchester and Ipswich Museum Service,

pers comm., 2006). The feathers had to be kept as dry as possible during this process as wetting caused the feather barbs to matt. When this occurred they were brushed back into place whilst being dried with a hair-dryer (Fig. 5).

Draft clean was used on one bird (S. Moore, Natural Sciences Conservator, HCCMS. *pers comms*., 2006). This cleaned the bird quite well. However it was very difficult to remove it all from the feathers afterwards. Groom stick was used on an area of another bird, however this was deemed inappropriate, as it could have pulled out loose feathers due to its tacky nature (Rae, A. Freelance conservator, Peacehaven. pers comms, 2007).

Paint stains were removed with IMS and acetone and attempts were made to remove the yellow fat stains with trichloroethane but this only worked to a certain extent

Fig. 4. Work experience students working on the plaster rock.

Consolidation

Some specimens had been subjected to virulent insect attack and had large areas of detached and loose feathers. As a last resort these were consolidated with a fixing spray. Detached feathers could be reattached with HMG, cellulose nitrate adhesive (S. Moore, Natural Sciences Conservator, HCCMS. *pers comms*., 2006).

One kittiwake had a loose wing. The wing was removed fully from the body and corroded wires removed from the wing (Fig. 6). The wing was in two separate pieces. The lower part was reattached to the body, using a fibreglass rod and quill dowel, adhered with HMG. Once dry, the area where the upper part would be attached was consolidated using HMG and IMS and the area built up with Japanese tissue paper (Fig. 7). This was repeated on the underside of the upper wing (Fig. 8). This created a good base for adhesion and the upper part was attached to the lower (Fig. 9).

Fig. 5. Using a hairdryer and brush to keep the feathers in

Another Kittiwake's tail had come become loose. It was carefully removed from the wire armature (Fig. 10) and consolidated with a fixing spray and HMG and gently pushed back onto the protruding wire armature (Fig. 11).

Fig. 6. Kittiwake with wing detached.

Fig. 7. Kittiwake with lower part of wing and Japanese tissue paper.

Fig. 8. Upper part of the wing with Japanese tissue paper attached.

Fig. 9. Kittiwake with the wing reattached.

Fig. 10. Kittiwake before tail feathers reattached.

Fig. 11. Kittiwake after tail feathers reattached.

Restoration

The balance between preservation and display had to be considered when looking at the birds' legs, feet and beaks where the paint had started to fade and peel. It was decided that it was unethical to remove or overpaint old and faded paint on these areas. Where the damage was very bad and would have shown clearly when on display a protective layer of B72 was applied to protect any remaining original paint. Then the colour was carefully matched. the 'hidden' areas were consolidated with B72 to prevent further damage (R. Entwistle, Colchester and Ipswich Museum Service, *pers comm.*, 2006). Where pests had damaged the webbed feet, they were consolidated with Japanese tissue paper, on top of which a layer of paraloid B72 was applied and then painted with acrylics (Moore, 2006).

Conservation of the seaweed

The seaweed was very grimy and brittle. It was washed and left to dry, spread out on netting over a frame. Klucel G was applied to consolidate and give it a 'damp' look. However after a few days the 'damp' effect was lost. Glycerine had been considered but it was decided this might attract pests.

Conservation of the eggs

Tests were carried out on cleaning eggshells. Solvol Autosol on cotton wool, then rinsed off with white spirit was tried. However the use of distilled water on swabs worked just as well.

Remounting the display

Returning the birds to the clean case proved to be considerably more difficult than removing them. It involved reattaching the birds to the plaster or wires, several metres up on a ladder in a dimly lit case as well as squeezing in-between the glass and the rock face. (Our rock climbing skills were put to good use!) The original wire was used, where possible, to re-hang the birds. If the original wire could not be used thin fishing line was substituted. Unfortunately the fishing line showed clearly when new, bright lighting was set up, and had to be retouched to the same colour as the old wire. The older wire blended in much better.

Eggs, seaweed and the loose rocks were returned and laid out as close to their original setting, using photographs taken before work started. New lighting in the form of spotlights completed the project along with recorded sound effects of sea birds and crashing waves.

Below lists the Health and Safety issues with the resins and solvents used on my project;

Resins
Paraloid B72 - Extremely Flammable. Avoid sources of ignition. Avoid skin contact.
Klucel G – If used with IMS – Highly Flammable. Wear gloves, wear eye protection whilst decant ing. Use adequate ventilation or extraction. It is advised to decant no more than 100ml into a beaker at any one time.

Alkalis
Sodium Hydroxide – Corrosive. Protective clothing (gloves and goggles) must be worn during preparation.

Degreasing agent
Pastosol AZ - Harmful. Ensure sufficient ventilation of the area. Wear dust mask or respirator, pro tective gloves, safety goggles and protective clothing.

Solvents
IMS – Highly flammable. Wear gloves, wear eye protection whilst decanting. Use adequate ventila tion or extraction. It is advised to decant no more than 100ml into a beaker at any 1 hour period. Cover the beaker and any swabs.

Acetone - Highly flammable, Irritant. Wear gloves, wear eye protection whilst decanting. Use ade quate ventilation or extraction. It is advised to decant no more than 100ml into a beaker at any one time. Cover the beaker and any swabs.

Trichloroethane – Irritant, Harmful. Wear protective gloves. Use adequate ventilation or extraction. It is advised to decant no more than 50mlml into a beaker at any one time. Cover the beaker.

Land and Sea Collections
I was also involved in a variety of smaller projects. These included cleaning a mounted Caribou head (Fig. 12), consolidating a partly fossilised mammoth tusk (Fig. 13) and reconstructing the facial features of a large seal (Fig. 14). I worked on the bird skin collection bagging and freezing them to treat and prevent further attacks from pests (Carter and Walker, 1999).

Another fascinating project was working with the fluid-filled collection. The collection contained an intriguing array of the weird and the wonderful from preserved millipedes and scorpions to fish and mice. This collection was stored in a variety of containers. Some were not airtight and therefore could not prevent the preservation fluid from evaporating. Specimens that had dried out were re-hydrated with a 10% solution of tri-sodium orthophosphate in water. Each specimen was rinsed in IMS (Fig. 15), placed in a kilner jar and refilled with IMS (Bowdrey, J. Curator of Natural History, Colchester and Ipswich Museum Service. pers comms, 2006).

Fig. 12. The author cleaning a mounted caribou head.

Fig. 13. A sub-fossil mammoth tusk after treatment.

Widening the Experience

Throughout the internship I have been continually learning and receiving training. I have also had the opportunity to attend relevant courses and seminars and meet up with experts prominent in this field. I have learnt about important issues such as climate control and pest management and worked on a large variety of projects, increasing my conservation skills and knowledge of natural history collections. Altogether this has proved a very interesting year.

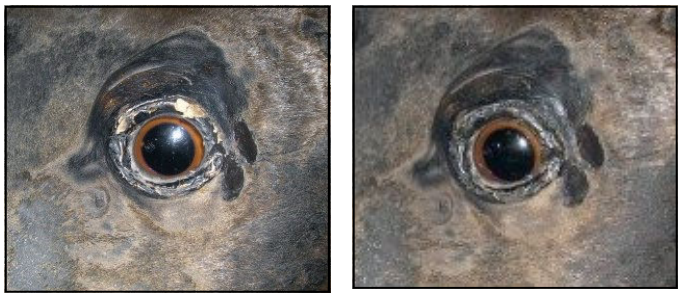


Fig. 14. A seals eye before (left) and after (right) treatment.

Acknowledgements

I would like to thank Colchester and Ipswich Museum service for their training and support throughout the year and Icon and HLF for running and funding this scheme. I would like to thank Robert Entwistle, Dominique Rogers, James Dickenson, Simon Moore, Jerry Bowdrey and Allyson Rae for their helpful advice. I would also like to thank all the volunteers, students and work experience pupils who helped me on this project throughout the year.

Fig. 15. A specimen being rinsed in IMS.

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Materials and Suppliers

Acetone, IMS, Synperonic A7, Trichloroethane – Surechem Products Limited, Lion Barn Industrial Estate, Needham Market, Suffolk, IP6 8NZ.
Klucel G - Conservation Resources UK Ltd, Units 1,2 and 4 Pony Rd, Horspath Industrial Estate, Cowley, Oxford, OX4 2RD
Paraloid B72 – Conservation Resources UK Ltd, Units 1,2 and 4 Pony Rd, Horspath Industrial Estate, Cowley, Oxford, OX4 2RD
Pastosol AZ, Trumpler UK Ltd, Unit 2, The Maltings Industrial Estate, Whitley Bridge, Goole, DN14 OHH
HMG – HMG Paints Ltd, Riverhurst Works, Collyhurst Rd, Manchester, M40 7RU

Preserving waterlogged wood with sugar

Ed Jarzembowski
Prof. Dr; Keeper of Natural History, Maidstone Museum & Bentlif Art Gallery

There is one kind of enquiry I dread - people bringing in a moist bone or a piece of wood found outdoors and then leaving it with me: it inevitably dries out, distorts and cracks up. Such specimens tend to be of public rather than specialist interest and do not warrant costly laboratory conservation.

However, any losses are discouraging. Some woods are more robust than others such as lignum vitae (an ironwood: *Guaiacum*) which will survive slow air drying with only some small cracks developing (Fig. 1). The figured item, a circa one-hundred-year old recent beachcombing find, was kept in a non-centrally heated room inside a recycled, cotton coffee-bean bag. Drying can also highlight features, e.g. growth rings (Fig. 2). By comparison, a freeze-dried example (Fig. 3, left) fared no better. (I should explain that these worn sheaves are the last remnants of wooden pulley blocks from the age of sail and attractive because of the cut-out pattern for the metal bearings on which they spun.)

Fig. 1. Air dried, lignum vitae (*Guaiacum*) sheave from the English Channel.. (Scale: 20p UK coin, 21 mm diameter)

Fig. 2. Regular growth rings in sheave fragment.

Last winter, the southwesterly storms presented me with a challenge- an actual block of elm (*Ulmus*) with lignum vitae sheaves cemented by concretionary limonite due to oxidation (rusting) of the former spindle and bearings (Figs. 4a,b). This was bound to crack up on drying because of the mixture of materials. At the suggestion of Peter Marsden (Hastings), I prepared a saturated solution of table sugar in boiled warm water, poured this into a lidded plastic box, and immersed the block for three months. The only visible change was a slight reddening of the solution due to a fine suspension of rust. I left it for another month to be on the safe side and then took it out, wiped off the excess sugar with a damp cloth, and slowly air dried it in the usual way for three weeks. The major observable difference was that the wood had lightened in colour; only one previous crack showed any sign of expansion (Figs. 4c,d). Sufficient sugar had clearly crystallised inside the cells to preserve the original waterlogged morphology. I do not know if this would work with larger pieces of wood, but 3-D preservation of hand-size specimens is possible with patience on a petty cash budget.

All images can be seen in colour on the online journal:

www.nhm.ac.uk/hosted_sites/natSCA/

Fig. 3. Freeze-dried sheave

Fig. 4.a

Fig. 4b

Fig. 4c

Fig. 4d. Composite pulley block. a, b waterlogged as found; c, d air dried after prolonged immersion in aqueous sugar solution

A New Method for the Restoration of Palaeontological Specimens Mounted in Canada balsam

Lu Allington-Jones, Natural History Museum

Abstract
Many museums contain slides mounted with Canada balsam. If this resin is poorly prepared, it can become crazed. Examples can be found within the British Type Graptolite Collection at the Natural History Museum, London. These are delicate dendroids prepared using the transfer technique. A search of the available literature and communication with museum workers highlighted suggestions for methods to rescue the cracked slides. These methods were tested, and the most suitable method proved to be a double transfer technique utilising carbowax. This technique may be used to rescue any specimen which is mounted in Canada balsam and which possesses an exposed surface. It is particularly important for the conservation of fragile specimens.

Introduction
The British Type Graptolite Collection at the NHM contains dendroids mounted in Canada balsam (a turpentine semi-fluid resin from the *Abies balsamea* fir) (Mills and White, 1987). These slides have been prepared from the collection of Mrs Robert Gray, which was acquired in 1920 and consists of dendroid graptolites from Girvan, Scotland. The preparations were carried out by O. M. Bulman and date from the 1920s. Professor Bulman was a distinguished palaeontologist and for many years the leading world authority on graptolites. He worked at Imperial College London, Cambridge University, Sidney Sussex College and Sedgwick Museum, Cambridge. He was editor of the Geological Magazine from 1934 and the president of the Geological Society from 1962 to 1964. His publications included 'Monograph of British Dendroid Graptolites', 'The Graptolites Prepared by Holme' and a section for Raymond C. Moore's 'Treatise on Invertebrate Palaeontology' (The Times, February 20, 1974). These specimens, therefore, represent an important period of publication.

Currently no suitable technique has been documented which is suitable for removing delicate specimens from Canada balsam and re-mounting them. This article explores the methods recommended within the published literature and compares the results with a newly proposed technique.

Production Technique
The slides were prepared using the 'transfer' technique, developed by palaeobotanists desiring to see both sides of fossil leaves (Elvers ,1988). The rock surface was coated with Canada balsam and a glass microscope slide pressed on top. The slide was then coated with a protective layer of wax. The rock was dissolved away using hydrofluoric acid, leaving the resistant fossil, in reverse, on the Canada balsam.

Canada balsam is of importance in optics because its refractive index (1.53 for the sodium D lines) is close to that of glass (Liu, 1971). It has been used as a mounting medium since the 1830s. Within the entomology collection at the NHM, 150 year old slides have not crystallised or absorbed moisture (Brown, 1997). Canada balsam is considered by Mound and Pitkin (1973) to be the only mountant that can be kept in a variety of climates without deteriorating. It does yellow with age but most researchers do not see this as a major problem (Brown, 1997).

> "Resin-based mountants such as Canada balsam and Euparal, which have stood the test of time, are probably the best option for permanent mounts." (Carter and Walker, 1999)

This is echoed by other workers: An informal internet discussion by Halliday (web 1) found that most workers consider Canada balsam to be the most suitable mounting medium. Galtier and Phillips (1999) state that "natural balsam remains unaltered by oxidation over long periods of time". After an extensive survey of the microscope slide mountants within the entomology collection at the NHM Brown (1997) also concludes that Euparal and Canada balsam are unsurpassed by modern materials. Euparal (a mixture of eucalyptol, camsal, paraldehyde and sandarac) is the best alternative to Canada balsam. This is because Euparal does not need to be dissolved in carcinogenic xylene (isomer of dimethyl benzene) and does not yellow with age (Brown, 1997). Euparal, however, can damage fine structures due to early development of a meniscus and can also craze if poorly prepared (Hood, 1940).

Current Condition of Specimens

Currently the Canada balsam is cracked, pieces are flaking off and being lost (Fig. 1). This is because the resin was heated too much during preparation and volatiles were lost too rapidly (Shute, C., Palaeontology Dept, NHM and Brown, P., Entomology Dept, NHM, *pers comms*, 2004). This has severely reduced the longevity of the mountant. In some cases the resin has separated from the glass rendering microscopical investigation impossible.

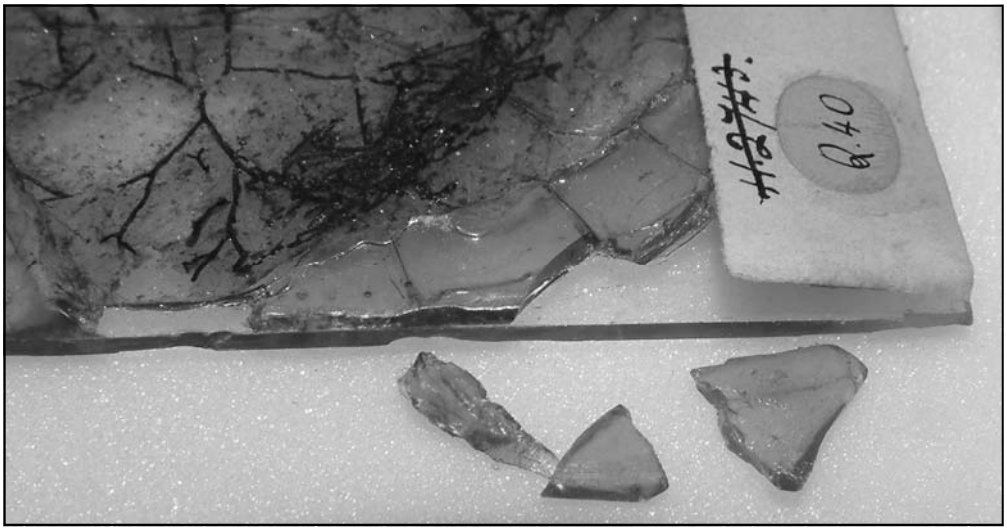

Fig. 1. Crazed Canada balsam slide containing dendroid graptolite.

Discussion of Possible Techniques

The advice of colleagues and expertise from the literature is invaluable when choosing what methods and products to use. Inspiration for new methods can also be gained from extensive reading. A literature survey was undertaken to enable decisions on how to conserve the slides and from that experimental methods were adopted. Personal communication with colleagues at the NHM and other institutions was utilised to enhance ideas developed from the literature and to identify the most appropriate methods and equipment to enable investigation.

According to Jones and Rowe (1999) successfully removing specimens from resin and reusing them is a "luxury [that] only applies to some fossil plants and spores." Carter and Walker (1999) state that it is impossible to recover specimens from cracked resin. A method for removing the graptolites and re-embedding them or repairing their existing mounting medium must be established. The curator would prefer that the graptolite should remain the same way up and that the surface of the specimen remains exposed. It is important to preserve the integrity of an object, especially if it is figured, as well as maintaining an exposed surface is important for light microscopy.

The suitability of Canada balsam as a storage medium has been established. It can therefore be used in methods to restore the specimens. Brunner and Blueford (1986) recommend the use of microwaves to re-heat Canada balsam slides. They state that conventional re-melting methods, using water baths, sand baths, bunsen burners and electrical hotplates, pose a risk of damaging or losing specimens. They believe that microwaves are superior because they heat the balsam from inside outward, the process does not heat the slide, heat intensity and duration is easy to control, and small ovens can be placed within fume cabinets. A microwave oven uses radio waves which are converted directly into atomic motion. At standard frequencies they are not absorbed by most plastics, glass or ceramics, and hence will not heat up the slide. In microwave cooking, the radio waves penetrate the food and excite water and fat molecules evenly throughout. The whole heating process is different than in an oven because it does not rely on the conduction of heat. Radio waves can, however, penetrate unevenly if the subject varies in thickness, and there are also "hot spots" caused by wave interference (web 2). The microwave method was used by Brunner and Blueford (1986) to reposition robust specimens. For their slides with cracked Canada balsam they added a drop of xylene and allowed them to stand over night under a dust cover.

One contributor in the survey of Halliday (web 1) found that specimens in balsam could be recovered by soaking in xylene and remounted. The process involves soaking the slides until the fossil floats freely, then slowly replacing the xylene with glycerol until it traps the specimens against the floor of the container. Approximately 5mm deep extra layer of glycerine would then be added and the alcohol removed with a pipette (Rickards, B., Dept of Earth Sciences, University of Cambridge, *pers comms* 2004). The material in question was, however, more robust than a graptolite. The dendroids would be too fragile for this technique. Another possible method would be to inject the slide with xylene and gradually add Paraloid B72 (poly (ethyl methacrylate-*co*-methylacrylate)) to the solution, thereby replacing the Canada balsam.

Transferring the slide by inversion into fresh resin would not fulfil the curator's request, but may be the only way to preserve the specimens. The fossil could be covered in Canada balsam, a slide pressed on top and the old slide removed with a hot knife or xylene. Canada balsam is a highly resistant medium and it becomes less soluble with age as volatiles are progressively released. The new layer of resin may dissolve before the old layer can be removed. A much simpler method would utilise an epoxy resin, such as Fynebond® (web 3), which is insoluble in xylene: the new resin would be poured on top of the fossil and the old resin dissolved with xylene, leaving the overturned fossil in the epoxy. This would pose less risk of damage to the specimen, but the result would be irreversible and the original surface would lie underneath. An alternative could be a double transfer: once into wax and then, when the old balsam has been removed, back into fresh balsam. The most suitable option would be carbowax™ (Polyethylene Glycol 1500), which is often used in palaeontology to make water-soluble supports during preparation. Carbowax is insoluble in xylene and should not dissolve whilst the old Canada balsam is being removed.

Crizzled glass can be impregnated with polymeric materials to consolidate the surface but this has been found to be ineffective (Brill, 1975). This process has been used to create fake amber fossils: Dr Ross at the NHM discovered a Canada balsam and amber hoax, where a fly "fossil" had been created within a central hollow. Fresh Canada balsam could therefore be added to the graptolite slides to fill up the cracks. This, however, obscures the surface desired by the curator.

Investigation and Discussion of Possible Methods

Slides were selected from a range kindly donated by various members of the palaeontology department. Only two slides were graptolites which had been prepared by O.M.B. Bulman. The remaining slides were chosen for their similarities: crazed Canada balsam holding delicate fossils. Several experiments were set up according to methods in the published literature, recommendations by colleagues or based on personal inspiration.

Microwave: The slides were heated at various temperatures and durations in an Amana® Commercial 1100 Watt microwave. At low temperatures and duration of up to 10 minutes no effect was made on the Canada balsam. At the highest temperature setting and 5 minutes bombardment duration, one sample achieved plasticity and two of the cracks sealed up but were still visible. One of the cracks opened up and a new crack appeared along side the embedded fossil, separating part of it from the main area. Many small vesicles appeared within the Canada balsam and it became darker in colour. Another sample was even more adversely affected. Many of the shards of resin flew off the slide completely. Those that were left melted. At high temperature and 6 minutes of bombardment the Canada balsam liquefied and darkened further, the vesicles were still present and the fossil became distorted. In Brunner and Blueford (1986) this method was used to free-up fossil radiolarians and reposition them, it was not used for repairing cracks or on large fragile fossils like the graptolites.

Xylene drops: Droplets of xylene were applied to the crazed slides using a pipette but evapourated before any effect was perceptible. Xylene is harmful or fatal if swallowed. Its vapour is also harmful and can affect the central nervous system. Xylene can also cause severe eye irritation, causes irritation to the skin and the respiratory tract. Chronic exposure can cause adverse liver, kidney and blood effects. The liquid and vapour are both flammable (MSDS number X2600). The slides were then placed in a polypropylene box on a layer of sympatex. Xylene was poured in until it covered the slides by 0.5mm depth. The lid of the box was then sealed and progress monitored every 5 minutes. After the first five minutes the Canada balsam appeared to be much clearer and cracks were beginning to heal, but crystals were forming on the surface. Over time the upper level cracks continued to improve but the crystals worsened. There were no changes between 20 and 45 minutes. The slides were then left to soak in the xylene for 3 days. When dried the crystals had disappeared and many of the cracks had healed but other cracks had opened up wider than before. One of the fossils suffered severe damage.

Exchange with Paraloid: The initial theory proposed injection of xylene, gradually changing the solution into Paraloid B72. The slide was soaked for an hour in xylene and the excess surrounding resin removed with a metal spatula. Then the xylene and paraloid solution was injected. Unfortunately Paraloid also dissolves in xylene and the resins became mixed. A drop of Paraloid was added on top of the slide to stabilise it. Around 30% of the fossil was lost in this process.

Transfer: Drops of Canada balsam in xylene were added to the slide, a new glass slide was pressed on top and the resin was allowed to set. A hot wire was then passed in between the two slides to melt the old Canada balsam and release the fossil. This method did not work: the fresh Canada balsam, richer in volatiles, melted preferentially and the fossil was disturbed by the wire's progress.

Double Transfer: Carbowax was heated in a microwave on full power for 1 minute and then cooled for 30 mins until crystals began to form. This prevented melting of the Canada balsam. The label was removed from the slide using a methyl cellulose poultice and reinforced with repair paper to prevent damage during treatment. Carbowax was poured over the fossil and allowed to cool. The slide was soaked in xylene until the resin had dissolved (this can take a few days or may take weeks, depending on the age and thickness of the resin). The fossil remained embedded in the carbowax. A new layer of Canada balsam in xylene was applied to the exposed fossil and a new glass slide pressed on top of it. After 2 weeks the carbowax was removed by soaking in water over night. The label was then reapplied to the slide using Paraloid B72 in acetone.

Conclusion

The microwave method produced very unsatisfactory results; the resin darkening and developing vesicles. The addition of fresh Canada balsam worked well to stabilise the slides, but does not fulfil the curator's requirement for exposure of the original surface. Adding drops of xylene was ineffectual, whilst soaking the whole slide in xylene led to damage of the fossil. The attempt to exchange Canada balsam with Paraloid B72 was completely unsuccessful; the two resins blended. During the inversion method the fossil was disturbed and the requirements of the curator were not met. The double transfer method, utilising carbowax, worked extremely well, although one of the graptolites became slightly disturbed during an early trial which had not allowed sufficient time for the fresh Canada balsam to set (Fig. 2). This was because the fresh resin was put into the water bath before it had set properly.

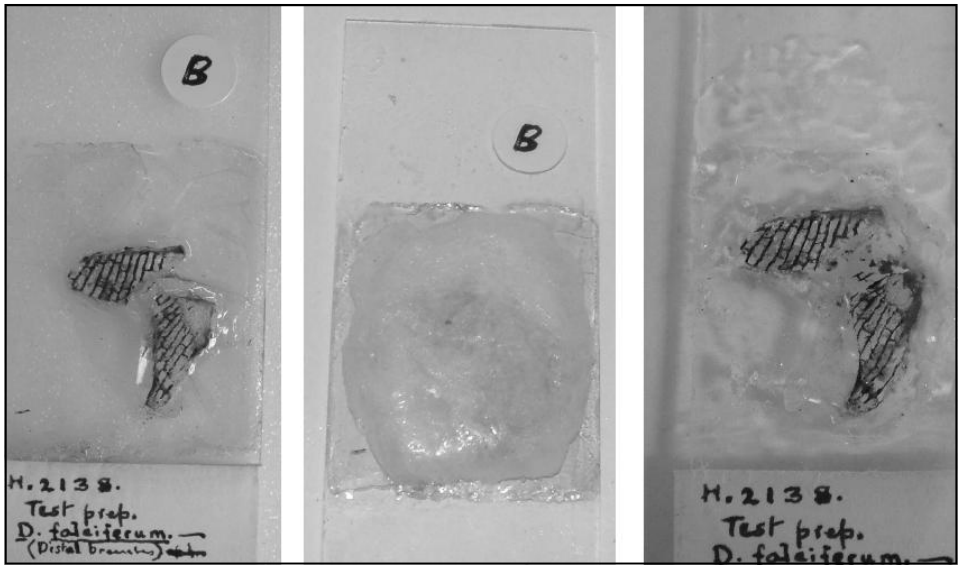

Fig. 2. An example of one of the slides treated with the double transfer technique. The photograph on the left is of the slide before treatment, the photograph in the centre shows carbowax during treatment and the photograph on the right is the slide after treatment. This particular example suffered disturbance because not enough time was allowed for the fresh resin to set.

Experimentation indicated that the best method for restoring the cracked Canada balsam slides is the double transfer technique. This method was subsequently applied to all of the slides mounted in Canada balsam within the graptolite collections in the Palaeontology Department. The process can take many weeks but

each step in itself is not time consuming. The total time actually taken is less than an hour per slide and relative time can be reduced if several slides are treated together. Care must be taken to ensure that the specimens remain undamaged. The greatest risk is from indelicate handling, the application of carbowax and fresh Canada balsam does not affect the fossils adversely. During the treatment the fresh resin is sandwiched between the wax and the slide, allowing a very small surface area for off-gassing and making it difficult to tell when the central areas are fully set. This causes a potential risk of premature transferral into the water bath. The fresh Canada balsam must therefore be allowed at least 4 weeks to set to prevent movement of the specimen, before the slide is immersed in water (for removal of the carbowax). If the fresh Canada balsam is not completely cured before the slide is immersed in water, it can also take on a slightly clouded appearance. This can be very simply remedied by applying a drop of xylene to the upper surface and allowing it to dry in a fume cabinet. As with all conservation treatments, the double transfer technique should only be performed if neglected specimens would be damaged or lost. It should not be carried out on stable slides. If appropriate care is taken, however, this treatment poses no risk to the specimens.

The use of this method on fossilised material prone to pyrite oxidation should be carefully considered, since the process involves water. If this method is used on such specimens, then the slides must remain immersed for the minimal amount of time (check after an hour) and dried as quickly as possible. Pyritic fossils should subsequently be stored in low humidity or oxygen-free microenvironments.

The resulting mount is reversible using the same method and the original surface is exposed, as requested by the curator. This is a valuable new method for use in restoring any delicate Canada balsam mounted slides.

Acknowledgements
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Collecting life: field collecting littoral marine animals for museum collections

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Introduction
While Devon has some of the most biodiverse coastline habitats in the British Isles, Plymouth, with its heavy industrial and naval usage, may not be thought of having a share in this species richness. However, following our littoral investigations over the summer of 2007, this particular view of Plymouth may not be so valid after all.

Plymouth City Museums and Art Gallery Spirit Collection
Before Plymouth City Museum and Art Gallery (PCMAG) opened in 1910, the trustees of the museum, sought to amass a comprehensive collection of Natural History specimens for the education and enlightenment of the people living in Plymouth. Between 1898 and 1910 a large number of specimens were acquired by the museum. The Marine Biological Association (MBA) sourced most of the wet preserved marine fauna, preserved in rectangular battery jars, specifically for display.

During late 2000, PCMAG was approached by the MBA to take on a large collection of over 2800 spirit preserved specimens and additional dry and microscope slide material. This large collection was the Plymouth Marine Fauna Collection (PMF Collection), which is a reference collection substantiating the *Plymouth Marine Fauna*, a compilation of records published in book form by the MBA, with editions in 1904, 1931 and 1957. The collection was not directly accessed for research by staff and students, and was stored in an external store.

The PMF Collection was transferred to PCMAG in 2001. With funding from the Museums, Libraries and Archives Council (MLA), *Renaissance in the Regions* initiative, additional staff and appropriate training in the conservation of wet-preserved specimens was funded between 2005-2007.

The Field Collection Project
Chris (an experience undergraduate marine biology student) and Hayley (a recent graduate in marine biology) were employed over the summer to collect, preserve and document littoral species to add to the large spirit collection held at PCMAG and to draw a picture of the range of species that can be found in around Plymouth's coastline. Three sites with easy access were chosen; Mt Edgcumbe, Jennycliff Bay and Mount Batten.

Each site was visited once a week over seven weeks, for three hours at a time. The School of Biological Sciences department at Plymouth University has strong links with Plymouth Museum, and allowed use of one of their labs to bring specimens back for narcotising, preservation and curation. The project remit was to collect a wide range of marine vertebrate and invertebrate organisms as possible from each site, as well as to attempt to fill gaps in the PMF Collection.

Collecting and Equipment
Initial concerns about the public and museum staff response to killing to collect were discussed with active researchers in marine biology, a number of local professionals responsible for nature conservation and other museum employees. Ultimately, we felt this trial field-collection project was worth pursuing. We obtained permission for collecting from Mount Edgcumbe Country Park Manager and Plymouth City Council Planning Department's Nature Conservation Team.

The first few weeks of the project were spent analysing the best collecting and preservation methods, beginning with an assessment of the tides to ascertain the optimum times to collect. After the fist week of sampling it was noticeable from Chris and Hayley's collecting buckets that collecting as the tide had started to come in proved to be more successful; a greater range of organisms were found, leading to the conclusion that many of the errant littoral animals hid under rocks, seaweed and rock crevices awaiting the return of the

sea.

Collecting techniques were kept relatively simple with no sampling strategy. This meant the team could look anywhere between the high and low water lines, and it allowed them to survey a large area. Simply looking under rocks and seaweeds proved successful in finding many species of fish, echinoderms and crustacea. Rocky outcrops housed many molluscs and cnidarians, such as sea anemones. Even surveying the rocky foreshore provided results, including a large Compass Jellyfish (*Chrysaora hysocella*) trapped in a rock pool by the receding tide (Fig 1).

Fig 1. The giant compass jellyfish, temporarily stored in a bucket in 70%IMS.

The equipment used was kept relatively simple, mainly for ease of transport. What couldn't be picked up by hand was captured with aquarium nets, invaluable for the faster moving species of fish. Trowels were used to investigate the riches of the mud and shingle, yielding several species of annelids (Fig 2).

Although Chris and Hayley had experience in collecting marine samples, this wasn't the case when it came to narcotising, fixing and preserving the specimens. While the museum was well stocked with Industrialised Methylated Spirit (IMS) to preserve specimens, it was part of their role to research and acquire the necessary narcotising agents.

Fig 2. Halyey Bishop with simple sampling equipment, surveying the best spot to sample.

Narcotising and preserving

The team's research proved both fruitful and frustrating. They researched different methods of narcotising certain phyla and species, but many different sources contradicted each other. Much of the current information gained from the web conflicted with the older texts that were found at the University of Plymouth Library. Also many of the chemical agents recommended were either unavailable or simply too hazardous to use. After discussions with museum staff and other professionals, six narcotising agents were chosen;

1. Acetic acid. This is able to assist in preventing tissue shrinkage when placed in a corrosive fixative (Lincoln and Sheals, 1979). This agent was not used due to time restrictions in the laboratory, and lack of chromic acid, which is required for the process.

2. Chloral hydrate. This anaesthetising crystal form can be sprinkled over the seawater containing a wide range of marine animals (Lincoln and Sheals, 1979). Again this chemical was not used, due to time restrictions in the lab. It can be used on athozoans, flatworms, and some molluscs, including the Scaphoda order (Smaldon and Lee, 1979).

3. Magnesium Sulphate. In crystal form, this can be sprinkled over seawater containing marine invertebrates to anaesthetise them and is mainly used on nudibranchs and chitons (Lincoln and Sheals, 1979). The results were poor for all species treated with this agent. Only a few individual specimens relaxed well enough to reveal their full body plan.

4. Menthol Crystals. These may be sprinkled over seawater containing molluscs and sea anemones. The organisms slip into a relaxed state, revealing their full body plan (Smaldon and Lee, 1979). Results of this chemical were mixed, with full relaxation rarely achieved in any species.

5. 70% IMS. This was used to preserve the specimens. It was also suitable for narcotising isopods, copepods, amphipods and sea urchins by immersion, as well as annelid species by adding a few drops to sea-

6. Alka-Seltzer™. This was suitable for narcotising fish and crustacea by adding a few tablets to seawater containing the animals. Due to the carbon dioxide saturation, the animals become unconscious almost immediately (University of Washington, 2002).

Chris and Hayley managed to narcotise specimens as humanely as possible after some trial and error. Preservation results were varied with some organisms reacting poorly to immersion into 70% IMS, while others remained in good condition. Species such as Cushion Stars (*Asterina gibbosa*) bleached quite considerably after IMS immersion and softer bodied species like Snake Locks Anemone's (*Anemonia viridis*) began to exude body fluids when placed in IMS. This led them to immerse the softer bodied organisms in to a 4% Formalin solution (with seawater) for several hours and then transfer the specimens into 70% IMS. This fixed the tissues and allows for the specimens to be preserved in 70% IMS. Table 1 illustrates the best methods for narcotising different Phyla, Class and Families.

Another problem faced with the soft-bodied organisms was their tendency to react violently when treated with the narcotising agents. One option was to chill or freeze specimens (Moore, 1989). Chilling enables the slow relaxation of soft-bodied animals such as the Strawberry Anemone (*Actinia fragacea*), the Moon Jellyfish (*Aurelia aurita*) and Compass Jellyfish (*Chrysoara hyoscella*). This also helped to kill them more humanely. Deep freezing on the other hand, helped preserve animals showing most if not all of their body plan, producing a better specimen for research and display. Animals such as the Sea Lemon (*Archidoris pseudoargus*), the Sea Slug (*Jorunna tormentosa*) and the Sea Hare (*Aplysia punctata*) benefited from this for of treatment and preservation.

Curation and Storage of the Plymouth Littoral Collection

Specimen sizes ranged from a few millimetres to almost 50 centimetres in length, so a wide variety of storage jars have been used. Most of the specimens have been stored in 2" x 1" vials and half pint Kilner jars. Larger specimens of Edible Crabs (*Cancer pagurus*) and Velvet Swimming Crabs (*Necora puber*) have bee stored in one pint Kilner jars. However, finding a suitable storage jar to store the largest specimen, the Compass Jellyfish, with a bell of 50cm, has proved difficult. This has impacted on the collecting regime, as it obviously limits the number of larger specimens that can adequately be dealt with. On occasion, larger specimens were put back due to lack of a suitable storage jar, although thankfully this has only been with species already well represented.

Now preserved, labelled and catalogued, the specimens will be added to the PMF Collection for future study, duplicate specimens embedded in resin for teaching and handling sessions and hopefully inclusion in a display illustrating Plymouth's rich, vibrant littoral heritage.

Conclusions

The project was funded through the *increasing access to collections* strand of *Renaissance in the Regions* funding. As with many areas of natural science, field collection of specimens is rarely if ever supported by acquisition budgets or indeed schemes such as *Collecting Cultures*. Plymouth City Museum & Art Gallery felt that this was an effective way to enhance a strong and important collection of British marine fauna. This was a trail project, on which we hope to build in partnership with the University of Plymouth School of Biological Sciences and the Marine Biological Association of the UK.

98 different species from the following Phylum are represented in the collection; Cnidaia, Nemertea, Sipuncula, Annelida, Echiura, Crustacea, Hexapoda, Pycnogonida, Mollusca, Echinodermata, Hemichordata, Insecta and Corrdata. (a full list of species can be seen in the Appendix.)

A total of 776 specimens were collected and curated. The project required little extra time from the Natural History Department staff. The total cost of the project is outlined below;

Staff costs for 3 days/week over 10 weeks	£3746.40
Materials and sundry items	£205.42
Total project cost	**£3951.82**

95% of the cost covered staff time. The total cost divided by the number of specimens works out at £5.09 per specimen. However, to buy wet preserved specimens on the open market is extremely difficult (especially those that are relevant to a museum's own collection) and much more costly. A recent auction offered an historic marine specimen in a glass jar at an estimate of £600-£800! The specimen was of course

Magnesium Sulphate	*Menthol Crystals*	*70% IMS*	*Alka-Seltzer™*
Mollusca Order: Nudibrachia Class: Gastropoda Bivalve	**Cnidaria** Family: Actiniidae	**Nemertea** Lineus sp.	**Cnidaria** Family: Actiniidae
	Mollusca Class: Polyplacophora Gastropoda Bivalvia	**Sipuncula** Family: Golfingdae	**Crustacea:** Order: Decapoda Isopoda
	Echinodermata Class: Asteroidae Family: Asterinidae Class: Ophiuroidea	**Annelida** Family: Nereidae Nephytidae Phyllodocidae Aphroditidae Glyceridae Eunicidae Cirratulidae Arenicolidae Terebellidae Spirobidae Ophllidae Class:	**Echinodermata** Family: Asterinidae Class: Ophiuroidea Family: Ophiocomidae Ophiotrichidae Amphiruridae
		Echinoidae Family: Echiindae	**Chordata** Family: Syngathidae Pleuronectidae Blennidae Cottidae Gobiidae
		Echiuran Thalassema sp.	
		Crustacea: Order: Decapoda Isopoda Amphipoda	
		Pycnogonida Family: Ammothidae	
		Echinodermata Class: Asteroidae Family: Asterinidae Class: Ophiuroidea Family: Ophiocomidae Ophiotrichidae	
		Urochordata Family: Ascidiidae	
		Insecta Order: Hexapoda	

Table 1. Best methods to narcotise different classes and Families.

of some historic interest and quite relevant to Plymouth's collections, but spending so much on a jar 4.5 inches tall, with an obscure specimen inside was difficult to justify.

The Sound covers a large area and not all the coastline is readily accessible, but a more thorough and scientific survey and collection plan covering a greater area may well prove useful in providing a rich resource and reference collection of the marine diversity during the 21st century. This is the first collection to be added to the PMF Collection in over 30 years. It is a valuable insight into the rich fauna around Plymouth *today*.

The collection techniques were successful although a wider range of equipment, including sweep nets and sieves for substrate analysis would incorporate more habitats and yield a greater array of species. Some aspects of the narcotising and preservation were difficult especially when dealing with the contradictory results the primary research uncovered. A comprehensive guide listing effective narcotising agents on certain species would be a helpful guide to anyone carrying out similar collecting.

From an educational point of view, this collection can certainly help future study of Plymouth's littoral habitats. It can be the starting point for more in-depth surveys and research of the area as a whole. It can also focus on individual species that can shed further light on the health and wealth of Plymouth's marine natural history. As a collection in its own right, it could well be the basis for future display at Plymouth Museum, offering a window for the public into the life on Plymouth's rich, diverse stunning coast.

Acknowledgments
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Appendix 1. Taxa sampled from the survey sites. 1 = Mount Edgcumbe, 2 = Jennycliff Bay, 3 = Mount Batten.

Phylum	Genus	Species	Code	Taxonomic Authority	Survey Site	No. of specimens
Cnidaria	*Actinia*	*equina*	D675	(Linnaeus, 1758)	1,2,3	15
	Actinia	*fragacea*	D676	Tugwell, 1856	1,2	7
	Anemonia	*viridis*	D679	(Forsskål, 1775)	2,3	23
	Aurelia	*aurita*	D48	(Linnaeus, 1758)	2	1
	Chrysaora	*hysoscella*	D41	(Linnaeus, 1766)	3	3
	Family *Sagartiidae*		D711		3	1

Appendix 1. Taxa sampled from the survey sites. 1 = Mount Edgcumbe, 2 = Jennycliff Bay, 3 = Mount Batten.

Phylum	Genus	Species	Code	Taxonomic Authority	Survey Site	No. of specimens
Nemertea	*Lineus*	*longissimus*	G54	(Gunnerus, 1770)	3	1
	Lineus	*ruber*	G55	(O F Müller, 1774)	3	1
	Lineus	*viridis*	G56	(O F Müller, 1774)	1	1
Sipuncula	Family *Golfingiidae*		N11		3	3
Annelida	*Arenicola*	*marina*	P931	(Linnaeus, 1758)	1,2	2
	Arenicolides	*branchialis*	P933	(Audouin & Milne-Edwards, 1833)	2	2
	Cirriformia	*tentaculata*	P839	Montagu, 1808	1	2
	Eulalia	*viridis*	P161	(Linnaeus, 1767)	2,3	4
	Eunice	*harassi*	P556	Audouin & Milne-Edwards, 1833	2	1
	Lepidonotus	*clava*	P81	(Montagu, 1808)	2,3	5
	Neanthes	*irrorata*	P470	(Malmgren, 1867)	3	1
	Nephtys	*hombergii*	P499	Savigny, 1818	2	1
	Nereis	*diversicolor*	P462	(O F Müller, 1776)	1,2	5
	Spirorbis	*spirorbis*	P1396	(Linnaeus, 1758)	1,3	11
	Family *Arenicolidae*		P928		2	5
	Family *Cirratulidae*		P822		3	3
	Family *Glyceridae*		P254		2,3	2
	Family *Nereidae*		P458		2,3	2
	Family *Opheliidae*		P993		2	1
	Family *Phyllodocidae*		P114		3	1
	Family *Tubificidae*		P1425		1	10
	Class *Hirudinea*		P1579		2	2
Echiura	*Thalassema*	*thalassemum*	O9	(Pallas, 1766)	2	1
Crustacea	*Abludomelita*	*obtusata*	S498	(Montagu, 1813)	1	1
	Athanus	*nitescens*	S1333	(Leach, 1814)	2,3	3
	Cancer	*pagurus*	S1566	Linnaeus, 1758	1,2,3	14
	Carcinus	*maenas*	S1594	(Linnaeus, 1758)	1,2,3	13
	Dynamene	*bidentata*	S865	(Adams, 1800)	1,3	4
	Echinogammarus	*marinus*	S466	(Leach, 1815)	1,3	2
	Galathea	*squamifera*	S1475	Leach, 1814	2,3	28
	Idotea	*baltica*	S935	(Pallas, 1772)	3	1
	Ligia	*oceanica*	S1056	(Linnaeus, 1767)	1,2	10
	Melita	*obtusata*	S498	(Montagu, 1813)	2	2

Appendix 1. Taxa sampled from the survey sites. 1 = Mount Edgcumbe, 2 = Jennycliff Bay, 3 = Mount Batten.

Phylum	Genus	Species	Code	Taxonomic Authority	Survey Site	No. of specimens
Crustacea	*Melita*	*obtusata*	S498	(Montagu, 1813)	2	2
	Pagurus	*bernhardus*	S1457	(Linnaeus, 1758)	1,2,3	10
	Palaemon	*elegans*	S1317	Rathke, 1837	1,2,3	43
	Pilumnus	*hirtellos*	S1615	(Linnaeus, 1761)	2,3	3
	Pisidia	*longicornis*	S1482	(Linnaeus, 1767)	3	3
	Porcellana	*platycheles*	S1484	(Pennant, 1777)	1,2,3	32
	Necora	*puber*	S1589	(Linnaeus, 1767)	1,2,3	7
	Siriella	*armata*	S34	(H Milne-Edwards, 1837)	1	1
	Xantho	*incisus*	S1619	Leach, 1814	2,3	7
	Family *Gammaridae*		S464		1	6
	Family *Hippolytidae*		S1334		2,3	4
	Family *Processidae*		S1361		2,3	5
Hexapoda	*Anurida*	*maritima*		Guérin, 1836	1	10
	Petrobius	*maritimus*		(Leach,1809)	2	1
Pycnogonida	*Endeis*	*spinosa*	Q30	(Montagu, 1808)	2	2
	Phoxichilidium	*femoratum*	Q48	(Rathke, 1799)	2	1
Mollusca	*Acanthochitona*	*fascicularis*	W87	(Linnaeus, 1767)	2,3	14
	Archidoris	*pseudoargus*	W1376	(Rapp, 1827)	2	1
	Calliostoma	*zizyphinum*	W182	(Linnaeus, 1758)	2,3	12
	Cerastoderma	*edule*	W1961	(Linnaeus, 1758)	1	1
	Crassostrea	*gigas*	W1761	(Thunberg, 1793)	1	1
	Gibbula	*cineraria*	W163	(Linnaeus, 1758)	2,3	14
	Gibbula	sp.	W165	(da Costa, 1778)	1,2	52
	Hinia	*reticulata*	W745	(Linnaeus, 1758)	1,2,3	21
	Hinia	*pygmaea*	W748	(Lamarck, 1822)	2,3	6
	Jorunna	*tomentosa*	W1386	(Cuvier, 1804)	3	1
	Lepidochitona	*cinerea*	W79	(Linnaeus, 1767)	1,2,3	12
	Littorina	*littorea*	W296	(Linnaeus, 1758)	1,2,3	31
	Littorina	*obtusata*	W302	(Linnaeus, 1758)	1,2	10
	Mytilus	*edulis*	W1695	Linnaeus, 1758	1	7
	Nucella	*lapillus*	W687	(Linnaeus, 1758)	1,2,3	41
	Ocenebra	*erinacea*	W685	(Linnaeus, 1758)	2,3	4
	Ocinebrina	*aciculata*	W689	(Lamarck, 1822)	2,3	3
	Ostrea	*edulis*	W1758	Linnaeus, 1758	2	1
	Patella	*vulgata*	W231	Linnaeus, 1759	1,2,3	17
	Patella	*depressa*	W229	Pennant, 1777	2	1
	Tapes	*decussatus*	W2115	(Linnaeus, 1758)	3	1

Appendix 1. Taxa sampled from the survey sites. 1 = Mount Edgcumbe, 2 = Jennycliff Bay, 3 = Mount Batten.

Phylum	Genus	Species	Code	Taxonomic Authority	Survey Site	No. of specimens
Mollusca	*Turritella*	*communis*	W270	Risso, 1826	3	1
	Family *Facelinidae*		W1466		3	1
	Family *Leptochitoninae*		W49		3	4
	Family *Muricidae*		W672		2	1
Echinodermata	*Amphiura*	*chiajei*	ZB152	Forbes, 1843	3	2
	Asterina	*gibbosa*	ZB59	(Pennant, 1777)	2,3	20
	Marthasterias	*glacialis*	ZB104	(Linnaeus, 1758)	2	1
	Ophiopsila	*aranea*	ZB131	(M Sars, 1859)	2	9
	Ophiothrix	*fragilis*	ZB124	(Abildgaard, 1789)	2,3	17
	Ophiura	*ophiura*	ZB170	(Linnaeus, 1758)	1,2,3	46
	Pawsonia	*saxicola*	ZB270	(Brady & Robertson, 1871)	3	2
	Psammechinus	*miliaris*	ZB193	(Gmelin, 1778)	2,3	12
Hemichordata	Family *Ascidiidae*		ZD82		2	2
Chordata	*Ciliata*	*mustela*	ZG111	(Linnaeus, 1758)	2,3	12
	Entelurus	*aequoreus*	ZG237	(Linnaeus, 1758)	3	1
	Gobius	*paganellus*	ZG468	Linnaeus, 1758	3	7
	Lipophrys	*pholis*	ZG412	(Linnaeus, 1758)	1,2,3	17
	Myxocephalus	*scorpius*	ZG281	(Linnaeus, 1758)	2	1
	Nerophis	*lumbriciformis*	ZG242	(Jenyns, 1835)	1,2,3	12
	Parablennius	*gattorugine*	ZG414	(Linnaeus, 1758)	3	1
	Sprattus	*sprattus*	ZG38	(Linnaeus, 1758)	2,3	24
	Order *Pleuronectiformes*		ZG545		2	1
	Total number of Species:		**98**			
	Total number of Specimens: 775					

Dismantling, painting and re-erection of an historical cast of the dinosaur *Iguanodon* in the Sedgwick Museum, Cambridge

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Abstract

A cast of the skeleton of the dinosaur Iguanodon *has stood in the Sedgwick Museum since at least 1910, but has belonged to the University of Cambridge since 1896.* Iguanodon *was fundamental to the development of palaeontology in the UK and Europe, and in 2004 the Museum dismantled, cleaned, conserved and painted its skeleton, a task which had not been undertaken of over 30 years. The skeleton was painted to match the colour of the original bones as found in Belgium, and once re-erected elements of the skeleton not previously mounted were attached. New interpretation was added to the display and the skeleton now stands as central attractor and unrivalled educational resource in the Museum.*

Introduction

On entering the Sedgwick Museum, visitors are greeted by the imposing figure of a full-size cast of a skeleton of the dinosaur *Iguanodon* (Fig. 1). The dinosaur is not only the first object noticed by visitors both young and old and often eliciting gasps of wonder, but has become iconic of the Museum. *Iguanodon* itself is important in the annals of palaeontology as one of the first extinct, giant terrestrial reptiles to be discovered and named and was one of the first dinosaurs to be recovered in its entirety and mounted in three-dimensions as though a living animal. Such was the fame of *Iguanodon* that casts were distributed across Europe. The skeleton has stood in the Sedgwick Museum since at least 1910, but has been in the University of Cambridge since 1896, and the history of its acquisition is explored here. In 2004, ongoing redevelopment of the Museum provided a once-in-a lifetime opportunity to dismantle the skeleton and undertake much needed cleaning, conservation work where necessary and repainting.

Fig. 1 The Sedgwick Museum cast of *Iguanodon* in the gallery prior to restoration.

The Sedgwick Museum and *Iguanodon*

The Sedgwick Museum is one of a number of museums within the University of Cambridge and is integrated into the Department of Earth Sciences. The Museum dates back to 1728 when John Woodward (1665-1727), a physic (medical doctor) and philosopher at Gresham College, bequeathed part of his collection of fossils (in the broad sense then employed), together with their catalogues, to the University of Cambridge. Woodward's bequeathment of two of cabinets of British fossils was accompanied by land whose income was to pay a lecturer to look after and show the collection to all who were interested (Price, 1989a). The University subsequently purchased the final two cabinets containing Woodward's collection of world fossils from his executors. Today, the Woodwardian collection is one of the oldest intact geological collections in its original cabinets in the world (Price, 1989a) and together with the original catalogues forms the nucleus of the present Sedgwick Museum collections.

Originally the Woodwardian collection was housed in a room off the old Arts School of the University,

and the lecturer became known as the 'Woodwardian Professor'. The most famous Woodwardian Professor was Adam Sedgwick (Anon., 1870), who raised money from the University and by public subscription to construct a purpose built museum in the 1842, which due to Woodward's bequest was known as the Woodwardian Museum. Sedgwick massively increased the size of the collections, sometimes from his own pocket, and by the time of his death in 1879 space in the Museum was insufficient to house the ever growing collections. In 1904, under the direction of his successor, Professor Thomas McKenny Hughes (Anon., 1906), a new building, again largely paid for by public subscription, was erected as a memorial to Adam Sedgwick – this is the current museum that now bears Sedgwick's name (Cowper Reed, 1903; Rickards and Price, 1985; Whyte, *et al*., 2004).

Today, the Sedgwick Museum houses one of the great geological collections, containing upwards of one million objects. Specimens and collections of importance include those collected by Mary Anning (Price, 1986) and the eccentric Thomas Hawkins (Taylor, 1989, 2002; O'Connor, 2003), the John Watson building stone collection (Andrew, 1994), geological models by Thomas Sopwith (Turner and Dearman, 1979), palaeontological models by H. Neville Hutchinson (Hutchinson, 1917, 1922), vast collections of gaptolites (Rickards, 1999), local Cretaceous 'coprolites' (Ford and O'Connor, 2002) and Pleistocene vertebrates including the Barrington hippopotamus (Butler, 1994). Much of the holdings were catalogued by A.G. 'Bertie' Brighton (Price, 1989b) and the Sedgwick Museum had one of the earliest computerised museum catalogues (Rogers *et al*., 1990).

Iguanodon

Iguanodon has pre-eminent importance in the early history of palaeontology in the UK and Europe, and was one of the first giant-sized land-living reptiles to be recognised as such (Mantell, 1825). It was one of the three animals (with *Hylaeosaurus* and *Scelidosaurus*) originally designated by Richard Owen as 'Dinosauria' (Owen, 1842; Desmond, 1979). At the time relatively little was known of the skeleton of *Iguanodon*, although it became iconic of the new sciences of geology and palaeontology (Cadbury, 2000). More complete remains were found in 1834 allowing the animal to be reconstructed as a giant lizard (Norman, 1993), and in 1854 a model of *Iguanodon* was constructed as a three-dimensional sculpture in a rhinoceros-like pose (famously with the thumb spike as a nose horn) in the Crystal Palace gardens, Sydenham, south London following the Great Exhibition of 1851 (Owen, 1854; McCarthy, 1995).

The fame of *Iguanodon* was enhanced between 1878 and 1881 by the discovery of 39 skeletons in a coal mine close to the town of Bernissart in south-west Belgium (Norman, 1987). These skeletons, many of which were beautifully preserved and some substantially complete, were carefully collected and sent to the Musée Royal d'Histoire Naturelle de Belgique (now the Institute Royal des Sciences Naturelles de Belgique). They provided, for the first time, dinosaur skeletons that could be mounted complete and in three-dimensions. Thus, *Iguanodon* was first mounted in the early 1880's in a bird- or kangaroo-like pose (Norman, 1985), and appeared to give firm evidence that dinosaurs were bipedal, rather than lizard- or rhinoceros-like. However, although *Iguanodon* has long been shown as standing upright (e.g. Swinton, 1973), subsequent research indicates that this traditional pose is inaccurate and that adult individuals of *Iguanodon* were probably most frequently quadrupedal (Norman, 1980; 1986; Wright, 1999).

The Sedgwick Museum *Iguanodon*

The Sedgwick Museum *Iguanodon* is a cast of one of the most complete of the Belgian specimens. The original skeleton was discovered in 1878 at a depth of 356 metres in the Bernissart mine, and was first published on in 1883. The original is housed in the Royal Museum of Natural History in Brussels, and the Sedgwick Museum specimen is one of a number of casts of this animal on display in Museums around the country; others casts can be found in the Natural History Museum, London (Woodward, 1895), and the Oxford University Museum, Oxford.

The cast of *Iguanodon* is of great importance to the Sedgwick Museum, as one of the first and most striking objects seen by visitors entering the galleries. Indeed, so important was *Iguanodon* that representations of the dinosaur appear on the outside of the building (Figs. 2a, b), and are carved onto the book ends of the Museum (now Department) library (Fig. 2c). Indeed *Iguanodon* has become iconic of the Sedgwick Museum and is incorporated, in stylised form, into the institutions logo (Fig. 3.). However, although phenomenally important to the Museum, *Iguanodon* was not part of the Sedgwick collections, when the current building was opened by King Edward VII on 1st March 1904 (Whyte, *et al*., 2004). So how did the cast of *Iguanodon* come to be in Cambridge, some 300 km from its site of discovery at Bernissart, and arrive in the Sedgwick Museum? The story of the acquisition of *Iguanodon* by the university and its transfer to the Sedg-

wick Museum can be reconstructed from letters available from the University Museum of Zoology Cambridge 'histories' records (http://www.zoo.cam.ac.uk/museum/ccmainpage.html accessed: 14 February 2008).

Fig. 2. *Iguanodon* as represented in the Sedgwick Museum building (a) the Downing Street doorway showing *Iguanodon* above the door to the left and (b) enlarged, (c) two *Iguanodon* carvings (of four) in the Department of Earth Sciences library.

The Sedgwick Museum
of Earth Sciences

The Sedgwick Museum of Earth Sciences

Fig. 3. Two versions of the Sedgwick Museum logo incorporating a stylised version of the Iguanodon.

History of the Sedgwick Museum Cast

Following application by Sir John Kirk, British plenipotentiary to the 1889-90 African slave trade conference in Brussels (McMullen, 2004), the University of Cambridge was promised, in February 1896, the donation of a cast of the skeleton of *Iguanodon* by the King Leopold II of Belgium. The casts were prepared and carefully packed in the Musée Royal d'Histoire Naturelle de Belgique and were ready for shipping on 15th July of that year. The specimen was sent on July 17th in eight boxes and insured for 4000 francs. The shipment was made by Mr Auguste Bulcke & Co. via Antwerp and Harwich, the latter being the closest port to Cambridge. In addition to the casts, the boxes contained the metal armature to support the bones, and instructions for assembling the skeleton. The specimen arrived safely on 24th July with 'minimal damage', and the skeleton was mounted by 13th August. A notice of the arrival of the skeleton was made in the Cambridge University Reporter on the 6th October, and on 15th of that month a Grace was passed by the Senate (the University's ruling council of scholars) authorising Charles Smith, the then Vice-Chancellor of the University, to convey the thanks to the King of the Belgians. A report of the presentation of the casts to the Museum of Zoology indicates the skeleton was accompanied by 'supplementary casts of the skull, lower jaw, ilium (one of the bones of the pelvis) and some other bones' (Harmer, 1896: 202); these additional casts are housed in the University Museum of Zoology (registered numbers R.5257, R5258 and T679).

The *Iguanodon* was temporarily placed in the lecture room of Comparative Anatomy. Edouard Dupont of the Brussels Museum indicated that the label accompanying the specimen should state: 'the specimen was supplied by the Museum in Brussels and donated by the King of Belgium' (letter dated 16th July 1896) or

'*Iguanodon Bernissartensis* Boulenger. Cretaceous. The *Iguanodon* of Bernissart, found in 1878 and mounted 1883. Donated by the Trustees of the Museum in Brussels' (letter of 24th July 1896). Dupont also indicated that various papers regarding the specimen would be sent to Cambridge. The historical display label currently associated with the cast is a composite of this information (Fig. 4), although it is not known when this was written. However, by November 1909, the zoological lecture rooms were to be rearranged, and a lantern installed. It was acknowledged that the Zoology Museum did not have enough space for *Iguanodon* and it was suggested that Professor Thomas McKenny Hughes (Anon., 1906), then Woodwardian Professor of Geology, might like to place the specimen in the Sedgwick Museum. Funds were found to dismantle the *Iguanodon* in Zoology (by the same man who had erected it 13 years earlier) and during the Christmas vacation of 1909-10 McKenny Hughes paid to have the specimen transported over the road to the Sedgwick. There is no record of *Iguanodon* having been moved since its erection in the Sedgwick Museum, although the skeleton had been dismounted and painted during the 1960's (M. Dorling and R. Long, pers. com., 2004).

Fig. 4. The historical label currently associated with *Iguanodon*. Note the difference in wording from that suggested at the time of acquisition of the skele-

Restoration of *Iguanodon*

In 2004, the opportunity to restore and repaint the *Iguanodon* presented itself due to redevelopment of the Museum funded by the Museums, Libraries and Archives Council's 'Designation Challenge Fund'. Funding was granted to replace the aging flooring (acquired from the Queen Mary liner) and to refurbish the Museum's electrical supply. This work required the *Iguanodon* and several display cases to be moved and offered a rare opportunity to dismantle, clean, restore and repaint the dinosaur. Remounting the skeleton in a more modern pose, or simply turning the head so as to face visitors upon entry to the Museum was considered, but it was decided that the animal should remain in its original, bipedal, mount for historical reasons and to act as a learning aid showing the nature of changing scientific thought.

Pre-restoration condition assessment

Prior to commencement of restoration, the *Iguanodon* skeleton was fully assessed. The dinosaur was on open display and situated very close to the main entrance of the Museum. The skeleton was 10.1 m (33 feet) long and 4.7 m (15 feet 6 inches) high and mounted on the original metal armature manufactured at the same time as the cast in Brussels. The armature was mounted on a low wooden plinth incorporating interpretative displays. The skeleton was cast in plaster of Paris, containing low levels of straw and other impurities, with an internal steel armature. Each of the major elements of the skeleton retained the stamp of the museum in Brussels impressed into the cast.

The skeleton was found to be, with very few exceptions, generally sound. The skeleton itself had been cast as a series of more than 130 separate elements, either single bones or as small units of conjoined bones, which were 'cradled' by the mount, rather than fixed to it. None of the individual elements were bolted directly to the armature or to each other. The feet were mounted in cast 'boots' to keep the individual bones in articulation, and the ischia (the posterior pelvic bones) were mounted in two detachable mounts, bolted to the main armature. The ischia, as with the original skeleton and other casts, had been mounted reversed with the left ischium on the right side of the body and vice versa. Several elements of the skeleton, including the left right side of the pelvis and the hyoids (bones from under the chin) were not mounted with the skeleton.

The skeleton had last been repainted during the 1960's (Fig. 5), and the existing colour was as a result of that work. At that time, a pale brown had been selected for the skeleton, however when tested in the gallery

the colour was considered too light and it was repainted a darker shade. Upon re-erection, the new colour, although giving better definition to the bones, had the unfortunate effect of periodically giving a purple tinge to the skeleton under the natural lighting conditions then in the gallery (Mike Dorling, pers. com., 2004). In addition, it became clear that, although dusted at low level, the higher elements had not been cleaned regularly, and the skeleton as a whole was in need of both cleaning and repainting. Clearly dismantling, moving, repainting and re-erecting this specimen would be a major undertaking.

Movement of the specimen and the surrounding display cases required the Museum to be shut. The work was carefully planned and programmed during the University summer teaching pause to permit use of the nearby laboratories; this also avoided clashes with school groups and other pre-planned visits. As the cast had not been dismantled or repainted for more than 30 years, no one in the museum knew for sure how to dismantle the skeleton. However, the Director of the Museum (Dr David Norman) was familiar with the mount, as he had worked extensively on *Iguanodon* and had handled and dismantled several of the original skeletons as part of his postgraduate research.

Dismantling

The Museum was cleared of surrounding display cases, and the existing interpretation dismantled from the plinth and stored. Elements of the cast were labelled with a unique number using tie on tags, and the skeleton photographed as we went along. The feet were dismantled first, as the most accessible elements and to check the procedure for the larger elements. With a system of work in place the head was the next dismantled, which required erection of a scaffolding tower (Fig. 6), and careful thought as to safe methods of working at height. The skull was found to consist of two pieces held together by a locking pin, which greatly facilitated removal and handling. The neck and cervical ribs were then removed, followed by the shoulder blades, arms and hands. The dorsal ribs were removed next and the backbone down to the pelvis. The loose pelvic elements and the legs were disassembled, and then the tail working from the tip forwards, until the elements were 'locked' on by the weight of the block containing the sacrum (pelvis plus sacral vertebrae) above. The pelvic block was the largest and most difficult element to remove, but fortunately could be reached from ground level as it took six people to lift it safely off the mount, thereby allowing the

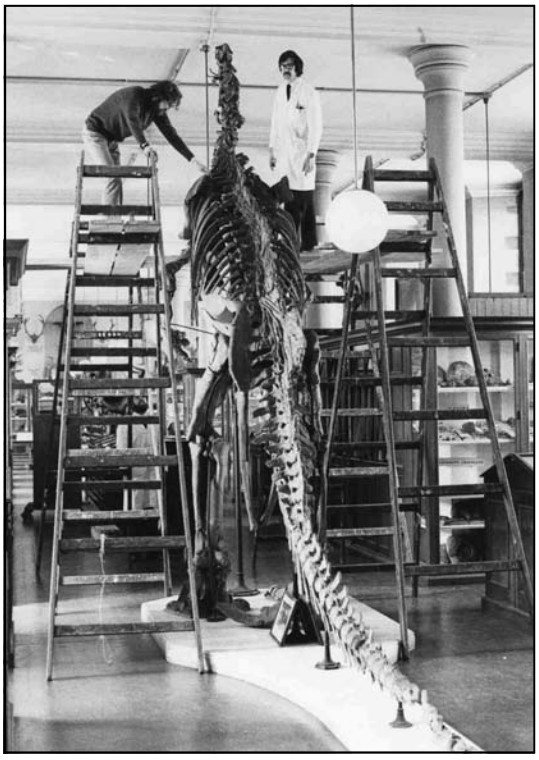

Fig. 5. Work being undertaken on *Iguanodon* during the 1960's by Mike Dorling (left) and Rod Long (right); exact date of the photograph unknown. Note the head has been removed and the unattached right ilium on the plinth between the feet.

Fig. 6. Scaffolding tower erected around *Iguanodon* to safely access high level elements of the skeleton (compare to fig. 5). Note the missing foot bones revealing the 'boots' in which the elements were housed.

remainder of the tail to be removed. The armature now had an artistic, almost ethereal beauty about it – a skeletal reminder of the skeleton we had just dismounted.

With the cast removed, the wooden plinth, with the steel armature still attached, was split along an existing dividing line and moved along the gallery to allow the new flooring to be laid. Beneath the plinth were discovered chalk marks indicating the position of the 'boots' for the feet, and the positions of the bases of the armature. These were presumably workman's marks dating back to 1909-10 when the skeleton was first erected in the Museum. However, it proved impossible to preserve these chalk marks, although a photographic record was kept.

Cleaning, repairs and painting

Once the *Iguanodon* specimen had been dismantled it was laid out in a nearby teaching laboratory, which necessitated transporting the cast upstairs. The benches were covered with inert Plastazote foam and each element cleaned and assessed for damage. Cleaning involved removal of the considerable quantity of dust that had accumulated over the years of being on open display. Brushing and swabbing using sponges dampened with distilled water, and immediately drying it, removed most of the accumulated grime. Use of water was kept to a minimum to keep the cast as dry as possible thereby minimising ingress of water reducing risk to the plaster and preventing corrosion of the internal metal armature. Stubborn areas dirt or stains were removed using a small amount of biodegradable plant based 'Ecover' detergent.

Some areas of the skeleton had sustained damage, which required repair, either whilst on open display, or during dismounting. These were mostly bony processes which had been chipped or damaged over the years, but the right femur had sustained considerable prior damage. The cast was repaired using plaster of Paris to be as sympathetic as possible to the original materials. The femur in particular required reconstruction of areas where the internal armature had flexed and broken off large flakes of plaster. Large areas of damage were repaired using buffered neutral pH archivists Polyvinyl acetate (PVA) adhesive and Paraloid B72 in acetone for small flakes. PVA was chosen for the larger areas as its flexibility was considered more appropriate. During setting, the joints were tied with acid free tape to allow the repairs to set firmly.

Painting

The decision was made to repaint the cast so as to match, as closely as possible, the colour of the original bones – a rich, dark chocolate-brown, with reconstructed elements painted black to match the original coaly matrix. This had the added advantage that the new paint scheme would be darker than the existing, allowing minimal application of paint, thereby retaining important surface detail. Under the direction of David Norman, who had worked extensively with the original material (Norman 1980, 1986), and supplemented by photographic references, suitable colours were selected. Initially a simple two colour paint scheme was attempted, but this left the bones appearing rather flat and featureless, both to the naked eye and when photographed. As the specimen was to be a key centre point to the gallery a decision was taken to laboriously hand paint the entire skeleton using a 'dry brushing' technique, mixing the colours on the cast, highlighting raised areas and applying a darker tone for depressions.

Acrylic paints were selected for their flexibility, an important factor with a large object made of composite materials. Additionally, acrylics can be applied without diluting or mixing, enabling application of the different colours in a consistent manner; this was particularly important over substantial areas and as a large team were involved in the painting process. Liquitex paints were selected as high-quality acrylics with good resistance to fading, ensuring longevity of colour under gallery lighting (Fig. 7). The colours selected were: Ivory Black, Mars Black, Burnt Sienna, Burnt Umber and Red Oxide. The paints were applied with 25 mm hog bristle brushes using a stippling action. The base colours were predominantly a mixture of Ivory Black and Mars Black, the next dominate colours were Burnt Sienna and Burnt Umber with highlighting applied using Red Oxide. The result was a much more realistic appearance to the cast than the original attempts, but extended the time required to paint the skeleton from the original estimate of two weeks to almost two months.

Whilst the skeleton was being restored and repainted, the mount was inspected for damage and itself repainted. The cradle for the skull was removed for ease of access, and the remainder of the armature painted *in situ*. The plinth was cleaned, ready for repainting once the skeleton had been re-erected – this could not be done earlier as we would need to walk over the plinth to re-erect the skeleton. Once the new flooring was in place, the plinth was repositioned approximately one metre forward of its original position, to provide greater impact for visitors. The armature was made safe and the Museum reopened to visitors.

Re-erection and display

Erecting the newly painted skeleton of *Iguanodon* was a challenge. It was important to minimise damage to the paint scheme during re-erection and, as the Museum was open to the public, had to be undertaken in carefully planned stages. However, dismantling the skeleton had provided important insights as to how the dinosaur had been mounted, aided by the fact that this was the way in which the skeleton had been erected originally. Re-mounting took place in the following order: tail; feet and lower legs; pelvic block; upper legs and the remainder of the pelvis; backbone; ribs; shoulder girdle, arms and hands; neck and finally the head. The Museum was kept open, and the local press invited, for the 'topping off ceremony' as the skull was gently placed in position. This resulted in valuable media coverage and in a number of visits to the Museum to see the newly refurbished *Iguanodon*.

Fig. 7. Liquitex acrylic paints and brush used for painting the *Iguanodon* skeleton. Utilising small brushes (here just 10 mm across) took considerable time to but permitted resulted in high-quality finish.

Once the skeleton was completely erected, a local engineering company was approached to produce a new armature for the previously unmounted right ilium and to realign the incorrectly positioned ischia of the pelvis. The ilium had not been attached to the skeleton before, and thus needed a new mount; the ischia had to be reversed and correctly placed. It is believed this is the only cast of *Iguanodon* fully mounted in this way. In addition, new displays were written and produced to accompany the refurbished skeleton. The plinth was painted and landscaped, and a new interpretive background installed. Never-before-seen models of *Iguanodon* from the Museum's collections were added to the plinth, together with a fossil footprint and the historical label originally associated with the specimen retained. The up-to-date interpretation, landscaping and models now form an integral display at the entrance of the Museum, and the skeleton is regularly admired by visitors, and is well used for undergraduate teaching.

Acknowledgements

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Harnessing Natural Talent

Jeanne Robinson, Kelvingrove Museum and Art Gallery

The naturalist - well-rounded and industrious character with a deep understanding of the natural world, exceptional identification skills and unrivalled field craft. Naturalists that are spotted in the wild are mostly older beasts with a grey pelage (or no pelage at all). Many lament the demise of the naturalist and rightly so, the most effective conservation practice is dependent on the skills they bring to the sector. Whilst universities generate a mass of biologists and ecologists each year, they often graduate with few field skills and little field experience. BTCV is attempting to bridge this practical skills gap with the help of a diverse array of partner organisations.

With help from the Heritage Lottery Fund, BTCV launched their Natural Talent Apprenticeship scheme in 2006. Like traditional apprenticeships and many good naturalists, the apprentice learns by working alongside an established expert. The apprenticeships last 12-18 months and each apprentice receives an annual bursary and some funds for equipment and additional training. The focus during recruitment has been on enthusiasm and commitment to conservation rather than formal qualifications. The hunt has been for recruits who are motivated and committed, as in addition to spending time with various mentors, they must spend a considerable amount on self-directed study and carry out a conservation project of their own design.

Each apprentice focuses on a specific taxonomic group or a conservation area. In 2006 apprentices were taken on to study Coleoptera, lichens, bryophytes, grassland and freshwater conservation. In 2007 a Hymenoptera and a mycology apprentice were recruited. The number and the quality of the applicants have been impressive. There were over 200 applicants for just 6 posts the year the scheme was launched, many of whom were volunteers in museums and conservation bodies. The scheme is set to grow further still in coming years. In 2008/9 a further ten naturally talented apprentices need to be found.

The apprenticeships rely on the good will of the training institutions and mentors. The Hunterian Museum (Glasgow) and Glasgow Museums (Culture and Sport Glasgow) were consulted when BTCV was developing the scheme. We agreed to mentor an apprentice coleopterist and Moya Burns was recruited in the launch year. It has been very satisfying to have someone motivated and capable working with our natural history collections (Fig. 1). It has been more satisfying still to see her applying her identification skills and using the collections to complete her project. Moya is already doing her bit for invertebrate conservation; investigating the efficacy of different trapping methods for monitoring beetles in Scottish woodlands. It is hoped that she and the other apprentices will go on to share their natural talents and develop that of others; it is intended that they will be tomorrow's mentors.

Fig. 1. Coleoptera apprentice, Moya Burns, at the HUntarian Museum, University of Glasgow.

Following the success of our first apprenticeship, we were delighted to offer the new hymenopterist, Cathy Fiedler our support and time (Fig. 2).

BTCV has tried to develop apprenticeships in those areas with the greatest skill gaps but unsurprisingly these are the trickiest to find suitable mentors for. In addition to ourselves, the Centre for Environmental Data and Recording (CEDaR), the Environment and Heritage Service, the Oxford University Museum of Natural History, Liverpool Museums, the National Trust for Northern Ireland, the Royal Botanic Gardens Edinburgh, the Scottish Wildlife Trust, the Scottish Agricultural College, the Natural History Museum, London, the Ulster Wildlife Trust and the National Trust for Northern Ireland. Agri-Food and Biosciences

Institute (AFBI) and the Ulster Wildlife Trust have given their time and support to the scheme. Currently the apprenticeships are based in Scotland and Northern Ireland but with sufficient interest and backing it may be possible to extend the scheme around the UK.

To find out more about the scheme and the new apprenticeships please visit www.btcv.org/naturaltalent. BTCV would be particularly keen to hear from you if you have skills and time you're willing to share with future apprentices.
Natural Talent, BTCV Scotland, Balallan House, 24 Allan Park, Stirling, FK8 2QG, Tel**:** 01786 479 697, Email**:** Natural-Talent@btcv.org.uk.

Fig. 2. Mentors and apprentice: (left to right) Jeanne Robinson (Glasgow Museums), Geoff Hancock (Huntarian Mueum, Glasgow) and Moya Burns (BTCV apprentice).

12-13th May 2008 Exploiting geoscience collections

Geological Society, Burlington House, Piccadilly London.
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Check GCG website for booking form.

Contact: Jeremy Giles, National Geoscience Data Centre, British Geological Survey, Keyworth, Nottingham, NG12 5GG. **Tel:** +44 115 936 3220. **email:** jrag@bgs.ac.uk

The Nest Collections ofthe Natural History Museum & of the Hunterian Museum, University of Glasgow: Developing a UK nest collection resource

Maggie Reilly, Curator of Zoology, Hunterian Museum, University of Glasgow
Douglas Russell, Curator Bird Group, Natural History Museum, Tring

Introduction

Birds' nests are a fascinating and valuable source of ornithological information, physical evidence of a particular aspect of the animal's life but curiously, nests are under-represented in collections. Where they are present, in the face of intense competition on curatorial time, their curation is often considered a 'low priority'. Nonetheless, this once neglected area of natural history collecting is at last receiving the attention it deserves, with the organisations holding the two largest collections of nests in the UK successfully working together to develop a major UK nest resource. The Natural History Museum (NHM) and the Hunterian Museum, University of Glasgow, have now been collaborating for over a year to enhance their respective collections in a co-ordinated manner. The National Nest Reference Collection (NNRC) at the Hunterian is explicitly focused on building up comprehensive geographical and time series coverage of British bird species, an area in which the NHM's collection is distinctly lacking.

Natural History Museum Collection

The NHM collection of nests at Tring contains around 4000 specimens, making it the largest collection of its kind in the UK. However, it is also a rather 'ad-hoc' collection, built up over the last 250 years by the largely unplanned acquisition of specimens from all over the world. In comparison to more intensely used collections such as skins, eggs and osteological material, it has received relatively little curatorial or research attention in recent years. Recent research though has highlighted the collection's historical and scientific importance (Steinheimer, 2003; Hansell, 2005) and over 170 different collectors have so far been recorded as having contributed nest specimens to the NHM, many from poorly represented and often remote destinations. Some were collected by renowned names in Zoology, e.g. John Gould (1804–1881), the ornithologist and publisher; Robert Ernest Cheesman (1878–1962), the explorer and naturalist, and John MacGillivray (1821–1867), the distinguished Scottish naturalist.

Over 30% of the NHM nest collection (1238 specimens) comprises Herbert Stevens's series from the Sikkim Himalaya in India. A prolific collector of Asian bird specimen material, study skins collected by Stevens are found in a number of institutions, including the Field Museum in Chicago, the Hancock Museum in Newcastle and the NHM. When he died in 1964 aged 87, he was still working on the arrangement and documentation of his egg and nest collections; consequently a great deal of cross referencing to the skins will be required to unlock these collections full potential. Thankfully, almost every single nest still bears its original collector's ID number so, although time consuming, cross-referring the data held in different museums is a viable future project.

This is moreover not the only series of nests to be linked with specimens contained in other venerable institutions. 1932 was a sad year for ornithology both at Tring and in the U.K. more generally. In perhaps his darkest hour, Lionel Walter Rothschild (1868–1937) was in severe financial straits, and when Dr Leonard Sanford arrived in England with a blank cheque from Gertrude Whitney, Walter felt compelled to sell his unique 280,000 strong bird skin collection to the American Museum of Natural History (AMNH) in New York. However, his collections of thousands of eggs and nests, many of which were collected in conjunction with some of the skins destined for New York, were not included in the deal and passed to the NHM as part of the Rothschild Bequest after his death. Rothschild had employed a complex worldwide network of over 400 collectors and 25% of the NHM nest collection derives from the Rothschild Bequest. Many of these specimens are from otherwise poorly explored areas, which makes these nests especially important.

In 2006 the Bird Group was awarded a student bursary to fund work on data reconciliation of the Rothschild nests collected by William John Ansorge (1850-1913) in Angola & Gabon with the corresponding parental skins now in the AMNH. A Cambridge undergraduate, Chloe Hardman, worked diligently cross-referring the original collector's ID numbers and nest labels with information held with the skins in New York. This work is now complete and being written up for publication. In a digital age, such collaborative projects are becoming increasingly practical and unquestionably enhance the utility of the collections of each institution involved.

Viewing separate collections as a collective, rather than a disparate resource clearly has distinct advantages. This ethos underlay the organisation of the first meeting of museum bird curators of Britain and Ireland in Cambridge in March 2006. Following initial discussions at this, Maggie Reilly and Mike Hansell from the Hunterian Museum, University of Glasgow, visited Douglas Russell at the NHM bird collection in August 2006 to discuss co-operative approaches to nest curation. The Hunterian's focussed series of British nests naturally complements, rather than competes with, the geographically and taxonomically broader NHM collection; preventing duplication of effort and providing potential opportunities for exchanges of material.

The Hunterian's National Nest Reference Collection

The NNRC came about as a result of a collaboration between a University of Glasgow academic, Professor Mike Hansell, with a specific research interest – the building behaviour of animals -and a University Museum sited in the academic department. In the course of his life-long study of the structures that animals make, Hansell had built up a collection of artefacts, initially arthropod structures as this was the focus of his earlier researches. However, from the late 1980's onwards, his interests turned towards birds' nests. The collection has grown and diversified in response to this developing research need but collecting accelerated after the impetus lent by creating an exhibition, for 1999, called 'The Animal Construction Company'. This was the Hunterian's contribution to Glasgow's year long festival to celebrate winning the prestigious European City of Culture award.

Building year on year, the NNRC now numbers over 1000 nests and images represents around half the 246 known breeding species. The Hunterian manages the nest collection and Mike Hansell co-ordinates the acquisition of nests. The aim of the collection is to build up multiple examples of the nests of each species of British breeding bird. This provides for studies of within-species as well as between-species variation in nest building. The bulk of the nests donated to the NNRC are collected by a network of professional and amateur ornithologists who respond to our requests for specimens. Particularly useful are nests that are linked to surveys or research. An example of this is an arrangement with the Nottinghamshire Wildlife Trust. Their Treswell Wood site has been intensively studied for many years with a bird census conducted each year since 1976. The NNRC has received nests for several species from this project since 1999, thereby building up a time series with excellent supporting data.

Ethical and legal guidelines are followed when collecting nests and field collectors are provided with instructions for collecting so as not to disturb the birds. Nests are an ephemeral resource for most birds – most species build, use and abandon the nest in a season. Nests that birds are likely to be re-used are not collected. Other practical restrictions apply. Many birds nest in scrapes in the grounds or burrows or similar uncollectable sites. Very large nests are not collected on the grounds of limited storage space. For such nests, where possible, photographic records plus data are acquired.

Relatively commoner species such as blue tits, chaffinches and blackbirds are well represented whereas less common species may not be represented at all. Some collection highlights are nests of the hawfinch (Fig. 1), the Scottish crossbill (Fig. 2) and the golden oriole (Fig, 3). These birds have very restricted breeding ranges in the UK.

Fig. 1. Hawfinch, *Coccothraustes coccothraustes*, nest (cat. no. 130286) from Pertshire.

Fig. 2. (above) Scottish Crossbill, *Loxia scotica,* nest (cat. cn. 126114) from Roshire.

Fig 3. (right) Golden oriole, *Oriolus oriolus*, nest (cat. No. 117473) from Suffolk.

The nests have a variety of uses in research, teaching and display. Nests may be of interest to ornithologists, entomologists, conservation scientists and botanists. Specific examples of research projects include the following: continuing his research this year Mike Hansell, and Dr Sue Healy of Edinburgh University, are studying the role of cognition in nest building using blackcap and garden warbler nests and this season a special request has gone out to field collectors for nests of those species. Over the last two years, Dr Charlie Deeming and Rosetta Blackman of the University of Lincoln have conducted a study into the insulation properties of nests correlated with parental attentiveness to the nests. Starting with a hypothesis that nests with low insulation would be built by birds that sat on their eggs for longer, the study did not prove this to be the case. Instead the surprising finding was made that thermal characteristics of blackbird nests correlated with the latitude at which they were built e.g. Scottish nests were thicker and better insulated. This study is now being extended to examine this unexpected result.

Undergraduate honours degree research projects looking at the composition of blue tit nests and the attachment mechanisms of reed warbler nests have been carried out. The Association for the Study of Animal Behaviour used photographs of nests in the Hunterian collection to prepare an on-line resource pack for secondary school teaching. There is also interest from writers and artists in the collection – a magpie nest that incorporated lots of bits of metal drew a great deal of attention! The main Hunterian Museum has just re-opened after a refurbishment and now includes a display on Animal Architecture where bird nests form an eye-catching centrepiece to the exhibit. The long-tailed tit and its nest (Fig. 4) a saliva nest from a cave swift and basket nests from Trinidadian oropendolas are amongst the intriguing specimens on show.

Conclusion

Bird nests are an important record of part of the lives of birds. In the past they have not received sufficient collecting or curatorial attention. A collaboration between the Natural History Museum and the Hunterian Museum in Glasgow is devoting time and expertise to acquiring and curating nest collections and increasing awareness of their importance and utility. A collaborative approach brings several mutual benefits. It will reduce duplication of effort, share scarce curatorial and academic resource and holds much potential for joint research projects to be developed.

Postscript

In response to feedback at the conference, we would like to produce a directory of nest collections in the UK. If you are interested in contributing to this please email Maggie Reilly (mreilly@museum.gla.ac.uk) a brief summary of your holdings and include your contact details. The submissions will be collated and an on-line directory made available at the Hunterian website.

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Fig. 4. Mount (cat. no. 130936) and nest (cat. no. 126127) of a long-tailed tit, Aegithalos caudatus. 'Star object' in a display on Animal Architecture at the refurbished Hunterian Museum (reopened in May 2007)

NEWS

Notices, Adverts & Meetings

Have you seen this label?

(Not to scale)

Plymouth City Museum and Art Gallery are currently undertaking a large project on a collection previously owned by Sir John St. Aubyn, the 5th Baronet (1758 to 1839). Recently we secured a grant from the Esmée Fairbairn Foundation to enable the museum's natural history department to conduct a variety of work on this collection. Currently, there is much interest in the 'missing' elements of the mineral collection and the journey to their respective resting places. After his death, Sir John St. Aubyn's collection was split by the mineral dealer Isaiah Deck (1792-1853), and although an extensive collection was arranged for the Civil Military Library at Devonport (now at Plymouth City Museum), the remaining minerals were auctioned.

As part of the project, Plymouth City Museum and Art Gallery is trying to locate other specimens from Sir John's mineral collection. We hope to locate as many specimens as we can so that Sir John's collection is fully documented. Our wish is to authenticate and photograph every specimen both in the museum and in other collections so that we can create an online digital database. Above is an example of one of the oldest labels associated with St. Aubyn's mineral specimens. If you think you may have a Sir John St. Aubyn specimen or you have any information about the history of this collection, please contact Plymouth City Museum. We understand that you may not want to participate in this project, but we would like to reassure you that we would only want to authenticate and photograph your specimen. For more information about Sir John, his collection and the labels associated with his minerals, please contact Plymouth City Museum and Art Gallery on 01752 304765 or email st.aubyn@plymouth.gov.uk. You can also visit our website www.plymouth.gov.uk/museums.

The International Institute for Conservation of Historic and Artistic Works IIC Congress 2008 – 'Conservation and Access'

Registration is now open for IIC's twenty-second international Congress, which will take place in London from the 15th to the 19th of Sept 2008. Full details are available at www.iiconservation.org

Enabling people to access and enjoy art and heritage is our shared aim. Cultural institutions throughout the world strive to provide and encourage physical and intellectual access to their collections and sites. Conservators and conservation scientists play a vital part in enabling cultural heritage to be enjoyed while not compromising its condition or survival.

The programme will examine the central role of conservation in the presentation and protection of the world's cultural heritage. It will explore the many ways that heritage professionals engage in this sharing worldwide, whether that involves people going to see that heritage or the heritage itself travelling the globe. An impressive range of over 40 speakers is lined up to report on contemporary thinking, current research and examples of best practice. Topics will include conservation involvement in:

- safe packing and transport
- managing the exposure of vulnerable objects and sites
- collaboration in education projects and enabling handling of collections
- strategic conservation management and prioritising access
- the use of computer technology for access
- discovering public attitudes to restoration
- public engagement with conservation

The varied locations for conservation involvement cover the range of archaeological sites, monuments, historic houses and churches, museums, libraries and archives. The types of object dealt with range from manuscripts to murals and from fossils to fireboats.

The approaches vary from technical experimentation to philosophical analysis, yet there is a common theme of assessing risks and judging the critical balance between access now and preservation for the benefit of future generations.

Contact details: Graham Voce, Executive Secretary, International Institute for Conservation of Historic and Artistic Works (IIC),6 Buckingham Street, London, WC2N 6BA
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Book Review

The Echalaz Bird Collection by Adrian Sailor. 76pp, 98 colour images, 23 halftones. Published by MPM Publishing, Ascot, 2007. ISBN – 978-09545596-7-0 Available from MPM, West Mains, London Road, Ascot, Berkshire, SL5 7DG price £28 plus £3.50 p&p.

Two reviewers kindly looked at this book. Here are their thoughts:

This is a small hardcover colour book, focusing on the taxidermy collection of Lieutenant Colonel Charles Theodore Echalaz (1844-1913). The author's own description of this book, pretty much sums it up: "This new book is a photographic record of the condition of the cases in 2007 with a brief description of the contents, condition, taxidermist and also where many of the birds were acquired".

After the short preface follows a biography of Charles Echalaz himself. Echalaz turns out to be a fascinating chap; a man very much of the Victorian era in which he lived. Plagued with ill health during his army career, Echalaz filled his spare time with hunting and shooting trips in India and the British Isles. It is the results of his British (and Irish) trips that make up the main subject of this book. Another point to make about Echalaz is that - unlike many Victorian museum benefactors - Echalaz did not simply leave his collection to a museum after his death. The Colonel was present at Waterloo Museum in Liverpool for the opening ceremony, and even gave a speech. (cont.)

However, this was just the beginning of the story for Echalaz's collections. During WWII - after a near miss on the Waterloo Museum by a Luftwaffe bomb - the collection was moved to Stockport Museum. In the mid 1960s it was moved back to just a few miles north of it's original home in Waterloo, albeit to the Department of Health in Crosby! In 1967 it found it's way to Crosby Library where a purpose built room was created for it called (unsurprisingly) the 'Echalaz Room'. After neglect, vandalism and burglary during the 1980s the Echalaz collection was finally moved into storage, where it still resides today. And, what of the Echalaz room in Crosby Library? - well, it is now a computer room, incongruously still bearing the Echalaz name above the door!

After a more detailed look at the taxidermists involved in making Echalaz's collection, the author moves on to descriptions of the cases themselves. The pictures are of the cases as they are today with a few reproductions of the original pictures in Echalaz's guide (unfortunately many of the recent photographs are at different angles from the originals, due to the constraints of council basement photography). The note-like text in this chapter is brief and clinical, e.g. "Glass intact, tape deteriorating. Painted backdrop sea and cliff scene, clean." Despite being a rather tedious part of the book (essentially a catalogue), this section could be useful to curators when starting to try to match a name to unsigned taxidermy cases in their own collections.

Apart from maybe a little more editing needed in the previously described 'Cases' section, my major criticism of this book (strangely enough) is the page numbers. Instead of plain old 1, 2, 3..., the decision was made to include a tiny vignette of Echalaz's face above the number on every single page. The whole idea is so reminiscent of Terry Gilliam's early animations, that on flicking through the pages I half expected Echalaz's mouth to open and close before a large foot to fell on his head! Otherwise, this is a perfectly presentable little book. If nothing else, it is worthy of publication as a record of this much-neglected collection. The interesting story of Echalaz's life is well researched, the history of his collection is a sobering reminder of the difficulties faced in order to house and maintain large natural history collections, and the pictures and descriptions are an important reference when researching taxidermy artists.
All in all, I think this book would be a welcome edition to any taxidermy enthusiast or natural history curator's bookshelf. It will certainly sit rather happily within the taxidermy section of our natural history library here in Norwich.

David M. Waterhouse
Assistant Curator of Natural History, Norfolk Museums and Archaeology Service

This fine publication is based on the collection of Lt. Col. C.T. Echalaz who donated it to the people of Liverpool in 1907. In recent years, a great deal of interest has developed around the history of taxidermy and taxidermists and this volume introduces us to the work of four eminent taxidermists of the period, Cecil Bisshopp of Oban, William Rochford Hine, Thomas Pickin and Charles Thorp. The book also introduces us to the collector himself and his attachment to the Waterloo area of Liverpool as well as the history of the collection which became a central part of the displays at the newly established Waterloo Museum which opened in 1908. Bombing, vandalism, several moves and the vagaries of time have taken its toll on the collection and, unfortunately, it is now held in a basement store in Crosby. Why do all such collections end up in basements or attics?

Museums have long discussed the problems of the storage and display of Victorian cases of taxidermy and Adrian Sailor takes this opportunity to look at the acknowledged problems of such collections and puts forward some of the arguments for and against a long-term viable future for this interesting and important material. If this collection was truly acknowledged as the work of a series of important artist-craftsmen, (which it is), we would not need to discuss the collection's future, and funding would, undoubtedly, have been found to house and display this material in a proper manner. It would thus have taken its proper place as part of our collective and creative history. This book should be read by all who are in charge of important historic taxidermy.

Adrian Norris, Joint-chair, ICOM Nat. Hist. Working Group on the Art of Taxidermy and its Cultural Heritage Importance

NatSCA - Adhesives Seminar

Flett Training Room, Natural History Museum. October 8th 2008

The adhesives seminar will discuss which adhesives are best for certain jobs in natural sciences conservation work. We are planning to outline the various types available, new types on the market, old types that are either no longer suitable or which are still used.

We need to take into account longevity, discolouration, molecular cross-linking with substrates (good [for strength] or bad [alters composition of substrate]), molecular structure, physical strength and techniques that can ameliorate present adhesive-conservation technology.

This will involve lots of practical demonstrations.

For further information, please contact Simon Moore (simon.moor@hants.gov.uk)

For booking information, please contact Tony Irwin (tony.orwin@norfolk.gov.uk)