Natural Sciences
Conservation Group

Newsletter

Issue 17 May-September, 2001

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NATURAL SCIENCES CONSERVATION GROUP

The NSCG-BCG Merge
Pyrite Decay Meeting
Transferring biological specimens from formalin to alcohol.
SPNHC 15th Annual Meeting

The Society

The Natural Sciences Conservation Group promotes: research and exchange of ideas; advances in technical and ethical standards; the public profile of the conservation and preservation of natural science collections and objects; training; and publications.

Membership

The Group is keen to open its membership to all those involved in the care and conservation of natural science objects and encourages their active participation.

Annual Subscription

Students (UK only)	£8.00
UK personal	£10.00
Overseas personal	£12.00
Institution	£25.00

Newsletter

The Newsletter is a forum for articles, views and opinions on the care, conservation and curation of natural history and associated material. The Newsletter is produced three times per annum (January, May and September) and is free to all members.

Advertisements

1/4 page	£15.00
1/2 page	£25.00
Full page	£50.00

Instructions for Authors

Material should be type-written and double-spaced in A4 format and if possible accompanied by a text file or Word document on disk (Dos-formatted). The pages should be numbered and the position of any tables and/or figures should be indicated on the hard copy. The names of animal and plant species should be underlined and the authority name given in full for the first time used, thereafter they may be omitted. All references should be given in full. Articles and other items for inclusion should be submitted to the Editor at least three weeks before the publication date.

Opinions expressed in the Newsletter are not necessarily those shared by the NSCG Committee, the Editor or the membership at large.

Editorial

"*There is no way to make people like change. You can only make them feel less threatened by it.*" Frederick Hayes, 1969

Those of who attended the joint AGM of the NSCG and the BCG, will undoubtedly have spent some time contemplating the topic on everyone's lips, the merge! (that and hangovers). If you haven't, well the time has come to make yourselves be heard. This newsletter includes a few pages on the pros and cons of a possible merge of the two societies, and inserted is a slip on which you must make your views be known to the committee.

I personally feel that if we are to survive and even grow, produce a descent and maybe even refereed journal and have a bigger voice in the museum world we must join forces and speak as one. However, the decision lies with you, the membership.

I am currently working in the Entomology Department at The Natural History Museum, London sharing my Museum Skills, well, what little I have. I've even got a free T-Shirt and balloons from the Millennium people, since I am now a member of the Millennium Awards Fellowship. I have noticed that throughout the Sharing Museum Skills awards scheme, little has been natural sciences based, are we too busy, or frightened of applying, or maybe its just we don't have the inclination. If ever there was a group of people who needed to get out there, network, share our skills and ideas with others, it's the natural science conservators and curators. We moan that the arts, IT, and 'front of house' gets more cash than us, but when its available we don't seem to apply. If nothing else, the balloons make it worth it.

As I step down at the next AGM, we shall be in need of a new Editor. Any members that feel they would like to fulfil their destiny by becoming an editor, please make yourselves known to a member of the NSCG committee.

Cheers

D.

VIEW FROM THE CHAIR

Another AGM has passed (our 8th since we first formed within UKIC in February 1993 and our 6th as an independent group). Bob Entwistle came to the end of his three-year term of office and I thank him for all the time and effort he has spent furthering Natural Science Conservation interests. I am sure he will continue his good work on committee! I also wish to thank Adrian Doyle and Vicky Purewal who have retired from committee. You have a new Chair who is not a full time or accredited conservator, although conservator nonetheless and expert in the small field of microscope slide conservation. I hope to serve NSCG's best interests as I have already done as Secretary. The view from where I sit is good, with two seminars planned for later in the year, one on historic insect collections and one on fluid preservation "do we really understand it". My time as Chair may see much change but to put any changes into perspective, let me précis our history.

The origins of the group lie in a lunch-time meeting at the Madrid World Congress; on the care and conservation of natural history collections, in May 1992. Those present (Kate Andrew, Chris Collins and Steve Garland) arranged a meeting at The Natural History Museum, on the 4th November 1992, where they called themselves the natural science collections care group. At this meeting were presentations from the United Kingdom Institute for Conservation (UKIC), from John Cooper (the then Geological Curators Group chair) and from the Society for the Preservation of Natural History Collections (SPNHC), the latter presented by a communication read by Kate Andrew. UKIC, who gave a very slick presentation, won the day. A working party met in York on 30th November 1992, where the group was constituted and a committee voted in place. The NSCG was formalised as a special interest group of UKIC in February 1993. Within two years, the UKIC changed their constitution so that it was necessary to be a member of UKIC before one could vote or be NSCG section committee members. We had a minority of 12 full members of UKIC within the NSCG membership and with the UKIC membership fee at about £60 (now about £120), we declared UDI and became independent.

Our membership has been growing steadily from the initial 25 to 130. We are a smaller and younger group compared to GCG and BCG but our influence on The National Council for Conservators and Restorers (NCCR) has been noticed and is greater than our small membership might indicate! NSCG is soon to take the Chair of this Council, which informs Government (via Resource) of our views as professional Conservators on National Policy. We have also gained charitable status for which we can thank Kate Andrew, Tracey Seddon and Maggie Reilly for their efforts.

Ever since we set up, a vision held be some, has been to see the amalgamation of all Natural Science collections care interests into one group, much along the lines of SPNHC in North America. Such views were published within The Newsletter (Issue 6, September 1997) when Simon Moore and myself put forward arguments for and against closer links with GCG and BCG, as well as the development of 'professional accreditation' within Conservation. Our own "way forward" working group, chaired by Kirsten Walker was set up three years ago to examine this issue and reported the need to maintain our identity as conservators. It also identified problems involved with the close association between GCG and The Geological Society.

Ten of our members have acquired 'Accreditation' via the 'Fast Track' route (with UKIC). So far there has been no Natural Science candidates for the new route to Accreditation via NCCR. This may reflect that many of our members are, like myself, hybrid conservators, curators, collections managers, registrars, education officers or whatever and so an accreditation for only part of our job is not so relevant to our professional status. Closer ties or even merging was discussed at both the BCG and the NSCG AGMs this year in Oxford. A working group will meet this summer to discuss this issue and the outcome of such talks will be published. If you have any strong views on the subject or on any other subject concerning Natural Science Conservation then please send letters to Darren Mann, our Editor, as 'The Newsletter' is the vehicle for your views! If we do merge with BCG our status on NCCR is assured, much as the Society of Archivists are represented and we will not have our views swamped by curators and managers because we will continue to make our conservation voice heard! One united group could mean an improved journal, one membership fee and better communication. Maybe GCG may will be interested in joining such a united group?

Paul A. Brown

Closer ties or a merger of NSCG with the BCG and possibly with the GCG

At the 2001 AGM of NSCG in Oxford, a proposal was made that a working group should look into closer ties with BCG and GCG with the possibility of forming one much larger combined society. NSCG had previously set up a working party, when this was first proposed three years ago, as covered in "View from the chair" this issue.

A working party met on 27th July to consider the proposal made at the 2001 AGM. BCG have taken the matter forward with their membership by publishing a paper in their August 2001 Issue 20, proposing a merger of BCG and NSCG and including a straw poll form with an SAE. NSCG committee had not had a chance to discus this further until a committee meeting on the 26th September in Birmingham.

NSCG committee decided that both the very positive views published by BCG, together with some alternative views should be presented. This would allow members who might not be fully aware of the arguments to have some basis upon which to make a decision.

NSCG committee has also requested that GCG also undertake a similar exercise. Opinions vary within NSCG committee members, however, it was felt that NSCG members views, rather than just those of the committee or a working party should be taken account of following the strength of opinion for closer ties expressed at the AGM

NSCG is a registered charity and as such, has to operate within the terms of its constitution, relevant parts of which are reproduced below. A full version of the NSCG constitution was published in issue 15, pp 25-30 (September 2000). As a charity, NSCG is required to fulfil its objects for the public benefit, rather than the benefit of its membership. The Trustees (i.e. the committee) are required to act in the best interest of the charity.

At this stage, NSCG wishes to gauge the opinion of its membership on whether a merger with BCG and GCG would be beneficial. To this end, NSCG committee has also decided to include an SAE for return of a straw poll ballot.

Amendments to the NSCG constitution require a two-thirds majority in favour; in order to proceed with any next steps, a similar majority would be required from this straw poll. NSCG committee would then work up necessary amendments to the constitution and possibly the organisation's name to be presented at the AGM in 2002 which would in turn require a two-thirds majority to be passed.

Relevant sections of NSCG constitution

1. Name

The name of the charity shall be the Natural Sciences Conservation Group, (or other such name as the Trustees may from time to time decide with approval from the Charity Commissioners).

The Group (hereinafter called the charity) is an unincorporated association with Charity Trustees elected by its members.

2. Objects

The objects of the charity shall be:

2.1. To advance the education of the public in natural science collections conservation.

2.2. To promote for the benefit of the public, the highest standards in the conservation, development, preparation, care and display of natural science collections and specimens.

3. Powers

In addition to any other powers which the Trustees may exercise the following powers in furtherance of their objects.

3.1. Power to encourage and develop education, training and research in natural science conservation through publications, regular meetings and seminars.

3.2. Power to raise funds and to invite and receive contributions, provided that in raising funds the trustees shall not undertake any substantial permanent trading activities.

3.3. Power to invest the funds of the charity in any of the investments for the time being authorised for the investment of trust funds.

3.4. The Trustees shall have the power to provide indemnity insurance for themselves out of the income of the charity provided that any such insurance shall not extend to any claim arising from any act or omission which the Trustees knew to be a breach of trust or breach of duty or which was committed by the Trustees in reckless disregard of whether it was a breach of trust or breach of duty or not.

3.5. Power to do all such lawful things as are necessary for the achievement of the objects.

5. Meetings and Proceedings of the Charity Trustees

5.1. The Trustees shall be charged with the organisation and promotion of the group.

5.2. The Trustees shall carry out the wishes of the membership as determined at the Annual General Meeting of members.

5.3. The Trustees shall meet as a committee at least three times a year in additional to holding an annual general meeting.

5.4. The quorum required for any meeting of the Trustees shall be three Trustees or one third of the total number of Trustees whichever number is the greater.

5.5. An emergency or special meeting of Trustees can be called to discuss a particular matter with 7 days notice.

5.6. The Trustee holding the officer post of chair shall chair all meetings, in their absence this duty can be undertaken by one of the other officer posts.

5.7. The chair has a right to a second or casting vote when the number of Trustees voting for or against a resolution are equal.

5.8. Minutes of meetings shall be taken.

15 Powers of Amendment

15.1. Subject to the following provisions of this clause, the Constitution may be amended by a resolution passed by not less than two-thirds of the members present and voting at a general meeting. The notice of the general meeting must include notice of the resolution setting out the terms of the amendment proposed.

15.2. No amendment may be made to clause 2, clause 3.4, clause 12, clause 14, clause 16 or this clause without the prior written approval of the Charity Commissioners.

15.3. No amendment may be made which would have the effect of making the charity cease to be a charity at law.

15.4. The Trustees must:

a. promptly send to the Commissioners a copy of any amendments made; and

b. keep a copy of any such amendment with this Constitution.

16. Power of Dissolution

If the Charity Trustees decide that it is necessary or advisable to dissolve the charity, they shall call a meeting of all members of the charity of which not less than 21 day's notice (stating the terms of the resolution) shall be given. If the proposal is confirmed by a two-thirds majority of those present and voting, the Charity Trustees shall have the power to realise any assets held by on or behalf of the charity. Any assets remaining after the satisfaction of any proper debts and liabilities shall be given or transferred to such other charitable institution or institutions having objects similar to the object of this charity as the members of the charity may determine, or failing that, shall be applied for some other charitable purpose.

A Proposal to Merge BCG With NSCG.

Steve Thompson (Secretary BCG) & Paul Brown (Chair NSCG), August 2001.

At the recent AGMs of both BCG and NSCG, there was a desire expressed to look again at the idea of merging the two groups. Many people at both meetings felt that there were considerable benefits to be gained from such a move, and that any drawbacks were outweighed by these benefits. An exploratory meeting was held on Thursday, July 27th, at the Natural History Museum, which concluded that such a merger appeared to be highly desirable, and what follows summarises the points that were discussed at the meeting.
We are seeking to gain benefits in two ways. The first is to improve the efficiency with which the groups are operated and the second is to improve the effectiveness with which we achieve our aims. The principal aim of both groups is to promote the care, development and use of the collections entrusted to our members and institutions. To support that aim, we are concerned with raising awareness of both our collections and our workers, and are aware of the ongoing problems facing the Geological and Biological Museum community.

With the above in mind, we believe the principal benefits to be the following:

- A single committee. We are only too well aware of how difficult it is to attract committee members who are able to offer the commitment necessary to do the job effectively. In addition, any communication problems that might exist between separate committees would be removed, and the problem of co-ordinating group activities would also be removed. The more groups that are involved, the worse this situation becomes. Good committee members are in high demand!

- A single meetings programme. There are few preferred slots in the year to run meetings, and all the groups go for them. Avoiding conflicting dates should elicit greater attendance. Furthermore, it is not uncommon for meetings by two groups to be on similar themes, which duplicates effort. Poor communication would cease to be an issue and meetings should be more economic to run.

- A single journal, and newsletter. One newsletter would carry more news and advertising and one journal would have more, and better, peer-reviewed papers, which would be of greater appeal to members and have a greater outside influence. Also, such a journal would have a larger and wider circulation and have more funds available for improving it. The merging of two sets of articles would go a long way towards relieving the pressure on editors to find copy for the publications and would avoid the repetition that occurs at present. There would be a considerable cost saving both in production and postage.
- A single subscription and set of finances. A single subscription would be greater than the current individual subscriptions, but substantially less than two. This would, of course, benefit those who currently belong to more than one group, but would also reflect the wider scope of the single organisation. The financial resource would also be considerably greater than that of an individual group, allowing us to achieve, for example, more one-off publications, improved publicity material, expensive keynote speakers, sponsorship of events, support for junior members, to name but a few.

- Greater influence. It is almost always the case that a bigger organisation has a bigger impact than a small one. Big trade unions or companies carry more influence, and are taken more seriously than little ones, and those of you who work in small museums will know of the extra advantages that the large museums have. However, there is more than simply being able to shout louder.

- A more streamlined operation, with the removal of conflicting meetings and duplication of effort, would mean that committees can be more effective and give members better value for money. Greater resources mean greater, and more focused efforts in the areas where we do act. Higher quality products mean greater impact on outside bodies.

- A single body is easier to deal with than a number of smaller bodies, which is crucial when we are trying to get people to pay attention to us such as government bodies and SPNHC. Furthermore, it is also more likely to attract would-be new members, including influential individuals who may be able to help us achieve our aims more effectively. It may also draw in members from abroad who might not join any of a

selection of smaller groups. A bigger and better run group is potentially more attractive and so becomes yet bigger and more influential. United we stand, divided we fall.

There are potential drawbacks, as various people have pointed out. The key issue is a perceived loss of identity of individual groups and their aims and a reduction in their voice and influence. None of the aims and purposes of the individual groups are in anyway incompatible with those of the single larger group. It is proposed that the aims, committee and constitution of any new group would be established in such a way that all of these aims would be explicitly included, promoted and mutually supported. Smaller groups can gain the support of a much larger membership. It was felt that other issues raised, such as affiliations to other groups and charitable status, are practical issues, to which there are satisfactory practical solutions. With the right people on committee, there need not be a reduction in any groups' voice or influence!

The question of which groups would be involved was addressed. There are three sister groups in the UK, the Biology Curator's Group, the Natural Sciences Conservation Group and the Geological Curators' Group. This proposal was raised, and is being discussed, by the first two of these groups. However, if the above potential benefits are actually realised by the merger of these two groups then it should be apparent that merging all three groups would be even more effective and beneficial to all concerned. There appears to be a feeling within GCG that they do not wish to be involved at the present time but they are invited to become involved to whatever extent they feel appropriate. Should they still decide not to be involved, this should not stand in the way of the continued co-operation, collaboration and mutual support currently enjoyed by the three groups.

A few potential drawbacks to merging.

The paper below is based on part on the discussion document produced by Paul Brown for the joint working group between NSCG and BCG. This meeting was held at the Natural History Museum on 26th July 2001 and was chaired by Rob Huxley. This paper includes contributions from Kate Andrew, Bob Entwistle and Vicky Purewal, together with some additional points made by Bob Entwistle, those parts in inverted commas are direct quotations.

1. Loss of identity for NSCG and for Natural Science Conservators and Conservation.

The BCG membership is much larger than ours. Will we be swamped? We parted from UKIC to gain a stronger voice and now have a greater influence through NCCR!

Would NSCG's healthy, monetary state be swallowed up by BCG ?– NSCG's assets can only be passed on to another charity with similar objects, but NSCG could extend it's objects.

Some (especially the professional full time Conservators) would rather be members of 'THE' Natural Science Conservation Group, than a member of a smaller sub-group again. Jerry Weber of the Society of Archivists (which is a similar mix of archivists and conservators) said "if we were to go along this route, we may have to learn how to shout loudly to make our voice heard". Conservators within SPNHC don't seem to have this problem.

Within the NSCG membership, there is a dichotomy in views between those who consider themselves Professional and Accredited Conservators and those who are Natural Sciences Collections carers who are interested in Conservation and/or do the job of conservator part time. Most (but not all) Accredited Conservators want to remain independent and most (but not all) hybrid natural science museum workers want to merge.

The forty members attending the AGM in Oxford may have been principally those who are also BCG members, since it was a joint meeting. How

much of an overlap with BCG and GCG is their in our membership? Do those members not at the AGM share their pro-merger views?

Establishing the discipline of conservation within the Natural Sciences has been hard work; NSCG is now know as the point of contact for both mainstream conservators and collection managers and curators seeking information. Would a merged group still maintain such a profile?

"NSCG is not concerned with systematics, biodiversity, field work, surveys, biological monitoring, recording and curation. This is the concern of the BCG. NSCG is a group for natural science conservators and for biologists interested in learning about natural science conservation. There is an overlap as fortunately curators wish to use conservation materials and techniques, but they should be learning this from a specific source and that is experienced Natural Science Conservators. NSCG is unique in what it is trying to achieve and has started to raise its profile quite considerably. Natural science conservation is extremely important in its own right and should be able to continue to do its good work without its being encompassed by a stronger, richer body".

2. Two-way merge is not desirable as compared to a three-way merge.

One view stated is that "a merger is only sensible if it brings together BCG, GCG and NSCG. There would be no benefit for a two-way merge - this could be misinterpreted as group 'x' being weak and having to join up with group 'y' to become financially viable, or to increase membership or to increase influence. A three-way merge with specialist meetings plus a joint AGM would be a much better vision and would not suffer from the above negative spin". Many who wish to see a merger would prefer all three groups to be involved to be like the SPNHC model.

The 'straw poll' voting slip is enclosed with this edition of The Newsletter along with an SAE. Please use it to represent your views and return it to Amanda Sutherland a.s.a.p.

Pyrite Decay Seminar

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The NSCG ran a very successful one-day seminar on Pyrite Decay on the 27th February 2001. The seminar, co-ordinated by Adrian Doyle, was held at the Natural History Museum, London and. was very well received, with approximately 25 people attending. The day was divided into the morning session of six talks by guest speakers and after lunch a visit to the Palaeontology Conservation Unit to see demonstrations of different treatments for pyrite decay. The last hour of the day was set aside for refreshments and informal discussion.

Paul Davis – A curators requirement for pyretic specimens

The first speaker was Paul Davis, a curator of Palaeo-Botony specimens at the Natural History Museum. He discussed the relationship between curators and conservators within collections management and the potential conflicts that may arise. The role of these two clearly overlap in the caring of objects although there are some subtle differences. Curators wish to handle and extract information from the specimens, whereas conservators are primarily concerned with the preservation of the specimens. This conflict is duplicated in the primary function of the museum, to hold the collections as a permanent resource to be held in trust for future generations and it's mission to maintain and develop its collections and use them to promote discovery, understanding, responsible use and enjoyment of the natural world. Paul Davis discussed the importance for the conservator and curator to communicate with each other and to identify common aims, needs and priorities with particular emphasis on specimens that had evidence or the potential to suffer pyrite decay.

David Gray – A case study: *Liopleurodon*

David is a conservator in the Palaeontology Department of the Natural History Museum, London. The specimen of *Liopleurodon ferox*, a pliosaur from the Oxford clay was found near Peterborough, about 60 years ago. David discussed the conservation and storage of the upper and lower jaw

of this specimen. The specimen was cracking and breaking due to pyrite decay caused by inappropriate environmental storage conditions. The previous conservation and repair treatments were outlined. Then David demonstrated how he had recently made a thorough attempt to understand the true nature of the specimen decay and solutions he had implemented for the long term storage of the specimen. This specimen was later shown to the group in the afternoon in the Palaeontology Conservation Unit.

Adrian Doyle – Barrier films and microclimates

Adrian Doyle is a conservator in the Palaeontology Conservation Unit at the Natural History Museum, London. Adrian described how he produced a large-scale 'micro-climate' enclosure for actively decaying pyritic plant specimens. To overcome the problem of having to use individual Stewarts® boxes for each specimen, he demonstrated how an existing, free standing, two cubic metre collections cabinet could be wrapped in a moisture resistant barrier film, (Marvelseal® 470), to provide a large scale 'micro-climate', using Art-Sorb® as an environmental control.

By using radio telemetric data loggers to monitor the environment, he showed that the wrapped cabinet provided a humidity level of approximately 45%, necessary to slow down further deterioration, within a range of +/- 4.5 relative humidity compared to the general collections area of +/- 16.9% during the 4 month trial period. This enclosure has allowed the installation of three hundred susceptible and actively decaying fossil plant specimens, thereby giving time for a systematic long-term conservation program to be undertaken as well as providing a suitable storage area after treatment.

Caroline Butler – Treatments at the National Museums & Galleries of Wales (NMGW)

Caroline is a geological conservator at the NMGW, Cardiff. Caroline explained how a variety of techniques had been tried over the years to halt the destruction of significant parts of the collections, some of which worked and others such as Dettol and PVA have not. Caroline went on to say that at the NMGW they had not found one solution to pyrite decay but used a number of different approaches in an effort to combat the problem.

- Firstly the palaeontological and mineralogical stores are air-conditioned although they do not always remain within the set parameters, microclimates are used for susceptible and deteriorating specimens.
- Another area being pursued to help prevent collections being subjected to fluctuating RH a 'low humidity cabinet' is currently being tested. Specimens are being removed from the main collection and stored separately in this facility.
- The Waller experimental ammonia method is used to treat the condition. Palaeontology specimens are commonly treated in NMGW whereas minerals are rarely treated.
- Fossils from certain locations are particularly susceptible to pyrite decay. Casts are made of some new specimens from those sites so that if deterioration does occur there is still a record of the specimen.
- Specimen labels have deteriorated due to contact with acid decay products. A project identifying and treating the damage has been initiated by NMGW.

Alison Stooshnov – Pyrite damaged paper label conservation.

Alison is a paper conservator at NMGW and is currently working on a project identifying and treating specimen labels affected by pyrite decay. This is the first time that pyrite decay of labels has been studied. While some attempts have been made to treat associated label, they have generally not offered a complete solution. Alison discussed that, to treat damaged labels and to provide further protection it is necessary to:

1. Remove pyrite decay products
2. Clean the paper
3. Neutralise the paper
4. Provide a stable support
5. Provide long-term protection
6.

Alison discussed the conservation method and materials she has used to address these problems.

Joy Irving – Pyrite Mineral Treatments

Joy Irving works at the Oxford University Museum of Natural History. She has been working on the mineralogy collection and discussed the procedure she used to treat the minerals in the collection at Oxford. She described how she carried out the Ammonia Hydroxide / Polyethylene Glycol treatment giving a step by step guide with accompanying slides. Joy then went on to say how the specimens were packed in stuart boxes after treatment and then stored in wooden drawers.

The afternoon was made up of practical demonstrations in the NHM palaeontology lab of two different treatments used for pyrite decay.

1. Ethanolamine thioglycollate in Industrial Methylated Spirit
2. Ammonia Hydroxide / Polyethylene Glycol

As these treatments were demonstrated the merits of each treatment were discussed. After the demonstration the group were show around the lab and also had a chance to see the *Liopleurodon ferox* specimen David Gray had conserved.

The last hour of the day was left for refreshment and an informal discussion about issues that had been raised during the day or any other conservation problems that people wanted to discuss.

Adrian designed a questionnaire for the attendees and had a positive response to the day. The informality, good value for money and a good balance of lecture and practical were good points of the day but the lack of provided lunch reduced the chance to network.

The lack of advertising was also noted, having missed advertising in GCG's newsletter 'Coprolite' although UKIC newsletter 'Grapevine' advert attracted some attendees. There did seem to be a genuine interest in further one day seminars of the same format of presentations and practicals and several topics were put forward. However, most attendees did not see the need to set up a Pyrite Decay Special Interest Group, as this was such a specialist field and personal contact by email should suffice.

The day was a success largely due to Adrian Doyle's organisation, for Bob Entwistle for chairing the sessions and for the staff of the PCU for helping with the afternoon session so I would like to thank him once again for a very useful day.

⇦ The Lectures

The Demonstrations ⇨

⇦ The Tours

Ammonia
A practical guide to the treatment and storage of minerals

Joy Irving, Oxford University Museum of Natural History, Parks Road, Oxford OX1 3PW
E-mail: joy.irving@oum.ox.ac.uk

This is aimed at non-specialist curators with small geological collections and limited resources who do not have access to specialized conservatorial help.

1. Rationale for the use of ammonia as a conservation treatment.
Oxidation of pyrite or marcasite, dimorphs of FeS_2, commonly cause destruction of geological material. Conditions that favour high rates of oxidation include fine grain size of the reactive material, and high RH and high temperature. But even at room temperature and moderate RH (>30%), some oxidation will occur in susceptible specimens. Neutralization by ammonia is important because the oxidation of pyrite leads to products such as ferrous sulphate and sulphuric acid.

Sulphuric acid acts as a solvent for removing passive oxide coatings, or tarnishes, thus exposing fresh surfaces for further oxidation, and it acts as an electrolyte to support any electrochemical oxidation that might occur. Ferrous sulphate will exist as any one of 3 hydrates at room temperature; but at about 60% RH the 1 to 7 hydrate transition occurs, resulting in a huge 256% volume expansion. This 7 hydrate, melanterite $FeSO4.7H_2O$, is the main cause of specimens cracking and falling apart. However, sulphuric acid and ferrous sulphate are both deliquescent, which will further accelerate oxidation above 30%RH. Thus any treatment which either removes or neutralizes the oxidation products is an essential part of conservation treatment for the specimens.

2. The treatment process used at OUMNH.
I shall briefly describe the process we use at OUMNH for treating pyritic specimens. This is based on Robert Waller's 1987 paper ' An Experimental Ammonia Gas Treatment Method for Oxidized Pyritic Mineral Specimens.'[1]. Prior to treatment, oxidation products can be removed carefully either by brushing or by means of sodium bicarbonate air abrasive, provided this is not going to threaten the integrity of the specimen. The importance of treating specimens early in the decay process before oxidation products become too widespread, cannot be stressed enough.

It is not necessary to spend a lot of money getting started. Because ammonia, as a gas, is all pervasive one can treat many specimens at the same time, in whatever size of container seems appropriate, and because the chemicals used are in small quantities and can often be recycled, the process is relatively cheap. For many years, we used two old fish tanks with draught-proofing around the top as a seal, together with a glass sheet as a lid, weighted down by heavy rocks spread out on a wooden tray. The shelves were made out of open-mesh plastic rescued from a skip, separated by glass jars as supports. We still use it for treating specimens that are too large for the current treatment desiccator. This desiccator is now kept in a fume cupboard which means that an ammonia filter gas mask and gas-proof goggles need not be used.

Together with the specimens, accompanying old pyrite-damaged labels can also be treated (to neutralize any attached acidic oxidation products), and also attached specimen labels, which will usually remain in place, though old varnish may react slightly with ammonia to give a brownish tinge.

At the bottom of a desiccator (30 x 30 x 45cm.) a bowl is placed, containing 35% ammonia solution together with polyethylene glycol (PEG) 400, the proportions being 0.2ml. of ammonium hydroxide to 1gm. of PEG 400 [1]. Because PEG 400 is a liquid, it is necessary to weigh out 1gm. of PEG, and measure the volume. This results in a ratio of 4.4ml. PEG to 1 ml. ammonium hydroxide, which can then be scaled up to suit the size of container. This has involved a certain amount of experimentation, initially resulting in specimens having to be re-treated. But for a desiccator of size 30 x 30 x 45cm., a working ratio of 330ml. of PEG to 75ml. of ammonia solution works for most small and medium sizes of specimen. Obviously, for larger specimens, more ammonia and PEG 400, in the same proportions, are required.

The specimens all rest on polyethylene foam pieces in the desiccator for two reasons. First, it allows better flow of ammonia around the specimens, since they do not then block the holes in the desiccator shelves. Second, it cushions them, as the crumbly orange reaction products of the treatment, ammonium sulphate and ferrous hydroxide, tend to make the specimens a little friable. Friability is reduced by the use of PEG 400 as a humectant, which depresses the water vapour pressure to the equivalent of about 50% RH, which should prevent condensation in fractures. (If ammonia solution only is used, then 100% RH is likely to be reached [2], and condensation, aided by deliquescence of the oxidation and reaction products, could then occur in fractures in the specimen, which may then disintegrate [1].).

Obviously it is necessary to know when the ammonia has been depleted, and consequently how long to leave the specimens in for. The standard indicating tube is about 5mm. wide, and is filled with a mixture that reflects the density and constituent compounds of typical pyritized specimens, such as ferrous sulphate (representing the powdery sulphates) and glass beads, representing the fine granular material such as quartz and euhedral pyrite. A 1:1 ratio of glass beads and ferrous sulphate is tamped into the tube, and this is cello taped to the upper part of the door, where the top shelf of specimens reside. This is to indicate that the ammonia has penetrated the uppermost specimens.

As the reaction proceeds, a blackish brown colour will progress down the tube, so it is easy to measure the daily progress. When it stops, the ammonia is, to all intents and purposes, depleted. This can take up to 10 days. [N.B. Chris Collins recommends no more than 5 days, even if the reaction front is still progressing. The reason for this is that PEG 400 absorbs water and binds it in rather than buffering the environment in the way that silica gel does [2]. Thus after a few days the PEG 400 will have absorbed as much water as it can, and the RH in the treatment desiccator will start to rise to unacceptably high levels [2].] The reaction front will usually travel approximately 30mm. down the tube, which is usually enough to penetrate, via microcracks, all the way to the centre of each specimen. It may also be necessary to replace the PEG 400 and ammonia solution, if, after 5 days, the reaction front has not progressed as far as is necessary to ensure complete penetration of the largest specimens.

PEG 400 can be recycled, and according to Waller, you should heat the solution to 150 deg. C, to drive off the water, and it can only be recycled so long as the solution remains colourless. But I find that if the temperature rises above 120 deg. C then it turns yellow, which means that it has degraded into PEG's with higher vapour pressures, and then should definitely NOT be recycled. I have found that the PEG 400 can only be recycled successfully no more than twice, even though Waller states that four times should be possible. [N.B. Chris Collins recommends that only fresh dry PEG 400 should be used, as even Rob Waller finds recycling tricky and has had problems with breakdown of PEG 400 [2].].

After completion of the treatment process, the specimens are then placed in another desiccator for a week, at the bottom of which is a tray full of conditioned silica gel. This is where the specimens are conditioned to their final storage RH% of 30-33% and also to allow the ammonia to dissipate. It is useful to keep a thermohygrometer in the desiccator to check that the RH never rises above 33%, as occasionally desiccator seals are not as airtight as they should be.

The indicating silica gel turns a beautiful shade of opaque cobalt blue, as ammonia is sorbed. This cobalt-ammonia complex is known as *cis* tetraamminedichlorocobalt(III) chloride ($[Co(NH_3)_4Cl_2]^+Cl^-$). After a couple of uses, this is replaced with more conditioned silica gel, having stirred it after the first use in order to expose more silica gel for ammonia sorption on the next occasion.

3. Conditioning the silica gel.

The method for conditioning small quantities of silica gel to a specific relative humidity, and hence equilibrium moisture content, is to allow them to equilibrate with a saturated salt solution which reliably enforces a known relative humidity. In the case of pyritic specimens, the silica gel is conditioned using magnesium chloride, which will enforce an ERH of 33%. 33% RH is a compromise between not allowing specimens to become too dry (particularly where clay minerals are present in the matrix) and the less than 30% recommended for the storage of pyritic specimens. In practise, the silica gel often is conditioned to about 30%, due to lack of time spent in the desiccator.

Potassium carbonate enforces an ERH of 43%. This is mostly used for the storage of vulnerable palaeontological material that is not pyritic, but which will suffer damage due to daily fluctuations in temperature / RH.

To condition the silica gel for pyritic specimens, make up a saturated solution of magnesium chloride, leaving an excess of about 1 cm. of precipitated salt in each container used. This minimizes concentration gradients in the solution, and ensures that whatever the atmospheric temperature, the solution will remain saturated. It has been found that for the size of desiccator used (30 x 30 x 45cm.), it is necessary to mix up about 2 litres of saturated magnesium chloride. This is to keep maintenance of the magnesium chloride to a minimum (it will evaporate). To minimize salt creep, containers used should always be made of plastic, and straight-sided, and the solution should only take up half the volume of each. The containers are then placed on the bottom and about half way up the desiccator to allow for a more even circulation.

The silica gel to be conditioned should be spread thinly in several 1cm. deep polystyrene trays, together with, but not on the same shelf as, the saturated magnesium chloride solution. These polystyrene trays are supported on polyethylene foam blocks, so as not to impede the circulation around the desiccator. About 800gm. of dry silica gel can be conditioned to 33% RH in 3-4 weeks. If more silica gel is put in, it just takes longer to condition. Therefore it is useful to have 2 or 3 desiccators conditioning the silica gel, according to need.

To re-condition used silica gel, which is at ambient RH, just place in a **very** low oven for a few hours with a thermohygrometer, to dry it to about 25 % RH, before placing it in the desiccator with the magnesium chloride to finish conditioning. If silica gel is to be used to enforce an RH **below** the average ambient RH, it should first be conditioned to too low an RH, then conditioned upward to the required RH. This will enforce the conditioned RH for longer, as it minimizes problems with hysteresis. (Hysteresis in silica gel results in a reduced capability to enforce the conditioned RH, i.e., the desorption curve is offset from the adsorption curve, and the RH drifts towards the ambient.) [3]

4. Storage and monitoring.

After the specimens have been conditioned for a week, they are stored in Stewart box microclimates with a humidity strip and a measured quantity of conditioned silica gel dependent upon the size of Stewart box.

Specimens can be a little friable after treatment, and so they are either placed in 2 cm. high polystyrene boxes lined with 1mm. thick 'Jiffy foam', or are surrounded by 'nests' of this inert polyethylene foam, depending on the size of the specimens. The specimens are then placed in the Stewart box. Old labels must be stored away from any **direct** contact with the specimen in case of further decay of the pyrite, preferably in an attached polyester wallet on the outside of the Stewart box.

To allow the conditioned silica gel maximum exposure inside the Stewart box, combinations of three sizes of the same 2 cm. high transparent polystyrene container (also obtainable from The Stewart Company) are again used. Measuring a specified amount into a polystyrene box causes minimal disturbance when changing the silica gel annually. Spreading silica gel across the bottom of the Stewart box underneath a layer of 'Jiffy foam' would cause undue disturbance to the specimens in these circumstances.

The amount of silica gel in each box is loosely based on the 20 kg. m^{-3} recommended by Gary Thomson in his 1977 paper 'Stabilization of RH in Exhibition Cases : Hygrometric Half-time' [4]. This was used as a starting point, taking into account the fact that the smaller the volume of a container, the greater will be the relative leakage from its lid seal, and hence more silica gel will be required than Thomson suggests. So, being constrained by (a) the size of the silica gel containers, (b) the need to have room for the specimen(s), and (c) the need to ensure that the silica gel will enforce the 33% RH for **at least** a year, workable amounts of silica gel that I use as standard for particular Stewart box sizes have been arrived at by experimentation. Since these boxes are fairly common in the Museum world, the following are examples of these workable amounts.

Workable weights of conditioned silica gel per Stewart box size to ensure 33%RH for at least one year

Stewart box size	Weight of silica gel used	G. Thomson recommended wt. (20 kg. / m-3)
0.5 litre (Butter Storer)	45gm.	4.5 times rec. wt.
1.0 litre (Lunch Pack)	70gm.	3.5 times rec. wt.
2.25 litre (Popular Pack)	90gm.	2.0 times rec. wt.
3.5 litre (Pizza Storer)	125gm.	approx. 1.75 times rec. wt.

The above weight used in Pizza boxes will actually enforce the 33% RH for 2 years, though it is important to check annually (now that the Stewart boxes are transparent) to see if the cobalt chloride has discoloured due to pollutants generated by oxidizing pyrite. Occasionally it happens that you may have to re-treat a specimen, but experience suggests that this happens in less than 5% of specimens treated. All smaller boxes must have their conditioned silica gel changed annually.

Though you do have to wear a dust mask and plastic gloves for Health and Safety reasons [5] when mixing the two sorts of silica gel, the biggest advantage of using indicating silica gel is that the cobalt chloride is very useful as a pollutant indicator, becoming, most commonly, yellowish brown (when the indicating silica gel is pink) or dirty greyish blue (when the indicating silica gel is blue), if the specimen needs re-treating (assuming there are no other pollutant generators in the box). This happens even before a sulphurous smell can be detected. This is obviously a reaction of gaseous oxidation products with the cobalt chloride.

Artsorb can be used in Stewart boxes in place of silica gel, but conditioning and any re-conditioning must be done by the manufacturers, which tends to make it expensive. Artsorb also lacks any pollution indicator.

The Stewart boxes must then be stored in a suitably stable environment, such as within wooden drawers inside wooden cabinets with doors, where our specimens are normally stored. Stability can be ascertained by regular

monitoring. There are many methods of monitoring, from the expensive radiometric systems to the inexpensive spot checks using thermohygrometers. But however monitoring is done, it is necessary to know the extent of any problem to decide how it can best be resolved. The buffering effect of our wooden cabinets and drawers appears to result in only a 10% variability in RH annually, between about 37% and 47%. (See Appendix 1). This is low enough for stability of conditioned micro-environments in the Stewart boxes, in that drift towards the average ambient RH will be slower, but RH is still too high to prevent some pyrite decay outside those microclimates.

This data was produced, not from the expensive radiometric system, but from weekly spot checks done with thermohygrometers. It is slightly more time-consuming, but for the internal drawer readings, because wood is such a good buffer, it is as accurate as the radiometric system, with which it has been checked for comparison.

All information about the specimen, including any conservation notes, appear on a conservation database which can generate the conservation labels attached to the lids of the Stewart boxes, and annual checking reports, so that one knows exactly which specimens to check and when, where they are stored in the Museum, and which ones need re-treating.

5. Problems encountered whilst treating minerals.

When treating minerals for pyrite decay, one has to take into account the associated minerals on the specimen. Each case must be assessed individually, since other sulphides may be present, such as chalcopyrite and chalcocite, which are not only sensitive to the presence of acids, but to alkalis such as ammonia. Frank Howie's chapter on 'Sulphides and allied minerals in collections' in 'The Care & Conservation of Geological Material' [3] is invaluable as a starting point in this respect.

There are two types of low temperature instability in sulphides and allied minerals: tarnishing, which is a self-limiting and non-destructive surface effect and is **generally** not influenced by crystal size and shape; while oxidation reactions which occur in the presence of water vapour in air are predominantly influenced by the surface area available for oxidation, and are normally destructive. Because hydrated oxidation products are formed in

both cases, if *d*-block transition metal ions are present, reaction with ammonia will often be accompanied by colour changes, which may be undesirable.

Tarnishing.
Tarnishing occurs with a number of sulphides and sulphosalts including most of those containing iron, lead, iron-copper mixtures, copper, nickel and cobalt. Often the reason appears to be due to the presence of 'impurities' such as other metal sulphides, for instance, the tarnishing of galena is likely to be due to the presence of a silver sulphide, with which galena is almost always associated. Most commonly, in the context of pyrite decay, is the presence of iron and its destabilizing effect on copper sulphides. Thus with chalcopyrite ($CuFeS_2$), very often found in association with oxidizing pyrite, a series of complex oxidation and transformation reactions occur in which iron is transported to the surface of the mineral, where it is oxidized, electrochemically, to a hydrated ferric oxide, probably complexed with water of hydration or hydroxyl ions (brown-red colours). The remaining sulphur-enriched copper sulphide underneath is oxidized slowly to copper sulphate (iridescent blue).

Oxidation reactions which occur in the presence of water vapour in air.
Oxidation reactions which occur in the presence of water vapour in air take place generally above 30% RH, hence the necessity of storage in a low RH environment after treatment. Typically, this type of reaction involves the oxidation of a sulphide to a sulphate species and the retention of H^+ ions in the reactive aqueous film on the surface of the mineral. Thus oxidizing pyrite will often cause appreciable oxidation of accompanying sulphides, even those that are normally very stable. One particularly common mineral assemblage found in intimate association with oxidizing pyrite are the sulphides sphalerite (ZnS) and galena (PbS). Under normal situations sphalerite is extremely stable, doesn't tarnish or react in air, but is **extremely** sensitive to the presence of acids, and will rapidly decompose when associated with oxidizing pyrite, as will galena.

Transition metal complexing.
In both types of low temperature instability, ammonia will react with the **hydrated** oxidation products of most *d*-block transition metal ions to produce a typical ammine complex, often, but not always, with accompanying colour changes; for instance, $[V(NH_3)_6]^{3+}$, $[Co(NH_3)_6]^{3+}$, $[Co(NH_3)_6]^{2+}$, $[Cr(NH_3)_6]^{3+}$, $[Ni(NH_3)_6]^{2+}$, $[Cu(NH_3)_4]^{2+}$, $[Co(NH_3)_4Cl_2]^+$, $[Cr(NH_3)_2Cl_4]^-$, $[Ag(NH_3)_2]^+$ and $[Zn(NH_3)_4]^{2+}$, the last two of which are colourless. Iron forms aqua complexes but **not** ammine complexes in the presence of ammonia. Transition metal compounds are usually coloured because the energy difference between the orbitals is very small, which means that the transition elements can absorb energy in the visible region of the electromagnetic spectrum to promote the electrons in their outer shell from a low energy to a higher one, i.e., **unpaired** *d*-electrons rise from a lower to a higher energy state. When this happens a wavelength for a colour is emitted. Ions which have the electronic configuration $3d^{10}$ such as the Cu^+ ion or Zn^{2+} ion are colourless, because they do not have any unpaired *d*-electrons.

As an example: pre-treatment condition of a decaying pyritic specimen showed accompanying chalcopyrite altered to velvety dark bluish-black minerals, likely to be a mixture of mostly copper sulphides slowly oxidizing to hydrated sulphates. After treatment with partially-dried ammonia, there were many patches of different blues and violet colours, where the dark-bluish black minerals were. The likely reasons for this are (a) the initial reaction of water molecules or hydroxyl ions to form complex ions such as tetra aqua copper $[Cu(H_2O)_4]^{2+}$ (pale blue), or di hydroxo tetra aqua copper $[Cu(OH)_2(H_2O)_4]$ (pale blue), and then (b) excess ammonia giving deep blue cuprammine complexes such as di ammine tetra aqua copper $[Cu(NH_3)_2(H_2O)_4]^{2+}$ (blue-violet), or tetra ammine copper $[Cu(NH_3)_4]^{2+}$ (bright blue), whose composition depends on the amount of ammonia present.

Pharmacosiderite.
So far, transition metal complex formation with ammonia has been the problem, but the reaction of **pharmacosiderite,** $KFe^{3+}_4(AsO_4)_3(OH)_4.6$-$7H_2O$, with ammonia was unexpected, since iron does not form ammine complexes with ammonia. Originally, the crystals of the specimen were dark green in colour, but because of the decaying pyritic state of the matrix it became necessary to treat the specimen using ammonia gas. The results of this were quite dramatic, in that while the specimen was sur-

rounded by an atmosphere of ammonia the crystals turned a bright red. However, when removed from the ammonia, and placed in a much drier environment, the crystals again changed colour gradually over the course of the next week ultimately to a dark reddish brown.

The structure of pharmacosiderite consists of an open zeolitic-like framework $[Fe_4(OH)_4(AsO_4)_3]^-$ with channels filled with alkalis, alkaline earths and water molecules [6]. Like zeolites, the water content can vary considerably and the cations are easily exchangeable accompanied by typical colour changes [7] as described. Zeolites are used for ion-exchange in the chemical industry as molecular sieves and catalysts, and because of their structure, there is ongoing research into pharmacosiderites for this purpose. Since the framework is unlikely to have been altered [7], merely the channel fillings, it would probably be appropriate to call the specimen ammonium pharmacosiderite for reasons given below.

Initially [8], it was thought that the cause of the colour change was due to the K^+ in the formula having been replaced by NH_4^+ in a one to one ratio. But having researched the literature further, it appears not to be this simple, as only a trace of potassium or other alkali metals have been found by previous investigators [7] in the pharmacosiderite crystal structure, green or brown. Neither does it appear to be that the colour change is produced by Fe^{2+} to Fe^{3+} [9]. Mutter et al [6], have 'proved definitely the **absence** of Fe^{2+}' in both a green and brown specimen tested. So Fe^{3+} appears to be the correct ionic state in pharmacosiderite.

Whilst totally surrounded by ammonia (as partially dried gas) the bright red colour persists, so sorption of ammonia on the surface of the crystal and / or within the channels is likely to be taking place. Since **all** ion-exchange with alkalis produces bright red coloration [7], this suggests that it is the effects of these trace cations upon the Fe^{3+} ion (see explanation in paragraph below), possibly by the replacement of hydrogen (or hydronium) ions in the channels, that is the cause of the colour change. There are two sorts of water molecules found within the channels. Certain water molecules are too widely separated to be hydrogen bonded to each other, but are probably bonded to the hydroxyl oxygen atoms of the framework by relatively strong hydrogen bonds. Other water molecules appear to be too far from the framework to be bonded to it, but are probably

weakly bonded to the previous water molecules [7]. This allows for ammonia to have a possible indirect effect upon Fe via the hydroxyl oxygen of the framework.

The underlying mechanism for the colour changes noticed in the specimen of treated pharmacosiderite is likely to be transitions involving ligand field effects, which can be related to the incompletely filled 3*d* orbitals. If Fe is written thus: $1s^2 2s^2 2p^6 3s^2 3p^6 3d^6 4s^2$, denoting the arrangements of electrons in orbitals within shells, Fe^{2+} is: $1s^2 2s^2 2p^6 3s^2 3p^6 3d^6$, and Fe^{3+} is: $1s^2 2s^2 2p^6 3s^2 3p^6 3d^5$. Absorption of light, and hence the coloured appearance of the specimen, is explained by electron transitions ***within*** the set of five 3*d* orbitals. All five 3*d* orbitals would normally have exactly the same energy level in the Fe^{3+} ion, but when this is surrounded by ligands (such as water), the 3*d* orbitals are no longer symmetrically arranged. Orbitals closer to the ligands are pushed to a slightly higher energy level than those further away. The 3*d* orbitals are split into two or more slightly different energy levels. The promotion of an electron from the lower to the higher of these *d* orbitals just happens to require energies within the range of visible light [10], and thus colour changes may occur. Complexing reactions involve competitions between different ligands for metal cations. The exchange of ions within the channels of the pharmacosiderite framework is thus likely to produce ligand orientation changes, causing the frequency, and hence colour, of the light absorbed to shift.

When removed from the gaseous ammonia, the colour of the crystals changed gradually from red to brown. There is likely to have been some ammonia desorption (though FT-IR results show at least some ammonia retention [11]), but the specimen was subjected to drier conditions than in the treatment desiccator where the PEG 400 only dries the ammonia to about 50% ERH [1]. It is likely then that the dark reddish brown that the specimen eventually became is due to further changes in the symmetry of 3*d* orbitals in the Fe^{3+} ion, brought about by different bonding arrangements due to loss of water and some ammonia from the channels.

Specimens of green pharmacosiderite from certain localities (Burdell Gill) have been known to change to brown naturally over a period of time [9]. Desorption of water is perhaps the likely reason, since this happens without the addition of alkalis. However, this does not explain why some

specimens from the same locality remain mostly green, as is the case at OUMNH. It is possible that they have a much higher water content, possibly reflecting different storage conditions, and / or a more acidic matrix, both contributing to a higher H^+ ion content. This needs further looking into.

It has been shown that treating with acidic solution causes the colour of brown specimens to return to green possibly by flooding the specimen again with H^+ (or H_3O^+) ions [7]. I feel it is probably not advisable to reverse the colour change of ammonium pharmacosiderite as this would mean undoing the neutralization of the pyrite decay, and the possibility of introducing instability into the specimen by means of micro-cracks which get worse with every ion-exchange process, i.e., crystals have been known to explode [6].

6. Conclusion.

When contemplating the treatment of pyritic mineral specimens, knowing which minerals are present makes it possible to predict which specimens are likely to produce coloured complexes in the presence of ammonia. These include the hydrated oxidation products of most *d*-block transition metal ions with unpaired *d* electrons, i.e., usually those with more than one important oxidation state, such as Ti, V, Cr, Mn, Fe, Co, Ni, Cu. Pharmacosiderite, with its hydrated open zeolitic-type framework and microchannels where ion-exchange may easily take place, with hindsight seems an obvious candidate for reaction with ammonia, but since knowledge of structural chemistry is not always in the forefront of one's mind, it is likely that other problems with ammonia may yet surface. It is not that this knowledge is unknown, but that conservators / curators with very little time to search literature are sometimes unaware of it and / or do not have the time to make it available to others. I hope therefore that this will help to promote further exchange of information on this matter.

Assessing specimens in a systematic way for any conservation needs upon acquisition makes sure of detecting all specimens with pyrite decay before unsightly oxidation products become too widespread. This can be followed by treatment if necessary, and most importantly, **correct storage**. Despite the problems that I've encountered with certain mineral specimens, most have been saved from their ultimate fate by following the

above regime. Even if specimens do fall apart after treatment it is not always a disaster, as the mineral assemblage that is important to the collections may have been saved, even though in several pieces. One also has to assess whether it really matters if treating with ammonia causes the formation of coloured complexes, since by not treating, one is possibly hastening the end of the specimen. This will obviously depend upon the importance of the specimen to the collection, and how much or how little of the specimen is likely to be affected. Putting it all in perspective, out of all the hundreds of specimens that I have treated, only about 5% have needed retreating, and one can count on the fingers of two hands those that have produced coloured complexes with ammonia. Ammonia is a successful treatment, and will remain important until we can **reliably** exclude water vapour and / or oxygen from vulnerable pyritic specimens.

References.

1: Waller, R. 1987. *An Experimental Ammonia Gas Treatment Method for Oxidized Pyrite Mineral Specimens*. Preprints (Working Group 13), pp. 623-630. ICOM Committee for Conservation. 8th Triennial Meeting, Sydney, Australia, 6-11 September, 1987. Getty Conservation Institute, Los Angeles.

2: Collins, Chris. Tues. 6 Mar. 2001. E-mail communication.

3: Howie, F.M. 1992. *The Care and Conservation of Geological Material. Minerals, Rocks, Meteorites and Lunar finds*. Edited by Frank M. Howie. Butterworth-Heinemann.

4: Thomson, G. Stabilization of RH in exhibition cases: hygrometric half-time. Studies in Conservation, 22, pp. 85-102. 1977.

5: European Commission Directive 98 / 98 / EC (amendment to 67 / 548 / EEC).

6: Mutter, G., Eysel, W., Greis, O. and Schmetzer, K. 1984. Crystal Chemistry of Natural and Ion-exchanged Pharmacosiderites. *Neues Jahrbuch fur Mineralogie Monatschefte*, pp. 183-192.

7: Buerger, M.J., Dollase, W.A. and Garaycochea – Wittke, I. 1967. The Structure and Composition of the Mineral Pharmacosiderite. *Zeitschrift fur Kristallographie*, 125, pp. 92-108.

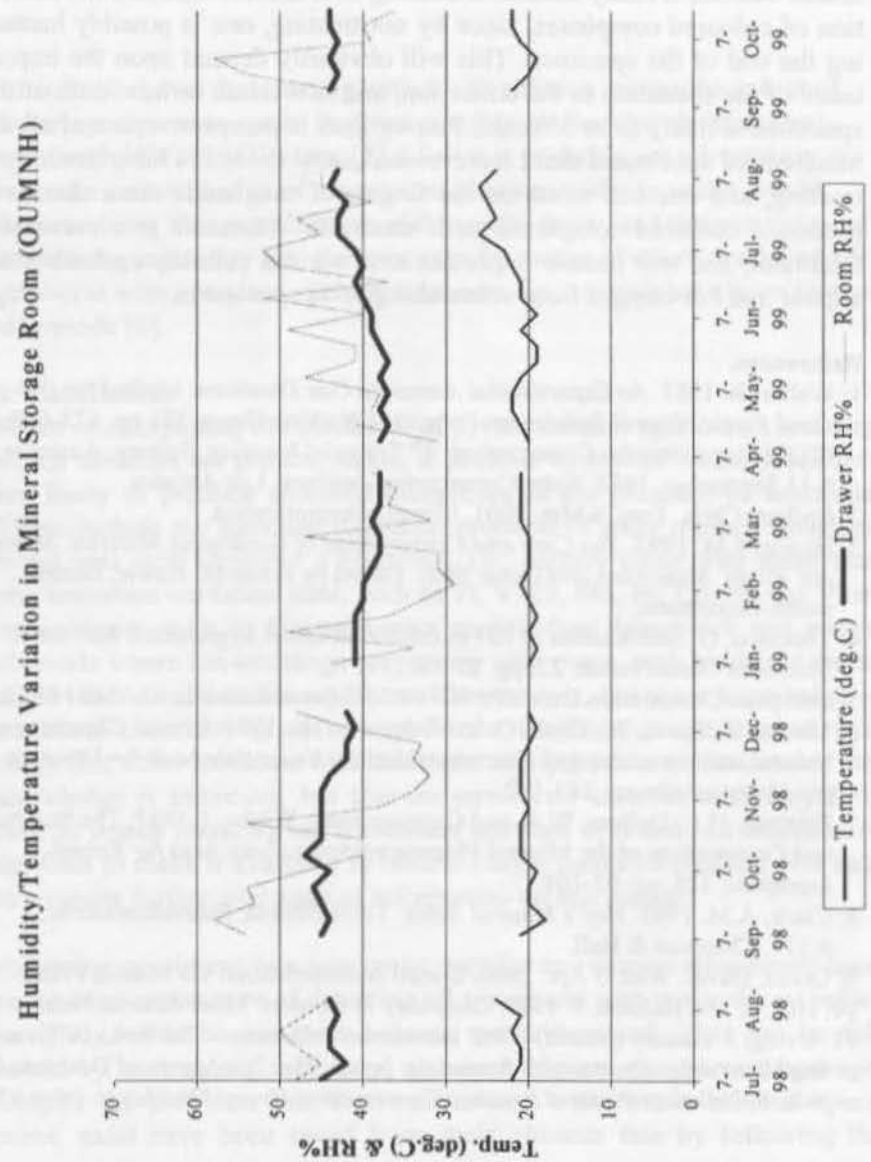
8: Clark, A.M. 1993. *Hey's Mineral Index*. Third Edition. Pharmacosiderite. p.539. Chapman & Hall.

9: Green, David. Wed. 5 Apr. 2000. E-mail communication via Monica Price.

10: Hill, G. and Holman, J. 1989. *Chemistry in Context*. Third Edition. Nelson.

11: Irving, J. January (March) 2000. Introduced Pollutants – The Risks of Treating Mineral Specimens with Ammonia. Insert: The Ten Agents of Deterioration: 8. Pollution. *Natural Sciences Conservation Group Newsletter*. Issue 13.

Appendix 1



SOCIETY FOR THE PRESERVATION OF NATURAL HISTORY COLLECTIONS

15th Annual Meeting, 8th-14th July 2000, Halifax, Nova Scotia, Canada.

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This year's SPNHC meeting, themed on Marine Biology, was held in the scenic city of Halifax, Nova Scotia, and hosted jointly by the Nova Scotia Museum of Natural History and the Geological Survey of Canada (Atlantic). In total, 115 delegates attended, including a Cuban, a Bermudan, two Dutch and four Brits. (Rob Huxley, William Lindsay, Julian Carter & Paul Brown), the rest being Canadians and Americans. Many delegates stayed at Shirreff Hall, part of Dalhousie University student accommodation.

The first official activities of the week consisted of field trips; whale watching in the Bay of Fundy, Nova Scotia's south shore, and the Joggins and Parrsboro Geology Tour. This delegate went on the latter, a coach ride through the forests and lakes of the glaciated Cambrian and Ordovician slates and greywackes of the central area, to the more agricultural Carboniferous red sandstones to the North. We visited the Fundy Geological Museum, Parrsboro, where we were guided round the small but well equipped fossil preparation laboratory by Tim Fedak, who showed us dinosaur fossil preparations currently being worked on. The public galleries had a good mix of real specimens and interactive models, with views over the Parrsboro Creek, just yards away. The Bay of Fundy reputedly has the highest tides in the world, so one hopes that this museum is built where it will not be inundated by abnormal tide and weather conditions! We then moved to the coastal cliff exposure of Carboniferous sandstones and coal seams, to see where the best of the reptile remains have been found. We were provided with a free Nova Scotia geology map and a series of papers on the local geology.

Monday was committee day and so non-committee members toured the town of Halifax visiting other Museums. The Maritime Museum of the Atlantic has a collection of small boats and interpretative exhibits, including the ex-WW2 Flower Class Corvette HMCS Sackville and the Canadian Hydrographic Service ship 'Arcadia'. The Halifax Citadel National Historic site, a Georgian fort with interpreters dressed as 'redcoats' and Union Jacks flying, was also visited. Some took a bus out to Peggy's Cove in the rain to study the glaciated granite scenery and watch the gale-blown Leach's petrels off the lighthouse point.

Most of the conference sessions were held at the Life Sciences building at Dalhousie University, a short walk from our accommodation. The conference proper started on Tuesday morning with opening and welcoming remarks. The outgoing President, Sally Sheldon, talked of the problems that SPNHC members have faced in gaining recognition for collections management as a valid and desirable profession. The keynote address consisted of a photographic exploration of the wreck of S.S. Titanic by Steve Blasco. After lunch, the first session themed 'building a better environment' commenced with Robert Huxley and William Lindsay of the NHM, presenting their talk 'Building a safer environment for collections: bringing the specimens back into focus'. The use of qualitative risk assessment in re-housing and moving of collections was examined, in parallel with health & safety legislation, all in the context of planning moves into the new Darwin Centre buildings at the NHM.

Next to speak was James Bryant of the Riverside Museum, California, who discussed the conservation and documentation of Victorian sea & shore bird specimens. Franklin Pember's 250 marine bird skins and egg sets have been subjected to packing, cleaning and condition assessment projects. The hazards associated with old taxidermy specimens and the safety measures employed were considered. Cleaned specimens were placed into original display cabinets with minor refitting to control relative humidity and off-gassing from the cabinets and to improve lighting and visibility. In 1999 an old egg collection was found at Riverside still enclosed in its 19th Century packing. The eggs were unpacked and the packing methods documented.

Risk assessment and conservation planning at the Canadian Museum of Nature, Ottawa, was the subject of Rob Waller's presentation. They have moved into a purpose-built, collection-holding building and many measures have been undertaken to reduce risks to the collections. Comparisons between two risk assessments illustrated the changes in risk perception, changes in understanding of and ability to quantify risk and changes in risk magnitude. Repeated risk assessments have greatly increased awareness of collection care issues and changes in risks to collections over time.

David von Endt from the Smithsonian Institution gave us a comparative study of collagen and keratin stability in museum storage fluids. Both materials were heated in 70% ethanol, 70% ethanol + 1% formalin, and 50% 2-propanol. Specimens were then weighed and concentrations of amino acids measured. Stability of bone, skin collagen and hair keratin varied in the different liquids. Skin collagen was less stable than hair keratin and the presence of formalin improved stability of collagen but not of keratin. Differential stability may require compromise in preservative used. The use of 2-propanol was found to be least effective.

Delegates then moved venue to the Nova Scotia Museum of Natural History for a series of Special Interest Group meetings. This delegate attended the Conservation SIG where the 'top ten' priorities for natural history collection conservation research were listed (from Paisley Cato's survey of SPNHC membership). Not in order of preference, these were:-

- Impact of preparation materials and methodologies on chemical and physical properties of specimens.
- Impact of preparation materials and methodologies on scientific utility of specimens [DNA etc.].
- Development of preparation methodologies that maximise scientific utility of specimens.
- Impact of treatments on the scientific utility of specimens.
- Methods to assess, systematically, the condition of specimens over time.
- Methods to assess, systematically, the condition of a collection of specimens over time.
- Methods to assess risk to collections to identify rational priorities for

collection preservation investments and research.

- Proper relative humidity and temperature parameters for a general collection.
- Materials specifications for containers.
- Methods for repair/restoration of damaged specimens.

There followed tours of the museum's top floor stores/work areas overlooking the Citadel. We were reminded that Nova Scotia Museums are all under one management system and can share resources and staff. The birds/mammals tour was led by Andrew Hebda who told us about the 2500 bird skins, 300 skeletons and a backlog of 3000 specimens waiting in the freezer. All are databased using their own MIMS system. Much of the collection was housed in grey metal cabinets with 12 wooden drawers each, made by Wards of Rochester, New York State. Labels on cabinets advertised the use of Vapona as an insecticide. The enclosed use of Vapona is illegal in the UK. The Entomology tour was led by the retired Barry Wright who is expert in microleps, coleophorids in particular. He talked about the many introductions of insects into Nova Scotia and showed the long series of the new pest noctuid *Noctua pronuba* (the common European Large Yellow-Underwing moth). He also discussed the Brown Spruce Longhorn *Tetropium fuscum* attack on Spruce in Point Pleasant Park and attempts to control it with flight interception traps, possibly followed by clear felling of many trees in the near future.

The Botany tour by Marianne Zinck (author of the Nova Scotia Flora) reported that the building had steady RH and temperature conditions and had no *Stegobium* beetles. Linen tape is used to affix specimens onto herbarium sheets and there is only minimal use of Mylar envelopes. She told us of the orphaned algae collection. John Gilhen guided us through the 10,000 herpetological and 75,000 fish specimens, much of the material in plastic containers, which have a lifetime of only 10 years. He mentioned the many vagrant fish species that arrive with the Gulf Stream and from the Eastern Atlantic. Specimens are collected from each province of Nova Scotia to illustrate local variation. Derek Davies showed us the Marine invertebrates and discussed the tetrad atlas work on Molluscs which reflects the geology by the presence/absence of suitable minerals for shell formation. As with the fish, the geographic position of Nova Scotia brings in many introductions including our familiar shore crab, which has been

spreading north along the east coast for some years at about walking pace! He also puzzled about how the European forest species *Cepaea hortensis* (White-lip Snail) could occur on local barren offshore islands and in local deposits of 3500 BC vintage. Could they have arrived with the ocean-travelling pre-Columbians from Europe? Then followed an 'ice-breaker' in the public galleries with local beer from the Garrison brewery, good food and a jazz band, 'The Harbour Trio'.

For Wednesday's sessions we returned to the Dalhousie Life Sciences Centre. The first session 'Cast in Stone' was presented by Deborah Skilliter of The Nova Scotia Museum of Natural History who told us of a planned travelling exhibition of trace fossils, and she elaborated on casting them. First a RTV silicone rubber mold is made of the track, trail, burrow, boring or coprolite using the two-component Smooth Sic 912 system. Casts are then made using Modified Gypsum which consists of powdered gypsum, resins and hardeners and is durable, inexpensive, has low toxicity and is easily coloured.

Next to speak was Robert Grantham, also of The Nova Scotia Museum of Natural History, who told the story of how they found two Mastodon skeletons in a local gypsum quarry, and how they lifted and conserved them. Both are considered to be 80,000 years old. The first specimen was rather wet so cling film and polyfoam were used instead of plaster to case the bones for lifting. In the laboratory, the wet bones were kept in humidity chambers where they attracted fungus, so they were moved to tanks of 30% methanol and then slowly dried and conserved with Aquasol WS24 and Aqualoid adhesive. The second specimen, an immature, was in a dry state and so was less problematical to conserve.

Following on was Tim Fedak (who had shown us the Bay of Fundy Conservation laboratory on Sunday) who talked about conservation problems posed by a compressed and fractured Jurassic dinosaur, and other reptile bone finds. The high tides erode the sandstone cliffs rapidly but the fossils shrink as they desiccate and also suffer from sea-salt deterioration.

Then came Andrew Hebda and the problems he has with the appropriation of whale bodies and preparing them as skeletons. He had recently used a historic house site, out of town, to de-flesh a Right Whale body using in-

terpretative information for visitors to the site.
After tea, the present and future presidents of SPNHC gave their views of SPNHC, past, present and future in a session entitled 'After the Millennium'. Rob Huxley briefly discussed BCG, GCG and NSCG in Britain, asserting that "you will be assimilated" by SPNHC and that "resistance is futile" in a 'Borg' like (Star Trek) manner!

The next session after lunch was entitled 'A moving experience' and began with a talk presented by Oskar Brandenburg and Andries van Dam about the methods of packing, transporting and storage of the anatomy collection at Leiden. The collection consists of 20,000 fluid and dry specimens and 1.3 million microscope slides. Transit risks will be minimised and storage and accessibility of the collection will be improved.

Then we heard of the problems that Lori Benson et. al. at the Science Museum of Minnesota faced when staff members packed and moved 1.75 million natural history specimens. Methods of packing, time management of staff, co-ordination and training of volunteers, interdepartmental communication, storage and transport issues were discussed and staff injuries exhibited!

James Cordeiro of the American Museum of Natural History listed common mistakes to avoid in large-scale collection relocation. The AMNH is currently relocating many of its invertebrate collections to a new storage facility. Specimens from 26 phyla, in ethanol and formalin, are to be moved to 650 single door units mostly on compactors. Written protocols and general recommendations from the Invertebrates Division may be of help for other institutions planning similar moves.

Session four; 'Learning, knowledge and collections' commenced with Ingrid Birker of the Redpath Museum, McGill University, Montreal, who talked about how they have made a university natural history collection into a meaningful learning experience. Even with visitor research, the nature of museum learning is difficult to measure and lacks coherent theory. Visitor behaviour, testing of exhibit parameters and evaluation of visitor experience has been used to measure acquisition of knowledge and understanding.

James Bryant of the Riverside Municipal Museum, California, discussed a packing method for an historic lichen collection. During 1999, the Jaeger collection was packed into stable, acid free materials making it more accessible and affording greater protection. The collection was also catalogued with descriptions and images using the Museum's ARGUS database software.

Jenny Pestovic told us of the 1999 Faber award and how their University collections are being improved as an education resource. University teaching and research collections with shortages of funding and space have expanded their roles in public interpretation. Jenny sent out a survey form to 262 museums and institutions of which 110 returned data. The survey identified the level of public education and research activity where public awareness of the collections, collection use for college teaching, faculty and staff involvement in public education and training of students in museum work. Case studies provided models for curators seeking to enhance public awareness. The results have yet to be fully analysed.

Jenny Leopold of the University of Kansas Natural History Museum described the 'Specify' Database management system and how it sustains their bio-diversity collections infrastructure. Historic data is often inaccessible or not available on databases. Many in-house databases are not designed to serve the greater community. The few commercially developed systems are expensive and with limited functionality and security. What she suggested you need is 'Specify', a robust, multi-taxon system with configurable interface, visual query and report tools, access to taxonomic and geographic file information and field-level read and write security, documentation and tutorials and help-desk user support. It is a consistent community computing platform for biological collections and future developments will include internet access to specimen data.

Posters and trade stands were available for perusal during refreshment breaks. Posters included:-

- Susan Fishman-Armstrong (Texas Tech University): the incorporation of bar codes to existing Museum databases.
- Raegan King (Texas Tech University): electronic field data capture using Wildcat III.
- Richard Monk (Texas Tech University): e-vouchers and digital im-

agery in natural history collections.

- Daniel Faber: design, creation and long-term maintenance of black & white digital images.
- Robert Baker (Texas Tech University) Global Information System co-ordinates assignment to classical museum localities.
- Stephen LeMay (Illinois): the manditory registering and monitoring of Institutional and privately owned natural history objects.
- Susan Woodward (Royal Ontario Museum): Triage work done to treat a webbing cloths moth species outbreak in an open storage area of taxidermy mounts.
- Gretchen Anderson (Science Museum Minnesota): improving laboratories visible to the public.
- Paisley Cato: the Survey of SPNHC membership on priorities for Natural History Collections Conservation Research.
- Lorraine Cornish (NHM London): cleaning fossils with lasers.
- Adrian Doyle (NHM London): managing a barrier film microclimate enclosure.
- David Gray (NHM London): replica production of the Maidstone Iguanadon.

That evening, delegates toured Halifax Harbour on the Harbour Queen in warm sunshine and then tucked into a lobster dinner at 'Murphy's on the Water', followed by a rock band 'Johnny and the Escorts' and dancing till late!

On Thursday, the fifth session 'Humans & Nature' started with Wayn Lyons describing methods of conservation of a human foetal teaching collection and the use of Magnetic Resonance Imaging for internal examination. James Cosgrove of the Royal British Columbia Museum then discussed a frozen human body found in a glacier. They communicated with the local 'First Nations' people about the discovery and formed a committee with them to agree as to what conservation and research could be done with the body. The remains were frozen at the same temperature and relative humidity as the glacier and wrapped, so as not to be contaminated by the modern environment

Daryl Fedje gave an absorbing talk on the finding of a prehistoric stone

tool on the continental shelf off British Columbia. Digital terrain imaging has revealed the drowned late-glacial landscape of the shelf. The stone tool was found at 150 m. depth and is the first tangible evidence of human occupation of the shelf in the Holocene.

After coffee, the SPNHC AGM took place where Sally Shelton relinquished her Presidency to Suzanne B. McLaren and committee reports were presented and awards given. The President's Award went to Julia Golden, who was unfortunately absent, for her services to SPNHC and to the collections care profession. There was a call for the membership to volunteer to sit on committees. The presidents, past, present and future gave an amusing, musical rendition of their shared plight.

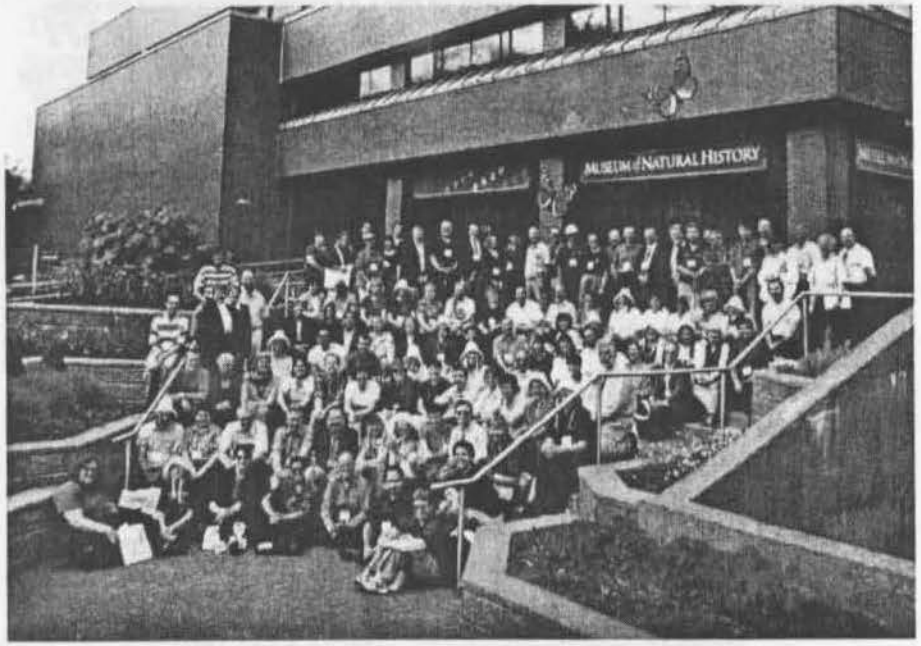
Delegates were then bussed to The Bedford Institute of Oceanography where a sumptuous bar-b-q had been laid on for us. There followed the last session of the conference, entitled 'marine heritage', with Paul Macnab demonstrating his virtual computer CD-ROM underwater tour of Sable Gully, the largest submarine canyon in eastern North America. The CD had a virtual journey through the canyon, with descriptions of ocean currents and temperatures, and resident plant and animal communities with pictures and sounds. Free copies of the CD were distributed to delegates! John Shaw then presented his argument for why there should be a search for the sunken remains of the 'mighty' H.M.S. Hood and a deep-sea exploration of the wreck attempted. Gordon Fader illustrated the methods of side-scanning sonar for illustrating the submarine topography and for pinpointing the many wrecks of Halifax Harbour, illustrated as colourful maps. Some of these wrecks were not known until this survey was carried out.

There followed tours of the Bedford Institute which houses many ocean sediment core samples which are in halves (one half stored and one half analysed). Storage of cores is in long plastic gutters held on dexion racking; also some on roller racking and some in cold storage (the older material dries out so needs to be stored cold). We saw the invertebrate identification laboratory where four parataxonomists identify indicator species. They are studying the effects that fishing has on Benthic habitats. We also had a potted history of the Institute and were shown items of historic oceanographic and hydrological equipment.

The bus ride back included a guided tour of Halifax with information ably imparted, by Alex Wilson, on the explosion of a munitions ship in 1917 which killed 1000 + people and we saw the Martello Tower built in 1790, in Point Pleasant Park.

Friday was spent at the Nova Scotia Museum of Natural History attending the Permits Workshop. This covered permits for agriculture, Health & Safety, CITES and cultural property. Much of the information was slanted toward the problems and legislation in Canada but the CITES information was of interest. The information presented at this workshop was produced as a bound volume with the disclaimer that the contents represented the opinions and experiences of the presenters and was given as guidelines only.

Thanks go to the co-chairs Iris Hardy and Alex Wilson for a stimulating and enjoyable conference. Next year the 16th SPNHC will be held at the California Academy of Sciences in San Francisco from 21st-26th June, 2001 (further information from Jean DeMouthe CAS, email: jde-



Transferring biological specimens from formalin to alcohol.

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In these days of greater Health & Safety awareness many curators are reviewing their fluid-preserved collections and transferring them from carcinogenic and dermatitic formalin to alcohol. Although this may seem straight-forward enough there are many traps and problems along the way.

First - are the specimens going to benefit from the transfer? Some will have been fixed and then preserved in special fluids, the nature of which is rarely recorded on the label (eg. formol glycerine), plant material may be preserved in 'Kew mixture' or a chlorophyll colour-preserving medium, transferring to alcohol will cause the chlorophyll to leach out (Moore, 1999).

Second- will the transfer improve DNA preservation? If the specimens have been fixed in 10% formalin (= 4% formaldehyde) then the DNA integrity will have been masked by the formaldehyde This reaction is non-reversible. Fresh specimens for molecular studies need to be stored in a minimum of 90% alcohol (Criscuolo, 1994).

Third- the transfer may seem to satisfy Health & Safety from the aspect of the personnel breathing in the fumes, but the transfer to alcohol brings in extra problems concerning flammability of the fluid. The added risk of faster evaporation (especially during Summer) means that more monitoring and topping up needs to be carried out. Keep in mind that as alcohol evaporates from a jar, the residual solution becomes dilute (Carter, 1995).

Fourth- most specimens will benefit from the change. Formalin requires buffering and does not fix lipids (only preserves them), alcohol dissolves lipids out and does not require buffering.

Fifth- wear surgical gloves - alcohol dehydrates the skin and can lead to dermatitic problems.

Sixth- check with your local Health & Safety Council, Water Board or County Council before tipping any diluted formalin down the drain. Small amounts (up to 5 litres per 24 hours, accompanied by ten times the equivalent volume of water) may be permitted - it is a useful bactericide but larger amounts may cause hazards to sewage personnel and might even neutralise settling tanks!

Order your IMS (Industrial Methylated Spirit - 74 OP - over proof) is the normal absolute alcohol, don't order ethanol as it is much more expensive. Check that you have a declaration of use from you local branch of HM Customs and Excise before you make the order. IMS comes in 2.5 litre bottles or 25 litre drums (cheaper pro rata) also ensure that you have the correct equipment for opening such drums (T key) and for storing them safely. Drums (especially) and bottles of IMS are potential fire hazards and require proper storage away from heat sources including sunlight. Securable metal bins are ideal or metal cupboards (for the bottles).

Technique

1: Find some empty (and clean!) 2.5 litre bottles and label them "Preserving IMS, 80% strength". Dilute your IMS to 80% (500ml of deionised water, tap-water will precipitate out any dissolved calcium salts), then add 2 litres of IMS). Most important - do this at least 24 hours before you start the process below as the mixing of these two fluids releases thousands of tiny air bubbles {dissolved in the water) and which will penetrate any immersed specimens and may cause them to float! 70-80% is ideal for preserving, full-strength can cause specimen embrittlement and be more volatile and flammable. Older deionisers can produce water ~with a low pH, check its pH (paper test strips, prior to use).
2: Make up baths of 20%, 40%, 60%, 80% IMS by diluting with deionised water. Again, this must be done at least 24 hours before any immersion can take place. If transferring fragile specimens, an additional 10% IMS bath is advisable.
3: Immerse your specimens in tap water until the smell of formalin disappears (but don't leave fragile specimens overnight or they may start to deteriorate).

4: Check inks on labels that are going to be immersed in alcohol for fastness and re-write labile-inked labels using Indian Ink or Pigma (archival ink) pens on suitable paper (Moore 1999).
5: Rinse specimens in deionised water and then transfer directly to the 10% or 20% IMS bath as appropriate.
6: Take the specimens up the IMS ladder to the 80% bath ensuring that specimens are left in each bath for 24-48 hours depending on, size and density. *[fish and other densely-muscled specimens may need longer to ensure penetration of the fluid]
7: Bottle the specimens in fresh 80% IMS. They should be the same size as before and should not have acquired any wrinkles or other signs of too-rapid dehydration. In some cases the colour may have been enhanced by the process but this may not last!
8: Check the specimens the next day, look for discolouration of the fluid - lipid leaching out? Leave it for a week or two checking frequently the depth of fluid colouration. When no further contaminant appears to be leaching out. renew the fluid. If any specimens are floating try to tease or gently squeeze out the trapped air. Small specimens will require vacuum treatment.
9: Vacuum treatment - specimens requiring vacuum treatment due to trapped air must be taken down the IMS ladder to deionised water. Any alcohol vapour in the vacuum line will damage the pump! After the trapped air has been released, bring the specimen up the ladder as before.

References

Carter, J. 1995. A short study into the changes in alcohol concentration due to evaporation. *Conservation News,* **56**: 24-25.
Criscuolo, G. 1994. Museum Spirit Collection and the preservation of DNA. *Conservation News,* 54: 39-40.
Moore S J, Fluid preservation, in *Care & Conservation of Natural History Collections,* Carter DJ & Walker, A. (eds). Butterworth & Heinemann, 1999.

One Day Seminar
Fluid Preservation - do we really understand it?

With the auspices of the NSCG, Simon Moore is organizing and hosting an instructional seminar (like the pyrite decay seminar at the NHM in late February) in Winchester at the HCC Museums Service on November 7th.

The seminar will be divided into 3 parts, firstly dealing with the biomechanics of fixation and preservation, secondly dealing with more specific problems - hopefully reviewing re-hydrating agents, moving collections, with updates on the latest Stoelzle {ground glass) storage jars. The afternoon will be devoted to practical demonstrations.

Draft programme for day

10.00-10.30 Introduction and Talk 1 (Simon Moore) History of fluid preservation, outline of fixation and preservation and 'new' preservatives.
10.30- 10.50 Talk 2 {Julian Carter) the biomechanics of formaldehyde alcohol fixation, brief outline of DNA fixation and storage in alcohol.
10.50- 11.10 Talk 3 (Simon Moore again) Histological effects of fixation and long-term preservation. (plus) preservatives- are they beneficial or not?
11.30- 11.50 Talk 4 (Maggie R) Review of current re-hydrating agents.
11.50- 12.10 Talk 5 (Clare Valentine) Moving the Porifera Collection into the new Darwin building combined with Health & Safety overview for this work.
12.10- 12.30 Talk 6 perhaps- recent updates on alizarin transparency techniques??
14.00 - 16.00 Demonstrations.
Drilling glass back plates, alcohol transference from formalin.

1- Use of Density Meter (JC) (Meetings Room)
2- 2- Celloidin technique {SJM) (Nat. Sci Cons. Lab)
3- 3- Re-hydration methods (MR) (Instruments Room)
4- 4- Transference of formalin-preserved material to IMS

16.00 Debriefing: questions, issues, surgery for problems, next seminar?
Topics for discussion if time: Narcotising techniques, when and when not to narcotise? Additives, including color preservatives: $Cu(NO^3)_2$, CuAc, glycerol, PPGlyc,, phenoxetol?, $Co(No^3)_2$, compound fixatives - Kew mixture, 'fern pickle'. Other ideas?

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Student Placement Wanted

I have recently completed third year of a Bachelor of Applied Science in the Conservation of Cultural Materials at the University of Canberra and have one subject to complete for graduation in July 2001. During my degree I have undertaken extra units in general biology, microbiology and molecular biology. As part of my degree I completed a research project on the effects of preparation materials on the DNA of museum mammal specimens and for my final unit will be investigating the role of bacteria in the biodeterioration of ornithology collections.

Sadly, natural history conservation is a largely neglected field in Australia and thus I believe that I would benefit from an internship in the U.K.. I am a British citizen and am intending to return and settle in the UK later this year.

Tessa Ivison
U982259@student.canberra.edu.au

Destructive Preservation

This book is the result of post graduate research by Stephen Williams, it deals with a number of interesting topics relating to preservation of natural history material, although mostly concerned with oesteological material, the concepts and theories therein could be applied to most other natural history materials.

There are interesting discussions on the history of the museum conservation movement since its early days, the meaning of preservation, and the issues compromising the conservation of natural history collections.

The main chapters are concerned with the nature of oesteological material, the stabilization, processing, maintenance and preservation of oesteological material, including some very detailed studies.

Williams, S.L. (1999) Destructive Preservation. 206pp.ISBN 91-7346-358-2. Published and Distributed by: Acta Universitatis Gothoburgensis, P.O. Box 222, SE-405 30 Göteborg, Sweden

Balmforth R.I.P.

As most of you are aware the Balmforth Engineering Limited, the company that supplied many of us with our entomological cabinets and alike have gone into liquidation. However, not all is lost as Stortech Ltd of Oldham have taken over the manufacture of the entomological caninets, this adds to their already extensive line of museum storage systems. At the trade show at the BCG/NSCG AGM Tony Baker (Stortech designer) spoke about the recently obtained contract for the supply of steel entomology cabinets to the Natural History Museum, London plus a number of other museums in the U.K. "We are also pleased that we have developed an excellent working relationship with Stephenson Blake, the suppliers of the interior drawers, and we can now prepare total costings for the requirements of both the cabinets and the drawers".

Stortech are specialist designers and consultants as well as manufacturers of storage equipment specifically for museums and art galleries, and their range also includes animal and bird skin drawer cabinets, herbarium cabinets and dust proof 'see through' doors for easy viewing of reserve collections.

Contact: Tony Baker (Consultant/Designer)
Stortech Limited, Linney Lane, Shaw, Oldham OL2 8HB
Tel. 01706 840422,
fax. 01706 882340,

E-mail stortech@dial.pipex.com
Website: www.stortech.ltd.uk

Another supplier of museum storage systems are:

Gerry Graves (Museums Manager)
System Store Solutions Ltd
Ham Lane, Lenham, Maidstone, Kent ME17 2LH

E-mail: sales@systemstoresolutions.com
Website: www.famispa.com

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