UKIC Accreditation Update

Simon Moore has kindly offered to sit on the UKIC accreditation Committee as Natural Sciences Rep., somewhat at the eleventh hour, and is now prepared to answer any questions that aspiring 'accreditees' may have. Please e-mail him (preferably) on musmsm@hants.gov.uk or call on 01962 846337.

The last meeting for the fast track system took place on the 14th of October. The fast track system is now all set to go ahead and those who have notified the UKIC office will get their forms in November.

Points to take note:

- To qualify for the fast track you must have completed at least 10 years in conservation, this does not mean that it has to be in the same discipline that you are applying to be accredited (within reasonable limits). Any training undergone will also be included in the 10 years. If you are close to completing your 10 years the committee will review your application and may allow you to proceed, particularly if there are not many fast track applicants from your chosen discipline.

- Your workplace may undertake to pay for your accreditation fees.

- You will need to get at least 2 sponsors who know of/understand your work, these may be from abroad if necessary.

- Insurers have indicated that rates for accredited conservators will be MUCH lower than previously.

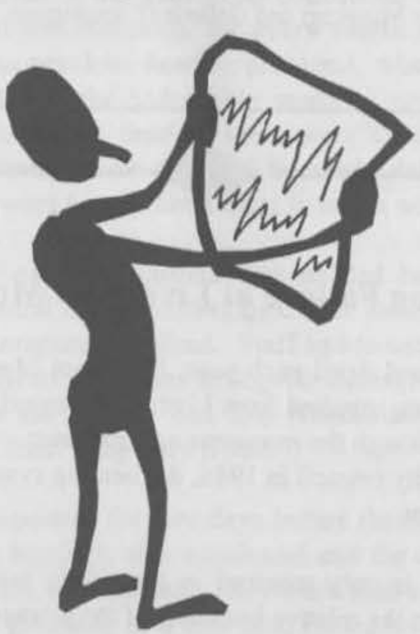
- The NSCG committee has agreed to go for the UKIC schemes.

- The Fast Track scheme will run during 1999 (two groups) during which candidates will be assessed according to the requirements set out by the accreditation committee.

- Once the fast track scheme has been completed then those who have been accredited will be asked to start assessing candidates for the mainstream scheme.

The Ten Agents of Deterioration

An issue by issue guide to the risks facing museum collections



5. Temperature & 6. Relative Humidity

Introduction

This is the fifth and sixth part of our series on the Ten Agents of Deterioration; the risks facing museum collections. The last edition of the newsletter did not include an insert such as this. This edition covers both 'Agents' Temperature and Relative humidity (RH) - hence this reference to 5 & 6 on the cover.

It was decided that we cover both topics in this issue as these agents' behaviour is often reflective upon one another.

For details of recommended standards of the relative humidity and temperature for the storage of natural history specimens see:

'2. Standards in the Museum Care of Collections of Biological Collections.1992' pp. 52,53 ISBN 0-948630-18-3

and,

'3. Standards in the Museum Care of Collections of Geological Collections.1993' p. 55 ISBN 0-948630-20-5

Both published by the Museums and Galleries Commission, U.K.

Donna Young

Heating Failure at Liverpool Museum

Between October and April each year, Liverpool Museum's building is dependent on heating supplied from Liverpool Central Library, the building next door. Although the museums and galleries were separated from the control of the city council in 1986, the heating system remains as part of the library system.

Generally, heating is only required in the winter months and prevents large fluctuations in the relative humidity of the storage areas. However, this year the summer had been exceptionally wet and cool so that by the time it was due to be switched on in October the relative humidity of the storage area was a little higher than normal. Unfortunately, this coincided with essential maintenance and repair work which the library needed to carry out on the heating system and it remained cut off for several weeks longer than normal. This, together with the cold, wet conditions experienced externally meant that the relative humidity began to increase rapidly peaking at 80%. Small monitors that are not particularly accurate but show when changes are occurring indicated that this may be causing problems in the storage area. As the relative humidity began to increase, and there were no indications as to when the heating would be back on, the Conservation division was contacted.

Some geological specimens are particularly vulnerable to high relative humidity and once it goes above 60% many of the commonest metal sulphides, such as pyrite and marcasite can be affected. These common minerals are found in a large number of rocks and fossils as well, which means that large areas of the geological collections can be affected and that providing microenvironments for every single specimen would be impractical. Unlike previous heating problems, where just one storage area was involved and the vulnerable material could be temporarily moved to a drier area, this time all areas were affected. Conservation arranged for six industrial scale dehumidifiers to be delivered to Liverpool Museum and these were hired from a local firm at a weekly rate.

The large number of dehumidifiers was needed because of the area occupied by the natural history collections. The storage area is a former gallery and is not compartmentalised. Staff had to empty water collected from the dehumidification process at regular intervals but initially there was so much from the air that one unit failed during the course of a weekend causing a small temporary flood.

The dehumidifiers operated for five days before the heating finally came on again. Relative humidity was monitored and the dehumidifiers were left running until 45% was reached. They were then switched off one by one. This was done gradually as it took time for the heating to be effective in such a large area and the relative humidity was monitored so fluctuations were minimal as control was switched from dehumidifiers to heating.

Wendy Simkiss
Assistant Curator, Earth Sciences
National Museums and Galleries on Merseyside

Biological Collections at Hampshire County Council Museums Service

Hampshire County Council Museums Service biology collections are stored in a building that was once a farm outhouse. Temperature and humidity fluctuations have always been a problem with annual parameters of 2° C to 27° C and 45% to 75% RH.

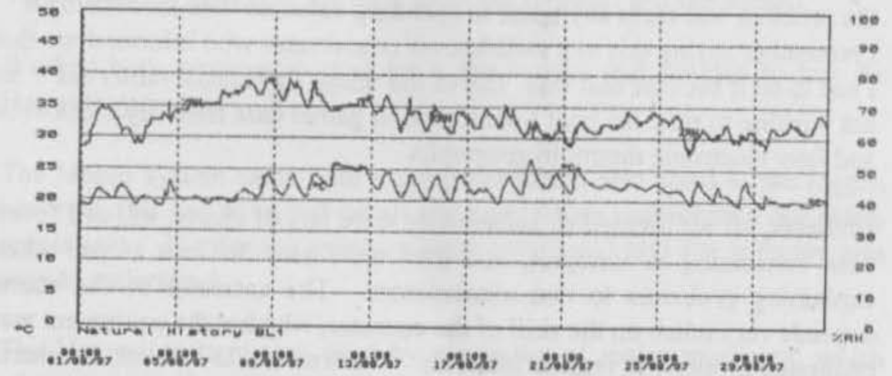
Results of high temperature combined with low RH in the summer season, provided me with extra work mending taxidermy cases whose backs had split apart, some in several places, allowing entry for the customary moth and beetle. Fortunately, this situation only arose in 1997, after the annual zenith for ingress of insect pests (March to May) so that no specimen damage ensured. The opposite extreme, cold and damp, provided mildew and other air-borne fungal spores to thrive either inside the cases or even on the exteriors as well.

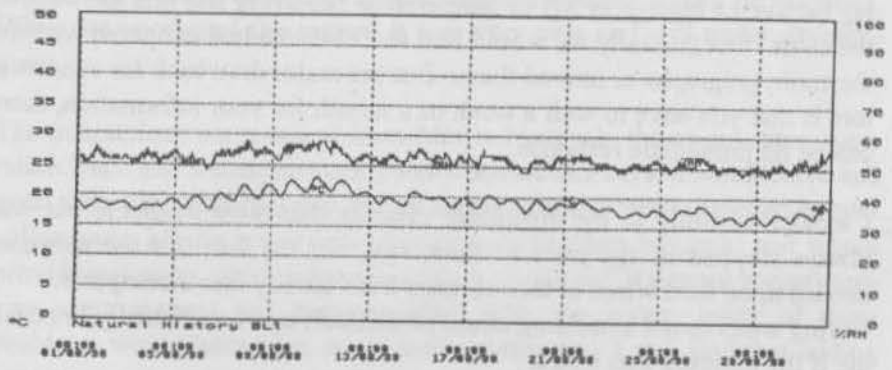
A Meaco monitoring system was installed c.1995 and proved effective in monitoring the numerous buildings around the site containing all manner of collections and which were all sensitive to hygrotemp fluctuations.

Block 1, as it is known, where the biology collections are housed, was listed as a priority for treatment and earlier this year a humidifier/de-humidifier and temperature regulatory system was installed using the Danish Cotes CR110B system for temperature regulation and dehumidification balanced with a Swiss Defensor 505 humidification system. The latter units are dish-shaped and sit on shelves near a hygrostat and self-activate if the humidity levels are too low. So the Swiss system is worked hard in the summer and the Danish system in the winter.

To date, the results are gratifyingly rewarding. No more split cases and no more fungal growth. The temperature level, although cool during November (11° C) compares favourably with what it used to be.

Cost for supplying and installing two dehumidification and three humidification systems and humidistats came to £5,253.00 excluding VAT, half of which was covered by a grant from SEMS. The equipment was supplied and installed by Sorption Wheel Services Ltd (SWS), 90 Station Road, Wickwar, Gloucestershire, GL12 8NB (Tel. 01454 299387, Fax. 01454 294278).





Figures show Humitemp traces for August 1997 and August 1998; (RH is upper trace), showing greater stability of fluctuations during 1998 and within normal storage parameters.

Simon Moore
Hampshire County Council Museums Service

Hanwell Telemetric System - a Users Report

Measuring RH and temperature has always been a problem for me. It was a time consuming occupation. If it was impossible to do anything about the problem was there any point in spending valuable time monitoring it. I remember saying this to a well-known conservator who informed me that I had to do it because that was "one of the things that conservators did". So not wishing to rock the boat I continued to gather data from my clockwork and later electronic thermohygrographs.

However, all we seemed to accumulate were lots of charts, which I found time consuming to interpret, and they were also difficult to use when explaining problems to non-conservators. The accuracy of the charts depends very much on the skill of the operator, whether the equipment was calibrated properly at regular intervals. The arms could be bent, the charts were sometimes not put on the same way every time, pens could dry out, and changing all the charts could be time consuming. Also there is a time lag between a change in RH or temperature occurring and this showing on the chart. Occasionally we would find that children had tampered with the thermohygrographs or moved them. But the major drawback for conservators is that you have to wait a week or a month for your information, there can be no immediate response.

I looked wistfully at the electronic systems that were available but was always stopped by the price of these systems; the fact that the monitors needed to be hard wired or downloaded individually into a computer. Laying wires round a building could be difficult and was virtually impossible if the building was listed.

It was not until the telemetric systems came on the market that the possibility of installing an electronic system became a possibility. No wires were needed, so installation was easier. The monitors were no more expensive than thermohygrographs, sometimes cheaper in fact. The main cost was in the logger, the software and a computer capable of running the system.

In 1994 we won a £2,000 prize in the Conservation Awards. With this and some of our own money we were able to think seriously about buying a telemetric system.

The two on the market at the time were the Hanwell and the Meaco.

We had both systems on trial for a few weeks and decided to buy the Hanwell system.

The Meaco system came with a computer which also acted as the logger, however, this had to be left on all the time, which contravened our safety regulations. The Meaco graphics were very good and the software was easy to understand.

The Hanwell system was used by a number of major museums, which when questioned gave glowing reports as to its effectiveness. The software and graphics were difficult to understand but we were informed that this was in the process of changing and constant updates would be provided. When we purchased the system it was very new and still under development.

The instructions we received from Martin Hancock, the co-inventor, were rather basic and a complete computer illiterate like myself would have had great difficulty installing and setting up the system without assistance from colleagues. Martin was always happy to help when he could and would provide any extra information on request. However, if a more comprehensive users manual had been supplied with the system many of these problems would have been more easily overcome. I still find that adding monitors to the system, changing plans or changing the set up in any way very confusing and difficult.

Overall the system has worked very well, although there have been a number of problems.

1. Thunder storms or radio interference can disrupt the logger and data can be lost.

2. Occasionally monitors have had trouble radioing into the logger. This can happen for no apparent reason and can be very frustrating. The monitor must then be tested to see if the problem is with the electronics or its position.

3. We have a modem link to an outside station. Setting up this link was difficult, and initially we had problems. The manufacturer's instructions were again basic, and after installation the modem would occasionally refuse to operate for no apparent reason.

4. The monitors are calibrated with 3 salts and via the computer. This can be a confusing and lengthy process, as each salt must be left on the monitor for about 20 minutes. At present we have 35 monitors and this is not a job we enjoy!

Monitors can be sent away for calibration but this service is expensive.

The advantages of the system are self-evident:

1. Once the system is set up and running the Windows based software is very user friendly and operation is straightforward.

2. Immediate access to continuously updated information. We can react to problems as they are occurring.

3. Alt analysis and interpretation can be done at the touch of a button.

4. The charts, plots graphs and summaries are easy for curatorial staff to understand. This has made it easier for us to initiate environmental controls plans in the galleries and stores. You can't argue with hard evidence when it is well presented!

5. The monitors are smaller and less obtrusive than thermohygrographs. Curators and designers are happy for us to place them in cases and in amongst displays.

In short, we are very happy with our Hanwell Telemetric System. Since its installation environmental control has a much higher profile in the museum and I have to do less hard sums!

Janette Pearson
Ipswich Museum

The following five pieces are all from Kate Andrew, Ludlow Museum.

The Specific Risks of Incorrect Temperature for Natural HistoryCollections - with particular reference to geological collections

An increase in temperature will increase all reaction rates, be it chemical breakdown or breeding bugs. Rob Waller's article in this issue discusses a risk assessment related to increased temperature.

Incorrect temperature can cause the following problems in mineral species; violation, dissociation of hydrates, thermal shock and fracturing of specimens with fluid inclusions exposed to high or low temperatures. Polymorphic phase transitions of some mineral species are also a function of temperature but the rate of change from temperature of formation to storage temperature is so slow that most species exist in a what is called a "metastable" state. For a thorough discussion of these potential problems, the chapter by Rob Waller "Temperature and humidity sensitive mineralogical and petrological specimens" in "The care and conservation of geological material" edited by Howie should be referred.

The manager of a general geological collection needs to be aware of the effects of incorrect temperature on some fairly common mineral species and on certain types of crystals.

KA

Species Prone to Thermal Shock and Cracking

Native sulphur is so heat sensitive (has a high co-efficient of thermal expansion) that it will suffer spalling if held tightly in the hand, this occurs as the outer part of the crystal expands much more rapidly than the inside. Native sulphur is a fairly common mineral, found in most collections.

Many crystalline minerals contain small cavities partly or wholly filled with liquid, these are called fluid inclusions. In an environment with rapidly changing temperature, for example, turning on display case lights or moving specimens from an unheated store to a warm room, the fluid in these inclusions may expand or contract more severely than the surround mineral, leading to fracturing or even explosive disintegration. Fluorite specimens are particularly prone to fracture damage from fluid inclusions.

Collection workers should be wary of potentially large temperature variations inside showcases used for minerals, traditionally lit very brightly, or where sunlight adds to the thermal gain. Mineral specimens should also be well packed for transportation and allowed time to acclimatise in a new environment before unpacking.

References:

Waller, R Temperature and humidity sensitive mineralogical and petrological specimens pp 25-50 in The care and conservation of geological material minerals, rocks, meteorites and lunar finds, ed Frank Howie, Butterworth Heinemann 1992.

Found, Christine and Helwig, Kate. The reliability of spot tests for the detection of arsenic and mercury in natural history collections: a case study. Collection Forum 11 (1), 1995, pp 6-15.

Andrew, K.J, Tetreault, J and Waller, R. A survey of pollutant concentrations in mineral collection cabinets. SSCR Journal, Feb 1993, Vol 4, no 1 pp 13-15.

Andrew, K J, Tetreault, J and Waller, R in press for Collections Forum - Pollutant Monitoring in Mineral Collections.

Frozen Collections and Incorrect Temperature

Increasingly, natural history collections contain frozen material, dead animals and birds awaiting mounting or skin preparation have long been stored in museums, but collections of frozen tissue intended for DNA sampling are becoming more common. Freezer alarms, back-up freezers or alternative power supplies should be in place where maintenance of collections below 0°C is essential. Elderly freezers should be checked regularly, a procedure that prevented a disaster from occurring at Ludlow Museum recently, we have kept the old freezer as a back up to the new one.

Specialist geological institutions may also house frozen material, for example ice cores from glaciers and polar ice sheets and frozen deep-sea soft sediment cores. Specialist low temperature tabs and cold weather clothing for staff are needed to work on these specimens.

KA

Conservation of Two Frozen Specimens, CMN 56973 and CMN 56974

The Canadian Museum of Nature mineral collection houses two very unusual specimens of native silver collected from a mine in the permafrost of northern Canada. The dendritic silver has grown in a vein of ice within the rock matrix.

Five specimens were originally collected in late 1980s, but despite being flown back to Ottawa in cooler boxes, only two survived the journey. These specimens were bagged and placed in the Mineral Sciences department chest freezer inside a cooler box.

Concern was expressed that over time, condensation would accumulate as frost on the specimens and could slowly become compacted and incorporated into the ice of the original specimens. Analysis of the ice would therefore be contaminated by modern water with the potential of invalidating results.

A decision was taken to clean the specimens and re-pack in such a way as to prevent ice formation and also to provide some buffering against melting in the event of a freezer failure or other temperature increase.

In the absence of a low temperature laboratory, conservation work was undertaken outside in a shaded carport during the Canadian winter. The exterior temperature was around -5°C.

The specimens were taken outside in the cooler box for conservation. Wearing disposable gloves, the specimens were unwrapped. The surface was found to be covered with a substantial amount of loose frost. This was gently removed by brushing and levering with dental tools, revealing an irregular vein of dense smooth ice in a grey and rust coloured rock matrix. Very beautiful completely untarnished silver was found growing in and out of the ice; the form of the silver was rather like a series of lobes of a liverwort. The ice had clearly melted a little since the specimens were collected as the silver protruded from the surface of the ice. Once cleaning was complete specimens were quickly transferred back to the cooler box and then into the freezer.

5mm thick crosslinked polyethylene closed cell Volara 2A foam was used to protect areas of the ice with protruding silver by cutting a hole in one layer of foam and placing a second layer on top. The specimens were then tightly wrapped in thin polythene, of the thickness used to make dry-cleaning garment covers.

A long 10cm wide strip of Volara foam was cut and used to bandage the specimens, this was intended to provide additional insulation and some buffering from temperature increases. Finally, a bag was constructed for each specimen from Marvelseal, an oxygen impermeable film used commercially for vacuum packed food. Marvelseal consists of three layers, an aluminium foil bonded to a polyester with a polyethylene layer to permit heat sealing.

Once the size of the specimens had been established, the bag was made in the lab by cutting and folding the film and then heat sealing both sides. Double seams were used to guard against failure. Working inside the freezer, the specimen was then placed inside the bag along with a specimen number and the third side heat sealed with a hand operated heat sealing device, leaving a small hole for the vacuum pump tube. As much air as possible was then evacuated from the bag with the vacuum pump, causing the bag to collapse onto the padded specimen, the gap was then also heat sealed with a double seam. Finally, the specimens were replaced in the cooler box inside the freezer. The position of the protruding silver was marked on the outside of the bag in indelible black ink to prevent future crushing.

Although this form of storage means that specimens cannot be viewed without cutting open the bag, these measures have now protected the specimens for almost eight years. An entire slide film was used to document the procedure and close up photographs were taken of both specimens. At the time that work was undertaken, oxygen impermeable clear film was not easily available, had clear film been used, the specimen would still not be visible because of the polythene wrapping and Volara padding.

Kate Andrew and Rob Waller undertook cleaning and re-packing of these specimens in 1991.

KA

Mineral Species, Herbarium Specimens and other Natural History Items with Sufficiently High Vapour Pressures to Cause Volatilisation

Since mercury and sulphur have relatively high vapour pressures, they will give off vapour even at normal room temperature. The rate of volatilisation will also increase with temperature. Native mercury and mercury containing mineral species (for example cinnabar) and also native sulphur should be stored in such a way as to reduce the rate of volatilisation and contain the emitted gasses.

Mercury and mercury containing mineral species should be stored in well-sealed containers (such as screw top glass jars or Stewart plastic boxes) and opened only in a well ventilated area. Not only will mercury vapour form amalgams with other native metals such as gold and silver, it is also a serious health risk. Mercury used in the production of felt was the cause of madness in hatters (refer to Alice in Wonderland), mercuric chloride solution routinely used to "poison" herbarium sheets until the early 1980s may well have a similar effect on botanists. Vicky Purewal's award winning research looked into contaminants including mercury on herbarium specimens. Mercury compounds were also used as a preservative in the preparation of vertebrate skins and mounts (Found & Helwig, 1995).

A test paper for detecting mercury vapour was developed for the pollutant monitoring project carried out on three Canadian mineral collections (Andrew, Waller and Tetreault 1993 and in press). The results of the monitoring clearly demonstrated the presence of mercury vapour in cabinets containing native mercury and mercury mineral species. More worryingly, wooden cabinets that had once held mercury-containing specimens were also continuing to emit mercury vapour.

Storage in well-sealed containers would also be sensible for native sulphur. Traditionally, mineral collections are stored in a systematic order, in small collections this results in all native species being stored together. Gaseous sulphur compounds will react with native silver causing sulphidation, a form of black tarnish.

KA

Temperature Monitoring within a Hazardous Environment

Investigative work into the detection of pesticide residues present on herbarium specimens, identified four main chemicals. These were residues of mercuric chloride, arsenic trioxide, barium fluorosilicate and naphthalene. Frequently all four of these pesticide residues were present on the same specimen. The toxicity of these chemicals is extremely high and health surveillance of staff in contact with arsenic and mercury is strongly advised.

The results of this work disclosed extremely high concentrations of arsenic, barium and mercury and staff in contact with the collections were tested for contamination. The results later on in the year revealed that key staff working on lower plants as well as the vascular material were developing slightly elevated readings for arsenic and mercury.

The collections should only be handled whilst wearing blue nitrile gloves, not vinyl and no work should be carried out unless the area is known to be well ventilated. A fume cupboard should be used if there is no alternative. Facemasks would benefit workers as dust particles will carry contaminants and these are easily dispersed and inhaled whilst handling specimens.

The air quality should be monitored for levels of mercury and arsenic. Naphthalene is generally an easy chemical to detect due to its strong aromatic smell. The NMGW herbarium air quality was well below the recommended Health and Safety Executive levels. The herbarium is not air-conditioned but is monitored for temperature and relative humidity fluctuations. A rise in the temperature of the herbarium will contribute to a rise in the vapour pressure of the chemicals present on the collections, therefore increasing the volume of contaminants within the air. Although Mercury is a metal it has a vapour pressure due to its being a liquid. It has a relatively low vapour pressure, but an extremely small amount of this vapour within the air will very quickly exceed the Occupational Exposure Levels (OELs) due to its hazardous nature. For example, OELs and Minimum Exposure Levels (MEL) for mercury are 0.025mg m^3 volume of mercury in m^3 of air (Croners, 1998). Naphthalene, mercuric chloride, arsenic trioxide and barium fluorosilicate levels may quickly exceed the HSE regulations even at low temperatures as very small levels in air are regarded as highly hazardous.

Monitoring the herbarium temperature is imperative and increasing ventilation after a period of warmer conditions is advisable.

Reference:
Croners (1998) Chemical Hazards *in* Kellard, B. *Substances Hazardous to Health.* Kingston upon Thames, Surrey, Croner Publications Ltd pp3/A-3/868.

Vicky Purewal
National Museums & Galleries of Wales

Note from Ed:
Though the 'Ten Agents...' series is primarily concerned with museum collections and not the people working on/with them, it was decided to include this last piece as it relates to comments by KA. Vicky hopes to publish a more detailed and comprehensive report of her work later in the year (see page 4 of main newsletter).

Incorrect Temperature as a Risk - how significant is it?

Incorrect temperature levels may pose any of the three types of risks to collections depending on the frequency of occurrence and severity of the risk (Waller, 1994, 1995). It is easy to consider and estimate the magnitude of a type 1, rare and catastrophic, incorrect temperature risk if one considers, for example, the fate of an ice core collection exposed to >°C for several days. Similarly, the type 2, sporadic and severe, occurrences of thermal shock causing fracturing of well crystallised mineral specimens, or partial melting of wax models or casts in a collection, are relatively simple to appraise. Incorrect temperature-type 3 (T-3) is another matter. Within the T 3 generic risk are considered the mild and gradual consequences of storage at a temperature level somewhat higher or lower than ideal.

What makes this risk difficult to incorporate in risk analysis is the fact that storage at a non-optimal temperature is seldom considered and calculated as a direct risk causing damage. Rather, it tends to be either complicit with another agent in causing damage, or simply contributes to the susceptibility of specimens to damage caused by another agent. As an example of complicity, consider how the susceptibility of a collection to insect pest damage might change depending on whether the collection is stored at 10°C or 30°C. As an example of incorrect temperatures contributing to susceptibility to damage by another agent of deterioration, consider the embrittlement, and eventual physical failure, of lignin rich, acidic herbarium sheets. The degradation, leading to eventual failure, of these sheets would proceed at a greatly reduced rate at 0°C as opposed to 25°C.

The interplay of temperature with other agents of deterioration might, at first, give the impression that the effect of modest changes in collection storage temperatures cannot be considered in a risk assessment context. Recently, however, an issue arose at the Canadian Museum of Nature that required exactly that consideration. The recently completed Natural Heritage Building was designed and built to provide a state of the art facility for housing our national natural science collections. Environmental conditions called for relative humidity levels that varied according to the principal materials in a collection but a constant temperature of 18°C was set for all collections. The selection of this temperature involved striking a balance between minimising pest activity and thermal degradation of collections, on the one hand, and energy and human requirements on the other. Encouraging separation of collection management from other activities better accommodated in laboratory or office spaces was seen a an additional benefit of lower temperatures.

After approximately one year in our new building, however, it was evident that maintaining 18°C made collection management work in the insect collection very difficult. The nature of the work done requires frequent, random access to all parts of the collection and detailed, meticulous handling and placement of minute fragile specimens. The difficulty in completing this work at a temperature as cool as 18°C was resulting in a reduction of collection management productivity. Consequently, we were required to evaluate the risk associated with raising the temperature in certain dry-biological collection areas to 21°C. Other considerations, beyond the scope of this discussion led to the selection of 21°C as the target rather than, say, 20°C or 22°C. The question we sought to answer was not: what is the exact (to several decimal places) dependence of total risk on temperature levels?; but, rather: will a 3°C increase in temperature cause a substantial (100%), significant (10%), slight (1%(0.1%), or negligible(0.1%) increase in total risk?

Review of the existing (1992) risk assessments, showed that there were no significant T-3 risks assessed for any of the dry biological collections. Of the remaining generic risks, the magnitudes of risk for physical force types 2 and 3 (PF-2 and PF-3) and for pests were considered most dependent on storage temperature over time. The risks PF-2 and PF-3) and for pests were considered most dependent on storage temperature over time. The risks PF-2 and PF-3 were responsible for approximately one-half of the total risk to three representative dry-biological collections (vascular plants, ornithology and invertebrate zoology). This will be considered first.

Within the generic risks, PF-2 and PF-3, are included a variety of specific risks leading to physical damage. Examples include physical damage from routine handling, overly crowded storage, handling and transportation accidents, and so on. It was estimated that approximately one half of the PF-2 and PF-3 risk would occur as readily for new material as for aged, embrittled material. Consequently, thermal degradation resulting in eventual physical damage was estimated to be responsible for about one quarter of the total risk to these collections (one half of PF-2 and PF-3 risk which itself is one half of total risk).

Stefan Michalski has recently reviewed the literature on the relative humidity and temperature dependence of a number of reactions causing deterioration in organic materials in museum collections (Michalski, pers. comm. 1998). He has found that all the experimental data, as well as the fundamental equations of chemical kinetics, support the general rule that reactions causing extensive organic degradation over periods of decades to centuries have activation energies in the range of 100kJ/mol K. This can also be stated as the rule of thumb of "half the rate for each 5°C drop". (Reactions that go to completion in minutes to days average half this activation energy, and follow the old chem-lab rule of "double the rate for each 10°C rise.) The effect of this on relative decay rates and remaining lifetimes are shown in Table 1.

Consequently, we expect a 50% increase in reaction rate to result from a 3°C increase in temperature. Applying this to the ¼ of total risk due to thermal degradation resulting in eventual physical damage gives an estimated 13% increase in total risk.

The risk due to pests in these three representative dry-biological collections accounted for approximately 3% of the total risk 1. This risk was associated primarily with insect pests. It was relatively low due to reasonable control of temperature and relative humidity and effective policies and procedures related to pest management. We believe that further improvements in environmental control and in policies and procedures related to pest management in our new building would result in some reduction in this risk, even at a temperature of 21°C. The fraction of total risk due to pests, for these collections in the NHB, is thought to be less than 3%. Consequently, the increment in total risk, due to the change in risk due to pests, resulting from a change in temperature from 18°C to 21°C, is thought to be much less than 3%. It is probably on the order of 1%.

The expected increment in total risk resulting from a change of temperature of + 3°C is an increase of about 14%. This number implies greater precision than is warranted considering the assumptions and roughness of estimates. Nevertheless, the true increment in risk is probably within or near the range of 10% to 20% increase. Consequently, we have answered the question set out. A 3°C increase in temperature will cause a significant (10 to 20%) increase in total risk.

The question then became will the proposed temperature change result in an increase in the utilisation of the collection that offsets the increase in total risk? The answers to that question were yes, for the insect collection, and no, not at this time, for the remaining collections.

In summary, it is possible to consider the effect of a change in mean temperature on the risk to collections. This is true even if no specific temperature - type 3 risks are identified. It is, however, necessary to know the total risk to collections and the proportion of the total that is comprised of risks affected by temperature. Moderate (1-5°C) changes in mean temperature for the storage of dry-biological collections at the CMN are predicted to result in significant (10%), as opposed to substantial (100%), slight (1% (0.1%), or negligible (0.1%) increments in total risk. The final decision of what constitutes an acceptable risk to collections depends on considerations related to collection management and utilisation. This suggests the idea that expressing risk per unit of utilisation may be more meaningful than simply expressing risk per collection. After all, in the words of the immortal IP Sofacto, "Collections not used are useless collections". (Sofacto, 1991).

Temp. Change	Relative Decay Rate	Relative Remaining Lifetime
-5	0.50	2.0
-4	0.57	1.75
-3	0.66	1.52
-2	0.76	1.32
-1	0.87	1.15
0	1	1
1	1.15	0.87
2	1.32	0.76
3	1.52	0.66
4	1.75	0.57
5	2.0	0.50

Table 1. Relative decay rate and relative remaining lifetime for degradation of organic materials assuming an activation energy of 100kJ/mol K and all other factors being constant. Table reproduced courtesy of Stefan Michalski, Canadian Conservation Institute.

Acknowledgements:

I am very grateful to Stefan Michalski for providing information on the temperature dependence of chemical degradation rates and for allowing that information to be reproduced here. I thank Stefan Michalski, Canadian Conservation Institute, Jean-Marc Gagnon and Judith Price, Canadian Museum of Nature, for helpful comments on this paper.

Total risk after correcting the risk due to fire for the situation in the new LHIB building. The risk due to fire had been very high for certain of these collections.

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Sofacto, I.P. 1991. Untitled poem. Remains To Be Seen. 4(2):4.
Waller, R., 1994. Conservation risk assessment: A strategy for managing resources for preventive conservation. Pre-prints of the Contributions to the Ottawa Congress, 12-16 September 1994, Preventive Conservation: Practice, Theory and Research, A. Roy and P. Smith (Eds.), IIC, London, p. 12-16.

Rob Waller
Canadian Museum of Nature

Hanwell Radio Telemetry

The Hanwell radio system has now been in use for eight years and has developed considerably during that time to accommodate ever more sophisticated requirements from customers. When the system is correctly installed and maintained, a very high degree of reliability is now routinely achieved in the collection of data.

The system is based around a data logger (The 'Architect') which in its latest version offers a range of features which ensure data integrity. These features include flash memory and on-board battery back up. The large memory capacity allows the unit to run for long periods of time independent of a Host PC.

The Temperature/Humidity sensors themselves are now in their MkIII version offering high accuracy Vaisala sensors as standard and optional LCD screens. These new units are also slimmer and lighter than their predecessors.

A wide range of sensors can be added to the standard system including Lux, Lux/UV, PT100 surface temperature sensors, smoke and flood detectors, people counters, power consumption meters and wood-moisture sensors.

One major development in the last year has been the acceptance of the system for environmental control as well as monitoring. A range of schemes have been implemented which include conservation heating for National Trust properties and the control of Humidifier/Dehumidifier combinations via Hanwell radio Humidistats.

Liz Halliday
Hanwell Instruments Ltd

- Changes suggested by the NSCG Committee have now been made to the list of specialisms relating to Natural Sciences.

- Proposal folders are available from the UKIC office.

Simon Moore
Hampshire County Council Museum Service

also....Insurance Update from Simon

Many thanks to all of you who responded to the blue sheet insurance form. Your details have been logged and the scheme is ready to go. There is one problem: I still need 4 more people to complete the scheme. At present we have 6 and need 10 to bring the premium level down to something that we can all afford ($250 rather than $415 that it would be for 6). I have been asked whether being accredited by UKIC on the fast track system would drastically alter insurance premiums and whereas Crowley Colosso would give accredited conservators a discount (unspecified at present) it would not (could not) drastically alter the present good offer. For those of you who are waiting to be accredited to get a better deal, don't bother waiting. Once you have been accredited, you will automatically receive the discount.

Bear in mind that the package we have been offered is very reasonable, the quote accounts for our not conserving works of art worth millions; I would urge you to accept this offer if you are doing any freelance work in the field of natural sciences.

Fill in the form and send it to me as soon as possible, so that we can get this scheme underway. To those of you who have already done so, I apologise for the delay, but I hope you can understand why!