NATIONAL PARK SERVICE
DEPARTMENT OF THE INTERIOR

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Storage Concerns For Geological Collections

Geological collections may contain a wide variety of materials, from vertebrate and non-vertebrate fossils to mineral and rock samples, together with accompanying records such as microscope slides, molds, and casts. These collections may also have sub-fossil materials, which includes some of the original organic components of the specimen. Other semi-organic specimens such as tusks, teeth, and modern bone and shell material used for comparative purposes may be in these collections, too.

Geological collections can be damaged by various environmental factors. However, even if collection storage areas are not ideal, good storage systems can help to prevent damage from light, relative humidity, biological attack, and pollutants.

Storage Systems

A good storage system may be as simple as a series of sturdy boxes. There are also cabinets made specifically for geological specimens (see *Conserve O Gram* 4/1). All materials used for collection storage should be inert, so that specimens are never exposed to material failure or harmful by-products. Ideally, cabinets should be made of powder-coated steel with drawers of steel or wood. Cabinet doors should seal tightly and have locks. All boxes, cabinets and drawers need to be clearly labeled to prevent unnecessary disruption of specimens.

Small specimens can be stored in cardboard trays in drawers. Acid-free cardboard specimen trays are unnecessary for geological specimens, but will last longer than acidic trays. Magnets or empty trays used as space holders in a drawer will prevent specimen trays from shifting within drawers. Sheets of polyethylene microfoam in different thicknesses can be used as bumpers or under specimens to prevent physical damage. Only use the type of foam that has no coloring or other additives. Labels can be protected in polyester folders made for negative storage (see paper by Waller, *in* Rose and De Torres, 1992). Acid-free paper stock should be used to create labels with maximum longevity.

Very small specimens can be stored in labeled polyethylene, polystyrene, or polypropylene vials. Large specimens should be stored on shelves or, if fragile, on form-fitted mounts of plaster of Paris and stable foam (see Fitzgerald et al, *in* Rose and De Torres, 1992). Exceeding floor loading limits may be an issue in densely packed geological collections. Consult with a structural engineer if this is a concern (see Waddington, 1993).

Light

Geology specimens should ideally be stored in closed cabinets and boxes that limit exposure to light. Ultraviolet (UV) and visible light can fade labels, and in some mineral specimens, exposure to light can fade colors and also cause decomposition. For example, red cinnabar can decompose to black metacinnabarite. Minerals such as maxixe beryl, blue celestite, and some brown topaz can fade (see Nassau, *in* Howie, 1992, for a list of light sensitive minerals). Light sensitive mineral specimens should not be exhibited and should be stored in closed cabinets. Light will also increase the rate of deterioration of latex rubber molds and of the adhesive on thin-section slides. Limiting oxygen access to latex

mold surfaces by covering them with a plaster of Paris support mold will limit degradation. All these objects will need protection from light. UV filters on light fixtures will block out ultraviolet light. Keep lights off when people are not in storage.

Relative Humidity (RH)

In general, geology collections require a moderate, stable RH just like other types of museum collections. Specimens with pyrite decay and some mineral specimens are exceptions to this rule, as described below.

Pyrite decay

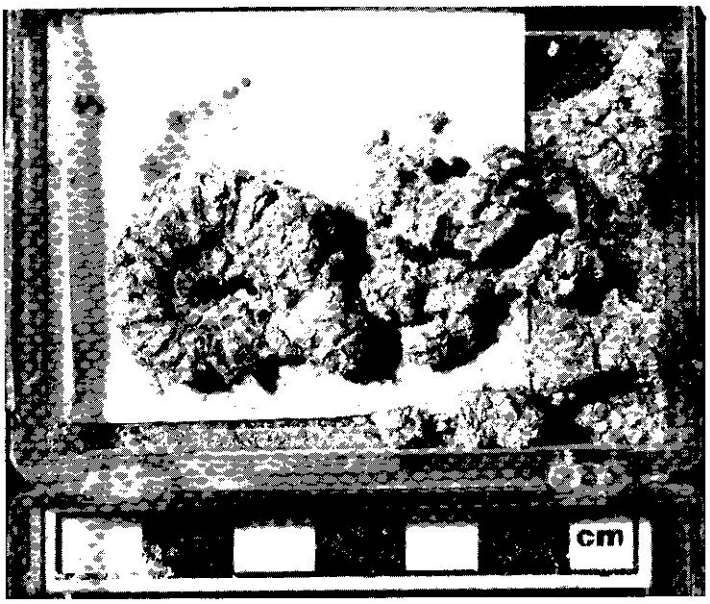
Some geological specimens are susceptible to "pyrite decay." The iron pyrite in these specimens can react with water and oxygen in the atmosphere to convert to iron sulfate. This compound is greater in volume than iron pyrite and typically causes the specimen to crack into pieces and fall apart. Acid produced in the reaction also helps to destroy the specimen. Typically, the end result of pyrite decay will be the reduction of the specimen to a pile of yellow/gray powder. Pyrite decay can be triggered by RH over 60%.

Specimens suffering from pyrite decay have a noticeable sulfur smell. Specimen labels and packaging are often stained or destroyed by the acid produced by the deterioration process.

Most pyrite decay in specimens can be prevented by keeping RH in the collection storage area below 60%. To halt decay once it has already started, however, specimens need to be isolated and stored in a very dry environment.

Other Specimens Damaged by RH

Many mineral specimens can be damaged by changes in RH. For example, very low RH



Example of damage caused by pyrite decay

(below 35% RH) may cause cracking as minerals lose water. High RH (e.g. above 60%) can cause deliquescent minerals to dissolve in the water they pick up from the atmosphere, rounding corners and reducing specimens in size, or eventually disintegrating them so that all that remains is a stain on a shelf or in a drawer. (For a list of the environmental requirements of different minerals, see the chapter by Waller, *in* Howie, 1992.)

Sub-fossil bone may be damaged by changes in humidity. Rapid fluctuations, in particular can cause cracking and splitting of specimens as they absorb and lose water. Clay minerals will be damaged in the same way. Shale specimens will crack and delaminate if RH is low.

The surfaces of specimens collected in coastal or other saline regions may exhibit the growth of salt crystals, called gypsum disease, in fluctuating RH. (This may also happen after certain types of treatment or specimen preparation.) Salt growth can cause surface damage. These crystals can be removed by gentle brushing and prevented by stabilizing RH in the collection storage area.

Metallic specimens may corrode at high RH. This can be a problem particularly in meteorite collections.

RH fluctuation can be limited by using well-sealed cabinets, particularly cabinets with wooden drawers, which will buffer RH changes.

Pollutants

Collection storage areas must be as dust-free as possible. It is difficult to remove dust from some specimens with rough and porous surfaces without causing damage. Dust levels can be decreased by good housekeeping and by sealing floors. Using well-sealed cabinets and polyethylene or cotton covers (unbleached and washed to remove sizing) will reduce dust (see *Conserve O Gram* 4/2). If the collection storage area is humid, it is better to use cotton covers so there is no chance of RH build-up beneath the cover. For safety reasons, collections containing radioactive specimens or toxic minerals should always be kept dust-free (see below).

Acids can sometimes off-gas from unsealed wooden storage furniture. These acids can react with calcareous (calcium carbonate containing) specimens to form powdery coatings, resulting in the destruction of surface detail. This is known as 'Byne's disease' in shell collections. If this is identified as a problem, wooden storage furniture must be sealed (contact a support office curator or a conservator), or specimens isolated from the acids in vapor barrier envelopes or wrapped in calcium carbonate buffered tissue paper inside ziplock bags.

Biological Pests

Insects can be a problem in geological collections if they attack paper specimen labels. Insects like silverfish and booklice will graze on mold growing on the surfaces of paper labels, removing the ink. Insects may also be attracted by mold growing on organic specimens or salty organic material and can graze on and damage these surfaces. Mold and insects thrive in high RH, and damage can therefore be limited by controlling humidity. Well-sealed cabinets will also prevent insect access. Cabinet doors can be retrofitted using silicone sponge gaskets if necessary (see *Conserve O Gram* 4/3). Insect monitoring and prevention in collection storage areas should be covered by the institutional Integrated Pest Management (IPM) plan.

Often, labels in geological collections contain important historical data. For example, the handwriting on a label may indicate who collected and cataloged that specimen. For this reason, never throw away old labels.

Health Hazards in Geological Storage Areas

Some fossil bones can emit radon, which can build up in well sealed cabinets (refer to *Conserve O Gram* 2/5). Collections may also contain radioactive mineral specimens such as autunite, carnotite, gummite, pitchblende, and uraninite. The main radiation hazard in geological collections is via ingestion or inhalation of radioactive dust. To reduce this risk, there should be no eating or drinking in collection storage areas, and dust should be reduced as much as possible. Friable specimens should never be dusted. All radioactive specimens should be stored in polyethylene bags with zip closures and labeled as radioactive. A dose rate meter can be used to detect particularly active specimens, which should be isolated.

Other potentially hazardous materials such as asbestos should also be stored in polyethylene self-sealing bags and clearly labeled. Cinnabar specimens may need to be stored in a vapor barrier envelope to reduce mercury vapor emission. Howie (1992) provides a list of common toxic minerals.

Wash your hands after working in geology collections. Disposable gloves and a toxic dust respirator should be used when working with radioactive or toxic specimens. Potentially

hazardous dust must be removed using a vacuum with a HEPA (High Energy Particulate Air) filter. This filter should be treated as hazardous waste and disposed of accordingly.

Contact the park safety officer or the regional public health officer for further help and information on safety issues.

Sources

Label Holders

Light Impressions, 439 Monroe Ave., P.O. Box 940, Rochester, NY 14607-0940; (800) 828-6216

Polyethylene, Polypropylene, Polystyrene vials

Durphy Packaging Co., 47 Richard Road, Ivyland, PA 18974-1512; (215) 674-1260

Nalge Company, P.O. Box 20365, 75 Panorama Creek Drive, Rochester, NY 14602-0365; (716) 586-8800

Wards Natural Science Ltd, P.O. Box 92912, 5100 W Henrietta Road, Rochester, NY 14692-9012; (800) 962-2660

Specimen trays

Ward Scientific (see above)

Vapor barrier bags

Keepsake Systems; (416) 703-4696 or (416) 703-5991

References

Brunton, C.H.C., T.P. Besterman, and J.A. Cooper. *Guidelines for the Curation of Geological Materials*. London: Geological Society Occasional Paper no. 17, 1985.

Howie, Frank M. *The Care and Conservation of Geological Material: Minerals, Rocks, Meteorite and Lunar Finds*. Oxford: Butterworth Heinemann, 1992.

Rose, Carolyn L. and Amparo R. De Torres. *Storage of Natural History Collections: Ideas and Practical Solutions*. Pittsburgh: Society for the Preservation of Natural History Collections, 1992.

Waddington, Janet. *Floor Loading Considerations in a Palaeontological Collection.* Collection Forum 9(1993): 65-69.

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