<http://www.amnh.org/our-research/natural-science-collections-conservation/general-conservation/preventive-conservation/pollutants>

# Pollutants

**General information on Pollutants and Collections**

The two general types of pollutants that contribute to the deterioration of museum collections are gasses and particulates.  These can be airborne or transferred by direct contact.  Airborne contaminants may include:

* Acidic gasses and ozone from the environment
* Organic and corrosive acids such as sulfur dioxide, nitrogen oxides, formaldehyde, etc. emitted by inappropriate storage or exhibit materials
* Abrasive particulates such as soot and dust

The most effective way to avoid damage from airborne pollutants is to prevent their deposition by having appropriate filters on HVAC systems, ensuring that windows are not opened in collection areas, and using enclosures in storage and displays.  When necessary, products with activated carbon, zeolites, or potassium permanganate will help capture gaseous pollutants in enclosed spaces.

Contaminants more commonly transferred via direct contact include:

* Oils and salts from skin transferred during handling - download the

**[Gloves Checklist](http://www.amnh.org/content/download/76537/1461125/file/Gloves%20Checklist.doc" \t "file)**

* Heavy metals such as arsenic that were used historically as pesticides on museum collections

By far the most common and problematic contaminant for most collections, though, is the dust and dirt that builds up in storage areas without proper housekeeping. Dust can be abrasive and attract pests, and removing it can cause damage to fragile specimens. Well-sealed cabinetry greatly reduces this problem, but can create other problems if the materials of the cabinetry or the storage materials inside off-gas, leading to a build-up of harmful gaseous pollutants.



Coral on open display can get dust embedded in the highly textured surface, making it difficult to clean or examine the delicate spines.

Tips to reduce dust and grime

* Make sure circulating air in the collection is as clean as possible by using filters on your A/C or HVAC system and making sure that they are changed regularly
* Keep windows closed in storage areas
* Keep specimen cabinet doors closed
* Use dust covers on open shelving

**Material Specific**

Pollutants and Invertebrate Zoology Collections

Freshwater and marine shell collections are susceptible to Byne’s “disease”.  This problem occurs when calcium carbon­ate (CaCO3) reacts with an acidic vapor to form salts. In museum collec­tions, this reaction generally occurs when acidic vapors such as acetic acid and formic acid from wood and wood products used in storage materials are in direct contact with the specimens.  High relative humidity speeds this reaction.  To combat this, use inert materials for long-term storage of specimens (download the Materials for Storage and Rehousing pdf in the Links & Resources section of this site)

Pollutants and Vertebrate Zoology Collections

Dust and dirt can permanently disfigure vertebrate zoology specimens.  Care should be taken to prevent the deposition of dust by using closed cabinets and appropriate storage materials.

Vertebrate zoology specimens on open display can accumulate a lot of dust, and dust removal can potentially be damaging to brittle hairs or feathers.

Pollutants and Paleontology Collections

In addition to the pollutants mentioned above, contaminants in paleontological collections can also come in the form of chemicals used in the preparation of specimens (e.g., acids or salts not rinsed away after treatment) or materials used in treatment such as adhesives and consolidants. Specimens suffering from pyrite “disease” emit sulfuric acid, which will contaminate storage materials and damage other specimens nearby. Any specimens suffering from pyrite disease should be isolated from the rest of the collection and stored in low relative humidity conditions.

Pollutants and Physical Sciences Collections

Geological specimens may be susceptible to Byne’s disease (see above) and Pyrite “disease”.  Pyrite (iron persulfide: FeS2), is often found in sedimentary rock.  If these specimens are exposed to conditions of high humidity “pyrite disease” (also known as pyrite “rot” or “decay”) can occur. The mineral oxidizes and forms iron sulphate (FeSO4); this oxidation product is several times the volume of the original mineral and the resulting crystal growth and expansion causes the specimen to fracture and crumble.

Mineral specimen with "pyrite disease".

The best way to combat this problem is by keeping specimens in dry conditions – under 45% RH. Once the damage begins it is irreversible and specimens should then be kept under 30% RH.  While there are some remedial treatments, good storage practices are the most efficient route for preservation.  For more on pyrite disease investigate the following resources:

* Sections U:7 and U8 of the National Park Service Museum Handbook Part I[**[http://www.nps.gov/history/museum/publications/MHI/AppendixU.pdf](http://www.nps.gov/history/museum/publications/MHI/AppendixU.pdf" \t "_self)**].
* Pyrite oxidation: Review and prevention by Akiko Shinya, Lisa Bergwall a poster presented at the 2007 Society of Vertebrate Paleontology annual meeting and available for viewing at  practices**[http://www.vertpaleo.org/education/documents/Shinya\_and\_Bergwall\_2007.pdf](http://www.vertpaleo.org/education/documents/Shinya_and_Bergwall_2007.pdf" \t "_self)**
* “Pyrite Preservation” by Sally Shelton in the Knoxville Gem and Mineral Society KGeMS Volume XXXII, Issue 2 from February 2001 p. 8    [**[http://www.discoveret.org/kgms/feb-01/feb01-8.htm](http://www.discoveret.org/kgms/feb-01/feb01-8.htm" \t "_self)**]
* Collins, Chris. 1995. Care and Conservation of Paleontological Material. Boston: Butterworth-Heinemann

**Additional Resources**

The Getty Conservation Institute website has information on their extensive research into museum pollutants [**[http://www.getty.edu/conservation/science/pollutants/index.html](http://www.getty.edu/conservation/science/pollutants/index.html" \t "_self)**]

Several National Park Service Conserve-O-Grams offer practical tips on dealing with gaseous and particulate pollutants.

* 3/5 Volcanic Ash: Cleaning Museum Objects [**[http://www.nps.gov/history/museum/publications/conserveogram/03-05.pdf](http://www.nps.gov/history/museum/publications/conserveogram/03-05.pdf" \t "_self)**]
* 4/2 Dust Covers for Open Steel Shelving [http://www.nps.gov/history/museum/publications/conserveogram/04-02.pdf]
* 11/15 Byne's "Disease:" How to Recognize, Handle and Store Affected Shells and Related Collections [**[http://www.nps.gov/history/museum/publications/conserveogram/11-15.pdf](http://www.nps.gov/history/museum/publications/conserveogram/11-15.pdf" \t "_self)**]