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Radioactive Minerals

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See also the NPS *Museum Handbook*, Part 1, Chapter 11 and Appendix H, Curatorial Health and Safety and *COG* 2/5 Fossil Vertebrates as Radon Source: Health Update.

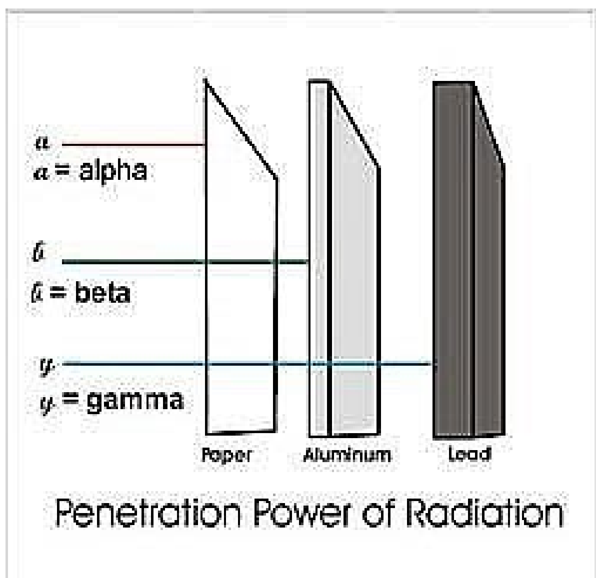
Examples of common radioactive minerals include Autunite (hydrated calcium uranium phosphate), Brannerite (uranium titanate), Carnotite (potassium uranium vanadate), Monazite (a mixed rare earth and thorium phosphate), Thorianite (thorium dioxide) and Uraninite (uranium dioxide). The vast majority of the radioactive content in minerals or ores is either uranium-238 or thorium-232. Many of these minerals may become deposited in both bone and wood fossils. If you are not able to identify the minerals yourself based on available references try to contact the geology department at the local university and see if a member of the faculty can aid with the identification. They may also be able to loan you a Geiger counter which is the best way to determine whether a mineral specimen is radioactive and the level of radiation. If a Geiger counter is not available, Blount (1990) has developed a simple way to test specimens by placing black and white film in a light-proof packet, placing the specimen on the package, and the developing the film to see if it is fogged.

Radioactive elements can produce three types of radiation: Alpha, Beta, and Gamma.

Alpha rays are the nuclei of helium atoms, two protons and two neutrons bound together. Alpha rays have a net positive charge. Alpha particles have only a weak ability to penetrate. A couple of inches of air or a few sheets of paper can effectively block them.

Beta rays are identical to the electrons found in atoms. Beta rays have a net negative charge. Beta rays have a greater penetrating power than Alpha rays and can penetrate 3 mm of aluminum.

Gamma rays are high-energy photons. This type of ray has the greatest penetrating power. It is able to pass through several centimeters of lead and still be detected on the other side. Thick lead is needed to protect against gamma radiation.



Standard Precautions when Working with Radioactive Specimens

Wear latex or nitrile gloves whenever handling radioactive specimens.

Always wash your hands after handling radioactive minerals.

Work to minimize deposits of radioactive particulates on staff or in the work area.

Always wear a lab coat or other protective outer wear.

Remember: There is an inverse square relationship between the level of exposure to radiation from a mineral and the distance you are from it. Radiation levels drop off dramatically the farther you are from the specimen.

If you're going to use shielding for a radioactive mineral on exhibit, it's best to make it out of wood and/or acrylic (Plexiglas®).

Radon

A number of uranium-series minerals release radon gas as a by-product of their natural radioactive breakdown. Radon is a colorless, odorless, tasteless gas that during its radioactive decay emits alpha particles. The short distances traveled by this form of ionizing radiation in the lung can cause cancer. Radon is heavier than air so will settle to the lowest part of a specimen cabinet or a room. Radon has a short half-life of 3.8 days but will be replaced so that in a closed specimen cabinet, it will reach equilibrium. Unlike radon, the daughter elements are not gaseous, but rather particulate in nature. They attach themselves to dust particles or other particulates that are suspended in the air. Once inhaled, they will reside in the lung and irradiate lung tissue based on their decay and associated respective half-lives (which range from a fraction of a second to less than 30 minutes).

If the collection contains radon producing minerals the collection room should have good ventilation to the outside (air should not be recirculated) with appropriate rates of air turnover in the room to reduce the radon levels. There should be some type of radon monitor in the room which should be checked on a regular basis. See also COG 2/5.

Cabinets with radioactive minerals should be labeled with the appropriate signage to indicate their presence.

Be sure to note the presence of these radioactive minerals in relevant emergency planning documents (such as your Museum Emergency Operations Plan [MEOP]) and brief all first responders on their presence.

For additional information on how other museums have dealt with radioactive minerals see: http://www.smmp.net/rept-rad.htm

References

Blount, A.M. 1990. "A low-cost radioactivity test for geological specimens." *Collection Forum* 6(1):8-11.

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Lambert, M.P. 1994. "Ionising radiation associated with the mineral collections of the National Museum of Wales." *Collection Forum* 10(2):65-80.

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