"Minerals that do things…"

Hands-on demonstrations of mineral properties

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Is it Hot in Here?

Object: **Radioactivity** is more common than you suspect. Students can detect radioactive rocks and minerals with a Geiger counter and investigate the radioactivity of some household items.

Procedure description: Students test rocks, minerals, and some household objects for radioactivity using a Geiger counter. Hold the Geiger counter's probe near the specimen to be tested. Some radiation monitors have special windows and/or covers that allow you to discriminate between alpha-, beta-, and gamma-radiation.

Specimens to test: Uranium minerals such as carnotite; thorium minerals; petrified wood (pieces from the Colorado Plateau may be radioactive); thorium mantles for Coleman gas lanterns; smoke detectors; radium dial alarm clocks and wristwatches; antique Fiesta Ware.

Equipment needed: A Geiger counter; other types of radiation detectors could also be used.

Scientific discussion: Naturally occurring radioactive minerals and rocks will give off alpha particles, beta particles, and/or gamma rays.

You do not need any special permits to handle naturally radioactive materials, but care in their handling is prudent. Limit your exposure time and avoid dust from radioactive minerals. You might want to store them in your garage or other well-ventilated space (to limit build up of radon gas).

Many mineral dealers will have at least some uranium minerals for sale. Carnotite, autunite, and tobernite are the more common radioactive minerals sold – it is also possible to find petrified wood and dinosaur bones that are radioactive.

Thorium mantles can be purchased in sporting goods stores. Old smoke detectors can be opened to expose the sensor. Note that the back of the smoke detector will have a notice reading something like "Contains radioactive material: 0.9 microcuries of americium-241." A button of americium-241 is in a metal can inside the smoke detector and, because it is an alpha-emitter, it is very hard to detect without cutting the can open. However, visitors are usually impressed when they read the notice on the back.

Additional possibilities: It is possible to acquire radioactive items such as radium dial alarm clocks and wristwatches in junk shops. These clocks will have dabs of pale green paint on the clock hands and at the numbers. This paint is a mixture of a phosphor and a small amount of radium. The dials no longer glow in the dark because the phosphor is burnt out. But the radium is still present and radioactive.

From before World War II until 1973, the Fiesta Red style of Fiesta Ware dinnerware was made with a bright orange uranium-rich glaze. You can still find radioactive Fiesta Ware cups, plates, and bowls in antique shops. Note: not all Fiesta Ware is radioactive, and not all radioactive dinnerware is Fiesta Ware. Also, antique ceramic dinnerware with glaze colors other than bright orange may also be radioactive – it is best to actually test pieces before buying one for demo purposes. Radium dial clocks and Fiesta Ware are nicely radioactive (without being overly dangerous for casual use) and will give a strong response on a Geiger counter. They are an interesting piece of history and instructive to students.

It is also instructive to show how radioactive shielding works. Place a thin piece of metal between a radioactive mineral and the Geiger counter will shield out the alpha-particles and most of the beta-particles but will not truncate gamma-rays. Likewise, alpha particles will not pass through your skin, so if you put your hand between the specimen and a uranium mineral you will see a substantial decline in the count rate. If you can get hold of a lead brick you can use it for shielding demonstrations, too.

Notes for demo tables: If you are doing demonstrations for large numbers of visitors (such as at a booth at a trade show), I've found that it is a good idea to place any radioactive minerals or rocks inside clear plastic bags. This keeps radioactive dust from contaminating other samples you are showing. This is important because most of your specimens will be relatively low-level, and the radioactive dust, while not enough to be hazardous to health, will get on non-radioactive specimens and only serve to confuse students.