

## Fluorescence

**Fluorescence** usually means emission of visible light from a substance being irradiated by ultraviolet energy. Fluorescent art posters viewed under “black light” are familiar examples. But this definition is really too narrow. Some minerals, for example, fluoresce in the infrared, but we cannot see the emitted light. Also, the energy could be an electron beam, X-rays, or even visible light of a different wavelength from that emitted. All fluorescence, though, involves the addition of energy by some means to a substance, and the reemission of part of that energy as electromagnetic radiation.

Approximately 100 minerals are known to fluoresce, and about 30 of these are found in an area of northwestern New Jersey, USA, known from its former zinc and iron mines in Franklin and Sterling Hill (Ogdensburg). The mines operated during the 19<sup>th</sup> and 20<sup>th</sup> Centuries. Museums have been established on their sites: Franklin Mineral Museum (<http://www.franklinmineralmuseum.com>) and Sterling Hill Mining Museum (<http://sterlinghillminingmuseum.org/>). Thousands of visitors come each year to view the mine history exhibits and go “Ooh and Aah!” in the mineral displayrooms.

Mineral specimens were provided for distribution at this GIFT Workshop by the Sterling Hill Mining Museum, so we express our appreciation to William Kroth and Earl Verbeek. The two most common fluorescent minerals are calcite (white under ordinary light, fluoresces pink) and willemite (brown under ordinary light, fluoresces green.). Calcite can also fluoresce in other colors—blue, orange, white, yellow, red, and green. Among other minerals found in the area and displayed there—as well as in museums around the world—are fluorite (usually blue to blue-violet); sphalerite (yellow to orange); and scheelite (blue to bluish-white).

Other locations around the world known for fluorescent mineral collecting include abandoned mines in Arizona and Utah (USA), and the Ilimaussaq igneous complex in Greenland. Some fossils also show fluorescence. Museum displays often include minerals that have been shaped by lapidary art into spheres, eggs, and other types of jewelry.

Fluorescence was described as early as the mid-1500s in certain types of wood. Chemists in the early 19<sup>th</sup> Century noted this in several chemicals. The name was first used by George Gabriel Stokes in 1852 to describe changes observed in fluor spar and uranium glass to transform invisible energy into blue light. Light is emitted when an electron that has been “excited” by some type of energy gives off a photon of light when it returns to its “ground state.” Related to fluorescence are biochemical effects known as “biofluorescence,” “bioluminescence,” and “biophosphorescence.”

In addition to mineralogy and gemology interests, fluorescence has been used in such practical applications as chemical sensors (fluorescent dyes and labels); biological and cosmic ray detectors; and fluorescent lamps. In these bulbs, an electric current excites mercury vapor and produces short-wave ultraviolet energy. This then causes the phosphor coating on the inside of the bulb to glow. Fluorescent lamps convert electrical energy into light more efficiently than incandescent lamps.