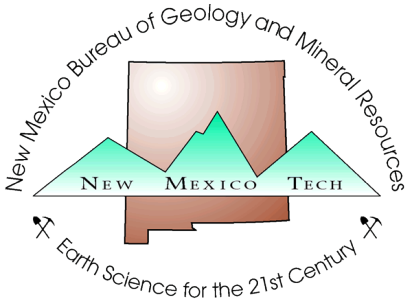
Light sensitive minerals

Virgil Lueth

39th Annual New Mexico Mineral Symposium
November 10-11, 2018,Socorro, NM
pp.34-35

The annual New Mexico Mineral Symposium provides a forum for both professionals and amateurs interested in mineralogy. The meeting allows all to share their cumulative knowledge of mineral occurrences and provides stimulus for mineralogical studies and new mineral discoveries. In addition, the informal atmosphere encourages intimate discussions among all interested in mineralogy and associated fields.

The symposium is organized each year by the Mineral Museum at the New Mexico Bureau of Geology & Mineral Resources.



This page is intentionally left blank to maintain order of facing pages.

Light sensitive minerals

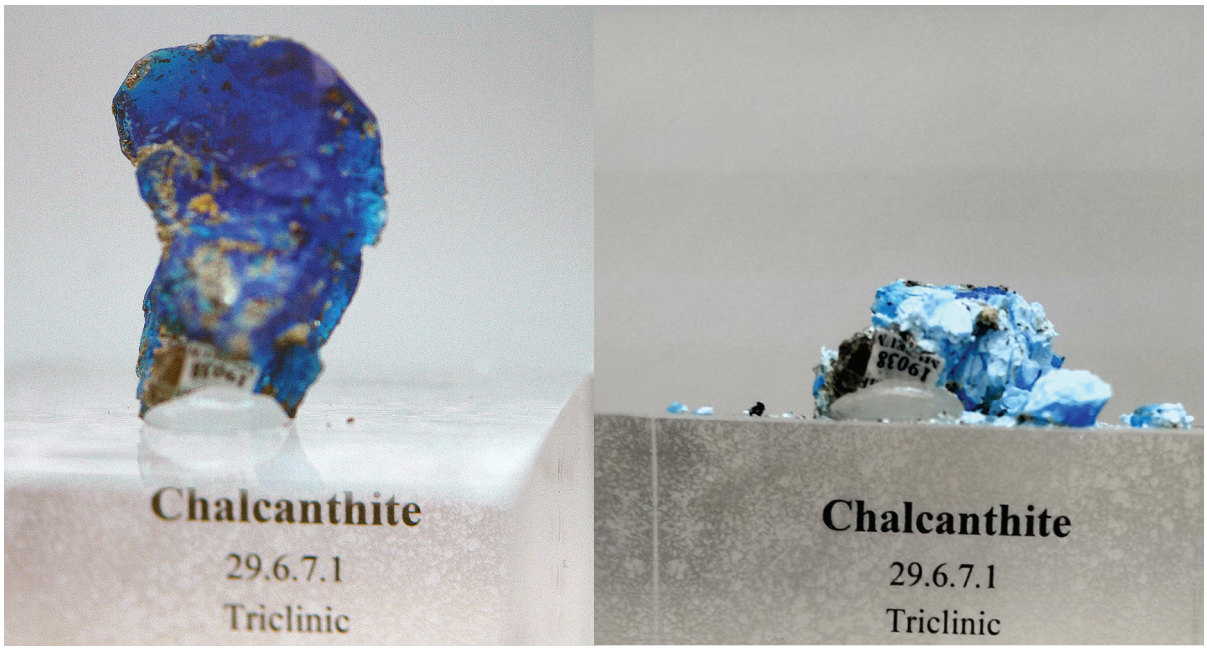
Virgil W. Lueth
New Mexico Bureau of Geology & Mineral Resources
New Mexico Tech, 801 Leroy Place, Socorro, NM 87828, virgil.lueth@nmt.edu

Light induced changes to mineral specimens have been recognized probably since the first proustite crystals were extracted from the ground and brought to the surface. Rapid color change in certain silver halide minerals is the basis of film photography. Close to home, New Mexico collectors are familiar with the rapid fading of blue fluorite specimens from various localities upon exposure to sunlight. This presentation explores the causes of color and presents possible techniques to mitigate or prevent specimen degradation from light exposure.

Twenty centimeter fluorite specimen from the Nakaye Mine, Sierra Co., NM. Photograph on left taken soon after acquisition in 2001, purple slightly enhanced due to fluorescence of film photography. Photograph on the right taken in 2012 after 11 years on display under filtered fluorescent bulbs. *Jeff Scovil photos.*

The seminal paper on light sensitive minerals was published in 1992 by Kurt Nassau. In that paper, he identified 35 light-induced color changes, 8 light-induced decompositions, and 78 light accelerated surface reactions. These changes he related to the 15 physical and chemical causes of color. A survey of the current internet reports of light sensitive minerals has expanded the list, but the causes remain the same. A few particular causes of color are more susceptible to alterations, especially those associated with color centers F (*Farbe*)-centers. The simplest example occurs in halite, sylvite or fluorite where one of the halide atoms is missing and the site is occupied by a single electron. When irradiated by natural sources, this single electron gets displaced and an F-center forms producing color that is normally not present. When external energy (heat or light) is applied to minerals with F-center coloration, the F-center can be removed and thus color disappears. F-centers also occur in quartz where Al3+ causes smoky coloration with radiation and Fe3+ where it initially causes orange and grades to purple. Other light sensitive color alterations occur in minerals with transition metal impurity valence charges in the ligand field (many gemstones) or through charge transfer (blue sapphire, lapis lazuli) and most biologic dyes.

One of the best ways to protect your collection from color induced degradation is to not collect sensitive minerals at all. But, if you insist on ignoring abstinence, there are a number of steps one can take to minimize light effects. Keeping specimens from light, stored in boxes or drawers, with only occasional visits to the lighted world is one option. Moderating or changing light sources is another option. Sunlight seems to be the greatest source of damage with lesser effects from specific types of light sources. Filters are another option; even a plain



Five centimeter tall chalcanthite crystal when placed initially on display in 2015 and current view of the specimen in 2018.

glass window lessens the damaging factor of sunlight by two thirds while specialized filters can do even more. It is also important to store specimens away from reactive partners, e.g. sulfur and silver.

Another important contribution that collectors can make to curatorial science is to photo-document your collections over time. A photograph upon acquisition followed by annual to biannual sessions may help you recognize degradation in your specimen before it becomes too significant. It may also help identify light sensitive changes in minerals heretofore unrecognized and allow for the development or institution of mitigation procedures to save their colors before they are "too far gone."

Reference:

Nassau, Kurt, 1992, Conserving light sensitive minerals and gems, *in* Howie, Frank, M., The Care and Conservation of Geological material: London, Butterworth-Heineman, p.11–24.