

## Sick Meteorites

Meteorites have broken off asteroids, whirled through space for billions of years, survived a fiery passage through the earth's atmosphere and bashed into the planet's surface. After this turbulent history, one would not expect these meteorites would meet one of their greatest danger residing in a cabinet in a museum. Yet it is here that they "catch" the dreaded "lawrencite disease". Once caught, the meteorite turns rusty, exudes green or brown goo and eventually falls to pieces. Only an air-tight sealing in dry nitrogen gas seems to hold off final destruction. These meteorites need to be on life support!

Of course "lawrencite disease" is not a biological condition like human diseases and it is definitely not catching! It is a kind of chemical weathering that afflicts meteorites that contain the mineral lawrencite. Lawrencite is iron chloride ( $\text{FeCl}_2$ ). It is a soft green to brown hexagonal mineral that forms small masses or coatings along the boundaries between the iron-nickel alloy minerals (such as taenite and kamacite) that make up the bulk of iron meteorites. The taenite and kamacite are what show up as the brightly shining tabular crystals seen on polished iron meteorite surfaces. The lawrencite films along the grain boundaries don't often show up on these polished surfaces, at least not at first. They will soon make their presence known as the meteorite is exposed to air and water.

Lawrencite shows a property called "deliquescence". This means it absorbs water from the air and liquefies. The liquefaction produces the brown to green goeey sludge which begins to form around the shiny metallic alloys. This sludge consists of iron oxides plus hydrochloric acid, which attacks the other iron minerals, making more sludge and so forth. Eventually the affected areas spread, wedge apart and alter the other minerals and eventually reduce the meteorite sample to a pile of rusty debris. There is no cure - short of sealing the meteorite away.

A meteorite type called pallasite is particularly vulnerable to this condition. These meteorites contain deep green clear olivine crystals set in a matrix of nickel-iron alloys. Slabbed and polished samples of pallasites are beautiful and expensive. However, if the lawrencite disease strikes, the sample deteriorates rapidly, with the olivine crystals falling out as the alloys rust away. Always look for incipient rusty or goeey areas along grain boundaries before buying one of these!

So it goes with meteorites foolish enough to leave the safety of pure space for the impure chemical soup we lovingly call our earth's environment.

- Dr. Bill Cordua, University of Wisconsin-River Falls

References:

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