

European Association of Geochemistry Photo Contest

October 2014

Recently, we won the [EAG Photo Contest](#) with a photomicrography entitled *Destructive Beauty*:



Recently formed Epsomite

The picture shows crystals of neofomed Epsomite (magnesium sulfate heptahydrate) in a wall of my own house, affected by «sulfate attack». The sulfate attack is the alteration process of building materials by rising damp rich in sulfate, usually from the groundwater or materials as plaster. When I closely examined the strong damage that suffered the wall, I observed glittering crystals in the water front that was moving upward by capillarity. As my passions are the photomicrography and the mineralogy, I saw it as an opportunity to understand how the groundwater destroy the building materials and thought that I had caught out *in the act* the process of formation of hydrated secondary phases by weathering of previous materials. Geochemistry in action in my own walls!. The glittering crystals saw promising, and, indeed, under the stereomicroscope showed the beautiful landscape shown in the picture.

As expected, the Raman spectrum of the crystals identified it as Epsomite. The magnesium sulfate reach saturation in the ascending water and forms efflorescences. In this case, the low temperature and stability of conditions favored the crystal growth. The crystallization of Epsomite, a highly hydrated mineral, provokes internal pressure in the materials, swelling, fractures and paint peeling. The Epsomite is not a stable mineral and, with decreasing relative humidity, dehydrates forming Pentahydrate (also identified by Raman spectroscopy), that forms white, pulverulent pseudomorphs after Epsomite. Further dehydration converts the crystals in a white powder. The dehydration lead to shrinking and collapse of the building material.



Partially dehydrated epsomite, forming pentahydrate (white)

The saturated sulfate solutions react with materials as concrete, forming other secondary phases. In the picture, thin acicular crystals of Thaumassite (lower right corner) has been identified. The reaction between sulfate rich infiltrating solutions and the calcium silicates and aluminates in the concrete, lead to the formation of Ettringite and Thaumassite, with associated flaking and softening of the concrete and consequent collapse of the structures.

Despite of the losses associated with the destruction of building materials, I could not resist the temptation to show the inner beauty of the process: beauty contained in the

transformation of materials and formation of new minerals, and the aesthetic impression of the crystals. This is the beauty of Nature, that remind us that all of our creations, civilizations and cultures, futile attempts to transcend, are weak, impermanent and subject to the laws of Geochemistry, that is, the law of constant flow and change. This beauty (conceptual and aesthetic), sometimes hidden to our naked eyes, but always present in Nature and our laboratories, drives my interest in the photomicrography. My routine equipment consist in a Nikon Coolpix camera attached to the phototube of a Zeiss Discovery V8 microscope. The picture is the result of layer composition of 10 frames. Field of view is 2 mm



«Destructive Beauty» in the EAG webpage.