

Supplemental Information

As a result of excitation by the UV-vis light (330 nm UV and 385 nm visible light sources attached to our microscope), the energy can be absorbed and cause electrons in the outermost shell of a molecule to be excited. The spontaneous emission of photons returns the molecule to its relaxed state. The emission of photons may produce fluorescence. Typically, this emitted light is at longer wavelengths than the excited UV-vis wavelengths (of 330 nm and 385 nm here). Many biomolecules, especially those with a high degree of conjugation, fluoresce when exposed to UV-vis light. The color of fluorescence corresponds to the wavelength of emitted light from the organic molecule. Emission of light at ~455-485 nm results in blue fluorescence. Green fluorescence indicates ~500-550 nm light. Orange and red fluorescence occur from ~600-650 nm and ~650-700 nm light, respectively. Therefore, seeing blue through the microscope indicates the presence of fluorescence in the ~455-485 nm wavelength range.

The fluorescent response, including the wavelength and the intensity of color, is dependent upon the type of organic molecule, the concentration of the biological material, and the absorption wavelength range. The 330 nm UV- 385 nm visible light we use in this study as an excitation source is not able to cause fluorescence in all biomolecules.

A wealth of literature in the fields of biology and physics in recent years has identified the wavelength ranges at which particular biomolecules (such as biofilms, chlorophyll, bacterial polysaccharide coatings, and the decay products of these biomolecules) fluoresce given excitation by different UV-vis absorption wavelengths. For example, Scott (2001) has determined specific fluorescent response of various types of carotenoids (such as beta-carotene) by different absorption wavelengths.

As a result of different studies, we have found, together with colleagues, that we can conduct transmitted light and UV-vis microscopy, followed by laser Raman spectroscopy, to identify individual organic suspects within fluid inclusions in halite and gypsum. For example, Conner and Benison (2013) report orange-pink fluorescence (in response to UV-vis light in the same wavelengths we use for this study) for the same specific rounded masses and crystals that have the distinct Raman spectra of beta-carotene. Therefore, in the Conner and Benison (2013) study, we interpreted those objects in fluid inclusions to be beta-carotene. Likewise, studies by Benison et al. (2008), Mormile and Storrie-Lombardi (2005), Schubert et al., (2009a, 2010) paired transmitted light and UV-vis microscopy with a biological or chemical identification method (laser Raman microscopy and/or molecular laboratory techniques such as isolation, culturing, and enrichment and DGGE) to characterize the fluorescence colors of prokaryotes, eukaryotes, and some organic compounds such as some carotenoids within fluid inclusions in

halite. Results of these studies suggest that most prokaryotes fluoresce green or green-blue, *Dunaliella* algae fluoresces blue, and beta-carotene fluoresces orange-red.

References not in the manuscript:

Benison, K.C., Jagniecki, E.A., Edwards, T.B., Mormile, M.C., and Storrie-Lombardi, M.C., 2008, “Hairy blobs”: Microbial suspects from modern and ancient ephemeral acid saline evaporites: *Astrobiology*, v. 8, n. 4, p. 807-821.

Scott, K.J., 2001, Detection and measurement of carotenoids by UV/VIS spectrophotometry: *Current Protocols in Food Analytical Chemistry*, F2.2.1 – F2.2.10.