Monterey diatomite—A rock with Opal-A and Biosilica

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What is the composition of diatomite? Well, let us start at the webmineral web site. No entry. Okay, let us go to that great source of public discourse, clichés, and bunk geology, mindat. It is a rock with opal-CT. Sometimes opal-A, opal-C, and quartz. Okay, just about anything. Hey, that really wraps it up. Now let us take a sample of Monterey diatomite from Palos Verdes and scan it in infrared. Then we can overlay it with reference samples and compare it to the author's master silica and opal classification keys. The author's opal key, though, has 3 additional opals not in our science, so this will be pointed out if this occurs in diatomite.

As the spectrum below does not show, it is zoomed in because the vast majority of diatomite is water, whose bands are cut off to the left of the graph. Mindat does point out it has water. The silica minerals are opal-A and biosilica, in roughly equal amounts. Biosilica is a mineral made biologically just like the iron compound maghemite that they list is made from iron-reducing bacteria, but maghemite is listed and biosilica is not. Too bad. A silica mineral species has gone missing.

Another flop for modern internet geology. Oh right, minerals are defined with X-ray spectroscopy. Okay, if you want to study the stars do you use a microscope? If not, why not? Correct, wrong instrument. XRD spectroscopy is equivalent when studying opals, which is why they cannot find half the opal species that exist. Opal-A literally means no XRD signal can be found, so that is the absence of a conclusion, that is not a mineral conclusion. XRD is great tech, but has limits. It does not work well on clays, not at all on opals, not at all on glassy phases of minerals, and poorly on agate and jasper rocks. For example, it is not used and cannot be used to study moganite silica found in agates and jaspers. For everything the author focuses his work on, XRD is not a good choice as it takes minerals like evaporites and incinerates them with its radiation. You cannot study a mineral composition if your energy source is simultaneously burning it. However, in infrared, these can all be studied just fine.

Stated here as slang the term opal-A is used to connect to the literature history, but as infrared study clearly points out, this is a mineral and is not amorphous to infrared spectroscopy. In infrared it scans as opal-monoclinic-tridymite (opal-MT). Along the same lines, opal-CT has no identifiable cristobalite despite important and well-accepted cristobalite bands in XRD as well as infrared, so this is defined by the author as opal-orthorhombic-tridymite (opal-OT). We have burial diagenesis or alteration of opal-MT, and thus it becomes at higher temperature opal-OT, and the 125 year mystery of just how opal-A becomes opal-CT goes away. Opal-C is cristobalite, which remains unchanged in this classification.

Note that opal-CT is not defined by any method of spectroscopy finding cristobalite. It is the only mineral identified by studying silica plate stacking distances using transmission electron microscopy. Yet, what a TEM sees versus what a method of spectroscopy sees are not necessarily the same thing nor operating on the same scale of observation. They use TEM presumably because XRD to study any opal results in data too poor of quality to use. Opal-CT is the only mineral defined by using microscopy.

Palos Verdes diatomite overlain with opal-A. Half the peaks are opal-A, the remainder are biosilica.