# IT'S LIKE THOUSAND BUBBLES BURSTING INSIDE A SAPPHIRE

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One of the frequent inclusion to see in sapphire is phase inclusion, which is not as such surprising to talk about. Although, this phase inclusion must have surprised Sir David Brewster, in 1823, when it was first time encountered.

In routine testing IGI-GTL, Delhi received one yellow sapphire for testing. Microscope analysis confirmed the stone to be natural and its other physical and optical properties concluded the stone to be sapphire.

A beautiful thing about that sapphire was one of its tabular negative crystal, apparently visible even with unaided eyes, as that was possessing vital area of stone's table. That was a three phase inclusion (at the temperature <31.2°C) containing a black solid phase, a gaseous phase and liquid and two phase (at the temperature >31.2°C) containing a black solid phase and liquid.

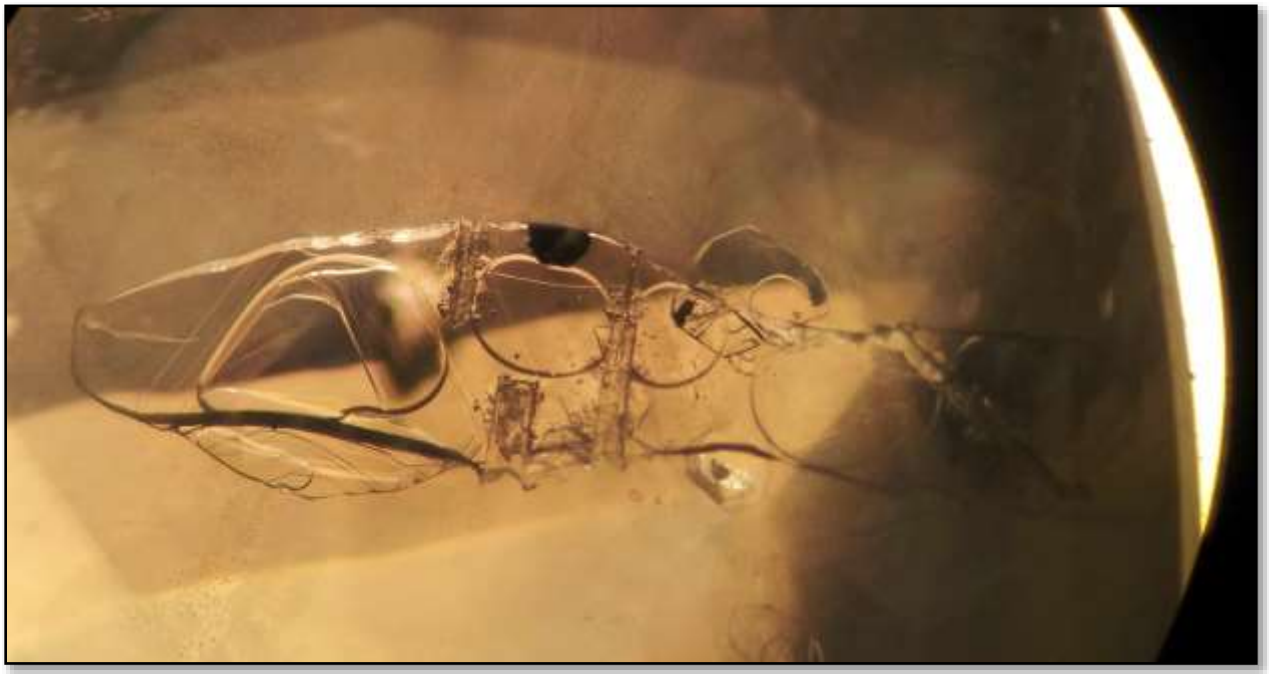
Such phase inclusions are usually encountered in sapphires from Sri Lanka. Black solid phase was probably graphite (on the basis of visual observation and as reported yet).

These phase inclusions are generally filled with liquid CO2 and CO2 bubble. To conclude the identity of liquid, temperature test was done to check that at what temperature this gaseous phase gets vanished and the liquid gets homogenized.

Critical angle of CO2 is 31.2°C (88.2°F), and if the gaseous phase persists even at the temperature greater than 31.2°C, it is probably not CO2, rather is some other material.

Whole experiment was captured in camera. A bowl of cold water was taken to drop the stone's temperature below 31.2°C (critical temperature of CO2), and optic fiber light source is used to heat up the stone (i.e. around 32°C and above) to homogenize liquid.

Stone was cooled in water and immediately fixed under the microscope. Even after around 15 minutes bubble did not vanish. First it was thought if that liquid is not CO2 and something else. Fiber Optic light was at full intensity but still not warm enough to vanish the bubble and stone was still cold to touch. It was noticed that air conditioner is just above the microscope, which was not letting the stone to warm up. Metal tweezer holding the stone was also cold due to some water drops in its indented body.



Tweezer was dried with tissue and stone was slightly rubbed in hands to warm it up little quickly, but unintentionally temperature of the stone became more than 31.2°C, and the liquid got homogenized while the stone was in hands only. While placing the stone back on the microscope for observation, by mistake a small drop of water got dropped on the stone. Fortunately as cold water drop fell on the stone, while the stone was under observation in microscope, that small cold water drop triggered the spontaneous bubbling of the liquid in that phase inclusion.

Stone was again warmed and placed under the microscope, this time deliberately metal tweezer was cooled with cold water and air conditioner was focused on the microscope to do its job of dropping the stone's temperature, as the room's temperature was already around 25°C.

Within seconds liquid of that negative cavity starts bubbling. Instead of capturing the video of homogenization of CO2 liquid, a beautiful video of CO2 bubble's evolution from liquid CO2 was captured. As if some champagne bottle has been opened and thousands of bubbles were bursting inside the sapphire. Probably this kind of bubbling was observed as the negative cavity was quite big and while observation that was approximately parallel to the stone's table, so instead of evolution from a single point, bubbling was visible in large area.

The frequent eruption of bubbles and homogenization of liquid at (approx.) 28 - 33°C, confirmed the phase to have CO2 liquid and CO2 gaseous phase. Although there is possibility of some other material also with CO2.

Notice the web like structure that forms just before the bubbles burst out, may be it's only because of its large flattened area parallel to table.