A review of:

Black Agates from Paleoproterozoic Pillow Lavas (Onega Basin, Karelian Craton, NW Russia): Mineralogy and Proposed Origin
By: Evgeniya N. Svetova, Svetlana Y. Chazhengina, Alexandra V. Stepanova, and Sergei A. Svetov (2021) Minerals, MDPI.com, Vol. 11. No. 918, 24 Pgs.

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Review by: Donald Kasper, 11/26/2022

Overview: The authors focus on the origin of black agates in a pillow lava site they reported on before. Pillow lava forms in sea water, so these are oceanic agates. The site consists of cherty agates with local agate banding centers in cherts stuffed with organic debris, particularly radiolarians.

Donald Kasper

Items as encountered are:

1. Pg1. "Agate and chalcedony are varieties of silica that are mostly composed of minute crystals of a-quartz. Chalcedony is band-free and characterised by uniform colouration, whereas agate is defined as banded or patterned chalcedony." False. "Band-free" is code for granular quartz. A granular quartz is a chert or a shale but agate is not chert and agate is not shale. Granular quartz called wonderstone does not have uniform coloration.
2. Pg 1. Okay if agates have quartzine and moganite, define these terms as others say quartzine means moganite.
3. Pg 1. "Paragenetic minerals" are not impurities, they are part of the agate structures, meaning agates are not chalcedonies.
4. Pg 1. "Different tints of green colour can be related to chlorite, epidote, or mica inclusions". Instead of listing every green mineral they can think of, actual study will show that the overwhelming green mineralization is celadonite. Epidote and chlorite are in agates exposed to metamorphic conditions, so are exceptionally rare.
5. Pg. 1. Dark coloration is invariably humic acid intrusion from weathering and has nothing to do with agate genesis. This is the case for the Brazil and India black agates. South Dakota agates that they ignore are real black agates.
6. Pg. 3. These are agates in pillow lavas. Pillow lavas are formed in the ocean. Now explain how weathering makes them in the ocean.
7. Pg. 4. "The size of agates ranges from 3 to 25 cm. They are composed of quartz-carbonate material with organic carbon impurities". Correct, agates are calcsilica rocks. The calcite produces alkaline conditions key to agate formation. This is not an impurity; it is how agates form. When a critical component of a geochemical system is identified as an "impurity" this means the author has no concept of what is going on.
8. Pg. 7. The presence of bands in the 2900-2700 cm-1 region in Raman infrared proves to the authors the presence of C-H bonds, which means CH3 methyl. In regular infrared the author uses, this methyl band comes from infrared study of carbon compounds. Well, that must wrap it up, except that this band in regular infrared is around all the time, and the author sees it enlarged when there is a lot of

carbonate in a specimen, and has a doublet identical to nearby carbonate doublets that occur all the time in carbonate rocks as carbonate water. This makes this region a carbonate overtone candidate. But, just throwing carbon compound infrared at mineralogical infrared is a source of a large amount of problems in mineral study and false conclusions. The problem is that infrared responds to crystal structure, but carbon compounds are amorphous. Raman and regular infrared don't necessarily have identical band responses such as infrared does not have a 502 cm-1 response to moganite, it has two different responses, one being 494-452 cm-1 doublet and central saddle. Yet, this is a case of CH3 methyl discussion being claimed in rocks. Are regular carbon compounds seen in rocks with reflectance infrared? In the author's experience, never. Carbon acts like a pure metal reflector with little tangible, distinct IR response.

9. Pg. 8. Photo E. This is a radiolarian chert. This is not a banded agate. The ooids are fossil radiolarians and quartz crystal points nucleated on the tests or shell fabric of the fossils. This is not fibrous agate banding, which does occur in Midwestern US cherts on radiolarian nuclei centers, but does not appear to be here. The oolitic things these authors are seeing are sea floor radiolarian fossils with agate, meaning this is when the agate was emplaced.
10. Pg. 9. Photo G. This is how quartzine is routinely defined—as spherulites of radial quartz. Then the authors could not bother to aim their Raman microscope at that to report what they see. The organic matter in all these rocks are see floor organics trapped in cherty agates. In sea water, salt thwarts agate formation and causes granular quartz to dominantly precipitate, but the chert only forms with volcanic ash, which the authors report. Looking carefully, sponge spicules will show up. Photo F of organic stringers may be parts of sponges. Discovering chert with organic matter is equivalent to saying you discovered chert.
11. Pg. 10. The radiolarian agates and cherts are found between pillows as the sediment was pushed around. The lave gets a chill margin quickly, so does not readily consume the sediment.
12. Pg. 10. A moss agate are bifurcated tube structures comprise of the clays celadonite and nontronite and saponite. The definition here is used for quartzine ooids in accumulations. Pg. 11 images are black gunk in blobs of cherts called moss agate. This is a serious misunderstanding of what a moss agate is.
13. Pg. 12, and figure in Pg. 13. Using backscatter electron microscopy (BSE) shows fine details, but a look does not prove or identify chlorite and feldspar inclusions so common in their cherts they call agates. They have cherty agates, cherts with occasional agate banding centers, often formed around radiolarian nuclei.
14. Pg. 15. The authors report phengite (muscovite) in agates. As there is a continuous series from muscovite to celadonite, this is probably over reporting potassium rich mica as muscovite instead of celadonite. From the author's huge IR archives, celadonite water is regularly seen, but so far no muscovite is.
15. Pg. 17. "The absence of other silica phases (opal, cristobalite, tridymite, and moganite) is typical for agates, which are hosted by either relatively old volcanic rocks or rocks that have been subjected to paleo-heating." Yet, take a snakeskin agate with an alpha-beta-moganite IR spectrum, torch it with an acetylene flame until it cracks and turns from gray to white, cool it, scan it again, the moganite is still there. What changes is a 3737 cm-1 ban appears as a high temperature exposure marker. An acetylene flame is 3160 C.
16. Pg. 17. The authors find quartzine but not moganite. Many other authors equivalence the two. It may be that moganite alters to or forms instead as quartzine under saline conditions, and does not

invert to quartz. There is only polarizing microscopy identification of quartzine (except for the author that models its spectrum in infrared) as these authors pile all the IDs together without explaining they found no quartzine by using Raman or XRD.

17. Pg. 18. They cite a source to determine temperature of formation 150 to 400 C. This is a generalization in the author's view rounding to 50 C, with an actual upper limit of 374 C, which is supercritical. This transition erases most if not all geothermometer markers and is a hard limit for study.

Conclusion:

Overall, the authors did not grasp much of the geologic system they studied. The ooids are radiolarians, the moss is organic sea floor gunk captured in chert, and the rocks are cherty agates which means cherts with local agate banding centers. The cherty agates between pillows of the lava formed from the volcanic ash present. The radiolarian chert is called poppy jasper by US collectors.