What is adularia? Isn't it just a bunch of orthoclase? Or sanidine?

Aren't they all just varieties of orthoclase?

By: Donald Kasper, 2-8-2022

To have our discussion about adularia first we have to define the term "variety". A variety comes from gemology where identical compositional minerals such as we can study them with our instruments, have different colors. The colors are usually trace elements at parts-per-million to parts-per-billion which we can see with out eyes but instruments from X-ray spectroscopy to Raman spectroscopy to infrared spectroscopy just cannot detect. If we find some element like iron or manganese using mass spectrometry, that does not prove it is the colorant, it just suggests it could be. Defect sites with water, defects refracting light, and other features of minerals produce colors with no metal cation present.

This then brings up the question—are the potassium feldspar series just varieties of the albite and orthoclase end members? The same goes for the albite to anorthite plagioclase series. Are these just varieties with different optical properties, or are they real minerals in their own right? When we look at popular sites like mindat, they are called varieties in both series. When we look at the scientific literature, these intermediate mineral names are used distinctly all the time. So, what is it from the author's infrared study standpoint? Let us look at an adularia, sometimes called a sanidine, sometimes called an orthoclase, and maybe other mineral names.

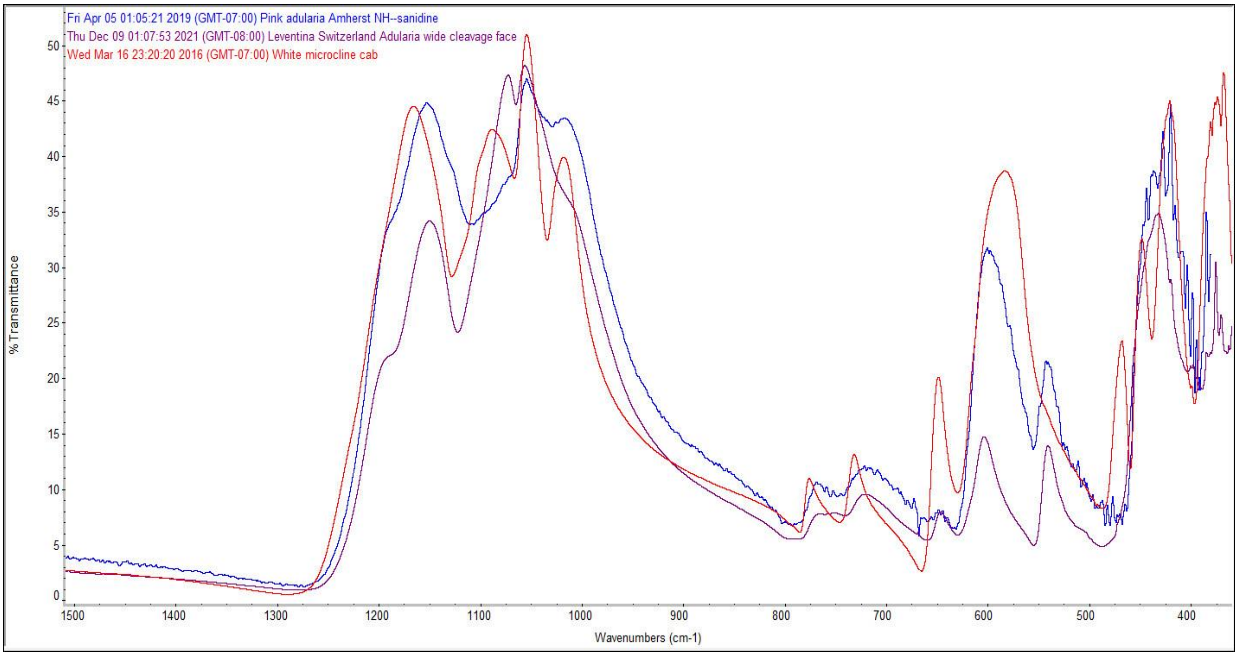
The key site where adularia was first described is in Switzerland. The infrared spectrum of a sample purchased that came from that locality is shown below. Orthoclase is easy to identify consistently in the literature, and the author has many samples of that, so it is overlaid. Microcline is easy to identify as a so-called variety of orthoclase, and that is also shown.

What we see in the literature is a study of the 600 to 500 cm-1 region. The little problem with that is that the peaks in that region are based on the crystal face being studied. The large tabular faces of all the feldspars are different than the slender side faces. Powder infrared blends will make all possible combinations. This is useless for study in the author's view.

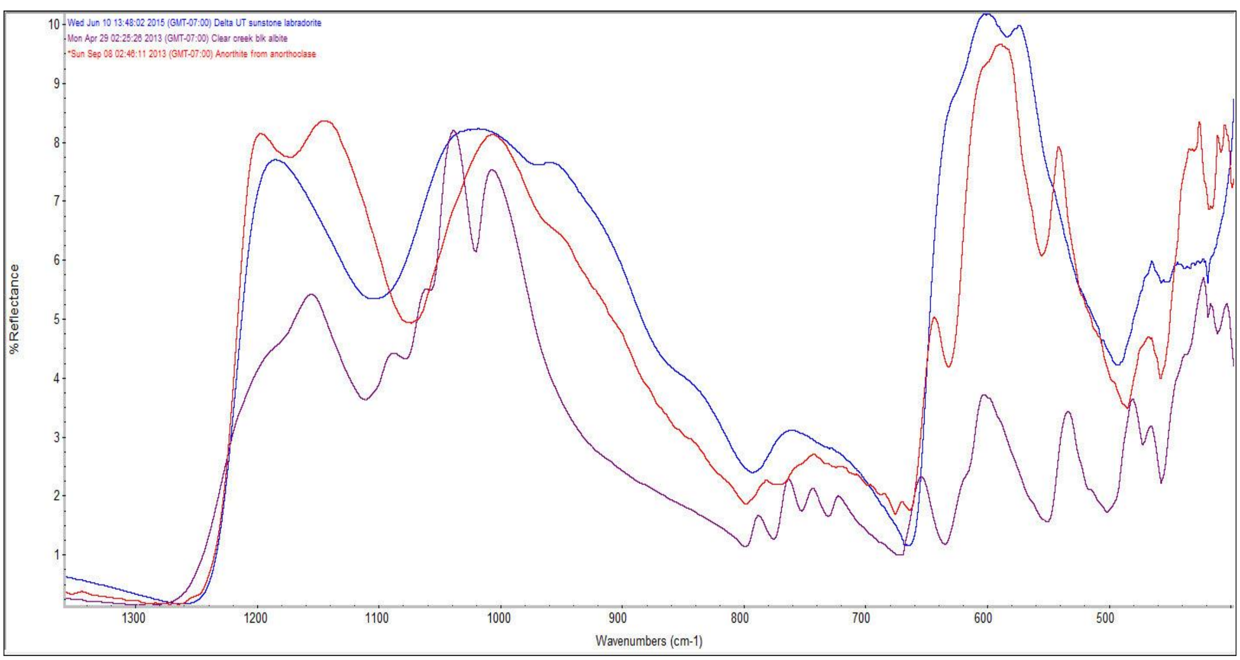
The 1100-1000 cm-1 region is very interesting. The spectra shown here are consistent with many other samples not shown where all 3 peaks are microcline, the left two are adularia, and the right two are orthoclase. A shifted pair is sanidine. From an infrared standpoint, all of these minerals in the potassium feldspar series are quite unique and for infrared, they are identifiably distinct minerals. That is, they are not compositionally identical varieties at all. With ten years of effort to get competent data from so many misidentified sites and poor literature, the distinction is clear.

Part of the problem is that our science has only constructed a ternary (3-element) diagram of potassium, sodium, and calcium for the feldspars, but in the sodium-potassium side of this triangle diagram, there isn't one potassium series, there are two. One series is for the plutonic rocks such as the granites, and the other series is for the extrusive rocks such as the lavas. Adularia, for example, is in the plutonic series only and sanidine is in the lava series only. Scrambling it all up into one pile of minerals that are associated only when lava intrudes granite and similar mixing of fundamental host rock types, just mangles the story. Unmangled, anorthoclase is clearly distinct from albite in infrared, it just may take you a decade to get enough samples (hundreds) to see the pattern. This is usually beyond the timeframe of university studies, and so our literature just drops out in resolving this matter.

In the plagioclase series, is labradorite just a variety? As the spectrum shows below it is unique and quite different from albite, and closer to anorthite, by which many then call it a variety of anorthite. Each mineral in the plagioclase series is distinct when you closely study key spectral features.



Sanidine (blue spectrum), adularia from Switzerland (violet spectrum), microcline (green spectrum). Microcline in the 1100-1000cm-1 region has 3 peaks, sanidine take the two right peaks, and adularia takes the two left peaks, leftmost is shitted in closer to the central peak. These peaks are very close to muscovite mica. Orthoclase has potassium and AlSi3O8 while muscovite has potassium and aluminum and AlSi3O10, so the author attributes that peak behavior to close to SiO4 with aluminum substitution.



Albite (violet spectrum), labradorite (blue spectrum), anorthite (red spectrum). It is not that albite has 4 peaks at 800 cm-1, but that it has a peak at 1092 cm-1 that demarcates it and the other feldspars close to it. It is missing in labradorite, so labradorite is not closely related as a variety of albite. The 920cm-1 roll does not appear in the albite-anorthite series until labradorite, and may be calcium.