The Ankerite Problem

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Ankerite is an iron-magnesium carbonate, $Ca(Fe,Mg)(CO_3)_2$. It is included in Phillip Morrill's species list (1960), *New Hampshire Mines and Mineral Localities*, and is listed for some NH localities in Art Smith's 2005 *Rocks & Minerals* article "New Hampshire Mineral Localities Index". I have had several New Hampshire specimens labeled as ankerite in my collection for decades. An "ankerite" sample is in my New Hampshire mineral species display at the Discovery Center in Concord. This specimen, with its supporting EDS analysis, is shown in Figures 1 and 2.

Figure 1: NH mineral display "ankerite". Westmoreland Crushed Stone Quarry. 3 cm specimen.

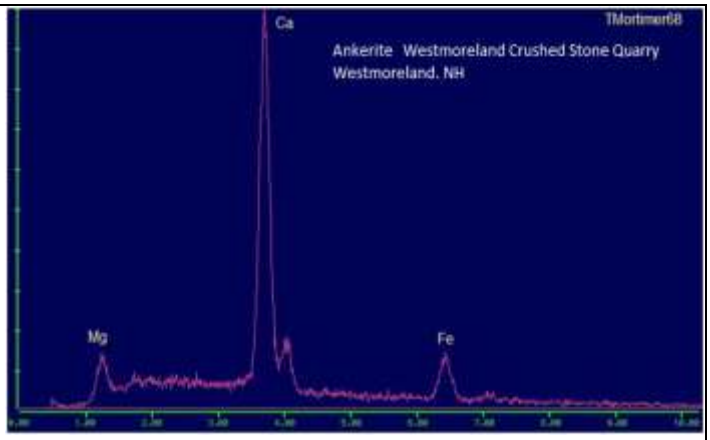

Figure 2: Kerry Day EDS analysis

The figure 2 Kerry Day EDS analysis was a qualitative one with an instrument having minimal response to sodium and lighter elements. Magnesium was at the margin of detectable elements. In his report, Kerry relied on his experience with the instrument to judge the relative amounts of Mg and Fe in suggesting the species ankerite.

Another "ankerite" in my collection was found at Mine Falls Park in Nashua, figures 3 and 4.

Figure 3: "Ankerite" Mine Falls Park, Nashua, NH Broken 3.5 cm tan rhombic "ankerite" crystal cross-section, with limonite rind, embedded in sphalerite.

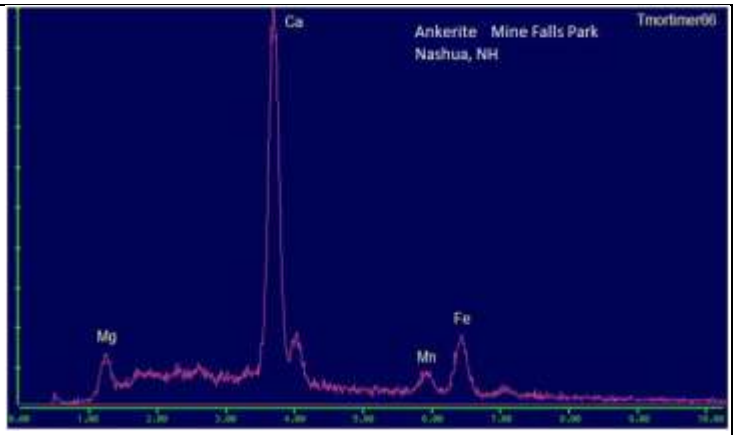

Figure 4: Kerry Day EDS analysis of Mine Falls Park "ankerite".

At this point readers have likely surmised that my use of quotation marks with ankerite indicate something is amiss with this identification. The topic of ankerite came up with Peter Cristofono during one of our commutes to a Boston College EDS session. Peter alerted me to the fact that ankerite is actually quite rare and that most specimens labeled ankerite are actually ferroan dolomite. Checking the mindat.org page on ankerite, I found the following statement:

"**Note**: Most (unanalysed) "ankerite" specimens are actually Fe-bearing (ferroan) dolomite (Mg>Fe), because of nomenclature changes. The majority of alleged "ankerite" photos here actually depict Fe-rich dolomite (except for a relatively few analytically confirmed ankerites). Even the old so-called "type locality ankerite" from Erzberg, Styria, would not quite fit the modern definition, with analysis showing (Mg 0.520, Fe 0.457, Mn 0.021) *apfu* (Schoklitsch, K. (1935) Zeit. Krist., 90, 433 - taken from DHZ).

The end-member composition CaFe(CO3)2 with dolomitic structural ordering has neither been synthesized (Goldsmith et al., 1962; Rosenberg, 1967) nor have they been found in nature (Dana's System of Mineralogy, Vol. II, 1951; Deer et al., 1962; Goldsmith et al., 1962; Beran, 1975); compositions reach about 70 mol.% CaFe(CO3)2."

Understanding that my New Hampshire ankerite specimens were at risk, I included grains of the Westmoreland and Nashua ankerite in our April, 2018 EDS analysis session. The analysis results confirmed Peter's conjecture. My "ankerite" specimens were actually ferroan dolomite. They contained insufficient iron to be ankerite.

The atoms per formula unit (APFU) computed from the BC EDS instrument quantitative tabulation of element atomic percents gave the following: (carbon was not quantified and carbonate not estimated)

Westmoreland ferroan dolomite: $Ca(Mg_{0.27}, Fe_{0.23})O_{2.7}$, normalized for one atom of Ca.
Nashua ferroan dolomite: $Ca(Mg_{0.51}, Fe_{0.23}, Mn_{0.07})O_6$, normalized for one atom of Ca.

Both analyses show Mg dominant over Fe, so ferroan dolomite. The Westmoreland ferroan dolomite is moderately close to being Fe dominant, within 5%.

So, presently, I will remove ankerite from my NH species list and from my NH display. Perhaps a future specimen will reinstate ankerite's status.