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Metamorphism in the Carolina Slate Belt: topaz composition and its implications

PHILIP E. ROSENBERG

Department of Geology, Washington State University
Pullman, Washington 99164

In a recent paper by Sykes and Moody (1978) an andalusite–topaz–quartz assemblage from Hillsborough, North Carolina is described and discussed. Refined unit-cell dimensions are used to estimate the F content (Ribbe and Rosenberg, 1971) and the crystallization temperature (Rosenberg, 1972) of topaz in this assemblage. However, due to an apparent error, the crystallization temperature has been underestimated by about 180°C.

This error may stem from the different crystallographic settings in use for topaz. Following Deer *et al.* (1962) and Rosenberg (1967), X-ray determinative methods for F in topaz (Ribbe and Rosenberg, 1971; Rosenberg, 1972) are based on the space group setting *Pmnb* whereas Sykes and Moody (1978) use the setting *Pbnm*. Thus (021) (Ribbe and Rosenberg, 1971; Rosenberg, 1972) ≡ (120) (Sykes and Moody, 1978). Apparently Sykes and Moody, finding that Δ_{021} in setting *Pbnm* was far too large to conform to the data of Rosenberg (1972), assumed that an error had transformed the intended X-ray reflection (121), which yields a Δ value in the required range, to (021). Therefore, they report and attempt to make use of Δ_{121}.

In any event the calculated value of d_{021} for the Hillsborough topaz equals 3.2087Å, which corresponds to a Δ_{021} [*vs.* CdF_2, 28.700°(2θ)Cu$K\alpha$] value of 0.897°, not 1.08° as determined by Sykes and Moody. Therefore, the crystallization temperature should be approximately 560° (Rosenberg, 1972) rather than <400°C (~380°C) as estimated by these authors. The stability field of F-bearing pyrophyllite which replaces topaz and andalusite in these rocks will then lie below 560°C, not 400°C. Thus, the assemblage topaz, quartz, pyrophyllite synthesized by Rosenberg (1972) at and below 500°C is not *necessarily* metastable above 400°C.

Sykes and Moody also make a confusing statement concerning the nature and significance of topaz solid solutions as defined by Rosenberg (1972). These solid solutions, characterized by the presence of excess Al and F, have not been synthesized in assemblages with quartz and mullite (*ibid*) nor have they been observed to any significant extent in nature (Ribbe and Rosenberg, 1971). Thus crystallization temperatures estimated from topaz compositions in synthetic mullite-bearing assemblages should be valid approximations for natural assemblages with andalusite or sillimanite rather than mullite.

Note that based on its *b* cell parameter (8.841Å) the Hillsborough topaz is slightly richer in OH than is topaz from Chesterfield County, South Carolina (b = 8.836Å; Ribbe and Rosenberg, 1971), the most OH-rich topaz previously reported in the modern literature.

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References

Deer, W. A., R. A. Howie and J. Zussman (1962) *Rock-forming Minerals, Vol. 1.* Wiley New York, 145–150.

Ribbe, P. H. and P. E. Rosenberg (1971) Optical and X-ray determinative methods for fluorine in topaz. *Am. Mineral., 56,* 1812–1821.

Rosenberg, P. E. (1967) Variations in the unit-cell dimensions of topaz and their significance. *Am. Mineral., 52,* 1890–1895.

——— (1972) Compositional variations in synthetic topaz. *Am. Mineral., 57,* 169–187.

Sykes, M. L. and J. B. Moody (1978) Pyrophyllite and metamorphism in the Carolina Slate belt. *Am. Mineral., 63,* 96–108.

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