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# Allanite and epidote weathering at the Coweeta Hydrologic Laboratory, western North Carolina, U.S.A.

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## ABSTRACT

Allanite and epidote occur in the parent rocks of weathered regolith at the Coweeta Hydrologic Laboratory in North Carolina and exhibit different responses to weathering. Petrographically, epidote and allanite are identical at Coweeta, and only with additional analytical techniques (e.g., EDS or LA-ICP-MS) can the two be distinguished. Allanite is more abundant in unweathered bedrock but weathers readily below the weathering front. In contrast, the much less abundant epidote persists into the solum with only minimal evidence of weathering. The rapid dissolution of allanite is likely influenced by its metamict nature. Both epidote and allanite at Coweeta dissolve by interface-controlled dissolution kinetics, evidenced by etch pits on grain surfaces. Etch pits appear to be either large "negative crystals," or small, shallow, and elongated. The incipient stage of allanite weathering is characterized by Al mobility and Fe precipitation as goethite. During the initial stage of allanite weathering, carbonate precipitates, but with progressive weathering the carbonate is dissolved.

Based on electron microprobe analyses and point-count data of the Ca-bearing phases in the Coweeta bedrock, accessory (<1%) allanite contains a minimum of approximately 25% of the total bedrock Ca by volume, whereas garnet and plagioclase contain 5% and 70%, respectively. Although allanite and epidote are Ca-hosts, only allanite is present in significant quantities, and is weathering sufficiently rapidly, to serve as an important source of Ca in pore and stream waters at Coweeta. Allanite weathering should, therefore, be evaluated in weathering studies of crystalline silicate bedrock, especially where other lines of evidence indicate the need to invoke additional Ca sources.