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The chemical composition of REE-Y-Th-U-rich accessory minerals in peraluminous granites of the Erzgebirge-Fichtelgebirge region, Germany, Part I: The monazite-(Ce)-brabantite solid solution series

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ABSTRACT

Peraluminous granites of the Erzgebirge-Fichtelgebirge, Germany, are hosts of various members of the monazite group of minerals that display an unprecedented compositional diversity. The Eibenstock S-type granite constitutes the third reported occurrence worldwide of brabantite and the first occurrence of this mineral in a granite. Many new occurrences of cheralite-(Ce), as well as a monazite-group mineral intermediate between monazite-(Ce) and huttonite for which the term huttonitic monazite is proposed, were discovered. Even ''common'' monazite-(Ce) may show extreme ranges of actinide and lanthanide element concentrations.

The granites that host brabantite and cheralite-(Ce) are highly differentiated, strongly peraluminous, low-temperature residual melts of S-type affinity, which are rich in fluorine and other volatile constituents but depleted in thorium and the light rare-earth elements. Such highly evolved, volatile-rich compositions resemble rare-element pegmatites and appear favorable for the precipitation of cheralite-(Ce) and brabantite, but not of monazite with large amounts of huttonitic substitution. Instead, these minerals occur preferentially in F-poor biotite and F-rich Li-mica granites of A-type affinity. Irrespective of the level of uranium in silicate melts, which may exceed that of thorium, the substitution of uranium in monazite remains limited.

The compositional data reported here are consistent with complete miscibility in the monazite-(Ce)-brabantite solid solution series under magmatic conditions. These granites contain monazites that span almost the entire compositional range reported for monazite-group minerals worldwide, and therefore granites appear to be ideal rocks in which to study the crystal chemistry of this mineral group in general.