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Chemical and paragenetic data on gadolinite-group minerals from Baveno and Cuasso al Monte, southern Alps, Italy

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ABSTRACT

A chemical and paragenetic study was performed on gadolinite-group minerals occurring in miarolitic pink granite and granophyric leucogranite of the subvolcanic Hercynian plutons at Baveno and Cuasso al Monte, Southern Alps, Italy. In the localities investigated, gadolinite-group minerals are hosted in massive pegmatite, in aplite, and in miarolitic cavities having different degrees of evolution. The petrological relations indicate that progressive crystallization has occurred from magmatic through to hydrothermal conditions. At Baveno, Ce-rich gadolinite-(Y) (with ΣREE >Y) formed during the primitive stages of pegmatite crystallization. Gadolinite-(Y) (with ΣREE <Y) formed in pegmatites and granophyric aplites during primitive to moderately evolved stages of these dikes. Gadolinite-(Y) (with ΣREE <Y) and hingganite-(Y), which contains a significant amount of the datolite component, occur in miarolitic cavities together with several rare-element accessory phases. During the latest stages, datolite formed with zeolites. At Cuasso al Monte, gadolinite is found only in primitive to highly evolved miarolitic cavities. The cores of these crystals consist of Nd-rich gadolinite-(Y) (with ΣREE >Y). Gadolinite-(Y) (with ΣREE <Y) formed during intermediate stages of evolution, and hingganite-(Y) is dominant in highly evolved miarolitic cavities together with several rare-element phases. The chemical differences observed in the gadolinites from the two localities may indicate a different parental magma composition and reflect a difference in the crystallization processes. In contrast to Baveno, the crystallization at Cuasso al Monte occurred under open-system conditions, which prevented the formation of a zeolite (datolite-bearing) stage and generated a typical medium- to low-temperature hydrothermal mineral assemblage consisting of quartz, fluorite, barite, sulfides, and carbonates. The large variations in the Y/Dy ratio observed in the studied samples may be due to a change in the fluorine abundance in hydrothermal fluids related to paragenetic effects and mixing processes.