

GENESIS OF THE CABALLO AND BURRO MOUNTAINS REE-BEARING EPISYENITE

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Extraordinarily potassium feldspar-rich rocks, termed “episyenite”, exposed in Proterozoic basement in the Caballo and Burro Mountains, New Mexico, have anomalously high concentrations of U, Th and rare earth elements (REE). Episyenite bodies may have been emplaced as magmatic dikes, or formed by interaction of potassium-rich metasomatic fluids with Proterozoic basement.

Field investigations show that brick-red episyenite tend to occur as clusters of elongate, sub-parallel bodies. Contacts between episyenite and host rock are typically gradational, along which transitional mineralogy, colors and textures are exhibited. Alteration and reddening of host rock has been observed along fractures. Spatial association of episyenites with pegmatite and aplite dikes, mafic xenoliths and complex textural variations in the host rock suggest that episyenites may be emplaced/formed near the margins of older plutons.

Textural, mineralogical and chemical variations between granitic basement, episyenite and transitional rocks were characterized by electron microprobe. Host rocks typically contain unaltered plagioclase, K-feldspar, quartz, biotite and magnetite with accessory zircon and monazite. Plagioclase and K-feldspar both contain patchy perthitic textures and quartz inclusions. Similar original mineralogy can be recognized in transitional samples, but are overprinted by extensive alteration. Many primary plagioclase and K-feldspar are surrounded by rims of secondary K-feldspar. The secondary K-feldspar is significantly less fractured, displays no perthitic textures, and contains micron size hematite inclusions. The most reddened episyenites are composed almost entirely of secondary, interlocking K-feldspar, with vein quartz and accessory amounts of zircon, apatite, rutile and hematite. K-feldspars crystals display no relict igneous textures. In one sample from the Caballo Mountains, a large REE-bearing phase was discovered, possibly the mineral parisite. Qualitative scans show it contains La, Ce, Pr, Nd, Y, Ca and F. In a second sample from the Caballos, a zircon crystal interpreted to be primary has been partially replaced by a REE-bearing alteration rind.

Field and microprobe observations suggest that episyenites are metasomatic in origin, formed by K-rich fluids migrating along fractures in Proterozoic basement, and are not primary igneous intrusions. Origin of the fluid responsible for metasomatism is, at this time, unknown. In the Caballo Mountains, the C-O Bliss Formation truncates episyenites and contains episyenite clasts in its basal transgressive lag, constraining metasomatism to older than late Cambrian. Similar stratigraphic control is not present in the Burro Mountains. Cambrian-Ordovician carbonatite and alkaline magmatism with associated K-metasomatism is well documented in southern Colorado and New Mexico. Though no carbonatite or alkaline intrusions are exposed in the Caballo or Burro Mountains, episyenites may be related to unexposed C-O intrusions at depth. Dating of metasomatic K-feldspars by the Ar/Ar method yield complex age spectra that suggest episyenites have experienced multiple thermal and/or recrystallization events. Apparent ages suggest minimum formation ages of ~460 Ma in the Caballo Mountains, and ~525 Ma in the Burro Mountains.