

Origin of zeolites in zoned amygdales from the North Mountain Basalt, Nova Scotia

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A variety of analyses (XRD, electron microprobe, SEM, EDS) have been made on eighteen samples of zoned amygdales and veins from the North Mountain Basalt between Morden and Ross Creek. Amygdales and veins consist principally of zeolites, but silica minerals are also common. Mordenite, the highest temperature form, is found on the rims of amygdales, with a pink outer zone and a greenish inner zone. The green colour is the result of an Fe-Mg-Na-rich mineral, possibly smectite. The cores of the amygdales consist of one of heulandite/clinoptilolite, epistilbite, or the stilbite group. Contact zones of different zeolites show porosity between crystals in the SEM. These pores appear linear and resemble fractures in thin sections. Barite rosettes, gypsum, Au, Cu, and Ni occur in pores in all zones. There is no evidence that these fractured or porous zones result from chemical corrosion. The limited extent of the porosity also suggests that it is not mechanical, resulting from hydraulic fracturing. Rather, it appears to be residual inter-crystal porosity, perhaps as a result of rapid precipitation. Although most authors have

attributed the North Mountain zeolites to burial metamorphism, several lines of evidence suggest that the zeolites are of hydrothermal origin. The presence of mordenite with labradorite suggests temperatures in excess of 250°C. Repetitive series of zeolites suggest repetitive changes in hydrothermal fluids. The variability in heulandite/clinoptilolite composition in a single sample indicates considerable variation in Si/Al and Na/K of circulating fluids. Concentration of minerals such as barite and gold in pores is also much more consistent with a hydrothermal than a burial metamorphism origin. A given sequence of zeolite minerals represents a gradually decreasing temperature of formation, such as mordenite precipitating first followed by Na-K-rich clinoptilolite and then by heulandite + Ca-rich clinoptilolite or epistilbite - epistilbite from fluids rich in Ca and heulandite/clinoptilolite from fluids rich in K-, or heulandite precipitating first and stilbite minerals later. The recognition of hydrothermal circulation in the North Mountain Basalt has implications for economic mineral potential.