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Mineralogy and Chemistry of Zeolite Minerals in Tertiary Alkaline Volcanics around Trabzon Area, NE Turkey

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Tertiary aged alkaline volcanics are commonly exposed around the Trabzon area located at the Northern Zone of the Eastern Pontide. Zeolite minerals are widespread in these volcanics consisting of pyroclastics including breccias and tuff; subvolcanics composing of basaltic dikes and sills, trachytic dikes, andesitic dikes and domes; lavas comprising of foid bearing brecciated lavas, pillow lavas and basaltic flows. The characteristic silicate minerals of these rocks are common augite and plagioclase, rare olivine, hornblende, biotite and leucite.

The host rock are weathered and hydrothermally altered in variable degree and locally shows silicification, chloritization, epidotization, argillization and zeolitization Alteration minerals are generally identified as replacements of phenocrystal and glass; in large cavities of pillow lavas and lava flows; around the breccia fragments and within matrix in pyroclastics; along fractures around the subvolcanics.

Plagioclase microlites and phenocrysts are partly replaced by albite, calcite, sericite and zeolite. Albitization and carbonitization of primary plagioclase also occurs as reaction rims or along crystal microfractures. Minor amounts of epidote are generally found as infilling, surrounded by zeolite and calcite and sometimes as the patchy replacement of plagioclase. Skeletal augite and rare olivine may be intensely fractured, occasionally chloritized and enveloped by opaque rims. Also, tranformation of leucite to analcime are generally observed at foid-bearing rocks. There is a partial alteration of rare hornblende and biotite to chlorite in some samples. The groundmass is commonly altered to calcite and zeolite or partially to chlorite and clay minerals. Chlorites are determined as infillings and replacement of glass in groundmass.

A variety of textural relationships among different mineral phase are distinguished in amygdales and veins. Ellipsoidal-circular shaped vesicles (0.5 to 10 cm in diameter) are partly embedded by zeolite, apophyllite, quartz, carbonate and clay minerals infillings. Zeolites form euhedral and subhedral crystals and isometric, radial, fibrous, acicular, tabular, globular, and granular morphology. Based on the XRD, SEM investigations and chemical analysis, zeolite minerals are represented by natrolite, analcime, leumontite, thomsonite, mesolite, skolecite, chabazite and heulandite. Accompanying minerals are apophyllite, calcite, aragonite, quartz and clay minerals.

Natrolite is a major zeolite minerals found at the mineralogical studies. Macroscopically, natrolite comprises fibrous crystals forming fan-like aggregates and prismatic, often acicular, radiating crystals. In most cases, natrolite associated with apophyllite and calcite. Mesolite, scolecite and thomsonite occur as overgrowths on natrolite in several of voids. The Si/Al ratio of natrolite varies between 1.45 and 1.91 and the average content of Na, Ca and K in the analysed crystals is 1.53, 0.27 and 0.02 atoms per unit cell, respectively. White coloured fibrous and radiating crystals of thomsonite has 1.17 Si/Al ratio and 1.95, 1.32 and 0.06 atoms per unit cell Ca, Na and K atomic content, respectively. Apophyllite is generally colourless or pinkish in colour with euhedral and anhedral forms and has exceptionally high fluorine content from 1.46 to 1.90 %wt. Structural Ca, K and Na atoms per unit cell are 9.87, 2.342 and 0.109, respectively. White or pinkish coloured laumontite is restricted area around dikes and shows nearly square prisms. The average Si/Al ratio of laumontite is 1.90 and the content of Ca, Na and K is 2.62, 0.81 and 0.10 atoms per unit cell, respectively.