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Clinoptilolite zeolitized tuff from Central Alborz Range, North Iran

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Zeolites are hydrated alumino-silicates of the alkaline and alkaline earth cations, principally sodium, potassium, calcium, and magnesium (Iijima 1980; Hay 1981). Zeolites occur principally in unmetamorphosed sedimentary rocks and are particularly widespread in volcani-clastic strata (Hay, 1978). Clinoptilolite is a natural zeolite of the heulandite group with the simplified formula of (Na, K)6 Si30 Al6 O72 .nH2. It is the most common natural zeolite found mainly in sedimentary rocks of volcanic origin.
Alborz zone is one of the important geological divisions in Iran. This zone is restricted to Kopeh dagh zone in North & Central Iranian zone in South and is a region of active deformation within the broad Arabian-Eurasia collision zone (Allen et al. 2003).
The zeolitized green tuff belt from Central Alborz which introduce here are made of volcanoclastic sequence of Karaj Formation. This belt is about 40 km long along Alborz Range and is Eocene in age. Zeolites and associated minerals of this altered vitric tuff studied. Zeolitization took place in some beds of Karaj Formations, with average range of 3 to 300 meters thickness. There are several gypsum lenses which interbed with a widespread green tuff succession in the studied area.
On the basis of chemical composition these tuffs are in the range of acid to intermediate volcanic rocks. Also magmatic affinity is calc-alkaline and geological setting of the area belongs to volcanic arc granitoid.
Petrographic data has shown that various shape and size of shard glass are the main component of tuffs. Based on the field studies, detail microscopy, XRD and electron microprobe analysis (EMPA), the following main minerals are determined: Clinoptilolite+montmorillonite+crystobalite. Clinoptilolite and smectite are predominant minerals in all altered samples. Concerning the Si/Al ratio of 40 point analyses of glass shards the Alborz tuff has clinoptilolite composition. Otherwise the chemical composition of altered shard glass is very similar to clinoptilolite structural formula. By using medium results of chemical data the structural formula for Firuzkuh clinoptilolite is as follow:
Si 29.91 Al 6.01 Fe2+ 951 Mg2+ 0.393 Ca 0.222 Na 3.162 K 1.422
Paleogeographic conditions have provided a marginal shallow seawater environment which has been filled by volcanoclastics sequence. In Eocene the zeolitization occur as layers which are confined stratigraphically, it seems this process that took place only in preferred tuffaceous horizons which enriched by shard glass. So the term staratabound can be used for this type zeolitization. In altered tuffs there are a close relationship between clinoptiloite and montmorilonite in some deposits.
Alborz range, there was an occasionally marine environment (existence of marine microfossils) with humid climate (remnants of plants in some points). Transformation process (glass zeolite + smectite) provides a further silica contribution to the system, which finally in supersaturation and decreasing pH favors the precipitation of silica in altered tuff. This may have occurred when ground water flow become to mix with saline water to lowering the pH.