Epithermal zeolite mineralisation, central Taupo Volcanic Zone, New Zealand

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In the central Taupo Volcanic Zone (TVZ), extensive zeolite (mordenite ± clinoptilolite) mineralisation occurs in late Quaternary rhyolitic vitric tuffs that were deposited in a lake formed by caldera collapse following the c. 290 ka Ohakuri ignimbrite eruptions. Glass shards in lacustrine vitric tuffs of the Ngakuru Formation and in the underlying Ohakuri Formation ignimbrite are replaced by mordenite ± clinoptilolite, along with hydrothermal K-feldspar, opal-CT and opal-A. This mineral assemblage is also found in the outer alteration zones of epithermal gold prospects at Ohakuri and Tahunaatara in the Ngakuru area. The zeolite mineralisation is associated with silica sinters and hydrothermal eruption breccias that were formed in recently extinct (c. 34 to 1.5 ka) geothermal systems. The occurrence of mordenite + clinoptilolite + smectite + opal-CT, as in the Ngakuru area, is typical of low-temperature (60–150^{o}C) hydrothermal alteration in rhyolitic caldera settings of Quaternary age – "Caldera-type zeolitisation". By analogy with the active geothermal systems, mordenite and clinoptilolite in the Ngakuru deposits probably formed at temperatures of 60 –110^{o}C as a result of interaction of alkali chloride water with glass shards and pumice in the vitric tuffs. The occurrence of silica sinters above the zeolitic tuffs implies deposition of sinter at the ground surface from hot alkali chloride water of near-neutral pH. The spatial association of the zeolite deposits with sinters indicates that the zeolites were formed at a shallow depth, i.e. 25 m to a maximum of 80 m below the paleosurface. Silica sinters and hydrothermal eruption breccias are widely recognized as surface manifestations of low-sulfidation (LS) epithermal or "hot spring" Au-Ag deposits. Hydrothermal chert and sediment silicification are also distal products of epithermal fluids in LS settings. In that context, the association of mordenite ± clinoptilolite with silicification in the form of opal CT as in the Ngakuru zeolite deposits may be regarded as a further manifestation of distal LS epithermal alteration.