Clay Minerals in Hydrothermally Altered Rocks at Wairakei, New Zealand*

A. Steiner

New Zealand Geological Survey, Box 30368, Lower Hutt, New Zealand

* An invited paper presented at 16th Clay Conference, Denver, Colorado.

Abstract: Geothermal fluid discharged by steam wells, which have been core drilled to depths as much as 4500 ft at Wairakei, New Zealand, has altered Pliocene to Pleistocene, silicic, mainly glassy volcanics and related aqueous tuffs and breccias. Measured temperatures (max. 265 ° C) indicate epithermal to mesothermal conditions in buried fault fissures, the locus of both the hydrothermal fluid and most intense alteration.

A supergene kaolinite alteration zone is distinguished from hypogene Ca-montmorillonite and combined micaceous and chloritic zones. The hypogene zones are usually wide and are temperature dependent and localized along fault fissures. Other common hypogene minerals are alkali feldspars, wairakite, epidote, quartz, calcite, laumontite, ptilolite, pyrite and pyrrhotite. Prehnite is rare.

The micaceous clay minerals include illite (about 10 Å) and a series of random mixed-layer illite-montmorillonites with *d*(001) values ranging from 10 · 28 to 12 · 45 Å. The amount of interstratified montmorillonite is related to temperature and fault fissures. Apart from rare mixed-layer swelling chlorite, the Fe-rich chloritic clay shows little or no variation in its composition. Both the micaceous clays and the chloritic clay result from alteration of earlier formed Ca-montmorillonite.

The stability of hydrothermal minerals is controlled by the temperature and chemical composition of the geothermal fluid ascending along the fault fissures. K-feldspar but not albite is deposited on fissure walls, but both alkali feldspars replace primary soda-lime plagioclase in the wall rock. The absence of albite on fissure walls is ascribed to low aqueous mNa^+/mK^+ ratio. Primary quartz is not affected by the altering solution but hydrothermal quartz is deposited on fissure walls and in the wall rock.

Clays and Clay Minerals; August 1968 v. 16; no. 3; p. 193-213; DOI: 10.1346/CCMN.1968.0160302

Clay Minerals Society (www.clays.org)