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HEAT SOURCE OF NELUMWEWA THERMAL SPRING AS REVEALED FROM CLAY MINERALS AND ALTERATION MINERALOGY

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Hydrothermal alteration is a common feature in the minerals associated with thermal springs. Some temperature sensitive clay minerals, produced as a result of hydrothermal alteration, can be used as geothermometers to determine source temperatures at depth. The present study was conducted at Polonnaruwa Nelumwewa thermal spring site; one of the ten low enthalpy thermal springs of Sri Lanka for analyzing the properties of extruded clay from the spring associated outlets in order to explain the subsurface thermal conditions. This extruded clay can probably be the alteration products of the minerals in subsurface rocks associated with the thermal sources transported to the surface with ascending thermal water.

The extruded clay was sampled and separated by mechanical sieving, dried and analysed for its mineral constituents using X-ray diffraction (XRD) and thermo-gravimetric analysis (TGA) methods. The XRD analysis indicated presence of chlorite, smectite and illite group minerals in the extruded clay. Same minerals were confirmed by TGA analyses.

Chlorite is a common mineral in greenschist facies metamorphic rocks and as hydrothermally altered (ferromagnesian minerals) product, in some igneous rocks. Illite and kaolinite group minerals are formed primarily during hydrothermal alterations or chemical weathering of feldspars under acid conditions.

Country rocks of the study area belong to amphibolite faceis and hence minerals such as chlorite and illite cannot be expected to occur in significant amounts. Therefore, illite and chlorite in the thermal spring clay can be considered as hydrothermally altered products from a deep seated formation. Studies in other parts of the world indicate that these clay minerals are formed at temperatures between 200-300 ^{0}C at deeper levels of thermal spring systems as alteration products. Under the natural geothermal gradient of 30 ^{0}C per km, groundwater has to percolate to a depth of at least 6 km to attain a temperature of 200 ^{0}C. Open fracture systems that can transmit water to such depths are probably unlikely in the study area which is only 50 m above the mean sea level.

Therefore, it can be suggested that the percolated meteoric water is heated at a much shallow depth from a heated body like a “Hot Dry Rock” in the Nelumwewa thermal spring system.

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