

Origin of the Manleluag Hyperalkaline Hot Spring, Philippines

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The origin of the Manleluag Hyperalkaline Hot Spring is a unique occurrence in the Philippines. It is characterized by hyperalkaline (pH10 to 11.5) and highly reducing waters (-200 to 300mV) with little dissolved oxygen present (<1mg/L). Active gaseous exhalation could be methane or hydrogen gas due to its combustible nature.

Its origin is puzzling to most and has been widely attributed to a nearby volcanic plug. Here we present an alternative origin of the Manleluag Hyperalkaline Hot Spring – it is produced by the dissolution of underlying gabbros of the Zambales Ophiolite. Its alkalinity is due to the hydrolysis of Mg-rich rocks (i.e. gabbros) while the hydrolysis and oxidation of iron in minerals (e.g. pyroxenes) accounts for its highly reducing state. A geochemical reaction path model (i.e. Geochemist's Workbench) was used to elucidate the chemical reactions that took place to produce this unique natural occurrence in the Philippines.