Oxygen Isotopic Constraints on the Origin of Nodular Silica-Apatite from the Har Peres Pyroclastics, Golan Heights, Israel

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Abstract: Oxygen isotope composition of three types of unique nodules which consist of amorphous silica-apatite, cristobalite-apatite and tridymite-apatite associations interspersed amidst basaltic pyroclastics from the Har Peres volcano, Golan Heights, Israel is reported. Unusual isotopic temperature (75 ° C estimated from oxygen isotope fractionation between cristobalite ($\delta^{18}O$ = +25.5‰)-apatite ($\delta^{18}O$ = +12.9‰) pair suggests that the nodule was not formed by present-day pedogenesis as has been previously proposed, but was a xenolith incorporated probably from the underlying siliceous phosphorites at a higher temperature. An observed negative oxygen isotopic fractionation ($\delta^{18}O$ = −5.1‰) between tridymite ($\delta^{18}O$ = +9.9‰) and associated apatite ($\delta^{18}O$ = +15.0‰) is indicative of the nodular formation under disequilibrium conditions. A plausible mechanism of formation of the apatite (and calcite) associated with tridymite is an epitaxial overgrowth on template tridymite of magmatic origin under the current weathering regime. Oxygen isotopic evidence indicates a complicated origin for the nodules.

Key Words: Apatite • Har Peres pyroclastics • Oxygen isotope

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