Supergene Origin of the Lastarria Kaolin Deposit, South-Central Chile, and Paleoclimatic Implications

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Abstract: The residual kaolin deposits near Lastarria, South-Central Chile, were formed by weathering of subvolcanic quartz porphyry stocks, which intruded the metamorphic basement of the Coastal Cordillera. The clay fractions (<2 μm) consist mainly of poorly-ordered, very fine-grained kaolinite and lath-shaped illite (17 – 38 wt. %) with minor amounts of quartz, sanidine, and goethite. A sample from the top of the deposit contains major quantities of gibbsite morphologically indistinguishable from kaolinite flakes. The gibbsite-free clays contain 35.5 – 36.6 wt. % Al_2O_3, 0.4 – 2.6 wt. % Fe_2O_3, 1.3 – 3.9 wt. % K_2O, and have low TiO_2 concentrations (<0.02 wt. %). The absence of quartz veining, the abundance of melt inclusions, and the scarcity of secondary fluid inclusions in quartz phenocrysts from altered rocks imply a lack of significant hydrothermal activity in the quartz porphyries. The $\delta^{18}O$ and δD values of the kaolins indicate formation in a weathering environment at significantly higher annual mean air temperatures (~12 °C) than present mean temperatures of ~9.4 °C. Uplift of the region alone probably cannot account for the change in climate. The stable isotope composition of gibbsite is consistent with an origin of desilication of kaolinite at superficial temperatures. Various criteria proposed to distinguish supergene from hypogene kaolins are discussed.

Key Words: Chemistry • DTA • Fluid Inclusions • Gibbsite • Hydrogen Isotopes • Hydrothermal • Illite • Kaolinite • Origin of Kaolin • Oxygen Isotopes • Weathering

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