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The role of biogenic processes in extraction of Ce during laterite weathering at Mount Weld REE deposit, Western Australia

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Mount Weld, one of world's richest REE deposits, is located in a weathered laterite cap of carbonatite [1, 2]. The laterite samples show REE_2O_3 content reaching 51.8 wt. % representing rocks with some of the highest REE content known to date. A special characteristic of Mount Weld laterite is the presence of intense negative Ce anomaly on chondrite normalised REE patterns ($Ce_{CN}/Ce^* = 0.68$; where $Ce^* = sqrt(La_{CN}*Pr_{CN})$. At the mineral level, the anomaly varies significantly: it is absent in partly corroded primary monazite (~1), while the supergene minerals florencite-(Ce) and rhabdophane-(Nd) demonstrate prominent Ce anomalies (0.6 and 0.2 respectively). An interesting feature of Mount Weld laterite is a presence of tube-like structures interpreted as paleo-plants that are composed of rhabdophane-(Nd).

Negative Ce anomaly is sometimes observed in carbonatite laterites [3]. Specific organic compounds could create conditions for fractionation of Ce from other REE at relatively reduced conditions [4, 5]. Therefore, in Mount Weld, the plant-mediated wreathing could have created conditions for extraction of Ce.

On the other hand, the solubility of Ce increases in alkaline waters of lakes where positive Ce anomalies have been sometimes observed [6]. The occurrence of lacustrine sediments above Mount Weld laterite suggest that the existence of a lake in the past and the loss of Ce to lake waters could be another mechanism for formation of the intense Ce anomalies in Mount Weld laterite. In both scenarios, the redistribution of Ce in the Mount Weld weathering profile occurred in a much wetter climate than at present.

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