

Clay-Hosted REE Deposits Associated to Eucla Basin Paleovalleys in Southern Australia

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The growing demand for rare-earth elements (REE), driven by the transition to renewable energy technologies and geopolitical supply uncertainties, has intensified the search for alternative REE sources. Current economic REE deposits are in regions of tropical weathering, where REE are absorbed onto the surfaces of clay minerals. During the late Cretaceous to Eocene, much of Western Australia experienced tropical climates that likely generated ionically bound REE deposits. These weathering profiles have been partially eroded and covered by sediments from the Eucla Basin and its associated paleovalleys. Since the Miocene, arid weathering, influenced by seasonal drainages, shaped the current landscape. Reworking of the tropical weathered profile formed: (1) preserved lower saprolite REE enriched zones located at the base of the paleovalleys (Esperance-Western Australia); (2) confined layers within the paleovalley sediments with REE that could be extracted by in-situ leaching (Wudinna-South Australia). We have studied three REE prospects associated with paleovalleys from Western and Eastern sides of the Eucla basin. Our preliminary results show that the majority of the REE are hosted by secondary phosphate and minor carbonate minerals at the lower saprolite zone. The REE mineralisation within paleovalley sediments at eastern Eucla is likely hosted by ionically bound REE in clay minerals, as no REE mineral phases were identified to account for the reported grades. This presence of ionically bound clay hosted REE could relate to more recent climate differences between the two regions, where the more wet climate of Esperance could be responsible for leaching ionically bound clays, reprecipitating it as secondary phosphate minerals at the lower saprolite, while the eastern side of the Eucla retains un-leached ionic clays. These observations highlight the importance of understanding the geometry, and sedimentation regimes of the Eucla basin paleovalleys, and climate history for generating clay-hosted REE exploration targets within southern Australia.