Insights from Timor-Leste Tectonics: Applications for Geologic Studies and Energy Exploration in Central Nevada

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Abstract

Nevada, situated within the multi-deformed fabric of the western United States, shares geological features with Timor-Leste, a region experiencing arc-continent collision. The study of Timor-Leste's actively rising Ramelau Mountain Range captures the collision between the Australian continental margin and the Banda Arc, which provides valuable insights applicable to Nevada's geology such as thrust geometry, evolution of folding and faulting, and structural influence on epithermal systems. In Timor-Leste, the Ramelau Range, initially mapped as a simple anticline, reveals a more complex structural evolution with thrust duplexing of Gondwana-aged Australian continental strata contributing significantly to its topography. Applying these findings to Nevada, where mostly Mesozoic arc-continent collisions accreted terranes now forming the western Cordillera, enhances our understanding of similar tectonic processes. Geometrical structural analysis of bedding, joint sets, fold axes, axial planes, and vergence directions within the Ramelau Range indicates a dominant SE-verging contractional regime with a NW-SE maximum stress direction, reflecting the arc-continent collision. Shortening estimates of the Ramelau uplift range from 25-50 km, with movement direction perpendicular to the continental margin, oblique to the NNE plate movement of Australia. Structural mapping and cross-sections through the range reveal fault propagation folds from meter to kilometer scale related to contraction, intersected by NW-SE strike-slip faults and E-W striking normal faults. Later-stage deformation stress regimes may be the result of ongoing oblique plate collision and increasing orogenic coupling. Investigating the active accretionary systems in Timor-Leste offers valuable parallels for characterizing the structural evolution of Nevadan geology. Additionally, exploring energy and mineral resource potential in Timor-Leste, including geothermal resources along collision-related structural features, provides insights for resource management and exploration in Nevada. This comparative analysis contributes to a deeper understanding of tectonic processes and their applications in geological research and resource development in both regions.