

Expanding Zn–Fe Skarn Exploration Targets in the Ruwai Area, Central Borneo, Indonesia, Using Integrated Prospectivity Modeling

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Exploration at the Ruwai skarn deposit, Central Borneo, Indonesia, was initiated in the 1980s by PT Tebolai Seng Perdana and is currently continued by PT Kapuas Prima Coal Tbk. The increasing availability of geological, geochemical, and geophysical datasets has created an opportunity for integrated mineral prospectivity analysis to support new target generation and sustainable resource discovery.

This study integrates 15,622 geochemical samples, regional geological mapping, and airborne magnetic data to evaluate Zn and Fe skarn prospectivity in the Ruwai area. Ten evidential layers were developed: proximity to faults, proximity to lithological contacts, magnetic lineaments derived from total derivative data, proximity to intrusions interpreted from reduced-to-pole and analytical signal magnetic responses, proximity to high-potassium zones, and proximity to Zn, Pb, Ag, and Fe geochemical anomalies. These layers were combined using a fuzzy gamma operator with a gamma value of 0.9, allowing balanced integration of restrictive and permissive relationships among controlling factors.

Results show that, at the regional scale, Zn skarn prospectivity is strongly influenced by the distribution of Zn anomalies, while in the near-mine area it is mainly controlled by Zn and Pb anomalies, with prospectivity extending toward Block 3. Regional Fe skarn prospectivity was classified into five classes, with the very high prospectivity class covering 32,952 ha. In the near-mine zone, Fe skarn prospectivity is also strongly associated with Fe anomalies. Known surface occurrences of Zn and Fe skarn mineralization are consistently located within high to very high prospectivity zones, indicating strong spatial agreement between the model outputs and observed mineralization. Further validation using three drill holes confirmed significant intersections of Zn and Fe skarn mineralization in zones predicted as highly prospective.