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## Influence of Mineral Microinclusions on Vectoring and Fertility Assessment Tools in the Green Rock Environment: A Case Study from Batu Hijau Porphyry Cu-Au Deposit, Indonesia

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Valuable chemical information is contained within alteration minerals such as chlorite and epidote, providing useful tools for vectoring and fertility assessment in porphyry exploration. Although previous studies have focused on these alteration minerals, it is common for them to contain microinclusions of other minerals that are also analyzed when acquiring LAICPMS data. Addressing this gap in current knowledge, this study reevaluates over 3000 legacy LA-ICPMS analyses from the Batu Hijau Porphyry Cu-Au deposit, focusing on the distribution and composition of microinclusions in chlorite and epidote.

Microinclusions in chlorite and epidote increase in frequency toward the center at Batu Hijau, reflecting intensity of hydrothermal activity and elevated trace elements in hydrothermal fluids. Through new LA-ICPMS and EPMA analyses on selected samples, this research confirms that mineral microinclusions, particularly titanite and apatite within chlorite and epidote associated with propylitic alteration, can serve as effective vectors for porphyry exploration and aid in fertility assessment.

In a magmatic environment, apatite co-crystallization has been demonstrated to affect the extents of Ce and Eu anomalies in zircon thereby impacting estimates of magma oxidation based on zircon compositions as well as influencing other trace elements. Ti-bearing microinclusions (rutile, titanite) are also prevalent in chlorite and epidote. Titanium contents can serve as temperature indicators in chlorite, vectoring toward the heat center of the system. Thus, the presence of microinclusions may artificially increase the measured Ti, thereby influencing vectoring outcomes.

Preliminary results indicate an increase in Zr, LREE, U, and As in titanite and LREE/HREE ratios in apatite microinclusions toward the deposit center. Sulphur contents in apatites potentially highlight the extents of the pyritic zone. Although further research is necessary, these findings reveal promising paths for new exploration tools within the porphyry-epithermal environment.