

Late Cretaceous Magnetism in the San Matias District, NW Colombia: Insights of a New Ca. 76 - 66 Ma Porphyry Copper Belt in the Northern Andes

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Colombia's Western Cordillera (WC) forms the northwestern corner of South America from the Caribbean region to Ecuador, comprising mostly accreted island arc terranes. The region's complex accretionary evolution and the lack of technical data confound the definition of a Cretaceous magmatic arc. Recently recognized porphyry-IOCG mineralization at the San Matias District (SMD) in the northernmost WC extension offers new understanding and insights into this region's magmatic and metallogenic evolution. It also illuminates new exploration opportunities for porphyry copper deposit (PCD) discoveries along the Northern Andes.

Petrography, lithogeochemistry, and zircon trace-element geochemistry of the SMD intrusions indicate low- to medium-K calc-alkaline affinity diorite to tonalite and their division into five magmatic suites. The ca. 74.4-70.0 Ma San Matías-La Jagua Magmatic suite (SMJS) is the most metallogenically significant. The SMJS hosts porphyry-style mineralization (e.g., Montiel E and Costa Azul) and exhibits depleted mantle Sr-Nd values and low radiogenic Pb isotope values similar to Galapagos Islands signatures. Lithogeochemistry (e.g., Sr/Y > 20 (26.2 - 58.8) and $Eu^* = 0.8 - 1.7$) and zircon trace-element geochemistry (e.g., $Eu^* > 0.35$, $Ce^*_{10} > 225$ and $Dy/Yb < 0.15$) are consistent with hornblende fractionation from hydrous oxidized magma and indicate enhanced fertility for PCDs.

With the addition of our new U-Pb ages, two periods of magmatic activity along the WC can be recognized: 1) ca. 93-85 Ma and 2) ca. 76-66 Ma. The latter is coeval with the SMJS ages and considered the fertile period for PCDs. The 76-66 Ma ages extend to the southern WC, where lithogeochemistry and mineral occurrences are consistent with those in the SMD. These findings support the definition of a new Cordillera-scale Andean metallogenic belt with significant and growing copper resources.