SEG 100 Conference: Celebrating a Century of Discovery

R14

The Late Miocene Middle Cauca Au-Cu Porphyry/Epithermal Belt, NW Colombia: Tectonomagmatic History and Controls on Mineralization

Hildebrando Leal-Mejia[1], Thomas Bissig[2], Craig Hart[1], Robet P. Shaw[3], Richard Friedman[4], Robert Creaser[5], Janet Gabites[4]
1. Mineral Deposit Research Unit - The University of British Columbia, Vancouver, BC, Canada, 2. Bissig Geoscience Consulting, Vancouver, BC, Canada, 3. Independent Consultant, Kelowna, BC, Canada, 4. Pacific Centre for Isotopic and Geochemical Research – The University of British Columbia, Vancouver, BC, Canada, 5. Canadian Centre for Isotopic Microanalysis, University of Alberta, Vancouver, BC, Canada

The late Miocene Middle Cauca Cu-Au porphyry/epithermal Belt (MCB) and adjacent areas are recognized as a highly prospective region within the Colombian Andes, being the focus of significant exploration since 2003. Although recent publications address the characterization of individual districts/deposits within the region, understanding the regional spatial and temporal tectonomagmatic history and the controls on the mineralization is a key aspect to support mineral exploration.

The ca. 120-km-long N-S-trending MCB comprises historically known and recently discovered deposits along the middle Cauca River valley, with porphyry-associated mineralization styles including porphyry Au-Cu (e.g., El Poma, Quinchía, Caramanta, La Mina, and Titiribí), porphyry Cu-Au (e.g., Nuevo Chaquiro), and LS-IS epithermal Au-Ag-Zn (Pb-Cu) (e.g., from S to N, Miraflores and Chuscal near Quinchía, Marmato, Yarumalito, El Zancudo near Titiribí) deposits. Adjacent areas also include important late Miocene deposits such as the La Colosa porphyry Au and the Buriticá vein-type Ag-Au-Zn (Pb, Cu).

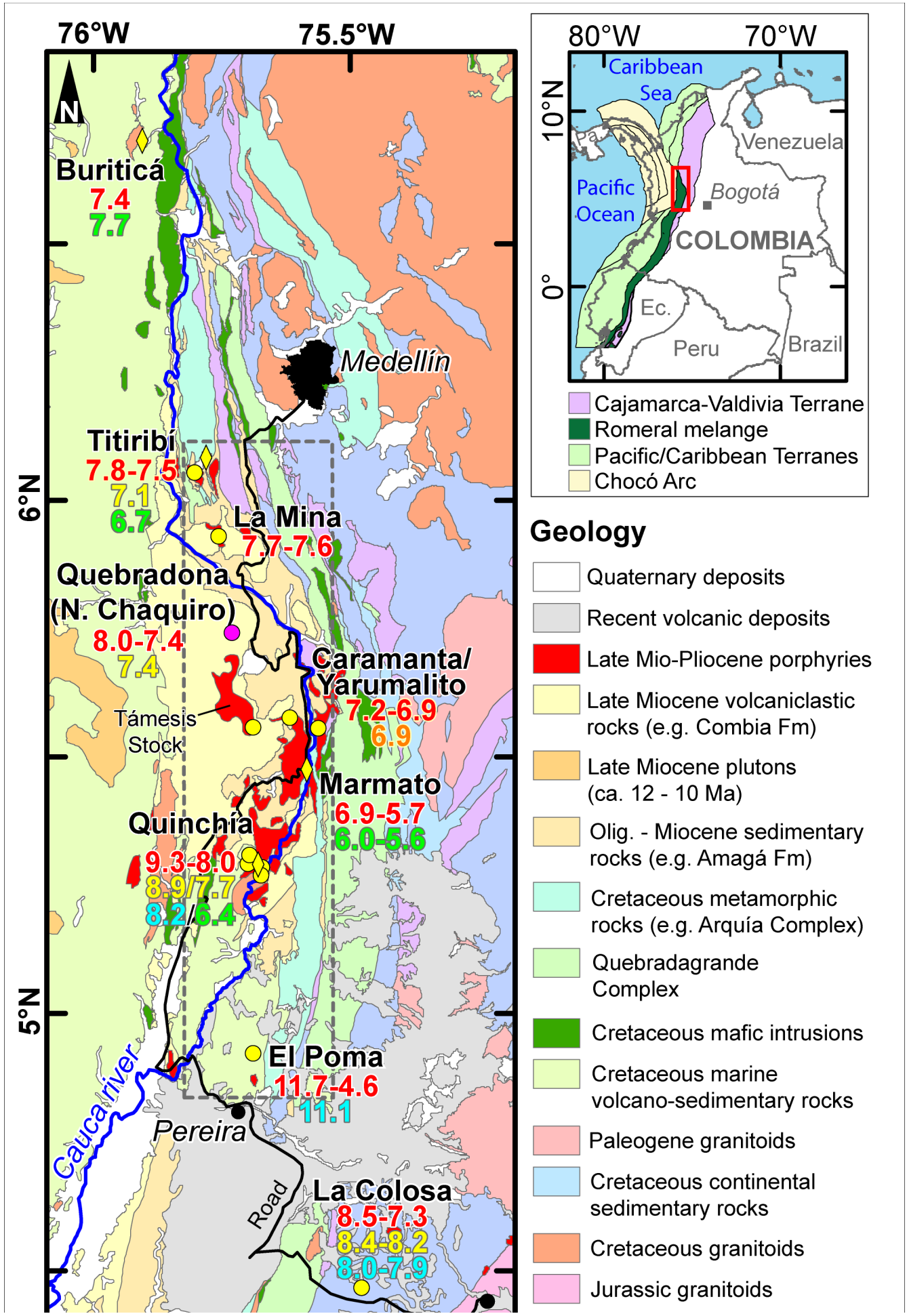
Porphyry and epithermal mineralizations are structurally controlled and spatially associated with weakly to moderately porphyritic hornblende-biotite plagioclase diorite-granodiorite-quartz monzonite stocks intruding the Romeral melange basement, as well as the overlying the early-middle Miocene Amagá Formation and the middle-late Miocene Combia Formation.

U-Pb CA-TIMS and LA-ICP-MS zircon ages obtained for intrusions across the MCB constrain the magmatism between ca. 12 and 4 Ma, with early magmatism (12-10 Ma) starting in the south at El Poma and Quinchía, followed by northward expansion along the MCB to reach the Titiribí district by 7.5 Ma and subsequent eastward migration to Caramanta-Yarumalito and Marmato (ca. 7.2-6.0 Ma).

Re-Os molybdenite and ^{40}Ar-^{39}Ar sericite analyses confirm the close temporal relationship of mineralization with the late Miocene magmatic event with multiple mineralizing episodes, most prolific between ca. 9.3 and 7.3 Ma.

Lithogeochemistry of igneous rocks associated with porphyry districts and age-equivalent porphyry intrusions unrelated to known mineralization confirm the mantle-derived, metaluminous, calc-alkaline affinity of the magmatism, associated with subduction of the Nazca Plate beneath the Pacific Margin of northwestern South America. However, subtle but important geochemical variations in both N-S and W-E directions are evident, including increasing SiO_2 content from N to S and characteristic “adakite-like” and “porphyry-fertile” geochemical signatures. Igneous rocks from the Titiribí District have a subtle but distinctly more alkaline character when compared to other districts to the south. Such a subtle alkalic character is also observed in igneous rocks from the Buriticá epithermal deposit.

The high Au/Cu ratios observed in the Miocene porphyry-related ore deposits are attributed to shallow emplacement of porphyry systems, as inferred from the temporal relationship of water-rich oxidized porphyry stocks with only slightly older host-volcanic rocks and from the proximity and similar age of epithermal and porphyry mineralization. At the Titiribí district, the Au-rich nature of mineralization can potentially be attributed to the mildly alkalic nature of magmatism. The Cu-poor but Au-rich nature of the giant La Colosa porphyry deposit is best explained by the relatively reduced nature of the causative intrusive rocks hosted in strongly reducing Paleozoic carbonaceous schists of the Cajamarca-Valdivia terrane.


76°W
75.5°W
6°N
5°N
N
Buriticá
7.4
7.7
Medellín
Titiribí
7.8-7.5
7.1
6.7
La Mina
7.7-7.6
Quebradona
(N. Chaquiro)
8.0-7.4
7.4
Caramanta/
Yarumalito
7.2-6.9
6.9
Támesis
Stock
Marmato
6.9-5.7
6.0-5.6
Quinchía
9.3-8.0
8.9/7.7
8.2/6.4
El Poma
11.7-4.6
11.1
Pereira
Cauca river
Road
La Colosa
8.5-7.3
8.4-8.2
8.0-7.9
80°W
70°W
10°N
0°
Caribbean
Sea
Venezuela
Pacific
Ocean
Bogotá
COLOMBIA
Ec.
Peru
Brazil
Cajamarca-Valdivia Terrane
Romeral melange
Pacific/Caribbean Terranes
Chocó Arc
Geology
Quaternary deposits
Recent volcanic deposits
Late Mio-Pliocene porphyries
Late Miocene volcaniclastic rocks (e.g. Combia Fm)
Late Miocene plutons (ca. 12 - 10 Ma)
Olig. - Miocene sedimentary rocks (e.g. Amagá Fm)
Cretaceous metamorphic rocks (e.g. Arquía Complex)
Quebradagrande Complex
Cretaceous mafic intrusions
Cretaceous marine volcano-sedimentary rocks
Paleogene granitoids
Cretaceous continental sedimentary rocks
Cretaceous granitoids
Jurassic granitoids

Permo-Triassic granitoids

Pz to Triassic met. rocks

Deposits

- Epithermal Au-Ag-Zn (Pb-Cu)
- Porphyry Au-Cu
- Porphyry Cu-Au-(Mo)

Geochronology

7.7 **Magmatic ages (Ma)**

7.7/7.7 Porphyry/epithermal mineralization ages (Ma)

7.7/7.7 Porphyry/epithermal alteration ages (Ma)