Cenozoic Magmatism and Mineral Deposits: Peru

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Cenozoic Tectonic Setting

Overview

- Notable deposits:
  - Peru: Gold and Silver
  - Chile: Copper
  - Bolivia Mineral Belt
- What types of magmatism/tectonic settings helped to create these mineral deposits?

Cenozoic Cordilleras

- Two main cordilleras
  - Occidental (west)
  - Oriental (east)
- Main volcanic activity today is located in Cordillera Occidental

Early Cenozoic

Sandeman et al. (1996)
The Subduction Situation

- Early Cenozoic: slow convergence
  - Steeply dipping Nazca plate
- Subduction zone moves closer to Pacific-Nazca Ridge, causing younger, more buoyant crust to be subducted
  - Shallower angle of subduction
  - Magmatism moves further inland and becomes wider
  - Exerts upward forces on the overlying continental crust
- *Pilger 1984*

Cordillera Oriental (East)

- Few Cenozoic sed. rocks
- Volcanics different from the typical calc-alkaline Andean volcanics (Cordillera Occidental)

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<th>CENOZOIC</th>
<th>Stages</th>
<th>Cordillera Oriental</th>
<th>Name and thickness</th>
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Eastern Cordillera

- Two-mica, cordierite-, and biotite-bearing volcanics
  - Usually associated with high K calc-alkaline basalts
  - North American Analog: Similar to the two-mica volcanics in the Sonoran and Mojave Desert Region.

South American Deposits

Tinka Resources Limited
Economic Geology of Peru

- Mined for Cu, Pb, Zn, Ag, Au, Fe
- All notable mining areas are within the cordillera

Peru: Gold and Silver Deposits

- 2003: Peru ranked as 2nd Ag and 6th Au producer
- Hydrothermal mineral deposits
- Notable deposits:
  - Arcata, Caylloma, and Orcopampa (each has produced over 40 mil. oz of Ag, and 100,000 to 1 mil. oz of Au), and many, many more
  - Deposits mostly in Tacaza Group (possibly also in Barroso group)

Tacaza Group

- Lower part mainly sed rx
  - coarse congl. -> interbedded ss and volcanic mudstones
- Two volcanic packages
  - Lower package: similar to underlying sed package, but with layers of tuffs and flows
  - Upper package: bedded flows, breccias, andesite tuffs, dacite and rhyolite lenses

Barroso Group

- Andesites and Dacites with pyroclastics
- Broken into two formations:
  - Malmanya Fm (andesite, dacite) and Vilcarini Fm (PF’s and lava sequences – evolved lavas)
- Veins with Au and Ag mineralizations
  - Also Pb, Zn, Cu
- Have found conflicting reports about the economic value of the Barroso Group (Fletcher et al. 1989)
Mineral Deposit Formation

- Do not appear to be from sills or laccoliths
  - Very little alteration and rarely mineralized
- Proposed formation model: (Fletcher et al. 1989)
  - Hot Taaca facilitates up-convection cell and circulate hydrothermal fluid
  - Hydrothermal fluid leeches materials from lava piles and deposits them along fracture zones

North American Analogs

- How does this compare to North America?
- Sonoran and Mojave Desert Regions
  - Increased buoyancy of crust induces crustal flexure; 2-mica deposits

Migration of Magmatism

- Three active volcanic zones in the Andes (north, central, south) broken up by areas of inactivity
- Shallower subduction causes magmatic zones to move to the north and south; central area becomes inactive

North American Analogs

- Colorado Mineral Belt
  - Gold and Silver deposits
  - Water circulating through rocks leeches elements and deposits them back out

North American Analogs

- Au and Ag deposits in Sonoran and Mojave Desert Regions
  - Porphyry deposits containing Cu, Pb, Zn, Au, and Ag

References


