Cenozoic volcanism in the Central Andes

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March 25, 2005

**Parinacota**

**Tectonic setting**

- **Volcanic Zones**
  - NVZ (Northern volcanic zone): Ecuador and Colombia
  - CVZ (Central volcanic zone): Southern Peru, northern Chile, southwestern Bolivia, and northwestern Argentina
  - SVZ (Southern volcanic zone): Southern Chile and southern Argentina

**Volcanism in the CVZ**

- Well defined zone of calc-alkaline andesite volcanism
- Scattered instances of calc-alkaline, high K and shoshonitic back-arc volcanoes
- A zone of voluminous silicic volcanism, characterized by large ignimbrite erupting calderas.

**CVZ**

- The CVZ is not as studied, or as well known, as the NVZ and SVZ.
- The CVZ is located between 14° s and 28° s.
- This zone is dominated by the Altiplano (Bolivia) and the Puna Plateau (Northern Chile and Argentina).
- The CVZ, unlike the NVZ and the SVZ, is underlain by thick crust (70 km).
Andesitic Cordilleran Volcanism

- The Andean Cordillera in the CVZ is 7500 km in length and is defined by active volcanoes.
- Many of the volcanoes in this area are over 6000 m in altitude (which makes them some of the world's highest volcanoes).
- These volcanoes are characteristically located about 250 km east of the trench and 100-125 km above the descending oceanic slab.
- Magmas are generated by partial melting of the hydrated mantle wedge.
- The volcanoes in this zone of the CVZ have lavas that are high potassium basaltic andesites, andesites, and dacites.

Ollague Volcano

Ollague is a 5800 m high andesitic strato volcano with a dacite lava dome at its summit.
During the Pleistocene dome collapses deposited debris avalanches (evidence for glaciation so pre-11000 yrs ago).

Ojos del Salado

The world highest active Holocene volcano (6887 m)
Most recent eruption 700 AD
Andesitic to Rhyolitic lava domes, pyroclastic flows

San Pedro

San Pedro is a 6145 m high stratovolcano.
Dacite lava flows are present
Last known eruption: 1960
**Back-Arc Volcanism**
- Large andesitic and dacite composite volcanoes which are found 100 km beyond the active (Andean) arc.
- These rocks have higher Nb and lowers Ba than those in the Andesite chain.
- Thus, the parent magmas for these volcanoes have different minor and trace element compositions and probably incorporate more of the plate.
- Volcanism occurred here over several million years and is related to some chemical and thermal evolution of the mantle below the area.
- Examples: Cerro Chorrillos and San Jeronimo in Argentina

**Large Silicic systems**
- There are extensive ignimbrite sheets in the CVZ, generally located at elevations around 4000 m.
- The large calderas that produced the ignimbrites are located 200 km east of the arc.
- They are mainly dacitic and are large (> 1000 km²).
- They seemed to be active over many millions of years.
- An Ignimbrite is a large volume pyroclastic flow.

**Altiplano-Puna volcanic complex**
- The largest silicic complex in the CVZ.
- Calderas include Pastos Grandes, La Pacana, Guacha and Purico.
- Ignimbrites from this complex cover 17,000 km².

**Cerro Panizos**
- Late Miocene in age
- 40 km in diameter
- 3 ignimbrite units (volume is 500 km³)
- Dacites
- SW Bolivia

**Western Cordillera comparison**
- The San Juan caldera complex in the western USA relates to the caldera complexes found in the Altiplano-Puna complex.
- Oligocene in age
- Rhyodacite to rhyolites in composition.
- Result from a low angle subduction.
- Volumes: 40,000 km³

**Cascades**
- Cascades are like the Andean arc.
Activity

Activity closest to the coast was about 300 km from the trench. (In the CVZ, the active arc was 250 km from the trench)

The style of volcanism changed as you got farther from the trench, just like in south america.

References

- http://pubs.usgs.gov/gip/volcus/fig15.gif
- http://volcano.space.edu/cvz/intro.html
- Global volcanism program
- Volcano world
- http://theory.uwinnipeg.ca/mod_tech/img260.gif
- http://www.geo.ucalgary.ca/~macrae/timescale/time_scale.gif