

## Volcanism in the Central Andes

Geology, volcanology and petrology along a transect from  
Arica to Volcán Parinacota (N. Chile)

Field leader: Gerhard Wörner, Göttingen

Sept. 28 - Oct. 7, 2019

**Overview:** Active continental margins are shaped by subduction-related magmatism, and the Central Andes of South America are a prime example. The “modern” Andean orogen with its present elevations and landscape characteristics has evolved over the past 25 Million years. Topics include:

- \* Orogenic processes and tectonic history of the Andes
  - from Proterozoic basement to Holocene volcanism
  - tectonic uplift, erosion, and gravitational collapse
- \* Petrology of continental arc magmatism.:
  - physical volcanology of Andean stratovolcanoes
  - Evolution of distinct trans-crustal magma systems
  - How to make a "real andesite" by magma mixing and magma storage
  - Ignimbrite "super-eruptions" and crustal melting
- \* Sediments on the Altiplano:
  - Miocene to Pliostocene deposits as climate archives
  - Salars and salt deposits
- \* Exceptional scenery and wildlife: hot springs, llamas, condors, flamingos, llairetta, qiwuña, ...

The excursion provides insight into the orogenic processes that formed the Central Andes: uplift, erosion, and climate history of the Atacama desert. However, the main topic is volcanology and petrology of continental arc magmatism. Magmas ascending from the mantle and interacting with increasingly thickened continental crust. This process is reflected in the volumes and compositional variations of the magmas that erupt at the surface and their relation to the tectonic history and in the evolution of trans-crustal magma systems that feed the iconic andesite stratovolcanoes on the Central Andes.

The region is exceptional for its magnificent geological scenery, beautiful landscapes, and wildlife.



**Field trip leader** Gerhard Wörner has more than 30 years of experience in field work on the area and published extensively on the geological evolution, volcanology and magmatic geochemistry related to magmatism in the Central Andes in this area.

**Required minimum attendance:** 14 (maximum 16) persons.

**Transportation** during the excursion by 4WD vehicles (two participants will be needed to drive one of the rental cars) starting from Arica, ending in Arica (northernmost Chile).

Airline connections to Arica from Santiago de Chile. Alternatively, border crossing (taxi, 20 \$) to/from Tacna airport in Peru (1h from Arica), with connections from/to Lima. Arica does not have international connections.

**Accommodation:** Overnight days 1 and 10 will be in Hotel Amaru (\*\*\*) at the Pacific coast in Arica, N. Chile. Days 2 through 9 we will be in Putre at 3500 m elevation in simple but comfortable mountain lodges (heating and warm water provided).

**Temperatures** at night will be below 0°C, maximum temperatures during the day not above 20°C with intense insolation.

**Elevations** during the day between 3500 and 4800 m above sea level.

**Costs of the excursion for members of DGGV or DMG: 1850 Euro**, includes transportation from and to Arica, hotel accommodation (days 1-10, double occupancy) and full meals (days 2-9). Safety equipment in case of high-altitude sickness will be available (oxygen-masks, satellite telephone, etc.). Information material, satellite images, maps and field guides will also be provided. Your air fair to and from Arica is not included.

**The budget is calculated based on 14 participants, at lower participation, prices per person will increase proportionally !**

We will be donating 180 Euro for every participant to atmosfair for projects that help to compensate the appropriate amount of CO<sub>2</sub> that will be produced by air travel from Frankfurt to Arica and back. See <https://www.atmosfair.de/de/> for information and how the CO<sub>2</sub> footprint is calculated. Each participant will receive a CO<sub>2</sub>-compensation certificate. This way, the CO<sub>2</sub>-footprint of this excursion is minimized.

## Registration

**Please indicate your interest to participate to Gerhard Wörner ([gwoerne@gwdg.de](mailto:gwoerne@gwdg.de)) before April 15. Formal registration and payments will be organized after that date.**

For further information, maps etc. see:

**ELEMENTS issue edited by Wörner et al 2018:**

<http://elementsmagazine.org/past-issues/central-andes/>

**A simple roadside geology field guide to the area**

[http://www.elementsmagazine.org/archives/e14\\_4/Lauca-NP\\_Geology\\_Guide.pdf](http://www.elementsmagazine.org/archives/e14_4/Lauca-NP_Geology_Guide.pdf)

**A "professional" field guide (from SOTA7, 2018)**

<http://www.uni-geochem.gwdg.de/de/>

**Students excursion webpage:**

<http://www.unigeochem.gwdg.de/de/exkursion/anden-2008>

**For teasers:** <https://www.sota7.org/gallery>

**and :** <https://www.youtube.com/watch?v=LaPjpfeO2lo&feature=youtu.be>

## Program

- Sept. 28 Day 1 Arrive to Arica airport, lodging at Hotel Amaru
- Sept. 29 Day 2 half-day seminar: Geology and tectonics of the Central Andes, excursion: Jurassic submarine volcanic rocks at the coast.
- Sept. 30 Day 3 Arica - Putre: Azapa Valley: stratigraphy, ignimbrites, erosion, and sedimentation on the margin of the Western Cordillera.  
Lodging: Hotel Chacana, Putre at 3500 m elevation
- Oct. 1 Day 4 Belen basement: Oldest rocks in Chile, tectonics and gravitational collapse on the western margin of the Altiplano
- Oct. 2 Day 5 Lake sediments and salars on the Altiplano, borax deposits, hotspots and wildlife (flamingos, vicuñas, ñandus, condors)
- Oct. 3 Day 6 Taapaca dacite dome complex, stratigraphy, pyroclastic deposits. Petrology of dacites and its sanidine megacrysts
- Oct. 4 Day 7 Parinacota stratigraphy, petrology, and geochemistry, Sector collapse, Old Cone – Young Cone; Lago Chungará, Parinacota village, distal Parinacota debris avalanche deposit, secondary mud flows
- Oct. 5 Day 8 Parinacota petrology, lava flows and domes, maximum elevation during the day 4860 m above sea level,  
involves 4-WD shuttle / **walking, total ca. 10 km between 4800 and 4600 m**)
- Oct. 6 Day 9 Return from Putre to Arica : Valley incision history, post-erosional ignimbrites descending from the Altiplano to the Pacific. Evening: welfare-dinner at restaurant “Maracuyá”, lodging at Hotel Amaru in Arica
- Oct. 7 Day 10 Leave Arica..., or
- Oct. 8 Optional day : guided 20 km full day hike through Azapa valley: Ignimbrites, erosion and sedimentation processes, tectonics, valley incision history. Minor transportation costs and additional night will have to be paid separately.

## Tour map

