

WP4.3 ZIP CONSOLIDATOR —Organizers for ZIP: GFZ
Onland continuous monitoring of the Chilean subduction Interface

Training course: Monday 5th to Thursday 9th of October

Fieldwork: Saturday 10th to Thursday 15th of October

Annual ZIP Meeting: 16th and 17th of October

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Training Course

The course is an introduction to the principles and applications of geodetic and geophysical data of the IPOC observatory. The course is intended to teach how modern monitoring techniques work in an active subduction zone. This training will integrate theory and practical applications, with a focus on GPS, and how they are applied to the study of problems in tectonics and other causes of motion and deformation. In addition, there will be an introduction to the theory and application of fundamental seismic principles applied to the study of the subduction interface. We will also examine some aspects of the paradox between short- and long term deformations by covering topics related to: crustal fault activity, tectonics control on the Andean Orogen, intermediate-depth seismicity in fossilized subduction channels and control on mechanical coupling at the plate interface.

Course requirement:

1 Laptop with unix system (Mac or Linux).

Duration: 6 days

Day 1– Monday 5th of October (09:00 – 18:00 hr)

9:00-10:45

Fundamental of Geodesy, (Chris Vigny)

11:00-12:00

Fundamental concepts of the subduction zone earthquake cycle (Marcos Moreno)

12:00-13:00

Basics of GPS measurements: uncertainties/precision/errors (Chris Vigny)

13:00-14:00

Lunch

14:00-15:30

Exercise 1: Computing Strain and Rotation rates in a GPS network (Chris Vigny)

15:30-17:30

Practical training session on using GPS receivers (Chris Vigny & Marcos Moreno)

18:00

Renting of cars for fieldwork.

Day 2– Tuesday 6th of October

8:30-15:00

Fieldwork: Installation of GPS receivers across a section of the Atacama fault.

16:00-17:00

Elastic deformation patterns (Chris Vigny)

17:00-18:00

Viscoelastic deformation in subduction zones (Marcos Moreno)

Day 3– Wednesday 7th of October

08:30-10:45

Exercise 2: Finding and applying a rigid rotation pole to a velocity field (Chris Vigny)

11:00-13:00

Exercise 3: Finite element modeling of earthquake cycle kinematics (Marcos Moreno)

13:00-14:00

Lunch

14:00-16:00

Inverting a velocity field around a faults (Chris Vigny)

16:00-18:00

FE-model derived Green Functions for slip inversion (Marcos Moreno)

Day 4– Thursday 8th of October

08:30-10:45

Introduction to global and local seismic networks and instrumentation

The Integrated Plate boundary Observatory Chile (IPOC) (Bernd Schurr)

11:00-13:00

The seismic architecture of subduction zones with a focus on northern Chile (Bernd Schurr)

13:30-18:00

Fieldwork: Collection of GPS receivers and data

Day 5– Friday 9th of October

09:00-09:45

Subduction along Chile and orogeny - from earthquakes to mountains (Onno Oncken)

09:45-10:30

Chilean Subduction earthquakes (Sergio Ruiz)

10:30-11:15

Active Faults in northern Chile – observations from 10^6 y to seconds (Pia Victor)

11:15-11:30

Coffee Break

11:30-12:15

25 years of GPS in Chile: what did we learn? (Chris Vigny)

12:15-12:45

GNSS in the Centro Sismológico Nacional (Juan Carlos Baez)

12:45-13:15

Inversion of static displacements due to large interplate earthquakes: towards real-time monitoring (Francisco del Campo)

13:15-13:45

Open discussion

13:45-14:30

Lunch

14:30-18:00

Course: Deformation and fluid-rock interaction in ancient subduction interfaces (Samuel Angiboust)

Fieldwork

Duration: 6 days

The megathrust plate boundary between the continental South American and the oceanic Nazca plates routinely generates megathrust earthquakes ($M_w > 8.5$) and drives the spectacular Andean orogen. The field trip will take advantage of exceptional geological environments and awe inspiring landscapes in the area of the Northern of Chile forearc to further the knowledge of active margin processes. The fieldwork will cover core topics including active tectonics, structural and geological history of the region, and volcanology. The fieldwork will be conducted at various locations to observe how landforms can be created and modified by tectonic processes and how geomorphology can be used to interpret the nature of tectonic activity. To understand the relation between the tectonic evolution of the Andes and the geo-resources we will visit the Chuquicamanta mine, which is the biggest open pit copper mine in the world.

The north of Chile is one of the most carefully monitored plate boundary systems in the world. Here, The International Plate boundary Observatory Chile (IPOC) uses a wide range of geophysical and geodetic instruments to improve our understanding of both the physical mechanisms underlying the earthquake processes and the natural hazards induced by them. In contrast to conventional observatories that monitor an individual signal only, IPOC is designed to capture a large range of different, possibly associated deformation processes by using different geophysical and geological observation methods (seismographs, strong-motion seismographs, GPS, magnetotelluric sensors, creepmeter, accelerometer, InSAR, etc.). During the fieldtrip we will visit a multi-parameter IPOC station.

Summary:

Day 1 – Saturday 10th of October

Evidence of long-term persistence of subduction earthquake segment boundaries: Mejillones Peninsula (Pia Victor).

Overnight stay: Antofagasta.

Day 2 – Sunday 11th of October

Michilla, Maria Helena and road to Calama (Pia Victor).

Overnight stay: Calama.

Day 3 – Monday 12th of October

Investigate faulting, folding and the major structural features: route Calama to Ollague (Onno Oncken).

Overnight stay: Calama.

Day 4 – Tuesday 13th of October

Morning: Earth Resources: Visit to Chuquicamata copper mine

Afternoon: Domeyko Anticlinal at Paso Barros Arana: Evidence of the crustal shortening in the Chilean Precordillera (Onno Oncken).

Overnight stay: San Pedro de Atacama.

Day 5 – Wednesday 14th of October

Earth Resources and Volcanics: Tatio
Overnight stay: San Pedro de Atacama.

Day 6 – Thursday 15th of October

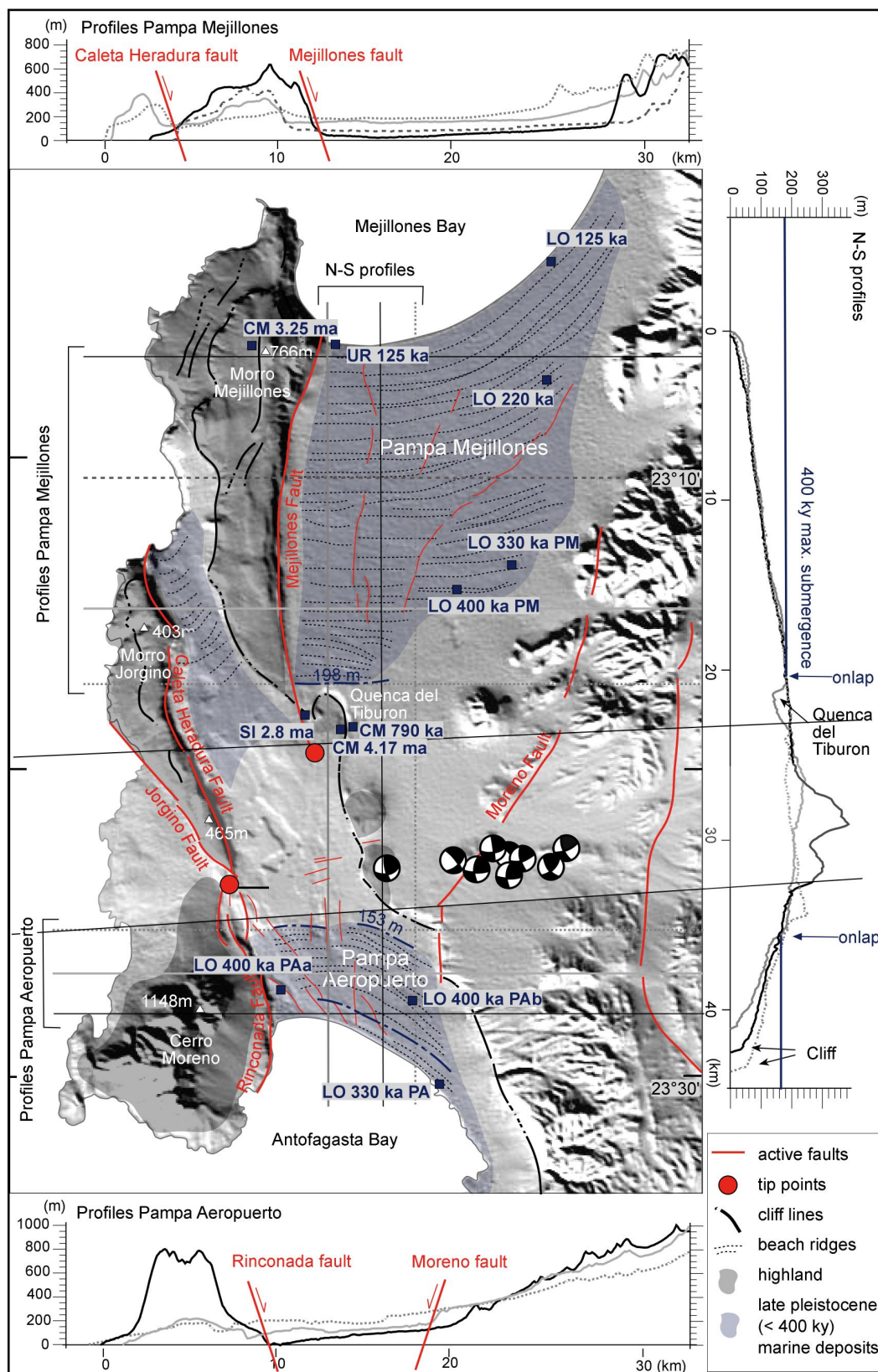
Visit to IPOC station PB06.

Fault rupture at the Salar del Carmen segment of the Atacama Fault System and + creepmeter observations (Pia Victor).

Overnight stay: Antofagasta.



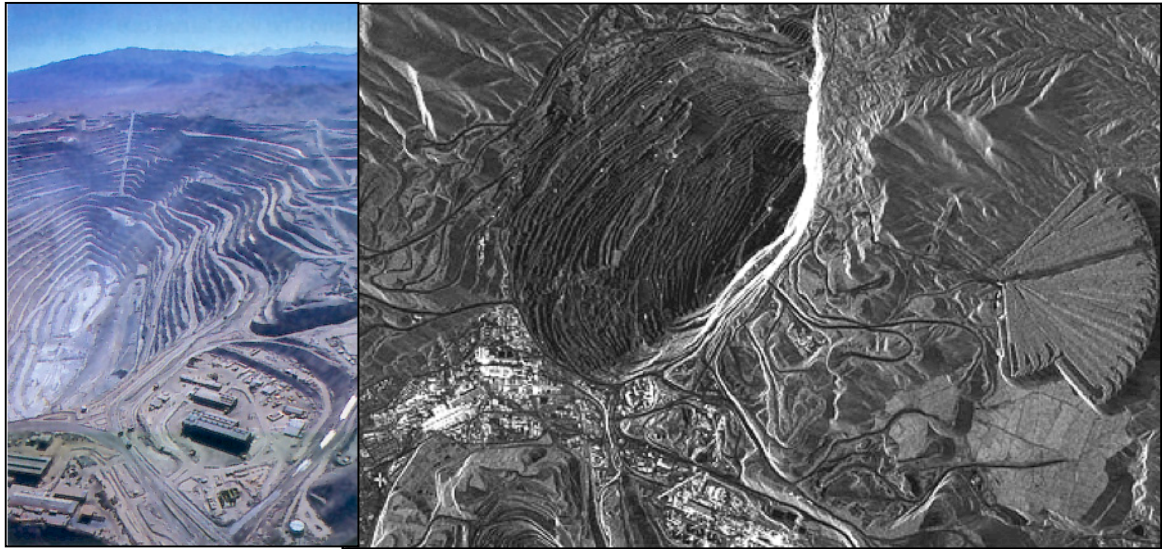
Map of places to visit.



Mejillones Peninsula



Oficina Santa Helena



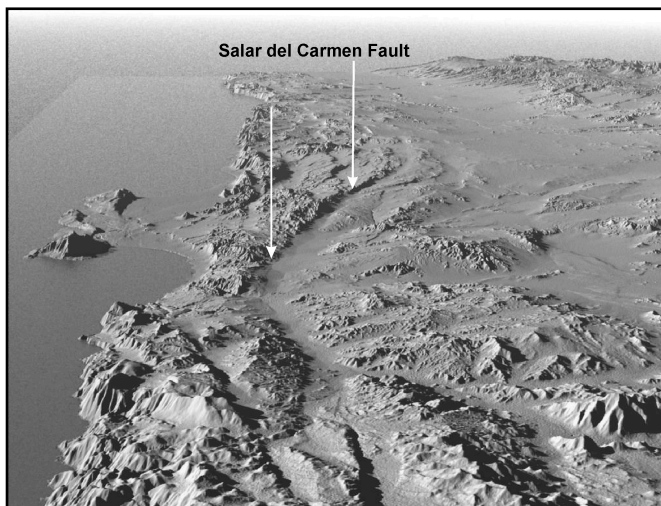
Chuquicamata Mine.



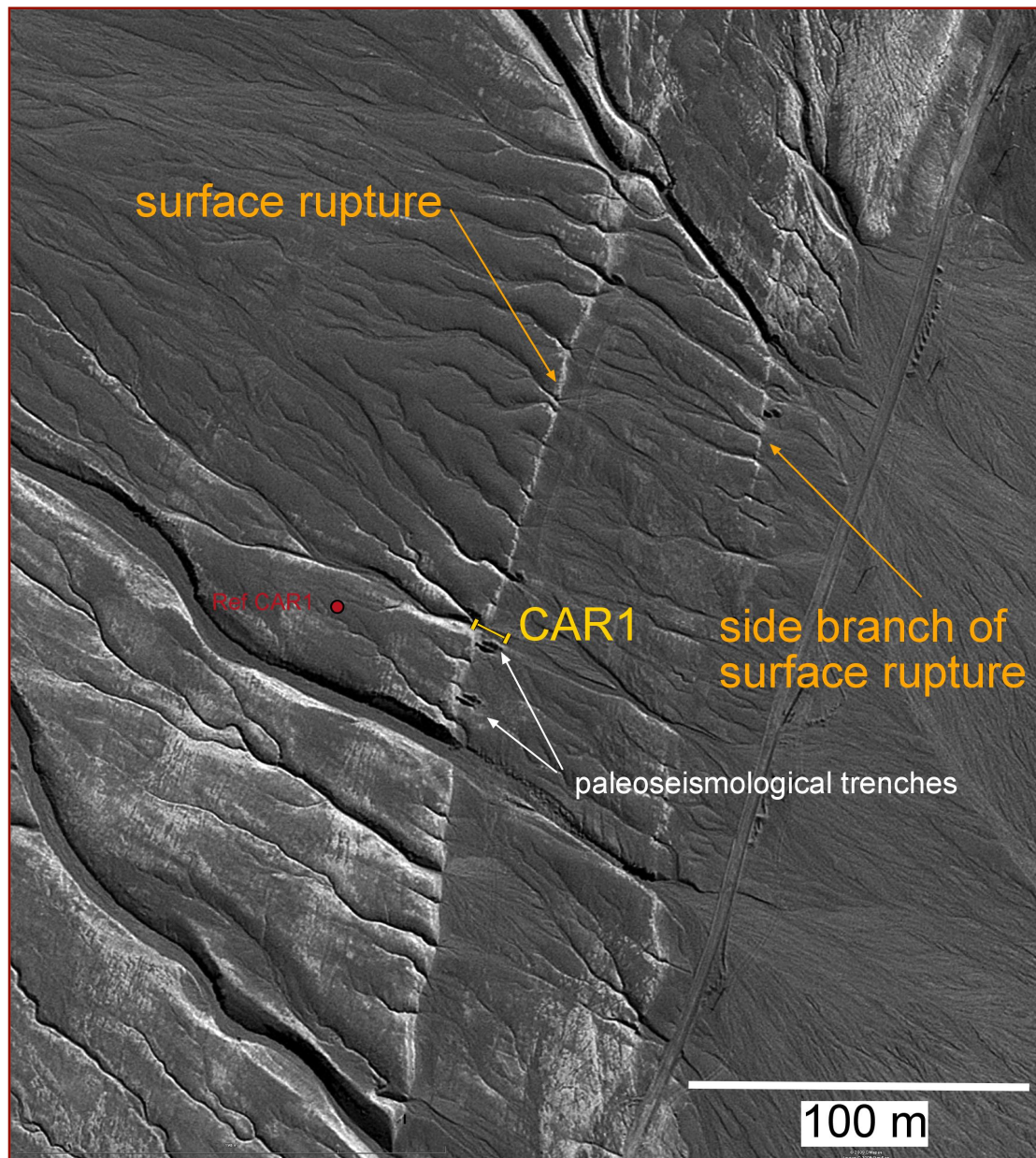
Valle de la Luna, San Pedro de Atacama



Cordillera de la Sal, San Pedro de Atacama.



Salar del Carmen



Salar del Carmen