

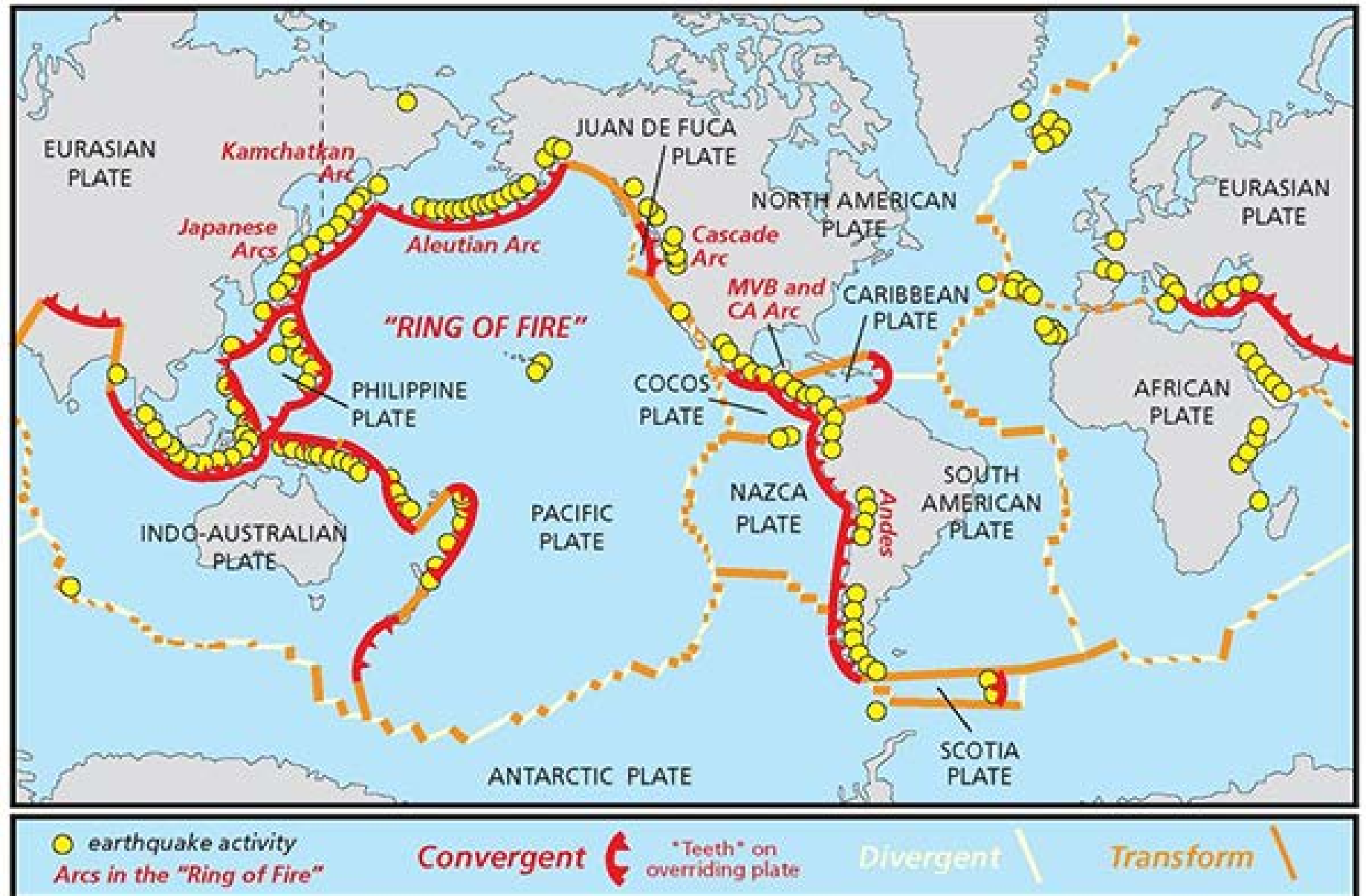
High Altitude, Remote Drilling Operations

A Study in Project Management

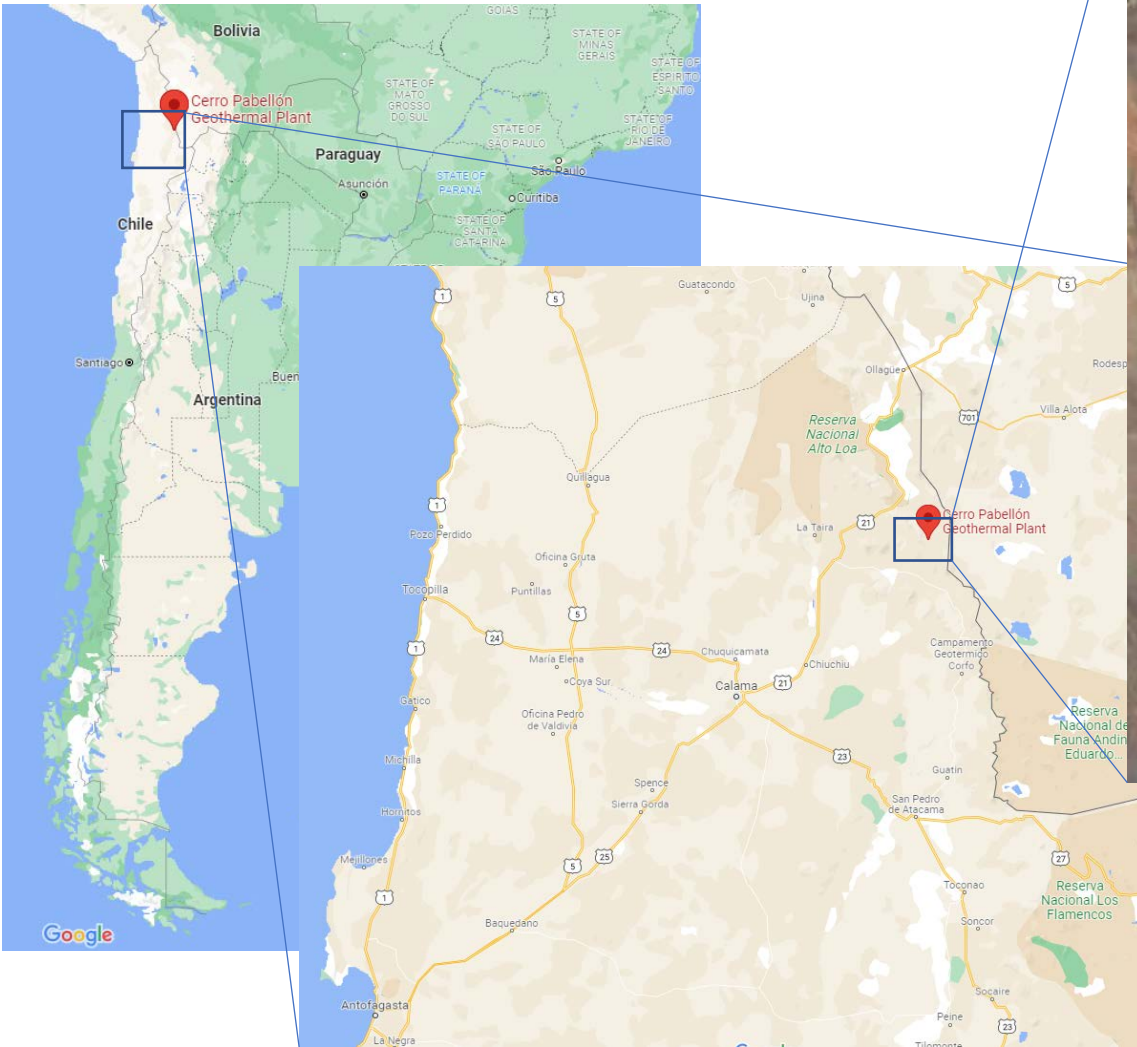
Preparations to Drill at the Cerro Pabellon Geothermal Field

Matt Holdeman

Ring of fire



Location, location,...



Location

Atacama Desert

- High altitude desert
- Less than 0.6 in rainfall per year
- Average elevation is 12,300 ft
- High winds

Cerro Pabellon sits at 14,500 to 15,400 ft



How did we get there?

Chilean Government incentive for Unconventional Renewable Energy

Cerro Pabellon was one of over a dozen concessions released for exploration and development

Operator issued an RFQ for a rig to drill 4 wells



Challenges

Extremely remote

Very high altitude

No suitable rig



Altitude



Rig

High altitude

Cold weather

Large hole – 36 in at surface

Well control at shallow depth

Mud cooling



BOP

26-1/2 in, 2000 psi Double
Ram



BOP

30 in, 500 psi annular



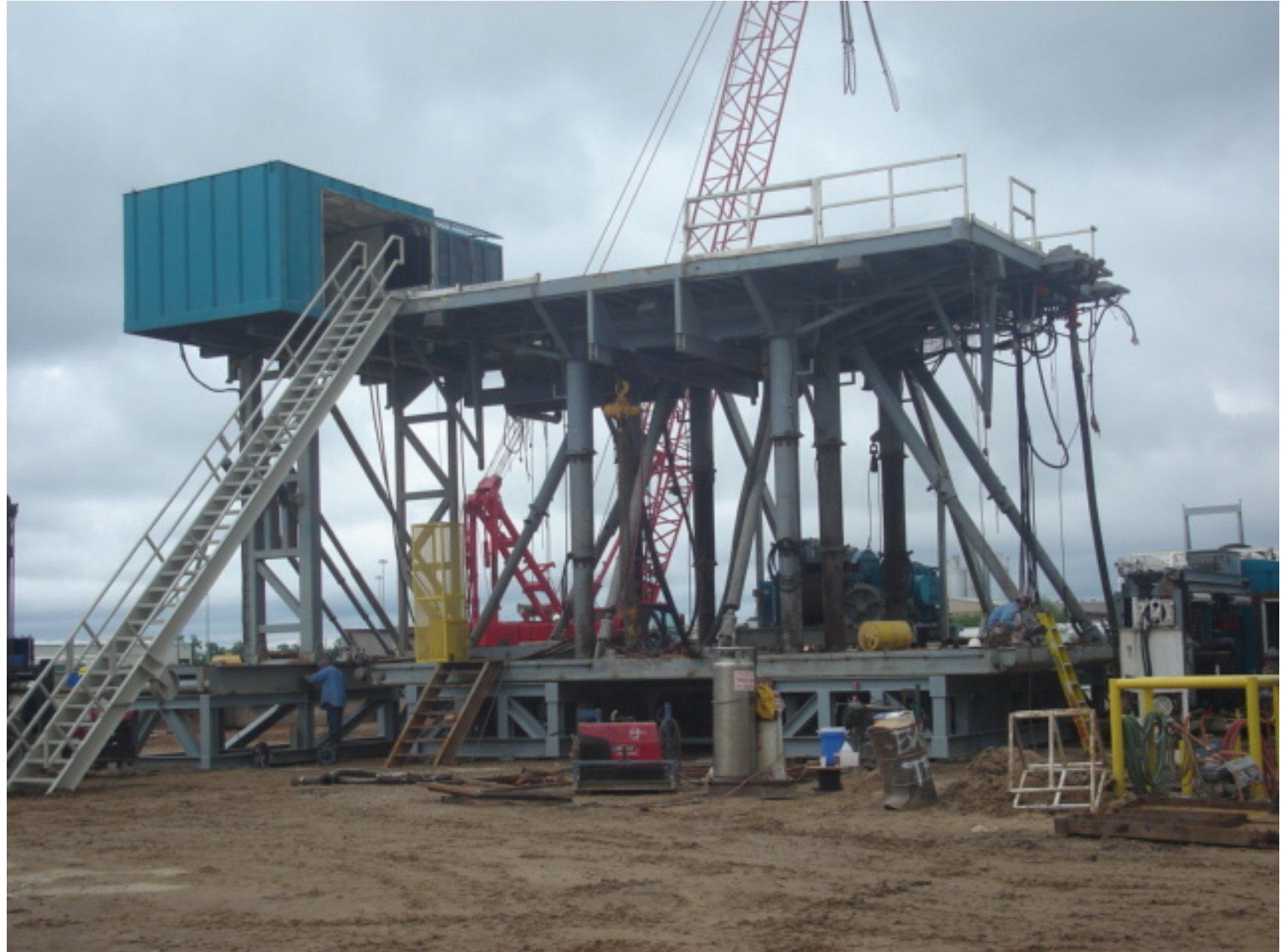
Rig

Complete strip down to the paint, modifications, inspection, and rebuild

Modifications for physical requirements

- Added 4 ft to the substructure
- BOP handling system
- 37-1/2" rotary table
- Racking board (regulatory)

Mud coolers



Rig

Modifications for altitude

- Additional generators and modified VFD on AC rig
- Fully mechanized handling system
 - Hydraulic catwalk
 - Iron roughneck
 - Power slips

Temperature modifications

- Windwalls for all manned areas
- Artic spec boiler system and heaters throughout the rig
- Elimination of all air systems



Independent Operations

Spares for nearly all equipment

1 year of operating and maintenance materials

Expanded on-site personnel

- Rig Manager
- Mechanic
- Electrician
- Welder

On-site medical facility with 24/7 staff including doctor

Full time ambulance



Personnel

Rig mechanization
modifications

High altitude medical
screening

Daily medical checks

Altered meal schedule

“Low” altitude camp at
10,500 ft



After Cerro
Pabellon?



Under construction



First Phase Complete

