Tectonic framework for the Energy Transition: Geothermal and CCS Geological Analogs along the Western North American Continental Margin, California (G583)

Tutors

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Overview

This course will explore a range of outcrops in central California to study topics inherent to the energy transition. Participants will be introduced to the tectonic setting of Western North America that provides opportunities for geothermal energy production, carbon sequestration (both mineralization and pore-scale trapping) and additionally, natural hydrogen exploration. Participants will learn how to characterize the locations of potential projects and explain the key geological factors that affect these and their feasibility.

Duration and Logistics

A 7-day field course based in Sacramento, California. Training will take place through in-class presentations, field observations, printed exercises and discussions in the field. Transport will be by coach.

Exertion Level

The field component of this course requires an **EASY** exertion level. There will be short hikes to outcrops mostly on flat to gently sloping terrain and gravel tracks. The climate in California during the spring and fall is variable with temperatures from 50°F (10°C) to hot and dry up to 100°F (38°C).

Level and Audience

Fundamental. The course is intended for a variety of professionals working in the energy transition including those responsible for policy on energy, regulators, energy sector investors and also those working on conservation. The course would also be suitable for geoscientists interested in a broad overview of energy transition topics.

Objectives

You will learn to:

1. Evaluate the regional tectonic framework and evolution for prediction of energy transition opportunities.
2. Describe regional geothermal systems and understand their relationships to tectonic evolution.
3. Analyze ultramafic rocks that are targeted for CO2 mineralization studies and natural hydrogen exploration.
4. Compare outcrop analogues to subsurface data for carbon sequestration in sedimentary rocks from several depositional environments.

5. Characterize the locations of potential projects and explain the key geological factors that affect these and their feasibility.

Course Content

Day 1: Arrive in Sacramento

Classroom:

• Introduction to the Tectonic setting (Sierra Nevada batholith and accreted terranes)
• Safety briefing

Overnight in Sacramento

Day 2: Sierra Nevada batholith (a remnant volcanic arc) and tectonic framework

Fieldwork:

Stop 2.1 – Old Donner Pass pluton
Stop 2.2 – Autochthonous arc-derived sandstones
Stop 2.3 – Neogene lahar deposits
Stop 2.4 – Melones Fault Zone
Stop 2.5 – Sheeted dikes

Overnight in Sacramento

Day 3: Sierra Nevada batholith and accreted terranes. Great Valley Group forearc basin deposits: analogs for carbon sequestration (mineralization and gas injection)

Fieldwork:

Stop 3.1 – Smartville ophiolite
Stop 3.2 – Sutter Buttes overlook, Hwy 20
Stop 3.3 – Great Valley ophiolite
Stop 3.4 – Serpentine diapir
Stop 3.5 – Upper Cretaceous-Lower Cretaceous boundary

Overnight in Sacramento

Day 4: Great Valley Group forearc basin deposits: Reassess Tectonic setting and the potential sites for carbon sequestration

Fieldwork:

Stop 4.1 – Cache Creek basin plain deposits
Stop 4.2 – Cache Creek deep-water lobe deposits
Stop 4.3 – Submarine canyon fill, Monticello Dam
Stop 4.4 – Basal Great Valley Group, Hwy 128 – SW Lake Berryessa: sedimentary serpentinite within basal GV group

Overnight in Sacramento

Day 5: Geothermal Opportunities

Fieldwork:

Stop 5.1 – Clear Lake facilities – discussion of the geothermal opportunities
Stop 5.2 – Introduction to Mt. Diablo geology and visit its north slopes

Overnight in Walnut Creek

Day 6: Transect from Mount Diablo to the Pacific Ocean

Fieldwork:

Stop 6.1: – Mt. Diablo serpentinites and gabbros
Stop 6.2 – Miocene outcrops (Berkeley) San Andreas Fault overlook
Stop 6.3 – Ring Mountain melange
Stop 6.4 – Point Bonita Lighthouse pillow basalts
Stop 6.5 – Marin Headlands cherts

Overnight in San Francisco

Day 7: Departure and travel home

Group departs for travel home