

Middle Jurassic Carbonate Platforms of NE France: inside the Ooid Shoals and surrounding Environments (G130)



Tutor(s)

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Overview

The Middle Jurassic outcrops of the south-eastern Paris Basin illustrate the complexity of architectures within ooid shoals and the interfingering with surrounding lagoon and open marine domains on carbonate platforms. These are exceptional analogues for several producing oil fields around the world, but also for geothermal energy, as the equivalent Middle Jurassic limestones are the main deep geothermal aquifer used in the Paris suburban area. The course provides an illustration of an integrated workflow for 3D modeling, starting with a review of the constraints to the static model acquired from subsurface data and including sedimentary architectures, distribution and evolution of petrophysical properties through diagenesis. All the key steps for robust static modeling are reviewed during the trip, always tying back to the geology and petrophysics.

Duration and Logistics

A 6-day field course based in the Auxois area (Burgundy, SE Paris Basin), with the itinerary and duration dependent on the technical objectives of the group. The course will comprise classroom lectures and fieldwork with transport by bus.

Level and Audience

Intermediate. This course is intended for geologists, geophysicists, petrophysicists or reservoir engineers. Knowledge of the fundamentals of carbonate sedimentology would be a useful prerequisite. However, a brief reminder of sedimentological elements and of sequence stratigraphy is scheduled in classroom on the first day. Practical logging sessions will also be organised in the field.

Exertion Level

This class requires an **EASY** exertion level. Access to the outcrops is easy, requiring only less than 10-15 minutes of walking. The longest walk is approximately 1.5km between 3 quarries on the same site. Outcrops include sections in both active and abandoned quarries.

Objectives

You will learn to:

1. Assess textures, allochems of carbonates and the range of preserved sedimentary structures.
2. Evaluate different carbonate facies and facies-association stratigraphic geometries in relation to environment of deposition, constrained within a sequence stratigraphic framework.
3. Examine large-scale sedimentary architectures and their impact on the heterogeneity at the reservoir scale.
4. Gauge the implications of sedimentological and diagenetic processes on petrophysical properties.
5. Assess the key steps for robust static modeling of different carbonate systems.

Course Content

Summary

The outcrops are well preserved in stone quarries and were studied for decades, but recent sedimentological, diagenetic, geophysical and petrophysical investigations, in combination with subsurface data, have reappraised old interpretations. The quarry sections also provide a unique opportunity to undertake an integrated study of these Jurassic shallow marine carbonates, investigating seismic and sub-seismic scale heterogeneities.

The field trip outcrop studies will follow the evolution of the various depositional environments, sedimentary facies and geometries in a constrained sequence-stratigraphic framework, which represents the skeleton of a 3D geological model. Investigations will follow the internal geometries and heterogeneities at the scale of a single third order sequence. This approach involves analysing several outcrop sites and making comparisons to related subsurface data (cores, logs, well seismic). In parallel with the sedimentological and stratigraphic outcrop study, a review of the diagenesis which affected the carbonates is included, in-order-to understand porosity and permeability distributions. Routine core analysis data and well log petrophysical data are integrated into this analysis.

Day 1

Arrival and travel to Semur-en-Auxois

Overnight: Semur-en-Auxois

Day 2

Morning Classroom:

- Introduction to the field trip
- Carbonates fundamentals (components and textures, depositional environments, basics of carbonate sequence stratigraphy)
- Safety briefing

Afternoon Fieldwork: Pouillenay quarry

- Bajocian platform dynamics
- Seismic scale geometries, dynamic of growth of coral patches, flooding of carbonates, diagenesis

Overnight: Semur-en-Auxois

Day 3

Fieldwork: Buffon and Chassignelles quarries

- Bathonian platform, introduction to the sequence stratigraphic framework and sedimentology of ooid shoals and lagoons

Overnight: Semur-en-Auxois

Day 4

Fieldwork: Massangis quarry

- Bathonian platform, following the same sequence introduced in Day 3; lateral variations of facies, sub-seismic scale heterogeneities, integration of some subsurface data; diagenesis, reservoir properties

Overnight: Semur-en-Auxois

Day 5

Fieldwork: Ravières quarries

- A site with 3 quarries all separated by less than a kilometre, illustrating the interior complexity of an ooid shoal (following the same sequence for lateral continuity)

Overnight: Semur-en-Auxois

Day 6

Course summary and travel home