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## N432: Clastic Reservoir Characterisation for Appraisal and Development (*Southern Pyrenees, Spain*)

Instructor(s): Philip Hirst and Gary Nichols

### Format and Duration

Field - 5 Days

Low Physical Demand

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### Summary

This field course integrates clastic sedimentological predictive models with reservoir characterisation for appraisal and field development, using case studies from the Cenozoic of the southern Pyrenees, Spain. Variations in depositional architecture are considered in terms of linked depositional systems, including fluvial, coastal, shallow marine, slope, and deepwater facies. The impacts of differing architectures on field development are considered, together with practical guidance on the choices available for building static and dynamic models.

This course is particularly well suited to provision as a tailored "in-house" learning experience, such as by focussing on a specific environment of deposition, and/or by incorporating your asset data for comparison.

**Business Impact:** Variations in stratigraphic architecture occur over short distances in clastic successions, both laterally and vertically, and strongly impact the **production performance** of a hydrocarbon reservoir. An understanding of the issues involved in **developing different architectures** in clastic systems and the **decisions** required to model these heterogenous reservoirs are critical to **predicting the long-term production behaviour**. Participants will be able to better understand clastic depositional systems and the practical application of that knowledge in the generation of **effective static and dynamic models**.

### Learning Outcomes

Participants will learn to:

1. Evaluate the sedimentology and basin fill architecture of a linked continental, shallow marine and deepwater depositional system.
2. Predict significant changes in sedimentology and stratigraphic architecture, both laterally and up or down dip in clastic reservoir systems.
3. Integrate the interactions of the controls on sandstone body architecture.
4. Assess the impact of depositional architectures, flow zones; and sedimentary heterogeneity on; potential recovery in different hydrocarbon fluid and development scenarios.
5. Plan how both static and dynamic data can be incorporated to characterise depositional architecture.
6. Evaluate and rate different modelling options for different architectures, fluids and development scenarios.
7. Manage the issues of up-scaling in heterogenous clastic systems and select appropriate techniques to use in different scenarios.

### Training Method

This is a field course in the southern Pyrenean foreland basins. Fieldwork includes presentations, sedimentological exercises, modelling exercises, and discussions. Short classroom sessions comprise a core visit, case studies, and reviews of the fieldwork.

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### Physical Demand

The physical demands for this course are LOW according to the RPS field course grading system; the course requires basic fitness levels. Fieldwork is carried out in the relatively gentle topography of the southern Pyrenees, at altitudes of 500-1200 m (1650-3950 ft). Access to the outcrops is straightforward, with many localities being roadside stops. Some short walks of up to 0.5 km take in riverside paths and scrubland. Transport will be by coach on paved roads.

### Who Should Attend

The course is aimed at geoscientists, petrophysicists, and reservoir engineers who wish to better understand clastic depositional systems and the practical application of that knowledge in the generation of effective static and dynamic models. Multi-disciplinary asset teams would benefit from attendance as a group. Managers and team leaders of such technical teams are also welcome.

### Course Content

Exercises carried out at outcrops and in classroom sessions illustrate the influence of sedimentological architecture on modelling options for different development scenarios. Predictive facies models will be discussed and their application to understanding the controls on the architectures developed and preserved in the rock record, from both an exploration and development perspective. The course will explore how to use static and dynamic data to differentiate between sedimentary architectures in the subsurface and examine production challenges posed by different sedimentary stacking and sedimentary depositional structures. Questions of scale, from core to log to outcrop to simulation model and then how to upscale in complex heterogeneous environments will be discussed in the field and classroom.

The following itinerary is intended as a guide, and may be modified according to weather and/or the participants' interests and focus.

#### Day 0: Arrival and travel to hotel in Tremp

#### Day 1: Fieldwork in Tremp area

- Basin introduction
- Tidally-influenced reservoir sandstone bodies in the Ager Basin
- Sandy braided fluvial facies in a confined valley setting, Tremp Basin
- Proximal pebbly braided river facies at the margin of the Ebro Basin
- A series of stops in shallow marine and coastal facies
- Overnight in Graus

#### Day 2: Fieldwork in the Ainsa area

- Reservoir sedimentology of offshore and barrier bar complexes

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- Turbidite reservoir facies in a proximal, channelised setting
- Core store visit of turbidite reservoir facies
- Overnight in Ainsa

### **Day 3: Fieldwork in the Jaca area**

- Prograding shoreline and deltaic facies in mixed carbonate/clastic successions
- Turbidite successions in submarine fan lobe complexes
- Basin margin facies in an internally-drained basin setting
- Overnight in Murillo de Gallego

### **Day 4: Fieldwork in the Ebro Basin, Huesca area**

- Reservoir-scale fluvial channel and overbank successions
- Heterogeneity of meandering river deposits
- Basin-margin facies variations and alluvial fan sedimentology
- Overnight in Murillo de Gallego

### **Day 5: Fieldwork in Ebro Basin and return to Barcelona**

- Basin-margin fluvial facies and downstream facies transitions
- Scale of reservoir heterogeneity in fluvial successions
- Channel and overbank fluvial reservoir architecture and connectivity
- Return to Barcelona and departure