N252: Reservoir Geology of Deepwater Systems: Processes, Architecture and Reservoir Quality Analysis *(Provence-Alpes-Cote d'Azur, SE France)*

Instructor(s): Bill McCaffrey

Format and Duration

Field - 7 Days
High Physical Demand

Summary

The course assembles a good working knowledge of the key processes that build deepwater clastic systems, and develops the skills needed to make informed depositional interpretations of these environments. It will entail detailed facies analysis of turbidites, linked to system architecture, with focus of the effects of bathymetric confinement, characterisation of sheet and incisional channel architectures and the processes that cause spatial and temporal transitions between these architectural styles.

Learning Outcomes

Participants will learn to:

1. Appraise bed scale deposits of particulate gravity currents, including debris flows, high and low concentration turbidites and hybrid event beds.
2. Assess the emplacement processes of deepwater clastic sequences from outcrop or core, and predict the geometrical scenario of deposition.
3. Characterise the depositional expression of transitional flow processes and formulate hypotheses for their spatial distribution.
4. Evaluate and predict the architecture of turbidite onlaps at bed and element scale.
5. Formulate development plans that incorporate insight into the mutual effects of channelisation, system onlap and slope instability on reservoir architecture.
6. Evaluate rival analogue systems when deciding how to apply analogues to subsurface systems.

Training Method

A seven-day field and classroom course in Maritime and Haute Alpes of S.E. France. Classroom lectures will detail the links between facies and depositional process that are necessary for interpretation of deepwater clastic deposits. In addition, the field areas and study focus for each field day will be outlined and the key learning outcomes summarised. Fieldwork will entail detailed studies of facies variability linked to sedimentary architecture in the context of known basin constraints. The proportion of field and classroom time is approximately 90:10.

Physical Demand

The physical demands for this course are HIGH, according to the Nautilus Training Alliance field course grading system. There will be walks on most days, the longest being 13 kms (8 miles), with an ascent/descent of approx 1000 m (3,280 ft). Due to an altitude of up to 2,500 m (8,202 ft), fatigue and shortness of breath may be felt more than for activity at lower altitudes. Typical alpine style mountain roads will be experienced and, therefore, the capacity for motion sickness.

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Who Should Attend

Geoscientists who have worked with deepwater clastic depositional systems and want to further improve their understanding, interpretation skills and predictive ability of the reservoir properties encountered within such depositional environments, especially through a deeper understanding of the processes that build deepwater clastic systems.

Prerequisites and Linking Courses

Participants must have some interpretation experience with deepwater clastics systems in order to derive maximum benefit from this course. There are no prerequisites for this course but a basic understanding of clastic sedimentation and stratigraphy acquired via N155 and N156 (at Basic Application Competence Level) on the Nautilus Training Alliance programme, is assumed.

This course is complementary to other deepwater courses in the Nautilus Training Alliance Clastics programme at Skilled Application Competence Level including N009, N028, N033, N315 and N107. Course N112 (Basin-Scale Analysis of a Confined Turbidite System (Gres d'Annot, SE France)) visits some areas in common with this field course but focuses on the fill history and links between a suite of structurally confined deep water sub-basins.

Course Content

Deepwater clastic depositional processes are almost uniquely complicated, involving process transformations between laminar and turbulent flows and vice versa, the development of variable system geometry (including aggradational and incised channel architectures, sheet architectures and both spatial and temporal transitions between architectural styles), and bathymetric effects at a range of scales.

The Gres d'Annot field locality includes a full spectrum of particulate gravity current deposits, including high and low concentration turbidites, mass transport deposits and transitional flow deposits. These can be placed in the context of local basin geometry, and the effects of flow interaction with subsea bathymetry in terms of facies and facies architecture examined in detail. During the course, participants will learn to characterise and appraise deepwater clastic deposits based upon an informed process understanding, and will acquire the approaches needed to relate facies and architectural variations to both local and basinal contexts. They will also gain experience in assessing the appropriateness of analogues for use in modelling subsurface scenarios.

Itinerary

Day 0:

- Arrive in Nice and spend the night at the Airport hotel, Nice
- Course introduction and safety briefing

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Day 1: Field and Lectures

- Introductory lecture on deepwater proccesses and products and the Annot Sandstone system
- Travel to and fieldwork near, Piera Cava
- Review the specific field aims for Day 2: proximal to distal variation in ponded minibasin fill

Day 2: Field and Lectures

- Peira Cava: Examination of base of slope facies assemblages and sedimentary architecture in a ponded minibasin setting; links between facies and bypass; channelisation, scour and lateral connectivity; mass transport processes; distal basin fill and spatial evolution of sedimentary character; fill-to-spill signatures
- Summary lecture:
  - Review of key insights from the field
  - Review specific field aims for Day 3: onlap characterisation and recognition of flow transformation processes

Day 3: Field and Lectures

- Drive to St. Benoit
- St. Benoit and Braux area: bathymetric confinement effects; growth strata, and rates of deformation vs. sedimentation rates; detailed assessment of the depositional signature of onlap processes; transitional flow formation, controls and deposit expression
- Summary lecture:
  - Review of key insights from the field;
  - Specific field aims for Day 4: scales of flow non-uniformity and deposit expression

Day 4: Field and Lectures

- Annot: overprinting non-uniformity effects at basin, outcrop and bed scale; facies and system geometry associations in unconfined and confined scenarios
- Summary lectures:
  - Review of key insights from the field;
  - Specific field aims for Day 5: modelling realistic scenarios

Day 5: Field and Lectures

- Chalufy: modelling compound architectural effects: the mutual influence of channels, onlaps and slope instability in different structural scenarios. This will involve an asset development exercise in the field.
- Summary lectures:
  - Review of key insights from the field;

- Specific aims for Day 6
- Drive to Champsaur

Day 6: Field and Lectures

- Champsaur: Examination of channel relationships and field conclusions
- Summary Lectures:
  - Review of Key insights from the field
  - Specific aims for Day 7

Day 7: Summary Lectures; Course Feedback

- Summary lectures:
  - Synthesis of the key insights from the field course
  - Analysis of pitfalls in interpretation and the limitations of the Annot depositional system in particular, and the outcrop analogues in general;
  - Course overview and summary;
  - Depart Hotel at Lunch for Lyon Airport. Participants unable to depart that evening will stay in a Airport Hotel for the evening.