N453: Deepwater Depositional Systems: Architecture, Processes and Reservoir Quality *(NE Apennines, Italy)*

Instructor(s): John Cater

3 Days	Competence Level: Skilled
Field Course	
Classroom Elements	
LOW	Low Physical Demand

Summary

This course will focus on the sedimentological aspects of Miocene gravity-flows deposited in the Apennine Foreland Basin and will also investigate the influence of inversion-related strike-slip tectonics on sedimentation. The outcrops can be used to show the types of sedimentary facies developed in confined and unconfined basinal settings and to contrast 'classical' turbidites with hyperpycnal deposits, relevant to intra-Heather Oxfordian reservoir sandstones. The features recording flow/depositional processes in these two facies types and fundamental differences such as the presence of co-genetic debrites, will be analysed. The influence of sea-floor topography on deposition will also be explored.

Learning Outcomes

Participants will learn to:

1. Appraise bed scale deposits of particulate gravity currents including classic turbidites with hyperpycnal deposits.
2. Evaluate the controls on bed-form generation in systems dominated by suspension fall-out versus tractional flow and discuss the sedimentary features that can be used to infer a shallow versus deep marine setting.
3. Assess the emplacement processes of deepwater clastic sequences and the range of facies present in weakly-confined gravity flow deposits.
4. Characterise the depositional expression of olistostromes and discuss a sedimentary versus tectonic origin.
5. Evalutae and predict the architecture and facies distribution of turbidite deposits in relation to the influence of basin topography.
6. Assess the influence of ductile material in poroperm data from diffierent types of turbidites and hyperpycnal deposits.

Duration and Training Method

A three-day field course comprising classroom sessions and exercises. The proportion of field to classroom time is approximately 90:10.

Physical Demand

The physical demands for this course are LOW according to the Nautilus Training Alliance field course grading system. Most of the outcrops are roadside cliffs that require minimal walking distances to reach. Transport on the course will be by bus.

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, especailly through a deeper understanding of the processes that

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build deepwater clastic systems.

Prerequisites and Linking Courses

Participants would benefit from having a basic knowledge of deepwater clastic systems. This can be gained from attending N155 (Introduction to Clastic Depositional Systems; a Petroleum Perspective. This course also links well with other deepwater offerings in the Nautilus Training Alliance portfolio incluidng N009, N028 N033, N107 and N112.

Course Content

The outcrops to be visited over the course of this excursion are located in the northern part of the Apennine Foreland Basin. The Apennines consist of nappes and thrusts accreted northeastwards onto a spur of the African continent. The uppermost thrust sheet (the Ligurian Nappe) is of oceanic affinity, whereas the lower nappes are composed of weakly deformed sediments deposited in the foreland basin during Oligocene and Miocene times as the nappes built up. The Adriatic Sea and Po Valley form the modern equivalent of the foreland basin. The Apennine foreland filled mainly with sediment derived from erosion of the Alps, rather than from the Apennine fold-belt; the latter was submerged until after the Miocene.

The Marnoso-Arenacea Formation comprises Miocene deep-water sandstones and mudrocks that have been overthrust by the older Ligurian material.

The succession begins with Middle Miocene (Langhian and early Serravallian) basin-plain turbidites, deposited when the basin was essentially undeformed. Sea-floor topography was subtle, being controlled by gradual compression and inversion of pre-existing structural lineaments as the Apennine collision progressed. Sediments deposited at this time generally record southeastward transport of essentially unconfined flows, fed down the basin axis from a delta located further to the northwest.

The Contessa Bed is a useful marker unit that records flow in the opposite direction (towards the NW), resulting from collapse of the margin of a carbonate platform. It comprises 2m to 6m of carbonate gravel and sand, overlain by a similar thickness of mud that settled from suspension as the flow waned.

These deposits pass up into a series of deep-water slide deposits (olistostromes) of later Serravallian age. These record the onset of sea-floor deformation as the Ligurian Nappe was uplifted. Later Miocene (Tortonian) turbidites include channelised and lobate sand bodies which were used by Mutti and Ricci-Lucchi (1972) to define one of the first deep-sea fan models.

Itinerary

Day 0

Arrival into Florence and transfer to hotel. Evening course introduction and saftey briefing followed by

dinner.

Day 1

Stop 1: Verghereto High: viewpoint showing the calcareous musdtones deposited on the Verghereto High during Tortonian times.

Stop 2: Bagno di Romagna: assess the exposed turbidites, debrites and slide deposits illustrating the range of facies present in weakly-confined gravity-flow deposits.

Stop 3: Narsetto overview: view of the Miocene fill of the foreland basin and lateral continuity of basin-plain turbidites exposed in the valley.

Stop 4: Susinello slide: examine a submarine slide recording instability related to the inititation of thrust deformation in the foreland basin and discuss tectonic versus sedimentary origin of olistostromes.

Overnight Bagno di Romagna.

Day 2

Stop 1: Contessa Bed: assess the Contessa Bed that formed in the early Serravallian due to collapse of a carbonate platform located further to the southeast.

Stop 2: Sant' Agata olistostrome, Sarsina.

Stop 3: Romagnano , Sarsina: characterise a shallowly-dipping succession of gravity-flow sandstones recording hyperpycnal flows and use sedimentary features to infer a shallow versus deep marine setting.

Overnight Bagno di Romagna.

Day 3

Stop 1: Mercato Saraceno: discuss controls on bed-form generation in systems dominated by suspension fall-out versus tractional flow.

Afternoon classroom session: exercises and data workshop.

Overnight Florence.

Day 4

Depart from Florence.