





# N241: Depositional Processes, Fabrics and Stratigraphic Framework of Mudrocks: Applications to Shale Reservoirs (*Colorado and Wyoming, USA*)

Tutor(s): Jeff May

5 Days	Competence Level: Skilled
 Field Course	
 Classroom Elements	
<b>MODERATE</b>	Moderate Physical Demand

## Summary

**Business Impact:** Participants will describe **mudrock cores**, develop familiarity with the range of **depositional processes in shale basins** and **correlate shales in outcrop and well logs** using a **sequence stratigraphic framework**.

This course utilizes cores, outcrops and well logs to examine and interpret the heterogeneity of fine-grained depositional systems. Participants. These skills will enhance their ability to evaluate the resource potential of shales.

## Learning Outcomes

Participants will learn to:

1. Evaluate similarities and differences among lithologically diverse shale systems.
2. Characterize heterogeneity within fine-grained units.
3. Assess the range of depositional processes in shale basins.
4. Develop an understanding of the controls on composition and fabric in mudrocks.
5. Perform descriptions of mudrocks in core.
6. Formulate interpretations and correlations of shales in outcrop and well logs utilizing a sequence stratigraphic framework.
7. Judge key factors that contribute to a successful shale resource play.

## Duration and Training Method

This is a five-day field course consisting of outcrop visits with field exercises supplemented by classroom sessions and a core workshop. The ratio of field time to classroom/core viewing is approximately 70/30.

## Physical Demand

The physical demands for this class are MODERATE according to the Nautilus Training Alliance field course grading system. Scrambling over rock outcrops and steep sections will be required, but most of the hikes would be considered moderate. The longest walk on the class is approximately 3.2 km (2 miles). Outcrops are at elevations between 1300 and 2000 m (3900 and 6000 ft). Weather conditions in Colorado and Wyoming can vary from warm and dry to cold and wet, with a Spring through Fall temperature range of 0 to 32 C (32 to 90 F). Transport will be in SUVs on black-top and unpaved roads.




## Who Should Attend

The course is appropriate for all geoscientists and engineers who are engaged in exploration and/ or exploitation of shale resources. Although the course is designed for experienced participants, those with



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less experience should also benefit from this course.

## Prerequisites and Linking Courses

Participants should have a basic understanding of clastic sedimentology and sequence stratigraphy, such as gained from N155 (Introduction to Clastic Depositional Systems: a Petroleum Perspective) and N251 (Well-Log Sequence Stratigraphy – Applications to Exploration and Production).

Related courses in unconventional resources include N313 (Evaluating Resource Plays: The Geology and Engineering of Shale, Tight and Coal Seam Gas Plays), N382 (Recognition of Mudstone Depositional Processes and Depositional Settings: Implications for Reservoir Heterogeneity and Play Extent), N250 (Evaluation Methods for Shale Gas Reservoirs) and N364 (Fracture Architecture, Sedimentology and Diagenesis of Organic-rich Mudstones of Ancient Upwelling Zones with Application to Naturally Fractured Reservoirs, California, USA).

## Course Content

Outcrops, cores and well-logs provide exposure to the extensive diversity in mudrock systems. Emphasis is placed on understanding the basic principles of deposition and stratigraphy of fine-grained deposits. Numerous hands-on exercises reinforce these concepts and demonstrate their applications to the evaluation of mudrock reservoir properties and assessment of wellbore targets.

### Itinerary (subject to change)

#### Day 0

- Travel to Golden, CO
- Evening introductory lecture, safety briefing and group dinner
- Overnight in Golden, CO

#### Day 1




- Morning classroom lecture
- Afternoon examination of Graneros, Greenhorn and Niobrara Shales in outcrops near Pueblo, CO
- Overnight in Golden, CO

#### Day 2



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- Core workshop, US Geological Survey, Denver, CO
- Overnight in Golden, CO

## Day 3

- Examine Niobrara outcrops near Boulder, CO and Niobrara and Mowry outcrops near Douglas, WY
- Overnight in Casper, WY

## Day 4

- Examination of a complete Mowry outcrop section near Alcova Reservoir
- Evening well-log workshop
- Overnight in Cody, WY

## Day 5

- Examination of Mowry outcrops at Potato Ridge (Greybull) and Buffalo State Park near Cody, WY
- Overnight in Cody, WY

## Day 6

- Fly out of Cody, WY