

N523: Sandstone Diagenesis and Reservoir Quality

Instructor(s): Richard Worden

Format and Duration

Classroom - 3 Days

Virtual - 5 Sessions

Summary

Business Impact: A better understanding of reservoir quality and diagenesis will lead to **improved exploration risking of reservoir quality** and provide a basis for **building reservoir models** and **choosing well locations during appraisal and development**. This knowledge will allow participants to add value to subsurface projects across the E&P life-cycle.

It is not good enough simply to explore for sandstone in the subsurface; Reservoir quality, in terms of both porosity and permeability, must be above threshold values for the reservoir to be economic both in terms of storage and deliverability.

Reservoir quality is a complex function of the clastic factory that supplied the sand, the environment of deposition, the processes that occur soon after deposition, compactional processes - both mechanical and chemical - that occur during burial, and the suite of thermally-controlled diagenetic cements including quartz, clay minerals, and carbonates. While there is a typical and broadly predictable suite of reservoir quality-degrading processes that remorselessly occur from the time of deposition to the time of exploitation of the reservoir, there are some fortunate circumstances that lead to anomalously elevated reservoir quality, which will be addressed in this course.

At the conclusion of the course you should feel confident about commissioning reservoir quality studies and interpreting reservoir quality-related data. You will also have an improved understanding of the relationship between reservoir quality and other sub-surface disciplines.

Learning Outcomes

Participants will learn to:

1. Recognise the fundamental link between reservoir quality and diagenesis in deeply buried strata; develop an understanding of the links between sandstone diagenesis and sedimentology, petrophysics, geomechanics and petroleum systems analysis.
2. Appreciate the relationships between environments of deposition and early (shallow, low temperature) diagenesis with their effects on reservoir quality in oil and gas fields.
3. Develop and apply understanding of the effects of clay, carbonate and quartz cements on sandstone reservoir quality.
4. Understand when and how sandstones compact, the links between chemical compaction and quartz cementation and the factors that can inhibit quartz cement, including microquartz coats, chlorite grain coats, early oil emplacement and early overpressure development.
5. Apply sandstone diagenesis concepts to rock quality prediction during exploration and reservoir model building.
6. Understand when to request which suite of analyses, including well-established and new techniques, and how to apply petrographic and other data to reservoir quality problems.

Training Method

This is a classroom or virtual classroom course comprising a mixture of lectures, discussion, case studies, and practical exercises.

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Who Should Attend

The course is aimed at all geoscientists, petrophysicists and reservoir engineers who wish to broaden and deepen their knowledge of clastic reservoir quality from all sandstone types, from all depositional environments and from all types of burial and thermal history. The course will provide an effective working knowledge of reservoir quality for all subsurface scientists and engineers and provides further insights to those who require a more detailed application of this subject matter while leading or managing subsurface projects.

Prerequisites and Linking Courses

While there are no formal prerequisites for this course, a basic knowledge of the fundamental sedimentological processes and petroleum systems is expected.

Course Content

The course is split into six sections, as shown below:

1. **Fundamentals:** The whole course in a nutshell.
2. **The clastic factory:** Preparing rocks to remember their past during burial.
3. **Depositional environments and facies:** We rarely make a silk purse from a sow's ear during diagenesis!
4. **Burial diagenesis - mechanical processes:** The inexorable journey south.
5. **Burial diagenesis - chemical processes:** It's getting hot in here... The destruction and enhancement of porosity due to temperature- and pressure-related processes.
6. **Applications:**
 - a) Diagenetic modelling for exploration risking of reservoir quality.
 - b) Reservoir characterisation and static model building.