



**2002 GCSSEPM Foundation Ed Picou Fellowship
Grant for Graduate Studies in the Earth Sciences
Recipient**

Laura Inés Net



Laura I. Net received her BS (1995) and PhD (1999) in Geological Sciences from the University of Buenos Aires, Argentina. She was awarded Fellowships from the University of Buenos Aires (1993-1995) and the Argentinean National Research Council (CONICET, 1995-2001). She worked as a Teaching Assistant at the Sedimentology area in the Department of Geological Sciences, University of Buenos Aires (1993-2001), and as Assistant Professor in the Department of Petroleum Engineering, Instituto

Tecnológico de Buenos Aires (2001). She has co-taught the short-course "Petrology and diagenesis of sandstones, with emphasis on the Argentinean Andean Basins of Upper Paleozoic and Tertiary ages" (2000-2001). She was also member of the Directive Committee (1996-1998) and Secretary (1998-2000) of the Argentinean Association of Sedimentology (AAS). Since fall 2001, she has been enrolled in a Master's Program in Geological Sciences at the John A. and Katherine G. Jackson School of Geosciences, the University of Texas at Austin, receiving financial support from Fulbright-YPF Foundation in Argentina, and the Geology Foundation, the University of Texas at Austin. Her geological interests are focused on clastic diagenesis, in particular sandstone and shale petrology, and sandstone diagenesis applied to reservoir quality assessment.

(Director's Note: Yes, Dr. Net is enrolled for a M.Sc. at the University of Texas. When I asked her why, she noted that it was the best way for her to expand her contacts into the oil industry as well as her interest in diagenesis. The path she has taken is certainly 'rocky!')

Diagenesis and Reservoir Quality of the Eolian Nugget/Navajo Sandstone

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Objectives

The aim of this project is to accomplish a petrographic study of the Navajo Sandstone (Early Jurassic) and equivalent units in order to evaluate its diagenetic processes and the impact they exerted on hydrocarbon reservoir quality properties. Both subsurface (core samples from oil wells) and outcrop samples will be used in this research.

The relevance of this work is related to the fact that although much work has been done in eolian reservoirs in a regional and outcrop scale, petrographic studies regarding the origins of their meter-scale heterogeneities are still lacking, and the main source of silica for quartz cement is hotly debated.

This project is involved with the factors that generated quite different amounts of quartz and carbonate cements in a sandstone unit that constitutes a major reservoir rock in central USA. Taking into account that the authigenic quartz has created significant inhomogeneities even at microscopic scale, it can ultimately control the flow path of hydrocarbons.

Thus, quartz cement becomes a crucial issue in reservoir quality assessment and prediction in these rocks. An accurate understanding of the factors and mechanisms that determined quartz cement distribution will certainly contribute to explain observed variations in porosity and permeability. Special attention will be put on how diagenesis is related to areas of good and poor hydrocarbon productivity into the reservoir, and on the factors that controlled the origin and distribution of the cements.

Description of the Project

The Navajo Sandstone (Early Jurassic) extends over the Colorado Plateau in northern Arizona and southern Utah; together with its correlatives (e.g. the Nugget Sandstone in NE Utah, NW Colorado and SW Wyoming) originally covered a minimum of 366,000 km², probably conforming the largest eolian deposit in North America.

The aim of this project is to accomplish a petrographic study of this unit in order to evaluate its diagenetic processes and the impact they exerted on hydrocarbon reservoir quality properties. Specifically, this study will focus on quartz cementation, taking into account that it is the main factor responsible for porosity and permeability reduction, although it varies widely in amount in the formation. Variables such as grain size, composition, sedimentary facies, temperature and depth of burial, distribution and abundance of stylolites, degree of intergranular pressure solution, fluid flow and pressure will be evaluated. Whether other cements are facies or depth controlled will also be assessed.

To carry out these goals, field work will include the description of different types and scales of eolian stratification, bed forms and bounding surfaces oriented to define depositional patterns and architecture of the sandstone bodies. Reservoir intervals and

potential permeability barriers will also be recognized. Lithofacies and lithofacies associations from outcrops will be then matched to core descriptions. A field trip to Utah is planned for July-August, 2002.

Laboratory work will include the characterization of depositional and diagenetic textures using thin sections. Additional techniques for identification and/or quantification of compaction, cementation and porosity textures include scanning electron microscopy (SEM), cathodoluminescence microscopy (CL), electron microprobe analysis (EMPA), petrographic image analysis (PIA), and stable isotope analysis of quartz and carbonate permeability data to correlate with petrographic parameters. Laboratory work will be done through the 2002-2003 academic year.

Quantification of some petrographic variables would also allow the use of diagenetic modeling programs for prediction of reservoir quality properties in undrilled areas of similar characteristics, or in other eolian reservoirs, such as the Norphlet.

To sum up, it is hoped that this project will contribute to the general knowledge of the diagenetic evolution of these eolian sandstones, explaining the factors that controlled the origin and distribution of quartz and carbonate cements, and ultimately, how diagenesis is related to areas of good and poor hydrocarbon productivity into the reservoir.