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Overview of a Giant Resource Play: Vaca Muerta Formation, Neuquen Basin, Argentina

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ABSTRACT: The Neuquen Basin is located in the provinces of Neuquen, Rio Negro, and Mendoza in western Argentina. Oil and gas have been produced in the Basin since 1918. The Late Jurassic to Early Cretaceous Vaca Muerta Formation constitutes the most areally extensive deep-marine sedimentary rock succession in the Neuquen Basin, covering approximately 30,000 square kilometers. The Vaca Muerta petroleum system is an emerging unconventional resource play that produces oil and gas from foreland basin strata, including tight organic-rich black shales, lime mudstones, and marls. The Vaca Muerta Formation has long been recognized as a principal source rock in the Neuquen Basin. The great thickness of the Formation (60 to 500 m), its favorable mineralogy, and its high organic content indicate it has potential for being a self-sourcing reservoir comparable to current unconventional plays in the United States, such as the Eagle Ford Shale. In 2013, the U.S. Energy Information Administration estimated technically recoverable reserves from the Vaca Muerta at 16.22 billion barrels of oil and 307.7 Tcf of gas. This presentation will give an overview of the Vaca Muerta petroleum system, and highlight studies being conducted by the Vaca Muerta Consortium at Colorado School of Mines.

The Vaca Muerta Formation is subdivided into three informal units: lower, middle, and upper Vaca Muerta. Our focus has been in the lower Vaca Muerta, based on its favorable organic content and mechanical stratigraphy. In general, the lower Vaca Muerta is composed of alternating mudstones-wackestones, bioclastic siltstones, carbonate mudstones, and bentonite facies. The mudstone-wackestone facies is characterized by an impermeable, wavy, clay-rich matrix that encompasses the kerogen grains. The concept of bedding-parallel microfracturing has been related to thermal maturation of kerogen in organic-rich black shales. Within the oil maturation window, overpressure at the lower Vaca Muerta interval is correlated with significant total organic content values (up to 10 wt%). These conditions eventually dominate the mechanical behavior of the formation.

Speaker Biography: Dr. John D. Humphrey is Associate Professor in the Department of Geology and Geological Engineering at Colorado School of Mines. He received his B.S. degree in Geology from the University of Vermont, where he was elected to Phi Beta Kappa and graduated Cum Laude. Dr. Humphrey received his M.Sc. and Ph.D. degrees from Brown University in Geological Sciences. He was on the faculty of Geosciences at the University of Texas at Dallas from 1986 to 1991. Since 1991, Dr. Humphrey has been on the faculty of Geology and Geological Engineering at CSM. He served as Department Head from 2006 to 2013. His areas of specialization include carbonate diagenesis & geochemistry, carbonate sedimentology & stratigraphy, carbonate reservoir characterization, stable isotope geochemistry, and paleoclimatology. Recent focus areas include the Bakken, Niobrara, and Vaca Muerta petroleum systems. He has been a consultant to the oil industry for over twenty-five years.

RMS-SEPM Main Page

RMS-SEPM Luncheon Page

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