AAPG Abstract, Long Beach 2012

Oil and Gas Potential of Alaska's Interior Rift Basins: New Frontier for Discovery

Gerald K. Van Kooten Department of Geology, Geography and Environmental Studies, Calvin College, Grand Rapids, Michigan 49546 and Petrotechnical Resources Alaska (PRA), 3601 C St., Anchorage, Alaska 99503. gkv2@calvin.edu

Michael Richter Michael Richter Exploration Consulting , 9500 Steeplechase Dr, Franktown, CO 80116. marichter@mac.com

Pierre A. Zippi Biostratigraphy.com, LLC, 7518 Twin Oaks Court, Garland, TX 75044 and Roy M. Huffington Department of Earth Sciences, Southern Methodist University, Dallas, TX 75275 paz@biostratigraphy.com

New seismic and well data highlight significant oil and gas potential in deep transpressional and extensional rift basins located in Interior Alaska. Together these basins occupy at least 13,000 mi^2.

The Nunivak #1 well, drilled in 2009 to 11,075' (Tvd) in the Nenana basin, provides a tie to seismic and stratigraphy, and confirms basin depths of about 25,000'. Inversion of gravity data and a basement interpretation based on gravity and aeromagnetics show the Nenana basin deepens and widens to the north.

The Nunivak #1 well documents excellent source rocks and a thermal gradient near continental average. Drilled sediments include Pliocene, Miocene, and Late Paleocene rocks, indicating the Nenana basin was active since at least the early Tertiary. An unconformity at 8110' spanning about 31 m.y. separates the Late Paleocene and Miocene. Thirty Rock-Eval analyses of coals and coaly shales from the Nunivak #1 well yield a hydrogen index up to 379 and average 240. HI values increase with depth in the well and the best source rocks are below 10,800'. Thermal modeling using kinetics from the Paris basin and humic coals from Indonesia shows oil expulsion begins at about 14,000' and expels about 2000 barrels oil /ac-ft. Oil-prone coals with similar HI's were found in shallow outcrop cores located along the southern margin of the Yukon Flats.

Based on these modeling results, oil volumes expelled in the northern Nenana basin may range into the billions of barrels of oil or oil equivalent. Source expulsion occurred within the last 20 m.y. and is likely continuing today. Additional source rocks in deep lake lacustrine facies may also be present in facies not seen at the periphery of the basin.

Both the Nenana basin and Yukon Flats have detectable light oil micro-seeps at the surface. Analysis of soil cores and lake bottom sediments detect hydrocarbons up to C5 and oil fluorescent analysis shows C6-C12 hydrocarbons in the Yukon Flats. These thermogenic oils were generated in an oil kitchen, possibly expelled by oil-prone coals, and migrated to the surface. With only one deep test in these rift basins, additional seismic and drilling is needed to evaluate a variety of structural and stratigraphic relationships along the basin margins.