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OIL AND GAS EXPLORATION NEAR YUCCA MOUNTAIN, SOUTHERN NEVADA

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ABSTRACT

Three oil exploration wells were drilled within 20 km of Yucca Mountain in 1991. Conodont samples from two of these new wells and 190 locations near Yucca Mountain and have been analyzed for color alteration indices (CAI), which can be correlated to thermal maturity and petroleum generation. Cambrian through Triassic rocks in the vicinity of Yucca Mountain have experienced temperatures too high to be capable of generating oil, except for a narrow zone (20 x 100 km) northeast of Yucca Mountain, where Mississippian through Triassic rocks are just within the upper limit of the oil generating window. Organic geochemical samples from the Mississippian Eleana Formation in this zone have low total organic carbon and low hydrogen indices, which, combined with overall pattern of CAI values, indicates that the entire Cambrian through Triassic sedimentary column is unfavorable as oil source rocks. While much of the Cambrian through Triassic rocks have thermal potential for gas, extensive Late Tertiary faulting at Yucca Mountain suggest that seals might be inadequate for retaining gas. No commercial gas fields have been found to date in Nevada or adjacent parts of California. Organic geochemistry on samples from a few Tertiary lacustrine deposits do show high carbon and hydrogen indices. However, the lacustrine deposits in these basin and range type valleys lack long range continuity and none of the present Nevada oil fields produce from such Tertiary valley-fill.

In comparison to the Railroad Valley area 200 km to the northeast, where 35 million barrels of oil have been produced, Yucca Mountain has much lower potential for oil and gas. Considering that the proposed repository at Yucca Mountain, including the surrounding "controlled area", is 90 km<sup>2</sup>, while the region surrounding Railroad Valley has over 10,000 km<sup>2</sup> with rich source rocks in the optimum thermal window, these data indicate that any oil or gas resources beneath Yucca Mountain would most likely be less than 1

million barrels of oil. Even though the potential is low based on accepted industry measures of source rock richness and thermal maturity, there are hundreds of independent oil companies in the United States and there remains a chance that one of them may wish to drill near Yucca Mountain in the future.

I. INTRODUCTION

Yucca Mountain, approximately 150 km northwest of Las Vegas, Nevada (Fig. 1), is being studied as a potential burial site for high-level nuclear waste. The proposed repository for nuclear waste is currently conceived as a 2.4 x 3.8 km (~6 km<sup>2</sup>) facility approximately 300 m beneath the surface of the mountain and about 200 m above the water table (Department of Energy Site Characterization Plan, 1988). The repository is to be surrounded by a "controlled area" approximately 10 x 14 km (~90 km<sup>2</sup>) (Fig. 1).

Controversy exists concerning possible important mineral or energy resources near Yucca Mountain.<sup>1,2</sup> In this paper, we will review the oil and gas exploration in the region and discuss the possibility of energy resources beneath Yucca Mountain. Nevada has produced 38 million barrels of oil between the initial discovery field in 1954 and 1992.<sup>3</sup> Railroad Valley, 200 km north-northeast of Yucca Mountain, has produced 93% of this oil. The remaining oil production is from Pine Valley, approximately 300 km north of Yucca Mountain. No significant gas resources have been discovered to date in Nevada. No oil or gas source rocks have been found in areas of California near Yucca Mountain.

This paper will (1) review the results of the three 1991 oil exploration wells, (2) describe the use of conodont color alteration to assess the thermal potential for hydrocarbons, (3) review the thermal maturity data from the 1991 exploration wells together with approximately 190 new sample lo-

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