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Oil and Gas Resources of the North African Trias/Ghadames Petroleum Province

Anadarko and its partners, ENI, Maersk and Sonatrach, have been active for over 15 years in the Ghadames Basin. This evaluation, based on the predictive methodology developed by J.J. Arps and T.G. Roberts and applied to public domain and company data, predicts that the potential of that Paleozoic-source, Triassic-reservoir petroleum system in the Ghadames Basin is less than one billion barrels of oil reserves yet to be discovered. It also predicts that all those reserves will be distributed in fields with reserves of less than 500 million barrels each.

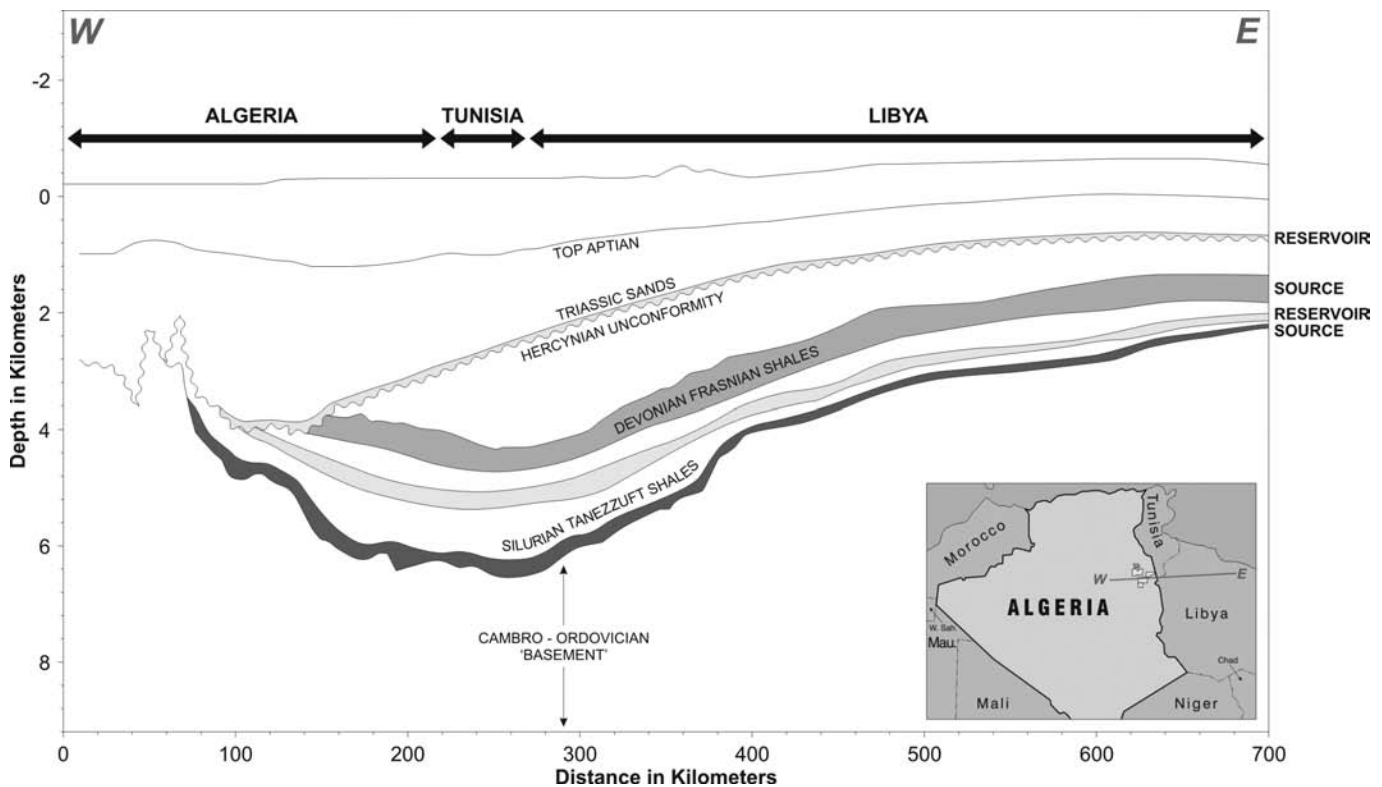
The Paleozoic-source, Triassic-reservoir petroleum system of the Ghadames Basin of North Africa extends from eastern Algeria,

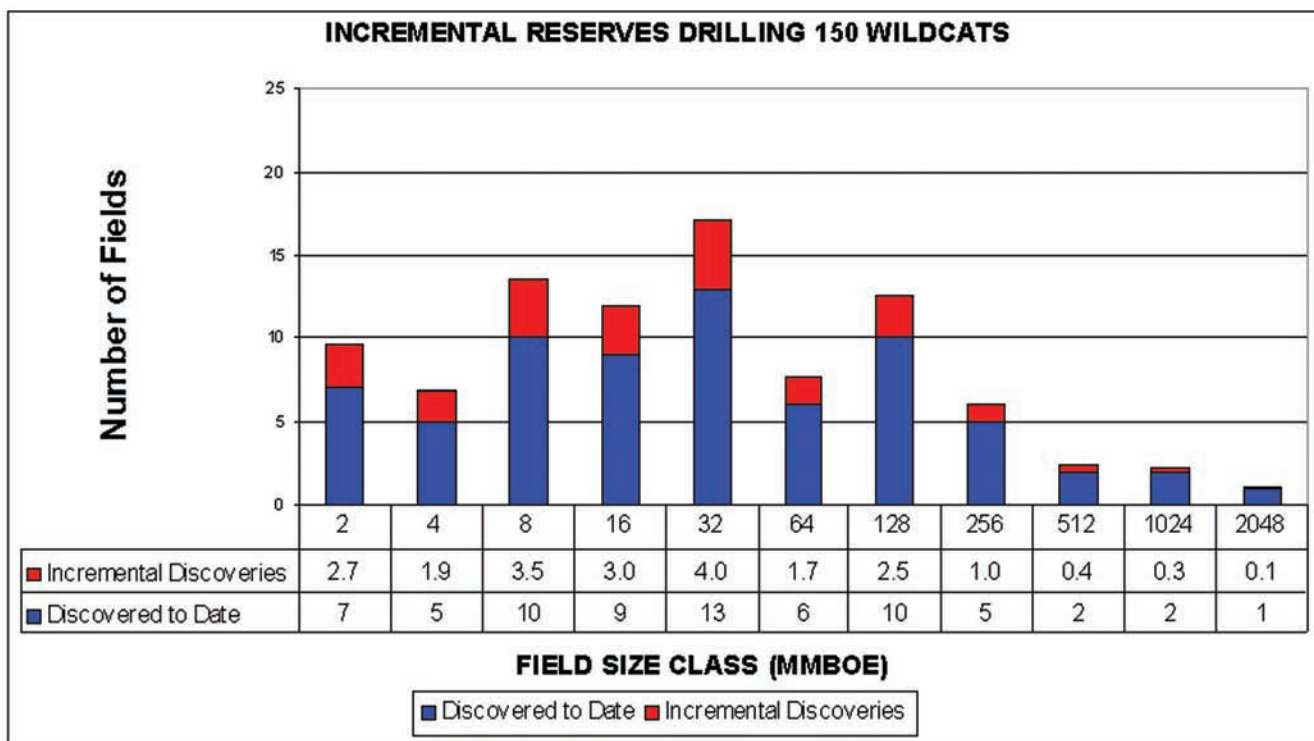
across southern Tunisia and into western Libya. Oil and gas in Triassic reservoirs have been correlated through the analyses of geochemical markers to have migrated primarily from Silurian and Devonian mudstones. Migration from the Paleozoic subcrop that was uplifted by the Hercynian Orogeny into overlying Triassic reservoirs is easy to envisage and probably very efficient, but there is also evidence for migration vertically up faults and for long distances along Devonian and Silurian sandstone carrier beds. Uneven subsidence in the

Triassic provided the accommodation space for the preservation of a semi-arid fluvio-deltaic clastic system that thickened from the western and northern edge of the basin toward Tunisia. The

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traps are structural and subtle but there is also evidence that the column heights are enhanced by stratigraphic components. The subtlety of the traps belies the fact that they have undergone a polyphase deformation history that has influenced sedimentation patterns in the Mesozoic. Despite the complicated Tertiary tectonic history, the seals remained intact. The Triassic reservoirs are capped by a mega-regional salt seal deposited in the Jurassic and Cretaceous.

In its world assessment of hydrocarbons in 2000, the U.S. Geological Survey estimated 4.4 billion barrels of liquid petroleum (crude oil plus natural gas liquids) and 12 tcf of gas remains in the Ghadames Basin. Our estimate would place the liquid potential at no more than 1 billion barrels. The Paleozoic-source, Triassic-reservoir petroleum system in the Ghadames Basin is now adequately explored to be assessed on the basis of its past performance, particularly in view of the high levels of seismic and drilling activity over the last decade. The Arps and Roberts method draws on past drilling results to predict the ultimate potential and the field size distribution. Our understanding of the geology and unique data-set of the basin also helps to validate input data and to calibrate the results. The methodology predicts limited additional conventional oil potential in the Ghadames Basin. The liquid potential expected to be found in the next 30 years is about 1 bbo to be exploited in fields with a range of about 50–200 mmbo.

The liquid potential of the deeper Paleozoic-source and Paleozoic-reservoir petroleum system is limited. The basin has

significant gas potential for which we make no estimates. From the number of exploratory wells and discovered fields, the deeper Paleozoic petroleum systems could be considered under-explored. However, over most of the basin the older reservoirs are most likely too tight due to their depth and also highly fractured. Much of the producible resource is most likely gas and distributed in numerous relatively small accumulations. ■

Biographical Sketch

ALLAN DRIGGS is a geologist at Anadarko Petroleum Corporation in the Woodlands. He received a BS in geology in 1975 and an MS in stratigraphy and sedimentation in 1976, both from Brigham Young University. He began his career in Midland with Exxon and then worked for Union Texas Petroleum for a couple of years before joining Anadarko in 1981. Assignments there have included stints in Houston and Denver before returning to Houston. Most of his career with Anadarko has been spent working international exploration in a variety of roles and projects, notably in Algeria. His particular interests include petroleum systems analysis, new ventures identification, resource prediction and fault analysis. A native of Driggs, Idaho, he has lived in Texas for 29 years. He and his wife have five married daughters and thirteen grandchildren scattered across the western US.

