P05

Source Rock and Reservoir Evaluation in Madagascar: Insights from New Fieldwork And Outcrop Analyses

M. O'Neill* (Robertson CGG)

Summary

In frontier areas geological fieldwork remains a basic but essential and highly valued tool for evaluating under explored regions. Compared with more sophisticated exploration techniques, fieldwork is a cost effective method that can reduce exploration risk and provide a deeper understanding of complex geology.
In the summer/autumn of 2016 Robertson CGG geological teams collected 590 samples from 403 locations in the Morondava, Majunga and Diego Ambilobe basins as well as along the east coast of Madagascar. Seeps were also sampled at various locations. Field traverses covering a cumulative distance of ~12,000 km, often with poor road conditions in remote areas were overcome to complete this work in an eleven week period. The sampling and analytical programme primarily targeted source rock and reservoir horizons in the Karoo and younger Mesozoic and Tertiary intervals. The results of new biostratigraphy, sedimentology and geochemistry studies will assist in refining the stratigraphy, understanding the proven and potential source rocks and gaining a deeper insight into the quality of both clastic and carbonate reservoirs.

Introduction

Madagascar remains extremely under explored with less than 100 wells drilled, only eight of which are located in offshore blocks. There is evidence of active petroleum systems through two giant, exhumed heavy oil fields, multiple oil seeps and wells that have tested both oil and gas.

In the last decade exploration activity has been limited to only 4 onshore wells and a small number of offshore seismic surveys. With such little information, how do we go about gaining new information to answer the key exploration questions?

Geological fieldwork remains a basic but essential and highly valued tool for evaluating under explored regions. Compared with more sophisticated exploration techniques, fieldwork is a cost effective method that can reduce exploration risk.

In the summer/autumn of 2016 Robertson CGG geological teams collected 590 samples from 403 locations in the Morondava, Majunga and Diego Ambilobe basins as well as along the east coast of Madagascar. Seeps were also sampled at various locations. Field traverses covering a cumulative distance of ~12,000 km, often with poor road conditions in remote areas were overcome to complete this work in an eleven week period. The sampling and analytical programme primarily targeted source rock and reservoir horizons in the Karoo and younger Mesozoic and Tertiary intervals. The results of new biostratigraphy, sedimentology and geochemistry studies will assist in refining the stratigraphy, understanding the proven and potential source rocks and gaining a deeper insight into the quality of both clastic and carbonate reservoirs.

For example: key questions regarding the origin of the Sakoa Group of southern Madagascar have been addressed. The base of the sequence was formerly interpreted as being of glacial origin and probably equivalent to the Dwyka glacials of Southern Africa. This interpretation was subsequently rejected in favour of an alluvial fan and debris flow origin (Wescott and Diggens, 1997). However, new observations suggest the basal Sakoa Group does indeed have characteristics strongly supportive of a glaciogenic origin, including massive diamictites with floating clasts, stratified diamictites with probable dropstones and metre-scale folds which do not affect adjacent beds (Figure 1).

Figure 1 *Boulders with classic glacial bullet-nosed morphology.*

Identification of reptile bones and teeth collected within the northern Morondava Basin has helped constrain the depositional environment of the Triassic Isalo Formation.

Sampling the source rock in Madagascar remained challenging; however samples that were collected have produced viable results and give further insight into the proven, and potential, source rocks of Madagascar (Figure 2). A key example is the identification of a Mesozoic source rock in the Northern basins of Madagascar.

Figure 2 *Oil seep sampled for geochemical analysis in the Moronodava basin.*

Sampling around the remote Pangalan Channel of eastern Madagascar has identified and dated clastic and carbonate sequences which have significant implications for the age of the poorly understood Ile St. Marie Basin.

References

Wescott, A.W. and Diggens, J.N. [1997] Depositional history and stratigraphic evolution of the Sakoa Group (Lower Karoo Supergroup) in the southern Morondava basin, Madagascar. *Journal of African Earth Sciences,* **4**, 585-601.