

ION helps guide exploration in East Africa

ion



BASINSPAN

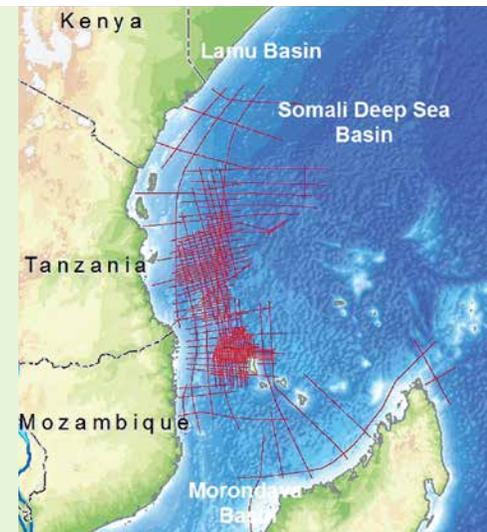
For decades, exploration in offshore East Africa was considered marginally prospective. Occasional successes offered hope, but several dry holes dampened interest and restricted investment in the region. The industry needed to better understand the reasons for the failures while developing new ideas that could lead to future success.

East AfricaSPAN™

OPPORTUNITY: For decades, exploration in offshore East Africa was considered marginally prospective. Occasional successes offered hope, but several dry holes dampened interest and restricted investment in the region. The industry needed to better understand the reasons for the failures while developing new ideas that could lead to future success.

SOLUTION: Build a contiguous and consistent regional geologic framework for the entire margin that extends the correlation from land to the offshore basin.

OUTCOME: East AfricaSPAN, supplemented by ComorosSPAN™, provides a regional framework that defines the extension of onshore rifts, and identifies the origin of basement lithologies and architecture. This geologic framework helps explain why early interpretation efforts failed and has guided recent exploration around the giant gas reserves discovered across the region. There is also renewed excitement about the potential for an oil window in the unexplored areas of the margin.



“We have persistently underestimated the amount of oil and gas that has been stored up in the earth’s crust.”

— WALLACE PRATT, 1952

Since 2000, approximately one-third of the world’s new oil and gas discoveries have been made in Africa. This sudden flush of discoveries – including enormous natural gas reservoirs along the continent’s eastern margin – offers great promise in a region historically passed over in the pursuit of hydrocarbons.

■ ION’s East AfricaSPAN™ is a key component of Africa’s new oil and gas exploration story. Located offshore Seychelles, Madagascar, Kenya, Tanzania, Mozambique and Comoros, East AfricaSPAN is a regional 2D seismic program encompassing nearly 30,000 kilometers of data designed to increase understanding of the region’s hydrocarbon potential.

■ Exploration and development in the area have proved challenging – legacy seismic datasets, some of which date to the 1970s, weren’t

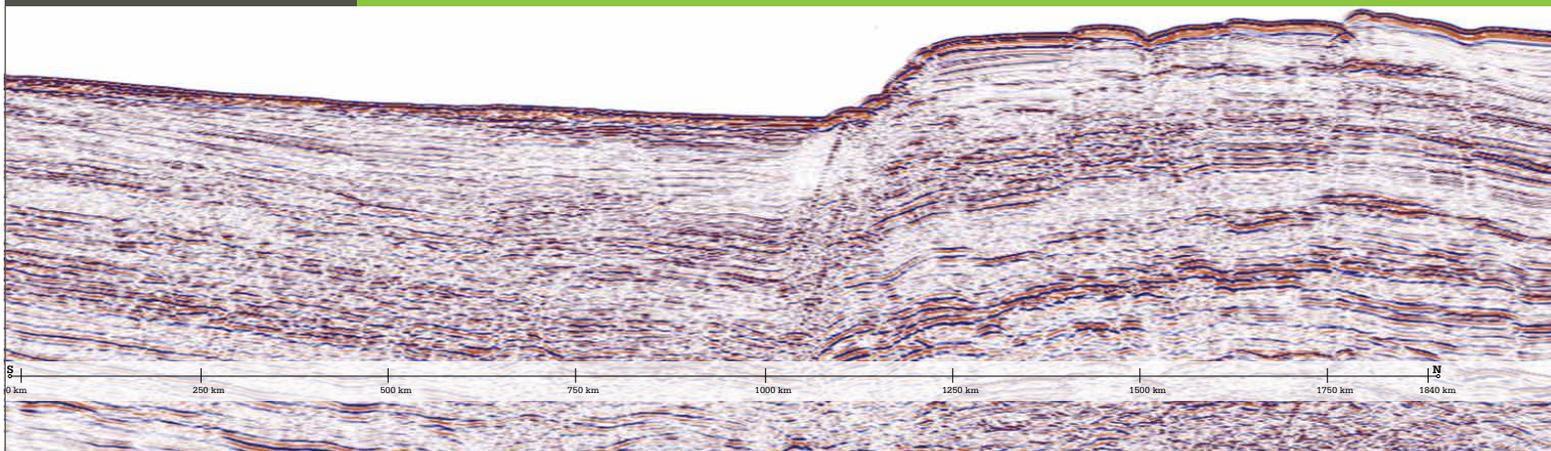
designed to create a basin-scale understanding of the petroleum systems along the margin.

■ Early exploration efforts proved difficult and inconsistent. Access was oftentimes extremely challenging, yet the promise remained. The margin showed a strong likelihood for the presence of deep water reservoirs, but getting a regional perspective during the exploration stage proved difficult. Geologists spent decades trying to locate hydrocarbons, but never managed to develop a successful understanding of the petroleum system, play type and fairways. As a result, East Africa began to lag behind other promising regions, including those across the continent along the West Africa offshore margin.

■ Interest resurged early in the 21st century, as political, business and market synergies became better aligned, and seismic exploration resumed.

■ EAST AFRICASPAN

Hydrocarbon indicators abound in the dataset offshore Mozambique (Rovuma delta)



The first new well in 25 years was drilled in the Songo Songo gas field offshore Tanzania, alleviating soaring power demands in Dar es Salaam. Renewed exploration results were often disappointing, though – a dry hole in the Lamu basin offshore Kenya in 2007, amidst keen expectations, appeared to condemn further oil exploration.

■ But the sudden success of gas temporarily alleviated oil concerns – breakthroughs began to emerge in 2011 and 2012, continuing through 2013. Persistence began to pay off. As a result of innovative advancements in seismic interpretation, new high-quality data began to reveal massive gas reserves. ION geophysicists and regional petroleum geologists began correlating conjugate ties across the full stratigraphy of offshore East Africa, an area larger than the Gulf of Mexico. Many observers underestimate the scale of the distances involved in measuring Africa's geological regions – the continent is the world's second largest, surpassed only by Asia.

■ Twenty-five new fields were discovered in the span of a few short years, with over 150 trillion cubic feet of recoverable assets in offshore Mozambique alone. We now know that these offshore reserves may exceed 300 trillion cubic feet of natural gas, 50 percent more than all natural gas reserves in the Gulf of Mexico. New data produced by ION geoscientists reveals excellent imaging of the rift architecture, transfer zones, Karoo hidden rifts and the Jurassic source rocks on the margin.

■ As far as the quest for oil, the possibility remains promising. The East AfricaSPAN data enables a correlation to Comoros, extending the trend of the Mozambique gas discoveries to the east. This data reveals the presence of possible oil just east of the continental margin. Future potential across the region includes possible deep water oil in the Rovuma basin; Jurassic petroleum identified offshore Madagascar; an extension of offshore Kenya success into Somalia; and deep water wells currently being assessed in Tanzania.

■ About BasinSPANS

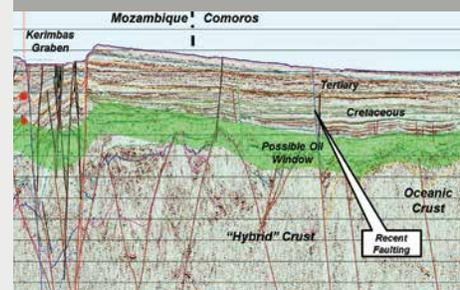
ION's BasinSPANS™ are geologically inspired, basin-scale seismic data programs that help oil & gas companies solve the toughest E&P problems. Each BasinSPAN is acquired and depth-imaged by ION's GX Technology experts using the most advanced geological and geophysical processing tools available.

■ BasinSPANS provide E&P companies with critical insight into the geologic evolution, deep basin architecture and depositional/structural histories of entire petroleum systems within a defined region. Unlike conventional multi-client seismic surveys, BasinSPANS are custom designed in collaboration with ION's GeoVentures group, regional experts and oil & gas companies.

■ ION's BasinSPAN library is among the largest and most advanced in the industry, consisting of nearly 400,000 kilometers of 2D, 3D and full-wave (multicomponent) data in virtually all major frontier basins around the world.

East AfricaSPAN objectives

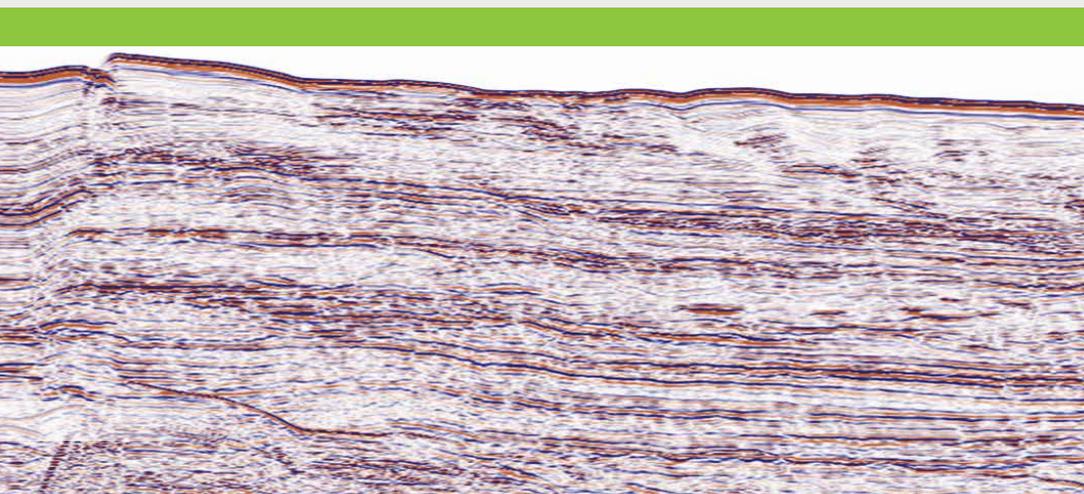
- Identify basement type and structure, sediment thickness and depositional framework, potential source kitchens and a regional basin definition
- Provide an advanced, consistent regional framework for identified petroleum systems in East Africa by analyzing the regional distribution of source rocks and wide-scale basement architecture
- Advance the understanding of new petroleum systems in deep water East Africa through direct ties to DSDP sites and key wells



East AfricaSPAN: powered by ION technology and innovation

Pre-Stack Depth Migration (PSDM) – ION's GX Technology group is a recognized leader and innovator in PSDM, delivering highest quality results while continually improving run-time performance. ION offers a comprehensive toolkit of PSDM technologies, including reverse time migration (RTM), Kirchhoff depth migration, beam migration and wave equation migration (WEM).

Pre-stack Time Migration (PSTM) – Designed for 2D/3D land and marine seismic data for which PSDM is not required, ION's PSTM algorithms offer superior amplitude and bandwidth preservation. Our methodology is not constrained by straight ray approximation, but rather uses a turning ray approach that can image very steep or overturned seismic events.





ION is a leading provider of technology-driven solutions to the global oil & gas industry. ION's offerings are designed to help companies reduce risk and optimize assets throughout the E&P lifecycle. For more information, visit iongeo.com.

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