[PS]Modern Geochemistry Methods to Prove Working Petroleum Systems: Applications for Offshore Myanmar*

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Abstract

Modern geochemical methods for offshore exploration can reduce exploration risk in frontier areas. Onshore, finding oil from seeps was the first method for oil and gas exploration. The hand-dug wells at oil seeps in the Yenandaung field in the Central Burma Basin that were certainly discovered far earlier but noted by Western visitors in 1755 are no exception. The Yenandaung oil fields are still producing today. In the hydrocarbon province to the west on the eastern margin of the Rakhine basin natural oil and gas seeps are present on Ramree and Cheduba Islands. Modern geochemistry methods are designed to find the offshore natural seeps and sample the seeps to provide information about source, maturity, and migration. This is conceptually easy but is more difficult, yet achievable, in practice. The perceived unreliability of offshore geochemical methods is largely attributed to deficiencies in sampling equipment and procedures that used to be common practice. Submersible and ROV studies show that the zone of active hydrocarbon seepage on the seafloor, as indicated by chemosynthetic communities, is relatively small.

An improved and effective method for conducting marine geochemical surveys use data acquired from modern multibeam echosounders, which can cover large areas quickly in deepwater, to locate seepage. Indications of seepage are interpreted from seabed morphology and attributes (backscatter) that can help determine where hydrocarbon-consuming chemosynthetic communities may be present. To sample the seep, coring devices are attached with a transponder and positioned using ultra-short baseline navigation. With navigation accuracy of 1% of water depth or better (20m at 2000m water depth), there is a high probability of sampling the target with a 6 m core barrel within the typical lateral geochemical gradient surrounding a natural seep. The first indications of a local working petroleum system can be determined during the survey through onboard analyses to be later confirmed at the shore-based laboratory through mass spectroscopy, isotopic, and biomarker analysis.

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Racey, A., and M. F. Ridd, 2015, Petroleum Geology of Myanmar, Memoir 45, Geological Society of London, 123 p.

Modern geochemistry methods to prove working petroleum systems: applications for offshore Myanmar

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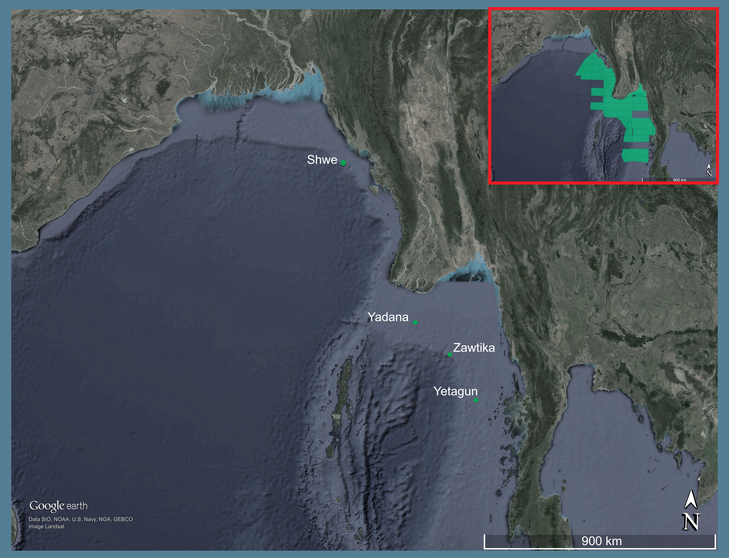
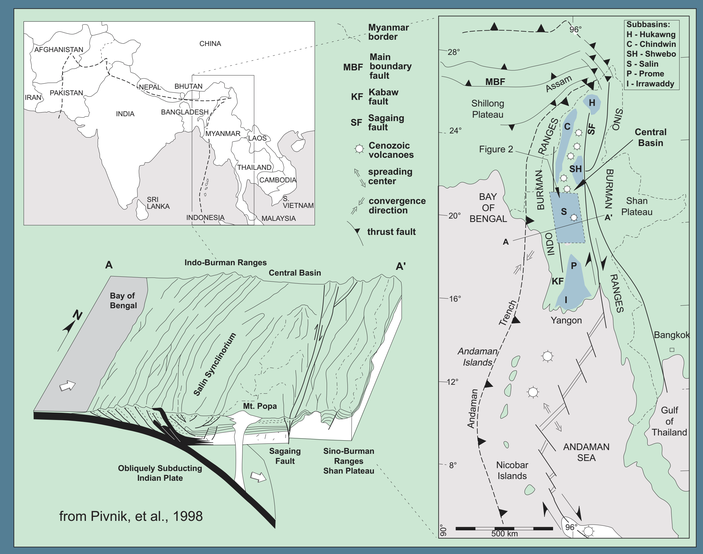
SEEP HUNTING | OIL & GAS | PETROLEUM GEOCHEMISTRY | FUGRO

Myanmar, one of the oldest oil producing regions, is underexplored and the offshore regions are largely unexplored. However, even with few wells and sparse exploration activity, four multi-Tcf gas fields have been discovered in different geologic settings in both carbonate and clastics. Most producing offshore discoveries in Myanmar are biogenic gas. Yetagun is the only offshore thermogenic gas field. The sole discoveries to date in the offshore Rakhine basin are the Pliocene Shwe biogenic gas fields (discovered in 2004-2006) in the north (Racey and Ridd, 2015).

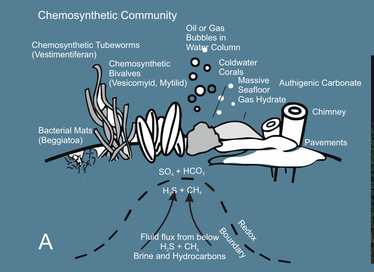
Two working petroleum systems- an Early to Middle Miocene petroleum system and a Late Eocene – Early Oligocene petroleum system should be present. The potential for a Late Cretaceous – Paleogene system in the deepwater areas is possible. One of the goals of a marine geochemistry survey is to identify potential migration pathways from the Cretaceous Paleogene source to the seabed. Possible oil slicks identified from satellite imagery suggest oil and thermogenics in the deepwater areas. Integrating regional 2D seismic and fast track 3D surveys, if available, with well calibrated modern multibeam seafloor and water column data should be an effective tool to help unlock the hydrocarbon potential and reduce exploration risk offshore Myanmar.



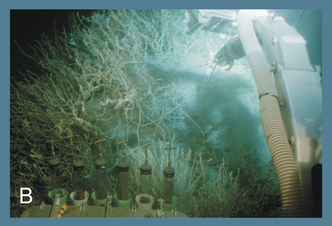
The areas offered for production sharing contracts in the Rakhine basin are yet unexplored. The Shwe gas discovery (2003) on the shallow water margin of the Rakhine Basin is a multi-Tcf biogenic gas field within the Lower Pliocene section. The Yadana, Yetagun, and Zawtika multi Tcf gas fields are in the rifted Andaman Sea



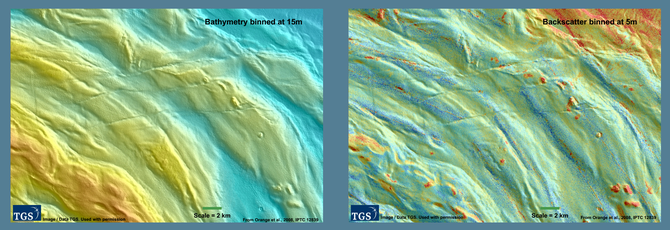
The deepwater Rakhine contains thick, up to 20km Tertiary foredeep sediments deposited over Cretaceous deep marine. An accretionary wedge forms along the suduction zone on the eastern, landward margin of the basin.



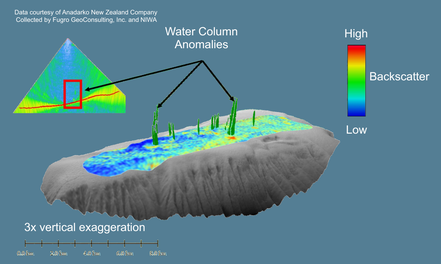
A) Typical seep community



B) Typical seep community deep water Gulf of Mexico, Photo Dan McConnell



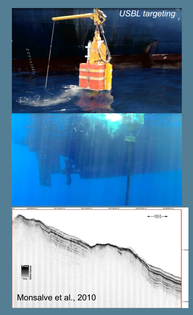
Left - Artificially illuminated multibeam data (topographic highs show as warm colors- reds and yellows) Right- Same data overlain with backscatter (here, high backscatter shows as warm colors). From Orange et al., 2008.



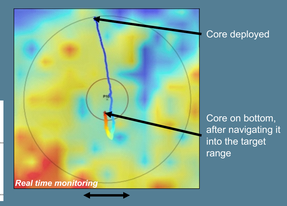
Modern multibeam echosounders measure seafloor depths, backscatter, and water column. Gas bubbles are small, typically 3mm - 10mm, yet they are able to be imaged with the latest generation ocean bottom depth echosounders.

A careful methodology is required to have the best chances of a successful marine geochemical campaign. Seeps are small, and the lateral geochemical gradient that holds the diagnostic geochemical signal beneath and around the seep have small extents.

Therefore, directing the core barrel (typicallly 6 m) to the seep target is critical.



- Missing the target by as few as tens of meters can lead to an *inconclusive* geochemical result.
- May lead to erroneous conclusions about the potential of the reservoirs in the block and can be problematic for the entire program.



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