

## Does the Quaint Oil of Mann-665 Cast Light on the Regional Geology?

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### ABSTRACT

The *Mann* field is the third in size of the onshore producing oil fields of Myanmar. The field is located in the *Salin Basin*, the most productive of the *Central Myanmar Basins* ("CMB"). State enterprise MOGE discovered the field in 1970, and put it in production in 1972. The field has produced a total of some 120 MMbbls and 123 Bscf gas, with a maximum output of 24,700 bopd in 1979. MPRL E&P has been the contractor for MOGE to enhance the oil recovery of the field since 1999 and is rewarded with a share of the incremental production. The field now produces some 1,320 bopd including some 970 bopd of incremental production due to MPRL E&P's and MOGE's efforts, with an average decline rate of only 4% compared to more than 12% before 1997.

Incremental petroleum has been produced by a combination of infill drilling, deepening, additional perforations and some innovative technologies pioneered by MPRL E&P and MOGE in the Myanmar onshore oil scene, such as hydro-fracturing and the use of enzymes and other paraffin scavengers. MPRL E&P and MOGE have also introduced international practices of HSE and CSR in the field long before they were enforceable by law in the country, including a mechanism of resolution of operational grievances praised by international watchdogs and nearly 90% of all formation and waste water reinjected in the formation.

The *Mann* structure is a 30-km long asymmetrical anticline with a northwards dipping axis, increasingly tight flanks southwards and a major westwards dipping reverse fault complex bounding the anticline to the East, where the flank is steeper than to the West. The *Mann* anticline is one of about a dozen similar structures described by U Ko Ko 2016 as belonging to a late Pleistocene N-S strike-slip deformation belt nearly parallel to the axis of the basins along the Ayearwaddy River, from the *Letpando* oil field in the North of the *Salin Basin* to the *Shwepyithar* wet gas field in the *Pyay Embayment* in the South. This deformation belt is characterised by en-échelon asymmetrical anticlines, partly filled with shallow oil and/or gas, with wet gas in deeper tighter reservoirs as proven in a few structures (such as *Mann* and *Pyay* fields).

The *Mann* field, located just north of the well-known Minbu mud volcanoes, is very compartmentalized, with three main fault blocks separated by late cross-field normal faults, each with their different exploitation challenges in terms of depth, stratigraphy, compartmentalization and pressure regime of reservoirs. The field produces a variety of oils spanning from 24° to 47° API from 22 Oligo-Miocene stacked reservoirs in 59 pools.

One of the means of enhancing production has been infill drilling. MPRL E&P has drilled about 21 deep infill wells, six of which exceeding 6,000 ft, most of them commercially quite successful. *Mann-665* was drilled in the southernmost much compartmentalised *DS* fault block and

has been producing since November 2009 some 5-6 bpd of the lightest oil in *Mann* practically without decline. The oil density measures some 47° API with very low paraffinic content by contrast with all other oils of the field. This peculiar oil probably migrated through a deep-seated network of faults intersecting the well bore near the main bounding fault to the East. The result of *M-665* has been one of the incentives to drill in 2011-2012 the deep exploratory well of *Mann Deep East-1*, which discovered a wet gas play in the Lowermost Oligocene *Shwezetaw* sandstones. This challenging well could not be tested because of excessive tectonically induced formation pressures needing a drilling mud of up to 21 ppg (sg 2.5) to be contained. MPRL E&P has attempted to integrate the basic oil analyses of *M-665* with other oil analyses in the field, as well as with stratigraphical, sedimentological and structural aspects to sketch some conclusions on exploration-appraisal prospectivity of the *Mann* field.