
Understanding the Geological Controls on Fluid Properties in the Carbonate Stringer Play of South Oman

Paul Taylor, Petroleum Development Oman LLC, Muscat, Oman, phone: +968 2467 5434, paul.taylor@pdo.co.om, Erdem Idiz, Shell International E&P, Rijswijk, Netherlands, Gordon Macleod, University of Edinburgh, School of GeoSciences, Edinburgh, United Kingdom, Mohammed Al Ghamhari, University of Newcastle, School of Civil Engineering & Geosciences, Newcastle upon Tyne, United Kingdom, and Steffen Ochs, Petroleum Development Oman LLC, Muscat, Oman.

The carbonate stringer play in the Infra-Cambrian Ara Group of South Oman contains oil and gas in carbonate reservoirs encased in salt. There is a wide range of reservoir depths (2km to >5km), temperatures (60 to 125°C) and pressures (from hydrostatic to almost lithostatic pressure gradients). Fluid properties within the reservoirs are highly variable; e.g. gas/oil ratios range from 180 to >4000 m³/m³.

Simple reservoir depth, pressure and temperature relationships were insufficient to explain the full variability of fluid properties observed in the fields and the occurrence of oil versus gas. Therefore a study was initiated to understand the underlying causes of the fluid property variability in the stringer reservoirs. This study utilised data from source rock pyrolysis, oil to gas cracking kinetic measurements, geochemical characterization of oils, gases and mud gas samples and PVT analysis data.

This approach showed that the bubble point pressures of the fluids were higher than could be explained by in-situ maturation of the stringer source/reservoir systems alone. Gas geochemistry data and PVT modelling showed that the elevated bubble points were, in fact, the result of mixing of oil and oil-associated gas with a separate gas charge, probably derived from highly mature pre-salt source rocks.

Our observations and resulting charge models allow gas risk for a stringer prospect to be addressed in terms of its burial depth, proximity to base or top salt and location in relation to pre-salt highs (explained by Al Rabei et al., this conference). We have also gained new insights into the nature of the mixed petroleum systems needed to explain the fluid properties in the carbonate stringer play and their implications for intra-salt and pre-salt prospectivity.
