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MIGRATION-FRACTIONATION OR RESERVOIR-FRACTIONATION? A CASE EXAMPLE FROM NORTHERN VERMILION, OFFSHORE LOUISIANA, USA

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Aims

Migration-fractionation, and variants such as migration-separation, are widely used but rather loose terms to describe changes in subsurface fluid phase and composition which occur during migration. However, does this process necessarily lead to the separated fluids being reservoired in a trap? The aims of this work were (a) to expand on the earlier studies of northern Vermilion (VR) by including gas data and reservoir compositions/PVT studies, in order to (b) to provide a more comprehensive picture of migration and the mechanisms which lead to the formation of the reservoired fluids.

Study area

VR14, 24 and 39 fields are located offshore Louisiana, USA (Fig. 1). VR14 produces from overpressured Upper Early Miocene (foram pick Rob M1) and normally pressured Middle & Late Miocene (Cib Op, Big2, Disc12 and Amph E) sands. VR39 field produces from normally pressured M. Miocene (Cib Op) sands. VR24 field produces from E. Miocene (Rob M9 – M14) sands at greater depths. The fields produce mainly gas/ condensate, but the Cib Op intervals in VR39 in particular initially contained low GOR oils with an overlying gas cap. The shallowest horizons (uppermost M. and L. Miocene) in VR14 and 39 contain very high GOR gases. Work by Curiale & Bromley (1996a & b), based on geochemical analysis of oils and condensates, suggested that they have a similar source and differences in composition are primarily the result of migration-controlled processes.

Results & Discussion

Reservoir fluid compositions for the gas/condensates from Cris(I) and deeper horizons show great similarities, regardless of field or reservoir age, pressure and temperature. Geochemical data for the gases support the previous conclusions based only on the liquid fraction (Curiale et al., 1996a, b) that the fluids share a common source. Furthermore, the data suggest that the subsurface oil phases share a common source with the gas/condensates.

PVT data and modeling work indicate that the oil phases are found at the low end of a widespread pressure ramp, and they formed by liquid drop-out as the pressure dropped below saturation pressure. However, modeling suggests that phase separation into oil and gas phases is unlikely to result in commercial oil accumulations if it occurred during migration, since the liquid dropout from typical gas phases is small (<10% of total volume). It is more likely that fractionation occurred in-reservoir as a result of rapid changes in pressure, probably due to fault movement, and so a better term to describe this might be reservoir-fraction. This was clearly a far more significant process in VR39 than in VR14. The high GOR, dry gases which formed as a result are currently found, often biodegraded, in the TexW and younger sands.

REFERENCES

Curiale J.A. and Bromley B.W. (1996a). Migration of petroleum into Vermilion 14 field, Gulf Coast, U.S.A. – molecular evidence. Org. Geochem. 24(5), 563-579.

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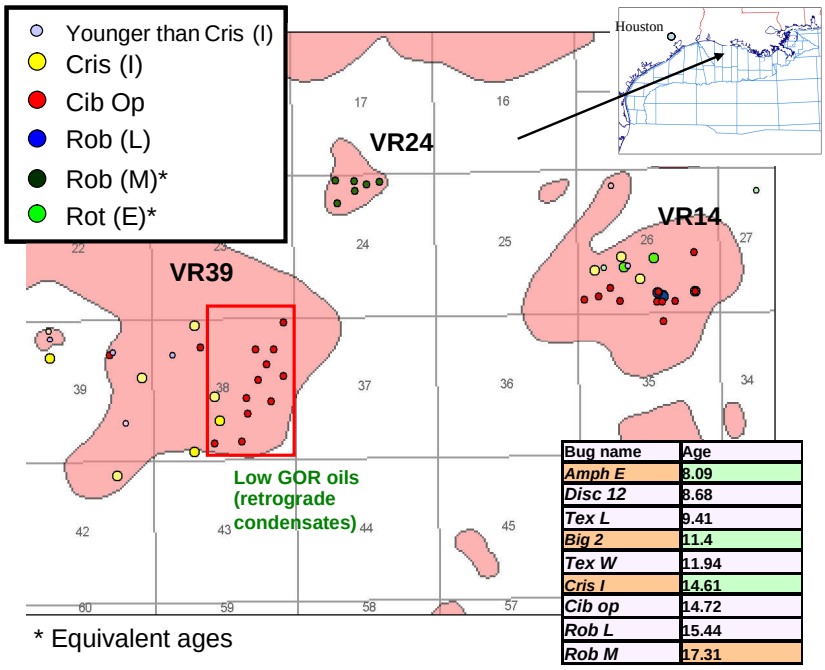

Figure 1. Location map.