

Controls on Oil Quality in Deep and Ultra-Deep Water Fields of the Campos Basin, Brazil

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Deep and ultra-deep water fields of the Campos Basin contain the large majority of Brazilian petroleum reserves. A succession of discoveries by Petrobras beginning in 1984 have resulted in the Albacora, Marlim, Albacora Leste, Marlim Sul, Barracuda, Caratinga, Roncador Jubarte and Cachalote deep water fields. These accumulations represent over 8 billion barrels of proven reserves, the majority of which occurs in turbidite sands of Miocene to Albian age. The principal source rocks are Barremian shales and carbonates of the Lagoa Feia Formation located in structural lows below and east of the fields.

Much of the oil in the Campos Basin is heavy (less than 20° API). In the deep-water fields API gravity varies from less than 15° to more than 30°, making this an important economic aspect of development. Oil quality becomes an even greater consideration in frontier exploration of the ultra-deep water region. This study has integrated a detailed geochemical study of oils from these deep-water fields with 1D and 2D basin modeling to assess the principal processes affecting oil quality.

Compositional modeling suggests that mature, fully evolved Lagoa Feia source rocks generate oil of API gravity 30° – 35° with a GOR approximately 100 scf/bbl. Lower oil quality is a complex function of biodegradation, regional variations in source rock thermal maturity, and mixing of bacterially-altered and unaltered oils. Understanding reservoir temperature history in relation to the timing of hydrocarbon charge appears to be an accurate basis for prediction of reservoir fluid quality in these fields.
