

Analogues for Atlantic Canada Reservoirs from the Wessex (England) and Lusitanian (Portugal) Basins

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Coastal exposures of Cretaceous-age, reservoir prone sediments in the Wessex basin and Channel sub-basin (southern UK), and the Lusitanian Basin (Portugal) provide keys to the subsurface reservoirs being exploited for oil and gas development offshore Atlantic Canada. These coastal areas have striking similarities to the offshore region of Canada and provide insight to structural controls and characteristics of these reservoirs. Outcrops demonstrate a range of depositional environments from terrigenous and non-marine, shallow siliciclastic and carbonate sediments, through to deep marine sediments. The outcrops provide clearer understanding of key stratigraphic surfaces representing conformable and non-conformable surfaces. Validation of these analogue sections and surfaces can help predict downdip, updip and lateral potential of the petroleum systems, especially source rock and reservoir. Many unconformities visible at outcrop are not readily apparent on examination of subsurface data and demonstrate the interplay of eustatic and tectonic controls and the effect of geodynamics along the margin that demonstrate of the episodic opening of the central and north Atlantic.

Hiscott et al. (1990) helped to establish the tectono-stratigraphic events and determined rates of sedimentation were relatively constant along the basin margins. Sinclair et al. (1994) examined wells from the Jeanne d'Arc basin offshore Newfoundland with those of the Porcupine and Outer Moray Firth basins with the objective of determining similarities in basin fill. The Channel and Wessex basin outcrops have been investigated in several studies (e.g. Channel Basin - Ruffell and Wach, 1991; Wessex Basin - Hesselbo et al. 1990). Lusitanian Basin studies include those of Cunha & Pena dos Reis (1995) and Dinis et al. (2008 and references therein).

The Wessex (Channel) and Lusitanian basins have relatively complex geological histories, multiple sources of sediment input, source rock analogues and variable depositional settings. The Lusitanian basin is an epi-continental basin on the west coastal areas and offshore western Portugal, bounded to the east and west by emergent Paleozoic highlands that provided the source of siliciclastic sediments to the basin. The Berlenga highlands separate the Peniche basin, deep offshore to the west, from the Lusitanian basin. The basin provides good outcrop analogues for a range of depositional environments systems ranging from fluvial to estuarine mixed sediments and coastal platform carbonates. The predominance of carbonates in the Lower Cretaceous sections compared to the Wessex basin to the north is likely a factor of paleo-latitude and climatic controls.

Three major fault zones divide the Wessex Basin into five subbasins, including the southernmost Channel Basin. Lower sea level in the latest Jurassic to Early Cretaceous created two depocentres separated by the London Brabant Massif with slower sedimentation rates in the northern basins. Within the basin there are minor unconformities and non-sequences due to eustatic changes and variable rates of local tectonic and regional tectonism. These were superseded by a major unconformity cutting the Mesozoic section in southern England associated with later Cimmerian tectonism, with the unconformity formed in an extensional setting. The deposition of the Lower Greensand in southern England marked the end of the late Cimmerian event.

