

Critically Evaluating the Current Depositional Models for the Pre-Salt Barra Velha Formation, Offshore Brazil

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ABSTRACT

Two contrasting models exist for the depositional settings for the Cretaceous Barra Velha Fm carbonate reservoirs of Santos Basin. One invokes deeper lakes with differentiated microbial platforms having relief of 100's metres, and smaller buildups. The other model is of very shallow, evaporitic, hyper-alkaline lakes with predominantly abiotic carbonate and Mg-silicate precipitates. The case for the former is based on the perceived presence of shelf-like platform margins, whereas the latter is based on analysis of a large data set supported by geochemical modelling. The hydrology of the Barra Velha lakes can be assessed by proxy using carbon and oxygen stable isotopes, by comparison with extensive studies from Quaternary lake deposits from East Africa. Co-variant trends in these Barra Velha isotopes suggest the former presence of shallow, evaporitic lakes either very extensive or sourced from a uniform aquifer. Identifying isolated carbonate buildups is now facilitated by scoring using work flows but this approach relates to marine systems and may not be appropriate for non-marine ones as the absence of modern or ancient large scale, non-marine buildups limits this approach. Instead the evidence shows that the large platform-like features are largely post-Barra Velha and structural in origin affected by varying degrees of subaerial erosion (denudation). While available sedimentological and geochemical evidence does not support the presence of platform-like features with 100's of metres of relief, this does not preclude the presence of large carbonate mounds and ridges analogous to those seen in modern extensional systems. However, as such features can be sub-lacustrine, sub-aerial or periodically both, their presence and interpreted relief cannot be used to draw reliable conclusions about palaeobathymetry Facies and well logs allow correlations to be made in the Barra Velha Fm from what appear to have been lows (lake floor) to highs (platform) within the basin, as defined beneath the base salt. This implies that these apparent topographic differences of hundreds of metres or more were not being reflected in any lithological differences at the time of deposition. This suggests that what appear to be palaeotopographic differences are due to later structuration, post-deposition of the lake sediments, and prior to salt deposition.