Reservoir Layering Controlled by the Taphonomy and Taphofacies of Coquinas From the Early Aptian Campos Basin, Brazil

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ABSTRACT

Major hydrocarbon producing reservoir units occur in mollusc-rich, coquinoid limestones of the Coqueiros Formation, early Aptian of the Campos Basin. These brackish water lake deposits of the South Atlantic continental rift basins are diverse and complex. For this reason, a more detailed approach than the conventional textural limestone classification is needed to understand the paleoenvironment, sedimentology and the pore systems of these coquinas. Taphonomy and taphofacies analysis has been used to further our understanding of the complex biofabrics in these limestones from the original lacustrine bivalve communities through their transport, fragmentation, and abrasion to eventual deposition. The shells that survive these various taphonomic filters build the final biofabrics and the sedimentary record. Subsequent micritisation and encrusting can significantly increase the preservation potential of shells and also affect the porosity development within these reservoir rocks. The biofabrics of the Coqueiros Fm have been studied from 9 wells (400m of core) and one FMI log (400m of continuous log) and nine taphofacies are recognised. These represent a taphonomic grade from more or less in situ shell assemblages in rudstones to floatstones through to fragmented and abraded rudstones and grainstones. The taphofacies reflect biological and hydraulic processes that have acted on the shells in the lake margin environment including fair weather wave concentration, storm concentration, and deeper lake condensed concentration. The taphofacies enable a bed by bed classification of the coquina cores that also explains their porosity and permeability variations and layering within the coquina reservoirs. The porosity range from 5 to 25% (average 11%) and the permeability ranges from <1 mD up to more than 1 Darcy. Such variability in reservoir quality suggests a great heterogeneity in facies and diagenesis. The taphofacies classification provides evidence for high frequency, metre-scale cycles and bedding-parallel layering within these limestone reservoirs. In addition they provide input into facies models that are used to explain the geometric arrangement and characterization of these complex coquina deposits