The relationship of transgressive systems tracts to sea-floor diagenesis, Lower Cretaceous, Scotian Basin

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Diagenesis in the Lower Cretaceous of the Scotian Basin is an important control on reservoir quality. Diagenetic processes include the effects of seafloor redox-controlled changes in pore-water and the re-mineralization of organic matter. The Lower Cretaceous rocks of the Scotian Basin are deltaic, with cycles of delta progradation with high sedimentation rates, capped by Transgressive System Tracts (TST) with low sedimentation rates. Seafloor diagenetic phases influence the entire diagenetic mineral assemblage, thus affecting reservoir quality. More so, these diagenetic mineral phases are commonly preserved where there is abrupt change in sedimentation rates, and also in coated grains found in the TST. This study assesses the role of seafloor diagenesis in the diagenetic system of the Lower Cretaceous of the Scotian Basin by studying the sedimentology, mineralogy, and geochemistry of TSTs and underlying sediments (defined as a sediment packet) from conventional core in two wells, Peskowesk A-99 (a proximal well, with 7 cores) and Thebaud C-74 (a distal well, with 6 cores). Cores were logged, photographed, compared with wireline logs, and sampled. Minerals were identified by petrographic microscope, SEM, and electron microprobe. Bulk geochemistry was determined by ICP-MS.

Several different types of TST are recognized, principally on the basis of the character of the TST sediments and the underlying depositional lithofacies. Some TST sediments include abundant shell fragments, others have very little siderite. Some overlie prodeltaic progradational facies, others overlie fluvial sediments capped by tidal flat facies or coastal marsh coals. The sediments in the studied TSTs include siderite cemented conglomerate, including intraclasts of reworked concretions, passing up into sandy mudstone, and eventually into black shales representing the maximum flooding surface (MFS). The TST sediments are strongly bioturbated. Most are characterized by the presence of glauconite and chlorite (identified by electron microprobe analysis), some coated grains, and the presence of patchy siderite. Geochemical data show concentration of phosphorus (P), sulphur (S), and strontium (Sr); a proxy for calcite, a few metres below the TST. The abundance of P appears to correlate with abundance of iron (Fe). Geochemically, the Lower Cretaceous sedimentary rocks of the Scotian Basin are unusual in having high titanium (Ti) and iron and very low calcium (Ca). As a result, the early diagenetic system is dominated by Fe minerals and locally by P. Mineral concentrations may result from the rapid change in sedimentation rate at the TST. The observed variation in mineralogy and geochemistry of the different TST packets can be tentatively related to their different facies associations and can be compared with modern sea-floor diagenetic systems in areas of high Fe availability.

Atlantic Geology, 2009, Volume 45, Number 1