

DEPOSITIONAL SETTING AND DIAGENESIS CONTROL ON THE RESERVOIR QUALITY OF DEVONIAN SANDSTONES FROM SOLIMÕES BASIN, NORTHERN BRAZIL

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RESUMO: Shallow marine Devonian sandstones of the Uerê Formation are important oil prospects in the Solimões Basin, western Brazilian Amazon Region. The reservoirs are sharp-based, progradational sandstones, deposited in a storm-dominated shelf complex, and overlain by Frasnian-Famennian black shales, which are the basin oil source rocks. Concentrations of sponge spicules occur interbedded with the sandstones, as remnants of isolated and colonial sponges, recrystallized to chert nodules, lenses and layers. In spite of their large lateral extent, the exploration of these sandstones is complicated by intense and heterogeneous diagenetic processes, which strongly affected reservoir quality. The porosity of the sandstones range from extremely tight (less than 5 %) to abnormally high values (up to 28 %), considering the long and complex burial history of the reservoirs. The main processes of porosity reduction are mechanical and chemical compaction and cementation by quartz overgrowths, carbonates (siderite and dolomite) and fibrous illite. The primary porosity of porous reservoirs was preserved by the inhibition of quartz overgrowth cementation and pressure dissolution by grain-rimming, eogenetic, microcrystalline quartz or chalcedony, in places associated to smectitic clay coatings. Such early diagenetic silica precipitation is related to the dissolution of siliceous sponge spicules. The transformation from the phase of highest entropy (amorphous opal) to the phase of lowest entropy (quartz) occurred in a dissolution-reprecipitation pathway thermodynamic- and kinetically controlled. Smectitic clay coatings, may have accelerated the opal-quartz transformation by competitively adsorbing silica. Mesogenetic quartz overgrowth cementation is heterogeneous from thin section to layer scale. This is attributed to inhibition of overgrowth by the presence of eogenetic microcrystalline quartz rims, and to the convection of hot fluids promoted by Triassic magmatism. The porous reservoirs were originally storm-reworked, hybrid sands rich in siliceous sponge spicules. Paragenetic and volumetric evolution models above described were adjusted to the burial and temperature histories of sandstones of the different petrofacies. A numerical model was thus developed using Monte Carlo technique in order to predict the distribution of porosity in the Devonian sandstones and compare with the measured values in thin sections. Input data for this model included the burial and temperature history from eight wells, and the composition and texture from 50 thin-sections.

PALAVRAS-CHAVE: SOLIMÕES BASIN; DIAGENESIS; RESERVOIR QUALITY.