Porosity Evolution in the Bassein Limestone of Panna and Mukta Fields, Offshore Western India: Burial Corrosion and Microporosity Development

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The Bassein Formation Eocene-Oligocene ramp carbonates are examples of formerly tight limestones in which all current porosity was produced at depth by burial corrosion. In the Panna Field dissolution created extensive breccia pipes and collapse features hundreds of metres in diameter. These appear to be associated with NNW-SSE trending strike-slip faults. Similar large-scale structures have not been identified in Mukta Field. However, both Panna and Mukta underwent a phase of selective corrosion, dissolving stylolites, stylolite-associated fractures and preferentially removing micrite matrix and finely crystalline grains such as miliolids and agglutinated foraminifera to produce extensive microporosity. This microporosity differs from the micro-rhombic calcite mosaics documented by some authors in Middle Eastern Cretaceous microporous carbonate reservoirs in that individual crystals show clear signs of dissolution (e.g. rounding) and enlarged pore throat diameters. This difference is also reflected in poroperm trends which are distinct from those of microporous Shuaiba reservoirs in Oman and the U.A.E. The causal late stage corrosion post-dated saddle dolomite growth and was followed by locally extensive dickite precipitation. This suite of diagenetic features and the paragenetic sequence are consistent with a mixing corrosion model of porosity development. Mass balance considerations and the TOC of the Panna-Mukta source rock preclude the possibility of major dissolution by acidic fluids generated from CO2 or carboxylic acids.

The data presented here point to a spectrum of microporosity development from: (1) chalk reservoirs in which intra- and interparticle microporosity is hosted in pelagic nanno- and microfossils, (2) matrix and intraparticle microporosity occurring in relatively pristine (i.e. mainly non-leached) micro-rhombic calcite mosaics and (3) corrosion-enhanced matrix and intraparticle microporosity in which individual calcite crystals have been rounded and reduced in size giving a concomitant increase in pore throat diameter relative to non-leached micro-rhombic calcite mosaics.