**Porosity controls in Peritethyan Carbonate Reservoirs**

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**Abstract**

It is commonly considered that reservoir properties of Peritethyan carbonates mostly originated from intense dissolution (vugs, molds, enlarged fractures, caverns) in a variety meteoric diagenetic environments. This dissolution took place prior to the burial by non-reservoir or seal units, under unconformities of different orders of magnitude or in shallow, near-surface aquifers. Primary depositional porosities are seen as extensively obliterated by cementation and compaction. Burial diagenetic environments are considered to modify (increasing or decreasing) the inherited early secondary porosity in variable degree. Nevertheless, it is generally accepted that depositional facies, their architecture and system tracts are the predominant control in the distribution and quality of present reservoir properties. The common observation of a downward-decreasing porosity profile from the top unconformity or sequence boundary appears as a circumstantial support of the early diagenetic origin of the porosity.

This review of rock data from numerous fields motivates re-evaluation of the predominant early porosity interpretation. Many observations reveal that diagnostic exposure facies (eogenetic and telogenetic) are essentially tight, with abundant early cements, internal sediments and intense mechanical and chemical compaction. The overall trend reflects a major destruction of porosity by pressure dissolution and cementation. The observed open porosity in reservoir rocks postdates: (a) latest interparticle cements, (b) different types of dissolution seams and stylolites, (c) most of the late cements in fractures and vugs. This open porosity was formed by late dissolution-corrosion in deep burial environments. Incipient late corrosion may show preference for microcrystalline fabrics, crystal orientations or along horizons of pressure dissolution (microporosity, enlarged fracture, mold), but advanced stages of corrosion also developed vugs, caverns and breccias. These corrosion fabrics are followed by a variety of late mineralizations (kaolinite, barite, anhydrite, gypsum, quartz, fluorite, pyrite, sphalerite, solid bitumen). Whereas these mineralizations are volumetrically insignificant, they provide critical fingerprints on the nature of the late diagenetic processes. Post-corrosion carbonate cements are rare (saddle dolomite, pokilotropic calcite). These late paragenetic associations are not limited to reservoir units and have a marked regional character. Selective analysis of stable isotopic ratios and fluid inclusions of the late cements support the involvement of hot fluids with variable salinities. The nature of the corrosive fluids could be related to mixing corrosion in relation to highly-evolved, deep-seated aquifers or to the roll-front of migrating hydrocarbons.
Of critical importance is to evaluate the amount or extent of early porosity preserved at the time of the late porosity generation in burial environments. The absence or rarity of demonstrable primary or early secondary porosity could be related to the intense late enhancement or to limitations of core recovery. In the case of complete destruction of early porosity, late porosity development will be exclusively controlled by a network of faults, fractures, horizons of pressure dissolution, unconformities or any rock discontinuities present at the time of generation of corrosive fluids. Depositional facies will play a minor role (except for shaly carbonates and evaporites). In the case of preserved or inherited early porosity, it is expected that late porosity will be preferentially controlled by depositional facies and geometries (in addition of the late structural control).

The evaluation of the relative importance of the late, deep-burial diagenesis in the present-day reservoir properties is proposed as an important element in the exploration and development of carbonate reservoirs. Integrated basin analysis, including late fluid/rock interactions and fluid migration models, could assist in highlighting areas of potential reservoir improvement by late corrosion in carbonate reservoirs.