
Porosity Destruction in Carbonate Platforms

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The important thing to understand about carbonate diagenesis is not necessarily how porosity is created, but how it is destroyed. Detailed core observations from two deeply-buried carbonate platforms (Finnmark platform, offshore north Norway, and Khuff Formation, offshore Iran) show that most vertical porosity variation can be accounted for by only two or three factors, including: (1) stylolite frequency, (2) proportion of argillaceous beds, and (3) anhydrite cement. The spatial distribution of these factors is determined by the depositional distribution of clay minerals (important for localizing chemical compaction) and the occurrence of hypersaline depositional conditions and associated brine reflux (important for localizing anhydrite precipitation). However, the intensity of chemical compaction and consequent porosity loss in adjacent beds by carbonate cementation also depend upon thermal exposure (temperature as a function of time). To the extent that the Finnmark and Khuff platforms may be regarded as representative of carbonate reservoirs in general, recognition of the above porosity-controlling factors can provide the basis for general models predicting carbonate reservoir potential at both reservoir and exploration scale. Distributions of clay and anhydrite should be predictable from stratigraphic architecture, whereas variations in thermal exposure can be mapped from basin analysis. In the present examples, factors that do not need to be considered include eogenetic carbonate cementation and dissolution, depositional facies (other than aspects related to clay and anhydrite content), and mesogenetic leaching to create late secondary porosity.
