ervoir rocks with either depositional or diagenetic porosity. Diagenetic reservoir porosity may originate before or after the establishment of an effective diagenetic seal. Hydrocarbon traps with diagenetic seals may conform in their geometry as well to structure or stratigraphy as to diagenetic facies. Therefore, some structural and stratigraphic traps may, in part or entirely, depend on diagenetic seals.

An example of such sealing is the Recinus Cardium "A" pool. In this field, lateral, top, and bottom sands have formed as a result of mesogenetic cementation at the margins of the sand body. The limiting injection pressure in these seals is approximately 550 psi (3,790 kPa) (mercury against air), which translates to a pore throat radius of 0.195 microns. This seal could effectively withstand a hydrocarbon-water injection pressure of 51 psi (352 kPa), which represents a trapped hydrocarbon column of between 200 and 500 ft (61 and 92 m). This clearly indicates that diagenetic seals can be tremendously effective.

Detailed analysis of diagenetic seals in sandstones and carbonate rocks can considerably improve our ability to predict their occurrence and to recognize their spatial and temporal relationship to reservoir rocks and hydrocarbon migration.

SCHOELL, MARTIN, Bundesanstalt für Geowissenschaften und Rohstoffe, Hannover, Federal Republic of Germany

Genetic Characterization of Natural Gases

An empirical model is presented in which the origin of most natural gases can be deduced from compositional variations in the gases.

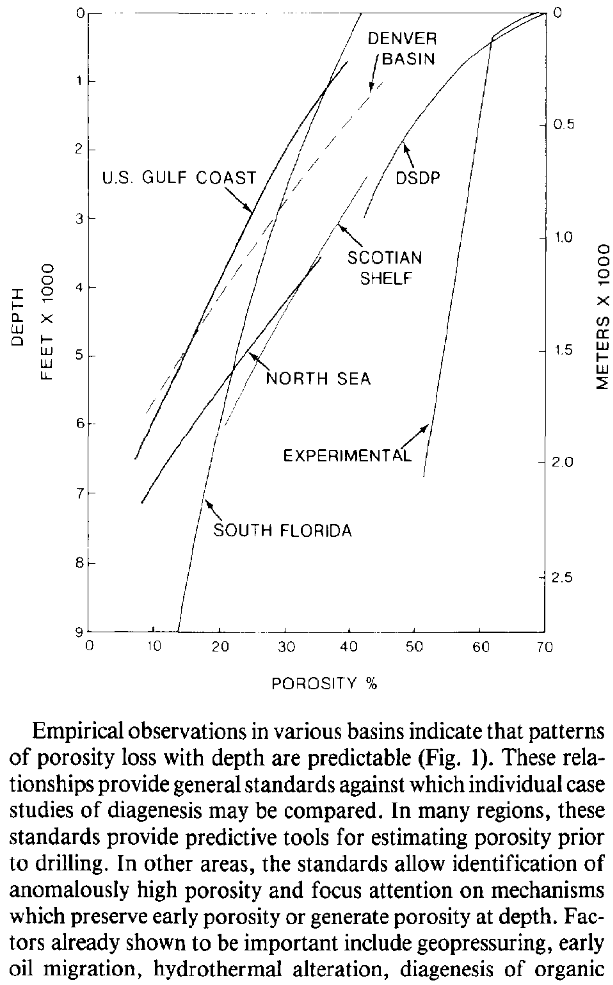
The genetic characterization is performed using the C_{2+} composition of the gases, the ^{13}C concentration in methane ($\delta^{13}C_1$) and ethane ($\delta^{13}C_2$), as well as the deuterium concentration in methane δD. Three diagrams are designed in which C_{2+}, $\delta^{13}D$, and $\delta^{13}C_2$ are plotted versus $\delta^{13}C_1$. In these three diagrams, compositional fields can be defined for primary gases, i.e., those gases for which compositional changes are due to processes occurring during their formation (biogenic and thermogenic associated and nonassociated gases, respectively). Secondary gases result from mixing processes after formation of gases. The variability of natural gases can be described by (and reduced to) predominantly various mixing processes of primary gases. Two types of migration of gases can be recognized: shallow migration where thermogenic gases are stripped of C_{2+} or become mixed with biogenic gases, and deep migration where deep dry gases become mixed with gases from more immature sources. Case histories will be presented to demonstrate the applicability of the model.

SCHOLLE, P. A.. and R. B. HALLEY, U.S. Geol. Survey, Denver, CO

Burial Diagenesis in Carbonate Rocks

Burial diagenesis, those changes in rock composition, mineralogy, and texture which occur below the zone of near-surface water circulation, generally becomes the dominant control on rock porosity at depths below a few hundred meters. Experimental, observational, and geochemical data show that porosity loss through burial diagenesis results from both physical and chemical compaction. In near-surface sections, dewatering, grain reorientation, grain breakage, and other mechanical processes lead to sediment/rock porosities as low as 30%. Continued porosity loss requires a combination of mechanical compaction, chemical dissolution at grain contacts and along solution seams, and reprecipitation as intergranular cement. Through these mechanisms carbonate rock porosity may be reduced to values near zero in "semi-closed" systems without significant introduction of allochthonous cementing material. Therefore, cementation may occur in systems where the only fluid movement is water expulsion.

Significant rates of noncompactional fluid flow increase the likelihood of cementation and make the identification of cements more complex. Such cements may be deposited by hydrothermal, artesian, or thermally convective fluids. Current research suggests that a combination of geochemical and petrographic criteria may eventually serve to distinguish cements of various origins.



Empirical observations in various basins indicate that patterns of porosity loss with depth are predictable (Fig. 1). These relationships provide general standards against which individual case studies of diagenesis may be compared. In many regions, these standards provide predictive tools for estimating porosity prior to drilling. In other areas, the standards allow identification of anomalously high porosity and focus attention on mechanisms which preserve early porosity or generate porosity at depth. Factors already shown to be important include geopressuring, early oil migration, hydrothermal alteration, diagenesis of organic matter, and dolomitization. Comparisions of oil field porosities with standard curves allow us to refine our basic understanding of diagenesis as well as our ability to predict reservoir quality.

SETTLE, MARK, NASA, Washington, D.C., and JAMES V. TARANIK, Univ. Nevada, Reno, NV

Current Research in Geological Applications of Remote Sensing Techniques and Implications for Petroleum Geology

Exploration geologists have made extensive use of aerial photography and orbital Landsat imagery, primarily for purposes of structural mapping. The Landsat 4 spacecraft launched in July 1982 is carrying a new imaging instrument called the Thematic Mapper which represents a significant advance over earlier Landsat sensors. The Thematic Mapper possesses improved