

Applied Sandstone Diagenesis - Practical Petrographic Solutions for a Variety of Common Exploration, Development and Production Problems

by S.A. Stonecipher, 2000; SEPM (Society for Sedimentary Geology) Short Course Notes #50, 1741 E. 71st Street, Tulsa, OK 74136-5108; 143 pages, softbound; \$63 (\$45 for SEPM members); ISBN 1-56576-074-3

“Applied Sandstones Diagenesis...” is organized as five case studies (as separate chapters) in which standard petrographic techniques (thin section, SEM, XRD) are applied to problems in exploration and production of oil and gas. Chapters are self-contained and include separate reference lists. The volume is well illustrated with numerous black and white line drawings, thin section pictures, and scanning electron micrographs. Some of the thin section photos would show many more features, if reproduced in color. Generally, the text is clearly written, although it could have benefited from some further editing to remove a few syntax and grammatical errors.

There is strong emphasis throughout the book on the influence of sedimentary facies and sequence stratigraphy on early diagenesis. In contrast, there is relatively little coverage of such topics as deep-burial diagenesis, clay mineral and fluid inclusion geothermometry, and predictive, quantitative models for cementation and porosity loss. Chapter 1, “Basic diagenetic facies models”, explores diverse diagenetic facies developed in delta plain, shore line, and delta front deposits of the Wilcox Formation (Texas Gulf Coast). Influences of facies-related variables (such as sediment composition, texture, and pore water chemistry) on diagenetic facies are covered in detail. In Chapter 2, “Sequence stratigraphy and diagenetic facies”, Stonecipher cites the Second Frontier Formation, Moxa Arch, Wyoming as an example of where markedly different diagenetic facies are developed in low-stand, valley fill and high stand fluvial deposits. She makes the interesting point that while the basal parts of incised valleys are typically braided stream or fluvio-estuarine deposits, they exhibit the diagenetic signatures of marine pore waters. On the other hand, high-stand fluvial deposits typically exhibit a meteoric diagenetic signature, according to the author. This leads to the suggestion that diagenetic features can be used to resolve ambiguities in sequence stratigraphic interpretation. Chapter 3,

entitled “Diagenetic overprints – unconformities”, documents the development of authigenic kaolinite, mosaic calcite, and enhanced reservoir quality below an unconformity developed on the Lower Cretaceous Greensand Group of the North Celtic Sea. Chapter 4 addresses how diagenesis relates to formation damage and well stimulation. Well-known damage mechanisms, such as migration and bridging by kaolinite particles and acid sensitivity of Fe-chlorite, are detailed, and remedies and treatments are discussed. Of special interest is the discussion of Pliocene turbidite reservoirs at Ewing Bank 873 (flextrend, Gulf of Mexico). These reservoirs contain variable amounts of the Na-zeolite mineral, clinoptilolite, which is common in other Gulf of Mexico, Tertiary sandstones. Clinoptilolite is soft and ductile. Where the mineral is abundant, its deformation through pressure depletion is associated with marked sandstone compaction and fines migration with consequent loss of permeability. A series of core flow experiments led to the development of an effective acid treatment for clinoptilolite, which was successfully implemented in the field. Chapter 5, entitled “Cautions about using core analysis data: The St. Peter Sandstone, Michigan Basin”, is a discussion about the impact of diagenetic facies on wettability and relative permeability. The volume concludes with a discussion on how to get maximum value from contract-service laboratories (Chapter 6).

I would recommend the book to exploration and development geologists in the oil and gas industry, and also to specialists in diagenesis and reservoir quality prediction. Parts will be of interest to reservoir and production engineers (especially Chapter 4 on “Diagenetic facies and formation damage”).

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