Linking Diagenesis to Sequence Stratigraphy: A Better Approach to Unravel and Predict Reservoir-Quality Evolution of Sandstones

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Linking diagenesis and sequence stratigraphy is proposed here for better elucidation and prediction of the reservoir quality of paralic and shallow-marine sandstones. The employment of this approach is possible because parameters, which are relevant for post-depositional alterations of reservoir quality of sandstones, can be obtained from sequence stratigraphic analyses, i.e. changes in the rates of relative sea level changes and sediment supply. These parameters include: (i) pore-water chemistry (marine, meteoric and brackish), (ii) detrital composition, particularly regarding the proportion of intra-basinal grains (e.g., mud intraclasts, bioclasts, and glaucony), (iii) residence time of sediments under certain geochemical conditions, (iv) amounts and types of organic matter, and (v) degree of bioturbation. Establishment of the links between diagenesis and sequence stratigraphy will thus enhance the assessment and prediction of the spatial and temporal distribution, volume, texture, and composition of the near-surface diagenetic alterations within: (i) lowstand, transgressive, highstand and falling-stage (forced regressive wedge) systems tracts, and (ii) in the vicinity of key sequence stratigraphic surfaces that include marine-flooding surfaces (i.e., parasequence boundaries), transgressive surfaces, maximum-flooding surfaces , and sequence boundaries, because these surfaces record rapid changes in the relative sea level, and hence marked changes in the five parameters outlined above. These near-surface diagenetic alterations will constrain, and thus allow the prediction of reservoir quality evolution pathways of deeply buried sandstones, such as tight gas reservoirs. Integrating diagenesis into sequence stratigraphy can, in some cases, aid stratigraphic correlation and the recognition of major sequence stratigraphic surfaces and eventually systems tracts.