Role of genetic/sedimentological concept in quantitative reservoir modeling and rock physics analysis

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Recent dramatic development of 3D seismic technology enables to obtain realistic subsurface geologic data, including reservoir distributions and reservoir properties, by means of rock physics analysis and modeling technique. It is expected that linking this technology to sedimentological concept and methods such as depositional systems and sequence stratigraphy leads to realistic and efficient solutions in reservoir distribution and property analysis, since such genetic process-related geologic information provides geologic constraints and a guideline for appropriate interpretation and evaluation.

This paper attempts to discuss the role of genetic/sedimentological information in quantitative reservoir modeling and rock physical analysis, and to propose integrated study methods of sedimentology-hosted reservoir characterization works.

Recent sedimentological concepts seek more genetic viewpoint than descriptive works, which was the old standard until twenty years ago. The concepts of sequence stratigraphy, depositional system and sedimentary facies are categorized into the newly developed sedimentological concepts based on the genesis and origin of sediments. Sequence stratigraphy is defined as a study of rock relationships within a chronostratigraphic framework of genetic and repetitive strata, bounded by unconformities and correlative conformities. Sequence stratigraphy provides genetically related basin-wide time surface information, which is useful in rock physical analysis and reservoir characterization works as the basic stratigraphic framework. Depositional sequence, which is the basic stratigraphic unit in sequence stratigraphy, comprises depositional systems, which correspond to a specific sedimentary environment package related to sedimentological and geographical aspects, such as submarine fan, delta, river, and alluvial fan systems. Each depositional system consists of own assemblages of sedimentary facies; e.g., a delta system consists of muddy delta plain facies, sandy delta front facies and silty prodelta facies. Therefore, depositional system provides important information on lithology and rock properties. Applying the concepts of depositional systems and sedimentary facies to rock physics and reservoir property analysis helps understand validity of results, accordingly.

As effective and efficient reservoir characterization works, it is recommended that sequence stratigraphic framework should be constructed before starting quantitative reservoir modeling, since it provides basic information of depositional surface and setting information. In parallel to actual reservoir characterization works, such depositional system and sedimentary facies information can be constraints for selecting parameters and evaluation of results.