3D seismic geomorphological analysis of sediment body: a new effective method of reservoir sedimentology

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Recent developments of 3D seismic and 3D visualization technologies have provided a strong impact on reservoir sedimentology in petroleum exploration and development, in terms of analytical methodology and concepts. 3D seismic technology enables us to obtain detailed three-dimensional views of sediment body morphology and depositional surfaces, such as fluvial channels, incised valleys, deep-sea channels, slope failures, submarine fans, carbonate reefs and sequence boundary surfaces, which we have estimated before using 1D or 2D data. This dramatic development of paleoenvironmental visualization technique resulted in the new research field 'seismic geomorphology' or 'seismic sedimentology' as an integrated concept of 3D seismic technology, sedimentology and sequence stratigraphy. The concept and methods of seismic geomorphology have been widely applied not only for three-dimensional depositional process analysis but also for quantitative reservoir characterization such as volumetric analysis and geostatistical simulation.

Recent seismic geomorphological analyses can be categorized into studies on fluvial systems and studies on submarine fan systems. The remarkable achievement of the submarine fan studies includes very clear images of detailed three-dimensional structures of each depositional element, which we have interpreted before. For example, leveed channel tends to show meandering or braided morphology like a fluvial channel, rather than a straight plan form, and depositional lobes, or frontal splays, tend to show highly channelized patterns at the proximal part.

It is concluded that 3D seismic technology is indispensable for the future reservoir sedimentology, as an effective, efficient and precise tool of distribution and property analysis.