Positive Versus Negative Thickness: Implications toward Reservoir Navigation

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ABSTRACT

Thickness represents the distance between two stratigraphic interfaces, with common descriptions being perpendicular thickness (aka true stratigraphic thickness, TST, with obvious implications toward the stratigraphic and structural system) and vertical thickness (VT, of importance to hydrocarbon pay determination). Thickness is traditionally thought of as positive; however, considering vector components of measuring thickness, e.g., in the direction of drilling a deviated wellbore, yields mathematical domains of positive and negative thickness. Practically speaking positive thickness indicates measurement or drilling downsection, whereas negative thickness indicates measurement upsection, with zero thickness parallel to bedding. While depth logs (measured depth, MD, and true vertical depth, TVD) represent the industry standard for presentation and correlation purposes, subtle variations in wellbore versus bedding orientations can yield significant variations in magnitude or even sign of depth versus thickness. For example, an actual fining-upward sequence can appear like a coarsening-upward sequence on the depth logs, or one can be drilling downward but exit the target upsection into roof strata. Integration of dip data, including from real-time image log analysis, with standard depth logs allows for quantitative full log conversion to VT and TST logs and thus improved insight into stratigraphic/structural positioning during drilling. Negative thickness logs are generated when wellbore survey and dip analysis indicates drilling upsection. Other interface orientations and distances, such as fault offset, fracture spacing, and fluid contact position, can treated in a similar manner as thickness. For example, fault separation parameters simply measure the distance (or thickness) between offset interfaces. In particular, subseismic faults often cause rapid stratigraphic position changes, to the point where reservoir exit may occur, but can be characterized by real-time image log analysis. Collective monitoring of various aspects allows for appropriate course changes to be made as necessary to satisfy overall well objectives and constraints.

Willis, J., 2010, Positive versus negative thickness: Implications toward reservoir navigation: Gulf Coast Association of Geological Societies Transactions, v. 60, p. 845.

AAPG Search and Discovery Article #90117©2010 GCAGS-GC SEPM Meeting, San Antonio, Texas, 10-12 October 2010.