Sonic Imaging Advances to Further Geological Interpretation

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ABSTRACT

In its simplest form, sonic logging provides a cost-efficient means to extract formation interval transit times so to generate a high-resolution velocity profile of the logged intervals. Using various empirical and experimentally-derived observations, lithological information such as porosity can be calculated. More recently, Hornby (1989) documented the use of borehole acoustic reflection data for high-resolution imaging. This is accomplished by processing acoustic data leveraging a workflow like the one used in surface seismic imaging. The output of such processing sequence is a set of images projected into a plane extending from the well enabling the interpretation of features of interest.

A recently developed processing technique (Bennett, 2018) uses a three-dimensional slowness time coherence (3D STC) approach to detect and characterize features in terms of direction and distance away from the well. When combined with knowledge of well trajectory, dip, azimuth and position of those reflectors is determined unambiguously. Such information can then be directly combined with other earth model data and used to further the interpretation or model building workflows.

It is worth noting that this technique also provides an aid to migration parameters selection to best capture features of interest as it does not rely on any a priori.

We offer examples where bed boundaries and fractures visible on borehole images are compared with reflectors identified using the newly developed sonic imaging technique. We show the sonic imaging results match the wellbore images. Furthermore, we show how these features extend away from the logged wellbore; thus, demonstrating the complementarity of the resistivity-based 'imaging' and sonic-derived imaging approaches.

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