Evaluating Textural Changes and Bedding Characteristics Within Clastic Environments Using Electrical Borehole Images.

S. M. Hansen and B. M. Newberry; Schlumberger Oilfield Services

Electrical borehole images have been utilized to evaluate clastic environments for over 15 years. During this period an interpreter has classified textural changes only as visual features and all bedding characteristics manually. Now two new semi-automatic products have been developed to capture high-resolution textural information from electrical borehole images, and characterize the bedding into bed thickness and bedding trends. These products will add attributes to image analysis that can supplant verbal descriptions of clastic textures. The first method, SandTex, analyzes the total image spectrum in a 1-in. interval around the well bore. An electrical heterogeneity index is calculated from the percentile resistivity distribution of the image spectrum. This resistivity spectrum can be divided into a well-sorted portion and the fractions that are either more resistive or conductive. The resistivities of these three fractions can then all be calculated. The second method, SandCount, is divided into two sections. The first section calculates the percentages of a simple one cutoff sand/shale model up to a 4 cutoff sand, silt, shale, tight, and wet sand model based on cutoffs applied to a calibrated image output. The second section is used to calculate bedding density and thickness from three different inputs. The bedding characteristics are computed from 1) the cutoffs listed above, 2) the inflection point on a squared high resolution resistivity curve or 3) from a dip set computed with an automatic dip computation algorithm. These outputs, heterogeneity-index, fractional resistivities, variability, along with bedding measurements and associated open hole log data, can be combined to compute a facies description that captures the textural content of these clastic environments. This high-resolution analysis can be used to verify the variations seen in nuclear magnetic permeability and relative pore sizes in a more precise geological context. By extracting pertinent information from electrical images, this technique makes image logs more accessible for use in petrophysical as well as geological analyses.