

Reservoir Applications of Electrical and Acoustic Borehole Images in Southeastern Mexico: New techniques to Evaluate Secondary Porosity and Estimate Net-to-Gross

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Borehole images enable core-like description of the subsurface reservoirs. They are ideal to characterize the distribution of vugs and fractures in rocks with negligible proportions of matrix porosity. Such characterization helps enhance accuracy in estimating reserves and modeling fluid flow that improves the hydrocarbon recoverability from such petrophysically complex reservoirs.

Manual evaluation of fractures and vugs revealed by borehole images is subjective and slow. A software technique that uses object attributes to resolve vugs and fractures from other features is therefore needed. This paper reports development of such technique and its application to the oil and gas reservoirs of Southern Mexico. This interactive software achieves image sculpturing by using thresholding and filtering to define vugs and fractures and remove the other objects. Quantitative interpretation is presented as continuous depth plots of secondary porosity and fracture aperture, length, and density. The paper then reviews a software package that computes net-to-gross thickness in such reservoirs. It applies threshold techniques to borehole images that are calibrated with the open-hole logs. The software generates cumulative sand and pay counts versus depth.

Examples from different reservoirs in Mexico's Southeastern offshore fields are presented to demonstrate the success of the new applications using electrical and acoustic borehole images acquired by Halliburton in wells drilled by Pemex. These imaging-answer products provide important insight into the unique and vital geological information required for effective and efficient management of above mentioned reservoirs in Mexico.
