

# **New Technique to Estimate High Resolution Porosity and Permeability of Carbonate Reservoirs from Electrical Borehole Images: A Case Study from Offshore Southern Mexico**

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Electrical borehole image logs are well suited to characterize the pore space in reservoirs because the conductivity measured is essentially due to the fluids in the invaded pore space. Earlier investigations (Chitale et al, 2004, 2005) reported successful application of image logs in estimating the secondary porosity in carbonate reservoirs. Here we present a technique to estimate the total porosity and permeability of a carbonate reservoir from borehole images.

The new technique determines total-, secondary- and the micro-porosity from high resolution electrical images. Conductivity data from the imaging tool is averaged over a moving window, and a transform is constructed to equate the image data to porosity. Density-neutron-cross-plots and NMR log are respectively used to calibrate the conductivity image to total- and micro-porosities. Secondary porosity is checked by calibrating the image with sonic log. Permeability is estimated by applying the Jennings-Lucia model that correlates porosity, rock types and permeability. Carbonate rock type is obtained from cores, cuttings and local knowledge.

This paper presents the results of applying the new technique to two wells drilled by Pemex in the Campeche marina region of southern Mexico targeting the Brecha reservoir. Application of the new technique of estimating high resolution porosity and permeability from the image logs yielded the following benefits for Pemex: (1) enhanced accuracy in defining flow units for reservoir modeling and reserves estimation and (2) greater control in efficient exploitation of the Brecha reservoir including optimization of the completion plan.