AAPG International Conference: October 24-27, 2004; Cancun, Mexico

# Quantitative Evaluation of Metamorphic Reservoirs with Microresistivity Images: A Case Study of An Oilfield from China Land

***Da Li Wang***[1], *Jie Zhao*[2], *Yu Hua Wang*[2], *and Yu Xi Wang*[1]. *(1) Schlumberger, 4th Floor,Lido Office Tower, Beijing, 100004, China, phone: +86 10 64746699 ext.2290, fax: +86 10 64376784, wangdl@beijing.oilfield.slb.com, (2) Da Qing Oilfield, PetroChina, Da Qing, 163453, China*

Metamorphic rocks are normally associated with vug or fracture porosity, or both. Quantitative evaluation is critical to making informed reservoir developmental decisions. When secondary porosity is estimated through microresistivity images, the value of the cementation exponent, m, is difficult to confirm, and usually a constant number such as 2 is used. Use of a constant can lead to a significantly erroneous calculation of secondary porosity in some land oilfields of China.

This paper is a case study from an oilfield of PetroChina. The reservoir rock is metamorphic, with well-developed vugs and fractures. The most important parameter in this reservoir evaluation is an accurate count of secondary porosity, derived using petrophysical logs, cores and microresistivity images. However, it was difficult to select the two most important parameters required for processing and analysis, m, the cementation exponent in Archie's equation, and the threshold factor which is used to set up a cutoff for analysis of the porosity distribution and the secondary porosity quantification. Sensitivity analysis was carried out between m, threshold factor, and secondary porosity to understand their interdependency. It was found that the magnitude of secondary porosity had a strong and inverse correlation with m, while the relationship was weak and inverse with the threshold factor. The importance of determining the correct value for m was clear.

The paper proposes the equations based on published charts that correlate the cementation exponent with both fracture porosity and total porosity. Secondary porosity values were calculated using both a constant m value of 2 and the new equations. The secondary porosity values estimated using the constant were in a much lower range than expected. Calculations from the equations, however, gave estimates of secondary porosity that were much closer to reality, as confirmed by well tests.

This paper therefore presents a proven method of calculating secondary porosities in metamorphic reservoirs in China.