Title: Dealing with Unique Minerals in Petrophysical Logs

**Authors:** Munish Kumar1, Ryan Isaac Lazaroo2

1Singapore University of Social Sciences, 2 Nanyang Technological University

\*Corresponding author. Email: munishkumar001@suss.edu.sg

**Abstract:** Most petrophysical equations and methods are designed to deal with hydrocarbons found within common mineralogies, such as quartz and feldspars within sandstones or calcite and dolomite within limestones. Petrophysical tools and techniques are designed with said minerals in mind, but if a field is discovered that has unique mineralogies not typically seen by most log analysts, it becomes more challenging to determine an appropriate petrophysical evaluation process for such unconventional reservoirs. In this paper, we aim to discuss our learnings using two unique case studies. The first is a well which had intersected opalines, and logged with conventional modern “western style” tools. The second is a well which has intersected tuffs and volcanics and which was logged with older “Russian style” tools.

For opalines, we discuss the potential mineral signatures observed on the well log data and the reservoir potential of the rocks. We find that the unique microporous structure created by opal-CT microspheres/lepispheres, combined with either fracture or matrix-porosity dominant properties, potentially allows for storage of hydrocarbons within the rock. Hence, we hypothesize that opaline reservoirs could be classed as “Low Resistivity Low Contrast” (LRLC) pay and should not be glossed over just because typical hydrocarbon indicators are not seen.

For tuffs and volcanics, we first share some of the challenges faced and methods used in conducting modern petrophysical interpretation with data from older Russian-style logs. Again, we discuss the potential mineral signatures observed on the logs and look at properties such as pore throat radii, size, and mineral composition and how that affected reservoir potential. Our findings indicate that the distribution of pore sizes allowed for greater connectivity within the rock, where the pore geometry effects aided in low residual oil saturations.