

## Core Data and the MRIL\* Show A New Approach To " Formation Factor "

G. R. Coates, A. D. Howard, Numar Corporation

### Abstract:

A new wireline logging technology, the Magnetic Resonance Imaging Log ( MRIL\* ), is now available to the industry. The basic concepts, <sup>1,2,3</sup>the tool's measurements and the comparison of the MRIL, in select environments, to core data and other logs have previously been published. However, the wealth of information that this tool brings opens the way to changing many of the ways formation evaluation is done. This paper reports on one of these, a study which links the MRIL to a key petrophysical property, water saturation.

By using comparison to both core and conventional log data, it is shown how the MRIL measurement can be used to improve log derived water saturation values. This is accomplished by establishing a tie between the MRIL and an exponent relating the bulk-volume water (BVW) content and the formations resistivity properties.

As many other industry reports have shown<sup>4</sup>, the bulk resistivity of the formation is responding to the BVW and its conductivity. These properties are traditionally related through the Archie functions where the BVW is separated into two individual components, the porosity and the water saturation, each then being exponentially related to formation factor and saturation respectively.

Another option, also already in the literature<sup>5</sup>, relates the BVW to the rocks  $R_w/R_t$  ratio through use of a single exponent,  $w$ . This paper reports on an investigation of the opportunity presented by the MRIL to determine  $w$  using the measured bulk volume of irreducible water (MBVI), as well as the total porosity (MPHI), in hopes of improving log derived saturation results. Core based values of  $m$  and  $n$  are also converted to  $w$  for verification purposes. From this set of information a technique is proposed for refining the saturation determination process, as well as revealing a new way to examine a zone's irreducible saturation qualities.

Anyone dealing with saturation determination from well logs, especially in complex lithologies, should find these approaches useful.