LOG EVALUATION OF CLASTIC SHALY FORMATIONS USING CORRECTED RWA-RATIO TECHNIQUES

C. B. Dennis - ARCO Exploration Company
T. D. Lawrence - ARCO Exploration Company*

* presently employed by Dresser Atlas

ABSTRACT

This Rwa-Ratio technique compensates simultaneously for the effects of shaliness on porosity and resistivity. The shale correction factor which aids in defining the effective porosity limit of hydrocarbon production can also be used to determine the magnitude of these shale effects. The ability to select the water saturation exponent permits flexibility in formations with varying physical characteristics.

INTRODUCTION

This Rwa-Ratio interpretation technique augments existing clastic shaly formation well log analysis methods and provides reasonable results in formations with high shale content.

Three (3) primary factors determine the manner in which shaliness affects log responses:

1. Amount of shale (Vsh = bulk volume fraction)

2. Type of clay (Montmorillonite, Illite, Kaolinite, etc.)

3. Distribution of Clay (Laminar, Structural, Dispersed)

Numerous methods have been proposed for applying shale corrections to well logs (DeWitte, 1950; Poupon et al., 1954; Hossin, 1960; Alger et al., 1963; Simandoux, 1963; Patchett et al., 1967; Waxman and Smits, 1968; Fertl and Hammack, 1971; Poupon et al., 1971; Fertl, 1972; Waxman and Thomas, 1972; Clavier et al., 1977; Frost and Fertl, 1979; Rukhovets and Fertl, 1981). These shale corrections are applied to porosity logs to determine effective porosity. Resistivity log corrections compensate for the effects of conductive clays.

The proposed relationships have been tested for an extended period of time and compare favorably with other state-of-the-art methods while offering the additional flexibility of the selection of water saturation exponent. This testing against present state-of-the-art methods is the main proof of the validity of the techniques. The Simandoux-type water saturation expression that was used for comparison was derived from the following equation 16-13 of Schlumberger Principles 1972:

R