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Comparison of Conventional Log Interpretation with Neutron Spectroscopy Log and X-Ray Diffraction Laboratory Analysis: a Case Study

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Abstract

The Elemental Capture Spectroscopy (ECS) log measures the concentrations of a number of elements (Al, Ba, Ca, Cl, Cu, Fe, Gd, H, K, Mg, Na, Ni, Si, S, and Ti) in the formation by neutron capture spectroscopy. These are used to compute mass fractions of certain components of the formation (clay, quartz-feldspar-micas, coal and carbonate). This log was recorded in a cored well of a large field in a deltaic environment with a view to checking the routine interpretation model of triple-combo logs.

The ECS log data were first validated against X-Ray Diffraction (XRD) measurements on 231 samples from a 166-meter cored interval.

A standard shaly-sand interpretation was performed using conventional logs (triple-combo) with the assumption that shale is made up entirely of clay minerals. This interpretation model had been used in over 600 wells in this field. XRD laboratory analysis confirms what can be expected: the so-called 100% shale point in fact consists of a lower clay fraction, 57% in our case. This is also consistent with the ECS log. An “adjusted interpretation” was performed, moving the wet-clay point to reflect the 57% clay fraction in shale. A third interpretation was performed using ECS clay fraction directly into the interpretation model. The question to be addressed was: “how are net-pay and hydrocarbon-pore-volume values affected by the change of interpretation parameters and the addition of the ECS log to the logging suite?”

The main result is that there is no significant difference between net-pay and hydrocarbon-pore-volume values obtained from the standard interpretation (using conventional logs), the “adjusted interpretation” (moving the wet-clay point to reflect the XRD clay fraction in shale), and the new interpretation (integrating the ECS log in the interpretation model). Based on these findings, it was concluded (1) that there is no need to re-interpret logs in all the wells using the new wet-clay point and (2) that the ECS log should not be recorded on a routine basis in this field.