Identify Potential Low-Resistivity Pay Using Visual Rock Analysis

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Although low-resistivity, low-contrast pay intervals have been recognized in the past, their economic significance has historically been overlooked. In the past, it was assumed that these intervals were either tight or water-bearing based on conventional wireline log evaluation. More recently, however, worldwide production and evaluation of these low-resistivity intervals has created an awareness of their importance.

There are many rock attributes that contribute to false, low-resistivity log responses. These attributes are visible through a binocular microscope at 20X to 50X magnification in cuttings, sidewall cores, and whole core samples. The attributes are easily defined and quantified by visual rock analysis.

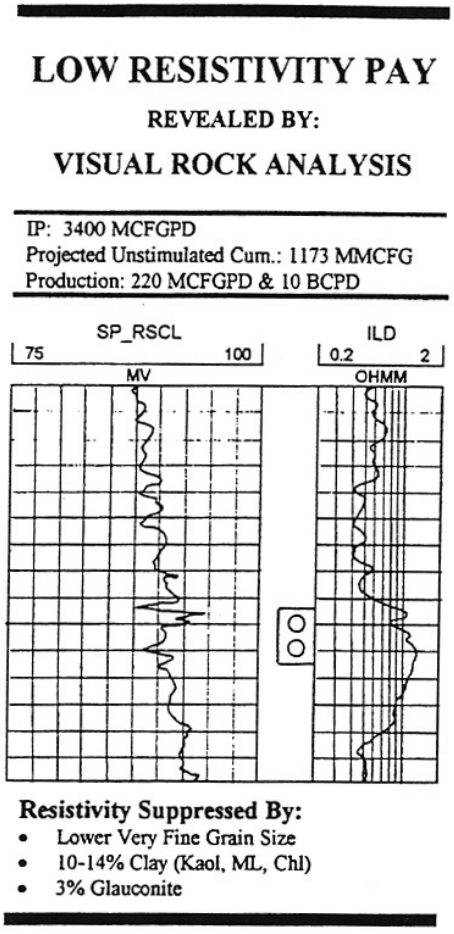
Understanding the causes of low-resistivity log response is essential when evaluating these subtle zones. Some of the more prevalent causes for misinterpreted low-resistivity zones are:

- interbedded or laminated sand/shale intervals,
- dispersed and structural clays,
- other conductive minerals such as pyrite, glauconite, and other members of the mica family,
- altered framework grains,
- finer grain sizes.

These geologic aspects of the rock cause erroneous low-resistivity readings because conventional wireline logging tools are unable to detect them. For instance:

- Interbedded or laminated sand/shale sequences are often too thin to be accurately modeled by wireline logging tools.
- Dispersed clays such as kaolinite, chlorite, illite, smectite, and mixed-layered clays pose problems for wireline logging tools because of their microporous nature. Conventional logging devices cannot differentiate the "bound" water in the microporous clay structure from the free water in the formation.
- Structural clay, or grain-sized fragments of shale and claystone, may lower the resistivity response of the wireline log if present in sufficient quantities.
- Conductive minerals, such as pyrite and the mica family, will cause a low-resistivity response. Glauconite and other micas also contain bound water in their micropores, further reducing the resistivity response.
- Altered framework grains, such as feldspar and igneous or metamorphic rock fragments, will resemble shale in their log responses, thereby causing a misinterpretation of the conventional wireline log.
- A thin film of water adheres to individual sand grains. The finer the grain size, the greater the surface area; and the greater the amount of bound water. This lowers the resistivity response.

Many currently producing low-resistivity, low-contrast zones were completed solely on the basis of a mudlog show. However, all of the geologic causes for false low-resistivity readings discussed above are visible features of the rock formation that can be identified through detailed rock analysis. This cost-effective analysis can provide additional confirmation of the potential for low-resistivity pay, thereby reducing the risk of bypassed pay.



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