Specific Productivity Index From Nuclear Magnetic Resonance and Production Logging: an Innovative Way to Address Production Optimization and Reservoir Modeling Issues

Marco Pirrone

LPS Evening Lecture, The Geological Society

Tuesday, 5th September

Conventional formation evaluation consists of petrophysical properties estimation and, possibly, log-facies classification by means of dedicated open-hole well log interpretation and modeling. The static formation evaluation outputs lack a direct and robust link with the actual dynamic behavior of the fluid flow in the porous medium they are describing. A simultaneous quantitative static and dynamic characterization at well location is a long-standing open problem to address production optimization issues and to produce a comprehensive and accurate reservoir model.

This talk deals with a novel approach for a static and dynamic petrophysical characterization that integrates special core analyses, nuclear magnetic resonance (NMR) log and multi-rate production logging tool (PLT) interpretation. The methodology provides an innovative log-facies classification and characterization that can be used to predict well performances.

The workflow is presented by means of a study performed on several wells intercepting an oil-bearing carbonate reservoir. In details, core-calibrated porosity partition and permeability from NMR represent the input for a multivariate statistical technique used to produce a log-facies classification with an inherent dynamic meaning. The actual dynamic characterization of the facies is established by the corresponding specific productivity index from multi-rate PLT analysis. Two wells used as blind tests demonstrate the reliability of the proposed workflow with respect to its prediction capability of oil production, even in a multi-layer scenario with different pressure regimes.

Although various approaches exist to qualitatively link static and dynamic properties at well location, the presented quantitative methodology allows an important step towards a real integrated petrophysical characterization. It represents a production optimization purposes driver and a fast and accurate tool to joint distribute static and dynamic properties in reservoir modeling.
BIOGRAPHY:
Marco Pirrone is a Production Petrophysicist at Eni and he has been with the company since 2009. He specializes in dielectric dispersion log analysis, rock physics modeling, nuclear magnetic resonance in porous media, cased-hole formation evaluation and production logging. Marco has authored or co-authored more than 15 technical papers. He holds a MSc degree in Physics and a PhD in Theoretical Physics from the University of Milano-Bicocca, Italy.