UR27

An Integrated Method for the Lithological Characterization of an Unconventional Oil Formation and its Impact on the Porous System

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Summary

The concept of an unconventional reservoir proposes to change the perspective of the rock, not only as a generator, but also a reservoir rock, this makes to focus on important characteristics as porosity and diagenesis.

The deposit models of carbonates lost definition in depth sea levels environments because of the minimum variation in their slope, however if it is possible to analyze in detail the allochemicals and orthochemicals components, the deposit environment could be interpreted. This interpretation gives the results of the impact of environment on rock texture, and how the texture improves or reduces porosity.

In order to determine the main lithologic characteristics and its relation with the porosity, were used 51 thin section, 15 sample with XRD-SEM-TOC acquired of 40 cores with a total of 27 wells at the study area. The description of the core samples were made megascopically to select systematically fragments that represent the main intervals in each core samples, and thus select samples for special studies and thin sections.

All the determinate characteristics are related to the data measured in well logs and are useful to determine best quality levels in the play.

Introduction

The present work deals with a multidisciplinary analysis applied for the lithological characterization and evaluation of the lithological control over the porous system of an Upper Jurassic formation in a Mexican basin. Based on this analysis, the units that compose this formation have been hierarchized in terms of reservoir quality.

Method and / or Theory

An integrated approach has been designed and applied in this study for the lithological characterization of this Upper Jurassic formation. In order to get an acceptable characterization 40 cores of 27 wells were studied in this project from which 51 thin sections were analyzed and 15 samples were studied for XRD-SEM-TOC analysis. As a result, this formation is made up of intercalations of thin bedded bioclastic limestones and bituminous limestones with sparse thin beds and laminae of bituminous shales, silty-rich shales, bentonite and chert. As a result of the laboratory analysis, well log interpretation and log description of core and cutting samples, 17 microfacies were identified in this formation. Particularly, five microfacies are rich in allochemical grains forming carbonate rocks ranging from wackestone to packstone. Based on this sedimentological analysis paleoenviromental maps and models were constructed for each subdivision of this formation. As a result, the paleoenvironments interpreted in this area range from external ramp to basin.

As a part of the petrographic analysis, several diagenetic processes were identified and typified in these rocks. So, the most important diagenetic processes that enhance the porosity in these rocks are dolomitization, corrosion and microfacturing. Particularly, these processes occur selectively over some specific horizons and within some specific areas. In general, this formation shows a range of effective porosity from 3 to 7%. The porosity types recognized, measured and characterized in these rocks are interparticle, intraparticle, dissolution and intercrystalline. However, the main porosities within these reservoir horizons are interparticle and intraparticle.
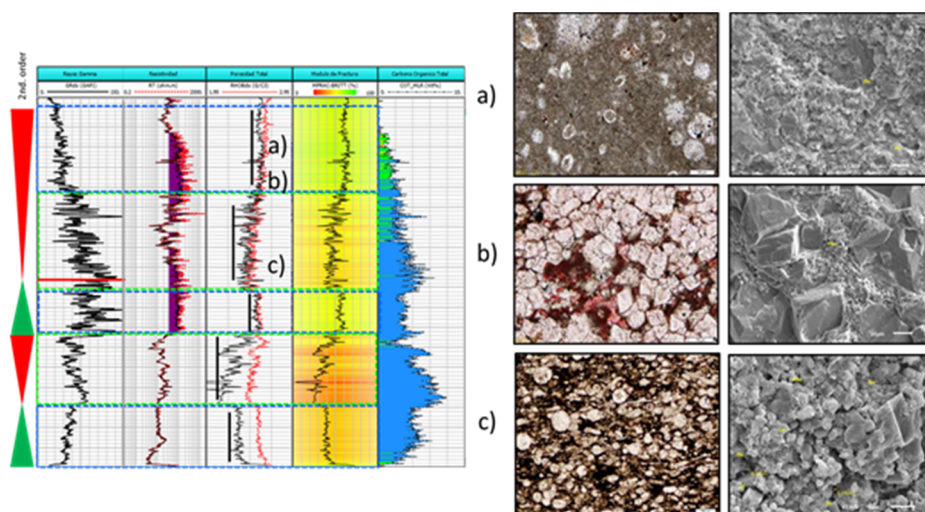

Figure 1 *Well logs that evidence the vertical lithological variation in this Upper Jurassic formation and the photomicrographs that show some of the most representative microfacies.*
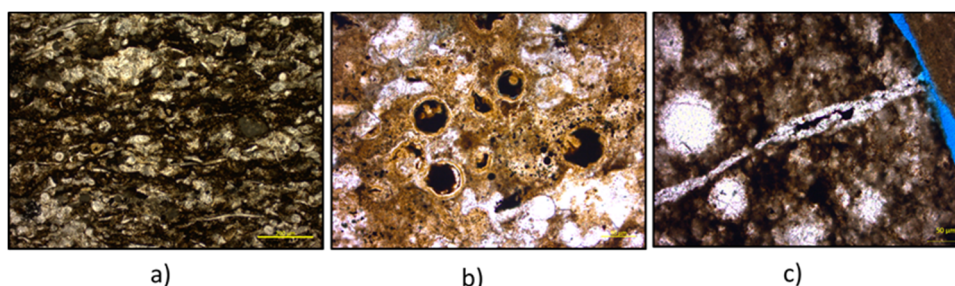
Figure 2 *Photomicrographs that show some of the porosity-types identified in these rocks. a) Interparticle, b) Intraparticle porosity and c) Micro fracture porosity filled by oil.*

Conclusions

1.- Facies is a conditioner in the occurrence of diagenetic processes and at the same time both control the porous system in this type of unconventional oil reservoirs,

2.- The most important porosity types within these reservoir horizons are interparticle and intraparticle,

3.- The abundance of allochemical grains in these carbonate rocks impacts positively in the increase of porosity,

4.- The diagenetic processes that improve the porosity of the studied rocks are dolomitization, dissolution and micro fracturing,

5.- It was confirmed that dark-colored carbonate rocks are organic rich and display high TOC values.

6.- The mineralogical XRD analysis reveals that these sequences are predominantly carbonate (60-70%) with a low proportion of clay minerals (<7%).

7.- SEM images were very useful for the identification and characterization of the dissolution and intercrystalline porosity.

Acknowledgments