UR05

Preservation Index of Organic Matter From Illite / Smectite (R3) Relationship

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Summary

There are factors that directly affect organic matter (OM) evolution; such as sedimentation, burial, organic productivity, oxygen saturation in water column and sediments, ocean circulation, sediment particle size and sedimentation rate. (Emerson & Hedges, 2003; Meyers, 1997).
However, there is another factor that has not been considered which is directly related to OM adsorption in clays (Illite/Smectite I/S). I/S is a determining factor for OM preservation (Heges & Keil, 1995).
We analyzed X-ray diffraction, SEM, Rock Eval and Biomarker data in two formations with clay content belonging to the Upper Cretaceous and Upper Jurassic. A correlation was observed between I/S vs TOC (%) and I/S (%) vs S2. Two mathematical models are proposed for each formation.
The results show that physicochemical water column conditions and OM depositional environment are not determinant factors to influence in OM preservation. OM responds to an adsorption process with I/S. Also I/S presence is altered by diagenetic processes which indirectly affect OM preservation.
The OM-IS analysis influences in volumetrics quantification, porosity and effective adsorption of methane gas (S. Chen et al., 2016; Shangbin C. et al.,2016). The evaluation with this criterion pretends to be a tool for potential and volumetries estimation in unconventional resources.

Introduction

In terms of preservation, many works show molecular affinity of organic matter (OM) with the mineral surface, being shown in clays of type Illite/Smectite (I/S) (Hongling *et al*, 2017) with ~5% of the total carbon (TC) being preserved in this way.
This has led the exploration works towards the OM preservation analysis in clays for unconventional resources.

Methods

Core samples were analyzed by Rock Eval 6 TOC, MINC (coal), CT, S1, S2, S3, HI, OI; Pristane/Phytane, hopanes, X-ray diffraction, Scanning Electron Microscopy (SEM), petrography, core description, Gamma ray and mineralogical logs (only Upper Jurassic) (PEMEX PEP).

Results

A linear trend was observed for TOC and S2 in Upper Cretaceous. Two equations were obtained by crossplot relationships I/S vs TOC, I/S vs S2 for Upper Cretaceous in this particular zone where the correlation coefficient varies slightly from R^2=0.83 and R^2=0.80 respectively (Figure 1). A comparative was performed to show the different factors that influence the OM adsortion.

In low TOC content zones, low primary productivity and anoxic-suboxic transition are not always observed, which probably indicate illitization.

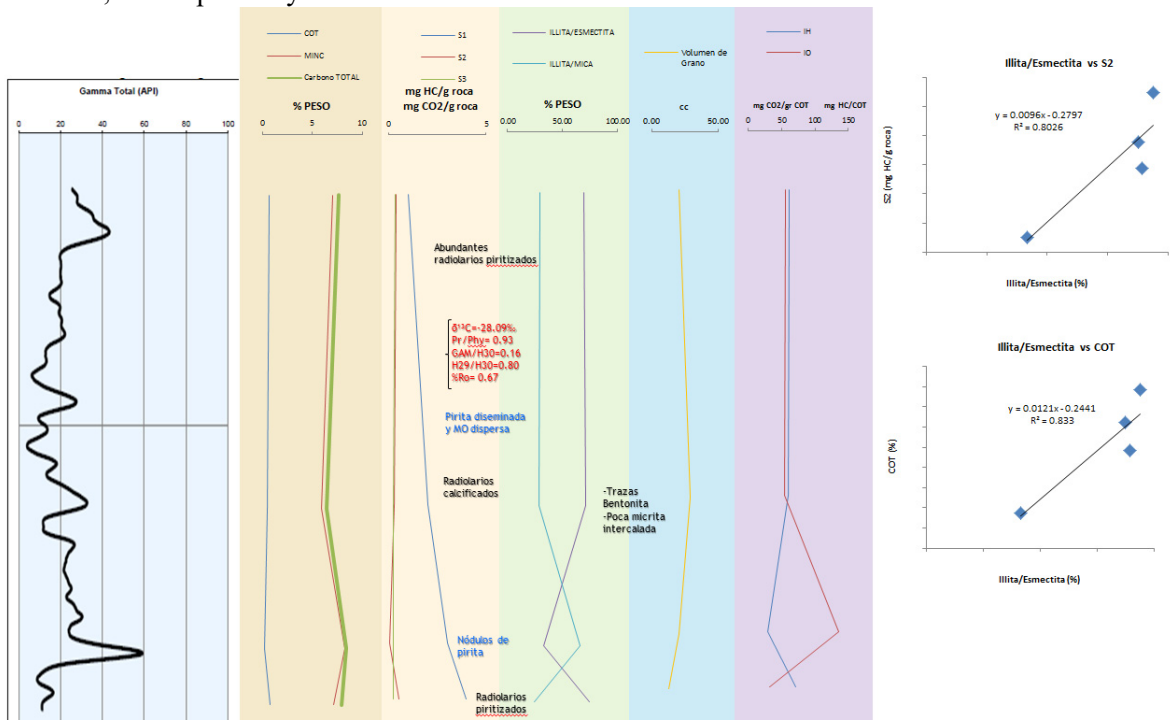

Figure 1 *Comparison of geochemical and mineralogical parameters (left) for Upper Cretaceous. Cross plots I/S vs TOC, S2 (right).*

For Upper Jurassic, two polynomial equations were obtained by crossplot relationship I/S vs TOC where the correlation coefficient again varies slightly showing the following values respectively R^2=0.88 and I/S vs S2 with R^2=0.86. In both parameters, two samples showed an inverse trend.
Sample 1, indicates an increase in salinity of the depositional environment as well as a continental contribution, possibly affected by diagenesis whereas In sample 2, dolomite crystals were observed, which indicates substitution of Fe for Mg (Fig.2) (Wilson M.J *et al*., 2016).

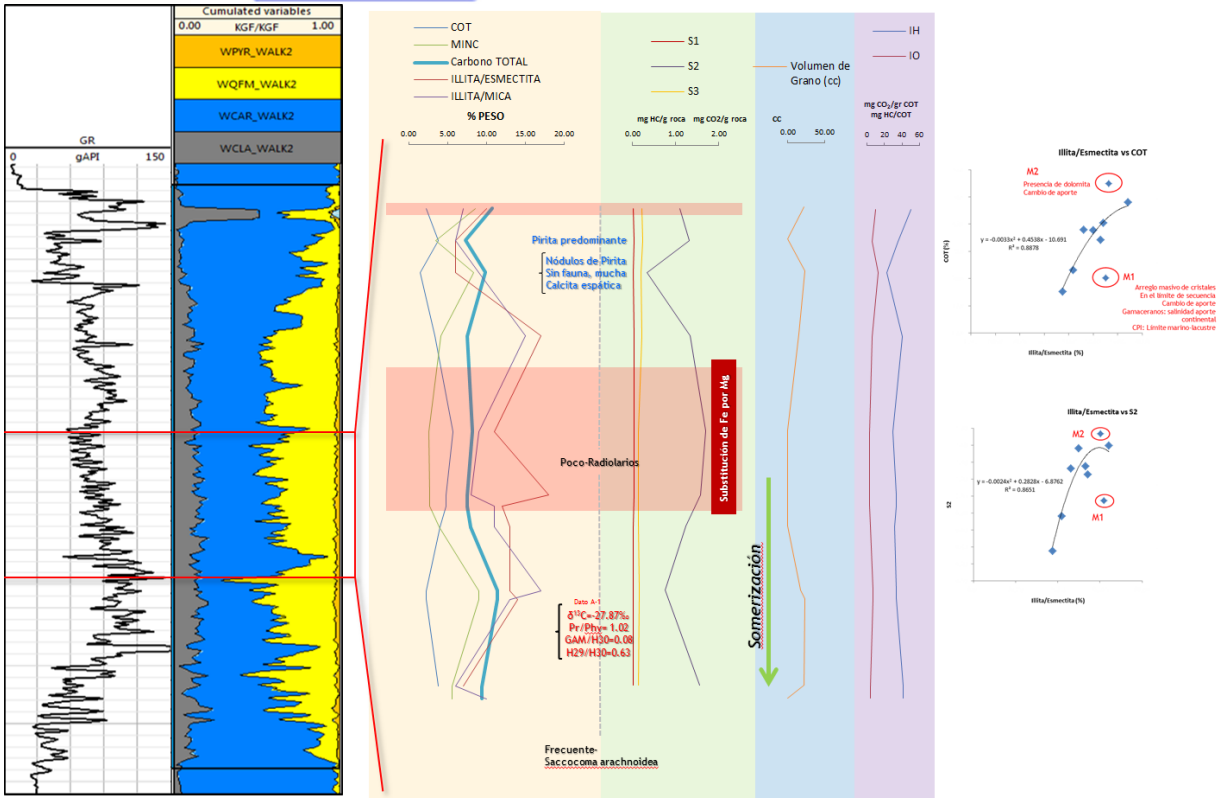

Figure 2. *Comparison of geochemical and mineralogical parameters (left) for Upper Jurassic. Cross plots I/S vs TOC, S2 (right).*

Conclusions

There are two linear crossplot relationships between I/S vs TOC, S2 for Upper Cretaceous and two polynomial for Upper Jurassic. The OM preservation in both formations is favorable under adsorption scheme, which is affected by diagenetic and autogenic processes. The physicochemical conditions of depositional environment are not a determining factor for OM preservation in this area. The OM-I/S analysis give a new way in exploration due to the direct influence of porosity quantification, volumetric and the effective adsorption of methane gas (S. Chen *et al*., 2016, Shangbin C. *et al*. 2016).

References

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