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Research Article

PHYSICO-CHEMICAL PROPERTIES OF SILURIAN HOT SHALE IN AHNET BASIN, ALGERIA (CAS STUDY WELL ASS-1)

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ABSTRACT

The prediction of hot shale interval in Silurian formation in a well drilled vertically in Ahnet basin Is by logging Data (Resistivity, Gamma Ray, Sonic) with calculation of total organic carbon (TOC) using Δ log R Method.

The aim of this paper is to present Physico-chemical Properties of Hot Shale using IR spectroscopy and gas chromatography-mass spectrometry analysis, This mixture of measurements evaluation and characterisation show that the hot shale interval located in the lower of Silurian, the molecules adsorbed at the surface of shale sheet are significantly different from petroleum hydrocarbons this result are also supported with gas-liquid chromatography showed that the study extract is a hydroxypropyl.

Keywords: Physic-chemical Analysis, Reservoirs characterization, sweet window Evaluation, Silurian Shale, Ahnet Basin

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1. INTRODUCTION

Shale's are considered as source rock that can generate hydrocarbons along its burial history, in this present paper we will focus more on the potential interval determined by the instantaneous evaluation of shale reservoir [1]. The characterization of shale formation it is an integrated approach using different analytical techniques of geochemistry such mineralogical recognition of potential zones, Classification of free and adsorbed hydrocarbons.

Shale reservoirs are rarely studied in Algeria, except some syntheses report from Sonatrach searchers [2,3] cause before shale formation is considered as source rock and not a principal objective of drilling, and mostly we use a performed bit to drill this section in a record time.

Ahnet Basin located in the West-Central part of Southern Algeria., with area around 75.000Km2, this basin is far about 1200Km from capital, positioned between the following geographic coordinates:

Easting: 01° 00' – 03° 00'

Northing: 24° 00' – 27° 00'

Borded to the north by by the Tidikelt plateau, which separates it from the Timimoun basin Timimoun basin, in the west by Bled El Mass-Azzel-Matti axis, which distinguishes it from the Reggane Basin reggane basin, to the east the Idjerane-Arak axis which separates it from the Mouydir basin,in the south is limited by Hoggar Massif

The most wells drilled in Ahnet Basin, has traversed a series of Mesozoic formation deposits on discordance on Palaeozoic formations, The Paleozoic is represented by many formations from the bottom to the top [1]

- Combro-Ordovicien: predominatly sandstone, transparent to trancluc ide, quartzitic with fine layer of shale.
- Silurian: gray-black shale to black, indurated, micaceous, silty, slightly flaky, coaly and pyritic with rare intercalation of sandstone white to translucent, fine to medium, , moderately hard friable and white limestone, microcrystalline, moderately hard.
- Devonian: alternating sandstone with shale, passage of fin layer of limestone..

The Silurian thicknesses are particularly important with average of 600m

This study was aimed to providing a more systematic evaluation of the potential zone or

sweet spot window, and Mineralogical identification of potential interval, including physic-chemical analysis we can show some interesting information's related to hydrocarbon type trapped in shale formation both free or adsorbed

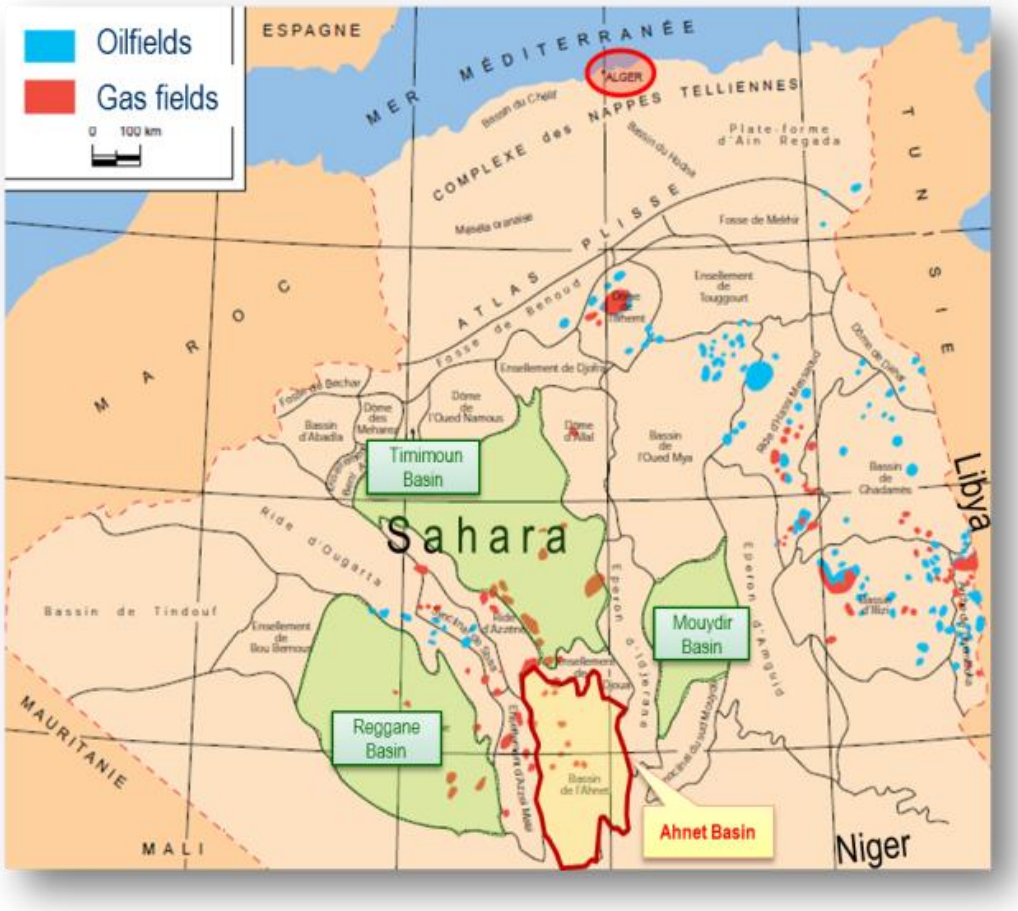

Fig.1. Geographical and Geological setting of Ahnet Basin[4]

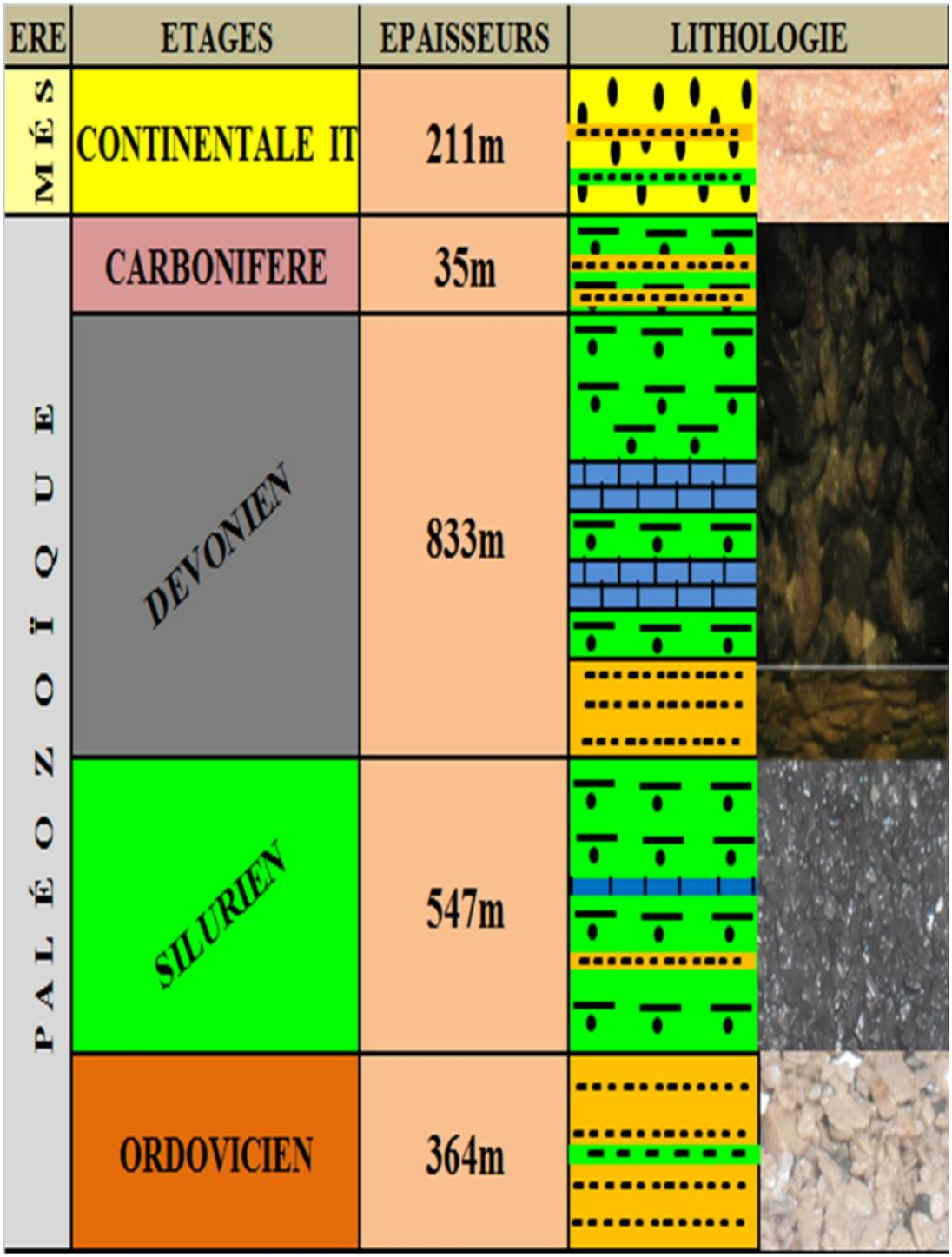

Fig.2. Synthetic Stratigraphic column of Ahnet Basin [1]

2. EXPERIMENTAL

2.1. Δ Log R Methode

For the estimation of organic carbon richness interval using Passey approach, we use sonic and resistivity curves, the scaling is 100 microseconds/foot = 2 logarithmic resistivity cycle,

the critical point in this method is the baseline condition who suggest that the two curves should be overlie each other at a significant depth The separation between them designated Δ Log R related proportionally with TOC, and we can calculate the TOC if the thermal maturity is determined[5].

The algebraic expression for the calculation of Δ Log R is:

$\Delta \text{ Log R Sonic} = \log10(R/R \text{ baseline}) + K \times (\Delta t - \Delta t \text{ baseline})$

2.2. Sampling

The objects of study were presented by two samples of shale powder recovred from ASS-1 in the potential interval determined by the protocol suggested by Kadri et al 2017.

Processing samples with chloroform allowed to distinguish yellow-brown extract, the average amount is approximately equal to the of 0.61%

2.3. Infrared spectroscopy

The infrared spectroscopy method involves subjecting a clay suspension diluted in potassium bromide solution (Kbr) to a range of infrared radiation. This technique allows us to identify the different functional groups present in kerogen, it is based on the principle of the absorption of electromagnetic waves by chemical bonds the absorption of infrared rays by the molecules led to the vibration of chemical bonds each bond is characterized by a specific absorbance bung[6].

2.4. gas chromatography-mass spectrometry

The gas chromatography-mass spectrometry using a device DFS Thermo Electron Corporation (Germany). Ionization method: electron impact. The energy of the ionizing electrons was 70 eV, ion source temperature of 250 °C. Capillary column used ID-BPX5, -50 m length, 0.32 mm-diameter. Carrier gas - helium. The initial temperature was 600C.

3. RESULTS AND DISCUSSION

To study the chemical composition of this extracts rock samples the method of IR spectroscopy was used (fig.3, 4). Spectra of both extracts were very similar in location and intensity of the absorption bands. They are hesitant O-H bonds in an alcoholic hydroxyl groups, an C-C and C = C bonds in the hydrocarbon structures.

For methyl CH_3 fragments were observed very low in intensity peaks of the absorption bands. And, in general, the frequency characteristic of the extracts studied show a very little resemblance to the compounds of the spectra of Hydrocarbons.

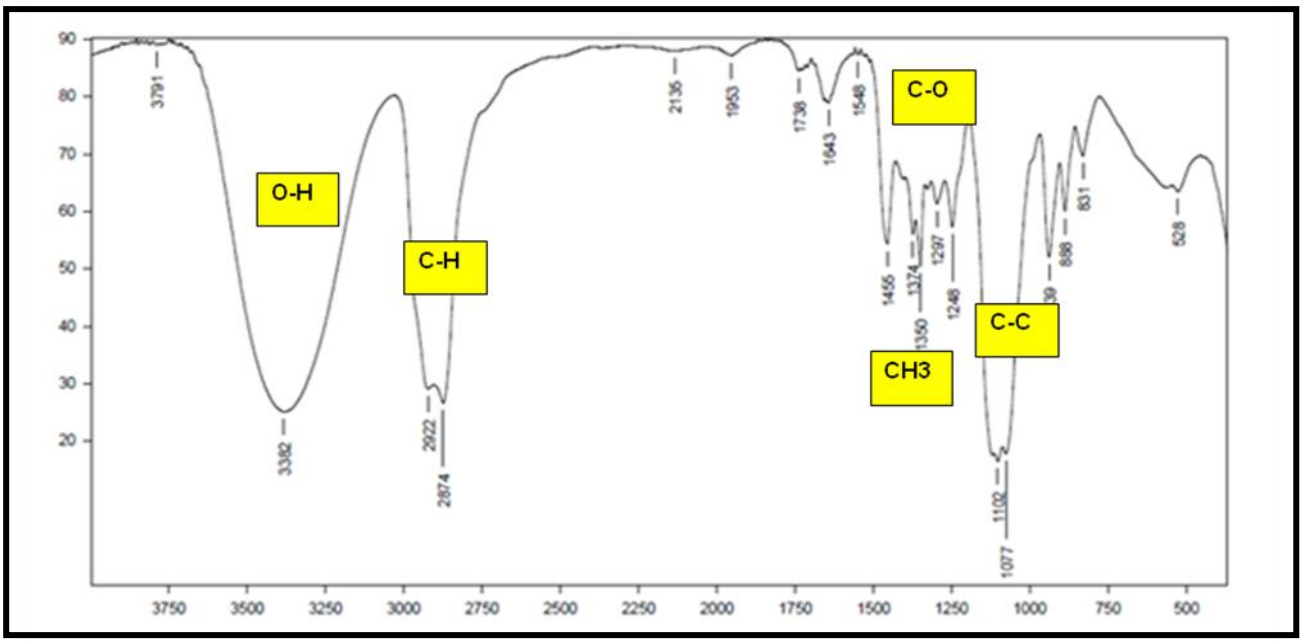

Fig.3. IR spectrum of the sample extracts number 1

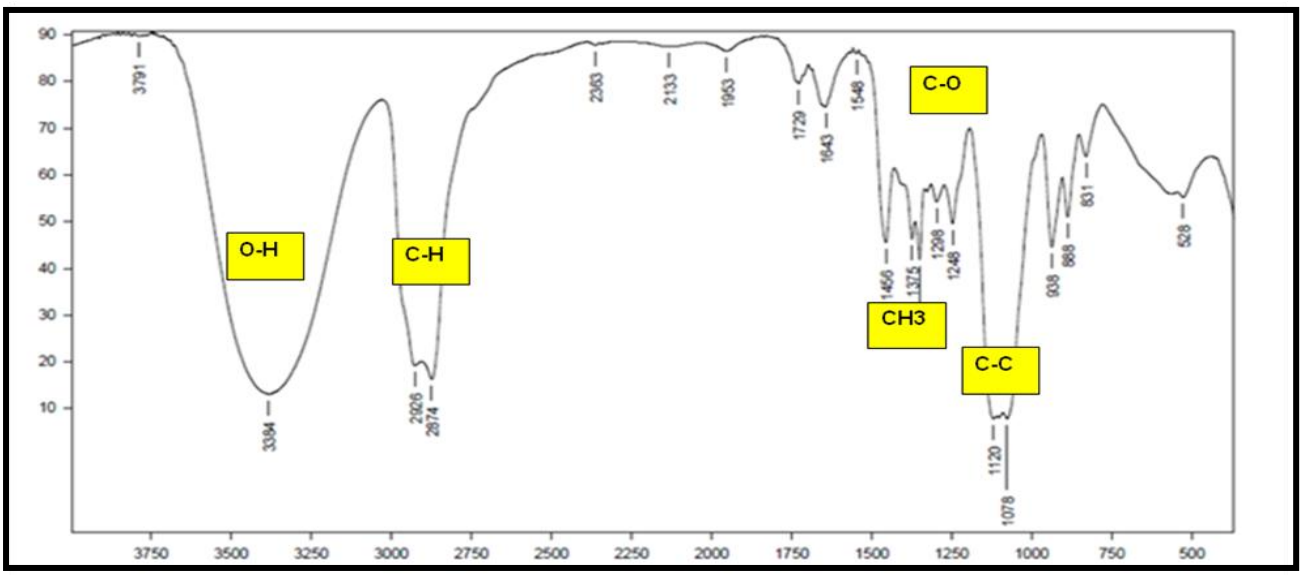

Fig.4. IR spectrum of the sample extracts number 2

To clarify the composition of the extract, one of samples extrat was involved by gas chromatography-mass spectrometry The resulting peaks showed the presence of more than ten

oxygen-containing compounds (ether and alcohol groups), which differ terminal fragments and the number of hydroxypropyl groups (fig;5).

Approximate structure of these compounds looks like in the form of a linear chain, whose main elements are hydroxypropyl fragments repeated several times, and related among themselves interconnected oxygen following hydroxypropyl groups. One end group for almost all of the compounds are presented in the form of alcoholic OH fragment and another as an alkyl or allyl radicals (fig6):

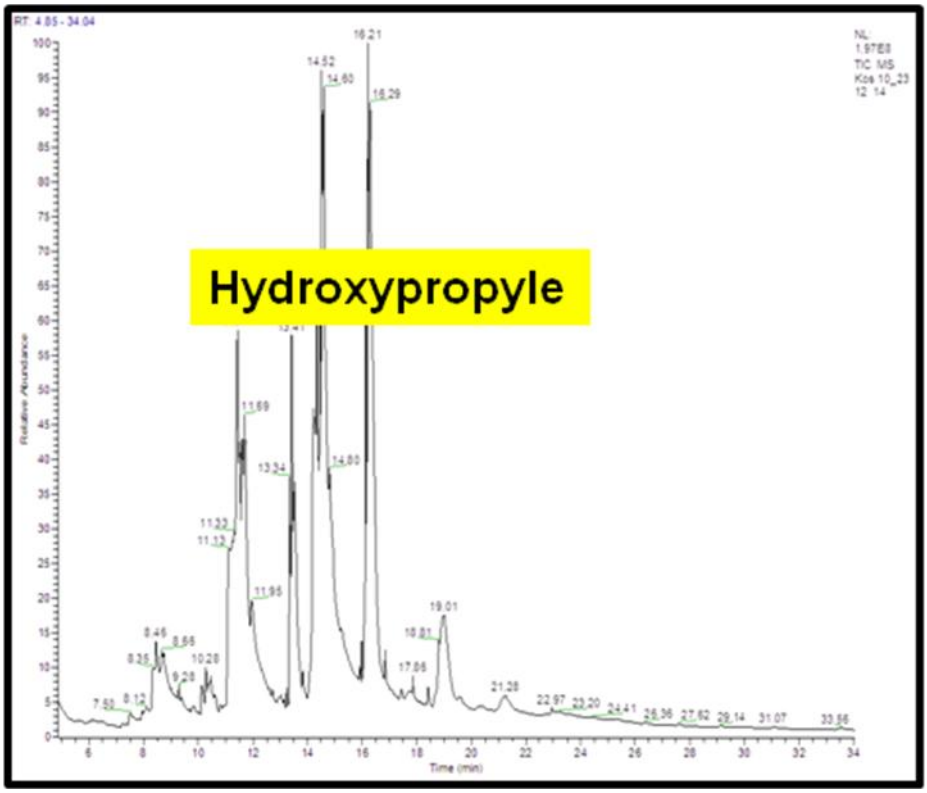

Fig.5. The chromatogram of the study sample

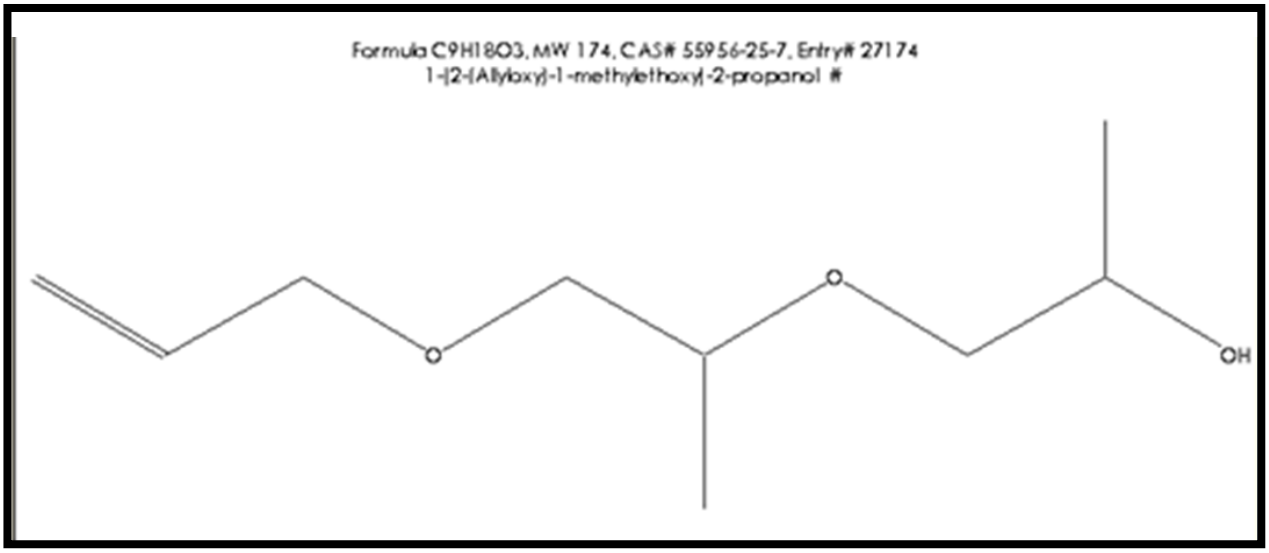

Fig.6. Approximate structure of organic compounds extract

4. CONCLUSION

The results of the study of hot shale samples in the Silurian of ASS-1 well, Ahnet Basin, ts (Algeria) Based on the analysis of two shale sampels extracts by IR spectroscopy showed that the molecules close to each other and the intensities of the absorption bands are significantly different from the number of petroleum hydrocarbons, and using the method of gas-liquid chromatography showed that the study extract is a mixture of a number of structurally related synthetic compounds with recurring hydroxypropyl moieties.

5. ACKNOWLEDGEMENTS

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