Source Rock Potential of the Mira Formation (Carboniferous, Southern Portugal) for Shale Gas plays

Extended Abstract

Pedro Branco

Introduction

According to data from the IEA (International Energy Agency) hydrocarbons will continue to dominate the world energy market for the next two decades, with natural gas increasing in importance. Due to this increase in demand, oil and gas companies have turned their attention to previously unexplored plays, especially onshore plays of Shale gas and shale oil. As of now, the most successful fields of shale gas are located in North America and Russia, but with the increase in demand other plays must be explored. The SPZ (South Portuguese Zone) and its Grupo do *Flysch* do Baixo Alentejo has been considered a potential source rock, and recently some studies have tried to encompass it in the unconventional resources realm. This study seeks to shed some light into this matter and contribute to the pool of data already published. With this objective in mind a set of samples from Mira Formation and Brejeira Formation have been collected and analyzed to determine their maturity by IC (Illite Crystalinity) and their geochemical Source Rock parameters (Rock-Eval Pirolysis).

Setting

The study was restricted to an area between the towns of Almodôvar in Beja district and Monchique in Faro district.

The studied formations are part of SPZ geological context, within the Grupo do *Flysch* do Baixo Alentejo, namely the Mira and base of the Brejeira Formations, consisting of a sequence of turbidite deposits, intercalating dark shales with greywackes, of Carboniferous age.

Methodology

The samples were collected from roadside outcrops, taking care to select the least altered material. For the X-ray difraction the samples where finely ground and sieved to separate the clay mineral fraction. For the geochemical analysis, the samples where properly shipped to GeoData Labs in Sehnde, Germany.

Illite Crystalinity

The Full Width Medium Hight (FHMW) of the 10 Å Illite peak was computed using a Lorentz equation adapted to the difractogram. The resulting data suggests a High maturity degree for all the samples, from the wet gas window, to strongly over-matured, with an increase in degree from NE to SW, in agreement to the stratigraphical age.

Rock-Eval Pirolysis
The resulting data, overall, suggest a low source-rock potential, with indications of existing hydrocarbons. The low Tmax values, usually an indication of low maturity, may be caused by low equipment sensitivity, due to very low S_2 peaks, which in several cases did not allow for a Tmax reading. Computed and plotted OI and HI also indicate an inert Kerogen.

Discussion

Maturation
Bibliographical Vitrinite Reflectance (VR) values suggest a highly overmature Organic matter accross all formations, while IC values indicate maturity levels spawning from wet gas to overmature. This difference in maturity indications is hard to explain, however both sets of data show the same tendencies of decreasing do SW and both represent high maturations.

TOC, Rock-Eval and Source Rock Potencial
In several studies conducted on the Grupo do *Flysch* do Baixo Alentejo, the Geochemical parameters are generally low, TOC around 0.6 wt%, S_1 around 0.8 mg HC/g TOC and S_2 around 0.1 mg HC/g TOC, pointing to a low source rock potential. However, considering all data, the formation seems to originally have been a source rock which generated and expelled hydrocarbons during the late Paleozoic to early Mesozoic (Triassic).

Conclusions
All things considered, the Mira Formation, and the Grupo do *Flysch* do Baixo Alentejo in general, seems to be a highly matured source rock with exhausted generating potential. The S_1 peaks from Rock-Eval suggest the existence of matured hydrocarbons trapped in the rock, however in low quantities. This allied to the complicated geometry, the intercalation of greywackes and the probable costs with logistics in the region may limit the atractiveness of the region.

There remains the possibility of ~~this~~ these formations acting as source rocks for Mesozoic conventional reservoirs to the south, in the Algarve, providing the Maturation timing continued later on.

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