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Geochemistry Characterization and Mineralogical Composition of Source Rock of Oligocene Age of Podu Morii Formation – Romania

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Summary

This paper presents the preliminary results of an ongoing study of the siliciclastic Oligocene deposits that compose the Gura Vitioarei – Copaceni Structure in the Teleajen Valley of, Romania. The objectives of this study include : hidrocarbon source rocks caracterization by organic mater quantity mesurement, hidrocarbon source rocks prediction, termic maturity determination of those source rocks. The modern analised methods that were used are Rock Evaluation, Vitrinite Reflectance and X Ray difractometer.

The maximum temperature registered was less than 435°C, the Vitrinite Reflectance value are between ,52% - 0,57%, which demonstrate that hydrocarbon source rock did not get into the petroleum window and is thermal juvenile. The type ok kerosene identified is the one type III and subordinate type II/III.

The X Ray difraction confirm the existence of argilaceous mineral which sugest diagenetic proceses tipicaly deep entombment diagenesis.

Introduction

Much of the modern petroleum geochemistry depends upon accurate assessment of the hydrocarbon capabilities of sedimentary rocks. This study proposes the evaluation of geochemical and mineralogical point of view of hydrocarbon source rock by determining kerosene type, thermal maturity of the source rock and petroleum potential of rock generator oil and mineralogical content of the rock.

The area study is located on Teleajen Valley (Romania), in the southern-east part of Eastern Carpathian Belt, on Valeni Pinten. The outcrop is represented by Oligocene marine sedimentary deposits. Based on geological view, this structure is part of the over thrust system, which evolution started in Mid Cretaceous till Pleistocene (Tarapoanca, 2004). The sedimentary formations from this area are part of a single sedimentary cycle Cretaceous – Miocene. The characteristic lithofacies are siliciclastic and sometimes mix: siliciclastic – carbonated. The most important petroleum system is being found in Oligocene level, and contains: source rocks, reservoir rocks and protector rocks.

The outcrop researched is located on the right side of Teleajen River. Next to Valenii de Munte City. The length of the formation is approximately 120 meters and 20 meters highest.

The sedimentary succession from the outcrop is built up on the veridical. The profile to be research is part of a over-thrust synclinal. The facies is represented by intercalation of quartzes sandstone and bituminous marls. The quartzes sandstones are known in the literature as sandstone Kliwa Formations. Kliva Formations is massive, friable, and present lutitic lens with carbonaceous fragments. The color of the sandstone strata is yellow – grey. They are constituting by quartz particles, with medium arenite dimension, very good sorted and very good rounded grain size. The quartz particles are being in a linear contact and sometimes concave – convex, rarely is present the overgrowth cement.

The bituminous marls called by Podu Morii strata, look like tabular body with sedimentary structure - parallel laminated. The color of the bituminous marls is ash – brown, bright, due to the presence of high quantity of organic material. It is also present a strong smell of hydrocarbon. On the strata face is remark the presence of pyrite and sulphur.

Methods

Based on mineralogical and geochemical methods a number of 12 layers from Podu Morii strata have been analyzed. The organic material identification presented in the rock, the type of kerosene from the hydrocarbon source rocks, the generate potential and the source rock potential could be determinate based on the results of the parameters from Rock-Eval and Vitrinite Reflectance analyses.

The HI (Hydrogen Index), OI (Oxygen Index) and also T max (maximum of temperature) values they have been included in Van Krevelen diagram where we can assess the type of kerogene.

Sample no	S1	S2	S3	Tmax	COT (%)	Min C (%)	HI	OI
F0	0.3	2.42	1.14	405	2.3	0.43	105	50
F1	0.67	32.42	3.02	412	7.29	0.27	445	41
F2	0.41	7.74	1.33	410	2.85	0.24	272	47
F4	0.46	6.78	1.69	409	2.86	0.26	237	59
F5	0.23	4.91	1.27	411	2.33	0.21	211	55
F8	3.1	**71.01**	3.2	403	**12.87**	0.28	**552**	25

F10	1.39	42.57	4.77	410	10.26	0.37	415	46
F11	1.06	39.96	4.52	403	11.52	0.38	347	39

Figure 1 Rock Evaluation Analyses

The Hydrogen parameter and the Oxygen parameter are indicated parameter at the kerosene type and together with the S2/S3 proportion, determine the potential of the rocks to generate significant increasing hydrocarbon for this rock.

Sample no	S1+S2	S2/S3	Kerosene Type	Thermal Maturity Stage	Deported Product
F0	2.72	2.12	III	Thermal Immaturity	Gas
F1	33.09	10.74	II	Thermal Immaturity	Oil
F2	8.15	5.82	II / III	Thermal Immaturity	Gas + Oil
F4	7.24	4.01	III	Thermal Immaturity	Gas
F5	5.14	3.87	III	Thermal Immaturity	Gas
F8	74.11	22.19	I	Thermal Immaturity	Oil
F10	43.96	8.92	II / III	Thermal Immaturity	Gas + Oil
F11	41.02	8.84	II / III	Thermal Immaturity	Gas + Oil

Figure 2 Rock – Evaluation analyses

Sample no	Potential Sources Rock		
	TOC	S_1	S_2
Fo	2,3	0,3	2,42
F1	7,29	0,67	32,42
F2	10,26	1,39	42,57
F4	11,52	1,06	39,96
F5	2,85	0,41	7,74
F8	2,86	0,46	6,78
F10	2,33	0,23	4,91
F11	12,87	3,1	71,01

Figure 3 Rock - Evaluation Analyses

DIAGRAMA VAN KREVELEN pentru probele de la Valenii de Munte

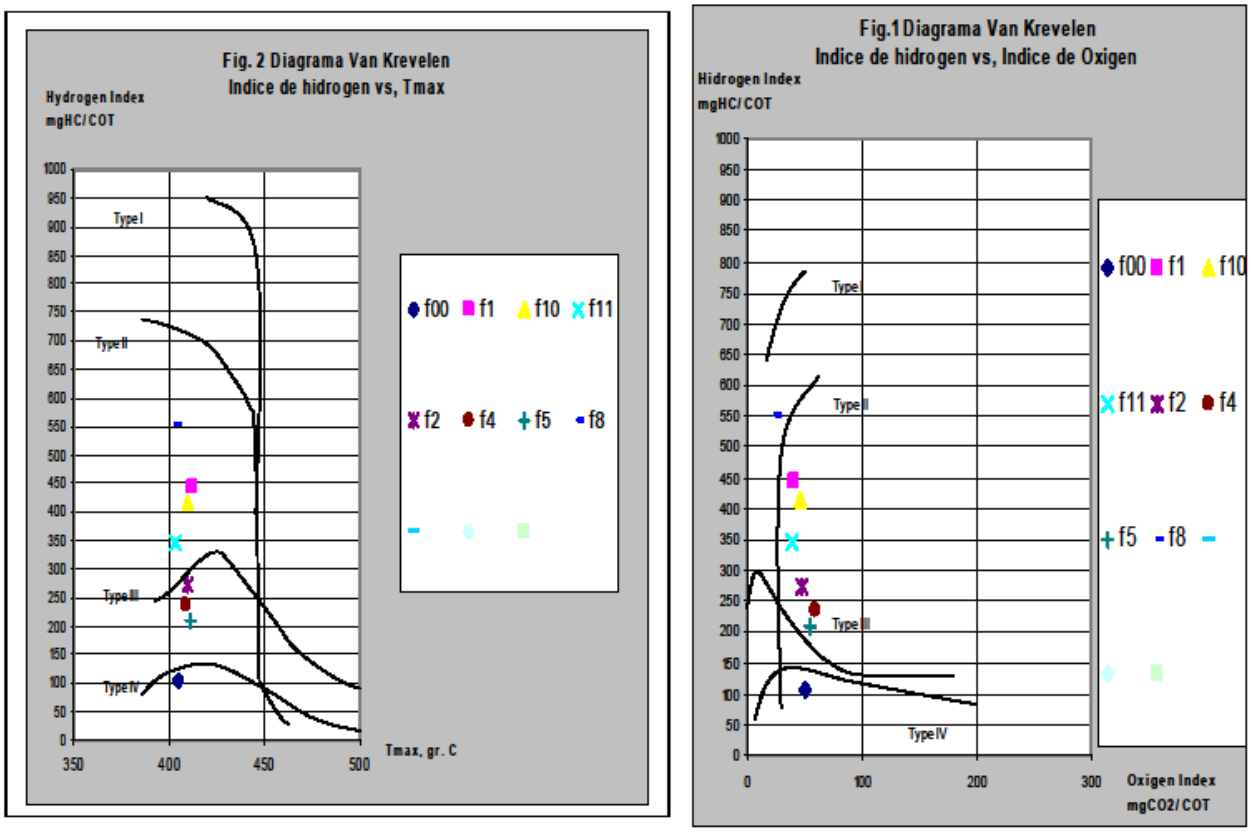

Figure 4 Van Krevelen Diagram of Valenii de Munte samples

Sample no	Generation potential		
	HI	S_2/S_3	Kerosene Type
Fo	105	2,12	III/IV

F1	445	10,74	II (oil)
F2	415	8,92	II (oil)
F4	347	8,84	II (oil)
F5	272	5,82	III (gas & oil)
F8	237	4,01	III (gas & oil)
F10	211	3,87	III (gas & oil)
F11	552	22,19	I (oil)

Figure 5 Rock Evaluation Analysis,

The Vitrinite is one of several types of organic matter commonly disseminated in the sand sedimentary rocks. The reflectance of vitrinit is the most utilized parameter for the quantitative estimation of thermal maturation.

Based on vitrinite reflectance the organic material has being identified in polish section in reflected light. They were prepared a number of 8 rock samples – Oligocene dysodile shale. The microscopically research was made with OLYMPUS microscope BX51, 50X objective and a software photometer MSP 200 also a photo camera Olympus. Is been make a number of 30 to 100 measurement. The reflectance values are between 0,52% - 0,57%, which indicate that the hydrocarbon source rock is thermal immature and did not went in the gas window.

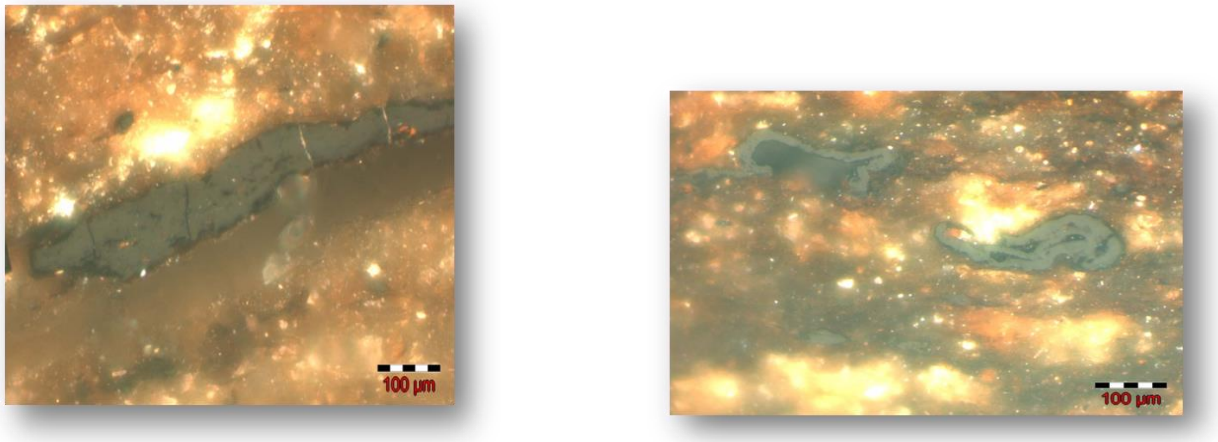

Figure 6 Vitrinite reflectance in thin - sections

Sample no	Maturity level	
	R_0%	$T_{max\ C}$
Fo	0,57	405
F1	0,52	412
F2	0,58	410
F4	0,55	409
F5	0,57	411

F8	0,57	403
F10	0,57	410
F11	0,67	403

Figure 7 Vitrinite Reflectance, final results

The identification of geochemical parameters was made with Rock Eval 6. Characterizing the organic matter from sedimentary rocks is one of the main objectives of organic geochemistry and is now widely recognized as a critical step in the evaluation of the hydrocarbon potential of a prospect.

X ray difractometer is being realized on disodilic samples treated to take off the organic material and the carbonates. It was utilized the PANalytical device from Mineralogical Departamnet from Univeristy of Bucharest.

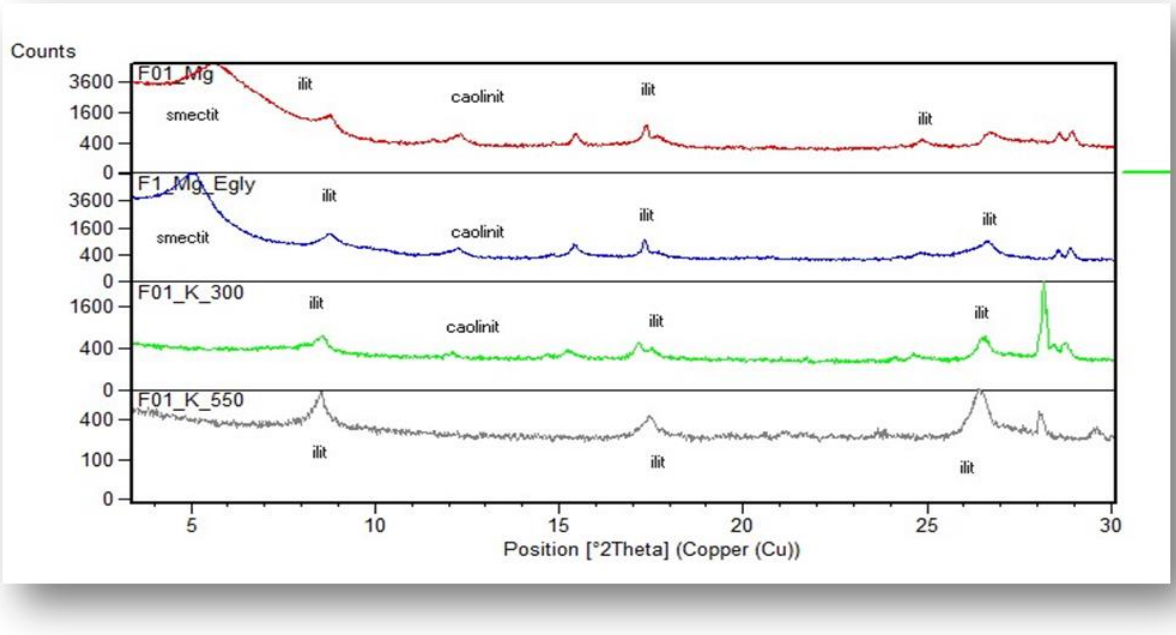

Figure 8 X Ray diffraction results

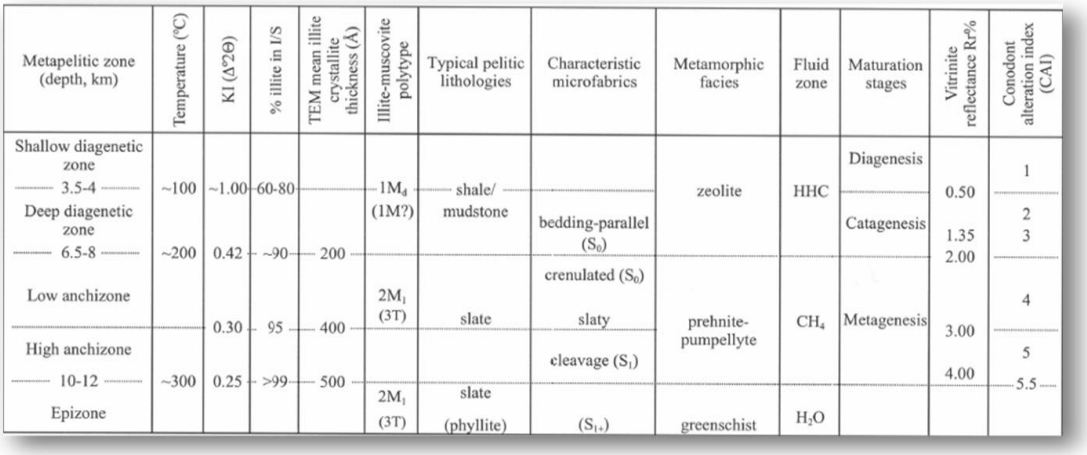

Figure 9 X Ray diffraction results

Conclusion

Following analyzes were determined: immature source rock, oleo genetic potential and kerosene type . The hydrocarbon source rock samples F1, F2 and F11 have not reached thermal maturity, they heading % Rm Huminite - Vitrinite ranging from 0.52 %- 0,57%, so there are not in oil window. Rocks are immature with values between 403 - 412 degrees Celsius, but the values of COT more 2,3%g in samples Fo, F2, F4, F5 increasing to 7,29%g in F1, to 10,26%g in F11, to 11,52%g in F11 and to 12,87%g to F8. Except is 8 sample which entered in oil window and became capable of generating hydrocarbons. Oligocene source rocks encountered on Teleajen Valley shows a potential high oleo genetic between 2,42mgHC/g to F0, F5, F4, F2 and higher between 32,42 mg HC/g to F1, 39,96 mgHC/g to F11, 42,57 mgHC/g to F10 and 71,01 mgHC/g to F8.

Another important feature that gave us a Rock-Eval results were values of hydrogen index which are significantly higher between 105 mgHC/COT at 552 mg HC/COT, which values help us to determine potential of hydrocarbon generation. Kerosene type of Van Krevelen diagram identified by Rock Eval analysis is the type III to F0, F4 and F5, is largely derived from the digenesis of vascular plans in an oxidizing environment. This kerosene type does not generate much oil, but it does provide gas. Kerosene of type II/III to F2, F10, F11 has mix origin: continental - marine, the source is represented by continental plans material, deposited in marine basin. The organic matter is mainly derived from phytoplankton and bacteria. In the sample F8 were identified Kerosene I type, is derived from lipid material, particularly that of algal origin and also from the several biodegradation of other organic compounds during early digenesis, suggesting another source.

X-ray diffraction analysis confirms the presence of clay minerals following: iIlit, kaolinite, smectit and intercalations HIS type . Mineralogical association indicates a separate deep water marine depositional environment.

References

Dembicki Jr.., H., 1993, Improved determination of source quality and kerogen type by combining Rock Eval and pyrolysis - gas chromatography results (abs.): AAPG 1993 Annual Convention Program, v.2, p.90.

Dow, W., 1977, Kerogen studies and geological interpretation: Journal of Geochemical Exploration, v.7, p.79-99.

Moore, D.M., Reynolds, R.C.Jr., 1997. X-Ray Diffraction and the Identification and Analysis of Clay minerals. Oxford University Press. 378 p

Magoon, L.B, and W.G.Dow, eds., 1994, The petroleum system - from source to trap: AAPG Memoir 60 - Chapter Applied Source Rock Geochemistry -Kenneth E.Peters, Marz Rose Cassa p.93-102.

Mutihac .V., Stratulat M., FECHET M,2004.: Geologia Romaniei, *Editura Didactica si Pedagogica, R.A.*, p. 191-195

Sandulescu, M. 1984: Geotectonica României. *Editura Tehnicã Bucureşti*, 355 pp.

Tssot, B., B.Durand, J.Espitalie, and A.Combaz, 1974, Influence of the nature and diagenesis of organic matter in the formation of petroleum: AAPG Blletin, v.58, p.499-506.