

Surface geochemical methods for oil and gas prospecting in rice fields – some constraints

S. DAS SHARMA

National Geophysical Research Institute, Uppal Road,
Hyderabad-500007, India (dassharma@rediffmail.com)

The subsurface occurrence of hydrocarbon produces a number of geochemical anomalies in the near-surface soil/sediment profile. The studies of such geochemical anomalies have proven to be extremely useful in locating potential areas for hydrocarbon exploration and exploitation (Schumacher, 1996). One of the prominent and widespread methods is the diagenetic carbonate technique, which tries to find out the relationship of near-surface diagenetic carbonate and carbonate cements with leakage of hydrocarbons from depth (Donovan, 1974).

In this work the carbon isotope compositions of soil carbonates formed in a vertical profile of about 1m, collected from a rice field near Kondapuram village (17°28'N, 78°42'E) are reported. The $\delta^{13}\text{C}$ values of these soil carbonates range from -7.9 to -43.9‰ VPDB. While the isotopic compositions close to -8‰ are generated in response to diffusion-controlled soil $\text{CO}_2\text{-CaCO}_3$ system under isotopic equilibrium condition (Cerling, 1984), those with extremely depleted values are resulted due to methanotrophic bacterial oxidation of methane emitted in the rice field. These isotopically depleted soil carbonates occur below the root zone and are similar in ^{13}C composition to diagenetic carbonates precipitated due to seepage of hydrocarbon from deep thermogenic source. The significance of this study for countries like India and China is enormous because they constitute more than 50% of the global rice growing areas (Mathews et al., 1991). Thus during surface geochemical exploration for oil and gas, the role of methanotroph-induced carbonate precipitation must be evaluated and care should be taken in interpretation of ^{13}C compositions of soil carbonates, particularly when the samples are collected from rice fields.

References

- Cerling T.E., (1984), *Earth Planet. Sci. Lett.* **71**, 229-240.
Donovan T.J., (1974), *AAPG Bull.* **58**, 429-446.
Mathews E., Fung I. and Lerner J., (1991), *Global Biogeochem. Cycles* **5**, 3-24.
Schumacher D., (1996), *AAPG Memoir* **66**, 71-89.

Variation in surface energy heterogeneity of crude oil-smectite complexes with different content of organic matter

LU XIANCAI¹, LIU QING², LIU XIANDONG¹,
ZHANG LINYE² AND HOU QINGFENG¹

¹State Key Laboratory of Mineral Deposit Research,
Department of Earth Sciences, Nanjing University,
Nanjing 210093, China (xcljun@nju.edu.cn)

²Geology Science Institute of Shengli Oilfield, Dongying
257125, China (liu@slof.com)

Three crude oil-smectite complexes and one pure smectite were prepared and their low-temperature (77.35 K) nitrogen adsorption isotherms in the relative pressure range of 10^{-6} – 0.14 were measured, subsequently. Then, surface fractal (D_{SF})^[1] and adsorption energy distribution (AED)^[2] (Fig.1) were calculated. While the content of crude oil in complexes increases from 0 to 6% and 15%, D_{SF} decreases from 2.87 to 2.69 and 2.53, and their AEDs changes evidently from 3 prominent peaks for pure smectite to just big one and trival one. According to the assignment of AED peaks of pure montmorillonite reported by Tournassat et al., it is found that crude oil molecules prefer interacting with the edge surface firstly, and then with the basal surface and interlayer surface orderly. Above results suggests that information of hydrocarbon formation and expulsion in source rocks could be tracked by measuring surface properties of organo-clays.

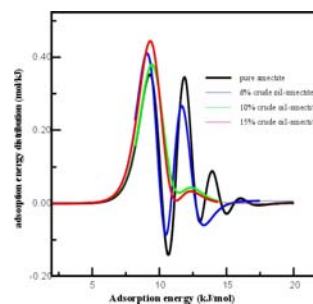


Fig. 1 AEDs of experimental samples

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References

- [1] A.V. Neimark, *Physica A* 191 (1992) 258.
[2] Tournassat C, et al. *Am. Min.* 2003, 88:1989.
[3] Jaroniec, M.; Madey, R. *Physical Adsorption on Heterogeneous Solids*; Elsevier; Amsterdam, 1988.