Preferred Analyses and Sample Preparations for Surface Geochemical Sediment Samples in Petroleum Exploration

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A range of options is available for shallow core sample aquisition, preservation and analyses.It has been shown that gravity coring provides samples of equal quality to piston coring, at greater safety and lower cost; while the best preservation is freezing to -80°C, since bactericides do not always penetrate clay samples and may contaminate. The advantages of analysing occluded and adsorbed gases instead of just headspace gas have also been shown. Regarding analyses of liquid hydrocarbons, the two most critical choices involve i) the bulk assessment of the total extract, and ii) the GC-MS analyses of the extract, and these techniques are the focus of this work.

Bulk analysis of the extract usually involves performing both gas chromatography (GC) and total scanning fluorescence (TSF). The GC method shows in chromatogram form, directly and unequivocally the compounds present in the sample and whether biodegradation has occurred. This analysis is undisputably necessary, not only due to its ability to show at a glance the type of hydrocarbons present, but also, when the extraction is performed quantitatively, to give the amounts of thermogenic hydrocarbons contra those from recent organic matter. TSF is rather an 'indirect' method, targeting the aromatic compounds, and relying on the fluorescing properties of these under different wavelengths. By comparison with reference samples containing known types of hydrocarbons the emission data are qualitatively interpreted. It is shown here however that the TSF results do not consistently agree with the GC analyses, which are considered as the benchmark. The disagreement can locally be quite opposite, TSF indicating thermogenic hydrocarbons in barren samples and vice versa. The value of performing TSF is then strongly questioned, especially as GC must in any case be performed on all samples.

GC-MS of the extract, to investigate biomarker- and aromatic compounds for source- and maturity parameters, can be performed by analysis of the whole extract, or of the saturated and aromatic fractions after liquid chromatography (e.g. MPLC) separation. The latter was previously considered the more reliable technique. However with development of high resolution MS, data of at least equal quality can be gained from the whole extract alone. This simplifies sample preparation besides lowering analysis costs. Examples are given of the preferential use of high resolution GC-MS showing this method to be the most effective.