Pyrolysis-GC/MS of Geochemical Samples

Application Note
Geochemical

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Geochemical samples such as source rock, shale and tar sands may be studied for the petroleum compounds they contain by the application of thermal techniques. The sample may be heated to a high temperature to evaluate the total organic content in one run, or heated to a variety of temperatures to fractionate the organic content. Typically, rock samples are heated to a relatively low temperature (300 - 400°) to release the volatile and semivolatile content, then heated again to pyrolyze the nonvolatile part. This heating may be done continuously at slow rates to determine the optimum temperature for the production of various fractions, or as a pulse-heating experiment directly to a gas chromatograph to identify the components.

The rock sample shown here was heated first to 400°C to examine the volatile compounds, then the same sample was heated to 700°C to pyrolyze the remaining orgnanic material. Figure 1 shows that at 400°C, most of the compounds are aliphatic hydrocarbons, with some aromatics (naphthalene and methyl naphthalene are marked) released as well. At 700°C, in Figure 2, the pyrolysis products create a complex chromatogram with both more organic content and a wider range of compounds. The series of double peaks are alkanes and alkenes, typical of source rocks, and the numbers above them indicate the number of carbons in the molecules. As shown, there is also a significant contribution of aromatic compounds, including polyaromatic hydrocarbons.

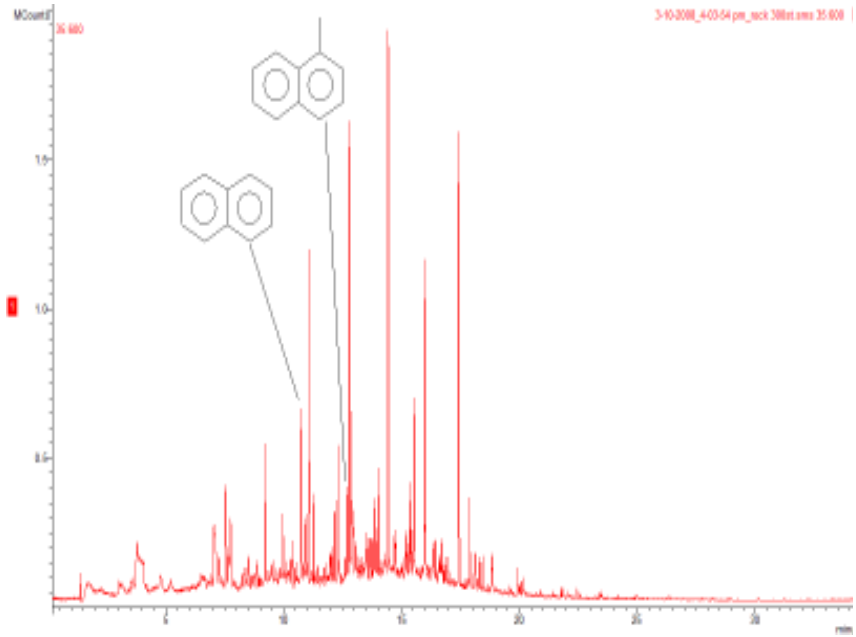

Figure 1. Source Rock Heated to 400°C

Instrument Conditions
Pyroprobe

Pyrolysis:	400°C and 700°C 15 seconds
Valve Oven:	300°C
Transfer Line:	325°C

GC/MS

Column:	5% phenyl (30m x 0.25mm)
Carrier:	Helium, 100:1 split
Injector:	350°C
Oven:	30°C for 2 minutes
	8°C/min to 325°C
	10 minutes
Mass Range:	35-550

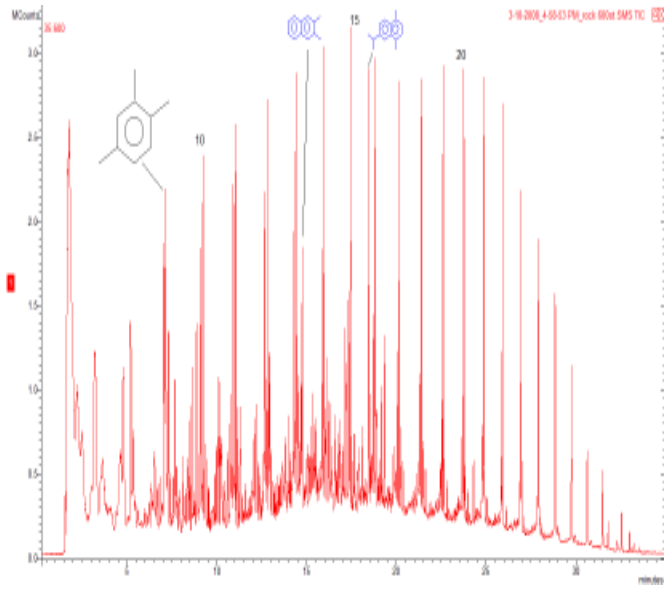

Figure 2. Rock sample heated to 700°C after 400°C, shown in figure 1.

FOR MORE INFORMATION
CONCERNING THIS APPLICATION, WE RECOMMEND THE
FOLLOWING READING:

Gray, N.R., Lancaster, C.J. and Gethner, J., Chemometric analysis of pyrolysate compositions: a model for predicting the organic matter type of source rocks using Pyrolysis-gas chromatography, J. Anal. Appl Pyrolysis, 20 (1991) 87-106.