GEOCHEMICAL CHARACTERIZATION AND CLASSIFICATION OF CUBAN ASPHALTITES

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Traditional biomarkers derived from steranes, terpanes and aromatic compounds were determined to characterize and classify eight asphaltites (asphaltene rich petroleum samples occurring as seeps or filling veins, joints, cavities and fissures). These samples correspond to several locations in Cuban island, and are intensely affected by biodegradation and weathering process.

Previous works have classified the Cuban oils in three main families according to their molecular and isotopic compositions (López *et al*., 2004; 2006; Pascual *et al*. 2006; Dominguez *et al*., 2005; 2006). The principal objective of this study was to correlate the genetic identity of the asphaltites studied to the well-known oil families. To achieve this, genetic molecular parameters were compared in order to establish oil-oil correlations. In spite of the absence of steranes in one of the eight samples, and low concentration in the rest of them, it was possible to determine the C_{27}, C_{28} and C_{29} steranes percentages and 20S/(20S+20R) and αββ/(αββ+ααα) ratios.

Concerning the study of aromatic compounds, three samples (MC, CA and ME) revealed the predominance of dibenzothiophene (DBT) over phenantrene (P), as well as predominance of methyl-dibenzothiophene (MDBT) over methyl- phenantrene (MP), suggesting a sulphur rich carbonate source rock (Hugues, 1984). These samples, and also LB and SM samples, show the following MDBT distribution: 4MDBT > 2 3MDBT < 1MDBT, suggesting a carbonate source paleoenvironment, although Radke and Willsch (1994) have previously interpreted this feature as an indication of low maturity rather than a carbonatic character. The samples: CB, MN and FS, on the other hand, showed a distinct pattern, with 4MDBT > 2,3MDBT > 1MDBT, which is typical of siliciclastic origin (Hugues, *ibid*).

Thermal evolution was investigated using several biomarker maturity parameters, such as C_{29} steranes isomers (20S/20S+20R and αββ/ αββ+ααα), 22S/22S+22R homohopane C_{31}, Ts/Tm ratio (Peters & Moldowan, 1993; Peters et al., 2005), and C23/C21 tricyclic ratios (Ekweozor and Strauz, 1983; Cassani, 1986), all of them applied to the saturate fraction. Other ratios were calculated from the aromatic fraction: Methyl-Phenantrene Index (MPI1), Maturity Index (PP-1) and Methyl-Dibenzothiophene ratio (MDR) (Radke *et al*., 1982b; 1986; Cassani *et al*., 1988). There was a general agreement between all the different maturity parameters used. All samples seem to represent petroleum in the early catagenetic stage, as shown in table 1 and figure 1.

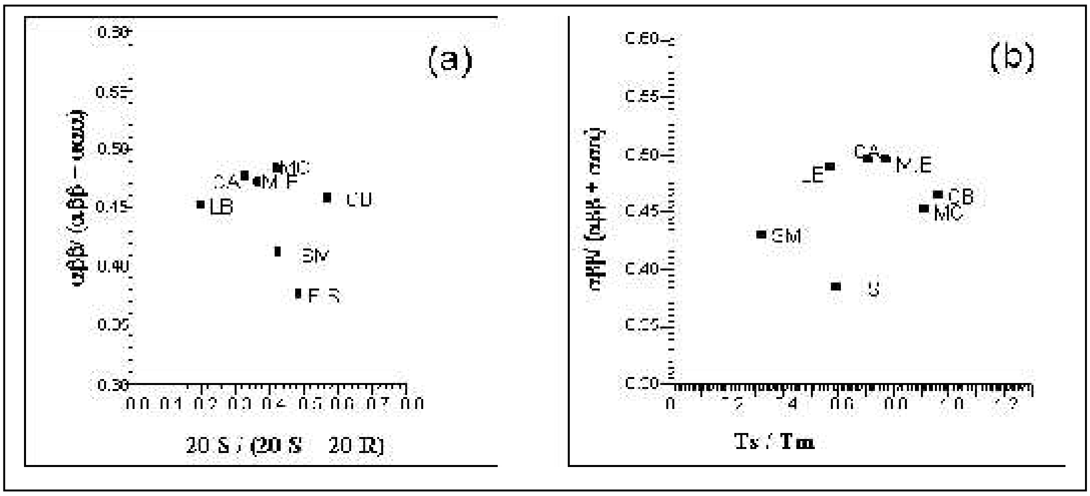

Figure 1. Some of maturity parameters analysed.

Statistical procedures (PCA and Cluster Analysis, figure 2) were used as auxiliary techniques to the genetic characterization and classification of samples and pointed that the majority of the samples were classified as Family II oils (marine anoxic carbonate sourced). Exception was observed in two samples (CB and MN), interpreted as belonging to Family III oils (normal marine siliciclastic suboxic sourced). The use of refractory aromatic compounds (*e.g*. phenantrene, dibenzothiophene and their alkyl derivatives) showed to be useful in oil-oil correlation of biodegrade surface petroleum shows.

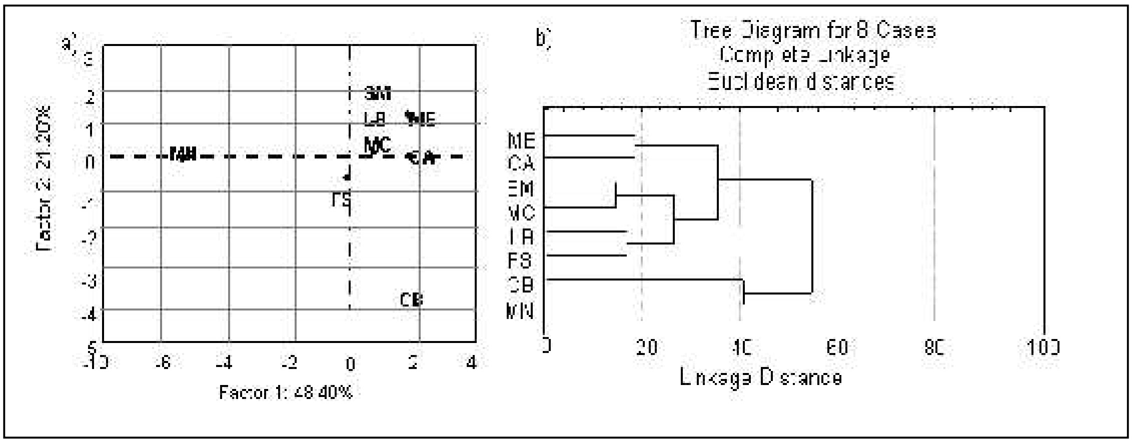

Figure 2. Statistic analysis of the samples, a) PCA analysis, b) Cluster analysis.

Table1. Principal parameters values used.

Samples	**CB**	**MC**	**CA**	**ME**	**LB**	**FS**	**SM**	**MN**
δ^{13}**C**	-28.66	-26.86	-27.67	-27.94	-26.22	-26.63	-26.27	-28.59
C23/C21 Tr	3.75	1.96	2.25	2.92	3.38	3	2.34	2.36
H29/H30	0.51	1.68	1.16	1.55	0.91	4.57	0.94	0.75
H35/H34	0.62	0.99	1.08	1.1	1.22	0.9	0.98	2.0
TET 24/26Tr	0.63	8.16	2.75	5.74	2.43	1.1	1.16	1.71
TET 24/H30	0.04	0.38	0.12	0.15	0.08	0.18	0.13	0.78
TPP	0.84	0.78	0.52	0.48	0.41	0.46	0.42	0.77
G/H30	0.02	0.07	0.26	0.14	0.1	0.09	0.3	0.33
Diast/ St. reg	0.34	0.06	0.4	0.17	0.19	0.8	0.84	n.d
C29/C27 St.	1.57	0.46	1.12	1.05	1	2.35	0.96	n.d
Hop/St	8.52	8.76	7.37	5.73	3.36	2.31	3.08	n.d
Ts/Tm	0.98	0.94	0.26	0.23	0.15	0.6	0.72	0.8
PP- 1	0.94	1.22	1.08	1.93	1.37	0.91	2.71	1.19
MPI1	1	0.82	0.93	0.52	0.73	1.1	0.37	0.84
DBT/P	0.3	1.21	2.62	2.5	0.32	0.05	0.36	0.27
DBT/MDBT	0.12	0.06	0.34	0.08	0.12	0.65	0.03	0.33
MDR	2.2	1.82	2.62	1.46	1.28	0.94	1.03	2.96

PP-1= (1MP+9MF)/(2MP+3MP), MPI1= 1.89(2MP+3MP)/P+1.26(1MP+9MP), MDR= 4MDBT/1MDBT, RMFI= 0.3*(MFI-1)+0.68.

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