CAN BIODEGRADATION AND EVAPORATION OF LIGHT N-ALKANE MEMBERS AFFECT DIAMONDOIDS CONCENTRATION IN CONDENSATES ?

L.C.S. Freitas [1*] and J.R. Cerqueira[1]

[1]PETROBRAS R&D Center, R. Horácio Macedo 950 , Cidade Universitária, Ilha do Fundão, Rio de Janeiro, 21941-915, RJ, Brazil, lcfreitas@petrobras.com.br

Some studies have been published showing how abundance of diamondoids generally become higher as the extent of oil cracking increases (Dahl *et. al*., 1999). The present study aims at showing the effect of biodegradation and evaporation of light *n*-alkanes members on the concentration of diamondoids in five condensate samples.

Condensate A was recovered from an Oligocene turbidite reservoir, where it was submitted to severe biodegradation processes and presented an API degree and density compatible to a biodegraded condensate (API = 21.92 and density of 0,9223 (Table 1)). Also presented the lowest concentration of saturated fraction (Figure 1). Gas Chromatogram presented mostly iso-alkanes, aromatics and almost total absence of *n*-alkanes (Figure 2 - Condensate A), but the highest diamondoids (3+4-methyldiamantanes) and Stigmastane concentrations 825 and 17.43 ppm, respectively (Figure 3). Seifert and Moldowan (1979), pointed out that a remarkable elevation of diamondoids and diamondoids species occurs at biodegradation rank of 8 (severe biodegradation), although this condensate sample could be ranked as heavy to severe (presence of isoalkanes, isoprenoids, aromatics and cycloalkanes).

Condensate samples B, C and D were reservoired at Albian platform sandstones. They presented partial loss of the light n-alkanes members (Figure 2), certainly due to volatilization, but did not undergo any biodegradation evidences. API degrees and density slightly varying from 33.27 to 36.5 and from 0.8588 to 0.8385, respectively (Table 1). Diamondoids (3+4-methyldiamantanes) concentration varying from 235 to 265ppm (Figure 3) and extremely low to insignificant Stigmastane concentrations.

Condensate sample E also reservoired at Albian platform sandstones, presented the highest API degree and lowest density values (46.95 and 0.7929, respectively), no loss of light *n*-alkane members and also no evidences of biodegradation. Yet, it presented the lowest diamondoid and stigmastane concentration among the samples, although the highest concentration of diamondoids was expected among the investigated samples.

Such analytical results lead us to conclude that for condensate samples, biodegradation and volatilization of the light *n*-alkane end members seem to play an important and significant role on the diamondoids concentration results.

Although these results are quite controversial, the ALAGO meeting about biodegradation seems to be the right forum for such discussions.

Table 1. Condensate samples and their API degrees, density and compounds fractions of saturates, aromatics and resins + asphaltenes (%)

Condensate samples	API degree	Density	Saturates (%)	Aromatics (%)	Resins + Asphal. (%)
A	22	0,9223	48	48	4
B	33	0,8588	73	24	3
C	34	0,8528	73	27	0
D	37	0,8385	72	27	1
E	47	0,7929	100	0	0

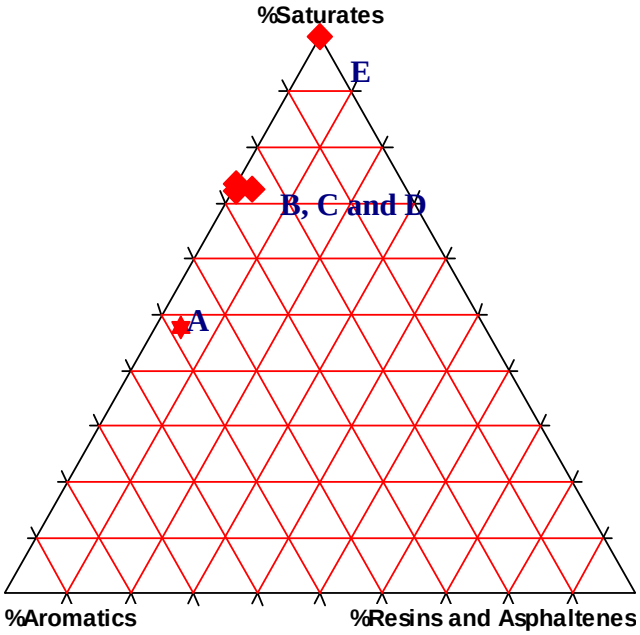
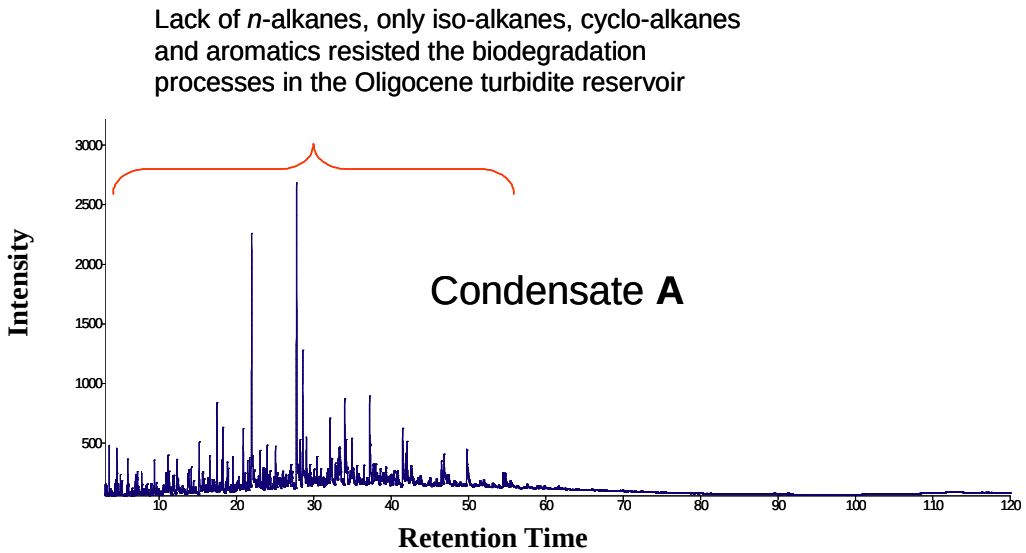


Figure 1. Showing a variation of saturates, aromatics and resins + asphaltenes (%) compounds among the condensate samples investigated that corroborates with the API degrees of Table 1.



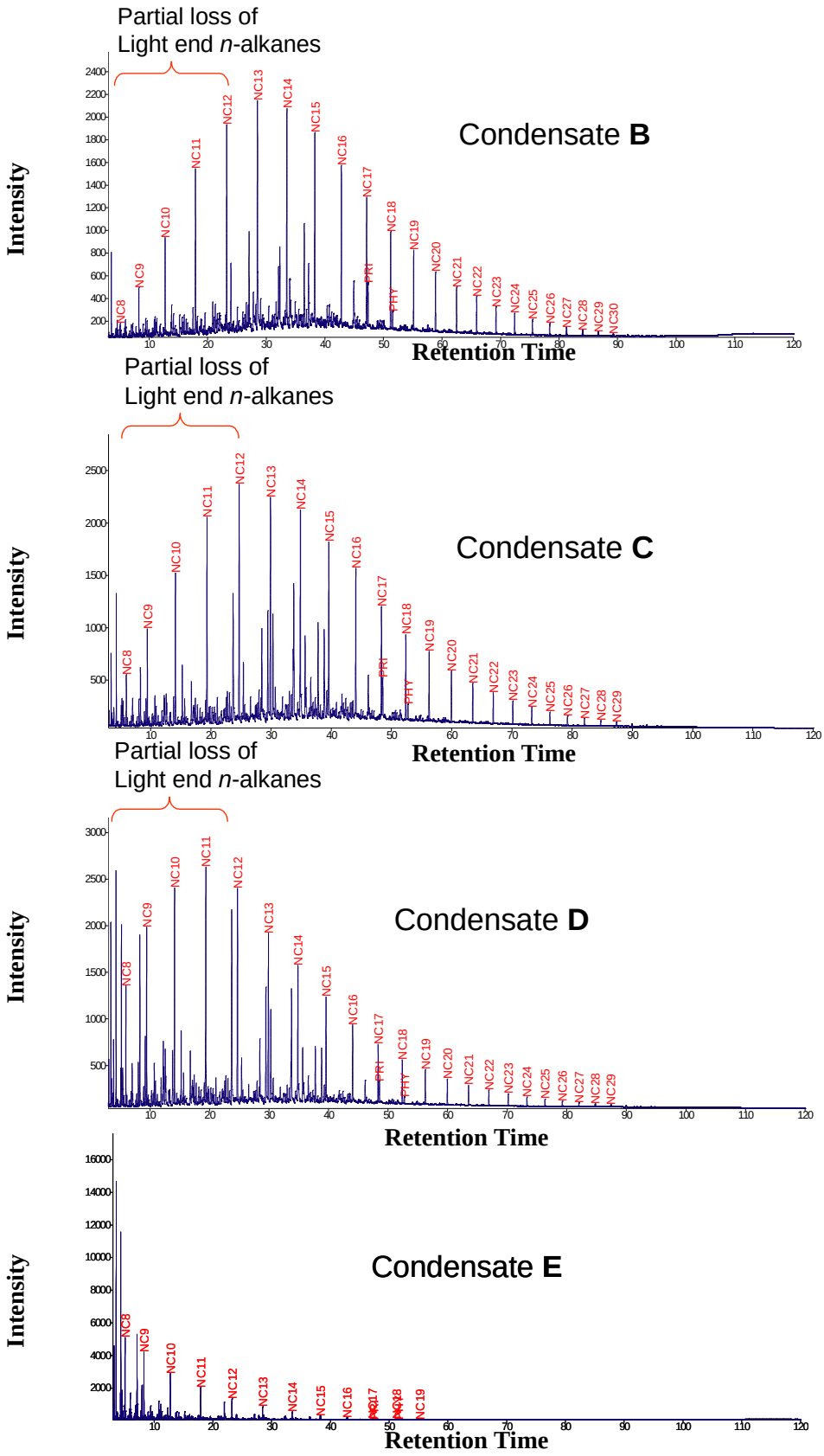


Figure 2. Gas Chromatograms of the condensate samples A, B, C, D and E showing a range from a biodegraded condensate (A), passing through non-biodegraded, but volatilizated light end *n*-alkane ones (B, C and D) to a totally non-biodegraded condensate sample (E).

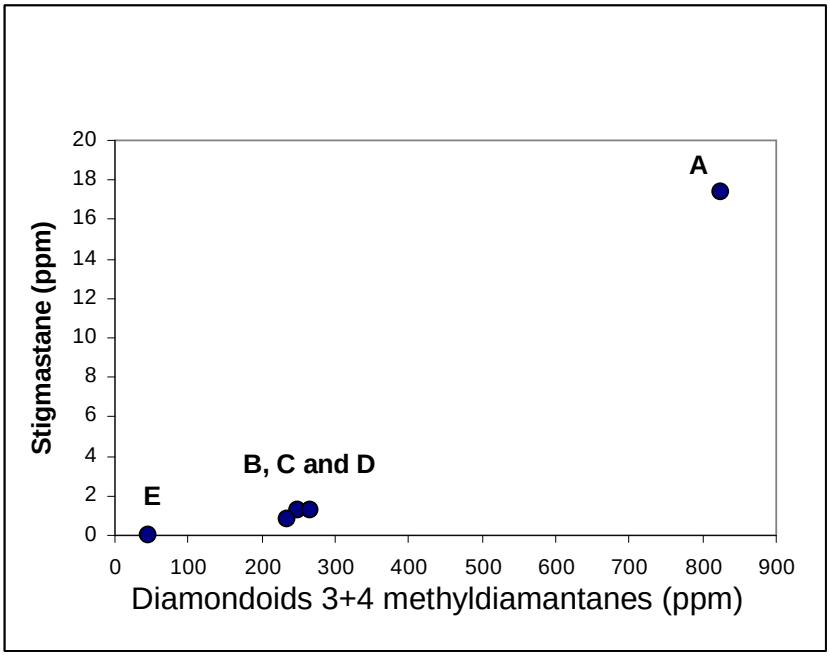


Figure 3. The highest diamondoids (ppm) and Stigmstane (ppm) concentration at Sample A, was interpreted as a result of biodegradation of the n-alknes saturated fraction, while the high Stigmastane concentration would be due to dissolution of Tertiary layers by the condensates along its migration pathways towards the Oligocene reservoir. Condensate samples B, C and D underwent partial loss of *n*-alkanes light members by evaporation or volatilization, but were not affected by biodegradation and presented 'intermediate' diamondoids concentration values. Condensate sample E, despite of presenting the highest API degree ($46{,}95^0$), presented the lowest diamondoid concentrations among all condensates investigated, no signs of volatilization or biodegradation. Apparently, biodegradation hás played an important role on the diamondoids concentration results.

REFERENCES

Dahl, J.E., Moldowan, J.M., Peters, K., Claypool, G., Rooney, M., Michael, G., Mellos, M. and Kohnen, M., 1999, Diamondoid hydrocarbons as indicators of oil cracking. Natgure, v. 399, p. 54-56.

Peters, K.E., and Moldowan, J.M., 1993. The biomarker guide. Application of Molecular Fossils in Petroleum Exploration. Prentice-Hall, Englewood Cliffs, New Jersey, 363 pages.

Peters, K.E., Walters, C.M. and Moldowan, J.M., 2005. The biomarker guide, 2nd Edition, Part 1, Biomarkers and Isotopes in the Environmental and Human History, Cambridge University Press, 474 pages.

Seifert, W.K and Moldowan, J.M., 1979. The effect of biodegradation on steranes and terpanes in crude oils. Geochimica et Cosmochimica Acta, v.43, 111-126.