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## **Integrated Study of Oil Seeps in the Campeche Bay, Cantarell Field Case History**

Natural oil and gas seeps have historically provided invaluable information to oil explorers in frontier areas because they indicate the presence of active petroleum systems. Mexican exploration activities in the Gulf of Mexico began soon after a fisherman, Mr. Cantarell, reported an oil seep in the Campeche Bay (Figure 1). The complex of oil fields later discovered beneath the seep was subsequently named after him.

Oil seeps are often characterized by intermittent activity; however, seepage in the Cantarell field occurs in the form of continuous pulses. RADARSAT-1 imagery confirmed this behavior from space (Figure 2). There is no consensus on the subsurface provenance of seepage. Postulated hypothesis include upward migration either from source rocks or from charged reservoirs.

The purpose of this study is to correlate high-resolution surface and subsurface geochemical data to discriminate the origin of the Cantarell oil seep. Selected samples are sea surface oil samples and oil samples from geologic reservoirs (Upper Jurassic-Oxfordian, Upper Jurassic-Kimmeridgian, Upper Jurassic-Tithonian, Lower Cretaceous, Upper Cretaceous, Upper Cretaceous-Paleocene breccia, Middle Eocene, and Lower Miocene).

The most appropriate sites to collect sea surface samples were determined taking into account the location of seepage slicks detected in RADARSAT-1 images. Oil samples were analyzed using gas and liquid chromatography, stable isotopic composition and biomarkers techniques (Figures 3 and 4). Geochemical parameters that are more sensitive to source rock characteristics and thermal maturity than to biodegradation were submitted to statistical analysis aiming the samples clustering (Figure 5).

Petroleum in the Campeche field area are has been generated by Tithonian source rocks (Guzmán-Vega *et al.*, 1995). In spite of generation by the same source rock, small differences in the geochemical parameters can be observed between oils produced by different rigs from the selected reservoirs. These differences are due the organic facies variability, thermal evolution and migration.

A good correlation was observed between geochemical analyses of the seeped oil samples and the petroleum sample collected at AKAL-G rig from the Paleocene-Cretaceous Breccia reservoir (Figures 3, 4 and 5). The correlation of the oil seep with particularly reservoired petroleum suggests that the origin of the seep is from this reservoir, and not from the source rock.

## **Reference**

Guzmán-Vega, M.A.; Mello, M.R.; Leon, V.; and Holguin, N. 1995 Tithonian oils from the Sureste basin, Mexico: The facies variability of their source rocks. In: **Grimaldi, J.O. and Dorransoro, C.** Eds. Organic Geochemistry: developments and human history. Selected papers from the 17<sup>th</sup> International Meeting on Organic Geochemistry, 1995. Donostia-San Sebastian, Spain, p.229-231.



Figure 01 - Manifestations of natural oil seepage in the Cantarell field area.

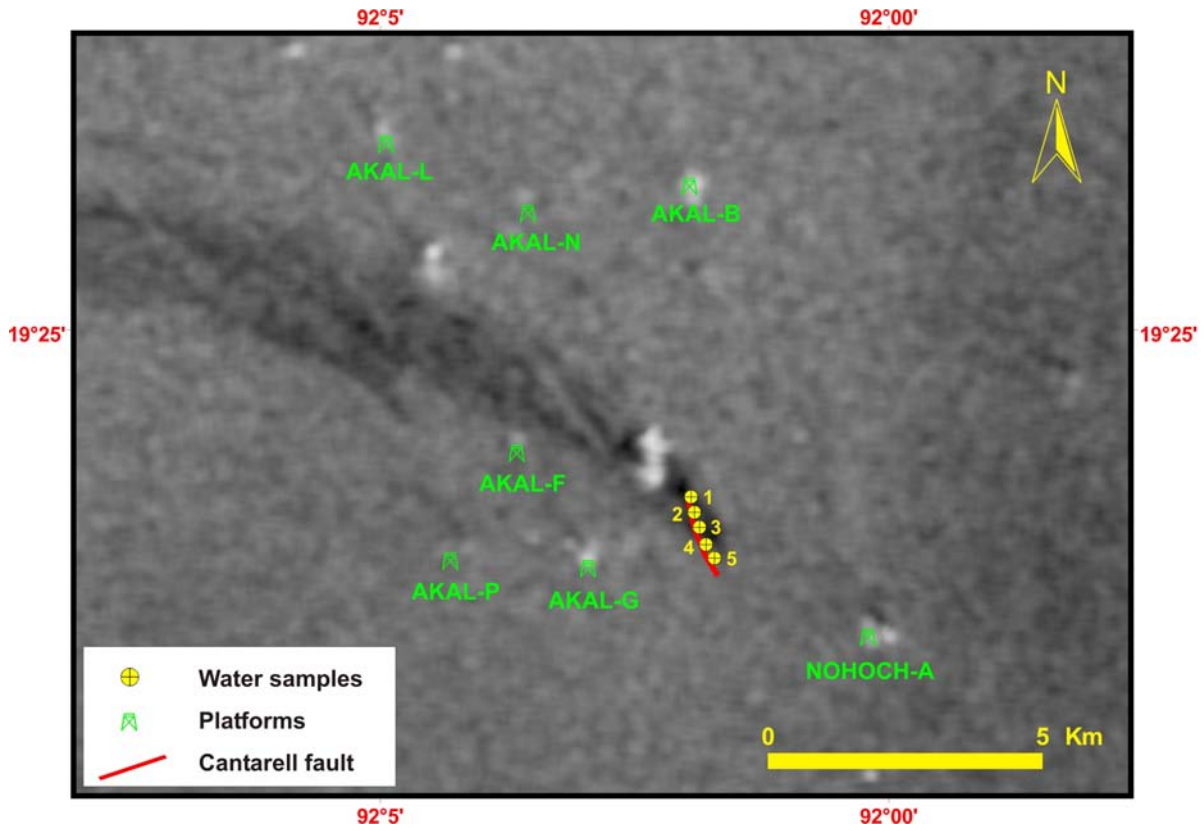


Figure 02 - RADARSAT-1 image showing the Cantarell oil seep and the samples location.

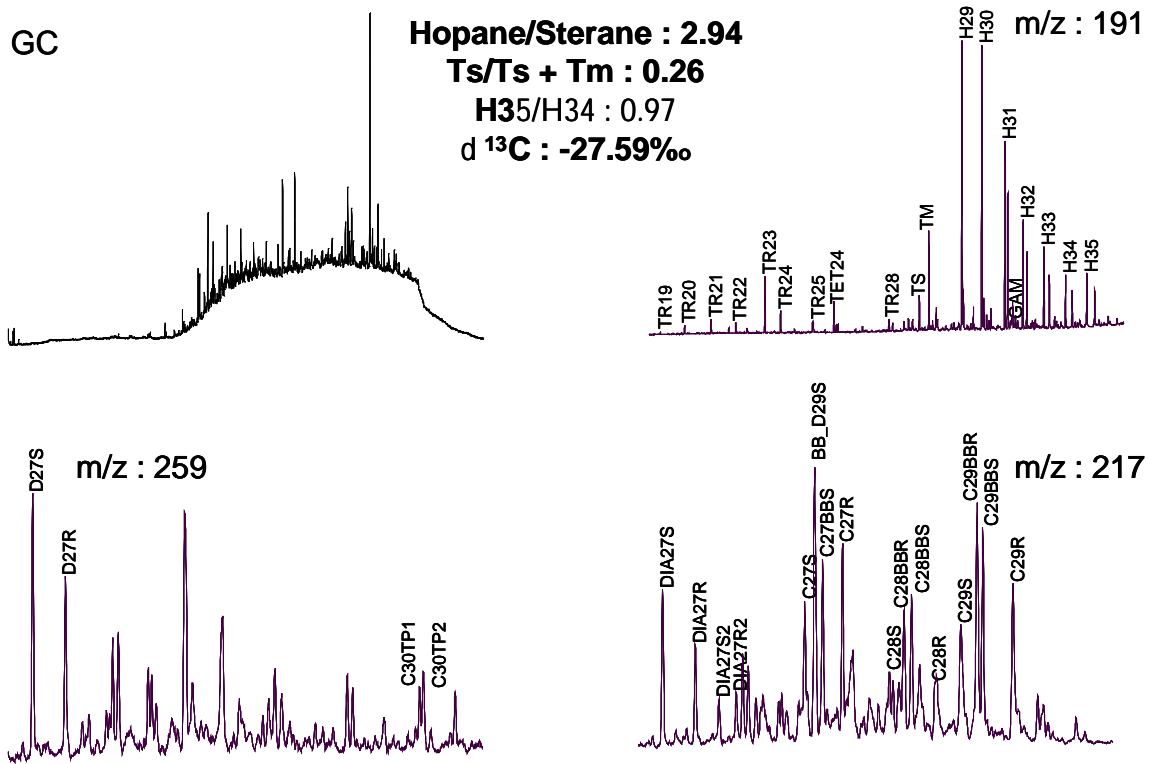


Figure 3: Gas chromatography, stable carbon isotope and biomarkers analyses results of seepage sample #3 (See Figure 2 for location).

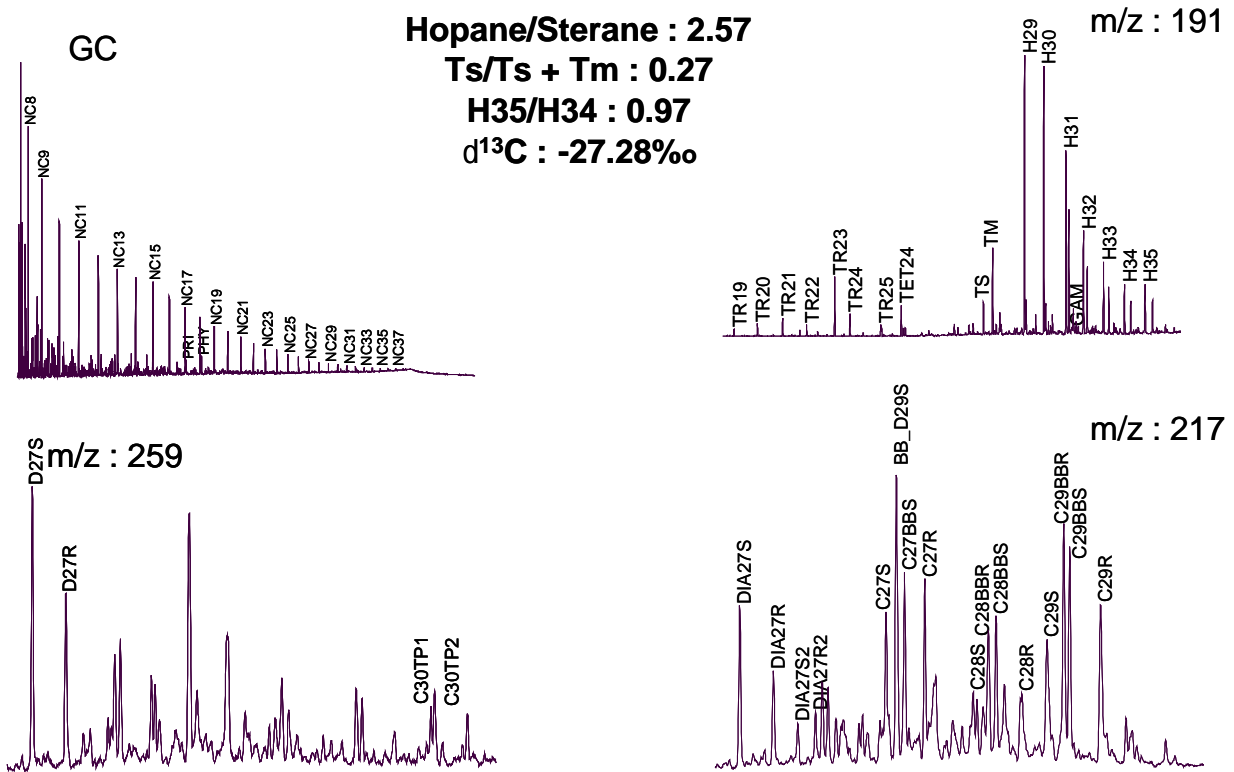


Figure 4: Gas chromatography, stable carbon isotope and biomarker analyses results from Well 289, AKAL-G rig (Paleocene/Upper Cretaceous: Breccia).

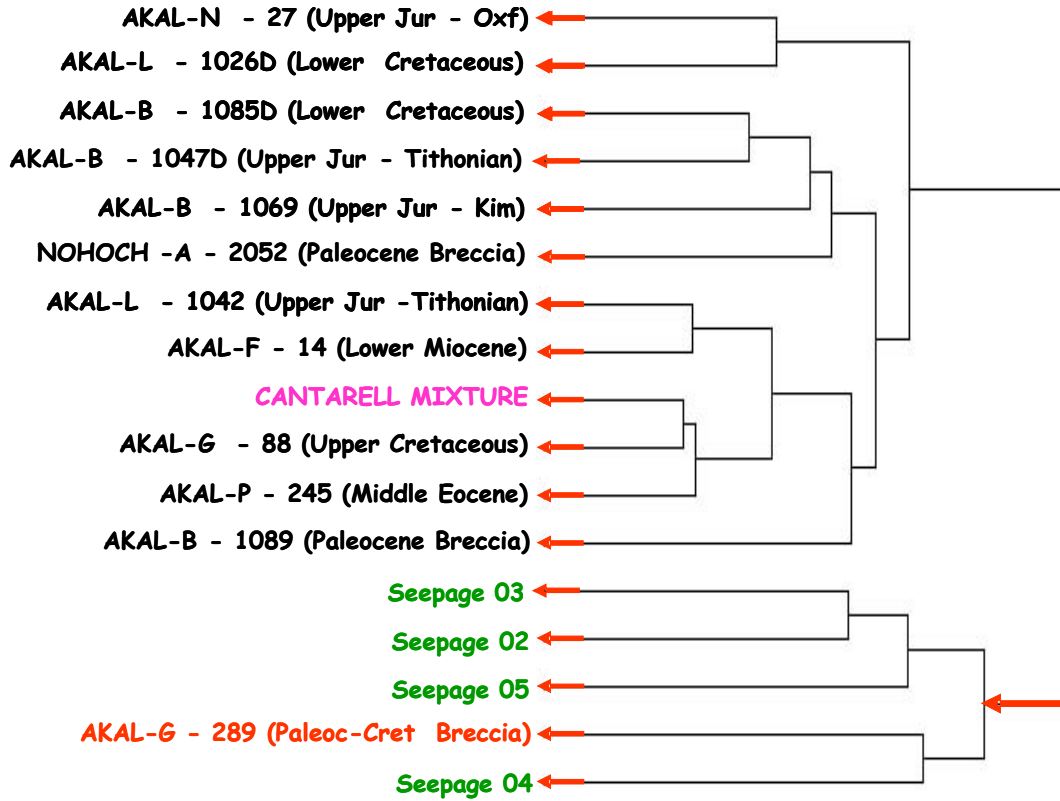


Figure 5: Clustering of geochemical parameters showing the correlation between seepage samples and petroleum from AKAL-G (Paleocene-Cretaceous Breccia).