Abundant 4-methyl diasterenes with 13C-riched stable carbon isotope compositions in the Maoming carbonaceous shale, SE China

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Abundant diasterenes (C_{27}~C_{29}) and 4-methyl diasterenes (C_{28}~C_{30}), higher than the most n-alkanes in the TIC chromatogram of the saturated hydrocarbon fraction, were detected in the Eocene Maoming lacustrine carbonaceous shale in SE China. Moreover, a much heavier $\delta^{13}C$ values(-17.2~-18.1‰) occurred in the rearranged 4-methylsterenes, which were larger than those of n-alkanes(-23.4~-28.7‰). Most importantly, these $\delta^{13}C$ values of diasterenes were also similar to those positive $\delta^{13}C$ values of C_{30} 4-methyl steranes(-13.1~-16.4‰).

The similar distribution characteristics and stable carbon isotopic compositions jointly indicate that the rearranged 4-methylsterenes shared the same biological source as the saturated 4-methylsterane homologues, which usually regarded deriving from dinoflagellates [1]. Considering the dinoflagellate species had been reported in the Maoming oil shale [2], which not only possess the CO_2-concentrating mechanism but also provide the initial 4-methyl cholesterols for the backbone rearrangement, their heavy $\delta^{13}C$ values of these steroids with 4-methyl diasterenes and steranes in this study could be well explained by its assimilating HCO_3^- as carbon source since bicarbonate ion usually 8.1‰ 13C-enriched than that dissolved CO_2 [CO_2(aq)] in lake water [3]. The presented obvious backbone rearrangement of the sterenes could be attributed to the presence of high amount of Kaolinite(54.4%) since it dominated in the clay mineral compositions of the shale sample [4].

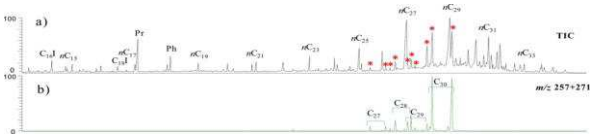

Figure 1: Distribution of rearranged sterenes(*) in the sample.

[1] Volkman (2008) *Appl Microbiol Biotechnol*. 60, 495-506. [2] Fu et al. (1985) *Geochimica*. 2, 99-114. [3] Hoins et al. (2016) *J Exp Mar Biol Ecol*. 481, 9-14. [4] Sieskind et al. (1979) *Geochim Cosmochim Ac*. 43, 1675-1679.