High AIR ratios and carbon isotope ratios of *n*-alkanes as a result of increasing maturity of oil

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Introduction

Aryl isoprenoids (AIPs) with 2,3,6-trimethyl substitutions in oil and rocks have been demonstrated as the indicator for photic-zone anoxia [1], and the AIR ratio (the proportion of C_{13-17} vs. C_{18-22} AIPs) can be used to assess the extent and persistence of this condition [2]. However, relative abundances of short-chain AIPs increase with maturity [3]. The degree of maturity effect on the AIR ratio is evaluated based on the AIPs from previously analyzed oil samples [4].

Discussion of results

The AIR ratio of 31 oil samples increases from 1.4 to 14.8 with increasing maturity, indicated by the decreasing ratio of pristane vs. C_{17} *n*-alkane (Pr/*n*C_{17}) and decreasing oil density (Figure 1). In addition, reported weight-mean $\delta^{13}C$ values of *n*-alkanes for these oils increases by ~3‰ within this range of AIR ratios, which agree with a maturity trend defined by the relationships between carbon isotope ratios and a variety of maturity indices [4]. Such a trend thus reflect relatively low thermal stability of isoprenoids side chain of AIPs, which is similar to much lower stability of acyclic isoprenoids relative to that of linear alkanes. Furthermore, significantly elevated AIR ratio for most of condensates is simply a result of relatively high abundance of C_{13} AIP, while C_{14-17} AIPs have been hardly detected in these samples.

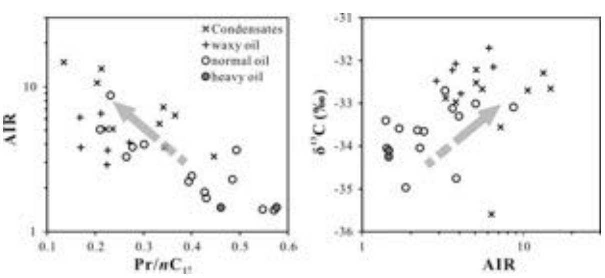

Figure 1: Cross plots of AIR vs. Pr/*n*C17 ratios and weight-mean $\delta^{13}C$ values of *n*-alkanes vs. AIR ratios of marine oils from the Tarim Basin, China.

[1] Summons & Powell (1986) *Nature* **319**, 763-765. [2] Schwarka & Frimmel (2004) *Chem. Geol.* **206**, 231-248. [3] Zhang et al. (2014) *Org. Geochem.* **77**, 126-139. [4] Jia et al. (2013) *Org. Geochem.* **36**, 225-238.