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OIL-SOURCE CORRELATION IN THE VULCAN SUB-BASIN (TIMOR SEA, NORTHERN AUSTRALIA): A COMBINED MOLECULAR AND COMPOUND-SPECIFIC $\delta^{13}C$ AND δD APPROACH

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Geochemical oil-source correlation studies typically involve the use of hydrocarbon distributions and/or compound-specific stable carbon isotopic compositions ($\delta^{13}C$) of *n*-alkanes to establish genetic relationships. There have been a limited number of reported cases where stable hydrogen isotopic compositions (δD) of individual compounds have been used for oil-source correlation purposes (e.g. Li *et al.*, 2001; Schimmelmann *et al.*, 2004), thus the robustness of the technique has not been rigorously tested. In this study, the application of compound-specific δD values in combination with $\delta^{13}C$ values and hydrocarbon distributions for oil-source correlation is evaluated.

δD values of hydrocarbons in bitumen and crude oils from the Vulcan Sub-basin (Timor Sea, Northern Australia) have been previously reported and used to evaluate source and thermal maturity (Dawson *et al.*, 2006), complementing other previously published research based on hydrocarbon distributions and compound-specific $\delta^{13}C$ values (Edwards *et al.*, 2004). The δD values of *n*-alkanes and regular isoprenoids from the oils largely support their prior classification into two end-member groups, A and B (Dawson *et al.*, 2006). Group A oils have a marine source affinity, whilst Group B oils have a terrigenous source affinity (Edwards *et al.*, 2004). For example, the $\delta^{13}C$ and δD values of *n*-alkanes in four Group A oils average -27.5‰ and -126‰, respectively; while in a Group B oil they average -26.3‰ and -102‰, respectively (e.g. Fig. 1). Four mixed oils contain *n*-alkanes with average $\delta^{13}C$ and δD values of -27.0‰ and -110‰, respectively. An exception is Tenacious-1 crude oil (Group A), which contains *n*-alkanes with more negative $\delta^{13}C$ values (averaging -28.9‰) and more positive δD values (averaging -113‰) compared to those from other Group A oils.

This study aims to both reinforce and extend the findings of Edwards *et al.* (2004) and Dawson *et al.* (2006) *via* analysis of additional Group A and Group B end-member oils (e.g. Fig. 1), and a Group A oil (Octavius) with similar, unusual isotopic features to Tenacious. Furthermore, the analysis of additional crude oil samples from multiple reservoirs where several oil charges are thought to have accumulated will be undertaken. The purpose of this study is to highlight the potential of using compound-specific δD values, in combination with molecular features and $\delta^{13}C$ values, for oil-source correlation in complex petroleum systems.

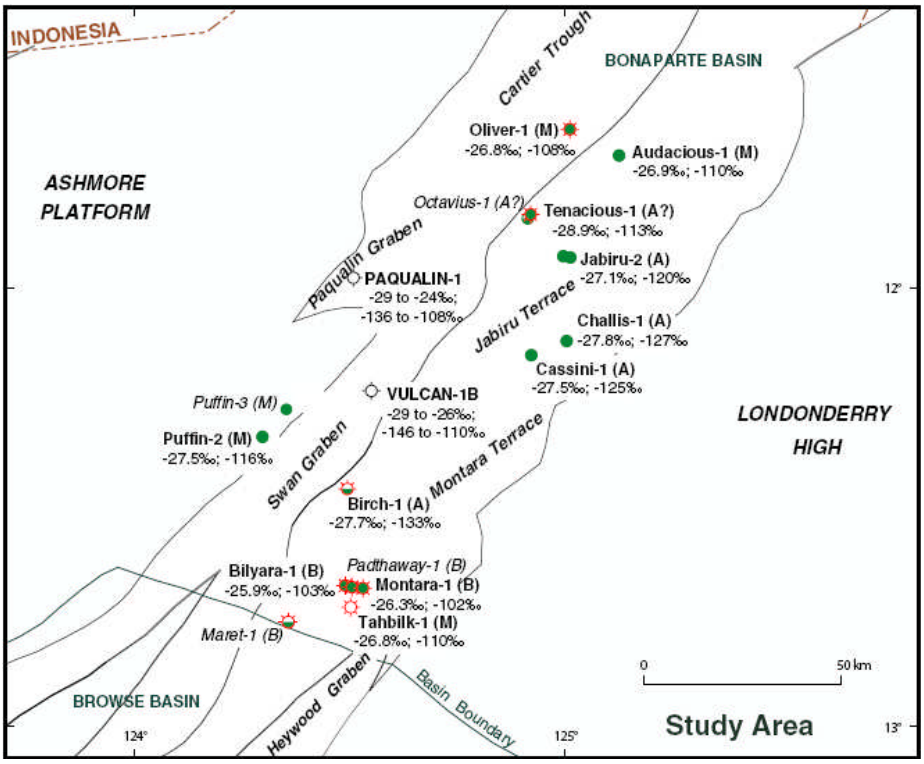

Figure 1. Map of the Vulcan Sub-basin (after Edwards *et al.*, 2004) showing well locations for various Group A (A) Group B (B) and Mixed (M) oils. Numbers underneath well names show the average *n*-alkane $\delta^{13}C$ and δD values, respectively. For Bilyara-1, the bulk δD value of the saturated hydrocarbon fraction is shown. Well names in italics are oils yet to be analysed.

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