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**Geochemical Characteristics of Solid Bitumen of Guizhong 1 in the Guizhong Depression,
SW China and Their Implications for the Origin of Natural Gas**

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The Guizhong Depression is located in the centre of Guangxi Province, China. It is a large marine sedimentary unit with an area of $4.6 \times 10^4 \text{ km}^2$ and a gross thickness of more than 8,000m from the Devonian to Carboniferous. A total of 47 wells were drilled to date (December, 2010) in the area, only 7 of which have the depths of more than 1000m. The deepest well, the Guizhong 1, was drilled in 2007 to a depth of 5151.86m and completed in the Lower Devonian Nagaoling Formation (D_{1n}). Lots of solid bitumen have been found in the well and filled in porosities and fractures of limestone and dolomite from four intervals with a total thickness of 709m. This is an exciting finding which probably indicates that it has good oil and gas exploration prospect in the Guizhong Depression.

In order to elucidate the geochemical characteristics of the solid bitumen and their implications for the origin of natural gas of the Guizhong Depression, twenty six solid bitumen samples from the Devonian in the Guizhong 1, and twenty one potential source rock samples from the Lower-Middle Devonian(D₁₋₂) of the Guizhong Depression and the Lower Cambrian Niutitang Formation (Є_{1n}) of the adjacent Qiannan Depression were analyzed for $\delta^{13}\text{C}$ values and biomarkers.

The results show that firstly the solid bitumen samples have bulk $\delta^{13}\text{C}$ (PDB) values from -27.4‰ to -23.0‰, average -25.8‰(n=26), and the individual normal alkanes (nC₁₅-nC₂₉) $\delta^{13}\text{C}$ values from -31.0‰ to -28.2‰. The values are well-correlated with bulk $\delta^{13}\text{C}$ values from -27.4‰ to -24.8‰, average -26.4‰ (n=13) and the individual normal alkanes (nC₁₅-nC₂₉) $\delta^{13}\text{C}$ values from -32.3‰ to -28.9‰ of the Lower-Middle Devonian source rocks, respectively. While the Niutitang Formation source rocks (Є_{1n}) have bulk $\delta^{13}\text{C}$ values from -35.8‰ to -30.8‰, average -34.0‰(n=8), which dramatically distinguish from that of the bitumens and the Lower-Middle Devonian source rocks(Fig.1). Importantly, the bitumens and the Lower-Middle Devonian source rocks show similar distribution pattern of the individual normal alkanes (nC₁₅-nC₂₉) $\delta^{13}\text{C}$ values. Secondly, they are both relatively rich in tricyclic terpanes and C₃₀ hopane, and poor in gammacerane, while the Niutitang Formation source rocks are relatively rich in gammacerane and C₃₀ hopane, and poor in tricyclic terpanes(Fig.2). Finally the bitumens and

the Lower-Middle Devonian source rocks have no triaromatic steroids, while the Niutitang Formation source rocks are relatively rich in the compounds.

In summary, it can be concluded that solid bitumen of Guizhong 1 must have been derived from the Lower-Middle Devonian source rocks based on carbon stable isotopes and biomarkers distribution. Therefore it can be further inferred that the natural gas of the Guizhong Depression must have been derived from the Lower-Middle Devonian source rocks.

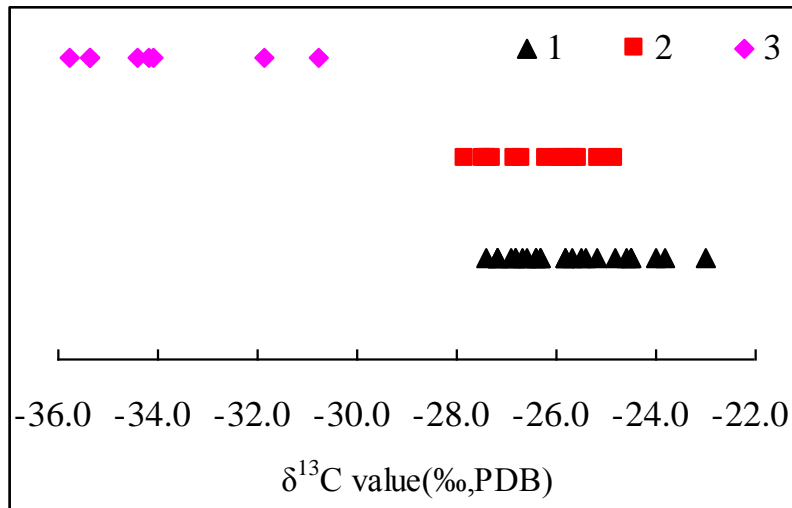


Fig.1. Correlation of bulk $\delta^{13}\text{C}$ values between bitumens and potential source rocks. 1. bitumens(D_{1-3}) of Guizhong 1; 2. source rocks of the Lower-Middle Devonian (D_{1-2}); 3. source rocks of the Lower Cambrian Niutitang Formation(C_{1n})

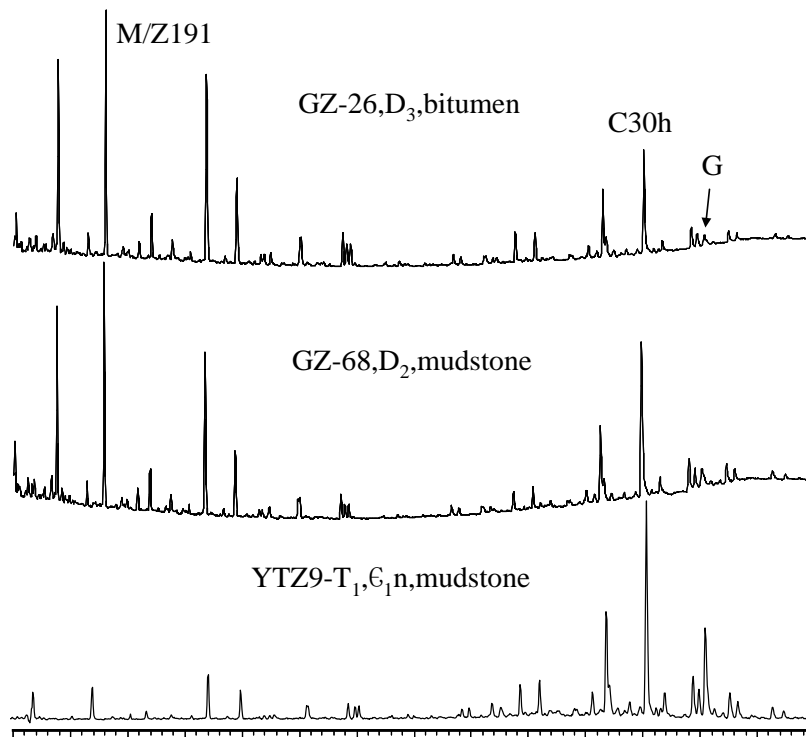


Fig.2. Biomarkers Distribution of the bitumen and potential source rocks