

## The Origin of the Lower Cambrian Niutitang Shale gas in Southeastern Chongqing, China

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The increasing global demand for clean energy has made it imperative to search for and exploit unconventional oil and gas resources. Organic-rich shales have received renewed attention because of their emergence as unconventional hydrocarbon reservoirs. Southeastern Chongqing is an important part of upper Yangtze plate, also a key area of shale gas exploration and development of China in the future. Hydrocarbon generation potential of Cambrian Niutitang shale are discussed according to analysis on organic matter abundance, type and source material. Niutitang shale features high organic content, with an average of 7%. The type of organic matter is of type I, excellent for oil-generating. Bitumen A, hydrocarbon generation potential ( $S_1+S_2$ ) and hydrogen index (IH) are very low, indicating liquid hydrocarbon which was generated during oil-generation peak period may be used up in high-over mature stage. Residual gas was extracted by vacuum crushing analytical method, mainly containing methane. One of the more significant observations in this work involves the carbon isotope compositions of the residual gas ( $C_1$ ,  $C_2$ , and  $C_3$ ) released by rock crushing. The carbon isotope analysis suggests that the shale gas stored in the organic-rich Niutitang shale was mostly generated from the cracking of residual bitumen and wet gas during a stage of significantly high maturity. A conventional  $\delta^{13}C_1$ - $\delta^{13}C_2$  trend was observed, and most  $\delta^{13}C_2$  values of the residual gases are heavier than those of the organic matter (OM) in the corresponding samples, indicating the splitting of ethane bonds and the release of smaller molecules, leading to  $^{13}C$  enrichment in the residual ethane.