

An in situ oil cracking gas reservoir in Cambrian-Sinian petroleum system of the Sichuan Basin, western China: Implications for hydrocarbon exploration in old and deep carbonate reservoirs

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A giant gasfield(Anyue) with an estimated geological reserve of more than $4403.8 \times 10^8 \text{m}^3$ was recently discovered in lower Cambrian carbonate reservoir at a burial depth of 4600-5000m in the Sichuan Basin, western China. Isotope geochemistry of gas and bitumen indicate that it was oil cracking gas. Studying the tectonic evolution history and hydrocarbon accumulation history, It was found that the recent gas field was generated from in situ oil cracking of paleo-oil pool charged in the early Triassic, approximately 290-250 million years ago. As well known, China's subaerial marine carbonate reservoirs have generally undergone multi-periods tectonic phases, many accumulations were destroyed later due to frequent tectonic movements, especially late Himalayan Orogeny. The oil and gas reservoirs often experienced physical adjustment and chemical alteration: on the one hand, adjusting and alternating of pre-existing traps caused oil and gas leakage or migration laterally; on the other hand, thermal evolution of oil was accelerated by deposition of massive strata, generating large amounts of cracking gas, much of them was scattered or altered during later tectonic movements. The key reason of Anyue huge gas field was stabilization of traps during multi-periods tectonic phases, for this reason, the physical adjustment nearly never happened and made suitable conditions for pre-existing paleo-oil pools and later in situ oil cracking gas reservoirs. This finding indicated that some old and deep carbonate reservoirs may be prospective frontier for future exploration if they could be avoided serious damage of tectonic movements.