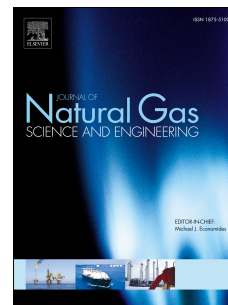


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Geochemistry and origin of continental natural gas in the western Sichuan basin, China

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1 Geochemistry and origin of continental natural gas in the Western Sichuan basin, China

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9 Abstract:

10 The molecular compositions and stable carbon and hydrogen isotopes of natural gases of Jurassic  
11 and Upper Triassic strata in western Sichuan Basin were investigated to assess the origin, maturity,  
12 sources. Then the results were compared with those of central Sichuan Basin. Results show that  
13 the natural gas in Western Sichuan basin is wet gas and the dry coefficient is higher than that of  
14 central Sichuan basin. The stable carbon and hydrogen isotopes represent a positive carbon  
15 isotopic series of alkanes (i.e.  $\delta^{13}\text{C}_1 < \delta^{13}\text{C}_2 < \delta^{13}\text{C}_3$ ). Continental natural gases in Sichuan Basin  
16 mainly belong to coal-derived gases, and only the gases from Jurassic strata in central Sichuan  
17 basin are oil-derived gases. Carbon dioxide is mainly abiogenic, with some biogenic. The  
18 abiogenic carbon dioxide is a result of the thermal metamorphism of carbonates. The natural gas in  
19 the Sichuan Basin mainly come from mature and high mature stage, while only the gases of  
20 Jurassic strata in central Sichuan Basin were generated in the mature stage. The Jurassic natural  
21 gas in western Sichuan basin possibly originated from a mixture of  $\text{T}_3\text{X}^3$  and  $\text{T}_3\text{X}^5$  black  
22 mudstones with low thermal maturity. However, the oil-derived gases of Jurassic strata in central  
23 Sichuan basin were found to come from Ziliujing-baitianba source rock. The deep Triassic natural  
24 gases in Western and Central Sichuan basin originated from the nearby or in situ source rocks of  
25 Xujiahe formation.

26 Keywords: Stable isotope, Light hydrocarbon, Sources of natural gas, Continental natural gas,  
27 Sichuan basin

28  
29 1 Introduction

30 Natural gas is mainly composed of hydrocarbons and non-hydrocarbons such as  $\text{CO}_2$ ,  $\text{N}_2$ ,  $\text{H}_2$ ,  
31  $\text{H}_2\text{S}$  and noble gases, such as He and Ar. The chemical compositions of alkanes combined with  
32 stable carbon and hydrogen isotopes can provide information on the origin of natural gases and  
33 assess gas-source correlations. Non-hydrocarbon gases are widely applied in natural gas genesis  
34 identification, maturity analysis, migration tracing, and gas source identification (Strapoč et al.,  
35 2007, 2008; Dai et al., 2012a, 2012b; Sun et al., 2016; Wang et al., 2017; Ozima and Podosek,  
36 2002; Burnard et al., 2013; Kotarba and Nagao, 2008; Prinzhofer et al., 2010; Prinzhofer, 2013;

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