

# Quantitative Prediction of TOC in Deep Marine Source Rocks of Qiongzhusi Fm. in the Central Sichuan Basin, China

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## Abstract

Deep marine source rocks are characterized by poor seismic data quality, difficult velocity field derivation and superimposed P-wave impedance distribution of the source rocks with different abundances, which hinder the application of conventional seismic prediction methods for high-quality source rocks. This paper presents a quantitative prediction method based on seismic inversion for marine source rocks, which is applicable to the Cambrian Qiongzhusi Fm. source rocks in Central Sichuan Basin. On the basis of geochemical analysis of cores, the single-well total organic carbon (TOC) curve was derived using logging method. Then, the sedimentary filling sequence and plane facies distribution of target horizon were determined by the seismic sedimentary sequence and plane facies analysis method. The high-frequency part of TOC curve and the low-frequency part of acoustic curve were fused to generate the pseudo-acoustic curve in order to identify high-quality source rocks. The petrophysical analysis was conducted to determine the criteria for geophysical parameter assessment of high-quality source rocks. Poststack frequency-divided inversion with phase-controlled waveform inversion as the core was made for the 3D area using the pseudo-acoustic curve to derive the high-resolution pseudo wave impedance volume, and the three-dimensional distribution of high-quality source rocks was predicted using the threshold for source rock assessment. Finally, the method was extended to 2D area to predict high-quality source rocks. According to the results, the Qiongzhusi Fm. high-quality source rocks (TOC >2%) in Central Sichuan Basin are 0-180 m thick. Specifically, the high-quality

source rocks in Qiong-1 Member mainly distribute in intracratonic rift areas, with a thickness of 0-150 m; the high-quality source rocks at the bottom of Qiong-2 Member distribute widely, with a thickness of 0-50 m. The hydrocarbon source conditions are good in the Qiongzhusi Fm. in the north slope of Central Sichuan paleo-uplift, where the high-quality source rocks is generally thicker than 100 m, indicative of favorable material base for extensive gas accumulation.

*Key words: Marine source rocks; High-quality source rock prediction; Central Sichuan; Qiongzhusi Fm.; TOC*