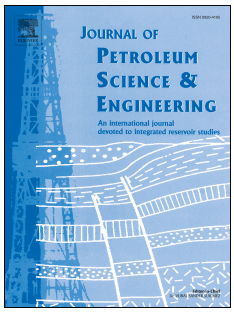
Accepted Manuscript



The evolution of pore-fluid pressure and its causes in the Sinian-Cambrian deep carbonate gas reservoirs in central Sichuan Basin, southwestern China

Wen Liu, Nansheng Qiu, Qiuchen Xu, Yifeng Liu, Anjiang Shen, Guangwu Zhang

PII: S0920-4105(18)30451-0

DOI: 10.1016/j.petrol.2018.05.057

Reference: PETROL 4986

To appear in: *Journal of Petroleum Science and Engineering*

Received Date: 21 December 2017

Revised Date: 16 May 2018

Accepted Date: 18 May 2018

Please cite this article as: Liu, W., Qiu, N., Xu, Q., Liu, Y., Shen, A., Zhang, G., The evolution of pore-fluid pressure and its causes in the Sinian-Cambrian deep carbonate gas reservoirs in central Sichuan Basin, southwestern China, *Journal of Petroleum Science and Engineering* (2018), doi: 10.1016/j.petrol.2018.05.057.

The evolution of pore-fluid pressure and its causes in the Sinian-Cambrian deep carbonate gas reservoirs in Central Sichuan Basin, Southwestern China

Wen Liu [a, b], Nansheng Qiu [a, b, *], Qiuchen Xu [a, b], Yifeng Liu [c], Anjiang Shen [d, e] Guangwu Zhang [f]

[a] State Key Laboratory of Petroleum Resources and Prospecting, China University of Petroleum, Beijing 102249, China

[b] College of Geoscience, China University of Petroleum, Beijing 102249, China

[c] School of Earth Sciences and Engineering, Nanjing University, Jiangsu 210023, China Key Laboratory of

[d] Carbonate Reservoirs, China National Petroleum Corporation, Hangzhou 310023, China

[e] PetroChina Hangzhou Research Institute of Geology, Hangzhou 310023, China

[f] Natural Gas Geology Division, Research Institute of Petroleum Exploration and Development, Langfang 065007, China

Abstract: Reconstructing the evolution of paleofluid pressure in carbonate reservoirs is a challenging problem, particularly when no oil-bearing fluid inclusions are available to provide barometric constraints on the fluid system. To recover the paleofluid pressure in the Sinian Dengying Formation (Z_2dn) and the Cambrian Longwangmiao Formation ($Є_1$l) of the central paleo-uplift of the Sichuan Basin, we conducted a comprehensive analysis combining the inclusion pressure-volume-temperature simulation, inclusions in situ Raman shifts, and basin modeling. The results showed that the evolution of the pore pressure could be divided into four stages. Prior to the end of the late Triassic, the whole central paleo-uplift was in a normal pressure state. During the Jurassic, a moderate overpressure prevailed in the dolomitic reservoirs of the Gaoshiti-Moxi area and decreased in the adjacent units. At the end of the early Cretaceous, the overpressure reached a maximum in the whole region and was strongest in the Longnüsi area, decreasing to the west. From the late Cretaceous to the present day, the central area of the basin has uplifted rapidly with the overpressure significantly decreasing. Z_2dn has been restored to normal pressure during the Neogene, while $Є_1$l remains moderately overpressurized. Based on an analysis of the structural background and preservation conditions, the types of sedimentary facies, the preservation condition of the traps, and the differential weathering process are the primary reasons for the different pressure states in Z_2dn and $Є_1$l during the last stages.

Keywords：Paleo-pressure reconstruction, Overpressure mechanism, Basin modeling, Fluid inclusions, Sichuan Basin

1. Introduction

Pressure studies in sedimentary basins, including distribution and evolution studies, have become an indispensable part of basin analysis, and play an important role in exploration of hydrocarbon resources and the forecasting of prospects. The distribution of the present pressure is a boundary condition of paleo-pressure reconstruction, which could be measured directly by measurement well drilling (MWD), drill-stem-test (DST), and deep well pressure gauge, or estimated indirectly in the exploration of new areas without downhole data (Eaton，1975；Zhang, 2011). The methods also vary for paleo-pressure reconstruction . In early studies, the fluid pressures were usually recovered using statistical methods such as experience plots and empirical