



Deformation process and physical modeling of the Cambrian salt-related structures in the southern and eastern Sichuan Basin

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The Cambrian carbonate & evaporite paragenesis system in the southern and eastern Sichuan Basin is made up of the Longwangmiao Formation and the Gaotai Formation. Under the compressive stress from NW-SE direction, the obvious plastic flow of the halite layers in the Cambrian easily resulted in the complex deformation of its overlying and underlying strata and a variety of salt related structures. The reliability of structural traps in the study area is generally low because of the great burial depth, low quality seismic data and lack of well drilling data. It's necessary to do the physical modeling of geological structures as an effective method to study the deformation mechanism and characteristics of salt structure. It has great significance to the seismic interpretation of geological structures.

In this paper, the process of physical modeling is expounded, and some conclusions about the salt related structural deformation of Cambrian are summarized. Firstly, the stratigraphic filling structure of Cambrian is studied and three kinds of stratigraphic framework model are established so as to provide a scaled geological model for physical modeling. Secondly, a template for the material selection of physical modeling is founded according to the relationship between extrusion strain rate and thickness of the stata from the physical modeling. Next, it is inferred that the deformation process and the key period of formation of salt-related structures in Cambrian by using seismic interpretation and balanced section of structural evolution. Finally, the physical simulation of three kinds of scaled geological models is carried out respectively with an instrument for the physical simulation under the unilateral extrusion, and the role of halite layers in the process of structural deformation is analyzed so as to establish possible structural styles and reservoir formation models

The results show that: 1) The halite layers in Cambrian play an important role for its upper and lower layers during the process of deformation, including acting as the regional detachment layers for slippage, regulation and filling of anticline nucleus, with few piercing salt structures formed. The evolution of deep and shallow structures and the deformation patterns are influenced by the thickness and distribution of halite layers. Usually, fault-related folds are developed above the halite layers, but the broad anticlines and imbricated-fault folds are developed below the halite layers; 2) The movement of the salt body is controlled by the basement fault, paleouplift, structural slope and the catastrophe zone of halite layers, which is prone to the accumulation and thickening the halite layers at the core of anticlinal fold [U+FF1B] 3) There are mainly four accumulation models in Cambrian, including the post-salt, pre-salt, intersalt and salt-welding, which are mainly controlled by the space-time configuration among the hydrocarbon source, the accumulation layer and the cap, structural style and the distribution of evaporative lagoon. The below-salt and the salt-welding is the key target of exploration in the future.

The conclusions of the paper are in good agreement with the results from the seismic interpretation and structural recovery, indicating that the methods and conclusions are instructive.