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Analysis of present-day stress based on Stress Measurement and Numerical Simulation in Qinshui Basin, Shanxi Province, China

Xu K. [1], Dai J.S.[1], Li M.P.[1], Ren Q.Q.[1]

[1] School of Geosciences, China University of Petroleum, Qingdao, China, xukee0505@163.com.

Qinshui Basin located in Shanxi Province, China, is well-known for its rich coal resources and has potential for coalbed methane. The basin occurs as a N-S trending synclinorium surrounded by mountains, and it is quite probable that the tectonic setting will exert some influence on the gas migration. It is now widely accepted that present-day stress is a key parameter in solid earth sciences and technology, and effectively provides a theoretical basis for designing gas-well pattern arrangement and adjustment. We report here the results of an in-depth study on the present-day stress state of coalbed methane in the Qinshui Basin.

Present-day stress test data of several single wells were collected, calculated, and inferred to establish a regression relation between stress and depth to 700m. The deeper stress state was investigated using the 15# coal seam during exploration drilling. Firstly, we made a three-dimensional numerical simulation using the latest analysis software *ANSYS 15.0* with finite element method. Then, the stress values of each node in the model were compiled and analyzed so as to establish a regression relation between stress and depth to 2500m. On the basis of this relation, we analyzed comprehensively the horizontal and sectional distribution of the present-day stress component and stress coefficients in Qinshui Basin.

Numerical simulation data reveal that the present-day maximum horizontal stress direction approximates the structural axis of the basin, following the fold trends, while lower stress values occur across these folds and also along fault zones. In detail, the maximum horizontal stress is predominantly oriented NNE-SSW and NE-SW. However, the fault zones exhibit an abnormally deflected multi-direction that is possibly contributed to the development of faults.

The sectional distribution of present-day stress in Qinshui Basin is primarily controlled by depth. The principal stresses including maximum and minimum horizontal stress as well as vertical stress, increase with depth. Moreover, the stress coefficients tend to be centralized. And the influence of gravity on present-day stress also increases with depth. Hence, the distribution of present-day stress in Qinshui Basin shows regular changes in horizontal and sectional scale, which is influenced by depth, faults, and structural configuration.

References:

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