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Characteristics of in-situ stress state and prediction of the permeability in the Upper Permian coalbed methane reservoir, western Guizhou region, SW China

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1 ***Characteristics of in-situ stress state and prediction of the***  
2 ***permeability in the Upper Permian coalbed methane reservoir,***  
3 ***western Guizhou region, SW China***

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12 **Abstract:** Coal permeability and in-situ stress state are important parameters for coalbed  
13 methane (CBM) exploration and development; however, the distribution pattern of the Upper  
14 Permian CBM reservoir permeability is poorly understood in the western Guizhou region, SW  
15 China. In the present study, based on measured injection/falloff and in-situ stress data in the  
16 Upper Permian coal seams of western Guizhou region, the present-day in-situ stress field, and  
17 its correlation with coal permeability were investigated. The orientation of the horizontal  
18 maximum principal stress ( $S_{Hmax}$ ) indicated a dominant ~NW-SE-trending. In addition, the  
19 present-day in-situ stress field showed an important control on coal permeability. The  
20 permeability in the Upper Permian coal seams decreased exponentially with the increased  
21 effective in-situ stress magnitude. By utilizing the finite element method (FEM), the  
22 present-day in-situ stress field in the western Guizhou was numerically analyzed based on a  
23 geomechanical two-dimensional (2D) model. Distribution of coal permeability in the Upper  
24 Permian CBM reservoir was predicted based on the relationship between coal permeability  
25 and effective in-situ stress magnitude. The results indicated that, in the western Guizhou  
26 region, vertically, coal permeability was relatively high and widely distributed shallower than  
27 approximately 780 m below ground level (bgl), whereas, it was extremely low and regularly  
28 varied with burial depth deeper than approximately 780 m bgl. Laterally, the distribution  
29 pattern of coal permeability was characterized by strong heterogeneity due to well-developed  
30 faults and folds. High values of the Upper Permian coal permeability were located in regions  
31 around Nayong-Zhijin, Panxian-Anlong and along Shuicheng-Liuzhi-Ziyun. The present study  
32 may provide geological references for the CBM reservoir productivity and subsequent analysis  
33 (e.g., wellbore stability, hydraulic fracturing design, and fault reactivation studies, etc.) in the  
34 western Guizhou region.

35 **Keywords:** coal permeability; in-situ stress state; coalbed methane reservoir; numerical  
36 simulation; Upper Permian; western Guizhou region  
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