Revisiting: Investigation on the dynamic evolution and evaluation of floor microseismic responses during extra-thick coal seam mining

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The mining of extremely thick coal seams causes strong disturbances to the floor strata. When a strong aquifer exists beneath the coal seam and the effective aquiclude is weak, the risk of floor water inrush increases significantly. In recent years, microseismic (MS) monitoring technology has been widely applied, and using MS monitoring to assess floor water inrush risk has proven to be a reliable and effective approach. To address the high-risk problem of floor water inrush during the extraction of extremely thick coal seams, this study employed MS monitoring to investigate the evolution characteristics of floor MS activity and its associated water inrush risk. The MS response characteristics induced by thick seam mining were analyzed, and a floor water inrush risk evaluation model was established based on the Analytic Hierarchy Process-Entropy Weight Method (AHP-EWM). The evaluation results were consistent with field monitoring data. The results indicate that most floor MS events in the 61607 working face of the Longwanggou Coal Mine were concentrated in the Taiyuan Formation. The MS monitoring indicators, such as the extent of the advanced influence zone, floor failure depth, and total daily released energy, showed strong correlations with observed data including water inflow and mine pressure. By summarizing the key controlling factors of floor water-inrush risk, this study departs from traditional static geological parameter indicators and instead focuses on dynamic indicators derived from the activity, spatiotemporal characteristics, and intensity characteristics of floor MS events. Integrating multiple influential factors of floor water inrush, a quantitative evaluation system for floor water-inrush hazard in extremely thick coal seam mining was established using the AHP-EWM combined subjective-objective weighting method, which shows good consistency with field monitoring results. This study provides theoretical and data support for analyzing the dynamic process and influencing factors of floor damage and fracture evolution under thick seam mining. It offers a new approach for predicting and forecasting water inrush risk, enriches the application of MS monitoring in mine floor water hazard prevention, and holds significant practical importance for promoting safe coal mine production.

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