Characteristics of Weathered Deep Troughs under Coupled Igneous Rock Intrusion in Karst Areas and Post-Treatment Imprint

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Abstract

The dam site area of the Zhangjiazhai Reservoir in Guizhou is influenced by the coupling effect of karst and igneous rock intrusion, with multiple deep weathering troughs developed, posing severe challenges to engineering construction. Through surface geological survey, pit and trench exploration, drilling, geophysical prospecting, and rock-soil mass testing, three longitudinal karst-weathering deep troughs were identified at the left dam abutment, and one horizontal weathering deep trough at the right dam abutment. The research revealed deep weathering troughs formed by two genetic mechanisms: "structure-igneous rock-karst coupling" and "contact zone differential weathering-structure-topography coupling". A treatment framework of "precision exploration-classified treatment-dynamic monitoring" was established for different types of weathering deep troughs, and differentiated treatment measures were proposed. After curtain grouting treatment, downstream springs dried up, the grouting effect was significant, and the treated dam foundation met stability requirements. The research clarified the classification characteristics, genetic mechanisms, and treatment measures of weathering deep troughs in karst-igneous rock intrusion coupling areas, providing a reference for similar projects.

Full Text

Preamble

Title: Development Characteristics and Treatment of Weathered Deep Troughs Coupled by Igneous Intrusions in Karst Areas

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Abstract: The dam site area of the Zhangjiazhai Reservoir in Guizhou is influenced by the coupling effects of karst and igneous intrusion, resulting in the development of multiple weathered deep troughs that pose severe challenges to engineering construction. Through comprehensive investigations including surface geological surveys, pit and trench exploration, drilling, geophysical prospecting, and rock-soil mass testing, the study identified three longitudinal karst-weathered deep troughs developed on the left dam abutment and one horizontal weathered deep trough on the right dam abutment.

The research revealed two distinct genetic mechanisms for these features: "structural-igneous rock-karst coupling" and "contact zone differential weathering-structure-topography coupling." A treatment framework encompassing "precision exploration-classified treatment-dynamic monitoring" was established for different types of weathered deep troughs, with differentiated treatment measures proposed accordingly. Following curtain grouting treatment, downstream springs dried up, demonstrating significant grouting effectiveness, and the treated dam foundation satisfied stability requirements. These findings clarify the classification characteristics, genetic mechanisms, and treatment measures for weathered deep troughs in karst-igneous intrusion coupling zones, providing valuable reference for similar engineering projects.

Keywords: Maokou Formation limestone; karst; diabase; reservoir; weathered deep trough

Note: Figure translations are in progress. See original paper for figures.