عنوان مقاله:

Cave Geomechanical Index (CGI). Classification and Contribution to the Conservation of Natural Caves in the Iron Mines

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خلاصه مقاله:

Cave geotechnical studies have been the key to meeting the requirements of Brazilian environmental legislation for the conservation of speleological heritage in mining areas. This paper presents a methodology that classifies iron caves according to their susceptibility to structural instability called the Cave Geomechanical Index (CGI). This index combines four variables: (۱) Rock Mass Rating (RMR), Bieniawski' s geomechanical variable, which classifies the quality of the rock mass hosting the cave; (۲) Hydraulic Radius (HR), an engineering variable that allows the dimension of the span to be evaluated; (۳) Ceiling Shape (CS), a speleological variable that indicates whether the ceiling geometry of the cave spans is favorable or unfavorable for block formation, and (۴) Ceiling Thickness (CT), a geotechnical variable that represents the depth between the ceiling of the cave and the surface of the ground regarding auto-support issues. The CGI was developed, applied and calibrated over four years, by monitoring ۶۳ spans from ۲۷ caves adjacent to active iron ore mines in Carajás, Pará state, Brazil, that had been authorized to be eliminated. This geomechanical classification system proved to be easy to implement and its results showed that ۷۶% of the spans with breakdown occurrences in the caves were classified as high or very high susceptibility to structural instability, while ۹۴% of the spans classified as low susceptibility did not show any signs of physical damage. The CGI is discussed with the focus on improving stability studies, predictability of cave breakdown mechanisms and geotechnical risk analysis of iron caves near mining operations.

کلمات کلیدی:

Iron cave, Stability assessment, Cave breakdown, Cave geomechanics, Risk analysis, Carajás