



Quantitative characterization of fault-fracture network and its controlling effects on epigenetic karst: A case study of the Devonian-Carboniferous in the Miaoqian area of southeastern Hunan, China

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Seepage capacity of the fluid is significantly enhanced in the carbonate rocks where fault-fracture network develops. Therefore, the scale, occurrence and spatial distribution of fault-fracture network are important factors controlling the development of epigenetic karst. Taking the Devonian-Carboniferous of Miaoqian area, southeastern Hunan, China as an example, this paper focuses on the controlling effects of fault-fracture network on epigenetic karst. The southeastern Hunan is located in the joint zone between the Yangtze plate and the Huaxia plate. In Indosinian period, the study area was in approximately S-N compressive setting, while in Yanshanian period it was converted to be in the WNW-ESE compressive setting. The fault-fracture network of the Devonian-Carboniferous in the Miaoqian area is the combined result of the above two periods of tectonic deformation. We utilized drones, laser range finder, 3D laser scanners and other equipments to make detailed measurements on geometries of the faults, fractures and karsts in Xijin Cave, Moonlight Cave, Jiuqu Cave, Moyanli Canyon and the surrounding region. The relationship between fault-fracture network and karst was analyzed, and the following conclusions are obtained: (1) the strong karst zone is controlled by reverse faults and shear joints developed in Indosinian and Yanshanian periods;(2) large karst caves mainly develop in the intersection of faults with different strikes;(3) the karst intensity is controlled by the scale, number of intersections and density of fault-fracture network. As the scale and density of fractures decrease, the karst intensity decreases from core to flanks;(4) The stalactite and stalagmites in the cave mainly develop along the reverse fault or large conjugate shear joints;(5) small dissolved pores and karst caves are mainly distributed as beads along the shear joints;(6) while fault-fracture network is not well-developed, karst intensity is weak with small dissolved fractures developing along bedding surfaces.