

ABSTRACT

The influence of mechanical stress on weathering and erosion has been overlooked in works focused on sandstone landforms formation, although stress has been shown to be a key factor in the formation of a number of different sandstone landforms recently. The main goal of the doctoral thesis is to understand the relationship between mechanical stress and weathering or erosion in the formation and development of sandstone landforms. The influence of mechanical stress on the mode of weathering and the rate of disintegration of the material forming historical monuments in Petra, Jordan was investigated on the site and on samples in laboratory. A negative exponential dependence has been proven between the speed of salt weathering and the magnitude of uniaxial compression of Petra sandstone samples. The role of mechanical stress as a mechanism controlling the formation and development of the shape of sandstone forms was further studied in rock overhangs, sandstone arcades and rock gates in the Czech Republic and the USA. The doctoral thesis presents and verifies a method using Střeleč sandstone as a natural analogue in physical models simulating weathering and erosion of cemented sandstone. These physical models usually take the form of a reduced initial shape of a sandstone object created *in situ* from the Střeleč sandstone in a quarry, to which an erosion factor simulating real weathering or erosion (water sprinkling) is applied. The field of mechanical stress in such a model determines which parts of the model are preferentially eroded and which remain, thus creating the final shape. The erosive process is continuously photographed, which allows construction of photogrammetric 3D model and arbitrary sections of its 3D shape, and modeling of stress distribution in the form in various stages of its evolution. The calculation of stress distribution has been used to interpret the results of physical models of weathering and erosion, and it has allowed to predict the places where the most intense weathering or erosion occurred on real rock landform or carved historical sandstone monuments. The formation and evolution of sandstone arcades has been also numerically simulated. It has been proven that the influence of mechanical stress on the formation of a number of sandstone landforms is crucial and for the first time a rock arch has been created under controlled conditions as one of the most elegant landforms in sandstones.