



Changes in pore geometry of limestone rocks as a result of a natural dissolution process

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Two samples of a Miocene limestone have been collected from a quarry located near Smerdyna (Poland), where an intense development of surface karst forms is observed. In particular, a large number of solution pipes is visible on the walls of the quarry, with diameters of about 0.5 m and lengths up to 6 meters. Sample S1 was collected from immediate vicinity of the tip of a relatively long solution pipe, whereas sample S2 was extracted about five meters away from the tip. The pore spaces of both samples were then analyzed using x-ray CT imaging. The samples show marked differences in their pore structure: sample S1 has porosity of 51%, which is much larger than the porosity of sample S2 (38%). In addition, there is a significant change in pore interconnectivity, manifested by a nearly twofold decrease of the absolute value of the Euler characteristic of sample S1 compared to S2. These structural changes are most likely caused by the various degree of natural dissolution of the rock body by the outflowing acidic waters carried down the solution pipe during its formation. Sample S1 was intensely dissolved due to its vicinity to the tip of the pipe. In contrast, sample S2 presumably remains mostly undissolved and preserves its original pore structure. Interestingly, sample S1 shows a relatively small but significant porosity variation along its length of 2.5cm: from about 54% at the part proximal to the surface of the pipe down to 52% at the distal end. This suggests a relatively long penetration length of the acidic solution, consistent with the large flow rates of water focused in the pipes.