Application of low frequency GPR antenna to fractures detection and 3D visualization in a new quarry bench

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Quarrying of ornamental stone deposits produces huge amount of wastes due to rock mass fractures that entail economic losses. Fractures in rock mass affect the quality and the required commercial size of stones blocks or may lead to difficulty of exploitation. There are several fracture detection and characterization methods and choice of a method is controlled by the application objective. After a review of fractures detection methods, we introduced a classification based on destructive and non-destructive methods. Among these methods, the authors investigated ground penetrating radar (GPR) as a data acquisition tool. The objective of this research is to image large aperture fractures (2-3 cm) as deep as possible, in a case study in a sandstone quarry in Firenzuola, Italy. The data acquisition was carried out by low frequency GPR antenna (70 MHz) in a 3D survey grid (7 m x 12 m) over the bench surface. Due to the wet and fractured condition of the rock mass, a penetration depth of just 14 m was obtained. Wise data processing led to enhancing the signal. A processing software allowed visualizing the data in 3D GPR cuboid. Interpretation of the main fractures was performed through the entire body of the cuboid. Extension, shape and orientation of the main fracture surfaces could be explored to be then an aid for the quarrying decision makers of this bench.

Biography

Mohamed Elkarmoty completed his BSc and MSc in Mining Engineering from Cairo University (Egypt) in 2013. He started his PhD research in 2014 at University of Bologna (Italy) under supervision of experts in the field. The PhD research is focused on the evaluation, production and optimization of ornamental stones quarries. He currently has a publication in an international conference and an under revision publication in an international journal.

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