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Lidar applications for the detection of movements in a cave: the example of the soapstone quarry of Bocheresse, Wallis, Switzerland

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The quarry of Bocheresse is located in the Val de Bagnes, in the Valais County (Switzerland) and was quarried for the soapstone used for the production of ovens. As the operation of the quarry is stopped nowadays, it is now a place of historical interest. Before its opening to visitors, a detailed study for the stability and movement detections was provided. This study was done by comparison of different TLS acquisitions. In such case, a Lidar Leica ScanStation 2 was used because it has the ability to make a 360° acquisition, including the roof of the cave. Three campaigns of Lidar data acquisition were provided (2008, 2009 and 2012) resulting into high resolution point clouds of the quarry. By comparison of the different datasets with PolyWorks software, four main rockfalls have been highlighted with volumes varying between 0.04 and 0.12 m3 and also blocks that have been purged and reworked materiel are clearly identified. It appears that, in 3 years, one of the wall of the cave moved forward of 1.5 cm with a maxima of 2 cm at the top. This wall presents a lot of fractures with important opening and also displacement along these fractures.
In this case, Lidar shows to be a powerful tool that can be used in areas with reduced accessibility (like the roof of the cave) and were visibility is limited.