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Experimental load cycling in the brittle field produces a more distributed fracture network

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Knowledge of the rock mechanical behaviour of rocks subjected to load-cycling is of importance for many engineering projects, where the material is subjected to regularly cycling stress levels. Engineering circumstances are, for example, civil construction settings of haulage roads, seasonal storage of hydrocarbons or CO_2 in depleted reservoirs and in magma movement in active volcanoes. The cyclic loading could result in a gradual weakening of the material and possibly into a different type of fracture network in comparison with material that has been loaded to failure only once. The results show that cyclic loading causes material to weaken progressively up to $\sim$20% in comparison with material that has been loaded to failure in one cycle. It is also seen that the fractures that form during cyclic loading are more distributed throughout the sample. In order to increase the connectivity and distribution of the fractures, cyclic loading can be attempted. It is expected that then a better distributed network of fractures will be formed potentially increasing the permeability of this fractured material. The progressive weakening of the material due to cyclic loading can cause an earlier loss of integrity of for example seals, and needs to be taken into account in in seasonal storage of fluids in subsurface reservoirs.