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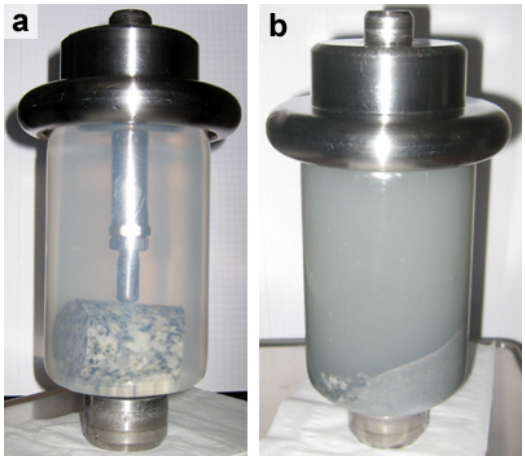
Liberation of Pore Water Using a HV Pulse Equipment and Study of Micro-Crack and Pre-weakening Development due to Electrical Explosions and Streamer Treatment

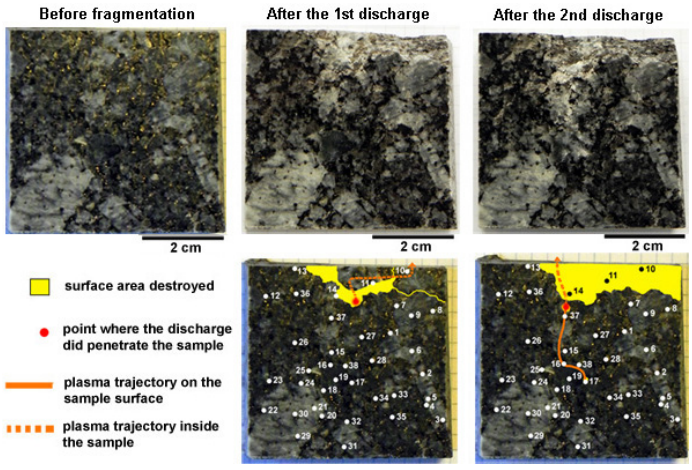
High Voltage (HV) pulse applications has been studied in the last decades for selective fragmentation of rocks and industrial materials. The development of this technology is opening frontiers for new application fields, such as pore water liberation and the deployment of HV pulse systems in the mining industry. The Swiss company SELFRAG AG has been financing researches and development of HV pulse equipments for these purposes.

This study comprehends three distinguished topics: (i) evaluation of the HV pulse technology as a new method for pore water extraction, and it potential advantages over conventional methods like acid leaching and out-diffusion; (ii) study of micro crack development in different types of geological materials, aiming to understand and predict rock and material behavior before HV pulse fragmentation; (iii) usage of electrical impulses (streamer) to pre-weak ceramic artificial samples without generation of shock waves.

Results show that HV pulse fragmentation allows to liberate and collect pore water, in very short time and contamination-free. Process development and refining of the methodology will further optimize the quality of the herein presented results. HV pulse fragmentation demonstrates very efficient capacity to enlarge micro crack networks, increasing permeability and pre-weakening. The mechanism of crack development is associated to the distribution of the shock wave energy along each discontinuity. Thus, crack development is controled by contrasts of mechanical properties between mineral, and the existence of a bond force hierarchy along each discontinuity. However, sample heterogeneities (in mineralogy, texture and structure) influence the energy transfer within the rock. Streamer treatment of ceramic samples results limited to the sample surface, so that no significantpre-weakening is produced without generation of shock waves.



Sealed bottle used to fragment the sample (a) before fragmentation and (b) after fragmentation. The height of the processing bottle is about 25cm.



Situation of the pegmatite sample after receiving 1 (left pictures) and 2 (right pictures) electrical discharges. The sketches below show the trajectory of the plasma on and/or into the sample, as well as the surface area destroyed by the shock wave produced. The numbered points are the monitoring points.

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