# EVOLUTION OF ROCK PERMEABILITY DURING FRACTURE PROCESS

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The purpose of this research is to experimentally investigate how the permeability of sedimentary and igneous rock samples (cores 30 mm in diameter and 60 mm in height) varies under confining pressure and uniaxial loading up to fracture. The permeability was determined on a regular basis by the constant fluid flow-rate method at fluid pressure gradient of 1 MPa. The permeability values were calculated according to Darcy's law under the laminar fluid flow assumption. The confining pressure was maintained at 20 or 30 MPa, and the average deformation rate was about 0.2×10E-7 1/s. The experiments were carried out under strain-control loading, with strain steps of about 8.3×10E-4 (50 mcm displacement of the press piston). The presses used as loading machines were servocontrolled GCTS RTR 4500 and Z 1000 INOVA. The testing techniques provided a complete stress-strain curve – from the elastic area to the yield point, with the formation of a narrow zone of microcracking. The result was the assessment of how the permeability varies over the entire loading interval. A single experiment lasted as long as 3 days, which, with the permeability being measured every 40 minutes, provided a detailed insight into how this parameter changed as the fracturing progressed. It is shown that the permeability changes are regular for all types of the studied rocks and mainly depend on the emergence and development of the fractures. During the elastic deformation stage, the permeability is determined by the primary rock structure and changes insignificantly as the stress increases. As the material approaches the yield point and begins to show inelastic behavior, the permeability increases significantly and can become 1-2 orders of magnitude higher than the primary matrix permeability. After the macrofracture zone is formed and the axial load drops, the permeability is almost unchanged, remaining at high values. We investigated acoustic regimes on sandstone twins (cut from the same original core) to compare changes in permeability and acoustic parameters during macrofracture preparation. It was found that, just as in earlier experiments, acoustic activity increases at the stage of a transition from elastic behavior to the yield point, which correlates well with the change in permeability. An analysis of the AE amplitude distribution showed that the energy of the events increases in a regular manner as the macrofracture keeps forming. This confirms that cracks grow in size and merge, which leads to formation of a large complexly built fracture zone that provides relatively high values of permeability at low values of acoustic activity, presumably due to the growing surface area of the microcracks being formed. It is possible the increase in permeability at the stage where cracks merge and grow can make an additional contribution to the formation of a "positive feedback which, according to the model of avalanche unstable fracturing formation (AUF), provides an avalanche-like development of the fracture process. Studying how permeability varies in tectonically active zones is important given the effects of induced seismicity. Laboratory studies were carried out in the Shared Research Facilities of IPE RAS.