Structural and petrophysical analysis have been conducted within the Melechov massif with focus on structures controlling the porosity, permeability and thermal conductivity of the rock. The structure of the massif has been constrained based on extensive dataset including AMS and field structural measurements of ductile and brittle structures. Maps and stereograms have been constructed to display the magnetic fabrics and the fracture system of the studied massif. The fracture system of the massif has been described by two principal and two supplementary sets of joints and by faults formed mainly by joint reactivation or less frequently formed as shear fractures. The measured petrophysical data have been used to characterize the effect of fracturing and alteration on pore space geometry and in turn on permeability, thermal conductivity and elastic properties of the studied granite. Distinct petrophysical properties have been identified for pristine granite, for fractured fresh granite as well as for fractured granite altered by Fe-oxide, chlorite and clay minerals. Relations between the measured petrophysical properties have been explained in terms of evolution of the rock pore space. A detailed microstructural study combined with multidirectional P-wave velocity measurements at high confining pressure and with AMS analysis has been conducted on a schlieren bearing sample of Lipnice granite. The study has shown that the granite VP anisotropy at low confining pressure was controlled by intergranular cracks interconnecting schlieren-subparallel cleavage cracks in micas and feldspars and by exfoliation fracture-subparallel intra- or trans-granular cracks in cleavage-free quartz. Major closing of the crack porosity linked to the schlieren granite below depth of 500 m has been interpreted in terms of crack compliance reflected by rapid increase in VP with confining pressure.