The permeability and specific storage of rocks in sedimentary layers at deep underground are important parameters for problems such as those related to the evaluation of buried natural gas and oil, CO₂ aquifer storage, and various kinds of waste storage. The permeability of a geologic material is dependent on the porosity of the material and the degree of connectivity between pores. The specific storage of geologic materials is dependent on the porosity of the material and the compressibility of both the material and the included fluid; accordingly, both the permeability and specific storage of geologic materials vary over wide ranges.

In this paper, we use the three-dimensional medial axis (3DMA) method to visualize and quantify the flow-relevant geometric properties of the pore structure in pressurized clastic sandstone. We measure distributions of pore size, channel length, coordination number, and number of connecting path. We present the effect of the hydrostatic pressure on permeability using the transient pulse method and giving a quantitative characterization of pore networks in intact clastic sandstone and clastic sandstone pressurized to 25 MPa. It is clear that permeability reduction as the hydrostatic pressure increases is attributable to the decrease in the population of pores with a radius of 20–90 micron. In addition, we present the changes in tortuosity in three directions for intact and stressed samples. In each direction, the tortuosity was greater under the stressed condition. Permeability reduction under pressurization to 25 MPa is attributed to these inner structural changes.