Change of pore connectivity in granular materials under axial compression

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The influence of axial compression on the connectivity of pores in granular materials was studied. Electrical conductivity and compressional wave velocity were simultaneously measured on brine-saturated granular materials under uniaxial compression. Spherical glass beads and oblate quartz sand were employed. X-ray micro CT was conducted on granular materials impregnated with epoxy resin to examine microstructure of pores. Compressional wave velocity increases and electrical conductivity decreases with increasing axial stress. When the axial stress was increased from 0 to 5 MPa, compressional wave velocity increased by around 12% in both materials and electrical conductivity decreased by 0.7 and 1.7% in glass beads and quartz sand, respectively. The increase in compressional wave velocity must reflect the increase in contact area between grains, which was observed with X-ray micro CT. The decrease in conductivity must be caused by the decrease in connectivity of pores. X-ray micro CT images show that the connectivity of pores is easily lost under axial compression in quartz sand owing to its oblate shape.

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