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Grain boundary cracking due to thermal expansion anisotropy in the earth 's crust

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Crack density in crustal rocks influences physical properties of rocks such as seismic wave velocity and electric conductivity. Grain boundary cracks, which are commonly observed in the rocks, are considered to be formed by accumulation of residual stress generated from thermal expansion anisotropy.
In this study, we model a generation of grain boundary cracks in the rocks. Firstly, we consider an emplacement of granite body and then it is cooled by thermal conduction in the crustal depth of ~1 0 km. We calculate thermal stress accumulated in quartz grain boundaries during the cooling of the granite body (Evans and Clarke, 1980). Then crack density with changing temperature with taking into account of thermal stress and grain boundary toughness are calculated. Further,, we obtain dependence of crack density on cooling rate.
We are also measuring seismic wave velocity and crack density in natural rocks with heating and cooling meta-chert. We measure crack density using laser-microscope
Based on these results, we want to demonstrate how the crack density changes with crustal depth. The result can be used to interpret geophysical observations such as seismic wave velocity and electron conductivity..

Keywords: grain boundary crack, thermal stress, physical property of crust, chert