



Thermoelastic deformation associated with a lava tube

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Active lava tubes have much higher temperatures than the surrounding rocks. Any change in the tube temperature produces a change in the temperature distribution in the rocks and induces a thermoelastic deformation in them. We calculate such a deformation by solving the equilibrium equation of linear thermoelasticity. We assume that the initial temperature distribution in the medium is the steady-state solution of the heat equation for a very long cylindrical tube at constant temperature, embedded in a medium with uniform thermal conductivity. We calculate the displacement and stress fields in the medium following to a temperature change of the tube. A temperature increase produces a dilatation of the medium and a contraction of the tube, while a temperature decrease produces the opposite effect. For a temperature change equal to 100 K, thermal stresses in the order of 10 MPa are produced, which are large enough to fracture the rocks surrounding the tube.