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Gelatins as rock analogs: a systematic study of their rheological and physical properties

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The choice of an analog material for laboratory scale models of tectonic processes is subject to conditions of geometric, kinematic, and dynamic similarity. In the crust/lithosphere system, rheological layering is a consequence of both compositional layering and the variations of temperature with depth. It is therefore important to search for model materials which scale properly and reproduce in the laboratory the whole spectrum of rheological behavior, from brittle to viscoelastic to viscous. The rheological and physical properties of a wide range of gelatins, in both gel- and sol-state, are systematically investigated as functions of temperature, composition, concentration, ageing and applied strain rate. Several types of rheometric tests (amplitude sweep, frequency sweep, temperature sweep) and flow tests are used to obtain storage and loss moduli, strength properties, viscoelastic range, and fluid viscosity. Other physical properites (density and thermal parameters) are also measured and compiled. The rheological variability of gelatins appears promising for their potential use as analog materials to model crustal and lithospheric deformation. As an example, the rheological and physical properties of pig skin 2.5%wt at 10°C are analyzed, and found to satisfy the scaling requirements for experimental models of crustal deformation.