nearly constant at 40-45 MPa, independent of pressure. In uniaxial stress tests, brittle fracture occurs in the salt at pressures below 10 MPa; ductile behavior is noted at all higher pressures. Failure in the brittle regime is preceded by volumetric expansion (dilatancy). Compactions of 0.005 to 0.01 always accompany ductile behavior in uniaxial stress loading. At pressures less than 100 MPa, the uniaxial strain loading path nearly intersects the failure envelope (uniaxial stress). At higher pressures, the shear stress diminishes slightly; the loading path then loads parallel to the failure envelope. The dynamic bulk modulus (K) determined from ultrasonic measurements increases from 19 to 23 GPa as pressure is raised to 10 MPa. Here K decreases slightly to pressures of 100 MPa. This is followed by a gentle increase to 24 GPa at 400 MPa pressure. The dynamic shear modulus (μ) increases monotonically from 12.5 to 16 GPa over the same pressure range. Static values for K and μ show much wider variations with pressure and are usually lower than the dynamic values.

HEARD, H. C., Comparison of the flow properties of rocks at crustal conditions, Phil. Trans. R. Soc. Lond. A., in press. [UCRL-76267, Preprint]

It is inferred that, although both primary and tertiary creep may be important in certain regions, large-scale ductile deformation in the earth's crust must be governed by secondary creep (steady state). This flow involves plastic deformation resulting from dislocation motion and diffusion. Geological, geophysical, and geochemical observations constrain the temperature (T), strain rate ($\dot{\varepsilon}$), and stress difference (σ) for rocks undergoing secondary creep to: -30 to 800°C, 10^{-7} to 10^{-15} s^{-1}, and up to 300 MPa (3 kbar). The actual conditions of secondary creep are strongly dependent on rock type and depth of deformation.

Useful laboratory data on rocks obtained over wide ranges of T, $\dot{\varepsilon}$, and σ are limited to ice, halite, marble, dolomite, quartzite, and dunite. Steady-state flow results are available for both wet and dry rocks; H_2O strongly affects the behavior of both quartzite and dunite, but has a negligible effect on halite and marble. Secondary-creep data for each rock are well fitted by $\dot{\varepsilon} = A \exp(-Q/RT)\sigma^n$, where Q is an activation energy for creep (diffusion) and A, R, and n are constants.

Comparison between those rocks expected in the deep crust indicates that at the highest T and at $\dot{\varepsilon}$ of 10^{-12} to 10^{-15} s^{-1}, σ is largest for dry dunite