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Unstressed and laboratory-stressed samples of graywacke sandstone from the site of the Rio Blanco gas-stimulation experiment were studied, both optically and with a scanning electron microscope, to relate imposed stress to pore and microcrack structure. This sandstone consisted of 100-300-μm-diam clasts (principally quartz and feldspar) in a fine-grained (<10 μm diam) matrix of clay and cementing minerals. The porosity of the rock was contained in tortuous networks of narrow (<10 μm diam) channels around and between cement grains. Samples deformed in both uniaxial-strain and uniaxial-stress experiments were studied. The microscopic effects of uniaxial-strain conditions were occasional short (<0.5 grain diam) transgranular fractures, partial breakdown of the cement, and narrow cracks at the grain boundaries. Increased strain appeared to increase the degree of fracturing. The effects of uniaxial-stress conditions varied with the confining pressure of the test. Macroscopic brittle behavior (one or two throughgoing fault zones) was observed in samples tested at confining pressures of less than 50 MPa. Microscopically, fracture in brittle samples was principally restricted to grain boundaries, with transgranular fractures observed only along the immediate fault. Away from this zone, clasts were unfractured, although the cement matrix was partially broken down. On the fault surface of brittle samples, there was little gouge or striation; this implies little friction during failure. Transitional behavior (macroscopic barreling of sample, recognizable shear zones) was exhibited by samples tested under confining pressures between 50 and 500 MPa. Transgranular fractures were observed throughout transitional samples, although their occurrence was highly concentrated in the vicinity of the fault zone. With the exception of the shear zone, these fractures rarely extended further than a grain diameter. On the shear surface, transitional samples showed a rubble-like appearance, with broken grain and cement fragments intermixed; this indicates frictional sliding on the shear surface. Macroscopic ductile behavior (barreled, no continuous shear zone) was observed in a sample tested at a confining pressure