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The Effect of Dolomite Gouge on Permeability.

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Two pure dolomite sample suites , the Badshot and Rock Creek dolomites were deformed at room temperature and under a variety of confining pressures and pore fluid pressures in order to measure the fracture permeability. Badshot samples are composed of $>$97 vol% dolomite with accessory quartz, calcite, tremolite, and muscovite and Rock Creek samples are composed of $>$85 vol% dolomite, with accessory calcite and quartz (located predominantly in veins) and talc (Austin and Kennedy, 2005). Badshot dolomite has been metamorphosed to amphibolite facies and subsequently annealed (Colpron *et al.*, 1996). At the hand sample scale, the rock is isotropic, except for minor, randomly oriented tremolite porphyroblasts, and weakly aligned muscovite. At the thin section scale, coarser grains have lobate grain boundaries, exhibit minor to no undulose extinction and few deformation twins, although well developed subgrains are present. Growth twins are common, as is the presence of well developed {10$\underline{1}$1} cleavage. Mean grain size 476 microns. Dolomite from the Rock Creek quarry is massive, with variably oriented quartz and calcite veining along with sealed cracks visible in hand sample. In thin section, grains are predominantly subhedral and equigranular. Twinning and {10$\underline{1}$1} cleavage are very rare within grains, as are intra and transgranular microcracks. Mean grain size is 30 microns. Both samples have essential no porosity.

All Badshot samples, regardless of the confining pressure, are in the transitional zone between brittle faulting and cataclastic flow. Rock Creek samples all have similar characteristics at the hand sample scale, regardless of the conditions of deformation. Samples contain diagonal to subvertical faults. In most cases, faults are accompanied by extensive damage at the ends of the samples interpreted to be a result of friction between the spacers and the samples. All Rock Creek samples have deformed in the brittle faulting regime. At the thin section scale, fractures in both rock types can be

interconnected which should promote permeability. However, even with the interconnected fractures, the permeabilty of the dolomite is essentially zero. Fractures are lined with an exceptionally fine-grained, powdered dolomite that essentially inhibits the migration of fluids. Even experiments done at no confining pressure and stopped before sliding on the fracture surfaces occurred had significant powdered gouge developed along the surfaces. In this regard, fracturing of low porosity, pure dolomite results in the development of fine grained gouge that does not appear to promote permeability. Both mechanical and permeabilty data will be presented.