New England Research, Inc.
331 Olcott Drive, Suite L1
White River Junction, VT 05001 USA
+1 802.296.2401
www.ner.com

Martin, R. J. and Boyd, P. J. (2012) "Characterization of Damage In Anisotropic Rock Due to Buried Explosions" Proceedings of 46th U.S. Rock Mechanics/Geomechanics Symposium, 24-27 June, Chicago, Illinois, 2012.

Abstract

In July 2008, five small (61 to 122 kg) chemical explosions were detonated in a low fracture density, homogeneous granite in Barre, VT. The physical properties of the granite were measured before and after the explosions on cores recovered in the vicinity of each shot. The changes in the post-shot properties were used to quantify damage at the micro, meso, and macro scales. The Barre granite is transversely isotropic; the elastic anisotropy is on the order of 20%. The anisotropy is due a planar array of microcracks, frequently referred to as the rift. After the shots were detonated, cores were recovered at various distances from each shot point. The pre-shot cores contained few preexisting fractures. In contrast, the post-shot cores show extensive damage; the intensity of the damage decreased with range. The damage zone extended laterally to 7 meters for the 122 kg shots.

Five distinct damage zones were identified. Near the emplacement, the rock was highly pulverized and granulated. Outward and above the emplacement level, the granite was characterized by high angle fractures parallel to the rift. This zone transitioned to a mostly intact matrix with few randomly oriented fractures out to the elastic region. At the microscale, damage was quantified by measuring the differences in ultrasonic wave speeds between the pre- and post-shot values on specimens of intact matrix rock. Near the working point, the P wave velocity decreased up to 12%. Damage at all scales was greatest above the emplacement level of the charge and parallel to the trend of the rift. The shapes of the zones of equal damage were non spherical. These results were used to interpret the seismic data collected on this experiment.

Contact NER for more information.