



Dynamic tensile fractures and pulverization from a deep borehole drilled into a fault zone

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Wide zones of pulverized rocks were recently observed in outcrops near large faults and it was hypothesized that they are products of massive dynamic fragmentation that occur during mega-earthquakes in the upper part of the earth crust. However, weathering and other near-surface processes suspected to be involved with the formation of the pulverization.

New supporting evidence for the origin of the pulverization by catastrophic events was discovered in rocks where a deep fault zone had been drilled through. Pulverized carbonate rocks occur continuously below 4900 m, in the lowermost 930 m of the Ma'anit –Joseph 3 borehole. A unique pattern of micro-fractures developed in well compacted, homogenous, and fine grained carbonates were recovered, characterized by on-going hierarchical branching of tight tensile cracks. The unique branching is a well known effect of instability in rapid tensile fractures when approaching elastic wave velocities. These fractures that have direct evidence of being created in deep burial setting, demonstrate that the pulverization is indeed an effect of dynamic loading and fracturing. Their extending to a significant depth indicates that a large part of earthquake energy can be absorbed by off-fault deformation.