The Unconfined Compressive Strength of SAFOD Core from Point-Load Penetrometer Tests

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Capturing critical fault attributes, in ideal cases, includes laboratory strength tests on fault materials or core samples. The San Andreas Fault Observatory at Depth (SAFOD) project is motivated by the need to answer fundamental questions on the physical and chemical processes controlling faulting and earthquake generation within major plate-boundaries. The intent of this poster is to demonstrate the functionality of the SAFOD Core Viewing methods for petrophysical and geological properties alongside geomechanical properties such as the unconfined compressive strength.

In 2007, approximately 135 ft (41.1 m) of 4 inch (10.61 cm) diameter rock cores was recovered from two actively deforming traces of the San Andreas Fault. 97 evenly (more or less) distributed index tests for Unconfined Compressive Strength (UCS) where performed on the cores using a modified point-load penetrometer. The point-load penetrometer used was a handheld micro-conical point indenter referred to as the Dimpler, in reference to the small conical depression that it creates. The core surface was first covered with compliant tape that is about a square inch in size. The conical tip of the indenter is coated with a (red) dye and then forced, at a constant axial load, through the tape and into the sample creating a conical red depression (dimple) on the tape. The combination of red dye and tape preserves a record of the dimple geometrical attributes. The geometrical attributes (e.g. diameter and depth) depend on the rock UCS. The diameter of a dimple is measured with a surface measuring magnifier. Correlation between dimple diameter and UCS has been previously established with triaxial testing. The SAFOD core gave Dimpler UCS values in the range of 10 psi (68.9 KPa) to 15,000 psi (103.4 MPa). The UCS index also allows correlations between geomechanical properties and well log-derived petrophysical properties and is a relative indicator of the tendency of fault material to dilate during slip episodes thereby enhancing fault-related fluid flow and leakage.

Providing scientific findings and results to the general public is another objective of the SAFOD project. To that end, a web based SAFOD Core Viewer was developed. The SAFOD Core Viewer is located at http://www.earthscope.org/data/safod_core_samples and http://www.earthscope.org/data/safod_core_viewer and supports Firefox, a freely available Mozzila web browser.