DEES Labs | FACT SHEET

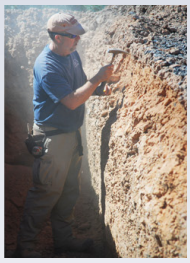
Desert Research Institute

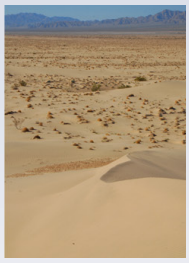
» Soil Characterization and Quaternary Pedology Lab

The Soil Characterization and Quaternary Pedology Laboratory is a non-profit analytical laboratory that conducts a wide range of physical and chemical analyses on soils and sediments, including suspended sediment samples. Capabilities focus upon measuring soil properties that can enhance the evaluation of soil hydrologic conditions, the evaluation of current and past environmental conditions, and the characterization of physiochemical processes in soils. Services may include complete field characterization of soil morphology.

The laboratory is utilized by numerous researchers from DRI, other research institutes, private companies, and government agencies. Current clients include Los Alamos National Laboratory, US Department of Defense, and several environmental agencies working on water quality issues in the Lake Tahoe Basin.







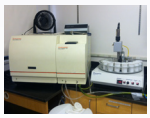
Analytical Capabilities:

Our extensive experience in field and lab-based soil analyses and our collaboration with multiple other labs and researchers within DRI allow us to play an important role in supporting numerous research projects and contracts. For a full description of analyses offered, please visit: http://www.dri.edu/soils-lab-services.

Particle Size Analysis

We routinely carry out laser particle size analysis of soil, sediment, and suspended sediment samples. The laboratory is equipped with state-of-the-art instrumentation for these analyses, including two laser analyzers (see below) and all apparatus required for sample preparation and pretreatment. We also offer traditional particle size analysis methods including sieve testing and the pipette method.

Malvern Mastersizer 3000
The Mastersizer 3000 is Malvern's newest instrument, released in 2011. It is equipped with two different dispersion units allowing the measurement of both wet and dry samples. It is capable of analyzing particle size ranges from 3.5 mm to 0.01 μm.



Micromeritics Saturn Digisizer 5200
The Digisizer analyzes samples in a liquid medium and is capable of analyzing in the range of 1 mm to 0.05 μm. It is equipped with an ultrasonic probe for internal sample dispersion and an autosampler (MasterTech) that can be set up to run 18 samples automatically.

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Chemical Analyses: We are equipped to measure Loss-on-Ignition, carbonate content, pH, and soluble salt content of soils. Collaborations with other labs within DRI allow additional chemical testing including anion and cation analysis using ion chromatography, and Fe oxides measurements using Atomic Absorption Spectrometry.

Mineralogy: We have full use of a state-of-the-art X-Ray Diffraction Instrument (Bruker D8 Advance) housed within DRI's Division of Atmospheric Sciences. Sample preparation, including crushing and milling of samples for bulk analysis, and isolation of silt and clay fractions, are carried out within our lab to allow mineralogy characterization of all size fractions of soil, sediment, and rock samples.

Geochronology: We are closely integrated with the E.L. Cord Luminescence Geochronology Lab, also in DEES, sharing expertise and services, and jointly working on processing samples for another dating technique – cosmogenic nuclide dating. Soil analyses are important for understanding the environmental conditions (e.g. water content, bulk density) and the stratigraphic context of geochronology samples, and are therefore crucial for interpretation of geochronology data. Since soil development can be used to indicate the relative ages of landforms, our joint services can provide a multi-pronged approach to answering Quaternary geochronology questions.

Field-based Soil and Landform Assessments: We have the expertise and facilities to perform detailed field description of soils and landforms, to make field measurements of geotechnical parameters (e.g. bulk density, water content, Stiffness and Young's modulus), and to monitor soil geophysical properties (including soil temperature, and electrical and thermal properties).

Applications:

Examples of past and present applications of data produced by the laboratory:

(1) Soil chronosequence development and calibrated soil dating in multiple climates across the US and in international locations (2) Characterization of dust, and surface and near-surface soil material for military operations (3) Stream sediment characterization for stream restoration projects and water quality and clarity issues in the Tahoe basin (4) Quaternary stratigraphy and soils of alluvial fans in the US, Spain, Mexico, and Chile (5) Parameter determination for vadose zone hydrologic modeling (6) Soil stratigraphy for paleoseismic hazard investigations.

Projects:

Three projects that the soils lab has participated in are highlighted here. For more examples, please visit: http://www.dri.edu/soils-lab-projects.

Surface soil and landform characterization was carried out for vehicle test courses at six US Army installations that span a broad range of climatic settings. Data collection included geotechnical data, soil texture (both geological and engineering classifications), and landform type. Datasets help in assessing trafficability and vehicle testing requirements in a range of military deployment locations. Project PI: Dr. Eric McDonald. Funded by U.S. Army Research Office. Image: Sara Jenkins

Prolific cleared circles on desert pavements in the Sonoran Desert have commonly been listed as cultural resources (CR), presumed to be sleeping or dancing circles of Native Americans. Their listing as CR restricts land use. Detailed analysis of lateral changes in soil characteristics across the features indicates that they are likely not anthropogenic; rather they comprise abandoned plant mounds and their ages may give insight into past climate changes. Project PI: Dr. Eric McDonald. Funded by Yuma Proving Ground. Image: Sara Jenkins.

Alluvial fans across several regions of Baja California are being characterized using mapping, field and lab analysis of soils, and multiple geochronology techniques (soil chronosequence development, luminescence & cosmogenic nuclide dating). Results will help in understanding the links between climate change and geomorphic processes, with implications for the impact of future climate change in the nearby highly populated LA Basin. Project PI: Dr. Jose Luis Antinao & Dr. Eric McDonald. Funded by NSF.