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12-30-2016

CAREER: Thermochronometric and textural signatures of fault damage zones and stimulating middle school student interest in earthquake science

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Recommended Citation

Ault, A. (2016). CAREER: Thermochronometric and textural signatures of fault damage zones and stimulating middle school student interest in earthquake science. Utah State University. https://doi.org/10.15142/T3T931

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DATA MANAGEMENT PLAN

CAREER: Thermochronometric and textural signatures of fault damage zone microseismicity and igniting middle school student interest in earthquake science

This project will comply with the Division of Earth Sciences (EAR) National Science Foundation Data Sharing Policy.

1. Samples and data types

Field samples including hematite and silica-coated fault surfaces, specularite veins, and crystalline bedrock will be collected for microstructural, petrological, geochemical, and geochronological analysis, as well as rock deformation experiments. Each sample will be given a unique sample ID and information including location (collected with GPS using WGS84 and decimal degrees), lithology, field photographs, and a field description, all recorded in a field notebook. Fault surface samples will additionally include fault orientation data (e.g., strike, dip), slickenline orientation data (e.g., trend, plunge), and kinematic data (e.g., sense of slip, offset). Thin sections, polished 1" round mounts, and Cu-tape mounts of rough fault materials will be made from select samples for microstructural, petrological, and SEM and AFM analysis. Select surfaces will be dissected into stacked wafers using the Nanofab FIB to be analyzed via SEM and TEM.

Bedrock sample processing for heavy mineral separates such as apatite results in sample mineral suites of various grain size and density. All samples will be labeled with corresponding sample ID, mineralogy, density, and other sample processing information. Hematite aliquots, extracted from fault surfaces with tweezer and/or a dremmel tool, will be stored in labeled petri dishes and vials with appropriate sample ID information. Prior to (U-Th)/He analysis, target hematite aliquots and apatite crystals will be photographed with cameras attached to picking microscopes. Apatite will be measured for the FT correction. Apatite for fission track analysis will be mounted in 1 mm thick epoxy mounts and polished. Aliquot and crystal descriptions and grain size information where appropriate will be recorded in Microsoft Excel workbooks.

2. Data and Metadata standards

Data will be compiled and stored in Microsoft Excel or ASCII format. Location information (GPS coordinates) will be compiled in decimal degrees using the World Geodetic System (WGS) 1984 datum. Unique sample IDs will be used for each sample location and sample type. A summary table will be generated that includes the unique Sample ID, the GPS location and information on the sample type, the types of analytical results available for these samples, date of analysis, and the laboratory where analysis was conducted. Table 1 presents examples of analytical data types and metadata acquired in this project.

Table 1. Analytical data and Metadata for each analytical suite

Analysis	Categories
Every sample type or analytical suite	Project name Project scientist/collected by Unique sample ID Sample type Location (UTM or Lat, Long: using WGS 1984 datum), elevation (m) Laboratory and instrumentation Analytical method if applicable Comments
Hematite and apatite (U-Th)/He analysis	Sample ID, UA ARHDL lab code $^4He/^3He$ (1σ error), He (ppm); line blanks, cold blanks, hot blanks, gas standards Isotope ratios (238/233, 238/235, 238/236, 232/229, 232/230, 152/147, 44/42; 1σ uncertainty); spike blanks, spike normals U, Th, Sm, Ca (ng, 1σ error); U, Th, Sm, Ca (ppm, 1σ error); calculated eU from grain morphology and Ca-based mass (1σ error) Uncorrected date (Ma, 1σ error) FT measurement (apatite only) Corrected date (Ma, 1σ error)
Apatite grain	Length, width (2 sides)

measurements	Crystal morphology and inclusion characteristics
Apatite fission track analysis	Target mineral, irradiation number, analyst Sample ID Zeta factor (1σ error), Glass U concentration (ppm) Number of crystals counted, counted tracks: N_s, N_i, N_g Dpar, Dper, R_{mr0}, ρ_s, $\rho_{I,}$ ρ_s/ρ_i Age (Ma, 1σ error), Central age (Ma, 1σ error) Age dispersion (%), Chi-squared
Microscopy (e.g., SEM, TEM, AFM)	Sample ID Analysis type and detector Operating conditions (e.g., magnification, accelerating voltage, beam size, vacuum pressure, working distance, dwell time)
Rock deformation experiments	Sample ID Torque (Nm), Normal force (MPa) Normal and angular displacement, δ (mm) Surface temperature (°C) Friction coefficient, μ_0, μ_W

3. Policies for Data Access and Sharing

The data generated from this project will be published in peer-reviewed, widely available scientific journals and through presentations at national conferences. All data will be made readily accessible in two ways. First, tables displaying all numerical data associated with the calculation of dates by (U-Th)/He, fission track, and U-Pb methods will be published either directly within these journals or as supplementary data tables and files in the journals' linked online databases. Publication of data in peer-reviewed scientific journals will occur during the project and at the end of the project. Secondly, data will be made available publically once submitted manuscripts are accepted for publication. Thermochronology acquired by USU personnel will be made available to users, free of charge, using the EarthChem database (Earthchem.org) using the (U-Th)/He and AFT templates and Utah State University open access Digital Commons website (http://digitalcommons.usu.edu/). Digital Commons is managed through the USU Merrill-Cazier Library. This archive is organized by discipline (e.g., Earth Sciences) and sub discipline (e.g., Geochemistry, Tectonics) allowing for easy searching and data access.

4. Policies for Data Re-use and Redistribution

Publication of data in peer-reviewed scientific journals will occur during the project and at the end of the project. Data will be made available publically through USU Digital Commons and EarthChem once submitted manuscripts are accepted for publication. Data not published within 5 years of the end of the project will be made publically available.

5. Plans for Archiving and Preservation of Samples

In addition to data products produced during this project, samples will require archiving. Hand samples, mineral separates, thin sections, aliquot/sample mounts for WLI/AFM/SEM, and SEM/TEM wafers related to rock samples collected by PI Ault and project postdoctoral fellow, PhD student, and undergraduate researchers will be archived in Ault's Mineral Microscopy and Separation Lab (M^2SL) in the USU Department of Geology. Tables of GPS locations, lithology, and map units for each sample will be published in journal articles that present the project results, but will be archived at USU with each sample and be available upon request. Rock deformation experiment starting materials and end-products will also be archived at M^2SL.