Data management plan for: Structural, Geochemical, and Permeability Measurements of the Basement Interface Contact and Associated Fault Zones Using Outcrop and Core Analog Studies: Implications for Injection Induced Seismicity in the Midcontinent Region

A Data Management Plan created using DMPTool

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Template: U.S.G.S.

Project abstract:

The location and timing of induced earthquakes km to 10+km's away from deep waste water injection wells near or at the base of the sedimentary reservoirs in the midcontinent region of the U. S. shows that fluid pressures are likely to be communicated via permeable pathways in the subsurface. We hypothesize that one of the likely pathways for fluid pressure migration occurs along the nonconformity contact or *interface* between the sedimentary bedrock and crystalline basement. Fault and fracture systems that intersect this *interface* and/or extend downwards into the crystalline basement may be reactivated as a result of the propagation of fluids and potential alteration of rock properties due to these fluid-rock interactions. Heterogeneities in physical and chemical rock properties along this interface will influence the distribution and rate of fluid migration and fluid propagation pressures, potentially leading to induced seismicity and associated hazards within the mid-continent region. It is critical to examine the spatial distribution of physical, chemical, and hydraulic properties and characterize the heterogeneity of this interface from the pore- to meter-scale, as these are the scales at which faults slip and earthquakes nucleate.

We propose to examine rock and hydraulic properties of the *interface contact* and fault zones that may intersect or cross-cut this contact by using integrative approach of field observations, whole-rock core analyses, stable isotope geochemistry, and laboratory permeability measurements. Much of the interface is buried within the midcontinent region, thus, we propose to focus on developing the structural and permeability architecture of key analog sites. We will use a compilation of our previous work coupled with new field and laboratory analyses to develop a more comprehensive inventory of rock and hydraulic properties of the interface contact within the mid-continent region and to evaluate the implications for fault reactivation and induced seismicity.

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1. Project and Contact Information

Funding Opportunity Title:2019 Earthquake Hazards External Grants Program

CFDA Number(s):15.807 -- Earthquake Hazards Program Assistance

U. S. Geological Survey National Earthquake Hazards Reduction Program

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Fundamental research to examine the contact between sedimentary rocks and crystalline rocks of the subsurface of the midcontinent of the U. S. This work explores the hydroglogic and mechanical nature of the contact for study of induced seismicity. This seismicity is thought to be caused by injection of large volumes of waste fluids from oil and gas production.

2019-01-01

2019-12-31

no

none

Question not answered.

2. Plan and Acquire

Newly collected data sets. Data will consist of field data, rock core, and permeability data. Field data will be acquired using standard field methods, with sampling of rocks. Outcrop descriptions of contacts at scales of 1:100-1:1000, and sampling, will be recorded with GPS and samples will be recorded in the IEDA database.

Existing 'data' is in the form of rock core, and any documents from previous projects. This includes well descriptions, logs, and any publically available files related to the core.

Samples of core will be collected from established core labs, and all samples will be acquired with permissions and documentations that each lab requires. Field sites will be accessed via public land sites.

Estimate 25 core samples, each 3 to 6 cm diamente, and 10-20 cm long for rock properties analyses. Approximately 25 hand samples from the field will be approximately 1000 cm3 in size (1-2 kg each).

Permeability data will consist of 25 lab tests, no more than 1 GB of data.

static

Data management will be modest - curation of field samples, core samples, and rock data. Field data also, approximately 30-40 person hours.

3. Describe/Metadata and Manage Quality

Permeability of rock core samples

Outcrop description of contacts at 2-4 sites

Grain size analysis - xcel spreadsheets

Whole-rock mineralogy and chemistry of rock samples

Images from thin-sections and SEM

XRD analysis plots

EDS images from SEM

xcel and .csv data sets, and maps in .png format

.xrdml, .hrf, .jpg, xcel, and word doc for XRD data

.png and word docs for SEM data

Field site description and sample collection. Core samples will be collected from labs. Rock characterization will include grain size analysis, X-ray diffraction analyses, whole rock chemistry, stable isotope data, and optical microscopy and petrography studies. Selected samples will be tested at Schlumberger.

Metadata will be collected and curated by Dr. Bradbury. These will be standard spreasheet data sets.

FGDC-CSDGM

Whole rock chemistry will be performed by a commercial lab that follows mining company exploration protocols Quality Management System that meets, as a minimum requirement, ISO 9001 and ISO/IEC 17025.

4. Backup/Secure and Preserve

Utah State University Department of Geology computers with daily and weeking external harddrive backups.

Short term data will be stored on 2 separate hard drives in 2 different office locations.

We use Time Machine backups that do hourly, daily, and weekly backups to two external drives.

Access is password restricted on all laboratory computers, and all Utah State computers are registered on the USU system, behind a firewall. All logins require a valid USU ID and Duo passcode.

Excel and csv files, GPS registered figures, and outcrop sample locations all on standard formats and programs.

Our data sets are stored in the USU digital commons system. These are backups are in two permanent data repositories that will be linked via standard urls.

https://works.bepress.com/james_evans/

No costs incurred for storage.

5. Publish and Share

We present results a national geologic and geophysical meetings, and publish inpeer reviewed publications. Data sets are made publically available via digital commons.

No access restrictions.

no.

Reviewed journal articles in journals such as Geophysical Research Letters, Geofluids, Geological Society of America publications.

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