

Geogenic gas release as a signal of rock deformation

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Project Tweet: Geogenic gas release signals to improve Nuclear Explosion Monitoring

Background/State of the Art Approach, Metrics and Outcomes

Impact

Geogenic noble gases are probably contained in all crustal rocks. These gases represent a unique signal source, their release may be related to deformation state of rock; sensing this signal informs us of deformation. We are evaluating this signal as a means to improve Nuclear Explosion Monitoring.

- Success will be measured in the field when we observe noble gas anomalies remotely to sense underground fracturing events.

This signal will be present when rock is fractured, thus this gas signal will be present with or without a RN signature

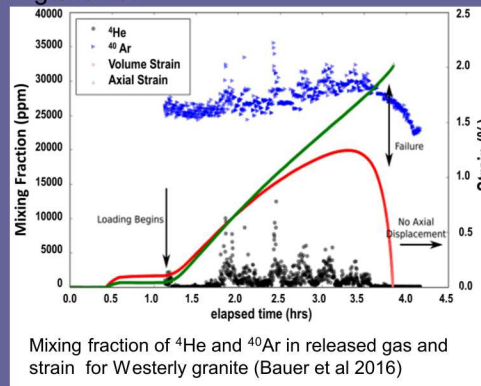
Lab work: started at TRL1 three years ago, now TRL2; Field deployment: TRL1

Publications:

Bauer, SJ, W.P. Gardner, H. Lee (2016), Release of radiogenic noble gases as a new signal of rock deformation, *Geophys. Res. Lett.*, 43, 10,688–10,694, doi:10.1002/2016GL070876.

Bauer, SJ, Observation of the Kaiser Effect Using Noble Gas Release Signals, *Rock Mech Rock Eng*, DOI 10.1007/s00603-017-1324-x

Bauer, SJ, ST Broome, WP Gardner, Release of geogenic gases as a signal of deformation in rock, *52nd US Rock Mech./ Geomechanics Symp.*, Seattle, WA, USA, 17–20 June 2018.



HOW IT WORKS, ASSUMPTIONS, LIMITATIONS

- Geogenic gases are released when rock fractures. Through careful lab sensing measurements using innovative methods, we are building an understanding of the relationships of the amount and type of gases released, and strain and stress state of rock.
- Laboratory measurements are difficult
- Field measurements present additional signal to noise challenges
- This work is risky because it is new and low TRL; if successful, the reward is large because it represents a new signal/sensor technology
- Noble gas compositions in the atmosphere are well understood
- Field measurement technologies will need improvement

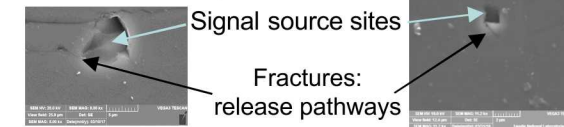
Goals/Action Plan

Current FY

- Lab testing and analyses to support field evaluation at Blue Canyon Dome in progress; Development of field methods underway;
- Field experiment is planned as part of Blue Canyon Dome test, Socorro, NM next quarter.

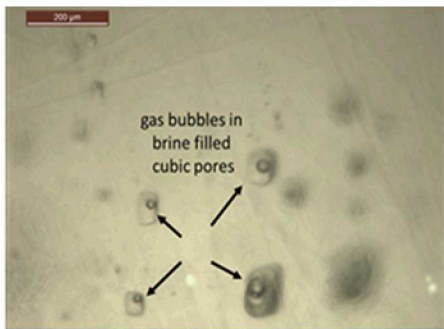
Future FY

- Detailed noble gas release signatures need to be defined for target lithologies
- Work to be incorporated in PE1.



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Gases in brine filled pores, bedded salt

Innovation