Newberry Deep Drilling Project
ICDP Workshop Sept 10-13, 2017 – Agenda

Saturday September 9

Participants arrive at Conference Center

7:00 pm -9:00 pm Ice Breaker at McMenamins Old St. Francis School

Sunday September 10

OSU Cascades – Tykeson Hall room 111

8:00 – 8:15 Welcome / Main Goals of the Workshop – *Alain Bonneville and Adam Schultz*
8:15 – 8:30 ICDP Introduction – *Thomas Wiersberg*

Why drilling to 450 C on a volcano? moderator *Adam Schultz*
8:30 – 8:50 Testing the feasibility of Super Hot Geothermal production – *Susan Petty*
8:50 – 9:10 Investigating the geomechanics of brittle ductile transition (BDT) – *Ahmad Ghassemi*
9:10 – 9:30 Describing magmatic plumbing systems and volcanic hazards – *Claude Jaupart*
9:30 – 10:00 Scientific objectives – group discussion/brainstorming

10:00 – 10:30 Coffee Break

Newberry Geothermal setting and site description. moderator Alain Bonneville
10:30-11:00 Newberry Volcano and the regional volcanic province – *Julie Donnelly-Nolan*
11:00 -11:30 Geology, stress regime, seismicity - *Trenton Cladouhos*
11:30-12:00 Geophysical knowledge of the site - *Adam Schultz*
12:00-12:10 Newberry geothermal wells and pads and other assets – *Laura Nofziger*
12:10 12:30 Questions – Open discussion

12:30-1:30 Lunch

Panel: What can we learn from other projects? moderator Roland Horne
1:30 – 1:50 Iceland Deep Drilling Project – *Gudmundur Omar Fridleifsson*
1:50 – 2:10 Krafla Magma Testbed – *John Eichelberger*
2:10 – 2:30 Japan Beyond Brittle Project – *Hiroshi Asanuma*
2:30 – 2:50 Campi Flegrei Deep Drilling Project - *Giuseppe De Natale*
2:50 – 3:30 Open discussion

3:30 – 4:00 Coffee Break

Panel: What can we do? What are the main technical challenges? moderator Carsten Sørlie
4:00 – 4:10 Drilling – bits, mud system, drill string – *Shigemi Naganawa*
4:10 – 4:20 Cementing / Casing – *Toshifumi Sugama*
4:20 – 4:30 Instrumentation / Logging / Coring – *Henning Hansen*
4:30 – 4:40 Stress measurements and Flow testing – *Francois Cornet*
4:40 – 4:50 Surface and downhole geophysics – *Sverre Knudsen*

4:50 – 5:30 Open discussion
6:00 Dinner (Dining/Academic building)

Monday September 11: Field trip

8:30 am - OSU Cascades parking lot

Morning: Visit Caldera, Obsidian Flow and Paulina Peak
Julia Donnelly-Nolan

Afternoon: Visit existing drill pads – 55-29 and 46-16, borehole seismometers and MT sites
Trenton Cladouhos, Laura Nofziger, Adam Schultz

Tuesday September 12: Finalize Primary Goals and then break-out groups

OSU Cascades – Tykeson Hall rooms 111, 205 and 209

8:00 – 9:00 Discussion "Goals and objectives and how to meet them". *Moderators Susan Petty and Shan de Silva*

9:00 – 2:00 Breakout groups. 6-9 people per group. Lunch with group. Some groups could combine or exchange members after lunch. *Each group should identify the critical scientific and technical questions (make a prioritized list) and strategies to address them.*

1. Volcanic hazards and phenomena: Caldera unrest, dyke propagations, etc. - *Seth Moran*
2. Permeability creation and maintenance in Super Hot Rock / *Trenton Cladouhos*
3. Data collection and HT instrumentation (e.g. geophysical data, rock mechanics, cores, logging) / *Grímur Björnsson*
4. Well drilling and casing / *Dennis Nielson*
5. Geothermal development– energy conversion, economics, future of Super-Hot Rock / *Robert Tucker*

2:00 – 3:00 Group reports (20 minutes each)

3:00 –3:15 Coffee break

3:15 – 4:00 Group reports (cont.)
4:00 – 5:00 General discussion - *Moderator Anders Noren*
5:00 - 5:15 Summary and action items for Wednesday
6:00 Dinner (Dining/Academic building)

Wednesday September 13: Draft Report and next step

OSU Cascades – Tykeson Hall rooms 111, 214 and 215

8:00 – 8:15 Recap and goals for the day – *Anders Noren*
8:15 – 12:00 Breakout group discussion and final report writing
12:00 – 12:30 Workshop conclusion and next steps - *A. Bonneville, T. Cladouhos, A. Schultz*

12:30-1:30 Lunch

1:30 pm Meeting adjourned

NDDP Google drive:

https://drive.google.com/drive/folders/0Bxuktabk2znIOHRqMnJiZkZ4OGs?usp=sharing

To well prepare the field trip (all documents on the Google drive):

USGS field-trip guide to Newberry
USGS fact sheet about the geology and monitoring at Newberry
USGS poster of the youngest lavas at Newberry

Provocative Questions for thought:

1. What can we realistically learn about volcanic hazards and dike emplacement way out here on the flank? Seems like we'd need to focus on cider cone eruptions not caldera eruptions.
2. Funders (both private and public) like to think that they are funding something unique. They don't want to be part of the herd, or repeat something that is done elsewhere. What is NEWGEN's unique claim?
    a. Hottest EGS well in the US or world?
    b. Best opportunity to collect a long interval of core (and cuttings) due to expected no losses.
    c. Best opportunity to drill into young intrusives to collect fluid samples at cooling margin.
    d. Only Super Hot project NOT located at existing geothermal field
    e. How can learnings from Newberry be applied in other locations world wide?
3. All Super critical wells have had casing problems during stimulation (IDDP-2) or flow testing (IDDP-1) or production (Prati-32). Even cooler EGS wells had problems during stimulation (NWG 55-29, Soultz). How do we learn from these projects? Can we wait to drill until laboratory work on materials reduces risk significantly?
4. Although 450 C at 5000 meters is mainly limited to active volcanic areas and existing geothermal fields, there are also hotspot traces like SRP/Idaho, where there are multiple calderas of differing ages along the trace, some of which might have residual magma accumulations at shallower depths. Despite the elevated number of such sites, Super Hot EGS at 5 km could not scale to make a worldwide breakthrough energy source. 450 C at 10 km is common to areas with active tectonics (Colorado, Nevada, Turkey) thus could potentially power large regions. What are the uncertainties of transferring what we learn at Newberry to other volcanic regions and to 2x the depths?
5. Investigating Newberry volcano and its plumbing will teach us a lot about nascent geothermal fields that are not hosted in a caldera. The Cascades is dotted by an incredible number of small volcanic cones and a few large stratovolcanoes, and it is quite likely that

the largest amount of magma is associated with the small volcanic cones once all their individual contributions have been added up. The geothermal potential of such a distributed system can only be assessed if one is able to know about the shallow plumbing, and this is where the Newberry project is original.

6. From the perspective of volcanic hazards, one important issue is how far from the focal area can peripheral vents and fissures be active (the focal area is presumably where magma is being fed from a deeper source). Another way of addressing this is to evaluate the distance that separates volcanic systems that are independent of one another (independent meaning not connected to the same feeder zone). Knowledge of the shallow stress field is key to these questions. Answers can be obtained at Newberry.

Scientific Objectives/Questions (independent of whether it is technically feasible to answer. Sunday 9:30- 10 am discussion)

- What is the rock strength and stress profile approaching the BDT?
- Why do earthquake nucleate near the BDT?
- What is mechanical response of 450 C rock to cold water stimulation? Or other stimulation fluids and methods?
- What are the fluid/rock reactions at 450C?
- Are there in situ fluids? What are their composition and where do the fluids come from?
- What is the role of supercritical fluids and magmatic gases on caldera unrest?