Merging high resolution geophysical and geochemical surveys to reduce exploration risk at Glass Buttes, Oregon

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Innovative technologies

Project's Objectives

The primary objective of this project is to combine a suite of high resolution geophysical and geochemical techniques to reduce exploration risk by characterizing hydrothermal alteration, fault geometries and relationships.

The intent of the proposed program is to use an innovative combination of geologic observation, modern remote sensing and geophysical techniques to analyze and structurally model this area prior to siting and drilling.

This presentation does not contain any proprietary, confidential, or otherwise restricted information

Overview

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

- Timeline
  - Project start date ***10/29/2009***
  - Project end date ***Q2 2012***
  - Percent complete Approx **10%**
- Budget
  - Total project funding **$8,704,260**
  - DOE share **$4,377,000**
  - Awardee share **$4,327,260**
  - FY10 funding **$2,615,400**
- Barriers
  - 'Blind' system
  - Biologically sensitive location
- Co-investigors
  - Oregon State University
  - Oregon Department of Geology and Mineral Industries (DOGAMI)

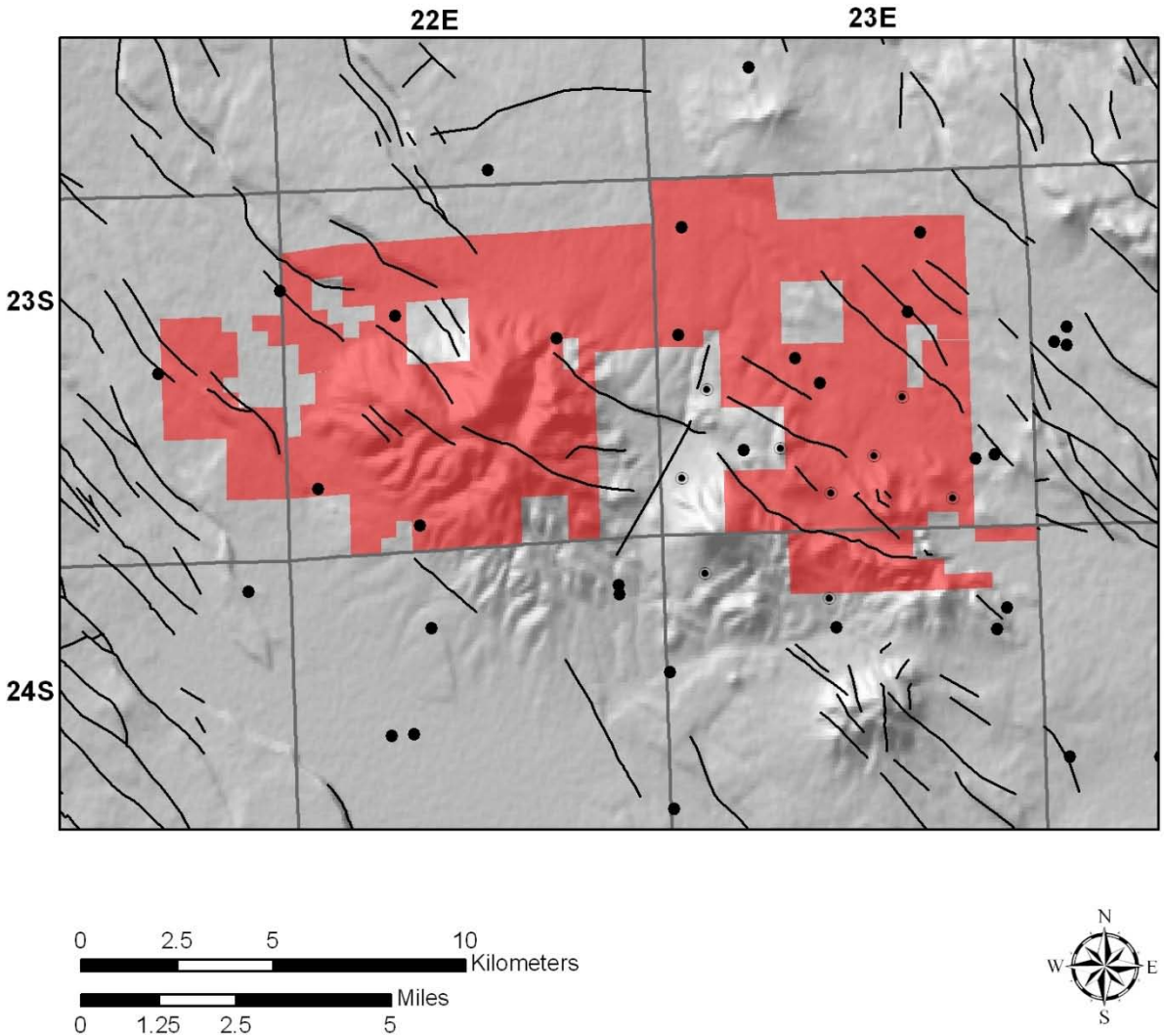
Ormat-DOE joint project

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

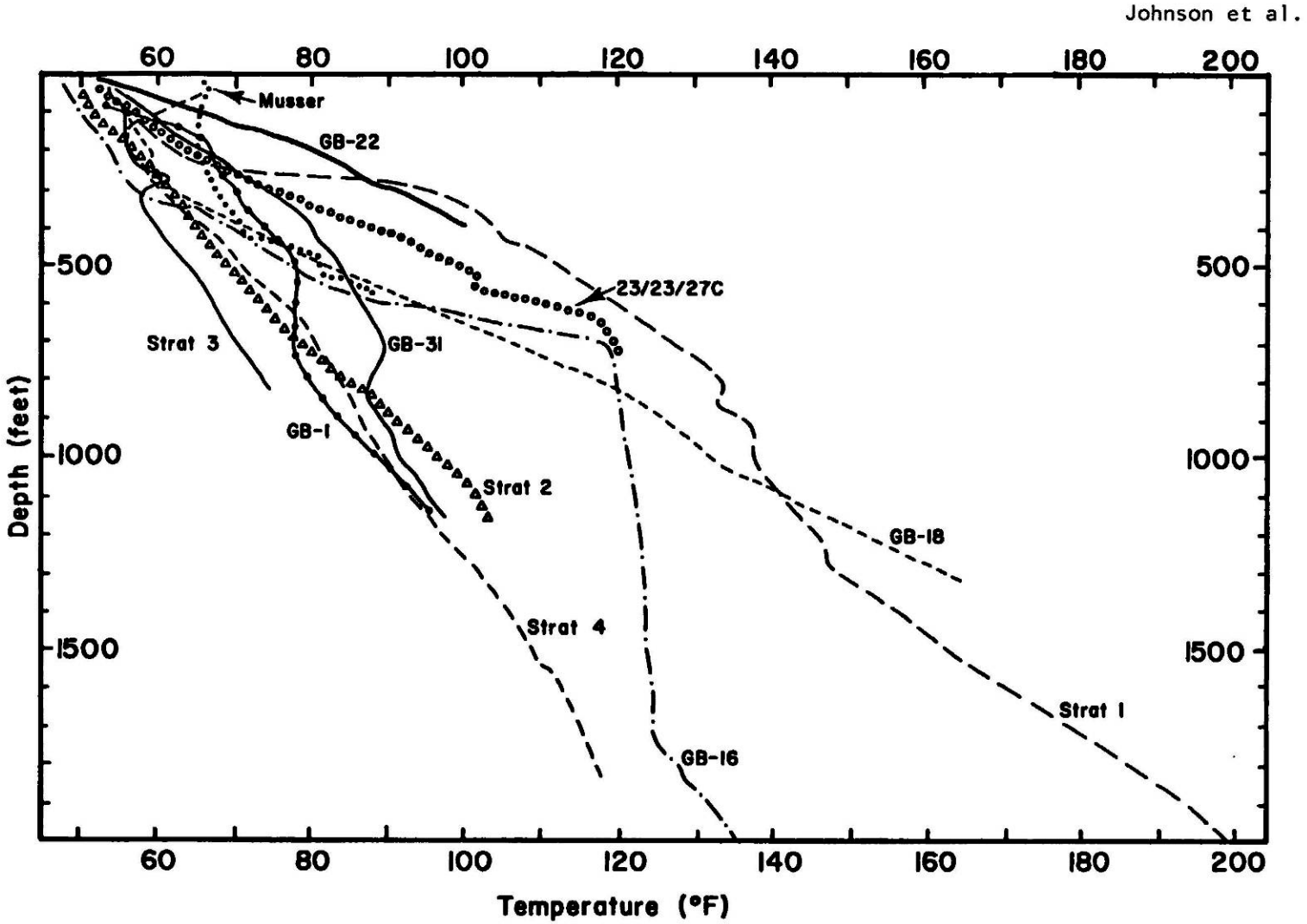
- Principal invesigator

  Patrick Walsh (Ormat)
- Co-investigators
  - John Dilles (OSU)
  - Ian Madin (DOGAMI)
  - Brigette Martini (Ormat)
  - Paul Spielman (Ormat)
  - Ezra Zemach (Ormat)
- DOE
  - GTP - DOE Golden Office

Glass Buttes Lease Map



Temperature logs



Validation of Innovative Exploration Technologies

- **Phase I – Exploration**
  - Characterize fault geometries and relationships
  - Characterize mineral assemblages (indicating hydrothermal alteration)
  - Geologic field work – OSU detailed mapping
  - Geophysics
    - Gravity - ~ 1km grid collected
    - High resolution aeromagnetic – currently being collected
    - Considering collecting MT survey if budget is available
  - Remote sensing – Innovative Technologies
    - LiDAR (Light Detection and Ranging) – contracted
    - Hyperspectral - collected
  - 3D geologic model to site slim wells

GO-NO GO DECISION CONCERNING PHASE II

The relative success of individual surveys and their combination will demonstrate low-impact methods and will influence future exploration

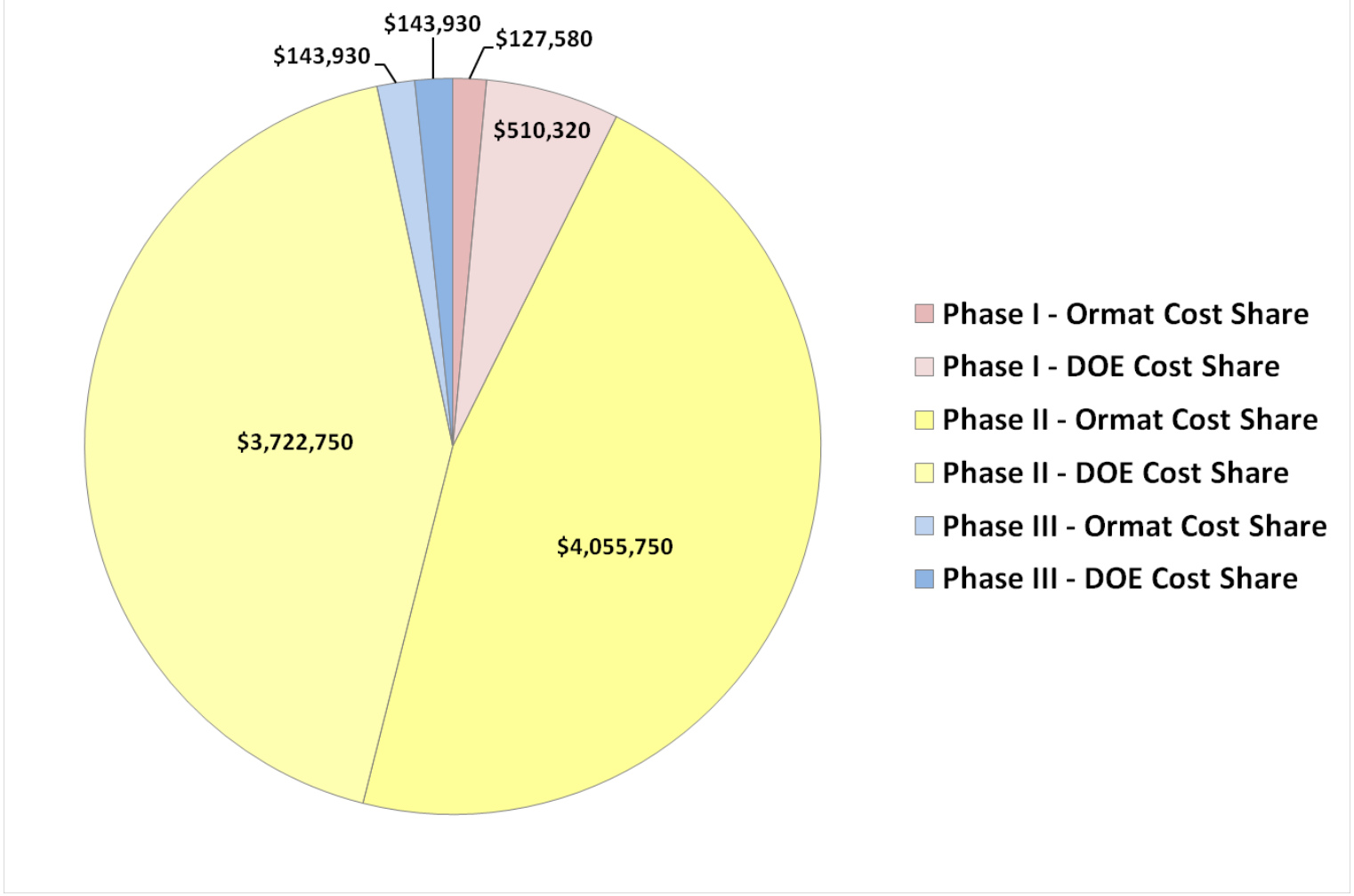
Exploration program

- **Phase II & III– Drilling & Flow Testing**
  - 2 slim holes ~3500 feet

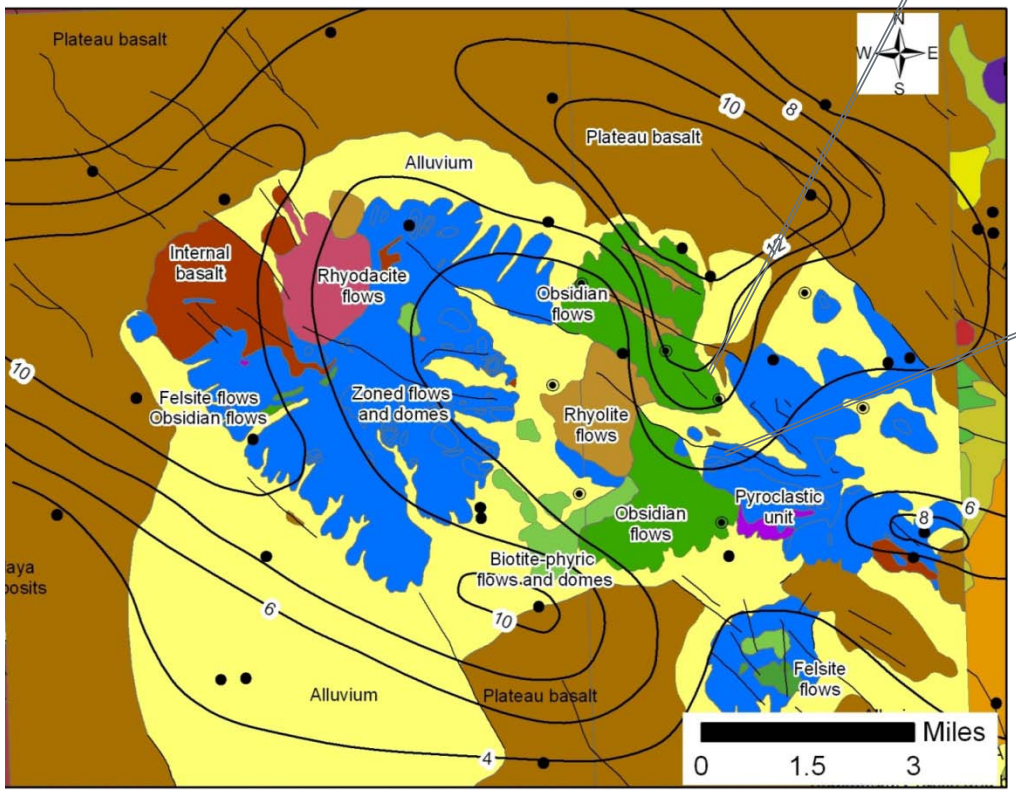
  GO-NO GO DECISION AFTER EACH WELL
  - 1 production well ~5000 feet
  - Wells Flow test
  - Reservoir properties (permeability, temperature)
  - Project economics
  - Power plant estimation
- Evaluation of methodology and proven resource

Glass Buttes - DOE funding breakdown

Project Total Budget: $8,704,260 with ~50% Ormat cost share



Geologic field work



Progress

- Initial geologic field work
- Widely spaced gravity (~1 km)
- Hyperspectral collected, currently being processed
- Aeromagnetic data 26% collected, waiting for better weather
- LiDAR - contract signed and scheduled
- Established 2 years plan for joint research with OSU, including M.S graduate program

Plans for 2010

- Collect geophysical and remote sensing surveys by end of Q3
- Additional geologic field work – Q2 and Q3
- Site slim wells and finalize permitting – Q4
- Initiate drilling – late Q4