

# Geothermal Exploration for Direct Use of Hot Water in Wells, Nevada

Nicolas Spycher<sup>1\*</sup>, Richard Zehner<sup>2</sup>, Andrew Zuza<sup>3</sup>, Markus Bill<sup>1</sup>, Bridget Ayling<sup>3</sup>, Richard Hammack<sup>4</sup>, Garret Veloski<sup>4</sup>, Mark McKay<sup>4</sup>, Emily Cameron<sup>4</sup>, Jennifer DiGiulio<sup>4</sup>, Patrick Dobson<sup>1</sup>, Devin Justman<sup>4</sup>, Roy Miller<sup>4</sup>, Mackenzie Mark-Moser<sup>4</sup>, Kelly Rose<sup>4</sup>, Drew Siler<sup>5</sup>, Ira Rackley<sup>6</sup>, Jolene Supp<sup>7</sup>, Kelby Bosshardt<sup>8</sup>

<sup>1</sup> Lawrence Berkeley National Laboratory, <sup>2</sup> Lumos and Associates, <sup>3</sup> University of Nevada Reno, <sup>4</sup> National Energy Technology Laboratory, <sup>5</sup> U.S. Geological Survey, <sup>6</sup> Elko Heat Company, <sup>7</sup> City of Wells, <sup>8</sup> Better City (\* Project PI's)



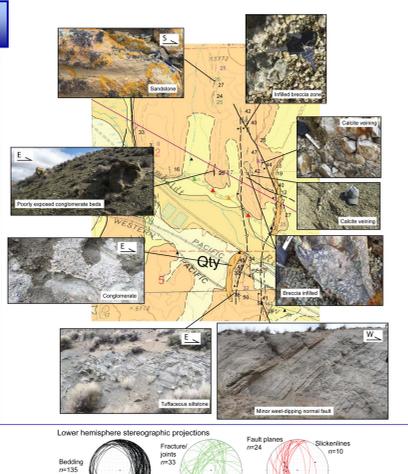
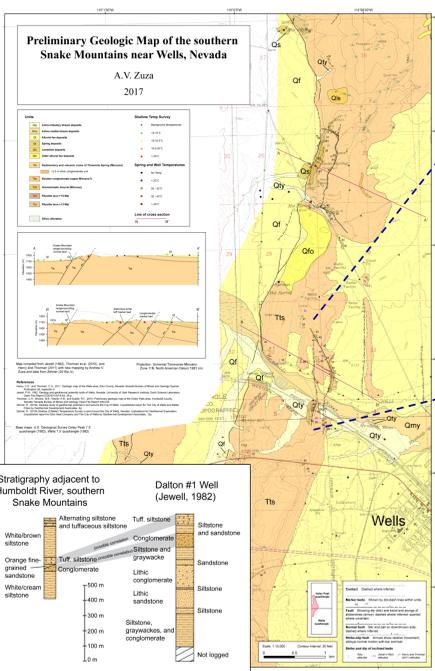
## BACKGROUND & OBJECTIVE

Geothermal activity in and around the City of Wells, Nevada, is evidenced by hot springs and hot waters in several private and municipal wells. Under the U.S. Department of Energy's Small Business Vouchers Pilot Program, research teams from Lawrence Berkeley National Laboratory (LBNL) and the National Energy Technology Laboratory (NETL), in collaboration with the University of Nevada, Reno (UNR), worked closely with the Elko Heat Company and the City of Wells with the objective to evaluate this geothermal resource and site a well for district heating and other direct use applications for the Wells community.

## APPROACH

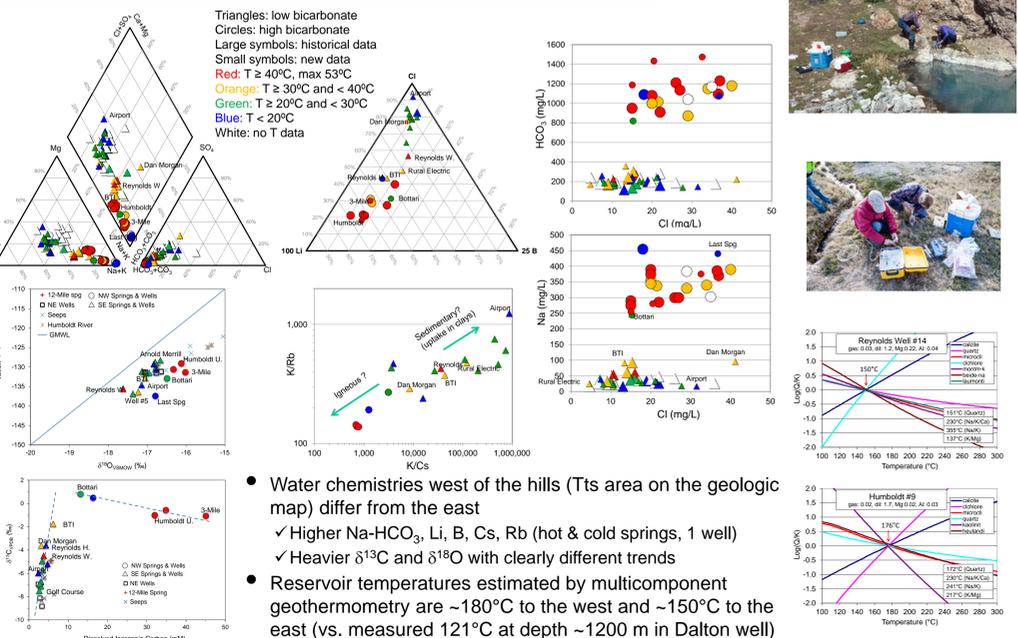
- Review of existing structural, geochemical, and geophysical information for the area
- Ground temperature surveys with 2-meter probes and deeper Geoprobe holes
- Collection and geochemical analysis of water samples from springs and wells
- Geologic and structural mapping
- Ground resistivity and EM geophysical surveys
- Data integration into a GIS geodatabase and a 3D conceptual geological model

## STRUCTURAL AND GEOLOGICAL MAPPING



- Two dominant fault/fracture orientations
  - ✓ NNE-striking and steeply dipping (~70°E or W) seem to dominate
  - ✓ WNW-striking and moderately dipping (~50-60°N or S)
- NNE faults are interpreted to be dip-slip normal faults with the hanging wall located to the west of the faults
- In several areas the rocks are altered and silicified
- Hot springs and alteration are located near mapped faults
- All rocks exposed are Cenozoic or younger in age

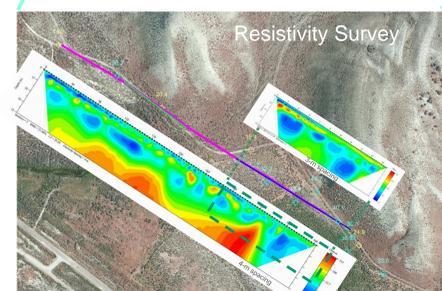
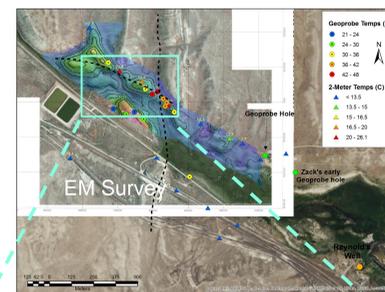
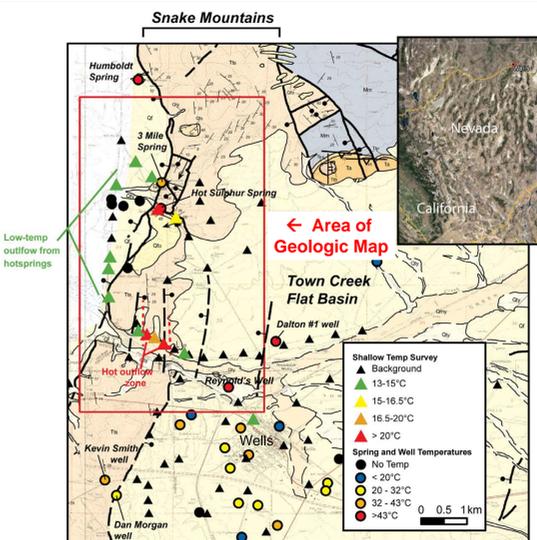
## WATER GEOCHEMISTRY AND GEOTHERMOMETRY



## SELECTED REFERENCES

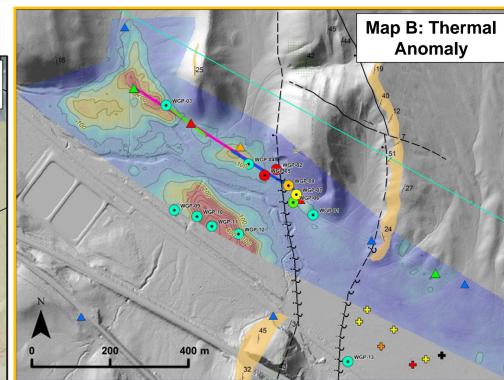
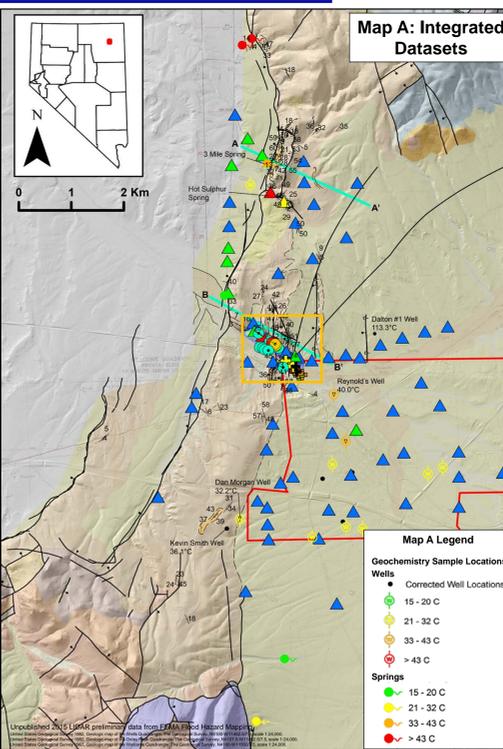
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 Jewell, P.W., Rahn, T.A., and Bowman, J.R., 1994, Hydrology and chemistry of thermal waters near Wells, Nevada. Ground Water, v. 32 (4), 657-665.  
 Zehner, R., 2017, Shallow (2-Meter) Temperature Survey in and Around the City of Wells, Nevada: Implications for Geothermal Exploration. Unpublished report for Elko Heat Company and The City of Wells by Zehner Geologic Consulting LLC, 12p.  
 Zehner, R., 2016, Desktop study of geothermal potential in and around the City of Wells. Unpublished report for The City of Wells and Better City by Zehner Geologic Consulting LLC, 9p.

## TEMPERATURE AND GEOPHYSICAL SURVEYS



- A shallow 2-m temperature survey identified an area with ground temperatures significantly higher than background
- Geoprobe temperature measurements narrowed down this target but penetration > 5 to 6 m was impeded by hard rocks
- EM conductivity did not correlate with temperature measurements
  - ✓ Conductive areas correlate with salt accumulations in the vadose zone soils
- A DC resistivity survey was conducted for better penetration
  - ✓ Confirmed inferred fault and adjacent low resistivity zone at depth > ~15 m
  - ✓ Horizontal, resistive layer may be the hard layer stopping the Geoprobe (possibly a silicified horizon)

## GIS DATA INTEGRATION



- Researched and created a data catalog of about seventy existing data resources to be integrated with seven new datasets collected in 2016 and 2017
- All data are being used to develop an EarthVision Subsurface Geosystems Model (in progress)

## CONCLUSIONS & FUTURE DIRECTIONS

- A zone of anomalously high temperatures was identified
- This area coincides with the possible intersection of NNE- and WNW-striking faults
- Low electrical resistivity in the shallow subsurface (depths < 50 m) suggests the presence of hot subsurface fluids at this location
- The different chemical and isotopic signatures in waters east and west of the anomaly suggest that the mapped NNE-striking faults may act as flow barriers
- Geothermal water in this zone could be outflow from the hot spring system to the north (likely) or from a blind system further east, or a mixture of both
- An exploration well is being drilled in this target area to determine if hot (> 60°C) water is present at shallow depth (< 150 m) and could be produced for direct use

## ACKNOWLEDGEMENTS

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