# Generating and Advancing Blind Targets Using Hydrogeochemistry:

## An Integrated and Multi-Scale Approach

James Buskard, Nevada Exploration Inc.

January 21, 2020

AME ROUNDUP


Nevada Exploration Inc

# Disclaimer

*This Presentation contains certain "forward-looking statements" including, without limitation, expectations, beliefs, plans and objectives regarding the timing and nature of estimated future exploration, success of exploration activities, and potential transactions and ventures discussed. Among the important factors that could cause actual results to differ materially from those indicated by such forward-looking statements are the risks inherent in mineral exploration, the need to obtain additional financing, environmental permits, the availability of needed personnel and equipment for exploration and development, fluctuations in the price of minerals, and general economic conditions.*

*Wade A. Hodges, CEO of Nevada Exploration Inc., is the Qualified Person, as defined in National Instrument 43-101, and has prepared the technical and scientific information contained in this Presentation.*

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**Why:** huge amount of information / $

**Frequently Asked Questions**

**When:** Regional → District → Target

**CASE STUDY**


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# Why:


## Exploration undercover

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# Exploration is a business (must create value)

| | | | | | |
|---|---|---|---|---|---|
| **Exploration Value Drivers** | SIZE OF THE PRIZE | X | CHANCE OF SUCCESS | > | COST TO TEST |

| | |
|---|---|
| **PERFORMANCE 2009 – 2018*** | $0.55 discovered per exploration $1<br>**Spent $198B to find $109B** |

*** SOURCE: Schodde (2019)**

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# Detection vs. prediction

Predict

Detect


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# Detection vs. prediction

## Predict


## Detect


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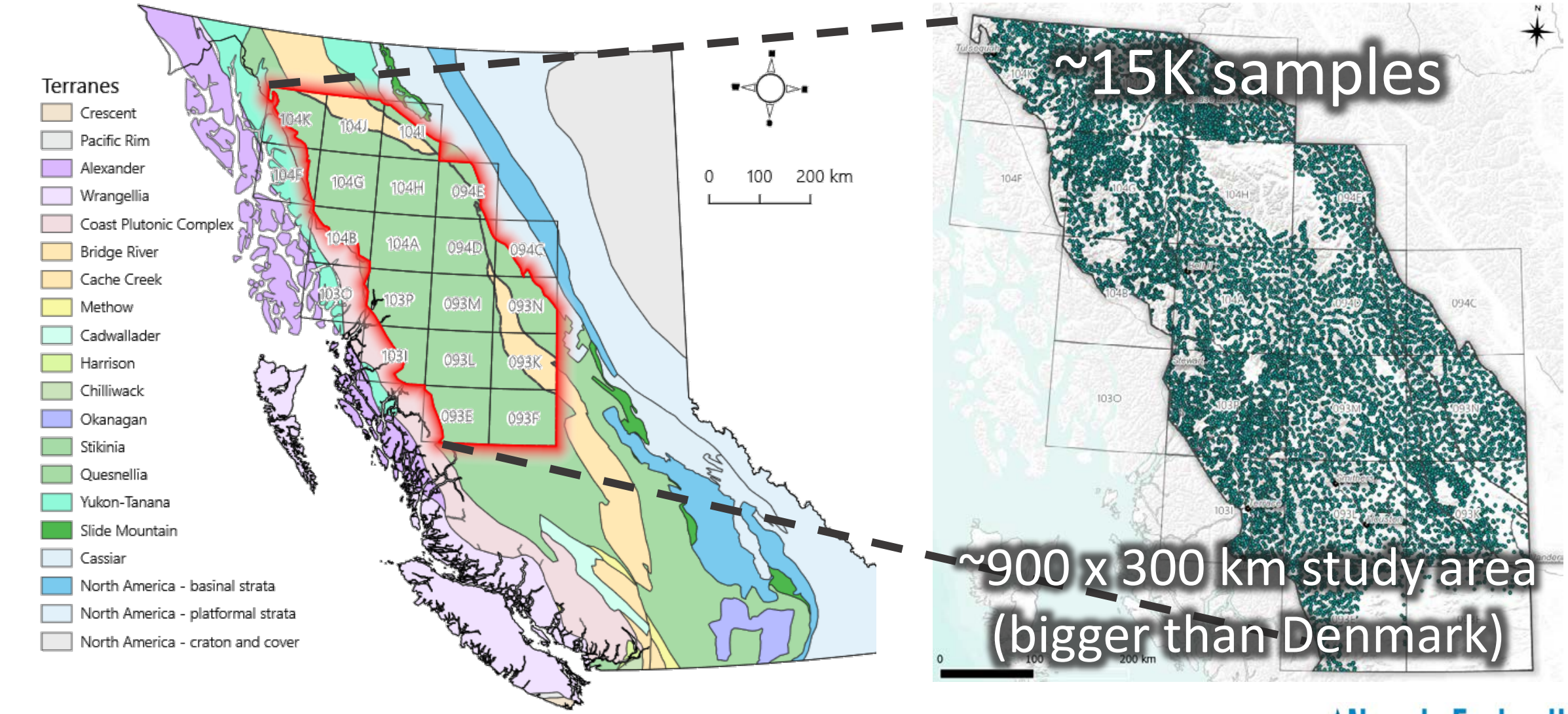
# Regional-scale geochemistry programs

## Stream sediment sampling in NW BC




**Matthew Bodnar, CSA Global**

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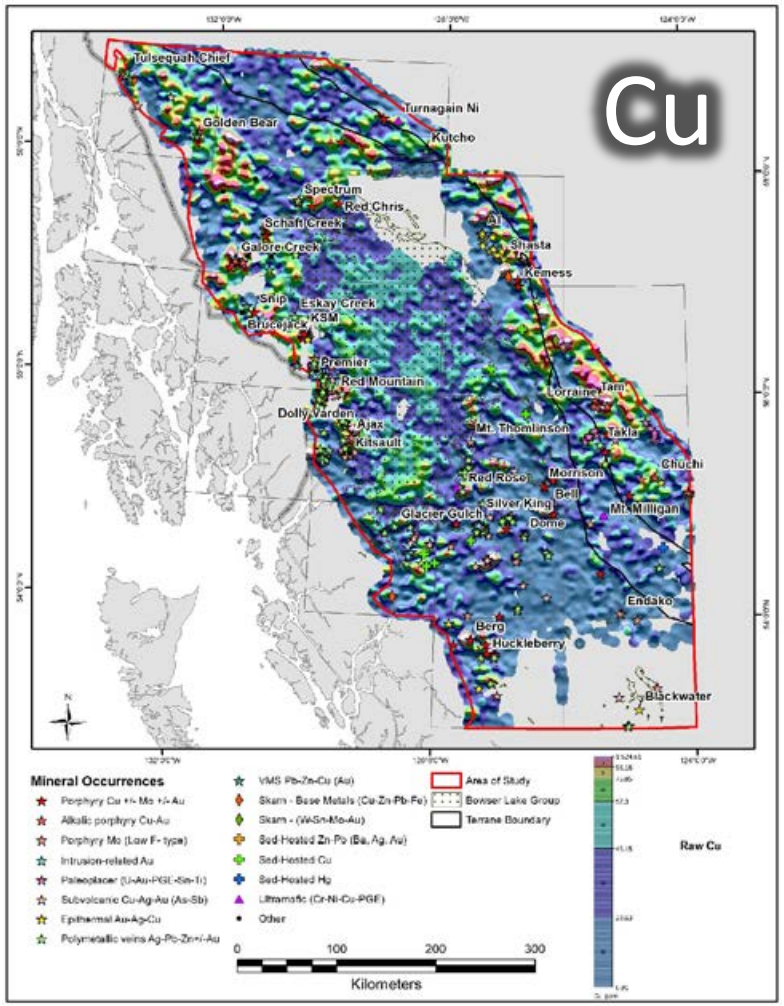
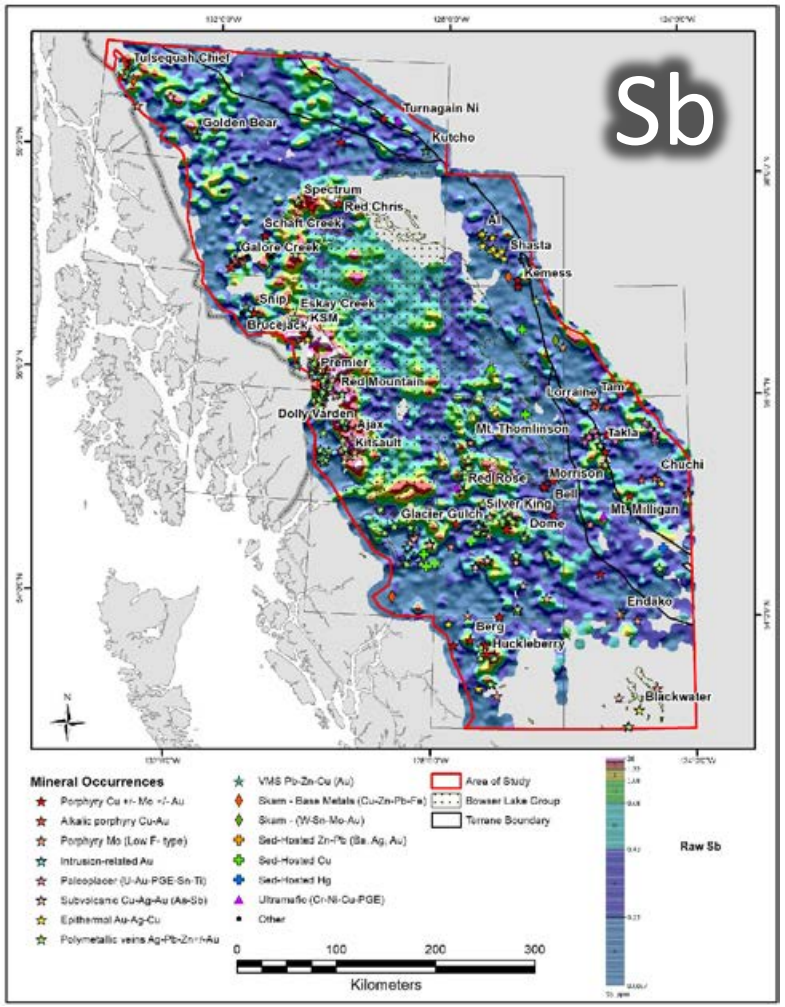
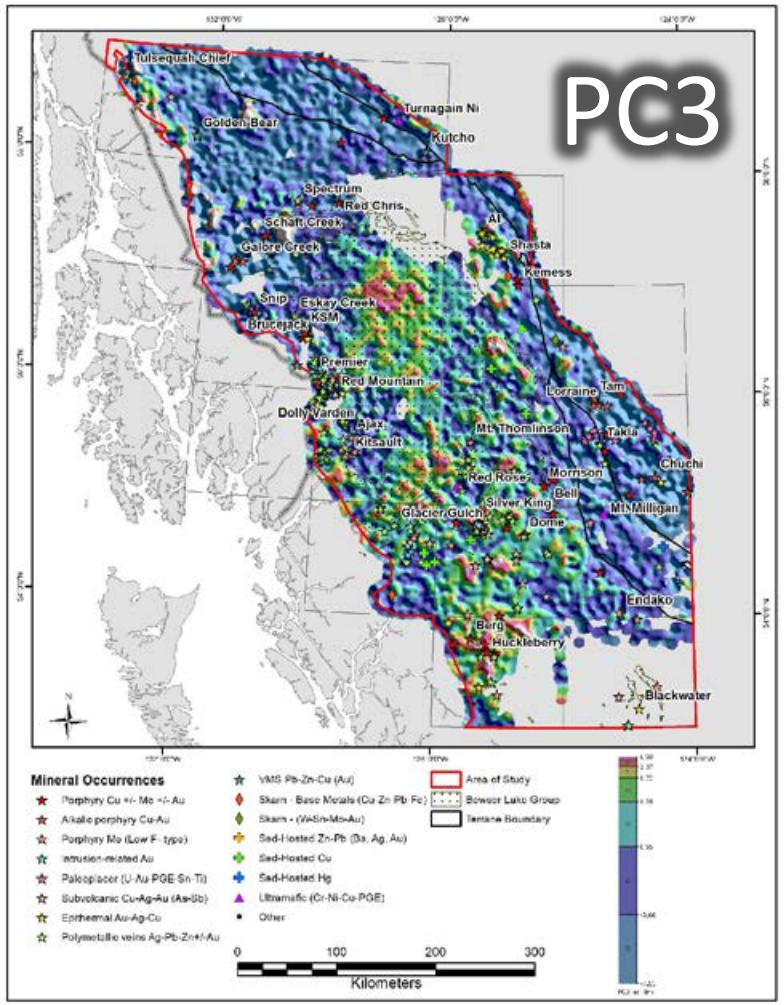
# Regional-scale geochemistry programs

## Stream sediment sampling in NW BC




**CSA Global Report № 110.2018, 18 May 2018**

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# The Holy Grail

**Reproduce past successes**

See through cover

Confirm presence of a mineral

Cost-effective to use over vast areas

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# Orders of magnitude drop in detection limits


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# New sampling media


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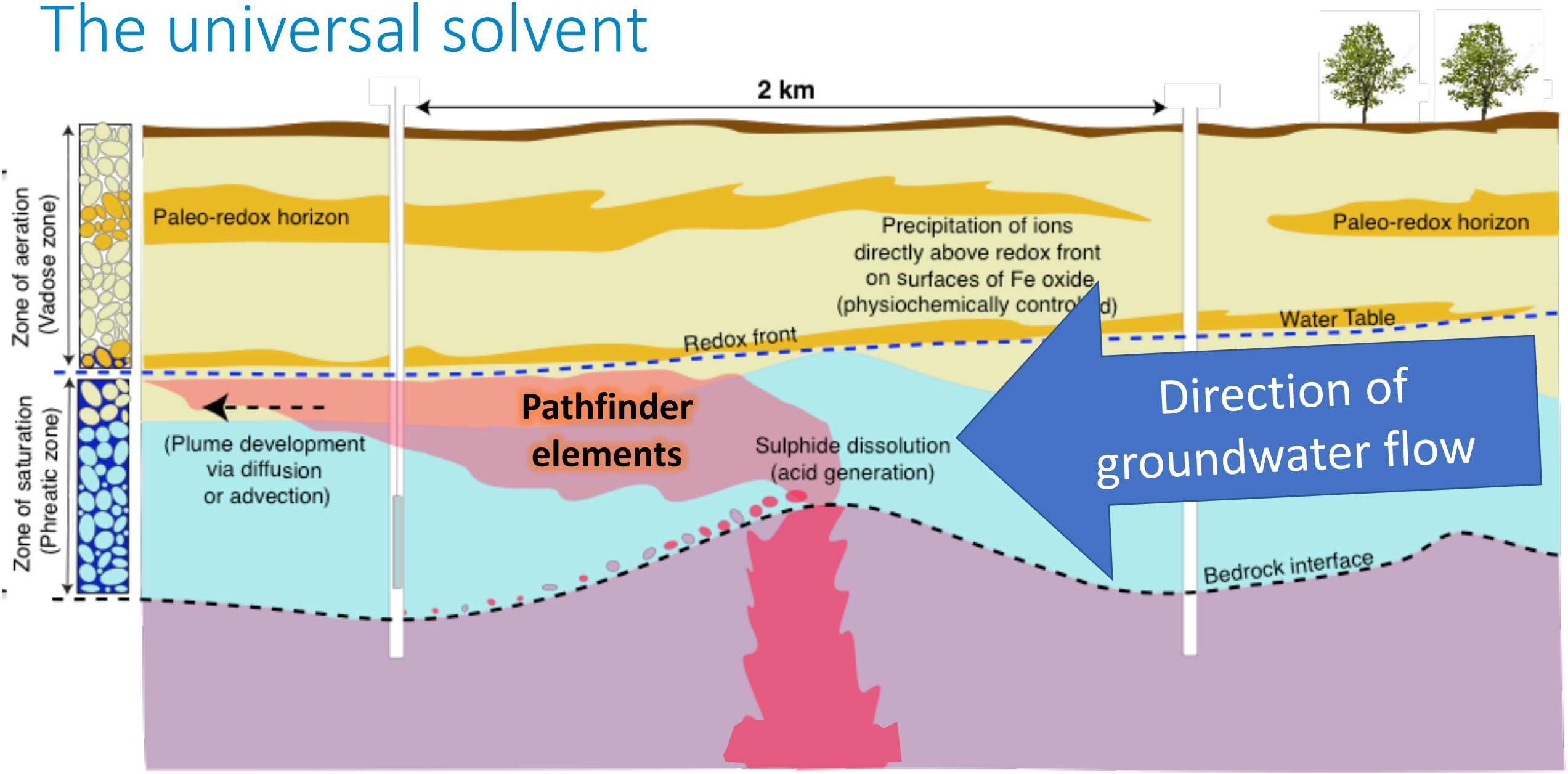
# The universal solvent




Kidder and Jones, 2017

# Why is clear

**Direct indication of minerals + pathfinders**

**Groundwater moves**

- Bigger footprints = fewer samples
- Creates vectors and gradients

**Can recharge from depth**

- Often along structures
- Detect deeper mineralization

**Open up new covered search spaces**

- Lowers exploration costs
- Focus use of more expensive tools


**Leybourne & Cameron, 2007**

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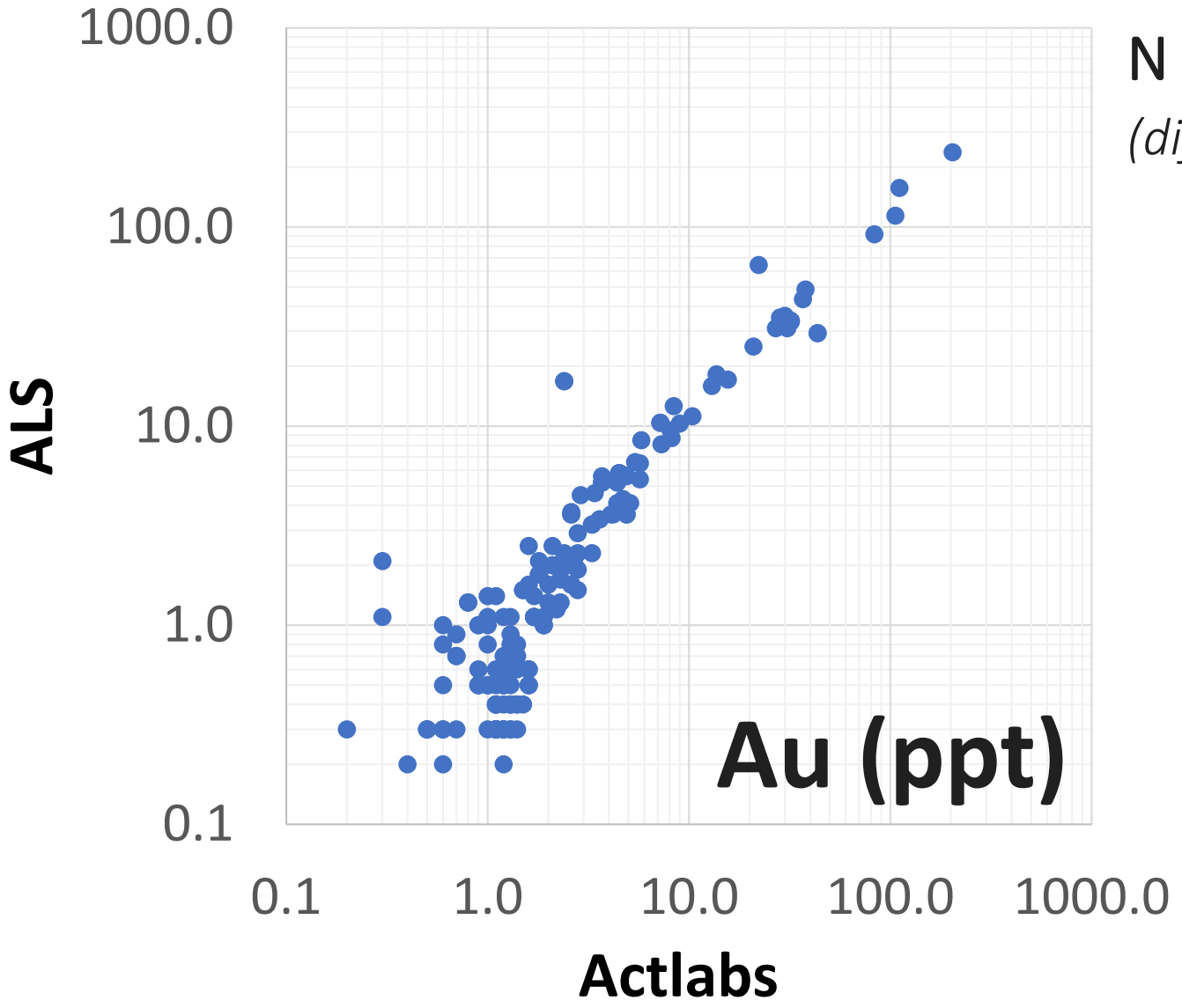
# PPT!?

## South Grass Valley Project

### 2019 Field Duplicates




N = 198

*(different labs & instruments)*

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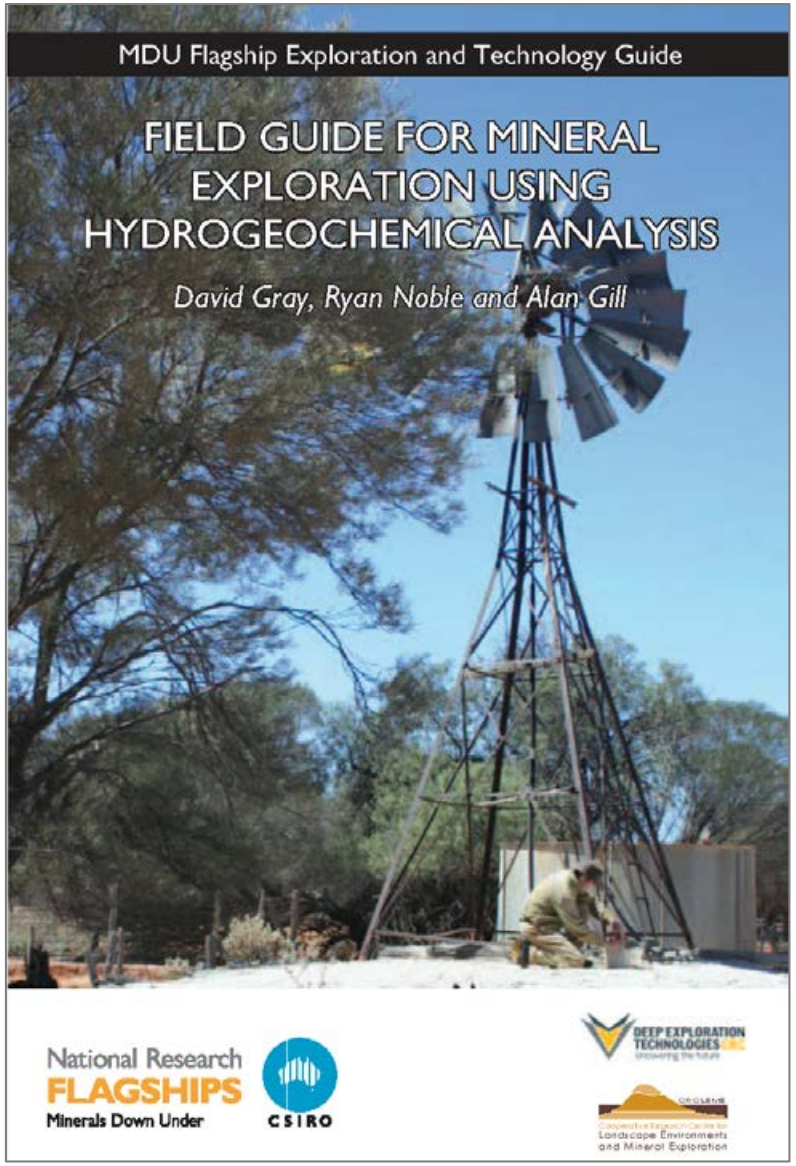
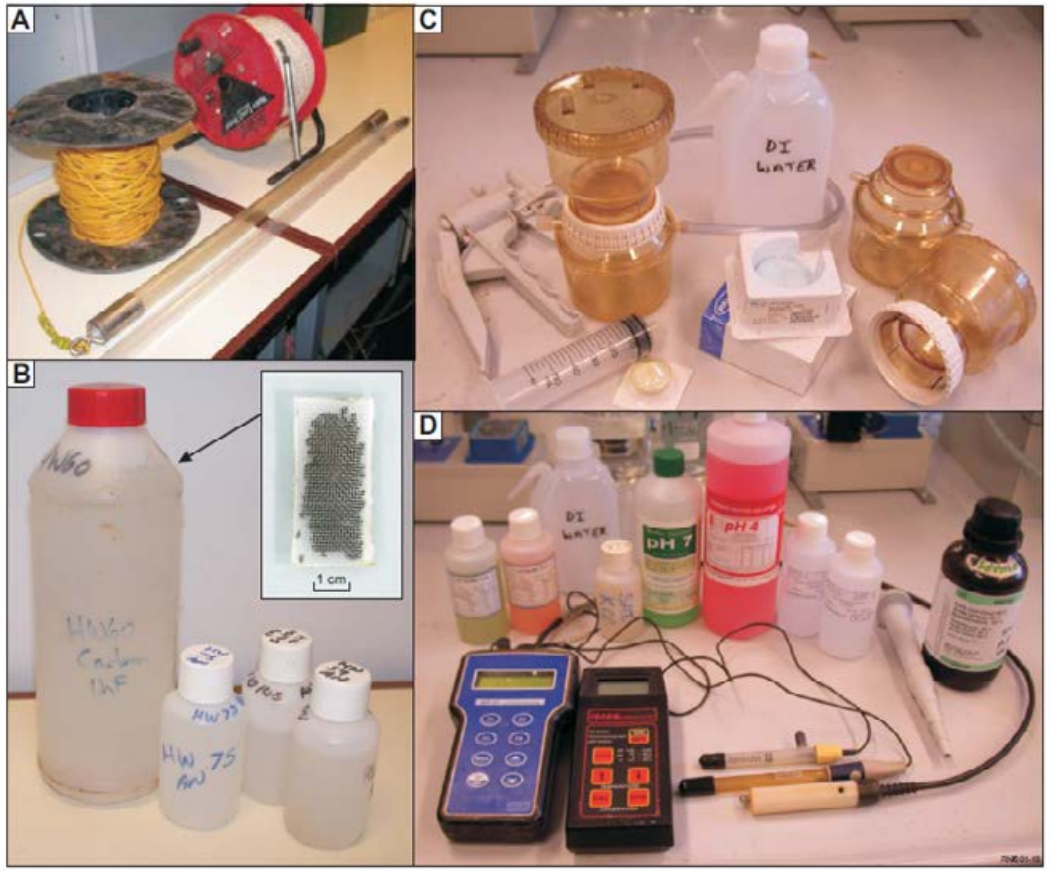
# How do you collect/prepare/analyze samples?








**Noble & Gray (2010)**

***AAG Explore March 2010***

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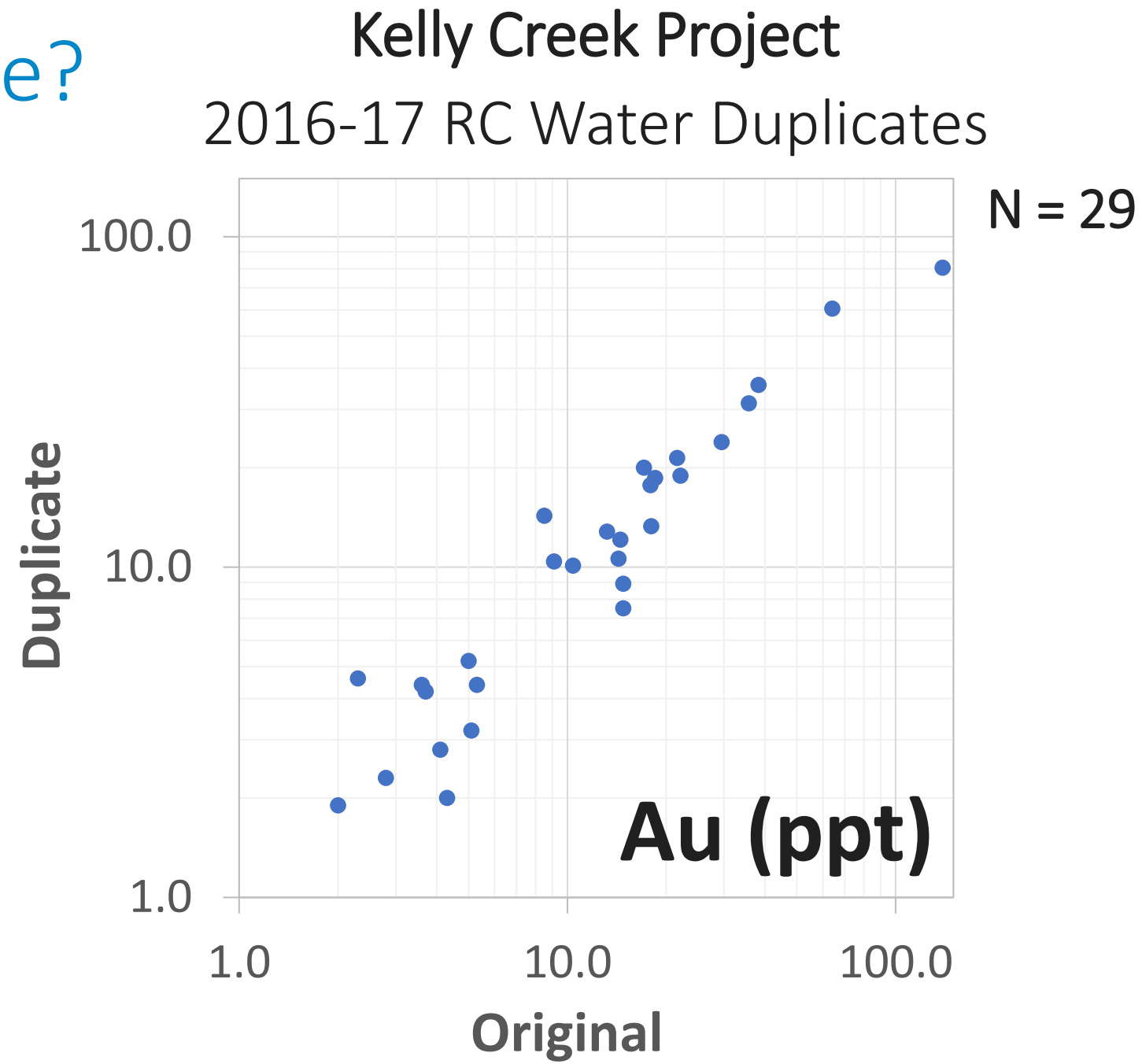
# Repeatable?


Kelly Creek Project
2016-17 RC Water Duplicates
N = 29
100.0
10.0
1.0
Duplicate
1.0
10.0
100.0
Original
Au (ppt)

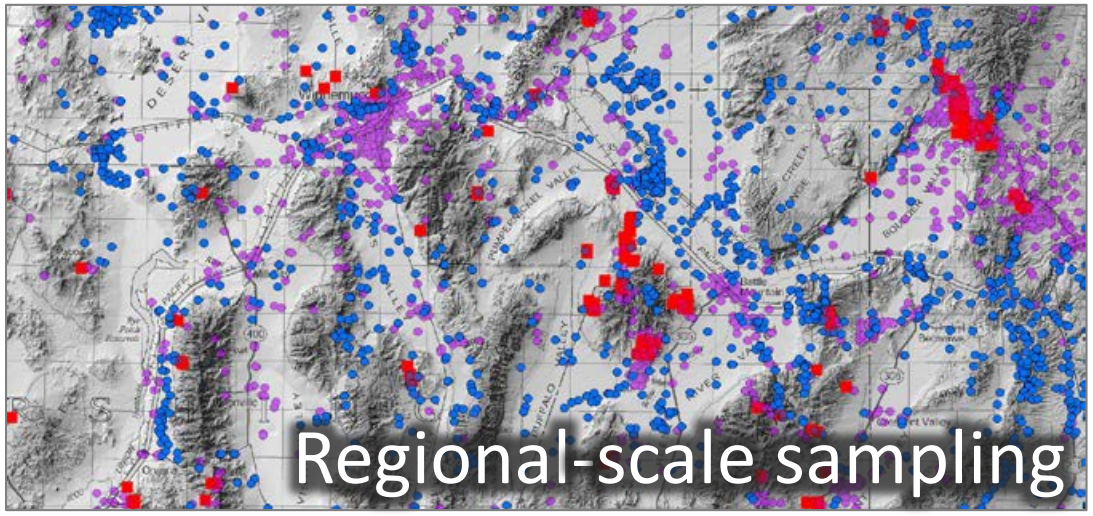
# What's anomalous?

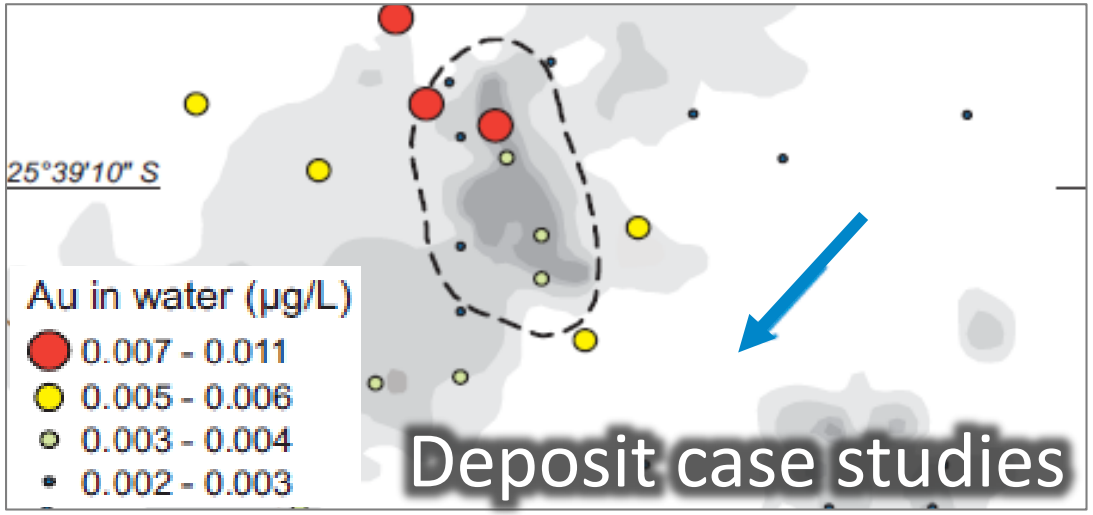
**Explorers need to know:**

- Background concentrations
- Concentrations at known deposits
- Appropriate sample spacing

**Requires**

- Regional context (large datasets)
- Deposit case studies

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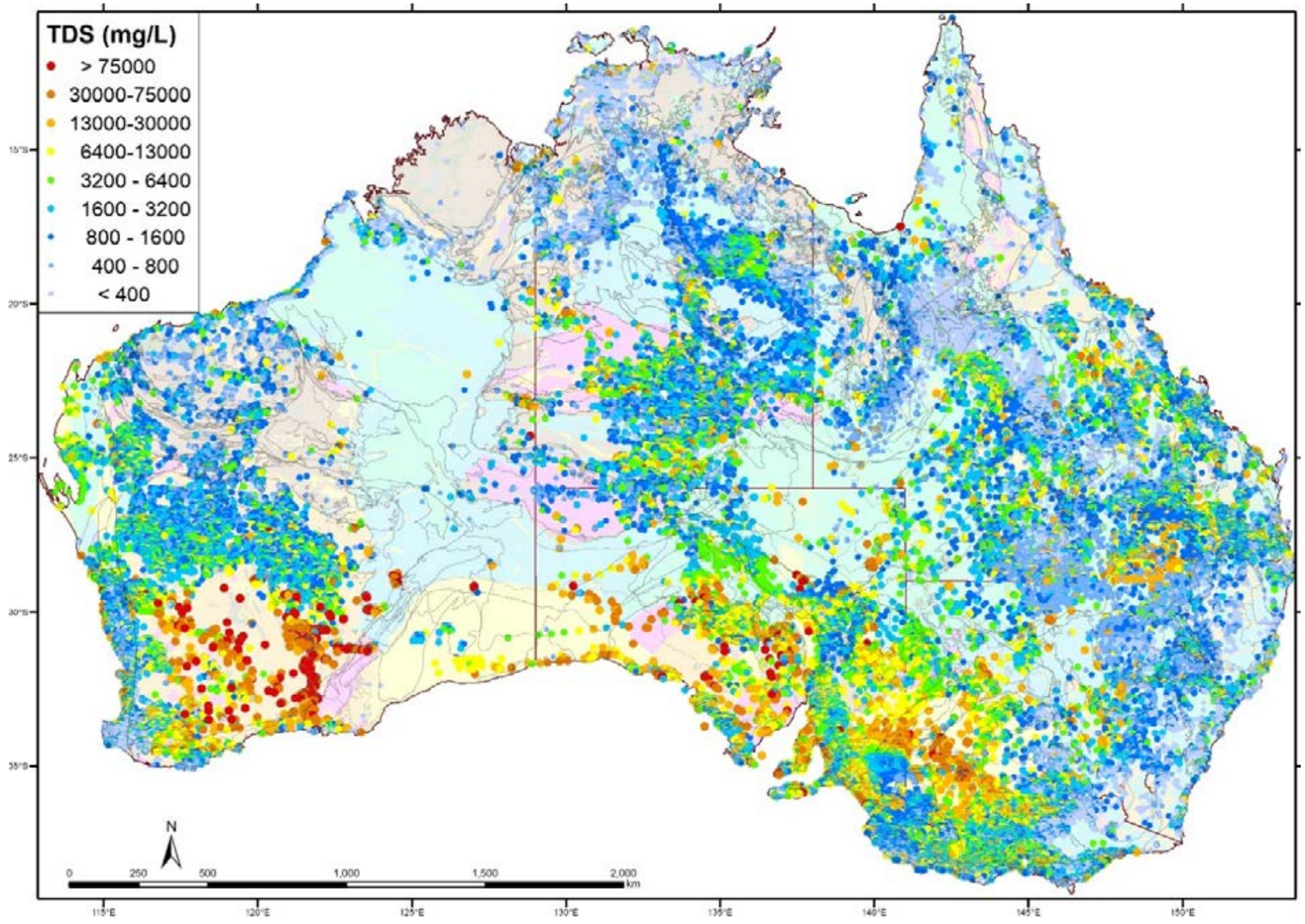
# Continental-scale hydrogeochemistry atlas




**Aggregated existing data:**

>380,000 samples

>30,000 Au analyses

**Reid et al. (2019)**

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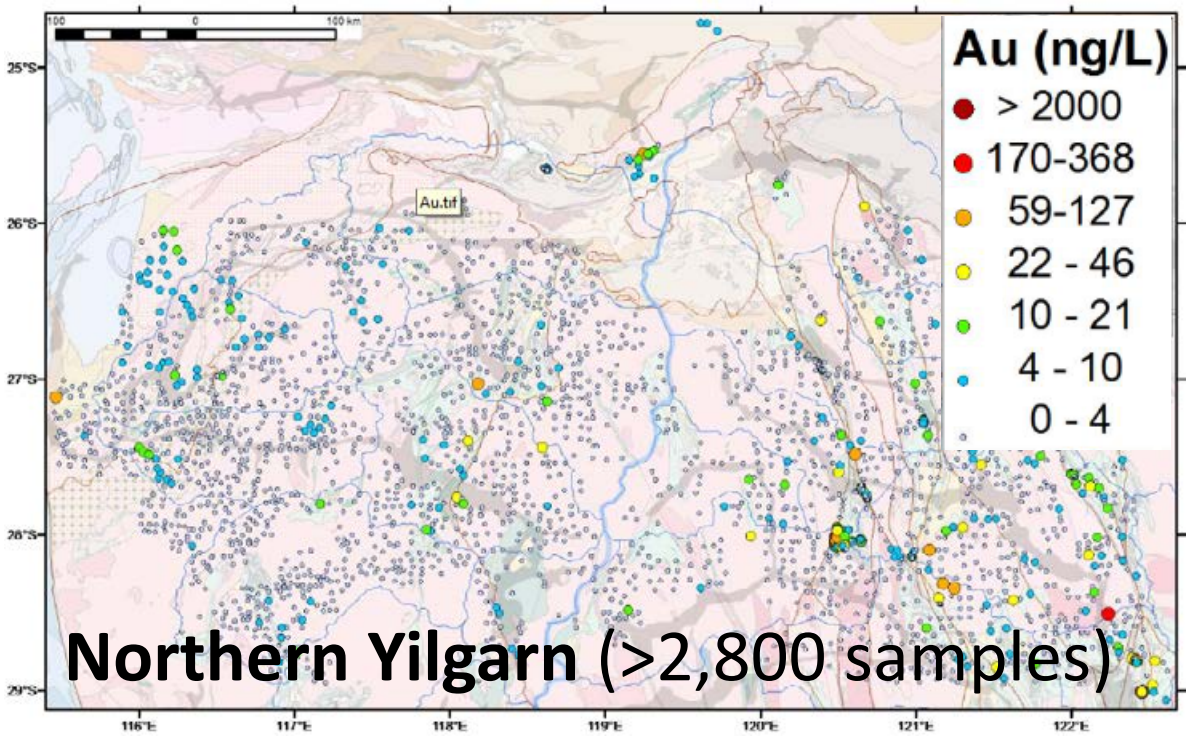
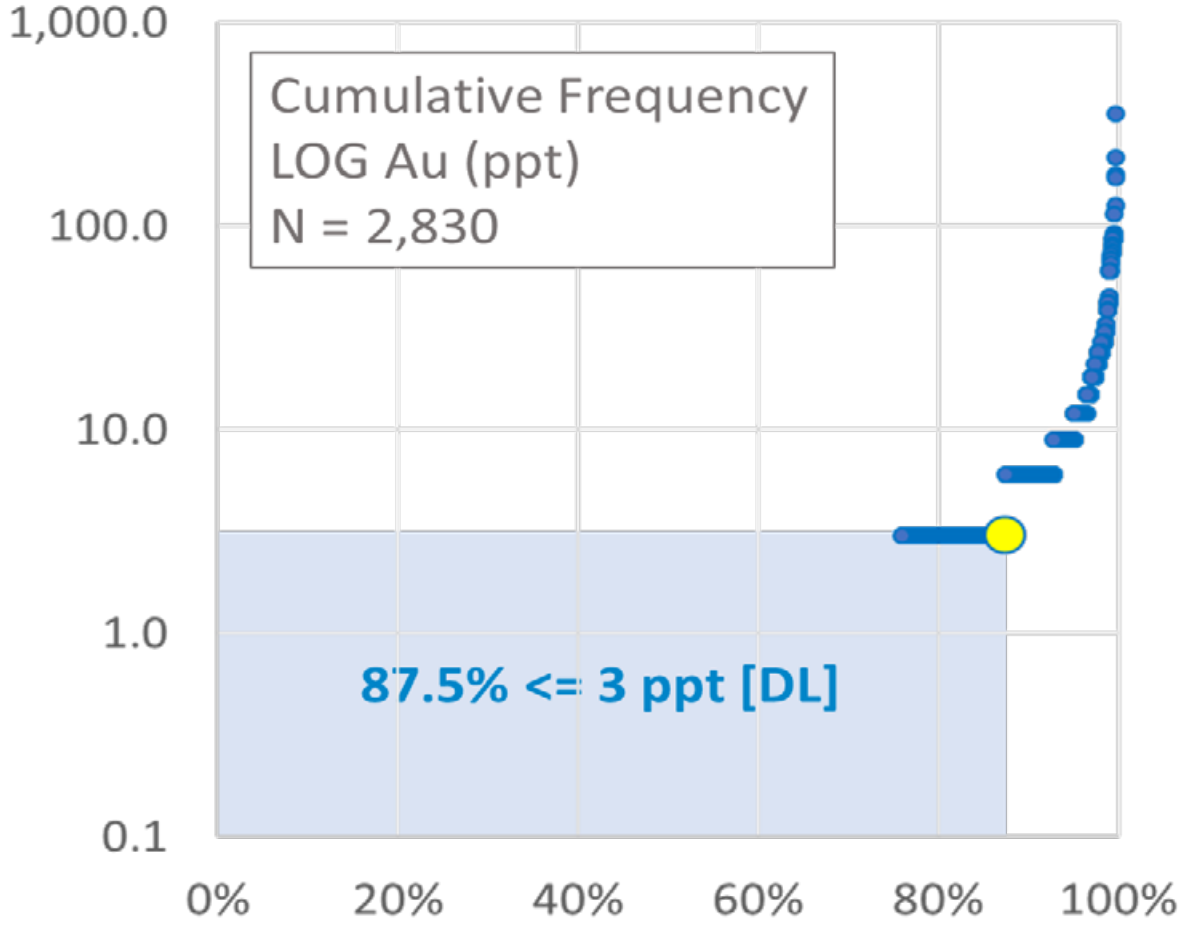
Gray et al. (2014)

# Regional-scale sampling program




**Northern Yilgarn** (>2,800 samples)




Low background concentrations

Multi-order-of-magnitude anomalies

**Reliably identified 15 of 18 larger-scale Au camps**

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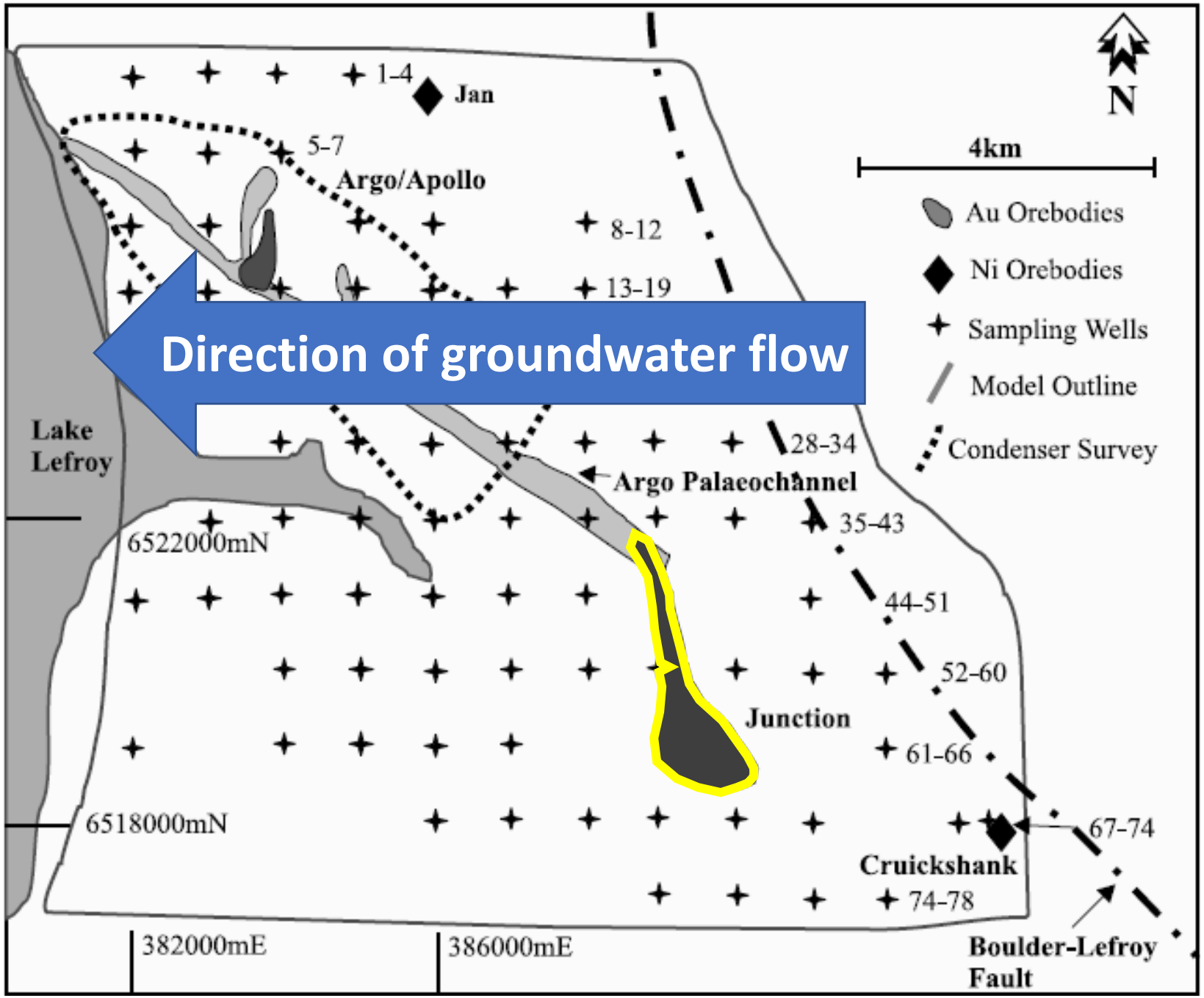
Carey et al. (2003)

# Appropriate sample spacing?

## St. Ives Area, Western Australia




**Junction (2.3 Moz Au)**

**1 km x 1 km grid**
(purpose-drilled holes)

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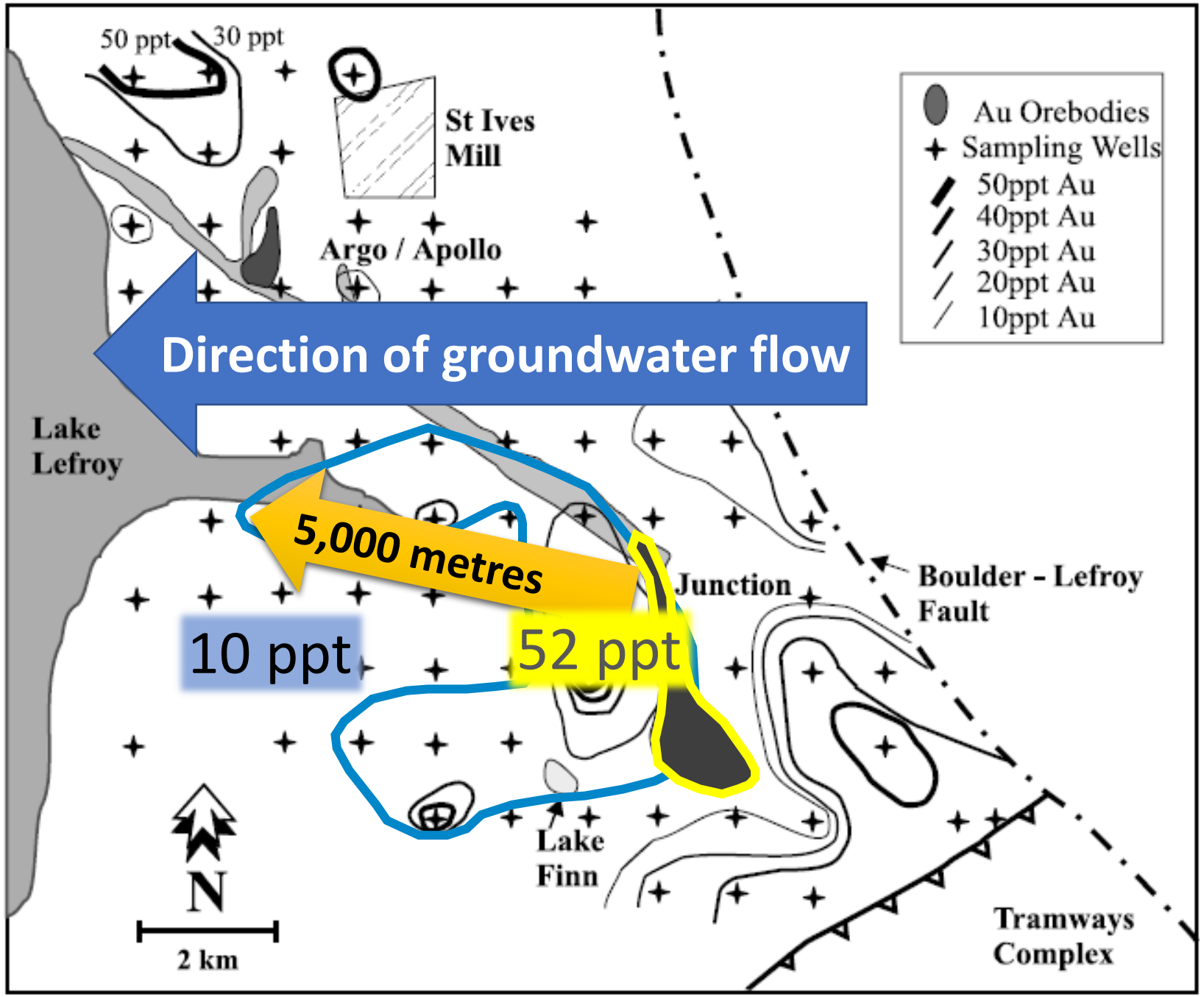
Carey et al. (2003)




# Appropriate sample spacing?

## St. Ives Area, Western Australia

**Results**

High sample (99th)

Footprint > Deposit
(10 ppt @ 5,000 m)

**Easily seen with 1 km sample spacing**

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# Where's it being used?

**Australia**

CSIRO

Independence Group

**Photos:**
**David Gray**

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# Where’s it being used?

**Chile**

First Quantum

Anglo American Chile &

Phelps Dodge

**Photos:**
**Peter Winterburn**

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# Where's it being used?


**Botswana and Zambia**

First Quantum

**Photos:**
**James Kidder**

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# Where’s it being used?


**Nevada**

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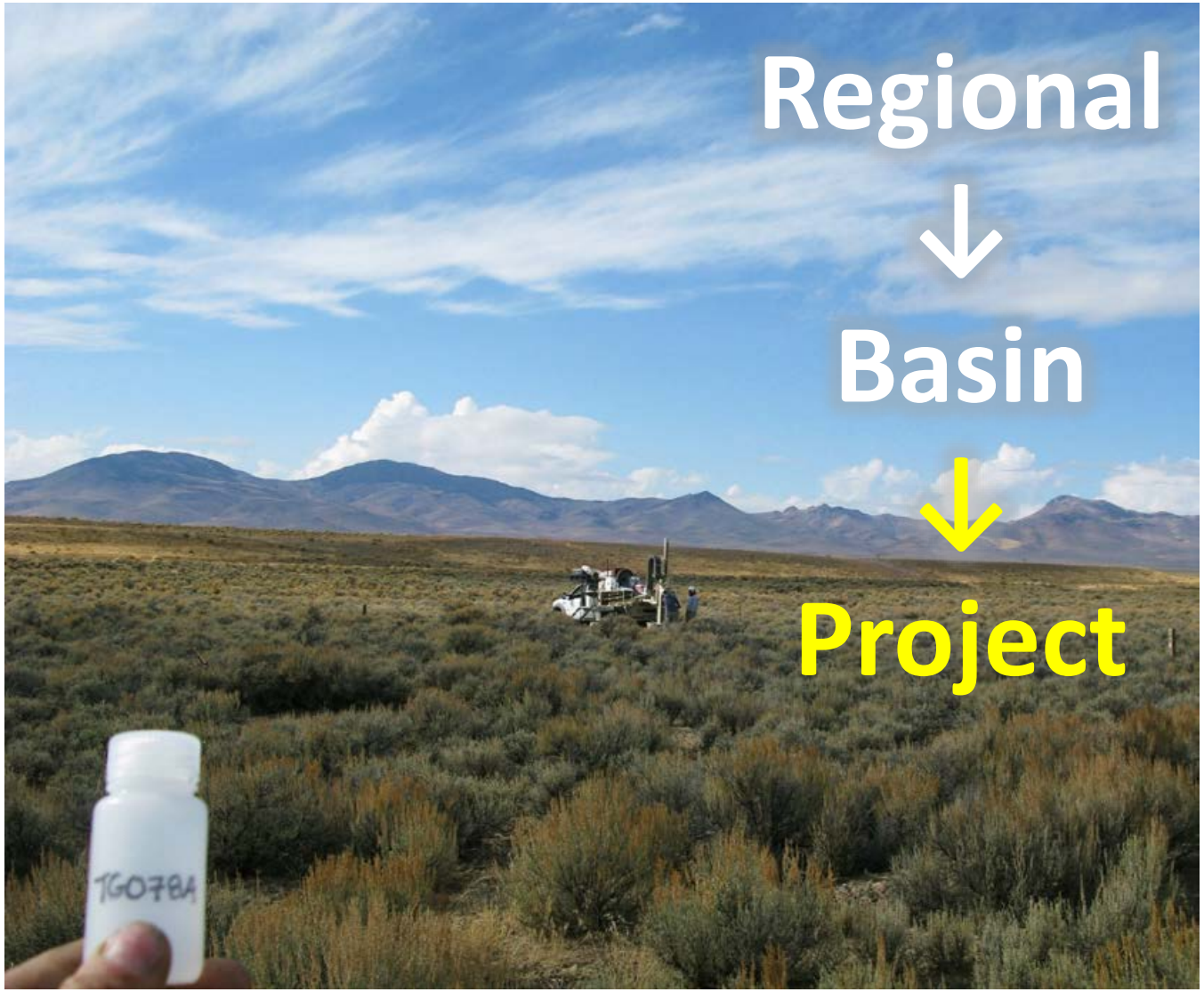
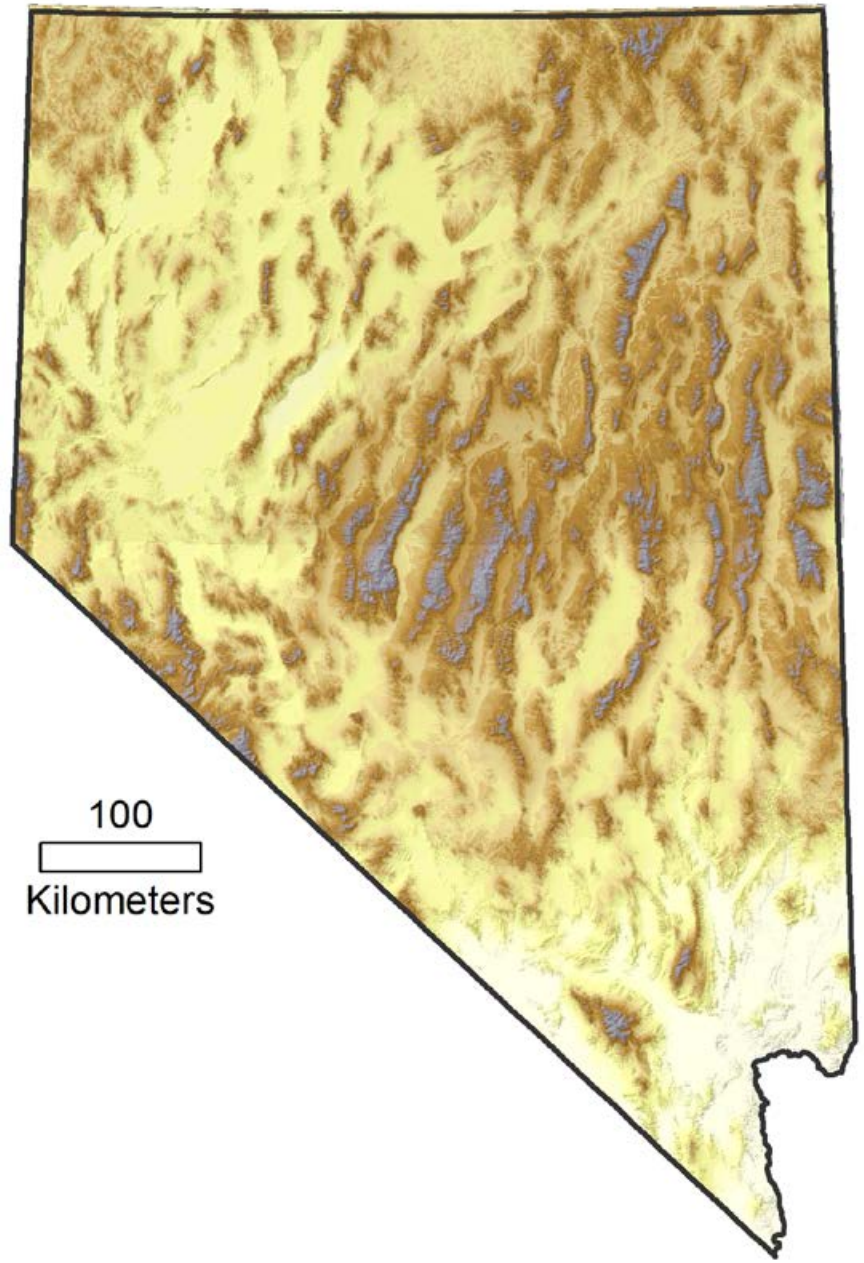
# Case study

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# Starts with regional area selection

**100,000** mapped prospects

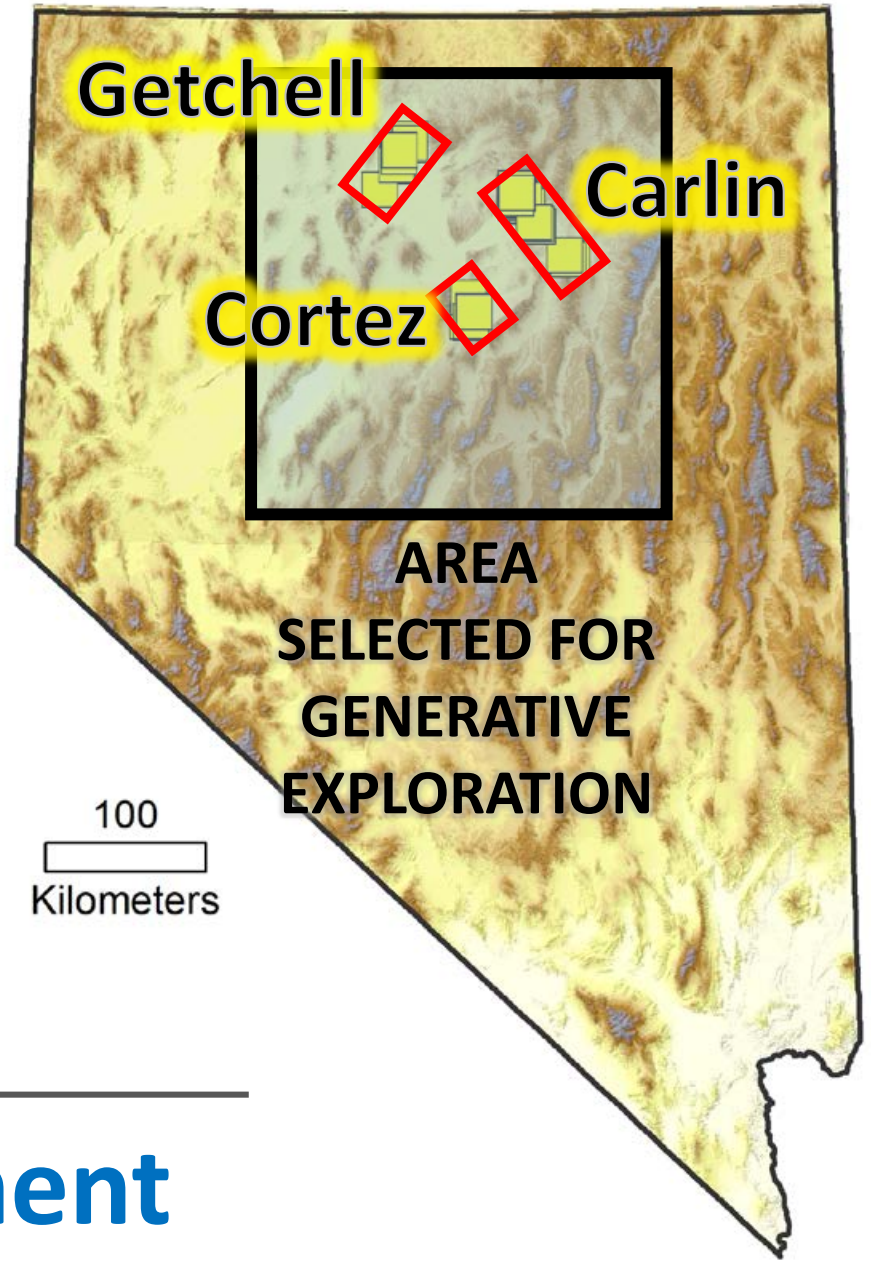
**600** gold mines

**5.6** Moz Au per year (↓40%)

**250** Moz Carlin Au endowment

**80** % of Carlin Au from 3 camps

**55** % under cover

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**>200 Moz Au residual endowment**

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# Biggest challenge: lack of existing bore holes

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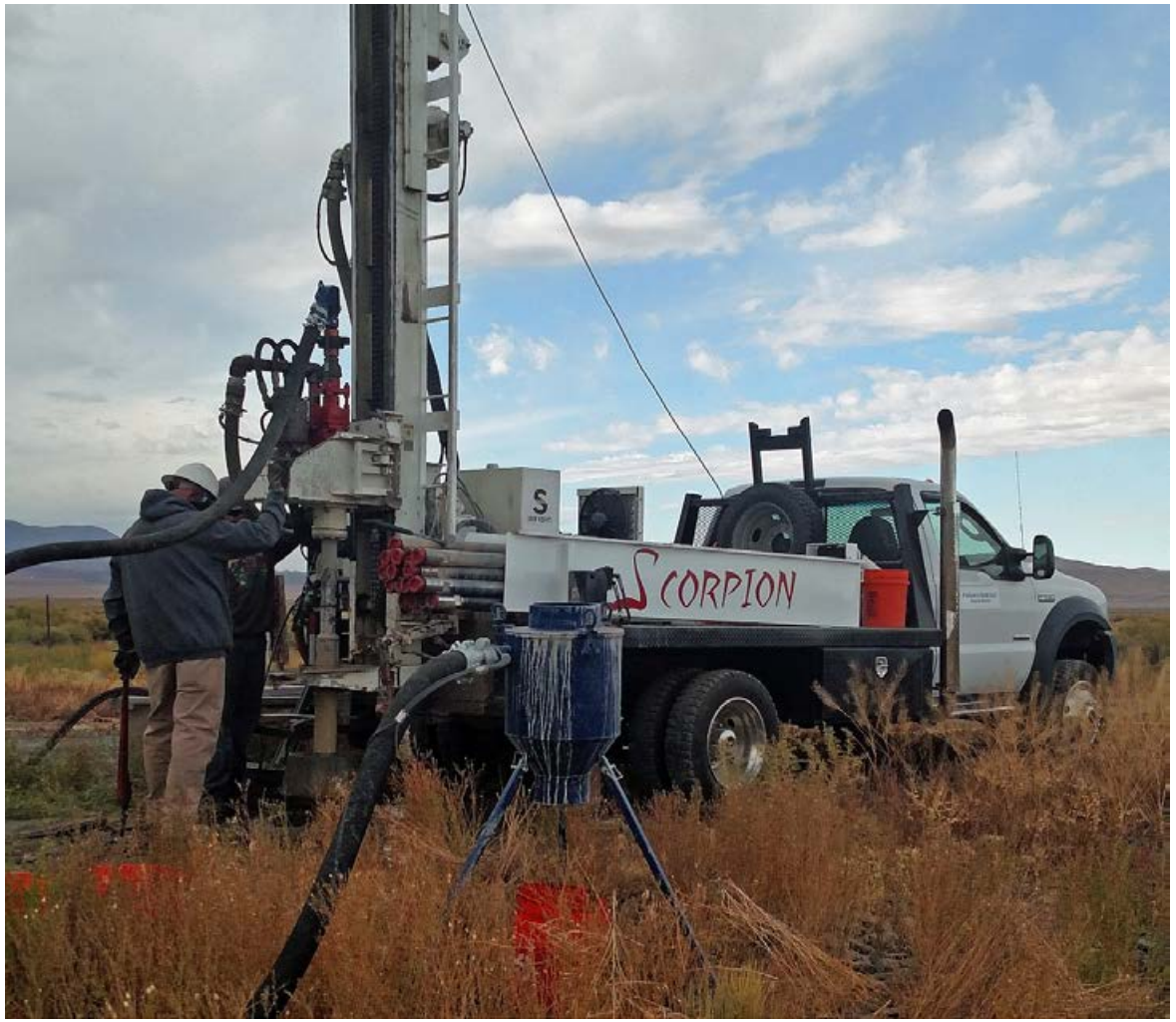
# Required: purpose-drilled bore holes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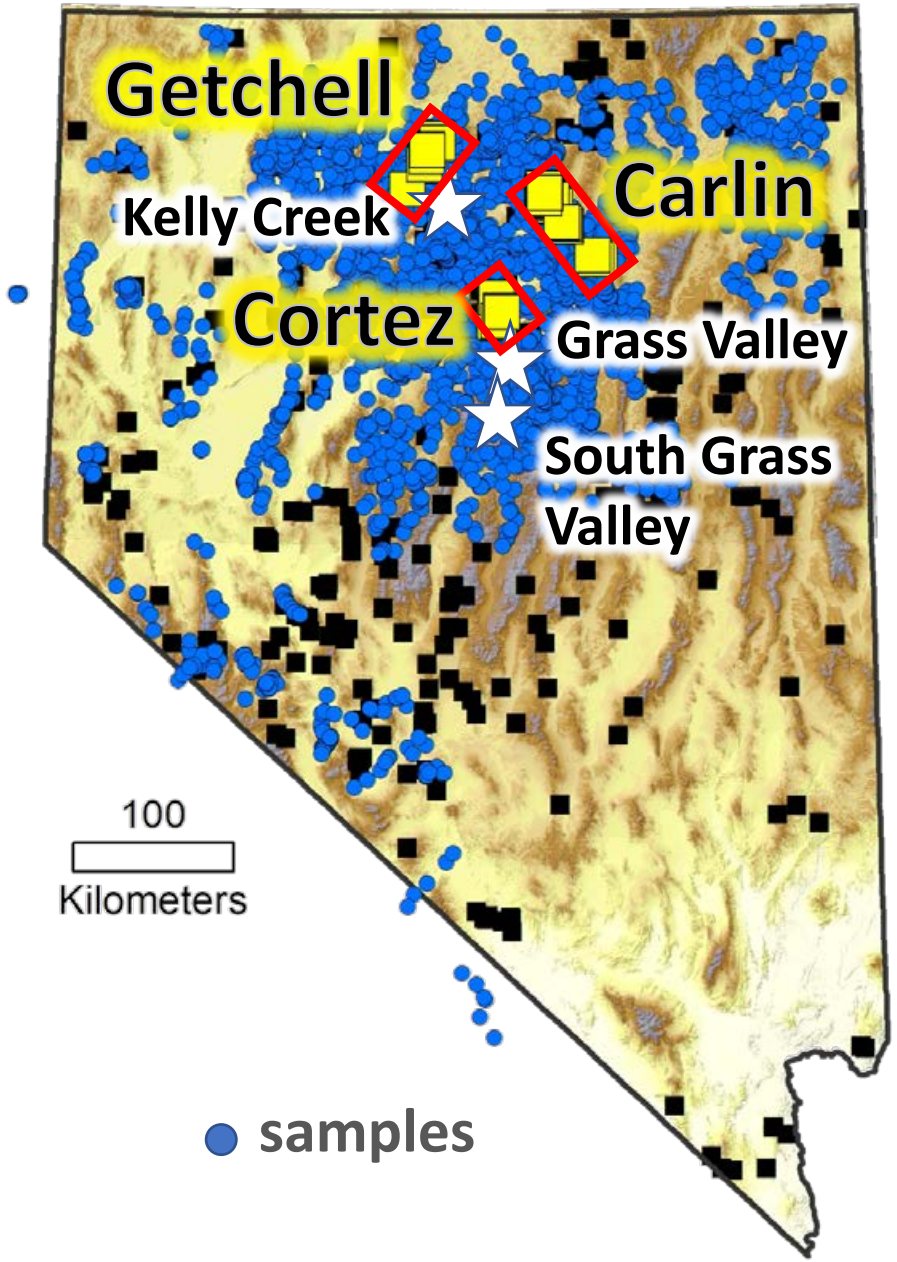
# Regional-scale sampling

>6,000 groundwater samples mostly from purpose-drilled sampling bores

Tested around >30 known gold mines

Database defining element distributions and exploration thresholds

**Selected three projects to advance**

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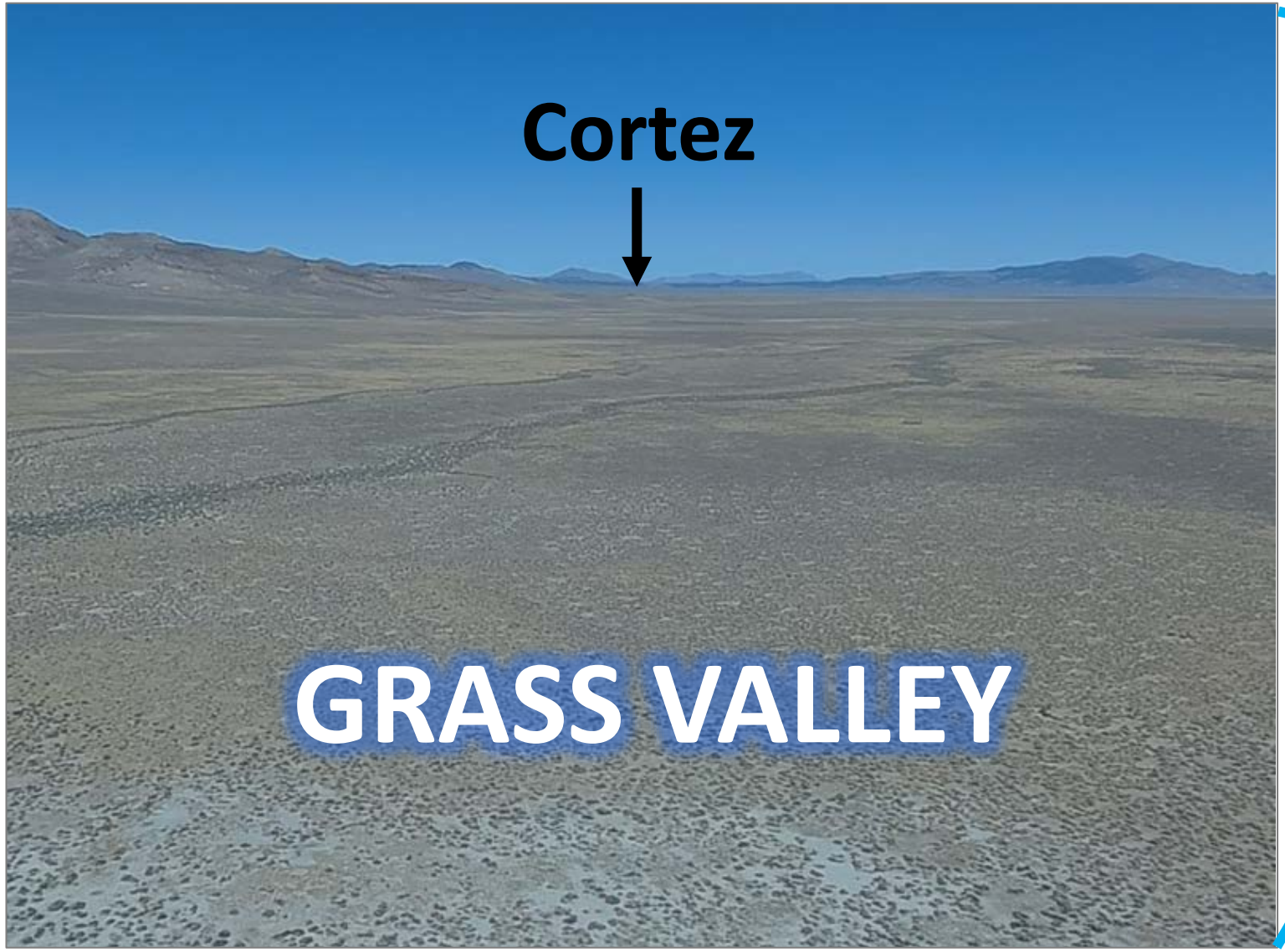
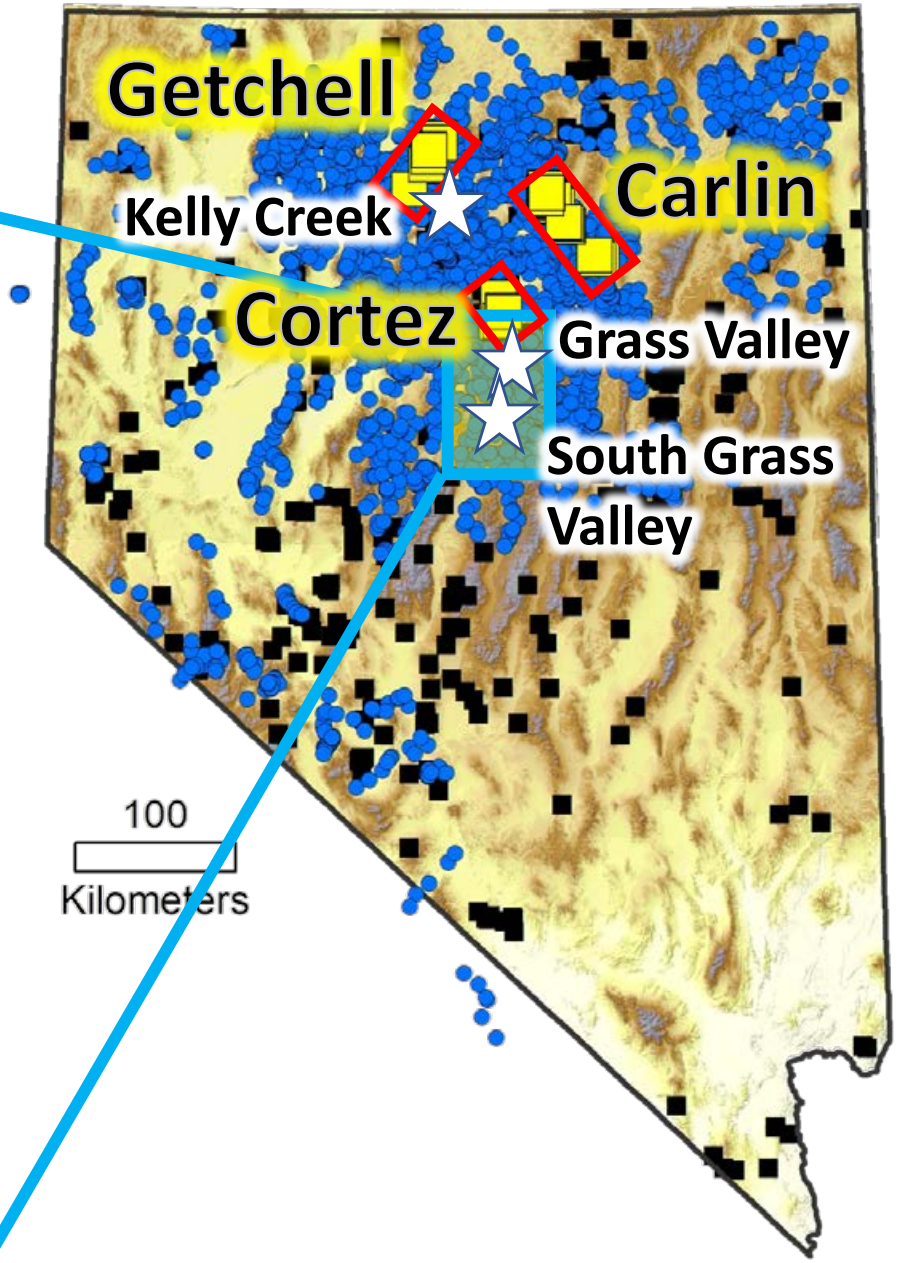
# On the ground

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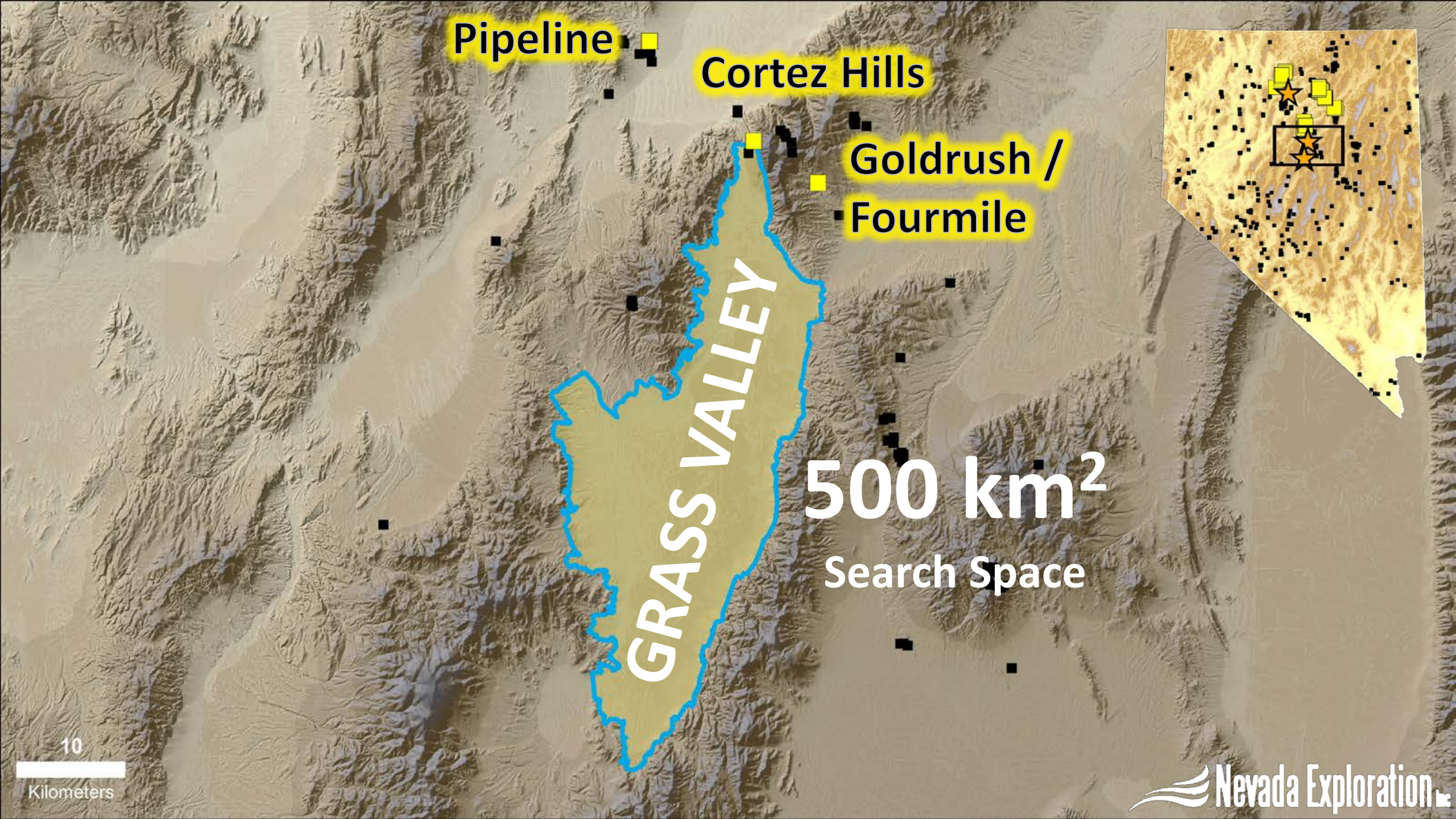
Pipeline
Cortez Hills
Goldrush /
Fourmile
GRASS VALLEY
500 km²
Search Space
10
Kilometers
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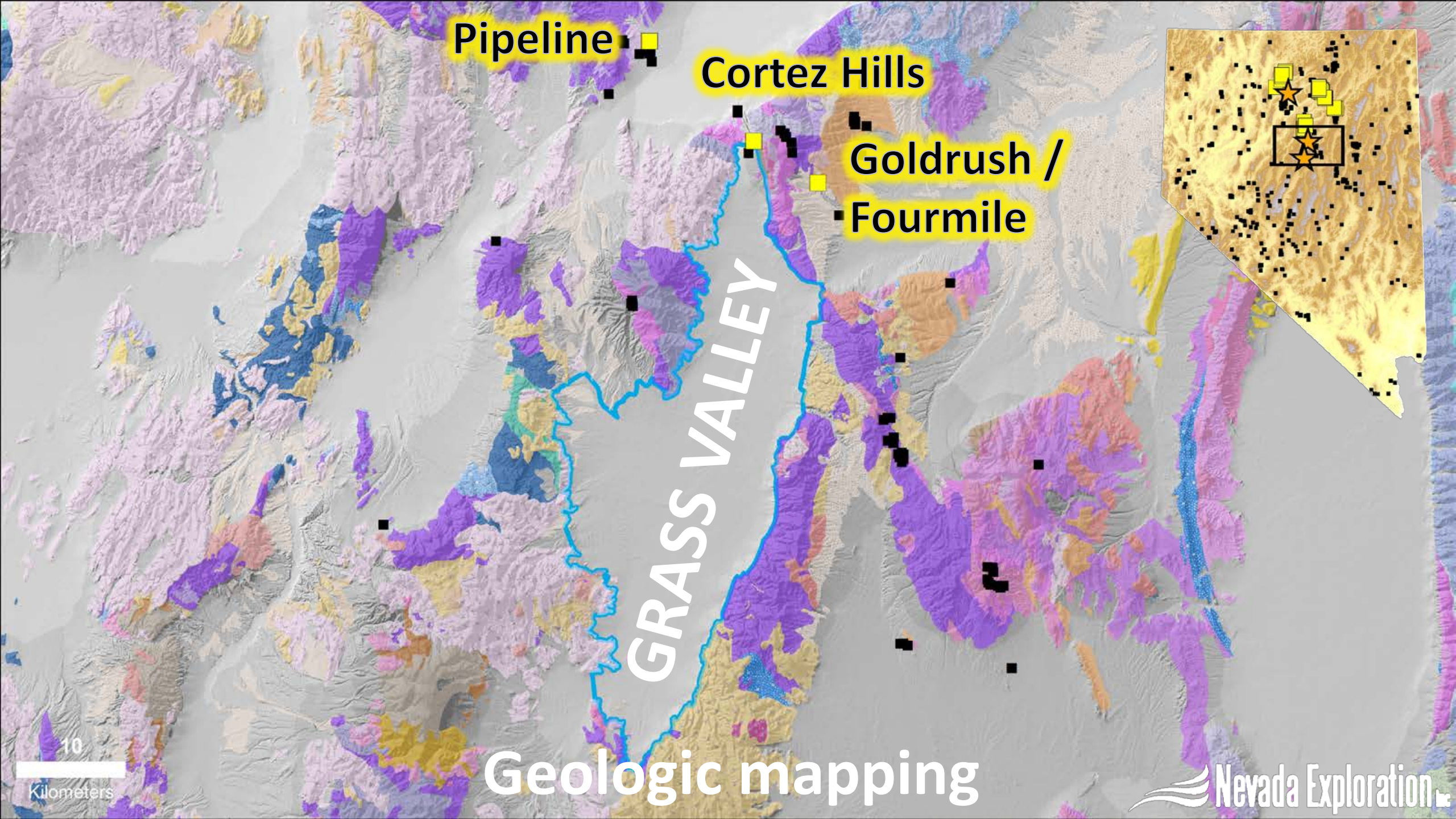
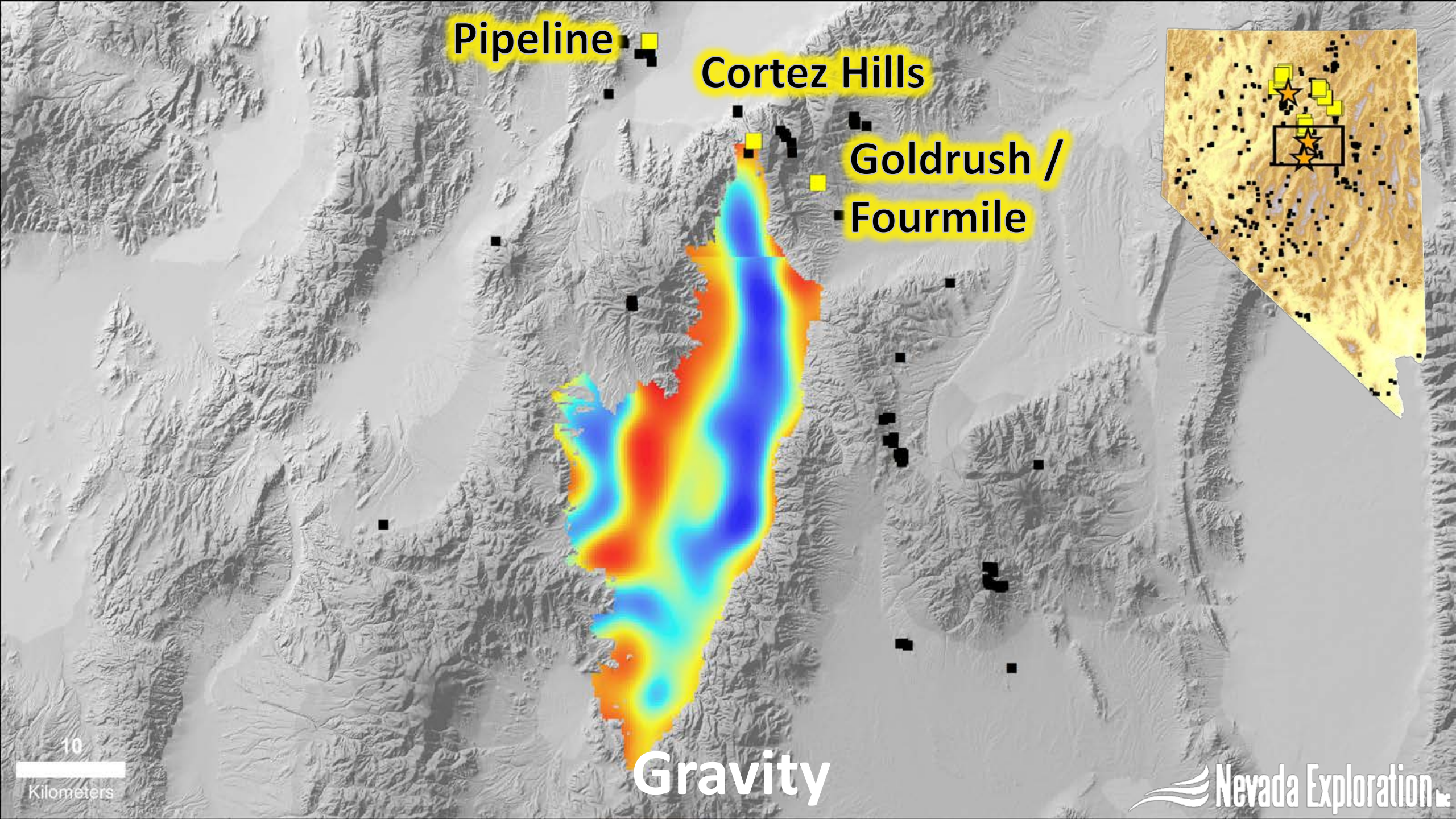

Pipeline
Cortez Hills
Goldrush /
Fourmile
GRASS VALLEY
10
Kilometers
Geologic mapping
Nevada Exploration


Pipeline
Cortez Hills
Goldrush /
Fourmile
Gravity
10
Kilometers
Nevada Exploration


Cortez Hills
Road to Goldrush / Fourmile
TG135A
Nevada Exploration Inc.


Nevada Exploration


Nevada Exploration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HSP149A
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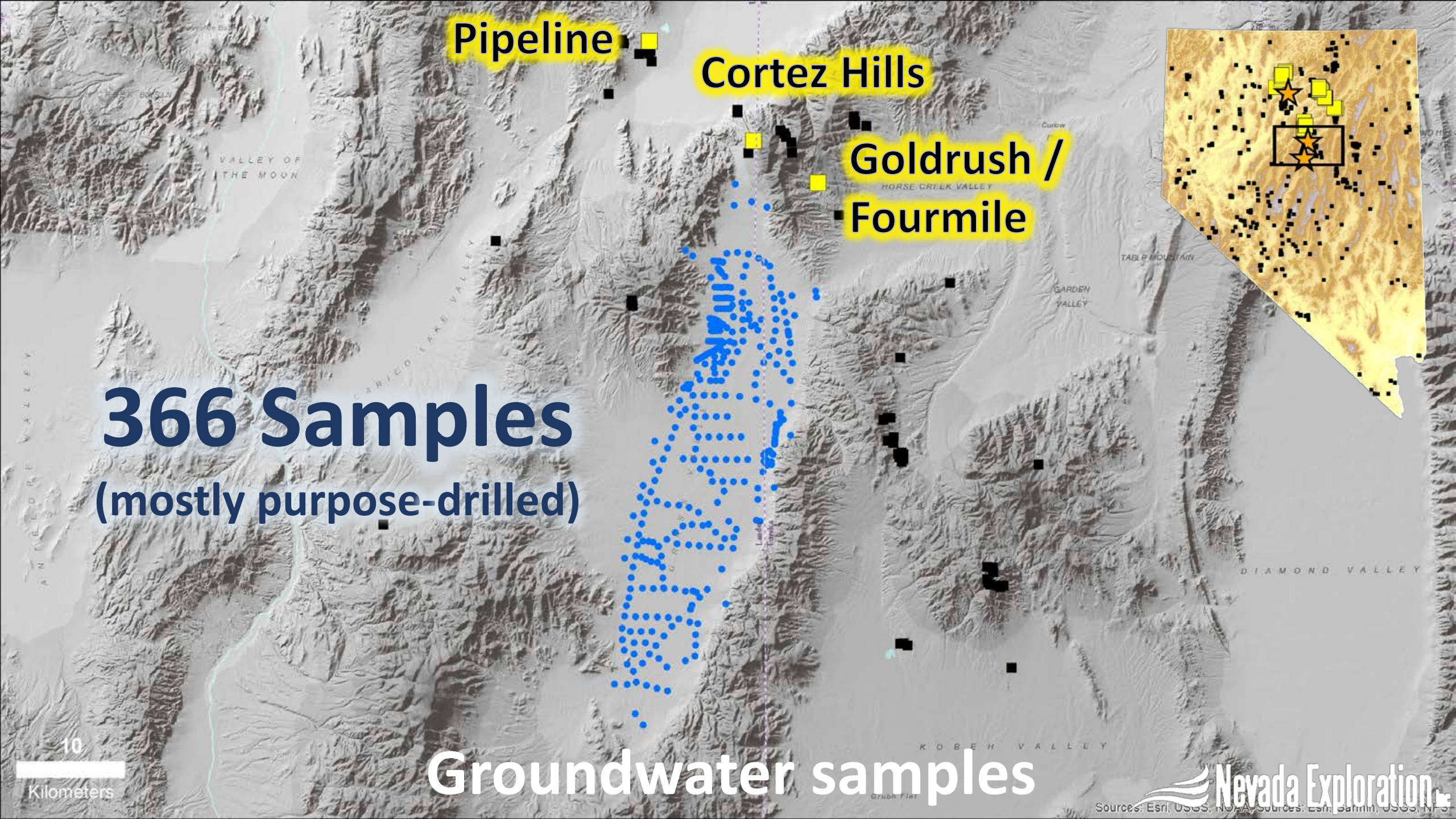
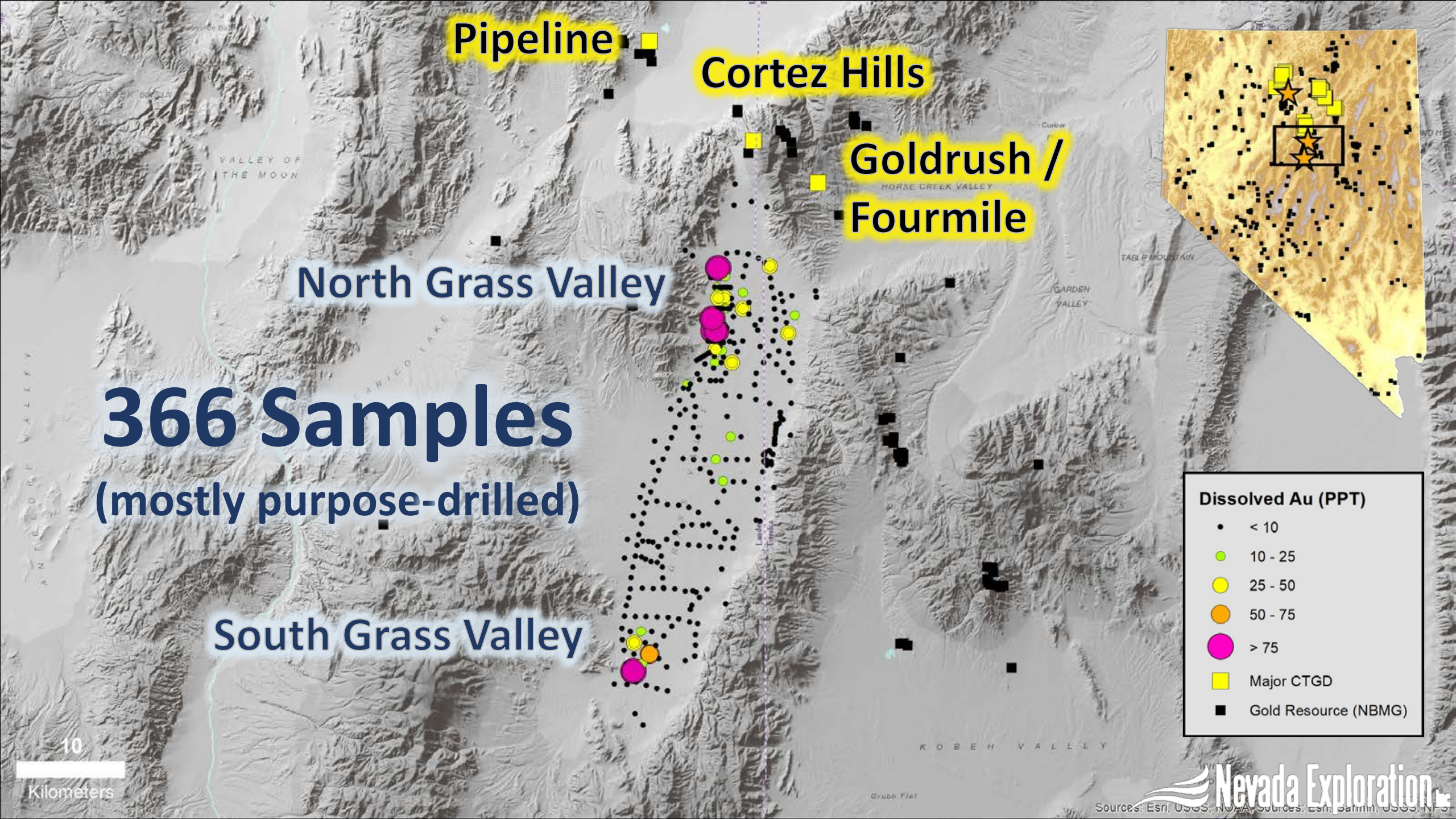
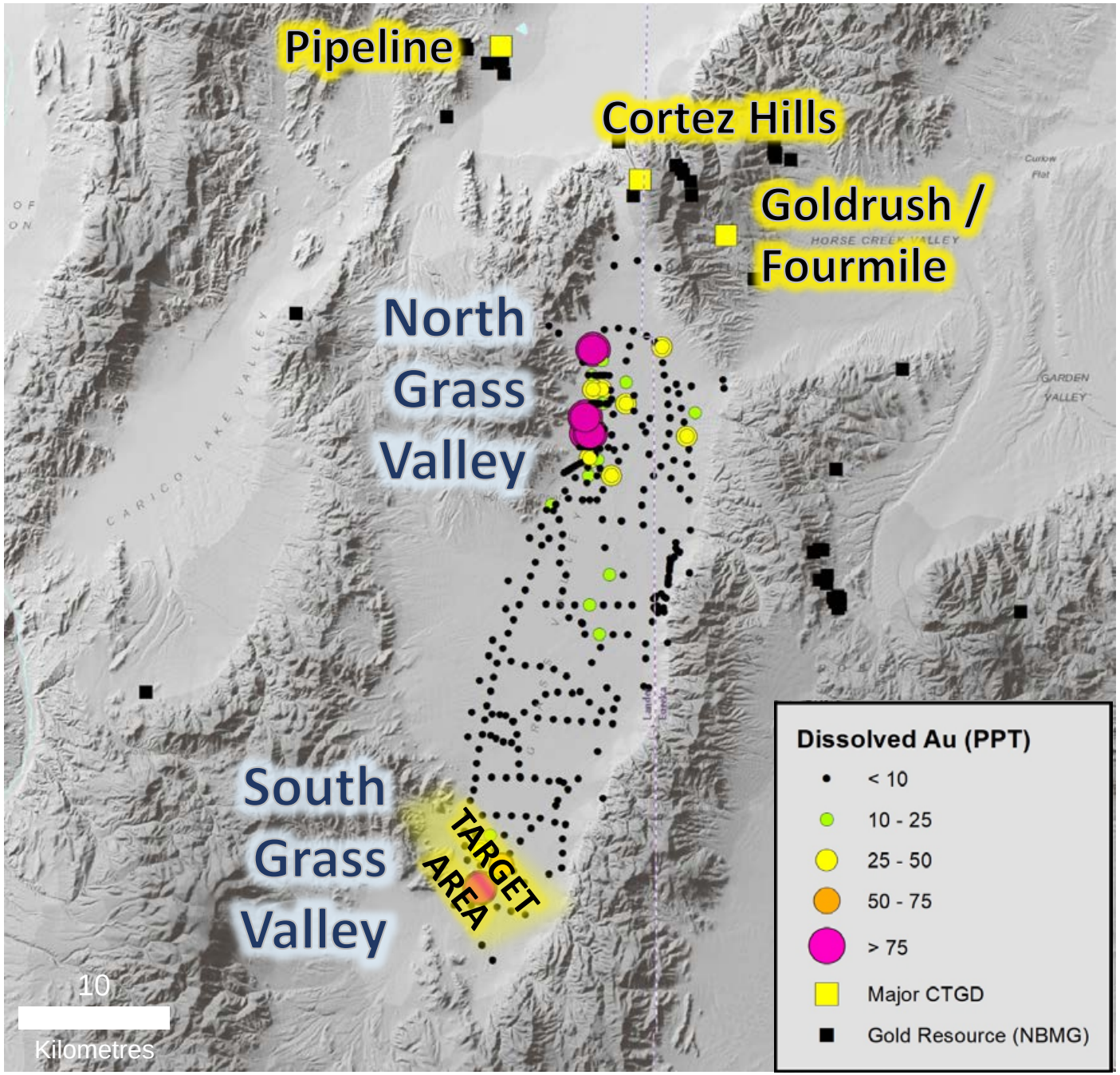

Pipeline
Cortez Hills
Goldrush /
Fourmile
366 Samples
(mostly purpose-drilled)
10
Kilometers
Groundwater samples
Nevada Exploration
Sources: Esri, USGS, NOAA


Pipeline
Cortez Hills
Goldrush /
Fourmile
North Grass Valley
South Grass Valley
366 Samples
(mostly purpose-drilled)
Dissolved Au (PPT)
< 10
10 - 25
25 - 50
50 - 75
> 75
Major CTGD
Gold Resource (NBMG)
10
Kilometers
Nevada Exploration
Sources: Esri, USGS, NOAA




# Basin-scale program

500 km$^2$ search space

$500,000 US program

**$1,000/km$^2$**

**RESULTS**

Low background

High-contrast anomalies

**What comes next?**

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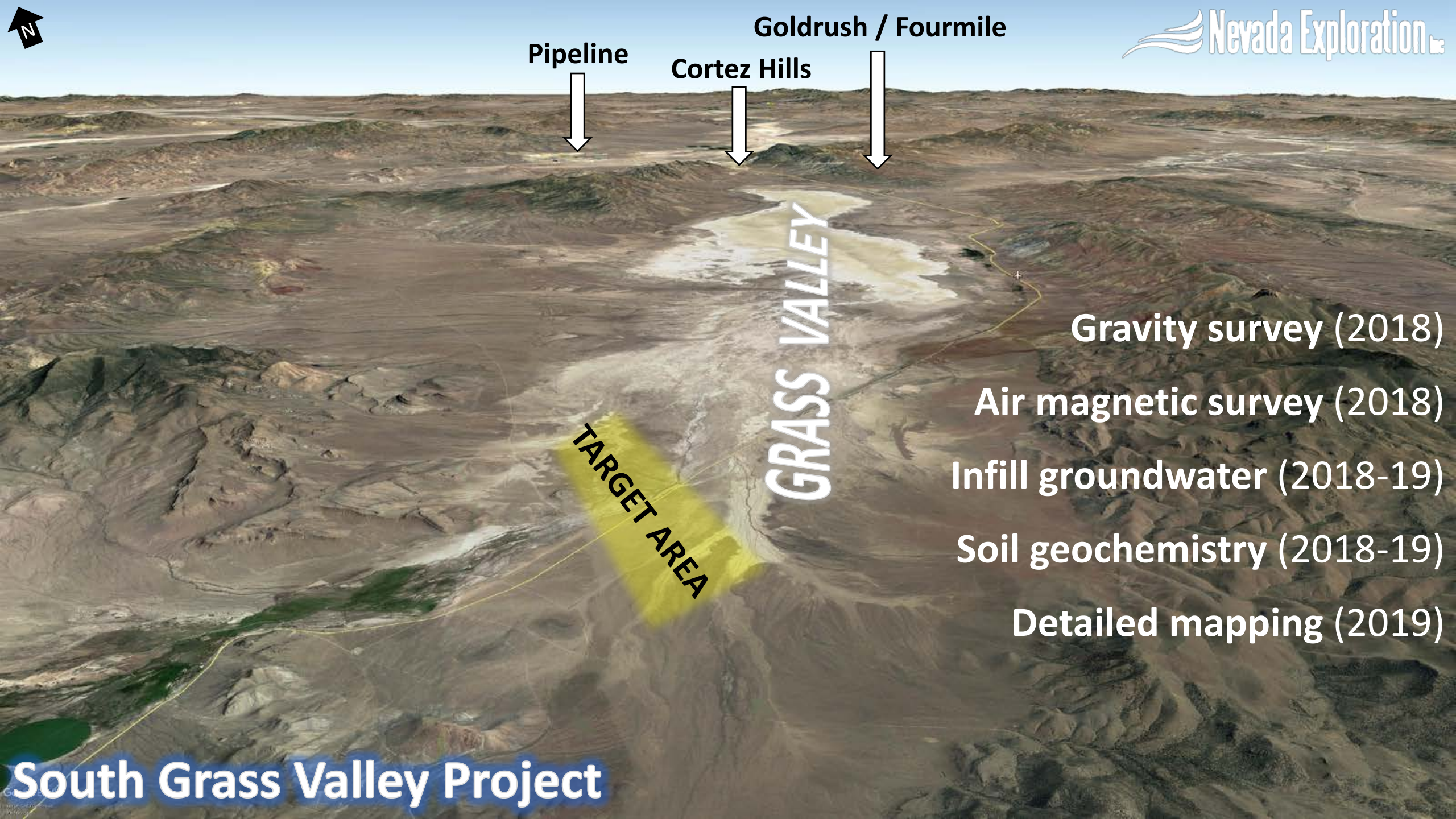
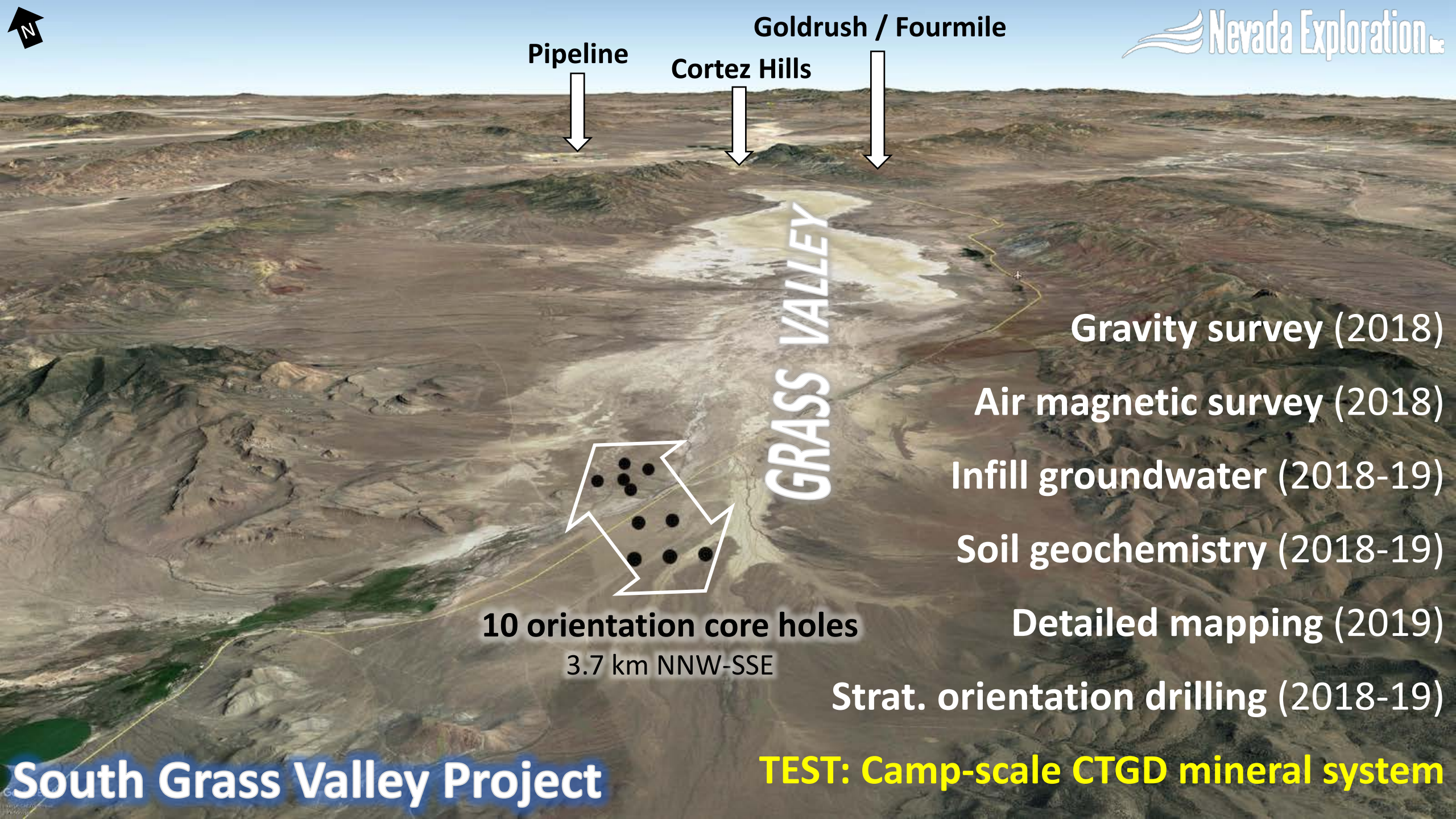
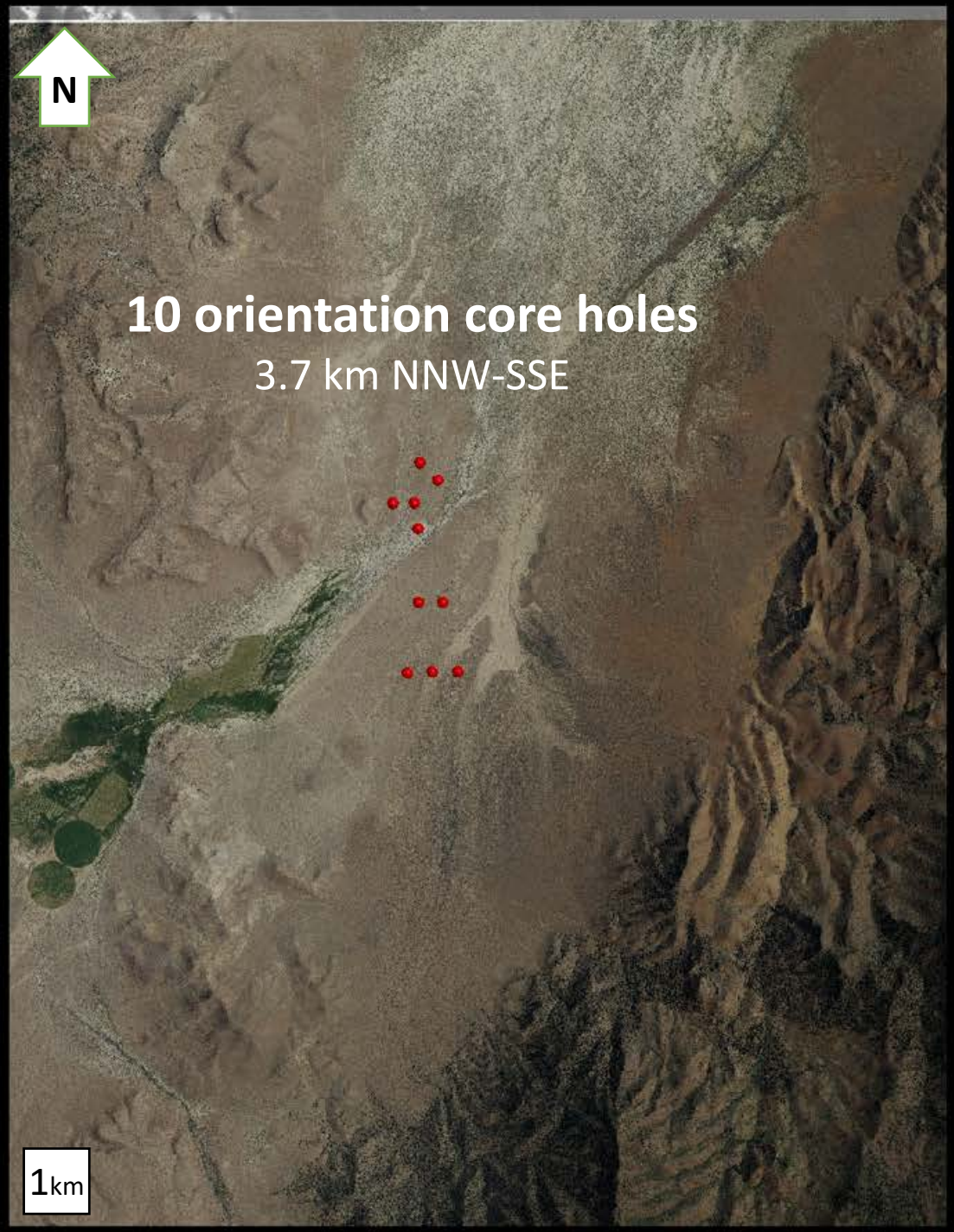
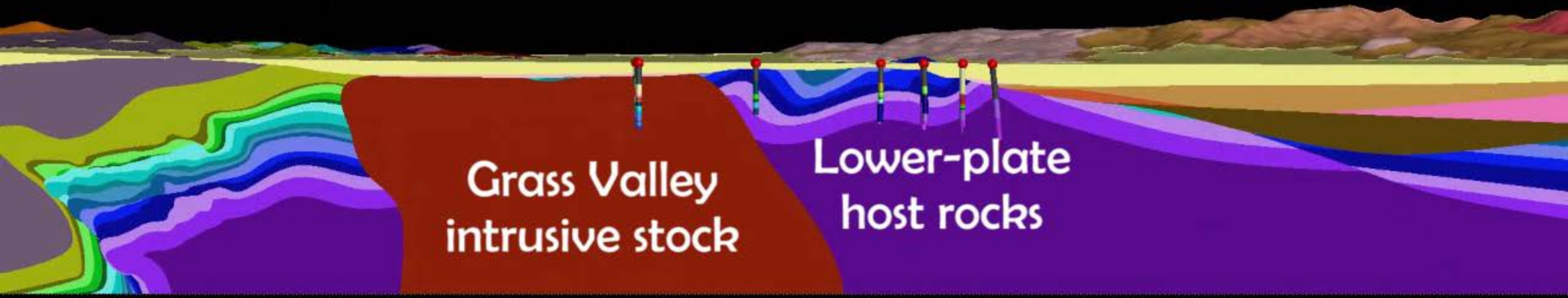

N
Pipeline
Cortez Hills
Goldrush / Fourmile
GRASS VALLEY
TARGET AREA
Nevada Exploration Inc
Gravity survey (2018)
Air magnetic survey (2018)
Infill groundwater (2018-19)
Soil geochemistry (2018-19)
Detailed mapping (2019)
South Grass Valley Project


N
Pipeline
Cortez Hills
Goldrush / Fourmile
GRASS VALLEY
10 orientation core holes
3.7 km NNW-SSE
Gravity survey (2018)
Air magnetic survey (2018)
Infill groundwater (2018-19)
Soil geochemistry (2018-19)
Detailed mapping (2019)
Strat. orientation drilling (2018-19)
TEST: Camp-scale CTGD mineral system
South Grass Valley Project


N
10 orientation core holes
3.7 km NNW-SSE
1km

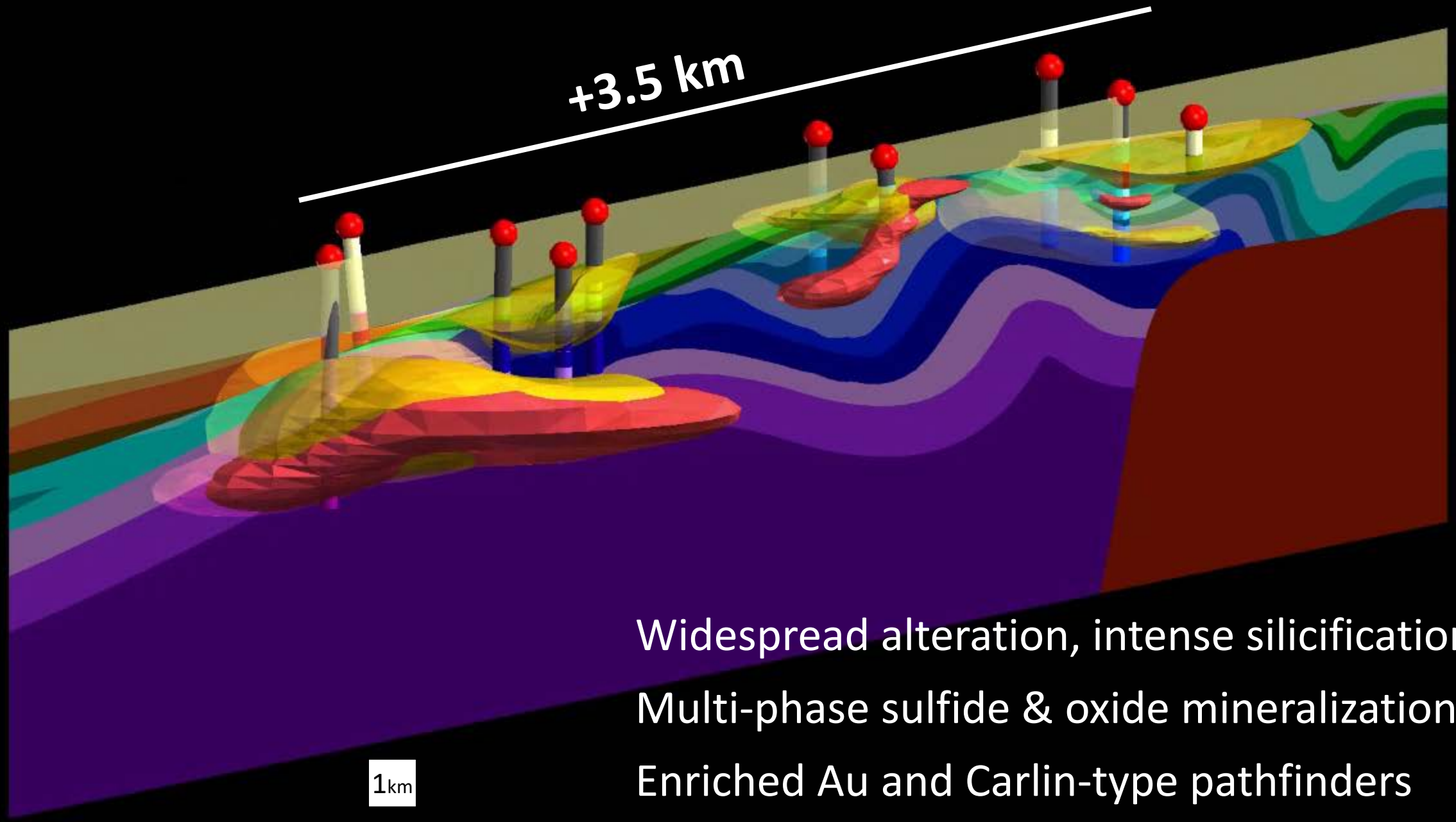
## Classic geologic architecture of a Carlin-type mineral system:

- Complex, regional-scale structural fabric with multiple structural trap sites
- Thick package of reactive lower-plate exhibiting significant brecciation
- Along the margin of a major intrusive




**Geologic model**

# Large Carlin-type mineral system

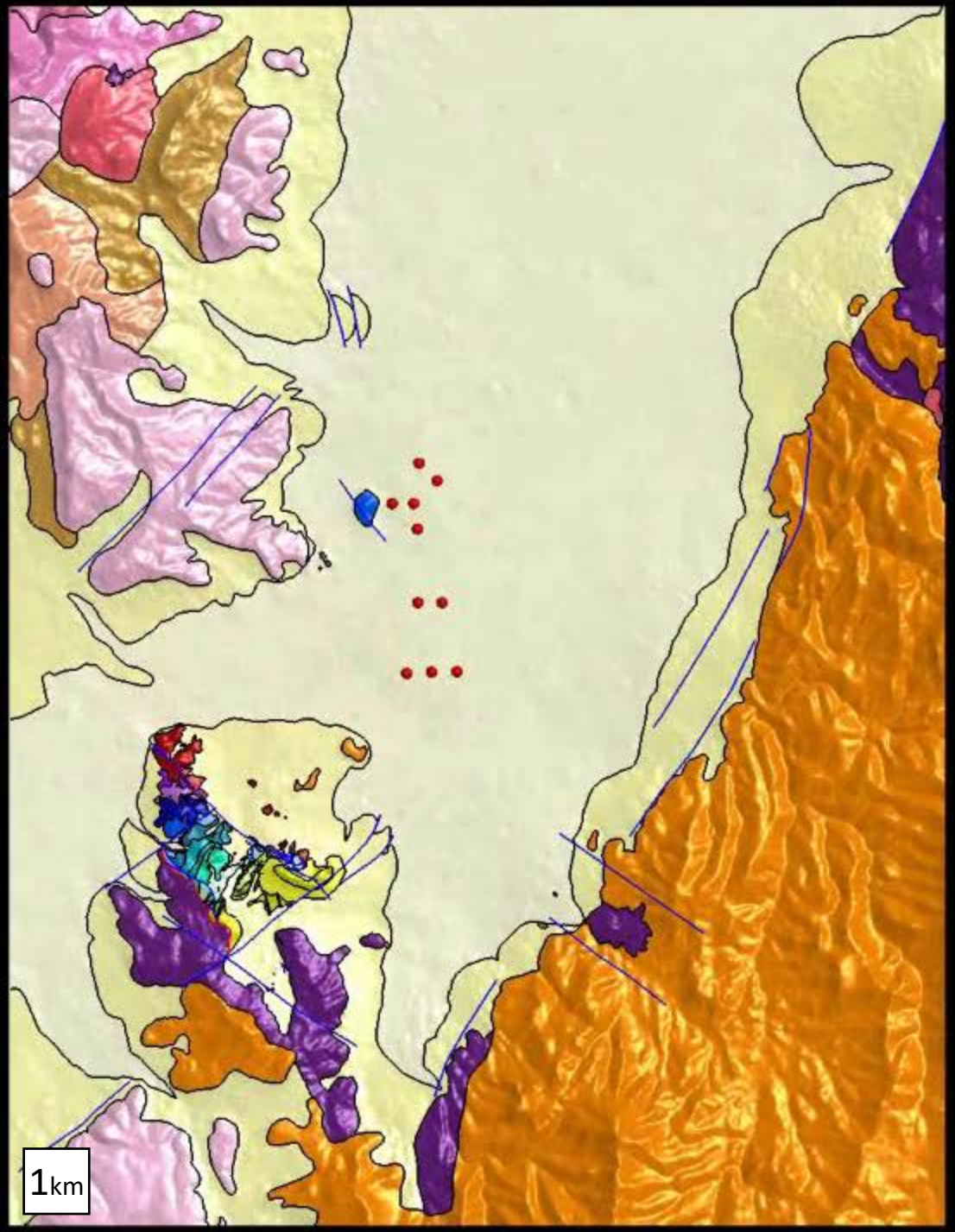


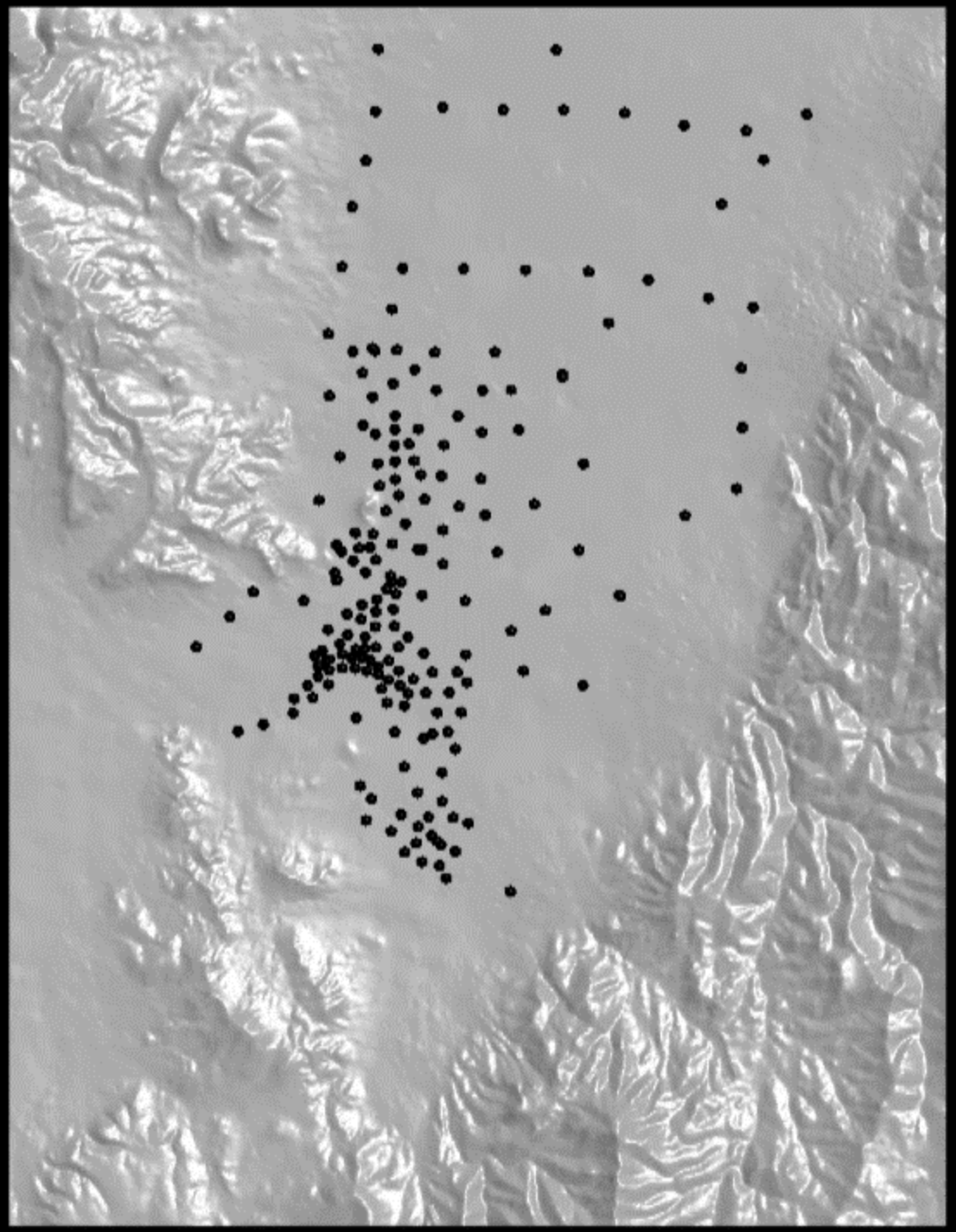

Widespread alteration, intense silicification

Multi-phase sulfide & oxide mineralization

Enriched Au and Carlin-type pathfinders

# Camp-scale hydrogeochemistry

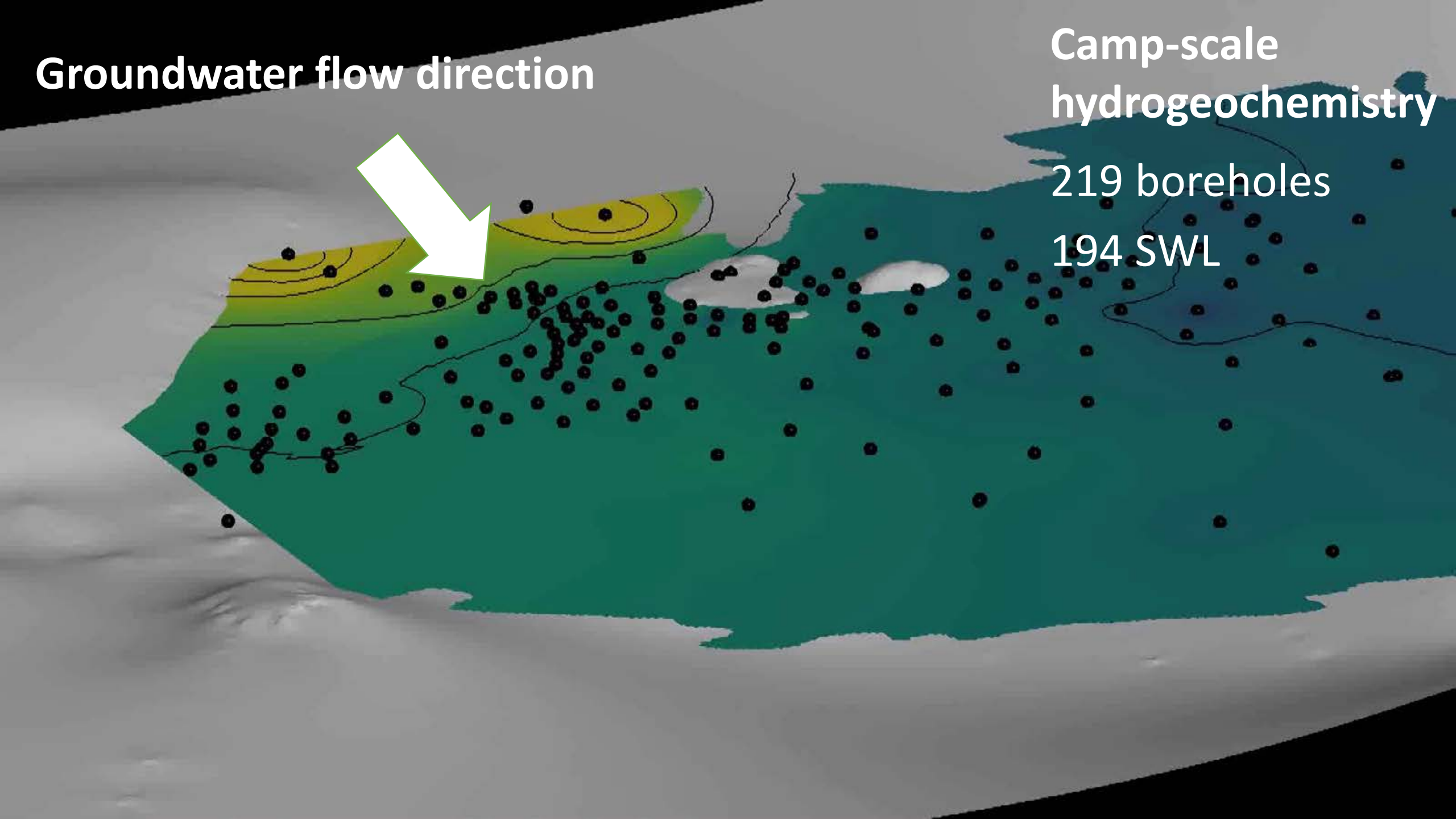


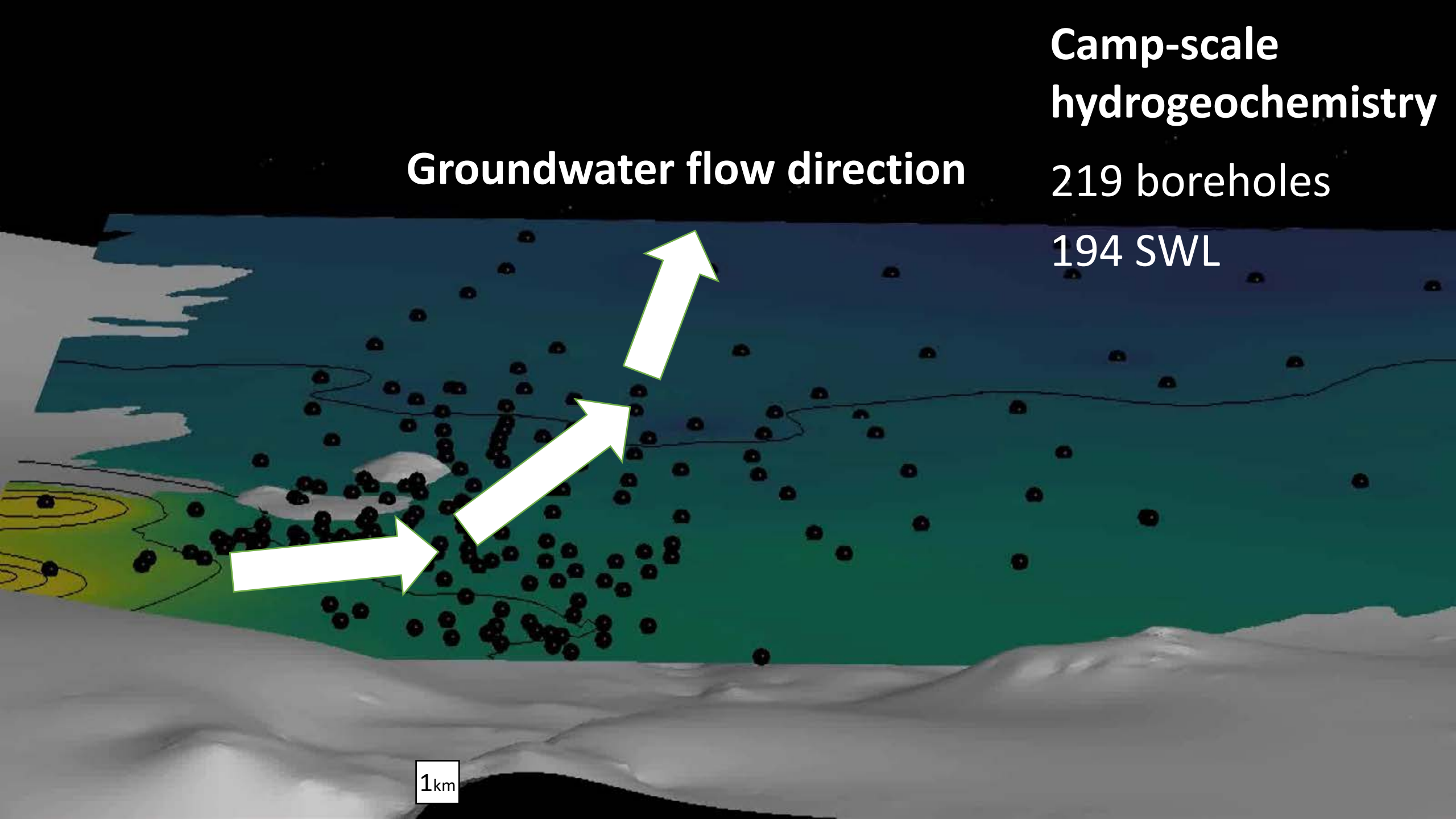


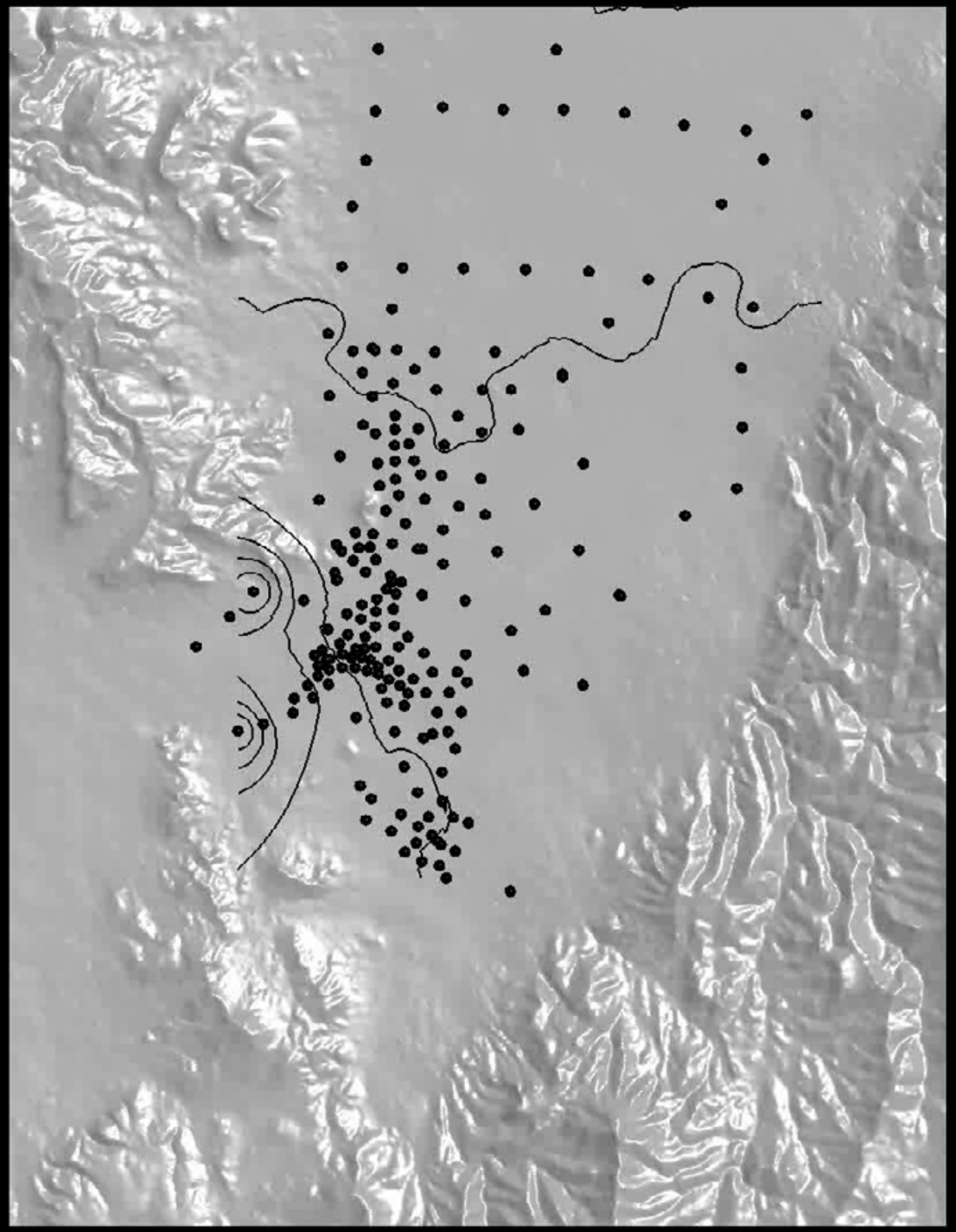
**Camp-scale hydrogeochemistry**

219 boreholes

194 SWL *(static water level measurements)*


Groundwater flow direction
Camp-scale hydrogeochemistry
219 boreholes
194 SWL


Camp-scale hydrogeochemistry
219 boreholes
194 SWL
Groundwater flow direction
1km

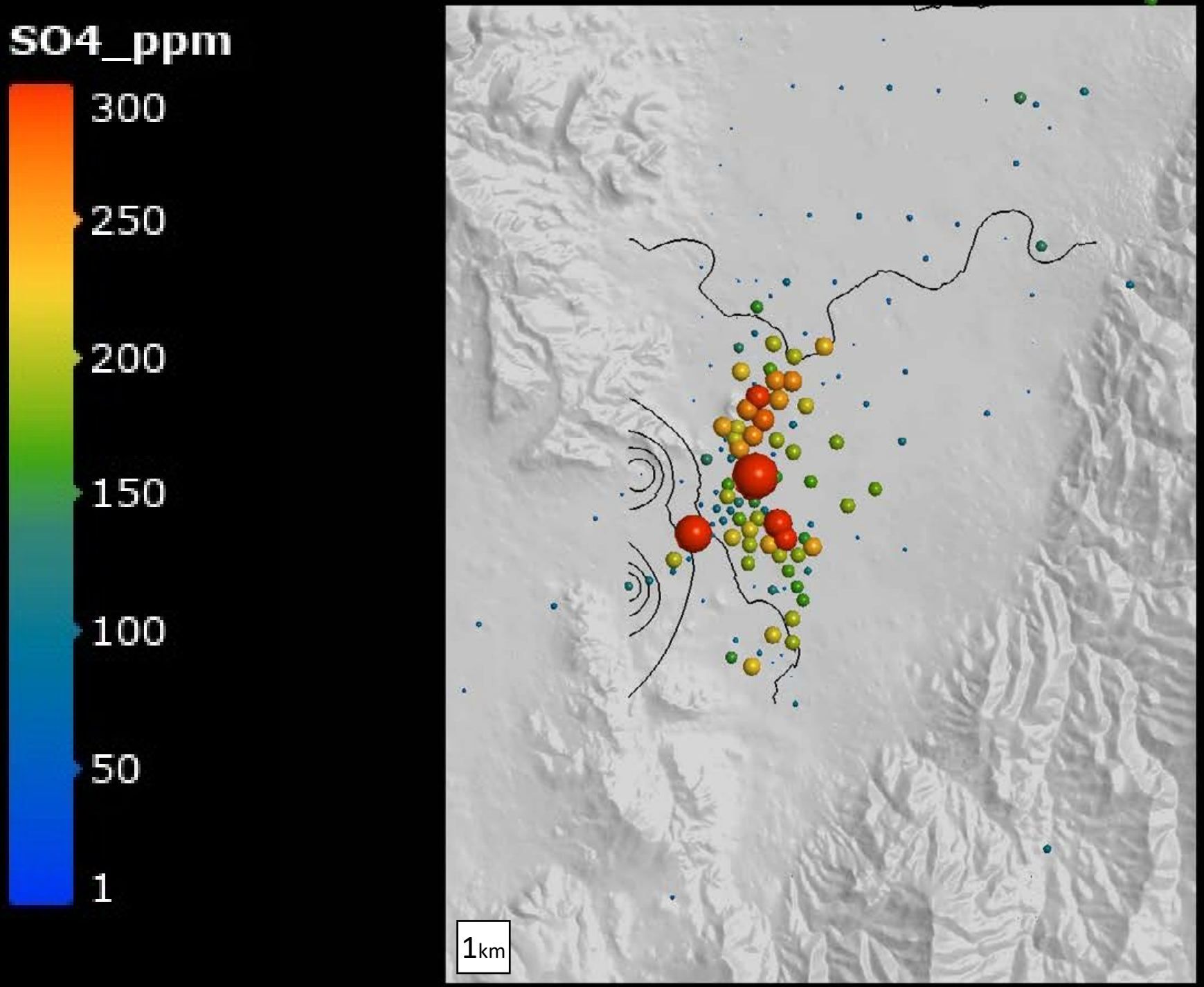


**Camp-scale hydrogeochemistry**

219 boreholes

194 SWL

425 groundwater samples

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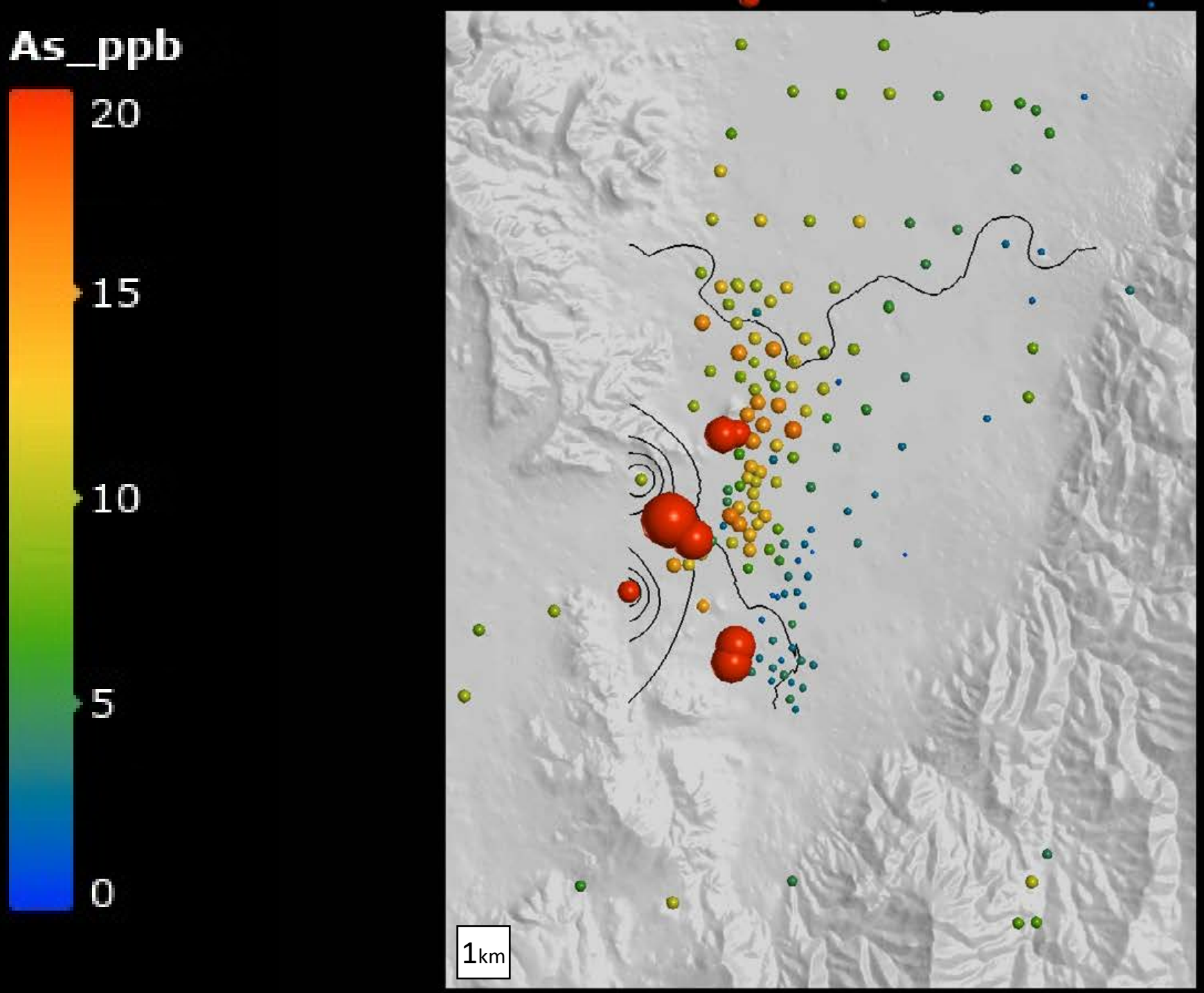
425 samples

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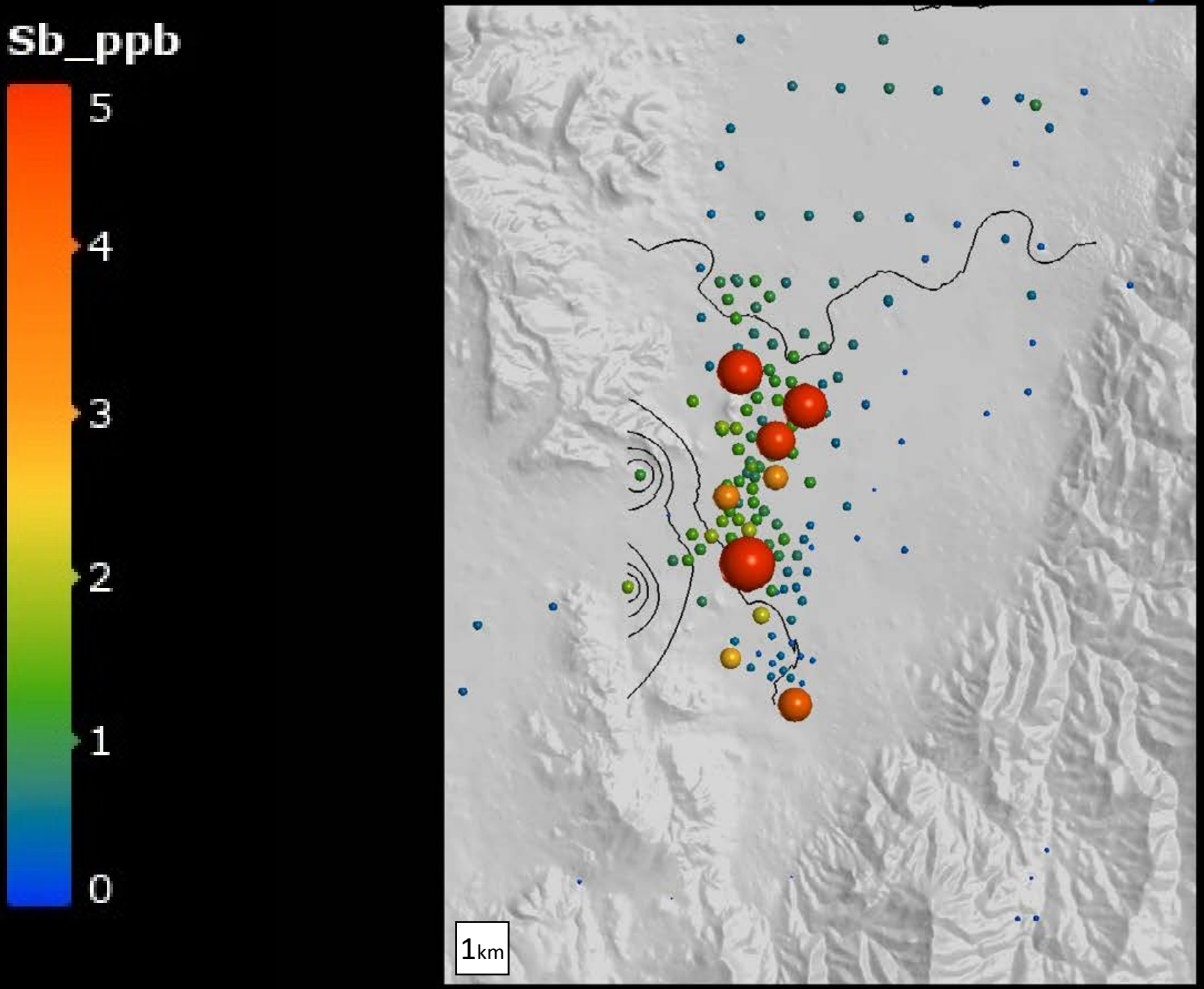


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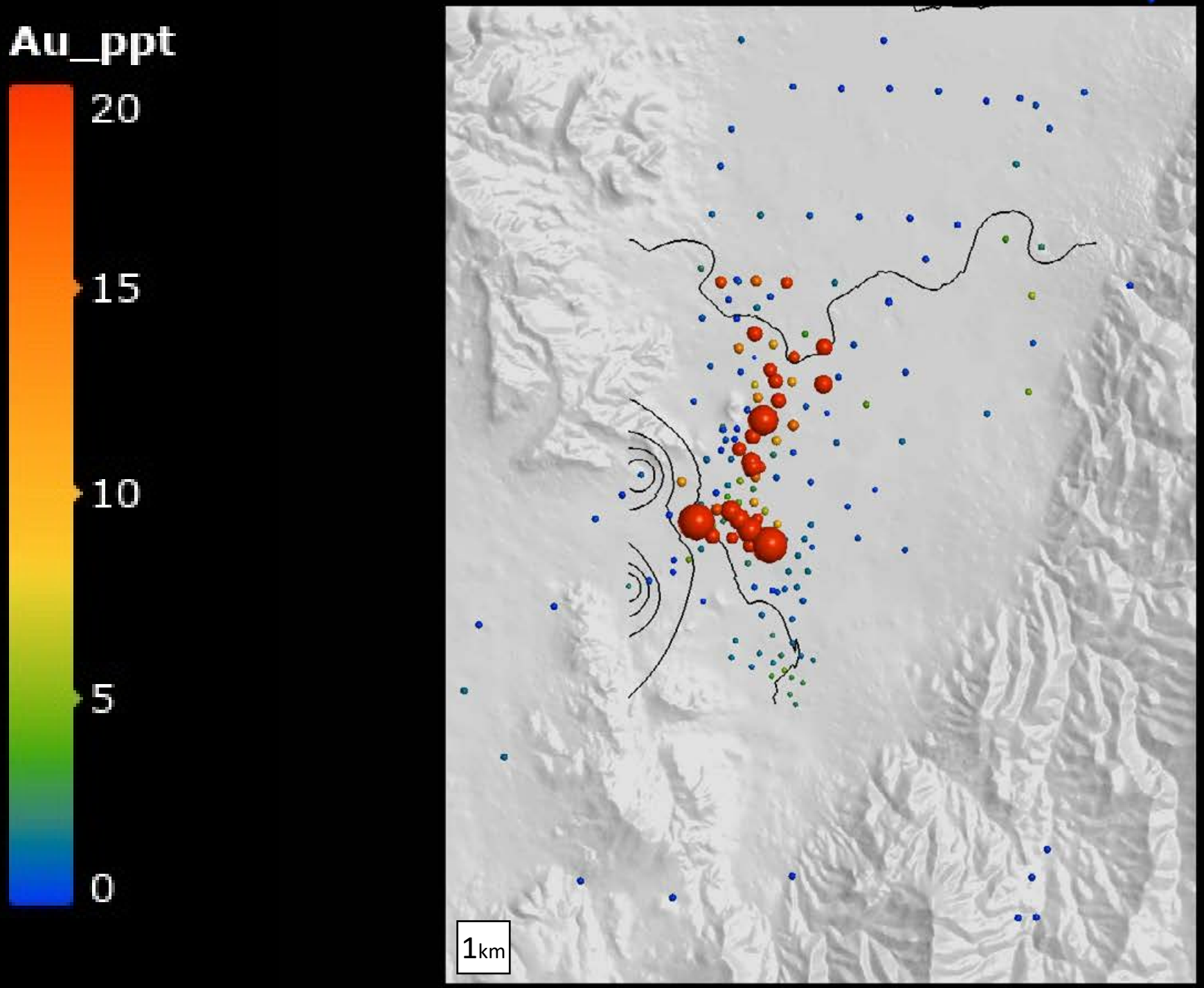
425 samples

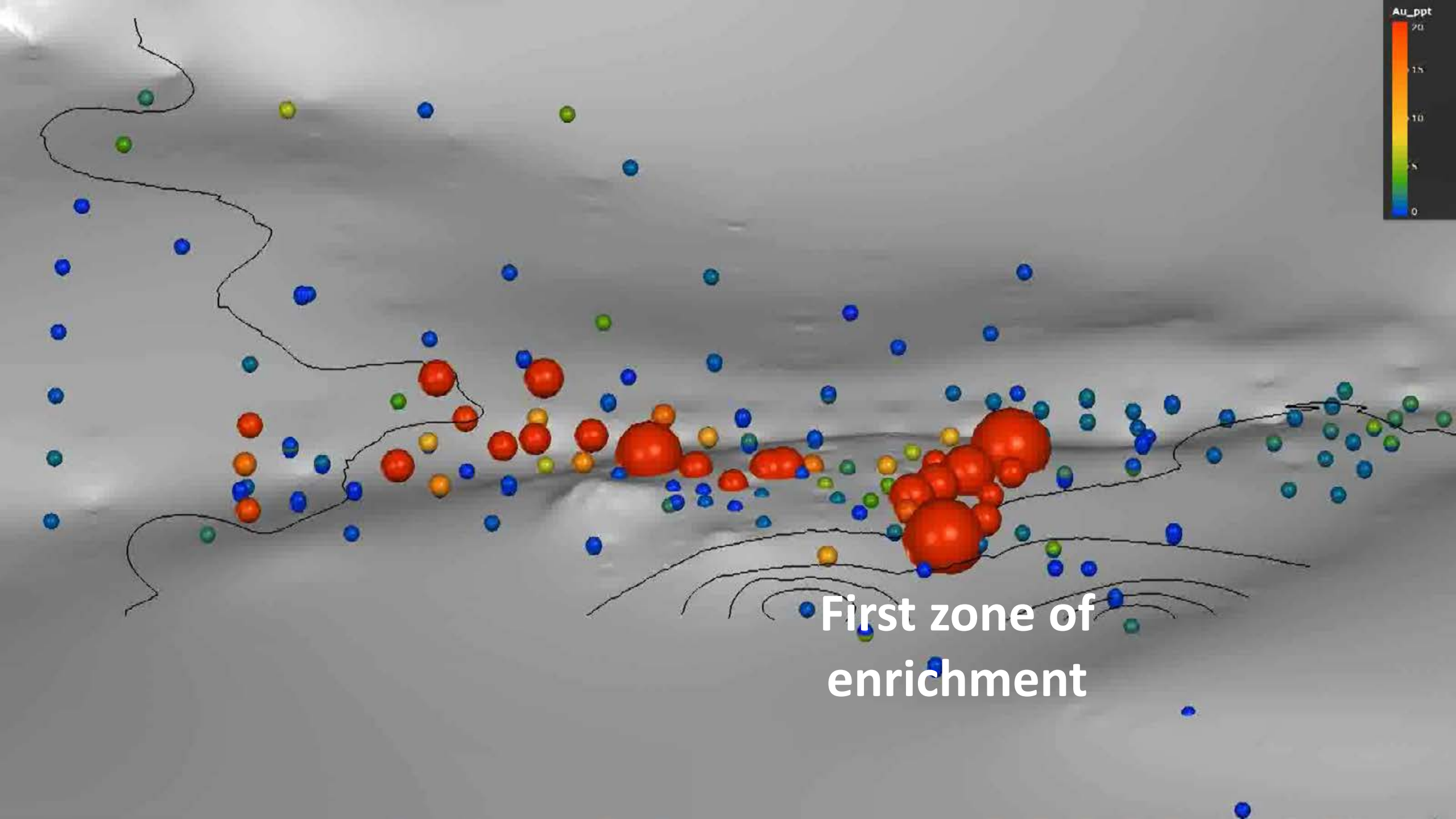


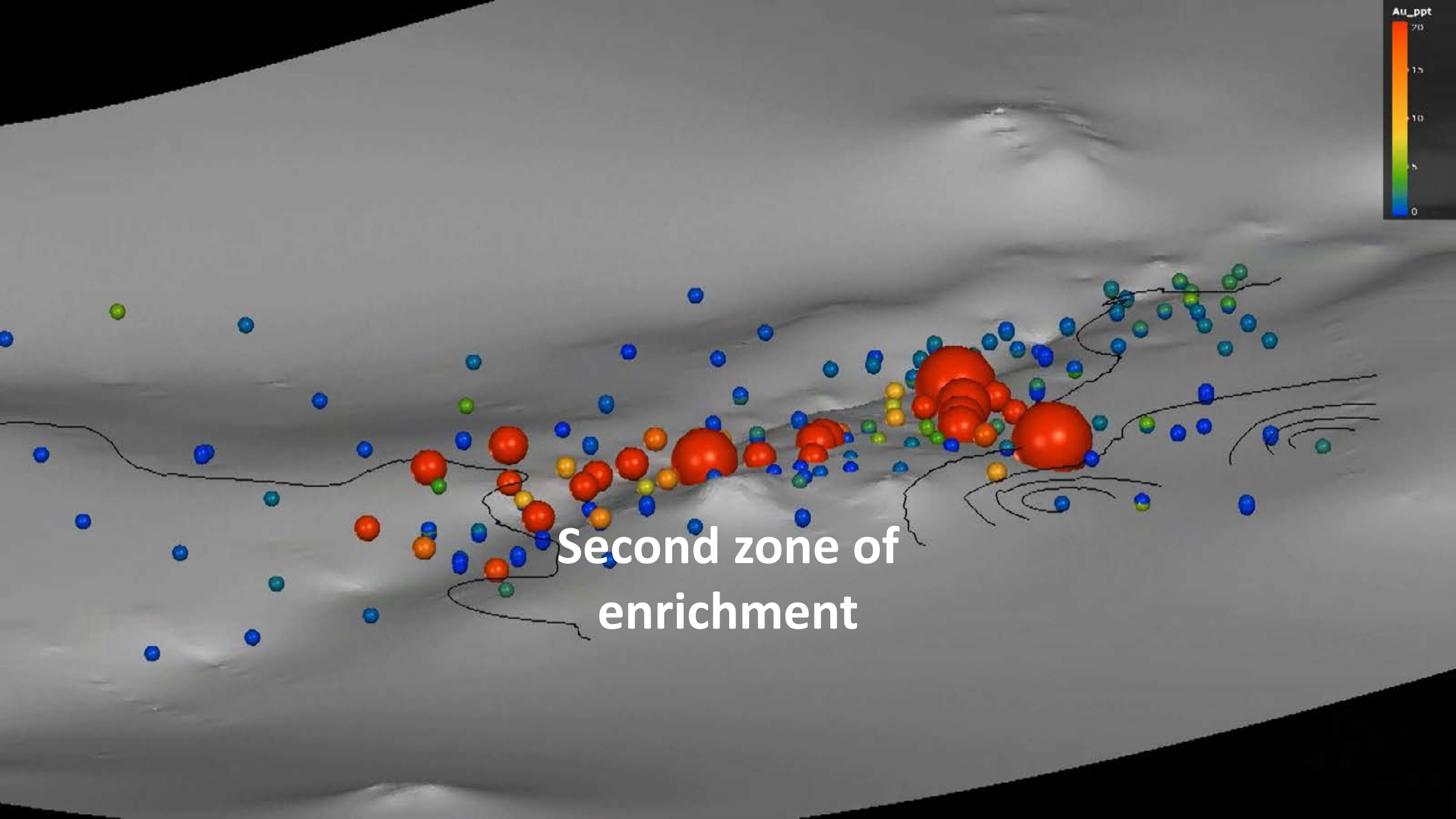

# Camp-scale hydrogeochemistry

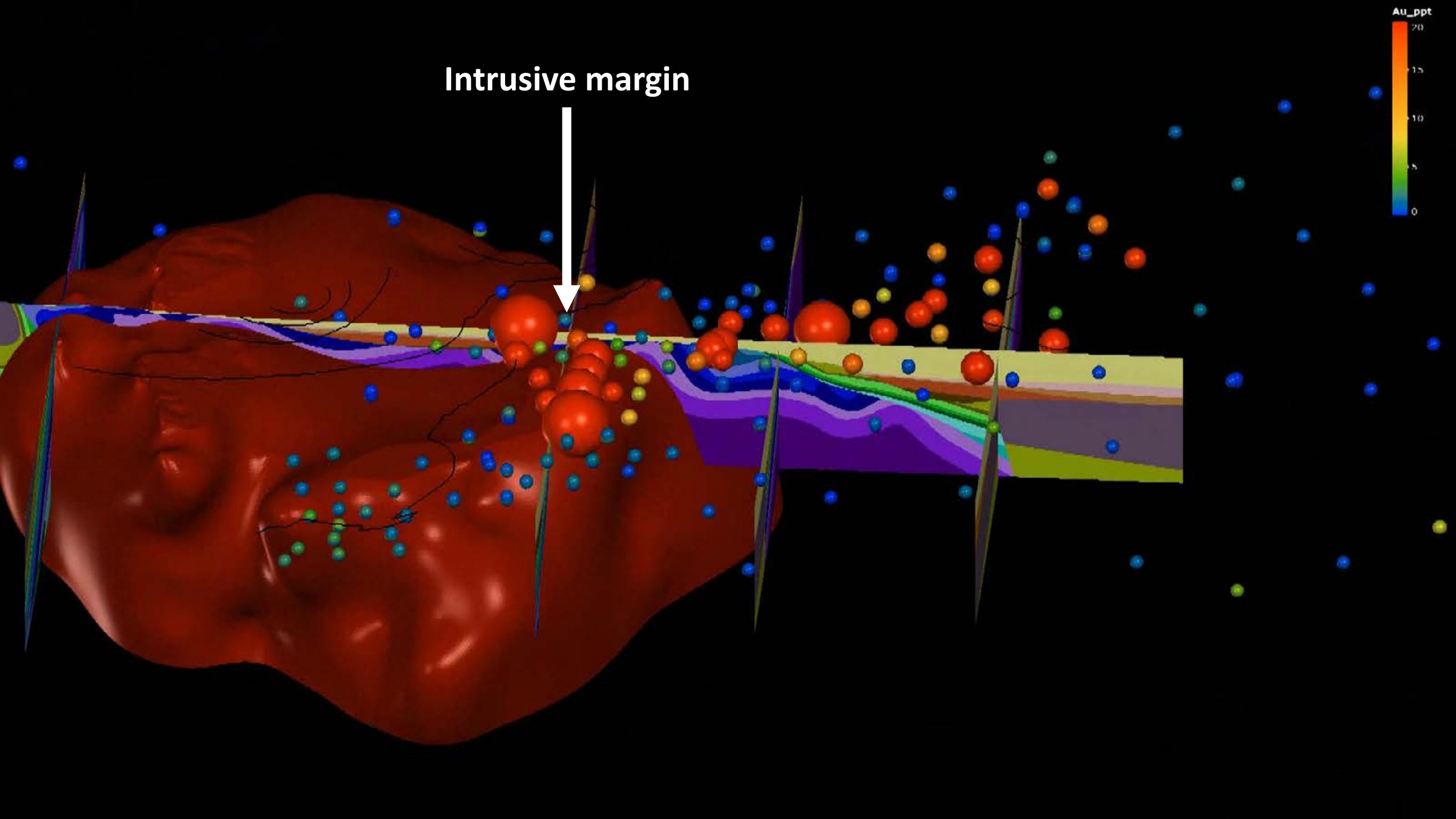
219 boreholes

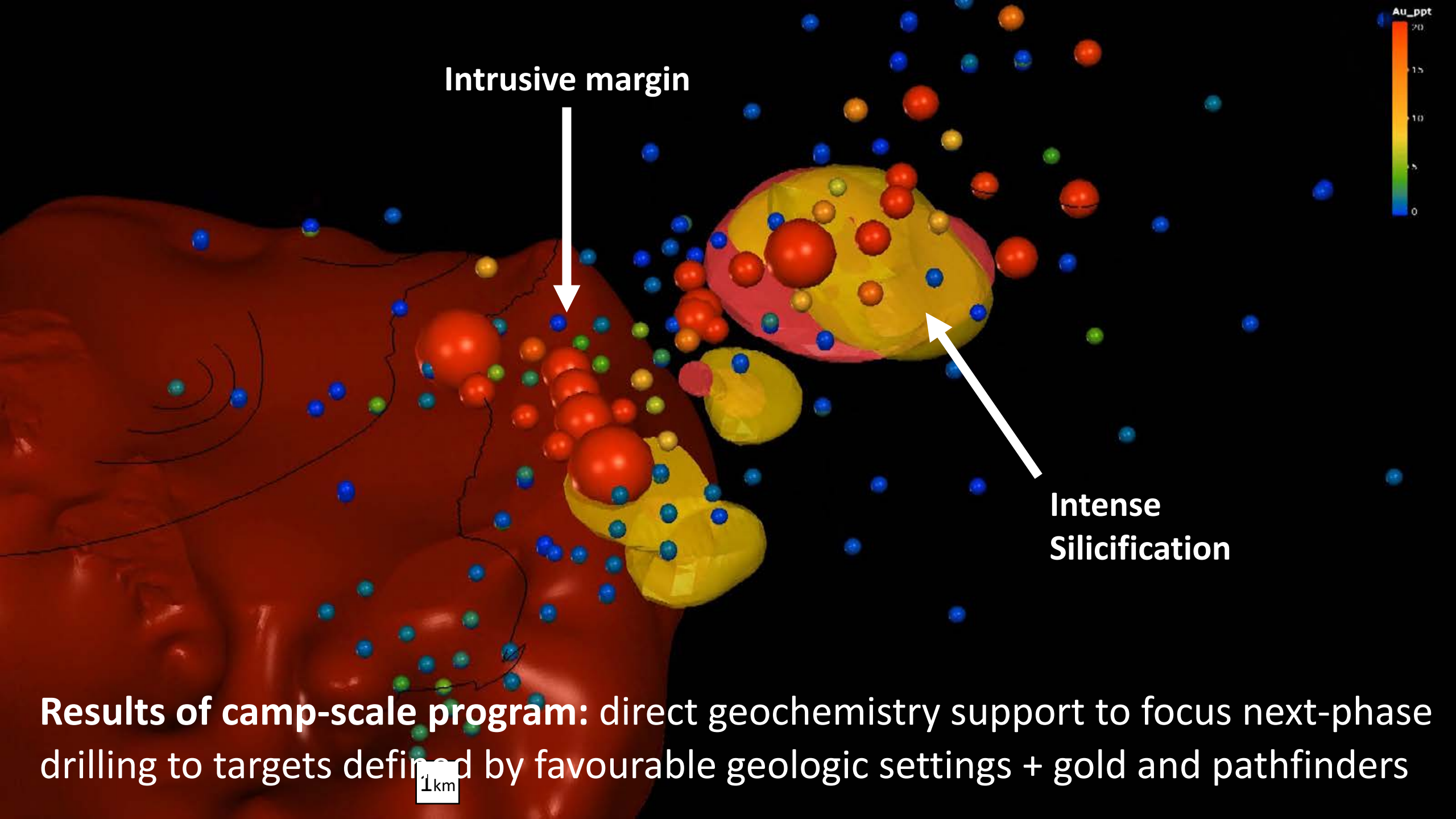
194 SWL

425 samples


Au_ppt
20
15
10
5
0
First zone of enrichment


Au_ppt
20
15
10
5
0
Second zone of enrichment

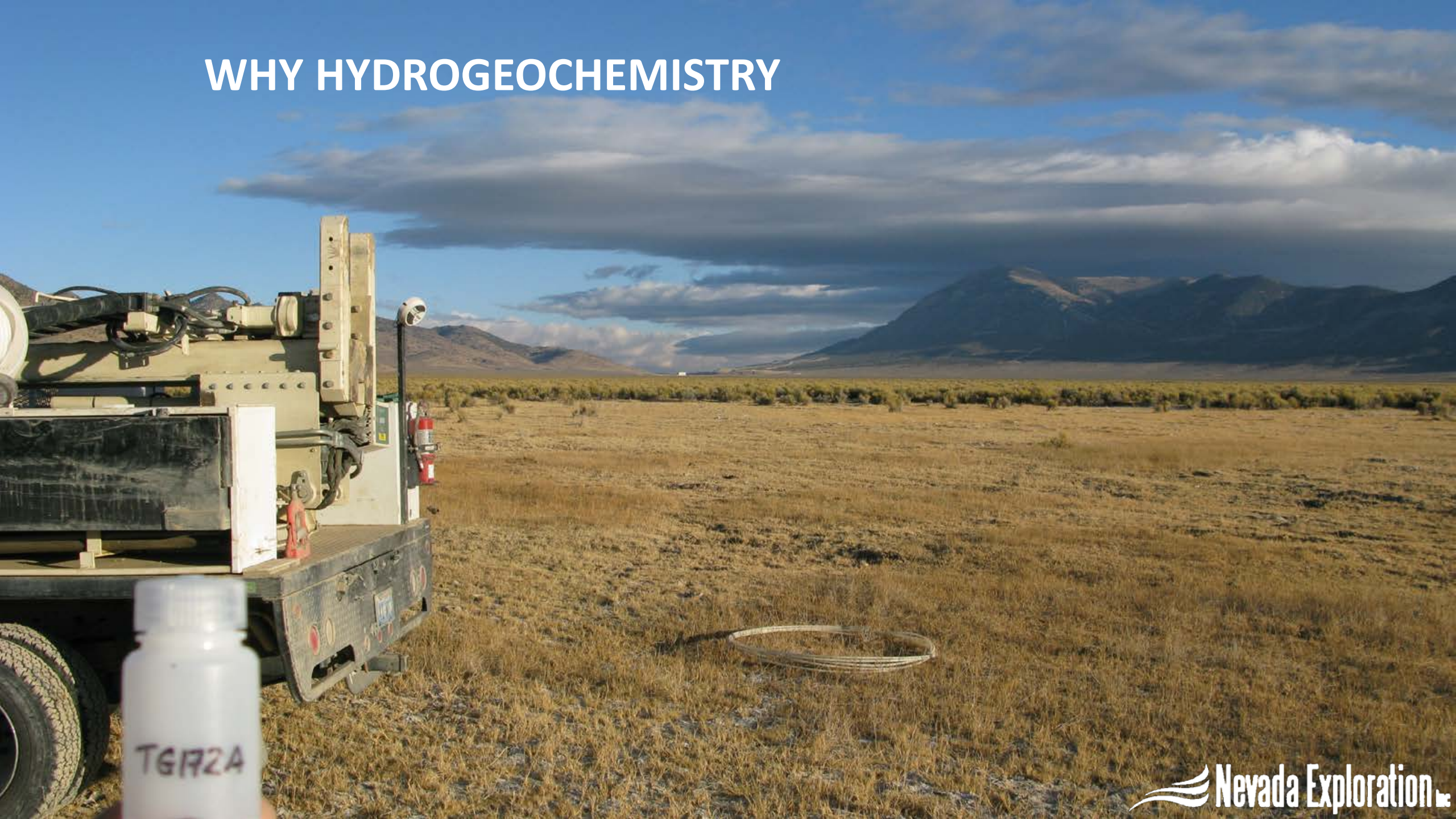

Intrusive margin
Au_ppt
20
15
10
5
0




**Results of camp-scale program:** direct geochemistry support to focus next-phase drilling to targets defined by favourable geologic settings + gold and pathfinders


Nevada Exploration
Blind
Search Space

# WHY HYDROGEOCHEMISTRY




Nevada Exploration Inc.

| WHY HYDROGEOCHEMISTRY | | WHEN |
|---|---|---|
| **Exploration is a business**<br>We're here to create value | **Provides opportunities to:**<br><br>Improve chance of success (direct detection)<br><br>Lower cost to test (fewer + cheaper samples)<br><br>Find better deposits (**new search spaces)** | **Adds value at multiple scales of application!**<br><br>Regional to district scale<br><br>**Target scale to focus the use of our most expensive tool: drilling** |

| CREATING VALUE | SIZE OF THE PRIZE | X | CHANCE OF SUCCESS | > | COST TO TEST |
|---|---|---|---|---|---|

Nevada Exploration Inc

# Thank you!

AME ROUNDUP.


Nevada Exploration Inc