Improving sinter as a tool for mineral exploration at the Ohakuri gold prospect, Taupō Volcanic Zone

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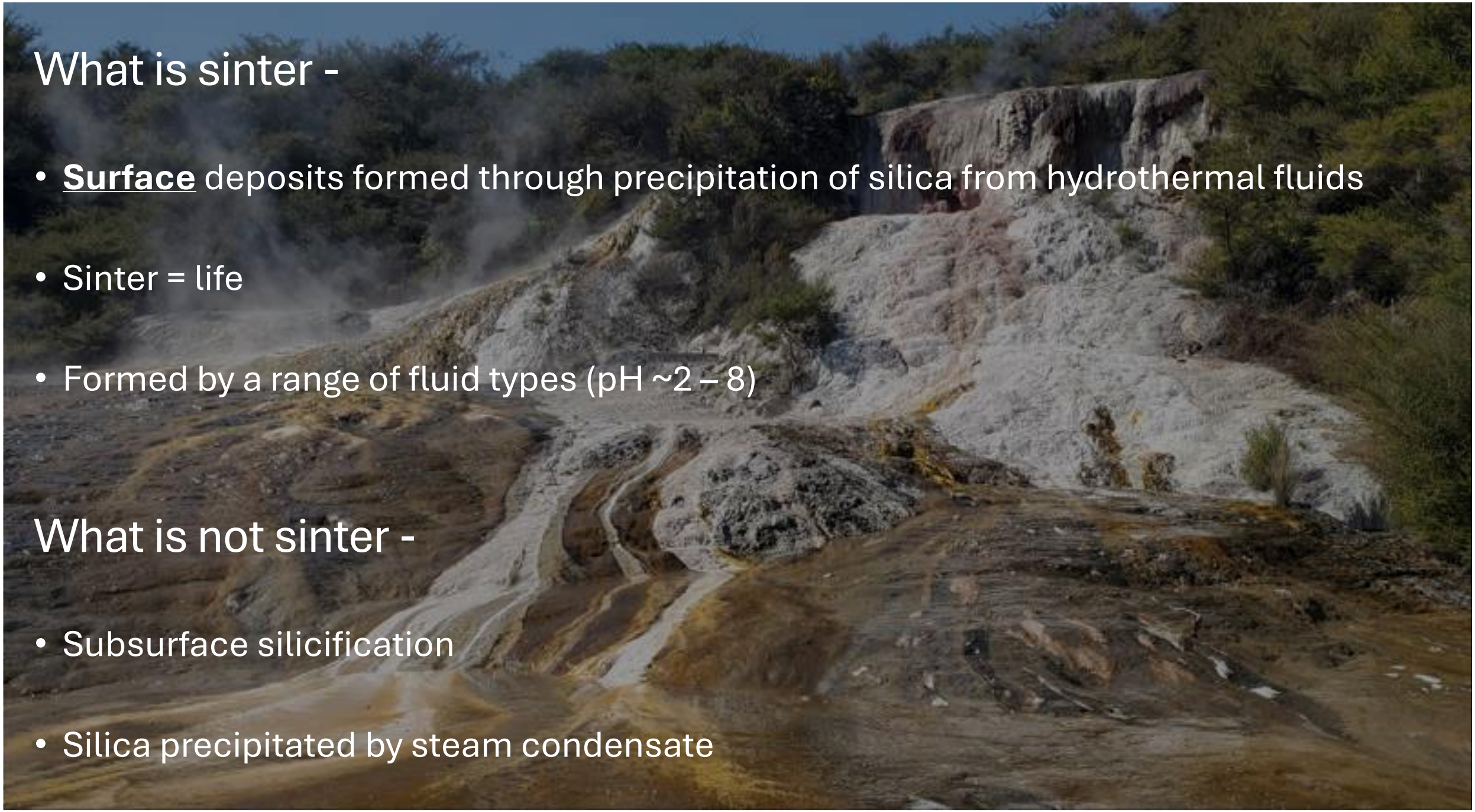
- My project – looking at sinter, specifically how microbes are preserved in sinter

- Ohakuri as a study site – sinter in drill core vs. outcrop



What is sinter -

- **Surface** deposits formed through precipitation of silica from hydrothermal fluids
- Sinter = life
- Formed by a range of fluid types (pH ~2 – 8)

What is not sinter -

- Subsurface silicification
- Silica precipitated by steam condensate

Sinters by fluid type:

Near-neutral alkali-chloride fluids:

- Thick, constructional sinters
- Large range of textures (lots of life)

Example: Orakei Korako – pH: 6.8 – 7.6

Acidic fluids:

- Small, thin sinters
- Restricted ranges of textures

Example: Rotokawa – pH: 2.1 – 5; high As, Sb, Au, Ag

Intermediate fluids:

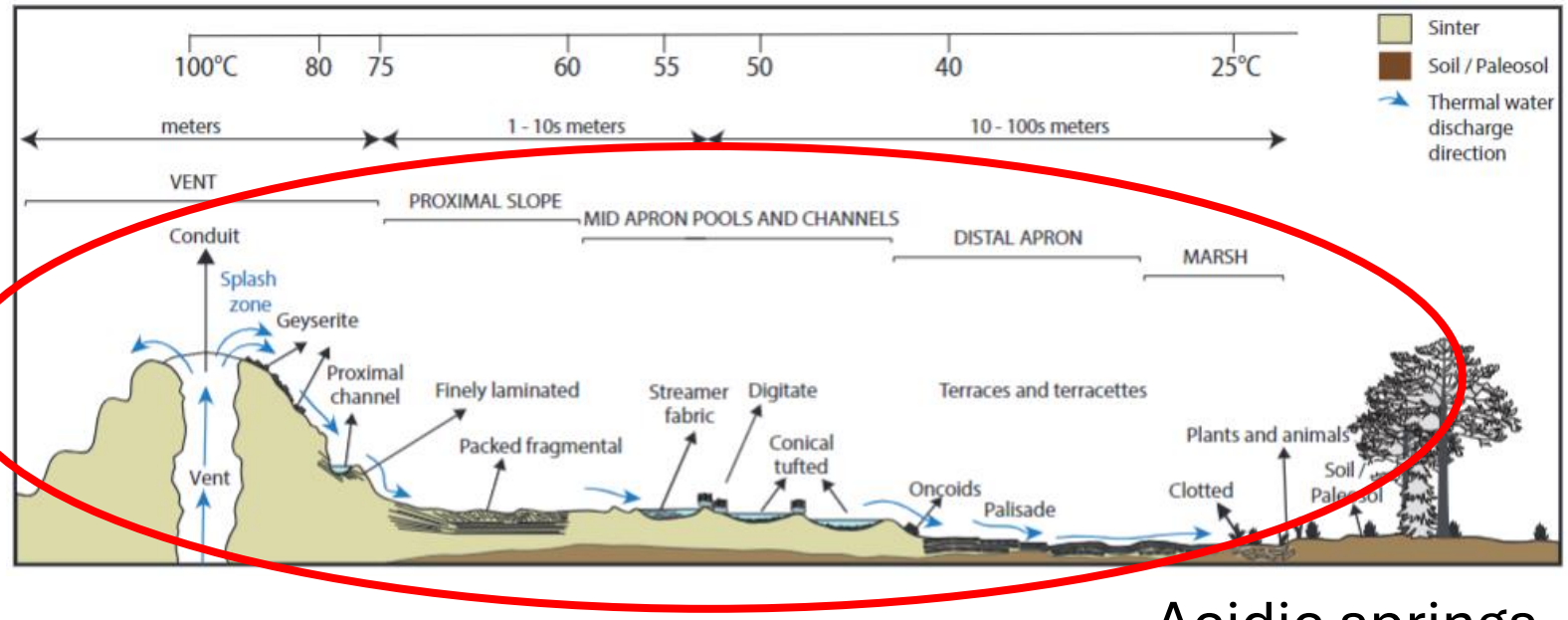
- Moderate sinters
- Somewhat restricted textures with abundant minerals

Example: Champagne Pool – pH: 5; high gas, As, Sb, Au

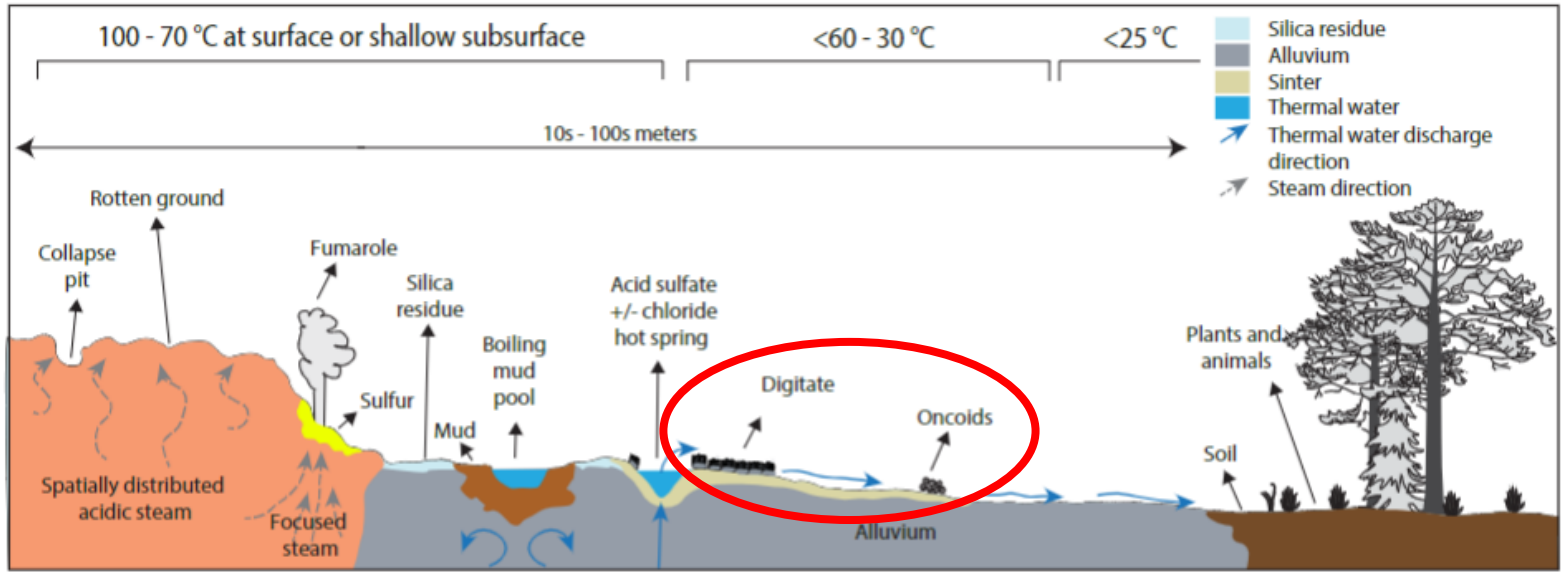
Sinter facies models

- Life is everywhere in hot springs
- Occurs in predictable assemblages
- Influences sinter textures
- Controlled by fluid type

Neutral alkali-chloride springs



Acidic springs

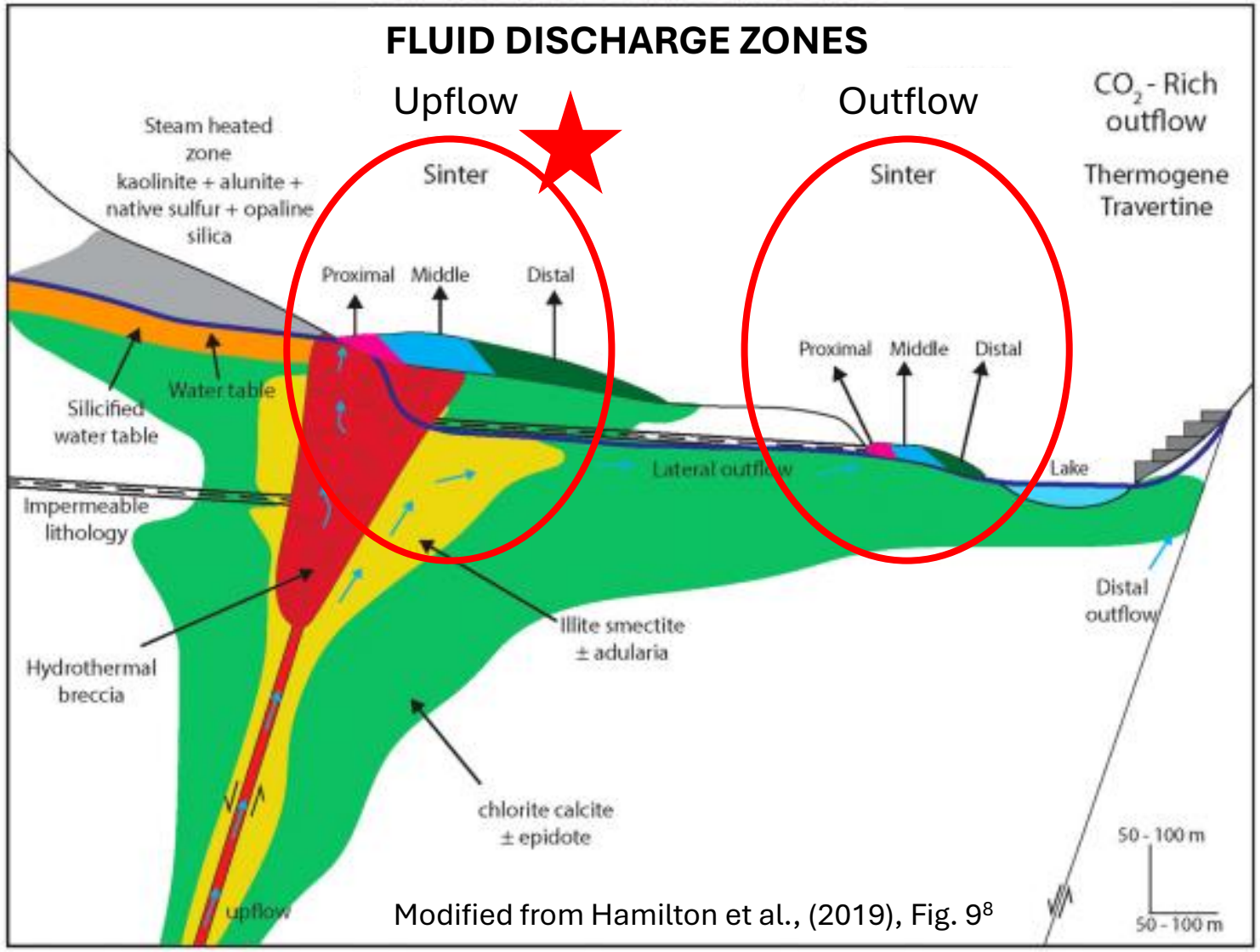


Sinter and mineral exploration

Sinter is just one tool among many

- Pros
  - Cheap
  - Records a lot about the system
- Cons
  - Hasn’t proven very useful

Relationships to mineralisation



Modified from Hamilton et al., (2019), Fig. 9[8]

Different sinters offer different values for mineral exploration

Neutral springs indicate boiling conditions conducive to high-grade ore formation

Acidic and intermediate springs lack the mechanisms for high-grade mineralisation

Crucial to distinguish between different types of sinter for informing exploration strategies!

Case study: Ohakuri

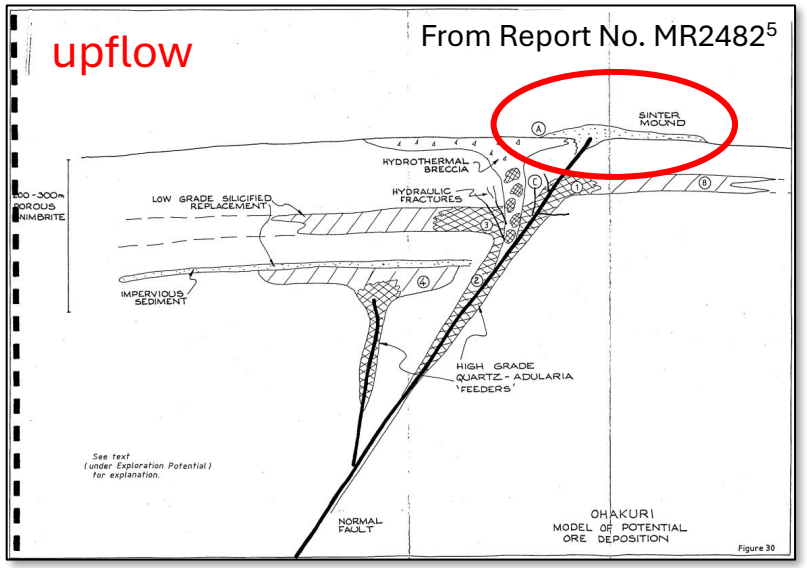
At Ohakuri, interpretations of sinter varied considerably:

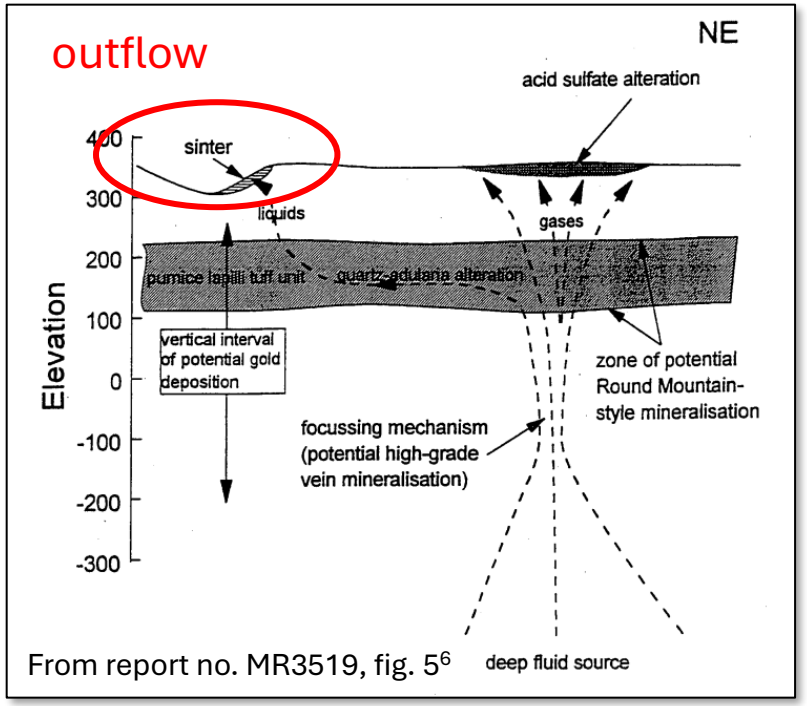
- Formed in the upflow zone
- Formed in the outflow zone*

Often compared to sinter at:

- Champagne Pool
- Rotokawa
- Broadlands-Ohaaki

*preferred model for past exploration





What does the sinter say about these models?

Results of Ohakuri sinter investigation:

- Thick sinter deposits
- Wide range of textures → Lots of life!!
- Trace concentrations of pathfinder elements

Confirmed through:
- 3.5 yrs study
- Fieldwork
- Drill-core analysis
- >300 hand samples
- >250 thin sections
- Review of all previous work

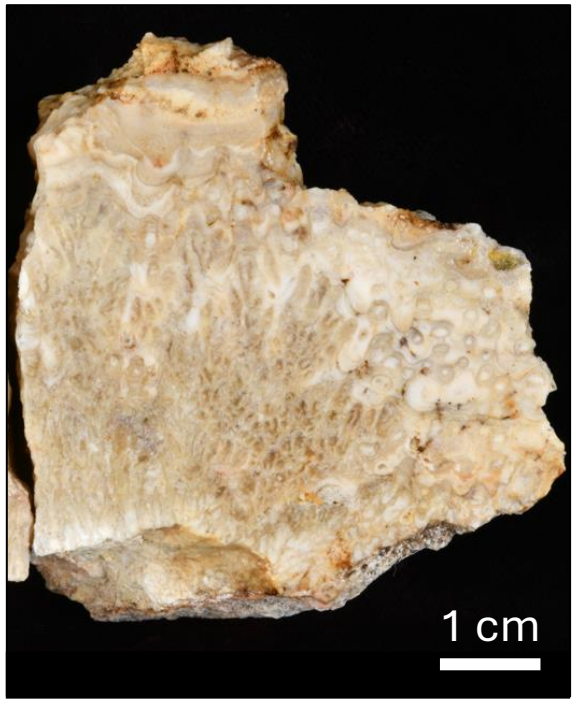
Vent textures:
Geyserite (4 sub-types)
Particulate siliceous sediment
Finely laminated
Eruption breccias* (2 sub-types)

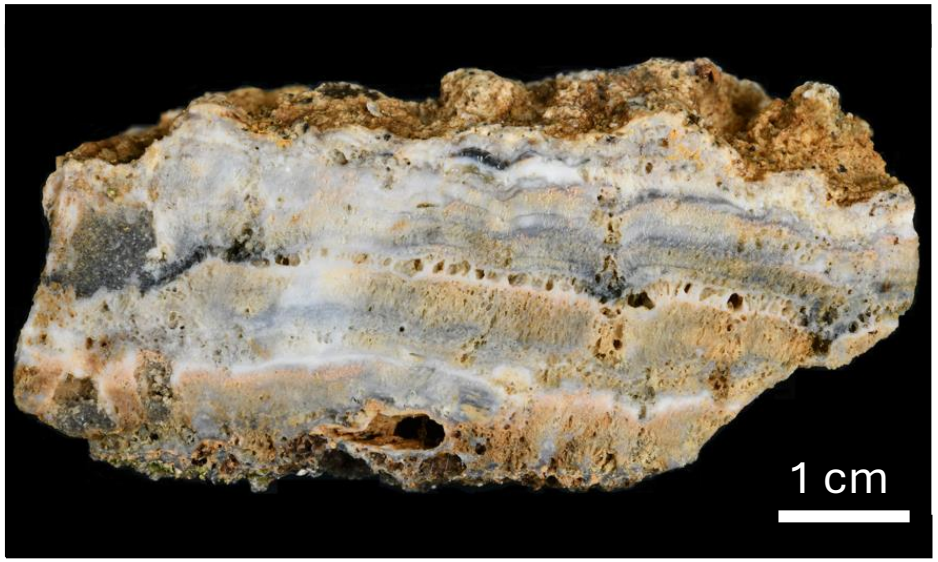
Mid-apron:
Streamer fabric
Domal stromatolites
Ropy pool mat
Conical tufts
Network fabric (2 sub-types)
Filiform laminae (4 sub-types)
Oncoids (2 sub-types)

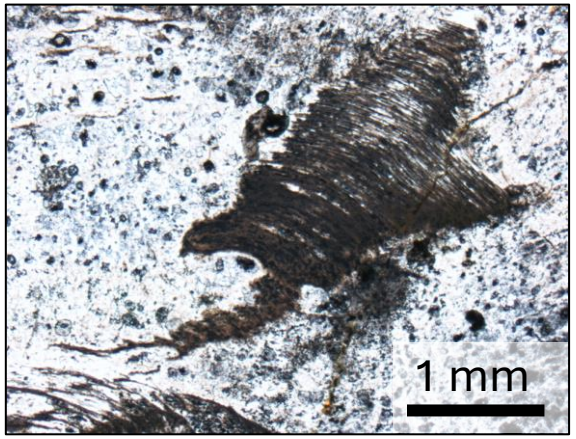
Distal-apron:
Palisade fabric (8 sub-types)
Sinter-clast breccia

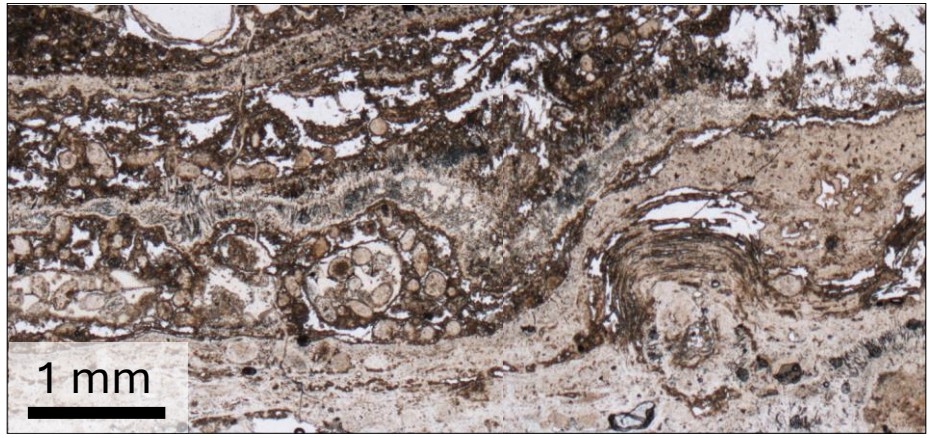
Sinter marsh:
Plant-rich
Peloidal
Clotted fabric

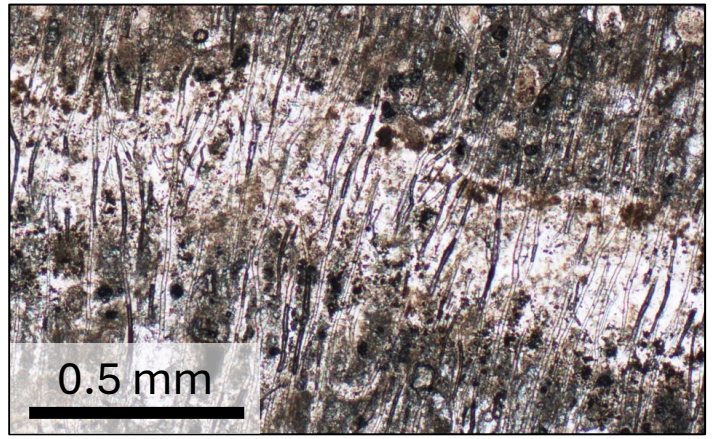
Sinter examples from Ohakuri











Vent geyserite

Mid-temperature

Low-temperature

Pseudo-sinter and tricky samples

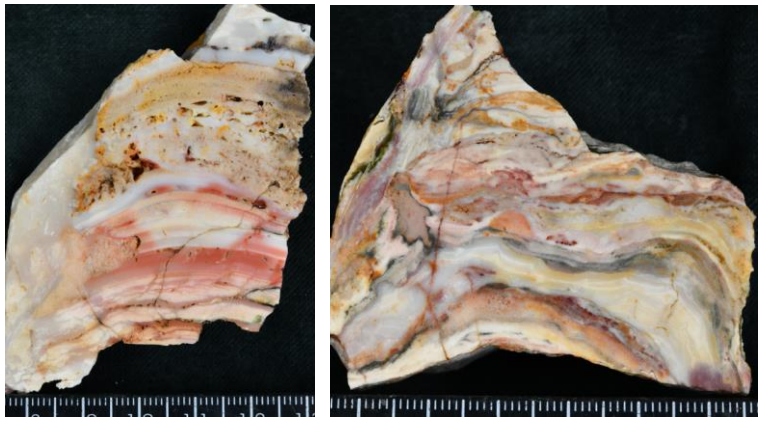
Observed at Ohakuri:
Silica residue (2 sub-types)
Silicified siltstone (5 sub-types)
Silicified volcaniclastic
Shallow veins
Silicified water table

What is pseudo-sinter?

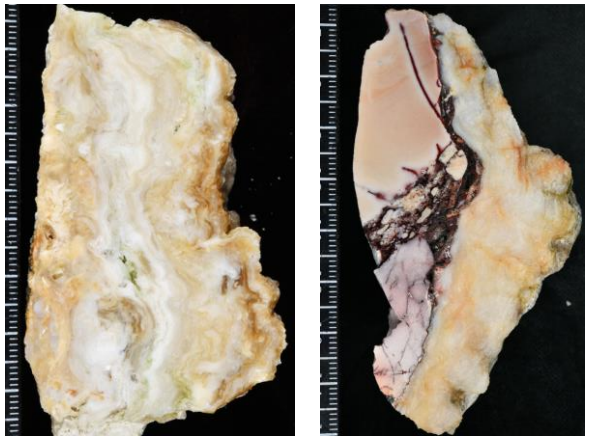
- Silicified materials commonly / easily mistaken for sinter
  - Often subsurface
  - Often post- sinter activity
  - No microbial influence*

OHCY-1
11.4 – 16 m

Lacustrine sediments



Silica residue

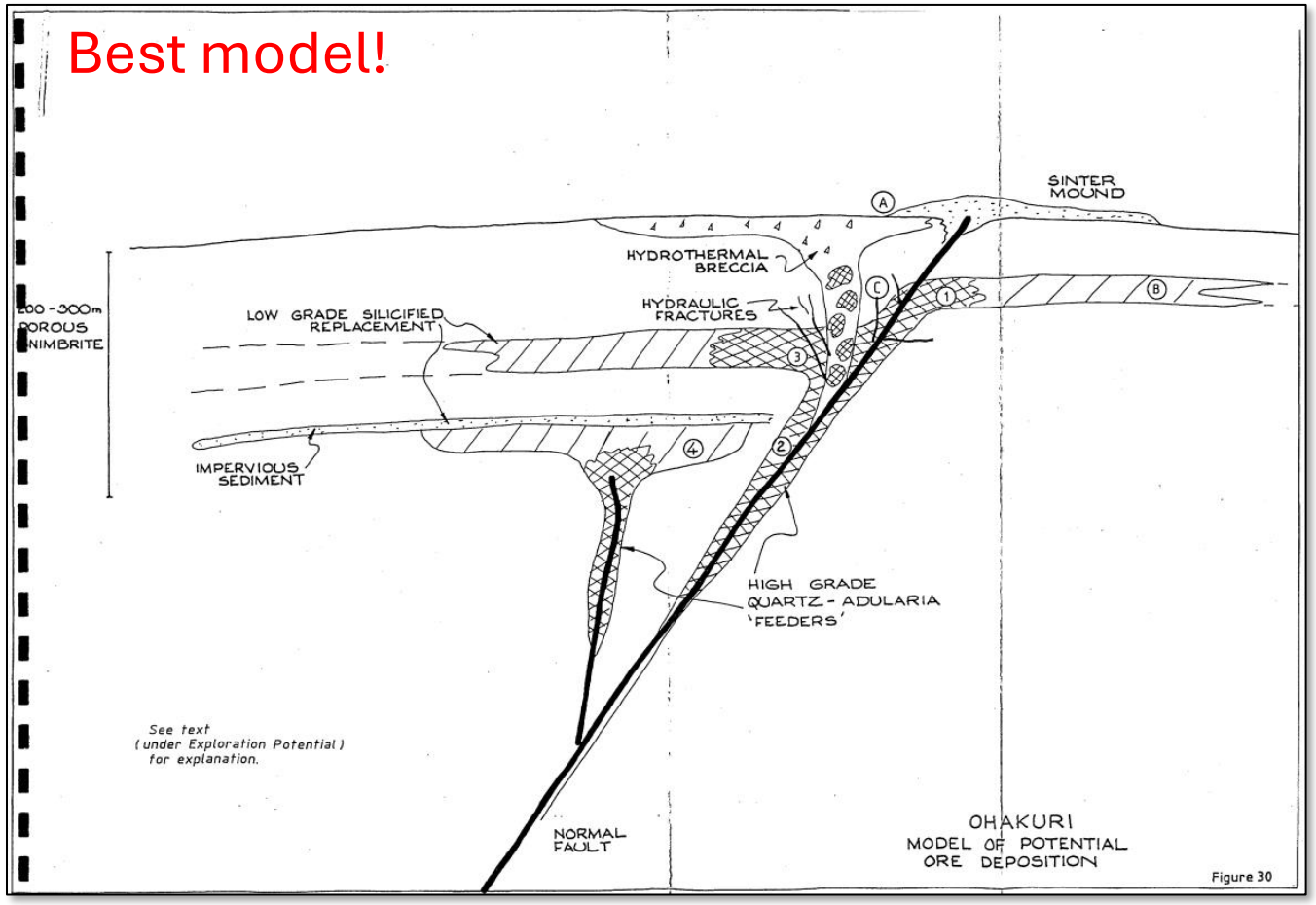


Interpreting the sinter at Ohakuri

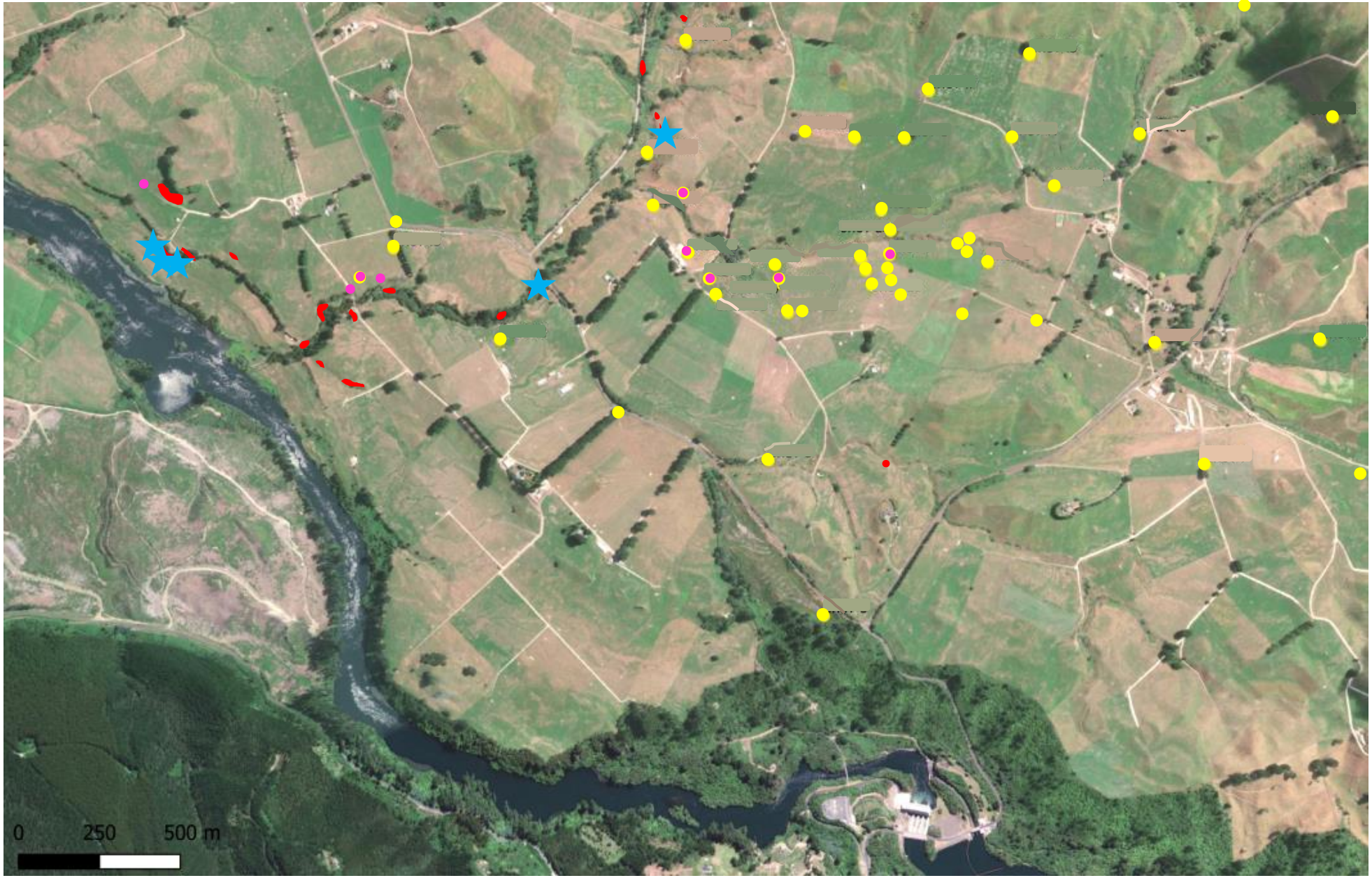
- Fluids: alkali-chloride, near-neutral, low-gas
- Direct ascent of fluids focused along structural controls
- Boiling of fluids in upflow zone
- Conditions conducive for high-grade ore formation

- 5 in-situ vents identified (geyserite)

- Exploration potential: Excellent



Previous model → missed opportunities?



Take away points:

- Not all sinter is the same
  - Ohakuri ≠ Champagne Pool…and that's a good thing!
- Better characterisation of sinter → improved tool for exploration
- More remains to be explored at Ohakuri

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Thank you!

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