

# **Glass and Fire**

## **Temperatures in Reconstructed Viking Era Bead furnaces**

Neil Peterson



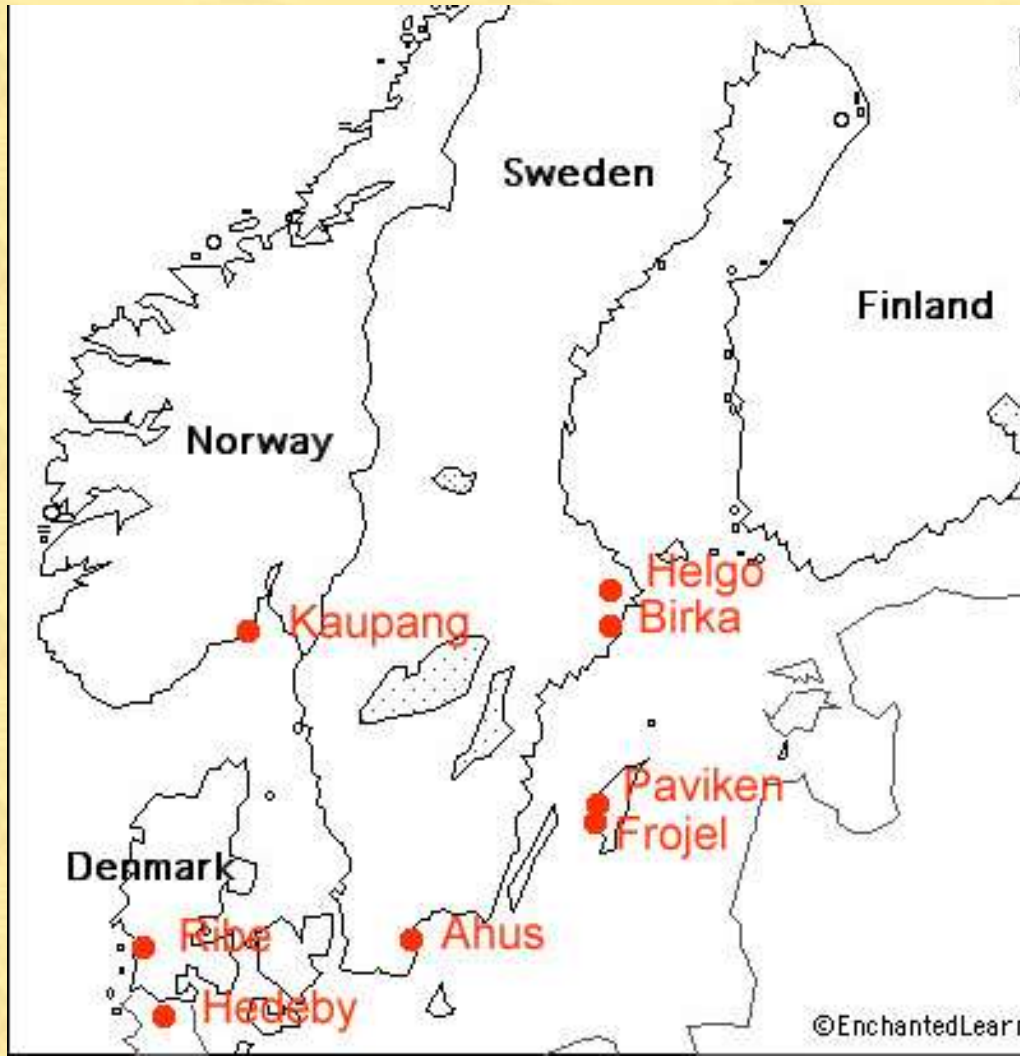
# Agenda

- Bead Production Background
- Furnace Reconstructions
- Temperature Measurements
- Conclusions & Future Directions



# Bead Production Background

- 8 Viking Era bead production locations



# Bead Production Background

- 8 Viking Era bead production locations
- Types of remains
  - Mandrels, pan



# Bead Production Background

- 8 Viking Era bead production locations
- Types of remains
  - Mandrels, pan
  - Broken beads



# Bead Production Background

- 8 Viking Era bead production locations
- Types of remains
  - Mandrels, pan
  - Broken beads
  - Raw material



# Bead Production Background

- 8 Viking Era bead production locations
- Types of remains
  - Mandrels, pan
  - Broken beads
  - Raw material
  - Semi-manufactures



# Bead Production Background

- 8 Viking Era bead production locations
- Types of remains
  - Mandrels, pan
  - Broken beads
  - Raw material
  - Semi-manufactures
- Bellows





# Agenda

- Bead Production Background
- Furnace Reconstructions
- Temperature Measurements
- Conclusions & Future Directions



# Furnace Reconstructions

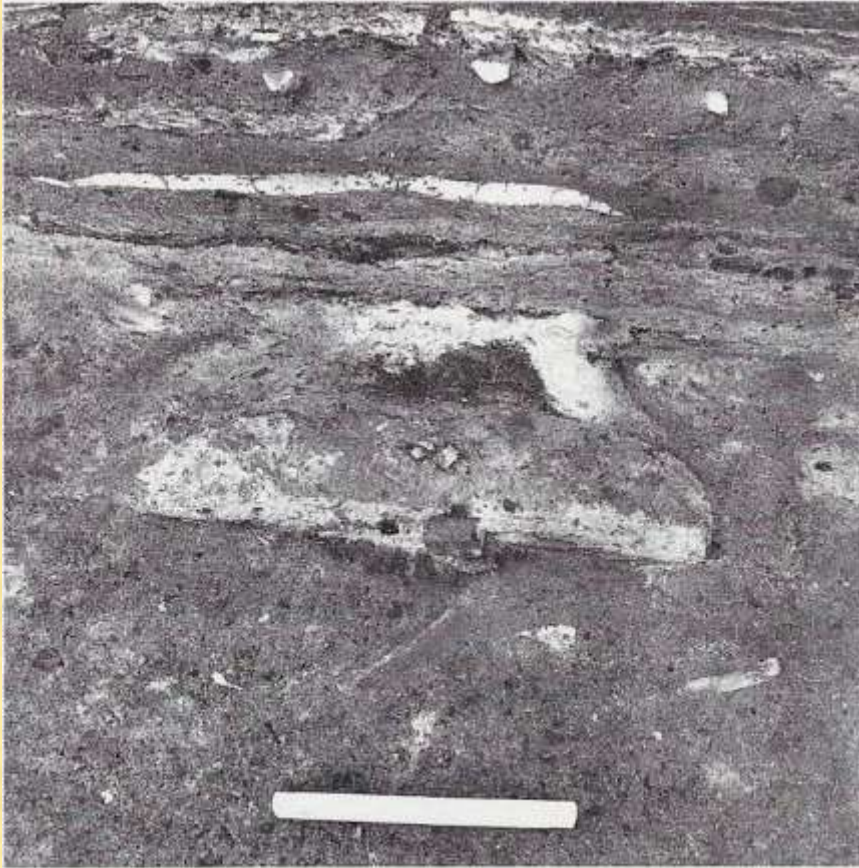


Fig.55 4M75, Kunstmuseets have. Hearth ÆZ, long-sectioned.

Photo: *Ribe Excavations 4*, Bencard et al 1990

- Furnace remains
  - Ribe only
  - 7 probable bead hearths
  - Clay/Cobb construction
  - No attached walls
    - Possible pieces of wall
  - No void in heat scars
  - No foot holes
  - Hearths are unbroken



# Furnace Reconstructions

- Two main styles
  - Oval 30x60cm
  - Circular 30cm
- Upper parts based on:
  - Sode (ethnoarchaeology) – large scale
  - Local blacksmith - Small scale heat patterns
  - Ribe bead maker designs



# Furnace Reconstructions - Ribe

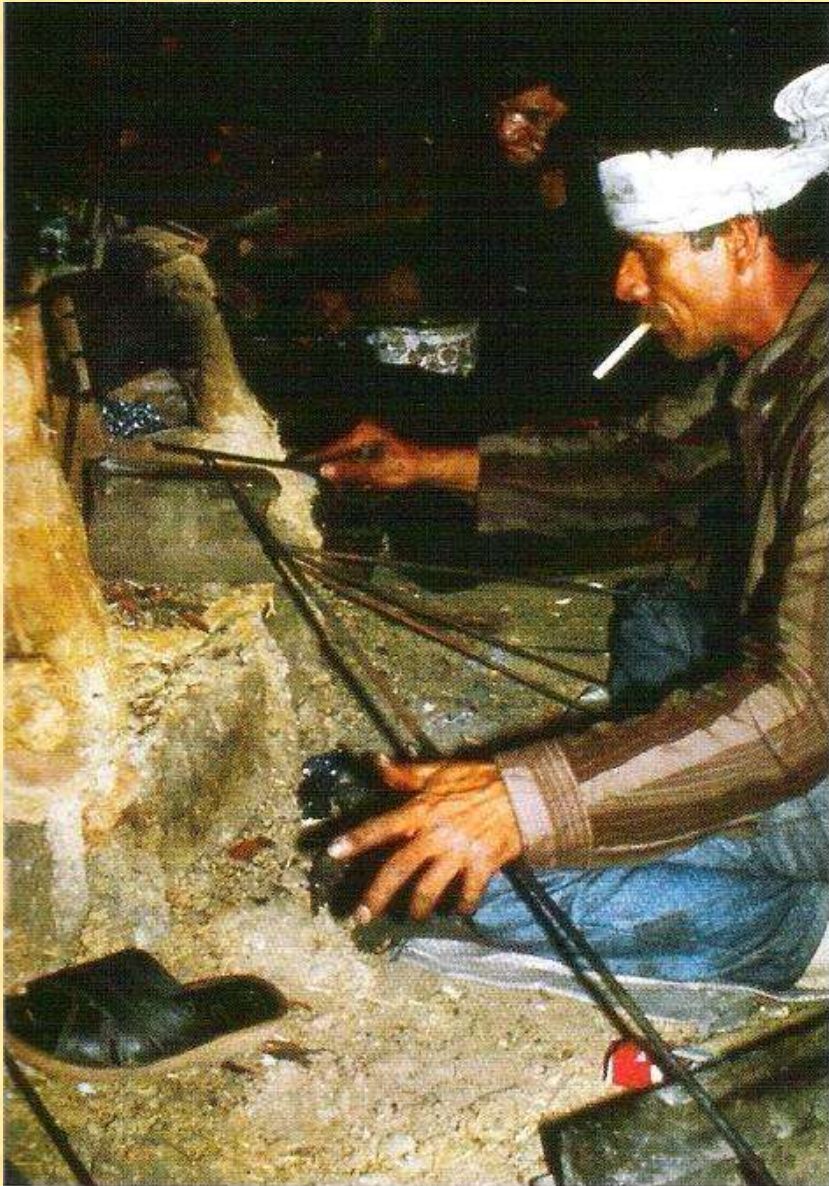


- Trine at Ribe
- Furnace elevated
- Workers seated

Photo: Trine Theut, Pers Corresp.



# Furnace Reconstructions - Sode



- India, Turkey
- High working ports
- Thick base
- 16-20 workers
- Furnace lasts 1 year

Photo: Fig 5.4 *Viking Age Glass Beads*  
*From Ribe, Denmark, In The Light Of*  
*Ethnographic Research Sode, in*  
Ornaments of the past, Beads Studies  
after Beck, 2003



# Furnace Reconstructions



“Sarah” furnace

- Oval 30x60cm
- Single chimney
- Two doors
- Back annealer
- Note the temp!



# Furnace Reconstructions



- “Goderich” furnace
- Oval 30x60cm
  - Two Chimneys
  - Two doors
  - Center top annealer



# Furnace Reconstructions



“Neil” furnace

- Circular 30cm
- One Chimney
- One Door
- Side annealer





# Agenda

- Bead Production Background
- Furnace Reconstructions
- Temperature Measurements
- Conclusions & Future Directions



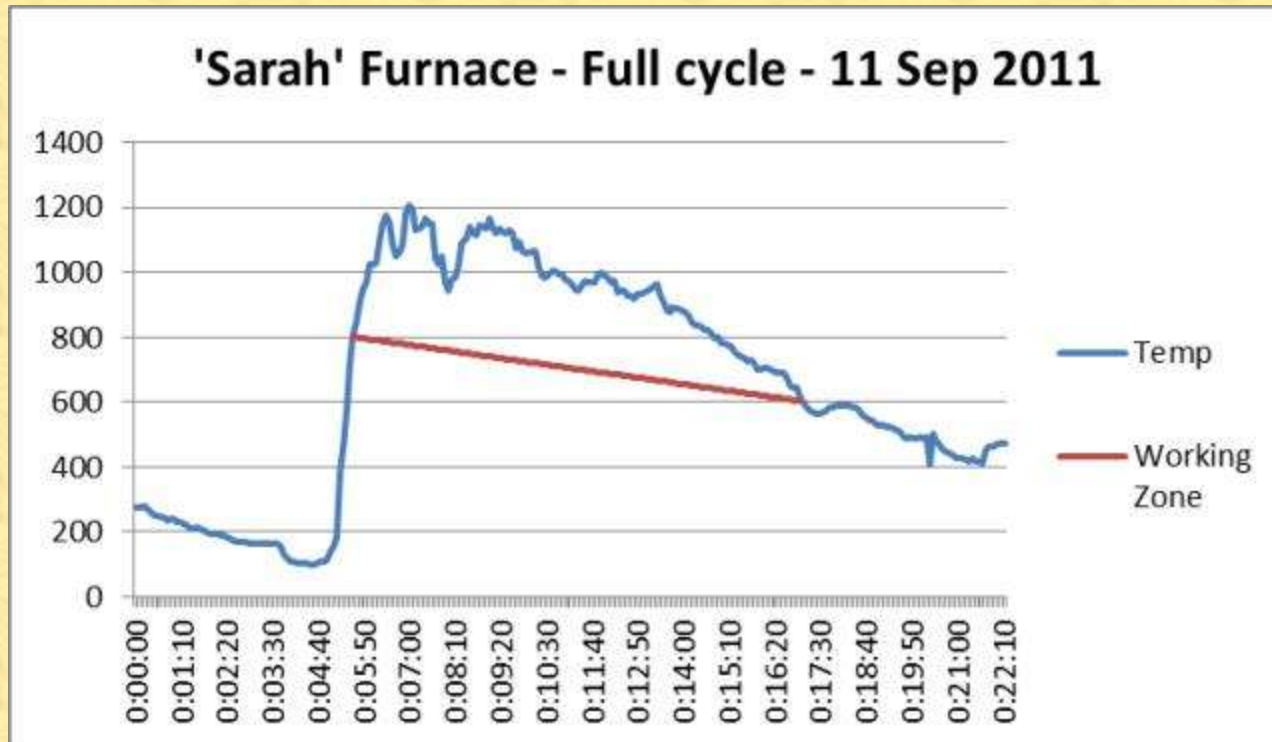
# Temperature Measurements

- One J/K thermocouple in chimney
- Video recording of full heat cycle
- Temps graphed every 5 seconds
- Working temp for glass 600°C+
- Higher temp to start (800°C)
- Air from blowers
- Two furnaces recorded
- Max Temp: 1200°C



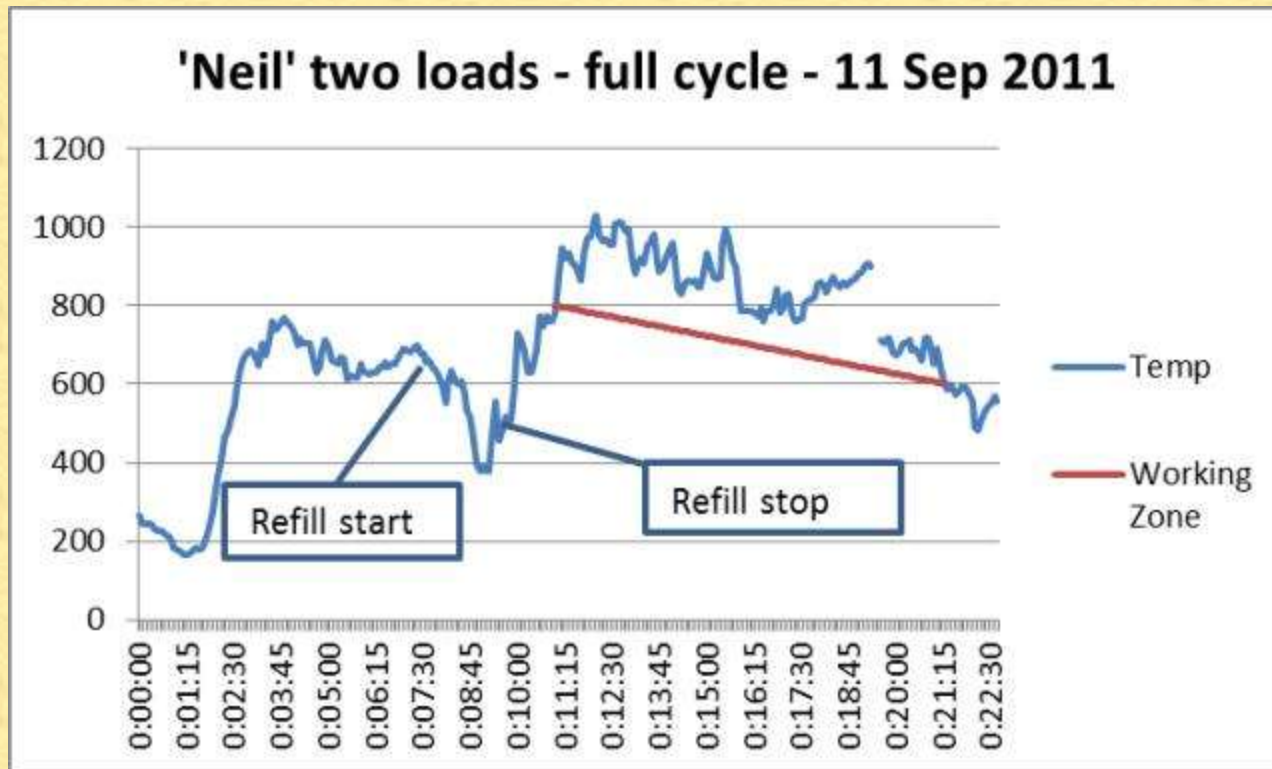
# First Temperatures - Sarah

- Air 0.04 Lpm
- 11:30 at working temperature



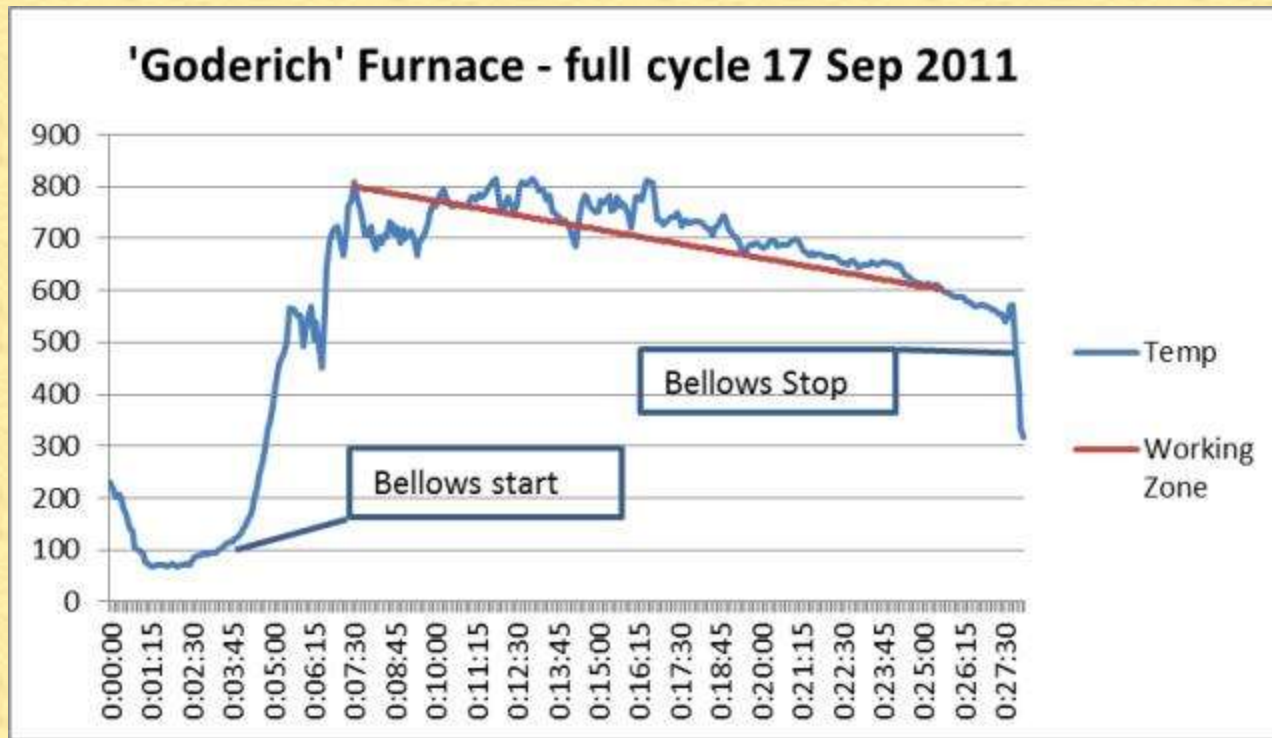
# First Temperatures - Neil

- Air 0.01 Lpm (small furnace)
- 10:20 at working temperature



# Second Temperatures - Goderich

- Bellows for air – 0.02 Lpm
- 18:10 at working temperature



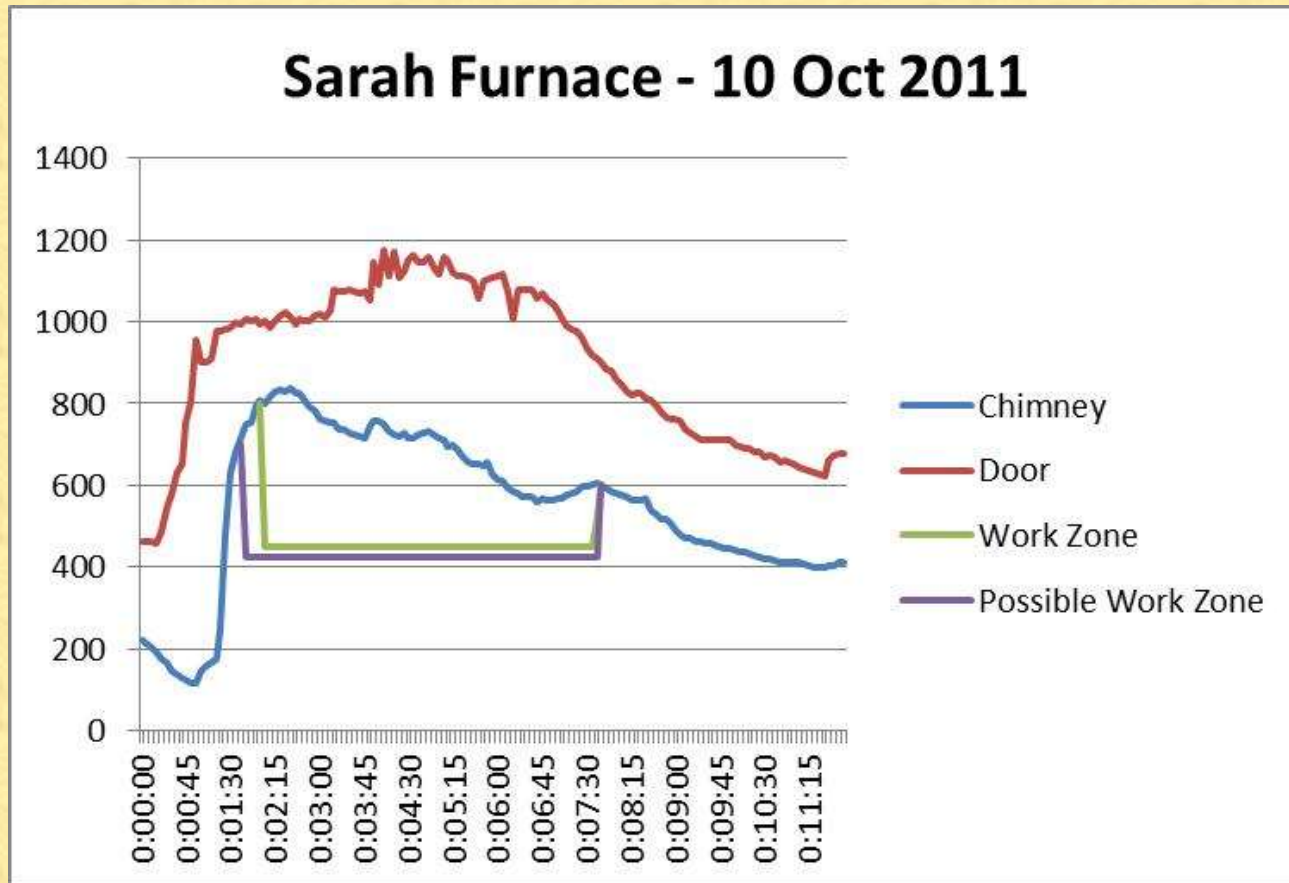
# Third Temperatures

- Follow-up based on preliminary results
- 2 J/K Thermocouples
  - Chimney & door



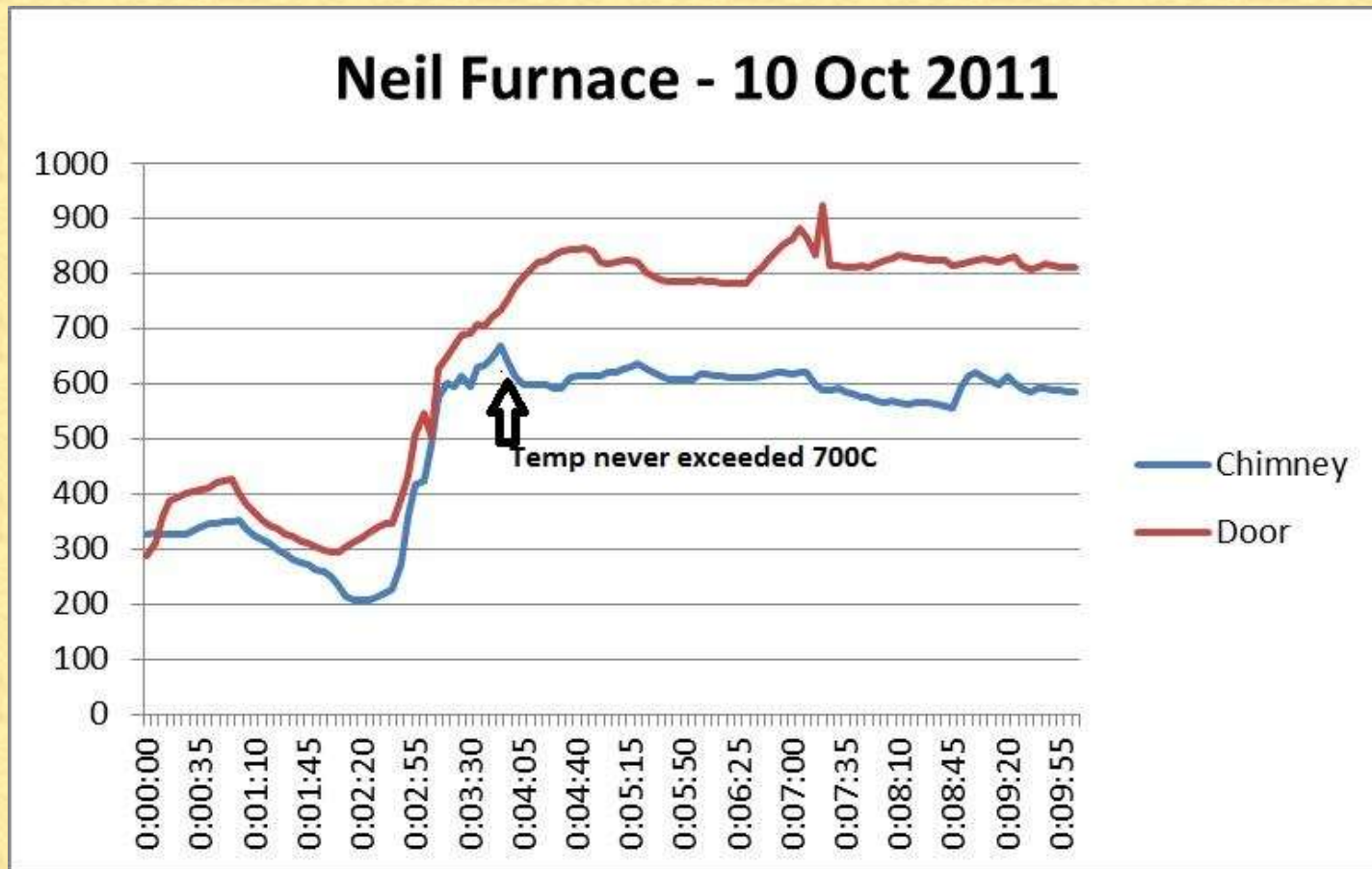
# Third Temperatures - Sarah

- Air 0.04 Lpm
- 5:50 at working temperature



# Third Temperatures - Neil

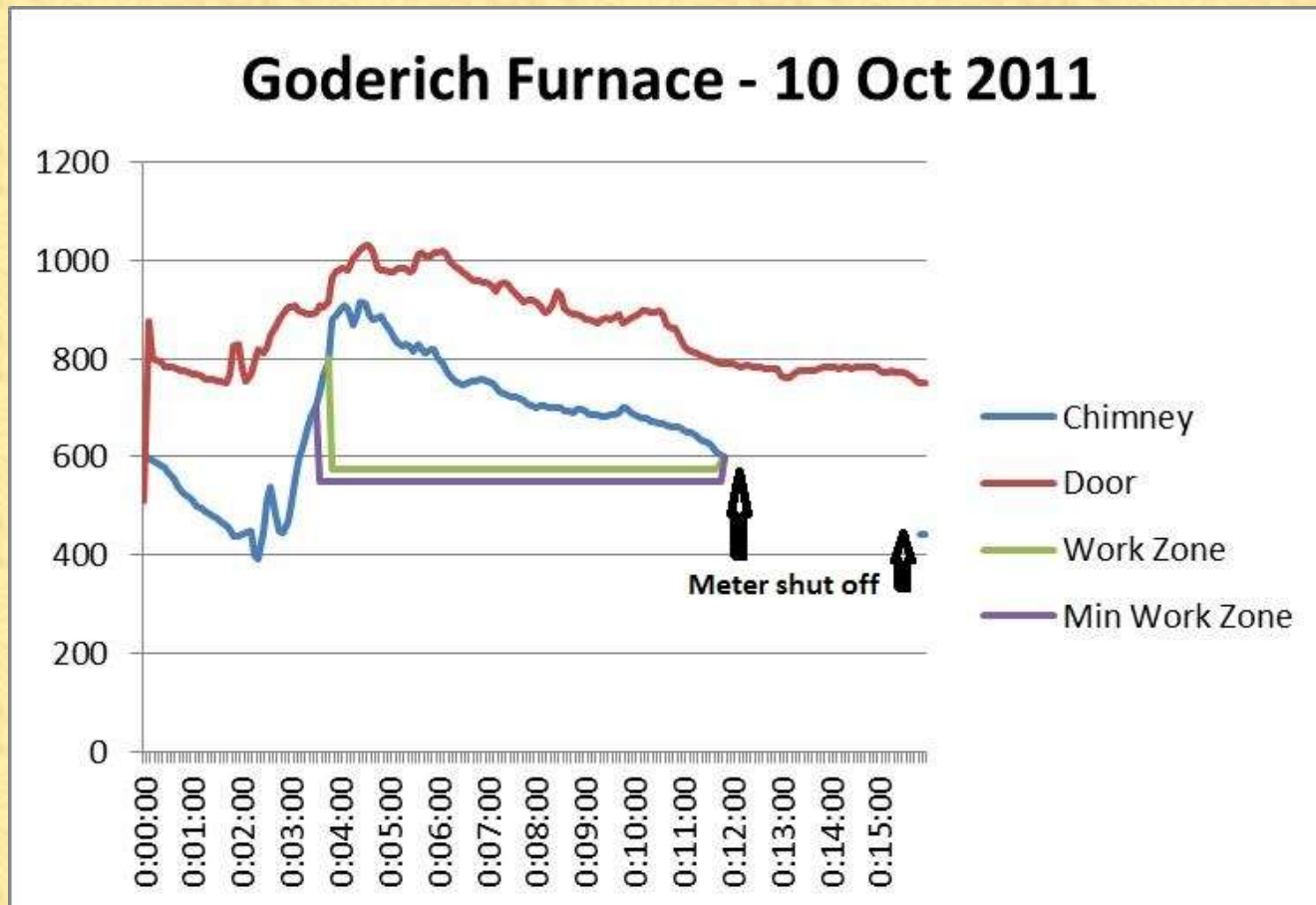
- Air 0.01 Lpm
- 5:30 near working temperature





# Third Temperatures - Goderich

- Air 0.04 Lpm
- 8:10 at working temperature



# Agenda

- Bead Production Background
- Furnace Reconstructions
- Temperature Measurements
- Conclusions & Future Directions



# Conclusions

- Possible to create required temps
- External temps affect working time
- Issues around ash/airflow
  - Historic examples



# Future Directions

- Need focused recording
- One day, many readings
  - Limit external temperature changes
  - Multiple readings for each furnace
  - Gate to fine tune airflow rate
- Inline airflow readings
- Datalogger would make life easier
- Matching heat pattern and construction



# Questions?

## Contact Us

<http://www.darkcompany.ca/beads>

[neil@treheima.ca](mailto:neil@treheima.ca)

