Uplift, thermal unrest and magma intrusion at Yellowstone Caldera

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Yellowstone Quick Facts

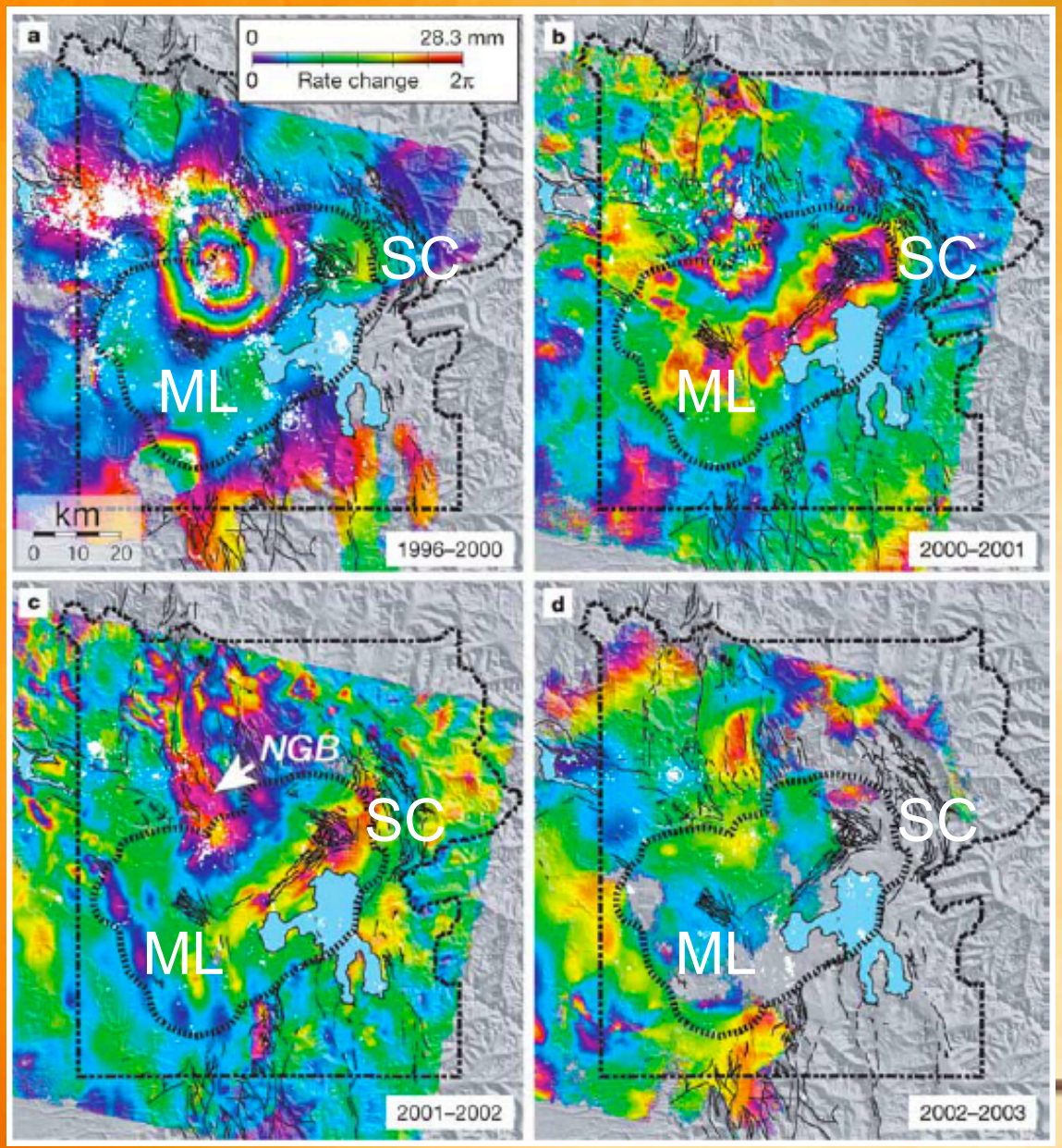
- Northeastern termination of hotspot track that began ~16 Ma
- caldera-forming eruption 640 ka
- 150 - 70 ka rhylotic flows cover caldera
- active uplift and subsidence in Pleistocene
- hydrothermal activity
- high seismicity

The Punchline

InSAR observations of deformation are consistent with variations in magma flow through the pluming system under Yellowstone.

i.e. It represents an increase/decrease in rate of magma movement (depending on location).

Observations



InSAR

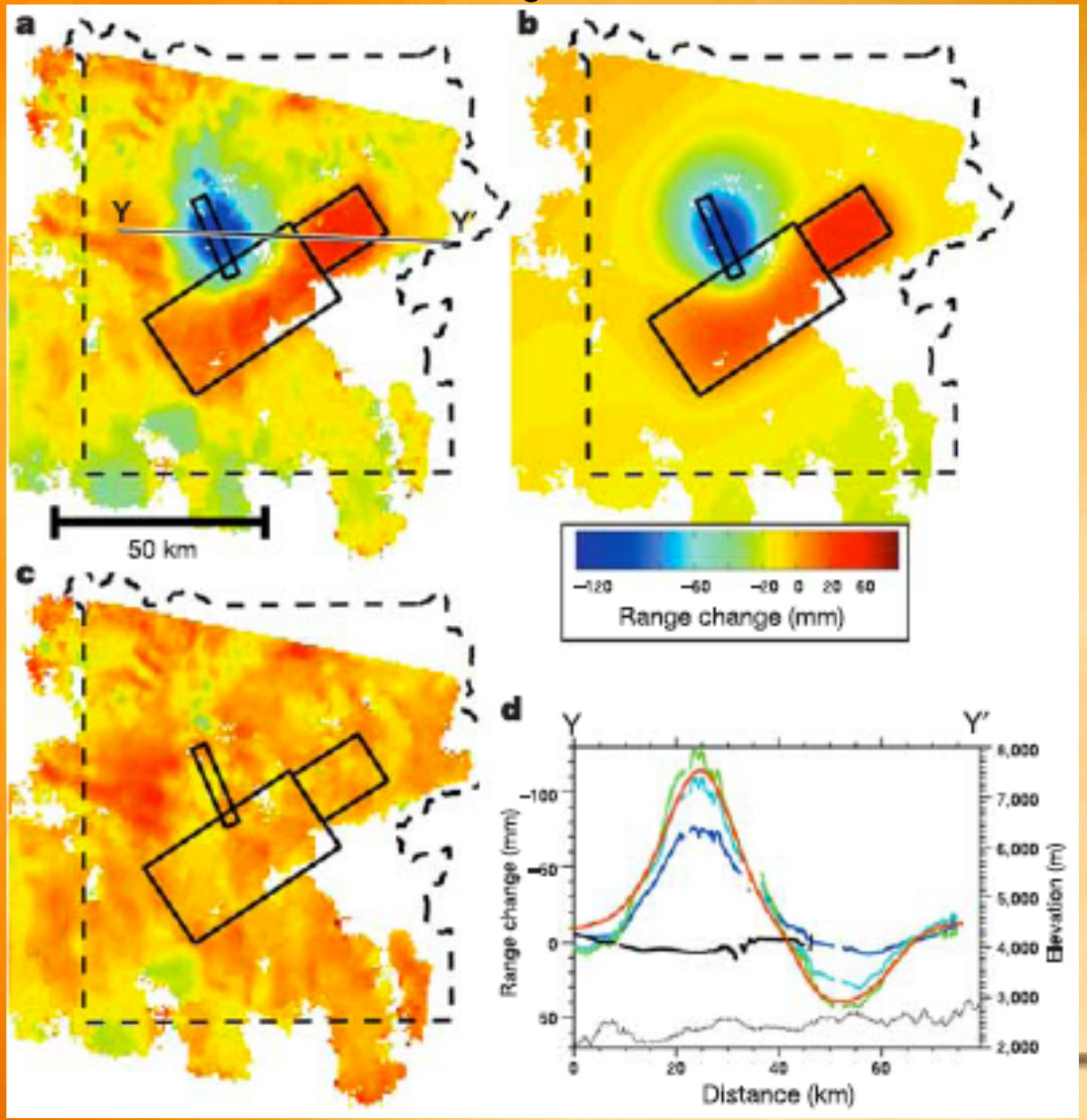
Interferograms 1996-2002

NUA - north rim uplift anomaly

Subsidence between SC and ML

Wicks, et al., 2006 (Figure 2)

Observed/Synthetic Comparison



Stacked Unwrapped interferogram

Modeled inflating / deflating sills

Inflating sill dips to N/NE

Previous Uplift Processes

1. Rhyolite crystallizes and releases volatile gases trapped by hydrothermal reservoir
2. Magma moves, forms and crystallizes

Wicks, et al., 2006 (Figure 3)

The Punchline

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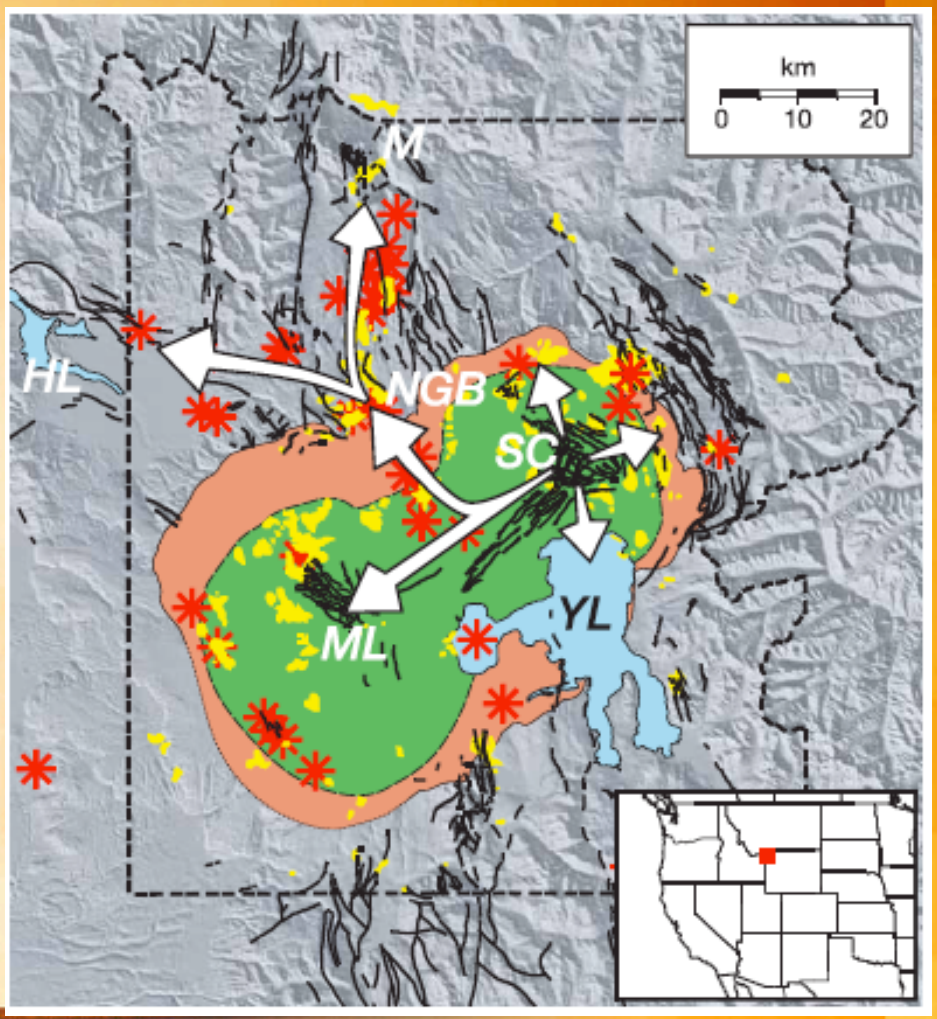
Implications

1. Magma Transport System

- Caldera uplift began with pulse of basaltic magma
- magma spread horizontally
- heat loss from basalt keeps hydrothermal system active
- Escapes caldera through Hebgen Lake fault zone (west) and Norris-Mammoth corridor (north)

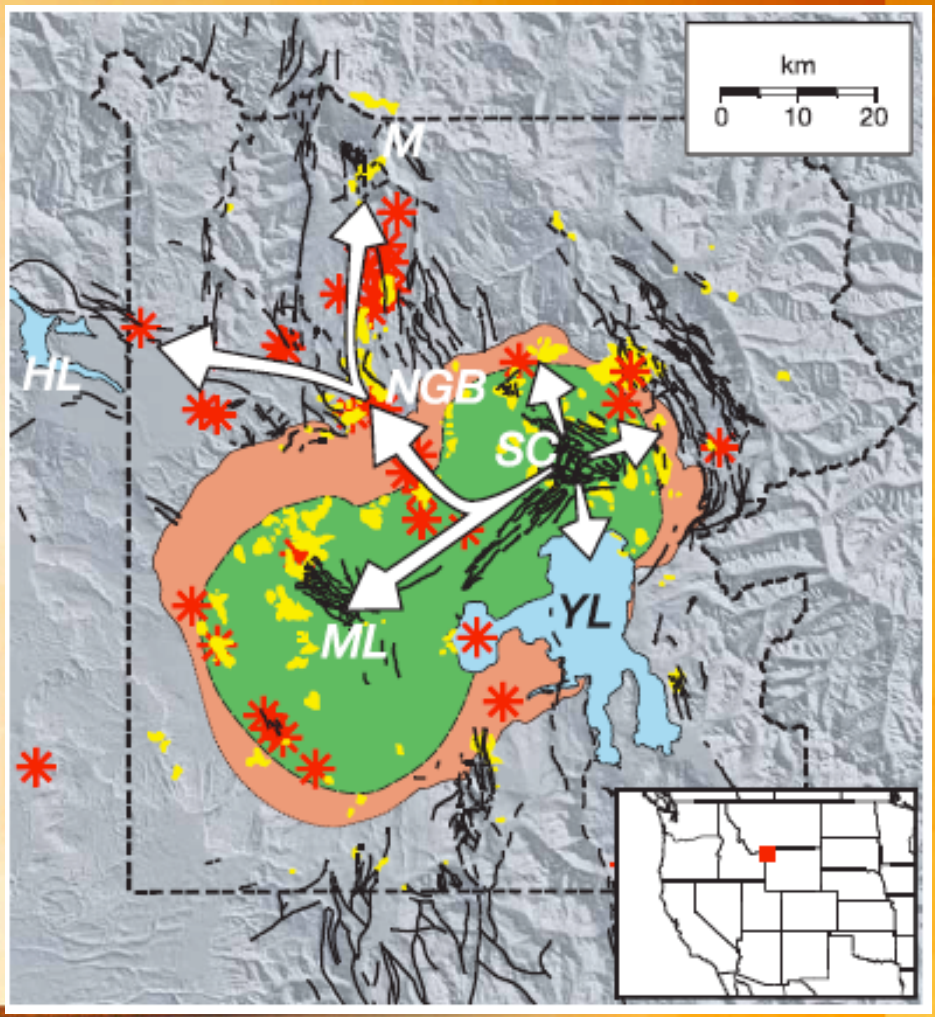


Wicks, et al., 2006 (Figure 1)

Implications

2. NUA Uplift

- West and North routes can't accommodate influx
- Deepening of sill to the N/NE acts as trap to negatively buoyant magma
- NUA Uplift - connection with small-scale inflation
- NUA Uplift - connection with Norris-Geyser basin thermal disturbances



Wicks, et al., 2006 (Figure 1)

Additional Thoughts

- GPS, seismic, potential field observations to support proposed model
- Implications for monitoring other volcanic areas