

The Yellowstone Super Volcano

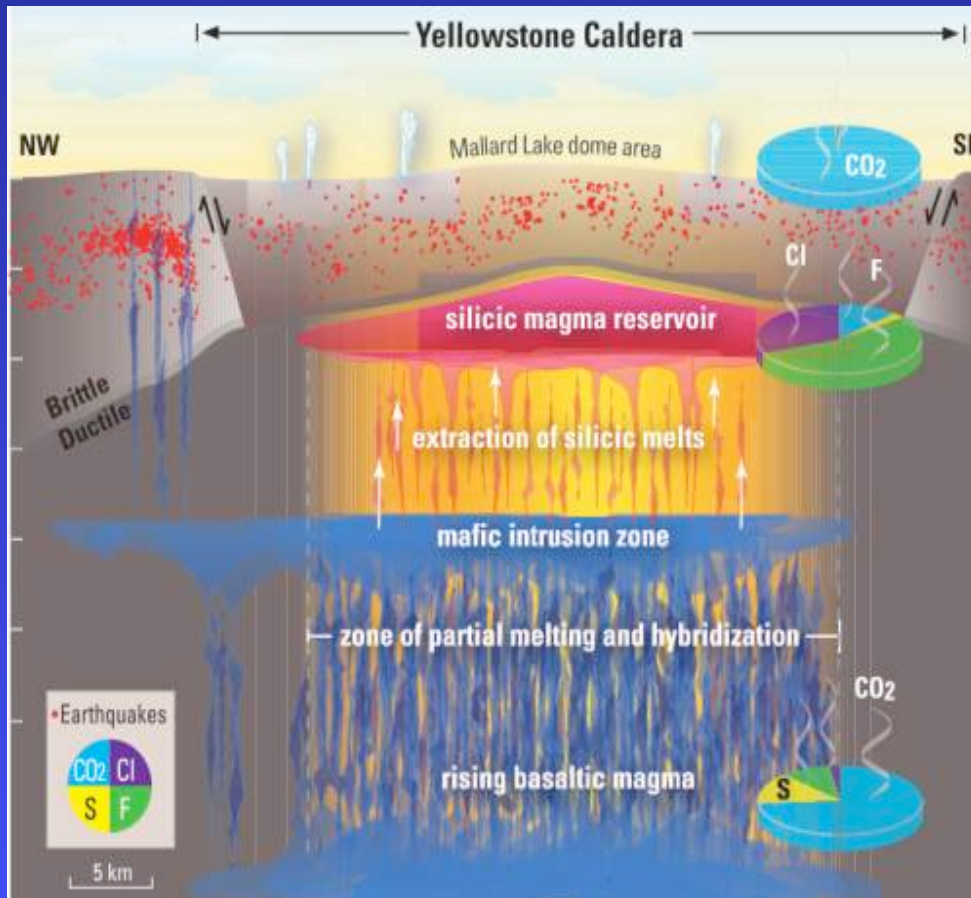
By: Scott Becker

Bubble bubble toil and trouble?



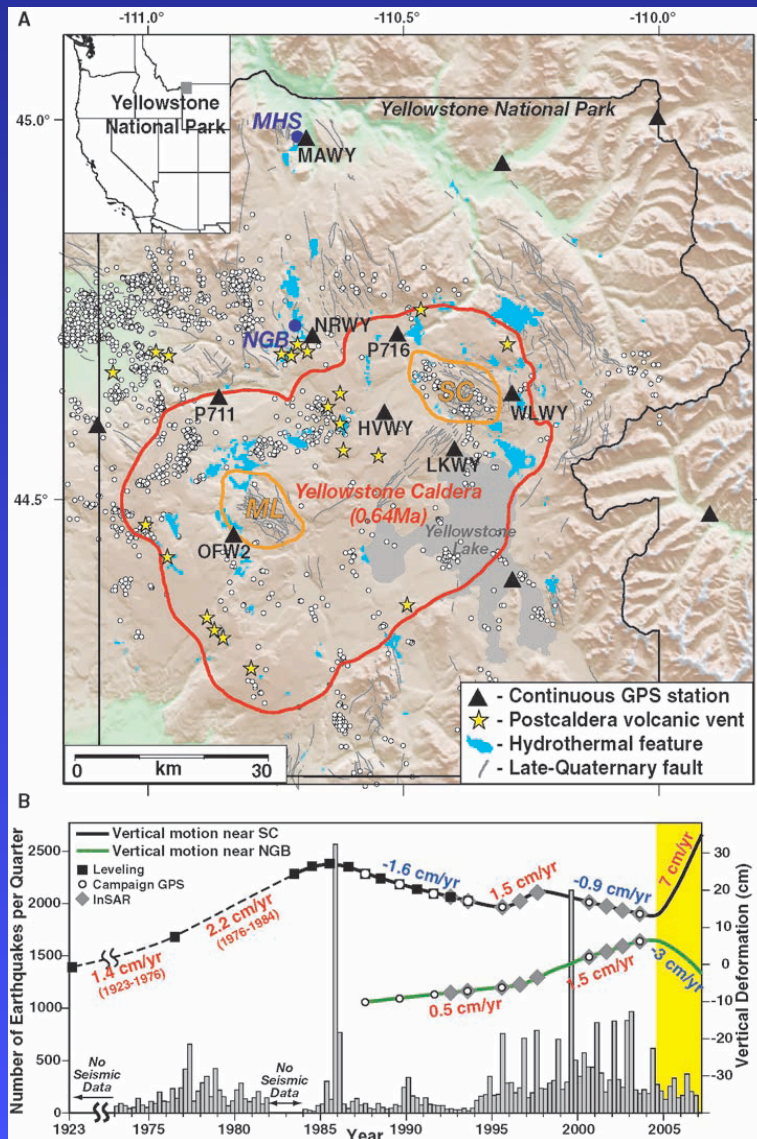
Field Camp 2009 (compliments of Taylor)

Tectonic Setting



- Yellowstone is an active volcano
- Powered by an intra-plate hotspot
- Basaltic magma (from ~ 50 km depth) rises through silica-rich crust
- Shallow silica-rich partially molten magma bodies result at depths of ~ 8-16 km
- Magma has a high viscosity and high volatile content
- Results in very explosive rhyolitic eruptions

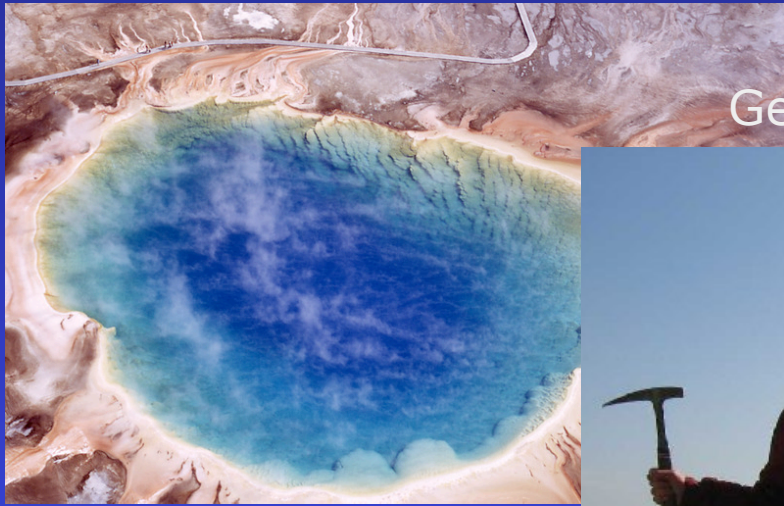
Within the Cauldron



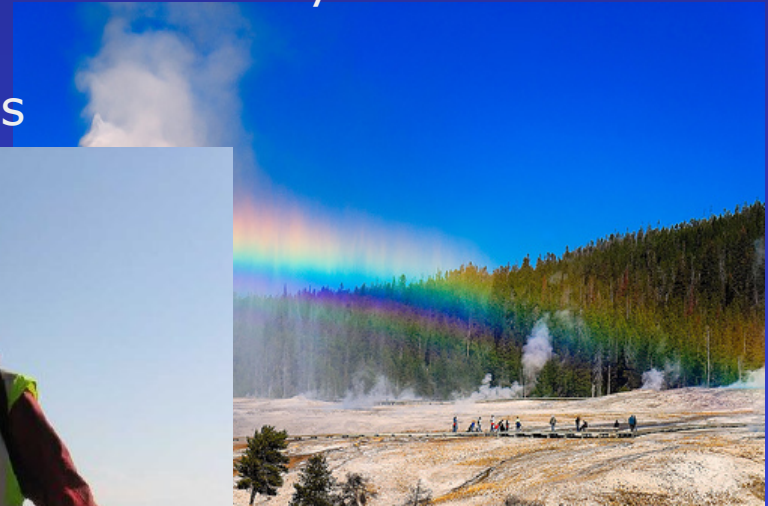
- The Yellowstone caldera is expansive (the youngest eruption formed a caldera 40 km wide and 60 km long)
- Caldera was formed by eruption of a large, shallow magma body. The magma chamber was emptied, and collapsed in on itself
- Recent accelerated uplift and an increasing number of seismic disturbances have been observed (2004-2006)
- The proposed mechanism is magma recharge and fluid pressurization
- Seismic data infer a magma body of ~4000 cubic km presently underlying the caldera

Features Caused by Volcanism

Hot springs



Geysers



Geologists



Fumaroles

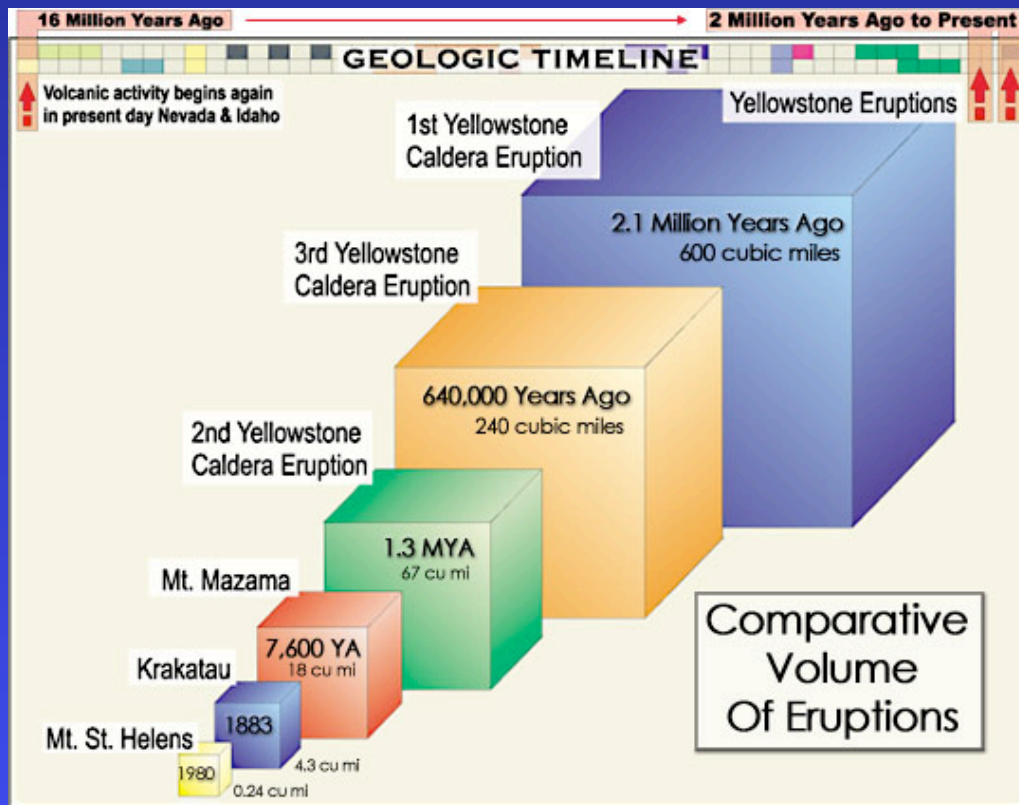


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Mud Pots



Historical Eruptions



- Three “super eruptions” in the last 2.1 million years (and several smaller eruptions)
- Total of ~2,500 cubic meters of magma was erupted
 - Huckleberry Ridge tuff
 - Mesa Falls Tuff
 - Lava Creek Tuff

Could go from this...

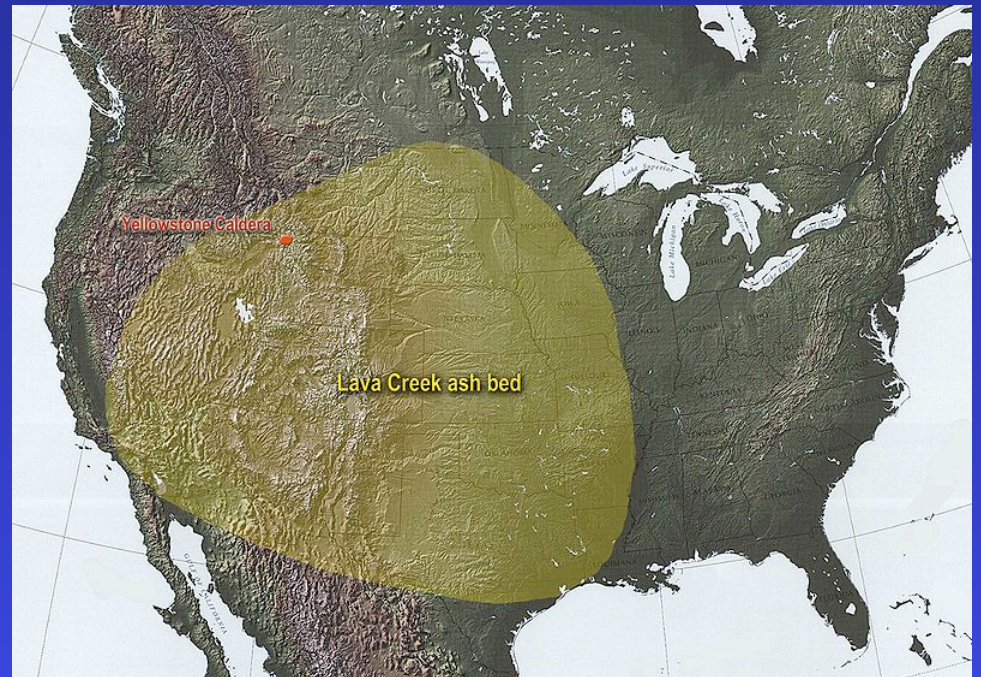


To this!




Possible Effects...

- Immediate area
 - Ash flows up to 600 meters deep
 - Hot pyroclastic flows
- Intermediate area
 - Significant ash fall over North America
- Globally
 - Sulfate aerosols injected into the stratosphere would decrease global temperature



Predicting an Eruption

- Difficult to do...
 - No “super eruption” has ever been observed/ documented in human history
 - Could look for:
 - Rapid uplift
 - Increased earthquake occurrence
 - Tremors (continuous, low frequency seismic waveform)
 - Considerable heat and gas flux
 - But these have been observed elsewhere, without a subsequent eruption (i.e Iwo Jima), with the exception of tremors
- 

Should We Be Worried?

Maybe...

but prob

Current
impend

On average
so



mes)

years or

Citations

- Lowenstern, L. B., et al. "Monitoring super-volcanoes: geophysical and geochemical signals at Yellowstone and other large caldera systems." The Royal Society v. 364 p. 2055-2072, 2006.
- Watts, K. "Yellowstone and Heise: Supervolcanoes That Lighten Up." Geotimes November, 2007.
- Chang, W., et al. "Accelerated Uplift and Magmatic Intrusion of the Yellowstone Caldera." Science v. 318, 2007
- Miller, C., and Wark, D., "Supervolcanoes and their Explosive Supereruptions." Elements V. 4, 2008.
- McGuire, W.J. "Global risk from extreme geophysical events: threat identification and assessment." The Royal Society v. 364 p.1889-1909, 2007
- Achenback, J. "When Yellowstone Explodes." National Geographic August, p. 56-70 1991

Questions?

