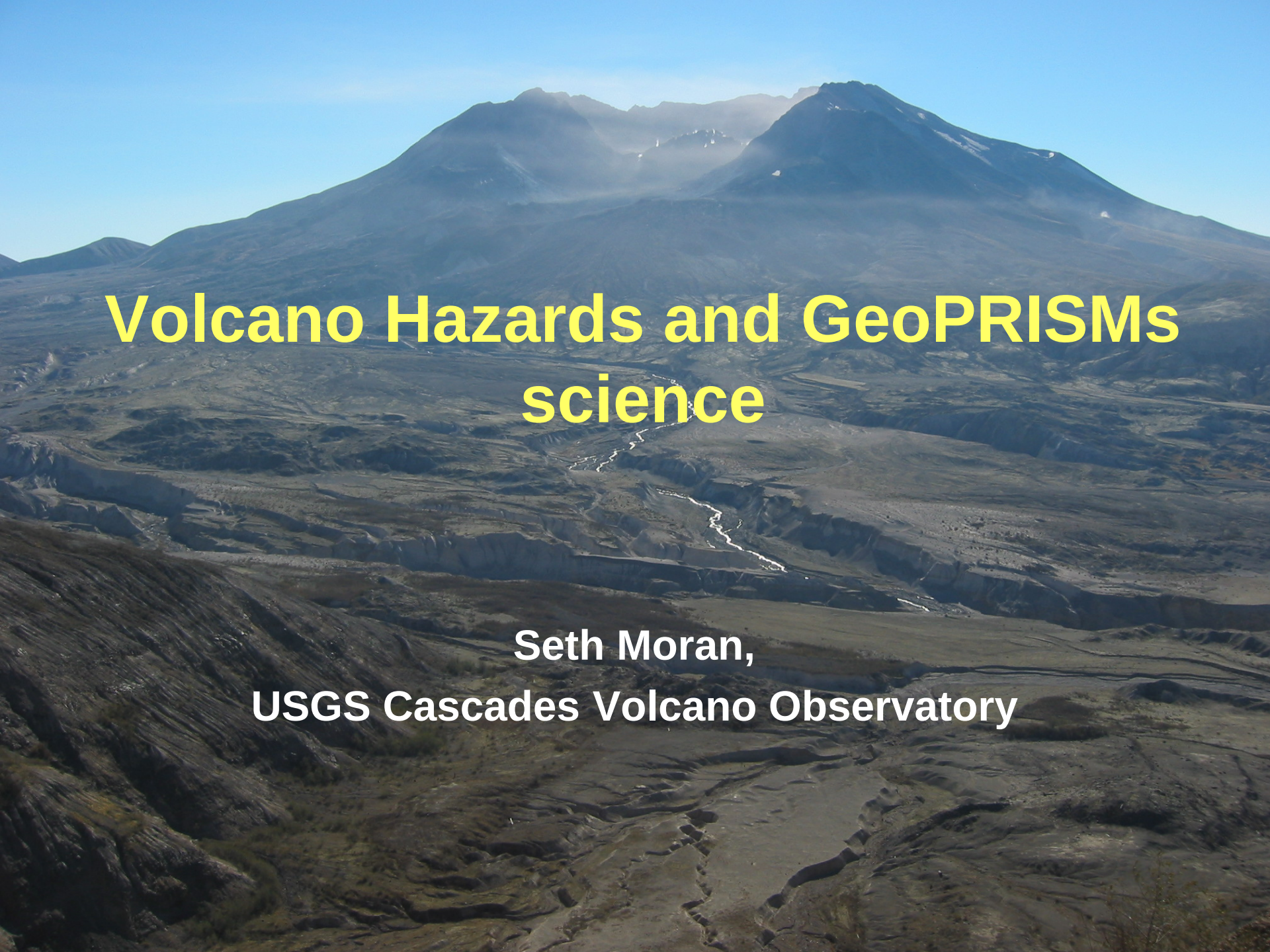

Volcano Hazards and GeoPRISMs science

Seth Moran,

USGS Cascades Volcano Observatory

Volcano Hazard: Definition

- Products and/or events related to a volcano with the potential to cause damage/economic loss or casualties *(eruption not required)*
- Characterizing hazard includes determining:
  a) How long will it last *(e.g., duration of ash production)*
  b) Spatial extent (*e.g., define areas with elevated* CO_2)
  c) Nature of event *(e.g., lahar vs. pyroclastic flow)*
  d) Nature of onset *(e.g., time between start of unrest and eruption)*
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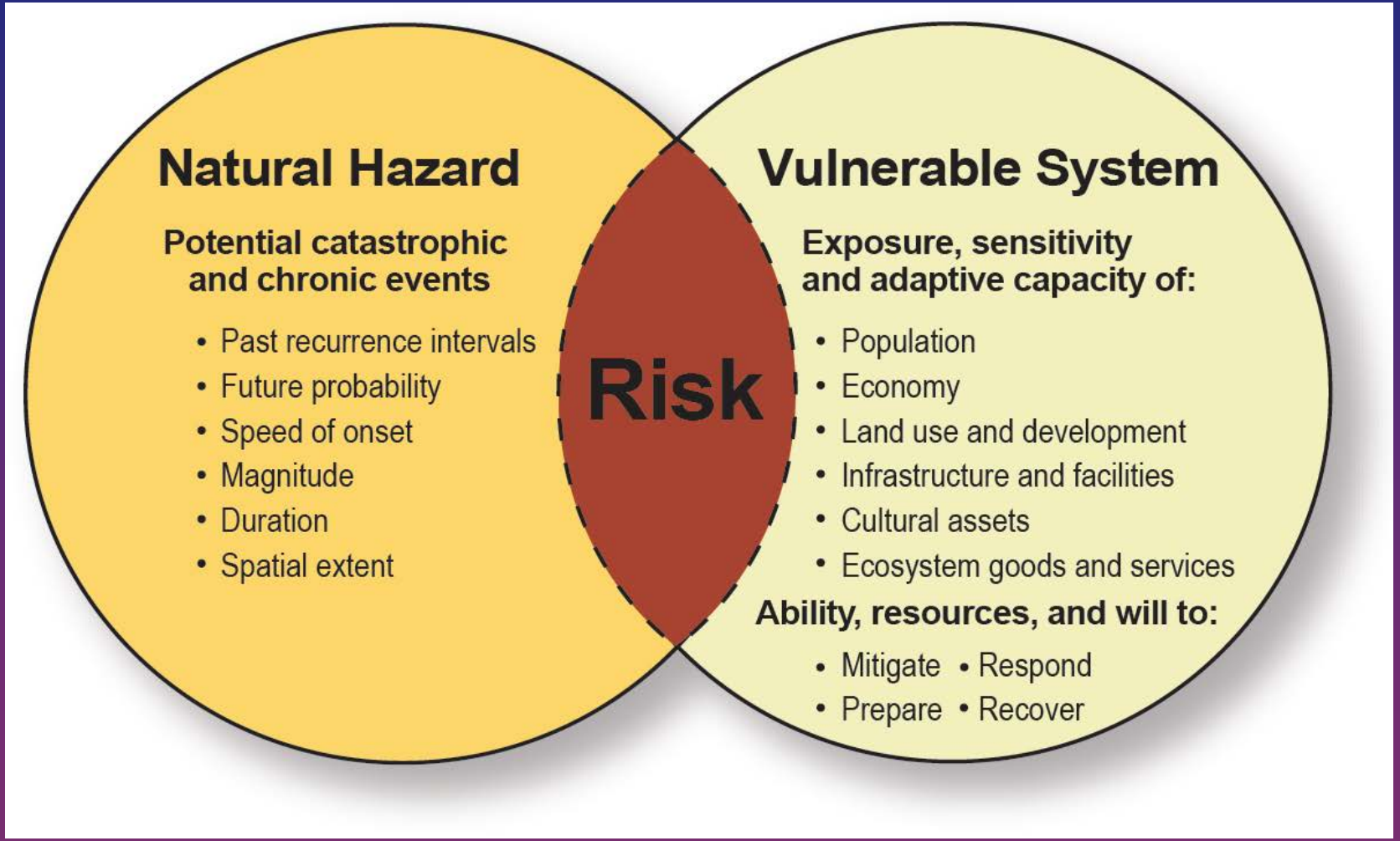
USGS

Volcano Hazard: Definition



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Wood, 2011, http://pubs.usgs.gov/fs/2011/3008/

NVEWS: US Volcano Threat (risk) Assessment

"Very High Threat" US Volcanoes

Cascade Volcanoes

Table 6: Results of NVEWS gap analysis. The monitoring gap for each volcano is determined by subtracting the value of the current monitoring level from the required monitoring level. Threat groups are color coded: very high threat is red, high is orange, moderate is yellow, low is blue, and very low is green. Gray highlighting indicates volcanoes that currently are erupting or showing heightened unrest (as of April 2005).

Volcano	State	Aviation-Threat Score	Threat Score	Required Monitoring Level	Current Monitoring Level	Monitoring Gap
Kilauea	HI	48	324	4	4	Eruption
St. Helens	WA	56	267	4	4	Eruption
Rainier	WA	35	244	4	2	2
Hood	OR	28	213	4	2	2
Shasta	CA	37	210	4	2	2
South Sister	OR	28	194	4	2	2
Lassen Volcanic Center	CA	31	186	4	2	2
Mauna Loa	HI	4	170	4	3	Unrest
Redoubt	AK	44	164	4	3	1
Crater Lake	OR	35	161	4	1	3
Baker	WA	14	156	4	2	2
Glacier Peak	WA	35	155	4	1	3
Makushin	AK	34	152	4	3	1
Akutan	AK	42	140	4	3	1
Spurr	AK	44	130	4	3	Unrest
Long Valley Caldera	CA	29	128	4	4	0
Newberry Volcano	OR	28	126	4	2	2
Augustine	AK	44	123	4	3	1

From Ewert et al., 2005

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USGS

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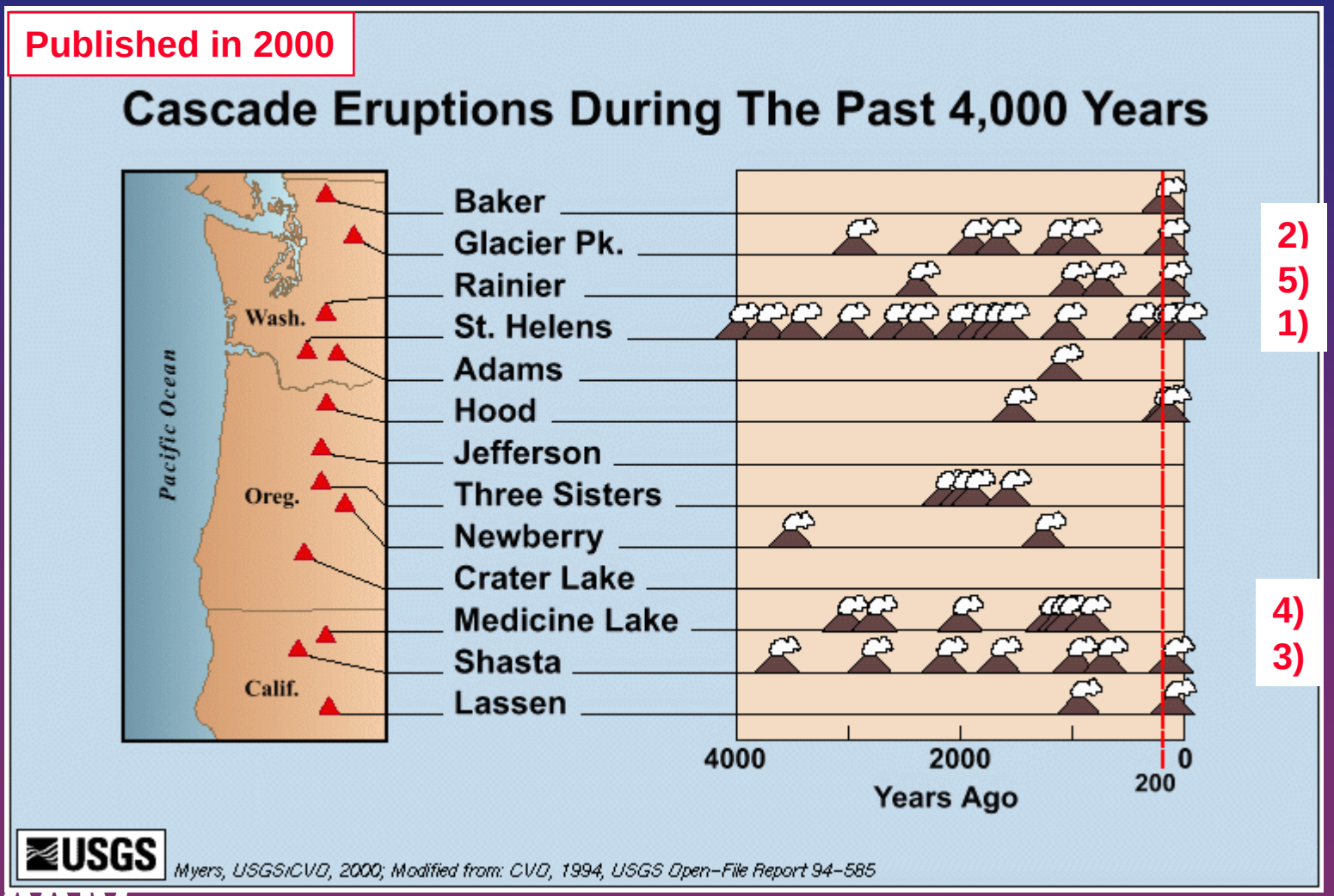
Geology ***Geology & Geophysics***

USGS

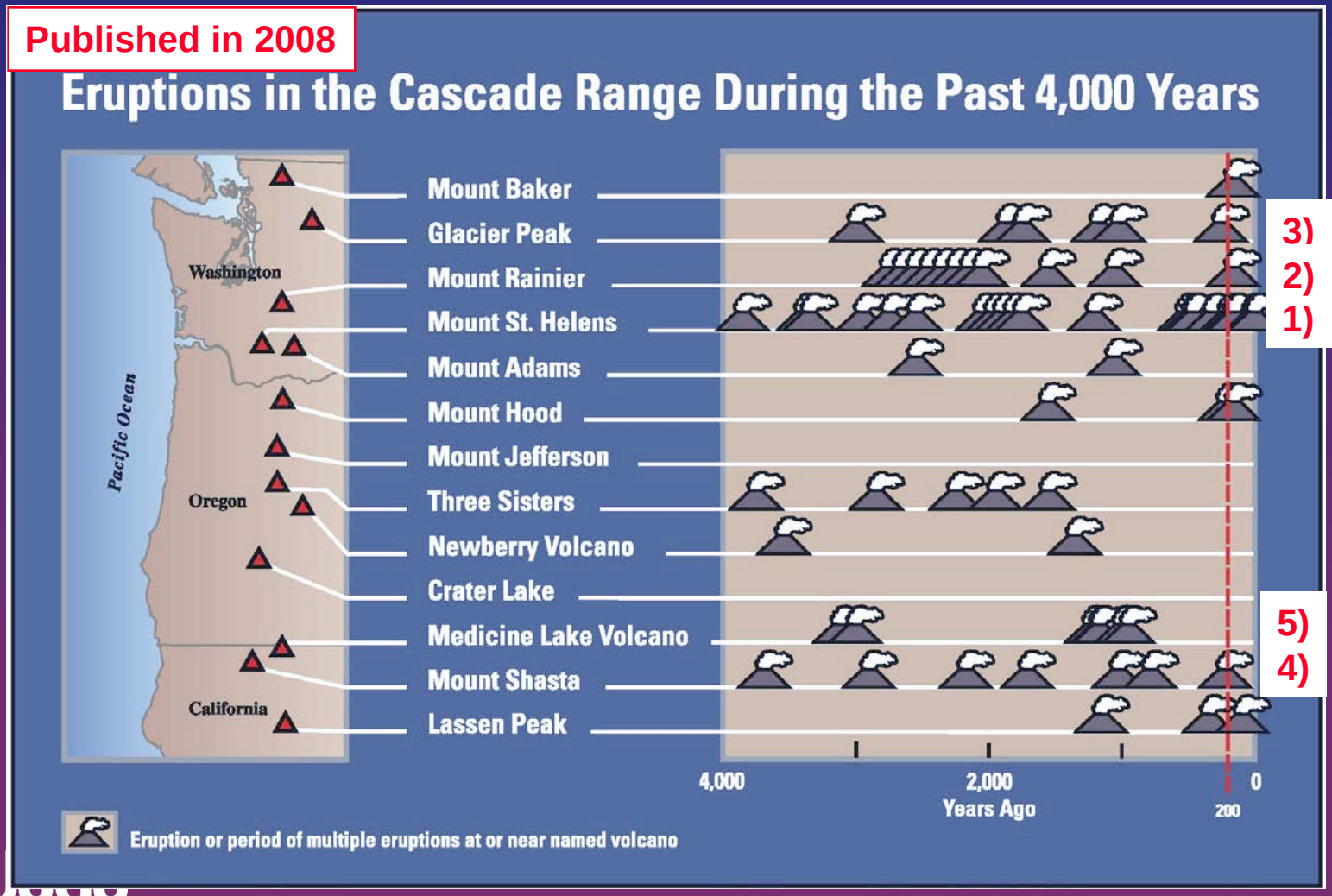
Eruption frequency: Improved knowledge from geologic mapping

Published in 2000

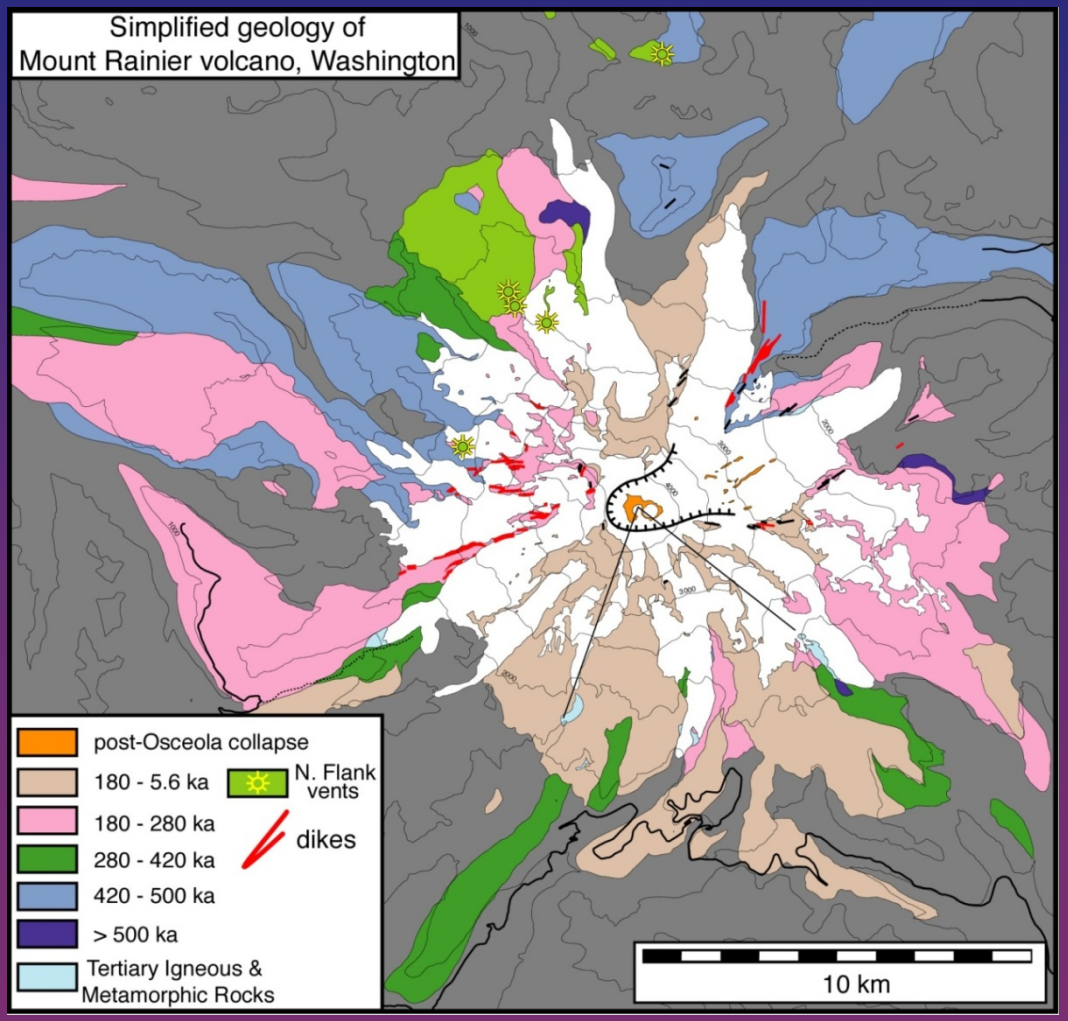


Eruption frequency: Improved knowledge due to geologic mapping

Published in 2008



Eruption frequency: Improved knowledge from geologic mapping



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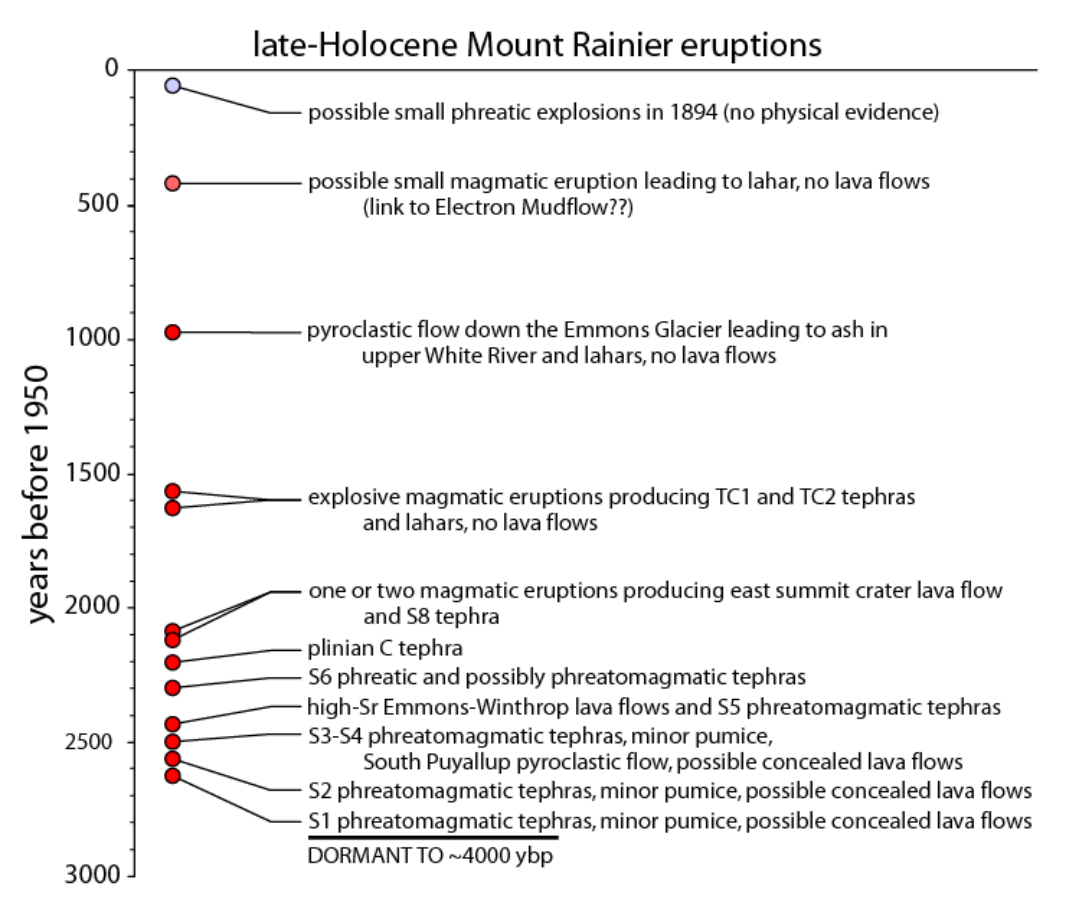
Sisson (pers communication, 2009)

Eruption frequency: Improved knowledge from geologic mapping



From Sisson & Vallance, 2009

USGS

Magmatic system models & hazards

How are models of magmatic systems relevant to understanding volcano hazards?

1) *Give a geologic context in which to interpret signs and symptoms of unrest (e.g., earthquakes, deformation, degassing).*
    - ➔ *Provides working hypotheses for interpreting unrest*
    - ➔ *Reduces uncertainty during unrest*

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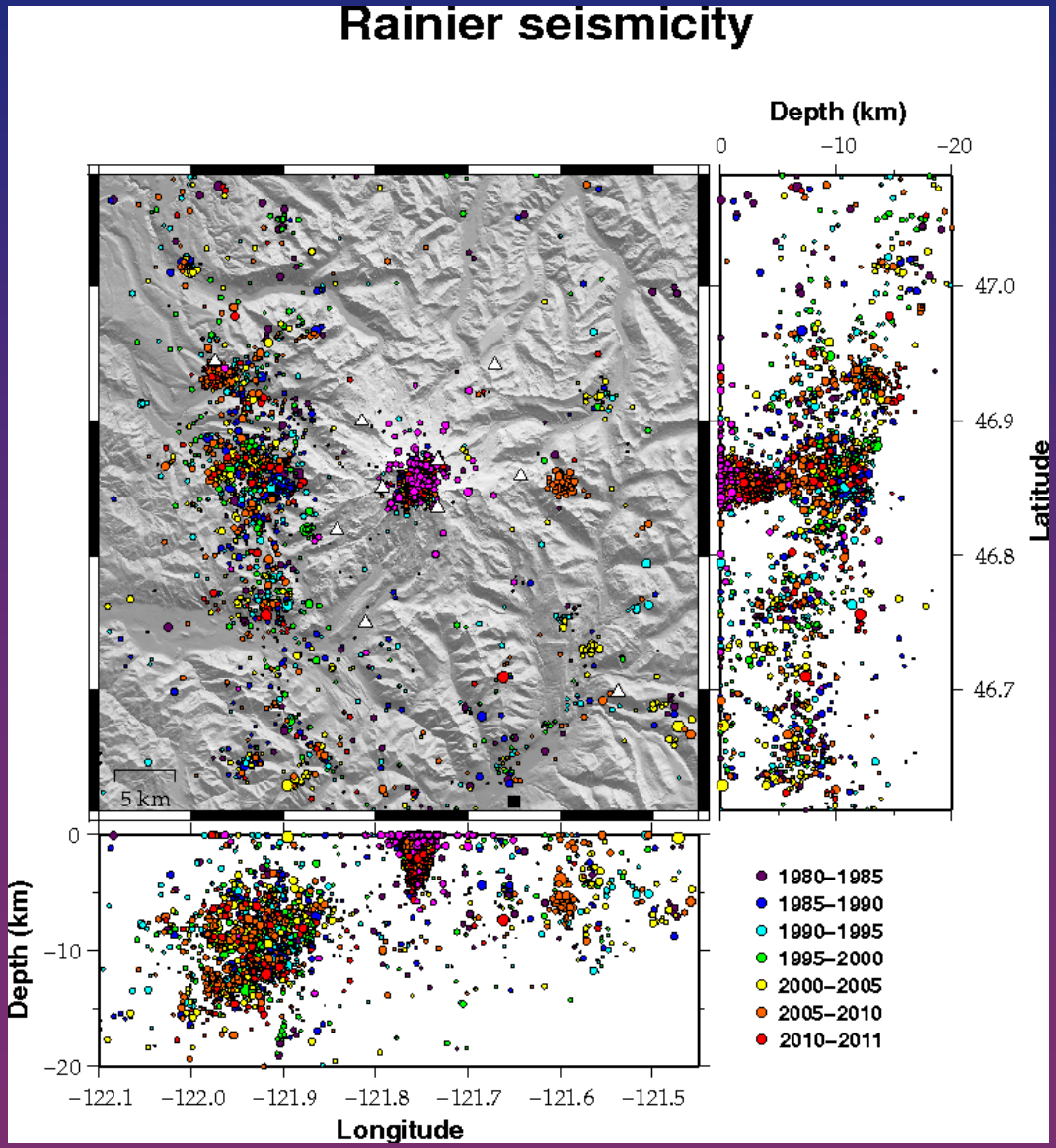
Magmatic system models & hazards

Why are there earthquakes at Mount Rainier?



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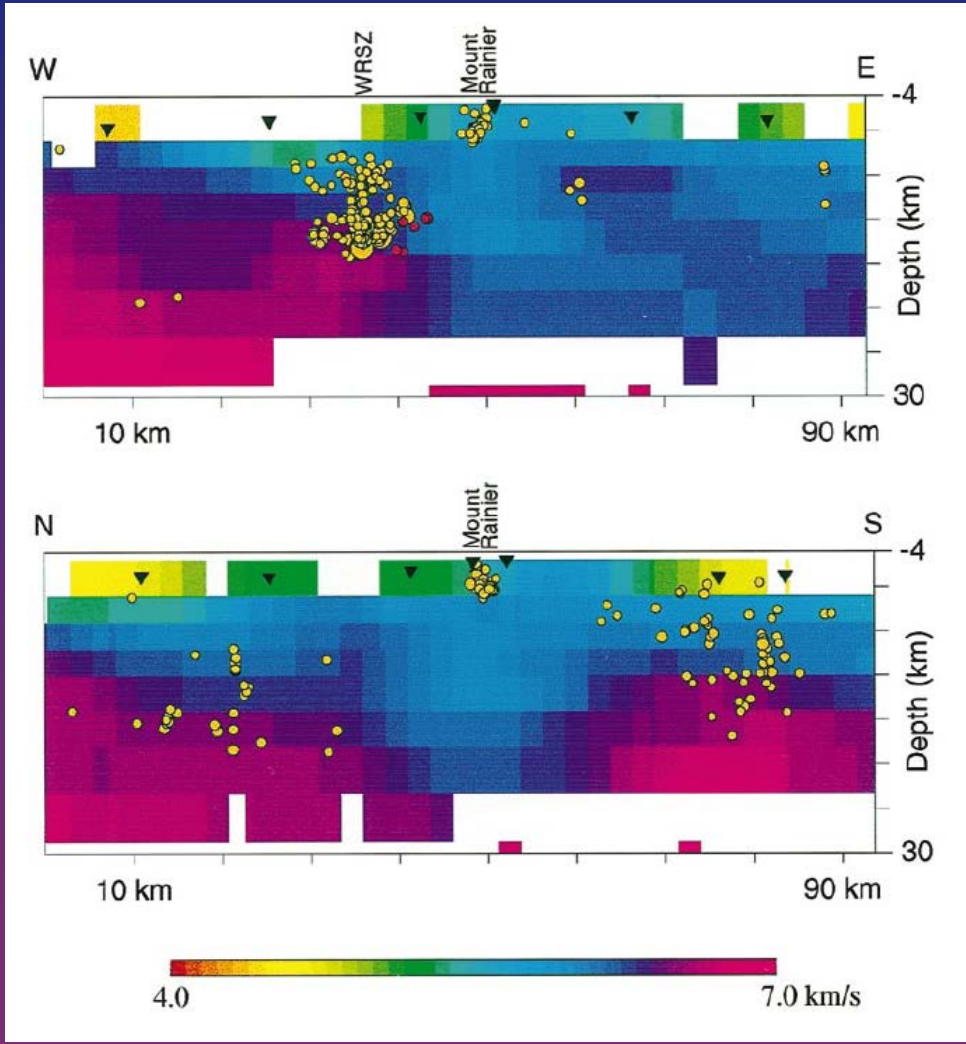
Magmatic system models & hazards



Moran et al., 2000

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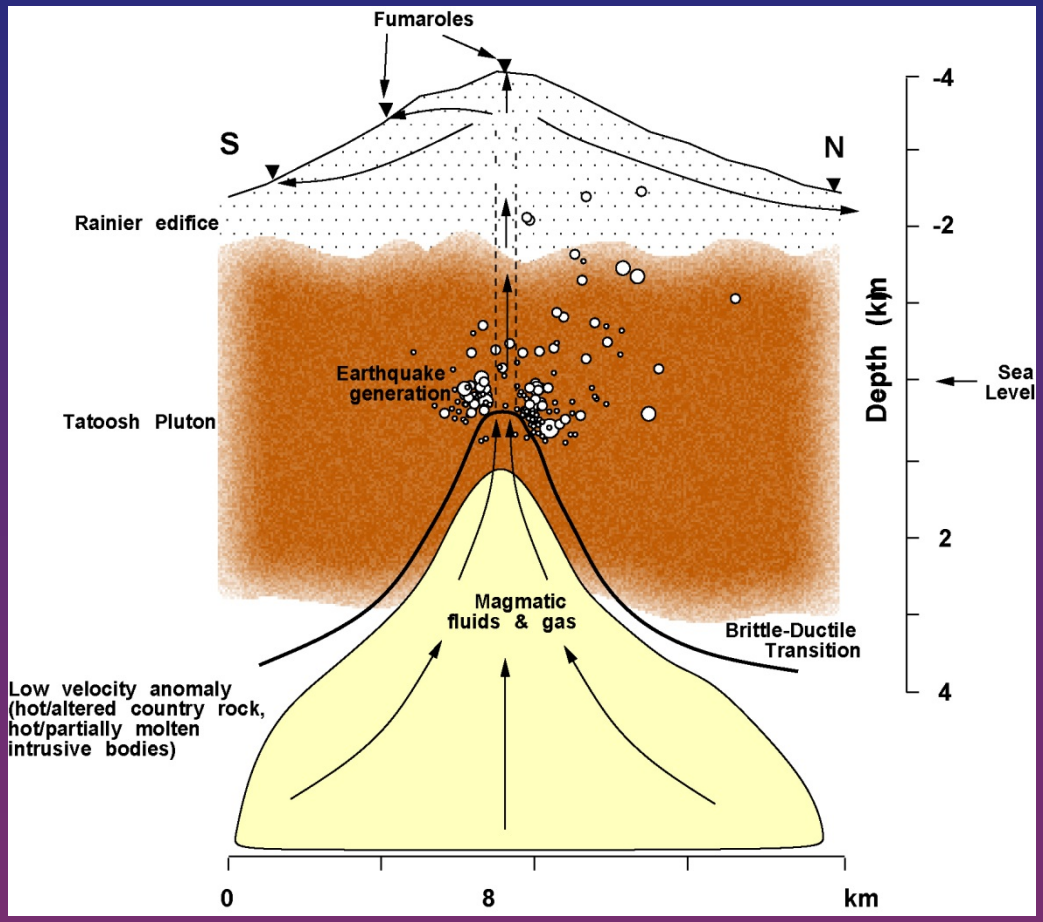
Magmatic system models & hazards

Mount Rainier Seismic/geologic model



modified from Moran et al., 2000

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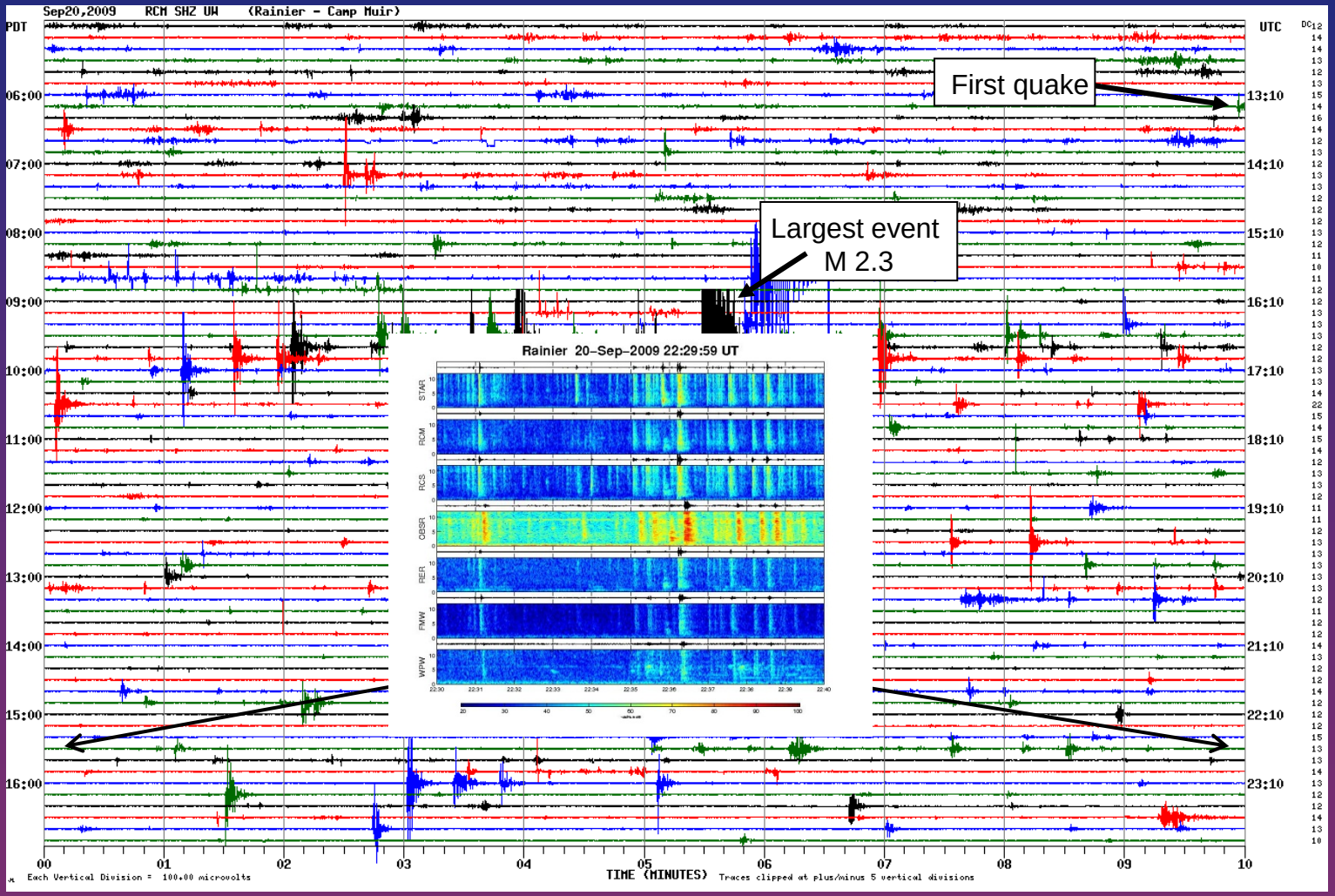
Magmatic system models & hazards



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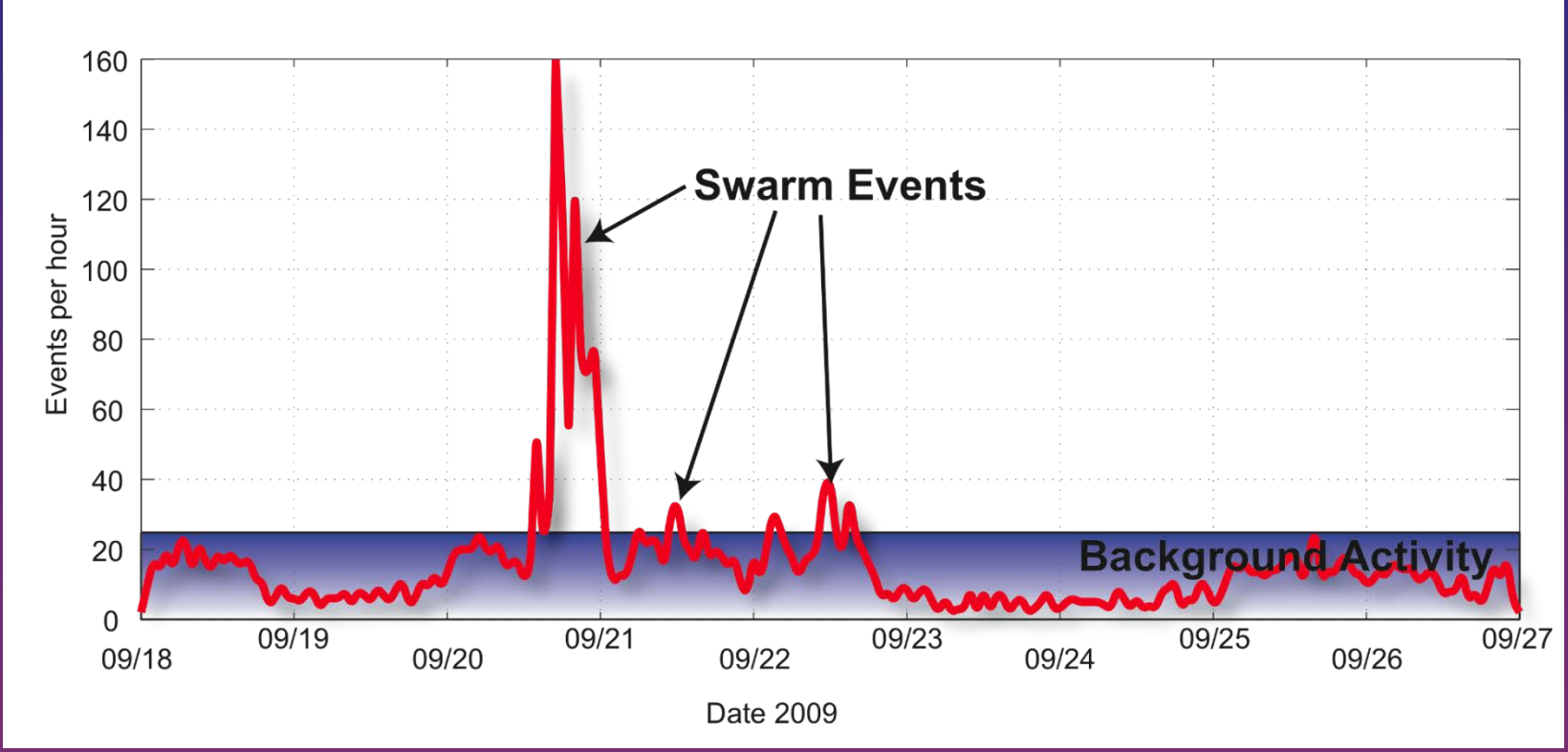
Mount Rainier swarm -- 09/20-09/23, 2009

Magmatic system models & hazards



USGS

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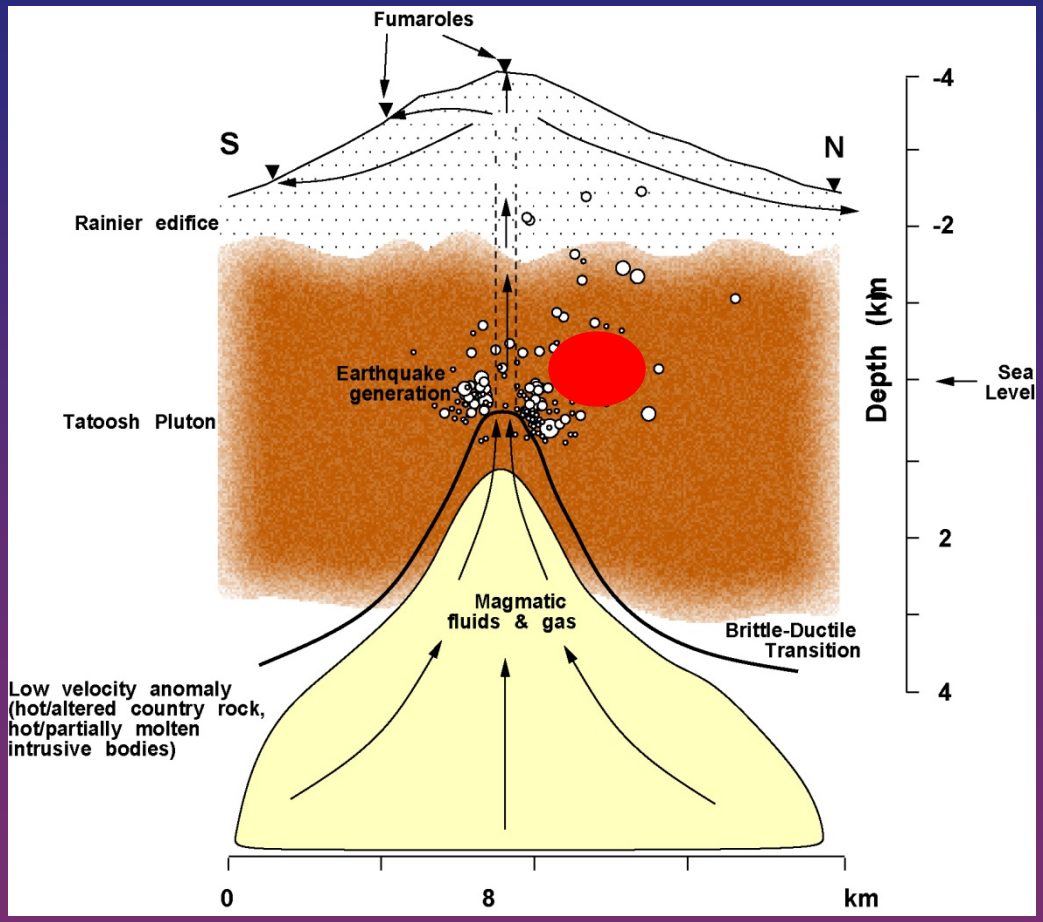
Magmatic system models & hazards

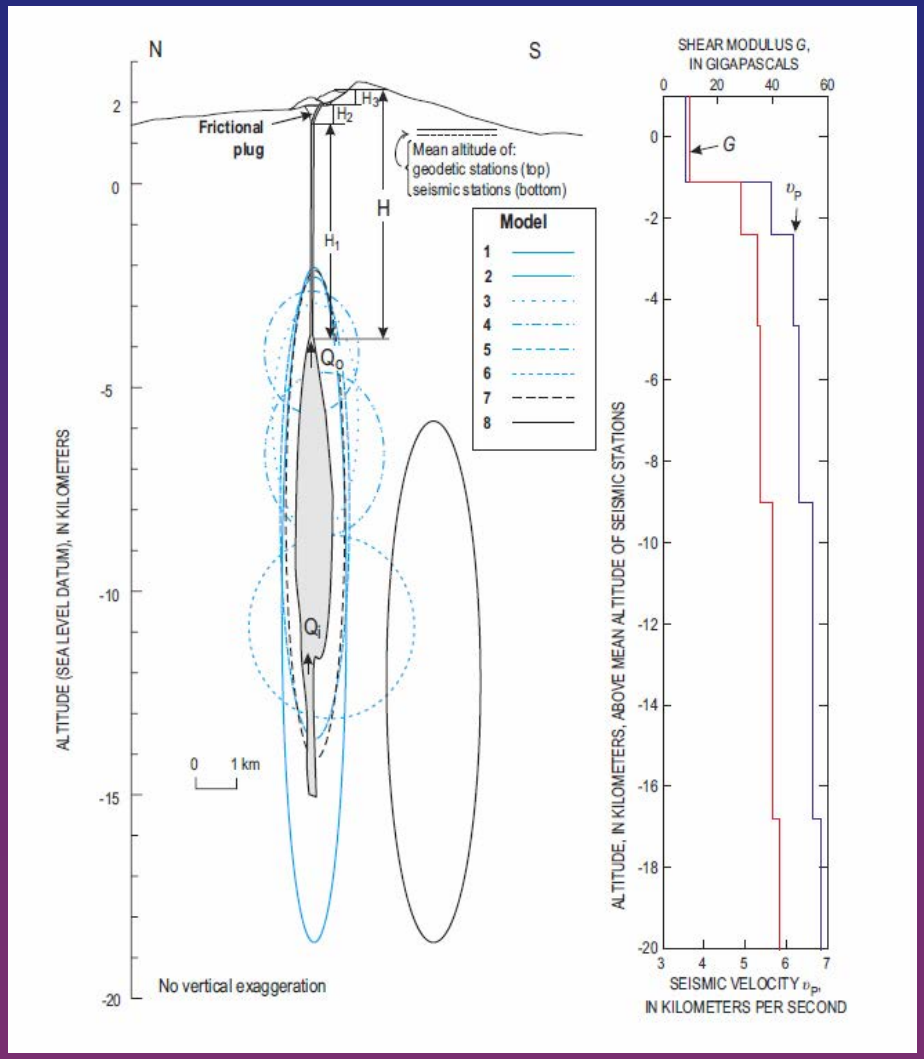
Mount Rainier
Seismic/geologic
model



modified from Moran et al., 2000

USGS

Magmatic system models & hazards



Answer is model dependent

Mastin et al., 2008

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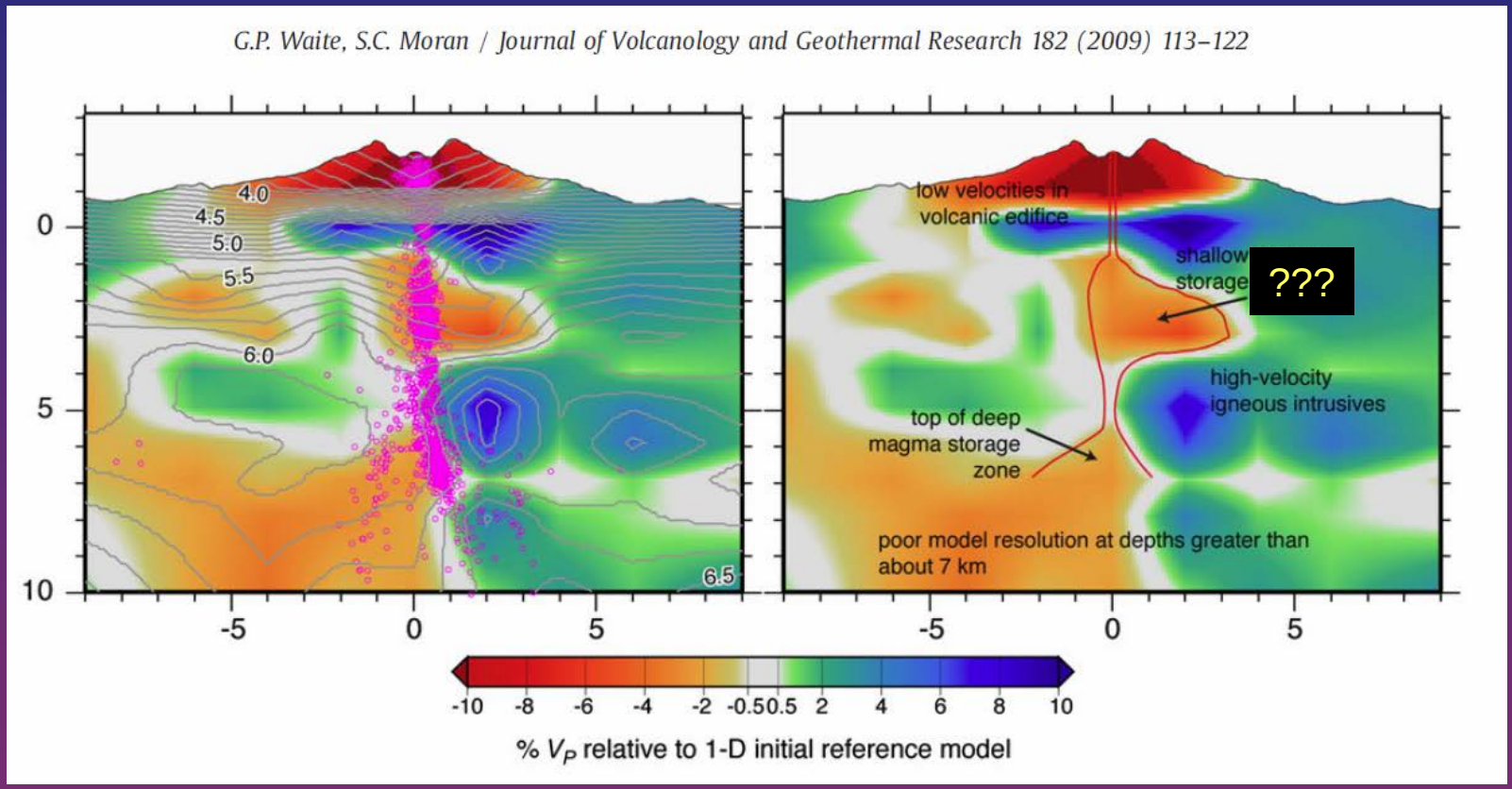
Magmatic system models & hazards



Waite and Moran, 2009

USGS

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   - ➔ *Reduces uncertainty during unrest*
2) *Provide starting point for detecting short-term changes in near-surface material properties (e.g., velocity, attenuation)*
3) *Deep LPs*

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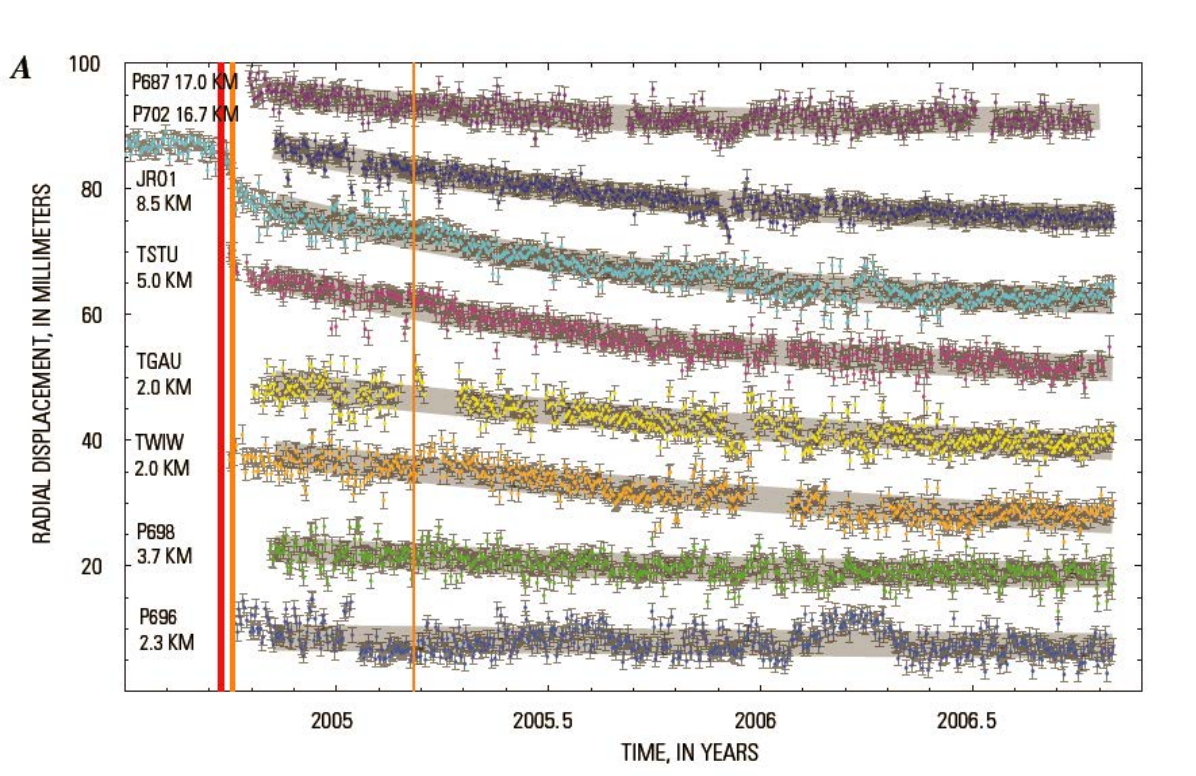
Magmatic system models & hazards

Mount St. Helens GPS data, 2004-2006

When will eruption end?



Lisowski et al., 2008

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