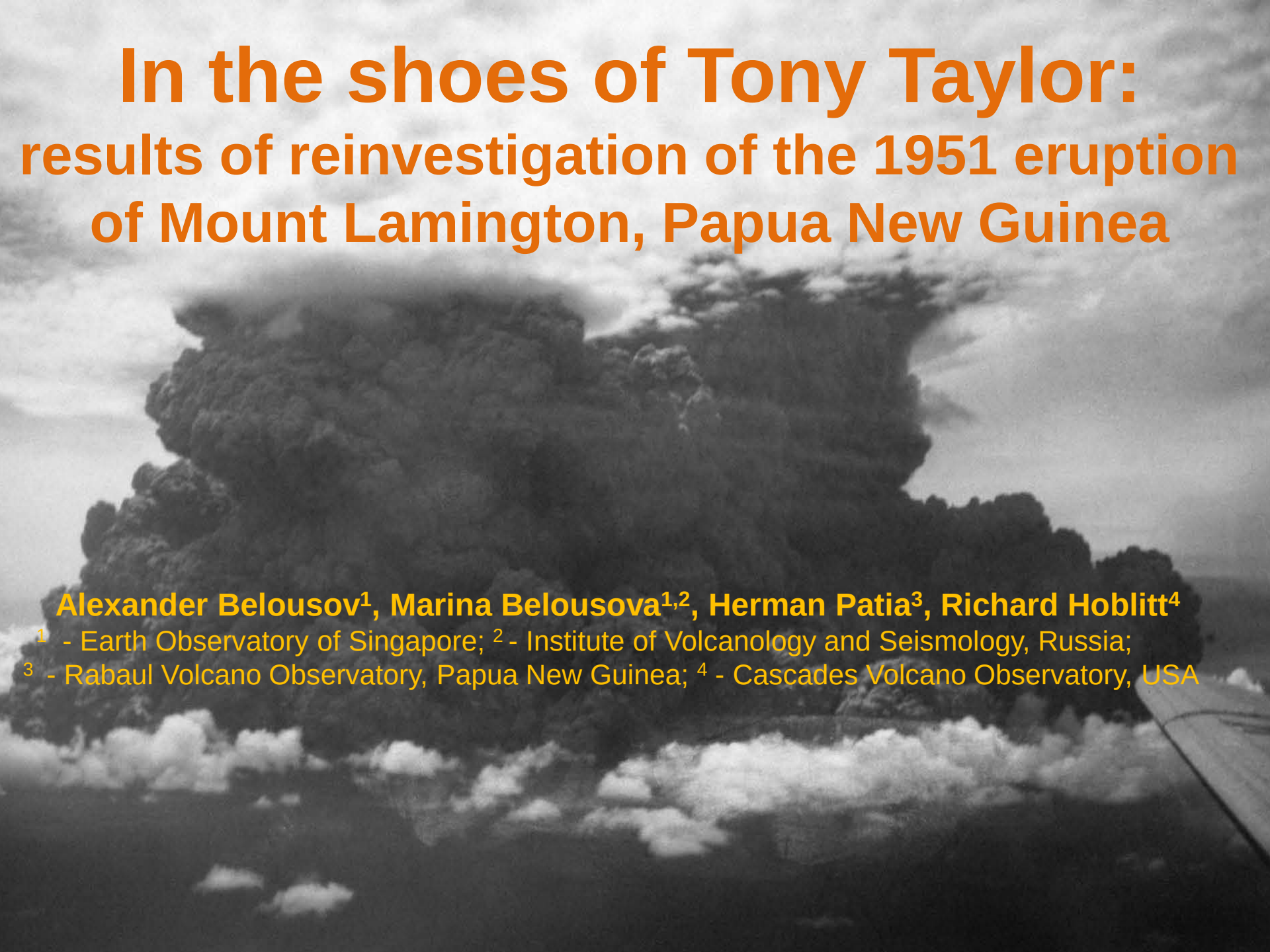
In the shoes of Tony Taylor:
results of reinvestigation of the 1951 eruption of Mount Lamington, Papua New Guinea



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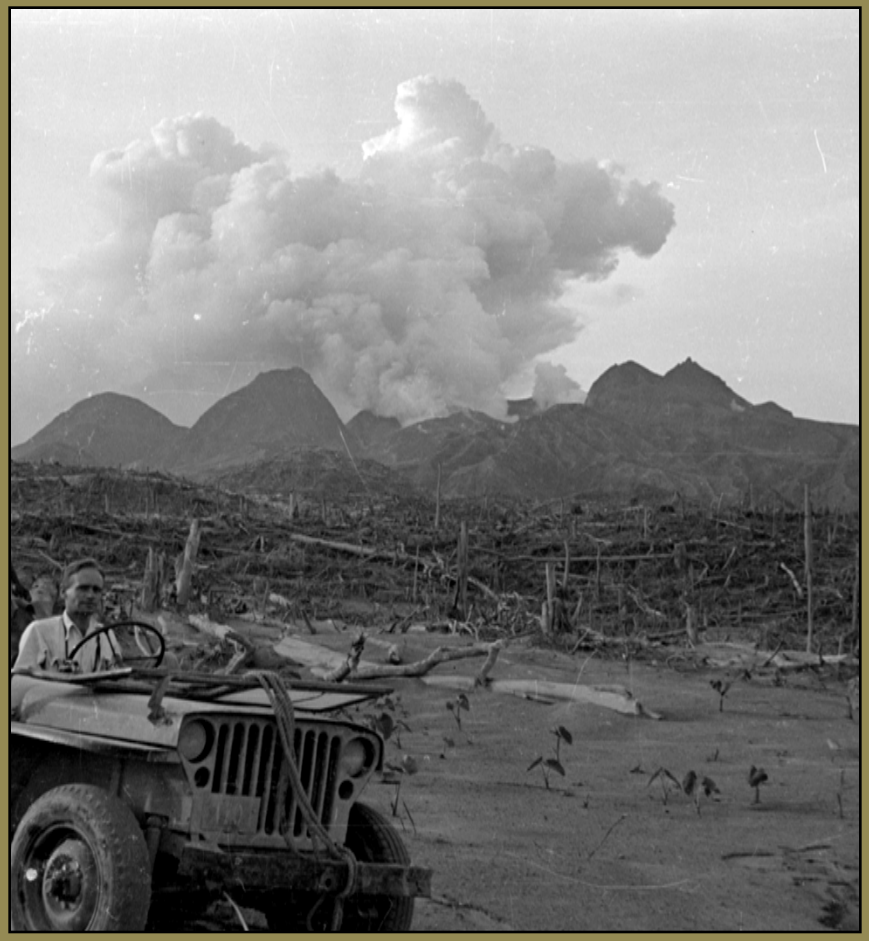
The 1951 eruption

Studied by Tony Taylor (1958)

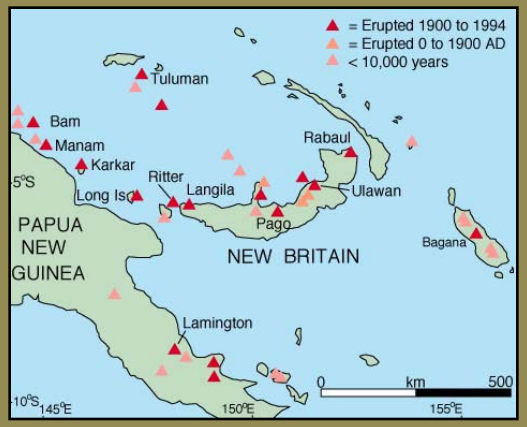


Old photos courtesy of National Library of Australia

Pre-climactic: strong seismicity, ground deformations, weak-moderate explosive activity (1 week)

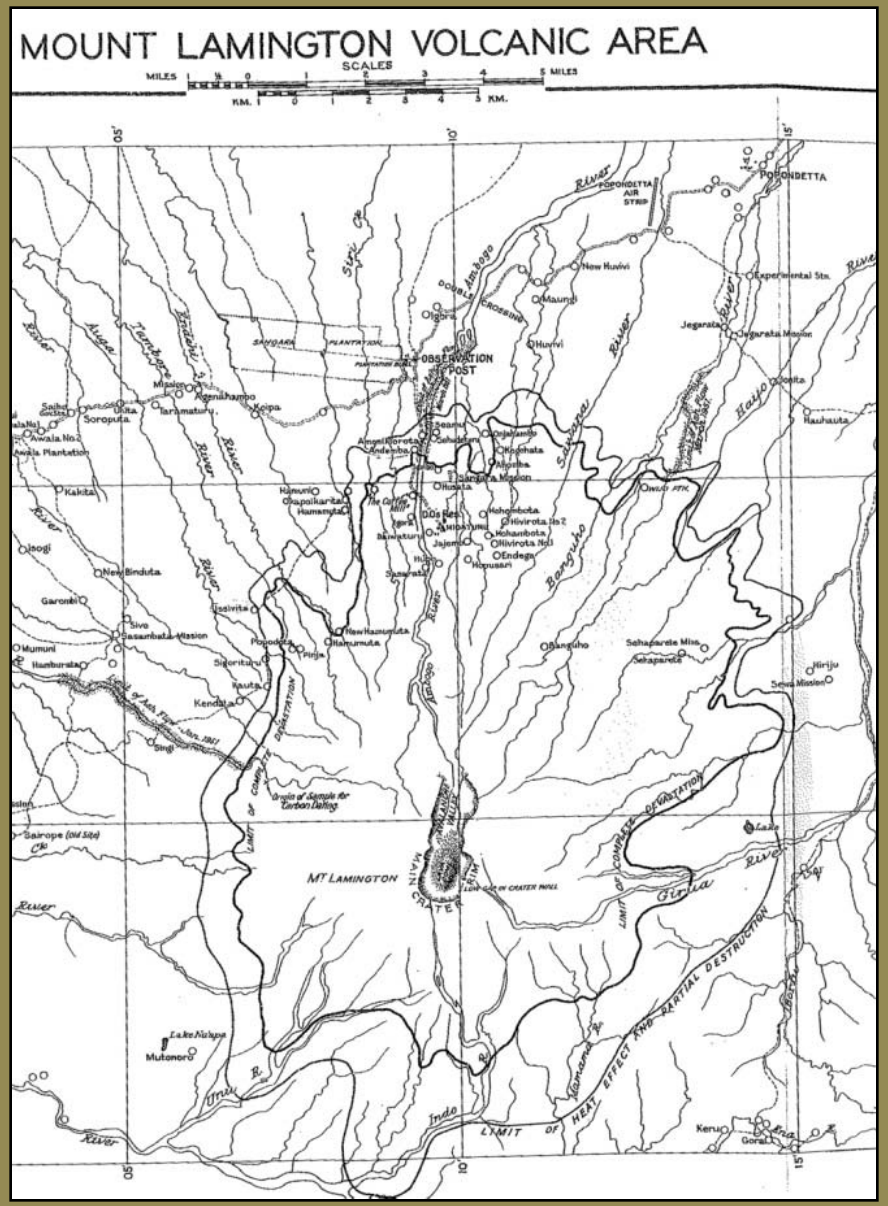
Climactic**:** On January 21 VEI 4 explosive Pelean type eruption

Post-climactic: Dome growth and weak-moderate explosive activity (>2 years)



The January 21, 1951 PDC

Devastated area 230 km²

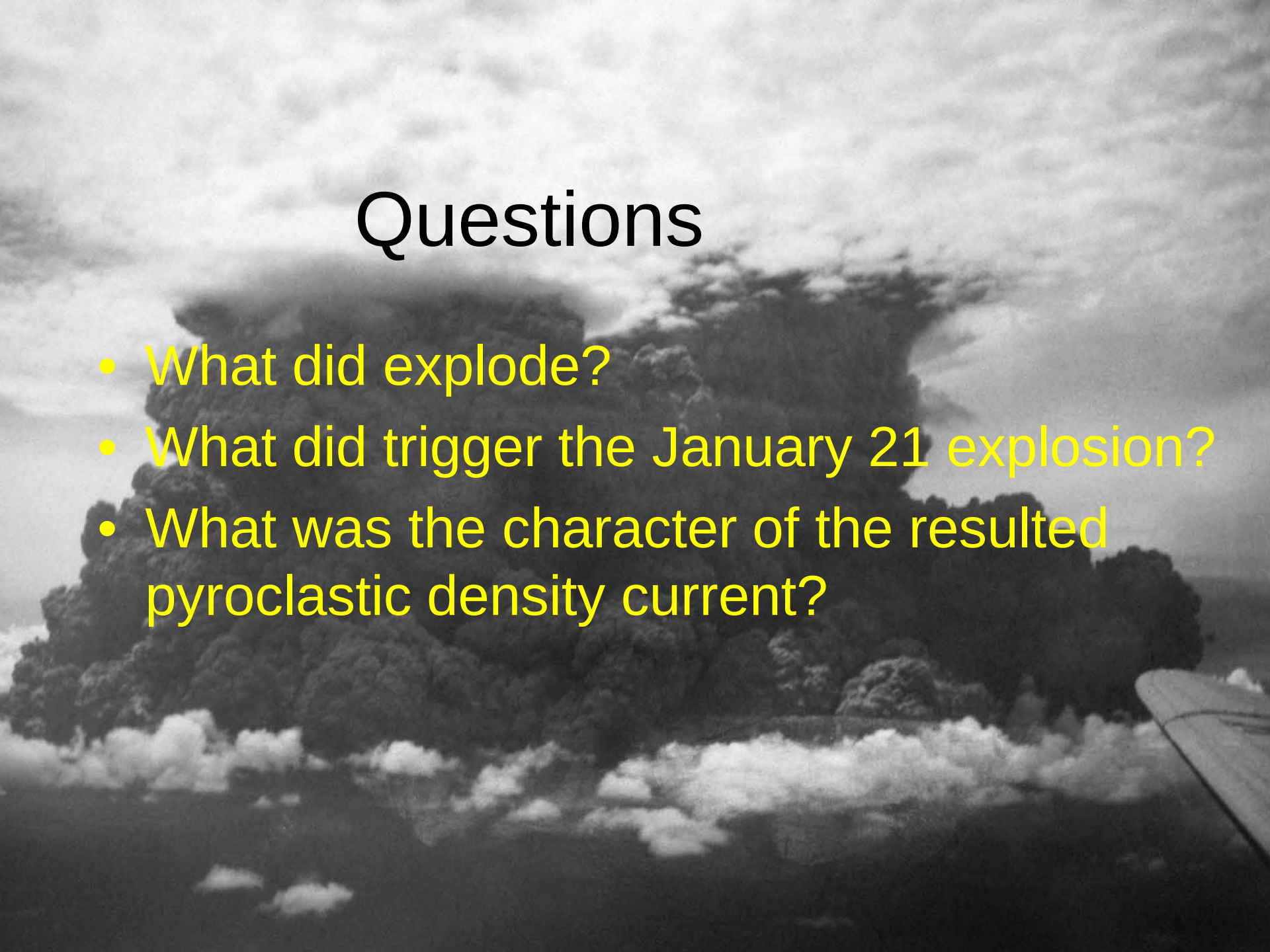


Devastated:

province capital Higaturu

and 16 villages;

~ 3500 casualties



Questions

- What did explode?
- What did trigger the January 21 explosion?
- What was the character of the resulted pyroclastic density current?

Cryptodome/dome intrusion during the pre-climactic stage

January 18, 1951:

"By midday …. a large hill built itself up between the hills at the foot of Lamington and the mountains in the rear. It was from the top of this hill that the ash was now issuing in terrific force, and flowing over the sides was a steamy white cloud which we could not distinguish even with a telescope, but it did not come more than about a third of the way down the newly built hill."

Mrs. Cowley

Taylor, 1958

What did explode?

Post-1951 dome

1982

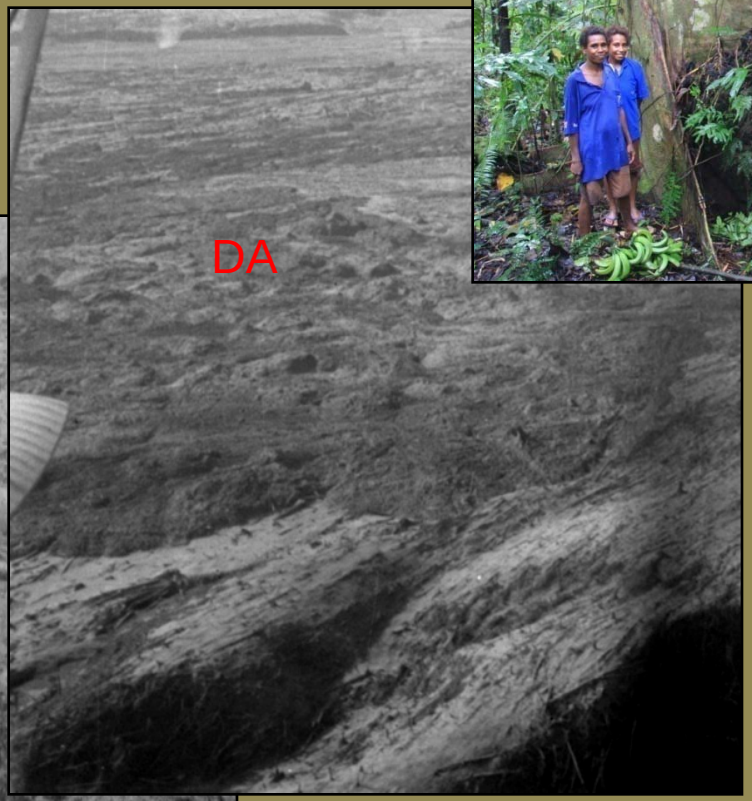
Did the edifice of the volcano collapse?

The 1951 debris avalanche

V = 0.02-0.04 km³

L = 8.5 km

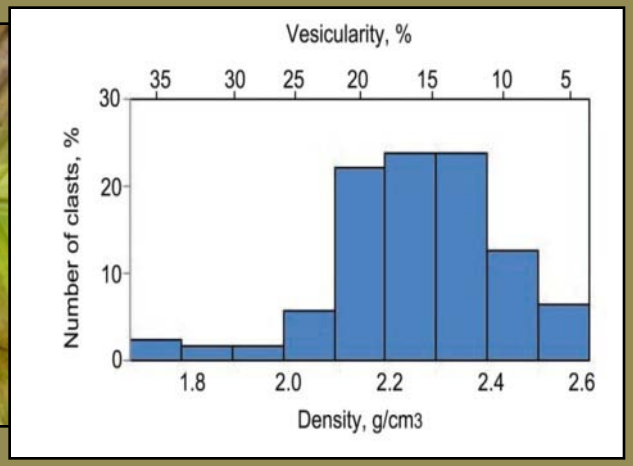
H/L = 0.14

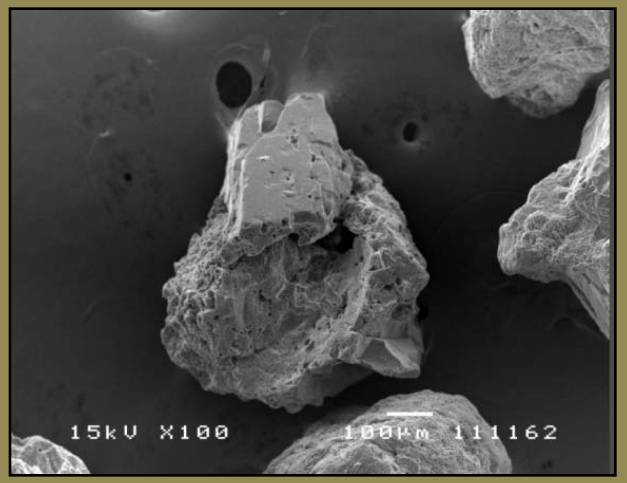


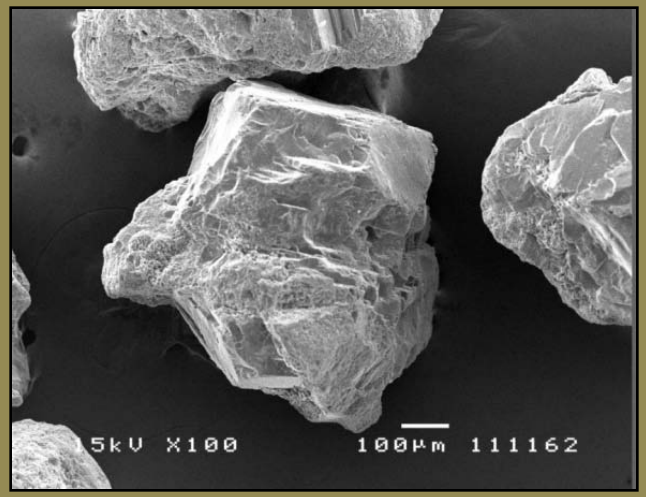
The 1951 debris avalanche deposit discovered on the old aerial photography

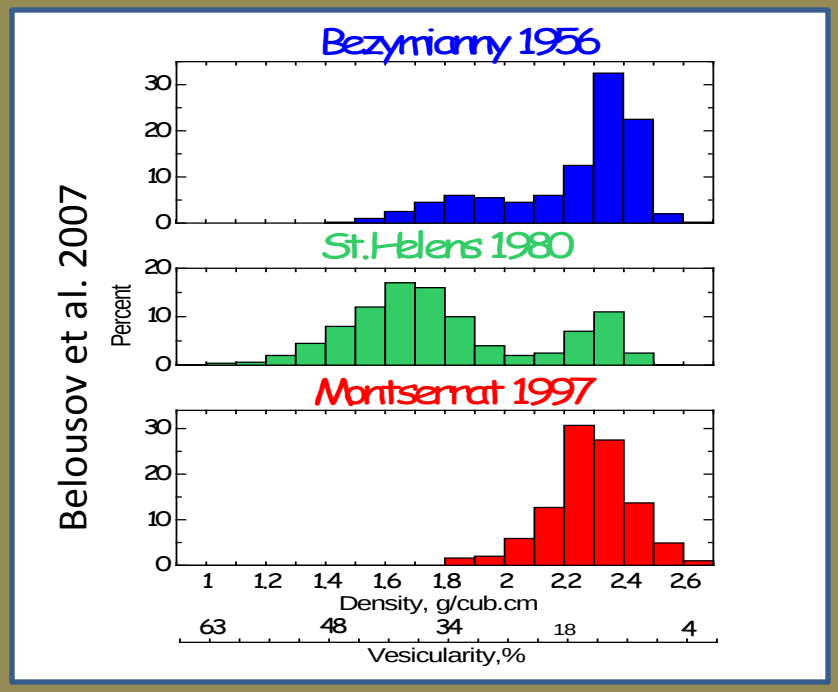
Erupted material

Juvenile particles >80%
(poorly vesiculated andesite)









The erupted magma was poorly vesiculated – comparable to the 1997 blast of Montserrat

What was the character of the resulted pyroclastic density current?

Location of points of detailed investigation

The 1951 PDC stratigraphy

One normally-graded/multiply-graded layer

Lower part contains admixture of the substrate (soil)

Layering common for deposits of directed blasts is not well-developed in the deposit of Mount Lamington.

Proximal

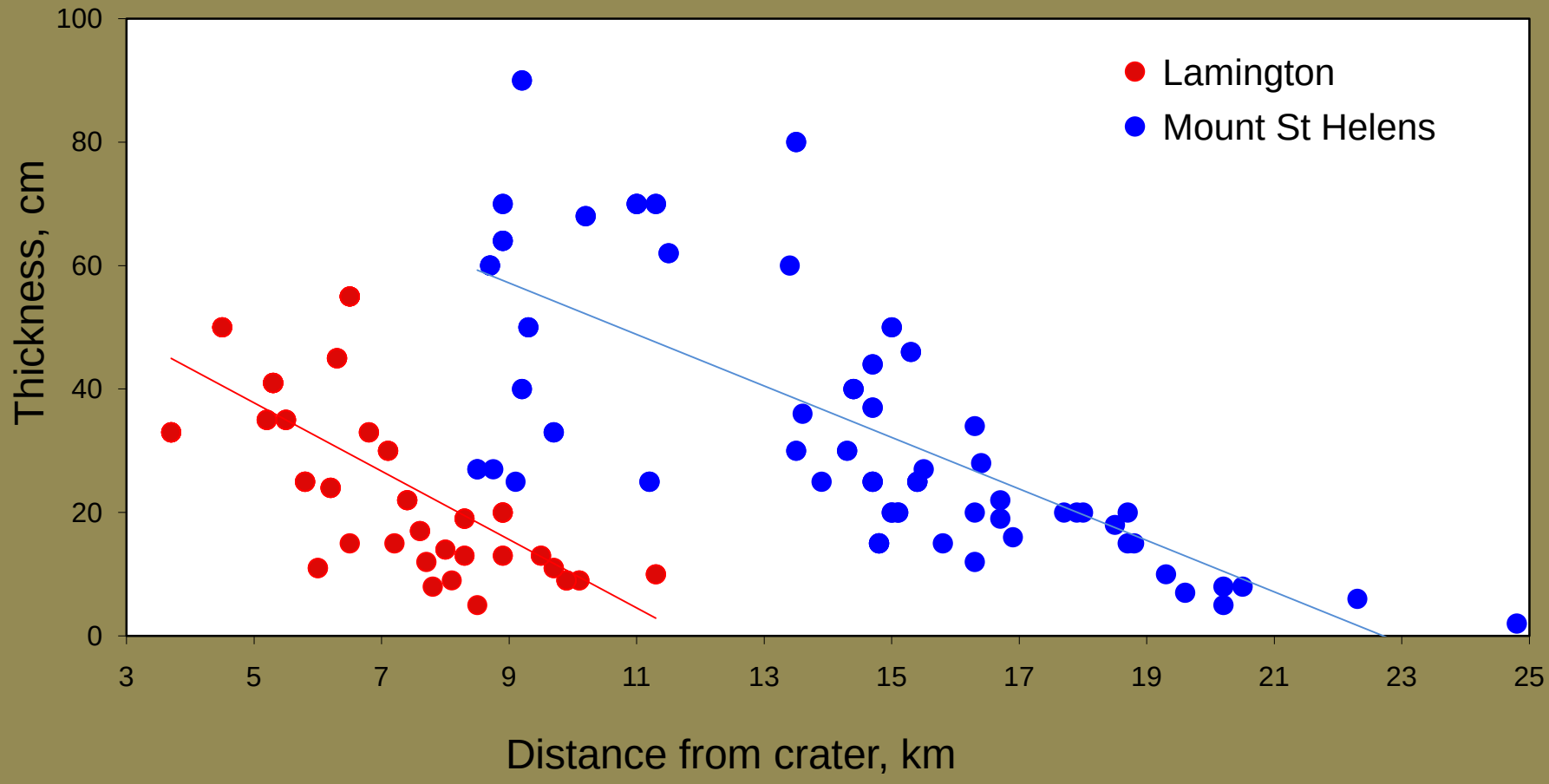
Medial

St. Helens

Distal

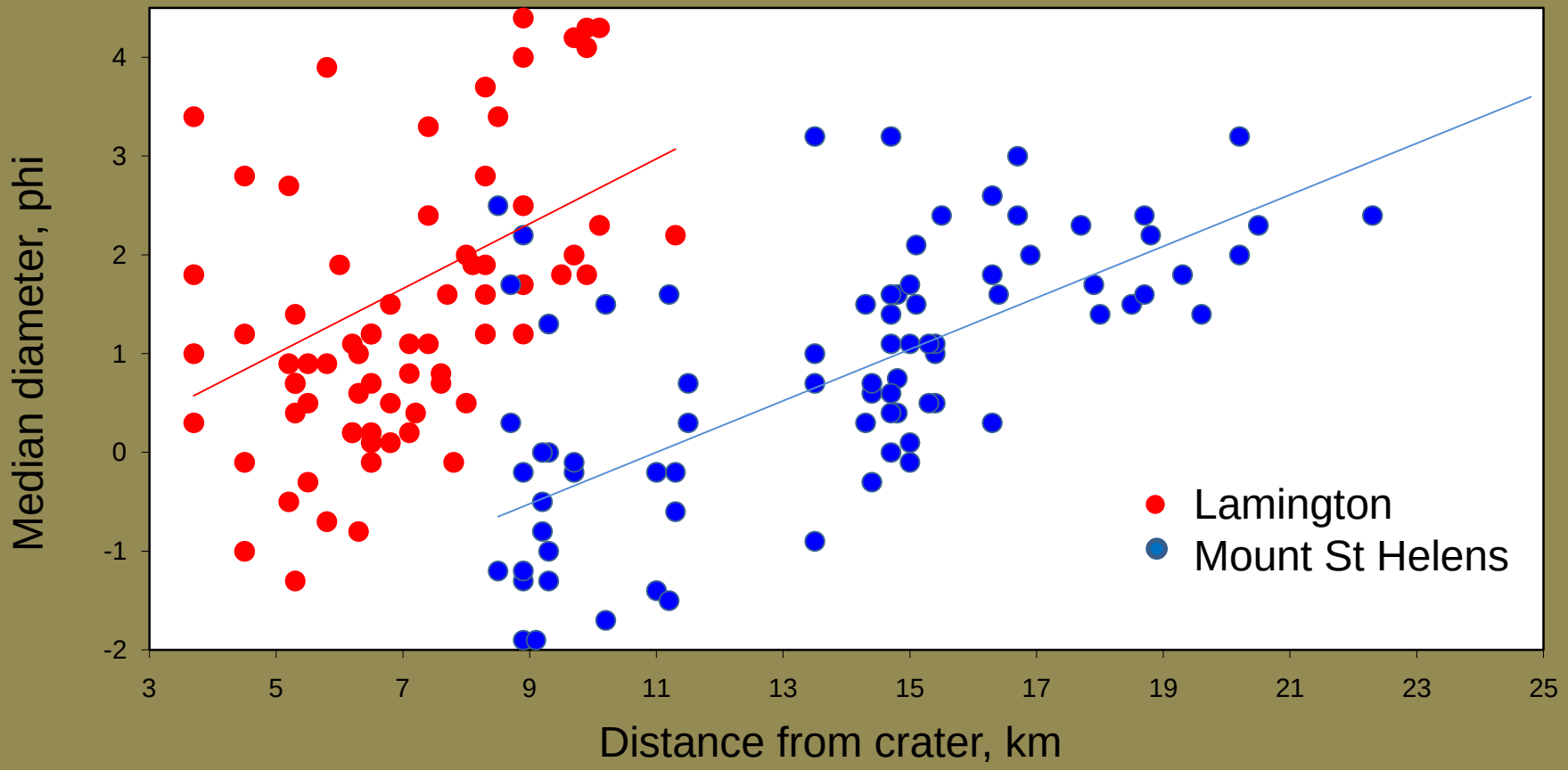
The 1951 PDC of Mount Lamington

Thickness/distance



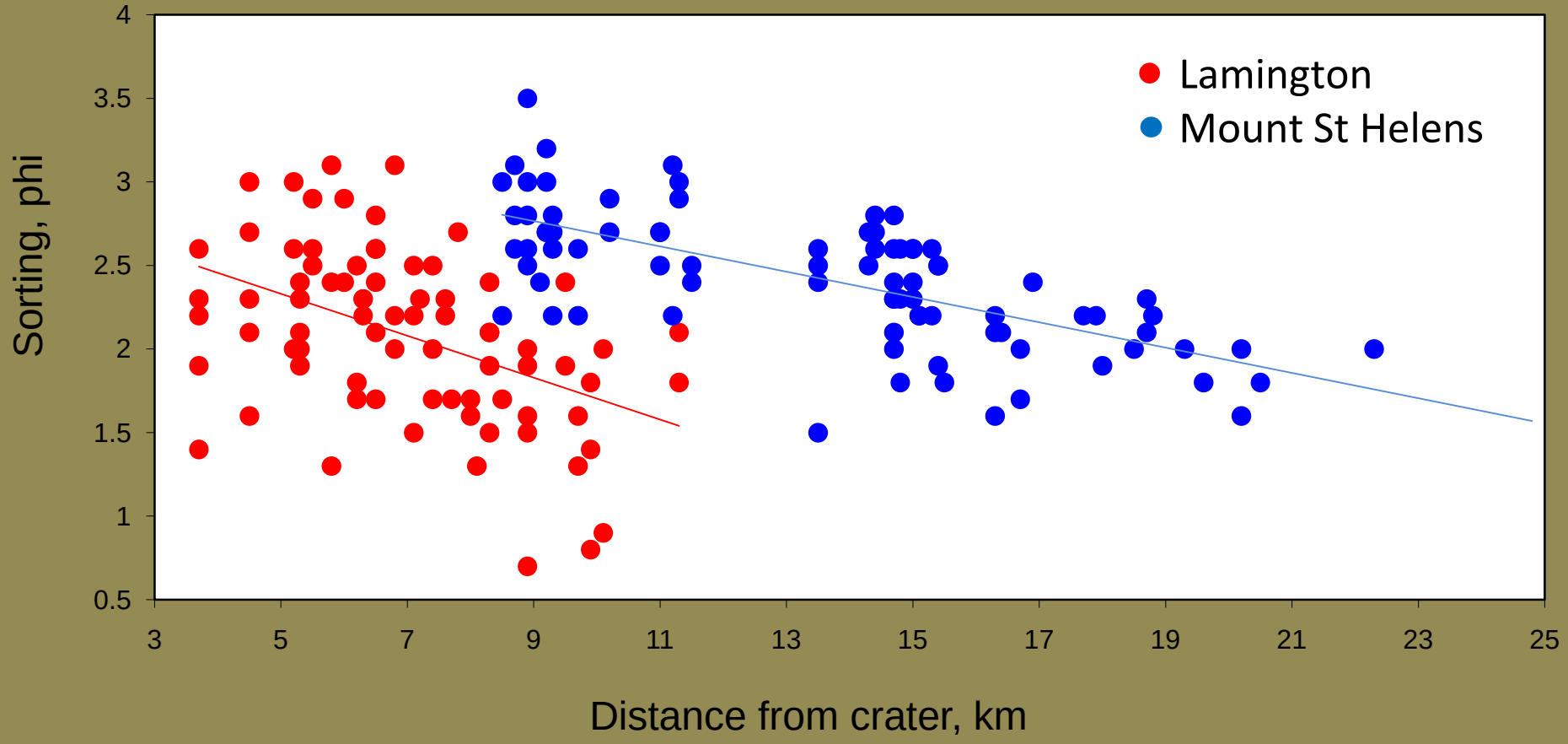
The 1951 PDC of Mount Lamington

Median diameter/distance



The 1951 PDC of Mount Lamington

Sorting/distance



Lamington vs. St. Helens

More symmetric area of devastation and less pronounced layering of the deposit

Why?

Mount Lamington, 1951

Mount St. Helens, 1980

The blast cloud of Lamington first ascended vertically before collapsing and producing a PDC.
More dilute PDC?

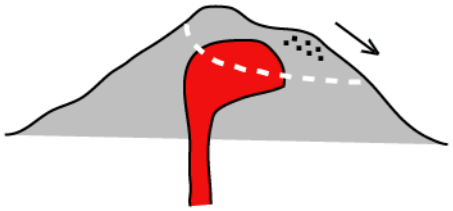
Position of magma

in the moment of failure

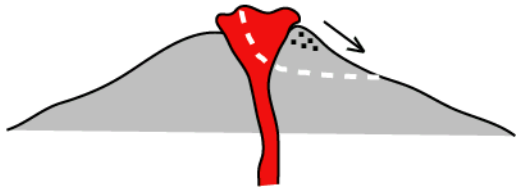
Blast

Bezymianny 1956

Mount St.Helens 1980



Soufriere Hills, Montserrat 1997



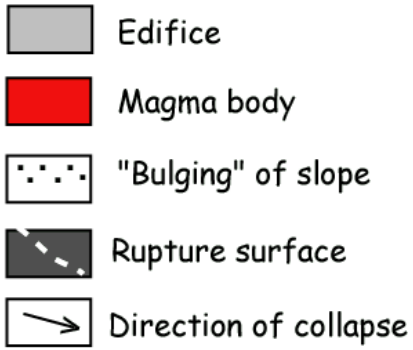
Failure surface intercepts magma

No blast

Harimkotan 1933
Shiveluch 1964

Failure surface does not intercept magma

Lamington?



Belousov et al. 2007

Conclusions

- Scenario of the 1951 eruption of Mount Lamington (cryptodome intrusion/edifice failure/blast), as well as the PDC dynamics are similar to those of directed blasts.
- The existing differences (more symmetric area of devastation and less pronounced layering of the blast deposit) we attribute to the fact that the Lamington blast cloud first ascended vertically before collapsing and producing a PDC. Consequently the PDC of Lamington ingested more air and was more dilute than the “classic” blast-generated PDCs.

Thank you!