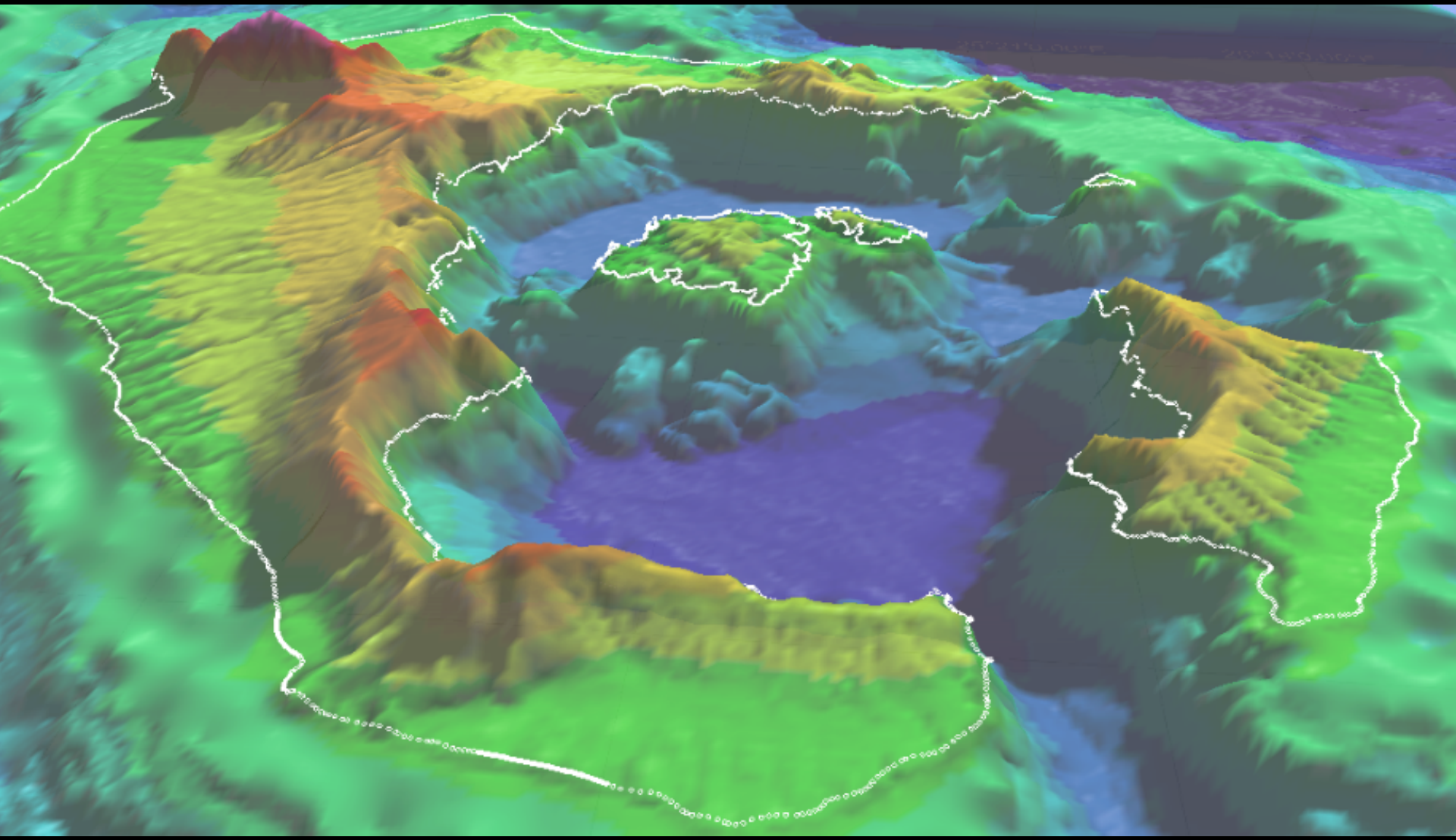
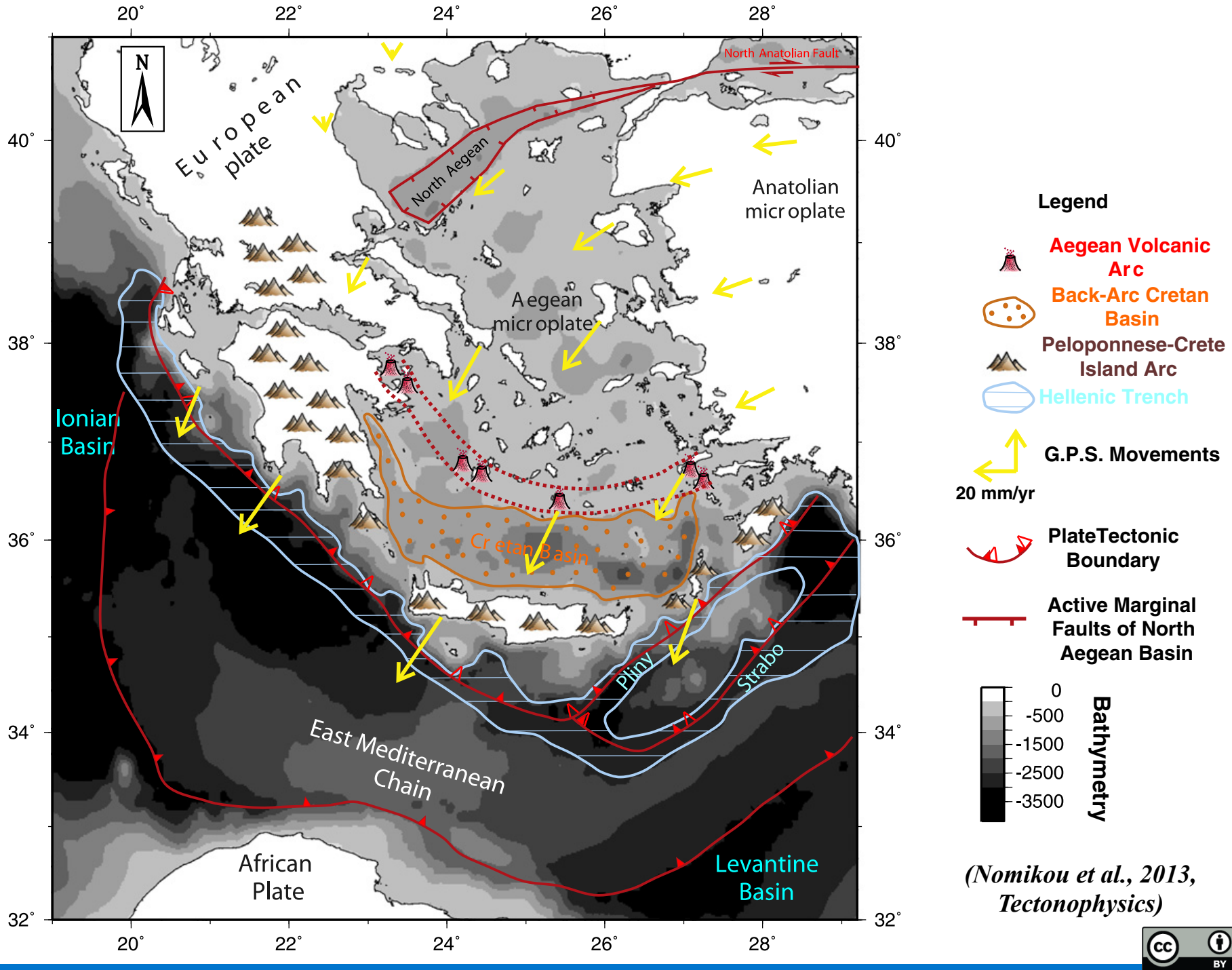


P. Nomikou, T.H. Druitt, C. Hübscher, T.A. Mather, M. Paulatto, L.M. Kalnins, K. Kelfoun, D. Papanikolaou, K. Bejelou, D. Lampridou, D.M. Pyle, S. Carey, A.B. Watts, B. Weiß, M.M. Parks

Post-eruptive flooding of Santorini caldera and implications for tsunami generation



(Nomikou et al., 2013, Tectonophysics)

The Minoan Eruption

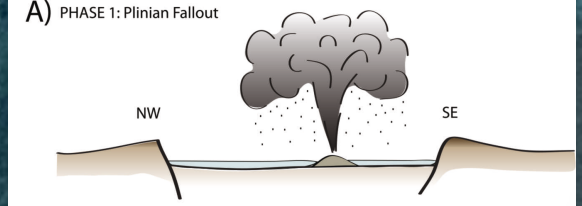
- **~1610 BC in** Late Bronze Age.
- One of largest **plinian** eruptions in younger time, followed by caldera collapse
  - Height of eruption column **~36-39 km** (Pyle, 1990), estimated **VEI of 6**.
  - Caldera collapse volume **~55 km³** (Sigurdsson et al., 2006)
  - Eruption deposit volume **78–86 km³**, => **largest known Holocene eruption** (Johnston et al., 2014)
- Seismic surveys show sediment sequence on the ocean floor around Santorini is generally massive or chaotic
  - Typical of submarine pyroclastic flow deposits

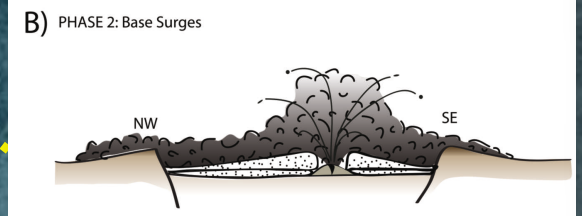
The Minoan eruption

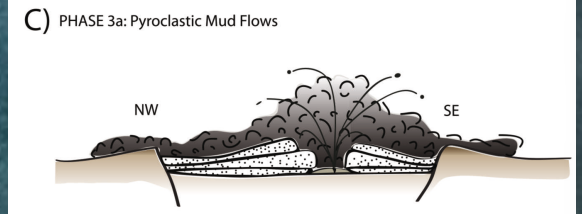
Phase 1

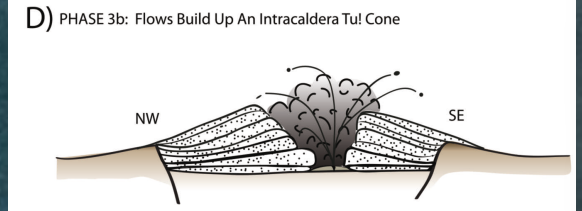
Phases 2,3

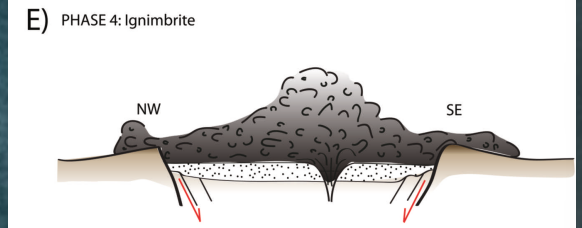
Phase 4

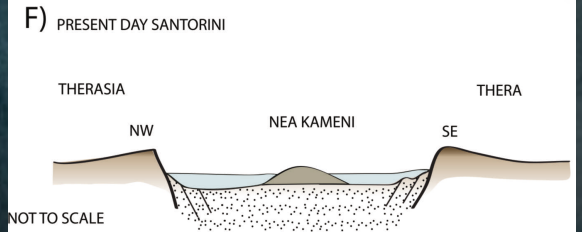




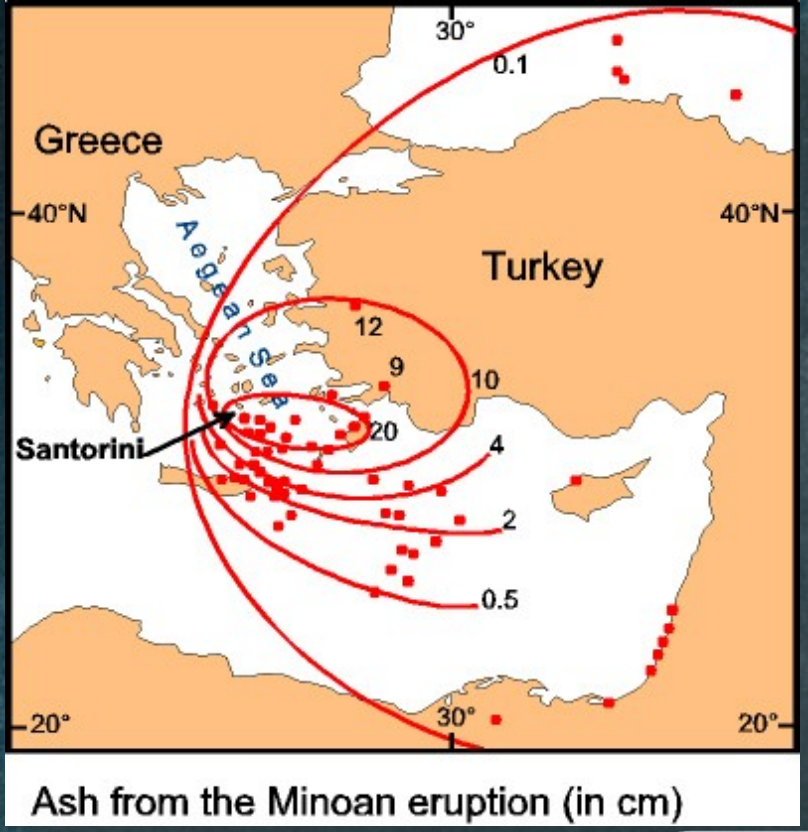




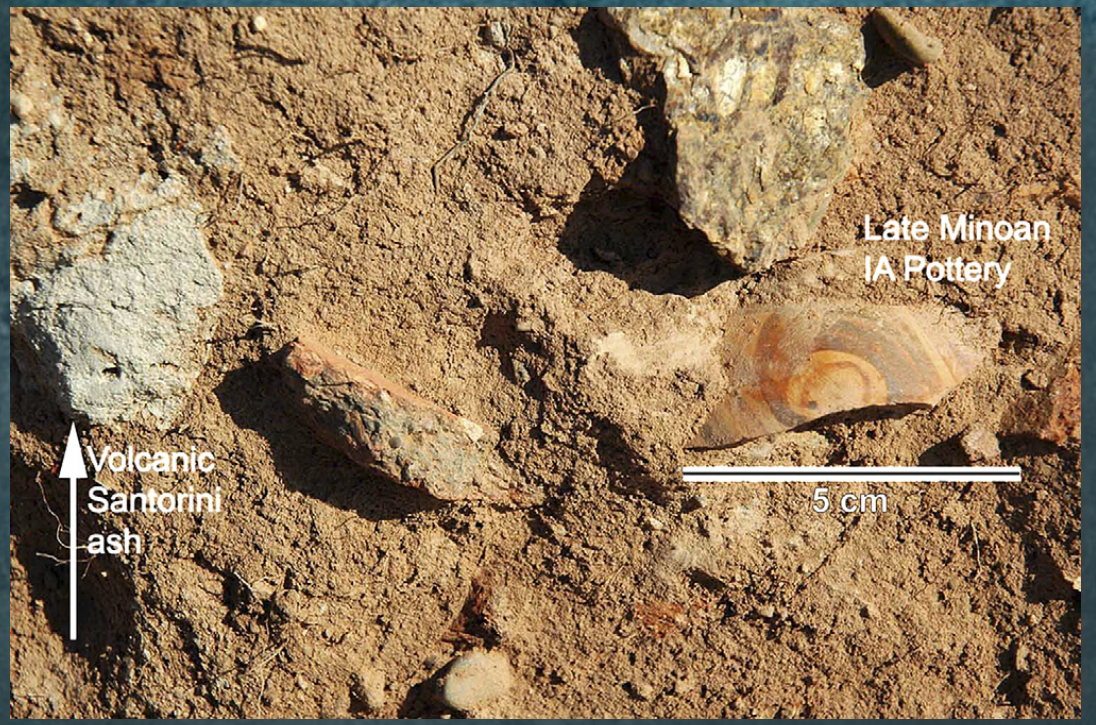




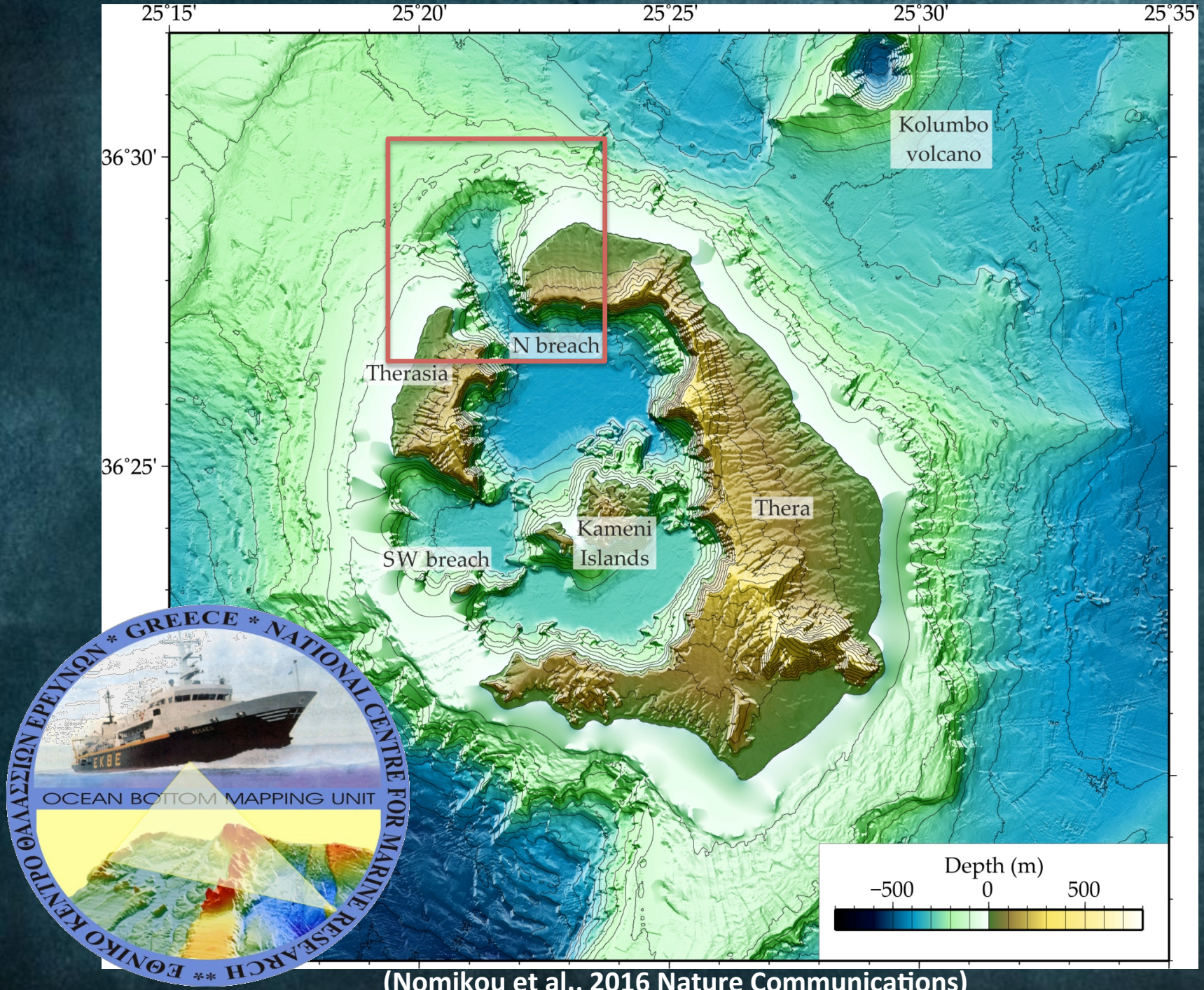
(Druitt, 2014)
(Johnston et al., 2014)



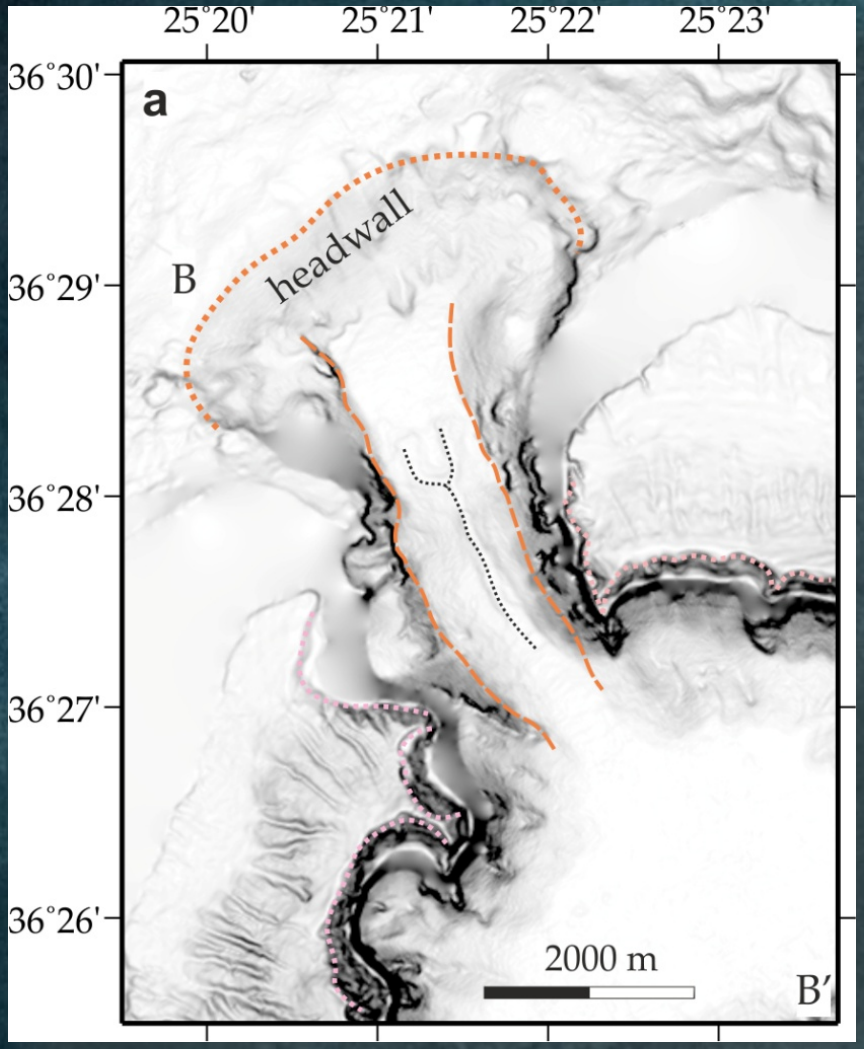
Ash from the Minoan eruption (in cm)

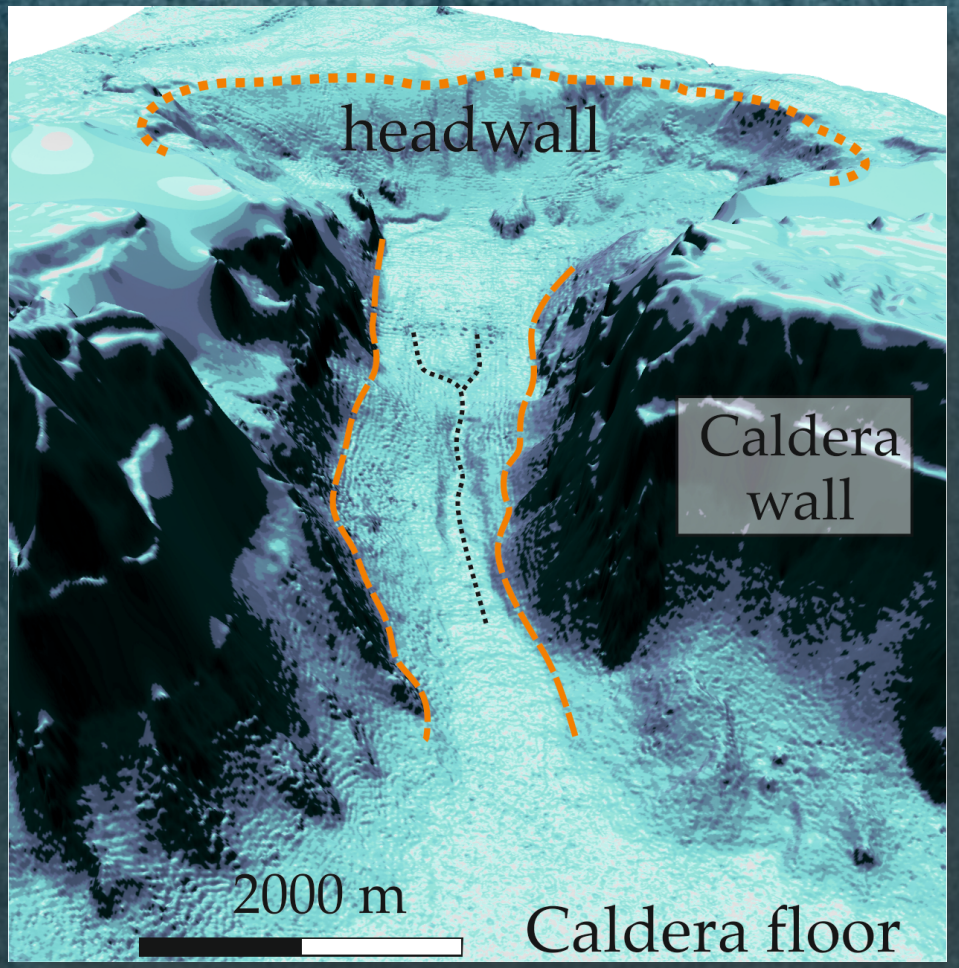


Geoarchaeological tsunami deposits at Palaiokastro (Crete) (Bruins et al., 2008)



(Nomikou et al., 2016 Nature Communications)

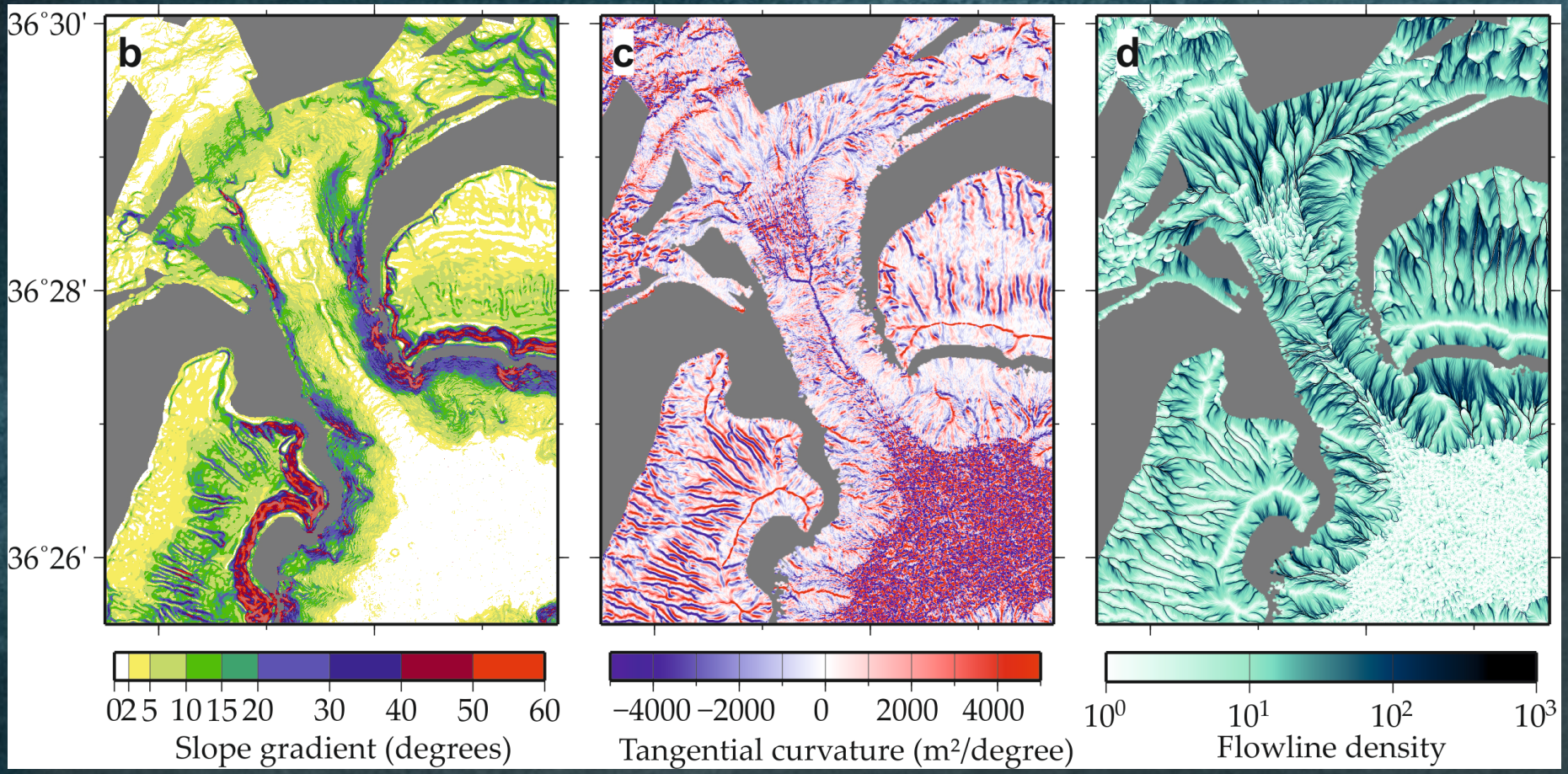




(Nomikou et al., 2016, Nature Communications)

North breach:

- 3 km long, 1 km wide, steep-sided U-shaped channel
- Broad, arcuate headwall up to 3 km wide
- Y-shaped drainage incised into main channel

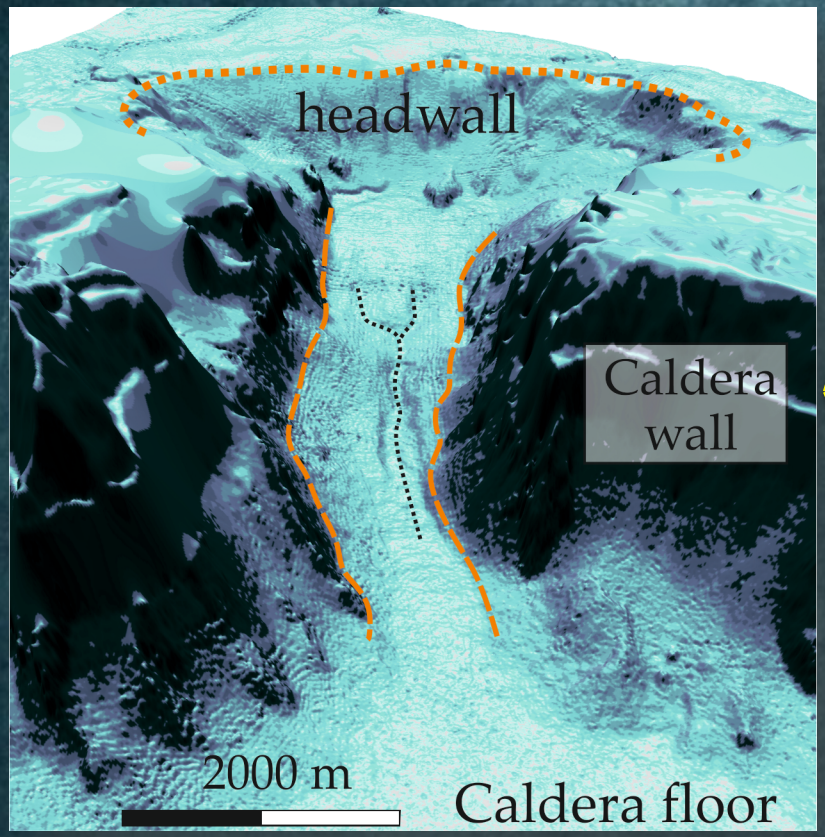


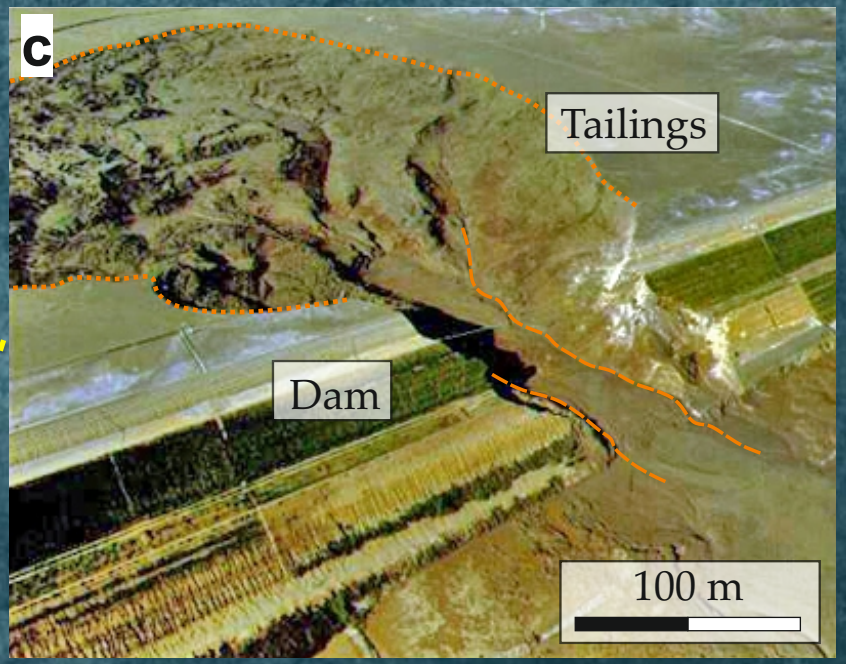
(Nomikou et al., 2016, Nature Communications)

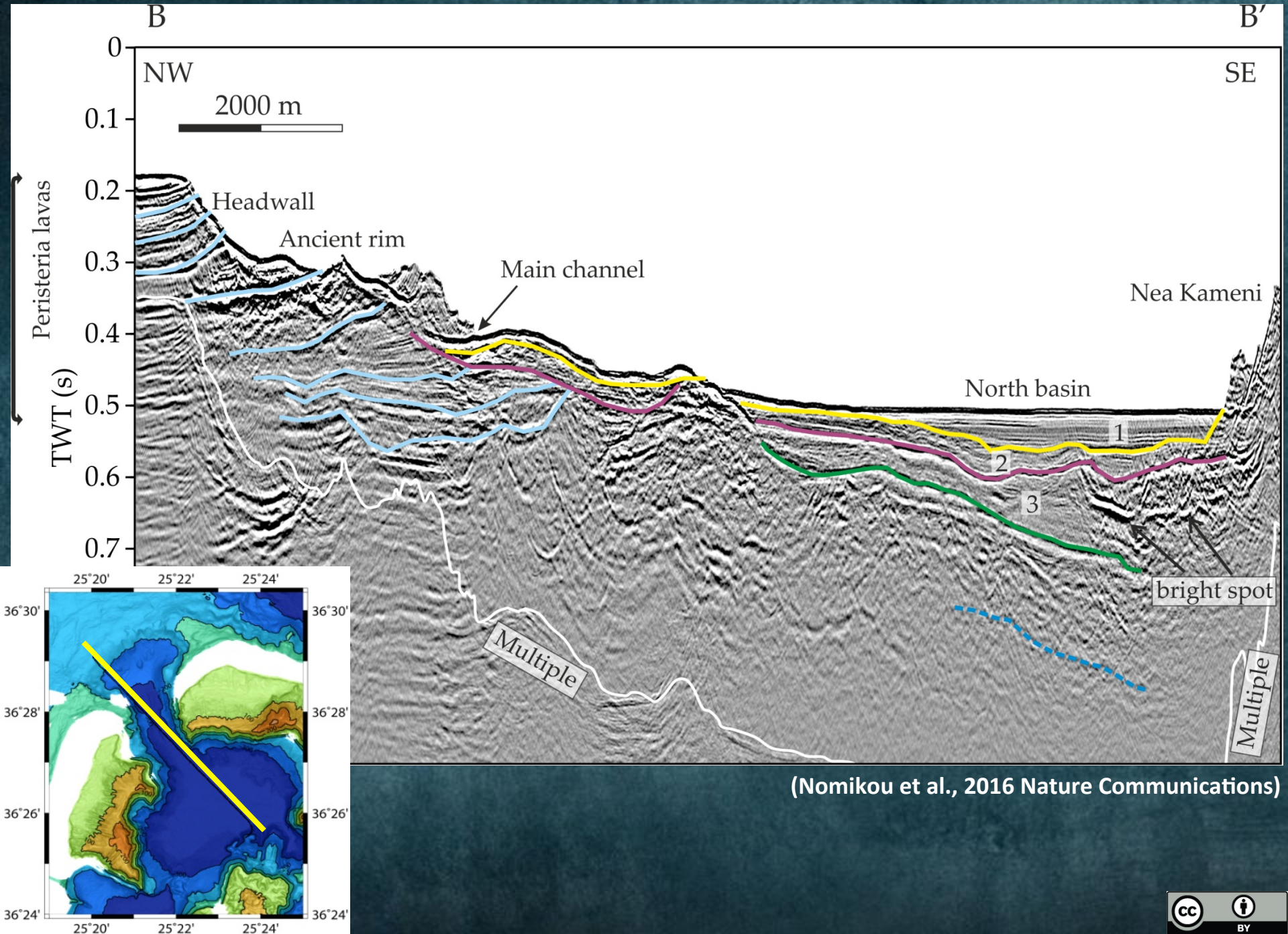
North breach:

- 3 km long, 1 km wide, steep-sided U-shaped channel
- Broad, arcuate headwall up to 3 km wide
- Y-shaped drainage incised into main channel

Strikingly similar erosive feature resulting from catastrophic failure of a dam (Virginia, South Africa)







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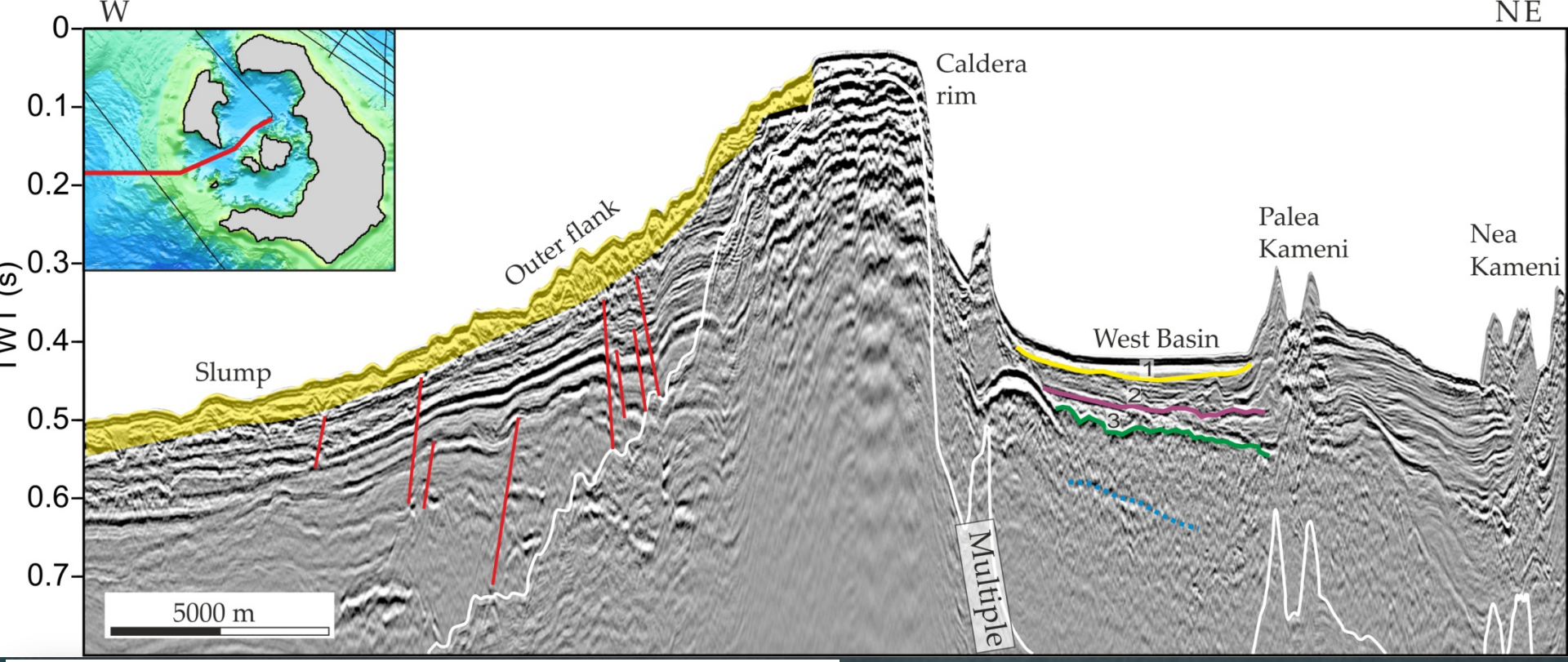
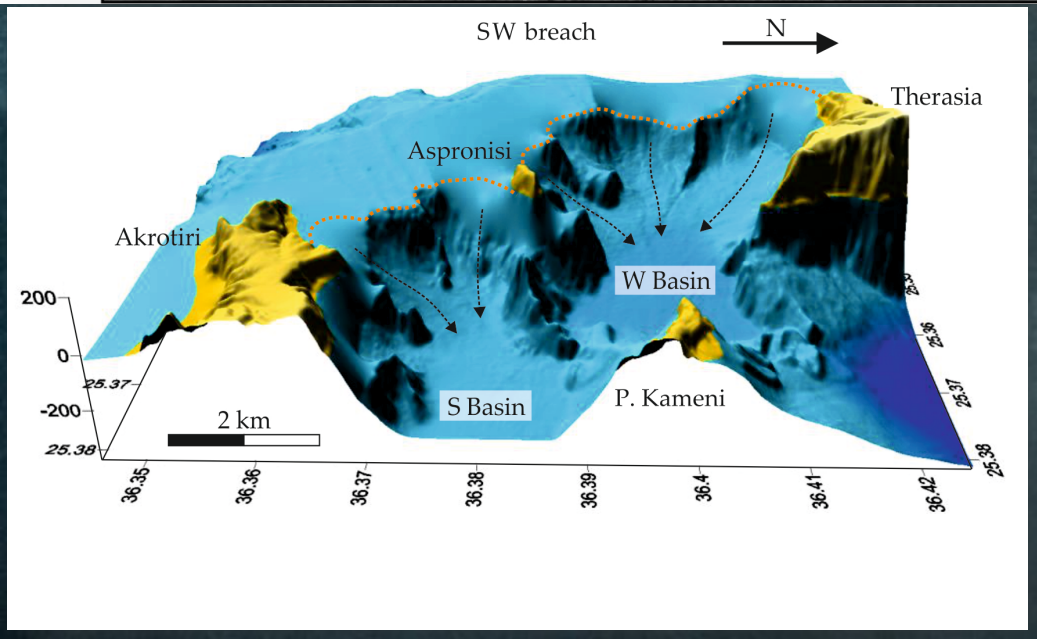
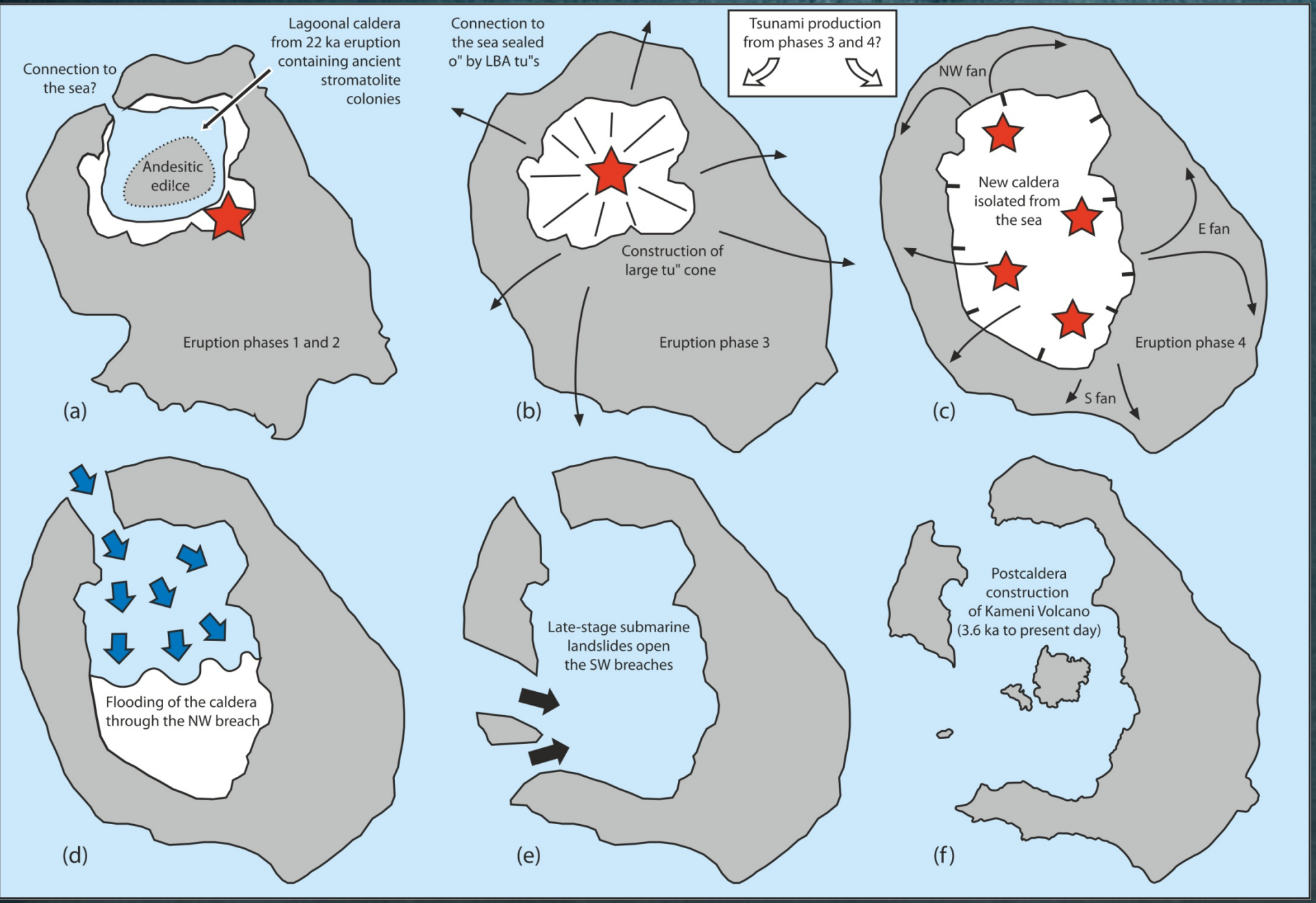




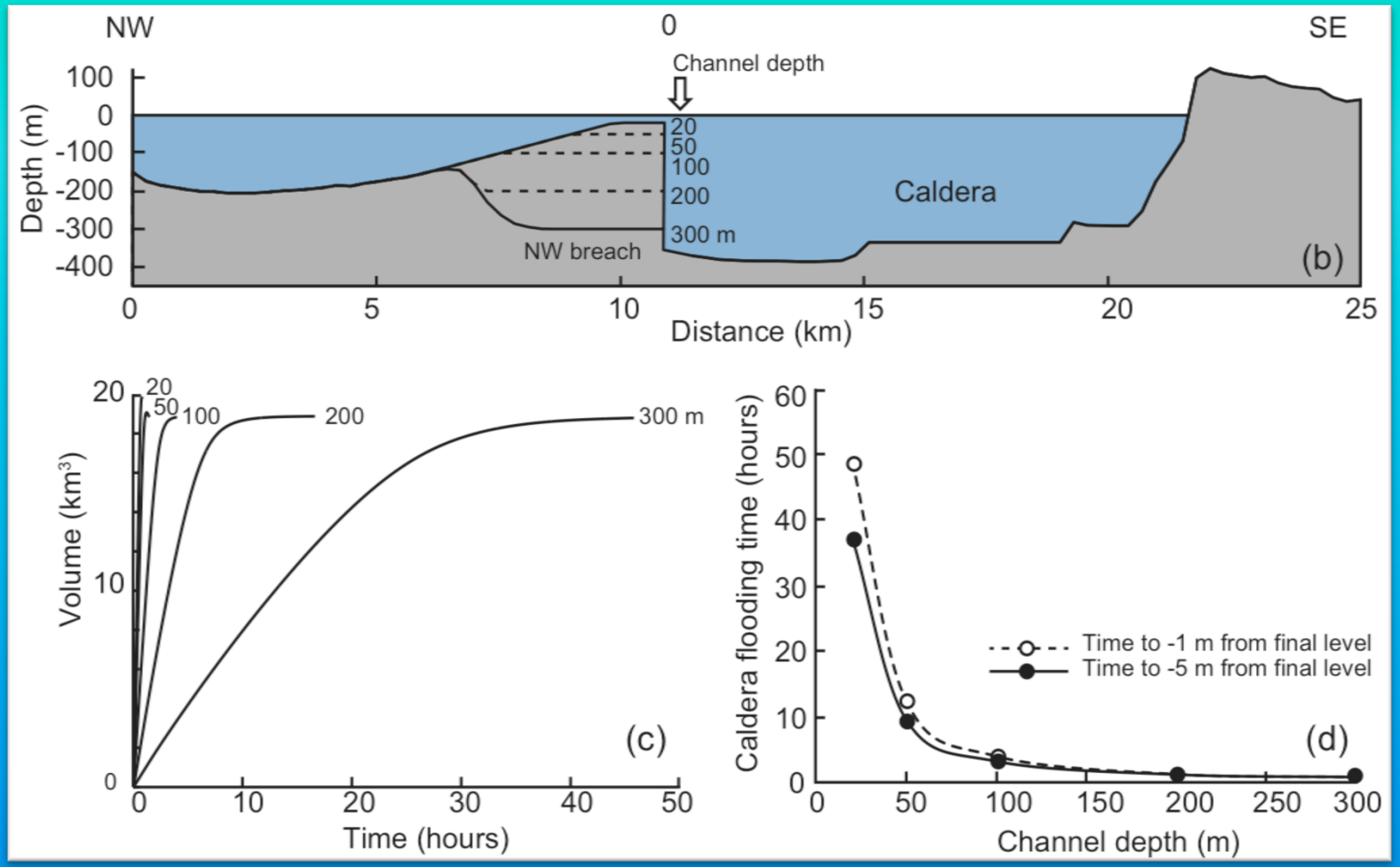
SW breach:

- Morphologically fresh
  - Little secondary slumping or drainage
- Headwalls steeper than N breach
  - Landslide scars with well preserved headwalls and intervening septa.



(Nomikou et al., 2016 Nature Communications)

Numerical modelling of flooding



- Could have generated large waves inside the caldera (with run-ups up to ~200 m)
- No significant (amplitude <~10 m) waves outside the caldera
- Need alternative source for Minoan tsunami: pyroclastic flows and slumping

Summary

- Santorini and the Minoan eruption (Late Bronze Age)
- New results combining Lidar, geological mapping, high resolution bathymetry, and marine seismic surveys
- Evidence for dry caldera collapse, followed by catastrophic dam failure and flooding
  - Dry collapse can't be tsunamigenic
  - Pyroclastic flows could have caused Minoan tsunami

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Post-eruptive flooding of Santorini caldera and implications for tsunami generation

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The New York Times

"An Ancient Tsunami That Ended a Civilization Gets Another Look"

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What triggered tsunamis that demolished Bronze-Age civilization?

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