**Samalas Unorganised Notes**

(Guillet et al., 2017)

* Largest Sulphur rich eruption of the common era
* Eruption magnitude and VEI of 7
* >40km3 of dense magma was expelled during the eruption
* Eruption column estimated to have reached altitudes of 43km
* But climate models tend to overpredict NH surface air cooling compared to proxy records
* Historical archives: Mediaeval texts attest to significant and widespread climate anomlalies over western Europe in the spring-autumn of 1258. Report cold, excessive rainfall, and cloudiness (impact on agriculture 🡪 Grape Harvest dates significantly delayed (1-2 weeks later than after Tambora). But doesn’t account for change in grape varieties/agricultural practices. In Germany *Annals of Speyer* refer to 1258 as *munkeliar* (dark year) suggesting dense dust veil. In England (Chronicle of John de Taxster) and Italy (Annales Ianuenses) a very dark lunar eclipse is also recorded for 1258. In Japan, *Mirror of the East* reports a wet, cold summer accompanied by heavy rainfall and strong winds. But contemporary sources limited beyond Europe.
* Use tree-ring network to show average surface cooling of -0.7C in 1258 and -1.2C in 1259.
* Use tree-ring network and ice core δ18O records to determine heterogeneity of NH summer cooling: cooling of -1.4 to -2C over Siberia and western Europe (associated with frost rings). In contrast in Quebec, Alaska, and Scandinavia cooling is limited – suggests internal climate variability outweighed volcanic forcing. Warm anomalies in Alaska (+0.3C) could be due to positive ENSO phase (El Nino likely to occur 1-2 years after an eruption). El Nino conditions inferred from tree-ring and sediment proxies for 1258/59.
* All sources agree on reduction in climate anomalies by 1260-61 (disagrees with models that exclude aerosol microphysics).
* Cooling is comparable to 1453, 1601, and 1816 – but Samalas released more sulphur? Cooling not linear with sulphur emissions.
* Aggravated ongoing famines in Western Europe and Japan

(Lavigne et al., 2013)

* Largest volcanic sulphur release of the past 7,000 yrs
* First identified Samalas volcano as source of 1257 eruption (Samalas Volcano/ Segara Anak caldera, Lombok Island, Indonesia)
* 40.2 +/-3 km3 DRE of magma was deposited
* Eruption column of 43km (+/-8.6km) – calculated from contour maps of lithic and pumice clasts. Also calculate MER, intensity, and duration
* Magnitude of 7 is a minimum estimate (see paper), intensity of 12
* Pumice fallout deposits and PCDs
* Radiocarbon dating of charcoal confirms mid-13th century eruption and glass geochemistry matches Ice core deposits
* Stratospheric sulphate load is two to eight times higher than Tambora or Krakatoa respectively
* Interhemispheric transport of tephra and sulphate confirms low latitude eruption
* *Babad Lombok* (historical record from Indonesia) records a catastrophic caldera forming eruption.
* Suggest caldera formed due to collapse associated with the withdrawal of large volumes of volatile-saturated magma.
* Historical records report a warm winter in Western Europe in the winter of 1257/58. Winter warming is a dynamic atmospheric response to tropical high-sulphate eruptions.
* Preferential tephra deposit to the west, indicative of easterly trade winds during the dry season, thus suggests eruption date between May and October 1257.

(Wade et al., 2020)

* Simulate climatic impacts of sulphate and halogen emissions. Sulphate cooling matches well with proxy records, but little evidence of significant halogen injection (only 1% of halogen inventory reaching stratosphere).
* Simulations that don’t include aerosol microphysics overestimate surface cooling compare to proxy records
* Aerosol size is very important for climatic effect. SO2 self-limiting effect.
* Co-emitted halogens potentially contribute to catastrophic ozone breakdown
* Surface cooling best reconstructed with a May – July eruption date
* Ozone depletion due to Samalas halogen emissions has yet to be conclusively proven or disproven, though unlikely to be high.

(Vidal et al., 2016)

* 158+/-12Tg of SO2 (1.8 times more than Tambora 1815), 227+/-18Tg of Cl, and up to 1.3+/-0.3Tg of Br within a day. Approx. 126Tg of SO2 injected into stratosphere
* New geochemical method to determine volatile emissions based on major and trace element chemistry of melt inclusions
* Halogen injection into the atmosphere depends on how much is scavenged – which depends on background conditions.