

# A preliminary Whanganui flood frequency record

Atene Bend,  
Whanganui River, New Zealand



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# Fluvial archives as flood recorders

Extreme flooding is a major hazard in New Zealand

- The current understanding of the risk posed by flooding is poorly understood
- Fluvial archives are under utilized in New Zealand
- CT scanning offers a novel new method for distinguishing event deposits from the surrounding stratigraphic package

NASA WORLDVIEW



2023 FEB 09

The storm track of Cyclone Gabrielle, Mid-February 2023. Cyclone Gabrielle resulted in widespread flooding over much of the North Island & 10 deaths.

**Slide 2**

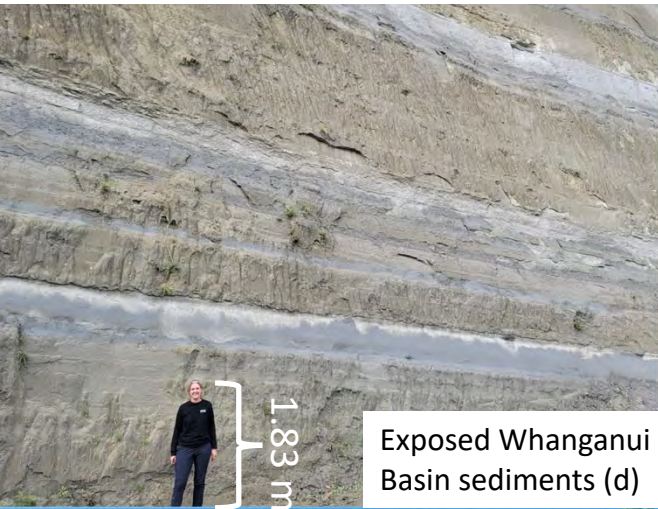
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**ID0**

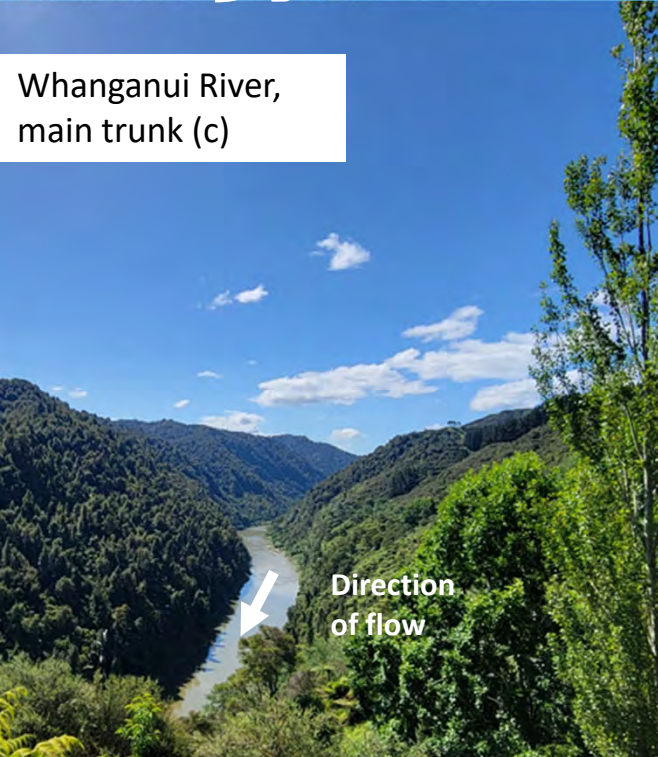
**Delete?**

Immy Doyle, 2023-09-11T20:52:41.659





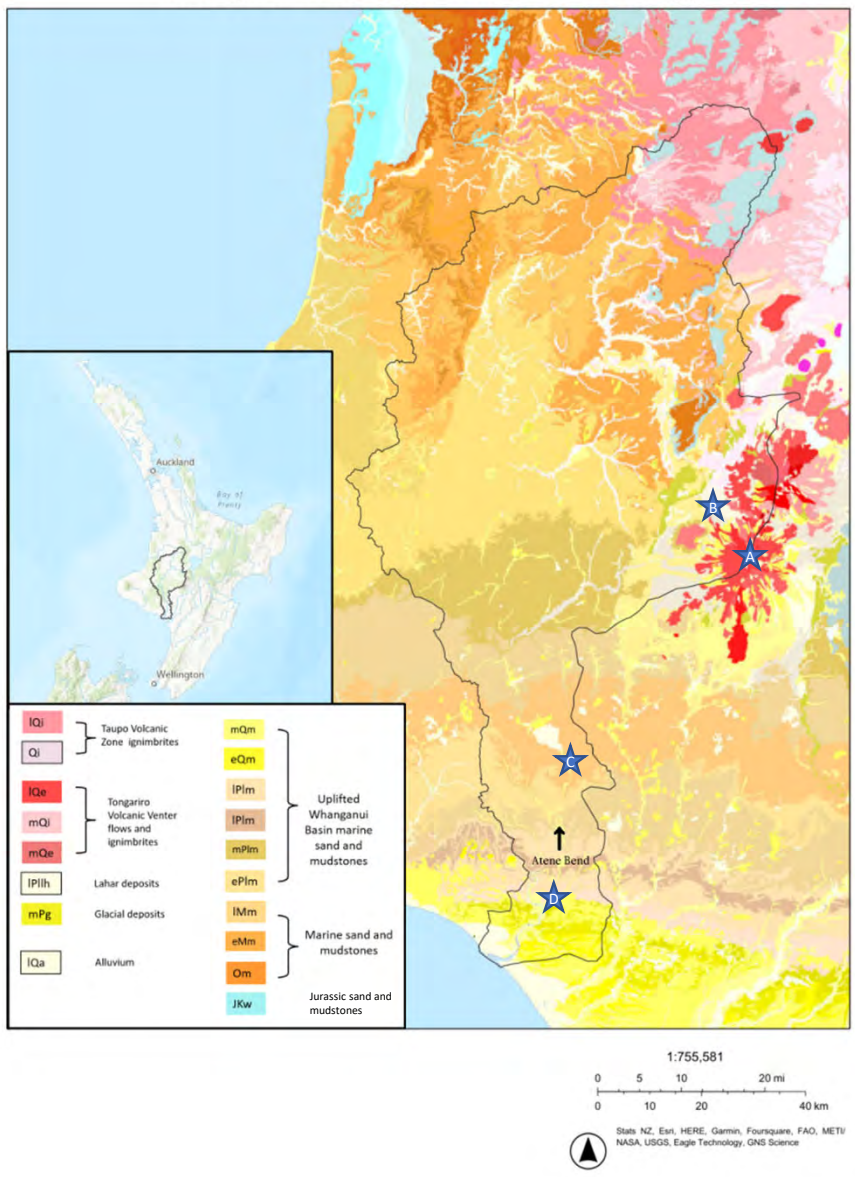
Exposed Whanganui Basin sediments (d)



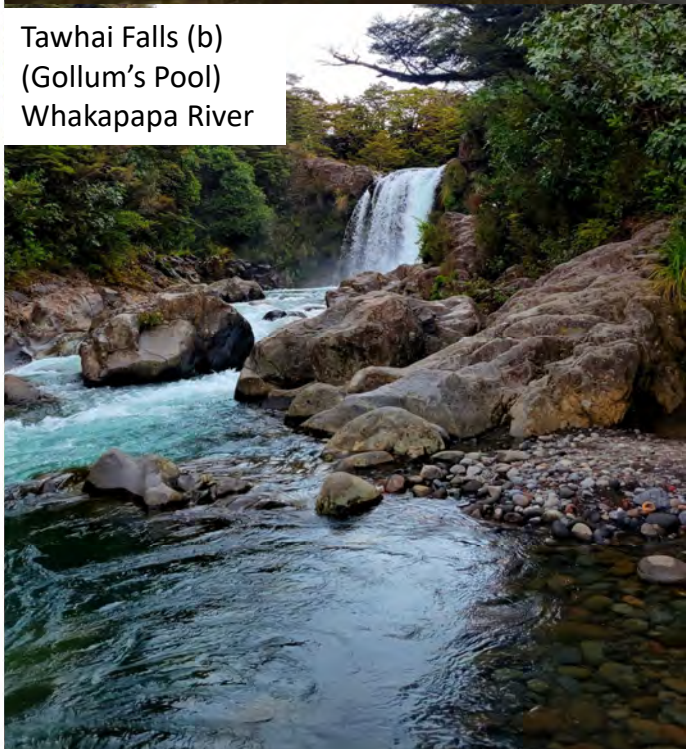
Whanganui River, main trunk (c)

Direction of flow

Whanganui River catchment area and Geology



Mt Ruapehu (a)



Tawhai Falls (b)  
(Gollum's Pool)  
Whakapapa River



## Research article

## A 2000 year record of palaeofloods in a volcanically-reset catchment: Whanganui River, New Zealand

Ian C. Fuller<sup>a,\*</sup>, Mark G. Macklin<sup>a,b,c</sup>, Willem H.J. Toonen<sup>d</sup>, Jonathan Turner<sup>e</sup>, Kevin Norton<sup>f</sup>

<sup>a</sup> Innovative River Solutions & Geosciences Group, School of Agriculture and Environment, Massey University, Palmerston North, New Zealand

<sup>b</sup> School of Geography & Lincoln Centre for Water and Planetary Health, University of Lincoln, Lincoln, UK

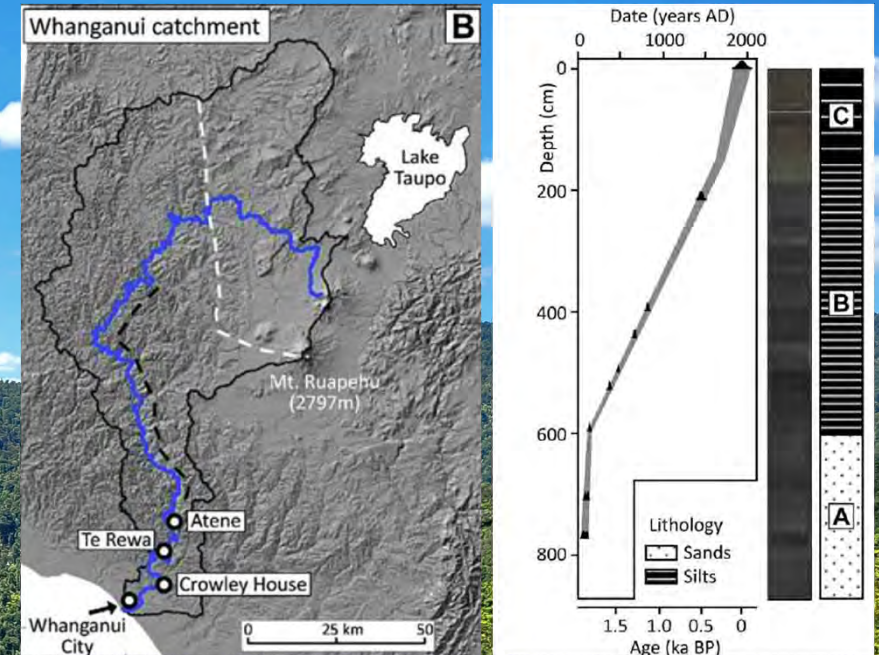
<sup>c</sup> Center for the Inland, La Trobe University, Melbourne, Australia

<sup>d</sup> Egyptology Unit, Faculty of Arts, Katholieke Universiteit Leuven, Leuven, Belgium

<sup>e</sup> School of Geography, University College Dublin, Dublin, Ireland

<sup>f</sup> School of Geography & Earth Sciences, Victoria University of Wellington, Wellington, New Zealand

- Recovered one 8.75 m core from the bend and two further cores from a location downstream
- Developed a 2000 yr record of flooding using ITRAX XRF geochemical data
- Hypothesized the  $1718 \pm 10$  cal yr BP Taupo eruption was the cause of the meander bend cut off

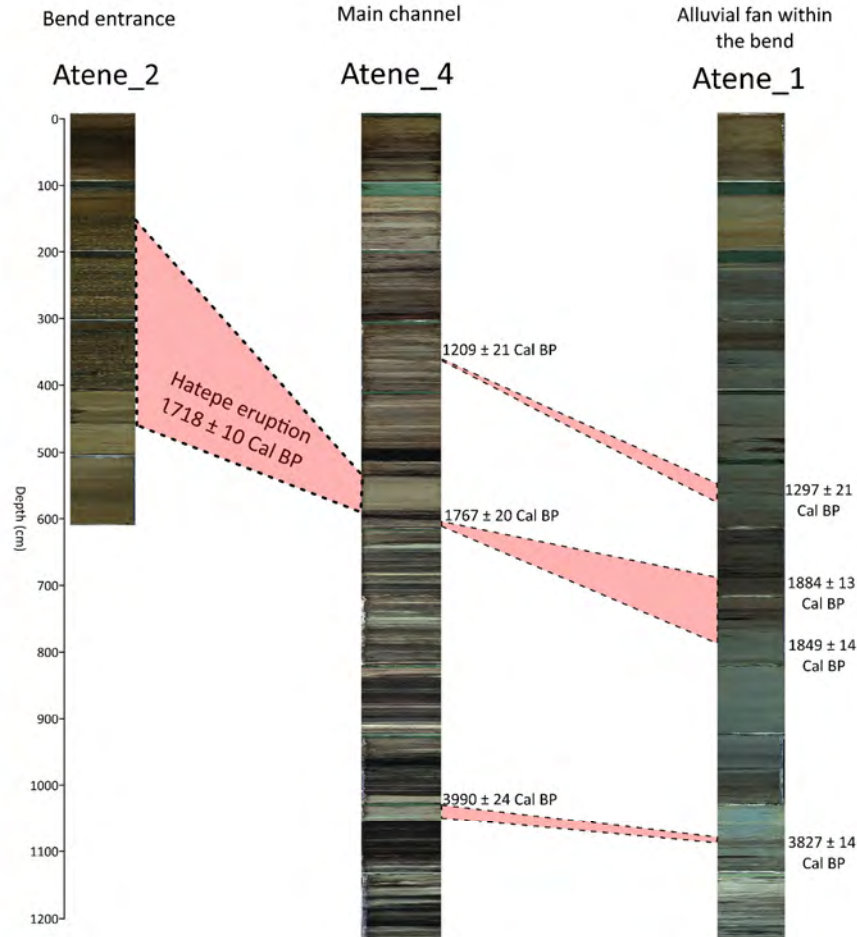
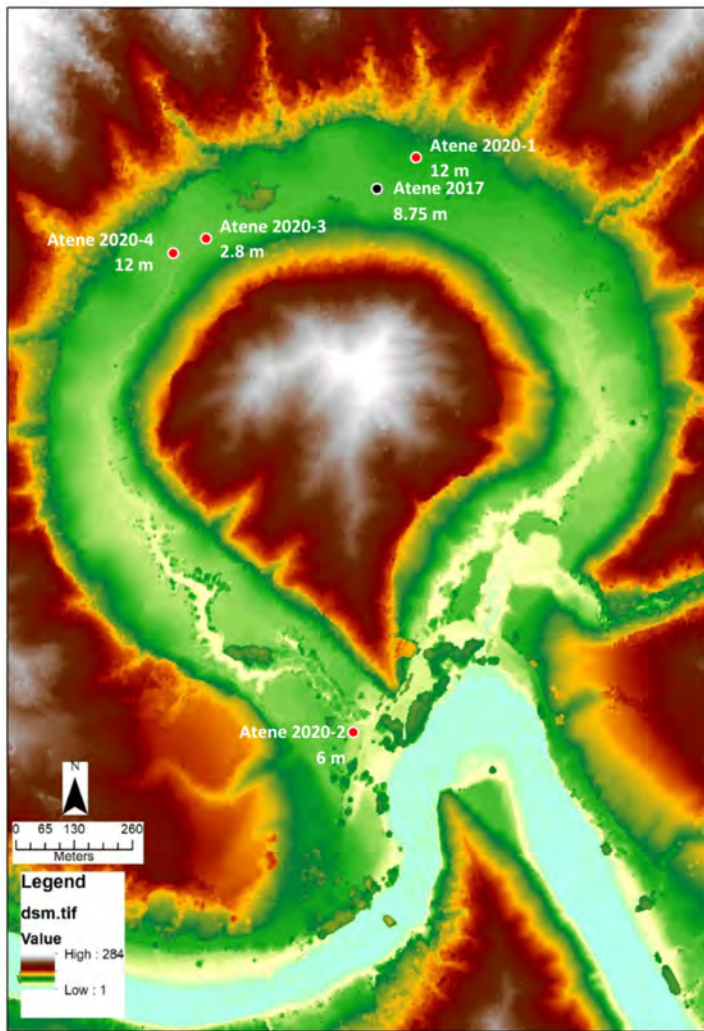


**Slide 4**

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**ID0** This slide needs to be reworked into a CT method slide  
Immy Doyle, 2023-08-18T00:35:33.098





## Four new cores collected April 2020

### Atene\_2

- Captures the 1718 ± 10 Cal BP Taupo (Hatepe) eruption & response

### Atene\_4

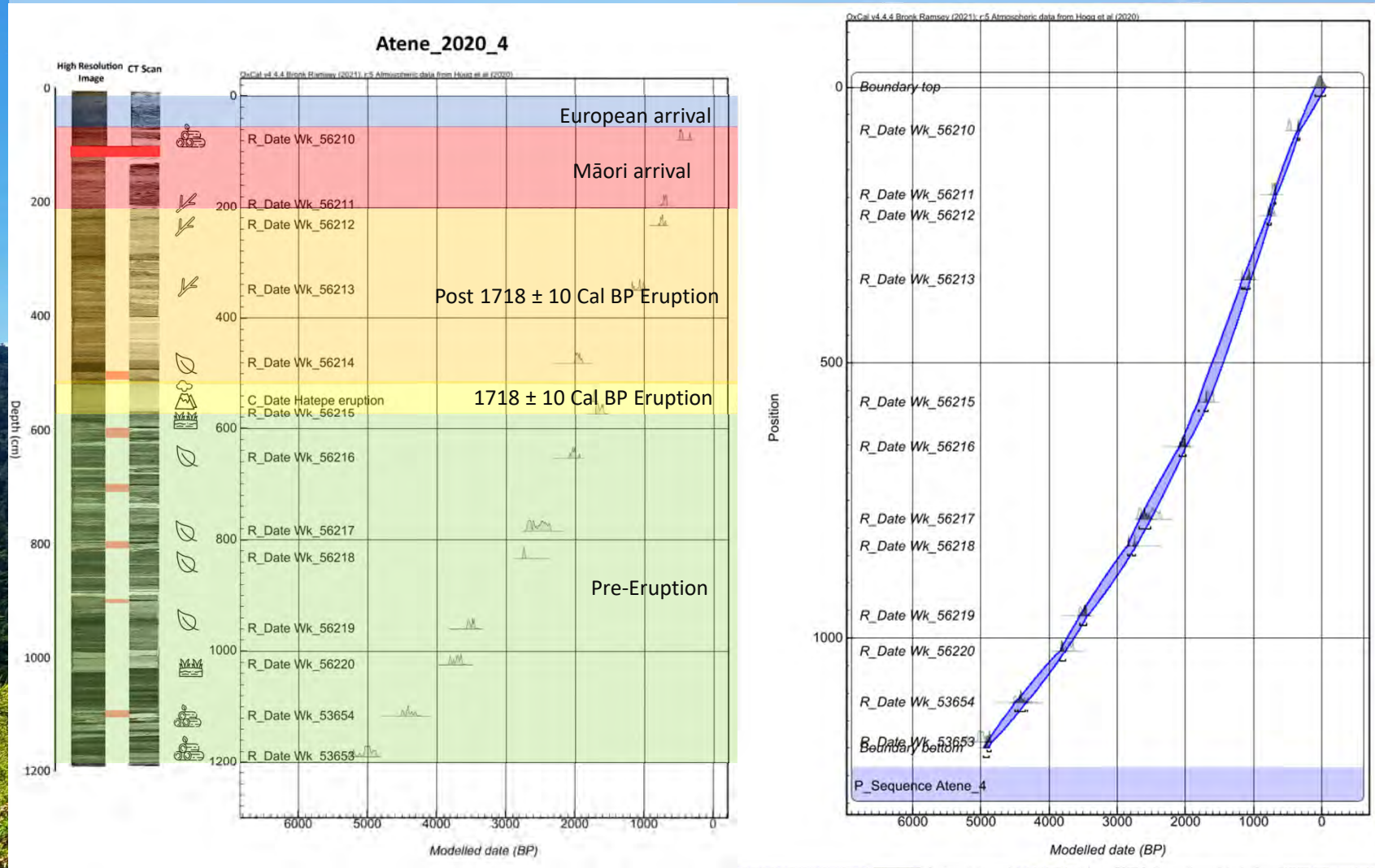
- Taken from the main channel, likely captures a combination of local and regional information

### Atene\_1

- Taken from an alluvial fan within the bend, likely captures a local record

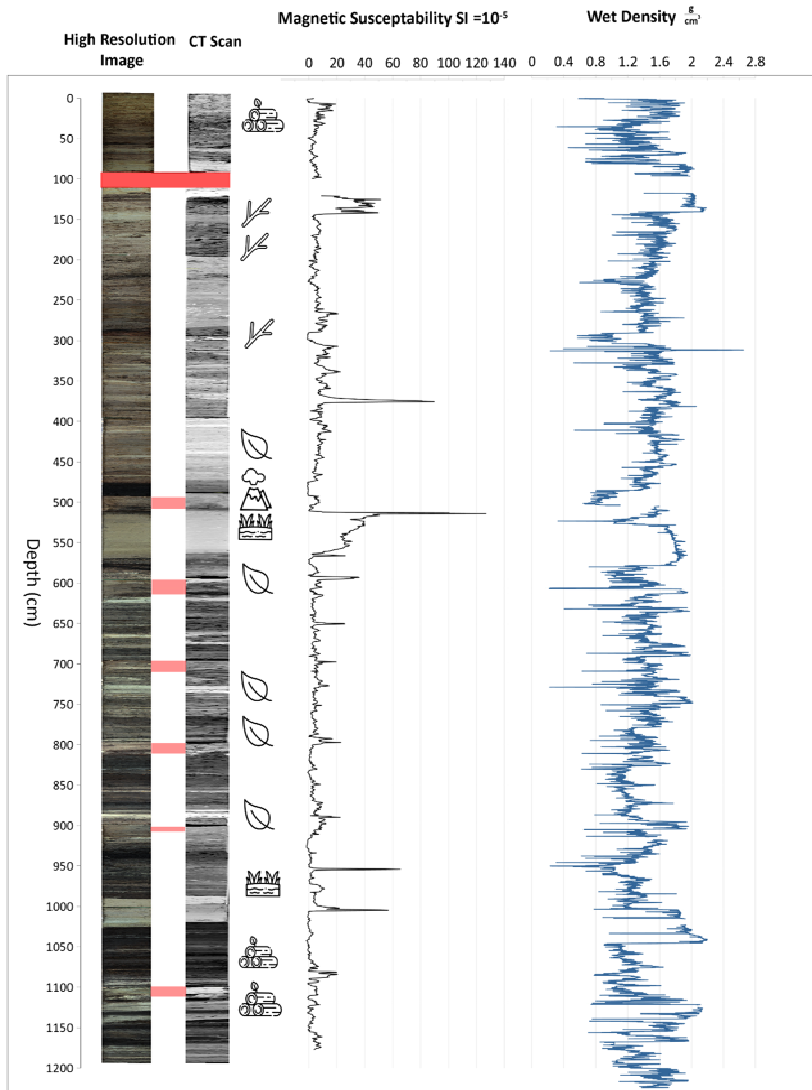


# Chronology



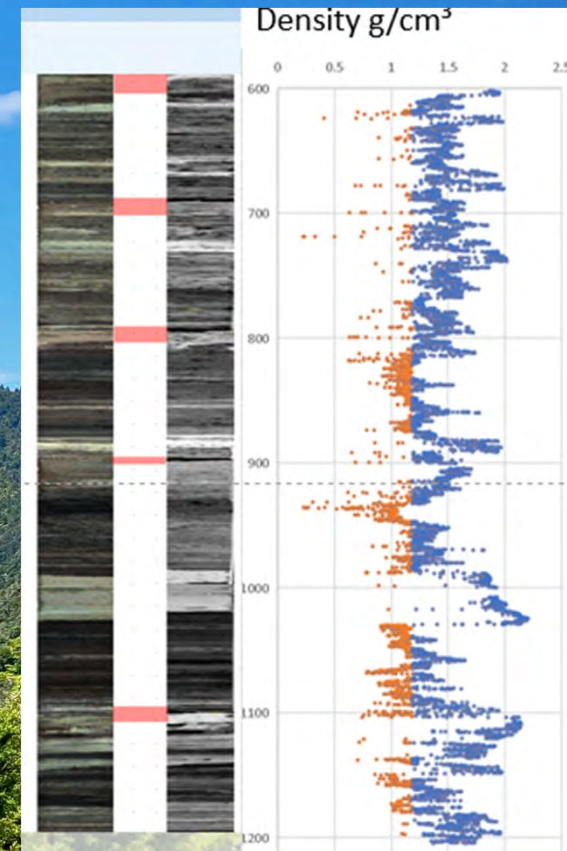


## Atene\_2020\_4



# Analysis

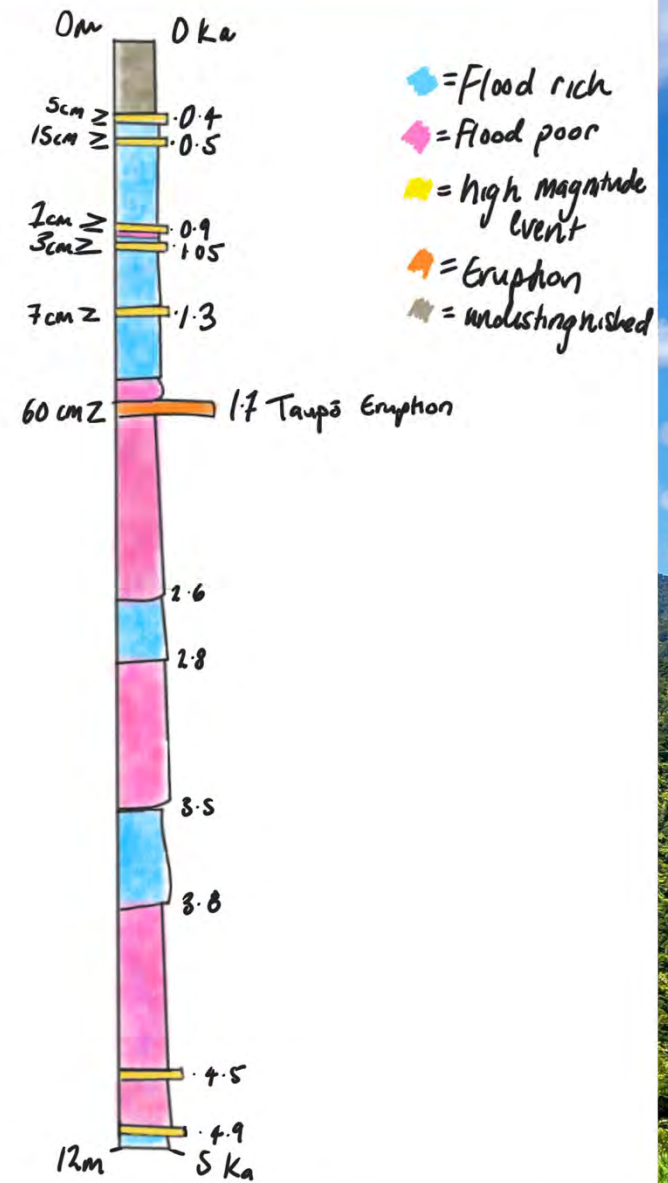
- CT analysis provides information on core composition and density
- 3D & 2D X-Ray imagery
- Density is related to the composition of the core
- Changes in density can therefore be used to identify and distinguish flood units





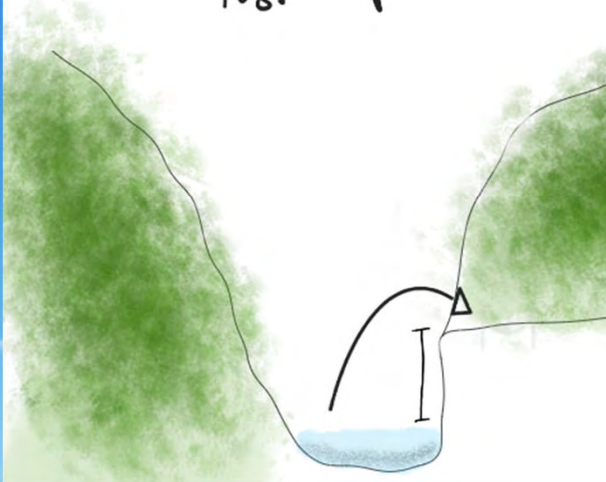
# Flood Frequency

- By connecting the flood record with the chronology, we can evaluate flood frequency and how it varies through time
- Flood rich episodes are periods of time identified to have a high frequency of events
- Flood poor episodes are periods where flood frequency is reduced
- Within an episode, there may be short clusters of increased or reduced frequency
- 7 extreme events identified

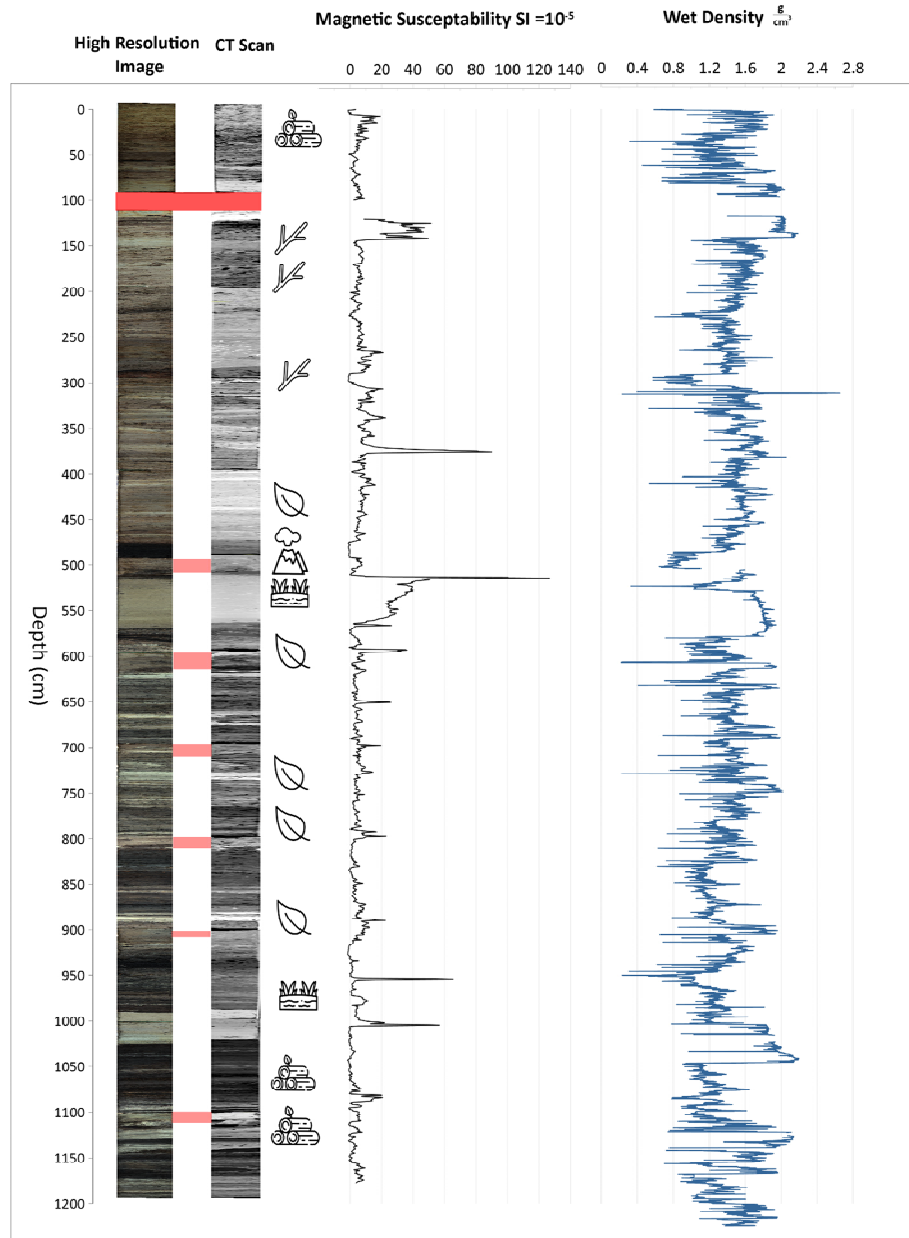




Post Taupō



Pre Taupō



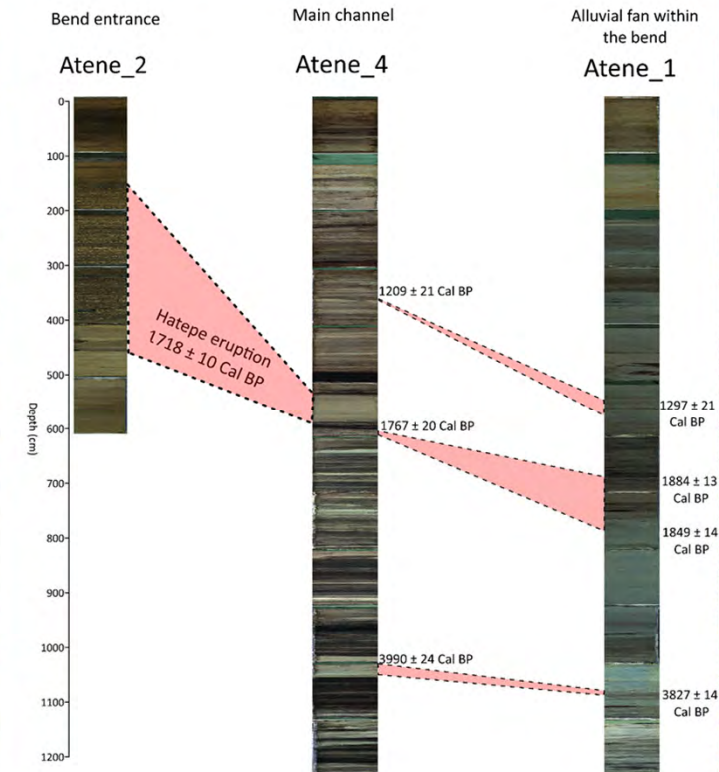
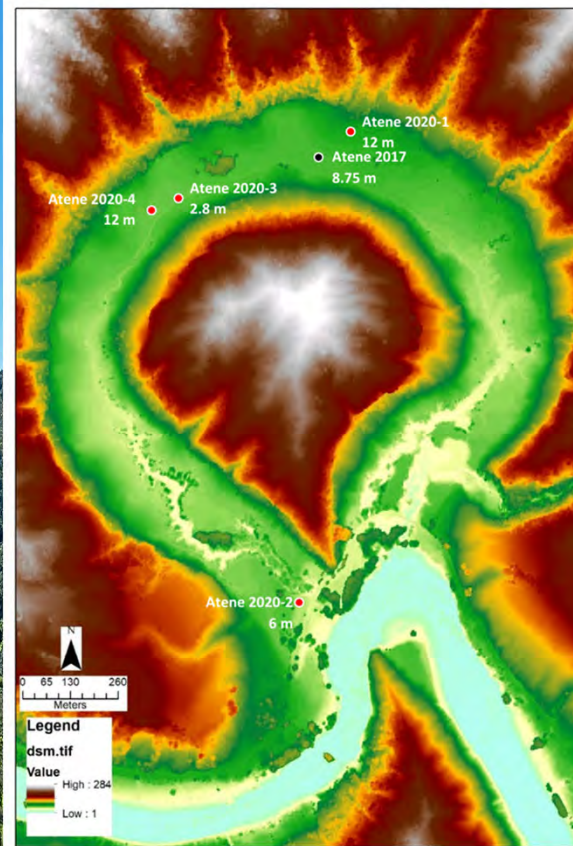
# Flood Magnitude

- The threshold required for a flood to be captured varies through the core
- Lower pre eruption
- Higher post eruption



# Findings

- The bend is much older than suggested by Fuller et al., (2019)
- Pre Taupo, channel connectivity was higher
- Reduced connectivity post Taupo suggests events recorded are of a higher magnitude than previously thought





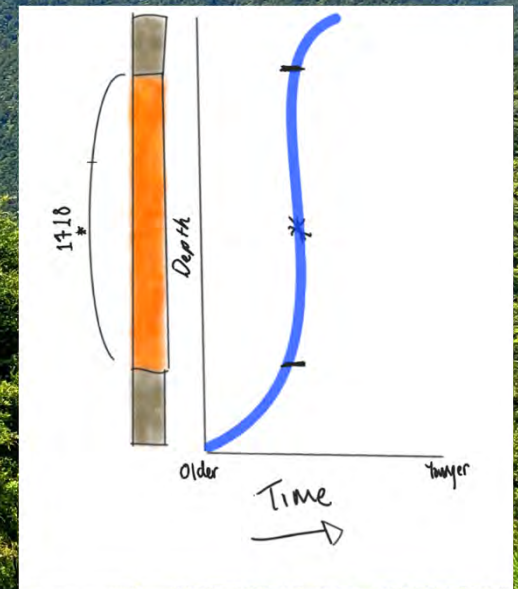
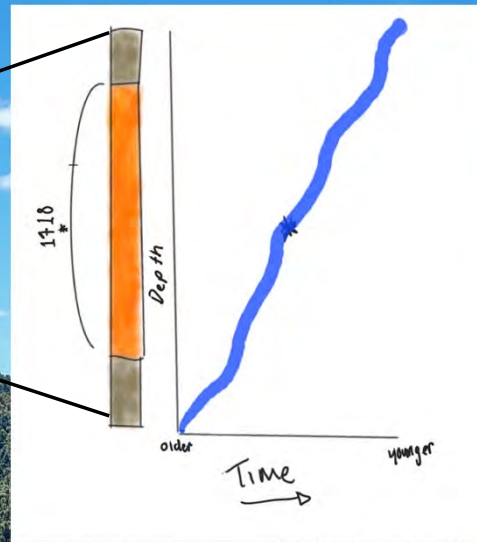
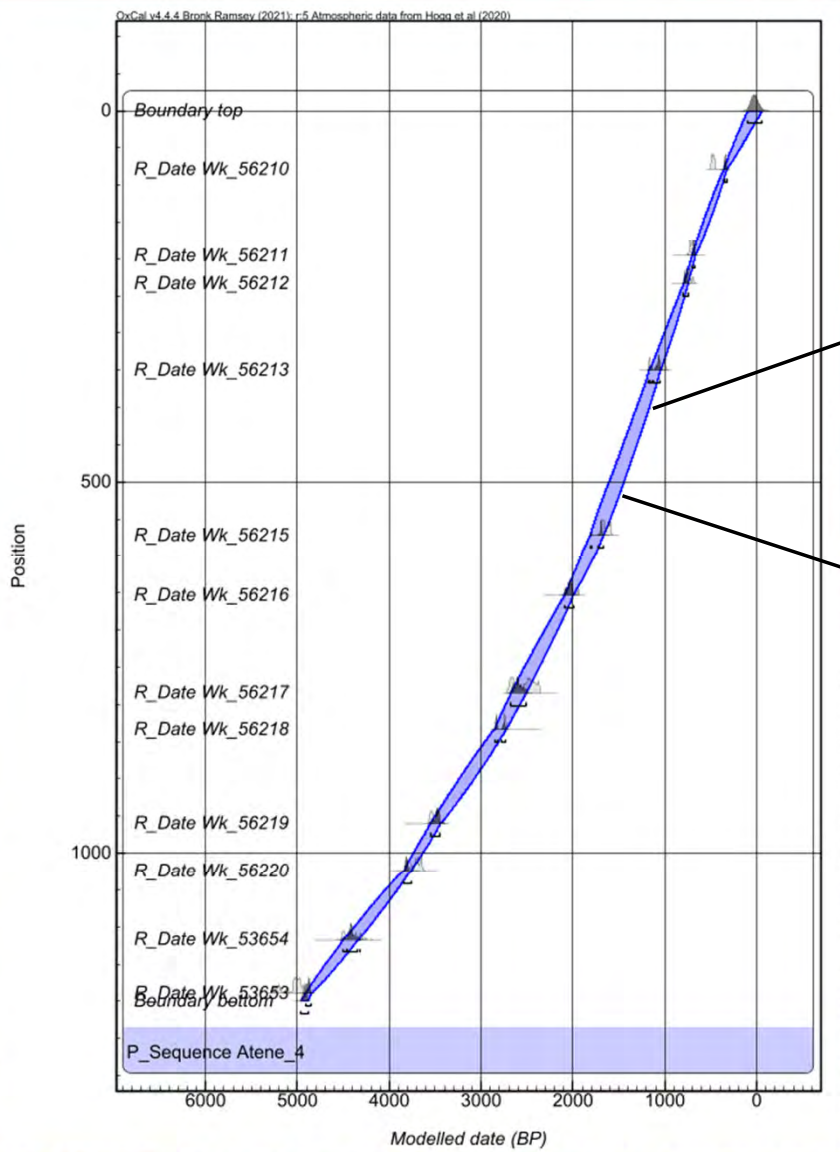
## Slide 10

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- ID0** Rework this slide  
Immy Doyle, 2023-07-16T15:54:19.685
- ID1** Put in new diagrams (changing flood level)  
Immy Doyle, 2023-09-11T20:53:49.549



# Next steps: Improving the chronology





# Next steps

- Additional radiocarbon dates have been sampled
- Density threshold needs refined
- Particle size analysis required to verify magnitude of events
- Evaluation of density data utilizing the improved age-depth model
- Publication of results (dec 2023)

