

Paleotsunami Current State Scientific Update

ICG/PTWS Scientific meeting of experts to understand tsunami sources, hazards, risk and uncertainties associated with the Vanuatu, San Cristobal and New Britain Subduction Zones

Port Vila, Vanuatu

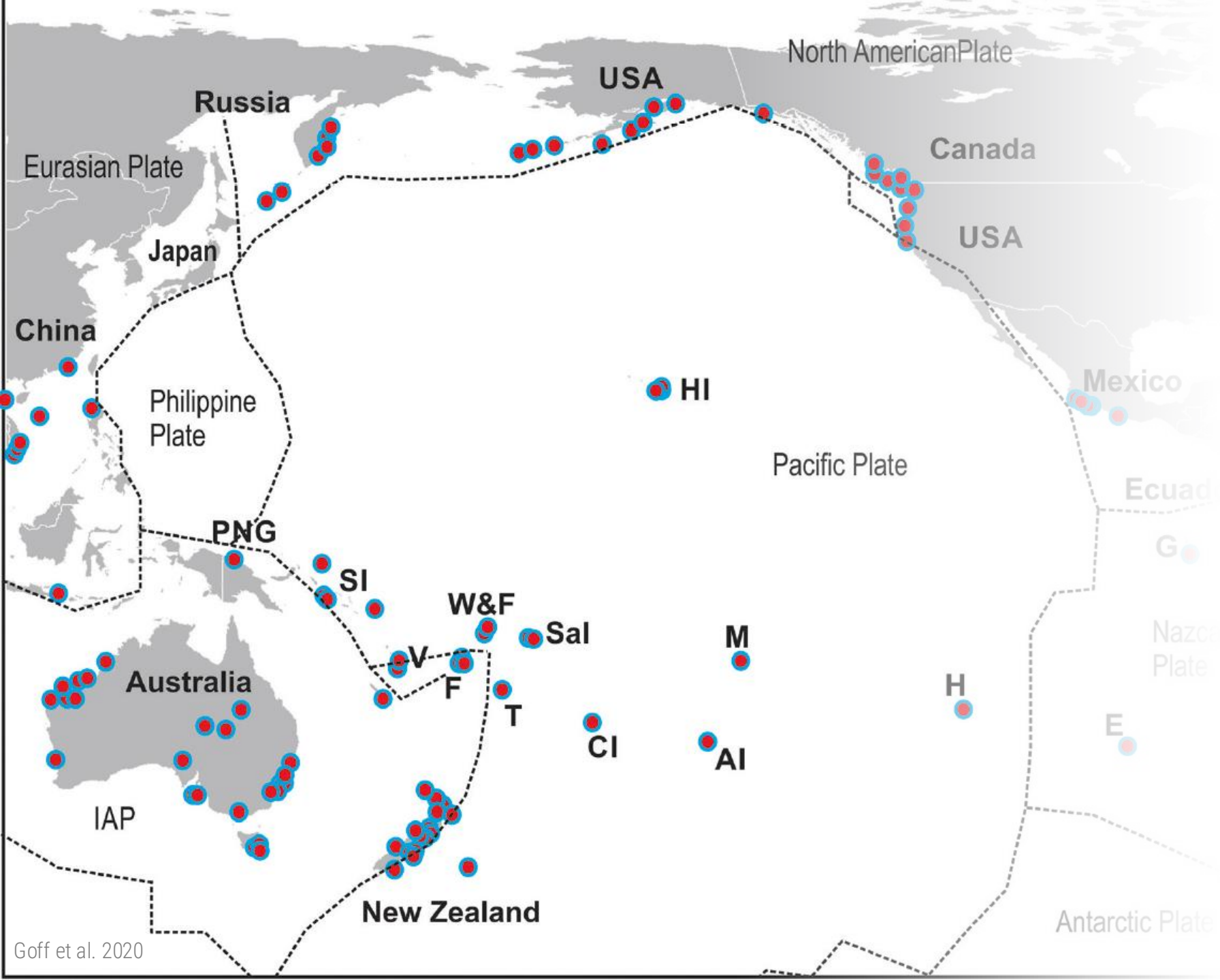
14–17 May 2024

Shaun Williams





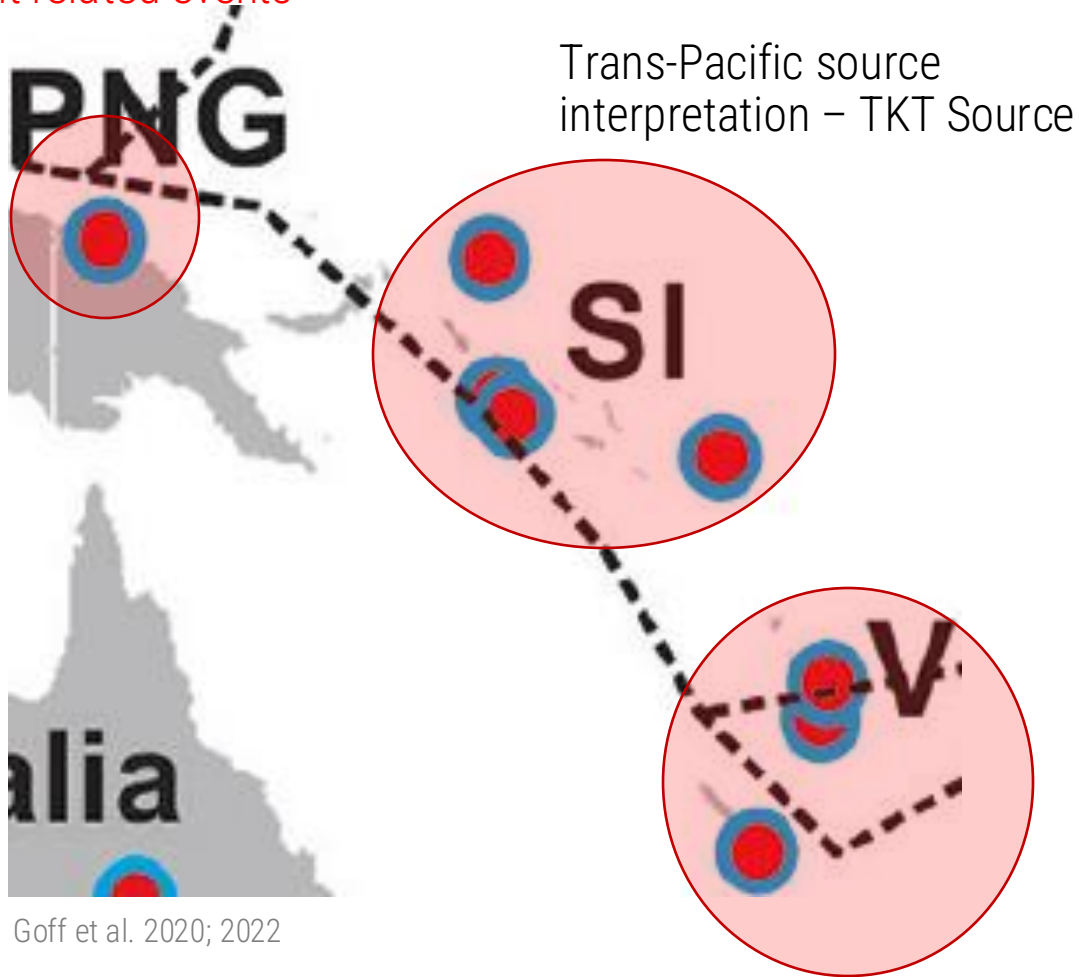
Acknowledgments



Outline

- Overview – Paleotsunami in the SW Pacific
- New Caledonia, Vanuatu, Solomon Islands and Papua New Guinea focus
- Commentary on Investigative Techniques
- Gaps and Challenges

Local sources – New Guinea
Fault related events



Goff et al. 2020; 2022

Combination - Trans-Pacific (TKT)
source and local EQ/Volcano sources

Overview of evidence

- New Caledonia, Vanuatu – mixture of sedimentary/ geological, archaeological, contextual
- Solomon Islands – based on re-interpretations of archaeological / contextual evidence
- PNG – limited to New Guinea fault

2023 Update – Paris et al.

First study on paleo-tsunamis (sedimentary evidence) in New Caledonia

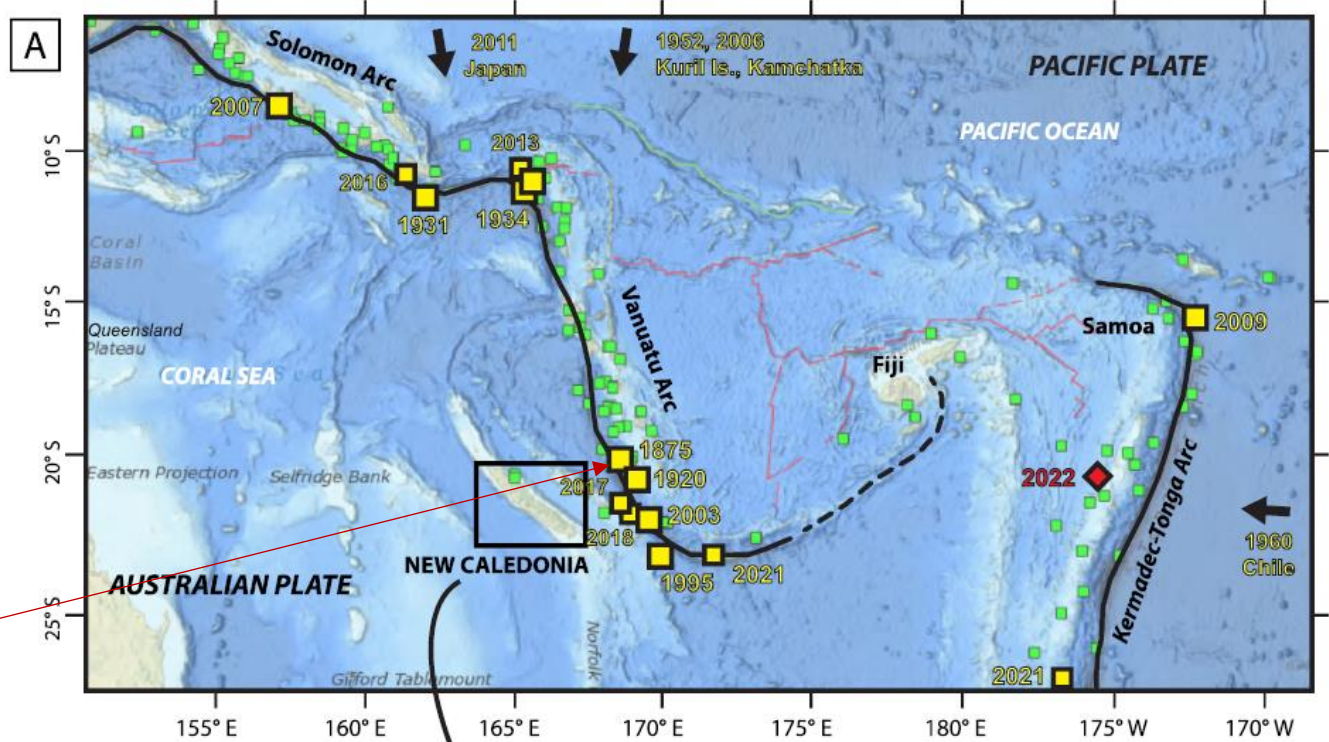
6 tsunamis preserved in the sedimentary record.

3 events <1000 BP

- 28-Mar 1875 tsunami
- ~1700 CE tsunami (related to 1729 Vanuatu EQ)??
- 15th C tsunami?? (trans-pacific event – TKT source)

2 events between 1000-2000 BP

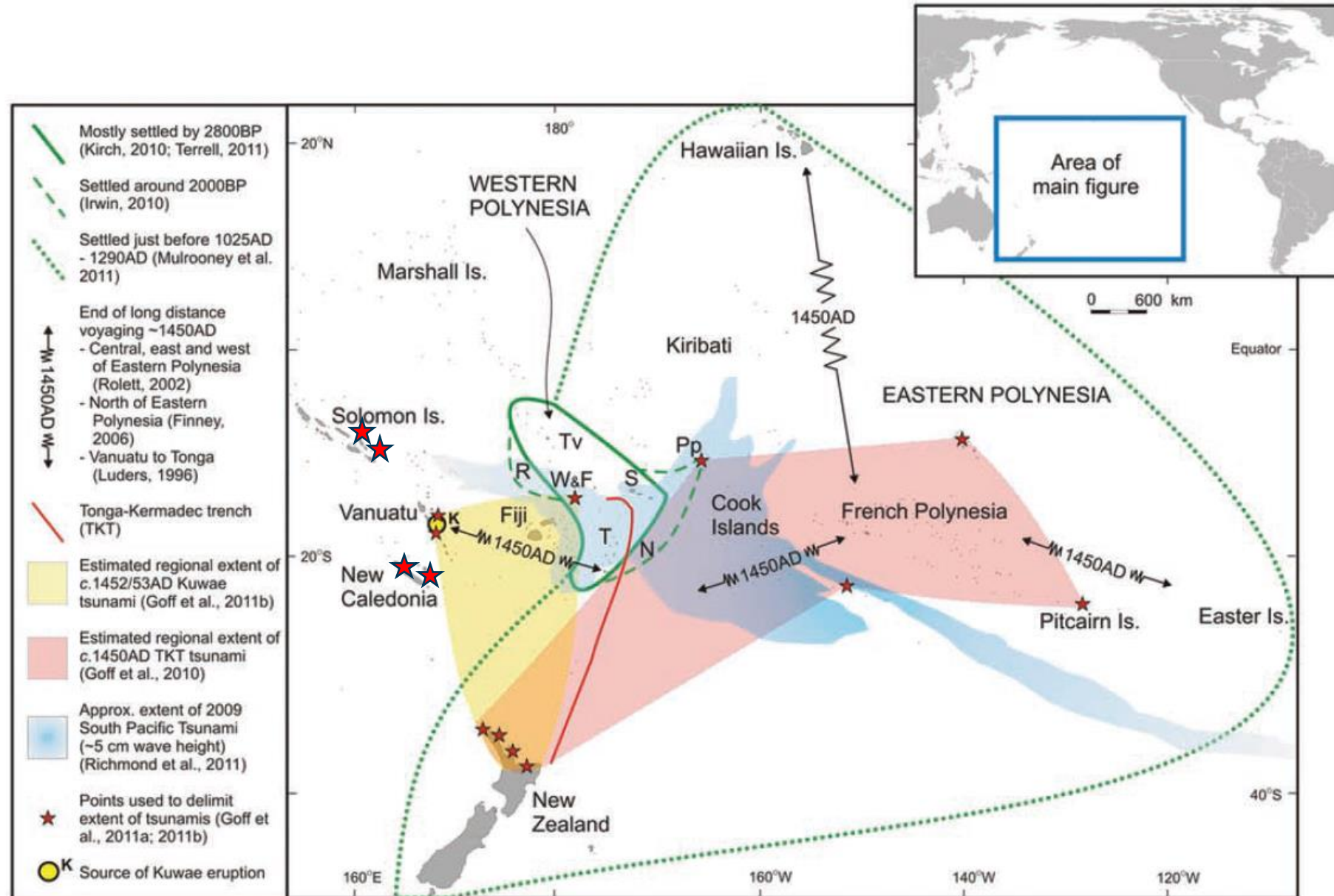
1 event ~3000 BP



Potential significant 15th C Trans-Pacific event

So-called 'history-changing event' on Pacific migration/cultural shifts (Goff et al. 2012; 2020 and 2022)

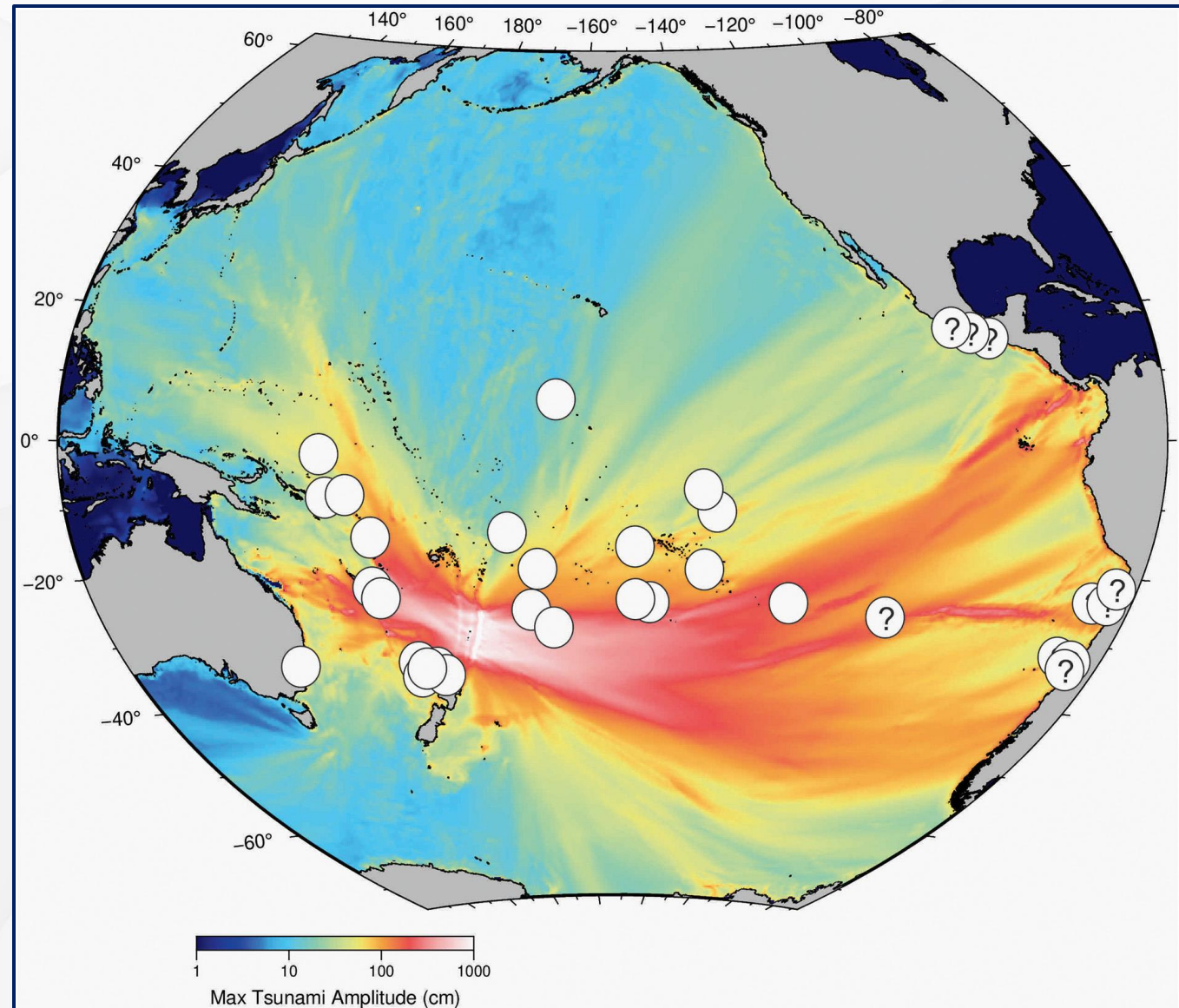
- ~1450 AD event
- Suggested to be linked to a possible Mw 9.4 Tonga-Kermadec EQ



15th C event – contrasting factors

The interpreted sources for a 15th C TKT-sourced event in West Pacific (Solomon Is., Vanuatu, New Caledonia) is ambiguous:

- Cain et al. 2019 (Solomon Islands) – TKT vs local/regional?
- Goff et al. 2022 (Solomon Is. / Vanuatu) – TKT vs Kuwae eruption?
- Paris et al. 2023 (New Caledonia)
- Lavigne et al. 2021 (Tonga) – introduces a potential volcanic instead of EQ source at TKT?





Commentary on Investigative Techniques

- Over the last decade – a major shift to using inter-disciplinary techniques in combination:
 - Geological, geomorphological, chemical, biological, numerical and geospatial modelling, archaeological, anthropological, contextual...
- Evidence, or interpretations thereof, are subject to ambiguity –
 - “...beware of seeing shapes in the clouds...”

Challenges & Gaps



Very limited paleotsunami investigations in Vanuatu, New Caledonia, Solomon Islands, Papua New Guinea



Such work can be relatively expensive and time consuming – but nevertheless important



Distinguishing tsunami from cyclone/storm deposits has improved – but interpretations can be ambiguous



Numerical modelling significantly helps narrow down areas to look for deposits – and help to validate potential sources corresponding to depositional evidence



Interpretations should be treated with care and scrutiny

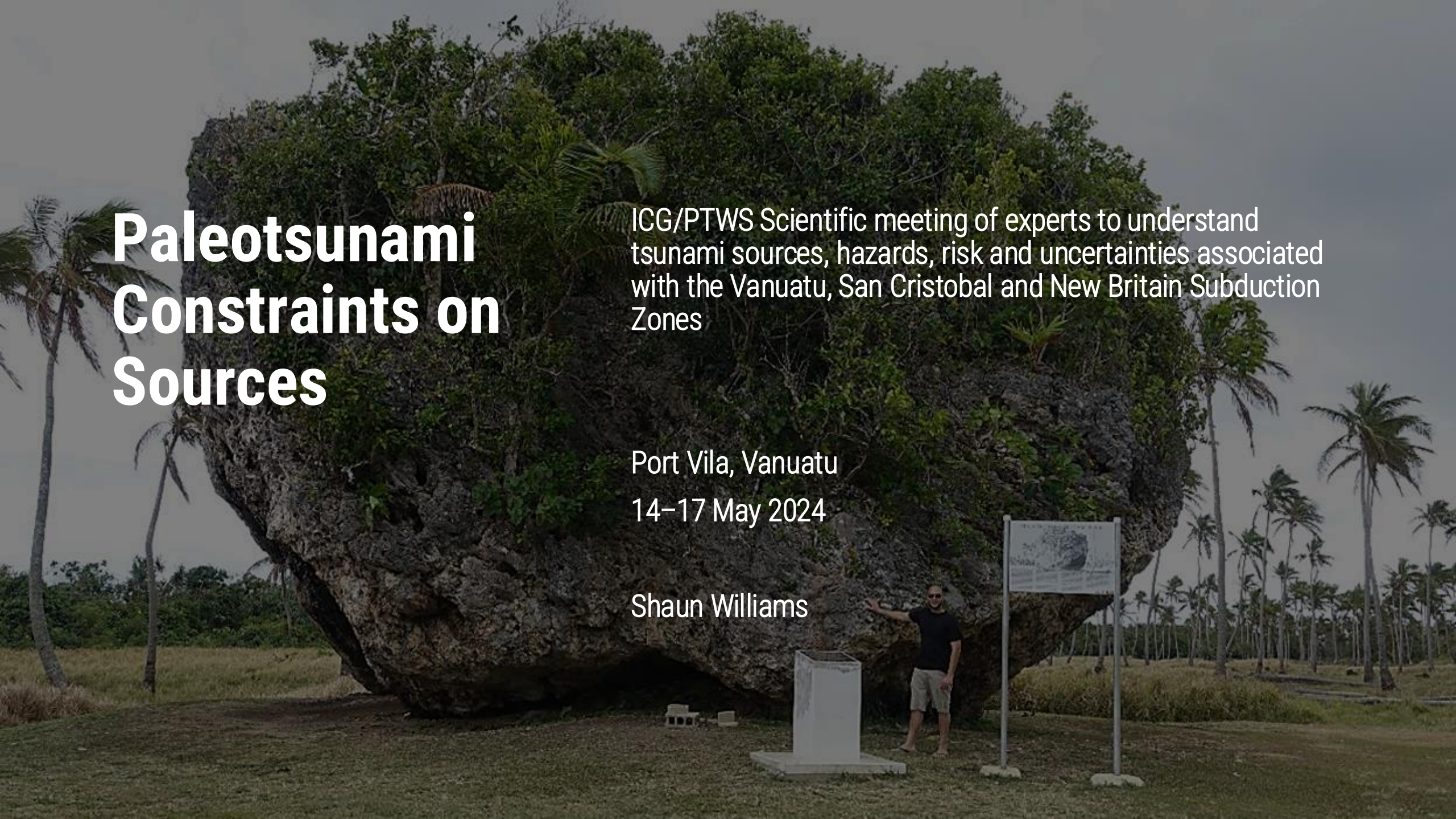
Paleotsunami Constraints on Sources

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Paleotsunami constraints on sources

- No paleotsunami constraints currently available for New Britain subduction source
- Some events potentially constrained by paleotsunami evidence
 - **Vanuatu Arc**
 - 1875 event (historical + sedimentary evidence – New Caledonia - Paris et al. 2023)
 - 1729 event? (geological + sedimentary evidence – New Caledonia - Paris et al. 2023)
 - 1452/53 – Kuwae eruption source - Vanuatu
 - **1450 event?** (archaeological + contextual evidence – Solomon Islands + New Caledonia + Vanuatu (Cain et al. 2019; Goff et al. 2022; Paris et al. 2023)
 - Currently interpreted to be associated with a potential 15th C TKT ~Mw9.4 event
 - However – the possibility of a Kuwae source or local-sourced event at San Cristobel subduction cannot be ruled out

(multiple events over last millenium)

Rabaul

??

Solomon Sea

Solomon Islands

Port Moresby

Possible San Christobel (1400-1500's)

Lata

Vanuatu

Kuwae Volcano (1450)

1729

Port Vila

1875

Wansville City

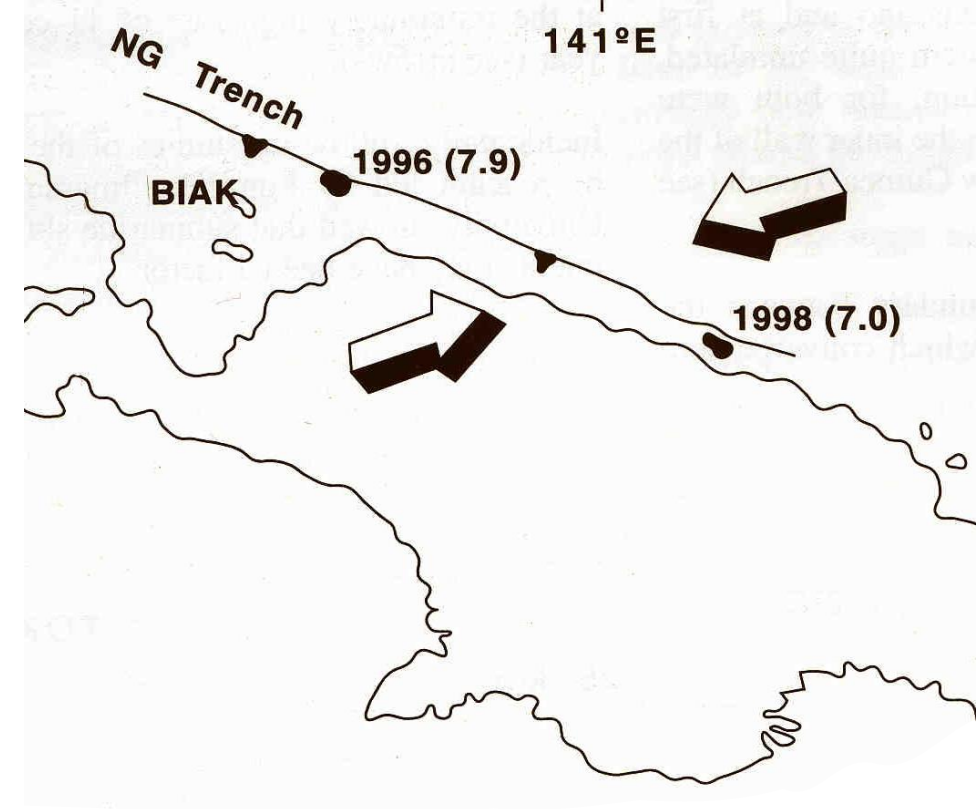
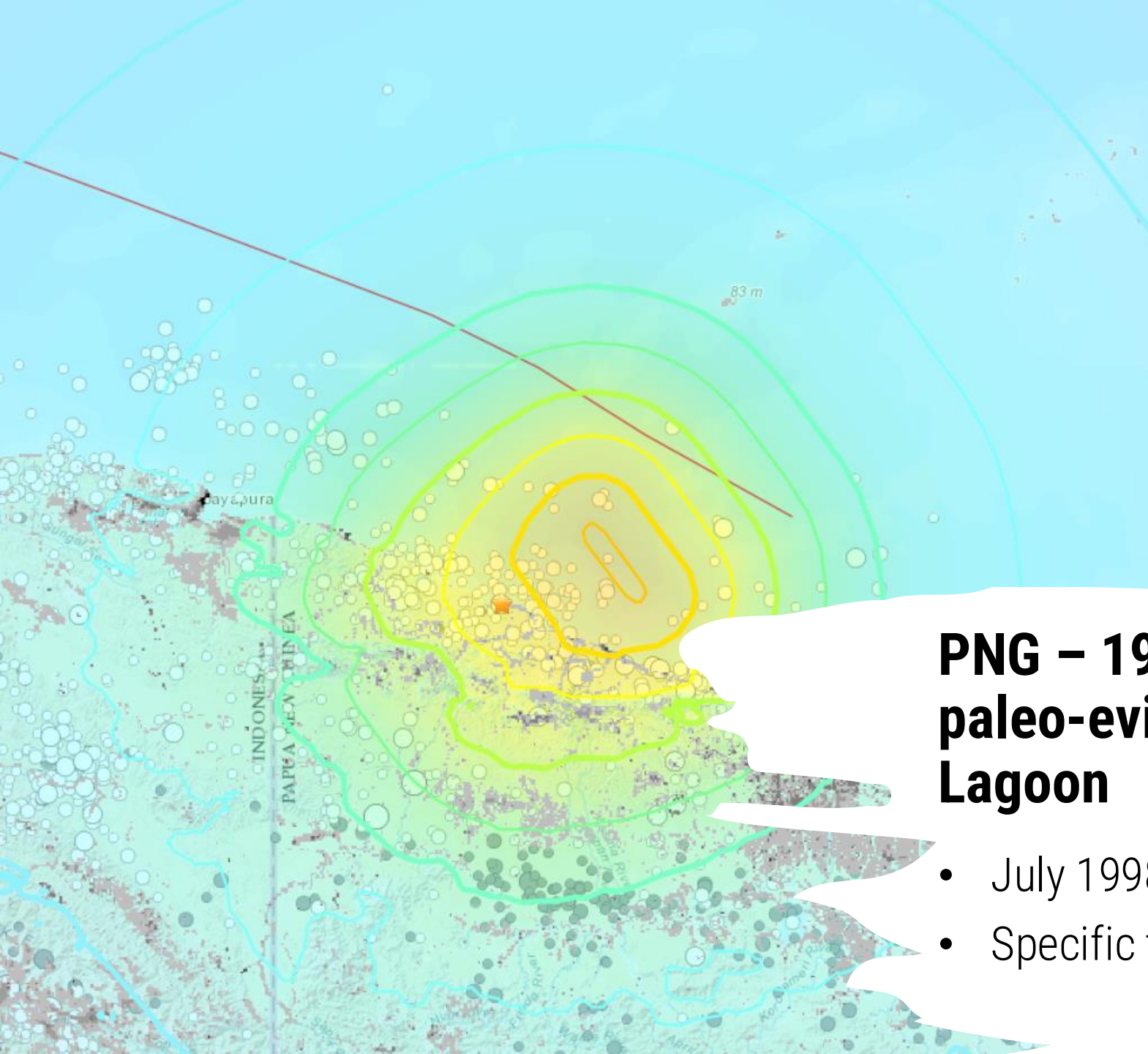
Coral Sea

Koumac

New Caledonia

Nouméa

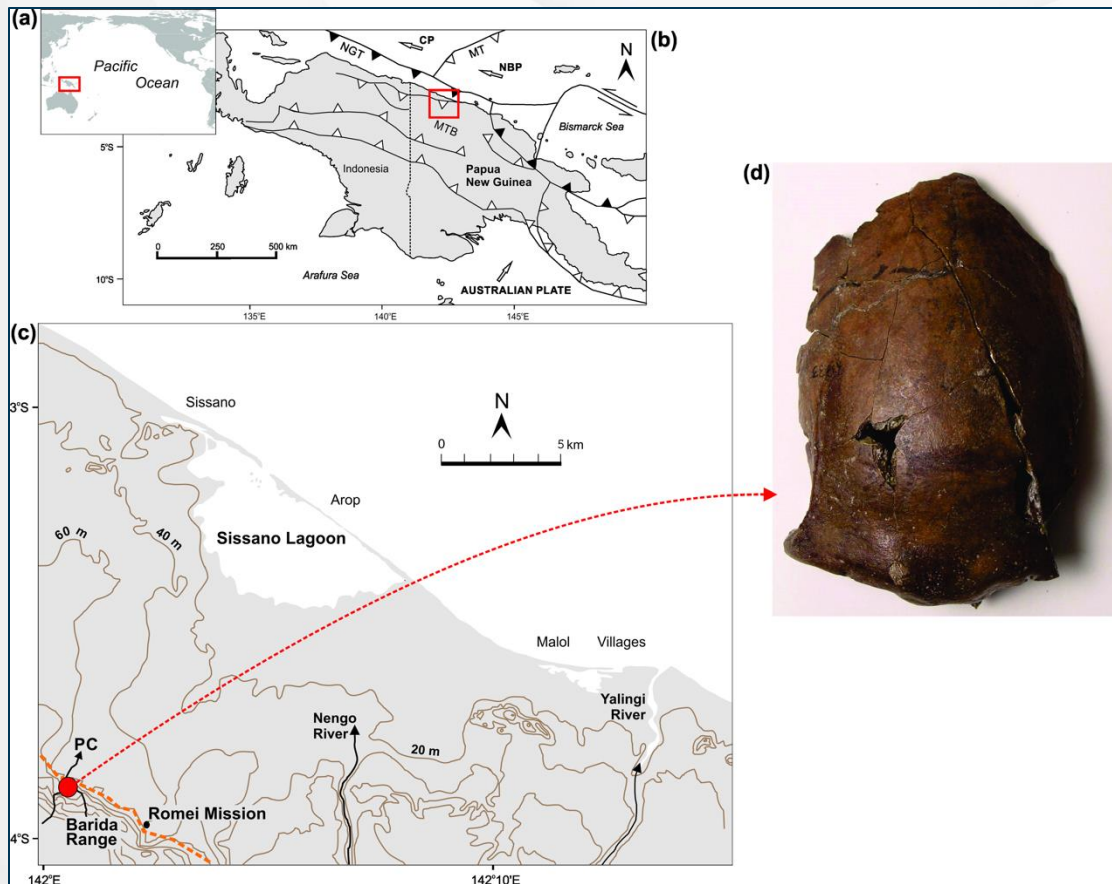
Mackay



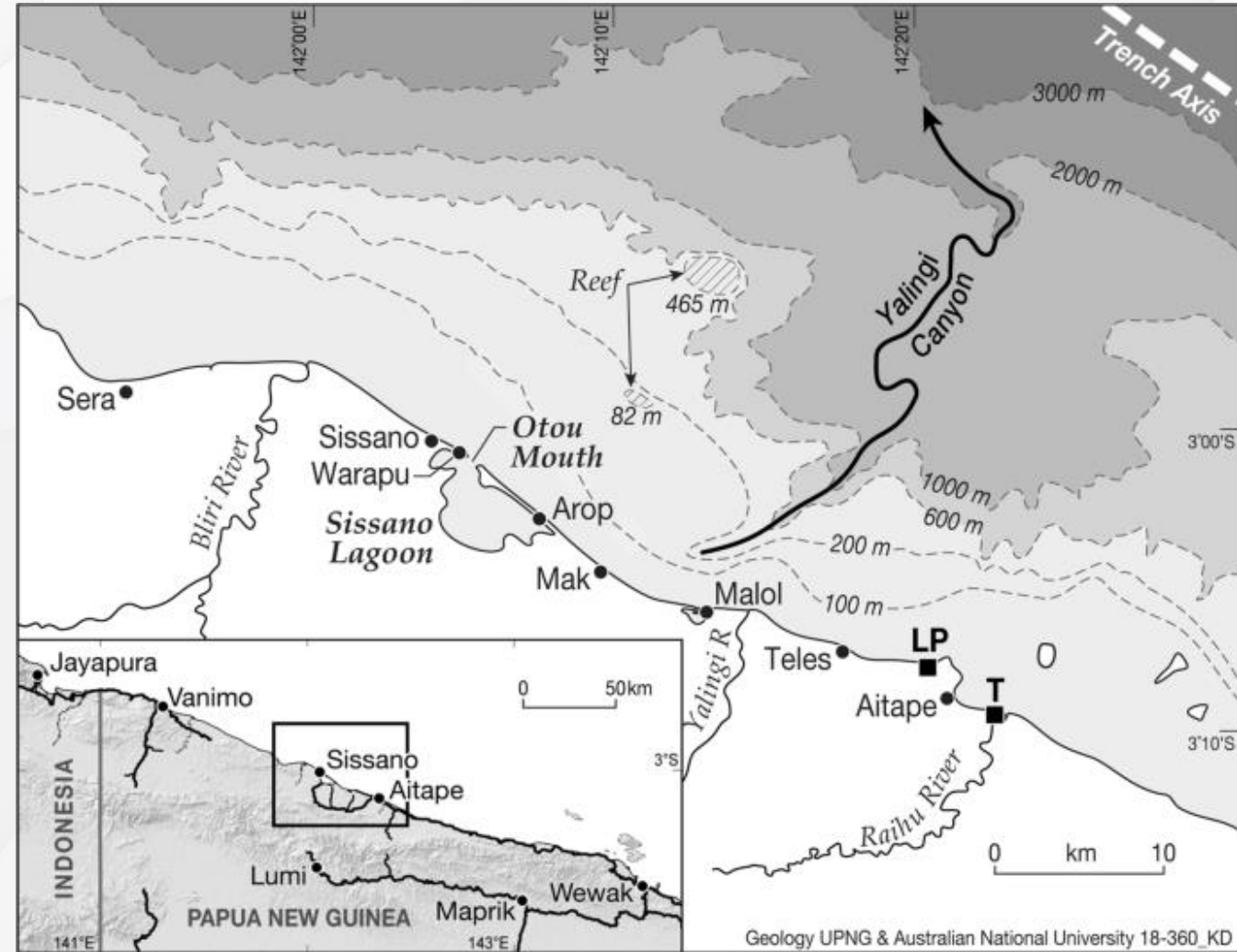
PNG – 1998 analogy for interpreting paleo-evidence at Aitape/Sissano Lagoon

- July 1998 Aitape EQ and Landslide Tsunami
- Specific to New Guinea fault in the north

Aitape / Sissano Lagoon – evidence for local events



Goff et al. 2017



Davies et al. 2019



NIWA

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**Thank you for your
Time and Attention**

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