

Paleoenvironmental indications and cyclostratigraphic studies of sediments from tropical Lake Towuti obtained from downhole logging

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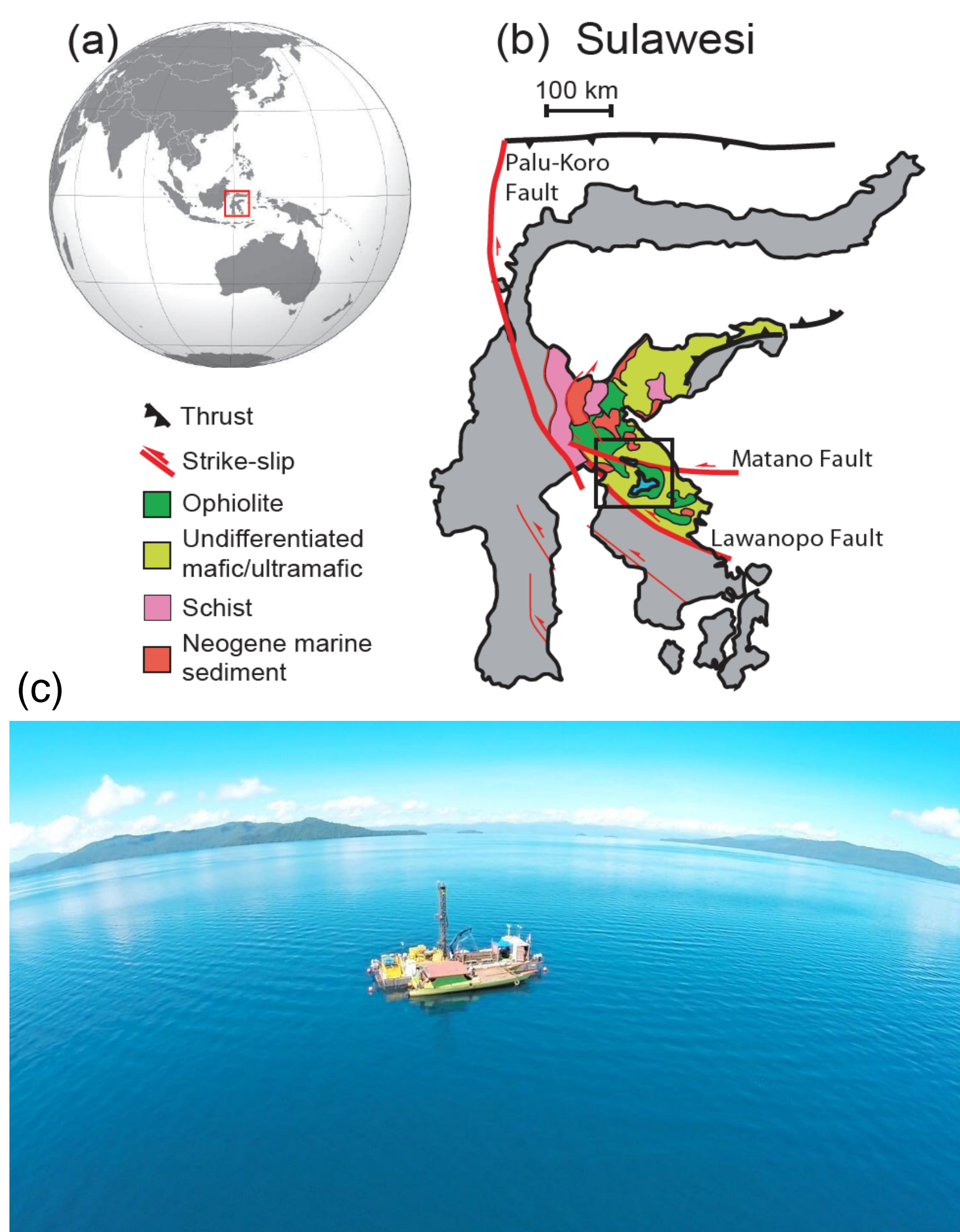
The Towuti Drilling Project



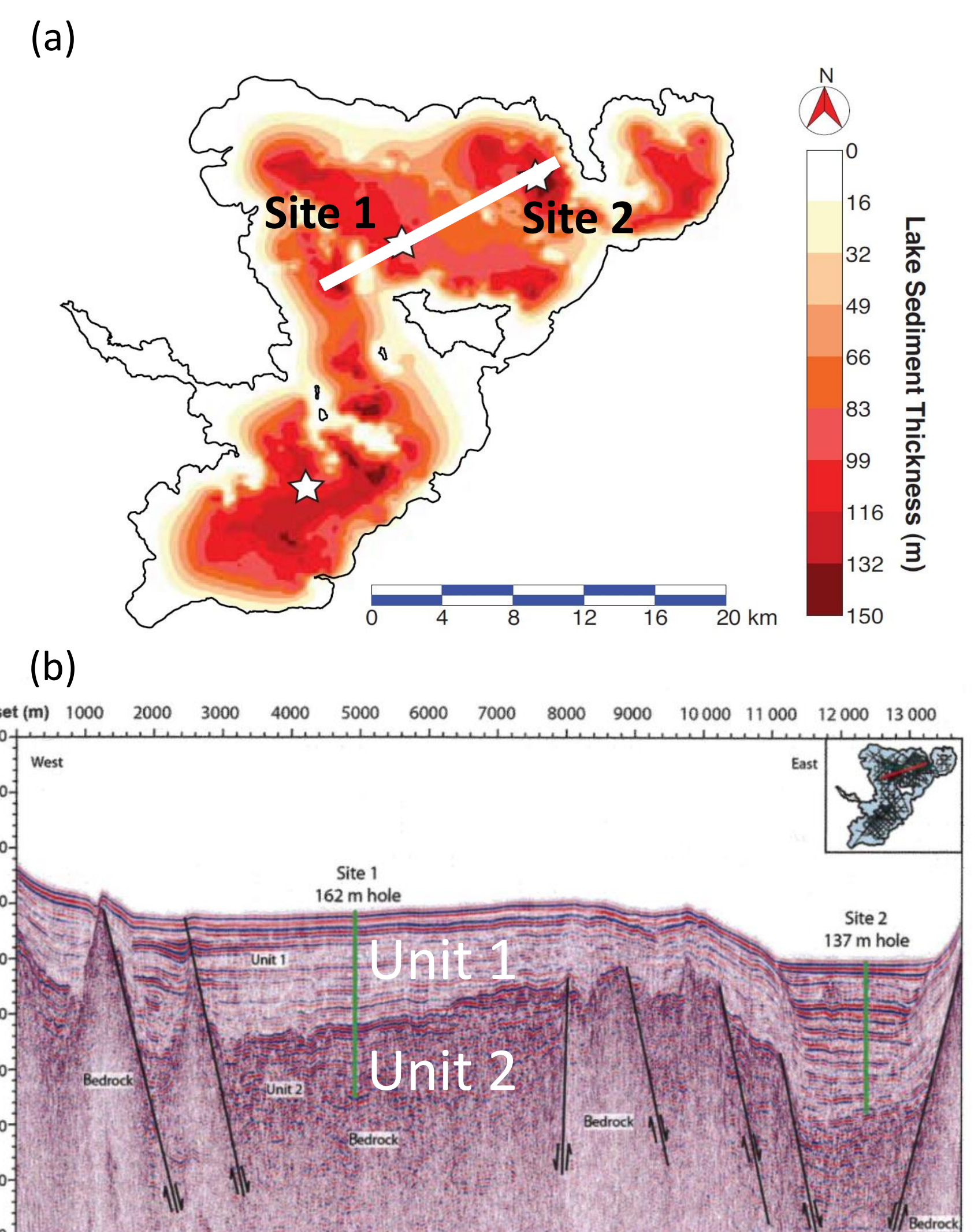
Lake Towuti is a tectonic lake on Sulawesi, Indonesia. It is located within the Indo Pacific Warm Pool, a region where relevant amounts of heat and moisture are produced for global atmospheric convection (De Deckker, 2016).

During an ICDP drilling campaign in 2015, the Leibniz Institute for Applied Geophysics conducted geophysical downhole logging measurements.

Recorded parameters are: Spectral gamma ray (total gamma ray, U-, Th-, K-concentration), resistivity (deep & shallow), magnetic susceptibility, acoustic velocity, caliper, temperature, salinity and images of an acoustic televiewer.



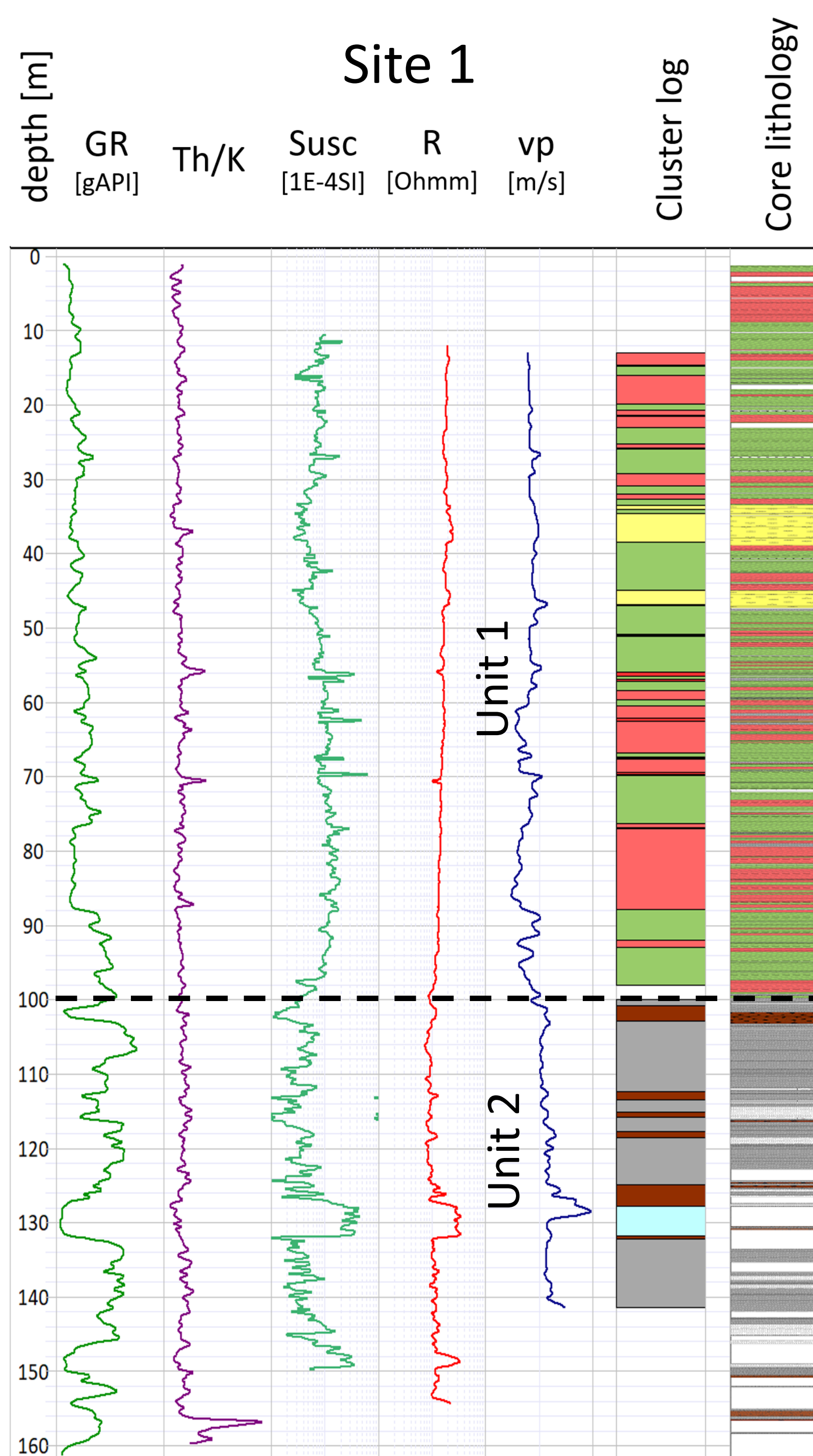
Overview map showing (a) the location of Sulawesi, (b) a geologic map of Sulawesi and (c) drill rig on Lake Towuti.



(a) Sediment thickness in Lake Towuti including logging sites. (b) Seismic reflection profile across the northern part of Lake Towuti showing both sites. Major features are Units 1 & 2, the bedrock formation and faults indicated by black lines (modified from Russel et al., 2016).

Lithostratigraphy

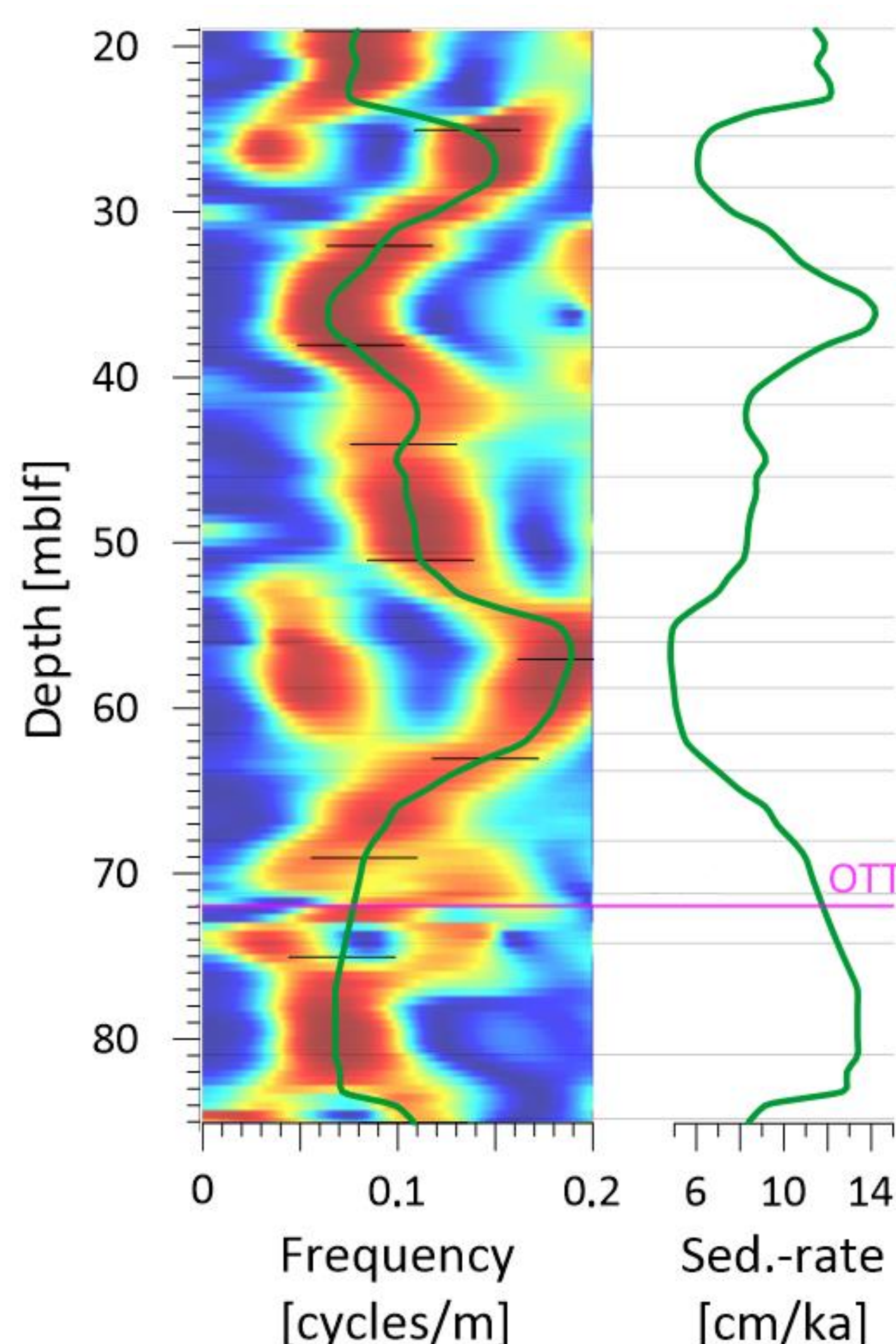
Artificial lithologic logs were created for each lithological unit separately. Cluster analysis is a valuable tool for a rough estimation of stratigraphic layers.



Site 1: Downhole logging data used for cluster analysis compared to lithological core description. Dashed line indicates change of lithology from Unit 1 to Unit 2.

Cyclostratigraphy

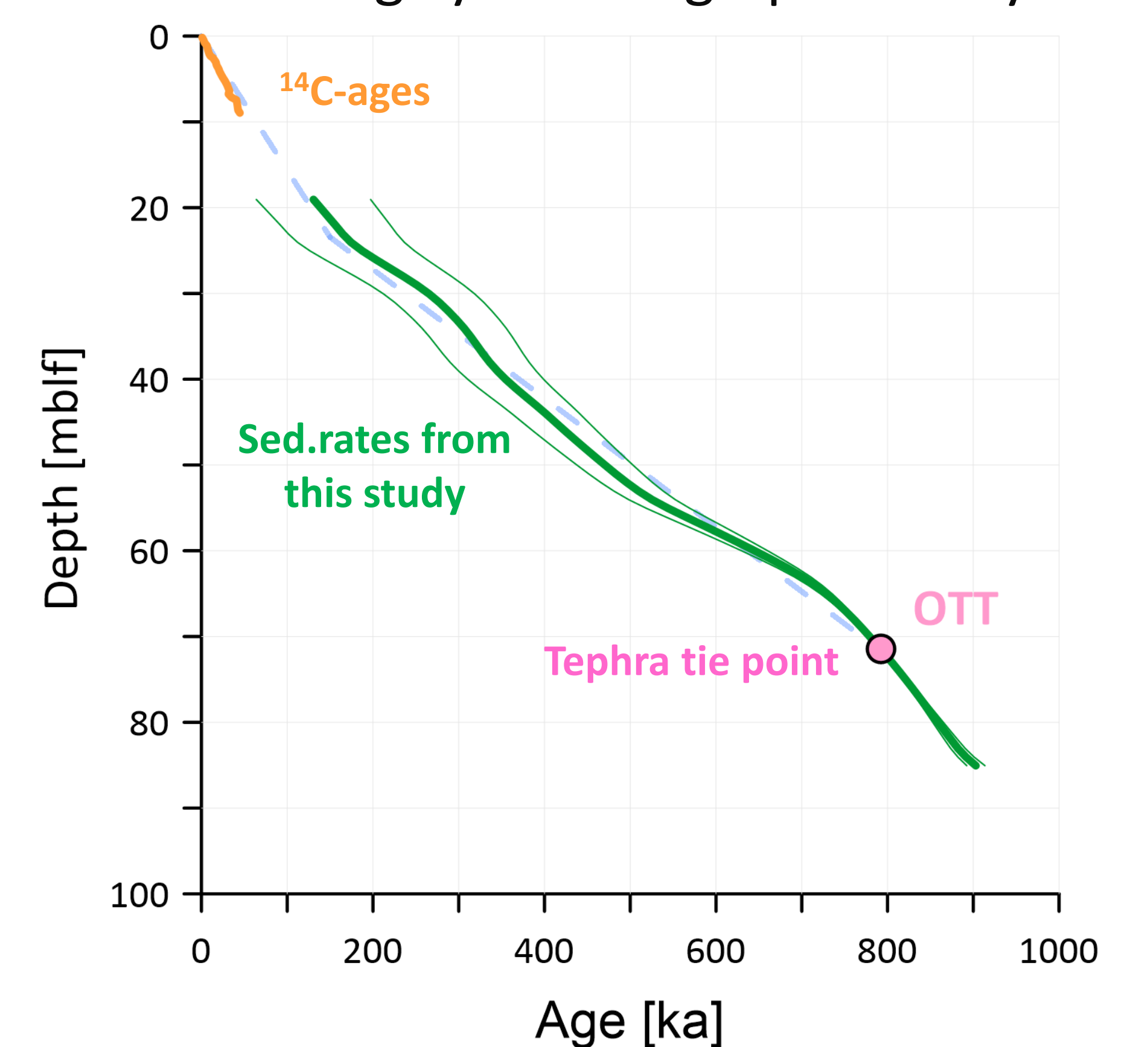
Cyclostratigraphic methods have the potential to improve our understanding of sedimentary processes and to enhance the accuracy of age-depth models, especially when dating material (e.g. tephra) is rare.



Amplitude spectrum created from processed magnetic susceptibility data from Unit 1. Green line indicates changes in sedimentation rates, which were calculated on the basis of a 110 ka cycle (combination of the 95 and 125 ka eccentricity cycle). OTT = Oldest Toba Tuff with age of 797 ka. mblf = meters below lake floor.

Age-depth model

The preliminary age-depth model improves using the sedimentation rate curve. More than 77% of the Lake Towuti's history is covered using cyclostratigraphic analysis.



Age-depth model including ^{14}C ages (orange) from Russell et al. (2014) and tephra dating tie point (pink) from Russell et al. (2020, in review). Cyclostratigraphic data from this study green line. Dashed blue line describes preliminary age depth model derived from linear interpolation of the OTT, an inflection at ~24 mblf (assumed here from paleointensity) and the sediment surface.

References

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- Russell et al. (2020, in review). The Pleistocene tectonic, biogeochemical, and limnological evolution of ferruginous Lake Towuti, Indonesia. *Palaeogeography Palaeoclimatology Palaeoecology*.
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