Seafloor structure and uppermost sedimentation in the Pigafetta Basin, Magellan Seamount Chain, and East Mariana Basin of the Central-Western Pacific

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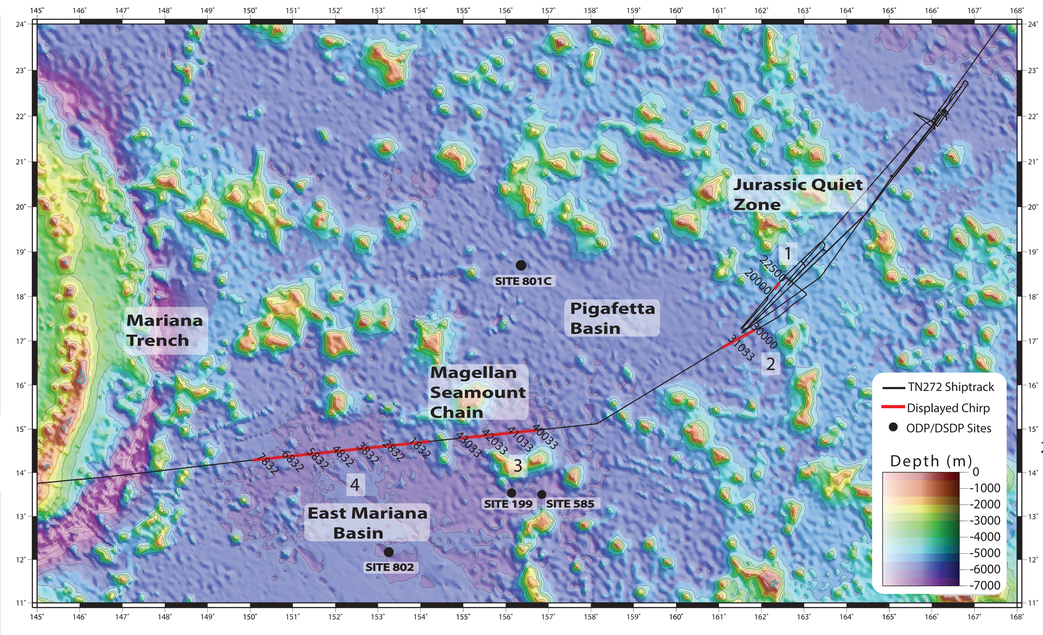
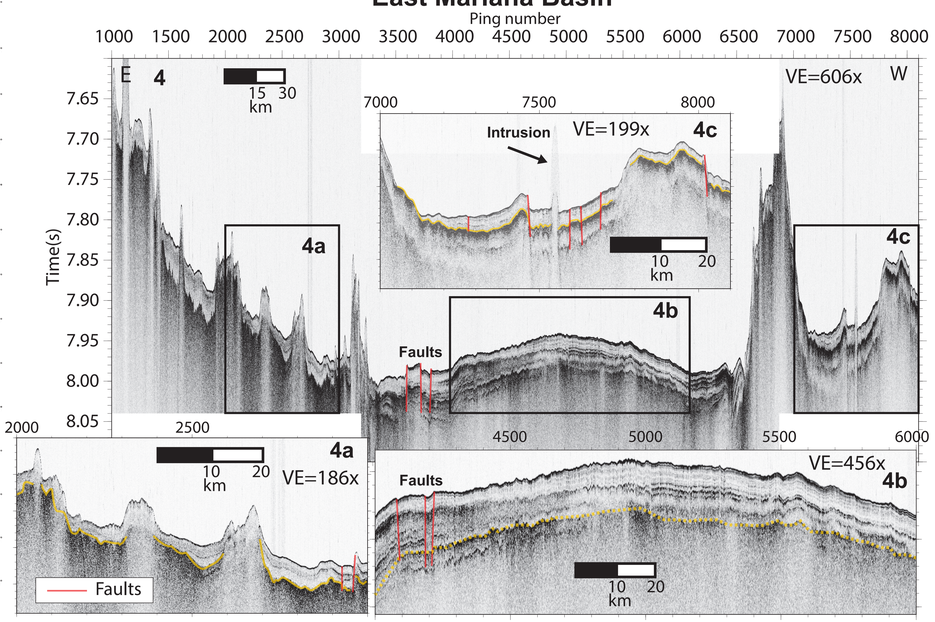
Introduction

We conducted a marine geophysical survey of the Central-Western Pacific seafloor in 2011 aboard the *R/V Thomas G. Thompson* (TN272). Our survey imaged some of the oldest seafloor on the planet in a region of sparse data coverage. We present new Chirp (3.5 kHz) and bathymetry data from the Mesozoic Hawaiian magnetic lineations (Jurassic Quiet Zone) and a transect from the south end of the Pigafetta Basin (PB), west across the Magellan Seamount Chain (MSC) and the East Mariana Basin (EMB) to the Mariana Trench. The Chirp system penetrates the overlying sediment cover to a depth of ~50 meters below seafloor (mbsf). The deepest part of the Chirp record is marked by a strongly reflecting horizon, which occasionally crops out at the seafloor near volcanic peaks or bathymetric highs. Correlation of these data to DSDP/ODP drill sites (801C, 802, 199, 585) enables us to compare seafloor structure and uppermost sedimentation in the Jurassic Quiet Zone (JQZ), Pigafetta Basin, Magellan Seamounts, and the East Mariana Basin.



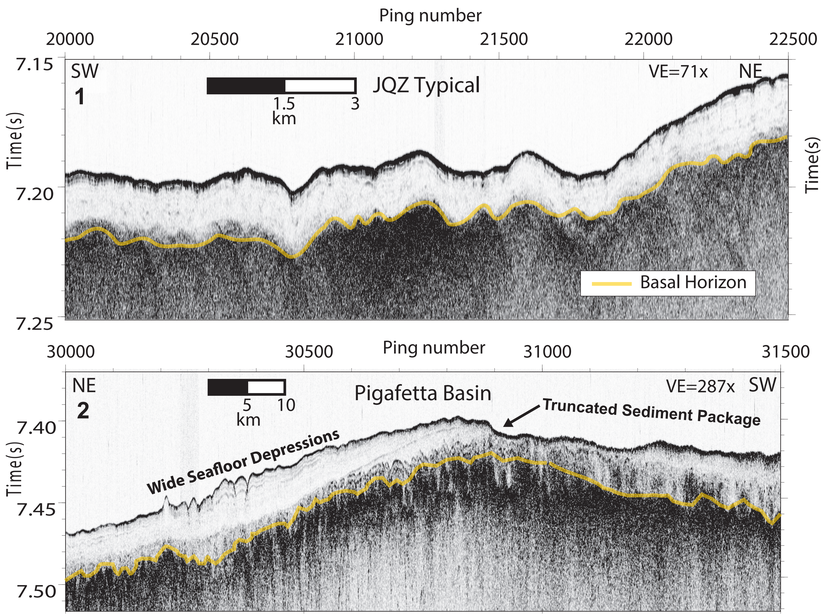
East Mariana Basin



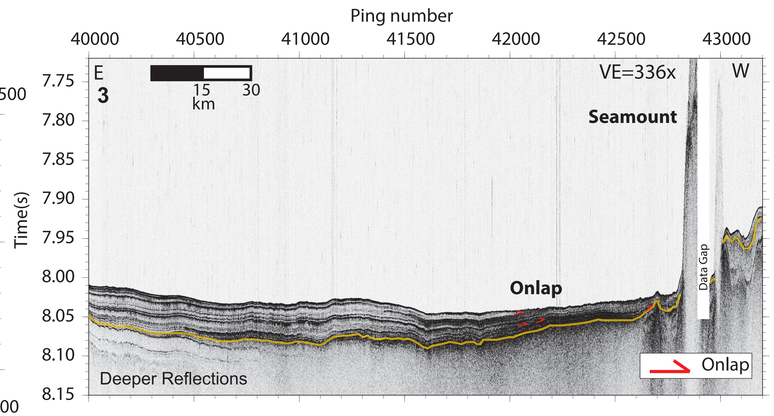
Jurassic Quiet Zone Study Area and Southern Pigafetta Basin

Uppermost sedimentation:
30-50m thick acoustically-transparent sediment layer which uniformly drapes the basal horizon in most regions. We interpret this layer to be composed of pelagic abyssal clay and radiolarian oozes (Abrams et al., 1993).

Basal horizon:
The strongly reflecting horizon is likely formed by a layer of chert-porcelanite (Abrams et al., 1993). In the southeastern Pigafetta Basin (161.3 E, 17 N) the basal horizon nears the seafloor at a depth of 5650 m and the transparent sediment package is truncated.

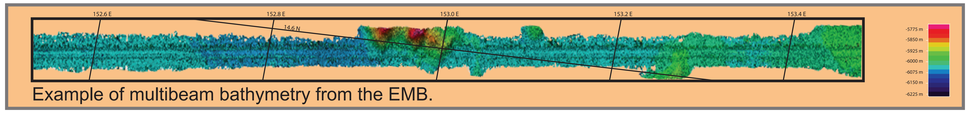


Magellan Seamount Chain



Uppermost sedimentation:
50 m thick sediment package characterized by stratified reflections. Volcaniclastic sediments as well as intrusions likely contribute to the layering (Shipboard, 1973, Shipboard,1986). The sediment layer thins to the west and onlaps the basal horizon near the base of a seamount.

Basal horizon:
Based on its depth at ~50 mbsf, we interpret the basal horizon in this region of the survey to be formed by interlayered nannochalk, limestone, tuff, and chert (Shipboard, 1973, Shipboard,1986).



Example of multibeam bathymetry from the EMB.

Uppermost sedimentation:
The data image several small, sediment-filled basins bounded by bathymetric highs formed by both faulting and volcanism. An ~15m transparent sediment layer (abyssal clay) lies above an ~35m stratified section which likely consists of volcaniclastic turbidites (Shipboard, 1990)

The basal horizon:
Based on its depth, and correlation to site 802, we interpret the basal horizon in this region of the survey to be formed by Miocene tuff (Shipboard, 1990).

Seafloor Structure:
At the western edge of the EMB, <250 km from the base of the Mariana Trench, we observe several normal faults with offsets from 5-45m.

Conclusions

In the JQZ, PB, and EMB, pelagic clay composes the youngest sediment layers, whereas in the MSC, there is evidence of more recent volcanic activity. Overall, abyssal clay thickness decreases toward the trench, as crustal age decreases and seafloor offset from normal faulting increases. The shipboard Chirp data provide valuable information about seafloor deformation and shallow sedimentation in a region of sparse data.

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