Broad seafloor depressions and new seamounts revealed in shipboard geophysical data from the Early Cretaceous – Middle Jurassic seafloor, Central-Western Pacific

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Abstract
We conducted a marine geophysical survey of the Central-Western Pacific seafloor in November-December 2011. Here we present initial interpretations of the shipboard geophysical data from a region of sparse data. During our 42-day cruise on the R/V Thomas G. Thompson (TN272) we obtained nearly 12,000 kilometers of multibeam bathymetry and backscatter (EM300 system) and Chirp sonar (3.5 kHz data). Our survey included (1) a transect from Hawaii, crossing Necker Ridge, to the Early Cretaceous portion of the Hawaiian magnetic lineations (29N, 170E); (2) several subparallel track lines across the Middle Jurassic – Early Cretaceous seafloor, specifically a corridor within the Mesozoic Hawaiian magnetic lineations (Jurassic Quiet Zone); and (3) a transect from the south end of the Papatka Basin westward across the Mariana Trench to Guam. In all these regions both Chirp and bathymetry data revealed the occurrence of submarine volcanic activity (i.e., seamounts and smaller volcanic peaks) not previously resolved or mapped by satellite-based predicted bathymetry, despite the limitations of using the Thompson's EM300 MB system in greater than 5 km of water. The Chirp data imaged a 3.5x-60 m thick transparent sedimentary layer which uniformly overlaps a strongly reflecting horizon observed at depths ranging from 4400-5900 meters. The subbottom system did not resolve features below this horizon. We interpret the transparent layer to be abyssal clay ubiquitous in the central-western Pacific and the strong reflection to be a chert layer based on core data from ODP Site 851C. Near the volcanic peaks we observed stratified sediment-filled basins, volcaniclastic sediments as well as intrusions likely contribute to the layering. We identified at least three broad, anomalous depressions in the Chirp data that are located in water depths of approximately 5530-5645 meters. These features appear as funnel-shaped, hyperbolic depressions with a wide opening tapering to a narrow base, differing from the concave seafloor depressions typical of the rest of the data set. The largest of these features is 25 m deep and 2 km across at the seafloor. These depressions are not identified in the EM300 MB data and further investigation may be needed to discover their origin. Our initial observations remind us that we have only scratched the surface of the deep Pacific. Many details, and indeed surprises remain to be discovered, and it is clear that shipboard surveys continue to be an important component in marine science.

EM300 Multibeam and 3.5 kHz Chirp Data
(2) JD 324 On JD 324 we observed wide seafloor depressions in the Chirp data that resembled large potholes ranging from 10-25 m deep and 1.5 km wide. We observed similar depressions on JD 324 and JD 335 that were less defined. These smaller depressions are 5-15 m deep and 0.5 km wide. Each of these depressions was located at the top of a 10-40 m thick transparent sediment package that overlies a strongly reflecting horizon which we interpret to be a chert layer. These wide seafloor depressions are not identifiable in the satellite-based predicted bathymetry or the shipboard multibeam bathymetry. They differ in morphology from concave seafloor depressions and faultbounded basins visible throughout the dataset.

Conclusions: Our survey filled in bathymetry gaps in the Jurassic Quiet Zone. We have identified anomalous seafloor depressions and numerous volcanic peaks and seamounts that were unreported prior to this study. This remains to be one of the main themes identified in the dataset and warrants further study.