US and Japanese Collaborative Research: A Magnetotelluric (MT) Transect Across the Mariana Subduction System

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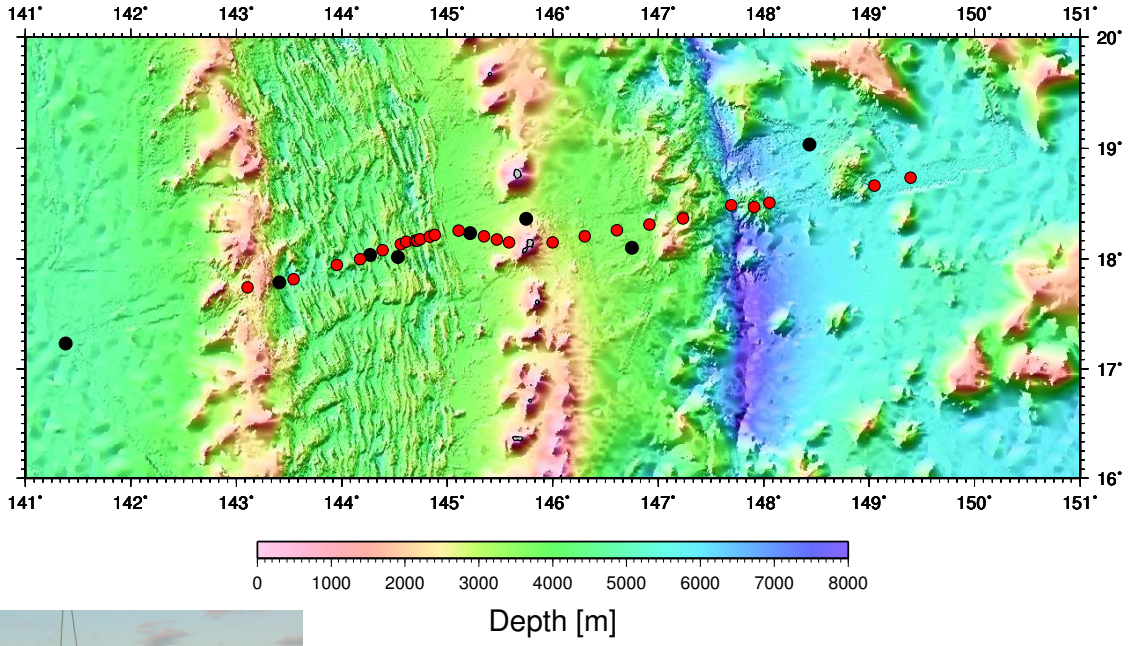
R. Evans[1], A. Chave[1]

[1]*Woods Hole Oceanographic Institution*

In collaboration with Japanese and Australian scientists, Margins funded an extensive MT profile across the central Mariana area to image the electrical structure of the Mariana subduction and back-arc system. The transect will use measurements of electrical resistivity to address issues of hydration in the mantle wedge, the distribution of subsequent melting, and patterns of flow in the mantle. In total, data from 33 MT sites have been recorded, in addition to a further 6 from previous studies. Most of the instruments were recovered in 2006, but the final two had to be abandoned due to a typhoon and were picked up in 2007. The full length of the transect is about 700km. The MT responses have been calculated and cleaned for topographic influence and are currently under analysis. The analysis so far has formed part of the PhD thesis for Tetsuo Matsuno, who has accepted a WHOI post- doctoral fellowship which he will commence this coming December. Initial features in models derived from 2D inversions of the data include: (1) a high resistivity region beneath the fore-arc extending to a depth of about 300km –which is the signal of the subducting slab, (2) a low resistivity region beneath the back-arc spreading center which extends to a depth of 100km and connects to a deeper low resistivity region, (3) a low resistivity region beneath the volcanic arc extending to a depth of 50km, (4) a low resistivity region beneath the serpentine diapirs in the fore-arc extending to a depth of 30km. Low resistivity regions may be associated with the presence of melt and/or water. All features described here are preliminary, and are the subject of on-going testing and interpretation. Future work will also involve incorporating our results with seismic models of the system, including comparisons of any electrical anisotropy with shear wave polarizations and inferences of flow patterns in the mantle wedge.



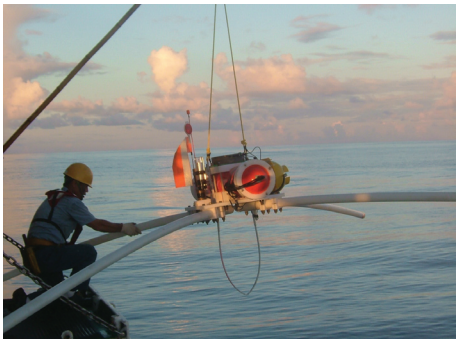


Figure: A map of the MT transect across the Mariana system showing locations of seafloor instruments (red dots) and stations from previous surveys (black dots). A photograph of one of the seafloor MT instruments being recovered (photograph by Tetsuo Matsuno).