

# Electrical Structure of 124 Ma Lithosphere Beneath the Northwest Pacific Basin

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We have been maintaining a SeaFloor ElectroMagnetic Station (Toh et al., 2004; SFEMS) in the Northwest Pacific at a site called NWP. It is situated on the seafloor as old as 124 Ma and as deep as approximately 5600 m. The acoustically confirmed coordinates of the presently operating SFEMS is (41 05.9211'N, 159 56.9093'E). SFEMS has been active for almost four years now, and yielded two-year long time-series to date which consists of the absolute geomagnetic total force, 3-component geomagnetic field and 2-component horizontal geoelectric field. In addition to the temporal electromagnetic (EM) variations, precise attitude data, viz., the instrument's orientation and horizontal two components of tilt were also recorded.

Among the above mentioned EM data, coherent magnetotelluric (MT) signals were squeezed out from the pairs of horizontal EM components of 500-day long duration in total. It turned out that the detided MT data prior to spectral analyses by RRRMT (Chave et al., 1987) were of high quality having MT coherences better than 0.8 in the period range of 1,000 s to 100,000 s. Moreover, both MT skewness and diagonal elements of the observed MT impedance tensor were proved small enough, suggesting the possibility of one-dimensional (1D) interpretation of the electrical structure beneath this very old seafloor. In fact, the rotation invariant estimate of MT scalar impedance synthesized from the determinant average of the observed MT tensor passed the D+ test (Parker, 1980) yielding a chi-square misfit of 29.0 for the determinant data of 20 degree of freedom that fell within the 95% confidence limit.

The 1D MT data were thus further modeled by the Occam inversion method (Constable et al., 1987) with a smooth constraint. The resultant 1D electrical model beneath the Northwest Pacific Basin were characterized as follows:

(1) The uppermost mantle is as resistive as ten to the power of five ohm.m, which is compatible with the resistivity of dry olivine.

(2) A conductor was found at a depth of around 40 km.

(3) A second conductor exists below the depth of about 100 km, which may correspond to the base of the electrical lithosphere.

Although the first and the third features are acceptable, the presence of the mid-plate conductor for the oceanic lithosphere of this age is very much unlikely. Further examination, therefore, of the derived 1D MT model was made for three aspects. First, robustness of the model was examined by putting a known structure at the very surface as a constraint. The surface structure to the depth of 475 m was assumed using the electrical logging data of an ODP hole close to NWP. Second, bathymetric effects were studied using a non-uniform surface thin sheet (McKirdy et al., 1985) and two-dimensional forward modeling and inversion (Uchida, 1993). Finally, long-period MT responses longer than 2-day were supplemented by geomagnetic C-responses (Schultz and Larsen, 1987) to improve model resolution of deeper parts. Results of these examinations will be presented in this session.