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Electrical feature supports the melt in the lithosphere – asthenosphere boundary as the origin of the petit-spot in northwestern Pacific

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Small-scale volcanoes possibly associated with flexure of oceanic lithosphere are called “petit-spots” and petit-spot volcanic fields have been recognized in many places in the world since the first discovery in northwestern Pacific (NWP) (Hirano et al., 2001; 2006). We have investigated the electrical conductivity structure of the lithosphere and asthenosphere through marine magnetotelluric (MT) survey to elucidate the magma generation and migration process of the NWP petit-spot. The MT array that consists of nine sites and covers about 1,000 km times 1,000 km area around the petit-spot. The data were collected during several periods in 2002–2008. A one-dimensional (1-D) representative structure in the array was first estimated to explain the averaged MT responses in the array. The 1-D profile suggest that the resistive layer, which may be interpreted as cool lithosphere, is likely thicker than predictions by typical models for thermally conductive cooling of the lithosphere having a finite thickness over time since its creation at a mid-ocean ridge (Baba et al., 2017). We have further analyzed the data using a three-dimensional inversion approach (Siripunvaraporn et al., 2005; Tada et al., 2012; Baba et al., 2013). The results show that the resistive lithospheric layer is thinner beneath the area off the outer rise along the Japan – Kuril Trench and the conductive anomaly may be centered just beneath the petit-spot field. This feature may suggest that the melt in the lithosphere – asthenosphere boundary (LAB) cumulates in the area as the result of the plate flexure. The model also shows a robust conductive anomaly in the upper most mantle depth beneath the petit-spot field, which encourages us to associate the volcanic activity at the seafloor and the anomaly in the LAB. Therefore, our result should be the first geophysical evidence directly supporting that the origin of the petit-spot magma is in the LAB although the origin has been discussed only based on geochemical evidences obtained from the lava samples. Further quantitative interpretation of electrical conductivity in terms of temperature, melt fraction and volatile (H_2O and CO_2) contents in the mantle will also be attempted and presented in the conference.