It is essential to assess the species and amount of volatile components in the mantle for understanding its dynamics and evolution. For this reason, we studied conductivity of the upper-mantle minerals as a function of temperature and incorporated water content. It is demonstrated that, although water incorporation to these minerals increases their conductivity, these effects are relatively small. In contrast, other research groups claimed significantly larger effects. Although our measurement was criticized due to lack of impedance spectroscopy, our new measurement by impedance spectroscopy proved appropriateness of our previous measurement. Our data suggested that their significantly large effects are experimental artifact. Highly conductive fluid phases must have been released from the hydrated minerals due to too high temperatures in their measurement, which masked conductivity of the minerals. Our laboratory-based conductivity model suggests 1) a very small conductivity jump at 410-km depth, 2) a remarkable conductivity jump at 520-km depth 3) dry mantle transition zone beneath the Pacific Ocean. It is also implied that very high amount of water (0.5 %) would be required for the high conductivity beneath the Philippine Sea if it is explained by hydration of the upper-mantle minerals. It was previously demonstrated that carbonate melts have much higher conductivity than silicate melt. We studied the effects of CO$_2$ component on conductivity of silicate melt, which demonstrated that the CO$_2$ component significantly increases melt conductivity. The high conductivity beneath the Philippine Sea could be explained by presence of small amount of carbonatitic melt in the deep mantle.