Geophysical Research Abstracts
Vol. 21, EGU2019-7667, 2019
EGU General Assembly 2019

Electrical Conductivity of Tremolite and Geophysical Implications

Kewei Shen, Duojun Wang, and Tao Liu

University of Chinese Academy of Sciences, College of Earth and Planetary Sciences, Geophysics, Beijing, China (shenkewei15@mails.ucas.ac.cn)

Magnetotalluric (MT) sounding results reveal that the electrical conductivity exhibit anomalous high values (∼0.1-1S/m) in subduction zones. The high anomalies of conductivities are generally attributed to the accumulation of conductive fluids or partial melting. Amphiboles are complex silicate minerals exhibiting wide chemical variation and play a key role in metamorphic petrology. Tremolite is a kind of calcic amphibole with scarcely any iron content. Tremolite with the water content of 2.1 wt.% can be stable to 80 km (2.5 GPa) even deeper in the upper mantle implying that the fluid flux resulted in the dehydration of calcic amphibole can be a significant cause to induce the geophysical observation anomalies. In this study, we measured the electrical conductivity of tremolite at pressures 1.0-2.0 GPa and temperatures 523-1273 K using a Solartron-1260 Impedance/Gain-Phase Analyzer in combination with a Solartron 1296 dielectric interface to study the effects of dehydration on the enhancement of conductivity. All the high-pressure experiments were carried out using a cubic-anvil high-pressure apparatus. Our results showed that conductivities increase with the increase of temperature and pressure has a weak influence on electrical conductivity. The infrared spectroscopy results indicated dehydration occurred and the electrical conductivity came up to maximum value (∼1 S/m) and remained almost unchanged during 1123-1273 K. The activation enthalpy of electrical conductivity increased from 82 kJ/mol to 141 kJ/mol. The relatively high conductivities in our study is due to the conductive aqueous fluid released from tremolite sample and could explain the high electrical conductivity anomalies at depths 30-65 km in subduction regions such as Southwest Japan.