The grain boundary conductivities of the peridotite at high pressure

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Under conditions of 4.0 GPa, 1373 K and frequency ranging from 10^{-2} to 10^6 Hz, the grain boundary conductivity of dry synthetic peridotite is measured by virtue of YJ-3000t Compact Six-anvil Solid High Temperature and High Pressure apparatus and Solartron-1260 Impedance/Gain-phase Analyzer. Five types of solid oxygen buffers including Ni+NiO, Fe+Fe_3O_4, Fe+FeO and Mo+MoO_2 are applied to control oxygen fugacity. The method on oxygen fugacity of sample cavity by virtue of the variation of oxygen buffers is also applied in the hydrous system [1]. We can draw the main conclusions as follows:

(1) With the rise of temperature (T), grain boundary conductivity (σ_{gb}) will increase, and Log σ_{gb} and $1/T$ conforms to Arrhenius relation. The linear correlation coefficient value (R^2) between the electrical conductivity and temperature is larger than 0.98.

(2) Under given pressure and temperature conditions, grain boundary conductivity increases with increasing oxygen fugacity.

Another different experimental data on the grain boundary electrical conductivity of dry synthetic peridotite at 2.0 GPa, 1073~1423 K and different oxygen fugacities has been shown as well [2].

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Oxygen oases and the Great Oxidation

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'Oxygen oases' in the high productivity regions of the surface ocean have been proposed to exist before the Great Oxidation [1]. Here we show that oxygen levels in the supersaturated surface ocean could be high enough to allow sufficient oxygen and carbon consumption by methantrophy or aerobic respiration to significantly reduce the oxygen and methane fluxes to the atmosphere, and that this broadens the bistable region of atmospheric transition [2], and hence could have delayed the 'Great Oxidation'. We propose that highly productive microbial ecosystems, with efficient element cycling based on oxygen, evolved in the surface oceans in advance of the oxidation of the atmosphere. This is consistent with recent interpretation of surface and deep ocean carbon isotope data from the time [3].

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