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高温高圧下における玄武岩マグマの密度・粘度・構造

Density, viscosity and structure of basaltic magma at high pressure and high temperature

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The properties of magma control magma-related processes such as volcanic activity and evolution of the Earth. Since these processes take place in the interior of the Earth, there is considerable interest in documenting how the properties of magma change with pressure. Therefore, we measured the density and viscosity of basaltic magma up to 6 GPa and revealed the pressure dependence of properties.

In case of basaltic magma, the densification between 4 GPa and 6 GPa was confirmed. On the other hand, the viscosity minimum of basaltic magma was occurred at 4 GPa, and the viscosity increase at higher pressure.

The macroscopic properties, such as density and viscosity, are strongly affected by the microscopic structure. Thus, we measured the structure of basaltic magma by using energy-dispersive X-ray diffraction method to figure out the densification and high viscous mechanisms.

According to the structure determination of basaltic magma, the T-O bond length became extended between 4.3 GPa and 5.5 GPa in spite of increasing pressure. The extension of T-O bond length reflects the increase of coordination number of T, such as Si and Al, because it is known that the T-O length of the TO6 tetrahedron is longer than that of TO4 octahedron.

The increase of coordination number caused the densification, and more viscous structure by forming network ([4]T+NBO=[5]T, [4]+2NBO=[6]T). This result is important to understand how the structure of magma controls the properties.

キーワード:玄武岩マグマ,密度,粘度,構造

Keywords: basaltic magma, density, viscosity, structure