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授与した学位	博 士
専攻分野の名称	学 術
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学位授与の要件	自然科学研究科 地球惑星物質科学専攻 (学位規則第4条第1項該当)
学位論文の題目	Hf-B-Li-Mg isotope systematics of late Cenozoic volcanic rocks from the Chugoku district, Southwest Japan: Implications for the property and transport mechanism of slab-derived fluids in the subduction zone (西南日本中国地方の後期新生代火山岩のハフニウム・ホウ素・リチウム・マグネシウム同位体システムティクス：沈み込み帯で発生するスラブ由来の流体の特性と輸送メカニズムの解明)
論文審査委員	教授 小林 桂 教授 田中 亮吏 准教授 国広 卓也 教授 Cheng Hao
学位論文内容の要旨	
Chapter 1: Introduction This chapter contains the incentive for and objectives of this study. Second, an introduction to the tectonic-geological background and geophysical observation in SW Japan and the volcanic history of the Chugoku district are introduced. In the final, previous studies on volcanic rocks, including the summary of geological setting, in the Chugoku district are summarized. Chapter 2: Evolution of slab-derived fluids beneath the SW Japan arc: Perspectives from Hf isotope compositions of volcanic rocks This chapter investigates Hf isotope compositions of 12-Ma to recent volcanic rocks from the Chugoku district in SW Japan, along with Sr-Nd isotope data produced in this study. Integrating with these isotope data with the existing elemental data, the spatiotemporal evolution of slab-derived fluids beneath SW Japan is discussed, and the sources and properties of slab-derived fluids to the sub-arc mantle are explored to place constraints on the effect of slab morphology on volcanic arc evolution. Chapter 3: Slab melting beneath the SW Japan arc driven by dehydration of altered oceanic serpentinite: Evidence from B isotopes This chapter reports new boron isotopic data obtained for high-Sr andesites and dacites (adakites), produced by melting of the subducting oceanic lithosphere, in the Chugoku district. In particular, the source of slab-derived fluids which facilitated slab melting is investigated using B isotopic signatures, and the role of serpentinites for melting of a crustal layer in subducted slab is discussed. Chapter 4: A rapid method of simultaneous chromatographic purification of Li and Mg for isotopic analyses using MC-ICP-MS This chapter presents an optimized protocol for the rapid and simultaneous purification of Li and Mg in silicate materials, which significantly reduces the separation time, required reagent volume, and procedural blanks compared to previous methods. Analytical results of Li and Mg isotope compositions of the reference materials are also presented. Chapter 5: Li isotope constraints on slab and mantle contribution to arc magmas in the SW Japan This chapter exhibits new Li isotopic data of volcanic rocks from the Chugoku district to explore the mechanism of why slab-derived Li signals are generally absent in global arcs and discuss the processes of how slab-derived $\delta^7\text{Li}$ features in arc magmas beneath the Chugoku district can be preserved based on numerical modeling. Chapter 6: Mg isotope fractionation during partial melting of the subducted slab and melt-mantle interaction in the SW Japan This chapter exhibits new Mg isotopic data of volcanic rocks from the Chugoku district to discuss the potential of Mg isotopes as a tracer of slab melting. The possible isotope fractionation that may occur during the melting of subducted oceanic crust is estimated. Secondly, the change of slab-derived Mg signature via the interaction of melt with wedge mantle during its ascent is examined based on mass-balance modeling involving diffusive isotope exchange. Chapter 7: Summary and future work This chapter provides the summary of the main conclusions reached by this research and the future direction to solve the remaining issues revealed by this research.	

論文審査結果の要旨

Mr. Zhang Wei has developed new methods for lithium and magnesium isotope analysis and combined them with previously developed methods to perform a comprehensive analysis of the hafnium, lithium, boron, and magnesium isotopic compositions of Late Cenozoic volcanic rocks in the Chugoku district of southwest Japan. By exploiting differences in the solubility of these elements in fluids/melt and their mineral-melt partitioning, he has investigated the contribution of each component (sediment, basaltic crust, and peridotitic mantle) in the magma and the state of the fluid/melt (aqueous fluid, supercritical fluid, and hydrous silicate melt) that contributed to the magma generation in the sub-arc mantle beneath the Chugoku area. The results of this study show that (1) subducted sediments melted and produced hydrous silicate melts, while the lower basaltic crust produced supercritical fluids in the early stage then changed to silicate melts in the later stage, (2) the contribution of fluids originating from the peridotite mantle part of the slab, which has not been emphasized, was clarified and is considered to have resulted in melting of overlying basaltic crust, and (3) time scale of fluid migration through the wedge mantle was estimated from the modeling of stable-isotope equilibria, which first gave a quantitative estimate of <0.3 million years, suggesting the plausible fluid migration by diapirs. These results provide the first model that rationally explain the mechanism of volcanogenesis in the Chugoku region, and the first highly original research that quantitatively clarified the actual conditions and migration patterns of slab-derived fluids. His PhD thesis is a highly original study and is fully recognized as a doctoral dissertation.