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論 文 要 旨

THESIS SUMMARY

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要旨（英文 800 語程度）
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In recent years, research has intensified in intraplate volcanic settings that generate more enriched and diversified lavas relative to voluminous outpourings in the mid-ocean ridges. Intraplate continental volcanic rocks have geochemical characteristics akin to those of intraplate oceanic volcanic rocks. These volcanic settings are commonly interpreted as 'locals' for hotspot manifestation, e.g., Hawaiian-Emperor Chain. Intraplate volcanoes of this type are easy to investigate as the volcanoes are products of a single hotspot. The Cameroon Volcanic Line (CVL) has a unique tecto-magmatic setting in the world involving volcanoes developed simultaneously on the ocean floor and the continental lithosphere erupting geochemically similar lavas. The alignment of volcanoes stretch from the Annobon island in the Atlantic Ocean straddling the continent/ocean boundary (COB) to the mainland Africa. The absence of a defined age pattern along the chain has rendered the hotspot hypothesis unsuitable. Alternative hypothesis from structural, geological, geophysical, petrological and geochemical studies are still a subject of contention. Evidence from trace elements and isotopic ratios suggest that the entire mantle beneath the CVL was metasomatized probably in the Mesozoic. This has accounted for heterogeneity revealed from studied lavas. Attempts to provide explanations to some of the unresolved questions (origin, nature of the mantle, metasomatic fluid and plume, and the interaction with the lithosphere) has been difficult due to limited data.

The Oku Volcanic Group (OVG) was selected to investigate some of the debated issues on the CVL because of: (1) its variety of volcanic suits that overlap lavas of the typical oceanic COB, and other continental volcanoes. (2) It is located approximately midway of the CVL. (3) The bifurcation of the CVL into two branches was initiated north of the OVG. (4) The OVG host numerous volcanic lakes, amongst which is the infamous Lake Nyos. (5) An abnormal $^{3}He/^{4}He$ offset was reported in Mt. Oku which is unexpected, if radiogenic $^{206}Pb/^{204}Pb$ decreased from the COB towards both sides of the chain, and (6) It is one of the least studied in terms of isotope geochemistry.

New data for major elements (n = 130), trace elements (n = 130), and Sr (n = 70), Nd (n = 70), and Pb (n = 60) isotope ratios have been generated for volcanic rocks in the OVG to interpret the petrogenesis of lavas. Major elements, trace elements and isotope composition suggest that the magma was generated

in the garnet stability field. Results indicate the existence of two principal groups of lavas: 1) Lavas with high radiogenic $^{206}Pb/^{204}Pb$ (>19.5), plotting in the FOZO field and showing a HIMU signature. 2) Lavas with depleted $^{206}Pb/^{204}Pb$ and slightly higher $^{87}Sr/^{86}Sr$, extending from the FOZO field towards the depleted mantle. The coexistence of these two groups of lavas suggests heterogeneity in the mantle and subcontinental lithospheric mantle reservoirs. This heterogeneity could originate from different degree of mixing in these reservoirs, the nature of the components involved and the extent of partial melting. Modelled results indicate mixing of at least three mantle components (mixture of different proportions of DMM+EM1 with HIMU) to account for the isotope characteristics. The highest value of $^{206}Pb/^{204}Pb$ (20.7) along the CVL has been reported in this study (Mt. Oku). The discovery of high radiogenic $^{206}Pb/^{204}Pb$ in this study alongside the HIMU signature reported in the Biu Plateau in the north of the CVL chain argue against decreasing HIMU signature from the COB towards the continental and oceanic CVL as proposed in previous studies. However, the trend in Sr-Nd-Pb isotope space plots for lavas with high radiogenic $^{206}Pb/^{204}Pb$ from the Biu Plateau (North) to the OVG (middle) and COB (south) of the chain could suggest an evolution of the HIMU signature within the CVL and thus may shed more light on the petrogenesis of lavas.

In the domain of risk mitigation, the geochemical results for samples from maar bearing volcanoes in the OVG suggests that the source of magma in the mantle beneath all the volcanoes (Nyos, Wum, Elum and Oku) investigated was enriched in CO_2. However, the shallow depth in Lakes Elum, Elum and Oku cannot permit significant accumulation of CO_2 that could pose a potential threat. On the contrary, the average depth of Lake Nyos (112 m) can permit large accumulation of CO_2 gas at its bottom that could be of potential risk.

Data generated in this study alongside literature data have been used to propose a hybrid plume model for the origin of the CVL. The origin of the CVL and geochemical signature of its lavas involves interplay of tectonic, geophysical and geochemical parameters. The tectonic parameter (rifting, faulting, shear) influences the migration of lavas while the geochemical parameters are influenced by mixing of at least three mantle components derived from the asthenosphere and the SLM.