Rare earth element geochemistry of Kestelek (Bursa) borate deposit, West Anatolian,Turkey

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In this study, rare earth element geochemistry of the Kestelek borate deposit, one of the Western Anotolian borate deposits, is investigated. The known borate deposits of the Turkey were deposited in the lacustrine environment during Miocene when the volcanic activity occurred since Tertiary to Quaternary. All of the Turkish borate deposits are classified as volcanic related deposits. Rare earth element analyses of borate (colemanite) samples with different depth and textural compositions which are collected from the three different ore zones of Kestelek borat deposit are evaluated. In this situation upper crust normalized distribution diagrams of rare earth elements are made to determine physicochemical conditions and original relations of the Kestelek borate occurance environment. Borate samples present two different groups at REE distribution diagrams which are made one by one for three different ore zones in Kestelek borate deposit. At the REE distribution diagrams, two different grouping of the curves signs that at least there are two different precipitation regimes. REE are generally constant at environment conditions which supply occuring straight lines. Second group curves, show clear anomalies, present negative Ce and positive Eu anomalies that exhibit hydrothermal source and precipitation regime with high oxygen fugacity (fO_2). Some samples show middle rare earth element enrichment. MREE enrichment is characterized at hot naturel fluids and acid leaching. At the same time, mid- acidic source origined REE components show positive Eu and MREE enrichment. According to REE analyses results of borate samples belong to the three different ore zones, positive Eu anomalies and ranges of borate samples (where La/Lu > 1) sign mid-acidic and high temperature conditions.

References

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Petrological and geochemical constraints on origin of St. Helena HIMU basalts

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Alkali basalts on St. Helena Island are characterized by elevated $^{206}Pb/^{204}Pb$ (>20.5) and $^{187}Os/^{188}Os$, coupled with depleted Sr and Nd isotopic signature. As a result they are representative of a mantle component referred as HIMU. In order to evaluate magmatic processes and source compositions of HIMU basalts, a detailed petrological and geochemical study was conducted on the shield building lava flows and dikes of the island.

The basalts show continuous compositional variation, which correlate well with petrographical features, such as modal abundance and crystal size of olivine and clinopyroxene phenocrysts. The compositional and petrographical diversity for alkali basalts can be explained by fractional crystallization of olivine and clinopyroxene at shallow depth (~1kb), and by subsequent changes in melt/crystal ratios when magma batches were extracted from a partially crystallized magma chamber.

Primary magma compositions for St. Helena basalts estimated by simulating the reverse path of fractional crystallization, show constant TiO_2/Al_2O_3, Yb/Tb, and highly incompatible element ratios, suggesting a homogeneous mantle source for these magmas. Examination using both pMELTS software (Ghiorso et al., 2002) and compiled data from high-pressure experimental studies for mafic rocks suggests that the primary magma can be in equilibrium with clinopyroxene and/or garnet at >ca. 2 GPa. This is the depth of the lithosphere/asthenosphere boundary beneath the island. It should be stressed that Ca and Al-rich eclogite or pyroxenite on silica-deficient in nature, not lherzolite, could be the mantle source for St. Helena basalt magmas. In order to form the source, contribution from recycled crustal material is necessary. This hypothesis is consistent with high $^{187}Os/^{188}Os$ of St. Helena basalts.

The primary magmas are characterized by low (Rb, Ba, Th, U)/Nb and Th/U ratios, and the absence of positive Sr and Eu anomalies. Together, these suggest that upper gabbroic portions of the less altered oceanic crust, rather than the lower plagioclase-rich cumulate gabbro, was recycled and involved in the mantle source of St. Helena basalt magmas.