Britholite-hellandite intergrowths and associated REE-minerals from the alkali-syenitic ejecta of the Vico volcanic complex (Latium, Italy): petrological implications bearing on REE mobility in volcanic systems

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Abstract: This paper describes the occurrence of Th-rich hellandite-(Ce) and britholite-(Ce) within a volcanic ejectum from a pyroclastic formation of the Vico volcanic complex, north of Rome, Italy. The host rock is a saturated alkali-syenite which consists mainly of potassium feldspar and plagioclase, together with fluor-biotite, plagioclase, titanite, clinopyroxene and magnetite. Hellandite-(Ce) and britholite-(Ce) are associated with this mineral assemblage which contains also several accessory phases including zircon, fluoroapatite, allanite, and silico-phosphates of Th, U, REE close in composition to cheralite-brabantite. Hellandite-(Ce) and britholite-(Ce) are typically intergrown with hellandite in all case observed rimming britholite. These unusual REE, Th, U minerals are secondary to the formation of the host rock and the compositions of the associated minerals suggest that they originated from fluids rich in F, P, and possibly S and C. The presence of fractures filled by clays containing dispersed REE-minerals, probably fluorocarbonates, suggests a very late-stage hydrothermal remobilization, transportation and redeposition of the REE. An important implication of such widespread secondary mineralization is that great care should be exerted when using bulk-rock trace-element data from these volcanic samples for geochemical modelling.

Key-words: hellandite, britholite, REE-phosphates, crystal chemistry, Latium volcanic district.

Introduction

The holocrystalline ejecta scattered throughout the Plio-Pleistocene pyroclastic formations of central Italy are a known source of incompatible-element-bearing minerals (Bellucci & Grassi, 1919; Bonatti & Gottardi, 1950) and have provided in the last decade an extraordinary variety of findings including Zr-Ti-REE+ACT (Th+U) oxides and silicates, e.g. baddeleyite, zircon, zirconolite, pyrochlore (Gianfagna, 1985; De Casa et al., 1986; Bellatreccia, 1997; Bellatreccia et al., 1998), REE-phosphates and borates (Della Ventura et al., 1993, 1996) and REE+ACT silicates and silico-borates (Demartin et al., 1983; Maras et al. 1995; Parodi et al., 1994; Burns et al., 1993). Several geochemical and petrological studies have been undertaken during the last decade to attempt to model, using the abundance and distribution of REE and actinides in the volcanic products (Cundari, 1979; Barbieri et al., 1988; Conticelli & Pecceirillo, 1992; Federico et al., 1994), the igneous