Geochemical fractionation of pegmatites from the Kabarore-Mparamirundi area (Burundi) as pathfinder to Sn-Ta-Nb pegmatites.

Denis TURIMUMAHORO[1]*, Philippe MUCHEZ[1], Stijn DEWAELE[2,3], Niels HULSBOSCH[1] & Louis NAHIMANA[4].

1 KU Leuven, Geodynamics and Geofluids Research Group, Department of Earth and Environmental Sciences, Celestijnenlaan 200E, B-3001 Leuven, Belgium.
2 Department of Geology and Mineralogy, Royal Museum for Central Africa (RMCA), Leuvensesteenweg 13, 3080 Tervuren, Belgium.
3 Ghent University, Department of Geology, Ghent, Krijgslaan 281, S8, Belgium.
4 Université du Burundi, Faculté des Sciences, Département des Sciences de la Terre, B.P 2700 Bujumbura, Burundi.
denis.turimumahoro@student.kuleuven.be

1. Introduction and geological setting

Located in northwestern Burundi in Central Africa, the Kabarore-Mparamirundi area forms part of the Sn-Ta-Nb-W-Au metallogenic province of the Mesoproterozoic Karagwe-Ankole Belt. This belt encompasses south Kivu and Maniema (DRC), Burundi, Rwanda, southwestern Uganda and northwestern Tanzania. It hosts significant Ta-Nb and Sn-bearing pegmatite intrusions associated with a Neoproterozoic tin granite generation (986 ± 10 Ma; SHRIMP U-Pb on zircon; Tack et al., 2010). In literature, the petro- and metallogenesis of pegmatites has been a controversial debate for decades (London, 2008). Varlamoff (1954) identified a regional mineralogical zonation of pegmatites in the Gatumba-Gitarama region of Rwanda (70 km from our study area) around the Gitarama pluton granite. A regional zonation is developed around a parental tin granite and the proximal pegmatites grade outwardly into biotite, two-mica and muscovite pegmatites. Rare-element (Nb–Ta–Sn) pegmatites occur most distal from the granite (Hulsbosch et al., 2014). Trace element modelling demonstrated that Rayleigh fractional crystallization governs this mineralogical and geochemical evolution from a granite source to common and eventually rare-element pegmatites (Hulsbosch et al, 2014).

The alkali metal concentration, i.e. K, Rb, and Cs, of dioctahedral micas are good indicators of the magmatic differentiation of pegmatites and are proxies for their mineralization potential (Černý et al., 1985). The aim of our study is to determine the degree of fractionation of the pegmatites of the Kabarore-Mparamirundi region and to correlate this fractionation with a regional mineralogical-geochemical zonation documented by Hulsbosch et al. (2013, 2014) around the granite pluton of Gitarama. The objective is to test if the trace element content of dioctahedral micas can be used as a vector tool for the exploration of mineralized or sterile pegmatites in the Kabarore-Mparamirundi area. Twenty-one muscovite samples from multiple pegmatite dykes from different localities in the area were analyzed for major, minor and trace elements by inductively coupled plasma optical emission spectrometry (ICP-OES) and inductively coupled plasma mass spectrometry (ICP-MS) respectively.

2. Results and interpretation

Concentrations of alkali metal elements (K, Rb, Cs) in muscovite vary in the range of 1450–7590 ppm for Rb, 40–1380 ppm for Cs and since K (in wt%) is a major element in muscovite it does not vary significantly within the samples (i.e between 9.9 and 10.3 wt%). The K/Rb and K/Cs ratios (in ppm/ppm) show a similar trend (Fig. 1). They range from 58 to 10 for K/Rb and from 2050 to 60 for K/Cs. According to the general model of fractional Rayleigh crystallization for the assessment of the regional differentiation mechanism of pegmatite zones around a parental granite, the model of Hulsbosch et al. (2014) is applied. The fractionation model states that the pegmatites close to the parental granite are the least fractionated whereas the distal pegmatites are the most fractionated. The modelled degree of crystallization of 78% - 99% crystallization suggests that the pegmatites of Kabarore-Mparamirundi region are highly differentiated. This fractionation interval corresponds to pegmatites of the muscovite zone and the Nb-Ta-Sn mineralized zone (Hulsbosch et al. 2014). Further studies are planned to petrographically and geochemically characterize the Gr5 parental granite from which these pegmatites are most probably derived.

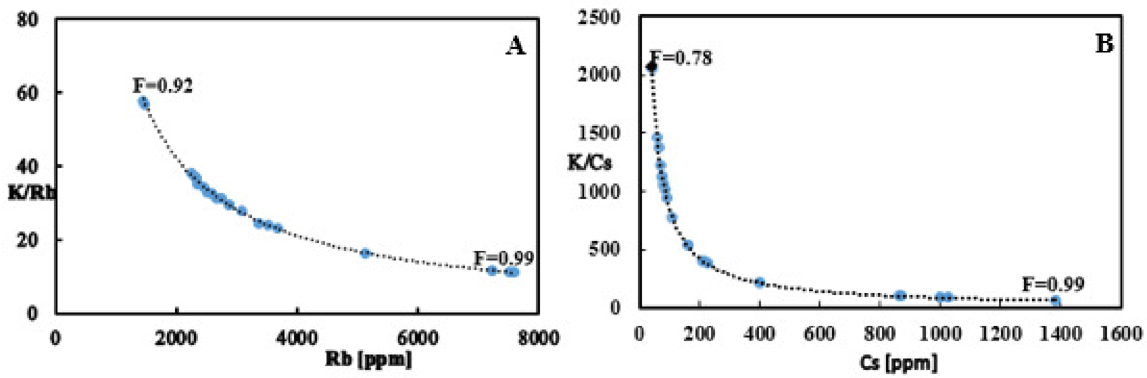

Figure 1. K/Rb vs Rb (A) and K/Cs vs Cs (B) plots of muscovite samples.

References

Černý, P., Meintzer R. E. & Anderson A. J., 1985. Extreme fractionation in rare element granitic pegmatites: selected examples of data and mechanism. Canadian Mineralogist, 23, 381-421.

Hulsbosch, N., Hertogen, J., Dewaele, S., André, L. & Muchez, P., 2014. Alkali metal and rare earth element evolution of rock-forming minerals from the Gatumba area pegmatites (Rwanda): Quantitative assessment of crystal-melt fractionation in the regional zonation of pegmatite groups. Geochimica et Cosmochimica Acta, 132, 349-374.

Hulsbosch, N., Hertogen, J., Dewaele, S., André, L. & Muchez, P., 2013. Petrographic and mineralogical characterisation of fractionated pegmatites culminating in the Nb-Ta-Sn pegmatites of the Gatumba area (western Rwanda). Geologica Belgica, 16, 105-117.

London, D. 2008. A petrologic assessment of internal zonation in granitic pegmatites. Lithos, 184-187, 74–104.

Varlamoff, N. 1954. Répartition des types de pegmatites autour de la partie nord-ouest du grand massif granitique de Nyanza. Annales de la société géologique de Belgique, 78, 1-21.