Magmatism, hydrothermalism and complex (REE and HFSE) mineralized system in the Upper Ruvubu alkaline Massif, Burundi

S. DECRÉE[1], P. BOULVAIS[2], C. COBERT[2], J.M. BAELE[3], V. GARDIEN[4], L. TACK[5] AND D. DEMAIFFE[6]

[1]Belgian Royal Institute of Natural Sciences, Belgium. Email: sophie.decree@naturalsciences.be
[2]Géosciences Rennes–UMR 6118, Rennes 1 Univ., France
[3]University of Mons, Belgium
[4]Claude Bernard University Lyon 1, France
[5]Royal Museum for Central Africa, Belgium
[6]University of Brussels (ULB), Belgium

The Neoproterozoic Upper Ruvubu alkaline plutonic complex (URAPC) comprises feldspathoidal syenites, diorites, quartz-bearing syenites, granites and a carbonatite intrusion. The latter displays exceptional mineralization features, among which giant zircon and ilmenite crystals, in an area of intense and extensive K-fenitization. Carbonatitic breccias are also encountered in the URAPC; they are characterized by the presence of monazite and REE-carbonates.

LA-ICP-MS analyses and stable isotope compositions of these REE-/HFSE-minerals (or paragenetically associated mineral phases) allow linking mineralization to both magmatic and surficial fluids. The involvement of (late-)magmatic processes is suggested by the oxygen isotope values obtained on the zircon and ilmenite giant crystals ($+4.0<\delta^{18}O<+4.7‰$ and $-1.4<\delta^{18}O<-4.3‰$, respectively), values that are in apparent equilibrium with the carbonatite body at high-temperature. In the carbonatitic breccia, the LREE-monazite is cogenetic with a magmatic Fe-Mn-calcite ($\delta^{18}O=+9.7‰;\delta^{13}C=-5.6‰$), suggesting a comparable origin. By contrast, late calcite, which is coeval with REE-carbonates, shows an increase in the $\delta^{18}O$ value ($\delta^{18}O=+12.5;\delta^{13}C=-5.0‰$). This highlights hydrothermal processes. At the scale of the URAPC, REE fractionation is visible in the most isotopically altered carbonatites, which points to mobilization of these elements. The site of re-deposition of the leached REE could be the carbonatitic breccia, where REE-carbonates are genetically linked to hydrothermally altered calcite. Another likely source for hydrothermal REE concentration in these breccias could be found in the fluids directly derived from the carbonatite magma, maybe deep-seated.

By analogy, at Gakara (distant of 40 km from the URAPC), where hydrothermal REE-mineralizations occur, a comparable deep-seated altered carbonatitic system could be envisaged to explain the high-level REE mineralization.