MINERALOGY AND CHEMISTRY OF CASSITERITE FROM BUGARURA-KULUTI DEPOSIT, KARAGWE-ANKOLE BELT, RWANDA

RYZNAR, J.
AGH-UST University of Science and Technology, Faculty of Geology, Geophysics and Environmental Protection, Kraków, Poland
E-mail: ryznar@agh.edu.pl

Geological background

Bugarura-Kuluti area belongs to the Central African Mezoproterozoic Karagwe-Ankole Belt (KAB) which together with Kibara Belt (KIB) forms one of the world's largest Ta-Nb-Sn-W province (HULSBOSCH, 2019). This metallogenic province stretches for over 1300 km from southern Uganda through north-western Tanzania, Rwanda, Burundi to the eastern part of Democratic Republic of Congo. The KAB consists mainly with siliciclastic pelite and arenite turbidite sequences which underwent a regional low-grade, greenschist to low-grade amphibolite facies metamorphism (BAUDET *et al*., 1988). The sediments of the KAB were intruded by bimodal magmatism resulting emplacement of the older granites called G1-G3 (1375 Ma; TACK *et al*., 2010) and the younger granites called G4 (986 ± 10 Ma; TACK *et al*., 2010). Granites "G4" are considered as the source of Sn, Ta-Nb and W mineralization and they have been described as F-poor, B-rich, non-deformed equigranular, peraluminous leucogranites (HULSBOSCH, 2019). The younger magmatic event was followed by emplacement of LCT pegmatites with Ta-Nb-Sn mineralization and hydrothermal quartz, quartz-muscovite veins with Sn and/or W mineralization (HULSBOSCH, 2019).

Results and discussion

The cassiterite from all of the type of deposits has common features like twinning, moderate to intense pleochroism, intense colourful anisotropy and mineral inclusions. However, chemistry of cassiterite, quantities and chemistry of mineral inclusions varies in different style of deposits. Moreover, macroscopically, cassiterite shows variations in its size and distribution. The cassiterite from pegmatites doesn't occur in much quantities. Usually, it is very fine-grained and occurs with Ta-Nb mineralization in kaolinized albite, muscovite and quartz zones. The size of crystals rarely exceeds 1 mm. Single crystals contain numerous mineral inclusions of columbite-group minerals. Chemically, cassiterite has elevated ZrO_2 (av. 0.1%), Ta_2O_5 (av. 1.1%), Nb_2O_5 (av. 0,.4%) and decreased TiO_2 (av. 0.1%) content compared to greisen and vein types. The cassiterite from greisen is chaotically distributed in the ore body and size of single crystals is around 1 cm. Mineral inclusions are composed of columbite-group minerals which locate in brighter zones of mineral. Cassiterite has also similar to pegmatite chemical composition with elevated ZrO_2 (av. 0.1%), Ta_2O_5 (av. 0.6%), Nb_2O_5 (av. 0.3%) and decreased TiO_2 (av. 0.05%) content. It is noteworthy that Ta-Nb content in greisen cassiterite is lower than in pegmatite. In both cases Ta > Nb. Hydrothermal quartz veins are the richest in Sn mineralization. The cassiterite concentrates as discontinuous pockets in muscovite selvages and on the contact with quartz. Mineral inclusions are not so numerous like in greisen and pegmatite. They are composed of rutile, ilmenite and rare columbite-group minerals. Contrary to greisen and pegmatite, the vein type cassiterite has elevated TiO_2 (av. 0.5%) and decreased ZrO_2 (av. 0.03%), Ta_2O_5 (av. 0.1%) and Nb_2O_5 (av. 0.1%) content. Fe + Mn of all cassiterite minerals show positive correlation with Nb + Ta which indicate magmatic evolutionary path. This confirms field observations and radial position of deposits around parental granite.

The chemical composition of cassiterite and its mineral inclusions can be considered as a valuable exploration tool when prospecting for primary cassiterite mineralization. During heavy mineral concentrate survey which is largely applied to rare metal mineralization, the chemical composition indicates the nature of primary mineralization (i.e., hydrothermal quartz vein, greisen or pegmatite).

References

BAUDET, D., HANON, M., LEMONNE, E., THEUNISSEN, K., BUYAGU, S., DEHANDSCHUTTER, J., NGIZIMANA, W., NSENGIYUMVA, P., RUSANGANWA, J. B. & TAHON, A. (1988): Annales de la Société Géologique de Belgique, 112: 225–246.

HULSBOSCH, N., (2019): In: Decrée, S. & Robb, L. (Eds.): Ore deposits: Origin, exploration, and exploitation. Geophysical Monograph, 242: 75–107.

TACK, L., WINGATE, M. T. D., DE WAELE, B., MEERT, J., BELOUSOVA, E., GRIFFIN, B., TAHON, A. & FERNANDEZ-ALONSO, M. (2010): Precambrian Research, 180(1–2): 63–84.