

Results of FTIR studying microdiamonds from gneisses and calc-silicate rocks from mine Kumdi-Kol, Northern Kazakhstan

E. SITNIKOVA AND V.S. SHATSKY

Institute Geology and Mineralogy, Siberian Branch of the RAS, 3prosp. Koptuyuga, Novosibirsk, 630090, Russia (sentyabrana@uiggm.nsc.ru, shatsky@uiggm.nsc.ru)

Statistically representative selection of microdiamonds from gneiss and calc-silicate rocks of the Kumdy-Kol deposit was first time studied by means of FTIR spectroscopy. Grayish yellow diamonds of the calc-silicate rocks are about 10-90 mkm in size and have cuboidal morphology. The morphology of microdiamonds from gneiss is more versatile. The crystals of octahedral, cubooctahedral and cuboidal morphologies were found there. They also have yellow color with grayish tint. The size of the gneiss microdiamonds varies between 15 and 150 mkm. The size of studied diamonds were about 60-150 mkm.

The selected diamonds have been studied with Bruker VERTEX-70 FTIR spectrometer equipped by Hyperion IR-microscope. IR spectra demonstrate that all of the studied diamonds contain nitrogen defects, which are manifested through the absorption at 1135 cm^{-1} (C-defects) and 1282 cm^{-1} (A-defects). Concentrations of nitrogen in the diamonds from different rocks are similar and vary from 700 to 2500 ppm ($\pm 20\%$). The nitrogen aggregation in the studied crystals varies from 30 up to 50% ($\pm 6-18\%$). The absorption at 3107 cm^{-1} indicates the presence of hydrogen defects. The intensity of absorption at 3107 cm^{-1} in gneiss diamonds is 5-20, while in calc-silicate rock diamonds - 2-10. Our data indicate that the studied microdiamonds belong to the Ib-IaA type.

IR spectra of diamonds from gneiss and calc-silicate rocks differ from each other in additional absorption lines. The spectra of calc-silicate rock diamonds testify to the presence of carbonate (1430 cm^{-1}) and silicate (1090 cm^{-1}) inclusions, water (banding vibrations at 1630 (1650) $\pm 5\text{ cm}^{-1}$ and stretching at 3420 cm^{-1}). The spectra of the gneiss diamonds do not demonstrate the presence of carbonates, silicates and/or water.

The differences of inclusion assemblages in microdiamonds from gneiss and calc-silicate rocks are the evidence of the extremely low mobility of the fluids/melts in the course of UHP metamorphism.

“Blood Coltan”: Fingerprinting of columbite-tantalite ores

M.A. SITNIKOVA¹, F. MELCHER¹, T. OBERTHÜR¹, F. HENJES-KUNST¹, A. GERDES², H. BRÄTZ³ AND D.W. DAVIS⁴

¹BGR, Stilleweg 2, D-30655 Hannover, Germany (f.melcher@bgr.de, mariaalexandrovna.sitnikova@bgr.de, Thomas.Oberthuer@bgr.de, Friedhelm.Henjes-Kunst@bgr.de)

²Institute of Geosciences, Petrology & Geochemistry Altenhöferallee, D-60438 Frankfurt am Main, Germany (gerdes@em.uni-frankfurt.de)

³Mineralogical Institute, Würzburg, Germany, Am Hubland, D-97074 Würzburg, Germany (helene.braetz@mail.uni-wuerzburg.de)

⁴Department of Geology, University of Toronto, 22 Russell Street, Toronto ON M5S 3B1, Canada (dond@geology.utoronto.ca)

The term “Blood Coltan” was coined for columbite-tantalite ores in the Congolese civil war, as their sale supported the conflict, especially in the eastern provinces of the DRC. Following the United Nations initiative to fingerprint the origin of conflict materials, the German Ministry for Economic Cooperation and Development decided to fund this pilot study on fingerprinting coltan ores.

So far about 160 samples have been obtained from the world's major coltan producing areas. Special attention is directed toward the Ta-Nb-Sn provinces in Africa: DR Congo, Rwanda, Mozambique and Namibia.

Using state of the art analytical tools, we are investigating a wide range of mineralogical and chemical parameters obtained from columbite-tantalite ores, in an attempt to distinguish between different ore provinces, down to the individual deposit scale.

Methods employed include XRF (bulk major and trace elements), XRD (structure), ore microscopy, fully automated electron microscopy (Mineral Liberation Analysis), electron microprobe analysis (major and minor), laser ablation-ICP-MS (trace elements, isotopes), and TIMS (U-Pb dating).

Elevated concentrations of U, and low amounts of common Pb in columbite-tantalite, facilitate the application of the U-Pb system to date columbite-tantalite. Consistent results of TIMS and LA-ICP-MS analyses in three different laboratories prove that columbite-tantalite yields concordant and reliable ages. In the samples analyzed so far from Africa, four age populations are evident: Archaean ($>2.6\text{ Ga}$), Palaeoproterozoic ($1.9-2.1\text{ Ga}$), early Neoproterozoic (“Kibaran”; $0.98-0.93\text{ Ga}$), and early Palaeozoic (ca. 0.5 Ga). The bulk of the current Central African columbite-tantalite production is from Kibaran pegmatites associated with late “G4” tin granites. Trace element concentration patterns, mineral assemblages, and zoning characteristics in these pegmatites are clearly different from rare element pegmatite-hosted Ta mineralization in Alto Ligonha, Mozambique.