New data on brazilianite from Minas Gerais, Brazil

Нови данни за бразилианит от Минас Жераис, Бразилия

***Stefka Dencheva*[1], *Ruslan I. Kostov*[2]**
***Стефка Денчева*[1], *Руслан И. Костов*[2]**

[1] Sofia University "St. Kliment Ohridski", 1504 Sofia; E-mail: stefka.dencheva@gmail.com
[2] University of Mining and Geology "St. Ivan Rilski", 1700 Sofia; E-mail: rikostov@yahoo.com

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Brazilianite $NaAl_3(PO_4)_2(OH)_4$ is reported for the first time from the Córrego Frio pegmatites, in the Conselheiro Pena District, Minas Gerais state in Brazil (Pough, Henderson, 1945; Franco et al., 1972; Cassedanne, 1983; Cook, 2000), and later on from several other occurrences (Bermanec et al., 2004; Cornejo, Bartorelli, 2010; Čobić et al., 2011; Chaves et al., 2015). Other deposits of the mineral are known from the Mendes Pimentel and São Geraldo do Baxio pegmatites, as well as in the Araçuaí District (Čobić et al., 2011); in Espírito Santo – Santa Teresa and Mantena; in Paraíba – Pedra Lavrada-Alto Patrimônio; in Rio Grande do Norte – Equador and Parelhas. Beside Brazil, the mineral is reported from pegmatites in several countries worldwide (Weiner, Hochleitner, 1997): Argentina, Australia, Austria, Canada, China, Czech Republic, Finland, France, Germany, Italy, Namibia, Rwanda, South Africa, Spain, United Kingdom and USA. Brazilianite belongs to the class of phosphates and crystallizes in the $P2_1/n$ space group of the Monoclinic System, a=11.233(6) Å, b=10.142(5) Å, c=7.097(4) Å and β=97.37(2)° (Gatehouse, Miskin, 1974). Brazilianite is a hydrothermal mineral in phosphate-rich zones of granite pegmatites.

Brazilianite crystals and aggregates from the Galiléia pegmatites in the Rio Doce Valley, Minas Gerais, are on display at the Museum of Unique Crystals "Ilia Deleff" (University of Mining and Geology "St. Ivan Rilski", Sofia). In the original type mine for brazilianite, Córrego Frio, crystals up to 10–12 cm have been reported (Franco et al., 1972). The pegmatites belong to the pegmatite district Conselheiro Pena, which is part of the Eastern Brazilian Pegmatite Province in the state of Minas Gerais. Most of the pegmatites in that region are hosted in the quartz-biotite schist of the São Tomé Formation linked to the Urucum granite (Čobić et al., 2011). In the vicinity of Lavra do Córrego Frio there are several pegmatites intruded in micaschists, and other occurrences in the state are known from the Itinga county (Cassedanne, 1983; Cornejo, Bartorelli, 2010). The mineral association for the Córrego Frio type pegmatite is muscovite, albite, quartz, fluorapatite, souzalite, scorzalite, arsenopyrite, beraunite, childrenite, dufrenite, frondelite, garnet, jahnsite, roscherite, sabugalite, strunzite, tapiolite, tourmaline, uraninite, wyllieite and zircon (Cassedanne, 1983). A burangaite-brazilianite association is described in the Divino das Laranjeiras county (Bermanec et al., 2004).

About 100 crystals and fragments up to 1–3 cm in size, as well as several crystal druses of brazilianite were examined under a stereomicroscope. In the brazilianite collection as associated minerals are observed mica, albite, quartz (rock crystal) and black tourmaline (in a single case epidote). The refractive indices 1.601–1.621 of brazilianite are measured on a System Eickhorst refractometer, and they correspond to the published data for the mineral. Crystals have distinct cleavage on {010}, conchoidal fracture, hardness 5.5; they transparent to translucent, in cases milky white because of fine cracks. Their colour varies from pale green to yellow-green, they have white streak and vitreous luster. On 29 crystal samples are described 25 crystallographic forms, among them 14 new forms, and a new crystal habit for the mineral is distinguished (Kostov, Dencheva, 2016).

Two pale green crystals from the Galiléia mines have been studied by electron paramagnetic resonance (EPR) – a hole center on an oxygen adjacent to an Al and a P was detected in both natural and X-ray irradiated brazilianite (Requardt et al., 1982). In the present EPR study, apart of hole centers in the the g=2 region and a possible vanadyl ion, a signal from a Fe^{3+} center in the g=4.3 region is detected at room temperature (Bruker EMX premium X, IGIC-BAS; Fig. 1). The Raman spectrum of brazilianite shows a series of sharp bands which are assigned to PO_4^{3-} and to $HOPO_3^{3-}$ stretching vibrations and multiple OH stretching vibrations show that OH units are not equivalent in the structure (Frost, Xi, 2012).

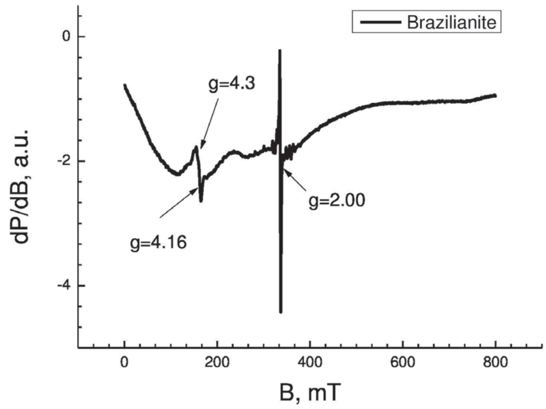

Fig. 1. EPR spectrum of brazilianite

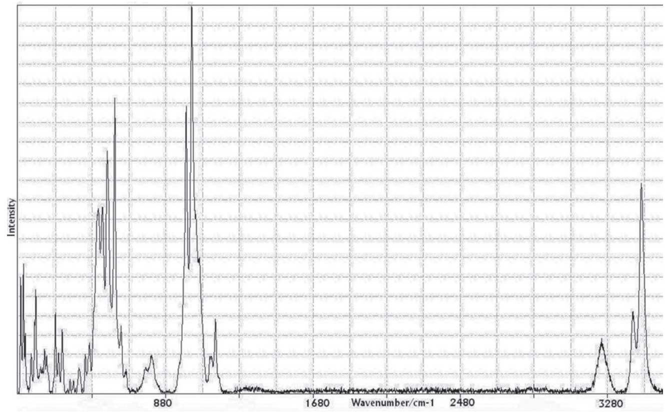

Fig. 2. Raman spectrum of brazilianite

Multiple Raman bands are observed in the PO_4^{3-} and $HOPO_3^{3-}$ bending region. Brazilianite samples in different orientations on natural faces are studied with a Micro-Raman spectrometer LabRAM HR, Horiba Jobin–Yvon (633 nm, He-Ne laser, 7.3 mW; SU) and a similar non-polarized spectrum is observed, but with an intense band about 3250 cm^{-1} (Fig. 2). The new spectroscopic data of brazilianite point to some differences in the presence and amount of impurity and electron-hole centers in the studied crystals, all linked to geochemical differences of the local pegmatites.

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