MINERALOGY OF THE BOA VISTA PEGMATITE, GALILÉIA, MINAS GERAIS, BRAZIL

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Fig. 1. Boa Vista pegmatite.

METHODS

Samples of accessory minerals were collected at the Boa Vista pegmatite for mineralogical studies and investigated using optical polarizing microscopy followed by mineral phase determination of 34 selected samples using a Philips X'pert powder diffractometer , with CuKα radiation filtered with a graphite monochromator running at 40 kV and 40 mA. An X-ray diffraction data sets were collected from 4 to 65°2θ.

For additional characterization of separated samples Tescan TS 5136 scanning electron microscope (SEM) operating in back scattered (BSE) mode at an accelerating voltage of 20 kV and current of 10 mA was used. The same SEM microscope equipped with the Oxford energy dispersive spectrometer (EDS), coupled with INCA 250 system, was used for elemental distribution analysis in the samples. EDS qualitative analysis and elemental mapping was performed on the carbon coated samples at an accelerating voltage of 20 kV. Quantitative studies by electron probe microanalysis are in progress.

INTRODUCTION

The Boa Vista pegmatite (Fig. 1) is located in the Conselheiro Pena pegmatite district, one of the metalogenetic subdivisions of the Eastern Brazilian pegmatite province (EBP) that encompasses an area of about 150,000 km^2, extending from Bahia to Rio de Janeiro states. Around 90% of the province is located in the eastern part of the State of Minas Gerais. This pegmatite district cover an area of about 500 km^2 in the municipalities of Conselheiro Pena and Galiléia, in the central Doce River basin, about 360 km northeasterward from the city of Belo Horizonte.

The Conselheiro Pena pegmatite district is inserted in the central domain of the Araçuaí mobile belt (Almeida 1977), formed during the Brasiliano orogeny (630–490 Ma) by accretion to the eastern margin of the São Francisco craton. In the studied area several suites of granitoid rocks are distinguished (Urucum and Palmital of Eocambrian to Paleozoic age, and Galiléia of Neoproterozoic age), intruding the schists of the Neoproterozoic São Tomé formation.

The São Tomé formation and the granites are found in a north-south extending synclinorium megastructure with metasediments dominating synclines of this structure, granitoid rocks in the adjacent anticlines. Ages of the pegmatite bodies are about 580 Ma (Nalini 1997), and are related to granite G2 supersuite (Pedrosa-Soares et al. 2001, 2009) intrusive in the metasediment units. They consist mostly of S-type peraluminous granites and minor metaluminous granites, generated during the syn-collisional stage of the Araçuaí orogen.

The very first description of mineral assemblage of the Boa Vista and others pegmatites in the vicinity were described by Chaves et al. (2005).

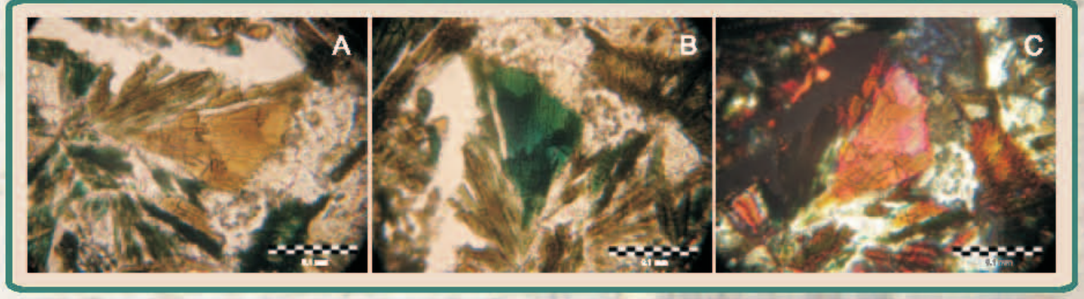

Fig. 2. Thin sections of rockbridgeite, showing intensive pleochroism. (A) Rockbridgeite spray; mineral is yellowish-brown parallel to X axis of indicatrix. (B) Rockbridgeite spray; mineral is bluish green parallel to Z axis of indicatrix. (C) Rockbridgeite spray (+).

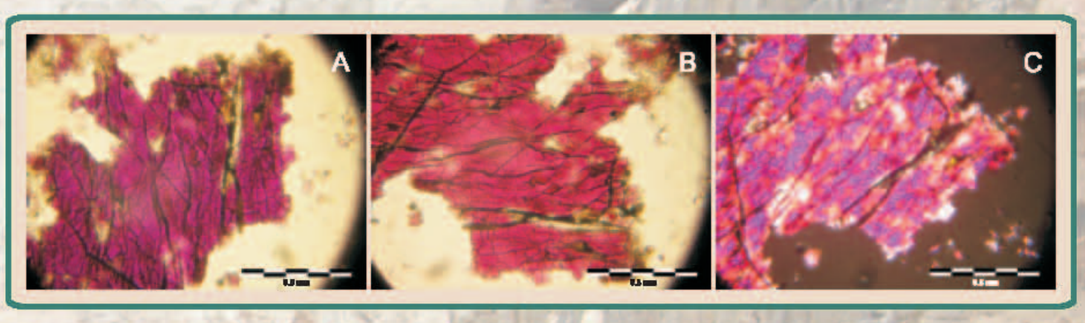

Fig. 3. Thin sections of heterosite, showing intensive pleochroism. (A) Heterosite; mineral is purplish-red parallel to Y axis of indicatrix. (B) Heterosite; mineral is red parallel to X axis of indicatrix. (C) Heterosite (+).

RESULTS

It was possible to distinguish 21 mineral species using optical polarizing microscopy (Figs. 2 and 3), X-ray powder diffraction (Fig. 4) and scanning electron microscopy (Fig. 5). Besides main pegmatitic minerals quartz, microcline, mica and albite, a number of rare minerals were identified (Tab. 1).

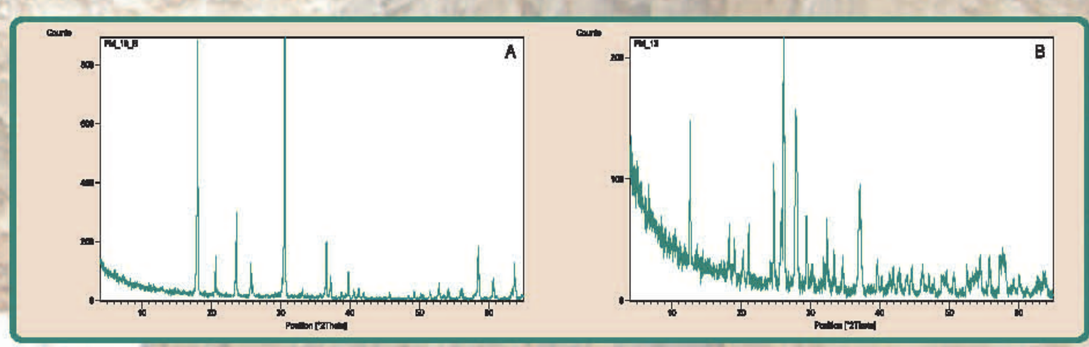

Fig. 4. Representative XRD patterns of phosphate minerals from Boa Vista: (A) heterosite and (B) rockbridgeite.

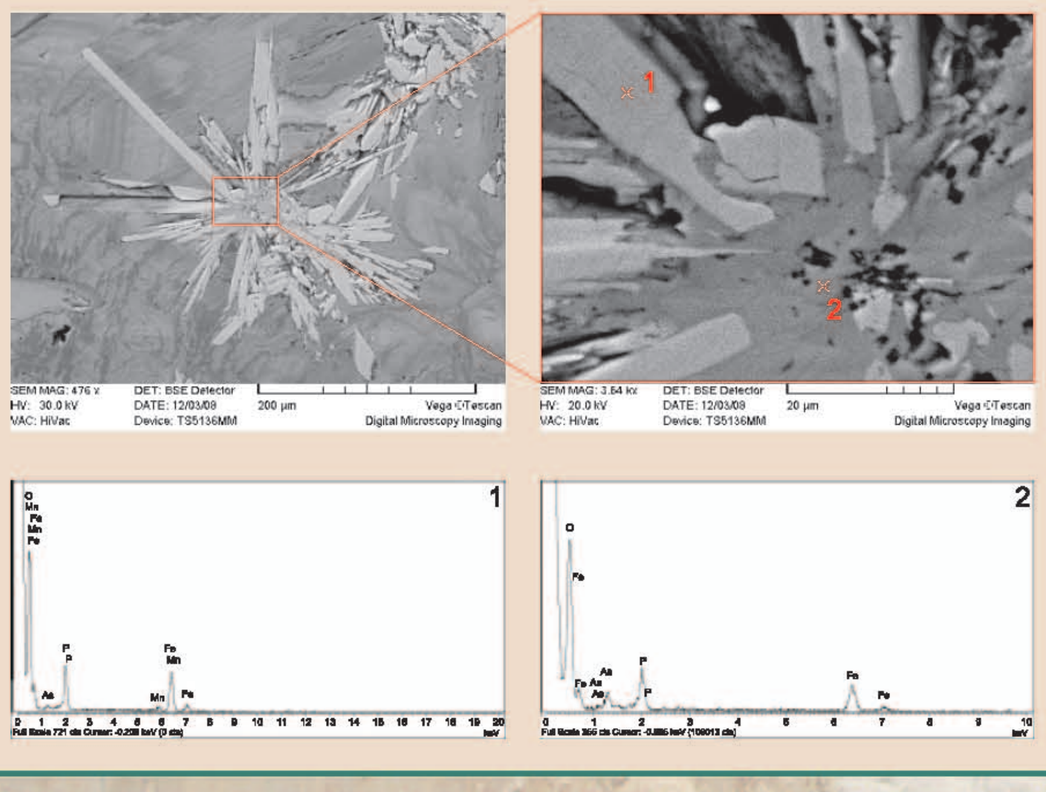

Fig. 5. BSE photographs and EDS spectrum of rockbridgeite (1) and phosphosiderite (2). Spray of rockbridgeite needles (1 to 20 µm thick and up to 300 µm long) growing from the core of phosphosiderite.

Tab. 1. List of identified minerals.

Elements	
Bismuth	Bi
Sulphides (including arsenides)	
Löllingite	$FeAs_2$
Oxides	
Cryptomelane	$K(Mn^{4+},Mn^{2+})_8O_{16}$
Quartz	SiO_2
*Fourmarierite	$PbU_4O_{13} \cdot 4H_2O$
Carbonates	
*Bütschliite	$K_2Ca(CO_3)_2$
Phosphates (including arsenates)	
Cyrilovite	$NaFe^{3+}_3(PO_4)_2(OH)_4 \cdot 2H_2O$
Frondelite	$(Mn^{2+},Fe^{2+})Fe^{3+}_4(PO_4)_3(OH)_5$
Heterosite	$FePO_4$
*Hureaulite	$H_2(Mn,Fe)_5(PO_4)_4 \cdot 4H_2O$
*Metatorbernite	$Cu(UO_2)_2(PO_4)_2 \cdot 8H_2O$
Phosphosiderite	$FePO_4 \cdot 2H_2O$
Rockbridgeite	$(Fe^{2+},Mn)Fe^{3+}_4(PO_4)_3(OH)_5$
*Strengite	$FePO_4 \cdot 2H_2O$
Variscite	$AlPO_4 \cdot 2H_2O$
*Scorodite	$FeAsO_4 \cdot 2H_2O$
Silicates	
Albite	$NaAlSi_3O_8$
Beryl	$Be_3Al_2Si_6O_{18}$
Microcline	$KAlSi_3O_8$
Mica	-
Spodumene	$LiAlSi_2O_6$

* Minerals described for the first time in the Boa Vista pegmatite.

DISCUSSION

Total amount of 21 different mineral species were determined in the Boa Vista pegmatite, half of which belongs to the phosphate mineral group. Common pegmatite minerals found in this pegmatite are albite, microcline, quartz, beryl, spodumene and mica. The other identified minerals are mainly phosphates. The other accessory minerals are cryptomelane, löllingite, fourmarierite, bütschliite, and bismuth. Tantalum and niobium minerals were not found, however, were described by Cassedanne and Cassedanne (1979) and Chaves et al. (2005).

This is the first systematic investigation of mineral samples from Boa Vista pegmatite. Six mineral were described for the first time in that pegmatite (fourmarierite, bütschliite, hureaulite, metatorbenite, strengite and scorodite).

According to minerals determined, Boa Vista pegmatite can be considered as a phosphate-rich pegmatite. Phosphates identified with used methods in the Boa Vista pegmatite are: hureaulite, cyrilovite, phosphosiderite, variscite, heterosite, strengite, rockbridgeite, metatorbernite, frondelite and scorodite (arsenate).

The phosphate assemblage occurs in miarolitic cavities up to 15 cm or in substitution to triphylite-lithiophilite.

Almost all phosphates identified in the Boa Vista pegmatite are secondary by origin and they belong to the low-temperature hydrothermal mineral assemblage, and just some of them could be formed by weathering. Only heterosite does not belong to this paragenesis because it is assumed as metasomatic phosphate (Moore 1973, Hawthorne 1998, Chaves et al. 2005, Chaves and Scholz 2008).

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