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METASOMATIC PYRITE FROM HYDROTHERMALLY ALTERED BORÓW  
GRANITE (STRZEGOM-SOBÓTKA MASSIF). PRELIMINARY REPORT.

**Abstract:** Pyrite of metasomatic origin is abundant in hydrothermally altered parts of the Borów granite (Strzegom-Sobótka Massif). Lack of quartz in relics present within the pyrite and similarity of chemical compositions of mineral inclusions in pyrite and granite-forming minerals indicate the fact, that the pyrite formation followed the hydrothermal alteration of granite.

**Keywords:** metasomatic pyrite, hydrothermal alteration, granite, Strzegom-Sobótka Massif.

#### INTRODUCTION

Pyrite is the most abundant ore mineral in granites and their pegmatites in the Strzegom-Sobótka Massif. Two generations of pyrite were distinguished by Sałaciński (1978): (1) pyrite I, crystallized in the temperature range of 250-200°C, and tend to form poikilocrystals; (2) pyrite II which forms pseudomorphs after pyrrhotite.

Samples for this study were collected in two quarries (Borów 14 and 17) located in the western part of the Strzegom-Sobótka Massif dominated by hornblende-biotite granite (Majerowicz 1972, Puziewicz 1990). Pyrite occurs there within hydrothermally altered granite associated with a multistage tectonic zone.

The modes of pyrite occurrence include: pyrite veinlets (Fig. 1a), polymineral veins, porphyroblasts, crystals in the intragranular space and coatings on fractures surface. Pyrite is also present in enclaves of mafic rocks (Janeczek 1985, Ciesielczuk 2000).

In this paper we describe metasomatic pyrite from hydrothermally altered granite in Borów in more detail.

#### METHODS OF INVESTIGATIONS

Samples of pyrite and host rocks were examined using a standard polarizing microscope. The quantitative chemical composition was determined using analytical scanning microscope JEOL JSM-35 equipped with microprobe attachment LINK QX2000 (Faculty of Earth Sciences, Keele University, UK). Polished surface of pyrite was etched for up to 8 hours using concentrated HNO<sub>3</sub>, HCl and HNO<sub>3</sub> : HCl = 3:1 as the etching reagents.

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## RESULTS

Euhedral or semihedral crystals of pyrite up to 1.5 cm in length are dotted with abundant inclusions of granite-forming minerals (K-feldspar, albite, chlorite, titanite, rutile, zircon and apatite) except for quartz and sericite (Fig. 1b, c). Chemical compositions of those mineral inclusions and major granite-forming minerals are almost identical within the analytical errors (Tab. 1) with the notable exception of K-feldspar which in the inclusion contains some amount of Ba. Mineral inclusions dissolved preferentially over pyrite during the treatment of the crystals with acids (Fig. 1d).

While pyrite crystals are mostly euhedral, examination of the crystal/host granite boundary revealed embayments within pyrite occupied by constituents of the granite.

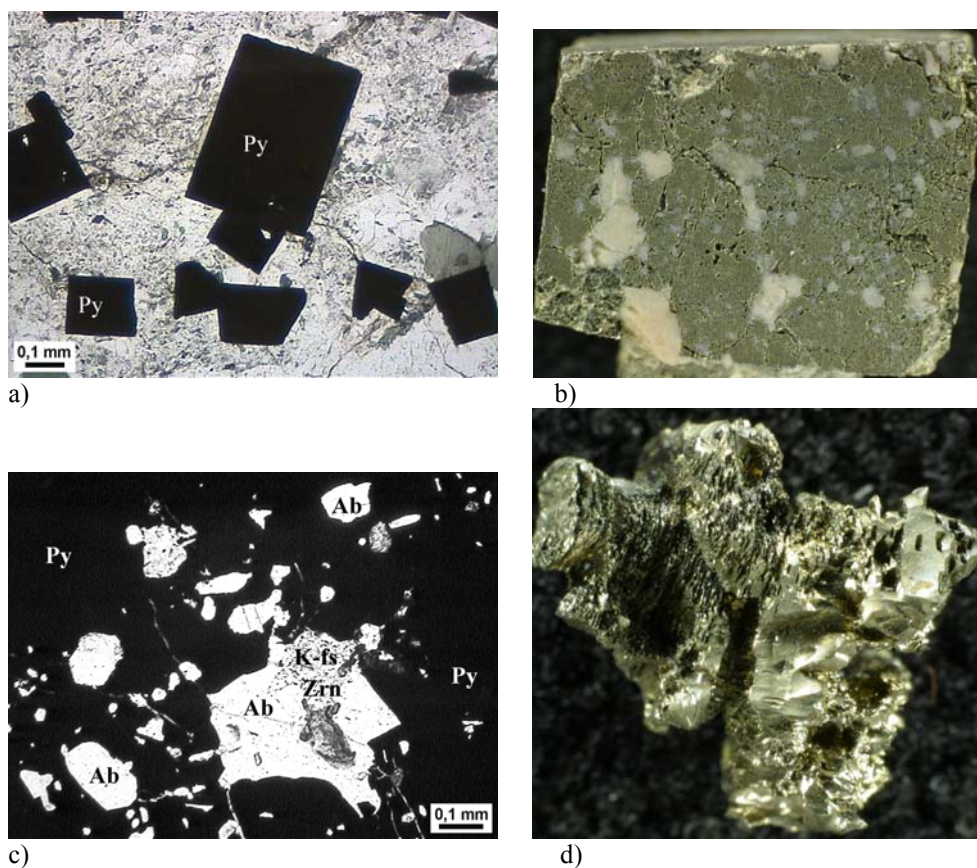


Fig. 1. a) Euhedral crystals of pyrite Py in a vein along the quartz vein/granite border (sample 846/5), b) hand specimen of single crystal of pyrite with inclusions of granite-forming minerals (lighter minerals). The diameter of the crystal is 15 mm. c) relics of rock-forming minerals within pyrite crystals: albite Ab, K-feldspar K-fs, zircon Zrn (sample 842), d) pyrite crystal after etching. Note the absence of relics of granite-forming minerals. The diameter of the crystal is 6 mm. a) and c) polarizing microscope, 1 nicol.

Table 1. Representative microprobe analyses of minerals included in pyrite crystals and in hydrothermally altered Borów granite. n – number of analyses.

	K-feldspar	albite	chlorite	K-feldspar	albite	chlorite
	<b>within the pyrite</b>			<b>within the granite</b>		
No sample	846/1, n=2	846/5, n=3	842, n=4	846/1, n=4	846/5, n=5	842, n=8
SiO <sub>2</sub>	65.26	68.18	23.69	64.43	68.95	24.10
TiO <sub>2</sub>	-	-	0.20	-	-	-
Al <sub>2</sub> O <sub>3</sub>	18.70	20.15	18.91	18.43	19.70	19.06
FeO+Fe <sub>2</sub> O <sub>3</sub>	-	0.79	40.03	-	-	39.01
MnO	-	-	0.31	-	-	0.31
MgO	-	0.09	5.24	0.05	-	5.41
CaO	0.31	-	0.10	0.32	0.09	0.21
Na <sub>2</sub> O	0.14	11.19	0.20	0.28	11.33	0.05
K <sub>2</sub> O	16.10	-	0.08	15.93	0.02	0.11
BaO	0.42	-	-	-	-	-
SO	-	0.05	0.10	-	-	0.01
<b>total</b>	<b>100.93</b>	<b>100.45</b>	<b>88.86</b>	<b>99.44</b>	<b>100.09</b>	<b>88.27</b>
An	2%	-		2%	-	
Ab	1%	100%		2%	100%	
Or	96%	-		96%	-	
Cn	1%	-		-	-	

## DISCUSSION AND CONCLUSIONS

The confinement of pyrite described in this report, to hydrothermally altered granite, often in the close proximity to quartz veins and the abundant inclusions of the altered granite-forming minerals suggest the metasomatic origin of pyrite (Fig. 1). Therefore, the inclusions are relics of the altered granite which survived the capillary and intragranular dissolution in front of the crystallizing pyrite. The absence of quartz in those relics suggests that this mineral was preferentially dissolved over feldspars and chlorite in the pyrite growth front. Perhaps quartz was dissolved by highly alkaline solutions that favor precipitation of sulphides.

Similarity of chemical compositions of mineral inclusions in pyrite and granite-forming minerals suggests that the alteration of granite occurred prior to the metasomatic crystallization of pyrite. However, both processes may have been genetically closely related i.e. hydrothermal alteration through the process of albitization of K-feldspars and replacement of biotite by chlorite (release of K<sup>+</sup>) may have caused increased alkalinity of the solutions, which in turn caused metasomatic replacement of granite by pyrite.

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