HORNBLENDE BREAKDOWN RIMS IN BEZYMIANNIY VOLCANO ANDESITES (KAMCHATKA)

Pletchov P.Yu., **Tsay A.E., Tscherbakov V.D.** (Geol. Dep. MSU)
pavel@web.ru

Bezymianniy is active andesitic volcano in Klyuchevskaya Group (Kamchatka). Famous explosive eruption of March 30, 1956 was presented by hornblende andesites, with plagioclase, orthopyroxene, hornblende and titanomagnetite in phenocrysts and plagioclase, orthopyroxene, titanomagnetite and small amount of glass in the groundmass. All hornblende phenocrysts surrounded by opacitic rim, and hornblende grains less then 30 mkm in size wholly replaced by plagioclase-pyroxene-titanomagnetite opacitic assemblage. We examined hornblende breakdown rims for different textures and morphology. In this study we determined mineral composition of breakdown rims and defined conditions of their growth.

We could determine both granular and symplectitic textures in breakdown rims (fig.1c). On sides (1$\bar{1}$0), ($\bar{1}$10), ($\bar{1}\bar{1}$0), (1$\bar{1}$0), (010), (0$\bar{1}$0) internal rim is granular, whereas external is symplectitic (fig.1a). On sides (001) (00$\bar{1}$) we occurred only symplectitic textures (fig.1c).

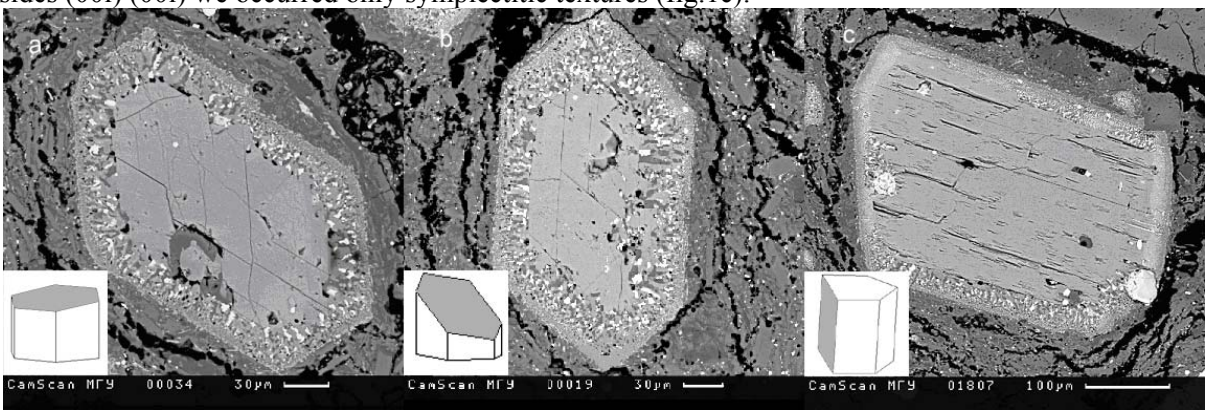

Fig.1. Different sections of hornblende phenocrysts with measured crystallographic orientation

We have random orientation of hornblende phenocrysts in thin sections and sections could represent different levels of grains (tops or middles). Fedorov's universal theodolitic stage was used to determine precise orientation. Visible thickness for each side was recalculated to thickness in section |001|. Breakdown rim thicknesses of different sides are in the limit of measurement error. Average thickness of hornblende breakdown rims in Bezymianny 1956 eruption products is 24±5 mkm.

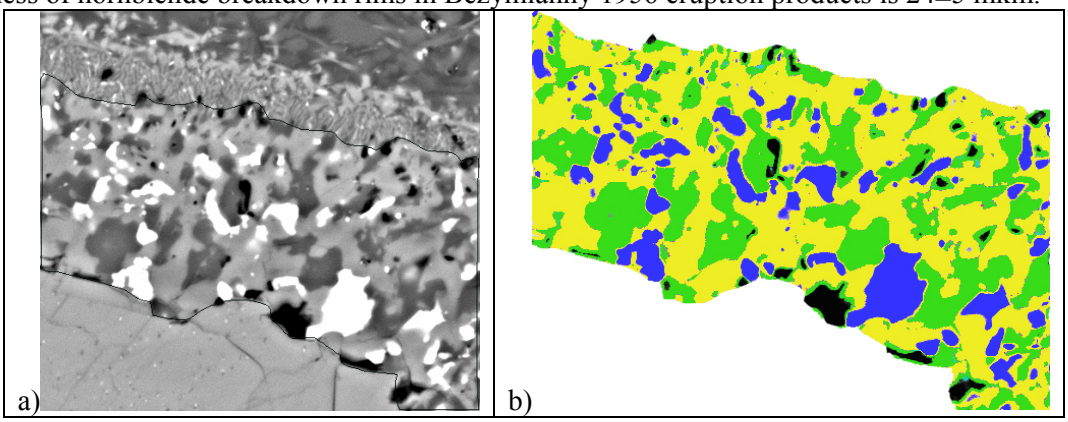

Fig.2. BSE image of the breakdown rim with granular (internal) and symplectitic (external) textures in grayscale (a) and in pseudocolor (b) modes

In BSE images of breakdown rims (fig.2.) each mineral (Pl, Px, Ti-Mt) was colored in different colors, each color pixels was counted and volume percent of each mineral was estimated (fig.2.). Measurement results on 12 grains (~500 measurements) summarized the table.

Table

	Plagioclase, vol.%	Pyroxene, vol.%	Titanomagnetite, vol.%
Whole breakdown rim, simplectitic + granular	29-38	54-62	7-14
Granular part of rim	31-40	48-59	9-16

Hornblende breakdown time estimations were based on Rutherford&Hill, 1993 experiments [6]. We used diffusion-like equation $t= t_0 + X^2/D$ (t – time in days, X – rim thickness in mkm, t_0, D – equation coefficients) for approximation all isobaric experiments in [6]. For hornblende breakdown reaction D lies in and t_0 lies in 1-10 days. It allows to estimate the time of hornblende breakdown for Bezymianny 1956 eruption as 4-37 days.

Conditions for phenocrysts assemblage were estimated as intersection of cotectic lines for silica-rich melt (from melt inclusions in Opx and Pl) with Opx-Pl-Hb assemblage and Holand&Blundy,1994 Hb-Pl geothermometer [2] (fig.3). Intersection shows T=890±20°C and P=6±2 kbar. Also, we used Anderson&Smith, 1995 [1] Al-in-hornblende geobarometer as minimum pressure estimation (fig.3.).

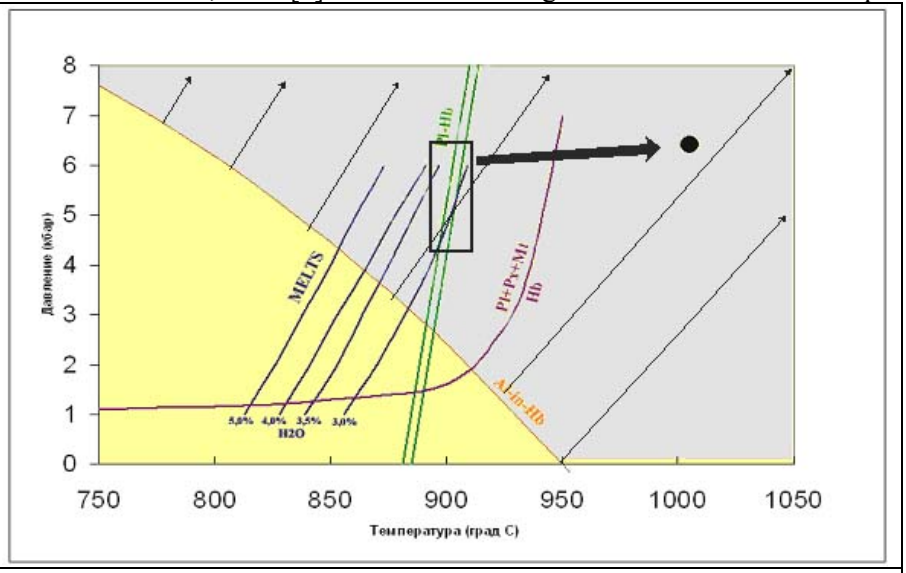

Fig.3. T-P diagram for Bezymianny andesites. Bluish field shows possible conditions by Anderson&Smith[1] geobarometer, green lines – H&B[2] conditions, Black rectangle is possible PT-field for phenocrysts assemblage, black circle is conditions for hornblende breakdown products. Hornblende stability line after [6].

Conditions for breakdown rim assemblage were determined independently by 2-Px geothermometers (1005±36°C) [3,5,7] and Cpx geobarometer 6.4± 1 [4].

Difference in PT-conditions for phenocrysts assemblage and hornblende breakdown products shows that isobaric heating from 890 to 1005°C took place in the magma chamber just before or during hornblende breakdown.

At determined pressure (6 kbar) we couldn't expect significant degassing or melt oxidation. In case of Bezymyanniy hornblende breakdown reaction is due to warming-up of magmatic chamber just before (4-37 days) catastrophic eruption at 30, March, 1956.

References

1. *Anderson and Smith.* 1995. American Mineralogist. V. 80. PP. 549-559.
2. *Holland T.J.B, Blundy J.D*. CMP. 1994. V. 116. PP. 433-447.
3. *Kretz R.* Geochim. et Cosmochim. Acta. 1982. V.46. PP. 411-421.
4. *Nimis P., Ulmer P.* CMP. 1998. V. 133. N 1-2. PP. 122-135.
5. *Perchuk L.L.* DAN SSSR. 1977. V. 233. N 3. PP. 456-459. (In Russian).
6. *Rutherford M.J., Hill P.M.* Geophysical Research. 1993. V. 98. N .B11. PP. 19.667-19.685.
7. *Wells P.R.A*. Contributions to Mineralogy and Petrology. 1977. V.62. PP. 129-139.

Electronic Scientific Information Journal "Herald of the Department of Earth Sciences RAS" № 1(24)'2006
ISSN 1819 – 6586
Informational Bulletin of the Annual Seminar of Experimental Mineralogy, Petrology and Geochemistry – 2006
URL: http://www.scgis.ru/russian/cp1251/h_dgggms/1-2006/informbul-1_2006/term-25e.pdf

Published on July, 1, 2006