ARCHIWUM MINERALOGICZNE
T. XLIX, z. 1, 1993

MELT AND FLUID INCLUSIONS STUDY IN OLIVINE PHENOCRYSTS FROM BANDAMA VOLCANIC COMPLEX (GRAN CANARIA, SPAIN)

A. GONZALES

Department of Geology, University of Las Palmas, Campus Universitario de Tafira, 35017 Las Palmas. Spain

R. CLOCCHIATTI

Groupe des Sciences de la Terre. Laboratoire Pierre Süe. C.E.Saclay, F-91191 Gif-sur-Yvette. Cedex, France

J. MANGAS

Department of Geology, University of Las Palmas, Campus Universitario de Tafira, 35017 Las Palmas. Spain

D. MASSARE

Groupe des Sciences de la Terre. Laboratoire Pierre Süe. C.E.Saclay, F-91191 Gif-sur-Yvette. Cedex, France

F.J. PEREZ-TORRADO

Department of Geology, University of Las Palmas, Campus Universitario de Tafira, 35017 Las Palmas. Spain

The Quaternary volcanic complex of Bandama in Gran Canaria (Canary Islands, Spain) is formed by a cone and a caldera. This complex developed a first with a Strombolian-type eruption which is characterized by the emis sion of pyroclastic rocks and lava flows of alkaline basanitic composition (SiO_2 41.8% and sum of alkalis 3.8%) This type of activity was disturbed by intermittent phreatomagmatic phenomena that gave place to base surf deposits and an elliptic caldera of the diameters: 1,000 m and 750 m, and mean depth of 200 m (Araña, Hansen and Martí, 1988).

In order to recognize the nature and origin of the olivine megacrysts and phenocrysts of Bandama, these crystals have been analysed, and the melt and fluid inclusions trapped in them have been studied.

The pyroclastic rocks and lava flows bear olivine and clinopyroxene megacrysts and phenocrysts and, in lower amounts, spinels including magnetite as microcrystals. The olivine is the most abundant mineral, it is unaltered, has a size ≥ 1 cm in the pyroclastic rocks proximal facies and in lava flows, and presents from idiomorphic to allotriomorphic forms. The composition of these olivines varies from Fo_{89} to Fo_{77} for the pyroclastic rocks and the lava flows with a distinct bimodal distribution between Fo_{80-82} and Fo_{86-88} in both of them. Megacrysts or phenocrysts consist of two zones: A (core) and B (rim), but it is possible to find crystals with only A or B zones:

I) A-zone crystals or core of megacrysts have the following characteristics:

1) A composition with high magnesium and nickel content (Fo_{89} and Ni ≈ 0.4%), low calcium content and ratio Ni/Ca ≈ 2.5.

2) When fluid and melt inclusions appear in A-zone crystals of core of megacrysts, these are distributed in the growth bands and in the hometrails, and all transition stages exist between melt and fluid inclusions. The melt inclusions vary greatly in shape, either rounded, elongated or irregular. Their size ranges from inder 5 µm to 50 µm. The melt inclusions are crystallized with CO_2 in the shrinkage bubble. The fluid inclusions are rounded or elongated in shape, having the dimension between less than 5 µm up to 250 µm. Microthermometric analyses confirm that the fluid trapped in the bubbles is almost pure CO_2 because the triple point temperatures vary between –56.9°C and –57.1°C. Two phases (CO_2L + CO_2G) are formed during the freezing processes and they homogenize at temperatures between –19°C and –34.8°C always in liquid phase. These last data show that the maximum density of the trapped CO_2 is as high as 1.1 g/cm^3 and its pressure is close to 10 kb at 1200°C (depth ≈ 30 km).

3) The minerals trapped in this zone are spinels (chromite with Cr_2O_3 =34 wt.%). A zone represents between 80% and 90% of megacrysts volume.

II) B-zone crystals of rim of megacrysts have the characteristics given below:

1) A composition with lower magnesium (Fo_{86-77}) and nickel content around 0.15%, and high calcium content, and ratios Ni/Ca varies between 1 and 0.3.

2) Fluid inclusions have not been found in this zone. Melt inclusions are generally only glass+ bubble and their composition is basanitic (the SiO_2 content varies between 39.8% and 41.7%, and the sum of alkalis ranges between 5.4 and 6.3 wt.%), which is very similar to the groundmass and the bulk rock compositions. In addition, the melt inclusions have high values of S and Cl (3000 ppm and 800 ppm, respectively), which are very different from the basalts cathegorized as the MORB type (Mathez, 1976) and similar to those appearing in the melt inclusions of the Etna lava flows (Metrich and

Clocchiatti, 1989). The melt inclusion homogenization temperatures range between 1100°C and 1180° ± 20°C.

3) The minerals trapped in this zone are titanomagnetites.

We can conclude that A crystals or A zones in composite A+B megacrysts are typical of high pressure environment (more than 10 kb) under mantle conditions. The microcrystals B and zones B in composite A+B megacrysts are typical of crystallization process at shallow levels (Th = 1100 – 1180 ± 20°C, low pressure, and a composition near to groundmass and rock).

REFERENCES

ARAÑA V., HANSEN A., MARTÍ J.C. (1988): La Caldera y el Pico de Vandama (Gran Canaria), *Bol. Geol. Min. España*. T. XCIX-I, p. 47-48.

MATHEZ E.A. (1976): Sulphur solubility and magmatic sulphides in submarine basalt glass. *Jour. Geophys. Res.*, vol. 81, p. 4260-4276.

METRICH N., CLOCCHIATTI R. (1989): Melt inclusions investigations of the volatile behaviour in historic alkaline magmas of Etna. *Bull. Volcanol.*, vol. 51, p. 185-198.