Geophysical Research Abstracts, Vol. 8, 09129, 2006
SRef-ID: 1607-7962/gra/EGU06-A-09129

Magma-dolomite interactions in nodules from the Vesuvius-Monte Somma 1631 fallout

M.L. Pascal (1,2), A. Di Muro (1,2), M. Fonteilles (2), C. Principe (3)

(1) UMR Minéralogie-Pétrologie, CNRS, France, (2) Pétrologie, Modélisation des Matériaux et Processus, University of Paris 6, France, (3) CNR, Pisa, Italy (mlp@pmmp.jussieu.fr / Phone: 33-1-4427-5240)

Out of 110 nodules from the Vesuvius 1631 fallout (and a few from Avellino eruption), many display features of mineral reactions that can be interpreted as interactions between the dolomitic wallrocks of the « magma chamber » and magma or magmatic fluid. Such interpretations are substantiated by similar reactions displayed in other occurrences of high-temperature skarns, e.g., Crestmore, California (Burnham, 1959), Scawt Hill, Scotland (Tilley and Harwood, 1931), Magureaua Vatei and Oravita-Ciclova, Romania (Pascal et al. 2005) and others, and by the available experimental phase diagrams and thermochemical data.

The dolomite, at first thermally changed to periclase-calcite marble, is invaded by (probably hydrothermal) veinlets mainly composed of leucite which typically produce reaction rims of phlogopite in the marble. Such phlogopite is then replaced by a forsterite-spinel association under hydrothermal CO_2-rich conditions.

Further reactions commonly take place in the forsterite-spinel (+/-phlogopite +/- calcite) skarns under the influence of magmas. Two main types of reactions are observed. The one is the replacement of forsterite by clinopyroxene and results in a texturally complicated rock composed of clinopyroxene, spinel and more-or-less resorbed phlogopite. Interstitial glass witnesses the presence of magma. The clinopyroxene, compositionally controlled by spinel and forsterite at first (7-8 wt% Al_2O_3), typically departs from this composition where forsterite is reacted out and reaches up to 20 wt.% Al_2O_3. Within a few millimeters of the contact with such skarns, the magmatic rock undergoes changes including crystallization of needle-shaped Al-rich (14 wt% Al_2O_3) clinopyroxene crystals and appearance of kalsilite and melilite (SM20Ak55Gh25). Kalsilite

and melilite (with a Mg-richer composition) then widely develop in the skarn, at the expense of phlogopite and clinopyroxene respectively.

The other, and rarer, type of reaction observed in some skarns is the direct development of melilite (typically Na-richer than in the other case, SM45Ak45Gh10), without clinopyroxene, accompanied by wollastonite, nepheline, garnet, volatile-rich feldspathoids (sodalite, cancrinite, microsommite) and perovskite.

Both types of magma-present reactions are characterized by melilite which typically results from Ca-contamination of the magma. The first type corresponds to a less evolved magma, the second to a more evolved, Na-richer magma. The main result of Ca-contamination is a loss of SiO_2 through crystallization of Ca- and Si-rich minerals, clinopyroxene (first type) or wollastonite +/- garnet (second type), responsible for the strong silica-undersaturation displayed by kalsilite and perovskite and by the most Al-rich compositions observed in clinopyroxenes.

Precise thermochemical modeling is consistent with the observed mineral associations, the conditions of stability of which are estimated to 900-950˚C with H_2O pressure as low as 20-30 MPa. From the disappearance of monticellite transiently developed in skarns, the CO_2 pressure is inferred to have increased during the reaction processes (cf data by Belkin et al 1985). The bearing of the observed reactions on both the H_2O content and the major element composition of the magma is presently investigated through the comparison of the clinopyroxenes and their melts inclusions in skarns vs. lavas.

Belkin et al. (1985) *Am. Mineral*. **70**, 288-303.

Burnham (1959) *Am. J. Sci*. **57**, 879-928.

Pascal et al. (2005) *Canad. Mineral.* 43, 857-881.

Tilley & Harwood (1931) *Mineral. Mag*. **22**, 439-468.