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PHYSICAL CONDITIONS OF PRIMITIVE TEPHRITIC MAGMAS FROM VESUVIUS: FIRST EXPERIMENTAL RESULTS

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Volatile-rich tephritic melts represent the most primitive compositions at Vesuvius. Recent eruptions (1906, 1944) record the multiple injections of such compositions at shallow levels, and their crystallization and mixing. Plinian magma chambers (eg, the 79 AD Pompei eruption) grow from the periodic supply of K-rich mafic melts. In order to better constrain the physical conditions (P, T, volatile fugacities, fO$_{2})$ of these tephritic magmas, high pressure phase equilibrium experiments have been performed on two natural samples, a tephrite (48{\%} SiO$_{2}$, Na$_{2}$O+K$_{2}$O=7.35{\%}, 6.73{\%} MgO, CaO/Al$_{2}$O$_{3}$=0.88) from a
lava-fountaining event slightly younger than the Pollena eruption (472 AD), and a K-basalt (48{\%} SiO$_{2}$, Na$_{2}$O+K$_{2}$O=5.83{\%}, 7.97{\%} MgO,
CaO/Al$_{2}$O$_{3}$=1.04) from the 1944 eruption. Charges consist of glass (made by fusing each sample at 1400\r{ }C, 1 atm) plus different amounts of water loaded in AuPd capsules. Experiments are performed mostly at 2 kbar between 1050 to 1150\r{ }C for $\sim $20 hours in an IHPV fitted with a drop-quench device and pressurized with Ar-H$_{2}$ mixtures. The fO$_{2}$ (between NNO and NNO+2) is determined from fH$_{2}$ (measured by NiPd-NiO-H$_{2}$O sensors) and fH$_{2}$O computed from the glass H$_{2}$O content (estimated from the ``by-difference" method calibrated against hydrous glass standards). Charges are studied by SEM and analyzed by electron microprobe. Glasses with H$_{2}$O concentration up to $\sim $5 wt{\%} can be quenched without any detectable crystallization. At 2 kbar,

clinopyroxene (up to Mg{\#}90) is the first phase to crystallize in both samples. For the K-basalt, the 1150\r{ }C liquidus is tightly bracketed by two charges with $\sim $4 and $\sim $5 wt{\%} H$_{2}$O in the melt. Phlogopite (Mg{\#}81) crystallizes from 1050\r{ }C. Clinopyroxene crystallization increases K$_{2}$O and Al$_{2}$O$_{3}$, and decreases CaO, MgO and CaO/Al$_{2}$O$_{3}$ in residual melts. At 1100\r{ }C, phonotephritic compositions identical to the mafic end-member of the Pollena eruption are generated. Leucite was not found but may appear in experiments $<$2 kbar. The lack of olivine is attributed to the elevated CaO/MgO of starting samples (1.9 and 1.75). Since olivines up to Fo$_{88.5}$ are present in the 1944 samples (up to Fo$_{90}$ in 1906), the starting samples are not representative of the most primitive tephritic melts. In order to simulate conditions of olivine crystallization, experiments with added olivine (Fo$_{91})$ have been performed at 1150\r{ }C, 2 kbar and with different melt H$_{2}$O concentrations. MgO concentrations ($\sim $9 wt{\%}) and CaO/MgO ($\sim $1.6) ie, respectively higher and lower than in starting samples, are needed for tephritic melts to become cosaturated with olivine and clinopyroxene (Mg{\#}92 diopside).