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Fine analysis of fines: ash features of weak explosive activity at Etna in fall 2006.

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Ash-sized pyroclasts have long since provided information useful to characterize explosive volcanic activity. More recently, ash characterization has proven itself capable of monitoring in semi-real time the evolution of important conduit processes such as magma degassing and crystallization at basaltic volcanoes. Here we use ash from the fall-winter 2006 eruption of Etna volcano (Southern Italy) to show how relatively simple and automated analysis can reveal textural details indicative of eruptive style. The eruption, that involved the Southeast Crater between August and December 2006, was characterized by three main explosive phases with dominant 1) strong Strombolian, 2) strong Strombolian to low fountaining and 3) ash venting type activity. Our case study comes from three ash samples (called A, B and C) related to the period between phases 2 and 3. Samples A and B were erupted during the 3-4 December and 29-30 November, both eruptions forming a bent plume that caused weak but prolonged ash fallout to the W (around the area of Biancavilla village) and to the NE (reaching the town of Reggio Calabria at about 70 km of distance from the vent), respectively. Sample C was erupted during the 24 November paroxysmal event. A moderate eruption column formed between 7 and 16 that reached at least 2 km above the vent, causing a significant tephra over the SE sector of Etna and the closure of the International Airport of Catania. Using a new generation, EDS-equipped, Field Emission Scanning Electron Microscope, we performed routine imaging and phase analysis of the pyroclasts, plus two types of automated particle analysis: first, the instrument identified and performed size and shape analysis of the particles; second, we acquired a single x-ray spectra from the whole surface of each particle and converted it into a standardless, quantitative analysis. Such analysis gives just a rough idea of the chemistry of the

erupted magma, but, in addition, it reflects the degree of alteration as well as the abundance of crystals in the particle. All analyses were performed “blind”, i.e., without the operator knowing the origin of the particles. The results show that samples A and B have almost identical chemical surface features, suggesting a similar degree of chemistry, crystallinity, and alteration. However, they differ for size and shape, sample B being finer, rounder, and better classed both in size and shape. Sample C is markedly different for its surface chemistry: in comparison to the other samples, particles of sample C are more homogeneous and more mafic, suggesting the eruption of a slightly less crystalline and evolved magma. Sample C particles also show a slightly broader size and shape distribution. The ash componentry also evidences essential differences among sample A, composed by abundant lithics ($>$32%), sample B, made of prevalent tachylite clasts (64%) and sample C, mainly consisting of sideromelane ($>$30%) and tachylite particles ($>$50%). Overall, our methodology provides, in a relatively short time and in a largely automated way, a quantitative characterization of ash particles capable of highlighting second-order differences originated during eruptions: in this case, the relative contribution and nature of “fresh” magma and “old” conduit lining to phases 2 and 3 of the 2006 Etna eruption.