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Ultrapotassic magma and carbonate substratum: complex interactions during maar eruptions at the Colli Albani Volcanic District, Central Italy

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Eruptive successions from single and multiple maars from the ultra-potassic Quaternary Colli Albani Volcanic District, SE of Rome, hold record of pre- to syn-eruptive interactions between ultra-K mafic magma and carbonate-silicoclastic wall-rocks. Maar deposits include both loose and strongly lithified wet and dry pyroclastic surge beds, Strombolian scoria fall beds, and lithic-rich explosion breccias. Scanning Electron Microscope analysis of the ash fraction reveals an hydromagmatic origin for most of the deposits, as well as the occurrence of solely phreatic ones. All deposits contain a broad range of variably thermomethamorphosed lithic clasts, including limestone, clay, marl, and volcanic and granular holocrystalline rocks. Notably, the same lithic types also occur as inclusions within the juvenile scoria clasts of the maar deposits (cored scoria). Along-stratigraphy variations in the type and abundance of the lithic clasts in the deposits suggest repeated vertical migrations of the magma fragmentation level with time. Also the type and abundance of lithic clasts enclosed in the cored scoria show large variations that record migrations in the locus of pre-fragmentation interaction of magma with country rock. The size and shape distribution of each type of lithic clast, integrated over the whole succession, provides inferences on the modes of extraction and fragmentation of the source rocks: for instance, the size distribution of carbonate lithic clasts shifts towards finer fractions in respect to lava ones, consistent with a more intense rock fracturation ab-initio, a more intense degree of syn-eruptive fragmentation, and/or a more prolonged phase of post-fragmentation transport and abrasion. By using literature models and combining information on crater size and

range of ballistically emplaced clasts we estimate the mechanical energy released by the most intense, crater-forming explosion of each eruption. Energy partition between crater excavation and particle ejection seems to provide a further constrain on the hydromagmatic vs. magmatic origin of maar craters.