Development and relationship of monogenetic and polygenetic volcanic fields in time and space: from field observations to numerical modeling

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In general, distributed volcanic fields are characterized by infrequent eruptions at monogenetic volcanoes, low average output rate, and a low spatial intensity of the eruptive vents. In contrast, central-vent-dominated systems, such as stratovolcanoes, and lava shields are characterized by frequent eruptions, high average flux rates, and high spatial intensity of eruptive vents. However, it has been observed that a stratovolcano is often associated to parasitic monogenetic vents on its flanks, related to the central silicic systems, and surrounded by an apron of monogenetic edifices that are part of the volcanic field but independent from the principal central system. It appears from spatial distribution and time-volume relationships that surface area of monogenetic fields reflects the lateral extent of the magma source region and the lack of magma focusing mechanisms. In contrast, magma is focused through a unique conduit system for polygenetic volcanoes, provided by a thermally and mechanically favorable pathway toward the surface that is maintained by frequent magma ascent and favorable stress conditions. We plan to relate surface observations of eruptive vents location and spatio-temporal evolution of the field area through time to processes that control magma focusing during ascent and storage in the crust. We choose to study fields that range from dispersed to central-vent dominated, through transitional fields (central felsic system with peripheral field of monogenetic vents independent from the rhyolitic system). We investigate different well-studied volcanic fields in the Western US and Western Europe in order to assess influence of the geodynamic setting and tectonic stress on the spatial distribution of magmatism, and extend our method to extra-terrestrial planets. We plan numerical simulations of lava flow inundation to look at field and edifice growth with time; and modeling of magma ascent in the crust to investigate magma focusing. In summary, incremental spatial intensity maps should reveal how fast a central conduit is created during the development of a volcanic field, and how this could influence the outbreak of dispersed monogenetic volcanoes that are not geochemically linked to the central system.