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Rapid incremental assembly of the Monte Capanne pluton (Elba Island, Tuscany) by downward stacking of magma sheets

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Granitic plutons frequently show cryptic facies variations characterized by diffuse contacts that are often interpreted to be the result of local differentiation processes at the emplacement level. We present an integrated field, petrographic and geochemical study of the Monte Capanne pluton (Elba Island, Italy) indicating that such facies differences, contrary to previous studies, reflect the original characters of distinct magma batches formed at depth and sequentially emplaced to produce a sheeted pluton.

The late Miocene Monte Capanne pluton was emplaced during the post-collisional extensional evolution of the Northern Apennine orogen. The pluton has a diameter of 10 km and has a mainly monzogranitic composition arising from mingling-mixing of dominant crustal melts with high-K calc-alkaline mafic magmas.

The pluton is characterized by the widespread occurrence of euhedral K-feldspar megacrysts, whose variations of size and abundance have been determined at 350 stations across the pluton. The megacryst distribution analysis defines three main facies: the San Piero facies (low to very low megacryst concentration), Sant'Andrea facies (high to very high megacryst concentration) and San Francesco facies with intermediate megacryst concentration.

The three facies show minor yet systematic differences in major and trace element contents, isotopic composition and biotites mineral chemistry; these variations are in-

dependent by the megacryst abundance. Overall, the San Piero facies displays lower SiO_2 coupled with higher CaO, MgO, Fe_2O_3 and Al_2O_3 abundance with respect to Sant'Andrea facies, as well as higher Sr, V, Cr and Ba contents. Isotopically, Sant'Andrea rocks are distinctly richer in radiogenic Sr than are the samples from the San Piero facies. Biotite composition is characterized by the lowest Fe# values (average 0.49 ± 0.01) for San Piero facies while in Sant'Andrea it exhibits the highest values (average 0.54 ± 0.01). The San Francesco facies defines intermediate fields partly overlapping those of the two extreme facies.

The association of geochemical data on whole rocks and biotites together with the reconstruction of crystallization sequence suggests that the facies formed at depth as distinct magma batches, acquiring peculiar geochemical features that were preserved after ascent and emplacement.

The new geological map based on K-feldspar megacryst distribution reveals the composite structure of the pluton characterized by an external shell constituted by the Sant'Andrea facies, and a core formed by the San Piero facies. In this view, the Monte Capanne pluton results to be assembled incrementally by downward stacking of three slightly different magma batches, building up a sheeted pluton in the intermediate-shallow crust. The three magma batches emplaced in a short time sequence as to not allow the development of sharp contacts upon advanced cooling of formerly emplaced batches, thus hampering geochronological efforts to unravel age difference between internal facies.