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Long-term magmatic evolution at the Campi Flegrei caldera (Southern Italy)

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Understanding the mechanisms that lead to the accumulation of large silicic upper-crustal magma bodies, potentially resulting in high magnitude caldera-forming eruptions, is fundamental to better constraining volcanic hazard of populous regions on Earth. Campi Flegrei is an excellent example of active and restless volcano, located in a densely populated area, which hosted, during the last 60 ka, two cataclysmic caldera-forming eruptions (Campanian Ignimbrite, ∼39 ka and Neapolitan Yellow Tuff, ∼15 ka) and a number of smaller magnitude volcanic events. Here we use detailed petrological data to reconstruct magma storage conditions and understand the past, present and future evolution of the magmatic system at Campi Flegrei. Our data reveal that during the two major eruptions most of the eruptible crystal-poor magma and part of the cumulate crystal mush were efficiently evacuated from the upper crustal reservoir, leading to a caldera collapse. Subsequently, the magmatic reservoir was replenished by more mafic magmas of deeper origin, which evolved through time towards more silicic, colder and more volatile-rich compositions. The most recent eruption at Monte Nuovo (1538 AD), characterized by highly evolved, low temperature and wet magmas akin to those that fed the pre-caldera magmatic activity, suggests that a potentially explosive magma reservoir might be currently present at Campi Flegrei.