On the unrest and eruptive behaviour of large calderas, with examples from Campi Flegrei

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Large calderas are the site of the most devastating eruptions occurred on Earth; they often display substantial unrest dynamics that puzzle volcanologists, and in some cases like the Campi Flegrei case, trouble them as well as the society for the enormous risks associated to their eruptions. Calderas display sequences of signals that would almost certainly prelude to an eruption if observed at central volcanoes; nonetheless, volcanic eruptions may not follow, while they may happen with definitely much weaker signals preceding them, as for the Rabaul eruption in 1994. Although largely debated, the origin of this controversial behaviour is still unclear. The caldera structure favours the development of large geothermal circulation, that is often invoked as an important controlling factor for the observed geophysical and geochemical changes. At least at Campi Flegrei, the structural setting of the caldera appears to have repeatedly favoured emplacement of small magma bodies at shallow (< 4 km) depth, creating a network of interconnected reservoirs capable to exchange mass and heat. The different efficiency of interconnections likely controlled the scale of the eruptions, resulting therefore in limited role of the most shallow batch on the eruption impact, and complicating the forecasts. Essentially, although our knowledge of caldera systems has evolved substantially, our understanding is still limited, contributing to increase their associated risk.