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Eruptions from calderas: the most devastating, the least understood

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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 Campi Flegrei, and possibly at other calderas like Krafla in Iceland, the structural setting appears to have repeatedly favoured emplacement of small magma bodies at very shallow (< 3 km) depth, creating a network of interconnected reservoirs capable to exchange mass and heat. The efficiency of interconnections likely controlled the scale of the eruptions, limiting the role of the shallow magmatic batch and complicating the forecasts. Although our knowledge of caldera systems has evolved substantially, their understanding is still limited, contributing to increase the associated risk.