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The Campi Flegrei Deep Drilling Project (CFDDP): New insight on caldera structure, evolution and hazard implications for the Naples area (Southern Italy)

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The 501 m deep hole of the Campi Flegrei Deep Drilling Project, located west of the Naples metropolitan area and inside the Campi Flegrei caldera, gives new insight to reconstruct the volcanotectonic evolution of this highly populated volcano. It is one of the highest risk volcanic areas in the world, but its tectonic structure, eruptive history, and size of the largest eruptions are intensely debated in the literature. New stratigraphic and 40Ar/39Ar geochronological dating allow us to determine, for the first time, the age of intracaldera deposits belonging to the two highest magnitude caldera-forming eruptions (i.e. Campanian Ignimbrite, CI, 39 ka, and Neapolitan Yellow Tuff, NYT, 14.9 ka) and to estimate the amount of collapse. Tuffs from 439 m of depth yield the first 40Ar/39Ar age of ca. 39 ka within the caldera, consistent with the CI. Volcanic rocks from the NYT were, moreover, detected between 250 and 160 m. Our findings highlight: (i) a reduction of the area affected by caldera collapse, which appears to not include the city of Naples; (ii) a small volume of the infilling caldera deposits, particularly for the CI, and (iii) the need for reassessment of the collapse amounts and mechanisms related to larger eruptions. Our results also imply a revaluation of volcanic risk for the eastern caldera area, including the city of Naples. The results of this study point out that large calderas are characterized by complex collapse mechanisms and dynamics, whose understanding needs more robust constraints, which can be obtained from scientific drilling.