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Integration of geophysical and geochemical data for the study of the North-Est Rift dynamics on Mount Etna volcano

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Mount Etna volcano is located at the front of the Apennine-Maghrebian Chain, along the Malta Escarpment, and lies on the Pliocene-Pleistocene foredeep deposits. The apparatus is characterized by a central conduit divided, at surface, into four summit craters, with a maximum elevation of 3329 m above sea level. In the upper part (>1500 m), three main "rift zones" can be identified: the NE Rift, the S Rift and the W Rift. These structures are probably shallow, do not tap deep magma and are usually directly fed by the central conduit, rather than from an underlying shallow magma chamber. The volcano is characterized by the displacement of its eastern to southern flanks, involving an on-shore area of >700 km2. This is confined to the north by the Pernicana fault system (PFS). The PFS, located on the NE sector of Mt. Etna, is >18 km long, from the NE Rift to the coastline. The western PFS is seismogenetic, while the eastern PFS undergoes creep movements. In its westernmost section, the PFS is divided into two main segments, the more northerly of these starting from the Monte Nero area of the NE Rift and the more southerly from Piano Provenzana. The PFS is kinematically connected, with a feedback mechanism, to eruptions occurring on the NE Rift. In spite of this relationship, the PFS has shown continuous activity between 1947 and 2002, a period when no eruptions occurred on the NE Rift, with major surface fracturing and seismic activity in 1984-1988.

Geophysical-geochemical investigation were conducted in the area where PFS is connected with the NE Rift, including the areas characterized by a consistent slip, as well as those structures through which the motion occurs. The aim of this work is to provide a multidisciplinary frame to characterize this dynamic and structural natural system. Magnetotelluric, geoelectric, self-potential and and soil gas emissions measurements give a comprehensive view on the geometry and depth of the lithological units together with fluid circulation insights. Here, the sedimentary basement, detected by the resistivity models, interfaces media with different physical characteristics where fluids flow play a crucial role interacting onto the Pernicana fault activity.