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Relationships between sinkholes areal distribution and main tectonic alignments in Abruzzo (Central Italy)

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Intermountain basins, developed at the back side of the Apennines overturning front, are the most evident morphological expressions of extensional tectonics in Central Italy and can be recognized in many different sections of the chain. L'Aquila basin and the adjoining Subequana valley are part of a single NW–SE elongated depression (about 60 km long) which began to develop about in the early Quaternary in response to the identification of various regional extensional tectonic alignments and the consequent starting of the basin subsidence.
This impressive morphological element is characterized by the presence of several large funnel-shaped features (locally named Fosse = trench) which affect mainly the Meso-Cenozoic carbonatic bedrock but also the Neogenic clastic sedimentary filling of the valley.
Some of these last elements are often occupied by ponds or significant artesian water resurgences like the Sinizzo Lake where, during L'Aquila earthquake of April 6th 2009, the shores collapsed and strong microseismic activity, deep rumbles and flow rate changes were reported for the following months. The Fosse mapped in the L'Aquila basin have widths in the order of hundreds of meters, a considerable difference of elevation respect the rims and present a general morphology very close to that of the classic dissolution karst sinkholes. Their evolution/localization is strictly related to the active fault systems which controls also the main tracts of the relief; the low volume of residual sedimentary deposits within the depression, not comparable with the total volume of rock removed, indicates that surface karst dissolution phenomena are absent or secondary. The elevations of the floor of many Fosse are higher respect the actual flood plain depending on their age; in fact relict circular forms, recognizable at upper altitude on the relief slope, confirm that the phenomenon has been active for a considerable period of time. About the genesis of this features, even if at present there is no evidence of hydrothermal activity or gas diffusion, morphological and geostructural analogy with the hydrothermal field of San Vittorino (Rieti) suggest dissolution processes related to the rising of underground mineralized fluids (piping) and a subsequent collapse phase, in a classic sink-hole evolutionary model. To note the areal distribution of these elements developed in a narrow band , WNW-ESE oriented, running for about 40 km parallel back to the tectonic front of the Gran Sasso and coinciding, with good approximation, to the seismogenic source of the earthquake of April 6th 2009 and of the major historical earthquakes which hit the region. Geophysical survey carried out after the last strong seismic event pointed out the presence of large hidden cavities developed in the Neogene sedimentary filling of the L'Aquila basin confirming that the phenomenon cannot be considered exhausted; then a geochemical mapping of the all area is started to identify suitable sites for monitoring fluid in relation to seismic activity and to evaluate the risk of potential, sudden phenomena of gravitational collapse.