

# **VOLCANOGENIC FLUORIDE AS A POSSIBLE OUTBREAK IN THE GENESIS OF SINKHOLE IN GROUNDWATER DISCHARGE AREAS OF CENTRAL ITALY**

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We propose sinkholes are due to the dissolution of the limestones by the attack of fluoridric acid derived by geothermal water rising up along the major structural discontinuities at the margin of the Apennines.

Major evidences for this hypothesis are:

- all the sinkholes develop at the western margin of the Apennines chain in proximity of volcanic complexes, or in the core of the Apennine where monogenic volcanic centres occurred.
- the sinkhole prone areas are located in correspondence of seismogenetic zones or active faults with resurgences of thermo-mineral waters.
- Most of the last volcanic episodes of each volcanic district are phreatomagmatic implying a continuous interaction between the rising magma and the deep regional aquifers.
- The anomalous fluorine content of most of the springs and in the regional aquifers in the volcanic areas.
- The presence of conspicuous fluorite deposits in the volcanic areas, and the abundance of related secondary minerals F-rich (Apatite, etc).
- There are intense CO<sub>2</sub> manifestations in all volcanic districts with deposition of travertine often enriched in fluorine.
- The sinkhole phenomena locate in groundwater discharge areas (GDA) implying a near-saturation state of the waters with respect to calcite. Furthermore, the confined karst bedrock aquifers have upwelling waters variously artesian, sometimes above the ground surface.

Our hypothesis is that F in the regional aquifer forms fluoridric acid (or the acid is directly introduced in the regional aquifer) giving the possibility to the water to attack the limestones of the carbonatic sequences of the Apennine. It is known that fluoridric acid is able to dissolve the limestones producing fluorite in its esothermic reactions liberating CO<sub>2</sub>.