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Geochemical monitoring of fluids from seismogenic structures: an approach to the seismic area of Sicily (Italy)

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Geochemical monitoring of fluids from earthquake-prone areas represents a new perspective to improve the knowledge of the seismogenic processes. Two areas in Italy appear suitable to be investigated for the relationships among the geochemical features of the released fluids, the tectonic setting and the occurrence of seismic swarms: the Umbria region (Central Apennines) and the Sicily region (Apennines-Maghrebide chain).

Over those wide areas gases and thermal waters are released in coincidence to seismogenic structures. Sicily has a complicated and somewhat controversial tectonic setting and many of the structures crossing the region are interpreted as seismogenetic.

The Umbria region was struck by a destructive seismic crisis in 1997-98. Fluids released in coincidence of the main tectonic structures of the area underwent significant variations, as function of the faulting activity.

Among the collected data, it results of particular interest the $^{3}He/^{4}He$ ratio highlighting variable contributions of mantle-derived helium into all the different sites. The contribution of mantle-derived helium it is not obvious in the continental lithosphere, where processes such as mantle-degassing through lithospheric faults or melt intruded along regional faults have to be considered to explain some results.

The observed geochemical anomalies were not related to seismic events, instead they appeared to be driven by crustal deformation-induced processes (i.e. permeability changes, microfratturing). Although the deformation characterizes the seismogenic

processe, the rock permeability variation and the microfratturing are not necessarily associated to seismicity. Since both the geodynamic setting of the area and any seismogenic process strongly influence the composition and the behaviour of the fluids, a better knowledge of their mutual relationships can add new subject to the debated problem of earthquake forecasting.