FLUID GEOCHEMISTRY AS TOOL TO DISCOVER GEOTHERMAL FIELDS, TRACE METALS, OIL&GAS RESERVES AND HAZARDOUS FAULTS

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The paper is a review of case histories studied mainly at INGV in the last 25 years, which adopted the "fluid geochemistry" discipline and methods, on field, laboratory and data elaboration, for different purposes in the frame of volcano-tectonics and energy/geo-resources research.

In particular fluid geochemistry was addressed to the following applications critically reviewed: i) the discovering of geothermal fields including their risks assessment, as gas burst, hints of induced/triggered seismicity as pressure pulses up to surface by the presence of faults etc…; ii) the discovering of trace metals, including those of U-TH series and generated radionuclides (^{222}Rn) as well as REEs accumulation. The same methods are used to assess their risks assessment mainly in geothermal/faulted areas (i.e. radon indoor; groundwater contamination by geothermal pathfinders as Hg, As, Sb, Tl, Ba, NH_4, ^{222}Rn, dissolved gases, organic components, etc…), towards new paradigms of water waste management (the paper will present the main state of art in Italy), along fault/volcanic systems; iii) the discovering of reserves and resources or potential small-hidden bodies of conventional and unconventional Oil & Gas, analyzing the gaseous, liquid and solid phases, i.e., CBM (Coal Bed Methane) and shale gas. Case histories overviewed will highlighted from Italy, Australia, Canada, Poland, Greece; iv) the discrimination by fluid geochemical space-temporal monitoring of hidden/buried fault systems or crossing points between different fault systems, separating segments, seismogenic or not. Different activated fault systems – in subduction/compressive/extensional framework have been reviewed (i.e. The Umbria-Marche seismic sequences of 1997 and 2016-2018, the Emilia-Romagna compressive front seismic sequence2012; the L'Aquila seismic sequence 2009) have been discussed. Faults are at the same time "hazardous" and "enriched" systems as a consequence to be powerful permeability barriers.

Very often these bodies - driven by the presence of a geochemical barrier along faults and volcanotectonic structures , i.e. oxy-reducing barriers accumulating metals, could seat of important reserves, as Uranium bearing bodies and other economic geology enrichments and therefore the paper review methods and critical issues, case by case. The importance of geochemical barriers (i.e. acidic/reducing/precipitation/CO_2 uprising linked) for elements and radionuclides mobility is growing after the first concepts elaborated by Perl'man during the '70s. CO_2-rich case histories bring to gas-burst too, mainly in a young geodynamical Italian country as Italy.

Hints about fluid-geochemistry continuous monitoring tools in active volcanic/seismic/energy prone areas are presented. Hints of future possible collaboration with Russian institutions on these topics are suggested.