Investigating diffuse CO_2 degassing in tectonically active areas by groundwater

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The deeply derived CO_2 from tectonically active areas is contributing in a significant proportion, still un-quantified in detail, to CO_2 Earth degassing. Several studies highlighted how in these tectonically active areas most of the CO_2 is dissolved in the groundwaters circulating in the large regional aquifers hosted by the permeable formations of the active orogens. Quantifying the amount of deep CO_2 dissolved into groundwater can represent a powerful tool for regional investigations, because springs are representative of their catchment area that can extend from tens to hundreds of square kilometers.

In the framework of projects supported by Deep Carbon Observatory we analyzed available data and collected new groundwaters samples to identify and quantifying (where possible) deep CO_2 emission from tectonically active areas. The new database already includes a large amount (~ 15,000) of chemical compositions and (when available) dissolved carbon isotopic compositions, from scientific publications, reports and web resources. The data refers mainly to groundwater of north America and southern-eastern Europe. In addition, during 2019, various field campaigns of groundwater sampling started in those areas of southern and eastern Europe where there are clear signs of CO_2 Earth degassing but lack of data (that is severe especially for what regards the isotopic composition of dissolved carbon).

The collected data, that include also information on the lithology and hydrogeology of the aquifers, were used to infer the origin of the dissolved carbon thorough mass balance computations. The most relevant preliminary results will be presented. These include (i) specific statistical analysis performed to define threshold value/s for the dissolved carbon capable to differentiate the areas affected by the influx of deep CO_2 and (ii) the quantification of the CO_2 flux from the deep source in the most favorable cases.

Finally, the availability of a large database represents an initial step to attempt an estimation of the CO_2 flux from tectonically active areas also because it highlights the most promising key areas and the area where data are missing.