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The importance of automatic continuous geochemical monitoring in an open conduit volcano (Stromboli, Italy)

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Depressurization during ascent produces increasing magma degassing and compositional changes of the exolved gas, basically controlled by the gas solubility in the magmatic melt. As gas is much more mobile than the magma, it moves more rapidly toward the surface. Thus, in principle, gas leakage anomalies should herald the eruption onset. The identification at the surface of such geochemical anomalies is however not so easy, as the raising gas can, at various depths, interact with and partly dissolve into aquifers. The hydrology of the volcanic edifice therefore plays an important role in controlling fluid geochemistry surface expression. In open conduit volcanoes like Stromboli, the transition from a steady state condition to an eruptive one could be short and in order to recognize anomalies due to magma upraise, a continuous record of crucial physico-chemical parameters is needed. At Stromboli there are a few shallow thermal wells near the NW coast (water table depth 5-30m; T = 35-46 ˚C). This shallow aquifer intercepts fluids raising from depth, of probable magmatic origin as indicated by isotopic composition. In one of these wells we have continuously measured for one year by an automatic station the physico-chemical parameters (pH, Eh, Conductivity, T) and dissolved CO_2 and CH_4. Three types of variations have been recognized: a) short term (6 hrs.) periodic ones, likely related to tides; b) long term ones possibly related to seasonal cycles, and c) long term (few days to week) non-periodic ones, that likely correspond to geochemical anomalies of volcanic significance. A variation of the last kind (slight increase of T, pH decrease and P_{CO2} increase) was recorded

before a violent explosive paroxysm occurred on April 5, 2003, that was then heralded by a strong release of magmatic gases (mostly CO2) nicely recorded by the monitoring station.