

Monticchio lakes

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The crater lakes are a natural hazard for the population living near them because they can generate limnic explosions, like as the disaster of Nyoos lake (Cameroon 1986), in which 1476 people and thousands of animals died. Crater lakes are able to store magmatic and hydrothermal gases and solubilising them into the water. An overpressure of the dissolved gases can generate a limnic eruption. Italy is characterised by an intense volcanic and seismic activity. Evidences of this past volcanism are the numerous crater lakes in Lazio and Campania. The most famous are Bolsena lakes, Vico, Bracciano, Monticchio lakes, Mezzano, Martignano, Albano, Nemi, Averno. The Monticchio lakes (Piccolo Lake (LPM) and the Grande Lake (LGM)) have formed in two maars localized in the Mt Vulture (Basilicata), a Quaternary, not active volcano, characterized by anomalous high flows of CO₂ emitted by soils. They are separated by an isthmus of about 200 m. The two lakes have different morphological characteristics: LPM has an area of 160.000 m², a steep floor and a maximum depth of 38 m. The LGM has an area of 380.000 m², and the maximum depth of 36 m in its northern part. The two lakes solubilise high level of gases. The high CO₂ tenors and the high values of He³/He⁴ isotope ratios are ascribable to a deep magmatic degassing.

In this study we investigate the physical-chemical parameters (electrical conductivity, temperature, Eh and pH) and the chemical composition of major and traces elements along two bathymetric profiles. Monticchio Lakes were sampled in June 2018. The samples, taken in different depth, are 20 in total: ten from LMP and ten from LMG. The physical-chemical parameters were measured at different depth by a multiparametric probe. The major and trace elements are analyzed in the laboratory of INGV (Istituto Nazionale di Geofisica e Vulcanologia) in Palermo.

The physical-chemical parameters show the different layers in Monticchio Lakes. In both lakes the range of temperature is 5.6 °C and 20 °C. Lakes show different range of pH being between 6.5 and 8.6 in LMP and between 6 and 7.6 in LMG. The range of Eh is between -152 and 258 mV and between -144 mV and 141 mV. in LMG and LMP respectively, being the negative values in depth due to anoxia phenomenon. The two lakes have a similar thermocline layer, around -6m. In summer, the both lakes are mostly layer because the sun energy warming the surface layer of lake. This phenomenon makes the hot layer upper the cold layer. In LMG, the range of electrical conductivity varies little with depth (411 - 526 microS/cm). Instead, in LMP, the range of electrical conductivity is greater ranging from 339 to 1456 microS/cm. For this reason, the halocline is different in both lakes, In LMP, the salt concentration increases with the depth.

LMP and LMG waters in Langelier-Ludwing classificative plot have both bicarbonate earth-alkaline compositions. On the contrary, traces elements (Li, Be, B, Al, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, As, Se, Rb, Sr, Mo, Cd, Sn, Sb, Te, Cs, Ba, Pb, Bi and U) have different characteristics. In LMP, B, V, Mn, Zn, Sr, Cr, Fe and Mn show higher concentrations respect the other trace elements. Instead in LMG, the more concentrated trace elements are Li, Ti, Cs, Rb, Ba, Fe and Mn. In Both lakes' Fe and Mn increase with the depth.

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