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Minero-chemical composition as environmental quality assessment tool of an artificial water reservoir: the case of the “Pietra del Pertusillo” lake (Basilicata, Italia)

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The Pietra del Pertusillo fresh-water reservoir is an artificial lake located in the High Agri River Valley (Basilicata); its dam was completed in 1963 for producing hydroelectric energy and providing water for human use to Puglia and Basilicata southern Italian regions (approximately 2 million people). Pertusillo lake lies within a national park because of the presence of many special protected areas.
This reservoir is a natural laboratory for assessing the sediment pollution from human activities, including: wastewater treatment plants, landfills, farms, treatment oil plant, plastics and other industrial activities. In addition, the Pertusillo reservoir is located in the area of the largest oil field of continental Europe. This anthropogenic pressure may thus represent an impact factor on the environmental equilibrium and consequently the knowledge and control on their quality represents a relevant environmental challenge.
This study reports the preliminary results of a multidisciplinary (sedimentological, mineralogical, geochemical) PhD research focused on the analysis of the lacustrine sediments filling the Pietra del Pertusillo fresh-water reservoir. The lakes and its sediments represent the natural sink for nutrients and possible pollutants which tend to accumulate in relation to the nature and composition of the solid matrix but also the concentration and characteristics of the substances themselves. Moreover the deeper sediments, deposited under undisturbed condition, represent the "historical memory" of the ecosystem.
Sub-aqueous lake sediments were investigated in May 2014, sampled using a small platform and a gravity corer (UWITEC, Austria) of 90 mm diameter which allowed to drill 19 cores up to 2 m long from the sediment/water interface. Successively cores were studied and described by using facies analysis techniques; a large number of core samples (147) were collected from the working half of each core, stored in HPDE containers, and frozen at -20°C for subsequent chemical and mineralogical analysis.
Further, in order to assess the provenance effects on the composition of lake sediments, the bedrock (Meso-Cenozoic rocks and Quaternary fluvial-lacustrine deposits) and the stream sediments of the main “Pietra del Pertusillo” tributaries, close to the detrital supply entry points of Pietra del Pertusillo lake were also sampled.
The mineralogical composition was obtained from randomly oriented powders by XRPD. Chemistry (major, minor, and trace elements) was performed on powdered samples by ICP-MS technique after a four acids digestion and lithium metaborate/tetraborate fusion to facilitate the destruction of possible resistate minerals.
Preliminary data related to the stream sediments show that both major and minor elements (including heavy metals, barium and arsenic) have a minor variability and are close to the median values of the bedrock. The mineralogical composition of the analysed samples can explain the elemental relationships,thus excluding any anthropogenic input.
The mineralogical composition of the lacustrine samples is made of quartz, carbonates, feldspars, muscovite/illite, chlorite, and interstratified clay minerals, and it is constant throughout the cores. Finally, as further step ot he research plan, we are processing 20 of all lake samples with the highest peaks of interstratified clay minerals, which likely represent the most reactive phases in our sediment-water system.