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First Tentative of Characterisation of Stratum Outcropping Inside the Roman Baths of Palazzo Valentini in Rome

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Abstract

Aim of this work is a first characterization of stratum outcropping inside the archaeological excavations of Palazzo Valentini in Rome, promoted and financed by the Province of Rome.

Through the physical-chemical and biological characterization it was possible to realize an identikit of this point of outcrop. The obtained results will feed into a database that will contain the same analyses for other points of stratum outcropping in the area of the Roman Forum. It also seeks to highlight a difference between the analysed water and those coming from the modern supply and sewer network in the area so dispelling any doubts about a possible their mixing occurring inside the building itself or from neighbour sources..

All the analyses were performed basing on the Italian rules foreseen for the spring waters, in particular for potable and mineral water [1], while the characterization exploits the modern techniques of multivariate analyses.

Introduction

Inside the underground ruins of Palazzo Valentini, built in the late 1500s near the Roman Forum, a water outcrop occurs in more than one point. Today Palazzo Valentini is the seat of the Province of Rome, after a number of extension works related to the various owners of the site.

The long process of excavation started in 2005 [2] and did emerge the remains of the podium of a huge temple, probably the Temple of the deified emperors Trajan and Plotina, two *domus (*A and B*)*, a terrace, and a full private bath complex (*privatis balnea*) belonging to the *domus* B ("Small Baths"), which include the following areas: *praefurnium*, *calidarium, laconicum, tepidarium, frigidarium, apodyterium*.

Differently from the public baths, with social gathering function, the construction of which fell in the internal politics of each emperor in the early centuries A.D., these, owned patrician, had a private function. It is said that the outcrop in the "Small Baths" is linked to an autonomous source.

Today, in fact, there are some veins of water at the same level with a low but perceptible flow of water that may drain into the roman channels still present and recognizable. The study will determine membership of groundwater in the area of the Roman Forum (or its eventual independence) or the autonomy of the same with respect to the wastewater of the area.

For this purpose, two samplings were performed at a distance of about a month at the deepest point of outcrop and, at the same time, drinking water available in the courtyard of the palace was taken. In addition, a two-week monitoring of the common source parameters such as pH, temperature, conductivity, ORP, O_2, NO_3, NH_4, air temperature was carried out.

For the full characterization of the source some other parameters have been measured in the laboratory: suspended solids by weighing the filtrate, residue at 180 °C, colour and organic matter by UV-Vis, anions by ion chromatography, cations by ICP, carbonates by titration [3].

Materials & Methods

For on-site monitoring 3 datalogger have been used: HD2156.2 (from DeltaOhm, Italy) with the electrodes KP-62 and SPT1GS; LabQuest (from Vernier LLC, USA) with the electrodes DO-BTA and STS-BTA; LabQuest2 (from Vernier LLC, USA) with the electrodes ORP-BTA, BTA-NO3, NH4-BTA. The distribution of the electrodes between the dataloggers was carefully planned in laboratory in order to eliminate interference between them.

For measurements in the laboratory we used: Millipore filtering systems, laboratory oven M710 (from Galli, Italy), chromatograph 761IC (from Metrhom, Swiss), with column AS9+AG9 (from Dionex, USA), Lambda 16 spectrophotometer (from Perkin Elmer, USA) with 2, 10 and 100mm quartz cuvette (from Helma, Germany), MilliQ ultrapure water (from Millipore, USA), Vista RL-CCD Simultaneous ICP-AES (from Varian, USA) and typical laboratory glassware and bench instruments.

Results

No significant variation were observed between the two sampling campaigns; so, in Table 1 the median values of six measurements (three for each sampling) are reported. In this period, the concentration of NH_4 was below the limit of detection.

Tab.1 comparison of chemical-physical values of the 2 sample campaign

	pH	Temp °C	cond µS.	ORP mV	NO_3 ppm	O_2 ppm
Sample1	8.1	18.0	803	212.3		5.8
Tap1	7.9	15.7	607	343.7		5.2
Sample2	8.1	18.7	827	278.4	13.6	4.8
Tap2	7.6	16.8	605	353.5		5.6

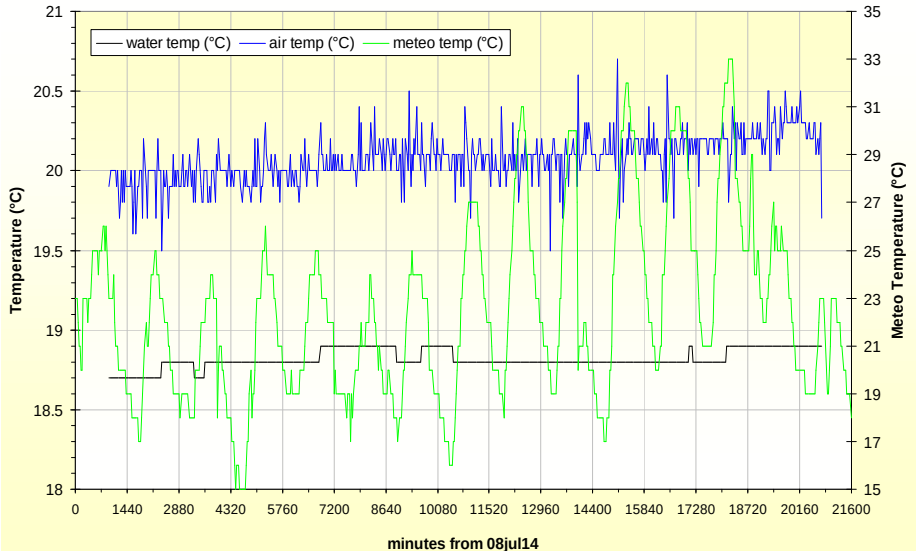

Fig.1, Run plots relative to the 15 days monitoring of indoor (blue), meteo (green) and spring water (black) temperature

In fig.1 results of the 15 days of monitoring are shown, it is clear the difference between the meteorological temperature (green), with daily variability, the almost constant microclimate (blue) typical of hypogean environment and the practically constant temperature of water (black) typical of a groundwater.
To better compare spring water and public tap water, the concentration of the main 4 cations and anions were measured in triplicates, in all the sampled waters, obtaining a matrix 12x8. The first multivariate analysis was plot a SPLOM (scatter plot matrix). An example is reported in fig. 2 for pH and ORP data; a strange 2 groups appear that need future investigation.

Conclusions

The choice of parameters to be measured resulted suitable to obtain an identikit of the samples. A further improvement will come from the microbiological analyses, to highlight eventual infiltration of sewages, that is not yet complete, and from a continuous monitoring of the groundwater level, to be related with the rainfall in order to evidence the wellspring behaviour.

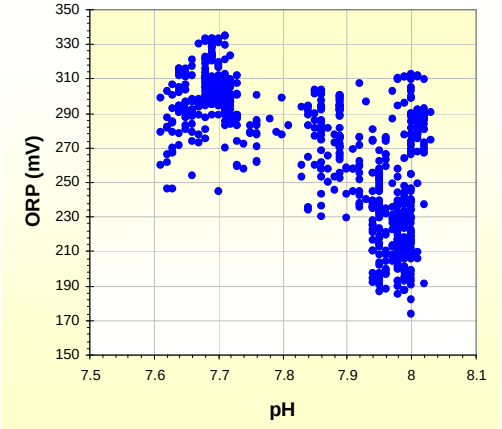

Fig.2, scatterplot of pH and ORP measured for all the analysed samples

References

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