

## Chemistry of rainfall water collected by local people in Gârda Seacă–Ghețari–Poiana Călineasa area (Bihor Mountains, Romania)

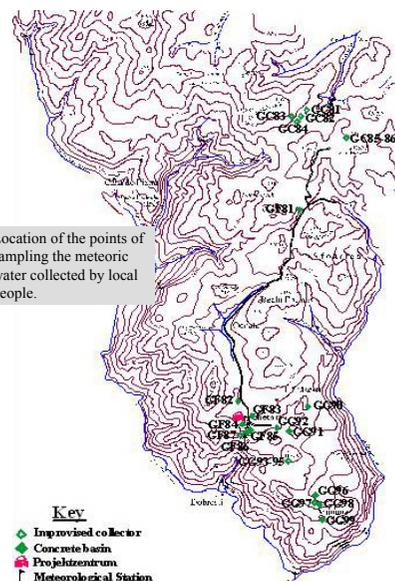
An interesting feature characteristic to this area is the utilization of meteoric water, on a quite large scale, by local people. There are places (the villages Ghețari and Munună, Poiana Călineasa) where in order to substitute to a certain extent the water deficit, local people have imagined various systems of collecting and storing rainfall dripping from the roofs of the buildings. The efficiency, and especially the influence of these procedures on the quality of the stored water are still questionable. According to our investigations, this water is prevalently used for domestic purposes, yet there exist also situations when it is used for cooking (for instance in Munună).

### Chemical composition of rainfall

The specific features of the meteoric water collected from the platform of the meteorological station placed in Ghețari village are pH values ranging between 4.47–6.45 and TDS values ranging between 3–33 mg L<sup>-1</sup>, this water displaying the characters of what is usually designated as "acid rain". SO<sub>4</sub><sup>2-</sup> is the prevalent anion, with a weight ranging between 14 and 44% of the total of major components, a fact that indicates the marine origine of rainfall, in conformity with the dominating direction of air masses displacements, namely from the west. It is worth mentioning that in the case of rains which last for several days consecutively, the first amounts of water exhibit a larger weight of the alkaline ions, Na<sup>+</sup> and K<sup>+</sup>, while toward the end of the rain the Ca<sup>2+</sup> and Mg<sup>2+</sup> ions, that are characteristic to the local aerosol become predominant.

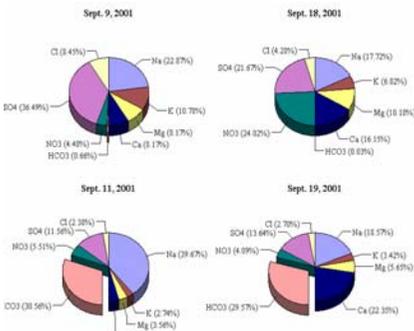
### Chemical composition of the collected water

The ammonium and nitrites concentrations detected in the rainfall water collected by local people are much higher than those in any groundwater or surface water having been analyzed in the area, exceeding all the limits imposed by existing drinking water regulations. It is anyway very difficult to recognize the chemical characters of the original rainfall water in the water accumulated in the storage pools. Microbiological analyses of rainfall water collected in large pools built in concrete outlined, in most considered cases, that the main specific parameters strongly exceeded the maximum admissible concentrations stipulated by the regulations in force.



Location of the points of sampling the meteoric water collected by local people.

**Key**  
 ◆ Improved collector  
 ● Concrete basin  
 ● Pseudotsitireum  
 † Meteorological Station



Comparisons between the various compositions of rainfall water sampled in successive days.



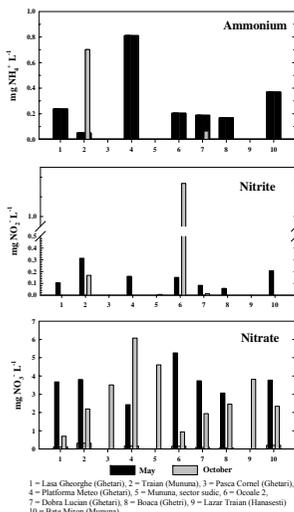
### Effect of the roof building material

The influence of the roof building material on the quality of the water that drips into the storage pool is probably minor, by considering the short duration of the contact between the roof and the water. Definitely, the deterioration of the stored rainfall water is due to the type of storage pool and to the way the later is maintained.

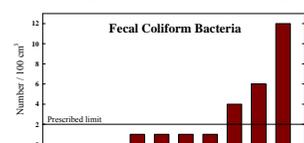
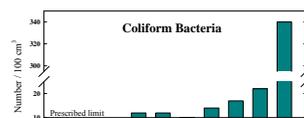
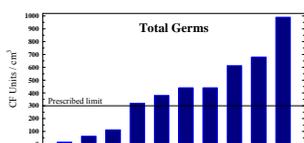


### Effect of the storage pool building characteristics

Next to many households there can be seen special pools, built in concrete, devised for the storage of large amounts of water, most of them being provided with systems for being closed and protected. At a first sight, the solution imagined by the local people and their concern for protecting the accumulated rainfall water cause a favorable surprise. Yet it is this very type of pools that display the highest nitrites and ammonium concentrations, thus indicating a much more severe deterioration of the concerned water, as compared to pools that are left open. There exist at least two causes that contribute to this situation. First, by isolating the pool, a reducing (anaerobic) environment is generated, the chemical equilibria take place within the water body and thus they are predisposed toward increasing the amounts of nitrites and ammonium, simultaneously with decreasing those of nitrates. Second, due to, on one hand the absence of alternative amounts of water, and on the other hand to the excessive size of these pools, it is cumbersome to secure an appropriate cleaning. There are no breaks between the stage of filling the pool with rainwater, and the stage of consumption, that results in its – usually partial - emptying, and as a consequence a series of undesirable compounds accumulate in the pool, with water actually providing an optimum environment for bacteria cultures.



1 = Lasa Gheorghie (Ghetari), 2 = Train (Mununa), 3 = Pasa Cornel (Ghetari), 4 = Platforma Meiso (Ghetari), 5 = Mununa, sector sudic, 6 = Ocoale 2, 7 = Dobra Lucian (Ghetari), 8 = Boasa (Ghetari), 9 = Laza Train (Hanuseni) 10 = Bate Miron (Mununa)



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Distribution of the concentrations of the main inorganic species of nitrogen (above) and of some microbiological parameters (right), in rainfall water collected by local people in special pools, built in concrete, most of them closed.