RELATIONSHIPS BETWEEN THE COMPOSITION OF VINEYARDS' ROCK, SOIL AND GRAPEVINE PARTS REGARDING CHEMICAL ELEMENTS, ON TWO EXAMPLES FROM MÁD, TOKAJ REGION, HUNGARY

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Mád is located on the western border of the historical Tokaj wine region, with its more than 900-hectare vineyard territory this makes it suitable for our research. We specifically studied two braes, the Király Hill and the Úrágya Hill. The goal was to examine the chemical elements in different parts of the grape, and to find connections between them and the composition of the vineyard and its soil. We assumed that the elements accumulated by the grapevine may be characteristic to the composition of the local soil. Some elements are expected to crystalize in the form of minerals, depending on their abundance and the plant physiology. In research related to vine and grape mineralization mostly the total or partial chemical composition is reported as "mineral part" thus we take the mineralogical approach to obtain more detailed data on the uptake and distribution of chemical elements which contribute to grape composition.

The choice of the two vineyards is based on their different petrology and geochemistry, while the Király Hill is an area of strong hydrothermal alteration (silicified rhyolite tuff with abundant quartz, kaolinite and alunite), the Úrágya Hill has mainly weathered rhyolite breccia with lesser extent of hydrothermal alteration (quartz, K-feldspars and minor alunite).

Sampling strategy was set up to allow the study of local chemical processes, thus a 2 m deep pit was excavated next to a vine-plant. Soil samples were taken from two depths of the profile, according to the two horizon-like strata of the soil. Rock fragments from the deeper horizon were also collected, assuming that they are important source for soil minerals, even if complex soil colloid transfer processes are considered. Root fragments were cut off from the pit bottom, and samples of leaves, stem and grapes were also collected after grape harvesting.

The rock and soil samples were examined for mineralogical and chemical composition (X-ray powder diffraction, XRD and X-ray fluorescence spectrometry, XRF), identification of soil clay minerals was done by diagnostic XRD investigation. The chemical composition and texture of grapevines parts (root, seed, leaf and peduncle) was investigated by scanning electron microscopy and energy-dispersive X-ray spectrometry (SEM+EDX). Plant parts were also subjected to XRD, to observe minerals in the main crystallized material, the cellulose matrix. Ash content and ash chemical composition was also investigated for some samples by inductively coupled plasma optical emission spectrometry (ICP-OES).

The mineralogy of the rock samples was found to be simple, featuring alunite and quartz on both sites, kaolinite on Király Hill and calcite and abundant sanidine on Úrágya Hill. SEM+EDS investigation of rock samples confirms XRD results and additionally reveals accessory minerals which are important micronutrients, like apatite for P. Other than these minerals the soils contained illite (mixed di- and trioctahedral), albite and smectites.

Chemical elements found in the rock could be found in the soils too, the only exception was sulphur, which was absent from the Úrágya samples. The elements from the soils were also found in the organic parts too, but in varying ratios between the two vineyards and the different plant parts. The Úrágya Hill grape was more enriched in K – related to sanidine, while S and Al beyond K was higher in the Király Hill grape, as defined by elevated alunite content of the rock and soil. Ca and Mg are usually more elevated than Si and Al, and their distribution in the organic tissue is related to specific parts. The highest Si accumulation is observed in the leaves, in organic-crystalline form.

What we also discovered, were idiomorphic calcite, quartz and oxalate mineralizations formed in the plant tissues. The oxalates have been identified as whewellite and weddellite with XRD. Less mineralized micrometric globules can be observed in most of the grapevine samples, which after contacting with iodine gave no reaction for starch, so by elimination we refer to them as yeast.

These results suggest that the enrichment of certain elements in grapevines is site-specific. However, the role of soil fluid migration and airborne soil forming mineral transport should be always considered in such studies. With further studies we can gain information on how the composition of a vineyard's rock and soil affects the grape, the wine made from it – and its „minerality".