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The role of soil biogeochemistry in wine taste: Soil factors influencing grape elemental composition, photosynthetic biomarkers and Cu/Zn isotopic signature of *Vitis vinifera*

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Understanding the influence of soil composition in wine taste is of great economic and environmental interest in France and around the world. Nevertheless the impact of soil composition on wine taste is still controversially discussed. Since inorganic soil components do not have a proper taste and do not enter the plant anyway, their influence needs to be induced by nutrient absorption and its impact on plant functioning and grape composition. Indeed recent development of geological tracers of origin proof the existence of soil chemical and isotopic signatures in wine. However, type and scale of the impact of soil composition on wine taste are not well understood yet, and little experimental evidence exists due to the complexity of mechanisms involved.

Thus, to provide evidence for the impact of soil composition on grape composition and potentially wine taste, we studied soil and plant material from two relevant vineyards (Soave, Italia). On those two directly adjacent vineyards, two different wines are produced with the same plant material and cultivation techniques. The vineyards only differ by their underlying bedrock – limestone *versus* basaltic rock - and thus present suitable conditions for investigating the impact of soil composition on grapes and wine.

Pedological and mineralogical parameters were analyzed for the two vineyards whereas chemical extractions (citrate, $CaCl_2$) were performed to determine nutrient bioavailability in both soils. Elemental compositions were determined by ICP-MS analyses in different compartments (soils, vine leaves and grapes). Isotopic fractionation of Cu and Zn was investigated in various samples as source tracers and in order to better understand fractionation mechanisms involved. Finally, plant health was studied using the Omega-3 biomarker which determines the fatty acid composition in vine leaves, directly involved in photosynthetic processes.

Results show that the vineyards are characterized by two different soil types due to the geological difference. These soils differ in elemental compositions and bioavailability of mineral nutrients, preconditions for a potential influence on plants and wine. Elemental ratios of soils are partly transmitted to leaves and grapes of correspondent plants, including nutrients such as Ca. Plant photosynthetic functioning is significantly better on the limestone vineyard due to lower Cu bioavailability: Omega-3 values are negatively linked to Cu bioavailability in corresponding soils. These observations suggest a difference in organic molecule synthesis depending on the vineyard soil, which might include components relevant for taste and fermentation. Cu and Zn isotopic ratios do not differ between both soils. The main fractionation of Cu and Zn isotopes occurs at the soil-plant interface making those isotopes suitable tracers for uptake mechanisms. As a result Zn isotope ratios reveal a strong recycling of Zn in the soil-plant continuum.

Our results show a significant influence of soil composition on grape composition, plant biochemistry and potentially wine taste. Determination of organic and sensorial composition of grapes and wine is ongoing and will be discussed in further communications.