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An Experimental Study on Traceability of Wine Using Radiogenic Isotope of Heavy Elements: $^{87}\text{Sr}/^{86}\text{Sr}$ in Single Grape Vinification, Vine, and Soils, from Brolio, Chianti Classico Area, Italy

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Traceability and certification of guarantee of authenticity and geographic origin of the agricultural products are among the more debated themes in the field of high quality productions, especially in the enological sector. The determination of radiogenic isotopes (such as those of Sr) as univocal marker, has been successfully tested during the last few years on some DOCG and DOC wines commonly found in the market.

We present a detailed, experimental study, using high precision analyses of $^{87}\text{Sr}/^{86}\text{Sr}$ of laboratory controlled single-grape vinification of one of the more important Italian wine (the *Sangiovese Chianti Classico*) from the *Barone Ricasoli* vineyards, one of the most ancient vineyards among the Chianti region. The final aim is to test how and if Sr isotopes represent an univocal geochemical marker to link the wine to its specific production *terroir* even at very local scale, and for extremely geologically variegated territory, such as the Tuscan countryside.

Sr isotope ratios were determined in a number of micro-vinifications obtained from grape-bunches sampled from single grape-plants, during four consecutive harvest vintages (2008-2011). The 11 selected sampling points are representative of six distinct vine parcels characterized by different soil-

substratum background. Together with grapes, the soil portion from the rooting horizon underneath each single vine-plant has been sampled and analyzed both as total and leachable (i.e. bio-available) portion to explore the behaviour of Sr adsorption by the plant.

Our results demonstrate an excellent reproducibility of the $^{87}\text{Sr}/^{86}\text{Sr}$ of each micro-vinification during the four harvesting years, suggesting that the Sr uptake process from the grapevine roots to its final product is time independent. Moreover, we find a well detectable variability of $^{87}\text{Sr}/^{86}\text{Sr}$ among the different sampling points, which are thus characterized by specific isotope values during time. The $^{87}\text{Sr}/^{86}\text{Sr}$ of the total soil are widely different from those of the relative leachate portion. Leachates show lower $^{87}\text{Sr}/^{86}\text{Sr}$ similar to those founded in the corresponding wine sample, indicating that the Sr signature is controlled by a selective leaching process of heavy element from soils.