



GEOLOGICAL, MINERALOGICAL AND GEOCHEMICAL INFLUENCES ON THE CULTIVATION OF VINES

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Abstract

Aims: The aims of this study are to determine the influences of the local geology, mineralogy and geochemistry of surroundings, substrate and soil on the cultivation of vines, these as an additional factor of specificity and locality in the production of wine and definition of terroir, as well as for the discrimination of local variance of substrate and soil properties for the strategic management of cultivation plots and/or the evaluation of new cultivation regions, necessary within a scope of global climate change.

Methods and Results: Four vineyards in central Chile were selected for multiple scale geological, geomorphological, mineralogical, geochemical and landscape evolution studies. These included regional to local scale geological and geomorphological mapping, hydrological and hydrogeochemical characterization, and mineralogical, geochemical and physicochemical studies of soil-substrate profiles within contrasting cultivation plots of the selected vineyards. Selection of vineyards included two along the coastal cordillera of Central Chile (Casablanca and San Antonio valleys: sp. Pinot noir), and two along the central depression valleys of south Central Chile (Santa Cruz and San Javier valleys: sp. Carmenera). In addition to soil and substrate studies, analysis of berries and juice were carried out, in order to contrast local plot geochemistry to the chemical properties of berries, and therefore the local influence of substrate/soil properties on production. Results determine that the local geological and geomorphological conditions clearly influence the distribution of substrate-soil and water composition, texture, permeability, and physicochemical properties, influencing equilibrium of pH, Eh and chemical composition of substrate/soil/water/plant interaction, having contrasting effects on the chemistry and properties of berries and juice.

Conclusions: Despite a long-standing debate on the influence of geology on the cultivation of vines and how these could affect the quality of wines, results demonstrate that at least local geological and geochemical site conditions do affect the physicochemical and chemical properties of the substrate/soil interface, therefore impacting the availability of natural nutrients, the physicochemical properties of soils (pH/Eh), the chemistry of water, and permeability and texture. Variance of these properties on a local vineyard scale, even at a plot scale, influence vine growth conditions, with an impact on berries and juice, hence, defining properties which may be regionally unique. Discrimination of unique conditions may allow determination of land plot selection criteria, be it for local selection of production plots, or for the evaluation and selection of new cultivation land, especially necessary in times of global climate change.

Significance and Impact of the Study: Chile, a world prime wine producer, must adapt to climate change. At present the production of premium wines is geographically well defined, the prime vine cultivation valleys classified on the base of climate and viticulture conditions, not taking into account the local geological and geomorphological characteristics. Characterization of these conditions further south, in regions that will soon be apt for vine cultivation, is highly relevant in order to ensure new production areas will be similar.

Keywords: Geology, mineralogy, geochemistry, climate change, adaptation