Biogeochemical controls on the trace element composition of wine.

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The trace element composition of wine has pragmatic applications in that it can in some cases be to determine the origin and authenticity of wines. However, information on how biogeochemical processes make possible the trace element fingerprinting of wines has broader implications for understanding controls on element concentrations in all vegetation. Elements in wines from any one restricted region behave (vary) according to basic geochemical principles; they group according to Goldschmidt's geochemical classification of the elements. However, lithophile elements form two groups, those soluble and those insoluble in water, suggesting that element behavior is dominantly controlled by solubility in water. Soil alkalinity, which is related to climate, plays a role in controlling the behavior of a few elements such as Sr which are made more available for uptake where concentrated in salts (calcite) in arid climates. The impact of soil trace element composition on wine composition has yet to be quantified, but large anthropogenic inputs to soil (e.g. Pb and As) are apparently reflected in wine chemistry, and the utility of using trace element concentrations in vegetation to look for ore deposits is well established. A factor apparently overlooked to this point is evapotranspiration. Recent studies of Canadian wines show that average concentrations of many elements from five regions correlate positively with Degree Growing Days (a monitor of the amount of heat received in each region). Apparently a major factor controlling the absolute concentration of elements in wines, is the amount of water evaporated from vines and grapes. Warmer climates lead to more evaporation and higher concentrations for all elements, with element ratios still reflecting relative solubility of elements in soil water.