Boron-Isotope Variation in Long Island Wines

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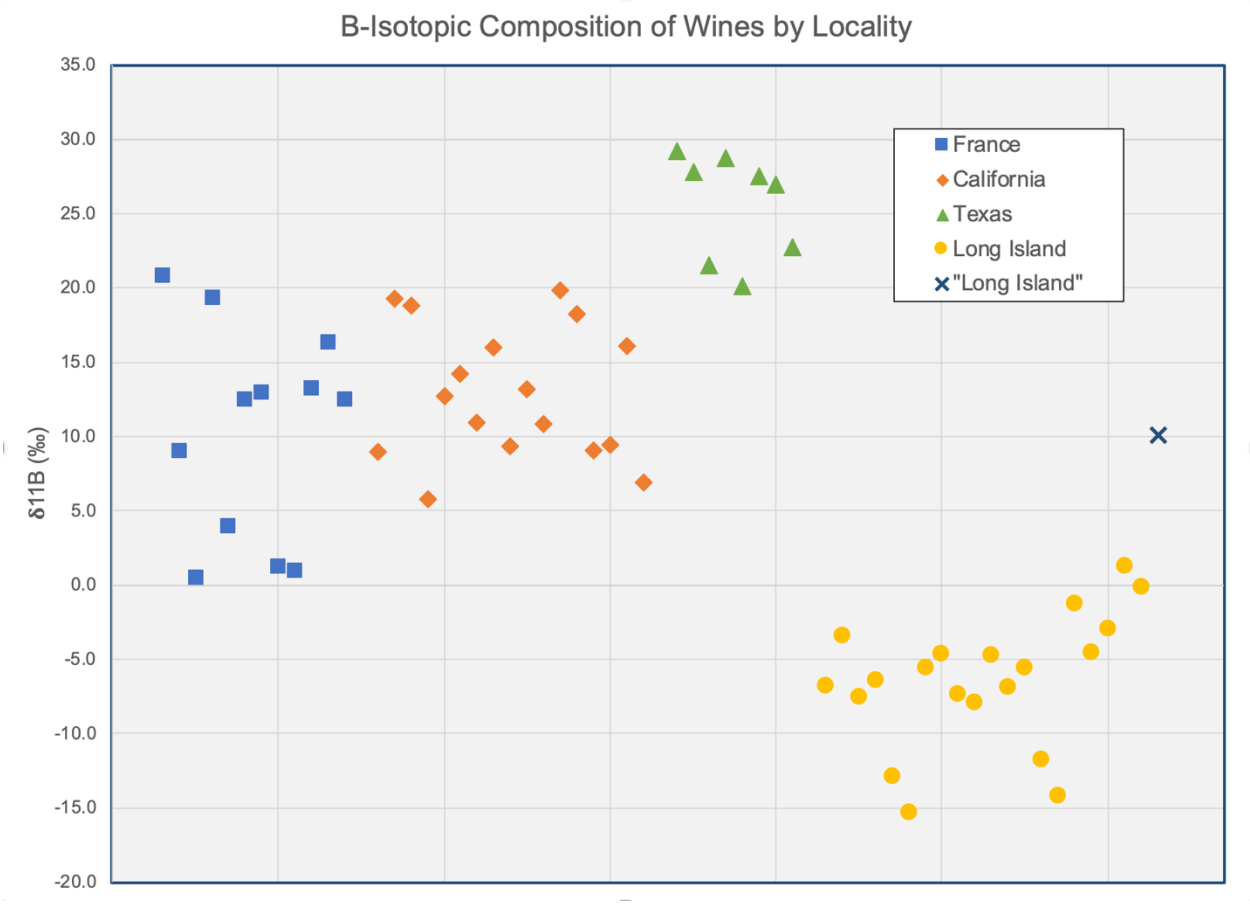
Deuterium (Bréas et al, 1996), Oxygen (Bréas et al, 1994), Strontium (Almeida and Vasconcelos, 2004, Marchionni et al, 2013), and even Lead-isotopes (Barbaste et al, 2001) have been used to source grape vineyards in order to fight wine fraud. Marketing low-end, low-quality wines as high-end, expensive wines is a multi-billion dollar industry. The Strontium-isotopic value of wine reflects the Strontium-isotopic signature of the soil the grape vineyard and can be used to verify the source of a particular wine's grapes. Coetzee and Vanhaecke (2005) and Vorster et al. (2010) suggested that Boron-isotopes could also be used to verify the provenance of wine grapes.

Boron (B) is an essential micronutrient for plants (Teasdale and Richards, 1990). B is added to fertilizers and B concentrations can be quite high in plants and their fruits, including grapes. Wine contains high concentrations (parts per million levels) of B and Coetzee and Vanhaecke (2005) were able to see differences between specific appellations of South Africa (Robertson, Stellenbosch, Swartland), France (Bergerac) and Italy (Valpolicella). However, unlike Strontium or Lead-isotopes, B-isotopes fractionate based on their environmental pH. While the soil and substrate will define the initial B-isotopic value of a plant, adding various amounts of fertilizer and water will alter the local pH and fractionate isotopic B uptaken into the plant. The plant itself may further fractionate B through biologic processes. Specific to winemaking, alteration to the grape juice and wine's pH during processing could further fractionate the B-isotopic signature from the original soil's initial values.

Long Island's North Fork is home to over 20 local vineyards along a 30-mile long peninsula of Holocene glacial deposits. The homogeneous geology (in the form of heterogeneous glacial till and huge loess deposits) provide a nice laboratory to study the effects of wine making on B-isotopes, while keeping the geology relatively controlled. Additionally, all of the wineries source their fertilizer from the same company. A survey of 20 wines of 100% Long Island grown grapes were analyzed for their B-isotope composition. The three vineyards studied revealed a range from +1‰ to -15‰. Samples of wines from locally sourced vineyards in California, France and Texas were also analyzed for comparison. Californian (Napa, Sonoma, and northern regions) wines ranged from +20‰ to +6‰; French (14 appellations) wines varied from +21‰ to +1‰; and Texan (Hill Country and High Plains) wines ranged from +29‰ to +20‰. One store bought Long Island wine was also included in the analyses and clearly indicates the grapes were sourced elsewhere from Long Island. Further analysis is in progress to determine the processes and changes in B-isotopes based on grape variety, fermentation, and clarification.



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