The evocative notion of minerality in wine: Sensorial reality or smart marketing?

Wendy V. Parr[a], Jordi Ballester[b], Dominique Valentin[b], Dominique Peyron[b], Claire Grose[c]

[a] *Lincoln University, Christchurch 7647, New Zealand*
[b] *CSGA UMR5170 CNRS, University of Burgundy, INRA*
[c] *I nstitute of Plant and Food Research, Marlborough, New Zealand*

1. INTRODUCTION

Sensory science can be considered a nexus in multi-disciplinary wine research, serving as a junction that brings together phenomena from viticultural, oenological, and marketing/ cultural research. This is most pronounced when complex wine characteristics such as quality, complexity, and so forth are investigated scientifically. Minerality in wine is one such enigmatic and elusive perceived characteristic that recently has come under scientific scrutiny. Despite its ill-defined nature, wine producers and wine critics increasingly use the term [1], linking perceived mineral characteristics with wine quality.

Historically, perceived minerality has been associated with *terroir* or source-of-origin of a wine, this association functioning as a powerful marketing tool for many of the world's more expensive wines. However, recent and convincing argument that application of the term "mineral" to wine sensory attributes is metaphorical has been put forward by geologist Alex Maltman [2]. Maltman presents data to demonstrate that it is unlikely that there is a direct link between soils and other aspects of vineyard geology and perception of mineral characteristics in wine. This leaves open the question as to what people are smelling and tasting in wine that results in verbal reports describing their sensory experience in terms of rocks, wet stones, soils, and so forth. One explanation offered for the association of perceived minerality with wine source-of-origin involves wine acidity, with qualitative and quantitative aspects of acidity in wine linked to *terroir* variables such as soil pH. Several other hypotheses have been put forward concerning the relation between perceived minerality in a wine and the wine's chemical and sensory characteristics. One that has gained attention implicates perception of

minerality in wines from New World countries that employ inert bottle closures as having its basis in sulphide reduction. Another potential source of perceived minerality in wine is the sensory context created by relative absence of perceived flavour such as fruity or vegetal characteristics. We investigated several of these hypotheses with the aim of understanding the sensorial reality of perceived minerality.

Given the metaphorical nature of perception of minerality, and hence involvement of psychological phenomena such as associative memory and language (e.g., in perception and verbal labelling of a wine as expressing "chalky" or "flinty" notes), the influence of a taster's culture and hence domain-specific, experiential history is relevant. We investigated influence of culture on perception and judgment of mineral character in white wine, with French (Old World) and New Zealand (New World) participants in the sensory study. A second independent variable investigated was mode of perception. Anecdotal reports concerning perception of mineral character in wine include debate as to whether minerality can be smelled, or whether it is purely a palate experience (Easton, 2009). Similar debate is found in terms of specific palate phenomena; mineral character features in reports by wine professionals as a tactile sensation as well as a flavour. On the assumption that perception of minerality in wine involves multi-modal sensory input, the present study included three separate conditions: (i) orthonasal olfaction alone; (ii) olfaction, taste and trigeminal stimulation (global perception); and (iii) palate sensations alone (nose-clip condition: taste and texture (trigeminal sensations)).

2. MATERIALS AND METHODS

Wine professionals from New Zealand (NZ) (N = 31) and from France (N = 32), each experienced with production and tasting of Sauvignon wines, participated. French subjects participated in one of three regions of France, namely Bordeaux (N = 10), Sancerre (N = 13), and Chablis (N = 9). New Zealanders participated in Marlborough, NZ. Each participant evaluated 16 100% Sauvignon blanc wines from the 2010 vintage, 8 wines from four sub-regions of Marlborough, NZ and 8 wines from the major Sauvignon regions of France. Wines were selected as reflecting well their source of origin and vintage (2010).

In each location the sensory studies were conducted over two sessions per participant. Wine samples were served blind in standardised tasting glasses that were opaque, and in a unique order for each participant according to a Williams Latin square arrangement. A fully within-subject design was employed where every participant evaluated every wine via free-sorting methodology and by descriptive rating of each wine under three conditions. The three wine-evaluation conditions comprised ortho-nasal olfaction only, palate only (taste and trigeminal stimulation: Nose-clip condition), and a global tasting condition. For the descriptive task, 20 scales were rated per wine in global condition, these comprising 5 Sauvignon flavour characteristics (herbaceous; boxwood; citrus; green; passion-fruit), 3 tastes (sweetness; bitterness; sourness), 5 descriptor classes considered as potential descriptions of types of perceived minerality and/or reductive characteristics (flinty/stony/smoky; chalky; iodine/oyster shell; pencil/graphite; matchstick/burnt rubber/sulphide), and 6 other characteristics (astringency; freshness; concentration; complexity; familiarity; liking). Subsets of these descriptors were rated in the ortho-nasal and palate-only conditions.

The wines employed in the sensory experiment underwent extensive physico-chemical analysis These data will not be described in the present article due to space limitations.

3. RESULTS AND DISCUSSION

Sorting task data show that French and New Zealanders classified the 16 wines similarly, in general differentiating French wines from New Zealand wines. Participant-generated descriptors applied to the sorted categories demonstrate that both groups reported the New Zealand Sauvignons as expressive aromatically with pyrazine and other green/herbaceous notes. On the other hand, several of the French wines were considered floral whilst others were judged complex, bitter and reductive.

Descriptive rating data were analysed for each mode-of-perception as a function of participant culture employing 1-way ANOVAs and several multivariate analyses including principal components analysis (PCA), regression analysis, and multi-factor analysis. The first result of interest is that minerality was perceived by both cultures in every condition, including by nose alone. Second, linear regression analysis demonstrated that perception of minerality associated statistically with several wine characteristics, some consistent across mode of perception (see Tables 1, 2 & 3). Third, the influence of culture produced more similarities than differences, suggesting participants shared a mental construct concerning the structural content of the concept 'mineral' as experienced in Sauvignon wines.

Predictors France	t	p	Predictors New Zealand	t	p
Citrus	5.29	< 0.0001	Citrus	3.78	< 0.001
Passionfruit	-4.64	< 0.0001	Passionfruit	-3.37	< 0.001
Flint/smoky	9.75	< 0.0001	Flint/smoky	7.23	< 0.0001
Chalky/calc	6.75	< 0.0001	Chalky/calc	5.94	< 0.0001
Lead/graph	2.62	<.01	Lead/graph	4.51	< 0.0001
Liking	3.10	< 0.01	Liking	3.01	< 0.01
Fresh/zingy	2.51	< 0.05	Concentrat	-2.05	< 0.05
Iodi/oyster	2.09	< 0.05			

Table 1. Significant minerality predictor variables for each culture for Olfaction condition (Linear Multiple Regression analysis, alpha < 0.05)

The evocative notion of minerality in wine: Sensorial reality or smart marketing?

Predictors France	t	p	Predictors New Zealand	t	p
Citrus	4.22	< 0.0001	Citrus	2.09	< 0.05
Bitter	2.08	< 0.05	Bitter	2.34	< 0.05
Chalky/calc	2.05	< 0.05	Chalky/calc	4.51	< 0.0001
Passfruit	-2.12	< 0.05	Conc/Wght	2.48	< 0.05
Sweet	-6.57	< 0.0001	Fresh/zingy	2.20	< 0.05
Flint/smo	4.61	< 0.0001	Herbaceous	2.23	< 0.05
Lead/graphite	2.81	<.01	Green	-2.42	< 0.05
Liking	1.98	< 0.05	Astringent	-2.17	< 0.05

Table 2. Significant minerality predictor variables
for each culture for Global condition
(Linear Multiple Regression analysis, alpha < 0.05)

Predictors France	t	p	Predictors New Zealand	t	p
Fresh/zingy	5.22	< 0.0001	Fresh/zingy	4.00	< 0.0001
Flint/smo	8.53	< 0.0001	Flint/smo	4.44	< 0.0001
Chalky/calc	6.66	< 0.0001	Chalky/calc	6.93	< 0.0001
Sour/acid	-2.26	< 0.05	Sour/acid	-2.26	< 0.05
Sweet	-4.33	< 0.05	Lead/graph	2.02	< 0.05
			Bitter	3.97	< 0.0001
			PalateWght	5.37	< 0.0001

Table 3. Significant minerality predictor variables
for each culture for Palate-only condition
(Linear Multiple Regression analysis, alpha < 0.05)

In conclusion, understanding the sensorial reality of perceived minerality was the major aim of the work described. Sensory data demonstrate cultural similarities and mode-of-perception differences in the mental construct 'mineral' as applied to white wine. The relative consistency of sensory responding across two diverse cultural groups supports the notion of an agreed sensory experience that gives rise to development of a mental representation that wine tasters label as 'mineral'. Which aspects of wine composition function as the source(s) of this shared mental construct will be reported in a manuscript in progress in which the physico-chemical data are analysed and associated with the sensory data from the 16 Sauvignon wines.

References.
1. S. Easton. Drinks Business, May (2009) 86.
2. A. Maltman. Journal of Wine Research, 24(3) (2013) 169.