



With slide 32 added
Post-Conference
Perceived Minerality:
Factors favoring or
suppressing

MINERALITY

EXAMINING, CHALLENGING & TASTING ITS MEANING

PRESENTED BY **ROGER C BOHRMICH MW**

SOCIETY OF WINE EDUCATORS CONFERENCE - AUGUST 2016

QUESTIONS NEEDING ANSWERS

Are there minerals in wine?

Can you smell and/or taste minerals in wine?

Is minerality derived only from minerals or other substances as well?

Which wine components act to diminish/accentuate the perception of minerality?

Can you have terroir without minerality?

Is minerality universal and international?

Can minerality be associated with all colors of wine?

Should we be using minerality as a valid & useful tasting term?

“MINERALITY” – WHERE DID THE TERM ORIGINATE?

“Minerality” is a made-up English word...
derived from a French word, also recently invented
Mineralité

Mineralité or reference to the “mineral” taste or
smell of wines cannot be found in old French
wine texts:

Chaptal (1756-1832)
Pijassou (1798-1820)
Jullien (1766-1832)



Image © Roger C. Bohmrich

“MINERALITY” – WHERE DID THE TERM ORIGINATE?

Mineralité or “minerality” or reference to the “mineral” taste or smell of wines cannot be found in contemporary references:

French or English dictionaries

Larousse “Wines & Vineyards of France”

Aroma wheel of UC-Davis

Emile Peynaud’s “The Taste of Wine”

Michael Broadbent’s books on wine tasting

“The Oxford Companion to Wine” - *until the latest edition*



Image © Roger C. Bohmrich

“no direct connection between the flavour of a wine and the geological minerals in the rocks...or the mineral elements in the soil. In any case, the minerals found in wine are below the threshold of sensory perception.”

The Oxford Companion to Wine, 4th edition

THE BELIEVER (AND PROMOTER):

"If one were to look for all the shared characteristics of Chablis, one would speak of freshness, finesse, purity and minerality."

BIVB press kit,
Chablis-The Crystalline Expression of a Terroir



THE SCIENTIST (AND SKEPTIC):



“Minerality is an abstract sensory descriptor and cannot be taken literally.”

Denis Dubourdieu,
Professor of Oenology, University of Bordeaux
château owner & winemaker

“The idea that vineyard geology can be literally tasted in the wine glass is mechanistically impossible.”

Alex Maltman, University of Wales
Journal of Wine Research, 2008

THE AGNOSTIC:

“On one side we know that the direct causal transfer of minerals from the soil to the finished wine is nothing we can prove. On the other side we observe varying styles of wines from different soils and geology.”

Roman Horvath MW, Domäne Wachau, Austria
Decanter, Dec 2014



Image © Roger C. Bohmrich

WINE REGIONS & THEIR MINERALS...*JUST SOME EXAMPLES*

Graphite – Priorat, Spain

Sulfur – Vulture, Campania & Etna, Italy

Pyrolusite (manganese oxide) – Moulin à Vent, France

Hematite (iron oxide) – Coonawarra, Australia

Gypsum (calcium sulfate) – Ribera del Duero, Spain

Calcite (calcium carbonate) – Champagne, Chablis, Côte de Beaune, France

Amphibole (amphibolite) – Muscadet, France

Muscovite, biotite (mica) – Fleurie, Alsace & Vinho Verde

Clay minerals (montmorillonite) – Côte de Nuits & Tokay, Hungary
(vermiculite) – Finger Lakes, New York

Feldspar & kaolinite – Dão, Portugal

Quartz (silicon dioxide)...flint – Loire, France & many others

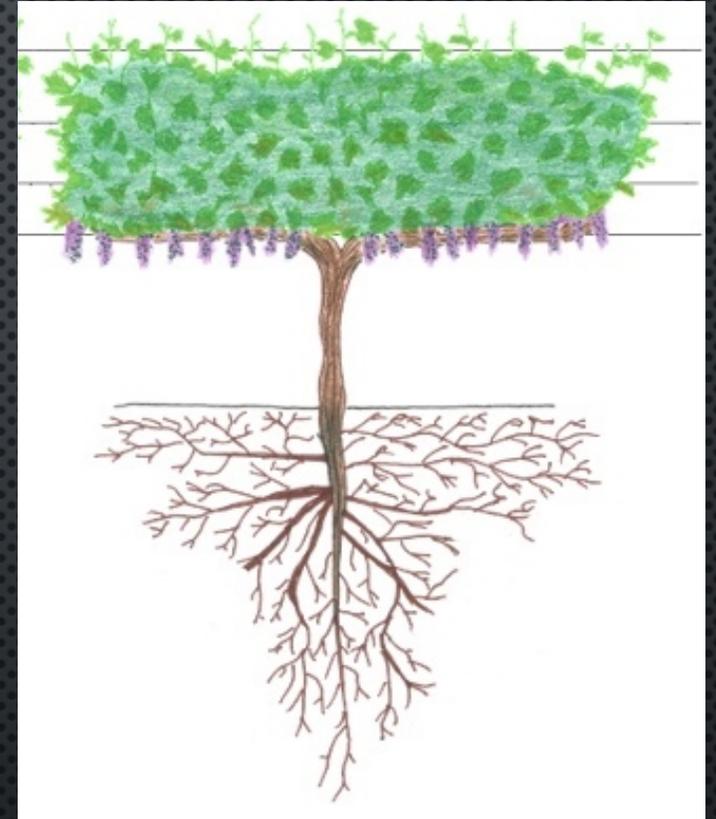
Quartzite – galets of Rhône Valley

And we could go on adding to the list!

Source: Alex Maltman

SOME SCIENTIFIC FACTS ABOUT MINERALS & VINES

BASIC TRUTH: ALL ROCKS ARE COMPOSED OF MINERALS,
SO ALL ROCKS ARE "MINERAL RICH"



GEOLOGICAL minerals make up stones & rocks

NUTRIENT minerals are derived from geological minerals
but are not identical

These nutrients are needed by the grapevine
in minuscule quantities

The roots of vines take up mineral nutrients in a **soluble** form
Nutrient minerals are dissolved...geological minerals are
insoluble complex compounds

Of the 16 essential nutrients for plant physiology...

Nitrogen, phosphorus & sulfur come principally from organic content of soil

Calcium, magnesium & potassium are all derived from soil

Calcium influences pH of soil & availability of other nutrients

Some minerals in wine result partly from winemaking procedures

ARE THERE MINERALS IN WINE?

May enter wine via fining/filtration (bentonite, DE, pad)

Perceived as sour/bitter taste

Cations AKA Minerals in wine	Typical Range (mg/l)
Potassium (K)	500-1500
Calcium (Ca)	50-150
Magnesium (Mg)	50-150
Sodium (Na)	10-50
Lithium (L)	5-60
Iron (Fe)	5-6

May enter wine via SO₂ addition (sodium metabisulfite), bentonite, egg white fining

Can reach 1 g/l in wines from seaside vineyards

Anions AKA Minerals in wine	Typical Range (mg/l)
Phosphate	150-1000 red 75-500 white
Sulfate	100-400

Heavy metals may come from chemical treatments (via roots, grapes), fining & filtering media

Cations AKA Minerals in Wine	Typical range (mg/l)
Manganese	60-150
Aluminum	0.7-0.9
Zinc	0.6-0.8
Rubidium	0.4-0.5
Copper	0.2-0.4

Additive to reduce hydrogen sulfide

Sources:

Concepts in Wine Chemistry, Y. Margalit
 Enological Chemistry, J. Moreno & R. Peinado
 UC Davis/Waterhouse Lab

MINERALS IN WINE: SCARCE OR PLENTIFUL?



Christopher Griffith, New York Times

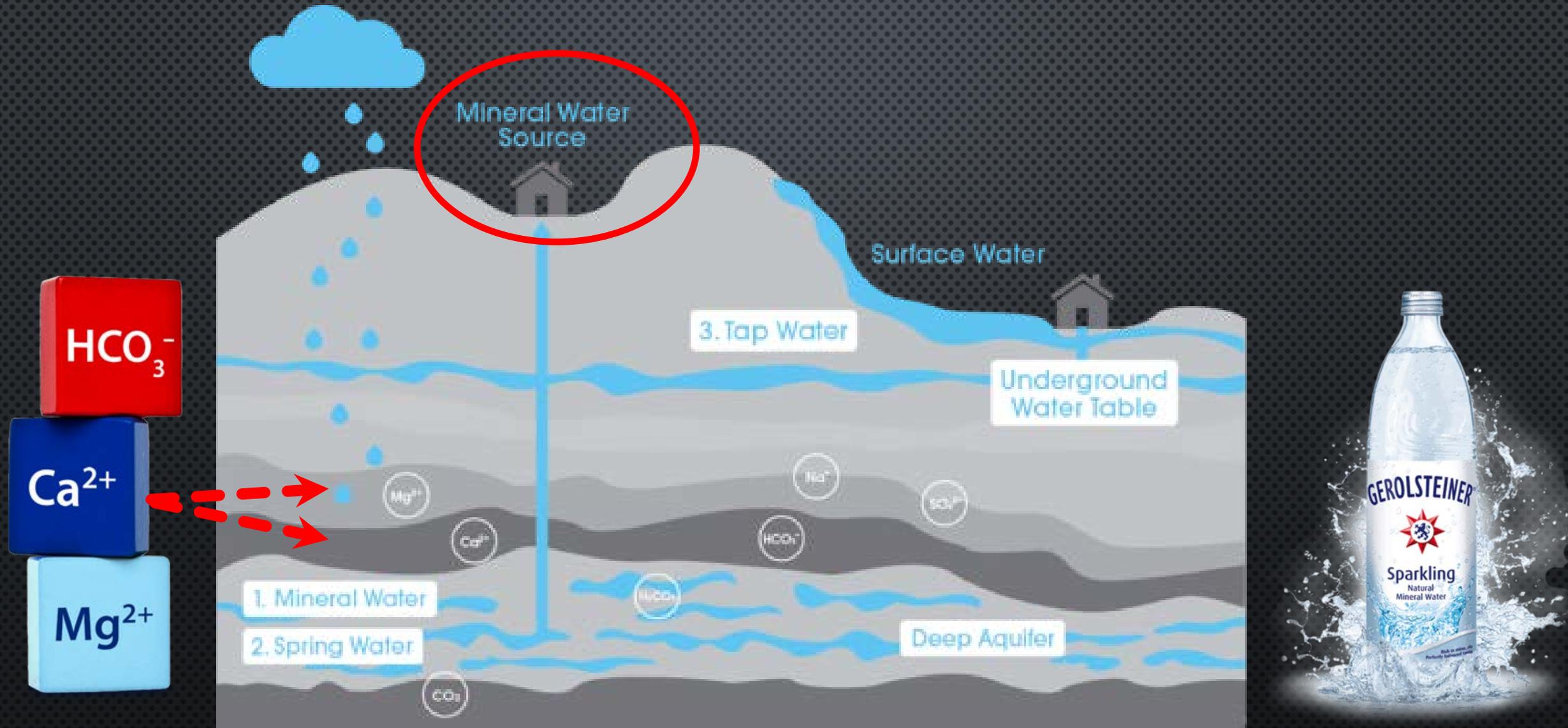
Simplified list of constituents

Water	85%
Ethanol	13%
Glycerol	1%
Organic acids	<u>0.4%</u>
	99.4%
All other constituents	0.6%



Inorganic content 0.2%  **Minerals**

MINERAL WATER: BONA FIDE MINERALITY

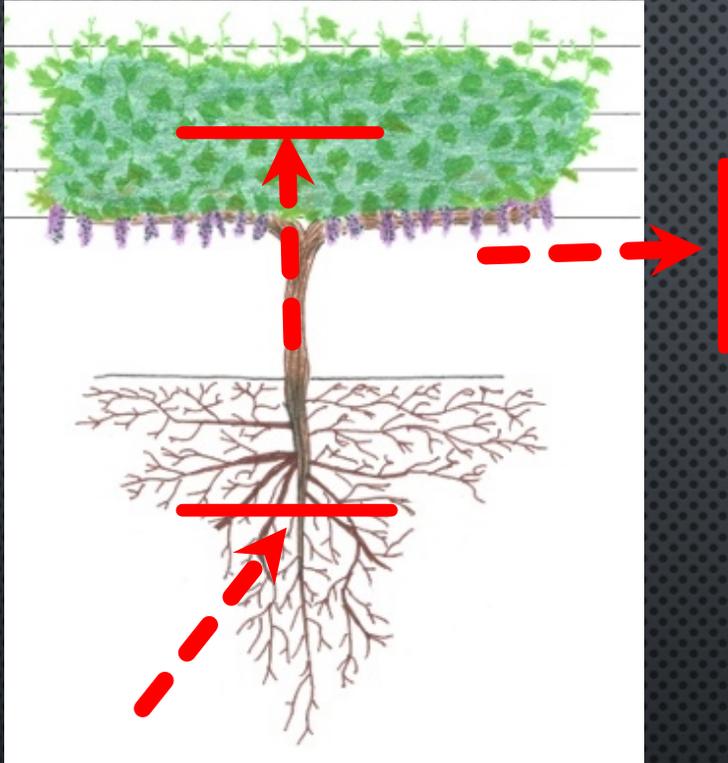


TASTING MINERALS IN WATER

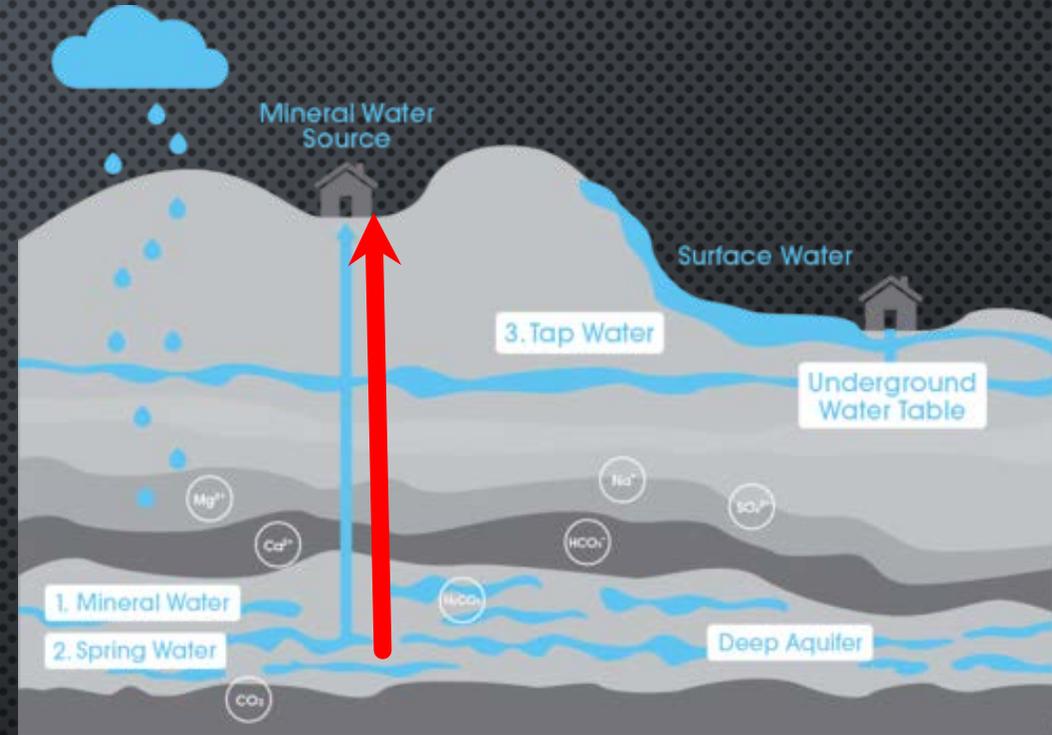
	<u>Gerolsteiner Sprudel/Medium</u>	San Pellegrino ^x	Perrier ^x	Ferrarelle ^x	Calistoga Mineral Water ^x
Comparative quantity = 1 litre Percentage = Proportion of recommended <u>Daily requirements</u>					
Calcium ⁱ	348mg 44%	179mg 22%	155mg 19%	365mg 46%	1mg 0%
Magnesium ⁱ	108mg 29%	52mg 14%	6mg 2%	18mg 5%	1mg 0%
Bicarbonate ⁱ	1.816mg -	239mg -	445mg -	1.403mg -	36mg -
Potassium ⁱ	11mg 1%	0mg -	0mg -	52mg 3%	14mg 1%
Sodium ⁱ	118mg 21%	33mg 6%	11mg 2%	50mg 9%	183mg 33%
Chloride ⁱ	40mg 5%	54mg 7%	25mg 3%	20mg 3%	224mg 28%
Sulphate ⁱ	38mg -	445mg -	46mg -	3mg -	83mg -
Total mineralization ⁱ	2.479mg	1.002mg	688mg	1.911mg	542mg

Values taken from respective manufacturer

NOT EQUIVALENT: MINERALS IN WATER & WINE



Vine roots take up *nutrient* minerals in parts per million to facilitate carbohydrate reactions. Minerals pass through the plant into the fruit, whose juice is fermented, resulting in a finished liquid with an entirely different profile.



Mineral water is drawn from the ground after having passed through soil layers, directly transferring minerals which are present in the bottled liquid after minimal handling.

FOURNIER PÈRE ET FILS SANCERRE "CUVÉE SILEX" 2013

Village of Sainte-Gemme - Loire Valley
Clay & flint (silex)
100% Sauvignon Blanc, 35-year old vines
Stainless steel, aging on fine lees with
bâtonnage 2 X per week
No malo

13% alcohol
7.1 TA
3.06 pH

Flint: a type of
silica, odorless
& tasteless
A. Maltman

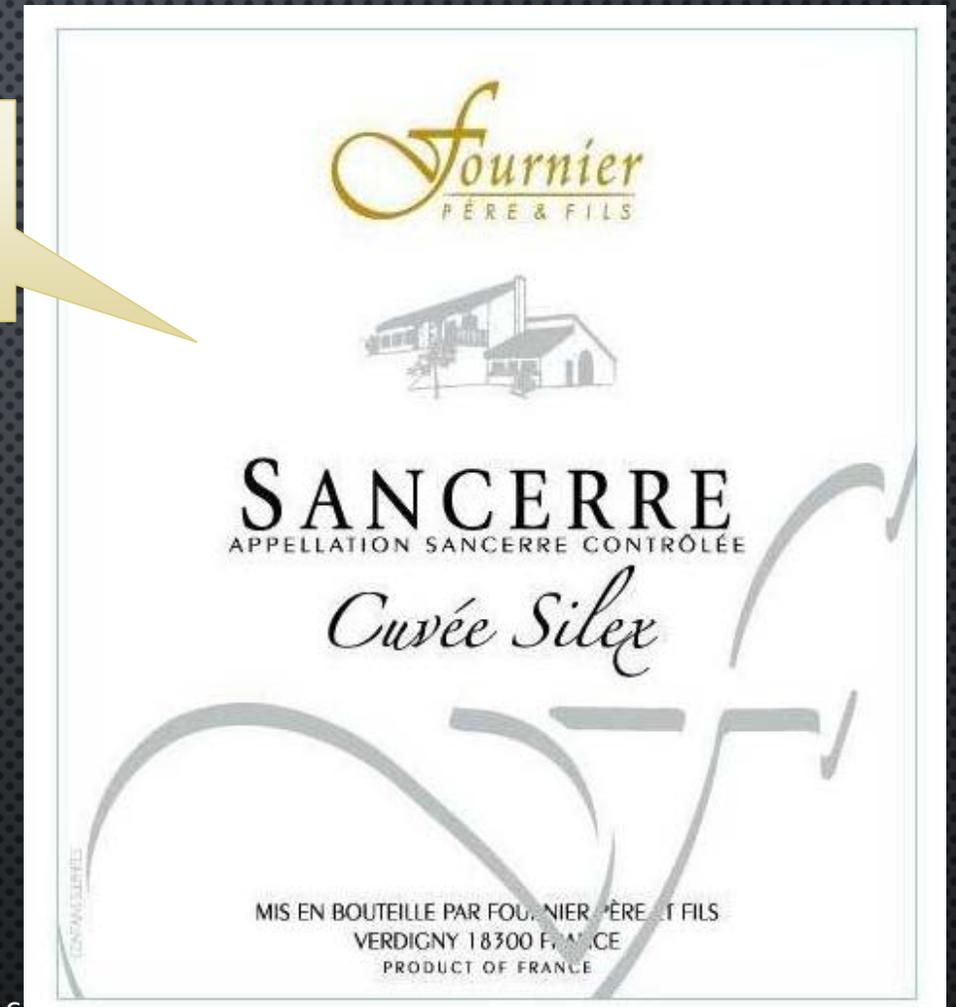


Roger Voss, Wine Enthusiast:

*"From vines grown on flint soil, this is a perfumed, crisp wine, hinting at almonds and spice. The background is a reminder of the soil, very **mineral** and severe."*

Notes from producer:

*"the unusual concentration of flint in this parcel confers subtle aromas of **gunflint**"*



Courtesy of David Milligan Selections

A STUDY: PERCEPTION OF MINERALITY BY FRENCH & NEW ZEALAND TASTERS

The starting place: “the term ‘mineral’ as applied to wine sensory attributes is metaphorical”

The basics:

31 New Zealand & 32 French wine professionals experienced with Sauvignon wines evaluated 16 Sauvignon Blanc wines from Marlborough, NZ & France

20 “scales” in English & French including:

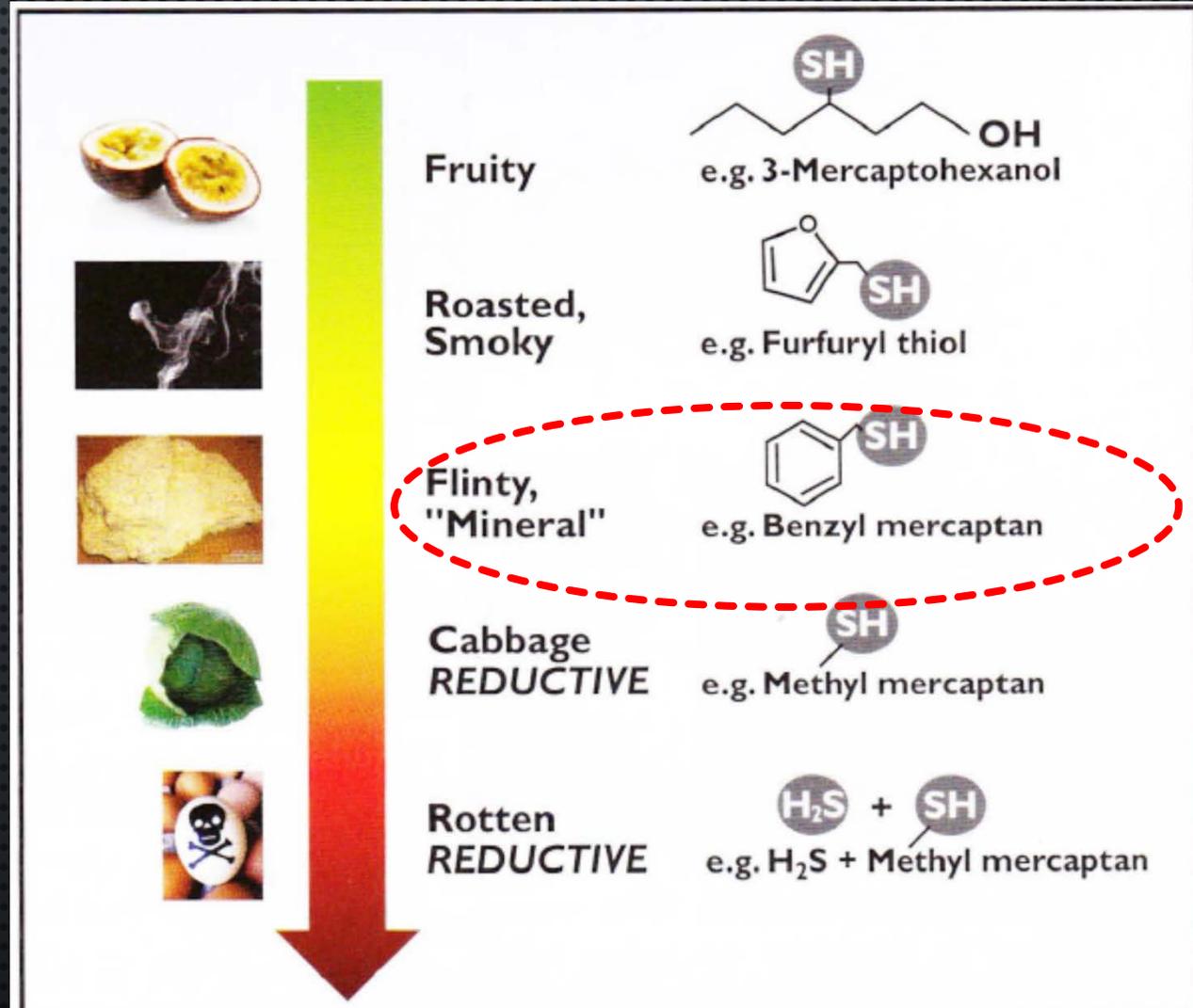
Varietal markers – passion fruit, herbaceous, citrus

Mineral and/or reductive – flinty/stony/gun flint, chalky/calcareous, iodine/oyster shell, matchstick, burnt rubber

Tastes – sweetness, bitterness, acidity/sourness, freshness/zingy

“Perceived minerality in Sauvignon wines: Influence of culture and perception mode”
Food Quality and Preference, April 2015 – W. Parr, J. Ballester, D. Peyron, C. Grose & D. Valentin

PERCEPTION OF MINERALITY: MANY FACES OF VOLATILE THIOLS



↓

Aroma of **gunflint** corresponds to **Methylbenzene thiol** detectable at extremely low concentrations – 0.3 billionth of g/l

Research of Denis Dubourdieu & others

“Many faces of volatile thiols in wine – Passion fruit with a hint of mineral, some smokiness but kind of skunky”
Practical Winery & Vineyard, January 2014 – Ugliano, M., Diéval, J-B., Bégrand, S., Vidal, S. (Nomacorc France)

PERCEPTION OF MINERALITY: CULTURAL DIFFERENCES & DESCRIPTORS

Conclusions:

- Both NZ & French tasters reported mineral characters via olfaction & in-mouth perception
- French participants relied more on olfaction relative to minerality
- Degree of consensus found was “unexpected”
- Negative predictors of minerality: passion fruit, herbaceous, sourness, sweetness, reductive notes
- **Positive predictors: bitterness, fresh/zingy****
 - **BUT: could be interpreted as acidity/sourness...was translated as *frâicheur*

Summary finding:

The more flavorsome the Sauvignon, the less minerality was perceived

“Perceived minerality in Sauvignon wines: Influence of culture and perception mode”
Food Quality and Preference, April 2015 – W. Parr, J. Ballester, D. Peyron, C. Grose & D. Valentin

DOMAINE GUIBERTEAU SAUMUR 2014

Brézé, Saumur – Anjou, Loire Valley
Clay & limestone soil
Organic cultivation
100% Chenin Blanc
Whole cluster pressing, indigenous yeast
Stainless steel, aging on fine lees

13% alcohol
9.3 TA
3.15 pH



Notes from Becky Wasserman:

*"on the hill of Brézé, chenins taste like none other in the Loire. They are so uncompromising, so violently assertive, so brilliantly **mineral**..."*

— *Domaine* —
Guiberteau

Saumur

APPELLATION SAUMUR CONTRÔLÉE

Mis en bouteille au domaine par
SCEV GUIBERTEAU - Propriétaires Récoltants
Mollay - 49260 ST JUST SUR DIVE - France

Contains Sulfites - Produce of France

13% VOL

RED WINE

750 ml
LRI

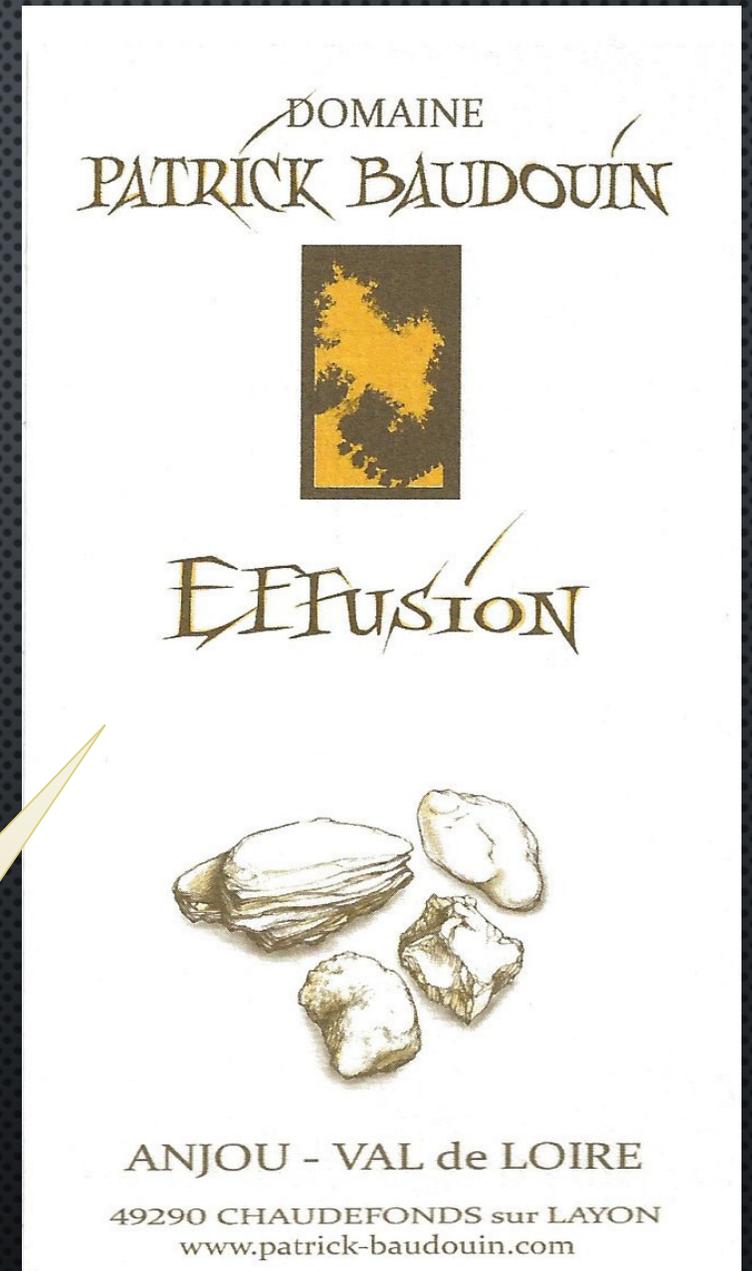
Courtesy of Becky Wasserman & Co.

DOMAINE PATRICK BAUDOIN ANJOU "EFFUSION" 2014

Chaudefonds sur Layon – Anjou, Loire Valley
2 parcels on volcanic ("effusive") soils:
Ardenay – shale, silica, sandstone
St.-Aubin de Luigné – shale, sandstone
100% Chenin Blanc
Certified organic wine
Fermented in Burgundian barrels (1-4 years old)
Very limited use of sulfur (30 mg/l total, 14 free)



12.5% alcohol
3.2 g/l RS
6.3 TA
3.18 pH



Courtesy of Becky Wasserman & Co.

FRITSCH GRÜNER VELTLINER "STEINBERG" 2015

12.5% alcohol
5.8 TA
pH not shared

Wagram, Austria
Steinberg vineyard
Loess, slate & granite
Biodynamic cultivation
100% Grüner Veltliner
Whole cluster pressing
Stainless steel



Tasting notes of importer:

"Very refined, true to its name (Steinberg) **mineralic**, puristic and finely structured. Its **salty minerality** is revealed straight through to the finale."

Courtesy of Monika Caha Selections



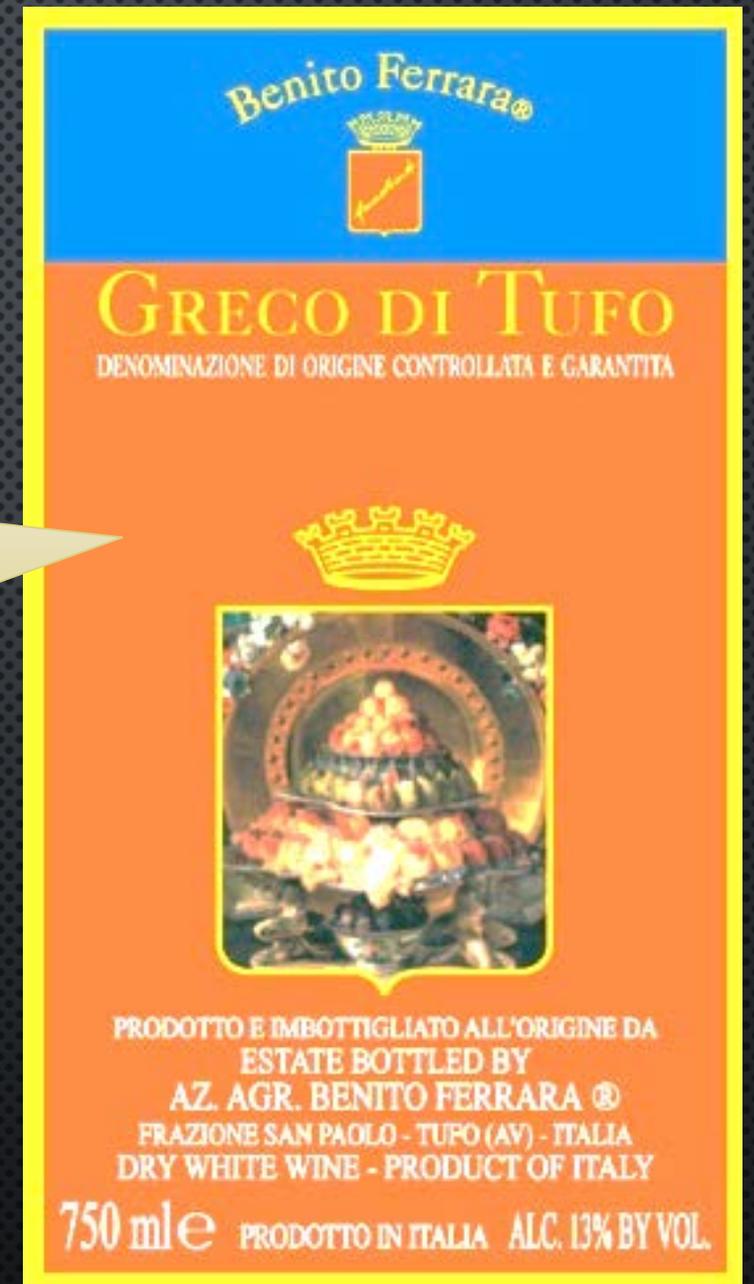
BENITO FERRARA GRECO DI TUFO DOCG 2014

Commune of Tufo, Campania, Italy
Calcareous, clayey "rich in minerals"
100% Greco
Whole cluster pressing, inoculated
Stainless steel for 7 months

13.0% alcohol
7.01 g/l TA
3.3 pH

Tasting notes of importer:

*"The Greco vineyards stand next to abandoned sulfur mines and sulfur rocks can be found amongst the vines: this gives the wines wonderful **mineral** notes."*



Courtesy of Mark De Grazia Selections

A STUDY: WAY BEYOND MINERALS...

The starting place:

“so-called **minerality** remains without a clear scientific consensus” as to chemical bases on which sensory perception is founded

The basics:

- o Two tasting panels – wine professionals & winemakers – in Spain were given 17 white & red wines described as “mineral” ... **they were not advised of the aim of the study**
- o 6 wines were selected as “most mineral” from the 17
- o These wines underwent detailed chemical analysis of many types

A statistical analysis revealed a variety of compounds in “mineral” wines...



“Chemical Basis of Minerality Perception in Wines”
“Sensorial Interpretation of Minerality in Wines”
Laboratorios Excell-Iberica, Logrono &
Outlook Wine (The Barcelona Wine School), Spain



CHEMICAL COMPOUNDS DEFINED AS “MINERAL” BY PCA

Chemical classification	White wines	Red wines
Routine parameters	Free sulfur dioxide	Free sulfur dioxide
	Total acidity & pH	Total acidity & pH
	Succinic acid	Succinic acid
Prefermentary aromatics	phenyl ethanol	phenyl ethanol
	Diethyl succinate	M-Cresol
	Ethyl decanoate	Butyrolactone
Aging aromatics	Decalactone	Decalactone
	4-ethylphenol	4-ethylphenol
	4-ethylguaiacol	4-ethylguaiacol
	Furfural/5-methylfurfural	Furfural/5-methylfurfural

“Sensorial Interpretation of Minerality in Wines”
 Laboratorios Excell-Iberica, Logrono &
 Outlook Wine (The Barcelona Wine School), Spain

WAY BEYOND MINERALS...

Conclusions:

- Presence of **succinic acid, low pH & high free SO₂** directly related to use of “minerality”
“with a probability of 95%”
- Other chemical compounds are also closely correlated, singly or together
- Perception of minerality “**not closely related**” to **levels of minerals** in either soil or wine

Summary finding:

Perception of minerality could be

“**result of synergistic effect of various compounds**” acting together



“Chemical Basis of Minerality Perception in Wines”
“Sensorial Interpretation of Minerality in Wines”
Laboratorios Excell-Iberica, Logrono &
Outlook Wine (The Barcelona Wine School), Spain



CHRISTIAN MOREAU PÈRE & FILS CHABLIS 2014

Pargues climat, left bank of Serein, Chablis
Calcareous clays of Kimmeridgian & Portlandian
100% Chardonnay, 47-year old vines
Sorted, pneumatic pressing, cold settling
Stainless steel, aging on fine lees for 10 months

12.52% alcohol
7.0 TA
3.21 pH

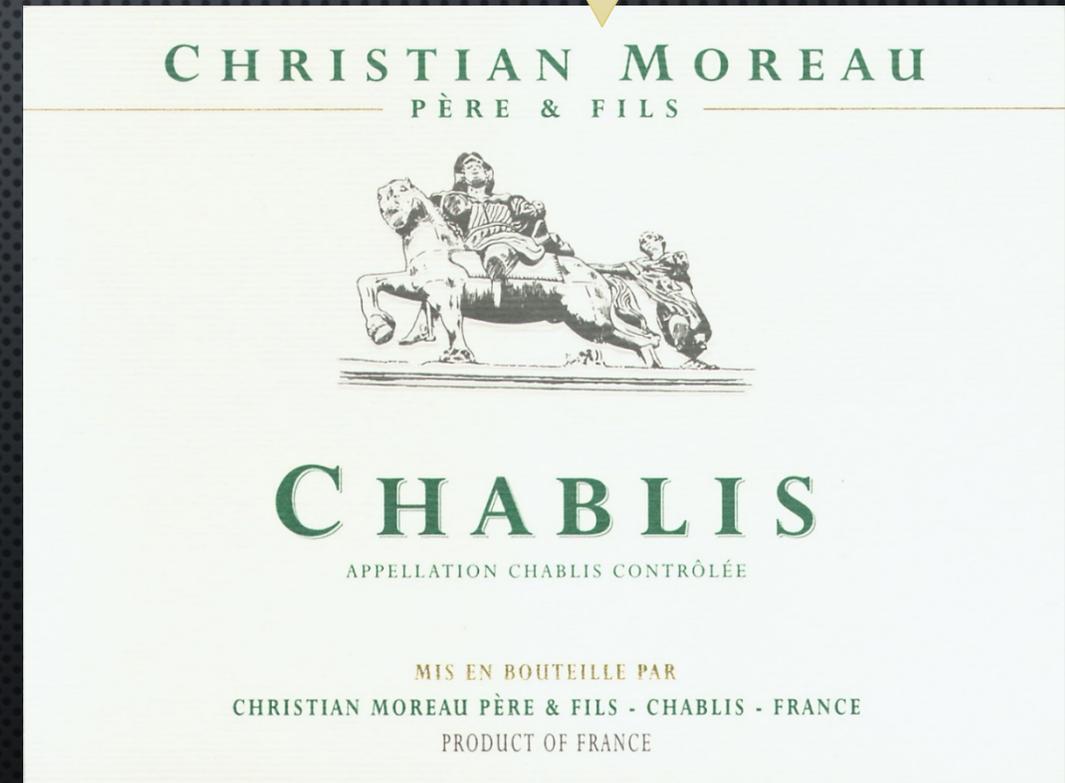
Allen Meadows, Burghound (Feb 2016):

"...there is good vibrancy and freshness to the saline and **mineral-inflected** middle weight flavors that terminate in a clean and dry but not really austere finish. This should be a lovely and altogether classic villages."



FOSSILS ARE MADE OF
GEOLOGICAL MINERALS,
HENCE THEY ARE
EQUIVALENT TO ROCKS -
NOT UNIQUELY ENDOWED

Alex Maltman

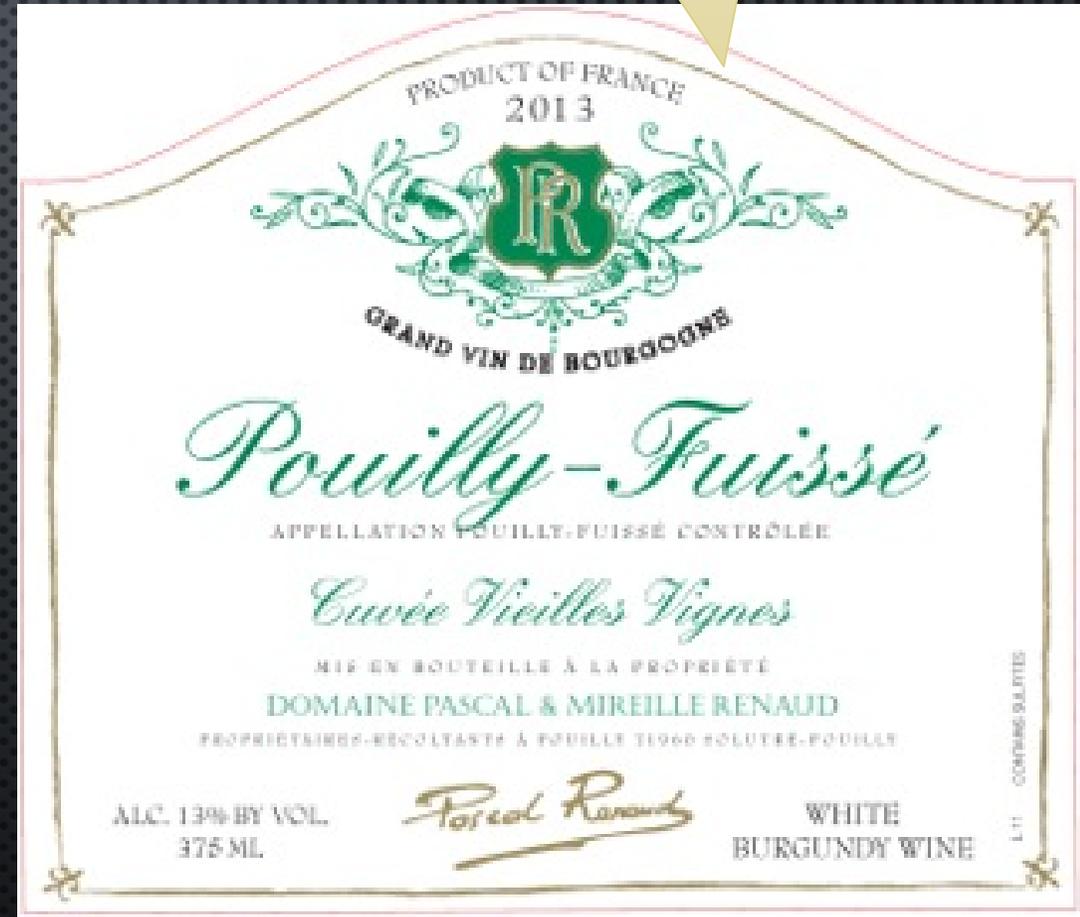


Courtesy of Frederick Wildman & Sons

DOMAINE PASCAL & MIREILLE RENAUD POUILLY-FUISSÉ “CUVÉE VIEILLES VIGNES” 2014

Solutré-Pouilly, Mâconnais
Limestone & clay
100% Chardonnay, vines 50 – 80 years old
Picking by hand
Small stainless tanks, some foudres

13 % alcohol
5.5 TA
3.33 pH



Courtesy of David Milligan Selections

STÉPHANE AVIRON CÔTE DE BROUILLY VIEILLES VIGNES 2013

13.25% alcohol
5.65 TA
3.56 pH

Côte de Brouilly (slopes of Mont Brouilly),
Haut Beaujolais
Granite & volcanic soils
Three-fourths from 60-year old vines & one-fourth from
40-year old vines
100% Gamay noir à jus blanc
Origins vinified & matured separately in new/used oak
barrels until blending
Very limited use of sulfur (29 mg/l total, 6 free)



Michael Apstein, Wine Review Online (October 2015):

*"If your tastes run to firmer rather than floral Beaujolais, turn to Aviron's 2013 Cote de Brouilly. Also made from old vine fruit, it's stonier -- **you can almost taste the granite soil** -- than his Fleurie..."*

TENUTA DELLE TERRE NERE ETNA ROSSO 2013

Etna, Sicily

Selection from all vineyards of estate on northern slope of Etna Volcano @ 2,000 – 3,000 ft.

Black volcanic pumice, volcanic sand, pebbles & ash

98% Nerello Mascalese, 2% Nerello Cappuccio

Parcels 6 & 50 years old

Temp controlled fermentation, spontaneous malo

Aged in large French oak (10-30 hl) for 10 months

14.35% alcohol
5.1 TA
3.7 pH



Comments from Wikipedia:

"the soil is volcanic and very rich in **minerals**"

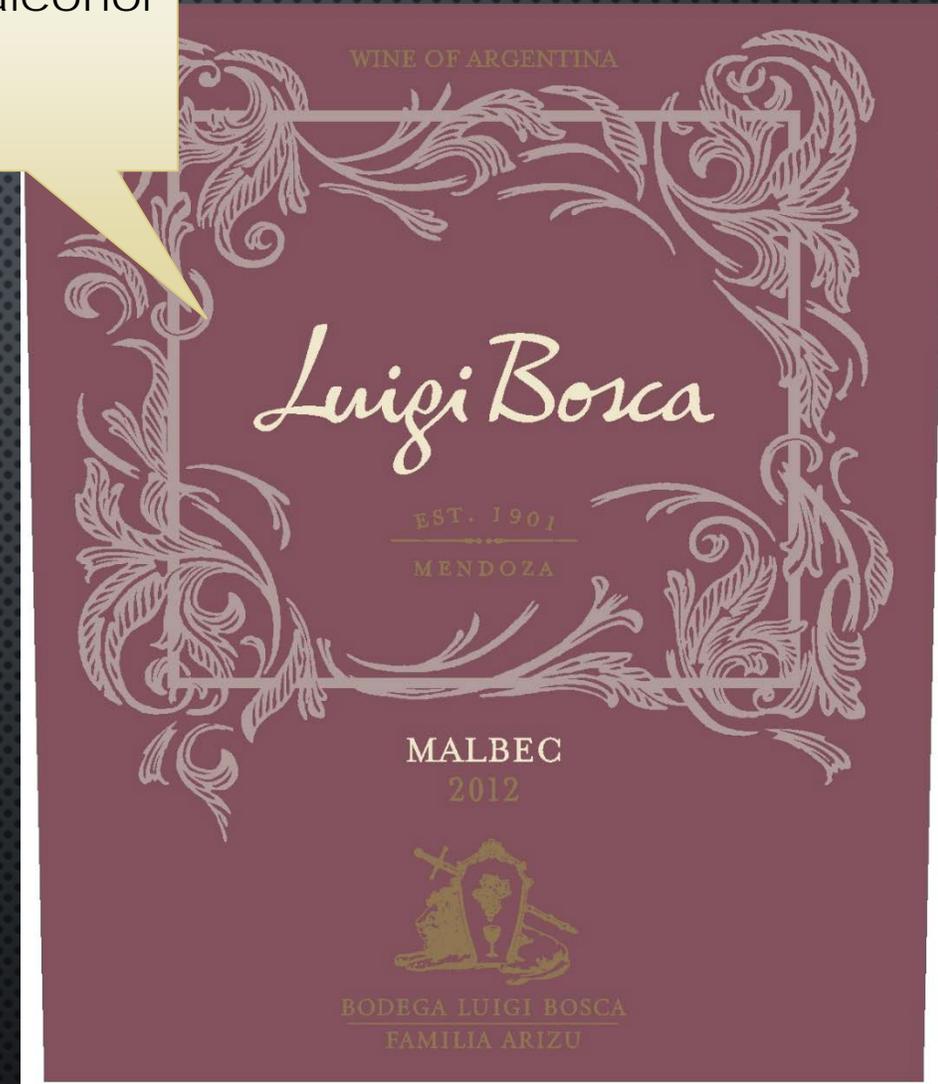


Courtesy of Mark De Grazia Selections

LUIGI BOSCA MALBEC 2013

La Linda vineyard @ 3,150 ft. on flat terrain (1.5% slope)
Vistalba, Lujan de Cuyo, Mendoza
Alluvial soils with clay & active lime
100% Malbec, 70-year old vines – hand harvested
Destemmed, selected clusters
Temp controlled fermentation in stainless tanks with
cultured yeasts
Aged in new French oak for 14 months

14.1% alcohol
5.2 TA
3.6 pH



Blair Walter, Felton Road,
Central Otago, New
Zealand (Wine Wisdom,
Mar 2014)

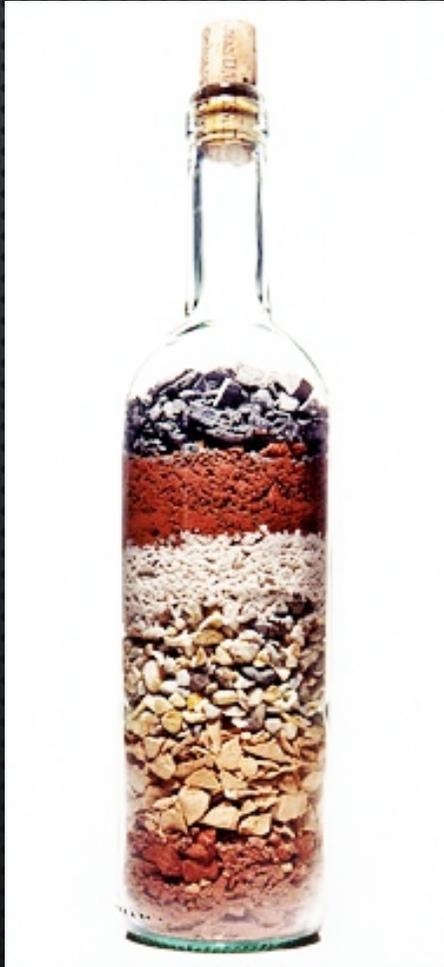
"Minerality in red wine is a less overt fruitiness, with some vineyard character; tasting the transparency of terroir."

Courtesy of Frederick Wildman & Sons



COMPETING DEPICTIONS OF MINERALITY

Minerality as a direct expression of minerals



Christopher Griffith, New York Times

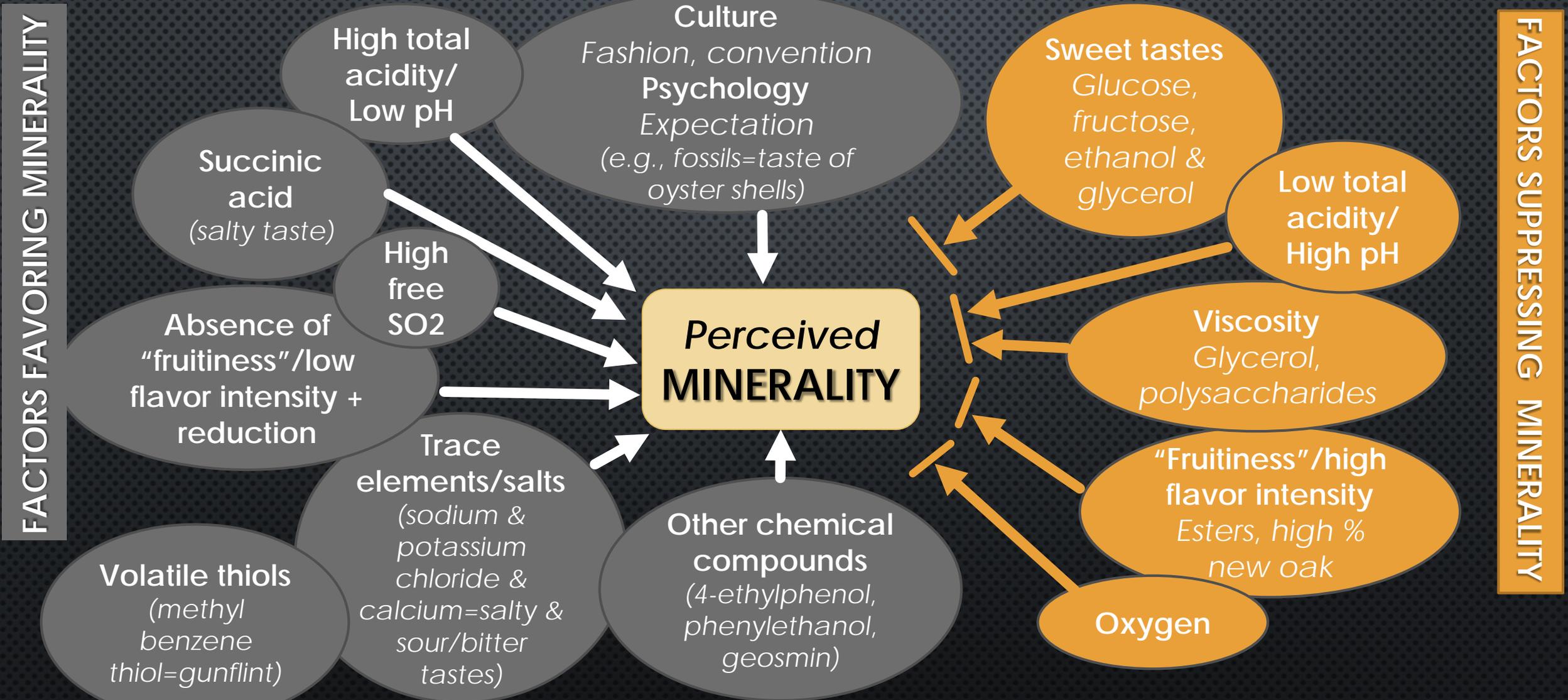
Minerality as a complex sensory phenomenon with many causes & expressions



Hazel Varanese

PERCEIVED MINERALITY: FACTORS FAVORING OR SUPPRESSING

MAPPING OUR PRESENT STATE OF KNOWLEDGE



→ Factors may act independently or in combination

MINERALITY READING LIST

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PRESENTED BY **ROGER C BOHRICH MW**

AUGUST 2016

COMMENTS & QUESTIONS ARE WELCOME: ROGER@VINTRINSIC.COM

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