The Concept of Terroir

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Terroir – a trans-disciplinary concept

The word ‘terroir’ is derived from the Latin.

It became established as a geographical term during the 17th and 18th centuries, when it was employed to describe the characteristics of a homogeneous physical area.

This lead to the first definition in modern language: “a stretch of land limited by its agricultural capacity”.

Thus, in the case of viticulture-oenology, the terroir concept has progressively integrated the agronomic, social and cultural dimensions of the area under consideration.

See for bibliographie: Deloire et al., CAB Reviews: Perspectives in Agriculture, Veterinary Science, Nutrition and Natural Resources (in press, april 2008).
From the vineyard to the wine and sensory: how to capture the complexity?

An integrated approach
Climate: a key factor of the terroir concept

- Temperature
- Light
- Wind
- Air humidity
- Rainfall
Frequency of vintages according to Huglin index classified as very warm (HI>3000) for Griffith (NSW)

Classification of viticultural climates (Tonietto and Carbonneau, 2004)

Very warm: >3000
Warm: >2400≤3000
Temperate warm: >2100≤2400
Temperate: >1800≤2100
Cool: >1500≤1800
Very cool: ≤ 1500

An increase of very warm vintages

Climatic data used are SILO drilled climatic data (Department of Science, Information Technology and the Arts, Queensland State Government, Australia).
Classification of viticultural climates (Tonietto and Carbonneau, 2004)

- Warm nights: >18
- Temperate nights: >14≤18
- Cool nights: >12≤14
- Very cool nights: ≤12

Climatic data used are SILO drilled climatic data (Department of Science, Information Technology and the Arts, Queensland State Government, Australia).
Day and night temperature and link to wine styles?

- Hot - Warm
- Warm
- Temperate - Cool
- Cool
9273 developmentally modulated probsets.

All day-detected transcripts were modulated at night, whereas 1843 genes were night-specific.
Roles of the soil

- Root morphology and distribution
- Vine water uptake
- Minerals uptake:
  - nitrogen (berry growth, aroma precursors)
  - potassium (berry pH)
Cultivars (clones)

Sauvignon Blanc, Chardonnay, Riesling, ...

Cabernet Sauvignon, Shiraz, Merlot, Chamboursin...
Oenological process
**Typicality**: a consensus on the taste between the tasters (*wine styles*).
Wine tasting: it’s an individual thing!

mmm... cherry!
... walnut!
... fruitcake!
... it’s an individual thing!

mmm... printing ink!
... old socks!
... car tyres!

... do you think so?!
While tasting and be a member of a “confrerie bachique”

You need a bit of equipment
The holy grail of wine typicality?

A French example: Chablis

macroclimate

microclimate

harvest dates
Un Terroir

Sol calcaire, formé au Kimméridgien (il y a environ 150 millions d'années), lorsqu'une mer chaude et peu profonde recouvrait Chablis
Contient des fossiles de petites huîtres appelées *Exogyra virgula*.
Les Climats

Les Climats peuvent être décrits comme l’ADN du vignoble de Bourgogne.

- parcelles précisément délimitées
- bénéficiant de conditions géologiques et climatiques spécifiques
- identifiées et mises en valeur par le travail des hommes.
Chablis

Le vignoble de Chablis, situé sur une zone géographique relativement concentrée, s'exprime au travers d'un seul cépage et puise son authenticité dans un sol datant du Kimmeridgien,

Il offre une large palette de vins et d'expressions qui séduisent un large public.

Le vignoble de Chablis c'est :
- un seul cépage, le Chardonnay
- un sous sol Kimmeridgien
- un savoir-faire acquis à travers des générations de vignerons
- 4 niveaux d'appellation
- 5400 ha
- 40 millions de bouteilles
- une présence dans près de 100 pays
- une pureté inimitable
Appellation Chablis Premier Cru

Vin dégusté :
Chablis 1er Cru Vaillons 2012
et
Chablis 1er cru Mont de Milieu 2008
Appellation Chablis Grand Cru

Décret de 1938
Sur les pentes abruptes de la rive droite du Serein où le Kimmeridgien affleure par endroits
Exposition principalement sud/sud ouest
Orientation qui permet d’être baignée par la lumière du matin au soir
Elevage minimum jusqu’au 15 mars de l’année qui suit la récolte
1 Appellation Chablis Grand Cru, 7 Climats

Vin dégusté
Chablis Grand Cru Bougros 2008
The holy grail of wine typicality?

Principal component analysis (axes F1 & F2: 97.88%) of 52 Sauvignon Blanc Wines in the Western Cape Province of South Africa. The style of wine, in terms of intensity of tropical and/or green characteristics, seems mainly related to the thermal condition of the regions at the macroclimatic level (warm versus cool). At the bunch level (microclimate), light and temperature will therefore influence berry composition and the style of wine. Factor 1 (F1) indicated by the horizontal axis explains 96.49% of the variance in the data and factor 2 (F2) indicated by the vertical axis explains 1.40% of the variance in the data set.

macroclimate  microclimate  harvest dates
Climate: primary driving factor of berry ripening

Principal component analysis (Axes F1 & F2: 97.89%) of 52 Sauvignon Blanc Wines in the Western Cape Province of South Africa. The style of wine, in terms of intensity of tropical and/or green characteristics, seems mainly related to the thermal condition of the regions at the macroclimatic level (warm versus cool). At the bunch level (microclimate), light and temperature will therefore influence berry composition and the style of wine. Factor 1 (F1) indicated by the horizontal axis explains 90.49% of the variance in the data and factor 2 (F2) indicated by the vertical axis explains 7.40% of the variance in the data set.
At which level do we have to study the climate effect on grapevine functioning and berry ripening?
The holy grail of wine typicality?

Principal component analysis (axes F1 & F2: 87.88%) of 52 Sauvignon Blanc Wines in the Western Cape Province of South Africa. The style of wine, in terms of intensity of tropical and/or green characteristics, seems mainly related to the thermal condition of the regions at the macroclimate level (warm versus cool). At the bunch level (microclimate), light and temperature will therefore influence berry composition and the style of wine. Factor 1 (F1) indicated by the horizontal axis explains 41.44% of the variance in the data and factor 2 (F2) indicated by the vertical axis explains 7.40% of the variance in the data set.

macroclimate  microclimate  harvest dates
Training system... Vertical shoot positioning
Gobelet « échalassé »
(L’Ormarins)
Effect of canopy manipulation on abiotic factors and grape and wine composition of *Vitis vinifera* L. cv. Sauvignon Blanc

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Methoxypyrazines

- IBMP (3-isobutyl-2-methoxypyrazine)
- IPMP (3-isopropyl-2-methoxypyrazine)
- MPsb (2-methoxy-3-sec-butylpyrazine)
  (Augustyn et. al., 1982)

- Sauvignon Blanc, Cabernet Sauvignon, Merlot, Cabernet franc, Carmenere

- 0.5-2 ng/L in water, synthetic wine and white wine; 10-16 ng/L in red wines (Sala et al, 2004)
Thiols

4-methyl-4-sulfanylpentan-2-one (4MSP); 0.8 ng/L

3-sulfanyl-hexylacetate (3SHA); 4 ng/L

3-sulfanylhexan-1-ol (3SH); 60 ng/L (Darriet et al., 1995; Tominaga et al., 1998; Dubourdieu et al., 2006)
- Tannins
- Organic acids
- Aromatic precursors
- Pyrazines
- Polyamines
- Minerals accumulation
- Amino acids

- Anthocyanins
- Aromatic precursors
- Tannin structure
- Sugar accumulation
No leaf removal treatment-UV (C-UV)

E  W

Shaded_canopy

Shaded_bunch

Morning shaded  Afternoon shaded
Both sides leaf removal (B-LR)

Both_canopy

Both_bunch

Morning exposed

Afternoon exposed
PCA Bi-Plot of Chemical and Sensory parameters

Bi-plot

- PC-1 (49%)
- PC-2 (28%)

- LR-UV
- M-LR
- A-LR

- C6C2
- c2Phc2
- C2iC5
- C8C2
- C2C6
- C4C2
- C2iC4
- IBMP

- Guava
- Overall Tropical
- Passion Fruit
- Pineapple
- Floral

- Acidity
- Green Pepper
- Grassy
- Overall Green
- Cooked Beans
- Asparagus
- Grassy Green Pepper
- Cooked Beans

- Bitterness

- 3SHA
- 3SH
- C3C2
- LR-UV
- IC5C2 IC4C2
- 2MC4C2
- IC5C2 C2IC5 C2iC4C5 C2iC6 IC4C2 IC5C2
The holy grail of wine typicality?

Principal component analysis (axes F1 & F2: 97.88%) of 52 Sauvignon Blanc Wines in the Western Cape Province of South Africa. The style of wine, in terms of intensity of tropical and/or green characteristics, seems mainly related to the thermal condition of the regions at the macroclimatic level (warm versus cool). At the bunch level (microclimate), light and temperature will therefore influence berry composition and the style of wine. Factor 1 (F1) indicated by the horizontal axis explains 96.49% of the variance in the data and factor 2 (F2) indicated by the vertical axis explains 7.40% of the variance in the data set.

macroclimate

microclimate

harvest dates
Sauvignon blanc

Observations (axes F1 and F2: 51.39 %)

Earlier harvest dates

Later harvest dates

Minerality
Neutral
Thin

Colour

Balanced
Asparagus
Grapefruit
Full
Guava
Complex

Sweet taste
Burn
Passion fruit
Tropical
Gooseberry
Apple
Ripe fruit
Mango
Melon

Acidic
Sour
Crisp
Citrus
Green bean
Green pepper
Reductive
Green-nose
Dusty
Watery
Bitter
Altydgedacht1

Sauvignon blanc

green-nose
tropical

Hue angle: 76
pH: 3.09
TA: 10.86
20.7°B

> 80 = green/asparagus/citrus/unripe
< 80 and > 70 = tropical/grapefruit/citrus/boxtree
< 70 = fermentative/neutral/terpene

Altydgedacht2

Hue angle: 74
pH: 3.13
TA: 9.54
22.9°B

green-nose
tropical

Hue angle:72
pH: 3.16
TA: 9.17
22.8°B

green-nose

tropical
Sauvignon blanc

> 80 = green/asparagus/citrus/unripe
< 80 and > 70 = tropical/grapefruit/citrus/boxtree
< 70 = fermentative/neutral/terpene
Chenin blanc

Observations (axes F 1 and F 2: 53.79 %)

Unbalanced
- Harsh acid
- Loose acid
- High TA
- Chemical
- Musty
- Medicinal
- Thin
- Ripe fruit
- Citrus

Balanced
- Good mouthfeel
- Candy-like
- Reductive
- Guava
- Pineapple
- Tropical
- Watermelon
- Jammy

Earlier harvest dates
- Later harvest dates

Peach
- Floral
- Honey
- Syrup

Spicy
- Sweaty
- Hay
- Perfumey

Colour

W
MSdT_1
Altygedacht_1
Altygedacht_3
MSdT_3
MSdT_2
Altygedacht_2
Chenin blanc

MSdT 1
- Hue angle: 75
- pH: 3.11
- TA: 12.29
- 14.2 °B

MSdT 2
- Hue angle: 73
- pH: 3.60
- TA: 6.37
- 20.7 °B

MSdT 3
- Hue angle: 74
- pH: 3.48
- TA: 6.10
- 21.3 °B

Fruit aromas:
- > 80 = green/asparagus/citrus/unripe
- < 80 and > 70 = tropical/grapefruit/citrus/boxtree
- < 70 = fermentative/neutral/terpene
A French example: Chablis

macroclimate

microclimate

harvest dates
“The typicality of an agricultural product is its property of belonging to a distinct type and identified by a reference group of individuals whose know-how is distributed throughout the sector, i.e. knowing how to:

- establish,
- produce,
- evaluate
- and appreciate.

This property should not be confused with conformity to a norm; quite the contrary, it accepts variety within the type.

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If it is supposed that typicality corresponds to an agreed taste, three different production strategies could be envisaged:

a) the typicality is revealed, in which case oenological processes are adapted to the revelation of the dominant harvest potential, and here, “terroir” effect includes vintage variability;

b) the typicality is “constructed”, in which case the potentialities of different grape are identified, the grapes are fermented separately or together and then the wine is blended to obtain a style corresponding to a target category;

c) the typicality is adapted to market demand, in which case oenological techniques are tailored to the harvest potential to obtain a product that immediately responds to market demand (the industrial approach to winemaking: coffee Pinotage, citrus Chardonnay, green Sauvignon blanc).

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Thanks you for your attention

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