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The 2003 vintage, an anticipation of future Bordeaux vintages in a context of climate change?



Let's remember 2003

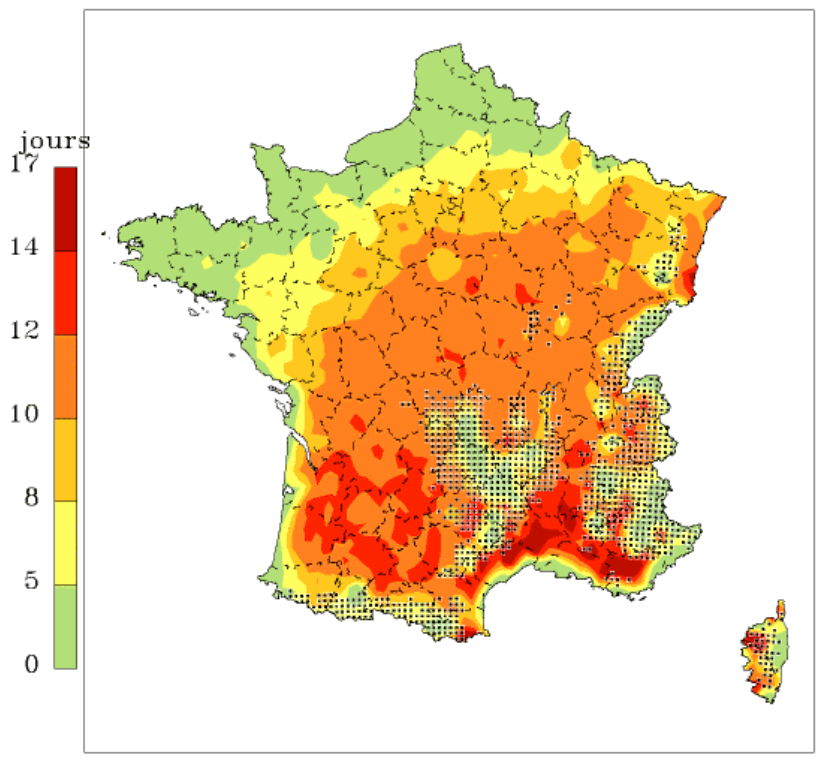


Let's remember the 2003 summer, in France

HOT SUMMER
 >12 days with maximal temperatures > to 35°C during August 2003



NOMBRE DE JOURS AVEC TEMPERATURE MAXIMALE \geq 35°C
 PERIODE DU 01/08/2003 AU 16/08/2003



Dramatic consequences for public health
 + 60% mortality (Hemon and Jouglu, 2003)

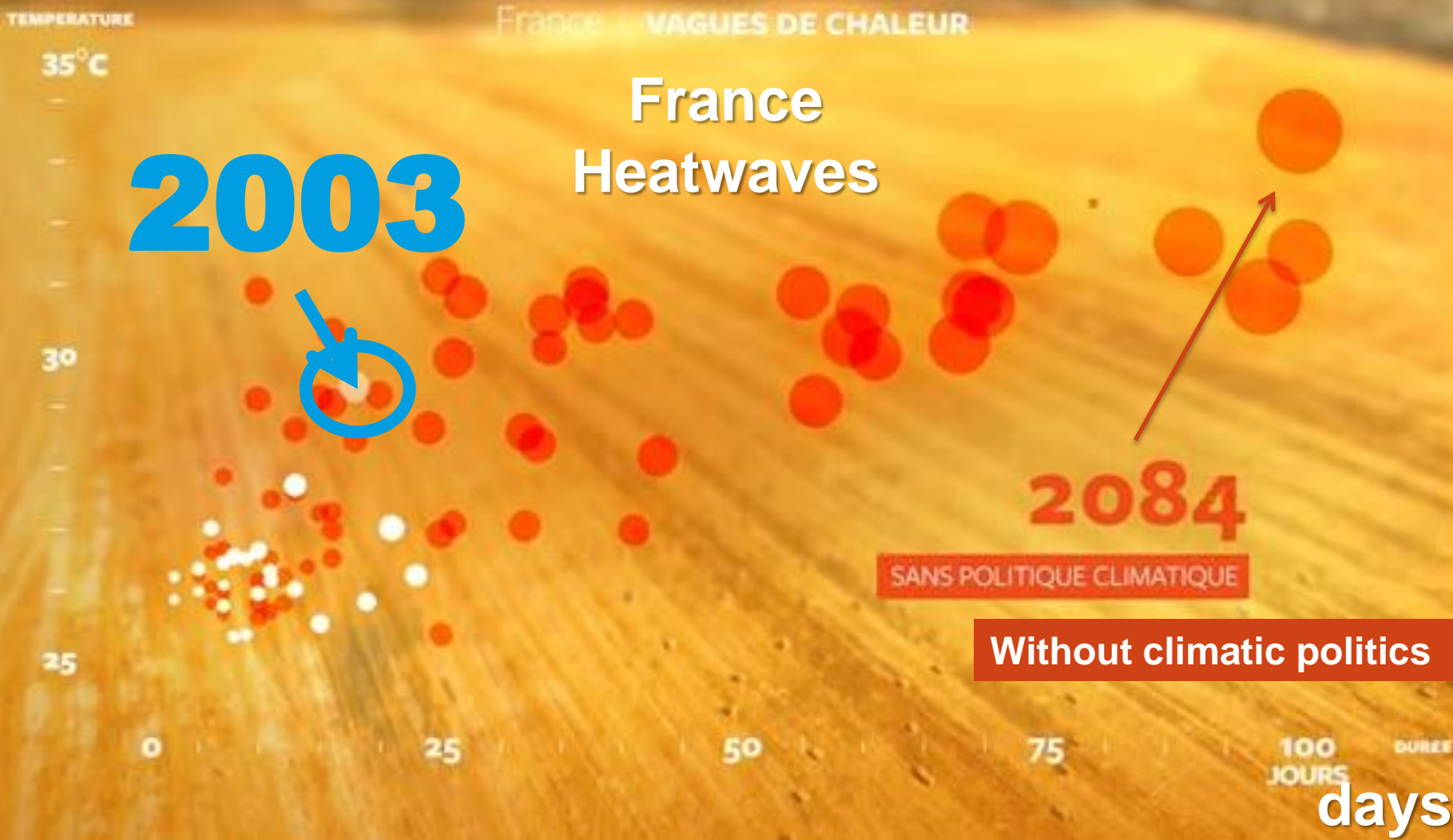
L'été meurtrier
 The murderer summer

Le Monde
 Canicule : une catastrophe humanitaire
 La France en état de choc sanitaire
 Canicule: l'échec du système
 Des vacances qui ont tué
 L'été le plus meurtrier en France depuis la Libération



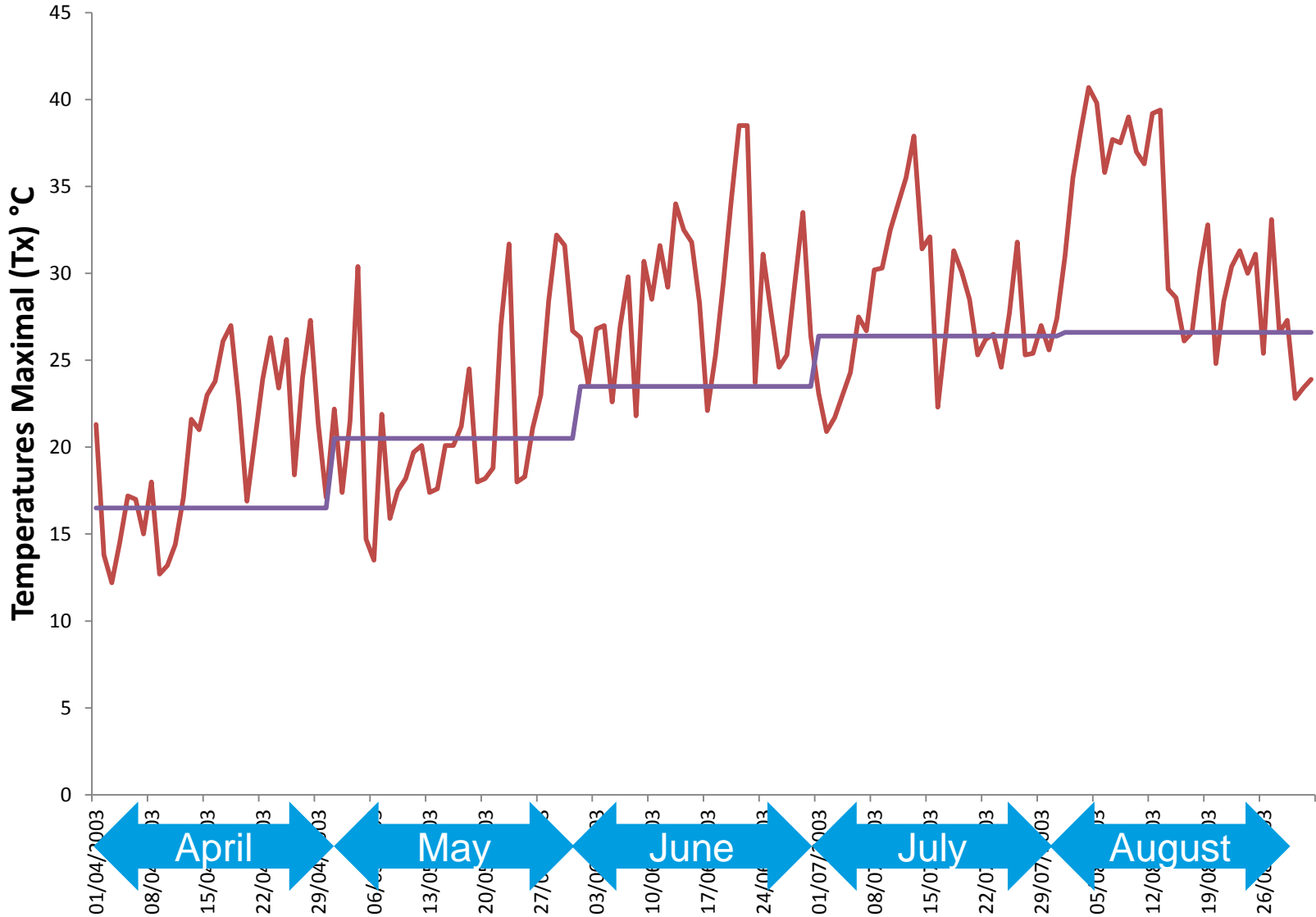
2003 an anticipation of the future?

www.meteofrance.fr



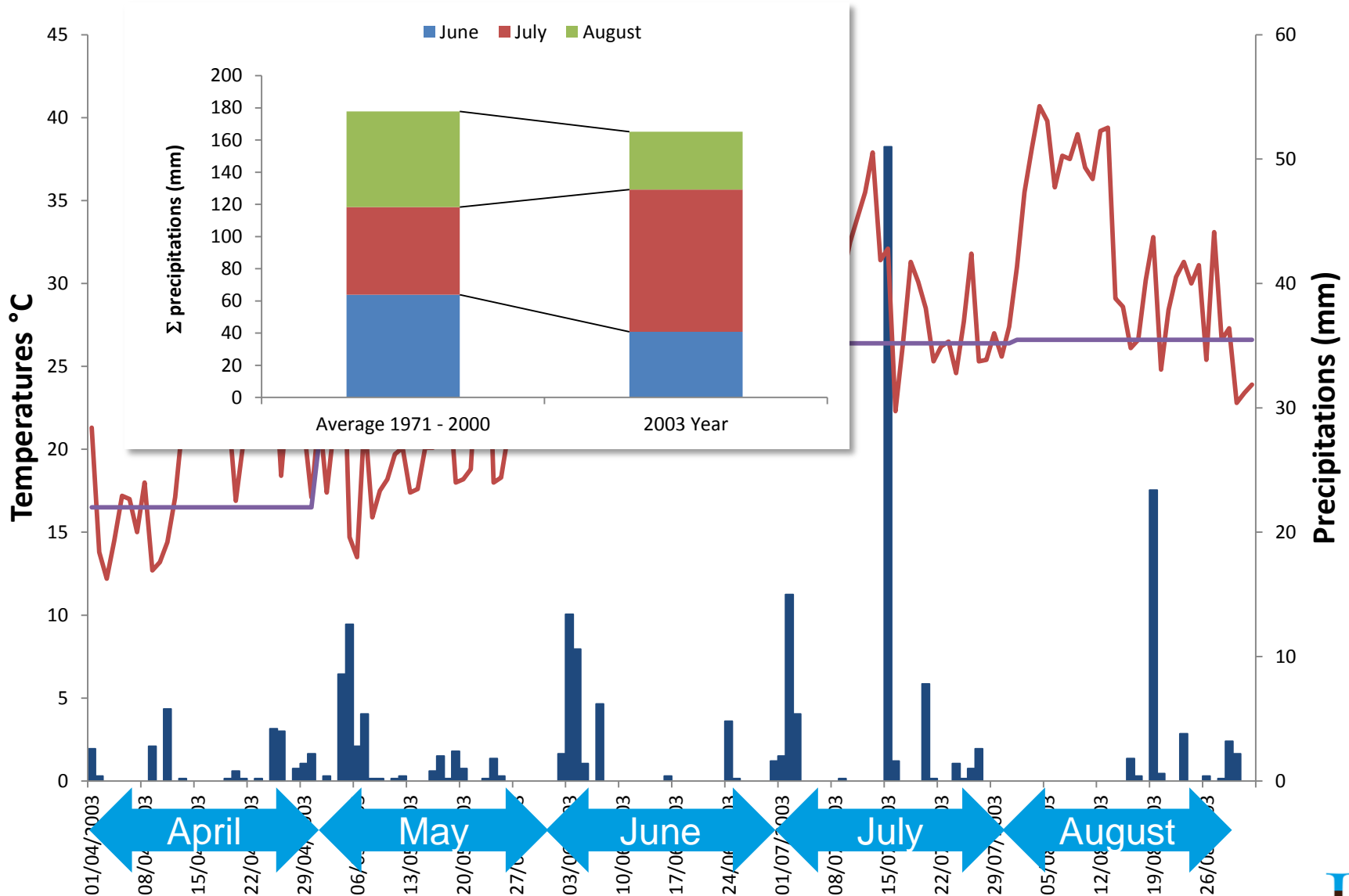
What about the 2003 vintage in Bordeaux ?

[1] www.meteo-bordeaux.fr



What about the 2003 vintage in Bordeaux ?

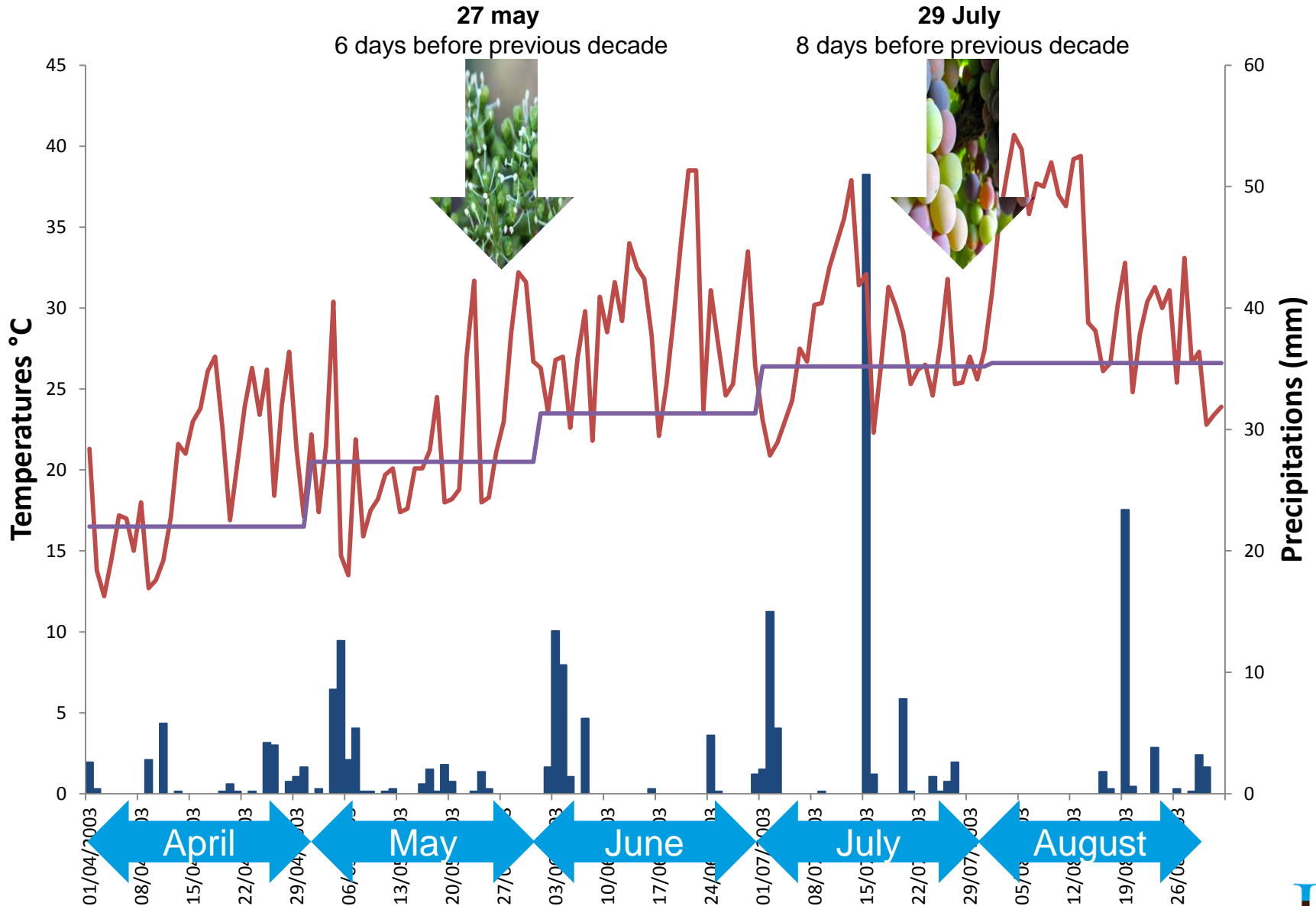
[1] www.meteo-bordeaux.fr



What about the 2003 vintage in Bordeaux ?

[1] www.meteo-bordeaux.fr

[2] G. Guimberteau & P. Ribéreau-Gayon / *le millésime 2003* / www.bordeauxraisins.fr



What about the 2003 vintage in Bordeaux ?

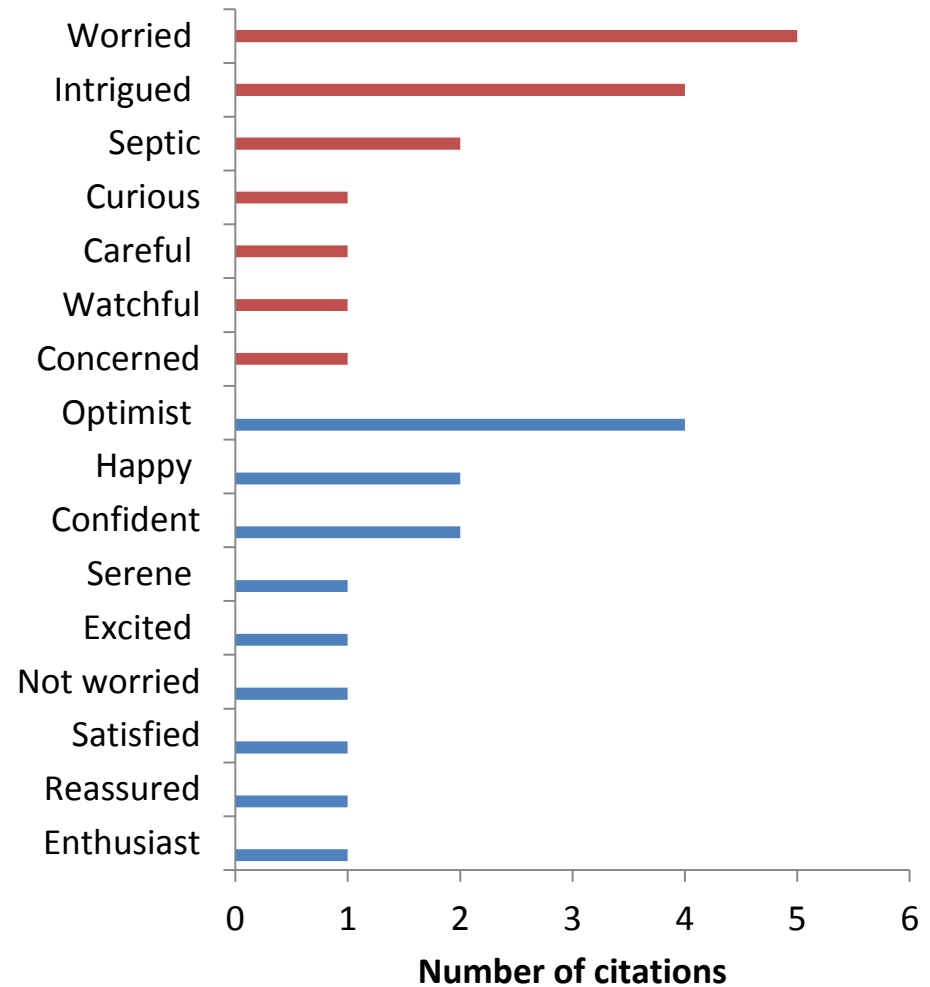
What was the state of mind of the wine maker at the 2003 summer?

18 wine makers
4 to 26 years of
experience in 2003

Ambivalent feelings

« *Concerned but confident* »

« *Optimistic but watchful* »



What about the 2003 vintage in Bordeaux ?

« *Du meilleur au plus mauvais! Le millésime 2003 est le plus hétérogène que Bordeaux ait connu de mémoire de vigneron* »

From the best to the worst ! 2003 is most heterogeneous vintage that Bordeaux knew in the memory of winegrowers

J. Dupont, Le Point, **13 may 2004**

The key criteria of heterogeneity

- Day of harvest
- Nature of soils
- Age of vines (in link to depth of roots)
- Viticultural choices (leaf removal)
- Oenological choices (extraction of immature seed tannins)

**HUMAN
CHOICES**

Our question



If 2003 can be an anticipation of the future climatic changes,

if the 2003 vintage was complex to manage,

what can we learn in 2016 from the aged 2003 wines ?

Look the present, to reveal the past and anticipate the future

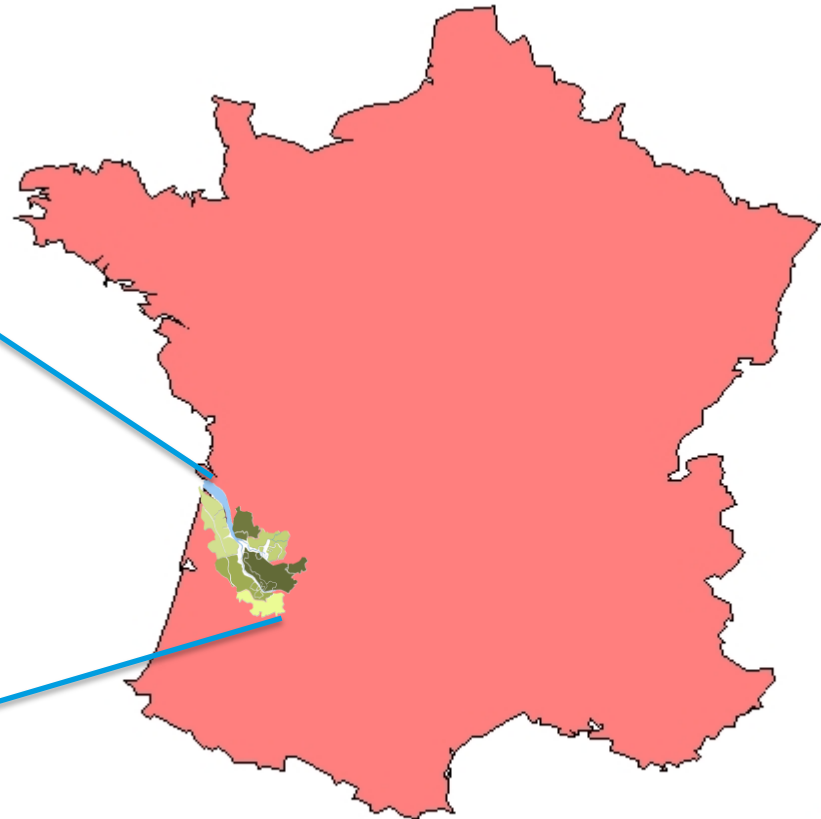
Experimental design

Let's remember the 2003 juices, in Bordeaux

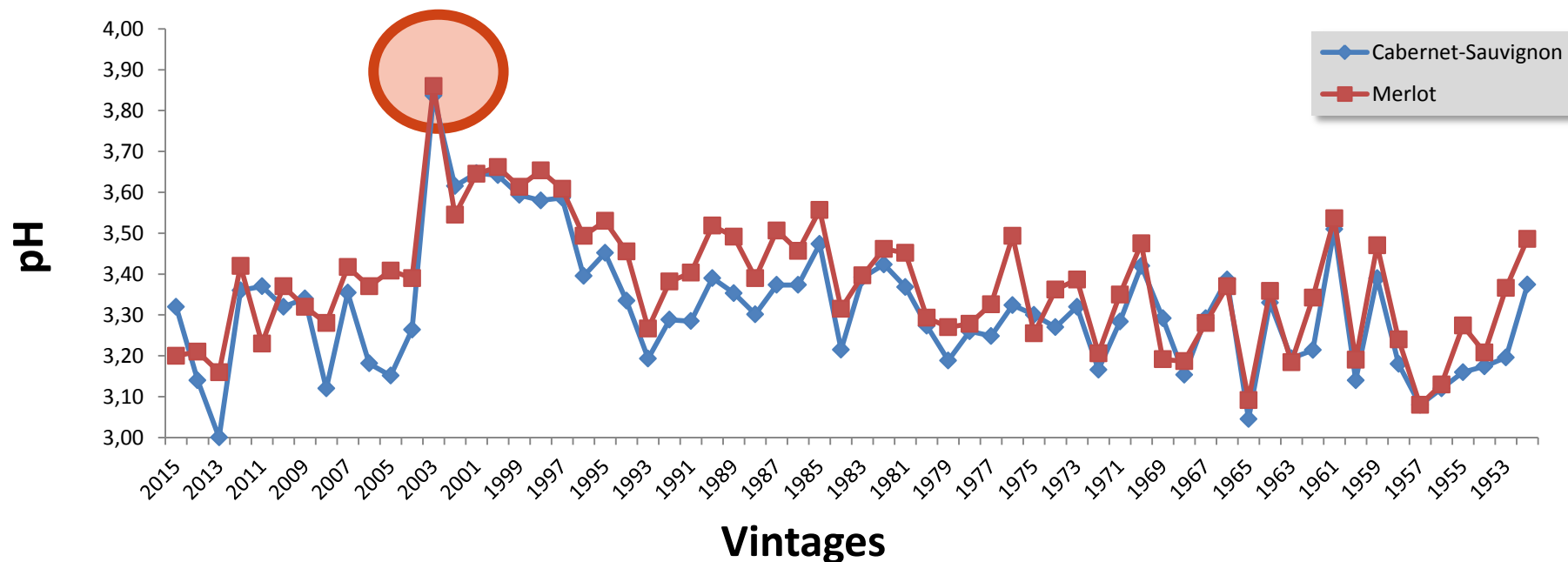


Bordeaux
raisins

Data kindly provided by L. Geny
Ripening Network, ISVV



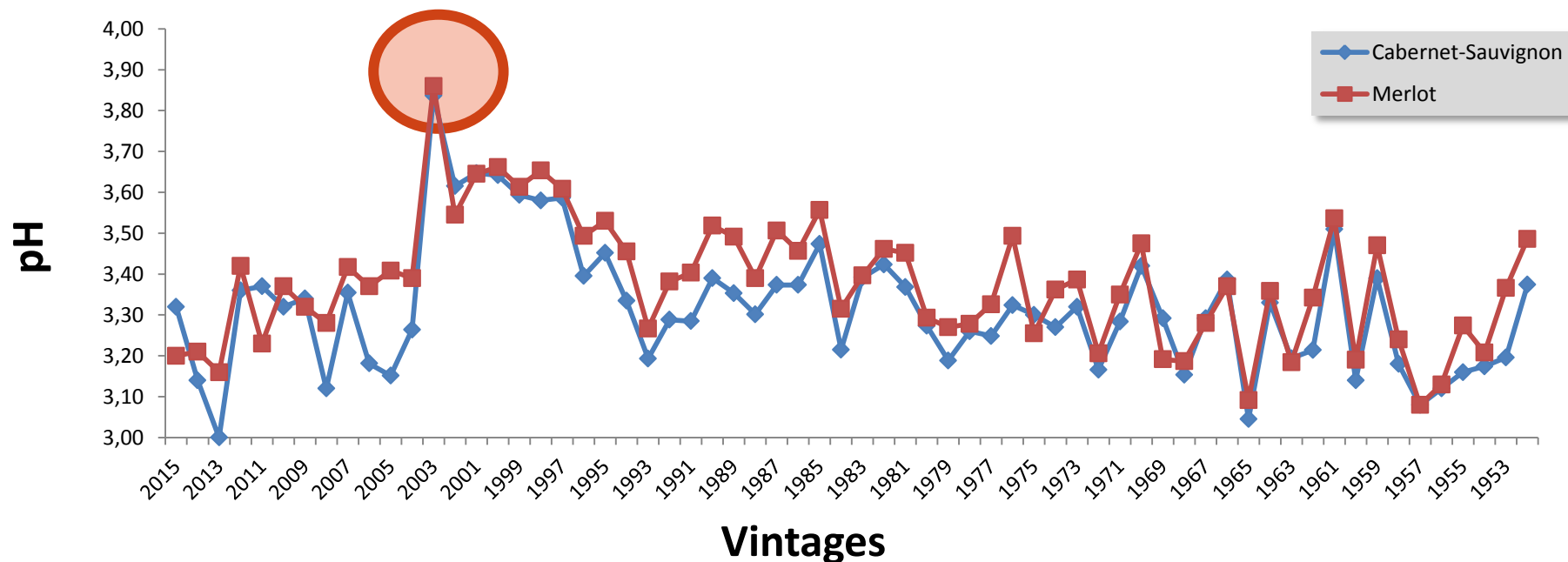
Let's remember the 2003 juices, in Bordeaux



Data kindly provided by L. Geny
Ripening Network, ISVV



Let's remember the 2003 juices, in Bordeaux



No similar compartment for :

- Total Acidity
- Malic Acid
- And even....

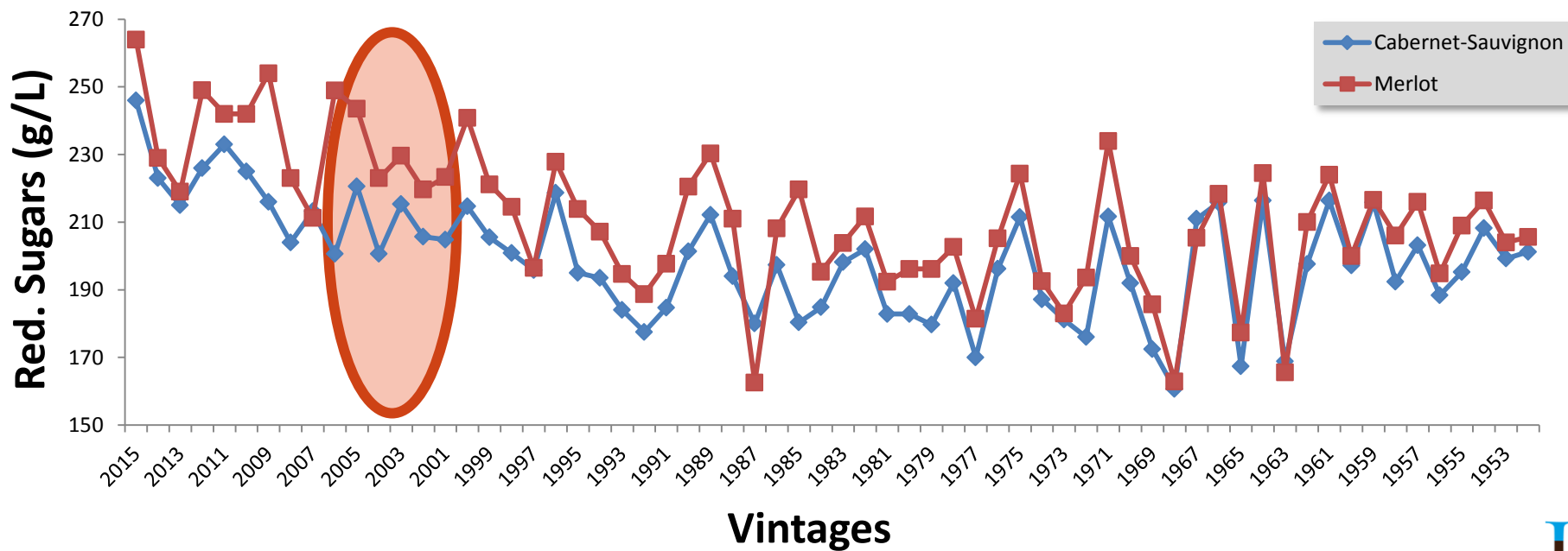
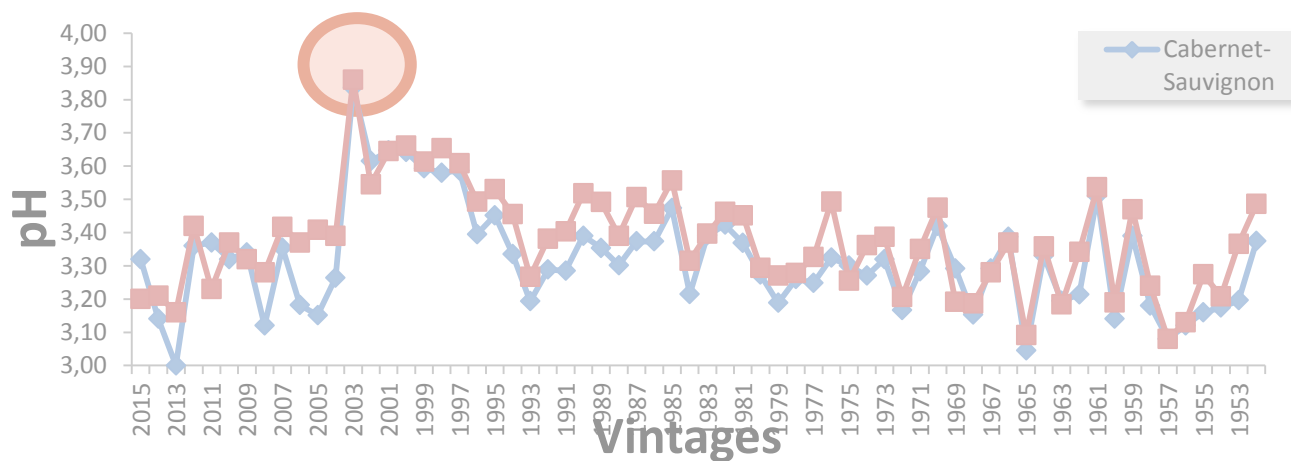


Bordeaux
raisins

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Let's remember the 2003 juices, in Bordeaux





2 examples

Contaminants
from
microbiological
spoilage

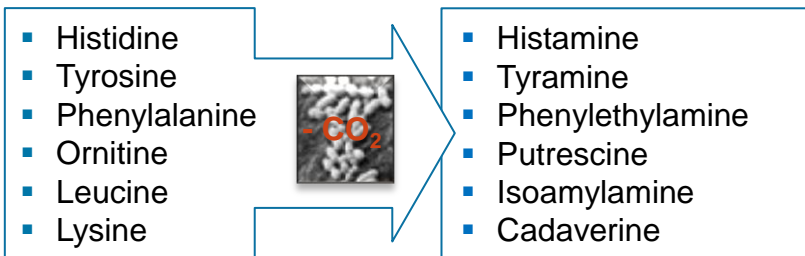
- Volatiles Amines
- Biogenic Amines

Ageing molecules
« pseudo primary
aromas »

Aromas from the
« Bouquet » the
positive ageing of
Bordeaux wines

What about biogenic and volatile amines?

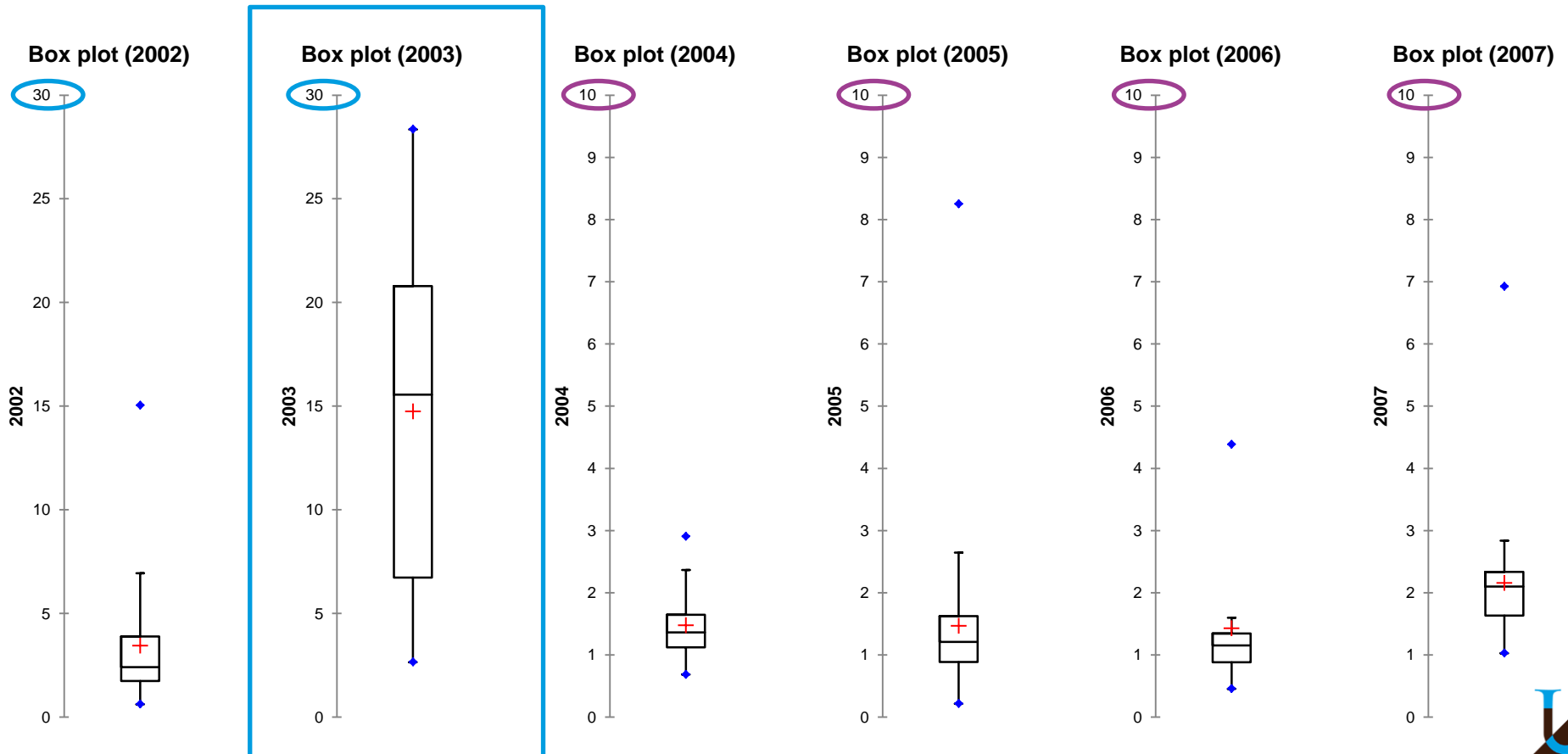
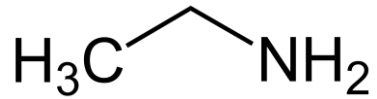
- Biogenic amines (BA) can be toxic ¹
- Volatile amines (VA) present rotten fish smell at mouth pH ¹
- In wines, they are formed after decarboxylation of amino acids by Lactic Acid Bacteria ^{2,3}



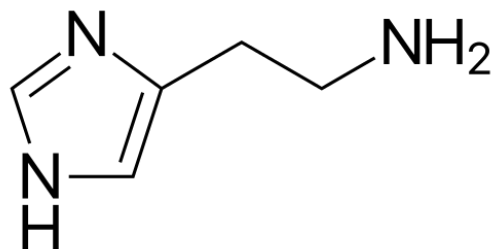
- 485 red wine samples from Bordeaux area
- Vintages : 2001 to 2007
- OIV quantification method (OPA derivation / HPLC / Fluo.)

[1] Lehtonen P., 1996, *Am. J. Enol. Vitic.*, 47, 127;
[2] Lonvaud-Funel A., 2001, *FEMS Microbiol. Let.*, 199, 9;
[3] Lucas P., Wonlken W., Claisse O., 2005, *Ap. Env. Microbiol.* 71, 1417

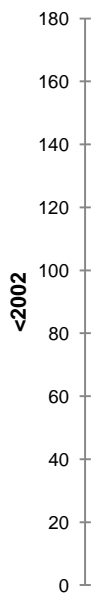
Volatiles Amines, Ethyl amine (mg/L)



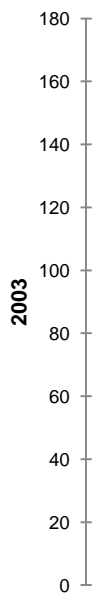
Biogenic Amines, Histamine (mg/L)



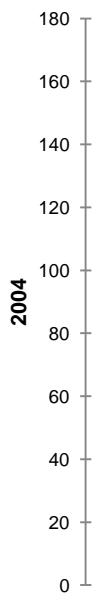
Box plot (<2002)



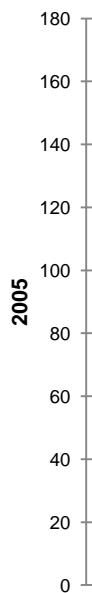
Box plot (2003)



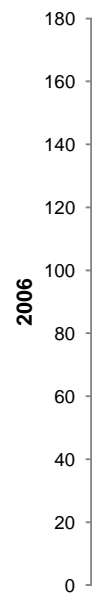
Box plot (2004)



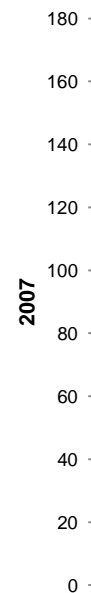
Box plot (2005)



Box plot (2006)



Box plot (2007)

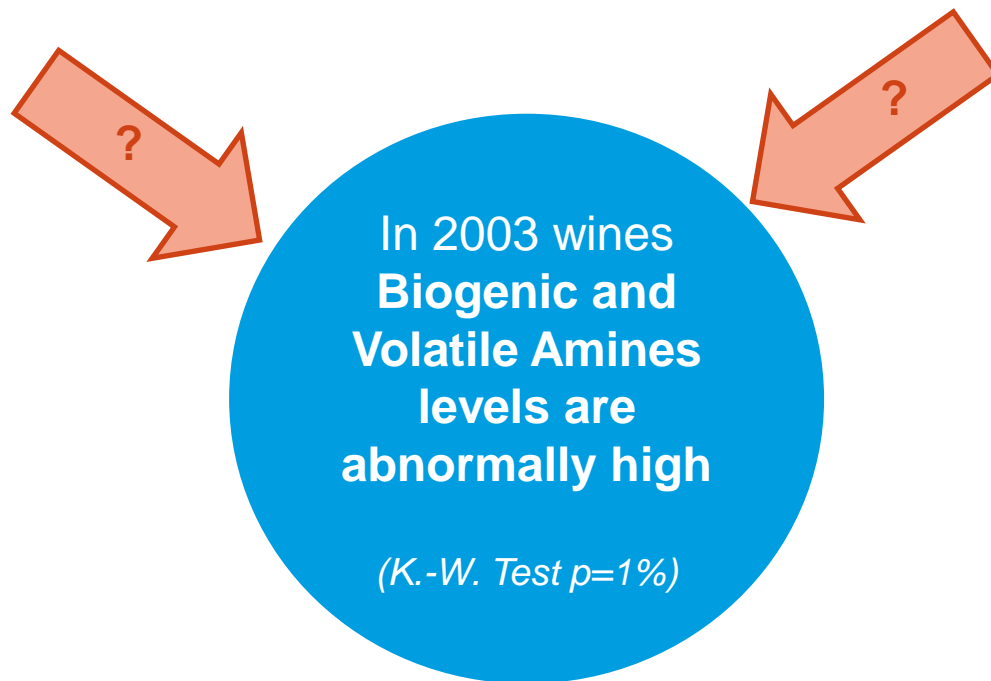


Conclusions on biogenic and volatile amines

Does heatwave can modify microbiota and favors decarboxylation ?



What is the role of pH ?



In 2003 wines
**Biogenic and
Volatile Amines
levels are
abnormally high**

(K.-W. Test p=1%)

Looking the present, to reveal the past and anticipate the future



2 examples

Contaminants
from
microbiological
spoilage

- Volatiles Amines
- Biogenic Amines

Ageing molecules
« pseudo primary
aromas »

Aromas from the
« Bouquet » the
positive ageing of
Bordeaux wines

Bouquet ageing compounds

Picard *et al.* 2015, Food Quality and Preferences,



FRESH FRUITS



TOASTY



LIQUORICE

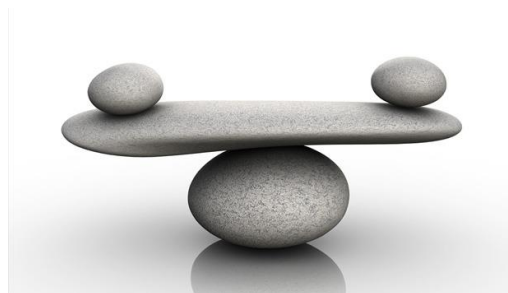
The « BOUQUET »
of the red
Bordeaux wines



UNDERGROWTH



SPICY



TRUFLE



EMPYREUMATIC
NUANCES



MINT

Bouquet ageing compounds

Experimental design



Merlot



C. Sauvignon



C. Franc

1996

1999

2001

2002

2003

2004

2005

2006

2007

1 Climate

1 Rootstock

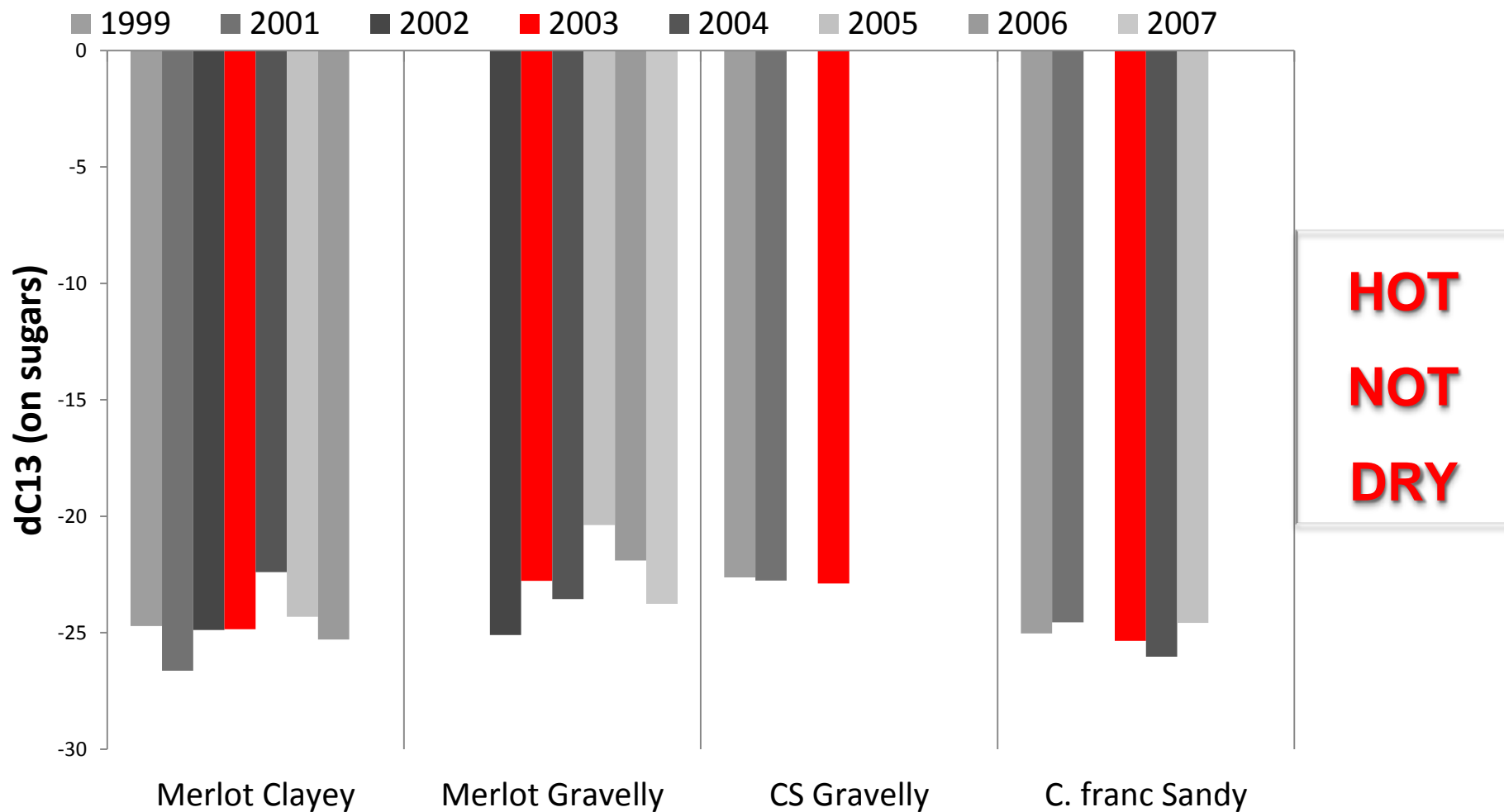
1 Vineyard
management
system

**Experimental scale
Vinifications
(50 L tanks)**

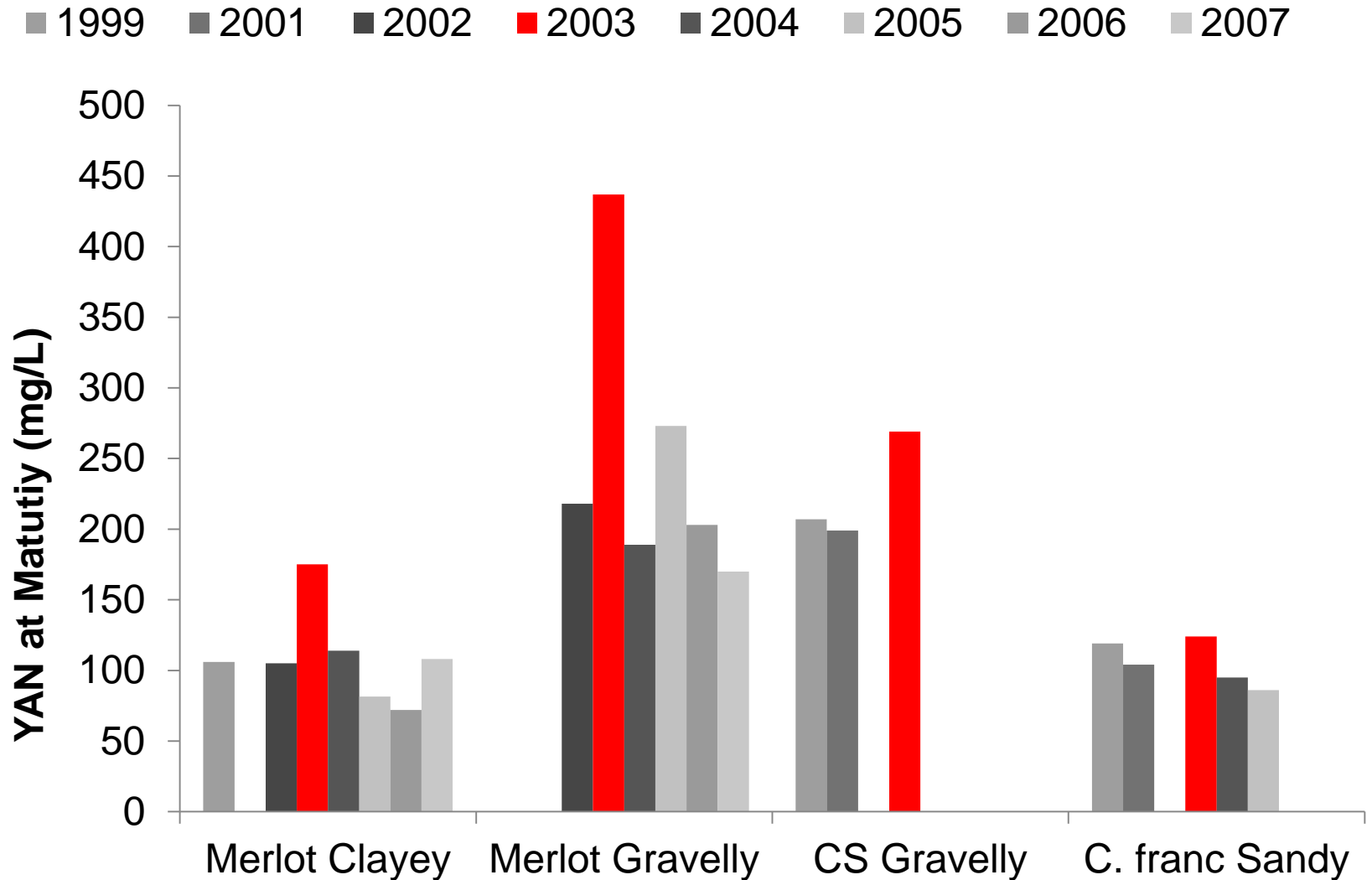


**43 wines kept in cellar until 2014
4 wines from 2003**

Hydric status of experimental vines in 2003



Nitrogen status of experimental vines in 2003



Bouquet ageing compounds

Picard *et al.* 2015, Food Quality and Preferences,



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TOASTY



LIQUORICE

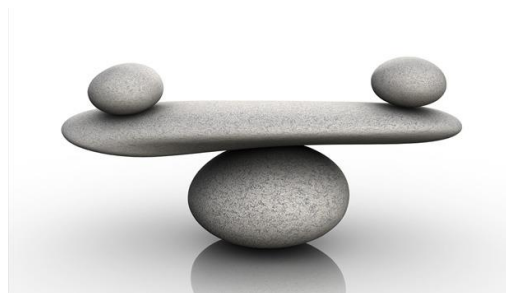
The « BOUQUET » of the red Bordeaux wines



TRUFFLE



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UNDERGROWTH



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MINT

Effect of 2003 vintage on Tabanones levels

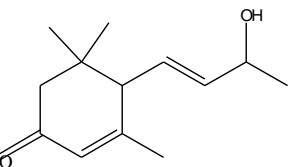
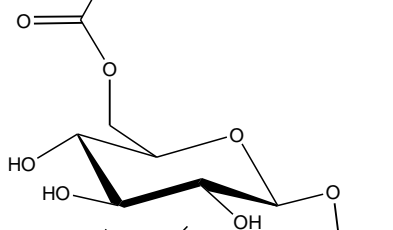
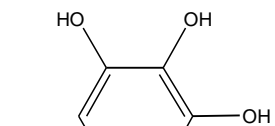
Slaghenaufi et al., Anal. Chim. Acta 2014



**EMPYREUMATIC
NUANCES**

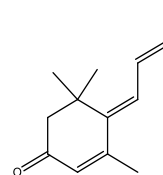


SPICY

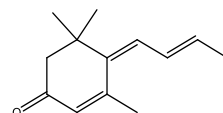


3-oxo- α -ionol

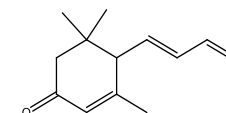
macarangioside E



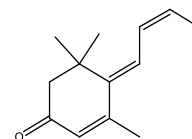
megastigma-4,6*E*,8*E*-trien-3-one



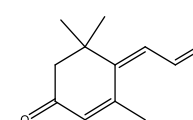
megastigma-4,6*Z*,8*E*-trien-3-one



megastigma-4,7*E*,9-trien-3-one



megastigma-4,6*E*,8*Z*-trien-3-one



megastigma-4,6*Z*,8*Z*-trien-3-one

Effect of 2003 vintage on Tabanone levels

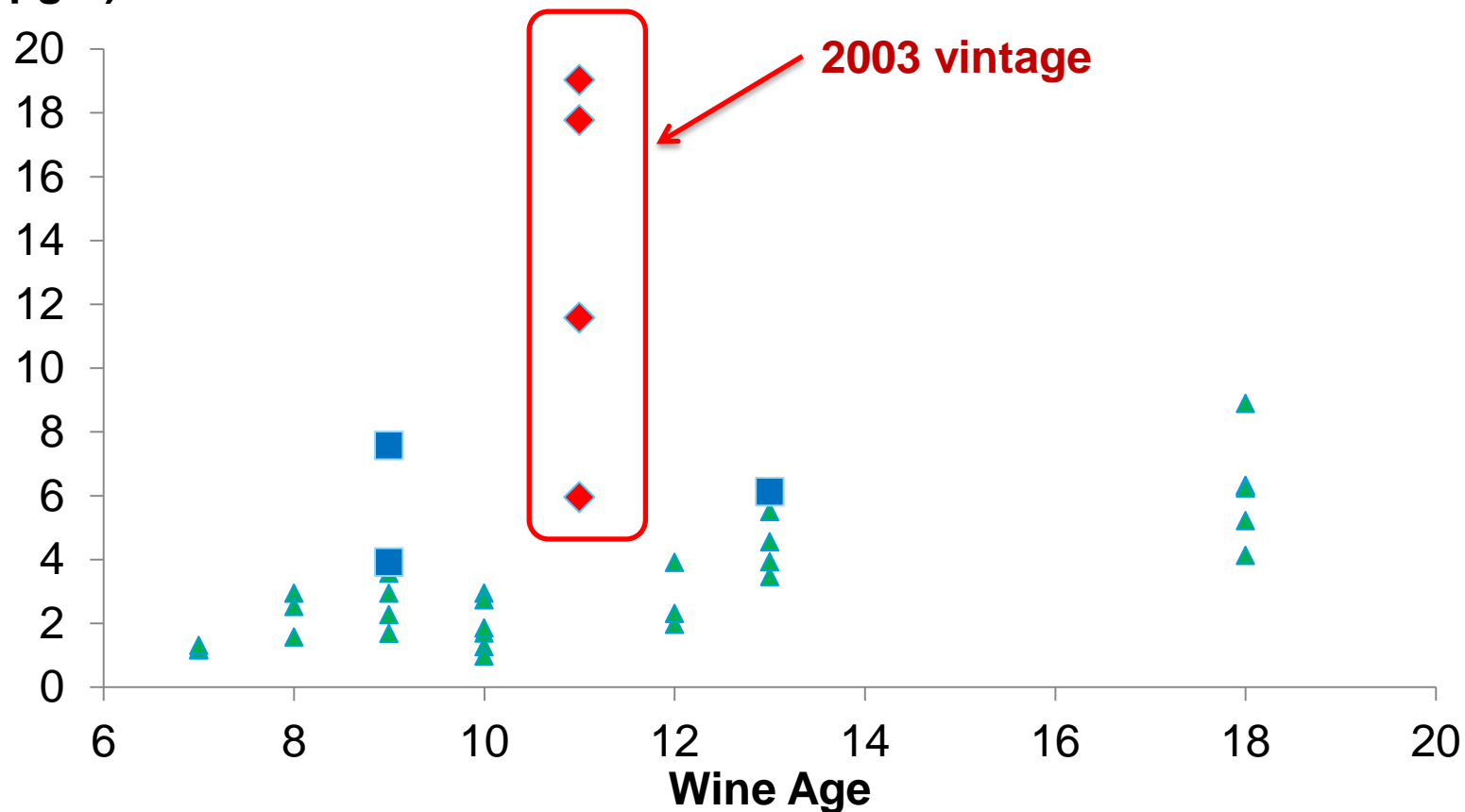


EMPYREUMATIC
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Σ of 4
tabanone
isomers
($\mu\text{g/L}$)



Bouquet ageing compounds

Picard *et al.* 2015, Food Quality and Preferences,



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TOASTY



LIQUORICE

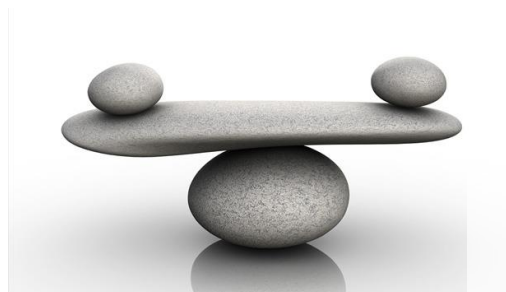
The « BOUQUET » of the red Bordeaux wines



UNDERGROWTH



SPICY



TRUFFLE

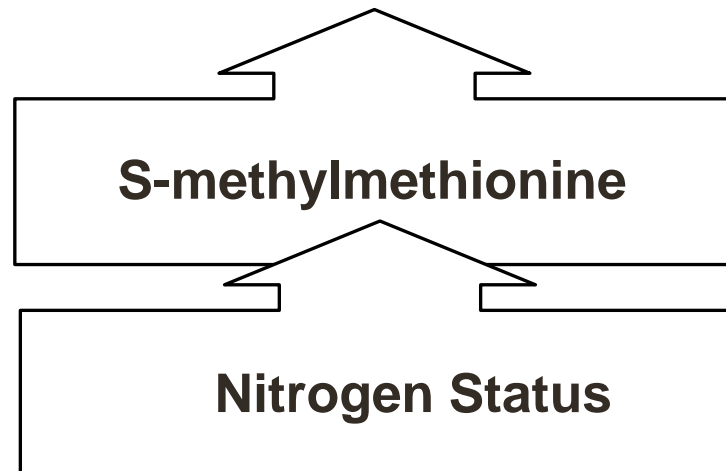
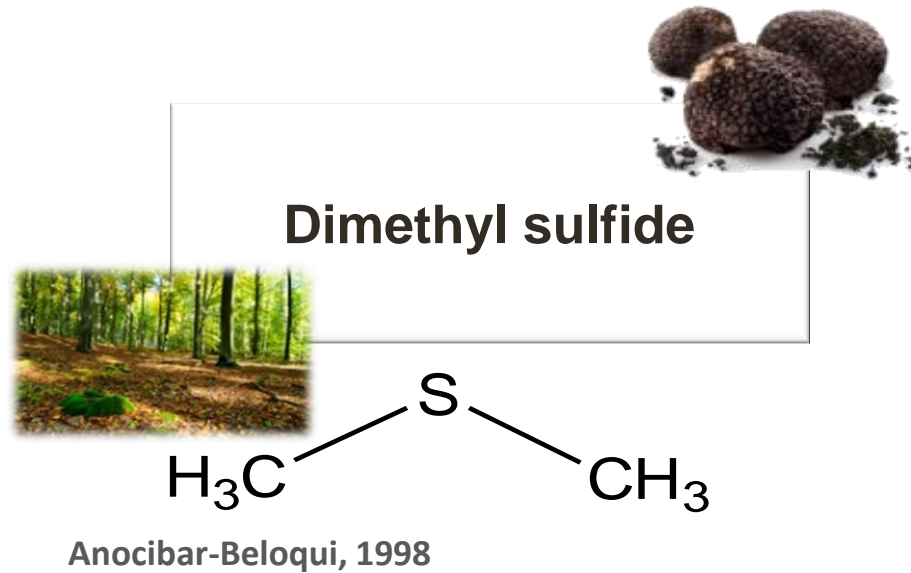


EMPYREUMATIC
NUANCES

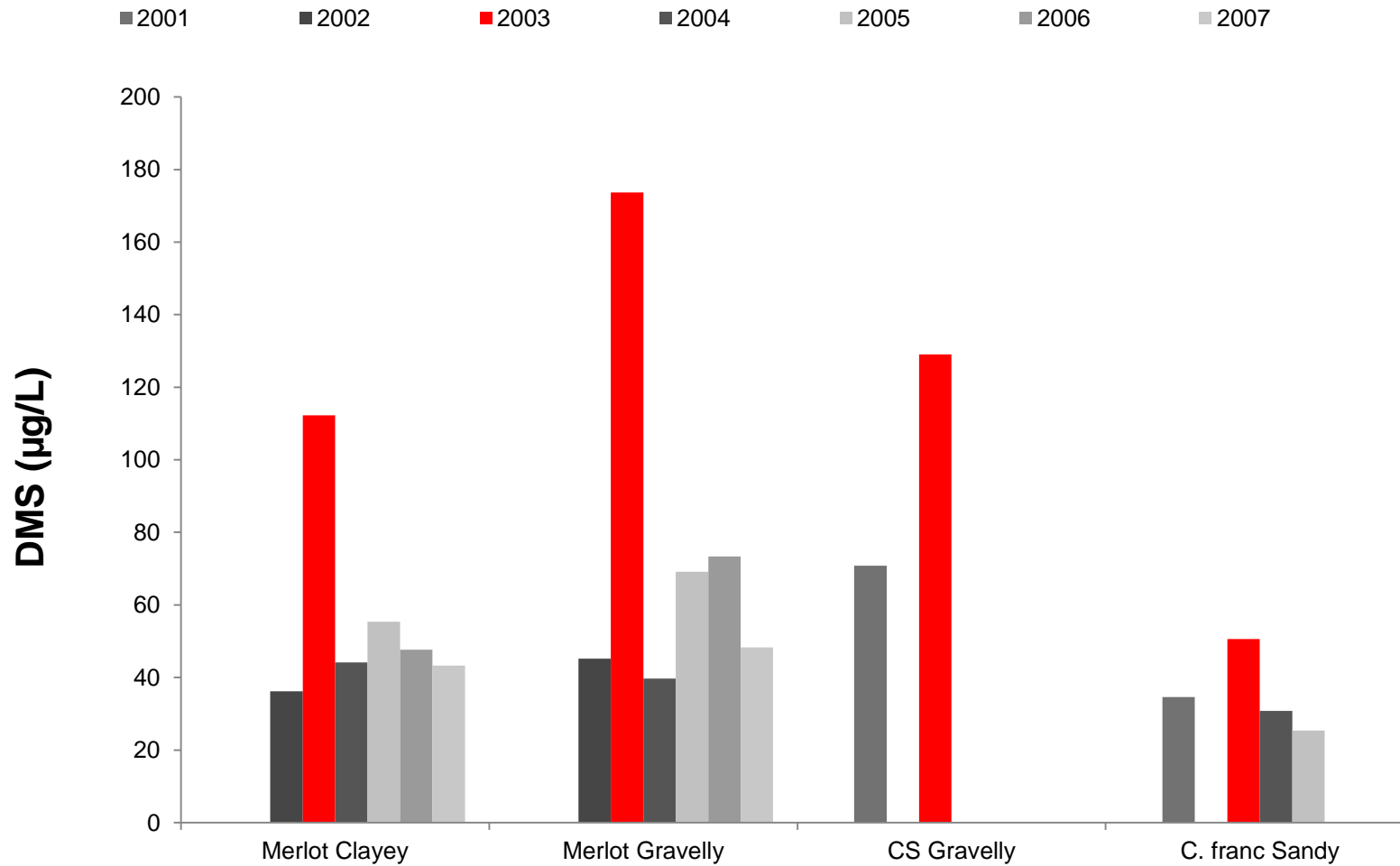


MINT

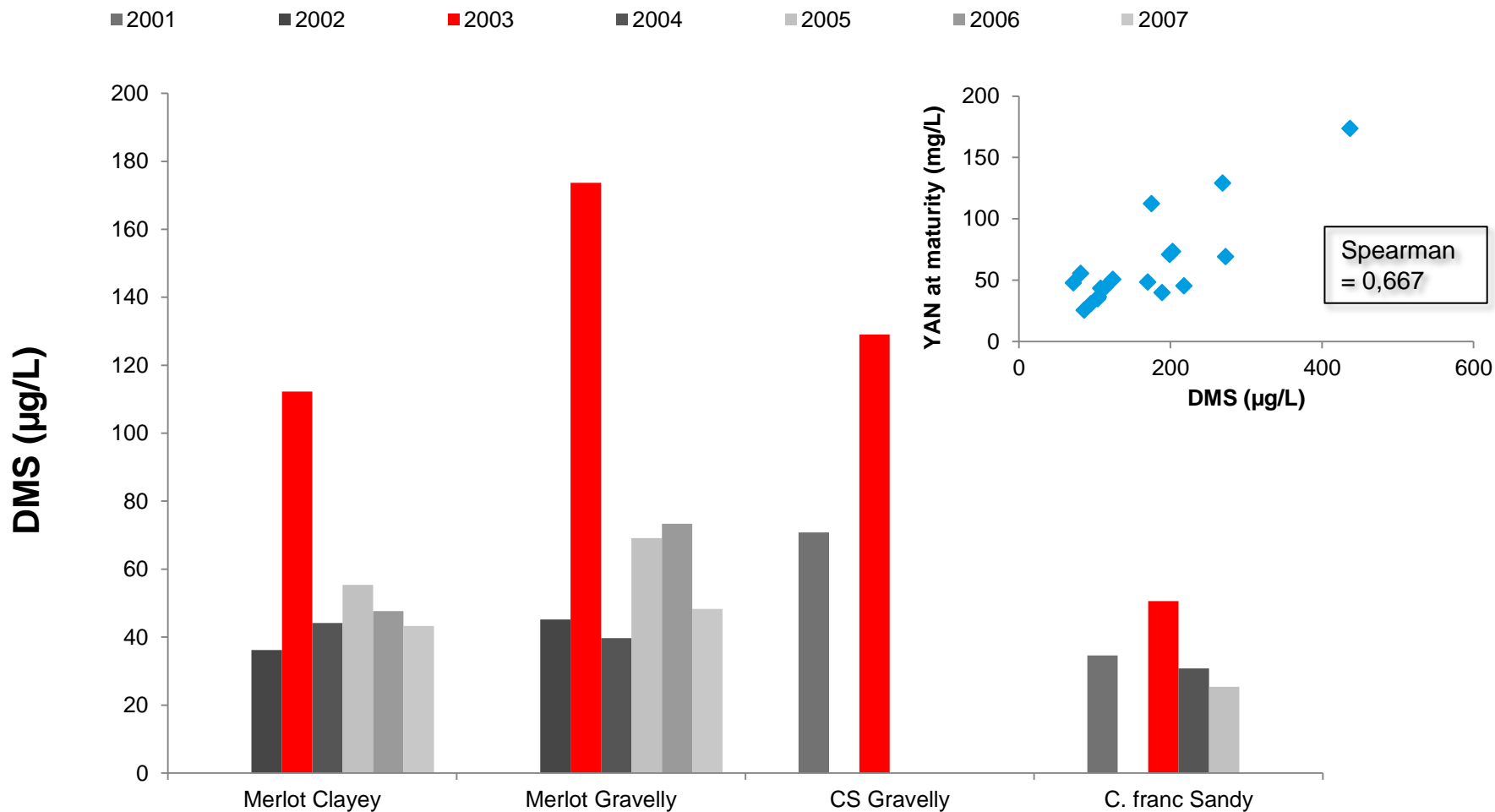
Dimethylsulfide



Effect of 2003 vintage on DMS levels



Effect of 2003 vintage on DMS levels



Bouquet ageing compounds



FRESH FRUITS



TOASTY



LIQUORICE

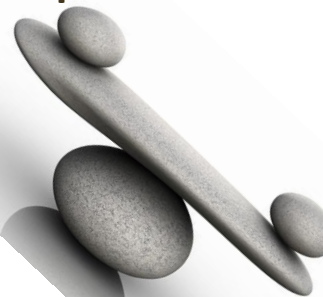
What is the real
impact of
heatwaves on
Bouquet
equilibrium?



TRUFFLE



SPICY



UNDERGROWTH

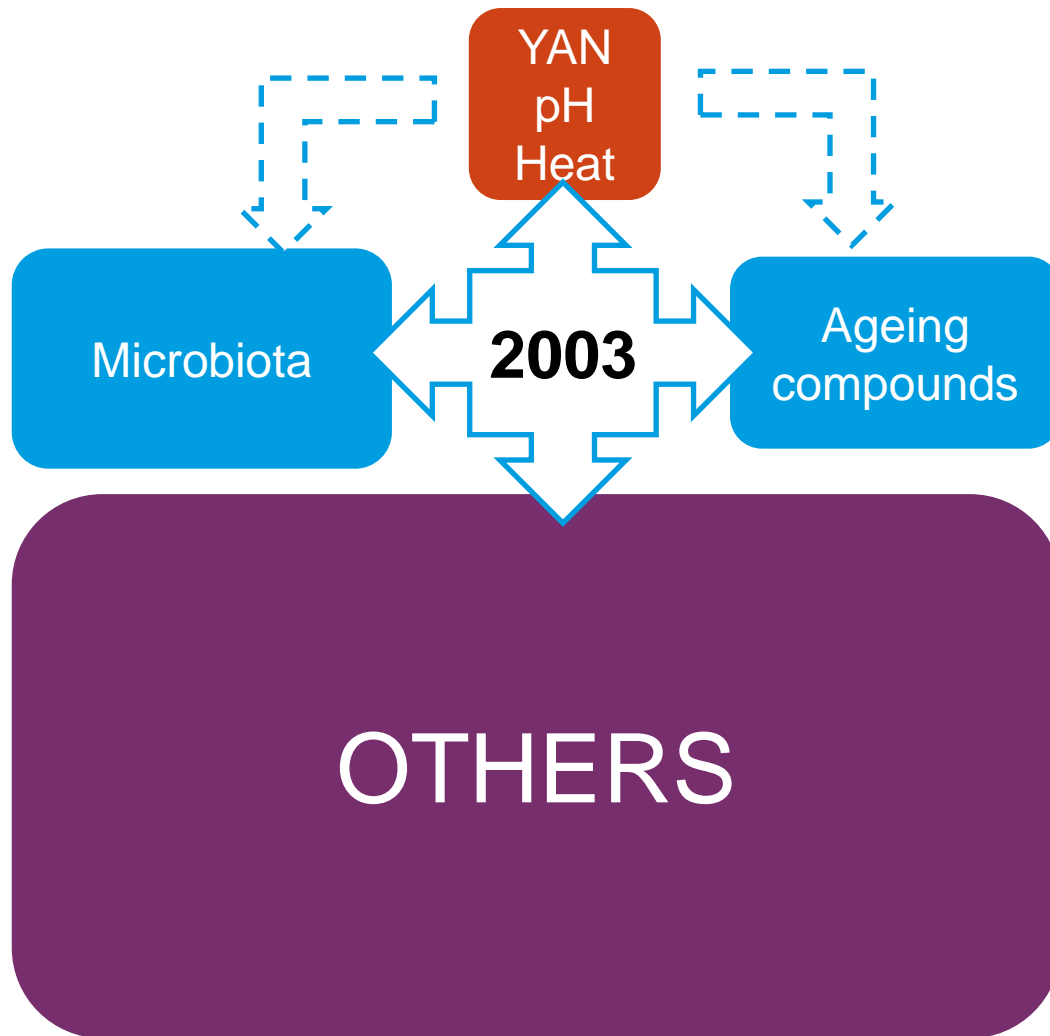


EMPYREUMATIC
NUANCES



MINT

Conclusions & Perspectives



“ Devant la nature, les gens ont souvent un sentiment d'impuissance. D'où la tentation d'intervenir, de vouloir agir sans savoir si c'est bien ou pas. Il faut de la retenue et de la modestie envers la vigne. En croyant bien faire on peut remettre en cause des équilibres. ”
P Pontalier

" In front of the nature, people often feels powerless. Exists a temptation to intervene, to act without knowing if it is good or not. The restraint and the modesty to the (vine) is necessary. **By believing to act well we can modify the balances.** “
P. Pontalier

université
de **BORDEAUX**



ISVV
INSTITUT DES SCIENCES
DE LA VIGNE ET DU VIN
BORDEAUX AQUITAINE

What about the 2003 vintage in Bordeaux ?

« *Du meilleur au plus mauvais! Le millésime 2003 est le plus hétérogène que Bordeaux ait connu de mémoire de vigneron* »

From the best to the worst ! 2003 is most heterogeneous vintage that Bordeaux knew in the memory of winegrowers

J. Dupont, Le Point, **13 may 2004**

The key criteria of heterogeneity

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The key criteria of heterogeneity

- Day of harvest
- Nature of soils

“ En 2003, le choix de la date des vendanges était particulièrement délicat et nécessitait la recherche d'un compromis. (...) Il fallait prendre en compte également la disparité de constitution des raisins d'un même cépage en fonction de la nature des sols. ”

In 2003, the choice of the date of the harvests was particularly delicate and required the search for a compromise (...) It was necessary to take into account also the disparity of **constitution of the grapes (...)** according to the **nature of soils.**

G. Guimberteau & P. Ribéreau-Gayon Le millésime 2003
www.bordeauxraisins.fr

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The key criteria of heterogeneity

- Day of harvest
- Nature of soils
- Age of vines in link to depth of roots

*“ En terme de connaissance du terroir, c’est une année exceptionnelle ”
(Henri Lurton, Château Brane Cantenac)*

" In term of knowledge of the terroir, it is an exceptional year"

What about the 2003 vintage in Bordeaux ?

« *Du meilleur au plus mauvais! Le millésime 2003 est le plus hétérogène que Bordeaux ait connu de mémoire de vigneron* »

From the best to the worst ! 2003 is most heterogeneous vintage that Bordeaux knew in the memory of winegrowers

J. Dupont, Le Point, **13 may 2004**

The key criteria of heterogeneity

- Day of harvest
- Nature of soils
- Age of vines in link to depth of roots
- Viticulture choices (leaf removal)

“ C’est une année extrêmement chaude mais pas extrêmement sèche. J’ai vu des raisins souffrir du chaud, je n’ai pas vu des raisins souffrir de la sécheresse (...) quand on lui a laissé ses feuilles.”
(Paul Pontalier, Château Margaux)

It is an extremely hot but not extremely dry year. I saw grapes suffering from the warmth, I did not see grapes suffering from the drought (...) when leaves have been kept

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[1] www.meteo-bordeaux.fr

