Professional training report at Chateau Chauvin, Saint-Emilion, Bordeaux Wine Region, France: Vintage 2020

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Statement of Honesty

All of the work in this dissertation is my own. I have written in my own words and have made the appropriate citations when necessary. I recognize and understand the severity of plagiarism, as it is academic dishonesty, and I promise that I have avoided it in all cases in the following professional training report.

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LIST OF ABBREVIATIONS

INAO…………………………………………………....Institut national des appellations d'origine

AOC…………………………………………………………...Appellation d'Origine Contrôlée

AOP…………………………………………………………...Appellation d'Origine Protégée

PAA……………………………………………………………………………..Peracetic Acid

MOG……………………………………………………………….Materials other than grapes

SO_2……………………………………………………………………………...Sulfur dioxide

CO_2…………………………………………………………………………....Carbon dioxide

H_2S………………………………………………………………………….....Hydrogen sulfide

YAN………………………………………………………………….Yeast assimilable nitrogen

MLF………………………………………………………………......Malolactic fermentation

AF……………………………………………………………………...Alcoholic fermentation

MOX………………………………………………………………………...micro-oxidation

DTR………………………………………………………………..Diurnal Temperature Range

ABSTRACT

For the purpose of this Master's thesis dissertation, an introduction and summary of the Bordeaux wine region was explained. Then, a critical review of Chateau Chauvin was done during the period of the harvest. All traditions and methods of this Chateau were respected for obtaining the high quality of their "Château Chauvin Grand Cru Classé" label. During the period of harvest, many processes were evaluated, including berry sampling, grape reception, sorting, crushing, yeast and nutrient addition, fermentation, pump-overs, pressing, malolactic fermentation, and ageing. These harvest operations were done in the Bordeaux wine region, in the appellation of Saint-Emilion. By conducting this critical review, there were some things identified that should be changed and improved upon in the future, such as increasing tank capacity, investing in new laboratory equipment, and more.

Key words: *Harvest, Fermentation, Saint Emilion, Ageing, Grand Cru Classe*

RESUMO

Para efeitos desta dissertação de dissertação de mestrado, foi explicada uma introdução e um resumo da região vinícola de Bordéus. Em seguida, uma revisão crítica do Chateau Chauvin foi feita durante o período da colheita. Todas as tradições e métodos deste Chateau foram respeitados para a obtenção da alta qualidade de seu rótulo "Château Chauvin Grand Cru Classé". Durante o período de colheita, muitos processos foram avaliados, incluindo amostragem de bagos, recepção de uvas, classificação, esmagamento, adição de fermento e nutrientes, fermentação, remontagem, prensagem, fermentação malolática e envelhecimento. Estas operações de colheita foram realizadas na região vinícola de Bordeaux, na denominação de Saint-Emilion. Ao conduzir essa revisão crítica, algumas coisas foram identificadas que deveriam ser alteradas e aprimoradas no futuro, como aumentar a capacidade do tanque, investir em novos equipamentos de laboratório e muito mais.

Palavras-chave: Colheita, Fermentação, Saint Emilion, Envelhecimento, Grand Cru Classe

RESUMO ALARGADO

Introdução:

Para esta dissertação de dissertação de mestrado concluí um estágio profissional no Chateau Chauvin, que é classificado como Grand Cru Classé Saint-Emilion. Saint-Emilion está localizado na parte oeste da França, na bela região vinícola de Bordeaux. Meu trabalho no Chateau Chauvin começou no dia 1º de setembro e terminou no dia 1º de dezembro de 2020. Nestes 3 meses no Chateau Chauvin, realizei muitas tarefas. Trabalhei na preparação da adega para a colheita, incluindo limpeza de tanques, bombas, mangueiras, piso e equipamentos de colheita. Com os meus colegas fui responsável pela recepção das uvas, controlo de qualidade, controlo da fermentação e obtenção dos requisitos sanitários na vindima. Após a vindima estive envolvido na preparação de vinhos para envelhecimento, o que incluiu a lotação dos vinhos, e preparação das pipas que serão utilizadas nesta vindima. Além disso, dou informações resumidas sobre a região vinícola de Bordeaux, sua história e os diferentes sistemas de classificação.

O objetivo desta dissertação de dissertação de mestrado profissional é acompanhar, explicar e comentar criticamente sobre cada etapa da produção de vinho tinto no Chateau Chauvin, Grand Cru Classe. Esta análise crítica pode ajudar a vinícola a melhorar suas práticas, bem como a me preparar para ser um enólogo crítico no futuro. Outro objetivo desta dissertação é tentar explicar o que faz com que os vinhos deste são tão únicos. É atribuído às diferentes práticas de viticultura e processo de vinificação, ou é o processo de envelhecimento ou o terroir único da denominação Saint-Emilion e de toda a região vinícola de Bordéus, ou no final é a combinação de todos esses fatores? Esta é uma questão que esta dissertação tentará responder.

Experiência Profissional:

A preparação da pré-colheita é principalmente orientada para a limpeza dos tanques, verificação e limpeza do equipamento de colheita, limpeza e preparação dos barris velhos para o vinho de prensa, e certificando-se de que havia suprimentos suficientes na adega (fermento, nutrientes e todos os outros vinhos aditivos). Após limpar e desinfetar todas as partes dos equipamentos, era muito importante verificar o funcionamento dos mesmos e passar graxa para que funcionassem perfeitamente. Outra parte importante da preparação da pré-colheita era preparar a sala de “armazenamento refrigerado”, porque

muitas vezes haveria dias em que mais uvas seriam colhidas do que poderiam ser processadas naquele dia. Portanto, essas uvas precisam ser mantidas frias durante a noite a cerca de 4 ° C no armazenamento refrigerado. Por último, a verificação contínua da maturidade das uvas nas diferentes parcelas é a ação pré-colheita mais importante. Todas as semanas, a equipe de vinificação coletava amostras de cada lote, provava as frutas e verificava os parâmetros químicos primários

Depois que a uva é processada e na cuba certa é hora dos processos de pré-fermentação. No Chateau Chauvin existem três ações diferentes antes de iniciar a fermentação. O primeiro é o saignee onde tiramos o mosto da cuba principal, clarifide e voltamos. Em segundo lugar está a maceração a frio, um processo de maceração a 5-8 ° C para extrair antocianinas. E a última é a inoculação de uma pequena quantidade de fermento comercial para produzir CO_2 o tempo todo e proteger nossa cuba sem adicionar gelo seco.

Em Chateau Chauvin todos os tonéis são inoculados com fermento comercial. Em um tanque usamos levedura não saccharomyces e em todos os outros usamos a cepa de levedura Saccharomyces. A fermentação começa 4-5 dias após o processamento da uva. A duração média da fermentação rondou os 15 dias. Durante a fermentação, realizamos alguns processos que incluem inoculação da levedura comercial, controle de temperatura, extração mecânica, fermentação malolática, oxigênio na fermentação, adição de nutrientes e saigne. O intervalo de temperatura durante a fermentação foi de 15-28 ° C (15 no início e meio ao final 28). Realizamos dois processos de extração mecânica distintos, como remontagem e delastagem. O oxigênio foi adicionado durante os processos de extração mecânica para aumentar o desenvolvimento das células de levedura e evitar aromas redutores.

Durante o período de pós fermentação (tempo após AF e antes da prensagem) realizamos algumas técnicas para aumentar a qualidade do nosso vinho. Para alterar o perfil aromático do nosso vinho utilizamos a técnica de micro oxidação durante alguns dias dependendo da evolução de cada dia. O processo mais importante do período de pós-fermentação foi a maceração na presença de maiores quantidades de etanol. O objetivo desta maceração era aumentar a extração de taninos e melhorar a estrutura do nosso vinho.

O envelhecimento no Chateau Chauvin todos os anos é feito em barricas de carvalho 100% francês de várias tanoarias de toda a França. As barricas que utilizámos eram todas de estilo Bordéus o que significa que a capacidade das barricas era de 225 L. Queremos evitar grande influência das barricas no vinho que estamos a envelhecer, pelo que utilizamos apenas barricas de tosta média e tosta média longa. Cerca de 50% dos nossos barris a cada ano são barris novos o que significa que os outros barris para envelhecimento são considerados barris velhos, nesta safra utilizamos 50% dos barris de 2020 e 50% dos barris de 2019. Os vinhos no Chateau Chauvin são envelhecidos de 12 a 14 meses em condições controladas. A temperatura dentro da sala de envelhecimento é em torno de 15 ° C e a umidade em torno de 70%.

Retiramos o vinho do barril a cada 3-4 meses, removemos menos do fundo e limpamos completamente o barril e o vinho de volta no barril. O processo de limpeza em uma vinícola é diferente para barris novos e velhos. Para barris novos que acabam de chegar, usamos o processo de enchimento com cerca de 20L de água, deixando-os para cima e olhando para baixo de cada lado por 3-4 horas, depois lavamos com água quente sob pressão por 2-3 minutos. Após essa secagem e queima uma pequena quantidade de enxofre dentro deles. Para barricas velhas usamos um programa de 2 min de água fria a alta pressão, 4 minutos de água quente a alta pressão e terminando com 2 min de água fria. Saindo para secar, se não formos usar no dia seguinte estamos queimando enxofre dentro do barril para preservá-los.

Conclusão

Nesta formação profissional no Chateau Chauvin, estive envolvido em todos os processos de vinificação, desde a degustação da uva para analisar o estágio de maturação até controlar a fermentação e colocar o vinho da vindima 2020 no envelhecimento. Neste processo aprendo sobre o terroir de St. Emilion, a história da propriedade e a tradição de todas as áreas. Pude aprender algumas coisas novas que nunca usei, mas ao mesmo tempo estava sempre apontando algumas coisas que eles não faziam corretamente. O Chateau Chauvin quer manter a qualidade dos seus vinhos, por isso estão planejando investir na ampliação da adega, que é muito boa. No futuro, eles devem investir em um laboratório de vinhos e equipamentos necessários para o funcionamento do laboratório. Depois de terminar minha experiência no Chateau Chauvin, posso dizer que não apenas o solo ou o clima de St.Emilion ou mesmo a influência humana tornam o vinho desta região excelente, o que torna o vinho da região de Bordeaux ótimo é a combinação de tudo isso, história da região de Bordeaux e França, tradição dos franceses, combinação única de solo e clima específico, castas autênticas, saber humano e amor incondicional pela vinha e pelo vinho e no final um pouco de sorte.

Introduction

For this Master’s thesis dissertation I completed a professional training at Chateau Chauvin, which is classified as a Saint-Emilion Grand Cru Classé. Saint-Emilion is located in the west part of France, in the beautiful Bordeaux wine region. My work at Chateau Chauvin started on the 1st of September, and finished on the 1st of December, 2020. In these 3 months at Chateau Chauvin, I performed many tasks. Initially, I worked on preparing the cellar for harvest. This included cleaning the tanks, pumps, hoses, floor, and harvest equipment to be ready for the incoming grapes. Then, alongside my colleagues, I was in charge of grape reception, quality control, fermentation control and meeting sanitary requirements during the harvest. After harvest I was involved in preparing wines for aging, which included the blending of wines, and preparation of the barrels that will be used during this vintage. I also had the opportunity to participate in numerous tastings with the winemakers and wine consultants at Chateau Chauvin, and to evaluate the developing wines or the finished wines. This allowed me to increase my tasting abilities and to practice tasting wines with other wine experts. Through all of these different tasks, I had the opportunity to increase my winemaking knowledge and experience, and better prepare myself for my future winemaking career. In my dissertation I will outline the different tasks I performed, and I will critically analyze these procedures and the overall winery operations at Chateau Chauvin.

In addition to this, I give summary information about the Bordeaux wine region, it’s history, and the different classification systems. The map below in Figure 1 shows the different appellations in the Bordeaux wine region, including the left and right bank regions. The Bordeaux classification system is one of the most complex in the world, and it is not entirely consistent throughout the entire region. Saint-Emilion is located on the right bank of the Bordeaux wine region, which is divided by the Dordogne river. There are some key differences between the left and right banks, which I will discuss in my dissertation. I also include detailed information about the climate, the soil types, the grape varieties planted, and the wine style that comes from the Bordeaux wine region. Bordeaux is a very famous region for producing wine, and it has a complex history. The Bordeaux winegrowing region is considered to be one of the wine capitals of the world, and it is often a benchmark for quality wines. I will attempt to explain why this is, and give an explanation about what makes these wines so special.

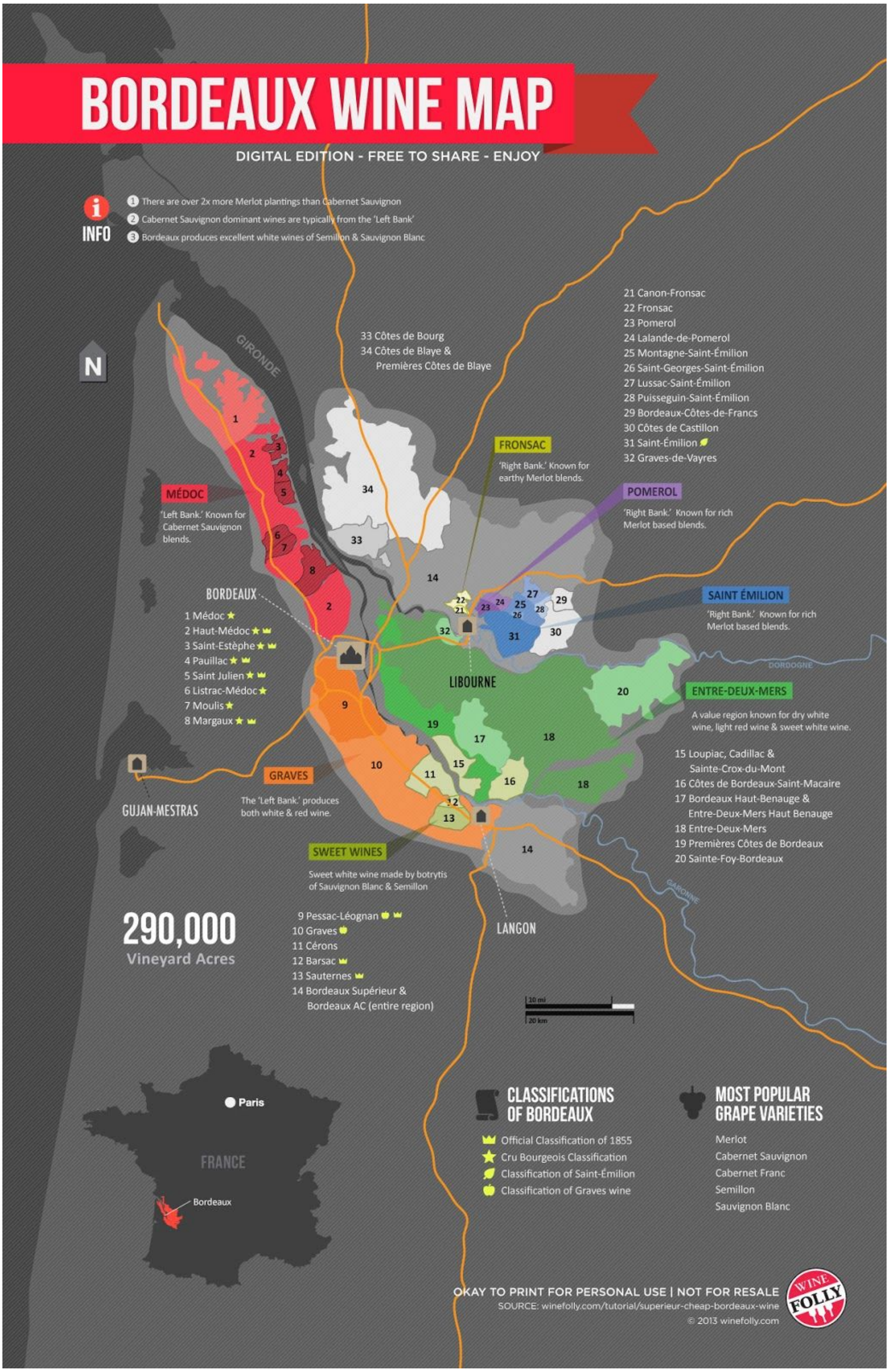

Figure 1

Map of Bordeaux Wine Region

From Wine Folly, 2013. https://winefolly.com/tips/superieur-cheap-bordeaux-wine/

Aims and Objectives

The purpose of this professional master's thesis dissertation is to follow, explain and critically comment on every step of red wine production at Chateau Chauvin, Grand Cru Classe. This critical analysis can help the winery improve upon their practices, as well as prepare myself to be a critical winemaker in the future. Another goal of this dissertation is to try to explain what makes wines from this are so unique. Is it attributed to the different viticulture practices and winemaking process, or is it the ageing process or the unique terroir of Saint-Emilion appellation and all of Bordeaux wine region, or in the end is combination of all these factors? This is a question that this dissertation will attempt to answer.

1.0 BORDEAUX WINE REGION

1.1 History of Bordeaux Wine Region

Even before Bordeaux became a vine-growing region, Bordeaux was a wine-trading center. In the beginning Bordeaux was an emporium, important primarily as a port (Coates, 2004). It probably was not until the third century AD that grapevines began to be widely planted in the locality. Ausonius, a poet, consul and tutor to Roman emperors, owned a vineyard in the area in the fourth century, and in one of his poems he refers not to the Dordogne but to the Garonne flowing gently at the bottom of his garden (Hugh, 1994). Expansion of the Bordeaux vineyard came in the 11th century, but it was most significant after the arrival of the English people after the marriage of the redoubtable Elenor of Aquitaine to Henry Plantagenet in 1152 (Interprofessional Council for Bordeaux Wine [CIVB], 2021). After that wedding, Bordeaux vineyards came under the jurisdiction of the English crown. During the 13-15th centuries AD, the vine replaced all other forms of agriculture in the area (CIVB, 2021). Hundreds of years after the English left, the leading export of France was wine, and England was its most important customer and Bordeaux's chief exporter (CIVB, 2021).

Even after the rising of the Dutch empire in the seventeenth century and the various economic treaties that discriminated against the French in favour of Portugal, the English remained the best customers of the finest Bordeaux wines (Hugh, 1994). In that time, the Netherlands became Bordeaux's major customer, but their requirements were more for cheap wines, and usually white wines (Coates, 2004).

1.2 Classification of Bordeaux Wine Region

The classification of the Bordeaux wine region comes in 1855 under Napoleon III, and now it serves as a measure of quality and prestige in the entire World. The principle of the Crus Classes ("classified growths") illustrates a typical terroir characteristic and dedicated human intervention over many years and generations to ensure the quality of its wines (Vins de Bordeaux, n.d.).

There are 5 classifications in Bordeaux wine region:

The 1855 Classification

Emperor Napoleon III asked each wine region to establish a classification in 1855 in Paris (Vins de Bordeaux, n.d.). The criteria had to do with the reputation of the wines and their prices. In this classification the only wines included were red wines from the Medoc, sweet white wines from the Sauternes and Barsac region, and one Graves red cru.

The categories:

- Red:

60 crus from the Médoc and 1 cru from Pessac-Léognan (Château Haut-Brion) based on 5 catégories: 5 Premiers Crus, 14 Deuxièmes Crus, 14 Troisièmes Crus, 10 Quatrièmes Crus, 19 Cinquièmes Crus (Vins de Bordeaux, n.d.).

- Sweet whites:

27 crus de la Sauternes and Barsac appellations: 1 Premier Cru Supérieur, 11 Premiers Crus, 15 Deuxièmes Crus (Vins de Bordeaux, n.d.).

The only change to this original classification was made in 1973 when Chateau Mouton Rothschild was promoted from the rank of Second Grand Cru Classe to the Premier Grand Cru Classe (Vins de Bordeaux, n.d.).

Graves Classification

On the request of the Syndicat de defense de l'appellation des Graves, the Institut national des appellations d'origine (INAO) established this classification (Vins de Bordeaux, n.d.). Criteria for this classification was by wine type (red or white) and municipality.

The categories:

In this classification we have 16 Crus, all of which belong to the Appellation d'Origine Controlee (AOC) Pessac-Leognan. There are 7 red, 3 white nad 6 both (red and white) (Vins de Bordeaux, n.d.).

Saint-Emilion Classification

In 1954, at the request of the Syndicat de défense de l'appellation Saint-Emilion, the institut national des appellations d'origine (INAO) began the classification of crus of Saint-Emilion appellation (Vins de Bordeaux, n.d.). INAO must revise this classification every ten years (Vins de Bordeaux, n.d.).

The categories according to the last classification in 2012 are: 64 Grands Crus Classes and 18 Premiers Grands Crus classés (Vins de Bordeaux, n.d.).

AOC Crus Bourgeois du Médoc Classification

Cru Bourgeois is a term that was established through sheer use, as its origin comes from the Middle Ages when the citizens (bourgeois), residents of the "burgh" of the Bordeaux, acquired the region's most significant lands and were subsequently granted this classification (Vins de Bordeaux, n.d.).

Every year around 250 properties, often family-owned, form the Alliance des Crus Bourgeois (Vins de Bordeaux, n.d.).

Crus Artisans Classification

"Crus Artisans" has existed for over 150 years. These small wineries often belonged to craftsmen, such as coopers and wheelwrights (Vins de Bordeaux, n.d.). The criteria to become a part of this classification is based on the quality and value of wines produced on small properties in one of the following Medoc applications: Medoc, Haut-Medoc, Listrac, Moulis, Margaux, Saint-Julien, Pauliac and Saint-Estephe (Vins de Bordeaux, n.d.).

On the main wine labels you can find the name "Cru Artisan."

1.3 Saint Emilion Classification

Back in 1955, one hundred years after the first Bordeaux wine Classification, the French National Institute of Appellations (INAO) made a classification of wines from Saint-Emilion Appellation (Les Vins de Saint-Emilion, n.d.). This was a response to the request from the union for the defence of the Saint-Emilion Grand Cru Appellation. According to the rules, this classification needs to be revised every ten years (Les Vins de Saint-Emilion, n.d.). The Saint-Emilion wine classification is one of the most modern and progressive classifications in the world of wine.The ten-year renewal inspires all the winegrowers in Saint-Emilion appellation to work hard and put more effort into their wine so that they might be classified in the future. From the day of the first classification until today, there have been a total of six classifications, with the last one being on the 6th of September, 2012 (Les Vins de Saint-Emilion, n.d.). The results of the 2012 classification, which are still in place today, have

82 classificated growth : 64 Grands Crus Classes and 18 Premiers Grands Crus Classes, of which 4 of them are category A (Les Vins de Saint-Emilion, n.d.).

In St. Emilion Grand Cru AOC we have three categories (Les Vins de Saint-Emilion, n.d.):

- Saint-Emilion Grand Cru Classé
- Saint-Emilion Premier Grand Cru Classé
- Saint-Emilion Premier Grand Cru Classé A

1.4 Château Chauvin

Chateau Chauvin is located north-west of the small town of Saint-Emilion, near the Pomerol appellation, and between Cheval-Blanc and the Butte de Rol. It is shown below in Figure 2. The story of Chateau Chauvin started in 1852 (Château Chauvin, n.d.). On auction in 1852, Chauvin's smallholding was divided into multiple properties, and Chauvin was bought by Jean Fourcaud-Laussac who in the same time bought a property that would become Chateau Cheval Blanc (Château Chauvin, n.d.).

Figure 2

Map of Chateau Chauvin and Saint-Emilion

From Chateau Chauvin, https://www.chateauchauvin.com/fr

Beginning with the first classification of Saint-Emilion wine region, Chauvin was classified and it will continue to be classified at each ten-year interval, including the most recent one in 2012. Six years ago, in 2014, Sylvie Cazes purchased Chateau Chauvin and gave it a new visual identity (Château Chauvin, n.d.). During some research into the property's archives, they found an old Chateau Chauvin label from 1929. They decided to use it as a working basis to create a future label. The old label contrasted with the current label is shown in Figure 3.

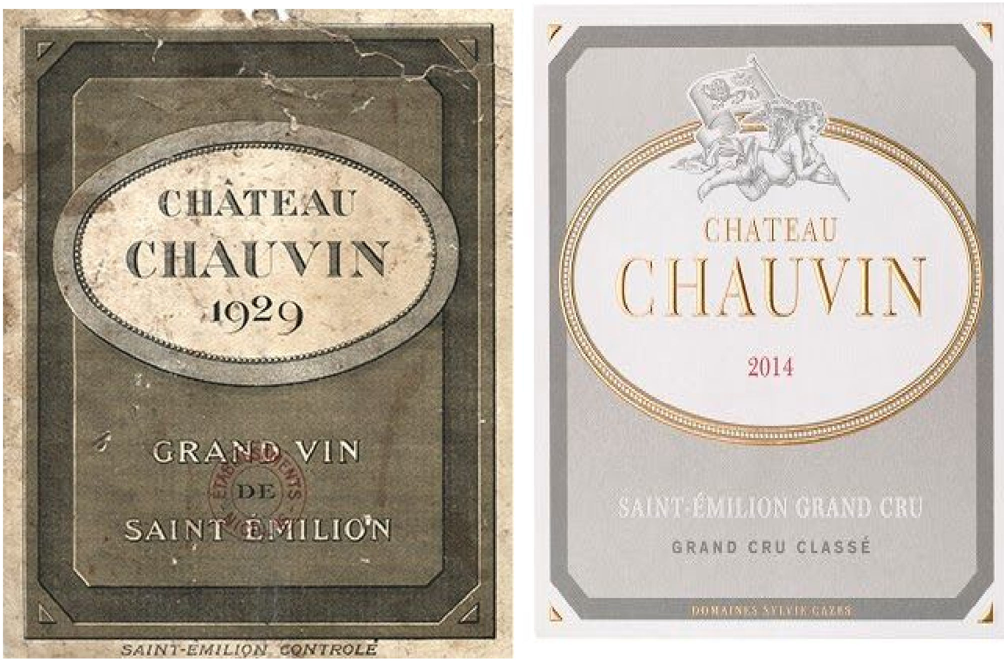

Figure 3

Comparison of the Old and New Chateau Chauvin Wine Labels

From Chateau Chauvin, https://www.chateauchauvin.com/fr

The soil in the vineyards at Chateau Chauvin is made up of sand and clay, along with iron filth similar to some Pomerol terroir (Château Chauvin, n.d.). The topsoil in the first one meter is primarily sand, with the clay lying beneath this. The vineyards of Chauvin are planted mostly with Merlot around 75%, Cabernet Franc 20% and Cabernet Sauvignon just 5% (Château Chauvin, n.d.). There are several different plots at Chauvin, and they can be seen in the map in Figure 4. The vineyards of Chateau Chauvin are planted on 15 hectares of land in St.Emilion area, with an average density of 6500 vines per hectare(Château Chauvin, n.d.). Production of Chateau Chauvin is around 40 hectoliters per hectare, depending on the year(Château Chauvin, n.d.).

Château Chauvin produces 2 wine labels. The first label is "Château Chauvin Grand Cru Classé" with annual production of 30000 to 50000 bottles (depending on the year), and the second label is "Folie de Chauvin Grand Cru" with annual production of 10000 to 20000 bottles(Château Chauvin, n.d.). The soil for the various plots plays a significant role in determining which grapes are destined for which label. A thorough map of the different vineyard plots at this property are shown below in Figure 4.

Figure 4

Map of Vineyard Plots at Chateau Chauvin

From Chateau Chauvin, https://www.chateauchauvin.com/fr

2. SAINT-EMILION:

2.1 Saint-Emilion Viticulture

Saint Emilion AOC covers 5500 ha of land under grapevines, and spreads over nine villages (Ministère de L' Agriculture et de l' Alimentation, 2017a). There are five grape varieties that are allowed to be cultivated in the Saint-Emilion AOC area: Merlot (with production of 60%), Cabernet Franc (with production of 30%), Cabernet Sauvignon (with production of 10%), and Malbec and Carmenere in a very small amount (Ministère de L' Agriculture et de l'Alimentation, 2017b). Merlot is the main variety of Saint-Emilion AOC, and it is usually planted using two different rootstocks 101-14 Millardet et de Grasset (101-14 MGt) and Riparia Gloire de Montpellier (Fayolle et al., 2019). Density size is usually around

6745 plants per hectare, where row spacing is around 1.45m and the inter-row space is covered with different cover crops such as *Avenia sativa*, *Secale cereal* and *Vicia sativa* (Fayolle et al., 2019).

2.2 Terroir of Saint-Emilion

An important factor in every vineyard in the world, and especially in Europe, is terroir. Terroir could be defined as an ecosystem in a certain time and place, that includes soil, climate, cultivar and the rootstock of the vine (Seguin, 1988). In this definition of terroir, we could add human influence in both the viticulture and enology aspects that affect the quality of the wine and its recognition (Seguin, 1986).

2.2.1 Soil

In Saint-Emilion Appellation d'Origine Protégée (AOP), the most dominant varieties are Merlot, Cabernet Franc and Cabernet Sauvignon (White, 2003). They are usually planted at around 6000 vine plants per hectare on soils with pH up to 8, which are considered to be acid to alkaline (White, 2003).
Soils in the Saint-Emilion lower lands are divided into three categories (van Leeuwen & Merouge, 1998):

- Soils that have gravel (50-70%) throughout their profile and they have very good drainage
- Soils with the first 1m of depth (topsoil) of sand but with a subsoil that has more silt and clay (around 20%)
- Soils with topsoil made of sandy to mix with sandy clay, but in the subsoil the amount of silt and clay becomes very high, around 90% (White, 2003).

All three soil categories above give a different style and quality of wine, and everything is linked to the water availability of the vines and the time of year of that availability. This is especially true in post-veraison time where the availability of water plays a key role in the formation and concentration of anthocyanins. Therefore it is very important for a soil with a higher percentage of clay to have good drainage, so as to avoid higher amounts of available water to the vine. The soils in Saint-Emilion with low water capacity (low percent clay) today and in the future will have a lot of problems to survive without irrigation as a consequence of global warming and climate change in Saint-Emilion, as can be seen throughout the world.

2.2.2 Climate

The altitude of Saint-Emilion is 83m above sea level (Climate-Data.org, n.d.). The climate in the Saint-Emilion area is warm and temperate. Throughout the whole year there is significant rainfall in Saint-Emilion. Even the driest months have plenty of rainfall. The average annual temperature in Saint-Emilion is 12.3°C, with about 900mm of precipitation in a year (Climate-Data.org, n.d.). The driest month is usually July, with an average of 52 mm of rain, and most of the rain falls in December, with an average of 100mm in that month (Climate-Data.org, n.d.). The warmest month of the year is August with an average temperature of 19.8°C, and the coldest month is January with an average monthly temperature of 4.9°C (Climate-Data.org, n.d.). This average annual climatic data can be summarized in Figure 5.

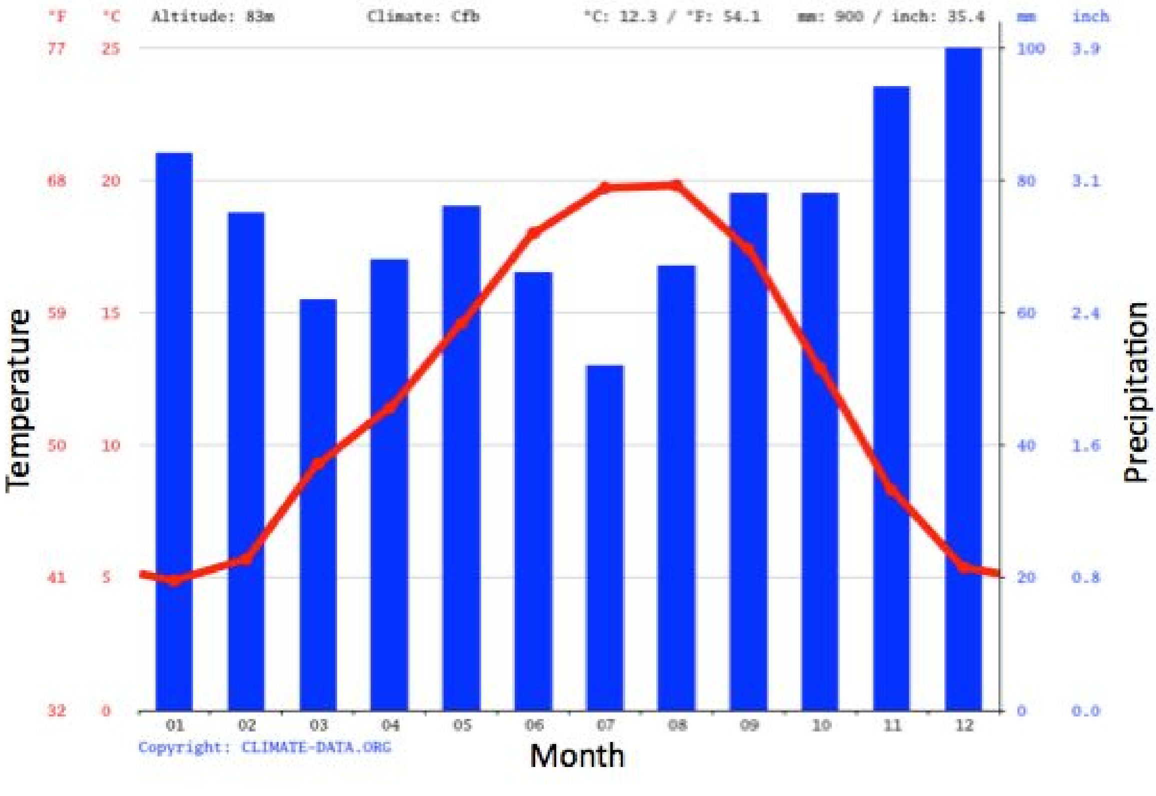

Figure 5

Average Temperature and Precipitation per Month for Saint-Emilion

From Climate-Data.org, Saint-Emilion Climate (France)

Note: The bars represent the average amount of precipitation (in mm or inches) by month (01 being January), and the red line represents the average monthly temperature (in ℃ or ℉)

The most ranked Bordeaux vintages are associated with higher heat accumulation in the growing season, with high insolation levels, high pressure and very low amount of precipitation over the growing season (Baccioco et al., 2014). Water conditions during pre-harvest veraison and ripening time are very important for future wine quality. The climate characteristics needed for the best vintages in Bordeaux are higher pressure, lack of rain precipitation, and days with large diurnal temperature ranges (DTRs) during pre-harvest time (Baccioco et al., 2014).

2.3 Varieties

The dominant grapes varieties that are produced in the Saint-Emilion region are Merlot and Cabernet Franc, but they are not the only ones that are produced. Several cultivars are permitted in the region. The next most produced grape varieties in Saint-Emilion are Cabernet Sauvignon followed by Malbec. Due to climate changes and temperature increases in the Saint-Emilion area, more wine growers have started to plant Cabernet Franc vines, as they mature a bit later than Merlot vines. This is likely to shift the overall make-up and style of future Saint-Emilion wines.

2.3.1 Merlot

The leading grape variety of the Saint-Emilion and Pomerol area is Merlot. Scientists from the research center at the University of California, Davis discovered that Merlot is an offspring of Cabernet Franc, and a sibling of Malbec, Cabernet Sauvignon and Carmenere (Boursiquot et al., 2009). The mother of Merlot was discovered in the late 2000s in Saint-Suliac in Brittany, and the variety was known as Madeleina or Raisin de La Madeleine (Robinson et al., 2012). Merlot is an early maturing variety, which has an early bud break that could be a problem because of spring frost. It is a vigorous and productive variety. Merlot is very sensitive to downy mildew and botrytis which can give big problems during the time of the harvest if there is rain in that period (Coates, 2004). Clusters of Merlot are cylindrical but fairly loose, berries are round but bigger and less coloured, and the skin is not that thick (Coates, 2004.). The colour of the Merlot berries is darker-blue and with a thinner skin (Robinson, 1986). After vinification, wines made from Merlot usually have a couple of degrees more alcohol than Cabernets, but they are less in acid, tannins and muscle. Merlot wines are soft and more aromatic, and they have the ability to mature faster (Coates, 2004). Merlot is the most planted wine-grape variety in the world, even though Cabernet Sauvignon is the most famous (Robinson et al., 2012).

2.3.2 Cabernet Franc

Cabernet Franc is one of the main wine grape varieties in the Bordeaux wine region. It is often used in a blend with a Cabernet Sauvignon and Merlot to form a "Bordeaux blend," but sometimes it is vinified alone, as is done in the Loire Valley. Cabernet Franc most likely has its origin in the south-west part of France, and this grape variety is used just for wine production (Plant Grape, 2020). Cabernet Franc is similar to Cabernet Sauvignon but it ripens around one week earlier (Robinson, 2006). Cabernet Franc is a medium vigorous variety and must be trained with moderate long pruning or short pruning depending on the climate where it is grown (Plant Grape, 2020). Cabernet Franc gives the best results on clay-limestone soils, but some good results could be achieved even on the sandy soils if there is not too much water stress (Plant Grape, 2020). Bunches of Cabernet Franc are medium sized and the berries are small with a darker blue colour and thin skin (Robinson, 2006). Cabernet Franc produces wines with quality aromas and good ageing potential (Plant Grape, 2020). As a wine, Cabernet Franc is more light than its son Cabernet Sauvignon, with a pale red colour and peppery aromas (Robinson et al., 2012)

2.3.3 Cabernet Sauvignon

Cabernet Sauvignon is one of the most popular wine grape varieties in the world and it is planted all over the wine growing countries in the world. Cabernet Sauvignon is the progeny of the two other wine varieties, Cabernet Franc and Sauvignon Blanc, and this cross between the two varieties probably happened in the 17th century (Clarke, 2001). Cabernet Sauvignon is a grape variety used for wine production, and it originally comes from the Bordeaux wine region (Plant Grape, 2020). Cabernet Sauvignon usually has a late budburst, and it is a very vigorous variety with long branches (Plant Grape, 2020). Climate plays a very important role in the production of Cabernet Sauvignon, because of its late bud burst and later ripening than other wine varieties. Cabernet Sauvignon is very sensitive to wood disease and powdery mildew (Plant Grape, 2020). The best grapes of this variety are grown on gravelly and well drained soils with good acidity that are well exposed (Plant Grape, 2020). The bunches are small with small round berries (Plant Grape, 2020). Wines made from this variety give good tannic structure and deep color when the grapes reach good maturity. If the grapes reach proper maturity, they can also give pleasant and complex aromas (Plant Grape, 2020). The flavour of Cabernet Sauvignon is closely connected to the viticulture practices and climatic influence. This is most notably seen by the flavour of green bell pepper caused by pyrazines from unripe grapes (Clarke, 2001). Wines from Cabernet Sauvignon are very good for ageing in wood (Plant Grape, 2020). The benefits of ageing

Cabernet Sauvignon in oak barrels is that it can help to soften the tannins, which Cabernet Sauvignon has in a high amount, and this can help to impart some wood characteristics such as vanilla and tobacco (Clarke, 2001).

3. PROFESSIONAL TRAINING REPORT AT CHATEAU CHAUVIN

3.1 Introduction

I started my professional training at Chateau Chauvin at the beginning of September, and immediately started preparing the cellar for harvest. Preparation of the winery for the new vintage, along with maturity control in the vineyard, are the most important tasks during the pre-harvest period. Harvest at Chateau Chauvin started at the end of September, and due to some rainy days, it lasted for 10 days. We harvested approximately 15 hectares with an average of 40hl of production per hectare. Harvest was done manually with 50 pickers, every day from 8:00 am until 16:00 in the afternoon. After finishing grape reception, we concentrated on polyphenol extraction by controlling the temperature, performing mechanical techniques, adding enzymes and other activities. Depending on the plot, we would start pressing the wines after 20-30 days of skin contact. Pressed wine was separated from the free run and was classified into three categories according to its quality.

3.2 Pre-Harvest Preparation

Pre-Harvest preparation is mostly oriented to the cleaning of tanks, checking and cleaning of harvest equipment, cleaning and preparing the old barrels for the press wine, and making sure that there were enough supplies in the cellar (yeast, nutrients and all other wine additions). After cleaning and disinfecting every part of the equipment, it was very important to check the function of them and put grease on them so they could work smoothly. Another important part of the pre-harvest preparation was to prepare the “cold storage” room, because often there would be days where more grapes would be harvested than could be processed for that day. Therefore those grapes needed to be kept cold overnight at around 4°C in the cold storage. Lastly, continuously checking the maturity of the grapes in the different plots is the most important pre-harvest action. Every week the winemaking team would take samples of each plot, taste the berries, and check primary chemistry parameters.

3.3 Harvest Date

The most important decision in winemaking is the date of the harvest. With choosing the date of the harvest, we are choosing the style of our wine in the future. To choose the right date we should use chemical parameters such as pH, sugar content (measured in °Brix), malic acid etc., and most importantly we should taste the berries and determine the right aromatic profile of our future wine. The date of the harvest is decided usually by the winemaker using some of this criteria (Suklje et al., 2017):

- Measuring total soluble solids, which are expressed in the Brix. This is the most commonly used measurement to determine the maturity of the berries in the vineyard (Suklje et al., 2017)
- Deciding by berry tasting. This is based on the subjective approach of the taster, who bases his decision on his experience and training (Suklje et al., 2017).

At Chateau Chauvin we used 2 methods to help us decide the optimal date of the harvest. We took samples of grape berries from each plot, and measured the density and pH. The second method was tasting the berries with the winemaker and wine consultant together with the viticulture and winemaking department. The first plot that was harvested was the young plot of Merlot, after that the decisions of when to harvest were under the influence of the weather. The plot of Cabernet Sauvignon was harvested before its ideal time, because it was pouring for a week and we did not want to wait any longer and risk having quality issues with the fruit. The Cabernet Sauvignon at Chateau Chauvin is more experimental and it does not make up a large percentage of the blend, and therefore harvesting it while it was still a bit green was not so detrimental to the overall vintage.

3.4 Cleaning and Sanitation

Cleaning is a process that involves the physical removal of inorganic and organic soils, while sanitization is the process of inactivation or killing microbes (Marx, n.d.). Both of these processes are preventive ones. Every winery has a high microbial load, especially in the time of the harvest. Microorganisms require a vector so they can spread through the winery, and vectors can be winemaking tools and equipment that are used throughout the winery (Marx, n.d.). In the wine industry there are several different cleaning choices, such as manual (with hoses, buckets, brushes) or semi-automatic, with a spray ball (Marx, n.d.). At Chateau Chauvin we used a semi-automatic system with sprinkles on the top of the vat, which are connected with our pump and cleaning product. The product that we used in our

Chateau was Potassium percarbonate-based, which is in the group of non-caustic alkaline products. The contact time of our cleaning product that was mixed with water was around 20 minutes, with a pump speed of 60hl/h. After cleaning we used water to rinse the vat and remove all of the cleaning product residue. Then the next step was to do proper sanitizing of the vat, which we do with using peracetic acid (PAA). Peracetic acid is effective at low temperatures and it breaks down to acetic acid, water and oxygen (Marx, n.d.). The last step after using the PAA was to do the final water rinse to remove sanitizer residue. It is important to thoroughly rinse between each step so that there is no residual product that can enter into the wine.

3.5 Harvest

Harvest Organization

Grape reception at Chateau Chauvin was optimized to produce very high quality wines. This started in the vineyard, where more than 50 pickers were harvesting grapes from early morning. These grapes were delivered to the winery by the truckload in just 5-10 minutes. With that fast transition from the vineyard to the winery, we avoided losing aromas, oxidation and the start of unwanted fermentation in the boxes. For the harvest we used 10kg boxes to avoid crushing the grapes in the boxes and releasing juice. Grapes were harvested early in the morning so that they came to the winery at a cooler temperature, which helped with aroma preservation. Harvest in Saint-Emilion is done at the end of September, so most often the temperature is a bit cooler anyways. Vats are set up at 5°C so we can keep grapes cold and we can have a cold maceration. When grapes arrived at the winery, there were two things that could happen: grapes would either go on to processing, or if the processing line was full they would go to the “cooling storage” at a temperature of 4°C, where they would wait until the winery could process them. To ensure the quality of the future wine, Chateau Chauvin sorts their grapes 5 times, using different methods.

- Shaking Table for Bunches

Grape bunches were put on the shaking table which was set at 2m high, so afterwards the bunches could fall into the destemming machine. By using the shaking table for bunches we ensure that bunches will fall into the destaming machine equally, not too fast and not too slow. If it is going too fast, we will have trouble in other parts of the grape reception. The shaking table is also able to take out some of the materials other than grape (MOG).

- Destemming and Sorting of the Berries by Size

After the shaking table, bunches went into the destemmer, where the berries were gently separated from the stems. The stems are pushed out , but the berries move on to the roller sorting table where sorting of berries and green waste disposal (stems, leaves, leaf stems, branches, foregin bodies. etc.) occurs. This sorts the berries by their size. We can optimize this sorting by adjusting the size of the screen and the design of the rollers.

- Sorting by Density

After separating the berries from the stems, and sorting by the size of the berries using the roller sorting table, grapes went on to a new sorting, which was sorting by density. This sorting differentiates the berries by their sugar content. To do this, we would make a pool of sugar water which was adjusted for depending on the preferred density. Grapes that are less dense than the sugar water solution (due to lack of ripeness, and therefore a lower sugar content) will float on the top of the water-sugar solution. Berries that are more dense than the set sugar water solution (therefore containing a higher level of sugars due to increased ripeness) will sink to the bottom, and these berries will be used for the wine production.

- Shaking Table for Berries

This shaking table has a couple of purposes in the overall sorting system. One of these purposes is to try to shake as much remaining water from the berries as possible. The second purpose is to eliminate small unripe green berries that are still attached to ripe berries. Lastly, its purpose is to evenly spread berries onto the sorting table so that they can be sorted by hand.

- Sorting by Hand

The final part of this sorting process is the sorting table by hand. This is a wide moving table of 4-5 meters long and 1 meter wide. After the shaking table, berries come onto the sorting table, where 4 people work to remove the last pieces of unripe grapes, MOG and everything else that we do not want in our future wine.

- Crushing

When the grapes pass all the different sorting steps to ensure high quality selection, it is time for gentle crushing. Chateau Chauvin crushed grapes very lightly, just to break the skin. We wanted to avoid stronger crushing because we assumed that some of the seeds are still green, and we did not want these green tannins extracted from the seeds and entering inside of our wine. At the time of crushing we would adjust automatically the addition of sulfur dioxide (SO_2), to an addition of 5g/hl. This is a low concentration, but it is sufficient to protect the wine while not disabling our yeasts in the future. After the vat is full (70-80% of the capacity of the vat) we would measure the density of the grape juice and its temperature.

4. PRE-FERMENTATION PROCESS

After the grapes are processed and in the correct tank, it is time for the pre-fermentation processes. At Chateau Chauvin there are three different actions before starting fermentation. The first one is saignee, where we take juice from the main vat, clarify it, and return it to its original vat. The second action is cold maceration, which is a process of maceration at 5-8°C to extract anthocyanins. The final action is the inoculation of the must with a small amount of commercial yeast to produce carbon dioxide (CO_2) all the time and to protect the vat without the need for adding dry ice.

4.1 Saignee

The process of "bleeding," or in French "saignee," is the process of taking out grape juice in order to concentrate the main vat. Usually winemakers take out 1-10% of juice from a vat and use it for rose wine. However, at Chateau Chauvin we would take all of the available juice from the vat and move it to another vat for clarification. We would use "Greenfine Must" from the company "Lamothe-Abiet" to aid in this clarification. Greenfine Must is a clarification agent, which prevents must oxidation (Lamothe-Abiet, 2012). The dosage that we would use was 20g/hl, which we would dilute in 10 times more water for good homogenization. In addition to the greenfine must we would add enzymes, in doses of 2g/hl. The goal of this clarification of the "Saignee" juice was to have a clean must, better colour stability, and clarification of oxidative phenolic compounds. After a clarification period of around 12-24 hours at a temperature of 10°C (to avoid the start of fermentation), we would rack the clean juice from heavy lees. We would then add the clean juice into the main vat, to continue the process of cold maceration.

4.2 Cold Maceration

Cold maceration would start immediately after the grapes arrived in the vat. The temperature of the vat was set to 4°C. The arriving grapes were already at a cold temperature (morning harvest or from cold storage from the day before) so we did not have a problem with achieving a goal temperature of around 7-8°C. The length of the cold maceration at Chateau Chauvin was around 4-5 days, and the goal of this cold maceration for this winery was mainly colour extraction. The process of the pre-fermentation cold maceration could influence the amount of the anthocyanins in the wine. Some studies have shown that after around 7 days of maceration at a cold temperature like 10°C , wines at the end of fermentation had more structure and unique aroma (Cejudo-Bastante et.al., 2014). By using a microscope you could see that the berry cell structure was broken by the cold temperature conditions, the cytoplasm leaked due ruptured cell walls and cold maceration was a good process to increase the amount of pigment substances from the grape (Guodong et al., 2017).

4.3 Inoculation

On the first day of cold maceration, we would inoculate the must with a small amount of commercial yeast. Even though the temperature was around 8°C, we would inoculate with yeast so that the species could start to produce small amounts of the CO_2 which would protect our juice during the period of cold maceration. This avoided the need for other protecting agents such as dry ice. For Inoculation we used 2 different yeast,first one was *Saccharomyces yeast "*Excellence XR", and second *non-Saccharomyces* yeast Concerto which is a strain of *Kluyveromyces thermotolerans.*

5. FERMENTATION

At Château Chauvin, all of the vats are inoculated with commercial yeast. This allows for a greater control over the fermentation process compared to a spontaneous fermentation, with more predictable results based on the yeast strain used. In just one vat we used non-*Saccharomyces* yeast, but on all of the others we used *Saccharomyces* yeast strains. Fermentation started 4-5 days after grappe processing. The average duration of fermentation was around 15 days total. During the fermentation we performed a couple of processes which included inoculation of the must with commercial yeast, temperature control, mechanical extraction, malolactic fermentation, oxygenation during fermentation, nutrient additions, and saignee. The temperature range during fermentation was 15-28°C (15°C at the start, and 28°C during the middle part of fermentation through to the end). We performed two different mechanical extraction processes, which were pump-overs and delastage. Oxygen was added during the mechanical extraction processes to increase the development of yeast cells and to avoid reductive aromas.

5.1 Inoculation

Yeast inoculation was done at 10g/hl to each vat using the commercial yeast species. We used two different types of yeast at Chateau Chauvin. One of them was a *Saccharomyces cerevisiae* yeast strain but the other was a non-*Saccharomyces* yeast strain called "Concerto." We used Concerto on just one vat, to increase its aroma complexity, body, and structure. Concerto is tolerant up to 10% volume of alcohol (Chr. Hansen, 2011). Therefore, after two thirds of the alcoholic fermentation was completed, we would add a *Saccharomyces* yeast strain to finish off the fermentation. *Saccharomyces* yeasts have a much higher alcohol tolerance and are the best yeast for performing alcoholic fermentation to dryness. Concerto was used on the vat which consisted of grapes from a young vineyard (4 years old), so we tried to extract the best of it. The main yeast that we used was called "Excellence XR." This selected yeast strain is used for the production of high quality red wine

(Lamothe-Abiet, 2007). Excellence XR produces wines with a lot of structure, richness and volume in the mouth (Lamothe-Abiet, 2007). This yeast has high polysaccharide and glycerol production, and low production of volatile acidity (Lamothe-Abiet, 2007). This yeast has good resistance to increasing alcohol content, up to 15% volume of alcohol (Lamothe-Abiet, 2007). The best results of this yeast are given on varieties such as Merlot, Cabernet Sauvignon, Cabernet Franc, Malbec, Syrah and Grenache (Lamothe-Abiet, 2007). The recommended dosage is 20g/hl, but at Chateau Chauvin we would add this in two doses, each of 10g/hl (Lamothe-Abiet, 2007).

To inoculate with this yeast, we would prepare 10 times more water at a temperature between 35-40°C (Lamothe-Abiet, 2007). To the yeast we would add a nutrient mix (which consist of nitrogen, vitamins and minerals) to promote yeast growth, viability and long term survival. We left this for approximately 20 minutes to rise and homogenize. After 20 minutes we would add the must (3 times more than the solution of yeast and water) in order to avoid thermal shock to the yeast. After adding the must we waited for 10 minutes and then we added the yeast solution to the vat and homogenised the must by pumping-over. The nutrient mix that we added to the yeast during inoculation was "Oenostim." Oenostim is the activator consisting of a combination of vitamins, minerals, fatty acids and sterols (Lamothe-Abiet, 2010). It is used at the beginning, when the active dry yeast is being rehydrated in the water (Lamothe-Abiet, 2010). Oenostim helps to produce a lower amount of volatile acidity and it can improve overall aroma production (Lamothe-Abiet, 2010).

The second yeast that we used in the winery was non-*Saccharomyces cerevisiae* strain. "Concerto is a pure strain of *Kluyveromyces thermotolerans*, which ensures a safe start to alcoholic fermentation" (Chr. Hansen, 2011). This yeast Concerto usually gives a wine with soft palate and round mouthfeel (Chr. Hansen, 2011). We used this yeast on the juice from the plot of Merlot which has in the past given a low body to the wine. Strains of *Kluyveromyces thermotolerans* are not able to finish fermentation, so in the last third of the alcoholic fermentation we added XR yeast (*Saccharomyces cerevisiae* strain) to finish the fermentation, and to overcome the shortcomings of the *Kluyveromyces thermotolerans* yeast (Chr. Hansen, 2011). Concerto produces very low amounts of SO_2 and dihydrogen sulfide (H_2S) (Chr. Hansen, 2011). Concerto comes in a vacuum sealed package of active dry yeast. Before using it we need to re-hydrate and activate the yeast before adding it to the must (Chr. Hansen, 2011). To re-hydrate Concerto we needed to prepare 10 times more water than the yeast at a temperature of around 20-25°C (Chr. Hansen, 2011). After rehydrating and activating the Concerto, we needed to add grape must so as to avoid some thermal shock (Chr. Hansen, 2011).

5.2 Temperature Control

Temperature control is very important for the extraction of tannins and for the quality of the aromas in the wine. Therefore we need to be careful with temperature. Starting with a pre-fermentation temperature of 8-9°C, we began to increase the temperature every day. The temperature at the start of the alcoholic fermentation was 15°C, and by the end it had reached 28°C. Products of alcoholic fermentation are ethyl alcohol, carbon dioxide, and last but not least alcohol. The amount of heat produced changes throughout the fermentation. Higher temperature of the fermenting must will have some effects on the quality of the future wine. Increased temperature of the fermenting must will influence the speed of fermentation, basically by increasing the speed of the fermentation. A faster fermentation could damage the wine for several reasons. With too high of a temperature we could damage or even kill the yeast, which could lead to a slower overall fermentation (sluggish) or even a stopped fermentation process(Morata, 2019). Some good aspects of a higher fermentation temperature are higher tannin and flavanol extraction, and the colour of the wine becomes more concentrated and intense. On the other hand, according to Harbertson et al. (2002), with higher temperature, anthocyanins form polymeric pigments and their concentration decreases. Without extraction of anthocyanins, but with higher extraction of tannins and flavanols (which are bitter and astringent), wines that ferment at a higher temperature could be unbalanced. We can control the temperature inside of the vat with cooling jackets on the vat, and today, every vat has a cooling jacket installed around the tank. Most of the winemakers today use this solution to control the temperature in their vats. During fermentation, however, the temperature inside the vat could be much more different than the temperature that is shown on our control devices. If we have bigger vats, that temperature will be less homogeneous. In the fermentation phase where production of the heat is the highest, temperature differences could be around 10°C, and could lead to uncontrolled processes. In different areas of the vat, the temperature could be very different. For example the highest temperature would be inside of the pomace cap. To homogenize the temperature inside of the vat, we performed a pump-over at least two times per day .

5.3 Extraction Process

In red winemaking the most important component is extraction, which gives the style to our wine. There are a couple types of extraction, and depending on the grape quality and the style of the desired wine, we chose one of them. Depending on the level of extraction desired, we would choose the duration of the operation and speed of the pump. One of the products of alcoholic fermentation is carbon dioxide, which forms a rising flow of gas bubbles. These gas bubbles carry the solids from the grape such as the grape skins to the top of the tank, and that is what makes up the pomace cap(Guerrini et al., 2016). It is in this cap that the tannins and anthocyanins exist(Guerrini et al., 2016). To manage this pomace cap we have several different methods available to us. “The most common methods are physical (duration of maceration, temperature control, carbon dioxide pressure), chemical (addition of sulfur dioxide), biochemical (maceration enzymes), and mechanical (pump-overs, delestage and punch downs)” (Guerrini et al., 2016). At Chateau Chauvin we used pump-overs everyday for our cap management, but depending on the extraction level, we would occasionally use the process of delestage. The process of the pump-over starts with drawing juice from the bottom of the vat and then pumping this juice on top of the vat where it is sprayed all over the pomace cap. There are two ways of doing pump-over. The first one is without the presence of oxygen (non-aerated conditions) and the second is with the presence of oxygen (aerated conditions). There are several benefits of performing pump-overs. The most important ones are promoting colour and flavour extraction, extraction of tannins and homogenization of sugar, yeast and temperature concentrations (Guerrini et al., 2016).

For a higher extraction of phenols we would perform a technique called “rack and return,” or delestage. To perform this technique, we would rack all of the juice from the fermenting vat into the empty one, and we would leave the grape skins in the fermenting vat just by themselves for a couple of hours. According to Morata (2019), when the juice is removed, the pomace cap falls down and comes into contact with the bottom of the vat, producing an increase in pressure which leads to the gentle extraction. After leaving the grape skins by themself for a couple of hours, it is time to bring the juice back to the original vat. From the top of the vat we drop the juice on the skin cap, which has an extraction effect, because of high juice pressure. One of the most important results of this technique is the breaking down of the skin cap, which helps with the diffusion of pigments and tannins into the juice. Other positive aspects of this technique are the aeration and homogenization of the juice and skins. At Chateau Chauvin we would perform this technique 1-2 times for each vat, depending on their extraction progress. The effect that we want to achieve with this technique is a high extraction of the phenolic compounds, but in the smoother form, while increasing the structure and body of our future wine. Figure 6, which is taken from Morata (2019), shows the right “window” for performing technique of rack and return, and results on the extraction of tannins. The right window is 4 or 5 days after the start of fermentation till 10 or 11 days after starting fermentation.

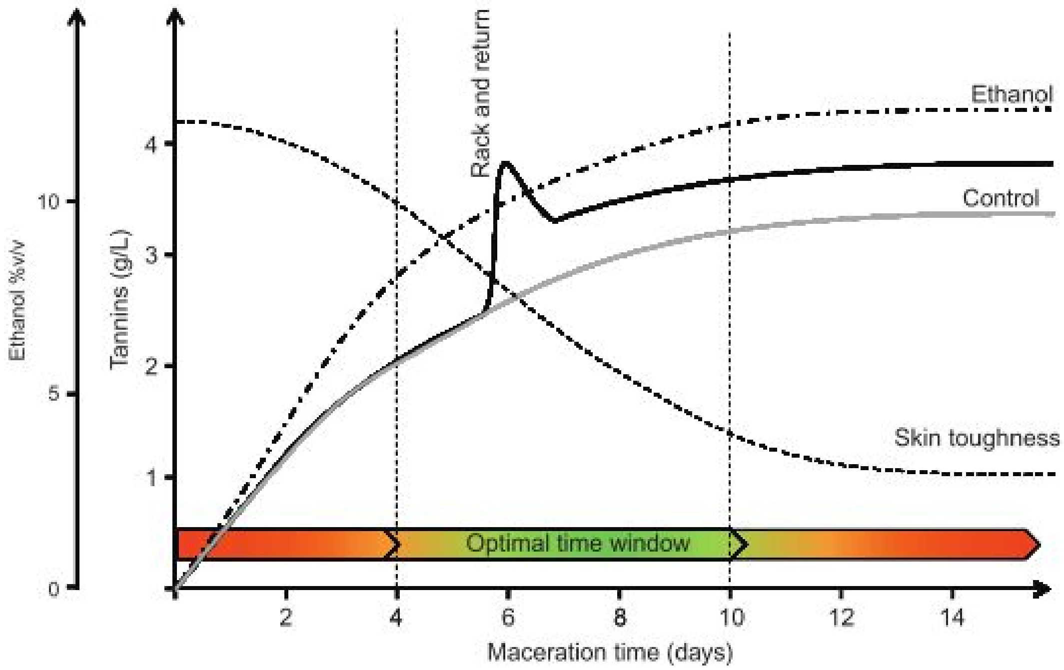

Figure 6

Effect of Rack and Return Extraction Processes on a Wine

From Morata, 2019. Red wine technology.

5.4 Oxygen During Fermentation

To avoid a stuck fermentation, reductive aromas, and to increase the sense of aromas in the wine we use oxygen during alcoholic fermentation. While doing pumpovers, we put the wide bucket under the vat, poured some wine inside of the bucket so the process of oxidation is well applied, and then pumped the juice back on top of the cap, spreading it evenly all over the cap. Oxygenation is exposure of wine to oxygen, and it can be controlled and have positive impacts on the wine, or it can have the total opposite effect where excessive amounts of oxygen have a negative impact on the wine (Blackburn, 2004). During alcoholic fermentation, the main purpose of adding oxygen is to avoid oxidative stress of yeast. Adding oxygen in alcoholic fermentation increases the ethanol resistance of yeast and increases the fermentative activity, while at the same time, decreases the production of sulphur dioxide (Blackburn, 2004). Yeast need an amount of around 9mg/l of oxygen during their growth phase (Zoecklein, 2007). Adding oxygen after wine achieves 10% volume of alcohol is not recommended, because most yeast do not have the ability to take up nutrients including oxygen, after 10% volume of alcohol (Comfort, 2008.) Yeast will assimilate nitrogen better when it has enough oxygen, otherwise if there is not enough oxygen, fatty acids will accumulate in yeast and they could be secreted in the wine, which could lead to a stuck fermentation (Bardi et al., 1999).

5.5 Saignee

At the mid point of the fermentation, we would take out 1-5% of the juice to concentrate our main vat. At this time, the saignee that we would take was very coloured and had some tannins and structure. We use this saignee for our second label wine, which is lighter in body and structure. The percentage of the juice that we would take from each vat depended on the quality of extraction at that time and on the quality of the juice. By removing some of this juice (saignee) we would concentrate our flavours in the main vat and increase the extraction.

5.6 Nutrient Addition

We would obtain a level of yeast assimilable nitrogen (YAN) between 200-300mg/l, with two "meals" of nitrogen. These "meals" were the necessary energy source for the yeast during the alcoholic fermentation. The first "meal" was added at the beginning of the fermentation, and the second was added in the middle. The YAN plays a big role in the efficiency of the fermentation, because it is related to the efficiency of the yeast species. The final flavour of the wine also depends on the amount of YAN (Jiranek et al.,1991). Due to the low amount of YAN during the red wine fermentation, there is the possibility of an appearance of H_2S notes at the end of the fermentation process (Henschke, 1996.).

5.7 Malolactic Fermentation:

Malolactic fermentation (MLF), or secondary fermentation, is enzymatic decarboxylation of the dicarboxylic malic acid to monocarboxylic lactic acid (Naouri et al., 1990). This fermentation usually comes right after alcoholic fermentation and is able to start spontaneously, or can be accelerated by adding the bacteria *Oenococcus oeni*. The process of malolactic fermentation is done in most red wines, and in some white and sparkling wines. The benefits of malolactic fermentation are that it has the ability to reduce the tart taste which is connected with malic acid, provides microbial stability, and increases aroma and flavour complexity (Bordons, 1997). Aroma modification after MLF, is caused by the release of diacetyl and other carbonyl compounds, which are representative of buttery aromas in the wines (Morata, 2019). If MLF is not controlled, we risk the formation of off-flavour compounds which include the production of higher amounts of acetic acid and volatile phenols. At Chateau Chauvin we used co-inoculation of *Oenococcus oeni* bacteria during alcoholic fermentation. We used a product of *Oenococcus oeni* bacteria from the company "Lamothe-Abiet" called "OENO 1." The dosage of this bacteria was 1g/hl. We did the co-inoculation for one vat only, and spread that bacteria through to the other vats. To prepare the bacteria we had to rehydrate "Oeno 1" bacteria in 20 times its weight in mineral water at room temperature. We waited for about 15 minutes and then added bacteria under the cap. To homogenize the vat we performed a pump-over in a closed atmosphere without oxygen. *Oenococcus oeni* is one of the three *Oenococcus* species. "*Oeni* species are nonmotile and asporogenous with ellipsoidal-to-spherical cells usually arranged in pairs of short chains, and have an optimal growth range between 20°C and 30°C and pH 4.8-5.5" (Morata, 2019).

5.8 Sulfur Dioxide Addition

Before and after fermentation we added sulfur dioxide (SO_2), in the amount of 5g/hl to the juice just after harvest, and around 5g/hl after MLF was completed. This addition of SO_2 is used to preserve the quality of the wine and as antioxidative protection. Sulfur dioxide in wine is divided into two forms: bound and free. Bound sulfites are the ones that have reacted with other molecules such as acetaldehyde, anthocyanins or some acids. Sulfur dioxide is used in the wine industry mostly to prevent oxidation, wine spoilage and colour change (Fazio & Warner, 1990).

6. POST-FERMENTATION

During the post fermentation period (the period after alcoholic fermentation [AF] and before pressing) we perform some techniques to increase the quality of our wine. To change the aromatic profile of our wine we use a micro-oxidation technique for the duration of a couple days, depending on the progress of each day. The most important process of the post-fermentation period is maceration in the presence of higher amounts of ethanol. The goal of this maceration is to increase the extraction of tannins and to improve the structure of our wine. Higher ethanol content in the wine allows for greater extraction.

6.1 Micro Oxidation

To improve the wine quality at Chateau Chauvin, we used a micro-oxygenation technique. This technique consists of adding small amounts of oxygen (O_2) inside of the wine. Adding a small amount of O_2 in the wine can improve the sensorial quality of red wine, but adding higher amounts can affect the wine in a negative way by way of oxidation of phenolic and aromatic compounds (Arapitsas et al., 2012). For the addition of a small amount of O_2, we used equipment that allowed us to correctly dose the amount added to the wine. Figure 7 shows a diagram of how this technique worked and the equipment used.

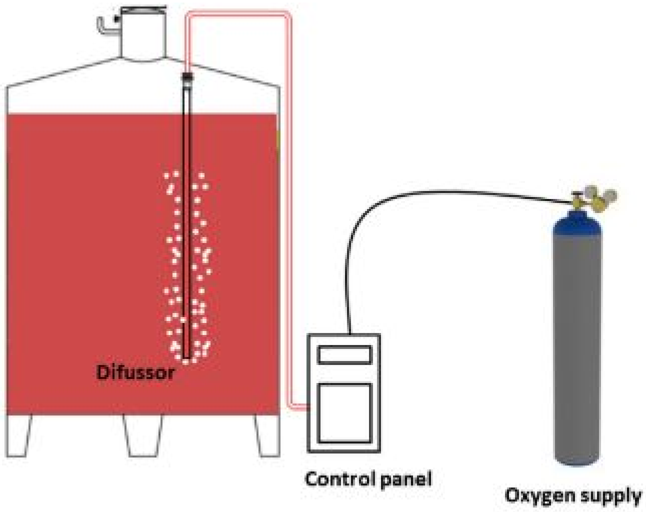

Figure 7

Diagram of Micro-oxidation Technique Used at Chateau Chauvin

From Morata, 2019. Red wine technology.

There are several benefits of using a micro-oxygenation technique, including the influence on yeast development during AF, stability of wine colour, improvement of mouthfeel and astringency of the wine, and improvement of wine aroma. The most important compounds of red wine are phenolic compounds, due to their role in organoleptic wine characteristics (Kennedy, 2008). “Oxygen favors the reactions involving phenolic compounds that leads to the formation of new anthocyanin-derived and polymeric compounds that stabilize wine color since they are partially resistant to SO_2 bleaching and more stable at wine pH” (Morata, 2019). The compounds in charge of complexity, astringency and bitterness of wine are phenolic compounds, but the main representative is flavan-3-ol (Vidal & Aagaard, 2008). During aging, these tannins go through depolymerization and polymerization because of low wine pH, and there is a difference between the wines where this process happened with or without the presence of oxygen, where In wines with oxygen, the result was a less astringent characteristic (Tanaka et al., 1994). The last, but still very important benefit of micro-oxidation is its influence on improving aromas of wine, such as decreasing the level of vegetal aromas by oxidizing pyrazines and thiols and increasing fruit aromas (Parpinello et al., 2011).

Oxygen was added to the wine at Chateau Chauvin at two different periods. The first one was during AF to aid the development of yeast and to avoid the reduction of the wine and a stuck fermentation. The second period of adding oxygen to the wine was after AF was finished. Using a micro-oxidation (MOX) device, which controlled the amount of oxygen that was added to each tank. The average time of adding oxygen into a wine was around 2-5 days, with an amount of 60ml/L in a month . Everyday we would monitor the changing aroma compounds, and then decide if it was enough or if we wanted more MOX. The main purpose of using MOX at Chateau Chauvin was to change the aromatic compounds to more mature and concentrate aromas, which was more fitting with the style of wine that the winery hoped to achieve.

6.2 Post-Fermentation Maceration

The duration of the post-fermentation maceration was 7-10 days, after finishing alcoholic fermentation. Maceration was done at a temperature of 27-28°C, depending on the vat. Every second day we would wet the cap, by performing pump-over without the presence of oxygen. Tastings were done daily to decide when we were going to take the wine off of the skin. Post-fermentation maceration could be done a couple of days, or even one month, after finishing alcoholic fermentation. Maceration is the process that is mostly used in production of red wine, where grape solids (skins,stems and seeds) stay in contact with must or the wine (Casassa et al., 2019).The advantage of post-fermentation maceration is skin contact with the juice of higher percentage of ethanol, which improves, and speeds up, the process of tannin extraction (Morata, 2019). According to the sensory profile of the wines that go through post fermentation maceration, the bitterness and astringency increases (Casassa et al., 2013). The main problem that could occur in this situation is the too much extraction of tannins if the process of post-fermentation maceration is not well controlled and giving us the taste of bitterness and astringency (Casassa et al., 2013). The development of spoilage microorganisms could occur in wines in post-fermentation maceration if the pH of the wine is high and SO_2 levels are low (Morata, 2019).

6.3 Draining

When the wine comes to the point where it should be taken off of the skins, we drain every drop of the juice from the vat and move it to another vat. We called that “free run” and that is considered to be the best quality, and it is qualified for the first label of Chateau Chauvin. We perform a drain one day before pressing. When there is no more wine inside of the vat, we leave the bucket overnight and open the valve of the vat, and allow it to drop down all night. We wanted to get as much of the wine out as possible. This “overnight wine” was then moved to the youngest available barrell (in this case, a barrel from 2018 or 2017).

6.4 Pressing

We used a small pneumatic press with a capacity of 5 tons. Wine coming from the press is classified as “Press 1” and “Press 2.” Press 1 is the wine that is pressed from 0 until 1.5 bars, and Press 2 is the wine that comes after pressing at a pressure of greater than 1.5 bars. The wine that came out of the press was moved into older barrels according to the quality of the press. Press 1 was moved into 2018 or 2017 barrique barrels, and press 2 was moved into 2016 barrique barrels. The turbidity of the press wine was very high at the moment, so we added 4.5 g of enzyme to each barrel to help with clarification. The press wines stayed inside of the barrels for approximately 2-3 weeks.

6.5 Press Blending

At the end of pressing all the vats, we had 44 barrels of press wines. The winemakers and myself took samples from every barrel and tasted them blindly, and classified them according to the quality. Classification of the press wine was divided depending on the quality. There was quality A, quality B and quality C. There were 8 quality A barrels, 16 quality B barrels, and 20 quality C barrels. We then racked them off of the lees into separate vats to prepare them for filtration. Press quality A will be used for the first wine of Chateau Chauvin, while quality B and C will be used for the blend of the second label wine.

6.6 Blending

It is difficult to find a “single variety wine” in the Bordeaux area. The signature wines of the Bordeaux wine region are both blends, a white blend which consists of varieties such as Sauvignon Blanc and Semilion, and a red wine blend which consist of varieties such as Merot, Cabernet Sauvignon, Cabernet Franc and Petit Verdot. Blending can be described as a mixing process. In the wine industry, blending could be done at a couple different stages of the winemaking process, and could involve the blending of wines of the same variety but with different chemical parameters (for example wines of the same variety with high and low acidity) a blend of different varieties but of the same colour (for example Merlot with Cabernet), or even a blend of varieties with different colour (for example, in the Rhone Valley Shiraz with Viogner). Wine could be blended before or after the ageing process. During ageing, the wine mouthfeel and aromatic characteristics change. It is always better to do the blending after each wine is aged separately. Blending at Chateau Chauvin was done before and after ageing. Before ageing we would blend wines with similar quality but same variety, and after ageing we would do the final blend which would make up that vintage. The final blend at Chateau Chauvin was usually assembled with 75% of wine from Merlot, 20% from Cabernet Franc, and 5% from Cabernet Sauvignon.

7. AGEING

One of the first things that comes to our mind when someone mentions wine is “wine barrel.” There is a long history between wine and barrels that dates back to early times (Vivas, 2002.). Originally, the Romans were transporting wines in amphoras, but when they arrived in the Gaul and learned how to build barrels they replaced them (Taransaud, 1976.). After that time, barrels spread all over the Mediterranean, and replaced the amphoras as the transporting vessel, because they had bigger capacity and they were more resistant then amphoras. For a long time after that, barrels were used for transporting oil, wine and other products. Today, however, they are replaced with steel and plastic. In the wine industry, wooden barrels are still used for wine ageing, and they are mainly barrels that are made from oak wood. There are some barrels on the market that are made from acacia, cherry, chestnut, or other woods, but they exist in very small quantities. Oak (or inlatin, Quercus), have more than 500 species which are mainly grown in the northern hemisphere, but only a couple of them are used in the wine industry (Oldfield & Eastwood, 2007). On the wine market there are three species that are mainly used and produced, two european species (*Quercus petraea* and *Quercus robur*) and one American species (*Quercus alba*) (Vivas, 2002). Oak species are grown all throughout North and Central America, Europe, the northern part of Africa, and the northern part of South America (Nixon, 2006). However, the main area of oak production is in France and the United States. For the purpose of the winemaking industry, the oak produced in France is called “French oak” and the oak produced in the United States is called “American oak.” Producing areas in France are Nevers, Alier, Troncais, Centre,Vosges, Bertrange, Jupilles which mostly produce *Q. petraea* and Limousin which produce *Q.robur*. A map of the different areas that produce French oak is shown in Figure 8. The American oak producing forests are located in the states of Virginia, Minnesota, Pennsylvania, California, North Carolina, Oregon and Missouri. The oak that is produced in these areas is mainly *Q. alba* or “American Oak.”

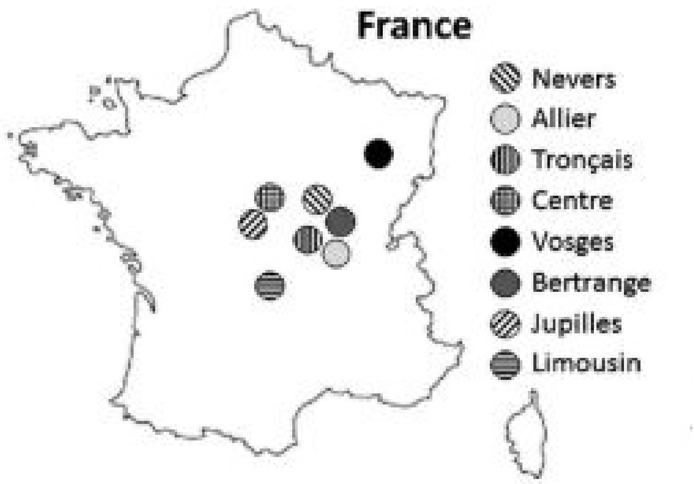

Figure 8

Map of the Wine Barrel Oak Producing Regions of France

From Morata, 2019. Red wine technology.

The most important characteristic of oak that is used in wine production is wood grain, which depends on the botanical and geographical origin of the oak (Vivas, 1995). In a cooperage, wood grain is defined as the size and regularity of the tree's yearly growth circles (Vivas, 1995). The grain of the oak is classified on three levels. The first classification is fine-grain, which means that there is five or more rings per one cm of wood, the second classification is medium-grain when there are 3 or 4 rings per one cm of wood, and last classification is coarse-grain where there are two or fewer rings per cm of wood (Feuillat et al., 1992). Grain size of the trees can be different between trees from the same forest, so some cooperages start to classify their wood based on the actual size of the grain, instead of geographically which was formerly the more common way of categorizing the oak (Morata, 2019). In history the most expensive oak for cooperages has always been the one with the finest grain, because the size of the grain influences the amount and quality of the impact of the oak wood and how it will impact the aging wine (Vivas, 1995; Vivas, 2002). Therefore, fine-grain oak barrels influence wine with more aromatic complexity and richness while have very low impact on the body of the wine, and coarse-grain oak has much more influence on the body of the wine than the aromatic profile of the wine (Chatonnet, 1995).

7.1 Production of Barrels

The process of barrel production starts by selecting the best trunks for the cooperage. Today most cooperages source their oak trees from forests that are controlled by humans (planted by humans and then harvested) where the trees that are over 100 years old can only be harvested, and then those trees need to be replaced for the future exploitation (Remy, 1991). Oak barrels are made from parts of wood that have the finest grain and without branches, those selected parts are cut into shorter pieces which will later define the volume and size of the barrels (Vivas, 2002.). Those shorter pieces will be cut into staves.

When we cut oak into staves, before we can make barrels out of them, they should be dried. There are two ways of preparing staves for barrel production. The first is natural seasoning, which is the process of leaving staves out in the open (outdoors) for two-three years (Vivas, 2002). During the period of natural seasoning in the open, the staves are washed by rain. With the natural seasoning, phenolic compounds could decrease (Doussot et al., 2002). At the same time, the volatile compounds released in the wine by oak barrel could increase in concentration (Chatonnet et al., 1994). By washing the staves in the rain we are eliminating some compounds that are undesirable and that we do not want to be released into our wine. The second method of preparing the staves for barrel production that we can use instead of natural seasoning is artificial drying, which is dehydrating the oak staves inside of drying chambers (Morata, 2019). The geographical location of where the seasoning of the staves takes place, as well as the length of the seasoning process, influences the chemistry of the staves and the ability to which a wine can extract oak compounds from it. Naturally, this then affects the final sensory and chemical composition of the end wine (Spillman et al., 2014). Barrels that are made with the staves from artificial drying will release chemical components into the wine that are significantly different from those released by the barrels that are made from the staves that were naturally seasoned. They produce wines which are poorer, less complex, and more bitter (Vivas & Glories, 1996).

After the staves have been aged properly, it is time to assemble the barrel, which is a very complex process that requires a lot of skill. The first step in assembling the oak barrel is to choose the staves according to their characteristics, such as their length. For one barrel we need 30 staves. When the cooper choses the staves he puts them side by side in the circle using toasting hoops to help him form the circle, which is an operation called "rosing" (Morata, 2019). Then the cooper puts the barrel over the fire, in a process that is divided into two stages. In the first stage, called cintrage (bending), the heat increases the flexibility of the staves which helps them to bend into the characteristic shape of the barrel (Morata, 2019). "Bousinage," or toasting, is the second phase, where we toast the barrel and by doing so physically change the structure of the wood, and with that we change the substances that the wine will extract from that barrel (Casassa et al., 2021). Toasting is generally recognized as the most important step in determining the physical and chemical composition of the oak staves (Navarro et al., 2016). During the process of making barrels, the toasting is performed with the goal of shaping and raising the barrel, as the heat helps the cooper to bend the staves into the barrel's shape (Casassa et al., 2021) Barrel toasting is classified into three levels: the first one is light toasting with around 20 minutes of toasting over the fire, the second level is medium toasting with 30 minutes of toasting, and the last level is heavy toasting with around 40 minutes of toasting over the fire (Morata, 2019). We can also define the toasting levels by the temperature achieved on the staves. For light toasting, the temperature on the staves should be around 100-150°C, while for medium and heavy toasting, it should be more than 150°C and 200°C (Jackson, 2014). The level of the toast can impart different aroma and flavour compounds into the wine and it will result in a different style of wine. After barrel toasting, it is time for the last step in barrel production, which is the insertion of the heads. “The heads are made from shorter staves that are rounded and beveled to form an edge that can be inserted into the croze groove. The head is then inserted and the toasting hoops are hammered and pressed to ensure tightness” (Morata, 2019). Figure 9 shows the entire barrel making process, and the various steps needed along the way.

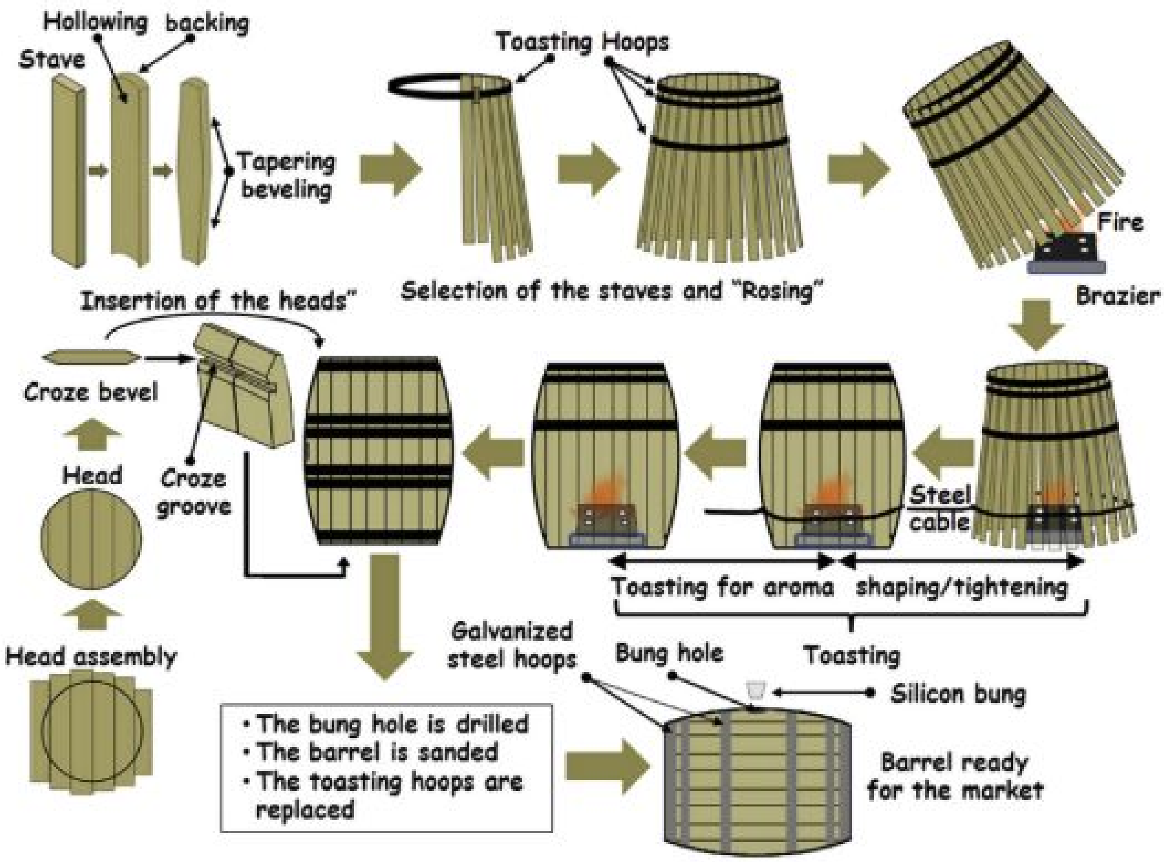

FIgure 9

Diagram of the Wine Barrel Production Process

From Morata, 2019. Red wine technology.

On today's barrel market we can find different types of barrels, which are classified by their origin, level of toasting, capacity and purpose. Origin classification is based on where the oak wood used to assemble the barrel is sourced from, for example “French” or “American”. Toasting level classification is based on the time that barrel spends on the fire (toasting), and it could be light (around 20 minutes), medium (around 30 minutes) or heavy (around 40 minutes). Historically, the barrels were used for transportation so there existed a classification of the barrels based on their purpose. Barrels that are used for ageing of wine are called “Chateau barrels” and barrels that are used for transport are called “Transport barrels” (Robinson 2003). The last classification of barrels is by the capacity of the barrels. The most popular and used barrels on the market are barrels with a capacity of 225L called a “Bordeaux barrel” and barrels with a capacity of the 300L called a “Burgundy barrel.” Besides these two most popular barrels, we also have “Sherry pipe” which has a capacity of 500L, “Porto pipe” which has a capacity of 650L, as well as other sizes (Robinson 2003).

7.2 Barrel Influence on the Wine

There are several complex processes that happen in the wine during the period of wine ageing in the barrel. These interactions are shown below in Figure 10.

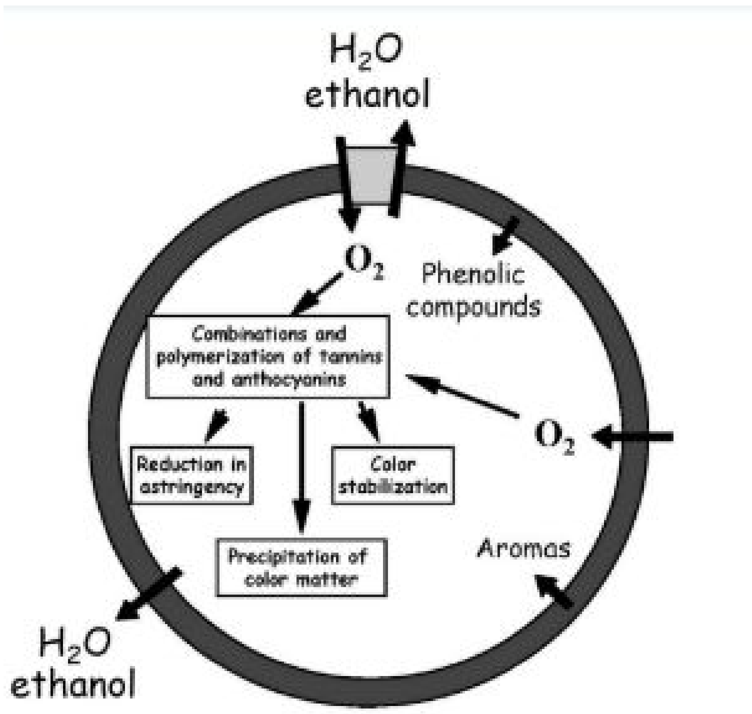

Figure 10

Processes of Gas Exchange During Wine Ageing in Barrel

From Morata, 2019. Red wine technology.

When we fill a barrel with wine, especially in a new barrel, the wood absorbs some amount of the wine and a certain amount of water and ethanol evaporate because of the porosity of the wood (Morata, 2019). The volume of the wine that we lose depends on the humidity and temperature in the room where ageing is being performed. This is why the ideal environmental conditions for a barrel room are a cool temperature with high humidity. During the wine ageing inside of the oak barrels, oak wood influences the wine by releasing certain volatile substances and changing the aroma of the wine by making it more intense and complex (Navarro et al., 2018). The aromatic profile of the wine is not the only aspect of it that changes, by releasing ellagitannins oak barrels influence the texture sensation and astringency (Navarro et al., 2016). When wine is inside of the barrels, it is under the influence of micro-oxidation which causes reactions of anthocyanins and proanthocyanidins, and a beneficial result of these reactions is the stabilization of the colour and a reduction in the astringency of the wine (Zamora, 2003). The last but very important result that happens when wine is aged in the oak barrel is the natural sedimentation of colloidal matter, which is unstable (Zamora, 2003). All of these reactions that happen during wine ageing in oak barrels depend on the origin of oak wood, the technique of seasoning the oak wood, the level of barrel toasting and on how many times the barrel was used previously (Morata, 2019).

7.3 Ageing at Chateau Chauvin

Ageing at Chateau Chauvin each year is done in 100% French oak barrels from several cooperages around France. The barrels that we used were all Bordeaux style barrels, which means the barrels had a capacity of 225 L. We want to avoid a high influence of the barrels on the wine that we are ageing, so at Chateau Chauvin we use only medium toast and medium long toast barrels. Around 50% of our barrels each year are new barrels which mean that the other barrels for ageing are considered old barrels. For this vintage we used 50% new (2020) barrels and 50% of 1 year old (2019) barrels. Wines at Chateau Chauvin are aged 12-14 months under controlled conditions. The temperature inside of the ageing room is around 15°C and humidity is around 70%, therefore these are good conditions for barrel aging.

We racked the wine from the barrel every 3-4 months, removed the lees from the bottom, and completely cleaned the barrel and then racked the wine back into the barrel. The cleaning process in a winery is different for new barrels and old barrels. For new barrels that have just arrived we first fill them with around 20L of water, and leave them upside-down on each side for 3-4 hours, and then clean them with hot pressure water for 2-3 minutes. This also allows us to make sure there are no leaks in the barrel and we will not lose any wine when it goes inside. After this, drying is done by burning a small amount of sulphur inside of the barrel. For old barrels we use a program of 2 minutes rinsing with cold high pressure water, 4 minutes of hot high pressure, and we finish with 2 minutes of cold water. For the drying, if we are not going to use them the next day we will burn sulphur inside of the barrel to preserve it. As I mentioned previously, Chateau Chauvin uses French oak from a couple of different cooperages in France. Some of these include:

- Tonnellerie Sylvain, which is located in Lussac. This cooperage produces wines not only barrels, and they are in charge of Chateau La Rose Perriere (Tonnellerie Sylvain, n.d.). They planted a vineyard with different varieties so they can understand and increase their knowledge of vinification and ageing in the barrels. They planted both red (Cabernet franc, Cabernet Sauvignon, Pinot Noir, Shiraz and Malbec) and white (Sauvignon, Semillon, Muscadelle and Chardonnay) grape varieties. “The purpose of these experiments is to better understand the association of the characteristics of the oak wood origin with the characteristics of the grapes and finally to assess the impact of the wood on the wine over time” (Tonnellerie Sylvain, n.d.). The main goal of this experiment is to be able in the future to advise customers about which type of oak is more suitable for different varieties. Every year they produce around 33000 barrels and export around 70% of their production (Tonnellerie Sylvain, n.d.).
- Tonnellerie Ermitage is another cooperage that we use at Chateau Chauvin. Ermitage selects oak that is more than 150 years old to make their barrels from ancient forests that are managed by the French Forestry Commision (Tonnellerie Ermitage, n.d.). Due to a steam pre-toasting process, the barrels that are produced at Ermitage extract extremely supple tannins and confer complexity to the wood (Tonnellerie Ermitage, n.d.). Ermitage barrels are made of oak wood from the most renowned forest of France such as Bertanges and Troncais. Bertranges forests cover around 8000 hectares in the Nevers region (Tonnellerie Ermitage, n.d.). The main oak species in Bertranges forest is Petraea oak which has very dense grain (Tonnellerie Ermitage, n.d.). The trees in this forest grow very slowly, and extract beautiful and subtle tannins in the wine. Tronçais is a forest that covers around 10500 hectares in the region Allier (Tonnellerie Ermitage, n.d.). This forest is not only famous for producing great oak barrels, but is very famous for the history of the forest. The forest was planted in the 17th century under the rule of Louis XIV (Tonnellerie Ermitage, n.d.). Its main purpose was to supply the oak that was necessary for the construction of French naval fleets (Tonnellerie Ermitage, n.d.). The dominant variety is *Quercus robur*. Oak trees of the forest Troncais are very tall and straight due the good climatic condition. Characteristics of the wine that is aged

in these barrels are the subtlety of its aroma and very precise structure (Tonnellerie Ermitage, n.d.). Wine that is aged in these barrels needs to be in the barrel for a longer period of time so as to attain their full integration.

8. CRITICAL ANALYSIS

Overall, Chateau Chauvin is a winery that produces high quality wines while controlling production from vineyard to bottle, but there is still room for improvement. The first thing that I noticed at this winery is that it is missing a "wine laboratory," which in my opinion is something that every winery must have, even if it is just tools for basic primary chemistry analysis. Looking from an economical point of view, every lab analysis costs a certain amount of money, and during the harvest at Chateau Chauvin we needed lab analysis on daily bases. Every grape sampling was done by a winemaker and then sent to a commercial lab to analyze it (weekly), and during harvest we would take samples from vats (daily) and send it to a couple of different labs for analysis, so that we could have analyses from 3 different labs for better accuracy. In the end this was quite costly for this Chateau. Instead of spending money like this, I think it would be better to purchase lab equipment, and make a small lab as a long term solution. The benefits of having our own lab would be faster analyses, overall a reduction of costs in the long term (and then this money could be used on other important things), we could double-check every analysis very quickly, and as a result we could make faster winemaking decisions instead of waiting on the results needed to base our decision on.

As I wrote in the previous pages of this thesis dissertation, Chateau Chauvin has very good equipment (with the exception of the laboratory), including very good inox tanks. However, the majority of those tanks have a higher capacity with 104 hl, which makes the job of fermenting the plots separately very difficult. Fermentation of plots separately would definitely increase the quality of the blend and give us more options. As it is, the winemakers are sometimes pushed to blend some plots during the harvest, even if they should not ideally be fermented together. The winery has plans to partially solve this problem by expanding the cellar, and this expansion should start soon. Chateau Chauvin will then have around 10 new tanks, mostly with 104 hl capacity.

For sorting the grapes they use 5 different techniques, which include 5 different machines. In my opinion, if they used an optical sorter they could reduce their expenses and increase quality. By reducing the number of people that work at the sorting table (4 or more people), on sorting by density (2 people) , at the shaking table (1 person), and if they stopped renting the machine for density sorting, Chateau Chauvin could easily be able to rent an optical sorter and increase the quality while simplifying the process of grape sorting. Nevertheless, the existing sorting process is very efficient, but complicated and expensive.

I noticed that this winery did not give too much attention to the protection of the grape juice against oxidation on the first day when they did saignee. Saignee was done without protection, a small amount of SO_2 could not protect that saignee, so they should definitely think more about protecting the juice at the beginning with dry ice. However, I can say that the idea of inoculating with a small amount of yeast during cold maceration was a very good idea. The yeast started producing enough CO_2 even during very low temperature (5-8°C), and this protected the juice during cold maceration without the need for adding dry ice. This also helps the winery to save money because commercially prepared active dry yeast can be quite expensive.

During post-fermentation maceration, wetting the cap was done every second day, and for a very short time. In my opinion, a cap should be wetted every day and protected with dry ice overnight. The wine after pressing was very oxidative. By wetting the cap more often and protecting it from oxidation we would have a much better quality of the press. The top of the pomace cap was very dry and oxidized, which in my opinion creates a low quality of the press wine.

Pressing was done with no protection, even though there was no CO_2 that could protect the wine and we did not add any dry ice or similar protectors. We added enzymes into every barrel to clarify very turbid pressed wines, but at that moment none of those wines finished malolactic fermentation. When malolactic fermentation started spontaneously because all the conditions were perfect for it to start (good temperature and low SO_2), lees would mix into the wine again. My proposal would be to add SO_2 or move the wine into a vat where we could control the temperature so as to avoid the start of malolactic fermentation, add enzymes to clarify the wine, and after 2-3 days rack the wine off of the lees. When the press wine is without that heavy lees we could co-inoculate it with bacteria or just increase the temperature to make good conditions for the start of malolactic fermentation.

In terms of marketing and selling the wine, it is my opinion that most of the wineries with the classification of “Grand Cru Classe” do not have a problem with putting their wines on the market and selling them. I would say that this holds true for Chateau Chauvin, as most of their wine is sold to the “Negociants” during “En Primeur,” and after that the wines are distributed to the American and European markets.

CONCLUSION

During this professional training at Chateau Chauvin, I was involved in all of the winemaking processes for the 2020 vintage, from tasting grapes in the vineyard in order to analyze the stage of maturity, until controlling the fermentation process and transitioning into the ageing process. Throughout this process I learned about the terroir of Saint-Emilion, the history of the property, and the traditions of all the areas. I was able to learn some new things that I had never used before, but at the same time I was able to point out some things and make some suggestions for how the winery could improve upon things for this vintage and for the future. Chateau Chauvin wants to maintain the high quality of their wines, so they are planning to invest in expanding their cellar which is a very good decision. In the future they should invest in a wine laboratory and equipment needed for the function of the lab. After finishing my experience at Chateau Chauvin, I can say that it is not only the soil or the climate of Saint-Emilion or even the human influence that makes the wine from this area so great, but what makes wine from the Bordeaux region great is a combination of all of these factors. It is the history of the Bordeaux area and of France, the traditions of the French people, a unique combination of soil and specific climate, authentic varieties, human knowledge and unconditional love for vineyards and the wine, and in the end a little bit of luck.

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