Texture of the topsoil defines a region
How acidity is delivered to the palate depending on whether the grapes grew on amphibolite, schist, gneiss, or granite

# Volcanic/Igneous

- ashy, edgy, a nervous sensation
- Tuff
    - in-between basalt and granite, come from fire
    - oft confused with limestone tuffeau
    - extrusive, blasted, fragmented lava rock
    - rich in silica, iron, contains larger crystals of quartz in a fine grained matrix
    - Tokaj, Hungary
        - basalt, tuff; continental harsh cold winter, warm summer: Harslevelu, Furmint
        - Hundreds of extinct volcanoes, overlaid by a complex variety of soils:
            - Nyirok - a volcanic soil said to produce the most powerful wines
            - Loess - a sandy silt with high clay content esp around Tokaj hill - lighter delicate wines
        - soft volcanic bedrock
            - vines **root deeply**, making water stress or nutrient deficiencies rare
            - ideal for digging the cellars for aging, known for the grey-black cushiony growths of the cellar fungus Zasmidium (previously Cladosporium) cellare, helping regulate humidity
    - Alto Piemonte
        - carema, lessona, fara, ghemme, sizzano, gattinara, boca, bramaterra

        - soils of boca and bramaterra are derived from a mix of intrusive porphyry and extrusive igneous rock, lava, or tuff
        - Boca:
            - 22-acre, highest elevation in area, Maggiorina trellising - sort of alberello (little tree) but not free form: vines pulled upward in four directions like tentacles hanging out to dry
            - the **highly acidic** porphyry soils (usu kms under the ground) might be why wines have an even longer life than the wines of Barolo where grapes grow on sediments
            - mother rock is so close to the soil, the roots actually manage to grow inside the gaps in the rocks and almost fuse the rock - this anchoring of the vines helps to prevent erosion and develops better fruit
        - Bramaterra:
            - also porphyry soils but here rock called porfido tufaceo contains silicon and boron also found in pumice in Etna, partnered with a sig bed of limestone
            - Bramaterra: granite, tuff: Nebbiolo, Croatina, Uva Rara
    - Campania: volcanic & sandy around Naples
        - Campi Flegrei DOC: tuff, pumice, sandy soils, FAST DRAINING: falanghina, piedirosso
        - Vesuvio DOC (Lacryma Christi):Coda di Volpe, piedirosso
- Granite
    - changes texture in wine
    - Weathers over time to produce a range of soils: mica, quartz, loess, clay - all easily crumbles into mixtures of gravel, sand, silt-sized particles
    - an edgy structure and a needle-like tang of acidity and freshness "minerality", a salty mineral edge (to Pinot Gris in Alsace for instance)

- with granite soils, the magic comes across in the tannins: wines a little drier and sensation of raspiness felt more in the back of the mouth almost in the jawbone oft with a nervous high-pitched sensation
- granite low in pH produces **high acidity** wines
- subdued aromatics when young but blossom with age
- freshness, savoriness, structure, subdued fruit flavors and aromatics (??)
- the degraded soil is low in pH thus acidic soils, the degradation allows metals eg iron to be delivered to the plant's system but yet being stony and acidic the soil is low on nutrition
- low fertility oft with low clay content leads to lower yield
- well draining with the right amount of weathering: advantageous in wet years as vines won't take in too much water and the roots wont dig down deep
- granite means theres a lot of quartz which means energy and porosity. With roots, water movement equals life. Granite creates very healthy and deep roots
- arzelle in northern Rhone, a crumbly type of granite, brittle, a compressed rock, pinkish red laced with iron
- when decomposed granite can be sandy: poor water retention which is terrifc in wet years but in dry seasons, vines suffer. When vines go thirsty, it affects the thickness of the grape skins, tannins, and fruit flavors [Syrah is drought tolerant]. Due to dryness, the region is prone to erosion (lessened by organic farming)
- granite gives the juicy sweet Syrah fruit a mineral side
- keeps fruit in check, helps to sand down tannins, give structure
- fewer viruses in vines in granite
- Muscadet
    - in Muscadet the wines can hint at tastes and smells of wet cardboard which can mimic a corked wine but after couple of years turn into tremendous majesty

        - Clos des Briords from Marc Ollivier of Domaine de la Pepiere Chateau-Thebaud full of granite: freshness and acidity, no real fruit, strong acidity and lean, smell of rocks
        - Jo Landrone's Domaine de la Louvetrie Fief du Breil on hillside of metamorphic orthogneiss with clay and small quartz: more fat, smell of rocks generated by acidity and far less apparent in orthogneiss soils, riper, rounder, not as long lived as Briords
    - northern Rhone
        - Hermitage: best sites Les Bessards, Le Meal, l'Ermite, Peleat, Les Beaunmes, sweet white wine Vin de Paille
        - Cornas: smallest warmest, finely decomposed granite sprinkled with limestone, best sites Reynard (mostly granite), Les Chaillots (some limestone)
        - Cote Rotie - Cote Blonde: mostly granite, gneiss
        - JL Chave:
            - limestone and granite are each other's opposite, in a dry year, the topsoil suffers from drought but the clay down below keeps humidity,
            - the granite gives reds aggressive tannins and the white grapes Marsanne and Roussanne gain finesse;
            - Croze-Hermitage gets bad rep bc clay [best sites on northeast facing steep hillsides on granite: Les Chassis, Les Sept Chemins, Les Meysonniers];
            - Les Bessards Vineyards where the most profound intense granite - all completely crushed rocks and the vines get dark green leaves and the grapes get extremely tannic;
            - in Le Meal vineyard where grapes are richer riper because soils have a higher pH - small pebbles and leaves more pale yellow green because the intake of iron is more difficult in a higher pH soil
            - being organic is important for natural yeasts, which might be everywhere in all vinyards but % different in

diff soils: on clay vines have more power, on poor soils of granite they struggle all the time, as long as the roots go deep to the cracks of the granite the vines will live forever as they will break into the drought and they will do well

- Sierra Neveda foothills (Syrah, Gamay, Mourvedre, Tempranillo): Steve Edmunds grows Syrah in both loam and decomposed granite and finds those in granite edgier
- Vermont: cool wet: Marquette, Louise, Swensons, Frontenac
- Victoria, southeast of Australia: a granite belt in Beechworth - hot and dry: Syrah, Pinot Noir, Gamay, Chardonnay
- Austria: thin soils over rock (granite or gneiss, crystalline bedrock locally as Urgestein) where Rieslings are as it needs less water than Gruner
- Beaujolais: northern hilly crus and villages AOCs at 200-500m with fast draining granite, schist, sandy soils
    - gamay on granite edgier and more acidic and does better in cold and damp, on limestone depending on clay content, fleshier and does better in dry and hot
    - Chardonnay - usu found in area in north of Beaujolais bordering the Mâcon Villages appellation - best on **cooler marl or limestone soils** that **slow down ripening, preserving acidity**
    - Saint-Amour: granite and clay
    - Julienas: sand-like granite on the west, gneiss and schist with veins of managanese & porphyry, alluvial with more clay on the east
    - Chiroubles: granite and clay smectite
    - Chenas: pink granite, red sand, quartz
    - Moulin-a-Vent: pinkest granite
    - Fleurie: pink granite with some clay
    - Morgon: mostly schist with patches of granite
    - Regnie: sand-like granite and schist

        - Brouilly: pink and blue intrusive igneous rocks, granite, diorite, schist (Pierre bleue), limestone, sandstone
        - Cote-de-Brouilly: pink/blue intrusive igneous rocks, pink granite on the west, blue diorite on north and south
    - Galicia - Rias Baixas:
        - Sand over granite bedrock - free draining st roots not in the water; pink quartz-flecked **granitic soils**, old vines in pergola
    - Ribeira Sacra and Ribeiro:
        - Mencia, Godello, Treixadura, Lado, Ferrol, Caino, Garnacha Tintorera
    - Sierra de Gredos:
        - Albillo, Garnacha
    - Bramaterra:
        - granite, tuff: Nebbiolo, Croatina, Uva Rara
    - Saint-Veran in Maconnais
        - silica-laced soil on granitic bedrock around Saint-Veran in Maconnais

- Alsace
- South Africa: **Granite (soils on foothill slopes, water retention for dry farming)**, Shale (good nutrient, water retention for dry farming), and Table Mountain sandstone (sandy, low nutrient, water retaining)
    - Coastal Regions: Darling District - Groenekloof Ward: ocean breeze, west coast with hills, SB, CS, Merlot, Shiraz (fresher than Durbanville) with granite soils of high water holding capacity, dry farming and bush vines common
    - Coastal Regions: Swartland District: diverse soil of low fertility granite and shale esp around Paardeberg
- Portugal: schist or granite in mountainous regions eg Vinho Verde, Douro, Dao and hilly Alentejo
    - Vinho Verde: granitic bedrock with a shallow topsoil of decomposed granite with a sandy texture: drainage, infertile, irrigation common
    - Alentejo: wide range of soils: granite, schist, limestone textured from sand to clay
- Monterey County - Chalone AVA: granite and limestone: free-draining low yield intensity++: CHard, PN, Chenin, PB, Sy
- Sierra Foothills: sandy clay loam from decomposed granite: retains water, dry farm
- Chile: granite volcanic in Andes, more gravel with sand silt in coastal regions
- South Africa: granite on foothill slopes, good water retention, dry farm
    - Coastal Regions - Cape Town District - Constantia Ward: low vigor granite soils above sandstone: good drainage
    - Coastal Regions - Cape Town District  - Stellenbosch: granite shale soils on slopes of Simonsberg, Bottlelary Hills, Stellenbosch Mountains, Helderberg
    - Coastal Regions - Darling District - Groenekloof Ward: ocean breeze, west coast with hills, SB, CS, Merlot, Shiraz (fresher than Durbanville) with granite soils of high water holding capacity, dry farming and bush vines common

        - Coastal Regions - Swartland: diverse soil of low fertility granite and shale esp around Paardeberg where top producers
- Basalt
    - when hot lava flow cools, best examples on islands
    - **volcanic sand**: Mount Etna in Sicily, Lanzarote in canary islands
    - **ashy finish** in wine, **salinity?**
    - **iron rich: rusty nail** component in wine
    - **granite and basalts in Alsace** gives **smoky and oily** textures esp in Riesling
    - Canary Isalnds: phylloxera never infested & volcanic basalt
        - Lanzarote and one section of La Palma: black ashen soils that squeak as if walking in ebony snow
        - picon
        - iron rich soils and black rocks left over from lava flows
        - Listan Blanco (Palomino) also in Roberto's parchel in **Santa Cruz** - direct translation of rugged sea air, Listan Negro (Pais, Mission), Negramoll (herbal), Malvasia - La Palma
    - Columbia Basin in Walla Walla Valley
        - **The Rocks District of Milton-Freewater** sub AVA on an area of basalt stones and graveled silt loam: **warm radiated from the stones lead to extra ripeness**
    - Washington:
        - basalt bedrock with sandy, silty loess, alluvial topsoils
        - sloped sites with variations in aspect and altitude - many sub AVAs are based on these topographical features
        - free draining, low in nutrients
        - low phylloxera risk due to sandy soils provide potential for growers to plant vines on own roots, low disease and pest pressure bc arid conditions and cold winters
        - frosts, winter freeze -> vines on slopes less at risk bc drainge of cold air
    - soil amelioration with basalt dust and exploiting its **water-holding** capacity vital amid climate change

- **assets to any cooler vineyard: radiating warmth**, **promoting ripening**, because lava cools quickly, extrusive rocks eg basalt are **fine grained**
- hard materials break down to **well-drained soils** thus impact on taste can start
- rocks weather into coal-dark or oft red soil due to iron: **essential nutrient in photosynthesis and aids chemical reactions, affects composition and concentration of phenolic compounds** responsible for aroma and flavor
- Mount Etna: basalt, ash: Nerello Mascalese, Cappuccio, Carricante: historically wines made in palmentos: a series of old cement bath-like cisterns outlawed in 1991
    - the **dirt is fertile** rich but the **basalt is sandy - fine sand - dry with little clay thus poor**, fertile+poor gives the wine its tension
    - grow the vine in **alberello** - where one **vine is strapped to a single chestnut pole instead of strung on a wire in more conventional trellising** - hard work but worth it as the grapes **get more nourishment from the plant thus grapes ripen evenly on the vine**
    - pumice gets spat out of caldera - light porous stones in black/gray, textured airy as coral - **helps absorb water that falls on Etna, nourishing the vine**
    - "volcanic soils are sandy soils, there is virtually no clay in the soil" [Carricante, Nerello Mascallese]
- Willamette Valley
    - Jory: colluvial sediments, mixture of rock and fine sand sediments from cliffs and hills, red soil, iron rich, sandy mixed with clay
    - very few examples of Pinot Noir on basalt other than in between Rhone and Loire - the Auvergne - where the wines tend more to layers of savory
    - the key lies in the variation in the kind of clay that binds the soil together: the clay in Jory is kaolin (removes inpurities

from the skin oft used in makeup), it swells in two directions in a series of flat sheets like planes of grass thus possible to walk in the wet vineyard without slipping and the microscopic bits of clay retain moisture in dry summers
        - mineral exchange is vastly different in basic soils like limestone vs the **acidic soils** of basalt
        - at higher altitudes: a mixture of marine sedimentary soils (e.g. sandstone), volcanic basalt and loess soils, less fertile -> small cordon-trained or replacement-cane pruned vineswith VSP trellising more common
        - on valley floor: fertile loam soils on the valley floors (60 m in altitude) left by floods in the Columbia Gorge thousands years ago -> most suited to Pinot Gris and, where Pinot Noir is grown, its vigour must be managed by large vine training systems eg Scott Henry
    - Chehalem Mountains AVA - the most plantings of any sub AVAs and a large number of wineries
        - 60 and 305 m, highest point of the ridge at 500m as a windbreak
        - range in altitude, aspects and soil types (loess, volcanic basalt and sedimentary) creates a diversity of vineyard sites -> diverse grapes
    - Dundee Hills: highest % of red iron-rich clay formed from basalt: retaining water during dry summers with little/no irrigation, avoiding vines shutting down and ensuring fully ripened grapes
- Soave: wet and temperate, east of Verona
    - foothills to the north where soils are limestone, clay, volcanic rocks - aka basalt which are naturally COOL(??), when coupled with high altitude, it slows down grape ripening thus full flavor ripeness at high acidity
    - flat plain in the south where soils are sandy alluvial -> typically med acidity, drunk young

- Tokaj, Hungary: basalt, tuff; continental harsh cold winter, warm summer: Harslevelu, Furmint
- Pfalz: a wide variety of soils - limestone, sandstone, basalt, and clay
- Trentino DOC:
  - local grapes: Teroldego. Marzemino, Lagrein
  - where Marzemino best/**ripest** from Ziresi sub zone due to full sun exposure and **rich calcareous clay and basalt** soils
- Mornington Peninsula (east of South Australia - Victoria -) (narrow peninsula between Port Phillip Bay and Bass Strait (Tasmania the other side)
  - cool/moderate, windy, long sunshine hours, cooling effect from wind (frost uncommon despite cool spring, reduce disease risks despite close to water, inhibit flowering) and water: mild autumn, prolonged growing season
  - flat excapt Red Hill at 250m alt, named after **red basalt soils**
  - retains winter rainwater throughout growing season thus irrigation unnecessary
  - vigor a problem in fertile soils thus vineyard mgt eg Lyre instead of VSP to control vigor important
  - free draining clay and sand elsewhere, irrigation necessary

- Australia - east coast - New South Wales where Hunter Valley, Central Ranges, and Southern New South Wales zones are
  - Central Ranges zone
  - Mudgee
  - Orange: reputed for high quality from small producers, slopes of Mount Canobolas (ancient volcano), and **deep red volcanic basalt soils**, yellow/brown clay loams, and shallow gravels, windy (spring frost —, fruit set :(), Shiraz, CS, Chard, SB, PG; producers: Ross Hill, Tamburlaine
  - Cowra

# Sedimentary:

Germany - Baden on sediments

- Limestone
  - calcareous soils
  - from ancient seabeds and coral reefs
  - white yellow chalky **porous sponge-like**
  - hard rock composed of **CaCO3 or dolomite as calcium-rich soils help maintain acidity** late in the growing season and **strengthen the grapes against certain diseases**
  - **water retaining** capabilities esp **dry farming**: calcium rich soil holds water allowing vine to drink instead of sitting in a pool of water, permitting soils to retain moisture in periods of dry weather but **allowing for good drainage during heavy rains**
  - the **quality of acid** comes through in wine
  - limestone is something you sense first up front in the mouth, on the tip of the tongue, and it betokens a long finish with **a linear structure**

- Saint Peray (northern Rhone)
- in purest state: brilliant **white chalky albariza in Jerez**
- Clare Valley in Australia: mix of red clay, limestone, slate
- Loire: Touraine - yellow and white tuffeau
  - Chalky fine-grained micaneous limestone, sand, clay, flint
  - Montlouis-sur-Loire: tuffeau gets a twist with more clay, flint and sand
  - Moutlouis and Vouvray: gravels, tuffeau, clay-silex; in Vouvray, you have more argilo-calcaire (aubuis aka clay-limestone) but also some argilo-silex (clay-flint), soils are rich so higher yield without losing quality (?) - giving vouvray more power and finesse; more sand and silex in Moutlouis aka poorer soils, lower yields
  - Sponge-like **tuffeau performs better in dry years** as it holds onto water
- Champagne - grey and white chalk
  - Full of limestone, soft porous chalk, almost solely composed of $CaCO_3$ with tiniest bit of clay, two kinds of chalk - hard belemnite formed from cuttlefish skeletons near the surface and micraster from sea urchin and starfish fossils
  - well draining in wet champagne
  - Aube: Kimmeridgian marls - **clay and limestone mix more clay**
- Slovenia: **Primorska of limestone** where continental with cold wet winters, grows Vitovska, Rebula, Teran, Refosk, Merlot, Malvasia
- Tablas Creek in CA
- Burgundy:
  - heavier clay mineral content in the north for reds CdN, softer slopes in Beaune thus far more susceptible to damaging summer hailstorms
  - East: more clay than limestone thus too fertile/flat for great wines where Passetoutgrains (Pinot and Gamay), Bourgogne Aligote, and basic Bourgogne red and white

        - Chablis: limestone based
            - Portlandian: **younger simpler less clay, weathered, harder limestone - fruitier wine**, where most of the rare red wines in the region of Auxerre planted on them
            - Kimmeridgian marl (Champagne, Chablis, Sancerre, England): **greater mineral-rich clay - mixture of crumbly marl with good drainage and high clay content for water retention** -> high quality, a greater intensity of undersea-beastie shells (comma-shaped tiny Exogyra virgula - an extinct oyster, and the spiral coils of ammonites): flinty flavor; Raveneau, Dauvissat
        - Hautes Cotes: vineyards land above Cote d'Or: cooler and drier, more marl, less limestone, little subsoil, a lot of clay in spots and a lot of limestone and clay mix
            - Gamay, Pinot Noir, Aligote, Chard; Do. Naudin-Ferrand, Montchovet, Nicolas Faure, Fanny Sabre, Jean-Claude Râteau
        - the Maconnais: "vent du Midi" wind from west, cold in winter warm in growing season; vines first planted here on limestone soils,
    - Jura: marl, limestone, and schist, clay rock of lime and sandstone - main issue being water retention and drainage in wet Jura;
        - Savagnin (Nature, Traminer, parent of Chenin Blanc, and Gruner, early budding/ripening, thick, best on blue-grey marls which soften acidity)
        - Pinot Noir best on Bajocian limestone, or wherever drainage is good eg gravelly soils
        - Poulsard (Ploussard in Pupillin), early ripening/budding, thin-skin, loves marl soils esp red which retains heat, wherever savagnin is
        - Trousseau (Maturana Tinta in Rioja, Bastardo in Portugal): early ripening/budding, loves heat, grows gravel and clay, prone to reduction
        - Ouille: topped off, non-ouille: wines not covered to keep it protected from O2 while in barrel, a voile (veil) of yeast forms on the surface of the wine ~flor; Vin Jaune must be aged in a barrel until December SIX years after harvest, and

bottled into a clavelin, a squat bottle of 62 kms just shy of 750ml wine bottle, the diff said to represent angels share; Chateau-Chalon the appllelation devoted entirely to Vin Jaune, historically released during first week of Feb bacchanal la Percee du Vin Jaune

- Chinon: on Vienne River, most famous site **Les Picasses**, most southeast on the left bank of Loire, wines profound from **tuffeau** slopes and simpler on the cooler alluvial flat; aged in wood for a year or longer when from limestone, quick fermentation/elevage when from sand; rare plantings of Chenin!
- Bourgueil: rustic edge with coarser tannins, Pierre Breton, Do. de la Chevalerie, wines benefit from longer aging in wood
- Saint-Nicolas-de-Bourgueil: flatter, more alluvial sand, less limestone: lighter easy to drink simpler vinification, CF loves tuffeau mixed with a little sand and clay bc its **water holding ability**
- Alsace: most crus - variations on limestone change with what its mixed with: more chalk more verticality closed when young, the structure is broad with a lemony acidity, the famous being fossil-laden muschelkalk and limestone
- parts of Languedoc-Roussillon: pic Sanit-Loup, Saint-Jean-de-Minervois, esp in **Corbieres** [but the metamorphic soil is the foundation of this area's identity]
- Southwest France: Madiran, soils on slopes: clay and limestone with good drainage
- Montalcino and Chianti: limestone, galestro (friable crumbly shale/schist with clay), alberese (Chianti's **ALBERESE** soil is **a marl whose limestone is from fossilized diatoms like Spain's Albariza but it's darker, less chalky and more compact and rocky**)
- Chile: limestone in Limari Valley
- Chianti Classico DOCG: **crumbly rock with clay and marl (galestro)**, **calcareous soils with clay (alberese)**, **sandstone, sandy soils**
    - **good drainage** with **sufficient water holding** capacity
    - Galestro: give aromatic wines with potential to age
    - Soils with more clay: more structure and body

- **Pfalz: basalt, limestone**
- Switzerland where Aligote grows
- Canada - **Ontario: high concentration** around the lakes
- **Saumur-Champigny white soil** Anjou Blanc: (classy: Clos Rougeard) in the district of Champigny-le-Sec on limestone - **Breton (aka CF)**, more silex around Puy-Notre-Dame with more Cab Sauv
    - the Saumur whites don't usually go through Malo possibly because (1) the **colder cellar** temperatures of the troglodyte caves inhibit it; (2) malo is **naturally inhibited** in that **limestone soils are lower in pH than schist and higher in acid**, which can be inhospitable to malo-lactic bacteria
- Piemonte
    - Asti: clay and limestone heavy
    - Roero: soils laden with gypsum, younger sandier
    - Langhe: marl-rich
    - Barolo: 2 major soil types separated by Alba-Barolo road
        - west: younger Tortonian calcareous **marl, more feminine wines** (generalities)
            - La Morra
            - Verduno
            - Roddi
            - Grinzane Cavour
            - Diano d'Alba
            - Novello
            - Cherasco
        - east: older Helvetian **sandstone, longer-lived stronger wines** (generalities)
            - Barolo
            - Castiglione Falletto
            - Serralunga d'Alba
            - Monforte d'Alba

        - 100% Nebbiolo, min 13% abv, min 38 months aging, 18 months in wood; Riserva min 62 months aging, 18 months in wood; vines must be planted at min elevation 170m, max 540m; complete northern exposure prohibited, vines at least 7 years old, max yield 56 hectoliters per hectare - lower if "Vigna" aka single vineyard
    - Gavi: Stefano Bellottie with his Cascina degli Ulivi on **red clay limestone soils**, the Cortese shows a magnificent expression; Carussin makes a more polite version of Cortese blended with Carica l'Asino (old varietal whose name means ‘load up the donkey’)
    - Monferrato: Fabrizio Iuli is a champion of Barbera, says it excels on the loose soil, a mixture of clay, silt, and a significant amount of limestone
    - Nebbiolo (Chiavennasca in Valtellina in Lombardia, Spanna in Alto Piemonte, Picotoner in Valle d'Aosta) likes the marly clay and hillsides
    - Barbaresco, Neive, Treiso: sites close to Tanaro River thus richer soils thus ripen earlier than Barolo
        - **Tortonian soils** as with the west side of Barolo: wines less tannic, softer, fruitier
        - min 26 months of aging, 9 months in wood
        - Riserva min 50 months aging, 9 months in wood
- Friuli: clay and limestone soils: Merlot, Refosco - sturdy red esp paired with breakable slats of sandstone
    - higher quality wines: from the hillside vineyards of **Collio DOC** and **Collio Orientali del Friuli DOC**: calcareous marl and sandstone; soils include compacted marl - **ponca** -with **excellent drainage**; mild altitude (200m), a range of slopes and exposure to windcontribute to lower yields and higher quality -> pricier and costlier
- Rioja:
    - Rioja Alta:
        - mostly limestone mixed with clay and alluvial **sand**

            - Lopez de Heredia: Sand gives structure, limestone slow maturation
        - Rioja Alavesa:
            - highest concentration in Rioja of calcareous clay soils
            - Lopez de Heredia Cubillo where vines struggle on the pure chalk
        - Rioja Baja:
            - iron-laced clay and alluvial
    - Portugal south near coast eg Bairrada, Lisboa, Tejo, Peninsula de Setubal: more varied soils - clays with high limestone, sandy, fertile alluvial eg Tejo (cf schist/granite in mountains)
        - Península de Setúbal: Mountains in the south provide cooler sites at higher altitudes on clay-**limestone** soils; much of the land in the region is flat and sandy, with more clay and schist further inland
        -
    - Austria: Limestone and schist eg on Leithaberg hills
    - Alsace for Riesling
    - Bordeaux: best sites on right bank from limestone plateau or the gravel section that borders Pomerol
    - New Zealand - SI - Canterbury - North - Waipara Valley:
        - flat valley floor on gravelly sandy loam -> lighter body less intense than those on north/northwest facing slopes on clay loams with differing % limestone
    - Clare Valley: 25% plantings Riesling, intense sunlight at low lat (thick canopy for protection from sunburn), limestone, higher acid than Eden, LIMESTONE SOILS of Watervale: more fertile (than Slate soils in Polish Hill), more aromatic floral style can be drunk young
    - Hudson River Region AVA: glacial deposits of shale, slate, schist, limestone
    -
- Marl: clay (more) and limestone mixture: drainage + retention, cooling - slow ripening
    - Barolo

    - Chianti Classico
    - Chablis
    - Jura
    -
- Loess
    - between silt and loam, made of wind-blown sediments, mostly silica, **a sandy silt with high clay**
    - Austria where Gruner grows (on richer soils loess or clay) eg Wachau, **Wagram** (Klassik, Reserve - subtle oak, dry wines + LH, Eiswein, Roter Veltliner - full body nutty with age, no DAC)
    - Walla Walla WA: well drained deep layer of sawdust
        - basalt bedrock with sandy, silty loess, alluvial topsoils bc several cycles of Missoulaflood events, volcanic activity, glacial movement; in south-central Washington, a number ofridges (anticlines) are where the bedrock rises towards the surface creating sloped sites withvariations in aspect and altitude - many sub AVAs are based on these topographical featuresfree draining, low in nutrients
    - Oregon: free draining marine sedimentary (sandstone), volcanic loess soils in most of the growing areas at higher altitudes - Willamette Valley: Chehalem Mountains AVA
    - Rheingau: sand, loam, loess around Hochheim in the east
    - Hungary: esp around the Tokaj hill, thought to produce lighter more delicate wines
    - New Zealand - north island - Wairarapa
        - the most southerly of NI
        - low yielding wines bc strong winds from Cook Strait during flowering/fruit set
        - free-draining alluvial gravel terraces with silt loam and loess: cooling influence as take longer to warm up than rocky soils: slow ripening, elongate growing season -> concentration/complexity+++

    - Australia - Limestone Coast Zone, Coonawarra: terra rossa: free draining iron rich loam, 50cm in depth over a hard limestone base
        - roots may struggle to penetrate, restricting vine's access to water
        - slightly alkaline
        - restricts uptake of vine nutrients;
        - both soils control vigor thus lower yields of concentrated grapes
        - softer limestone under hard limestone layer: retains water for irrigation;
        - other parts include limestone and brown/black clay soils: retain more water thus vigorous vines esp in wet years: higher yields of less concentration
- Sandstone
    - composed of quartz and/or feld-spar, color depends on mineral content
    - Alsace: the local pink from iron Gres des Vosges, Strasbourg: wines can be more shy, initially with a nervous acidity, and a bony structure; limestone mixed with sand - more sand more direct flavor
    - Piedmonte
    - Oregon - Willamette Valley at higher altitudes: a mixture of sandstone, volcanic basalt and loess soils, less fertile -> small cordon-trained or replacement-cane pruned vineswith VSP trellising more common
        - Chehalem Mountains, **Ribbon Ridge**, **Yamhill-Carlton District** AVAs
        - as opposed to fertile loam soils on the valley floors (60 m in altitude) suited to Pinot Gris and, where Pinot Noir is grown, its **vigour** must be **managed** by large vine training systems such as **Scott Henry**

    - Rheingau - sandstone and slate in the west (Spatburguner the key grape)
    - part of Chianti
    - (eastern?) Georgia: Khaheti - limestone and sandstone where hot and desert like, grows Saperavi, Rkatsiteli, Kisi

- Silex (Flint)
    - when quartz-like silicon dioxide caught within chalk and through chemical changes -> metal-like hard silex aka flint or chert
    - exists almost exclusively where limestone is found
    - eastern central Loire: Montlouis-sur-Loire Vouvray, Sancerre, Pouilly-Fume, Touraine
        - Sancerre, Pouilly-Fume: limestone, silex -> some believe this addition to mostly limestone soils gives the wines their extra smokiness
        - Sancerre Silex: flinty soils that accumulate heat and lead to early ripening eg Les Remains
            - fruit grown on these soils are said to produce mineral and smoky wines
        - Sauv Blanc on Silex: truffles, peaches, distinct minerality. From the flintier soils, you get a blend of sweet earth and fruit aromas with a strong lingering vibrancy, a kind of fruit in the wine that needs to be teased out — Gaudry
        - the flint-stone/silex which can make the soil quite bright or give it a soft orange hue, oft gets the credit for giving wines flint like aromas
        - Chenin on silex has a distinct smoked salt, gunpowder element due to heat absorption by the flint-stones in the sun: Philippe Foreau, Francois Pinon in Vouvray
        - more silex southwest north of Toulouse in town of Fronton known inexp wines from Negrette, Domaine Le Roc, Chateau Plaisance

    - Saumur AOC: Saumur-Champigny AOC (red 85%CF): chalk, flint, clay soils - good drainage + water holding capacity, valuable in dry periods
    - Touraine: limestone, clay, flint, alluvial
- Shale
    - dark and layered like slate
    - didnt go through heat of metamorphism only pressure
    - sedimentary compressed mud with quartz and other minerals
    - Good nutrients, water retention - good for dry farming
    - part of Swartland around Malmesbury
    - Santa Barbara
        - Santa Maria Valley AVA: northern, west to east funneling cool Pacific Ocean air east, lowering temp, 100-250m on hillside slopes: sandy clay shale loam (PN Chard)
    - Montalcino - **galestro**: the soils baked in the Tuscan sun until it turned into brittle friable mineral sheets
        - Fonterenza, Carbaiona, Soldera, Stella di Campalto
        - Sangiovese best on friable shale limestone soils: excellent drainage; reasonably good on clay

    - Santa Cruz mountains:
        - Mount Eden at Martin Ray vineyard - site of one of first few plantings of Pinot Noir in US, Arnot-Roberts
    - Finger Lakes: Hermann J Wiemer, Element Winery, Bellwether, Nathan Kendall, Shaw Vineyard, Bloomer Creek (Riesling!)
    - Hudson River Valley: glacial deposits of shale, slate, schist and limestone
    - South Africa: Granite (soils on foothill slopes, water retention for dry farming), **Shale (good nutrient, water retention for dry farming)**, and Table Mountain sandstone (sandy, low nutrient, water retaining)
        - Coastal Regions: Cape Town District - Durbanville Ward: shale soils with high water holding capacity, uitable for dry framing
        - Coastal Regions: Darling District - Groenekloof Ward: ocean breeze, west coast with hills, SB, CS, Merlot, Shiraz (fresher than Durbanville) with granite soils of high water holding capacity, dry farming and bush vines common
        - Coastal Regions: Swartland District: diverse soil of low fertility granite and shale esp around Paardeberg

- **Mudstone**: hold and release great amounts of water
    - Oslavia in subregion Friuli Colli Orientali, close to Slovenia: Radikon, Josko Gravner, Movia Damijan Podversic, Vodopivec, dario Princic
- **Diatomite**/Diatomaceous Rock/Kieselguhr
    - main ingredients in water filters, cat litter, toothpaste
    - totally absorbs moisture, white as chalk, no calcium carbonate: 90% silica from fossilized bits of diatoms (algae): needs composting to help vines grow, retain some water, create humus
    - white soft rock made of compressed diatoms and fossils of algae and other creatures w/o $CaCO_3$ content, almost pure silica with little organic matter

    - parts of Santa Barbara, Santa Rita hills near Lompoc (Raj Parr) where dry farmed - rare
    - Jerez: albariza - a blend of limestone with an abundance of diatoms: **absorbs moisture** remarkably due to fossils in the diatoms (where diatoms meet calcium carbonate); chalk
- Heavy **Clay**
    - chunky quality in fruit
    - clay minerals form in sheets
    - richness in middle palate, sometimes a rustiness sometimes a deep cherry not from the vine
    - blocky in the mouth
    - generous and rounder wines
    - Abruzzo: calcareous clay - Trebbiano, Pecorino, Montepulciano
    - Emilia Romagna in Italy
    - Imereti in Georgia: limestone and clay where rainy and cool, grows Tsolikauri, Tsitska, Otskhanuri Sapere
    - Burgundy: clay mixed with limestone
    - plasticity and ability to expand and contract with water and hold onto minerals for plant's digestion
    - when clay dries it shrinks and hardens on the surface but deep down the clay subsoil holds onto the moisture and dole out to soils during drought conditions
    - Alsace: variations on limestone change with what's mixed with: more clay means a firmer wine
    - Bordeaux:
        - pockets of clay on left bank Bordeaux esp Saint-Estephe
            - while robust and characterful, not asprestigious as those grown on gravel
        - far more clay on right bank Bordeaux
            - barring sig patches of gravel in Libournais
- Gravel
    - sediment and limestone

- **rocks easily absorb the heat and contribute to more alcoholic wine**s, help to warm sites
- **great drainage** esp beneficial in wet regions eg Graves
- light in color thus warms the earth, reflecting the sun and holding onto heat
- whether limestone or basalt, texture and size trumps the mineral component of gravel
- Walla Walla in WA
- Chile - river valleys: fertile alluvial soils with areas of clay, sand, silt and gravel, soil on the slopes less fertile: more gravel with sand and silt in coastal regions
- Argentina - middle areas dominated by gravel, sands, silts [larger stones with calcareous deposits at higher alt close to Andes, loamy clay soils in lower areas]
- Australia
  - New South Wales: Central Ranges zone - Orange: deep red volcanic basalt soils, yellow/brown clay loams, shallow gravels
  - Southwest zone - Margaret River: free-draining gravel soils (irrigation essential from water in dams from winter rainfall), infertile, reduces vigor; Leeuwin, Moss Wood
- New Zealand:
  - NI - Wairarapa
    - the most southerly of NI
    - low yielding wines bc strong winds from Cook Strait during flowering/fruit set
    - free draining alluvial gravel terraces with silt loam and loess: coolinginfluence as take longer to warm up than rocky soils: slow ripening, elongate growingseason -> concentration/complexity+++
    - Ata Rangi and Dry River

        - NI - Hawke's Bay: gravel, alluvial soils, 2 known subregions: Gimblett Gravels and Bridge Pa, both on alluvial terraces with gravelly soils:
        - NI - Hawke's Bay - Gimblett Gravels: stony topsoils get very warm during day and release heat into evening helping Syrah, Cab Sauv ripen, free draining: irrigation necessary even with high rainfall
        - SI - Marlborough: 2 main valleys - Wairau:
            - Westernmost edges (westernmost edges (less moderating influence from ocean: warmer days, cooler nights, greater diurnal range, greater rick of frost) of Marlborough to Cloudy Bay at eastern end; gravel, silt, sand, loam, clay soils, in general more fertile water table higher nearer the coast thus higher yielding than inland, free draining soils require irrigation but also provides warmth to extend growing season; Sauv Blanc most planted, PN, Chard, PG also widely planted
        - SI-Central Otago: gravel to clay with schist as the parent rock, low in organic matter: compost and cover crops widely used to improve nutrient levels and soil structure
        - SI-Nelson - Moutere Hills: northwest clay-based gravel w/ sandy/loam topsoils on undulating terrain, low elevation, low nutrient, water retaining
        - SI-Cantebury - Waipara Valley: flat valley floor on gravelly sandy loam -> lighter body less intense than those on north/northwest facing slopes on clay loams with differing % limestone
        -
    - Chateauneuf-du-Pape - galets
    - Southwest France;
        - the Dordogne - Bergerac AOC: clay, limestone, some gravel
    - Bordeaux:
        - left bank - Medoc/Graves: beneficial in getting hard-to-ripen vines of Bordeaux to give tasty fruit
            - Medoc varied - rocky gravelly hills
            - Medoc - Saint-Emillion: limestone full of marine fossils ~Saumur-Champigny
            - Left bank: more gravel and clay: CS, Merlot (wherever clay)
            - Haut-Medoc AOC and its subregions

            - Saint-Estèphe AOC: clay away from estuary, gravel banks close to estuary where CSauv grows
        - Right bank: more continental with limestone, heavier clay: CF, Merlot (wherever clay), Merlot-heavy
            - best sites on right bank from limestone plateau or the gravel section that borders **Pomerol**
            - 2.5 mile^2 of Pomerol (Petrus, Lafleur): clay over limestone, sandy loam with pockets of iron deposits ["crasse de fer" or rotted iron — defines the best/profound wines of the area: gives the wines a very characteristic flavor of something fat and metallic which many associates with truffles - lafleur]
    - Austria: Gravel and volcanic eg in Steiermark and parts of Kamptal
    - Touraine red wine AOCs have sand, gravel, and clay limestone soils
    - Trousseau needs a warm site to ripen eg gravels, warmer lower part of the slope or well exposed higher steeper slopes
        - Jura: mainly clay and marl some limestone
    - North Trentino - Teroldego Rotaliano DOC on sandy and gravelly soils where best Teroldegos are
    - Veneto - Valpolicella: south flatlands with gravel and sand thus warmer fruitier less acidity lower concentration
    - Sonoma County - Alexander Valley with poor free-draining sand and gravel at higher altitudes
        - Kendall-Jackson (Stonestreet Estate), Seghesio

    - Central Coast - Monterey AVA of free-draining sandy loam and gravel soils
    - Walla Walla Valley AVA - The Rocks District of Milton-Freewater sub AVA on an area of basalt stones and graveled silt loam
    - Canada - Ontario: clay, sand, *less* of gravel and rocks

# Metamorphic

- Slate
    - dark and brittle, almost neutral pH
    - formed under less heat/pressure than schist, less compressed
    - comes in diff colors and textures
    - best slate/schist **layered at right angles to the Earth's surface** rather than horizontally, which affects the way **water seeps in directly** <- critical as the soils can have **poor retention** if clay content is low
    - both slate/schist erodes quickly esp if there are winter freezes as in Mosel, thus **easier for roots to dig deep into the ground for water**
    - slate crumbles easily and when soils properly worked, vines squiggles through inhospitable soils
    - "**slate gives a spine to reds with black stone or moist cellar floor flavors**" - the real effect of the soil is in how well it **affords the vine access to nutrients/water to be in balance**
    - "the potash minerals are feldspar and mica, and these are mainly contained in **granite, gneiss, and mica slate**. Soils that are derived in a good measure from these rocks are the richest in potash thus the best for vineyards others being equal"
    - Mosel/Ahr: broader longer more color shades "schiefer" no differentiation between slate/schist
        - wet chilly, mean temp 65F in summer
        - steepest at 65 degrees

        - slate and schist called slate - schiefer, thin topsoils
        - dark color: retains heat during the day and radiates it out at night
        - heat retention and drainage really help here
        - few organic bc earth closed up and compacted, wouldnt drain
        - Gray, blue, red, brown slate - many claim diff colors of soils create diff wines
            - the gray gives a more elegant style, a softer slate with yellow fruits and white peach
            - the blue Devonian slate gives intense astringency when young but in its finish explodes with yellow fruit that's more ripe, exotic, and tropical
            - red slate gets color from high iron content and delivers more herbal notes plus more structure and complexity but vines need ~7 years to develop
    - Rheinhessen: Rheinterrasse
        - A stretch of steeply sloping sites on the west bank of river round Nierstein/Oppenheim
        - East facing, warm morning sun in the coolest part of the day enhancing ripeness
        - Close to Rhine which moderates - extend ripening season
        - Roter Hang: Rotliegenden soil - iron rich red soil of slate clay and limestone - smoky in Riesling
        - Weingut Gunderlock
    - Nahe - wide variety of soils/conditions
        - Vineyards in the east esp those on south facing banks of Nahe between Schlossbockelheim and Bad Kreuznach have some warmest conditions, moderated by Rhine and Nahe rivers, thus max sunlight
        - Steep slopes on slate and sandstone
    - Bierzo DO in Castilla y Leon: best sides on hillside slopes 500-850m with shallow poor slate soils: good drainage, limits vigor
    - Priorat: poor and stony soils, some outcrops of clay

        - slate based llicorella: thin rocky low in nutrient with mica reflecting light and heat back onto vines
        - Bedrock of slate **splits into vertical layers**: vines can dig deep for water as soil of low water retention
        - Low nutrient and water level: low yield esp old vines
    - Anjou Noir - as in the tuffeau limestone Anjou Blanc and the dark schist and slate of Anjou Noir
        - Chenin on schist and slate fleshier and more savory than limestone-grown, "Chenin on dark rocks austere, powerful, bitter, and intellectual"
        - south-facing slopes of slate and schist between the Loire, Aubance, and Layon Rivers, mingled into the soils is "schistes greseux" — clayish schist with some silica, or sandy shale — a mongrel clay made up of plenty of quartz, mica, feldspar, as well as bits of igneous rocks, green basaltic spilite, greenish rhyolite
        - **Savennieres**:
            - intense, powerful, high abv
            - Nicolas Joly: **Coulee de Serrant** monopole, **Les Vieux Clos** below CdS **in Savennieres**, **Le Clos de la Bergerie** in **Roche aux Moines**
            - mainly schist with some patches pf volcanic
        - Reds: Grolleau (Domaine des Sablonnettes, Benoit Courault), **CF on schist with more concentration** and power a bit more "rustic"
    - Galicia (while granite near the coast, lots of granitic outposts) schist and slate inland
        - Geologist Alex Maltman: slate is an aggregate of several complex silicate minerals bonded to give a characteristic aptitude for cleaving into thin sheets, it is palpbaly absurd that in the wine there exists a cleavable complex solid
        - water retention - useful in wet climates, and heat retention - works well in high elevations -> in Priorat gives high abv ~16%

    - Ribeira Sacra
        - whites mostly on granite: Godello, Loureiro, Treixadura, Palomino
        - reds - 85% Mencia (low acid??), Brancellao, Souson, Garnacha, Tintorera (Alicante Bouchet), Merenzao (Trousseau, Bastardo), Tempranillo, Espadeiro [gamay like], Caino Tinto [gamay like]
    - Hudson River Region AVA: glacial deposits of shale, slate, schist, limestone
    - Clare Valley: north of Adelaide Hills, northmost of Mount Lofty ranges: 25% plantings Riesling, intense sunlight at low lat (thick canopy for protection from sunburn), limestone, higher acid than Eden, SLATE SOILS of Polish Hill: infertile, less aromatic flintier style in youth, long aging to honey toasty

- Schist/mica
- higher pH higher density than slate, all shades
- "whatever the climate is, wines from grapes in schist are big wines, they can also show a streak of iron alongside powerful tannins" - terrior expert Pedro Parra
- schist is particularly great when they sit at a right angle to the Earth s.t. roots can go deep for water, alleviating hydric stress when plants could shut down due to heat, leading to green unripe tannins and aromas, even better with a little clay mixed with limestone marl
- Anjou Noir - as in the tuffeau limestone Anjou Blanc and the dark schist and slate of Anjou Noir
    - critic Michel Bettane likening Chenin on schist to "stale choucroute, old cheese rind, rancid butter, moldy dough"
    - best Chenin from schist have a deep violet and quince compelxity with a round, plump, grainy, juicy fruitiness
    - in the cool wet years schist does best with **heat retention and excellent drainage**

    - in the Noir, due to possibly higher cellar temperature and higher pH in schist soils, wines are left with a softer acidity (lactic) since malo could happen, or mineral or tension or whatever you might call it, thus softer, less angular
    - humidity from three main rivers - the Loire, Layton, Aubance - the protection from the southwestern rains by the Massif des Mauges, making it one of the warmest driest spots of Loire, boosting wines' abv; humid wind blows up from the Atlantic -> botrytis here much more than Anjou Blanc (inland, less humidity/fog influence)
- Ribeira Sacra "lousas" - bold hard forms
- Languedoc: Faugeres and Saint-Chinian (high elevation)
    - "schist **radiates** an energy that effect men's behaviors"
    - large slabs "dalles": hardly anything grows on the soil except vine, super low vineyards
    - "schistes gréseux": more clay-like texture
    - friable brittle fragile: "frites"
    - with constant erosion from sun and wind, the rock breaks down feeding vines nutrients
- Roussillon: broken stone mats "dalles" and slender fragments "frites"
    - Maury, Fitou, Collioure, Banyuls (high elevation)

- Cote Rotie - Cote Brune: mica rich heavy schist "mica schist"
- Jura: marl limestone and schist; WSET: soils mainly clay and marl, limestone someplaces
- Saumur-Champigny: schist and limestone-derived soils
- Austria: Limestone and schist eg on Leithaberg hills
- Beaujolais crus, villages AOCs northern part hilly at 200-500m with fast draining granite, schist, sandy soils
- Languedoc: Saint-Chinian AOC between Minoervois and Faugeres, mainly rose/red from >=50% MSG: northern zone: arid fast-draining schist: low yield, intensity++; Saint-Chinian Roquebrun AOC, Saint-Chinian Berlou AOC
- Languedoc: Corbieres AOC, btw inland and coastal, schist, Carignan;
- Languedoc: Faugeres AOC: 250-400m, well-drained low fertility schist
- Portugal: schist or granite in mountainous regions eg Vinho Verdo, Douro, Dao, and hilly Alentejo
    - Douro Bedrock - schist, shallow topsoil of decomposed schist, low in organic matter, stony in texture, stores little water;
    - >>splits into vertical layers the vine roots can break through it in search of water - important bc many of the Douro's hillside vineyards are not set up for irrigation
    - Alentejo: wide range of soils: granite, schist, limestone textured from sand to clay
    - Península de Setúbal: Mountains in the south provide cooler sites at higher altitudes on clay-limestone soils; much of the land in the region is flat and sandy, with more clay and schist further inland
- Hudson River Region AVA: glacial deposits of shale, slate, schist, limestone
- New Zealand - SI - Central Otago: gravel to clay with schist as the parent rock, low in organic matter: compost and cover crops widely used to improve nutrient levels and soil structure

- Gneiss
    - looks like granite but metamorphic
    - infertile soil, no water retention, **well-draining**, thus **high elevation wet years** turn out great
    - like granite: coarse texture
    - gneiss gives a darker **more focused fruit**
    - wines from granite and gneiss are <u>expressive in youth with an edgy structure</u>
    - **wet Nantes** area in Loire
    - Austria's primary rock (**for Riesling/Neuburger**):
        - thin soils over rock (granite or gneiss, crystalline bedrock locally as Urgestein): where Rieslings are as it needs less water than Gruner
        - Wachau: intense wines on dramatic rocky slopes with very little topsoil eg Nikolaihof, west of Vienna
        - Kamptal: Martin Arndorfer from terrior in Heiligenstein
        - Gaisberg has gneiss where Neuburger and Roter Vetliner can handle a low amount of water well w/o losing quality or aromas
        - Gruner Veltliner is much more sensitive in water - if it gets water-stressed you can taste it usu in higher amount of phenolics and less focused fruit, gray and dusty aromas
        - Riesling and Neuburger like gneiss, they usu show a **minerality and vibrancy** <u>based on the mineralogy of gneiss</u> combined with a lively soil
    - Cote-Rotie
    - Alsace close to the Vosges in the west
- Amphibolite
    - Majority of Muscadet on gneiss, orthogneiss, amphibolite despite granite fame
    - gives Muscadet a **salty crystalline** edge - the sea-style of Muscadet

# Sand

- anything pulverized: white silica or black grains of basaltic glass
- Well-draining: great for monsoon season bad for droughts unless in humid climates
- where most old vines' roots are
- James Busby: the sandy soil will, in general, produce a delicate wine
- can produce a simple wine esp beachy sands of silica as a direct translation of fruit flavor for uncomplicated but fun representations
- Sedimentary Californian Evangelho vineyard outside of Sacramento (Bedrock, Dirty & Rowdy, Sandlands, Dashe)
- Colares in Portugal

# Silt

- stone dust, finer, more fertile, better water retention than sand
- prone to compaction

# Loam

- a combination of textural elements
- fertile loam is an even mixture of sediments: **sand, silt, clay**
- in much of California were compounded by fertile soils: loads of fruitiness
    - increase competition in vineyards by growing the right vegetables between rows and adjust the trellising

    - Sonoma County - Dry Creek Valley AVA: mixed but gravel sandy loam on valley floor, gravel red clay loam on slopes and benches: gravelly free draining reduces vigor/yield
    - Monterey County - Monterey AVA: sandy loam and gravel soil - free draining
    - Santa Barbara - Santa Maria Valley AVA: 100-250m hillside slopes on sandy clay shale loam
    - Central Valley - Lodi AVA: flatland sites on free-draining sandy and clay loam soils
    - Sierra Foothills: sandy clay loam from decomposed granite, retains water suitable for dry farming
- Oregon - Walla Walla Valley AVA - The Rocks District of Milton-Freewater sub-AVA on an area of basalt stones and graveled silt loam
- Oregon - Willamette Valley AVA - valley floor
    - Fertile loam soils on valley soils (for PG, PN but vigor managed by large vine training sys eg SCott Henry)

- Long Island AVA - North Fork sub AVA (sand) and Hamptons sub AVA (silt loam): both free-draining and infertile - reduce vigor
- Southwest - Madiran - flatter land: clay, clay+loam soils for less tannic wines, drunk young
- Canada - British Columbia - Okanagan Valley: glacial deposit esp loams, increasingly sandy in south thus irrigation essential
- Argentina
    - alluvial soils deposited by rivers down from Andes
    - texture varies: larger stones with calcareous deposits dominate higher alt closer to Andes;
    - middle areas dominated by gravel, sands, silts;
    - lower areas: deeper **loamy**-clay soils, richer in nutrients
- South Africa - Breede River Valley Region - Worcester District: loamy soils fertile for bulk - Colombard+Chenin+Chard,SB,V,Shz
- New Zealand - NI - Gisborne (eastern tip): majority of vines on a flat fertile floodplain of loam, clay, and silt
- New Zealand - NI - Wairarapa: most southerly -> Wellington Wine Country (Masterton, Gladstone, Martinborough): PN (higher fine grained tannins than else), SB where free draining gravel terraces with silt loam and loess dominate: cooling as it takes longer to warm up than rocky soils; slows ripening, prolong ripening: intensity+++
- New Zealand - SI - Nelson - Moutere Hills subregion: clay based gravel soils with sandy loam topsoil on undulating terrain

- New Zealand - SI - Nelson - Waimea Plains subregion: low lying alluvial soils with fine silt, clay loams of moderate fertility: free draining, lighter body fresh fruit
- Australia - Limestone Coast Zone, Coonawarra: terra rossa: free draining iron rich loam, 50cm in depth over a hard limestone base
    - roots may struggle to penetrate, restricting vine's access to water;
    - slightly alkaline: restricts uptake of vine nutrients;
    - both soils control vigor thus lower yields of concentrated grapes
    - softer limestone under hard limestone layer - retains water for irrigation;
    - other parts include limestone and brown/black clay soils: retain more water thus vigorous vines esp in wet years: higher yields of less concentration
- Australia - Victoria - Port Phillip Zone - Macedon Ranges: one of coolest in mainland, shallow granitic sandy soils on hillsides
- Australia - Victoria - Northeast Victoria zone - King Valley: well drained loam with high fertility: vigor mgt needed
- Australia - New South Wales - Hunter Valley Zone: Lower Hunter: closer to coast w/ sea breezes thus cooler than Upper Hunter, hill at low alt, sandy/clay loams over clay base
- Rheingau: steep slopes around Rudesheim, Geisenheim (home of famous research institute), Johannisberg, Hattenheim, Erbach | sand, loam, loess around Hochheim in the east, sandstone and slate further west
- Lesser sites of Bierzo from Castilla y Leon inexp high yielding wines: flat plain in the middle of DO, lowerer slops, fertile silty loam soils
- Spain - Penedes DO - Penedes Superior
    - High alt 500-800m, cooling, diurnal, spring frost inland areas

    - Loam soils with calcareous components; can store enough water through ripening
- Dao DOC: weathered granite with a sandy or loamy texture, low in organic matter, free-draining, reduce vigor, water stress an issue

# Alsace:

- Andre Ostertag: Pinot Gris expresses soils in his corpulence, but with age PG shows the great tannic structure, almost behaving like a white wine. Riesling is a sponge of the soil much more capable in capturing the subtleties.
- Gentil: min 50% Riesling, Muscat, and/or Gewurtztraminer, PG; rest made of Sylvaner, Chasselas, and/or Pinot Blanc; before blending each grape varietal must be vinified separately and must officially qualify as AOC
- Edelzwicker: any blended wine
- Klevner: Pinot Blanc blended with Auxerrois
- 1626 Trimbach
    - Clos St Hune: 1.67 hectare of pure limestone, 8000 bottles in a good vintage, vineyard in Hunawihr (grand cru)

# Sancerre - three types of soils

- Cailottes: very shallow soils (25-40mm) over limestone - fruit grown on these soils are said to produce the most aromatic wines that are first to be ready to drink and to have less potential for ageing
- Silex: flinty soils that accumulate heat and lead to early ripening eg Les Remains
    - fruit grown on these soils are said to produce mineral and smoky wines
- Terre Blanches:

- the same limestone and marl that is to be found in Chablis - **Slow ripening** on these soils which include some of Sancerre's most famous vineyards: **Côte des Monts Damnés**, Cul de Beaujeu
- fruit grown on these soils are said to produce the most structured wines that need long maturation before they are ready to drink and age well

# Muscadet Crus Communaux (P93)

1. Gorges: clay and quartz atop gabbro
2. Le Pallet: ...