SAKE

SERVING TEMPS:

- warmed sake - 45-50°C (98-110°F) → just above body temperature.
- chilled sake: just below room temperature. (≈55°F / 13°C)

- An alcoholic beverage brewed primarily from rice + water.
  - ↳ 13-17% ABV
  - ↳ high % of glucose, nitrogen & amino acids
  - ↳ low acid, high pH

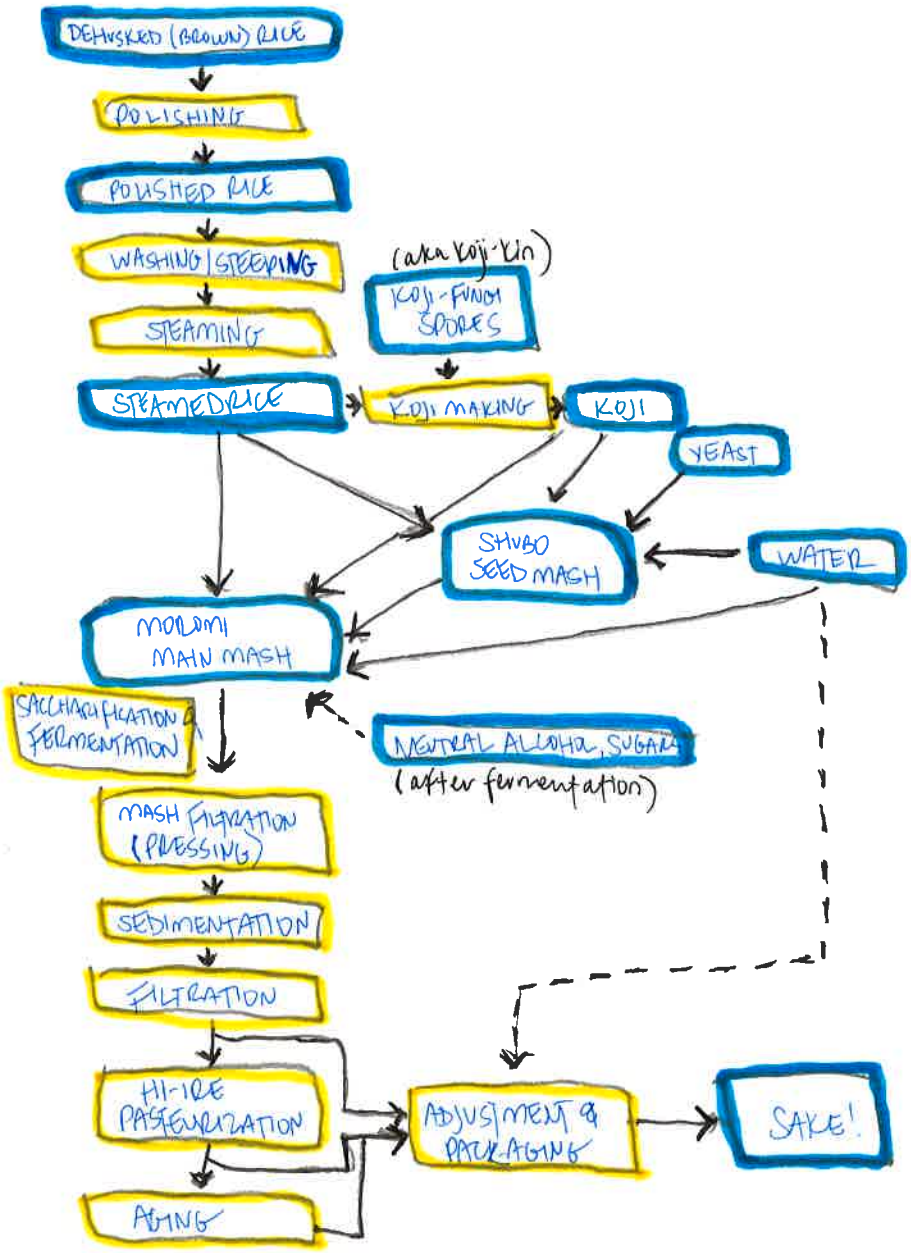
CULTURAL BACKGROUND

- the term sake is often used to denote alcoholic beverages in general, including wine, beer & whisky.
  - ↳ sake as we know it is also called "Nihon-shu" or "Sei-shu" (Japan) (clear)
- China is the birthplace of saccharification via mold.
  - ↳ the use of molds instead of malt to turn starch into sugar
- heating sake originated in the 9th century, when aristocrats would warm sake to entertain guests.

OUTLINE OF SAKE BREWING

- RICE - broadly two varieties: indica, a long-grained variety, and japonica, a short-grained variety. Each is further divided into sticky & non-sticky rice.
  - NON-STICKY JAPONICA rice is used to brew sake, as is it the most common type of eaten rice.
  - "sake rice" is used to make premium styles → large grains, low protein content & high solubility during the brewing process.
- WATER - historically, sake makers erected breweries near good water sources.
  - quality standards → no more than .02 ppm of iron.
- RICE POLISHING/MILLING
  - the outer layers of rice contain large amounts of fats, minerals & proteins that spoil the flavor.
  - a high-speed rotating roller is used to polish.
  - 30% is an average milling rate - leaving 70% of the rice grain. This would be known as having a seimai-buai (polishing ratio) of 70%.

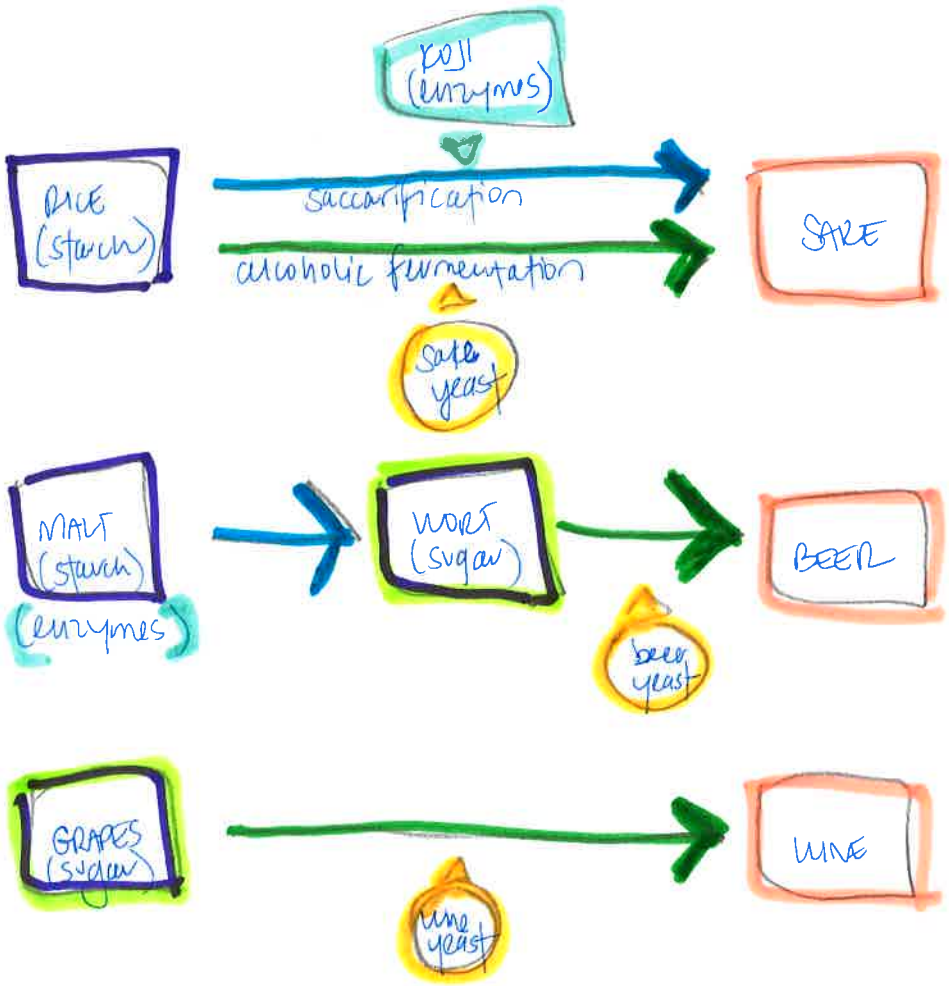
OUTLINE of SAKE BREWING



- WASHING, STEEPING & STEAMING
  - After milling, the polished rice is washed to remove the bran, then steeped in water.
  - When the grain has absorbed 30% of its weight in water, it is removed from the water & steamed for one hour.
    - ↳ less moist & sticky than boiled rice

OUTLINE OF SAKE BREWING

- KOME-KOJI (KOJ-RICE) MAKING
  - for grain fermentation, necessary to have a source of enzymes to break down starch into sugar, break down protein, and produce peptides & amino acids.
  - for beer, malt is the source of these enzymes, but for sake, kome-koji is used. Made by cultivating koji-fungi on steamed rice. Koji-rice may simply be called koji.
  - Koji fungus = aspergillus oryzae
  - the first step in making the koji is to inoculate steamed rice w/ the spores of koji-fungi, called tane-koji. Germination ensues. 2 days.
  - temp. controlled process in a koji-muro (koji room). 30°C w/ humidity of 50-80%.
  - polished rice to make koji is called koji-mai.



OUTLINE OF SAKE BREWING

- YEAST & SEED MASH
  - before the main fermentation, the brewers prepares seed mash, also called shubo or moto by significantly increasing the amount of top-grade yeast.
    - "mother of sake" — "base" / "source"
  - it is important to produce highly acidic shubo to suppress microbes that spoil sake
    - ↳ these of lactic acid bacilli & lactic acid can promote.

- MAIN MASH + FERMENTATION ("moromi")
  - the standard ratios of steamed rice, koji & water placed in the fermentation ~~tate~~ tank are:
    - steamed rice - 80
    - koji - 20
    - water - 130
  - this is added over the course of 4 days (in 3 steps)
    - day 1 - 1/6 of total, plus shubo — 12°C
    - day 2 - nothing > yeast multiplies
    - day 3 - 2/6 of total added — 10°C
    - day 4 - remaining 3/6 is added — 8°C
  - koji converts the starch to sugar & yeast converts the sugar to alcohol simultaneously
  - fermentation process takes 3-4 weeks & yields alcohol content of 17-20%.
  - using a lower fermentation temp (below 12°C to start) makes for a longer (4-5 weeks) fermentation, reducing acidity & making for a fruity sake w/ a clean taste.

OUTLINE OF SAKE BREWING

- MASH FILTRATION (PRESSING)
  - when the fermentation is complete, the moromi is filtered w/ cloth & the undissolved rice & yeast removed.
  - the cake left over from the process is called sake kasu (filtered sake cake). It contains 8% alcohol. Can be eaten, used to make shochu, or for pickling vegetables.
- SEDIMENTATION & FILTRATION
  - racking, filtration & fining to make clear
  - active charcoal is also allowed for decoloring, flavor adjustment & control of the aging process (by removing substances that cause color + flavor changes w/ age)
    - ↳ persimmon tannin & silica allowed.
- PASTEURIZATION
  - aka "hi-ire"
  - temps of 60-65°C
  - sterilize the liquid & render enzymes inactive
  - if enzymes remain, they often increase sweetness + oxidation in the final product.
  - pasteurization often happens twice → before aging & before bottling.
- AGING
  - most sake is aged in tank 6 months - 1 year. Most sake is brewed in the fall + winter following rice harvest, aged during spring & summer + shipped the next fall.
- ADJUSTMENT + PACKAGING
  - Before bottling, brewers often add water to reduce alcohol to 15%. They may also pasteurize + filter again.

TYPES OF SAKE

- Japan's Liquor Tax Act defines the ingredients that must be used for sake:
  - rice
  - koji
  - water
  - neutral alcohol (ethyl alcohol of agricultural origin, called jozo-alcohol)
  - sugar
- Special designations ("tokutei-meisho") include: [account for 30% of sake]
  - ginjo
  - daiginjo
  - junmai ginjo
  - junmai daiginjo
  - junmai
  - honjozo
  - ↳ only these premium designations can include further descriptions like "koshu" & "nama genshu"
  - ↳ the rice used to make specialty designated sake must undergo inspection
  - ↳ the amount of koji-mai (polished rice used to make koji) used in the production of koji rice must be equal to at least 15% of the total weight of the polished rice used.

GINJO

- >40% of the outer layer has been removed by milling
- fermentation occurs at lower temps & takes longer
- jozo-alcohol equivalent of up to 10% of the weight of the polished rice may be added.
- ginjo-ka = fruity fragrance

DAIGINJO

- form of ginjo w/ even more highly polished rice, >50% removed. more refined taste & stronger "ginjo-ka"

JUNMAI, TOKUBETSU JUNMAI

→ a higher degree of polishing or special bottling. often falls into ginjo/daiginjo categories.

- made only from rice, koji + water
- NO required polishing ratio
- typically high in acidity and umami, w/ relatively little sweetness

TYPES OF SAKE

JUNMAI GINJO

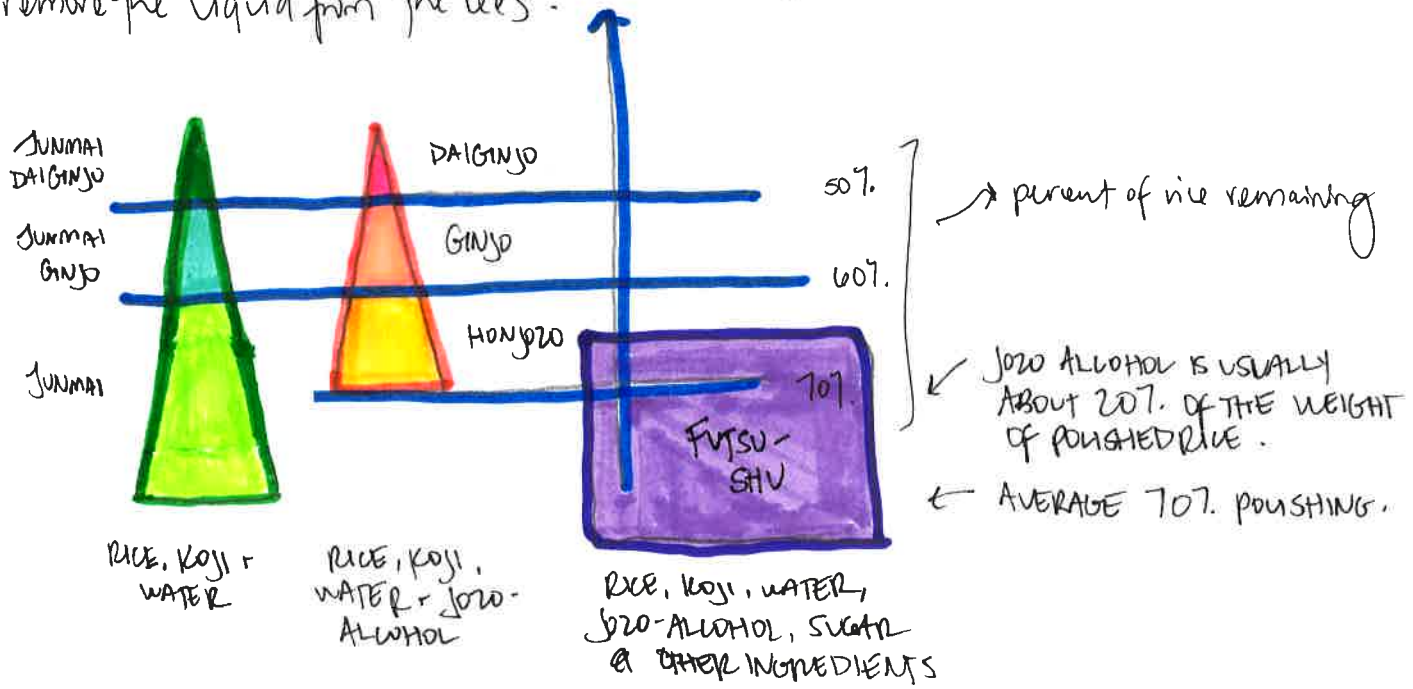
- ginjo brewing techniques employed (but no added alcohol) → cooler + slower ferments → ginjo-ka
- > 40% of outer layer milled

JUNMAI DAIGINJO

- regarded as the highest grade sake
- > 50% of outer layer milled

HONJOZO

- > 30% of outer layer removed, alcohol is added. • Driven + lighter.
- no ginjo-ka or aging-induced aroma. Good acidity + umami.
- alcohol is added usually after fermentation, just before the sake is pressed to remove the liquid from the lees.



OTHER LABELING DESIGNATIONS

- Shinshu: Sake brewed during the current year.
- Nigori / Nigorizake: a coarser cloth or net is used for filtration. Cloudy. "Less filtered"
- Namazake / Nama-chozo-shu: Namazake is unpasteurized, Nama-chozo-shu is not pasteurized before aging, but pasteurized before it is bottled.
- Koshu: Aged sake, min. 3 years. Little "ginjo-ka" → more savory flavors.
- Genshu: Undiluted sake, 17-20%.
- Taruzake: Sake aged in Japanese cedar casks.
- Sparkling sake: Can be made via secondary fermentation or injection of CO_2.

METHODS OF TASTING SAKE

- **VESSELS:**
  - Japanese breweries & analysis laboratories use a special vessel called a **Kikichoko**. Serving temp. for tasting is recommended at 18-20°C.
    - → 180 ml. white porcelain vessel w/ 2 concentric cobalt blue circles inside the bottom → enables detection of color + turbidity

- **APPEARANCE:**
  - if not a nigori, should be clear
  - can be slightly yellow if not treated w/ active charcoal (in youth)

- **AROMA:**
  - ginjo-ka ("ka" = aroma) → apple, pear, banana, melon, lychee → comes from esthers produced during fermentation.
    - → highly polished rice, cool + slow ferments produce this.

- **PALATE:**
  - "umami" → associated w/ the presence of glutamic acid.
  - amakara = sweetness
  - a short finish is desirable

- **FAULTS:**
  - **Zatsuni** - unrefined / unbalanced.
  - **Lightstrike**
  - **Hine-ka** - oxidized or sulphurous aromatics
  - **Corky / mustiness** - sake is not corked, but breweries / casks / mold can be contaminated w/ TCA.

SERVING SAKE

- Light + high temp
- humidity is not an issue → corks
- VESSELS:
  - a glass is used to serve sake below room temperature → a sake glass is 160 ml. or 110 ml. A bordeaux glass is also acceptable.
  - Sakazuki (sake cup) - earthenware or porcelain vessels
  - tokkuri - heated sake is served in a 150 ml. - 300 ml. porcelain vessel called a tokkuri or o-choshi.
  - chirori - pewter or copper vessel used to heat sake.
- SERVING TEMP:
  - ginjo-shu + namazake should be served slightly chilled at 8-10°C.
  - "kan" (warm sake) is the traditional way to drink it. Heated to 42-45°C.
    - ↳ junmai-shu, which is low in sweetness & high in acid, can find balance @ higher temps.
    - ↳ not heated directly, but usually via a water bath.

OTHER LABELING DESIGNATIONS

- Tenkuri - "handmade" → junmai or honjozo, brewed using traditional methods
- Namazume-shu: sake pasteurized once, before maturation.
- Kijoshu: Sake is used in the brewing process instead of water.
- Ki-Ippon: a junmai-shu brewed at only one brewery
- Hiyaoroshi: traditional method of nama, where the sake is pasteurized once, before maturation, then aged until the following fall.

SERVING SAKE

- LABELING OF TECHNICAL INFORMATION
  - Nihonshu-do: Sake value meter. In general, correlates to sweetness (w/ negative values indicating sweeter styles), but can be affected by alcohol + non-sweet sugars
  - Sando: acidity. measured in tartaric acidity.
  - Aminosan-do: amino acid value
  - Amakara value: another sweetness measure. Glucose-acidity. Dry < .3, med. Dry .3-1, med. Sweet 1-1.8, Sweet > 1.8.

YAMAHAI + KIMOTO

- Traditionally, it was believed that rice + koji had to be mixed + crushed into a purée when creating the moto (aka shubo). To achieve this, brewery workers would ram oar-like poles into the small vat for hours on end → this activity is known as yama-oroshi.
- In 1909, it was discovered that the enzymes in the koji would eventually dissolve all the rice w/o any ramming → just needed more water + higher temps.
- Yamahai = hai-shi (cessation) of yama-oroshi
- In 1911 it was discovered that ~~added~~ adding lactic acid would speed up the process (as well as prevent wild yeast & unwanted bacteria)
  - ↳ "Sokujo moto" = fast-developing moto (achieved through lactic acid)
  - ↳ this is most of the Sake on the market.
  - ↳ if labelled just "yamahai" the assumption is that lactic acid has not been added. funkier style, more acidity.
- Kimoto is the original process, where pole-ramming is used. Seen for less refined styles.

FACTORS INFLUENCING TYPES + VARIETIES

RICE

- 270 varieties of rice are grown in Japan. These include certain varieties, known as sake rice, which are suitable for use in sake making.
- Sake rice grains are large & have a white core (shinpaku), as well as low protein content. They are water absorbent, resilient when steamed, and easy to turn into koji (because of ample shinpaku).
- In Japan, each region has its own designated varieties of sake rice. Well known ones include: Yamadanishiki, Gohyakumangoku, Miyamanishiki & Omachi. In 2010, 95 varieties of sake rice were grown.
- The outer layers of rice contain protein, fats, minerals & vitamins, which speeds up the fermentation process. Some amount of them, though, are important for the proliferation of koji & yeast.
  - ↳ Seimai-buai = amount remaining (%) → the lower that number, the higher the cost of producing the sake.
- Vintage variation!
  - in years where temps are low & sunlight insufficient → the rice grains are smaller & more soluble, resulting in heavier tasting sake.
  - hot years → weaker tasting sake (grains are less soluble)

WATER

- most water in Japan is soft, but in some areas the water is quite hard. (high calcium carbonate levels)
  - ↳ calcium stimulates the production & extraction of enzymes.
- other minerals in hard water → potassium, magnesium, phosphates → assist fermentation through promotion of koji fungi & yeast.
- Sakes made in areas w/ hard water tend to be full bodied + dry.

FACTORS INFLUENCING TYPES + VARIETIES

"toji" = brewmaster

KOJI MAKING

- each brewery makes its own koji (unlike malt production)
- broadly speaking, koji styles can be divided into **sohaze** & **tsukihaze**

sohaze

- the koji-fungi covers the entire rice grain, sending many hyphae (strands) into the kernel.
- strong enzymatic activity.
- dissolves the rice well & promotes strong fermentation
- used to produce futsu-shu to which alcohol is added & fuller bodied styles in general.

tsukihaze

- the koji fungi grows in a spotted pattern over the grain.
- appropriate enzymatic activity, but the vitamin & fatty acid content is lower.
- used for ginjo-shu & more delicate styles.

YEAST

- Kyokai-kobo = "Brewing Society yeast" → distributed & selected by the Brewing Society of Japan.
- Numbered, developed between 1935 + 2006, and selected for desired acidity & flavor profile. → Number 7: the most commonly used.

STYLES

- Divided into methods for introducing lactic acid to the mash

adding lactic acid bacilli

- kimoto
- yamahaimoto

- these methods take a long time, allowing the acid to form, the yeast to proliferate & the bacilli to be killed off. 4 weeks.
- less common now, but is said to create a more complex sake.

adding brewing grade lactic acid

- sokujomoto

- the length of the bacilli process led to the rise of sokujomoto. Lactic acid itself is added, eliminating the need for the bacilli culture. Shortens process by 2 weeks.

FACTORS INFLUENCING TYPES + VARIETIES

GINJO-SHU

- the keys to making ginjo-shu w/ pronounced aroma & light taste:
  1) good quality ingredients
  2) low seimai-buai - reduces the amount of fat + inhibits the formation of fruity esters
     - reduces the protein content + produces a light taste
     - suppresses yeast activity → reduces acidity.
  3) Ginjo-koji making: tsukihaze style w/ low seimai-buai rice
  4) Low temp. fermentation (selection of yeast for low-temps)
  5) moderate pressing during mash filtration

JOZO ALCOHOL

- made from molasses & grains, normally 30% ABV.
- less than 10% of the weight of the rice may be added for honjozo, ginjo + daiginjo.
- adding alcohol extracts aroma ingredients, especially esters. At the same time, it dilutes ingredients derived from rice & fermentation, reducing acidity & umami to give the sake a light taste.
- in addition to jozo alcohol, the following may be added to futsu-shu: Shochu, sugars, organic acids, amino-acid salts, sake + sake kasu. max. 50% of weight of rice.
- additions must be noted on the label.

Nigori = "cloudy" but Muroka doesn't have to be cloudy.

FILTRATION

- the best quality sake is not the first run, but the second (still free run, w/o applying pressure to the moromi).
- fukurodori / shizuku sake = "sake-drip" → no pressure at all.
- muroka → "non-filtered sake". A cloth filter is always used to separate the sake, so sake is always filtered to some extent. Muroka can mean no additional filtering, or filtered w/o using active charcoal. (usually what commonly meant by muroka)

FACTORS INFLUENCING TYPES + VARIETIES

PASTEURIZATION

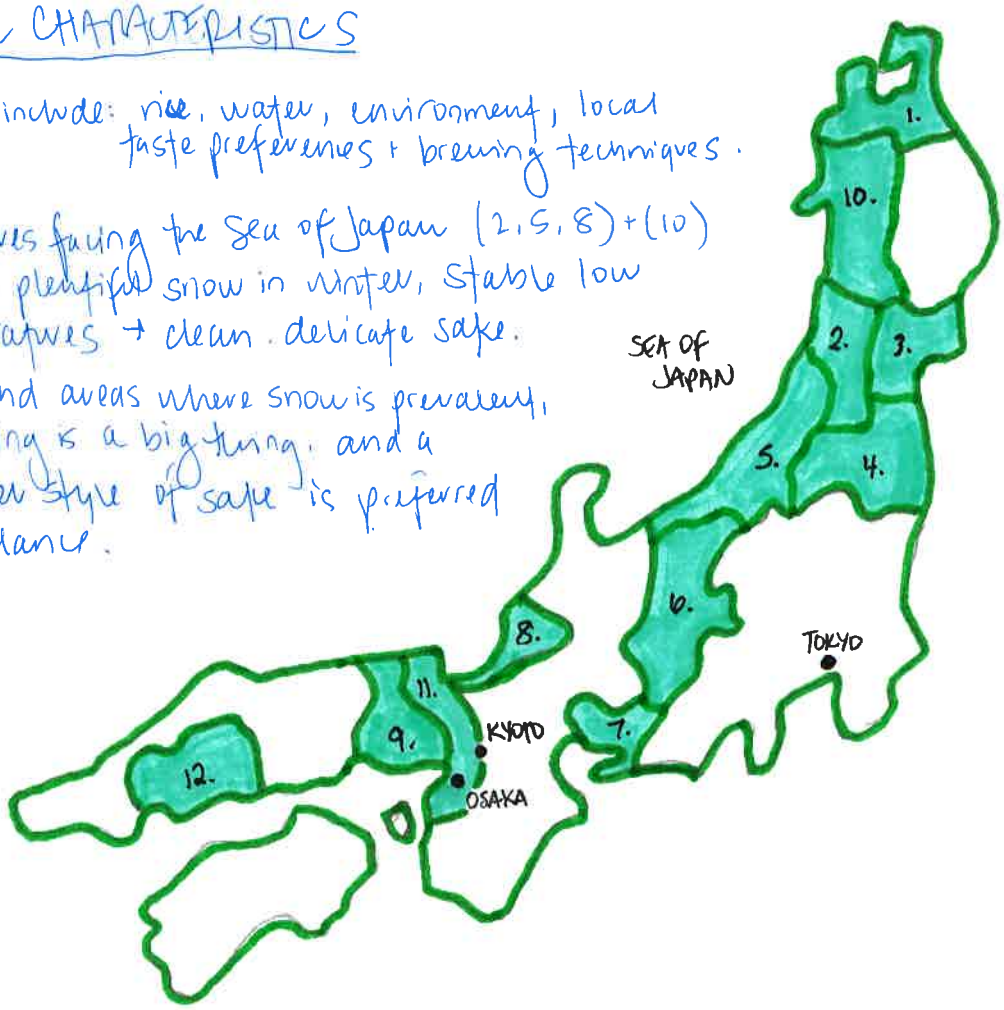
- stabilization & halting activity of enzymes
- unpasteurized sake relies on cold storage & transportation systems.

STORAGE

- namazake is stored below 5°C.
- some ginjo-shu is stored below 10°C, but most is stored at room temp.

REGIONAL CHARACTERISTICS

- Factors include: rice, water, environment, local taste preferences + brewing techniques.
- Prefectures facing the Sea of Japan (2, 5, 8) + (10) receive plentiful snow in winter, stable low temperatures + clean, delicate sake.
- In inland areas where snow is prevalent, salt-curing is a big thing, and a sweeter style of sake is preferred to balance.



1. AOMORI
2. YAMAGATA
3. MIYAGI
4. FUKUSHIMA
5. NIIGATA
6. NAGANO
7. AICHI
8. FUKUI
9. HYOGO (NADA)
10. AKITA
11. FUSHIMI
12. SAIJO

FACTORS INFLUENCING AMOUNT OF BODY IN SAKE

	FULL	LIGHT
COMPONENTS	• high alcohol content • high acidity • negative Nihonshu-do • high sugar content • high amino acid value	• low alcohol content • low acidity • positive Nihonshu-do • low in sugar content • low amino acid value
VARIETY OF RICE	• Varieties that dissolve easily, such as Yamadanishiki, Omachi	• Varieties that are less soluble, such as Gohyakumangoku.
SEIMAI-BUAI	high	low *
WATER QUALITY	hard	soft
RATIO OF WATER TO RICE	low	high
KOJI-MAKING STYLE	Sonare	Tsukihane *
SHUBO	kimoto, yamahaimoto	Sokujomoto
FERMENTATION TEMP.	high	low *
RATIO OF UNDISSOLVED SOLIDS	low	high *
TIME TO PASTEURIZATION (NAMAZAKE PERIOD)	long	short
STORAGE TEMP.	high	low
FILTERING	unfiltered	filtered + use of active charcoal

* essential for brewing ginjo-shu

KURAMOTO (BREWERIES) + TOJI (BREWMASTERS)

- The availability of cooling equipment & refrigerated storage of rice means it is now possible to produce sake throughout the year, but still much sake production starts after the autumn harvest of rice.
- 1300 kuramoto in Japan.
- there is a national accreditation system for sake-brewing skills

HISTORY OF SAKE

- dates back to at least the 3rd century
- 12th - 15th century → techniques were honed
  - previously, polished rice was only used to make the koji, otherwise using unpolished rice to make sake.
  - morohaku sake became a thing in this period → polished rice for both koji & sake.
- 18th - 19th century - Nada becomes the center of Sake production. to this day remains

Sakekasu = sake lees

→ Hyogo.

ALCOHOLIC BEVERAGES IN JAPAN

- beer has been in decline since 1993, but is still the most produced category.
- b/t 1993 + 1998 → Happoshu emerged. A beer-like beverage w/ less than 67% malt content. Lower tax than "beer". "Alcopops" cannot be called "beer" if less than 67%. that contain malt are also classified as Happoshu.

→ because the Japanese definition of beer does not permit for additional flavoring ingredients, many foreign beers are considered Happoshu.

- Beer flavored beverages called "the third Beer" (aka Daisan beer) have been developed to compete w/ Happoshu. Even lower tax; NO MALT. Combination of various potions. "beer flavored soft drink w/ spirits mixed in"
- 4 major Japanese beer companies - Asahi, Kirin, Suntory & Sapporo.