



OLLI Fall Semester 2020
Session 2, September 8

The Plague

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The Plague

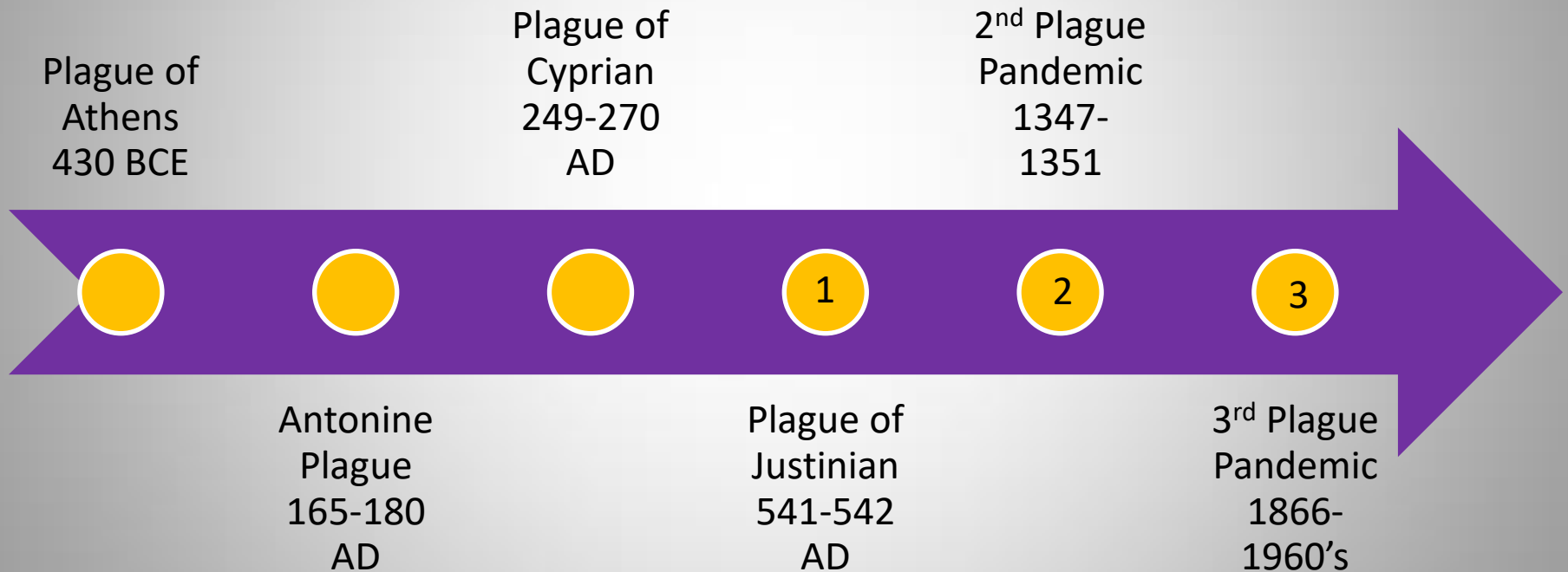
(Actually, the Many Plagues)

Review Through Times and Places
Ideas, Theories, Contradictions

The Many Plagues

- Plague of Athens
- Antonine Plague
- Plague of Cyprian
- 1st Plague Pandemic (Justinian/Galen)
- 2nd Plague Pandemic (The Great Mortality)
- 3rd Plague Pandemic (The Modern Pandemic)

Plagues Timeline



The image shows the Parthenon on the Acropolis in Athens, Greece. The temple is a large, ancient Greek temple dedicated to the goddess Athena. It features a series of tall, fluted columns supporting a heavy entablature. The sky is a clear, pale blue. The text "PLAGUE OF ATHENS" and "430 BCE" is overlaid on the lower left portion of the image.

PLAGUE OF ATHENS

430 BCE

Plague of Athens ⁽¹⁾

430 BCE

- Killed over 30,000 citizens, sailors, and soldiers of Athens (1/4 to 1/3 of the population).
- Returned in 429 BCE and in 427 BCE.
- Pericles, statesman, general, and ruler died.
- His 2 sons also died.

Plague of Athens

430 BCE

- Thucydides wrote about the epidemic that began in Ethiopia, passed through Egypt and Libya, and then to the Greek world.
- Entered Athens through Piraeus, city's port.
- Athens' armies weakened, but Sparta didn't want to risk getting ill, so war slowed down.

Plague of Athens (2)

Symptoms

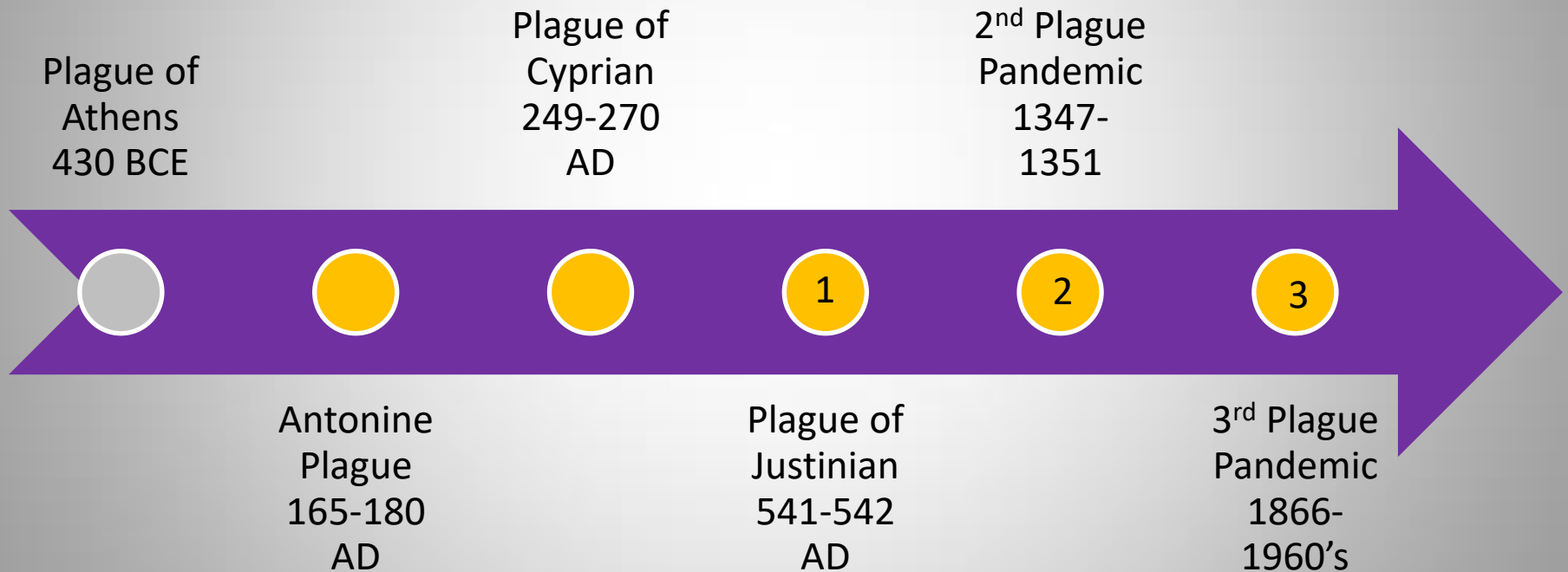
- High fever 103 °F to 104 °F that rises slowly.
- Chills.
- Lack of appetite.
- Stomach pain.
- Diarrhea/constipation.
- Intestinal perforation or hemorrhage
- Bradycardia (slow heart rate).
- Headaches.
- Delusions and confusion.
- Myalgia (muscle pain).
- Weakness.
- Rash of flat "rose spots".

Plague of Athens

430 BCE

- Outbreak of the bubonic plague?
- Symptoms, epidemiology, and DNA studies of corpses, lead to alternative explanations:
 - Measles.
 - Toxic Shock Syndrome.
 - Anthrax.
 - Ebola or a related viral hemorrhagic fever.
 - Typhus or typhoid fever.
 - Smallpox.

Plagues Timeline





ANTONINE PLAGUE

165-180 AD

Antonine Plague ⁽¹⁾

165-180 AD

- Named for Marcus Aurelius Antoninus.
- Also known as Plague of Galen (he described it).
- Death count about 5 million (1/3 of population).
- Devastated the Roman army.

Antonine Plague (2)

165-180 AD

- Brought from Parthian Wars by Lucius Verus.
- Roman troops brought home Parthian treasures and an Asian war “souvenir”.
- Asia Minor to Greece, to Italy and then Rome.
- Infested Roman empire along trade routes.

Antonine Plague (2)

165-180 AD

- Symptoms: fever, diarrhea, pharyngitis and a skin eruption on the 9th day of the illness.
- Scabbed over and left disfiguring scars.
- Reappeared in 189 AD with a mortality of 2,000/day, about 25% of those affected.
- Possible etiologies: smallpox or measles ?

Antonine Plague (3)

165-180 AD

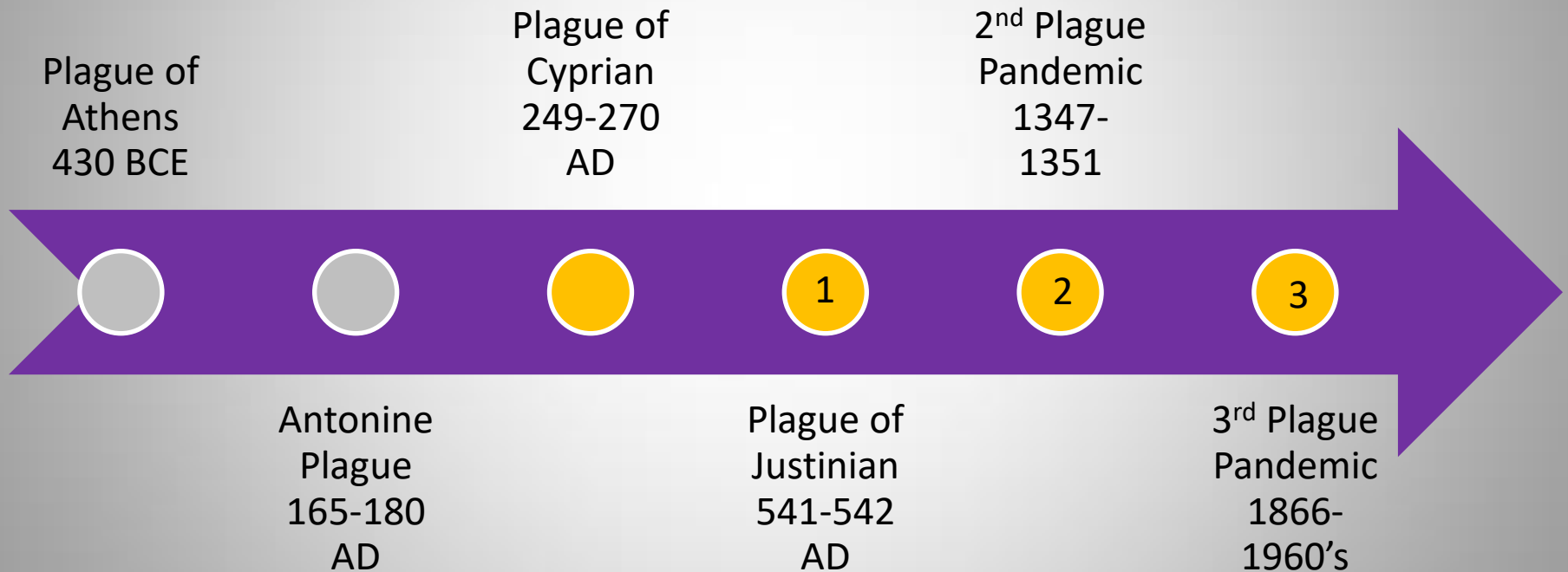
- Partially blamed for demise of Roman Empire.
- Decreased Roman commerce in SE Asia.
- Damaged Roman sea trade with Egypt & India.
- Rise of magic and cult faith healing.

OUTBREAK

The Roman Empire in 117 AD, at its greatest extent



Plagues Timeline





PLAGUE OF CYPRIAN

249-262 AD

Plague of Cyprian ⁽¹⁾

249-262 AD

- Named after Cyprian, Bishop of Carthage.
- Symptoms: fever, diarrhea, severe limb pain, conjunctivitis with loss of vision, hemorrhagic stool & vomit, distal gangrene, weakness.
- Suspect agents include: pandemic influenza, smallpox and a viral hemorrhagic fever virus.

Plague of Cyprian (2)

249-262 AD

- 249-262 AD., decimated Rome's population.
- Loss of 62% of population (from 500,000 to about 190,000).
- Athenian historian writes of 5,000 deaths/day.

Plague of Cyprian (3)

249-262 AD

Beliefs on origin:

- “corrupted air” that spread over the empire.
- “disease was transmitted through the clothes or simply by sight” (power of the eye).
- Phrase shows an instinctive sense of contagion!

Plague of Cyprian ⁽⁴⁾

Etiology

- Bubonic ?: pathology, seasonality or transmission.
- Smallpox ?: no rash, weakened limbs don't fit.
- Influenza ?: lack of respiratory symptoms.
- Typhus, cholera and measles: ? remotely possible.
- Viral hemorrhagic fever: Filoviruses = Ebola?

Plague Controversies

- WH McNeill asserts that the Antonine Plague and the Plague of Cyprian were the first transfers from animal hosts to humanity.
- Two different disease plagues, 1 of smallpox and 1 of measles, but not in that order.
- DCh Stathakopoulos asserts that both outbreaks were of smallpox

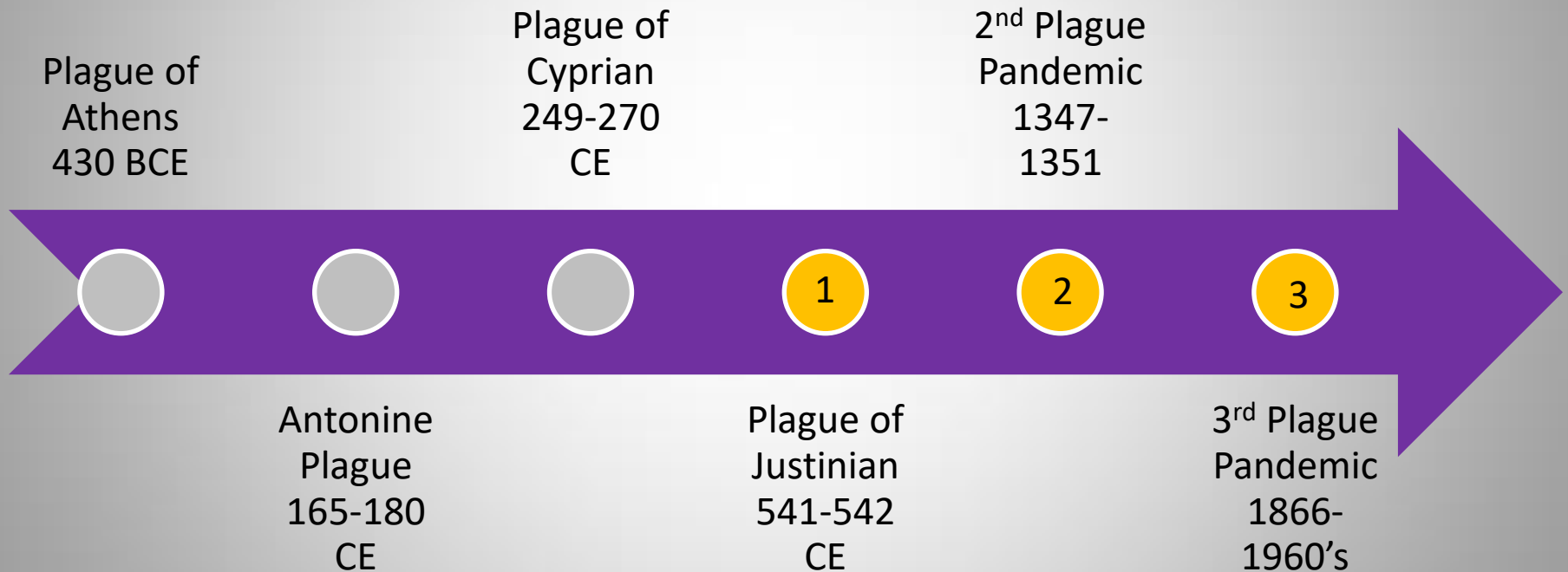
Smallpox

- In 400 BCE mummies.
- Occurred in outbreaks.
- In 18th-century Europe, killed ~400,000 people per year.
- Produced 1/3 of all cases of blindness.
- May have killed up to 300 million people in the 20th century.
- Killed around 500M people in the last 100 years of its existence.
- Until 1967, 15 M cases occurred per year.
- Eradicated in 1977.

The Plague In Europe

- Three major outbreaks of plague in the 6th, 14th, and 19th centuries.
- It did not completely disappear in between.
- It kept reappearing in milder forms, with some regularity in Europe until the 17th century.

Plagues Timeline





PLAGUE OF JUSTINIAN

aka THE FIRST PLAGUE PANDEMIC

Plague of Justinian ⁽¹⁾

541-542 CE

- Justinian I, emperor at the initial outbreak.
- He contracted the disease, but survived.
- Originated in Central Asia, in Qinghai, China.
- First reported from the port of Pelusium in Egypt.
- Spread east to Palestina and north to Alexandria.

Plague of Justinian ⁽²⁾

541-542 CE

- Recurrences until 750 AD (2 centuries).
- About 25–50 million dead (13–26% of the world's population in 541 AD).
- First recorded epidemic of *bubonic plague*.
- Procopius described 5,000 deaths/day in the capital Constantinople (40% of city).

Plague of Justinian ⁽³⁾

541-542 CE

Symptoms:

- Delusion.
- High fever.
- **Swellings in armpits, groin, behind ears.**
- Some lapsed into comas.
- Others died almost immediately.
- Rest of victims suffered for days before death.

Plague of Justinian ⁽⁴⁾

541-542 CE

- Description of typical buboes and symptoms.
- Plague started in seaports and went inland.
- Typical of rat/flea transmission.
- Self-limited because it killed off susceptibles.

Plague of Justinian (5)

Effects on the Empire (1)

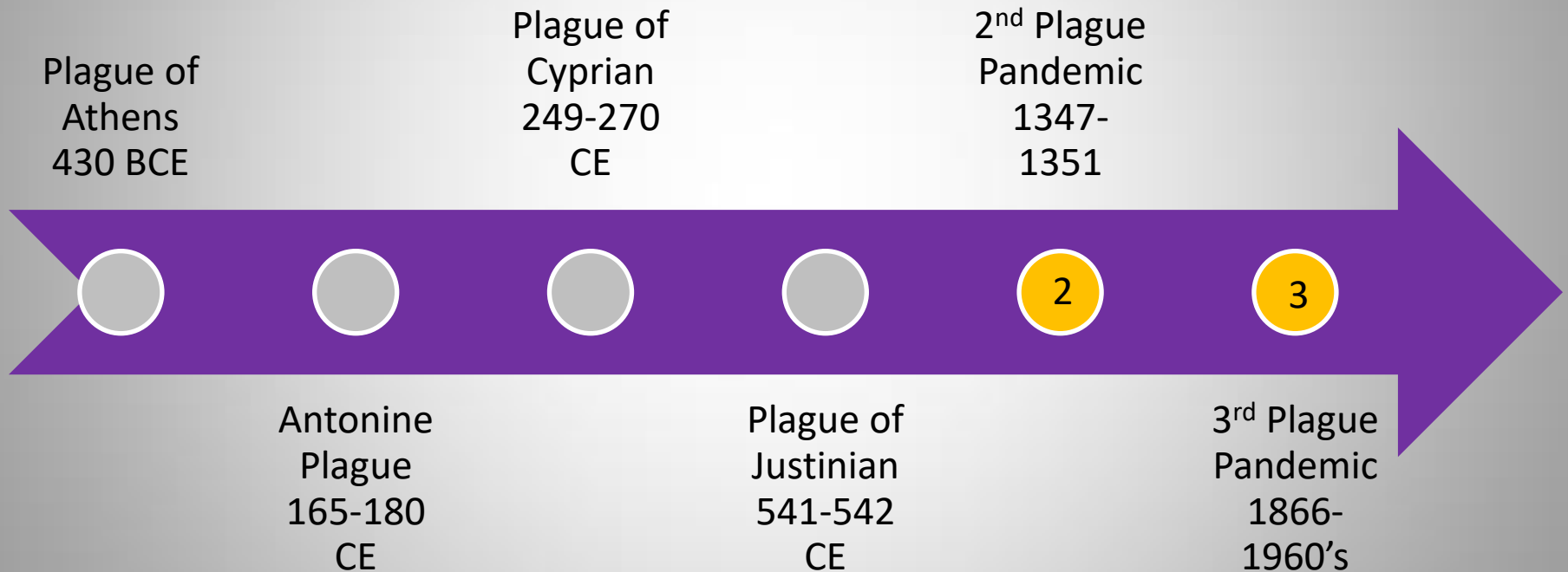
- In 568, the Lombards invaded Northern Italy and split the Italian peninsula.
- In North Africa & the Near East, the empire was unable to block Arabic invasions.
- Ongoing wars with the Goths in Italy and the Vandals in Carthage.
- Armed forces decreased due to plague, loss of crops, lack of new recruits.

Plague of Justinian (6)

Effects on the Empire (2)

- Hit the Byzantine Empire, Constantinople, the Sasanian Empire and Mediterranean ports.
- Weakened Justinian's efforts to reunite the Western and the Eastern Roman Empires.
- Economic collapse of Byzantium.
 - Agriculture and trade decreased.
 - Lost manpower.
 - Taxes lost.
 - Money spent on multiple wars.

Plagues Timeline





SECOND PLAGUE PANDEMIC 1347-1351

In the 14th Century: 1346-1353

The Great Plague

Contemporary Names

- La moria grandissima.
- La mortaleza grande.
- Peligro grande.
- La gran mortandad
- Très grande mortalité.
- Grosse Pestilentz.
- Huge mortalyte.
- Big death.
- La Peste

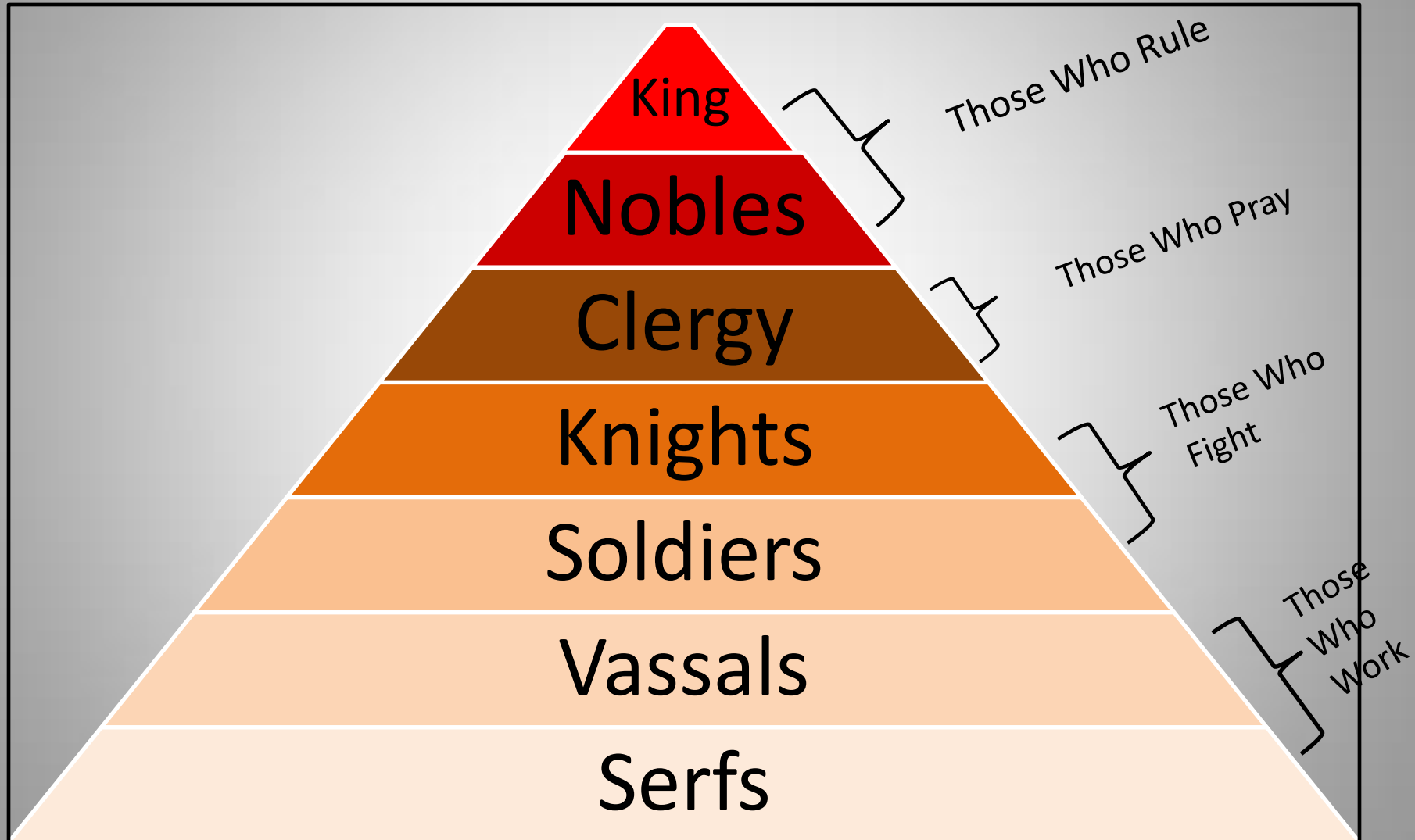
The Black Death

- The Plague was not called the Black Death until centuries after it initially spread through Europe.
- “Black Death” is used to suggest the horror of the epidemic as a dark, black, terrifying time.
- It does *not* refer to the color of some lesions.

The PLAGUE

- Called the bubonic plague because of the large dark buboes around the lymph nodes.
- The Pima Indians use the word *oimmeddam* (wandering sickness).
- Backward thinking prevailed.

Medieval Society Structure



1 - 7- 23 Rule

Distance and Rate of movement

- 23 days by foot
- 7 days by horse
- 1 day by sea

The plague traveled about 2.5 miles/day.

Spread of the Plague

Mediterranean
and Italian
Seaports

Caffa,
Sea of
Azof, and
the Black
Sea

Khanate
of the
Golden
Horde

Caravans,
Trade
Routes,
and the
Silk Road

CHINA

WEST

EAST

Plague Spread Over Water Shipping Routes



World Spread of the Plague

Spread graphic starts from the East (right) and progresses to the West (left).

































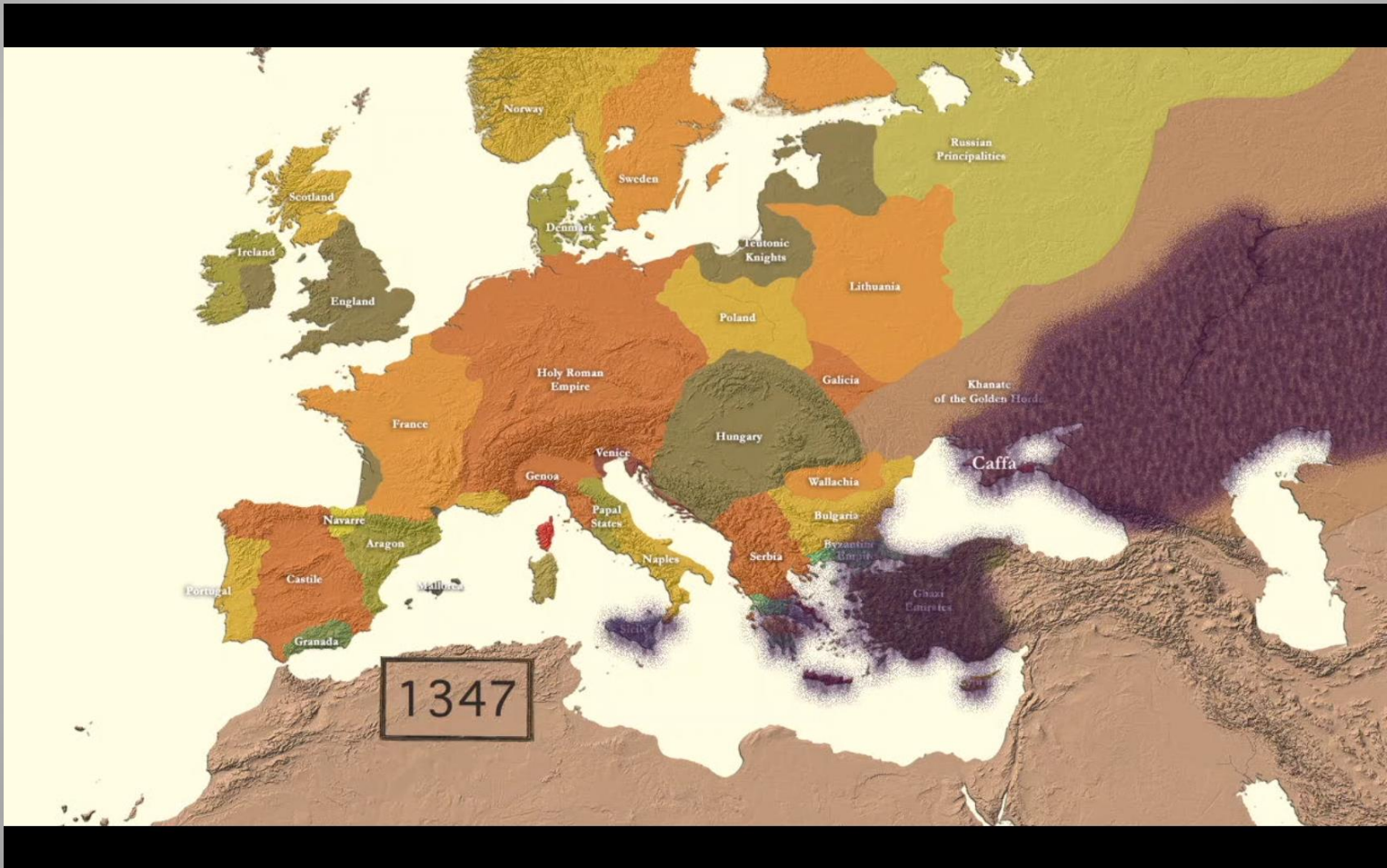


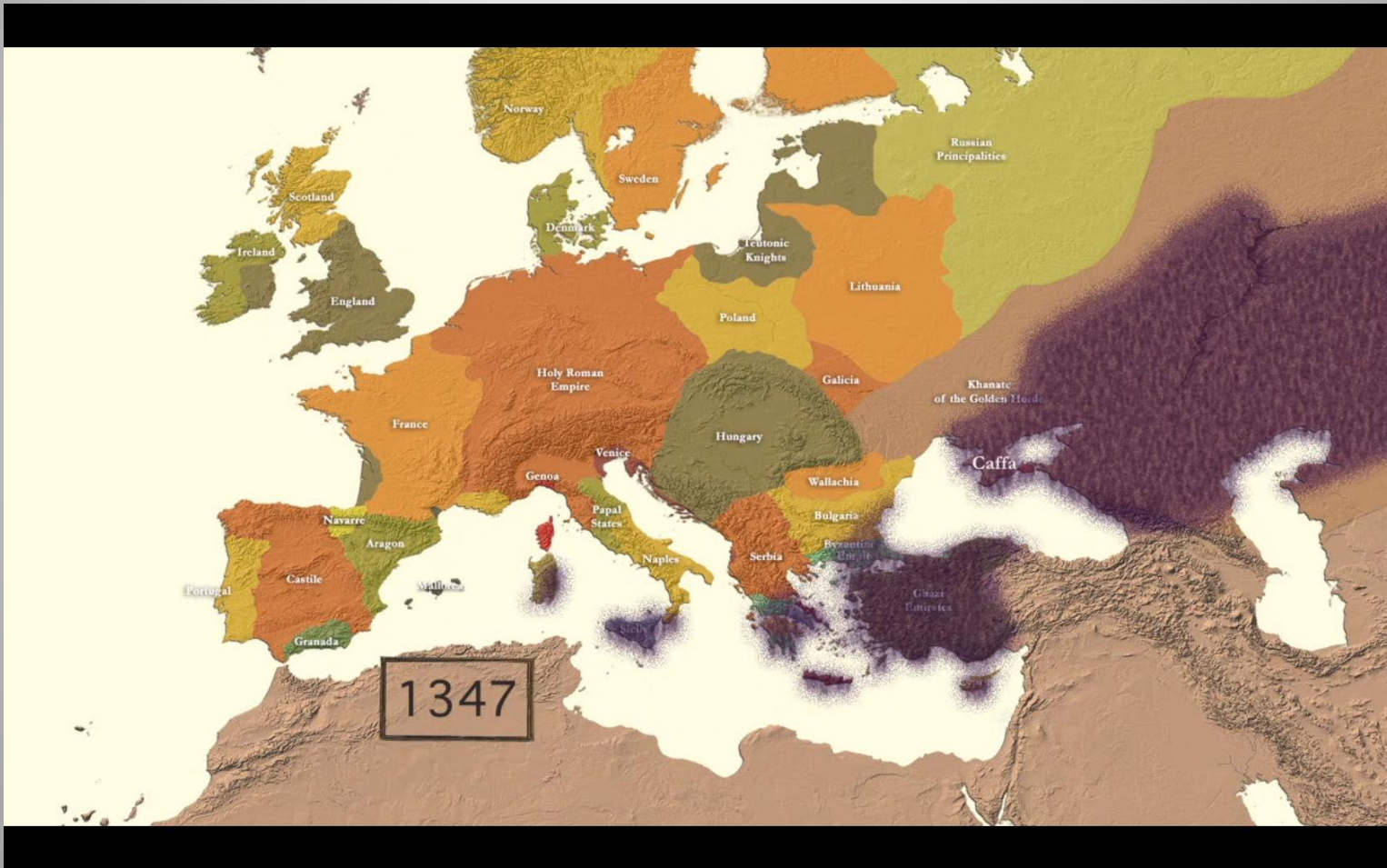


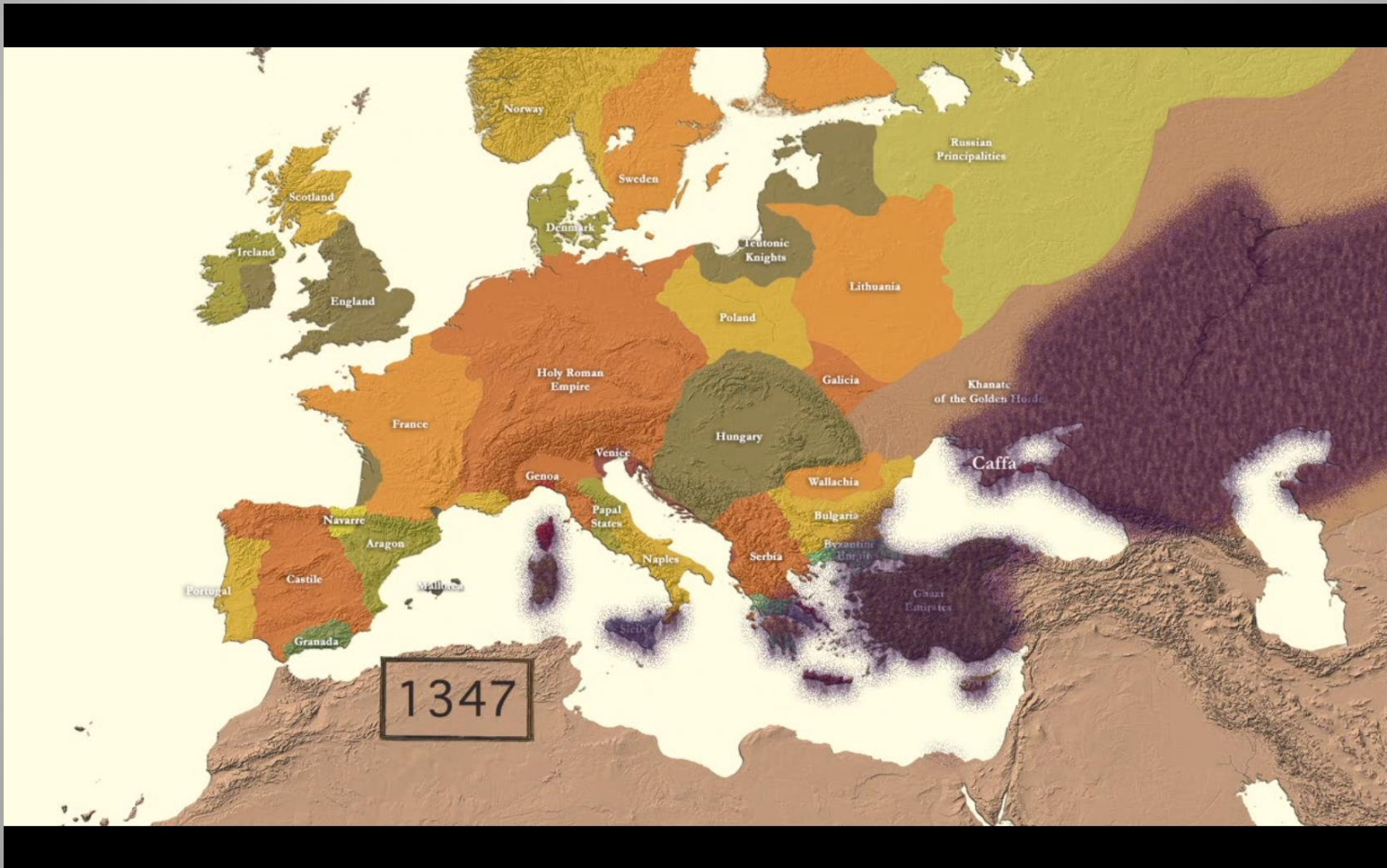










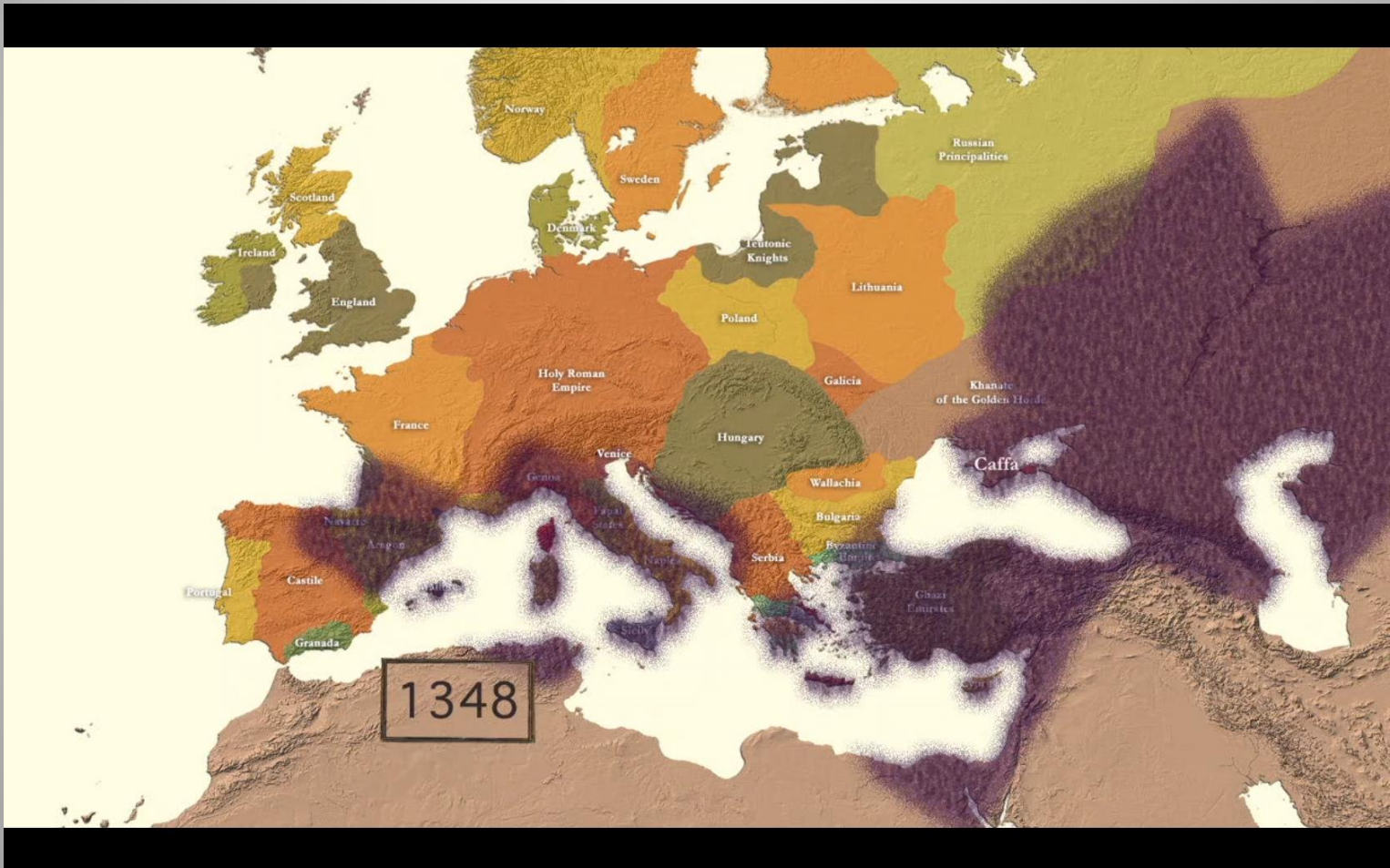


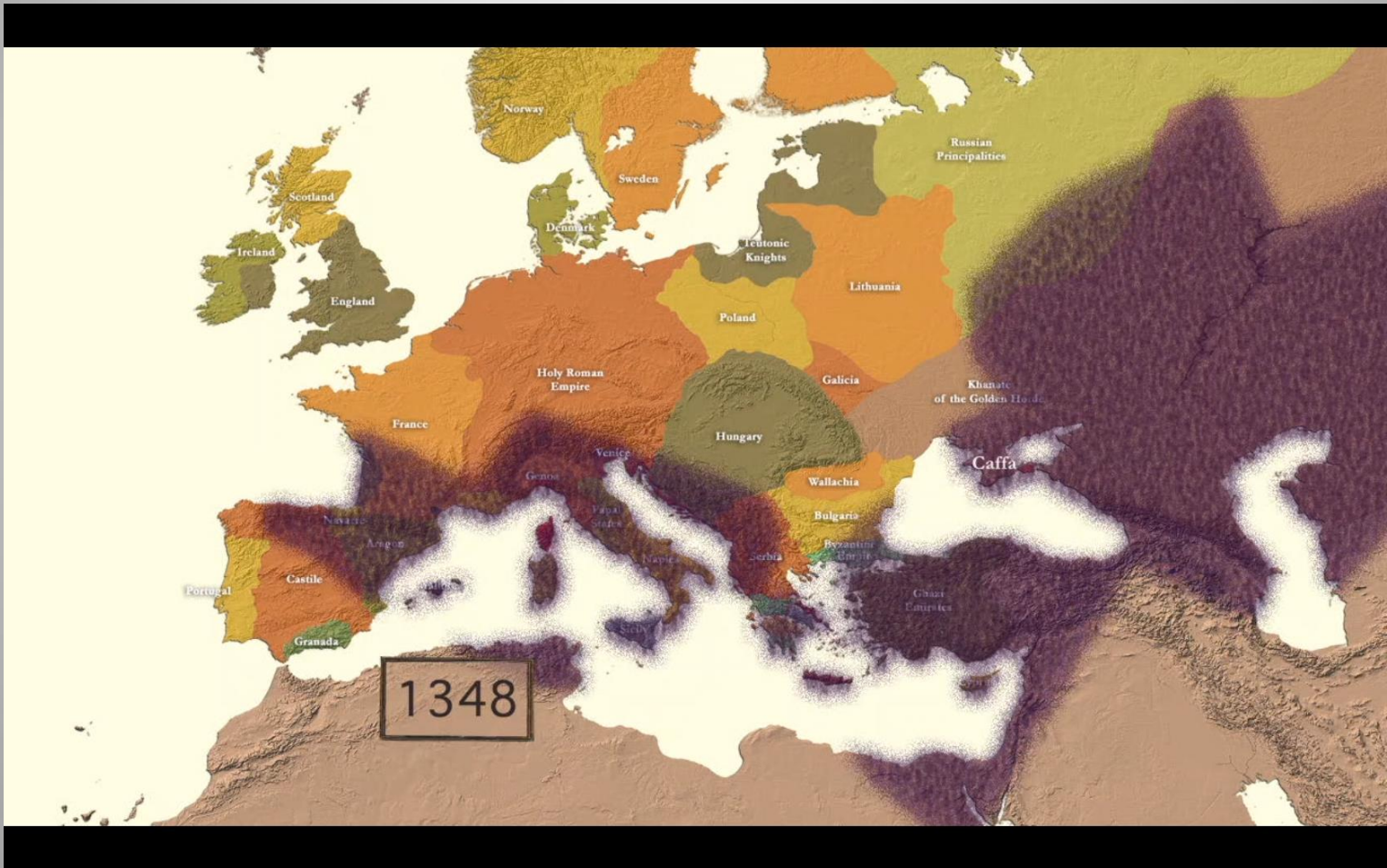


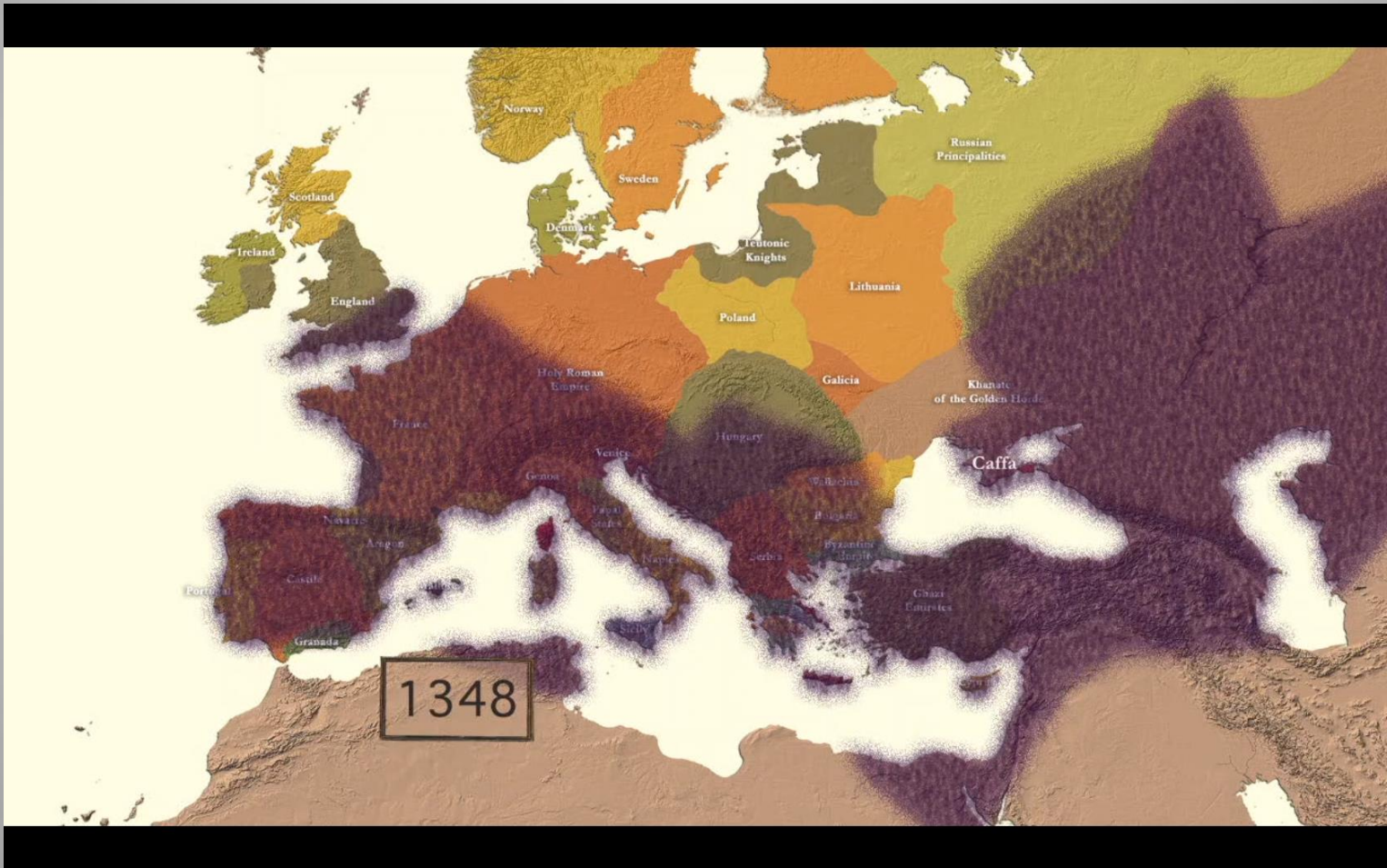


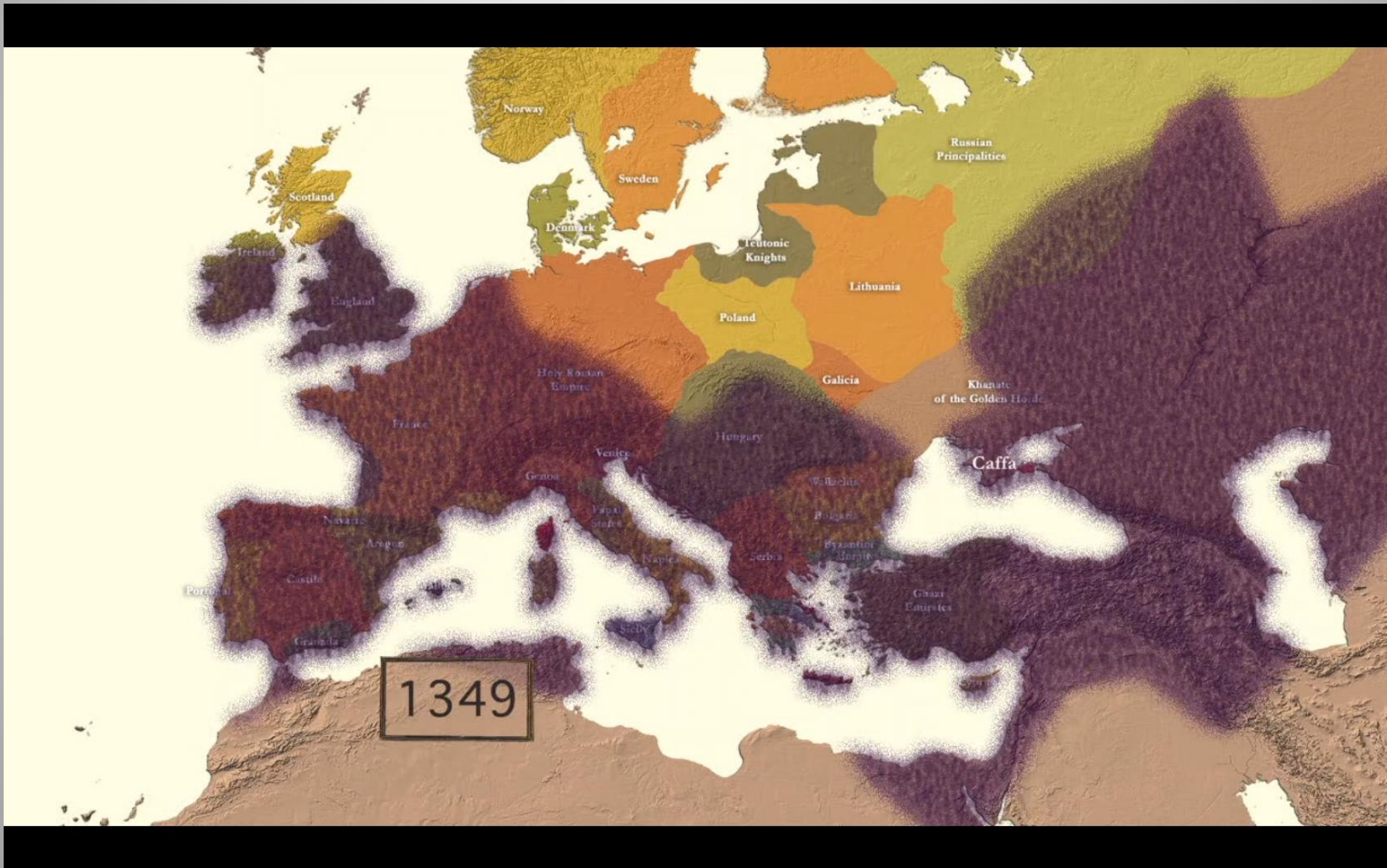




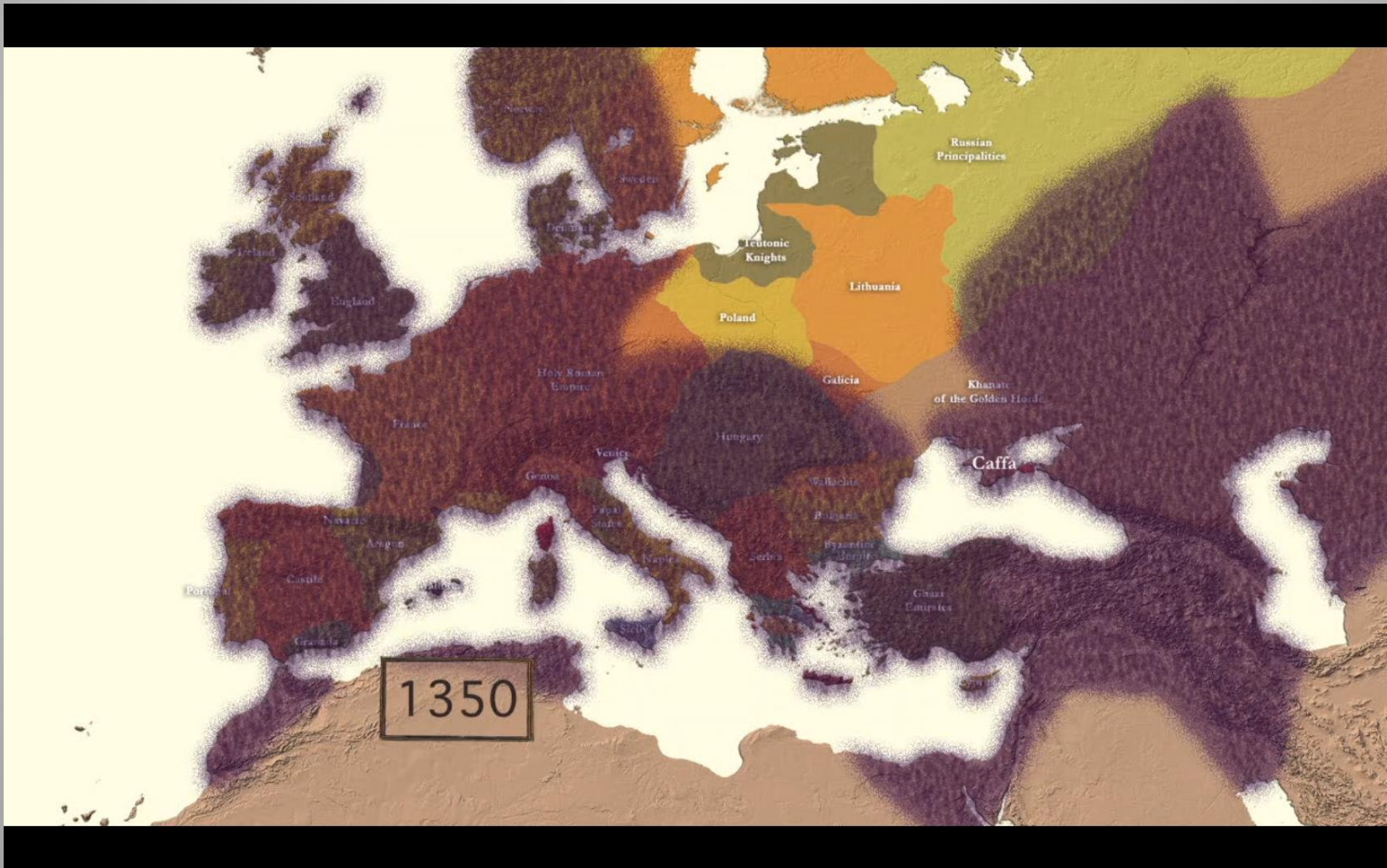


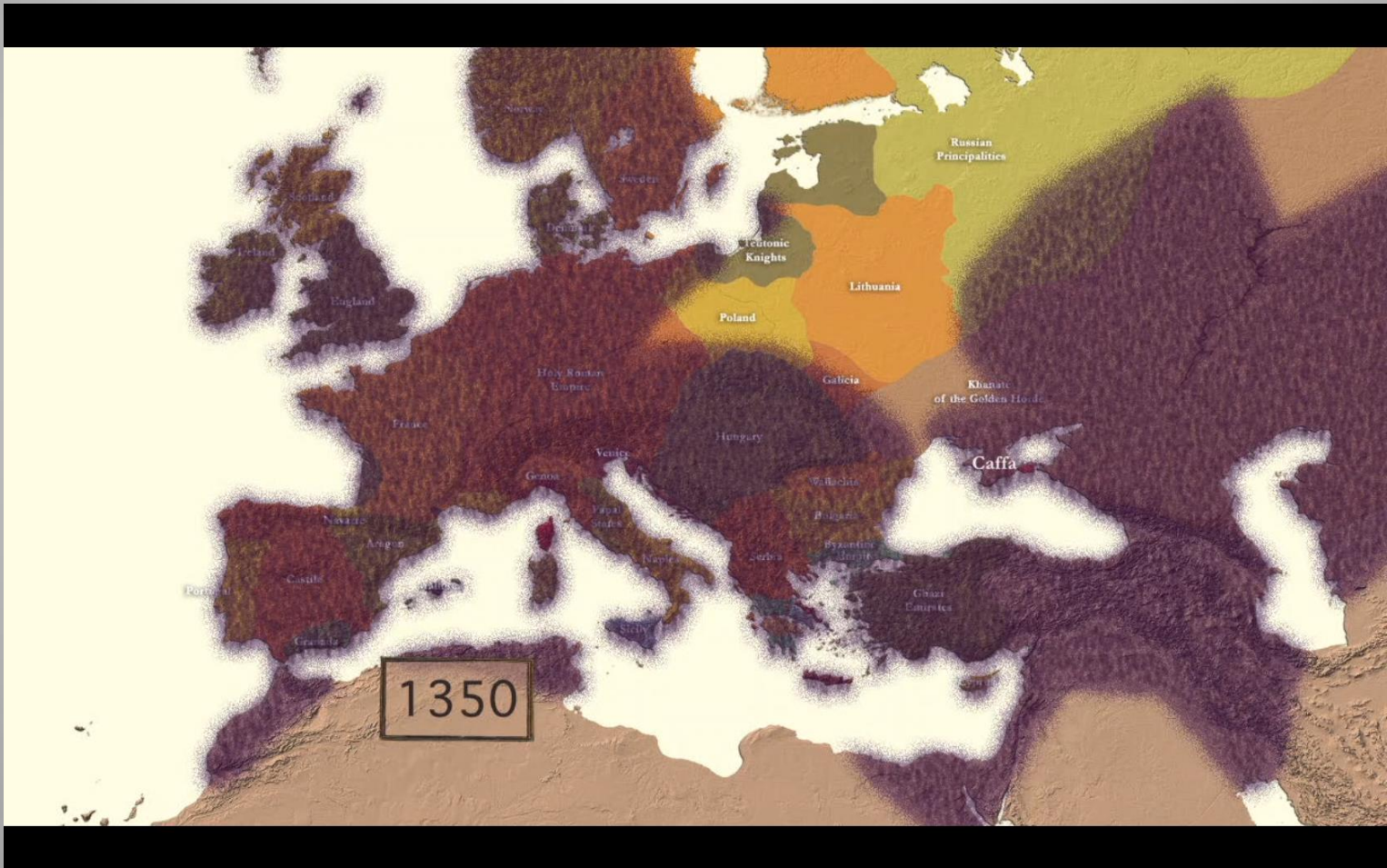


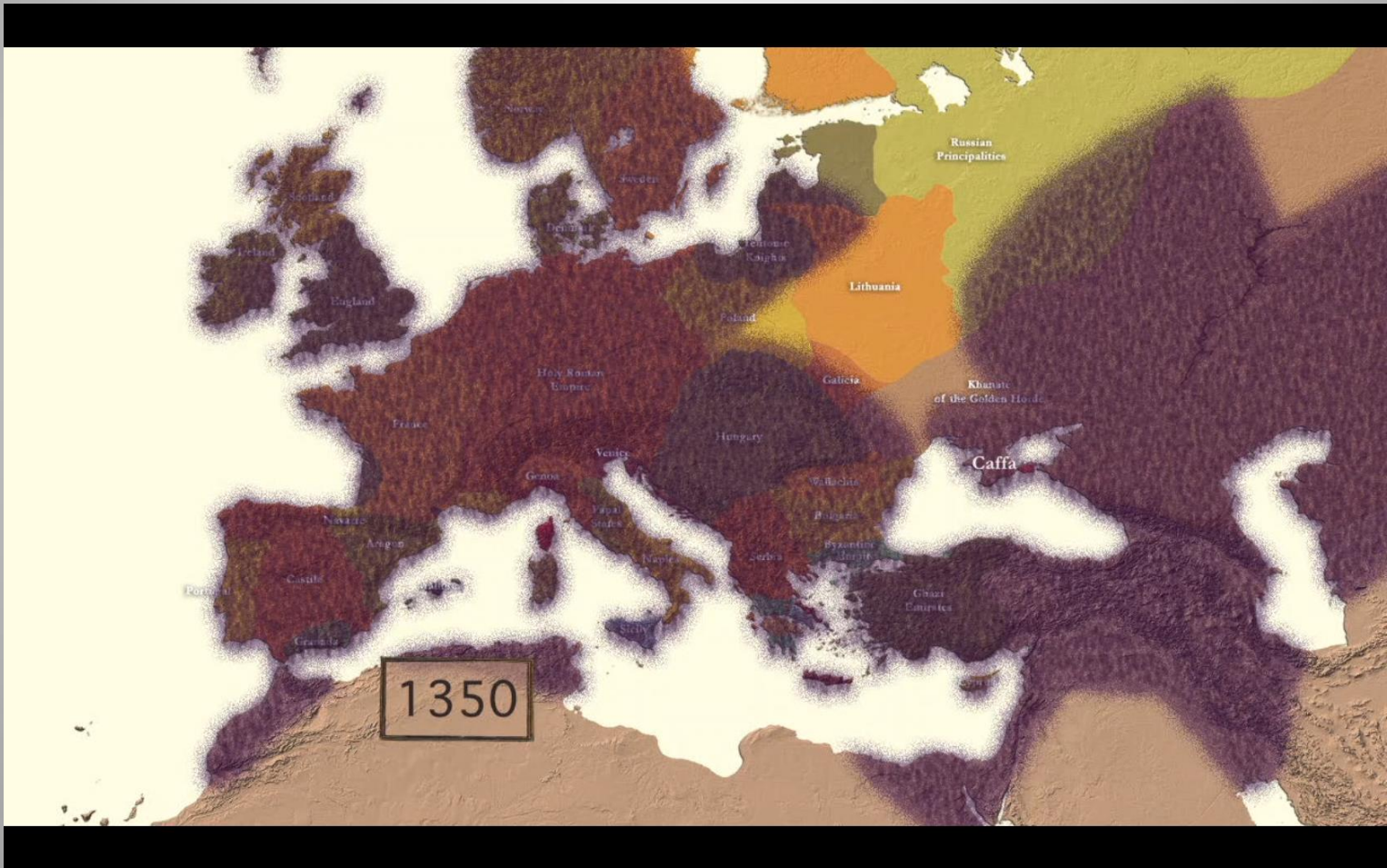


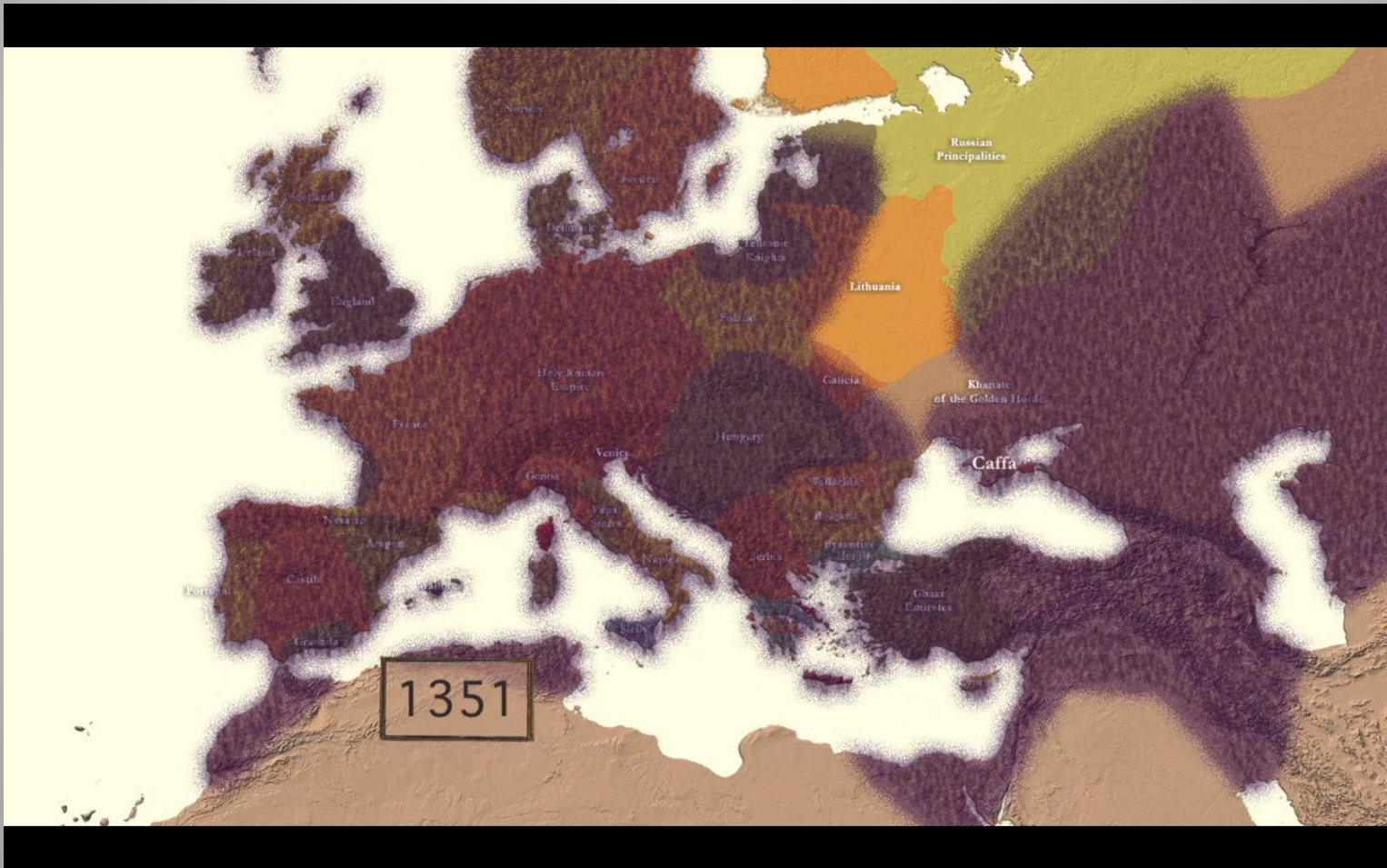


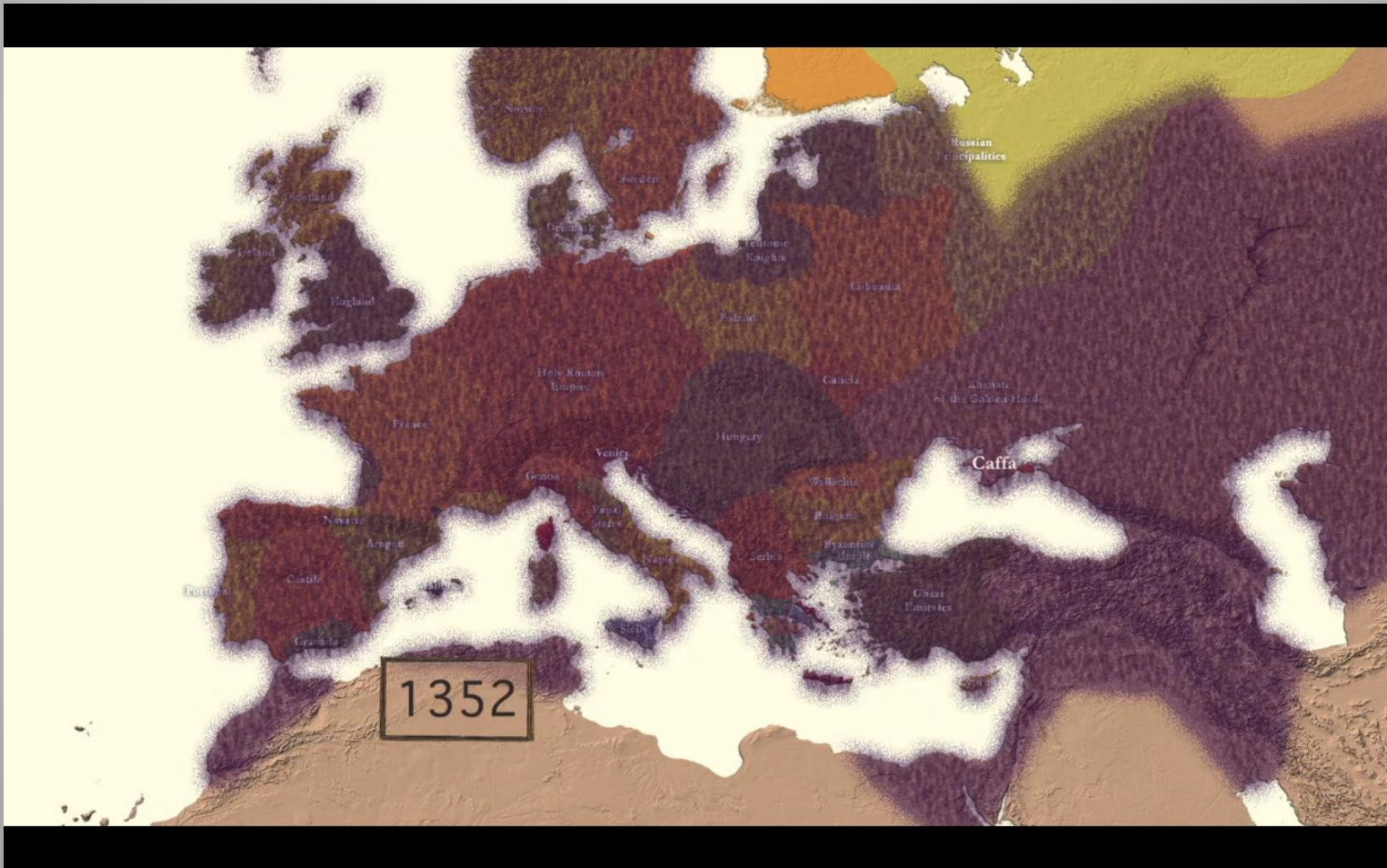












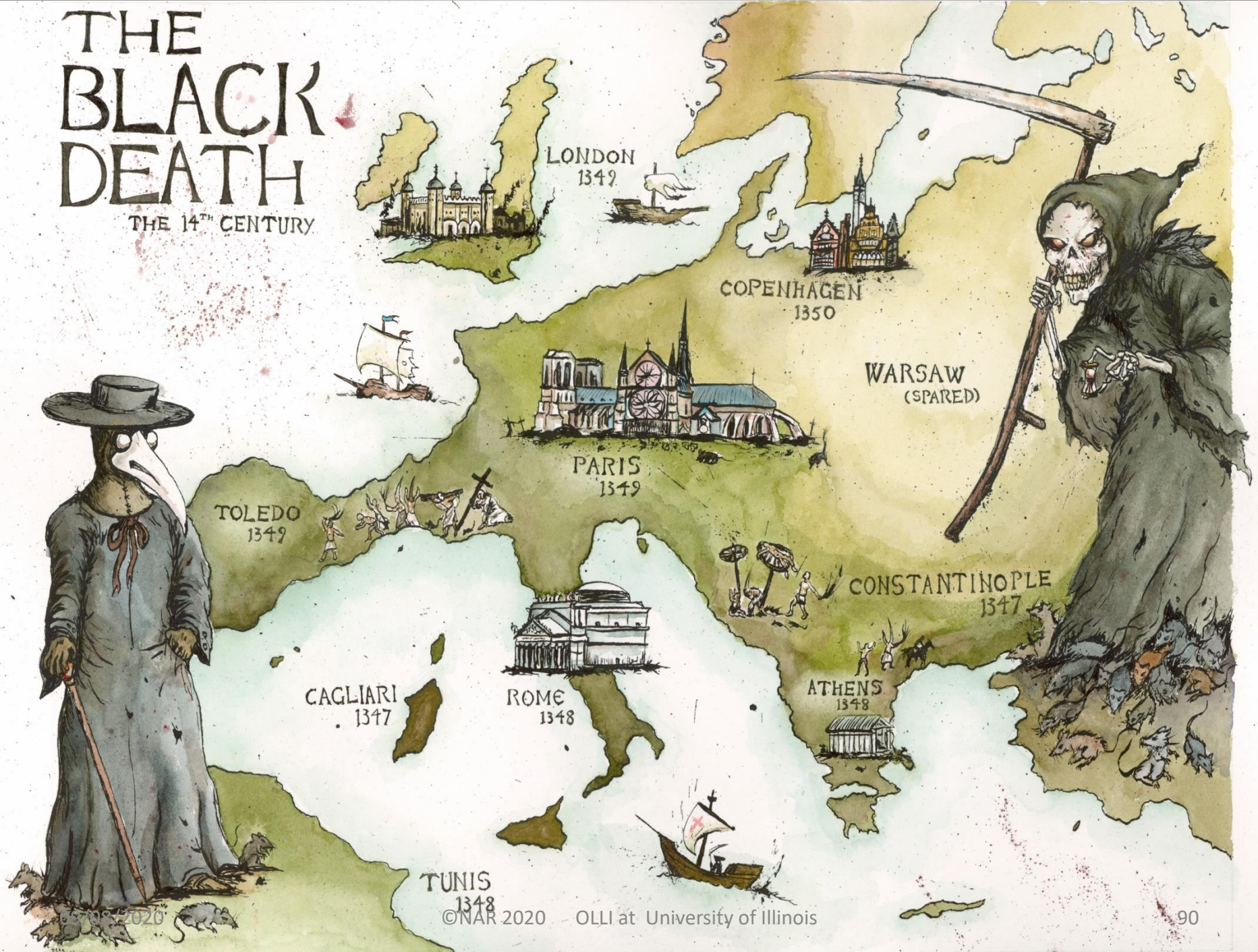






THE BLACK DEATH

THE 14TH CENTURY



LONDON
1349

COPENHAGEN
1350

WARSAW
(SPARED)

PARIS
1349

TOLEDO
1349

CONSTANTINOPLE
1347

CAGLIARI
1347

ROME
1348

ATHENS
1348

TUNIS
1348

Types of Plague

- Bubonic.
- Pneumonic (Pulmonary).
- Septicemic.

Bubonic Plague

- Most common form.
- 2-7 days incubation period.
- Most survivable.
- 60% mortality.
- Lymphatic system.
- Egg-shaped painful buboes.
- Petechiae.
- Malodorousness.
- Chills, fever.
- Vomiting, diarrhea.

Pneumonic Plague



- Second most common.
- ***Can spread person-to-person.***
- Rapid contagion.
- 2-3 days of symptoms.
- 90-95% mortality.
- Transmitted by blood, sputum or saliva.
- Fever, coughing and spitting blood.
- Invasion of lungs and airways by bacillus.

Septicemic Plague (1)



- Least frequent type.
- Almost 100% mortality.
- Very fast progression.
- No time to get buboes.
- Death in 1-3 days
- High fevers.
- Widespread blood infection.
- Purple skin patches.
- Purpura due to DIC.*

* Disseminated Intravascular Coagulation

Septicemic Plague (2)

- DIC produces red/black patchy rashes and bumps all over the body.
- Medieval people said that a dead person bore “the sign” of the plague.
- A final common sign of advanced septicemic plague is the vomiting of blood.

Septicemic Plague (3)



Purpuric lesions from DIC

Distal Gangrene from DIC

Paintings

Literature

Poetry

THE ARTS AND THE PLAGUE

PAINTINGS



The Triumph of Death

(Trionfo della Morte)

Unknown, Circa 1488

**Fresco in the
Pallazzo Abatelli
Palermo, Italy**

Size: 19 by 21 feet



The Triumph of Death

Enhanced photograph.

Not attributed in Internet

Death on its Pale Horse



Dead and Dying Prelates & Clerics



Surviving Religious People and Surviving Nobles



LITERATURE AND THE PLAGUE

The Decameron of Boccaccio



- 100 stories told by 7 women and 3 men over 10 days, fleeing Florence during the Plague.
- Humor, love, pain, passion, lust, resignation.
- Graphic description of the Plague and its effects on people and society.

Literature

- *La Peste* (Albert Camus).
- *The Masque of the Red Death* (Edgar Allan Poe).
- *The Canterbury Tales* (Geoffrey Chaucer).
- *Journal of the Plague Year: The Marseilles Plague,*
- *Due Preparations for the Plague: London Plague.*
(Both by Daniel Defoe).

Poetry

- *A Litany in Time of Plague*: Thomas Nashe
- *The Triumph of Death*: John Davies
- *Soliloquy XVI*: Mary Latter
- *Pestilence*: Philip Freneau
- *The Plague*: Christina Rossetti
- *There It Is*: Jayne Cortez

The Pied Piper of Hamelin



- A piper who is offered money to lead the rats away from a town.
- As he plays his music, the rats follow him and drown in the river.
- The agreed sum is not paid, so he plays again and all the town's children follow him into the mountains to never return.

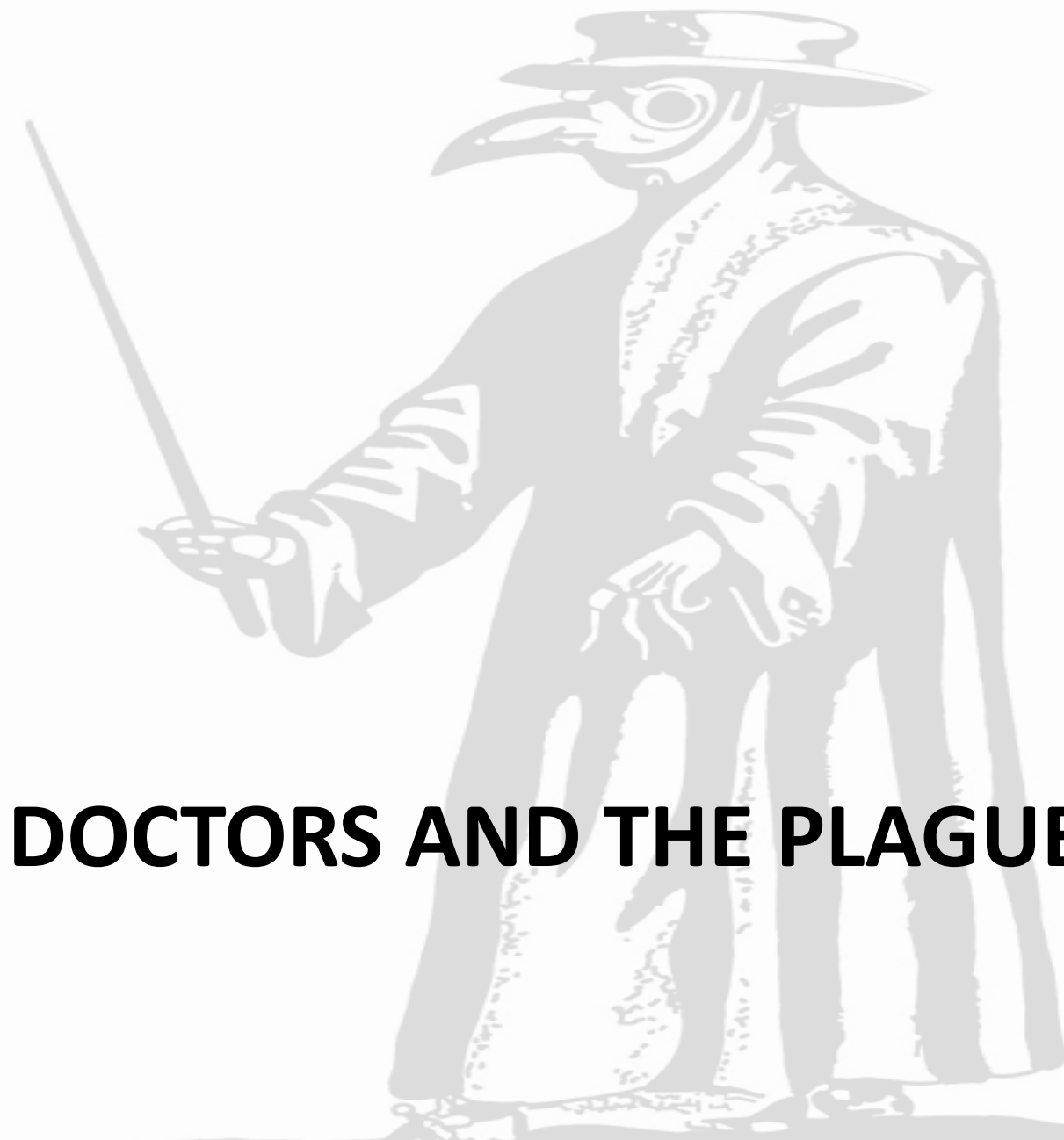
Plague in France

- Between June 1348 and December 1349, “Paris lost the equivalent of a good-sized village almost every day, and on bad days, a good-sized town.”¹
- By March of 1348 Pope Clement VI consecrated the Rhone River to bury bodies of plague victims as there was no more room left on land.
- Pope granted plenary indulgence, for all who died of plague.
- Decreed that last confession could be made to anyone who was present, even a woman!

1.. J. Kelly 2006

France and Its Royalty

- Most of Paris did not flee the city.
- The French King Philip VI did, and moved , around the countryside to escape the Plague.
- He escaped, died of natural causes in 1350, but his queen died of the Plague.



DOCTORS AND THE PLAGUE

Tall, Wide-Brim hat

Long beak mask

Medical Kit

Long Pole

Quill jar

Document Case

Lamp for Illumination

Long, waxed robe

Pointed shoes

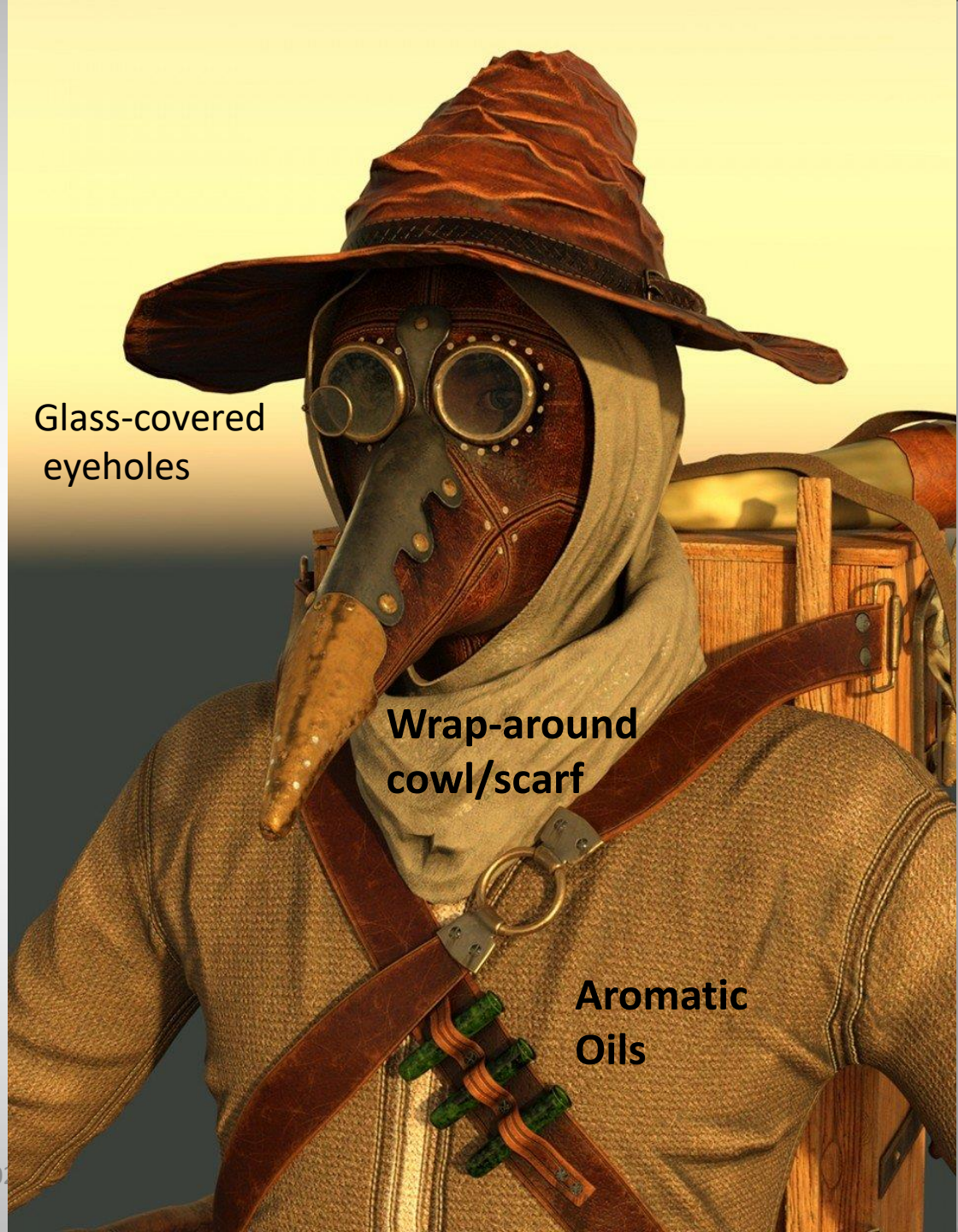


Is it a Bird?
Is it a Scarecrow?
Is it a Clown?
Oh, No. It's a Doctor.

Glass-covered
eyeholes

Wrap-around
cowl/scarf

Aromatic
Oils



Plague Doctor's Arsenal



Chest of Tools



Doctors and the Plague

- In France and Germany, plague Doctors were usually paid by the towns or villages.
- Doctors also functioned as notaries.
- They helped to keep statistics of deaths.
- Sometimes made money on the side.

PLAGUE TREATMENTS

Treat According to Cause

- Supernatural causes:
 - Wrath of God.
 - Work of the devil.
 - Alignment of the planets.
- Natural causes:
 - “bad air” (miasma).
 - Unbalance of the humors of the body.
- Real cause unknown, so real cure not possible.

Miasma: Cause & Treatment

- John Colle, an English physician said that the best way to counteract bad air that carried infection was with more bad air: “One foul smell drives out another”.
- He prescribed sniffing a latrine every morning.
- People gathered around public latrines inhaling deeply.
- They thought that smelling a bigger stink would ward off contagion from the bad smell that carried plague.

Medical Knowledge

Hippocrates of Cos ~ 460-470 BCE

- Disease has natural (not supernatural or divine) causes.
- Health = balance of the 4 humors.
- Illness = imbalance: dyscrasia (bad mixture of humors).
- Cure is accomplished by evacuating undesired humors:
 - Emetics.
 - Purgation.
 - Bloodletting.
 - Treatment included dietary and behavioral measures.

Roots of Hippocratic Medicine



Four Basic Body Humors:

Blood

Yellow bile

Black bile

Phlegm

Medical Knowledge

Aristotle of Stageira ~ 384-322 BCE

- The heart, not the brain controls the body.
- Physical pain is the body's inability to assimilate certain foods.
- Doctrine of the **Four Basic Qualities**:
 - Hot.
 - Cold.
 - Wet.
 - Dry.
- Foundation for notions of balance and homeostasis.

Medical Knowledge

Galen of Pergamon ~ 130-210 CE (1)

- The circulatory system consisted of two separate one-way systems of distribution.
- Venous blood was generated in the liver, and arterial blood originated in the heart,
- After use by the body, the blood was then regenerated in either the liver or the heart, completing the cycle.

Medical Knowledge

Galen of Pergamon ~ 130-210 CE (2)

- Believed in predeterminism (master plan).
- Tuberculosis (*phthisis*) not caused by “evil airs.”
- The cure, according to the early Romans:
 - Bathe in human urine
 - Drink elephant’s blood.
 - Eat wolves’ livers.
- Described the Antonine Plague.

Medical Knowledge

Galen of Pergamon ~ 130-210 CE (3)

- Believed in the humors.
- Used blood-letting by cupping.
- Described the plague but did not involve himself with treating victims of it.
- Prescribed “Galenicals” (compounded mixtures of at least 10 different herbs or substances).

Preventive Measures

- Avoid the Sick.
- Kill Troublemakers:
 - Heretics
 - Sinners.
 - Blasphemers.
 - Fornicators.
- Avoid Gerbils.
- Thousands of Jews massacred in 1348 - 1349.

Treatments ? ⁽¹⁾

- No one knew exactly how people got the plague, so no one really knew how to prevent or treat it.
- According to one doctor:
“Instantaneous death occurs when the aerial spirit escaping from the eyes of the sick man strikes the healthy person standing near and looking at the sick person.”

Treatments ? ⁽²⁾

- Seal the house (and everyone in it) for 40 days.
- Avoid Summer (never a winter epidemic of plague).
- Carry flowers and herbs in hands.
- Have a fire at home or on streets.

Treatments ? ⁽³⁾

- Smoking (mandatory including children).
- Vinegar (bathe or disinfect surfaces).
- Lucky Charms, amulets and talismans.
- Charlatans sold plague 'cures':
 - Potions laced with mercury, arsenic or ground dried frog legs.
 - 'Plague water' was a popular cure (galenical).
 - Powdered unicorn horn and cemetery soil.

Treatments ? ⁽⁴⁾

- Strapping live chickens around plague buboes until chicken is dead.
- Sweating and then applying to buboes a recently killed pigeon.
- Lancing and draining buboes
- Bloodletting

Religious Treatments

- Prayer, prayer – and more prayer.
- Set prayers and Bible extracts for plague.
- Mass of St. Sebastian (patron saint of plague).
prayer and penance: first line of defense.
- Self-Flagellation (whipping) for 33 ½ days.

The Only Remedy!

- 16th Century Giovanni Ingrassia said the only remedy for plague was pills made of:
 - *Cito*
 - *Longe*
 - *Tarde*
- Which means:
 - Run swiftly.
 - Go far.
 - Come back tardily.

CAUSE OF THE PLAGUE

Origins of the Plague

- University of Paris issued the *Compendium de Epidemia per Collegium Facultatis Medicorum Parisius* (1947).
- Written by 46 medical eminences of the Paris School of Medicine.
- Emphasized how earthquakes, floods, rare weather, planetary conjunctions and “bad air” contributed to the outbreak of plague.

According to those scholars, the Great Plague was created from :

“a triple conjunction of Saturn, Jupiter and Mars in the 40th degree of Aquarius, occurring on the 20th of March 1345”.

The Deadly Duo



The black roof rat, *Rattus rattus* and the Oriental rat flea, *Xenopsilla cheopis* are blamed for transmission of *Yersinia pestis*.

Rattus rattus

(Ship rat, Roof rat or House rat)

- Typical adult is 5.0 to 7.2 in long, tail is 5.9 to 8.7 in, and weighs 2.6 to 8.1 oz.
- Other rodents may be implicated in the plague:
 - Voles
 - Marmots
 - Gerbils
 - Ground squirrels
 - Prairie dogs
 - Chipmunks
 - Rabbits

Xenopsylla Cheopis

- Body is about $\frac{1}{10}$ of an inch long (~ 2.5 mm).
- Flea's mouth has two functions:
 - squirting saliva or partly digested blood into the bite.
 - sucking up blood from the host (transmits pathogens).
- Fleas smell exhaled CO₂ from humans & animals and jump rapidly to feed on the new host.
- Wingless, but can use its legs to jump up to 200 times its own body length (about 20 in).

Xenopsylla Jumping

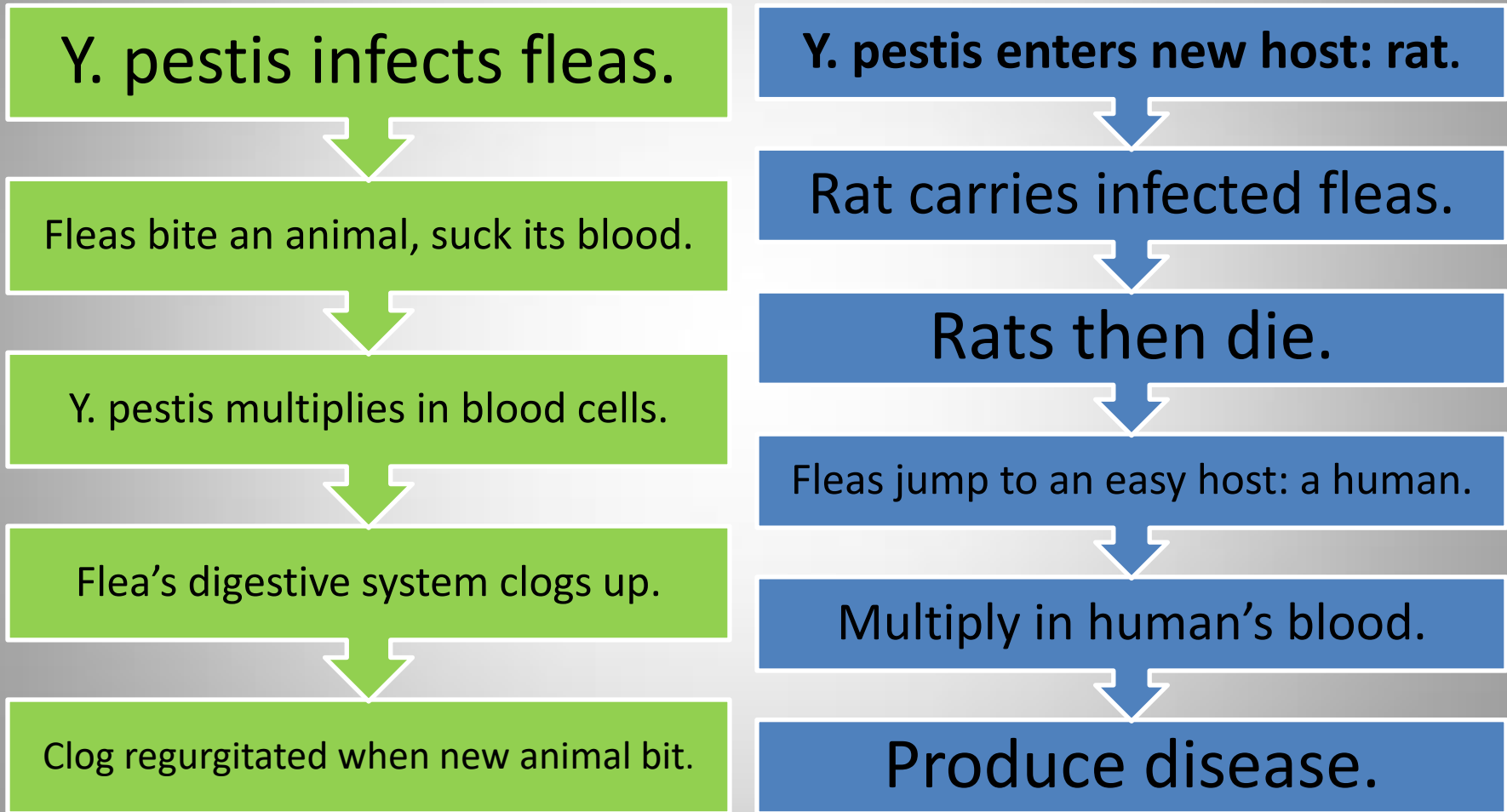


Yersinia Pestis

- Cocobacillus.
- Stick-shaped.
- Gram Negative.
- Non-Spore forming.
- Non-motile.
- Facultative anaerobe.
- Inhibits antibodies.
- Avoids destruction by the immune system.
- Suppresses phagocytosis.
- Grows in lymph nodes.
- Causes lymphadenopathy.

Multiplies very rapidly: Numbers double every 2 hours; may reach 100 billion per gram of host's tissue.

Yersinia Pestis



Yersinia Pestis

Four Yersinia pestis bacteria are shown, each with a multi-layered, colorful structure. The bacteria are rod-shaped and arranged in a loose cluster. The colors range from light blue and green to yellow, orange, and red, suggesting different internal components or staining.

Y. pestis is a versatile equal-opportunity killer:

- Fleas.
- Rodents.
- Humans.
- Dogs.
- Cats.
- Camels.
- Chickens.
- Pigs.

Of Scales and Numbers

- Remember “Biblical proportions”?
- The Black Death is known to have killed 30-60% of Europe’s total population.
- Recent evidence shows this estimate is too low.
- Some authors have described that the plague inflicted death “on an eye-watering scale”.

THIRD PLAGUE PANDEMIC

1866-1960'S

Spread of Plague

Thanks to steamship transport, spread to:

- Madagascar
- Southeast Asia
- South Africa
- South America
- Russia
- Australia
- San Francisco and Western US (~1900)

The Third Plague Pandemic

~1894-1950

Emerged in
Himalayan
borders
between
China and
India ~ 1855.

Traveled
East, not
West.

Infected
South China,
Canton, and
Hong Kong in
1894.

Reached
Macao and
Fuzhou in
1895.

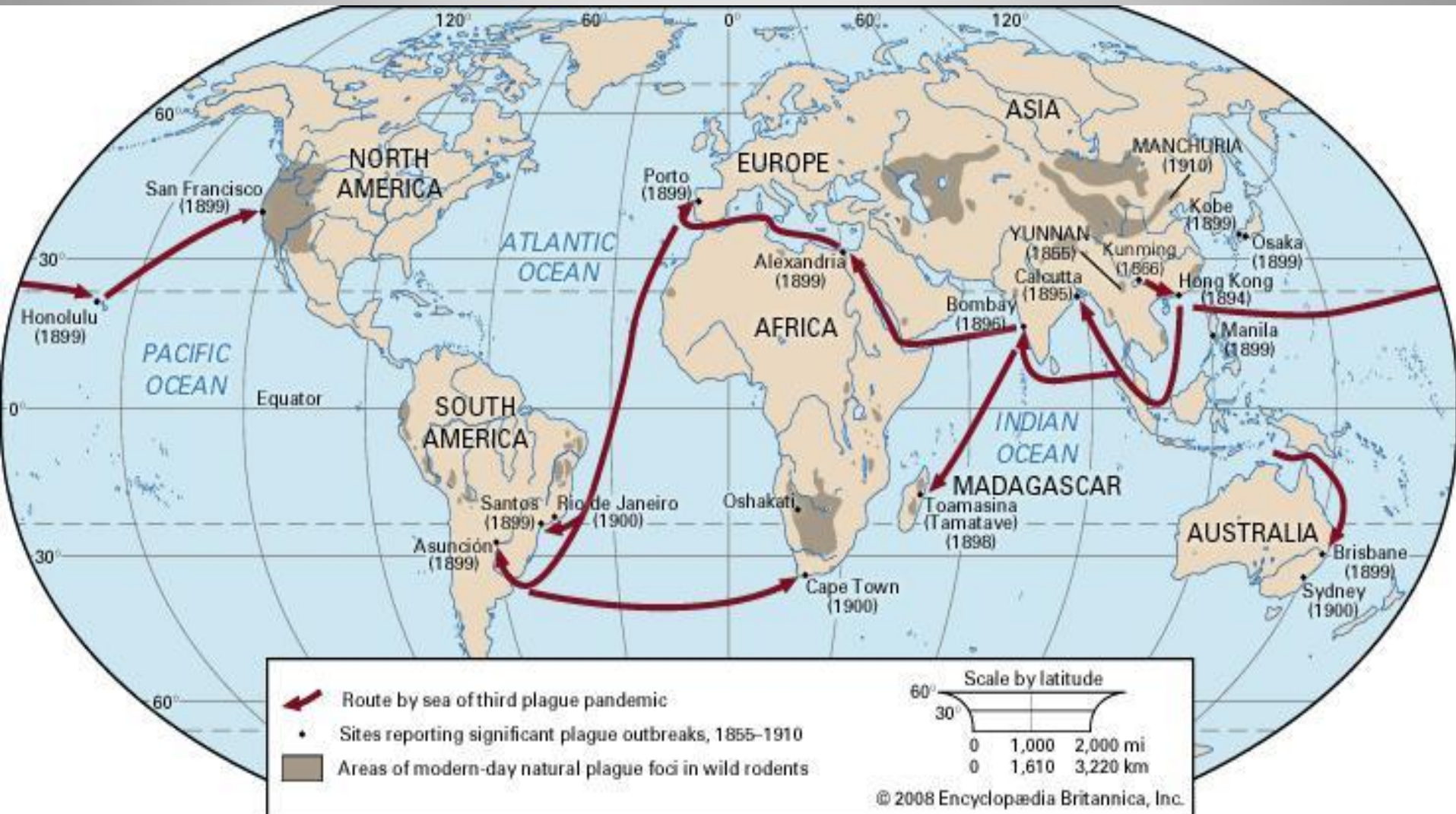
Hit
Singapore
and
Bombay in
1896.

Spread of Plague

Thanks to steamship transport, spread to:

- Madagascar
- Southeast Asia
- South Africa
- South America
- Russia
- Australia
- San Francisco and Western US (~1900)

Maritime Spread of Pandemic



First Outbreaks in Some Ports ¹

City	Mo./Yr.	Pop. Density	Cases	Deaths And %
Hong Kong	05/1894	240	2,573	2,445 (95%)
Bombay	08/1896	770	2,000+	1800+ (?) (90%)
Alexandria	05/1899	325	130	70 (54%)
Oporto	06/1899	170	310	114 (37%)
Honolulu	12/1899	40	71	60 (85%)
Sydney	01/1900	480	303	103 (34%)
Buenos Aires	01/1900	665	120	90 (75%)
Rio de Janeiro	01/1900	800	580	299 (52%)
San Francisco	03/1900	350	121	119 (98%)
Glasgow	08/1900	750	36	16 (44%)
Cape Town	02/1901	120	807	389 (48%)

1. M Echenberg 2002

Mortality of Third Pandemic

- India hardest hit (North and West regions).
 - Killed about 12 million people by 1930.
 - This was 95% of total world's mortality.
- In Manchuria (Northeastern China):
 - Mostly pneumonic plague.
 - Killed 60,000 in 1910-1911 and 8,500 in 1920-1921.

Science to the Rescue

- Bacillus discovered in Honk Kong in 1894.
- Independently by Alexandre Yersin and Kitasato Shibazaburō.
- Initially named Pasteurella, later changed to Yersinia.
- Paul-Louis Simond discovered the rat-flea vector for the disease transmission.

Recap of Session 2

- The diverse plagues through the ages:
 - Plague of Athens
 - Antonine Plague
 - Plague of Cyprian
- Three Pandemics of the Plague:
 - 1st pandemic (Justinian)
 - 2nd Pandemic: The Great Plague
 - 3rd Pandemic: The Modern Plague
- Etiology, symptoms, treatments



