

STS 007

Class Notes Class 9

Early empires

Read Diamond pp. 9-10 – past present and future form a continuum: “relevance”: how the world works

Review Christian chap. 10

What are large structural changes he looks for? – what matters – longue duree, substructures, big picture

Imp of geography

Why focus on agrarian civilizations?

Systems and networks

Scientific metaphors

Modes of intensification

What is the overall picture?

Malthusian cycles, overshoots

Axial age (Karl Jaspers 1949) – substructure superstructure argument – similar with writing, laws - Cuneiform, beginning ca 8000 BCE (counting merchandise); more abstract cuneiform ca. 3300 BCE – lists for 500 years

## **Mediterranean – Egypt, Greece, Rome.**

See:

[http://upload.wikimedia.org/wikipedia/commons/thumb/d/d8/Mediterranean\\_Sea\\_political\\_map-en.svg/800px-Mediterranean\\_Sea\\_political\\_map-en.svg.png](http://upload.wikimedia.org/wikipedia/commons/thumb/d/d8/Mediterranean_Sea_political_map-en.svg/800px-Mediterranean_Sea_political_map-en.svg.png)

Long period of coexistence of Neolithic farmers and river valley civilizations (Iraq, Egypt)

Classic case: Egypt

Water control: canals, dikes, earthworks – flood of Nile predictable in timing, salt free 3 month flood season– dikes divided land into basins, so water could stand for a month to deposit its silt before it flowed downstream – devised calendar connected to Sirius rising in dawn with the sun – pulleys and treadmills to lift the water – civilization lasted 3000 years

To learn about the Great Pyramid of Giza, see: [Pyramid of Giza](#)

See: <http://beautifulplacestovisit.com/large/ruins/Giza-Pyramids-Egypt.jpg>

Sphinx of Giza carved out of limestone bedrock, largest single-stone castle in the world

See: [http://www.riddleofthesphinx.com/artifacts/artifacts\\_photos.html](http://www.riddleofthesphinx.com/artifacts/artifacts_photos.html)

See; <http://www.truthmagazine.com/wordpress/wp-content/uploads/photos0809/Sphinx-and-Cheops-pyramid-3.gif>

Lasted 3000 years

Slow decline: remember Antony and Cleopatra, Egypt still to be reckoned with around BCE

One reason for emphasis on Middle East: not just Christian bias, but also the key “center of gravity” for so long and also remains are especially visible – as a cautionary tale

Read Ozymandias

Sometimes you can see the problems; sometimes not, invisible sources of weakness

Sometimes you can see the remains, sometimes not

Balance of Neolithic farmers and herdsman and river valley civilizations was broken - Two disruptive inventions: iron and horses – game changers

Iron

See: [http://www.ntimages.net/Maps\\_Sat-views/imagemaps/italy-i-map.gif](http://www.ntimages.net/Maps_Sat-views/imagemaps/italy-i-map.gif)

Reading from Greek and Roman Technology Sourcebook

1. Attitude - how much due to humans, how much to gods; five ages/metals

5<sup>th</sup> age of man: gold, silver, bronze, heroes, iron – opposite of progress - arguments

Raw metals: copper, silver, gold – axe of Ice Man of Alps was of native copper – source of trade – needed bellows (200 BCE) needed to get metal hot enough to melt and cast

Used for axes, saw blades, knives, swords, armor – ordinary people used stone and wood

Copper works better when mixed with tin (soft: bronze (copper to tin ten to one) – lower melting point, not so brittle, kept an edge, easy to cast – tin not that common – used in mid east, N Africa, Europe, China, in Americas from 500 on

Iron: much harder than bronze – needed more heat to smelt – wrought iron is brittle, doesn't hold an edge well – but much more iron ore around, much cheaper once blacksmiths learned how to smelt it – much more efficient axes

Iron making reached India from Mesopotamia ca. 1000 BCE – axes – to China ca. 700 BCE – transformed Africa – could cut down forests – Bantus –

By 4<sup>th</sup> c BCE iron swords could cut through bronze

Also from Greek and Roman Sourcebook: sources of energy – most of all animal, both human (slaves, soldiers) and animals

Horses domesticated in 3<sup>rd</sup> millennium BCE – next millennium much lighter wheels – fast and deadly chariots with two wheels, two horses, driver and archer – a real advantage

Then in 2<sup>nd</sup> millennium BCE, bigger horses, riding, cavalrymen – nomads invaded Egypt – Assyrians armed infantry with iron swords and battering rams – long conflicts between settled empires and nomadic herdsman

with iron and horses and wheeled vehicles, an era of warfare – larger empires – richer, did a lot of building – dependence of slave labor

1500 BCE to 500 CE the great age of construction – succession of empires in Europe, Mid East, India, China – had rain, water, needed efficient methods of comm and trans

Romans on top 3<sup>rd</sup> c. BCE to 500 CE –

See:

<http://kollinz.ironcube.info/kollin/amazingplaces/places/Roman%20Forum,%20Rome,%20Italy.jpg>

## **Mesoamerica**

First though, Mesoamerica – 2000 year lag

In the Americas, sequence is much more mysterious: Diamond has a couple chapters on this (Maya, Anasazi) – lack of large mammals

Teotihuacan – Tay o tee wah con

See: [http://www.world-mysteries.com/teotihuacan\\_bw.jpg](http://www.world-mysteries.com/teotihuacan_bw.jpg)

50 km north of Mexico City – first true city in the Americas

Few small villages in 500 BCE – rose to power between 300 and 700

Height in 500 CE had 100,000 to 200,000 people, grand architecture

Read Christian, page 302, for more information about Teotihuacan.

See: <http://www.shunya.net/Pictures/Mexico/mexico02/Teotihuacan/PyramidSun.jpg>

<http://en.wikipedia.org/wiki/Teotihuacan>

[http://xenophilus.files.wordpress.com/2008/07/teotihuacan2\\_1024.jpg](http://xenophilus.files.wordpress.com/2008/07/teotihuacan2_1024.jpg)

For more information about the Mayan civilization, see: [Mayan civilization](#)

<http://www.manatee.k12.fl.us/sites/elementary/samoset/chichen2.jpg>

Also resting on agriculture – highlands -chinampa system –

Also trade and cities

Pyramids in system – height and size

Alignment, math

Mystery of decline and fall

Aztec Empire in central Mexico, created in 1400s –

Capital was Tenochtitlan – description of Cortez’s lieutenant

For more information on Tenochtitlan, see: [Tenochtitlan](#)

See: <http://www.1st-art-gallery.com/thumbnaill/141143/1/Detail-From-The-Great-City-Of-Tenochtitlan-, -From-The-Pre-Hispanic-And-Colonial-Mexico-Cycle, -1945-52.jpg>

Similar with Maya to the south

Networks in whole region

Irrigation

Writing

Decline and fall about same time – similar mysteries (Diamond speculates)

Equivalent to Rome is Aztec empire, created in 15<sup>th</sup> c.

Tennawktitlan

Waterworks – defense, also free water springs – aqueducts

Difference: invasion and conquest 1519 –

Read Christian p. 302

What technologies are evident?

Guns – metals

Ages of man: gold silver bronze heroes, iron

Iron: hard, but needs heat and working (brittle) – can cut through bronze (by 4<sup>th</sup> c. BCE)

The mystery of these empires' disappearance

The poignance of Rome's decline and fall

Gibbon sitting in the forum as the sun set

Three ways to look at its technologies:

1. Thinking like a state – command economy – most visible – “tools of empire”
2. Living like a person – less visible
3. Interacting with the world – less visible E flows, problems not always obvious (one of Diamond's main points)

what are the “tools of empire”?

## **Roads**

Mounted warriors in Europe came only with Charles Martel 732.

(William McNeill, Power, pp. 18-19)

The Appian Way

See: <http://geanderson.files.wordpress.com/2009/03/appian-way3.jpg>

<http://people.hofstra.edu/geotrans/eng/ch3en/conc3en/img/appianway.jpg>

[http://upload.wikimedia.org/wikipedia/commons/b/b9/NSRW\\_Appian\\_Way.png](http://upload.wikimedia.org/wikipedia/commons/b/b9/NSRW_Appian_Way.png)

Had 50000 miles of roads later in the empire

To learn more about the Appian way, see: [Appian Way](#)

Roman bridges

To learn more about roman bridges, see: [Roman bridges](#)

[http://en.wikipedia.org/wiki/File:Bridge\\_Alcantara.JPG](http://en.wikipedia.org/wiki/File:Bridge_Alcantara.JPG)

[http://en.wikipedia.org/wiki/File:Cendere\\_%C3%87ayi,\\_severische\\_Br%C3%BCcke.jpg](http://en.wikipedia.org/wiki/File:Cendere_%C3%87ayi,_severische_Br%C3%BCcke.jpg)

[http://en.wikipedia.org/wiki/File:035\\_Conrad\\_Cichorius,\\_Die\\_Reliefs\\_der\\_Traianss%C3%A4ule,\\_Tafel\\_XXXV\\_%28Ausschnitt\\_01%29.jpg](http://en.wikipedia.org/wiki/File:035_Conrad_Cichorius,_Die_Reliefs_der_Traianss%C3%A4ule,_Tafel_XXXV_%28Ausschnitt_01%29.jpg)

Similarly, aqueducts for water

To learn more about roman aqueducts, see: [Roman aqueduct](#).

See: [http://bobnholli.com/Gallery/albums/album03/3\\_Roman\\_Aqueducts0003.jpg](http://bobnholli.com/Gallery/albums/album03/3_Roman_Aqueducts0003.jpg)

<http://www.tomisimo.org/blog/wp-content/uploads/2007/07/segovia-roman-aqueduct.jpg>

<http://www.kmkz.com/jonesj/gallery/Pont%20du%20Gard,%20Roman%20Aqueduct.jpg>

<http://upload.wikimedia.org/wikipedia/commons/9/90/Archscrew2.jpg>

9 canals to Rome, totaling 300 miles, from streams in Apennines – steady gradient of 2-3 inches to the mile

Segovia, half a mile long, still used

Pont du Gard in southern France: 900 feet long, 160 ft high

Interlude: Vitruvius

To learn more about Marcus Vitruvius Pollio, see: [Marcus Vitruvius Pollio](#) and [Roman Military Borders and Fortifications](#)

## War machines: catapults, siege engines

Elite: officials and warriors

See: <http://www.galen-frysinger.com/syria/river06.jpg>

<http://galen-frysinger.com/syria/river09.jpg>

<http://www.cathar.info/12cathars/carcwalls12.gif>

<http://www.legion-fourteen.com/romans.htm>

Formal law

Writing

Bureaucracy and taxation (Bethlehem story) See: [Peter Bruegel the Elder \(ca. 1520 – 1569\) Census at Bethlehem, 1566. Museum voor Oude Kunst, Brussels](#)

See: [http://en.wikipedia.org/wiki/File:Limes\\_and\\_borders.gif](http://en.wikipedia.org/wiki/File:Limes_and_borders.gif)

## City building esp. Rome

Coliseum – stadium 600 feet long, 175 wide, holds 50,000, built 72 to 80 CE

See: <http://www.traveladventures.org/continents/europe/images/colosseum03.jpg>

<http://www.traveladventures.org/continents/europe/images/colosseum05.jpg>

Pantheon – domed building, interior diameter 142 feet (built 110-125 CE)

See: <http://www.kmkz.com/jonesj/gallery/aerial%20view%20of%20the%20Pantheon.jpg>

[http://cdn.wn.com/pd/73/34/63f33795a4a88447f70b050a96f0\\_grande.jpg](http://cdn.wn.com/pd/73/34/63f33795a4a88447f70b050a96f0_grande.jpg)

Columns, obelisks - engraved

See: <http://www.kmkz.com/jonesj/gallery/Column%20of%20Trajan.jpg>

<http://www.kmkz.com/jonesj/gallery/Arch%20of%20Constantine.jpg>

Heating and bathing

See: [http://upload.wikimedia.org/wikipedia/commons/2/23/Bignor\\_Villa\\_Hypocaust\\_1.JPG](http://upload.wikimedia.org/wikipedia/commons/2/23/Bignor_Villa_Hypocaust_1.JPG)

<http://www.old-picture.com/europe/pictures/Circular-Abbey.jpg>

<http://www.myenglandtravel.com/images/bath/RomanBath.jpg>

Sewers

To learn about sewers in Rome, see: [Cloaca Maxima](#)

Catacombs – cemeteries

See: [http://www.italianvisits.com/images/lroma-im/rome-im\\_monuments/rome-monument\\_catacombs.jpg](http://www.italianvisits.com/images/lroma-im/rome-im_monuments/rome-monument_catacombs.jpg)

[http://www.bible-archaeology.info/images/Rome\\_Priscilla\\_rectangular\\_burial\\_niches.jpg](http://www.bible-archaeology.info/images/Rome_Priscilla_rectangular_burial_niches.jpg)

[http://3.bp.blogspot.com/\\_iuX4zetSxBA/SCwL-JZQ1pI/AAAAAAAAAGM/bEW4PhOy9C8/s400/1538437-Catacombs-Rome.jpg%5C](http://3.bp.blogspot.com/_iuX4zetSxBA/SCwL-JZQ1pI/AAAAAAAAAGM/bEW4PhOy9C8/s400/1538437-Catacombs-Rome.jpg%5C)

Population 500,000 maybe to a million

Pompeii much more typical: 20000

Also city-building, but on a smaller scale: Pompeii – you can begin to see more of daily life

What disasters reveal: Frozen in time, 24 August 79 CE – (remember when we read Hiroshima) – 2000 perished

nine to 20 feet of hot ash and pumice and gases

extent of city

theatre, amphitheatre

paved streets

food

baths, brothel

houses, fountains, gardens

Pottery around 6-7000 BCE – not useful if you are moving around: heavy, fragile – first in Japan (Jomon)

Fibers: hemp or ramie (vegetable fibers), silk (trade secret in China), flax (linen), cotton (India and Americas), wool – earliest looms 6000 BCE – fragments of linen date to 4500 BCE – felt made first from wool

Funereal plaques with carpenter's square on it, or signs of spinning/weaving

Beliefs

Entertainment

See: <http://schools-wikipedia.org/images/320/32039.jpg.htm>

<http://www.chauffeurs-italy.com/uploads/images/Image/Pompei%20-%20Villa.jpg>

<http://www.utexas.edu/courses/italianarch/jpgs/0002090003.gif>

<http://pompeii.virginia.edu/aerialforum.jpg>

<http://schools-wikipedia.org/images/851/85117.jpg.htm>

<http://www.photos4travel.com/travelArticles/photos/pompeii.jpg>

[http://0.tqn.com/d/archaeology/1/0/r/1/1/pompeii\\_narrow\\_street.jpg](http://0.tqn.com/d/archaeology/1/0/r/1/1/pompeii_narrow_street.jpg)

<http://upload.wikimedia.org/wikipedia/commons/9/9c/Pompeii-Street.jpg>

<http://www.stoneschool.com/Work/Siggraph/2006/Pompeii.jpg>

<http://0.tqn.com/d/cruises/1/0/-/Q/3/pompeii015.JPG>

<http://images.travelpod.com/users/jaywehrs/1.1202057160.pompeii-stadium.jpg>

[http://lh5.ggpht.com/\\_XVVrSxodlCM/R5UZOQNe9jI/AAAAAAAAAFI/Rn19tp5Ph2M/Ruins+of+Pompeii+23.JPG](http://lh5.ggpht.com/_XVVrSxodlCM/R5UZOQNe9jI/AAAAAAAAAFI/Rn19tp5Ph2M/Ruins+of+Pompeii+23.JPG)

[http://farm1.static.flickr.com/105/303312484\\_5085f052c0.jpg](http://farm1.static.flickr.com/105/303312484_5085f052c0.jpg)

<http://cdn.buzznet.com/assets/users12/bluenun/default/pompeii-hot-tub-bath-house--large-msg-116033786777.jpg>

[http://www.bbc.co.uk/history/ancient/romans/images/pompeii\\_art\\_vettii.jpg](http://www.bbc.co.uk/history/ancient/romans/images/pompeii_art_vettii.jpg)

<http://www.kmkz.com/jonesj/gallery/Peristyle%20in%20Roman%20Home.jpg>

[http://www.blogandgo.co.uk/A55A21/BlogAndGo.nsf/0BF5ED2AA517925D8025735F00827F01/\\$file/mPompe14.jpg](http://www.blogandgo.co.uk/A55A21/BlogAndGo.nsf/0BF5ED2AA517925D8025735F00827F01/$file/mPompe14.jpg)

<http://schools-wikipedia.org/images/851/85114.jpg>

<http://schools-wikipedia.org/images/851/85106.jpg.htm>

[http://calitreview.com/images/pompeii\\_dice\\_players.jpg](http://calitreview.com/images/pompeii_dice_players.jpg)

<http://www.utexas.edu/courses/romanciv/Romancivimages17/petroniusimages/05cavecanem.jpg>

<http://www.utexas.edu/courses/italianarch/jpgs/9902280001.jpg>

<http://www.utexas.edu/courses/italianarch/jpgs/9906220505.jpg>

[http://www.italy.artviva.com/media/img\\_pagine/134/pompeii-wall-fresco-italy-t.jpg](http://www.italy.artviva.com/media/img_pagine/134/pompeii-wall-fresco-italy-t.jpg)

<http://www.bluffton.edu/~sullivanm/italy/pompeii/0117.jpg>

The fall of a city vs fall of a civilization

As Christian emphasizes, huge drop in population in first c CE

Population of Italy declined 50% between 200 and 600 CE (McClellan and Dorn, 95)

Split in 4<sup>th</sup> century, sacking by Goths in 410 – last emperor deposed 476 – then split into parts, including Holy Roman Empire in Europe and Eastern Empire

Ca. 45 million at time of Augustus.

To learn more about the Roman Empire, see: [http://en.wikipedia.org/wiki/Roman\\_empire](http://en.wikipedia.org/wiki/Roman_empire)

Why?

Obvious reasons: plagues, warfare

World religion - (Constantine's conversion 337)

“blocage” argument (using wind power to drive an air pump for a water organ) – presence of slaves – attitudes - Energy crisis?

Diamond: “(13-14) ...collapses for ecological or other reasons often masquerade as military defeats...had long been “barbarian” tribes in norther Europe and central Asia – Rome held them off for a thousand years –

Opponents now better organized, equipped, more horses (climate change link?)

Rome weakened by ec, pol, envl and other problems?

Gibbon sitting in the forum

Warning for today

Two pieces from NYTimes

Collapses – some large, some small, some civilizations don't last forever; reasons for disappearance not always clear

Sometimes the largest are the most vulnerable

And what is least visible is most important

Next week's reading takes us up to the take off point, ca. 800 years ago

“technohistorical revolution” or “Modern Revolution”

Brief chapter in Christian, selections from Mumford (who he was) – cultural roots of technical civilization

Energy:

Sailing ships from 4<sup>th</sup> millennium BC (remember story about Crete)

Water power widely used from 2<sup>nd</sup> or 3<sup>rd</sup> c. BC: water wheels with paddles, grinding grain

Knowledge of steam power was of little use because of scarcity of fuel, relatively small scale of iron-working

Charcoal the most popular fuel in antiquity besides wood and straw (high heat, relatively smokeless, relatively dense) – Sarah esp.- compression, breaking up the coals, needing a draft

Coal or peat were scarce – some lignite, soft coal, not much used for metal-working

Petroleum – esp. Iraq – flammable naphtha – byproduct in production of kerosene

Illuminant: wax, pitch, olive oil (animal fat further north)

[http://www.dailyventure.com/960x300/rome\\_forum\\_16.jpg](http://www.dailyventure.com/960x300/rome_forum_16.jpg)

Roman republic and empire

Two levels:

Technologies of daily life – psyche – motives – mindset – not all about causes (fascination with past as “another country” or even another planet)

Techs as tools of empire – military and “soft” power – occupation, coercion, rule

Fascination with the life cycle of world domination

Edward Gibbon – D and R of Roman Emp – Christianity as major cause

Piers Brendon – D and F of Br Emp

Paul Kennedy – Rise and Fall of Great Powers 1988 – overextension argument

Two things to look for: tools of daily life (inner and outer), tools of empire

Christian Chap. 11 One world – Modern Era

Before 1400, mix of lifeways

Now: read p. 342

History works differently = how? To p. 351

Emphasis on new technologies, plural

Why? Review of major theories of social science, incl. Marx

His modification – p. 360 – global changes but Europe with specific advantages in geography

(also “pre-adapted,” however)

MIT OpenCourseWare  
<http://ocw.mit.edu>

STS.007 Technology in History  
Fall 2010

For information about citing these materials or our Terms of Use, visit: <http://ocw.mit.edu/terms>.