Lecture 13

Cities in History; Urban Precursors: Hunter-Gatherer Camps and Densification

13.1 Cities in History : The Mother of all Social Experiments

IUS 7.1

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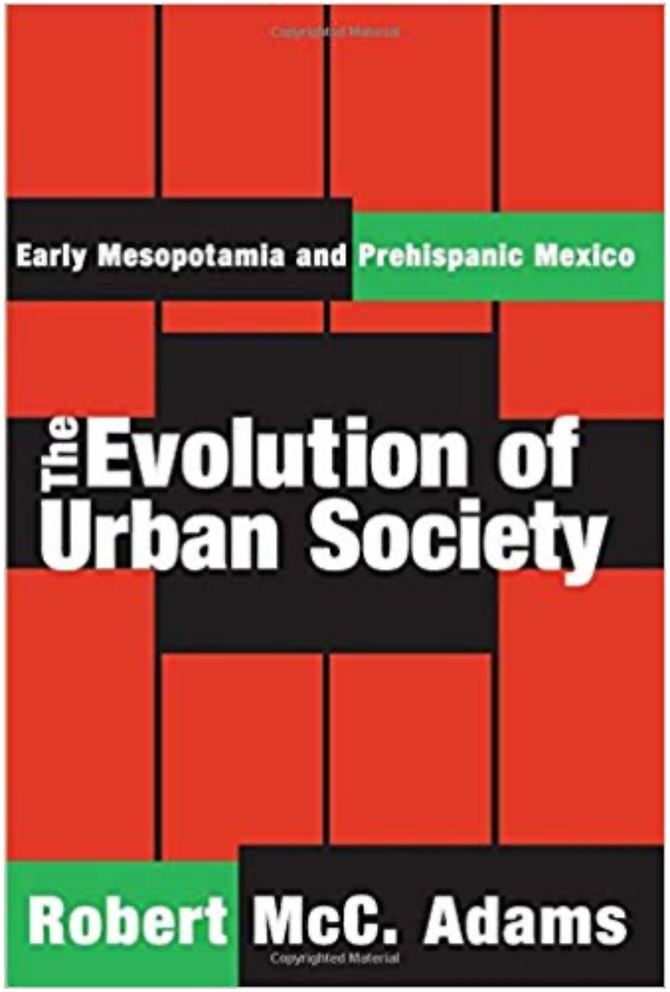
All workable social systems are predicated on creating reliable forms of cooperation among an extensive population and then distributing the fruits of that cooperation across the population in ways that prevent the outbreak of catastrophic levels of violence.

—Josiah Ober, The Rise and Fall of Classical Greece, 2015.

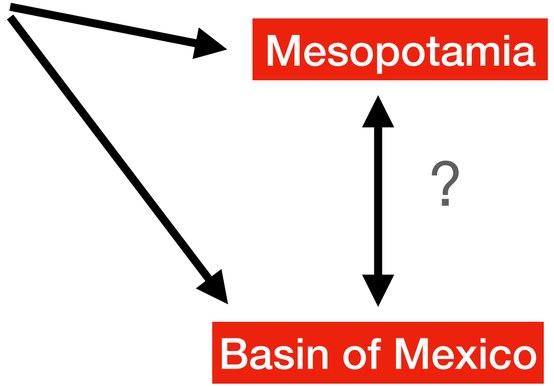
Another UChicago First:



Robert McCormick Adams

"This volume is concerned with the presentation and analysis of regularities on our two best documented cases of early, independent urban societies. It seeks to provide as systematic a comparison as the data permits of institutional forms and trends of growth that are to be found in both of them.

Emphasizing basic similarities in structure rather than the many acknowledged formal features by which each culture is rendered distinguishable from all others, it seeks to demonstrate that both the societies in question can usefully be regarded as variants of a single processual pattern."



https://www.routledge.com/The-Evolution-of-Urban-Society-Early-Mesopotamia-and-Prehispanic-Mexico/Adams/p/book/9780202308180

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This November is the Wikipedia Asian Month. Come join us.

Processual archaeology

From Wikipedia, the free encyclopedia

Processual archaeology (formerly the **New Archaeology**) is a form of archaeological theory that had its genesis in 1958 with the work of Gordon Willey and Philip Phillips, *Method and Theory in American Archaeology,* in which the pair stated that "American archaeology is anthropology or it is nothing" (Willey and Phillips, 1958:2), a rephrasing of Frederic William Maitland's comment: "My own belief is that by and by anthropology will have the choice between being history and being nothing."[1] This idea implied that the goals of archaeology were, in fact, the goals of anthropology, which were to answer questions about humans and human society. That was a critique of the former period in archaeology, the Culture-Historical phase in which archaeologists thought that any information that artifacts contained about past people and past ways of life was lost once the items became included in the archaeological record. All they felt could be done was to catalogue, describe, and create timelines based on the artifacts.[2]

Processual archaeology originated in American Archaeology, where analysing historical change over time had proved difficult with existing technology

Proponents of this new phase in archaeology claimed that with the rigorous use of the scientific method it was possible to get past the limits of the archaeological record and learn something about how the people who used the artifacts lived. Colin Renfrew, a proponent of the new processual archaeology, observed in 1987 that it focuses attention on "the underlying historical processes which are at the root of change". Archaeology, he noted "has learnt to speak with greater authority and accuracy about the ecology of past societies, their technology, their economic basis and their social organization. Now it is beginning to interest itself in the ideology of early communities: their religions, the way they expressed rank, status and group identity."[3]

The advent and evolution of writing

credit: Oriental Institute

Denise Schmandt-Besserat

Urban economy

Remember, Uruk was a great city. There was a priesthood, there were craftsmen. Food was gathered from the surrounding countryside.

An urban economy requires trading, and planning, and taxation too. Picture the world's first accountants, sitting at the door of the temple storehouse, using the little loaf tokens to count as the sacks of grain arrive and leave.

Denise Schmandt-Besserat pointed out something else revolutionary. The abstract marks on the cuneiform tablets matched the tokens. Everyone else had missed the resemblance because the writing didn't seem to be a picture of anything.

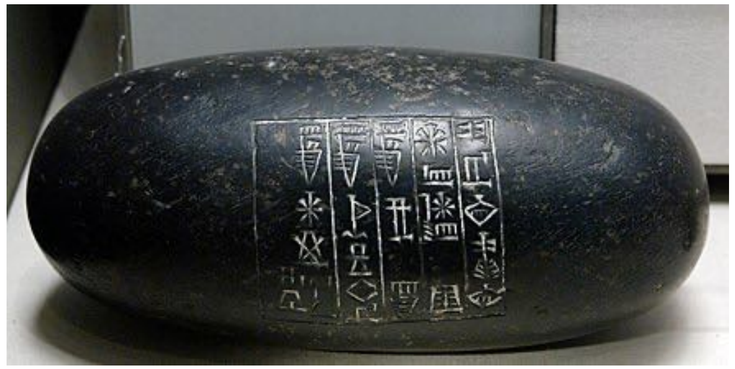
But Schmandt-Besserat realised what had happened. The tablets had been used to record the back-and-forth of the tokens, which themselves were recording the back-and-forth of the sheep, the grain, and the jars of honey.

https://www.bbc.com/news/business-39870485

Letters (and numbers) from the first cities

1-5. Six lambs, one (goat-)kid, day 30,
from Abbasaga, Intaea took in charge.*

Political document



Bridegroom, dear to my heart,
Goodly is your beauty, honeysweet,
Lion, dear to my heart,
Goodly is your beauty, honeysweet.

You have captivated me, let me stand tremblingly before you.

[*it then gets pretty racy !*]

The Love Song of Shu-Sin

https://www.worldhistory.org/article/750/the-worlds-oldest-love-poem/

The “Urban Package”

Symbolic Culture

Accounting, written language, standard weights and measures, time and socioeconomic planning, (money comes later)

Division of Knowledge and Labor; Social Interdependence

Public Goods

monuments, aqueducts, streets, walls

Social Contracts (law), Resource Redistribution, Social Policy

managing inequality, insecurity and conflict

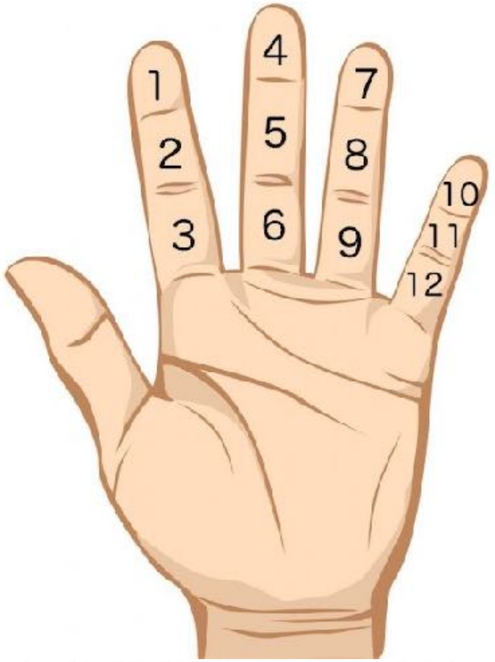
Code of Hammurabi

The result is (fast) **cumulative culture**:

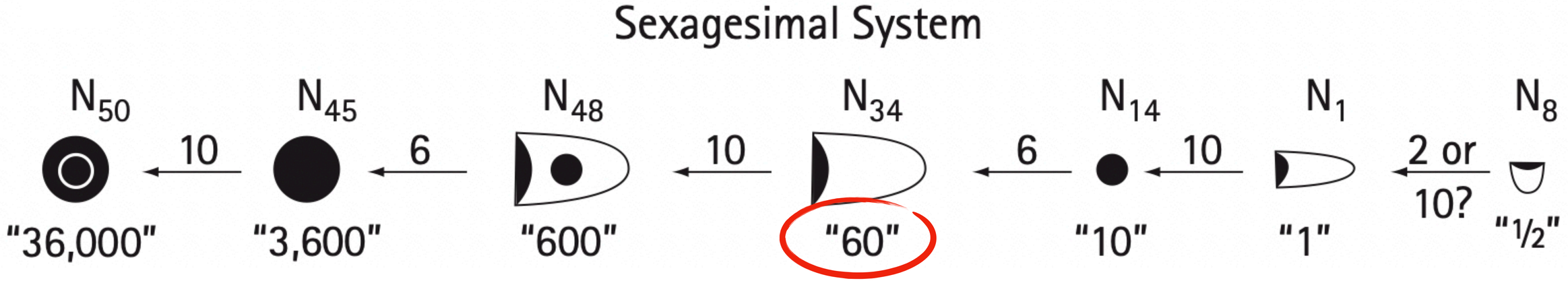
A symbolic encoding of memory and actions that holds societies together

Societies Learn, History begins

why do we tell time this way? angles, latitude, longitude?



Credit: ScienceABC



What ideas did we get from other great cities in the past?

Babylon

Athens

Rome

Paris

London

Tokyo

NYC

Beijing

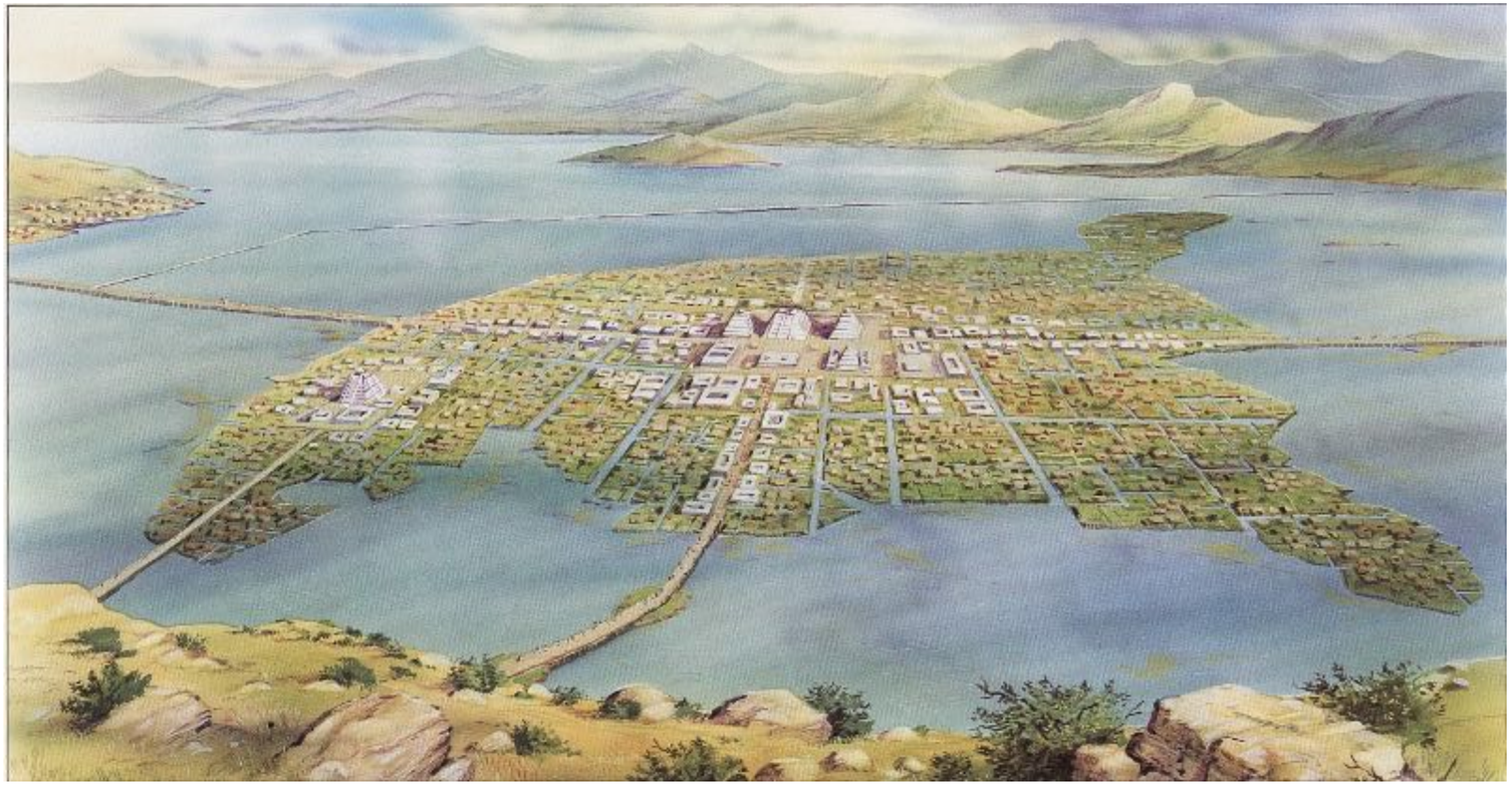
Mumbai

insert you favorite city…

Lagos

Tenochtitlan

Aztec capital, ~200,000 people



The mother of all social experiments

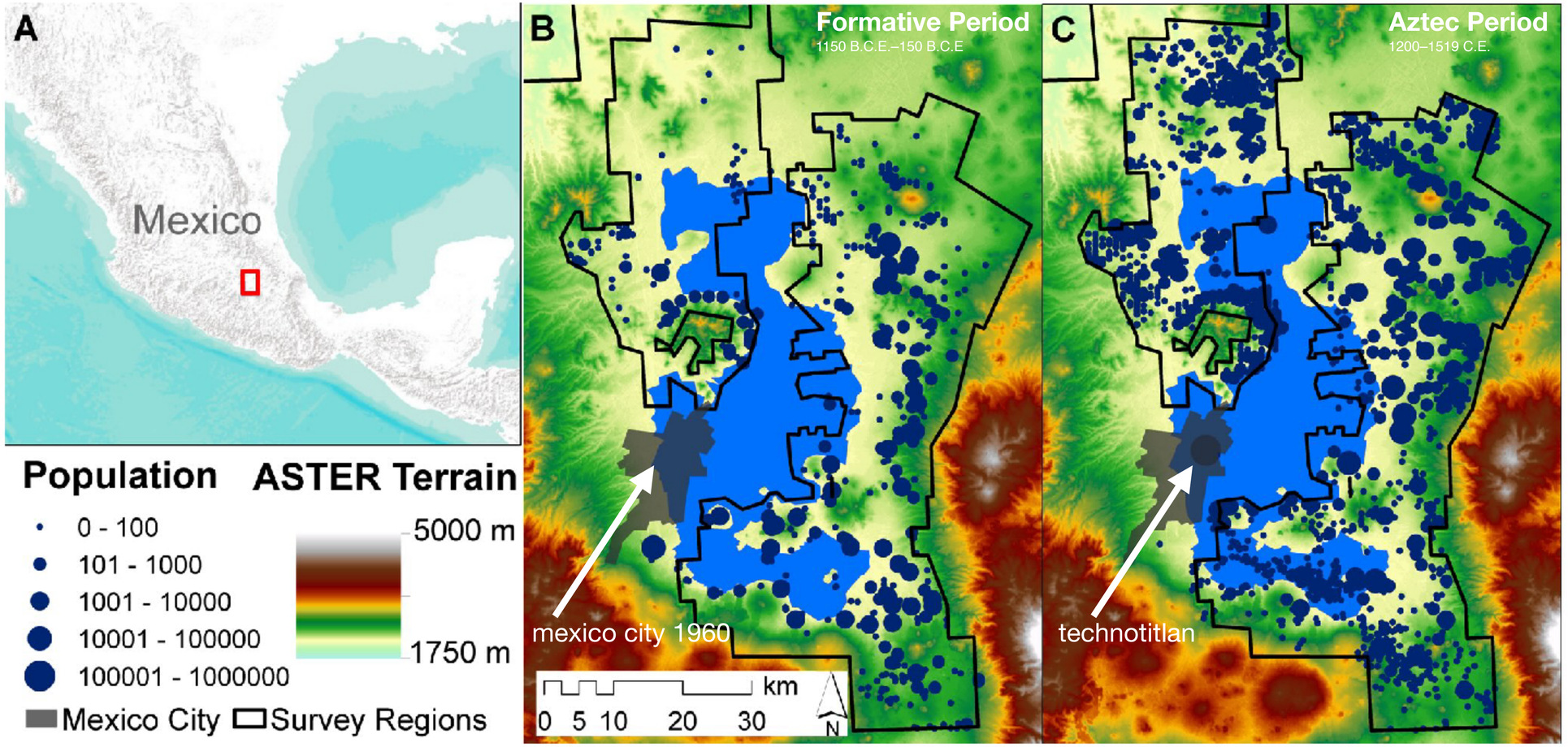
we beheld on that great lake a great multitude of canoes, some coming with supplies of food and others returning loaded with cargoes of merchandise; and we saw that from every house of that great city and of all the other cities that were built in the water it was impossible to pass from house to house, except by drawbridges which were made of wood or in canoes; and we saw in those cities temples and oratories like towers and fortresses and all gleaming white, and it was a wonderful thing to behold….

After having examined and considered all that we had seen we turned to look at the great market place and the crowds of people that were in it, some buying and others selling, so that the murmur and hum of their voices and words that they used could be heard more than a league off.

Some of the soldiers among us who had been in many parts of the world, in Constantinople, and all over Italy, and in Rome, said that they had never beheld so large a market place and so full of people, and so well regulated and arranged.

Bernal Diaz del Castillo
True Story of the Conquest on New Spain (1568) about 1519

The Valley of Mexico



Ortman, Cabaniss, Sturm, Bettencourt 2014

https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0087902

Population Density Estimation in Archeology

Method 1: Sherd densities

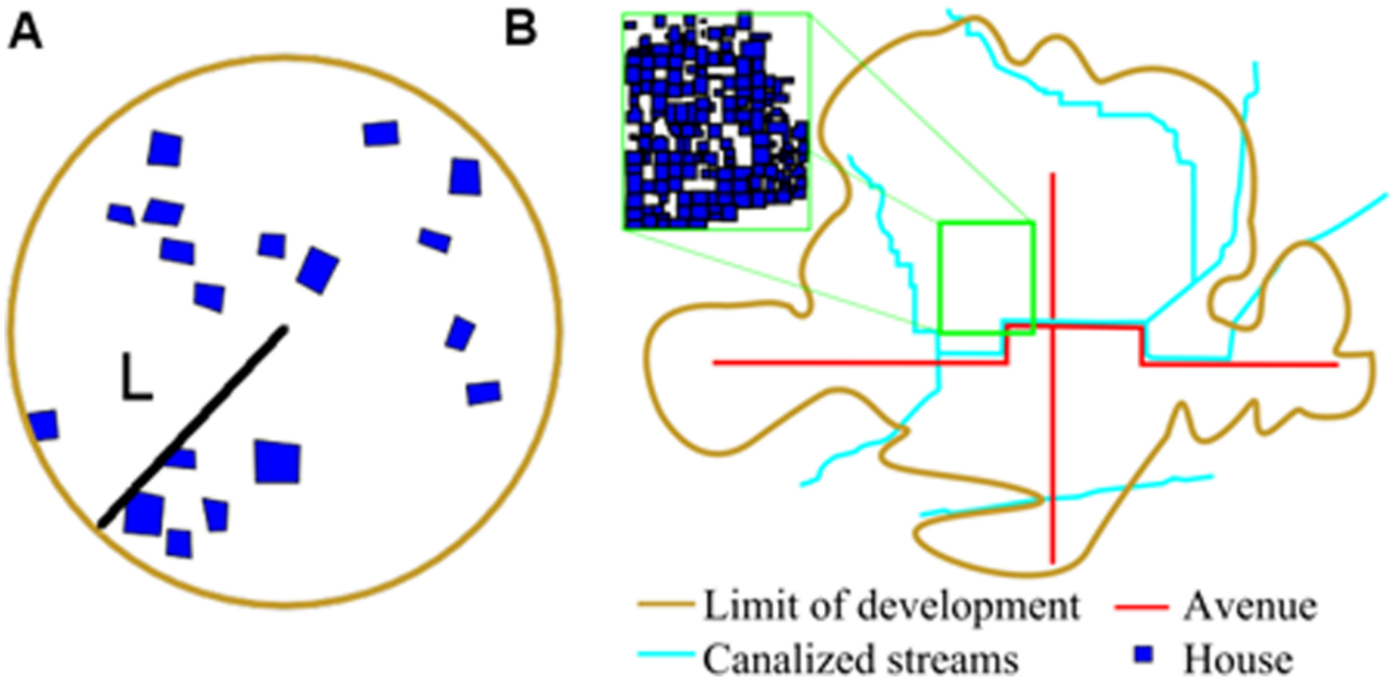
- Very Light – A wide scattering of surface debris so that only one or two sherds may be present every few meters; associated with compact rancherias of 2–5 persons/ha.
- Light – A continuous distribution of sherds every 20–30 cm, but with no significant build-up in sherd density beyond that point; associated with scattered villages of 5–10 persons/ha.
- Light-Moderate – Although most of the area contains light surface remains, delimited areas of substantial buildup containing as many as 100–200 sherds per square meter consistently appear; associated with compact low-density villages of 10–25 persons/ha.
- Moderate – A continuous layer of sherds, so that any randomly placed 1-meter square might yield 100 to 200 pieces of pottery; associated with compact high-density villages of 25–50 persons/ha.
- Moderate-Heavy – Over most of the area occupation occurs in moderate densities, however, in a few localized areas a 1-m square might contain 200–400 pieces of pottery; upper range of compact high-density villages of 50–100 persons/ha.
- Heavy – Densities of 200–400 sherds per 1-m square are continuous such that sherds are literally one atop another, so that a randomly placed 1-m square might produce as many as 400–800 pieces of pottery; associated with the upper range of compact high-density villages of 50–100 persons/ha.

Method 2: Room and house counts

multiply room occupancy by total number of rooms

Networked versus Amorphous Settlements

can we tell the difference?



How does the total built area of the settlement depend on its population?

$$A(N) = A_0 N^{\alpha}$$

$$\alpha \simeq 2/3$$

$$A_n(N) = A_0 N^{\nu}$$

$$\nu \simeq 5/6$$

Spatial Densification if you throw all the data together

Group:	Formative	Classic	Toltec	Aztec
N sites	230	272	484	546
MLE $a[ha]$	.200	.274	.196	.180
95% C.I.	.174–.277	.206–.400	.167–.256	.154–.230
MLE α	.708	.573	.715	.731
95% C.I.	.654–.736	.507–.654	.674–.763	.702–.777
OLS $a[ha]$	.235	.294	.215	.195
95% C.I.	.198–.277	.214–.407	.184–.253	.175–.222
OLS α	.700	.627	.708	.750
95% C.I.	.654–.740	.544–.705	.655–.752	.714–.785
Magnitude	33,850	95,597	22,502	212,500
Centrality	.295	.620	.229	.350
Productivity	700	1,400	1,400	3,000

Estimated pre-factors a and exponents α for four Pre-Hispanic periods. Parameter estimates and 95% confidence intervals (CI) obtained via maximum likelihood estimation (MLE) and ordinary least squares minimization (OLS). *Magnitude* is the estimated population size of the largest settlement, *Centrality* its fraction of the total population, and *Productivity* the yield (kg maize/ha) of the most productive agricultural strategy [53].

← one ha per household baseline

Sublinear

https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0087902

Spatial Densification

stratified by amorphous vs networked settlements

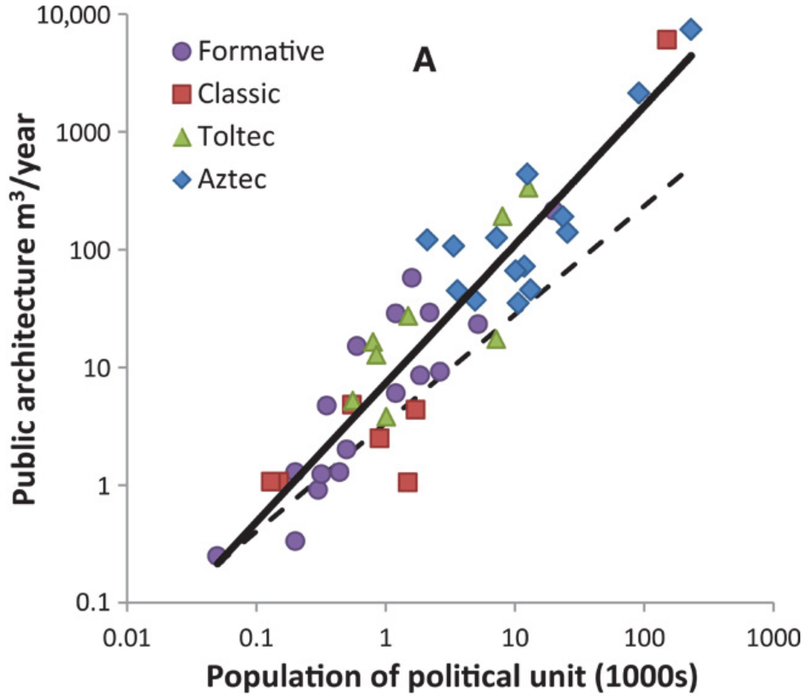
Group:	Amorphous	Networked	1960
N sites	1510	22	181
MLE $a[ha]$	.265	.294	.365
95% C.I.	.220–.285	.001–5.45	.206–.925
MLE α	.652	.724	.601
95% C.I.	.626–.674	.434–1.135	.493–.706
OLS $a[ha]$	.237	.109	.445
95% C.I.	.217–.259	.009–1.303	.250–.945
OLS α	.671	.853	.641
95% C.I.	.651–.691	.598–1.109	.552–.729
OLS r^2	.741	.709	.532

Estimated pre-factors a, exponents α and 95% confidence intervals (CI) obtained via maximum likelihood estimation (MLE) and ordinary least squares minimization (OLS).

Sublinear

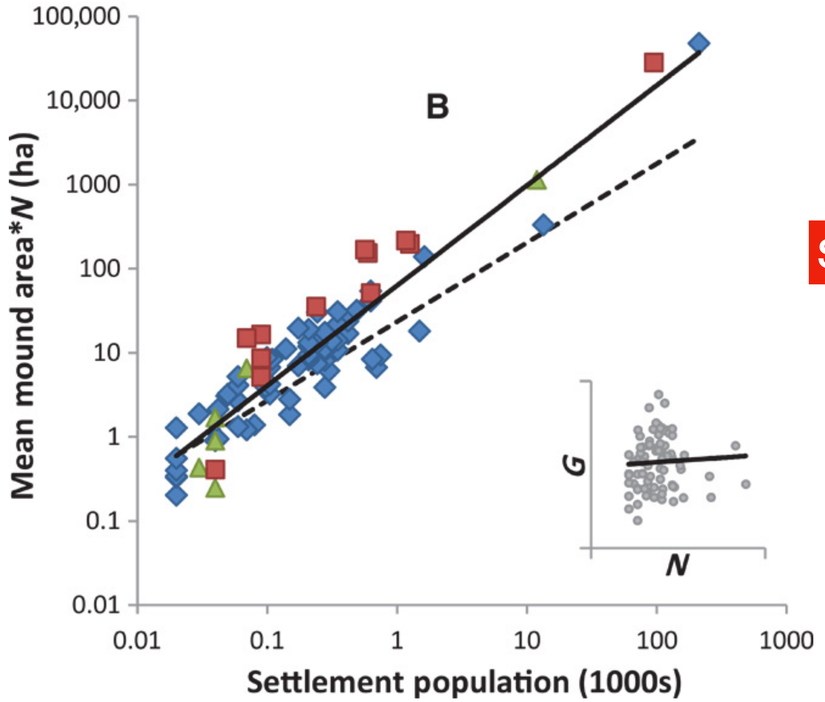
https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0087902

Where did ancient societies put their wealth?



Increasing returns in Monument Volume

Superlinear

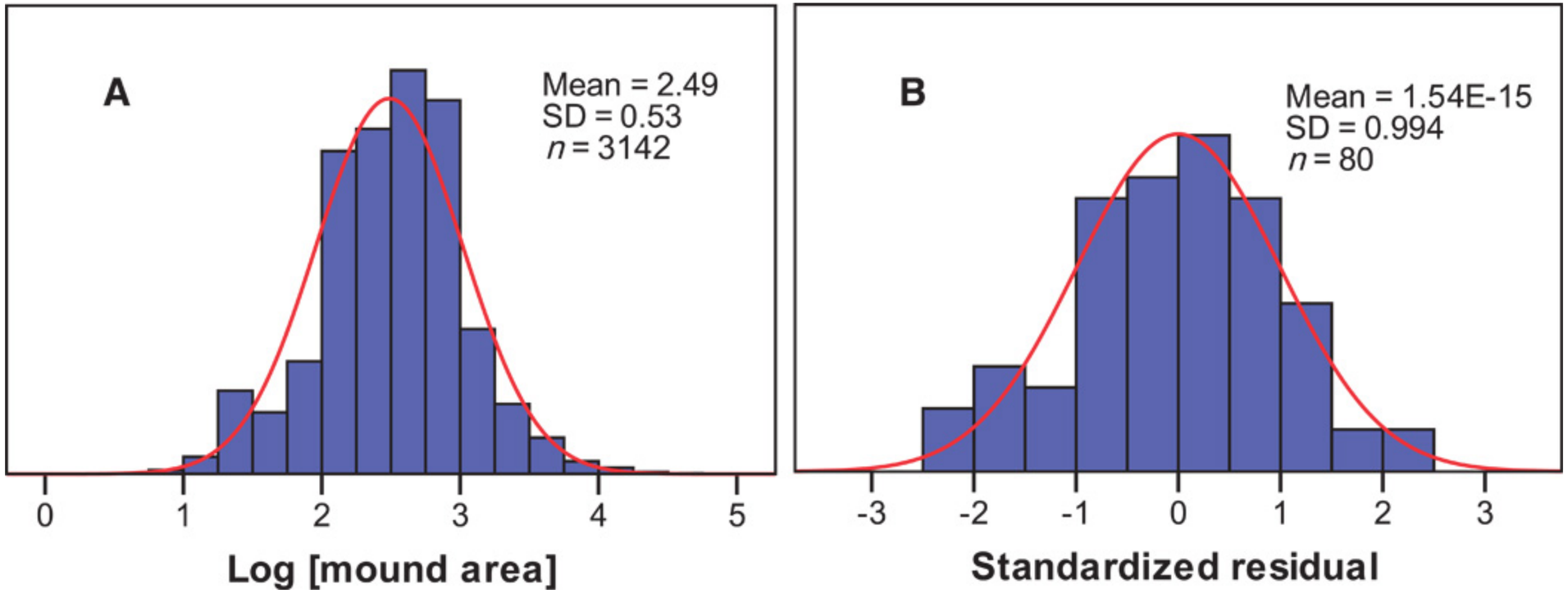


Increasing returns in Home Construction

Superlinear

https://www.science.org/doi/10.1126/sciadv.1400066

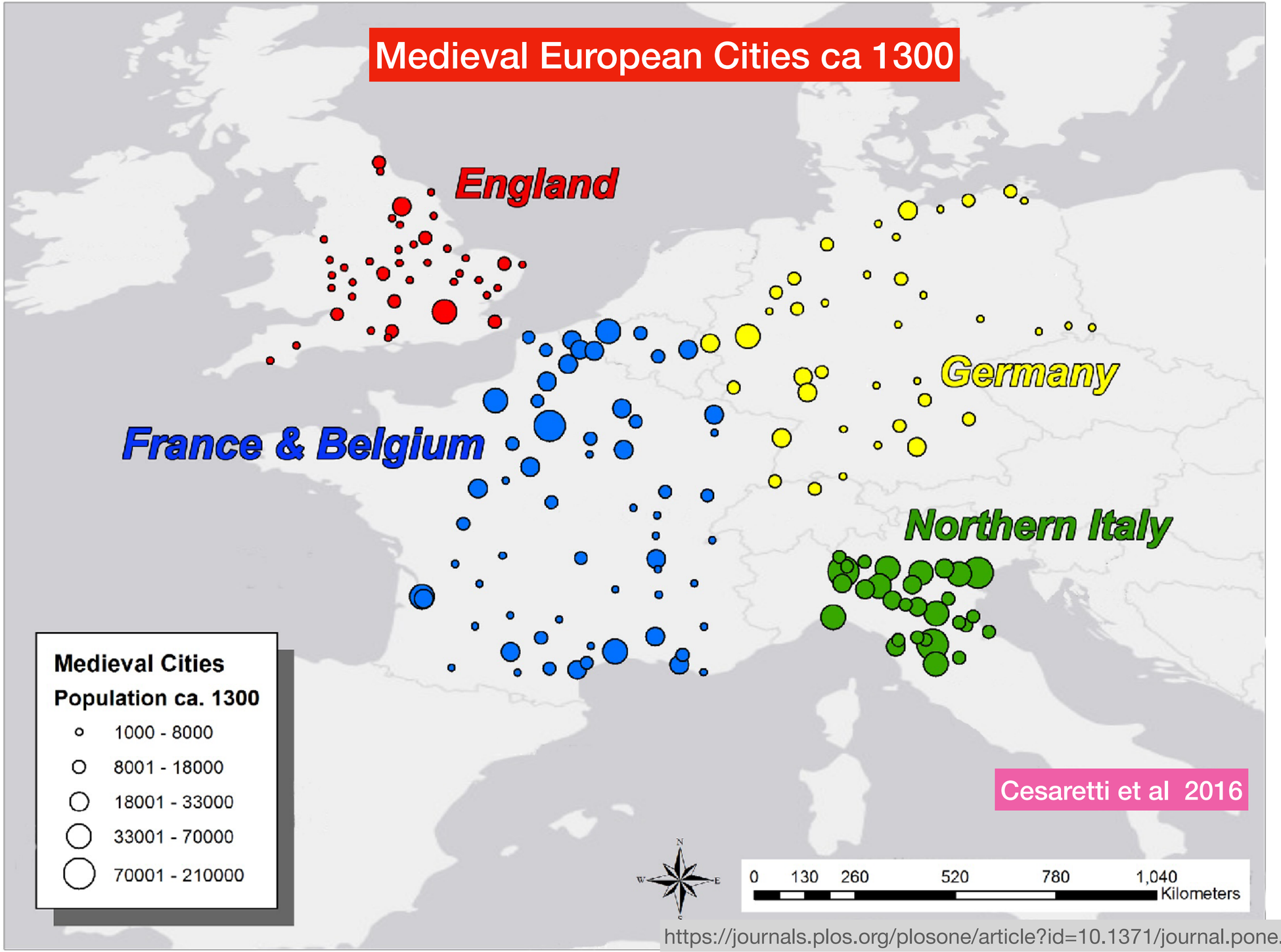
Approximately Lognormal “Wealth” Distribution



Histograms of domestic-mound areas. (**A**) Distribution of log-transformed domestic mound areas across all sites. (**B**) Distribution of residuals from OLS regression of log [settlement population] versus log [mean house area]. Note that both distributions are approximately normal [Kolmogorov-Smirnov (Lilliefors) test results are $P < 0.001$ for (A) and $P = 0.2$ for (B)].

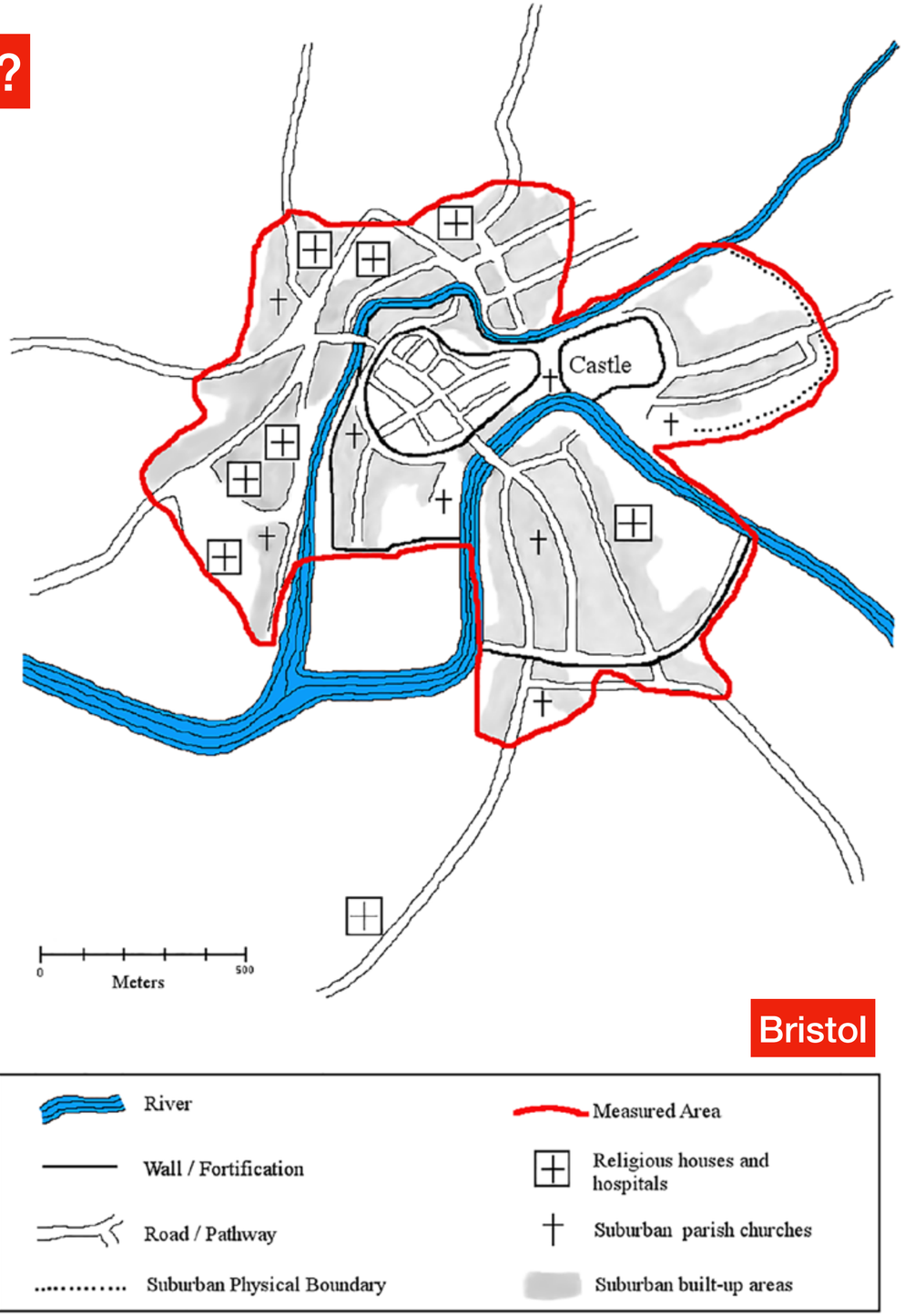
So Basin of Mexico City show scaling relations similar to modern cities, but with appropriate quantities

https://www.science.org/doi/10.1126/sciadv.1400066



https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0162678

How to measure urban area?



Bristol

Cesaretti et al 2016

Spatial Densification

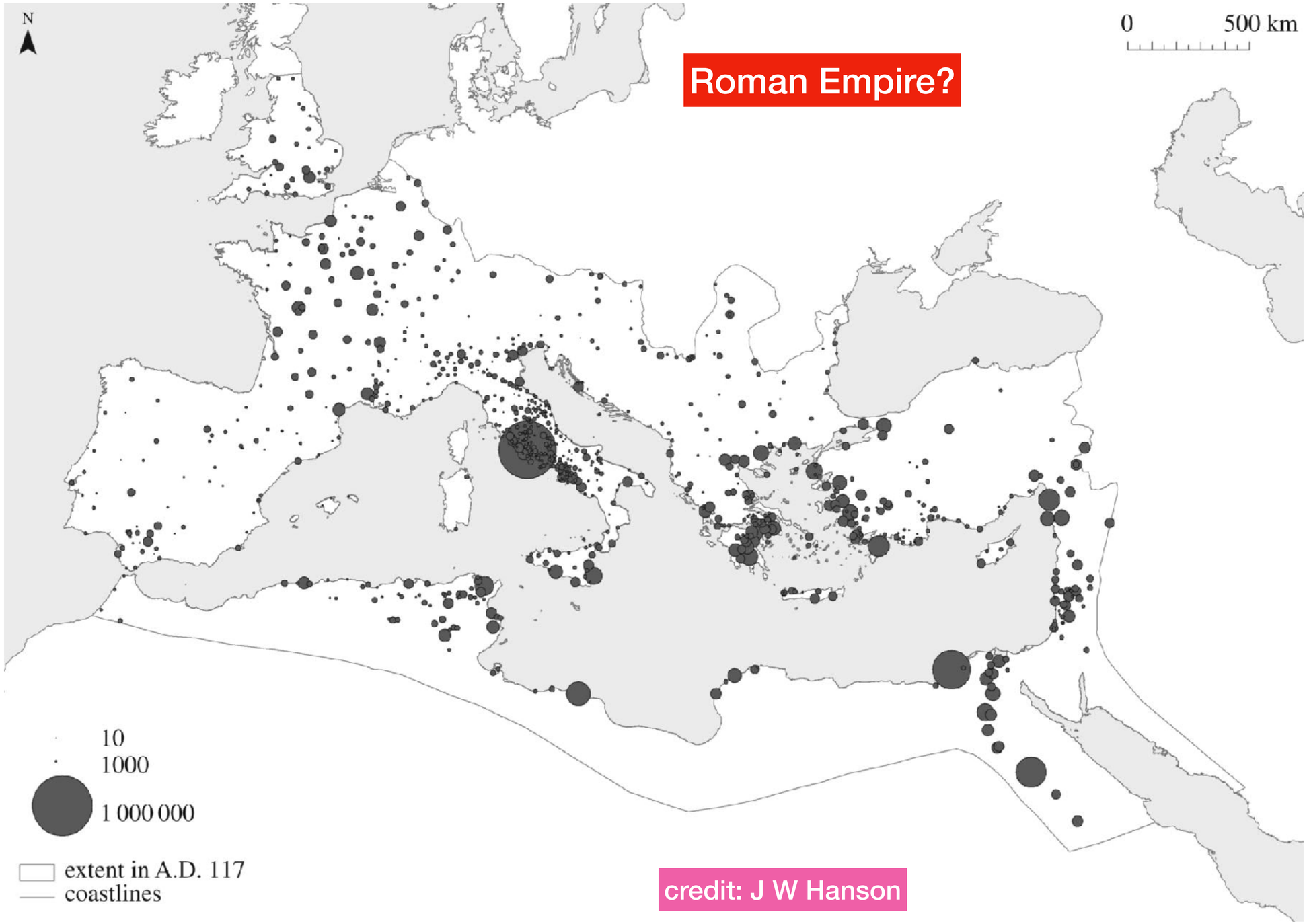
Model	*N*	*adj-R^2*	*α (S.E.)*	*α C.I.*	*B (S.E.)*	*β C.I.*
France & Belgium	63	0.84	-2.942 (0.334)	[-4.045, -1.839]	0.790 (0.035)	[0.665, 0.914]
England	40	0.79	-2.124 (0.551)	[-3.240, -1.008]	0.730 (0.062)	[0.604, 0.856]
Germany	40	0.77	-2.422 (0.623)	[-3.681, -1.163]	0.754 (0.068)	[0.616, 0.891]
N. Italy	30	0.71	-2.23 (0.764)	[-3.795, -0.664]	0.720 (0.075)	[0.566, 0.874]
All Cities	173	0.81	-2.125 (0.248)	[-2.615, -1.635]	0.714 (0.026)	[0.662, 0.766]

Notes: Estimations done using OLS with corrections made for heteroscedasticity. Standard errors are in parentheses, and confidence intervals are in brackets (all scaling coefficients are sig. at the .05 level). See text for details.

doi:10.1371/journal.pone.0162678.t001

Cesaretti et al 2016

https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0162678



http://www.archaeopress.com/ArchaeopressShop/Public/displayProductDetail.asp?id=%7B20D434EB-311A-4576-9571-EC9498B08665%7D

A systematic method for estimating the populations of Greek and Roman settlements

J. W. Hanson and S. G. Ortman

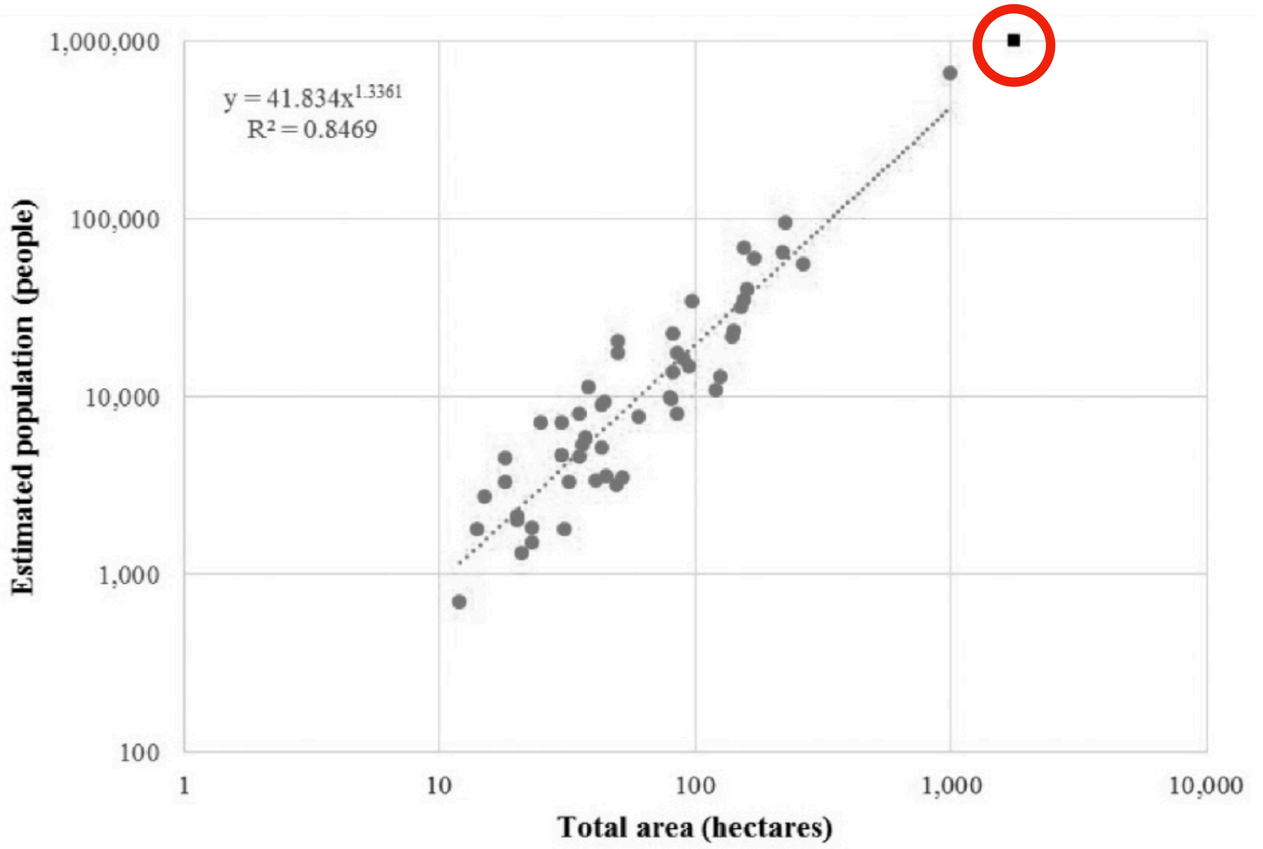


Fig. 3. Log-log graph showing relationship between the settled area (in ha) and estimated populations of various settlements; the black square represents commonly-cited estimates for the settled area and population of Rome.

Hanson, Ortman 2017

https://www.cambridge.org/core/journals/journal-of-roman-archaeology/article/systematic-method-for-estimating-the-populations-of-greek-and-roman-settlements/32413192CB46847949394D750342B5D4

Table 1. The relationships between population and various measures of urban form in cities in the Roman Empire.

Dependent variable	Number of cases	Exponent (95% C.I.)	Pre-factor (95% C.I.)	R^2	Significance
Inhabited area (ha)*	53	0.65 (0.59–0.72)	0.15 (0.08–0.27)	0.88	<0.0001
Forum/agora area (m^2)	80	0.67 (0.57–0.77)	9.15 (3.59–23.28)	0.68	<0.0001
Street area (m^2)	80	0.67 (0.59–0.75)	158.63 (74.67–336.99)	0.77	<0.0001
Street length (m)	80	0.52 (0.45–0.59)	77.02 (39.90–148.67)	0.72	<0.0001
Street width (m)	80	0.16 (0.09–0.24)	2.03 (1.04–3.94)	0.20	<0.0001
Block area (m^2)	80	0.47 (0.32–0.61)	180.55 (46.92–694.73)	0.33	<0.0001

* Results from Hanson & Ortman (2017: tab. 5).

consistent with $\delta = 1/3$

https://www.cambridge.org/core/services/aop-cambridge-core/content/view/0A1433E14B6469E08B2B027B7C54ED6B/S0003598X18001928a.pdf/urban-form-infrastructure-and-spatial-organisation-in-the-roman-empire.pdf

college of carpenters

Urbanism and the division of labour in the Roman Empire

J. W. Hanson, S. G. Ortman, J. Lobo

Published 15 November 2017. DOI: 10.1098/rsif.2017.0367

Table 2.

Analysis results.

dependent variable	inscriptions	associations	associations/inscriptions	$D(N)$
intercept	−0.341	−2.147	−1.807	−1.821
β	0.643 (0.092)	0.328 (0.048)	−0.314 (0.087)	0.657 (0.077)
95% CI	[0.461, 0.825]	[0.233, 0.424]	[−0.486, −0.141]	[0.614, 0.797]
R^2	0.58	0.35	0.59	0.66
N	210	210	210	210

sublinear

https://royalsocietypublishing.org/doi/10.1098/rsif.2017.0367

Table 1. Empirical support for settlement scaling theory from archaeological and historical sources. In all cases the independent variable is settlement population.

Case	Dependent Variable	N	Exponent (95% C.I.)	r^2	P	Source
Ancestral Pueblo villages, southwest Colorado, USA (1060 - 1280 CE)	Settled area (ha)	278	$\alpha = .662$ (.513-.812)	.216	<.000	1
Ancestral Pueblo villages, southwest Colorado, USA (1060 - 1280 CE)	Total house area (m^2)	130	$1 + \delta = 1.167$ (1.044-1.289)	.735	<.000	1
Ancestral Mandan/Hidatsa villages, North Dakota, USA (1200 - 1886 CE)	Settled Area (ha)	35	$\alpha = .643$ (.483-.802)	.654	<.000	1
Ancestral Mandan/Hidatsa villages, North Dakota, USA (1200 - 1886 CE)	Mean house area (m^2)	17	$\delta = .163$ (.038-.287)	.305	.022	1
Farming/administrative settlements, central Andes, Peru (1000 - 1532 CE)	Settled area (ha)	57	$\alpha = .696$ (*SE*=.065)	.679	<.000	2
Herding settlements, central Andes, Peru (1000 - 1532 CE)	Settled area (ha)	39	$\alpha = .655$ (*SE*=.158)	.318	<.000	2
Wanka settlements, central Andes, Peru (1000 - 1532 CE)	Domestic structure size (m^2)	91	$\delta = .139$ (*SE*=.037)	.135	<.000	2
"Amorphous" settlements (pop.≤5000), Basin of Mexico (1150 BCE - 1520 CE)	Settled area (ha)	1510	$\alpha = .671$ (.651-.691)	.741	<.000	3
"Networked" settlements (pop.>5000), Basin of Mexico (1150 BCE - 1520 CE)	Built area (ha)	22	$\alpha = .853$ (.598-1.109)	.709	<.000	3
Pre-Hispanic settlements, Basin of Mexico (1150 BCE - 1520 CE)	Civic mound volume (m^3/yr)	48	$1 + \delta = 1.177$ (1.028-1.327)	.852	<.000	3
Pre-Hispanic settlements, Basin of Mexico (1150 BCE - 1520 CE)	Mean domestic mound area (m^2)	80	$\delta = .190$ (.083-.298)	.863	<.000	3
Medieval European cities and towns (1300 CE)	Settled area (ha)	173	$\alpha = .714$ (*SE*=.026)	.810	<.000	4
Ancient Greek and Roman Cities (100 BCE - 300 CE)	Settled area (ha)	53	$\alpha = .654$ (.587-.721)	.877	<.000	5
Imperial Roman Cities (100 BCE - 300 CE)	Association diversity	210	$1 - \delta = .657$ (.614-.797)	.66	<.000	6
Northwest Coast villages, Alaska and British Columbia (19th century CE)	Settled area (ha)	50	$\alpha = .741$ (*SE*–.101)	.41	<.000	7

NR = Not reported; *SE* = Standard Error (when a confidence interval is not reported).

Ortman et al 2019

https://journals.sagepub.com/doi/10.1177/0042098019873796

Economic growth in Roman Britain

SCIENCE ADVANCES | RESEARCH ARTICLE

ANTHROPOLOGY

Identification and measurement of intensive economic growth in a Roman imperial province

Scott G. Ortman[1,2,3]*, José Lobo[4], Lisa Lodwick[5]†, Rob Wiseman[6], Olivia Bulik[1], Victoria Harbison[2], Luís M. A. Bettencourt[3,7]

A key question in economic history is the degree to which preindustrial economies could generate sustained increases in per capita productivity. Previous studies suggest that, in many preindustrial contexts, growth was primarily a consequence of agglomeration. Here, we examine evidence for three different socioeconomic rates that are available from the archaeological record for Roman Britain. We find that all three measures show increasing returns to scale with settlement population, with a common elasticity that is consistent with the expectation from settlement scaling theory. We also identify a pattern of increase in baseline rates, similar to that observed in contemporary societies, suggesting that this economy did generate modest levels of per capita productivity growth over a four-century period. Last, we suggest that the observed growth is attributable to changes in transportation costs and to institutions and technologies related to socioeconomic interchange. These findings reinforce the view that differences between ancient and contemporary economies are more a matter of degree than kind.

Economic growth is not a model invention

https://www.science.org/doi/epdf/10.1126/sciadv.adk5517

Cities in History

Evidence for consistent urban scaling throughout history, culture and geography for

Densification of Settlements :
Amorphous and Networked

Increasing Returns in Socioeconomic Productivity

Division of Labor and Knowledge

Urban Systems

Political and Technological “Sophistication”

Episodic economic growth

This allows us to establish a science of cities throughout history and read the past in terms of socioeconomic processes

credit:Gabriel Garcia