Col·lecció INSTRUMENTA 65

PAISAJES PRODUCTIVOS Y REDES COMERCIALES EN EL IMPERIO ROMANO

PRODUCTIVE LANDSCAPES AND TRADE NETWORKS IN THE ROMAN EMPIRE

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UNIVERSITAT DE BARCELONA
Edicions

Universidad de Barcelona. Datos catalográficos

Paisajes productivos y redes comerciales en el Imperio Romano = Productive landscapes and trade networks in the Roman Empire. – (Col·lecció Instrumenta ; 65)

Inclou referències bibliogràfiques
ISBN 978-84-9168-263-9

I. Remesal Rodríguez, José, editor literari II. Revilla Calvo, Víctor, editor literari III. Martín-Arroyo Sánchez, Daniel J., editor literari. IV. Martín i Oliveras, Antoni, editor literari V. Títol paral·lel: Productive landscapes and trade networks in the Roman Empire VI. Col·lecció: Instrumenta (Universitat de Barcelona) ; 65
1. Imperi Romà, 30 aC-476 dC 2. Medi rural 3. Productes agrícoles 4. Comerç d'aliments 5. Distribució comercial 6. Ceràmica romana 7. Història econòmica 8. Història antiga

Adolf Florensa, s/n
08028 Barcelona
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www.publicacions.ub.edu

1.ª edición: Barcelona, 2019

Director de la colección: José Remesal
Secretario de la colección: Antonio Aguilera

CEIPAC
http://ceipac.ub.edu

Sello de Calidad en Edición Académica. Promovido por la Unión de Editoriales Universitarias Españolas (UNE) y avalado por la Agencia Nacional de Evaluación de la Calidad y Acreditación (ANECA) y la Fundación Española para la Ciencia y la Tecnología (FECYT).

Unión Europea: *ERC grant agreement nº ERC-ADG340828*. ARIADNE plus is funded by the European Commission under the H2020 Programme, contract no. H2020-INFRAIA-2018-1-823914.

Gobierno de España: DGICYT: PB89-244; PB96-218; APC 1998-119; APC 1999-0033; APC 1999-034; BHA 2000-0731; PGC 2000-2409-E; BHA 2001-5046E; BHA2002-11006E; HUM2004-01662/HIST; HUM200421129E; HUM2005-23853E; HUM2006-27988E; HP2005-0016; HUM2007-30842-E/HIST; HAR2008-00210; HAR2011-24593; HAR2015-66771-P (MINECO/FEDER, UE); HAR2017-85635-P (MINECO/FEDER, UE).
MAEX: AECI29/04/P/E; AECI.A/2589/05; AECI.A/4772/06; AECI.A/01437/07; AECI.A/017285/08.

Generalitat de Catalunya: *Grup de Recerca de Qualitat*: SGR 95/200; SGR 99/00426; 2001 SGR 00010; 2005 SGR 01010; 2009 SGR 480; 2014 SGR 218; 2017 SGR 512; ACES 98-22/3; ACES 99/00006; 2002ACES 00092; 2006-EXCAV0006; 2006ACD 00069.

Calidad en Edición Académica
Academic Publishing Quality

European Research Council

The research leading to these results has received funding from the European Research Council under the European Union's Seventh Framework Programme (FP7/2007-2013). ERC grant agreement nº ERC-2013-ADG340828.

Gobierno de España
Ministerio de Ciencia e Innovación

Montaje: Ariane Capdevila Sanz y Mateo González Vázquez.

Imagen de la cubierta: Mosaico de los trabajos del campo (detalle). Museo de Cherchell, Argelia.

Impresión: Gráficas Rey

Depósito legal: B-14.915-2019

ISBN: 978-84-9168-263-9

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Prólogo

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Este volumen recoge las contribuciones y discusiones tenidas durante la celebración de la sección: *The production and distribution of food in the Roman Empire: modelling political, economic and social dynamics,* (27ª reunión del *TRAC* en Durham, 28-31 marzo 2017).

Pretendíamos, desde la perspectiva del proyecto EPNet (*Production and Distribution of Food during the Roman Empire: Economic and Political Dynamics*) discutir algunos aspectos de la economía romana, partiendo no sólo de los métodos analíticos tradicionales, sino desde la aplicación de métodos formales, que nos permitan discutir, desde nuevas perspectivas, las visiones económicas sobre el Imperio Romano.

Hemos partido, más que de una discusión general y teórica sobre la economía romana, de un análisis de casos concretos, que permiten entrever la complejidad de la economía imperial romana. De lo particular podremos ir abstrayendo precisiones de carácter más general que nos ayuden a comprender el sistema en su globalidad.

El Imperio Romano abarcó un amplísimo espacio con culturas y sistemas económicos diversos, pero que, como cualquier imperio, instituyó mecanismos, que le permitieran beneficiarse de los recursos del territorio conquistado. Podemos pensar en la producción de productos destinados al autoconsumo o a satisfacer las necesidades de un área reducida. Podemos analizar productos creados en una región concreta, como las diversos tipos de vajilla de mesa, destinados, sin embargo, a un amplio mercado, que exigen una amplia red de transporte y comercialización. Podemos analizar los recursos mineros, que no sólo exigen una amplia red de transporte y comercialización sino también de elaboración en las cuencas mineras y de transformación en los lugares donde llegasen dichos productos en forma de lingotes.

En nuestro caso, hemos prestado más atención a la producción y comercio de productos alimentarios. Asegurar su propio mantenimiento es el primer intento de cualquier sociedad. Bien lo recuerda Aristóteles, quien afirma que la primera cuestión que se discutía en las reuniones de las pritanías atenienses era si había grano o no en la ciudad. Si había grano, se podían discutir otras cuestiones.

Cuando estudiamos este problema, si hablamos de una sociedad compleja, como la de cualquier imperio, se nos abre la necesidad de abordar el tema desde muy diversas perspectivas: en primer lugar, los estudios dedicados a comprender los problemas relacionados con la organización de la propiedad de la tierra, que a su vez puede ser abordado desde el punto de vista del conquistador y de las relaciones que cada territorio conquistado establece con el poder central y de qué modo cada uno de los territorios responden a esa nueva situación. Sobre el problema de la propiedad de la tierra, se impone la cuestión de los modos de explotación, que son los que determinan el mayor o menor desarrollo de una región. Las formas de explotación en el mundo romano pasan por la discusión sobre una explotación de carácter esclavista, por formas más mitigadas, como el colonato, o la existencia de pequeños y medianos propietarios o de un gran grupo de trabajadores por cuenta ajena.

La dieta mediterránea, como bien sabemos, tiene tres productos básicos, trigo, vino y aceite. El primero se comercializaba en sacos, razón por la que se conservan pocos testimonios materiales de su comercio. En cambio, del vino y del aceite, que son productor elaborados a partir de la uva y la aceituna y se transportaron en ánforas, se han conservado muchos más testimonios arqueológicos. Otros muchos productos, entre los que destacan las conservas de pescado también se transportaron en ánforas. Pero en la comercialización de estos productos no sólo interviene la capacidad de producir, sino de transportar, en función de los limitados medios de transporte en la antigüedad, sólo las regiones que tuvieron a su alcance la posibilidad de un transporte marítimo-fluvial pudieron exportar los excedentes de sus productos y en consecuencia tener interés por producirlos. Sin duda, la gran distribución de productos vinculados a las conservas de pescado es una buena muestra de cuanto decimos.

La visión tradicional sobre la economía romana, siguiendo la frase del fisiócrata francés del siglo XVIII, Vincent de Gournay, era la de *Laissez faire et laissez passer, le monde va de lui même*. El estado romano no intervino en el desarrollo de la política económica del imperio. Se defendía que el Emperador sólo había intervenido en el acaparamiento del trigo de Egipto, para satisfacer las necesidades de las *frumentationes* en Roma.

La investigación desarrollada desde el grupo CEIPAC ha puesto de manifiesto, que el emperador debía asegurar no sólo la llegada de grano a Roma, sino conseguir la paz social asegurando el abastecimiento general de cualquier producto, para ahuyentar el fantasma del hambre en la capital del Imperio, Roma. Por otra parte, hemos puesto de manifiesto cómo el emperador estaba también obligado a asegurar el abastecimiento del Ejército. Todo ello obligó al estado romano a intervenir directamente en multitud de aspectos económicos.

El estado romano no monopolizo los medios de transporte, que dejó en manos de privados. La necesidad del Estado de acarrear productos, fuese a Roma o a los campamentos militares o a los teatros de operaciones militares, favoreció el desarrollo de un comercio a larga distancia que, sin el estímulo de las necesidades estatales, se hubiese visto muy limitado.

La investigación actual exige estudiar las características de la producción de cada uno de los productos y sus sistemas de comercialización. Al mismo tiempo estudiar qué papel jugó cada una de las provincias del Imperio Romano, como se relacionaron estas entre sí y con el poder central y de qué modo pudieron influir, a través de sus agentes, en el desarrollo general de la política económica de Roma.

Monte Testaccio. Un archivo único[1]

José Remesal Rodríguez

El monte Testaccio se encuentra situado en la zona logística de la antigua Roma, cerca de los *horrea Galbana* y *Seiana*[2]. (Fig. 1). En la actualidad tiene un perímetro próximo a un kilómetro y una altura próxima a 50 mts. (Fig. 2). Tiene la peculiaridad de que está compuesto, exclusivamente, por los restos de millones de ánforas, con la particularidad de que más del 80% corresponden a un solo tipo anfórico, conocido como tipo Dressel 20 (Fig. 3), que, como ya señaló Dressel, proceden de la provincia romana de la Bética y que, como sabemos, contuvieron aceite de oliva[3]. El resto de las ánforas allí conservadas proceden, en su mayoría de las provincias romanas de Tripolitania y el África proconsular. En muy escasa proporción proceden de las regiones orientales del Mediterráneo (+- 1%). También estas ánforas contuvieron aceite de oliva.

Las ánforas romanas fueron selladas, con mayor o menor frecuencia, antes de la cocción del vaso. Estos "sellos", tan duraderos como la misma cerámica, son muy frecuentes en las ánforas Dressel 20, gracias a los cuales hemos podido constatar su amplia distribución por todo el occidente romano y, en menor medida, también en la parte oriental del imperio. Si no todas las ánforas se sellaron[4], si necesitaron de una "etiqueta" (*titulus pictus*) que informase del producto contenido, del nombre del comerciante que las transportaba y de algunas anotaciones de control aduanero y fiscal. Los *tituli picti*, escritos con tinta negra o roja, han desaparecido en la mayoría de los casos. En el Testaccio se han conservado abundantemente.

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[1] Esta investigación se integra en el proyecto: *Production and Distribution of Food during the Roman Empire: Economic and political Dynamics*. Financiado por la UE (FP7/2007-2013) ERC grant agreement mº ERC-2013-ADG340828 y en el proyecto HAR2017-85635-P.

[2] RODRÍGUEZ ALMEIDA, E. 1984. AGUILERA MARTÍN, A. 2002.

[3] DRESSEL, H. 1878.

[4] REMESAL RODRIGUEZ, J. 2016. Con el estado actual de la discusión y la bibliografía.

Figura 1. La llanura subaventina. Imagen extraída de: Aguilera, A. El monte Testaccio y la llanura subaventina. Topografía extra portam Trigeminam. Roma 2002, fig.7.

Figura 2. Vista aérea del Monte Testaccio hoy día. Imagen extraída de: Ramieri, A.M. "Roma e il Testaccio tra storia, costume e tutela" en Blázquez Martínez, J.M., Remesal Rodríguez, J. (Eds.) Estudios sobre el Monte Testaccio (Roma) IV. Instrumenta 24. Barcelona 2007, p.382, Fig. 1.

Moving food supplies to the Roman garrison of the Dobrogea

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This paper aims to illustrate a method of modelling the transport requirements necessary to move grain to feed the Roman army. The study region is the Dobrogea, that part of the Roman province of Lower Moesia where the Danube turns north and then east to complete its journey to the sea. This is a compact area where settlement activity is thought to have been encouraged in antiquity to provide food to feed the army.[1] The size of the garrison is reasonably well understood and quantifiable, and so therefore are their food requirements – the grain element of which can be represented as a quantity of arable land. For Romania there is a national database of archaeological sites – cIMeC – which is openly available, so that a survey of Roman period sites can be made starting from a single resource. This allows one to suggest an agricultural potential for the region in antiquity. With a quantifiable need and a quantifiable suggested solution it is possible to calculate how many vehicles of different types would have been required to move this arable produce. The road network of the region is also well understood and known to be extensive. As a result the routes by which a particular quantity of arable produce may have travelled to the garrison were many and various, and the possible permutations of transport solutions countless. However, by the use of the Service Area function within ArcGIS it is possible to arrive at suggestions of the most effective routes by which a particular fort was supplied. When moving any commodity by wagon or pack animal, some part of the cargo space must be given over to feed-barley for the animals. This reduces the effective cargo capacity of the vehicle by an increasing amount for every day travelled. If dealing with a finite local arable potential, the need for feed-barley also denudes the quantity of arable available to provide food for the garrison. By calculating the additional arable penalties that different transport methods brought with

[1] POULTER 1980: 729-744

them it is possible to measure the relative merits of slower oxen-drawn vehicles requiring less feed-barley, against faster mule-drawn vehicles requiring more feed-barley. The models proposed ought to show efficient methods which, although calculated with a computer tool, ought to reflect those used in antiquity, assuming that the Roman garrison and their suppliers strove for some level of efficiency.

The Roman garrison for the Dobrogea was derived from *diplomata*, to comprise nominally 12,827 men and 1738 horse.[2] The military ration was derived from Polybius who gives a daily bread-wheat ration for troops of two-thirds of an attic *medimnus*, a month. It is thought that Polybius was using a Greek equivalence to a Roman measure of two *sextarii* a day, which depending on the specific density of the grain is equivalent to 0.809kg of bread-wheat.[3] Polybius' figures for cavalry barley are not so straightforward; he reports a monthly ration of seven Attic *medimni* for a legionary cavalryman and five Attic *medimni* for an auxiliary cavalryman. These are quite significant quantities 235-168kg a month and it is thought that they were sufficient for remounts and/or, a pack animal. Dividing the legionary figure by three and the auxiliary figure by two, a single animal more probably consumed 2.5kg of feed-barley a day; a figure which is broadly corroborated by both an Egyptian papyrus and a writing tablet from Carlisle.[4] Mules employed as draft or pack animals needed less feed-barley than horses, a figure of 2kg a day was used. Green fodder, hay or other fodder crops, or simple pasture would have also been required. For simplicity of argument it is assumed that animals grazed pasture daily from the fields and these needs are not included in my calculations.[5] Oxen require far less feed-barley than green fodder, indeed if not working hard they can survive by just grazing, but I assumed they consumed 2.25kg of feed-barley a day. The military would have had civilian service providers attendant on them. Their number is difficult to be gauge: if they made up 20% of the general population for the region, which is in itself derived from a very broad brush estimate of 8 persons per km^2, then that would equal 13,920 service providers. I further assume they ate 70% as much bread-wheat as the soldiers. All of these numbers can be questioned; but what they do is allow me to suggest an annual arable need associated with the army of nominally 21,326ha. The farm workers that produced this food would have also needed to feed themselves, but because they would have eaten at source, for the purpose of the transport calculations their needs are excluded.

Against this need I have previously considered the study area to arrive at a quantified arable product in the region.[6] This was done with reference to the Romanian national database of sites – cIMeC – which aims to record every known archaeological site in the region. This has to be treated with caution, the criteria by which a site is added, and in particular the scale or status of that site is not always apparent, additionally the dating, whether a site was Roman or later Roman is often open to interpretation. Nevertheless it was used as a baseline against published works, especially Bărbulescu's archaeological survey of the region and Suceveanu's work.[7] One can quibble about the classification of particular sites, the scale of arable associated with these sites, the agricultural regimes employed, whether land was fallowed or crop-rotation practised and the potential crop yields; but, ultimately some arable potential is evident in the landscape. In large part this appears to have been provided by 46 *vici* in the region that were established with the arrival of the garrison.[8] I have

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[2] RMD 399 (= RMD 165) AD 145, ROXAN 1994: 286-7; HOLDER 2006: 813 , RMD 50 AD 157, ROXAN 1978: 72-3

[3] Polybius 6.39; Pliny *NH* 18.66 for a specific density of Chersonesus bread wheat of 75kg/hl; FOXHALL & FORBES 1982: 62; ROTH 1999: 18-19

[4] *P Amh*. 2.107; *Tab. Luguval.* 1; TOMLIN 1998: 45, 48-49; ADAMS 1999: 120-121; ROTH 1999: 63-6 4; *cf* ENGELS 1980: 18, 126 who suggests 5.5kg a day

[5] GOLDSWORTHY 1996: 295; ROTH 1999: 61-67

[6] MATTHEWS 2015: 839-844

[7] SUCEVEANU 1991; BĂRBULESCU 2001

[8] POULTER 1980: 729-744

The Economy of Roman wine: A proposal for analyse an intensive wine production system and trade. Case Study Research: *Regio Laeetana (Hispania Citerior Tarraconensis)* from 1st century BC to 3rd century AD

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"Hispaniarum Laeetana copia nobilitantur,
elegantia vero Tarraconensia atque
Lauronensia et Baliarica ex insulis
conferuntur Italiae primis".
Caius Plinius Secundus, *Naturalis Historia* XIV, 71[2]

Introduction

Ancient Roman viticulture has multiple fields of knowledge and expertise with enormous possibilities for research. Most studies dedicated to the development of viticulture in antiquity, have

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[2] "Among the Hispanian (wines), the Laietanian (wine) is famous for its large productivity; beside the Tarraconensian (wine), the Lauronensian (wine) and the Balearian (wine) from the islands, (these ones) gather a certain elegance comparable to the best Italian (wines)" (Author's translation).

in common the use of the archaeological information and the written sources as a complementary support to confirm the absolute chronology of a settlement, a socio-economic phenomenon or an exact location of a winegrowing production or a pottery activity in a specific territory[3].

The intensive viticulture practised during the Roman period in the ancient Laetanian region situated in the centre of Catalan Coastal Depression was a widespread phenomenon with huge economic implications which represented a cultural revolution for this territory in all areas and at all orders. This research project builds on a previous work where was established the theoretical and epistemological framework of study of the different variables, factors and endogenous and exogenous agents involved in every stage of the production, distribution, trade and consumption of wine in the Roman period between the 1st century BC and 3rd century AD[4].

A further study must be focused on a geospatial and geoeconomic analysis, which supposes the identification of the settlement patterns, the organization of the rural habitat, the forms of production and management related to the crops capacities to obtain optimal yields for generating surpluses in a context of a growing population. The utilization of quantitative methods such as mathematics, statistics and linear programming models allows us to interpret and make predictions, regressions, and reconstructions about the evolution of the wine economy, understood as a situation that includes all the aspects needed to produce wines of various qualities, along with a group of complementary activities related to the production, elaboration, distribution, trade and consumption.

Epistemological & methodological issues

This research is developed from the application of the assumptions defended by the *scientific realism* or *ratio-empiricism* theoretical current and also by the application of the experimental and hypothetical-deductive method.

From a *conceptual* point of view we distinguish three levels of knowledge:

- *Study in-depth of written sources -primaries and secondary's- and also the ancient iconography*. Latin agronomist like Cato, Varro, Columella, Palladio and Pliny the Elder described issues related to the production systems and trade as agrarian techniques, vine-growing procedures, and winemaking processes. Other authors like Martial, Ovid, Horace, Juvenal and Virgil, inform us about symbolic aspects, tastes and preferences in wine consumption during the Roman period. Iconographic representations in different supports like sculpture, painting, gravure and so on, shows technological elements fixtures and tools, some of the perishable nature.
- *Study of the archaeological evidence and ethnographic parallels analysis*. It supposes the seeking of parallels in other similarly archaeological sites, near or far, with the same issues and chronologies. Ethnographic data from modern and contemporary periods can provide different models and techno functional solutions that could be applied in our interpretations.
- *Experimental Archaeology*. It consists in the rigorous reproduction of winegrowing and winemaking ancient production procedures and trade processes applying the ancient techniques and technological resources to check or refute our working hypotheses.

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[3] REVILLA (1998), p. 185.
[4] MARTÍN i OLIVERAS (2015b).

From a *territorial* point of view we distinguish six types of studies:

- *Paleoenvironmental analysis*: Provide important information that enables us to make inferences related to the landscape transformation, whether natural or anthropic and its evolution over time. It includes different "data proxy" markers from inter alia: Sedimentological, palynological, carpological, anthracological analysis, etc.
- *Geospatial analysis*: Serves for modelling the settlement patterns related to the landowners, the *fundus* extension and the characterization of different typologies of production centres and workshops related to winemaking or pottery production: *villae* system, big or little specialized farms with *torcularia* and/or *cellae vinariae*, *figlinae*, etc., and its evolution over time[5]. A combination of tools will be used to implement them: Geographic Information Systems (GIS), relational databases and statistical analysis programs.
- *Archaeomorphological analysis*: For modelling agricultural uses of territory from a diachronic point of view as regards the geomorphological structure of the fields and land distribution evolution: *ager divisus et asignatus* (*cadastro et centuriato*), *ager per extremitatem mensura comprehensus* and *ager arcifinalis*, the types of terrain and soils and the configuration of the vineyards by different cultivation techniques and propagation systems, driving and pruning the grapevines, etc.
- *Technofunctional analysis:* Both for the installations (building organization), for the production structures (kilns, collecting and storage tanks, tools and enamelware, etc.) and also for the technological innovation in machinery, processes, and procedures: kiln types, wine presses, winemaking techniques, etc., in each settlement "type".
- *Geoeconomic analysis:* To calculate efficiency, profitability and scales of productivity in absolute terms of the maximum productive capacity of the properties as a whole, both for the vineyards (*Crop Simulation Models*-CRM) and for the processing and storage installations (productivity *yields*). These geoeconomic studies can be also analysed at different levels and territorial scales: macroeconomics (*regio*), mesoeconomics (*territorium*) and microeconomics (*torcularium atque figlina*).
- *Demographic analysis*: To calculate the fluctuations of population and to analyse its role as labour force in the agrarian economic system over time, either due to a good economic performance or either due to an economic and social crisis that could be motivated by multiple factors as migrations, plagues, diseases, war etc., that means population increases or decreases.

Written sources quotations

Hispanian wines are occasionally mentioned in the literature between the mid-1st century BC and the mid-2nd century AD, despite including Greeks and Romans writers from a wide range of social and cultural backgrounds, members of the elite or individuals of more humble origins, both from Italy and from the provinces and some in direct connection with the emperors themselves as in the case of

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[5] Frontinus in *De agrorum qualitate, Praef.*1.2.3.; divides lands into three heads or *qualitates*: *Ager divisus et assignatus*; *ager mensura comprehensus* and *ager arcifinius*. *Ager divisus et assignatus* was public land that was assigned or granted to private persons by *centuriato et catastro*. The *ager mensura comprehensus* appears to signify a tract, of which the limits were defined by measurement, which was given in the mass to some community: '*cujus modus universus civitati est assignatus*'. The *ager arcifinius* appears to express the whole of a territory, which had only some natural or arbitrary boundary, and was not defined by measurement: '*qui nulla mensura continetur*'. See: http://www.thelatinlibrary.com/frontinus.html. Also see: SMITH (1875): *AGER*, in *Lacus Curtius*: http:// penelope.uchicago.edu/Thayer/E/Roman/Texts/secondary/SMIGRA*/Ager.html; CASTILLO (2011), p. 83-110.

GIS-based Modelling for the *Riparia*/*Vinea* Ratio: from *Portus Gaditanus* to *Nabrissa Veneria*[1]

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1. Introduction

Models are idealized representations of our assumptions. Here we deal with a Roman agrarian context in a specific delineated geographical area. However, the re-creation of rural settlement is secondary to the analysis of an agrarian formula, which is our principal goal. Focus on this modelling enables us to study the possibilities of the implantation of a Roman vine training system (the *uinea iugata*), dealing with the ideal self-sufficiency and the limitations in a simulated historical context. The starting point is a ratio given by *Columella* in order to supply osier-willow and reeds for the *iuga* in the vineyards, as bindings and cross-rails (Col. 4, 30, 2.). Other training systems could be adopted as well as other species, but advantages in productivity and the suitability of raw materials were related to this ratio. The main motivation would come from the viticulture itself as a lucrative activity.

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[1] We are grateful to Nick Bennett-Britton for the English revision.
[2] EPNet (Production and Distribution of Food during the Roman Empire: Economics and Political Dynamics) (FP7/2007-2013)/ERC *grant agreement* nº 340828. http://www.roman-ep.net. The CEIPAC's research lines are supported too by the Project HAR2015-66771-P (MINECO/FEDER. UE).
[3] RIPARIA 2 La interacción histórica sociedad-medio ambiente: humedales y espacios lacustres de la Bética romana. MINECO. Programa Estatal de Fomento de la Investigación Científica y Técnica de Excelencia (HAR2016-77724-P).

La localización de los viñedos de Marco Columela: literatura agronómica y análisis GIS en el interfluvio Guadalquivir-Guadalete[1]

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Sobre la producción vinaria en el espacio de estudio y el conocimiento de la estructura del poblamiento rural. Indicadores de la producción vitivinícola

La historiografía asume la importancia de la vitivinicultura romana en las campiñas del interfluvio Guadalquivir-Guadalete aunque no se ha realizado aún una investigación territorial profunda sobre esta actividad agraria en la región. Los indicadores de la existencia de estos aprovechamientos se hallan tanto en las fuentes literarias como en las arqueológicas. Por ejemplo, en los espacios artesanales de tradición púnica del entorno gaditano se atestigua la producción, en los inicios del período romano republicano en *Hispania*, de ánforas que imitan las series vinarias greco-itálicas y las más antiguas variantes de la Dr. 1[2]. Ya en época tardo-republicana continúa la producción de estas imitaciones anfóricas en las series más tardías de la misma familia Dr. 1C y Dr. 1D, asociadas al envasado de productos vinificados, producidas tanto en las campiñas gaditanas como en las hastenses, y en el marco del modelo artesanal

[1] Esta contribución se ha desarrollado en el marco del proyecto *RIPARIA 2 La interacción histórica sociedad-medio ambiente: humedales y espacios lacustres de la Bética romana*. MINECO. Programa Estatal de Fomento de la Investigación Científica y Técnica de Excelencia (HAR2016-77724-P). lazaro.lagostena@uca.es .
[2] BUSTAMANTE, MARTÍN-ARROYO, 2004.

romano implantado con la municipalización cívica y la colonización territorial[3]. Al mismo tiempo se reconoce la producción local, especialmente asociada al *ager Hastensis,* de otros envases vinícolas, relacionados con la familia de las denominadas Haltern 70[4]. Hasta que no se caractericen mejor estas últimas producciones no estaremos en condiciones de incorporar con precisión a nuestras fuentes la información proporcionada por la epigrafía anfórica pintada, sellada o grafitada que se le asocia.

Respecto a los sistemas de plantación y a las estructuras edilicias relacionadas con la transformación vinícola en el agro hastense, carecemos por ahora de suficiente información sobre la *pars rustica* y la *pars fructuaria* de las potenciales *villae* del territorio dedicadas a estas actividades. Es una consecuencia de la escasez de intervenciones arqueológicas practicadas en los espacios productivos del ámbito rural en la provincia gaditana[5] y constituye actualmente una línea de estudio de gran interés para su desarrollo.

Entre la información transmitida por las fuentes literaria cabe destacar la alusión de Estrabón a las exportaciones vinarias turdetanas, dato que nos ubica en un escenario productivo relacionado con los derivados vinícolas de la región ya consolidado en tiempos augusteos, aunque la cita se refiere a un amplio territorio[6]. Sin embargo sigue siendo la obra de Columela y sus alusiones a las prácticas agrícolas de su tío Marco, como veremos luego, el mejor refrendo de la existencia y de la incidencia económica de la viticultura romana en este territorio.

Sobre el territorio de estudio

El espacio sobre el que centramos el estudio, actualmente el de mayor potencialidad vitícola de la provincia gaditana y parte del Marco Productivo del Jerez/Sherry, se ubica geográficamente entre las desembocaduras de los ríos Guadalquivir y Guadalete, y está limitado por la costa atlántica al Oeste (Figura 1). Constituye una fértil campiña que conoce una ocupación y explotación agraria sin solución de continuidad desde la Prehistoria Reciente[7]. Esta vinculación del espacio productivo con los grandes ríos de la región y la costa marítima constituyó en la Antigüedad un importante incentivo para el desarrollo de una agricultura orientada a la transformación de productos alimenticios, de gran interés en el comercio marítimo, como los derivados del fruto de la vid.

Desde el punto de vista del ordenamiento cívico, el territorio estuvo bajo la influencia jurisdiccional del municipio de *Gades* y de la colonia *Hasta Regia*, sin que hasta la fecha se haya propuesto una hipótesis de delimitación entre los *territoria* de ambas entidades.

Es un espacio bien comunicado tanto por la red de puertos marítimos y fluviales establecida entre *Gades* y *Hasta* como por el paso de la *via Augusta* que, desde la desembocadura del Guadalete y *portus Gaditanus*, se dirige hacia *Hasta Regia, iter* viario que hubo de constituir el principal eje de articulación del *ager* en cuestión[8]. También destacada es la posición de ambas entidades en relación

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[3] LAGÓSTENA, 1996,
[4] CARRERAS, 2001; CARRERAS 2004.
[5] Sobre las estructuras edilicias excavadas *vide*: RAMOS, RIESCO, 1990; MATA, LAGOSTENA, 1997; MATA, 2001. Sobre los indicios de los sistemas de plantación, *vide*: LÓPEZ AMADOR, RUIZ GIL, 2007a; LÓPEZ AMADOR, RUIZ GIL, 2007b.
[6] Str. III.2.6.
[7] LÓPEZ AMADOR , RUIZ MATA, RUIZ GIL, 2008.
[8] Para la articulación marítima, LAGÓSTENA, 2014; sobre este *iter* de la *via Augusta*: SILLIÈRES, 1990; RUIZ GIL, LÓPEZ AMADOR, 2004; MARTÍN-ARROYO, 2013.

Villae y *Figlinae* a orillas del *Lacus Ligustinus*. Análisis GIS y prospección geofísica en el *territorium* ribereño de *Hasta Regia*

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El *territorium* de la colonia romana *Hasta Regia* se extiende entre la divisoria de aguas de la cuenca del Guadalquivir y las orillas del antiguo *Lacus Ligustinus* en la provincia de *Baetica*. Este territorio, caracterizado por su feraz campiña, su condición ribereña, y surcado por numerosos esteros, como describía Estrabón, conoció una intensa explotación agrícola, destacando la producción y la exportación de derivados vitivinícolas en ánforas de la familia Dressel 1 y Haltern 70. La aplicación de técnicas de análisis GIS combinadas con prospección geofísica con georradar nos permite proponer nuevas claves del ordenamiento de este espacio, conocido hasta la fecha mediante prospecciones superficiales tradicionales. Se analiza la distribución del sistema de *villae* en un espacio presuntamente centuriado. Igualmente, se identifican y analizan los alfares productores de ánforas destinadas a la distribución de los productos hastenses. La exploración de la *urbs* con georradar

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Stream X permite reflexionar sobre la aplicación metodológica de nuevas técnicas al estudio no invasivo del territorio urbano y productivo de la ciudad romana.

1. El *ager Hastensis*: estado de su delimitación y conocimiento.

Hasta Regia fue una de las colonias establecidas en la *provincia Ulterior Baetica,* adscrita al *conventus Hispalensis* según informa Plinio[2]. A pesar de su estatus destacado no ha recibido especial atención por parte de la investigación reciente, y poco se conoce sobre el alcance de su proyección territorial, sobre la extensión de la *pertica* de la ciudad, sobre posibles parcelaciones relacionadas con su trayectoria cívica, sobre la organización, dimensión y articulación de su *ager* en definitiva.

El alcance del *territorium* bajo la jurisdicción de la *civitas* Hastense no ha sido objeto de publicaciones específicas[3]. La información transmitida por el conocido Bronce de Lascuta, según la cual el poder político territorial de la ciudad alcanzaría a la población de *turris Lascutana*, que se ubicaría en el actual término municipal de Alcalá de los Gazules, sugeriría que la ciudad de los esteros disponía de un amplísimo espacio sometido a su dominio[4]. Parece necesario matizar este dato proporcionado por el epígrafe dado que su contexto histórico - la conclusión de la segunda Guerra Púnica, la *deditio* que supuso el *foedus Gaditanus*, los inicios de la administración provincial romana en la *Ulterior,* el vacío momentáneo de poder regional que supusieron estos acontecimientos- justifica un intento de establecimiento en la región de un nuevo dominio político por parte de la ancestral comunidad de *Hasta,* y proporciona una explicación plausible y coyuntural del literal del decreto de L. Emilio Paulo[5].

Para ofrecer una hipótesis sobre el alcance de la jurisdicción territorial de la *colonia Hasta Regia* hemos recurrido a la combinación de algunos aspectos que parecen determinantes en la percepción y la ordenación del espacio compartido por muchas de las sociedades de la antigüedad mediterránea. Estas perspectivas están presentes también en la cosmovisión del paisaje cívico de la sociedad latina. Nos referimos al recurso a los límites geográficos y orográficos de un espacio como base de la articulación del mismo, al que se deben añadir otros factores de índole cultural, como los simbólicos y los religiosos[6]. El objetivo es establecer un marco territorial hipotético, verosímil y válido para un período concreto, que permita una modelización del funcionamiento económico de este espacio rural, extrapolable para su comparación con otras propuestas territoriales, otras comunidades y otras cronologías .

Los principales confines naturales que delimitarían el espacio de la ciudad son, por una parte las actuales marismas del río *Baetis*, hoy terrenos sedimentarios conformados sobre la isolínea de

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[2] Plin. *N.H.* 3.11

[3] Véase la contribución de LAGÓSTENA y TRAPERO en este mismo volumen. Sobre ello se ha reflexionado y se ha dedicado interesantes aportaciones en MARTÍN-ARROYO, 2013, 284 ss.

[4] *C.I.L.* II, 5041. Amplísima es la bibliografía dedicada a diversos aspectos del epígrafe. Consideramos que *turris Lascutana* se debía corresponder con el *oppidum* localizado en la finca Las Correderas, mientras *Lascuta* se ubicaría bajo el actual pueblo de Alcalá de los Gazules, siendo por tanto entidades distintas aunque lógicamente emparentadas.

[5] CHIC GARCÍA, 1984; LAGÓSTENA, 2011, 161 ss.

[6] Cabe recurrir aquí al esclarecedor testimonio de Hygino, *De condicionibus agrorum*, 2: *Territorii [aeque] iuris controversia agitatur, quotiens propter exigenda tributa de possessione litigatur, cum dicat una pars in sui eam fine territorii constituta<m>, et altera e contrario similiter. Quae re<s> [haec autem controversia] territorialibus est finienda terminibus, nam invenimus saepe in publicis instrumentis significanter inscripta territoria ita ut EX COLL<ICVL>O QVI APPELLATVR ILLE, AD FLVMEN ILLVD, ET PER FLVMEN ILLVD AD RIVVM ILLVM aut VIAM ILLAM, ET PER VIAM ILLAM AD INFIMA MONTIS ILLIVS, QVI LOCVS APPELLATVR ILLE, ET INDE PER IVGVM MONTIS ILLIVS IN SVMM<VM> ET PER SVMMVM MONTIS PER DIVERGIA AQVAE AD LOCVM QVI APPELLATVR ILLE, ET INDE DEORSVM VERSVS AD LOCVM ILLVM, ET INDE AD COMP<I>TVM ILLIVS, ET INDE PER MONVMENTVM ILLIVS AD locum unde primum coepit scriptura esse* (CASTILLO PASCUAL, 2011).

Food and Power in the Post-Roman North: The Role of Food Supply in the Shaping of Power in Post-Roman Britannia

Paul Gorton

Introduction

Current theories regarding political change in Britain between AD 400 and 650 fail to fully explain the situation as it developed beyond the beginning of the fifth century[1]. Attempts have been made to develop a catch-all model that covers the decline of some Roman sites and the development of early medieval elite sites. Some have argued for a complete collapse of Roman authority, resulting in a bottom-up approach to societal rebuilding[2], others have argued that new power-groups appropriated Roman military defences and sites for their own legitimation and security. The latter model has seen several different iterations regarding northern Britain, including the re-defence of Hadrian's Wall in the sub-Roman period under the command of a still functioning *Dux Britanniarum*[3], and the development of political units around small Roman policing units, stationed beyond a retreating frontier, interacting with existing British political units[4].

This paper considers the development of the political situation in the frontier zone of Hadrian's Wall, where there seems to be a difficulty understanding how the occupational and political situations evolved between the fourth century and the seventh. I would argue that there is no catch-all

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[1] I wish to thank my supervisors, Rick Jones and Alaric Hall, for their assistance on this piece. I am particularly grateful to Rick for his suggestions for the supply of the Roman garrison in Britain.
[2] FAULKNER, 2001.
[3] DARK, 1992.
[4] HALSALL, 2013.

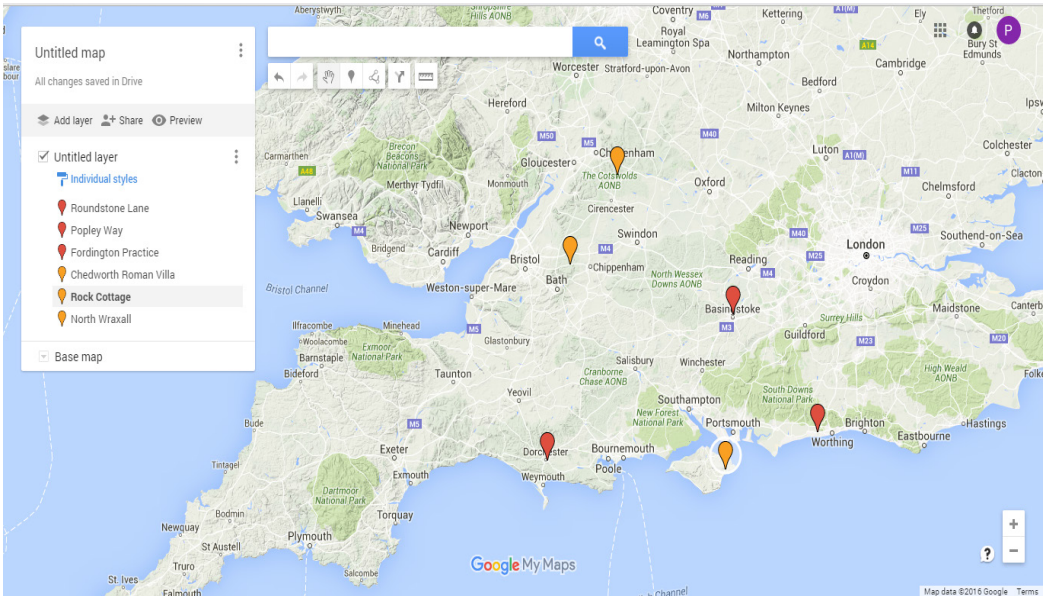
explanation and that what occurred were local developments aimed at resolving local issues with little resemblance to a grand political narrative. These local responses may have come from a playbook with which some broader models of political change are consistent, but no model explains the whole situation. This paper considers the utility of a different model (first applied to the villa region of southern Britannia) for the frontier region, to be applied alongside those others to explain some local developments. It also considers why those case studies that do not fit this model fail to do so.

Colm O'Brien has identified several attempts to explain why some Hadrian's Wall forts remained in use beyond AD 400, whilst others seem to have failed[5]. Tony Wilmott suggested that Birdoswald survived because the fort's garrison continued to extract taxes and developed into a self-sustaining unit by allying with local civilian groups under the command of a hereditary commander[6].Rob Collins has suggested that a reduction in the number of crossing points enabled some fort commanders to control movement through Hadrian's Wall, putting them in a position of power which developed into regional authority[7]. Both of these models include fort garrisons' eventual development into an elite warband which eventually became the nodes around which the early medieval kingdoms of the North formed. Furthermore, Collins has suggested that the shared experience of life as limitanei on the British frontier created a community amongst the frontier soldiers[8]. This principle, called Occupational Community Theory, is echoed by Ian Wood's suggestions for the origins of Bernicia. Wood asked: 'were the Bernicii (…) heirs to the Wall?'[9] This theory has been expanded to suggest a Germanic language as the spoken language of the frontier elites[10] and a consideration of whether the descendants of the frontier troops on Hadrian's Wall came to see themselves 'as part of the Anglian people of Northumbria.'[11] This poses interesting questions about how this development came about and how much of the frontier came to belong to these peoples and why certain parts of the frontier did not become part of the kingdom of Bernicia.

Seeking to explain continuity at villa sites in the lowland zone of Britannia, James Gerrard has proposed a model based on the control of food surpluses. He argues that at several Romano-British villa sites during the fifth century there was a move to centralise elements of crop storage and processing from their usual position at the periphery of the estates, putting them under the direct supervision of the landlord.[12] This, he argues, was a by-product of the unstable position that the Romano-British elite found themselves in after the diminishing of Roman authority in Britannia. He states that the relocation of these features could indicate 'a weakening of the obligations that assured the smooth rendering of the agricultural surplus to the elite'[13] and thus a need to bring them under direct elite control. This model maps the change from fourth-century villa sites such as Roundstone Lane, Angmering (Sussex), Popley near Basingstoke (Hampshire) and Fordington Bottom (Dorset), where corn driers are sited on the periphery of villa estates, to fifth-century sites such as Chedworth, Butleigh (Somerset), Brading and Rock (Isle of Wight) and North Wraxall (Wiltshire) where these driers were moved to areas that had previously been associated with elite functions.[14] Further to this is the association of these areas with industrial activities such as iron-making, as it was

[5] O'BRIEN, 2010, 110–20.
[6] WILMOTT, 1997, 228.
[7] COLLINS IN O'BRIEN, 2010, 113.
[8] COLLINS IN O'BRIEN, 2010, 111
[9] COLLINS IN O'BRIEN, 2010, 111
[10] SALWAY, 2001; ROBERTS, 2010, 120.
[11] WOOD, 2007; ROBERTS, 2010, 120.
[12] GERRARD, 2013, 225–28.
[13] GERRARD, 2013, 257.
[14] GERRARD, 2013, 257.

‘necessary to equip and maintain not only the retinue but also the equipment needed for everyday use.’[15] Through this movement the elites were able to consolidate their power and create stable nodes from which they could govern their locality. Gerrard comments that ‘from these locations the remnants of the Romano-British elite exercised control from what was a traditional seat of power.’[16] This association of lower-status activity with areas of elite function has the potential to be applied in the northern frontier zone, where changes in the use of buildings have been observed in a period beginning in around AD 350 and continuing after AD 400. This may suggest that some of the former forts of the frontier zone became seats of power for an elite which continued to identify with Roman culture, from which the fort commanders could have become regional powers in a similar way to those elites of the South.



Gerrard’s Villas:

- 4th C. villas inc. Roundstone Lane, Popley, Fordington Bottom
- 5th C. villas inc. Chedworth, Brading and Rock, North Wraxall

This paper considers the development and occupation at several sites across the frontier zone, including the wall forts of Birdoswald and Vindolanda, a frontier fort at Binchester, and the villa complex at Ingleby Barwick. It considers the potential of Gerrard’s southern villa model at each of these sites, making efforts to consider the placement of industrially and agriculturally important apparatus.

[15] GERRARD, 2013, 255.
[16] GERRARD, 2013, 258.

De Agri Cultura Experientia. From Modern Agronomy to Roman Economic Analysis

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1. Introduction

The modelling of modern agriculture is complex and wide-ranging. It is therefore not surprising that many techniques applied by geographers to measure or predict productive output from current datasets – such as ecological niche modelling, agro-ecological zoning, and habitat suitability modelling – have not been explored in more depth in terms of their applicability to the past. This paper presents some experiments applying a selection of agronomic modelling techniques to ancient datasets, and discusses the potentials and limitations of using these methods to investigate economic strategies in relation to agricultural and pastoral practices in the past.

Early Imperial Roman Italy is used here as a focus for trialling these agronomic methods, with a detailed case study from the Middle Tiber Valley. The aim is to investigate a range of crops and elements of animal husbandry. The case study corresponds to an area in which suitability maps were previously used to investigate potential agricultural production and its impact on settlement patterns in the Late Republic and Early Empire.[1] These models essentially look at land suitability, a method that has been used since the 1970s to study modern farming, and elements of which have been incorporated into some archaeological studies.[2] Though the models used herein follow a similar land

[1] GOODCHILD & WITCHER 2010.
[2] e.g. VAN JOOLEN 2003, WILSON 1994.

Ancient rural settlement and land use in the Sarno River plain (Campania, Italy): Predictive models and quantitative analyses

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The build-up of a comprehensive GIS database of archaeological evidence of the pre-Roman and Roman period in the hinterland of Pompeii has, so far, yielded a dataset of more than 650 entities. About 140 of them were assigned to Roman farms (*villae rusticae*) which are believed to have played an important role in ancient rural life and economy of the Sarno River plain. This involves agricultural production not only of food to supply the urban centres Pompeii, Stabiae and Nuceria but also of goods (e.g. wine) to be exported to Rome as well as to the western and eastern Mediterranean. To gain a more detailed understanding of the ancient rural settlement structure of the Sarno River plain, this fragmentary dataset on *villae rusticae* was used to carry out a series of quantitative GIS-based spatial analyses. At first, spatial statistics aimed at recognizing spatial patterns, trends and relationships of the distribution of *villae rusticae* to validate the first simply visual impression of a clustered organization around the urban centres Pompeii and Stabiae. Subsequently, a predictive modelling approach aimed at determining the potential area that may have been occupied by *villae rusticae* and agricultural production. This model incorporates paleo-environmental parameters and also tries to quantify some socio-economic parameters that may have controlled the spatial distribution of *villae rusticae*. For that, a recently generated, pre-AD 79 paleo-landscape model of the Sarno River plain was utilized characterizing the ancient topographical conditions before the eruption of Vesuvius in

AD 79. Finally, quantitative analyses and other GIS-assisted methods result in the reconstruction of the settlement structure in the hinterland of Pompeii, the *ager Pompeianus*.

1. Introduction

In recent decades, studies in the field of quantitative modelling of rural settlement have much increased and advanced the refining of attached methodologies[1]. In regions where archaeological rural structures are sparse and without context, a valuable approach to conceive a more complete concept of land use by settlement and cultivation is indeed the application of models. An instructive example represents the recent analysis of rural settlement in the Tiber valley which is based on sophisticated modelling[2]. The Sarno River plain affected most heavily by the eruption of Vesuvius in 79 CE provides an ideal playing field to practise analysis of rural settlement structures by applying predictive modelling (figure 1). In the Roman period, the territories of Pompeii and Stabiae were densely settled by farms (*villae, villae rusticae*) and the land was intensively cultivated. The exceptional state of preservation of both, archaeological findings and paleo-environmental features as well as paleo-botanical material, gives the unique opportunity to study structure and characteristics of the rural settlement in the context of the paleo-landscape. However, our knowledge about the actual ancient situation of the settlement density is fragmentary due to the randomness of archaeological discoveries. Therefore, in previous work, we developed advanced modelling tools in order to generate a predictive model which is able to indicate most favourable locations of Roman farms and agricultural land over a wide area of the Sarno River valley[3]. In this paper we take another big step forward and conduct an analysis and interpretation of the rural settlement on the northern part of the Sarno River, using the previously generated predictive model of suitability for the development of Roman farms and agricultural production. Beforehand, we shortly summarize the applied modelling methodology.

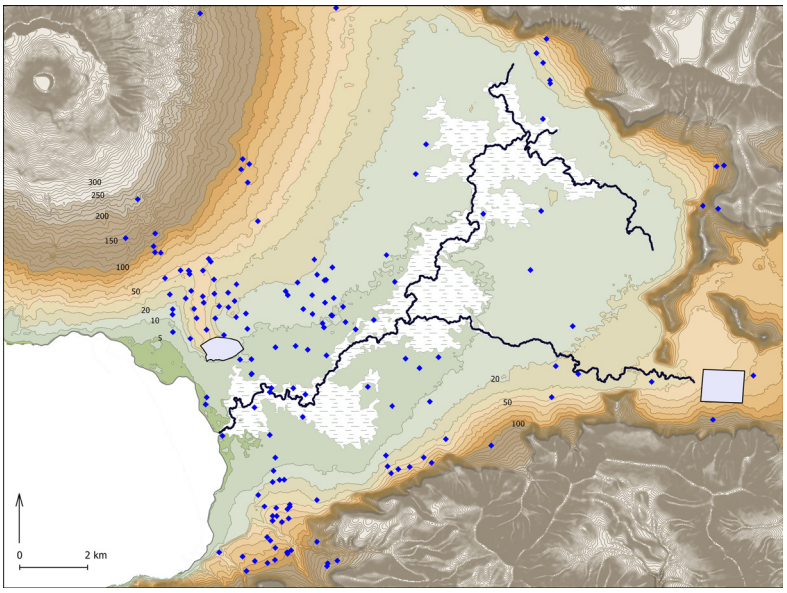

Figure 1. Sarno River plain. Digital elevation model (DEM) of the situation before the eruption of Vesuvius in 79 CE, mapped with the find spots of villas and the location of the ancient towns of Pompeii and Nuceria. (Vogel & Seiler)

[1] VERHAGEN 2007; GOODCHILD & WITCHER 2009; VERHAGEN & WHITLEY 2011.
[2] GOODCHILD 2007; GOODCHILD 2013.
[3] VOGEL, MÄRKER & SEILER 2016a.

Simulando el aprendizaje: modelización basada en agentes para comprender la producción anfórica en el Imperio Romano

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La producción de ánforas de aceite de oliva en el Imperio Romano

Uno de los items más característicos para conocer el desarrollo económico comercial del Imperio Romano ha sido el estudio cerámico. En gran medida por ser uno de los elementos materiales con mayor presencia en el contexto arqueológico y que mejor ha sobrevivido al paso del tiempo[1]. De la misma forma que nuestros contenedores actuales, su forma y volumen se encuentran estrechamente relacionados con el contenido, el lugar de fabricación, así como otras variables culturales, sociales y económicas que determinan la cantidad y calidad del producto[2]. Asimismo, la arraigada tendencia de utilizar la cerámica como indicador cronológico sigue siendo esencial para fechar los niveles de ocupación a partir de los cambios relacionados con su morfología. Como forma de detectar estos cambios, desde un principio se tendió a explicar este proceso a partir de clasificaciones basadas en variaciones morfométricas, aunque tan sólo una pequeña parte presentase pautas de evolución morfológica susceptibles de ser reconocidas a simple vista y reconstruidas en un sentido diacrónico. La eficacia de este tipo de clasificaciones permitió su perdurabilidad como

[1] REMESAL, 1977; REMESAL, 1998; TEMIN, 2013.
[2] BEVAN, 2014.

método a lo largo de los años a pesar de depender en cierta manera de la habilidad y percepción del ser humano[3]. El surgimiento de nuevas metodologías vinculadas con el avance tecnológico y el auge de proyectos multidisciplinares dieron lugar a la aparición de alternativas asociadas con otras disciplinas científicas. En cierta manera, estas *no tan* nuevas herramientas se fueron convirtiendo en un soporte esencial para detectar procesos de cambios entre diferentes tipos de producciones que serían inapreciables en los contextos arqueológicos.

Para solventar este problema, en los últimos años ha sido frecuente el diseño de modelos computacionales que permiten explorar diferentes fenómenos relacionados con esta casuística mediante el análisis de diversas formas de interacción entre individuos centrados en un entorno concreto[4]. En nuestro caso, dicha metodología nos ha permitido explorar estas cuestiones analizando las producciones de ánforas a gran escala durante el Imperio Romano. Durante este periodo surge progresivamente una amplia infraestructura con el objetivo de albergar una vasta producción, convirtiéndose a la larga en uno de los principales suministros de aceite para todas las provincias del Imperio Romano[5]. La gran cantidad de piezas anfóricas localizadas relacionadas con este comercio se encuentran estrechamente vinculadas con las dinámicas de cambio en la producción a través de la detección de diferentes patrones morfológicos en el registro arqueológico. De esta forma, resulta comprensible poder entender una parte de las dinámicas productivas del Imperio susceptibles de variar en el tiempo y en el espacio dependiendo de diferentes factores económicos, políticos o sociales[6]. En particular, nuestro interés versa en comprender qué mecanismos de transmisión, usados para enseñar a fabricar ánforas, permiten generar esta variabilidad para así poder detectar diferentes patrones de producción a través del uso de datos arqueológicos y simulación.

Con respecto a los modos de transmisión cultural, pueden distinguirse entre tres tipos: horizontal, vertical y oblicua. Si se aplica a la evolución cultural, transmisión horizontal sería cuando el aprendizaje es transmitido entre individuos de una misma generación de forma contemporánea. Este modelo se encuentra estrechamente relacionado con el aprendizaje vinculado a un sistema de intercambios y contactos con otras culturas[7]. En cuanto a la transmisión vertical, el modelo de aprendizaje es el resultado de una transmisión entre parentescos, es decir, de padres o madres a descendientes mientras que en la transmisión oblicua el aprendizaje es transmitido de una generación anterior a otra más reciente, sin ningún tipo de parentesco. Este último tipo de intercambio de mecanismos de conocimiento es conocido en otras sociedades a través de estudios etnológicos como una forma de perpetuar el oficio y el aprendizaje heredados[8].

Estas diferencias en la producción también podrían verse afectadas por diversos factores, entre ellos la distancia geográfica. En nuestro caso, planteamos como hipótesis la probabilidad de compartir rasgos morfométricos en la producción dependiendo de la distancia espacial: los talleres de producción más cercanos compartirían mayores rasgos morfométricos que los más lejanos. Se trataría de un hecho conocido por "aislamiento por distancia", donde se asocia la variación genética con la frecuencia geográfica[9]. Como veremos más adelante, este fenómeno explica que la probabilidad de

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[3] EEKENS &BETTINGER, 2001
[4] DEL CASTILLO, 2011.
[5] CHIC GARCÍA, 2010-2011.
[6] REMESAL, 2011
[7] CAVALLI-SFORZA & FELDMAN, 1981
[8] EPSTEIN, 1998 ; BOWSER & PATTON, 2008
[9] SHENNAN ET AL., 2015

The *porticus* bears all the grain: an update of the area of the Porticus Minuciae (Rome), between archaeology and social history

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1. Introduction

The following work is a preliminary report about my PhD project concerning the topography of roman public wheat distributions. A project with the ambitious goal of bringing new light to the original aspect and function of the only certain *porticus Minucia* known until now, recognisable with the remains located around via delle Botteghe Oscure in Rome. Rivers of ink have been spilled about this topic and particularly about the identification of the name of the *porticus* after the discovery of its central temple in 1937, during the works for the widening of the old via delle Botteghe Oscure.[1] It was previously identified as the temple of Bellona *in Circo* and only after Guglielmo Gatti's correct identification of the Crypta Balbi and Lucos Cozza's work about the Marble Plan of Rome it was clear that it could be the temple of one of the *porticus Minuciae*.

2. The porticus Minuciae within the historical sources

Going in order, the names of both the builder and the building come from a passage of Velleius Paterculus (II, 8, 3) who talks about one or more *porticus Minucia* built by Marcus Minucius

[1] Cf. SANTANGELI VALENZANI 1995, pp. 89-92.

Rufus at the end of the II century BC.[2] It was probably the place where, interpreting a passage of Cicero, Antonius and probably other officials, set up their tribunals.[3]

For the imperial age, the earliest indication comes from an inscription of an imperial freedman, who lived under the rule of Claudius, who was registered to the 14th day and the 42nd *ostium* of the *Minucia.*[4] It shows that a distribution system divided per days and counters (*ostia*) already existed during the reign of Claudius and that it took place at the *porticus Minucia*.[5] A link between the *porticus Minucia* and the distributions of grain is confirmed by a later passage of Lucius Apuleius' *De mundo* (35): *... et alius ad Minuciam frumentatum venit…* In the III century AD, we find a *Minucia* in a passage of the *Historia Augusta,* talking about a bad auspice that occurred at the end of Commodus' reign and using, for the first time, the spelling *Minicia* instead of *Minucia*.[6]

In the calendars it occurs twice: the *Fasti praenestini* (6-10 AD), for December 22nd, report the celebration of the *Laribus Permarinis in porticu Minucia*[7], and in the calendar of Philocalus (354 AD), under June 4th, where we find a *Ludi in Minicia.*[8] The indication, within the *Fasti Praenestini*, of the *Laribus Permarinis in portico Minucia* celebrations, indicates that the temple of these deities, vowed by M. Emilius Regillus in 190 BC and dedicated by M. Emilius Lepidus in 179, were perhaps later enclosed by the first *porticus Minucia*.[9]

In 354 AD the Chronograph mentions, for the first time, the *porticus Minucia vetus* making a list of buildings built or restored by Domitian after the blaze that hit the City in 80 AD.[10] Inside the same *corpus*, the Regionaries place two *porticus Minuciae* in the IX Region of the City: a *vetus* one and a *frumentaria* one, listed together between the *Porticus Philippi* and the *Crypta Balbi*.[11]

To recap, since the time of Claudius there is proof that the distribution of grain to the populace took place in a *porticus Minucia*, presumably a triumphal portico built by Marcus Minucius Rufus at the end of the II century BC or, perhaps, in a new portico built during the reign of Claudius and called *frumentaria*.[12] This latter, together with the circa 21 inscriptions of the *plebs frumentaria* still

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[2] Vell. Pat. II, 8, 3: *Per eadem tempora clarus eius Minucii, qui porticus, quae hodieque celebres sunt, molitus est, ex Scordiscis triumphus fuit.* M. Minucius Rufus was consul in 110 BC and triumphed in 106 BC. F. Zevi (1993, p. 663) supposes that the triumph gave the opportunity to make the *porticus* as triumphal portico. Cf. also COARELLI 1997, pp. 296-297.

[3] Cic. *Phil*., II, 84: *Quidlibet, modo ne nauseet, faciat, quod in porticu Minucia fecit.* Cf. NICOLET 1976, pp. 48-50.

[4] *CIL* VI, 10223 = *ILS* 6071: *Ti. Claudius Aug. lib. |Ianuarius, curator | de Minucia die XIIII| ostio XLII, et| Avonia Tyche uxor eius| Pituaniani solaria de sua impensa… fecerunt.* Cf. VAN BERCHEM 1939, pp. 37-38; VIRLOUVET 1995, pp. 131, 236-241; 2009, pp. 61-64, 208-212; ZEVI 1993, p. 665. For an overview about the *frumentationes* and the problem of the *Minuciae* see CARDINALI 1906; VIRLOUVET 1987, 1995, 2009; NICOLET 1976.

[5] About the relationship between the *gens Minucia* and the *frumentationes* cf., among others, COARELLI 1997, pp. 300-302.

[6] *Commod.,* 16: *Herculis signum aeneum per plures dies sudavit in Minicia.*

[7] *CIL* I², p. 238: *[D XI C(omitialis) Laribus Perm]arinis in porti[cu Mi]nuci[a].* Cf. DEGRASSI 1963, p. 465.

[8] *CIL* I², p. 266: *III (nonas Iunias) senatus legitimus pridie (nonas Iunias) Ludi in Minicia.* Cf. DEGRASSI 1963, p. 543.

[9] Macrob. *Saturn.*, I, 10, 10: *Undecimo autem kalendas (Ianuarias) feriae sunt Laribus dedicatae, quibus aedem bello Antiochi Aemilius Regillus praetor in campo Martio curandam vovit.* Liv. XL, 52, 4-5: *Idem* (M. Aemilius Lepidus) *dedicavit aedem Larum Permarinum in Campo. Voverat eam annis undecim ante L. Aemilius Regillus navali proelio adversus praefectos regis Antiochi. Supra valvas templi tabula cum titulo hoc fixa est.* Cf. DEGRASSI 1963, p. 543; ZEVI 1993, p. 664; 2007, pp. 369-382; COARELLI 1997, pp. 258-268.

[10] Chron.: *Hoc imperante multae operae publicae fabricatae sunt:* (…) *Divorum, Iseum et Serapeum, Minervam Chalcidicam, Odium, Minuciam veterem, Stadium* (…). (VALENTINI-ZUCCHETTI 1940, pp. 121-132). In the Suetonius' passage about the same episode (*Dom.*, 5) the building is not mentioned.

[11] *Curiosum: ...Porticum Philippi, Minuciam Veterem et Frumentariam, Cryptam Balbi…; Notitia: ...Porticum Philippi, Minucias II (duas), veterem et frumentariam, cryptam Balbi...* (VALENTINI-ZUCCHETTI 1940, pp. 121-132).

[12] This thesis is accepted by F. Zevi (1993, p. 666).

Dressel 6B and Dressel 6A's oil and wine production in North Italy and the Adriatic western coast (1st century BC - 2nd century AD)

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1. Introduction

Since 1990 our research team is carrying on a study over a great number of amphorae (more than 5.000) in *Venetia*, used to improve the terrain and to drain the surface water.[1] This technique was used between the second half of 1st century BC and the first half of 2nd century AD[2] (fig. 1).

The frequent recovery of great quantities of amphorae in the river Po Valley towns allowed us to recover, for different range of time, the provenance of the containers and of the foodstuffs, in order to understand the amount of trade connections.

[1] MAZZOCCHIN 2013, 49-61.
[2] The pictures are published on concession of *Ministero dei beni e delle attività culturali e del turismo*; the copy is forbidden.

Figure 1. A reclamation depot with amphorae found in Padua.

In these contexts, Dressel 6B for oil and Dressel 6A for wine are the most numerous amphorae evidences; these are all Adriatic and north eastern Italy productions. Beyond them, there are mostly wine, oil and alum amphorae which come from Eastern areas and partially from the West, in particular the fish sauces's amphorae from *Baetica*.

Dressel 6A are wine amphorae, with gently rounded rim, distinct or ridge carination on the shoulder, where the shoulder meets the body, long and vertical handles, cylinder-shaped neck; pear-shaped body, the spike is long. Their production starts at the end of 1st century BC and goes on till the half of 1st century AD.[3]

Dressel 6B amphorae, as it is known,[4] are oil containers, with gently rounded rim, rounded shoulder, vertical handles with elliptical section, cone shaped neck, pear-shaped body, small knob at the base. Dressel 6B were produced for a long time, from the half of 1st century BC to the 4th century AD [5].

2. The Research status and the methods

Methodology developed to identify the provenience of Dressel 6A and Dressel 6B re-used in *Venetia* contexts of reclamation started out with the analysis of well-known workshops data.

Recent studies focused on wine and oil amphorae productive workshops along the Western Adriatic coast and in Northern river Po Valley[6]. In these years, the research teams of University of Pisa (South *Picenum* Survey Project) and University of Ghent (The Potenza Valley Survey) with Soprintendenza delle Marche carried out essential archaeological studies. Research methodology[7] is based on archaeological survey and detailed archaeological excavation; the discovery of clay quarries, kilns, productive buildings, as basins or drying buildings etc., ceramic overfired dumps are

[3] CIPRIANO & MAZZOCCHIN 2018.
[4] CIPRIANO 2009.
[5] For the chronology of Dressel 6B amphorae connected with their morphology see CARRE & PESAVENTO MATTIOLI 2003.
[6] CARRE, MONSIEUR & PESAVENTO MATTIOLI 2014; AURIEMMA & DEGRASSI 2015.
[7] About the relevance of scientific method of productive area identification: PANELLA 2010 and CARRE, MONSIEUR & PESAVENTO MATTIOLI 2014: 417-419.

Epilogue. Modelling Roman agricultural production: people, pots and power

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Throughout the late medieval and early modern periods, writers sought to explain the presence of a mountain of pottery sherds—a *mons manufactus*—on the bank of the River Tiber at Rome. One enduring interpretation can be traced back at least as far as Giovanni Cavallini's *Polistoria* of the mid fourteenth century: these ceramic sherds were the remains of vessels used to bring to the ancient city tribute from Rome's provinces and client kingdoms.[1] The hill therefore was a material manifestation of the city's imperial power, a monument to the emperors' ability to concentrate the wealth of the world at its centre. After almost 150 years of archaeological investigations, starting with Heinrich Dressel's excavations in the 1870s, we now know that Monte Testaccio is formed from millions of smashed amphorae filled originally, not with gold from Persia, but with green gold from Hispania: olive oil to feed and fuel the city's million-strong population. This 'unique archive', as José Remesal Rodríguez describes it, documenting the supply of a staple agricultural product to the city of Rome, is an appropriate place to begin this edited collection on the productive landscapes and trade networks of the Roman Empire. For more than simply waste packaging, these amphorae at the end of their life-histories have rich stories to tell about distant landscapes, about rural production and urban consumption, and about the complex technological, social and political organization needed to transport them thousands of kilometres across the Mediterranean. From Monte Testaccio, the other papers of this volume then spread out to consider case studies as far removed as coast of south-western Spain and the Dobrogea

[1] Donkin 2017.

in eastern Romania, and from Hadrian's Wall in Britain back to the heart of empire in the hinterlands of Rome and Pompeii. This epilogue draws out some of the key themes that emerge from these contributions and identifies some challenges and avenues for future research.

The volume, like the original conference session from which it derives, presents a diverse set of papers that demonstrate the richness and complexity of the evidence for agricultural production, trade and consumption in the Roman world. The authors make use of varied data sets, methods and theoretical models to interpret and evaluate the scale, organisation and significance of agrarian landscapes and the supply of urban and military markets. Central to many of the papers is the evidence of field survey: the collection of surface archaeological materials and the mapping of foci of activity across the landscape. In most cases, however, these data are supplemented with a variety of other sources including the study of stamps and *tituli picti* on amphorae and the texts of Roman authors, especially that of Columella who was probably born at Gades, the geographical focus of several of the contributions. Collectively, the papers also deploy a wide range of techniques from traditional urban topography through to GIS modelling and statistical analysis. This diversity of approaches is both a necessity and a strength of Roman archaeology and essential for dealing with the complexity and abundance of evidence. At the same time, the need to integrate these methods and their results is of growing importance due to the real challenges of dealing with the varied scales of analysis and levels of confidence involved.

Quantifying crops

At the heart of the volume are a set of six papers that make use of varied GIS applications to evaluate the productive potential and organisation of rural landscapes in Spain and Italy. Daniel Martín-Arroyo Sánchez and María del Mar Castro García evaluate the supply of willow and reeds sourced from wetlands (*riparia*) for viticultural use on estates in the territories of *Portus Gaditanus* and *Nabrissa Veneria*. Columella, like most agronomists, advocates self-sufficiency in such matters, but the authors' results demonstrate that, because *riparia* is unevenly distributed, sites had differential access to these resources. These results—like those of others reported here—highlight the discrepancy between ideal and reality but, more importantly, open up the potential for thinking about the economic relationships, and social dependencies, implicit in the uneven distribution of such resources.

Lázaro Lagóstena Barrios and Pedro Trapero Fernández also look to Columella in their examination of the territory between the Guadalquivir and Guadalete rivers, the hinterlands of the *municipium* of *Gades* and *colonia* of *Hasta Regia*. Using a set of topographical and environmental criteria, such as soils and solar insolation, the authors classify the landscape according to its agricultural potential, from best to worst. The results indicate that while only a small percentage of these urban territories falls into the category of the very best agricultural land, nevertheless, the distribution of known sites demonstrates that estates were able to produce for markets by locating in areas with access to a mix of resources, plus good communications and proximity to urban centres. Focusing down on the territory of *Hasta Regia*, José Antonio Ruiz, Lázaro Lagostena Barrios, Jenny Pérez Marrero, Domingo Martín Mochales, Pedro Trapero Fernández and Javier Catalán González also use GIS to examine the organisation of rural production, similarly identifying the uneven distribution of settlement in relation to natural resources. Their paper, however, moves on to wider questions, including the networks of movement between rural settlements, central places, ports and sacred spaces and even touches on the notion of the *cosmovisión*, or world view, of the inhabitants. Most important, however, is that the authors begin the process of integrating the rural evidence with

the urban, in the form of a georadar survey of part of the urban plateau, moving towards a holistic view of ancient civic space. Rural landscapes were linked to the wider world via local urban centres and their landowning families and market facilities. Whether or not these centres hosted production or processing activities, their administrative services and social infrastructure were essential for connecting local landscapes with the wider economy.

The paper by Helen Goodchild also makes use of GIS modelling of landscape suitability, drawing on ancient authors to calibrate variables such as sowing rates and yields. Here, she develops some of her earlier work on the productive potential of the hinterland of Rome by integrating data and methods used to evaluate modern-day farming. Drawing on a variety of resources developed for the planning and management of contemporary global agriculture, Goodchild works first at the scale of Italy, using criteria such as the availability of water to map the relative suitability of the peninsula for different crops and domestic animals. She then shifts focus to return to a small patch of the *ager Veientanus*, north of Rome, analysed in a previous study, to evaluate the performance of generalised models when applied at the local scale. This exercise produces the reassuring outcome that it is indeed possible to reproduce the original results, despite the shift in scale and the use of different variables. Significantly, however, this result also suggests that the original model, which used fewer and less complex variables, was just as effective as the new and more elaborate model. This raises the question of diminishing returns. It is tempting to add ever more parameters and variables into our models in the belief that this will make them better or more accurate, but this may not always be true. This result is a useful reminder of the need to evaluate our models and to focus attention on the most important aspects. Models, as Goodchild and a number of the other contributors emphasise, are not intended to be realistic, but rather to simplify reality so that real-world complexity can be understood.

Adopting a broadly similar approach to the previous contributors, Antoni Martín i Oliveras, Victor Revilla Calvo and José Remesal Rodríguez turn for their case study to the rich archaeological evidence of the Laetanian region on the Catalan coast. Their paper presents a particularly wide-ranging and comprehensive review of both the broader concepts and local data leading to the outline of an ambitious and all-encompassing model of Roman viticulture. This theoretical and methodological framework offers good potential for application to other wine-producing landscapes; it remains, nonetheless, a model of one specific sector of the Roman economy; from the Mediterranean coast, one only need travel a few kilometres inland to find a very different, and complementary, economic situation. Importantly, Antoni Martín i Oliveras, Victor Revilla Calvo and José Remesal Rodríguez introduce two fundamental issues: social and economic hierarchy—the diversity of sites and people represented by the 'dots' on our distribution maps—and, second, the explicit recognition of change through time—the temporal evolution of agricultural landscapes.

The final paper to adopt a modelling approach, by Florian Seiler, Sebastian Vogel and Domenico Esposito, deploys GIS methods to evaluate the agricultural exploitation of the Sarno river plain to the north and east of Pompeii. The quality of the evidence from the Vesuvian sites is enviable in many respects—but it also brings its own special challenges. In particular, the deep burial of ancient settlement, and the sprawl of modern development, means that the distribution of known sites is particularly patchy and additional work is needed to reconstruct the nature of the pre-AD79 landscape. Florian Seiler, Sebastian Vogel and Domenico Esposito characterise the locations and economic potential of settlements known through excavation, and then look to predict the locations of as-yet-undiscovered villas. Filling up the Sarno plain in this way demonstrates the economic potential of Pompeii's hinterland and contextualizes the evidence from the city for the processing and export of agricultural products. Of course, predictive models are only as good as the data used to

'train' them and this inevitably requires assumptions; for example, Florian Seiler, Sebastian Vogel and Domenico Esposito note a thin scattering of sites at higher elevations on the slopes of Vesuvius—are these traces of a more substantial occupation of these areas (underrepresented because archaeological work and accidental discoveries have focused closer to the city) or outliers of the main concentration on the plain? Not unreasonably, the authors assume the latter due to the limited availability of water on the volcano's slopes, but there is always the risk of circularity in such models. Nonetheless, a key result of the paper is the dense distribution of the modelled estates, mostly intervisible with their neighbours and only a few minutes' walk apart. As the authors rightly note, this has both economic and social implications including "a certain level of social control". Modelling agrarian landscapes is about much more than the quantification of crops.

Integration, connectivity and networks

All of these contributions, and the other papers in this volume, adopt case studies—specific urban hinterlands or individual monuments. Collectively, these raise issues of comparison, integration and scale. Firstly, how do we compare between these case studies to evaluate the similarities and differences? In some cases, the authors use generalisations of Roman agrarian organisation to interpret their specific contexts; does this risk homogenising the diversity of rural landscapes? Conversely, others concentrate on detailing the specifics of their case studies using bespoke methods, but how comparable are the results? Understanding the overall scale and organisation of the Roman economy requires the development of methods for rigorous comparison to draw out systematically the variability of rural landscapes. Above and beyond comparison, however, we also need theories and methods to advance the integration of these case studies. The individual urban hinterlands of Spain, for example, were connected to the demands of the city of Rome and the military frontiers. None of the papers here sets itself the impossibly ambitious task of addressing 'the' Roman economy, but all of their results are inevitably shaped by issues that extend far beyond the boundaries of any individual *territorium*. The decision to exploit certain soils or to plant particular crops was determined by a wider range of considerations than those experienced directly on the farm and amenable to modelling with environmental and climatological proxies.[2]

The paper by Silvia Cipriano and Stefania Mazzocchin, for example, points to the importance and potential of the integration of local case studies into wider models of the Roman economy. Like many of the other contributors, the authors concentrate on amphorae—this time, the Dressel 6A and 6B types from northern Adriatic Italy. Silvia Cipriano and Stefania Mazzocchin make use of an extraordinary assemblage of largely complete amphorae, preserved on account of their use as field drains (another reminder that amphorae could have useful lives after their original contents had been consumed). The authors are able to document relatively fine-grained shifts in the production and consumption of wine through the import and export of amphorae between the mid first century BC and the Flavian period. A brief window of local North Italic wine production during the Augustan age is particularly noticeable. During earlier and later phases, however, wine was imported from else, latterly from Picenum. The authors note the "impressive organization of production and marketing of wine" connected with the *gens Iulia* and imperial property in Picenum, but do not here investigate the mechanisms through which the economies of these two regions interacted and the consequent phases of expansion and contraction. It is these connections that allows this, and all the other case studies presented here, to contribute to wider debates about agricultural production and economy in the Roman world. These local cycles of growth and decline, opportunity and competition, animate

[2] E.g. Halstead 2014.

and articulate the wider Roman economy. The latter is often measured in terms of overall *per capita* growth, a single figure representing millions of lives and dozens of provinces, but it was in local rural landscapes that the variable effects of integration into the wider imperial economy—Roman globalization—were most visible and often most detrimental.[3]

The integration of the Roman economy also raises the theme of connectivity and the infrastructural and human networks that linked the producing and consuming regions of the Roman world. In terms of consumers, the two main groups that drove the long-distance supply of agricultural produce were the citizens of Rome and the soldiers of the imperial frontiers. In both cases, we can study the logistics of transporting oil from Baetica to Britannia or grain from the fields of Egypt to the Field of Mars—the ships, ports, routes, seasonality and journey times. It was, however, first and foremost social and political considerations that shaped such economic activities. Several papers directly address these issues. The central importance of Monte Testaccio has already been mentioned. The paper by José Remesal Rodríguez summarizes some of the results of 30 years' of excavation by researchers from CEIPAC and, in particular, the wealth of epigraphic evidence in the form of amphora stamps and *tituli picti*. Who and what, exactly, do these texts represent? Some scholars argue that the *tria nomina* stamps on Dressel 20 indicate the owners or managers of the *figlinae* that produced the amphorae; Remesal, however, argues that these individuals are, in fact, the oil producers. If correct, these stamps open up the interpretive possibilities as we connect not with the organization of pottery production, but rather with the agents and administration of the oil trade. This is the social network that created and directed the economic links between provincial producers and metropolitan consumers.

The other great consumer of the Roman world, the military, is the subject of the paper by Stephen Matthews. He uses the concept of 'service areas' around the Roman forts of the Dobrogea region, between the Danube and the Black Sea coast, to model the transport requirements for the supply of grain to the garrisons. Through quantification both of demand and of the costs of different transport methods (e.g. ox-wagon versus mule train), he is able to identify the cost-effectiveness of different supply arrangements. Matthews draws on a diverse range of sources to populate his model—from the Vindolanda Tablets to the Theodosian Code—illustrating the ingenuity required to patch together the evidence. The results indicate that mule-drawn wagons, as depicted on Trajan's Column, turn out to be the least efficient means of transporting bulky supplies. Matthews notes that this may reflect the different requirements of campaigning armies versus settled garrisons, but it may also indicate the role of display and propaganda—the conspicuous consumption of resources—and therefore the need for caution in combining very different sources of evidence. Matthews' models allow for the useful evaluation of different logistical solutions from least to most efficient; they cannot yet, however, demonstrate which of these options was used in reality. This does not invalidate the exercise for, as noted by Matthews and several of the other contributors, it is precisely the ability to make assumptions explicit and to evaluate the effects of changing variables that makes such modelling a valuable endeavour. The results, however, should not be confused with reality.[4]

Paul Gorton's paper also focuses on military sites but takes us to the post-Roman landscape of fifth-century Britain, by when not only Mediterranean imports of oil and wine had dried up, but even the use of wheel-thrown pottery and coinage. The communities based in the forts of the former Roman frontier, however, still needed to eat and Gorton examines the role of food supply to these

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[3] Witcher 2017a.

[4] For another recent example of modelling of transport and supply on the frontiers, see Weaverdyck 2019.

sites in terms of the 'shaping of power'. By examining the archaeological evidence for continuity of activity and shifting attention to storage and prestige structures at each fort, Gorton identifies different strategies used by the communities of each site to sustain themselves as local centres of authority. Although a very different context from that of the other papers in this volume, the attention directed to the social and political aspects of food supply in this particular case study is a reminder of the importance of these considerations in relation to all ancient economic activity.

Big data and quantification

A key theme linking several of the papers is the use of quantification and modelling. This allows us, for example, to appreciate the scale of demand and its impact on rural landscapes or the organization of the distribution systems required to move foodstuffs. At the same time, however, it is noticeable that as we move into the context of post-Roman Britain, and the quantity of evidence declines, so too the use of quantification drops away. This raises an important question. Are quantification and modelling deployed in order to handle the 'big data' available from the Roman period or, specifically, because the organisation of the Roman economy is particularly suited to analysis with modern concepts and methods. As Goodchild notes in her chapter, just because something *can* be quantified does mean that it *should* be quantified. Formalist techniques of quantification and modelling present a veneer of objectivity but, like any method, may shape results and predispose us towards certain interpretations of them. Quantification, for example, tends to focus on abundant categories of evidence such as amphorae, which are readily translatable into proxies of 'commodities' such as oil and wine. But these goods formed only one sector of a much wider range of economic activity—including cereal cultivation and animal husbandry—and, moreover, wine, oil and ceramics were not exchanged and used solely under commercial conditions. We only need think of the diversity of social contexts in which objects such as Dressel 2-4 amphorae were used to appreciate that commercial exchange was only one form of economic activity.[5] Wine amphorae and terra sigillata tablewares may only have behaved as commodities—that is, goods interchangeable with other goods of the same type—for a brief part of their much longer life-histories—as drainage channels or burial containers, cheap crockery or markers of distant contacts and social status. In other words, the very abundance of some categories of material culture might lead us to use methods that emphasise scale, complexity and connectivity in ways that we would not for other periods. The use of modern economic models to discuss the Roman economy,[6] for example, contrasts with the ways in which we talk about the Etruscan, Phoenician or early medieval economies. Recently, Astrid Van Oyen has argued that formalist methods are predisposed towards modernist interpretations of the Roman economy;[7] the concepts and tools of the present-day economist make it difficult (though not impossible) to recognize primitivist tendencies because the methods assume autonomous profit-seeking individuals, looking to maximize returns through economically rational use of resources. As a result, such analyses of the Roman economy quickly turn to questions of growth, performance and prices, separating issues of economy from social power. The relative ease with which we can now quantify the Roman economy can make it easy to forget about the imperial authority, the colonial control, the military interventions and the political necessities, that shaped economic activity. In practice, theoretical and explanatory models of the Roman economy have advanced beyond the binary primitivist versus modernist, and substantivist versus formalist, dichotomies.[8] Our models

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[5] Witcher 2017b.
[6] e.g. Jones 2014.
[7] Van Oyen 2017: 1357.
[8] e.g. Morris, Saller & Scheidel 2007.

therefore need to integrate people and power, information and institutions, as critical parameters in understanding the Roman economy. This involves developing more ambitious models that look beyond individual economic sectors characterized by the archaeologically prominent evidence for investment in specialist production, and the integration other economic sectors and the articulation of the structural links between them. How, for example, did viticulture in one region mesh with the agricultural production of neighbouring areas? Commercial wine estates worked by slaves required extra labour for the vintage; this could have been hired from local farms and villages with 'spare' labour or from nearby regions with capacity due to their different agricultural cycles. We have models to quantify wine production, but what component of a region's economic activity does this represent—in terms of land area, labour and wealth? How did this vary over time and how did the development of one region impact the development of another?

Finally, discussion of the role of labour is reminder that we should not to lose sight of the people—both collectively and as individual human agents—that underlie abstract concepts such as 'the economy'. Several of the papers emphasize the critical role of demography—or overall population size—in the organisation of agricultural production and the modelling of consumer demand. It is also important, however, to keep in mind the diversity of rural communities, looking beyond villa owners and their families to free, dependent and slave populations. The well-known difficulties of recognizing these groups archaeologically should not mean that they are neglected and the papers by Antoni Martín i Oliveras, Victor Revilla Calvo and José Remesal Rodríguez, and Florian Seiler, Sebastian Vogel and Domenico Esposito, and Helen Goodchild all hint at possible social dependencies in the rural landscape. Critical to developing this endeavour is the need to break the assumption that each rural site was at the centre of an independent estate operated along the lines of an idealized Catonian farm.[9] In turn, this opens the potential for more nuanced models of agricultural production that accommodate the variety of social and economic structural dependence.

The paper by Maria Coto Sarmiento, Simon Carrignon, Xavier Rubio-Campillo and José Remesal Rodríguez on the transmission of craft skills in the production of amphorae offers one example of how we can begin to think about the relationships between rural communities—in this instance, potters. Taking measurements of amphora rims from *figlinae* in Baetica, the authors use Principal Components Analysis to analyze slight variations in their forms and to relate these to models of skills transmission: vertical (i.e. without contact between *figlinae*) and horizontal (i.e. contact with other *figlinae*, declining with distance). Despite superficially appearing to be a highly standardized product, the authors identify systematic differences in the amphorae produced at individual workshops. They conclude that, initially, skills were transmitted vertically within individual *figlinae*, shifting to a horizontal model and the development of a wider network of potters that exchanged ideas and who moved to the nearby workshops to apply them. Approaches such as this permit insights into the human story of agricultural production and the communities of people that underpinned the Roman economy.

Coda

In contrast to the quantification and modelling techniques deployed by most of the other contributions to this volume, the paper by Andrea Guaglianone presents a more traditional topographical re-evaluation of the evidence for the location and form of the *porticus Minucia* at Rome. This detailed analysis of the rich but fragmentary archaeological, textual, epigraphic and antiquarian

[9] Witcher 2006.

sources is an example of the complex and specialist work that underpins so much of our knowledge of the ancient city and upon which synthetic accounts rely. More importantly, in the context of the present volume, this study of the *porticus Minucia* is a reminder that the supply of Rome involved not only the provision of efficient infrastructure for the transport and storage of foodstuffs—ports and granaries, roads and canals—but also the monumental display of the distribution of food to its citizens. We should not forget that Rome's population grew more or less to its greatest size well before the elaborate infrastructure of Portus was completed or the supply of Spanish oil began. As such, much of what we quantify—whether broken amphorae or the storage capacity of granaries—was not what was essential to supply the city with calories, but rather additional investment in the display of supply deemed necessary to the sustain the political regime.

And this brings us back to where we began, in Rome, with a mountain of sherds on the bank of the Tiber. A century and a half of archaeological research and 50 years of globalization have led us to an interpretation of Monte Testaccio, not as a monument to Rome's tributary empire, but rather as a monument to its complex and dynamic economy. Yet, whether understood as a statement of power or of economy, this 35m-high dump of broken amphorae remains a potent symbol of the city's ability to extract the wealth of distant landscapes to support its privileged citizens. The *mons manufactus* manifests both power and production, control and consumption. The Roman economy was a political economy.

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European Research Council

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