

Archeologia in Sicilia - Progetti di collaborazione internazionale

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ABSTRACTS

Alex Walthall (The Department of Classics at the University of Texas at Austin)

Reconsidering the Hellenistic Household: Reflections from the CAP Excavation at Morgantina (2014–2018)

This paper offers an overview of the work completed between 2014 and 2018 by members of the Contrada Agnese Project (CAP), a long-term research and excavation project conducted under the auspices of the American Excavations at Morgantina. Since 2014, the CAP excavations have focused on uncovering and studying the remains of an Early Hellenistic house, once located at the western periphery of the ancient city. From the outset of the project, the CAP team has made it among their principal objectives to investigate the functional diversity embodied in the ancient household by illuminating aspects of daily life that are frequently underrepresented in studies of domestic space in ancient Mediterranean contexts, such as diet, household industry, and opportunistic reuse/renovation. In this talk, I situate the house—its construction, use, and abandonment—against the dual backdrop of domestic architecture and urban development at Morgantina during the third and second centuries BCE. I consider the CAP house in light of the better-known peristyle houses that flanked the city's agora and discuss both how this building fits within the current framework of domestic architecture at Morgantina and how it offers new vantage points for future research. Throughout, I share a number of discoveries made in the course of the excavation and discuss how they have come to shape our understanding of the development and use of domestic space in Hellenistic

Sandra Lucre (American excavations at Morgantina)

Baths and Bathing at Morgantina: The North Baths and South Baths

The North Baths and South Baths at Morgantina were excavated under the auspices of the American Excavations at Morgantina. They constitute the most complete extant evidence of the high point of development, in the third century BCE, of Greek thermal architecture. This presentation focuses on the novel characteristics of design, technology, and decoration of these complexes, and the development of new related industries, that raised Greek baths and bathing culture to an unprecedented level of sophistication and leisure. The baths are discussed in the context of urban developments at Morgantina, and the mixed use character of the Contrada Agnese neighborhood where they are located, raising questions related to ownership, clientele, and the diverse use of urban space. As reflections of dynamic influences from Syracuse, the Morgantina baths are vivid manifestations of the lively culture of science, technology, and the arts that characterized the kingdom of Syracuse as a major Hellenistic center.

Vera Greco (Parco Archeologico Naxos Taormina)

Enhancing archaeology with architecture

One of the main objectives of my work as director of the Archaeological Park of Naxos Taormina was to enhance, that is to give value, to the extraordinary archaeological heritage it contains, for which it was established, the result of research and passion by illustrious Italian archaeologists, but also of research, excavations, and studies conducted by foreign institutes of archeology, such as the Finnish and Swedish institutes. Thanks to the collaboration with the Department of Architecture of Palermo, we continued the work conducted by Jari Pakkanen on the archaeological area of Naxos, returning a survey carried out with drone and 3D laser scanner of the whole area, and a masterplan in which each intervention it is integrated and organically integrated into a single cultural project.

The topography of Ancient Naxos, the discovery of the Arsenal, the cyclopean walls of entry to the ancient city with their watch towers, the relationship with the sea, the sanctuary, the temple, were the cornerstones from which the analysis started. resulted in the project idea. Instead the excavations carried out in Francavilla by Kristian Gorandsson, thanks to which a part of the ancient urban area of Francavilla was brought to light, triggered a process of valorisation, first of all with the demolition of the obsolete and inadequate structures for covering the excavations, innocent and onduline tubes, and a museum of the Palazzo Cagnone adjacent to the area, with the transfer of the finds belonging to the Park and coming from the Antiquarium, which will be followed by the study and the realization of a new covering to protect the finds and the green layout of the area, which, thanks to an agreement-agreement with the Alcantara River Park, will be directly connected to the nature trail of the river's springs, the so-called "Gurne", a landscape element of great beauty, an evocative environment that brings back the importance strategic of the river as a connection line for the ancient civilizations, and as a source of precious and indispensable nourishment for the inhabitants, the reason for the numerous Paleolithic and prehistoric settlements in the entire Alcantara region.

Maria Costanza Lentini and Jari Pakkanen (Il Parco Archeologico di Naxos & gli Istituti Finlandesi di Atene e Roma e con l'Istituto Svedese di Roma)

La cooperazione del Parco Archeologico di Naxos con gli Istituti Finlandesi di Atene e Roma: risultati e prospettive di ricerca

La convenzione tra Parco Archeologico di Naxos e Istituto Finlandese di Atene, poi ampliata all'Istituto di Roma, ha avuto una durata triennale dal 2014 al 2017. Ha prodotto risultati decisivi per la conoscenza dell'assetto urbano dell'antica colonia di Naxos, insieme mettendo in valore e notevolmente aggiornando la ricerca compiuta in oltre sessant'anni di scavo. Uno dei principali risultati è stata la produzione di una pianta geo-referenziata. Alle campagne topografiche (2015-2017 campagne di rilevamento 3D, dal 2017 con impiego di drone) si sono affiancate tre campagne geofisiche condotte dal Dr. Apostolos Sarris della Foundation for Research and Technology, Hellas (F.O.R.T.H.) Creta. Sono state condotte brevi campagne di scavo, e sviluppato un interessante progetto di archeologia ambientale relativo allo scavo di un pozzo di età classica. La cooperazione con gli Istituti Finlandesi ha, senza dubbio,

incrementato e migliorato la ricerca dell'antica colonia Naxos, contribuendo con la sua multidisciplinarietà alla valorizzazione dell'antico territorio urbano. Alla luce di questi risultati è in corso di stipula una nuova convenzione che permetta di proseguire e ampliare la ricerca appena conclusa. Il programma prevede la prosecuzione delle escavazioni nel sito con particolare riguardo al versante meridionale delle mura di cinta. Il programma mira ad accrescere la conoscenza dell'antica Naxos, nel contempo dotando il parco di nuovi percorsi di visita per una sua più completa fruizione.

Kristian Göransson (Swedish Institute in Rome)

Francavilla di Sicilia. A Greek settlement in the hinterland of Naxos

This paper offers a preliminary presentation of the excavations undertaken at Francavilla di Sicilia between 2016 and 2018 by the Swedish Institute in Rome in collaboration with the Parco Archeologico di Naxos Taormina. Francavilla di Sicilia is located in the Alcantara Valley, 20 km inland from Giardini-Naxos, on the northern slopes of Mount Etna. The excavations take place on a plot of land by the Palazzo Cagnone owned by the Comune di Francavilla. A geophysical survey was done for the project by The British School at Rome in 2016 in order to establish where to open the trenches. Walls, tiles from collapsed roofs and large quantities of pottery and other finds dating to the 5th century BC have been unearthed in the three seasons undertaken so far. The results of the project will be set into a wider framework of ancient north-eastern Sicily as well as discussed in relation to previous archaeological work in at this anonymous Greek settlement dating to the Archaic and Classical periods.

Jonathan Prag & Lorenzo Campagna (Faculty of Classics, University of Oxford & Università degli Studi di Messina)

The Halaesa Archaeological Project: the Sanctuary of Apollo

Since 2017 a joint project of the Universities of Messina and Oxford has been undertaking annual campaigns of excavation and study of the northern 'acropolis' of the ancient site of Halaesa (Tusa, Province of Messina), with the support of the Soprintendenza BB.CC.AA. di Messina, the Polo Regionale di Messina per i Siti Culturali, and the Museo Regionale delle Tradizioni Silvo Pastorali di Mistretta, as well as the Comune di Tusa. This paper will present a preliminary report of the findings to date. The northern hill, 240m a.s.l., is the high point of the ancient city, and has traditionally been identified as the site of the Sanctuary of Apollo, attested in ancient literary and epigraphic sources. The summit of the hill forms a north-south ridge, on which can be identified the remains an artificial platform c.4.5m high x c.40m long x c.17m wide. Work to date, concentrated in three areas, has identified an access ramp at the southern end and the traces of at least three structures on individual podia (oriented E-W) on the top of the platform; at least one of these took the form of a Doric temple. At present it is not possible to offer secure dating for these structures. Further work is planned to clarify the phases and form of the platform and its superstructures, as well as the surrounding sanctuary area.

Roksana Chowaniec

Multidisciplinary studies on the ancient town of Akrai/Acrae, Sicily. Ten years of Italian-Polish collaboration (2009-2019)

The presentation will be focused on multidisciplinary studies on the ancient Akrai/Acrae, located in the Hyblaean Mountains of SE Sicily, and on direct vicinity of the urban center. The town founded in 664/663 BC, developed while centuries, with an intense architectural boom in the second half of 3rd c. BC and after the fall of the mother-colony Syracuse in 212 BC, later incorporated into the Roman province, has functioned till Late Antiquity.

The recent excavations, based on the cooperation between the University of Warsaw and the *Polo Regionale di Siracusa per i siti e i musei archeologici*, represented by Dr. Maria Musumeci and Dr. Rosa Lanteri (earlier Soprintendenza BB.CC.AA. di Siracusa) reveal the remains of a Late Hellenistic-Roman households, showing various stages of redevelopment and usage, with especially clear-cut after the 50s–70s of 4rd c. AD, and late Roman-Byzantine layers (residential area was redesigned and transformed into the zone of domestic craft activities). Thanks to interdisciplinary research, methodical excavations and archaeometric analysis, the studies here go beyond architectural research. The excavations were preceded by non-invasive investigations (geophysical investigations, geodetic analysis, aerial photography and photogrammetry, survey) and some of the activities are regularly repeated.

The rich and long history of town brought very interesting material permitting the studies on ancient dietary and environment. Through osteological, archaeobotanical, lipid and isotopic analysis, as well as observation of the artefacts (pottery, glassware, kitchenware, and tools) it was possible to find the majority of interesting and hitherto unknown facts on culinary preferences of inhabitants and their environment, despite the early stage of research. The works are also focused on understanding the exploitation of landscape and raw materials in town and its vicinity (building activities, pottery production, farming, planting, manufacturing, water supply, etc.).

The excavations campaigns and research are subsidised by the Polish National Science Center (no. UMO-2016/21/B/HS3/00026) the Ministry of Science and Higher Education (no. 4815/E-343/SPUB/2018/1), the American Numismatic Society.

Peter B. Campbell, Sebastiano Tusa, William M. Murray, Adriana Fresina, Cecilia Buccellato, Francesca Oliveri, & Mateusz Polakowski

The Battle of the Egadi Islands, 241 BC: 2017-2018 Results

The First Punic War (264-241 B.C.) was fought primarily at sea. The deciding battle occurred on 10 March, 241 B.C., when the Roman fleet met the Carthaginian force as it sailed from Marettimo toward My Eryx. The Roman victory was so decisive that Carthage sued for peace, thus ending the war. From 2005-2015, a collaborative project between the Soprintendenza del Mare and RPM Nautical Foundation identified the site of the battle. 11 warship rams, over a dozen helmets, and hundreds of amphoras mark the location of the battle. From 2017-2018

the project entered a second phase, a collaboration between the two partners and Global Underwater Explorers. These two seasons have located 8 additional rams, as well as more helmets and amphoras. These new finds continue to delineate the battle zone and inform us about the conflict that took place there. The survey is creating a detailed map of the battle and providing new insights into ancient naval warfare.

Justin Leidwanger (Stanford University), Elizabeth S. Greene (Brock University), Leopoldo Repola (Suor Orsola Benincasa University), and Fabrizio Sgroi (Soprintendenza del Mare)

The Marzamemi Maritime Heritage Project: From Seabed to Museum and Beyond

Timmy Gambin (Archaeology Centre, University of Malta)

Collaborative work off Sicily's Coasts - Five years of underwater research

Michael Kolb (Dept. of Sociology and Anthropology Metropolitan State University of Denver)

The Salemi Survey Project. Long-term landscape change and political consolidation 3000 BC - AD 600

Landscape archaeology conducted in the communities of Salemi and Alcamo have tracked long-term landscape change as well as identified overlapping networks of economic interaction at both local and regional levels. The agricultural and commercial role of interior western Sicily has always been of vital importance to foreign colonizers and indigenous communities alike, as the Late Bronze and Early Iron Age settlements, mainstays of indigenous development and political consolidation, gave way to Elymian, Roman, and medieval polities. The use of systematic nested survey, geomorphic analysis, and excavation, serve to describe spatial arrays of material culture that span 1,000 years and illustrate the complex historical tapestry of colonization and conflict in the region.

Emma Blake & Rossella Giglio (University of Arizona & Soprintendenza dei Beni Culturali di Trapani)

Mapping cross-channel connections: the Marsala Hinterland Survey

The Arizona Sicily Project is an intensive pedestrian survey in the coastal territory between the Sicilian cities of Marsala and Mazara del Vallo. The project, which began in 2018, focuses on a key feature of this territory: its proximity to North Africa. This zone is the closest point on the island to North Africa, separated from Tunisia by 145 km of water. The project's primary research aim is to document the quantities of North African imports to western Sicily in all periods, in order to reconstruct North African connections to the peoples of this part of the island. Previous work in the region has demonstrated high numbers of North African artifacts in western Sicily in punctuated periods from the Paleolithic onwards, but this project is the first to attempt to document and quantify those contacts over all periods, to understand the deep history of these relations, and how they distinguish the western third of the island from other parts of Sicily. The Arizona Sicily Project is conducted in collaboration with the Soprintendenza dei Beni Culturali di Trapani.

Antonella Mandruzzato – Martina Seifert – Debora Oswald (Università degli Studi di Palermo & Universität Hamburg)

The Archaeological Map of Lilybaeum

“Archaeological maps are, by definition, a tool for the management of the cultural heritage, planning and urban development” (L. Rocha – G. Branco, *Archaeological maps: methods and techniques for territorial analysis, ArcheoSciences* 33 (suppl.), 2009, 141). The ‘Archaeological Map of Lilybaeum’ is the result of the long-standing scientific cooperation between Palermo and Hamburg Universities in Marsala.

This paper investigates the various methods of field research that have been used to gather the necessary data for the archaeological map of ancient Lilybaeum. The methods covered in particular will be topographical (geodetic) survey and aerial survey by Remotely Piloted Aircraft Systems (RPAS, better known as ‘drones’). Our aim is to explore the impact of the results obtained from these different methods on already existing research hypotheses and the ways in which the resulting map enhances our knowledge of the ancient city of Lilybaeum.

Christian Mühlenbock (Lödöse Museum)

Monte Polizzo – 20 years later

A little more than 20 years ago the Scandinavian Sicilian Archaeological Project was initiated as a co-operative large scale international archaeological project. The main target for the investigations was the hilltop settlement Monte Polizzo. The site was presumably the home of an indigenous group, the Elymians who generally inhabited the interior of western Sicily where they formed a conglomerate of interconnected settlements, often placed on high ground where the inhabitants enjoyed a commanding view of the surrounding landscape. One of the

main aims with the project was to examine the impact from Greek and Phoenician colonization on the local society. Therefore, a broad spectrum of archaeological contexts were examined simultaneously. Here, I will mostly focus on the settlement data from five excavated houses. The habitation data from Monte Polizzo is unique in a west Sicilian setting the sense that it is one of very few sites from where we have comprehensive data from so many different and, contemporary contexts. The evidence indicates that key element in the social and political organisation of the community in question were centred around the house as an arena for social and political negotiations and competition. The house was not only a home in the strictest sense of the word; it was also a place for domestic production and a place intended for more public displays such as exquisite feasts. Ample evidence of house rituals and religious practices indicates that the house was a place for both worship and cult. There is also a strong sense of the past visible in both architectural features and objects. In this sense the society at Monte Polizzo encompass some major similarities with a house society as defined by Claude Levi-Stauss. Here it is suggested that the Greek and Phoenician neighbours triggered a rapid change that largely was harboured in the confines of already existing local traditions and practices.

Cecilia Sandström (University of Gothenburg)

The importance of environmental settings and river navigability for the Monte Polizzo area, 600-500BC

The aim of this presentation is to highlight the importance of environmental settings and river courses as main factors determining early Elymian trade patterns. The specific focus is how the Elymians on the settlement of Monte Polizzo engaged with their environment, with the explicit regard to rivers, as rivers could provide easy access to the sea and global trade markets. The importance of these rivers for inner network transactions is also emphasized. Could the watercourses near Monte Polizzo have been navigable and used as transportation routes between different settlements in the area? Interesting geomorphological settings and their impact on river navigability will be discussed. The rivers that originate near the settlement are the Cúddia River, Mazaro River, Délia /Grande and the River Caldo and Freddo.

Peter Day and Veronica Testolini (University of Sheffield)

Inter-disciplinary research in the Trapani Mountains: the MEMOLA FP7 Project

The Trapani Mountains project was developed in the context of a wider European project (MEMOLA: MEditerranean MOUNTainous LANDscape FP7) and provides an example of a successful international inter-disciplinary collaboration in Sicily, with partners from UK, Spanish and Sicilian Institutions (Archaeology Department. University of Sheffield; Archaeobotany laboratory of the Consejo Superior de Investigaciones Científicas (CSIC)- Spanish School at Rome; Earth Science Department. University of Palermo; Arqueoandalusí. Arqueología y Patrimonio S.L.). The project consisted of a landscape survey that employed a traditional systematic collection of findings coupled with the characterisation of anthropogenic soils using high definition chemical analysis (HHpXRF), a particular focus of such survey was the transition from the Late Antique to the Medieval period, a time of cultural

change in the territory with the establishment of new Islamic rulers. The preliminary results of the survey indicate the site of Pizzo Monaco as an interesting feature in the territory worth of a stratigraphic investigation; in addition to the excavation a detailed soil survey of the site, and a macroscopic and microscopic study of ceramic materials were carried out.

The inter-disciplinary collaboration between different institutions and the methodology consequently developed allowed to reconstruct some aspects of the landscape use, the settlements chronology, the use of local raw materials in ceramic production; and also helped to shed light on everyday life in the settlement of Pizzo Monaco. These results were employed to inform local communities, but also EU policies on the use-efficiency and conservation of cultural landscape.

Martin Mohr (Institut für Archäologie, Universität Zürich)

The gymnasium of Ietas Discovered? New Excavations in the Eastern Quarter on Monte Iato

The lecture presents the new focus of the research project of the University of Zurich on Monte Iato in the context of the excavations undertaken since 2012 above the Peristyle Houses E1 and E2 in the eastern quarter. On the basis of the latest research, it can be shown that in the late 2nd or early 1st century BC a monumental building was attached to an already existing room furnished with exceptionally well-preserved wall paintings in the First Pompeian style. It was at that time that the older room was converted into a cookshop (*thermopolium*). The monumental building arguably covered an area of more than 1'100 square metres and was made accessible via a path leading to the monumental main entrance of the building. The southern part of the building is characterised by its mighty substructures as well as the complicated and meticulous construction of an elaborate internal and external ducting system. This must have served to channel away considerable quantities of water from possibly a well or maybe even baths situated in the building's interior. The prestigious character, the technical effort invested in the building, as well as its specific topographic situation and its association with a *thermopolium*, raise the question whether it may have been a public building, perhaps even the *gymnasium of Ietas*.

Prof. Dr. Elena Mango (University of Bern)

The Himera Project of the University of Bern – A collaboration with the Parco Archeologico di Himera

The Himera Project of the University of Bern Himera was initiated thanks to an invitation from the Director of the Archeological Park of Himera in 2012, Dr. F. Spatafora, and accompanied by a quinquennial convention that has been prolonged for an additional five years. The Project concentrates on the Piano del Tamburino, an elevated plain next to the Piano di Imera with the so-called Upper City. The location of the Piano del Tamburino within the colony as well as its topographic morphology represent ideal conditions for urbanization – an urbanization which has begun to take on shape and dimensions through our research. The results to date from our multidisciplinary approach and pursued by seven excavation

campaigns so far have provided new insights about the environment and development of the Piano del Tamburino, that will contribute to a new understanding of the cultural landscape of the city and, consequently, of its importance within the colonial network.

Christoph Reusser (Institut für Archäologie, Universität Zürich)

The Research Project of the University of Zurich on Monte Iato (Palermo) – The Last Ten Years and a Glimpse into the Future

The lecture focuses on the work conducted on Monte Iato over the last ten years by the team from the University of Zurich. Our excavations and studies are not limited to the ancient phases of the city but also take into consideration the very important mediaeval, Arab period of the site. The excavation campaigns concentrated on buildings in the western quarter, the city centre with the agora and a new area that was opened above the well-known eastern quarter. The excavations, mostly limited to areas already studied during earlier campaigns, were directed by specific questions relating to chronology, possible architectural reconstructions and the evaluation of building phases. Important new results have been gained regarding the chronology of several public and private buildings and the importance of the site in the Late Republican period. The western part of the plateau, which until now had never been investigated, has since been surveyed by an British team.

As regards material studies, extended work has been conducted on the local painted and unpainted archaic pottery, the large number of finds from a shop on the southern edge of the agora and the metal finds dating from the Archaic, Hellenistic-Roman and especially the mediaeval period. Gas-chromatography and FTIR analyses have given new insights into the use of specific Archaic vases and the content of transport amphorae from the site.

Birgit Öhlinger and Erich Kistler (Universität Innsbruck)

Between the Late Archaic House and the ‘Aphrodite temple’«. After ten years of Innsbruck archaeological investigations at Monte Iato

For almost ten years the University of Innsbruck has been exploring the area between the Late Archaic House and the ‘Aphrodite temple’ in the western quarter of the ancient settlement at Monte Iato (Western Sicily). Besides the investigation of the post-archaic phases, the main focus of research lies on the archaic period dealing with the following questions: How, when and why did the Late Archaic house with its elaborate banqueting rooms and the so-called ‘Aphrodite temple’ become connected in cult-topographical terms? How does the change of the later from an indigenous feasting house in Greek design to a proper temple with an altar in the front go along with that? And how can these changes be explained against the background of increasing interactions with the world of the Greek and Phoenician coastal cities of western Sicily. On the basis of our architectural investigations we attempt to provide answers to these questions on the formation and transformation processes of this central cult area of the indigenous Monte Iato.

Johannes Bergemann (Georg-August-Universität, Göttingen)

Sicily in the Iron Age and the concept of Greek Chora

As χώρα is generally referred to the surrounding area of a Greek πόλις. The terminology is relatively clear, even if there are a few terminological deviations. But what makes the chora? How do χώρα and εσχατιά develop in the findings of archaeological surveys? Three Göttingen projects in Gela, Monti Sicani and Kamarina have investigated coastal and inland areas with comparable methods. The comparison gives new clues for a concretization of χώρα and εσχατιά. The paper will give an overview of the activities of Göttingen University in Sicily in field archaeology, colloquia and publications

Jonathan Prag (University of Oxford)

Sicily: an open access digital corpus of Sicilian epigraphy

I.Sicily (<http://sicily.classics.ox.ac.uk/>) is a TEI-XML EpiDoc (<http://epidoc.sourceforge.net>) corpus, hosting full digital editions of all the inscriptions, in all languages, from ancient Sicily (7th cent. BC – 7th cent. AD). The project currently publishes records for over 3,250 lapidary inscriptions (approx. 75% of the estimated total), including extensive metadata about the inscription's material form, archaeological context, and publication record (further information on the project at <https://isicily.wordpress.com>). Central to the undertaking is the work of (re)cataloguing all the inscriptions on the island (the principle of autopsy), and a major focus of the project is collaboration with the museums and collections of the island. The project maintains a database of museum collections (<http://sicily.classics.ox.ac.uk/museums>), publishing individual museum catalogues, and as part of the collaboration has assisted in the curation of epigraphic exhibitions at Catania, Halaesa, and Siracusa. Collaborative work has already been undertaken with museums and archaeological authorities in Siracusa, Catania, Messina, Agrigento, Palermo, Termini Imerese, and a number of smaller collections such as Halaesa, San Marco d'Alunzio and Cefalù. The project places a heavy emphasis upon collaborative study and publication, as well as open access to data, and this presentation will illustrate the current state of the corpus, and outline both the opportunities and the challenges which such an approach brings.

Martin Carver, Girolamo Fiorentino & Alessandra Molinari (The University of York, Università del Salento & Università degli Studi di Roma "Tor Vergata")

Food and Agriculture under changing regime. Sicily between 6th to 13th c. A.D. (ERC Project 693600 SicTransit - 2016-2021)

Sicily in transition investigates and try to explain the experience of ordinary people during changes in government. The project focuses on Sicily between the 6th and 13th century, during which time power changed hands from Byzantine, to Arab to Norman to Swabian authorities. Our objectives are to demonstrate how social structure, settlement, agriculture, trade and demography changed using the methods of archaeology, bioarchaeology and

biomolecular archaeology, and so to draw general lessons on which factors were most significant in the promotion of well-being, tolerance or strife.

For the Rome seminar (April 2019) we would like to concentrate on some of the results of our project, that can be specially related on the production, consumption and trade of food. This could include the study of the whole territory of Castronovo di Sicilia (Palermo) from 5th to 13th c., the transformations of the exchange networks of Sicilian foodstuffs in the same period and the introduction of new plants during Islamic times (the so called green revolution).