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Tadrart Acacus Rock Art Sites

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Introduction

The Tadrart Acacus is a sandstone massif range located in the southwestern side of Libya, in the core of the Sahara, close to the Algerian border. The area is today a harsh and dry landscape, inhabited by a few Tuareg families, but it has not always been a desert. During the humid climatic fluctuations occurring particularly in the Holocene, the area was greener and suited for animal and human life. Evidence of the ancient occupations is spread all over the massif and the neighboring areas in the form of open-air sites (isolated finds, scatters of artifacts, or megalithic structures) as well as stratified archaeological deposits preserved in rockshelters and caves. It is in these same contexts that one of the richest concentrations of Saharan rock art is hosted. In 1985, the rock art sites of Tadrart Acacus were inserted in the UNESCO list of World Heritage Sites as an example of "a unique or at least exceptional testimony to a cultural tradition or to a civilization which is living or which has disappeared" (Criterion III: http://whc.unesco.org/en/criteria/).

Definition

Rock art sites of Tadrart Acacus represent an outstanding record of ancient human groups who lived in the central Saharan region during the Holocene, from the early hunting-gathering communities to the emergence of the first Pastoral society, to the development of the Garamantian state (Mori 1965; Barich 1987; Muzzolini 1995; Cremaschi & di Lernia 1998; Le Quellec 1998; Liverani 2005), until the Tuareg occupation (Biagetti & Chalcraft 2012). The subjects and scenes are painted and engraved on cliffs, isolated boulders or on the walls of rockshelters, and in the rare deep caves. They mainly represent animals and humans, both isolated, in groups and performing daily or ritual activities. Set into the wider archaeological and paleoclimatic framework, rock art adds important elements to the reconstruction of the environmental, sociocultural, and ideological dynamics of the past cultures.

Key Issues/Current Debates/Future Directions/Examples

Discovery and Outline of Research

The presence of rock art evidence from the Sahara was first reported by European militaries and travellers crossing the region since the late nineteenth and the mid-twentieth centuries.

C. Smith (ed.), *Encyclopedia of Global Archaeology*, DOI 10.1007/978-1-4419-0465-2,

Anyway, until recent times, the Tadrart Acacus massif was almost unknown to the international community.

In 1894, F. Foureau reported the first notice about the presence of engravings in the area; in 1926, the Abbé Breuil and his collaborators published the site of In Ezzan, located southeast of Ghat, and about two decades later Paolo Graziosi worked in the southern areas of Selfufet, In Arrechin, and Tachisset (all sites today in the Algerian Tadrart – Graziosi 1942). In 1955, Fabrizio Mori crossed the western cliff edge of the Acacus, discovering the prehistoric paintings and engravings hosted on the walls of rockshelters and caves. Mori's team explored and documented the northern and central area of the massif, focussing on the area of Ti-n-Lalan (1955–1959), and later mainly on the central and southern wadis. Since 1960, for the first time in North Africa, the study of rock art was supported by excavations, a modern multidisciplinary approach and new methodologies, including radiocarbon dating (Mori 1965).

In the 1990s, the research in the area was characterized by a new territorial scale, aimed at enhancing the knowledge of the paleoenvironmental and sociocultural dynamics occurring in the massif and its surroundings (Cremaschi & di Lernia 1998; Mori 1998). The conservation issue was one of the research topics of this phase. Since the 2000s, the main aims of research are devoted to a landscape approach and to the contextualization and systematic recording of the rock art. Emphasis on the state of preservation led to identify various causes of decay due to natural and anthropic factors (Cremaschi et al. 2005; di Lernia & Zampetti 2008). Huge efforts are directed towards active actions for the preservation and management of the rock art sites and the wider cultural landscape of the Tadrart Acacus, to tackle the changes taking place in Libya (Cremaschi et al. 2005; di Lernia 2006; di Lernia & Gallinaro 2011).

Nature and Location of the Art

The Tadrart Acacus is dissected by a fossil drainage network resulting in wide valleys and deep canyons –relicts of a landscape shaped by the tertiary equatorial climate – where prolonged processes of fluvial and pseudo-karst actions caused the formation of rockshelters and caves. These morphological features, located on terraces at different altitude along the steep slopes flanking the wadis and canyons, hosted the human groups since the Late Pleistocene (Cremaschi & di Lernia 1998).

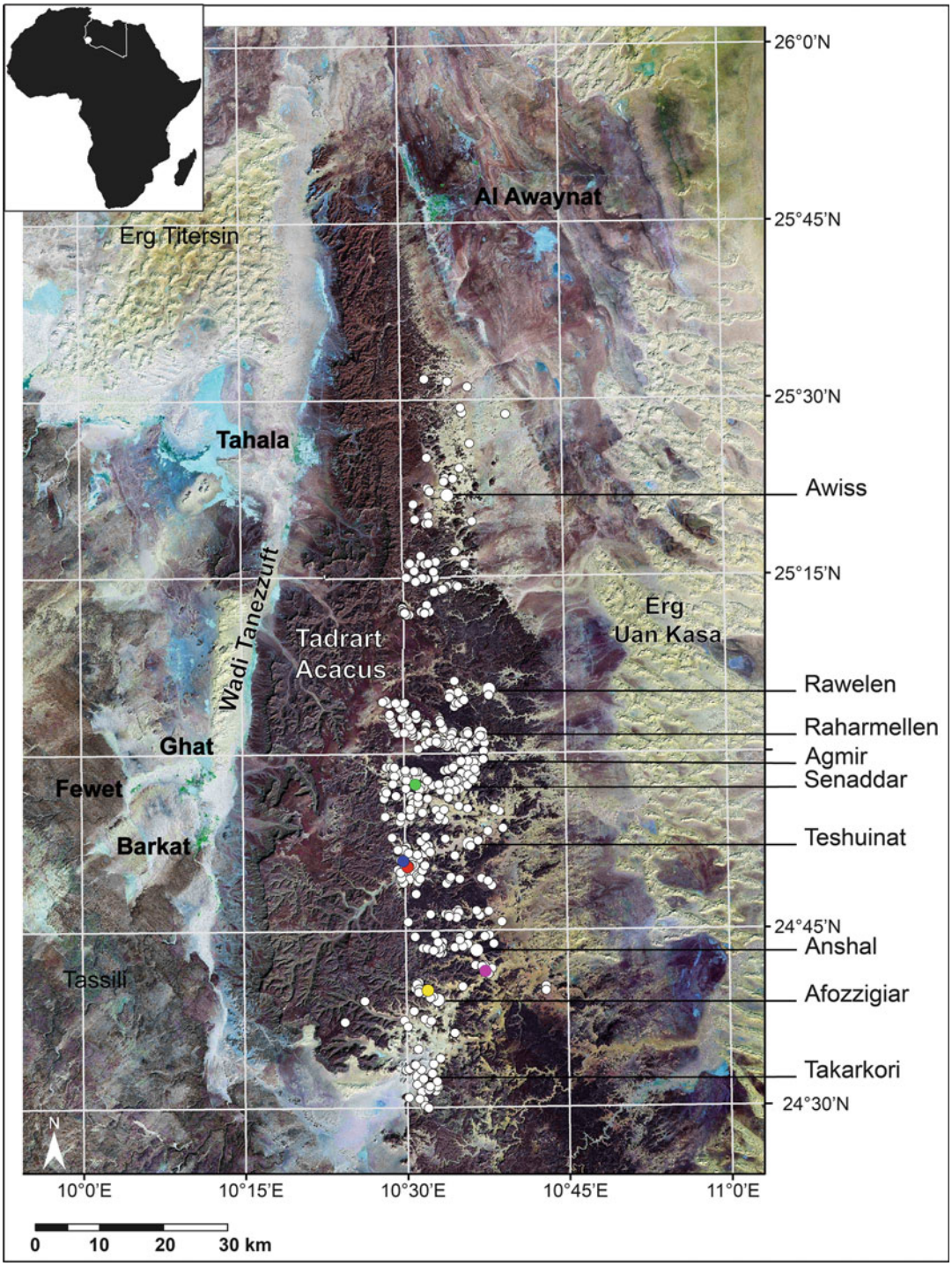
Rock art in the area takes the form of both paintings and engravings and occurs on the walls of the rockshelters and in the rare caves, as well as in open-air locations like cliffs or isolated boulders.

Nearly 500 rock art sites have been recognized in the whole massif (di Lernia & Gallinaro 2011), with a major concentration on the eastern side and inside the major wadi systems (Fig. 1). Rock art sites reflect the geomorphological settings of the massif: small shelters and rock walls characterize the northern area, whereas the presence of a more complex fluvial network in the central and southern areas favored the formation of a higher number of wider rockshelters and caves.

Around 80 % of rock art is presently found inside the rockshelters – which are partially protected from sunlight and main weathering factors – mainly located close to the wadi bottom. The cliffs and the isolated boulders host almost exclusively engravings. The artworks occur as isolated subjects, scenes, or, most commonly, palimpsests of overlapping subjects or scenes differing in technique, style, and chronology.

Styles and Chronology

The definition of styles and their chronology represents one of the main traditional topics of rock art research. In the Central Saharan massifs, including Tadrart Acacus and the nearby Messak Settafet in Libya and the Algerian Tassili N'Ajjer, the debate has been particularly heated, thanks to the richness of the evidence and the intensity of research. The main controversy spreads about the definition of the chronological depth of the rock art. A long chronology proposed by Mori (1965) was opposed by a short one mainly developed by Muzzolini (1991).



Tadrart Acacus Rock Art Sites, Fig. 1 Satellite image of the Tadrart Acacus, SW Libya, showing the distribution of rock art sites (GIS elaboration of M. Gallinaro – base map: Landsat imagery)

Mori identified the earliest rock art as a Late Pleistocene/Early Holocene production, realized by hunter-gatherers, whereas Muzzolini referred all the rock art evidence to the Holocene, starting with the Pastoral Neolithic. Until recently, the arguments were mainly based on the animal portrayed, stylistic and iconographic considerations, the presence of patina and superimpositions, while few archaeological or environmental data were analytically considered. Even if a precise chronology is still unavailable, the recent archaeological and paleoenvironmental investigations in the area and its surroundings are contributing to better fix the crono-cultural associations of the rock art, suggesting a development at least along the entire Holocene, since pre-pastoral times (Cremaschi et al. 2008; di Lernia & Gallinaro 2010). The definition of "styles" here proposed takes into account the terminologies used by Lhote (1958) and Mori (1965). The proposed chronology is correlated with the main phases of human occupation archaeologically recognized in the last decade of multidisciplinary research. The "styles" can be summarized as follows (*contra* – both terminology and chronology – Muzzolini 1991; Le Quellec 1998):

– *Wild Fauna*: only engravings representing wild animals, typical of more humid, southern environments. Big mammals like elephants, rhinoceros, giraffes, wild bovids, and rarely felines and reptiles are represented, isolated, or in groups. These subjects are often represented almost natural size and occur on cliffs and rockshelters located at the wadi bottom. The sites are widespread in the central wadis of the massifs, with a main concentration along the wadi Rahrmellen. On the basis of superimpositions, the nature and weathering of the rock varnish, the type of subjects, and specific stylistic aspects, these engravings are thought to be the earliest form of Saharan rock art. There are possible cultural associations with Early Acacus hunter-gatherers, archaeologically dated to the beginning of the Holocene, after the hyperarid Pleistocene phase (*ca* IX millennium BCE). A type site of the Wild Fauna Style is Ti-n-Ascigh, a rockshelter located along wadi Senaddar (Fig. 1: green dot), where a wide panel with a complex superimposition of engravings shows subjects referable to different styles, from the Wild Fauna to the *Tifinagh* inscriptions (Mori 1965; Cremaschi et al. 2008).
– *Round Heads*: paintings and some engravings decorating the walls of rockshelters and caves. Anthropomorphic figures with rounded heads are often associated with wild animals, especially Barbary sheep and antelopes. The traits are steady; the figures are generally represented in profile and can be realized with different techniques: a simple contour, in flat color, or polychromy. This "style" is characterized by the presence of hunting scenes and complex scenes of dance and ritual activities, traditionally referred to a sacred and symbolic sphere. The Round Head artworks are spread all over the massif, with major clusters along the middle course of wadi Teshuinat and the southernmost wadis. The Late Acacus foragers, performing a delayed use of food and a first taming of the Barbary sheep (di Lernia 2001), radiocarbon dated in the area to around eighth–seventh millennia BCE, represent a possible cultural and chronological frame for this art form. The painted couple of Afozzigiar I (Fig. 2), a rockshelter in the middle course of the eponymous wadi (Fig. 1: yellow dot), is a masterpiece of this style (Mori 1998: 191–192; Gallinaro et al. 2008: 218–220).
– *Pastoral*: paintings and engravings representing the most common type of rock art, with thousands of sites throughout the Sahara. The main subjects refer to domestic cattle and pastoral life. Scenes of daily activities, as well as milking and management of herds, alternating with hunting or ritual scenes, emphasize the complexity of these pastoral groups. The artworks are in naturalistic style in flat color or polychromy; the subjects are reproduced in various attitudes and with many details like body paintings, clothing, and hairstyles. Pastoral rock art contexts are nearly 50 % of the total; they are widespread all over the massif with dense concentrations

Tadrart Acacus Rock Art Sites, Fig. 2 Couple in Round Head style painted in Afozzigiar I rockshelter (Photo © The Italian Archaeological Mission in the Sahara)

along the main fluvial systems. Indications from excavations both in the Tadrart Acacus (Mori 1965, 1998; Dunne et al. 2012) and Messak, together with radiocarbon determinations on paint samples (di Lernia & Gallinaro 2010, here references), indicate the fifth millennium BCE as the apex of this art style. On the basis of archaeological data, it is possible that this style lasted from around sixth to mid-third-fourth millennium BCE. Uan Amil cave, along wadi Teshuinat (Fig. 1: red dot - Mori 1965: 124–131; Gallinaro et al. 2008: 157–163), is one of the most famous rock art sites of Pastoral style (Fig. 3).

– *Horse/Bitriangular*: mostly paintings with some engravings. This style features the bitriangular geometric representation of human figures in flat color and records the appearance of domestic horses. Humans are engaged in different activities: pastoral scenes, domestic activities, and conviviality, often in an oasis context, alternate with hunting/war scenes with flying gallop chariots, or fights were humans wield spear or lance. The artworks are mainly located on the walls of rockshelters and are widespread over the whole massif, with major clustering along the central and southern wadis, especially along the course of wadi Senaddar. The represented scenes reflect the final phases of the Pastoral period and the early Garamantian culture, approximately between the mid-third millennium BCE to first millennium BCE. The chariot of T-Afozzigiar-t site (Fig. 4), along the eponymous wadi (Fig. 1: pink dot), is a good example of this style (Mori 1998: 219; Gallinaro et al. 2008: 210–211). The earliest occurrence of Libyco-Berber inscriptions has been dated to this phase, as first testimony of writing (e.g., Liverani 2005). Those texts carved or painted on the stone walls of the Tadrart Acacus are anyway hardly datable with precision: they cover a long chronological span, ranging from Garamantian to present times and to present day, as "Tifinagh" alphabet is still used by local Tuareg groups (Biagetti et al. 2012, here references).
– *Camel*: widespread style, featured by the representation of camel (*Camelus dromedarius*). Bitriangular highly stylized, human figures, flocks of goats, caravans, palm trees, and hunting or battle scene, painted or engraved, are the typical subjects represented. The high schematism and the low accuracy of the representations and its late date determined a scarce interest by the scholars. The phase is traditionally associated with the classic and final phases of Garamantian culture (third century BCE to sixth century CE), but a more appropriate study of the evidence can open new scenarios about the most recent phases of the massif's occupation. Ti-n-Abrukin site, along wadi Teshuinat (Fig. 1: blue dot), shows a heterogeneous set of paintings in different styles, where Camel artworks are well represented (Fig. 5 - Gallinaro et al. 2008: 170–174).

Tadrart Acacus Rock Art Sites, Fig. 3 Hairdressing scene in Pastoral style in Uan Amil cave (Photo © The Italian Archaeological Mission in the Sahara)

Tadrart Acacus Rock Art Sites, Fig. 4 Chariot in Bitriangular/Horse style, painted in T-Afozzigiar-t rockshelter (Photo © The Italian Archaeological Mission in the Sahara)

Threats to the Rock Art

The rock art is by its nature one of the most fragile aspects of the cultural heritage. It is affected by natural and anthropic threats that can continuously damage it, and the Tadrart Acacus rock art sites are not an exception. Natural factors, like erosional and chemical processes, determined, according to recent estimates (Cremaschi et al. 2008), the vanishing of nearly 50 % of the artworks. High risks have been represented by the uncontrolled access to the sites by thousands of tourists and even scholars, washing, scraping, and touching the art, therefore accelerating the natural process of vanishing. Vandalism has been recorded as well. Several actions to reduce these threats have been proposed and partially realized, but the major project to create a National Park has never been implemented (di Lernia & Gallinaro 2011, here references). The isolation

Tadrart Acacus Rock Art Sites, Fig. 5 Caravan in Camel style along the rock wall of Ti-n-Abrukin rockshelter (Photo © The Italian Archaeological Mission in the Sahara)

of the region, after the 2011 uprising in Libya, represents a new and uncontrolled threat to the heritage.

Future Directions

The future direction of the research is twofold: a main immediate action has to be directed to the preservation, restoring and monitoring of the rock art, and their management should directly involve the local communities. On the side of rock art research, future efforts need to be addressed to improve the documentation and develop a systematic archaeological approach, including the use of the newest dating methods, e.g., OSL (optically stimulated luminescence). Finally, the contextual study of the artworks should be inserted in a wider reconstruction of local dynamics within the outside world.

Cross-References

- ▶ Conservation and Management of Archaeological Sites
- ▶ North and Saharan Africa: Geography and Chronology
- ▶ Rock Art Sites: Management and Conservation
- ▶ Rock Art, Forms of

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Taiwan: Archaeological Museums

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Brief Definition of the Topic

Taiwan has a vibrant museums sector which has seen recent capital developments of older museums and the creation of new ones, both site and regional museums, with strong archaeological and ethnographical departments and exhibitions. At the top of the hierarchy are the national museums in Taipei of which the National Palace Museum (NPM) (National Palace Museum n.d.) is the largest, most visited, and internationally best known. This museum has at its core the very substantial collection of antiquities and works of art from the Palace Museum in the Forbidden City in Beijing. The Palace became a museum in 1925 on the departure of the Puyi Emperor. Much of the collection was taken away by the Kuomintang authorities from 1931 for safekeeping in the face of the Japanese invasion and moved about China for two decades before approximately a quarter of the collections still in their control were taken to Taiwan during the evacuation of the mainland by forces and people loyal to Chiang Kai-shek. This marked the end of the Chinese Civil War and the establishment of the Peoples' Republic on the mainland. The collection includes a great range of objects derived from archaeological sites and casual discoveries to works of art and craft created for the Imperial Court or collected by the Imperial families throughout the centuries. The NPM houses, in recently renovated and extended galleries, extensive exhibitions illustrative of the history and archaeology of China with a strong emphasis on prestige objects of high aesthetic value. The guiding principles are art historical and culture historical. The museum has a strong presence in scholarship, and its activities are supported by a research library which contains many manuscripts and early Chinese printed books of importance, laboratories, and restoration and conservation facilities. The PRC maintains a continuing claim to the island as part of its territory and to the collections in the NPM.

The collections in the possession of the Institute of History and Philology of Academia Sinica in Taipei are of the highest archaeological importance and derive from fieldwork carried out in China under the auspices of the Academy (founded 1928) (Museum of the Institute of History and Philology n.d.). Members of the Academy, who moved to Taiwan following the Chinese Civil War, established the institution in Taipei where, after an initial period of difficulty, it began to flourish with the expansion of the economy.

The Academy maintains a strong interest in Chinese archaeology and ethnology, and its collections reflect recent fieldwork as well as the inheritance from the institution's past.

The National History Museum, Taipei, founded in 1955 has at its core material brought from mainland China principally from Henan Museum and includes substantial amounts of archaeological material. Its wide remit covers history, art history, and decorative arts. It maintains strong links with museums in the PRC (National History Museum n.d.).

The National Taiwan Museum in Taipei, housed in a colonial Japanese building, has important ethnographical collections illustrating the material culture of the indigenous peoples of the island and has the earliest human remains from Taiwan dating to about 12,000 BCE. The scope of this museum encompasses natural history as well as ethnography (http://formosa.ntm.gov.tw/web/en/exhibition.aspx).

The National Museum of Taiwan History in Tainan City opened in 2011 explores the history and archaeology of Taiwan from the Paleolithic to the present day. It has a strong interest in folklife studies (National Museum of Taiwan History n.d.).

Important museums built to display the results of excavations include the Shihsanhang Museum (Shihsanhang Museum n.d.) and the National Prehistory Museum incorporating the results of excavations at Peinan, Tainan City (National Prehistory Museum n.d.). The museum is part of a wider heritage complex which includes a museum of human rights recalling the oppression of the early days of the Kuomintang government of the island (Explore Taiwan's first museum of archaeology n.d.).

Cross-References

- ▶ China: Museums
- ▶ Cultural Heritage Management and Armed Conflict
- ▶ Ethnic Identity and Archaeology
- ▶ Nationalism and Archaeology
- ▶ Overseas Chinese Archaeology

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Tamaki Makau-Rau Accord on the Display of Human Remains and Sacred Objects (2005)

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Introduction

The Tamaki Makau-Rau Accord on the Display of Human Remains and Sacred Objects was adopted by the World Archaeological Congress (WAC) in 2006. Drafted by indigenous and non-indigenous people with expertise including cultural heritage, museums, and archaeology, the Accord provides six key principles for decision making around the display of human remains and sacred objects. Developed and proposed in November 2005 at a WAC Inter-Congress held in Auckland on the "Uses and Abuses of Archaeology for Indigenous People," and adopted in January 2006 by the WAC Council, the Accord supplements two other WAC ethical codes that are also relevant to archaeology, museums, and the study of indigenous human remains and

cultural heritage: *The Vermillion Accord* (1989) and *The Code of Ethics of Members Obligations to Indigenous Peoples* (1990). It should therefore be seen as an additional example of development, by indigenous people and archaeologists, of guidelines to ensure consultative and collaborative ethical practice, although focused on display and exhibition rather than current and future research. In its preamble (see below), the Accord stipulates that its definition of "display" includes conference presentation or publications, and thus incorporates display of *images* of human remains and sacred objects as well as the human remains and sacred objects themselves.

Definition

The Tamaki Makau-Rau Accord consists of a preamble and a set of six principles:

> In recognition of the principles adopted by the Vermillion Accord, the display of human remains and sacred objects is recognized as a sensitive issue. Human remains include any organic remains and associated material. Sacred objects are those that are of special significance to a community. Display means the presentation in any media or form of human remains and sacred objects, whether on a single occasion or on an ongoing basis, including conference presentations or publications. Community may include, but is not limited to, ethnic, racial, religious, traditional, or Indigenous groups of people.
>
> WAC reiterates its commitment to scientific principles governing the study of the human past. We agree that the display of human remains or sacred objects may serve to illuminate our common humanity. As archaeologists, we believe that good science is guided by ethical principles and that our work must involve consultation and collaboration with communities. The members of the WAC council agree to assist with making contacts within the affected communities.
>
> Any person(s) or organization considering displaying such material or already doing so should take account of the following principles:
>
> 1. Permission should be obtained from the affected community or communities.
> 2. Should permission be refused that decision is final and should be respected.
> 3. Should permission be granted, any conditions to which that permission is subject should be complied with in full.
> 4. All display should be culturally appropriate.
> 5. Permission can be withdrawn or amended at any stage and such decisions should be respected.
> 6. Regular consultation with the affected community should ensure that the display remains culturally appropriate.

Key Issues

Many museums and other collecting institutions around the world hold human remains. With the rise of the reburial movement in the 1980s, there has been considerable debate about the repatriation of remains whose location in museums without the consent of source communities has been strongly contested by indigenous groups worldwide, but particularly from Australia, New Zealand, Scandinavia, and North America. The reburial movement has led to significant changes in museum policy in these countries and some others, particularly the UK (Simpson 2002; Fforde & Hubert 2006; Turnbull & Pickering 2010; Pickering 2011). Deep concern about the display and scientific use of human remains has been voiced by indigenous groups as a component of the reburial movement (Hammil & Cruz 1989; Fforde et al. 2002; Watkins 2002, 2010), with some groups requesting that remains be taken off display as a first step in negotiations for repatriation with the holding institution (Hubert 1989: 131). In Australia, the early 1970s witnessed the first shifts in museum policy, with some institutions resolving to no longer accept newly discovered Aboriginal remains without express permission from the source community, and to remove human remains and significant cultural material from display.

Analysis of the ethics of display and the adoption of new policy and guidelines has been in response to indigenous concerns (as has the development of particular policies – see Museums Australia 2005) and the Tamaki Makau-Rau Accord should be viewed mainly in this context. However, the preamble to the Accord makes it clear that these principles are not aimed at solely indigenous remains and the debate around display has had broader analysis. Indeed, over the past decade there has been

increasing discussion about the use of curated human remains of any geographical origin and the ethics of their display, including under what circumstances and how remains should be exhibited and viewed, particularly by the public (Sayer 2010: 95-109). Points of discussion have included, for example: respect for the wishes of the deceased; whether or not consent was given by kin; concerns and requests voiced by source communities and the public; the educational value of display; and the meaning of scientific and public interest in human remains and burial practices (Alberti et al. 2009; Sayer 2010: 95-109). In the UK, for example, discussion about Gunther van Hagen's Body Worlds (an exhibition of human and animal bodies in a variety of postures which have been preserved through plastination), arguments raised by Pagan groups about the treatment of the ancient British dead, internal and external debate by individual museums, government and professional organizations, and the work of the Human Tissue Authority (a nongovernmental public body in the UK created by the 2004 Human Tissue Act which, broadly, regulates the use of human bodies, organs, and tissue for purposes that include research, transplantation, education, and training), among others, all demonstrate the work conducted in this area (Swain 2002; Alberti et al. 2009; Sayer 2010: 95–109).

Policies and guidelines developed during this period by museums and professional bodies in relation to holdings of human remains frequently include sections relating to display as well as repatriation, although they vary in their advice (e.g., Wellcome Trust nd; Museum Ethnographers Group 1994; Department of Culture, Media and Sport 2005; Museums Australia 2005; and see Pickering 2011). While the international debate rarely deals with the display of images of human remains (whether in publication, exhibition, or presentation), those in countries with indigenous populations have addressed these issues. Thus, for example, the display of remains and images of remains (and replicas of them) is considered in section 1.4.10 of *Continuing Cultures, Ongoing Responsibilities: Principles and Guidelines for Australian Museums Working with Aboriginal and Torres Strait Islander Cultural Heritage* adopted by Museums Australia in 2005, which states that human remains:

> should not be displayed in public, except in special circumstances where parts of the remains are an integral part of other items, such as human teeth incorporated in an item of personal attire. In such cases the traditional custodians or those authorised by them, must agree to the display of such items. Equally, images and replicas of ancestral remains held in museums must not be exhibited or in any other way made available to the public without the prior permission of the traditional custodians or those authorised by them (2005: 18).

Although the reburial debate has frequently focused solely on human remains, this by no means always reflects the viewpoint of those of indigenous source communities (e.g., Maddra 1996; Tapsell 2000). Thus, it is not surprising that the Tamaki Makau-Rau Accord also encompasses sacred objects. Like human remains, sacred objects in museums and other holding institutions have also been the subject of requests for repatriation and/or removal from display, and the formation of ethical guidelines around their display and exhibition is similarly contextualized. In some instances, issues surrounding display of sacred objects predates discussion about repatriation. Thus, restricted ceremonial objects were removed from display by the South Australian Museum certainly in the 1970s and there is some evidence that this had occurred in the 1930s (Clarke & Anderson 1998: 172, 173).

It is also important to note that national legislation and policy in the USA and Australia encompass both human remains and sacred objects. Thus in the USA, *The Native American Graves Protection and Repatriation Act* (1990) relates to human remains and cultural items (including funerary objects, sacred objects, and objects of cultural patrimony). In Australia, sections 1.5.9 and 1.5.10 of *Continuing Cultures, Ongoing Responsibilities* deals with the display of sacred objects as well as images and replicas of them, setting out that such items should not be displayed to the public without the express permission of traditional custodians, and that museums should make visitors aware of the presence of such items (2005: 19).

The Tamaki Makau-Rau Accord therefore reflects deliberation on the issues of display around human remains and sacred objects that were driven initially by indigenous concerns about the continued curation of their ancestral remains in museum collections, but developed into a broader context internationally. It demonstrates continuing discussion around the ethics of archaeology, particular that of the indigenous past (e.g., Zimmerman et al. 2003; Phillips & Allen 2010). Considered together with the Vermillion Accord and the Code of Ethics on Members Obligations to Indigenous Peoples, the Tamaki Makau-Rau document also reflects the role of the World Archaeological Congress in this debate and the development of the ethics of professional practice in archaeology and related disciplines.

Cross-References

- ▶ Australia: Indigenous Cultural Property Return
- ▶ Australia: Repatriation Acts
- ▶ Ethics and Human Remains
- ▶ Human Remains in Museums
- ▶ Indigenous Intellectual Property Issues in Archaeology
- ▶ Native American Graves Protection and Repatriation Act (NAGPRA), USA
- ▶ Repatriation and Restitution of Cultural Property: Relevant Rules of International Law
- ▶ Repatriation of Cultural Property in the United States: A Case Study in NAGPRA (USA)
- ▶ Sacred Site Conservation and Preservation
- ▶ Vermillion Accord on Human Remains (1989) (Indigenous Archaeology)
- ▶ World Archaeological Congress (WAC)
- ▶ World Archaeological Congress (WAC): First Code of Ethics

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Tangible Heritage in Archaeology

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Introduction and Definition

The term tangible heritage refers in general to all the material traces such as archaeological sites, historical monuments, artifacts, and objects that are significant to a community, a nation, or/and humanity. The term is often used to distinguish such heritage elements from "intangible heritage," recognized by UNESCO in 2003, to refer to practices, representations, expressions, knowledge skills, as well as instruments, objects, artifacts, and cultural spaces associated therewith of living communities. The term "intangible heritage" replaced what was referred to in an earlier UNESCO document in 1989 as traditional culture and folklore. The designation of an intangible category of heritage led to the distinction of varieties of "material" archaeological and historical elements of heritage – "tangible heritage."

In the UNESCO 1972 convention, what is now called tangible heritage included monuments, sites, and buildings. This designation goes back to the Venice Charter (1964). Mostly concerned initially with archaeological sites, the term was later broadened to refer to groups of buildings, vernacular architecture, and industrial and twentieth-century-built heritage.

By 1992, the UNESCO World Heritage List recognized a category referred to as "cultural landscapes," which included places and areas shaped through human activities over numerous generations such as terraced cultivated fields or desert oases, whether inhabited by living communities or abandoned; natural sacred sites of mountains, springs, wells, rivers, and other natural features; historical gardens; and other landscapes designed and maintained intentionally.

Key Issues/Current Debates/Future Directions/Examples

The emergence and popularity of the term "non-tangible" (later intangible) heritage and hence "tangible heritage" was due to an increasing awareness of the role of culture in politics and economics in the 1960s. The growing interest in culture as a means of defining ethnic identities popularized the use of [cultural] heritage to refer to the "cultural background" of a group. Most of the ethnic groups seeking recognition and equity were distinguished mostly by their language, "folklore," and customs, i.e., more by what came to be known as intangible heritage vis-a-vis tangible heritage.

The recognition of intangible heritage within a sociopolitical context in the twentieth century and consequently the emergence of the term "tangible" heritage were defined previously on the basis of distinguished architectural buildings and monuments. Although the [tangible] cultural heritage was broadened to include "sites," the criteria for selecting tangible heritage on the world heritage list are predominantly biased toward architecture, buildings, human settlements, land use, technology, monumental arts, town planning, or landscape design and refer to the human values, ideas, and beliefs that tangible elements exemplify.

It may be recalled that the World Heritage List has been conceived as a means of celebrating the

monuments and sites of outstanding *universal* (transcultural) value as a follow-up to the salvage of the Abu Simbel Temple and other monuments of Nubia, in the context of the UNESCO mission for peace and intercultural understanding. However, heritage – as the cultural endowment handed down from preceding generations – may be conceptualized on the level of a nation, a society, or a community. Consequently, the sociocultural dimension embedded in the notion of heritage and the inherent attribution of heritage to a "group" of people necessitates not only a reconsideration of the types of tangible heritage but also the relationship between tangible and intangible heritage.

The material remains often selected as tangible heritage consist not only of buildings or groups of buildings, historical towns and gardens, and cultural landscapes but also of any objects or places which have been significantly modified by human actions. This includes objects made from a variety of materials (e.g., glass, textiles, stone, ceramics, metals, wood, paper) and locales such as quarries and rock art sites.

Evidently, the materials regarded as heritage are those deemed to be of *value* by a living group of peoples who *perceive* themselves as inheritors of that heritage. Accordingly what is regarded as tangible heritage is inseparable from an intangible intellectual value judgment. On an international level as in UNESCO, the community that makes the selection of items of "universal" value consists of experts working from their own professional traditions as architects, geographers, art historians, or archaeologists. By contrast, what is regarded as national heritage is often an expression of a state policy (that may or may not be representative of the nation). Thus, in this and other cases, tangible heritage, particularly monuments, is bound not only with a value judgment but also with an "objective." Castles, forts, palaces, and cathedrals and grand mosques signal state supremacy and the preeminence of religion and serve as nodes for symbolic actions, visits, performances, and literary discourses that perpetuate the socialization of people as national subjects and religious followers. On a community level, tangible heritage may be associated with tombs, religious shrines, or ancestral sites and objects. This multilevel conceptualization of heritage explains how in a modern nation state the heritage of ethnic groups or minorities has been marginalized in favor of an "invented" (or "discovered") so-called "common" national heritage as a means for unifying the nation. Monuments, especially buildings; museums displaying certain collections; and specific places have been designed to proclaim national identity. In Europe, for example, tangible heritage in capital cities affirmed an affiliation with the Graeco-Roman civilizations. In modern Egypt, Cairo was redesigned to become a European city to forge a new identity at variance with the traditional "oriental" culture. In this period of cultural transformation (especially the nineteenth century), tangible heritage was intensively manipulated to create the current notion of "West" and "East" preparing the stage for the proponents of the clash of civilizations.

From another point of view, with the growing importance of tourism as an industry with profitable revenues, certain heritage elements were marketed as properties, commodities, and commercial assets. Although heritage is indeed a valuable resource for economic development, the economic exploitation of sites, museums, and buildings may undermine indigenous human development and disrupts existing social structures.

Tourism flourished after the advent of rapid means of travel, in the context of colonialism, industrialization, and a world divided between the industrial rich and the rural poor. As such, tourism engendered feelings of inequity on the basis of material differences in clothing and modes of transportation and places of residence between tourists and locals. It encouraged illicit digging and illegal sale of antiquities, and it favored the selection of specific elements of tangible heritage (exotic, grandiose, mysterious) as heritage icons. The linkage between tourism and "vacation" led to an emphasis on recreation and entertainment, contrary to the initial notion of tourism during the Enlightenment which centered on "cultural pilgrimage." In the making of our

modern world, the role of tourism in manipulating tangible heritage can hardly be ignored.

The effect of tourism has also infiltrated academia as books by archaeologists and historians on treasures and TV series on "discoveries" and "adventures" abound. Here again, tangible heritage is selected and valorized through [intangible] narratives and practices. The objectives in this case are tinted with gaining wealth and fame.

The study of tangible heritage in academia suffers from other problems. Traditionally the study of archaeological or historical objects has focused on categorization, classification, and description with the aim of recognizing "periods" and "cultural areas." Although this has been superseded since the 1960s, with an emphasis on explanation and process, tangible heritage remains culturally under-theorized when it comes to how it articulates with the society it came from or how it can inform us of the role of tangible heritage in the making of history. Beyond an interest in tangible heritage for religious, aesthetic/artistic, technical (dating back to certain stages in the cultural evolution of Europe), is a new horizon for a new agenda, by which it can contribute to a culture of peace, reconciliation, cultural continuities, intercultural coevolution, and creativity. The latter requires a rethinking of "authenticity" and what it implies for a reinterpretation of tangible heritage as a source of innovation and renewal.

In sum, the notion of tangible heritage is inseparable from that of intangible heritage (previously called folklore, customs, and traditions). The previous neglect and current valorization of intangible heritage are related to changing sociopolitical conditions before and after the 1960s. However, tangible and intangible heritage are still regarded as separate categories given the disciplinary divide between those interested in tangible heritage (architects, archaeologists, geographers) and intangible heritage (folklorists). It is therefore crucial to recognize the intangible component of tangible heritage and the materiality associated with most intangible cultural heritage activities. The road ahead depends on how a new generation of scholars, freed from the restrictive fences of professional grounds and equipped with a comprehensive, dynamic view of heritage, will develop new interpretive and curatorial approaches that integrate tangible and intangible strands of cultural heritage elements and how they will contend with conflicts within and between communities, nations, and international organization concerning the criteria of selecting heritage and why we need heritage in the first place.

Cross-References

- ▶ Intangible Cultural Heritage
- ▶ International Conventions Pertaining to Heritage Policy: Introduction

Further Reading

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Tanzania's History and Heritage

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Introduction

Tanzania was founded on April 26, 1964, from the union between the former British protectorate of Tanganyika and the Zanzibar archipelago that consists of Unguja, also commonly called Zanzibar Island, and Pemba Island. After 42 years under British rule, Tanganyika gained its independence in 1961 and, similar to the former People's Republic of Zanzibar and Pemba, remained a sovereign state until the two independent countries signed the Articles of the Union treaty to create the United Republic of Tanzania. The second head of state and former

Minister of Natural Resources and Tourism, Ali Hassan Mwinyi (1985–1995), reformed the failing economy from his predecessor Julius Nyerere's socialist administration by promoting the private sector, "free market forces," and export-producing businesses.

It was Mwinyi's reforms that encouraged the growth of tourism and heritage protection. The Ministry of Natural Resources and Tourism (MNRT) adopted the republic's first National Tourism Policy, and the Tanzanian Tourism Board (TTB) was established during Mwinyi's tenure as president. The MNRT oversees the nation's cultural and natural resources along with the tourism sector and enacts policies to ensure sustainable natural and cultural heritage management. The MNRT is charged with protecting Tanzania's cultural and natural resources and developing tourism. It is divided into five divisions: Antiquities, Fisheries, Forestry and Beekeeping, and Tourism and Wildlife.

The National Museum of Tanzania, an institution under the MNRT, is a consortium of five museums charged with "collecting, conserving, displaying and researching" Tanzania's cultural and natural history (MNRT 1999). The Museum and House of Culture's vision is to repurpose Tanzania's culture and heritage to create a "strong sense of value and pride" in current and future generations of Tanzanians. In concurrence with this mission, the museum boasts that the famous fossil skull of Australopithecus boisei "Zinj" in its collection is the pride of Tanzania. Dr. Louis Leakey and his wife discovered Zinj in 1959 at Olduvai Gorge, a ravine with numerous hominid fossils.

Key Issues/Current Debates/Future Directions/Examples

Mainland Tanzania

Northern Tanzania, together with southern Kenya, is known as Africa's "Safariland" (Salazar 2006). Over 28 % of Tanzania's 945,234 km^2 is set aside to safeguard the country's rich natural heritage (Mabula & Bower 2010). This network comprises the Ngorongoro Conservation Area Authority (NCAA) based in Northern Tanzania and national parks including the often visited Serengeti National Park (SENAPA), with most of the protected land dedicated to game reserves and game controlled areas – 15 % and 8 %, respectively (Mabula & Bower 2010). In response to the popularity of nature exploration and the "big five" African animals (Salazar 2006), Tanzania privileges nature preservation and wildlife conservation over cultural heritage management.

The 1964 Antiquities Act of Tanzania vested The Department of Antiquities with the ownership of Tanzania's "tangible cultural heritage resources" (Mabula & Bower 2010). Under the Act, the Director of Antiquities authorizes and manages tangible heritage resources and grants licenses to research heritage sites.

According to ICCROM's legal frameworks for the protection of immovable cultural heritage, the 1964 Antiquities Act of Tanzania vested The Department of Antiquities with the ownership of Tanzania's "tangible cultural heritage resources" (Mabula & Bower 2010). Under the Act, the Director of Antiquities authorizes and manages tangible heritage resources and grants licenses to research heritage sites. ICCROM's legal frameworks for the protection of immovable cultural heritage describe the 1964 Antiquities Act as the "basic legislation" mandating the protection of the following categories of cultural heritage: conservation areas, monuments, protected (ethnographic) objects, and relics. Under this Act, the Minister has the authority to place any area, object, or structure with cultural value under protection (Kamamba 2009).

The Act defines monuments as structures, carvings, incisions, paintings, or modifications to the earth made by humans before 1863 or the remaining ruins. Protected objects are Swahili-style wooden doors and doorframes dated before 1940 or, according to Kamamba, any object the Minister declares merits protection. Ornately carved nineteenth-century doors and doorframes symbolize artistic sophistication and wealth and are particularly at risk for being sold to tourists and hotels for their beauty (Sheriff 2001).

A relic is any movable object including human, fauna, and floral remains that predate 1863 along with fossils and impressions produced by humans before 1863 (Kamamba 2009). The Act charges anyone who locates objects, relics, or sites that may be culturally significant with reporting their "discovery to the appropriate authorities" (Kamamba 2009), but this law is not stringently enforced, and instructions on legally handling cultural objects are unclear. Legal ambiguities allow the destruction, neglect, exploitation, or illegal selling of many heritage objects and sites.

Before commencing development projects, the Tanzanian government recognizes the importance of carrying out environmental impact assessments (EIAs); in fact both UNESCO and the World Bank require investors to conduct EIAs "to ascertain expected impacts on the environment . . . and to prevent destruction damage," but "Cultural Heritage Impact Assessments (CHIA) are not often conducted because they are "not explicit in Tanzania's cultural heritage legislation" (Mabula & Bower 2010). For example, the Ngorongoro Conservation Area Authority (NCAA) is in place to protect the area's rich natural heritage, but no equivalent organizations to safeguard archaeological heritage.

The Ngorongoro Pastoralist Project constructed an earth dam in 2000 in the culturally significant Laetoli site, only 2 km from the famous Australopithecine footprints. Laetoli has a rich deposit of early human and hominid fossils and artifacts – now compromised by rising water levels. The dam was built for the local Maasai to collect water for themselves and their livestock during the rainy season. The NCAA attempted to make the Laetoli hominids more visible and relevant to the local Maasai by inviting local officials, elders, and other community members to perform "a traditional ceremony to bless the site" (Mabula & Bower 2010). Gaining local support for such projects is often challenging because investing in cultural heritage management is often treated as a luxury and only considered after primary needs such as healthcare, food, and "political stability" are met (Mabula 2000).

The Ngorongoro Conservation Area, the only world heritage site in Tanzania categorized under UNESCO's "mixed" criterion with both outstanding cultural and natural heritage, attracts the most visitors of all the tourist destinations in the republic, and nearly 40 % of foreign tourists visited the NCA in 2001 (Charnley 2005). The NCA was added to the UNESCO World Heritage List in 1978 as a natural heritage site and inscribed under the cultural criterion in 2010. In terms of natural heritage, this site contains the Ngorongoro Crater, described by UNESCO to be the world's largest caldera (the collapsed mouth of a volcano), as well as Olduvai Gorge – home to nearly 25,000 animals (UNESCO n.d.) and one of the very most important archaeological sites in the world. This ravine contains the fossils of a series of modern human predecessors including, but not limited to, Australopithecus, Homo habilis, and Homo erectus; each hominid represents stages of human evolution spanning 4 million years. Archaeologists also found handmade tools and animal bones in the gorge; the tools are testaments to human ingenuity and the bones helped shape ideas about early hominid diets. Another noteworthy archaeological site located 45 km south of the gorge is Laetoli, famous for the three sets of bipedal Australopithecus afarensis footprints preserved in volcanic ash. Unfortunately Olduvai Gorge has fallen into disrepair because the fossils and museums have been neglected and vandalized. Grasses and acacia trees have grown over and endangered the Laetoli footprints (Mabula 2000), and although Olduvai Gorge brings in revenue (in 1998 nearly 39,108 tourists spent $60,000 in entry fees), little of the economic gain was reinvested into developing the site (Mabula 2000).

The Kondoa Rock Art cultural sites, added to the World Heritage List in 2006, are collections of painted images found in more than 150 shelters on the sedimentary rock formations that border the Great Rift Valley spanning more than 2,336 km^2 (UNESCO n.d.); several of the rock sites have been repurposed as ritual sites by the nearby Maasai communities. According to UNESCO these sites "provide a unique testimony to the

changing socio-economic base of the area from hunter-gatherer to agro-pastoralist, and the beliefs and ideas associated with the different societies." The Department of Antiquities does not have up-to-date records on the scope of paintings within these sites, so UNESCO encourages any surveys or assessments "to ascertain the scope of the site[s]" (n.d.).

The Ruins of Kilwa Kisiwani and the Ruins of Songo Mnara are on the World Heritage List (in 1981) as well as UNESCO's List of World Heritage in Danger in 2004. These cultural sites are the remains of two trading ports on islands near the coast (nearly 300 km south of Dar es Salaam) where goods such as gold, pearls, perfumes, and porcelain were sold from the thirteenth to the sixteenth century. Housing complexes, public squares, mosques, and domestic dwellings on the islands serve as a chapter in Swahili culture and architecture, "offering important insights regarding economic, social and political dynamics in this region" (n.d.). The Great Mosque of Kilwa Kisiwani is the oldest mosque on the East African coast. Although the two sites are protected under the Antiquities Act and a 2004 Management Plan, uncontrolled urban expansion, coastal damage by beach erosion, and inadequate conservation efforts have resulted in long-term threats.

The Central Slave and Ivory Trade Route was submitted by the Antiquities Department in 2006 as a testimony to the cruel treatment of African slaves in Central and East Africa, including Tanzania. Slaves were held on the coast and many times sent to Zanzibar and then sold to Arab countries. The recommendation for this site to be inducted into the World Heritage List is based on engaging the tragic history of the slave trade, preserving the visible, physical reminders of this trade route remain in Tanzania's landscape and researching and documenting the "memories" of human suffering and enslavement to preserve the cultures and traditions of the people who live along the trade route (UNESCO n.d.).

Zanzibar

The Stone Town of Zanzibar is Zanzibar's most popular attraction. The town is a large, well-preserved former slave-trading port on Unguja Island that was inscribed in UNESCOs World Heritage List in 2000. The stone town of nearly 2,000 buildings is noteworthy for its historic urban landscape developed from more than two centuries of Swahili, Portuguese, Arabic, and Yemeni cultural influences and architectural traditions (Mohamed 2001; Sheriff 2001). UNESCO describes the Stone Town as an example of cultural fusion as its architecture demonstrates the melding of African, Arab, and European cultures. This site is characterized by survivals of Portuguese churches and forts, and Islamic mansions that were eventually "amalgamated and homogenized into a characteristic [vernacular] Swahili architecture" and over time influenced by new styles brought by immigrants to Zanzibar (UNESCO n.d.)

In 2009 the Flemish government helped coordinate and launch a series of historic urban landscape (HUL) workshops on Africa's east coast by introducing HUL to governments and host communities in "World Heritage-designated cities" including the Stone Town of Zanzibar. These workshops are to include training for government officials and the community at large on urban landscape conservation and facilitators to promote research for the development of a "toolkit for urban conservation," revisiting the groundwork of the 1972 World Heritage Convention for establishing urban development, and "management of the World Heritage Cities Programme" (UNESCO n.d.). Domestic as well as international agencies are vested in the Stone City. The Zanzibar Stone Town Heritage Society "Jumuiya Ya Uhifadhi Mji Mkongwe" is an NGO established in 2002. The society's mission is to promote the conservation of the Stone Town's heritage, environment, and the "cultural welfare of its inhabitants" (2010); it works towards this mission with a list of objectives that include raising awareness of the Stone Town's conservation concerns, and, similar to UNESCO's HUL workshops, the society provides community outreach activities, training, services, research, and technical support to improve the Stone Town's urban landscape. The society also

lobbies for conservation policies and builds relationships with other organizations interested in conservation.

Cross-References

- ▶ Archaeology and Anthropology
- ▶ Olduvai Gorge Archaeological Site
- ▶ Tangible Heritage in Archaeology
- ▶ UNESCO World Heritage List and "Imbalanced" Properties: An African Perspective
- ▶ World Heritage and Human Rights

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Taphonomy in Bioarchaeology and Human Osteology

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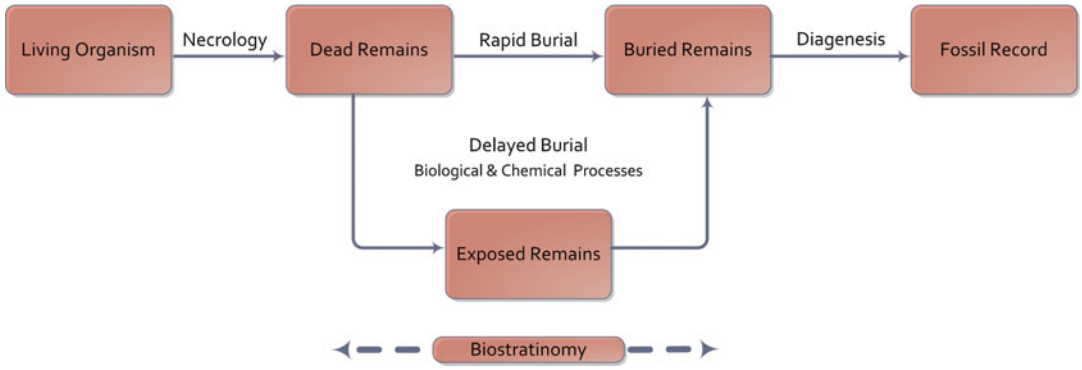
Introduction

Classical Taphonomy

Traditionally, taphonomy was studied by paleontologists to interpret the processes that operate on organic remains that comprise a part of the fossil record. A major focus of taphonomy was to understand the effects of those processes in order to reconstruct the past as it pertains to a particular fossil assemblage (Shipman 1981). Years later, archaeologists began to study taphonomy in order to determine how and why floral and faunal remains accumulated and differentially preserved within the archaeological record. Interpretation of the postmortem, pre-, and post-burial histories of faunal assemblages is critical in determining their association with hominid activity and behavior. Archaeologists typically separate natural from cultural processes when identifying evidence of human interaction with faunal remains (Lyman 1994).

Various models of fossil assemblage formation have been proposed, depicting a general taphonomic history. The *taphonomic history* defines the chronology of taphonomic agents and processes affecting the faunal remains and may include a cyclic sequence of events (e.g., a bone may be buried, exposed, gnawed, transported, and reburied). A *taphonomic agent* refers to the source of modification to the faunal remains (e.g., hyena), while a *taphonomic process* describes the dynamic action of that agent on the remains (e.g., gnawing). The *taphonomic effect* is the result of a taphonomic process (Lyman 1994). The basis of taphonomy is therefore the qualitative and, where possible, quantitative analysis of the taphonomic effects, processes, and agents acting on carcasses and skeletal tissues.



Taphonomy in Bioarchaeology and Human Osteology, Fig. 1 Transformation stages from living organism to fossil (based on Behrensmeyer & Kidwell 1985; Martin 1999)

The geological context in which faunal remains are discovered and their distribution in the stratigraphy may provide important information about the paleoenvironment and formation of the site. However, information about the taphonomic history of faunal remains comes specifically from the recovered animal carcasses and skeletal tissues (Shipman 1981). Postmortem processes affecting skeletal remains, and subsequently the state of preservation of the bone, reflect the sequence of taphonomic events which comprise the taphonomic history. An understanding of the taphonomic history of faunal remains aids archaeologists in explaining their interaction with prehistoric human populations (Micozzi 1991; Lyman 1994).

Fig. 1 provides an overview of the transformation from living organism to fossil (based on Behrensmeyer & Kidwell 1985; Martin 1999).

Organisms must pass through three distinct and separate stages to become a part of the fossil record. These stages span the time frame from death to discovery and/or recovery. The first stage involves the death or loss of a part of an organism and is referred to as necrology. Necrology can be denoted by T_0 and represents the initial stage of the taphonomic history. Processes that occur from death through to burial represent the second stage and are referred to as biostratinomy. These processes result from reworking and destruction of the remains and may include decomposition, scavenging, bioturbation, and postmortem transport. The third stage is termed diagenesis and refers to the physical and chemical processes occurring after burial. Diagenetic processes result in the transformation of organic material to mineral in sediments and include dissolution, leaching, and recrystallization (Micozzi 1991). T_1 represents the time of discovery. One of the many challenges of taphonomic analysis is to identify the processes and agents acting on the remains during the time frame to fossilization (i.e., T_1–T_0).

The postmortem factors that can act on faunal remains are numerous and include both physical and animal-related processes (Ubelaker 1997). Destruction and modification of bone can result from physical factors such as rock fall, weathering, burial, shockwaves, diagenesis, and cryoturbation, as well as animal-related processes including trampling, gnawing, and digestion (Marshall 1989; Micozzi 1991). Dispersal and postmortem transport of remains may also involve animals or may result from gravity or fluvial processes. Discriminating between nonhuman and human agents of bone modification with respect to human subsistence patterns involves analyzing taphonomic factors such as scavenging, hunting, butchering, and transport of prey (Bonnichsen & Sorg 1989). Numerous other chemical, biological, and physical factors can also affect the probability of the remains being preserved.

Forensic Taphonomy

Many of these taphonomic processes are also important in the analysis of more recently

skeletonized remains. As a result, the principles of taphonomy are now utilized in the field of forensic science. Forensic taphonomy involves the use of taphonomic models and approaches to estimate time since death, reconstruct the events surrounding death and pre- and post-burial, and discriminate between bone modifications resulting from human behavior and those caused by taphonomic factors (Haglund & Sorg 1997; Ubelaker 1997). Due to the multidisciplinary approach required in a forensic investigation, forensic taphonomy may encompass experts in anthropology, archaeology, soil science, palynology, and many other disciplines based on the particular requirements of the crime scene.

In a forensic context, taphonomy is used to define all events acting on human remains between death and discovery. This time frame (i.e., T_1–T_0) will be considerably shorter for forensically relevant remains when compared to remains of paleontological or archaeological significance. Additionally, postmortem decomposition varies considerably between geographical regions and can also demonstrate significant variation across and within microenvironments (Ubelaker 1997).

Due to the shorter time frame, forensic anthropologists are also concerned with soft tissue decomposition rates and patterns, in addition to bone modification, disarticulation, and dispersal (Haglund & Sorg 1997). Research in the field of forensic taphonomy must therefore focus on the effects of taphonomic agents on both soft tissue and hard tissue in a range of environments. Influencing factors may include temperature, moisture levels, clothing, burial type, trauma, biomass, soil texture, and other environmental conditions (Micozzi 1991; Ubelaker 1997). Consideration must be given to all of these parameters and many more when interpreting the taphonomic history of human remains in a forensic investigation.

Definition

Taphonomy is the study of the transition of organic remains from the biosphere into the lithosphere as a result of geological, biological, and chemical processes which act on the remains (Shipman 1981; Lyman 1994; Martin 1999). The science of taphonomy has been practiced for centuries. However the term "taphonomy" was first defined by Russian paleontologist, I.A. Efremov (1940), to denote a subdiscipline of paleontology which studied the events that occur between death and fossilization. The term was derived from Greek roots: *taphos*, meaning burial, and *nomos*, meaning laws (Micozzi 1991; Lyman 1994; Martin 1999).

The definition of taphonomy has since been extended to incorporate the study of bone accumulation and modification from a site formation perspective (Bonnichsen & Sorg 1989) and interpreting the life history of a fossil from the time of death to the time of recovery (Olson 1980). The latter definition recognizes the importance of understanding the circumstances surrounding the event and the time since death or deposition.

Key Issues and Current Debates

Early Taphonomic Research

Taphonomic research in the fields of paleontology and archaeology has predominantly been directed towards reconstructing paleoenvironments, identifying factors which cause destruction or modification of bone, understanding dispersal and transport of remains, and discriminating between nonhuman and human agents of bone modification (Haglund & Sorg 1997).

A key issue and one of the major foci of taphonomic research is to understand the biases inherent in the fossil record. When interpreting a fossil assemblage, it is necessary to determine how that collection of skeletal remains was derived from the animal community that once populated the area. Since not all animals, and even fewer plants, are preserved through time, the fossil record provides an incomplete picture of the original ecosystem.

The process of recovering faunal remains is also a biasing factor. Researchers may affect the assemblage by differentially sampling,

collecting, and recording the data based on personal observation and expertise. Archaeologists must therefore be aware of the taphonomic significance of the stratigraphic and sedimentary context of faunal remains when sampling (Lyman 1994).

When the term was first defined, Efremov (1940) determined that the study of taphonomy would focus on four major problems encountered in paleontology. First, the state of preservation of fossils is often poor and the number of skeletons few, due to the increased destruction experienced over time and the variations in the size of fauna sampled. Second, a faunal assemblage may not have been associated in life but rather may have accumulated accidentally either at death (known as thanatocoenose) or after death (known as taphocoenose). Third, the appearance of a presumably new fauna without identifiable ancestors in the site formation may not necessarily represent a new group of species as ancestral species may not have been preserved under the prior environmental conditions. And finally, the preservation of species and skeletal elements will vary in different sedimentary environments, and assemblages may not resemble the same species due to fossilization of a select sample of the original community (Shipman 1981).

For many years it was incorrectly assumed that a fossil record was a snapshot of an animal community which had been preserved through the processes of fossilization. Taphonomic studies have assisted in reducing the assumptions once made about fossil assemblages. It is now understood that animals do not necessarily die in the environment within which they lived and that an abundance of one fossilized species in the fossil record does not represent an abundance of that species in the original community.

It is no longer assumed that two species found in the same assemblage lived together in the same environment or that the lack of a species in an assemblage represents their rarity or absence in the original community (Shipman 1981). By studying taphonomic data and observing taphonomic patterns, paleontologists and archaeologists are now able to provide more meaningful interpretations of the fossil record.

Recent Taphonomic Research

During the period 1970–1986, the field of taphonomy expanded beyond the focus on bias and placed a strong emphasis on actualistic, process-oriented research. Scientists recognized that the original definition of taphonomy failed to encompass the broader focus of how fossil assemblages change during preservation as a result of both the addition and loss of information (Behrensmeyer & Kidwell 1985). Behrensmeyer and Kidwell proposed a new definition for the field as "the study of processes of preservation and how they affect information in the fossil record" (Behrensmeyer & Kidwell 1985: 105).

During this same period, actualistic studies between life and death assemblages became important, and the processes of death and decomposition were extensively studied by Behrensmeyer and colleagues in African terrestrial environments (Behrensmeyer 1978; Behrensmeyer et al. 1979). Despite the difficulties experienced in reconstructing the past using fossil assemblages, their studies demonstrated that modern bone assemblages can resemble the living animal community (Behrensmeyer et al. 1979). This new perspective led to research in middle-to-large scale taphonomic phenomena and the dynamic interactions between biological and geological processes.

After decades of taphonomic research and much debate, the following rules are generally accepted as empirical principles of taphonomy (based on Martin 1999), but by no means represent a complete list.

1. An organism is more likely to be preserved if it comprises hard parts.
2. Preservation is considerably enhanced if the remains are rapidly buried in fine-grained sediment.
3. Preservation is considerably enhanced in the absence of decomposition and scavengers.
4. Chemical and physical destruction resulting from decay, abrasion, transportation, predation, scavenging, and dissolution will cause a loss of information about community structure and species abundance.
5. Taphonomic information loss in terrestrial and fluvial environments predominantly results

from transport, disarticulation, and breakage by water, predators, scavengers, trampling, etc.
6. Bioturbation and physical alteration preferentially mixes sediments upward causing temporal mixing of different communities and leading to an increased diversity in morphological features of fossil ancestries.
7. Taphonomic transformation can lead to information gain for reconstructing the environment and past community dynamics.
8. Catastrophic burials (e.g., Lagerstätten – fossil deposits demonstrating remarkable diversity or preservation) are valuable for providing a snapshot of the population dynamics but are not representative of the temporal variation in populations.

Since taphonomic processes can act on biological remains during the period of death and discovery, it is recognized that some skeletal remains may survive better than others with time. The ultimate goal of taphonomy is thus to identify and quantify the biases associated with the process of fossilization to allow for accurate interpretations of the relative abundance of organisms in a fossil assemblage.

Forensic Taphonomic Research

Taphonomic research in the field of forensic taphonomy faces additional challenges in deciphering the effects of human behavior on human remains. The structural differences between human remains and nonhuman remains will cause variation in their response to taphonomic agents. In addition to analyzing the taphonomic effects such as weathering, gnawing, and trampling, forensic anthropologists must also interpret the effects of cultural processes such as embalming, burial, and cremation (Ubelaker 1997).

While the forensic anthropologist may draw parallels with some of the principles of paleotaphonomy (e.g., Behrensmeyer's (1978) stages of bone weathering), many of these effects must be individually studied on forensic remains in order to understand their taphonomic impact. One of the main challenges in forensic taphonomy today is understanding how postmortem changes to human remains will affect the estimation of time since death. Research in this complex area has many complications, but advances are being made by researchers employing observational and experimental taphonomic studies in a range of forensic environments.

Future Directions and Examples

Over the past two decades, process-based research has provided a valuable understanding of the taphonomic bias in modern environments. However, a key issue that remains is the extent to which taphonomic bias varies with time. Much research has gone into understanding how the taphonomic bias varies with depositional environment, but there is little understanding of how this same bias has changed through time, although there are examples that it potentially has (Allison & Bottjer 2010).

Examples of biomolecular and biological evolution highlight the fact that some organic remains and skeletons are more likely to preserve than others and that this has changed over time. The evolution of burrowing organisms can also alter taphonomic bias by disturbing and potentially degrading faunal remains buried in the sedimentary environment, as it has been shown that the depth of burrowing has increased with time. Additionally, Fossil Lagerstätten represent snapshots of preservation that clearly demonstrate temporal variation in fossilization (Allison & Briggs 1991).

Fossil Lagerstätten refer to rare fossil deposits which have undergone exceptional preservation and include evidence of soft tissues. This concept was first popularized by Seilacher's group at the University of Tübingen (Behrensmeyer & Kidwell 1985; Allison & Bottjer 2010) and led to extensive efforts to investigate current and new Lagerstätten. Research in this area focused on understanding the taphonomic processes leading to exceptional preservation of soft tissue which advanced a new field of experimental taphonomy. Fossil Lagerstätten represent unique but excellent examples of preservation in the fossil record.

Taphonomic research now benefits from a diversity of approaches including field, laboratory,

and database studies. Allison and Bottjer (2010) predict that database studies will be more frequently used in the future but also highlight the need for ongoing field studies to populate those databases. They propose that the major gaps still remaining in taphonomic knowledge relate to Precambrian taphonomy, organic geochemistry, and global biodiversity. Future research in these fields will help to elucidate a better understanding of the early history of Earth, the pathways between organic molecules and the preservation of organic carbon, and the impact of mass extinction events on taphonomic processes.

Although the field of taphonomy is now considered to be well established, the field of forensic taphonomy is still in its infancy. During the past two decades, considerable advances have been made in forensic taphonomy (Micozzi 1991; Haglund & Sorg 1997). However, further research is still required to understand the effect of taphonomic processes and agents on soft tissue and hard tissue in the numerous environments in which decomposition can occur. The random nature by which many crimes are committed means that almost any environment can be utilized to dispose of remains. These environments must continue to be the focus of taphonomic studies to assist forensic anthropologists in accurately understanding the processes of tissue decomposition and preservation.

Cross-References

- ▶ Forensic Anthropology and Archaeology in Disaster Response
- ▶ Forensic Anthropology: Definition
- ▶ Human Remains Recovery: Archaeological and Forensic Perspectives
- ▶ Skeletal Biology: Definition
- ▶ Time Since Death in Bioarchaeology and Human Osteology

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Taphonomy in Human Evolution

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Introduction

Taphonomic research is essential for the interpretation of fossil plant or animal assemblages that are recovered from early archaeological sites. Within human evolutionary studies, it provides a way to reconstruct past processes that have acted on fossil assemblages of direct relevance to our understanding of early hominin and early modern human behavior. Taphonomic research may be applied to the fossil remains of human ancestors themselves, the remains of the animals and plants that were part of their ecological surroundings, or the material remnants of their behavior (e.g., the discarded remains of their meals). Without taphonomy, the many processes that can operate on an assemblage over the long time periods represented by the human evolutionary record could not be reliably untangled.

Taphonomic processes are typically viewed as reductive and destructive, taking away information from a complete picture of the forms and ecologies of living things in the past. However, taphonomic processes can also add information about the circumstances of deposition and subsequent modification of what are now fossil remains. Each intervening taphonomic process that alters a fossil or an assemblage also has the potential to leave a trace, thus allowing information about the processes themselves to be reconstructed. This kind of research has sparked several debates within human evolutionary studies, leading to the interpretation and reinterpretation of some of the most significant archaeological sites over the course of the last four decades.

Definition

Taphonomy in human evolution is taphonomic research used most commonly to aid interpretation of the subsistence behavior of early humans and our ancestors. In this context, it is most often used in reference to fossil animal bones. However, it may also be applied to the interpretation of other remains that are of relevance to understanding the behavior of human ancestors or aspects of their ecological settings.

Key Issues/Current Debates/Future Directions/Examples

Theoretical Frameworks and Key Figures

Charles K. (Bob) Brain was a pioneer in taphonomic research within a human evolutionary framework. In the 1960s, he used observations of how dogs modified bones discarded by people to formulate ideas of what this would look like in the fossil record. He later (Brain 1981) wrote a book entitled "*The Hunters or the Hunted?*" in which he used these observations to interpret the faunal assemblages from Sterkfontein and other early hominin-bearing cave sites from South Africa. Previously, the fossil animal bones from these sites were thought to have been either food debris or even weapons used by early hominins such as *Australopithecus africanus*. Brain's taphonomic work debunked many of these ideas by demonstrating that in fact the majority of the fossil remains – including the remains of hominins – were the result of carnivore predation (Fig. 1). This interpretation has stood the test of time and is currently still accepted as the most parsimonious explanation.

In the same year, another landmark book was written by Lewis R. Binford (1981), entitled "*Bones: Ancient Men and Modern Myths*." Binford argued that within Paleolithic research,

Taphonomy in Human Evolution, Fig. 1 The classic illustration by Bob Brain of a fossil hominin skull exhibiting two puncture marks that fit the tooth spacing of a fossil leopard found at the same site (Image courtesy of the Ditsong National Museum of Natural History)

many of the interpretations about how fossil faunal assemblages were formed were made post hoc, resulting in the perpetuation of unevaluated "myths" about the past. He had spent several years studying how modern hunter-gatherers obtain and discard faunal remains, with a particular focus on understanding how bone accumulations at archaeological sites are created. He also noticed that such accumulations may be modified or independently created by nonhuman processes, such as carnivore denning and scavenging. Binford used these observations to stress the importance of applying middle-range theory to link interpretations of the past directly to observations made in the present. This theoretical framework continues to play an essential role in taphonomic research today.

Actualistic Research

The experiments and observations performed by Brain and Binford are examples of actualistic research. Such research is performed under the uniformitarian assumption that modern processes we observe today also happened in the past. Therefore, by the observing the traces or impacts certain behaviors leave in the modern day, one can infer that the same behaviors also caused similar traces or impacts on fossil assemblages in the past.

Within human evolutionary studies, actualistic taphonomic research has taken three major forms: basic experimentation, naturalistic experimentation, and ethnographic observation. Basic experimentation offers the most control to the researcher. Bones or other objects of interest are subjected to taphonomic processes under simulated conditions where a wide variety of variables can be known and manipulated. Naturalistic experimentation is similar, except that the bone or other object of interest is introduced into a natural setting and the transformation it undergoes is observed more passively as several variables within the system may operate simultaneously upon it.

Arguably, modern hunter-gatherers are not the ideal analogue for all early archaeological sites. However, ethnographic observation of how living humans acquire, process, and discard bones does provide essential information on human decision-making and archaeological site formation. Notable examples that have been applied to the human evolutionary record are Binford's (1981) book, which drew heavily on his experiences with the Nunamiut of Alaska, and the work of Bunn et al. (1988) with the Hadza of the Eyasi Basin of Tanzania. All three forms of actualistic research have underlain some of the largest debates in zooarchaeology and taphonomy as they have been executed in a human evolutionary context.

Key Debates in Human Evolution: Hunting Versus Scavenging

The ability to regularly acquire meat and fat from large ungulate resources is considered to have been an important watershed in the diet and behavior of our ancestors. Prior to the actualistic work that became prominent in the 1980s, it was frequently taken for granted that if fossil animal remains were found in association with stone artifacts, then the fossils were also there as the result of hominin activity. A famous example is the FLK *Zinjanthropus*, or "Zinj" site at Olduvai Gorge, Tanzania, which dates to approximately 1.84 Ma ago. Excavations in the 1960s by Mary Leakey revealed a rich and well-preserved fossil faunal assemblage in association with stone artifacts, which was interpreted by many archaeologists as evidence that the site was a "home base" or "living floor" used by early hominins. Binford's (1981) book took this assumption to task,

concluding on the basis of bone breakage and skeletal part representation that there was little evidence of the site being used as a home base in the same sense that modern hunter-gatherers set up a camp and then bring the results of their foraging back to this central place. Binford argued that the bone accumulations in association with stone tools could be explained simply by hominins scavenging after carnivore kills.

Subsequent researchers such as Shipman and Rose (1983) emphasized the use of microscopic techniques to reliably identify signatures of hominin modification such as cut marks from stone tools. They further cautioned against the assumption that bone accumulations such as that at Zinj represented the remains of hunted meals. However, when Bunn and Kroll (1986) reanalyzed the assemblage, they argued that both skeletal element abundances and bone surface modification suggested that early hominins were actually capable of hunting large mammals and bringing them back to particular sites on the landscape to be butchered. This debate became known as the "Hunting versus Scavenging" debate.

In a naturalistic study conducted in Serengeti National Park, Blumenschine (1988) simulated a series of "hominin-first" and "carnivore-first" scenarios by leaving bones for scavenging by wild hyenas. Both hominins and carnivores would have broken bones for the fat-rich marrow inside, but the study showed that they would have left different traces on the bone surfaces when they did so, and in different proportions. When hominins were first, there would have been more hammerstone percussion marks, and when carnivores were first, there would have been more carnivore tooth marks. When applied to the Zinj assemblage, the large numbers of tooth marks suggested it had been heavily modified by carnivore activity. The implication for human evolutionary studies was that our earliest tool-using ancestors would have only gotten access to meat and marrow through scavenging.

The case seemed to have been closed, until Domínguez-Rodrigo and Barba (2006) introduced a new element to the debate. They argued that full account had not been taken of other agents that can produce marks on bones. Specifically, fungus and bacteria can etch bone surfaces in such a way that they may resemble tooth marks – thus, leading to an overestimate of the role carnivores had in modifying the assemblage. Again they turned to the Zinj assemblage as an example.

The debate is not yet settled, with a new generation of taphonomists now arguing that the evidence for scavenging at the site is still stronger than any evidence of early hominins having first access. Although most researchers doubt that early tool-using hominins were as proficient at hunting as modern humans, no agreement has been reached about how all the bones came to be accumulated at Zinj. However, the debate has spurred the development of taphonomy forward as a discipline by demanding new and more rigorous interpretive models, experimental designs, and actualistic analogues.

Key Debates in Human Evolution: Hunting Proficiency of Early Humans

Taphonomic research has also been instrumental in investigations not just of the origins of hunting per se, but the origins of *modern* hunting ability. The modern human origins debate began to escalate during the 1980s as researchers sought to understand when, where, and how our species first emerged sometime after about 300 thousand years ago, only to later disperse around the globe. The debate has since encompassed both the fossil hominin and archaeological records, with archaeologists focusing on uncovering evidence of the origins of modern human *behavior*, including subsistence. Because fossil animal bones are some of the most commonly preserved material remnants of subsistence behavior, much of the focus has been on large faunal assemblages from early anatomically modern human sites such as Klasies River Mouth in South Africa. Part of the debate has also revolved around questions of the subsistence behavior of our extinct close relatives that were *not* anatomically modern, for example, the Neanderthals in Europe.

Initial work by Klein (1975) at Klasies River Mouth suggested that early people were able to hunt some animals, but not the most dangerous ones. This was based on straightforward

interpretation of faunal abundances at the site, which showed that more dangerous animals such as Cape buffalo (*Syncerus caffer*) and bush-pig (*Potamochoerus porcus*) only became common during the Later Stone Age, after behaviorally modern people had evolved. Again, Binford (1984) had a different interpretation. He proposed instead that most of the faunal remains at the site showed evidence of being scavenged by people and that early anatomically modern humans could not have been adept hunters at all. Because no modern hunting and gathering group is known to purely obtain mean through scavenging, interpretations such as these set up a dichotomy between the evolution of modern *anatomy* (which was already in place) and modern *behavior* (which was in this case interpreted to have evolved later).

Stiner's (1994) study of the faunal remains from Neanderthal sites in Europe also suggested that Neanderthals periodically used scavenging as a primary mode of meat acquisition. A major component to the interpretations by all these researchers was the fact that major meat-bearing limb elements were uncommon relative to head and foot elements at each of the sites they had identified as containing scavenged assemblages. The reasoning was that head and foot elements represent the nutritionally poor "leftover" carcass portions and that a "hunted" assemblage should contain higher abundances of meaty limb portions.

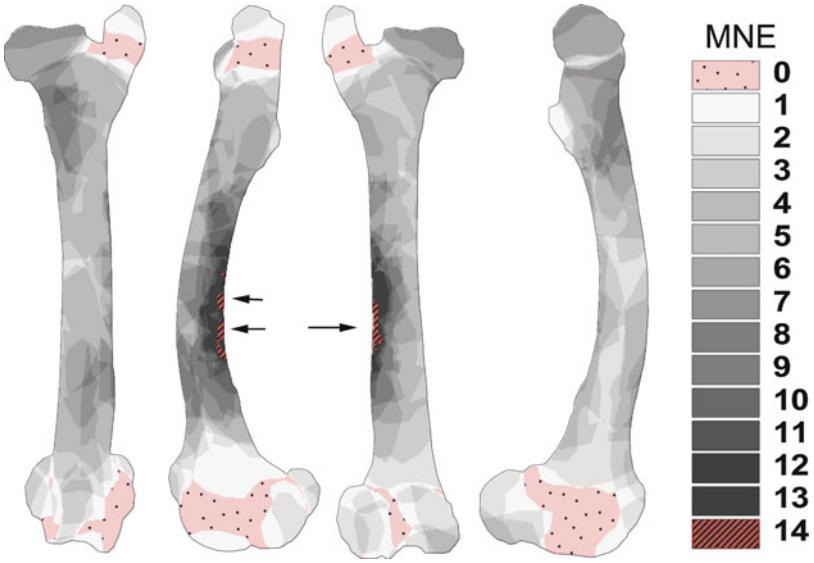
However, many of the sites used by these authors had suffered from serious excavator bias. Certain components of the assemblages that had not been considered to be taxonomically diagnostic had been discarded. Because long bone shaft fragments are challenging to identify, they had frequently suffered this fate. However, the more diagnostic long bone end portions had been retained, and these formed the basis of long bone element counts. What the data at such sites were actually showing was relatively low proportions of *long bone ends only* relative to high numbers of head and foot elements.

In Marean et al.'s (1992) basic experimental study on hyena ravaging of modern bone assemblages in a captive setting, they found that hyenas preferentially consume greasy skeletal elements or element portions compared to other portions, such as dense long bone shafts. Therefore, an archaeological assemblage that has been ravaged by hyenas – or by extension other bone-modifying carnivores – would be expected to have most of the limb elements represented by shaft fragments rather than the greasy (but unfortunately more taxonomically diagnostic) end portions. At sites where shaft fragments had been preferentially discarded by the excavator, most of the remaining evidence for meat-bearing limb bones would have also been discarded (Fig. 2). Without the shaft fragments available, the observed "head and foot" pattern could be explained equally by carnivores scavenging after hominins or by hominins scavenging after carnivores. This sparked a debate that was still being joined by researchers such as Pickering et al. (2003), over a decade after the original hyena study had been published.

Since the early 2000s, the debate has cooled and an array of research has been conducted at other South African early modern human and European Neanderthal sites of similar or even older age. When complete assemblages are used for analysis and bone surfaces are scrutinized for evidence of hominin butchery, the taphonomic research shows that both hominin species enjoyed early access to carcasses. Both were also likely adept hunters of large ungulates, although they may have used different apparatus to do so. The emphasis of current research is now on exploring the variability that existed within subsistence strategies during this time period and using taphonomy to untangle the specific depositional histories of bone accumulations at these sites.

Key Debates in Human Evolution: Origins of Hominin Butchery

Despite the interpretive strength offered by actualistic research, it is not always a straightforward matter to apply it to a fossil assemblage. It is commonly the case that one taphonomic process may imprint over another, and ancient bones have had a lot more time to be exposed to different processes than modern



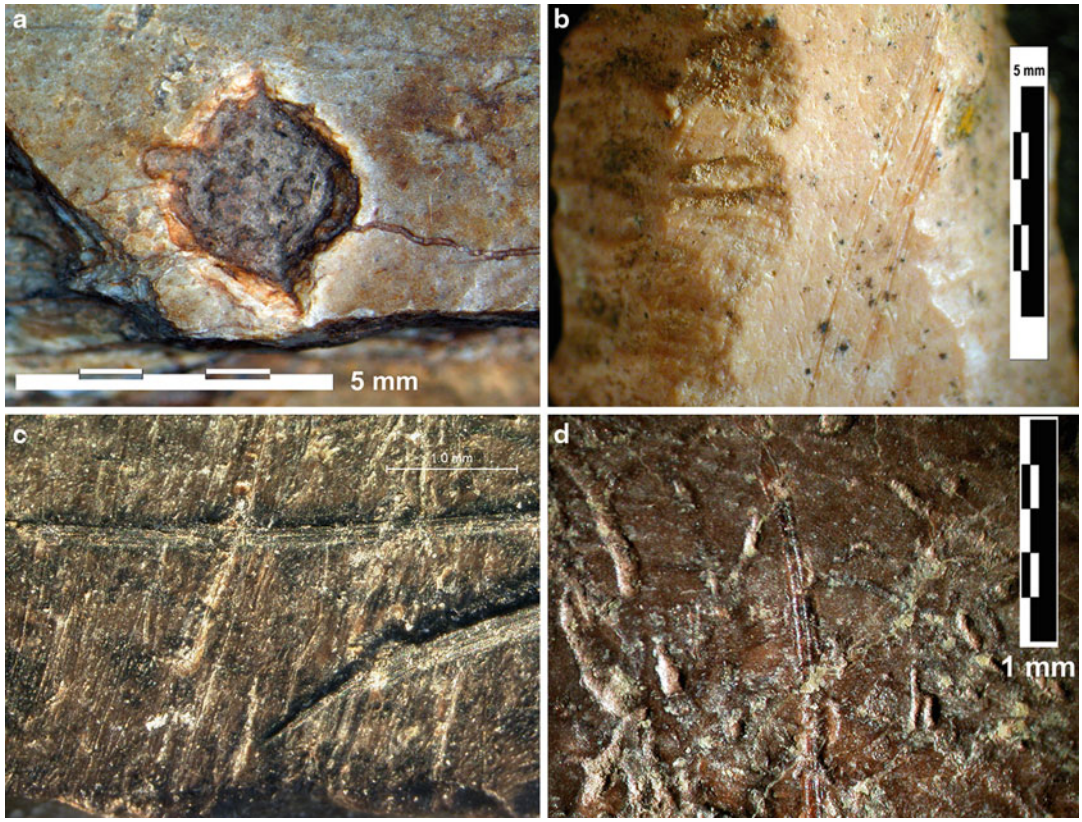
Taphonomy in Human Evolution, Fig. 2 Generic template of the left femur of an ungulate showing differences in preservation between the shaft and the ends. All femoral fragments drawn onto the image were recovered from the South African cave site of Pinnacle Point Cave 13B, which is partially contemporaneous with Klasies River Mouth. Darker areas represent parts of the bone that have several specimens representing that portion, *red* striped areas (with *arrows*) indicate the portions with the most preserved specimens, and *pink* spotted areas indicate regions that are not represented at all in the assemblage. In this case, twice as many individual left femora are represented by the shafts as by the ends

bones (Fig. 3). More dangerously, some processes result in equifinality in fossil assemblages, whereby different pathways produce the same end result. In these cases, the many potential processes leading to the point at which a fossil is studied cannot be reliably reconstructed, and this can have a major impact on the overall behavioral interpretation of a site.

One of the key lines of evidence researchers have used to argue for or against hominin butchery at fossil sites is bone surface modification. Cut, percussion, and tooth marks were initially all thought to be diagnostic of either hominin or carnivore activity. The timing of carcass access was thought to be able to be directly read from relative proportions of these marks or by the locations or intensities of these marks. For example, cut marks superimposed over tooth marks could be taken as evidence of hominins scavenging after carnivores, and the reverse could also be true for tooth marks superimposed over cut marks.

However, the principle of using bone surface modification in taphonomy hinges on the ability of researchers to accurately tie a trace on a fossil to its underlying cause. Fossils are found in a variety of depositional contexts, and the number of possible processes that can damage their surfaces is overwhelming and site-specific. In the early 1980s, there was much debate over the best criteria (microscopic and macroscopic) one could use to confidently identify cut marks. In 1986, Behrensmeyer et al. (1986) showed that even cut marks, which were thought to be diagnostic of stone-tool-wielding hominins, may be mimicked by natural processes such as trampling. Such uncertainties have led to some of the most heated debates in archaeological research pertaining to early hominin diet, and over the last decade, many of the debates from the 1980s have been resurrected in the context of both old and new discoveries.

Recently, McPherron et al. (2010) reported two fossil specimens from the Dikika DIK-55 site in the Afar region of Ethiopia that bore surface modification interpreted to be caused by hominin butchery with stone tools. The two



Taphonomy in Human Evolution, Fig. 3 Examples of bone surface modification on fossils, showing the potential overprinting of taphonomic processes in sequence from negligible to extreme: (**a**) a bisected pit filled with matrix thought to be typical of crocodile modification on a fossil specimen from the Ledi-Geraru study area in Ethiopia; (**b**) a cut mark that has been partially erased by rodent gnawing from Sandia Cave, New Mexico; (**c**) a cut mark that has been completely covered by a percussion mark (fine striations) from the site of Blombos Cave, South Africa; and (**d**) a cut mark that has been extensively covered by root or fungus etching and emplacement of matrix from the Loiyangalani site in Tanzania

specimens predated the earliest known flaked stone artifacts by over 800 thousand years, suggesting that taphonomic analysis of fossil bones might be the best way to reveal the earliest evidence for tool-assisted subsistence behavior in the archaeological record. Furthermore, if the marks were produced through butchery, it would mean that hominin exploitation of large ungulate meat and fat resources – and the confrontation this would have sparked with large carnivores over the same resources – began much earlier in our lineage than previously thought. Indeed, it would have meant that our small-brained Australopithecine ancestors were already entering into novel subsistence niches and leaving an early archaeological record as they did so.

However, researchers such as Domínguez-Rodrigo et al. (2010) questioned the identification of the marks as having been produced by stone-wielding hominins. Instead, they have proposed that they are mimics of butchery marks and that they have been produced through natural means. During similar debates in the 1980s and 1990s, the issue of how to diagnose bone surface modification was tackled through actualistic research, blind tests, and the use of advanced methods such as scanning electron microscopy. However, there is a growing awareness in taphonomy that actualistic work normally only addresses one or a handful of the potential processes that can impact a bone from the time an organism dies until the time the fossil is studied.

The debate over the DIK-55 specimens remains inconclusive today, in spite of the wealth of knowledge accumulated over several decades of actualistic research. This illustrates how taphonomy in human evolution is an ever-growing and still relatively nascent field of study. Until more evidence is recovered, the verdict on whether or not Australopithecine hominins used tools to butcher meat will likely remain stalled. However, from a historical perspective, all these debates provide valuable insight into how changing views of human ancestors have shifted along with the prevailing research climate. New evidence has brought old ideas back to the forefront, and in many cases (as at Zinj), the same datasets have been used to argue for completely contradictory interpretations of past hominin behavior. The cyclical nature of these debates suggests that in the future, taphonomists will be looking to draw from novel methods and innovations in both method and theory. They will be seeking to push the boundaries of what is known and striving to move beyond arguing about what is perhaps in the end unknowable.

Cross-References

- ▶ Binford, Lewis R. (Hunter-Gatherer and Mid-Range Societies)
- ▶ Leakey Family
- ▶ Middle-Range Theory in Archaeology
- ▶ Neanderthals and Their Contemporaries
- ▶ Olduvai Gorge Archaeological Site
- ▶ *Paranthropus*
- ▶ Taphonomy: Definition

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Taphonomy, Regional

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Introduction

Taphonomy is a discipline common to many fields, like paleontology, geology, paleoecology, or archaeology. Its basic goal is to understand the transition of organic materials, for example, bones or soft tissues, from the biosphere to the lithosphere (Lyman 1994). Taphonomic information is routinely used by archaeologists to assess the quality of archaeological data, to evaluate the loss of cultural and ecological information, to pursue paleobiological questions, and sometimes also to acquire paleoecological information (Gifford 1981; Behrensmeyer 1993; Lyman 1994; Marean 1995). In other words, the conditions which are adequate for the formation of fossils are a central concern of taphonomy. Archaeological applications are usually focused on the preservation of bones, but they also cover cases involving transformations of lithic tools, pottery, or other kinds of materials. In most cases local scales of analysis are used – usually, the site – and indeed those scales are adequate to perform most of these tasks. The literature is full of successful examples of application of taphonomic analysis at a local scale (Pickering et al. 2007; Stuart & Larkin 2010). However, the fact that the scale at which most archaeological problems are usually stated is regional is a valid reason to also advocate for a regional scale of taphonomic analysis (Borrero 1988).

Definition

The basic goal of regional taphonomy is to understand the dynamics of environments at large spatial scales, particularly the processes responsible of bone accumulations. An accumulation of bones is usually defined as any surface or stratigraphy occurrence of vertebrate remains of more than one individual in a well-circumscribed area, around 100 m^2 (Behrensmeyer 1991: 293), and it is the result of a variety of processes. The regional distribution of bone accumulations and its causes constitutes the central subject of the analysis (Haynes 1982; Behrensmeyer 1983; Borrero 1988). These bone accumulations may be the result of the activities of one or more agents, and one important task is that of separating those agents in an effort toward understanding the causes behind the different bone accumulations. Taphonomic analysis can help to separate fossil bone accumulations created by hominins, carnivores, water, or other varied agents (Haynes 1980; Behrensmeyer 1991; Gutiérrez et al. 2010). On the other hand, beyond the identification of

the depositional agents, a regional taphonomy may provide an understanding of the impact of the recent natural "bone rain" on the regional archaeological record. The formation of palimpsests and other issues of contamination of archaeological and recent bone assemblages can be assessed in this way. In other words, an understanding of what bones can be used for a cultural discussion and what bones inform on modern and fossil natural processes at different loci is the expected result of a regional taphonomy.

Historical Background

Taphonomic research in Tierra del Fuego provides a substantial example of some of the properties of a regional taphonomy. This example highlights the importance of the processes of contamination of archaeological sites with modern bones and the necessity to understand the causes creating those palimpsests. The San Pablo region in the Atlantic coast of Tierra del Fuego, Argentina, is characterized by extensive *Nothofagus* sp. forests that alternate with peats and prairies. This region was actively used by hunter-gatherers during the Late Holocene. It is also a place regularly inhabited by guanacos (*Lama guanicoe*). This study showed that most of the known archaeological sites of that region dated between approximately 300 BP and present were contaminated with recently deposited guanaco bones. Longitudinal observations made along several years confirmed the vertical migration of recently deposited guanaco bones contaminated many archaeological assemblages (Borrero 1990). This problem was aggravated by the fact that the modern bones that were contaminating the archaeological assemblages were highly fragmented. Similar mixes of old and recent bones were also noted when other archaeological assemblages were studied on the island or in Patagonia. Given the fact that guanacos were also the main prey for prehistoric hunter-gatherers, the separation of archaeological and "natural" bones is generally difficult to achieve. Generally speaking, taphonomic research produced a suite of taphonomic principles – rates of weathering, ranking of bone destruction, bone selectivity by different carnivores or by running water, etc. – that can be used to separate recently deposited bones from archaeological bones (Borrero 2007). This separation is crucial to acquire a trustable list of the guanaco parts selected for human consumption. Similar problems involve other species in other places (Behrensmeyer 1991; Lyman 1994).

Key Issues/Current Debates

Knowledge about the regional distribution of the archaeological materials is important for any regionally oriented taphonomic research program (Dunnell & Dancey 1983). In other words, this is the only way to know at which places artifacts and natural bones had the potential to overlap in space and also at which places good bone preservation is to be expected. The best way to do this combines taphonomic and geoarchaeological work.

The more useful data collection strategies are those that at the same time will record both archaeological and taphonomic information. Surface bones recorded in transects or blocks (Behrensmeyer 1983) need to be classified by species, element, completeness, degree of disarticulation, abrasion stage, weathering stage, and classes of damage (carnivores, rodents, etc.) (Lyman 1994). When possible, evidence of cause of death, age at death, presence of associated tracks, feathers or scats, and type of substrate must also be recorded. The potential for burial can be evaluated not only by using soil probes but also by analyzing the correlation between weathering stages and bone burial – usually defined as 50 % or more of the element covered by sediments (Behrensmeyer 1991). Frequency information is usually transformed into densities per square meter to facilitate comparisons. The archaeology of the places that show high risk of bone contamination needs to be

stratigraphically examined using test pits. In this way, by using the locally recorded fossil and taphonomic information and general taphonomic principles, the degree of bone contamination can be assessed.

Other regional approaches to taphonomy exist, some of which rely almost exclusively on naturalistic data. One example is the work of Blumenschine (1987) at Serengeti and Ngorongoro, Kenya. This particular study was oriented toward the identification of the scavenger opportunities offered by modern environments. The research goal was to use them as analogs for the Plio-Pleistocene hominin landscapes. This study was criticized for two main reasons. First, it was observed that even the best modern analogs differ significantly from the habitats of the Plio-Pleistocene in the variety and distribution of carnivores and herbivores. Second, it was suggested that places like Serengeti cannot be considered as the best analog for that period in East Africa (Tappen 2001). Anyway, this is an extreme situation in which environments separated by c. two million years or more are compared. In spite of the tremendous differences imposed by this situation, regional naturalistic observations have proved important in the evaluation of many similar situations (Haynes 1982; Behrensmeyer 1983). This is particularly true when these observations are complemented with experimental taphonomic work (Dominguez-Rodrigo 2012). An understanding of the basic processes that govern the deposition and preservation of organic remains provides ways of separating those components of the fossil record that can be attributed to human activities.

Most of the approaches that try to identify regional taphonomic signals principally work with surface records, but there are conditions under which stratigraphic approaches can be used as well. One example is the work at Olorgesailie, Kenya, where the spatial distribution of at least two different time periods was examined and compared using regional taphonomic properties (Potts et al. 1999). In the ideal case, both surface and stratigraphic samples should be employed, and it is their comparative integration that proves to be more informative.

Future Directions

Regional taphonomy is a way to study and understand potential biases affecting archaeological assemblages. It is also a useful way to acquire paleoecological information and to select the most adequate places to answer specific research questions. Effectively, an understanding of the formation of palimpsests can be used to select places with better integrity or with the capacity to inform about particular activities, like scavenging or hunting. In turn, the knowledge about the aggregational history of the deposits can be used to study paleoclimatic and palaeoenvironmental issues (Bobe et al. 2007). For these reasons regional taphonomy is a research strategy that appears to be especially not only useful during the early phases of archaeological research but also capable of obtaining primary information. Most places in the world offer conditions for contamination of older bone assemblages with more recent bones. Regional taphonomy offers one way to respond effectively to that challenge.

Cross-References

- ▶ Taphonomy in Bioarchaeology and Human Osteology
- ▶ Taphonomy: Definition
- ▶ Vertebrate Taphonomy in Archaeological Research

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Taphonomy: Definition

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The term taphonomy (from the Greek *taphos* – τάφος – meaning burial and *nomos*, νόμος, meaning law) is defined as the study of the transition of plant and animal organisms after death from the biosphere (living surfaces) to the lithosphere (underground). Taphonomists study processes such as decomposition or burial that affect organisms after death and which ultimately result in animals and plants becoming part of the fossil record.

Cross-References

▶ Taphonomy in Bioarchaeology and Human Osteology
▶ Taphonomy in Human Evolution
▶ Taphonomy, Regional

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Tarlow, Sarah

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Basic Biographical Information

Sarah Tarlow is a historical archaeologist based in the United Kingdom. She received her B.A. in English Literature from Sheffield University in 1989 and her M.Phil. (1990) and Ph.D. (1995) in Archaeology from the University of Cambridge. She taught at the University of Wales, Lampeter, between 1995 and 2000, before taking up a position as lecturer in Historical Archaeology at the University of Leicester. She was appointed to senior lecturer in 2006 and was appointed to a personal chair in spring 2012.

Among many high-profile professional duties, Tarlow has been an active editorial contributor to the journal *Archaeological Dialogues* and the leading figure in the development of the teaching and research programs in Historical Archaeology at the University of Leicester.

Major Accomplishments

Tarlow's doctoral thesis, supervised by Ian Hodder, was titled *Metaphors of Death in Orkney, CE 1600–1945* and explored how early modern and modern gravestones could be studied by archaeologists as evidence of attitudes to death, and especially to the history of emotion and affect. Developed into a book-length study of *Bereavement and Commemoration* in 1999, Tarlow's Orkney research pioneered research into the archaeology of emotion, actively critiquing previous (especially Marxist) archaeological studies of funerary practices from a distinctive perspective that holds some commonalities with feminist archaeologies.

During the 2000s, Tarlow's studies of modern death came to engage more with social history: both through her account of Oliver Cromwell's head (Tarlow 2008) and her book-length study of *Ritual, Belief and the Dead in Early Modern Britain and Ireland* (Tarlow 2011). In 2011, this led to the award of a large research grant for a groundbreaking interdisciplinary project "Harnessing the Power of the Criminal Corpse" (funded by the Wellcome Trust), which brings archaeological thinking together with medical and criminal history, folklore, literature, and philosophy.

At the same time, she has contributed significantly to methodological and theoretical debates about the relationships between archaeology and history: in her pioneering edited volume *The Familiar Past?* (with Susie West, 1999), in her groundbreaking studies of utopian communities, and in her book-length account of the archaeology of improvement in the eighteenth and nineteenth centuries (Tarlow 2007). Tarlow also played an active role in the early development of the CHAT conference group, hosting the second (2004) meeting at the University of Leicester.

Cross-References

- ▶ Churchyard Archaeology
- ▶ Contemporary and Historical Archaeology in Theory (CHAT)
- ▶ Critical Historical Archaeology
- ▶ Death, Burial, and Commemoration in Historical Archaeology
- ▶ Post-Medieval Archaeology (Europe)
- ▶ Social Identity in Historical Archaeology
- ▶ Western Europe: Historical Archaeology

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Taro: Origins and Development

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Taro: Origins and Development, Fig. 1 Wild taro (*C. esculenta*) in swamp with *Pandanus* in lowland rainforest, Daintree National Park, Australia (Photo: Matthews 2008)

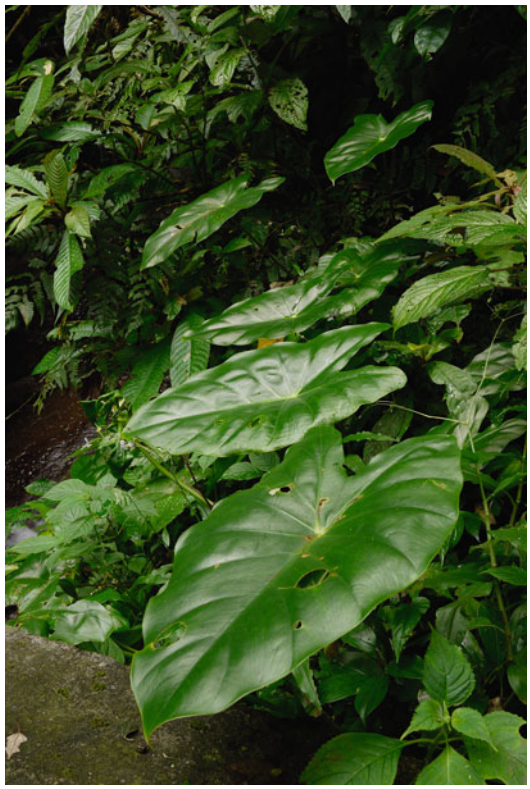
Basic Species Information

taro (less commonly: *cocoyam, dasheen, eddoe*) (English), *kolokasi* (Greek), *qolqas* (Arabic), *kachu* (Bengalese), *arvi* (Hindi), *pein-u* (Burmese), *yu* (Chinese), *satoimo* (Japanese), *khoai nuoc* (Vietnamese), *gabi* (Tagalog), *kaladi* (Malay), *talas* (Palawan, Bahasa), *taro* (Maori, Samoan), *ma* (Papua New Guinea), *gwaza* (Hausa), *iso koko* (Yoruba), *ede epi* (Igbo), *mayugwa* (Zanzibar). The genus *Colocasia* (L.) contains at least nine and perhaps many more distinct species, all of which are found in humid to semiaquatic habitats in Southeast Asia to southern China. They are soft acrid herbs, often 0.5–2 m tall, leaves large, heart-shaped, with blades supported on long centrally inserted petioles (hence peltate) above an erect or underground corm. Male and female flowers appear on the same inflorescence (spadix with spathe, raised on a peduncle). After pollination by insects, numerous berries with many small seeds are produced. Some species, including taro (*C. esculenta*, Figs. 1, 2), display waxy, non-shining leaves that repel water (wax is on micro-hairs that reduce reflection), while others display non-waxy, shiny, wettable leaves (e.g., *C. lihengiae*, Fig. 3). On taro, two to several fruiting heads may appear in sequence in one season from a single axil. Vegetative propagation of taro is by side-corms with many buds (many or most cultivars) or by long stolons with many nodes (many cultivars and most wild forms).

Taxonomy and Geographical Distribution

Taro was first described by Linnaeus in 1753 based on material derived from the Mediterranean region, where it has been cultivated since antiquity. He put the species in the genus *Arum* under the name *Arum esculentum* L. In 1832, Schott transferred taro from genus *Arum* to

Taro: Origins and Development, Fig. 2 Removing acrid skin from the starchy corm of cultivated taro, Kokoda Valley, Papua New Guinea (Photo Matthews 2008). Starchy residues like those attached to the knife here have been reported archaeologically on stone tools



Taro: Origins and Development, Fig. 3 *Colocasia lihengiae* Long and Liu, wild in Ba Vi National Park, Vietnam (Nguyen 2005; Photo Matthews & Du 2011)

a new genus, *Colocasia* Schott, based on the type species *Colocasia antiquorum* Schott, a name later understood as a synonym for *C. esculenta* (L.) Schott. Many different names have existed for the same plant, including *Caladium esculentum* (L.) Vent. 1801, *Colocasia esculenta* var. *aquatilis* Hassk. 1840, *C. antiquorum* var. *aquatilis* (Hassk.) Krause 1920, and *C. esculenta* var. *antiquorum* (Schott) Hubb. and Rehder 1932. Early taxonomists erected many species of *Colocasia* based on collections of wild plants and diverse cultivated forms of what is now called taro (*C. esculenta*). Recent work in mountainous regions of Southeast Asia has led to the discovery and description of further wild species. Consensus is lacking on the full number of distinct species; nine are noted here and more certainly exist:

1. *Colocasia esculenta* (L.) Schott 1832, highly polymorphic (Plucknett 1983) with diverse wild-type and domesticated forms; cultivated in most tropical to warm-temperate regions of the world; possibly evolved in low mountains of Southeast Asia (vicinity of other wild species in mountains), now distributed in natural and disturbed habitats in subtropical to tropical regions from India to China,

Australia, and Melanesia (the likely natural range), and notably absent from Taiwan as a wild plant.
2. *C. formosana* Hayata 1919, abundant and widespread in Taiwan; forms a morphologically homogeneous wild population and is not known in domesticated form; morphologically distinct, but minimally so, from wild *C. esculenta*.
3. *C. fallax*, Schott 1859, wild in Himalaya.
4. *C. affinis* Schott 1859, wild in mainland Southeast Asia, lower altitudes.
5. *C. lihengiae* Long and Liu 2001 wild in mountains, northern Vietnam to Yunnan, China.
6. *C. menglaensis* Yin, Li, and Xu 2004, wild in mountains, northern Vietnam to Yunnan, China.
7. *C. yunnanensis* Long and Cai 2006, wild in mountains, Yunnan, China.
8. *C. oresbia* Hay 1996, wild on Mt. Kinabalu, Borneo.
9. *C. gigantea* (Blume) J. D. Hook. 1893, a leaf vegetable (petiole only) in Southeast to East Asia and especially popular in Vietnam; wild in karst landscapes of mainland Southeast Asia; a taxonomic and genetic outlier, distant from other *Colocasia* species.

Major Domestication Traits

Rumphius (seventeenth century) may have been the first author to describe with words and illustration a natural wild form of taro (*Caladium aquatile;* syn. *C. esculenta* var. *aquatilis;* cf. Matthews 1991) in Ambon, eastern Indonesia; he saw wild taro growing along rivers, and it was used as fodder for pigs, a usage that is widespread today in Southeast Asia. Wild taro is very acrid, like most Araceae, and is widely known as a famine food that requires special care in the selection and preparation of parts eaten (corms, leaves, stolons). Major domestication traits are:

1. Reduction in acridity of raw tissue or an increase in the susceptibility of the acrid factor (an enzyme) to heat (cooking) or both.
2. Increase in the bulk of the starchy corms, with diverse associated changes in flavor and texture.
3. Distinctive green-white, purple-red, and yellow-orange colors in leaves, stolons, corms, and inflorescences; color variation aids cultivar identification and has aesthetic appeal in gardens and on plate.
4. Cold adaptation (many small side-corms) and day-length sensitivity in northern temperate cultivars.

Acridity helps protect against herbivores, reducing costs for cultivation and storage but increasing costs for processing and consumption. According to cultivar, the corms, side-corms, or leaves (blade or petiole) are main parts eaten; the stolons and spathes of some cultivars are also eaten.

Timing and Tracking Domestication

Cultivars in Eurasia are very ancient since taro is mentioned in ancient texts that date back to around 2,000 years ago in both China and the eastern Mediterranean (Matthews 2006). Northern, temperate-adapted cultivars of taro may have originated in the northern margins of the natural range, in eastern Himalaya, where taro could breed, where triploids often appeared, and where farmers could select traits favorable to winter storage, spring propagation, and summer cultivation. The earliest association of taro with agricultural infrastructure, some 6,400–7,000 years ago, has been found at Kuk Swamp in Papua New Guinea (Denham & Barton 2006). In Papua New Guinea, taro used at early dates could have been a natural wild form or could have been undergoing domestication in response to changes in landscape management, cultivation methods, cooking methods, and food preferences.

Genetic studies have shown that taro cultivars are very diverse and form a number of distinct gene pools; the great diversity within diploid and triploid cultivars ($2n = 2x = 28$, $2n = 3x = 42$) indicates domestication many times. Wild populations have not been studied

in enough detail, or in enough places, to identify source regions and routes of movement. Since cultivars are carefully maintained as clones, some may be hundreds if not thousands of years old and may have spread in many different directions, over vast distances, with trade and human migration. The antiquity of taro in Africa is much debated. Wild populations are not known there, and the crop was possibly introduced from multiple directions at different times: overland from West Asia, via the Indian Ocean from Southeast Asia, and via the Mediterranean Sea to North Africa and the Iberian Peninsula. Taro first reached the Caribbean and Central America as a food of slaves carried from West Africa.

Cross-References

- ▶ Agriculture: Definition and Overview
- ▶ Agricultural Practices: A Case Study from Papua New Guinea
- ▶ Archaeobotany of Early Agriculture: Microbotanical Analysis
- ▶ Domestication Syndrome in Plants
- ▶ Domestication: Definition and Overview
- ▶ Genetics of Early Plant Domestication: DNA and aDNA
- ▶ Kuk Swamp: Agriculture and Domestication
- ▶ Niah Cave (The West Mouth)
- ▶ Plant Domestication and Cultivation in Archaeology
- ▶ Plant Processing Technologies in Archaeology
- ▶ Vegeculture: General Principles

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Tavares da Silva, Carlos

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Basic Biographical Information

Carlos Tavares da Silva (Fig. 1) was born in Portugal in 1944. He obtained his academic qualifications in geology (1967) and biology (1975) from the Universidade de Lisboa. Between 1967 and 1974, Carlos Tavares da Silva was an archaeological adviser of the Educational Ministry (Junta Nacional de Educação) in the municipalities of Setúbal and Palmela. He was an archaeologist in Gabinete da Área de Sines, from1972 to 1974, and he was Director of the Archaeological Service of Gabinete da

Tavares da Silva, Carlos, Fig. 1 Carlos Tavares da Silva (Castro de Chibanes, 2012)

Área de Sines, from 1974 to 1988 (Tavares da Silva & Soares 1981), and he coordinated the archaeological unit of the Natural Park of Sudoeste Alentejano e Costa Vicentina between 1988 and 2000. He has been Director of the Archaeological Center of the Museum of Archaeology and Ethnography in the District of Setúbal since 1974 and co-director of the archaeological review, *Setúbal Arqueológica*, since 1974. He lectures in prehistory at the Universidade de Lisboa.

Carlos Tavares da Silva had been a member of the Scientific Committee of the Portuguese Institute for Archaeology and Cultural Heritage and of the International Union of Pre- and Protohistoric Commission on Neolithic civilizations of the Mediterranean and Europe. He is also a member of the Academia da História in Portugal and researcher of the Archaeological Center of the Universidade de Lisboa. He is the President of the Scientific Committee of the archaeological site of Tróia. He is the author and coauthor of some two hundred publications. In 2004 he was awarded the Gulbenkian Archaeological Award in recognition of his services to archaeology in Portugal.

Major Accomplishments

Carlos Tavares da Silva has directed and co-directed more than 100 archaeological excavations based on research projects and rescue programs. From 1997 to 2002, he worked on the largest archaeological project of Southern Portugal, in Alqueva, (dam of the Guadiana River) and also worked on the preceding archaeological and cultural heritage survey to evaluate the environmental impact of the dam's construction, with Joaquina Soares and José Manuel Mascarenhas.

Carlos Tavares da Silva has played an important role in the development of Portuguese urban and rescue archaeology. With Joaquina Soares, he convened the first national congress on this matter "I Encontro Nacional de Arqueologia Urbana" at Setúbal in 1985. Carlos Tavares da Silva's main contributions in the field of archaeology research are (I) formulation of the first periodization model for the Chalcolithic of Portuguese Estremadura (Tavares da Silva & Soares 1986); (II) identification of the first Chalcolithic fortifications from the III millennium cal BC in Southern Portugal, with Joaquina Soares (Ferreira da Silva et al. 1993); (III) Neolithization process in the Southwest Portuguese Coast, with Joaquina Soares (Tavares da Silva & Soares 2006); (IV) discovery and study of the settlement strategy of the Middle Bronze Age of SW Iberia (Cultura do Bronze do Sudoeste), with Joaquina Soares; (V) identification and excavation of the first Phoenician factory (Abul, in the Sado estuary) currently known in the Atlantic façade of Iberian Peninsula, with Francoise Mayet (Mayet & Tavares da Silva 2000); (VI) the urban archaeology of Setúbal; and (VII) salted fish and fish sauce industry in the Roman Period on the Southwest Portuguese Coast (Tavares da Silva & Soares 1993; Mayet & Tavares da Silva 1998, 2002).

Cross-References

- ▶ Europe: Mesolithic-Neolithic Transition
- ▶ Fortifications, Archaeology of
- ▶ Hunter-Gatherers, Archaeology of
- ▶ Social Archaeology
- ▶ Urban Archaeology

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Taylor, R. E. (Erv)

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Basic Biographical Information

R. E. (Erv) Taylor (1938–) is an American archaeologist best known for his work in radiocarbon dating (C14). He received his Ph.D. in anthropology at the University of California, Los Angeles (UCLA), in 1970 with an emphasis on archaeology and archaeological sciences/archaeometry. His doctoral research, under the direction of C. W. Meighan, was undertaken in the laboratory of Nobel laureate Willard F. Libby. From 1972 to 1973, he was an NSF postdoctoral fellow in chemistry at UCLA working with Daniel Kivelson.

From 1969 to 2005, he rose to professor in the Department of Anthropology at the University of California, Riverside (UCR), and has been professor emeritus since 2005. He served as chairperson of that department from 1993 to 2000. He was director of the radiocarbon laboratory at UCR from 1973 to 2003. Since 2003, he has been a Cotsen fellow at the Cotsen Institute of Archaeology, University of California, Los Angeles (UCLA), and, since 2004, has also been a visiting scientist at the Keck Accelerator Mass Spectrometer Laboratory, University of California, Irvine.

Major Accomplishments

Taylor's research has focused on examining the application of dating and analytical techniques in archaeology, with particular emphasis on radiocarbon. He is recognized for his work involving the C14 dating of bone, particularly human bone samples associated or thought to be associated with the earliest human populations in the New World.

In the early part of his career, Taylor published a series of papers focused on the evaluation of C14 data from various sites in West Mexico.

In connection with these studies, he published some of the first papers concerned with defining the marine reservoir effects in the C14 dating of shell for the Pacific coasts of North, Central, and South America and the first large suite of C14 dates on organics extracted from ceramics.

In the 1980s and extending into the early 1990s, Taylor was involved in pioneering applications of the use of accelerator mass spectrometry (AMS) technology to C14 dating of archaeological materials, in association with the AMS laboratory at the University of Arizona. Later, he was instrumental in developing support for establishing the Center for Accelerator Mass Spectrometry for the University of California at the Lawrence Livermore National Laboratory.

Taylor initiated studies with a number of collaborators resulting in major downward revisions in the Pleistocene ages assigned to a series of California Paleo-Indian skeletons, particularly Sunnyvale, Yuha, Los Angeles, and Haverty. The UCR laboratory was also responsible for C14 dates on the Calaveras Skull, the "Piltdown" of the New World (Taylor et al. 1992a). His laboratory obtained the first C14 age determinations on the Kennewick skeleton (Taylor et al. 1998). He has also been involved in continuing studies focused on the accuracy of C14 dates from the site of Monte Verde in Chile and possible regional offsets in C14 calibration data for the mid-1st millennium BCE (Taylor et al. 1999).

In the 1970s, Taylor was involved in early studies in obsidian sourcing and hydration dating and edited the first volume addressing archaeological and geochemical issues involving obsidian (Taylor 1976).

Taylor has authored over 100 journal articles in a wide range of scholarly journals including *Science*, *Nature*, *American Antiquity*, *Antiquity*, *Historical Archaeology*, *World Archaeology*, and *Radiocarbon*. He is the author/editor of several significant books: *Chronologies in New World Archaeology* (Taylor & Meighan 1978), *Radiocarbon Dating: An Archaeological Perspective* (Taylor 1987), *Radiocarbon After Four Decades: An Interdisciplinary Perspective* (Taylor et al. 1992b), and *Chronometric Dating in Archaeology* (Taylor & Aitken 1997).

Taylor's career accomplishments were recognized with the awarding of the 2004 Fryxell Award for Interdisciplinary Research, from the Society for American Archaeology, of which he is a longtime member. He is a fellow of the American Association for the Advancement of Science and the American Anthropological Association. He was a cofounder of the Society for Archaeological Sciences, as well as its first president (1980–1981) and general secretary for 20 years (1982–2002).

Cross-References

- ▶ Archaeology: Definition
- ▶ Bone: Chemical Analysis
- ▶ Kennewick Man Case: Scientific Studies and Legal Issues
- ▶ Monte Verde, Archaeology of
- ▶ Paleoindians
- ▶ Peopling of the Americas
- ▶ Radiocarbon Dating in Archaeology
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Techniques of Paleolithic Art

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Brief Definition of the Topic

Techniques used by Upper Paleolithic groups to produce their graphic works of art provide almost inexhaustible sources on "ways of doing." They also enable us to reflect on the levels of practice of "artists," on the internal organization of societies, and on the implication of the individuals in the procurement of pigments, tools, and mediums.

In studying the techniques of Paleolithic artists, we seek to identify the set of processes of formal construction from the level of a single trace, to their combination into the form of a drawing all the way to the use of the graphic space whether it be on a restricted medium like an object or on a wall.

The study of techniques allows for the understanding of the artists' gestures and the mediums used in the different graphic works.

The mediums of prehistoric representations are multiple and varied from objects of portable art (including bone, stone tablet, ivory, antler) to cave walls, shelters under rock, and rocky blocks in the open air. It is possible to distinguish two main categories of techniques employed: those that add material during the course of the work and those that proceed by removing matter.

In the first category we find the use of pigment for drawing or painting. The coloring is deposited on the medium (bone, rock, or others). The state of the coloring material allows us to distinguish a drawing from a painting. A painting requires a liquid pigment which is applied with a paintbrush, a brush, with the tips of the fingers, or even blown with the mouth, while drawings require a compact pigment, prepared in the form of chalk, pencil, or pastel.

The second category of techniques of Paleolithic art is illustrated by the removal of matter such as engraving, sculpture, and some types of modeling.

These general principles are applicable to all forms of prehistoric art. We see them being implemented on the first decorated representations, for example, the drawings and paintings on the Chauvet-Pont-d'Arc Cave – at 36,000 cal BP.

Upon this theoretical basis, Paleolithic techniques seem relatively simple. It is important to understand as a follow-up how the "artists" combine their gestures and whether the results obtained seem to conform to the goals that we imagine they had set for themselves.

Generally, the fundamental actions of engraving are relatively easy to master if we take into consideration some physical constraints associated with the support (bone, stone, antler) and the tool (flint, finger, stick). Once the bases are acquired, we can evaluate the quality of the designers according to two criteria: the mastery of the drawing and the technical skill. All the know-how of the Paleolithic artist resides in the acquisition of these two foundations.

The most beautiful examples of drawings in the Chauvet Cave perfectly illustrate this double mastery. Admittedly, one should not underestimate the creative imagination of the individual and its capacity for invention or for breaking the rules. Nevertheless, the expertise and graphic innovations remain in the large majority of cases subject to the social codes that govern the artistic production of this cultural group, and the control of society over the individual is highlighted throughout the duration of the Upper Paleolithic.

From the appearance of the first graphic manifestations, all techniques (engravings, sculpture, drawing, painting, modeling) are present and acquired. They persist throughout the Upper Paleolithic.

In Chauvet Cave, the combination of graphic and technical expertise, which characterized the important compositions of black paintings during the Aurignacian, along with the very early dates, destabilized some researchers. To summarize, we can say that all adaptations to the medium are present in Chauvet Cave: the drawing incised with the finger tips, with the flint tool on hard surfaces or softer limestone all the way to the use of more complex techniques requiring combined successive gestures (i.e., on the Panneau des Cheveaux). To start, the artist prepared the surface, removing a portion of the fine film of ochre clay that covers the rock surface. Next, the artist set up the figures by species beginning with the rhinoceros, aurochs, and finally the horses. The contours of the animals are first made with charcoal and then the inner surface of silhouettes is hand faded by mixing directly on the wall, charcoal, chalk, and clay remains. The colors obtained thus present nuances that fade from dark gray to light gray and dark brown gray. The next phase is a clipping of figures with a chisel made of flint to clarify the contours and highlight the black animal heads in contrast to the white limestone.

Throughout the Upper Paleolithic, the prehistoric peoples adapted these processes as well on objects as on cave walls and rock shelters. Thus, in the Magdalenian, we see in some regions the development of monumental friezes carved on hard limestone deep inside rock shelters such as Angles-sur-l'Anglin (Vienne) and Cap Blanc (Dordogne). In the Pyrenees, a specialty of clay modeling is evidenced in several neighboring caves such as Le Tuc d'Audoubert in Ariege and Montespan (Haute-Garonne).

According to 14C dating, portable art shortly precedes parietal art but, from the origin, we note that the same patterns (in technique and symbols) govern the works, with no noticeable difference. However, it is principally during the Magdalenian that we find a large diversity of objects, illustrating the range of techniques and supporting media. And as with parietal art, we find variable expertise according to the authors. Here again, it is the combination of criteria that establishes a qualitative difference. A number of objects of portable art stand out because of the choice of material, such as the tooth of a sperm whale sculptured at Mas d'Azil, or in matching of theme and support, such as the self-licking bison at La Madeleine, not to mention the Aurignacian figurines in Germany or the Gravettian female statuettes.

Today we know that graphic techniques and their degree of elaboration do not have a chronological value. We cannot qualify a culture based only on our reflection of the procedural techniques employed in the realization of images, both abstract and figurative. We must also forget the notion of "technical progress" in the sense of an evolution in artistic knowledge that would improve over time. In rock art, evolutionary progress does not exist and we must rethink our paradigms.

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- ▶ Europe: Paleolithic Art
- ▶ Europe: Prehistoric Rock Art
- ▶ Rock Art, Forms of

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Technological Studies in Archaeological Science

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Introduction

Technological studies are concerned with many of the big questions of archaeology: Who made the objects we find? What materials did ancient people use? Where did they obtain their raw materials, and how did they craft pottery, stone tools, buildings, clothing, and other useful items? How did they communicate technological knowledge to each other, and how and where did they trade raw materials and finished objects? Why did people value certain materials and products over others?

The extent to which scholars can answer these questions depends upon the physical evidence left behind (e.g., pottery kilns, potsherds and broken glass vessels, chert debitage, scraps of preserved textiles), the context of the finds, and the nature of historical information, if any. For example, when dealing with the Roman pottery industry in Italy, France, and Germany, scholars find stamps (Fig. 1) of potters and manufacturers and literary evidence in addition to physical pottery installations for interpretation. In contrast, prehistoric stone pipe and figurine production in North America must be reconstructed from the physical remains (quarry sites and finished objects) alone.

Technological Studies in Archaeological Science, Fig. 1 Manufacturer's stamp on Roman *terra sigillata* (Photo by S. Wisseman, University of Illinois)

Evaluating the evidence is a multidisciplinary endeavor, with teams of specialists collaborating to use appropriate analytical techniques and other approaches such as experimental replication of artifacts to reconstruct early technologies. Success, defined here as arriving at the most likely construction methods and materials used by ancient craftsmen, requires asking the right questions throughout the research process and following a coherent research strategy.

Definition

The study of ancient technologies is really about processes and patterns of human behavior and about tracing the journey of an object from its beginning as a lump of wet clay or a chunk of obsidian to a finished product used and valued by human beings. This research starts with provenance studies (see separate entry) that examine the question of source (where people found their raw materials) and the trade and exchange of materials and products across the landscape.

Technological studies, the primary focus of this entry, reveal material properties and some of the reasons people chose particular materials to fashion into pots, tools, figurines, and cloth, plus the methods they used for fabrication. Such studies are conducted today using a sequence of archaeometric methods (analyzing composition, structure, date, etc., using imaging, microscopic, mineralogical, and chemical techniques). To be cost-effective, most researchers move from macro to micro examination and from simplest techniques (e.g., light microscopy, X-ray radiography) to more complex ones (e.g., neutron activation analysis). Depending on the nature of the research questions posed, it is often useful to perform mineralogical analysis (e.g., petrography, X-ray diffraction) prior to elemental analyses (e.g., X-ray fluorescence) (Emerson et al. 2005).

Understanding the decisions craftsmen made during production (such as how to compensate for bad weather or insufficient fuel during a pottery firing) requires research that goes beyond using instruments for materials analysis. Ethnoarchaeology is the study of living craftsmen who still use traditional practices that can sometimes clarify ancient procedures, and experimental archaeology is the careful replication of artifacts using, as much as possible, materials and methods available to ancient people. Such experiments teach the researchers about the limitations of specific materials, how much skill was required to make tools such as obsidian knives or large ceramic storage jars, and the pitfalls of assuming one knows how something was made just from casual observation or book learning.

For societies who left no written record, detailed examination of the location, layout, and debris of a production site can reveal patterns of behavior that contribute to our understanding of *chaîne opératoire*, or sequence of operations. Social organization and status of craftsmen can sometimes be inferred, although such research is much easier with written or artistic records (e.g., literary sources describing Greek ceramic manufacture and images of potters at work on vases). Cognitive archaeology is the recreation of decision-making and teaching processes used by early craftsmen (e.g., how to judge the correct temperature of an iron forge) through imitation by modern craftsmen. Another area of research is use-wear or use-alteration analysis: the examination of items such as potsherds, cooking pots, or stone tools using magnification, organic residue analysis, and other techniques to determine how artifacts were used and reused over time.

Historical Background

During the early years of archaeometric research, the focus of technological studies was primarily on inorganic materials: clay, metal, and stone. The field was dominated by compositional and authenticity studies using techniques borrowed from chemistry and the physical sciences (various types of microscopy, spectroscopy, radiography, neutron activation analysis, etc.). Early research (in part because some of it was conducted by chemists and physicists rather than archaeologists) focused more on questions of what and how (composition and methods of construction) than on who and why. As archaeologists and anthropologists became increasingly involved in interdisciplinary projects, emphasis shifted to strategies for determining function of artifacts, processes of the craftsmen, and patterns of use and discard.

In the United States, the work of archaeologist Anna O. Shepard (Bishop & Lange 1991) set the stage for careful interdisciplinary studies of ceramics, while physicist Michael Tite's research in Britain applied scientific techniques to the study of composition and structure of ceramics, enamels, glass, stone, and metals. Today, with a host of newer techniques available from the biological sciences, researchers are including organic materials (e.g., textiles, bone, ivory) in their quest to reconstruct ancient technologies of every sort and set the materials and methods used by craftsmen into a broader human context.

This broader human context requires expanding our definition of what was important to the people who made the artifacts we study.

For example, a craftsman's choice of raw material depends not only upon physical properties (e.g., color, hardness, or behavior when heated) but location relative to production sites and perceived value of a material. Early researchers such as Dean Arnold considered factors such as the weight (of wet clay), the method of transport available, and the amount of manpower required to collect raw materials. However, peoples' choices of material are also influenced by a desire for exotica, even when the cost of transport of labor is high. For example, researchers in the mid-continental United States have proven that pipestone workers often chose raw material from far away for reasons that are not always clear to modern archaeologists, selecting Minnesota red catlinite over locally available Ohio flint clay (Emerson et al. 2005).

Key Issues and Current Debates

Archaeologists are interdisciplinary scholars out of necessity. Because excavation usually produces only fragmentary physical evidence, archaeologists must be creative about combining approaches to extract the maximum amount of information from potsherds, stone flakes, and scraps of deteriorated textiles. When time and budgets permit, examination of the technologies employed in making a ceramic or glass container, a stone or metal tool, or a piece of cloth often includes the full range of compositional and structural studies (archaeometry), experimental replication, and ethnographic analogy.

Experimental archaeology is one way to illuminate factors in selection or manufacture of artifacts that are not immediately obvious. Although this approach gives the archaeologist firsthand experience of materials and processes, extrapolation of this experience into the past is fraught with difficulties. The researcher needs to understand the processes well enough to identify the variables involved (e.g., choice of raw materials, type of fuel, time, temperature, and atmosphere in a ceramic firing) and then control as many independent variables as possible (Hamilton 2008). If modern materials or tools are employed in the experiments, these additional variables must be taken into account in evaluating the success of the experiments (Claassen 1981). Also, it is easy for the replicator to assume that because he has discovered one way something could be done (e.g., throwing a large vase in three sections), that it was the only way it was done in antiquity. Experimental archaeology also helps researchers narrow down possibilities: Finding out that a method of construction is impossible is useful information when it forces them to consider other methods. It also teaches archaeologists the value of hands-on experiments: For example, it becomes clear when making round-bottomed cooking vessels out of clay that using a shallow, already-fired bowl as a mold for the base speeds up the coiling process and thus increases the rate of production of multiple molded-bottom, coiled-body bowls. Similarly, burnishing a pot with a smooth pebble for half an hour in many directions makes classical archaeologists appreciate the value of the slave labor used in ancient Athens.

An example of a thoughtful and well-designed ceramic project is Eric Hostetter's recreation of Lydian terracotta roofing tiles from the site of Sardis in Turkey (Hostetter 1994). Local clays and slips and detailed molds were used for authenticity, but a compromise was reached on the nature of the kilns due to time constraints. After an experimental wood kiln produced reducing conditions that affected the clarity of colors of the finished tiles, electric and gas kilns were employed to achieve a consistent final product that could be displayed to site visitors.

One of the best examples of experimental archaeology in recent years is Peter Schmidt's study of ironworking in East Africa. This study successfully blended ethnographic observation of traditional blacksmithing techniques, replication of ancient artifacts, and materials analyses of both the replicates and the artifacts (Schmidt 1997). In addition to conducting his own experiments with other archaeologists in collaboration with a metallurgist, Schmidt organized several modern smelts that were performed by living Haya craftsmen in Buhaya, Tanzania.

He comments, "we needed a method of investigation that exploited the evidence of modern smelts but did not assume that ancient practices were identical to modern ones." This meant the team had to "determine the fingerprints that technological behaviors such as preheating leave behind and then to look for these and other fingerprints in the physical remains of historic or prehistoric smelts" (Schmidt 1997: 129). This approach produced useful information on where slag accumulated in the furnace, temperature ranges, and reuse of some types of slags. Izumi Shimada used a similar combined approach of archaeometric analyses and experimental archaeology to reconstruct the processes and furnace construction used by copper alloy metalworkers at Batán Grande, Peru. Shimada also built a replica pottery kiln at Sícan, Peru, as part of a larger ceramic study (Shimada 2005).

Another example of a metalworking study that combines replication of artifacts with ethnographic observation is Charles Keller's work on African and North American ironworking. While in Africa, Keller served as an apprentice to a blacksmith because he wanted to learn how people learn and how craftsmen communicate valuable technological information nonverbally: by showing or telling rather than using blueprints. This illustrates one of the aspects of cognitive archaeology, trying to understand what a craftsman knows and how he knows it. For example, judging the heat of the forge is often done by color ("red" heat vs. "white" heat), and an apprentice quickly learns by watching someone more experienced about what works and what does not. Or, when making a replica of an eighteenth-century skimmer, a blacksmith holding the historical artifacts but possessing no set of step-by-step instructions must use prior experience and trial and error to achieve the desired result (Keller 1994). Similarly, Raku potters learn that visual cues are the best indicators for when to pull a pot out of the kiln and put it in sawdust: when the glaze looks "like melted ice cream" (Ron Kovatch, *pers. comm.*).

Other examples of combined approaches (experimental replication, archaeometry, and use-wear analysis) include flintknapping and butchering experiments conducted by scholars such as Nicholas Toth. Toth recreated his own Oldowan tool kit at Koobi Fora, Kenya, learning by experience which rocks and methods (e.g., percussion, anvil) worked best to produce hammerstones, choppers, and scrapers. Then he used his tools to butcher elephants and other animals. Such work informs the archaeologist about which tools are best for which tasks (removing skin, stripping flesh, scraping or cutting bone or plant fibers), and microscopy reveals polishes left by different materials.

Technological Studies in Archaeological Science, Fig. 2 SEM of flax fibers from Egyptian mummy wrappings (Photo by M. Raheel, University of Illinois)

When researchers are more concerned with materials and their properties than processes of manufacture, traditional laboratory analysis can answer many questions. Compositional and structural analyses reveal constituents of dyes and pigments in textiles, enamels, ceramic glazes, and glass. Textile chemists such as Kathryn Jakes and Pamela Martoglio have used infrared spectroscopy, scanning electron microscopy (SEM), and other techniques to identify fibers, coatings, and finishes on textiles (Martoglio & Jakes 1990). These methods work particularly well on well-preserved cloth from environments such as Peru or Egypt; SEM has been used to characterize layers of wrappings (Fig. 2) on Egyptian mummies (Proefke et al. 1992).

Many scholars (e.g., M. S. Tite 1987) have employed surface analytical techniques such as X-ray fluorescence (XRF) to identify the elements (e.g., cobalt for blue, copper for green,

iron for red) used to color Roman glass and medieval enamels. Since many extant pieces of ancient glass were isolated from their original contexts and preserved in museum collections, the question of authenticity occurs frequently. For example, the British Museum wondered if the famous Portland Vase, a spectacular luxury piece with cutout white glass overlaying a blue body, was really Roman or much later, of Renaissance date. Tiny fragments left over from an earlier repair allowed researchers to examine structure and composition using scanning electron microscopy/energy-dispersive spectroscopy (SEM/EDS) and determine that the glass' low potash and magnesia content were consistent with Roman production (Freestone 1991).

Glass was often used in combination with other materials, for example, faience (a ceramic body composed mostly of crushed quartz with an alkaline glaze). A true ceramic glaze is a thin layer of glass bonded to clay, and this layering can been seen easily with an SEM examination. Fluxes (e.g., alkalis, iron oxides) were used to lower the melting point of silica in the glaze material so it would vitrify before the rest of the pot. Other crossover technology is enameling, invented by ancient Egyptians, because it involves melting glass over a metal substrate (Lambert 1997).

The black surface finish of Greek vases confounded archaeometrists and experimental archaeologists for many years. Is it a slip (a suspension of clay in water) or a true glaze? The term for Attic "glaze" is sometimes replaced by "gloss" because it was initially assumed to be a fine suspension of the same clay used for the body of the vase Greek clay naturally contains illite and iron oxide, minerals that act as fluxes to lower the melting temperature of the surface coating. While some researchers believe that this composition explains the glossy finish so prized by the Athenians and their customers, one study indicates that the surface coating really is a glaze and that the composition was not accidental. Kingery (1991) concluded that the Greeks probably employed special glaze clays and carefully controlled additions of potassium and iron oxide and demonstrated that there is actually a thin layer of glass on the fired surface.

Technological Studies in Archaeological Science, Fig. 3 X-ray of Chinese bowl (Photo by R. Keen, University of Illinois)

X-ray radiography and other imaging techniques continue to help archaeologists and museum curators answer questions about structure and dating of objects that cannot be destructively sampled. For example, X-rays confirmed the late twelfth century CE date of a Japanese wooden statue and the late tenth century BCE date of a Chinese bronze *gui* bowl. In the former case, the issue was one-piece construction vs. multipiece construction, and in the latter case, the X-rays revealed that the Chinese bronze bowl had been cast upside down in a multipiece mold. Also present were bubbles (Fig. 3) in the metal from trapped gas, a feature often present in ancient bronzes but not in modern ones. A pinpoint analysis of the metal (sample taken from the base) showed a leaded bronze with 10–20 % tin and no zinc composition consistent with the early date (Vitali et al. 1986). One of the advantages of X-ray technology is that it is less expensive than CT scanning or other advanced medical imaging and is more widely available (at the University of Illinois, researchers have examined everything from Byzantine necklaces to Egyptian mummies at an on-campus veterinary facility).

Current research includes experimental archaeology in new areas, such as ceramic production and cooking methods for North American grains and seeds in periods before European contact. At the Illinois State Archaeological Survey, replicate cooking pots were used to compare two cooking methods used by Woodland peoples:

rock boiling (inserting preheated rocks into a grain/water mix) and direct heat (placing the grain-and-water-filled pot directly in the fire) to compare speed of heating and cooking efficiency. The experiments demonstrated that both methods worked for cooking quinoa (a modern descendant of *Chenopodium*, a grain used in the Midwest before about 800 CE) to an edible state in about 20 min and that the necessity of reheating the rocks explained spillover marks, charring, and residues near the lips of the vessels and grit in the gruel (Wisseman 2005).

Colorants used in ancient North American textiles have been examined by comparing fragmentary, barely colored archaeological samples with replicate cloth using close approximations of ancient ingredients: ferrous oxide, ground bloodroot, beef fat, etc. Various types of microscopy, ICP-MS (inductively coupled plasma mass spectrometry), and forensic photography were used to establish a protocol for identification of trace amounts of both inorganic and organic colorants (Baldia & Jakes 2007). This study is a good example of a research project that has broader implications than a single, focused study: It sets up future research by demonstrating a workable selection of processes and a sequence of analyses to achieve useable results.

Future Directions

Archaeologists will continue to use combined approaches (laboratory analysis, ethnographic observation, and experimental replication of artifacts) to extract the maximum information out of fragmentary archaeological materials, especially organics. Larger projects that cut across technologies may become more common. For example, metalworking study of silver production at Rio Tinto, Spain, during Roman times has produced surprising results that impact analyses of Egyptian mummies. Some of the lead oxides that are by-products of the process form the red pigment *minium*, recently found by a team from the Getty Conservation Institute to be the major colorant in approximately ten Roman-period "red shroud" mummies now in museums around the world. The discovery of exotic and expensive ingredient (in addition to gold leaf) confirms that the "red shroud" mummies were commissioned by well-to-do families in Roman Egypt. The ever-expanding field of mummy studies combines analyses of human remains for health and dietary information with studies of wrappings (e.g., Egyptian linens and Peruvian textiles), resins, amulets, and tools used in embalming procedures and burial rituals.

As the instrumentation available to researchers becomes ever more sophisticated, new possibilities for analysis open up. However, such innovations can be extremely expensive and inaccessible to all but select research teams. One example is synchrotron radiation-based X-ray fluorescence and X-ray diffraction (available at only a few locations in the world such as Argonne National Laboratory), used by Elizabeth Friedman and colleagues at the Illinois Institute of Technology to obtain subsurface data from metal artifacts that cannot be destructively sampled. Other examples include micro-CT scanning for extremely high resolution imaging of tiny samples and next-generation DNA sequencing, currently employed by European researchers to analyze the genome of the Italian Iceman mummy.

One has to keep in mind that the latest techniques are not always required to answer simple questions: For example, distinguishing between brass and bronze requires identifying only three elements, copper plus either tin or zinc. Thus a technique such as energy-dispersive X-ray analysis may be sufficient and a much more cost-effective choice than synchrotron XRF. Similarly, older techniques such as metallography, the microscopic examination of polished sections of metal artifacts, are still extremely useful for detecting craftsmen's methods, for example, cold working vs. repeated heating and cooling of a copper artifact. Appropriate application of archaeometric techniques requires a sequential approach, beginning with the simplest and most cost-effective techniques, with frequent collaborative discussion at each stage to evaluate not only the results but whether and how to proceed with further tests.

Technological Studies in Archaeological Science, Fig. 4 Experimental stumpware used as firedogs (Photo by S. Wisseman, University of Illinois)

Another future trend is combining traditional laboratory-based instrumentation with portable instruments, for example, X-ray fluorescence spectrometers that can rapidly and nondestructively collect data in the field or museum setting. Protocols are still being developed, and the performance of different portable instruments is being compared for accuracy and precision (Shackley 2010).

Despite all the modern instrumentation available today for the study of ancient artifacts and technologies, there are still questions researchers cannot answer, often because archaeological context or other information is missing. For example, in Mississippian archaeology in North America, a mysterious ceramic artifact continues to baffle archaeologists. Called "stumpware," it is a two- or three-legged fired clay piece (Fig. 4) that may be either a funnel for draining lime-treated maize or a firedog used to support cooking pots. Sometimes the stumpware is perforated, but not always in the same place. Some stumpware has a chalky white residue on the exterior, some does not. Could the holes be added by the potter to speed drying time of these thick ceramic pieces? What is the correct function of stumpware, and does it change function over time? Residue analysis, such as that performed by Richard Evershed at Bristol University in the UK to identify embalming resins in Egyptian mummies, may eventually produce an answer.

Finally, the interdisciplinary nature of research on ancient technologies requires more cross-training of archaeologists. While most archaeologists cannot be equally well versed in archaeology and chemistry or the other natural and physical sciences, more than a passing familiarity with available analytical techniques and their advantages and disadvantages is a necessity. Only then can the kind of sustained and fruitful dialogue between specialists of different backgrounds produce results that help scholars successfully interpret the technological behavior of past cultures.

Cross-References

- ▶ Ceramics, Ancient Greek
- ▶ Ceramics: Scientific Analysis
- ▶ Classical (Greek) Archaeology
- ▶ Cognitive Archaeology
- ▶ DNA and Skeletal Analysis in Bioarchaeology and Human Osteology
- ▶ Ethnoarchaeology
- ▶ Pigment Analysis in Archaeology
- ▶ Plant Processing Technologies in Archaeology
- ▶ Quinoa: Origins and Development
- ▶ Woodland and Mississippian Cultures of the North American Heartland
- ▶ X-Ray Diffraction (XRD): Applications in Archaeology
- ▶ X-Ray Fluorescence (XRF): Applications in Archaeology

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Television and Archaeology: Views from the UK and Beyond

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Introduction

For millions of people, their primary engagement with archaeology is through the now-traditional medium of linear broadcast television (Merriman 1991: 119-20; Holtorf 2007: 52-54). Though undoubtedly challenged by newer ubiquitous information technologies with rapidly evolving modes of reception, after more than half a century, this largely remains the case (Pokotylo & Guppy 1999; Payton 2002; Clack & Brittain 2007: 14). However, any archaeological message on any media platform is generated, transmitted, and received within a particular sociocultural technological environment. Viewed as material culture, the historical, economic, political, and ideological context of broadcasting might itself be considered as an anthropological or indeed archaeological meta-narrative (see Huhtamo & Parrika 2011).

Furthermore, archaeology, a project almost wholly funded directly or indirectly from the public purse, is granted singular public trust (Hodder 1987: 166). Yet, the TV broadcasts of the twentieth century's economically developed countries – those that created mass audiences for electronic media – inevitably reflected particular geo-historical views of both scientific method and world culture. This context for the establishment of many of the most enduring themes, formats, and common tropes of TV archaeology must be pertinent to any understanding of a dynamic interacting relationship.

As a subject, archaeology perfectly answered the call of Lord Reith – founder and first director general of the British Broadcasting Corporation (1927) – to "educate, inform and entertain." Accordingly, the decades from the early 1950s – especially in the United Kingdom with

this public service remit for its publically funded broadcaster – generated a recognizable genre for TV archaeology. If many of the formats then created have survived because they are somehow fit for purpose, we might still ask if or how this purpose has changed. TV archaeology could certainly be said to have consolidated, if not originated, new areas of research, to have widened public interest and involved new communities in the archaeological process. Nevertheless, we might consider that in the intervening years, beyond methodological advance, archaeological thinking has also evolved.

Definition

Archaeology, ancient story
Television, far sight
Broadcast, to scatter seed

1. Single TV program or series whose content deals with archaeological research or opinion or the historiography of archaeology or otherwise substantially relies on archaeological data or theory to inform a broadcast narrative.
2. Single TV program or series whose content contains archaeological research or opinion or the historiography of archaeology or otherwise deals with or utilizes archaeological data or theory to form some part of a broadcast narrative.
3. Archaeologies of broadcast media, broadcast networks, or associated television technologies.

Historical Background

Archaeology first impacted a popular television audience as that most recognizable and enduring TV staple: the panel game. Broadcast from Philadelphia USA, the long-running Peabody Award-winning network quiz show *What in the World*? ran from 1951 to 1965 (WCAU TV; CBS). The (necessarily) studio-based series saw a distinguished panel of experts asked to identify artifacts from the worldwide collection of the *University of Pennsylvania Museum of Archaeology and Anthropology*. Clearly offered as entertainment – over opening titles, the camera tracked through swirling mist to reveal the first mystery object while a portentous commentator "your offscreen voice," identified the item for viewers – the show did not lack academic substance. The Penn Museum acted as coproducer, and its director, Dr. Froelich Rainey, fronted each program as on-screen host. Eminent archaeologists and anthropologists (and in episode four, celebrity guest, actor Vincent Price) readily tested their expertise – and reputation – while recognizing relics on live TV before viewing millions.

Nor was jeopardy lacking in the UK's more staid response though, BBC's *Animal Vegetable Mineral* (1952–1959) strived less for dramatic effect. Gone were dry-ice, offscreen voices and celebrity guests, or indeed the freedom of panelists to stroll across the studio to a rotating plinth and the article in question. Artifacts were now handed to panelists sat solidly behind their stage-set desk. Whether different production values were due to institutional reticence, seriousness of intent or less developed studio techniques, AVM's guests, and mystery artifacts – picked from the British Museum, regional galleries, and university collections – were as distinguished as those of its American counterpart.

Leading archaeologists of their day, Cambridge professor, editor of the Antiquity journal, and question-master Glyn Daniel, Mortimer Wheeler, Gordon Childe, and Jacquetta Hawkes all played the game. These luminaries, whose collective scholarly publication was unequaled, evidently understood this popular entertainment as a logical extension of their normal educational remit. Just how popular may be judged by Mortimer Wheeler and Glyn Daniel being voted TV Personality of the Year in two successive years (1954, 1955). While following transmissions of AVM, "libraries found that neglected shelves of archaeological books were suddenly empty" (Paul Johnstone: Times obituary of 17.3.1976).

The runaway success of *Animal Vegetable Mineral* established archaeology as a television fixture, and its producers proceeded to set an agenda that determined our views.

Paul Johnstone, Mary Adams "Head of Talks" (factual broadcasting), and then new recruit, assistant producer David Attenborough, helped establish the language and syntax of TV archaeology with a genre which (exceptionally) has never left British television screens.

With *Buried Treasure* (1954–1958), the production team shifted the archaeological question from "what" to "how." If inspired by John Lubbock and Augustus Pitt Rivers, the series introduced experimental archaeology to television. So, Mortimer Wheeler duly grimaced at tasting the last meal of Tollund Man as identified from remains in the gut of the Iron Age bog body. Viewers saw how a prehistoric round house was built and – an enduring TV fascination – how the builders of Stonehenge might have transported 60 blue dolerite stones some two hundred miles from the Preseli Hills of Pembrokeshire to Salisbury Plain.

A defining moment came in 1965 when David Attenborough abandoned his doctorate in social anthropology to return to television as controller of a new color TV channel. Arriving with a mission, Attenborough promptly invited Johnstone, his former boss, to create a unique department dedicated to archaeology and history.

This confluence of a ready audience, the personal support of management within a well-resourced public institution at a turbulent yet broadly progressive historical moment coincided with emergent technologies (for Actor Network Theory see Latour 1993). Development in the design of the Arriflex BL provided a lighter, silent camera that could be handheld, while faster 16 mm colour film stocks allowed for minimal lighting. These together with the introduction of portable Nagra III magnetic tape recorders and an ability to record synchronous sound and picture meant Johnstone's specialist unit could economically film the process as well as the product of archaeology.

Chronicle, BBC 2's flagship series, ran from 1966 to 1991, coinciding with formative years for archaeology. Again, practitioners at the leading edge of archaeology including Colin Renfrew and Barry Cunliffe played their part, but it was the subject matter of *Chronicle* that did much to widen the scope and ambition of archaeological discourse in Britain.

While *Chronicle* was anything but parochial, frequently traveling worldwide to film iconic sites, the series also acted locally as an early forum for community archaeology. In 1970, *Chronicle* helped mobilize amateur enthusiasts to champion nineteenth- and twentieth-century industrial archaeology – a discipline not yet universally accepted by professional archaeologists. Local societies, founded to conserve particular factories or machines, were invited to compete in order to feature in a special series of *Chronicle* films. Consequently, film segments on the restoration of an abandoned needle-making factory at Redditch, research into the history of Manx lead mines, the Faversham gunpowder mill, and salvaging of steam engines from nineteenth-century cotton mills were duly transmitted.

Likewise, Johnstone's enthusiasm for maritime archaeology provided a recurring theme, which helped establish another academic subdiscipline. This saw ever more ambitious archaeological experiment, including the building and sea trial of a 21 foot long replica Bronze Age skin boat. Chronicle also contributed to some of the most daunting industrial/maritime rescue archaeology ever undertaken.

The 1970 return of Isambard Kingdom Brunel's iron steamship SS Great Britain to Bristol and her surprisingly intact construction dock 127 years to the day after the vessel's outward voyage became headline news. Towed from her ignominious berth as a guano-storing hulk ship in the Falkland Islands/Malvinas, the 69-day trip was filmed by onboard Chronicle producer Ray Sutcliffe. Two years in the making, the program on the SS Great Britain (now refurbished and one of Bristol's favorite tourist attractions) had been a major investment but by no means *Chronicle*'s greatest.

From 1968 to 1970, the BBC funded three seasons of excavation at Silbury Hill, Wiltshire Richard Atkinson's investigations into the reputedly largest prehistoric earthwork in Europe meant tunneling through chalk and clay to the core of the 37 m high, late Neolithic mound. This involved not just large-scale archaeology

and specialized mine engineering but for the broadcaster, an ongoing commitment of resources. To supplement filming over four years, outside broadcast (OB) units – newly designed for BBC 2's sports coverage – with their mobile control rooms, live-feed transmitters, lights, generator trucks, camera and sound crews, electricians, riggers and drivers, were regularly commandeered for live updates on the excavation's progress. Although for some journalists not an unqualified success – few artifacts were found and no King Sil on a golden horse – *Chronicle*'s dedication to the Silbury Hill project speaks volumes for how former British television executives valued archaeology.

It might seem extraordinary that archaeology could rank with moon landings, state occasions, or international sporting fixtures as landmark television, but in 1970 and again 10 years later with the raising of the Tudor battleship Mary Rose, archaeology was presented as rolling news and live TV event.

Key Issues

Formatting Archaeology

Television has long held a special place in British culture. Moreover, in the four last decades of the century, a protected UK broadcasting industry could encourage bold experiment allowing controversy or even failure. In this environment, a blueprint for TV archaeology was formulated and much since could be thought variations on a theme. Considering 590 UK programs broadcast between 1999 and 2002 during its millennial "golden age," Karol Kulik identified six distinct categories of TV archaeology (2006: 75-88).

Time Team now in its final season (broadcast 1994–2013) exemplifies the first of these: archaeology as process or "backstage." Despite an emphasis on professional and technological know-how, the Channel 4 format retained an element of jeopardy inherited from its game show origin: the arbitrary time limit of a three 3-day dig. Featuring a different location every week, each show targets a particular period or site type. Archaeological questions are posed and *Time Team* viewers follow the progress of excavation and site interpretation and are offered insight into practical fieldwork. Realistically enough, professional disagreement is not uncommon, and results can be unpredictable. Widely accepted as the market leader with consistent audience brand loyalty, the process-driven "behind-the-scenes" approach of *Time Team* along with protagonists Mick Aston (until 2012) and Phil Harding, for many, came to define TV archaeology.

Particularly popular with cable and satellite networks, Kulik's "detective" format poses a mystery or riddle that – it is proposed – archaeology alone can solve. On-screen archaeologists may offer and evaluate evidence, but the detective story narrative begs solution. Unlike programs focusing on the investigative process, here a script is prewritten to reach a foregone conclusion. The question asked may be more or less valid in presupposing that any single meaningful answer is possible. Its underlying premise – Atlantis, ancient aliens, "lost" civilizations – might also be questionable.

Less overtly sensational, the "expository" model follows John Grierson's documentary style (see Winston 1995). Taking a seriously minded, educational overview, typically of large-scale cultural phenomena, an illustrated lecture is delivered by omniscient "voice-of-god" commentary, which links authoritative screened interviews.

An increasingly ubiquitous format, the "essay" differs from the above in that it is narrated by an on-screen presenter offering a (supposedly) personal point of view on some general archaeological theme. If expert opinion is sought, the presenter asks the questions and – despite taking a greater or lesser part in the scriptwriting – records voice-over commentary. It is not always apparent whose views we really hear.

Kulik describes programs that consist wholly of archaeological experiment as "how-to." These may reconstruct buildings or lifeways, recreate ancient technologies, or solve an ancient engineering conundrum. BBC's *Living in the Past* (1978) in which volunteer families lived for

a year in a simulated Iron Age Village is claimed to have invented "reality TV." This was the prototype for the German *Steinzeit: Das Experiment* (Stone Age: The Experiment SWR/ARD 2007), the biggest TV archaeology event ever. The climactic episode, which saw two reenactors leave their newly built Neolithic pile dwelling on Lake Constance to retrace Otzi's last journey across the Alps, reached a truly astonishing 30.4 million viewers over two consecutive evenings (Bailey et al. 2009).

Lastly, "reconstruction" refers to a TV narrative, which based on archaeological research relies on actors with appropriate costume and sets to dramatize some past event(s). Particularly popular in non-Anglophone continental Europe and while costly, being commentary driven, these lend themselves to language "versioning," thus facilitating resale and universal distribution.

Marketing Archaeology

Commoditization in a globalized television market have seen international coproduction become the norm. These products are characterized by periodic narrative cliff-hangers for the ready insertion of frequent commercial breaks. Meanwhile, an accompanying tendency for multinational corporations to acquire medium sized independent production companies whose chief asset is the exploitation of existing intellectual property – TV format rights – will favor homogenization over experiment and uneconomic risk (Kretschmer et al. 2009).

While game show and "reality television" – the most commercial international formats – have historical associations with TV archaeology, these are perhaps less likely to shape its future. Rather, "pop" archaeology's proven themes of pyramids, mummies, skeletons, treasure, unsolved mystery, or notions of heritage and cultural identity presented as high-gloss factual television may endure as readily tradable commodities.

Since Kulik developed her typology, few archaeology programs defy niche categorization. Among these, BBC 1's costly ill-fated drama series *Bonekickers*, which had a fictionalized university archaeology department as setting for a high-concept adventure serial, is memorable. A second series was not commissioned (Bailey et al. 2009).

Although informed and refreshingly different, the guerrilla-film approach and montage editing of Canadian Simcha Jacobovici's *Naked Archaeologist* (Vision TV) challenged orthodox ideas of both television and archaeology. The show's mischievous humor made it particularly difficult for European terrestrial broadcasters to understand or schedule.

However, up to a third of all Swedish viewers regularly watched the series *Utgrävarna* (Excavators SVT 2005). The reflexive "post-memory work" of archaeologist Jonna Ulin demonstrated that screening views not just of, but from, the subaltern could make popular TV. Inspired by the excavation of her own grandmother's childhood home, Ulin based each episode on an abandoned contemporary site and the memories of neighbors, family photograph albums, and the discarded or treasured things of everyday life – archaeology as evocation.

Some other TV programs dealing with material culture or heritage are not explicitly badged as archaeology (see *Saving Britain's Past* BBC 2; 2010) while magazine formats may include just some archaeological content (*Coast* BBC 2; 2005 to present).

Discussion

Archaeology gripped public imagination long before any dominant TV narrative. Best-selling books, accounts of excavation, fabulous finds, and forgotten civilizations from Egypt or the Near East were popular since at least the 1920s. For their archaeologist authors, such publications needed only to adapt and edit the familiar conventions of report or scholarly monograph with explanatory text and discussion illustrated by drawings and photographs. In the first half of the twentieth century, archaeologists could transmit their message directly.

With the emergence of TV as focus of family life, as electronic hearth in the living rooms of the postwar western world, such communication became a more collaborative venture. Millions, who perhaps rarely explored museums or pored over books on great excavations or paused to

think about how or why one might relate to abandoned things, found analogous enquiry transmitted unbidden into their home. If a historic opportunity for those who considered public communication a central disciplinary concern, archaeologists necessarily approached the small screen on its own terms.

It is the responsibility of the television producer(s) to oversee a protracted, creative, technical process and who is contracted to manage and deliver programs to a licensed broadcast network with access to a complex telecommunications infrastructure. As such, the lead author or final editor of a TV show could rarely if ever be a working archaeologist. Given this, any productive collaboration depends not just on trust and acceptance of different cultures, traditions, and professional imperatives but how producer and archaeologist each *imagine* medium and message. To what extent archaeology is visualized as method, practice, sanctioned treasure hunt, or platform for ideas, or again, television approached as powerful but superficial medium, animated textbook, opportunity for reflexive exercise, or vehicle for original research, determines the outcome.

Any dissonance in academic restraint and lively popular storytelling might be resolved – or in skillful hands even harnessed to creative effect – if the nature of a particular narrative is mutually agreed and understood.

Today, the early adopters of mass media in those same affluent countries broadcast to an increasingly skeptical public. However, for their audiences, which have since come to question many traditional secular or religious authorities, faith in the status of archaeological proof – as seen on TV – seems to be unshaken. This may have much to do with different perceptions of archaeology and what – in the minds of broadcasters – archaeology offers television viewers.

Thus, in what we are constantly reminded is a visual medium, image needs description rather than critique. In this view archaeology is self-explanatory, an end in itself requiring no further justification or contextualization. Seeing is believing, while TV archaeology avoids overt theory and the politics of archaeology remain subliminal.

If any such uncritical accounts – however well intentioned – act as an authoritative source for founding mythologies or help establish dubious notions of identity, this is problematic. The possibility of inferring any special historical or territorial claim from archaeological research must make its popular representation a central disciplinary concern. Or indeed of general concern, for as Stephanie Moser notes, disciplinary boundaries are permeable, and a continuum exists between the interacting spheres of archaeological practice, representations of archaeology, and its public reception (Moser 2004: 262-283; also see Shanks 2007: 274).

Public Image, Public Effect

While a direct causal relationship between TV archaeology and active participation in heritage or archaeological pursuits is difficult to prove (for a critique of the media "effects model," see Gauntlett 1998), limited data suggest a strong correlation. In the UK, negative evidence, at least, suggests that preexisting self-selection was instrumental, in that ethnic minorities have very largely chosen not to watch "heritage" themed TV (Piccini 2006), or join the archaeological profession in any capacity (Aitchison & Edwards 2008: 11, 14), or apply to study archaeology at university (UCAS figures 1995–2006).

Yet, sampling of prospective candidates and first-year undergraduate students at archaeology departments in Bristol and Southampton overwhelmingly suggests previous interest in televised archaeology (Bailey 2007–11, unpublished). For this generation, *Time Team*, frequently watched in the company of at least one parent, was most often cited as favored viewing. So these partial data might suggest the show's consolidation of archaeology's long-standing appeal within the family rather than as initial inspiration.

English Heritage statistics too confirm family background as highly influential but also indicate that intensive generalised TV viewing (over 5 h a day) reduced this groups probability of visits to "historic attractions" by up to 13 %, while for viewers of "heritage TV," including archaeology, visits to "monuments, castles, and ruins" increased by a significant 12 % (Wineinger 2011).

It seems that rather than simple cause and effect, TV archaeology relates to other archaeologies as part of a network of interdependent practices, a key relationship that helps shape a collective cultural consciousness.

Cross-References

- Agency in Archaeological Theory
- Archaeology and Politics
- Film, Archaeology in
- Media and Archaeology
- Public Archaeology, The Move Towards
- Reflexivity in Archaeology
- Silbury Hill: Environmental Archaeology

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Tells in Archaeology

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Introduction and Definition

Archaeological mounds form when activities and settlement were conducted at a site over time

Tells in Archaeology, Fig. 1 Aerial view of excavations and large monumental buildings at Tell Brak, Syria (43 m high, >800 m long, and 40 ha in size) (After Gerster 2003: Fig. 32.)

and sediment and material accumulation rates exceed those of truncation or erosion. In Southwest Asia an archaeological mound is called a "tell" in Arabic, "tepe" or "chogha" in Farsi, and "höyük" in Turkish. In the ancient Near East, mounds may vary in size from c. 30 m to 1 km in diameter and in height from c. 1 to >43 m (Fig. 1). The archaeological investigation of these mounds presents a range of major challenges: (1) low mounds and the bases of mounds may be masked by several meters of sediments from rivers, hill-wash, or erosion; (2) early levels may be buried below many meters of later settlement and difficult to access; (3) materials may be recycled and redeposited throughout a mound by successive construction and digging of pits or graves, for example; (4) with shifting settlement patterns and variations in construction and leveling, mounds are not uniform "layer cakes" and include truncated or eroded areas; and (5) mounds may represent only one aspect of settlement patterns and strategies, but may be overrepresented in field investigations due to their predominance in the landscape. Mound sites nevertheless often provide rich sequences of well-preserved deposits and many aspects of ecological and social strategies. The examples below are largely from interdisciplinary excavations in Syria.

Key Issues/Current Debates/Future Directions/Examples

Satellite imagery, aerial photography, surface survey, and *geomorphology* have been applied to study the extensive networks and landscapes of large and small sites in the steppe regions of northern Syria, as in the Tell Hamoukar survey (Ur 2010). Here, satellite pictures showed that many tell sites were connected by radial routeways that formed from at least the fourth millennium BCE. Surveys of artifacts, notably pottery, on large and small tell sites, have identified several major peaks in settlement in northern Syria, notably in the mid-late fourth and mid-third millennia BCE, as well as decline, as in the late third millennium BCE during a period of climatic stress, when many large sites were partially abandoned and smaller sites along watercourses were frequented (Wilkinson 2003).

At the scale of individual tell sites, specific periods and types of activity areas have been *evaluated* by close integration of studies of *surface*

Tells in Archaeology, Fig. 2 Micro-history of a large walled building and surfaces in a street in area HS3, Tell Brak. Location of blocks for microscopic analysis of sequences also shown

materials and tell *geomorphology* and *topography* to detect in situ materials in actively eroding areas of mounds. By these methods, previously unexplored and otherwise deeply buried levels from the Ninevite five periods of the early third millennium BCE were excavated at several points around the large mound of Tell Brak, including a small temple/shrine (Fig. 1; Matthews 2003).

Rapid extensive investigation of subsurface features and buildings at tell sites have been very effectively investigated by *geophysics*, as in the recovery of the whole plan of the lower town of the mid-third millennium BCE at Chuera, by *surface scraping*, as at Tell Brak (Matthews 2003), and by *mechanized sweeping*, as at Sheikh Hamad. Walls, features, and floors were often constructed from compressed mud or mud brick and mud plaster. These may show clearly (Fig. 2), but when the fill around them is from similar materials (e.g., from leveling or collapse), they may be more difficult to detect.

The definition of walls and surfaces depends on close observation of the characteristics of deposits and interfaces between layers. The edges of walls can be identified in plan by shaving clean the excavation surface with a hoe or trowel if deposits are moist or by cleaning briskly with a large brush if dry. During excavation, wall and surface faces can be detected by looking and feeling for changes in composition, texture, structure, and fractures along edges or surfaces using a small pick or trowel. Section profiles provide an important *reflexive* record of deposits and features as they are being excavated and should be kept clean (an artist's palette knife is particularly effective) and regularly examined at the edge of trenches or in strategic sections through features and floors. Records are made of structures (buildings), features (walls, hearths), and layers (floor deposits or fills) using digital photography and videos, high-precision architectural survey, plans, section drawings, and written descriptions.

The detailed histories of buildings and settlements have also been studied using techniques for analyzing sequences of floors and activity residues, such as *microstratigraphy* and *micromorphology* (microscopic analysis of layer content and sequences) (Fig. 2; Matthews 2003) and *chemical mapping* (as at Çatalhöyük, Turkey). An increasing range of analyses can be conducted in the field. These include portable X-ray fluorescence to characterize architectural and artifactual materials and activity residues (e.g., high phosphorus concentrations), and microscopic analysis of spot samples of sediment to look for plant phytoliths and dung spherulites to identify animal pens, for example, and thereby inform excavation and sampling strategies (as conducted by the Central Zagros Archaeological Project (http://www.czap.org/)). Exemplary interdisciplinary scientific analyses of spectacular burials at the mid-second millennium BCE site of Qatna, in western Syria, include study of the human remains, artifact materials and technology, and organic residues within the vessels.

Large-scale long-term research excavations at major tell sites are providing major insights into the diverse structure and histories of these settlements including changing social and political organization, economies, and ritual practices, which are becoming increasingly well defined. Examples in Syria, from regional and local centers, include Ebla, Tell Brak (Oates et al. 2001), and Tell Beydar in the third millennium; Tell Leilan in the second millennium BCE; and Sheikh Hamad in the first millennium BCE. Rescue excavations are also contributing to research. For example, the integration of the archaeobotanical and archaeozoological data

from rescue excavations at several small sites along the Khabur river, sampled prior to their flooding by dam waters, has enabled study of major developments in the intensification of agriculture in the fifth-third millennia BCE in this region (Fortin & Aurenche 1998).

The results from many of these projects have been closely integrated in regional conferences, workshops, and major chronological and environmental research projects and frameworks, such as ARCANE (http://www.arcane.uni-tuebingen.de), and extensively published. Some sites have been conserved and presented for public display and dissemination in situ, within museums and on websites.

Cross-References

- ▶ Aerial and Satellite Remote Sensing in Archaeology
- ▶ Aerial Archaeology
- ▶ Çatalhöyük Archaeological Site
- ▶ Surface Survey: Method and Strategies

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Tenochtitlan (Aztec): Geography and Culture

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Introduction

To understand part by part what Tenochtitlan was, we have to look first into knowing how Tenochtitlan initiated and how it was organized. On the very top of the gods that occupied the most prominent space within temple of their city was Huitzilopochtli. He represented the solar cult, but in this city, there was a long list of gods that were recognized by their people who built and lived there. His pyramid was built as a dual pyramid and had a shrine in the south, and another for a god named Tlaloc was built in the north, who represented legitimacy and antiquity, as well as rain, lightening, fertility, and earth. Gods like Tlaloc, who was risen from a spring. According to Miller and Taube (1993: 93) Tlaloc welcomed Huitzilopochtli when the Aztecs fled the mainland and went to the island in the middle of Lake Texcoco in 1345. Among these two gods was born the conception of war in the shape of fire and water, but it was under Huitzilopochtli's outset human sacrifice and war ("hummingbird of the south"), while Tlaloc was known as "the provider."

Authors suggest (Miller & Taube 1993: 25) that this tribute of human sacrifice became unfavorable at the time of the Spanish conquest, as the Aztecs never imagined this practice of taking enemies from their surroundings to sacrifice through their special type of wars would have taken a toll at end of their culture.

It is possibly that since these times the Aztecs or the people that had arrived to Aztlán were traditionally practicing the *xochiyaoyotl* or the "flowery war."

As Miller and Taube (1993: 42) have pointed out, the name Aztec become popularized by

William Prescott in his book Conquest of Mexico and introduced earlier by Alexander von Humboldt in the nineteenth century, he gave the meaning of "people of Aztlán." Aztlán means "place of whiteness." But these people rarely called themselves under this name; instead, they called themselves Mexica, or sometimes the Culhua Mexica, to denote their linkage with Culhuacan as old Toltec lineages.

Definition

The founding of Tenochtitlan historically belongs to very late Postclassic time 1345 BCE, and through history, it is recognized as a large city almost comparable to Venice in Italy. Although there is no record of what type of people was there before the arrival of the Aztec or Mexica, the type of people that built the city did not take long to build such a large beautiful place that amazed the Spanish. As they advance in the making of the magnificence and efficiency of the city, they advance geographically incorporating two specific things: trade and tribute. In order to be in one end skillfully and the other to keep a tradition, they allowed themselves to incorporate more gods like Xipe Totec from the area of Oaxaca, although sometimes they humiliated their gods by placing them within dark, designed to be their prison (Miller & Taube 1993: 24). They traded with the Pochtecas long distances and become commerce specialists as far as Guatemala and the Veracruz coast; led the way for the Mexica to become an empire, to struggle into battles; and defeated their neighbors the Tepanecs in 1428.

A key issue for understanding of power is that the Mexica replaced their traditional tribal administrative system of four heads for one *tlatoani*, who was the supreme ruler in political and religious affairs. Like many societies around the globe, the power was passed from father to son (as the case of Motecuhzoma I to Motecuhzoma II), even though the system allowed for a new *tlatoani* to be selected by the council from one of hundreds of male nobles, in practice was blood related (Miller & Taube 1993: 168).

One of the amazing aspects of life was to find by the Spanish a type of baptism among the Mexica. This tradition consisted in removing any type of pollution from the parents and was more associated to purification. In the bath ritual the midwife pours water from a vessel placed on a reed mat over the infant and was presented with the tools necessary for adult life. In the sixteenth century, the Mendoza codex appears illustrations of sculptor, feather worker, painter, and goldsmith, each accompanied with feathers and shields of a warrior. The females' illustration comes with sweeping and spinning cotton tools (Miller & Taube 1993: 44).

The city of Tenochtitlan developed a complex organization that allowed for the construction of amazing temples, gardens, exotic animals, and an excellent cuisine. The increase in counted amounts of tribute and regalias took their settlement pattern to incorporate buildings, bridges, and streets along channels, where the boatmen in canoes made this transportation a commodity to navigate from place to place. The length of bridges was so wide that ten horsemen could cross them abreast (Hofstadter 2005).

Spanish conqueror Hernan Cortes describes in his accounts they had a market where over 60,000 people could be trading in goods. One of the rulers known as Motecuhzoma II lived along with its retinue in one of the large palaces to the west of the city. The rest of the people lived in clans, the group of the administration were the *calpullis*, and had barrios or neighborhoods for foreigners and craftsmen.

The city of Tenochtitlan might have been founded under two different migrations of the Mexicas led by Huitzilopochtli. Fray Bernardino de Sahagun accounts that this god was born in 1 pedernal 1168 BCE under the teomama of Cuauhtlequetzqui. Then the Mexicas settled in Tullan, Atitalaquia, and Tequixquiac and built the chinampas or chinamitl, which is an agricultural system based in raised clay bed over their lakes. It might be that originally they were going to Coatepec, but there was a period of conflicts between Huitzilopochtli and the Mexicas; Huitzilopochtli ordered to dry all lakes and

channels, so all native plants and animals perished, which was registered in the year 2 caña.

There is a large quantity of historical accounts about migrations. Migrations are not histories of people leading and leaving one physical space to another but of gods themselves who lead their way to specific tribes.

An earlier migration told also by Fray Bernardino de Sahagun is based in the narration of the birth of Huitzilopochtli in a hill named Coatepec located next to Tula. In this place, a woman named Coatlicue was the mother of the brothers Centzon Huitznahua and the sister Coyolxauhqui. The brothers were ashamed of their sister's pregnancy and prepared a war against her and their mother. Huitzilopochtli was born and helped the brothers to light up a snake made out of teas called Xiuhcoatl, to wound Coyolxauhqui with, which was cut up in pieces up in the mountain falling down from it.

Miller and Taube (1993: 94) account that Huitzilopochtli led his people into the valley of Mexico in Chapultepec at the end of the thirteenth century. As his people was unwelcomed into the region, war was made among the neighbors, this time led by Copil, the son of Malinalxochitl, the betrayed sister of Huitzilopochtli left behind at Chicomoztoc. Later, Huitzilopochtli sacrificed Copil, and his heart was hurled onto a rock in Lake Texcoco, giving birth to the city of the Aztecs.

Years later, Huitzilopochtli was forced to lead his people to Culhuacan, in the other side of the lake, where the noble ancestors of the Toltec lived and become a little more than slaves. Huitzilopochtli saw that this land was not their promised destination and that Tizapan had much more to offer. He suggested to noble lords of Culhuacan to ask to their gods for a noble bride; in fear of the Aztec mercenaries, the lords complied, but the Aztecs flayed her, and a priest put on her skin. During a celebration for the arrival of a new goddess, they saw the priest wearing the princess skin. The Culhua fiercely replied to Aztec barbarism and forced the Aztecs to leave the lake. The survivors refuge in an island there where they found an eagle sitting on a cactus growing from a rock, the very image Huitzilopochtli had told them to seek generations before. The migrations or, like some authors call it, the wanderings of Huitzilopochtli came to an end, according to most sources, in 1345 with the founding of Tenochtitlan.

Another chronicle called Mexicayotl accounts that after leaving several towns, the Mexicas settled in Coatepec and Tula, along with the Chichimecas. The Otomies being early occupants allowed the Mexicas to built their temples and put their gods in it. Huitzilopochtli was the main god among them. The ball games, the *tzompantli* and a dam to plant a variety of cultives, water animals, and native trees gave way to the building of a large city.

The Ramirez Codex mentions the migration of the Mexica in Coatepec during the first pilgrimage, adding that they had a first division of the group in Michoacán and a second one in Malinalco; the rest arrived to Tula, settling in a mountain called Coatepec – Hill of the Serpent. The codex narrates the reasons of why Huitzilopochtli gets into conflict with his own people, as they wanted to remain in Coatepec, after seeing the bountiful and prosperous life they had approached, but this was against the desires of Huitzilopochtli, who executed them all by opening and eating their hearts.

Fray Diego de Duran accounts precisely the reason why Huitzilopochtli kills and opens the chest of Coyolxau – the older sister of Coyolxauhqui and the brothers Centzon Huitznahua – is because of their desires to stay live in a beautiful place they had built and trying to convince Huitzilopochtli to stay there, provoking with this the drought of the channels and lakes they had developed into an agricultural system reaching an economic and social power.

Key Issues/Current Debates/Future Directions/Examples

Other chronicles like Tezozomoc and Tovar repeat the same history. Current debates according to some authors state that Huitzilopochtli led his people out of Aztlán but

to a unknown place located in the same region of Aztlán (Hofstadter 2005) and other suggest to Coatepec (Miller & Taube 1993).

For example, the Boutorini code makes remarks on the ethnic groups of pilgrimage by the aztlameca leaded by cuatro teteutiin or teomama, which had specifics names – Mixcoatl, Cuauhcoatl, Apanecatl, and Chimalma – glyphs, and functions within the organization of the Tenochtitlan state. The roles were in relationship with religion, government, tax, and war correspondent to a chiefdom composed by lineage members, a woman called Chimalma, as priest – numen – two nephews and granddaughter-nieces, all relatives of Huitzilopochtli. Some authors argue that the name Chimalma is also a rivalry title among the descendants of Huitzilopochtli, as was related to rights for lands. Culhua rituals were addressed in specific to sacrifice daughters of the señores or lords. This aspect is amended by the Boutorini code which addresses a change in the political structure by the elimination of the feminine power, based in the historical and mythical events in Malinalco and Coatepec by the killing of Coyolxauhqui.

Another example is based in the fall of Tula at the end of a horizon called early Postclassic for the valley of Mexico. This event marks a change in the ethnic sociopolitical structure. Deities belonging to ethnic groups also change their importance accordingly, for example, Quetzalcoatl in its representation as Ehecatl and Tlahuizcalpantecuhtli no longer has importance as Venus – in correlation with nature reproductive cycles, being Tlaloc as its predecessor – it is replaced by Xipe Totec, as a god related to the earth fertility, and Xolotl, as deities belong to dominated ethnias.

To understand the depth of the Aztec a key issue might be a version that during the fifth sun according to the legend of the suns, the fight among Quetzalcoatl and Tezcatlipoca, the death of itzpapalotl by Mixocoatl, and the death of the Coyolxauhqui all implicates the birth of Huitzilopochtli as the myth. The socioeconomic summit of Tenochtitlan with the birth and life of Huitzilopochtli is explained by an author under a materialist conceptualization like the cycle of life, reproduction, cosmogony, and the necessary energy and sacrifice involved in it (Corona 1981: 22-25).

The legend of the suns is related to the first creation; each sun is presided by a race of people who are either destroyed or transformed into a particular creature. Tezcatlipoca is the god of the first sun, the people are giants that get devoured by jaguars. The second sun is presided by Ehecatl, the god of wind; the people are destroyed by the wind and they become monkeys. The third sun is consumed by rain and lightning, presided by Tlaloc the rain god; their people became butterflies, dogs, and turkeys. The fourth sun is presided by Chalchiuhtlicue; a flood transforms their people into fish. In the fifth sun, Tezcatlipoca and Quetzalcoatl raise the heavens by transforming themselves into great trees. They created the earth by slaying a huge earth monster, described as a caiman as a deity called Tlaltecutli. Quetzalcoatl and Xolotl descend to the underworld to retrieve the remains of the people destroyed in the flood, tricking the god of death Mictlantecuhtli. The bones were carried to Tamoanchan, where the gods grounded the bones and added blood to create the flesh of the current race of people.

The above diverse chronicles allowed for inferences about their ethnic composition and certain aspects of their socioeconomic and political systems, pertaining to myths within chronological events, the magnificence of their settlement patterns to understand their religion, and the level of ideology as far as the dominium of a group within a state (Corona 1981: 13).

The span and cult life under which the god Huitzilopochtli existed is a key issue to understand patrons, leaders, and long-standing lineages of the Aztec or Mexica. For example, the 18 veintenas of the Aztec calendar were based in festivals of primary agriculture dedicated to the rain and maize gods, but of the four of those veintenas, the principal deity is Huitzilopochtli; few other deities repeat like Xiuhtecutli and Tlaloque. The principal celebrations were feasts: feasts of merchants, small feast for death, and bloodletting; for the second are amaranth tamales, feast of the *xocotl* pole; for the third: lifting of posts, planting of trees, stretching of

limbs, bloodletting, first flowers and fruits, sacrifice to Xochiquetzal impersonator, and feasts to water deities (Miller & Taube 1993: 178).

Future directions are to take initial departures based in either migrations, cults, ethnic groups, or lines of socioeconomic development in order to rebuild, separate, and/or join myth from history.

Cult study has to incorporate the ideology of ethnic groups that went from adoring the sun, with Huitzilopochtli, to adoring the moon with Coyolxauhqui, or both at the same time, but as Huitzilopochtli was who allowed Coyolxauhqui to exist, what was the sociopolitical situation pervaded that took Huitzilopochtli to destroy her? was it based in the economic tribute or zones that were tributing less to Huitzilopochtli because Coyolxauhqui was an older fertility goddess in Central Mexico?

One important matter to take into consideration is the time issue, how long before Huitzilopochtli allowed her existence along with many other central gods to come to decay within a controlled zone versus a time with less control and/or pay of tribute and regalias, in behalf of Huitzilopochtli.

Future studies might touch in issues based, for example, in the categorization of tributes or products that were handled according to the spatial distribution of ethnic groups. One of the key issues for such endeavor consists in analyzing closer the use of the sun calendar among the Mexicas and the large region it had influence upon. Each linguistic group had different names for the 365 days calendar. Among the Mexica, it was called *xíhuiltl*, *yza* for the Zapotec, *cuiya* for Mixtec, and *Haab* for the Maya (Marcus 2000: 15).

Cross-References

- ▶ Battlefield Archaeology
- ▶ Mesoamerica: Subsistence Strategies by Region
- ▶ Mexico's Heritage
- ▶ Mexico: Historical Archaeology
- ▶ Oral Sources and Oral History
- ▶ Peopling of the Americas
- ▶ Teotihuacan (La Ventilla): Field Method

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Teotihuacan (La Ventilla): Field Method

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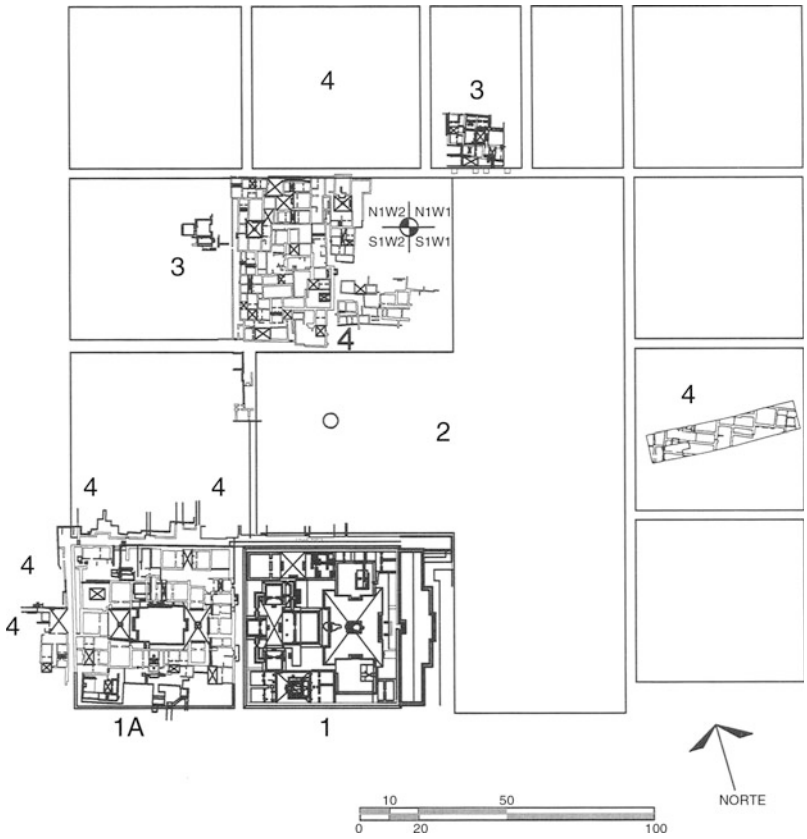
Brief Definition of the Topic

Teotihuacan was a great metropolis during the Classic Mesoamerican period, and its importance



Teotihuacan (La Ventilla): Field Method, Fig. 1 *1*. Neighborhood temple, *1A*. Compound of the Glyphs, *2*. Public Square, *3*. Residential compounds, *4*. Living quarters, *5*. Streets that surround the departmental compounds

and influence marked the political, ideological, and economic development of a great part of the Central Mexican Plateau. The study of the city's architecture and town planning, as well as its internal and external social relationships, is key to understanding the cultural development of this culture. Fieldwork began with detailed mapping of the upstanding monuments, and a high-precision survey of pottery discarded on the surface (Millon 1973). This work aimed to discover as much as possible about the town without damaging the monuments or disturbing the strata by excavation. The pottery distribution proved very informative: the quantities recorded were displayed in the form of contour maps that showed the primary areas of discard (all pottery) and the areas of high-status residence (the distribution of the fine ware: regular thin orange) (Cowgill et al. 1984).

Investigations in the neighborhood of La Ventilla conducted since 1992 have identified a number of structures that are fundamental to understanding social relationships in the city; together, they make up the greatest area excavated and researched of any neighborhood in Teotihuacan (Fig. 1).

The neighborhood temple (4,814 m^2) is defined by a block of houses of 60 × 70 m, integrated by three temples arranged around a central square (1). The Compound of the Glyphs (4,758 m^2) corresponds to an elite monumental complex with political and administrative functions (1A). The residential compounds are defined as a group of houses and workshops mainly involved in lapidary and shell working (3). Between the two elite complexes and the compound of artisans is the Public Square, an area of more than a hectare, without any apparent buildings (2).

The excavation in La Ventilla follows the parameters set by the *Teotihuacan Mapping Project* (Millon 1973). The general grid, oriented

towards the Teotihuacan north, is divided into 1 m^2. The wide area of excavation will allow us to study the full extent of a neighborhood in detail.

All the archaeological strata and objects are excavated stratigraphically and located in three dimensions. Except in cases that merit it, the excavated area is backfilled once all the information has been recorded. The study of the different materials is conducted in specific areas and labs allocated in the archaeological area, although the support of other Mexican institutions, according to arrangements of the Archaeological Council of the National Institute of Anthropology and History of México, is also fundamental.

Cross-References

▶ Field Method in Archaeology: Overview
▶ Teotihuacan: Geography and Culture

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Teotihuacan: Geography and Culture

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Introduction

The city of Teotihuacan is located in the northeast part of the Valley of Mexico. It is delineated by the Cerro Gordo and Cerro de Malinalco to the north, Cerro Patlachique to the south, the Cerro de Cuautlancingo to the east, and Cerro de Tlahuilco to the west. The Teotihuacan Valley contains approximately 600 km^2 of land area and is located at a height of between 2,240 and 2,300 m above sea level.

Definition

Teotihuacan was an essentially urban culture, a multiethnic society arranged according to a precise model of town planning, linked by family relationships and lines of descent (Millon 1973). However, beneath this is concealed a series of complex questions on sociopolitical organization and integration, within a single urban space over six centuries of cultural development. Over the last few years, scholars have drawn attention to the multiethnicity of the inhabitants of Teotihuacan, which is demonstrated by the different ethnic quarters found in the city. During the classical period, the city contained almost 80 % of the population of the Valley of Mexico. However, the rural population experienced exponential growth and had a tendency toward small settlements located throughout the territory (Sanders et al. 1979).

The Pyramids of the Sun and the Moon that are located in the central area of the city are understood as an expression of religious, political, and ideological power (Fig. 1). In addition, a political administrative area has been identified southeast of the archaeological area. This is the magnificent collection of the Citadel and contains the Temple of the Feathered Serpent. Control of the production of green obsidian from the Sierra de las Navajas (Hidalgo) had a decisive role in the expansion of the city (Spence 1981).

Key Issues

Teotihuacan provides an opportunity to study a densely populated, long-lasting city with inhabitants of various origins. This scenario leads to a number of questions regarding the way the city was organized and governed and its expansion across Mesoamerica. While it cannot be said that Teotihuacan is where the Mesoamerican city was "invented," we can say it is where it achieved a high degree of complexity.

Teotihuacan: Geography and Culture,
Fig. 1 Pyramids of the Sun and the Moon photo by Miguel Morales INAH-ZAT

There are various interpretations as to the origin of Teotihuacan. In a process of cultural consolidation, these can be grouped into the Altiplano Late Preclassic period, the successive volcanic eruptions that occurred in the Altiplano and the Valley of Mexico, and the subsequent movements of people who would find the Teotihuacan Valley to be not only a habitable but also a religious place to live (Sanders et al. 1979: 106–107; Angulo 1997: 147; Carballo & Pluckhan 2007; Uruñuela & Plunket 2007). However, we should remember that it is not easy to find early traces of occupation and urban growth due to the way the city itself was constructed, which involved constant architectural restructuring and alterations to the evidence in situ. The Tzacualli (1–150 d.C.) and Miccaotli phases (150–200 d.C.) indicate a society with well-defined cultural complexity. However, its political forms of organization are difficult to interpret due to the apparent unwillingness of the Teotihuacanos to highlight individuality. This characteristic differentiates them from their contemporaries such as the Mayas, whose governing elite maintained a public program that depicted their triumphs and established their legitimacy along with personal and family successes and their links with ancestors and the gods. Rather than a royal dynasty, in Teotihuacan we should imagine a tightly knit elite group

Teotihuacan: Geography and Culture,
Fig. 2 Teotihuacan elite member, Tepantitla complex photo taken by Miguel Morales INAH-ZAT

which superimposed a corporate model for exercising power onto individual interests that were established along family lines of descent (Fig. 2). Research into this corporate model has been carried out by various scholars, with some outstanding work being produced by Linda Manzanilla (2006).

The Tlamimilolpa phase (200–350 d.C.) provides a clear example of a far-reaching program of architectural reorganization for the city, though this is not exclusive to the Classic period. This architectural reorganization can be seen from research carried out in caves to the east and southeast of the Pyramid of the Sun, which

Teotihuacan: Geography and Culture, Fig. 3 Yayahuala complex photo taken by Miguel Morales INAH-ZAT

show the use of quarries and a large-scale post-Teotihuacan process of reoccupation, altering earlier signs of construction (Moragas 1995; Manzanilla 2006). One of the questions that arises concerns when the town-planning model of the Late Preclassic period in the Valley of Mexico changed to the multifamily model that took shape in Teotihuacan during the Classic period. During the Late Preclassic period, each group of housing followed some common patterns (Fig. 3). Many Teotihuacanists believe that during this period each local district became the center of socioeconomic and ideological activity for groups of families linked by a common origin. However, this emergent model can be connected to the city's expansion and the consolidation of the Teotihuacan town-planning model, which broke with the previous socioeconomic structure found in the Valley of Mexico, as demonstrated by Manzanilla in a research she carried out in Cuanalan. The same pattern occurs in the structure of Teotihuacan domestic organization if it is compared with that of the Maya (Cowgill 1997; Manzanilla 1985).

The Xolalpan phase (350/400–550 d.C.) shows the consolidation of all aspects of Teotihuacan culture. The presence of Teotihuacan in Mesoamerica expanded during this period. This has been interpreted as the success of the Teotihuacan model and therefore is associated with cultural success and growth. A competing interpretation is that, on the contrary, this expansion was due to the migration of certain groups from the city to live outside of the territory that was under the control of the city and that this was the first evidence of a profound crisis that led to the collapse of the city (García Chávez 1998).

The Metepec phase (550–650 d.C.) encompasses the collapse of the city. There have been a many different explanations for the fall of Teotihuacan. They can be grouped into two general lines of interpretation: internal reasons (sociopolitical crisis) and external reasons

(ecological-invasionist crisis). These interpretations attempt to identify the key factor that triggered the events that lead to the collapse of the city and the consequences of this for the surrounding area. Although it should be recognized that a single factor will not explain the collapse of Teotihuacan, it is also true that interpretations pointing to multiple causes are not completely satisfactory as they meet the same problem of having to identify an initial factor that prompted the great final crisis. The collapse phenomenon, therefore, also needs to be reassessed from other perspectives, not so much to find its immediate causes but to characterize the different processes that emerge from each study of the case. Some elements that need to be included in a nuanced understanding of the collapse of Teotihuacan include social stratification, the presence of Coyotlatelco culture inside the city during Teotihuacan times, and the contraction of the Teotihuacan state during the Xolalpan phase (Moragas 2005).

Cross-References

- ▶ Mesoamerica: Complex Society Development
- ▶ Teotihuacan (La Ventilla): Field Method

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Terp Excavation in the Netherlands

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Introduction

Before the first sea dykes were constructed in the twelfth or thirteenth century CE, the coastal area of the Northern Netherlands was dominated by extensive salt-marsh. Habitation in this unstable maritime landscape was concentrated on relatively high ridges, often along tidal gullies. Because such ridges were still subject to flooding several times a year, people had constructed artificial dwelling mounds or *terps* (in Dutch: *terpen* or *wierden*) from the first colonization of the salt-marsh area in seventh century BCE. They started with one or more small house platforms, which were gradually raised and extended with layers of sods, dung, and trash. The present-day terps, often still clearly visible in the flat landscape,

represent the final phase of their development. Although being constructed for a different reason and in a different landscape, terps can be compared to *tells* in the Eastern Mediterranean, also comprising many overlapping habitation layers that may cover a period of several thousand of years at the same site.

Key Issues/Current Debates/Future Directions/Examples

The current method of excavating terps was largely developed during a research project at the site of Wijnaldum-"Tjitsma," in the northwestern part of Friesland (Besteman et al. 1999). Following the discovery of an 17 cm long, gold disc-on-bow brooch (c. CE 600), the universities of Groningen and Amsterdam joined forces to get a better understanding of the archaeological context of this exceptional, probably royal find. Between 1991 and 1993, a total of 8,000 m^2 was excavated, 7 % of the terp's total volume. This project pioneered a new strategy, which involved *stripping* with a mechanical excavator, the systematic use of a *metal detector* (resulting in the unprecedented number of c. 5,000 metal finds), and *wet screening* (e.g., resulting in the discovery of gold drops, sherds of glass vessels, and numerous fish-bones).

A cross of two areas was opened, measuring 210 × 76 m. The top soil was removed by a mechanical excavator in layers of 5 cm or less at a time and the surface checked for metal finds with a detector. The first archaeological horizon generally appeared at a depth of 40–60 cm below the present ground surface, whereupon it was cleaned by hand, drawn, and photographed (Fig. 1). All *negative features* and *sod-walls* were *sectioned* and documented, and the soil from all features was wet screened with a mesh width of 4 mm. Organic- or find-rich features were also sampled for zoological and botanical remains. This process was repeated at the next level, which was usually 20–25 cm below the previous one. Locations of exceptional finds, like sherds concentrations or human and animal skeletons, were examined in greater detail.

Terp Excavation in the Netherlands, Fig. 1 Excavating a horizontal level at the terp site of Wijnaldum-"Tjitsma" (Friesland): After the top soil is removed with a mechanical digger, the archaeological level is cleaned using a flat shovel, revealing the outlines of features cut into the clayey soil. Today, precision machining with a grading bucket may leave a surface clean enough to excavate (Photo: University of Groningen, Groningen Institute of Archaeology)

Some reflections on this methodology suggest future developments. The recording of the site using the *planum method* has the disadvantage of disconnecting finds and features belonging to the same cultural layer and disconnecting the horizontal horizons and the vertical sections, since these are recorded separately. The Wijnaldum experience showed that such links can only partly be made afterwards, even by using three-dimensional reconstructions of digitized drawings. Ideally, the original surface of the cultural layers should be excavated, and recorded in three dimensions. In practice, large-scale terp excavations have already become too

Terp Excavation in the Netherlands, Fig. 2 Recording a "free section" at Anjum (Friesland). Interfaces between layers are outlined on the surface of the cleaned section and labeled, before being recorded with written descriptions, measured drawings, and photographs. Objects disturbed or located by metal detector are assigned to their layer of origin. The stratified sequence seen in section provides a basic narrative for the occupation of the terp (Photo: University of Groningen, Groningen Institute of Archaeology)

time-consuming and too expensive to encourage the extra burden of stratigraphic excavation.

One new research method that is economic and effective makes use of existing sections already cut through known terp sites. Between 1840 and 1945, about two-thirds of all terp sites in the Northern Netherlands were completely or partly dug away, to be sold as humus to enrich the sand and peat soils in the hinterland. These sites can be investigated by cleaning the escarpment of the surviving intact mound (Fig. 2). In this way sections of 100–200 m long and 3–4 m high can be studied in only four to five weeks without eroding the remaining terp. Added to the results of "traditional" excavations, these *free sections* give valuable insights into the structure, chronology, and conservation of terp sites in different parts of the Northern Netherlands (see Nicolay 2010).

Cross-References

- ▶ Adaptation in Archaeology
- ▶ Human Impacts on Ancient Marine Ecosystems
- ▶ Maritime Landscapes
- ▶ Tells in Archaeology

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Terracotta Architectural Sculpture in Classical Archaeology

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Introduction

In Central Italy, hardly anything survives of the buildings and temples, except for the stone foundations and many tons of architectural terracottas. Easily broken and damaged, the decoration had to be replaced frequently, with styles that varied throughout the different regions of

Etruria, Latium, and Campania. Each area had important centers for the production of architectural terracottas and even entire roofs, and exported these to different sites by sea.

To protect the wooden superstructure of houses and temples from weathering, architects adopted the Greek invention of terracotta roof tiles and antefixes to cover and embellish the sloping roofs, revetment plaques to cover horizontal beams, and simas for the raking pedimental and lateral elements. The end of the gables remained open, thus creating space for small pedimental roofs with additional tiles and antefixes. Indeed, the roofs of Etruscan buildings were among the most complex and decorative in the ancient world. Private houses too were regularly adorned with decorative terracotta roofs, although from the middle of the sixth century BCE onward, only temples or public buildings were given decorated roofs. One of the many particular features of Central-Italic architectural decoration that distinguishes it from that in mainland Greece is the presence of figural decoration in the pediments and on the roofs themselves, in the shape of acroteria and ridgepole statues.

Key Issues/Current Debates/Future Directions/Examples

Terracotta Roofs in Etruria

The earliest roofs known to us today had only painted decoration with mould-made elements such as small antefixes with female heads. This early phenomenon appeared primarily in Etruria, mainly at Murlo, Acquarossa, and Tarquinia. In the early Archaic period up to the end of the sixth century BCE, Southern Etruria, with Caere and Veii, seems to have been predominant in producing roofs and roof decoration, Caere being the first center working in a specific Ionian style. This style coincided with the so-called First Phase roofs with mould-made decoration using figural scenes and antefixes with gorgon masks or female heads. During the sixth century BCE, the simple female head was by far the most common type used, with several different types datable to the second half of the century, mostly coming from Caere. The female-head antefixes were very popular, their moulds being much used, varied, and altered. This was not only because of their attractiveness, but also undoubtedly because of the power of the image as such. Their significance must surely be connected to the goddesses venerated in the temples they decorated, who were represented by images of nymphs, priestesses, or perhaps even by an image of the goddess herself. Popular especially during the second quarter of the sixth century BCE were military scenes of departing warriors or armed riders, but later such scenes more commonly included banquets, processions of chariots, and, for the pedimental slopes, chariot and horse races. The open pediments were given reliefs, protecting and covering the ends of the *columen* and *mutuli*. The lateral corners of the roof, as well as the *apex*, were usually given decoration in the shape of acroteria, terracotta sculpture in-the-round. In Etruria especially, the ridgepoles were decorated with abundant terracotta statuary.

Terracotta Roofs in Campania

Overlapping to a degree, but certainly by the end of the sixth century, Campania, with centers like Cumae and Capua, seems to have taken over the market with an especially popular but short-lived roof system, with antefixes set in tongue frames and revetments with floral elements like hanging palmettes and chains of lotuses. The first *columen* and *mutulus* plaques derive from the Campanian system. Modest acroteria in the shape of sphinxes, disks, or single winged figures were placed up on the roof. This style was adopted all over Central Italy, only to be copied and in the end replaced by the local styles and techniques of traveling workshops in Latium; there, local styles and techniques dominated the area until 480 BCE. It is called the Second or Late Archaic Phase, beginning in the last quarter of the sixth century BCE and showing a marked change in the style of the decorative system. This was influenced by the Campanian system, with floral elements replacing figural scenes, and large antefixes with female heads or gorgon masks surrounded by tongue frames slowly developing into entire figures or pairs of figures up to a height

of half a meter. The format of the revetment plaques for the pediments and the lateral sides of the buildings was also enlarged with tall tongues above a flat painted frieze with meander or *guilloche*, under which there was a moulded frieze with palmettes and lotus flowers, or *anthemion* chains linked by volute bands. The pediments were filled with large *columen* and *mutulus* plaques showing hand-made reliefs with figural and mythological scenes. On top of the roofs appeared large statues of gods and warriors, set in pairs or in otherwise complex scenes. This completely new style of revetment was introduced in conjunction with the development of larger temple architecture and continued well into the fifth century BCE. By then, only temples were given these rich decorative roofs.

Terracotta Roofs in Southern Italy

Archaic architectural terracottas from Southern Italy and Sicily are famous for their richness in quality and quantity, and their "transitional" position between the terracotta roofs of mainland Greece and those of Central Italy. It is said that they represent the best of both traditions, showing a rich variation in painted decorative motifs and a fully fledged Greek-oriented styling. Both Sicily and Southern Italy employ two different and incompatible roof systems, one with lateral simas along the eaves and a second with antefixes and eaves tiles. The system using antefix plus eaves tile seems to have been cheaper in production than that with lateral simas along the eaves, and was said to have originated in northwestern Greece. It was particularly popular for modest buildings, such as small temples, *naiskoi*, and grave monuments. Southern Italy in particular quickly adopted the idea of decorative antefixes with eaves tiles for its buildings. These antefixes are invariably combined with horseshoe-shaped cover tiles and a hybrid roof system with flat pan tiles. For the Tarantine antefixes, this has not always been the case. Circular antefixes were used also to cover the *kalypter* in the pediment of small temples. The prime period of production in Southern Italy started around the middle of the sixth century BCE. It continued, especially in the main production center of architectural terracottas in Tarentum, well into the fourth century BCE. The main source of influence on roofs and their characteristics (antefixes and simas) came from Asia Minor (Ionia). Through Sicily its influence permeated into Southern Italy. Corfu, on the other hand, had a direct influence on the production of antefixes in Southern Italy, at Sybaris, Lecce, and Tarentum. After about 550 BCE, both Sicily and Asia Minor seem to have been dominant in influencing the typology in decoration and images in Southern Italy.

Terracotta Roofs in Italy, After 500 BCE

By the end of the Archaic period, this new roof system had developed in Central Italy that was exclusive to religious buildings. The change of political rule, the dominance of Rome, and the impulse from Greek immigrants from Southern Italy, all contributed to influence this process. This new system is known as the Second Phase. The roofs of private houses and elite buildings were no longer given terracotta decoration. Temples grew larger and more monumental than before, and their roofs became more elaborate and complex. The dimensions of each individual roof element became larger, with antefixes, for instance, reaching heights of about half a meter. Large terracotta sculpture was placed on the roof. Reliefs in the open pediments which covered the ends of the beams grew larger, and carried mythological figures and scenes that almost completely filled the pediment. Revetment plaques and raking simas were given floral decoration instead of figural scenes and became more complex in construction. This new style with full-figure antefixes became popular and the most common decoration was a group of dancing satyrs and maenads, *Mischwesen*, along with full-size heads of mythological figures and goddesses. Around the middle of the fifth century BCE, the centers of central and inland Etruria gained in importance at the expense of the coastal cities. Orvieto and Città Castellana in particular became large production centers for roofs. The models from these workshops spread over a large area, including cities such as Arezzo, Perugia, Talamone, and Tarquinia. This development into monumentality on a large scale continued

in the periods after the fourth century BCE, at pace with the revival of the Etruscan centers after a short period of decline. The previously inset roofs placed on the floor of open pediments (the recessed gable) that had formed part of Archaic temple architecture gradually disappeared, to be replaced by fully fledged pedimental groups set against a closed background. The first of these appeared in Rome itself and is dated to the end of the fourth century BCE. During the Classical period, decoration consisted of large heads of satyrs and females surrounded by large concave frames decorated with floral motifs in relief which alternated along the eaves of large temples. For smaller buildings or for use on the floor of recessed gables, smaller heads surrounded by a frame of long, concave tongues continued to be used, and heads wearing floral wreaths became very popular. In contrast to the nymphs of the Archaic period, the female heads now represented maenads. They were accompanied by heads of satyrs identifiable by their animal ears, and characterized by their ivy wreaths or frames with ivy and bunches of grapes as followers of Dionysos. The same types continued into the fourth century and the Hellenistic period, the heads reflecting contemporary styles of sculpture. Third-century terracotta production was strongly influenced by the destruction of two important Etruscan sites, Volsinii (264 BCE) and Città Castellana (241 BCE), and by the foundation of the Roman colony in Cosa (273 BCE), where a new important production center of roofs was set up. Subsequently, it was in the newly reinforced Latin colonies everywhere in Northern and Central Italy, where the organized urban centers were provided with temples of the Etrusco-Italic type. With the rich decoration of their pediments and mould-made elements, they represented instruments of Roman propaganda. In the following period, between the third and second centuries BCE, when Roman Italy was itself being constructed, Etrusco-Italic temples and roof systems, and their figured terracotta decorations were true *fictiles fabulae*. Placed in a program of renovation that was especially important for the local elites, they underscored the people's Roman citizenship. This period was marked by a strong economic and cultural renewal, when Etruscan cities like Falerii, Telamone, Cosa, Vulci, Luni, and Città Alba commissioned monumental temples with rich pedimental decoration in terracotta. The pediments were filled with statuary groups, taking Greek-Hellenistic pedimental sculpture as an example of style, composition, and *themata*. The scenes displayed were quiet scenes of standing or seated figures from the pantheon (like the myths of Ariadne and Andromeda), or complex scenes from legendary wars and fights, complete with chariots, horses, and monsters (like scenes from the Trojan War or the Theban cycle). Often these scenes represented actual wars and victories, and had a strong political impact.

Terracotta Roofs in Roman Italy

Romanization forged ahead throughout Central Italy influencing the imagery and quality of the old Etruscan models in roof decoration, replacing it slowly but surely by a standardized Roman roof system. In the more southern regions, especially in Campania and Lucania, the decoration of temples was more modest in comparison to that of the temples in Etruria and Latium, the only images used being those in antefixes of a Campanian type with female heads and revetment plaques with Medusa heads. The final monumental stage in the development of architectural decoration was reached in the second century BCE, with the introduction of some new types of antefixes, mostly *Potnia Theroon* antefixes and antefixes with heads of Athena. The closed pediment was now apparent everywhere; its complex and rich statuary groups changed the overall appearance of the temples, fully providing them with Roman political propaganda and a frontal aspect of prime importance. Themes reflected historical events in religious and mythological contexts. It has been called the "Latin triumphal art" and was executed in the Hellenistic, "Neo-Attic" style, a *koine* in an artistic sense, which was omnipresent and dominated the whole of the Mediterranean world. In all Italic territories, architectural terracottas became widely distributed, both in the areas surrounding the great cities and in many distant places on the peninsula. In Roman times, the

terracotta decoration of temples was still much admired. Pedimental decoration in terracotta was visible both in Rome itself as well as in provincial towns Architectural terracottas from the Roman period are plentiful, but in comparison with roofs from the Archaic, Classical and Hellenistic periods, they are much less complex in variation and type. The Etruscan tradition of protecting and decorating temples with terracotta elements was slowly abandoned in favor of the embellishment of public and sacred buildings with stone and marble. Large antefixes disappeared altogether. The dominant production centers of architectural terracottas Città Castellana and Orvieto diminished in importance, and production returned mainly to Rome, where workshops developed new models of Hellenistic origin. Greek artists and artisans dominated the artistic scene and production from the second century BCE onward. They acquired complete autonomy and distributed their products throughout the whole of Central Italy and beyond. One group is predominant, the revetment plaques of the "Campana" type which were produced from the first century BCE onward and which by far outweighed the production of other roof decoration and decorated the exterior of sacred, and other public buildings, as well as private ones, such as villas. Roman antefixes have not received so much attention as "Campana" reliefs, probably due to their simplicity and modest artistic value. Their dimensions are small and their figural motifs limited. Medusa seems to have remained a popular type for both antefixes and other revetments in the Roman period. Production reached its peak in the Augustan and Julian-Claudian periods, coinciding with the explosion in building activities in the early imperial period. Decorative architectural terracottas became unusual after Imperial times, after the second century CE; marble was preferred then everywhere over decoration in terracotta.

Technique and Manufacture

A mould or *matrix*, like no other object in terracotta, informs us about both the production process and the distribution of architectural terracottas in Antiquity. Moulds were used to produce decorative elements when several were needed: raking and lateral simas, antefixes, or revetment plaques. They show the first phase of the creation of parts of the roof decoration, as well as the reproduction of other elements. Moulds were important tools for coroplasts, enabling them to reproduce hundreds of roof elements of the same quality at the same time, as well as enabling distribution over a vast region. Moreover, creating new moulds of existing revetment plaques or antefixes made it possible to use one type of roof decoration over several generations. Moulds are rarely preserved. Not many workshops producing roofs have been located during excavations, so the chance of finding workman's tools is relatively small. It also seems that moulds were not thrown away immediately but kept in use for a long period of time. They were sometimes even repaired. Today, some twenty moulds for antefixes and a few for relief plaques or other roof parts are known, namely, those from Città Castellana, Orvieto, and Capua. Only in one case, that of the Amsterdam mould Cat. no. 36, was a cast ever found during excavations, although some casts seem to have derived from the same type. Reconstructing the production process of terracotta objects is relatively easy, since working in clay has not changed over the centuries. The process of the creation of a mould and its subsequent use is as follows. The perfect model or *patrix*, created by a master coroplast, was covered with wax or oil after firing. Then a thick layer of soft clay was pressed over the *patrix*, thus creating a copy in negative, a mould. Presumably the same clay was used for both moulds and final products. After drying, the mould could easily be taken apart, thanks to the oily layer dividing it from the model. The mould was cut into a manageable format. Thus, all details of the model were copied in the mould. Sometimes extra details were added to the final product, but the moulds we know are all very detailed as regards hairdo, facial features, and decoration. After using the mould for the production of, for instance, the antefixes of a roof (a single mould could be sufficient), they were slipped, and then painted with a mixture of slip and natural pigments such as iron oxides and calcium. The products were fired between

800 °C and 1,050 °C, thus fixing the colors to the surface so as to withstand the weather. In this way, some colors have been preserved right up to the present day.

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► Religion, Italo-Roman, Archaeology of

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Terramara Santa Rosa di Poviglio Alluvial Site

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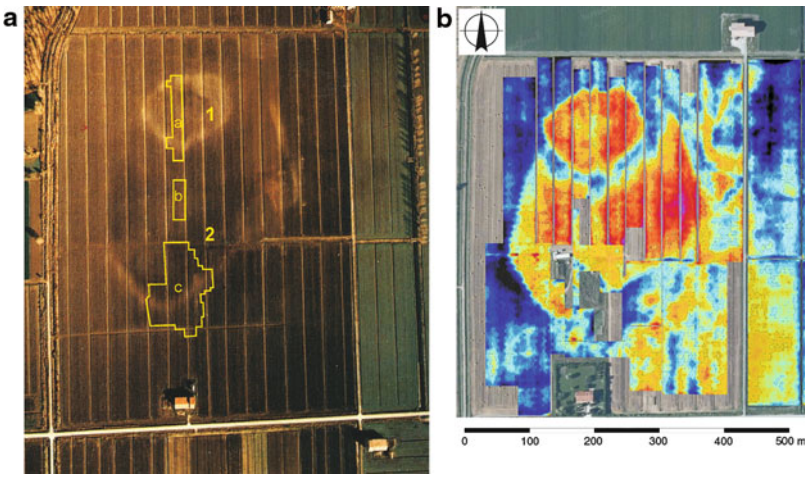
Introduction

The "Terramare" are banked and moated villages dating to the Middle and Recent Bronze ages (1600–1150 year BCE), located in the alluvial plain of the Po river, northern Italy. They are witness to a complex society, whose subsistence was based on intensive agriculture, pastoralism, and long-range trade (Barfield 1994). The Terramare people first carried out a radical clearing of the Po plain to provide land for intensive agriculture, and changed the natural drainage by digging canals and ditches to feed moats surrounding the villages and to irrigate the fields in the countryside (Cremaschi et al. 2006). The culture reached its apogee, along with a prolific population, at the beginning of the Recent Bronze age, but at the end of this period suffered a societal collapse that led to the abandonment of the villages in a few generations (Cardarelli 2010).

Key Issues/Current Debates/Future Directions/Examples

The Terramare have been a major subject of research by the Italian pioneers of prehistoric archaeology (Pearce 1998), but had been neglected for at least sixty years, and were thought to be almost destroyed by quarrying for soil during the nineteenth century. But at the beginning of the 1970s, geomorphological mapping of the Po plain, using aerial photography, demonstrated that the Terramare had largely survived quarrying. From that period onward, several projects have marked a new stage in their study (Bernabò Brea et al. 1997).

In the framework of this renewed interest, the archaeological excavation of Santa Rosa took on the task of extensively exploring a Terramara village, with the explicit aim of shedding light on its architectural structures and its development



Terramara Santa Rosa di Poviglio Alluvial Site, Fig. 1 The Terramara Santa Rosa as seen on the aerial photograph (*left*) and on the base of near-surface geophysical prospection (*right*). Aerial photograph: *1* – small village; *2* – large village. *Yellow lines* delimitate the areas excavated up to now: (**a**) area in the small village 1984–1992; (**b**) area between the two villages 2008–2011; (**c**) area in the large village and in the moat 1993–2011. Geophysical prospection: *blue colors* indicate conductive media (*clayey deposits*) indicating moat ditches and flood deposits surrounding the site; yellowish/reddish colors indicate resistive media (*sandy-silty deposits*) putting in evidence the Terramara shape (Mele et al. 2011)

Terramara Santa Rosa di Poviglio Alluvial Site, Fig. 2 The area excavated in the large village. The buildings, indicated by clusters of post *holes*, are delimited by peripheral moat. Note the high concentration of *circular wells*

over the 400 years that the village lasted. The Santa Rosa site was selected by virtue of its good state of preservation and because it was threatened with destruction by agricultural work. The site was defined by aerial photography, which revealed its limits in outline (Fig. 1a). Subsequent geophysical survey showed up areas of high and low conductivity, indicating areas dominated by wet and dry features (color coded on Fig. 1b). The interpretation is of two settlements, each surrounded by clay ramparts and moats.

Excavation has been carried out under the aegis of the SoprintendenzaaiBeniArcheologici of Emilia Romagna and the local authority, and performed by a professional team, which also trains archaeology students for the principal research institution (University of Milan). The aims of the excavation are to map the detailed occupation of the larger (7 ha) settlement and explore the relationship between the two. The first 28 seasons have opened an area of 1 hectare, revealing the defenses, post-rows of buildings, and numerous wells (Bernabò Brea & Cremaschi 2004; Fig. 2). The excavation period is limited to the summer season; during the winter/spring seasons, the water tables rise very close to the ground surface, make digging difficult (Fig. 3).

Terramara Santa Rosa di Poviglio Alluvial Site, Fig. 3 Archaeologists at work in the course of a field season in the Terramara Poviglio Santa Rosa

The original settlement was built at the edge of the Po river during the Middle Bronze Age, and consisted of a group of rectangular houses on piles protected by a timber palisade. At the beginning of the Later Bronze age, the Terramara reached its maximum expansion with the construction of the large village. Inside it, the houses were still on piles, but arranged along specific alignments and organized into quarters bounded by roads going through the village and crossing the surrounding moat over wooden bridges thereupon reaching the countryside (Cremaschi & Pizzi 2011). At the end of the Late Bronze Age, the village underwent a radical renovation: the houses were no longer built on piles, but rested on the ground according to the block-house technique. The peripheral wooden fences were replaced by massive earth ramparts.

The region in which the Terramare previously flourished was abandoned for at least five centuries. The Santa Rosa village area became a mound, covered with forest and surrounded by marshes which colonized the former ditches. It was settled again only in the sixth century BCE by Etruscan colonists.

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► Excavation Methods in Archaeology

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Textiles and Fabrics: Conservation and Preservation

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Introduction

A textile is a binary system of fibers or other materials worked into threads. In essence a textile is formed by weaving, but the term can also be used more generically and thus covers flexible products made in other techniques, as, for instance, twining, needle binding, knotting, and knitting. Felting and basketry are also techniques related to textiles. Thus, textiles can be seen as one part of an overall cloth culture, which may include many different materials and techniques (Harris 2012).

Around the world and throughout time, humans have created textiles by exploiting different natural resources and inventing tools and methodologies to change these resources into a viable product. Some areas are rich in traditional textile resources, like materials for fibers, dyes, and tools, but also in less resource plentiful areas, humans have found solutions for fulfilling the demand for textiles.

Definition

Until very recent times, textiles were primarily made from natural fibers of either plant or animal origin. The most well-known plant fibers are flax, hemp, nettle, and cotton, while the most well-known animal fibers are sheep wool and silk. Like any perishable organic material, these fibers are subject to rapid decomposition in archaeological contexts, and their preservation requires special conditions to prohibit their destruction by microorganisms.

Key Issues/Current Debates/Future Directions/Examples

Contexts

Environmental conditions affect the survival of plant and animal fiber materials in various ways. In general, an acidic environment favors the preservation of proteinaceous fibers, while a alcaline environment does the same for fibers of vegetal origin. As most degradation requires the presence of air, many textiles have been found in contexts where anaerobic and/or waterlogged conditions occur. Other conditions like extreme dryness or permanent frost; the presence of salt; exposure to fire, which leads to the creation of carbonized samples; or through mineralization when coming into contact with metal salts have also preserved many textiles.

The find context influences the preservation of archaeological textiles. In Europe, most textile remains have been found in connection with burials, such as costumes, wrappings of human remains and/or grave goods, furnishing, and other utility textiles. In inhumation graves, the organic materials are often exposed to heavy and fast degradation, and, in most cases, it takes special conditions as, for instance, the presence of metal salts from copper or iron to prevent the degradation (e.g., Bender Jørgensen 1992; Rast-Eicher 2008; Gleba & Mannering 2012). Though these textiles are often very small and in a stage where further organic analyses are excluded, they still offer due to their number and firm structure an important source to European textile technology. In dry climates as in Egypt, many textiles have been preserved by desiccation and aided by the burial custom of embalming the dead. In a similar way, the special tradition of embalming and placing the dead in caves, which was performed in the pre-Columbian Inca kingdom, has preserved many colorful textiles made of cotton and wool in South America. Frozen environments like the Norse burials in Greenland have left fabrics almost unaltered, and in the recent years, the melting of glaciers in, for instance, Switzerland and Norway have also revealed well-preserved textile finds. In Denmark, the waterlogged, anaerobic, and acidic environment

in burial mounds has favored the preservation of a large collection of complete Bronze Age textiles and costumes.

Other important contexts where textiles may occur are settlements, harbor areas, garbage dumps, and earth fillings. Many excavations in medieval towns around Europe have revealed new and important textile corpuses that supplement and challenge information based on written sources, and also textiles found in churches and relics provide important perspectives to our textile history. Especially in Northern Europe, many textiles have been found in connection with ritual offerings, as in weapons deposits, or together with mummified human remains. From these lake and bog contexts, many complete wool textiles and other objects made of skin and fur dated to the Iron Age have been preserved. Until recently, it was believed that this acidic environment in the North European high bogs only favored preservation of proteinaceous origin, while it was only larger objects of plant origin like cords and ropes made of tree bast, stems of flax, and wooden objects that could be preserved in bogs. Nevertheless, during the reexamination of the Huldremose Woman (Fig. 1), the last remains of a textile in plant fiber was discovered on her back, and threads from this weave could also be located in many folds in her skin (Frei et al. 2009). This is the first time that a plant fiber textile has been recorded from a bog context in Denmark. This example shows that although a specific context and environment in general favors a specific material, every archaeological find is in itself unique. When excavating new finds or researching already excavated finds, it is important to be open for all possibilities in order not to overlook important archaeological materials.

The scarcity and poor preservation of archaeological textiles are two factors usually cited for the absence of focus on textile studies. Although valid to a certain extent, such reasoning has obscured the fact that textiles are much more abundant in archaeological contexts than generally assumed and should, whenever present, be studied in the same way as any other archaeological finds.

Textile Research and Scientific Analyses

Textiles have an enormous potential in archaeological research, being able to tell about social, chronological, and cultural aspects of past societies, and at the same time providing us with a unique opportunity to come very close to the prehistoric or historic individual. Substantial information about past societies can be gained from the study of textiles, but this information depends on the analytical tools and methods used. A textile contains information about the process and the tools used in the various stage of its production. The decoding of a textile is imperative for the understanding of the many different processes involved in its production, and the methods may vary according to the state of preservation (Andersson Strand et al. 2010). For instance, the processing of a fiber material from the source to the final thread and the weaving and sewing will not only tell about breeding systems and the technological knowledge of that time but also indicate more subtle information about visual preferences and human desires.

Fiber identification is an important starting point in textile research as it indicates the properties of this material as well as the possible use. The identification of fibers is in most cases based on morphological characteristics performed by various types of microscopy. The optical microscopy is the most basic tool which together with scanning electron microscopy (SEM) enables precise photographing and measuring. In these cases sampling is necessary. Fiber identification can be difficult in cases of highly aged and deteriorated samples where fiber characteristics have been changed and/or where sampling is complicated by the fragility or the scarcity of the fibers. In such cases, scanning electron microscopy is especially useful and combined with energy dispersive X-ray spectroscopy (SEM/EDX) inorganic elements in the fibers such as pigments, mordants, and salts, and proteins in animal fibers can also be analyzed. Transmitted electron microscopy (TEM) can provide information on the internal fiber structure such as the pigmentation of wool fibers. Gas chromatography/mass spectrometry (GC/MS) and infrared microspectroscopy (FTIR) are useful

Textiles and Fabrics: Conservation and Preservation, Fig. 1 The Huldremose Woman's costume consists of two skin capes, a woven skirt and a scarf in wool, and an undergarment in plant fiber. The woman and her fantastic well-preserved costume were found in a bog on Djursland in Denmark in 1879 and belong to the National Museum of Denmark. The find is 14C dated to 350–341 BCE

analytical methods for the identification of resins, oils, and balsams that can have been applied to textiles. High-performance liquid chromatography (HPLC) is used to obtain information about dyes or dye components that are not visually detectable anymore. Especially, dye analysis provides important information to the archaeological interpretation that characterize visual preferences, technology, and exchange of know-how and goods (Vanden Berghe et al. 2009). Radiocarbon dating (^{14}C) can be used for textiles from disturbed contexts or contexts where no other datable object exists (Mannering et al. 2010). Textile materials are, in general, well suited and reliable for 14C dating, although the presence of conservation substances should be evaluated before sampling. Stable isotopes can reveal facts about the nutrition (Wilson et al. 2001), while strontium isotopic analysis, which has now been adapted to fibrous material, can reveal whether the textiles are of local or nonlocal origin (Frei et al. 2008). DNA sequencing is useful for the identification of specific species, which are otherwise hard to identify, but the results

highly depend on the preservation conditions (Ørsted Brandt et al. 2011). Detection of species of animal origin can also be done with mass spectrometry-based protein sequencing (MSPS) (Schmidt et al. 2011).

The constant improvement of scientific analytical methods and the development of new ones will often inspire further analyses. Yet, most analytical tools require sampling, and it is important to develop more nondestructive methods in order to secure our common world heritage, and to improve working conditions and the scientific outcome. The importance of taking samples should be evaluated prior to analysis, and sampling should preferably be done before any contamination has occurred. Accurate documentation, preferably by photographs, of where samples have been taken is imperative.

Preservation and Conservation

The aim of an active conservation treatment is to improve the condition of the textile by trying to eliminate some of the causes of deterioration, and the aim of preventive conservation is to slow down the rate of further degradation (Skals 1996). Textiles preserved in archaeological contexts are often weak and tend to be fragile and decompose easily when exposed to changes in the climatic conditions and to touching and handling. A general rule is that dry textiles should be kept dry, wet textiles kept wet, and textiles should be stored in a cool place until the conservation treatment can commence. Adding consolidants during retrieval or biocides to avoid bacterial or fungus growth should be avoided as future scientific analyses thereby will be complicated or prevented (Gillis & Nosch 2007).

The method of drying waterlogged archaeological textiles and the questions of pretreatment with lubricating additives such as polyethylene glycol (PEG) or glycerol are factors which has been the focus of much discussion and research. Freeze drying has been evaluated as the gentlest form of drying. It can be done under vacuum or at atmospheric pressure. The discussions regarding pretreatment are somewhat unresolved because the additives in theory are soluble and the treatment reversible. Nevertheless, it can be very difficult to completely remove additives from archaeological fibers. Lubricants are often added to waterlogged wood to replace the water that has filled the empty spaces in the cell structure. Adding lubricants to textile fibers with the aim of replacing the water in the fiber structure is a different matter. The molecular structure is different from wood, and the empty spaces inside fibers are very tiny. Furthermore, the yarn structure, consisting of many fine fibers twisted together, will cause the liquid additives to run into all the air spaces and coat the fibers. Completely removing them is impossible without much damaging manipulation of the textiles. Also future scientific analyses will be unreliable. Avoiding the use of lubricants is therefore recommended (Peacock 2005).

Cleaning of textiles is an irreversible process, and the effect of cleaning on the condition of the textile must be evaluated before a treatment is chosen. Thorough cleaning of wet archaeological textiles prior to drying should be avoided as should also wet cleaning of dry archaeological textiles. Dirt can be the cause of long-term degradation but also be part of the history of the object. Likewise, the cleaning process may remove less stable substances like dyes and paint which may not be visible to the naked eye, or pollen assemblages stored in the textile, which in turn contain information about human activities and the environment.

The long-term preservation of textiles will be enhanced by good, clean, and cool storage. Fragile textiles should be supported, and shelves and drawers should be well fixed to eliminate mechanical damage. The textiles should be protected from deteriorating effects of light, heat, and high humidity, and regular monitoring for insect infestation is recommended.

Due to the fragile nature of textiles, they will inevitably degrade. Careful handling and ideal storage are preventive methods that can slow down the degradation, but they can never prohibit or stop it. Therefore, it is of utmost importance that archaeological textiles are analyzed and studied when possible. In this work, a useful tool is high-resolution digital photography which provides accurate documentation of the object and its

condition at a certain time. At the same time, this technique also opens for a wider scientific use and dissemination of these fragile objects, which reaches beyond their physical presence.

Conclusion

Textile research is a worldwide occupation which is performed within many different disciplines. This is also the case within archaeological textile research where the theoretical and methodological approach, to a large extent, depends on the research traditions in the different geographical and cultural historical areas. Research in archaeological textiles are performed by, among others, archaeologist, historians, art historians, textile designers, conservators, and crafts people, and each in their way, they are able to contribute with important aspects to the understanding of the production and use of textiles.

Textiles and fabrics are an important part of our common world heritage. Most cultures and peoples around the world use textiles for multiple purposes and the same are true for past societies. Common for this worldwide endeavor is first and foremost the wish to keep warm and comfortable, but textiles also have an important role in expressing who we are – our gender, age, family affiliation, status, occupation, religion, and ethnicity. Knowledge of textile history is hence a key to our understanding of a multitude of human issues.

Cross-References

- ▶ Authentication and Conservation in Archaeological Science
- ▶ Domestic Archaeology: Textiles of Northern Mediterranean

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Thailand: Cultural Heritage Management

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Introduction and Definition

Thailand has a long history of cultural development, but the management of cultural heritage under a protective framework did not begin until fairly recently.

It is interesting to note that throughout its history of cultural development, perceptions of the past varied from place to place depending upon influences such as religions, beliefs, and political situations. For example, Thai people as Buddhists generally perceive the past as something that represents change and becoming. It may be abandoned quickly and easily. It is expected that new things can be created, invented, or established. Thus, restoration or reconstruction of old pagodas or stupas, pavilions, and other religious buildings is not culturally wrong. Byrne (1995) brilliantly discussed the use of stupa and conservation conflicts in Thailand. Strictly speaking, the past as interpreted by King Rama VI, during his reign, was a key tool in building nationalism. He convinced the people to be proud of their culture and past (Vella 1978).

Historical Background

Regarding concern about the destruction of cultural heritage in terms of archaeological resource management in modern sense, the first protection law called "Pra Kaad Khet Rang Wat Poo Rai Khut Wat" or "Proclamation on Temple Boundary and Temple Looters" was issued in 1851 during the reign of King Rama IV (Fine Arts Department 1968). The main objective of the law was to prevent temples from being looted.

It should be noted that during his reign (1851–1868), Thailand (or Siam, as it was known at that time) was in an early stage of its development of international relations. While the king wanted to open the country to forge relationships with developed countries such as the United States, England, and France (see Symananda 1993), he was aware of the negative slide of colonization. For this reason, he revived an awareness of the past as a way of supporting nation building or developing a sense of national unity and pride (Symananda 1993).

Through his reign, a number of archaeological research projects, including the preparation of museum displays, were carried out. However, since the works were the result of the king's personal interests – not of government policies – they were conducted only by small groups of elites who worked only on royal projects. Nevertheless, the value and meaning of cultural resources were interpreted as important heritage of the nation, deserving protection.

The revival of the past was continued during the reign of King Rama V, (1868–1910).

King Chulalongkorn, as he was also called, was not only a well-known reformer but also a great scholar. He was interested in a variety of disciplines such as archaeology, ethnography, and history; wrote a number of books concerning archaeology; set up a museum hall in his palace (1874); solicited the return of stolen objects from Museum of Ethnology in Berlin, Germany (1886); established the Museum Department (1888) which was a government agency; founded the Antiquity Club (1907), which promoted the study of archaeology, art, and history; and established the Literature Club (1914) (Fine Arts Department 1989; Charoenwongsa 1994; Ketudhat 1995). It should also be noted that the first scientific excavations that were conducted by Phraya Boranrajathanin in Ayutthaya were another important point that marks the progress in archaeological heritage management.

These greatly increased public awareness of the significance of cultural heritage and eventually led to the development of culture heritage management in the country. It should be stated that in the king's sense, cultural heritage referred to everything that was old. Thus, it is not surprising that, even at the present time, there is no clear and specific definition of cultural heritage used in the legislative context. The commonly used references are ancient monuments, ancient objects, and art objects.

In 1926, 6 years after the end of King Chulalongkorn's reign, the Bangkok Museum Act was enacted. This brought about the establishment of Thailand's first public museum, the Bangkok Museum. In addition, the regulations concerning "transportation of ancient objects and art objects" were promulgated in response to the immense trafficking and smuggling of antiquities. It should be noted that the management of cultural resources mainly involved the protection of archaeological remains.

A remarkable change occurred in the time of Prime Minister Field Marshal Pibulsonggram (1897–1964). Pibulsonggram clarified his role in the government, and tried to use elements of culture as tools to cultivate nationalism and patriotism. For example, he encouraged the people to use and buy only Thai products and required them to be in – what he called "civilized" – dressing, that is, coats, trousers, blouses, shirts, hats, gloves, and ties (Suwannathat-Pian 1995: 135-151).

Furthermore, Luang Wichitwathakan (1898–1962), a prominent scholar and prolific history writer in this period, asserted in one of his studies on the ethnic history of the Tai people that the Thais were the most ancient race, instead of "one of the most ancient" (Charoenwongsa 1994: 1). Kasetsiri (1979: 166-168) interpreted Luang Wichitwathakan's history as an ideological weapon of the new ruling elite, particularly the military, to seek justification for ruling the country.

During Pibulsonggram's government, a large number of acts, regulations, and laws that applied to cultural heritage were passed; the most effective ones were the National Culture Act of 1940, the 1940 Council of Culture, and the 1945 Act of the Ministry of Culture. In 1979, when General Kriangsak Chamananda was the Prime Minister, the Office of the National Culture Commission was established. Later, Prime Minister General Prem Tinsulanonda announced the national culture policy. Most recently, under the administration of Chuan Leekphai's cabinet, the government declared the year 1994 as the Thai Culture Promotion Year to promote public awareness of the value of Thai traditions and customs. This nationwide campaign dealt mostly with nonmaterial aspects of the culture such as beliefs, ideologies, religion, and folklore. In regard to the management of archaeological resources, the Fine Arts Department's Office of Archaeology, Ministry of Culture has taken responsibility since 1926.

Key Issues/Current Debates

The Administration of Cultural Heritage

The "official" management of cultural heritage in Thailand is a government duty operated by the two major departments of the Ministry of Culture: the Fine Arts Department and the Office of Cultural Promotion. The first organization is mainly responsible for tangible heritage

preservation and management, particularly through the administration by the two offices of the Fine Arts Department, the Office of Archaeology and the Office National Museums, while the latter is largely taking care of intangible heritage. As for the tangible or physical cultural heritage, the Office of Archaeology is "the key agency working on the restoration of ancient monuments and archaeological sites. It is also responsible for the preservation and investigation of archaeological remains for the benefit of the nation, for the sake of the study of the nation's history, and for the perpetuation of the cultural heritage of the nation" (Fine Arts Department 1990: 24).

Administratively, the Office of Archaeology is one of the ten agencies of the Fine Arts Department in the Ministry of Culture, which is the only organization responsible for the management of cultural resources in the country. The Office of Archaeology was first formed as a club in 1908 – the Antiquity Club. It was gradually reformed and its status was later changed from a private club to a government agency. In its administrative structure, the Office of Archaeology is divided into seven sections: General Affairs, Planning and Evaluation, Research, Restoration and Preservation of Ancient Monuments, Preservation and Restoration of Mural Painting and Nonremovable Sculptures, Control and Maintenance, and Historical Park Projects.

Furthermore, according to the law, the Office of Archaeology is given full authority to grant permission or reject proposals for undertaking archaeological investigations on public land. In 1995, the Office of Archaeology was merged with the Office of National Museums into the Office of Archaeology and National Museums but was later separated as an individual agency under the umbrella of the Fine Arts Department as is the Office of National Museums.

Broadly speaking, there are two major groups of archaeologists in Thailand. One group, whose work is mostly concentrated on restoration, preservation, and inventory of archaeological sites, districts, and ancient cities, is associated with the Fine Arts Department (FAD), while the other is associated with academic institutions such as universities and colleges. In response to the Historical Park Projects, a great number of surveys of archaeological sites and monuments by FAD's archaeologists during the past ten years were primarily and specifically designed to rescue major archaeological sites and then develop them into "historical parks." Charoenwongsa (1994: 2) remark: "administrators/managers enjoy themselves more towards restoration of ancient monuments. The situation has not changed very much. . .." This seems ironical because Musigakama (1995: 38), a former director of the Office of Archaeology, stated that the Office of Archaeology is responsible not only for survey, maintenance, restoration, and preservation of archaeological heritage but also for scientific study of archaeological records.

After joint expedition projects with foreign counterparts during the 1960s, the Thailand's Fine Arts Department initiated many mobile projects to counter looting activities in the 1970s. Under the direction of Pisit Charoenwongsa, the Northeast Thailand Archaeological Project was established in 1975 out of its predecessor, the Ban Chiang Excavation Project (a joint effort between the Fine Arts Department and the University Museum, University of Pennsylvania which was carried out under the coordination of Pisit Charoenwongsa and the late Dr. Chester F. Gorman). With the success of the Northeast Thailand Archaeological Project, the Office of Archaeology (then called as Archaeology Division) created another three regional – northern, central, and southern Thailand – archaeological projects.

Following that, regional field projects were brought under the central administration of Thailand Archaeological Project (TAP). As director of TAP and the Research Section of Archaeology Division, Pisit advised his younger colleagues to choose among themselves their own project directions. In 1980s, Khemchart Thepchai, Tarapong Srisuchart (current director of the Office of Archaeology as of 2012–2013), Bovornvate Rungruchee, Amphan Kijngam, Sathaporn Khanyuen, Sayan Pricharnchit, and Niti Saengwan were

directors of these regional projects. To enrich their experiences, some of them moved or rotated from one project to another.

In the 1980s, the Thailand Archaeological Projects and its regional field projects produced several hundred site survey reports for the first time and with that came a large data collection which resulted in about 50 publications in book form during the late 1980s and beginning of 1990s.

There are both pros and cons in the cooperation between western and Thai archaeologists. Many good elements brought by western colleagues include the concept of multidiscipline/problem-oriented research programs and systematic study of archaeological remains. However, some projects caused misunderstandings and negative feelings between participants, due largely to differences in culture/traditions and the self-centeredness of certain individuals.

Legislation Relating to the Protection of Cultural Heritage

As mentioned earlier, the first protection law issued in the reign of King Rama IV was short lived and was limited to the protection of royal temples. In 1934, the first comprehensive legislation was drafted and was later amended three times – in 1943, 1961, and 1992. The last amendment was announced in the Royal Gazette on March 29, 1992 in the reign of the present king. This has been called Ancient Monuments, Ancient Objects, Art Objects and National Museum Act of 1961. In addition, a number of separate regulations such as the Act of the Ministry of Education and the Announcement of the Fine Arts Department have been occasionally issued in line with the Act of 1961 (for details, see Fine Arts Department 2005).

The 1961 Act, together with additional amendments and regulations, has broad coverage: it includes definitions of specific terms, regulations, permit applications, ownership, lists of endangered sites, national museum, and illegal trafficking, transportation of ancient objects, and penalties.

Unlike such other countries as the United States and Australia, Thailand has no particular law on burial sites, underwater archaeological sites, and properties belonging to particular ethnic or indigenous peoples. According to the act, any objects buried or left on public land belong to the nation.

Public Education

Public interest in cultural heritage is powerful, as the public becomes the driving force behind efforts to conserve the past. In Thailand, the first formal center for public education in archaeology is the Faculty of Archaeology, Silpakorn University. This institution has the only center of training and recruitment of archaeologists for over a decade. Most Thai archaeologists have been trained at this institution. The courses focus mainly on Thai archaeology and a basic understanding of archaeological practices, and the degrees offered are B.A., M.A., and Ph.D. It was as recent as just in 2006 that an undergraduate course entitled "Cultural Resource Management" was included and taught for the first time in Thailand by the faculty members and experts from other government and private organization throughout the country at Silpakorn University Department of Archaeology. An M.A. program in Cultural Resource Management at Silpakorn University has been offered since 2007, and it has been well received, judging by the increasing number of students.

Interestingly, during the past few decades, many other public schools, colleges, and universities, for example, Thammasat University, Chulalongkorn University, Khon Kaen University, Chiang Mai University, Srinakharinwirot University, Burapha University, and several other colleges (mostly former teachers' colleges which are now known as Rajabhat University Complexes), have developed archaeology programs and have introduced archaeology courses in their curriculum, but none offers degrees in archaeology. Archaeology programs have yet to be introduced to the elementary and secondary schools. Therefore, school children learn very little about Thai history and culture in schools.

Besides formal education, knowledge about the past has been transmitted to the public

through various kinds of nonformal educational mediums. Museums are one type of nonformal education centers; throughout the country, there are more than 30 public museums operated by the Office of Archaeology and National Museum. In 1995, for example, the Thai government granted a budget of about 2 billion baht (about $80 million) to build provincial museums throughout the country.

In addition to the government-owned museums, there are a number of private museums and public organizations such as the Museum of the Siam Society, the Ancient City Co. Ltd, the Jim Thompson House, Princess Maha Chakri Sirindhorn Anthropology Centre, Museum Siam, and the Museum of Prehistory in Siriraj Hospital of Mahidol University. There are also groups of archaeological volunteers who occasionally organize field trips to archaeological and historic sites around Thailand, as well as neighboring countries such as Laos, Burma, Cambodia, and Vietnam. It is an indication that archaeological study tours are now becoming popular in Thailand. It should also be noted that during the past 5 years, there has been an increase in numbers of public magazines promoting natural and cultural tourism in Thailand and neighboring countries.

Major Contemporary Problems

Major problems concerning the management of archaeological heritage in Thailand are basically similar to those found in other countries in the world.

Looting

Looting is probably a never ending problem in Thailand. Through time, many archaeological prehistoric and historic sites have been illegally unearthed. In many cases, the looters are asked by middlemen who are merchants from Bangkok to hunt for antiquities. The ideal sites for looting are prehistoric sites in central and northeastern Thailand where they can easily gain access and where the sites cover large areas. The artifacts hunted in clued pottery, stone bracelets, beads, and bronze weapons. Surprisingly, a man in a team of looters confessed, when arrested, that he learned how to dig by observing archaeologists while they were at work. Another woman in the same team said that they have no choice but to hunt for antiquities for money because they were poor and did not own any pieces of land (Pumathon 1994: 28). In the case of historic sites, the favored artifact classes would be Buddha images and architectural decorative elements (e.g., stone lintels, wooden windows, and doors of Buddhist monasteries).

Government Officials Versus Local People

This problem arises mostly in the context of restoration of monuments which are currently used as shrines or sacred sites. This may be due to different understanding of the value of archaeological resources between government officials and local people. For example, most recently, there was a movement of people in Lopburi Province to protest the restoration of an ancient monument in the city. Archaeologists from the Office of Archaeology wanted to dissemble the monument and restore it by the so-called "anastylosis" method, but the people in the province wanted to know why the monument had to be taken apart first. They were very concerned about the destruction of the monument because it has great spiritual value for the people in the province.

In another case, the Office of Archaeology reshaped a giant pagoda, Wat Chedi Luang, in Chiang Mai, northern Thailand, without enough investigation and public hearings. The restoration resulted in the deformation of a pagoda which disappointed the locals and the scholars so much that they called a meeting to stop the work (Suksawasdi 1993).

There are few well-trained archaeologists working in government agencies, most of them received only basic training and have limited experience in doing archaeology. They often face problems because, many times, they are assigned to carry out work for which they are not trained.

Problem of Contract Work

At present, the preservation and restoration of archaeological remains and historic buildings is

in the hands of technicians, rather than archaeologists. Archaeologists should research essential informational before the restoration begins, as a practical and academic approach, but often that task is left to the technicians. Probably due to the lack of sufficient evidence, a clear explanation of why this problem still remains is impossible. It is strongly recommended that a code of ethics of practitioners must be prepared. These technicians are lacking in basic archaeological knowledge, and they are even lacking in appreciation for the value of cultural resources. They just want to finish their work as soon as possible because of constraints of time and money. Thus, a lot of valuable information has been lost. For example, in the restoration of an ancient ruin in Ratchaburi, workers of a contract company reconstructed the ruin by first disassembling it and then reconstructing it. Unfortunately, the workers did not know what the original shape of the monument had been. The result of their work is archaeologically wrong, and the monument looks very ugly.

Different Perception of the Value of Cultural Heritage

Conflicts between cultural heritage practitioners and the local people have occurred due to different understanding of the value of cultural resources. Archaeologists of the Office of Archaeology and cultural heritage practitioners tend to focus on the informational and economic value of the archaeological resources, while the local people consider their spiritual or symbolic value. A good example is a small simple hillock near a temple in a village of Nakhon Phanom Province. Outsiders may view it as just a normal natural setting in the area, but for people in the village, it is a "sacred place" according to their myth. Annually, the villagers perform religious rites and celebrations at the place which has also been an important meeting area between people from Laos and Thailand (Vallibhotama 1992: 211). My recent pilot research (Lertcharnrit & Niyomsap 2008), conducted in a remote village where archaeological site museum is located in central Thailand, on indigenous perceptions and knowledge about archaeology revealed that when asked what archaeology is, the majority of respondents (41 %) perceived that archaeology is human skeletal remains (see Table 1).

Thailand: Cultural Heritage Management, Table 1 Public knowledge and perception about archaeology in a Thai village in central Thailand when asked "what do you think of when you hear the word "archaeology?" (N = 85)

Archaeology in villagers' perceptions	Percentage of answers
Human skeletal remains	41.18
Artifacts	23.53
Ancient history/the past	17.65
Ceramics/ancient ornaments (beads, bracelets)	14.12
Ban Chiang[a]	9.41
Ban Pong Manao[b]	2.35

[a]Ban Chiang is a widely known prehistoric site in the northeast because it is a cultural world heritage site
[b]Ban Pong Manao is an Iron Age site where an archaeological site museum is located and also the name of the village I conducted the research

Future Directions

The "professional" management of cultural heritage in Thailand has long been developed, and it is still in need of further development. It needs a lot of change especially in term of legislation and policy. To reduce controversy, the protection law should be open for public participation, providing opportunity for the public to offer input into decisions and actions.

Cooperation between the Fine Arts Department and other private and government agencies/organizations and public audiences, on both local and national levels (i.e., the Ministry of Agriculture, Ministry of Education, Department of Highways, Department of Religious Affairs, Royal Irrigation Department, Amateur Cultural Heritage Conservation Clubs, Subdistrict Administration Organizations, village heads, provincial governors, etc.), will help upgrade the quality of the management program.

The Fine Arts Department's Office of Archaeology desperately needs to build nationwide and

worldwide networks in the coming years, while a strong public education program should be considered as part of an essential strategy to change public attitudes toward the past.

It should be remembered that the people who live near the sites are the best protectors of cultural resources. Once people have recognized the value and meaning of cultural resources, protection and management will be more successful.

Lastly, in the globalization era, the Fine Arts Department's Office of Archaeology should also build global alliance with international organizations and professionals, not only the UNESCO and ICOMOS which Thailand is a member but also other nonprofit organizations located in southeast Asian countries, such as the Heritage Watch in Cambodia, and in broader regions of the world (e.g., the Getty Foundation, the World Archaeological Congress, the Southeast archaeological Center). In addition, local and public participation and cultural education programs must be developed as well.

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The Guianas: Pre-Columbian Heritage

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Introduction

Up to recently, pre-Columbian coastal Guianas were almost always forgotten in any study on the

The Guianas: Pre-Columbian Heritage, Fig. 1 Map of the Guianas indicating the coastal Guianas that extend on five countries (Drawing Rostain)

prehistory of Amazonia. In most publications, only the archaeology of the valley of the Amazon was presented, leaving away all the lands north of the Guianas watershed that were completely ignored.

Coastal Guianas are located north of the Guianas watershed line where rivers do not go from north to south toward the Amazon River but flow to the north toward the Atlantic Ocean. This concerns three entire countries that are Guyana, Suriname, and French Guiana and three states that are Delta Amacuro y Bolivar (partially) in Venezuela and Amapá in Brazil (Fig. 1). Remarkable progress and discoveries made these last years in the archaeology of the Guianas have changed the vision on the cultural developments and the role of this territory during pre-Columbian times. Archaeologists are now aware of the importance of the northern part of the lower Amazon, especially the Amapá State, as a crucial cultural cradle, but also of the extraordinary pre-Columbian human developments in the Guianas and particularly along the coast.

Comparing to the Andean societies or even to the cultures of the Pacific coast, many persons believe that there is no prehistoric monument in the Guianas or in Amazonia. It is common to ear that archaeological sites of this region are only constituted of some pottery sherds, few lithic artifacts, and many postholes. However, if it is true that pre-Columbian did not built architecture of stone, they did produce all kind of monumental structures. The most famous are obviously made on rocks or with stone as the petroglyphs, the rock paintings, and the geoglyphs but also the grinder stones that are so frequent on the Guianas. Because the scarcity of stone in the region, pre-Columbian Indigenous also made many earthworks that can be more discrete at a first glance and difficult to see on the ground, so they were unrecognized for a long time. They are raised fields, residential mounds, causeways, canals, and ditched hills.

Finally, it is impossible to ignore one of the main heritages left by pre-Columbian people that is an important part of the vegetational composition. During more than 10,000 years, hunter-gatherers, horticulturalists, and agriculturalist had modified plant species by inbreeding of species, favored plant associations, and created vegetation composition in specific landscapes. An important part of the actual rainforest results from millennia of vegetation manipulation and transformation by the Indigenous.

Key Issues

Pre-Columbian Stone Monuments Heritage

Stone monuments are the most famous pre-Columbian remains known in the Guianas because of their "artistic" value. Four different types of rock sites can be distinguished: petroglyphs (Fig. 2), rock paintings, geoglyphs, and grinder stones.

Petroglyphs are common through all the Guianas but, because the scarcity of investigations, only some of them are known and studied (Dubelaar 1986; Williams 2003). They are found either inland or on the coast, with a preference in the proximity of water but not systematically and almost always close to a hill (Mazière 2008). Anthropomorphic and zoomorphic figures are very frequent. First ones are often with raised arms and spread legs or just represented by a head with eyes and mouth (Fig. 3). Recognizable animals are snakes, fishes, birds, monkeys, caimans, felines, etc. (Fig. 4). There also are many geometric figures. Techniques of manufacture are varied including incision, grooving, staking, and grinding.

As in other parts of Amazonia, rock paintings are more rare in the Guianas than petroglyphs. They are very common in Venezuela but only few sites are known in the Guianas: one in Suriname and another one in French Guiana. The reason can be the destruction of the paintings by the weather and the acidity.

Various monuments made of stones are recognized in the Guianas (Boomert 1981). They can be erected or lay on the ground according to a certain distribution. The most impressive megalithic groups are the stone alignments found in the savannas of Rupununi in Guyana, Sipaliwini in Suriname, and in Parú and Amapá in Brazil. They are very large stand up slabs, eventually slightly modified by percussion, disposed in line, circle, or in triangle. Megalithic sites on the central coast of Amapá are generally found on hills, which are characterized by large panoramas (Meggers & Evans 1957; Rostain 2011). They can be far, up to 10 km, from the closest rock deposit so it had been a substantial work to bring enormous stone slabs to the site. They consist of vertical granite slabs that are arranged in lines, circles, or triangles (Fig. 5). Recent excavations made in the megalithic site of Rego Grande demonstrated a funerary use but also an astronomic function (Cabral & Saldanha 2009). Alignments of slabs laid on their face are found on the rocky top of granitic inselbergs that are free of vegetation and with open panoramas. The most diverse assemblages are located on the Mitaraka sugarloaves, at the southern boundary between Brazil and French Guiana (Hurault et al. 1963). They can be arranged in line or in such a way to form zoomorphic figures, similar to those of the petroglyphs, that have been interpreted as lizards, turtles, or human beings.

Hundreds of grinder stones have been found in the Guianas. A grinder stone is the remain of the result of the grinding and the polishing of stone tools preforms to make axes, chisels, points, etc. (Fig. 6). They are located along the rivers and small creeks and on the coastal outcrops in French Guiana. These marks can be classified in five types (Rostain 1994). The "cupule" is a small circular cavity. The "cupule with bump" is similar to the first one but it presents a central protuberance. The "almond" is an irregular basin, vaguely oval or rectangular, and not deep. The "ship's hull" is a wide and deep spindle-shaped basin. The "groove" is a deep and straight spindle-shaped cavity, with triangular or rounded profile. Different types of grinder can occur on the same rock outcrop. Sometimes, two types are combined that is mostly one, two, or three grooves inside a ship's hull. This last one was made first and reused after to make the grooves. The four first types result from the shaping and grinding of the sides of the tool and the sharpening of the cutting-edge. The groove is made shaping of the edges (and not by the sharpening as it is often said). Ship's hulls are much more common inland than cupules but they are absent on the coast that could indicate technical differences. Ship's hulls result from a short up-and-down grinding while cupules and almonds are made by a circular movement.

Pre-Columbian Earthworks Heritage

Pre-Columbian groups were also landscape makers because they built a variety of

The Guianas: Pre-Columbian Heritage, Fig. 2 Drawing of a petroglyph by Morissot in 1886, Middle Orinoco, Venezuela (Morisot 2002)

The Guianas: Pre-Columbian Heritage, Fig. 3 Petroglyph of the Carapa, near Kourou, central French Guiana (Photo Rostain)

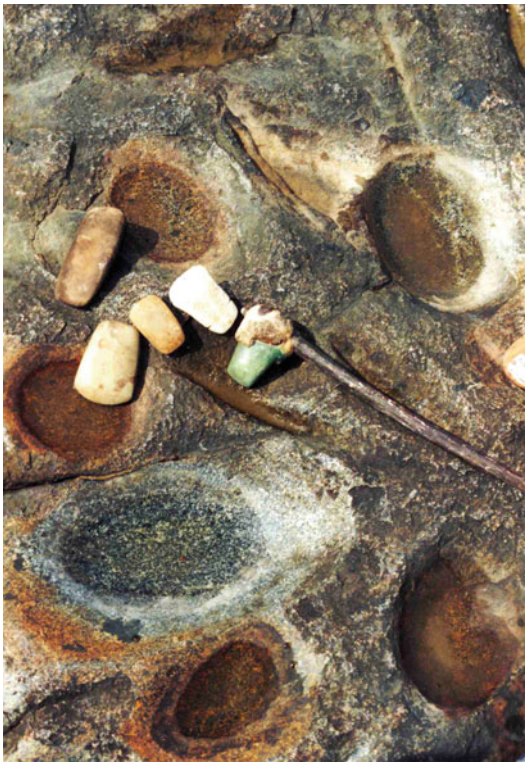
The Guianas: Pre-Columbian Heritage, Fig. 4 Petroglyph of Pascaud, Cayenne Island, French Guiana (Photo Rostain)

earthworks, particularly along the Guianas coast (Rostain 2010). They are raised fields, residential and funerary mounds, causeways, canals, and ditched hills.

Raised fields are agricultural small earth mounds with two main functions: to secure a dry location for cultivation in flooding areas and to concentrate fertile material (Fig. 7). Thousands of pre-Columbian raised fields surrounded by ditches are located in the coastal zone of the Guianas. They are mainly attributed to Arauquinoid populations, which occupied a territory of 600 km long between Guyana and French Guyana from CE 650 to 1650. Raised fields are classified on the basis of their size, shape, and topographical location. This last criterion is indicative of differences of adaptation to the hydrographical conditions and to the nature of the soil. Four types of raised field are distinguished:

- Ridged fields are found in the three Guianas. They are elongated and narrow, measuring between 1 and 3 m in width, 5–30 m in length, and 30–80 cm in height. They take the shape of the slope between the sandy ridges and the swamp. Their distribution can be related to the altitude and the water level. At the foot of the Quaternary sand ridges, elongated raised fields are positioned in the direction of the slope to allow for easy drainage. Near the top of the sand ridges, the ridged fields are arranged perpendicular to the slope for optimal water retention.

The Guianas: Pre-Columbian Heritage, Fig. 5 Megalithic site of Rego Grande, Northern Amapá, Brazil (Photo Rostain)



The Guianas: Pre-Columbian Heritage, Fig. 6 Grinder stone with some stone axes on a beach of Cayenne Island, French Guiana (Photo Rostain)

- Large raised fields range in size from 2 to 5 m diameter and from 30 to 100 cm height. These raised fields are rounded-off rectangular to square (Fig. 8). Their size ranges from 3 to 4 m wide, 4–30 m long, and 50–100 cm high. These large raised fields are located in the most flooded areas and their sizes are smaller in the deepest swamps.
- Medium-sized raised fields are round, square, or rectangular. Their size ranges from 1.5 to 3 m diameter and 20–30 cm high. They occur in large clusters.
- Small, rounded raised fields range in size from 50 to 100 cm diameter and in height from 20 to 50 cm. They cover the entire surface of the seasonally flooded savannas, which become completely dry in August.

Along the French Guiana coast, raised fields generally are arranged in rough squares and, often, the largest are located in the deepest and wettest areas. Raised fields were built and disposed according to the differences of water level during the two annual seasons. In fact, water is the main physical constraint. The location of raised fields between the high and low areas suggests a precise selection by the Indigenous.

The Guianas: Pre-Columbian Heritage, Fig. 7 Raised field in a flooded area, Galibi area, eastern Suriname (Photo Rostain)

The Guianas: Pre-Columbian Heritage, Fig. 8 Raised fields along slope of sand bars, Karouabo area, central French Guiana (Photo Rostain)

However, this was not always enough to prevent drowning of the raised fields. For that reason, it was necessary to surround some groups of raised fields by a belt ditch. In some cases, the checkerboard distribution of the ridged fields also reflects the need to control the water level.

In some areas, the whole surface of the lower area is covered by raised fields, and in other areas, only the edge of the sandy ridges has raised fields. Six main categories of organization and types of raised fields can be distinguished from west to east in the Guianas coast. In eastern Guyana, elongated raised fields are distributed perpendicularly to a river. In western Suriname, complexes are made of small groups of elongated raised fields. In eastern Suriname, up to the Mana River in French Guiana, parallel and ridged fields are in flooded depressions. Between the Iracoubo and Sinnamary rivers, savannas are covered by a large number of rounded medium-sized raised fields. Between the Sinnamary and Kourou rivers, rounded or square raised fields associated

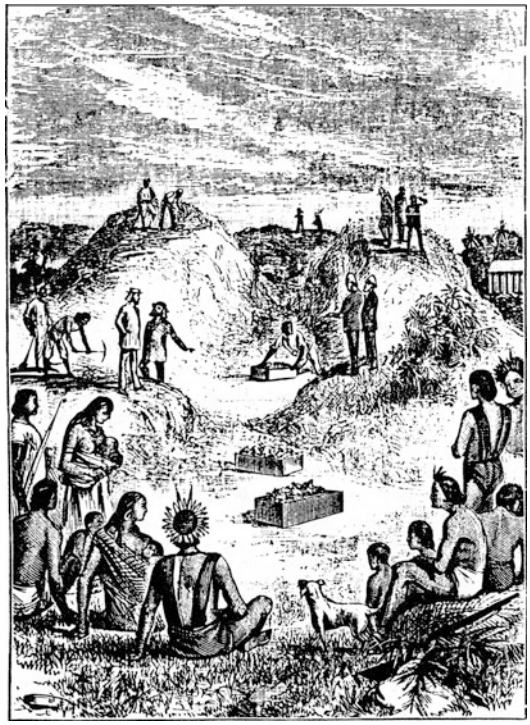
The Guianas: Pre-Columbian Heritage, Fig. 9 Hertenrits artificial clay mound, Arauquinoid culture (CE 650–1250), western Suriname (Photo Geisjkes c. 1950)

with ridged fields are located in the savannas and along the edge of the sandy ridges. Between the Kourou River and Cayenne Island, rounded or square raised fields cover the savannas like the area between the Iracoubo and Sinnamary rivers. These variations can represent cultural, chronological, or technical differences.

Artificial residential/funerary mounds are associated with raised-field complexes in various countries of South America like in the Llanos of Apure, in Venezuela, where several Arauquinoid mounds and raised fields have been found. Between the Berbice River in Guyana and the Coppename River in Suriname, sandy ridges are absent, so local people had to build rounded clay mounds above the water level to erect their villages. At least, nine mounds were erected on a landscape where fresh, brackish, and salt waters met, but other possible artificial mounds have been reported in this area. c. CE 300, a Barrancoid group raised two mounds. From CE 650, Arauquinoid communities built progressively layer-by-layer new mounds that they occupied up to CE 1250. Their territory extended to cover a region some 210 km long and 25 km wide.

Hertenrits is the largest of the mounds, with a raised area estimated at 4 ha (Fig. 9). It measures 200–320 m in diameter and 2.5 m high. The area around the mounds was inundated with freshwater at the end of the wet season. Humans modified some water lines to connect them or to improve natural drainage. A ditch of 20–100 m wide surrounds the Hertenrits mound. Five wharves of 20 m long and at least 1 m deep are disposed on the periphery to receive canoes. Two smaller satellite mounds were built diametrically opposite, equidistant from Hertenrits: Wageningen-1 is 4 km to the east and Wageningen-3 is 3 km to the west. Shallow seasonally inundated canals run radially, connecting the Hertenrits mound to raised fields and to the two other mounds. These canals were used as pathways during the dry season and as waterways during the rainy season, strongly suggesting that the three mounds were occupied at the same time. The inhabitants of Hertenrits organized and managed their territory in a precise and specific manner.

It is important to note here that long before, other pre-Columbian people have developed other solutions to inhabit flooded zones. Between 6800 and 3550 BP (Williams 1992), the fisher-gatherers of the Alaska culture, in western Guyana, raised the floors of their settlements to live close to the shore (Fig. 10). They set aside the shells of marine resources they consumed, gradually forming enormous mounds above the flood level. These *sambaquís* are evidence of the importance of marine shellfish for these populations, who appear to have been attracted by richness of the fauna and flora.



The Guianas: Pre-Columbian Heritage, Fig. 10 Waramuri shell mound during the excavation in the nineteenth century, western Guyana (Brett 1868: 430)

Causeways are frequent near Arauquinoid sites of the Llanos de Apure in Venezuela, but not so common in the Guianas. Some raised pathways have been found in Suriname and French Guiana. They are oriented in a north–south direction and they generally cut through the swamps, connecting two west–east sand ridges or one sand ridge to the shore. They can reach up to 600 m long and 8 m wide.

Ditches made by pre-Columbian groups are difficult to recognize because, after several centuries, alluvium and vegetation tend to obliterate them. Moreover, Creole farmers had also made small canals during the twentieth century, which might be confused with pre-Columbian ones. Stereoscopic interpretation of aerial photographs also shows that there are numerous water lines, which do not follow the natural flow and must have been made by people. Ditches were made to improve water control. Small and curved waterlines perpendicular to the direction of the natural water flow enclose groups of raised fields. They are relatively narrow at their extremities and generally form a pond at the center. These ditches prevented too much water near the raised fields during the rainy season. They also most likely served as water reserves during the dry season. Straight and regular canals were used for the drainage of excessive water and, perhaps, as water tanks or fishponds. They often connect archaeological settlements on sand ridge and raised-field complexes. Some of them are exceptionally long and could serve for canoe travel through the flooded savannas. Ponds were sometimes dug near a sand ridge or in the middle of a swamp. They are generally rounded or irregular. It is probable that they were used as water tanks and fishponds.

During the first millennium CE, specific sites locally named "montagnes couronnées" (literally "crowned hills") appeared in French Guiana, northern Amapá in Brazil, and eastern Suriname. They can be made by trenches surrounding the top of a hill or ditches closing a spur on a riverbank. They are linear, oval, or round with a diameter between 100 and 300 m. Ditches measure 5–15 m wide and 1–3 m deep. Some entrances can be made by embankment through the ditch. Few pottery sherds, very eroded and not decorated, are generally found in these sites. Most of the sites are dated between the first centuries of our era and the thirteenth century (Mazière 1997; Versteeg 2003). Fortification purposes or ceremonial function have been ascribed to these sites.

Future Directions

Guianas are not the favorite spot for tourism so little attention has been given to pre-Columbian remains. Although archaeology still is relatively incipient in the Guianas because scientific programs have been conducted only for 30 years, it is already possible to draw up a panorama of the pre-Columbian occupation of this huge region (Rostain 2008). For the last decade, Guianas has known a remarkable increase in archaeological investigation, especially by the realization of large projects. On the contrary, very few actions

have been carried out to preserve archaeological heritage. Governmental institutions are missing or have neither power, nor fund, to protect this patrimony. Even a simple inventory of stone monuments and earthworks as it is presented in this entry has never been done at the scale of the five Guianas because of patrimony politics and investigations were very nationalistic without consultation with neighbors. There is also no real desire to promote Indigenous past in these countries that prefer to put a slant on historical remains. The result is that pre-Columbian heritage is gradually destroyed by neglecting and vandalism.

To finish, there is a curious phenomenon acting on the preservation of certain archaeological remains. Leaf-cutter ants (*Atta* species) are generally considered as one of the main plagues for rainforest agriculture. These voracious insects are a nuisance for humans because they defoliate crops and destroy plantations. However, the same ant also permits the preservation of raised fields. Ants act as "central place foragers" and as "mound builders" (McKey et al. 2010). They construct deep nests, bringing subsoil to raised-field surfaces. Ants move materials to the raised fields where they set their nest. *Acromyrmex* workers carry large quantities of plants to the nest to feed their fungal symbiont. Moreover, transport of material to surface of abandoned raised fields thus at least partially compensates losses due to erosion and maintains the mound height. By reducing the erodibility of raised fields and by transporting materials to them, thereby compensating erosional losses, communities of ecosystem engineers on raised fields maintain the concentration of resources (and organisms) on raised fields and their depletion in the surrounding matrix. In conclusion, ecosystem engineers are responsible for the preservation of pre-Columbian raised fields up to nowadays. They are ants, earthworms, termites, and even plants. Each of them played a function more or less important.

It is noteworthy to outline that after their abandonment by human social mammals, raised fields were managed and preserved by natural social insects. In the Guianas, Nature tends to preserve Culture.

Cross-References

- ▶ Aerial Archaeology
- ▶ Agrarian Landscapes: Environmental Archaeological Studies
- ▶ Cultural Landscapes: Conservation and Preservation
- ▶ Earthen Architecture in Archaeological Conservation and Preservation
- ▶ French Guiana: Archaeology and Minority Communities
- ▶ Geoglyphs
- ▶ Landscape Domestication and Archaeology
- ▶ People as Agents of Environmental Change
- ▶ Rostain, Stéphen
- ▶ South American Rock Art
- ▶ The Guianas: Pre-Columbian Heritage

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Theoretical Archaeology Group (TAG)

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Brief Definition of the Topic

A conference that is known as much for its social life as its cutting-edge theory, the Theoretical Archaeology Group (TAG), is a successful and idiosyncratic institution in the prime of life. The organization has a distinctive and somewhat anarchic ethos, consisting of an annual conference that meets once a year, with no membership requirements or dues. The meeting moves from one university to another annually (the Republic of Ireland is included) and is organized by volunteers from the host institution. Efforts are made to keep costs down for each meeting and to provide cheap or free accommodation for students, so that the conference is affordable and available to all. Each conference is run entirely by the sponsoring institution, so that each one differs according to the priorities and interests of the department that hosts it. Representatives of institutions that have previously hosted TAG gather for an informal committee meeting at the annual conference. This committee hears pitches and makes decisions as to where the conference will next be held. In the UK TAG is now in its fourth decade of meetings, with attendances generally in the range of 400–600 participants, including some from overseas. TAG has produced healthy offspring, including Nordic TAG, held biennially in Scandinavia, and TAG-USA, which began in 2008 at Columbia University. Other conferences that have been influenced by the TAG model include the Theoretical Roman Archaeology Conference (TRAC) and, most recently, STAG, the Scottish Theoretical Archaeology Group and TAG Turkey, held at Ege University, İzmir in May 2013. In this entry we will provide a brief overview of TAG's history and development in the UK and the USA.

TAG emerged at the end of the 1970s, in a search for a British venue to discuss archaeological theory. A conversation between Colin Renfrew, then at Southampton University, and Andrew Fleming at Sheffield led to the formation of a Sheffield-Southampton colloquium. Its third meeting, held in Sheffield in 1979, was open to all, and from 1981, when it was hosted by Reading University, the conference started its current pattern of being held at a different sponsoring university every year (a more detailed history may be found in Fleming & Johnson 1990). TAG has developed into a venue where

a postgraduate student can give his or her first academic paper and also mingle with established academics on the dance floor or in the conference room. The conference aims to open a productive space for dialog, with the emphasis on the theoretical and political implications of a topic. Sessions are kept open to encourage participation and to foster a diverse range of perspectives. Since the late 1980s the conference has been something of a nursery for post-processual and interpretive archaeologies (e.g., Bintliff 1991 and response by Thomas & Tilley 1992). It is sometimes said that TAG participants can become obsessed with the quest for new theoretical perspectives (Chippindale 1990: 464), but then again, TAG is a great place to get a sense of the questions that are animating the field at any particular moment; its agenda is driven by its participants. The British meeting has seen less intense debate in recent years, perhaps because of the growth in the number and size of sessions. Experimentation is not restricted to the topics of papers; in recent years participants have tried out a variety of formats and venues for their contributions. Memorable sessions include the video installation "Neolithic Stories Untold" at the 2003 conference at the University of Wales Lampeter (Van Rossenburg 2004: 56), a poetry poster session on landscape and archaeology at Sheffield TAG in 2005, and an "intervention" organized by Ian Russell and Andrew Cochrane at York TAG in 2007. This included the placement of 150 replica Cycladic figurines around the conference buildings and grounds (http://www.iarchitectures.com/irac2.html#show). Reactions varied from enthusiastic collection of the objects to nonplussed indifference.

The US TAG was started in 2008 at Columbia University, where it was imported by two British archaeologists Brian Boyd and Zoë Crossland. Although the US TAG was modeled on the British conference in terms of ethos and organization, it has gone on to develop its own character and theoretical interests. British TAG has a strong core focus on British and European prehistory, whereas the US conference deals with a more eclectic range of regions and time periods and is quite interdisciplinary in feel. Sociocultural anthropologists, geographers, philosophers, historians, and social theorists are regularly included in sessions, whether as discussants or presenters. TAG-USA also has a substantial proportion of international participants, with around 40 % coming from outside the USA at the first conference at Columbia University. Severin Fowles' Thing Theory session from the same conference gives a sense of the feel of TAG in the USA. This session included participants from the USA, Canada, Europe, and South America and counted students and established scholars among the people involved. Participants came from a range of backgrounds, including contributions from outside archaeology, such as those by Jane Bennett and Brian Larkin. The session also had an associated art exhibit entitled "nomadic dresses," a project by Mariana Frochtengarten that used the circulation and modification of clothing between artists to explore the role of material culture in social interactions and exchange.

Links to all the conference websites (some no longer in operation unfortunately) can be found on Antiquity's website (www.antiquity.ac.uk/tag/index.html), which also lists publications arising from the conference, as well as articles about TAG, many of which are affectionate and critical reviews of particular annual meetings. There is also a US website that provides links and information about TAG in the USA (www.tag-usa.org). Pamela Jane Smith has started to record and archive the oral history of TAG, carrying out interviews with archaeologists who were involved in its early days (http://www.arch.cam.ac.uk/personal-histories/tag.html), and recently archaeologists have started to study the history of the conference itself as a means to track the changing profile of archaeology over the years (Gaydarska 2009).

Cross-References

- ▶ Archaeology and Politics
- ▶ Critical Theory in Archaeology
- ▶ Interpretation in Archaeological Theory

▶ Practice Theory in Archaeology
▶ Processualism in Archaeological Theory
▶ Renfrew, Colin

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Thompson, Homer

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Basic Biographical Information

Homer Thompson (1906–2000) is best known for his formative contribution to the excavation of the civic center of ancient Athens. He was born in Ontario and raised in British Columbia, the son of classically minded parents. He received his B.A. and M.A. in Classics from the University of British Columbia, Vancouver, in 1925 and 1927, respectively, and his Ph.D. from the University of Michigan in 1929. That same year he collaborated with the Greek archaeologist Konstantinos Kourouniotes on an investigation of the Athenian Pnyx. On the recommendation of Benjamin Dean Meritt, Thompson was appointed one of the first two fellows of the American School of Classical Studies at Athens' excavations in the Athenian Agora, in 1931. At the Agora he met and married another fellow, Dorothy Burr, a prominent archaeologist in her own right.

Major Accomplishments

From 1933 to 1947 Thompson held the position of Professor of Classical Archaeology at the University of Toronto, concurrently acting as an assistant curator of the classical collection at the Royal Ontario Museum. This term was interrupted by World War II, during which Thompson served as an intelligence officer with the Royal Navy, stationed at Bari. Visiting Athens in 1944, during the Greek Civil War, he was briefly held captive, but talked his way out and parted from his captors on friendly terms. He was appointed field director of the Agora Excavations in 1945, a position he held until 1967. In 1947 Thompson became Professor of Classical Archaeology at the Institute for Advanced Study in Princeton, a position he retained for over 50 years – as emeritus from 1977 onward – until his death in 2000. He received the Archaeological Institute of America's Gold Medal for Distinguished Archaeological Achievement in 1972.

Thompson devoted his career to the study of the Athenian Agora and played a tremendous part in the formation of its current physical and intellectual state. He authored numerous scholarly articles as well as two monographs, including 1972's *The Agora of Athens* (with R. E. Wycherley). He supervised the publication of the first 11 volumes of the Agora excavation series, as well as a series of Agora Picture Books, designed to be easily accessible to a general audience. Thompson was insistent that archaeologists had a responsibility to the public to present and publish the results of their work. Above and beyond his own publications, Thompson's great accomplishment was in bringing together and overseeing a large and diverse group of scholars for over 20 years.

Cross-References

▶ American School of Classical Studies at Athens (ASCSA)
▶ Epigraphy, Greek
▶ Stoa
▶ Urban Planning in the Greek World

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Thomsen, Christian Jürgensen

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Basic Biographical Information

Christian Jürgensen Thomsen (1788–1865) organized the major Danish museum collections in the mid-nineteenth century and became famous for introducing the Three-Age System, the division of prehistoric time in a Stone, Bronze, and Iron Age (Fig. 1). He was born in Copenhagen as son of a wealthy merchant, whose business he carried on after the death of his father in 1833. As a young man, he developed an excellent knowledge of numismatics, history, and art, and he made personal acquaintance with many of the young artists of that time. In spite of having no academic background, in 1816, he became secretary of the Royal Commission for the Preservation of Antiquities, established in 1807, obtaining official membership of the Commission in 1827. Besides being responsible for the Museum for Nordic Antiquities (Fig. 2), Thomsen became the organizer of other museum collections in the 1840s and 1950s. From 1830, he was a member of a commission organizing the Royal Armory Collection. In 1832, he was attached to the Coin Cabinet as inspector and became its director in 1842. From 1839, he also worked as an inspector at the Royal Museum of Art. For his extraordinary efforts to organize the most important Danish museums, he obtained the order of high-ranking councilor. He was succeeded as director for the Museum for Nordic Antiquities by J.J.A. Worsaae.

Thomsen, Christian Jürgensen, Fig. 1 C.J. Thomsen (1788–1865) (Painting by J.V. Gertner. The Danish National Museum)

Major Accomplishments

As secretary of the Antiquities Commission, Thomsen started to catalogue the collection of the Museum for Nordic Antiquities, the embryo of the later National Museum, in 1817. In 1819, he arranged an exhibition of antiquities in a limited space adjacent to the University Library on the upper floor of the Holy Trinity Church in

Thomsen, Christian Jürgensen, Fig. 2 C.J. Thomsen showing the Museum for Nordic Antiquities to visitors at the Christiansborg Castle in 1846 (Drawing by Magnus Petersen. The Danish National Museum)

Copenhagen. It was during recording and arranging the collection that Thomsen developed the Three-Age System, not only as a technological model but as a chronological sequence based on the combination of finds (Gräslund 1981). He emphasized the importance of careful recording of find circumstances during archaeological excavations and thereby introduced a principle fundamental to archaeological practice. In 1825, Thomsen had worked out a definition of the Stone, Bronze, and Iron Ages, which was initially disseminated through his correspondence with learned colleagues. One of them was Bror Emil Hildebrand (1806–1884) at the Historical Museum of the University of Lund, Sweden, who visited Thomsen in 1830 and subsequently arranged the collection of the Historical Museum in Lund according to the Three-Age System (Stjernquist 2005). In 1833, the Museum for Nordic Antiquities had been moved to new premises at the Christiansborg Castle in Copenhagen, where Thomsen could arrange the prehistoric and medieval collections under more favorable conditions and where the Three-Age System came to justice. Thomsen's own description of the Three Ages was not published before 1836 in his contribution to *Ledetraad til nordisk Oldkyndighed*, which was translated into German (1837) and English (1848) and thereby obtained international attention. Thomsen's own literary production was limited, but his work can be followed in his correspondence with colleagues. In 1856–1857, he issued a publication about Nordic gold bracteates with a classification that laid the foundation for later research.

Thomsen became responsible for establishing other museum collections, when the Royal Danish *Kunstkammer* was broken up in the 1840s (Gundestrup 1985): the Ethnographical Museum in 1841 (Hermansen 1941), the Classical Antiquities Cabinet in 1851, and the Museum of Sculpture and Handicraft in 1852. Under Thomsen's leadership, these collections, the Museum for Nordic Antiquities and the Coin Cabinet, were brought together during the 1850s and 1860s under one roof in *Prinsens Palais*, since 1892 the permanent residence of the National Museum. Thomsen was also actively engaged in the establishment of local museums in major provincial towns such as Odense (in 1818), Kiel (in 1834), and Flensburg (in 1852).

Of Thomsen's own collection of coins, the largest in private ownership at that time, more than 12,000 medieval coins were purchased by benefactors after his death and donated to the Coin Cabinet.

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Throckmorton, Peter

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Basic Biographical Information

Peter Throckmorton (1928–1990) played an enormous role in the creation of the field of nautical archaeology. Born in New York, he eventually rebelled against his privileged background, running away from boarding school in Colorado to seek adventure. He worked on various vessels in the Pacific, finally reaching Hawaii, where he learned to dive. After four years in the army, in Japan and Korea, he enrolled in the University of Hawaii and worked on a terrestrial archaeological excavation. Although he never graduated from college, he also studied at the Musée de l'Homme in Paris.

Major Accomplishments

Working as photojournalists, Throckmorton and Herb Greer covered the Algerian War dressed as rebels. In 1958, on returning overland to Europe from shooting a tiger-hunt story in India, he stopped in Bodrum, Turkey, to write about local sponge divers. Sailing and diving with Kemal Aras, he was shown ancient wrecks and was told about the most intriguing, which lay near Cape Gelidonya on the southern coast. He reached that site the following year while guiding an American sailing expedition. Recognizing that the wreck dated to the Bronze Age, he convinced the University of Pennsylvania Museum to organize an expedition, which led in 1960 to Throckmorton and George Bass conducting the first complete excavation of an ancient shipwreck on the seabed.

Throckmorton then moved to Greece where, beginning in 1962, he mapped the remains of two Roman stone carriers near Methone. He sailed his *Archangel* to Italy to explore other Roman stone carriers and, in 1967–1968, with his wife Joan, excavated one at Torre Sgaratta that carried sarcophagi from the late second or early third century. By then he and Gerhard Kapitän had excavated a seventh-century hull partly preserved in a marsh at Pantano Longarini in Sicily.

Back in Greece in 1970, he recognized that an old motor ship was a converted square rigger and determined that she was the *Elissa*, built in Liverpool in 1877; he and Karl Kortum of the San Francisco Maritime Museum acquired the vessel and arranged for her to be purchased in 1975 and restored by the Galveston Historical Foundation; she is now a major tourist attraction and sail-training ship in Galveston, one of her original ports of call. Also in 1970 he partially excavated a cargo containing twelfth-century Byzantine plates at Pelagos in the Northern Sporades and in 1975 located another Bronze Age wreck (2500 BCE) at Dokos near Hydra.

He recognized the importance of the many nineteenth-century hulks preserved in the

Falkland Islands and in 1976 explored and surveyed the clipper ship *Snow Squall* (1851), the *Charles Cooper* (1856), and the Maine-built *St. Mary* (1890), a section of which he sent to the Maine State Museum in 1978.

From 1986 to 1988, Throckmorton was an adjunct professor at Nova Southeastern University. He died at his last home, in Newcastle, Maine.

His books include *The Lost Ships* (1964), the misleadingly titled *Diving for Treasure* (1965), *Shipwrecks and Archaeology* (1970), *The Sea Remembers: Shipwrecks and Archaeology* (1987), and *Spiro and the Sponge Fleet* (1964) for children.

Cross-References

- ▶ Bass, George Fletcher
- ▶ Hellenistic and Roman Anatolia, Archaeology of
- ▶ Late Antique Anatolia, Archaeology of
- ▶ Mediterranean Sea: Maritime Archaeology
- ▶ Ship Archaeology
- ▶ Underwater Archaeology
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Time Since Death in Bioarchaeology and Human Osteology

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Introduction and Definition

Time since death (TSD) is defined as the time frame between death and discovery of an organism. When estimated in an archaeological context, this time frame may be referred to as time since deposition and in a forensic context can be termed postmortem interval. Time since death cannot be established with certainty and for this reason is provided as an estimate of the range of time encompassing the period when death occurred. A shorter postmortem interval is typically associated with a narrower time range, while a longer postmortem interval has a broader time range and includes a wider margin of error. Presently, there is no single indicator which provides a reliable or accurate measure of the time since death of an organism.

Key Issues and Current Debates

Current Methods for Estimating Time Since Death

In a forensic investigation, the most reliable estimates of time since death are based upon observations and measurements made by a forensic pathologist during an autopsy. Key indicators can include rigor mortis (process of muscle stiffening), algor mortis (process of body cooling), and livor mortis (gravitational blood settling), while the analysis of the gastric contents and vitreous humor may also assist in estimating the time since death. Depending on the surrounding environmental conditions at the time of death, these indicators are often only applicable for the first few hours to days following death. During this period, the process of decomposition will commence and the pathologist will use collective biochemical indicators such as autolysis, putrefaction, and liquefaction to assess the stage of decomposition and thus approximate time since death.

The process of decomposition will attract insects to the remains if the body is in an accessible location. The life cycle of insects can also be used to estimate time since death through the discipline of forensic entomology. The TSD estimate may span days, weeks, months, or years but becomes limited once insect activity has ceased. Forensic entomologists typically use alternative terminology to denote

the stages of decomposition which includes fresh, bloat, active decay, advanced decay, and dry/remains or skeletonization. Until the point of skeletonization, both the forensic pathologist and entomologist rely on the biochemical degradation of soft tissue to assist with the estimation of a minimum TSD.

Effect of Decomposition on the Estimation of Time Since Death

Once soft tissue degrades from an organism, the estimation of time since death becomes increasingly more difficult. This is an issue commonly faced by the anthropologist or archaeologist as the time elapsed since deposition is considerably longer for archaeological remains compared to forensically significant remains. In an archaeological context, the remains may be partially or completely skeletonized and only hard tissue (i.e., bone) will remain as evidence of the original deposition. When analyzing evidence that is very old, the archaeologist or anthropologist must interpret how the condition of the remains at the time of discovery has varied since the time of deposition. This requires an understanding of decay rates and the taphonomic processes which can act on the remains over time.

Nawrocki (1995) identifies three major classes of taphonomic processes when dealing with human remains recovered from a historical period: environmental, individual, and cultural factors. Environmental factors (e.g., temperature) are external variables which can act on the remains and are specific to the geographical region and microenvironment in which the process of decay occurred. Individual factors (e.g., body weight) originate with the deceased person and can also contribute to the decomposition process. Cultural factors (e.g., embalming) relate to the mortuary activities following ones death. Most of the time, these classes are mutually exclusive; however, certain factors may be classified under more than one class.

Environmental factors can be further divided into biotic and abiotic factors (Nawrocki 1995). A biotic factor refers to any living component that acts on another organism. Biotic factors which can act on bone are numerous and include scavenging and chewing by carnivorous animals, dispersal and fracturing by burrowing animals, tunneling by plant roots, and microbiological degradation by bacteria and fungi. Abiotic factors are the nonliving components which act on the organism such as temperature, moisture, light, wind, altitude, and soil pH (Ubelaker 1997).

There are many factors specific to an individual which cause variation in bone decomposition and subsequently hinder the estimation of time since death. Different bones within the body, and even different areas of the same bone, will show variation across an individual. Some bones will be dense (cortical) while other bones will be spongy (trabecular) yielding a larger surface area per volume of bone which is subjected to degradation. As a result, cortical bone tends to resist degradation better than trabecular bone. Additional factors which may affect the degree of skeletal degradation or preservation include antemortem disease, perimortem trauma, and body size differences resulting from age and gender (Nawrocki 1995).

Cultural factors are unique to humans and can include the preparation of the individual following death, burial below ground or in vaults or tombs, or cremation of the remains. The process of burial in a coffin can enhance soft and hard tissue preservation. Burial is known to slow the rate of decomposition when compared to remains left on the soil surface (Forbes 2008). Retardation of decomposition is predominantly the result of restricted access to vertebrate and invertebrate activity; however, the coffin can also act as a barrier thus protecting the bone from the impact of surrounding soil and vegetation. Since animal carcasses on the surface are often rapidly scavenged, scattered, and dispersed, only buried remains typically become part of the archaeological record. The act of burial may improve the estimation of time since death by preserving the skeletal material but, in doing so, also makes the study of human remains considerably more complex.

Behrensmeyer's (1978) stages of bone weathering represent one of the more commonly utilized methods for estimating time since deposition of bone. During research investigating mammal bones in the Amboseli Basin of southern

Kenya, Behrensmeyer identified six stages of bone weathering. This model has been used to better understand and reconstruct the archaeological record of animal remains. While not commonly employed in a forensic context, the model can assist in differentiating weathering effects on bone from perimortem trauma (Ubelaker 1997).

Effect of Preservation on the Estimation of Time Since Death

Preservation of human remains as a result of natural or cultural processes can reduce the accuracy of time since death estimations if not accounted for. Natural preservation of soft tissue can result from desiccation (rapid drying), freezing and sublimation (freeze drying), adipocere formation, and fixation by tannic acids (Sledzik & Micozzi 1997). Cultural preservation may involve elaborate methods for preserving both soft and hard tissue or may simply involve the injection of chemicals for embalming and funereal purposes. In the archaeological record, one or more of these factors can act on the body over time, and it is not uncommon for archaeological human remains to be mistaken for forensically significant remains when first discovered due to their excellent preservation.

The processes of desiccation and sublimation rely on the rapid loss of moisture. Desiccation results from the drying out of soft tissue in hot, dry climatological regions and can affect the entire body or specific areas of the body depending on the degree of exposure. Mummification is the product of desiccation which restricts postmortem decomposition and promotes preservation of both soft and hard tissue. Climates conducive to mummification have been found in South America (e.g., Chile and Peru), southwestern USA, the desert regions of Africa, and the outback of Australia (Sledzik & Micozzi 1997). Mummification can also occur in enclosed environments and an understanding of this process is important in forensic investigations when estimating time since death. Mummification of recently deceased remains can occur in apartments or houses whereby the continuous heating during winter months produces a hot, dry internal environment.

Sublimation is typically observed in cold or freezing environments and results from the transformation of frozen water to a gaseous phase in soft tissue coupled with the inhibition of decomposer organisms. Regions conducive to natural sublimation include the Arctic and Antarctic circles as well as cold, high-altitude environments. One of the best known natural mummies of the world, "Ötzi – the Iceman," was discovered in a cold, dry environment in the Ötztal Alps along the Italian-Austrian border (Fleckinger 2010). The excellent preservation of soft tissue allowed for the dating of his remains, demonstrating that he is among the oldest, and most well-preserved, natural mummies ever discovered. Dating remains of archaeological significance is readily achieved as typically only an approximate estimation is required ($\pm$100 years). On occasion, forensically significant remains are discovered in cold or freezing environments, demonstrating a "fresh" appearance which contradicts their true postmortem interval. However, it is unlikely that sublimation would occur in a forensic context, simply due to the length of time required for the process to be complete (Sledzik & Micozzi 1997).

Adipocere formation is a commonly encountered phenomenon in wet environments; however, its formation is not restricted to waterlogged locations (Forbes 2008). Adipocere results from the chemical degradation of adipose tissue to produce a solid, stable product comprising predominantly saturated fatty acids. Adipocere formation is associated with the inhibition of decay and as a result adipocere-laden corpses are resistant to decomposition. Adipocere can form over the entire body or can be restricted to specific parts of the body depending on the amount and translocation of neutral fats within an individual. Similar to other types of natural preservation, its preserving effects can aid the recovery of soft tissue in the archaeological record, but can complicate the estimation of time since death in a forensic investigation. Adipocere formation can be valuable for suggesting a minimum amount of time since decomposition and can also provide information about the depositional environment (Forbes 2008).

Peat bogs represent an alternative preservation environment often encountered in the archaeological record. Both human and animal remains have been discovered in wetland peat deposits, demonstrating varying degrees of preservation and a range of trauma and pathology (Brothwell & Gill-Robinson 2002). Preservation is thought to result from the action of humic acids and the reduced aerobic and bacterial nature of bogs. To date, more than 2,000 finds have been recorded with the majority of bodies discovered across northern Europe. Estimating the time of deposition for bog bodies is achieved using radiocarbon dating so as to place the remains in a particular time sequence or era. Many of the recovered bodies have been dated between 800 BCE and 100 CE, and there still remains considerable debate about the reason for their deposition. More recently deceased victims are occasionally discovered in peat bogs; however, they rarely display the same level of preservation as historical discoveries.

Future Directions

Research over the past century has focused on improving the accuracy of time since death estimations. Thanatochemistry is a term commonly used in forensic pathology to describe the postmortem chemical processes which occur in the body. Studies in this area have focused on chemical, biochemical, biological, and microbiological methods for accurately determining the time of death. A review of this field in 2005 demonstrated that little headway had been made in improving the accuracy of determining the postmortem interval (Madea 2005). However, during the latter half of the last century, the field of forensic entomology was advanced becoming an alternative method for estimating a minimum TSD of decomposed remains. The combination of these methodologies is currently the most accurate available to the field of forensic science.

A range of alternative methods have been investigated to assist with estimating time since death in forensic investigations. Decomposition chemistry represents a variation of the field of thanatochemistry whereby studies focus on the chemical and biochemical degradation of soft tissue across the entire decomposition period. Vass and coauthors (1992, 2002) have proposed the use of various classes of chemical compounds including volatile fatty acids, amino acids, and other decomposition by-products for estimating time since death. Swann et al. (2010) also identified a series of short- and long-chain fatty acids as well as amino acids and biogenic amines that are periodically produced in decomposition fluid. Additional studies on decomposition chemistry have investigated total nitrogen, soil-extractable phosphorous, lipid-phosphorus (Benninger et al. 2008), and ninhydrin-reactive nitrogen levels (Van Belle et al. 2009; Spicka et al. 2011) in soil environments. All have shown some potential as indictors for time since death over extended postmortem periods.

However, in the field of archaeology, such methods are rarely useful as only skeletal elements are typically recovered. The majority of research in this area has thus focused on improving the methods used for dating anthropological skeletal remains. A range of morphological, chemical, immunological, and radiological studies have been conducted over the past century (Forbes & Nugent 2009). Morphological studies investigated physical characteristics such as bone density, specific gravity, and weight, while the chemical and immunological studies focused on organic components of bone, bone extracts, and bone diagenesis. The major challenge in all of these studies was an inability to account for the effect of taphonomic processes on bone degradation.

One of the more promising areas of investigation has been the use of radioactive isotopes to date archaeological and forensic bone samples. Radiocarbon (^{14}C) dating is commonly employed for dating historical and archaeological material, including human and animal remains. More recently, radiocarbon dating with reference to the modern-bomb curve has been employed to determine the date of birth

and death of recently skeletonized human remains (Ubelaker et al. 2006). The method uses the "bomb pulse" produced in the atmosphere between 1950 and 1963 as a result of extensive nuclear weapons testing. The temporal decay of radiocarbon in cortical and trabecular bone has been successfully employed on adults of known birth and death dates, demonstrating the value of this method for estimating time since death of forensically relevant skeletal remains (Ubelaker et al. 2006).

Cross-References

- ▶ Forensic and Archaeological Analyses: Similarities and Differences
- ▶ Forensic Anthropology: Definition
- ▶ Human Remains Recovery: Archaeological and Forensic Perspectives
- ▶ Skeletal Biology: Definition
- ▶ Taphonomy in Bioarchaeology and Human Osteology

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Basic Biographical Information

Phillip Vallentine Tobias was a South African paleoanthropologist and human biologist. He was born in Durban, South Africa, in 1925 to Joseph Newman Tobias and Fanny (née) Rosendorff. His father was a toyshop owner and his mother was a piano teacher. Tobias was fascinated by natural history from a young age. His wolf-cub scout leader introduced him to osteology and anatomy. His interests in genetics, zoology, and archaeology followed from frequent visits to the Durban Natural History Museum during his teenage years.

Tobias entered the University of the Witwatersrand (Wits) in 1942, where he earned B.Sc. and B.Sc. Honours degrees (1946, 1947), the medical degrees M.B., B.Ch. (1950), and a Ph.D. (1953) in cytogenetics under the tutelage of Joseph Gillman. He then held fellowships to continue his work at Cambridge University (1955) and various academic institutions in the United States (1956). After his return to South Africa, Tobias was mentored by Raymond Dart and was later awarded a D.Sc. degree (1967) for his research on hominin evolution. He was appointed demonstrator and instructor in histology and physiology at Wits in 1945 and subsequently served as Lecturer (1951–1952), Senior Lecturer (1953–1958), Professor and Head of the Department of Anatomy and Human Biology (1959–1990), and as Dean of the Faculty of Medicine (1980–1982). He remained active as Professor Emeritus at the university until his death on June 7, 2012.

Major Accomplishments

Tobias made many contributions to Science, with nearly 1,200 published works on topics including genetics, human evolution, anatomy, growth and development, and the history and philosophy of science. He is particularly well known for his descriptions of early hominins from Olduvai Gorge in Tanzania, especially *Paranthropus boisei*, and for co-naming *Homo habilis* with Louis Leakey and John Napier in 1964. He supervised excavations at the South African fossil hominin site of Sterkfontein for four decades beginning in 1966. Tobias also conducted fieldwork at a number of other fossil sites in southern Africa and studied human variation and cytogenetics of living people and other mammals.

Tobias also worked assiduously on the meaning and political ramifications of race and fought indefatigably against racism. He was elected President of the National Union of South African Students in 1948, the year the Nationalist Government enacted apartheid legislation to define and enforce segregation. Tobias soon after began the first anti-apartheid campaign in a South African University to keep enrollment open to all, participating in protests against these oppressive laws. His activism continued throughout the apartheid era. For example, he coauthored a formal complaint to the South African Medical Council that brought world attention to the mishandling of the Steven Biko case. Biko, the founder of the Black Consciousness Movement, died from injuries sustained during interrogation by police. He also lobbied for repatriation from France of the remains of Saartjie Baartman, a Khoikhoi slave that had been exhibited around Europe as "the Hottentot Venus" in the early nineteenth century.

Tobias is likewise known for his efforts toward reconciliation between science and religion, particularly in the relationship between evolution and theology. He participated in two working groups organized by the Pontifical Academy that contributed to the revision by Pope John Paul II of the Church's attitude toward evolution. Tobias was in fact born into a Jewish family and served during his youth as President of the Junior Hebrew Congregation in Durban. Indeed, the young Tobias even evinced an interest in studying for the rabbinate.

Tobias received numerous accolades for his scientific and humanitarian accomplishments.

These include numerous distinguished metals, prizes, awards, and honorary degrees. He was a Fellow of the Royal Society (London) and a Foreign Associate of the National Academy of Sciences of the United States and the American Philosophical Society, Commander of the Order of Merit of France, and Commander of the National Order of Merit of Italy.

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- ▶ Australopithecines
- ▶ *Homo habilis*
- ▶ Human Evolution: Theory and Progress

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Togola, Téréba

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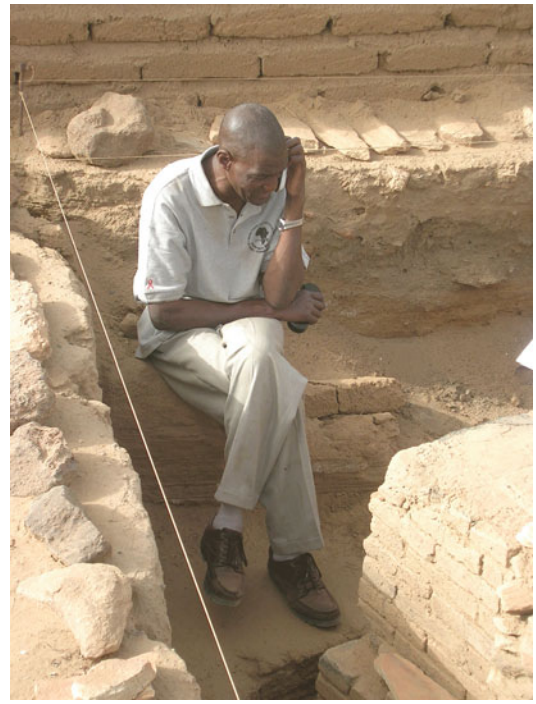
Basic Biographical Information

Téréba Togola (Figs. 1 and 2), who died November 5, 2005, was a tireless advocate of Malian cultural heritage. An expert in the field, Téréba Togola distinguished himself by his thirst for knowledge and strong sense of sharing. This open spirit strongly influenced the new

Togola, Téréba, Fig. 1 Téréba Togola (Photo taken during a conference)



Togola, Téréba, Fig. 2 Téréba Togola (Photo taken at the site of the Kankou Moussa mosque in Gao)

generation of Malian archaeologists, who still take him as a reference point in their own activities.

Born in 1948, Téréba Togola began his professional career as a primary school teacher. In 1976, he entered the Ecole Normale Supérieure of Bamako (ENSUP) where he took his first courses in archaeology, a discipline that he would follow for the remainder of his life. The thesis he completed at the end of his studies at ENSUP in 1982, entitled *Inventaire analytique des sites archéologiques du Cercle de Bougouni (Région de Sikasso)*, is testament to his commitment to archaeology. Téréba Togola subsequently worked at the Institut des Sciences Humaines (ISH), where he actively participated in numerous archaeological missions across Mali, including the Mema region. He was a member of the team that worked on a project to create an inventory of archaeological sites in the lakes region and the Inner Niger Delta (Togola & Raimbault 1991). It was here that he met Roderick J. McIntosh and Susan K. McIntosh, who integrated him into their team of archaeological researchers working in the Timbuktu region of northern Mali (1983) and at Dia (1986). In 1986, Téréba Togola was awarded a Fulbright Scholarship (USA) (1986–1993), which enabled him to further his studies at the Department of Anthropology at Rice University, Houston, Texas, where he obtained a Master of Arts in archaeology in 1988 and a Ph.D. in Archaeology in 1993. His doctoral thesis on the theme: *Investigations of Iron Age Sites in the Mema Region (Mali)* was published posthumously (Togola 2008). On his return to Mali in 1994, Téréba Togola joined the ISH and became the head of the archaeology section. In 1998, he was appointed the Director of National Arts and Culture (DNAC) in Mali, and subsequently the head of the National Directorate of Cultural Heritage (DNPC).

Téréba Togola was an active member of the following professional organizations and associations: the Society of Africanist Archaeologists (SAFA), the West African Association of Archaeology (AOAA), and the Mande Studies Association (MANSA). He was one of the main organizers of the 11th Congress of the PanAfrican Association of Prehistory and Related Studies (PANAF) in Bamako in 2001, the proceedings of which he coedited and co-published with Klena Sanogo (Sanogo & Togola 2004).

Major Accomplishments

In this capacity as the head of the archaeology section at the ISH, Téréba Togola directed the archaeological components of the environmental impact studies in the gold mining areas of Keniéba, Sadiola, Tabakoto (Kayes region), and Kalana et Yanfolila (Sikasso region) between 1994 and 1997. In 1995, archaeological research carried out under his supervision in the Boucle du Baoulé region revealed the richness and the diversity of archaeological sites in the National Park of the Boucle du Baoulé. Téréba Togola also took an active part in initiating and implementing an archaeological research program in the southwest region of Gourma, directed by Kevin MacDonald (1993–1996). Funded by the World Monument Funds, Téréba Togola codirected archaeological excavations at Jenné-jeno from December 1996 to February 1997.

After Téréba Togola became the Director of National Arts and Culture (DNAC) his tasks included the preservation and promotion of cultural heritage. Under his leadership, the DNAC was restructured. This led in 2001 to the creation of two different entities: the National Directorate of Cultural Heritage (DNPC), which manages the inventory, protection, restoration, and the dissemination of national cultural heritage, and the National Directorate for Cultural Action (CAA), which works to promote the creation of artistic works and their dissemination.

Dr. Togola became the head of the DNPC, where under his direction some outstanding actions were undertaken, including the design and realization of the Cultural Map of Mali (2004), the inscription in 2004 of the Tomb of Askia on the World Heritage List, the withdrawal of the ancient city of Timbuktu from the List of World Heritage in Danger (2005), and the listing

of the Jaaral and Degal cultural space (i.e., the crossing of the river *Diaka* in Diafarabé and the descent of cattle in the *bourgoutières* in Dialloubé-Téninkoun) in 2005 as a masterpiece of oral and intangible world heritage. Dr. Togola largely contributed to the restoration of the Komoguel mosque in Mopti, classified as national heritage in 2005, and of the historic city of Hamdallaye, classified as national heritage in 2007. In addition, he contributed to fundraising for the restoration of Fort Medina (Kayes), which was classified as a national heritage site in 1992. Téréba Togola also continued archaeological research, such as on the site of the Kankou Moussa mosque, where an ongoing research program was initiated in 2003–2004 in collaboration with the Swedish International Development Agency (SIDA-SAREC) and the National Museum of Ethnology, Osaka (Japan).

Cross-References

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- ▶ Sanogo, Kléna
- ▶ West Africa: Museums
- ▶ World Heritage List: Criteria, Inscription, and Representation
- ▶ World Monuments Fund (WMF)

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Tomatoes: Origins and Development

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Basic Species Information

Although Linnaeus (1753) classified tomato as *Solanum lycopersicum*, the taxonomy of tomato has been subject to great debate. Various alternative taxonomic classifications have been proposed, principally as *Lycopersicon esculentum*, which is still in common usage (e.g., Doebley et al. 2006). Multiple genetic studies now unequivocally confirm the tomato as belonging to the genus *Solanum*. Confusingly, some researchers split tomatoes into the weedy *S. lycopersicum* var. *cerasiforme* and the cultivated *S. lycopersicum var. lycopersicum*, whereas others refer solely to *Solanum lycopersicum*. The latter classification is followed here.

Tomatoes are one of the most significant, in terms of production, crop plants in the world. Although generally considered to be a fruit, the tomato is also classified as a vegetable. Tomatoes are rich sources of several nutrients and vitamins. Tomatoes are herbaceous perennials, although in many growing environments they behave as annuals; for example, they tend to die off after frost or dry periods (Peralta & Spooner 2007). Tomatoes exhibit a wide climatic tolerance, although cultivated varieties require regular watering. They are diploids, are grown from seed, and exhibit considerable morphological variability. Tomatoes are considered a model plant to study the genetics of diploid plants (Peralta & Spooner 2007) and for studying fruit development (The Tomato Genome Consortium 2012).

Wild tomatoes are native to western South America, extending in altitude from near the coast to the high Andes (above 3,000 m altitude) and extending from central Ecuador, across Peru, to northern Chile. The climatic and environmental diversity of environments has contributed to the diversity of wild tomatoes.

Major Domestication Traits

Different theories have been proposed for the region of tomato domestication (following Peralta & Spooner 2007: 14-17). Since De Candolle (1884), a Peruvian hypothesis has predominated based on a combination of botanical, historical, and linguistic inferences. However, Jenkins (1948) proposed an alternative Mexican hypothesis based on multidisciplinary evidence, primarily the center of cultivar diversity (using morphological criteria), as well as more anecdotal historical sources and linguistic inferences. Questions regarding the origin and domestication history of tomato have only recently been clarified by genetic analyses.

Although there are several hundred varieties of cultivated tomato, they exhibit extremely limited genetic variability from each other and from the closest wild ancestor. For example, genomic sequences of an inbred (domesticated) tomato cultivar 'Heinz 1706' and the closest wild relative, *Solanum pimpinellifolium*, exhibit limited genetic divergence and recent admixture (The Tomato Genome Consortium 2012). Despite limited genetic variation, there is considerable morphological variation among cultivated varieties and between cultivars and wild types.

Hybridization between wild and cultivated species of tomato has been documented for *Solanum pimpinellifolium* and *Solanum lycopersicum*. As Peralta and Spooner (2007: 13) observe: "The reciprocal introgression of traits into both taxa generates complex morphological [and presumably genetic] gradation between them that makes their taxonomic identification difficult." Against this backdrop of complexity, specific genetic attributes of cultivated tomatoes have been identified that control for domestication traits, primarily fruit size (*fw2.2*, the "domestication gene" in tomatoes; Zeder et al. 2006), as well as differences between cultivated varieties, such as synchronicity and timing of fruit ripening and fruit shape (Doebley et al. 2006). Although these genetic attributes may be present in wild plants, they are more frequent in cultivated varieties of tomato (Nesbitt & Tanksley 2002). Significantly, recent genetic improvement of tomato has been designed for increased shelf life and synchronous fruiting, which has seemingly occurred at the expense of flavor (ACTI 1989).

Despite limited genetic variation, there is phylogenetic structure that enables aspects of the geodomestication process to be inferred:

> . . . we hypothesize that, based on the molecular and morphological data presented, *S. l. cerasiforme* originated from *S. pimpinellifolium*. The tomato was later domesticated [to *S. l. lycopersicum*] from *S. l. cerasiforme* in a process composed of several phases: first, a predomestication was carried out in the Andean region, during which *S. l. cerasiforme* developed a notable morphological diversity that included bigger fruits, which are even today being cultivated as small-fruited tomatoes. Those materials were then carried to Mesoamerica and it was there that the true domestication occurred, thus creating the traditional big-fruited tomato varieties. From there, the Spaniards took tomatoes to Spain and Italy, and from there they spread to the rest of the world (Blanca et al. 2012: e48198).

Although the terminology of predomestication and "true domestication" may not be helpful and may best be characterized as stages of domestication, Blanca et al. (2012) clearly identify a domestication cline from the most closely related wild tomato species (*S. pimpinellifolium*) to the weedy *S. lycopersicum* var. *cerasiforme*, to the cultivated *S. lycopersicum var. lycopersicum*. Additionally, the staged interpretation of tomato domestication encompasses aspects of both De Candolle's Peruvian and Jenkins' Mexican hypotheses.

Timing and Tracking Domestication

Unfortunately, there is extremely sparse archaeological data for tomatoes to clarify genetically based or earlier scenarios of domestication. No pertinent data predate approximately 1,000 years ago. There are also uncertain claims for depictions of tomatoes on ceramic spindle whorls dating to 500–1000 CE in Columbia (McMeekin 1992), but these may represent other flowering *Solanum* species, including potatoes (Peralta & Spooner 2007: 16-17). Sufficient taxonomic specificity in archaeobotanical and stylistic interpretations is also lacking to assess the relevance, if any, of these finds for understanding tomato domestication.

Historical sources show that tomatoes were grown in Mexico at the time of Spanish conquest. Tomatoes were subsequently introduced to Europe in the early to mid-sixteenth century, in the decades immediately following that conquest. Initially, plants were grown as curios, medicinal plants or ornamentals because they were considered inedible or poisonous (Peralta & Spooner 2007: 17-19). Tomatoes were first grown for food during the seventeenth and eighteenth centuries in southern Europe, especially in Italy.

Although De Candolle (1884) speculated that tomatoes may not have been domesticated long before European colonization of the Americas, in the absence of robust archaeological evidence, this is an open question. At present, the geodomestication pathways of tomato domestication can be tracked using genetics and other botanical attributes. The historical time depth for these processes is unclear. Although historical linguistics can offer valuable insights (e.g., Campbell and Kaufman 1976), the history of tomato domestication awaits an archaeobotanically derived chronology.

Cross-References

- ▶ Agriculture: Definition and Overview
- ▶ Archaeobotany of Early Agriculture: Macrobotany
- ▶ Domestication Syndrome in Plants
- ▶ Domestication: Definition and Overview
- ▶ Genetics of Early Plant Domestication: DNA and aDNA
- ▶ Plant Domestication and Cultivation in Archaeology
- ▶ Plant Processing Technologies in Archaeology
- ▶ Potato: Origins and Development

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Tombs, Etruscan

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Introduction

Etruscan tombs, Etruscan necropoleis/cemeteries, and Etruscan tomb architecture belong to the most interesting, exciting, and expressive groups of monuments of Etruscan civilization. They furnish a great deal of precious information about Etruscan culture, art, architecture, life, burial customs, funeral rites, and religion. They often reflect historical, economic, and social changes as well. Undoubtedly, the Etruscans invested many financial resources and architectural, technical, and artistic skill in their necropoleis and tombs. Thanks to the discoveries and excavations of thousands of tombs since the Renaissance period, we know much more about the world of the dead than the world of the living in Etruria.

The first discoveries of important Etruscan tombs and tomb monuments date to the Renaissance (late fifteenth–early sixteenth century CE), especially in Tuscany and in the area of Viterbo. It is possible that even great Renaissance artists such as Leonardo da Vinci and Michelangelo drew inspiration from some Etruscan tomb or tomb monument. The second half of the eighteenth century CE (the period of the so-called Etruscheria) and the nineteenth century CE (the period of Romanticism and Neoclassicism) were particularly rich in terms of discoveries (Dennis 1848). Even today, new tombs are discovered both by regular and clandestine excavations, although the main scholarly interest in recent decades lies more in the archaeology of Etruscan settlements and sanctuaries.

Among the most recent and important discoveries we can mention the Cutu Tomb at Perugia, the new excavations around the Tomb of the Five Chairs at Cerveteri (Fig. 2), the Tumulo del Sodo II at Cortona-Camucia, the two Doganaccia Tumuli at Tarquinia (Fig. 4), the Tomb of the Demons at Cerveteri-Greppe Sant'Angelo, the painted Tombs of the Blue Demons at Tarquinia, of the Infernal Quadriga at Sarteano near Chiusi, and of the Roaring Lions at Veii, as well as the restoration of the Cuccumella Tumulus at Vulci and the "Little Petra" (rock tombs) in a former quarry at Populonia. There are only a few general, overview publications on Etruscan necropoleis and tombs which we owe mainly to archaeologists such as F. Prayon and J. P. Oleson (Akerström 1934; Demus-Quatember 1958; Prayon 1975; Oleson 1982; Colonna 1986; Prayon 1986; Prayon 2000; Steingräber 2010).

Definition

We have to deal with an enormous amount of monuments and materials dating from the ninth to the first century BCE in all areas of Etruria including even the "colonial" areas in northern Italy (Emilia-Romagna) and Campania in the south. We can distinguish between single tombs, small groups of tombs, and true necropoleis. Some of the Etruscan necropoleis such as the Banditaccia of Cerveteri belong among the most extensive of the ancient Mediterranean world (Drago Troccoli 2006). Concerning typology, we must distinguish strictly between "tombs" on the one hand and "tomb/burial monuments" on the other hand. The most important aspects regard typology, chronology, topographical diffusion/extension, context in the necropolis, architectural elements,

decoration elements, elements for the ancestor cult, and burial gifts. It also must be noted that for Etruria, tomb architecture is a partial and precious source of proxy evidence for the largely destroyed and lost Etruscan domestic architecture (Prayon 1975). There are of course different approaches to this extremely extensive and complex topic – a more technical-architectural one, a more art-historical one, a more religious one, and a more social-economic one.

Historical Background

Etruscan tombs cover a long period from the early Iron Age (so-called Villanovan period) to the late Hellenistic period, which means from the ninth and eighth to the second and first centuries BCE. Often they clearly reflect political, economic, social, and religious changes of Etruscan civilization (Izzet 2007; Riva 2010). Thus, the most robust periods of Etruscan civilization such as the Orientalizing and Archaic phases (seventh–sixth century BCE) and the late Classical and early Hellenistic phases (fourth–third century BCE) offer us particularly monumental and rich examples of tomb architecture and burial gifts both in North and South Etruria. Concerning Etruscan tomb architecture, we must distinguish strictly between the different territories of Etruria characterized by different geological, cultural, and social-economic situations.

Key Issues/Current Debates

The key issues of current research are:

1. Necropoleis: planning, organization, extension, and development

In the Villanovan period (ninth–eighth century BCE), the necropoleis were still isolated from each other, but during the Orientalizing and Archaic periods, they extended until they entirely surrounded the inhabited area and even outstripped it in area. The different geological and geographical conditions in South and North Etruria resulted often in different forms of cemeteries and tombs. In Cerveteri, the Banditaccia necropolis – the most impressive and best preserved necropolis of Etruria – and in Orvieto, the Crocifisso del Tufo necropolis are outstanding and extremely instructive examples, reflecting in part the layout of the cities themselves. During the sixth century with the rise of a new middle class, hundreds of small tumuli (tumuletti), and later cube tombs, were planned and erected according to the direction of the necropolis' streets and accessible directly from them. After the middle of the sixth century, parts of the cemeteries are characterized by a kind of Hippodamian system with an orthogonal network of roads and rectangular squares and mostly uniform cube tombs which is not only a sign of a more intensive use of space but also a clear reflection of new tendencies in urban system (such as in Marzabotto near Bologna after 500 BCE) (Steingräber 2003). At the same time, the necropoleis reflect social changes and probably new laws and norms intended to limit conspicuous consumption as part of the funeral ritual.

2. Tombs: typology, chronology, diffusion, architectural elements, and decorations

The Etruscan word for tomb is "*suthi*." Among the main tomb types, we have to mention pozzo/pozzetto tombs (well/pit tombs) for cremation burials, fossa tombs, loculus tombs, niche tombs, chamber tombs, cassone tombs (Vulci), sarcophagus, and stone cist tombs. According to the different regions, sites, geological conditions, local traditions, and social status, there is a greatly varied typology (Steingräber 1981). A very important change in burial custom took place in the early seventh century with the transformation of larger fossa tombs into chamber tombs destined for the burial of family groups. We can observe this change from single to collective burial particularly well in the extended cemeteries of Cerveteri. The general tendency of monumentalization is well documented in South Etruria not only in Cerveteri and its territory (Blera, San Giuliano, San Giovenale) but also in Vulci, Tarquinia, and Veii, too. In North Etruria, the chamber tombs and the tumuli are mostly built in limestone or sandstone blocks and slabs (Populonia (Fig. 5), Vetulonia,

Artimino, Quinto Fiorentino, Castellina in Chianti, Cortona), whereas in South Etruria, hollowed-out structures in the soft volcanic tufa stone prevail (Fig. 3). Characteristic for North Etruria (especially between Volterra and Florence) in the later Orientalizing period (second half of seventh and early sixth century) are round burial chambers with a false cupola and sometimes a central pillar (the so-called tholos tombs). While these are reminiscent of Bronze Age Mycenaean tholoi from the Aegean world, they in fact reveal special architectural connections with the Sardinian nuraghe. An earlier predecessor, we find only in Populonia toward the end of the ninth and the beginning of the eighth century in a much smaller size but already characterized by a circle of slabs and a small tumulus, a single entrance, a circular chamber, and a false cupola. During the Orientalizing period in Vetulonia and Populonia, the circular false cupola rests atop a square chamber. The tombs of Cortona, Castellina in Chianti, and Artimino are characterized mainly by the arrangement of rectangular chambers with corbelled vaults along a longitudinal axis. The development of tomb architecture during the seventh and sixth centuries BCE in South Etruria – particularly at Cerveteri – is extremely varied and instructive. Prayon (1975) divided these tombs into six main types (A–F) according to their ground plans, type of entrance corridor (dromos), door, and window shapes; types of roofs, ceilings, and "furniture" such as tomb beds, sarcophagus beds, benches, thrones, chairs, baskets and altars, columns, pillars, capitals, and profile bases, and type of monument and exterior architecture. Those tombs often reproduce many details of the interiors of Etruscan houses (Drago Troccoli 2006). The Regolini-Galassi Tomb and the Tomb of the Hut or Thached Roof belong to the oldest chamber tombs in Cerveteri with a long open dromos and the chambers situated on the longitudinal axis. Whereas the corbelled vault of the Regolini-Galassi Tomb is built in tufa slabs, the two chambers of the other tomb are completely hollowed out and – concerning the vaults – clearly influenced by contemporaneous hut architecture. A very characteristic tomb type (Prayon type D) was common in Cerveteri and its territory during the late seventh and the first half of the sixth century and is clearly influenced by house and palace architecture (as in Veii and Acquarossa). It is characterized by a large antechamber and three burial chambers behind it, often with a rich "furnishing" (as in the Tomb of the Shields and Chairs in Cerveteri). The same ground plan is documented after the middle of the sixth century in temple architecture, too (the so-called templum tuscanicum of Vitruvius, *Arch.* 4.7). A major change occurs toward the end of the sixth century when the tombs – especially in the Cerveteri area – no longer imitated actual houses and consisted normally only of one square chamber with simple benches along the walls. This quite simple and monotonous one room type remained typical for the following centuries. Only after the middle of the fourth century BCE some tombs of new aristocratic families – especially in Cerveteri, Tarquinia, and Vulci – become again more richly decorated with architectural elements (pilasters, loculi/wall niches, beds) and painted or stuccoed elements (as in the famous Tomb of the Reliefs in Cerveteri belonging to the Matuna family). These imitated in an abstract way the central part of contemporary dwellings (atrium houses), while the smaller rooms reflected the bed chambers (*cubicula*) of those houses; in the tombs, these are reduced to simple loculi used for burials. The burial of the tomb's founding couple was particularly emphasized normally by a huge alcove in the center of the back wall according to the idea of heroization of the deceased (as in the Tombs of the Reliefs, Alcova, and Torlonia in Cerveteri and in the Mercareccia Tomb in Tarquinia). The huge number of burials of several generations underlines the continuity of the gentilician groups. Quite different is the tomb type with the barrel vaulting built in stone blocks which is documented first in the early Hellenistic period in Cerveteri (Tomb of the Demons in Località Greppe Sant'Angelo) and Orvieto and in the middle Hellenistic period mainly in the territories of Chiusi, Cortona, and Perugia. Completely different is the Velimna/Volumni Tomb at Perugia (second century BCE), with its symmetrical layout

Tombs, Etruscan, Fig. 1 Cerveteri, Banditaccia necropolis: tumulus with chamber tomb (seventh century BCE)

of several chambers grouped around a T-shaped nucleus resembling the patrician *atrium-tablinum* house type, which was obviously of Etrusco-Italic origin and goes back to the Archaic period.

3. Tomb Monuments: typology, chronology, diffusion, and elements of decoration

The Etruscan word for a tomb monument, cippus, or sema is "*cana*" (Steingräber 2010). Among the tomb monuments, we have to distinguish between stone circles (interrupted and continuous, especially in Vetulonia and Marsiliana d'Albegna); tumuli and tumuletti (especially in the seventh and first half of the sixth century); cubes, half cubes, and false cubes (from the second half of the sixth century to the third century); houses (mainly in the sixth century); porticus (mainly in the sixth and third centuries); and temples, aediculae, and tholoi (mainly in the third century). A great change was connected with the construction of large tumuli (diameters up to 80 m) both in South and North Etruria (Fig. 1) replacing the small "Archaic tumuli" and with the definitive confirmation of a new leading aristocratic class, the so-called principes. The large tumuli of the Orientalizing period – characterized normally by a base with a profile – often contain more chamber tombs, in a few cases as many as six or seven. These tombs go back often to different periods and present a different typology. Each tumulus belonged to a particular family or *gens* and served for several generations. The oldest tomb in a tumulus is always oriented toward the northwest, which means toward the section of the underworld gods on the Etruscan celestial partition. After the middle of the sixth century BCE, the cube tombs with their square appearance prevailed particularly in Cerveteri, in the South Etruscan rock tomb area (Blera, San Giuliano, Tuscania), and in Orvieto. In Populonia, the tumuli were replaced by built aedicula tombs with characteristic gabled roofs (Fig. 6) and smaller sarcophagus and stone cist tombs. Tomb monuments of the second half of the fourth and the third century became richer again as their external facades were often revaluated by architectural and sculptural decorations. In some cases, the old fashioned tumulus was used again as a tomb monument (Tomba Torlonia at Cerveteri).

4. Elements for the cult of the dead: typology, functions, and materials for the rites and sacrifices

Etruscan tombs and tomb monuments did not serve only as burial places but also as sites for funeral rites and for the worship of the dead. Particular – mostly architectural – elements

Tombs, Etruscan, Fig. 2 Cerveteri, Banditaccia necropolis: Tomba delle Cinque Sedie = Tomb of the Five Chairs (seventh century BCE)

Tombs, Etruscan, Fig. 3 San Giuliano, Valle Cappellana: chamber tomb of Valle Cappellana I with two columns (around 600 BCE)

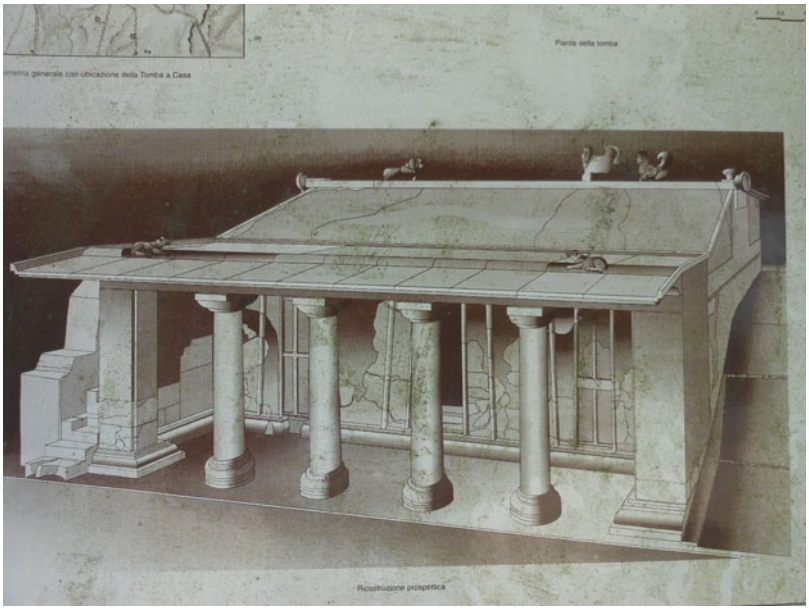
were destined exclusively for the cult and rites in honor of the deceased and ancestors (Steingräber 1997). Some of these elements are of monumental character and size. In Cerveteri (Tomb of the Five Chairs) (Fig. 2), Vulci, and San Giuliano (Cima Tomb), we find tomb chambers with remains of altars, thrones and chairs, tables, and chests in stone, but without any burials which functioned exclusively as cult rooms for sacrifices and burial rites. Many tumuli – specially in Cerveteri – have ramps or added platforms (like in Artimino) or terraces. Most cube tombs have lateral stairs which allow one to climb to the top of the monument, obviously for ritual purposes. The upper platforms of the cube tombs have the size and function of

Tombs, Etruscan, Fig. 4 Tarquinia, Monterozzi necropolis: chamber tomb partly reconstructed in the Doganaccia Tumulus (seventh century BCE)

Tombs, Etruscan, Fig. 5 Populonia, San Cerbone necropolis: Tomba dei Letti funebri = Tomb of the Funeral Beds with stone beds (seventh century BCE)

monumental altars. Some special areas with benches could be used for funeral banquets. The most impressive example is the so-called terrace altar of the Tumulo del Sodo II in Cortona-Camucia decorated with palmettes of Ionic style and two sculptural groups dating from the late Orientalizing period. From this monumental terrace altar, one could climb up to a naiskos/aedicula on the top of the huge tumulus. Both structures were clearly intended for funeral rites and ceremonies. Open squares and "ritual theaters" are documented also in Grotta Porcina near Blera (in combination with a round altar), Vulci (in front of the Cuccumella tomb), and Tarquinia (in front of the Luzi tomb).

Tombs, Etruscan, Fig. 6 Populonia, San Cerbone necropolis: Aedicula tomb (sixth century BCE)



Tombs, Etruscan, Fig. 7 Tuscania, Pian di Mola: rock tomb in house shape with porticus (sixth century BCE)

5. Rock tomb architecture: diffusion, typology, chronology, and "ideology"

This phenomenon is unique in Italy and characteristic of the inner parts of South Etruria (today mainly the Province of Viterbo) from the first half of the sixth to the third/second century BCE (Colonna di Paolo 1978; Steingräber 2009). We find the most important examples of rock tombs – with a rich typology including cube, house, aedicula, temple, porticus, and tholos tombs – in the Archaic period in Tuscania (Fig. 7), San Giuliano, and Blera and in the Hellenistic period in Norchia, Castel d'Asso, and Sovana (Figs. 8–10). The most common type

Tombs, Etruscan, Fig. 8 Sovana: model of the Ildebranda Tomb = rock temple tomb (third century BCE)

Tombs, Etruscan, Fig. 9 Sovana: pediment of the Tomba dei Demoni alati = Tomb of the Winged Demons (third century BCE)

was the cube or half cube tomb most probably inspired by the – partly constructed – cube tombs of Cerveteri. Influences of palace architecture manifest themselves particularly in the facade of the house tomb with porticus at Pian di Mola near Tuscania of the early Archaic period (Fig. 7). The most noble rock tombs such as the temple and porticus tombs of Norchia (Doric tombs, Lattanzi Tomb) and Sovana (Ildebranda (Fig. 8) and Pola Tomb) reveal influences from temple and palace architecture. Great attention and care were paid especially to the external appearance of the rock monuments and facades characterized by profiles, doors, and false doors of the so-called

Tombs, Etruscan, Fig. 10 Sovana: Tomba della Sirena = Tomb of the Siren, an aedicula tomb with a Skylla relief in the pediment and a sculpture of a demon (third century BCE)

Tombs, Etruscan, Fig. 11 Bomarzo: "Piramide" = "Pyramid," a monumental rock altar (first century BCE–first century CE)

Doric type and by painted and sculpted decorations (Figs. 9–10). Most of them not only served as burials but also as cult places and monumental altars.

6. Rock Monuments of the late Etruscan and Roman period

The Etruscan tradition of rock monuments mostly of funerary character continues even in Roman times, specially in the first century BCE and the first century CE and particularly in the area between the Monti Cimini and the Tiber valley around Bomarzo (Fig. 11), Soriano nel Cimino, and Vitorchiano. They offer a rich typology and are partly characterized by Latin inscriptions indicating the names – often of Etruscan origin – of the deceased, the patrons,

Tombs, Etruscan, Fig. 12 Cerveteri, Banditaccia necropolis: monumental stone cippus in house shape near the Tomba delle Cinque Sedie = Tomb of the Five Chairs (seventh century BCE)

and some divinities such as the Bona Dea (Steingräber & Prayon 2011).

7. Burial gifts: composition, materials, quantity/amount, quality/value, provenance, local and foreign elements, and "ideology"

The composition, materials, quantity, and quality of the burial gifts – in most cases unfortunately, not more complete and intact – give us a lot of information about age, sex, social status, and taste of the deceased and of course about chronology and duration of the use of a tomb. In addition, the composition of the burial gifts including often both local and foreign objects informs us about the economic and cultural relations between the respective Etruscan town and other Etruscan towns and foreign areas. Especially in the Orientalizing period, the burial gifts of the aristocratic tombs (*principes*), such as Regolini-Galassi Tomb in Cerveteri, were particularly rich including numerous imported exotic objects from different areas in the Near East, Egypt, and different areas of the Greek world.

8. Varia

Other important aspects concern tomb inscriptions, cippi, tomb sculptures, and tomb paintings. Tomb inscriptions are quite rare in the early periods apart from the Orvieto tombs (sixth century) but later documented on cippi and facades such as in Norchia and Castel d'Asso and in the painted tombs (mainly in Tarquinia). In the case of Orvieto's Crocifisso del Tufo necropolis, the inscriptions give us information about the different provenance of the tomb owners (from Umbria and even from the Celtic area). Stone cippi could be erected in front of the tomb entrance, upon the tomb monument, or sometimes even in the tomb and indicate specific burials (Fig. 12). Their size, material, and typology differ according to local customs and different periods in Etruria. Sculptures of wild animals and monsters as "guardians" in front of the tomb monument or tomb entrance – particularly in Vulci – were probably of an apotropaic character and especially common in the Archaic period. The phenomenon of tomb painting is typically Etruscan but was mainly concentrated in Tarquinia. Painted chamber tombs are documented in Etruria from the early seventh century until the late third century BCE. In addition to those painted tombs at Tarquinia, examples are also known from Veii, Cerveteri, Vulci, Orvieto, Chiusi, and some smaller sites. The rich and colorful iconography of these tomb

paintings furnishes us with a great deal of information about Etruscan life and afterlife (Naso 1996; Steingräber 2006).

International Perspectives

Concerning the international/Mediterranean context of Etruscan tomb architecture and burial gifts, the following aspects are of particular interest:

1. Foreign influences, models, and parallels from/in Asia Minor (particularly in Phrygia, Lydia, Lycia, and Caria), Cyprus (Salamis), Syria (Ugarit), Macedonia, Apulia, Campania, Umbria, Sabina, and *Latium vetus*.
2. The spread of the so-called Macedonian barrel-vaulted tomb type via North Apulia/Daunia and Campania to South Etruria (Cerveteri, Orvieto) and later to North Etruria (Chiusi, Cortona, and Perugia).
3. Hellenistic temple and porticus tombs in the South Etruscan rock tomb area (Norchia, Sovana) clearly influenced partly by the mausolea and heroa of Asia Minor (concerning the general conception and "ideology") connected with the idea of heroization of the deceased and partly by decoration elements from Magna Graecia and Apulia.
4. The burial gifts in Etruscan tombs – especially those of the seventh and sixth centuries BCE – offer us a lot of information about the international connections between Etruria and the Near Eastern areas (Cyprus, Phoenicia, North Syria, Assyria, Urartu, Egypt), the Greek world (Attica, Corinth, Euboea, Aegean islands, Eastern Greece/Ionia, Magna Graecia, and Sicily), Asia Minor, Carthage, and Sardinia.

Future Directions

Some of the main Etruscan necropoleis such as the Banditaccia necropolis of Cerveteri are not yet completely and sufficiently published. We should make every possible effort to close these painful gaps. Main desiderata should be considered by the way more international cooperation, the creation of valid and helpful databases, and still more paleoanthropological, paleozoological, and paleobotanical research for the reconstruction of general living conditions in Etruria and the preparation and publication of a well-organized handbook/manual on Etruscan necropoleis, tombs, and tomb architecture including the most recent excavations, discoveries, and research.

Cross-References

- ▶ Burial Practices and Tombs in the Roman World
- ▶ Central Italy: Etrusco-Italic Sanctuaries
- ▶ Iconography, Etruscan
- ▶ Tombs, Greek (Iron Age)

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Tombs, Greek (Iron Age)

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Introduction

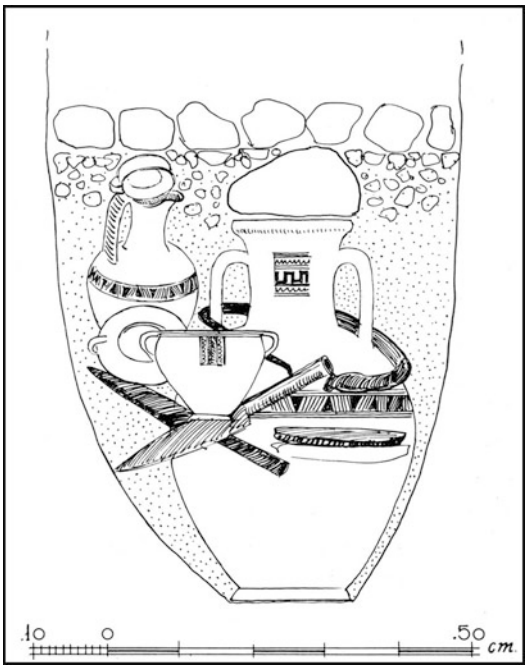
Funerary evidence is one of the traditional fields of Greek archaeology, but only in relatively recent times has it developed as a major source in its own right for the study of Greek culture and

society, the focus being traditionally on great public architecture and figurative art.

Historical Background

Among the many changes that took place in Greece between the end of the Bronze Age and the beginning of the Iron Age are those in burial customs. Multiple burials disappear and individual pit or cist tombs become the new standard. Cremation also establishes itself, even though not across the whole Greek world and not all at the same time. In important regions such as Argolis, Boeotia, and some of the islands (Sporades, northern Cyclades, Kos), inhumation was still in use until the end of the eighth century BCE. In the Peloponnesus, cremation remains a minority practice. On Crete cremation is prevalent, but there the traditional collective graves remained in use. In many regions, the two practices coexist, with a ratio variable from one site to another. The adoption of one rather than the other ritual also depends on sex and age, as illustrated by an exceptional burial of the tenth century BCE, the so-called *heroon* of Lefkandi, a monumental apsidal building with two deep trenches, one for horse burials and the other for a cremated man and a inhumated woman. In general, cremation was reserved for adults, while children were inhumed and infants buried in large pots (*enchytrismos*).

Athens is the best known case study for the development of Iron Age burial customs (Morris 1987). Starting from the Protogeometric period (1050–900 BCE), cremation is standard for adults, or at least the vast majority of them, while children are inhumed. It appears that some burial grounds are used predominantly for adults and others for children. Indicators of sex are objects – weapons and ornaments – and the shape of the ash container, neck-handled amphorae for men and shoulder-handled or belly-handled for women. The cinerary urn is buried in a trench along with pyre debris and burnt offerings. Grave goods are usually few, chiefly pottery vases, pins, fibulae, rings, and bracelets. In the Early Geometric (900–850 BCE) graves,



Tombs, Greek (Iron Age), Fig. 1 Athens, male cremation burial, c. 900 BCE (From *Hesperia* 21, 1952)

markers appear, undecorated stones and/or large vases, amphorae or craters, the latter reserved for men. Over the ninth century BCE and especially in its second half appear elite tombs with rich sets of grave goods including weapons, metal objects, gold jewelry, and ivory and faience imports, (Fig. 1) while child tombs become rare and the overall number of graves decreases. In the eighth century BCE, inhumation returns as the main ritual, but cremation is also found, in some cases in burials with bronze cauldrons as ash containers. These may allude not only to banquets and consumption of boiled meat, but also to myths in which cauldrons are used for magic rituals of regeneration and rebirth. Vases used as grave markers grow to monumental size and are decorated with scenes of funerary ritual such as the laying out of the body, and its being borne out to the grave. The second half of the eighth century BCE brings about many changes. Large family burial grounds featuring many tombs of children appear, and there is high variability in the composition of sets of grave goods and in the details of funerary behavior. In the last decade of

the century, elite tombs are found mostly in the rural districts, while burials become more standardized in the city cemeteries. These new developments have been interpreted against the background of the formation of the polis and its ideology.

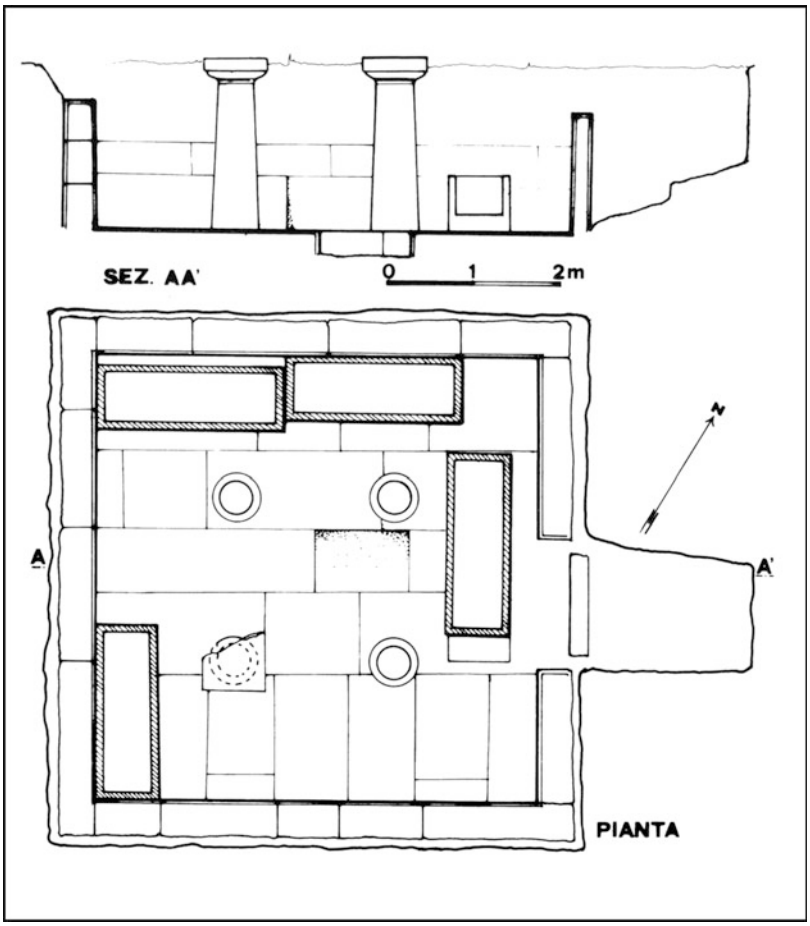
A very different trend is visible in the seventh century BCE, not only in the number of graves, but also in the burial customs. Cremation returns and there is a strong increase of practices that give the dead a heroic status (e.g., Houby-Nielsen 1996). The body is burnt directly inside the trench (a ritual that in the *Iliad* is reserved to Patroclus), together with very few or no objects, while other offerings are found in deposits separated from the grave, among which the so-called offering ditches. These are remains of table-like structures made of wood and bricks on which food and fine banquet pottery was burnt. After the fire had died down, the ditches were sealed and covered by mounds or funerary buildings topped by large vases or stone markers. Mounds of the seventh century are clustered in family plots and remain in use sometimes for a very long time.

In the sixth century BCE, some aspects of the funerary ritual become simpler (end of the offering ditches, smaller mounds), perhaps as the result of laws against luxury in funerals mentioned by Cicero (*de Leg*. 2.64). However, stone stelai and statues are now largely used as a permanent sign of elite status, which ensure the lasting memory of the name and the rank of the dead. Two new large mounds are also built, one according to some scholars for the *genos* of the Alcmeonids, the other for foreign ambassadors of the period of the tyrants. The archaic cemetery near the agora, used between c. 560 and 500 BCE, has been attributed to the Peisistratids because of its location. However, it seems unlikely that these tombs, which were protected by a wall that was repaired after the Persian invasion and were respected for centuries, actually belonged to the tyrants. More likely this is a burial ground relative to the Areopagus that ceased to be used when the city space was more rigorously defined.

Outside of Athens evidence is less abundant, but some trends are visible. In the eighth century BCE at Argos, where inhumation was the norm, the upper classes used large cist tombs, among which some had full panoplies of weapons, probably alluding to the ideal of the Homeric hero, while ordinary burials are in large jars. In the same period, exceptional offerings, including monumental bronze tripods, were dedicated in the city sanctuaries as a clear demonstration of the emergence of an aristocratic class that publicly displays its status. At the end of the eighth century BCE, weapons are not included in burials anymore, a trend that is also found in the rest of the Greek world. With the disappearance of the tombs of hero warriors, exceptional offerings are exclusively reserved for the sanctuary, the common space where the aristocracy can display its status in a less strictly personal and familiar setting. The formation of an egalitarian ideology within the ruling class may also be reflected in the standardized Argive burial practices of the seventh century BCE, based on multiple burials inside large jars.

The model of the Homeric hero warrior is also important in Euboea. At Lefkandi, tombs cluster around the tumulus built on the Protogeometric *heroon*. At Eretria, adults are cremated either directly in pits or on pyres and their remains are collected in bronze cauldrons. A small group of seven adult graves arranged around a central male burial is exceptional not only because of the use of bronze cauldrons for men and women alike and their select grave goods – weapons and ornaments only – but also because of their location and their later history. When the city wall was built in about 680 BCE, the small cemetery, now just inside the West gate, was transformed into a hero shrine protected by an enclosure and marked by a triangular monument. This transformation is considered by some a strategy of the polis to appropriate the ancient "heroes" turning them into public figures, while others think that it was actually their own *genos* who, by making the tombs of their ancestors the object of public cult, claimed for the family a permanently prominent role in the developing polis.

Aspects of this funerary tradition are passed to the Euboean western colonies in Italy. At Pithecusa, there are no "hero" graves, but the



Tombs, Greek (Iron Age), Fig. 2 Taras, chamber tomb (From Lippolis 1994)

burial customs are similar, with cremation for adults, inhumation in pits for adolescents, and *enchytrismos* for infants. The cemetery is organized in tight family clusters. At Cuma, however, are also present elite cremation burials with bronze cauldron. Tomb 103 of Fondo Artiaco stands out for its rich set of personal ornaments and silver vases, which compares with princely burials of contemporary Etruria, Latium, and Campania. Between the late eighth and the early seventh century BCE, Euboean funerary customs influenced those of the elites of central Tyrrhenian Italy and constituted one of the components of a common culture which crossed ethnic difference and emphasized common class belonging.

The development of strong aristocracies in the Archaic age may also account for the reappearance of chamber tombs in some regions of the Greek world such as Cyrene, Thera, Aegina, Samos, Miletus, and Rhodes. Crete is a special case because of its traditionalism, which is the reason for the continuing use or reuse of *tholos* tombs and the fortune of chamber tombs. In some Eastern Greek poleis (Chios, Clazomenae, Ephesus, Smyrna, Larissa-on-the-Hermos, Pitane), elite tombs, frequently in sarcophagi, are covered by tumuli, perhaps after the Lydian model. Chamber tombs, some of which imitate banquet halls (Fig. 2), are also found at Taras until c. 470 BCE, when these and other manifestations of aristocratic culture fall into disuse, probably because of local political developments (Lippolis 1994). More isolated occurrences are found in other areas, such as the monument of Menekrates on Corfu, a massive cylindrical building of a type which is also known at Athens.

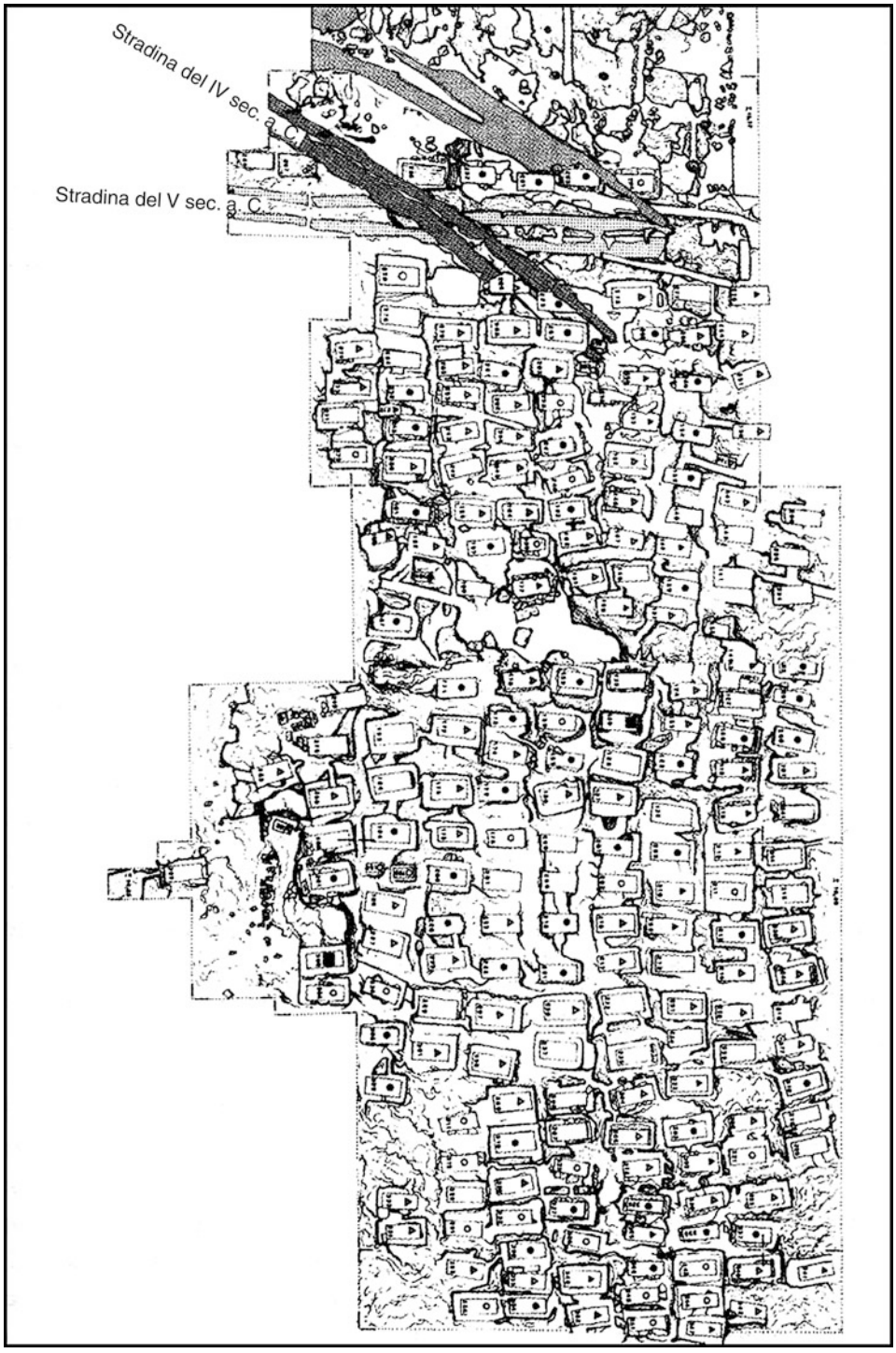
In the fifth century, there is a general decrease of funerary luxury while the city structures develop and increase their control. In Athens, funerary sculpture declines sharply and monumental tombs cease, the exception being the continuing use of ancient mounds, probably a surviving privilege of aristocratic *genoi*. In the cemeteries of Athens, inhumation is the prevailing ritual, but cremation does not disappear and is found in variable ratios in different burial grounds. Adults are buried in individual pit tombs, pits lined with slabs, tile graves, and sarcophagi, while children are buried in reused amphorae, pots, clay tubs, small tile graves, and small sarcophagi. Cremation is both primary and secondary, with a variety of ash containers including bronze vases. The overall impression of homogeneity is in part contradicted by the differences between cemeteries both in ritual and selection of grave goods, for instance, in the presence or absence of *lekythoi* (bottles for perfumed oil), on which tombs and grave markers are frequently represented (Fig. 3). In general, burials are accompanied by only a few objects, including vases for perfumed oil, cups, bowls, and jugs, and small lidded containers.

Tombs, Greek (Iron Age), Fig. 3 Athenian white-ground lekythos with woman at a tomb (From *Annali dell'Istituto Orientale di Napoli, sezione di Archeologia e Storia Antica* 1988)

In the last quarter of the fifth century BCE, when the polis structures are under pressure because of the Peloponnesian War, leveling ideology seems to be less effective. Funerary luxury reappears in form of figured stelai, monumental tombs and family enclosures lined along the roads entering the city. Selection of individuals with formal burial is now stricter and the number of tombs of children drops.

In the fifth century BCE, similar trends of standardization of burial practices are also found in the rest of Greece. One of the most spectacular cases is the South cemetery of Poseidonia (Italy), established in the early fifth century BCE following an extremely regular layout (Cipriani 1989) (Fig. 4). Graves uniform in type and size (pits and cists) and arranged in parallel rows occupy intensively all space available. There is no distinction between family plots, which are however visible in the North cemeteries, established when the city was founded c. 600 BCE. When present, objects in tombs are few and mark sex and age of the dead, and its related social role. Strigils and oil flasks alluding to the gymnasium are reserved for young men. This image of an ordered and egalitarian community, where differences depend on age and sex, not on birth and status, is projected at the time when the urban area undergoes significant transformations emphasizing collective identity, such as the construction of a hero shrine of the founder in the late sixth century BCE and of a round assembly building in the early fifth century BCE.

The most striking exceptions to the general rule are mostly limited to peripheral areas at the margins of the polis world, such as Sindos on the Thermaic Gulf, where burials are exceptionally rich. Tombs feature bronze objects, gold jewelry, weapons, miniature models of banquet instruments and wagons (four-wheeled for women and two-wheeled for men), and gold-leaf masks covering the face of the deceased. The burials of Sindos still represent the traditional image of the aristocratic *oikos* based on war, banquet, and luxurious lifestyle, which had



Tombs, Greek (Iron Age), Fig. 4 Poseidonia, cemetery of S. Venera (From Cipriani 1989)

Tombs, Greek (Iron Age), Fig. 5 Athens, Kerameikos cemetery (Photo by Giovanni Dall'Orto, Nov 12, 2009, copyright free – public domain on Wikipedia Commons)

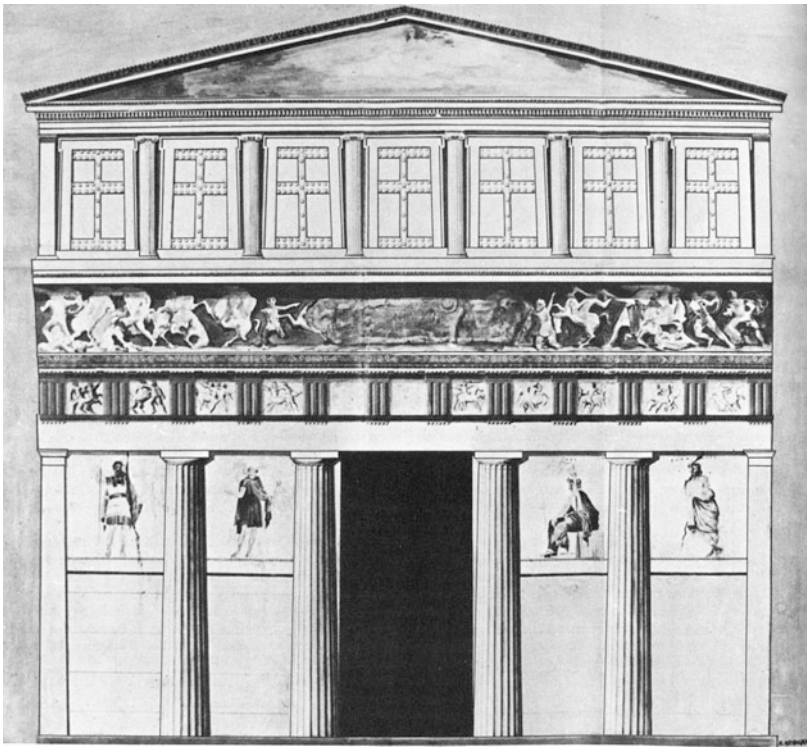
disappeared in the rest of Greece with the full development of city structures.

However, as mentioned for Athens, in the last decades of the fifth century BCE, signs of the crisis of the egalitarian model of classical polis are visible in several areas of Greece, along with the diffusion of practices aimed at individual salvation such as the "Charon's fee." Coins are first found in burials at Corinth and other cities of Peloponnesus, and soon after in the rest of the Greek world including the Western colonies. The interpretation of this practice is not univocal, but its first literary mention in the *Frogs* of Aristophanes (vv. 140 and 270) sounds like the parody of a custom that was well known to the audience and was perceived as alien from the traditional polis culture supported by the playwright.

The fourth century BCE is a period of transition and continuing crisis in the egalitarian principles of the classical polis, as demonstrated by the blooming of Athenian funerary sculpture. The elites compete in the construction of impressive family tomb enclosures, with the wall facing the road in fine ashlar masonry topped by stelai, other markers of different shape, and sculptures of sirens, lions, and dogs (Fig. 5).

Demetrius of Phaleron, governor of the city established by Cassander, reacted against these trends in his laws, probably influenced by ideas developed within the Peripatetic school. Theophrastus, the successor of Aristotle, is said to have explicitly forbidden any ostentation and unnecessary expense for his own burial (Diog. Laert. 5.53). Cicero (*de Leg*. 2.66) mentions the legislation of Demetrius against funerary luxury, which included restrictions on grave markers. The effect of these measures was apparently serious and may have been a major factor in the sudden crisis of Attic funerary sculpture, which did not recover visibly even after the end of his rule. The political and economic decline of the city probably also played a role. In the Hellenistic age, tomb enclosures were still in use, but were not as monumental as they used to be. In Hellenistic Attica, cremation became more frequent, but in general, burial customs did not change much. Among the new elements are gold wreaths that mark the heroic status of the dead, following the cultural trends of the period, and the diffusion of the "Charon's fee."

It is not in Athens but in other regions of the Hellenistic world that change in burial customs is

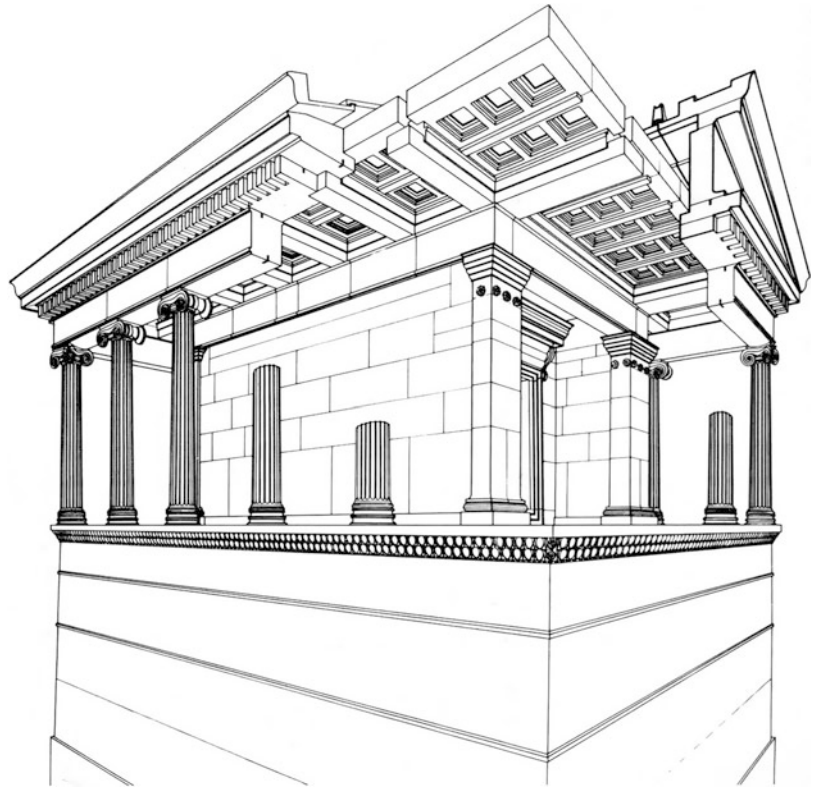


Tombs, Greek (Iron Age), Fig. 6 Facade of the Great Tomb of Leucadia (From Charboneau et al. 1978)

most apparent, frequently influenced by trends that had developed outside the Greek world, in regions where Greek architecture and art had been adapted to meet the needs of very different societies (Fedak 1990).

In Macedonia, the aristocracy was buried in tombs marked by monumental mounds. The "heroic" ritual of cremation in metal urns (including gold and silver) probably alludes to the model of the Homeric poems, which were an integral part of the culture of the Macedonian elite. References to the "Homeric" customs were combined with eschatologic doctrines. The crater used as ash container in a tomb of Derveni is decorated with scenes of complex Dionysiac symbology, and in the pyre debris were fragments of a papyrus containing a philosophical and religious treatise. Grave goods, when they have escaped looting, are very rich. The royal burials were accompanied by precious weapons, sets of silver and bronze vessels, and luxury items of all kinds. In the second half of the fourth century BCE, a specific tomb architecture developed in Macedonia, consisting of a mound covering a barrel-vaulted chamber with an architectural facade, and often enriched by wall paintings and sculptured stone beds and thrones (Fig. 6). This typology remained typical of Macedonia and had limited influence outside the kingdom, mostly in the bordering regions of Thrace, Epirus, and Thessaly, but it might have influenced the development of chamber tombs with architectural facade in other areas of the Hellenistic world.

Another influential tradition is that of the monumental tomb-heroon which had developed in Asia, where local elites had long adopted Greek architectural and stylistic models for original creations. An early example is the Monument of the Nereids at Xanthos in Lycia, a synthesis of the local tradition of tombs set at the top of a rectangular pillar, and Greek temple architecture and sculpture (Fig. 7). This trend is also seen in the Mausoleum of Halicarnassus, an awe-inspiring dynastic tomb decorated by Greek artists, built in the center of the new capital of the

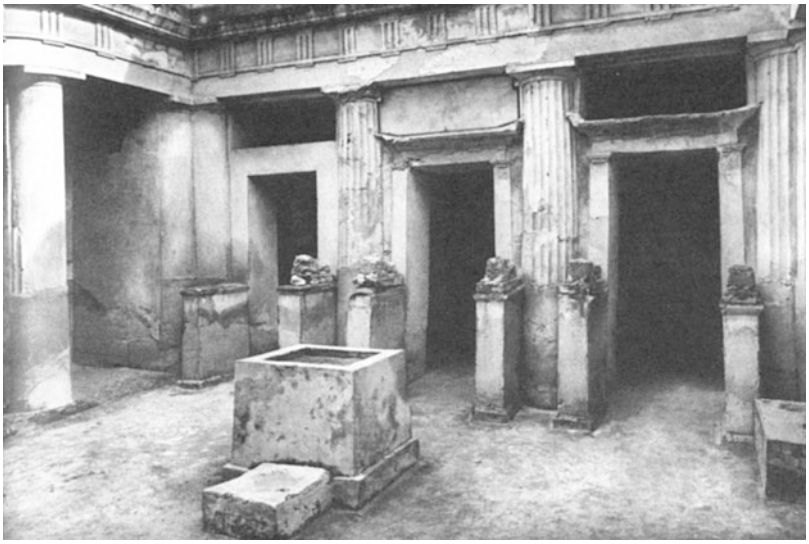


Tombs, Greek (Iron Age), Fig. 7 Reconstruction of the Monument of the Nereids of Xanthos (From Bianchi Bandinelli & Paribeni 1976)

Hecatomnids, which would be the inescapable model and comparison for every later monumental tomb. Monuments influenced by the Mausoleum typology – stepped base, tall podium, temple-like upper level with free or engaged columns, pyramid with sculpture group at the top – are, for instance, the Lion tomb at Knidos and the mausoleum of Belevi. The tomb of Mausolos is also the ultimate model of the many types of towering tombs of the late Hellenistic period, such as the "Tomb of Theron" at Akragas and the tower tombs of Numidia. This typology was also successfully adopted in Roman Italy (Coarelli & Thébert 1988).

In Asia, another kind of tomb architecture developed as well, rock-cut chamber tombs with an architectural facade. They were already known in the Persian Empire, for instance, in the royal necropolis of Naqsh-e Rustem. Elements of Greek architecture are progressively incorporated and their facade assumes the appearance of a temple-like architecture. These tombs are found over a large part of Anatolia, where suitable rock formations exist. The most conspicuous ones are in Lycia and Pisidia.

The tombs of the Hellenistic kings are largely unknown. Our main source of information on most of them is short and not very informative literary accounts. The most famous, the tomb of Alexander the Great in Alexandria, was probably covered by a tumulus and, after the renovation decided by Ptolemy IV, was incorporated into a complex also including the graves of the Ptolemies. The most reliable image of the monument is probably preserved by the Mausoleum of Augustus, who visited the tomb of Alexander and regarded him as a great model. If the tomb in its last version was actually a round monument with cylindrical podium, it may be the model of a series of round monumental tombs found both in the Hellenistic and Roman world. Except for the tombs of Vergina and the tombs of the vassal kings of Rome of the latest Hellenistic period, the archaeological record is



Tombs, Greek (Iron Age), Fig. 8 Alexandria, tomb 1 of the necropolis of Mustafa Pasha (From Charboneau et al. 1978)

quite small. The mausoleum of Belevi near Ephesus, which closely follows the model of Halicarnassus, might originally have been planned for Lysimachus, and some believe it was used for Antiochus II.

In the Hellenistic period, there is tension between the egalitarian classical tradition, which was still a revered ideological model in the Greek cities, and the rise of a select elite who was eager to express its status. In the cities of Asia Minor, the upper classes frequently limit their funerary representation to family enclosures with stelai following the tradition of late classical Attic sculpture, with the addition of banquet scenes where the deceased is accompanied by family and servants. Representations and epitaphs focus on the traditional moral and civic virtues. Nonetheless, especially in the advanced Hellenistic period, urban elites are more and more willing to follow different models of funerary self-representation. The members of the elite are celebrated in cemeteries as heroes and receive exceptional honors (statues and inscriptions) in the urban setting. In the ancient Spartan colony of Taras, a new funerary tradition develops, featuring tomb monuments with complex architectural and figural decoration, chamber tombs, and richer sets of grave goods, while the earlier system, based on very standardized tomb typology and grave goods, slowly disintegrates (Lippolis 1994). In the family tomb of Archokrates on Rhodes, the model of the rock-cut tomb with architectural facade is expanded to form a sort of two-level theatrical stage including altars, a design which fits in with the general "theatralization" of many aspects of public life in the Hellenistic cities. Another monument exemplary of the developing trends is the tomb of Charmylos on Kos, with a semi-subterranean chamber and a two-storey upper building, including an inscription which states that the monument and the surrounding garden are sacred to the Twelve Gods and Charmylos, "hero of the Charmyloi."

In Alexandria, a metropolis of recent foundation, funerary customs are as diverse as its population. One of the most common is secondary cremation in urns of different types, among which is a type of *hydria* (water pitcher) with painted decoration and sometimes inscriptions. Inhumation is also practiced. There are both individual tombs and chamber tombs of different sizes, the largest with open courtyard arranged as a pseudo-peristyle with architectural facades, on which burial chambers open (Fig. 8). These are also found in areas under Ptolemaic authority (Cyprus and Cyrene). Other collective tombs are long corridors with a number of small loculi

closed by slabs. Sometimes, especially in the later Hellenistic period, decoration is a blend of Greek and Egyptian elements.

The great variability of funerary behaviors and strategies of the Hellenistic periods, with some general trends and a number of local traditions, is not interrupted by the Roman conquest. Instead, it becomes a major component of the funerary culture of the Roman world.

Key Issues/Current Debates

In the last half century, the funerary rituals and the attitude to death of Greek society have been investigated by scholars of different schools. Both the Anglo-American Post-Processual Archaeology and the French and Italian Anthropology of the Ancient World have strongly criticized the search for universally valid "laws" in the interpretation of funerary evidence attempted by Processual Archaeology in the 1960s and 1970s (e.g., Saxe 1970; Binford 1971). From different points of view, both schools have stressed the complexity of the relationship between burial customs and society. Funerary rituals, of which burials are the main evidence available to us, are considered as a complex system of symbols, which does not constitute an immediate and reliable representation of the society that produced it. Rather, in those rituals, the image of that society is constructed and re-interpreted through the filter of ideology, using a specific code of symbols (e.g., Hodder 1984; D'Agostino 1985). As a result, funerary practices reflect the identity of the dead as it is constructed and represented by the living based on their vision of life, death, and the relationship between these two dimensions. Therefore, burials, rather than representing the individual, are a major source of information on the group he/she belonged to. The two schools also agree on the need for integration of the funerary record with all other categories of evidence available in order to place it in its specific context and decipher its language.

Burials have been largely used as a major source for the study of Greek society in all its phases, but have played an especially important role for its earliest period, when literary and epigraphic evidence is scanty and the non-funerary archaeological record very incomplete. As a result, burial analysis has been central in the recent debate on polis formation. Scholars have outlined general trends which can be interpreted as products of the developing collective ideology of the polis, such as the abandonment of ostentatious funerary practices and the transfer of the richest offerings from the grave to the common space of the sanctuary. These are very stimulating results, even though the model of classical polis should not be automatically applied to the study of much earlier periods when social dynamics were substantially different (Polignac 1996).

International Perspectives

In the field of the study of Greek burials, the contribution of the Anglo-Saxon school – where theoretical debate has developed especially within Prehistoric archaeology and anthropology – has concentrated especially on the study of the so-called Dark Age. The work of I. Morris on the cemeteries of Athens between Submycenaean and the Archaic age still follows some principles of the Processual approach, namely, the use of quantitative analysis, but takes into account the great problem of representativity of funerary evidence, at least from the demographic point of view. In some phases, the Athenian cemeteries present an acceptable representation neither of the demographic nor of the social structure of the population. This picture is explained by assuming that access to a formal burial was restricted, and in some periods, it became the exclusive privilege of the elite. Statistic methods have been used by J. Whitley in his study of the relationship between artisanal production and social level in the grave goods of the Athenian Dark Age (Whitley 1991). Both works have received appreciation and criticism, especially regarding the issue of quantitative analysis (Shanks 1991; D'Agostino & D'Onofrio 1993). The utility of such methods was defended by Morris, although his theoretical position has become closer to Post-processual archaeology (Morris 1992). The French and Italian schools

have focused especially on the most complex and structured aspects of Greek funerary evidence, such as the iconography of figured monuments, and its relationship to literary sources (e.g., Gnoli & Vernant 1982). Other important academic traditions, such as the German one, have also produced valuable contributions – e.g., the excavation of the Kerameikos cemetery – but the theoretical aspect has been less developed, particularly in classical archaeology. However, in the last decades, German classical archaeology has been more active in this field, with a special interest in the potential of quantitative methods (e.g., Graepler 1997).

Future Directions

In light of the current views of the nature and limits of the evidence, the prevailing attitude today leans toward the selection of relatively homogeneous and sufficiently large samples, especially if the data of the cemeteries can be integrated with those from settlements, cult spaces, literary tradition, etc. The actual availability of such samples has been scarce, though. A very few Greek cemeteries have been extensively excavated, and even fewer are those where adequate procedures have been used, the majority of information being from salvage excavations. Cases like the necropolis of Pantanello in the territory of Metaponto, fully and accurately excavated, studied, and published (Carter et al. 1998), are still exceptions. Therefore, the state of the evidence often obstructs the use of Greek funerary evidence to its full potential. The systematic diffusion of analysis of human skeletal remains – still not a standard practice – is likely to have a dramatic impact. Current debates on demographic trends and representativity of funerary evidence are in fact largely based on reasonable but arguable assumptions about the archaeological indicators of sex and age. It is also to be expected that the increase of quality and quantity of data produced by the advancement of methods of analysis and the refinement of theoretical background will make the issue of the use of quantitative methods especially relevant in the near future.

Cross-References

- ▶ Burial Practices and Tombs in the Roman World
- ▶ Classical Greece, Archaeology of (c. 490–323 BCE)
- ▶ Early Iron Age Greece (c. 1150–700 BCE)
- ▶ Polis

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Topography of Rome

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Introduction

Since the topography of Rome is concerned with a range of evidentiary material, any approach must involve a detailed consideration both of landscape and cultural-historical material. It is also notable that while the textual and epigraphic corpora are static (by virtue of being ancient), archaeological material continues to emerge that has direct bearing on the study of the city's topography, as clearly demonstrated by the excavations undertaken for the construction of Rome's newest metro-train line (Egidi et al. 2010). Such new discoveries always carry with them the possibility of rewriting in substantial ways the topography of the city.

Definition

Derived from Greek, topography literally means "place writing" and has, since the Renaissance, constituted a major branch of Roman studies. The topography of the city of Rome has come to be defined as its own subdiscipline within the field of Roman archaeology. As such, this area, by necessity, combines the study of the ancient literary and epigraphic record with the archaeological, architectural, and spatial study of the ancient city. The field is narrow in its purview but extremely interdisciplinary and involves the study of the city from its origins in the early first millennium BCE to the present day. Advances in digital recording and modeling promise to expand the scope of topographic studies.

Key Issues and Current Debates

The Site of Rome

The site of Rome comprises a number of steep-sided hills with relatively flat tops and subsummits in the valley of the Tiber river. The Tiber and Rome are essentially linked in that not only did the river help determine the site ideal for settlement and facilitate commerce but its frequent flooding also provided continual challenges for managing and mitigating flood waters and the damage they caused (Le Gall 1953; Aldrete 2007). From the early Iron Age onward, these hills served as *loci* for human settlement. The initial instances of settlement in the Tiber valley came in the form of small village communities, distinguished in the archaeological record by means of the remains of domestic architecture (often executed in wattle and daub) as well as by means of burials. Prominent villages have been identified on the Palatine, Capitoline, and Esquiline hills, mostly by means of the discovery of outlying necropoleis related thereto; of special note is the Iron Age cemetery known as the

Sepolcretum (Gjerstad *Early Rome II* 1956). The swampy and seasonally flooded valley surrounded by these hills initially served as a necropolis (a key area of which is known as the *Sepolcretum*) but later came to be transformed into a central civic space, the *Forum Romanum* (Coarelli 1983–1992). This formerly inundated space was made usable by a massive program of artificial landfills; those anthropic layers have been sampled and studied by archaeologists, including Giacomo Boni, Einar Gjerstad, and, most recently, Albert Ammerman (Gjerstad *Early Rome III* 1960; Ammerman 1990, 1996), leading to the conclusion that the intentional landfill project occurred during the seventh and sixth centuries BCE.

Early and Archaic Rome

The origins of the settlement we call Rome date to the Iron Age when independent village-sized communities gradually coalesced into a state-level archaic community. The state formation mechanisms remain a matter of scholarly debate, although recent proposals include theories that point to the sharing of power, resources, and territory amongst tribal leaders (Terrenato 2011). The foundation story perpetuated in antiquity from at least the third century BCE onward focused on legendary figures such as Romulus, making him the responsible party for Rome's foundation (Liv. 1.9–13; Ovid *Fast.* 3.167–258; Ovid *Ars* 1.101–34; Plut. *Rom.* 14–15). While some scholars relegate Romulus to the mythical margin, others embrace his historicity wholeheartedly (Carandini 1997; 2007). By the sixth century BCE, Rome was a powerful state and the elite architecture of the city – both private and sacred – had achieved monumentality, with the poliadic temple of the city (*Iuppiter Optimus Maximus*) being the largest structure of peninsular Italy.

Republican Rome

The Republican period (fifth through first centuries BCE) may be characterized by Rome's growth, both in terms of human population and architectural elaboration. Overall, however, the Republican period often witnessed haphazard architectural development as even extensive projects often represented the interests and prerogatives of individuals rather than the organized efforts of a centralized, state-level program. To this end leading aristocrats and those attempting to climb the ladder of the social hierarchy utilized Rome's physical space as a mechanism of message making in order to solidify personal and familial status in full view of the Roman populace. Showy personal monuments such as the *fornix Fabianus* (Val. Max. 3.2.17; Appian, *BellCiv* 1.16), the *Sepulcrum Scipionum* (Cic. *Tusc.* 1.13; Coarelli 1972), or the *Columna Rostrata* of Caius Duilius (Plin. *HN* 34.20) all served to cue collective memory responses on the part of the Roman viewership, all the while appropriately celebrating the dedicant and/or honorand. The commemorative force of Republican public monuments would be reinforced by Augustan dedications like the *Summi viri* in the Forum of Augustus (Suet. *Aug.* 31) and the *Fasti Triumphales* (Degrassi 1954).

During the Republican period (fifth through first centuries BCE), the topographic development of the city of Rome can perhaps best be described as haphazard, given that during some periods (e.g., the fifth century) there is evidence of very little construction, while at other points (e.g., second and first centuries) an enormous amount of development unfolded. Various scholars have been able to produce fairly comprehensive listings of information on monumental building in the Republican period based on the study of the textual and archaeological records (Crawford & Coarelli 1977; Ziółkowski 1992).

The middle of the first century BCE altered the arc of Rome's topographic growth forever as the political arena spawned a series of powerful, charismatic leaders who deftly employed programs of public construction as a means to bolster claims of political legitimacy and endear themselves to the urban populace. Among these men Pompey the Great, Julius Caesar, and Augustus are notable, not only in that their building programs were well conceived (and generally well received) but also in that they provided a paradigm on the basis of which later

imperial patrons would operate. Augustus' building program, described in his own words in his list of achievements (*Res Gestae Divi Augusti*), transformed the city, particularly with respect to its public and sacred architecture (Favro 1996).

Imperial Rome

The Imperial city from the time of Augustus onward may be best characterized by programs of civic architectural patronage interrupted by periodic unrest that generally disrupted the city's fabric and its upkeep. The aforementioned Augustan building program created a high standard of achievement, as the scope and scale of this program would have been difficult to equal. Augustan complexes transformed the city, totaling hundreds of thousands of square meters of built surface in the form of civic, sacred, and familial buildings, not to mention infrastructure projects. Augustus' successors struggled with their roles as civic patrons, although the emperor Claudius notably expanded the *pomerium* of the city (Tac. *Ann*. 12.23.2–24). The great fire of Rome under Nero (64 CE) radically altered the imperial city as, in wreaking havoc in the city center, it cleared a large amount of land that was subsequently reallocated for imperial usage, most famously in the construction of the Neronian palace park known as the *Domus Aurea* (Plin. *HN* 36.111; Suet. *Nero* 31; Ball 2003). While the Neronian fire and subsequent program was radical, it was short lived as the subsequent building programs of the Flavian emperors reallocated a good deal of space for public usage, some in quite ostentatious ways – notably the Flavian amphitheater, *Templum Pacis*, and the Baths of Titus (Suet. *Vesp*. 9; Darwall-Smith 1996). The Flavian program moved Rome into the second century CE in a stable and reasonably well-maintained state, in spite of a second major urban fire in 80 CE. The second century, Rome's most stable and prosperous period, saw Rome benefit directly from the patronage from a string of adoptive emperors stretching from Trajan to the Antonines. Key monumental programs like the Forum of Trajan and its honorific column articulated imperial ideology while taking full advantage of the tableaux of Rome's urban landscape (Packer 1997; Meneghini 2006). Even after the end of the Antonine line, the model of the ideologically informed imperial building program continued to inform the actions of subsequent emperors, even those who found themselves in office in turbulent and uncertain times in the later second and third century CE (DeLaine 1997; Cooley 2007); this continuity is also evident in public, commemorative monuments such as the Decennalia monument (*CIL* 6.1204).

Rome in Late Antiquity

The arrival of the fourth century CE signaled significant changes for the city of Rome. Its diminishing strategic and economic importance spelled a gradual end to monumental public building programs, especially after Constantine I transferred the center of administration to the city of Constantinople in the eastern Mediterranean. Nevertheless, the first third of the century witnessed massive building at Rome, in part to help bolster Constantine's claim to power. These programs included the completion of projects belonging to his predecessors, notably the *Basilica Nova* (Pol. *Silv*. 545), alongside new programs such as the Arch of Constantine adjacent to the Flavian Amphitheater (*CIL* 6.1139). All the while Constantine was further altering Rome's topographic history by making way for Christianity in the public sphere, creating a series of Christian basilicae at the urban periphery; these sites would prove vital in Rome's history as their role as pilgrimage locales would continue to make Rome relevant even after the fall of the western empire. It seems that the notoriety of Rome's monuments continued in Late Antiquity, as demonstrated by notable episodes such as the visit of Constantius II to Rome in the middle of the fourth century when he stopped and marveled at the Forum of Trajan (Amm. Marc. 16.10.15). *Ex novo* construction tapered off after the fourth century; the last ancient monument to be erected in the Forum Romanum was the Column of Phocas in 608 CE. The ancient city, with greatly contracted population, gave way to the Medieval city, wherein ties to the past were broken and ancient monuments both reused and cannibalized

(Arena et al. 2001–2004). It would take the force of the Renaissance to reestablish links to the past.

Organization of the Ancient City

The organization of the ancient city of Rome began with the demarcation of its ritual boundary (*pomerium*), an act ascribed to Romulus. The *pomerium* was an essential and inviolable aspect of an Italic city, as it regulated actions connected to the settlement and the conduct of business inside and outside the limit. The regulation against adult intramural burial stems from the pomerial tradition. The same traditional foundation story holds that Romulus created a settlement centered on the Palatine hill, referred to as *Roma quadrata* (Tacitus *Ann*. 12.24). The meaning of this term remains obscure and scholars debate whether it refers to the *pomerium* of early Rome or perhaps to an augural *templum* of sorts. The growing city of Rome was eventually divided into districts (*regiones*), an act ascribed to Servius Tullius (r. 578–535 BCE). These regions (*regiones quattuor*) were named *Suburana*, *Esquilina*, *Collina*, and *Palatina* (Varro *LL* 5.45; Liv. 1.43; Dion. Hal. *Ant. Rom*. 4.14) and may have corresponded to latent tribal or familial identities in the early city. The fourteen Augustan regions established in 7 BCE replaced these Servian districts (Lott 2004). Each district was further subdivided into neighborhoods (*vici*). This redistricting reflected a need for increased administration in a city whose burgeoning population must have stressed the central authority's resources. These regions (and their neighborhoods) served as administrative districts in the city and also may be connected to the creation of shared, place-based memory and identity. The ancient boundaries of the districts can be determined, although not with absolute certainty, by means of the Late Antique documents known as *Curiosum et Notitia* (The *Curiosum* (Vat. Lat. 1984, 3321, 3227) and the *Notitia* (Vienna *Latinus* 162)). These documents could have originated from the city's administrative apparatus, as the office of the urban prefect (*praefectus urbanus*) was responsible for city administration (for the documents, see Arce 1999).

Rediscovering Rome's Topography

It is difficult to pinpoint the time at which an awareness of Rome's topography started, but Athanasius Kircher (vix. 1601/2–1680), the Jesuit polymath, certainly had an awareness of spatial studies vis-à-vis the archaeology of Rome, as demonstrated by his mapping of the Roman Campagna (Kircher 1671; Evans 2012). This topographic awareness involved the exploration of ruins in the landscape, exemplified by the aqueduct hunter (and Kircher's contemporary) Raffaello Fabretti (vix. 1618–1700) and followed on the previous century in which papal authority had begun to direct the creation of plans of the city of Rome that came to include ancient ruins. The landmark plan of Leonardo Bufalini, published in 1551 under Pope Julius III, included reconstructed plotting of the ruins in the city and represented a new milestone in the mapping of the ancient city (see edition of Ehrle 1911). Bufalini's work would inspire the great topographers Giambattista Nolli (vix. 1701–1756) and Giovanni Battista Piranesi (vix. 1720–1778). The former's *Pianta Grande di Roma* was engraved on 12 copper plates and published in 1748. It is simultaneously an aesthetic masterpiece and a hyper-detailed rendering of the city of Rome from a bird's eye perspective. It, along with Bufalini's plan, proved fundamental, influencing Piranesi in his creation of his various views – both fantastical and realistic – of the ancient city. Piranesi published his *Pianta di Roma e del Campo Marzio* in 1774 and his *Le antichità romane* in 1784. These cartographers certainly changed popular perception of Rome and began the process of contextualizing her many ancient ruins; they perhaps also carry forward an ancient worldview that also had an awareness of the city's topography. The rediscovery of the first fragments of the Severan marble plan or *Forma Urbis Romae* in 1562 represents a major milestone in the study of Rome's topography (viz., Bellori 1673). Incised on marble slabs, the Severan plan presents a view of third-century CE Rome at a scale of 1:240 and provides many clues as to how the Romans conceived of their own world (Reynolds 1996; Trimble 2008). The plan has been studied

exhaustively and continues to be the focus of ongoing work undertaken by Stanford University (Carettoni 1960; Rodriguez Almeida 2002). It is not clear whether the Severan marble plan was meant to be a functional map or a decorative installation; what is clear is that the orientation of the city differs radically from the traditional north-oriented maps used today. The Severan marble plan served as an enormously important influence in the nineteenth century when the pioneering Roman archaeologist and topographer Rodolfo Lanciani (vix. 1845–1929) produced his own landmark *Forma Urbis Romae* between 1893 and 1901. Lanciani's map, divided into 46 sheets, presented the city at a scale of 1:1000 and plotted the ancient topographic features (in black ink) and the modern urban features (in red ink). The *Forma Urbis Romae* influenced twentieth-century projects, including Italo Gismondi's famous model of Rome ("Il Plastico") produced for the Museo della Civiltà Romana from 1935 onward. That model, at a scale of 1:250, shows the city of Rome at the time of Constantine I in the fourth century CE. Lanciani's map remains an important source for topographic studies.

Topographic Scholarship

The early to middle twentieth century saw the creation of other major topographic compendia, including the *Topographical Dictionary of Ancient Rome* produced by S. B. Platner and T. Ashby (1929), that built on major nineteenth-century scholarship (Jordan & Hülsen 1871–1907). In the *Fontes ad topographiam veteris urbis Romae pertinentes* (1952), G. Lugli collected the relevant literary and epigraphic resources for the study of the topography of the city of Rome; these were organized in 8 volumes according to the Augustan regions of the city. The *Fontes* are essential for the study of the city and its monuments in that a great deal of the specific, place-based knowledge that survives is preserved in textual form. The later twentieth century saw the publication of two major topographic lexica, one for the city of Rome itself (Steinby 1993–2000; continuing now in supplementary volumes) and another for its *suburbium* or hinterland (La Regina 2001–2008). These lexica record entries for named topographic features; an additional companion series has now been established to document the history of urban excavation at Rome (e.g., Coarelli & Battaglini 2004, 2006), which taken along with Lanciani's fieldwork diaries (Buonocore 1997-present) provide invaluable insight into the process by which the topography of the city has been explored and, in many cases, clarified. Also worthy of mention is a pictorial compendium to the topography of the city compiled by E. Nash using the photographic archive of the Deutsches Archäologische Institut (Nash 1962). These photographs remain an invaluable resource for the study of the city and its archaeological remains. Series of twentieth-century excavations have produced numerous site- and/or monument-based studies that are invaluable for the study of the city and, in particular, its topographic problems. The recently produced *Atlante di Roma antica* (Carandini 2012) draws on this wealth of excavation information and presents reconstructed plan and elevation views for the ancient city.

International Perspectives and Future Directions

The study of Rome's topography has always been possessed of an international dimension, as the collaboration between English, German, and Italian scholars drove the major advances in Roman topographic scholarship during the nineteenth century. The Anglo-Italian connection in topographic studies remains strong, cemented in the early twentieth century by Thomas Ashby, then director of the British School at Rome. In the twenty-first century topographic scholarship continues to benefit from international cooperation; this is particularly true as digital initiatives, including linked data projects, continue to widen the reach of traditional scholarship. Projects such as Stanford University's digitization of the fragments of the Severan marble plan and the digital modeling of Rome undertaken by the University of California, Los Angeles and the University of Virginia demonstrate that not only

is the study of Rome's topography international in nature but that digital applications represent an important new phase field this field of archaeological scholarship. These visualization studies move the wealth of topographic information and site-based knowledge into the virtual space, allowing for various modeling exercises (e.g., Johanson 2009; Favro & Johanson 2010). Just as field archaeologists have embraced the power and potential of digital visualization approaches, so too has Roman topography. This is true not only in terms of 3D modeling but also in terms of employing Geographic Information Systems (GIS) as an instrument for field recording and post-excavation analysis. The potential of Light Detection And Ranging (LIDAR) is now emerging as a revolutionary tool for studying both landscape and topography; in the case of a built environment like Rome, LIDAR allows for the construction of digital elevation models (DEM) and digital terrain models (DTM) that allow for ancient landscapes to be reconstructed. While these technologies represent the lead edge of today's scholarship, their aim is perfectly in line with the long history of the study of Rome's topography, from the sculptors of the Severan marble plan, to Bufalini, Nolli, and Piranesi, to Lanciani and Gismondi, and to the scholars of today.

Cross-References

- ▶ Ashby, Thomas
- ▶ Boni, Giacomo
- ▶ Domestic Architecture, Roman
- ▶ Forum
- ▶ Lanciani, Rodolfo
- ▶ Vicus

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Torii, Ryūzō

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Basic Biographical Information

Ryuzo Torii (1870–1953) (Fig. 1) was a Japanese archaeologist and anthropologist. He was born in Tokushima in 1870, as the second son of a wealthy tobacco merchant. He left elementary school in the second grade and studied anthropology by himself. He became a member of the newly established Tokyo Anthropological Society when he was 16 years old and moved to Tokyo in 1892. He obtained a job organizing specimens for anthropology classes at the Tokyo Imperial University (now the University of Tokyo). Torii undertook his first fieldwork abroad at the Liaodong Peninsula in 1895 by chance and became fascinated with dolmens. This was the beginning of his tireless fieldwork in many areas of East Asia such as Taiwan, Siberia, northeast China, Mongol, the Chishima Islands, and Okinawa, conducted over 50 years. Torii married Kimiko in 1901. She often accompanied him on fieldwork and helped with his research.

Torii, Ryūzō, Fig. 1 Ryuzo Torii (Photo courtesy of Tokushima Prefectural Torii Memorial Museum)

Ryuzo Torii's academic career was not smooth. In 1905 he was appointed as a lecturer with the College of Science, Tokyo Imperial University. He obtained a doctorate degree in 1921 and became an associate professor at the Tokyo Imperial University in 1922, then professor at Kokugakuin University in 1923. However, he left his post at the Tokyo Imperial University and established a private anthropology research center in 1924. He was instrumental in the founding of Sophia University in Tokyo and became a professor and Head of the Department of Literature at this university in 1928. Torii quit teaching at Kokugakuin University in 1933. He was a visiting professor of Yanjing University in Beijing from 1939 to 1951 and continued active fieldwork in Shandong province in China. From 1941 to 1945 he was held under house arrest while the university was closed due to the Second World War. He died in Tokyo in 1953 at the age of 82.

Major Accomplishments

Ryuzo Torii is a unique figure in the history of Japanese archaeology and anthropology because of his lack of formal education. No one equals him in terms of the geographic range of his fieldwork and the width of his research interests, which included prehistoric archaeology, historic archaeology, physical anthropology, cultural anthropology, and folklore. Torii learned observation-centered research methods from Shogoro Tsuboi, who he respected as a teacher. Torii was quick to adopt the new technologies of the day, such as photography and the gramophone for recording audiovisual data. He took the first anthropological photos of the native people of Taiwan during his fieldwork there in 1896. The vast amounts of ethnographic record and photographs that he collected are regarded as important first-rate data today and are now housed in the National Museum of Ethnology, Japan.

Torii was interested in archaeology and carried out a number of excavations in Korea, China, Mongolia, and Japan. Through his archaeological research, he recognized close interregional relationships in prehistory and insisted that Japanese ancient culture had been under significant influence from the continent. In his fieldwork on the Chishima Islands, Torii found that the Chishima Ainu had been using stone tools and pottery and lived in pit houses until the recent past. He concluded that the Ainu people were descendants of the prehistoric inhabitants on the Japanese Archipelago. This hypothesis ran counter to the Koropokkur hypothesis advocated by Shogoro Tsuboi concerning indigenous inhabitants of Japan. At the time of Torii's fieldwork, the Chishima Ainu were on the verge of ethnic extinction due to the emigration policy of the Japanese government. Torii felt deeply sorry for the situation and tried to do his best to record their life and culture. He took part in research in Korea from 1911 for the Japanese government after Japan's annexation of Korea in 1910 and conducted both ethnographic research and archaeological excavations of Stone Age sites and burial mounds. His archaeological collections are now stored at the University Museum, the University of Tokyo.

As with archaeologists from other parts of the world, Ryuzo Torii's work is inextricably linked to colonial processes. He has been criticized as an accomplice of Japan's colonialism. Although he did not intentionally support militaristic colonial policies, his fieldwork was inseparable from the colonization process. His theory that Japanese and Koreans are descended from the same ancestors was used to justify Japan's annexation of Korea.

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- ▶ Japan: Indigenous Occupation
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Torrence, Robin

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Basic Biographical Information

Robin Torrence is an archaeologist and a senior principal research scientist at the Australian

Museum, Sydney, Australia. She grew up in Illinois, USA, and graduated magna cum laude from Bryn Mawr College, Pennsylvania, gaining an B.A. in 1971. She completed a Master's degree (1974) and a Ph.D. (1981) in Anthropology at the University of New Mexico, USA. Between the years of 1969 and 2013, she has been involved in extensive archaeological field and laboratory and museum projects in the USA, Europe, Papua New Guinea, and Far East Russia. More recently, she has turned her attention to the archaeology of ethnographic museum collections.

Early in her career Dr. Torrence undertook graduate teaching roles in the University of New Mexico and later held academic appointments at several universities in the USA, Great Britain, and Australia as lecturer and associate professor. While at the University of Sheffield, UK, she participated in a field school in excavation and surveying at Roystone Grange, Derbyshire. During her career she has taught a wide range of subjects concerning archaeological theory and practice including practical courses in lithics, quantitative data analysis, and computing in archaeology and theoretical subjects predominantly in anthropology, exchange, hunter-gatherer studies, and stone tool technology.

Current research interests include method and theory in lithic studies, archaeology of the Pacific region, prehistoric exchange (with special reference to obsidian), role of natural disasters and risk avoidance in long-term history, Indigenous agency within colonial societies (with special reference to Papua New Guinea), and complexity and diversity of material culture and hunter-gatherers.

Major Accomplishments

Throughout her career, Dr. Torrence has been on national committees such as the Pompeii Committee, UK (1979); Executive Committee, Theoretical Archaeology Group, UK (1979–1989); National Committee for the International Union of Pre- and Proto-historic Sciences, London (1982–1986); Committee on Archaeology and Anthropology, Royal Anthropological Institute, London (1982–1989); Council, Royal Anthropological Institute, London (1983–1986); Institute of Field Archaeology, Committee on Theoretical Archaeology (1984–1985); and Steering Committee, Southampton-York Archaeological Simulation System, Science Research Council (1987–1988).

Dr. Torrence has been on editorial boards of major peer-reviewed journals such as *Man* (1983–1989), the *Journal of Mediterranean Archaeology* (1987–1991), *Bulletin of the Indo-Pacific Prehistory Association (*2007–2009), and *Museum Anthropology (*2009–2012), with current editorial board appointments in *Archaeology in Oceania*, *Lithic Technology*, *Journal of Field Archaeology*, *Australian Archaeology*, and *Heritage Management*. She is a senior editor of the *Journal of Archaeological Science*.

From the years 1973 to 2012, Dr. Torrence has published 1 single authored and 12 edited books and over 100 articles in archaeology and anthropology. She was the founder and chairperson of the Ancient Starch Research Group (1998–2000) and was the treasurer of the World Archaeological Congress (1995–2003).

She has had a key role in developing new methods for studying trade, stone tool use, and ancient starch analysis and currently conducts interdisciplinary research into understanding changes in the nature of western Pacific societies over the past 50,000 years.

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Tourism, Archaeology, and Ethics: A Case Study in the Rupununi Region of Guyana

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Introduction and Definition

Ethics is a feature found in seemingly every discussable topic. It guides moral decision-making, informs strategic thought, and ultimately influences human behavior. Ethics is based upon the principle that individuals are members of a community, cogs in a much larger machine. There is hence a fundamental responsibility for individual motives to align with the needs of the larger community. This entry briefly elaborates on this concept with a particular focus on the ethical relationship between tourism and archaeology. Key themes that are considered include the respective ethical frameworks for tourism and archaeology and the relationship between their unification. Also examined is how this relationship can effectively be developed within an emerging tourism and understudied archaeological site: the Rupununi region of Guyana.

Key Issues/Current Debates/Future Directions/Examples

Ethics, Tourism, and Sustainability

As one of the world's largest industries, tourism involves much of the world's natural and cultural heritage resources. In 2010 alone, there were 935 million international tourism arrivals who spent an estimated US$ 919 billion worldwide (UNWTO 2011). Within an industry of this magnitude, there has been, and continues to be, a plethora of impacts on the local economy, communities, and natural and cultural heritage. Moreover, there exists a multitude of stakeholders with their own varied interests. Thus, there is an essential need to consider the role of ethics in tourism development (Payne & Dimanche 1996: 998; Malloy & Fennell 1998: 454). Yet, what ethical framework can be used that universally appeals to all tourism stakeholders? How do you balance the interests of one group with another? Ultimately, it is argued that these questions can be answered by referring back to the well-established notion of sustainability.

Defining sustainability has been regarded as an ambiguous process and varied in relation to the context (Shearman 1990: 1). However, Shearman (1990: 2–3) asserts that the contextual definition is irrelevant and the "meaning of sustainability is far from ambiguous." Indeed, the concept, quite simply, revolves around techniques that utilize resources in a manner which does not deplete or permanently damage them. It is a concept which has existed for hundreds, if not thousands, of years and goes beyond the current exploitation of its namesake. Moreover, sustainability does not relate specifically to the natural environment, society, or corporate economic frameworks – instead it is a concept which is broad enough to be applicable to all. But why is sustainability important? What are the ethical reasons for wanting to use sustainable management structures? Ultimately, this desire for sustainability refers to the prolonged positive impacts for present and future anthropocentric and biocentric systems (Shearman 1990: 5).

Sustainability is in alignment with an ethical framework known as teleology. Within this system of ethical thought, moral conduct is determined by the end result (Malloy & Fennell 1998: 455). Teleology is guided by two governing "schools of thought" – hedonism and utilitarianism (Malloy & Fennell 1998: 455). Both of these disciplines are concerned with maximizing benefits and minimizing negative impacts – delivering the notion of "good." However, while hedonism focuses on individual priorities, utilitarianism deals with the "greatest good for the greatest number" (Malloy & Fennell 1998: 455). Sustainability is a pursued end result because it endeavors for the prolonged life of resources for present and future generations – the greatest good for the greatest number.

Teleology does not argue that one should simply "be good" and follow ethical rules as the concept of deontology does. Instead, teleology emphasizes that a desired outcome (such as sustainability) is better for all of mankind. Similarly, American philosopher Henry David Thoreau (1817–1862) once wrote that people should "be not simply good, be good for something." In this manner, teleological utilitarianism demonstrates why tourism resources should be safeguarded and used ethically by all generations. Furthermore, tourism possesses several stakeholders whose interest should be valued equally, and teleology presents a framework to accomplish this task. The following paragraphs discuss the role and placement of archaeological resources in alignment with this ethical tourism framework.

Archaeological Resource Education and Preservation

Archaeology also utilizes a teleological framework but positions this ethical structure with a focus on the greatest good for the archaeological record. Indeed, Lynott (1997: 593–594) argues that first and foremost, archaeologists should promote "stewardship" of archaeological resources to improve their understanding and preservation for future generations. However, he (Lynott 1997: 593–594) also asserts that within the need to conserve and safeguard the record, there is a dual need to use it for educational and interpretation purposes (see also Meskell 2000: 161). It is in this capacity where archaeological resources can be a significant and viable tourism product.

Cultural heritage tourism is one of the fastest growing sectors in the tourism industry and encompasses archaeotourism, a form of tourism focusing on archaeological resources (du Cros 2001: 165; Wurz & van der Merwe 2005: 10; Levine et al. 2005: 401; Karki et al. 2006: 47; Ramsey & Everitt 2008: 909). However, archaeological resources are unique and "highly sensitive" to tourism use and consequently require vigilant preservation (Wurz & van der Merwe 2005: 10; Ramsey & Everitt 2008: 913). The needs of such a growing tourism sector hence require to be balanced with the management of the archaeological record (Wurz & van der Merwe 2005: 11). Whereas equality is usually promoted among stakeholders in sustainable tourism frameworks, Wurz and van der Merwe (2005: 11) argue that when archaeological resources are involved, the record's preservation must always receive priority over tourism objectives. This is justified by the fragile nature of archaeological assets and their importance in representing the heritage of living communities for present and future generations (du Cros 2001: 166; Atalay 2006: 283).

This view echoes the same principles found in a teleological framework for tourism. There is an ethical obligation for archaeologists to protect the record for all generations to benefit and learn from, yet this can often conflict with tourism priorities. However, the need to ensure the "greatest good for the greatest number" has superiority and gives archaeologists the ethical "right" to shelter heritage resources away from tourism development. The sustainable use of archaeological resources is still the targeted end result, and the manner in which this target is achieved is irrelevant (du Cros 2001: 166). Archaeologists do have a responsibility to present their findings to the public today, but they have an equally important responsibility to safeguard material heritage for future generations. In essence, archaeologists should work congruently with sustainable tourism frameworks in order to actively contribute to the preservation of heritage resources while working to interpret their meaning for visitors (Wurz & van der Merwe 2005: 11). This next section examines a contextual location where tourism development is increasing in an area where there are significant but unknown archaeological resources.

Finding the Right Way Forward: Archaeotourism in the Rupununi

The Rupununi is a vast tract of land in central Guyana. The landscape is composed of naturally occurring savannah wetlands and tropical rainforests, and the region has been largely inaccessible until recently. The small population of 16,000 inhabitants is predominantly comprised of three main indigenous groups who occupy most of the land: the Makushi in the north and the Wapishana and Wai-Wai in the south (Nycander et al. 2010: 13). Various archaeological studies

Tourism, Archaeology, and Ethics: A Case Study in the Rupununi Region of Guyana, Fig. 1 Amerindian petroglyphs (Photo by Jared Bowers)

have proven that Amerindians have been living in the region for over 7,000 years, initially as hunter gatherers with land cultivation occurring around 2,000 BCE (Williams 2003: 3–11).

The Rupununi is rich in both natural and cultural heritage resources. As a result, several communities have been increasingly developing tourism programs as their primary source of revenue in an area struggling with diversifying its economic activity. However, with one to two thousand visitors a year, tourism is still in its infancy and remains a low-impact activity. Local cultural heritage used for tourism includes a number of archaeological resources. These resources are primarily comprised of pictographs and petroglyphs (Fig. 1) but also include stone tools, chipping stations, rock circles, and polissoirs (Williams 1979).

Plew (2004: 12) revealed that the Rupununi is host to a wealth of archaeological resources which remain "relatively unexplored." Indigenous Amerindian communities have occupied and used both the savannah and rainforest environments for thousands of years. An exploration of the archaeological record in the region could consequently be useful in addressing significant research questions in northeastern South America (Plew 2004: 7). These questions refer to topics such as ritual sites, food procurement, and hunting strategies among the Rupununi's transient communities. Long-term environmental patterns inside the region could also be documented (Plew 2004: 7). Despite remaining mostly unexplored, the utilization of these archaeological resources for tourism is currently on the increase. This underlines the need for an effective management structure.

As both tourism and archaeology seek to progress their development in the region, the use of a teleological framework will become increasingly important. Within this framework, defining how to simultaneously safeguard and use archaeological resources for economic gain will be the primary focus. However, the guiding principle should be how to use this resource for the greatest good for the greatest number. It is essential that management figures establish both sustainable visitation guidelines such as limits of acceptable change and maximum visitor cap and research tactics with, for instance, community archaeology and public participation. These methods will ensure that the resource remains protected for present and future generations (Marshall 2002: 218; Wurz & van der Merwe 2005: 15).

Conclusion

This entry set out to gain an understanding on the ethical relationship between tourism and archaeology. Individual ethical frameworks for tourism and archaeology were explored, as well as how the unification of both disciplines can be used to achieve a similar ethical goal. This ethical goal is the ingrained concept of sustainability and can be reached through a teleological system of thought. This entry briefly investigated this relationship in the Rupununi region of Guyana and stressed the importance for sustainability in the education and preservation of archaeological resources. The author argues that it is essential for all future use of archaeological resources for tourism to consider and prioritize sustainability – in order to ensure that all are able to experience our cultural heritage.

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Trackways in Archaeological Conservation and Preservation

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Introduction

Ichnology is the branch of paleontology that studies human and animal fossil tracks and trackways, both of which are widespread across the world. That trackway sites are quite common is not surprising: an animal makes many tracks and traces during its life but leaves only one set of remains which, if skeletal, may be preserved in the fossil record. This entry is concerned with the preservation of trackway sites. Through the ICHNOS Project, Lockley and colleagues provide a record of some 63 hominid and human footprint sites, ordered by approximate age (Lockley et al. 2007). All of these are, needless to say, younger by far than the many known dinosaur track sites and the vastly older invertebrate trackway sites from the Paleozoic era. From a preservation point of view, it is not relevant to distinguish between categories of track maker. Hominid and dinosaur track sites in particular fascinate the public and are good exemplars pertaining to preservation and public access to exposed sites.

Definition

A number of aspects make trackways important as sources of scientific, social, and behavioral

information: the size of the track maker, stride, soft tissue morphology, predatory or flight behavior, and so on. Essentially there is no substance to a track, only the imprint of tissue on the surface carries information, and it is this that is the object of preservation. Preservation thus poses challenges. Trackways are found across a spectrum of substrate types. The track surface depends on the geology of the site and varies from soil or mud to hard, weather-resistant rock in some cases of fossilized tracks. However, almost all rock types in which tracks are impressed were soft sediments, although metamorphic or secondary depositional processes after burial (e.g., limonite or calcite formation on the track surface) may alter the petrology. It is obvious that the substrate must have characteristics capable of retaining detail of the track. Thus, mud or volcanic ash fall cannot be too wet or too dry or tracks will not survive or they will be ill resolved and of little value. A further requirement for survival is protection of the tracks by rapid burial through natural processes, or through having been made in a cave as in Chauvet (Clottes 2001: 37), where erosional processes do not erase the prints. That so many traces and tracks survive in the palaeontological and archaeological record is indicative of the frequency and ubiquity of their creation; many more sites than those existing today must have been lost through erosion and clearly many are yet to be found.

Trackways in Archaeological Conservation and Preservation, Fig. 1 When Neil Armstrong trod on the surface of the moon, July 20, 1969, images of his footprints were instantly recognizable as symbolic of humankind's first tentative steps into the cosmos (Photo courtesy of NASA)

Key Issues/Current Debates/Future Directions/Examples

From a preservation perspective two aspects of how trackways are valued by various constituencies are relevant. Scientific and archaeological values, falling under the disciplines of ichnology and palaeoanthropology, derive from the unique information trackways can yield that fossil bones or other archaeological evidence may not afford. Social and symbolic values emanate from public education and the way people respond to these frail traces of the past. Tracks evoke a moment in time, recent or tens of thousands or millions of years ago, and invite musings about the maker of the tracks, whether human or animal, and the circumstances under which they were formed. People thus relate powerfully to tracks, such as the iconic image of Neil Armstrong's footprint on the moon and the Laetoli hominid trails, which bracket a time span of 3.6 Ma and symbolize the journey of the human species (Figs. 1 and 2).

Essentially three options exist for the conservation and preservation of trackways. All have been undertaken at various sites. These are to lift the trackway or some of the individual prints for removal to a museum or place of safekeeping; to bury or rebury the site; to shelter it and open it to visitors; or to leave it exposed without an attempt at preservation. In each of these scenarios, high-level documentation is an essential starting point. Photogrammetry and laser scanning provide noncontact recording of surfaces in three dimensions. This is especially useful in cases where the

Trackways in Archaeological Conservation and Preservation, Fig. 2 At the site of Laetoli, trails of three hominids, two walking in tandem, and crossed by hipparion tracks (*bottom* of image), were imprinted 3.6 Ma ago. The southern part of the trackway is shown after re-excavation and conservation in 1995 (Photo: 1995, J. Paul Getty Trust)

surface is too fragile to allow molding for replication as a cast. The photographic and digital records of surfaces are a fundamental research tool and provide a standard for future condition monitoring.

The decision-making process as to whether the site is to be lifted, buried, sheltered, or left exposed can be contentious when different stakeholders or constituencies are involved if, for example, either the scientific or social values, including economic ones, take the foreground to the detriment of the others. Significance issues that need to be weighed in the decision include the environment and landscape in which the trackway exists. To move a site in toto, or to remove only individual prints which destroy the relationship between them (gait, stride length), is contrary to the accepted ethic of conservation in context. Both are irreversible interventions. Removal ascribes scientific value only and overlooks the cultural and natural significance in the landscape. On the other hand, leaving a trackway in situ requires protection. If exposed, inevitably weather and erosion will destroy the site. Consequently, for many preservationists, the options then become sheltering (Stanley-Price & Matero 2001) or reburial (Nixon 2001; Stanley-Price & Burch 2004). The excavator, scientific community, and the public often regard reburial as the less desirable option: it removes the evidence from access and view. If the trackway site is of high significance, there is a tendency for a decision to be taken for the site to be opened for visitation, usually under a structure that serves a protective and interpretive function. This is a time of great risk for an excavated site since temporary protection and security may not be adequate while design and funding for a shelter are being sought. As a number of case studies reveal, none of these options is ideal, and each has advantages and disadvantages. Examples are considered below.

Lifting a Trackway Site: Glen Rose Dinosaur Trackways

The dinosaur footprints in the lower Cretaceous deposits of the Paluxy River near Glen Rose in Texas serve to illustrate problems that may arise when a trackway site is relocated. The site has been known since 1908 and comprises exceptionally well-preserved carnosaur and sauropod footprints in immediate proximity to each other. A large section of the dolomitic trackway was removed in 1939 and taken to the American Museum of Natural History (AMNH), and a further part went to the Texas Memorial Museum (TMM) where it is housed in a special building. The section in the TMM has displayed severe deterioration, including surface spalling and exfoliation associated with the crystal growth of soluble salts, principally epsomite. The environmental conditions in the building, including excessive humidity and capillary rise from ground water, are reportedly responsible for the condition of the trackways (Shelton et al. 1993).

It is apparent that the inadequate monitoring of the condition of the tracks in the TMM permitted deterioration to occur to an advanced stage before the damage was fully realized. The other part of the contiguous trackway in the AMNH apparently has not suffered damage. The remaining trackways, still in situ, have also shown no deterioration and are protected by the Texas Parks and Wildlife Department in what is now Dinosaur Valley National Monument (Farlow 1993).

A related example is from South Africa: The human footprint site is situated about 130 km north of Cape Town on the Langebaan Lagoon. Here a few tracks were found in dune rock dating to 120,000 years BP. Because the site is frequented by visitors who habitually carve graffiti into the soft dune rock and also because of vulnerability to wave erosion, the tracks were removed by helicopter and transported to the Iziko Museum in Cape Town (Roberts 2008). The fragmentary front print was lost during this rescue, though a cast exists.

Trackways in Archaeological Conservation and Preservation, Fig. 3 Southern part of the Laetoli trackway during reburial in 1995 showing the reburial stratigraphy incorporating sieved local sands and geosynthetic materials with a final boulder capping (Photo: 1995, J. Paul Getty Trust)

Reburial: Laetoli Hominid Trackway Site

The earliest hominid trackway, 3.6 Ma old, is at the site of Laetoli in Tanzania (Fig. 2). The Laetoli tracks exemplify many of the issues and controversies that bear upon highly significant sites and their preservation. When, in 1978, fossil footprints of a purported human ancestor (*Australopithecus afarensis)* were discovered during a palaeontological expedition led by Mary Leakey, scientific and public attention was immense, reflecting both their scientific and symbolic significance. The prints, partly exposed through erosion, were found at the site of Laetoli, to the south of Olduvai Gorge, where Louis and Mary Leakey did their pioneering work researching human evolution. Securely dated, the footprints resolved one of the major debates in palaeoanthropology. At Olduvai and other sites in Africa and beyond, the search for evidence of human evolution has focused on fossil bones; but while fossils have been the primary means of understanding our origins, they cannot answer all the scientific questions. One debate had been the development of the brain in relation to bipedalism. The Laetoli trackway was evidence that bipedalism preceded development of the brain. Excavated in 1978 and 1979, the trackway consists of footprints of three individuals in two parallel trails some 30 m long, preserved in volcanic ash. The Leakey team used various techniques to document the trackway, including molding, casting, and photogrammetry, before reburying the trails in 1979 as a means of protection. After reburial the site revegetated. Although its condition was not known, nor was it monitored because of its remoteness, there was concern that root growth from Acacia trees was damaging the tracks. A multiyear conservation project involved re-excavation, removal of trees and roots, stabilization of the trackway and site, scientific restudy, and reburial (Fig. 3) (Demas & Agnew 2006). A small-scale replica reburial trench was created adjacent to the site to

Trackways in Archaeological Conservation and Preservation, Fig. 4 In the flat barren landscape of the Willandra Lakes, the 20,000-year-old human prints are shallowly buried by layers of permeable synthetic textile to protect them from freeze-thaw cycles and wind scour (Photo: 2007, J. Paul Getty Trust)

provide surrogate monitoring through periodic re-excavation (Agnew & Demas 2004). Reburial removed the trackway from future public access. As a means of compensation, a cast of the trackways and interpretive material was created at the nearby Olduvai Museum. More than 10 years later, a political decision was taken, but yet to be implemented, to reexpose the tracks for tourism.

Another example is from the Willandra Lakes Region World Heritage area. The Willandra Lakes area was the site of discovery in 2003 of human footprints dated to 20,000 years BP (Webb et al. 2006). The site has revealed over 700 prints and 23 trackways of men, women, and children. Apart from the tracks themselves, the Willandra Lakes World Heritage area is also important for an understanding of Australia's prehistory through the skeletal collections (http://www.visitmungo.com.au/world-heritage). Three traditional tribal groups maintain responsibility for the site with the assistance of the New South Wales National Park Service and other organizations. After documentation and scientific study, the footprints were buried under sand and a covering of a synthetic textile as protection from wind scour and to provide insulation against damaging freeze-thaw (Fig. 4). Considerable discussion took place among the traditional communities and professionals regarding the future of the site: whether it should be replicated for display, on site or nearby, or buried permanently, or opened to visitation under a shelter. Based on clear photographic evidence of rapid deterioration of exposed tracks, the decision was made to keep the site buried. Interpretation of the tracks is done off-site.

Sheltering: Lark Quarry Dinosaur Stampede

Known today as the Dinosaur Stampede National Monument, in central Queensland, Australia, the site was one of the first three places to be listed on the National Heritage List in July 2004. Located 100 km south of the town of Winton, the site features unique evidence of a dinosaur stampede, with almost 4,000 tracks clearly visible in an area of some 210 m^2 (Fig. 5). The footprints are interpreted as a fossilized record of a predator stalking and causing the chaotic stampede of around 150 bipedal dinosaurs, varying in size from that of a chicken to larger types about the size of Australia's flightless bird the emu.

The site is claimed to be the only known dinosaur stampede and a record of a few minutes in time during the Cretaceous era, 95 Ma ago. Today an ecologically sustainable building covers the trackways protecting the footprints from weather, humans, and wildlife. The state-of-the-art building is, however, not the first shelter to be built over the site. Excavated in

Trackways in Archaeological Conservation and Preservation, Fig. 5 Some of the 4,000 individual tracks of dinosaurs dating to 95 Ma ago at the Lark Quarry site. Image shows ornithopod and coelurosaur and two of the eleven carnosaur tracks (Photo: 2007, J. Paul Getty Trust)

1977–1978, the significance of the site resulted in a decision, despite its remoteness and lack of infrastructure and personnel, to open it to the public. A number of organizations were appointed as joint trustees of the site, and while funding was being secured for a roof, the site was protected with straw under plastic sheeting. The problems that subsequently arose, during and after construction of the flat pentagonal roof, are numerous. They range from burning of the straw and loss of a holotype footprint during unsupervised construction of the roof, to the occupation by kangaroos seeking shade, to souveniring by visitors since the site was not staffed for security or interpretation. Additional problems were flooding of the site from the uphill slope, dust accumulation in the prints, and a general inability of the trackway to be understood by visitors (Agnew et al. 1989).

Nor was the new building (Fig. 6), erected in 2001, without problems. Collapse of a large rammed earth internal wall, intended to provide thermal stability of the interior environment, onto the visitors' walkway and trackway, occurred not long after the site had been opened to the public (Meiklejohn 2003).

Unprotected Sites: Formby Point

Trackways may be too extensive for practicable preservation measures to be warranted. Nor would the high cost justify attempts to save them from erosion. Under such circumstances, full documentation and recording is the only option. There are many such sites. Well known are the intertidal coastal trackway sites on the west coast of Britain. The Formby site, dated about 5,500 BP, is of high scientific value and the prints of children, women, men, and a number of animals, including deer, aurochs, and birds, have been recorded. About 145 different trails at Formby alone have been noted, and as the succession of silts and sands become exposed during accelerated beach erosion, the imprint bearing sediments are revealed. Photography of the footprints, recording their positions, and lifting and making casts of selected specimens has been an ongoing research project (Roberts et al. 1996).

Discussion

All exposed remains are subject to the vicissitudes of weather and damage, none more than tracks, which are essentially ephemeral traces comprised only of the substrate itself. Stabilizing fragile tracks may require treatments, such as surface consolidation, reversible crack filling, and edge buttressing of the Lark Quarry trackway (Agnew et al. 1989), but should be undertaken with due caution; strengthening of the substrate for purposes of molding is of particular concern, as the experience with the application of Bedacryl on the Laetoli tracks in 1978 demonstrated (Demas et al. 1996). The use of 3-D technologies to capture virtual reconstructions and create physical replicas now offers a noninvasive alternative to molding. Precise, accurate, and accessible archived documentation and periodic monitoring are the most important measures that can be taken for the preservation of these fragile and unique traces regardless of other interventions undertaken.

When the significance of a site is high, the desire to open it to visitation may override sustainable considerations of preservation. Seldom are all the threats or limitations taken fully into account. These may include, to name a few, damage to the site while fundraising and preparations are being made for sheltering and interpretation; lack of security and long-term maintenance of a protective structure; insufficient staffing and

Trackways in Archaeological Conservation and Preservation, Fig. 6 The second protective structure built in 2001 over the Lark Quarry dinosaur stampede trackway (Photo: 2007, J. Paul Getty Trust)

infrastructure; and unanticipated consequences of sheltering such as dust accumulation obscuring the tracks, birds and animals in the shelter, accumulation of damaging soluble salts, plant growth, and so on. It is unusual too for an objective assessment of the visitation potential to guide the decision. Thus, when visitor numbers do not meet expectations, there may be a decline in funding and inevitable neglect over the long term.

Trackways of significance will continue to be discovered. Their preservation requires a complex decision-making process based on thorough understanding of significance, investigation of environmental conditions, careful assessment of threats, and long-term human and financial resources.

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Cross-References

- ▶ Australia's Archaeological Heritage
- ▶ Australopithecines
- ▶ Conservation and Preservation in Archaeology in the Twenty-First Century
- ▶ Cultural Heritage and the Public
- ▶ Descendant Communities in French Guiana: Amerindians
- ▶ First Australians: Origins
- ▶ Hominids, Earliest African
- ▶ Hominin Paleoecology and Environmental Archaeology
- ▶ Ileret Footprints
- ▶ Leakey Family
- ▶ Lucy
- ▶ Olduvai Gorge Archaeological Site
- ▶ Sustainability and Cultural Heritage
- ▶ Uses of Heritage

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Trade and Transport in the Ancient Mediterranean

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Introduction

The subject of trade and transport leads into different questions and forms of analysis depending on the perspective adopted. From an economic point of view, trade is part of developing systems of exchange by which the production and consumption of goods are linked over small and longer distances. Major questions include which and what quantities of goods were traded where and by what means, how much of a surplus was available for trade, and how effectively trade, transport, and currency fulfilled their purposes within a specified geographical range. Which social, political, and technological circumstances affected volumes of trade, and what factors stimulated or prohibited the development and expansion of markets? The emergence of price-setting markets is central for economic history. Economic historians are aware that trade via markets is only one possible way of moving goods and services from their place of production to that of consumption, but it is the one with the greatest net profit and thus the condition for growth. Anthropologists do not look for the evolution of markets. From this perspective, exchange is an index for different types of social and political organization. Trade via price-setting markets controlled by supply and demand is only one type of exchange mechanism that developed under particular social and political circumstances in early modern Europe. In other social and political settings, distribution controlled by states (such as tribute and redistribution), or by social networks (in which gift exchange and other morally controlled reciprocal exchanges are practiced), is more suitable for linking production, consumption, and people. Trade itself can take different forms of organization, shading into barter, redistribution, or gift exchange, depending on the type of social organization in which it develops. For archaeologists, finally, trade is above all a sign of cultural exchange, interaction, and contact. Traded artifacts, their style, and material composition signify the combined flow of resources, ideas, and information between groups of distinct identities and resource endowments. Archaeologists investigate the directions and scope of such flows in order to identify the geographical range of cultural influence and development. Economic questions, especially links of production and consumption, are analyzed too, but the nature of archaeological evidence points to quantitative and technological rather than to institutional and

social characteristics of trade. In the last quarter of the twentieth century, economic, anthropological, and archaeological perspectives have been fruitfully combined in order to investigate ancient trade not just as a simpler version of later European trade but as a subset of competing and interdependent forms of exchange which characterize and reflect different types of social organization, cultural interaction, and economic development at different periods of time.

Definition

Trade can also be defined in different ways. It may refer to the peaceful buying and selling of goods in contrast to moneyless barter, gift exchange, piracy, and violent forms of appropriation; it may refer to transactions external to a society rather than to their internal ones; it may refer to an exchange of resources where the material value of the goods exchanged is more central than the celebration of the relationship in which the valuables are exchanged; or it may be defined as a commercial exchange in the hands of a clearly defined social group guided principally by profit rather than other motives. Each of these definitions has been highly contested in recent years, but they are equally valid as long as they are not regarded as the very essence of trade across cultures and time. For classical antiquity, it is most suitable to define trade as the external exchange of material goods (which included slaves and animals) distinct from either barter or gift exchange. It can then be asked how trade, and the social groups undertaking it, interacted and overlapped with barter, gift exchange, piracy, plunder, and their respective representatives. It is not helpful, however, to define ancient trade by the involvement of money, markets, professional traders, or the profit motive. Although all of the aforementioned factors played some, and at times important, roles in ancient trade, their absence did not mean an absence of trade.

The terms closest to the proposed definition of trade are in Greek *emporiē* (seaborne commerce) and in Latin *negotiatio* or *commercium* (commerce). In the early writings of Hesiod and Homer, we also find the term *prēxis* which referred to the kind of trade Greek aristocrats practiced in contrast to the trade pursued by lesser people and foreigners (Tandy 1997: 75). Yet the distinction is no longer found in the sixth century BCE, confirming that it was a social and cultural polemic emerging from social threats associated with anonymous trading contacts.

Key Issues and Current Debates

Sea transport was the cheapest way of carrying goods over distance. From c. 1400 BCE, deep-hulled ships are attested from the Near East and Egypt, which were propelled by a sail, rather than oars, to allow space for the cargo. Ships could vary in size considerably. Some were fairly small (e.g., less than 14 m), carrying loads of 20 t or less. By the Hellenistic period, ships of a carrying capacity of c. 150 t were quite normal, and those of 350–500 t not rare (Parker 1992). Transport by land was long regarded by scholars as too expensive in comparison to seaborne trade. For a bulky commodity like grain, a sea voyage added c. 2 % per 100 miles to the costs, whereas freight charges over land by mule or cart could add over 50 % (Morley 2007b: 26). But costs of transport varied considerably according to both commodity and region. From the fourth century BCE onwards, the road system in Italy facilitated the transport of goods over land, while extensive finds of wine amphorae on sites in Gaul and southern Germany from the early second century show that land transport did not prohibit exchange networks from developing where demand emerged (Patterson 1998). It should be noted, however, that the Greeks in the Hellenistic period were quick to establish their own sea routes to India and Arabia via the Red Sea and the Arabian Gulf to reduce the amount of distance to be covered by caravan routes (von Reden 2007).

The vitality of Graeco-Roman trade emerged within a particular ecosystem and successful human attempts to overcome ecological constraints. The Mediterranean is an ecological zone with similar climate, fauna, and flora that

support similar strategies of production, consumption, and risk management. At the same time, the zone has a great diversity of landscapes, microclimates, and resource endowments, which fosters agricultural specialization and diversification. There is, for example, a great diversity of annual rainfall, which means that droughts and crop failure in one region may not affect another nearby. Raw materials, such as metals, stone, wood, or clay, are not evenly distributed, while the soil produces very different qualities and quantities of staple foods (grain, vine, and olives). The indented Mediterranean coastline, moreover, encourages small-scale autarkic settlement, while the sea with its many islands supports communication and exchange. Large numbers of rivers open up into the sea, connecting dispersed hinterlands with Mediterranean Sea routes and, conversely, facilitate transport of goods from continental sites. The possibilities of transgressing a local ecosystem successfully are thus comparatively easy and at the same time rewarding. "Connectivity" is the term that has been coined for this typical Mediterranean pattern of settlement and communication, providing a helpful concept for understanding the political and ecological conditions of Mediterranean trade during classical antiquity (Horden & Purcell 2000).

Mycenaean Linear B tablets of the Bronze Age are virtually silent about trade, although self-definition through exotic materials is characteristic of the Mycenaean elite from the Shaft Grave period onwards (Bennet 2007: 201). Four documents from the Knossos Ld (i) series mention *xenwia* (cloth), which probably referred to cloth "for export." Three Bronze Age shipwrecks, two found off the southern coast of Turkey and one at Point Iria in the southern Argolid, provide archaeological evidence for the substantial movement of goods in the Aegean during that period. The largest of the three, which was perhaps 16–17 m long, carried 10 t of copper, a ton of tin, 175 blue glass ingots, 150 Canaanite jars, and 10 large Cypriot containers containing over 100 pieces of Cypriot fine-ware pottery. Lead isotope analysis of the copper ingots in combination with the Cypriot pottery suggests that the ship was on its voyage from Cyprus into the Aegean, after having stopped for ivory in Syria and possibly Egypt. High-value objects (glass, copper, and tin) indicate that it moved goods at the highest level of social interaction (ibid.). Contemporary literary evidence from el-Amarna in Egypt suggests, moreover, that such valuables were presented as gifts or tribute to maintain diplomatic ties between royal houses (Aubet 2001: 134-5), although the involvement of professional middlemen or agents in such exchanges is not unlikely.

Archaeological and literary evidence for the movement of goods and people across the Mediterranean increases in the late ninth and early eighth centuries BCE after a period of highly localized interaction during the Early Iron Age. Greek settlements participating in this movement were above all Corinth, Chalkis, Eretria, Miletus, and Phokaia. Yet undoubtedly pioneering were the Phoenician cities of the Levant, above all Tyre. By the end of the ninth century, Phoenicians had founded trading colonies in Cyprus (c. 820 BCE), Spain (early eighth century), North Africa, Sicily, and Sardinia. The Greeks followed with their earliest colonial foundation at Pithecusae/Ischia in c. 750 BCE and some kind of regular presence at Al Mina at the mouth of the river Orontes in Syria. Both of the so-called Lyre-Player seals, originating probably in North Syria, and Euboean pendent-semicircle *skyphoi* and plates attest regular Greek contacts with Syria, the Levant, and the western coast of Italy during this period (Osborne 2007). The directions of trade, shipwrecks, and literary evidence in combination suggest that the Greek demand for minerals continued to dominate the exchange of goods abroad, while manufactured products, above all pottery and textiles, as well as slaves, perfume, foodstuffs, and a range of raw materials completed what were mostly mixed cargoes. Etruscan cities such as Caere, Tarquinia, and Populonia entered interregional trade by the end of the seventh century BCE with contacts concentrating around Massilia and along the southern coast of France (Dietler 2007: 248–250). Much of their activity seems to have been stimulated by the Greek colonists' demand for wine.

The texts of Homer and Hesiod help to understand the social organization of trade and exchange in the archaic period (Tandy 1997). Among the Greeks, most long-distance exchange of high-value goods seems to have been controlled by aristocratic landlords (*basileis*) and took the form of gift exchange in relationships of guest-friendship (*xenia*, Herman 1987). In addition, small local journeys were undertaken intermittently by well-off peasants, such as the Boeotian poet Hesiod, who had enough surplus to dispose of along the nearby coasts in the dead season after the harvest. While this so-called cabotage mattered little in terms of aggregate value in comparison with the large-scale ventures of wealthy chiefs, it is assumed to have made up the bulk of archaic trade (Horden & Purcell 2000). A third type of trade was in the hands of professional traders. In the *Odyssey* these are always foreigners (Phoenicians or "Taphians"; e.g., *Od*. 8.14 ff.), but the Greek trading settlements (*emporia*) abroad, such as at Pithecusae and, from the seventh century BCE onwards, Naucratis (Egypt), Gravisca (Italy), Massilia (France), and Emporion (Spain), show that there were large numbers of Greek professional traders as well. These towns or settlement areas have been identified as trading diasporas of populations that had no social ties among the communities with whom they traded and interacted in special institutional environments (Curtin 1984). One such environment was the port of trade, best exemplified by the Greek town Naucratis in Egypt. This town in the west of the Nile Delta was granted by Psammetichus I to Greek traders in the last quarter of the seventh century BCE and served as an enclave for Greek communities who could establish here places of worship and markets. There is some indication that markets were strongly controlled by the host administration, partly to link different economic systems and languages (Möller 2000), but also for the purpose of taxation. In practice, these trading communities provided a breeding space for knowledge about interregional supply and demand (Osborne 2007). In archaic Naucratis we find Chian *chalices* which seem to have been produced to order (Möller 2000: 136-40), while still in the fourth century BCE it was in Naucratis that a business consortium able to control grain trade and prices between Rhodes, Egypt, and Athens emerged (von Reden 2010: 131).

By the sixth century BCE, migration had dispersed Greeks in settlements around the Black Sea, Sicily, Southern Italy, and the southern coasts of France and Spain. Although the vast majority of these were dominated by agrarian subsistence economies, their urban centers created new demand for Greek products and a supply of raw materials and products from these areas at lesser costs. A series of technological changes both reflected and stimulated further the expansion of trade during the sixth century BCE. Firstly, the traditional Egyptian rigging with a square boom to which the sail was fixed developed into a loose-footed square sail fitted with brails at regular intervals. This made it possible to lift the sail up and shift it to the sides, which allowed full control over the sail according to the strength and direction of winds (Casson 1994: 43–44). Secondly, although some maritime installations are known from the Early Iron Age, the first permanent harbor facilities (breakwaters, ship sheds, and dockyards) appear in the sixth century BCE. There was at first no functional differentiation of military and commercial harbors. But other infrastructural innovations, such as the stone trackway (*diolkos*) for transporting ships and cargoes across the Isthmus of Corinth dating c. 600 BCE, show the general value attached to infrastructural improvement in the demonstration of power between individuals and poleis. The third technical innovation was coinage. Invented in Lydia at the end of the seventh century BCE, it soon spread into Greece where the first coins were struck by about 550 BCE. Monetary payment had been possible for centuries on the basis of bullion and ingots cut to size and certified by local temples, but coinage facilitated monetary transactions and at the same time created a new linkage between trade and the identity of *poleis* and their political allies (von Reden 2010). Gradually, moreover, coinage paved the way for greater monetary coherence and better comparability of prices and value.

The Athenian naval confederacy of 479 BCE was another influence on trade with enormous economic consequences. It began with the expansion of the Athenian fleet in the 480s that was possible only with the supply of an unsuspected windfall of silver from the Athenian mines minted into coinage and with the import of timber from foreign resources. It is unlikely that wood and pitch were imported into Athens via the market rather than through the channels of personal political guest-friendship ties which provided the elite with economic resources to be invested into social and political power (Herman 1987); but coined silver was certainly used for the payment of the labor force. There followed the fortification of the Piraeus at around the same time and the Athenian control of the sea routes as an immediate consequence of her sea power. Other consequences were more gradual: firstly, a massive expansion of Athenian coinage and the gradual supersession of competing, especially Aeginetan, coinages (Figueira 1998); secondly, the growth of the Piraeus into a central harbor and marketplace for Greek and foreign products; and thirdly, the emergence of Athens as a center of consumption at an unprecedented scale. The Athenian League was not a tributary empire where the power to extract goods and services in kind puts limits to the growth of trade. Instead, Athens' commitment to monetary payment stimulated trade and a larger amount of poleis and people to earn and spend money in markets. A substantial part of regular imports in Athens (and presumably other *poleis* of which we are less well informed) was grain with which the cities could compensate for recurring shortages of locally grown cereals and ensure the provision of better-quality wheat available especially from the Black Sea area. A host of other goods, both luxuries and semiluxuries (staples of better quality from elsewhere), made up the substantial volume of imports. Important institutions developed during this period. Money changers, followed by banks (*trapezai*), appear in the second and the last quarter of the fifth century BCE, respectively. Lending and borrowing for commercial purposes increased and led to the invention of a particular kind of maritime credit (*nautica daneia*; first attested in the late fifth century, Eup. *CAF* fr. 43). In such contracts the cargo of the ship, rather than personal surety or landed property, serves as security for a loan. By 415 BCE the revenues from harbor tolls, levied as a 2 % tax on the value of the cargo, were so substantial both in Athens and the harbors of her allies that they could substitute for the tribute Athens was no longer able to extract. In the fourth century, maritime courts were established which provided quick solutions of legal conflicts under the special condition of foreigners being involved. For, despite the enormous economic importance trade had gained during the fifth century, both in aggregate value and in social terms, trade and banking was mostly in the hands of foreigners and resident aliens (*metoikoi*). Athens also tightened the control over its coinage to increase trust in what had become an interregional currency. In addition, we hear of the possibility of making monetary orders in writing to bankers in other places, which, though not being a proper form of giro, allowed the transfer of credit from one place to another (von Reden 2010).

It is contentious, and indeed fruitless, to compare the development of trade in the ancient Mediterranean with that of early modern Europe. But the combined effects of the Athenian Empire, its silver resources, political organization (leading to particularly effective ways of collective decision-making and legislation), and commitment to coinage created an institutional structure for the development of trade in the following centuries. The Macedonians modeled their coinage and law on that of Athens and showed the same commitment to coinage and markets in their payment of mercenaries and the provision of military supplies via local markets. The Macedonian conquest of the Persian Empire also led to the foundation of new cities in which the Greek military settlers and civilians lived a markedly Greek lifestyle. At the same time, the Macedonian kings took over from the Persians a treasure and tribute system which put at their disposal levels of wealth incomparable to those of Greek *poleis*. The fusion of Near Eastern resources, Greek economic structures (including coinage), and the demand for Greek products outside the

Greek mainland boosted the level of trade, measurable by the increase of sea travel, minting, and size of cities. Alexandria's total population is estimated at around 200,000 by the third century BCE, which is almost twice as much as the estimated total population of all Attica in the classical period and four times as much as that of the biggest towns of the former Persian Empire. The fact that the fabulous monetary wealth of the Ptolemies was dependent on silver that, because of the lack of silver mines in Egypt, must have come into the country by circulation shows that their prosperity rested as much on tribute as on export (von Reden 2007). A corollary of Alexandria's role in Mediterranean trade is the movement of the major port of transit from Piraeus to Delos by the end of the fourth and to Rhodes in the third and second centuries BCE, leading the Roman government to declare it a tax-free port in 166 BCE. In much of Hellenistic trade, kings, their administrations, and managers of royal estates were involved. But given that all of them acted in tandem with, and through, agents who pursued their own economic business at the side, it is impossible to disentangle fully trade under royal control from private enterprise. The link between private and public/royal enterprise and control is probably one of the reasons for grain prices staying at surprisingly similar levels from the classical through to the Roman period (Rathbone Forthcoming). Given the unparalleled role of this staple for peace and prosperity, the grain supply of urban markets was a political issue influenced economically by kings, emperors, and local benefactors rather than the supply-and-demand mechanism. For other commodities traded in the Mediterranean, we are lacking the data to analyze price formation. But in the rare cases where this is possible, there seems to have been a regional, rather than a Mediterranean-wide, pattern (Reger 1994).

By the beginning of the third century BCE, the Romans had expanded their trading contacts into the Italian peninsula, the Western Mediterranean, and the Adriatic region. Greeks from Massilia, Northern Greece, and Phokaia had established in continental Europe from the late sixth to the fourth centuries BCE contacts which were dominated by some Italian imports, especially of wine and fine pottery, from the early second century BCE onwards (Woolf 1998: 174-6) The end of the Second Punic War in 218 BCE created Roman hegemony over the Carthaginian sphere of influence in the West. Roman trade in the Adriatic in 229/8 BCE was conspicuous enough to suggest that the conflict with the Illyrians resulted from Roman intervention on traders' request against Illyrian piracy (Polyb. 2.2–6). The gradual increase of Roman participation in Greek trading networks is shown by the gradual spread of Roman amphorae into the Greek East, by commercial settlements of Romans and Italians on Delos and the presence of Roman merchants at Alexandria (Harris 2007). The most important effect of the expansion of Roman trade into the Greek sphere of influence was the spread of Greek financial sophistication into Rome and Italy (ibid.). Greek banking, credit operations, forms of monetary transfer, and transfer of debt claims to third parties became a vital condition for the economy of the Roman elite to function between Italy and the provinces (Andreau 1999). With the expansion of the Roman Empire, the scale of trade in the Mediterranean changed. The number of shipwrecks dated to the period between 100 BCE and 300 CE is far greater than in the periods before and after, suggesting – despite some archaeological bias – a scale of maritime transport not reached again until the high Renaissance (Parker 1992; Patterson 1998). Larger ships of 200–400 t were used more frequently. A certain type of amphora (so-called Lamboglia 2) produced in Apulia is now found everywhere in the Western Mediterranean, while some African amphorae occur on most sites between Britain and Egypt. Amphorae used in any type of interregional trade also became more standardized, which must be taken as another indicator for the regularity with which goods were moved (Morley 2007a). Access to new mines and foreign treasuries created a massive increase in the total volume of coinage circulating in the Roman Empire from the second century BCE onwards. By the time of the first century CE, the Roman denarius currency had become an imperial coinage accepted throughout

the Roman Empire (except Egypt), creating a fairly homogenous monetary zone. The growth of the city of Rome, finally, exceeded by far that of any royal capital in the Hellenistic world; this growth was demographically possible only if external resources kept pace with increasing consumption levels. The major zone of Roman trade was the empire, but there is now massive evidence that trade journeys of considerable scale and value were undertaken beyond the edges of the Roman world. Among the best attestations is the trade in spices, ivory, marble, and fine textiles with the east coast of Africa, as well as areas beyond the Red Sea, and India (Rathbone 2000; Wilson et al. 2013).

The period from the late third century CE onwards is generally regarded as a time of recession, distress, and transformation which affected trade in complex ways. There was recurring stress of the imperial currency and of enforcing central law and taxation and a trend towards greater regionalization. As a result, the diversity of local economic situations becomes more visible, and there is a notable diversity of responses to central policy. There are, moreover, clear indications that the Roman government aimed to reduce the role of private intermediation in the trading of certain products, while maritime transport became a compulsory office (*munus*) rather than a profession left to private contractors (Giardina 2007). But there is as yet no clear indication that, despite changes in organization, the scale of trade declined in aggregate value. Moreover, answers to the question of the degree of change in late antiquity depend largely on how scholars assess the nature of the Roman economy in the preceding centuries. How much did trade conform to the model of a free and integrated market economy?

The first question to be addressed is whether in the first centuries of the Roman Empire there developed new structures of trade and finance. An increasingly differentiated system of banking and financial intermediation – most importantly, legally protected forms of cashless transfer of money over distance – emerged during the two centuries before and after the reign of Augustus (Andreau 1999; Harris 2007). But it seems fairly certain that any long-distance trade and transport continued to be based on midsize transport and maritime loans, while large-scale ventures were achieved by pooling the capacities of several financial and transport resources. Thus is the picture emerging from a papyrus documenting the credit operations related to a huge business journey between a Roman trading post in Muziris on the South Indian coast and Alexandria in the second century CE (SB XVIII 13167 with Rathbone 2003). Thus was also the strategy of Cato the Elder in the second century BCE who spread his credit among an association of 50 traders to reduce the risk of loss and increase his own profit (Plut. *Cat*. 21.6).

The second question relates to the system of exchange behind the movement of goods and money. According to an influential model, the Roman economy in the Mediterranean came to be more integrated than before through taxation, the requirements of the Roman army, and trade (Hopkins 1980). There was an uneven productivity in the provinces of the empire and an uneven demand for military supplies, since armies were stationed above all in the provinces at the frontiers while the provinces with high productivity were those closer to the Roman center. Through monetary taxation, monetary army payment, and army supply via local markets, the Roman government mobilized a large amount of goods and money and thereby stimulated trade and a market economy. The model has been challenged on various grounds, for example, for its lack of consideration of economic activity that did not result, directly or indirectly, from the initiatives of the Roman state (Patterson 1998; Morley 2007a). Both the Roman and provincial elites, and the emperors themselves, had high stakes in long-distance trade in order to increase their wealth and dispose of their agrarian surplus. Though rarely running themselves financial business and trade enterprises, they participated in them through their agents, freedman, and slaves who were merchants, bankers, and business managers (Aubert 1994). Moreover, the trade and financial business of the Roman elite were inseparably intertwined with the financial administration of the provinces they governed (just as there was an overlap

between the imperial economy and the economic business of the emperors), which makes it impossible to disentangle the interests of the state from what appears to be genuine trade.

The third question is whether the Roman Empire was a single economic zone linked by price-setting markets. The empire-wide consumption of wine and its mass production for export in Italy, Gaul, and Africa have been at the center of recent debates. Not only is the movement of these goods archaeologically well documented by the movement of amphorae but the production and distribution of wine, in contrast to that of grain, had always been profit oriented and rarely been interfered with by governments. There does seem to be a notable increase of wine amphorae of provincial origin between 50 BCE and 100 CE that coincides with a decrease of Italian amphorae (both for wine and other agricultural products) during the same period (Panella & Tchernia 2002). But if Italian wine amphorae are taken as a category of their own, the coincidence is less marked, and it has been argued that the increase of provincial imports in Rome and elsewhere was driven by increased consumption rather than price competition (Panella & Tchernia 2002). Moreover, the export of wine to provincial places seems to have petered out as soon as these places became able to meet new levels of demand by local production (Morley 2007a).

Future Directions

While the debates over the role of markets in the Mediterranean are likely to continue, the future of research in ancient trade will lie in the analysis of regional interaction, local economic systems and the question of cultural, social, or political factors that shaped the organization of different types of exchange and their mutual interaction (Wilson et al. 2013). As the interdependence of trade and tribute, the interaction of state-controlled and private trade, and of violent and nonviolent forms of exchange come into focus, analyses of trade in the modern sense become increasingly problematic (Aubet 2001; Bresson 2008: 178–180). Moreover, as global historical approaches and economic world systems analyses begin to influence research on Graeco-Roman antiquity, the nature and consequences of trade across cultural borders receive increasing attention (Shaw 2009; Wilson et al. 2013).

Cross-References

- ▶ Ceramics, Roman Imperial
- ▶ Economy, Roman
- ▶ Emporion
- ▶ Numismatics, Ancient Greek
- ▶ Numismatics, Roman Imperial
- ▶ Numismatics, Roman Republican

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Trade Beads in Historical Archaeology

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Introduction

During the last five centuries, European trade beads markedly influenced political economies at multiple scales. Columbus introduced glass trade beads to the New World, and the Portuguese introduced later European beads to much of sub-Saharan Africa, beginning with coastal regions in West Africa. Indo-Pacific, or Trade Wind, beads already dominated the market for trade beads in the Indian Ocean region (Wood 2011) and, in Asia, as far north as Japan (Francis 2002). Bead production in Amsterdam, in Venice, and at locations in Bohemia gained momentum in the seventeenth century. The Dutch, Spanish, English, and French widely distributed European glass trade beads and exchanged them for desired items, needed services, and slaves in the lands bordering the Atlantic and Indian oceans. The Spanish mission period in Florida

(1633–1704) and the late seventeenth-century to eighteenth-century fur trade of northwestern North America are notable examples. Explorers, such as Richard Burton, and the European and Islamic inspired slave and ivory caravans of the nineteenth century circulated tons of European trade beads into East and Central Africa.

Definition

Beads are small ornaments used singly or in groups. They are suspended from the body as personal adornments, worn in the hair, or sewn onto clothes or household objects. Beads are made from a variety of natural and synthetic materials – for later periods, notably from glass – and meet a range of social purposes. Glass beads and beads of shell deserve particular attention from historical archaeologists. Due to their variety and ease of transport, Europeans and indigenous Americans and Africans exchanged beads, gave them as gifts, or used them as currency. Thus, beads are key indicators of contact and culture change. Non-Europeans often gradually adopted glass beads into their social practices and systems of status. For this and other reasons, archaeologists commonly find glass beads in burials at sites that postdate CE1500 in the Americas. Different European powers and people living in the Americas, Africa, and Asia produced and consumed different beads based on changes in access to raw materials, trends in production and technique, shifts in distribution networks, and local desires for specific bead types (e.g., Wood 2011).

Key Issues and Examples

Trade beads are particularly useful in historical archaeology, but they also present challenges (Spector 1976). Beads of glass, shell, and semiprecious stone tend to preserve well and may serve as valued chronological markers. However, beads tend to migrate across site strata and require detailed comparative study. At a minimum, bead analysis requires a classificatory system based on size, manufacturing technique, structure, shape, and color/diaphaneity (Kidd & Kidd 1970; Karlkins 1985; Wood 2011). For European glass trade beads, artisans used three primary techniques: drawing, winding, and molding. They made red, blue, black, white, and multicolor tubes, barrels, doughnuts, and spheres. In structure, European trade beads are simple (one color/layer of glass), compound (layered multiple glasses), or complex (with applique or inset decorations). Shell beads from the Americas, Africa, and elsewhere during the last 500 years frequently appear as discs or tubes. The great variation in bead types and their shifts in use indicate the prominent role of trade beads in the emerging social entanglements of regional and global exchange.

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- ▶ Mission Archaeology in North America
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Translation and Indigenization

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Introduction

Translation, broadly speaking, lies at the heart of archaeology. Archaeologists translate their technical recordings of material finds and their contexts into understandings of past human thought and action. They translate the technical findings of other disciplines – geology, say, or physics – into archaeological terms and vice versa. They also translate their work from one language to another, from Vietnamese to French, for instance. Finally, they translate their "technical talk" into lay terms for public consumption. This last is ultimately the most important, because without the understanding and support of the wider, nonprofessional community, it would be well-nigh impossible for archaeologists to access the sites and acquire the funding necessary for them to practice their craft. This entry concerns one special form of "translation for the public," namely, translation of archaeological approaches and results for Indigenous and other descendent communities. This kind of translation is often called "indigenization." It is special because the political and ethical dimensions of such translation are more pronounced than in other cases.

Definition

There are two basic forms of translation. The first is literal information transfer based on word-for-word interpreting. The second is literary transposition, which aims to convey the sense and sensibility of what is being translated, rather than a word-to-word conversion. According to Friedrich Schleiermacher, the nineteenth century German theologian who first drew the foregoing distinction, literary translation "moves the reader toward the writer," whereas literal interpretation "moves the writer toward the reader" (Schleiermacher 1813: 41–2, cited in Munday 2001: 28). The latter is obviously important; one cannot simply ignore the literal meaning(s) of the original words. Yet many translators and scholars of translation believe that it is even more important to capture coherently the significance or conceptual thrust of those original words taken as a whole rather than individually. Translation in this sense is seen as an original, creative act.

Translation for archaeologists working with Indigenous people actually entails something of both approaches, of "moving the (local) reader toward the (archaeological) writer," and "moving the (archaeological) writer toward the (local) reader." On the one hand, the archaeologist needs to know, as intimately as possible, the cultural context into which a translation is to be introduced so that the translation can be sufficiently culturally competent to be comprehensible to the target audience. On the other hand, there is no point in an archaeological intervention where the translation is undetectable, as many translations aim to be, so that the introduced material just slips unnoticed into the local cultural setting. The recipients of a translation need to "feel *das Fremde*," the foreignness, of the translation if it is to make a difference to them (Eco 2004: 192). As Eco (2004) recognizes, translation is thus not a matter of choosing

between literalness or creativity or what Venuti in various publications discusses as "domestication and foreignization" (Munday 2001: 145–8). Rather, it is a matter of *negotiation* between the various parties involved.

Key Issues

The Problem of Negotiation

Any such negotiation is problematic because it must strike a delicate three-way balance between making something culturally competent and comprehensible, accurately representing the original meaning, and behaving ethically towards local perspectives. Misrepresentation of the original can be a "sin of commission" as well as omission, through mistranslation, oversimplification, censoring, or if one's "artistic license" drifts into editorializing. This is why it is often said that to translate is to betray – that it is impossible to translate something without betraying the truth of the original. Inadvertent betrayal is easy because it is often hard to divine the intention of the person who originally produced the words in question. If they are one's own words, it is one thing, but if they are those of another can be very hard to be confident that one's translation does in fact capture what was "really meant."

In translating archaeology for consumption by Indigenous people, there is also the issue of betraying the target audience, of behaving unethically towards local perspectives. This matter is not usually taken up by translators or scholars of translation other than those such as Spivak (e.g., 1993) who are concerned with postcolonial politics. This betrayal can occur in either or both of two ways. The first is when archaeologists translate simply to impose their views more effectively on local people in a straightforward continuation of colonial domination. The second form of betrayal is more subtle. Its discussion is controversial, to the extent that it turns postcolonial wisdom on its head, and that is when archaeologists seek to make their translation "invisible" (Venuti cited in Munday 2001: 146) to its recipients. "Domestication," or what in other contexts is called seeking "resonance" (Lilley 2009), can in fact be insidious "colonization by stealth" rather than what it is presumably intended to be, namely, a strategy of decolonization, of making archaeology "community driven."

The Two-Way Ethics of Negotiated Translation

At root, archaeology is archaeology. The discipline is a theoretically and technically very broad church, and this is not the place to try to define it more closely. Plainly, though, it is not social work or community development work. Nor is it really able to be truly indigenized or domesticated: it is and in the final analysis will always remain part of the Western Enlightenment project. It can, however, be deeply sensitized to Indigenous perspectives and concerns while remaining true to itself. It must do both to be of interest and relevance to Indigenous communities. If it is not sensitized, it will not be culturally competent or comprehensible. Yet if archaeology betrays its own values by attempting to disguise if not eliminate its indispensible scientific basis, it will be without value to anyone, including Indigenous people, because it will not be able to offer anything that cannot be found elsewhere. If archaeologists cannot justify what archaeology is "for" without trying to pretend it is something else, Indigenous and other communities will not see any point to it (Sand et al. 2006).

A crucial question to ask at this juncture is how to advance a translational project in a manner that is ethical rather than just pragmatically effective in its approach both to the discipline of archaeology and to descendent communities. Ethics are central in the latter connection because encouraging people to "take archaeology into their lives" necessarily incurs some degree of change in their beliefs about their worlds. One must reflect in depth on one's rationale: why should I want to change people's minds in this way? What could possibly be the benefit for them? Would any such benefit outweigh any immediate or longer-term negative impact the changes might cause? A standard ethical checklist is a useful guide here. How does one's approach sit with questions of justice,

autonomy, non-maleficence (doing no harm), and beneficence (doing good)? The critical thing to remember in making an assessment is that "the perfect is the enemy of the good." One will rarely, if ever, be able to develop an approach that gets a "perfect score" on all counts. Rather, one should aim for a negotiated settlement where everyone gets enough of what they need to satisfy the requirements they first brought to the negotiation (Eco 2004: 6).

Resonance

Conventional approaches to "translation as negotiation" usually seek to achieve what is known as "resonance" because a new perspective ostensibly "needs to be resonant with cultural traditions and narratives to be appealing" (Merry 2006: 39). Attempting to move the archaeological writer towards the descendent reader is undoubtedly seen to be more ethical insofar as it helps redress imbalances of power and reduces the conceptual violence done to local people. Anecdotally, at least some archaeologists seem to believe that this means they have to give up science and replace it with an application of archaeological techniques somehow shorn of the discipline's larger theoretical and methodological framework. Merry (2006: 41), paraphrasing Ferree, points out though that "resonant discourses are less radical than nonresonant ones... [so] resonance is a costly choice because it may limit the possibility for longterm change." This is because deeply ingrained traditions can profoundly restrict the negotiation, thus "ignoring the continual contestation over meanings, their ambiguity, and their susceptibility to change" (Merry 2006: 41).

On this basis, it can be contended that archaeologists should support "a more dialogic analysis that sees the production of meaning as contested, shaped by both group conflict and by the internal dynamics of the discourse itself" Merry (2006: 41–2). Similar arguments can be heard from descendent communities. Even if local people are not interested in much (or anything) that archaeologists might say, they generally still expect archaeologists to "hold up their end" professionally and do reliable, scientifically credible archaeology. They emphatically do not want to see archaeological techniques applied in a theoretical and methodological vacuum in the hope that this or that empirical titbit might appeal to the local community or part(s) thereof. To paraphrase, the reaction is to ask why descendent communities should take archaeology seriously if archaeologists don't. If so-called professionals are not going to do proper scientific archaeology, why bother descendents with a half-baked version? What exactly do archaeologists stand for, if not the integrity of their discipline?

Archaeology will be much better placed to benefit from the intellectual and practical opportunities that dialogue can offer if archaeologists acknowledge rather than deny the inevitability of, first, some level of conflict or disagreement or dissonance between themselves and Indigenous people and other descendent communities and, second, the constant need to justify what constitutes best professional practice. To take full advantage of these insights, translation should ideally proceed from one particular end of a continuum of variation in the degree to which "local cultural forms and practices are incorporated into imported institutions" (Merry 2006: 44). The end from which the discipline should try to depart is hybridization, a negotiated form of syncretism "that merges imported institutions and symbols with local ones, sometimes uneasily" (Merry 2006: 44). Merry (2006: 48) portrays the resulting conceptual mergers as "thickly shaped by local institutions and structures." At the other end of the continuum, where many past and contemporary attempts at collaboration remained lodged, lies "replication," in which "the imported institution remains largely unchanged from its... prototype... [and the] adaptation is superficial and primarily decorative" (Merry 2006: 44). Replications are only "thinly adapted to local circumstances" (Merry 2006: 48).

Through Thick and Thin

It must be emphasized that nonresonant approaches do not have to be only "decorative. . .thinly adapted" replications. There are many ways to adapt "thickly" to local circumstances: archaeologists do not have to discard science, and local people do not have to give up

their own understandings. Oral-historical and archaeological particulars do not have to match precisely to match effectively. Archaeologists should not feel obliged to prove the details of local narratives nor local communities to look to science to confirm their version of events. Such close congruence between accounts may be possible and even sought out in some contexts, but coherence of even profoundly divergent conceptions of the past can also be achieved at a more abstract, conceptual level. Archaeology and local narratives can agree, for instance, that certain broad forms of activity occurred, perhaps even in generically similar places in roughly equivalent sequences. We might see, for instance, shared interest in initial colonization, changes in specific technologies, introductions of specific domesticates or exotic fauna, or the presence or absence of ongoing population movement, perhaps to or from particular directions.

Thick links can also be created along ethical lines, by archaeologists and local communities accepting with humility and good grace rather than resignation or hostility what each may perceive as the other's willingness or unwillingness to vary or surrender certain aspects of their customary practice. A crucial aspect of this situation is archaeologists accepting that local people may be unwilling to share everything they know about the past, such as certain mythological accounts, genealogical details, or locations of particular sites or sorts of sites. Some archaeologists might believe that people will tell researchers everything they know provided the scientists ask the right questions in the right way and will accept what the researchers say provided the scientists use the right wording in the right language to explain themselves, thus enabling archaeologists to be utterly familiar with local custom and practice. Language obviously plays a pivotal role in effective cross-cultural communication (Lilley 2009: 54–8), but in the end, no amount of eloquent translation or even fluency in local languages will convince people to divulge secret or sensitive knowledge they do not want to (or are not in a social or political position to) divulge. Nor will it make them accept archaeological interpretations they do not want to accept. Recognizing this fact rather than attempting to force the issue with locals or flagellating oneself or one's colleagues for failing to communicate effectively can go a long way towards creating a "thick" adaptation to local circumstances.

Meta-interests

One thing that should greatly assist all involved in this process of translation as negotiation is what observers as different as Andrew Fleming and Tim Ingold have identified as local people's and archaeology's shared interest in "the temporality of the landscape" (cf. Sheehan & Lilley 2008). Thus, Fleming (2006: 271–2, original emphasis) describes how archaeologists as well as native dwellers

> *work* in the field... in the open air. An outsider at first, the landscape archaeologist has no choice but to become engaged in the landscape, to become an insider as a consequence of acquired knowledge... Landscape archaeologists are not obsessed with the attainment of hard-edged objectivity always and everywhere, and our field discourse always and necessarily involves thinking about the intentionality and mindsets of people in the past'.

More lyrically, Ingold (2000: 189) understands that

> For both the archaeologist and the native dweller, the landscape tells – or rather is – a story, 'a chronicle of life and dwelling' (Adam 1998: 54). It enfolds the lives and times of predecessors who, over the generations, have moved around in it and played their part in its formation. To perceive the landscape is therefore to carry out an act of remembrance, and remembering is not so much a matter of calling up an internal image, stored in the mind, as of engaging perceptually with an environment that is itself pregnant with the past.

Coming to "translation as negotiation" from this shared "meta-interest" is surely key to the indigenization of archaeology.

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Basic Biographical Information

Percy Trezise (1923–2005), who became a pioneer of Australian rock art research, was born in 1923 and raised in country Victoria. He trained as an RAAF pilot in World War II and after the war became a commercial pilot. Following a stint in the Kimberley flying for the Air Beef scheme, he moved to Cairns in 1957 to take up a position with Ansett Airlines. As a pilot for Ansett and the Cairns Aerial Ambulance, Trezise flew regularly across Cape York Peninsula, the Gulf of Carpentaria, and the Torres Straits, transporting freight and passengers to and from remote cattle stations, bush settlements, and Indigenous communities. In his spare time, he developed his skills as an artist and embarked on a parallel career as a landscape painter and author and illustrator of children's books.

Although not professionally trained in anthropology (or archaeology), Trezise developed a serious interest in Aboriginal culture as a result of his experiences in the bush and was inspired to read the Australian anthropological literature, including the publications of Donald Thomson and Ursula McConnel who had worked in Cape York Peninsula. In 1962 at Karumba on the Gulf of Carpentaria, Trezise met Dick Roughsey (1920–1985), a Lardil man from Mornington Island. This was the beginning of a lasting friendship and professional collaboration between the two men. After retiring from flying in the late 1970s, Trezise engaged full-time in rock art research, writing, and painting until his death in 2005.

Major Accomplishments

Trezise was introduced to Aboriginal rock art in 1960 when he investigated reports of rock paintings south of Laura, in a locality which came to be known as Split Rock. Thereafter, he made unofficial aerial surveys for likely rock art locations while flying over the spectacular escarpments and gorges of the vast belt of sandstone country between Cooktown and the Great Divide. He followed up these aerial observations with arduous dry-season expeditions (on foot) to the remote plateaux and escarpments to locate and record the art.

From the early 1960s, Trezise was a recipient of research grants from the Australian Institute of Aboriginal Studies (AIAS, now AIATSIS, the Australian Institute of Aboriginal and Torres Strait Islander Studies) to document rock art in southeast Cape York Peninsula, following recording methods developed by Fred McCarthy,

then Principal of AIAS. Trezise mapped major rock art sites and localities across the region and applied his artistic abilities to produce annotated, scaled drawings of the art in its various techniques (painting, engraving, and stencilling). Knowledgeable Aboriginal people identified rock art subjects (motifs) which became the basis for his classification system. Trezise was the first to report and document the ubiquitous Quinkan spirit figures of the Laura sandstones and to characterize the area as "the Quinkan region." From the 1960s to c. 1986, following his fieldwork, he deposited (variously) photographic, print, audiotape, and graphic records at AIAS/AIATSIS.

Without Dick Roughsey's assistance, it is unlikely that Trezise would have gained the trust of senior Aboriginal men (including Willy Long, George Pegus, Harry Mole, Caesar Lee Cheu, and Mitchell McGreen) whose contributions were crucial to his research. The men led Trezise to sites, provided insights into Aboriginal culture and rock art, related their traditional stories and languages, and narrated personal accounts of the devastating impacts of white colonization on Aboriginal people. As well as contributing to survey and recording in the Quinkan region, Dick Roughsey, who became a distinguished artist and public figure (he was awarded an OBE in 1978 for his services to Aboriginal art and culture), worked with Trezise in documenting the Lardil culture of Mornington Island (Roughsey 1975). With Wally O'Grady of the Cape York Conservation Council, Trezise and Roughsey lobbied state and commonwealth governments for the conservation and protection of Quinkan rock art. As a result of their extended campaign (see Trezise & Roughsey 1975), the Queensland government created the Quinkan Reserves and introduced cultural heritage management strategies in the region. Trezise's efforts also led to the Commonwealth government listing of "Quinkan Country" on the Register of the National Estate. In Cairns, he played a major role in preventing the establishment of a wood chip industry in the North Queensland rainforests.

Trezise's first major publication, *Quinkan Country* (1969), was intended for a general audience but was reviewed favorably in academic circles. According to MacIntosh (1970: 83) "(*Quinkan Country*) opens up an area practically untouched previously, for studies in Australian prehistory." Trezise's (1971) monograph *Rock Art of South-east Cape York Peninsula* was seminal in Australian rock art studies, and its classification scheme provided a basis for later typological analyses of Quinkan rock art. Trezise published numerous articles and papers, and his final account (Trezise 1993) presents an overview of a lifetime in rock art research. Some of Trezise's theories on Australian prehistory were controversial, e.g., his identification of extinct fauna in Quinkan rock art.

From the outset of his research, Trezise assisted, consulted, and worked with archaeologists and rock art specialists who came to work in the Laura/Quinkan region, including Richard Wright, Andrée Rosenfeld, Josephine Flood, Mike Morwood, Alan Watchman, and the author (NC). He was instrumental in having European rock art specialist Andrée Rosenfeld and her colleagues undertake the Early Man excavation in the early 1970s, a project which provided solid evidence for the late Pleistocene origins of Quinkan art. Stylistic analyses of Quinkan rock art conducted by Rosenfeld and other archaeologists have been much reliant on Trezise's graphic records.

In 1998 Trezise donated his personal archive of records to James Cook University, Cairns. In his lifetime, Trezise received various awards, including a Churchill Fellowship in 1972 for overseas rock art studies and an Order of Australia in 1996. In 2004, he was awarded an Honorary Doctor of Letters degree from James Cook University for contributions to Aboriginal studies and conservation. Trezise's legacy includes his many publications, a substantial rock art archive, and a body of ethnographic and ethno-historic work which is highly regarded (and often cited) by anthropologists and others preparing Aboriginal land claims and native title applications (Cole 2011).

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- ▶ Australian Rock Art
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Trigger, Bruce Graham

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Basic Biographical Information

Archaeologist, historian, theorist, activist-critic, Bruce Graham Trigger was born on June 18, 1937, in Preston, Ontario, and died on December 1, 2006, in Montreal, Quebec. He received his undergraduate education at the University of Toronto (B.A. in anthropology, 1959) and took his doctorate at Yale University (Ph.D. in anthropology, 1964) studying under George Murdock and Irving Rouse. He taught briefly at Northwestern University before joining the faculty of McGill University in 1964 as an Assistant Professor. He rose quickly through the ranks, promoted to Associate Professor in 1967 and then Professor in 1969. He was appointed the James McGill Professor of Anthropology in 2001.

Trigger was the recipient of numerous honors and prizes. He was a fellow of the Royal Society of Canada (elected 1976). He is the recipient of the Canadian Silver Jubilee Medal (1977), the Cornplanter Medal (1979), the Innis-Gérin Medal, Royal Society of Canada (1985), and the Prix de Québec (1991). In 2001 he was made an Officer of the National Order of Quebec and in 2005 an Officer of the Order of Canada for his sustained contributions to the social sciences. He received honorary degrees from the University of New Brunswick (1987), University of Waterloo (1990), University of Western Ontario (1995), McMaster University (1999), and the University of Toronto (2003). He was an honorary fellow of the Society of Antiquaries of Scotland (1981) and an honorary member of the Prehistoric Society (UK) (1991).

Trigger's contributions span the entire range of archaeological theory and practice. He carried out archaeological investigations in Egypt, Sudan,

and Canada (e.g., Trigger 1965). He wrote extensively about the Huron and other First Peoples in Canada and their historical relations with early European settlers (e.g., Trigger 1976a). His study of the development of the concept of sociolcultural evolution (Trigger 1998) over the last three centuries and his writings on other theoretical topics (e.g., Trigger 1978, 2003a) stand as models of meticulous argumentation and clarity. So do his scathing commentary and criticism of universities that succumbing to pressures by the New Right have increasingly allowed business interests and government agencies to set their agendas and put profits ahead of open, critical thought (Trigger 1992).

Major Accomplishments

Trigger's archaeological writings move seamlessly from his monumental histories of archaeological thought through his analyses of contemporary issues in archaeological theory and praxis to his comparative studies of the rise of early civilizations. His histories were written at different scales. In some instances, he used a microscope to prepare a fine-grained analysis of the life and thought of individuals like Daniel Wilson or V. Gordon Childe (e.g., Trigger 1966, 1980a). In other instances, he peered through a somewhat wider lens to discern how particular patterns in the mosaic of archaeology appeared in the past and have developed along different pathways to the present day – such as nationalism, romanticism, or regional research traditions (e.g., Trigger 1984, 1995a). Finally, in the two editions of *A History of Archaeological Thought* (Trigger & Glover 1989, 2006), he stepped back to see the larger picture composed of the mutual interactions and interconnections of the parts with one another and with the wider whole as these developed through time; here, the fine-grained texture derived from studying individuals or regional traditions is replaced by perspective, understanding, and appreciation of the totality as a whole.

Archaeology, for Trigger (1981), is an historical science. Consequently, his discussions of contemporary archaeological theory and praxis, their connections with other disciplines, and their relations to the wider social concerns were typically framed in terms of conception of society and history that viewed them as processes involving emergence, formation, reproduction, and transformation. This was a dialectical conception of society and history that was finely tuned to structural inequalities (e.g., Trigger 1976b). He appreciated the significance of structural inequalities: the diverse understandings (standpoints) that groups with different relations to power have of society and the contested terrains of debate that occur as a result. It was apparent in his writings about ancient societies, how archaeologists understood and wrote about those societies, and how native peoples responded to those interpretations. This was perhaps most evident in his writings about the relations between archaeologists and native peoples – especially "Archaeology and the Image of the American Indian" (Trigger 1980b), "The Past as Power" (Trigger 1985), and "A Present of Their Past? Anthropologists, Native People and Their Heritage" (Trigger & Glover 1988). He believed that the accumulation of knowledge had potentially transformative effects, and his writings on the historiography of the relations between First Peoples and European settlers have had a profound effect on the way Canadian history is taught today.

Trigger's approach to archaeology was systematically comparative. This was as true of the collections he coedited with Ian Glover on regional traditions of archaeological research for *World Archaeology* (Trigger & Glover 1981, 1982) as it was of his *Understanding Early Civilizations* (Trigger 2003b). Here, he was less concerned with the rise of civilization per se than with understanding how the sociopolitical organization, economy, and cognitive and symbolic aspects of early state-based societies were articulated with one another; how these articulations came into being as earlier social institutions and practices were distorted, dissolved, and soon replaced by emergence forms; and the ways in which they provided the social cement that at least temporarily held

together these structures of inequality. He paid close attention to the diversity of early civilizations, since he was well aware that they were not all the same. The book's wealth of empirical detail is matched by that of its theoretical underpinnings and comparisons of the standpoints different archaeologists have put forth concerning the rise of civilization. It is easy to imagine the debates Trigger was having with different colleagues and shows that knowledge is produced not merely through the accumulation of more facts but also honing and refining the frameworks we use to understand them.

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- ▶ Childe, Vere Gordon (Theory)
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- ▶ Cultural Heritage Management and Native Americans
- ▶ Histories of the Archaeological Discipline: Issues to Consider
- ▶ History and Archaeology: Relationship Over Time (US Perspective)
- ▶ Marx, Karl
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- ▶ Nationalism and Archaeology
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Trinh, Hiep Hoang

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Basic Biographical Information

Hiep Hoang Trinh holds a Ph.D. in Archaeology from Vietnam Ministry of Training and Education; an M.A. in Archaeology from the University of Social Sciences and Humanities, National University, Hanoi; and B.A. in History from Hanoi University. He is the principal researcher and head of the Department for Metal Age Studies at the Vietnam Institute of Archaeology of the Vietnam Academy of Social Sciences (VASS).

Major Accomplishments

Since 1995, his work at the Institute of Archaeology has focused on several research areas such as pre-protohistorical archaeology of northern Vietnam, pre-Dong Son cultures in northern Vietnam, Neolithic and Metal Age cultural interaction between northeast Asia and northern Vietnam, and ancient social networks.

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Tsuboi, Shogoro

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Basic Biographical Information

Shogoro Tsuboi (1863–1913) was one of founders of Japanese anthropology and archaeology. He was born in Ryogoku, Tokyo, in 1863. He entered Tokyo University to study biology in 1883 and established the *Society of*

Anthropology with his friends the following year. In 1886 he started publishing the "Anthropological Report" (presently known as the *Journal of the Anthropological Society of Nippon*). He studied abroad for three years, in the UK and France, from 1889. Returning to Japan in 1892, he became a professor at the National University of Science (later, the Department of Science, Tokyo University) and the following year, founded the first anthropology class in Japan. Dr Tsuboi produced a number of excellent students in various disciplines, including anthropology, ethnology, archaeology, and geology. In 1899 he obtained a doctorate of science from Tokyo University. He died in 1913 while attending the Fifth Congress for the Union Académique International (UAI) in St Petersburg, Russia.

Major Accomplishments

Besides being a child prodigy, Shogoro Tsuboi liked collecting, observing, and sketching whatever he was interested in. He also began publishing a journal and setting up study societies as early as his teenage years. In 1883 he wrote his first essay titled "Consideration on Pottery from Meguro Village." After that, he wrote energetically for a variety of academic fields covering anthropology, ethnology, archaeology, folklore, and modernology (the study of modern social phenomena). Over his lifetime, he wrote more than 1,000 essays for a variety of books and magazines for the general public as well as for academic journals published by organizations such as the Tokyo Anthropological Society and the Anthropological Society of Nippon.

In the field of archaeology, besides studies covering all prehistoric times, Shogoro Tsuboi worked particularly on the manners and customs of ancient Japanese people, Ainu culture, *haniwa* figures, and ancient Egyptian culture. Among his numerous works, three stand out as his major contributions to Japanese archaeology.

Shogoro Tsuboi's first major accomplishment was the discovery and identification of Yayoi pottery, later associated with the culture of the first period of farming in Japanese. In 1884, Dr Tsuboi and his friend recovered an unknown type reddish pot from the Mukogaoka shell mound in Yayoi-cho, Tokyo. They found it to be totally different to Jomon pottery in style and decoration and named it "Yayoi"-type pottery after the place name of its discovery while placing it chronologically between pottery of Jomon and Kofun (burial mound) periods.

The second major accomplishment of Shogoro Tsuboi involved the genesis of scientific research and reporting on burial mounds. In 1886 he conducted a very systematic and elaborate excavation of burial mounds in Ashikaga Park, Tochigi. He recorded and sketched in situ every object in the stone chambers as well as the mound. He then published "An excavation report of Ashikaga burial mounds," which had a great impact, not only on later studies of burial mounds but also on excavation methods and techniques in general.

Thirdly, Shogoro Tsuboi did much to vitalize the fields of archaeology and anthropology through academic debates. Among them, the most well known is his "Koro-Pok-Guru" hypothesis. In 1887, Tsuboi proposed that the "Koro-Pok-Guru" (small people from the folklore of the Ainu people of the northern Japanese islands) were the original people of Japan. This initiated a hot discussion on the origin of Japanese people and culture, with his views pitted against those of scientists who supported the hypothesis that the Ainu were the original people. This debate continued until Tsuboi's death in 1913.

Shogoro Tsuboi not only promoted academic fields but also disseminated scholarly knowledge energetically to the general public through plain and clear explanations and with public lectures, sometimes in cooperation with Mitsukoshi Department Store. He loved objects, people, and humor and created a grand network of colleagues with the same interests. He was a titan of knowledge in the liberal atmosphere of the Meiji Period and may be called the first practitioner of public archaeology in Japan.

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Tsude, Hiroshi

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Basic Biographical Information

Hiroshi Tsude is a Japanese archaeologist and historian. He was born in Osaka in 1942. He graduated from Kozu High School and entered Kyoto University to study archaeology under mainly Yukio Kobayashi, who was famed for his empirical research on chiefly tombs and society in Kofun period. After his undergraduate studies, Hiroshi Tsude worked as a research associate at Kyoto University, when he excavated several tumuli in Otokuni district, Kyoto prefecture, to launch his own research of Kofun period.

In 1977 Hiroshi Tsude was appointed to the post of Associate Professor of Shiga University near Kyoto. Shortly thereafter, he moved to Osaka University. As an Associate Professor in the Department of Japanese History at Osaka University, Dr. Tsude fostered many archaeologists working on the Yayoi and Kofun period prehistoric periods in Japan through his research and education. Dr. Tsude continued this work until his retirement in 2005. He was promoted to Professor of the newly established Department of Archaeology at Osaka University in 1988, and the following year, he obtained his doctoral degree in archaeology.

In 1989 Hiroshi Tsude received the Seiryo Hamada award, an award which is regarded as most honorable among Japanese archaeologists and historians.

Major Accomplishments

Hiroshi Tsude has made significant theoretical and practical contributions to the studies of social development and state formation in Japan through his use of Marxist theory and of an anthropological approach based on archaeological analysis.

Early in his career, Dr. Tsude attempted to reconstruct the development of an agricultural society in the Japanese archipelago. He undertook a Marxist analysis of iron farming implements, settlement systems, regionality of pottery in the Yayoi period, and reconsideration of farming families and their land ownership and published this in the volume *Nihon noko shakai no seiritsu katei* (*Formation Process of Agricultural Society in Japan*, see Tsude 1989). In the late 1990s, Dr. Tsude centered his research study on chiefly tumuli in the Kofun period. He attempted to reconstruct the political relationships among chiefs buried in these tumuli through a comparative analysis of the size and shape of the mounds and coffins and typological study of their offerings. This analysis was published in *Zenpokoenfun to Shakai* (*Keyhole Shaped Tumuli and Their Social Background*, see Tsude 2006). In this work Dr. Tsude argued that the Kofun period (third to sixth centuries) was an early state in Japan. This stimulated widespread discussions about state formation processes in prehistoric Japan.

Cross-References

▶ Japan: Indigenous Occupation

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Tupi-Guarani Archaeology in Brazil

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Introduction

Tupi-Guarani archaeology is one of the most studied themes in Brazil and South America, mainly because Tupi-Guarani-speaking peoples, living along the Atlantic coast, were among the first contacted by Europeans around 1500 CE. As a result of this early historical contact, a massive written record has been created about these Indigenous peoples. Ethnohistorical and ethnographic records provide a picture of the Tupi-Guarani as living in large villages organized in regional chiefdoms commanded by political leaders (*caciques*) and shamans (*pajés*). Their economy was heavily based on slash-and-burn agriculture (maize, manioc, beans, and squash, among many other crops), but hunting and collecting has always remained vital. The practice of war and anthropophagy has decisive social significance as a means of acquiring status and power as well as expanding territories through conquering, establishing political alliances, and, mainly after contact, enslaving other peoples.

From an archaeological perspective, the continental occupation of the Tupi-Guarani-speaking peoples can be understood as long-term history, a formidable demographic expansion that interacted with other cultures from prehistoric times until today. The principal question for archaeology is, then, to understand the origins of the Tupi-Guarani culture and establish the archaeological correlates for such a deep historical process.

Definition

The Tupi-Guarani live in several groups and have more than 30 closely related languages. They are widely dispersed in the tropical and subtropical lowlands, a polygon that involves Brazil, southern Venezuela, eastern Peru and Bolivia, Paraguay, northern Argentina, and Uruguay. Although demographic data are unclear, there are estimates up to one million Tupi people just before contact (Fausto 1992: 382-383). Nowadays Tupi-Guarani speakers compose no more than 250,000 people.

Key Issues and Current Debates

Despite the friendly first contacts with the Portuguese and other Europeans, the Tupi soon faced the hardship of slavery and genocide wars, as in most places of the New World. Even so, their widespread language and culture have provided common linguistic grounds (the *nheen gatu* or "general language") for the Jesuit and Portuguese expansion in the South American hinterland and have been persevered, throughout historical times, to this day.

Noelli (1993) has detected two academic trends in Tupi-Guarani archaeology, which he has named *ethnological imperialism* and *archaeological domain*. The first is related to ethnographers like Ehrenreich, Von Martius, Métraux, von den Steinen, Nimuendajú, and d'Orbigny, who synthesized written and iconographic historical documents from the colonial period (made by travelers, missionaries, and military) and which

Tupi-Guarani Archaeology in Brazil, Fig. 1 Métraux (1927) expansion model for the Tupi-Guarani (Modified from Fausto 1992: 384)

were sometimes supplemented by ethnographic observations. These approaches were accompanied by linguistic studies and focused on defining cultural traces and explaining the migratory waves across the continent. It did not take long to realize (e.g., by the accounts of the Jesuit priest Montoya and the French chronicler Jean de Léry) that the correlation between the geometric polychrome-painted style of pottery production and Tupian-speaking groups, highlighting the archaeological dimension of the Tupi-Guarani history.

One of the most important researchers of this period is the French ethnographer Alfred Métraux. His assumptions became rather paradigmatic and have had a strong influence on archaeological research, particularly as regards three focal points: (1) The Tupi-Guarani people's permanent search for the "land without evil," historically known as *yvy marane'y* in Tupian language. This ideology would explain the spreading out of the Tupi expansion throughout South American lowlands. (2) The polychrome pottery style would be linked to the Tupi-Guarani culture, thus indicating the extent of the Tupi-Guarani territory before contact (Métraux 1948). (3) The existence of a cultural boundary somewhere in the area of what is today the state of São Paulo, in Brazil. Such a linguistic boundary separates the Tupi peoples to the north from the Guarani speakers to the south. This linguistic and cultural split would inspire archaeologists to look for differences in technology and style of pottery (Fig. 1).

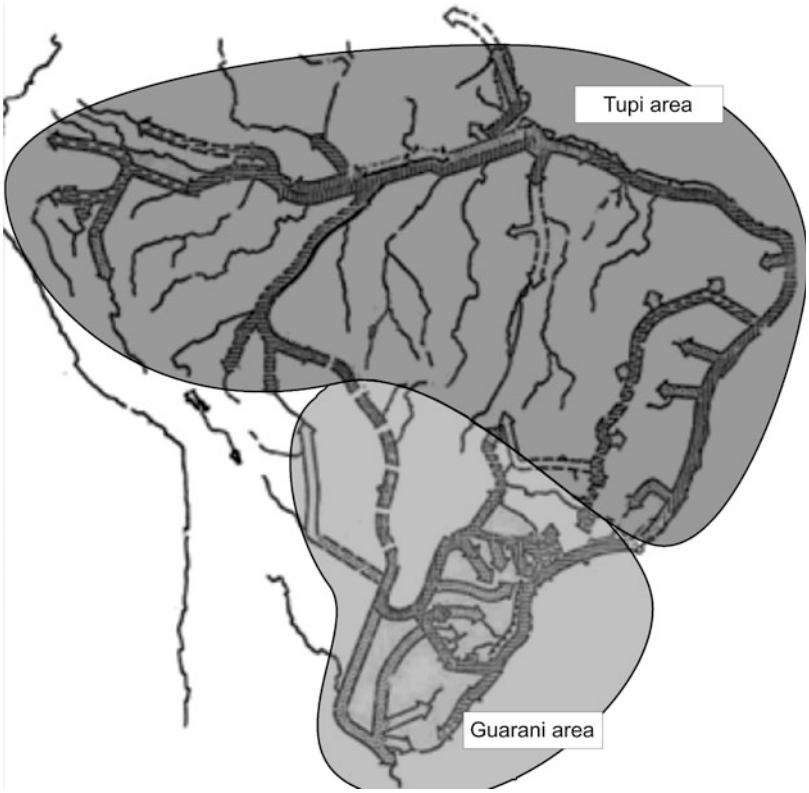
The beginning of the *archaeological domain* is related to the implementation of the National Program of Archaeological Research (PRONAPA), a research project with continental dimensions, coordinated by Betty Meggers and Clifford Evans, from the Smithsonian Institution in the USA, between 1965 and 1970.

The PRONAPA, aiming at large-scale mapping of archaeological cultures (organized in traditions and phases) by its material (mostly ceramic) correlates, has emphasized cultural (material) sequencing and did not put much effort in anthropological or linguistic perspectives. In this sense, the Tupi-Guarani tradition was considered "(. . .) a cultural tradition characterized by corrugated, brushed and polychrome pottery (red and/or black under engobe white or red), secondary burials in urns, polished stone axes and the use of *tembetás*" or labial adornments (Chmyz et al 1976: 146). This dissociation of archaeological material culture from precolonial times and the ethnohistorical and ethnographic record of the (still alive) Tupi speakers has not taken into account the continuity of Indigenous historical processes and has disarticulated the perception of the native peoples' rights, with political consequences (Noelli 1993). This approach changed only after the 1980s when Brochado (1984), articulating radiocarbon chronology, archaeological, ethnohistorical, and linguistic data, sought a vertical historical long-term perspective relating the archaeological past to living native societies and ultimately recognizing that undertaking Tupi-Guarani archaeology in Brazil is to make Indigenous history.

In spite of its merits, the continuous-historical model suggested by Brochado (1984) has received several critiques as regards the relationships between archaeological cultures and ethnic groups. According to Lima (2011), it contributes to the conception of ethnic groups as internally homogeneous, historically continuous, and externally defined by cultural and linguistic characteristics. In the same way, according to Schiavetto (2003), the continuous-historical model has depicted the Tupi-Guarani culture as a homogeneous block unalterable and static, resulting from the indiscriminate use of archaeological, ethnohistorical, and ethnographic sources. Following this perspective, the continuous model has no resonance of contemporary cultural diversity, as considered from an "emic," fluid, and dynamical concept of culture; thus, a variety of "peoples" would hide behind ceramic and linguistic continuity. The debate continues.

Another research focus is the origins of Tupi-Guarani culture, in both cultural and geographical terms. Based on the historical migrations of Tupi-Guarani recorded by chroniclers and voyagers, Métraux (1927) proposed one of the first models in the twentieth century, suggesting the watershed of Paraná-Paraguay as the provenience area, with a migratory movement from south to north shortly before the arrival of the Europeans. More recently, Meggers (1987) suggested that the origin of this culture would be located somewhere on the Madeira River, with migrations to the south and, later, to the north. Following Métraux, Meggers also considered the Tupi-Guarani movement fast and relatively recent, around 500–1000 CE. From the point of view of historical linguistics (based on lexical-statistical method), Rodrigues (1964) suggested that the origin of the Proto-Tupi culture could be the region between the Madeira and Xingu rivers in the southwestern Amazon around 3000 BCE, with further developments and ramifications as they expanded to the east and south, acquiring distinct cultural characteristics.

Brochado (1984), following Lathrap's (1970) "cardiac model" (the idea that the Amazon was a radiating center of cultures), considers that the origins of the Proto-Tupi-Guarani are related to the Amazonian Polychrome Tradition. From the central Amazon, around 3000 BCE, demographic pressure would lead to a process of differentiation and expansion in two migratory waves. The Guarani went south via Madeira-Guapore watershed, ultimately reaching the Paraná-Paraguay Basin, being already well established around 100 BCE. Afterwards, the Guarani reached the Atlantic coast in successive expansionist movements along the lower Parana (Plata) basin, turning north along the shore. On the other hand, around 500 BCE, the Tupi culture would have gone down the Amazon River to its mouth, in a movement from the west to the east, reaching the northeastern shores of Brazil, and then turning south along the coast (where they are usually called Tupinambás). This migration would have been linear and fast, following the Atlantic coastline. About a few hundred years before the arrival of Europeans, these two

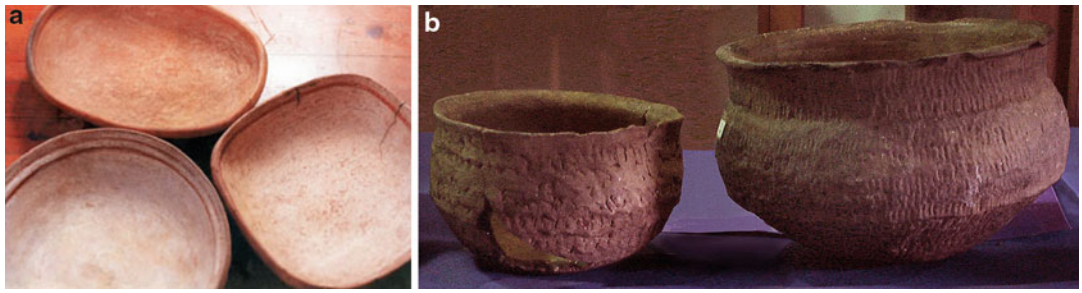


Tupi-Guarani Archaeology in Brazil, Fig. 2 The expansion routes of Tupi-Guarani, with Tupi and Guarani global areas (Modified from Noelli 2008)

opposite migratory waves would have met, configuring a boundary around southeastern Brazil (Fig. 2).

Brochado (1984) and others have identified discrete stylistic differences between Tupi-Guarani pottery assemblages from the southern and northern parts of the country, in close correspondence to the linguistic boundary between the Guarani and the Tupinambá, respectively. Synthetically, Tupinambá ceramics are painted with geometric designs in red, black, and orange, with white or red engobe, in close proximity to the Polychrome Tradition in Amazonia. Tupinambá paintings are extremely well done, with technical refinement and accuracy. On the other side, the southern set called Guarani tradition covers part of the states of São Paulo, Paraná, Santa Catarina, Rio Grande do Sul in Brazil, as well as Uruguay, Paraguay, and the region of northern Argentina. The finishing style of Guarani pottery is predominantly plastic (although painted motifs are always present) with a strict set of vessel shapes and sizes. Pottery decoration employs a variety of finishing techniques such as smoothing, corrugating, ungulating, painting, brushing, slotting, and different kinds of incisions. Despite these differences, it is clear that they belong to the same cultural tradition. In both traditions, the enduring sophisticated iconography suggests enduring teaching-learning relations involving both experienced and beginner potters (Fig. 3).

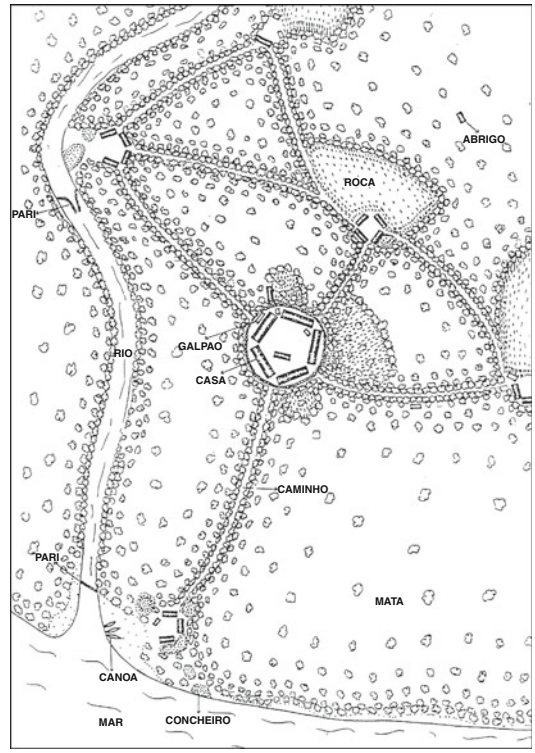
Noelli (2008), following Brochado's model, states that the Tupi-Guarani culture has its origins in a wide region in the southern Amazon area, a polygon to the south of the middle and lower Amazon, between Tocantins and Madeira/Guapore rivers. This proposal was strongly debated by Fausto (1992), who adopted Métraux's ideas about a territorial expansion from south to north. Moreover, Buarque (2009) has dated Tupinambá sites in Rio de Janeiro coast around 900 BCE, suggesting that the territorial expansion of Tupi-Guarani was older than



Tupi-Guarani Archaeology in Brazil, Fig. 3 (**a**) Typical Tupinambá-painted vessels with square and elliptical shapes from Araruama, Rio de Janeiro, Brazil (photo Beto Barcelos). (**b**) Typical Guarani-corrugated vessels with complex shapes from the Collection of Farroupilha Museum, Rio Grande do Sul, Brazil

archaeologists had thought so far and that the origins of this culture should not be on the north, but rather towards southern Brazil. So, up to this point, there is still no consensus about the origins of the Tupi-Guarani culture and its obscure relationships with Amazonian polychrome tradition. From a cultural perspective, both models provide the Tupi-Guarani archaeology with an important sociological foundation, explaining the continental scale of the Tupi-Guarani territorial dispersion as a result of a diachronic historical long-term process of demographic expansion, only disrupted by the European conquest.

The Tupi-Guarani culture expands itself by splitting villages into cells systematically subdivided over time. This process, called "swarming" by Brochado (1984), produces a radial expansion of the territory in gradual population waves, thus occupying the territory in a systematic way, acting socially, politically, and economically in the shaping of the landscape; manipulating botanical species; domesticating animals; intervening on topography; and transforming the environment. According to Noelli (1993) and Assis (1996), the territorial organization of the Tupi-Guarani is constituted by the house (*oka*), where lies the nuclear family; by the village (*amundá* or *teýy*), where the extended family resides; by the set of villages included in a territory (*teko'á*); and by the set of *teko'á* that configures a large territory as a nation (*guará*). By definition, *teko'á* constitutes a set of villages and camps (*tapyi*), interconnected by paths (*piabiru*).



Tupi-Guarani Archaeology in Brazil, Fig. 4 Graphic idealization of a *teko'á*, showing the houses, traps, gardens, ports, jungle, and the pathways linking all the spaces (Modified from Assis 1996)

It configures a territory bordered by landforms such as rivers, hills, and streams. This territorial organization is defined by symbolic aspects and consolidated through political alliances that determine degrees of prestige and social status in relationships between villages (Fig. 4).

In the twenty-first century, Tupi-Guarani archaeology has adopted an Indigenous history approach, integrating and confronting archaeological, ethnohistorical, and ethnographic sources. There is also a concern with the observation of technology and behavioral patterns as a mechanism for understanding the archaeological record. In addition, there is a growing investment in political engagement, adding theoretical reasoning and scientific political agendas in defense of Indigenous heritage and civil rights as regards land reservations and the protection of environmentally threatened territories and heritage landscapes. In this sense, Tupi-Guarani archaeology has overcome the old divide between strict archaeological and anthropological/linguistic perspectives, making it possible to approach the Tupi-Guarani people's history and culture in a holistic way.

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- ▶ Meggers, Betty Jane

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Turkey: Archaeological Museums

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Introduction

As archaeological material in Turkey is legally state property, archaeological museums have played a crucial role in state museum policies. In recent years, the Ministry of Culture and Tourism has been investing heavily in the establishment of museums associated with important archaeological sites. The construction program aims to present the excavation results using modern technology to enrich the visitor experience. New museums also engage in educational programs for their communities and include workshops and other facilities aimed at attracting children's attention and enhancing the value of the museums in their respective regions.

Key Issues/Current Debates/Future Directions/Examples

Museums of Turkey

The first museum in Turkey was founded in 1846 by Fethi Ahmet Pasha at Hagia Eirene, which had

Turkey: Archaeological Museums, Fig. 1 Osman Hamdi Bey is one of the most prominent figures in the development of museums and archaeology in Turkey (Public Domain)

previously been used as a military depot in Istanbul. The museum was later renamed *Müze-i Hûmâyun* (Imperial Museum), and Mr. Edward Goold, who had been teaching at *Mekteb-i Sultânî*, was appointed director. *Asar-ı Atika Nizamnamesi*, the first thorough legislation regarding protection of ancient artifacts, was passed in 1869. The legislation required all parties to apply for permission from the Ministry of Education for excavations on Ottoman soil and banned overseas sales and movement of material while permitting local sales. In 1872, Dr. Philipp Anton Dethier was appointed director of *Müze-i Hûmâyun*. During his directorate, artifacts from the Hagia Eirene were moved to the Tiled Kiosk Museum. In 1874, a second law was passed, which was proved unsatisfactory in fighting (abuse). A new age for Turkish museology began after Osman Hamdi Bey was appointed director of the museum. He played a pivotal role in the preparation of the new legislation for ancient artifacts, which forbade all transactions and export overseas. Istanbul Archaeological Museum, Konya Museum (1902), and Bursa Museum (1904) were also built during his directorate. He also played a crucial role in the first scientific excavations in Ottoman territory as well as in the formation of modern museological standards. Following his death, his brother Halil Edhem Bey took up on the role of director. He particularly focused on the development of museums in Anatolia. The Museum of Turkish and Islamic Arts (1914) and The Ancient Orient Museum (1925), both in Istanbul, were also established during his period (Fig. 1).

Istanbul Archaeological Museums consist of the Archaeological Museum, the Ancient Orient Museum (Eski Şark Eserleri Müzesi), and the Tiled Kiosk Museum (Çinili Köşk Müzesi). The museum complex was opened to visitors in 1891. They house a large number of finds from the Ottoman territory, material from Seljuk and Ottoman eras, and a Children's Museum (Fig. 2).

After the War of Independence, Atatürk paid a great deal of attention to museums and personally contributed to the foundation of several. During the early years of the Republic, numerous museums were made accessible through development and restoration operations on a national scale. Besides construction of new museums, several architecturally significant buildings were converted to museums. Ayasofya (Hagia Sophia), built by the Roman emperor Justinian in 537, was designated as a monument museum in 1935. Another Justinian period church, Chora, was also arranged as a museum in 1945. Topkapı Palace, the seat of the administration from the time of Mehmet the Conqueror was converted to a museum by Atatürk's directive in 1924. The museum in Manisa, the core Lydian territory, was created in 1937 in a *madrasa* built by the famous sixteenth-century Ottoman architect Sinan (Fig. 3).

Ankara Ethnographic Museum, the first museum of the Republic, was opened to visitors in 1930 to display and house the cultural heritage of Anatolia beginning from the first Turkish states and principates to more recent times. Stemming from Atatürk's idea to establish a museum devoted to Hittite civilization, the growing number of Hittite objects brought to Ankara necessitated a large building. For this purpose, two Ottoman buildings were restored to establish the Museum of Anatolian Civilizations, which took its final form in 1968, one building having been reserved for the administrative section. The museum houses various objects from Paleolithic

Turkey: Archaeological Museums, Fig. 2 Founded in late nineteenth century, Istanbul Archaeological Museums complex is still one of the most visited national museums (Photo: Soner Ateşoğulları)

Turkey: Archaeological Museums, Fig. 3 The Museum of Anatolian Civilizations, stemming from Atatürk's idea to establish a museum devoted to Hittite archaeology, later developed into a museum presenting the whole ancient civilizations in Turkey (Photo: Soner Ateşoğulları)

times to the Ottoman period, including many prominent examples from Çatalhöyük, the Assyrian Colonies, and the Phrygian, Lydian, and Urartian periods. In the core Hittite territory, namely, Çorum province, the first museum was established in 1940 in Alacahöyük, the site of the Early Bronze Age royal tombs and a Hittite town. The year 1968 saw the opening of two museums in the region, one in Boğazköy, where capital Hattusa is located, and in Çorum. In the Phrygian capital Gordion, a museum was built beside the so-called Tumulus of Midas in 1964. In Uşak, another Lydian territory, a museum was established in 1970. The repatriated pieces from the so-called Croesus Treasure are displayed in the museum.

The museum directorate in Van Province in Eastern Anatolia, the central town of which covers the Urartian capital Tushpa, was established in 1972 for display after decades of

Turkey: Archaeological Museums, Fig. 4 Three-storied Gaziantep Zeugma Mosaic Museum presents the rich collection of mosaics and other finds from the riverside Roman city of Zeugma

collecting and storage of artifacts under state control. A considerable number of museum directorates established close to ancient cities in Muğla, Aydın, and İzmir provinces provide for effective management of the Aegean heritage in Western Anatolia. Those directorates are responsible for numerous open-air museums just as the Nevşehir and Ürgüp museum directorates in Cappadocia, where many rock-cut churches and underground settlements are found.

The Hellenic and Roman past of Anatolia is present in almost all the archaeological museums in Turkey, but museums in the coastal provinces in the Mediterranean, Aegean, Marmara, and western Black Sea regions are exceptionally rich in this material; examples include Antalya, Adana, Mersin, Hatay, İzmir, Bursa, Kocaeli, Sinop, and Samsun museums. Several inland provinces that have the ruins of prosperous ancient cities like Sagalassos (Burdur), Hierapolis (Denizli), Zeugma (Gaziantep), Pessinus (Eskişehir), and Perre (Adıyaman) also have equally remarkable collections.

The museums in southeastern Anatolia (Diyarbakır, Kahramanmaraş, Elazığ, Şanlıurfa, Malatya, Mardin, Gaziantep), the region comprising a remarkable part of Mesopotamia, house rich Neolithic and Chalcolithic finds brought from numerous excavations in mounds, some of which shed light on the beginning of agriculture and the domestication of animals.

As a result of the careful and meticulous work during 1970s and 1980s, there has been an increase in the number and variety of museums. An Act of 1983 (Number 2863) allowed private museums to be established. Today, there are a total number of 364 museums, 190 of which are under jurisdiction of the Ministry and 174 of which are private museums audited by it, among which are some that have won international awards like European Museum of the Year Award. In addition to these, there are 130 open-air museums under jurisdiction of the Ministry. An increasing number of new museums are no longer alienating and cold spaces, but are structures that host conferences, seminars, social and cultural events, exhibitions, publications for the education, and advancement of the public.

New Archaeological Museums

The momentum that has been generated in the past decade has allowed the Ministry to restore over fifty museums and recently to construct several new ones including Gaziantep Zeugma Mosaic Museum (Fig. 4), the world's biggest mosaic museum (2011), Kırşehir Kaman Kalehöyük Archaeology Museum (2009) (the design and construction expenses of which were

covered by the Japanese government), Sivas Museum (2009), Eskişehir Eti Archaeology Museum (2011), Aydın Museum (2012), and Tokat Archaeology and Ethnography Museum (2012).

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- ▶ Cultural Heritage Management and Submerged Sites
- ▶ Hellenistic and Roman Anatolia, Archaeology of
- ▶ Regional/Site Museums
- ▶ Southeast Europe: Archaeological Museums

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Turkey: Domestication

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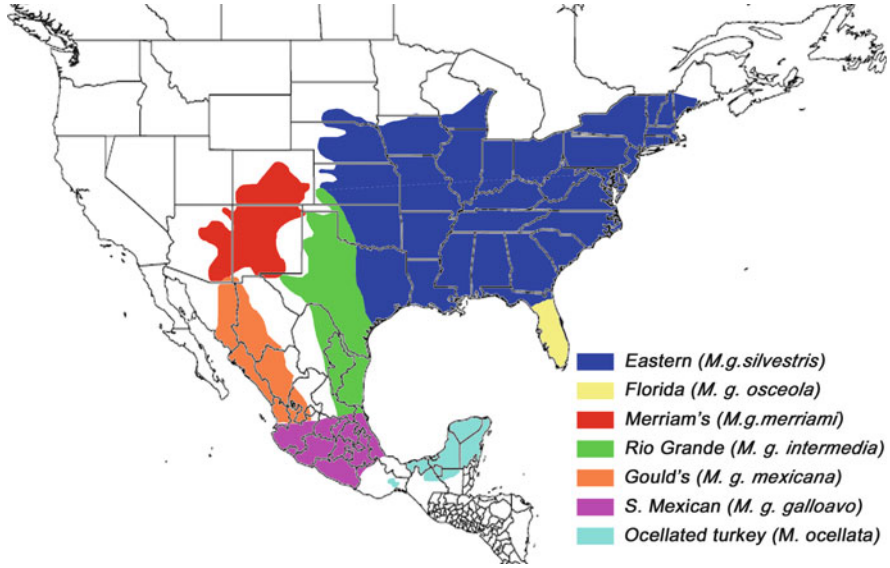
The turkey (*Meleagris gallopavo*) is a member of the order Galliformes, which include chickens, guineas, peafowls, and other terrestrial birds. Within the family Meleagrididae, there is one living genus, *Meleagris*, with two living species: *Meleagris gallopavo*, the North American turkey, and *M. ocellata*, the ocellated turkey.

Five wild turkey subspecies currently occupy distinct territories in North and Central America (Fig. 1) (Dickson 1992; Schorger 1966): *M. g. silvestris* (Eastern wild turkey) inhabits the deciduous forest and oak-savannah of the eastern half of the USA, *M. g. osceola* (Florida wild turkey) resides in evergreen and tropical areas of southern Florida, *M. g. intermedia* (Rio Grande wild turkey) ranges over the south central plains and north-eastern Mexico, *M. g. merriami* (Merriam's wild turkey) ranges within the montane-woodlands of the Southwest USA, and *M. g. mexicana* (Gould's wild turkey) occupies the pine-oak forests of southern Arizona and New Mexico, and north-western Mexico. A sixth subspecies, *M. g. gallopavo* (South Mexican wild turkey), which occupied south-central Mexico, is now thought to be extinct (Dickson 1992). The closely related ocellated turkey currently occupies Mexico's Yucatan peninsula and parts of northern Belize and Guatemala.

Meleagrids are characterized by their relatively large-size, naked, carunculated heads and broad square-ended body feathers. Mature males are generally larger than females, with a breast sponge (a fibrous mass of tissue over the breast), a beard (a hairlike appendage on the breast), an enlarged frontal caruncle (or snood, the fleshy protuberance at the dorsal base of the beak), and enlarged tarsometatarsals spurs. As part of the male behavioral displays, the skin of the head and neck can change color rapidly to blue, red, and white,



Turkey: Domestication, Fig. 1 Assumed original distribution of the wild turkey subspecies in North America (Based on Schorger 1966)

coupled with expansion and lengthening of the frontal caruncle (Dickson 1992).

Most heritage breeds developed in Europe (e.g., Norfolk Black, Cambridgeshire Bronze, White Austrian, Buff, Blue, and Ronquieres) are smaller than North American wild turkeys, while those raised commercially for consumption (e.g., Broad-Breasted Bronze and Broad-Breasted White) tend to be larger (Marsden 1971). In general, turkeys raised for meat have white plumage, are top-heavy, with hypertrophied breasts and thighs, and reach sexual maturity faster than wild turkeys. Since 1940s, turkeys have been under intense selection for weight, conformation, and an ability to be raised efficiently in confinement, resulting in an overall decline in reproductive abilities and fitness, and a reduction in genetic variability.

The turkey played an important spiritual and secular role in precontact indigenous cultures of Mesoamerica and the American Southwest. In Mesoamerica, sporadic evidence of turkey use appears as early as 800–100 BCE (Breitburg 1988). Domestic turkey stocks were established by CE 180 within the Tehuacán valley and intensify until the Columbian era (Flannery 1967). Current archaeological and genetic evidence suggest that the Mesoamerican domestic turkey was locally domesticated from *M. g. gallopavo* populations (Speller et al. 2010). From historical accounts, it is clear that turkeys were raised in large numbers at many Mexican sites for both food and tribute to local leaders (Schorger 1966). The spread of turkeys into the Yucatan and further south may have begun as early as the late Preclassic (300 BCE–CE 100) (Thornton et al. 2012), becoming more widespread just prior to the arrival of the Spanish. In general, few archaeological turkey bones are found in Yucatan sites (Schorger 1966); instead, large quantities of ocellated turkey bones are recovered in the Mayan region. Turkeys were widely distributed within Central America by Columbian times, reaching Peru in the late 1400s, Ecuador around CE 1587, and Chile around CE 1650 (Crawford 1992).

The Southwest domestic turkey seems to have a separate origin from the Mesoamerican turkey. Previous hypotheses assumed that initial domestication either took place in situ (with

M. g. merriami as the progenitor) or in Mesoamerica with subsequent dispersal of domestic turkeys into the Southwest (following the general pattern of cultigens like maize, squash, and beans) (Breitburg 1988). However, ancient and modern DNA analyses suggest the that either the Eastern or Rio Grande wild turkeys (*M. g. silvestris* or *intermedia*) represent the wild progenitor of the Southwest domestic turkey, with previously domesticated stocks being introduced into the region by 200 BCE (Speller et al. 2010).

The Ancestral Pueblo, the subsistence horticulturalists of the Colorado Plateau, were the predominant exploiters of turkey in the region. The first concrete archaeological evidence for domestic stocks in the Southwest begins c. 200 BCE–CE 500, with the recovery of turkey coprolites from the site of Turkey Pen Ruin, UT, indicating that turkeys were being confined and raised within a human habitation (Breitburg 1988). During the Basketmaker Phases (100 BCE–CE 750), evidence for turkey exploitation and husbandry is restricted to some loose feathers, feather blankets, a few turkey bones, and some complete desiccated bird, indicating that turkeys were prized more for their feathers rather than for their meat (Munro 2006). After CE 900, there is intensification in turkey husbandry, evidenced by greater quantities of turkey bones, as well as higher frequencies of butchery marks, suggesting that turkeys were playing a more important role as a food source, especially in the Northern San Juan region (Driver 2002). This pattern continues until the sixteenth century when the effects of disease and conflict associated with Spanish Colonialism, as well as the introduction of sheep and chicken, all contributed to dramatic declines in local turkey husbandry during the eighteenth and nineteenth centuries, perhaps even resulting in the complete extirpation of the Southwest domestic turkey.

Modern domestic turkey breeds worldwide seem to be descended from the Mesoamerican domestic turkey, and not the Southwest domestic breed. Turkeys were transported from Mexico to Europe in the early sixteenth century, where they quickly spread across the continent. Over the following centuries, several varieties were developed in Europe and subsequently imported onto the US Atlantic Seaboard in the eighteenth century. Hybridizations between the European domesticates and the wild turkeys were widespread with heterosis producing much larger and more vigorous animals (Crawford 1992). These hybrid varieties eventually become the forerunner to the Narragansett, Slate, and Bronze turkeys of today (Marsden 1971).

Cross-References

- ▶ Genetics of Animal Domestication: Recent Advances
- ▶ Maya Geography and Culture: Ancient and Contemporary
- ▶ Southwest United States and Northwestern Mexico: Geography and Culture
- ▶ Tenochtitlan (Aztec): Geography and Culture

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