




The Study of Adoption in Archaeological Human Remains

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Abstract: This review aims to establish criteria for identifying an adoption process in an archaeological context. We define adoption as raising an individual who does not belong genetically to the family. Adoption appears in different moments of past societies, and when establishing a “family” nucleus burial place we must consider certain social behaviors, such as burials under the houses, collective burials, or laying bodies in specific positions. After observing these signs, we are carrying out a genetic analysis, in order to confirm a biologically related family nucleus. These traces have been traditionally linked to family nuclei because they have been found previously in burials where biological kinship was confirmed. However, there can be cases where, after carrying out the genetic analyses, it is confirmed that certain individuals are not genetically related. In such cases, an adoption case cannot be ruled out. These cases are not easy to identify due to the differences between societies and cultures, so more in-depth studies should be carried out on the type of funeral practice in which these human remains are found to be able to discriminate an adopted individual from one who was not adopted. Therefore, the study of adoption should be carried out based on an in-depth knowledge of the cultural background, before using a powerful tool such as ancient DNA technology.

Keywords: adoption; archaeological site; genetics; families; kinship; burials



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1. Introduction

Adoption is understood as a process by which a person assumes the upbringing of another person, usually a child. It is not ruled out that the adoption may be of an adult. However, the concept of “adoption” has changed throughout History. The modern form of adoption arose in the United States in the mid-19th century, when the American Civil War resulted in unprecedented overcrowding in orphanages and founding homes (Gomes et al. 2021). Consequently, the Orphan Train movement of 1859 arose, which eventually sent some 2,000,000 children from urban centers to rural eastern regions; however, the children were generally hired rather than adopted (O'Connor 2004).

Another concept that has changed in different times and societies is the family or family nucleus. Currently, it is understood in Western societies as a set of individuals who are genetically related, such as parents, children, grandparents, or uncles. Generally, we refer to a direct and generationally close family, but there are exceptions with family members further away from the family tree, such as a third cousin, for example. In a restricted sense, the “nuclear family” can be considered a group or a threesome comprising a father, a mother, and one or more children. There are cases of individuals who are not genetically related representing a role in the family of the adoptive child (Sumaza and Rodríguez 2003). In this review, we will refer to these concepts of family or nuclear family and we will use it under this definition.

Throughout History, different forms of the adoption practice have appeared. The oldest well-documented adoption practices date to ancient Mesopotamia and Rome (Lindsay

2009). Although there is no record of adoption in most ancient chronological periods, it is very important to note that this does not mean that the phenomenon of adoption did not exist, and this will have consequences for approaching an archaeological find.

Adoptions have been detected in many cultures throughout History but for different purposes. While the European Western idea of adoption focuses on extending family lines, the evidence suggests that the objective of this practice in Asiatic cultures was to ensure the continuity of cultural and religious practices (Baelo Álvarez 2013).

From the moment of adoption, this individual is part of the new family and, therefore, will learn and carry out the traditions of the new family nucleus. Among these traditions, there are funeral or burial acts and practices after the death of an individual. These acts have been widely studied since the first populations of which we are aware. Thus, after the death of an individual from the group, as a religious–cultural practice, the body was buried or taken to a sacred or special place (Baelo Álvarez 2013). These data will be very useful for our bibliographic review, which will consist of finding possible facts of adoption in archaeological sites. This is so because we will have a lot of information about different types of ceremonies and burial rituals and how they focused or did not focus on the family nucleus, in such a way that we can discriminate family groups between different burials.

Given the widespread cult of death in almost all cultures, human remains of ancient populations have been found that, through genetic studies, have shown that not all individuals are related. One possible interpretation is to think that it could have been an act of adoption. For example, there are cases of collective (simultaneous) burials, supposedly of a family, whose individuals were not related, where the family hypothesis was ruled out with molecular analysis (Palomo-Díez et al. 2018). Adoption cannot be talked about in all cases in which we find unrelated individuals; it will be the researcher's task to collect as much information as possible to be able to discriminate whether or not there is an adoption case.

Depending on space and time, adoption has undergone significant changes and modifications, following the characteristic cultural norms and values of each of the societies in which it has manifested itself as a legal–social act. From the nineteenth century (XIX century), adoptive parenthood acquired enormous relevance, interest, and social visibility. All this is a consequence of the decrease in fertility rates, the incorporation of women into the labor market (the average age at which they decide to have children was postponed), the separation of marriage from reproduction, social changes in maternity (abortion and contraception), and the increase in marital infertility rates, but adoption was already carried out in ancient societies as previously mentioned (Hernández et al. 2003).

The analysis of genetics has had a great impact on society in the field of adoption. As a result, adopted people can know who their biological parents are. The right to identity implicates a wide range of ideas, among which is the right to know one's biological origins. In terms of adoption, in Spain, for example, this issue was overcome with the entry of Law 54/2007 of December 28 on international adoption, which led to the recognition of this right for adopted children (Echegaray 2020).

At the moment, genetic studies of parents concerned about their genetic descendants' health are increasing. Diseases that may be in the parents as carriers who do not suffer from them and a high probability of passing on mutations that may lead their children to have a disease or malformation affect the parents' decision to adopt (Joseph 2021).

A typical situation could be families formed by a couple with descendants of previous marriages and/or relations. However, this case could be assumed as a special type of adoption, where one or both members of the couple “adopt” the offspring of the couple. In these cases, the cultural concept of family is not consistent with the biological concept of kinship. As for marriage between people of the same sex, in the same way as divorce, the simple relationship of a couple does not make sense analyzed from a genetic point of view unless the offspring of the couple is studied. In this case, we can find cases where only one of the members of the couple has a biological relationship with the descendants of the family nucleus, or, in the case of marriage between persons of the same sex with adopted descendants, where there is no biological link with the descendants (Gomes et al.

2021). From a forensic point of view, many difficulties can be imagined when it comes to identifying a person whose parents or biological descendants are unknown. To solve this, many databases have been created that are used as tools to register personal DNA profiles, which will make statistical analyses between profiles of relatives and individuals to find matches (Carracedo et al. 2010).

These same situations could have occurred in ancient societies along with facts such as not defining the family nucleus as we currently do and, for example, the fact that the family nucleus refers to a small region in which the family members live together. To this, we add the previously mentioned cases of finding family sites where the individuals are not genetically related or individuals in different sites that are genetically related. Due to all this, the question arises as to how we know whether we have an adoption case at a site. Our objective is to collect all the information possible to be able to determine if it is an adoption case or not.

2. Adoption: The Evolution of the Concept

Adoption has been practiced throughout Human History with its legal, social, and ethical implications (Paulissian 1999). Legally considered as taking an individual born to others as one's descendent, adoption dates to ancient times, although the procedure has considerably changed over time and is not common to all cultures (Eugena 2015). The process is usually legal, but in some cultures adoption happens by social ritual. As part of the process of adoption, the adoptee's legal relationship with the biological parents may be terminated (David 2003).

There are plenty of motives for a family to adopt an individual, child, or adult. The death of parents from disease, famine, or war can contribute to the possibility that an individual, mainly a child, be adopted. However, the motives to adopt have been changing accompanying the ethical, social, and legal changes in each society. Some cases of adoption in ancient societies are briefly described below, as well as the main reasons for this practice (Baelo Álvarez 2013).

2.1. Ancient Mesopotamian Society (Approximately 3250 b.C.–539 b.C.)

According to Eugena 2015, there were a significant number of orphans or abandoned children in ancient Mesopotamia. The ancient Mesopotamians had laws, social customs, and traditions that tried to protect the rights and interests of both the adopters and adoptees and the adoption contract was documented and corroborated by witnesses and sealed on tablets (Paulissian 1999).

The most famous law code is the Codex Hammurabi where, regarding adoption, it could be read, for example: "If a man adopts a child and to his name as son, and rear him, this grown son cannot be demanded back again. If a man adopts a son, and if after he has taken him, he injures his foster father and mother, then this adopted son shall return to his father's house. If an artisan has undertaken to rear a child and teaches him his craft, he cannot be demanded back" (excerpt from the Codex Hammurabi, lines 185–188).

The most common form was adopting a newborn baby. Concerning adults, they could become part of another family by their own will, called "arrogation" (Nemet-Nejat 1998; Eugena 2015).

The reasons ancient Mesopotamians adopted children were analogous to modern ones. Childless couples adopted orphaned or abandoned children to give them protection and family. It was also common for couples with their sons and daughters to adopt a son or a daughter, who would have the same civil rights as biological children, including inheritance rights. According to Eugena (2015), slaves could be adopted too.

Several adoption documents were found in different Near Eastern cities. One main difference from the law codes is that this information does not only act upon parent–child adoption but also sibling adoption, as well as the fact that women could also adopt (Vromans 2017).

2.1.1. Adoption in Mesopotamia

One of the characteristic features of the ancient Mesopotamian civilizations that emerged from the lower channels of the Tigris and Euphrates rivers was the enormous influence that these civilizations exerted on the spiritual and material development of humanity.

Thanks to compiling work, all the traditions and social customs of the time were established in writing, to regulate and standardize private behavior in an agricultural livestock society, in which labor and commerce were the mainstays of its economy and the basis of social and religious life (Baelo Álvarez 2013).

Among them, we highlight adoptive paternity and surrogate motherhood, contractual figures, with the purpose and social utility of perpetuating the family (religious) domestic cult and transmitting *post mortem* the heritage of the father of the family (indivisible and inalienable collective assets) in the absence of descendants, successors, or heirs.

In this way, the father of the family in the absence of a descendant (either a man or a woman), to fully transmit all patrimonial assets and designate an heir and a usufructuary thereof, could adopt a third party (a member of another family that will have numerous children and that will give up one of them for adoption), a foreigner, or, exceptionally, a slave, who, to obtain their freedom or modify their personal and civil status, had to compensate the adopter economically.

The adoption also had a religious character, since in the absence of descendants the adoption served to perpetuate the domestic cult of the ancestors, perform their funeral obsequies, and ingratiate themselves with the gods (redeem the sins of the deceased) through offerings and sacrifices, especially taking into account the role played by family deities in the protection of the community.

Rules were already written on when an adoption could be dissolved and in which cases it could not. Examples of these cases, respectively, are as follows:

- When there was violence on the part of the adoptee towards the adoptive family, they would be returned.
- When the adoptee learned the family trade, he was not able to return to his family of origin.

In addition, adoption contracts were written. Within this period, we can differentiate different societies in which the adoption fulfilled some or all of the purposes explained above.

In Babylonian society, the social function of adoption as a contractual figure was patrimonial (transmit assets) and related to succession (institute an heir in the absence of descendants) in its private sphere; in its public sphere, it was eminently religious (perpetuating the domestic cult and externalizing the fiction of creating blood ties to the son who is not blood by nature).

Hammurabi's Code, with a compiling and instructive purpose, regulated the duties, rights, and obligations of adopters and adoptive children. In turn, and in the absence of descendants, gestation contracts allowed the wife (since she was sterile) to provide her husband with an heir through a surrogate or surrogate mother.

In the ancient city of Nuzi (Mesopotamia, present-day Iraq), any type of sale, donation, or commercial transaction of a family patrimonial asset (*res extra commercium*) was presented under the legal fiction of adoption. Its purpose was patrimonial (transmission of family assets), related to succession (designate an heir), religious (perpetuate domestic worship and carry out funeral obsequies), and private (ordering *inter vivos* or *post mortem* services, such as assisting, caring for, and caring for the adopter in his old age).

Lastly, the adoptive institution in Nippur (Mesopotamia, present-day Iraq) did not have a succession purpose but was patrimonial (purchase contract) and eminently social (mobility or ascent of the adoptee on the political, religious, and economic scale). The gestation contracts (as a "reproductive act") would replace the absence of descendants and heirs since the father of the family and not his wife (as was the case in the city of Nuzi) was the principal party.

2.1.2. Ancient Assyria (Approximately 2025 b.C.–609 b.C.) and Babylonia (Approximately 1894 b.C.–539 b.C.)

In the case of ancient Assyria and Babylonia, even though a marriage that failed to generate a male son heir could be officially dissolved or a second wife could be taken to bear a son as an heir, the adoption of a child was a common practice (Paulissian 1999).

Similar to what happens today, another common reason was the desire of the adoptive parents to have a son/daughter who would support them in their old age and perform the religious rites required upon their death. This was the reason why eunuchs of the royal palace and the females dedicated to religious celibacy also adopted children. However, a craftsman could have adopted a male heir for apprenticeship to guarantee the permanency of the family business (Paulissian 1999).

Not many other cultures in the ancient Near East have reported on adoption. For example, there is no evidence of adoption in the Hittite Empire (Vromans 2017).

2.2. Ancient Egyptian Society (Approximately 3200 b. C–31 b.C.)

Egyptian law codes are not known; however, there are pieces of evidence indicating their existence. The presence of adoption in Egyptian law can only be endorsed by support from legal written sources. It is clear from these scarce literary examples that direct lineage heritage was very important to Egyptian culture, and succession was the main motive for adoption (Teeter 2017; Vromans 2017). As an example, a letter refers to the scribe Nakhtemmut as having “poor character”: “he is “not like a human being” because he has not caused his wife to become pregnant “like his fellow men. (. . .) And what is worse, he has not even adopted an orphan to remedy the situation” (Teeter 2017). Adoption in Egypt was not only a way to add to one’s family, but, legally, it was an accepted way to pass an inheritance of goods (or even high office) to someone who was not in the direct line of descent, and so in some cases adoption had nothing to do with fertility (Teeter 2017). This tradition was verified in ancient Egyptian society, at least until the year 639 A.D., when Amr ibn al-As conquered Egypt and, presumably, prohibited adoption.

The studies and investigations that have been carried out in the different archaeological sites of the Egyptian Empire and analyses of the papyrological, normative, and literary documentation present in the historical archives certify the presence of the adoptive institution during the last stage of the Old Kingdom of Egypt for dynastic purposes, political and religious. Before this stage, no reference was found in this civilization that proves the existence of the adoptive institution.

This conclusion was reached by the discovery of the French archaeologist Georges Legrain of a series of adoptive stelae, which give off a significance of adoptive paternity in the religious and dynastic context of the ancient Egyptian civilization of adoption to enthrone the “Divine Worshipers” of the Dynastic god Amon-Ra (among other deities). Through adoption, the political power and tacit hegemony of the city were ensured over the rest of the territories of Egypt (it was an instrument of political domination and dynastic consolidation). It was also considered that adoptive paternity during the Old Kingdom of Egypt had a patrimonial and succession purpose (compatible with its religious, political, and dynastic nature); the adoptee did not lose the ties that united him with his natural family and preserved his name and rights to the succession of his father by nature.

During the Ptolemaic dynasty, in the late stage of the historical period of Greco-Roman domination we find a series of manuscripts and documents written on papyrus that confirm the legal nature and contractual nature of adoption in Egypt by allowing a third party to, whether a man or a woman, a relative or a stranger, submit a minor under their power through the contractual figure of adoption.

In all the adoption contracts analyzed, a series of clauses were stipulated regarding the obligatory nature of the adopter to raise the minor that they were going to adopt, take care of them, educate them, and establish them as heir to the family patrimony upon their death.

2.3. Ancient Greek Society (Approximately 1200 b.C.–146 b.C.)

Adoption is an important institution in Greek life. Greek marriages were characterized by endogamy, probably to maintain the integrity of Estates, which were transmitted by inheritance through the male line. In order to succeed in an Estate, an heir needed to be recognized as the deceased's legitimate descendant. Either a natural or an adopted son could inherit without further objection ([Lindsay 2010](#)).

The original aim of adoption was thought of as a device to ensure succession in the male line when there were no legitimate male heirs. The consequence of such an arrangement was that the adoptive son inherited all his father's possessions and had to maintain his social and religious obligations just like an authentic son. Generally, in fourth-century cases at Athens, an adopted son was selected from near relatives. There was a preference for the adoption of agnatic relatives. Moreover, it was common to adopt a son or sons for marriage to the biological daughter or daughters.

Inheritance seems central, and it is significant whether or not the adopter died with legitimate sons. If there were none, the adoptive son became the heir, also assuming debts and other obligations related to the role. If there were other children, born later than the adoption, then the adopted son would receive a daughter's share ([Lindsay 2010](#)).

Athenian adoptions of the fourth century b.C. appear to have the same focus as those of the fourth century b.C. during the high Classical period. Adoption enabled a rich person without descendants to continue his line and to ensure that his interests were protected in old age. In the case of both Greece and Rome, adoption appears to have been, essentially, for the rich people ([Lindsay 2010](#)).

Models of Adoption in Ancient Greece

In ancient Greece and its city-states, two different models of social, civil, and family organization coexisted: the oligarchic and martial system of Sparta as opposed to the model of Athens and the Cretan city of Gortyna.

In the Spartan model, due to the characteristics of its iron sociopolitical organization (in which all children were the property of the State that was in charge of their education, upbringing, and guardianship with the intent to form vigorous, obedient, and courageous soldiers), adoption was not contemplated as a social institution and filiation or kinship was dependent on the family, whose social function was eminently reproductive and economic.

Education was based on discipline, obedience, and uniformity. Citizenship rights were obtained by the mere fact of being born in Sparta, but full citizenship was only achieved after passing different degrees, such as joining the army (with the category of citizen-soldier), accessing a plot of arable land, or contributing to banquets for social or religious groups ([Baelo Álvarez 2013](#)).

2.4. Ancient Roman Society (Approximately 753 b.C.–476 a.C.)

In Rome, the term was *adoption*, which also comprehended *adrogatio* when an adult was adopted as a son *homo sui juris* that was not in the power of his parent or was himself a paterfamilias. Both adoption and *adrogatio* gave the adopted individual the same obligations and privileges as a birth child, and they were legally entitled to inherit and carry on the family name ([Eugena 2015](#)). In Rome in the first century A.D., a prosperous but childless adult who wanted an heir would adopt a postpubescent male, often a slave, to be his son ([Andrews 2004](#)). Indeed, adoption was practiced as a way of securing an heir in ancient Rome. The emperor Trajan, for example, adopted Hadrian, who succeeded him as emperor in 117 A. D. Octavius Augustus was the adopted heir of Julius Caesar (posthumously adopted) through the process of *adrogatio*. He was Caesar's nephew. Other adopted Roman emperors were Tiberius, Caligula, Nero, Antoninus Pius, Marcus Aurelius, Hadrian, and Trajan ([Mitchell 2007](#); [Eugena 2015](#)). In the case of politicians, adoption worked also as a technique that enabled the different ideologies of succession to coexist for hundreds of years. Indeed, adoptions often seem to have happened simultaneously with the newly adopted son being married to a biological daughter of the family, at least in the case of

imperial adoption practices (Mitchell 2007). Although there is very little evidence of this practice occurring with consistency among the poorer classes, this type of adoption system was a tactic frequently employed by the imperial families (Mitchell 2007).

According to Eugena (2015), firstly, only men could adopt according to their paterfamilias status. This changed later (second century A.D.), and women were also permitted to adopt.

According to Mitchell (2007), although sporadically employed by Byzantine emperors, it seems to have disappeared in the West once the Germanic kingdoms replaced the Roman imperial administration.

2.5. Ancient Muslim Societies

Children could also be received into a family by a form of adoption known as “acknowledgement of parenthood”. If there were already children in the family unit, the adopted child could not inherit family property (Mitchell 2007).

3. The Archaeological Site of Family Nuclei

Since the first indications of burial rituals, for example, in the Paleolithic with *Homo neanderthalensis*, a lot of information has been collected from different societies through the knowledge of these rituals, since they provide a wealth of archaeological information. Burials take different forms depending on local customs and traditions, as well as the religious background of the deceased and their family (Walter 2005; Pomeroy et al. 2020).

From the beginning of research at the end of the 19th century to the present, it has been one of the most significant aspects of these societies, being used recurrently as a basic element in the definition of culture (Aranda Jiménez et al. 2007). In recent decades, the studies carried out on these necropolises have had as their main objective the analysis of the social structure of these populations. Characteristics such as the type of burial, the quantitative and qualitative variability of grave goods, and the paleopathology and activity patterns of the buried individuals have been used to propose a highly hierarchical society organized into social classes (Aranda Jiménez and Fernando 2006). We will use this information found in the deposits to discuss, with a genetic analysis, which corroborates the family relationship, if we can determine certain funeral rituals as typical of family nuclei.

3.1. Types of Burials

Before starting to talk about family sites, it is opportune to differentiate and define two types of burials: multiple burials and collective burials. Multiple burials are those that contain several burials carried out in the same funeral act or in very close time and space and that, therefore, reflect an “episodic” character and, consequently, are of a certain exceptional nature, remaining intact after the obsequies that accompany them to the deposit of the bodies (Andrés Rupérez 1998). The interpretation of a tomb with several bodies as multiple burials has the difficulty that comes with reaching the taphonomic appreciations that certify the simultaneity or the temporal proximity of the different burials (Chambon and Jean 2007).

In contrast, collective burials refer to burials carried out in the same space but at different times. In examples of this modality of burials, it is more evident that most of these tombs host, above all, female burials with children or only female ones. Therefore, multiple burials respond to a different concept from collective burials carried out in natural shelters, megaliths, or even large graves used as deferred-use pantheons. This justifies the three basic differences that characterize these multiple burials compared to collective ones: the smaller the number of individuals that they incorporate, the smaller the size of the chambers and the lack of access to them. While the collective graves are designed to be able to be reopened, the multiple ones are designed to be sealed or protected by an ephemeral cover, which is removed when the death of the last individual that was planned to be buried occurs. This practice facilitates the conservation of the bodies in anatomical connection when the skeletonizations take place in a crowded environment and allows for a deepening of the taphonomic reading (Chambon and Jean 2007).

3.2. Funeral Rituals

Taking these definitions into account, we can differentiate between the different deposits that we can name. In this way, in this section we will focus on seeing the different burial rituals that occurred in different times and cultures in family nuclei; that is, we will be able to intuit only with a first look at the site and without laboratory information if that site may belong to a family core. Our objective is to know well the rituals carried out in the family nucleus whose relationship has been genetically proven so that when we find one or several individuals who are not related to the family nucleus we can relate them to an adoption fact and therefore show that they belong to the family nucleus.

It is worth mentioning that this study will have a lot of interpretation. There are many societies whose family nucleus is not like the one we defined at the beginning of the review and whose individuals are not genetically related. These societies currently also exist and have a much broader concept of family. Small tribes of unrelated individuals were treated as family units and thus carried out their burial rituals ([Sánchez 2008](#)), for example, some tribes in Ethiopia or in Uganda regions, with traditions and funeral ceremonies. The ceremonies consist of dances, songs, and decorations for the deceased who is buried with the rest of the deceased members of the tribe ([Abrante García 2022](#)). For this reason, apart from the burial rituals that we will see below, it will also be necessary to take into account the customs and types of societies to see if these burial rituals that we will name can be compared to those of the problem site. Next, we will name burial rituals that have been found in family nuclei.

One of the rituals that have been seen to be related to family nuclei is to bury individuals under the family home as a cultural–spiritual fact that dead relatives continue to belong to the family. Examples of this were found in Tamtoc (Tamuín, México), complex urban societies between the 2nd and 15th centuries of our era, which left testimony of their cultural identity through the vestiges of their ancient city. The forms of human burial characteristic of these societies during the Classic (650 to 900 AD) and Postclassic (900 to 1450 AD) periods are other examples of this. People were buried under the house in different positions, such as flexed lateral decubitus, lateral decubitus, flexed dorsal decubitus, and dorsal decubitus. Along with these burials, we could find offerings in the form of ceramics, shells, or colored stones Classic (400 to 900 AD) and Postclassic (900 to 1521 AD). This type of burial is considered more intimate. It would be attended by the people with whom they had social relationships (neighbors, relatives, and friends) and who lived in the houses ([Mora Martínez and Guillermo 2021](#)).

In the Hispanic towns of Antiquity, they also had the custom of burying their dead in the basement of the house, to perpetuate their memory and invoke their protection. Deposits were found in the town of La Torrecilla, in the Los Bermejales reservoir (Arenas del Rey, Granada, Spain), or the Bergistano town of Camp-Maurí (on the hill of this name, belonging to the current municipality of Berga-La Vall dan, Alto Llobregat): remains of relatives were found buried there, both adult and child individuals with clear indications of having been celebrated as a ritual and not as an accidental death ([Riu 1982](#)). These behaviors have been seen in some societies and as the way of burying their dead has evolved. The ritual explained above is known as “houses of the dead” and alludes to the fact that the family was gaining importance compared to the so-called clan of the dead hunter-gatherer societies ([Rubio de Miguel 2004](#)).

Burying all family members on the same tombstone or tomb, in a collective burial, is a burial ritual practiced within family nuclei. In addition, it is a ritual that is maintained today. This type of burial is usually accompanied by specific positions (Figure 1) of the individuals, either in the same or different strata of the site together with objects, which may indicate the position and hierarchy of that individual in the family nucleus. Examples of this can be non-bell-shaped multiple burials (without a bell shape), that women are better represented than men, and that, among these groups, there is a special interest in highlighting the strong maternal-filial and family bond existing through frequent associations of female adults with children and of groups whose ages and sex are identified with those of a nuclear family

(Sonlleva et al. 2014; Blasco et al. 2014). In turn, the construction of small tombs isolated from each other or burials in small groups were motivated by this family relationship and therefore may give us more clues to burial by relationship. In addition, all of them are found in the vicinity of habitable or productive structures (Tente 2015).



Figure 1. In this figure, we can see a burial to the Chalcolithic society, where the individuals are placed in a special way: (a) this is a real image of the burials; (b) this is a 3D computer-generated image (Blasco et al. 2014).

From the placement of the high-quality grave goods deposited in these tombs, it is not unreasonable to interpret them as the pantheons of prestigious families or lineages (Archaeological 2014). Examples of the aforementioned rituals can be seen in the archaeological site called “Madrid 2-41” in which 11 individuals were found with a differential presence of ceramics and ornaments, in addition to specific positions, such as women and children together or very close, and all were maternally related (Cuenca et al. 2005; Silva et al. 2008).

Another indication that specific sites may belong to a family nucleus is finding differences in the anthropometric study of the bones from the site concerning the society and period from which they are dated. For example, if it has been calculated according to the Pearson method that the size of the femurs of other individuals found there from the same era and society is 46 cm in length and in the site the femurs are shorter in all individuals, it can be hypothesized that they belong to the same family but did not belong to the society (Heras Martínez et al. 2014; Tejero et al. 2018).

All these rituals have not been fixed in time and have occurred more or less frequently at different times. In the Neolithic and Medieval periods, the most frequent ritual was to find individual burials, except for the Copper Age, when the most common were collective burials. In the Modern Age, it was common to find both types of burial (Lopes Gomes 2020).

Given this series of burial rituals related to family nuclei, we can state with a high probability that the individuals found in a site whose burial rituals are like those mentioned above will present a relationship of kinship but will not for that reason have a genetic relationship. These same conclusions are reached in other studies, such as that of Lopes Gomes (2020), in which burials from four different eras are studied (Neolithic, Copper Age, Medieval, and Modern) and it is argued that although a single burial pattern is not observed, most often individuals buried in consecutive single graves are not related; in multiple burials, individuals buried simultaneously are usually biologically related. This fact has been documented in the different historical periods analyzed. Finally, in non-simultaneous multiple burials, regardless of the historical period, there is no single pattern, and it is possible to find both biologically related individuals and individuals without any biological link (Lopes Gomes 2020).

4. Genetic Procedures to Determine Kinship

When we find multiple burials, the kinship analysis can provide interesting information to understand different social behaviors characteristics (Gamba Cristina et al. 2010;

[Palomo-Díez 2015](#); [Palomo-Díez et al. 2018](#)). To perform this kind of close familial relationship study, the main genetic markers employed are autosomal DNA markers. Nevertheless, mitochondrial DNA and the Y chromosome can also provide additional information. Hereby, we analyze the different applications of each one of the markers commented on.

4.1. Autosomal Markers

Autosomal markers are located on the 22 pairs of chromosomes inherited from parents. They are useful when close kinship is performed because they are inherited directly, 50% from the father and 50% from the mother, so a person shares half of his/her autosomal genome with his/her mother and the other half with his/her father. However, autosomal markers have the disadvantage that their nuclear origin makes their recovery much more difficult when the biological sample has low-template DNA (LTD) or molecular degradation since we only have 2 autosomal DNA copies per cell, a minute quantity when compared with the 1000–10,000 copies of mitochondrial DNA present in each cell of the individual ([Palomo-Díez and Ana María 2022](#)). Moreover, when we face up to LTD, it is essential to keep in mind the possible appearance of stochastic phenomena (highly unbalanced alleles in a marker, allelic dropout, loci dropout, etc.) ([Butler 2014](#)).

The autosomal DNA analysis is performed by studying three kinds of markers: short tandem repeats (STRs), single-nucleotide polymorphism (SNP) and insertion–deletion polymorphisms (InDels).

STRs are small fragments of two to six base pairs that are repeated a certain number of times. These markers have become popular because they are easily amplifiable by PCR and are useful in bioarchaeology to identify individuals or establish close kinship relationships ([Butler 2014](#); [Gamba Cristina et al. 2010](#); [Palomo-Díez et al. 2018](#)).

A single-nucleotide polymorphism (SNP) is a genomic variant at a single base position in DNA ([Sobrinho et al. 2005](#)). It is still difficult to give an estimate of the number of SNPs in the human genome, but in the different public and private databases more than five million SNPs have been collected and around four million SNPs have been validated; this is to say they have been confirmed to be polymorphic in one or various major population groups. Their abundance, despite their simplicity and rather limited polymorphic content, is the main reason for their current enormous interest ([Sobrinho et al. 2005](#)).

Of the millions of SNPs that have been found in the human genome, some can be selected that fulfill a much more specific function. Some of these functions may be identified, guiding the biogeographical origin of individuals, SNPs related to specific phenotypic characteristics, or the study of lineage. In the case of using SNPs for identification, studies like the one performed by [Cardenas et al. 2010](#), which applies the 22 most polymorphic SNPs described by [Porrás et al. \(2009\)](#) in specific populations to investigate if these SNPs met the population parameters commonly used in forensic genetics, for example, the matching probability, the discrimination power and the exclusion power. The results presented a sufficient level of confidence to be used as supplementary markers ([Cárdenas et al. 2010](#)).

The prediction of the biogeographic origin by SNPs is based on the existence of a series of polymorphisms, whose variability is found between specific groups of individuals or populations (allotypic variants) and not between individuals of the same population (idiotypic variants) ([Fondevila and María 2014](#)). In turn, the prediction of phenotypic characteristics or EVCs (external visible characteristics) is one of the newest applications of SNPs. It is currently under study and only a small number of traits of interest can be confidently predicted at present. This application tries, in parallel to the aforementioned prediction of biogeographic origin, to find information related to a completely unknown individual, based on a biological reminder that gives us access to the variability of its genome. In this case, those polymorphic positions whose variability is statistically associated with the spectrum of a quantifiable physical trait will be studied ([Fondevila and María 2014](#)). In this way, we can use these SNPs to compare individuals from the same site. In case of not finding similarities in the phenotypic, identification, or biogeographic origin traits, it reinforces the adoption hypothesis.

Moreover, the use of SNPs has a great advantage in degraded samples since by only looking for a nucleotide we have a better chance of finding it and there are no fractures in the sequence.

In the case of InDels, only the position of a fragment is studied and change could be or not be present (if it is present there is an insertion and if it is absent there is a deletion). In the case of, for example, mitochondrial DNA INdels, they are detected with a reference DNA sequence. Compared with STRs, this third kind of marker could be a better option when the DNA is badly preserved and showing high fragmentation levels because the analyzed fragments are shorter than the STRs.

In these cases, the autosomal markers are the best option to determine close relationships; nevertheless, in these cases, when samples have bad DNA preservation, the study could be complemented by the analysis of mitochondrial DNA (mtDNA), although sequencing would be the best option.

4.2. Lineage Markers and Sexual Chromosome Markers

4.2.1. Mitochondrial DNA

MtDNA is considered a lineage marker because it is unchanged and inherited from mothers to sons and daughters generation by generation (Palomo-Díez and Ana María 2022). So, the mitochondrial haplotype of a man is the same as the haplotype of his mother, and it is the same as his sister's and brother's haplotypes and the same as all the persons from his maternal lineage (Figure 2). So, by analyzing the mtDNA from a group of exhumed skeletons we can know if they belong to the same maternal lineage, to the same family from the maternal point of view. With this premise, we can say that mtDNA is less discriminating than autosomal markers, because mtDNA does not allow for determining close kinship, but it could be useful to determine lineage relationships through maternal lineage. In the case of adoption, it could also be useful because the lack of sharing of mtDNA among a probable mother and a probable son could be accepted when mtDNA profiles are different, but the kinship could not be verified if they share the same mtDNA profile. In contrast to nuclear markers, it must be said that mtDNA does not allow individualization and is only useful to establish maternal lineages (Palomo-Díez and Ana María 2022).

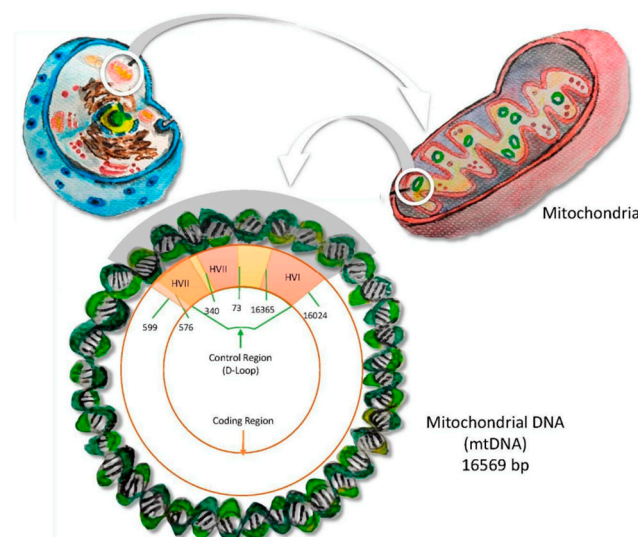


Figure 2. In this figure, we can see the mtDNA location and structure (Palomo-Díez and Ana María 2022).

One of the most well-known mtDNA applications is the approximation of the biogeographical origin, by the determination of haplotypes and haplogroups associated with different geographical areas (Van Oven and Manfred 2009). Nevertheless, the issue that matters to us here is not that. However, mtDNA can also be employed with other targets.

One of its advantages is the high number of mtDNA copies, especially when faced with LTD samples. Moreover, mtDNA analysis can be useful in disaster victim identification. In Thailand in Southeast Asia, in 2004, it was possible to identify 200 victims by 200 reference relative samples, comparing mtDNA sequences from 258 tooth samples (Deng et al. 2005). In addition, it can also be useful in war events, such as the skeletal remains exhumed from a mass grave from the Spanish Civil War (1936–1939), where it was possible to identify a person by comparing the mtDNA sequence with her putative sister (Ríos et al. 2010). These are only two examples of how mtDNA can be useful for identification in massive victim events. When there are no direct relatives to establish kinship, mtDNA is especially interesting, as long as the kinship is through the maternal lineage. However, when the results point to confirming identity by mtDNA, contrary to nuclear DNA, in the case of mtDNA, they do not refer to an individual but a group of individuals of the same maternal lineage (Palomo-Díez and Ana María 2022).

Regarding the way to analyze mtDNA, the main kinds of markers studied in this molecule are single-nucleotide polymorphisms (SNPs), that is, changes that occurred in specific nucleotide positions. Traditionally, the mtDNA regions studied have been the three hypervariable regions I, II, and III, by Sanger sequencing. However, the great development of massively parallel sequencing techniques in recent years has made it possible to study complete sequences of the entire mitochondrial genome.

4.2.2. Y Chromosome

The Y chromosome is another interesting lineage marker, but it is also a sexual chromosome marker, so it has specific interesting characteristics and utilities. However, it can only be studied in men and then only has one Y chromosome copy per cell, so it could be even more difficult to analyze in badly preserved samples. Nevertheless, it shows many interesting applications in human genetics. Firstly, from the forensic point of view, the detection of the Y chromosome in a sample determines the presence of a male in this sample, because the Y chromosome is present exclusively in males (it is especially interesting, for example, in sexual assault samples). To this aim, many commercial STR kits include Y chromosome markers, such as the STR marker DYS391, the InDels marker Y InDels, and a fragment of the amelogenin gene (for example, the GlobalFiler™ PCR Amplification Kit, ThermoFisher).

In the same way as mtDNA, the Y chromosome polymorphisms are applied for inferring the paternal biogeography ancestry, due to the absence of recombination (the Y chromosome only recombines in two small imperceptible zones, PARS 1 and PARS 2). These studies can be performed both by Y-STR analysis or by Y-SNP analysis. Because of the lower mutation rates of Y-SNPs relative to Y-STRs, geographic ancestry signatures are much longer at Y-SNPs, before being broken via mutations (Kayser et al. 2004, p. 552).

The most important application of the Y chromosome in bioarchaeology is its ability to exclude two individuals from belonging to the same paternal lineage, and so far it has been used in many paternity tests to solve different historical investigations, for example, in the paternity dispute of US President Thomas Jefferson (Foster et al. 1998; Palomo-Díez and Ana María 2022). Furthermore, it is an important way to perform genealogical studies. In many modern societies, the transmission of the father's surname is linked with the biological inheritance of the male Y chromosome. So, the Y chromosome could be used as a tool to establish a possible correlation between surnames and specific Y haplotypes (Jobling et al. 2004; Sykes and Catherine 2000; Martinez-Gonzalez et al. 2012; Claerhout et al. 2020). In this case, and also when faced with multiple victims' identification, the Y chromosome can be useful when autosomal DNA is not enough, for example, when there are no close relatives, and we can establish kinship through the paternal lineage (Palomo-Díez et al. 2019).

As has been commented before, it is possible to analyze different kinds of markers in the Y chromosome: SNPs, STRs, or even InDels.

In the case of SNPs, the analytic process could be performed by PCR amplifying by specific primers and posterior Sanger sequencing. The same process could be performed to amplify InDels or by Snapshot technology. In the case of STRs, there are different STR PCR commercial kits, such as Y Filer and Y Filer plus (Applied Biosystems–ThermoFisher). In addition, next-generation sequencing techniques could be applied.

4.2.3. X Chromosome

The X chromosome shows different inheritance patterns in men and women. Its specific mode of transmission is what motivates the interest of its study, since its transmission depends on the sex of the individuals, providing a different approach than that of using autosomal markers. In normal female cells, there is a pair of X chromosomes that recombine with each other, just like autosomes. As for male cells, the X chromosome has no homologue, only recombining with a little region of the Y chromosome. In this way, a father transmits to all his daughters a full copy of his X chromosome, while a mother randomly transmits a copy of one of her two X chromosomes to daughters and sons, after recombination, as for autosomes (2022).

So, normal male individuals have only one non-recombining X chromosome, which is transmitted as a haplotype (like mtDNA or the Y chromosome), in the same way, to all daughters. In contrast, female individuals have two recombining X chromosomes, which are transmitted to descendants like autosomal chromosomes (Gomes and Eduardo 2022). Because of these special X characteristics, the X chromosome can provide interesting kinship information in specific cases, contributing to solving some specific situations. For example, to determine a possible sisterhood kinship between two women, it is possible that autosomal STRs could be insufficient, but they must share the X chromosome inherited by their father, and it must be exactly equal in both. The X chromosome could also be useful to determine the paternity of the daughter when the mother is absent or to establish a relationship between a woman and her grandmother by her father's lineage, because they must share one identical X chromosome.

Given the types of genetic analyses that we will be able to carry out to establish kinship relationships, in our review the genetic part will have two main functions. The first one is to associate in a family nucleus all the individuals found in the same site in which we have found characteristics of a family burial. Once we have the kinship relationship analyses, obtaining a negative kinship relationship from some individuals will set off the alarm of a possible adoption case. In this case, all the premises would have to be fulfilled to be able to affirm with a greater probability that it is a case of adoption.

5. Archaeological Sites with Related and Unrelated Individuals

At this point, we will talk about specific archaeological sites in which genetic analyses have been carried out, and it has been seen that in the same tomb we found biologically related and unrelated individuals. For the analyses, European sites from different prehistoric periods have been selected, which are characterized by having established family relationships between individuals. The sites had a large number of familiar related individuals and also individuals with no known biological relationships. With these examples, we show that being in the same grave does not strictly refer to a family nucleus.

Among the recent works on the establishment of family relationships between Neolithic individuals, that of Fowler et al. 2022 stands out. In this article, they analyzed 35 individuals in an Early Neolithic Tomb from Britain (Hazleton North). The tomb was dated to 3700 BC. A pedigree that integrated 27 individuals in 5 generations was built out of ancient DNA data. One male progenitor had five children with four women. There were eight individuals without evidence of biological relation in the first or second degree. The authors considered that *“kinship may not have been the only criterion for inclusion in the tomb”*. Some or all individuals could have been buried in the same tomb by association, co-residence, or adoption (Fowler et al. 2022). Moreover, three males were not descendants of the principal male but were biological sons of women who had other children with him

or his male-line genetic descendants. The authors concluded that these individuals could have been adopted. In this case, the concept of adoption refers to individuals who only share one parent. In this example, we can find signs of family burials such as separate tombs for each family in a community.

In the article of [Schroeder et al. \(2019\)](#), again in Neolithic individuals in Koszyce (southern Poland), a study was carried out in a mass grave associated with the Globular Amphore Culture (3300–2700 BCE). In this case, 15 individuals (men, women, and children) were found with signs of blows to the head. It is striking how carefully the bodies were placed according to their family relationships (Figure 3). Thus, the mothers were buried with their children. There is an adult woman, between 30 and 35 years old, who does not appear to be genetically related to any individual in the tomb. She presents a completely different mitochondrial DNA profile from the rest of the individuals in the tomb. She is buried near a 16–17-year-old individual. This raises the fact of adoption, but there is the possibility of other situations, such as the question of whether she is his partner or his partner died during the attack.

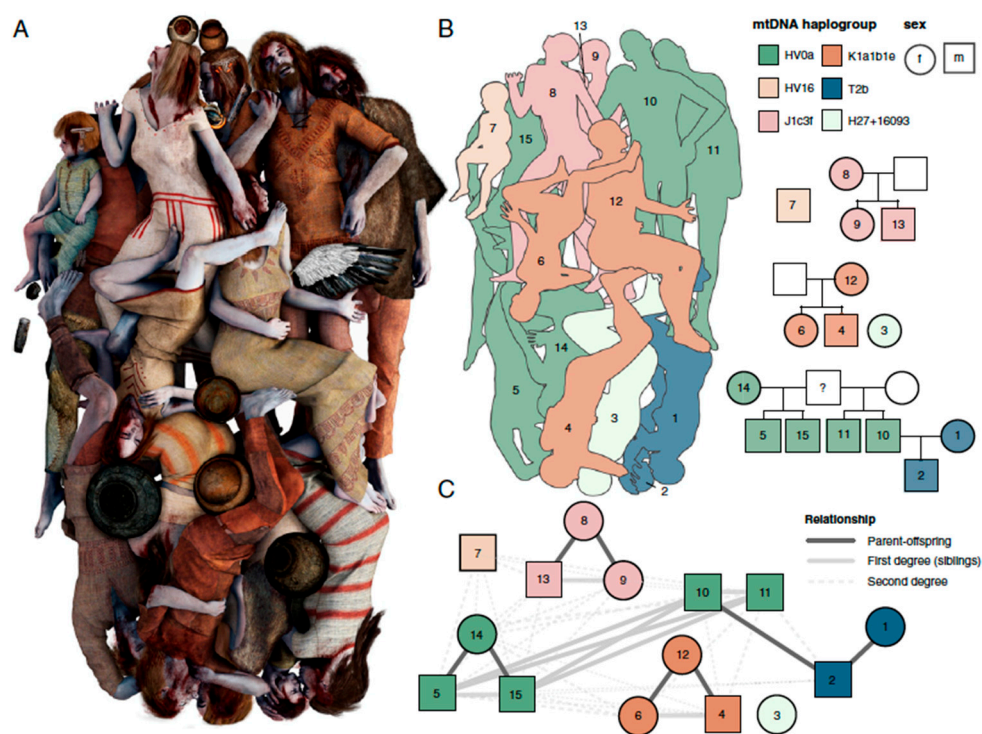


Figure 3. (A) Artistic reconstruction of the Koszyce mass burial based partly on phenotypic traits inferred from the ancient genomes. (B) Schematic representation of the burial and pedigree plots showing kinship relations between the Koszyce individuals inferred from genetic data. (C) Kinship network based on kinship coefficients inferred from IBS scores for pairs of Koszyce individuals showing first- and second-degree relationships ([Schroeder et al. 2019](#)).

Obtained data seem to suggest that Neolithic societies in Central Europe followed a patrilineal model with female exogamy ([Haak et al. 2008](#); [Knipper et al. 2017](#)). Moreover, most adult males of the group are not in the grave. Can it be that the woman was adopted by this family, and the next man is a relative? These are questions that cannot be answered with actual data.

Regarding the Bronze Age, [Mittnik et al. \(2019\)](#) studied farmstead-related cemeteries in South Germany from the period between the Late Neolithic period and Middle Bronze Age. In the analysis of 14 sites that correspond to the Corded Ware Complex, Bell Beaker Complex, Early Bronze Age, and Middle Bronze Age, it was observed that the established biological relations in first- and second-degree corresponded to individuals buried together.

DNA analysis seems to indicate that these are patrilineal societies with female exogamy. Moreover, it is observed that the males who do not belong to the main line do not have close relatives buried with them. In one of the sites (Haunstetten-Postillionstraße) corresponding to the Early Bronze Age, nine individuals were identified that could belong to the same genealogy spanning four or five generations, with every male sharing the same Y chromosome haplogroup. Six family members were buried close together in the northern part of the cemetery. All individuals sampled from the northern group with a metal pit are biologically related to each other. However, there is a tomb of a woman with the same funerary characteristics as the previous ones and close to them, although biologically unrelated. Therefore, in addition to family relationships, there may be other criteria when burying individuals in nearby graves.

6. Discussion

As we have been able to observe, adoption is an activity that has been carried out since the first civilizations and has occurred in different cultures and times. We do not know how often it occurred in different societies, but it must have been on a regular basis for there to be laws and writings to regulate it. In each of the times and cultures, it occurred for different reasons or purposes, either to continue a line of succession or as a way to avoid discrimination against a woman or couple when they could not conceive. Although we do not know how often adoption occurred in different societies, it can be intuited that, due to the creation of norms and laws that regulate it, the frequency of adoption cases would have been significant. So, when interpreting the results obtained after the analysis of a tomb, the possibility of adoption must be considered. As observed in this review, there are very few studies in which this possibility is contemplated.

We assume that we will handle the adoption hypothesis when we find an archaeological site in which the vast majority of individuals have a genetic family relationship and there are a few individuals whose genetic analysis demonstrates an absence of biological bond, although they were all buried together, or when we observe children buried with adults without any biological link between them. To carry out the kinship study, we must choose the genetic analysis that best suits our samples or the information we want to verify. An example can be an archaeological site in which we only find women and children, in which case we would be interested in analyzing the mtDNA to find out if there is any maternal relationship between them, such as mother–children or grandmother–grandchildren. In the case of males, we will analyze the Y chromosome to admit or discard a paternal lineage between them.

One of the main problems that we can find when carrying out this research is the genetic analysis of the samples. The samples are critical, since they have low concentrations of DNA and this will be of poor quality. In addition, they are samples that are usually found buried directly in the ground, which makes the degradation of biological materials more pronounced. This makes the work of extracting and amplifying DNA and trying to obtain enough genetic material to carry out the analyses complex, as mentioned in the review. Very efficient DNA extraction methods should be used, taking care of contamination with exogenous DNA. Once the genetic analysis has been carried out and the kinship relationships that exist between the individuals can be seen, we can find several problems in the following hypothetical situation of a prehistoric site: For example, we found a site of 11 individuals in the same grave. The placement of the bodies was performed with special care in placing women and children together in contact, and in other stratigraphic levels of the tomb we found men together with ornamentation and vessels; in addition, this tomb is near some remains of what was a house.

The main problems that we can find in this fictitious example are as follows:

The concept of family is something that has occurred in different ways in different cultures since there are different concepts of what the family unit was in addition to the way we know it today. An example of a current family in Western Europe is parents, grandparents, children, and uncles; our neighbors do not belong to that family unit, no

matter how good a relationship we have with them. As discussed in point 3.2, this can be observed in African tribes where all the individuals of the tribe, whether or not they are genetically related, are treated as a family unit. This can lead us to confusion when it comes to finding unrelated individuals, since perhaps what we think is an adopted child is a child from another family who had a very close relationship with the family found at the site or the partner of one of the individuals with whom they would not have had offspring yet. In these last two cases, we cannot talk about adoption cases.

For this reason, when carrying out the genetic analysis of a burial, if we find that there is no biological kinship between some individuals, it may let us suppose the adoption hypothesis or the hypothesis of other family interpretations where individuals do not need to have a biological bond to belong to the same family. For this reason, an in-depth study of the type of society in which the site occurs is always very important, as well as the burial place period.

It is possible to find, as mentioned in previous examples, cases in which children of other previous couples are found, but in this case we will find a biological relationship with at least one of the adults and it will not be taken into account as adoption.

Although this review may have many unknowns and variables that cannot be controlled because we are studying human remains of the past, an exhaustive study of the type of society that existed at that time and place can elucidate many of these unknowns and thus be able to ensure with greater certainty a fact of adoption in an archaeological site.

Although genetic study helps to rule out biological relationships or to establish them with a precision that cannot be achieved with any other technique, whether or not there is a case of adoption cannot be answered only with the information we obtain from the genetic study. That is why the adoption study should be multidisciplinary but not exclude genetics. A hypothesis must be elaborated based on the cultural background of the site, referring to all the information on the types of family sites and the rituals and cultures that occurred at the times in which the site is dated, because only then can conjectures be created that can be deciphered with the help of genetics.

This type of study is simplified when at a site we find the so-called tombstones, also called *stelae*, whose function is to identify the buried person(s) in the grave. Remains of tombstones have been found that are associated with the graves of the Kurgan culture (which includes a wide variety of communities originating from the steppes of the middle and lower Volga, Russia) from about five thousand years ago. Inscriptions were also found on stone and wooden tombstones on mounds dating back to the Bronze Age. The Greeks buried commoners and elites in inscribed tombs. Likewise, in the pre-Roman city of Vulci (Italy) abundant Roman tombs have been found with statues, reliefs, and inscriptions that tell stories (Saša 2022). This extra information can help us to more accurately locate the remains that we can find in the tomb and discover what relationship they have between them.

In addition, as mentioned in the PhD Thesis by Gomes et al. (2020) and also mentioned in Section 3.2, it was normal for deceased individuals to be buried individually in a sacred place or place of worship, but we see that in the following periods of collective burials the sacred places, such as a cathedral or funeral as an example, began to have limited space. Here, the individuals would begin to be buried individually, but due to lack of space already occupied tombs would have to be used; hence, the tombs already used are completed with individuals of the family.

The task of identifying adoption cases becomes simpler as we get closer to the current dates since we find more information in the deposits. This information can be in the form of the tombstone, knowledge about the society, or the types of funeral rituals they performed. Hence, multidisciplinary is important when studying a possible case of adoption.

Finally, we want to highlight the importance of knowledge of past societies for the genealogy of families, for example, in discovering a succession chain of emperors of ancient Rome in which none of the heirs to the throne belonged to the family geneti-

cally but rather were adopted by the emperor's family as worthy candidates for power (Juan and Del Mar 2021).

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